FINAL
REGULATORY IMPACT STATEMENT FOR DECISION
(RIS 2009-02)

Proposal to Revise the Building Code of Australia requirements for Construction in Bushfire Prone Areas

February 2009

This Regulatory Impact Statement (RIS) has been prepared in accordance with the requirements of *Best Practice Regulation: A Guide for Ministerial Councils and National Standard Setting Bodies*, endorsed by the Council of Australian Governments in 2007. Its purpose is to inform interested parties regarding a proposal to revise existing regulatory requirements for construction in bushfire prone areas. Comments were invited on the Consultation RIS (2008-01) and have been considered in this Final RIS.

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1.1 The Regulatory Impact Assessment process

Under Council of Australian Governments' (COAG) requirements, national standard-setting bodies such as the Australian Building Codes Board (ABCB) are required to develop a Regulatory Impact Statement (RIS) for public consultation for proposals that substantially alter existing regulatory arrangements. The requirements are detailed in COAG *Best Practice Regulation*[1].

This RIS has been prepared for the incorporation of the proposed amendments to the Australian Standard AS 3959-1999 *Construction of buildings in bushfire prone areas* (the Standard), which is referenced by the Building Code of Australia (BCA) for the protection of buildings from the impact of bushfires. The RIS examines the policy choices through a rational, comparative framework demonstrating that the resulting regulatory proposal is likely to result in higher net benefits to the community than the identified alternatives.

It should be noted that this RIS considers the impacts of the proposed measures on new buildings only, more specifically, an agreed sample of Class 1 buildings. Although the provisions can also be applied to existing building alterations and additions, the BCA has been developed predominantly to apply to new construction and its application to existing buildings is at the discretion of the local approval authority and respective jurisdictional legislation. As such, an analysis of the impacts on existing buildings is not included in this RIS.

1.2 The review process

The Australian Government recently endorsed the view that "at least every five years, all regulation (not subject to sunset provisions) should, following a screening process, be reviewed with the scope of the review tailored to the nature of the regulation and its perceived performance".[2]

This position is further supported by the 2004 COAG *Inquiry on Bushfire Mitigation and Management*, which included in its report a recommendation that "the review of the Building Code of Australia, with particular reference to the Construction of Buildings in Bushfire Prone Areas Standard – to deal with resistance to natural hazards, including bushfires – be completed by the Australian Building Codes Board as a matter of priority" (Ellis *et al* 2004: p. 95, Recommendation 6.2). As noted, the ABCB references AS 3959-1999 in the BCA for the protection of buildings from the impact of bushfires. The Standard has now been reviewed and revised by Standards Australia Committee FP-020. The current version of the revised Standard was received by the ABCB in August 2008, at which point preparations for this RIS were already well advanced.

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[1] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007.
[2] Department of Prime Minister and Cabinet (2006), *Rethinking regulation: Report of the Taskforce on Reducing Regulatory Burdens on Businesses: Australian Government's Response*, p. 88.

AS 3959-1999 is intended to address the risk that property owners will not voluntarily include appropriate levels of bushfire protection and survival measures in new buildings in bushfire prone areas (BPAs). To the extent that the current Standard may not reflect current knowledge about the nature and extent of bushfire risks and the effectiveness of different prevention measures in mitigating those risks, it is appropriate to review the Standard.

The review process has considered changes to both the current site risk assessment methodology and the associated building and construction requirements. The intention being to provide a more accurate assessment of the risks associated with a given site, and to define an appropriate level of bushfire protection in the construction of new houses.

1.3 Objectives

The proposed amendments to the BCA and AS 3959-1999 seek to provide an efficient response to the risk that property owners will not voluntarily include bushfire protection and survival measures in new buildings in BPAs.

Specifically, the proposed Standard and the alternative options considered are seeking to achieve the following Government objectives:

- A reduction in the danger to life and the risk of property damage by ensuring that buildings have appropriate resistance to bushfires;
- The provision of outcome based regulation which allows industry to develop the most technically efficient and appropriate solutions;
- Address the identified market failures in relation to the provision of bushfire resistant features; and
- Ensure that the regulatory requirements are cost effective and transparent.

1.4 Identification of feasible policy options

In accordance with COAG requirements, this RIS identifies and considers the merits of alternative means of achieving the objectives of effective bushfire protection including:

- Intermediate forms of regulation (self regulation, co-regulation or quasi-regulation);
- Non-regulatory options (information campaigns, voluntary Standard, or taxes and subsidies); and
- Alternative levels of regulatory stringency of the regulatory proposal (i.e. the revised Standard) and how it differs from the status quo (i.e. continuing with the current Standard).

The lack of alignment between those with responsibility for incorporating bushfire protection in the design and construction of houses and those who realise their benefits, mean it is unlikely that an intermediate form of regulation would achieve the Government's objectives. The risks associated with non-compliance are exacerbated by the potentially serious consequences of bushfire events, including both substantial risks to public health and safety, and economic impacts.

Non-regulatory interventions on their own appear to be inappropriate responses to bushfire protection measures for houses built in BPAs, because they would not provide the level of protection and minimisation of damages required by the public and the government.

The proposed Standard represents a regulatory option and involves a revised site assessment framework and related construction requirements. The proposed regulatory approach is a simplified procedure involving the following five steps:

1. Determine the relevant Fire Danger Index (FDI);

2. Determine the relevant vegetation type;

3. Determine the distance of the site from the vegetation;

4. Determine the effective slope of the site under the vegetation; and

5. Determine the bushfire attack level (BAL) based on steps 1 to 4.

Compared to the current methodology, the relative FDI represents an additional factor in the site assessment, which allows for variations in bushfire risks across different geographical locations. Further, the revised methodology is based on *effective slope of the land under the vegetation*, rather than the *slope of the land between the vegetation and the site*, which is a more important determinant of the rate of fire spread, the severity of the fire, and the ultimate level of radiant heat flux. Finally, the proposed Standard also incorporates additional slope and distance categories to support a more detailed site risk assessment.

Based on an assessment of the above variables, the BAL of a given site is determined as one of the following six categories ranging from BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 to BAL-FZ, where a site assessment of BAL-12.5 and above triggers a requirement to include bushfire protection measures.

The proposed Standard is based on an assumed average flame temperature of 1000K[3]. In order to provide an assessment of alternative levels of regulatory stringency, the potential implications and sensitivity to variations in this assumed flame temperature was also assessed.

Therefore, this RIS provides a comparative assessment between the current arrangements (i.e. AS 3959-1999) and three alternative regulatory measures, namely:

- *Option 1* – the proposed Standard based on an assumed flame temperature of 1000K;

[3] K = Kelvin temperature scale, zero Kelvin corresponds to -273.15^{o} on the Celsius temperature scale.

- *Option 2* – a lower level of regulatory stringency (i.e. regulatory requirements based on an assumed flame temperature of 910K); and

- *Option 3* – a higher level of regulatory stringency (i.e. regulatory requirements based on an assumed flame temperature of 1090K).

The costs and benefits associated with these shortlisted options are assessed in detail in the subsequent cost benefit analysis.

1.5 Cost benefit analysis

The RIS provides an assessment of the costs and benefits associated with each Option compared to the current arrangements. The analysis separately considers the following:

- Estimated cost impact on individual building owners;

- Estimated aggregate cost impacts at a State / Territory level; and

- An assessment of the expected qualitative costs and benefits.

The outcome of each component of the analysis is presented below.

1.5.1 Cost impact on individual building owners

The analysis indicates that the introduction of the proposed Standard or the alternative regulatory options would be expected to provide a net benefit to the majority of building owners. However, additional costs may be imposed on individual building owners in some circumstances due to specific site characteristics and / or the type of construction.

Table 1-1 below provides a summary of the expected cost impacts of the proposed Standard (i.e. Option 1) and the alternative regulatory options (i.e. Options 2 and 3) for a sample of individual building owners. These costs represent the change in construction costs for each option compared to current arrangements (i.e. AS 3959-1999).

Table 1-1: Expected construction cost increase / (reduction) by house type

House type / Site assessment	Option 1 (1000K)	Option 2 (910K)	Option 3 (1090K)
Expected cost change			
Base house	($3,409)	($4,191)	($2,506)
Large two storey	($6,910)	($8,580)	($5,654)
ELC house[4]	$1,929	($1,477)	$7,337
Percentage cost change			
Base house	-1.2%	-1.5%	-0.9%
Large two storey	-1.8%	-2.2%	-1.5%

[4] Elevated lightweight construction (ELC) house

House type / Site Assessment	Option 1 (1000K)	Option 2 (910K)	Option 3 (1090K)
Percentage cost change			
ELC house	0.6%	-0.4%	2.2%

This can be summarised as follows:

- A reduction in construction costs of around 0.9-2.2 per cent for both the *base house* and the *large two storey* house under all options being considered;

- A decrease in the construction costs associated with an *ELC house* under Option 2 (0.4 per cent); and

- An increase in construction costs for the *ELC house* under Option 1 (0.6 per cent) and Option 3 (2.2 per cent).

Overall, Option 3 is likely to represent the most expensive option for all house types. It is expected to deliver a comparatively smaller cost reduction for the *base house* and the *large two storey house*, and would involve a cost increase for the *ELC house*.

A more detailed analysis of these cost estimates suggests some variation depending on site characteristics and the type of construction. For example:

- Across all house types, construction costs for sites currently categorised as LOW or MEDIUM are expected to increase. The increase in costs ranges from $1,900 to $4,000, depending on the type of house constructed and the regulatory option chosen. For sites currently categorised as LOW, these increases largely relate to construction on sites that are not subject to any additional construction requirements in the current Standard, which would be categorised as BAL-12.5 or above under the proposed site assessment framework (i.e. they would incorporate specific protection measures);

- The construction costs on sites currently categorised as EXTREME and HIGH are likely to decrease under Options 1 and 2 for the *base house* and the *large two storey house*, with estimated savings to building owners of between $10,000 and $13,000 for a *base house* and between $18,000 and $25,000 for the *large two storey* house depending on the regulation option chosen; and

- The construction costs for the *ELC house* are likely to increase under Options 1 and 3 for sites previously categorised as EXTREME. The expected cost increase ranges from $13,000 to $21,000 depending on the option chosen. This appears to reflect a more appropriate level of bushfire protection given the type of house being constructed and the assessed level of site risk.

The estimated cost impacts described above are likely to be a reflection of a more robust site assessment methodology, and an improved alignment between the assessed level of risk and the associated construction requirements. As such, the expected decrease in construction costs at the aggregate level does not represent a greater acceptance of bushfire risk, but instead a more appropriate level of protection being required.

1.5.2 Aggregate cost impacts

The estimated annual cost impacts associated with each option are based on estimated construction activity in BPAs and the cost estimates for each house type. In the absence of any available data, it was also necessary to make assumptions on the proportion of each house type constructed in BPAs under two different scenarios:

- Scenario 1 – Construction in BPAs is spread evenly across the three different house types; and

- Scenario 2 – 50 per cent of construction relates to the *base house*, with the remaining 50 per cent spread evenly across the *large two storey house* and the *ELC house*.

Table 1-1 to Table 1-3 provide the estimated annual impact in construction costs at the State/Territory and the national level for all options under both scenarios.

Table 1-1: Option 1 – estimated annual cost increase / (reduction)

State / Territory	Option 1 (1000K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($11.7m)	($12.3m)
NT	$0.0	$0.0
QLD	($6.2m)	($6.5m)
SA	($3.5m)	($3.7m)
TAS	$0.0	$0.0
VIC	($8.4m)	($8.9m)
WA	($1.3m)	($1.3m)
TOTAL	**($31.1m)**	**($32.8m)**

Table 1-2: Option 2 – estimated annual cost increase / (reduction)

State / Territory	Option 2 (910K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($19.8m)	($19.2m)
NT	$0.0	$0.0
QLD	($10.5m)	($10.2m)
SA	($6.0m)	($5.8m)
TAS	$0.0	$0.0
VIC	($14.3m)	($13.9m)
WA	($2.1m)	($2.1m)
TOTAL	**($52.8m)**	**($51.2m)**

Table 1-3: Option 3 – estimated annual cost increase / (reduction)

State / Territory	Option 3 (1090K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($1.1m)	($3.5m)
NT	$0.0	$0.0
QLD	($0.6m)	($1.8m)
SA	($0.3m)	($1.0m)
TAS	$0.0	$0.0
VIC	($0.8m)	($2.5m)
WA	($0.1m)	($0.4m)
TOTAL	**($3.0m)**	**($9.2m)**

The expected aggregate annual construction cost savings under each option are in the order of $31m-$33m for Option 1, $51m-$53m for Option 2 and $3.0m-$9.2m for Option 3. This indicates while all options are likely to deliver cost reductions to building owners, Option 3 is expected to provide a comparatively smaller annual reduction in construction costs.

1.5.3 Qualitative assessment

In addition to quantitative cost savings, qualitative costs and benefits should also be considered when assessing the overall impact of the proposed Standard and the alternative options. Qualitative costs and benefits include:

- *Costs*
  - Individuals – the proposed Standard may impact adversely on some individuals depending on the site characteristics and preferred house design. However, while in some cases the construction of certain house types will become more expensive, this does not preclude the individual from choosing a less expensive alternative, which is more appropriate given the assessed level of site risk. Therefore, the impacts are largely limited to a restriction in consumer choice, rather than a cost impost; and
  - Businesses – the proposed Standard may impact the demand for certain house types, but is unlikely to impact the overall demand for construction in BPAs. That is, while some houses will become relatively more expensive, others will become less expensive.
- *Benefits*
  - Individuals – The proposed Standard is likely to lead to a reduction in the costs associated with bushfire events, such as damage costs, disruptions to normal life and impacts on health and well-being. Annual building related damage costs attributed to bushfire events is roughly estimated at $71.6 million, but this figure is likely to be conservative as it does not include the broader costs associated with bushfire events (i.e. consequential losses).

- Businesses – the proposed Standard may stimulate demand for the construction of some house types, which become relatively less expensive and more attractive under the proposed arrangements; and

- Government – the proposed Standard could lead to a reduction in social disruption costs and the adverse economic impacts associated with bushfire events.

1.6 Public Consultation

Prior to formal public release, the draft Consultation RIS was released to State and Territory building administrations in early October 2008 and to Standards Australia Committee FP-020 in mid-October, to provide these key stakeholders with opportunity to comment on preliminary outcomes and to assess the document for accuracy with regard to technical content. No comments were received from the States and Territories, while one set of comments was received from an FP-020 member, ostensibly seeking clarification of some issues.

Once cleared for public consultation by the Office of Best Practice Regulation, the Consultation RIS was released for comment in mid-November 2008 for a period of approximately four weeks. This was extended by one week for those parties who requested an extension of time to allow broader consultation within their respective groups. Responses were received from 18 organisations with many national industry associations consolidating the comments of their State and/or Territory member organisations. A list of respondents can be found at Appendix D and a summary of comment and how it has been treated in this Final RIS is described in 10.4.

Generally, all submissions were supportive of the proposal with similar levels of support for the two higher level options provided in the RIS, i.e. Option 1 (1000K) and Option 3 (1090K). There was only minor support for Option 2 (910K). Much of the support for Option 3 came from the fire service or fire service industry. The housing industry supported Option 1. The outcomes of the consultation process have not changed the initial findings or conclusions of the Consultation RIS.

1.7 Findings

The RIS analysis concludes the following:

Construction cost impacts

- The revised Standard is likely to lead to cost savings when building in BPAs:

  - On an individual level, all Options are likely to lead to cost savings for the *base house* and the *large two storey house*, while building an *ELC house* is expected to lead to an increase in construction costs under Options 1 and 3. Further, Option 3 is likely to lead to comparatively lower construction cost savings when compared to the other options;

  - On an aggregate level, the options would lead to a decrease in construction costs for houses located in BPAs by approximately $3m-$53m per annum nationally. Option 3 provides a lower level of cost savings compared to Options 1 and 2 (i.e. a reduction of around 80-90 per cent); and

- It must be noted that the cost savings estimates are dependent on the assumptions used (e.g. level of adoption of the BCA), and do not represent an increased acceptance of bushfire risk in construction. Further, they do not provide for changes in consumer demand patterns in favour of less expensive house designs.

Benefits

- There are other incremental benefits associated with the revised Standard above those provided by the current arrangements. These benefits are in addition to the construction cost savings resulting from the revised Standard, but are difficult to quantify because:

  - Housing survivability information is not available for buildings built under AS 3959-1999 and as such, costs attributable to building to this standard cannot be assessed against possible losses;

  - It is difficult to measure the improvement in housing survivability as a result of the revised Standard as housing survivability is influenced by a range of factors other than bushfire protection measures that are provided by AS 3959; and

  - It is difficult to estimate building related costs, as not all damage incurred in a bushfire event can be attributed to the loss of a building.

- The revised Standard will impose minimal incremental business compliance costs and has no adverse impact on competition.

Conclusion

It can be concluded that all proposed regulatory options are likely to deliver an overall net benefit compared to the current arrangements. That is, the benefits of increased protection and reduced construction costs are likely to outweigh any additional costs. Comment received through the RIS public consultation process did not identify any issues of significance that would alter this conclusion. The general response was supportive of the proposal, although there were differing opinions regarding which of the two higher levels of protection should be adopted, i.e. Option 1 (1000K) or Option 3 (1090K). There was minimal support for Option 2 (910K).

All Options were assessed as likely to support the achievement of the Government objectives, with Option 1 assessed relatively more favourably as it provides a greater level of protection than Option 2, without a considerable variation in construction costs. Although Option 3 provides more stringent bushfire protection measures, the construction cost savings are considerably lower. Option 3 would need to provide further benefits of around $30m-$40m per annum to achieve the same level of benefits as Options 1 and 2.

The distinction between Options 1 and 2 is marginal. Although Option 1 is more expensive in terms of construction costs, it provides a higher level of bushfire protection. In aggregate, Option 1 would need to provide around $20m per annum in other benefits to provide a net cost benefit at least equal to Option 2. This may be a reasonable expectation as Option 1 is based on an assumed flame temperature of 1000K and Option 2 on an assumed flame temperature of 910K.

Therefore, on this basis Option 1 (i.e. 1000K) represents the preferred option.

2 Introduction

Under Council of Australian Governments' (COAG) requirements, national standard-setting bodies such as the Australian Building Codes Board (ABCB) are required to develop a Regulatory Impact Statement (RIS) for proposals that substantially alter existing regulatory arrangements. This requirement is reaffirmed in the ABCB's Inter-Government Agreement[5] (IGA) which requires that there must be a rigorously tested rationale for regulation.

A draft RIS ('Consultation RIS') is initially undertaken for the purposes of public consultation. The Consultation RIS may be developed further following its public release, taking into account the outcomes from the community consultation. A Final RIS is then developed for decision-makers. This entire process is undertaken in cooperation with the Office of Best Practice Regulation and in accordance with the process established in the COAG *Best Practice Regulation Guide*[6] and presents the rationale, costs and benefits, and impacts of the proposal.

The primary purpose of a RIS is to examine the policy choices through a rational, comparative framework and to demonstrate that the resulting regulatory proposal is likely to result in higher net benefits to the community than the identified alternatives.

This RIS analyses the likely impact of adopting changes to the Building Code of Australia (BCA) construction requirements for buildings in designated bushfire prone areas (BPAs). These changes have come about through the revision of the BCA referenced Australian Standard AS 3959-1999 *Construction of buildings in bushfire prone areas* (the Standard).

Whilst the current regulatory framework in this area has worked well, increasing knowledge of the risks of bushfire and how these can best be managed has prompted a review of the existing Standard. Ensuring that the Standard is up to date and reflects current research and contemporary building practices is important given the ongoing level of building activity in BPAs and the expectation that the risk of bushfire events occurring in the future will increase.

The need for a review is supported by the 2004 COAG *Inquiry on Bushfire Mitigation and Management*, which included in its report a recommendation that "the review of the Building Code of Australia, with particular reference to the Construction of Buildings in Bushfire Prone Areas Standard – to deal with resistance to natural hazards, including bushfires – be completed by the Australian Building Codes Board as a matter of priority" (Ellis *et al* 2004: p. 95, Recommendation 6.2). This RIS is prepared as a part of that initiative.

2.1 Policy context

There are large areas across Australia where the incidence of bushfires is considered a serious risk. These areas are predominantly rural, but they can also include urban rural interface areas on the edge of urban settlements.

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[5] The ABCB IGA can be located at www.abcb.gov.au
[6] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007.

The BCA and the Australian Standards

This RIS concerns the revision of the Australian Standard AS 3959-1999 *Construction of buildings in bushfire prone areas* referenced by the BCA for the safeguarding of building occupants from injury, through the protection of the building itself, in the event of a bushfire.[7]

Requirements of the BCA

The BCA requires that residential Class 1, 2 & 3 buildings constructed in designated BPAs provide appropriate resistance to bushfires in order to reduce the danger to life and minimise the risks of building loss. The BCA establishes performance requirements that require buildings in designated BPAs to be designed and constructed to reduce the risk of ignition from a bushfire as the fire front passes. The BCA is performance based and allows compliance with the Performance Requirements by adopting two broad types of building solutions:

- Implementing the deemed-to-satisfy (DTS) provisions which are specific construction requirements that are either contained in the BCA or in BCA referenced documents such as Australian Standards. DTS compliance is achieved by adherence with AS 3959-1999 or by complying with the BCA's Acceptable Construction Practice for building elements including flooring systems, external walls and doors, windows and vents which is based on AS 3959-1999; or

- Formulating an alternative solution that can be shown to be at least equivalent to the DTS provisions or which can be demonstrated as complying with the Performance Requirements.

Periodic review of the Standard

The importance of the Standard is reinforced by the frequent occurrence of bushfire events within Australia and the reasonably significant level of ongoing construction activity in BPAs.

The Standard was last revised in 1999. There are several reasons why individual Standards within the BCA are reviewed on a regular basis. These include changes to the understanding of risks which exist in the broader built environment and how these can best be managed, and changes in building materials and practices as a result of technological developments. Given the BCA is the technical basis for building standards in all of Australia's jurisdictions, it is important that standards are reviewed on a regular basis to take account of these changes; so relevancy can be maintained and compliance burdens minimised.

The current revisions proposed for AS 3959-1999 primarily relate to aspects of the site assessment methodology and specific construction requirements. There is inter-dependency between the provisions in these areas, namely that the site assessment process determines the specific construction requirements for a building which is to be constructed in a BPA.

[7] The BCA is produced and maintained by the Australian Building Codes Board on behalf of the Australian Government and State and Territory Governments. The BCA has been given the status of building regulations by all States and Territories. These regulations are effected through jurisdictional legislation.

To a large extent the proposed revisions originate from a spate of bushfire incidents in Australia in recent years and insights from research around these. However, they also reflect a heightened level of awareness in the building industry about the potential impacts of climate change on Australia's rural environment in coming years, such as an increase in the frequency of both drought conditions and extreme weather events (e.g. days over 35 degrees Celsius). Should these revisions proceed, they will be given effect through jurisdictional legislative frameworks.

Review process

The review process, from which the proposed changes stem, was initiated in 2001 by Standards Australia and received further impetus from a 2002 report on natural disaster mitigation prepared for the Council of Australian Governments (COAG) in 2004, when a national inquiry on bushfire mitigation and management was undertaken, also on behalf of COAG. As a result, the ABCB was requested to review building requirements with regard to bushfire protection. The review was to include the provisions of the BCA and the primary reference Australian Standard AS 3959-1999. As a result, a revised Standard has been drafted and proposed for replacement of the 1999 version.

A draft revision of the revised Standard was released for public comment in March 2003. As a result of the comments received, a second draft of the revised Standard was released for public comment in February 2005. Further comments were then received and incorporated into a third draft of the revised Standard — it is this draft for which this RIS has been prepared.

2.2 Current legislative framework

The BCA is given the status of building regulations by all States and Territories. However, the BCA bushfire provisions only apply to areas that are designated BPAs. The BCA does not designate BPAs — States and Territories are responsible for this, having regard to the conditions which prevail in their own jurisdictions. Appendix A outlines in more detail the arrangements for BPA designation in each jurisdiction. Once a BPA designation has been made, the provisions of the BCA's bushfire provisions are automatically engaged. The current arrangements in each jurisdiction are briefly summarised in Table 2-1 below.

Table 2-1: Current arrangements for designation of BPAs

State / Territory	Designation of BPAs
Australian Capital Territory	All non-urban land is defined as bushfire prone
New South Wales	Council area mapping is undertaken in accordance with the *Bushfire Prone Mapping Guidelines* of the Rural Fire Service.
Northern Territory	There is a general requirement for a 4 metre firebreak on the perimeter of allotments, but no formal BPAs in the NT
Queensland	As in NSW, councils work with the (Queensland) Rural Fire Service to map BPAs
South Australia	Large areas of the State have been mapped for their bushfire risks, with BPA designations made accordingly. Mapping activities are currently being undertaken for some of the lower risk areas in the State

Tasmania	Tasmania does not employ the BPA terminology, and instead uses its council based planning schemes as a basis for risk designations
Victoria	Councils have completed the task of designating BPAs
Western Australia	Councils are in the process of progressing BPA designations

In addition to the broad based BPA designations resulting from the processes outlined above, jurisdictions can make case-by-case designations to engage the provisions of the BCA. Irrespective of how a designation is made, the main issues of interest are the effectiveness of the BCA's bushfire provisions and the way in which the provisions are integrated with approval processes in each jurisdiction.

It should also be noted that where a BPA designation is made, the provisions of the BCA are only engaged to the extent that they are enshrined in jurisdictional legislation. Victoria and WA for example, have adopted the BCA 'as is', whereas NSW, SA and Queensland have variously altered the relationships prescribed in the BCA between the degree of bushfire risk and the associated building measures required.

3 Nature and extent of the problem

3.1 Overview

The problem targeted by AS3959-1999 *Construction of buildings in bushfire prone areas* is the risk that property owners will not voluntarily include appropriate levels of bushfire protection and survival measures in new buildings in BPAs.

Where building purchasers do not perceive value from bushfire protections or do not understand their level of exposure to the risk of bushfires, there is little or no incentive for builders to include bushfire resistant features in construction. This is because purchasers are unlikely to choose to meet the additional costs that builders may incur to provide these protections. The imposition of these costs may also reduce demand for construction in BPAs.

Further, to the extent that the current Standard does not reflect current knowledge about the nature and extent of bushfire risks and the effectiveness of different prevention measures in mitigating those risks, it may be timely to review the Standard. The objective being to ensure that the Standard provides an accurate assessment of the risks associated with a particular site, and prescribes building and construction requirements which are more aligned with the assessed level of risk exposure. The need for a review is supported by COAG (2004), which has requested that the ABCB review building requirements with regard to bushfire protection.

In this section the nature and extent of this problem is explored. The nature of the threat posed by bushfires to buildings and the profile of bushfire risk in Australia are discussed. We also consider the level of ongoing building activity in BPAs and consider whether the current regulatory arrangements, individual responses and the insurance industry provide a robust solution to the problem of houses in BPAs being under-protected against the risk of bushfire events.

This discussion highlights the unique nature of the problem and outlines evidence which suggests that the magnitude of the problem will increase in years to come. Combined, these considerations underpin the case for government intervention in this area.

3.2 Nature of bushfire risk

3.2.1 Bushfires and buildings

The bushfire risk associated with a given building is related to its design and construction, prevailing weather conditions, amount and type of fuel load (vegetation) and the relationship of building to vegetation. There are also other factors outside the scope of the BCA, including site and building maintenance, occupant actions during and after a bushfire event and emergency response.

Material combustion risks

Buildings can be exposed to bushfires in three ways:

1. Burning debris or embers can fall or be blown onto — or into — combustible parts of a building;

2. Radiant heat, if severe enough, can act to ignite susceptible materials; and

3. Contact with direct flames can ignite a building.

Whilst a building may be exposed to the combined attack of all three elements, research has shown that embers and burning debris are the major means of ignition.[8] There are numerous accounts of unprotected buildings surviving the bushfire front, with or without the assistance of the fire brigade and the owners, only to be burnt down later by embers which have accumulated and gone undetected.

Vegetation and topographical risks

In addition to the design and construction of the building, there are two other variables which have an important bearing on a building's susceptibility to bushfire — the type (and density) of vegetation in the immediate area and the slope of the surrounding terrain.

Vegetation is a fuel source for bushfires. As the combustibility of vegetation varies, the bushfire risk associated with a given site is related to the type of vegetation in the vicinity of the building, and the distance of that building from the predominant vegetation. By way of example, the bushfire risk is generally considered to be low for a given building if there is no vegetation within 100 metres of the building, whereas close proximity to a tall eucalypt forest would result in a high level of bushfire risk.

The slope of the terrain surrounding a building can also have a bearing on the level of bushfire risk. In particular, it is the slope of the terrain that has a direct influence on the rate of fire spread. Fire travels faster up hills. Thus the risk for a given property is greater if there is combustible vegetation on a downslope than if the terrain were level, or there is vegetation sloping above the property (i.e. an upslope).

Other risks

There are additional factors that influence a building's susceptibility to bushfire damage. These include the combustibility of gardens (i.e. vegetation size and type), the extent of surrounding leaf and twig litter, the nature and location of outbuildings and the pre, during and post fire suppression activities of occupants[9]. These factors, although potentially major contributors, are beyond the scope of the BCA and therefore not included in this analysis.

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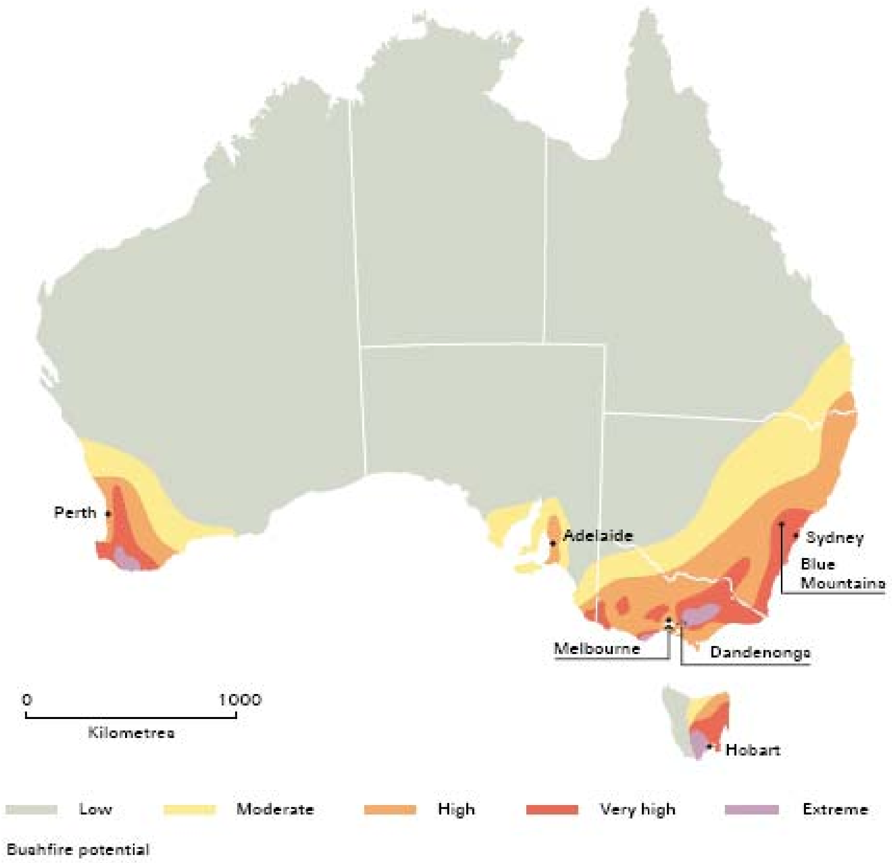
[8] Chen K. & J. McAneney (2004), Quantifying bushfire penetration into urban areas in Australia , Geophysical Research Letters, Vol. 31, L12212, doi:10.1029/2004GL020244, 2004.
[9] Leonard, J.E. & Blanchi, R. (2004), Bushfire at the urban interface: Lessons from the Otway fires (1983), Sydney fires (1994) and Canberra fires (2003).

3.2.2 Geographic profile of bushfire risk in Australia

In addition to building and site-specific factors, the level of bushfire risk also varies according to geographic location. The history of bushfires in Australia provides a broad indication of where bushfires are likely to occur. This history is summarised in Figure 1 and has been described as follows:

> *Areas of moderate to extreme bushfire potential are concentrated in the southern and south-eastern margins of Australia. … All of the areas of high or extreme bushfire potential are regarded as having low or moderate drought potential combined with moderate to heavy fuel loads and low frequency of extreme fire weather. Three areas of extreme bushfire potential have been identified – the far south-west of Western Australia, north-east of Melbourne, and around Hobart. Areas of very high potential surround these areas with a major area extending along the New South Wales coast and including Sydney. Almost all of Victoria has a high to extreme bushfire potential*[10]

Figure 1: Bushfire potential in Australia



Blong R J, Sinai D and Packham C, 2000, **Natural Perils in Australia and New Zealand** , Swiss Reinsurance, Sydney , 120p.

[10] Blong R., D. Sinai & C. Packham (2000), *Natural perils in Australia and New Zealand*, Swiss Re Australia Ltd, pp. 91-2.

Definitions:	
Low	The combination of heavy continuous grass and extreme fire weather is rare.
Moderate	Predominantly areas with light-grass fuel loads or where extreme fire weather is relatively uncommon.
High	Predominantly areas with grassland fuels or forests and woodlands with grass understoreys, and extreme fire weather somewhat variable within zone.
Very high	Areas with moderate forest fuels and moderate frequency of extreme fire weather.
Extreme	Areas with heavy forest fuels and relatively low frequency of extreme fire weather.

Source: Reproduced from Blong RJ et al 2000: page 90-91, but originally from Johnson RW 1995: page 51

While the risk classifications within Figure 1 above are relatively general, the diagram usefully highlights the risk of bushfire events across Australia.

3.2.3 Conclusion – nature of bushfire risk

In summary, the level of risk for a particular building is related to a combination of the following factors:

- Building materials and systems used and any specific prevention measures incorporated in the design and construction of new houses;
- The type and density of vegetation in the immediate vicinity of the site and the distance of the building from that vegetation;
- The slope of the terrain surrounding the site; and
- The geographical location of the site.

Given the above, it is important that the site risk assessment contained in the Standard takes account of these factors. As noted, additional risks such as the actions of occupants, with regard to the nature and maintenance of gardens and any pre, during and post fire suppression activities, are outside both the scope of the BCA and this analysis.

3.3 Extent of bushfire risk

3.3.1 Current level of bushfire risk and rate of damages / losses

Researchers from Macquarie University's National Hazards Research Centre (NHRC) have published a series of papers in recent years on bushfire incidents which provide insights on the risk of bushfires, particularly in relation to the probability of damage initiated by past events.[11]

[11] Papers include: 1. McAneney, J., Chen, K., Crompton, R. and Pitman, A. (2007). Australian Bushfire Losses: Past, Present and Future. Proceedings of the Wildfire 2007 4a Conferencia Internacional sobre Incendios Forestales , Spain, 13-17 May, 2007 and 2. Chen, K. and McAneney, K.J., 2005. The bushfire threat in urban areas. Australasian Science, 26(1): 14-16.

This work has used satellite imagery to determine how exposed Australian buildings are to bushfire events. At the time of writing, the exposure of 8.2 million addresses (out of a total 10.2 million addresses in Australia) has been assessed. This research has found that 20 per cent of the assessed addresses are within 700 metres of an interface between a rural and urban area, and 4.1 per cent of addresses are 'front row' addresses, or within 50 metres of a rural/urban interface. These findings were significant because previous bushfire events have demonstrated that ember attacks can occur over interface distances of 700 metres. That is, a large number of properties within Australia are potentially susceptible to ember attack if there was a bushfire in the area in which they are located.[12]

The NHRC has also examined the historical rates of building damage and loss associated with bushfire events in Australia. This work has found that on average 84 buildings are lost to bushfire in Australia each year — there is however, significant variation around the timing of these losses; while there have been no losses in about 40 per cent of years since 1900, five mega bushfires have destroyed over 500 houses each.

In 2001, the Bureau of Transport Economics (BTE) published estimates of the economic costs of bushfires and other natural disasters in Australia. Table 3-1 below provides the key findings of the BTE study (values expressed in 1998 prices).[13]

Table 3-1: Estimated costs of bushfire events

Bushfire events	BTE findings
Frequency	There were 23 bushfires that caused significant property loss[14] in the 33 years from 1967 to 1999, an average of 0.7 bushfires per year. There were no bushfires in 55% of years.
Total cost	$2.5 billion over the period 1967-99
Average annual cost	$77 million per annum
Average cost per bushfire	$109 million per fire
Significance of large bushfires	The Ash Wednesday fires in Victoria (February 1983) account for 40% of the total cost, or $1 billion
Cyclical pattern	The historical record, back to the 1930s, indicates that bushfires occur in cycles. It takes time for an area that has been burnt to accumulate the fuel for a subsequent fire.

Note: all values expressed in this table are in 1998 prices/dollars.

It should be noted that these cost estimates are approximate, and include some costs unrelated to building damages (e.g. loss of crops, livestock). However, they do not account for the full range of costs associated with bushfire events. Other costs would include (but not be limited to) indirect production losses, deaths and injuries, emotional and psychological effects and social support.

[12] McAneney, J., Chen, K., Crompton, R. and Pitman, A. (2007). Australian Bushfire Losses: Past, Present and Future. Proceedings of the Wildfire 2007 4a Conferencia Internacional sobre Incendios Forestales , Spain, 13-17 May, 2007.]
[13] Bureau of Transport Economics, *Economic costs of natural disasters in Australia*, BTE Report 103 (2001)
[14] The BTE study only considers natural disasters that result in damage above $10 million. Bushfires with damage costs below $10 million have not been included.

In addition, McAneney[15] estimated that the annual average damage, consisting of current asset values for home and contents, is valued at $33.5m (2003 dollars). When the annual average damage is adjusted for the annual volatility of losses[16], the national bushfire risk premium per annum amounts to $62.4m, which is **$71.6m**[17] in current value.

Whilst this existing research is useful, it does not readily provide quantitative support for the proposed revision to AS 3959-1999 discussed here. This is because the large majority of buildings in BPAs pre-date the introduction of the current standard.

3.3.2 Building activity in BPAs

The ABCB commissioned a survey of a sample of councils to confirm analysis undertaken by the NHRC (trading as Risk Frontiers) in relation to current building activity in BPAs. The survey targeted councils with historic bushfire damages and indicated that around 11,000 new houses are built in BPAs each year, which is about 10 per cent of all new house building activity. With reference to the discussion in Section 2.2, the reliability of these results does vary somewhat by jurisdiction due to variations in progress with mapping activities and BPA designations. However, the results clearly indicate that there is a significant level of building activity occurring in BPAs. This, in addition to the discussion on climate change as a risk factor below, further reiterates the importance of reviewing the standards for the construction of buildings in BPAs on a regular basis.

Of the new construction activity, the majority is concentrated in NSW (about 40 per cent), Victoria (about 25 per cent) and Queensland (about 19 per cent) which — as depicted in Figure 1 — are characterised as having large areas that have a moderate to very high risk of experiencing bushfire events.

3.3.3 Climate change: Driving an increase in Australia's risk profile?

While research on the potential impacts of climate change on Australia is ongoing, one of the early predictions emerging from this area is that the risk of bushfires will increase in coming years due to an increase in the frequency of drought conditions and extreme weather events (such as high winds, which can drive the spread of bushfires).

CSIRO researchers have assessed the impact of climate change on fire weather, and recently reported the following (FFDI is the 'forest fire danger index'):

> *… A key finding of this study is that an increase in fire-weather risk is likely at most sites in 2020 and 2050, including the average number of days when the FFDI rating is very high or extreme. The combined frequencies of days with very high and extreme FFDI ratings are likely to increase by 4-25% by 2020 and 15-70% by 2050. For example, the*

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[15] K. John McAneney, 'Australian Bushfire: Quantifying and Pricing the Risk to Residential Properties', Risk Frontiers, Macquarie University, NSW.
[16] This takes into account I in 100 year event that equates to a likely loss of AU$0.7 billion and 1 in 250 year event that equates to a likely loss of AU$1.1 billion.
[17] This has been calculated by taking the 2003 value of $62.4 million to the value it would be in 2008 using the consumer price index. (http://www.rba.gov.au/Statistics/AlphaListing/alpha_listing_c.html)

> *FFDI results indicate that Canberra is likely to have an annual average of 25.6-28.6 very high or extreme fire danger days by 2020 and 27.9-38.3 days by 2050, compared to a present average of 23.1 days. The increase in fire-weather risk is generally largest inland. Tasmania is likely to be relatively unaffected. (Hennessy et al 2005: page 5)*

These results reiterate the importance of reviewing the Standard for the construction of buildings in BPAs on a regular basis to ensure they reflect current research and contemporary building practices for managing emerging risks in this area.

3.3.4 Conclusion – extent of bushfire risk

In summary, while the likelihood of a significant bushfire event impacting a given site or homeowner is relatively low, the potential consequences from such an event are considerable. Furthermore, continued construction activity in BPAs and the potential impacts of climate change suggest that it is likely that a greater number of households will be exposed to bushfire risk in the future.

3.4 The rationale for intervention – market failures

3.4.1 Introduction

Given the nature and extent of the risks faced by householders in BPAs, it is important that appropriate levels of bushfire protection and survival measures are included for new buildings in these areas. However, due to a range of issues, it is unlikely that in the absence of intervention, the market will deliver the best outcomes for society (i.e. appropriate levels of protection). Non-intervention increases the risk of increased costs to householders in BPAs.

In the event that a market does not deliver the best outcomes for society – for example, because of the existence of market distortions or imperfections, the market is said to be 'failing' and government intervention could be justified on the grounds that it could improve economic outcomes and the economic welfare of society.

This section suggests that the threat of bushfire damage is unlikely to be addressed appropriately by the market due to:

- imperfect individual responses;
- imperfect industry responses;
- insurance market limitations; and
- unpriced negative externalities.

These imperfect responses would arise due to an array of market failures including insufficient information, bounded rationality and information asymmetry, and provide a rationale for continued Government intervention. These market failures are further explored in the sections below.

3.4.2 Imperfect individual responses

Building owners clearly have a strong self interest in protecting themselves and their properties from the risks and consequences of a bushfire event. In principle, owners can undertake direct measures, such as using building designs and materials that resist ignition and clearing vegetation from around the building, provided that information on these risks is easily available. Owners can then analyse the information to balance the risk of loss against the cost of risk reduction measures, and thus choose the level of exposure they are willing to accept. However in practice, this may not occur because of market failures summarised below.

Insufficient information and 'bounded rationality'

To determine the risks associated with building on a particular site and the appropriate mitigation measures to adopt building owners would need information about how risks are influenced by factors such as:

- Building characteristics – such as materials for walls and roofs, decking materials, quality of maintenance, size of windows and type of glazing;
- Property characteristics – proximity and condition of outbuildings, fencing material, nature and density of vegetation, accumulation of rubbish and other flammable material;
- Environmental characteristics – including bushland vegetation, distance to bushland, slope of land, ignition of houses in close proximity; and
- Occupant characteristics – such as quality of active defence, experience and understanding, availability of equipment.

The information may be highly technical, extensive and difficult to comprehend. In practical terms it may not be realistic to assume that individuals would, as a matter of course, have the capacity to assemble, analyse and assess the range of information necessary to form a fully informed view of the building risks. For example, studies, such as that by Kunreuther et al[18], have documented the limitations of individuals' rationality in the context of natural hazard perception and insurance decisions.

Given the above, 'bounded rationality' could potentially result in: failure to adopt appropriate bushfire protection measures during the construction phase of a house; and the under-insurance of houses in BPAs due to the inability of individuals to fully comprehend and interpret the bushfire and damage risks they are exposed to.

[18] Kunreuther H., R. Binsber, L. Miller, P. Sagi, P. Slovic and N. Katz (1978), *Disaster Insurance Protection: Public Policy Lessons*, John Wiley and Sons, Interscience Publications, New York.

3.4.3 Imperfect industry response – split incentives

The benefits of bushfire protection of buildings do not accrue to the party that designs or builds the house. Designers and builders have incentives to minimise building costs in order to attract home owners and remain competitive in the building industry, yet decisions made during the building design and construction phases can significantly impact on the probability of house survival and on the damage incurred in the event of a bushfire. Without intervention, builders do not have incentives to voluntarily incorporate bushfire protection measures in the design and building materials of houses, where house owners are price driven and unable to verify the benefits arising from an increase in building costs.

3.4.4 Insurance market limitations

The insurance industry seeks to help individuals (a) strike an optimal balance between risk and the cost of risk reduction and (b) diversify risks and losses associated with a given event equitably. Whilst the services provided by the insurance industry are valuable to many people, there is a limit to their usefulness in terms of managing the risk of damage from bushfire events.

Specifically, the insurance market is unlikely to provide an adequate response for the following reasons:

- Insurance does not reduce the risk of a bushfire occurring or provide homeowners with protection, it only provides ex-post compensation for damages arising from bushfire events with the cost of insurance reflecting the risk of loss and damage; and

- Insurance may not provide adequate compensation for the full impacts of bushfire events (e.g. social disruption).

Furthermore, to the extent that regulatory arrangements can reduce the risk of bushfire damages, the cost of insurance should decrease.

3.4.5 Unpriced negative externality

Imposing costs on neighbours

To some extent the level of protection associated with a given property depends not only on the actions of that property's owner, but also those of neighbouring property owners. That is, the individual response of one householder can have 'external effects' which can increase the risk to other buildings in the immediate vicinity.

These 'external effects' include failure to maintain surrounding vegetation, building with inappropriate construction materials, an unoccupied house and not having the appropriate equipment to defend their property in the event of a bushfire. The non-action of house owners can affect the probability of ignition of surrounding houses in the event of a bushfire. As the costs associated with these negative external effects are not borne by the house owner that generates them, there is little incentive for owners to minimise such effects.

A survey[19] of the Otway Ranges fire of 1983 in Victoria showed that factors determining the survival of houses included the presence of people and their fire-fighting activities and the use of particular wall and roof cladding materials. It showed masonry wall cladding, a tiled roof and occupants who stayed to fight the fire, improved the chance of house survival. The survey indicated that residents were able to save their houses by extinguishing burning materials around the houses and by extinguishing small ignitions of the house itself before these small fires became uncontrollable. In addition, in many cases, residents not only carried out salvage operations on their own house but also their neighbours'. More recent research into housing survivability in the Canberra bushfire of 2003 gives support to the findings above.[20]

The evidence demonstrates that non-action by house owners not only increases the risk of destruction of their own houses but can have adverse effects on neighbouring houses. Incentives to take mitigating measures is reduced when a house owner has purchased insurance and when they cannot be made liable for the destruction of neighbouring houses even if their non-action was a contributing factor.

Imposing costs on society

The actions or non-actions of property owners in minimising the risk and cost of damage to their own or surrounding properties can also have a wider impact on society. In the event of a bushfire where houses are destroyed and individuals are left homeless and possibly destitute, the Government or society would be expected to provide assistance to such individuals. Assistance could come in the form of disaster relief or welfare assistance.

Society would also incur costs associated with emergency services, volunteer time, and production losses. While the Standard will not prevent the occurrence or frequency of bushfires, the Standard is likely to ensure houses are better equipped to withstand bushfire attacks, and so reduce the broader impacts on society of bushfire events. Government intervention is justified in order to minimise the cost impact to society.

3.4.6 Conclusion – market failures

In summary, due to the imperfect responses and a range of market failures explained above, it is unlikely that in the absence of regulation, householders would voluntarily, or have the knowledge to, include appropriate levels of bushfire protection and survival measures in new buildings in BPAs. This is likely to result in increased risks associated with death, injuries and damage costs to property. Therefore, Government intervention is justified on the grounds that it could deliver a more efficient outcome for society.

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[19] Ramsay G. C., N. A. McArthur and V. P. Dowling (1996), 'Building in a fire-prone environment: research on building survival in two major fires', *Proc. Linn. Soc. N.S.W. 116*, pp. 133-40.
[20] Blanchi, R. and J. Leonard (2005), 'Investigation of bushfire attack mechanisms resulting in house loss in the ACT bushfire 2003', Bushfire CRC Report.

3.5 Periodic review of the Standard – regulatory review

Having established the rationale for Government intervention in Section 3.4, a periodic review and update of the current arrangements is necessary to:

- Enhance consistency with the Australian Government policy objectives;
- Reflect stakeholder feedback;
- Minimise losses that may result from increased building activity and climate change; and
- Address imperfections in the current Standard.

That is, it is important that the chosen form of Government intervention supports the efficient delivery of improved economic and welfare outcomes.

3.5.1 Consistency with the Australian Government policy objectives

The Australian Government recently endorsed the need for a periodic review of regulation. In its response to the recommendations of a review by the Regulation Taskforce on reducing regulatory burden on businesses, the Australian Government agreed that "at least every five years, all regulation (not subject to sunset provisions) should, following a screening process, be reviewed, with the scope of the review tailored to the nature of the regulation and its perceived performance".[21] Further, based on the outcomes of the *National Inquiry on Bushfire Mitigation and Management (2004),* COAG has requested that the ABCB review building requirements with regard to bushfire protection.

There are several reasons why individual standards within the BCA are reviewed on a regular basis. These include changes to the understanding of risks which exist in the broader built environment and how these can best be managed, and changes in the stock of building materials as a result of technological developments. Given the BCA is the basis for the regulatory building standards in all of Australia's jurisdictions, it is important that they are reviewed on a regular basis to take account of these changes so their relevancy can be maintained and compliance burdens minimised.

The ABCB references AS 3959-1999 in the BCA for the protection of buildings from the impact of bushfires. The Standard has now been reviewed and revised by Standards Australia Committee FP-020. The current version of the revised Standard was received by the ABCB in August 2008.

3.5.2 Stakeholder feedback

A draft of the revised Standard was released for public comment in March 2003. As a result of the comments received, a second draft of the revised Standard was released for public comment

[21] Department of Prime Minister and Cabinet (2006), *Rethinking regulation: Report of the Taskforce on Reducing Regulatory Burdens on Businesses: Australian Government's Response*, p. 88.

in February 2005. Further comments were received and incorporated into a third draft of the revised Standard — it is this draft for which this RIS has been prepared.

3.5.3 Increased building activity and climate change

As discussed in Section 3.3, an increase in building activity around BPAs and increased exposure of such houses to bushfires as a result of climatic change, increases both bushfire risks and potential damage costs for house owners. A revision of the current Standard would incorporate the latest knowledge and technological development available in bushfire protection measures and could potentially lower the risks and damage costs that house owners would otherwise be exposed to. The revised Standard does this by adopting a more scientific approach to the process of site assessment and the associated construction requirements, by better aligning the process with the increase in bushfire risk due to climatic change.

3.5.4 Insufficiencies in the current Standard

The revised Standard is more likely to effectively deal with bushfire risk because it takes a more scientific approach to the assessment of risks associated with a particular site and aligns construction requirements with the assessed category of bushfire attack risk. For example, the revised Standard will:

- Incorporate a geographical factor through a fire danger index (FDI) into the process of site risk assessment;

  A relevant FDI is determined for an identified region within a jurisdiction. The FDI values may be refined within a jurisdiction or region where sufficient climatological data is available and in consultation with the relevant regulatory authority. A higher FDI represents a higher likelihood of ignition and difficulty in suppressing a bushfire. Victoria (excluding the Alpine regions), the Australian Capital Territory and New South Wales (excluding the Alpine regions) have been allocated the highest index of 100 compared to the Northern Territory and Queensland that have been allocated an index of 40. A geographical factor has previously not been included in the bushfire risk assessment process.

- Change the determination of effective slope and the number of categories of slope;

  Latest knowledge on bushfire risk assessment revealed that the slope of the land *under the vegetation* is more important than the slope *between the site and the edge of the vegetation* as it has direct influence on the rate of fire spread, the severity of the fire and the ultimate level of radiant heat flux. In addition, the number of slope categories has been increased to five; and

- Align construction requirements to the new categories of bushfire attack.

  The bushfire attack level (BAL) for a particular site can be determined by checking the relevant tables in the Standard. The number of bushfire attack categories has been revised from four in AS 3959-1999 to six in the proposed Standard to better align the construction requirements to the risk of bushfire attack for each category.

3.5.5 Conclusion – a need to review the Standard

In summary, it is important that the Standard be reviewed to ensure it reflects increasing knowledge of the risks of bushfires and how those risks can best be managed. The requirement for periodic review is a stated Australian Government policy objective.

In particular, there may be opportunity to introduce an improved site risk assessment process, and to update the building and construction requirements to reflect the latest knowledge and technology in bushfire protection measures. These revisions should deliver benefits of improved and more cost efficient protections.

3.6 Summary of rationale for Government intervention and proposed amendments

The problem targeted by AS 3959-1999 *Construction of buildings in bushfire prone areas* is the risk that property owners will not voluntarily include sufficient bushfire protection and survival measures in new buildings in BPAs.

The discussion on the nature and extent of this problem highlighted the range of factors that influence the level of risk faced by householders in BPAs, and how bushfire risk is likely to be an ongoing public concern given ongoing building activity in BPAs and the anticipated impacts of climate change.

Imperfections in current regulatory arrangements and the capacity of individuals and the market to respond effectively, provides the rationale for continuing Government intervention, and a review of the current Standard.

The rationale for continued Government intervention is based on the following market failures:

- Individuals are unlikely to make appropriate decisions due to insufficient information and bounded rationality (i.e. sufficient information is difficult to obtain and analyse);

- The building industry is unlikely to incorporate appropriate bushfire protection measures in the design and construction of a new house as they involve an increase in building costs, and because homeowners are unable to verify the long term benefits associated with those measures;

- While insurance provides ex-post compensation for bushfire damages, it does not mitigate the risk of a bushfire occurring, and it does not provide adequate compensation for the full impacts associated with bushfire events; and

- The existence of unpriced negative externalities in that the action of a particular property owner influences the risk exposure of neighbouring property owners, and could also result in broader societal impacts.

The rationale for a review of the current regulatory arrangements (i.e. the type of Government intervention) is based on the following:

- Australian Government support for the periodic review of regulation to reflect current knowledge and technology;

- A COAG recommendation that the ABCB review building requirements with regard to bushfire protection;

- A range of stakeholder feedback received on earlier drafts of the proposed Standard, which highlighted areas of concern;

- The anticipated increase in both the number of houses constructed in BPAs and the frequency of bushfire events; and

- Identified opportunities to potentially improve the site assessment process, and achieve a better alignment between construction requirements and the assessed level of bushfire risk.

In light of these considerations, there is a strong case for a review of the current regulatory arrangements, so the risk of bushfire events to buildings, and humans, can be minimised.

4 Objectives of Government intervention

The ABCB's mission is to address issues relating to health, safety, amenity and sustainability in buildings through the creation of nationally consistent building codes, standards, regulatory requirements and regulatory systems.

The objectives of the ABCB are to:

- develop building codes and standards that accord with strategic priorities established by Ministers from time to time, having regard to societal needs and expectations;
- establish building codes and standards that are the minimum necessary to achieve relevant health, safety, amenity and sustainability objectives efficiently; and
- ensure that, in determining the area of regulation and the level of the requirements:
  - there is a rigorously tested rationale for the regulation;
  - the regulation would generate benefits to society greater than the costs (that is, net benefits);
  - there is no regulatory or non-regulatory alternative (whether under the responsibility of the Board or not) that would generate higher net benefits; and
  - the competitive effects of the regulation have been considered and the regulation is no more restrictive than necessary in the public interest.

The proposed amendments to the BCA and AS 3959-1999 are designed to support the objectives of both the ABCB and COAG, and seek to provide an efficient response to the risk that property owners will not voluntarily include bushfire protection and survival measures in new buildings in BPAs.

In particular, the proposed Standard and the alternative options being considered are seeking to achieve the following:

- A reduction in the danger to life and the risk of property damage by ensuring that buildings have appropriate resistance to bushfires;
- The provision of outcome based regulation which allows industry to develop the most technically efficient and appropriate solutions;
- Address the identified market failures in relation to the provision of bushfire resistant features; and
- Ensure that the regulatory requirements are cost effective and transparent.

Furthermore, the proposed Standard reflects an Australian Government initiative to complete five yearly periodic reviews of regulation, to ensure that it remains suitable for its purpose.

5 Identification of feasible policy options

5.1 Introduction

This chapter identifies and considers the merits of alternative means of achieving the Government objectives of effective bushfire protection.

This discussion of feasible alternatives is divided into four sections:

- A description of the regulatory proposal (i.e. the revised Standard) and how it differs from the status quo (i.e. continuing with the current Standard);
- A discussion of other forms of regulation and non-regulatory options;
- Consideration of alternative levels of regulatory stringency; and
- A shortlist of feasible policy options for detailed assessment.

The shortlisted options are then assessed in further detail in the subsequent analysis.

5.2 Description of the regulatory proposal

The proposed Standard was prepared by the Standards Australia Committee FP-020, "Construction in bushfire prone areas". If deemed suitable, the revised AS 3959 is proposed for reference in the BCA and will supersede the previous edition, AS 3959-1999.

The proposed Standard specifies requirements for the design and construction of buildings in BPAs in order to improve their resistance to bushfire attack from burning embers, radiant heat, flame contact and combinations of the three attack forms. The Standard relates specifically to residential construction in BPAs. It outlines a process to assess the risk of a given site and then details specific construction requirements based on the outcome of the site risk assessment.

The Standard represents a substantial change from existing regulatory arrangements – both to the current site assessment methodology and the associated construction requirements. In particular, it seeks to establish a site assessment framework that more accurately reflects the level of risk associated with a given site and construction requirements that provide an appropriate level of protection to the assessed level of risk.

The following is a brief description of the proposed Standard, and the nature and effect of the main changes from existing arrangements.

5.2.1 Site assessment methodology

The existing Standard assigns sites in designated BPAs a category of bushfire attack of either 'LOW', 'MEDIUM', 'HIGH' or 'EXTREME' based on an assessment of the following factors:

- The predominant vegetation – i.e. four classes and 28 different types;

- The distance of the site from that vegetation – i.e. four distance categories; and

- The slope of the land between the predominant vegetation and the site – i.e. two slope categories.

In comparison, the updated site assessment methodology incorporates both a variation to the above factors, and defines further categories of bushfire attack. These changes are designed to provide a more accurate assessment of the level of bushfire risk associated with a particular site, and to enable definition of appropriate construction requirements.

Specifically, the proposed methodology provides two alternative methods for determining the bushfire attack level (BAL):

- A simplified procedure that is comparable to the existing process, and involves five procedural steps to determine the relevant BAL, which is based on a set of defined factors; or

- A detailed procedure that utilises calculations to determine the category of bushfire attack where a more specific result is sought or where the site condition is outside the scope of the simplified procedure.

The simplified procedure involves the following five steps:

1. Determine the relevant Fire Danger Index (FDI);

2. Determine the relevant vegetation type;

3. Determine the distance of the site from the vegetation;

4. Determine the effective slope of the site under the vegetation; and

5. Determine the BAL based on steps 1 to 4.

Compared to the current methodology, the relative Fire Danger Index (FDI) represents an additional factor in the site assessment, which allows for variations in bushfire risks across different geographical locations. Further, the revised methodology is based on *effective slope of the land under the vegetation*, rather than the *slope of the land between the vegetation and the site*, which is a more important determinant of the rate of fire spread, the severity of the fire, and the ultimate level of radiant heat flux.

Finally, the proposed Standard also incorporates additional slope and distance categories to support a more robust site risk assessment.

Based on an assessment of the above variables, the BAL of a given site is determined as one of the following six categories:

- BAL-LOW;
- BAL-12.5;
- BAL-19;
- BAL-29;
- BAL-40; and
- BAL-FZ.

Similar to the current Standard, the assessed BAL for the site corresponds to a range of specific construction requirements which are designed to provide an appropriate level of bushfire protection (i.e. reflect the assessed site risk).

The more detailed method for determining the category of bushfire attack is applied for all circumstances where the effective slope under the classified vegetation is no more than 30 degrees downslope and the site slope is no more than 20 degrees, regardless of slope type. This is for reasons relating to the anticipated increase in convective heat from the bushfire flames and environmental constraints on site slopes over a certain level. As such, to support a realistic and conservative assessment of the proposed Standard, this RIS focuses primarily on the impacts associated with the 'simple' site assessment framework.

5.2.2 Construction requirements

The current Standard provides three levels of construction requirements for houses constructed in BPAs:

- *Level 1 construction* for the category of 'MEDIUM' bushfire attack;
- *Level 2 construction* for the category of 'HIGH' bushfire attack; and
- *Level 3 construction* for the category of 'EXTREME' bushfire attack.

For the category of 'LOW' bushfire attack, the degree of bushfire risk is considered insufficient to warrant specific construction requirements. The Standard covers various elements of a building such as flooring systems, external walls, external doors, roofs, etc.

In comparison, the proposed Standard provides a range of general construction requirements for houses built in BPAs, and four different levels of construction requirements that reflect the assessed BAL of a given site. Similar to the existing Standard, for sites assessed as BAL-LOW, the degree of bushfire risk is considered insufficient to warrant specific construction requirements.

In addition to a number of general construction requirements (e.g. for garages), the Standard incorporates specific requirements for each of the following building elements:

- Floors and subfloor supports;
- External walls;
- External glazed elements and assemblies and external doors;
- Roofs;
- Verandas, decks, steps, ramps and landings; and
- Water and gas supply pipes.

The specific requirements for each of these elements are based on the assessed BAL, and are designed to provide an appropriate level of protection for the assessed level of risk exposure.

5.3 Alternative policy approaches

5.3.1 Other forms of regulation

The regulatory proposal involves the level of bushfire protection of buildings being subject to explicit government regulation, which is one form of regulation. The COAG *Best Practice Regulation* guide identified a spectrum of regulatory approaches with explicit government regulation at one end of the spectrum and self-regulation at the other. Intermediate forms of regulation (quasi-regulation and co-regulation) are also identified.

Self-regulation

Self-regulation involves industry formulating rules and codes of conduct, and being solely responsible for their enforcement. It generally requires a viable industry association with broad coverage and members that will voluntarily adhere to a code of conduct devised by other members. Minimal sanctions such as loss of membership or peer disapproval are required to ensure broad compliance, and the government role is reduced to facilitation and advice.

Self-regulation should be considered where:

- There is no strong public concern, in particular, no major health and safety concern;
- The problem is a low risk event and of low impact or significance; and
- The problem can be fixed by the market itself, for example, there may be an incentive for individuals or groups to develop and comply with self-regulatory arrangements (industry survival or market advantage).[22]

[22] Office of Best Practice Regulation *Best Practice Regulation Handbook 2006, p. 4-7.*

Based on the above criteria, self-regulation is unlikely to provide an appropriate response for construction in BPAs. This is because although bushfires are a low risk of occurrence event, their potential impacts are substantial, and there are major public health and safety concerns. Further, because the benefits of enhanced bushfire protection in buildings do not accrue to the building industry (i.e. split incentives) it is unlikely that self-regulation would result in an appropriate level of protection being incorporated in the design and construction of new houses.

Quasi-regulation

Quasi-regulation is similar to self-regulation, but is distinguished by a stronger role for government in endorsing industry codes, providing technical guidance, or entering into government-industry agreements.

One option could be for the government to encourage and assist the building industry to formulate appropriate standards but leave the compliance as a voluntary matter or subject to professional sanction. Possible sanctions range from information sanctions to exclusions from professional bodies.

Similar to self-regulation, it is unlikely that quasi-regulation would deliver an efficient outcome for construction in BPAs. This is due to an unacceptable risk of non-compliance and the potentially serious and widespread consequences of bushfire events.

Co-regulation

Co-regulation involves government providing some form of legislative underpinning for industry codes and standards. This may involve delegating regulatory powers to industry, enforcement of undertakings to comply with codes, or providing a fall-back position of explicit regulation in the event that industry fails to self-regulate.

Co-regulation is also unlikely to achieve the Government policy objectives for construction in BPAs. While the current arrangements possess some elements of co-regulation (i.e. Standards backed by legislation), the Standards are enforced by Government organisations rather than industry itself. This is because without Government and legislative backing, there is considerable risk that a co-regulatory approach would result in higher levels of non-compliance, and the potential consequences of that non-compliance are unacceptable to Government.

Conclusions

The lack of alignment between those with responsibility for incorporating bushfire protection in the design and construction of houses, and those who realise their benefits, mean it is unlikely that an intermediate form of regulation would achieve the Government’s objectives. The risks associated with non-compliance are exacerbated by the potentially serious consequences of bushfire events, including both substantial risks to public health and safety, and economic impacts.

5.3.2 Non-regulatory intervention

A range of alternative instruments that might be used as alternatives to regulatory intervention, include:

- Information and education campaigns;
- Standards including voluntary, non-regulatory, performance-based or prescriptive; and
- Market-based instruments such as taxes and subsidies.

Information and education campaigns

Information and education campaigns regarding fuel removal and maintenance of the surroundings of a house are important and can improve house survivability, but are outside the scope of the BCA. Section 3.4.2 suggests that even with complete information, individuals are unlikely to be able to adopt appropriate bushfire protection measures due to the technical aspects of risk assessment and product knowledge combined with the assumed limited technical and analytical ability of lay-people. This limits the effectiveness of any information or education campaigns.

Standards

While voluntary Standards could provide flexibility, it is unlikely that without legislative backing, e.g. through State and Territory based legislation that the building industry would voluntarily comply with the Standards. This relates to the issue of split incentives, where the building industry does not realise the benefits associated with the increased levels of protection.

The current arrangement incorporates some characteristics of a non-regulatory approach such as using a performance-based framework and providing builders with flexibility to satisfy the performance requirements through the DTS provisions or allowing builders to formulate an alternative solution that demonstrates compliance. That is, the Standards facilitate the process of compliance but the BCA does not mandate compulsory compliance with the Standards if a builder is able to demonstrate compliance via an alternative manner.

Taxes and subsidies

Taxes and subsidies are unlikely to provide sufficient incentive to encourage the adoption of appropriate bushfire protection measures as they would still require individuals to bear substantial up-front costs. Although these additional costs are likely to be outweighed by longer term benefits, the lack of readily available information around bushfire risk and the likely difficulties individuals would face in comprehending and acting rationally on that information, mean that there could be a significant risk that individuals would have insufficient incentive to incur the costs of implementing effective bushfire protection.

Conclusions

Non-regulatory interventions, on their own, appear to be inappropriate responses to bushfire protection measures for houses built in BPAs, because they would not provide the level of assurance of protection and minimisation of damages required by the public and the government.

5.4 Alternative degrees of regulatory stringency

In addition to alternative forms of regulation or non-regulatory measures, there are alternatives available that are similar to the regulatory proposal, but that are more or less stringent. The alternative degrees of regulatory stringency would require comparably higher or lower levels of bushfire protection in designated BPAs.

In considering the appropriate level of regulatory stringency, it is important to recognise the inability of policy makers to access the information required to *optimise* the level of stringency in the proposed regulations. This includes information about the range of factors that influence the frequency and severity of bushfire events, information relating to building materials and their properties, construction costs, and information relating to the benefits associated with increased bushfire protection.

Given the inherent complexity in achieving an optimal balance between the increased construction costs associated with prevention measures and the additional bushfire protection they provide, three variations to the stringency of the proposed site assessment framework, via three different flame temperature inputs, are being assessed. The proposed standard is based on a 1000K[23] flame temperature but in order to assess the potential implications and sensitivity to variations in this assumed flame temperature, this RIS will also consider the assessed impacts of either a 910K flame temperature or a 1090K flame temperature.

5.5 Shortlist of options for detailed consideration

Overall, government policy for the construction of dwellings in BPAs is for mandated Performance Requirements to be implemented through the BCA. This reflects a view, partly based on experience, that voluntary and information based approaches are likely to have limited effectiveness. Given the anticipated increase in the frequency and severity of bushfire events, recent increases in the construction activity in BPAs, and imperfections in the individual and market responses to this problem, government has settled on a regulatory approach.

Given the decision for a continuing regulatory approach, this RIS provides a comparative assessment of alternative regulatory measures, namely:

- A *Base Case* – the status quo or ‘existing regulation’ option (i.e. AS 3959-1999);
- *Option 1* – the proposed Standard based on a flame temperature of 1000K; and

[23] K = Kelvin temperature scale, zero Kelvin corresponds to -273.15^{o} on the Celsius temperature scale.

- *Option 2* and *Option 3* – two alternative levels of regulatory stringency (i.e. 910K and 1090K flame temperatures).

The costs and benefits associated with these shortlisted options are assessed in detail in the subsequent analysis.

6 Cost impact of proposals on building owners

6.1 Introduction

This Section provides an assessment of the impact of the proposed Standard on individual building owners. It involves quantification of the incremental change in construction costs for a given sample of house designs and varying site characteristics. The estimated cost impacts on building owners is extended to the State and national level in the following section, together with an assessment of the other costs and benefits associated with the proposed Standard.

The analysis in this section requires consideration of both the implications of the proposed changes to the site assessment methodology and the associated changes to the detailed construction requirements in the Standard. In order to undertake this comparative analysis, assumptions are required of the types of housing construction in BPAs, as the incremental change in construction costs will vary according to the size, design and type of building being constructed.

The analysis is structured as follows:

- Identification of a sample of representative building designs for assessment;
- An assessment of the impact of the changes to the site assessment methodology; and
- An estimate of the incremental changes in the building and construction costs for the identified sample.

The remainder of this Section details the analysis in each of these areas.

6.2 Identifying a sample of buildings

Based on the feedback and views from members of Standards Committee (FP-020), three standard house designs were identified as representative and selected for further analysis:

- A *base house*;
- A *large two storey house*; and
- An *elevated lightweight construction (ELC) house*.

The chosen designs sought to represent the range of house sizes and designs that might be constructed in BPAs. The analysis also required assumptions of the materials used for the construction of each house type (e.g. timber weatherboard or brick veneer). In order to provide a conservative or *worst case* estimate of the potential impact of the proposed Standard on the construction costs for each house type, timber weatherboard construction was assumed for the base house and ELC house designs while the large two story house is assumed to be brick veneered.

The specific house designs and material assumptions used in the analysis are included as Appendix B to this RIS.

6.3 Impact of changes to the site assessment methodology

As the prescribed changes to the construction requirements are based on the outcome of the site risk assessment, it is important to first identify the impact of the changes to the site assessment methodology.

Table 6-1 below provides a summary of the changes to the site assessment framework.

Table 6-1: Summary of changes to site assessment framework

Site assessment factors	Current Standard	Proposed Standard
Geographical factors	Not considered as part of the assessment	The relative FDI for a region or jurisdiction is included as part of the assessment
Slope	Assessment includes the slope of the land *between* the vegetation and the site	Assessment includes the slope of the land *under* the vegetation
Vegetation	Standards define 6 classes of vegetation and 28 different types	Standards define 8 classes of vegetation and 28 different types
Distance from vegetation	Standards define 4 distance bands as a factor in the site assessment	Multiple distance bands included as a factor in the site assessment
Assessed category of bushfire attack	Site assessment defines 4 different categories of bushfire attack	Site assessment defines 6 different categories of bushfire attack

As shown above, the revised site assessment framework is based on a different set of site-specific factors, which means a direct comparison between methodologies is not possible.

Therefore, an alternative approach was developed to produce a probability weighted ‘comparator matrix’ to support a comparison between methodologies. The matrix provided a summary of the range of possible changes to the outcome of the site risk assessment under the proposed Standard, and the likelihood of each possible change.

In order to develop the matrix, a representative range of possible site assessment outcomes under the current Standard, and the potential equivalent outcomes under the proposed Standard were identified. In defining the ‘possible’ outcomes under the current Standard, a number of simplifying assumptions were made around the type of vegetation likely to be prevalent in BPAs (refer Appendix C for detailed approach and assumptions).

For each defined possible outcome under the current Standard, the following steps were completed:

- Identification of a corresponding vegetation classification;
- Identification of a corresponding slope category; and
- Identification of a corresponding range of distances between the building and the predominant vegetation.

The analysis then considered permutations of the above variables, and estimated the likelihood of their occurrence. This process was then repeated for each 'possible' assessment outcome, and for each FDI category to provide an overall probability of change (i.e. the 'comparator matrix').

Table 6-2 below provides the matrix which summarises the potential changes to the site assessment under the proposed Standard (i.e. Option 1 – 1000K).

Table 6-2: Comparator matrix for the proposed Standard (Option 1 – 1000k)

Category of bushfire attack		Current Standard			
		Extreme	High	Medium	Low
Option 1 (1000K)	BAL-FZ	68.4%	5.1%	0.0%	0.0%
	BAL-40	14.1%	5.7%	0.0%	0.0%
	BAL-29	13.5%	16.4%	1.0%	0.0%
	BAL-19	3.5%	26.8%	2.8%	0.0%
	BAL-12.5	0.5%	46.0%	94.6%	18.6%
	BAL-LOW	0.0%	0.0%	1.7%	81.4%
Total		**100.0%**	**100.0%**	**100.0%**	**100.0%**

For example, based on the matrix above, 81 per cent of sites currently categorised as 'LOW' would be categorised as BAL-LOW, and 19 per cent as BAL-12.5. A similar matrix was constructed for each of the options being considered within this RIS (i.e. a total of 3 matrices).

The detailed assumptions and calculations underpinning the development of the comparator matrices are provided as Appendix C to this RIS.

6.4 Construction cost impacts

The estimated construction cost impacts for the sample of house designs was based on 'extra over' costs developed by a quantity surveyor. These estimated the incremental impact of the current and proposed Standards on the construction costs for the three house designs.

Where alternative design solutions are suggested, the cost estimates are based on the quantity surveyors view of the most likely solution, which in most cases would also represent the lowest cost solution[24]. Further detail of the scope, assumptions and outcomes from the quantity surveying work undertaken is provided in Appendix C to this RIS.

[24] The interpretation of the specification requirements and the choice between alternative design solutions was based on the best endeavours of the quantity surveyor rather than specific design advice.

Table 6-3 below provides a summary of the additional construction costs incurred for each house type across each category of bushfire attack (current and proposed). For example, construction of an 'ELC' house to meet the requirements for a site assessed as 'BAL-19' is likely to cost around $21,000 more than if it were built in an area not designated as a BPA.

Table 6-3 – Cost of compliance with current and proposed Standard

Category of bushfire attack	Base house	Large two storey	ELC house
Current Standard			
LOW	$0	$0	$0
MEDIUM	$9,196	$12,586	$19,174
HIGH	$24,469	$36,529	$42,573
EXTREME	$29,483	$43,810	$53,489
Proposed Standard			
BAL-LOW	$0	$0	$0
BAL-12.5	$11,535	$14,981	$21,428
BAL-19	$11,535	$14,981	$21,428
BAL-29	$15,471	$17,095	$35,024
BAL-40	$17,107	$19,751	$62,357
BAL-FZ	$20,885	$28,905	$76,679

The cost impacts identified above incorporate an allowance for *shielding* which effectively reduces the construction requirements for an elevation of the building that is not exposed to the source of bushfire attack.[25]

The change in construction costs for a given house type between the current and proposed Standards are related to the impact of the proposed changes to the site assessment framework, which are defined in the 'comparator matrices' (see Appendix C). That is, it is necessary to first identify the corresponding category of bushfire attack, before the cost impact can be estimated.

Change in construction cost for each house type across current categories of bushfire attack

Table 6-4 below summarises the likely change in construction costs for each house type across each of the current categories of bushfire attack. For example, a *base house* built on a site previously categorised as LOW, is estimated to incur an additional $1,300 in construction costs whereas if it was built on a site previously categorised as HIGH, it would result in a cost savings of $13,000 under the proposed Standard (i.e. Option 1).

[25] The analysis assumed that one side of each house (i.e. 25 per cent) would incorporate a lower level of bushfire protection (i.e. a category lower), with the minimum requirement being BAL 12.5.

Table 6-4: Cost changes for each house type and category of bushfire attack

House type / Site assessment	Option 1[26] (1000K)	Option 2 (910K)	Option 3 (1090K)
Base house			
EXTREME	($10,235)	($13,233)	($9,016)
HIGH	($11,492)	($11,864)	($9,100)
MEDIUM	$2,186	$2,162	$2,567
LOW	$2,142	$2,150	$2,139
Large two storey			
EXTREME	($18,348)	($25,007)	($15,897)
HIGH	($20,217)	($20,777)	($17,370)
MEDIUM	$2,168	$2,156	$2,488
LOW	$2,781	$2,792	$2,778
ELC house			
EXTREME	$13,343	($14)	$21,281
HIGH	($13,752)	($15,034)	$474
MEDIUM	$2,030	$1,945	$3,976
LOW	$3,978	$3,993	$3,974

The cost estimates above suggest the following broad conclusions:

- Across all house types, construction costs for sites currently categorised as LOW or MEDIUM are expected to increase. The increase in costs ranges from $1,900 to $4,000, depending on the type of house constructed and the regulatory option chosen. For sites currently categorised as LOW, these increases largely relate to construction on sites that are not subject to any additional construction requirements in the current Standard, which would be categorised as BAL-12.5 or above under the proposed site assessment framework (i.e. they would incorporate specific protection measures);

- The construction costs on sites currently categorised as EXTREME and HIGH are likely to decrease under Options 1 and 2 for the *base house* and the *large two storey house*, with estimated savings to building owners of between $10,000 and $13,000 for a *base house* and between $18,000 and $25,000 for the *large two storey* house depending on the regulation option chosen; and

- The construction costs for the *ELC house* are likely to increase under Options 1 and 3 for sites previously categorised as EXTREME. The expected cost increase ranges from $13,000 to $21,000 depending on the option chosen. This appears to reflect a more appropriate level of bushfire protection given the type of house being constructed and the assessed level of site risk.

The estimated cost impacts described above are likely to be a reflection of a more robust site assessment methodology, and an improved alignment between the assessed level of risk and the

[26] Option 1 is the proposed standard at the flame temperature of 1000K. Options 2 and 3 represent different level of regulatory stringency. Option 2 represents a lower flame temperature of 910K and Option 2 represents a higher temperature of 1090K.

associated construction requirements. Therefore, although it is likely that construction costs in designated BPAs would decrease in many cases, this does not reflect a greater acceptance of bushfire related risk under the proposed arrangements, but instead a more appropriate level of protection being required. Similarly, while the proposed arrangements are expected to involve additional construction costs for some sites currently categorised as LOW, this estimated cost impact is likely to be due to a more accurate assessment of bushfire risk for those sites.

Furthermore, as the proposed arrangements are intended to prescribe more risk reflective construction requirements, there is considerable variability in the estimated cost impacts for different site characteristics and types of construction. For example, for sites previously categorised as EXTREME, the estimated cost impacts vary significantly across house designs. While it is estimated that the costs associated with construction of a *base house* or a *large two storey house* would decrease compared to the current arrangements, the construction of an *ELC house* is likely to incur substantially greater costs. This cost differential is due to the *ELC house* being relatively less bushfire resistant, and therefore requiring a greater level of protection. In comparison, under current arrangements there is less variation in the estimated cost impacts across each house design, which may imply a less risk reflective approach to bushfire mitigation.

A more detailed breakdown of the cost estimates and the approach taken is provided as Appendix C to this RIS.

Expected change in construction costs for each house type

Table 6-5 below summarises the expected cost impacts for each house type across each option under consideration, and as a percentage of total construction costs. This is achieved by applying the probability weightings contained in the comparator matrices to the identified cost changes for each category of bushfire attack.

Table 6-5: Expected construction cost increase (reduction) by house type

House type / Site assessment	Option 1 (1000K)	Option 2 (910K)	Option 3 (1090K)
Expected cost increase			
Base house	($3,409)	($4,191)	($2,506)
Large two storey	($6,910)	($8,580)	($5,654)
ELC house[27]	$1,929	($1,477)	$7,337
Percentage cost change			
Base house	-1.2%	-1.5%	-0.9%
Large two storey	-1.8%	-2.2%	-1.5%
ELC house	0.6%	-0.4%	2.2%

These estimates are based on a number of assumptions, including:

- Estimated construction activity across each current category of bushfire attack; and

[27] Elevated lightweight construction (ELC) house

- Broad cost estimates for the construction of each house type in the absence of any bushfire protection measures.

As shown above, the expected cost impact on individual building owners can be summarised as follows:

- A reduction in construction costs of around 0.9 to 2.2 per cent for both the *base house* and the *large two storey* house under all options being considered;

- A 0.4 per cent decrease in the construction costs associated with an *ELC house* under Option 2; and

- An increase in construction costs of 0.6-2.2 per cent for the *ELC house* under Options 2 and 3.

Overall, while the likely cost impacts are comparable for both Options 1 and 2, it is expected that Option 3 would provide a lower level of benefits for the *base house* and the *large two storey house*, and would involve a significant cost increase for the *ELC house*.

A more detailed breakdown of the cost estimates, the approach taken for the analysis and the underpinning assumptions is provided as Appendix C to this RIS.

6.5 Conclusions

The expected impact on the identified sample of building designs can be summarised as follows:

- An expected decrease in construction costs for the majority of building owners under each option;

- An expected increase in construction costs in the following cases:

    - Construction on sites currently assessed as LOW category of bushfire attack. These are not currently required to incorporate additional bushfire protection measures. However, under the proposed Standard, such sites may be assessed as BAL-12.5 (or higher) and would therefore incur additional construction costs;

    - Construction on sites currently assessed as MEDIUM category of bushfire attack, which are now largely assessed as BAL-12.5 and subject to more costly bushfire protection requirements;

    - Construction of houses with similar characteristics to the *ELC house*; and

- Option 3 is expected to represent the most expensive option for all house types.

The expected cost impacts described above are likely to be due to a more accurate assessment of site risk, and a better alignment between the level of bushfire prevention required and the assessed level of risk. As such, the expected overall cost decrease does not represent a greater acceptance of bushfire risk, but instead a more appropriate level of protection being required

7 Estimate the impact of the proposed changes at the State and national level

7.1 Introduction

This Section provides an assessment of the impact of the proposed Standard at the State and national level, and is structured as follows:

- Identification of the different groups impacted by the proposed Standard;
- A quantitative assessment of the monetary impacts associated with each option;
- A qualitative assessment of the benefits associated with each option;
- A qualitative assessment of the costs associated with each option (information may be unavailable for the quantification of some costs); and
- A comparative assessment of the costs and benefits associated with each option.

With the exception of the estimated changes to construction costs, the analysis is qualitative rather than quantitative. This reflects the data limitations and uncertainty associated with many of the anticipated impacts. For example, it is not possible to identify the extent to which a change in the construction requirements will reduce the risk of damage due to bushfires. However, where possible, the assessment has sought to utilise data to understand the general magnitude of the unquantifiable impacts.

7.2 Groups impacted by the proposed Standard

The groups affected by the revised Standard are individuals, businesses and the Government. This section discusses the costs and benefits of the revised Standard on each group.

7.2.1 Individuals

Householders who choose to build houses in BPAs are directly impacted by the revised Standard. Improvements to the site risk assessment and better alignment of construction requirements to the assessed level of risk should enhance the bushfire protection of houses and hence improve house survivability and reduce potential costs of damage to house owners. However, there is a risk that the revised Standard could impose additional building costs on some house owners.

Fire fighters and disaster relief workers may also be indirectly affected by the revised Standard in that if house survivability improves, the manpower required to defend properties during bushfires could be impacted, with consequential production impacts to the economy and future community disruption due to bushfires.

7.2.2 Businesses

The revised Standard directly impacts businesses in the design and construction industry as well as certification practitioners. It may impact demand patterns for the construction for house types that become relatively more or less expensive under the proposed arrangements, and will require the design and construction industry and certification practitioners to adapt, familiarise and implement the revised Standard. This could involve additional training or education costs for such businesses (refer Section 8).

The insurance industry would be indirectly impacted by the revised Standard in that its implementation may support a more accurate and efficient pricing of bushfire risk, which will also provide benefits to individuals taking out insurance.

7.2.3 Government

An improvement in house survivability and potential reduction in damage costs implies that Government could incur less cost associated with providing disaster funding and assistance to individuals and communities in the event of a bushfire. The proposed Standard may also reduce the costs associated with community disruption and the adverse economic impacts associated with bushfire events.

7.3 Quantitative assessment – construction cost impacts

The quantitative assessment is limited to an estimate of the change in construction costs at the State and national level associated with the proposed Standard (i.e. Option 1 – 1000K) and the alternative options being considered (i.e. Option 2 – 910K, Option 3 – 1090K). The cost estimates provided are based on the estimated impacts on a sample of building owners (refer to Section 6) and estimated construction activity in BPAs across Australia.

Due to data limitations and uncertainty around the nature and extent of future construction activity, the aggregate cost estimates are based on a number of simplifying assumptions and should be considered indicative. A more detailed description of the approach taken and the detailed assumptions required is provided as Appendix C to this RIS.

7.3.1 Construction activity in BPAs across Australia

The estimated construction activity in BPAs was based on a survey undertaken on behalf of the ABCB on a sample of councils to obtain information about building activity in bushfire prone areas.[28] It concluded, (with medium confidence) that construction in BPAs amounted to around 11,000 houses per year or 10 per cent of the total number of new houses.

Table 7-1 below provides a summary of estimated construction in BPAs for each State and Territory and the assumed construction cost index for each jurisdiction[29].

[28] Survey organised as sensitivity analysis to assess data provided by the National Hazards Research Centre (trading as Risk Frontiers), and completed as part of Stage 1 work undertaken for this RIS.
[29] Assumed cost variation across jurisdictions based on advice received from Quantity Surveyor

Table 7-1: Estimated construction activity in BPAs

Jurisdiction	Number per year	Cost index
Australian Capital Territory	10	100
New South Wales	4,483	93
Northern Territory	0	n/a
Queensland	2,118	104
South Australia	1,400	90
Tasmania	0	n/a
Victoria	2,870	105
Western Australia	374	121
Total	**11,254**	**n/a**

The level of confidence in the estimates above varies across jurisdictions, with confidence highest for ACT and NT, but low for QLD and WA where few councils have designated BPAs, and TAS where some councils reference the Standard but do not employ the concept of BPAs.

The development of robust estimates for all jurisdictions would require a census of councils, which is beyond the scope of this RIS. On balance, the councils surveyed expected the rate of building in BPAs to increase. Therefore, the cost effects described in this section are also limited by the uncertainty in future construction activity.

Average construction cost impacts (per annum)

In the absence of any available data, it was also necessary to make an assumption around the proportion of each house type constructed in BPAs, with two different scenarios considered:

- Scenario 1 – Construction in BPAs is spread evenly across the three different house types; and
- Scenario 2 – 50 per cent of construction relates to the *base house*, with the remaining 50 per cent spread evenly across the *large two storey house* and the *ELC house*.

The second scenario is based on the assumption that construction activity is more likely to be concentrated at the lower level (i.e. the *base house*). Therefore, there is a risk that the cost estimates under Scenario 1 could be disproportionately influenced by the costs associated with the other two house types.

Table 7-2 provides the estimated annual impact in construction costs at the State / Territory and the national level for Option 1 under both scenarios.

Table 7-2: Option 1 – estimated annual cost increase / (reduction)

State / Territory	Option 1 (1000K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($11.7m)	($12.3m)
NT	$0.0	$0.0
QLD	($6.2m)	($6.5m)
SA	($3.5m)	($3.7m)
TAS	$0.0	$0.0
VIC	($8.4m)	($8.9m)
WA	($1.3m)	($1.3m)
TOTAL	**($31.1m)**	**($32.8m)**

Based on the above, the expected decrease in annual construction costs under Option 1 is in the order of $31m-$33m at an aggregate level.

Table 7-3 provides the estimated annual impact in construction costs at the State / Territory and the national level for Option 2 under both scenarios.

Table 7-3: Option 2 – estimated annual cost increase / (reduction)

State / Territory	Option 2 (910K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($19.8m)	($19.2m)
NT	$0.0	$0.0
QLD	($10.5m)	($10.2m)
SA	($6.0m)	($5.8m)
TAS	$0.0	$0.0
VIC	($14.3m)	($13.9m)
WA	($2.1m)	($2.1m)
TOTAL	**($52.8m)**	**($51.2m)**

Based on the above, the expected decrease in annual construction costs under Option 2 is in the order of $51m-$53m at an aggregate level.

Table 7-4 provides the estimated annual impact in construction costs at the State / Territory and the national level for Option 3 under both scenarios.

Table 7-4: Option 3 – estimated annual cost increase / (reduction)

State / Territory	Option 3 (1090K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($1.1m)	($3.5m)
NT	$0.0	$0.0
QLD	($0.6m)	($1.8m)
SA	($0.3m)	($1.0m)
TAS	$0.0	$0.0
VIC	($0.8m)	($2.5m)
WA	($0.1m)	($0.4m)
TOTAL	**($3.0m)**	**($9.2m)**

Based on the above, the expected decrease in annual construction costs under Option 3 is in the order of $3m-$9m at an aggregate level.

In order to test the sensitivity of these outcomes to variations in the key inputs, two alternative escalations were applied to the estimated construction costs for each house type:

- A 10 per cent increase was applied to the ‘extra over’ costs estimated by the quantity surveyor for compliance with the current and proposed Standards; and
- A 10 per cent increase was applied only to the ‘extra over’ costs required for compliance with the proposed Standard.

The sensitivity testing found that although the estimated savings would vary, the key findings from the analysis were unchanged. That is, there is a net benefit associated with each Option, and Option 3 remains relatively more costly than Options 1 and 2. Further details around the outcomes from the sensitivity testing are provided in Appendix C.

Net present value of cost savings

Table 7-5 below provides the estimated net present value (NPV) of the expected cost savings under each option. The NPV calculated is based on an assumed 10 year regulatory life and a discount rate of 7 per cent (NPV also estimated based on alternative discount rates for the purposes of sensitivity testing).

Table 7-5: Estimated NPV of the expected cost savings (Options 1 to 3)

Estimated NPV	Discount rate		
	3 per cent	7 per cent	11 per cent
Option 1	$265m-$279m	$218m-$230m	$183m-$193m
Option 2	$437m-$450m	$360m-$371m	$302m-$311m
Option 3	$26m-$79m	$21m-$65m	$18m-$54m

The estimated NPVs provided above indicate a saving of between $21m-$371m across all options over the assumed life of the proposed arrangements.

Conclusions

Based on the assessment described above, it is reasonable to expect that all options would lead to a decrease in aggregate annual construction costs (ranging between $3m and $53m per annum). Further, this expected decrease in costs is likely to be substantially higher for Options 1 and 2 (approximately $31m-$53m) than for Option 3 (approximately $3m-$9m). It is likely that the cost savings under the proposed Standard, regardless of the option under which buildings are constructed, is due to a better assessment of bushfire risk under the new five step procedure and the alignment of construction needs according to the bushfire attack level assigned to each site.

It should be noted that the estimated cost reductions will be affected by differences in the level of adoption of the BCA across jurisdictions. For example, NSW implements variations to the BCA, replacing Section 2 "Site Bushfire Attack Assessment" of AS 3959-1999 with Planning for Bushfire Protection 2001 Appendix 3 "Site Assessment for Bushfire Attack". This provides an alternative methodology that is thought to be more relevant to NSW conditions for identifying the category of bushfire attack and the associated construction requirements to apply at various distances from the hazard. AS 3959 then provides the building construction materials and design requirements relevant to the level of construction.[30] On the other hand, Queensland appears to have adopted a lower level of requirements.

In addition, the estimated costs are based on an assumption that the current relative demand for the three house designs is unchanged. However, the revised Standard could influence the pattern of demand. For example, if as a consequence of the proposed Standard, the construction costs for an *ELC house* are comparatively higher, demand for this house type may decrease in favour of less expensive alternatives. Therefore, the estimated cost savings may be understated.

The cost estimates above are based on an assumption of timber weatherboard construction for the base house and ELC house designs, which would require greater level of bushfire protection than other forms of construction to comply with the proposed Standard. For example, if instead the cost impacts were estimated on the basis of brick veneer construction, the magnitude of the cost reductions would be greater.

[30] http://www.planning.nsw.gov.au/plansforaction/bushfireguidelines.asp

7.4 Qualitative assessment – benefits associated with the proposed Standard

The revised Standard does not reduce the probability of a bushfire event occurring or ensure the survival of a house. The revised Standard is beneficial to the Australian community to the extent that it has the potential to reduce the costs that individuals, businesses and the Government incur as a result of damages due to bushfire events.

7.4.1 Benefits to individuals

Potential reduction in direct tangible costs – damage costs

Direct tangible costs are physical losses such as the costs associated with the destruction of a house as a result of a bushfire event. To the extent that the revised Standard aims to improve the survivability of a house in the event of a bushfire, as a result of incorporating the most recent knowledge of risks and construction measures to mitigate those risks, it should translate to a decrease in the costs incurred by householders, both individually and at the aggregate level.

The cost of natural disasters in Australia, including bushfire damages, were estimated by the Bureau of Transport Economics (BTE)[31] in 2001. The estimates were for the period 1967-99, but excluded bushfires causing damage of less than $10 million. Bushfires were found to contribute 7.1 per cent of total disaster costs, but contributed disproportionately to deaths and injuries. The BTE figures were estimated by applying a multiplier of three to the total value of insurance claims for bushfires.[32] The estimates also include costs unrelated to building damage, such as the loss of crops and livestock. Key findings are presented in the table below, with values expressed in 1998 prices.

Table 7-6: Key findings of the BTE study

Bushfire events	BTE estimates
Frequency	There were 23 bushfires that caused significant property loss[33] in the 33 years from 1967 to 1999, an average of 0.7 bushfires per year. There were no bushfires in 55% of years.
Total cost	$2.5 billion over the period of 1967-99
Average annual cost	$77 million per year
Average cost per bushfire	$109 million per fire

[31] Now the Bureau of Transport and Regional Economics (BTRE). BTE (2001), *Economic costs of natural disasters in Australia*, BTE Report 103.
[32] The multipliers were based on a study by Joy, C.S. 1991, 'The cost of natural disasters in Australia', paper presented at the Climate Change Impacts and Adaptation Workshop, Climatic Impacts Centre, Macquarie University, New South Wales, Australia, 13–15 May.
[33] The BTE study only considers natural disasters that result in damage above $10 million. Bushfires with damage costs below $10 million have not been included.

Bushfire events	BTE estimates
Significance of large bushfires	The Ash Wednesday fires in Victoria (February 1983) accounted for 40 per cent of the total cost ($1 billion).
Cyclical pattern	Historical records back to the 1930s indicate that bushfires occur in cycles as it takes time for an area that has been burnt to accumulate the fuel for a subsequent fire.

Source: BTE (2001)

However, from the information above it is not possible to identify the reduction in building related damage costs as a result of enhanced building standards.

The BTE provided a more detailed breakdown of costs for one bushfire event, Victoria's Ash Wednesday fires in February 1983. These are reported below together with the percentage assigned as building related costs, which are the costs incurred as a consequence of the destruction of a building.

Table 7-7: Estimated costs of Ash Wednesday bushfire, 1983

Cost category	Estimated costs ($'000)*	Building related costs	
		%**	($'000)
Direct tangible costs			
Residential structures and contents	377,870	100	377,870
Commercial & Industrial structures & contents	31,584	100	31,584
Public buildings – structures & contents	52,000	100	52,000
Vehicles	11,165	50	5,583
Infrastructure	15,484	0	0
Agriculture (crops, pasture, fences, livestock)	272,812	0	0
Subtotal	**760,915**		**467,037**
Indirect tangible costs			
Business disruption	NA	50	--
Loss of public services	NA	100	--
Business clean-up	NA	50	--
Household clean-up	NA	50	--
Public buildings clean-up	NA	100	--
Household alternative accommodation	12,801	100	12,801
Agriculture	NA	0	--
Transport networks	NA	0	--
Disaster response & relief (inc. volunteers)	16,205	50	8,103
Volunteer contributions to disaster relief	11,291	50	5,646
Subtotal	**40,297**		**26,550**
Intangible costs			
Fatalities	96,200	0	0
Injuries	69,117	0	0

Cost category	Estimated costs ($'000)*	Building related costs	
		%**	($'000)
Emotional and psychological effects	NA	50	--
Environmental damage, memorabilia & cultural heritage	NA	50	--
Subtotal	**165,317**		**0**
Total	**966,529**		**493,587**

Notes:
NA No estimates found in the available literature
* BTE (2001 table 5.5) collated these costs estimates from a number of reports dealing with various impacts of the Ash Wednesday fires. Costs are in 1999 prices.
** Estimate provided by Syneca Consulting

The above table indicates that nearly half of the Ash Wednesday bushfire damage costs are building related costs, with some studies[34] estimating that approximately 2300 homes were destroyed. A rough estimation of building related costs for each house destroyed in the Ash Wednesday bushfire is approximately $214,603 (1999 dollars) or $285,785[35] in current value.

However, the building related cost per house destroyed does not represent the amount that could be saved if the proposed Standard were to be implemented. It is based on a single particularly large scale event bushfire event, which does not provide a fair representation of damages associated with bushfires generally. The figures also include the damage costs associated with houses built prior to the implementation of the existing Standard, which would be unlikely to incorporate minimal bushfire protection measures. It is also not possible to identify the contribution of the level of bushfire protection (or lack of) to the likelihood of the house being destroyed.

While the estimate from this single bushfire event cannot be used to inform a judgment about cost reduction due to enhanced protection, it puts into context the magnitude of building related costs associated with bushfire events, and their proportion of total damage costs.

Research by John McAneney[36] from Risk Frontiers, which takes into account a greater number of bushfire events, estimated that on average 83 houses are lost annually and the annual average damage, which is made up of current asset values for home and contents, is valued at $33.5m (2003 dollars). When the annual average damage is adjusted for the annual volatility of losses[37], the national bushfire risk premium per annum amounts to $62.4m, which is **$71.6m**[38] in current value. However, McAneney notes that this figure does not represent the true cost as there are other costs that have not been accounted for, which are likely to dwarf the premium calculated

[34] McAneney J., K. Chen, R. Crompton & A. Pitman, *Australian Bushfire Losses: Past, Present and Future*, Risk Frontiers (Macquarie University) and Climate Change Centre (University of New South Wales).
[35] This has been calculated by taking the 1999 value of $214,603 to the value it would be in 2008 using the consumer price index. (http://www.rba.gov.au/Statistics/AlphaListing/alpha_listing_c.html)
[36] K. John McAneney, 'Australian Bushfire: Quantifying and Pricing the Risk to Residential Properties', Risk Frontiers, Macquarie University, NSW.
[37] This takes into account I in 100 year event that equates to a likely loss of AU$0.7 billion and 1 in 250 year event that equates to a likely loss of AU$1.1 billion.
[38] This has been calculated by taking the 2003 value of $62.4 million to the value it would be in 2008 using the consumer price index. (http://www.rba.gov.au/Statistics/AlphaListing/alpha_listing_c.html)

here. This implies that the $71.6m estimated could represent a very conservative estimate of the true annual cost of bushfire events.

Research completed by Leonard and Bowditch[39] from the CSIRO supports the ability of the Standards to prevent damage loss. Their research showed:

> "*prescriptive requirements such as AS 3959 and the NSW Planning for Bushfire Protection booklet (NSW Rural Fire Service 2001) influence house design and human behaviour in two ways: firstly, in their mandatory adoption in the relevant areas and, secondly, their use as advisory documents for individuals who elect to modify or build their house for improved bushfire resistance.*"

However, because a house prescriptively built to these requirements has yet to be subject to a bushfire attack, it is not possible to accurately assess the effectiveness of enhanced bushfire protection measures in reducing estimated annual damage costs.

Potential reduction in indirect tangible costs – disruptions to normal life

Indirect tangible costs include broader economic impacts such as loss of production as a result of disruption to businesses and productive work requiring volunteers when housing is lost. Other costs include clean up costs and disaster relief packages. While the improvement in house resistance to bushfire is unlikely to reduce the resources allocated by brigades to fight bushfires, it is likely that improved protection could lead to a reduction in the other cost categories.

Potential reduction in intangible costs – health and wellbeing

Intangible costs are those for which no market exists, such as injuries and fatalities, emotional and physiological effects, household disruption and loss of memorabilia.

MacFarlane and Clayer (1997)[40] investigated the prevalence of mental health problems following the Ash Wednesday bushfire event. Twelve months after the fires, 42 per cent of the victims were defined as potential psychiatric cases, which is significantly greater than for communities that have not experienced a natural disaster. Twenty months after the fires, 23 per cent of the victims remained potential psychiatric cases.

The study also found that the prevalence of mental health problems could have been higher in the absence of a special team of welfare workers to provide counselling services and the existence of "protective" factors (e.g. low unemployment) in the chosen sample.

Another intangible cost is those associated with injuries and fatalities. The Ash Wednesday bushfire resulted in 76 deaths and injured in excess of 2500 people.

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[39] Leonard, J. E. & P. A. Bowditch, *Findings of Studies of Houses Damaged by Bushfire in Australia*, CSIRO Manufacturing & Infrastructure Technology, Melbourne, Victoria, Australia.
[40] Marfarlane A. C. & J. R. Clayer (1997), Psychiatric morbidity following a natural disaster: an Australian bushfire, *Soc Psychiatry Psychiatr Epidemiol*, Vol 32, pp. 261-68.

While it is important to consider the intangible benefits associated with reduced injuries, deaths and improved mental health outcomes, it is difficult to link these benefits directly to construction requirements and house survivability. However, all else being equal it is probably reasonable to assume that increasing property survivability could help to mitigate trauma and other intangible costs.

7.4.2 Businesses

Potential reduction in tangible costs – insurance pay outs

The insurance industry bears significant risk of bushfire events. In terms of insured losses, Ash Wednesday stands as Australia's largest bushfire event and sixth largest natural disaster. If the Ash Wednesday losses are indexed to today's prices, the total insured loss would be of the order of $300m to 350m, with 1511 houses lost.

Leonard and Bowditch[41] found that the insured losses in the Canberra fires in 2003 were comparable to the losses on Ash Wednesday, with approximately 516 houses destroyed. While fewer houses were lost in the Canberra fires, there has been a considerable increase in the asset value at the urban interface that needs to be considered for future policy.

Dunn (2003)[42] found that for bushfires, insured losses average out to $29.4 million per annum. For the 2001 and 2002 Sydney bushfires, around 57 per cent of paid claims related to domestic buildings and their contents. Approximately a third of which is the value of contents while the building's value made up two thirds of the insurance payout. Therefore, an estimate of insured losses due to bushfires for domestic buildings is approximately $11.1 million per annum.

To the extent that the revised Standard may reduce potential losses, the price of risk reflected in insurance prices borne by households should also reduce.

7.4.3 Government

Disaster relief and assistance funding

The Governments of all States and Territories, as well as the Commonwealth, provide disaster relief and assistance in the event of bushfires. Such assistance is available to individuals as well as communities. Natural disaster management is constitutionally a State and Territory responsibility, and each jurisdiction determines the criteria and level of assistance provided to individuals and communities affected by a natural disaster.

The Australian Government reimburses 50 per cent of State and Territory expenditure on personal hardship and distress (PHD) for individuals. PHD expenditure is used for emergency food, clothes, accommodation, repairs to housing and replacement of essential household items

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[41] Leonard J.E. & P.A. Bowditch, *Findings of Studies of Houses Damaged by Bushfire in Australia*, CSIRO Manufacturing & Infrastructure Technology, Melbourne, Victoria, Australia.
[42] Dunn A. (2003), *Economic Impact of Bushfire on the Community*, Timber Development Association (NSW).

and personal effects. Assistance to communities for restoration or replacement of essential public infrastructure (such as roads and bridges) and concessional interest rate loans to small businesses, voluntary non-profit bodies and needy individuals are also provided by State and Territory governments. The Australian Government reimburses 50 to 75 per cent of such expenditure.[43]

If housing survivability improves as a result of the revised Standard, PHD expenditure which are costs mostly related to the destruction of houses and property could decrease. Overall, disaster relief and assistance funding to individuals and the community in the event of a bushfire could potentially decrease if more houses survive.

7.5 Qualitative assessment – costs associated with the proposed Standard

7.5.1 Individuals

The revised Standard could impact on the preferences of potential house builders to build on particular sites due to costs. This may include individuals who purchased land with the intention to build, which could become more expensive for them under the revised Standard.[44] Examples include circumstances not covered by both site assessment methodologies. The revised Standard however does not prevent builders from building as long as a performance approach is used that complies with the Performance Requirements.

While in some cases the construction of certain house types will become more expensive, this does not preclude the individual from choosing a less expensive alternative, which is more appropriate given the assessed level of site risk. Therefore, the impacts are largely limited to a restriction in consumer choice, rather than a cost impost.

7.5.2 Businesses

It is possible that the revised Standard may impose more stringent construction requirements for a given site and therefore lead to a reduction in market demand for new housing. However, at the aggregate level it is unlikely that there would be a material decrease in construction due to the proposed Standard. Instead, it is more likely that either the type of construction (i.e. alternative designs) would be modified, or an alternative location would be chosen.

7.6 Evaluation of Options – comparative assessment of costs and benefits

In assessing the overall impact of the proposed Standard (i.e. Option 1 – 1000K) and the alternative Options (i.e. Option 2 – 910K and Option 3 – 1090K), this RIS utilises two approaches:

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[43] http://www.ema.gov.au/agd/EMA/emaInternet.nsf/Page/Communities_Natural_Disasters_NDRRA_NDRRA_Funding_Assistance

[44] Dunn A. (2003), *Economic Impact of Bushfire on the Community*, Timber Development Association (NSW).

- A qualitative summary of the overall costs and benefits associated with each option, relative to the status quo; and
- A balanced scorecard approach, which provides a comparative assessment of the extent to which each option will support the achievement of the Government's objectives.

Both approaches are described in further detail below.

7.6.1 Summary of costs and benefits

Table 7-8 provides a summary of the costs and benefits discussed in the sections above, and a qualitative assessment of the likely overall impact of each option relative to the status quo.

Table 7-8: Summary table of impacts by Option

Option	Costs / Benefits	Groups impacted: Government	Groups impacted: Business	Groups impacted: Individuals	Overall impact
Option 1 (1000K)	**Costs**	• Administration and review of Standards	• Minimal compliance costs • Reduced market demand for certain house types or sites	• An increase in construction costs for some building owners	• It is reasonable to expect that the benefits associated with aggregate construction cost savings and reduced bushfire damages would outweigh the anticipated costs. • While some *individual* building owners and businesses may be adversely impacted, it is likely that the aggregate impacts would be positive (i.e. a net benefit) • The potential variation in assessed impacts is discussed in more detail below.
	Benefits	• Potential reduction in disaster relief funding	• Increased market demand for certain house types	• Aggregate construction cost savings of around $31m-$33m • Potential reduction in the annual *building related damage cost* (currently around $71.6m) • Improved health and wellbeing	
Option 2 (910K)	**Costs**	• Administration and review of Standards	• Minimal compliance costs • Reduced market demand for certain house types or sites	• An increase in construction costs for some building owners	
	Benefits	• Potential reduction in disaster relief funding	• Increased market demand for certain house types	• Aggregate construction cost savings of between $51m-$53m • Potential reduction in the annual *building related damage cost* (currently around $71.6m) • Improved health and wellbeing	
Option 3 (1090K)	**Costs**	• Administration and review of Standards	• Minimal compliance costs • Reduced market demand for certain house types or sites	• An increase in construction costs for some building owners	
	Benefits	• Potential reduction in disaster relief funding	• Increased market demand for certain house types	• Aggregate construction cost savings of between $3m-$9m • Potential reduction in the annual *building related damage cost* (currently around $71.6m) • Improved health and wellbeing	

Based on the above summary table, the following conclusions can be made:

- All Options appear likely to deliver an overall net benefit compared to the current arrangements (i.e. benefits of increased protection and reduced construction costs are likely to outweigh any additional costs);

- While Option 3 is likely to provide a greater level of protection from bushfire events (i.e. reduced damages), it will not deliver the same level of construction cost savings;

- For Option 3 to deliver a net benefit comparable to that for Options 1 and 2, it would need to provide a further reduction in *building related damages* of around $30-40m per annum. As shown in Table 7-8, this represents around half of the estimated total annual damage costs, which indicates that such a reduction is unlikely; and

- Option 2 is expected to provide around $20m in additional construction cost savings compared to Option 1. Therefore, in order to deliver a greater net benefit, Option 1 would need to provide additional benefits (i.e. reduced damages, improved health and wellbeing, etc) of the same magnitude.

Therefore, while it reasonable to conclude that all options would provide a net benefit relative to the status quo and that Options 1 and 2 are preferred to Option 3, the distinction between Options 1 and 2 is less clear.

7.6.2 Balanced scorecard assessment

This RIS also uses the 'balanced scorecard approach' to compare the costs and benefits of each option to the base case and assess their comparative merits. This approach is preferred where it is difficult to quantify and assign monetary values to the impacts associated with a proposed measure, which is the case for the revised *AS 3959* as most of the benefits are difficult to quantify and therefore discussed qualitatively. Thus, the balanced scorecard approach allows a comparison of the three options by assigning a relative score to each.

Evaluation criteria

The evaluation criteria used to assess the options are based on the four objectives of the proposed regulation. Each option has been evaluated on the degree to which it supports:

- A reduction in the danger to life and the risk of property damage by ensuring that buildings have appropriate resistance to bushfires;

- The provision of outcome based regulation which allows industry to develop the most technically efficient and appropriate solutions;

- Address the identified market failures in relation to the provision of bushfire resistant features; and

- Ensure that the regulatory requirements are cost effective and transparent.

A nine-point scale has been used to assess the options against each of the criteria. The table below outlines the scoring scheme used.

Table 7-9: Scoring scale

Score	Impact of option on criteria
4	Highly desirable
3	More desirable
2	Desirable
1	Slightly desirable
0	Neutral
-1	Slightly undesirable
-2	Undesirable
-3	More undesirable
-4	Highly undesirable

The base case (i.e. no change to the current arrangements) always scores zero against each criterion, with the scores awarded to the other options being relative to the base case. To illustrate, if an option receives a score of '4' against the criteria on 'a reduction in the danger to life and the risk of property damage by ensuring that buildings have appropriate resistance to bushfires' this indicates that the option has a "*highly desirable impact in reducing the danger to life and the risk of property damage by ensuring that buildings have appropriate resistance to bushfires*" relative to the base case.

Weightings

Table 7-10 below outlines the weightings applied to each criteria for the purposes of this assessment.

Table 7-10: The criteria weightings

Criteria	Weightings (%)
Reduction in the danger to life and the risk of property damage	30
Technically efficient and appropriate solutions	20
Address market failures	20
Regulatory requirements are cost effective and transparent	30

The first and fourth criteria are given a weighting of 30 per cent while the second and third criteria are assigned a weighting of 20 per cent.

As the revised Standard is specifically aimed at addressing building requirements for houses in BPAs, the first criterion on reducing danger to life and risk of property damage is given more importance. Equally important is that the options are able to demonstrate that the level of protection provided is achieved cost effectively, that the benefits outweigh the costs. This is in line with Principle 3 of the *COAG Principles of Best Regulation*, that regulation should generate the greatest net benefits to the community. Thus the fourth criterion is also given the weighting of 30 per cent.

The second and third criteria are important in ensuring that the regulation is effective and relevant over time (Principle 6 of the *COAG Principles of Best Regulation*) and have each been assigned a weight of 20 per cent.

Overall score

The score of each option has been calculated by multiplying the score assigned to each criterion by its weighting and summing the result. The balanced scorecard in Section 7.6.3 provides an assessment of the overall net benefit or cost of the proposed options. The score assigned to each criterion for each option is based on an assessment of their relative benefits and costs.

7.6.3 Option evaluation

This section scores each option against the evaluation criteria and describes the basis on which the scores were assigned.

Reduction in the danger to life and the risk of property damage

All the options are expected to increase the protection that householders have in the event of a bushfire by improving house survivability and hence reducing the risk of danger to life and the associated damage costs. The review process and the options being considered are intended to reflect the latest knowledge and technology in bushfire protection in the updated Standard.

Each option is based on a different flame temperature, with a higher flame temperature changing the bushfire attack level a building might fall into. That is a building would typically be classified in a higher bushfire attack level under the higher flame temperature option than under a lower flame temperature option. This results in more stringent construction requirements due to the change in bushfire attack level. Therefore, the higher the flame temperature, the greater the level of protection provided by the regulations. Therefore Option 1 is given a score of 3; Option 2 is given a score of 2 while Option 3 is given a score of 4.

Technically efficient and appropriate solutions

The proposed Standard provides performance based regulatory arrangements, which are intended to enable industry to develop the most technically efficient and appropriate solution. As the regulatory mechanism and approach is consistent across each option, all were allocated a positive score against this criteria.

The level of protection provided by each option is based on an assumed flame temperature. Option 1 (1000K) was selected as the most representative scenario and is therefore assessed more favourably. Therefore, Option 1 is given a score of 4 and Options 2 and 3 are given a score of 3.

Address market failures

All options, including the base case, are likely to address the market failures discussed in Section 2.4 adequately, and are therefore all allocated a score of 0.

Regulatory requirements are cost effective and transparent

Based on the quantitative assessment, it is likely that all options would result in a decrease in construction costs compared to the current Standard (i.e. the base case). Option 1 is given a score of 3, Option 2 is given a score of 4 and Option 3 is given a score of 1. This is a reflection of the quantitative assessment in section 6.3, which found that Option 3 is likely to deliver the lowest level of construction cost saving (i.e. approximately a third of that for Options 1 or 2). Cost savings under Option 1 and 2 are comparable, with Option 2 being the most cost efficient option.

7.6.4 Balance scorecard assessment

The balanced scorecard below aggregates the scores assigned to each option against the evaluation criteria to arrive at an overall assessment for each option. The 'weighted score' is obtained by multiplying the 'assigned score' for each criteria under each option with the 'weighting' allocated to each criteria. For example, Option 1 was given a 'assigned score' of 3 in meeting the criteria of a 'reduction in the danger to life and the risk of property damage. This is multiplied by the weighting of 30 per cent that is assigned to that criterion to arrive at a weighted score of 0.9. The total weighted score is the sum of individual weighted scores across all criteria for each option. The higher the total weighted score, the more likely that a particular option will deliver higher overall net benefits.

Option 1 scores highest against the criteria and would be expected to deliver the highest overall net benefits if implemented.

Table 7-11: The balanced scorecard for the proposed options

Criteria	Weighting (%)	Base case		Option 1: 1000K		Option 2: 910K		Option 3: 1090K	
		Assigned score	Weighted score	Assigned score	Weighted score	Assigned score	Weighted score	Assigned score	Weighted score
Reduction in the danger to life and the risk of property damage	30	0	0.0	3	0.9	2	0.6	4	1.2
Technically efficient and appropriate solutions	20	0	0.0	4	0.8	3	0.6	3	0.6
Address market failures	20	0	0.0	0	0.0	0	0.0	0	0.0
Regulatory requirements are cost effective and transparent	30	0	0.0	3	0.9	4	1.2	1	0.3
Total	**100**	**0**	**0.0**	**10**	**2.6**	**9**	**2.4**	**8**	**2.1**

The assessment above supports the previous conclusion that all options represent a net benefit relative to the current arrangements, and that Options 1 and 2 are likely to be the most beneficial. However, it also concludes that Option 1 is more likely to support the achievement of the project objectives.

7.7 Conclusions

The cost benefit analysis in this Section provides a quantitative assessment of the expected construction cost impacts at a State and national level, and a qualitative assessment of the other costs and benefits associated with the proposed Standard and the options being considered.

The analysis indicates that the introduction of the proposed Standard could result in the following impacts at the State and national level:

- All Options lead to a decrease in construction costs for houses in designated BPAs of approximately $3m to $53m per annum. The expected decrease in construction costs is substantially lower for Option 3 (approximately $3m to $9m) than for Options 1 and 2 (approximately $31m to $53m). The decrease in cost is likely to be a result of a better assessment of bushfire risk level using the proposed five step procedure and the alignment of bushfire protection measures according to the bushfire attack level assigned to each site;

- It is expected that the savings from the proposed Standard would not be limited to a reduction in construction costs. Although difficult to quantify, annual building related damage costs due to bushfires are conservatively estimated to be $71.6m. Through the provision of increased protection, all Options will provide a reduction in these total annual damage costs, and also other consequential losses associated with bushfire losses; and

- All Options were assessed as likely to support the achievement of the Government objectives, with Option 1 assessed relatively more favourably as it provides a greater level of protection than Option 2, without a considerable variation in construction costs. Although Option 3 provides more stringent bushfire protection measures, the construction cost savings are considerably lower. Option 3 would need to provide further benefits of around $30m-$40m per annum to achieve the same level of benefits as Options 1 and 2.

The distinction between Options 1 and 2 is marginal. Although Option 1 is more expensive in terms of construction costs, it provides a higher level of bushfire protection. In aggregate, Option 1 would need to provide around $20m per annum in other benefits to provide a net cost benefit at least equal to Option 2. This may be a reasonable expectation as Option 1 is based on an assumed flame temperature of 1000K and Option 2 on an assumed flame temperature of 910K.

Therefore, on this basis Option 1 (i.e. 1000K) represents the preferred option.

8 Business compliance costs

8.1 Introduction

The COAG *Best Practice Regulation* guide requires consideration of the compliance burden imposed on businesses. This is the additional (incremental) cost incurred by businesses when complying with regulations. Quantification of compliance costs using the Business Costs Calculator (BCC) is required for proposals that are likely to impose medium or significant compliance costs on business.

Compliance costs include:

- Notification costs – requirement to report certain events;
- Education costs – keeping abreast with regulatory requirements;
- Cost of gaining permission – to conduct certain activities;
- Purchase costs – requirement to purchase materials or equipment;
- Record keeping costs – keeping up-to-date records;
- Enforcement costs – cooperating with audits or inspections;
- Publication and documentation costs – producing documents for third parties; and
- Procedural costs – costs incurred that are of a non-administrative nature (e.g. requirement to conduct fire drills).[45]

Business, particularly the building industry, already incurs compliance costs under existing arrangements. We consider below the potential extent of any additional compliance costs under the proposed Standard.

8.2 Assessment of additional compliance costs

The revised Standard may impose additional compliance costs in three ways:

- Inclusion of a new bushfire attack assessment methodology;
- Inclusion of additional steps within the methodology; and
- Familiarisation and education costs.

The likelihood of additional compliance costs in each of these areas is discussed below.

[45] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007, p. 27.

Assessment methods

The proposed Standard provides two methods for undertaking the site assessment and determining the bushfire attack level:

- *Method 1* – a simplified procedure that involves five procedural steps to determine the category of bushfire attack, which is subject to limitations around the circumstances in which it can be applied.

- *Method 2* – a detailed calculation-based procedure to determine the category of bushfire attack, which can be applied where a more specific result is sought or where the site conditions are outside of the scope of Method 1.

Given that builders are unlikely to incur additional costs unnecessarily, it is reasonable to assume that Method 2 is unlikely to be the preferred assessment method unless it is mandatory or if it is likely to result in costs savings compared to Method 1. Therefore, it is reasonable to infer that the compliance costs associated with Method 1 would represent the higher range of such costs.

The current Standard requires a site assessment that is essentially the same as the approach under Method 1. Therefore, it is unlikely that there will be an incremental change in compliance costs for the implementation of the revised Standard.

Additional steps in the assessment process

Under Method 1 the proposed Standard sets out a five-step procedure for assessing bushfire attack level risks. This represents two steps additional to the current Standard. These steps require determining the FDI (dependent on the state and territory and area where the house will be situated) and measuring the effective slope under the vegetation surrounding the site.

The FDI is easily obtained from a table that lists the FDI across all Australian jurisdictions and the areas within the jurisdictions. Measuring the slope under the vegetation should not be materially different from measuring the slope of the site, which was the requirement under the current Standard. Therefore, the two additional steps are unlikely to impose additional compliance costs.

Familiarisation and Educational costs

The revised assessment methodology can be applied relatively easily, as the additional steps require information that is either similar to the current process (the effective slope of vegetation) or have already been provided (FDI for all jurisdictions). Some time or effort could be required from practitioners to familiarise or educate themselves with the revised Standard but this is unlikely to impose significant compliance costs.

8.3 Conclusion

The revised Standard is likely to impose business compliance costs in three ways. Firstly through the inclusion of an additional risk assessment methodology, secondly through additional steps in the assessment process and lastly through the familiarisation with the revised Standard.

It is unlikely that the additional risk assessment methodology will impose significant compliance cost as builders are unlikely to apply Method 2 unless it is mandatory or is cost saving. Therefore Method 1, which is similar to the risk assessment methodology currently in place, is likely to be the methodology that will be applied the majority of the time and will not result in incremental change to current business compliance costs.

The two additional steps in the assessment process are unlikely to impose significant business compliance costs as they can be easily implemented.

While the familiarisation with the revised Standard will result in practitioners incurring some educational and familiarisation costs, it is unlikely that the time and effort would impose significant business costs.

Based on the assessment above, the revised Standard is unlikely to impose medium or significant compliance costs on businesses. Therefore, it is not necessary to calculate the compliance costs on businesses using the BCC as required by the COAG *Best Practice Regulation.*

9 Assessment of competition impacts

As part of the RIS process, the COAG *Best Practice Regulation* guide requires that the competition impacts of proposed regulation be considered. A preliminary analysis can be conducted by working through the questions in the Competition Assessment Checklist set out in the guide. Where this preliminary analysis indicates there could be an impact on competition, a competition assessment should be undertaken as part of the RIS.

The checklist questions are:

- Would the regulatory proposal restrict or reduce the number and range of suppliers?
- Would the regulatory proposal restrict or reduce the ability of suppliers to compete?
- Would the regulatory proposal alter suppliers' incentives to compete vigorously?[46]

Does the proposed Standard restrict or reduce the number and range of suppliers?

It is unlikely that the revised Standard will affect or restrict competition. The revised Standard imposes minimal incremental compliance costs on businesses. This would not act as a barrier to entry nor restrict or reduce the number or range of businesses operating in the design or construction industry.

While the *ELC house* is relatively more expensive to construct under the proposed Standard, it is likely to impose minimal impact on the number or range of suppliers as it is reasonable to assume that design and construction companies build a range of houses and do not specialise in just one particular design. In addition, the *base house* and *large two storey* houses are cheaper to construct under the proposed Standard. This could lead to a substitution effect, with more building owners preferring such designs over the *ELC house* and hence increasing the demand for products related to such designs. Business is unlikely to be adversely affected as a result of the *ELC house* being relatively more expensive to construct.

Does the proposed Standard restrict or reduce the ability of suppliers to compete?

The revised Standard may impose a different set of construction requirements based on the assessed bushfire attack level, which could restrict builders to the use of a particular type of product or material in order to meet the regulatory requirements. However, because the regulations generally specify a range of products for compliance, it is unlikely that the proposed arrangements would restrict or reduce the ability of any suppliers to compete or impact on the ability of a builder to build houses that comply with the requirements.

[46] COAG Best Practice Regulation, A Guide for Ministerial Councils and National Standard Setting Bodies, October 2007, p. 29.

Does the proposed Standard impact incentives to compete vigorously?

The revised Standard does not impact or alter material suppliers' nor builders' incentives to compete vigorously. Given that building in BPAs is likely to cost less under the revised Standard, it could lead to a further increase in building activity. This could encourage more builders to participate in the building industry and increase competition amongst builders.

Conclusion

Overall, it is likely that competition will improve as the revised Standard is part of the BCA, which is a performance-based regulation, and provides flexibility to builders to meet the obligations by providing optional DTS solutions, while the review of the Standard provides timely updating of the required compliance procedures.

10 Consultation

Principle 7 in the COAG *Best Practice Regulations* guide requires effective consultation with affected stakeholders at all stages of the regulatory cycle. Public consultation is an important part of any regulatory development process. Consultation should occur when the options for regulatory action are being considered. The COAG process recommends a best practice consultation process that adheres to seven principles:

- *Continuity* – Consultation should be a continuous process that starts early in the policy development process.

- *Targeting* – Consultation should be widely based to ensure it captures the diversity of stakeholders affected by the proposed changes. This includes Commonwealth, State, Territory and local governments, as appropriate.

- *Appropriate timeliness* – Consultation should start when policy objectives and options are being identified. Throughout the consultation process stakeholders should be given sufficient time to provide considered responses.

- *Accessibility* – Stakeholder groups should be informed of proposed consultations, and be provided with information about proposals, via a range of means appropriate to those groups.

- *Transparency* – Ministerial Councils need to explain clearly the objectives of the consultation process, the regulation policy framework within which consultations will take place and provide feedback on how they have considered consultation responses.

- *Consistency and flexibility* – Consistent consultation procedures can make it easier for stakeholders to participate. However, this must be balanced with the need for consultation arrangements to be designed to suit the circumstances of the particular proposal under consideration.

- *Evaluation and review* – Policy agencies should evaluate consultation processes and continue to examine ways of making them more effective.

This RIS has been prepared as part of the best practice consultation process and has been made publicly available to interested parties for comments and feedback. The ABCB and Standards Australia consultation processes discussed below, are consistent with best practice consultation processes and adhere to the seven principles set out above. The outcomes of the ABCB pre-public and public consultation processes for this RIS are discussed in 10.3 and 10.4.

10.1 ABCB Consultation Process

The Consultation Protocol

The ABCB is committed to regular review of the BCA and to amend and update the BCA to ensure that it meets changing community standards. To facilitate this, the ABCB maintains regular and extensive consultative relationships with a wide range of stakeholders. In particular, a continuous feedback mechanism exists and is maintained through State and Territory building control administrations, industry and the senior national technical advisory group, the Building Codes Committee. Further, a National Technical Summit provides an annual forum for industry, government and other stakeholders to have input into the ABCB Annual Business Plan. These mechanisms ensure that opportunities for regulatory reform are identified and assessed for implementation in a timely manner.

All ABCB regulatory proposals are developed in a consultative framework in accordance with the Inter-Government Agreement. Key stakeholders are identified and approached for inclusion in relevant project specific committees and working groups. Thus, all proposals have widespread industry and government involvement.

The ABCB has also developed a Consultation Protocol[47], which includes provisions for a consultation process and consultation forums. The Protocol explains the ABCB's philosophy of engaging constructively with the community and industry in key issues affecting buildings and describes the various consultation mechanisms available to ABCB stakeholders.

The ABCB's consultation processes are a range of programs that allows the ABCB to consult widely with stakeholders via:

- the proposal for change process ;
- the National Technical Summit;
- the release of BCA amendments for comments;
- regulatory impact assessments;
- impact assessment protocol;
- research consultations;
- ABCB approval that reports directly to ministers responsible for building; and
- international collaboration.

The Protocol also ensures that the ABCB engages with their stakeholders via a range of events and information series through:

- the Building Codes Committee with representatives from a broad cross section of building professions and all levels of government;
- its Consultation Committees;

[47] Available on http://www.abcb.gov.au/index.cfm?objectid=49960DC7-BD3E-5920-745CE09F1334889C

- public information seminars;
- its biennial National Conference;
- its technical magazine, the ABRB;
- its free 1300 service advisory line which provides information for industry and the general public to clarify BCA technical matters and access technical advice about provisions; and
- the ABCB website.

The Impact Assessment Protocol 2007

The ABCB Impact Assessment Protocol 2007 ensures that the impact assessment processes are accountable and transparent, and allow for significant stakeholder consultation and participation. The impact assessment processes include:

- Proposals for Change (PFC) which require a change-proposer to justify any projected amendment to the BCA, in accordance with COAG regulatory principles. PFCs are consulted on and in some instances considered at a National Technical Summit attended by industry representatives, government officials and members of the research community;
- Preliminary Impact Assessments (PIA) which allow for early-stage impact analysis of proposed changes to the BCA. Although complementary to the PFC process, a PIA allows for a more thorough impact assessment to be carried out by the ABCB; and
- Regulatory Impact Statements (RIS) which provide a comprehensive assessment of the impacts of proposed regulation.

Additional stakeholder consultation

As part of the development of this RIS, the ABCB provided an opportunity to members of Standards Australia Committee FP-020 to assess and comment on the content of this document with regard to the technical proposal put forward, prior to making it available for public comment. These comments have been considered and reflected in the RIS.

10.2 Standards Australia Consultation Process

Standards Australia has more than 7000 committee members across Australia and around 1000 technical committees developing Standards. Standards are researched, developed and revised by Committees made up of people from government, business and industry, the community and people from academia.

For the development of new Standards[48], Standards Australia requires:

- Project approval by the appropriate Technical Committee and Standards Sector Board that there is genuine support for the Standard, that it improves economic efficiency, that there is a net benefit and that it is in the national interest;

- A preliminary draft that demonstrates that the proposed Standard will in no way act as a barrier to trade, competition or innovative development and that International Standards are adopted to the maximum possible extent. In the absence of an appropriate International Standard, and after verification that the proposed Standard will in no way be anti-competitive, the Committee proceeds to prepare a draft for a new Australian Standard;

- A draft is made available for public comment, usually over a period of two or three months as it is essential that anyone who feels that they have something to contribute to the draft Standard use the public comment period to comment on its provisions;

- All comments from the public are considered in detail by the Committee and, if necessary, further drafting is undertaken; and

- The Committee then votes on the final draft. For the Standard to be published, the ballot must demonstrate substantial agreement with no major dissenting interests.

In order to ensure that Standards remain relevant over time, Standards Australia requires that all Standards need to be reviewed from time to time, as technology, knowledge and community needs change. For this reason an automatic review process exists. Major Standards and those dealing with topics continually undergoing rapid change are revised and republished within a maximum period of seven years. Most others are revised within ten years of their publication date. This RIS is for the revision of Australian Standard *AS 3959-1999* and is consistent with the review process set out above.

Draft Revised Standard Consultation Process

The current review process, from which the proposed amendments stem, was initiated in 2001 by Standards Australia. It received further impetus from a report on natural disaster mitigation prepared for COAG in 2002, and in 2004, when a national inquiry on bushfire mitigation and management was undertaken, also on behalf of COAG. As a result, the ABCB was directed to review building requirements with regards to bushfire protection. The review was to include the provisions of the BCA and primary reference Australian Standard *AS 3959-1999*.

A draft revision of the revised Standard (DR 03182) was released for public comment in March 2003. The draft focused on two main components: the site assessment methodology and the specific construction requirements.

As a result of the comments received, a second draft of the revised Standard (DR 05060) was released for public comment in February 2005. Further comments were received and

[48] It should be noted that the Standard development model described is the method under which the revised Standard has been developed. Standards Australia is currently in the process of introducing a new business model.

incorporated into a third draft of the revised Standard — it is this draft for which the Consultation RIS was prepared.

10.3 Pre-public release Consultation

Prior to formal public release the draft Consultation RIS was released to State and Territory building administrations in early October 2008 and to Standards Australia Committee FP-020 in mid-October, to provide these key stakeholders with opportunity to comment on preliminary outcomes and to assess the document for accuracy with regard to technical content. No comments were received from the States and Territories, while one set of comments was received from an FP-020 member, the Timber Development Association (TDA), and these were addressed as noted below prior to the public consultation release in November 2008. No comments were received from State and Territory building administrations.

In general, the TDA were satisfied that the proposal appeared to have achieved its original intention of providing a cost-effective solution to construction in bushfire prone areas. However, they raised a number of issues including a concern over perceived lack of clarity with regard to the quantity surveyor assumptions used, challenging some general claims made in the RIS and questioning the accuracy of figures used in some of the tables.

In response to concern over cost assumptions, the quantity surveyor cost report was included in the public consultation documentation along with the Consultation RIS. This document provides a break-up of each sample house measured against both the current requirements and proposed changes. Assumptions were made on the best judgement of the quantity surveyor, based on experience and industry knowledge. With regard to claims in the RIS relating to the effectiveness of the existing Standard, these were clarified and expanded where necessary. In response to questions regarding the figures in Appendix C tables, these were checked for accuracy by the consultant, consequently revealing a misinterpretation of the application of a 'shielding' factor in the draft Standard. This was corrected and flow-on corrections to linked tables were made. These changes were made to the document prior to its release for public consultation. The overall conclusion and recommendations of the draft RIS remained unchanged.

10.4 Public Consultation

Once cleared for public consultation by the OBPR, the Consultation RIS was publicly released for approximately four weeks. This period was extended by one week for those parties who requested an extension of time to allow broader consultation within their respective groups. Responses were received from 18 organisations. Many industry organisation responses represented consolidation of State and/or Territory member organisation comments. A list of respondents can be found at Appendix D. A summary of comment and how it has been treated in this Final RIS is described below.

Support for RIS analysis options

There was general support for the proposed changes from all respondents with half of those who offered a preference of options selecting Option 1 (1000K) and half selecting Option 3 (1090K). The majority of those preferring Option 1 were building industry related, with the Housing Industry Association (HIA) suggesting that 1000K was the most realistic option for national use. Much of the support for Option 3 (1090K) came from the fire service or fire service industry, generally suggesting that anything less would provide inadequate protection. One group, Timber Queensland, expressed a preference for Option 2 (910K), to better align with the climatic and vegetation differences in Queensland. In contrast, the Australasian Fire and Emergency Services Authorities Council (AFAC) suggested that the 910K flame temperature option was arbitrary, with no basis for support, and should be removed. The Association of Consulting Engineers Australia (ACEA) noted support for a co-regulation approach, with Master Builders Qld suggesting something similar, based on the provision of information booklets to home owners as a means of educating on the importance of maintaining building and property integrity.

RIS methodology and content

Master Builders Qld expressed disappointment with the analysis undertaken as part of the RIS. They suggest comments and assumptions made about house design costs and the three flame temperature options are unconvincing, but stated that they support the broader objectives of the proposal. No specific details, alternate assumptions or costings were provided in their submission. Response to comment on cost assumptions is included below.

Evidence of a problem

Timber Qld noted the statement "housing survivability information is not available for buildings built under AS 3959-1999 as such, houses have not been exposed to a bushfire event at present", suggesting that such buildings may have been exposed and survived and questioning the need to revise the Standard at all. It is quite feasible that recently built houses have survived bushfire attack, for whatever reason, but the point made in the RIS is that the data that is available is not so narrowly defined as to identify building age, nor compliance with particular regulations, such as designation as bushfire prone under legislation or separate direction to comply with AS 3959. The rationale behind the review of AS 3959 is clearly stated in Chapter 3 and the effectiveness of the current document is not in question, just its suitability.

Additional benefits

Bodycote Warringtonfire (Aus) Pty Ltd noted that the positive preliminary outcome of the RIS was partially attributable to the introduction of the new Bushfire Attack Levels (BAL), in particular BAL 40 and BAL Flame Zone, and the more targeted approach of the revised construction details. Timber QLD suggest that savings demonstrated in the RIS can be attributed to the introduction of BAL 19, resulting in the lessening of requirements for buildings in lower risk situations. They also pointed out that the inclusion in the proposal of two test Standards, AS

1530.8.1 & AS 1530.8.2[49], provides users with alternative options of compliance that are not currently available. The introduction of the test Standards supports the objectives of the BCA of encouraging performance based solutions through the use of innovative design. Master Builders (Qld) also noted support for the introduction of the FDI factors, to better represent climatic and geographic variations.

Quantity surveyor costings & assumptions

There was some comment provided by the timber groups and the HIA regarding the allowance used for fire retardant coatings. One respondent offered that compliant coatings were more in the order of $25/m^2 and not the $3/m^2 quoted in the report. It is acknowledged that the higher cost may apply as suggested, but due to this method of protection only being applied to some of the existing provision scenarios, the only total costs to increase (should the rate be changed) would be those selected. This would potentially increase the savings in these cases. As the overall impact at a State and national level would be minimal and the outcome would be the same, no adjustments have been made in this final RIS.

Some other cost assumptions were questioned by CSIRO, such as those applying to the selection of shutters and brick cladding. The approach used by the quantity surveyor is noted in the introduction of the cost report and 6.3 of this RIS. It highlights that the required protective improvements would have the maximum impact over base house materials used. The cost report also states, where shutters are allowed for at lower levels: *"Shutters are used in this option. Where not used there are many other implications."* Minimising the increase in cost would in fact potentially reduce the overall cost of the proposal. Adjusting cost assumptions slightly in any direction will have minimal impact on the outcome at the State and national level.

Estimated construction activity

The HIA raised concerns over the estimated construction activity described in the RIS for the ACT, stating that the figure was grossly underestimated, with concerns also for NSW due to the nature of their State based assessment process. As stated in the RIS, the estimated construction activity for bushfire prone areas has been calculated on data provided by Risk Frontiers with a sensitivity analysis undertaken of a selection of bushfire prone local government areas. This is deemed to be the most effective means of determining risk levels on a national scale. Attempting to define individual sites and estates that may or may not be captured through varying planning regimes in the various States and Territories at any particular point in time is impractical. In reality, the analysis of impacts of the three flame temperature options has, overall, indicated a positive benefit over cost result. An increase in dwelling numbers will not necessarily alter this, it will only increase the value of the construction cost savings.

[49] Part 8.1 "*Tests on elements of construction for buildings exposed to simulated bushfire attack – Radiant heat and small flaming sources*" & Part 8.2 "*Tests on elements of construction for buildings exposed to simulated bushfire attack – Large flaming sources*".

Existing buildings, alterations and additions

Concern was raised that existing buildings, the largest proportion of potentially bushfire susceptible buildings, had not been included in the Consultation RIS. It is worth noting that neither the BCA, nor the State or Territory legislation that references it, applies retrospectively to existing buildings hence they do not form part of the RIS analysis. HIA and Timber Qld also expressed concern that alterations and additions to existing buildings were not included in the RIS. Although it is acknowledged that this aspect of the industry would be impacted, determining likely scenarios would be problematic, due to variability of application. This, combined with the discretionary approach to existing parts of buildings adopted by most regulatory authorities, makes the quantification of costs, and benefits in relation to existing buildings, virtually impossible. That said, given that the outcome of the analysis on new buildings was positive to varying degrees against all options, it may be reasonable to assume that the application of the BCA to alterations and additions to existing buildings also has the potential to provide a positive outcome.

State and Territory BCA variations

Another area that received comment was the omission in the Consultation RIS of any consideration of State and Territory variations to the BCA and concern that the proposal in its current form may lead to ongoing or new State variations. Some of this concern is related to suggestions from the NSW Rural Fire Service (NSWRFS) that they will pursue NSW variations should a flame temperature of 1090K not be adopted, and some is linked to a perceived lack of consideration in the proposed Standard for differing vegetation and climatic conditions in Queensland.

Firstly, on the issue of flame temperature, the final decision as to which level of stringency is chosen ultimately rests with governments. Should a jurisdiction choose to not accept that decision it is their prerogative. With regard to the Queensland issue, the revised Standard introduces a fire danger index (FDI), as discussed in 3.5.4, which provides regions with the ability to more accurately balance their local conditions with the necessary level of protection. Queensland has been allocated the lowest level of 40 with the majority of Victoria and large areas of NSW set at 100.

Climate change

It was suggested in the submission by the Friends of the Box-Ironbark Forests that climate change costs/benefits should have been included in the analysis, noting that a potentially substantial increase in "Catastrophic Fire Weather" is anticipated in Melbourne over the next 40 years. It is acknowledged that discussion within governments and the science community on the implications of climate change has been comprehensive, but it is also ongoing. Caution is recommended with regard to considering exceeding the minimum necessary regulatory goals of the BCA, bearing in mind that the BCA, and its technical Standards, are regularly reviewed for their suitability. Note also that a higher level of protection is always available to home owners should they so choose, and other means of protection beyond the BCA such as vegetation control and suitable property management, are also available as a means of reducing future risk.

Alternative analyses – lower building losses

The NSWRFS have provided an alternate modelling approach to that used in the RIS, in order to capture potential savings that could be achieved through a possible reduction in house loss. AFAC are supportive of the approach and the CSIRO similarly suggested that lower flame temperature allowances will lead to greater house losses.

The NSWRFS modelling outcomes based on their inputs confirm that the higher the flame temperature option chosen, the greater the potential for annual savings based on increased resilience of buildings. As a result NSWRFS suggest that Option 3 (1090K) should be used as the default flame temperature, based on it having the lowest potential value of losses of the three options. It should be noted, however, that the modelling does not consider the status quo, i.e. the current provisions contained in AS 3959-1999, providing no comparison with which to determine a necessity for the highest level of stringency.

The discussion in Chapter 3 on the nature and extent of the problem covers the rationale for government intervention and reasoning behind the review of current arrangements and it does not indicate in any way that the current provisions have failed. The recommended preferred option, Option 1, is chosen based on a higher level of benefits than Option 3 whilst providing increased protection over Option 2.

Cost of fire

There has been some confusion as to the manner in which the current rate of damages is discussed in the RIS. Two figures are referenced, one being the average annual cost of bushfire estimated by the Bureau of Transport Economics (BTE) in 2001 (based on 1998 prices) of $77m, which includes some costs unrelated to building damage. The other is the $71.6m annual average damage adjusted to current prices from McAneney's 2003 estimate. Both of these figures are referenced accordingly and the point being made in the RIS is that these figures, identified by separate sources, are within a similar order of magnitude.

Issues beyond the scope of the RIS

Some technical and planning issues beyond the scope of the RIS were raised, including the site assessment process not accounting for surrounding development, disagreement raised by AFAC regarding the introduction of BAL 40 and BAL Flame Zone categories into the Standard, and some concern regarding the adequacy of protection for sub-floor spaces. Timber Qld also suggest that lower bushfire hazards associated with tropical and sub-tropical climates and vegetation have not been considered in the Standard. These are all issues for consideration by Standards Australia committee FP-020, although the latter is discussed in 3.5.4, as noted earlier.

Other issues

The outputs resulting from the comparator matrix raised a few questions due to the counterintuitive appearance of some of the figures, i.e. a high percentage of dwellings currently classified as 'High' under Options 1 & 2 falling into the BAL 12.5 category, BAL 12.5 being the second lowest of the new categories. This outcome is largely the result of the representative inputs for vegetation type agreed with committee FP-020, i.e. *forest* and *tall shrub*. As can be seen in Table C-1 the removal of *woodland, low shrubs, open woodland / shrubland* and *grassland* reduces the number of permutations from 48 to 16 and removes much of the lower risk categories from the comparator matrix, providing what could be perceived as an imbalance in the results in some areas. This coupled with only indicative construction activity data has provided what must be appreciated are reasonably high level cost results. It must also be remembered that the comparator matrix approach was chosen because no definitive comparison could be provided by FP-020 between the current and proposed site assessment factors.

For example, CSIRO suggest that Option 1 would provide a lower level of protection than the current Standard based on a direct comparison between existing and proposed categories of bushfire attack. This is at odds with the advice of FP-020 who stated that a direct comparison could only be assumed, as the existing levels had no technical basis. This was the reasoning behind KPMG developing a comparator matrix for the Consultation RIS. No further evidence has been provided in submissions to indicate any other means of comparison.

The inclusion of Class 1 houses only in the analysis was also raised as an issue, however the analysis provided is justified on the basis that Class 1 buildings are the predominant building type constructed in these areas and are quite possibly at a higher risk than other building classifications.

Additional issues raised related to occupant intervention, homeowner education, and an ageing population, although of great importance, are considered beyond the scope and control of the BCA, and therefore this analysis.

10.5 Conclusion

The ABCB and Standards Australia consultation processes are consistent with the seven principles associated with best practice consultation process. Examples of how the processes meet the seven principles include:

- Continuity – the requirement for a PIA under the Impact Assessment Protocol 2007 addresses this principle;
- Targeting – both the ABCB and Standards Australia have technical committees made up of a range of stakeholders from both industry and different levels of government;
- Appropriate timeliness – A draft Standard is usually available for public comment over a period of two to three months to ensure that anybody who feels that they have something to contribute is given ample time to do so;
- Accessibility – the ABCB engages with stakeholders using various communication channels including websites, public information seminars, conferences and the production of a technical magazine;
- Transparency – the requirement that a consultation RIS be prepared for public comment ensures that the process of revising Australian Standard AS 3959-1999 is transparent;

- Consistency and flexibility – the Impact Assessment Protocol 2007 ensures that there is a consistent consultation framework to ensure that relevant stakeholders are consulted at the appropriate time in the review process; and

- Evaluation and review – the Impact Assessment Protocol 2007 was prepared as a response to the 2006 COAG *National Reform Agenda* and the Regulation Taskforce report *Rethinking Regulation*, where the ABCB undertook a review of its processes to ensure the rigour of its impact assessment and consultation processes and to further its role as a 'gatekeeper' of robust regulatory procedures.

A significant number of submissions were received during the public consultation period, demonstrating the importance of, and interest in, the issue of bushfire protection. Generally, all submissions were supportive of the proposal with similar levels of support for the two higher level options provided in the RIS, i.e. Option 1 (1000K) and Option 3 (1090K). There was only minor support for Option 2 (910K). Much of the support for Option 3 came from the fire service or fire service industry. The housing industry supported Option 1.

The outcomes of the consultation process have not changed the initial findings or conclusions of the Consultation RIS.

11 Implementation and review

If approved, the measures are proposed for reference in the BCA to replace the current AS 3959-1999.

As a matter of policy, proposed changes to the BCA are released in advance of implementation to allow time for familiarisation and education and for industry to modify its practices to accommodate the changes.

It is expected that building control administrations and industry organisations, in association with the ABCB, will conduct information training seminars on the new measures prior to their introduction in to the BCA.

There is no fixed schedule for reviewing provisions of the BCA. However, the ABCB maintains regular and extensive consultative relationships with a wide range of stakeholders. It relies on this process to identify emerging concerns.

12 Conclusions and recommendations

The RIS analysis found the following:

Quantitative analysis

- On an aggregate level, the options would lead to a decrease in construction costs for houses located in BPAs by approximately $3m-$53m per annum nationally. Option 3 provides a lower level of cost savings compared to Options 1 and 2 (i.e. around 80-90 per cent)

- At an individual level, Option 2 is likely to lead to the greatest cost savings for all house designs, while building an *ELC house* under Options 1 and 3 is expected to lead to an increase in construction costs. Further, Option 3 is likely to lead to comparatively lower construction cost savings when compared to the other options;

- The estimated cost impacts are likely to be a reflection of a more robust site assessment methodology, and an improved alignment between the assessed level of risk and the associated construction requirements. As such, the expected overall cost decrease does not represent a greater acceptance of bushfire risk, but instead a more appropriate level of protection being required; and

- It must be noted that the cost savings estimates are dependent on the assumptions used. These include the differences in the level of adoption of the BCA across jurisdictions, and the level of construction activity for each house type. Further, they do not provide for changes in consumer demand patterns in favour of less expensive house designs.

Qualitative analysis

In addition to quantitative cost savings, qualitative costs and benefits should also be considered when assessing the overall impact of the proposed Standard and the alternative options. Qualitative costs and benefits include:

- There is likely to be a benefit associated with a reduction in the costs associated with bushfire events, such as damage costs, disruptions to normal life and impacts on health and well-being. Annual building related damage costs attributed to bushfire events are roughly estimated at $71.6 million, but this figure is likely to be conservative as it does not include the broader costs associated with bushfire events (i.e. consequential losses);

- The proposed Standard may impact adversely on some individuals depending on the site characteristics and preferred house design. However, while in some cases the construction of certain house types will become more expensive, this does not preclude the individual from choosing a less expensive alternative, which is more appropriate given the assessed level of site risk. Therefore, the impacts are largely limited to a restriction in consumer choice, rather than a cost impost;

- The proposed arrangements may impact the demand for certain house types, but is unlikely to impact the overall demand for construction in BPAs. That is, while some houses will become relatively more expensive, others will become less expensive; and

- There may be a reduction in social disruption costs and the adverse economic impacts associated with bushfire events.

Conclusion

It can be concluded that all potential regulatory options are likely to deliver an overall net benefit compared to the current arrangements. That is, the benefits of increased protection and reduced construction costs are likely to outweigh any additional costs. Comment received through the RIS public consultation process did not identify any issues of significance that would alter this conclusion. The general response was supportive of the proposal, although there were differing opinions as to which of the two higher levels of protection should be adopted, i.e. Option 1 (1000K) or Option 3 (1090K). There was minimal support for Option 2 (910K).

Although Option 3 provides more stringent bushfire protection measures, the construction cost savings based on the scenarios used within this RIS are considerably lower. Option 3 would need to provide further benefits of around $30m-$40m per annum to achieve the same level of benefits as Options 1 and 2.

The distinction between Options 1 and 2 is marginal. Although Option 1 is more expensive in terms of construction costs, it provides a higher level of bushfire protection. In aggregate, Option 1 would need to provide around $20m per annum in other benefits to provide a net cost benefit at least equal to Option 2. This may be a reasonable expectation as Option 1 is based on an assumed flame temperature of 1000K and Option 2 on an assumed flame temperature of 910K.

Therefore, on this basis Option 1 (i.e. 1000K) represents the preferred option.

13 Bibliography

ABCB (1999), Regulatory impact statement: building in bushfire-prone areas, Canberra.

Blanchi, R. and J. Leonard (2005), 'Investigation of bushfire attack mechanisms resulting in house loss in the ACT bushfire 2003', Bushfire CRC Report.

Blong R, D Sinai & C Packham (2000) Natural perils in Australia and New Zealand, Swiss Re Australia Ltd.

BTE (2001) Economic costs of natural disasters in Australia, BTE Report 103.

Bureau of Transport Economics, *Economic costs of natural disasters in Australia*, BTE Report 103 (2001).

Chen K. & J. McAneney (2004), Quantifying bushfire penetration into urban areas in Australia , Geophysical Research Letters, Vol. 31, L12212, doi:10.1029/2004GL020244, 2004.

Chen, K. and McAneney, K.J., 2005. The bushfire threat in urban areas. Australasian Science, 26(1): 14-16.

Clayer JR, C Bookless-Pratz & RL Harris (1885) 'Some health consequences of a natural disaster', Medical Journal of Australia, 143:182-4.

COAG (1997), Principles and Guidelines for National Standard Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies.

COAG (2004), *Natural Disasters in Australia: reform, mitigation, relief and recovery*, report to COAG by a high level officials' group.

COAG (2005), *Response - National Inquiry on Bushfire Mitigation and Management*, http://www.coagbushfireenquiry.gov.au/report/response.htm

COAG Best Practice Regulation, *A Guide for Ministerial Councils and National Standard Setting Bodies*, October 2007.

Department of Prime Minister and Cabinet (2006), *Rethinking regulation: Report of the Taskforce on Reducing Regulatory Burdens on Businesses: Australian Government's Response.*

Dore M & D Etkin (2000) 'The importance of measuring the social costs of natural disasters at a time of climate change', The Australian Journal of Emergency Management, 15 (3), Spring, 46–51.

Dunn A. (2003), Economic Impact of Bushfire on the Community, Timber Development Association (NSW).

Ellis S, P Kanowski & R Whelan (2004) National Inquiry on Bushfire Mitigation and Management, COAG, Commonwealth of Australia, Canberra.

IPCC (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability – Summary for Policy-makers, Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report.

Johnson RW, RJ Blong & CT Ryan (1995) Natural Hazards: their potential in the Pacific South-west, Australian Geological Survey Organisation.

K. John McAneney, 'Australian Bushfire: Quantifying and Pricing the Risk to Residential Properties', Risk Frontiers, Macquarie University, NSW.

Kunreuther H., R. Binsber, L. Miller, P. Sagi, P. Slovic and N. Katz (1978), *Disaster Insurance Protection: Public Policy Lessons*, John Wiley and Sons, Interscience Publications, New York.

Leonard J, R Leicester & P Bowditch (2004) 'Bushfire catastrophe: myth or fact?', Aon Re Australia's 8th Hazards and Capital Risk Management.

Leonard, J. E. & P. A. Bowditch, *Findings of Studies of Houses Damaged by Bushfire in Australia*, CSIRO Manufacturing & Infrastructure Technology, Melbourne, Victoria, Australia.

Marfarlane A. C. & J. R. Clayer (1997), Psychiatric morbidity following a natural disaster: an Australian bushfire, Soc Psychiatry Psychiatr Epidemiol, Vol 32, pp. 261-68.

Matthews K (2002) Natural Disasters in Australia: reforming mitigation, relief and recovery arrangements, COAG.

McAneney J (2005) 'Australian Bushfire: Quantifying and Pricing the Risk to Residential Properties', Proceedings of the Symposium on Planning for Natural Hazards - How Can We Mitigate the Impacts? University of Wollongong, 2-5 February 2005.

McAneney, J., Chen, K., Crompton, R. and Pitman, A. (2007), Australian Bushfire Losses: Past, Present and Future. Proceedings of the Wildfire 2007 4a Conferencia Internacional sobre Incendios Forestales , Spain, 13-17 May, 2007.

McFarlane AC & B Raphael (1984) "Ash Wednesday: the effect of a fire", Australian and New Zealand Journal of Psychiatry, 18:341-51.

McFarlane AC, JR Clayer & CL Bookless (1997) "Psychiatric morbidity following a disaster: an Australian Bushfire", Social Psychiatry and Psychiatric Epidemiology 32:261-8.

Office of Best Practice Regulation *Best Practice Regulation Handbook 2006.*

Parliament of CoA (2003) A Nation Charred: Report on the inquiry into bushfires, House of Representatives, Select Committee into the recent Australian Bushfires.

Pitman AJ, GT Narisma, KJ McAneney (2007) "The impact of climate change on Australian bushfire risk", Climate Change (in press).

Ramsay G. C., N. A. McArthur and V. P. Dowling (1996), ‘Building in a fire-prone environment: research on building survival in two major fires’, *Proc. Linn. Soc. N.S.W. 116*, pp. 133-40.

RFS (2001) Planning for Bushfire Protection.

Winter G & JS Fried (2000) ‘Homeowner Perspectives on Fire Hazard, Responsibility, and Management Strategies at the Wildland–Urban Interface’, Society and Natural Resources, 13 : 33- 49.

A State and Territory arrangements for the designation of BPAs and determination of bushfire protection measures

Australian Capital Territory

BPAs are designated by section 29A of the ACT's *Building Regulation 2004*. It provides for the designation of the following types of non-urban land as BPAs:

- land that is categorised as broad-acre; rural; hills, ridges and buffer areas; river corridors; mountains and bushlands; plantation forestry; and major roads; and
- land that is, under the national capital plan, not categorised as urban; industrial centre; or Lake Burley Griffin and foreshores.

None of the urban areas of the ACT are designated BPAs. Development applications for the suburbs of Canberra are determined case by case and approval can require compliance with the BCA and or AS 3959-1999. However, the vegetation types and the distances to the bushland fringe are such that the urban risk is generally rated 'low' and building measures are not required.

New South Wales

NSW manages bushfire risks at the land-use planning stage, at the sub-division stage, and finally at the building stage. Almost all councils (142 of 153) had completed the mapping of BPAs at December 2006. Individual developments can also be determined as bushfire prone in the process of approving the application.

Councils make the initial determination, but submit difficult and disputed applications to the Rural Fire Service (RFS) for assessment. The RFS usually does an on-site assessment before making a recommendation to council, which then makes the final decision.

The practical effect of designation is to engage the BCA and call upon AS 3959-1999, but with variations relating to site assessment procedures and provisions to vary the requirements on a case by case basis.

Northern Territory

NT's Building Advisory Services Branch administers the *Building Act 1993* and associated building regulations, not councils.

After consulting with Australasian Fire Authorities Council, the Branch determined that NT vegetation is such that AS 3959-1999 should not be adopted. The only bushfire measure in the NT is the requirement to preserve a 4 metre perimeter to bushland.

Queensland

With the introduction of the State Planning Policy (SPP) in September 2003, there is now a relationship between the Guidelines called up by the SPP and the bushfire provisions given in the BCA, which in turn, calls upon AS 3959-1999. The SPP requires councils to assess bushfire hazards in the manner prescribed by *SPP Guideline 01/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslip.* The guideline also references Bushfire Risk Analysis maps prepared by the Queensland Fire and Rescue Service (QFRS).

The maps rate bushfire hazards as high, medium or low. There are no bushfire construction requirements for low and medium categories. Sites with a high rating must implement Level 1 construction as defined by AS 3959-1999. Note that this is a 3 level rating system (low, medium and high), not the 4 level rating system of AS 3959-1999 (low, medium, high and extreme). Queensland employs the construction levels of AS 3959-1999 but uses a site classification system that is considered to be suited to its vegetation types.

Of the 8 councils that responded to the ABCB survey, 5 had designated BPAs.

South Australia

New homes in BPAs must comply with the bushfire requirements in the council's Development Plan, as well as those in the BCA or South Australian Housing Code. However, the identification of BPAs in Development Plans is an on-going process. At June 2003, 13 councils with higher levels of bushfire risk – such as Adelaide Hills and Mount Barker – had designated BPAs.

SA is currently working through a 2 stage process that will determine the need to designate BPAs in other parts of the state with lesser risks.

The practical effect of designation is to engage the BCA and call upon AS 3959-1999, but with some variations relating to timbers treated with fire retardant, protection of sub-floor spaces and attached structures such as garages, protection of wall cladding and roof penetrations, and the mapping of SA risk categories onto the risk categories employed by the BCA and AS 3959-1999.

Certain other aspects of proposed developments are also reviewed for compliance with Development Plans, and may involve review by the South Australian Country Fire Service.

Tasmania

Tasmania seems not to have worked through an information-intensive and analytical approach in relation to its designation of BPAs. Typically, council Planning Schemes simply define the areas at risk as those within 100 metres of the bush. Planning Schemes can reference AS 3959-1999 to define the required building measures, but this is not always the case.

Planning Schemes are approved by the Resource Planning and Development Commission.

Victoria

Victoria has a dual system of designating BPAs. The older method uses the BPA terminology and engages the CFA in the planning process. The new method employs Wildfire Management Overlays under the Planning and Environment Act.

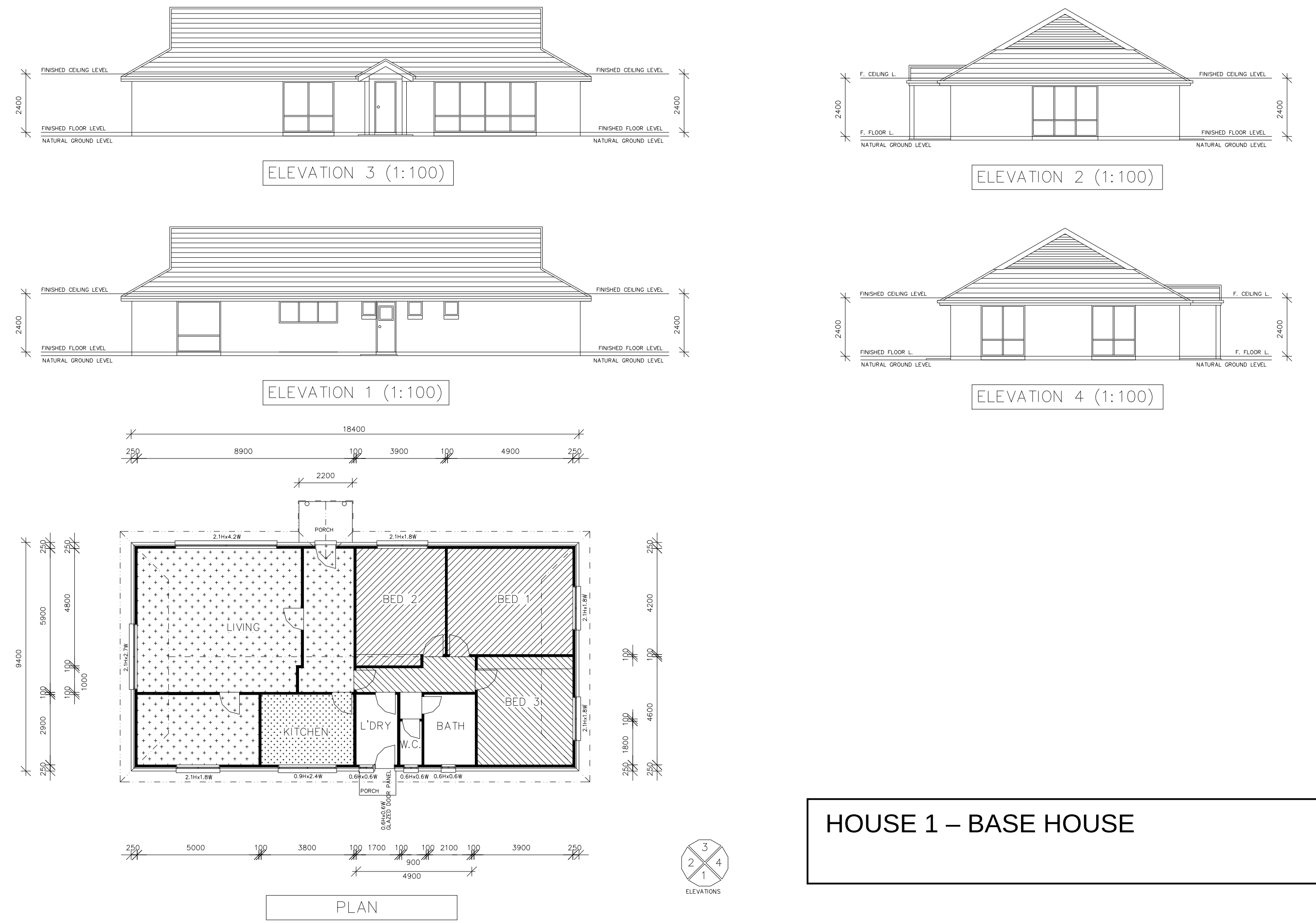
The practical effect is the same in both cases, which is to engage the BCA and call up AS 3959-1999.

Western Australia

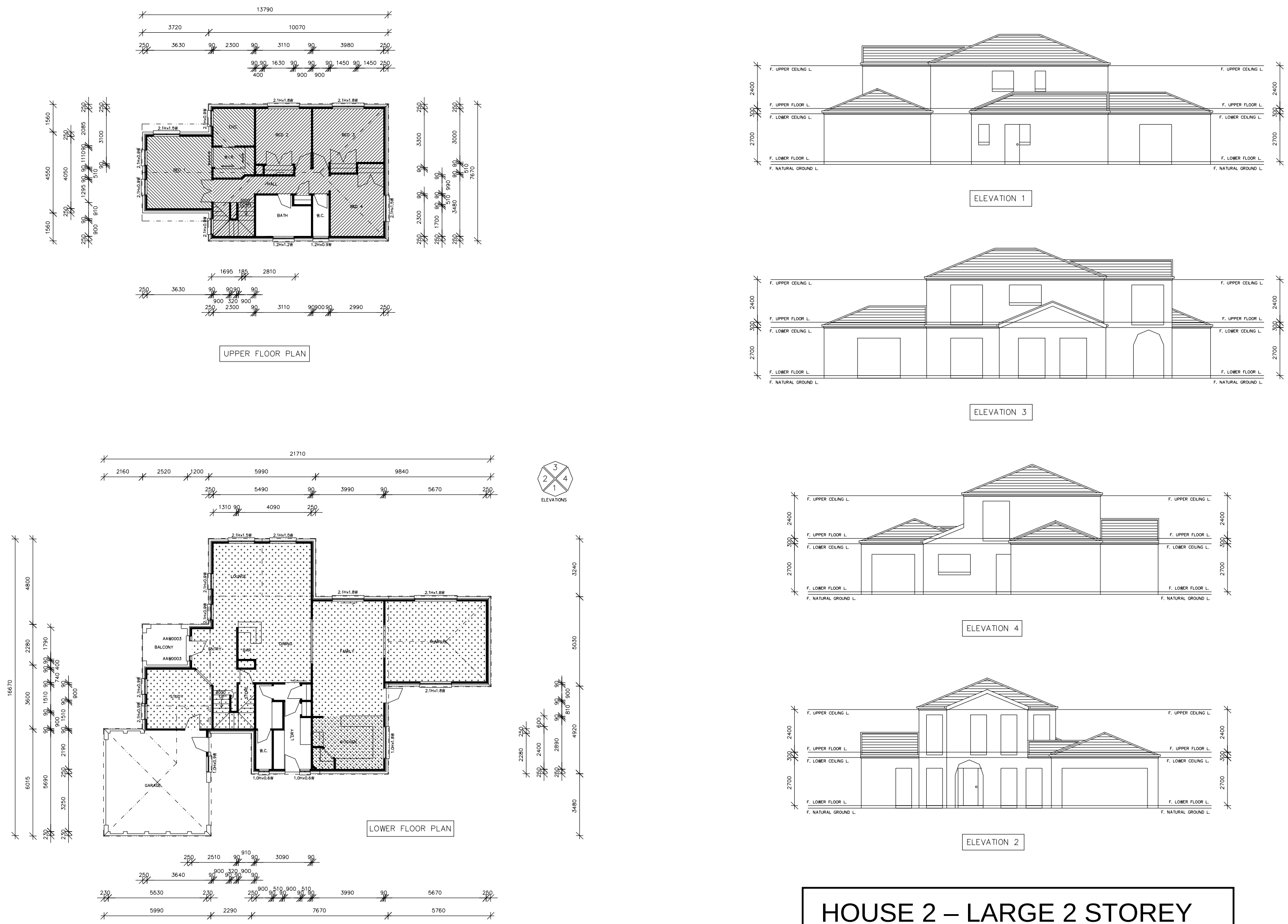
WA has initiated a process of requiring councils to address bushfire risks and designate BPAs as appropriate. However, only a few councils have completed the process. The planning cycle is problematic: planning documents are only reviewed every five years. Another factor is that bushfires are a significant threat to only a small proportion of council areas, mainly in the south-west corner of WA.

The practical effect of designation is to engage the BCA and call upon AS 3959-1999.

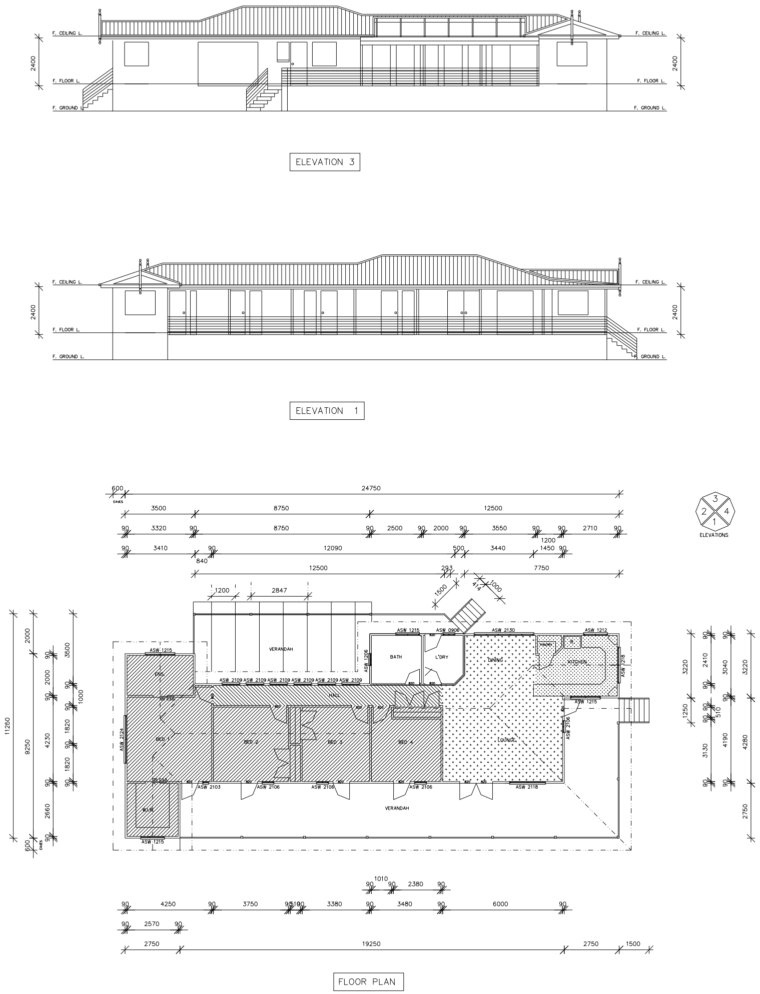
B Standard house designs used in the analysis



HOUSE 1 – BASE HOUSE



HOUSE 2 – LARGE 2 STOREY



HOUSE 3 – ELEVATED LIGHTWEIGHT CONSTRUCTION (ELC)

C Detailed cost estimates

This Appendix describes the detailed approach, the assumptions used to estimate the likely construction cost impacts of the proposed Standard and the alternative options being considered.

The analysis was completed in three stages:

1. Identify impact of changes to the site assessment framework;

2. Estimate the cost impacts of the associated changes to the construction requirements for a sample of owner occupiers; and

3. Estimate the impact of the proposed changes at a State and national level.

A description of the specific steps and assumptions involved in each stage of the analysis is provided below.

C.1 Changes to the site assessment methodology

The proposed site assessment framework is based on a different set of site-specific factors to the current methodology, which means a direct comparison between assessment outcomes is not possible.

Therefore, an alternative approach was developed to produce a probability weighted ‘comparator matrix’ to support a comparison between methodologies. The matrix provided a summary of the range of possible changes to the outcome of the site risk assessment under the proposed Standard, and the likelihood of each possible change.

The development of the comparator matrices involved the following steps:

- Identification of a range of representative outcomes from the current site assessment methodology;

- Identification of the range of potential equivalent outcomes under the proposed Standard; and

- Estimate the likelihood of each potential equivalent outcome.

Range of representative outcomes from the current site assessment methodology

Under the existing Standard, sites in designated bushfire prone areas are assigned a category of bushfire attack (i.e. EXTREME, HIGH, MEDIUM, LOW) based on an assessment of the following variables:

- the predominant vegetation (e.g. forest, woodland, grassland, etc);
- the distance of the site from that vegetation; and
- the slope of the land between the predominant vegetation and the site.

Table C-1 below outlines how these three variables are combined to define the relevant category of bushfire attack.

Table C-1: Current site assessment framework (adapted from AS 3959-1999)

Current site assessment framework	**Distance of the site from predominant vegetation class**							
	<15m		**15-40m**		**>40-100m**		**>100m**	
Slope (degrees)	**>10**	**<=10**	**>10**	**<=10**	**>10**	**<=10**	**>10**	**<=10**
Predominant vegetation	*Categories of bushfire attack*							
A. Forest	Ext	Ext	High	High	Med	Med	Low	Low
B. Woodland	Ext	Ext	High	High	Med	Low	Low	Low
C. Tall shrubs	Ext	Ext	High	High	Med	Low	Low	Low
D. Low shrubs	High	Med	Med	Low	Low	Low	Low	Low
E. Open woodland / shrubland	Med	Med	Low	Low	Low	Low	Low	Low
F. Grassland	Med	Low	Low	Low	Low	Low	Low	Low

As shown above, while there are just four categories of bushfire attack, there are 48 possible outcomes from the site assessment (i.e. 48 possible permutations of the defined variables). In order to identify a representative range of possible outcomes from the site assessment (i.e. a sample of the 48 possible outcomes), it is important to consider the likelihood that each permutation will take place, and make some simplifying assumptions.

To this end, for the purposes of this comparative analysis it was assumed that the predominant vegetation in designated BPAs would be one of either *forest* or *tall shrubs*. This assumption was informed by a meeting with representatives from the Standards Australia committee FP-020, and effectively reduces the number of possible outcomes from 48 to 16 (i.e. the highlighted rows above).

Range of possible equivalent outcomes in the proposed Standard

In order to understand the corresponding site assessment outcome in the proposed Standard for each defined possible outcome, the following steps were completed:

- Identification of a corresponding vegetation classification;

- it was assumed that *forest* and *tall shrubs* in the current Standard corresponded to *forest* and *closed shrub* respectively in the proposed Standard[50];

- Identification of a corresponding slope category (multiple permutations)[51]; and
- Identification of a corresponding range of distances from vegetation (multiple permutations).

Table C-2 below provides a worked example for a site currently categorised as 'extreme' with the following characteristics:

- *forest* as the predominant vegetation;
- a slope that is less than or equal to 10 degrees; and
- located less than 15m from the predominant vegetation.

It details all possible permutations for such a site under the proposed Standard and the associated category of bushfire attack.

Table C-2: Worked example – identification of corresponding site assessment outcome

Fire Danger Index	Predominant vegetation	Slope	Distance	Bushfire attack category
FDI 100	Forest	>5-10	<23	BAL-FZ
FDI 100	Forest	>0-5	<18	BAL-FZ
FDI 100	Forest	upslope/flat	<14	BAL-FZ
FDI 100	Forest	upslope/flat	14-<19	BAL-FZ
FDI 80	Forest	>5-10	<19	BAL-FZ
FDI 80	Forest	>0-5	<5	BAL-FZ
FDI 80	Forest	upslope/flat	<12	BAL-FZ
FDI 80	Forest	upslope/flat	12-<16	BAL-40
FDI 50	Forest	>5-10	<13	BAL-FZ
FDI 50	Forest	>5-10	13-<17	BAL-40
FDI 50	Forest	>0-5	<10	BAL-FZ
FDI 50	Forest	>0-5	10-<14	BAL-40
FDI 50	Forest	>0-5	14-<20	BAL-29
FDI 50	Forest	upslope/flat	<8	BAL-FZ
FDI 50	Forest	upslope/flat	8-<11	BAL-40
FDI 50	Forest	upslope/flat	11-<17	BAL-29
FDI 40	Forest	>5-10	<11	BAL-FZ
FDI 40	Forest	>5-10	11-<14	BAL-40

[50] This assumption was informed by a meeting with representatives from the Standards Australia committee FP-020
[51] It was assumed that the *slope under the vegetation* for a given site was equal to the *slope between the site and the vegetation* (i.e. effectively no material change to the 'slope factor')

Fire Danger Index	Predominant vegetation	Slope	Distance	Bushfire attack category
FDI 40	Forest	>5-10	14-<21	BAL-29
FDI 40	Forest	>0-5	<9	BAL-FZ
FDI 40	Forest	>0-5	9-<12	BAL-40
FDI 40	Forest	>0-5	12-<17	BAL-29
FDI 40	Forest	upslope/flat	<7	BAL-FZ
FDI 40	Forest	upslope/flat	7-<10	BAL-40
FDI 40	Forest	upslope/flat	10-<14	BAL-29
FDI 40	Forest	upslope/flat	14-<21	BAL-19

As shown above, a site with these characteristics could potentially be assessed as BAL-FZ, BAL-40, BAL-29 or BAL-19 under the proposed Standard. The process outlined above was repeated for all identified possible options (i.e. 16 in total).

Estimate the likelihood of each potential equivalent outcome.

The next step in the analysis involved estimating the likelihood of each identified possible category of bushfire attack. For example, in the case above, the likelihood that a site with the specified characteristics would be assessed as BAL-FZ, BAL-40, BAL-29 or BAL-19 was estimated.

Because the level of construction across FDI categories is likely to vary (i.e. is not equally distributed), the likelihood was first estimated separately for each FDI.

Table C-3 below provides a worked example of the process undertaken for the FDI 100 category for a site with the specified characteristics (i.e. Forest, distance of less than 15m, slope of less than or equal to 10 degrees).

Table C-3: Worked example – estimating the likelihood of each identified outcome

Predominant vegetation	Slope	Distance category	Bushfire attack category	Overlap range	Probability within overlap range	Weighted probability
Forest	>5-10	<23	BAL-FZ	15m	100%	33%
Forest	>0-5	<18	BAL-FZ	15m	100%	33%
Forest	upslope/flat	<14	BAL-FZ	14m	93%	31%
Forest	upslope/flat	14-<19	BAL-FZ	1m	7%	2%

The estimated likelihood is based on the amount of overlap between the distance category in the current Standard (i.e. less than 15m) and the possible permutations in the proposed Standard (see above).

In estimating the likelihood, it was necessary to make the following simplifying assumptions:

- Where a slope category in the current Standard corresponds to multiple slope categories in the proposed standards, the probability distribution was assumed to be uniform
  - e.g. if a site has an assessed slope of between 10-20 degrees, this slope is equally likely to also be between 10-15 or 15-20 degrees
- The probability distribution for the distance between the site and the predominant vegetation within each defined band is uniform
  - e.g. within a band of 15-40m, a site is equally likely to be 16m, 39m or any other distance from the predominant vegetation.

The process outlined above was then repeated for all FDI categories, and a weighted average calculated based on estimated construction activity for each FDI. Table C-4 below details the assumed FDI for each State / Territory.

Table C-4: FDI assumptions for each State / Territory

Jurisdiction	Number per year	Percentage of construction	Assigned FDI
Australian Capital Territory	10	0.1%	100
New South Wales	4483	39.8%	80 / 100
Northern Territory	0	0.0%	40
Queensland	2118	18.8%	40
South Australia	1400	12.4%	80
Tasmania	0	0.0%	50
Victoria	2870	25.5%	100
Western Australia	374	3.3%	80
Total	**11,254**	**100.0%**	

Conclusions – possible changes to the site assessment methodology and their respective likelihood

Tables C-5 to C-7 below provide the matrices summarising the potential changes to the site assessment under the proposed Standard (i.e. 1000K), Option 2 (910K) and Option 3 (1090K).

Table C-5: Option 1 – Comparator matrix

Category of bushfire attack		Current Standard			
		Extreme	High	Medium	Low
Option 1 (1000K)	BAL-FZ	68.4%	5.1%	0.0%	0.0%
	BAL-40	14.1%	5.7%	0.0%	0.0%
	BAL-29	13.5%	16.4%	1.0%	0.0%
	BAL-19	3.5%	26.8%	2.8%	0.0%
	BAL-12.5	0.5%	46.0%	94.6%	18.6%
	BAL-LOW	0.0%	0.0%	1.7%	81.4%

Category of bushfire attack		Current Standard			
		Extreme	High	Medium	Low
Total		**100.0%**	**100.0%**	**100.0%**	**100.0%**

For example, based on the matrix above, 81 per cent of sites currently categorised as 'LOW' would be categorised as BAL-LOW, and 19 per cent as BAL-12.5.

Table C-6: Option 2 – Comparator matrix

Category of bushfire attack		Current Standard			
		Extreme	High	Medium	Low
Option 2 (910K)	BAL-FZ	0.0%	0.0%	0.0%	0.0%
	BAL-40	72.7%	11.1%	0.0%	0.0%
	BAL-29	16.9%	11.5%	0.3%	0.0%
	BAL-19	8.8%	20.0%	2.5%	0.0%
	BAL-12.5	1.6%	57.4%	95.5%	18.6%
	BAL-LOW	0.0%	0.0%	1.6%	81.4%
Total		**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table C-7: Option 3 – Comparator matrix

Category of bushfire attack		Current Standard			
		Extreme	High	Medium	Low
Option 3 (1090K)	BAL-FZ	89.6%	20.4%	0.8%	0.0%
	BAL-40	8.8%	17.0%	2.1%	0.0%
	BAL-29	1.6%	24.9%	5.5%	0.0%
	BAL-19	0.0%	24.0%	10.9%	0.0%
	BAL-12.5	0.0%	13.7%	79.0%	18.5%
	BAL-LOW	0.0%	0.0%	1.6%	81.5%
Total		**100.0%**	**100.0%**	**100.0%**	**100.0%**

C.2 Estimated cost increase

The estimated incremental change in construction costs for the sample of designs was based on 'extra over' costs provided by a quantity surveyor for compliance with both the current and proposed Standards. Where alternative design solutions are suggested, the cost estimates are based on the most likely solution, which in most cases would also represent the lowest cost solution.

Table C-8 below provides a summary of the additional construction costs incurred for each house type across each category of bushfire attack (current and proposed).

Table C-8: Cost of compliance with current and proposed Standard

Category of bushfire attack	Base house	Large two storey	ELC house
Current Standard			
LOW	$0	$0	$0
MEDIUM	$9,196	$12,586	$19,174
HIGH	$24,469	$36,529	$42,573
EXTREME	$29,483	$43,810	$53,489
Proposed Standard			
BAL-LOW	$0	$0	$0
BAL-12.5	$11,535	$14,981	$21,428
BAL-19	$11,535	$14,981	$21,428
BAL-29	$15,471	$17,095	$35,024
BAL-40	$17,107	$19,751	$62,357
BAL-FZ	$20,885	$28,905	$76,679

These estimates were prepared for three house designs (refer Appendix B) and are based on the requirements set out in the current Standard and the pre ballot draft document of the proposed Standard. In preparing these estimates the following assumptions were made:

- Costs are in A$ excluding GST;
- An allowance of 18 per cent has been included for Builders Preliminaries in the Extra Over Costs;
- Fees & land costs are excluded;
- Rates used are based on proximity to ACT. Assuming ACT has a Cost Index of 100, other cities in Australia would be approximately:
    - Adelaide 90
    - Brisbane 102
    - Cairns 106
    - Melbourne 105
    - Perth 121
    - Sydney 93
- Rates are at current day fluctuation price. No allowance has been made for inflation;
- Where the specification requirements are not clear, the Quantity Surveyor used their best endeavours to interpret the requirements; and

- Where alternative design solutions are suggested, costs were only provided for one option.

The cost impacts identified above also incorporate an allowance for *shielding* which effectively reduces the construction requirements for an elevation of the building that it not exposed to the source of bushfire attack.[52]

Table C-9 summarises the change in construction costs between the current and proposed Standard for each category of bushfire attack.

Table C-9: Estimated change in construction costs

House type / Site assessment	EXTREME	HIGH	MEDIUM	LOW
Base house				
BAL-FZ	($8,598)	($3,584)	$11,689	$20,885
BAL-40	($12,376)	($7,362)	$7,911	$17,107
BAL-29	($14,012)	($8,998)	$6,275	$15,471
BAL-19	($17,948)	($12,934)	$2,339	$11,535
BAL-12.5	($17,948)	($12,934)	$2,339	$11,535
BAL-LOW	($29,483)	($24,469)	($9,196)	$0
Large two storey				
BAL-FZ	($14,905)	($7,624)	$16,319	$28,905
BAL-40	($24,059)	($16,778)	$7,165	$19,751
BAL-29	($26,716)	($19,435)	$4,509	$17,095
BAL-19	($28,829)	($21,548)	$2,395	$14,981
BAL-12.5	($28,829)	($21,548)	$2,395	$14,981
BAL-LOW	($43,810)	($36,529)	($12,586)	$0
ELC house				
BAL-FZ	$23,190	$34,106	$57,505	$76,679
BAL-40	$8,868	$19,784	$43,183	$62,357
BAL-29	($18,465)	($7,549)	$15,850	$35,024
BAL-19	($32,061)	($21,145)	$2,254	$21,428
BAL-12.5	($32,061)	($21,145)	$2,254	$21,428
BAL-LOW	($53,489)	($42,573)	($19,174)	$0

However, in order to estimate the expected change in construction costs for a given house type between the current and proposed Standard, it is necessary to understand the impact of the proposed changes to the site assessment framework, which are defined in the 'comparator matrices' depicted above.

Change in construction cost for each house type across current categories of bushfire attack

Table C-10 below summarises the likely change in construction costs for each house type across each of the current categories of bushfire attack based on the identified comparator matrices.

[52] The analysis assumed that one side of each house (i.e. 25 per cent) would incorporate a lower level of bushfire protection (i.e. a category lower), with the minimum requirement being BAL 12.5.

Table C-10: Cost changes for each house type and category of bushfire attack

House type / Site assessment	Option 1[53] (1000K)	Option 2 (910K)	Option 3 (1090K)
Base house			
EXTREME	($10,235)	($13,233)	($9,016)
HIGH	($11,492)	($11,864)	($9,100)
MEDIUM	$2,186	$2,162	$2,567
LOW	$2,142	$2,150	$2,139
Large two storey			
EXTREME	($18,348)	($25,007)	($15,897)
HIGH	($20,217)	($20,777)	($17,370)
MEDIUM	$2,168	$2,156	$2,488
LOW	$2,781	$2,792	$2,778
ELC house			
EXTREME	$13,343	($14)	$21,281
HIGH	($13,752)	($15,034)	$474
MEDIUM	$2,030	$1,945	$3,976
LOW	$3,978	$3,993	$3,974

For example, based on the table above, the construction costs associated with an *ELC house* in a site currently categorised as LOW, would increase by $3,974-$3,993 depending on the option being assessed. While it may seem counter-intuitive that it is expected to be more expensive to construct under Option 2 compared to Option 3, this is a result of the comparator matrix, which indicates that around 19 per cent of sites currently categorised as LOW would be classified as BAL-12.5 under both Options 2 and 3, and would therefore require the implementation of bushfire protection measures.

Table C-11 provides an estimate of the expected construction cost impacts for each house types.

Table C-11: Expected construction cost increase (reduction) by each house type

House type / Site assessment	Option 1 (1000K)	Option 2 (910K)	Option 3 (1090K)
Expected cost increase			
Base house	($3,409)	($4,191)	($2,506)
Large two storey	($6,910)	($8,580)	($5,654)
ELC house	$1,929	($1,477)	$7,337
Percentage cost increase[54]			
Base house	-1.2%	-1.5%	-0.9%
Large two storey	-1.8%	-2.2%	-1.5%
ELC house	0.6%	-0.4%	2.2%

[53] Option 1 is the proposed standard at the flame temperature of 1000K. Options 2 and 3 represent different level of regulatory stringency. Option 2 represents a lower flame temperature of 910K and Option 2 represents a higher temperature of 1090K compared to the proposed standard.
[54] Based on broad order costs provided by a quantity surveyor for each house design – i.e. $280,260 for the *base house*, $388,347 for the *large two storey house*, and $330,011 for the *ELC house*

The estimates above are based on an assumed proportional allocation of construction activity across the current categories of bushfire attack, namely:

- EXTREME – 25 per cent;
- HIGH – 20 per cent;
- MEDIUM – 37 per cent; and
- LOW – 18 per cent.

These percentages are based on high-level analysis undertaken in relation to construction activity in NSW, and should be considered indicative. However, in the absence of more robust information, the same percentage allocations have been assumed for the remainder of Australia.

C.3 Estimate the impact of the proposed changes at a State and National level

The estimated impact of the proposed Standard at the State and national level is based on assumed construction activity in BPAs, which was sourced from a survey undertaken on behalf of the ABCB, on a sample of councils to obtain information about building activity in bushfire prone areas. It concluded (with medium confidence), that construction in BPAs amounted to approximately 11,000 houses per year or 10 per cent of the total number of new houses.

Table C-12 below provides a summary of estimated construction in BPAs for each State / Territory and the assumed construction cost index for each jurisdiction (provided by the Quantity Surveyor).

Table C-11: Construction activity and cost variation across State / Territories

Jurisdiction	Number per year	Cost index[55]
Australian Capital Territory	10	100
New South Wales	4483	93
Northern Territory	0	n/a
Queensland	2118	104
South Australia	1400	90
Tasmania	0	n/a
Victoria	2870	105
Western Australia	374	121
Total	**11,254**	**n/a**

In the absence of any available data, it was also necessary to make an assumption around the proportion of each house type constructed in BPAs, with two different scenarios considered:

[55] Assumed cost variation across jurisdictions based on advice received from Quantity Surveyor

- Scenario 1 – Construction in BPAs is spread evenly across the three different house types; and
- Scenario 2 – 50 per cent of construction relates to the *base house*, with the remaining 50 per cent spread evenly across the *large two storey house* and the *ELC house*.

Tables C-12 to C-14 provides the estimated annual change in construction costs at the State / Territory and the national level for each option under both scenarios.

Table C-12: Option 1 – estimated annual cost increases (reduction)

State / Territory	Option 1 (1000K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($11.7m)	($12.3m)
NT	$0.0	$0.0
QLD	($6.2m)	($6.5m)
SA	($3.5m)	($3.7m)
TAS	$0.0	$0.0
VIC	($8.4m)	($8.9m)
WA	($1.3m)	($1.3m)
TOTAL	**($31.1m)**	**($32.8m)**

Table C-13: Option 2 – estimated annual cost increases (reduction)

State / Territory	Option 2 (910K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)
NSW	($19.8m)	($19.2m)
NT	$0.0	$0.0
QLD	($10.5m)	($10.2m)
SA	($6.0m)	($5.8m)
TAS	$0.0	$0.0
VIC	($14.3m)	($13.9m)
WA	($2.1m)	($2.1m)
TOTAL	**($52.8m)**	**($51.2m)**

Table C-14: Option 3 – estimated annual cost increases (reduction)

State / Territory	Option 3 (1090K)	
	Scenario 1	Scenario 2
ACT	(<$0.1m)	(<$0.1m)

State / Territory	Option 3 (1090K)	
	Scenario 1	Scenario 2
NSW	($1.1m)	($3.5m)
NT	$0.0	$0.0
QLD	($0.6m)	($1.8m)
SA	($0.3m)	($1.0m)
TAS	$0.0	$0.0
VIC	($0.8m)	($2.5m)
WA	($0.1m)	($0.4m)
TOTAL	**($3.0m)**	**($9.2m)**

C.4 Sensitivity testing

The sensitivity of these findings was assessed by considering the following variations to key inputs:

- Escalation of the estimated construction cost impacts for both the current and proposed Standard by 10 per cent; and
- Escalation of the estimated construction cost impacts of the proposed Standard by 10 per cent.

Table C-15 and C-16 summarise the outcomes from this analysis.

Table C-15: Construction costs increase by 10 per cent under current and proposed Standard – estimated annual cost impact

State / Territory	Option 1	Option 2	Option 3
ACT	(<$1m)	(<$1m)	(<$1m)
NSW	($16m-$17m)	($24m-$25m)	($6m-$8m)
NT	$0	$0	$0
QLD	($9m)	($13m)	($3m-4m)
SA	($5m)	($7m)	($2m-3m)
TAS	$0	$0	$0
VIC	($12m)	($17m-$18m)	($5m-$6m)
WA	($2m)	($3m)	($1m)
TOTAL	**($44m-$45m)**	**($63m-$66m)**	**($17m-$22m)**

Table C-16: Construction costs increase by 10 per cent under proposed Standard – estimated annual cost impact

State / Territory	Option 1	Option 2	Option 3
ACT	(<$1m)	(<$1m)	<$1m
NSW	($7m-$8m)	($15m-$16m)	$0-$3m
NT	$0	$0	$0
QLD	($4m)	($8m)	$0-$1m
SA	($2m-3m)	($5m)	$0-$1m
TAS	$0	$0	$0
VIC	($5m-$6m)	($11m)	<$1m-$2m
WA	($1m)	($2m)	<$1m
TOTAL	**($20m-$22m)**	**($41m-$42m)**	**<$1m-$7m**

As shown above, although the estimated savings vary under the alternative scenarios, the key findings from the analysis will remain unchanged. That is, there is a substantial net benefit associated with Options 1 and 2, and Option 3 remains relatively less attractive than Options 1 and 2.

D Public comment submissions

This appendix lists organisations that provided submissions to the ABCB through the Public Comment process and their preferred option where stated in their submission.

Table D-1 Public Comment submissions and option preferences

Organisation	Option 1 (1000K)	Option 2 (910K)	Option 3 (1090K)
ACT Planning and Land Authority			
Association of Consulting Engineers Australia	✓		✓
Australasian Fire and Emergency Services Authorities Council			✓
Bodycote Warringtonfire (Aus) Pty Ltd	✓		
Building Codes Queensland	✓		
Building Products Innovation Council			
CSIRO			✓
Department of Housing & Works (Western Australia)			
Friends of the Box-Ironbark Forests (Mt Alexander Region)			✓
Housing Industry Association	✓		
Housing Industry Association Queensland	✓		
Master Buildings Queensland	✓		
NSW Department of Planning			✓
NSW Rural Fire Service			✓
Planning SA (South Australia)			
Queensland Department of Emergency Services			
Timber Development Association			
Timber Queensland		✓	