S5 ENVIRONMENTAL

BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT PLAN

189 - 195 Teviot Road, Greenbank

Client: Mr Chin-Yuan Chang C/- Urbicus
Reference: S525221_BHAMP_v1.2
Date: 29/05/2026

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Quality Control

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Version Control

Version	Description	Date	Author	Reviewer	Approver
1.0	Final	26 March 2026	JD (EnvSc.)	DE (Snr. Ecologist)	RS (Director)
1.1	Modified Layout – Minor Updates	11 May 2026	JD (EnvSc.)	DE (Snr. Ecologist)	RS (Director)
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Disclaimer

S5 Consulting Pty Ltd trading as S5 Environmental has developed this Bushfire Hazard and Bushfire Attack Level Assessment, taking into consideration the Australian Standard (AS3959-2018) - Construction of Buildings in Bushfire-prone Areas, the State Planning Policy and relevant local authority policies and guidelines. However, there can be no guarantee that following the recommendations made in this assessment can guarantee safety of property and human life.

Fire is an element of nature, and as such fire events (small or large) can have disastrous outcomes even with the best planning in place. The authors of this report and S5 Consulting Pty Ltd accept no responsibility for any harm to property or human life caused by fire or any other cause to persons utilising property or structures.

Abbreviations

AS 3959-2018	*Australian Standard 3959-2018 Construction of Buildings in Bushfire-prone Areas*
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BMP	Bushfire Management Plan
BMZ	Bushfire Management Zone
BPA	Bushfire Prone Area
BRC	Bushfire Resilient Communities (The State of Queensland 2019b)
CFA	Country Fire Authority
EPZ	Environmental Protection Zone
FFDI	Forest Fire Danger Index
ha	Hectares
LCC	Logan City Council
PDA	Priority Development Area
PFLI	Potential Fire Line Intensity
QFD	Queensland Fire Department
RE	Regional Ecosystem
RFS	Rural Fire Service
SEQ	South East Queensland
SPP	*State Planning Policy, 2017*
VHC	Vegetation Hazard Class

1.0 INTRODUCTION

S5 Environmental was commissioned by Urbicus, on behalf of their client Mr Chin-Yuan Chang to undertake a Bushfire Hazard Assessment and Management Plan (BHAMP) as part of supporting documentation for a proposed townhouse development at 189-195 Teviot Road, Greenbank, refer to **Table 1**.

The aim of this BHAMP is to undertake a site-specific bushfire hazard assessment, determine any set back required between the proposed development and any hazardous vegetation identified, and prepare a Bushfire Management Plan to ensure the proposed development is not exposed to an unacceptable bushfire risk and can comply with relevant legislative bushfire requirements.

Table 1. Site Description

Street Address	189-195 Teviot Road, Greenbank	**Lot on Plan**	Lot 17 on RP210430
LGA/State	Logan City Council (LCC) Economic Development Queensland (EDQ)	**Area**	2.005 ha
Zone	Priority Development Area (PDA)	**Priority Development Area**	Greater Flagstone
Current State	Lot 17 on RP210430, herein referred to as the 'subject site', is located within the Greater Flagstone Priority Development Area (PDA). The site currently contains a single unoccupied dwelling with associated outbuildings (e.g. sheds). The lot is moderately vegetated, with the eastern portion largely cleared and comprising non-remnant vegetation. Access into the site is provided via an existing crossover and driveway off Teviot Road along the eastern boundary. The western extent of the site contains areas of native regrowth. The surrounding area is experiencing significant urban densification. Teviot Road has recently been upgraded from two to four lanes in conjunction with a major residential development to the east. The lots to the north plus the south-east (at the corner of Leanne Court and Teviot Road, have approved development applications, and the adjoining lot to the south is subject to a subdivision application which is advanced in the decision process. These surrounding approvals and proposals where they are well advanced, have been considered as part this assessment (refer to **Figure 1**).		
Proposed Development	S5 Environmental understands that Urbicus are assisting their Client, Mr Chin-Yuan Chang, with a Development Application for the subject site located at 189-195 Teviot Road, Greenbank. It is also understood that the Client intends to lodge a Development		

Application with Economic Development Queensland (EDQ) for a townhouse proposal on the site.

The development is proposed to comprise three stages: a 1 into 5 lot subdivision at Stage 1 (plus a road reserve for Kobee Street, traversing through the western extent and connecting the adjacent lots to the north and south. Stage 2 is the development of the townhouses in the western extent, on the proposed lots 1, 2 and 4 (townhouses 72 – 86), with these townhouses on new lots, plus the park dedication and stormwater treatment and detention basin in proposed lot 3 in the south-western corner. Stage 3 comprises the balance of the townhouses in the proposed lot 5 (townhouses 1 – 71).

Access to the development is proposed via the internal road network of the approved subdivision to the north, as well as through future connections to the internal roads of the proposed development to the south. The northern adjoining development connects to Teviot Road via a newly constructed road, while the southern development is accessed via Leanne Court, which has a new signalised intersection with Teviot Road.

The park dedication area on the proposed lot 3 which will also incorporate the stormwater management area, will connect to the proposed Environmental Protection Zone on the adjacent lot to the south. Refer to **Figures 2 and 3** for the proposed development layout.

Figure 1. Site Aerial (source: Nearmap, date:03.12.2025)

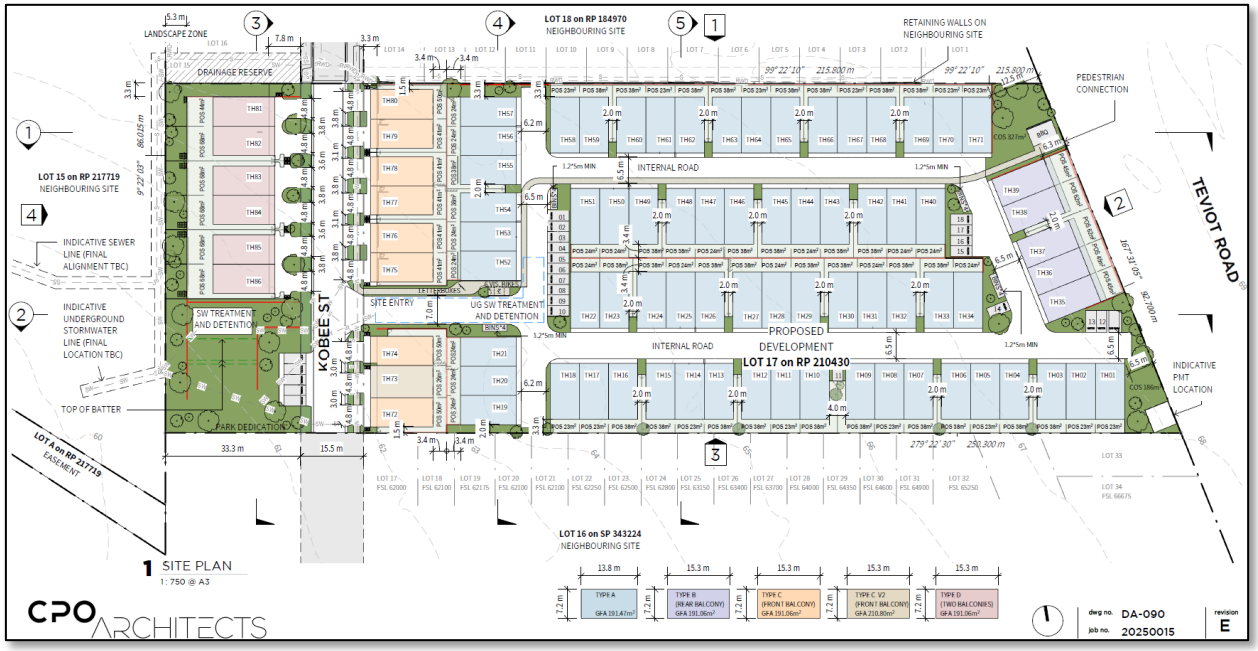

Figure 2. Proposed Plans (source: CPO Architects, DA-090, 20250015 Rev E.)

Figure 3. Proposed Site Layout (source: CPO Architects, DA-090, 20250015 Rev E.)

2.0 STATUTORY REQUIREMENTS

2.1 Development Applications in Bushfire Prone Areas

Bushfire Prone Areas are identified at both the State and Local Government Level. The State Planning Policy (SPP) Bushfire Prone Area map was developed by CSIRO to map areas with Very High, High and Medium Potential Bushfire Intensity. The SPP also maps a 100 m Potential Impact Buffer. The site is located within a Priority Development Area and as such will be assessed under the SPP: Safety and Resilience to Hazards, including Natural Hazards, Risk and Resilience – Bushfire Prone Areas, noting that the *Logan Planning Scheme 2015* has integrated all aspects of the SPP. The SPP Bushfire Prone Areas Overlay map, was consulted to determine the preliminary bushfire hazard ratings of the site and locality (within 150 m).

The SPP maps the western extent of the subject site, extending northward, as containing medium potential bushfire intensity. Additional medium intensity patches are mapped to the south and east, with the corresponding potential impact buffer covering the balance of the subject site and the wider assessment area (a 150 m buffer off the townhouses within the proposed development footprint). Refer to **Figure 4**.

The areas mapped as medium potential bushfire intensity to the north and east of the site overlaps land that has recently been cleared or developed for urban purposes.

Given that potentially hazardous vegetation is mapped both within and surrounding the proposed development area, a more detailed investigation of the site-specific bushfire hazard characteristics has been undertaken to determine the actual bushfire hazard present.

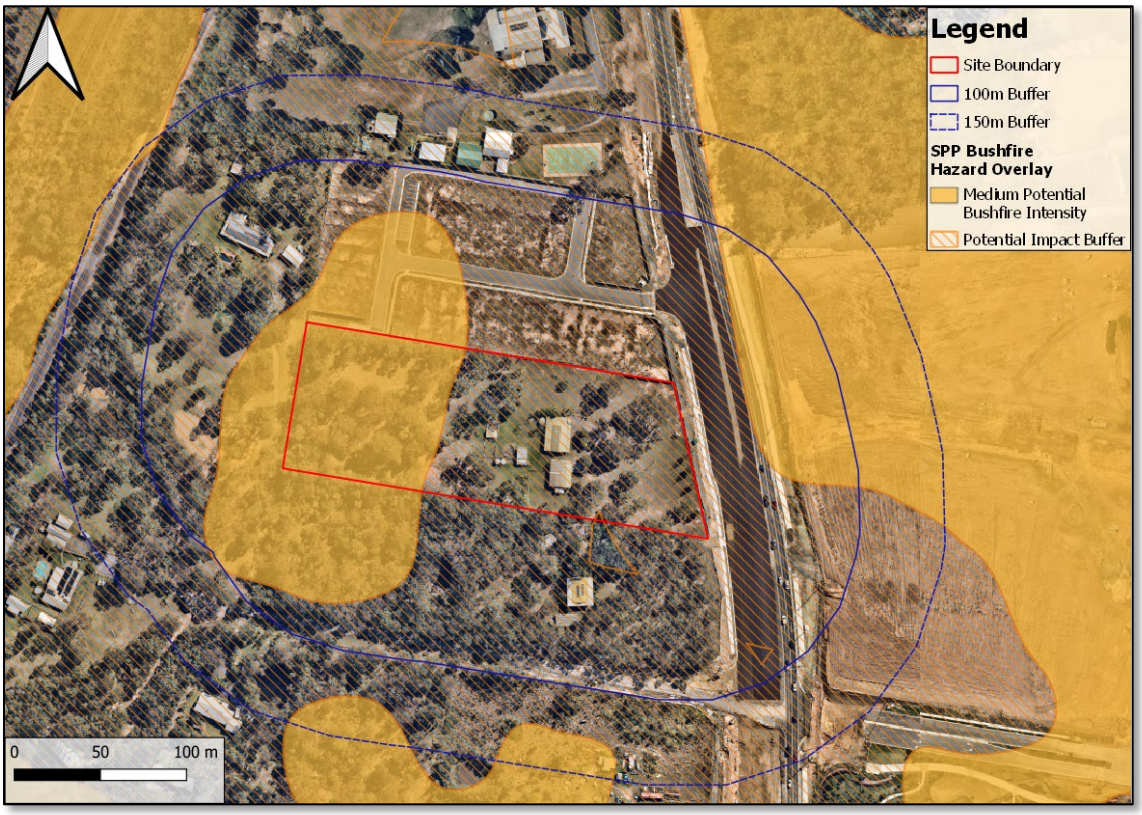

Figure 4. SPP Bushfire Prone Areas Mapping within and in Proximity to the Site

3.0 METHODOLOGY

3.1 Bushfire Hazard Assessment

The SPP Potential Bushfire Intensity classifications are based on the *New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland* (Leonard *et al.* 2014). This State-wide mapping methodology was developed to identify Bushfire Prone Areas in support of bushfire hazard provisions of Queensland's State Planning Policy. The new methodology scales bushfire hazard based on the Potential Fire-line Intensity (PFLI) of a severe bushfire and can be used to predict the radiation profile of areas located adjacent to potentially hazardous vegetation and an associated Potential Impact Buffer.

Accordingly, the classification of an area's PFLI is calculated as a combination of the following three metrics, using the below equation (Leonard *et al.* 2014):

- Total fuel load (W);
- The McArthur Forest Fire Danger Index (FFDI), and
- Maximum Landscape Slope (θ in ^{o}).

$$FI = 0.62\, W^2\, FFDI \exp(0.069\, \theta)$$

For the purposes of the bushfire hazard assessment, S5 Environmental have utilised data from the Queensland Fire Department (QFD) published to the Queensland Government's Queensland Spatial Catalogue (QSpatial) for fuel load and FFDI. PFLI is delineated into a number of hazard categories shown in **Table 2**, and each patch of hazardous vegetation can be classed as Very High, High, Medium, Grassland or low hazard according to the PFLI determined for that specific patch. Any patch of hazardous vegetation classed as Very High, High or Medium is buffered by 100 m called the Potential Impact Buffer.

The Potential Impact Buffer is also considered a Bushfire Prone Area, along with hazardous vegetation with a PFLI of Very High, High or Medium. Any development within a bushfire prone area requires further assessment of radiant heat exposure, assessment against the relevant local planning scheme bushfire code and/or an assessment against the SPP assessment benchmarks for Natural hazards, risk and resilience relevant to bushfire and the development of a site-specific bushfire management plan to ensure that the proposed development is exposed to an acceptable or tolerable bushfire risk.

Table 2. Potential Bushfire Intensity Classification

Potential Bushfire Intensity Class	Potential Fire-line Intensity (PFLI)
Very high	>40,000kW/m
High	20,000 – 40,000kW/m
Medium	4,000 – 20,000kW/m
Low	<4,000kW/m

3.2 Modification of Potential Intensity of Small Patches and Corridors

Using the Bushfire Resilient Communities (BRC) methodology in Section 4.2.6 (The State of Queensland 2019b), small patches and narrow corridors of hazardous vegetation were removed from the map of hazardous vegetation within 150 m of the proposed development. This is as small, isolated and/or narrow patches of hazardous vegetation are not large enough to support a fully developed fire. As stated in the BRC methodology (The State of Queensland 2019b), small, isolated or narrow patches are unlikely to reach a potential fire-line intensity greater than 4,000 kW/m^2 and as such, are considered to be low hazard and not classed as a Bushfire Prone Area. The *SPP Technical Reference Guide - Bushfire Resilient Communities* (2019) summarises research by Leonard and Opie (2017) outlines four steps to filter out small patches and narrow corridors of continuous fuel (see **Table 3** below).

Table 3. Steps to Downgrade Bushfire Intensity

Step	Description
1	Remove small, isolated patches of **continuous** fuel (< 1 ha) surrounded completely by either discontinuous fuel or no fuel. These patches must be further than 100 m from other continuous fuel patches greater than 2 ha in area.
2	Downgrade intensity of small patches (0.5 to 3 ha) of **continuous** vegetation surrounded completely by either discontinuous or no fuel, which is more than 100 m from other **continuous** fuel patches greater than 2 ha in area.
3	Remove narrow corridors of **continuous** fuel (less than 50m in width). The process erodes, then dilates by 25 m in width all **continuous** fuel patches in relation to **discontinuous** areas.
4	Remove small fragments (< 0.5 ha) of shrub-dominated or hazardous tree vegetation.

3.3 Radiant Heat Exposure Assessment

Radiant heat exposure for the proposed development was calculated using a Method 2 from the AS 3959-*2018 Construction of Buildings in Bushfire-prone Areas*. This Method 2 calculates the Bushfire Attack Level (BAL) for a proposed development by determining the minimum distance between hazardous vegetation and the development to achieve each BAL level. As BAL directly correlates to radiant heat exposure, this calculation reflects the level of bushfire risk for a proposed development (see **Table 4 and Figure 5**).

To determine the radiant heat exposure for the proposed development, the online Flamesol Minimum Distance Calculator (FPA, 2023) was used to determine the required setbacks to hazardous vegetation to achieve an acceptable radiant heat exposure for the proposed development.

Currently, S5 Environmental understand there is one set of inputs for a Method 2 calculation in accordance with AS3959-2018 or Bushfire Resilient Communities (BRC), which are accepted by LCC. Accordingly, the inputs to the BAL/radiant heat exposure assessment used for the purposes of this assessment are summarised in **Table 5,** below. This approach and set of inputs are generally more conservative and accurate as they incorporate higher fuel loads and flame temperature, as well as a site specific FFDI.

Table 4. BAL and Radiant Heat Exposure

BAL Score	Radiant Heat Exposure
Low	-
12.5	12.5 kW/m^2
19	19 kW/m^2
29	29 kW/m^2
40	40 kW/m^2
Flame zone (FZ)	> 40 kW/m^2

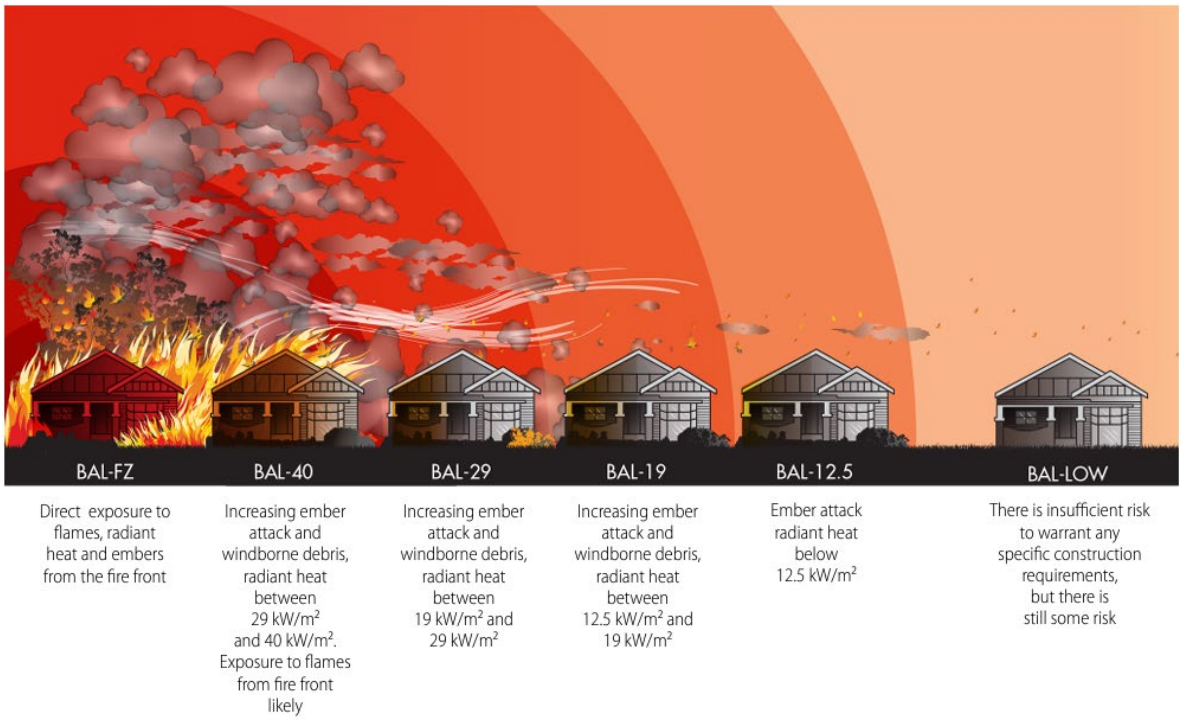

Figure 5. Bushfire Attack Levels (BAL) (Source: WAPC, 2024)

Table 5. Parameter inputs for Method 2 from AS3959-2018

Parameter	AS Method 2
Surface fuel load (t/ha)	Surface fuel load for identified VHC (surface + near surface)
Overall fuel load (t/ha)	Total fuel load for identified VHC
Flame temperature	1,200 K
FDI/FFDI	From BRC MapViewer/QSpatial
Standard inputs	Bushfire Resilient Communities (QG 2019b)
Effective slope	Measured as the slope under the hazardous vegetation.
Site slope	Measured as the slope between the hazardous vegetation and the site.
Flame Width	Flame width is assumed to be 100 m (AS 3959-2018) unless a short-fire run.

3.4 Short Fire Run

Small or narrow patches of hazardous vegetation are unlikely to support a fully developed bushfire due to their limited size (see **Figure 6** for a schematic representation of how fire moves across a landscape, demonstrating this). As such, the flame width and height in these small patches will not reach the standard inputs for the Method 2 from AS3959-2018 as these standard inputs are based on a fully developed bushfire. In these cases, a short fire run calculation can be used. The short fire run methodology can only be applied when there is a maximum fire run of 150 m as measured on the effective slope. In these cases where a short fire run can be justified, and thus a reduced flame width and height for a Method 2 calculation, the method from the *Short Fire Run: Methodology for Assessing Bush Fire Risk for Low Risk Vegetation* (NSW Rural Fire Service, 2019) is adopted. This methodology has **not** been utilised for this assessment.

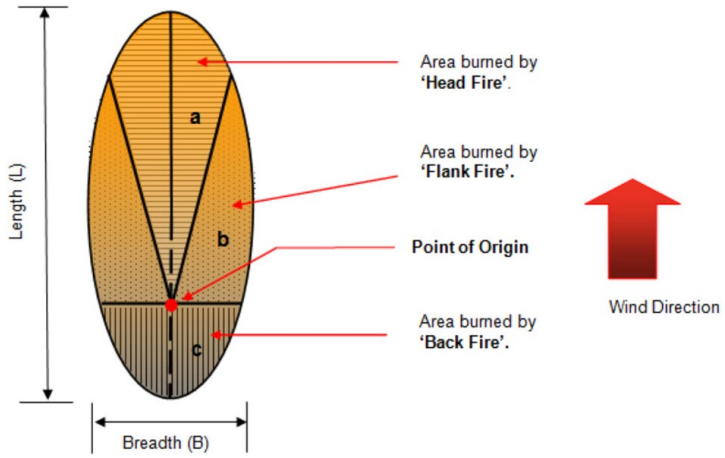

Figure 6. Schematic Diagram of Simple Elliptical Fire Growth Model (Van Wagner 1969) from NSW Rural Fire Surface (2019)

The Short Flame Run formula utilised to calculate the flame width is as follows:

$$\frac{Length\ of\ Vegetation\ along\ effective\ slope\ (xx\ m)}{1.0 + 0.0012\ (Wind\ speed\ (30km/hr)^{2.154}} = Flame\ Width\ (xx\ m)$$

4.0 BUSHFIRE HAZARD ASSESSMENT

4.1 Potential Fire-line Intensity Assessment

In accordance with *A New Methodology for State-wide mapping of bushfire prone areas in Queensland* (Leonard *et al.* 2014), fuel loads derived from ground-truthed Vegetation Hazard Classes (VHCs), effective slope and FFDI were used to calculate the PFLI of hazardous vegetation within 150m of the proposed development and hazardous into the relevant PFLI category. The following sections discuss how these parameters were determined to calculate PFLI for hazardous vegetation in the investigation area.

4.1.1 Vegetation Hazard Class Mapping

In accordance with the *New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland* (Leonard *et al.* 2014), potential fuel loads are assigned to vegetation categories (VHCs) by amalgamating land use and vegetation types with a moderately consistent fuel load and structure.

The potential fuel load assigned to each VHC is intended to reflect the upper range of fuel loads expected for the characteristic vegetation types, landscape features and site conditions for the class. It is based on an estimate of the ***80th percentile (%) fuel load of the "long unburnt condition"*** for the class (typically greater than 10 years without burning).

Using the QFD BRC MapViewer, numerous VHCs were mapped within and adjacent to the subject site, an extract is shown below in **Figure 7.**

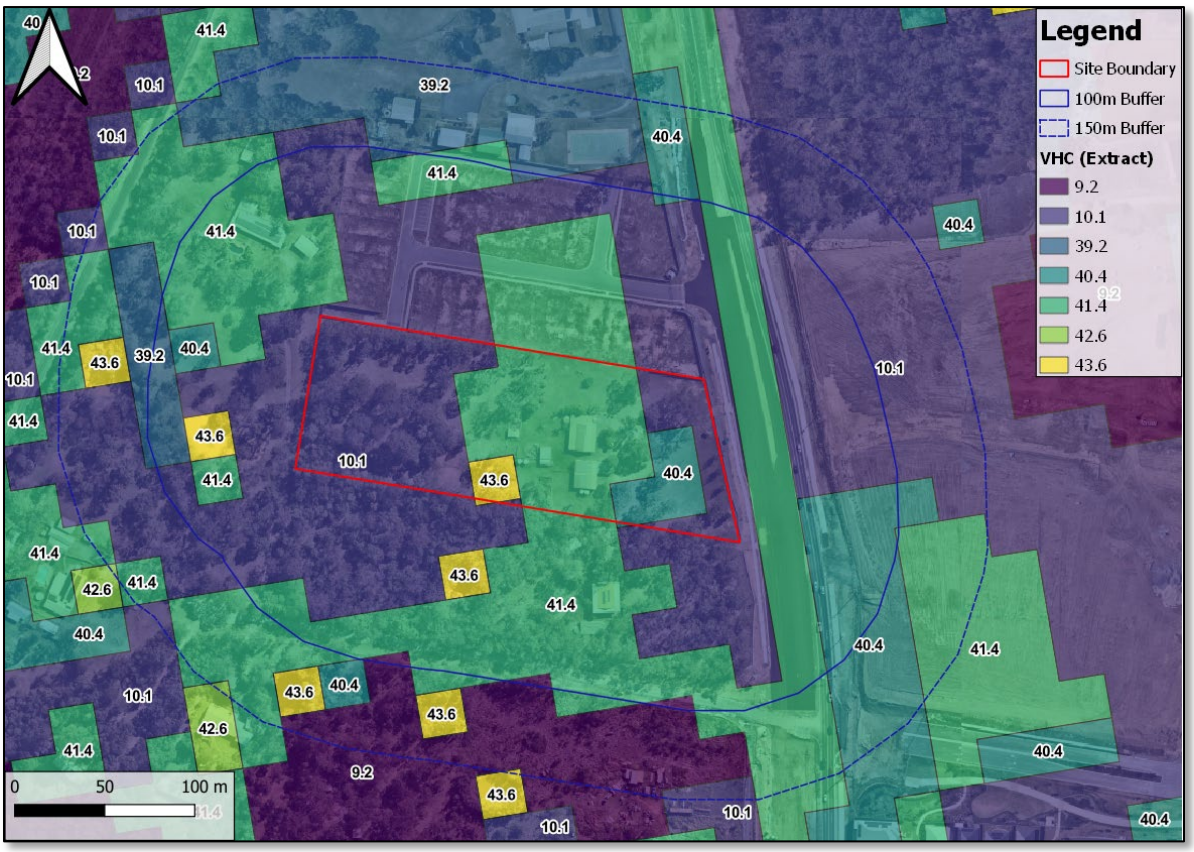

Figure 7. Extract of Vegetation Hazard Classes from the BRC MapViewer

4.1.2 Vegetation Hazard Class Verification

To verify the State Government's mapped Vegetation Hazard Classes (VHCs) within and adjacent to the subject site, S5 Environmental Ecologists conducted a site inspection on the 8th January 2026, and subsequently undertook a Reliability Assessment in accordance with the BRC methodology, comparing available bushfire and vegetation mapping against observed on-ground conditions. The reliability assessment incorporated a comprehensive review of available aerial imagery and overlay mapping for the site and a 150 m buffer surrounding the proposed development.

The subject site has been state mapped with VHC 41.4 '*discontinuous low grass or tree cover*', through the central portion corresponding with the dwelling and associated structures, a small area of VHC 40.4 '*continuous low grass or tree cover*' extends off this to the east. The western portion and along the eastern boundary are mapped under VHC 10.1 '*spotted gum dominated open forests*'. Post-development the site will be largely cleared with a high density of townhouses, and therefore the VHC has been modified to VHC 42.6 '*nil to very low vegetation cover*' to reflect this future state. The south-western corner will be open space and the stormwater management area, it has been modified to VHC 9.2 '*moist to dry eucalypt woodland on coastal lowlands and ranges*', which is in line with the retained vegetation on the adjoining lot to the south which reflects the ground-truthed Regional Ecosystem (RE) of 12.9-10.12 on the adjacent lot, with that area potentially undergoing a level of rehabilitation consistent with this RE.

The adjoining lots to the north and south have either approved development applications (north) or applications which have progressed to an advanced stage of the approval process (south), both of which have new internal roads which connect with the subject site. These, along with the upgraded Teviot Road corridor and new development east of Teviot Road, have a modified VHC 42.6 to reflect their current and future condition. The remaining remnant vegetation east of Teviot Road retains the mapped VHC 10.1.

To the west is a large-residential lot which has large areas of scattered canopy of a maintained grass understorey. A small area of denser tree cover is adjacent to a large dam. VHC 41.4 has been assigned over the maintained areas and VHC 10.1 has been retained over the denser areas where the maintained understorey is absent. Dams throughout the investigation area have been assigned VHC 43.6 '*waterbodies or very low vegetation cover*'.

To the south-east, a large lot on the corner of Leanne Court and Teviot Road has an approved commercial centre fronting Teviot Road along with a larger masterplan with vegetation clearing approval across the entirety of the site which has already been subject to a level of clearing, it has been modified to VHC 42.6 to reflect the approved future development. The balance of the area to the south the mapped VHCs of 10.1, 9.2, 41.4 and 43.6 have been retained but refined, to reflect the on-ground conditions.

The VHC mapping has, therefore, been modified to reflect the on-ground conditions more accurately, and to reflect the post-development state of the subject site and locality (see **Figure 8**). As spatially indicated in **Figure 8**, the modified VHCs have been restricted to a 150 m buffer from the development area, as the more distant areas are not relevant for the purposes of this Bushfire Hazard Assessment.

Plates 1 to **6** below show the various areas and communities existing across the site and throughout the assessment area.

Plate 1. View through the eastern portion of the site toTeviot Road.

Plate 2. Adjoining lot to the north, cleared for development.

Plate 3. View west along Leanne Court.

Plate 4. Western extent of the subject site.

Plate 5. Patch of vegetation to be retained on the adjoining lot, south of the stormwater retention area (VHC 9.2).

Plate 6. Adjoining lot to the west, VHC 41.4 with a patch of VHC 10.1 on the far side of the dam.

Figure 8. Ground-truthed and Post-development Vegetation Hazard Classes

4.1.3 Fuel Loads

Table 6 below, summarises the associated fuel loads of the final VHCs in relation to the proposed development.

Table 6. Summary of VHCs and their Associated Fuel Continuity and Loads

VHC	VHC Description	Fuel Continuity	Potential Fuel Load * (t/ha)
			Total
9.2	Moist to dry eucalypt woodland on coastal lowlands and ranges	Continuous	17.2
10.1	Spotted gum comminated open forests	Continuous	20.8
39.2	Low to moderate tree cover in built-up areas	Discontinuous	8
41.4	Discontinuous low grass or tree cover	Discontinuous	3
42.6	Nil to very low vegetation cover	Discontinuous	2
43.6	Water bodies or very low vegetation cover	Discontinuous	0

*CSIRO A Methodology for State-wide Mapping of Annual Fuel Load and Bushfire Hazard in Queensland. Glenn Newnham, Kimberley Opie, Justin Leonard CSIRO Land and Water, 2017.

After ground-truthing the VHCs within the assessment area, continuous VHCs were rasterized to undergo the processing stages. Continuous and discontinuous fuel VHCs are defined as:

- **Continuous**: Vegetation and land uses which possess generally consistent fuel loads which can develop a full flame front; and
- **Discontinuous**: Vegetation and land uses which possess fuel loads which are incapable of supporting a full flame front.

The rasterization process extracts the attribute value of the polygon which occupies the centre of the raster pixel (a 25 m by 25 m cell) and uses it to populate the same cell within a raster layer. This will result in continuous VHCs within the assessment area being rasterized whilst discontinuous VHCs remain un-rasterized. Refer to **Figure 9**.

4.1.4 Modification of Potential Intensity of Small Patches and Corridors

Following the rasterization of the continuous VHCs as outlined above (i.e., VHCs 9.2 and 10.1), S5 Environmental have applied Step 3 in accordance with the downgrading stages outlined within both Leonard and Opie (2017) and BRC (2019). Step 3 is separated into two parts:

A. the shrinking of continuous fuel load pixels adjacent to discontinuous fuel loads (i.e., continuous fuel pixels adjacent to discontinuous fuel are removed); and
B. the dilation of residual continuous fuel patches by one pixel (i.e., residual continuous fuel pixels are dilated back out one pixel).

This will result in the removal of narrow corridors less than 50 m in width (< 3 pixels), as following the initial shrinking of continuous fuel pixels adjacent to discontinuous vegetation (Step 3A), no residual pixels associated with the narrow corridor will remain and dilation cannot occur (Step 3B). Refer to **Figure 9** and **Figure 10**. Corridor widths are checked in GIS and are only removed through downgrading where they are < 50m in width.

Following the implementation of the processing stages, A number of narrow corridors and a small patch, associated with the VHC 9.2 and 10.1 to the west, have been downgraded. A patch of VHC 9.2 to the south was identified as the potentially hazardous vegetation in the investigation area. The pixelated form of the finalised continuous vegetation is to be utilised within the PFLI calculations in **Section 4.1.7** and was smoothed to reflect ground-truthed conditions. Refer to **Figure 11** and **Figure 12**.

Figure 9. Shrinking of patches of continuous fuel at the interface with non-continuous fuel

Figure 10. Step 3b – Dilation of residual continuous fuel patches

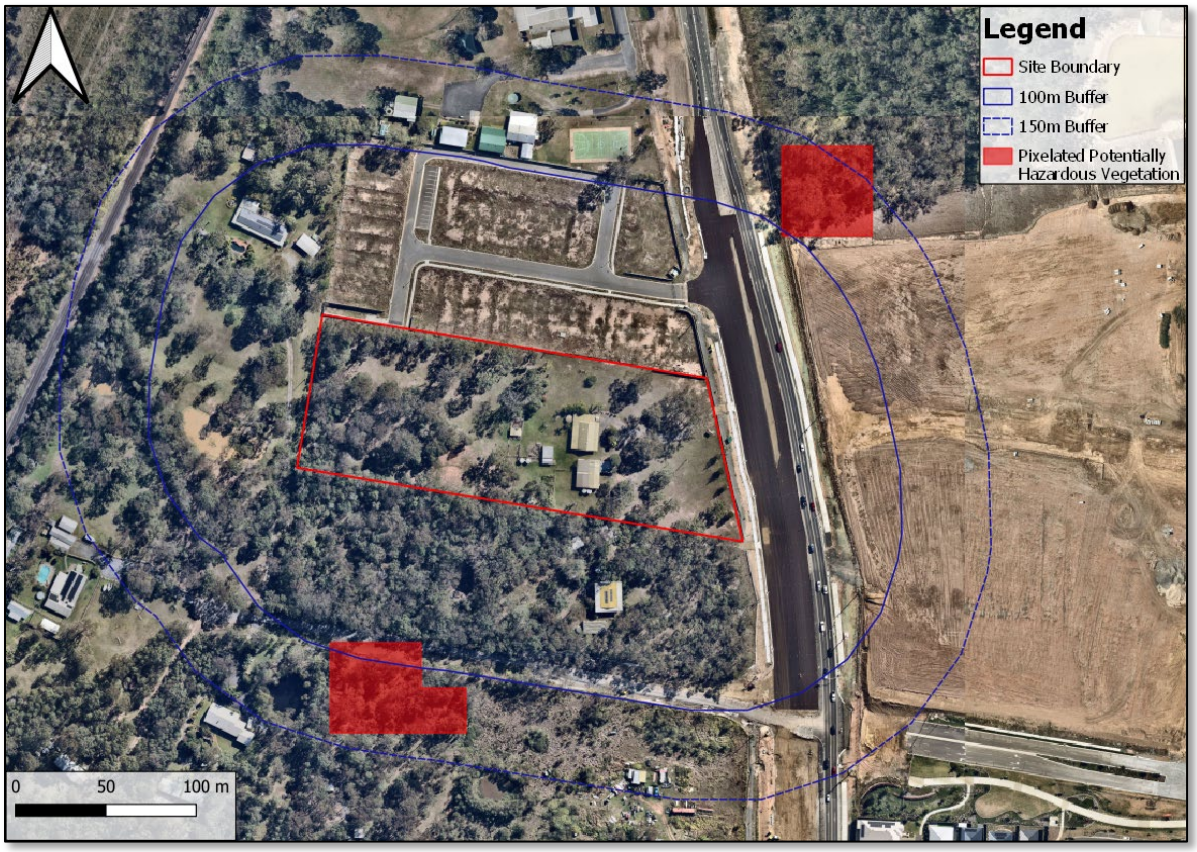

Figure 11. Finalised pixelated hazardous vegetation within the assessment area (nearmap 8/12/24).

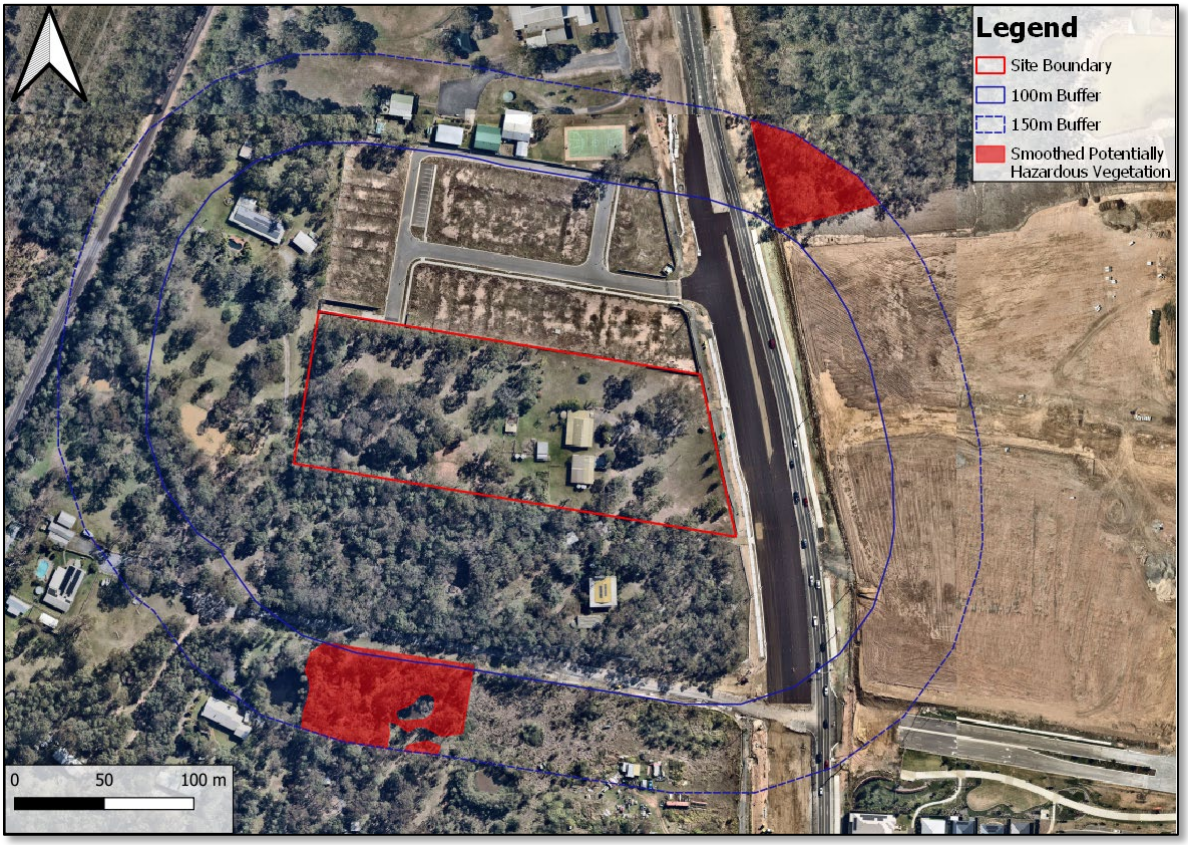

Figure 12. Smoothed hazardous vegetation to reflect ground-truthed conditions and vegetation

4.1.5 Slope Assessment

The slope of vegetated land over which a bushfire passes has a strong influence on both the intensity and rate of spread of the bushfire. From a bushfire hazard assessment perspective, the relevant slopes to consider are the slopes beneath areas of potentially hazardous vegetation, defined as "effective slope" in AS 3959-2018, that would be retained within or adjacent to the proposed development site. Also relevant, is whether the vegetated land is situated upslope or downslope of the proposed development. As fire travels faster upslope, there is a significant reduction in risk and fire-line intensity for sites that sit below the vegetation. The potentially hazardous vegetation to the south was determined to be at the same elevation as the proposed development, as was the slope under the hazardous vegetation (effective slope) present within the assessment area. Measurements for effective and site slope (the area between the development and the hazardous vegetation) for the BAL setback calculations (refer to **Figure 13** and **Appendix B**).

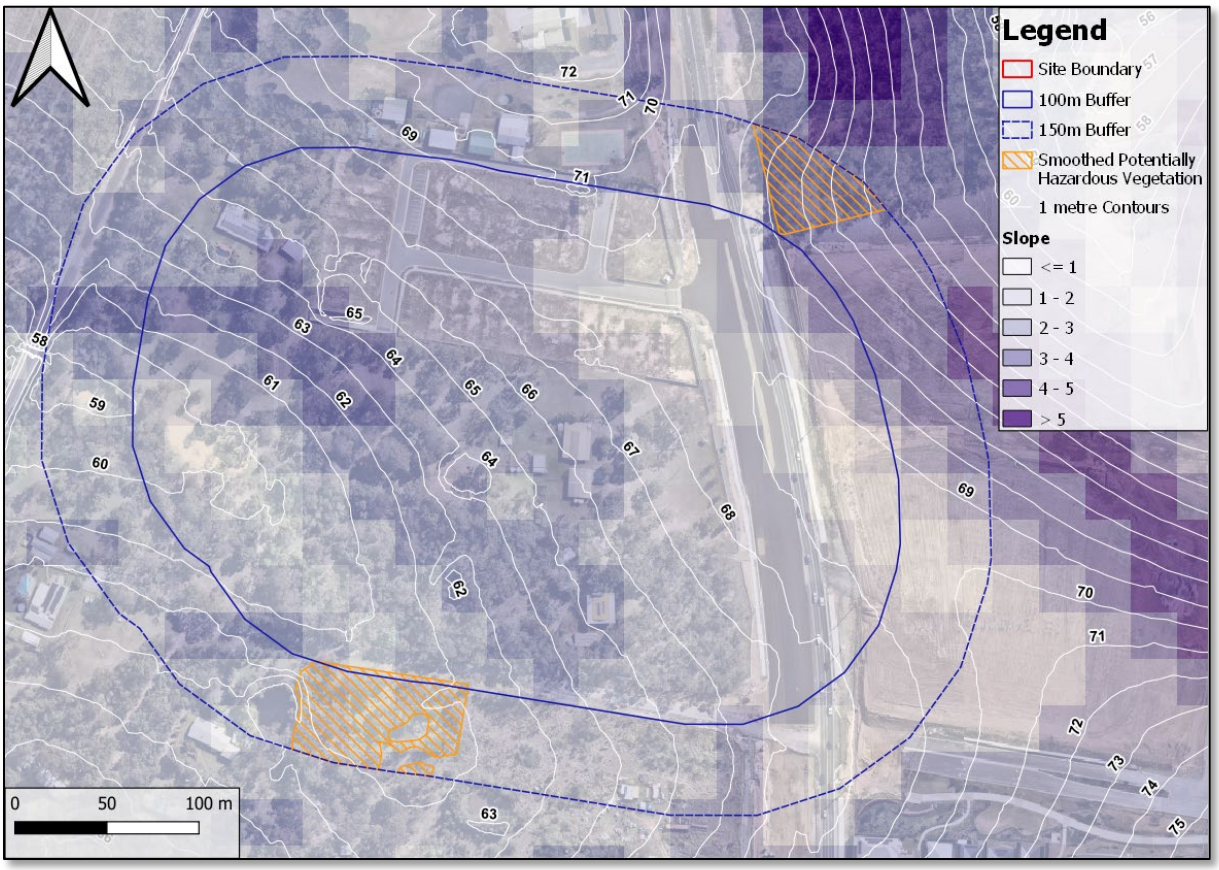

Figure 13. Slope within and in Proximity to the Proposed Development

4.1.6 Forest Fire Danger Index

In accordance with the Australian Standard (AS) 3959-2018, *Construction of Buildings in Bushfire Prone Areas*, the Fire Danger Index (FDI) indicates the chance of a fire starting, its intensity, rate of spread and the difficultly of its suppressions, according to several combinations of relative humidity, air temperature, wind speed as well as long- and short-term drought effects. The QFD BRC MapViewer indicates that the site-specific Forest Fire Danger Index (FFDI) for the subject site is split **55/56**. The higher value of **56** has been adopted for the setback calculations.

4.1.7 Potential Fire Line Intensity

A calculation of the Potential Fire Line Intensity (PFLI) calculation was undertaken using the PFLI equation in **Section 3.1**, for the potentially hazardous vegetation identified in **Section 4.1**. Based on this PFLI calculation, the potentially hazardous vegetation to the south of the proposed development was mapped to contain areas of medium potential bushfire intensity (i.e., 4,000 to 20,000 kW/m), associated with VHC 9.2. Refer to **Figure 14**.

4.2 Hazardous Vegetation

Vegetation mapped as VHC 9.2 to the south of the Leanne Court and the proposed development area was determined to be the hazardous vegetation within the assessment area.

As this vegetation is within 100 m of the proposed development area, the proposed residential subdivision is therefore within a Bushfire Prone Area. As such, a Bushfire Attack Level (BAL) assessment has been conducted to determine the radiant heat flux and BAL the future Lots may be exposed to.

The vegetation associated with VHC 10.1 east of Teviot Road is over 100m from the proposed townhouses and is therefore excluded from further assessment.

Figure 14. Potential Fire Line Intensity (PFLI)

5.0 BUSHFIRE ATTACK LEVEL ASSESSMENT

This BAL assessment has focused on the potential impact of a fire event in hazardous vegetation located within 100 m of the subject site. Hazardous vegetation in relation to the proposed development was determined to be the vegetation to the south of the development area (refer to **Figure 14**). A Method 2 assessment in accordance with AS3959-2018 utilising the online Flamesol Minimum Distance Calculator was undertaken to determine the required setbacks from hazardous vegetation to the south of the proposed development (see **Table 7** and **Figure 15** and **Figure 16**). Refer to **Appendix B** for inputs and outputs from the Flamesol Minimum Distance Calculator.

Table 7. Summary of Setbacks and Radiant Heat Exposure for the Proposed Development

Radiant Heat Exposure (kW/m^2)	BAL	Distance from Hazardous Vegetation
-	Low	100 m
12.5	12.5	29.5 m
19	19	20.7 m
29	29	14.1 m
40	40	10.4 m
> 40	FZ	< 10.4 m

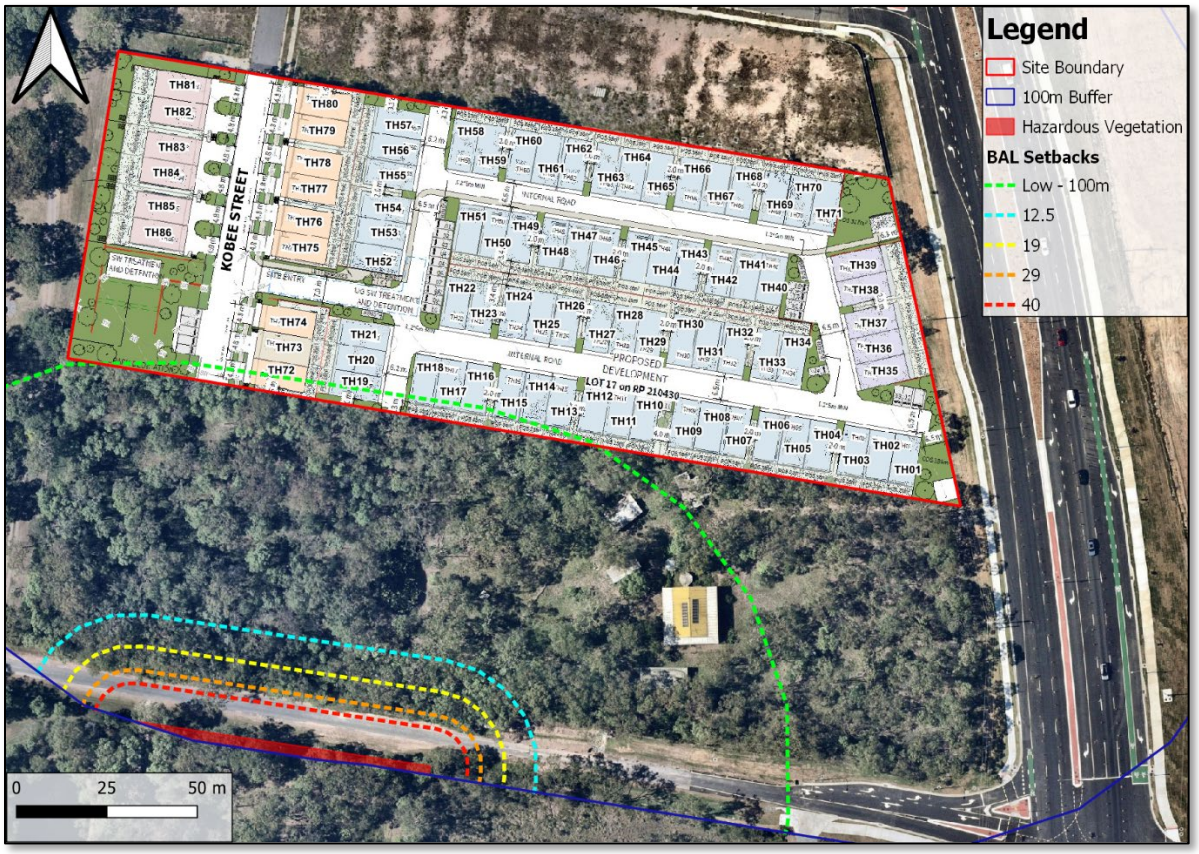

Figure 15. Radiant Heat Flux Setbacks

Figure 16. BAL as Applicable Over the Proposed Development

Based on the results of the radiant heat exposure assessment, 7 townhouses will achieve BAL 12.5, with the balance of the site outside of the bushfire prone area, being greater than 100m from the hazardous vegetation to the south.

Townhouses 14, 15, 16, 17, 18, 19 and 72 along the southern boundary are intersected by the BAL-Low (100m) contour line, and as such are located in the BAL 12.5 zone. Yards for townhouses 12 and 13 are also intersected by the BAL 12.5 area. As these townhouses are connected to other townhouses and townhouse blocks are located in close proximity to other blocks, despite their being located outside the bushfire prone area, it is recommended that advice from a building certifier or architect are obtained into the BAL construction requirements of adjacent buildings. Refer to **Table 8**.

It is important to note that although a dwelling and associated structures (where a non-habitable structure has not achieved the appropriate setback from a habitable structure) may straddle BAL contours, the highest BAL the structure is in, is the applicable BAL for construction purposes.

Hazardous vegetation lies outside of the subject site, and post-development and construction of the development to the south further shields the development from the hazard. As such a formalised Asset Protection Zone has not been prescribed for the site.

Table 8. BAL Requirements for Proposed Lots

Townhouse	Applicable BAL Score
14, 15, 16, 17, 18, 19, 72	**12.5**
1 – 13, 20 – 71, 73 - 86	**Low** *Outside of the Bushfire Prone Area*

As the development has been determined to be located within a bushfire prone area, a Bushfire Management Plan has been prepared and is presented in **Section 6.0**.

6.0 BUSHFIRE MANAGEMENT PLAN

This Bushfire Management Plan (BMP) identifies management measures that must be implemented to ensure that the risk of bushfire attack is reduced to an acceptable level. It is first important to understand the processes that influence bushfire behaviour (**Section 6.1**), and the sources of damage that threaten people, infrastructure and property (**Section 6.2**).

6.1 Bushfire Behaviour

Understanding bushfire behaviour is imperative when planning new development. There are three main factors which influence fire behaviour as follows:

1) Topography

Slope influences the speed and intensity of a fire. Fire is known to burn faster uphill as flames and radiant heat preheat the vegetation ahead of the fire, drying it out and making it increasingly flammable. As a rule of thumb, for every 10 degrees slope, fire doubles in speed. Refer to **Figure 17**, below.

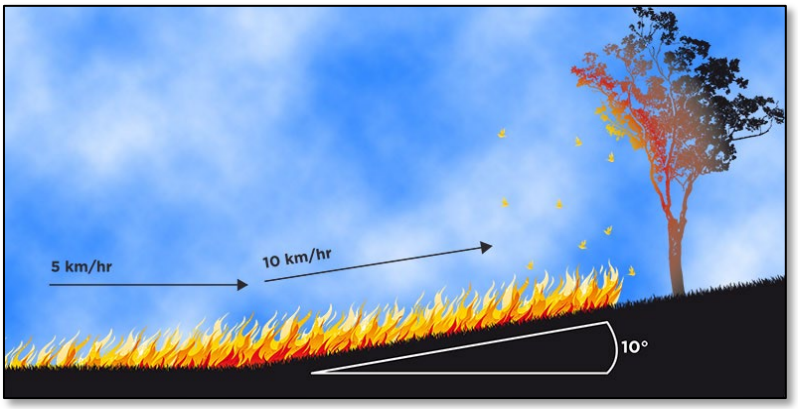

Figure 17. Effects of Topography on Bushfire (source: Country Fire Authority)

2) Weather Conditions

Bushfire weather conditions are fundamentally defined by temperature, humidity, wind, atmospheric conditions and past rainfall. For example, summer weather conditions increase the flammability of vegetation. Wind influences the speed and direction in which fire travels, fire intensity and possibility of spot fires from burning debris. A measure of weather conditions is the Forest Fire Danger Index (FFDI) and Grassland Fire Danger Index (GFDI). These measures are useful in determining the fire danger rating (refer to **Fire Danger Rating** in **Figure 18**).

3) Vegetation

Vegetation is the source of fuel for a bushfire. The amount of fuel surrounding a building can directly impact a buildings survival. Vegetation management, landscaping for bushfire and breaking the continuity of vegetation can limit the spread of fire.

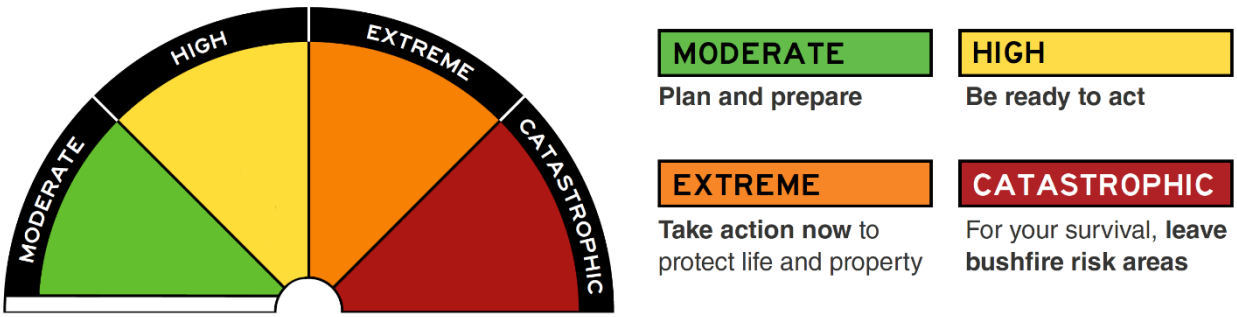

Figure 18. Australian Fire Danger Rating System (source: AFAC, 2025)

6.2 Bushfire Damage Sources

The Country Fire Authority (2012) states, "*Bushfires can vary in intensity and scale across the landscape*". As the past bushfire events throughout Australia have illustrated, bushfires can be devastating and lead to long-running fires which are difficult to suppress. Building survival is influenced by many interacting factors. The four main ways buildings are destroyed during a bushfire include:

- Ember attack;
- Radiant heat;
- Direct flame contact; and
- Fire-driven wind.

Ember Attack

Research indicates that the most common way buildings catch on fire is through ember attack (80% of house loss). Ember attack occurs when small burning twigs, bark, leaf are carried by wind and land in and around a building. Embers can ignite flammable plants, leaf litter, fences, outdoor furniture and sheds (refer to **Figure 19**, below). Ember attack is addressed within the AS 3959-2018 through Construction Standard requirements.

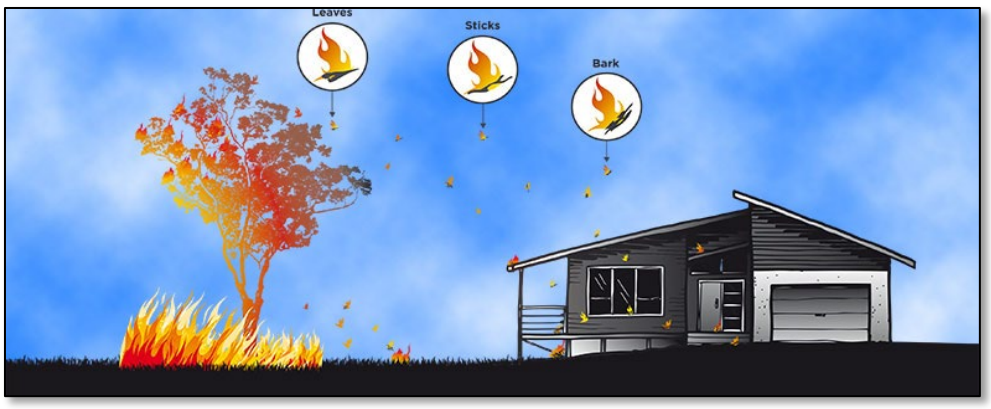

Figure 19. Ember Attack (source: Country Fire Authority)

Radiant Heat

Radiant heat is the heat created from burning fuel during a bushfire. Radiant heat can ignite surfaces without direct flame contact or ember attack, dry out vegetation ahead of the bushfire, crack glass (allowing embers to enter a building) and distort and melt materials (refer to **Figure 20**, below). The most common cause of loss of human life is via radiant heat (CFA, 2018).

Figure 20. Radiant Heat (source: Country Fire Authority)

Direct Flame Contact

Direct flame contact occurs when a fire front reaches a building, this is referred to as the 'Flame Zone'. Approximately 20% of house loss occurs when houses/buildings are directly adjacent to bushland.

Fire-driven Wind

Fire-driven wind can carry embers, cause trees to fall onto buildings, can break windows and destroy structures. The closer a building is to a fire front, the more severe the impact of fire-driven wind.

6.3 Management and Mitigation Measures – Permanent Buildings

Management and mitigation measures are generally outlined in relevant planning instruments at both the State and Local Government level.

Mitigation measures emphasize resilience to bushfire and are categorised into the following groups for the permanent structures within the site.

- Layout design;
- Building and construction requirements;
- Firefighting infrastructure;
- Bushfire emergency plan; and
- Vegetation management and landscaping.

6.3.1 Layout Design

Access and Egress

Access to the proposed residential subdivision will be achieved via new roads constructed as part of developments adjacent to the northern and southern boundaries (Kobee Street), noting that these developments have yet to be constructed. The development to the north will be accessed via a new intersection with Teviot Road. The development to the south will be accessed off Leanne Court to the south which connects with Teviot Road to the east via a new signalised intersection.

An internal road network is present through the development. Additionally, access and egress on foot may be achieved through to Teviot Road to the east, away from the hazardous vegetation through areas of open communal space on the eastern side of the development. Multiple modes of egress will assist with preventing entrapment during a bushfire event.

S5 Environmental recommend, where applicable, that internal roads be constructed to satisfy QFD '*Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots*', to be confirmed by the Project Town Planner or Engineer.

Leanne Court and Teviot Road are considered suitable to carry emergency fire-fighting appliances, provide emergency evacuation and to prevent entrapment during a bushfire.

Siting of Development

The proposed residential development is sited within an area of Low Potential Fire Line Intensity (> 4,000 kW/m^2) and is separated from the vegetation assessed as hazardous by Leanne Court and a future residential development. The maximum BAL score achieved by the proposed development is BAL 12.5 with the site largely outside of the bushfire prone area. These setbacks were modelled utilising the Flamesol BAL Minimum Distance Calculator (refer to **Appendix B**). The siting of the development is considered to ensure the proposed development is exposed to an acceptable level of bushfire risk.

6.3.2 Building and Construction Requirements

In accordance with the BCA, the AS 3959-2018 requirements for construction of buildings applies to any new Class 1, 2, 3 or 10a Building (when ancillary to a Class 1, 2, or 3 Building). Therefore, any future habitable Class 1, 2 and/or 3 buildings and their ancillary Class 10a building/s within the development must adhere to the relevant BAL construction Standards based on their location. Advice on how to meet the applicable construction requirements may be sought from the project architect, builder and/or certifier.

Early Warning Systems

Smoke alarms should be installed in accordance with the Building Code of Australia and the AS 3786-1993 - *Smoke Alarms*. The Queensland Fire and Emergency Services recommends photoelectric smoke alarms (not ionization alarms). Photoelectric smoke alarms are generally more effective than ionization types as they detect visible particles of combustion. The development may have additional requirements for hydrants and water supply to be conditioned as appropriate and required by the approving authority.

6.3.3 Firefighting Infrastructure

The site is expected to be connected to a reticulated water supply network. It is expected that the reticulated water supply network within the area complies with the provisions outlined in the SEQ Water Supply, Sewage Design and Construction Code. Additionally, fire hydrants are to be designed, sited and installed within the subdivision in accordance with AS2419.1-2009.

6.3.4 Bushfire Emergency

In the event of a Bushfire Emergency, call triple zero (000)

The Greenbank Rural Fire Brigade is located approximately 550 m (by road) to the north of the subject site. The contact details for the Greenbank Rural Fire Brigade are:

- Address: 133 Teviot Road, Greenbank 4124
- Phone: (07) 3297 5896 *or* 0417 706 345

6.3.5 Vegetation Management and Landscaping

Bioretention Basin

The proposed stormwater basin and park dedication in the south-west corner, which will be connected to the open area in the adjacent site, this was assessed as continuous fuel vegetation reflecting VHC 9.2. This area will be accessed off the new road , Kobee Street, and will be exposed a maximum of 12.5 kW/m^2.

Staging

The development will be undertaken over three stages, with the first being subdivision, the second being development of the western extent of the subject site including the through road (Kobee Street), and the third being development within the eastern extent of the site.

Hazardous vegetation will not be present on the site during or post-development of Stage 2 however the balance of the site should be managed (e.g. grass to be maintained) until the commencement of Stage 3 construction.

Landscaping

S5 Environmental recommend that future lot owners are advised of the BAL applicable to their lot, and that they adhere to the following advice (outlined in the SPP Technical Reference Guide – Bushfire Resilient Communities) on low flammability landscaping, ***particularly for areas located within 100 m of hazardous vegetation.***

Landscaping plays an important role in increasing a buildings' ability to endure bushfire attack. Landscaping for bushfire reduces the risk of ember attack which is the most common cause of building loss during bushfire. This includes utilisation of low flammability treatments such as rock mulches (gravel and fertilizer), concrete retaining blocks, and appropriate plantings.

Appropriate plant attributes to consider implementing in landscape design to reduce bushfire risk include:

- High leaf moisture content;
- Lower volatile oil content;

- Higher leaf mineral content;
- Broad-leaved species;
- Resilience to pruning;
- Low ignition likelihood;
- A low volume of persistent dead leaves/branches;
- Smooth or tightly held bark; and,
- Leaves and twigs that do not regularly fall.

Management of landscaped areas may include irrigation of garden and greenery areas to ensure a well-watered, low flammability landscape. Additionally, within the BAL 12.5, bushfire prone area, trees should not overhang the roofline, touch walls or other elements of buildings.

The Victorian Country Fire Authority (CFA) have produced an online Plant Selection Key which facilitates landscape designers and property owners to select fire wise garden plants. The CFA have also produced the publication 'Landscaping for Bushfire: Garden Design and Plant Selection' (CFA, 2022). This publication, in conjunction with the 'Bushfire Resilient Building Guidance for Queensland Homes' (QLD Government and CSIRO, 2020), outlines planning, designing, choosing suitable plants, maintaining gardens and provides a Plant Selection Key, and can be obtained from their website.

7.0 CONCLUSION

This Bushfire Hazard Assessment concluded that an area along the southern boundary of the proposed development, is within 100 m of potentially hazardous vegetation to the south. The AS 3959-2018 Method 2 radiant heat flux exposure assessment determined that the residential development will be exposed to a maximum radiant heat exposure of 12.5 kW/m^2, equivalent to BAL 12.5, with only 7 of the 86 townhouses being exposed to BAL 12.5. The remaining 79 townhouses are greater than 100m away and therefore outside of the bushfire prone area.

Accordingly, all buildings exposed to BAL 12.5 will have to adhere to the relevant BAL construction requirements. A building certifier is to instruct on the building requirements of townhouses outside of the bushfire prone area but connected to or adjacent to those exposed to 12.5 kW/m^2.

The adjacent lot to the south forms part of the internal road network and access, is in the late stages of the development approval process and as such this report has assumed it's approval. Where it is not approved, this report will require updating.

S5 Environmental have prepared a site-specific Bushfire Management Plan to support the proposed residential development, which recommends key mitigation measures to be implemented to ensure the risk to people, infrastructure and property is acceptable and minimised.

Overall, the proposed development complies with the SPP Bushfire Assessment Benchmarks, refer to **Appendix A**.

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APPENDIX A

SPP Bushfire Assessment Benchmarks

Assessment Benchmark	Response
Assessment Benchmark 3 **Development other than that assessed against (1) above, avoids natural hazard areas, or where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level.**	The proposed development is for multiple dwellings (townhouses). It does not involve vulnerable uses and community infrastructure for essential services. S5 Environmental have undertaken a bushfire hazard and BAL assessment as above and determined that 7 of the 86 proposed new townhouses will be exposed to a maximum radiant heat flux no greater than 12.5 kW/m^2 (equivalent to BAL 12.5), as a narrow incursion into the site along the southern boundary. The remaining 79 townhouses are wholly located outside of the bushfire prone area (BAL Low). The layout therefore minimises the number of lots and townhouses exposed to hazardous vegetation. The site is separated from the vegetation assessed as hazardous by an adjoining lot with an active development application for a subdivision, and Leanne Court. A new internal road is proposed through the development which will connect and provide access into the development to developments on the adjoining lots to the north and south. The area is undergoing rapid densification of residential, urban land uses, with Teviot Road to the east having received major upgrades and widening. Access to the south will be through the adjoining lot, via Leanne Court which connects to Teviot Road by a signalised intersection. To the north, new roads will connect to Teviot Road, away from the hazardous vegetation. The new roads, Leanne Court and Teviot Road are suitable for emergency service vehicles. Following the implementation of recommendations as outlined within the Bushfire Management Plan, S5 Environmental are of the opinion that the risks to people and development will be at an acceptable level.
Assessment Benchmark 4	The development will support, and not hinder, disaster management response or recovery capacity or capabilities.

Development supports, and does not hinder, disaster management response or recovery capacity or capabilities.	Development comprises townhouses which will be connected to a reticulated water supply. The townhouses are not exposed to a radiant heat flux level of greater 12.5 kW/m^2. Access into the site will be via internal roads from developments to the north and south. The development to the north connects to Teviot Road to the east via a newly constructed intersection, and to south access is off Leanne Court which in turn connects with Teviot Road via a new signalised intersection. Teviot Road has recently undergone major upgrades. Pedestrian access may be possible onto Teviot Road from within the lot via communal open space on the eastern extent of the development. The road network and fire hydrants are to be designed and installed in accordance with The *Fire hydrant and vehicle access guidelines for residential, commercial and industrial lots*, (QFD, 03/2025) and the *Road Planning and Design Manual 2nd edition* (DTMR, 2013), where applicable. The development will be connected to a reticulated water supply. As per the Bushfire Management Plan (BMP), it is recommended this complies with the provisions outlined in the SEQ Water Supply, Sewage Design and Construction Code. Additionally, fire hydrants where appropriate are to be designed, sited and installed within the subdivision in accordance with AS2419.1-2009 and QFD Guidance, to be conditioned where appropriate by the authorising authority.
Assessment Benchmark 5 **Development directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties.**	S5 Environmental are of the understanding that the proposed development will not increase the bushfire risk to the subject site or surrounding properties. Vegetation Management has been recommended in **Section 6.0**. The identified hazardous vegetation is separated from the subject site by Leanne Court, a two-lane, sealed road, and a future residential development. A stormwater treatment and detention basin in the south-western corner, which will connect to similar on the development to the south, has been assessed as mature, continuous vegetation.

	Hazardous vegetation is outside of the subject site, with 7 of 86 of townhouses, exposed to a maximum of 12.5 kW/m2 and the remaining 79 townhouses outside of the bushfire prone area. As such an Asset Protection Zone has not been prescribed for the development. Landscaping recommendations have been made in the Bushfire Management Plan (**Section 6.0**).
Assessment Benchmark 6 **Risks to public safety and the environment from the location of hazardous materials and the release of these materials as a result of a natural hazard are avoided.**	S5 Environmental understands the proposed development is for a residential townhouse development, and will not include the bulk storage of hazardous materials.
Assessment benchmark 7 **The natural processes and the protective function of landforms and vegetation that can mitigate risks associated with the natural hazard are maintained or enhanced.**	S5 Environmental understands the proposed development will not increase the fuel load of vegetation considered hazardous to the development or surrounding area. A Bushfire Management Plan for the site including landscaping recommendations, has been prepared in **Section 6.0**.

APPENDIX B

Flamesol Inputs and Outputs

Summary of Input Parameters for Hazardous Vegetation to the South

Parameter	Input	Note
FFDI	56	Source: QFD BRC MapViewer. The hazardous vegetation is a 55/56 split, with the higher value of 56 adopted for the calculation.
Surface Fuel Load	14.9 t/ha	Surface and Near Surface Fuel Load – QFD VHC 9.2.
Overall Fuel Load	17.2 t/ha	Total Fuel Load – QFD VHC 9.2.
Effective Slope	0 ◦	The hazardous vegetation is on-grade with the proposed development.
Site Slope	0 ◦	The Hazardous vegetation is on-grade with the proposed development.
Flame Temperature	1,200 K	Standard input in accordance with the BRC.
Flame Width	100 m	Standard input, in accordance with AS 3959-2018.

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Calculated March 17, 2026, 1:20 am (MDc v.4.9)

S525221

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	56	Rate of spread	1 km/h
Vegetation Classification	Forest	Flame length	8.57 m
Understorey fuel load	14.9 t/ha	Flame angle	66 °, 72 °, 77 °, 80 °, 82 ° & 85 °
Total fuel load	17.2 t/ha	Elevation of receiver	3.91 m, 4.07 m, 4.17 m, 4.22 m, 4.24 m & 4.26 m
Vegetation height	n/a	Fire intensity	8,898 kW/m
Effective slope	0 °	Transmissivity	0.875, 0.86, 0.839, 0.816, 0.804 & 0.742
Site slope	0 °	Viewfactor	0.4072, 0.2997, 0.2023, 0.1368, 0.111 & 0.03
Flame width	100 m	Minimum distance to < 40 kW/m²	10.4 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	14.1 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	20.7 m
Flame temperature	1,200 K	Minimum distance to < 12.5 kW/m²	29.5 m

Flamesol Calculator Outputs for Required Setbacks from Hazardous Vegetation to the South

APPENDIX C

Slope Lines and Calculations

Project: 189-195 Teviot Road, Greenbank
Number: S525221

ENVIRONMENTAL

BUSHFIRE SLOPE CALCULATOR

South

Effective Slope						**Site Slope**					
Direction	Flat					Direction	Flat				
Top Elevation	62	m				Top Elevation	62	m			
Bottom Elevation	62	m	Slope %	0.00%		Bottom Elevation	62	m	Slope %	0.00%	
Distance	53.3	m	**Slope (°)**	**0.00**		Distance	96.8	m	**Slope (°)**	**0.00**