



BUSHFIRE MANAGEMENT PLAN

Northshore Christian Grammar School (NCGS), Alkimos

Version: 1.0 Reference: 3706 November 2015



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DOCUMENT DETAILS

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Date: 05/11/2015

In signing the above, I declare the report is true and accurate to the best of my knowledge at the time of issue.

RUIC Fire is a trading name of
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EXECUTIVE SUMMARY

Rural Fire Risk Consultancy Pty Ltd trading as RUIC Fire specialises in bushfire engineering and performance based design and construction solutions. RUIC Fire was engaged by the proponent to prepare this Bushfire Management Plan to support the proposed Northshore Christian Grammar School in Alkimos.

Strategic bushfire hazard level assessment of the site and surrounding area was completed in accordance with Planning for Bushfire Protection Guidelines 2nd Edition (FESA, 2010). Development will occur on land having an overall Low Bushfire Hazard Rating.

Risk assessment was completed in accordance with ISO31000:2009 and COAG's National Inquiry on Bushfire Mitigation and Management (2004). It is concluded that post implementation of the treatments detailed in this Bushfire Management Plan, the bushfire related risk is not prohibitive of development.

The proposed development is designed using the performance criteria of Planning for Bushfire Protection Guidelines 2nd Edition (FESA, 2010) with due regard for draft Planning for Bushfire Risk Management Guidelines Appendix 4 (May, 2014). In complying with this Bushfire Management Plan the development will comply with all required bushfire related planning and risk requirements.

Required bushfire planning design requirements are summarised as:

General:

- (i) An evacuation plan will be developed and rehearsed on an ongoing basis to facilitate timely and safe evacuation.

Stage 1:

- (i) A 35 metre cleared Building Protection Zone will be implemented to ensure a maximum BAL-12.5 rating for all Stage 1 buildings.
- (ii) All Stage 1 buildings will be constructed in accordance with the enhanced safety standards of BAL-29.

Masterplan:

- (ii) A 17m landscaped buffer, east of the outer ring road will be implemented in order to ensure a maximum BAL-29 rating for the completed Masterplan development.
- (iii) A 50,000 litre dedicated bushfire fighting and 500,000 litre structural firefighting water supply will be incorporated into firefighting water tanks on site at the Masterplan stage.

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1.0 Introduction

1.1 Scope

The proponent engaged Rural Fire Risk Consultancy Pty Ltd (RUIC Fire) to prepare a site specific Bushfire Management Plan (BMP) to support the proposed Northshore Christian Grammar School (the development) in the Shorehaven Estate in Alkimos (the site) (Figure 1A). The proposed development involves the following stages:

- i. Stage 1 – Primary School GLA Building and Kindy/Preparatory Building.
- ii. Future Stages – Masterplan – Additional GLA Buildings, Community Centre, Performing Arts Centre, Specialist Hub Buildings, Gymnasium, Café, Senior School Classrooms, Junior School Classrooms and Administration Buildings.

It is recognised that the development of the Northshore Christian Grammar school is a long term strategy and that the Masterplan concept layout is likely to change in the coming years. This BMP specifically addresses compliance of Stage 1 development in accordance with PfbPG and draft SPP 3.7 and demonstrates how compliance of the Masterplan can be met.

For each revision and finalisation of the Masterplan, this Bushfire Management Plan must be reviewed and updated for each future stage of development.

1.2 Objectives

The objectives of the BMP are to:

- i. Achieve consistency with objectives and policy measures of the current Planning for Bushfire Protection Guidelines 2nd Edition (PfbPG); draft SPP 3.7 Planning for Bushfire Risk Management (SPP3.7) and the Planning for Bushfire Risk Management Guidelines (SPP3.7 Guidelines), and any local planning scheme provisions relating to bushfire;
- ii. Understand and document the extent of bushfire risk for the BMP area;
- iii. Prepare bushfire risk management measures for bushfire management of all land subject of the Plan, with due regard for people, property, infrastructure and the environment;
- iv. Nominate individuals and organisations responsible for fire management and associated works within the plan area (e.g. local government for land vested in it and private property owners for freehold land); and
- v. Define an assessment procedure which will evaluate the effectiveness and impact of proposed, as well as existing, bushfire risk management measures and strategies.

1.3 Document Review

In accordance with SPP3.7 Guidelines this Bushfire Management Plan is valid for a period of 5 years only from the date of issue, or until such time as there is a revision to the Masterplan, whichever is lesser. The relevant Jurisdiction Having Authority is responsible for the evaluation and effectiveness of all mitigation strategies detailed in this Bushfire Management Plan.

Once the Masterplan has been finalised, this Bushfire Management Plan must be reviewed and updated for each future stage of development.

1.4 Planning Context

1.4.1 Existing Bushfire Management Plans

No Bushfire Management Plan exists for the site.

1.4.2 Bushfire Prone Designation

Formal designation of an area as “Bushfire Prone” provides the legislative trigger to enforce all Class 1, 2, 3, and associated Class 10a buildings to be constructed in accordance with AS 3959 - 2009 Construction of buildings in bushfire prone areas.

Whilst AS3959 does not apply to the Class 9b buildings that the school will consist of, as a precautionary principle, all new proposed buildings shall be voluntarily aligned as far as practicable to AS3959 to the degree necessary as detailed further in this report.

1.4.3 City of Wanneroo

The City of Wanneroo DPS No.2 does not identify the site as bushfire prone. No bushfire prone mapping has been developed by the City of Wanneroo.

The City of Wanneroo Guidelines for Development & Subdivision of Land (2003) details the standards and expectations for the development and subdivision of land within the municipality. Subsection D10 Development Design Specification Bushfire Protection (D10)(1998) details the specifications to be incorporated into the project design to provide for the protection of life and property; and bring fire to a halt. Specifications identified in D10 have been incorporated into the design of the project. Where conflict between D10 (1998) and PFBPG or draft SPP3.7 occurs the higher standard of bushfire protection is adopted.

1.4.4 Draft State Planning Policy 3.7 Planning for Bushfire Risk Management

Draft State Planning Policy 3.7 Planning for Bushfire Risk Management Guidelines (WAPC, 2014b, s2, p4) identifies three ways a site may be designated as bushfire prone:

- i. if the land is identified as bushfire-prone on a local government bushfire map approved by a resolution of Council and designated by the Fire and Emergency Services (FES) Commissioner; or
- ii. if the land is not covered by a map in (1), but is identified as bushfire-prone on the State Bushfire-Prone Area Map prepared and designated by the FES Commissioner; or
- iii. if the land is not covered by either a local government map in (1) or the State Bushfire-Prone Area Map in (2), but is within 100 metres of an area of bushfire-prone vegetation equal to or greater than one hectare (default position).

Bushfire-prone vegetation includes types of vegetation classified in Australian Standard 3959: Construction of buildings in bushfire-prone areas (AS 3959). AS 3959 is included by direct reference in the Building Code of Australia (BCA).

WAPC has provided specific advice that draft State Planning Policy 3.7 Planning for Bushfire Risk Management is a seriously entertained document that must be given due consideration.

1.4.5 Section 70A Notice on Title

The development is subject to a S70A Notification on Title stating that this Bushfire Management Plan is applicable to the site.

1.4.6 Vulnerable Land Use Considerations

Development of schools and educational institutions receives limited specific guidance in regards to design requirements to achieve the necessary level of protection from bushfire. Draft SPP3.7 policy measure 6.10 address the requirements for educational institutions.

Draft SPP3.7 requires that “vulnerable use” development complies with draft SPP3.7 policy measure 6.10. “Vulnerable use” is defined as land use which is occupied by persons who may be less able to respond in a bushfire emergency, such as child or aged care centres, tourist accommodation, educational establishments, hospitals, and corrective institutions.

Draft SPP3.7 policy measure 6.10 states:

“Proposals for vulnerable or high-risk land uses in moderate bushfire hazard level areas shall not be supported unless they are accompanied by a Bushfire Management Plan, prepared by a fire consultant, that demonstrates compliance with the bushfire protection criteria, and which includes an emergency evacuation plan for proposed occupants and/or risk management for any flammable on-site hazards, to the satisfaction of the decision-maker.”

Recognising the importance of the protection of occupants is the highest priority within the school, the proponent will develop a comprehensive evacuation plan/emergency plan as an essential safety requirement of this Bushfire Management Plan.

Whilst AS 3959 is not applicable to Class 9b buildings (i.e. school classrooms), the proponent has designed all Stage 1 buildings to be resilient to ember attack. Additionally, all buildings will be constructed to align to BAL-29 standard regardless of the lower, BAL-12.5 equivalent level of radiant heat impact that was calculated for Stage 1 buildings (section 3.3).

These measures, in addition to the other bushfire resistant design solutions incorporated into this Bushfire Management Plan are designed to specifically satisfy draft SPP3.7 policy measure 6.10.

1.5 Bushfire Context

The following documents are identified as being referenced to provide the performance criteria and technical specifications for this Bushfire Management Plan:

- i. City of Wanneroo. (2001). District Planning Scheme No. 2.
- ii. Ellis, S., Kanowski, P., & Whelan, R. (2004). National Inquiry on Bushfire Mitigation and Management. Council of Australian Governments.
- iii. FESA. (2010). Planning for Bush Fire Protection Guidelines 2nd Edition Perth: Western Australia.
- iv. Government of Western Australia. (2014.) Planning and Development (Bushfire Risk Management) Regulations.
- v. Standards Australia. (2009). AS 3959 - 2009 Construction of buildings in bushfire prone areas: SAI Global.
- vi. Standards Australia. (2009). ISO AS 31000:2009 Risk management principles and guidelines: SAI Global.

- vii. Standards Australia. (2013). HB89:2013 Risk management - Guidelines on risk assessment techniques (Vol. HB 89:2013). Sydney: SAI Global.
- viii. Standards Australia. (2013). HB 436:2013 Risk management guidelines - Companion to AS/NZS ISO 31000:2009 (Vol. HB436:2013). Sydney: SAI Global.
- ix. WAPC. (2013). Planning Bulletin 111/2013 Planning for Bushfire. Western Australian Planning Commission.
- x. WAPC. (2014a). Draft State Planning Policy 3.7 Planning for Bushfire Risk Management. West Australian Planning Commission.
- xi. WAPC. (2014b). Draft State Planning Policy 3.7 Planning for Bushfire Risk Management Guidelines. West Australian Planning Commission.
- xii. WAPC. (2014c). Draft State Planning Policy 3.7 Planning for Bushfire Risk Management Guidelines Appendices. West Australian Planning Commission, Department of Fire and Emergency Services.

1.6 Summary

In the absence of a local or state government bushfire prone map, areas of the site within the City of Wanneroo shall be subject to assessment in accordance with PfbPG. Areas of the site within 100m of bushfire prone vegetation shall be identified as bushfire prone in accordance with the default position of PfbPG and draft SPP3.7.

The proposed development is identified as a “vulnerable use.” This Bushfire Management Plan demonstrates that the proposed development satisfies all bushfire related planning requirements ensuring the highest standard of safety practicable is achieved in line with all statutory and policy requirements.

The format of this report is consistent with PfbPG but the development is assessed against the requirements of both PfbPG and draft SPP3.7 Guidelines.

2.0 Site Details

2.1 Description

2.1.1 Location

The site is located in the Suburb of Alkimos within the Shorehaven Estate in the Municipality of the City of Wanneroo, approximately 44km north of the Perth CBD. The site is located approximately 1km by road, west of Marmion Avenue and lies within 200m west of the future Mitchell Freeway.

2.1.2 Proposed Land Use

The school is proposed to be constructed in stages.

Stage 1 includes the following buildings and elements as indicated on Revision H of the Site Plan (Figure 2B).

- Bus Embayment;
- Parking Bays;
- Student Drop and Go Bays;
- Primary School Playing Field and Outdoor Space;
- Drop and Go Area;
- Hardcourts;
- Playground;
- GLA Classrooms; and
- Kindy / PP Classrooms.

Revision V of the Masterplan (Figure 2C) illustrates the conceptual completed design of the proposed campus and contains the following buildings and elements:

- Bus Embayment;
- Parking Bays;
- Student Drop and Go Bays;
- Primary School Playing Field and Outdoor Space;
- Secondary School Playing Field and Outdoor Space;
- Gymnasium and Health/Sports GLA;
- Café;
- Hardcourts (primary and secondary);
- Administration Building;
- Playground;
- Junior Learning Hub Buildings;
- Senior Learning Hub Buildings ;
- Specialist Hub Buildings;
- Community Centre;
- Performing Arts Theatre;
- Private Driveway; and
- Site Fire Tanks and Pumps.

2.1.3 Access

The southern end of the site is directly accessed by a public road that extends east from Maroon Avenue (Figure 2A, 2B) and terminates at the western site boundary. Maroon Avenue is connected to Marmion Avenue approximately 1km west of the site by Bluewater Drive via multiple routes.

Once the development is complete, the site shall also be accessed directly from a future public road that borders the western site boundary, via two access points into the proposed school parking bays and bus embayment area. This future road also connects to the proposed ring road within the site that originates in the northwest corner of the site, traversing the northern and eastern boundaries of the proposed school buildings. The ring road connects to a private driveway bordering the internal southern border of the site, linking back with the public road network west of the site.

Marmion Avenue currently provides the main access to the site and the surrounding area of Alkimos and provides direct access to areas north and south of the site. Marmion Avenue also provides access to Wanneroo Road, east of the site via Hester Avenue (approximately 9.8km south of the site) and Yanchep Beach Road (approximately 8.5km north of the site).

A detailed Traffic Management Plan prepared by ARUP Traffic ensures that alternate egress routes and destinations are available at all times and weather conditions. This Traffic Management Plan should be referred to for full details.

As verified by the Traffic Engineering Consultants (Appendix 1), the public access roads and internal road structure shall allow private and emergency vehicles to access, egress and safely move through the site at all times. The additional Emergency Access point at the north of the site provides a second access and egress point to the site.

This demonstrates compliance with Performance Criteria P2, identified as "The internal layout, design and construction of public and private vehicular access in the subdivision/development allows emergency and other vehicles to move through it easily and safely at all times."

2.1.4 Water Supply

A water main is planned to be installed along the western lot boundary, within the western road reserve. This will serve a fire services ring main which will connect a series of hydrants for each new building/stage. Specific placement of hydrants to support bushfire and structural firefighting purposes are to be negotiated with the Department of Fire and Emergency Services to ensure maximum benefit is achieved. The provision of reticulated scheme water and firefighting hydrants satisfies Acceptable Solution A4.1

In addition to the scheme water supply, upon completion of the Masterplan, the site shall incorporate a dedicated 50,000 litre bushfire fighting water supply as well as 500,000 litre structural firefighting water tanks. The tank incorporating the bushfire fighting supply shall have both full flow 50mm ball valve camlock couplings (positive pressure) in addition to 110mm storz

couplings to facilitate hard suction access for structural firefighting appliances. Firefighting water tanks will not be required during Stage 1 and will be installed at a later stage.

This demonstrates compliance with Performance Criteria P3 as "The development is provided with a permanent and secure water supply that is sufficient for firefighting purposes."

2.1.5 Conservation Value

Whereas the development does not include any declared conservation areas to be maintained under covenant, the existing native scrub vegetation east of the ring road is proposed to be retained.

Development and maintenance of the Building Protection Zone and all other bushfire management strategies detailed in this report are designed to be implemented in a manner that protects priority flora species where identified.

2.1.6 Climate

Data collected from the Bureau of Meteorology indicates that the site experiences a temperate climate characterised by mild winter periods and hot, dry summers. The bushfire danger period occurs during the dryer summer months where grass curing has occurred and humidity is low. The effect of climate on potential bushfire behaviour is incorporated into modelling of bushfire impact in section 3 of this report in accordance with AS 3959 through the selection of a Fire Danger Index of 80 as assigned to Western Australia.

All design bushfire events are modelled on days having a Fire Danger Index (FDI) of 80 (equivalent to a Severe Bushfire Danger Rating), students being present and required winds occurring, despite:

- i. CSIRO CAWCR Technical Report No. 10 identifying that this FDI is not achieved in even the 99th percentile of historical weather data for the greater location; and
- ii. Analysis of weather data identifies that the required winds to support fire impact on the school occur on less than 30% of recorded days (Bureau of Meteorology, 2015).

2.1.7 Site Topography

The natural relief of the site and surrounding area is gently undulating with elevations between 30 to 40m AHD as illustrated in Figure 2G (Landgate data).

The actual slope of the land under each vegetation plot was measured on site using an inclinometer. Topography potentially affecting bushfire behaviour that may impact the site is identified in Figure 2G and incorporated into bushfire modelling provided in section 3 of this report.

2.1.8 Bushfire Fuels

The following AS 3959 vegetation structures are located within the site or within 100m of the site boundary:

- (i) Class A Forest;
- (ii) Class B Woodland;
- (iii) Class D Scrub; and
- (iv) Areas exempt from classification in accordance with AS 3959 s2.2.3.2

AS 3959 vegetation structures within 100m of the site are mapped in Figure 2D and illustrated in the associated plates. Bushfire fuel loads are identified as consistent with AS 3959 Table B2 for radiant heat flux modelling purposes.

2.1.9 Conclusion

The proposed school is situated at the interface with natural scrub vegetation, areas cleared for future development and existing residential development. Vegetation within and surrounding the site is conducive to supporting extended bushfire behaviour. The design of the school ensures areas of low threat vegetation such as Building Protection Zones and landscaped/cleared buffer areas) provide a substantial buffer from unmodified vegetation, mostly external to the site. In order to address the potential bushfire threats to the proposed school, the proponent has included bushfire considerations and design standards into the development as far as is reasonably practicable. These design standards incorporate worst case scenario bushfire impact as assessed in section 3 and detailed in section 4 of this report.

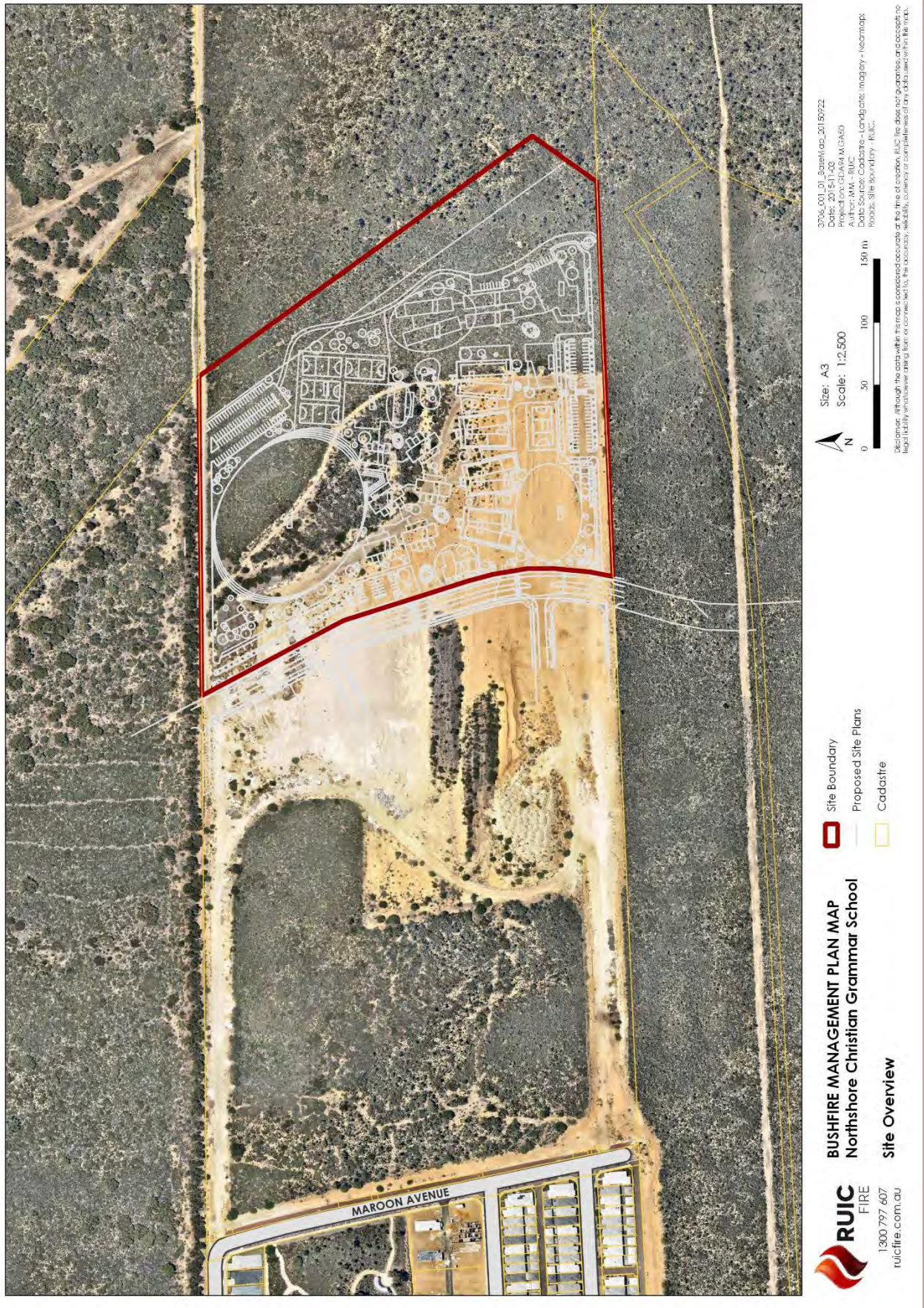


Figure 2A: Site overview with Masterplan overlay

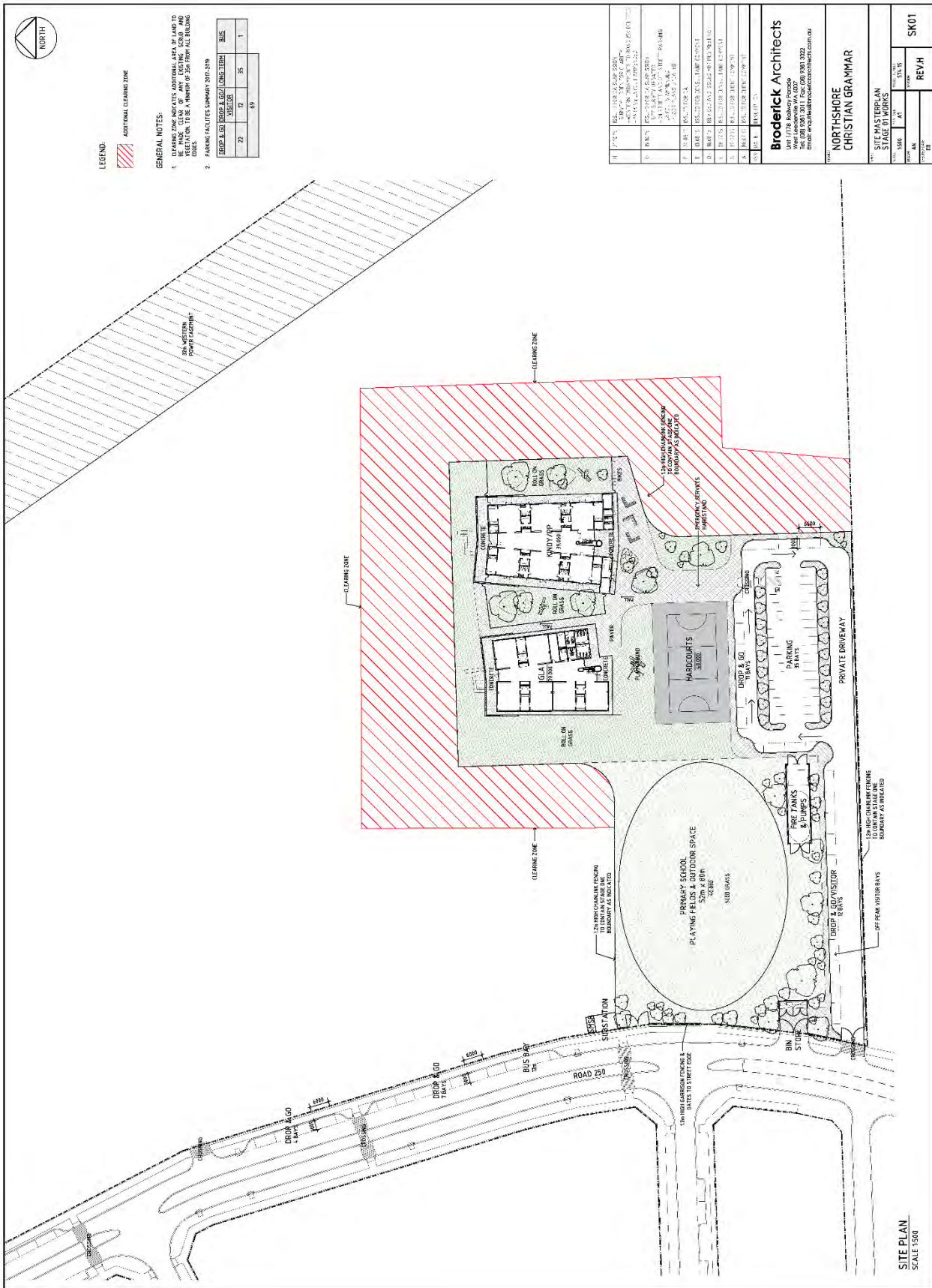


Figure 2B: Stage 1 Site Plan Revision H (Client, 2015)



Figure 2C: Site Masterplan Revision V (Client, 2015)

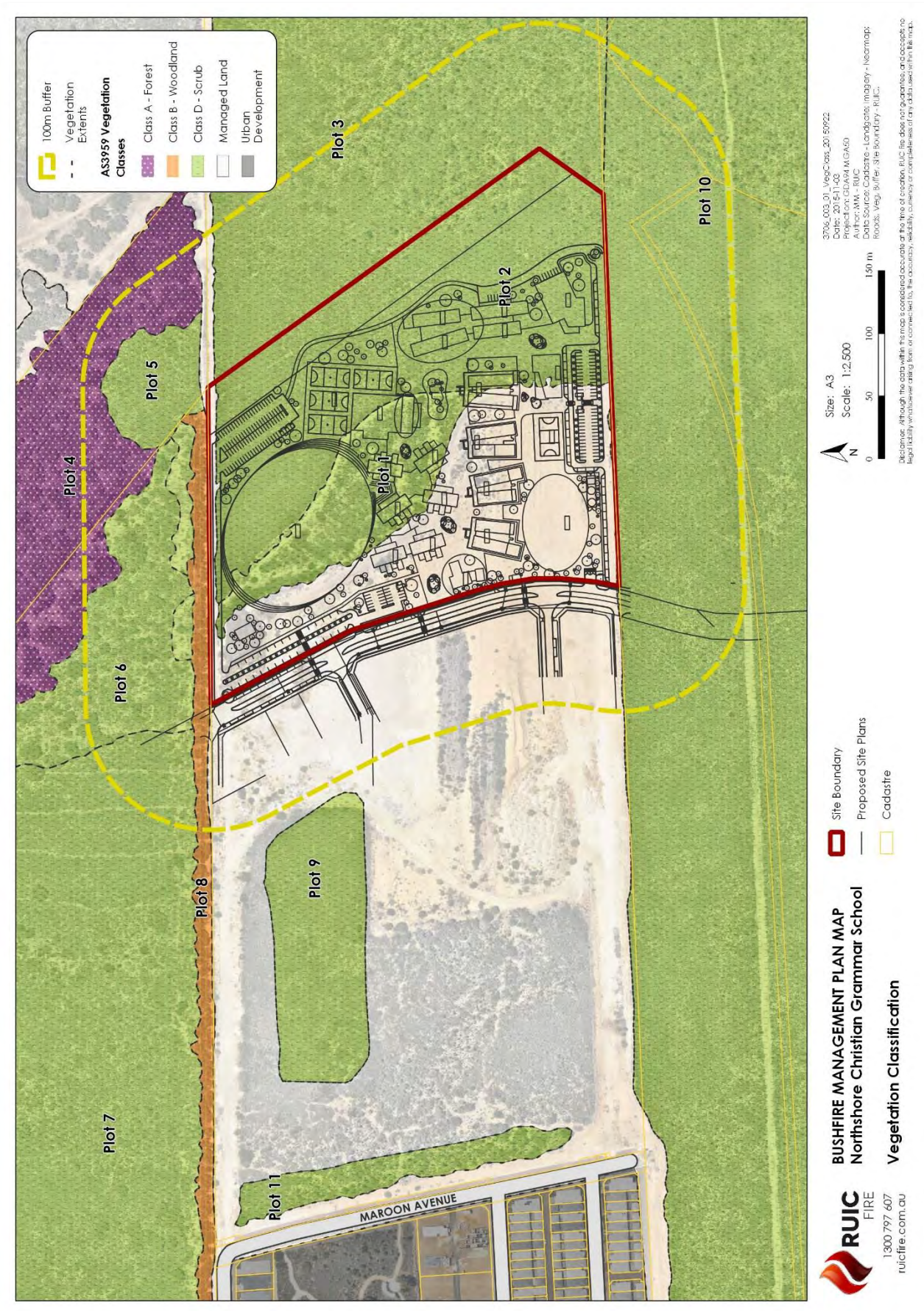


Figure 2D: Vegetation Classification (Pre-development)

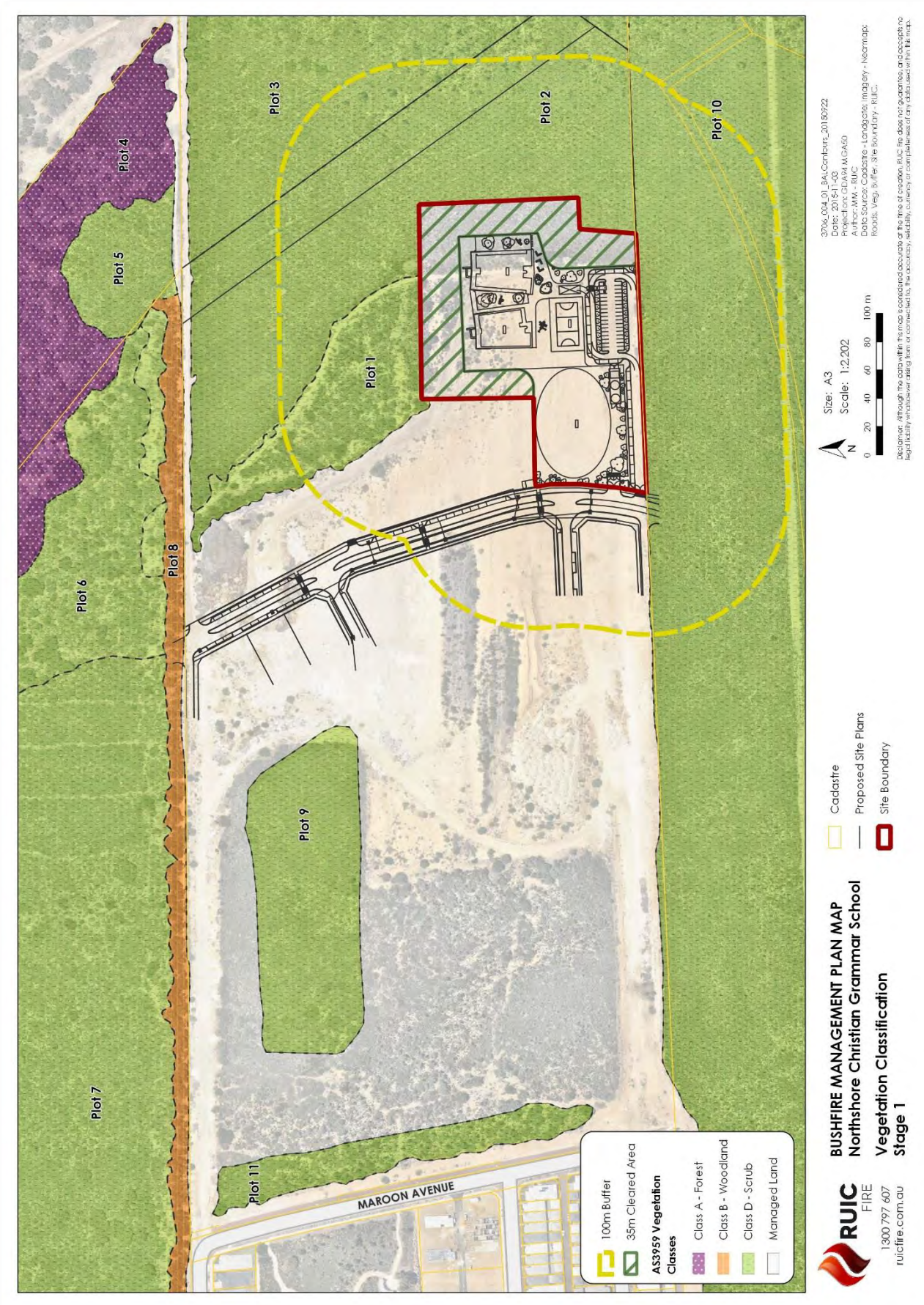


Figure 2E: Vegetation Classification (Post-development) – Stage 1



Figure 2F: Vegetation Classification (Post-development) – Masterplan



Plate i: Plot 1 - Class D Scrub

(entire plot will be landscaped to low threat)



Plate ii: Plot 2 - Class D Scrub

(plot will be partially landscaped to low threat)



Plate iii: Plot 3 - Class D Scrub



Plate iv: Plot 4 - Class A Forest



Plate v: Plot 5 - Class D Scrub



Plate vi: Plot 6 - Class D Scrub



Plate vii: Plot 7 - Class D Scrub



Plate viii: Plot 8 - Class B Woodland



Plate ix: Plot 9 - Class D Scrub



Plate x: Plot 10 - Class D Scrub



Plate xi: Plot 11 - Class D Scrub

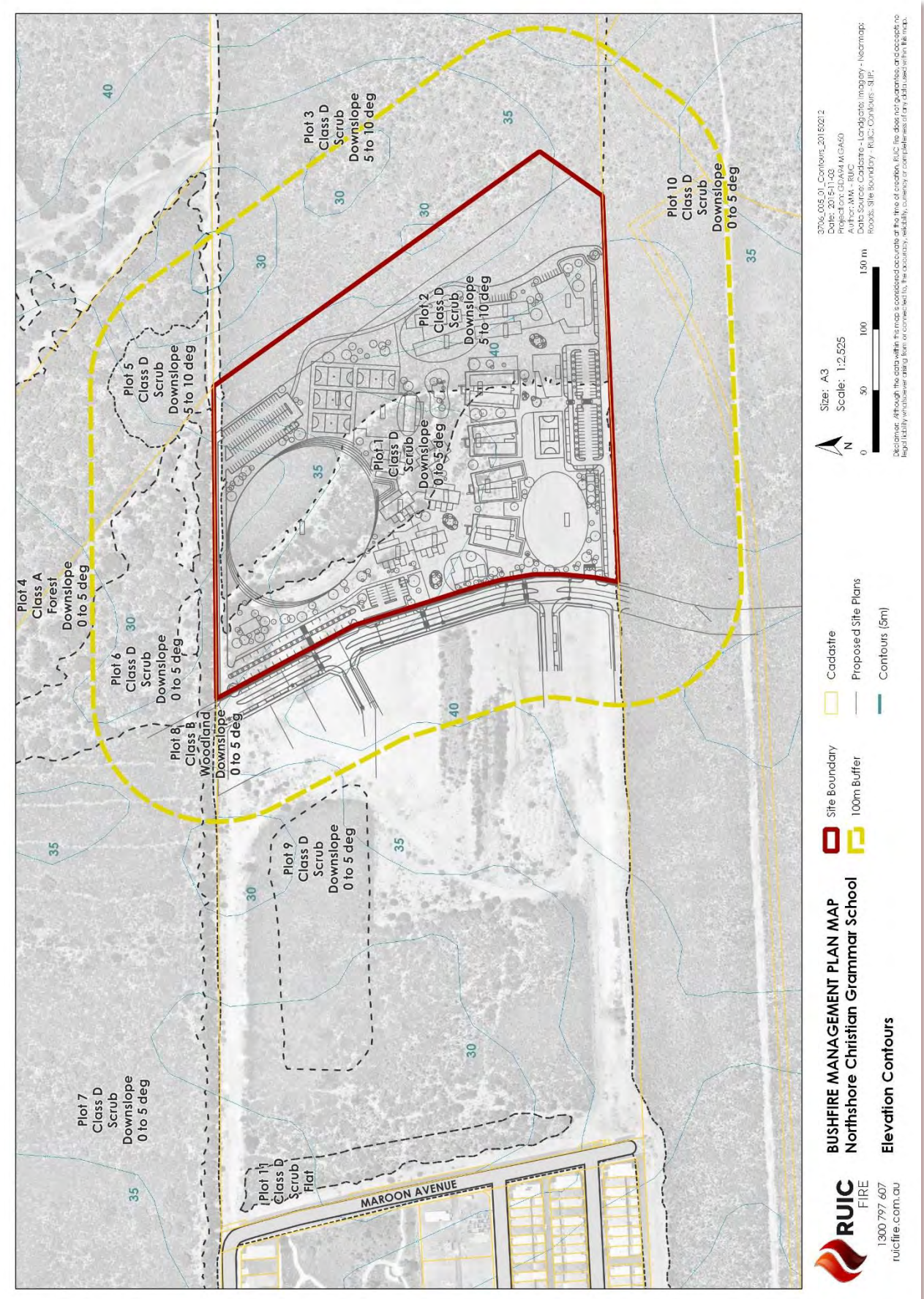


Figure 2G: Site elevations and effective slope

3.0 Bushfire Assessment

3.1 Potential for Bushfire Activity

As the construction of the proposed school will occur in stages, low threat landscaping and/or clearing will be implemented around each stage to ensure at least a maximum BAL-29 rating for each building.

During Stage 1, a 35m low threat landscaped or cleared buffer from Plot 1 Class D Scrub vegetation (downslope >0 to 5°) and Plot 2 Class D Scrub vegetation (downslope >5 to 10°) will ensure a maximum BAL-12.5 rating for this stage (Figures 2C, 2F & 3G). The Stage 1 buildings will be constructed to BAL-29, enhancing safety for future occupants in the event of a bushfire.

Once construction of the final Masterplan is complete, the entire area of the site that lies west of the ring road will be landscaped to a low threat state (Figure 2E). This will essentially result in elimination of the potential for bushfire ignition occurring within the built environment parts of the development. Additionally, a 17m landscaped buffer will lie adjacent to the eastern side of the ring road, ensuring a maximum BAL-29 rating for the school buildings.

Due to the connectivity of the remaining scrub vegetation within the site and scrub and woodland vegetation adjacent to the site with extensive tracts of vegetation in the wider area, a bushfire occurring in this vegetation has the potential to be part of a large scale bushfire event.

The impact of such an event on the proposed development and the potential for ignition of vegetation from activities within the site itself will be managed through:

- i. Education of staff and students regarding potential for bushfire and the adoption of bushfire prevention as a core value of the Northshore Christian Grammar School;
- ii. Development of a detailed and well-rehearsed evacuation plan;
- iii. Ensuring the development design complies with all required Performance Requirements / Performance Principles; and
- iv. Adherence of occupants to fire restrictions and total fire bans.

These strategies are detailed in section 4 of the report.

3.2 Bushfire Hazard Assessment

The Bushfire Hazard Assessment was completed in accordance with PfbPG Appendix 1 (Figures 3D, 3E & 3F).

Bushfire hazard is defined as "The flammability, arrangement and quantity of vegetation, dead or alive, that can be burnt in a bush fire. Development is to be avoided in extreme bush fire hazard designated areas" (PfbPG, p13).

3.2.1 Pre-development

Pre-development, vegetation hazards within the lot boundaries are identified as approximately 66% extreme hazard (Class D Scrub across the development site) and 33% low hazard (the remaining cleared land within the site) (Figure 3D).

3.2.2 Stage 1

On completion of the Stage 1 development, vegetation hazards within the Stage 1 boundary are identified as 100% low hazard (Figure 3E).

On the basis of the "predominant vegetation", the Stage 1 site shall have low bushfire hazard level on completion of Stage 1 development.

3.2.3 Masterplan

On completion of the final Masterplan development, vegetation hazards within the lot boundaries are identified as approximately 20% extreme hazard (Class D Scrub east of the outer ring road and 17m landscaped buffer area) and 80% low hazard (the entire area of land west of the outer ring road and 17m buffer where development will occur) (Figure 3F).

On the basis of the "predominant vegetation", the site shall have a low bushfire hazard level on final completion of the final Masterplan development.

3.2.4 Conclusion

On the basis of the "predominant vegetation", the site shall have a low bushfire hazard level on final completion of the development.

All classrooms and development are proposed to occur on land with a low bushfire hazard level only. During Stage 1 development, the 35m cleared buffer area (Figures 2C, 2F & 3E) ensures that areas of extreme hazard level vegetation that will be landscaped at a later stage are well separated from the classrooms, hardcourts, parking bays and playing fields. The 17m buffer east of the ring road also ensures sufficient separation from extreme hazards for the Masterplan layout (Figure 3F).

It is important to acknowledge that the qualitative Bushfire Hazard Assessment methodology (PfBPG Appendix 1, p18) is different to the quantified methodology for determining the Bushfire Attack Level to a building as detailed in AS 3959. Under the current PfBPG it is possible for a site to have an elevated BAL rating (if declared bushfire prone) whilst having a Low Bushfire Hazard rating. Further, the methodology for calculating vegetation fuel load is inconsistent between PfBPG and AS 3959 meaning that a dwelling may be deemed not to require a BAL rating by planning and granted approval, yet can be subject to a BAL-FZ rating when it comes to obtaining a building licence. As a result of the inconsistencies between the Bushfire Hazard Assessment and BAL Calculation methodologies and vegetation classifications, discrepancy exists between the associated mapping in this report.

3.3 Bushfire Impact Analysis & BAL Ratings

Potential bushfire impact analysis was undertaken in accordance with AS 3959 Methodology 1 to ensure an inherent and significant safety factor is incorporated into the construction of all buildings. The analysis determines the potential worst case scenario radiant heat impact on each of the buildings and non-building elements of the proposed school in the event of bushfire within vegetation identified as a bushfire threat.

Potential bushfire impact modelled in accordance with AS 3959-2009 is detailed in Figure 3G and Table 3A for Stage 1 and Figure 3H and Table 3B for the Masterplan.

The modelling identifies that through the separation afforded by the proposed setbacks, public and private roads and strategic landscaping buffers, the maximum potential radiant

heat impact for the proposed development on the school buildings is BAL-29. This satisfies SPP3.7 Element 1: Location, Acceptable Solution 1.

Table 3A: Stage 1 – Maximum BAL rating for each building

Building	Veg. Plot	Veg. Classification	Effective Slope	Separation (m)	Max. BAL
GLA Classrooms	Plot 1	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5
Kindy / PP Classrooms	Plot 1	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5

Table 3B: Stage 1 – Maximum BAL rating for each non-building element

Element	Veg. Plot	Veg. Classification	Effective Slope	Separation (m)	Max. BAL
Bus Embayment	Plot 1	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Primary School Hardcourts	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5
	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Primary School Parking Bays	Plot 10	Class D Scrub	Downslope >0 to 5°	<11	FZ
Drop and Go Area	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Primary School Playing Field	Plot 10	Class D Scrub	Downslope >0 to 5°	22-<31	19
Playground	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5

Table 3C: Masterplan – Maximum BAL rating for each building

Building / Element	Veg. Plot	Veg. Classification	Effective Slope	Separation (m)	Max. BAL
Performing Arts Building	Plot 10	Class D Scrub	Downslope >0 to 5°	15-<22	29
Admin Building	N/A	N/A	N/A	>100	Low
Y1 & Y2 Classrooms	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Y4 & Y3 Classrooms	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Y5 & Y6 Classrooms	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5

Y7 Classroom	N/A	N/A	N/A	>100	Low
Y78 Classroom	N/A	N/A	N/A	>100	Low
Y9 Classroom	N/A	N/A	N/A	>100	Low
Y10 Classroom	N/A	N/A	N/A	>100	Low
Y11 Classroom	N/A	N/A	N/A	>100	Low
Y12 Classroom	N/A	N/A	N/A	>100	Low
PP & K Building	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5
	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Food Tech Building	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5
Materials Tech Building	Plot 2	Class D Scrub	Downslope >5 to 10°	24-<35	19
Science / Arts Building W	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5
Science / Arts Building E	Plot 2	Class D Scrub	Downslope >5 to 10°	24-<35	19
Gym & Cafe	Plot 2	Class D Scrub	Downslope >5 to 10°	35-<100	12.5

Table 3D: Masterplan – Maximum BAL rating for each non-building element

Element	Veg. Plot	Veg. Classification	Effective Slope	Separation (m)	Max. BAL
Primary School Playing Field	Plot 10	Class D Scrub	Downslope >0 to 5°	22-<31	19
Primary School Hardcourts	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Parking Bays (S)	Plot 10	Class D Scrub	Downslope >0 to 5°	<11	FZ
Parking Bays (NE)	Plot 8	Class B Woodland	Downslope >0 to 5°	<11	FZ
Parking Bays (W)	Plot 8	Class B Woodland	Downslope >0 to 5°	<13	FZ
Secondary School Playing Field	Plot 8	Class B Woodland	Downslope >0 to 5°	<13	FZ

Secondary School Hardcourts	Plot 2	Class D Scrub	Downslope >5 to 10°	24-<35	19
Community Centre	Plot 10	Class D Scrub	Downslope >0 to 5°	31-<100	12.5
Site Fire Tanks and Pumps	Plot 10	Class D Scrub	Downslope >0 to 5°	15-<22	29

3.4 Potential human impact and sheltering sites

Due to the large areas of surrounding Class D Scrub vegetation external to the school site, a bushfire event realised on completion of both Stage 1 and the future Masterplan development has the potential to travel rapidly towards the school and cause injury or fatalities to exposed persons without protection in certain areas. Whilst the enhanced construction of buildings within the school provide refuges, there are also open areas within the school site that are suitable for sheltering from a bushfire in the event that occupants are unable to be evacuated.

Radiant heat flux and expected impacts on the human body are outlined in Table 3E. Figures 3G and 3H illustrate three radiant heat flux scenarios for the proposed stages. Radiant heat flux of 2.5 kW/m² is the deemed level of exposure permitted for evacuating occupants from structure fires in the BCA whilst 5kW/m² has been shown not to cause adverse effects in limited human trials (see Table 3E).

For Stage 1, areas outside of the green line (which is equivalent to the level of radiant emitted by the sun), including the northern third of the playing fields and the playground would be suitable bushfire refuge areas (Figure 3G).

On completion of the Masterplan development, a large proportion of the school site will be suitable for sheltering in the event of a bushfire including the southern half of the secondary school playing fields, all classrooms and other areas of open space (Figure 3H).

Table 3E: Radiant heat flux impacts (BCA, 2015; Robinson et al., 2011, Raj, 2008a; Raj, 2008b)

Radiant Heat Flux (kW/m ²)	Human effect
35	Significant chance of instantaneous fatality for unprotected exposed persons.
23	Likely fatality for extended exposure and chance of instantaneous fatality for unprotected exposed persons.
12.6	Significant chance of fatality for unprotected extended exposure.
5	Limited human trials indicated no adverse effects
4.7	Will cause pain in 15-20 seconds unprotected exposure. Will cause injury after 30 seconds unprotected exposure.
2.5	Level of exposure permitted for evacuating occupants in the Building Code of Australia

2.1	Minimum heat radiation required to cause pain after 60 seconds unprotected exposure
1.3	Exposure from mid-day sun

3.5 Risk Assessment

Risk is not an event (SAHB 436:2013 s2.1). It is not an explosion, bushfire, flood or other emergency. Risk cannot be expressed as either positive or negative, but rather as the likelihood of a consequence, positive or negative, occurring. In the context of planning for bushfire protection, bushfire is considered a risk source that can impact upon the objectives of preventing damage or loss to life, property and the environmental assets (prioritised in that order).

Management of bushfire related risk is a shared responsibility (Keelty, 2011). Risk criteria are sourced from Emergency Management Australia (2010); FESA (2010); and stakeholder consultation. Residual bushfire related risk to identified assets within the proposed development following implementation of the risk mitigation strategies is summarised in Table 3B in accordance with:

- ISO31000:2009 Risk management – principles and guidelines;
- SAHB 436:2013 Risk management guidelines – Companion to AS/NZS ISO 31000:2009;
- National Inquiry on Bushfire Mitigation and Management (2010).

The risk assessment demonstrates that after application of the risk management strategies incorporated into the design of the development, the residual bushfire related risk post subdivision is significantly reduced compared to the current state.

Table 3F: Risk assessment of development

Risk No.	Risk Statement	Impact Category	Pre-development Risk Level	Prevention Controls (Planning Specific)	Post-development Residual Risk Level
1.	There is the potential that a bushfire will impact the proposed development which in turn will cause death or injury to persons.	People	High	<ul style="list-style-type: none"> • All proposed Stage 1 buildings built to BAL-29 regardless of the BAL-12.5 rating. • 35m cleared buffer around Stage 1 to protect life and property. • 17m landscaped buffer to east of ring road ensures max. BAL-29 rating for current Masterplan layout. • Safe areas for occupants to shelter from bushfire within each stage. • Future stage buildings constructed to AS 3959 in accordance with the identified max. BAL-29 rating. • Development design incorporates easy access for firefighters and permanent firefighting water supplies. • Compliance with fire restrictions and Total Fire Bans for all outdoor activities. 	Low

				<ul style="list-style-type: none"> School has adopted a policy whereby closure will occur for all days where a Fire Danger Rating of Severe or Catastrophic is forecast. 	
2.	There is the potential that a bushfire will impact the proposed development, which in turn will cause destruction of or damage to the proposed dwellings.	Infrastructure	High	<ul style="list-style-type: none"> All proposed Stage 1 buildings built to BAL-29 regardless of the BAL-12.5 rating. 35m cleared buffer around Stage 1 to protect life and property. 17m landscaped buffer to east of ring road ensures max. BAL-29 rating for current and future Masterplan layout. Future stage buildings constructed to AS 3959 in accordance with the identified max. BAL-29 rating. Development design incorporates easy access for firefighters and permanent firefighting water supplies. Compliance with fire restrictions and Total Fire Bans for all outdoor activities. 	Low
3.	There is the potential that a bushfire will impact the proposed development, which in turn will cause destruction of or damage to environmental assets.	Environment	High	<ul style="list-style-type: none"> Low threat landscaping within the development area reduces the potential for fire spread to other areas of unmodified vegetation. 	Low

3.6 Bushfire Landscaping Guidelines

It is important that landscaping design within the proposed development does not constitute a bushfire threat. This may be achieved through aligning landscaping design of Public Open Space (POS), Road Reserves and Parks & Recreational Reserves with Low Threat exclusion clauses defined in AS 3959 - 2009 s2.2.3.2. Examples include:

- i. Landscaping design within POS and Recreational Reserves being consistent with AS 3959 - 2009 s2.2.3.2(f) to ensure vegetation does not create vertically and horizontally continuous fuel structures that may contribute to bushfire intensity (Figure 3A and 3B);
- ii. Where areas of bushland are to be included as part of landscaping design, ensuring they are consistent with AS 3959 - 2009 s2.2.3.2(c) being less than 0.25ha in area and not within 20m of each other or proposed dwellings (Figure 3C);
- iii. Utilising non-vegetated areas within the development consistent with AS 3959 - 2009 s2.2.3.2 (e) to provide enhanced separation between buildings and vegetation identified as a bushfire threat external to the site boundaries; and

- iv. Utilising Fire-Wise plant species that are resistant to the effects of fire (guidance can be found at <http://www.cfa.vic.gov.au/plan-prepare/landscaping-for-bushfire>).



Figure 3A: Low Threat vegetation



Figure 3B: Low Threat POS

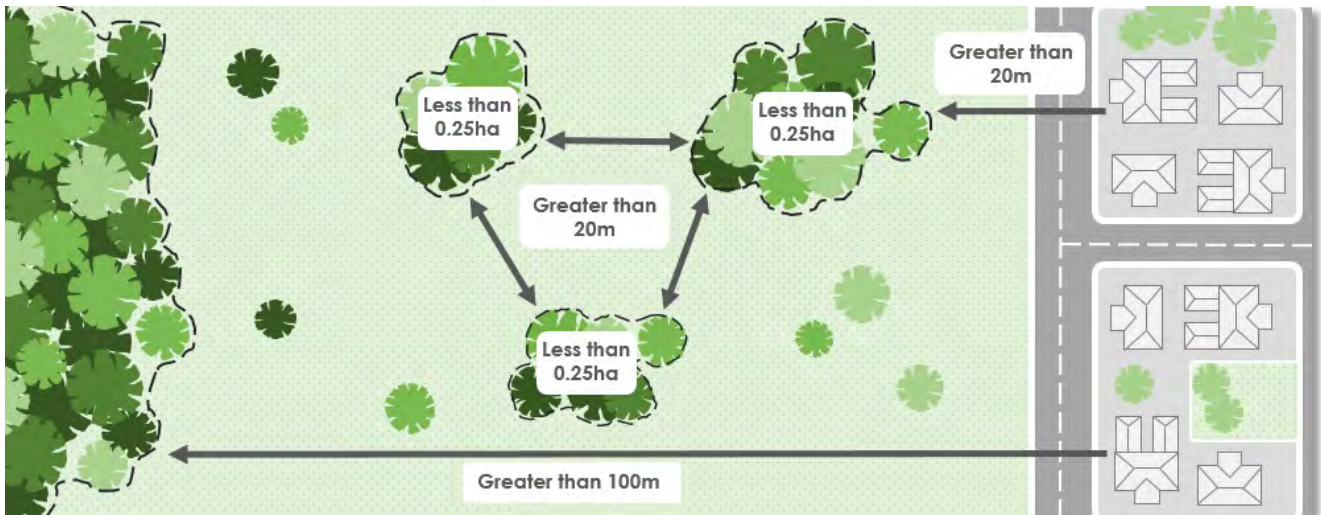


Figure 3C: Example of low threat vegetation landscaping

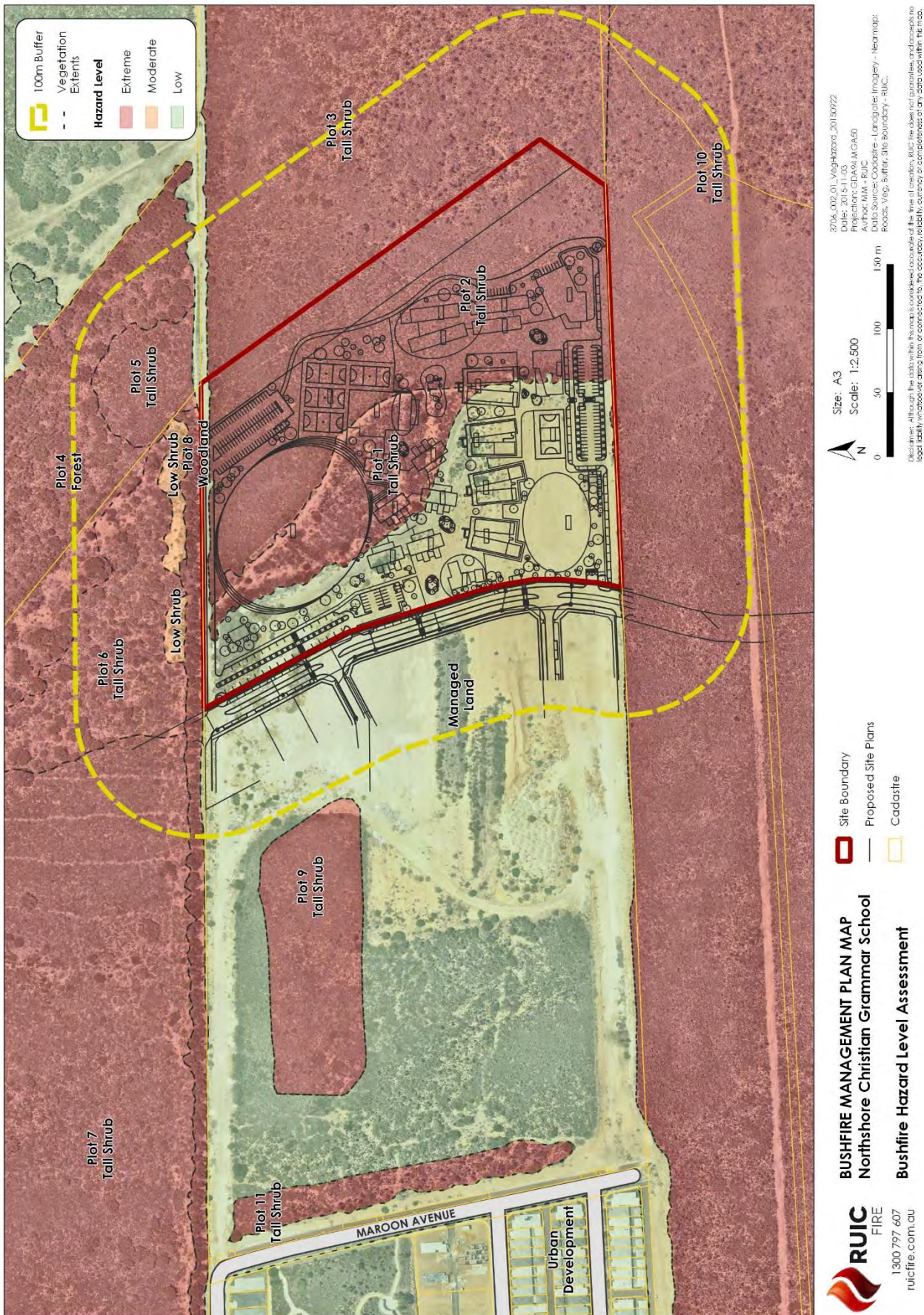


Figure 3D: Bushfire Hazard Assessment (Pre-development)

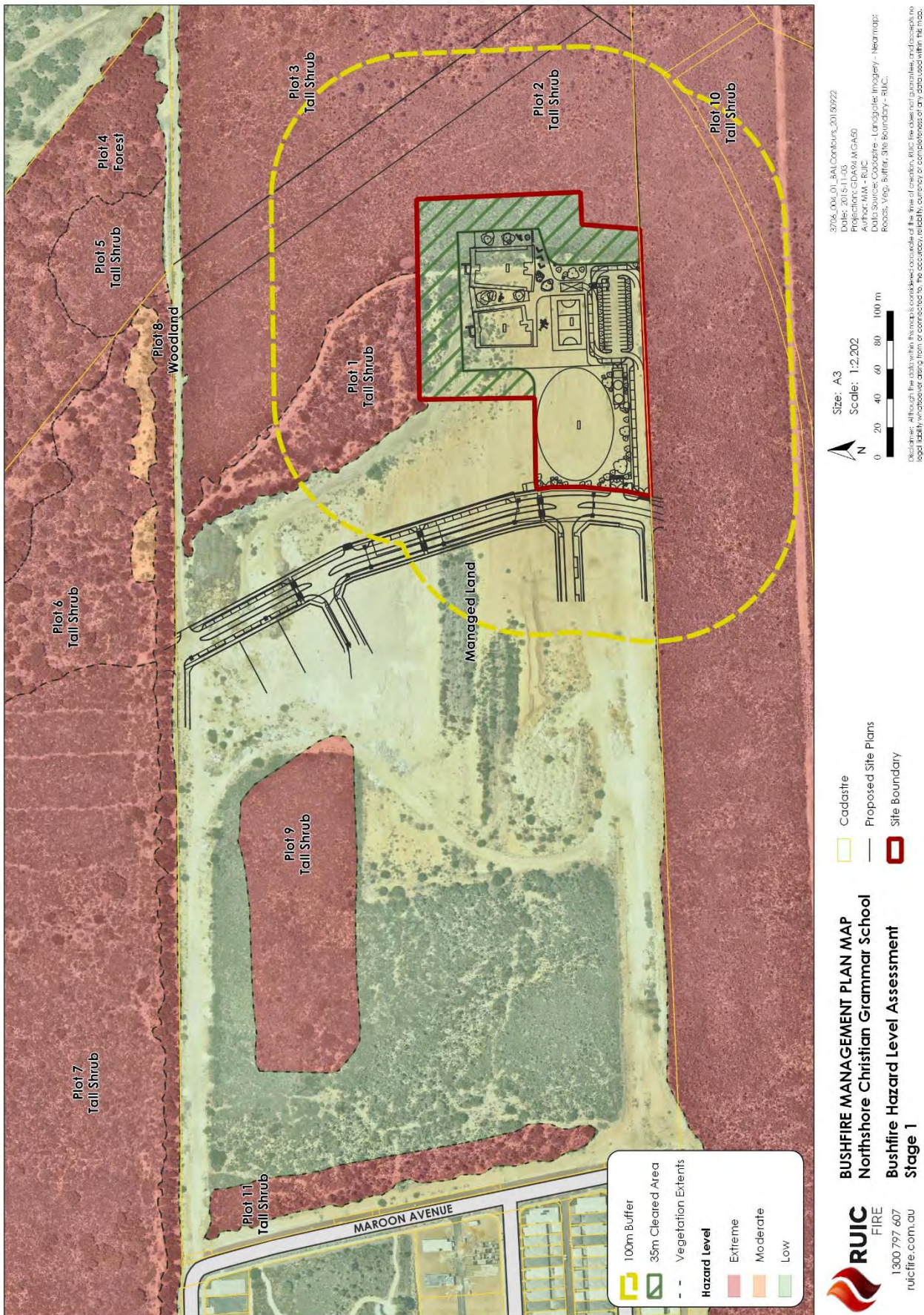


Figure 3E: Bushfire Hazard Assessment (Post-development) – Stage 1

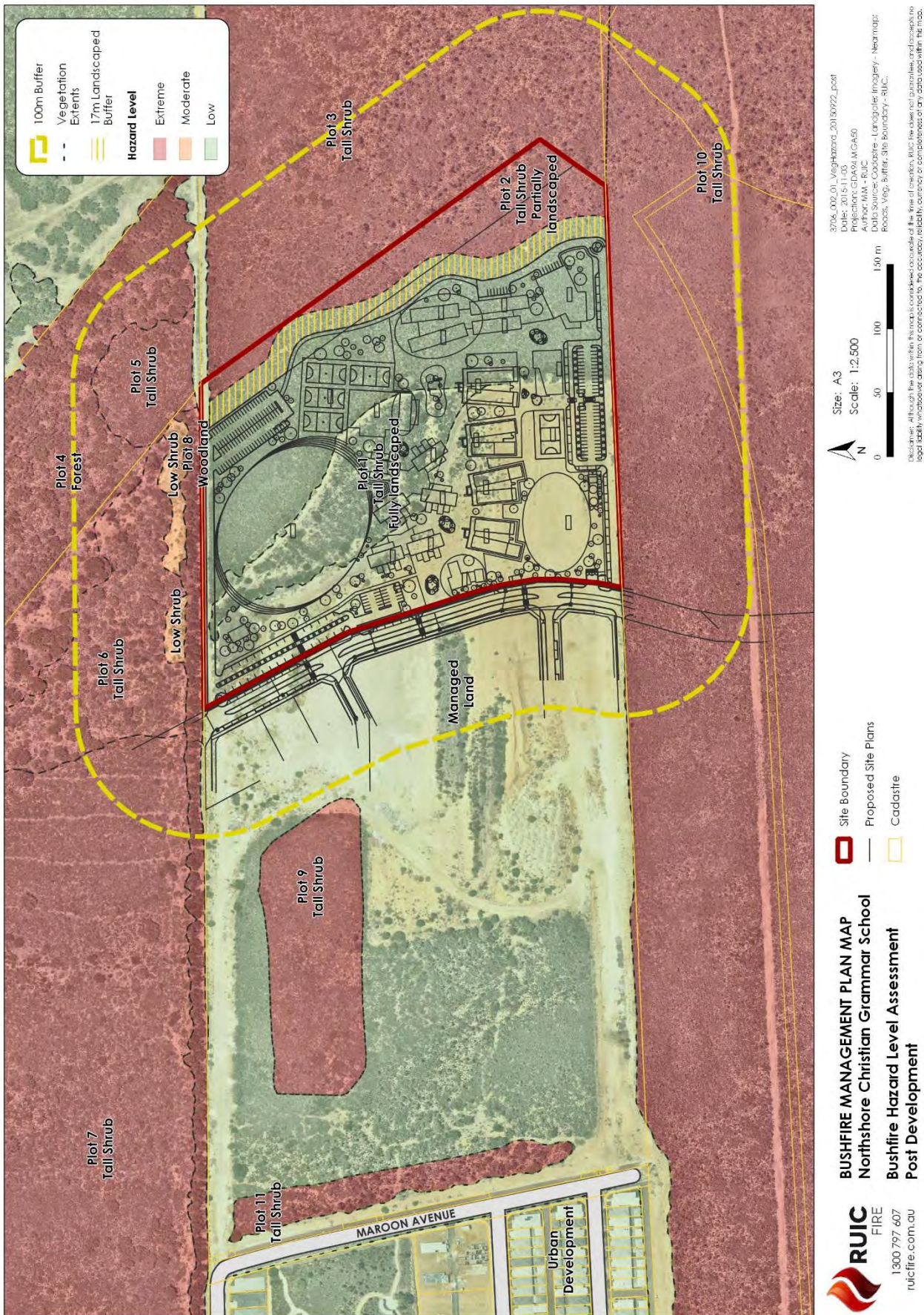


Figure 3F: Bushfire Hazard Assessment (Post-development) – Masterplan

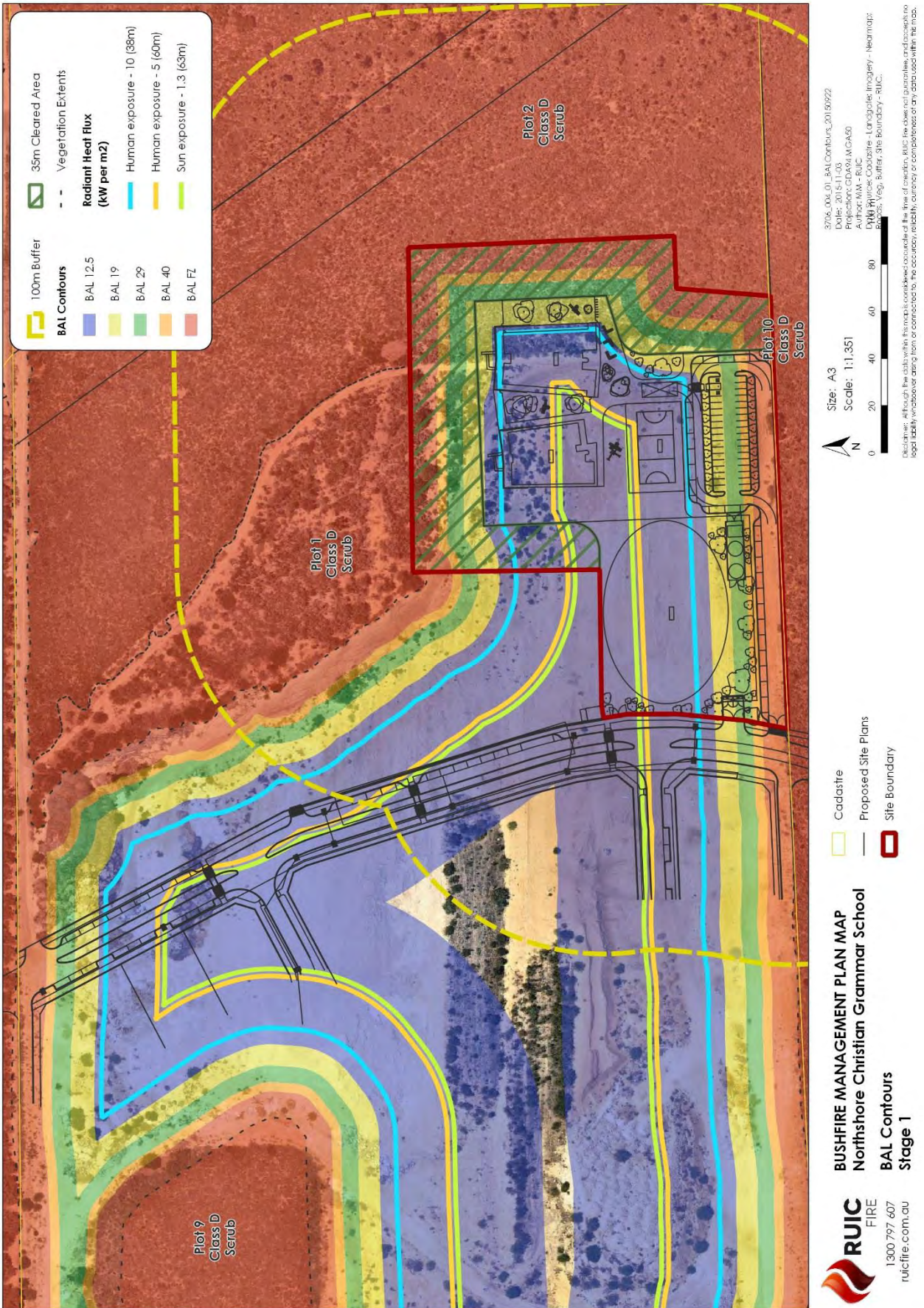


Figure 3G: Bushfire Attack Level Contours (Post-development) - Stage 1

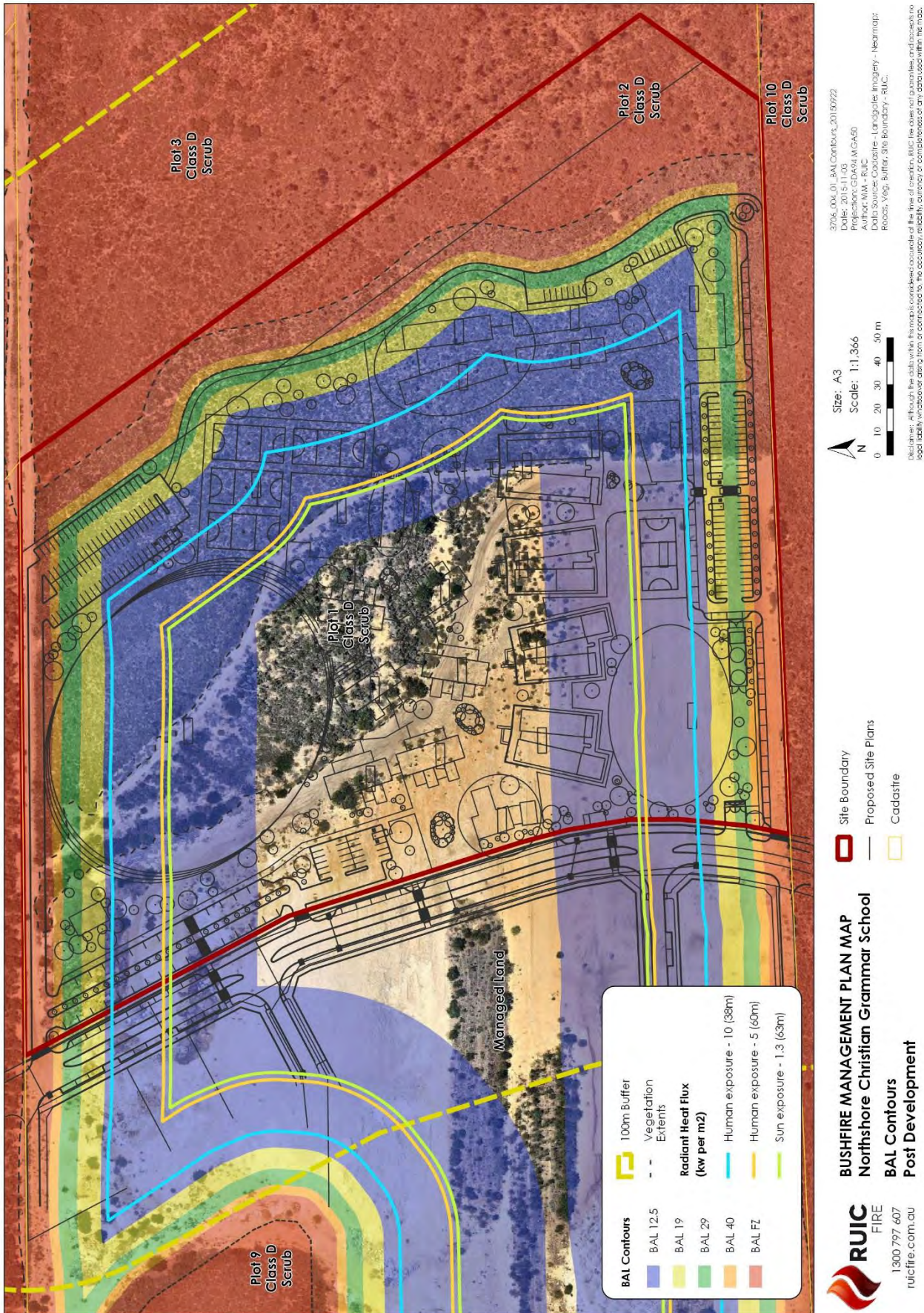


Figure 3H: Bushfire Attack Level Contours (Post-development) - Masterplan

3.7 Performance Criteria and Compliance

All stages of development are located on land having a low hazard level and the development is identified as being subject to a low level of bushfire related risk. In order to reduce the level of risk further, the development incorporates bushfire mitigation measures into the overall design in accordance with the requirements of PFBPG and draft SPP3.7.

The compliance of the development against the Elements and Performance Criteria of Planning for Bushfire Protection Guidelines 2nd Edition is summarised in Table 3G. The cross-compliance of the development against the Elements and Performance Principles of draft SPP3.7 is summarised in Table 3H. Where Performance Based Solutions are utilised, detailed justification is provided in the relevant section of this report.

Table 3G: Performance Criteria Compliance: Planning for Bushfire Protection Guidelines 2nd Edition

Element	Acceptable Solution	Compliance		Acceptable Solution (AS) or Performance Based Solution (PBS)
1. Location	A1.1 Development location	Does the proposal comply with performance criteria P1 by applying acceptable solution A1.1?	✓	AS 1
2. Vehicular Access	A2.1 Two access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.1?	✓	AS 2
	A2.2 Public roads	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.2?	N/A	N/A
	A2.3 Culs-de-sac	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.3?	N/A	N/A
	A2.4 Battle axes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.4?	N/A	N/A
	A2.5 Private driveways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.5?	✓	AS 3
	A2.6 Emergency access ways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.6?	N/A	N/A
	A2.7 Fire service access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.7?	N/A	N/A
	A2.8 Gates	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.8?	N/A	N/A
	A2.9 Firebreak widths	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.9?	✓	AS 4
	A2.10 Signs	Does the proposal comply with performance criteria P2 by	NA/	N/A

		applying acceptable solution A2.10?		
3. Water	A3.1 Reticulated supply	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.1?	✓	AS 5 PBS 1 - Supplementary firefighting water provided by dedicated water tanks (post Stage 1)
	A3.2 Non reticulated areas – water tanks	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.2?	N/A	N/A
	A3.3 Non reticulated areas - dam	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.3?	N/A	N/A
4. Siting	A4.1 Hazard separation – moderate to extreme bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.1?	✓	AS 6
	A4.2 Hazard separation – low bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.2?	N/A	N/A – No grassland within 20m of the site
	A4.3 Building protection zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.3?	✓	PBS 2 - Increased BPZ to 35m around Stage 1 buildings for enhanced safety
	A4.4 Hazard separation zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.4?	N/A	N/A – Buildings constructed to AS 3959 to facilitate reduced distance
	A4.5 Reduction in bushfire attack due to shielding	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.5?	✓	AS 7 – Shielding will be disregarded to improve occupant safety
5. Design	A5.1 Compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.1?	✓	AS 8
	A5.2 Non-compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.2?	N/A	N/A

Table 3H: Element & Performance Principle Compliance: draft SPP3.7 Appendix 4

Element	Compliance	Acceptable Solution (AS) or Performance Based Solution (PBS)
1. Location	✓	Acceptable Solution 1 Development Location
2. Siting of Development	✓	Acceptable Solution 6 Separation from Moderate & Extreme Hazards Performance Based Solution 2 Building Protection Zone
3. Vehicular Access	✓	Acceptable Solution 2 Access and Egress Acceptable Solution 4 Private Driveways
4. Water	✓	Acceptable Solution 5 Reticulated Areas Performance Based Solution 1 Water Supply

3.8 Conclusion

The development has been specifically designed to reduce the vulnerability of potential bushfire impact in accordance all applicable policy and planning requirements whilst respecting the environmental significance of vegetation within and external to the site.

The Bushfire Hazard level, bushfire related risk level and BAL rating applicable to the proposed lots are not prohibitive of development. All residual bushfire related risk levels affecting the site are identified as low. In accordance with PfBPG and draft SPP3.7, the bushfire risk to the proposed development is not considered unreasonable and should not prohibit development of the site subject to the measures detailed in this Fire Management Plan being complied with.

This Bushfire Management Plan demonstrates compliance of the development with all relevant performance criteria detailed in PfBPG and all Elements and Performance Principles of draft SPP3.7 Guidelines Appendix 4.

4.0 Bush Fire Risk Mitigation

The bush fire risk mitigation strategies detailed in this report are designed to comply with the Performance Criteria detailed in PfBPG; WAPC Planning Bulletin 111/2013; and draft SPP3.7 Guidelines.

- The notation (P3) refers to Performance Criteria 3 of PfBPG. Where a Performance Based Solution is offered detailed justification is provided.
- The notation (A3.1) refers to Acceptable Solution 3.1 of PfBPG.
- The notation (E3.1) refers to Explanatory Note 3.1 of the PfBPG.
- Where discrepancy occurs between State and Local bushfire planning provisions the higher standard of mitigation has been selected.

Where performance based design solutions are proposed, detailed justification is provided in the relevant section.

4.1 Element 1 - Location of Development

Intent: To ensure that development/intensification of land use is located in areas where the bush fire hazard does not present an unreasonable level of risk to life and property.

Performance Principle (P1): The subdivision/development is located in an area where the bush fire hazard level is manageable.

Acceptable Solution 1 **Development Location**

The Stage 1 site and overall Masterplan site is subject to an overall low hazard level. The development shall only occur on land having a low bushfire hazard level (when assessed in accordance with PfBPG) and shall be protected by Building Protection Zones to ensure a maximum BAL-29 rating applies to all potential future buildings.

The risk shall be further reduced by ensuring all access and egress requirements and firefighting water supplies shall comply with the relevant Performance Principles. The development facilitates a significant reduction in the overall level of bushfire related risk to the subject lot and surrounding lots than could otherwise be achieved without the development proceeding. This satisfies the intent of Performance Principle P1.

4.2 Element 2 - Vehicular Access

Intent: To ensure that the vehicular access serving a subdivision/ development is safe in the event of a bush fire occurring.

Performance Principle (P2): The internal layout, design and construction of public and private vehicular access in the subdivision/development allows emergency and other vehicles to move through it easily and safely at all times.

The following Acceptable Solutions are not applicable to the proposed development:

- i. A2.2 Public Roads - The proposed development does not include the construction of any new public roads.
- ii. A2.3 Culs-de-sac – The proposed development does not include the construction of any culs-de-sac.
- iii. A2.4 Battle-axes – The proposed development does not include the construction of any battle-axes.
- iv. A2.6 Emergency Access Ways – The proposed development does not require emergency access ways, complying with A2.6 to satisfy the requirement to allow emergency and other vehicles to move through it easily and safely at all times.
- v. A2.7 Fire Service Access Routes – The proposed development does not require fire service access routes, complying with A2.7 to satisfy the requirement to allow emergency and other vehicles to move through it easily and safely at all times.
- vi. A2.8 Gates – Emergency access ways and fire service access routes are not required, therefore gates will not be used to restrict access these.
- vii. A2.9 Signage – Emergency access ways and fire service access routes are not required, therefore associated signage is not required.

Acceptable Solution 2

Two Access Routes A2.1

The site is currently directly accessed a public road that extends east from Maroon Avenue (Figure 2A, 2B) and terminates at the western site boundary. Maroon Avenue is connected to Marmion Avenue approximately 1km west of the site by Bluewater Drive via multiple routes. Marmion Avenue currently provides the main access to the site and the surrounding area of Alkimos and provides direct access to areas north and south of the site. Marmion Avenue also provides access to Wanneroo Road, east of the site via Hester Avenue (approximately 9.8km south of the site) and Yanchep Beach Road (approximately 8.5km north of the site). Once the proposed future public road network has been constructed west of the site boundaries, the access and egress options for the development will be further increased.

The existing and future extensive public and private road network therefore facilitates multiple egress and access routes to the site at all times and in all weather conditions.

Acceptable Solution 3

Private Driveways A2.5

All dwellings located more than 50m from a public road are required to be serviced by a Private driveway meeting the specifications of A2.5. The private driveway identified on the Stage 1 Site Plan also acts as a firebreak for the southern site boundary (see A2.8).

a) Standard:

- i. As per table 4A.

b) Implementation:

- i. Prior to construction of the development serviced by the private driveway.

c) Development:

- i. It is the responsibility of the developer to ensure private driveways meet the required construction standards.
- d) Maintenance:
- i. It is the responsibility of the Northshore Christian Grammar School to ensure private driveways continue to meet the required construction standards.

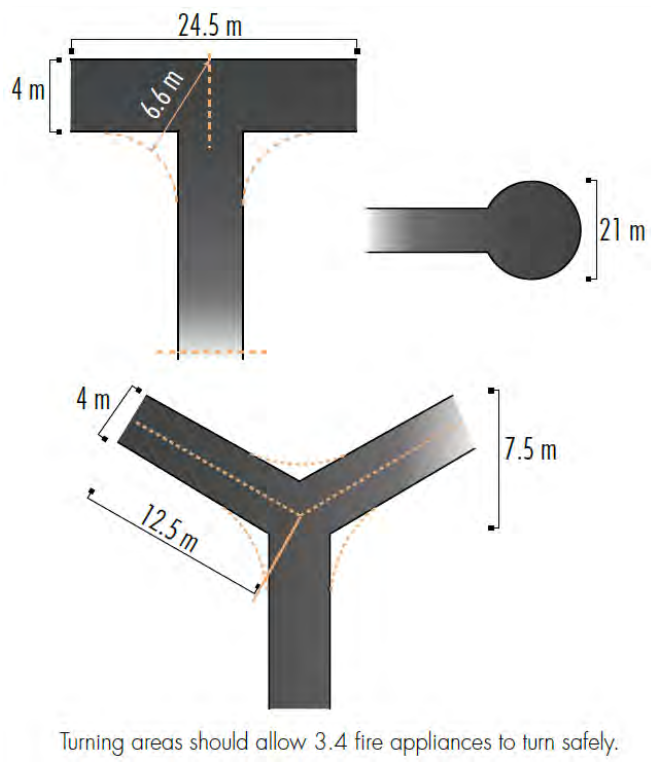


Figure 4A: Examples of private driveway turn around areas

Acceptable Solution 4

Firebreaks A2.9

The internal perimeter of the site is bordered in the north, east and south by private roads that serve as trafficable firebreaks for fire appliance access. The site is bordered by the private driveway in the south, the unsealed outer ring road in the east and the parking bay access road in the north. The internal perimeter roads, acting as firebreaks, shall have a minimum width of three (3) metres in accordance with A2.9.

Should the private internal perimeter roads not be constructed before the construction of Stage 1 begins, mineral earth firebreaks, shall be installed in their place. In accordance with the City of Wanneroo annual firebreak notice, firebreaks must be a minimum width and height of 3m and cleared by the 15th of November each year and maintained until the following April.

4.3 Element 3 – Water Supply

Intent: To ensure that water is available to the development to enable life and property to be defended from bush fire.

Performance Principle (P3): The development is provided with a permanent and secure water supply that is sufficient for firefighting purposes.

Acceptable Solution 5

Reticulated Area A3.1

The development is provided with a reticulated water supply, together with fire hydrants, in accordance with the specifications of the relevant water supply authority and DFES.

A water main is planned to be installed along the western lot boundary, within the western road reserve. This will serve a fire services ring main which will connect a series of hydrants for each new building/stage. Specific placement of hydrants to support bushfire and structural firefighting purposes are to be negotiated with the Department of Fire and Emergency Services to ensure maximum benefit is achieved.

The provision of reticulated scheme water and firefighting hydrants satisfies Acceptable Solution A4.1

Performance Based Solution 1 **Element 3 Water**

Justification:

In order to supplement the reticulated water supply at the Masterplan stage, a dedicated 50,000 litre bushfire fighting water tank as well as a dedicated 500,000 litre structural firefighting water tank will be installed on site at the Masterplan stage. To achieve the required performance principle of Element 3; a performance based solution shall be applied.

Performance Based Solution:

Dedicated water tanks incorporating a dedicated firefighting water reserve for both bushfire and structural fire are proposed to provide additional /alternative water for firefighting efforts at the Masterplan Stage.

The tank incorporating the bushfire fighting supply shall have both full flow 50mm ball valve camlock couplings (positive pressure) in addition to 110mm stortz couplings to facilitate hard suction access for structural firefighting appliances. Firefighting water tanks will not be required during Stage 1 and will be installed at a later stage.

The provision of dedicated firefighting tanks demonstrates compliance with Performance Criteria P3 as "The development is provided with a permanent and secure water supply that is sufficient for firefighting purposes."

Future water tanks are subject to meeting the following requirements:

a) Standard:

1. Bush firefighting tank:

- i. volume: 50,000L dedicated bush firefighting reserve;

- i. 50mm camlock coupling with full flow ball valve suitable for local firefighting appliances in accordance with relevant standards from the Department of Fire and Emergency Services;
 - ii. above ground tanks are constructed of concrete or metal and the stands of raised tanks are constructed using non-combustible materials and heat shielding where appropriate (i.e. heat shielding will be required in the case of metal tank stands);
 - iii. incorporate an externally visible heat resistant float gauge; and
 - iv. hardstand and turn around area suitable for a 3.4 appliance are provided within 3 metres of each water tank.
2. Structural firefighting tank:
- i. volume: 500,000L dedicated structural firefighting reserve;
 - ii. 50mm camlock coupling with full flow ball valve for local firefighting appliances in accordance with relevant standards from the Department of Fire and Emergency Services;
 - iii. above ground tanks are constructed of concrete or metal and the stands of raised tanks are constructed using non-combustible materials and heat shielding where appropriate (i.e. heat shielding will be required in the case of metal tank stands);
 - iv. incorporate an externally visible heat resistant float gauge; and
 - v. hardstand and turn around area suitable for a 3.4 appliance are provided within 3 metres of each water tank.
- b) Implementation:
- i. All new dedicated rainwater tanks are required to meet the standards at the time of construction.
 - ii. The minimum 50,000L and 500,000L dedicated firefighting reserves shall be placed in the tanks at the time of buildings construction.
 - iii. The tanks will be installed at the Masterplan stage.
- c) Development:
- iv. It is the responsibility of the developer to ensure the firefighting tanks meets the required construction standards on installation.
- d) Maintenance:
- v. It is the responsibility of the Northshore Christian Grammar School to ensure that the rainwater tanks and firefighting valves are operational at all times.

4.4 Element 4 – Siting of Development

Intent: To ensure that the siting of development minimises the level of bushfire impact.

Performance Principle (P4): The siting (including paths and landscaping) of the development minimises the bush fire risk to life and property.

- i. A4.2 Hazard separation – low bush fire hazard level - There is no grassland within 20m of the development site.
- ii. A4.4 Hazard separation zone – All buildings will be constructed to AS 3959 to facilitate the reduced separation distance as described in Acceptable Solution 7.

Acceptable Solution 6

Hazard Separation – Moderate to Extreme Bushfire Hazard Level A4.1

Every building is sited a minimum distance of 100 metres from any vegetation classified in AS 3959 as forest, woodland, closed shrub, open shrub, mallee/mulga and rainforest and 50 metres from unmanaged grassland, or has its construction standard increased to align with the appropriate BAL for that location. Where a building cannot be located a minimum distance of 100m from the vegetation the building must be constructed to the higher standard as described in AS 3959.

Whereas separation of 100m from vegetation having a moderate or extreme hazard rating cannot be achieved within the lot boundaries, all future proposed buildings shall be constructed in accordance with AS 3959 and are sited to ensure a maximum BAL-29 rating, demonstrating compliance with Acceptable Solution A1.1 and A4.1.

Performance Based Solution 2

Building Protection Zone A4.3

The Building Protection Zone (BPZ) is a low fuel area immediately surrounding a building and is designed to minimise the likelihood of flame contact with buildings. Features such as driveways, footpaths, roads, vegetable patches, lawn or landscaped garden (including deciduous trees and fire resistant plant species) may form part of building protection zones. Areas of vegetation deemed Low Threat Vegetation and managed in a reduced fuel state inclusive of Public Open Space and nature strips may form part of a building's defendable space. Isolated shrubs and trees may be retained within building protection zones.

Acceptable Solution A4.3 standard for the building protection zone is modified to remove the reference to tree crowns being spaced in accordance with the BCA as the Building Code of Australia does not comment on landscaping measures. The BCA directly references AS 3959 - 2009 for the calculation of bushfire radiant heat flux, therefore AS 3959 - 2009 s2.2.3.2 (f) Low Threat Vegetation is subsequently used to define the standard required for vegetation within the building protection zone.

Justification:

Acceptable Solution A4.3 requires a minimum 20m BPZ to surround every building. In order to demonstrate increased safety of the Stage 1 development buildings and elements, the BPZ will be extended to 35m to ensure a maximum BAL-12.5 rating. In addition to the extended

BPZ, all Stage 1 buildings will be constructed in accordance with the enhanced requirements of BAL-29 in order to further increase the safety of future inhabitants.

The performance based solution exceeds the requirements of Acceptable Solution A4.3. It also disregards concessions provided by AS 3959 c3.5 Shielding, resulting in a further enhanced level of safety.

a) Standard:

- i. width: 35 metres measured from the chain link fence containing the Stage 1 boundary as shown on the Stage 1 Site Plan (Figures 2C & 3E) to achieve a maximum BAL-12.5 rating for Stage 1 of the development.
- ii. fuel load: reduced to and maintained at 2 tonnes per hectare and maintained in accordance with AS 3959 - 2009 s2.2.3.2 (f) stated here as:

"Including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks. NOTE: Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm)."

Note: priority species may be retained within the BPZ as part of an overall Low Threat landscaping design.

- iii. trees are low pruned at least to a height of 2 metres
- iv. no tall shrub or tree is located within 4 metres of a building (including windows)
- v. there are no tree crowns overhanging the building
- vi. fences and sheds within the building protection zone are constructed using non-combustible materials(e.g. colourbond iron, brick, limestone)
- vii. shrubs in the building protection zone have no dead material within the plant
- viii. tall shrubs in the building protection zone are not planted in clumps close to the building i.e. within 3 metres
- ix. trees in the building protection zone have no dead material within the plant's crown or on the bole.

a) Implementation:

Prior to the use of future buildings.

b) Development:

It is the responsibility of the developer to ensure the design standard is established.

c) Maintenance:

It is the responsibility of Northshore Christian Grammar School to ensure the design standard continues to be achieved at all times post completion of the development.

Acceptable Solution 7

Reduction in bush fire attack level due to shielding A4.5

Shielding provision may be applicable for future buildings within the school. However, the design of the school disregards concessions provided by AS 3959 c3.5 Shielding, resulting in an enhanced level of safety for future occupants.

4.5 Element 5 – Design of Development

Intent: To ensure that the siting of development minimises the level of bush fire impact.

Performance Criteria (P4): The design of the development is appropriate to the level of bush fire hazard that applies to the development site. Notes to P5: One way for residential development to meet this performance criterion would be compliance with AS 3959.

Acceptable Solution 8

Element 5 Design of Development

The proposed development complies or exceeds the standards of A4.1, A4.2, A4.3 and A4.4 thereby complying with A5.1.

Table 4A: Vehicle access technical requirements

Technical requirement	Public roads (NA)	Culs-de-sac (NA)	Battle-axes (NA)	Private driveways	Emergency access ways (NA)	Fire service access routes (NA)
Trafficable Surface (m)	6	6	4	4	6	6
Horizontal Clearance (m)	6	6	6	6	6	6
Vertical Clearance (m)	4	N/A	4	4	4	4
Maximum Grade	1 in 8	1 in 8	1 in 8	1 in 8	1 in 8	1 in 7
Maximum Grade over <50m	1 in 5	1 in 5	1 in 5	1 in 5	1 in 5	1 in 4
Maximum Average Grade	1 in 7	1 in 7	1 in 7	1 in 7	1 in 7	1 in 5
Weight Capacity (t)	15	15	15	15	15	15
Crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves Inner Radius (m)	12	12	12	12	12	12

4.6 Works and Responsibilities

Table 4B summarises the responsible party for each mitigation strategy and the time frame in which it must be completed.

Table 4B: Developer Schedule of Works

Strategy	Implementation		Maintenance	
	Responsible	Time Frame	Responsible	Time Frame
Amendments to BMP	Any amendments to this FMP shall be approved by the relevant Jurisdiction Having Authority.			
Building Protection Zone	Developer	Prior to use of buildings	NCGS	Ongoing
Firebreaks – Mineral earth (if required)	Developer	Prior to 15th November each year	NCGS	Ongoing
Firebreaks - Private roads acting as firebreaks)	Developer	Prior to use of buildings	NCGS	Ongoing
Battle axes	Developer	Prior to use of buildings	NCGS	Ongoing
Private Driveways	Developer	Prior to use of buildings	NCGS	Ongoing
Construction to AS 3959	Developer	On construction of all buildings	NCGS	Ongoing
Landscaping	Develop	Prior to use of buildings	NCGS	Ongoing
Firefighting Water – Hydrants	Developer	Prior to use of Stage 1 buildings	Water Corporation	Ongoing
Firefighting Water - Tanks	Developer	Subsequent to completion of Stage 1 and prior to construction of future stages	NCGS	Ongoing
Firefighting Services & Response	DFES and Local Government	Ongoing	DFES and Local Government	Ongoing
Fuel Load Reduction and Fire Break Notice	Local Government	Annually	Local Government	Annually
Inspection and Issue of Works Orders or Fines.	Local Government	Ongoing	Local Government	Ongoing

5.0 References

- Bureau of Meteorology. (2015). Climate Data Online. Retrieved from www.bom.gov.au.
- City of Wanneroo. (1998). Western Australia Development Design Specification D10: Bushfire Protection. City of Wanneroo, Western Australia.
- City of Wanneroo. (2001). District Planning Scheme No. 2. City of Wanneroo, Western Australia.
- City of Wanneroo. (2003). Guidelines for development and subdivision of land: Development design specifications. City of Wanneroo, Western Australia.
- City of Wanneroo. (nd). Protect your home and property from bushfires pamphlet. City of Wanneroo, Western Australia.
- Ellis, S., Kanowski, P., & Whelan, R. (2004). National Inquiry on Bushfire Mitigation and Management. Commonwealth of Australia, Canberra.
- FESA. (2010). Planning for Bush Fire Protection Guidelines 2nd Edition Perth: Western Australian Planning Commission Fire and Emergency Services Authority of Western Australia.
- RUIC Fire. (2013). Bushfire Attack Level Calculator v7.f.
- Standards Australia. (2009). AS 3959 - 2009 Construction of buildings in bushfire prone areas: SAI Global.
- Standards Australia. (2009). ISO AS 31000:2009 Risk management principles and guidelines: SAI Global.
- Standards Australia. (2013). HB89:2013 Risk management - Guidelines on risk assessment techniques (Vol. HB 89:2013). Sydney: SAI Global.
- Standards Australia. (2013). HB 436:2013 Risk management guidelines - Companion to AS/NZS ISO 31000:2009 (Vol. HB436:2013). Sydney: SAI Global.
- WAPC. (2006). State Planning Policy 3.4 Natural Hazards and Disasters. State Law Publisher.
- WAPC. (2013). Planning Bulletin 111/2013 Planning for Bushfire. Western Australian Planning Commission.
- WAPC. (2014a) Draft State Planning Policy 3.7 Planning for Bushfire Risk Management. West Australian Planning Commission.
- WAPC. (2014b) Draft State Planning Policy 3.7 Planning for Bushfire Risk Management Guidelines. West Australian Planning Commission.
- WAPC. (2014c) Draft State Planning Policy 3.7 Planning for Bushfire Risk Management Guidelines Appendices. West Australian Planning Commission, Department of Fire and Emergency Services.