

Bushfire Assessment

In relation to

Port Macquarie Base Hospital

Prepared for

Watpac Construction (NSW) Pty Ltd

April 2014

(Issue 1)

Project: 140131

© This document is copyright.

Email: info@bushfireconsultants.com.au

Mail: PO Box 34 Forster NSW 2428

Office: Suite 1, Level 1, 20 Wallis
Street, Forster NSW 2428

Phone (02) 6555 5522

Fax (02) 6554 7505

TABLE of CONTENTS

1.	INTRODUCTION	2
1.1	SCOPE	3
2.	BUSHFIRE ASSESSMENT CONSIDERATIONS	4
2.1	BUSHFIRE PRONE LAND	4
2.2	AS3959-2009: CONSTRUCTION OF BUILDINGS IN BUSHFIRE-PRONE AREAS	4
2.3	PREVIOUS BUSHFIRE ATTACK LEVEL ASSESSMENTS	6
3.	BCA PROVISIONS	9
3.1	BCA PERFORMANCE REQUIREMENT	9
3.2	BCA DEEMED-TO-SATISFY PROVISIONS	9
4.	ASSESSMENT METHOD & ACCEPTANCE CRITERIA	10
5.	ASSESSMENT OF THE ALTERNATIVE SOLUTION	11
5.1	THE EXPECTED INTENSITY OF BUSHFIRE ATTACK	11
5.2	SURVEILLANCE AND POTENTIAL FOR EARLY DETECTION OF A BUSHFIRE	13
5.3	POTENTIAL FOR IGNITION OF BUILDINGS	13
5.4	POTENTIAL MEANS OF ENTRY FOR EMBERS & MITIGATING DESIGN ELEMENTS	14
6.	CONCLUSION – ALTERNATIVE SOLUTION	16
	REFERENCES	17

© This document is copyright.

It is a breach of copyright for this document to be used to support a development application for any persons/entities other than those for whom this document was prepared. Other than for the purpose for which this document has been prepared and subject to conditions prescribed under the Copyright Act no part of this document may in any form nor by any means be reproduced or stored in a retrieval system or transmitted without the prior written permission of ABAC Australian Bushfire Assessment Consultants.

1. Introduction

The Port Macquarie Base Hospital (PMBH) complex is on land known as Lot 23 DP 1099567, Wrights Road, Port Macquarie. Additions are presently being constructed to the western end of the Port Macquarie Base Hospital (PMBH).

The work in association with the additions to the PMBH is subject to compliance with the provisions of AS3959-2009 (Design and construction of buildings in bushfire-prone areas).

Areas of technical non-compliance with AS3959 have been identified by the certifier in terms of the construction of the additions to the western end of the PMBH.

Relevant to this report, these relate to:

- installation of mesh to openings for mechanical services intakes and discharges forming part of the air handling system for the Port Macquarie Base Hospital; and
- grilles with apertures of 3mm in west-facing Level 1 dock roller shutters.

ABAC Australian Bushfire Assessment Consultants (ABAC) has been commissioned by Watpac Construction (NSW) Pty Ltd (Watpac) to consider the formulation of an alternative solution in relation to the technical non-compliances identified above.

The brief requires:

- a site inspection of the facility;
- investigation of the issues identified in relation to the technical non-compliances to AS3959-2009 identified above; and
- the assessment to be undertaken by a BPAD-Level 3 Accredited Bushfire Planning & Design Practitioner.

A site inspection was conducted on 14 March 2014.

Simon Carroll, a BPAD-Level 3 practitioner certified by FPA Australia, carried out the assessment.

1.1 Scope

The scope of this report is limited to the issues relating to the specific areas of technical non-compliance with AS3959 identified by the certifier in terms of the construction of the additions to the PMBH.

Watpac proposes to delete the requirements for the installation of mesh to:

- openings for mechanical services intakes and discharges forming part of the air handling system for the Port Macquarie Base Hospital; and
- fixed louvres to the perimeter of the Level 4 Plant area; and
- grilles (with an aperture size of 3mm) in the west-facing Level 1 dock roller shutters.

The scope of this report is to consider the formulation of an alternative solution in relation to the technical non-compliances identified above.

The following matters, inter alia, are outside the scope of this assessment.

- maintenance of vegetation on or adjacent to the site;
- emergency evacuation procedures for the hospital;
- compliance or otherwise of the building works with the provisions of the Building Code of Australia (BCA), particularly Parts C, D and E of the BCA.

2. Bushfire Assessment Considerations

The additions to the hospital which are the subject of this report are located at the western end of the existing hospital, approximately 24 metres from the western boundary of Lot 23 with the Oxley Highway road reserve.

2.1 Bushfire Prone Land

Port Macquarie-Hastings Council's Bushfire Prone Land Mapping indicates that the area along the western boundary of Lot 23 is mapped as bushfire prone land. This area along the western boundary of Lot 23 is mapped as being located within the 30 metre bushfire buffer to Category 2 vegetation. The Category 2 vegetation exists within the eastern part of the road reserve to the Oxley Highway and effectively acts as a visual/landscaped buffer between the Highway and the Hospital site.

The remainder of the PMBH site, estimated at 95% or more of the total area of the overall site, is not mapped as bushfire prone land.

2.2 AS3959-2009: Construction of Buildings in Bushfire-prone areas

The objective of AS3959-2009 (Construction of Buildings in Bushfire Prone Areas) is to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- (a) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and
- (b) intensity of the bushfire attack on the building.

The Standard notes that it is first necessary to determine the Bushfire Attack Level (BAL) – by an assessment of the site and classified vegetation impacting on the site – before construction requirements can be determined.

AS3959-2009 uses six (6) BALs, each of which are based on heat flux exposure standards. Table 3.1 of AS3959-2009 provides a description of the characteristics of each BAL used in the Standard. In summary, these are:

- BAL – LOW: there is insufficient risk to warrant specific construction requirements;
- BAL – 12.5 (heat flux exposure $\leq 12.5 \text{ kW/m}^2$): ember attack;
- BAL – 19 (heat flux exposure $> 12.5 \text{ kW/m}^2$ and $\leq 19 \text{ kW/m}^2$): increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux;
- BAL – 29 (heat flux exposure $> 19 \text{ kW/m}^2$ and $\leq 29 \text{ kW/m}^2$): increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux;
- BAL – 40 (heat flux exposure $> 29 \text{ kW/m}^2$ and $\leq 40 \text{ kW/m}^2$): increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux with the increased likelihood of exposure to flames; and
- BAL – FZ (heat flux exposure $> 40 \text{ kW/m}^2$): direct exposure to flames from fire front in addition to heat flux and ember attack.

Section 2 of AS3959-2009 provides the basis for the determination of bushfire attack level (BAL) for a site (or building). For the PMBH site, which is located in the North Coast fire weather district of NSW, the relevant fire danger index (FDI) for the purposes of identifying the BAL is FDI 80.

Table 2.4.3 of AS3959-2009 assigns the relevant BAL based upon the distance of a site (or building) from classified vegetation. The BAL is also influenced by the slope of the land between the building(s) and the classified vegetation. Section 2.2.3 of AS3959-2009 outlines the procedure for the classification of vegetation.

The determination of the BAL is relevant where buildings are located within 100 metres of classified vegetation.

2.3 Previous Bushfire Attack Level Assessments

Information provided by the client indicates that there have been two (2) previous Bushfire Attack Level (BAL) assessments carried out for the additions to the PMBH. Each of these assessments were conducted by Bushfire Certifiers (Reference: 11186), with the latest assessment detailed in a report dated 19 December 2013 (Reference: 11186a). That report identifies that the assessed BAL for the additions to the PMBH is BAL-19 for the purposes of AS3959-2009.

This assessment by Bushfire Certifiers replaces a previous assessment, by the same entity, which had identified that the additions to PMBH would be subject to BAL-40 for the purposes of AS3959-2009. This was based on assessment of the vegetation outside the western boundary of the PMBH site – between the site and the eastern side of the Oxley Highway roadway – as “forest” for the purposes of the NSW Rural Fire Service guideline entitled *Planning for Bush Fire Protection 2006* and Table 2.4.3 of AS3959-2009 (with respect to the determination of the applicable BAL).

The December 2013 assessment by Bushfire Certifiers revised the vegetation classification from forest to remnant vegetation for the purposes of Appendix 2 of *Planning for Bush Fire Protection 2006*.

Remnant vegetation constitutes a low hazard for the purposes of A2.3 of *Planning for Bush Fire Protection 2006*, characteristically because of the inherently low bushfire hazard potential of such vegetation. In this case, the vegetation is clearly constrained between the western boundary of the PMBH site and the eastern side of the Oxley Highway. Importantly, A2.3 of *Planning for Bush Fire Protection 2006* provides that building construction standards for areas of remnant vegetation can be considered as the same as for rainforests.

Determination of the BAL via Table 2.4.3 of AS3959-2009 on the basis of the vegetation being considered as *rainforest* gave the result of BAL-19 according to the December 2013 assessment by Bushfire Certifiers.

2.4 Comment on the previous BAL assessment

The December 2013 assessment by Bushfire Certifiers was based on an assessment of the effective slope as being $>0-5^{\circ}$ downslope under the vegetation. The effective slope of land under vegetation may be considered as the slope of the land most likely to influence the behaviour of any bushfire that may occur within the vegetation.

Overall, the purpose of this report is not to review the assessment by Bushfire Certifiers. As such, the most recent assessment of BAL-19 is adopted for the purposes of this exercise.

That said, however, the characteristics of the land under the vegetation suggest that the effective slope of the land – which variable to a minor degree – might be considered closer to 0° . The substitution of this effective slope would result in the assessed BAL reducing to BAL-12.5 for the purposes of AS3959-2009.

The provisions of the BCA that are discussed in Section 3 of this report apply to sites that are within a designated bushfire prone area. The PMBH site is technically within a designated bushfire prone area, with only a limited area along and adjacent to the western boundary of the overall site mapped as bushfire prone land.

An option is available to quantitatively determine the BAL using Appendix B of AS3959-2009: Detailed Method for Determining the Bushfire Attack Level (BAL), (Method 2).

It is considered that the detailed calculations as per Appendix B of AS 3959 are not appropriate for the alternative solution that is the subject of this report for the following reasons:

- The only vegetation within 100 metres of the additions to PMBH is the strip of vegetation to the west. This vegetation is contiguous with a longer strip of vegetation that fringes the eastern side of the Oxley Highway corridor to the north and south of the PMBH site. The depth of the vegetation (east to west), while greater than 50 metres in parts is limited by the Highway to the west and the PMBH site and residential and other development to the north and south.

- The other elevations of PMBH are greater than 100 metres from any potential bushfire hazard vegetation in other directions. A smaller area of vegetation, identified in the assessment by Bushfire Certifiers, is located to the north of the addition to the hospital. This vegetation is, however, located within the PMBH and can be maintained in conjunction with the use of the site as required.
- Calculations as per Appendix B of AS 3959 will only simulate the radiant heat flux (RHF) arising from a bushfire front in any vegetation at “x” metres from a building as a radiant panel. Any calculations would not, therefore differentiate between what RHF may arise from an area of vegetation that has a run of only 40-50 metres or that from an area of vegetation that may have a run at a development of hundreds of metres (if not kilometres).
- Relevant to the above point, as the fire run potential of the vegetation “unit” being considered is very limited, detailed calculations would conservatively overestimate the potential available bushfire fuel. Consequently, the potential intensity of any bushfire event and resultant RHF would also be significantly overestimated.

Accordingly, calculations as per Appendix B of AS 3959 are of little value in terms of determining what an appropriate or realistic RHF may be in this matter. In other words, calculations as to the RHF would simply be a function of the proximity of the hospital building to the vegetation (to the west) in this case, rather than characteristics of that vegetation, particularly its very limited depth east to west because of the existence of the highway corridor.

Regardless of the final BAL, however, it is clear that the major mode of bushfire attack as a result of any bushfire impacting on the particular are of vegetation outside the western boundary of the PMBH site will be via ember attack.

As a result, an assessment of the expected intensity of bushfire attack on the hospital addition is at Section 5.1.

3. BCA Provisions

Part G5 (Construction in bushfire prone areas) of the BCA (NCC Volume 1 - 2013) contains the bushfire protection requirements for the development.

Relevant to bushfire protection aspects, a summary of the main BCA construction parameters for PMBH is provided below.

Building use	Hospital
BCA Classification	Class 9a

3.1 BCA Performance Requirement

The relevant Performance Requirement is NSW GP5.1, as follows:

A building that is constructed in a designated bushfire prone area must be designed and constructed to reduce the risk of ignition from a bushfire while the fire front passes.

3.2 BCA Deemed-to-satisfy provisions

The deemed-to-satisfy (DTS) provisions that correspond to NSW GP5.1 are NSW G5.2 (Protection) as follows:

In a designated bushfire prone area, a Class 2 building, a Class 3 building, a Class 4 part of a building or a Class 9 building that is a special fire protection purpose or a Class 10a building or deck associated with such a building or part, must comply with the following—

- (a) AS 3959 except for Section 9 Construction for Bushfire Attack Level FZ (BAL-FZ). Buildings subject to BAL-FZ must comply with specific conditions of development consent for construction at this level; or*
- (b) the requirements of (a) above as modified by the development consent following consultation with the NSW Rural Fire Service under section 79BA of the Environmental Planning and Assessment Act 1979; or*
- (c) the requirements of (a) above as modified by development consent with a bushfire safety authority issued under section 100B of the Rural Fires Act 1997 for the purposes of integrated development.*

There is no information available that any requirements of either a development consent and/or a bushfire safety authority modify the requirements of G5.2(a). On this basis, the applicable DTS provision is G5.2(a).

Relevant to the additions to the PMBH, it is a general provision of AS3959-2009 (for each BAL, except BAL-LOW), that mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, be applied to any openings of 3mm or more.

The subject of this report is a variation to the DTS provisions, as Watpac proposes to delete the requirements for the installation of mesh to:

- openings for mechanical services intakes and discharges forming part of the air handling system for the Port Macquarie Base Hospital; and
- fixed louvres to the perimeter of the Level 4 Plant area; and
- grilles (with aperture size of 3mm) in the west-facing Level 1 dock roller shutters.

The deletion of these requirements involves an alternative solution in relation to the building.

4. Assessment Method & Acceptance Criteria

An Alternative Solution for the provision of fire safety measures to address the bushfire risk has been formulated for compliance with Performance Requirement NSW GP5.1 (BCA Volume 1 Section A0.5(b)(i)).

Assessment of the proposed Alternative Solution to demonstrate compliance with Performance Requirement NSW GP5.1 is to be by Expert Judgement (BCA Volume 1 Section A0.9(d)).

The proposed Alternative Solution will be considered to be acceptable if it can be demonstrated that the proposal will not increase the potential for ignition caused by burning embers generated by a bushfire that is commensurate with the expected intensity of the bushfire attack on the subject building.

5. Assessment of the Alternative Solution

As stated in (4) above, the proposed Alternative Solution will be considered to be acceptable if it can be demonstrated that the proposal will not increase the potential for ignition caused by burning embers generated by a bushfire that is commensurate with the expected intensity of the bushfire attack on the subject building.

5.1 The expected intensity of bushfire attack

The premise of the Alternative Solution approach is that there is a specific bushfire risk for the hospital additions based upon the vegetation that is present to the west (and north-west) of the site. This does not equate to that equivalent to a fully developed fire occurring in a body of vegetation that might extend for a distance of hundreds of metres from a particular development.

The vegetation in question is significantly constrained between the PMBH site and the Oxley Highway. While assigned a BAL, the fact that this vegetation is heavily constrained evidences that it is unlikely to support or sustain any bushfire that would be likely to subject the hospital buildings to prolonged and intense ember attack to any extent that might increase the potential for ignition of the building.

A qualitative assessment of the bushfire risk posed to the additions to the PMBH by any vegetation outside the western boundary of the site was undertaken. A site inspection was conducted to assist in providing a qualitative assessment of the potential bushfire risk arising from the vegetation located outside the western boundary of the site. The distance from the building to the nearest vegetation was noted as being approximately 24 metres.

The purpose of the qualitative assessment was to determine what would be considered to be the 'realistic' potential bushfire attack with respect to the vegetation outside the western boundary of the PMBH site. The conclusion of this assessment is that any potential bushfire hazard potential arising from that vegetation is relatively low, despite the numerical determination of the bushfire attack level for the vegetation as BAL-19 in the December 2013 assessment by Bushfire Certifiers.

The 'worst case' potential fire that might affect the additions to the PMBH is likely to occur in vegetation to the south-west, between the southern side of Wrights Road and Kingfisher Drive and this may result in the building being subject to some degree of ember attack.

In relation to the vegetation directly to the west of the PMBH building, it is acknowledged that a potential bushfire event may involve a bushfire initiating at the eastern side of the Oxley Highway – perhaps due to a discarded lit cigarette or by arson – and then running east towards the western boundary of the PMBH site. A pathway running through the land containing the vegetation provides an effective and permanent separation distance between the eastern extent of the vegetation and the western boundary of the PMBH site.

The structure of the vegetation within the land to the west of the PMBH site is such that it is mainly elevated fuel.

If the vegetation within the land outside the western boundary of the PMBH site was to be considered as a discrete unit in terms of potential bushfire risk to the additions to the hospital, then conditions would need to first be conducive to make the vegetation within the slope available as fuel, then result in the ignition of a fire and effect its growth to the point where significant ember generation is likely to occur. This would be subject to any fire not being noticed or detected for a prolonged period of time which, given the prominent location of the site, is unlikely to occur. Any ember generation by a fire in this vegetation (or nearby vegetation) would be preceded by a significant amount of smoke generation which would be highly visible to users of the hospital, motorists on the Oxley Highway or nearby residents. This would result in any fire being reported and fire brigade intervention at early stages in the development of the fire.

There is no known bushfire history for the vegetation to the west of the site to provide for any conclusion to be drawn as to how frequently, if ever, this vegetation has been subject to fire.

Consequently, while it is possible that an uncontrolled fire event may initiate within the vegetation outside the western boundary of the PMBH site, it is unlikely that any fire would have the potential to approach the PMBH site as a

sustained and consistent line fire given the limited depth of the vegetation from east to west. It is noted this depth reduces as one moves further north to the area between the Oxley Highway and residential development (directly to the north of the PMBH site).

The limited fuel within the relevant area of vegetation is unlikely to promote fire intensity to anywhere near the extent that might be otherwise expected to be generated by a fully developed scrub fire. The potential for any significant and sustained ember attack on the PMBH buildings is correspondingly limited.

5.2 Surveillance and potential for early detection of a bushfire

The PMBH site is in an area that has a significant degree of inherent surveillance – both natural and applied – through its prominent visual location from a number of well used public areas, including the Oxley Highway to the west and the presence of 24 hour security patrols on site. This implies that any bushfire that might occur in vegetation on land outside the western boundary of the PMBH site would be detected and reported early. This would limit the potential for any fire to fully develop and generate any significant amount of embers that might impact on the PMBH. It is unlikely that any fire would occur within the vegetation and go unnoticed for any length of time that would result in the fire being able to fully develop.

5.3 Potential for ignition of buildings

The nature of the hospital building(s) and the inherent fire protection features incorporated via its design and construction will also limit any potential for ignition of the building.

The PMBH complex is a highly fire engineered building and is characterised by construction that is inherently fire resisting due to the requirements of the BCA. The requirements of the BCA also extend to the provision of extensive fire detection and suppression measures within the hospital buildings.

The PMBH complex is sprinkler protected throughout.

5.4 Potential means of entry for embers & mitigating design elements

There are three (3) main potential means of entry to the building by embers. These are via:

- (a) fixed louvres to the Level 4 plant room/platform;
- (b) the air intake and exhaust ducts to the mechanical services/air handling plant; and
- (c) grilles (with aperture size of 3mm) in the west-facing Level 1 dock roller shutters.

The proposal to delete the requirement for mesh to be applied in relation to (a) and (b) relates to the design and operation of the mechanical services/air handling plant.

The fixed louvres in (a) are designed to maintain an “open” area of 80%. Application of mesh with an aperture size of 2mm to the rear face of the louvre openings would require alteration to the design and operation of the air handling units as any reduction of the “open” area would adversely impact on the operation of the plant.

In relation to the issue relating to the air intake and exhaust ducts in (b), according to the project mechanical engineers, the installation of mesh as per AS3959:

- would adversely affect the efficiency of the plant requiring at least a 20% increase in fan power/input;
- may give rise to problems in relation to gas installation due to the potential pressure drop in plant zones; and
- is likely to create maintenance and safety issues for cleaning.

Mitigating design characteristics – Fixed Louvres to Level 4 Plant

- The Level 4 Plant area is constructed of, and contains, only non-combustible materials and finishes. There is no potential for ignition if embers did penetrate this area.
- The area is fully sprinkler protected.

- a manual alarm point is located at each end of the Level 4 Plant room/area.
- all internal areas are covered by thermal and smoke detectors.
- all penetrations in the slab to the Level 4 Plant area are collared at the slab.
- The building is highly fire engineered and is fitted with extensive fire detection and suppression equipment.
- There should be signage prohibiting storage of any materials not part of the plant and equipment.

Mitigating design characteristics – Air intake and exhaust ducts to air handling system

- ductwork within the building is fitted with smoke alarms
- The Building Management System (BMS) will initiate shutdown of air intake in a fire event upon detection of smoke at intake. Smoke from a bushfire will potentially enter intake before any ember generation and attack occurs.
- Insulation is non-combustible.
- There are dampers up-stream of the air handling units for air intakes.
- in a general fire alarm, system shuts down and the outside air dampers close.
- All plant and equipment is non-combustible.
- When the exhaust is operating and the dampers are open the air flow out will prevent the embers from entering the building and when the exhaust is not operating the dampers will close as there is no air flow to open them and the closed dampers will prevent the ingress of the embers.

Mitigating design characteristics – grilles (with aperture size of 3mm) in the Level 1 dock roller shutters

- all rooms served by the roller shutters are protected by sprinklers;
- Construction of walls, floor and roof of rooms served by the roller shutters is non-combustible throughout;
- smoke and thermal detectors are fitted.

6. Conclusion – Alternative Solution

Relevant to the additions to the PMBH, it is a general provision of AS3959-2009 (for each BAL, except BAL-LOW), that mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, be applied to any openings of 3mm or more.

It is proposed by the client that the following be adopted as an Alternative Solution:

The requirements for construction to the standard for BAL-19 (for the purposes of AS3959-2009) for the additions to the Port Macquarie Base Hospital varied so as to delete requirements for the installation of mesh to:

- *openings for mechanical services intakes and discharges forming part of the air handling system; and*
- *fixed louvres to the perimeter of the Level 4 Plant area; and*
- *grilles (with aperture size of 3mm) in the west-facing Level 1 dock roller shutters.*

The assessment of the Alternative Solution in Section 5 above has demonstrated that the proposal will not increase the potential for ignition caused by burning embers generated by a bushfire that is commensurate with the expected intensity of the bushfire attack on the subject building. This Alternative Solution is based on expert judgement.



SIMON CARROLL

Graduate Diploma in Design for Bushfire Prone Areas MFPAA

BPAD-Level 3 Certified Practitioner BPD-L3-09326, Bushfire Planning and Design, FPAA

Graduate Diploma in Building Fire Safety & Risk Engineering

References

NSW Rural Fire Service (2006)

Planning for Bush Fire Protection.

AS 3959, "Construction of buildings in bushfire-prone areas" (incorporating Amendments Nos. 1, 2 and 3), Standards Australia, 2009.

National Construction Code Series Volume One: Building Code of Australia Class 2 to Class 9 Buildings, Australian Building Codes Board, Canberra, Australia, 2013.