Asset Protection Zone Project

Wye River and Separation Creek

VICTORIA State Government | Environment, Land, Water and Planning

Printed by DELWP

ISBN 978-1-76047-364-8 (Online)

ISBN 978-1-76047-364-8 (Online)

Accessibility

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Index of Abbreviations

APZ	Asset Protection Zone
BAL	Bushfire Attack Level
COS	Colac Otway Shire
DELWP	Department of Environment, Land, Water and Planning
EMV	Emergency Management Victoria
FZ	Flame Zone (highest BAL rating)
PV	Parks Victoria
WRSC	Wye River and Separation Creek
CFA	Country Fire Authority
EMV	Emergency Management Victoria

Executive Summary

The Wye River – Jamieson Track fire impacted on the townships of Wye River and Separation Creek (WRSC) on 25 December 2015 and destroyed 116 structures: 95 in Wye River, 21 in Separation Creek and damaged many others. The Wye River–Jamieson Track fire continued to burn for 34 days until it was contained on 21 January 2016.

During the *Resettle and Reconnect* phase of recovery, at the request of the community, the Victorian Government committed to undertaking a technical assessment of the feasibility, impacts, consequences, benefits and costs of establishing an Asset Protection Zone (APZ) around the townships – with a view to understand how any potential APZ could reduce the Bushfire Attack Level (BAL) ratings of properties adjacent to forested areas and thereby reduce associated constructions costs.

Technical assessment conducted by the project team involved:

- The BAL ratings of properties adjacent to any potential APZ
- operational feasibility of implementation – including safety
- the effectives of an APZ in reducing bushfire risk
- geotechnical impacts
- biodiversity impacts
- amenity (aesthetic) impacts
- financial costs
- community support for establishing and maintaining potential APZ options.

The assessment also considered likely implementation timeframes and whether potential APZ options could be maintained year-on-year, a necessary requirement for BAL outcomes. The project team also investigated the policy context and legal mechanisms that would enable establishment and maintenance of an APZ on the private land surrounding WRSC. It was determined that the legal considerations need to be considered separately, prior to any decision to proceed.

Results indicated that while implementing some APZ options may be operationally feasible, there inherent limitations, various geotechnical, biodiversity and amenity impacts, and significant financial costs to establishing and maintaining an APZ around the townships of WRSC. The technical assessment also showed that an APZ alone will not reduce the intensity or consequence of a bushfire impacting on WRSC, given the design limitations of an APZ; its function, and expected fire behaviour in the area. Moreover, there is little marginal benefit of implementing any of the APZ options when compared to building private homes to the current regulatory framework (and associated BAL ratings).

A comprehensive engagement program was run in conjunction with technical assessment, which found the residents of WRSC held divergent views on the APZ options. In a community-wide survey, 42% of respondents indicated that they wished to maintain the status quo or implement ‘something else’, as opposed to implementing an APZ. In the same survey, 74% of respondents preferred strategies that would provide safer and easier access for firefighters to conduct fuel management activities such as planned burning, as well as suppression in bushfire season, over an outcome purely focused on BAL reduction.

These findings further supported the technical assessment which deemed that an APZ would not be an effective approach to reducing BAL ratings of properties adjacent to forested areas, in order to reduce associated construction costs.

While this project focussed on the construction of an APZ to reduce BAL ratings and constructions costs, there have been significant benefits arising from the technical assessment undertaken. The key benefit is that the more detailed and site specific information obtained during the assessment has enabled BAL ratings to be reviewed and refined for 93 properties at WRSC.

The project has also highlighted the importance of a more strategic approach to reducing bushfire risk and building community resilience. This approach, which includes consideration of vegetation management, alongside the full range of actions that can be taken community, State and local government across public and private land, will be pursued through community-based bushfire management planning – a key implementation action in *Safer Together* – the Victorian Government's new approach to reducing the risk of bushfire.

Introduction

The Wye River – Jamieson Track fire impacted on the townships of Wye River and Separation Creek (WRSC) on 25 December, 2015. While no lives were lost, the fire impacted on 116 structures and destroyed many other assets, such as retaining walls, water tanks and septic systems.

All new houses constructed in Victoria sited within a Bushfire Prone Area (BPA) or a Bushfire Management Overlay (BMO) have to comply with *Australian Standard 3959 – 2009: construction of buildings in bushfire prone areas* (AS 3959 or the Standard). The Standard outlines a variety of building standards – Bushfire Attack Levels (BAL) which are a relative index of the anticipated level of energy that a structure might be exposed to from a bushfire given the prevailing landscape context. Structures with higher BAL ratings theoretically provide a greater level of protection to building occupants and to the structure itself. There are six BAL ratings in total (LOW, 12.5, 19, 29, 40 and Flame Zone (FZ)). A BMO covers the entirety of the residential settlements of WRSC and thus all new residential structures are normally required to complete a BMO / BAL assessment before a planning permit can be issued.

To facilitate efficient rebuilding and reduce the cost of residents engaging consultants to conduct individual BAL assessments, the Victoria Government contracted Terramatrix Pty. Ltd. to complete a settlement-wide BAL assessment study. This approach ensured that a consistent methodology was applied and expedited the process for residents. Based on landscape assumptions applied, the Terramatrix report determined that most properties in WRSC would need to be rebuilt to BAL-40 or BAL-FZ, with a small pocket required to BAL-29. The Terramatrix report suggested that if alternative vegetation management could be implemented then BAL ratings would likely be lower.

When the Terramatrix BAL assessment study was released in early April, the report included reference to the potential for vegetation management via an APZ to further reduce BAL ratings around the township.

In response to requests by the WRSC community, the Victorian Government committed to undertaking technical assessment of the feasibility, impacts, consequences, benefits, costs and community support for a number of hypothetical vegetation modification options that would reduce BAL ratings throughout the townships, primarily through implementing an APZ. APZs were seen by the community at the time as a key mechanism to reduce BAL ratings and therefore reducing the associated construction costs.

Heavily modified strips of vegetation (referred to herein as ‘APZ’), such as the options being assessed for Wye River and Separation Creek, have limited usage across the state by DELWP and Parks Victoria. APZs have been principally applied to Surf Coast townships including Lorne, Moggs Creek and Anglesea given landscape and fire behaviour characteristics in these areas of the Otways, which renders APZs an appropriate tool for supporting landscape fire management and for reducing risk to townships. APZs are generally established as part of a suite of fire risk management tools to deliver on the following objectives:

1. Provide vehicular access for firefighting vehicles and vegetation maintenance machines
2. Provide a safer work environment for firefighters in the event of a fire (reduced radiant heat and safer access and egress).

3. Provide an established boundary from which to carry out hazard reduction burning, or in the event of an approaching bushfire, back burning operations.
4. Provide an area between vegetation and a structure to limit radiant heat and flame exposure, and reduce short distance spotting (ember attack) on the adjacent structure in the event of an approaching bushfire.

To conduct the APZ technical assessment, a project team (Table 1) including expert bushfire scientists, was established to lead the direction of these assessments, with support from local DELWP staff. The APZ Project Team consisted of the following members:

Table 1: Asset Protection Zone Project Team

Name:	Organisation
Kevin Tolhurst	The University of Melbourne
Justin Leonard	CSIRO
Tony Miner	A.S. Miner Geotechnical
Hamish Allan	Terramatrix Pty. Ltd.
Erin Letovsky	DELWP
Andrew Morrow	DELWP
Liam Fogarty	DELWP
Tim Gazzard	DELWP
Peter Galvin	DELWP
Tegan Brown	DELWP
Bec Cross	DELWP
Kim Stanley	DELWP

More specifically, the purpose of this project was to:

- evaluate the level and extent of fuel management that would be required to alter BAL ratings (with a focus on houses currently rated Flame Zone) and reduce construction costs
- provide a more detailed assessment of fire behaviour in key fuel and terrain locations, at the settlement-wide and individual level, and a more detailed fuel assessment within the township, which may inform assessments
- investigate broad land and fuel management options that are more effective based on landscape constraints
- assess the feasibility of implementing an APZ
- investigate and assess the impacts of constructing an APZ (erosion, amenity, ecological and other potential factors), as well as the potential benefits in terms of reducing radiant heat exposure for properties and impacting BAL ratings
- assess the costs of constructing and maintaining an APZ

The APZ Project Team addressed the following key questions:

1. *What APZ (in terms of width, location in relation to assets, vegetation retention) would be required to deliver BAL-40 ratings for the greatest number of perimeter properties within the town, currently rated at BAL-FZ? What would be required to do this?*
2. *What are other opportunities or broader land management options available to reduce the consequence of fire arrival and establishing asset protection in the landscape, and what opportunities would the community wish to pursue?*
3. *Are there areas in and around the township where vegetation management could be implemented to reduce BAL-FZ ratings of properties?*

This report outlines the technical methodology that was employed during the APZ project and expands on the results of those analyses. It also outlines the community engagement strategies employed during this project to:

- inform and educate community members about APZ options, purposes, and uses in other areas of the Otways, as well as within the townships, and
- seek community views and input on APZ options assessed as part of this project.

The community views, feedback and preferences on APZ options represent one part of this multi-faceted assessment of options. This report also seeks to place the APZ Project in a whole of landscape bushfire management context aligned to the following principles embodied in *Safer Together*, the Government's approach for reducing the risk of bushfire in Victoria:

- Putting the community at the centre of our work
- Ensuring land and fire agencies are working together
- Being able to measure the success of our actions, and
- Using improved science and technology to inform making better decisions.

Technical Assessments

Initial BAL assessment

The initial Terramatrix settlement-wide BAL assessment was released in April. The release of the initial settlement-wide BAL assessment led to the instigation of this APZ technical analysis.

Impact assessment

Due to the complexity of the area under consideration for an APZ, the project team determined that there would be a variety of potential APZ options. When assessing the impacts of a variety of options across multiple objectives, a consequence table is an effective way of organising and displaying this information. The APZ options and objectives relevant to the study are outlined below.

APZ Options

Five potential APZ options (Table 2) have been included in this report, some of which involve implementation of an APZ and some do not. These options have been selected from an initial set of nine candidate options analysed during the course of this project. These five options were selected for analysis within this report because they most effectively represent the key features within the nine original options that were presented at the community cluster meetings. Full details on the nine options initially developed are available within the related Community Engagement Report.

Table 2: APZ options and descriptions for each

Option name	Description and assumptions
Option A (No change) No APZ, status quo BAL	No change to BALs gazetted in Planning Scheme, based on settlement-wide BAL assessment (Terramatrix, 2016). - assumption that residents will rebuild on same building footprint
Option B (Re-siting) Re-siting of dwellings where feasible, no APZ	No change to BALs gazetted in Planning Scheme, based on settlement-wide BAL assessment (Terramatrix, 2016). - assumption that residents will rebuild, but where possible / feasible*, will re-site dwellings, to a more favourable position within their existing blocks to enable construction to BAL-40 standard, and will use same footprint *size* of structure -
Option C (Revised BAL and resiting) Refreshed BAL modelling plus re-siting homes in blocks where possible, no APZ	Application of refreshed BAL modelling using refined fuel and localised fire behaviour modelling inputs. - assumption that residents will rebuild, but where possible / feasible*, will re-site dwellings, to a more favourable spot within their existing blocks to enable construction to BAL-40 standard, and will use same footprint *size* of structure

Option D (Revised BAL and operationally feasible APZ) Operationally feasible APZ, refreshed BAL modelling, re-siting of homes where possible	APZ implemented only in locations where operationally possible to do so on basis of slope constraints (areas less than 25 degrees), and being "minimum distance," (i.e. the width of the APZ being the minimum required to move the adjacent house site out of BAL-FZ exposure) - assumption that residents will rebuild, but where possible / feasible*, will re-site dwellings, to a more favourable spot within their existing blocks to enable construction to BAL-40 standard, and will use same footprint *size* of structure Application of refreshed BAL modelling using refined fuel and localised fire behaviour modelling inputs.
Option E (Revised BAL and maximum APZ) APZ surrounding township (operationally feasible and not feasible), refreshed BAL modelling, re-siting of homes where possible	APZ implemented around the township, regardless of operational feasibility as assessed using slope constraints and being "minimum distance," (i.e. the width of the APZ being the minimum required to move the adjacent house site out of BAL-FZ exposure). - Assumption that residents will rebuild, but where possible / feasible*, will re-site dwellings, to a more favourable spot within their existing blocks to enable construction to BAL-40 standard, and will use same footprint *size* of structure. Application of refreshed BAL modelling using refined fuel and localised fire behaviour modelling inputs.

*Indicates where it was considered feasible to re-site dwellings within the boundary of the allotment. Dwellings were identified using a desktop assessment with re-siting constrained only where:

- slope was greater than 25 degrees
- the allotment could accommodate the existing dwelling shape and size within the parcel, and enable orientation to remain unchanged (i.e. dwelling could be shifted sideways or back, but not rotated)
- the house was destroyed (if the house was undamaged or partly damaged, then these houses were not counted).

Objectives

The efficacy of the APZ options was measured against a variety of objectives –things that the residents of WRSC, the broader community, DELWP and its partner agencies value. Some objectives are numerical, and therefore relatively simplistic to measure and compare. Others, such as 'community values' are more difficult and require a constructed scale to measure a relative change in efficacy for different APZ options across the objective. There are three types of performance measures that are utilised in decision making contexts: natural measures, proxy measures and constructed scales. Where possible, natural measures are preferred as they are the most simple and require no interpretation on the part of the decision maker. For example, if reporting on the economic impact associated with a hazard, the natural measure is dollars.

However, in many circumstances, natural measures may be difficult to express quantitatively. In these circumstances, the project team decided to use either constructed scales or proxy measures. Proxy measures were used to measure biodiversity impacts (e.g. habitat scores) and constructed scales for measures such as geotechnical risk and safety of staff. In the developing the constructed scales we were guided by the work of Gregory (2012) [1]"*Structured Decision Making – A practical guide to Environmental Management Choices*".

Landscape bushfire management options

The ability of APZ options to benefit landscape bushfire management activities in the area was assessed on the basis of whether APZ options delivered on key performance criteria associated with the use of APZs as part of broader landscape bushfire risk management. Assessing broader firefighting benefits of APZs is critical in understanding the relative contribution APZs may provide as part of a holistic strategy to reduce the risk of bushfire to WRSC townships.

APZs provide township bushfire risk reduction benefits where they are able to effectively:

- Provide safe access, particularly to land and fire managers – often through continuous strips of cleared vegetation with clear links to existing access networks
- Provide safe workplaces for firefighters and crew, during fire suppression operations and for fuel reduction burning
- Reduce flame length and exposure of flame length to assets
- Reduce short distance spotting of embers, which is a major contributor to house loss in bushfires

The ability of APZs to meet key performance criteria and provide benefits was assessed by DELWP bushfire risk analysts and operational experts, as well as by fire behaviour experts. A constructed scale was utilised to explore the variation in performance of each alternative.

APZs that were established only to reduce adjacent BAL ratings from FZ to BAL-40 generally only rated as having a benefit of either "none" or "low".

Table 3: Constructed scale description of the benefit each APZ option provides to landscape bushfire management strategies.

Benefit Class	Description
None	Doesn't provide an benefit to fire fighters
Low	May provide a small tactical advantage to fire fighters (generally meets 1 out of the 3 criteria.
Moderate	Provides some benefit to fire fighters (Generally meets 2 out of the 3 criteria)
High	Provides a significant advantage to fire fighters (Generally meets all the criteria)

[1] Gregory, G, Failing, L, Hardstone, M, Long, G, McDaniels, T & Ohlson, D 2012, *Structured Decision Making – a practical guide to environmental management choices*, Wiley-Blackwell, Sussex.

Geotechnical Analysis

Geotechnical site assessments and analyses were conducted by Tony Miner (A.S Miner Pty. Ltd.) to provide advice on potential erosion risks and consequences as a product of vegetation removal for APZ works and works during implementation. More specifically, geotechnical analysis included:

- assessment of the impacts of any roading and clearing based on APZ mapping and the retaining wall and drainage strategy in townships
- providing advice on potential erosion and drainage risks (erosion risks to life and properties upslope and downslope, and safety risks to those accessing APZ e.g. firefighters)
- validating on ground slope angles for these areas.
- undertaking geotechnical assessments of the feasibility of installing bunkers in areas where it would not be possible to modify BAL ratings by altering vegetation.

Outputs from these analyses were used to determine where APZs were feasible from a geotechnical perspective and the relative risks to the geotechnical stability of the area. Geotechnical information was utilised to shape the APZ options and to provide a geotechnical risk context for APZ decision-making.

The description of geotechnical risk was completed for each segment of APZ by consultants A.S. Miner Geotechnical and Baynes Geologic. The resulting report, "*Geotechnical implications associated with the establishment of asset protection zone APZs in the townships of Wye River and Separation Creek*" provides a comprehensive overview of the initial review of APZ technical risk.

Using Miner and Baynes' work as the foundation, DELWP worked with A.S Miner Geotechnical to develop a complete risk assessment for each section of APZ. This utilised the "*Practice note guidelines for Landslide Risk Management 2007 – Appendix C: Landslide Risk Assessment*" risk assessment procedure as the basis for assigning risk of each hazard (shallow slide, sheet erosion, gully erosion) to assets potentially affected (e.g. roads, houses, creeks/rivers, etc.)

Table 4: Example of Geotechnical Risk Assessment for a section of APZ.

Site	Geotech report identifier	Description of Site	Hazard	Asset	Consequence	Likelihood - Pre-works	Risk - Pre-works	Likelihood - Post works	Risk - Post Works
5-Dunoon Rd	WN4	•Several larger areas between 30-40 degrees and other areas generally above 25 degrees. •Erosion and/or sedimentation will probably occur in most circumstances. •Reasonable vegetaion now exists which is similar to post fire density and coverage but shows some minor signs of impact;	Shallow Landslide	Cassidy Tk	Minor	Likely	Moderate	Almost Certain	High
			Shallow Landslide	Houses	Insignificant	Likely	Low	Almost Certain	Low
			Sheet Erosion	Cassidy Tk	Insignificant	Possible	Low	Likely	Low
			Sheet Erosion	Houses	Insignificant	Possible	Low	Likely	Low

To simplify the description of geotechnical risk, a constructed scale was developed with 3 classes (Table 5) that describe the care required to mitigate landslide and erosion risks in the landscape.

Table 5: Description of mitigation care required to ameliorate geotechnical risk

Geotechnical	Description

Mitigation Care Class	
Very High Care	Deep Seated Landslide Area and/or active erosion is present and > 35 degrees and/or slopes show evidence of earlier repeated failures
High Care	Between 25-35 degrees and active/erosion is present and/or slopes show some evidence of earlier failures
Moderate Care	Slope is between 10 and 25 degrees and/or Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;

Safety

The potential safety risks that each APZ option posed were assessed and categorised by likelihood and magnitude of consequence. The risk assessment process was undertaken in collaboration with experienced operational managers within the Otway District to evaluate the risk of injury or death to those using or accessing the potential APZs, including firefighters, crews, or maintenance contractors. The risk assessment process was undertaken using DELWP's *"Risk Management Guidelines v1.0" risk matrix (pages 23-27).*

Risks were considered on the basis of the steep terrain, which presents risk of crew slips and falls and machinery roll-over. Risks were also considered on the basis of the APZ option meeting future performance criteria, such as providing a safe working environment for firefighters or crew during fire suppression or management operations.

A key consideration in the discussion of safety risks associated with the establishment and maintenance of APZs was the likelihood of crew working with machinery on slopes in excess of 25 degree – which has historically been the slope limit for DELWP-contracted machinery. Given the limited experience of working in excess of 25 degrees with existing machinery, a conservative approach was utilised in assigning the likelihood of machine failure.

Similar to the Geotechnical Risk assessment, a simple constructed scale was developed to communicate the relative safety risks to the community. This constructed scale is shown below in Table 6.

Table 6: Staff and Contractor Safety Risk Classes used in the constructed scale

Safety Risk Class	Description
Very High Risk	Over the lifetime of the project, likely that there would be serious injury or possibly death to crew or contractors. Almost certain there would be some minor injuries that may require hospitalisation.
High Risk	Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation.
Moderate Risk	Serious injury is possible to occur over the lifetime of the

project. Minor injury is likely.

Biodiversity values and ecosystem functioning

All of the APZ options under consideration involve modifying the vegetation around the township. When considering conducting works on public land, DELWP has to take into account the biodiversity impacts during establishment and maintenance. These assessments include our responsibilities under the *Flora and Fauna Guarantee Act 1988* (VIC) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth).

Impacts on native vegetation resulting from fuel treatments (APZ establishment and maintenance) were assessed. These varied according to vegetation type and APZ cluster. A *Biodiversity impact and offset requirements* report (DELWP 2016) was generated for APZ options using modelled data, specifically, those APZ options representing "minimum distance" (i.e. minimum width required to deliver BAL outcomes).

Modelled data was used to calculate native vegetation losses, offsets, and associated impacts on threatened species habitat.

Native vegetation was assessed using a desktop analysis of modelled vegetation condition and field observations.

Three distinct vegetation types exist across the proposed APZs:

- *Riparian Forest*
  This vegetation is found along Riverside Drive. It consists of a stand of mature Blackwood trees and is characterised by dense patches of shrubs, ferns and grasses.

- *Coastal Headland Scrub*
  This vegetation is found close to the coast along Iluka Avenue and Sturt Court. The vegetation is characterised by wind-pruned scrub to 2-3 m tall with occasional emergent eucalypts on steep coastal headlands.

- *Shrubby Foothill Forest*
  This is the main vegetation type in the area and covers all other APZs clusters around Wye River and Separation Creek. The vegetation is found on ridges and exposed aspects and consists of a medium eucalypt forest dominated by Blue-gum with lower strata of narrow-leaved shrubs, ferns and grasses.

Results represented a partial loss of native vegetation as opposed to a total loss of vegetation across APZs, to reflect vegetation modification requirements of APZs.

Native vegetation offset costs were determined subjectively as the median of market-based prices, and were calculated at $135,000 per General Biodiversity Equivalence Unit (BEU).

Other biodiversity attributes of each vegetation type and APZ cluster were also assessed using a combination of desktop analyses and field observations, and a constructed scale was used to score biodiversity attributes. Habitat for all rare or threatened species in the area, such as Powerful Owl, Grey Goshawk and the Otway Black Snail was considered in the analysis.

Amenity

Creation of an APZ typically involves removal of 50 per cent of the canopy in fully-vegetated areas; removal of understorey vegetation, and maintenance of an area to resemble a park-like landscape. While it is difficult to estimate the number of trees per hectare this would translate to, in many areas of the town the level of canopy cover would remain the same as its present (post-fire) level. An example of an APZ implemented in Moggs Creek is shown below, in Figure 1.

Figure 1: APZ implemented in Moggs Creek, with understorey removed

Community members place significant value on the visual amenity offered by Wye River and Separation Creek, and this value has the potential to be significantly impacted by implementation of APZs.

Impacts of options on visual amenity of the township were assessed using data obtained through community surveys, conducted during neighbourhood meetings (held July 2016) and made available online to the whole community. Community members were shown 3D visual representations of various APZ options within Wye River and Separation Creek, based on estimated canopy cover removal following three years of regrowth, and feedback was sought on their views. This is detailed within the community engagement section.

Community Support

Community support was measured using data obtained through surveys provided to residents attending neighbourhood cluster meetings (described in the relevant section below) and a survey made available to the broader community, to capture views and preferences on APZ options.
Further detail is provided within the community engagement section, and in the Community Engagement Report.

Bushfire Attack Level

Implications for each APZ option in terms of the relative reduction in Bushfire Attack Level (BAL) which could be assessed for each property were considered. Only properties in the township with fire-impacted house sites (those destroyed or damaged) which had full or partial BAL-FZ exposure were considered as a starting point for this assessment, given the public commitment to investigate technical aspects of APZs and impacts on BAL ratings for affected residents who may wish to rebuild existing dwellings. Given the known localised impacts of APZs, the potential impacts on BAL ratings are limited within these townships to those properties immediately adjacent to any potential APZ option. Therefore, the benefit is limited to a potential reduction from BAL-FZ to BAL-40 for the properties studied.

Furthermore, implications for BAL ratings for properties of each option are only hypothetical and are not guaranteed. Any proposed change to BAL ratings currently gazetted in the Colac Otway Planning Scheme requires approval by the Minister for Planning, and would need to reflect a current state of hazard reduction - meaning those implementing the option would likely need to provide assurance of ongoing maintenance of APZ areas to a required standard before any change is considered. Given that these changes are not guaranteed nor linked with certainty to any APZ option, the assessment of BAL ratings for properties associated with APZ options are purely for comparison and form a technical assessment only. BAL assessments were undertaken by Terramatrix Pty Ltd.

As part of this project, new and more refined information was collected on township fuels and on potential fire behaviour within the townships, on the basis of more detailed site inspections. The use of this new information is detailed under *Updated fuel and fire behaviour assessment*

Implementation and maintenance cost

The financial cost of implementing APZ options was estimated on the basis of both a required establishment (or initial implementation) cost to create the APZ and an annual maintenance cost. Annual maintenance costs reflect the need to maintain vegetation modifications in a prescribed state, to realise benefits and meet performance requirements. The steep terrain and attributes of the land surrounding Wye River and Separation Creek presents unique challenges both for the establishment and maintenance of APZs around the townships. Costs attributed to APZ options are indicative only and were estimated using standard cost parameters for establishment of APZs, as well as contingencies associated with works in similar terrain. These are summarised in **Appendix 1**.

Implementation costs of options included estimated costs of works, labour, project management, and those associated with meeting certain statutory requirements, such as biodiversity offsets and cultural heritage management plan development. Establishment costs also considered the potential option of securing interests in land on which APZ options were proposed (such as potential purchase or compensation).

Maintenance costs of options, which are represented as annual, ongoing costs, include maintenance works and labour, as well as costs associated with ensuring compliance of landowners with vegetation management requirements (education, enforcement, etc.).

Presentation of APZ options to community members did not address attribution of establishment or maintenance costs to any particular party, given the potential need to develop appropriate cost-sharing arrangements or resourcing arrangements reflective of the *Safer Together* principles.

Consequence tables presented to community included only maintenance costs represented as a proportion of DELWP's Otway District annual budget for APZ maintenance for comparison, with figures provided where requested.

Implementation timeframes

Implementation timeframes for APZ options were based on operational experience in implementing APZs and on information obtained through geotechnical analysis. Geotechnical risk needs to be managed throughout the process, which may increase the total amount of time required to fully establish any APZ. The implementation timeframes also incorporate time required to obtain necessary statutory approvals, such as cultural heritage management plans, detailed biodiversity offset assessments, and land acquisition or management agreements with private landowners.

Neighbourhood cluster analysis

Initial desktop assessments identified that only those properties immediately adjacent to potential APZ options – primarily, properties on the perimeter of the townships – would be candidates for any potential reduction in BAL ratings associated with an APZ. Effectively, APZs would only reduce potential hazard or flame exposure to certain properties on the perimeter of the town, to the extent that this may affect these properties' BAL ratings.

Field assessments were undertaken in April and May 2016 to identify areas in the townships which would require similar vegetation management treatments in order to impact BAL ratings, on the basis of terrain / topography and fuel type, as well as required maintenance regimes.
This analysis identified distinct clusters of properties within the townships, which would all, in theory, be subject to a similar vegetation management treatment on or adjacent to their properties in order to provide a potential BAL rating reduction to one or more properties within that cluster.

The purpose of this clustering was to facilitate engagement with the community and discuss options, impacts, and consequences of APZ options at a localised scale, with community members who would be directly affected by APZ options, either through potential impacts to BAL ratings, visual amenity, geotechnical concerns, or other consequences.
Eight neighbourhood cluster groups were established on the basis of the initial analysis and are shown in the map in **Appendix 2**.

Updated fuel and fire behaviour assessment

During the APZ project, bushfire experts Kevin Tolhurst, Justin Leonard and Hamish Allan described fuel inputs and likely bushfire behaviour in Wye River and Separation Creek in a more specific and site-specific manner than had initially been considered in the first iteration of BAL assessments. These refined inputs informed a refreshed assessment of BAL ratings settlement-wide for use within the technical analyses of APZ options. This process has been outlined in a complimentary report by Terramatrix.

Any potential application or use of refreshed BAL ratings for properties, beyond the purpose of informing assessment of APZ options, is outside the scope of this APZ project. Should these be proposed for consideration in any planning scheme amendment, any Ministerial approvals required would be pursued separately and outside the scope of this work.

Additionally, Kevin Tolhurst and Justin Leonard presented to the community at a number of forums, including Community Resilience Committee meetings in April and May 2016, and broader

community meetings in May 2016. They discussed fire behaviour within the Otways and specifically, Wye River and Separation Creek, as well as what the likely considerations of any APZ may be given the nature of fire behaviour within the region and uniquely within this area of the Otways.

Land tenure

The land on which APZ options are situated is almost exclusively privately owned, and is part of a forested estate managed by trusts. Most APZs currently in operation across Victoria are established on Crown land, within DELWP or its land managers' estates. Only a small portion of one of the APZ options under consideration in this study would be situated on public land, including Crown land reserve managed by the Otway Coast Committee (situated below Iluka Avenue, above Paddy's Path), appointed under the *Crown Land Reserves Act 1978* and internal Colac Otway Shire Council reserves.

The majority of APZ options considered, however, would be located on the privately-owned forest estate surrounding the townships. This land is shown as outlined in yellow in the aerial photograph (Fig 2). A detailed land tenure map is provided in **Appendix 2**.

There is no precedent for this kind of APZ in Victoria. Therefore, if an APZ were implemented, an appropriate mechanism or agreement would need to be put in place to govern management of the APZ over its lifespan.

Figure 2: Privately-owned land surrounding Wye River and Separation Creek townships, outlined in yellow, representing the privately owned estate land.

Community Engagement

A comprehensive community engagement program was designed to complement the technical components of the APZ Project. The primary objectives of the engagement program were to assist community members of WRSC to understand and explore the costs and benefits of an APZ in their townships and to elicit community feedback to include in decision making commentary. The engagement approach included a field trip; localised 'cluster' on-site meetings; a landscape visualisation tool; an online survey and two community open houses.

Field Trip

A bus tour was held on 3 July 2016 to provide residents an opportunity to discuss the landscape context, fire behaviour and the variety of impacts that an APZ might have on community values with bushfire experts such as Kevin Tolhurst and local land and fire managers. This tour also provided participants an opportunity to understand the visual impact of any actions by visiting existing APZs in Anglesea and Fairhaven, as well as speaking with community members (CFA Captain, local resident living adjacent to an APZ) about their experiences of living close to or working in existing APZs.

Cluster Meetings

DELWP held eight neighbourhood cluster meetings in WRSC on 8, 9, 15, and 16 July 2016 to discuss the impacts of potential APZ options at a localised scale. The cluster meetings presented an opportunity for residents to discuss related issues with experts in bushfire behaviour, planning, geotechnical risk and operational risk and to understand the consequences of APZ in greater detail, whilst sharing their perspectives, ideas and feedback on the different options considered in the project. The cluster meetings were also designed to elicit information from the community to assist populating the consequence tables. This included how people thought their visual and landscape amenity may be impacted, and their level of support or opposition for the various AZP options.

Landscape Visualisation

DELWP engaged GHD to provide a 3D visualisation product that would display the likely impact of APZ options in a visual and interactive format that was based on the aesthetics of the area. The visualisation tool was available for residents to view at the clusters meetings, and has since been utilised for a variety of engagement events.

The options shown in the visualisation tool included:

- No treatment
- Minimum distance APZ, being the minimum width of an APZ that would be required in a cluster area, on the basis of fire behaviour and vegetation modelling, that would remove a property from BAL-FZ exposure
- DELWP standard 40 metre wide APZ, being the standard width of APZ that DELWP would usually implement in order to provide vehicular access for firefighters and support planned burning options
- Adjacent homes with examples of well-maintained and poorly maintained vegetation.

Figure 3: An example of a 40 m APZ as illustrated in the visualisation tool.

Figure 4: An example of a minimum distance APZ as illustrated in the visualisation tool.

Online Community Survey

An online survey to capture broader community opinions regarding APZs was undertaken so the project team could ensure that the views of those unable to attend cluster meetings in WRSC were integrated into decision making. The survey was publicised through the community website established for the Wye River and Separation Creek recovery program and at community meetings. The data from this survey complemented that obtained through neighbourhood cluster meetings.

Respondents to the survey were provided with a two minute video describing the appearance of APZs, using 3D imagery. The video can be seen at https://youtu.be/L_IhAIUZvnc. Further information on the visualisation tool can be found in the APZ Engagement Report.

Open Houses

Open House Events were held in Wye River (7 August) and Melbourne (10^{h} August) to share the results of the field trip, cluster meetings and online survey with the wider community. The Open House Events also provided an additional opportunity to discuss APZ options, consequences and potential benefits.

Results

Establishing and maintaining any of the APZ options presented in this assessment have both financial and non-financial costs; the financial costs relating to the establishment and long-term maintenance of the APZs and non-financial costs are referred to through the results as ‘consequences’ – the impact of the APZ on biodiversity, amenities and neighbourhood views on APZs.

Consequence analysis

The following chapter reports on the consequences of implementing a variety of APZ options around the townships. A summary of the consequence analysis, based on amalgamation of analyses performed for each of the 8 neighbourhood cluster groups, is provided below (Table 7). Consequence analyses for each of eight neighbourhood cluster meetings are provided in **Appendix 3**. Note that for some objectives, such as biodiversity, ecosystem functioning and landscape amenity, results are unable to be amalgamated in the below table, and are detailed in the individual cluster consequence tables in **Appendix 3**. Specific data on community views obtained through surveys of cluster meeting attendees are also provided in **Appendix 3**.

Table 7: Consolidated consequence table for each APZ option, with results for each objective. Results are a combination of each on-site cluster meeting, combined into one table.

Options			Option A	Option B	Option C	Option D	Option E
All Clusters Summary Table Objectives	**Performance Measure**	**Additional information about performance measure**	BAL ratings as gazetted in the Planning Scheme, based on WRSC BAL Assessment Study (Terramatrix, 2016). No APZ.	BAL ratings as gazetted in Planning Scheme, and re-siting building footprints outside FZ within blocks to achieve lower BAL ratings where possible. No APZ.	Refreshed BAL ratings using updated, localised fuel assessments and fire modelling within the townships. Building footprints re-sited outside FZ where possible on properties. No APZ.	APZ implemented only in locations where operationally possible, and applying refreshed BAL assessment.	APZ implemented across the whole township despite operational limitations, and applying refreshed BAL assessment. Represents operationally and not operationally feasible APZ.
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone (full or partial exposure)	•Count includes fire affected house sites that are fully or partially in flame zone; •Re-siting is only considered an option for destroyed houses.	63	47	36	25	5
2) Maximise Landscape Fire Management Options	Constructed Scale	**Benefits** 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Low Benefit	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in *ALL* APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	Moderate Risk	Very High Risk
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	Moderate Care	High - Very High Care
5) Minimise maintenance cost	% of total DELWP Otway District APZ maintenance budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is approximately $20K. Estimated cost of maintenance for Option D is $85K/ year and for Option E is $115K/ year.	NA	NA	NA	375%	575%
6) Maximise Landscape Amenity	Constructed Scale		No broad-scale vegetation modification required; vegetation modification may be at allotment level. Community views captured in cluster analyses.			Requires canopy cover of 50% (reduction from full canopy cover) and removal of understory vegetation. Community views captured in cluster analyses.	
7) Maximise Community Attitude	Constructed Scale		Divergent community views on APZs; almost 30% of those surveyed prefer status quo.	Supported as part of a broader range of options to manage bushfire risk and impacts to towns, vs just an APZ.	Specific feedback on this option not sought, but would be supported as a means of more accurately reflecting hazard in townships.	Divergent community veiws apparent on APZs. For those supporting APZs, more than 70% prefer options that deliver overall bushfire safety and management benefits vs. just BAL reduction outcomes. The APZ options proposed do not deliver on this community preference.	
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	Habitat Scores are site specific. The best habitat score possible is 66, and worst is 30. APZs generally half the habitat score. Due to challenges in amalgamating scores across clusters, consequences for this objective are set out in the individual cluster consequence tables.				
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	2-4 years	2-4 years

Impacts on specific biodiversity values

In general, the condition of existing native vegetation and habitat in APZ clusters is considered to be 'moderate' to 'low'; due to past vegetation disturbance in the township interface area and exposure to weeds and predation. However, the presence of vegetation and perceived *environmental value* is an important aesthetic value for community members in Wye River and Separation Creek townships, as expressed during multiple community meetings and through community feedback. Feedback from the community suggested there was greater concern about potential removal of vegetation as opposed to a reduction in habitat quality.

Depending on the characteristics of the vegetation, fuel treatment will result in a partial loss of native vegetation, and a reduction in modelled vegetation condition by 50 per cent (rather than a total loss.)

By looking at the different habitat attributes used to assess vegetation condition, impacts on native vegetation and habitat will broadly consist of the following:

- Large trees – removal of some hazardous trees, retention of most large trees
- Tree canopy cover – retention of at least 20 per cent canopy where possible
- Understory – removal of most understory vegetation, retention of some patches
- Weeds – possible increase in weed invasion
- Recruitment – minimal vegetation recruitment due to ongoing slashing / mulching
- Logs / Litter – removal of most logs, debris and stumps

Overall, vegetation modification for APZ creation will result in a partial loss of native vegetation, and some large trees and patches of understorey vegetation will be retained. By retaining these habitat attributes, the vegetation can still retain its basic ecological function.

Habitat for rare or threatened species was also assessed. Results indicate that APZs do not have a proportional impact on threatened species due to the small amount of clearing proposed relative to the large extent of habitat available in the surrounding landscape. Modelled habitat for the threatened Australian Mudfish exists in Wye River, which partially overlaps with the Valley Rd and Riverside Drive APZs assessed. Given that the species inhabits wetland and river systems, the proposed APZs will not have an impact and the species and therefore does not require any further consideration. Further information is detailed in the *Biodiversity impact and offset requirements report* (DELWP 2016) which has been generated using modelled data. This report is available from the DELWP Barwon Otway Bushfire Risk Landscape Team.

Possible impacts on the following biodiversity values will vary according to the vegetation type and neighbourhood cluster. The neighbourhood cluster tables provide detailed scoring for each value in each APZ cluster and treatment option, and are summarised in the below table.

Table 8: The possible impacts on each biodiversity value under consideration as a result of implementing any of the APZ options.

BIODIVERSITY	IMPACT	IMPACT DESCRIPTION

VALUE		
Native vegetation condition	Moderate	Partial (50%) loss of native vegetation across treatment options, including some large trees and understorey vegetation.
Koalas	Low to Moderate	The main vegetation type in the area is Shrubby Foothill Forest (Blue-gum), which is the species' preferred habitat. Impacts however expected to be Low to Moderate for both treatments due to the retention of large trees and 20% canopy cover.
Birds	Low to Moderate	Impacts are expected to be Low to Moderate for treatments due to the retention of large trees and 20% canopy cover.
Medium-large mammals	Nil	APZs are expected to favour large mammals due to treatments promoting growth of grasses and herbs.
Small mammals	Moderate to High	The removal of understorey habitat and logs / litter will have a moderate to high impact on small mammals. Wider APZs may further restrict the movement of animals through the site and a higher exposure to predation. Retention of some understorey patches will minimise impacts.
Hollow-dependent fauna	Low	Impacts are expected to be Low for treatments due to the retention of large trees with hollows. Few large trees exist across the site.
Weed invasion	Moderate	Weed invasion may increase in treated areas due to increased light penetrating the ground layer and favouring weed species.
Introduced predators	Moderate	The removal of understorey vegetation may increase the movement and activity of introduced predators in these interface areas and create further 'edge effects'.

Impacts on geotechnical risk

Geotechnical site assessments and analyses were conducted by Tony Miner (A.S Miner Pty. Ltd.) to provide advice on potential erosion risks and consequences as a product of vegetation removal for APZ works and works during implementation. These risks were analysed in a format that allowed the authors to understand the amount of work or care required to mitigate the risks. Results indicated that only Options D and E would have a significant geotechnical impact – however these ranged from moderate to very high in options D and E respectively. As outlined in Table 5, APZ options that require 'very high care' include areas where deep-seated landslide is likely or where active erosion is present. Geotechnical concerns, machinery movements and the work required to mitigate these risks would have required staged works over a number of years, and be highly dependent on appropriate weather.

Impacts on amenity

Community views on the impacts of amenity varied when addressed in the community-wide survey. When asked about the visual appearance of an APZ (of the width required to reduce BAL

ratings), 45 per cent responded *like* / *like very much*, 42 per cent selected *dislike* / *dislike very much* and 13 per cent were indifferent.

When survey respondents were asked to rate how important the visual impact of an APZ was when thinking about whether an APZ should be implemented or not, 45 per cent believed the visual appearance was very important. Respondents also felt that the likely changes to fauna abundance and sightings were also important – 45 per cent also rated it very important.

Options comparison for BAL outcomes

Table 9: Options comparison for those options that return a potential BAL outcome, including costs, benefits and potential implementation issues.

	OPTIONS				
OBJECTIVES / CHARACTERISTICS	**OPTION A: No change**	**OPTION B: Re-siting**	**OPTION C: Revised BAL and re-siting**	**OPTION D: Revised BAL and operationally feasible APZ**	**OPTION E: Revised BAL and maximum APZ**
Description	BAL ratings as gazetted in the Planning Scheme, based on WRSC BAL Assessment Study (Terramatrix, 2016). No APZ.	BAL ratings as gazetted in Planning Scheme, and re-siting building footprints outside FZ within blocks to achieve lower BAL ratings where possible. No APZ.	Refreshed BAL ratings using updated, localised fuel assessments and fire modelling within the townships. Building footprints re-sited outside FZ where possible on properties. No APZ.	APZ implemented only in locations where operationally possible, and applying refreshed BAL assessment.	APZ implemented across the whole township despite operational limitations, and applying refreshed BAL assessment. Represents operationally and not operationally feasible APZ.
Capital cost to implement and maintain option	$0	$0	$0	**Establishment:** $400,000 – $2,025,000 **Approximate annual maintenance:** $85,000	**Establishment:** $650,000 - $2,275,000 **Approximate annual maintenance:** $115,000
Number of house sites (destroyed or damaged) with BAL-FZ exposure*	63	47	36	25	5
House sites taken out of FZ exposure with each option (added benefit)*	NA	16	11 (27 total taken out of FZ)	11 (38 total taken out of FZ)	20 (58 total taken out of FZ)
Capital cost per lot (beneficiary) for option implementation and maintenance	0	0	0	$36,000 -$185,000 establishment cost for 11 benefitting properties, + $7,000 per year for ongoing maintenance	$21,000-$74,000 establishment cost for 31 benefitting properties, + $4,000 per year for ongoing maintenance
Time for implementation	Immediate	Immediate for lots where possible	1-2 months	2-4 years; BAL outcomes not guaranteed following implementation.	2-4 years if implementation possible; BAL outcomes not guaranteed following implementation.
Biodiversity impact	No broad scale vegetation modification required, therefore impact on biodiversity assumed negligible.	No broad scale vegetation modification required, therefore impact on biodiversity assumed negligible.	No broad scale vegetation modification required, therefore impact on biodiversity assumed negligible.	Biodiversity impacts range from NIL in large mammals to Moderate/High for small mammals. Detail in Table 8.	Biodiversity impacts range from NIL in large mammals to Moderate/High for small mammals. Detail in Table 8.
Geotechnical impacts (as a function of work required to mitigate risks)	NA	NA	NA	Moderate	High / Very High
Community views (derived from amenity impact assessment & visualisation tool)	Divergent community views – almost 30% surveyed prefer status quo.	Supported as part of a broader range of options to manage bushfire risk and impacts to towns.	Specific feedback not sought on this option, based on other engagement outcomes would be supported as a means of more accurately reflecting township hazards.	Divergent community views apparent on APZs. For those supporting APZs, more than 70% prefer options that deliver overall bushfire safety and management benefits when compared to BAL outcomes only. The APZ options proposed do not contribute to this community preference.	
Legal or policy impediments	Existing status – already implemented and in place. No current legal or policy impediments	No current legal or policy impediments.	Application of new information in refreshed BAL assessment requires approval from Minister for Planning.	Significant legal and policy impediments for State Government.	Significant legal and policy impediments for State Government.

**The numbers in relation to houses taken out of BAL-FZ contain implicit assumptions that include the following:*

- *Calculations and absolute house numbers are based on situations where a change to BAL extent on the property, or resiting had the capacity to reduce the BAL rating of the entire building footprint – not just a partial BAL reduction on the allotment.*

- *These different methods of counting may therefore not directly match the numbers in the Revised BAL Analysis Report (Terramatrix, 2016). However, the base calculations and methodology are consistent.*

Financial Cost

As outlined in Table 9, the operationally feasible APZ would only provide a benefit (with regards to reduction of BAL ratings) to 11 fire-impacted house sites within the entire township if the refined BAL ratings are also applied.
Given that there are very limited other material benefits provided by such an APZ on its own (i.e. with respect to bushfire risk reduction outcomes, access, etc.), these 11 properties represent the primary beneficiaries of an operationally feasible APZ.

Option D, the operationally feasible APZ, would require works on approximately 5.5 hectares. The costs of establishing the operationally feasible APZ option (Option D) would be between $400,000 and $2.025 million, and likely closer to the upper limit. This is because implementation of the operationally feasible APZ option would likely require compensation to landowners for land on which an APZ would be sited or outright purchase of the land at approximately $1.35 million.

Option E, the maximum APZ (around the township), including feasible and non-feasible areas, would require works on approximately 11 hectares and was calculated assuming “minimum distance” widths (the minimum width of an APZ required to move adjacent properties out of full or partial BAL-FZ exposure, into BAL-40). Establishment cost of the maximum APZ around the entire township would be between $650,000 million and $2.275 million. It is possible that additional costs may be associated with this option if land use agreements are required to implement Option E on other private land parcels.

Bushfire risk reduction and support for landscape fuel management options

APZ options (feasible and maximum) were assessed against DELWP’s key performance criteria for APZs. These key performance criteria (outlined in Technical Assessments) focus on supporting bushfire risk reduction to the township and on landscape fire management activities. Neither of these criteria was met by Option D (Table 9), while Option E was only able to partially meet the key performance criteria of an APZ. That is, APZs that are designed to reduce BAL ratings as described in Options C and D, on their own, do not support delivery of key landscape fire management activities tailored at reducing bushfire risk to the townships of Wye River and Separation Creek.

The APZ options (Options D and E) would be non-continuous, limited by steep terrain, and narrow in many instances. These options would not provide or support safe access for firefighters or their vehicles to conduct fire management activities – such as planned burning or back-burning. Additionally, given the fire behaviour characteristics known to occur in the Otways, particularly around Wye River and Separation Creek, the APZ options would not be effective in reducing ember attack on adjacent properties, or ember attack on the township in the event of a bushfire.

Wye River and Separation Creek are vulnerable to long-range ember spotting (approximately 3-5 kilometres). An APZ is tens of metres wide and is not able to support fuel reduction burning would have a negligible impact on reducing bushfire risk to the townships.

Information on the limitations of APZs was presented to the WRSC community by Justin Leonard and Kevin Tolhurst, and presented in this video:
https://youtu.be/ELlUrgddQBM. This is further detailed in the Discussion section.

Legal and land tenure analysis

Assessment of legal options is detailed in the Discussion section.

Fine grained fuel modelling and potential fire behaviour modelling

Indicative results of refreshed BAL assessments, using the fine-grained fuel modelling and potential fire behaviour modelling undertaken for the townships of WRSC, are incorporated into the consequence analysis (Table 7) and the options analysis (Table 9) above. Figures for impacted house sites that are fully or partially within BAL-FZ should be considered indicative for the purposes of this analysis only - they are based on, although separate to the BAL ratings provided by Terramatrix Pty Ltd in the refreshed BAL assessment.

Community engagement

Results of community surveys and feedback indicate:

- Respondents held divided views as to whether or not an APZ should be implemented around the townships. 42 per cent of those responding to the whole community survey would prefer to maintain the status quo, or implement another mechanism, as opposed to implementing any APZ at this time (Figure 5).
- For those who supported implementing an APZ, this preference was largely driven by desires for improved bushfire safety and management outcomes as opposed to a desire to reduce BAL ratings (Figure 6).
- For those who preferred to maintain the status quo (no APZ) or investigate other options, the main drivers of this preference were importance placed on preserving the natural environment and the belief that APZs would not work or were not the best solution available.

There were 31 respondents to the overall community survey. In relation to the types of APZs preferred by participants, 74 per cent of community respondents believed supporting firefighters with safer and easier access for planned burning and fighting bushfires was more important than reducing BAL ratings for properties immediately adjacent to APZs (Figure 7). In relation to considering other means of reducing bushfire risk and implications across the settlements, 71 per cent of community respondents believed it was more important to further investigate bushfire risk reduction options throughout the whole settlement area as opposed to reducing BAL ratings for properties immediately adjacent to APZs (Figure 8).

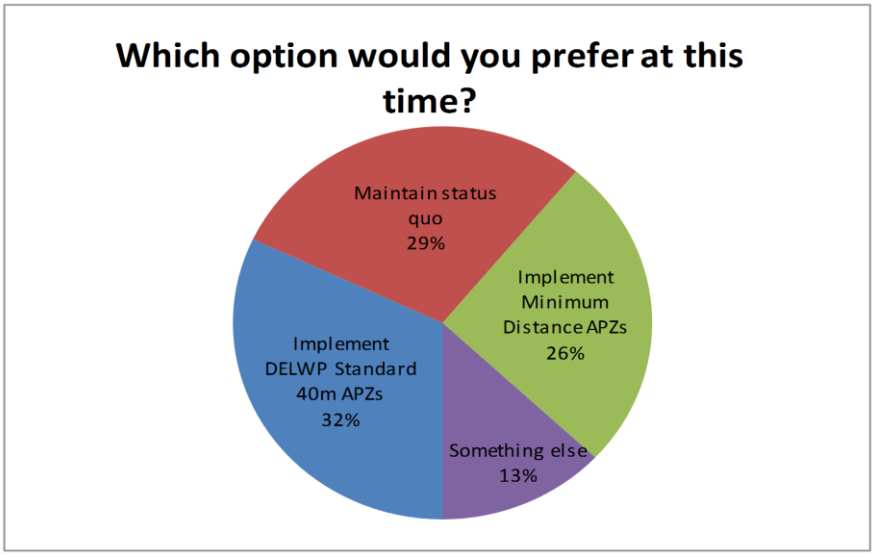

Figure 5: A graphical representation of community survey results in response to the question ' which [APZ] option would you prefer at this time?' with no clear indication of preference across the options.

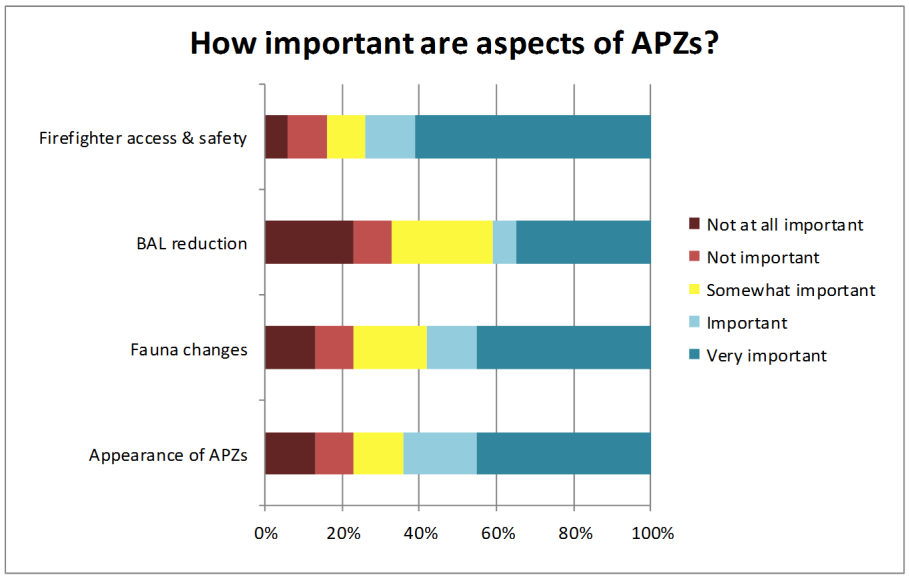

Figure 6: A graphical representation of online community survey responses, outlining how important four components of APZ implementation are to residents' decision-making processes.

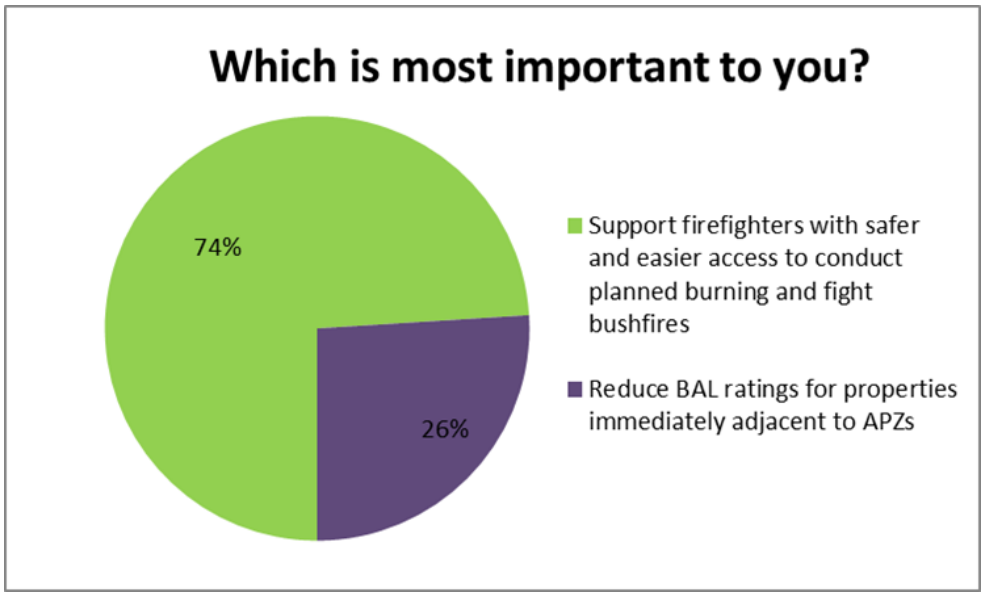

Figure 7: A graphical representation of responses to the online community survey, illustrating how important supporting firefighter safety and access (green) is compared to only reducing BAL ratings for affected residents (purple).

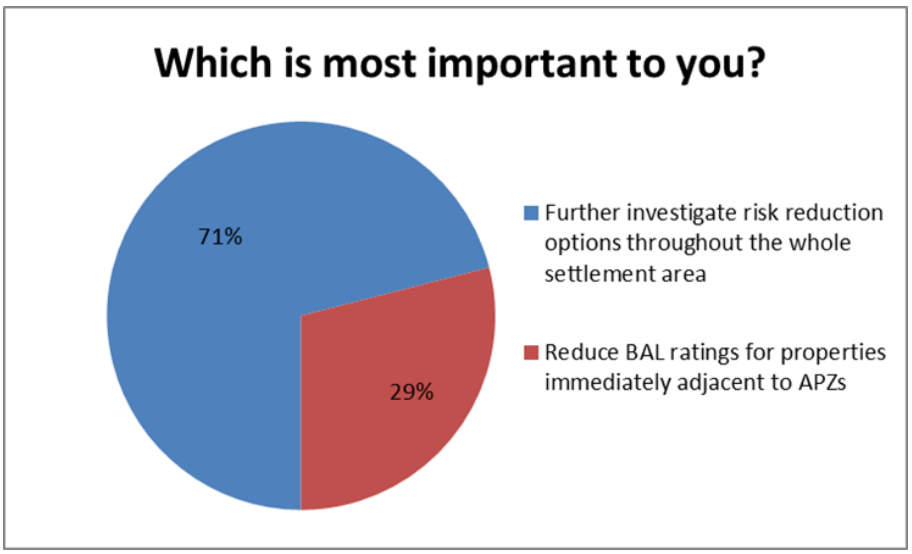

Figure 8: A graphical representation of responses to the online community survey, illustrating whether respondents felt it was more important to further investigate other risk reduction options (blue) or to reduce BAL ratings (red).

Results of surveys conducted at neighbourhood cluster meetings are cluster-specific, and are summarised in cluster consequence tables (**Appendix 3**). Detailed neighbourhood cluster engagement outcomes are outlined in the APZ Community Engagement Report.

Discussion

Analysis of all data collected and assessment of APZ options showed that there are impacts and inherent limitations to establishing and maintaining any of the APZ options considered in this report to deliver a BAL outcome while also supporting landscape fire management activities. These limitations mean that any benefits derived from the APZ options could not be realised with certainty nor in a way that aligns with community preferences and fire risk reduction outcomes.

BAL implications of APZs

In the initial settlement-wide BAL assessment for WRSC (Terramatrix, 2016), the building footprint of the majority of fire-affected allotments was assessed as BAL-40 or BAL-FZ along the township boundary – the highest two ratings of a possible six, with a small pocket assessed as BAL-29 on the inner blocks. These ratings were the result of a combination of topography, fuel, vegetation management assumptions and constraints as well as vegetation management activity within the townships.

The outcomes of the initial BAL assessment study were accepted by State and Local Government. Fire behaviour experts, such as those involved in this project, have reaffirmed that BAL-40 ratings in the majority of instances appropriately reflect the bushfire hazard present to dwellings. The objective of this APZ project was specifically to assess the implications (feasibility, costs, and consequences) of an APZ around Wye River and Separation Creek, and the potential for any APZ options to reduce the BAL ratings of fire-affected properties. It should be noted that BAL ratings are not a proxy for bushfire risk; while they do indicate likely hazard exposure for a building during a bushfire, they do not incorporate every component of bushfire risk that a township might face during a bushfire.

Bushfire risk is managed in a variety of ways with activities and tools extending throughout the landscape. Critical components of a holistic bushfire risk management strategy include fuel reduction burning (undertaken by DELWP, PV and CFA), ensuring adequate access and infrastructure support for suppression activities, management of fuels within residential blocks within the townships and land use planning and building regulations.

Analysis showed that the APZ options considered operationally feasible to deliver, from a mechanical point of view, could provide a BAL outcome (i.e. a potential reduction from BAL-FZ to BAL-40) for up to 11 properties within WRSC if a refreshed BAL assessment was also applied to the township. The minimum distance APZ options (Table 9) provide limited material bushfire risk reduction. Therefore, the possible BAL rating reduction for approximately 11 properties is considered to be the only benefit that an APZ would provide. This needs to be weighed against the costs (financial and non-financial) and other consequences of establishing such an APZ. Similarly, the certainty of benefit realisation needs to be carefully considered in decision-making.

BAL outcomes as a result of APZ assessments

The detailed and site specific information that was collected as part of the APZ assessment has enabled the refinement of BAL ratings for 93 properties in Wye River and Separation Creek. This refinement was due to a significant body of work by experts such as Kevin Tolhurst, Justin Leonard and Hamish Allan, in conjunction with local DELWP staff. More localised topography information (down to 0.5 m) was able to be combined with site-specific fuel analysis to, in some instances,

lower the initial BAL ratings. This outcomes provides a certain and immediate outcome for property owners in WRSC to begin rebuilding.

Cost comparison

Recent presentations at the Building Design Exhibition convened by the Office of the Victorian Government Architect demonstrated that fire-related elements in a BAL-40 structure generally amount to an increase of 3 per cent to the total build cost, as many of these elements are already required to meet other standards (e.g. energy efficiency, usage of toughened safety glass).
Estimating the average cost implications for rebuilding houses to BAL-FZ is challenging, given variations in site characteristics, design factors and materials. The cost differential will also vary depending on whether rebuilding works will involve retrofitting an existing dwelling, or designing a new dwelling, with the latter providing opportunities for more cost-effective options to be included throughout the design phase. The key driver of increased construction costs between BAL-40 and BAL-FZ is the requirement for a higher standard of window system, including glass. Minimising the use of large windows, or designing windows in a more strategic manner will minimise rebuild costs significantly. While individual design choices influence cost substantially for each rebuild, estimates from presentations at the Building Design Exhibition and Victorian Building Authority indicate that percentage increase in cost between a BAL-40 and BAL-FZ house may result in a cost increase of between ten and 20 per cent. While there is no “typical” house in WRSC, this may result in an increase of between $50,000 and $70,000 per dwelling. However, given the generally high value of houses in this area, this cost could be underestimated and will depend on design choices and siting of those wishing to rebuild.

In order to assist residents to minimise rebuild costs, Government has supported a number of other measures within its recovery program, such as supporting land capability and waste-water technical studies, providing tailored technical advice, and engaging experts to develop guidance for rebuilding in cost-effective ways that support holistic township resilience.

There are a number of options considered in this project which may also support residents to rebuild in more cost effective ways, which need to be weighed up against township resilience objectives. These include options to re-site dwellings, where possible, within residential allotments to remove the rebuilding envelope from BAL-FZ exposure, and potential refresh of BAL assessments using finer grained fuel assessments and localised fire behaviour modelling. These options are not associated with a capital cost. Re-siting dwellings within the same block could provide a benefit to, indicatively, 16 fire affected dwellings from a BAL perspective (25% of impacted dwellings assessed as exposed to BAL-FZ). Re-siting dwellings where possible and refreshing BAL assessments could benefit, indicatively, 43% of fire impacted dwellings with FZ exposure.

Any APZ option if implemented will incur an implementation or establishment cost and an ongoing maintenance cost, to provide assurance of benefits derived (through management of vegetation). An operationally feasible APZ in WRSC – designed to reduce BAL ratings - would provide a BAL outcomes to approximately 11 fire-affected house sites. With an implementation cost of up to $2.025 million, which includes costs likely required to purchase adjacent freehold land; this would result in a capital establishment cost of up to $185,000 for each of the 11 beneficiaries. Maintenance would cost approximately $7,000 per beneficiary per year, ongoing, to support the delivery of an ongoing benefit – or a total of approximately $75,000 per annum. This represents 3.75 times the annual budget of the DELWP Otway Fire District for APZ maintenance, which is

apportioned across other high risk townships – and where empirical analysis has found APZs to have an appreciable bushfire risk outcome.

Bushfire risk reduction outcomes for Wye River and Separation Creek

Any APZ option that could potentially be implemented in Wye River or Separation Creek would have a limited ability to reduce the risk of bushfire faced by the townships of Wye River and Separation Creek.

Bushfire risk can be thought of as a product of likelihood and consequence. Because any APZ option that could be established would be at the township interface, there is no inherent reduction in the likelihood of ignition or the likelihood of impact of a bushfire. In some townships, APZs can reduce the consequence of a bushfire as it impacts on a settlement (by reducing the intensity or heat of a fire), thereby reducing the bushfire risk that a township faces. However, the fuel type, topography and expected bushfire behaviour in the Otways landscape means that any APZ option outlined in this report would provide very little impediment to a landscape scale bushfire, thereby causing a marginal reduction in potential consequence.

During the Wye River – Jamieson Track fire, properties were primarily impacted by a township fire that was ignited by long range spotting from the broader landscape that eventually burnt north out of the townships towards the bushfire. Because of the vegetation type (largely wet forest) and prevailing weather conditions in the immediate area around WRSC, DELWP and Parks Victoria have an extremely limited capacity to conduct planned burning that would reduce the bark hazard fuel loads that cause long range spotting.

An investigation conducted by Justin Leonard of the CSIRO determined that most structures in WRSC were destroyed by a relatively low intensity township fire with flame heights averaging less than 0.4 metres, largely spreading by house-to-house ignition and through township fuels on private property. In response to this, EMV convened an Expert Panel to provide voluntary guidelines for residents to 'harden' their properties to bushfire. These are innovative guidelines that provide advice for residents to make not only their houses but their properties and townships more adapted to fire – to ultimately reduce the spread and impact of bushfire once it has arrived in the township. The investigation conducted by Leonard (2016)[2] illustrated that bushfire risk mitigation actions implemented at an allotment level, such as through hardening measures, are likely to increase township resilience to a greater extent than any APZ constructed for the purpose of reducing flame contact. This is particularly true for WRSC, where the risk to the townships is the result of long-distance ember spotting (e.g. originating from five kilometres away) igniting township fine fuels (e.g. leaf litter and vegetation), and other heavy fuels (such as retaining walls, tanks, cars, etc.). The greater risk to life and property in a bushfire scenario in WRSC is more likely the result of long-range ember spotting, rather than being attributable to any single fire front from the adjacent forest. This risk cannot be overcome by an APZ alone.

The APZ options that we were asked to consider by the community, outlined in this report, do not have the capacity to reduce either the likelihood of a bushfire starting or impacting WRSC, or the consequence of a bushfire impacting on the townships. APZs cannot reduce long range ember spotting (embers are more likely to be airborne and move over the top of any APZ implemented) and because an operationally feasible APZ designed to reduce BAL ratings, such as those

[2] Leonard, J, Opie, K, Blanchi, R, Newnham, G & Holland M 2016, *Wye River / Separation Creek post-bushfire building survey findings*, CSIRO Client Report EP16924.

considered in this report (Table 9) would not encompass the boundary of the whole township, it would provide only marginal benefit in reducing the consequence of impact by firefighter intervention during an incident. Operationally feasible APZ options to reduce BAL ratings, investigated through this report would also not support safe, effective, or reliable delivery of landscape bushfire management options, such as planned burning to reduce fuel loads further back behind the township interface in addition to suppression options.

Confidence of delivery

There are a variety of factors that limit the ability to deliver and confidently maintain an APZ in both the short- and long-term and this limitation exists regardless of which body is responsible for implementation and maintenance (i.e. State or local government, community, etc.) For a BAL outcome to be realised, the Minister for Planning must be satisfied that the hazard reduction mechanism can be maintained in the long-term. From the perspective of DELWP, on the basis of the analyses undertaken on APZ options, even implementation of a technically feasible APZ option would not provide guaranteed realisation of any benefits arising from such an APZ. These factors are expanded on below and include crew safety during implementation and maintenance, legal ability to establish and maintain an APZ on private land and the long lead time required for such projects.

Legal considerations for establishment of an APZ

If an APZ was implemented, a suitable mechanism or agreement governing ongoing management of the works, and ensuring a secure continued basis for maintenance of the APZ, would need to be identified and implemented.

Any proposed changes to the Colac Otway Planning Scheme, in terms of BAL ratings, must be approved by the Minister for Planning and would need to reflect a current state of hazard exposure. Therefore, BAL assessments would not be able to reflect any APZ derived BAL reduction until after its implementation - limiting its effectiveness in providing a BAL outcome to those seeking to rebuild in the short and medium term.

Safety

A risk assessment based on the Department's risk management framework outlined significant safety risks for those undertaking establishment and maintenance works on any potential APZ option. This is largely due to the steepness of the landscape and the underlying soil and geotechnical profile, which is vulnerable to landslide. DELWP has assessed that year-on-year, the risk to DELWP staff and contractors could not be mitigated to an acceptable level with any degree of confidence, thereby compromising the ability to meet the performance standard of an APZ over the long-term. Maintenance in a managed state, to realise benefits of any APZ, could not be reliably provided.

In addition to the safety concerns to staff and contractors during implementation and maintenance, the operationally feasible APZ options outlined above have a compromised ability to ensure firefighter safety in the future. Under normal works arrangements, DELWP and its partner land managers implement APZs to provide for the following, in supporting broader landscape fire management options and risk reduction:

1. Vehicular access for firefighting vehicles and vegetation maintenance machines

2. A safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress).
3. An established boundary from which to carry out hazard reduction burning, or in the event of an approaching bushfire, back burning operations.
4. An area between vegetation and a structure to limit radiant heat, ember attack and flame contact on the adjacent structure in the event of an approaching bushfire.

APZ options that are constructed to provide a BAL outcome, that were assessed in this study – D and E (Table 9) - do not meet all the required performance characteristics of an APZ. This is due to a variety of factors, but largely the non-continuous nature of the options and the steepness of the slopes on which any APZ option would be implemented.

Resourcing

Given the high cost of annual maintenance of options (3.75 to 5.7 times the DELWP Otway District's annual APZ maintenance budget), it is highly unlikely that the Otway District would be able to maintain any potential APZ to the required performance standard without supplementary annual funding. The district's annual maintenance budget is apportioned on the basis of need and bushfire risk, meaning that any reprioritisation would compromise DELWP's ability to provide effective risk management to other locations where APZs have been shown to be effective risk mitigation mechanisms.

APZs have a high opportunity cost – meaning that they require continuous allocation of funding for maintenance once implementation has occurred for any benefits to be realised in the long-term. This limits flexibility in responding to dynamic bushfire risk levels across the Otway District. The APZ options assessed in this study do not support landscape bushfire risk management actions that would reduce bushfire risk in the townships. Therefore, the implementation and maintenance of the APZ options would result in allocation of public resources for limited and private benefit. This arrangement does not support the shared risk management approach, driven by Victoria's *Safer Together* policy.

Design and planning timelines

Operational assessments conducted by local DELWP staff in the Otway District and Barwon South West Region have estimated that implementing the APZ options as outlined above could take up to four years. This timeframe includes design, obtaining appropriate planning approvals, and staged works to establish an APZ in a steep area where vegetation removal must be staggered over time to reduce geotechnical and erosion risks in the landscape. The timeframe also includes time for the potential purchase of land or entering into agreements with landowners, and additional time to seek funding or establish appropriate cost-sharing arrangements with other agencies or beneficiaries. It is likely that this timeframe would not provide a suitable BAL reduction outcome for residents wishing to rebuild in the short and medium term, thereby reducing the utility of an APZ for this purpose.

Community views on APZ options

Two main issues that the community has expressed concern for during the engagement process include regulatory standards for rebuilding (and the potential subsequent financial implications of increased rebuilding standards) and the aesthetic impacts of vegetation management options, particularly following the removal of fire-affected trees within the WRSC townships.

For those community members who expressed a preference to not implement an APZ or to implement something else (42% of respondents in Fig. 5), this preference was driven by the value placed on the natural environment and a concern regarding environmental and aesthetic impacts. Aesthetic impacts were not the only driver of community views on the APZ options. Results from the community-wide survey suggest that the majority of residents in WRSC want the best outcome of the most people – even if that outcome does not involve an APZ. This theme is supported by a majority of people finding it more important to further investigate risk reduction options throughout the whole settlement area (71%) and support firefighters with safer and easier access to conduct planned burning and fight bushfires (74%) than reduce BAL ratings for properties immediately adjacent to APZs. Community surveys and comments show a clear community preference for supporting mechanisms that deliver broader benefits fire emergency firefighting and for strategies to reduce bushfire risk, such as planned burning. The APZ options that the residents of WRSC asked us to investigate in this study do not deliver on the community preferences outlined above.

Conclusion

Assessment conducted as part of this project has determined that there are geotechnical, biodiversity and amenity impacts, high costs and significant limitations to establishing and maintaining an APZ around the townships of Wye River and Separation Creek for the purpose of reducing BAL ratings of properties adjacent to forested areas, particularly to reduce associated construction costs.

Moreover, there is marginal benefit of implementing the APZ options assessed as part of this project when compared to other mechanisms available to support township resettlement and resilience. These mechanisms include those which can be pursued by individuals, such as re-siting properties where feasible and building to the current regulatory standards, and those which can be supported by government agencies or local government, such as ensuring that regulations are targeted and effective and working together with the community through actions that implement *Safer Together* such as community based bushfire management and emergency planning.

The technical assessment has shown that an APZ alone will not reduce the intensity or consequence of a bushfire impacting on the townships of Wye River and Separation Creek, given design limitations of APZs, their function, and expected fire behaviour in the area. Additionally, , the APZ options that are designed to reduce BAL ratings and which are operationally feasible do not necessarily allow for safe firefighter access during an emergency, nor meet key performance criteria, limiting their use as effective components to broader landscape bushfire management options.

APZs are used in limited situations by public land managers as one of a suite of tools to facilitate community emergency risk preparedness and bushfire risk management, and represent a complementary tool to a broader bushfire risk management strategy. Their suitability for use and efficacy in reducing bushfire risk needs to be assessed as part of a holistic strategy which considers and prioritises suitable tools to most effectively manage risk to life and property across the landscape, within a prioritised framework across the landscape and state.

The Project Team recommends that an APZ not be progressed at Wye River and Separation Creek for the purposes of reducing BAL ratings and therefore construction costs.

Future Directions

In any landscape, there are a broad variety of actions that can reduce the likelihood, consequence and overall bushfire risk that a township faces. DELWP, the CFA, COS and its partner agencies in fire and emergency management are continuing to investigate the relative benefit of a variety of options that are consistent the communities vision and requirements, and which reduce bushfire risk in the communities of Wye River and Separation Creek.

In line with *Safer Together*, by strengthening engagement and partnering with the community a better alignment of the actions taken to reduce the risk of bushfire with specific local values, capabilities and needs will be achieved. This approach supports shared responsibility, including appropriate community co-ownership of bushfire management and community resilience outcomes, and enables individuals to better manage their bushfire risk.

While an APZ is not recommended for the purposes of reducing BAL ratings and construction costs, vegetation management within and around the townships should be considered alongside the full suite of actions that can be taken on public and private land to reduce bushfire risk and build community resilience. DELWP is working with the communities of Wye River, Separation Creek and Kennett River to develop a community based bushfire management plan, as a key implementation action in *Safer Together*. The development of this plan provides the opportunity to identify the most effective and appropriate mix of strategies and actions to reduce bushfire risk and build community resilience - under a model of shared responsibility between individuals, communities, State and local government.

Appendix A – Cost breakdown

Costs associated with APZ establishment, maintenance, and compliance

Establishment costings were calculated based on costs incurred during previous strategic fuel break establishment in the Otway area. Maintenance and roading costs applied standard State Roading Cost Models. Maintenance costs were further validated utilising local Otway Fire District examples. Establishment and maintenance costs were further adjusted by four slope classes, namely < 10 degrees, 10-25 degrees, 25-35 degrees and > 35 degrees.

Compliance costs have been estimated based on discussions with local governments (Colac Otway Shire, Surf Coast Shire). Compliance costs include those costs associated with monitoring and enforcing legal obligations of private landowners, such as requirements for managing fuel loads on private properties adjacent to APZs. These obligations are typically carried out by Municipal Fire Prevention Officers, authorised to enforce provisions of the *Country Fire Authority Act 1958*. Costs also include education and awareness activities associated with compliance, which are typically performed by municipal staff.

The land on which an APZ would be implemented is largely freehold land. Legal advice suggests as potential options either acquiring the land directly, or financially incentivising landholders to enter into agreements with DELWP and / or others to enable access to the land. For the purposes of estimating implementation costs, these costs include the cost of purchasing the land outright, expressed in the upper limit of implementation costs. It is assumed that financially incentivising landowners would be less than this figure. Purchase price of the private land is approximately $1.35 million, which is the listed sale price.

Table 10: A breakdown of cost estimates for construction and maintenance of potential APZ options in Wye River and Separation Creek.

APZ Construction Costs	
$ Estimate p/ha	Description
$10,110.00	Mulching per ha. (1 forestry mulcher, 2 excavators, 1 bobcat)
$8,250.00	Tree Removal
$2,500	Project supervision
$1,000	Traffic Management
16.80%	CPI (difference between costing model and today)
100%	Ad Hoc variables
$ 43,720.34	**Total APZ construction cost p/ha**

APZ Maintenance Costs	
$ Estimate p/ha	Description
$ 3,750.00	Heavy vegetation maintenance - lashing & mulching up to 150mm diameter
$ -	Weed management

	100%	Ad Hoc variables
$ 7,500.00		**Total APZ maintenance cost p/ha/yr.**

Road Construction Costs		
$ Estimate p/km		Description
$	12,600.00	Construction estimate using SRC maintenance tool (Class 5D/ 5E)
	$2,500	Project supervision
	190%	Ad Hoc variables
$ 43,790.00		**Total road construction costs p/km**

Road Maintenance Costs		
$ Estimate p/km		Description
$	3,150.00	Maintenance estimate using SRC maintenance tool (Class 5D/5E)
	100%	Ad Hoc variables
$ 6,300.00		**Total road maintenance costs p/km/yr.**

Additional considerations (one off costs?)		
$	100,000.00	Cultural Heritage Management plan(s) – Estimate
$	150,000.00	Native Vegetation Offsets - Estimate
$	25,000.00	Council costs (planning permits)

Appendix B – Mapping products

I. Cluster map (Figure 9)

II. Land tenure map (Fig 10)

III. Options maps – implications for impacted house sites of each option on exposure to BAL-FZ ratings (Fig 11).

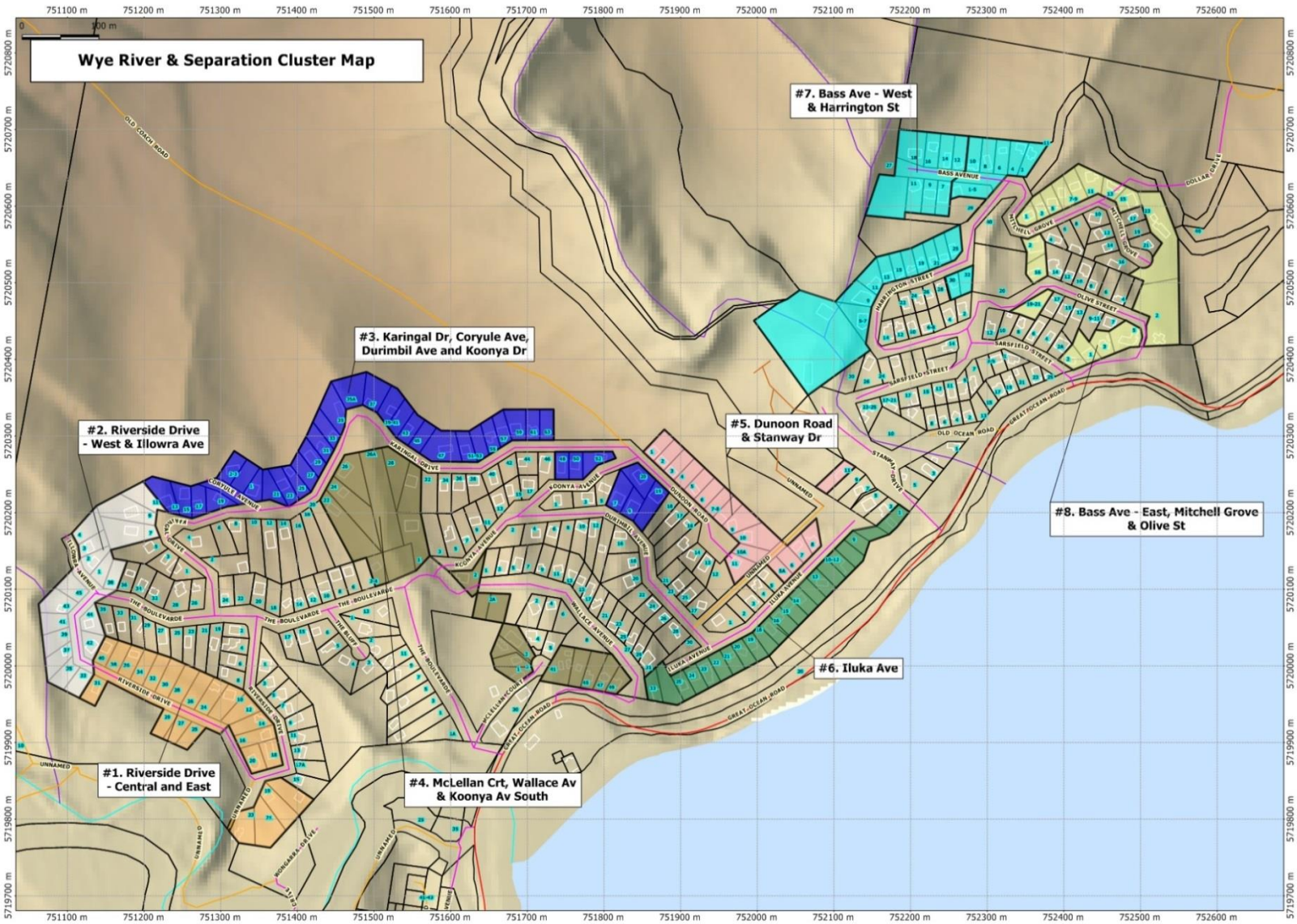

Figure 9: Cluster map identifying each of the eight neighbourhood clusters within Wye River and Separation Creek

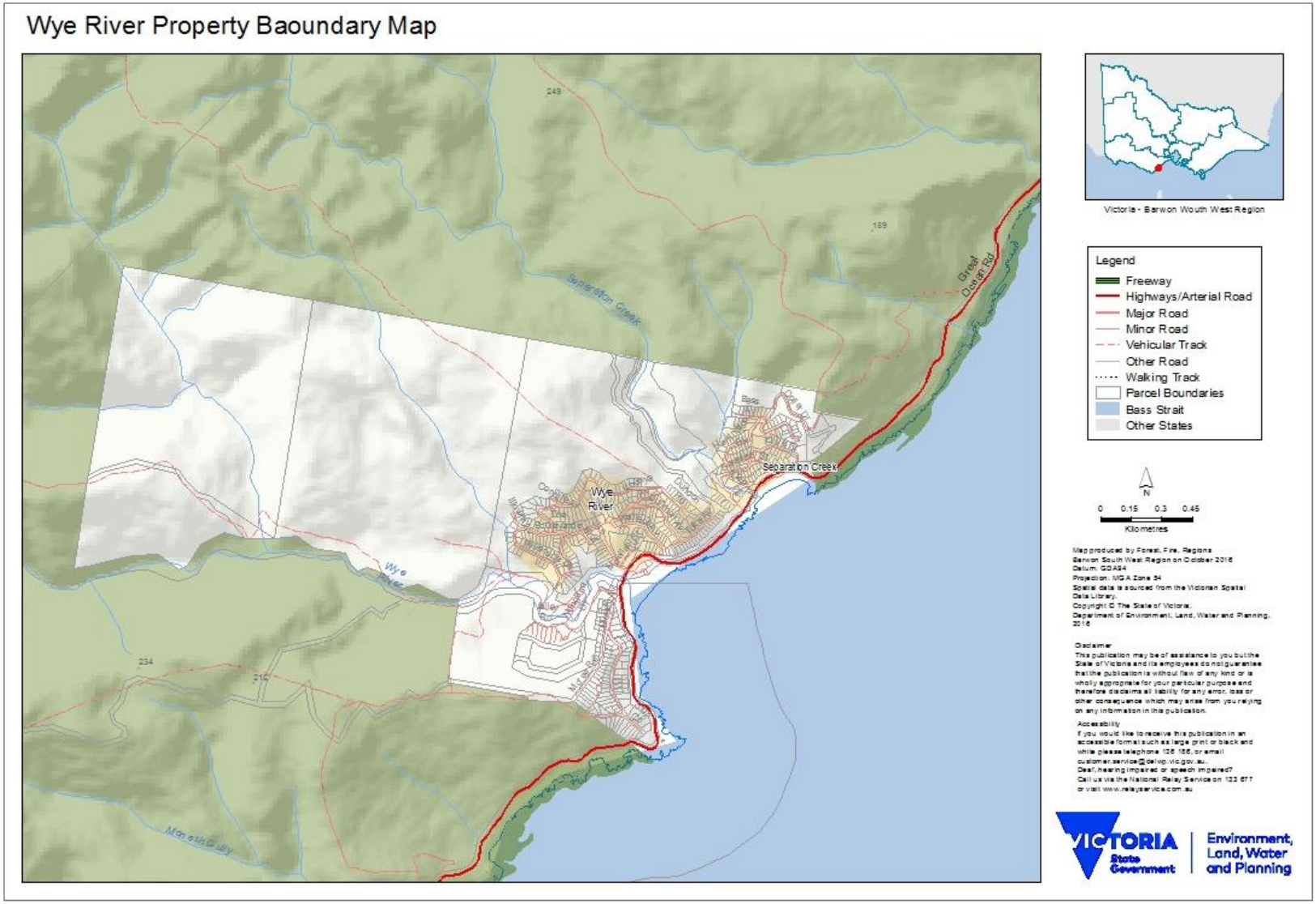

Figure 10. Land tenure map of Wye River and Separation Creek and surrounds, with privately-owned forested land surrounding the townships, managed as part of an estate, shaded white. Public land on this map is shaded green.

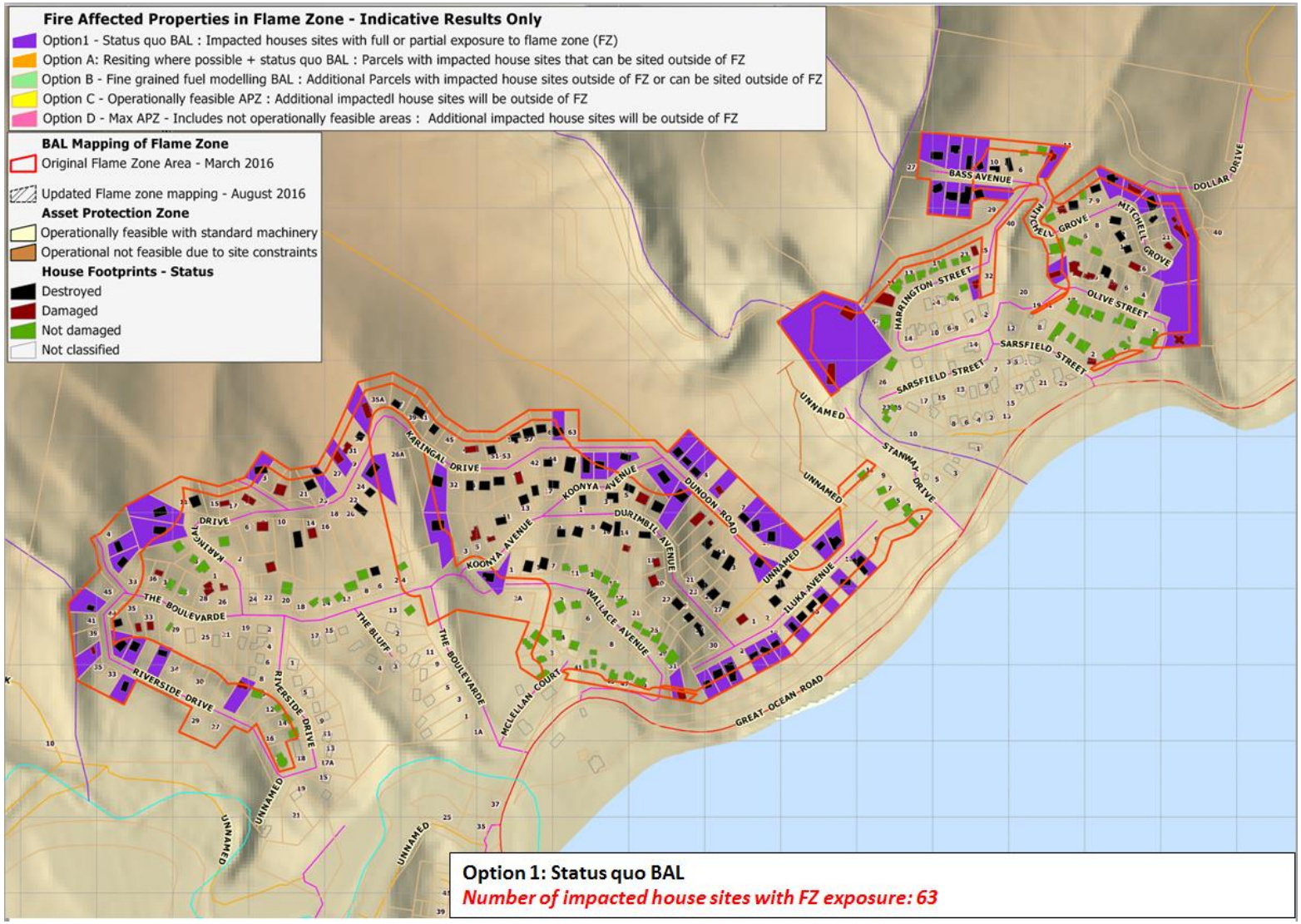

Figure 11. Options maps and implications for BAL ratings - impact of Option A on WRSC properties with house sites exposed to BAL-FZ.

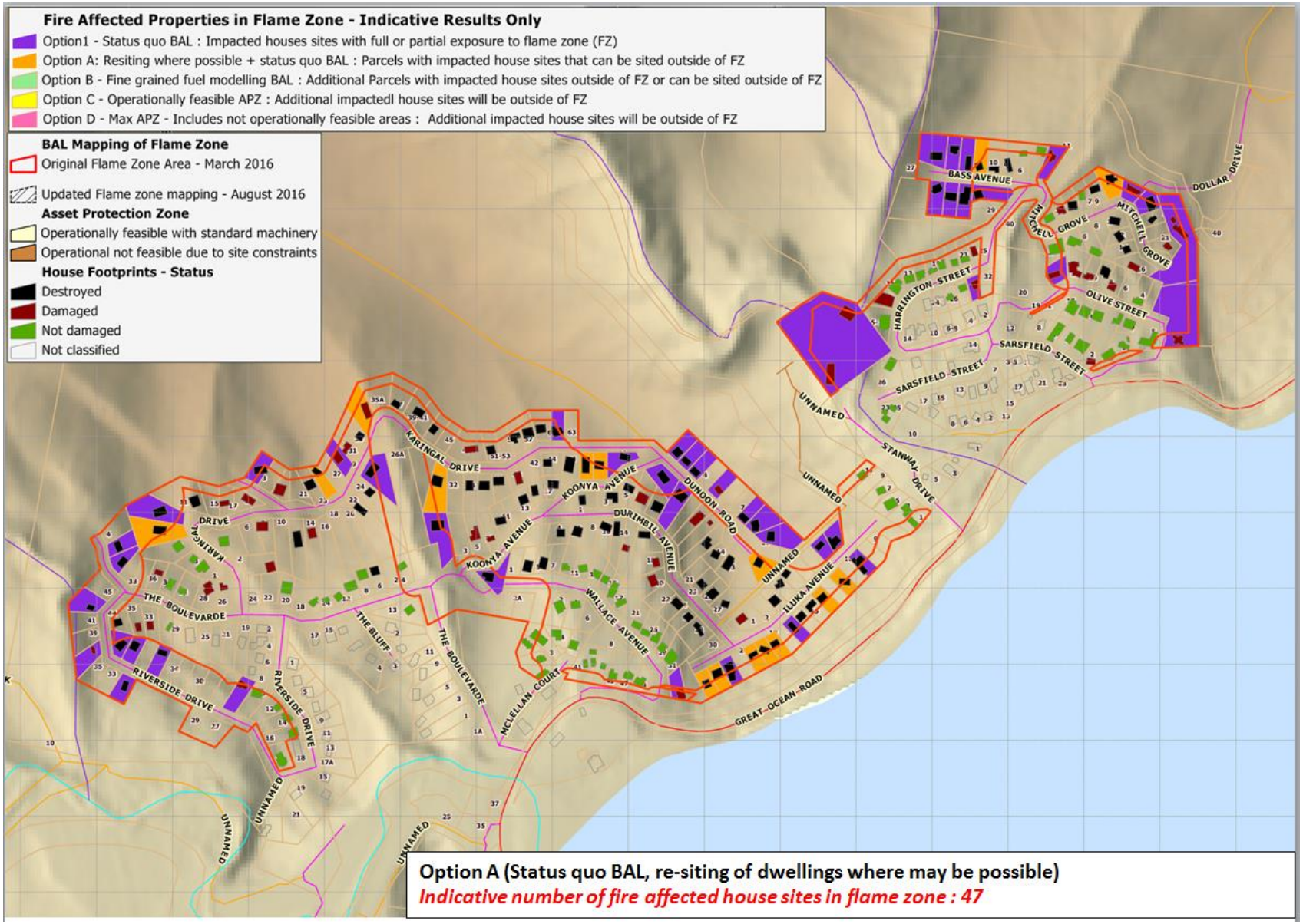

Figure 12. Options maps and implications for BAL ratings: Impact of Option B on WRSC properties with house sites exposed to BAL-FZ.

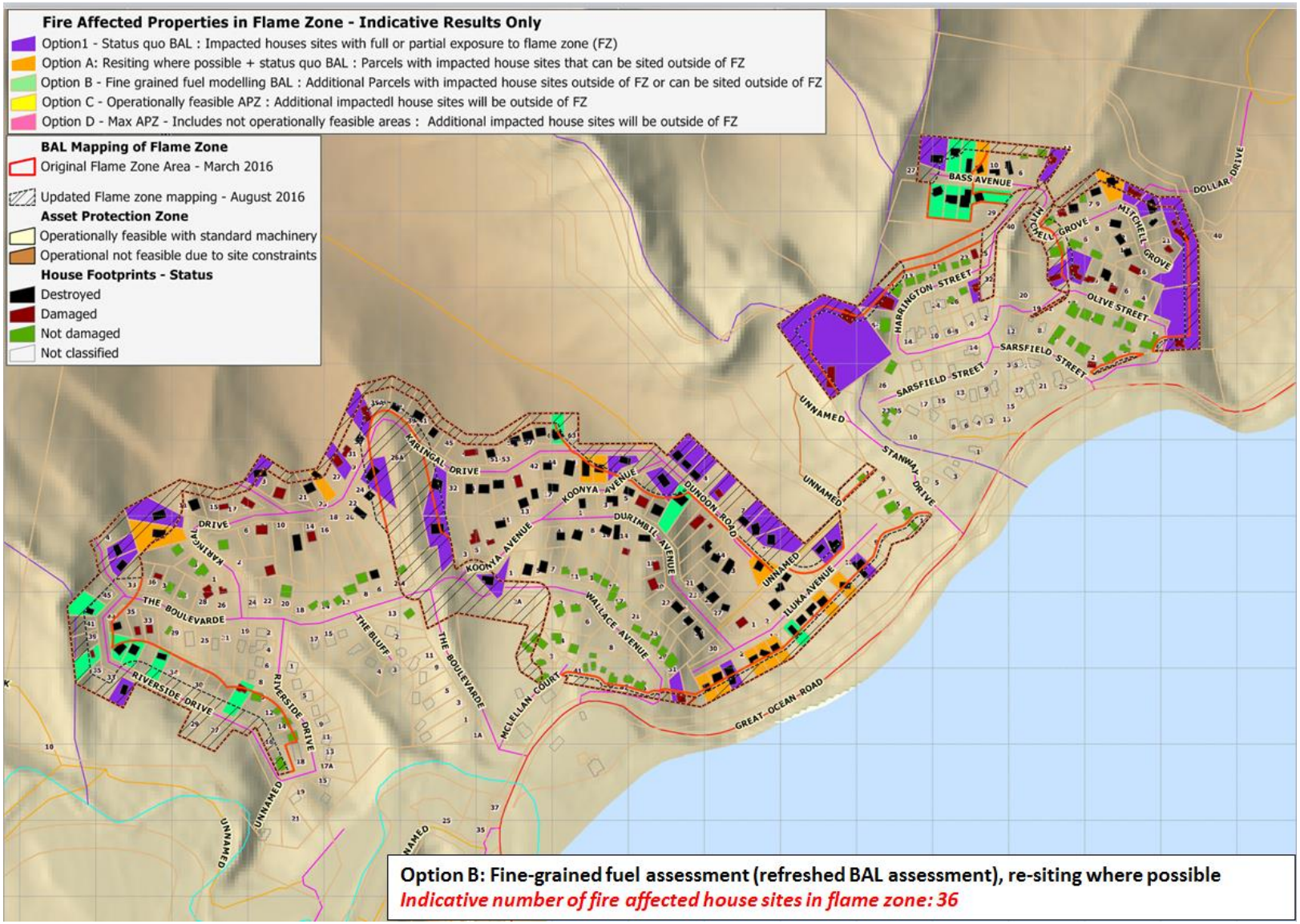

Figure 13. Options maps and implications for BAL ratings -impact of Option C on WRSC properties with house sites exposed to BAL-FZ.

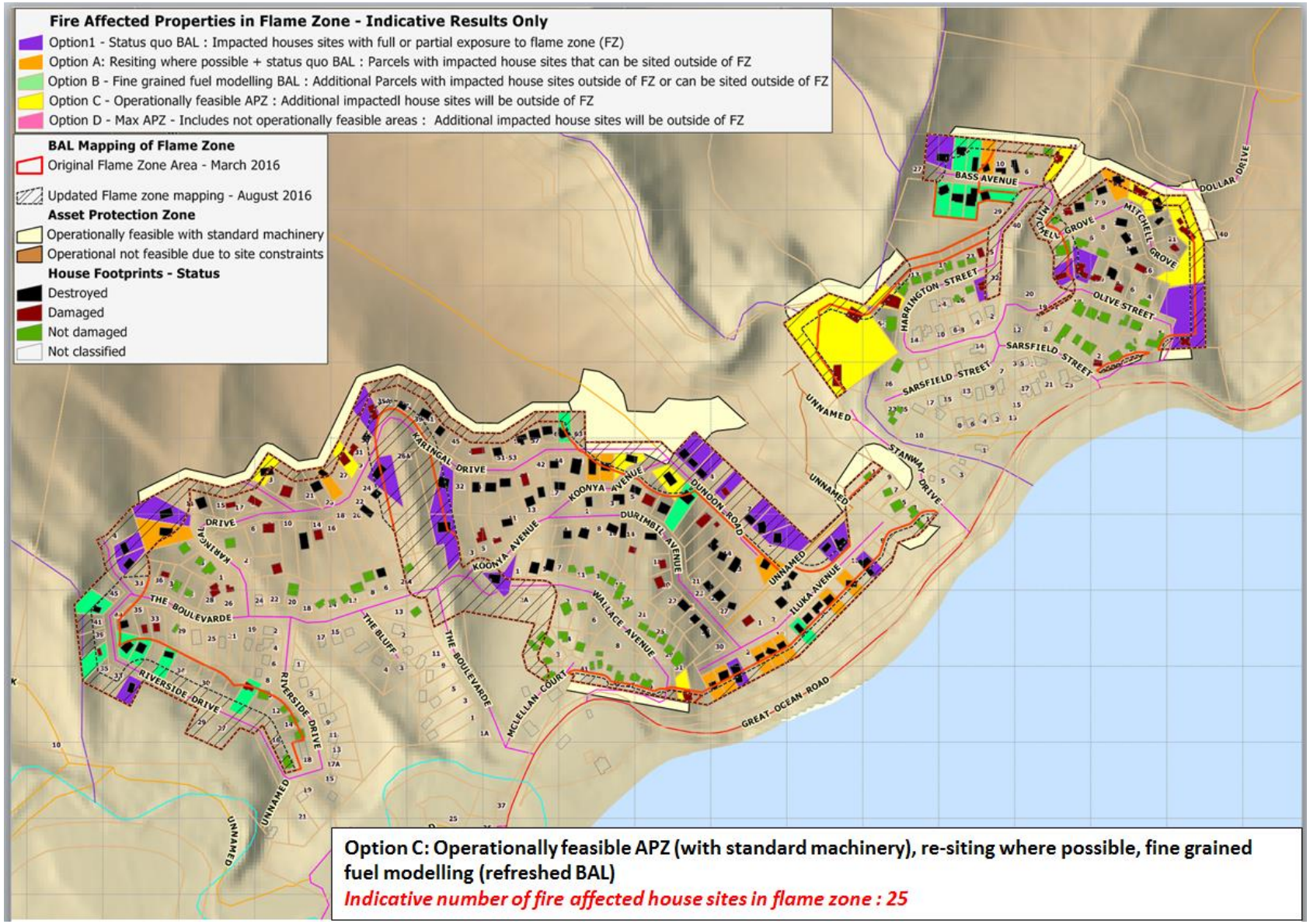

Figure 14. Options maps and implications for BAL ratings -impact of Option D on WRSC properties with house sites exposed to BAL-FZ.

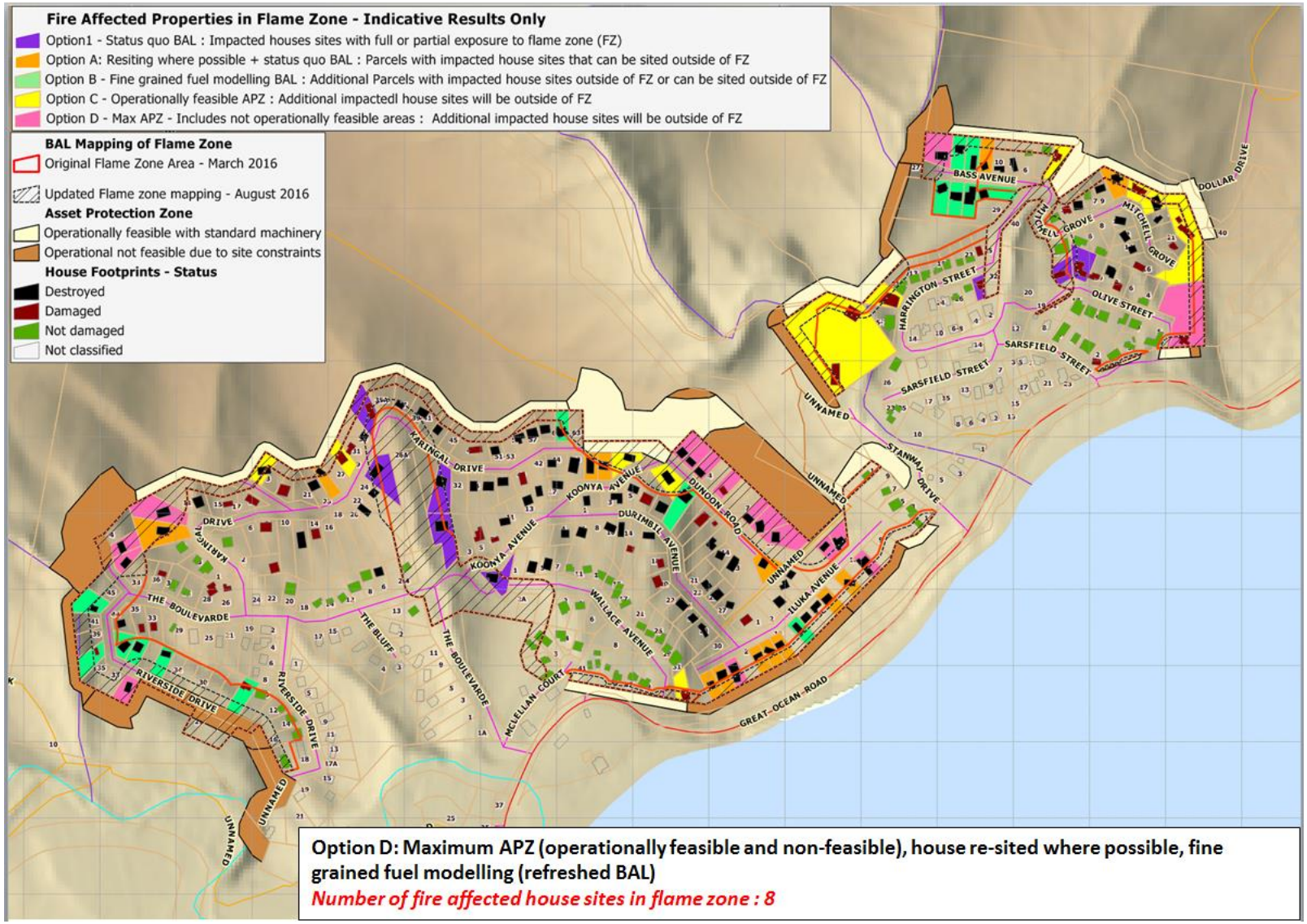

Figure 15. Options maps and implications for BAL ratings -impact of Option E on WRSC properties with house sites exposed to BAL-FZ.

Appendix C – Cluster Engagement Maps

I. Cluster 1 (Figure 16)
II. Cluster 2 (Figure 17)
III. Cluster 3 (Figure 18)
IV. Cluster 4 (Figure 19)
V. Cluster 5 (Figure 20)
VI. Cluster 6 (Figure 21)
VII. Cluster 7 (Figure 22)
VIII. Cluster 8 (Figure 23)

Cluster #1.Riverside Drive-Central and East Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	4	4	1	1	0
2) Maximise Landscape Fire Management Options	Constructed Scale	**Benefits** 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	NA	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in all APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	NA	Very High Risk
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	NA	Very High Care
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	NA	400%
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**		**NIL**	**NIL**	**NIL**	**NIL**
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**		**NIL**	**NIL**	**NIL**	**NIL**
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	38	38	38	NA	19
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	NA	2-4 years

Figure 16: Consequence table for Cluster 1.

Cluster #2.Riverside Drive-West & Illowra Ave Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	7	6	3	3	0
2) Maximise Landscape Fire Management Options	Constructed Scale	Benefits 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	NA	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in all APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	NA	Very High
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: Care required to mitigate Landslide and Erosion Risks	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	NA	Very High
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	NA	400%
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	- **6** - - -	NA	NA	NA	**1** **5** - - -
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	- - **1** **2** **3**	NA	NA	NA	**2** **4** - - -
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	66	66	66	NA	33
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	NA	2-4 years

Figure 17: Consequence table for Cluster 2.

Cluster #3.Karingal Dr, Coryule Ave,Durimbil Ave and Koonya Dr Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	10	6	5	1	1
2) Maximise Landscape Fire Management Options	Constructed Scale	Benefits 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Moderate Benefit	NA
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in all APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	High Risk	NA
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ	Constructed Scale: Care required to mitigate Landslide and Erosion Risks	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures	NA	NA	NA	Moderate to High Care	NA
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	400%	NA
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	2 5 - 1 2	NA	NA	2 2 2 4 -	NA
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	5 3 - 2 1	NA	NA	4 2 4 - -	NA
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	50	50	50	25	NA
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	2-4 years	NA

Figure 18. Consequence table for Cluster 3.

Cluster #4. Wye River Council Reserve (Gully and Memorial Park) and Wallace St Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	4	3	4	4	4
2) Maximise Landscape Fire Management Options	Constructed Scale	Benefits 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Low Benefit	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in *ALL* APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	NA	Moderate
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	Moderate outside of Gully; High in Gully	NA
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	400%	NA
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	**1** **2 Could be bette** **3** - -	NA	NA	- **6** **4** - -	**4** **2** - **2** **2**
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	- **3** - **3** -	NA	NA	- **9** - **1** -	**6** - **1** **1** **2**
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	30	30	30	15	Not calculated
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	2-4 years	2-4 years

Figure 19. Figure 19. Consequence table for Cluster 4.

Cluster #5.Dunoon Road& Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	10	9	9	9	0
2) Maximise Landscape Fire Management Options	Constructed Scale	**Benefits** 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Very Low Benefit	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in all APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	Moderate Risk	Very High Risk
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	Moderate Care	Very High Care
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	NA	400%
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	1 - 1 - 2	NA	NA	- 2 1 1 -	2 - 1 - 1
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	1 1 - 1 1	NA	NA	- 3 - 1 -	2 1 - 1 -
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	40	40	40	40	20
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	2-4 years	2-4 years

Figure 20. Figure 20. Consequence table for Cluster 5.

Cluster #6.Iluka Ave Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	11	4	3	2	0
2) Maximise Landscape Fire Management Options	Constructed Scale	**Benefits** 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Low Benefit	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in all APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	Moderate-High Risk (assuming use of Haul Rd)	Moderate-High Risk (assuming use of Haul Rd)
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	Very High Care	Very High Care
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	400%	400%
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	- 1 - - 2	NA	NA	2 1 - - -	- 2 1 - -
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	- - 1 - 2	NA	NA	2 - 1 - -	- 2 1 - -
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	36	36	36	18	18
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	2-4 years	2-4 years

Figure 21. Consequence table for Cluster 6.

Cluster #7.Bass Ave - West& Harrington St Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	11	10	5	2	0
2) Maximise Landscape Fire Management Options	Constructed Scale	**Benefits** 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Low Benefit	Low-Moderate Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in all APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	Moderate Risk	Very High Risk
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	Moderate Care	Very High Care
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	400%	400%
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	2 - - - 3	NA	NA	1 - 4 - -	2 1 - 2 -
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	- 1 2 - 3	NA	NA	2 - 4 - -	2 2 - 2 -
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	Outside Town: 58-66 Internal Reserve: 34	Outside Town: 58-66 Internal Reserve: 34	Outside Town: 58-66 Internal Reserve: 34	Outside Town: 29-33 Internal Reserve: 17	Outside Town: 29-33 Internal Reserve: 17
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	2-4 years	2-4 years

Figure 22. Consequence table for Cluster 7.

Cluster #8. Mitchell Grove& Olive St. This includes east side of gully reserve but not Bass Ave. Objectives	Performance Measure	Additional information about performance measure	Option 1	Option A	Option B	Option C	Option D
1) Minimise house sites (destroyed and damaged) required to rebuild to Flame Zone BAL	Count of houses within flame zone	Count of fire-affected house sites (destroyed or damaged) with full or partial BAL FZ exposure	6	5	6	3	0
2) Maximise Landscape Fire Management Options	Constructed Scale	**Benefits** 1. Provide vehicular access for firefighter vehicles and vegetation maintenance machines and has good connectivity 2. Provide a safer work environment for firefighters in the event of a fire (reduced radiation and easy access and egress). 3. Provide an established boundary from which to carryout hazard reduction burns and/or backburning operations. 4. Reduce the radiation and ember loads on neighbouring houses from an approaching bushfire.	No Benefit	No Benefit	No Benefit	Low Benefit	Low Benefit
3) Minimise Safety Risk to Fire Fighters and Contractors during establishment & maintenance	Constructed Scale	**Assessment reflects exposure for a 50 year period in *ALL* APZs in Wye River and Separation Creek** • Very High = Over the lifetime of the project expect that there would be some serious injury or possibly death. Almost certain there would be some minor injuries that may require hospitalisation. • High = Over the lifetime of the project there is a reduced chance of serious injury or death, but it is still possible. Almost certain there would be some minor injuries that may require hospitalisation. • Moderate = Serious injury is possible to occur over the lifetime of the project. Minor injury is likely.	None	None	None	Moderate Risk	Moderate to High Risk (only very small area of steep area is required to be treated
4) Minimise erosion / landslip risk to infrastructure and water quality associated with APZ Construction	Constructed Scale: **Care required to mitigate Landslide and Erosion Risks**	• Very High = Deep Seated Landslide Area **and/or** active erosion is present and > 35 degrees **and/or** slopes show evidence of earlier repeated failures • High = between 25-35 degrees and active/erosion is present **and/or** slopes show some evidence of earlier failures • Moderate = Slope is between 10 and 25 degrees **and/or** Erosion and/or sedimentation will probably occur in most circumstances within drainage lines;	NA	NA	NA	Moderate Care	Moderate Care
5) Minimise maintenance cost to Otway Fire District	% of total Otway road and fuel management budget	% is for the whole package of works across all the sites. Annual budget for Otway Fire District for APZ maintenance is $20K. Estimated cost of maintenance for Option C is $150K/ year and for Option D is $250K/ year.	NA	NA	NA	400%	400%
6) Maximise Landscape Amenity	Constructed Scale	**Best** **Good** **Indifferent** **Poor** **Worst**	- - - 1 7	NA	NA	- 7 - - -	NA
7) Maximise Community Attitude	Constructed Scale	**Strongly Support** **Support** **Indifferent** **Opposition** **Strong Opposition**	- - 1 - 8	NA	NA	3 5 - 1 -	NA
8) Maximise Biodiversity / Ecosystem Functioning	Modelled Native Vegetation Condition Score (0-100)	• 100 – High quality vegetation; large trees, and all understory strata present. No weeds. High biodiversity value. • 50 – Moderate quality vegetation; some large trees and understorey vegetation. Some weeds. • 10 – Low quality vegetation; no trees or understorey vegetation, weed infested. Low biodiversity value.	Outside Town: 62 Internal Reserve: 34	Outside Town: 62 Internal Reserve: 34	Outside Town: 62 Internal Reserve: 34	Outside Town: 31 Internal Reserve: 17	Outside Town: 31 Internal Reserve: 17
9) Minimise APZ Implementation Timeframe	Years (or portion of)	Timeframes takes into account: • Ease of implementation - Particularly slope • Tenure of Land • Geotechnical and Safety Risks	NA	NA	NA	1-2 years	1-2 years

Figure 23. Consequence table for Cluster 8.

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