5. Project Alternatives

The alignments for the Western Highway Project have been developed through a detailed three phase options assessment process.

The Project Area was divided into zones to allow for comparison of options against the existing alignment and identified preferable options having regard to social, environmental and economic impacts.

The first phase of the options assessment process for the Project involved development of a long list of alignment option. A rapid assessment with specialists in the relevant fields was undertaken to consider the benefits and disbenefits of each option against the objectives of the EES and Project. The outcome was a shortlist of alignment options.

In the second phase, the shortlisted options were further assessed. The objective was to identify a recommended option in each zone that, on balance, had the lowest potential impact. However in three zones there were multiple options which were comparable and therefore considered for further assessment. The preferred options within each zone were connected to provide three alignment options from the start to the end of Section 2 (Beaufort to Ararat).

During the third phase, the impacts of these three options were assessed in detail by specialists to assist in determining their preferred option.

All options would all have some negative impacts on flora, fauna, cultural heritage and amenity compared with the no project scenario. However, all Options were considered beneficial compared to the no project scenario due to improved transport safety and efficiency benefits for landowners along the alignment and for the township of Buangor, which would be bypassed, thereby removing heavy vehicles from the centre of town.

Following the risk assessment, Options 1 and 2 were deemed to have less impacts than Option 3, and were therefore carried through into the EES.

Based on feedback from specialists VicRoads has a preference for Option 2, but acknowledges that Option 1 would also satisfy the overall project objectives.

VicRoads understands that as a result of the EES process, either Option could be recommended for approval and therefore, submissions will need to be sought for both options.

5.1 Introduction

This section describes the Project alignment alternatives that have been considered, and the process followed to select final alignments options.

In the development of the Environment Effects Statement, consideration has been given to the 'no project' scenario as well as alternate design measures to address project objectives.

In order to address the Project objectives, it has been deemed necessary to duplicate the Western Highway and a detailed analysis of options has been undertaken.

The assessment of alignment options was undertaken in three phases as illustrated in Figure 5-1 and outlined in the Options Assessment Report forming Appendix B of the EES.

**Phase 1** involved developing a range of alignment options, followed by a rapid assessment to identify a shortlist.

**Phase 2** involved the detailed assessment of the options shortlisted in Phase 1 to identify a recommended option in each zone.

**Phase 3** involved an Environmental Risk Assessment of the recommended alignment options and completion of the specialist impact assessments. The Phase 2 assessment identified multiple recommended options in three zones, therefore the environmental risk assessment was utilised to identify preferred alignments for presentation in this EES.

As a result of this process, two options were considered feasible for adoption by VicRoads. These options were Option 1 and Option 2, which were subject to further refinement in order to mitigate potential areas of impact.

VicRoads considers that either Option 1 or Option 2 would provide an acceptable solution. Both options have a range of benefits and impacts and it is considered appropriate that the community has an opportunity to express their preferences.
Figure 5-1 Alignment Options Assessment Process
5.2 Consideration of Relevant Alternatives

As part of the process to determine feasible duplicated highway alignment options, consideration has been given to the resultant impact of no upgrade to the highway and consideration of implementing of design alternatives to address safety and efficiency requirements.

5.2.1 The 'No Project' Scenario

Consideration of the 'no project' scenario is important in order to evaluate the implications of not undertaking the Project.

The chapters for each study discipline describe the existing conditions within their specific study area in order to establish the baseline for impact assessments.

The rationale for the Project is outlined in Chapter 2 (Project Rationale) of this EES. The relevant key objectives of the Project are:

- Improvement of road safety;
- Improvement of transport and freight efficiency;
- Provision of adequate and improved rest areas; and
- Provision of alignments to allow for the possible future bypasses of Beaufort and Ararat.

Without the Western Highway Project, freight and personal vehicles would continue to utilise an existing road that does not provide sufficient and safe passing areas or a road geometry that meets current highway or freeway standards. Continued use of the highway without any upgrade could result in additional accidents.

With continued population growth within the regions and continued reliance by road freight, there would be increased demand on the Western Highway which could result in a deterioration of road safety and amenity for surrounding landowners. The potential decline in road safety can be mitigated by a revised road layout, as proposed by the Project.

In order to assess the options against the 'no project', the evaluation framework has considered the potential benefits and adverse impacts of each option as follows:

- The alignment options were rated as being either better or worse than the 'no project'; and
- Acknowledging that neither the benefits nor the adverse impacts attributable to the proposed Project, as documented in the EES, would be realised for the 'no project'.

5.2.2 Alternative Solutions

As part of the Project, a number of solutions have been considered in order to improve connectivity and efficiency between Ballarat and Stawell. These potential solutions include:

- Use of an alternate route;
- Use of an alternative transport mode;
- Construction of a greater number of overtaking opportunities; or
- Duplication of the Western Highway.

5.2.2.1 Use of an alternate route

In addition to the Western Highway corridor, another possible corridor would be the Sunraysia Highway through the towns of Learmonth, Waubra and Lexton, connecting to the Pyrenees Highway via Elmhurst and then extending to the north of the Ararat Hills Regional Park into Great Western and then along the Western Highway into Stawell. While this corridor could be marginally shorter (depending on the final route chosen), at 106km, compared with 108km for the existing Western Highway corridor, this alternative was not considered for further investigation due to:

- The Sunraysia and Pyrenees Highways are classified as B routes under the Linking Victoria Strategy and would require significant upgrades to the vertical and horizontal alignments to meet the M road standard;
- It would require considerable construction of new roads (through hilly and environmentally sensitive landscapes) to be completed between the Sunraysia Highway and Pyrenees Highway and Western Highway before such a corridor could be available for interstate traffic. This would have a substantial social impact as there would be a large length of road that would be through “greenfield” sites as there is not an existing road corridor. The planning and land severance impacts would be far greater for a “greenfield” option, this option would also be far more expensive as it would not make use of the existing Western Highway corridor and infrastructure; and
- The current Western Highway corridor better serves the major towns of Beaufort and Ararat, as well as the major Grampians tourist area and therefore an alternative corridor would not get maximum use. The proposed option provides improved access to popular tourist areas which in turn will create economic opportunities. If an alternative corridor to the north was used, the existing Western Highway would have to be maintained as a high standard parallel route.
The option of using alternative routes is also not considered feasible because alternative roads are not constructed to the standard required for the traffic. The cost of upgrading an alternative route would be far in excess of the option of duplicating the existing highway and it would provide a detrimental impact to existing major towns on the highway through leaving the existing travel time and safety issues on the existing highway unresolved.

5.2.2.2 Use of an alternative transport mode

The use of alternative transport mode is also not considered feasible due to 75% of the freight between Melbourne and Adelaide being non-bulk items. The need for these items to be collected from and distributed to many different locations means that there is a reliance on flexibility in the delivery chain that is provided by road solutions.

5.2.2.3 Construction of a greater number of overtaking opportunities

The Western Highway between Ballarat and Stawell has a number of overtaking lanes along the route. It has been determined that constructing more overtaking lanes along the Western Highway between Ballarat and Stawell alone are not adequate for the following reasons:

- Although overtaking lanes provide some relief to congestion, they are not as effective in addressing to the road safety issues along the highway. Opposing directions of traffic are not separated so the risk of head on crashes remains high unless a median barrier is introduced. While a median barrier is a hazard in itself and also provides maintenance issues, it is also not considered appropriate in this case due to the high proportion of trucks and the fact that trucks may still penetrate the barriers.

- Overtaking lanes do not allow the speed limit to be raised to 110km/h.

- Overtaking lanes do not cater for overtaking of vehicles that can travel at or near the speed limit on shallow gradients.

While this is a potentially cheaper response, this alternative does not fully address the travel time issue as the posted speed would have to remain at 100km/h and there would still be delays behind slow moving vehicles in the sections that did not have overtaking lanes. More significantly, the opposing directions of traffic are not separated under this option, therefore the current safety issue associated with head on crashes is not treated, leaving this risk within this corridor.

5.2.2.4 Duplication of the Western Highway

This option involves the construction of a second carriage way and increasing the number of lanes on the highway to four lanes.

This option doubles the capacity of the highway and provides for considerably safer overtaking opportunities. The separation of the two directions of traffic will reduce the likelihood of head on crashes and reduce the chances of rear end crashes by allowing vehicles to use the extra lane to move around slow or stationary vehicles on the highway.

The duplication of the Western Highway will allow safer access to and from adjoining local roads and private properties through the construction of wide median treatments at existing intersections and some private properties. The wide median intersections will allow safe turning movements to and from local roads or private entrances.

For the above reasons, it has been determined that the duplication of the Western Highway between Ballarat and Stawell, including Section 2 (between Beaufort and Ararat), would be the most appropriate means of addressing safety and efficiency.
5.3 Phase 1: Development of Alignment Options

Phase 1 involved developing a long list of alignment options, followed by a rapid assessment to refine them into a shortlist for a more thorough consideration in Phase 2.

All potential alignments assumed a freeway (AMP1) standard design, in the ultimate, and a highway (AMP3) in the interim in order to realise the maximum benefits from improved travel times and safety.

5.3.1 Initial Considerations

A number of factors and features within the project area influenced the development of the initial ‘long-list’ (Phase 1) alignment alternatives. The Phase 1 alignment options sought to meet the project objectives and avoid known constraints. These included:

- The need for an appropriate connection with the existing highway
- Allowing for future bypasses of Beaufort and Ararat
- Ensuring design and safety standards are achieved
- Optimising use of existing infrastructure
- Minimising ecological and social impacts.

A project area boundary was established based on an area 1.5km either side of the existing highway to encompass a reasonable deviation from the existing highway having regard to cost and travel time considerations. The project area excluded areas of environmental or social sensitivities, such as the Langi Ghiran State Park and the township of Buangor. Refer to Figure 5-2 for the project area.
Figure 5-2  Section 2 Project Area
5.3.2 Developing ‘Long List’ Options

Prior to the commencement of the EES, VicRoads had established some initial options through preliminary environmental and engineering investigations, and initial consultation with the community and regulatory agencies. This information was used to generate additional concepts in a workshop in April 2011 involving specialist traffic engineers, environmental scientists and town planners, together with VicRoads staff. Feasibility, performance, planning and environmental factors were taken into account. The outputs of this process are described in Table 5-1 to Table 5-4. The alignments were considered in four zones at this stage of the assessment and are shown in Figure 5-3 to Figure 5-6. Shortlisted options were identified for further consideration.

Table 5-1 Zone 1 Long List Options Description

<table>
<thead>
<tr>
<th>Option</th>
<th>Description (*eliminated options shaded grey)</th>
<th>Shortlisted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1: Beaufort to Eurambeen-Streatham Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1A</td>
<td>Duplication on the north side of existing highway for east-bound lanes with wide median from Martins Lane to east of Eurambeen-Streatham Road and use of the existing highway for west-bound lanes</td>
<td>✔</td>
</tr>
<tr>
<td>1AB</td>
<td>Duplication on the south side of existing highway for west-bound lanes and use of existing highway for east bound lanes – to Martins Lane</td>
<td>✔</td>
</tr>
<tr>
<td>1B</td>
<td>Duplication on the north side of existing highway for east-bound lanes with narrower median than 1A from Martins Lane to Eurambeen-Streatham Road and use of the existing highway for west-bound lanes</td>
<td>✔</td>
</tr>
<tr>
<td>1C</td>
<td>Duplication on the south side of existing highway for west-bound lanes from bottom of Box’s Cutting to Eurambeen-Streatham Road and use of the existing highway for east-bound lanes</td>
<td>✔</td>
</tr>
</tbody>
</table>

Figure 5-3 Zone 1 Long list Options
<table>
<thead>
<tr>
<th>OPTION</th>
<th>Description (*eliminated options shaded grey)</th>
<th>Shortlisted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 2: Eurambeen-Streatham Road to Charliecombe Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>Duplication on the north side of existing highway for east-bound lanes and use of existing highway for west-bound lanes</td>
<td>✓</td>
</tr>
<tr>
<td>2B</td>
<td>Duplication on the south side of existing highway for west-bound lanes and use of existing highway for east-bound lanes</td>
<td>✓</td>
</tr>
<tr>
<td>2C</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) to south of existing highway from Goulds Lane/ Ferntree Gully Road to east of Charliecombe Road</td>
<td></td>
</tr>
<tr>
<td>2E</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) to south of existing highway from Waldrons Road to Mile Post Lane</td>
<td>✓</td>
</tr>
<tr>
<td>2G</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) from Goulds Lane/ Ferntree Gully Road well to the south of existing highway and crossing to the south of the railway line to join Option 3D</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5-4 Zone 2 Long list Options**

*Intersection of Western Highway and Crockers Lane*
### Table 5-3 Zone 3 Long list Options Description

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Description (*eliminated options shaded grey)</th>
<th>Shortlisted</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>Duplication on the north side of existing highway through Buangor for east-bound lanes and use of existing highway for west-bound lanes</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>Duplication on the south side of existing highway through Buangor for west-bound lanes and use of existing highway for east-bound lanes</td>
<td></td>
</tr>
<tr>
<td>3C</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) bypassing Buangor to north of existing highway from Peacocks Road to Buangor-Ben Nevis Road</td>
<td>✔</td>
</tr>
<tr>
<td>3D</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) bypassing Buangor to south of existing highway and running along the south side of the railway line from near Charliecombe Road to west of Hillside Road</td>
<td>✔</td>
</tr>
<tr>
<td>3E</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) bypassing Buangor to north of existing highway from Andersons Road to west of Buangor-Ben Nevis Road</td>
<td>✔</td>
</tr>
<tr>
<td>3C-3E</td>
<td>Join between the eastern end of Option 3E and the western end of Option 3C to provide new dual carriageway highway (with divided east-bound and west-bound lanes) bypassing Buangor to the north from Andersons Road to Buangor-Ben Nevis Road</td>
<td>✔</td>
</tr>
<tr>
<td>3F</td>
<td>Duplication on the north side of existing highway for east-bound lanes and utilizing existing highway for west-bound lanes from Pope Road to near Langi Ghiran Track</td>
<td></td>
</tr>
<tr>
<td>3G</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) to south of existing highway from Pope Road to west of Hillside Road</td>
<td>✔</td>
</tr>
<tr>
<td>3H</td>
<td>New dual carriageway highway (with divided east-bound and west-bound lanes) running well south of Option 3G from east of Pope Road to near eastern end of Hillside Road</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Figure 5-5 Zone 3 Long list Options

Cobb& Co Staging Stables - Buangor
### Table 5-4 Zone 4 Long List Options Description

<table>
<thead>
<tr>
<th>Option</th>
<th>Description (*eliminated options shaded grey)</th>
<th>Shortlisted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 4: Langi Ghiran to Ararat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>Duplication on the south side of existing highway for west-bound lanes and utilizing existing highway for east-bound lanes throughout entire zone</td>
<td>✔</td>
</tr>
<tr>
<td>4B</td>
<td>Same as Option 4A but new highway to south of existing highway for approx. 2km to reduce removal of native vegetation</td>
<td>✔</td>
</tr>
<tr>
<td>4CA</td>
<td>As for Option 4A but new highway south of existing highway for approx. 5km (joining with Option 3G) to reduce removal of native vegetation</td>
<td>✔</td>
</tr>
<tr>
<td>4D</td>
<td>New highway (with divided east-bound and west-bound lanes) from around eastern end of Hillside Road running well south of existing highway to west of Hopkins River</td>
<td></td>
</tr>
<tr>
<td>4E</td>
<td>New highway from around eastern end of Hillside Road running well south of existing highway to western end of Hillside Road</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Figure 5-6 Zone 4 Long list Options

### 5.3.3 Method for Refining the 'Long List’

A ‘rapid assessment workshop’ was held in May 2011 to refine the long list of options identified in Table 5-1 to Table 5-4 into a shorter list of potential and feasible options. Participants at the workshop included traffic engineers, environmental scientists and town planners, alongside VicRoads project staff.

The options were rated against a set of objectives described in Table 5-5, which were derived from the Project Objectives and the draft EES Scoping Requirements (May 2011). For each objective, a set of initial evaluation criteria was used to establish the degree that the objective could be met in terms of potential project benefits or disbenefits, according to the definitions provided in the ratings table shown in Table 5-6. This assessment process applied the draft evaluation objectives identified in the Scoping Requirements as provided by the Department of Planning and Community Development.

Within each zone the ratings for each option were aggregated, which allowed their preference to be ranked relative to each other. Options that addressed the Project Objectives and Scoping Requirements were shortlisted for further consideration (as highlighted with ticks in Table 5-1 to Table 5-4). Options which were clearly less favourable were eliminated and these are elaborated in Table 5-7.
<table>
<thead>
<tr>
<th>Objective</th>
<th>Initial Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VicRoads’ Project Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>Reduce travel time</td>
<td>▪ Travel time in Project Section 2 overall</td>
</tr>
</tbody>
</table>
| Improve safety | ▪ Reduction in at-grade intersections  
▪ Potential for grade-separation of major and/or dangerous intersections  
▪ Reduction in number of properties with access to highway  
▪ Potential for adequate rest area  
▪ Compliant with standards for future High Productivity Freight Vehicle loads |
| Complement future bypasses (Beaufort, Ararat) | ▪ Allow for future bypasses of Beaufort and Ararat |
| Minimisation of construction and acquisition costs and maximisation of use of the existing highway | ▪ Minimise construction cost (including service relocations)  
▪ Minimise land acquisition cost  
▪ Avoid difficult geotechnical ground conditions  
▪ Avoid areas of potential land contamination  
▪ Maximise length of existing highway able to be utilised |
| **Evaluation Objectives from Draft Scoping Guidelines** | |
| Avoid or minimise effects on species and ecological communities | ▪ Area and quality of native vegetation to be removed  
▪ Impacts on habitat integrity/fragmentation |
| Avoid or minimise disruption and other adverse effects on infrastructure, land use, households and road users | ▪ Number of railway crossings  
▪ Impact on utility services with high cost for relocation  
▪ Extent and impact of change to existing and future land use (consistency with applicable planning policies)  
▪ Approximate number of dwellings affected by full or partial acquisition  
▪ Approximate number and significance of businesses (including agricultural) affected by full or partial acquisition  
▪ Approximate area of land to be acquired  
▪ Approximate area of public open space either directly impacted (required) or indirectly impacted (located nearby).  
▪ Approximate number and size of linkages irreversibly severed  
▪ No introduction of significant barrier(s) to movement within communities |
| Protect Aboriginal and non-Aboriginal cultural heritage | ▪ Number of listed European cultural heritage sites requiring removal or impacted  
▪ Number of listed Aboriginal cultural heritage sites requiring removal or impacted |
| Avoid or minimise noise, visual and other amenity effects | ▪ Approximate number of sensitive receptors within 250m of route alignment |
| Protect catchment values, surface water and groundwater quality, stream flows and floodway capacity | ▪ Approximate number of waterway crossings  
▪ Length of road in areas subject to inundation (potential impact on flooding potential)  
▪ Potential for interception of water table |
| Provide for long-term management of retained native vegetation and habitat areas within and adjacent to the road | ▪ Area of native vegetation and habitat protected within road reserve and adjacent land as percentage of total vegetation and habitat currently present |
### Table 5-6 Impacts Rating Table

<table>
<thead>
<tr>
<th>Potential Project Benefits</th>
<th>Rating Colour Code</th>
<th>Potential Project Disbenefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant benefit to the State</td>
<td>VERY WELL 3</td>
<td></td>
</tr>
<tr>
<td>Superior benefit to the region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy consistency with superior positive impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate benefit to the State</td>
<td>WELL 2</td>
<td></td>
</tr>
<tr>
<td>Significant benefit to the region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superior benefit to the locality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy consistency with significant positive impact</td>
<td>MODERATELY WELL 1</td>
<td></td>
</tr>
<tr>
<td>Moderate benefit to the region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant benefit to the locality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy consistency with moderate positive impact</td>
<td>MODERATELY POOR -1</td>
<td></td>
</tr>
<tr>
<td>Localised minor benefits for some local areas or individuals</td>
<td>PARTIAL</td>
<td></td>
</tr>
<tr>
<td>(Phase 2 assessment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal benefit at any level</td>
<td>NEGLIGIBLE 0</td>
<td>Minimal disbenefit at any level</td>
</tr>
<tr>
<td></td>
<td>LOW</td>
<td>Localised minor impact for some local areas or individuals (Phase 2 assessment)</td>
</tr>
<tr>
<td></td>
<td>MODERATELY POOR -1</td>
<td>Moderate disbenefit to the region</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Significant disbenefit to the locality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Policy inconsistency with moderate negative impact</td>
</tr>
<tr>
<td></td>
<td>POOR -2</td>
<td>Moderate disbenefit to the State</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Significant disbenefit to the region</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe disbenefit to the locality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Policy inconsistency with significant negative impact</td>
</tr>
<tr>
<td></td>
<td>VERY POOR -3</td>
<td>Significant disbenefit to the State</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe disbenefit to the region</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Policy inconsistency with severe negative impact</td>
</tr>
</tbody>
</table>
### 5.3.4 Result of Phase 1 Assessment

As a result of the Phase 1 Assessment, a number of options within each of the zones were eliminated from further consideration. Table 5-7 details the rationale for elimination of options from further assessment as part of Phase 2 assessment. It is noted that all options within Zone 1 were carried through into Phase 2. However, some Options within in Zones 2, 3 and 4 were eliminated.

### Table 5-7 Rationale for eliminated options in Phase 1

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Reason for elimination</th>
</tr>
</thead>
</table>
| 2C     | - Poor rating for avoiding or minimising disruption and other adverse effects on infrastructure, land use, households and road users  
        - Moderately poor rating for avoiding or minimising effects on species and ecological communities  
        - Moderately poor rating for minimising construction and acquisition costs  
        - Moderately poor rating for maximising use of existing highway |
| 2G     | - Poor rating for avoiding or minimising disruption and other adverse effects on infrastructure, land use, households and road users  
        - Poor rating for minimising construction and acquisition costs  
        - Moderately poor rating for reducing travel time  
        - Moderately poor rating for avoiding or minimising effects on species and ecological communities  
        - Moderately poor rating for avoiding or minimising noise, visual and other amenity effects  
        - Moderately poor rating for maximising use of existing highway |
| 3A     | - Poor rating for avoiding or minimising effects on species and ecological communities  
        - Poor rating for avoiding or minimising disruption and other adverse effects on infrastructure, land use, households and road users  
        - Poor rating for protecting cultural heritage  
        - Moderately poor rating for avoiding or minimising noise, visual and other amenity effects |
| 3B     | - Poor rating for avoiding or minimising effects on species and ecological communities  
        - Poor rating for avoiding or minimising disruption and other adverse effects on infrastructure, land use, households and road users  
        - Moderately poor rating for avoiding or minimising noise, visual and other amenity effects  
        - Moderately poor rating for maximising construction and acquisition costs |
| 3D     | - Poor rating for minimising construction and acquisition costs  
        - Moderately poor rating for avoiding or minimising effects on species and ecological communities  
        - Moderately poor rating for avoiding or minimising disruption and other adverse effects on infrastructure, land use, households and road users  
        - Moderately poor rating for avoiding or minimising noise, visual and other amenity effects  
        - Moderately poor rating for maximising use of the existing highway |
| 3F     | - Poor rating for improved travel time  
        - Moderately poor rating for improved safety as the current highway does not meet AMP1 design standards  
        - Poor rating on impact on species or ecological communities compared to options further away  
        - Moderately poor for engineering requirements associated with the crossing of the railway line in this location |
| 4D     | - Poor rating for avoiding or minimising disruption and other adverse effects on infrastructure, land use, households and road users  
        - Poor rating for minimisation of construction and acquisition costs  
        - Poor rating for maximising use of existing highway  
        - Moderately poor rating for complementing future bypass of Ararat  
        - Moderately poor rating for protecting cultural heritage  
        - Moderately poor rating for avoiding or minimising noise, visual and other amenity effects |
5.4 Phase 2: Shortlisting of Alignment Options

Phase 2 involved a more detailed assessment of the shortlisted options identified in Phase 1 to enable the selection of a preferred alignment. The Phase 2 assessment was based on the maximum likely construction footprint and assumed divided rural highway AMP3 requirements would be accommodated within the freeway AMP1 (maximum construction) footprint.

A similar ranking process to that of Phase 1 was used for the rapid assessment, however a more detailed ratings table (shown in Table 5-6) and evaluation framework were adopted for Phase 2 (refer to Options Assessment Report in Technical Appendix B).

Options were rated to be either better than or worse than the base case (‘no project’) in relation to the evaluation criteria. This approach avoids discrepancies that can occur when rating options relative to each other. Specific methodologies adopted for this refinement of options selection are detailed in Section 5.4.5 for each technical area. The outcomes of the Phase 2 assessment are further documented in the Options Assessment Report in Technical Appendix B.

5.4.1 Assessment of Zones

As part of the Phase 2 Assessment, Zone 1 and Zone 3 were further divided into subzones to allow for more detailed comparison of options across defined areas, such as the bypass of Buangor. Accordingly, the Phase 2 Assessment considered and analysed six zones within the Section 2 Project Area. Table 5-8 outlines the conversion of the previous four zones to six zones.

It is noted the physical start and conclusion of each zone does not directly align between the long list and shortlist, but provides a general indication of where each zone is physically located. The six zones are outlined in Sections 5.5.1 to 5.5.6.

Table 5-8  Zone conversion from long list to shortlist

<table>
<thead>
<tr>
<th>Long List Zone (Phase 1)</th>
<th>Physical Description</th>
<th>Shortlist Zone (Phase 2)</th>
<th>Physical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>Beaufort to Eurambeen - Streatham Road</td>
<td>Zone 1</td>
<td>Beaufort to Box's Cutting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zone 2</td>
<td>Box's Cutting to Waldron's Road</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Eurambeen-Streatham Road to Charliecombe Road</td>
<td>Zone 3</td>
<td>Waldron's Road to Charliecombe Road / Peacocks Road</td>
</tr>
<tr>
<td>Zone 3</td>
<td>Charliecombe Road to Langi Ghiran Track</td>
<td>Zone 4</td>
<td>Charliecombe Road / Peacocks Road to Pope Road</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zone 5</td>
<td>Pope Road to Langi Ghiran Track</td>
</tr>
<tr>
<td>Zone 4</td>
<td>Langi Ghiran Track to Heath Street, Ararat</td>
<td>Zone 6</td>
<td>Langi Ghiran Track to Heath Street, Ararat</td>
</tr>
</tbody>
</table>

5.4.2 Assumed Design Considerations

For the purpose of undertaking the Phase 2 assessment, the following assumptions were made regarding the design of the shortlisted options:

- The duplicated Western Highway would be designed for a 110km/h posted speed limit.
- Where sections of the preferred alignment utilise the existing highway, the existing bi-directional road would be converted to a single direction, and a new parallel carriageway would be constructed to serve traffic travelling in the other direction.
- Construction corridor was assumed to be approximately 40m wide for a new carriageway where the existing highway would be utilised for one carriageway.
- Where the Project involves construction of two new carriageways, a construction corridor of 80m would be required. This width was allocated in order to accommodate a wide median to allow for turning of B Double trucks at intersections under AMP3 highway conditions, and to achieve an appropriate level of clear zone associated with road side objects. In cases where this was considered, it was assumed that the existing roadway would be retained and operate as a two-way local access road.
5.4.3 Community Consultation on Shortlisted Options
The assessment of shortlisted options commenced with consulting the community, with public meetings held in Buangor to establish their values and views on the shortlisted options. Community meetings were held in Buangor on 13 July 2011, at Beaufort on 16 July 2011 and Ararat on 14 July 2011. The meetings were advertised in an Information Bulletin which was posted to the surrounding area and notices were placed in local newspapers.

Alignment alternatives were presented, by way of a public display, to provide information on the route options and provide the community with the opportunity to ask questions and provide feedback.

Further detail of the community information sessions and feedback received is provided in Chapter 7 (Community and Stakeholder Engagement).

5.4.4 Assessment Criteria
In Phase 2, the evaluation criteria were refined for each of the Project Objectives and Evaluation Objectives, considering relevant legislation and policies (refer Table 5-9).

The criteria addressed the following disciplines:

- Planning and Land Use
- Cultural Heritage
- Traffic and Transport
- Air Quality
- Soils and Geology
- Noise
- Groundwater
- Visual and Landscape
- Surface Water
- Social
- Biodiversity and Habitat
- Economics

Estimated construction costs were only considered where the options could not be differentiated in other respects. Each option was rated against the evaluation criteria using the ratings table shown in Table 5-6.

Table 5-9  Phase 2 Evaluation Objectives and Evaluation Criteria

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Evaluation Criteria</th>
<th>Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>To avoid or minimise effects on species and ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) and/or the Flora and Fauna Guarantee Act 1988 (Vic)</td>
<td>Extent of impacts to matters of National Environmental Significance (NES). Extent of impacts to species, communities and processes listed under the Flora and Fauna Guarantee Act 1988 (FFG Act).</td>
<td>Flora and Fauna</td>
</tr>
<tr>
<td>To comply with requirements and best meet the objectives of ‘Victoria’s Native Vegetation Management – A Framework for Action’ and to minimise impacts on wildlife corridors.</td>
<td>Net gain requirements for removal of native vegetation. Extent of impact to native habitat and vegetation which is of very high conservation significance. Extent of impact on wildlife corridors (considering extent, connectivity and known species records).</td>
<td>Flora and Fauna</td>
</tr>
<tr>
<td>To protect Aboriginal and non-Aboriginal cultural heritage</td>
<td>Extent of impact on registered and potential Victorian Aboriginal Heritage Register (VAHR) places excluding mortuary trees and burnt mounds. Impact on registered and potential mortuary trees and burnt mounds (VAHR places). Impact on registered and potential Victorian Heritage Inventory (HI) places, local planning schemes Heritage Overlay (HO) places, Victorian Heritage Register (VHR) places and other Historical Heritage Registers.</td>
<td>Cultural Heritage (Aboriginal and Non-Aboriginal)</td>
</tr>
<tr>
<td>To avoid or minimise disruption and other adverse effects on infrastructure, land use (including agriculture and residential) and households, as well as road users during construction and/or resulting from the highway alignment.</td>
<td>Extent of impact on major utility services. Extent and impact of change to existing land use (consistency with applicable planning policies). Extent and impact of change to future land use (consistency with applicable planning policies).</td>
<td>Planning and Land Use</td>
</tr>
<tr>
<td></td>
<td>Extent of impact on access, mobility, social severance. Extent of impact of the full or partial acquisition of properties. Impacts from dislocation effects. Extent of impacts from amenity changes. Extent of impacts on community facilities. Community Context: The expressed concerns of local people.</td>
<td>Social</td>
</tr>
<tr>
<td></td>
<td>Number and significance of businesses (including agricultural) affected by full or partial acquisition. Extent of impact on accessibility for industry and tourism opportunities. Extent of impact on rail operations during construction.</td>
<td>Economic</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Evaluation Criteria</td>
<td>Discipline</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Extent of impact on road safety. Travel times for road users during construction phase and consideration of impact on rail users. Impact on travel times for road users during operation phase. Degree to which AMP3 design (with provisions for upgrade to AMP1) requirements are met.</td>
<td>Traffic and Transport</td>
<td></td>
</tr>
<tr>
<td>To minimise noise, landscape, visual and other adverse amenity effects on the environment and local residents during the construction and operation of the proposed duplicated highway to the extent practicable.</td>
<td>Visual and Landscape</td>
<td></td>
</tr>
<tr>
<td>Extent of impact upon the visual amenity of adjacent residents. Extent of visual impact upon townships and places of cultural and natural value. Extent of impact on sensitive landscape character types. Distances from dwellings and other sensitive receptors (e.g. schools) to road alignment for each option. Extent of impact of construction dust on sensitive receptors within close proximity to the road. Extent of impact of emissions into the atmosphere as a measure of potential contribution to regional load of air pollutants. Predicted impact of vehicle emissions on sensitive receptors within a minimum distance as evaluated by AusRoads using expected, indicative traffic emissions and sectional meteorology.</td>
<td>Noise Air Quality</td>
<td></td>
</tr>
<tr>
<td>To protect catchment values, surface water and groundwater quality, stream flows and floodway capacity, as well as to avoid impacts on protected beneficial uses.</td>
<td>Surface Water</td>
<td></td>
</tr>
<tr>
<td>Extent of potential impact to waterway value taking into account the following: Beneficial uses of the waterway. No. of waterway crossings and effective footprint area of waterway affected. Status of river health of the catchment system (including downstream receiving waterway). Status of river health (local scale e.g. bank condition, in-stream features). Potential to increase flooding risk taking into account the following: Effective width of floodplain (measured by 100 year flood extent). Complexity of floodplain interactions. Extent of impact of gross contamination from historic land use (including historic landfills), and potential cost of works. Extent of exposure to watercourse embankments and river beds (potential triggers for erosion/instability criteria). Extent of potential impact of poor soils and / or topographic location on road construction or operation activities (unstable, low strength subgrades, wet or poor draining areas). Extent of potential impacts (decline/deterioration) to groundwater quality and implications for beneficial uses. Extent of disruption of groundwater flow (recharge, discharge) i.e. flow paths, availability (for users, environment). Potential for alteration of groundwater levels.</td>
<td>Soils and Geology Groundwater</td>
<td></td>
</tr>
</tbody>
</table>

### Technical Studies

This Section presents a summary of the assessment approach for each technical impact assessment study undertaken to inform Phase 2 of the options assessment. The outcome of the assessments is presented in Section 5.5.

#### 5.4.5.1 Planning and Land Use

Each alignment option was assessed with regard to land use and planning conditions. This involved consideration of:

- Relevant Planning Schemes (Pyrenees and Ararat)
- Aerial photography and infrastructure servicing mapping, considering policy directions contained within the relevant planning scheme at a local and state level, particularly those relating to urban growth and land use change

- Current and future land uses and development supported by the zoning and overlay controls in the relevant planning scheme
- Discussions with Council Planners
- Copies of current Planning Permit Applications lodged with Council
- Observations from site inspections.

The impact on utility services was evaluated by considering whether a highway crossing or infrastructure relocation was necessary, or if relocated, could be accommodated within the new road reserve. It was assumed that linear assets would need relocation to the edge of the new road reserve if the alignment option impacted a length of utility greater than 200m. Extended lengths requiring relocation were considered to be significant
impacts due to land acquisitions associated with protecting maintenance access.

The alignment options were considered in relation to existing and future potential land uses, and the extent and impact of any change was assessed by evaluating consistency with applicable planning policies. The proportion of properties to be acquired, and how the acquisition would affect land use was relevant. The impact significance was influenced by the type of use of the part of the property affected, and the proportion of the property to be acquired. Severance and fragmentation issues were considered in the context of potential impact on land productivity.

5.4.5.2 Traffic and Transport
The following factors were considered to assess each alignment option against the evaluation criteria:

- Extent of impact on road safety
  Consideration was given to the ability of the alignment options to reduce the risk of casualty crashes occurring, compared to the existing highway. This was done with regard to identified existing road safety concerns established using crash histories. The estimated road geometry and sight distances of the alignment options were relevant.

- Travel times for road users during construction phase and consideration of impact on rail users

The impact on road user travel times was informed by considering the significance of likely construction activities on the existing carriageway and the rail line, with any opportunity for staging construction.

- Impact on travel times for road users during operation phase
  The objective of this criterion was to consider the impact to highway travel times during the operation phase, when the highway speed limit is expected to be 110km/h, additional capacity is provided and existing overtaking constraints are removed. The change in travel time was considered cumulatively for all vehicles that are expected to use the upgraded Western Highway.

- Degree to which AMP3 – divided rural highway design – design (with provisions for upgrade to AMP1 – freeway) requirements are met
  The ability of the alignment options to be consistent with the Performance Objectives, Standards and Principal Characteristics of VicRoads AMP3, while allowing for upgrade to AMP1 in the future, was assessed. Relevant considerations included the level of control over site access points, intersection spacing, crossing movements and vehicle turns such as U-turns controlled by medians and median breaks, and turning lanes separated from through lanes, where warranted.
5.4.5.3 Soils and Geology
A desktop review was undertaken to ascertain the existing soil and geological conditions and potential for contamination within the study area. The assessment against relevant criteria involved a review of:

- Historical aerial photographs of the area to assist in establishing the physical patterns of development over time. Historic agricultural, commercial, industrial or waste disposal land uses indicate potential land contamination.
- Publically available literature and geotechnical information relevant to the study area.
- Relevant available borehole, test pit and other geotechnical data.
- Development of a preliminary geological and geotechnical model of the study area.
- A preliminary acid sulphate soil hazard assessment.

5.4.5.4 Groundwater
The groundwater assessment of alignment options focused on areas which were likely to be significantly below grade (natural surface level) and therefore had potential to interact with the groundwater system. Whilst areas above grade can result in impacts to groundwater, these are considered a lower risk and can generally be mitigated using a number of common engineering design and construction techniques. Areas above grade, or shallow cuts (generally less than 4m) were considered to have negligible impacts.

From a regional perspective, the groundwater resources are generally considered to be low yielding and of poor quality (saline), and this has resulted in limited development of groundwater, apart from the occasional stock bore.

5.4.5.5 Surface Water
An assessment of potential impacts on waterway ecological values was made based on existing waterway data, the DSE Index of Stream Classification and aerial photography. For the four major waterway crossings, this was supplemented by a site inspection. The following features at each waterway crossing were taken into account:

- Size of footprint
- Bank and channel condition
- In-stream features
- Riparian habitat
- Floodplain condition and features.

The potential implications for flood risk were estimated by considering modelling undertaken by Bonacci Water Ltd (June 2012) to estimate the 100 year average recurrence interval flood.

5.4.5.6 Biodiversity and Habitat
The extent that the options affect matters of National Environmental Significance (NES) was established using the likely presence of flora and fauna species or communities listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) within the assumed construction corridor for each option. Similarly, species, communities and processes listed under the FFG Act were used to establish the impact on significant matters at the State level.

The impact to native habitat and vegetation of very high conservation significance was assessed using preliminary Net Gain calculations and estimates of the number of Large Old Trees potentially impacted. Impacts to wildlife corridors were based on the extent impacted, their connectivity and known species records. The assessment against criteria involved a review of:

- Net Gain requirements
- Extent of impact to native habitat and vegetation which is of very high conservation significance
- Extent of impacts to matters of NES
- Extent of impacts to species, communities and processes listed under the FFG Act
- Extent and impact on wildlife corridors (considering extent, connectivity and known species records).

5.4.5.7 Historic and Cultural Heritage
A risk-based approach was adopted by identifying areas with low, medium or high potential for presence of both Aboriginal and non-Aboriginal values. This considered both known sites based on registered places, and predicted sites and places based on environmental features and cultural values which could have influenced historic Aboriginal occupation.

To model predicted areas of Aboriginal cultural heritage, the Victorian Aboriginal Heritage Register (VAHR) and geological and environmental spatial...
datasets were combined with findings from a review of archaeological reports and local Aboriginal community consultation. The model was based on the following assumptions:

- All landforms within 200m of waterways may be sensitive for Aboriginal cultural heritage (as specified in s. 23 of the Aboriginal Heritage Regulations 2007).
- The potential for historic Aboriginal occupation areas such as camp sites is considerably lower on steeply sloping ground compared to level ground.
- Vegetation structure established through an Ecological Vegetation Class (EVC) dataset reflects potential greater resource availability, and therefore an increased likelihood of Aboriginal occupation.
- Geology is an indicator of resource availability, correlated with the likelihood of encountering quarry sites for the manufacture of stone tools, and for influencing the historic distribution of flora and fauna resources.
- The potential for Aboriginal Mortuary Trees to be present in the project area. A Mortuary Tree is the location of a secondary ‘burial’ of human remains. Trees aged greater than 250 years are potential burial sites and therefore preference is for options where these old trees are avoided.

The cultural values as expressed by the Wathaurung and Martang communities were represented spatially. This was instrumental for assessing the pattern of past human occupation across the landscape, and continuing cultural relevance. Traditional cultural knowledge and scientific knowledge were able to be examined concurrently to better inform decisions for the Options Assessment.

The potential impact on registered and potential non-Aboriginal Cultural (Historical) Heritage was established following a ground truthing survey of previously registered historic places within the study area, undertaken in September 2011. The following registers were consulted prior to the field examination:

- Victorian Heritage Register
- Victorian Heritage Inventory
- Register of the National Estate
- Commonwealth Heritage List
- National Heritage List
- Planning Scheme Heritage Overlays
- The National Trust List.

5.4.5.8 Air Quality

Road projects generate two types of air quality impacts: dust and other minor emissions due to construction activity, and vehicle emissions dispersing away from the running lanes during operation. When comparing a Project option with the ‘no project’, operational traffic emissions can be considered to be always better with the Project proceeding due to smoother traffic flow and construction emissions would always provide a worsening impact compared to a ‘no project’.

The risk and significance of impacts decreases with increasing distance from the source. To evaluate construction dust the number of sensitive receptors (in this case dwellings) within 15m, 80m, 100m and 200m respectively from the construction area was counted for each option, and a weighting factor was applied to rank closer receptors as having higher risk of exposure.

To evaluate operational impacts, Austroads criteria were used to define distances from the road where the objectives in the State Environmental Protection Policy (Air Quality) might not be met.

The contribution to the regional load of air pollutants was assessed as the total amount of pollutants released into the atmosphere over the alignment length. All options would be an improvement on existing conditions due to better traffic flow with dual carriageways.

5.4.5.9 Noise

Background noise levels were measured at a sample of existing dwellings located in close proximity to the highway using a combination of unattended noise loggers and attended noise measurements. The noise disturbance criterion was assessed by reviewing each option against the presence and number of sensitive receptors (dwellings) within 15m, 15-50m, 50-120m, and 120-200m. Each of these bands was assigned a magnitude weighting, with the highest being those closest to the highway. The same process was undertaken for the existing highway in order to provide a comparison to the ‘no project’.

Whilst construction noise was not specifically modelled it was considered that the indicators (buffer distances) for operational noise are a suitable proxy for construction noise.

5.4.5.10 Visual and Landscape

The assessment was informed by a site inspection from publicly accessible locations, and a review of aerial photography and topographic information. The following was considered to assess each alignment option against the evaluation criteria.

The extent of impact on adjacent residents was estimated by quantifying the number of households within 500m to the option, and those within 150m proximity. The number of houses within each distance zone was used as an indicator of potential impact.

The extent of visual landscape change from townships, vistas and places of cultural and natural value was assessed based on proximity, level of
significance of the place of natural or cultural value, the size of any township, and visual prominence.

Landscape character types were identified, and the capacity of each to absorb the visual change from the Project established based on an estimate of the percentage of the character type altered, and the sensitivity of the character type to visual change. The “Bushland” and “Mountain bushland” landscape character types were considered to have high landscape sensitivity, whereas the “Existing Highway” and “Vegetated Plantations” were considered to have a very low landscape sensitivity and therefore, considered to be resilient to change.

5.4.5.11 Social
A sound understanding of the current conditions and social factors that apply to a study area encompassing the existing Western Highway and local roads was established through the following:

- Site visits to the area, including attendance at community information sessions and Council meetings, and meeting with several affected landowners and to understand the physical environment impacted by the alignment options;
- Review of the community feedback collected informally at the public information displays and provided later through feedback forms and records of VicRoads contacts with affected landowners, as well as feedback provided through stakeholder interviews;
- Review of the information collected on the location of community services and facilities;
- Review of the social policy data collected during for the existing conditions report; and
- Consideration of the number of properties potentially severed by each option and the number of houses potentially affected, either by acquisition or amenity impacts.

The following was considered to assess each alignment option against the evaluation criteria.

- Extent of impact on access, mobility and severance.
  Each option was assessed based on whether it would create barriers to access adjacent properties, whether it would increase travel times for landowners and whether any property severance was severe enough to create a negative social impact. This was based on the basic assumptions made with regard to access and intersections. The locations of median breaks were not identified for shortlisted options so these were not considered.

- Extent of impact of the full or partial acquisition of properties.
  Each option was assessed based on the anticipated community impacts of full or partial acquisition of properties.

- Impacts from dislocation effects.
  Each option was assessed based on whether it may lead to a dislocation impact for the landowner. This was a qualitative assessment based on the options maps and data on the number of houses within 50m and 100m distances respectively from each option.

- Extent of impact from amenity changes.
  Each option was assessed based on its potential to lead to negative effects on the amenity of adjacent properties. However, this criterion was not rated in the options assessment matrix because the components of amenity impacts are covered in individual ratings for air, noise, landscape and transport criteria.

- Extent of impacts on community facilities.
  Each option was assessed based upon its impact on facilities for the local or broader community.

- Community context – the expressed concerns of the local people.
  Each option was assessed based on the community response from the landowner information sessions and feedback forms. This was a preliminary qualitative assessment which was intended to reflect the community response to each option. Community consultation is described in more detail in Chapter 7 (Community and Stakeholder Engagement).

5.4.5.12 Economic
The economic assessment was informed by existing information, aerial imagery and outcomes from community consultation, discussions with council officers, and some affected landowners.

The following was considered to assess each alignment option against the evaluation criteria.

- Number and significance of businesses affected by full or partial acquisition.
  To assess this criterion the direct land loss, degree of severance, relationship to allotment and tenement boundaries, and effects on infrastructure was considered. Agricultural, tourism and commercial sites were assessed on whether land loss would be a disbenefit or benefit to the viability of the affected businesses.

- Impact on accessibility for industry and tourism opportunities.
  Consideration was given to ownership patterns of allotments within the study area, planning zones (industrial or business), and the importance of the site, or tourist destination as identified in local economic and tourism development plans and strategies.
  Accessibility impacts were established by considering townships within the study area,
particularly those that would be bypassed by an option. Highway visibility was relevant as some businesses rely on highway trade, and a reduction is likely to affect the impetus or impulse of a customer to access a site as well as accessibility itself.

Impact on Rail Operations during Construction.
Disruption is likely to occur only where an option involves work in the rail corridor, taking into account any disrupted passenger movements affecting the locality, region or the State. Potential for the greatest impact is work involving new railway crossings.

5.5 Outcomes of Phase 2 Options Assessment
This section outlines the outcomes of phase 2 of the alignment options assessment and recommended options within each zone.

5.5.1 Zone 1: Beaufort to Box’s Cutting
Zone 1 contained two options for assessment (1A and 1B) and extended from the railway line crossing west of Beaufort to Box’s Cutting.

Options 1A and 1B were assessed as having a similar overall rating. During the Risk Workshop, the options were assessed as being identical for all criteria other than for some flora and fauna, social and economic criteria (Refer to Appendix O for the Environmental Risk Report).

On balance, Option 1B was selected due to social and economic impacts on the large agricultural landholdings along the northern boundary, and because it utilised the existing highway.

The two options rated similarly from the perspective of potential impacts on flora and fauna except that Option 1B was assessed as having slightly higher negative impacts on species and communities listed under the FFG Act and on wildlife corridors than Option 1A. However, it was discussed with specialists that the total losses of native vegetation are conservatively high for both options due to a large proportion of the remnant vegetation being located adjacent to the existing road and included in the area of vegetation which could be lost.

The shortlisted and recommended option in Zone 1 are shown in Figure 5-7.

Figure 5-7 Zone 1 shortlist and recommended alignments

5.5.2 Zone 2: Box’s Cutting to Waldrons Road
Zone 2 comprises two options for assessment (2A and 2B).

A summary of the assessment against key aspects is discussed in the following paragraphs. A combination of Option 2A and Option 2B was recommended as the preferred option for Zone 2. The recommended alignment involves Option 2A from the eastern end of Zone 2 to Fiery Creek, where the alignment crosses over to Option 2B from there to the western end of Zone 2. Option 2B was assessed as having the lower overall negative impacts of the two shortlisted options which were assessed for Zone 2.

Option 2B has slightly higher negative impacts on some categories of flora and fauna value (potential impacts on EPBC Act and FFG Act listed communities – being Plains Grassland predominantly located in the vicinity of the Eurambeen-Streatham Road intersection) than Option 2A. However, Option 2B has lower negative impacts on social values (due to the likelihood of significant impacts on two houses in that part of the zone west of Fiery Creek compared with the likelihood of significant impacts on four houses for Option 2A). The recommended combination of 2A and 2B reduces the impacts on native grassland of Option 2B whilst having the reduced impact on houses that 2B provides.

The differences in potential flora and fauna impacts of the two options are not significant, except that Option 2B has higher potential impacts on the Plains Grassland EVC in the central part of the zone (primarily east of Fiery Creek). However, the
position of large old trees in the western part of the zone (west of Ferntree Gully Road) provides potentially greater impacts for Option 2A than Option 2B. Therefore, a combination of Option 2A at the eastern end of the zone (to around Fiery Creek) and Option 2B at the western end of the zone would have potential for lower impacts on native vegetation and habitat than each of the options singularly.

The recommended option for Zone 2 is a combination of Option 2A and 2B. It starts as Option 2A (up to Fiery Creek) because it has less potential impact on EPBC and FFG listed communities. Option 2B is recommended from Fiery Creek because it has less social impacts by avoiding impact to more houses than Option 2A.

The shortlisted and recommended option in Zone 2 are shown in Figure 5-8.

Figure 5-8 Zone 2 shortlist and recommended alignments

5.5.3 Zone 3: Waldrons Road to Charliecombe Road/Andersons Road

Zone 3 (Waldrons Road to Charliecombe Road/Andersons Road) has two options for assessment. A summary of the assessment against key aspects is discussed in the following paragraphs.

Option 3A was recommended as the preferred option for Zone 3. This option was assessed as having the lower overall negative impacts of the two shortlisted options which were assessed for Zone 3.

Option 3A would have a greater impact on native vegetation and habitat than Option 3B (specifically, ‘low’ compared with ‘negligible’ impacts in relation to impacts on communities listed under the EPBC Act and FFG Act and on wildlife corridors). However, it was identified that there is potential for significant reduction of impacts for Option 3A by relatively minor realignment of the proposed new carriageway further into adjacent cleared land. This may have some impact on vegetation within Woodnaggerak Bushland Reserve; however the vegetation alongside the road frontage is of lower significance than the vegetation further within the reserve.

Option 3B would have higher negative impacts on land use, social, economic and visual values than Option 3A because Option 3B would involve a new highway alignment which severs several farm properties to the south of the existing highway. It therefore would have consequent economic and social impacts and local residents provided a negative response to this option in the community information session on shortlisted options. Option 3B has higher potential negative impacts on surface water values because it extends alongside a watercourse for part of its length.

Option 3A was recommended in Zone 3 because it has lower potential social, economic, visual and cultural heritage impacts. Whilst Option 3A intersects a strip along the front of Woodnaggerak Reserve, which has significant flora and fauna values, it results in less land severance and social impacts so it is recommended over Option 3B.

The shortlisted and recommended option in Zone 3 are shown in Figure 5-9.
5.5.4 **Zone 4: Charliecombe/Andersons Road to Pope Road (including the bypass of Buangor)**

Zone 4 (Andersons Road to Pope Road) comprises four Options for assessment. A summary of the assessment against key aspects is discussed in the following paragraphs.

Rather than selecting a single recommended alignment, two of the four shortlisted options for Zone 4, Options 4B and 4D, were selected for further assessment as alternative alignment options.

Whilst Option 4C (not recommended for further assessment) is the highest ranked of the options for Zone 4 overall, it has a similar overall score to Option 4B and connects with the same options in Zone 5 (5A and 5B). Option 4C has not been selected primarily because it has higher potential impacts on vegetation and habitat of very high conservation significance than Options 4B and 4D (the other options involving a northern bypass of Buangor).

Options 4B, 4C and 4D have potential for higher overall impacts on flora and fauna than Option 4A as they potentially all impact on remnant woodland areas to the north of Buangor. Option 4D has lower potential net gain requirements than Options 4B and 4C as it does not impact on roadside vegetation to the west of Buangor. However, the total losses of native vegetation are conservative for each of Options 4B, 4C and 4D because it is possible to significantly reduce the amount of vegetation loss by shifting the alignment of each option a relatively short distance laterally. By contrast, it is not possible to reduce the impacts of Option 4A because the railway line and township are immediately to the north and land further to the south similarly contains a high number of large old trees.

Option 4A, the only option involving a southern bypass of the town of Buangor, has the lowest overall score of the options for Zone 4, because it has the highest impacts on potential Aboriginal cultural heritage values due to potential mortuary trees and burnt mounds, and social values due to impact on access, mobility and social severance. Option 4A also had 'moderately poor' impacts for land use, surface water and geology and soils.

Options 4B and 4D have been recommended in Zone 4 because they have lower potential cultural heritage, social, land use, surface water and geological impacts than Option 4A. Options 4B and 4D also have lower potential flora and fauna impacts than Option 4C.

The shortlisted and recommended options in Zone 4 are shown in Figure 5-10.
5.5.5 Zone 5: Pope Road to Langi Ghiran Track

Zone 5 extends from Pope Road to Langi Ghiran Track, near the eastern end of Hillside Road, and had three options for assessment. A summary of the assessment against key aspects is discussed in the following paragraphs.

All of the three shortlisted options for Zone 5 - Options 5A, 5B and 5C - have been selected for further assessment as alternative alignment options. Alternative alignment options have been selected for each of Zones 4, 5 and 6 primarily because the option with the lowest overall negative impacts for each of these zones does not connect with the similarly ranked option for the adjoining zones. Options 5A, 5B and 5C have been selected primarily because each of these options are required to connect the combinations of the options recommended for being taken forward for Zone 4 (Options 4B and 4D respectively) and Zone 6 (6A and 6C respectively). There is little difference between the overall scores for each of the Options 5A, 5B and 5C and apart from risk of impact to Aboriginal cultural heritage (rated as 'poor' for Options 5A and 5B), and no individual risks have been rated as higher than 'moderately poor'.

The potential impacts on flora and fauna are higher overall for Options 5A and 5C than Option 5B. However, the total losses from Plains Grassy Woodland and Alluvial Terraces Herb-rich Woodland EVCs adjacent to the existing highway are very conservative for Option 5A because it is possible to significantly reduce the amount of vegetation loss from these EVCs by shifting the alignment of this option a relatively short distance laterally. However, it is not possible to significantly reduce the impacts of Options 5B or 5C because they comprise longer sections of new road alignment which would need significant shifts to change impacts significantly.

Option 5C (new highway alignment along the southern side of the railway line) has the best overall score of the three options in Zone 5, primarily because it has the lowest risk of impact on Aboriginal cultural heritage (rated as 'moderately poor') and the lowest land use and economic impacts (being located alongside the railway line rather than through farming properties as with both Options 5A and 5B).

Option 5A has the worst overall score of the three shortlisted options, however this overall score is similar to that of the second ranked option (5B). It has the lowest overall rating for potential impact on vegetation and habitat of very high conservation significance; however this impact is rated as 'moderately poor' compared with 'low' for options 5B and 5C. It also has the lowest overall ranking for risk of impacts on cultural heritage values (because it has a higher risk of impact on potential Aboriginal mortuary trees and mounds than the other two options). However, Option 5A is ranked higher than Option 5B in relation to planning and land use impacts (because Option 5B has greater property severance impacts) and equally with Option 5B for most categories of impact.

All options in Zone 5 are recommended for further assessment in the EES process as they have comparable levels of potential impact and provide connectivity to the multiple options being assessed in Zones 4 and 6. Overall however, Option 5C has slightly less potential impacts to cultural heritage, land use and economic values than Options 5A and 5B.

The shortlisted and recommended options in Zone 5 are shown in Figure 5-11.
5.5.6 Zone 6: Langi Ghiran Track to Heath Street, Ararat

Zone 6 extends from the Langi Ghiran Track to Heath Street, Ararat. There were five options for assessment. A summary of the assessment against key aspects is discussed in the following paragraphs.

Options 6A and 6C have been selected for further assessment as alternative alignment options for Zone 6. These options are the first and fourth ranked options overall for Zone 6 and they connect with the first and third ranked options for Zone 5 (Options 5C and 5A respectively).

The potential impacts on flora and fauna are higher overall for Options 6A and 6B than Option 6C as they cut through an area comprising high to very high conservation significance Hills Herb-rich Woodland EVC, medium to high conservation significance Heathy Woodland EVC and high conservation significance Grassy Dry Forest EVC adjacent to Langi Ghiran State Park. Option 6C has lower potential impacts because it avoids impacts on most of this area of native vegetation adjacent to Langi Ghiran State Park. Options 6D and 6F have lower impacts than Option 6C because they run through farmland for a greater distance before re-joining the existing highway alignment. However, they both impact many large old trees and small patches of high conservation significance Grassy Dry Forest EVC in the farmland between the existing highway and Hillside Road. In addition, Option 6F involves a new crossing of the Hopkins River well away from the existing road crossing and in this respect, is likely to have higher impacts than the other options, all of which involve a new bridge alongside the existing bridge.

Option 6A has the lowest overall planning and land use, social and economic impacts of all the options. Both options connect with all options recommended for Zone 5.

The shortlisted and recommended options in Zone 6 are shown in Figure 5-12.

Figure 5-11 Zone 5 shortlist and recommended alignments
5.5.7 Final Alignment Options
The objective of the Phase 2 assessment was to identify a recommended option in each zone that, on balance, had the lowest potential impact. However in three zones there were multiple options which were comparable and therefore considered for further assessment.

The recommended options within each zone were connected to provide three complete alignment options that extended from the start to end of the project area. These were renamed as Options 1, 2 and 3 and were further assessed in Phase 3. The option are described in Table 5-10 and shown in Figure 5-13.

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
<th>Zone 4</th>
<th>Zone 5</th>
<th>Zone 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>1B</td>
<td>2A → 2B</td>
<td>3A</td>
<td>4B</td>
<td>5A</td>
<td>6C</td>
</tr>
<tr>
<td>Option 2</td>
<td>1B</td>
<td>2A → 2B</td>
<td>3A</td>
<td>4D</td>
<td>5C</td>
<td>6A</td>
</tr>
<tr>
<td>Option 3</td>
<td>1B</td>
<td>2A → 2B</td>
<td>3A</td>
<td>4B</td>
<td>5B</td>
<td>6A</td>
</tr>
</tbody>
</table>

5.6 Phase 3: Environmental Risk Assessment
In January 2012, an Environmental Risk Assessment Workshop was held with specialists to identify potential risks associated with the three alignments identified in Phase 2 and to help inform and refine a final alignment.

As many environmental risks are difficult to quantify, a semi-quantitative risk assessment was undertaken. This means that risks have been quantified where possible, however if that is not possible without significant assumptions, then a qualitative assessment has been made by relevant technical specialists.

The scope of the risk assessment included construction and operational risks of the Project in relation to social, environmental and economic values on both a local and regional scale. The risk assessment did not consider risks of project delays or reputational, financial or organisational effectiveness risks posed to VicRoads or the contractor(s) managing or undertaking the project.

An initial risk assessment was undertaken for each impact pathway as identified by specialists for each of the three alignment options for Section 2. This initial rating assumed implementation of the standard VicRoads environmental management procedures and design measures. After each risk was assigned a rating, proportional management and mitigation measures were developed. The risk rating was then re-evaluated, taking into account the additional management and mitigation measures, to identify the residual risk from the Project.

Once a preliminary risk register was completed by each technical specialist, a risk workshop was held to discuss the key risks. This workshop allowed technical specialists from each discipline to collectively discuss risks which were interrelated.

The difference between alignment options was discussed with specialists during the workshop. Option 1 was preferred by the traffic, flora and fauna, social, and soils and geology specialists. Option 2 was only preferred by the surface water and economic specialists.
As a result of the outcomes from the Environmental Risk Workshop, it was decided that both Option 1 and Option 2 would be considered for refinement and incorporation into the EES.

Following the risk assessment, Options 1 and 2 were deemed to have less impacts than Option 3, and were therefore carried through into the EES.

The risk assessment is presented in a report appended to the EES (refer Technical Appendix Q).

**5.7 Refinement of Alignments Post Risk Assessment Workshop**

Following the Environmental Risk Workshop it became clear that further micro alignments were required to reduce the impacts of both Option 1 and Option 2.

The refinements were applied along the length of the each alignment option. Whilst the risk assessment was undertaken for the complete alignment options, the refinements have been described by zone to allow for comparison of the final alignments to the recommended options identified in Phase 2 of the options assessment.

The final alignment options are illustrated in the Technical Appendix A mapbooks.

**Zone 1**

During discussions, it became evident that whilst some vegetation could be maintained via the micro alignment process, if the new carriageways were moved to the north, there could be additional benefits such as:

- Addressing the gradeline issues with the existing cutting that currently prevent safe sight distances being achieved;
- Reverting the existing highway to a local road to maintain access for properties and local roads to the south;
- Reducing the impact on vegetation on the south of the existing highway; and
- Minimising the impacts on landowners to the south of the highway.

As a result of the Risk Assessment Process, the final alignment within Zone 1 has been realigned to the north of the original 1A and will result in a new Cutting, to the north of the existing Box’s Cutting.

**Zone 2**

Within Zone 2 micro alignment was required to allow for access to properties to be maintained. This resulted in the existing highway being used as a service road under highway conditions and the new carriageways being situated slightly to the south.

**Zone 3**

Micro alignment in Zone 3 allowed for vegetation within the existing road reserve to be maintained by utilising a wide median treatment. This resulted in the existing highway being used as the eastbound carriageway and service roads to be off-set from the highway to protect the vegetation which is currently alongside the highway.

**Zone 4**

The final alignment options in Zone 4 were subject to micro alignment to allow for vegetation to be retained between Buangor–Ben Nevis Road and Pope Road.

The two options extending through Zone 4 provide for the northern bypass of Buangor and have a centralised interchange into the town.

**Zone 5**

The final alignments for Zone 5 were subject to micro alignment to allow for gradeline considerations and to minimise impacts on native vegetation along the existing highway.

**Zone 6**

The final alignments in Zone 6 were subject to micro alignment to allow for access to properties and Langi Ghiran State Park to be maintained under freeway conditions.

**5.8 Identification of a Preferred and Alternate Option**

The outcomes of the risk assessment (refer to Technical Appendix Q) revealed that the risks of each option are comparable and there is not a clearly preferred option. Through the risk assessment process, Options 1 and 2 were considered preferable by more specialists than Option 3. Additionally, Option 3 is similar to Option 1 and did not provide any greater benefit or appear to have less risk than Option 1. Therefore, Option 3 was not taken forward into the EES.

On balance, Option 1 was preferred by the traffic, flora and fauna, social, and soils and geology, air quality and cultural heritage specialists, whilst Option 2 was preferred by the surface water and economic specialists.

Both Options 1 and 2 have a range of benefits and impacts and a summary of this information has been included in Table 5-11. Having regard to feedback from the specialists on potential impacts and overall benefits (refer to Table 5-11), Option 2 has been identified as the VicRoads preferred option. Option 1 remains under consideration as an alternate alignment option through the EES process.
<table>
<thead>
<tr>
<th>DISCIPLINE</th>
<th>OPTION 1</th>
<th>OPTION 2</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and Land Use</td>
<td>▪ Less length of fibre optic cable relocation</td>
<td>▪ Less land severance, thereby reducing impacts on farming/grazing within the area</td>
<td></td>
</tr>
<tr>
<td>Traffic and Transport</td>
<td></td>
<td>▪ No discernible difference between either Option</td>
<td></td>
</tr>
<tr>
<td>Soils &amp; Geology</td>
<td>▪ Reduced risk of encountering unstable geological units in the vicinity of Langi Ghiran railway cutting</td>
<td>▪ Approximately 1.2 million cubic metres less fill earthworks required</td>
<td></td>
</tr>
<tr>
<td>Groundwater</td>
<td></td>
<td>▪ No discernible difference between either Option</td>
<td></td>
</tr>
<tr>
<td>Surface Water</td>
<td></td>
<td>▪ Less potential impact to flooding, and disturbance to significant waterways (due to a shorter crossing of the Billy Billy Creek, with less impact on the aquatic habitat and Dwarf Galaxias within the creek)</td>
<td></td>
</tr>
<tr>
<td>Biodiversity and Habitat</td>
<td>Removal of:</td>
<td>Removal of:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ One Spiny Rice Flower</td>
<td>▪ One Spiny Rice Flower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 31.56 hectares of Golden Sun Moth habitat</td>
<td>▪ 23.8 hectares of Golden Sun Moth habitat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 5.25 hectares of Natural Temperate Grassland of the Victorian Volcanic Plain</td>
<td>▪ 5.25 hectares of Natural Temperate Grassland of the Victorian Volcanic Plain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 11.14 hectares of Grassy Eucalypt Woodland of the Victorian Volcanic Plain</td>
<td>▪ 8.65 hectares of Grassy Eucalypt Woodland of the Victorian Volcanic Plain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ One Golden Cowslip</td>
<td>▪ Brown Toadlet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 12 Emerald-lip Greenhoods</td>
<td>▪ Brown Treecreeper</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Brown Toadlet</td>
<td>▪ Eight Yarra Gums</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Brown Treecreeper</td>
<td>▪ 131 hectares of EVCs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 110 hectares of EVCs</td>
<td>▪ 214 Large Old Trees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 221 Large Old Trees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultural Heritage</td>
<td>▪ Encounters nine Indigenous places of minor significance and three of moderate significance.</td>
<td>▪ Encounters nine Indigenous places of minor significance and two of moderate significance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Requires the relocation of the Major Mitchell Cairn (historical heritage)</td>
<td>▪ Requires the relocation of the Major Mitchell Cairn (historical heritage)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Encounters Peacock’s Road House ruins (low significance) and the former Colvinsby School site (moderate significance) of historical heritage</td>
<td>▪ Encounters Peacock’s Road House ruins (low significance) and the former Colvinsby School site (moderate significance) of historical heritage</td>
<td></td>
</tr>
<tr>
<td>Air Quality</td>
<td>▪ 51 potential sensitive receptors within the construction dust impact zone</td>
<td>▪ 47 potential sensitive receptors within the construction dust impact zone</td>
<td></td>
</tr>
<tr>
<td>Noise &amp; Vibration</td>
<td>▪ A ‘clearly noticeable’ increase in traffic noise levels for six dwellings</td>
<td>▪ A ‘clearly noticeable’ increase in traffic noise levels for five dwellings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ A ‘clearly noticeable’ decrease in traffic noise levels for nine dwellings</td>
<td>▪ A ‘clearly noticeable’ decrease in traffic noise levels for 17 dwellings</td>
<td></td>
</tr>
</tbody>
</table>
## Comparison of Option 1 and Option 2

<table>
<thead>
<tr>
<th>DISCIPLINE</th>
<th>OPTION 1</th>
<th>OPTION 2</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual &amp; Landscape</td>
<td>▪ Preferred alignment due to duplication impacting land near Langi Ghiran State Park that is visually affected by the existing Western Highway, resulting in an insignificant additional visual impact</td>
<td>▪ Preferred alignment due to duplication impacting land near Langi Ghiran State Park that is visually affected by the existing Western Highway, resulting in an insignificant additional visual impact</td>
<td>▪ Preferred alignment due to duplication impacting land near Langi Ghiran State Park that is visually affected by the existing Western Highway, resulting in an insignificant additional visual impact</td>
</tr>
<tr>
<td>Social</td>
<td>▪ Two dwellings to be acquired</td>
<td>▪ Three dwellings to be acquired</td>
<td>▪ Two dwellings to be acquired</td>
</tr>
<tr>
<td>Economic</td>
<td>▪ Marginally greater economic impact for the wider community.</td>
<td>▪ Marginally greater economic impact for the wider community.</td>
<td>▪ Marginally greater economic impact for the wider community.</td>
</tr>
<tr>
<td>Matters of NES</td>
<td>Removal of:</td>
<td>Removal of:</td>
<td>▪ Impacts also considered in Biodiversity &amp; Habitat chapter</td>
</tr>
<tr>
<td></td>
<td>▪ One Spiny Rice Flower</td>
<td>▪ One Spiny Rice Flower</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### 5.9 Conclusion

As a result of the three phase assessment process and taking into consideration feedback received at community information sessions, VicRoads presents Option 1 and Option 2 for consideration as part of the EES.

Both Options 1 and 2 would meet project objectives and deliver the desired benefits of improved road safety and transport efficiency.

Option 2 has less land severance and therefore less impact on farming productivity within the Project Area. From an environmental perspective, Option 2 also has slightly less impact golden sun moth habitat and would result in the removal of less Grassy Eucalypt Woodland of the Victorian Volcanic Plains.

Option 1 has a reduced risk of encountering unstable geological units given its alignment along the existing highway corridor at Langi Ghiran State Park compared to Option 2. Option 1 would also result in the removal of 21ha fewer EVC’s compared to Option 2 and would result in one less dwelling being directly impacted by the alignment.

Based on an analysis of potential impacts of each option, VicRoads prefers Option 2, but acknowledges that Option 1 would also satisfy the overall project objectives.

VicRoads understands that as a result of the EES process, either Option 1 or Option 2 could be recommended for approval and therefore, submissions will need to be sought for both options. The proposed alignments for Option 1 and Option 2 are shown in Figure 5-13 and are included in the mapbooks contained in Technical Appendix A to the EES.
Figure 5-13 VicRoads Preferred and Alternate Options