APPENDIX 8: BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT PLAN (BHAMP)

BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT PLAN

Citiswich - Stage 7

20 November 2023

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LITORIA

CONTENTS

1 INTRODUCTION

The following Bushfire Hazard Assessment and Management Plan (BHAMP) has been prepared by Litoria Consulting on behalf of Walker Bremer Park Pty Ltd for the Citiswich Estate commercial development located at Warrego Highway, Bundamba, Queensland. The Citiswich Estate development is comprised of seven (7) stages, of which the subject of the report is Stage 7. Stage 7 is comprised of three lots (subject land) and is described as:

- Lot 13 on SP 238272 (Warrego Highway, Ipswich 4303),
- Lot 34 on SP 326668 (Warrego Highway, Ipswich 4303), and
- Lot 2 on RP 104683 (Warrego Highway, Ipswich 4303).

Figure 1 (Map 1) shows an aerial photo of the subject land.

The purpose of the BHAMP was to:

i. Identify and measure site-specific factors which contribute to bushfire hazard,
ii. Assess the extent of bushfire prone areas (post-development) and calculate:
    a. Potential fire intensity (PFI, kW/m),
    b. Radiant heat flux (kW/m^2).
iii. For development within areas of potential fireline intensity or the potential impact buffer (100m), assess Bushfire Attack Level (BAL) in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire-prone areas* (AS 3959:2018).
iv. Where applicable, identify management measures to achieve compliance with relevant permit conditions, planning scheme requirements and State Planning Policy assessment benchmarks.

The BHAMP has been prepared generally in accordance with State Planning Policy (SPP) guidance material, including Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a).

The report is divided into the following sections:

i. Introduction,
ii. Development,
iii. Overview of bushfire hazard,
iv. Regulatory framework,
v. Methods,
vi. Results, and
vii. Bushfire Management and Planning.

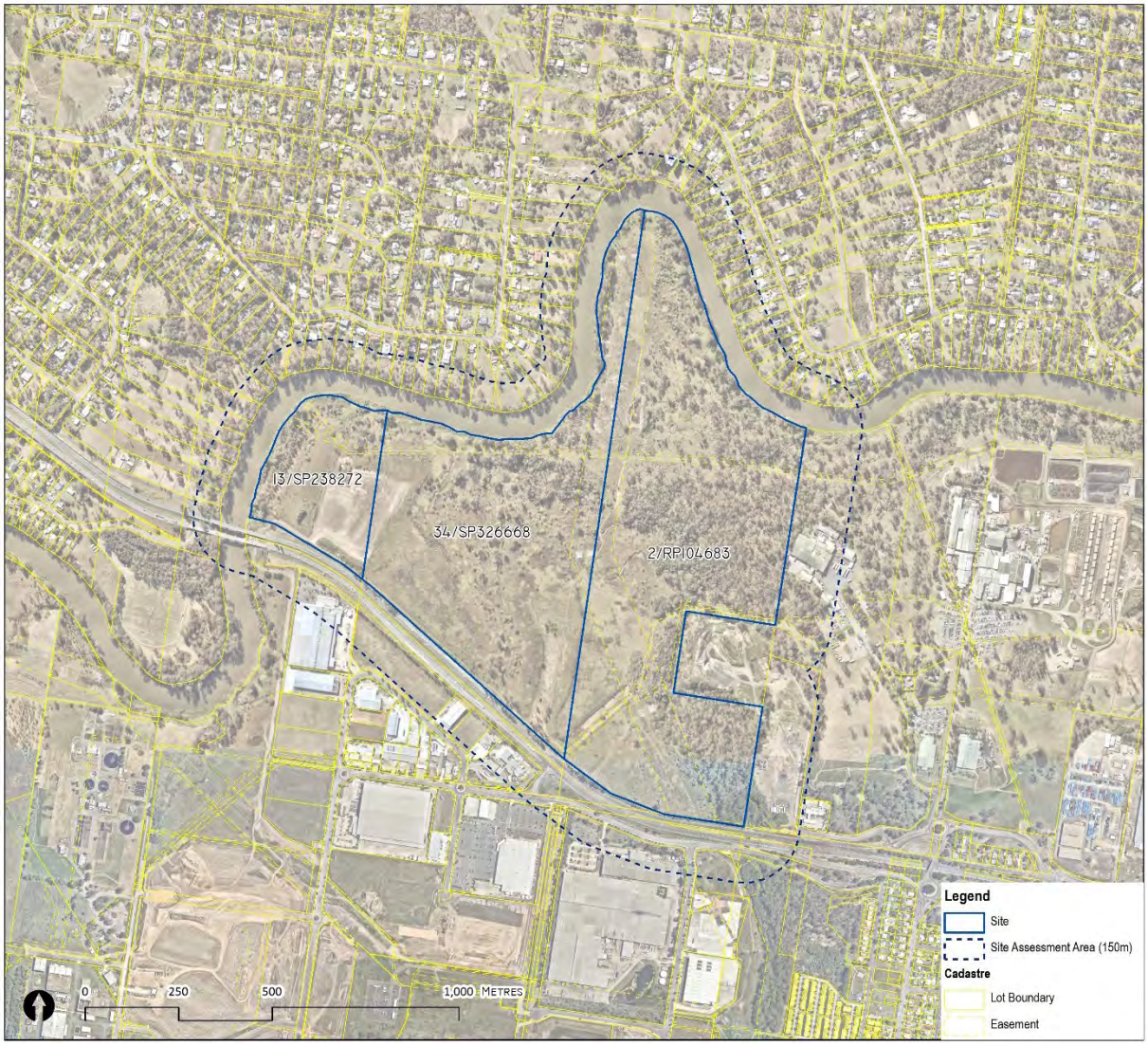

FIGURE 1: DIGITAL AERIAL PHOTOGRAPH OF THE SITE (NEARMAP 2023, IMAGE DATE JULY 22).

2 PROPOSED DEVELOPMENT

Stage 7 of Citiswich is located in Bundamba in the Ipswich City Council local government area. The subject land is located on the banks of the Bremer River and is bordered by the Bremer River to the north and west, the Warrego Highway to the south and existing industrial development to the east, including an abattoir.

The Stage 7 land is zoned Regionally Significant Business Enterprise and Industry Areas - General Business and Industry (low & medium impact) according to the Ipswich Planning Scheme (Ipswich City Council 2006). These areas serve as a buffer between industrial and residential developments.

The proposed development of Stage 7 involves reconfiguration of a lot - subdivision of three (3) lots into fifteen (15) industrial use lots, together with operational works to develop and service the industrial lots. Stage 7 is comprised of:

- 67.3 ha for mixed-use development,
- 47.7 ha of land balance land outside of the development footprint.

The balance land is proposed to be dedicated to Ipswich City Council as open space.

The proposed development follows a series of existing approvals over the subject land, including:

- Preliminary approval for the Citiswich Masterplan development submitted in 2002 to the Ipswich City Council (ICC) to subdivide and develop the site for a mixture of commercial / industrial, residential, and open space purposes across 7 stages. On June 30, 2004, Ipswich City Council granted preliminary approval to change the material use of premises and reconfigure a lot for the development of the Citiswich Estate (formerly Bremer Business Park). The approval was evaluated and granted under the Integrated Planning Act 1997 (IPA) (Qld).
- On July 11, 2018, the Ipswich City Council issued Approval No. 3356/2002/MAMC/A as a change application to the preliminary approval to ensure uniformity across all major approvals for the Citiswich Estate.
- Other approvals pertaining to Stage 7 include:
  - Approval (DA 5450 / 2010 Stage 7 – ROL) subdivision of lot 13 SP 227111 into two lots. Lot 13 (north of Warrego Hwy) and Lot 131 (south of Warrego Hwy).
  - Approval (DA 6231 / 2018 Stage 7 – ROL) subdivision of Lot 34 into 2 lots (separate north and south of Warrego Hwy).
  - Approval (DA 3668 / 2013 Stage 7 – OPW) within the footprint of the current Preliminary Approval allowing a 30-metre corridor to drain the Warrego Highway low point. (Decision Notice dated – 10 December 2013).

The proposed development plan can be found in Figure 2, Map 1 and Appendix 1. The proposed landscape master plan can be found in Appendix 2.

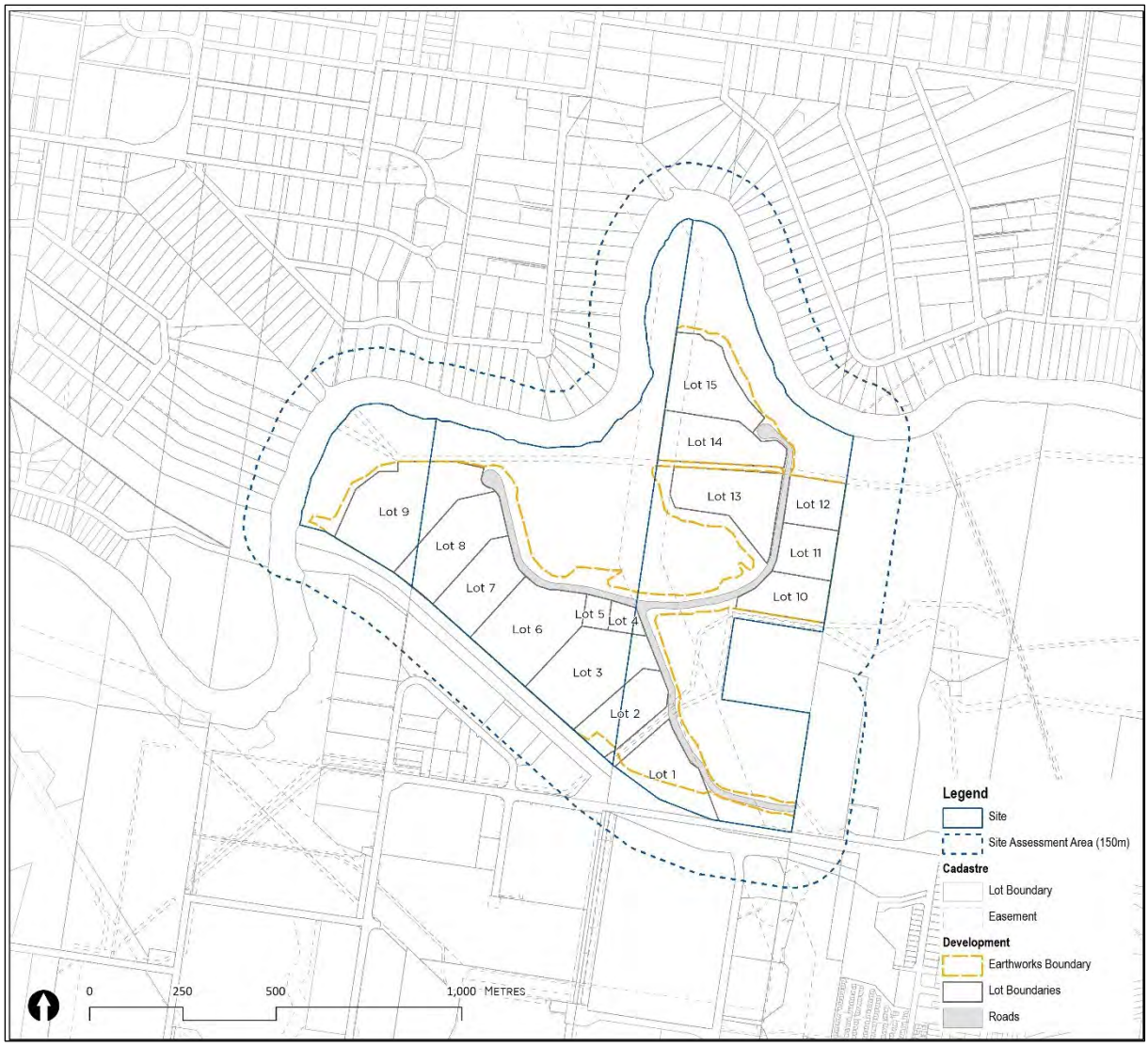

FIGURE 2: CITISWICH STAGE 7 PROPOSED DEVELOPMENT FOOTPRINT (SOURCE: ARCADIS AUSTRALIA PACIFIC PTY LTD, GENERAL ARRANGEMENT PLAN, ISSUE 04, 25/08/23).

3 BUSHFIRE HAZARD

Bushfire prone areas in Queensland are identified, mapped and categorised as a function of potential fireline intensity (kW/m). Potential fireline intensity is a function of fire weather severity (FFDI), landscape slope and fuel load based on classified vegetation communities according to the method described by Leonard *et al.* (2014) (Refer to Figure 3).

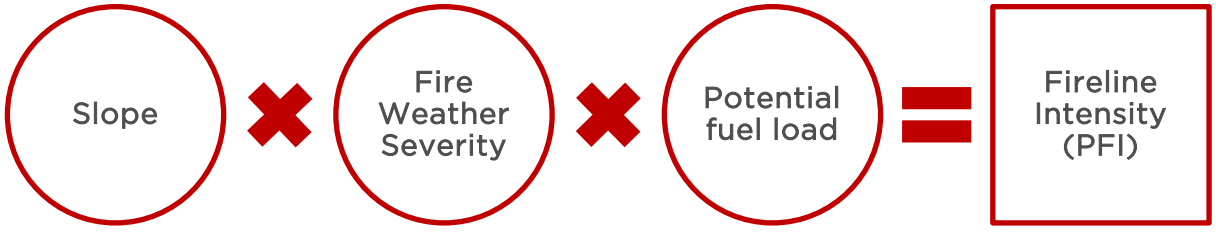

FIGURE 3: METHOD FOR CALCULATION OF POTENTIAL FIRELINE INTENSITY (PFI) (LEONARD *ET AL.* 2014).

Areas of potential fireline intensity include potentially hazardous vegetation that could support a significant bushfire or be subject to significant bushfire attack. It includes potentially hazardous vegetation with a Medium (4,000 – 20,000 kW/m), High (20,000 – 40,000 kW/m) or Very High (40,000+ kW/m) Potential Bushfire Intensity. Bushfires in these areas have the potential for high to extreme levels of flame attack, radiant heat and ember attack. Land adjacent to bushfire prone areas is also at risk of significant bushfire attack from embers, flames or radiant heat. The latter are identified as potential impact buffer areas and include all land within 100m of areas mapped as Medium, High or Very High Potential Bushfire Intensity. Together, the areas of potential fireline intensity and potential impact buffer form bushfire prone areas.

Vegetated parts of the landscape which support fireline intensities of less than 4,000 kW/m are categorised as grassfire prone areas or low hazard areas (e.g., rainforest or water or non-vegetated urban areas).

The SPP methodology was developed to overcome limitations of the approach adopted by the previous State Planning Policy (SPP 1/03), including the failure to consider regional differences in fire weather severity, effective slope and the diversity of vegetation types and fuel loads across Queensland (Leonard and Blanchi 2012). The new methodology estimates the potential fireline intensity at the landscape scale. Fireline intensity is a standardised measure of the rate that an advancing head fire would consume fuel energy per unit time per unit length fire front (Byram 1959). As noted by Leonard *et al.* (2014), the benefits of utilising fireline intensity as the principal measure of bushfire hazard, is that it can also be used to estimate the potential flame length (e.g. Alexander and Cruz 2012) and radiant heat flux based on distance from hazardous vegetation. Radiant heat flux can then be used to determine:

- minimum separation distance from hazardous vegetation needed to afford safety levels to people and/or buildings (Zarate *et al.* 2008; Newnham *et al.* 2013), and
- estimates of Bushfire Attack Level (Standards Australia 2018), which can provide a connection between landscape scale bushfire metrics and site level decisions for building design.

The new methodology also excludes extraneous variables such as an ambiguous weighting of hazard according to topographic aspect. The improved hazard assessment methodology provides for more accurate identification of bushfire prone areas and the potential severity of bushfires — providing the basis for planning and development strategies which are proportional to the level of bushfire hazard.

4 REGULATORY FRAMEWORK

Management of bushfire hazard in Queensland is considered an integral component of land use planning and development decisions given the potential significant impact on people, social wellbeing, property, the economy, the environment and infrastructure.

There are two (2) bushfire hazard planning instruments considered as part of this BHAMP that regulate development to avoid and mitigate potential impacts associated with bushfire hazard, namely:

- State Planning Policy (SPP) under the *Planning Act 2016* (Qld); and,
- Ipswich Planning Scheme 2006.

4.1 STATE PLANNING POLICY

The SPP identifies the Queensland Government's policies about matters of state interest in land use planning and development (Department of Infrastructure Local Government and Planning 2017). The SPP is a broad and comprehensive statutory planning instrument which sits above regional plans, standard planning scheme provisions and local government planning schemes within the hierarchy of planning instruments outlined in the *Planning Act 2016* (Qld).

The SPP identifies the State interest in relation to bushfire hazard planning and management outcomes for development in bushfire prone areas. It sets out, *inter alia*, development assessment requirements for certain applications where a local planning scheme has not yet appropriately integrated the SPP and includes a State-wide map of bushfire prone areas. The SPP map of bushfire prone areas (SPP map) is based on modelled potential fireline intensity according to the method described by Leonard *et al.* (2014). The SPP identifies land that could support a significant bushfire or be subject to significant bushfire attack. It includes areas of hazardous vegetation with a Very High, High or Medium Potential Bushfire Intensity, together with land within 100m of *bushfire prone areas* as a *potential impact buffer*. The potential impact buffer identifies land that may be subject to significant flame attack, radiant heat or ember attack. Research indicates that not only does a very high intensity bushfire have the potential to cause injury from radiant heat exposure up to 100m away, but over 80% of housing loss and human life loss occurs within 100m of bushland (Leonard *et al.* 2014). Figure **4** (Map 2) indicates the SPP map for the site (Department of State Development Manufacturing Infrastructure and Planning 2023).

The SPP is supported by the State Planning Policy – state interest guidance material. Natural hazards, risk and resilience - Bushfire (SPP Guidance Material) (Department of State Development Manufacturing Infrastructure and Planning 2019) and a technical manual: *Bushfire Resilient Communities* (Queensland Fire and Emergency Services 2019a),

which provides an overview of the method for undertaking bushfire hazard assessment as per Leonard *et al.* (2014).

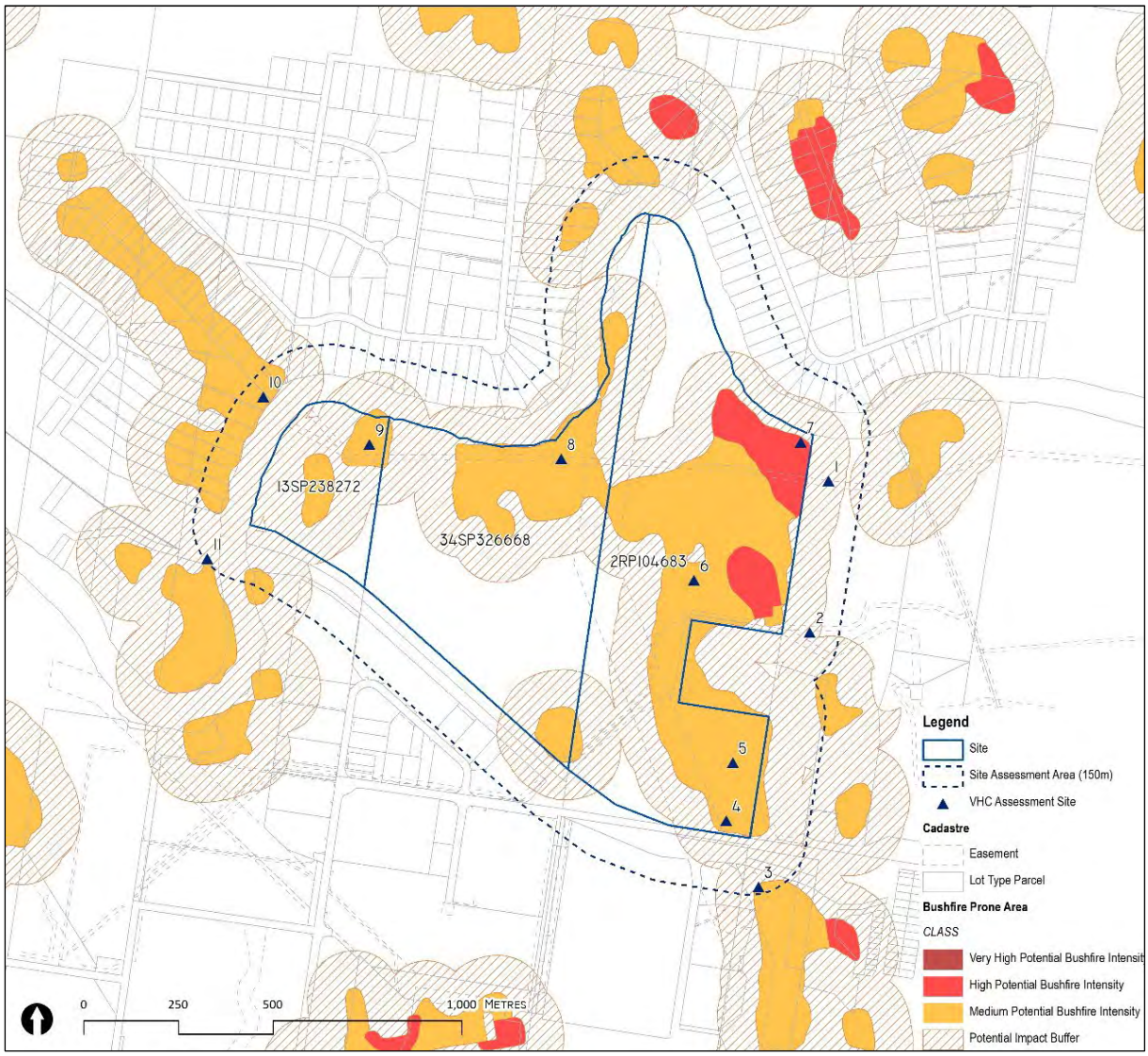

FIGURE 4: EXCERPT FROM STATE PLANNING POLICY STATE-WIDE MAP OF BUSHFIRE PRONE AREAS (DEPARTMENT OF STATE DEVELOPMENT MANUFACTURING INFRASTRUCTURE AND PLANNING 2023).

4.2 IPSWICH PLANNING SCHEME

Ipswich Planning Scheme 2006 (IPS) identifies areas subject to bushfire hazard on the Bushfire risk areas map. The site does not contain any mapped bushfire hazard areas according to the Ipswich City Council bushfire risk areas overlay map.

The Ipswich City Plan was gazetted prior to relevant State interest in relation to planning for bushfire hazard. Differences between the level and extent of hazard indicated on the SPP map and the Ipswich City Council bushfire overlay map are a consequence of the different methods used to assess bushfire hazard (c.f.

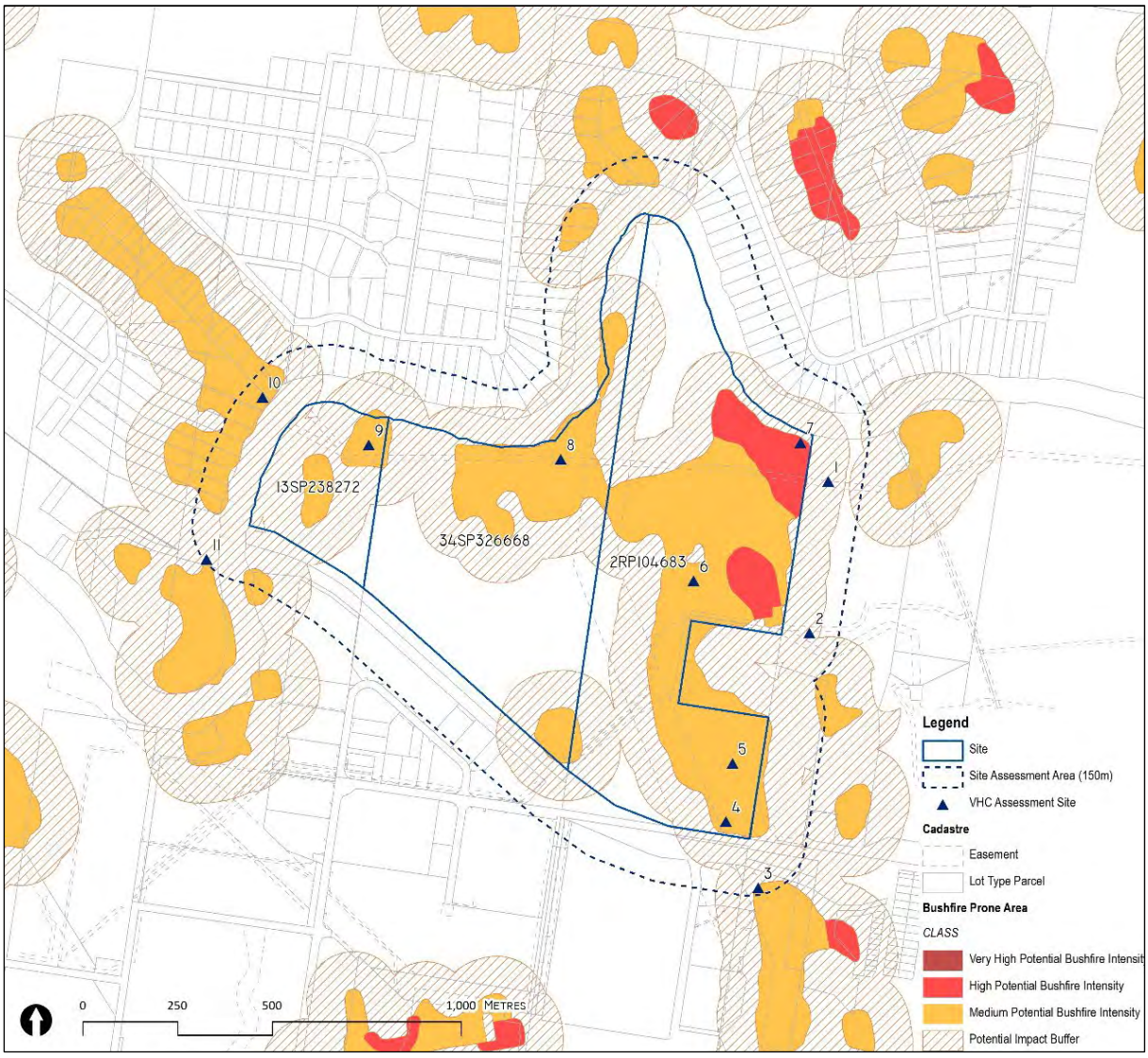

FIGURE 4: EXCERPT FROM STATE PLANNING POLICY STATE-WIDE MAP OF BUSHFIRE PRONE AREAS (DEPARTMENT OF STATE DEVELOPMENT MANUFACTURING INFRASTRUCTURE AND PLANNING 2023).

and Figure 5). The current SPP utilises a quantitative method as per Leonard *et al.* (2014) which predicts actual fire behaviour including calculation of predicted fire intensity and rate of spread using a modified version of McArthur's equation. Despite differences

between the SPP and Ipswich City Council mapping, the SPP mapping indicates there is a level of risk requiring assessment on the site. As such, the assessment has been prepared in accordance with current State Planning Policy.

The following section of the report provides an overview of the methodology used to assess bushfire hazard, including quantitative measurement of fire intensity and, where necessary, radiant heat flux.

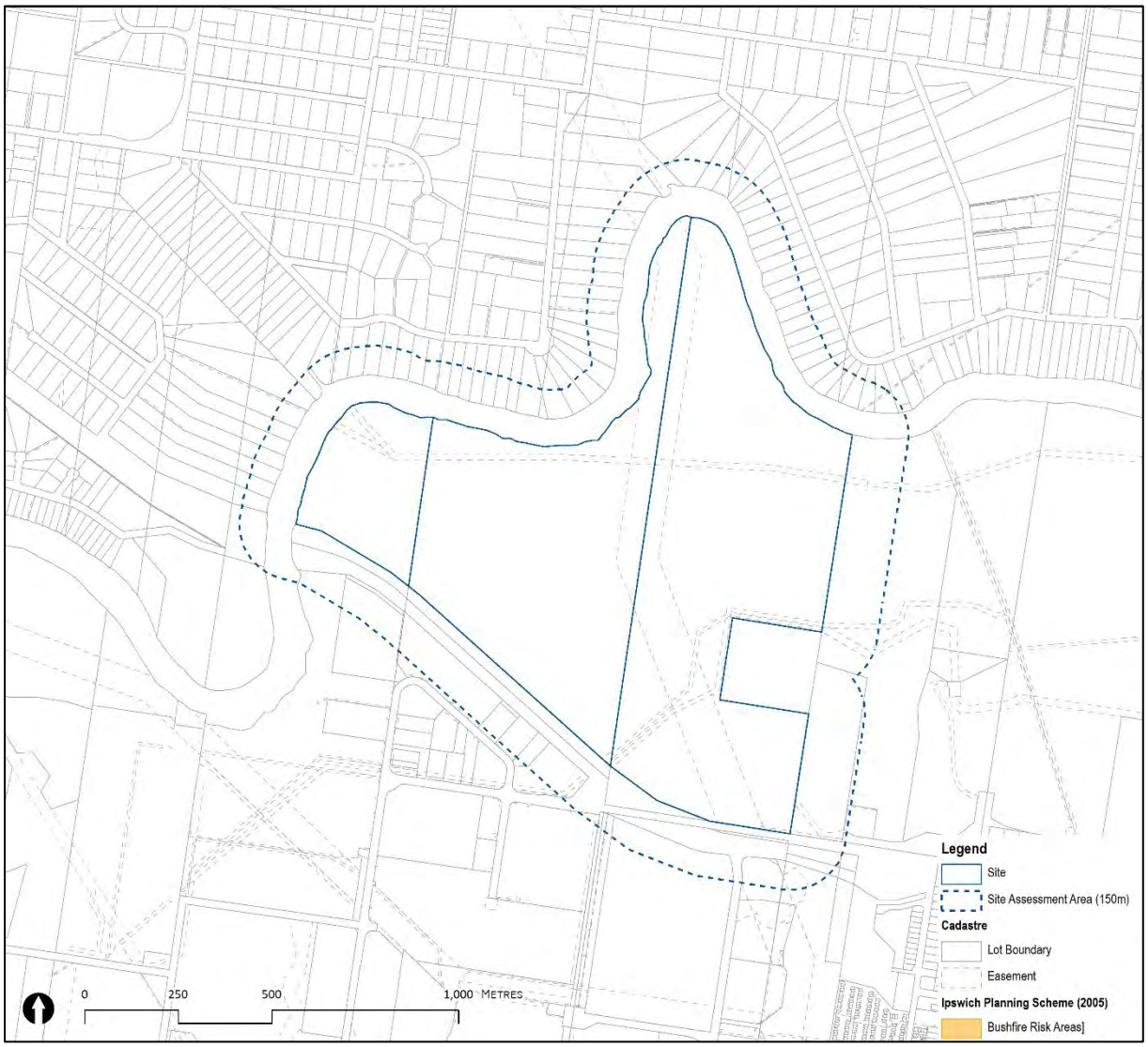

FIGURE 5: IPSWICH PLANNING SCHEME BUSHFIRE RISK AREA (IPSWICH CITY COUNCIL 2006).

5 METHODS

Bushfire prone areas in Queensland are identified, mapped and categorised as a function of potential fireline intensity (kW/m). Potential fireline intensity can be calculated and mapped spatially as a function of three inputs according to the method described by Leonard *et al.* (2014) (Refer to Figure 3):

i. Fuel load based on vegetation hazard classes,
ii. Maximum landscape slope, and,
iii. Fire weather severity.

The method described by Leonard *et al.* (2014) utilises a modified version of the McArthur Equation (McArthur 1967; Noble *et al.* 1980). Hazard assessment should incorporate both the development footprint and all land within 150 metres of the development footprint (site assessment area) (Queensland Fire and Emergency Services 2019a). Where development involves or proposes changes to the configuration of vegetation within the site assessment area, the re-modelling of bushfire behaviour is necessary.

Modelling of potential fireline intensity should incorporate the effects of the proposed development on the configuration of vegetation within the site assessment area including:

- all necessary clearing to support the development and infrastructure, and,
- all requirements for revegetation, landscaping or environmental offsets.

Modelling potential fireline intensity utilised a combination of desktop and field methods, including geoprocessing of spatial inputs and modelling of bushfire hazard according to the process described in Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a). The modelling included the following measures of fire behaviour:

i. Potential bushfire fireline intensity (PFI, kW/m);
ii. Radiant heat flux/Bushfire Attack Level (kW/m^2/BAL) according to the View Factor Method described in AS 3959:2018 using the SPP Bushfire Asset Protection Zone Width Calculator (Queensland Fire and Emergency Services 2019b).

5.1 INPUTS

Fire behaviour modelling was carried out via GIS spatial modelling using rasterised inputs[1] described by Leonard *et al.* (2014):

i. Fuel load based on a combination site-based survey and desktop assessment of vegetation hazard class;
ii. Maximum landscape slope; and,
iii. Fire weather severity/FFDI.

5.1.1 VEGETATION HAZARD CLASS AND FUEL LOAD

Fuel load was derived from an estimate of potential fuel load (tonnes/ha) for 25 grouped *vegetation hazard classes* (VHCs). VHCs have been categorised from a combination of regional ecosystem maps, pre-clearing regional ecosystem maps (where no remnant vegetation is mapped), foliage projection cover maps, land use maps, water body maps, air photo interpretation (API) and tree plantation maps (Leonard *et al.* 2014). Map 4 and Map 5 (attached) show the SPP VHCs and SPP potential fuel loads for the site assessment area, respectively.

As part of the hazard assessment, VHCs were assessed at several locations within the 150m site assessment area (Refer to Map 6 and Appendix 3). VHCs within the site assessment area were determined in accordance with Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a) using a combination of:

i. Quaternary botanical survey according to Neldner *et al.* (2012);
ii. Current regional ecosystem mapping[2]; and,
iii. API using current[3], high-resolution[4], rectified aerial photography.

The modelled VHCs for the subject land reflect the proposed development i.e., ultimate land use and include VHCs associated with proposed vegetation retention and/or revegetation, where applicable (Refer to Map 6).

Where observations indicated that the observed VHC differed from the mapped VHC, the classification or extent of VHC was altered to reflect the observed or post-development vegetation community and the potential fuel load which corresponded with that VHC (c.f. Map 4 and 6). Non-forest vegetation hazard classes associated with rural and urban areas were categorised according to a combination of foliage projection cover maps, land use

[1] VHC/fuel load, maximum landscape slope and fire weather severity input rasters can be accessed via the Queensland Government Information Service (http://dds.information.qld.gov.au/dds/).

[2]Department of Environment and Science (2021). Biodiversity status of remnant regional ecosystems v12.0. Queensland Herbarium. Brisbane, State of Queensland..

[3] 2022.

[4] Greater than 1:10,000 resolution.

maps and air photo interpretation (API), with supplementary site-based survey to confirm desktop mapping. The results of the site-based survey of VHCs is contained in Appendix 3.

Results of the VHC assessment indicated the following differences between SPP VHC map and modelled VHCs:

- The proposed development will result in the removal of hazardous vegetation including VHC 10.1 *Spotted gum dominated open forests* and VHC 16.2 *Eucalyptus dominated woodland on drainage lines and alluvial plains.* Areas of proposed development are classed VHC 40.1 *Permanent bare or very sparse vegetation.* The latter is a non-bushfire prone VHC and does not contribute to bushfire hazard (Queensland Fire and Emergency Services 2019a).
- Discontinuous vegetation in the open space around the proposed development are comprised of a mosaic of vegetation hazard classes:
    - The majority of the open space is cleared and disturbed areas mapped as VHC 37.1 *Grassland with sparse mature or regrowth tree or shrub overstory vegetation.*
    - VHC 10.1 *Spotted gum dominated open forests* remains in pockets in the northeastern region of the site and is less than the mapped extent.
    - VHC 16.2 *Eucalyptus dominated woodland on drainage lines and alluvial plains* comprises the remainder of the retained vegetation on the site and is slightly larger in extent along the northern boundary along the Bremer River. Other patches of VHC 16.2 *Eucalyptus dominated woodland on drainage lines and alluvial plains* in various locations differed slightly from mapped extents and was corrected where necessary to align with the on-ground extent of the vegetation community.

As per Leonard *et al.* (2014), the *Potential Fuel Load assigned to each Vegetation Hazard Class is generally representative of the higher fuel load expected for the typical vegetation types, landscape and site conditions within each Vegetation Hazard Class. This Potential Fuel Load of each Vegetation Hazard Class would approximate the 80th percentile fuel load of the "long unburnt condition" for the class (generally greater than 10 years without burning).* Modelled fuel loads for each of the amended VHCs were unchanged from the loads recommended by Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a). Fuel loads for modelled VHCs were as per the Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a); with hybrid or complex communities receiving the sum of the proportional fuel load of each constituent VHC (e.g. remnant vegetation containing a mix of regional ecosystems). Areas containing unmanaged regrowth or revegetation were mapped according to *"long unburnt condition" for the class* i.e., the potential fuel load of the vegetation type at maturity. Map 7 indicates the modelled fuel loads.

5.1.2 LANDSCAPE SLOPE

Landscape slope was created from a 25m resolution digital terrain model (DTM) by calculating the maximum slope (in degrees) from the central pixel in a group of 9 x 9 cells to the eight (8) adjoining cells in that group.

Maximum landscape slope within the site assessment area varied from one (1) to ten (10) degrees (Refer to Map 8).

5.1.3 FIRE WEATHER SEVERITY

In addition to vegetation fuel loads and slope, fire behaviour and intensity is influenced by a range of weather variables such as wind speed, relative humidity, temperature and atmospheric conditions, as well preceding drought conditions[5].

These variables are summarised as an index value which can be used by proxy to estimate and predict fire behaviour: Fire Weather Severity (FWS). The McArthur Forest Fire Danger Index (FFDI) (McArthur 1967) is the most widely used proxy of fire weather severity in Australia and is used for both bushfire hazard assessment, emergency management and in regulations such as in AS 3959:2018 *Construction of buildings in bushfire-prone areas*. Unlike AS 3959:2018, which adopts a single FFDI for all of Queensland (40), fire weather conditions vary spatially according to temperature, wind, relative humidity and precipitation. Although FWS is equivalent to the Forest Fire Danger Index (FFDI) defined in AS 3959:2018; spatially explicit FWS values for Queensland have been calibrated by Leonard *et al.* (2014) based on a gridded prediction of the FFDI from long term spatial weather products produced by the Australian Bureau of Meteorology. Adopted FWS values reflect a 1:20 year or 5% annual exceedance probability (AEP) weather event.

Climate change projections suggest that the likelihood, intensity and extent of bushfires are likely to increase, together with longer, hotter and drier fire seasons (Bureau of Meteorology 2019). The gridded fire weather severity values for Queensland have been adjusted to reflect the expected climate in 2050 using the Intergovernmental Panel on Climate Change A1FI climate scenario[6] (Queensland Fire and Emergency Services 2019a).

The fire weather severity used for the purpose of calculating fireline intensity was based on 1 in 20 year weather conditions (i.e., 5% annual exceedance probability) to reflect the severity of fires and events suited to mitigation through land use planning in Queensland and was based on advice from the Queensland Fire and Emergency Services.

An FFDI of 57 was adopted based on the 5% AEP event as per Leonard *et al.* (2014) (Refer to Map 9).

[5] Days since last rainfall.

[6] The SRES A1FI scenario is most similar to the current RCP 8.5 scenario.

5.2 MODEL

5.2.1 PATCH AND CORRIDOR FILTERING

Hazardous vegetation within rural and urban landscapes is frequently fragmented, giving rise to smaller patches and narrow corridors of vegetation that are likely to have lower fireline intensities than larger expanses of continuous vegetation.

The spatial context of these patches and corridors of vegetation has a major influence on the likelihood of fire arrival, the severity of a fire at the boundary of the patch, and the behaviour of a fire within the patch.

Because of the potential contribution of grass fires to the intensity of fire in tree or shrub dominated hazardous vegetation, bushfire hazard assessment of patches and corridors needs to take account of the fuel properties of adjacent vegetation or other land uses.

Continuous vegetation, such as forest, shrubland or grass, has a generally uniform distribution of fuel that supports a continuous flame front under a range of weather conditions. In contrast, non-continuous vegetation or land uses, such as built-up areas or water bodies, are not expected to support a continuous flame front because they do not contain sufficient fuel load to carry a fire.

Patch and corridor filtering rules are therefore required to identify and amend the estimated hazard potential of narrow or small patches of vegetation likely to prevent a running fire front from reaching the potential fireline intensity levels estimated by Equation 1 (Refer to Section 5.2.2).

Patch and corridor filtering rules were applied to the locally refined vegetation hazard class map in accordance with Leonard and Opie (2017) and Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a) to reflect the likelihood of lower fireline intensities in smaller vegetation patches and narrow vegetation corridors, particularly where those patches are otherwise surrounded by fragmented and discontinuous fuel sources, such as small patches and narrow corridors of vegetation within established urban areas.

5.2.2 POTENTIAL FIRELINE INTENSITY

Fuel load, VHC, landscape slope and FFDI were represented spatially in 10m resolution input rasters. The input rasters were modelled using GIS software to generate a model of potential fire behaviour for the 5% AEP event. Maps 7 to 9 indicate the site-specific modelled inputs for potential fuel load (Map 7), maximum landscape slope (Map 8) and fire weather severity/FFDI (Map 9), respectively.

PFI was calculated in accordance with Leonard *et al.* (2014a):

$$PFI = 0.62\, W^2 FFDI e^{(0.069\theta)} \qquad \text{(Equation 1)}$$

Where: PFI = Potential Fireline Intensity (kW/m);
W = Potential fuel load (tonnes/ha);
$FFDI$ = Fire weather severity/FFDI; and,
θ = Maximum slope (degrees).

Resulting PFI was then classified into one of three (3) *potential bushfire hazard classes*, as outlined in Table 1.

TABLE 1: POTENTIAL BUSHFIRE INTENSITY CLASSES (SOURCE: LEONARD *ET AL.* 2014).

Potential Bushfire Intensity	Potential Fireline Intensity
Very High	40,000+ kW/m
High	20,000 – 40,000 kW/m
Medium	4,000 – 20,000 kW/m

5.2.3 RADIANT HEAT FLUX

Where modelling results indicated that the proposed lot boundaries are located within a bushfire prone area and/or potential impact buffer, radiant heat flux and associated Bushfire Attack Level (BAL) was calculated according to the View Factor Method described in AS 3959:2018 (Standards Australia 2018). Separation distances for achieving the various BAL levels were calculated using the SPP Bushfire Asset Protection Zone Width Calculator (Queensland Fire and Emergency Services 2019b), including inputs based on:

- Distance(s) between the closest edge of the proposed lot boundaries and adjacent hazardous vegetation was measured via spatial analysis in GIS to ensure a high level of precision, with radiant heat flux calculated consistent with the height of the adjacent vegetation, maximum flame angle and modelled flame lengths.
- Fuel loads were derived from site-based survey of vegetation hazard classes (Map 7 and Appendix 3).
- Effective and site slope under the classified vegetation were calculated from the landscape slope map (Map 8).
- An FFDI of 57 based on the 5% AEP event as per Leonard *et al.* (2014) (Refer to Map 9).

6 RESULTS

The modelling results are described in terms of the extent and category of bushfire prone areas, potential fire line intensity and radiant heat flux levels (where applicable).

6.1 BUSHFIRE BEHAVIOUR

Modelling results based on the AEP 5% FFDI indicated that the subject land contains several small patches of medium potential fireline intensity, with parts of the development footprint located within the potential impact buffer (Refer to Figure 6and Map 10). Development within the potential impact buffer is potentially at risk from the main forms of bushfire attack including flame attack, radiant heat and ember attack.

Modelled bushfire prone areas differed from the extent and classification of bushfire prone areas indicated by both the SPP State-wide map of bushfire prone areas and the Ipswich Planning Scheme. The differences were attributable to the following factors:

- vegetation hazard class mapping based on pre-2017 vegetation cover and regional ecosystem mapping,
- mapping errors and anomalies e.g., incorrect classification of Vegetation Hazard Classes,
- the effect of recent development on the configuration of vegetation within the landscape, and
- consequential 'patch and corridor filtering' based on the observed configuration of VHCs.

In the case of smaller isolated patches, model results are generally conservative. Based on the configuration of retained vegetation on the site, fragmentation of hazardous vegetation within the landscape and smaller patch sizes; modelled fire line intensity is unlikely to reach the 'potential' values identified by the model. Although such patches support hazardous or classified vegetation, small patches of vegetation (< 2 ha) and narrow corridors and areas of continuous fuel (< 75 metres in width) are not sufficiently large or wide to support a fully developed flame front (Catchpole et al. 1982). These areas are less likely to ignite due to their disconnection with fuels that can carry running fire fronts. If ignited by a point or line ignition, these areas will limit the fire head width, hence fireline intensity. The combined effect of lower ignition likelihood and lower intensity is likely to result in lower fireline intensity than predicted by the model results.

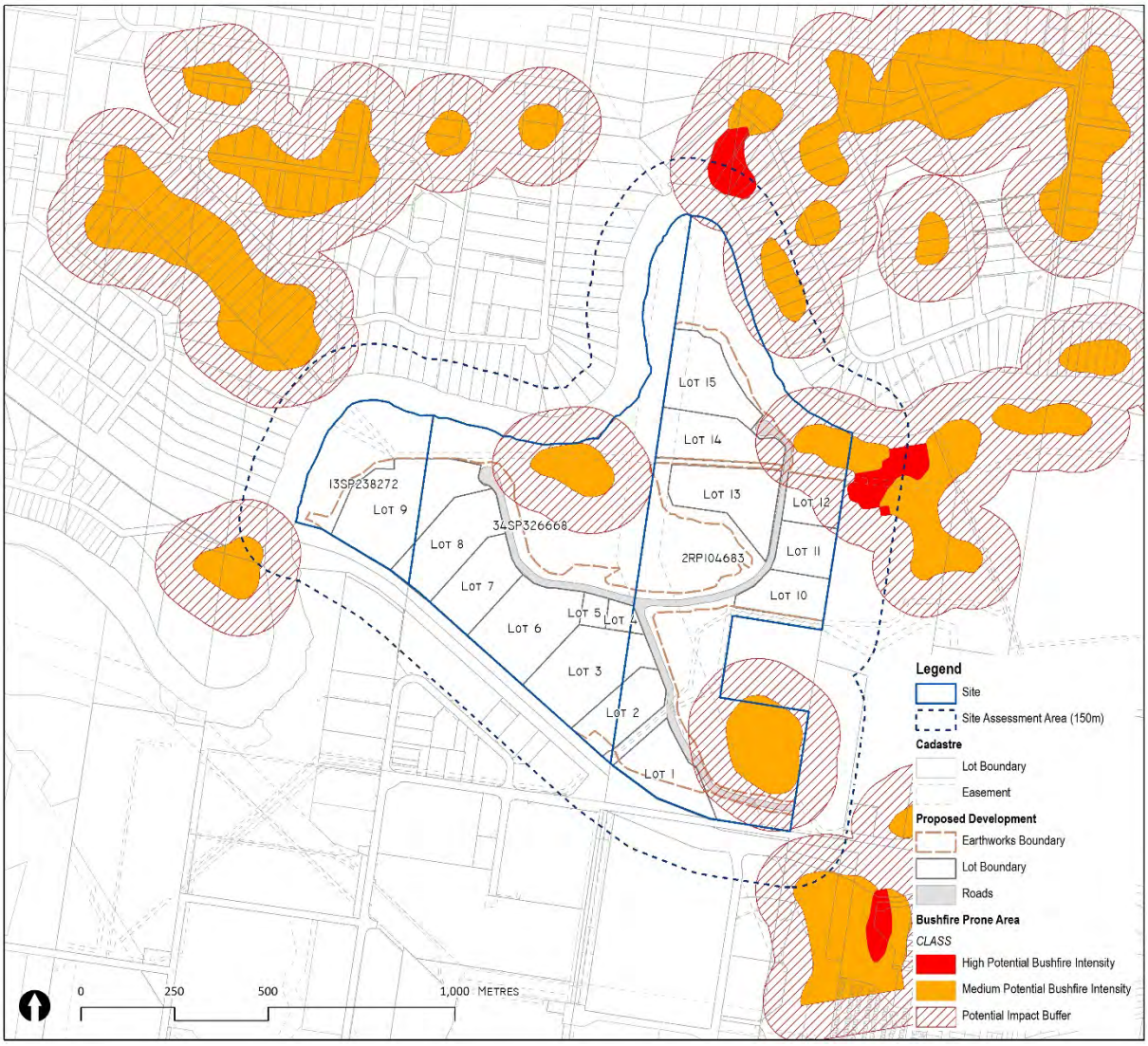

FIGURE 6: MODELLED BUSHFIRE PRONE AREAS.

6.2 RADIANT HEAT FLUX

Radiant heat flux was calculated based on the distance between the closest edge of the structure to adjacent hazardous vegetation in accordance with Method 2 of AS 3959:2018 (View Factor Method), utilising the input data described in Section 5 and the SPP Bushfire Asset Protection Zone Width Calculator (Queensland Fire and Emergency Services 2019b). The maximum view factor and radiant heat exposure was calculated i.e., the combination of fuel, FFDI and site and effective slopes which maximised radiant heat flux, including south and south-east, west and north-west aspects. The model input data and results of the calculations are indicated in Tables 2 to 6 for the maximum attack vectors for each VHC.

The outcomes of the calculations indicated that:

- Lots 2 through to 10 are located outside of the potential impact buffer and are not at significant risk of bushfire attack.
- Lot 1 is located in the potential impact buffer, but separated from bushfire prone areas by a perimeter road and open space:
  - The maximum level of potential radiant heat flux at the closest point on the boundary of Lot 1 is 2.8 kW/m^2.
  - This is a level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29) and no additional setbacks or asset protection zone is required.
- Lot 14 is located in the potential impact buffer, but separated from bushfire prone areas by a perimeter road:
  - The maximum level of potential radiant heat flux at the closest point on the northern boundary of Lots 14 is 34.59 kW/m^2.
  - To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lot 14 would need to be setback at least 23m from the northern boundary of the lot (Refer to Table 3).
- Lots 11, 12 and 15 directly adjoin hazardous vegetation that include areas of medium and high potential fireline intensity:
  - The maximum level of potential radiant heat flux at the closest point on the eastern boundary of Lots 11 and 12 is 111.69 kW/m^2. For Lot 15, the maximum level of potential radiant heat flux at the closest point on the boundary is 85.16 kW/m^2.
  - To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lots 11 and 12 would need to be setback at least 23m from the eastern boundary of the lot (Refer to **Error! Reference source not found.**).
  - For Lot 12, additional separation is also required between any future buildings or structures and the northern boundary of the lot. To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lots 12 would need to be setback at least 23m from the northern boundary of the lot (Refer to Table 3).

For Lot 15, to achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings would need to be setback at least 19.5m from the eastern boundary of the lot (Refer to Table 4). Results indicate that the proposed development is at risk of bushfire attack and that planning and management to reduce bushfire attack risk is required.

TABLE 2: SPP APZ WIDTH CALCULATOR RESULTS – LOT 11 AND 12 – EAST ASPECT (VHC 10.1)

SPP Bushfire Asset Protection Zone Width Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
Input Values			
FIRE WEATHER SEVERITY	FDI		57.00
VEGETATION HAZARD CLASS	VHC	-	10.1 Spotted gum dominated open forest
REMNANT STATUS	-	-	Non-Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	θ	degrees	1.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	23.00
Output Values			
SURFACE FUEL LOAD	-	t/ha	16.3
NEAR SURFACE FUEL LOAD	-	t/ha	3.00
BARK FUEL LOAD	-	t/ha	1.50
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	20.80
TOTAL SURFACE FUEL LOAD	w	t/ha	19.30
POTENTIAL FIRE LINE INTENSITY	I	kW/m	18696
RADIANT HEAT FLUX	q	kW/m2	28.78
BUSHFIRE ATTACK LEVEL (AS 3959-2018)	BAL	-	BAL 29

DISCLAIMER: Fire-line intensity and radiant heat calculations where effective slope exceeds 20 degrees (downslope) or 15 degrees (upslope) may be unreliable. In these locations, specialist assessment is warranted.

TABLE 3: SPP APZ WIDTH CALCULATOR RESULTS – PROPOSED LOTS 12 AND 14 - NORTH EAST ASPECT (VHC 10.1).

SPP Bushfire Asset Protection Zone Width Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
Input Values			
FIRE WEATHER SEVERITY	FDI		57.00
VEGETATION HAZARD CLASS	VHC	-	10.1 Spotted gum dominated open forest
REMNANT STATUS	-	-	Non-Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	4.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	θ	degrees	1.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	22
Output Values			
SURFACE FUEL LOAD	-	t/ha	16.3
NEAR SURFACE FUEL LOAD	-	t/ha	3.00
BARK FUEL LOAD	-	t/ha	1.50
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	20.80
TOTAL SURFACE FUEL LOAD	w	t/ha	19.30
POTENTIAL FIRE LINE INTENSITY	I	kW/m	18696
RADIANT HEAT FLUX	q	kW/m2	28.58
BUSHFIRE ATTACK LEVEL (AS 3959-2018)	BAL	-	BAL 29

DISCLAIMER: Fire-line intensity and radiant heat calculations where effective slope exceeds 20 degrees (downslope) or 15 degrees (upslope) may be unreliable. In these locations, specialist assessment is warranted.

TABLE 4: SPP APZ WIDTH CALCULATOR RESULTS – PROPOSED LOTS 14 AND 15 - NORTH EAST ASPECT (VHC 16.2).

SPP Bushfire Asset Protection Zone Width Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
Input Values			
FIRE WEATHER SEVERITY	FDI		57.00
VEGETATION HAZARD CLASS	VHC	-	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
REMNANT STATUS	-	-	Non-Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	11.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	θ	degrees	1.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	19.50
Output Values			
SURFACE FUEL LOAD	-	t/ha	7.5
NEAR SURFACE FUEL LOAD	-	t/ha	3.6
BARK FUEL LOAD	-	t/ha	0.50
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	11.60
TOTAL SURFACE FUEL LOAD	w	t/ha	11.10
POTENTIAL FIRE LINE INTENSITY	I	kW/m	9720
RADIANT HEAT FLUX	q	kW/m2	28.27
BUSHFIRE ATTACK LEVEL (AS 3959-2018)	BAL	-	BAL 29

DISCLAIMER: Fire-line intensity and radiant heat calculations where effective slope exceeds 20 degrees (downslope) or 15 degrees (upslope) may be unreliable. In these locations, specialist assessment is warranted.

7 BUSHFIRE MANAGEMENT AND PLANNING

The following sections assess the proposed development against the applicable planning requirements including identification of management measures to reduce the risk of bushfire attack to acceptable or tolerable levels.

7.1 BUSHFIRE MANAGEMENT MEASURES

The outcomes of the bushfire hazard assessment indicated that the proposed development is at risk of bushfire attack and that planning and management to reduce bushfire attack risk is required.

Planning and management measures to reduce the risk of bushfire attack can be categorised as:

i. Separation,
ii. Building,
iii. Access and evacuation,
iv. Water supply,
v. Landscape and vegetation management.

7.1.1 SEPARATION / ASSET PROTECTION ZONE

Empirical studies of bushfire-related loss of dwellings and other buildings in Australia have demonstrated a negative relationship between proximity to hazardous vegetation and house loss (Chen and McAneney 2004; Blanchi *et al.* 2014). Evidence demonstrates that increasing the distance that buildings are separated from hazardous vegetation and the presence of fuels is critical to reducing bushfire risks associated with direct flame contact, radiant heat exposure and ember attack (Blanchi *et al.* 2014). Provision of separation between hazardous vegetation and the development also reduces the design and construction costs adjacent to bushland by reducing the BAL to the building (Leonard and Blanchi 2012).

Separation areas or asset protection zones (APZs) should only include measures or uses which assist in reducing bushfire attack risks such as fire trails or perimeter roads and asset protection or fuel management zones (e.g., maintained lawns or fire-resistant landscaping).

In this case:

- The proposed development incorporates a mix of perimeter roads between lots and hazardous vegetation where it is practicable to do so (Refer to Figure 6 and Map 10, attached).
- In order to achieve an acceptable or tolerable level of bushfire attack risk, Asset Protection Zones are required on proposed Lots 11, 12, 14 and 15:
  - To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lots 11 and 12 should be setback at least 23m from the eastern boundary of the lot (Refer to **Error! Reference source not found.**).
  - To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lots 12 and 14 should be setback at least 23m from the northern boundary of the lot (Refer to Table 3).
  - To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lot 15 should be setback at least 19.5m from the eastern boundary of the lot (Refer to Table 4).
- Regardless of any building requirements, buildings on proposed lots 11, 12, 14 and 15 should be located outside of the nominated APZs.
- APZs should be established and maintained in a 'low fuel state'. Suitable uses include:
  - Hardstand areas.
  - Irrigated and maintained lawn areas.
  - Cultivated gardens subject to landscaping and vegetation management requirements identified in section 7.1.5.

Figure 7 and Map 11 illustrates the minimum 29 kW/m^2 APZs for future buildings.

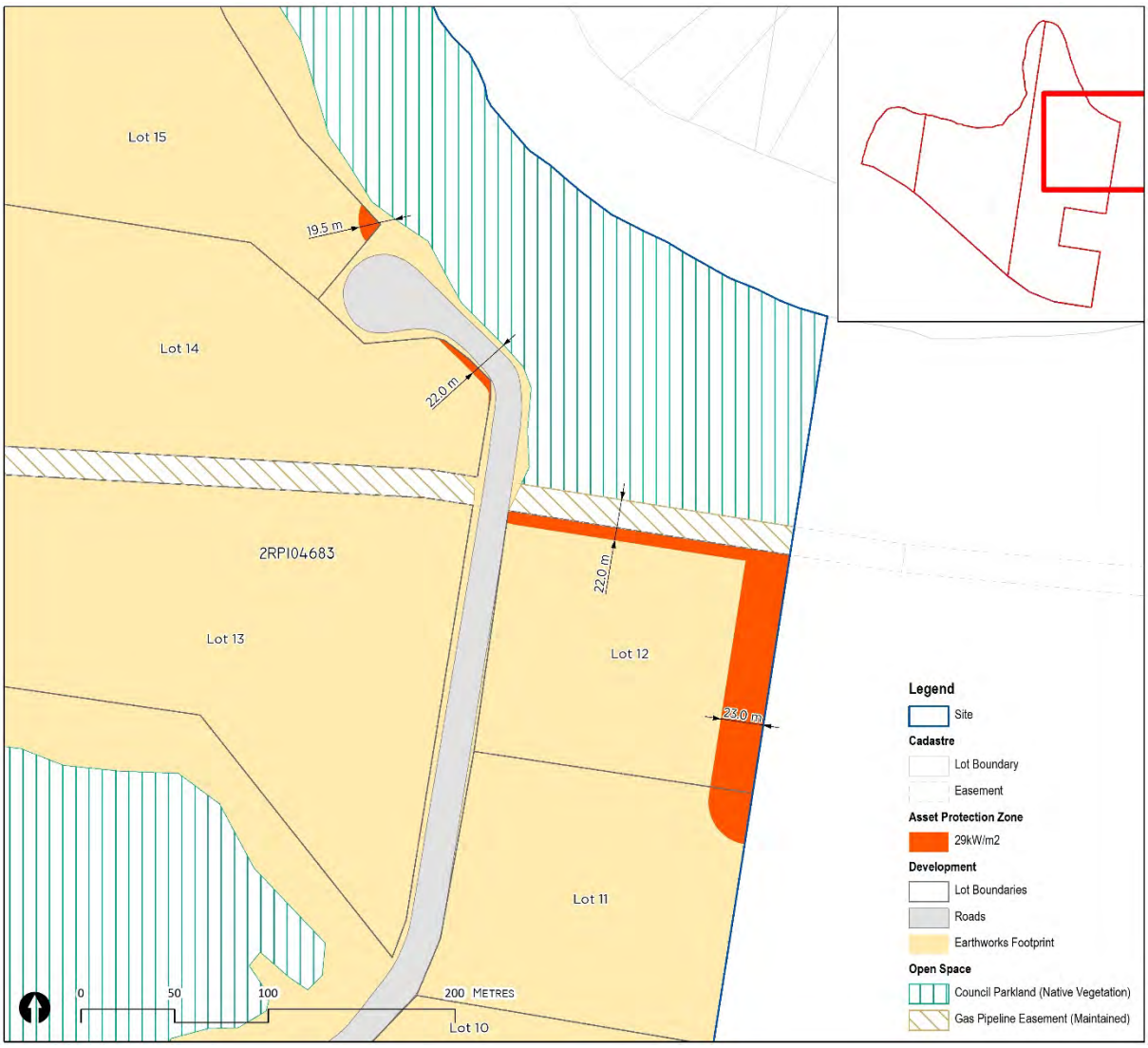

FIGURE 7: PROPOSED DEVELOPMENT AND MODELLED APZS BASED ON DISTANCES BETWEEN HAZARDOUS VEGETATION CONTAINING AREAS OF POTENTIAL FIRELINE INTENSITY.

7.1.2 BUILDING

Improving the design and construction of buildings to withstand bushfire attack is one of the most significant management measures to reduce the likelihood of property loss or loss of life (Blanchi *et al.* 2014).

Certain new buildings within *designated bushfire prone areas* require assessment against the National Construction Code (NCC). The NCC performance requirement is deemed to have been met where the building complies with either AS 3959:2018 or the NASH Standard - Steel Framed Construction in Bushfire Areas[7] (National Association of Steel Framed Housing 2014). Both AS 3959:2018 and the NASH Standard contain provisions which can be used for construction to resist bushfires in order to reduce the risk of

[7] Applies to steel-framed construction only.

bushfire attack. These provisions include requirements for burning debris and ember protection, controls on the combustibility of exterior materials, and the protection of openings, such as windows and doors. The NCC requirements do not apply to non-residential buildings (Class 4-9) such as offices, shops, hospitals and schools.

Both AS 3959:2018 and the NASH Standard are concerned with improving the ability of buildings in designated bushfire-prone areas to better withstand attack from bushfire, thus giving a measure of protection to the building occupants (until the fire front passes) as well as to the building itself. Table 5 outlines current Bushfire Attack Levels, radiant heat flux thresholds and relevant sections of AS 3959:2018 which specifies building design and construction features. Figure 8illustrates the relationship between BAL, radiant heat and bushfire attack mechanisms.

TABLE 5: BALS AND REPRESENTATIVE HEAT FLUX THRESHOLDS, LEVELS OF EXPOSURE AND RELEVANT SECTIONS OF AS 3959:2018 OUTLINING RELEVANT CONSTRUCTION REQUIREMENTS (STANDARDS AUSTRALIA 2018).

Bushfire Attack Level (BAL)	Heat flux exposure thresholds	Relevant sections of AS 3959:2018
BAL 12.5	< 12.5kW/ m2	3 and 5
BAL 19	>12.5 kW/m2 to 19 kW/m2	3 and 6
BAL 29	>19 kW/m2 to 29 kW/m2	3 and 7
BAL 40	>29 kW/m2 to 40 kW/m2	3 and 8
BAL FZ	>40 kW/m2	3 and 9

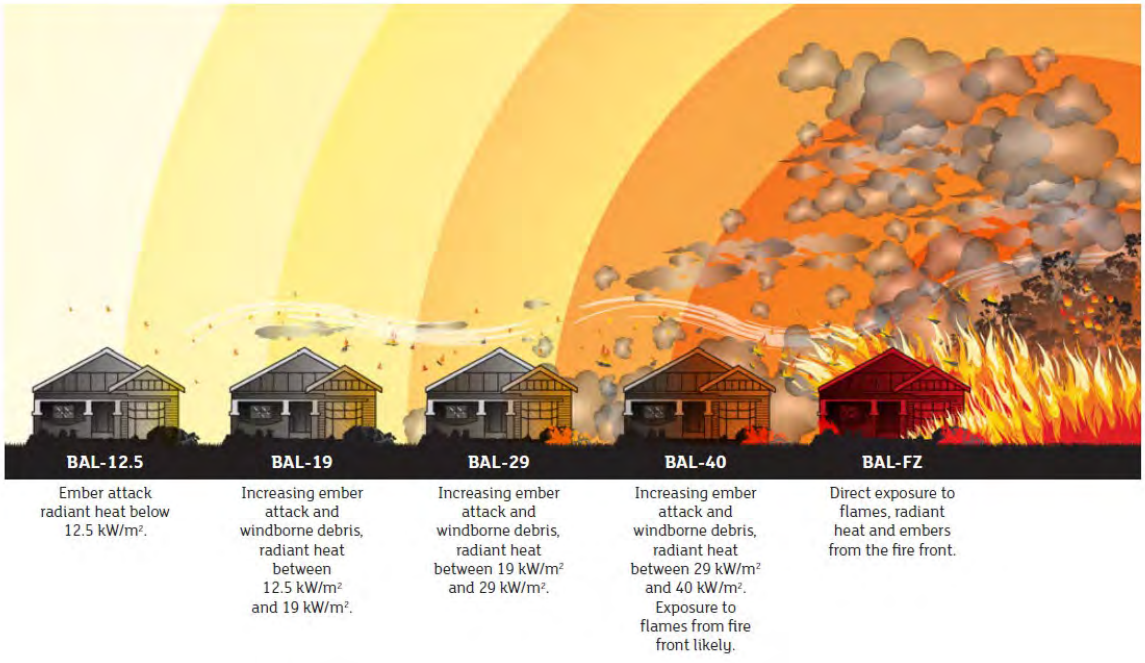

FIGURE 8: BAL/RADIANT HEAT LEVELS AND BUSHFIRE ATTACK MECHANISMS (SOURCE: COUNTRY FIRE AUTHORITY 2012).

Results of the radiant heat flux calculations according to Method 2 of AS 3959:2018 using the SPP Bushfire Asset Protection Zone Width Calculator (Queensland Fire and Emergency Services 2019b) indicated that regardless of NCC requirements, buildings on proposed lots 11, 12, 14 and 15 should be located outside of the nominated APZs (Refer to Figure 7).

7.1.3 ACCESS

Access to and from sites reduces the risk of bushfire attack by:

- Providing easy and safe movement away from any encroaching fire;
- Providing easy and safe access for firefighting and other emergency vehicles; and,
- Allowing for alternative safe access and evacuation routes should access in one direction be blocked in the event of a bushfire.
- Design and implementation of an evacuation plan in accordance with AS 3745 Planning for Emergencies in Facilities and the *Work Health and Safety Regulation 2011* (Qld).

In particular, emergency services and uses providing community support services should have direct access to safe access and egress routes. Safe access and egress routes do not expose emergency and community support services to bushfire hazard. If routes are exposed to bushfire hazard, alternative direct and safe routes should be provided.

In the case of the development:

- Perimeter roads have been provided between areas of open space that contain hazardous vegetation.
- Access to and egress from the site is via sealed roads that comply with the Queensland Fire and Emergency Services (2015) *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots*.
- In the unlikely event that access, or egress to Westphalen Drive is blocked, there are suitable sheltering-in-place options on each of the proposed lots that are not exposed to bushfire attack risk.

7.1.4 WATER SUPPLY

Access to an adequate reticulated or dedicated, static water supply for firefighting purposes is an essential element of bushfire safety planning.

In the case of the proposed development, the site has access to reticulated water supply and water pressure suitable for firefighting. Reticulated hydrant systems should be installed and located in accordance with the Queensland Fire and Emergency Services (2015) *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots* or where Queensland Urban Utilities specifies a design and performance criteria above the requirements of AS 2419.1 2005 Appendix B, the Queensland Urban Utilities requirements will be adopted.

7.1.5 LANDSCAPE AND VEGETATION MANAGEMENT

Proximity to hazardous vegetation and bushfire fuel sources increased the likelihood and risk of bushfire attack. In addition to maximising the distance between buildings / structures and hazardous vegetation, fuel load management via landscape design and vegetation management is integral to reducing bushfire attack risk (e.g., controlled burning, mowing/slashing etc.).

In the case of the proposed development, landscaping within the separation distances should be designed and managed to minimise flame contact and radiant heat exposure to buildings, and the potential for ignition from ember attack. Examples of landscape design and vegetation (fuel load) management measures include:

- Selection of low-flammability trees and shrubs with good barrier-forming attributes e.g., rainforest species.
- Fencing using treated hardwood or non-combustible materials.
- Planting or maintaining plant species which minimise leaf litter drop and minimise contribution to the accumulation surface fuel i.e., persistent leaf litter.
- Planting or maintaining low-flammability species.
- Planting or maintaining species with attributes which:
  - Reduce the ease of combustion;
  - Minimise contribution to potential fuel load; or,
  - Act as a potential barrier, reducing the rate of fire spread.
- Landscape maintenance, including the maintenance of separation distances and fuel loads.

In the case of the proposed development, landscaping within the nominated APZs should be designed and managed as follows:

- Avoid vegetation that regularly dries out during the bushfire season.
- Avoid storage of green waste within the curtilage of the buildings.
- Maintain and remove:
  - dead or dry leaves, twigs and branches.
  - leaves and branches which overhang buildings and pathways.
- Dead plants should be removed immediately during the bushfire season.
- Maintaining plants and garden beds clear of ground litter and other combustible debris.
- Irrigating during periods of hot, dry weather.
- Any future fences within nominated APZs shall have fencing constructed from:
  - non-combustible materials (e.g., wire stringers, sheet metal or masonry); or
  - treated hardwood, where the timber fence does not connect to the building and has a minimum of 1 metre separation from the building. Where such a fence connects directly to or has less than 1 metre separation from the building it shall be constructed from non-combustible materials.

8 SUMMARY

The following Bushfire Hazard Assessment and Management Plan (BHAMP) has been prepared by Litoria Consulting on behalf of Walker Bremer Park Pty Ltd for the Citiswich Estate commercial development located at Warrego Highway, Bundamba, Queensland. The Citiswich Estate development is comprised of seven (7) stages, of which the subject of the report is Stage 7. The subject land is described as:

- Lot 13 on SP 238272 (Warrego Highway, Ipswich 4303),
- Lot 34 on SP 326668 (Warrego Highway, Ipswich 4303), and
- Lot 2 on RP 104683 (Warrego Highway, Ipswich 4303).

The purpose of the BHAMP was to:

i. Identify and measure site-specific factors which contribute to bushfire hazard,
ii. Assess the extent of bushfire prone areas (post-development) and calculate:
    a. Potential fire intensity (PFI, kW/m),
    b. Radiant heat flux (kW/m^2).
iii. For development within areas of potential fireline intensity or the potential impact buffer (100m), assess Bushfire Attack Level (BAL) in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire-prone areas* (AS 3959:2018).
iv. Where applicable, identify management measures to achieve compliance with relevant permit conditions, planning scheme requirements and State Planning Policy assessment benchmarks.

Bushfire hazard for the study area was modelled according to the methods described in Bushfire Resilient Communities (Queensland Fire and Emergency Services 2019a) and Leonard *et al.* (2014), including the creation of a quantitative model of the following measures of fire behaviour:

i. Potential bushfire fireline intensity (PFI, kW/m);
ii. Radiant heat flux/Bushfire Attack Level (kW/m^2, BAL) according to the View Factor Method described in AS 3959:2018 using the SPP Bushfire Asset Protection Zone Width Calculator (Queensland Fire and Emergency Services 2019b).

The fire behaviour modelling was carried out via GIS spatial modelling using rasterised inputs described by Leonard *et al.* (2014):

i. Fuel load based on site-specific assessment of vegetation hazard class;
ii. Maximum landscape slope; and,
iii. Fire weather severity/FFDI.

Modelling results based on the AEP 5% FFDI indicated that the subject land contains several small patches of medium potential fireline intensity, with parts of the development footprint located within the potential impact buffer (Refer to Figure 6and Map 10). Development within the potential impact buffer is potentially at risk from the main forms

of bushfire attack including flame attack, radiant heat and ember attack. The outcomes of the bushfire hazard assessment indicated that the proposed development is at risk of bushfire attack and that planning and management to reduce bushfire attack risk is required.

The following planning and management measures should be implemented to reduce the risk of bushfire attack to an acceptable or tolerable level:

- Asset Protection Zones are required for proposed Lots 11, 12, 14 and 15.
- To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lots 11 and 12 should be setback at least 23m from the eastern boundary of the lot (Refer to **Error! Reference source not found.**).
- To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lots 12 and 14 should be setback at least 23m from the northern boundary of the lot (Refer to Table 3).
- To achieve a maximum level of potential radiant heat flux of less than 29 kW/m^2 (BAL-29), new buildings on Lot 15 should be setback at least 19.5m from the eastern boundary of the lot (Refer to Table 4).
- Regardless of any building requirements, buildings on proposed lots 11, 12, 14 and 15 should be located outside of the nominated APZs.
- APZs should be established and maintained in a 'low fuel state'. Suitable uses include:
  - Hardstand areas.
  - Irrigated and maintained lawn areas.
  - Cultivated gardens subject to landscaping and vegetation management requirements identified in section 7.1.5.
- Reticulated hydrant systems should be installed and located in accordance with the Queensland Fire and Emergency Services (2015) *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots* or where Queensland Urban Utilities specifies a design and performance criteria above the requirements of AS 2419.1 2005 Appendix B, the Queensland Urban Utilities requirements will be adopted.
- Landscaping within the nominated APZs should be designed and managed as follows:
  - Avoid vegetation that regularly dries out during the bushfire season.
  - Avoid storage of green waste within the curtilage of the buildings.
  - Maintain and remove:
    - dead or dry leaves, twigs and branches.
    - leaves and branches which overhang buildings and pathways.
  - Dead plants should be removed immediately during the bushfire season.
  - Maintaining plants and garden beds clear of ground litter and other combustible debris.
  - Irrigating during periods of hot, dry weather.
  - Any future fences within nominated APZs shall have fencing constructed from:
    - non-combustible materials (e.g., wire stringers, sheet metal or masonry); or
    - treated hardwood, where the timber fence does not connect to the building and has a minimum of 1 metre separation from the building. Where such a

fence connects directly to or has less than 1 metre separation from the building it shall be constructed from non-combustible materials.

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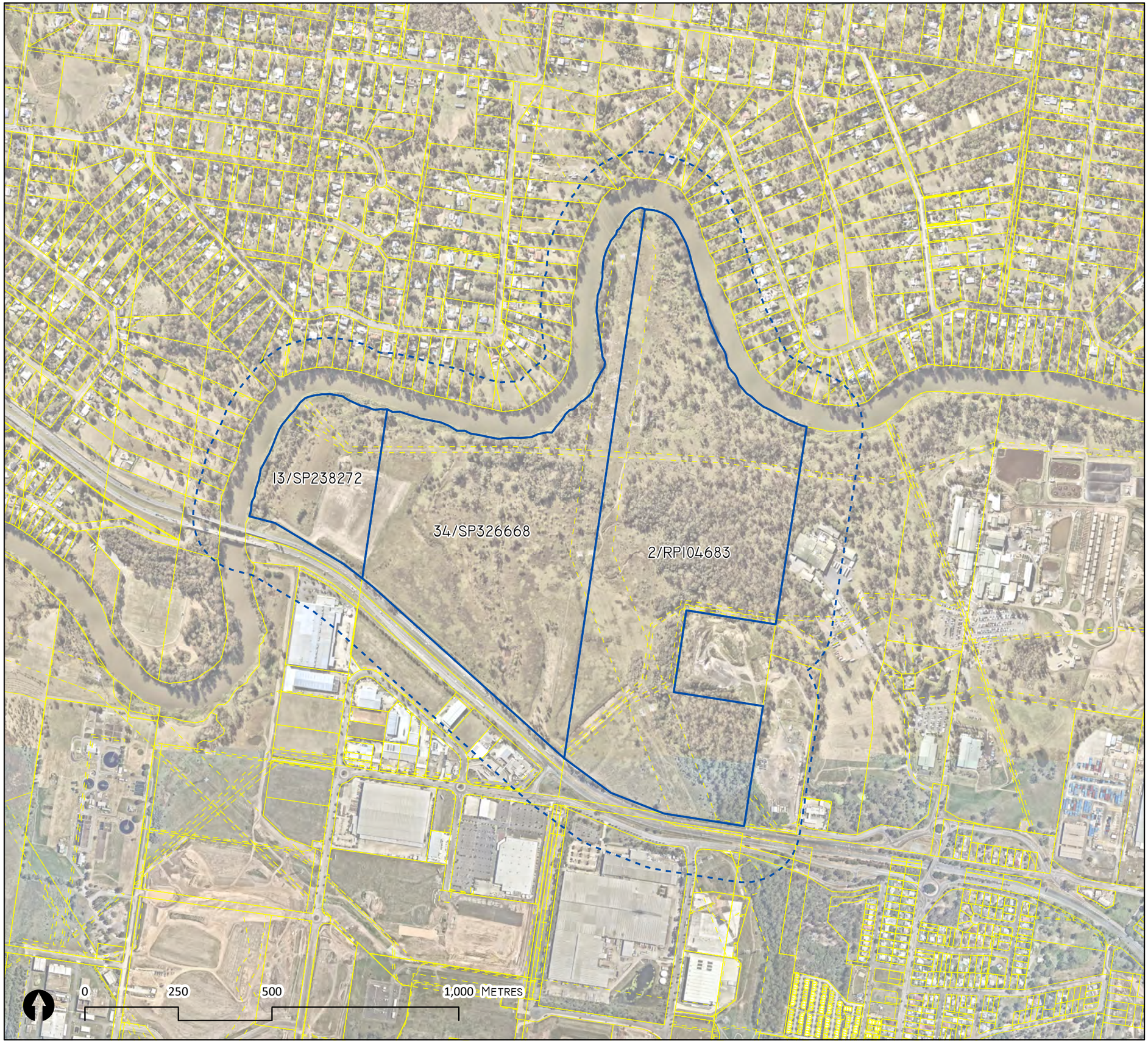
Map 1: Aerial photograph of site (Nearmap 2023)



Legend

- Site
- Site Assessment Area (150m)

Cadastre

- Lot Boundary
- Easement

DCDB: Based on or contains data provided by the State of Queensland (Department of Natural Resources and Mines) 2016. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

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Date Created: 14/11/2023

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lvl 3 22 wandoo st fortitude valley
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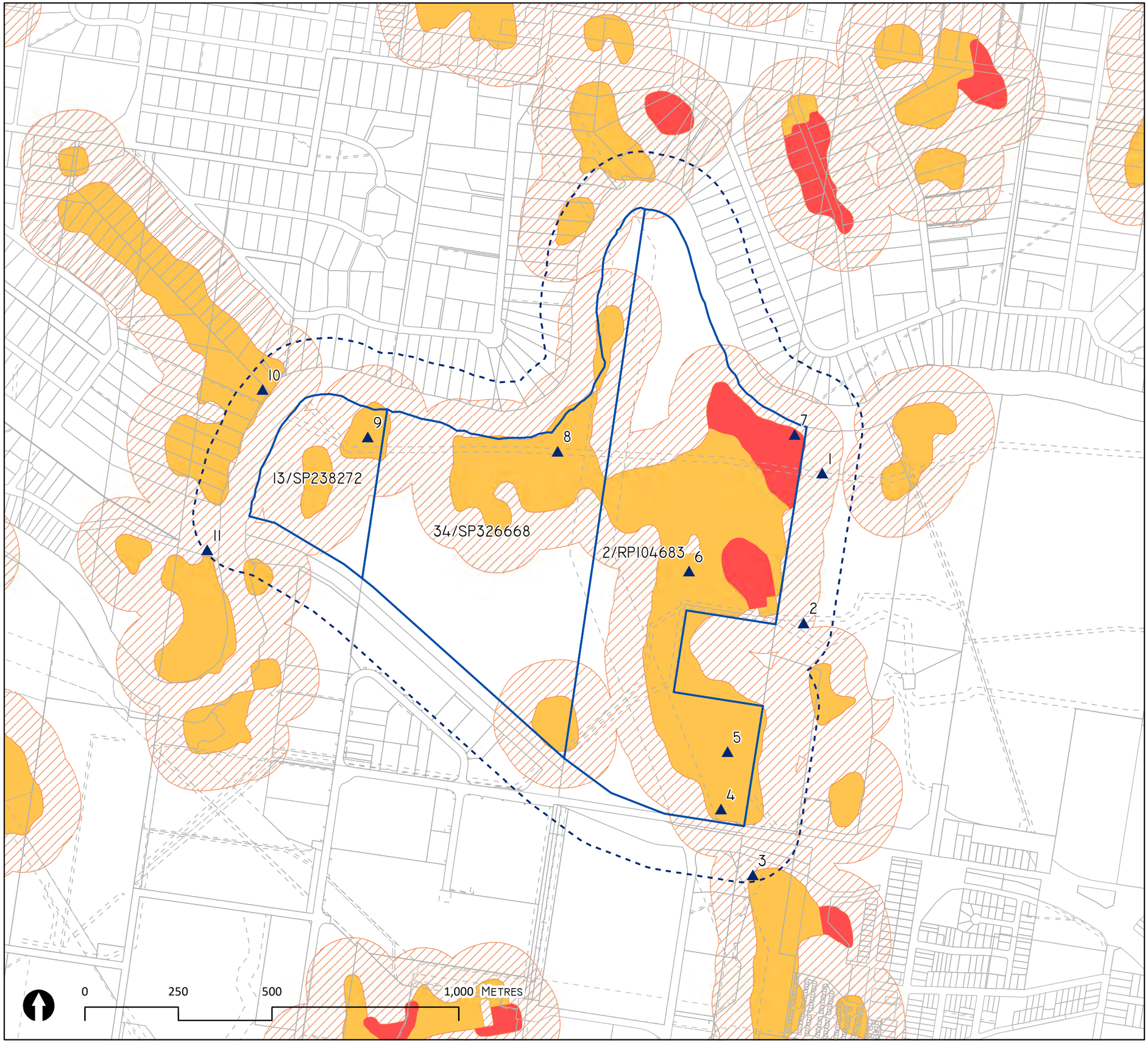
p: +61 7 3852 4855 f: +61 7 3319 8953
e: info@litoria.com.au

Map 2: SPP Map of Bushfire Prone Areas



Legend

- Site
- Site Assessment Area (150m)
- VHC Assessment Site

Cadastre

- Lot Boundary
- Easement

Bushfire Prone Area

CLASS

- Very High Potential Bushfire Intensity
- High Potential Bushfire Intensity
- Medium Potential Bushfire Intensity
- Potential Impact Buffer

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Bushfire hazard area: © State of Queensland (Public Safety Business Agency) (2019). Bushfire hazard area - Bushfire prone area - inputs – Queensland. While every care is taken to ensure the accuracy of the spatial data layer, all data custodians and/or the State of Queensland makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs to which the user might incur as a result of the data being inaccurate or incomplete in any way and for any reason. Available from http://dds.information.qld.gov.au/dds?title="Bushfirehazardarea-Bushfirepronearea-inputs-Queensland"

1:10,000

Date Created: 14/11/2023

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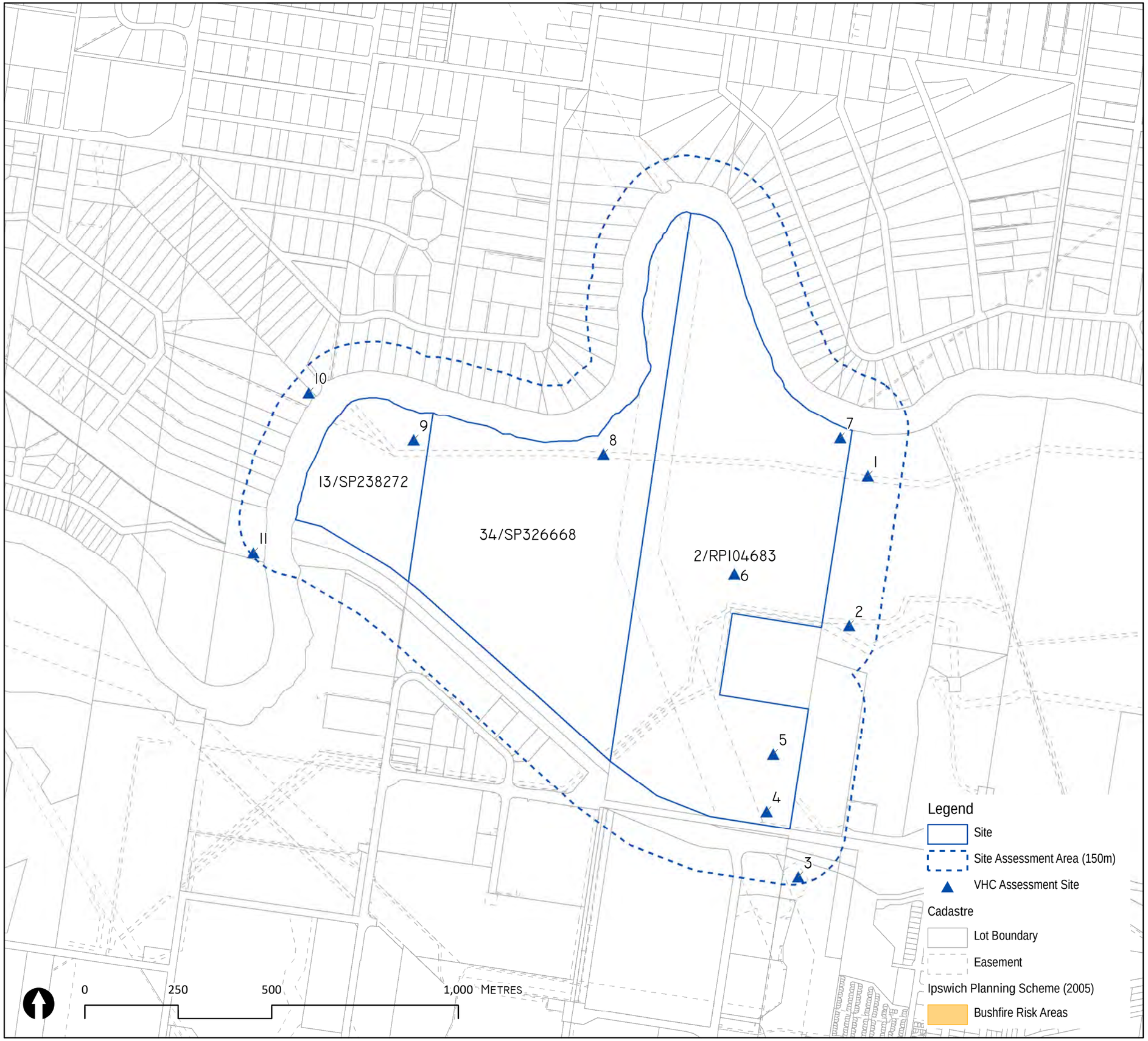
Map 3: Ipswich Planning Scheme 2006 - ICC OV01 Bushfire Risk



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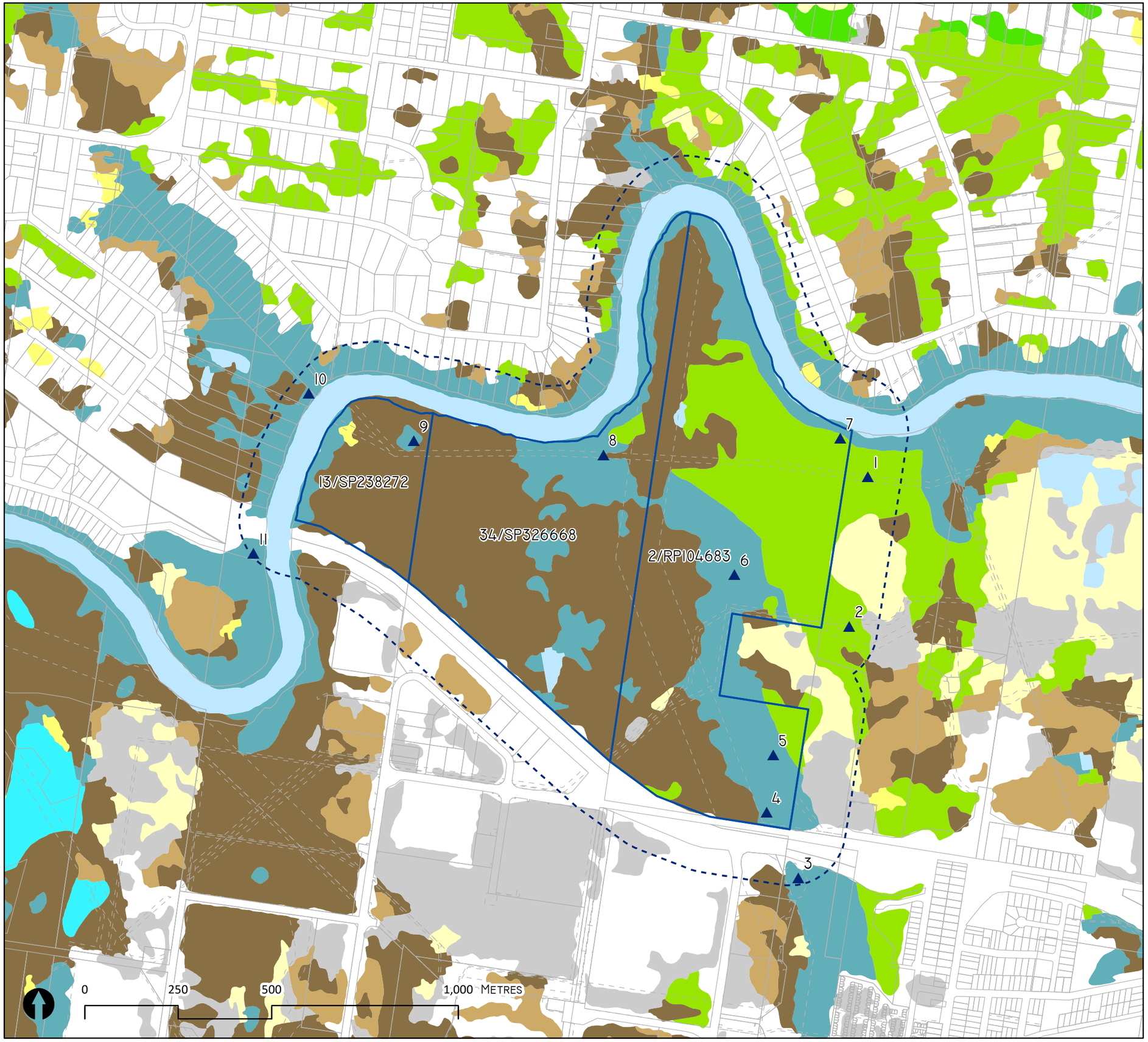
Map 4: SPP Input Map - Vegetation Hazard Class



Legend

Site

Site Assessment Area (150m)

VHC Assessment Site

Cadastre

Lot Boundary

Easement

Potential Fuel Load

Vegetation Hazard Class Number

- 9.1 Moist to dry eucalypt open forests on coastal lowlands and ranges
- 10.1 Spotted gum dominated open forests
- 16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
- 34.5 Sedgeland dominated wetlands*
- 37.1 Grassland with sparse mature or regrowth tree or shrub overstory vegetation
- 37.2 Mown or slashed grassland with sparse mature or regrowth tree or shrub overstory vegetation
- 39.1 Highly modified vegetation with mature or regrowth elements with nil or reduced vegetative ground cover
- 39.2 Built area interspersed with sparse vegetation elements, buildings and artificial cover
- 40.1 Permanent bare or very sparse vegetation
- 40.2 Permanent water bodies

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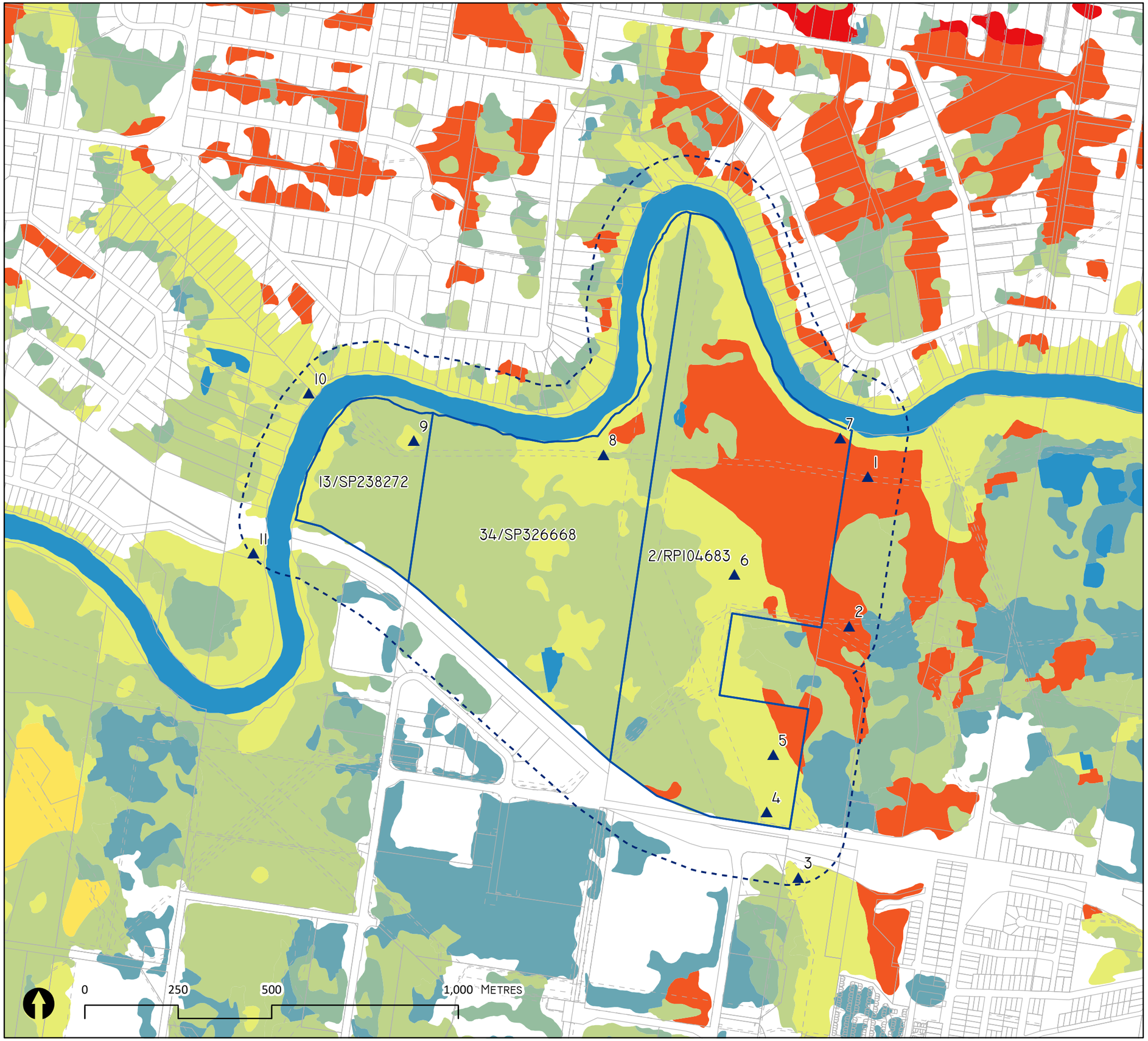
Map 5: SPP Input Map - Potential Fuel Load



Legend

- Site
- Site Assessment Area (150m)
- VHC Assessment Site

Cadastre

- Lot Boundary
- Easement

Potential Fuel Load

Tonnes / ha

- 0
- 2
- 3
- 5
- 11.6
- 13
- 14.4
- 17.4
- 20.8
- 24.2

1:10,000

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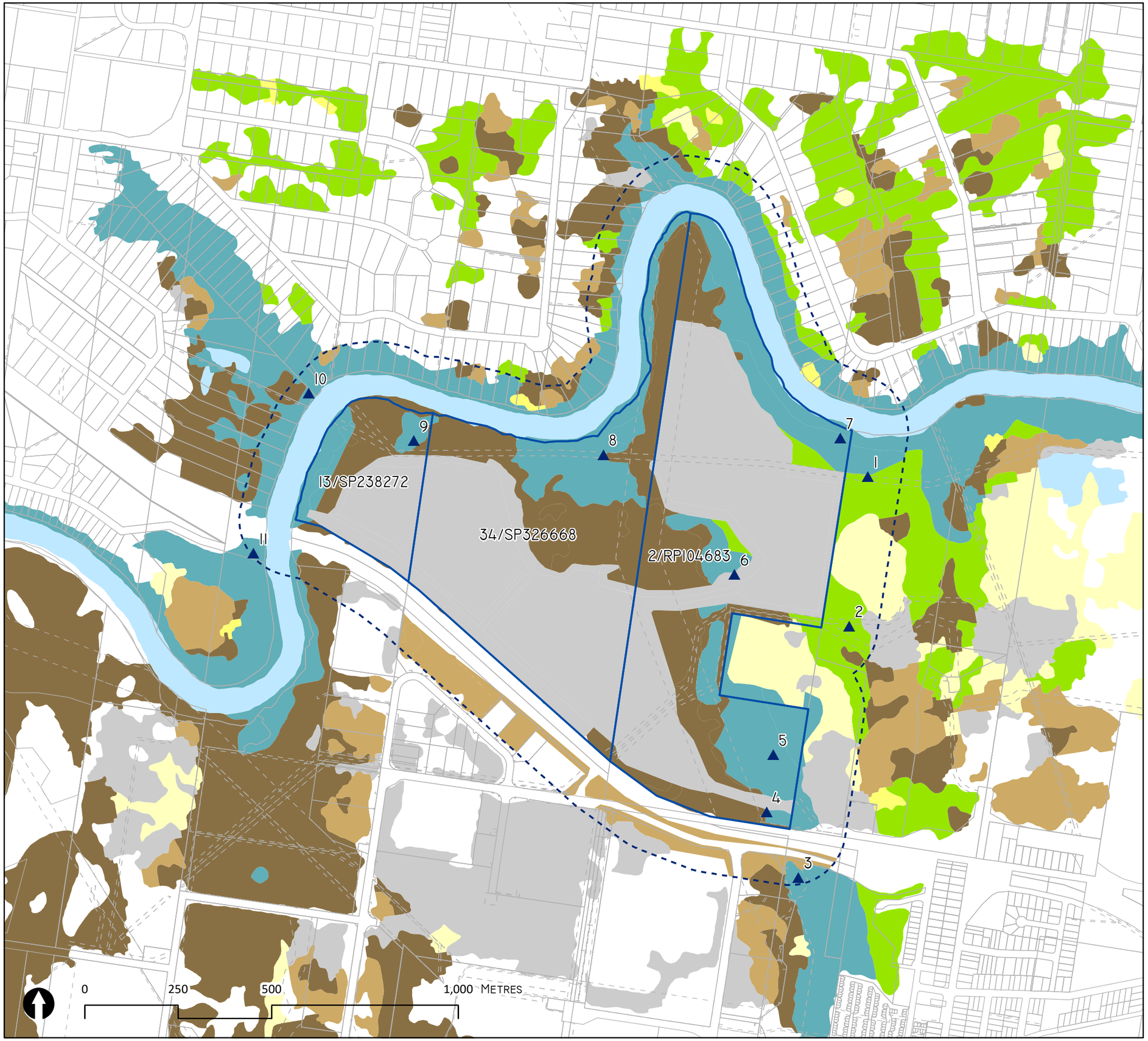
Map 6: Modelled Vegetation Hazard Class



Legend

- Site
- Site Assessment Area (150m)
- VHC Assessment Site

Cadastre

- Lot Boundary
- Easement

Modelled Potential Fuel Load

Vegetation Hazard Class Number

- 10.1 Spotted gum dominated open forests
- 16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
- 37.1 Grassland with sparse mature or regrowth tree or shrub overstory vegetation
- 37.2 Mown or slashed grassland with sparse mature or regrowth tree or shrub overstory vegetation
- 39.1 Highly modified vegetation with mature or regrowth elements with nil or reduced vegetative ground cover
- 39.2 Built area interspersed with sparse vegetation elements, buildings and artificial cover
- 40.1 Permanent bare or very sparse vegetation
- 40.2 Permanent water bodies

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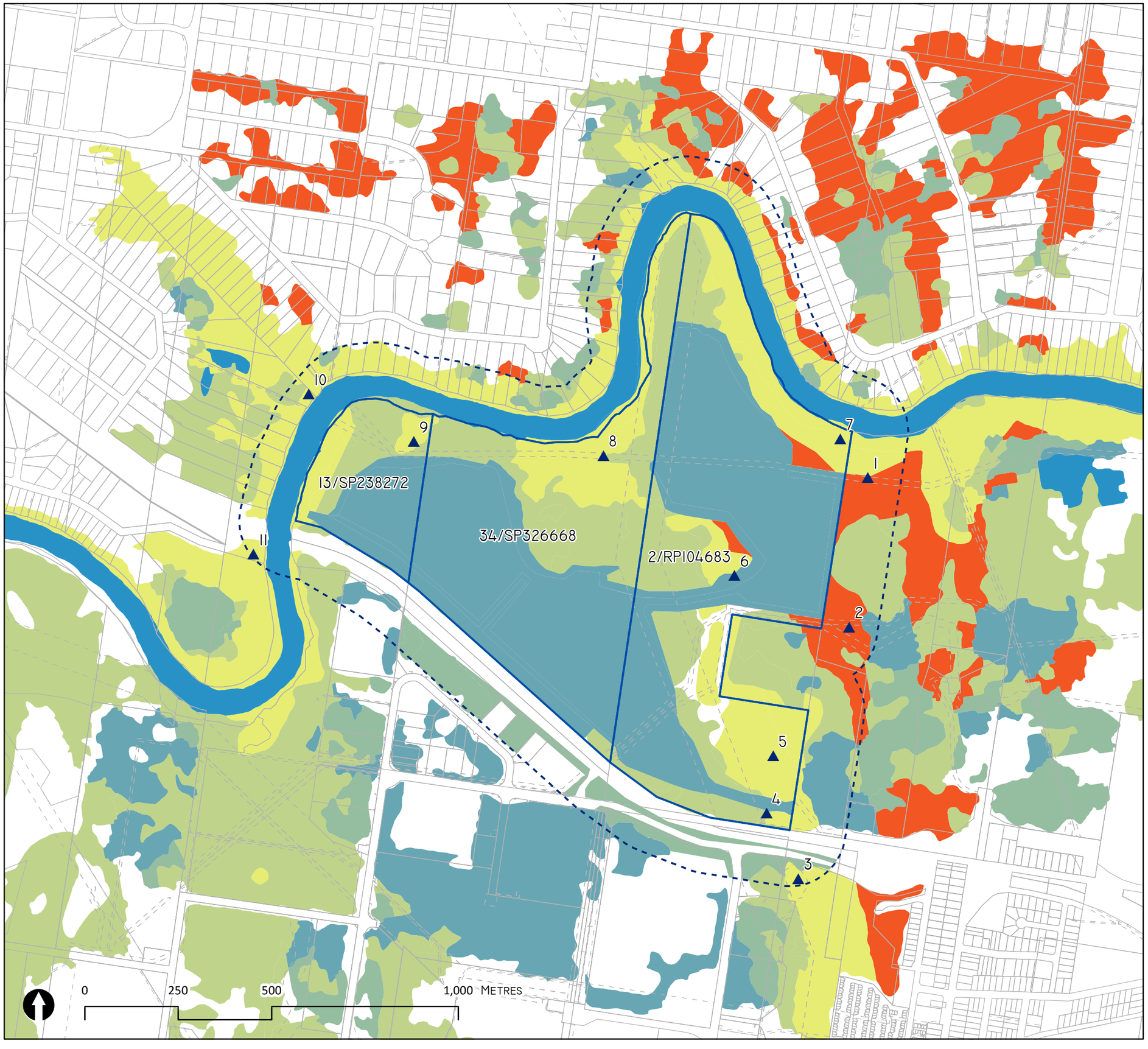
Map 6: Modelled Vegetation Hazard Class



Legend

- Site
- Site Assessment Area (150m)
- VHC Assessment Site

Cadastre

- Lot Boundary
- Easement

Modelled Potential Fuel Load

Tonnes / ha

- 0
- 2
- 3
- 5
- 11.6
- 13
- 14.4
- 17.4
- 20.8
- 24.2

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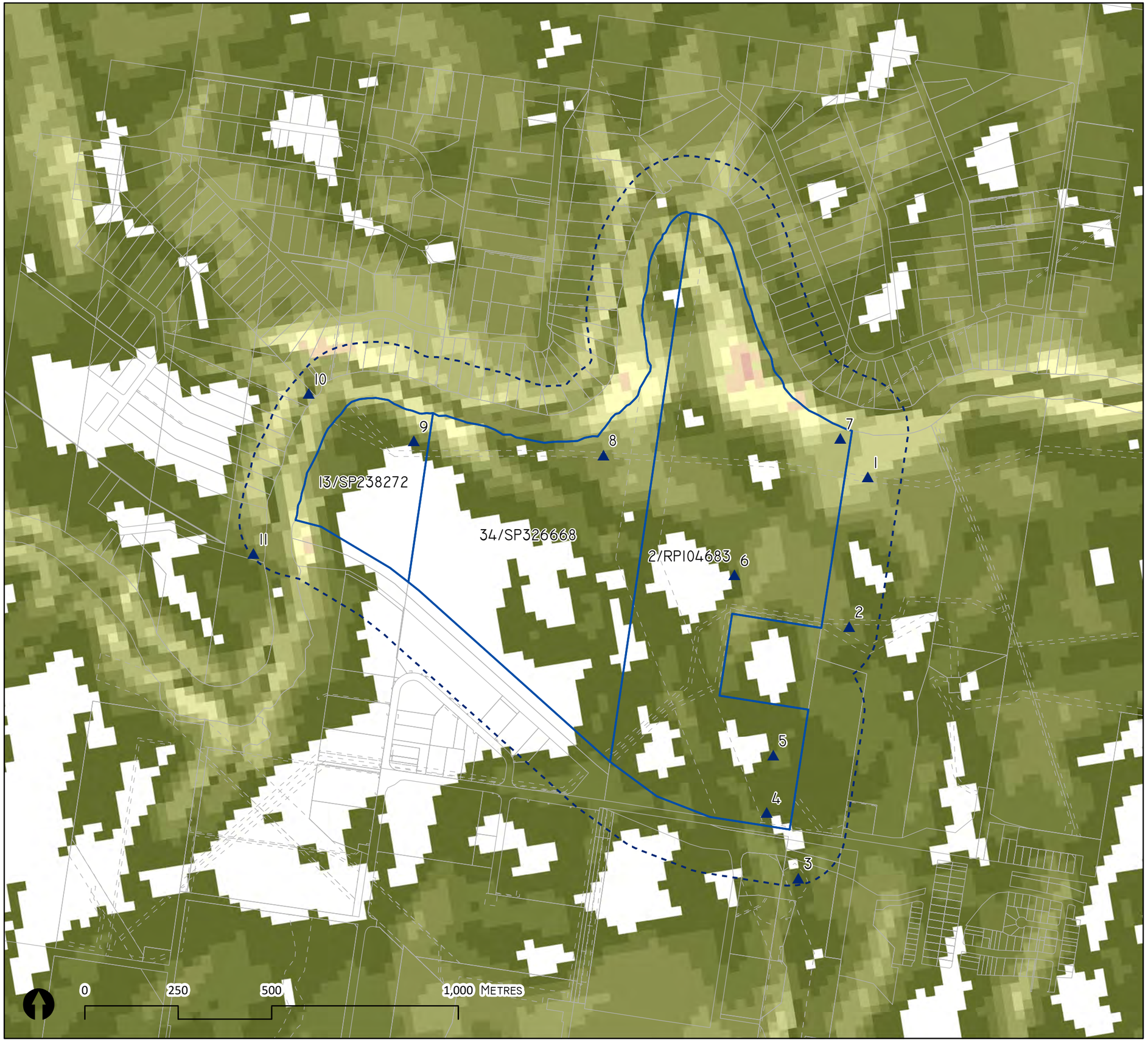
Map 8: SPP Input Map - Maximum Landscape Slope



Legend

- Site
- Site Assessment Area (150m)
- VHC Assessment Site

Cadastre

- Lot Boundary
- Easement

Maximum Landscape Slope

Degrees

High : 66

Low : 1

1:10,000

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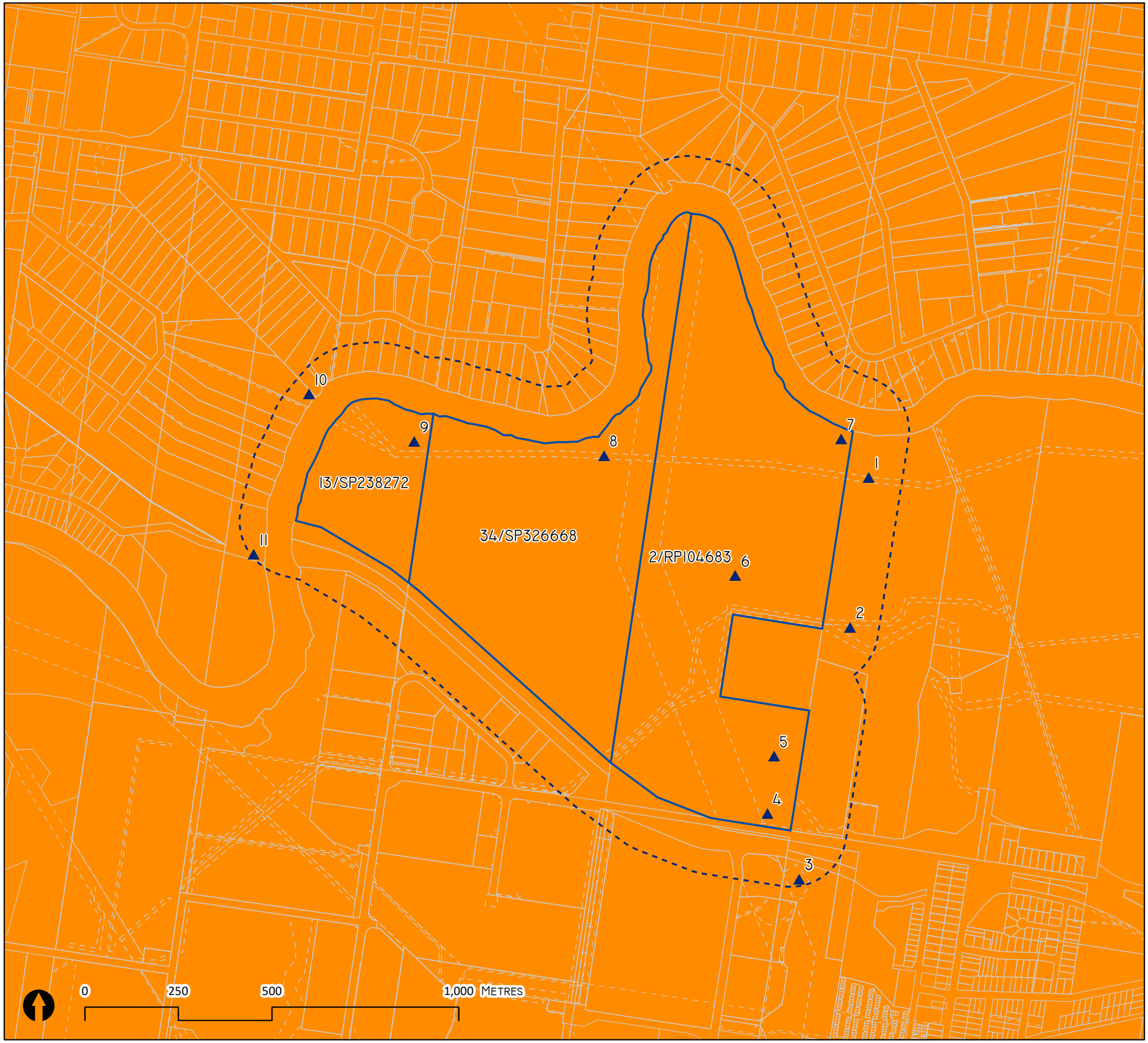
Map 9: SPP Input Map - Fire Weather Severity



Legend

- Site
- Site Assessment Area (150m)
- VHC Assessment Site

Cadastre

- Lot Boundary
- Easement

Fire Weather Severity

FFDI

- High : 138
- Low : 41

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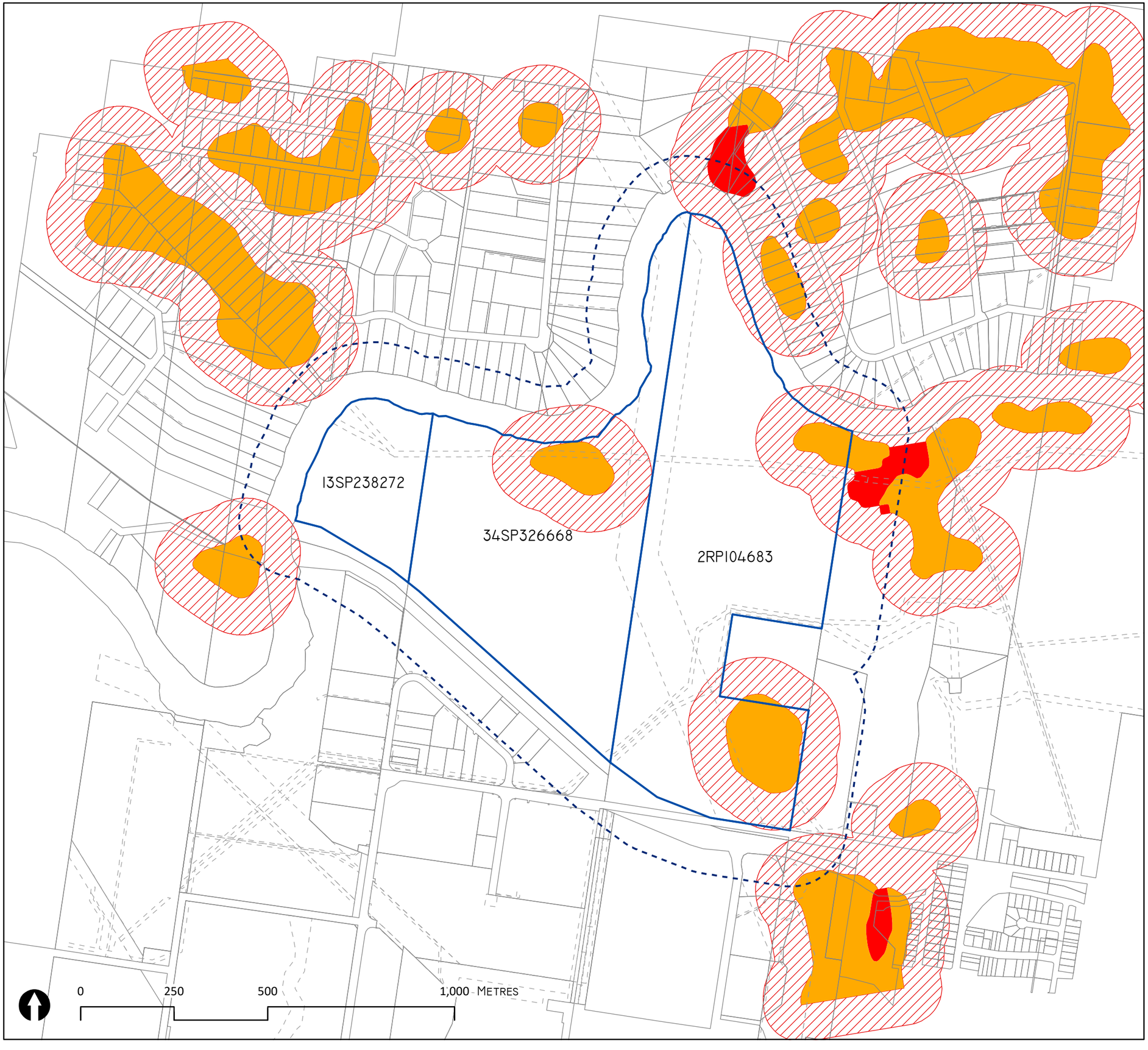
Map 10: Modelled Bushfire Prone Areas



Legend

- Site
- Site Assessment Area (150m)

Cadastre

- Lot Boundary
- Easement

Bushfire Prone Area

CLASS

- High Potential Bushfire Intensity
- Medium Potential Bushfire Intensity
- Potential Impact Buffer

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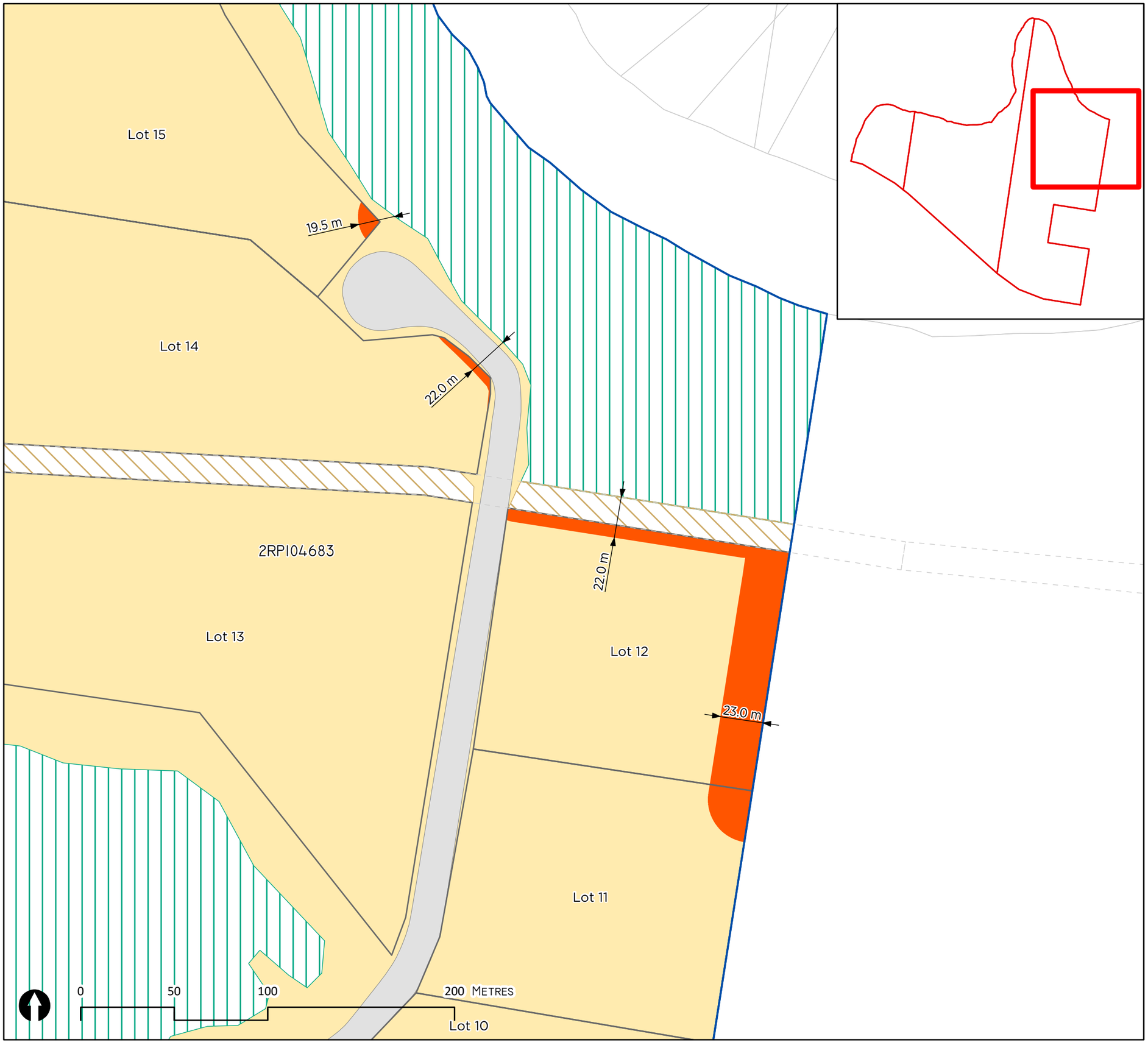
Map 11: Asset Protection Zones



Legend

- Site

Cadastre

- Lot Boundary
- Easement

Asset Protection Zone

- 29kW/m2

Development

- Lot Boundaries
- Roads
- Earthworks Footprint

Open Space

- Council Parkland (Native Vegetation)
- Gas Pipeline Easement (Maintained)

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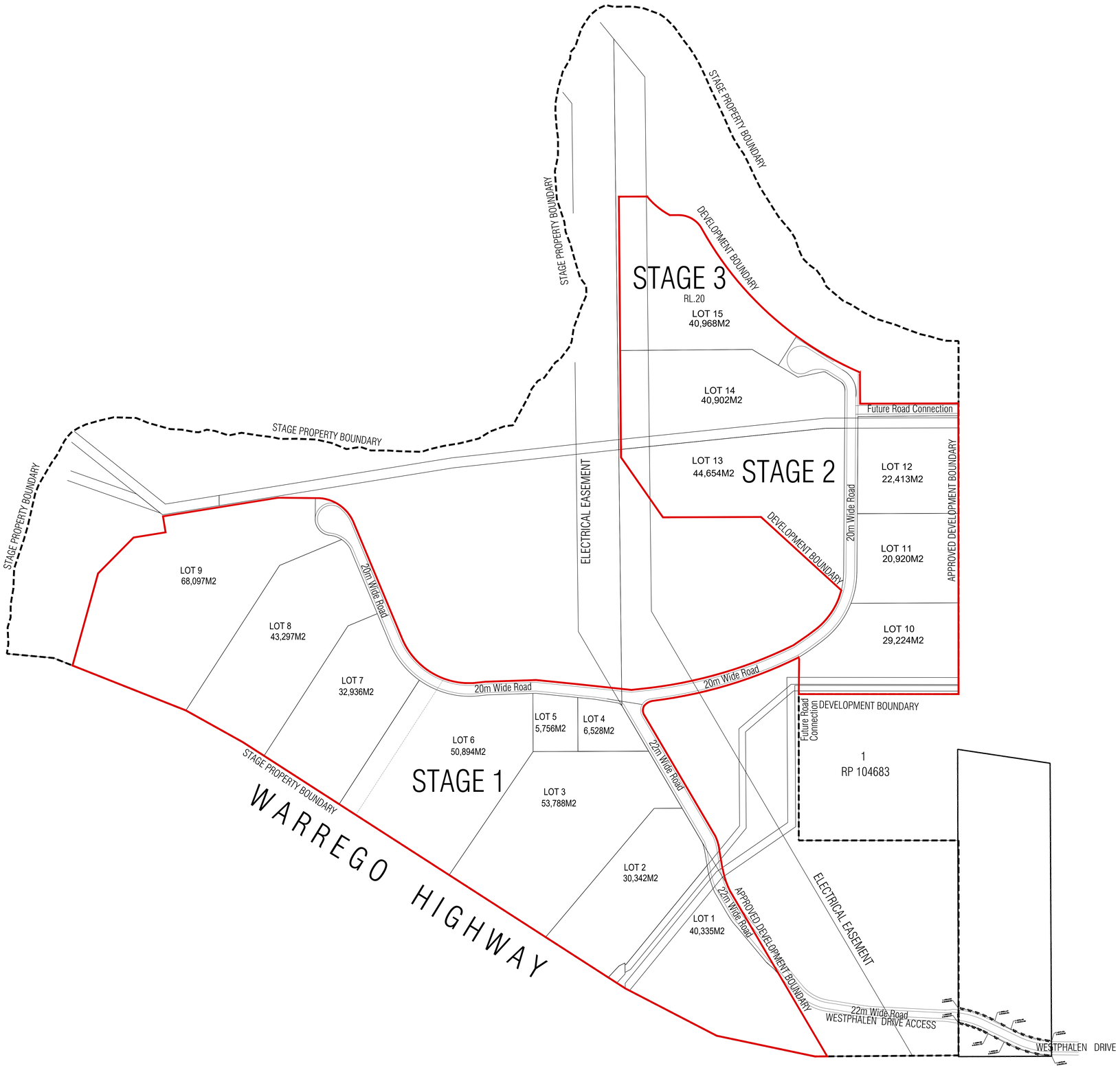
APPENDIX 1: PROPOSED PLAN OF DEVELOPMENT

CITISWICH STAGE 7

Warrego Highway, Bundamba QLD

	574 478 m²	DA APPROVED DEVELOPMENT AREA

Lots 1-9	331 973 m²	STAGE 1
Lots 10-13	122 384 m²	STAGE 2
Lots 14-15	76 697 m²	STAGE 3
	531 054 m²	TOTAL NLA APPROVED DEVELOPMENT BOUNDARY



CITISWICH BUSINESS PARK - STAGE 7 - Approved Development Boundary

Date 22-Aug-23

Drawing number WC-CS7-MP-074 Clean

APPENDIX 2: PROPOSED LANDSCAPE MASTER PLAN

APPENDIX 3: VEGETATION HAZARD CLASS SURVEY

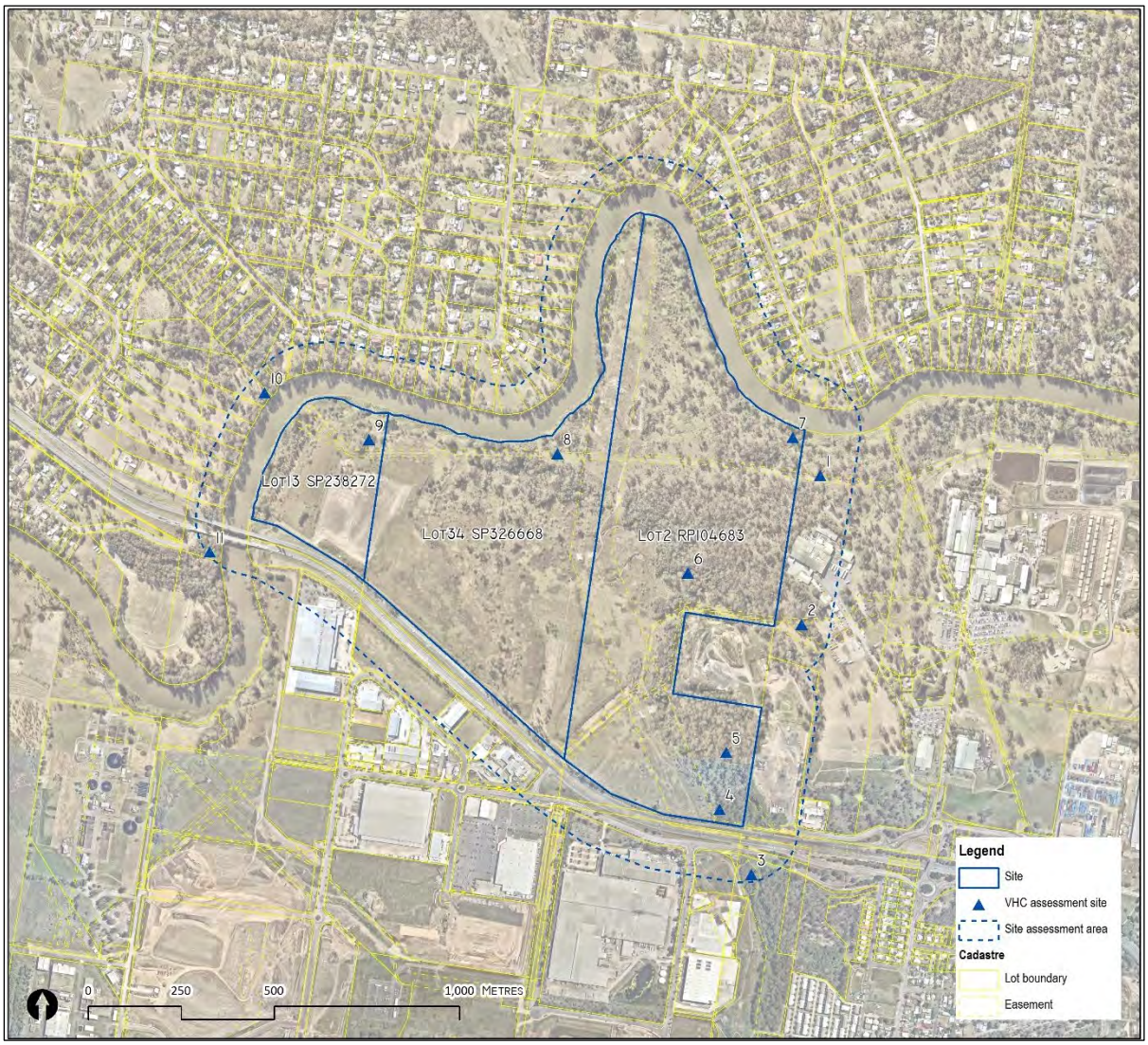


FIGURE 9: RECTIFIED DIGITAL AERIAL PHOTOGRAPH OF THE SITE, SITE ASSESSMENT BUFFER AND VHC ASSESSMENT SITES (NEARMAP 2023).

Site No.:	1
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.3 Spotted gum dominated open forests.
Observed VHC (Litoria Consulting):	16.3 Spotted gum dominated open forests.
Potential fuel load:	
Notes:	• Structure categories: tall trees 10-30m, very sparse • Canopy species (T1) (22m; very sparse): *Eucalyptus tereticornis, Corymbia tessellaris, Eucalyptus moluccana,* and *Corymbia citriodora.* • Canopy species (T2) (12 – 17 m; sparse) includes canopy recruits, *Corymbia torelliana*, and *Acacia sp.* • Shrub species (2-6m) includes canopy recruits, *Opuntia stricta*, and *Lantana camara.* • The understory is weedy and dominated by exotic grasses: *Megathyrsus maximus, Sporobolus pyramidalis*, *Harissa sp., Ageratum houstonianum, Senecio madagascariensis,* and *Bidens pilosa.* • Near surface fuel: Continuous near surface unmaintained / un-grazed exotic grasses 0.8m height • Surface fuel: <10% scattered and discontinuous leaf litter, limited fallen branches or woody debris.

Site No.:	2
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.3 Spotted gum dominated open forests.
Observed VHC (Litoria Consulting):	16.3 Spotted gum dominated open forests.
Potential fuel load:	20.8
Notes:	• Structure categories: trees, 10-30m, sparse • Canopy species (T1) (16 – 22 m; very sparse): *Eucalyptus tereticornis, Corymbia tessellaris* and *Corymbia citriodora.* • Canopy species (T2) (8 – 15 m; sparse): dominant *Acacia glaucocarpa* with *Celtis sinensis* and *Sygarus romanzoffia.* • Shrub species (2-3m) including canopy recruits and L*antana camara.* • Understory is weedy, including exotic grass sp., *Ageratum houstonianum, Bidens pilosa, Asparagus sp., Passiflora suberosa.* • Near surface fuel: Patches of unmaintained exotic grasses at 0.4m height ~50% cover • Surface fuel: Discontinuous leaf litter cover ~50%, 3cm depth, fallen branches <10cm diameter common

Site No.:	3
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Structure categories: trees low 2-10m mid dense • Emergent (T1) (18m, very sparse) *Eucalyptus tereticornis.* • Canopy species (T2) (8 – 10 m; mid dense): *Lophostemon suaveolens* and *Melaleuca quinquenervia.* • Shrub species (2 – 3 m; mid dense): canopy spp., *Acacia sp.*, *Senna pendula,* and *Lomandra longifolia*. • Understory weedy including *Lomandra longifolia, Lantana camara, Ageratum houstonianum, Bidens pilosa, Asparagus sp.* and *Passiflora suberosa.* • Near surface fuel: Discontinuous fuel, dominated by invasive herbaceous species, patches of *Panicum sp* to 1m, occasional fallen logs >20cm diameter. Twigs and woody debris frequent. • Surface fuel: 70% leaf litter cover 2 – 3 cm depth. • Wet / boggy, near waterway.

Site No.:	4
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Structure categories: Tall trees 10-30m, sparse • Canopy species (T1) (16 – 22 m; very sparse): Species include *Eucalyptus tereticornis, Eucalyptus siderophloia, Corymbia intermedia.* • Canopy species (T2) (8 – 12m; sparse): Canopy spp., *Acacia sp., Lophostemon suaveolens* and *Alphitonia excelsa.* • Shrub species (2 – 6 m; sparse): *Acacia spp., Opuntia stricta,* and *Lantana camara.* • Understory contains *Megathyrsus maximus, Paspalum spp., Lantana camara* and *Ageratum houstonianum*. • Near surface fuel: Dominated by continuous unmaintained exotic grasses up to 2m height. Woody debris uncommon, aside from *Lantana camara* debris. • Surace fuel consists of continuous leaf litter 2-3cm depth.


Site No.:	5
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Structure categories: Tall trees 10-30m, sparse • Canopy species (T1) (18 – 25 m; sparse): *Eucalyptus tereticornis, Eucalyptus crebra, Corymbia tessellaris* and *Corymbia citriodora.* • Canopy species (T2) (8 – 15 m; mid dense): Canopy spp., *Acacia spp., Celtis sinensis* and *Alphitonia excelsa.* • Shrub species (2 – 6 m; mid dense) Canopy spp. and *Lantana camara*. • The understory is weedy except for patches of *Calyptochloa gracillima* and *Parsonsia straminea,* otherwise dominated by exotic grasses, *Megathyrsus maximus, Ageratum houstonianum, Asparagus sp.* • Alluvium, wet, dense understory with waterway tracking through the vegetation. • Near surface fuel dominated by exotic grasses. • Surface fuel includes leaf litter ~70% cover. • Little to no woody debris however woody vine sp are common.

Site No.:	6
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Structure: Trees high 10-30m, mid dense • Canopy species (T1) (14 – 18 m, mid dense): *Casuarina cunninghamiana* dominant, among *Eucalyptus tessellaris, Eucalyptus tereticornis, Lophostemon suaveolens.* Canopy often smothered by *Asparagus sp.* (climbing). • Canopy species (T2) (6 – 14 m; very dense) *Casuarina cunninghamiana* and *Celtis sinensis.* • The understory is sparse and dominated by weeds, particularly *Asparagus sp.* (climbing). • Discontinuous near surface fuel consisting of scattered dead branches, high volume of twiggy debris and dead and living vines. • Continuous surface fuel consists of 85% leaf litter at 1 – 2 cm depth, material dominated by casuarina needles. • Intersected by a waterway.

Site No.:	7
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.3 Spotted gum dominated open forests.
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Structure: Tall trees 10-30m, very sparse • Canopy species (T1) (22m – 25 m; very sparse): *Eucalyptus tereticornis* (dominant) and *Corymbia intermedia, Corymbia tessellaris and Eucalyptus crebra.* • Canopy species (T2) (10 - 16 m; very sparse): Canopy sp., and *Casuarina cunninghamiana.* • Shrub species (2-6m) Canopy spp., *Opuntia stricta* and *Lantana camara.* • The understory is weedy, including *Megathyrsus maximus, Ageratum houstonianum, Panicum sp., Harissa sp., Senecio madagascariensis and Bidens pilosa.* • Near surface fuel: Continuous near surface pasture grasses at up to 1.5m height • Surface fuel: Discontinuous leaf litter cover at <20%, more common at large tree bases

Towards river / away from river

Site No.:	8
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Structure: Tall trees 10-30m • Canopy species (T1) (18 – 20 m; very sparse): *Eucalyptus tereticornis, Eucalyptus crebra, Casuarina cunninghamiana.* • Canopy species (T2) (10 – 18 m; sparse) *Casuarina cunninghamiana* (many dead), *Celtis sinensis*. • Shrub species (2 - 10 m; very dense): *Celtis sinensis, Lantana camara.* • Understory absent or minimal due to exotic spp. crowding, where prevalent, consists of exotic grass including *Melinis repens, Chloris gayana.* • Near surface fuel includes numerous dead branches and trees, several near surface dead tree bodies >20cm diameter. • Surface fuel is discontinuous deep, dry >95% leaf litter cover, 1-5cm depth.

Site No.:	9
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Trees high 10-30m, very sparse • Canopy species (T1) (16 – 20 m; very sparse): *Corymbia tessellaris, Eucalyptus tereticornis, Corymbia citriodora* and *Eucalyptus crebra.* • Canopy species (T2) (8 – 15 m; very sparse): Canopy spp., *Celtis sinensis* and many standing dead trees. • Shrub species: *Lantana camara* and *Opuntia stricta.* • The understory is dominated by exotic species including *Megathyrsus maximus, Lantana camara, Bidens pilosa, Ipomoea cairica, Asparagus sp., Cirsium vulgare.* • Near surface fuel: many woody >20cm diameter fallen trees and standing dead shrubs, discontinuous. • Surface fuel: Little to no leaf litter among grass, <25%.

Site No.:	10
Site address:	Citiswich northern bank (across river, observed at point 10)
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Trees high 10-30m, mid dense • Canopy species (T1) (18 – 25 m; sparse): *Eucalyptus tereticornis* (dominant). • Canopy species (T2) (8 – 10 m; dense) unidentified. • Understory composed of vines and grasses, discontinuous near surface fuel. • Maintained track near river's edge

Site No.:	11
Site address:	Citiswich, Warrego Highway
Mapped VHC (PSBA):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Observed VHC (Litoria Consulting):	16.2 Eucalyptus dominated woodland on drainage lines and alluvial plains
Potential fuel load:	11.6
Notes:	• Trees low 2-10m, dense • Canopy species (T1) (8 – 10 m; dense) *Casuarina cunninghamiana* and *Celtis sinensis,* often smothered by vines. • Shrub generally absent (smothered by vines). • The understory is weedy and consists largely of vine spp., and vegetation smothered with vines. Understory includes *Lantana camara, Passiflora suberosa Asparagus sp. (climbing), Parsonsia straminea.* • Near surface fuel: many woody >20cm diameter fallen trees, twigs and debris and dead vines. • Surface fuel: Leaf litter discontinuous, 40% ground cover, 1cm depth. • Wet / boggy environment.