Bushfire Development Report

to inform the Greenvale North Part 2 PSP at
1170G Mickleham Road
Greenvale VIC 3059

Report prepared for
Satterley Property Group Pty Ltd

February 2023, Updated May 2024

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Cover image: Looking south over Greenvale Reservoir.

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1 Introduction

This Bushfire Development Report (BDR) has been prepared for Satterley Property Group Pty Ltd, to assess how the proposed Precinct Structure Plan (PSP) at 1170G Mickleham Road, Greenvale VIC 3059 ('the site') can respond to the bushfire risk and the applicable Victorian planning and building controls that relate to bushfire, in particular the objective and applicable strategies of the Planning Policy Framework (PPF) at Clause 13.02-1S *Bushfire Planning* in the Hume Planning Scheme (Clause 13.02-1S Hume Planning Scheme) and the requirements of the Building Regulations.

This report has been prepared to inform key recommendations and considerations in relation to bushfire risk for the Greenvale North PSP (Part 2). The site forms part of the Greenvale North (R1) Precinct Structure Plan (PSP), originally gazetted in 2011 and amended in 2017. It is anticipated that the Greenvale North R1 precinct will accommodate approximately 3,500 people in approximately 1,300 dwellings when fully developed (VPA, 2017). The Greenvale North (R1) PSP shows the site as an 'investigation area' which was excluded from the PSP because of unresolved drainage issues. This area will be addressed in the Greenvale North Precinct Structure Plan (Part 2).

This report assesses the bushfire risk and demonstrates how the PSP at 1170G Mickleham Road can respond to the objectives and strategies for bushfire safety at Clauses 13.02-1S (Clause 13.02-1S Hume Planning Scheme) in the Planning Policy Framework (PPF).

The site is mostly within a designated Bushfire Prone Area (BPA). BPAs are those areas subject to or likely to be subject to bushfires, as determined by the Minister for Planning. Land around the site is being progressively removed from the BPA as urban development commences and the hazardous vegetation is removed. The site is adjacent to the Greenvale Reservoir, the presence of which has some implications for the development of the site.

Higher hazard land within a BPA, that may be subject to extreme bushfire behaviour, is covered by the Bushfire Management Overlay (BMO); however, no part of the site is affected by the BMO and the closest BMO areas are approximately 4.3 km to the south-west.

This report assesses the bushfire hazard and identifies how the proposed development can appropriately mitigate any bushfire risk and respond to and comply with the applicable bushfire planning and building controls. These are:

- Clause 13.02-1S *Bushfire Planning*, which is the State planning policy for bushfire. The development proposal needs to show that it meets the objective and applicable strategies of the policy.
- The Building Act 1993 and associated Building Regulations 2018, which require bushfire protection standards in designated BPAs, for Class 1, 2 and 3[1] buildings, certain Class 9 and 4

[1] Class 1, 2 and 3 buildings are defined in the NCC and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.

buildings[2], and Class 10A buildings[3] or decks adjacent to, or connected with, these classes of buildings.

It has been prepared in accordance with applicable guidance for the assessment of, and response to, bushfire risk provided in:

- Bushfire State Planning Policy Amendment VC140, Planning Advisory Note 68 (DELWP, 2018);
- AS 3959-2018 *Construction of buildings in bushfire prone areas* (Standards Australia, 2020);
- *Design guidelines for settlement planning at the bushfire interface* (DELWP, 2020): and
- *Planning Permit Applications Bushfire Management Overlay Technical Guide* (DELWP, 2017).

1.1 Site summary

Address:	1170G Mickleham Road, Greenvale VIC 3059
Property size:	25.05 ha
Local Government Area:	Hume City Council
Zone/s	Rural Conservation Zone - Schedule 3 (RCZ3)
Overlay/s	Environmental Significance Overlay and Schedule 9 (ESO9) Vegetation Protection Overlay and Schedule 4 (VPO4) – partial coverage
Directory reference:	Melway 179 C1
Site assessment date:	23/11/2021
Assessed by:	John Eastwood

[2] Applicable Class 9 buildings are Class 9a health-care buildings, Class 9b early childhood centres, primary and secondary schools, Class 9c residential care buildings, and any Class 4 parts of a building associated with these Class 9 buildings.

[3] Class 10a buildings are defined in the NCC as non-habitable buildings including sheds, carports, and private garages.

2 Bushfire planning and building controls

This section summarises the applicable planning and building controls that relate to bushfire. Section 5 describes how planning and design of the site can respond to and comply with the controls.

2.1 Clause 13.01-1S Natural Hazards and Climate Change

The objective of this Clause is to minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning. Specified strategies to achieve the objective are:

- *'Respond to the risks associated with climate change in planning and management decision making processes.*
- *Identify at risk areas using the best available data and climate change science.*
- *Integrate strategic land use planning with emergency management decision making.*
- *Direct population growth and development to low risk locations.*
- *Develop adaptation response strategies for existing settlements in risk areas to accommodate change over time.*
- *Ensure planning controls allow for risk mitigation and climate change adaptation strategies to be implemented.*
- *Site and design development to minimise risk to life, health, property, the natural environment and community infrastructure from natural hazards'* (Clause 13.02-1S Hume Planning Scheme).

Especially in southern and eastern Australia, since the 1950's there has been an increase in the length of the fire weather season and a greater number of higher risk days associated with climate change (CSIRO/BOM, 2022). The National Council for Fire and Emergency Services (AFAC) identify that a failure of building codes and land use planning to adequately adapt to climate change is a significant risk (AFAC, 2018).

This Clause supports the adoption of a precautionary approach to the identification and mitigation of bushfire risk.

2.2 Clause 13.02-1S Bushfire Planning

Clause 13.02-1S has the objective '*To strengthen the resilience of settlements and communities to bushfire through risk based planning that prioritises the protection of human life*' (Clause 13.02-1S Hume Planning Scheme). The policy must be applied to all planning and decision making under the Planning and Environment Act 1987, relating to land which is:

- Within a designated BPA;
- Subject to a BMO; or
- Proposed to be used or developed in a way that may create a bushfire hazard.

Clause 13.02-1S requires priority to be given to the protection of human life by:

- *'Prioritising the protection of human life over all other policy considerations.*

- *Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.*
- *Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process'* (Clause 13.02-1S Hume Planning Scheme).

Key strategies are stipulated in Clause 13.02-1S that require strategic planning documents, planning scheme amendments and development plan approvals to properly assess bushfire risk and include appropriate bushfire protection measures. This also applies to planning permit applications for:

- Subdivisions of more than 10 lots;
- Accommodation;
- Child care centre;
- Education centre;
- Emergency services facility;
- Hospital;
- Indoor recreation facility;
- Major sports and recreation facility;
- Place of assembly; and
- Any application for development that will result in people congregating in large numbers.

Development should not be approved where '*…a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented*' (Clause 13.02-1S Hume Planning Scheme).

This study assesses the hazard and identifies the bushfire protection measures that will be required for future development within the Greenvale North PSP (Part 2). The development of the site can appropriately prioritise the protection of human life and meet the objective and relevant strategies of Clause 13.02-1S by appropriate layout and design, including ensuring applicable buildings will be constructed to a BAL-12.5 construction standard.

Analysis of how the development can respond to the objective and applicable strategies in Clause 13.02-1S is provided in Section 5.2.

2.3 Clause 71.02-3 Integrated decision making

Clause 71.02-3 states that planning and responsible authorities should endeavour to integrate policies and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas, the protection of human life must be prioritised over all other policy considerations (Clause 71.02-3 Hume Planning Scheme).

2.4 Bushfire Prone Area (BPA)

The development is in a Bushfire Prone Area (BPA) (see Figure 1) (see Maps 1 and 2 for coverage of the 'Non-BPA' areas). BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning. Those areas of highest bushfire risk within the BPA are designated as BMO areas.

Figure 1 - BPA coverage (brown shading) of site (in red outline) (VicPlan, 2024).

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code 2022 (NCC), require specific design and construction standards for Class 1, 2 and 3[4] buildings, certain Class 9 and 4 buildings[5], and Class 10A buildings[6] or decks adjacent to, or connected with, these classes of buildings.

For Class 1 buildings (dwellings) and associated Class 10A buildings or decks, the applicable performance requirement in the NCC is:

'A Class 1 building or a Class 10a building or deck associated with a Class 1 building that is constructed in a designated bushfire prone area must be designed and constructed to—

(a) reduce the risk of ignition from a design bushfire with an annual exceedance probability not more than 1:50 years; and

[4] Class 1, 2 and 3 buildings are defined in the NCC and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.

[5] Applicable Class 9 buildings are Class 9a health-care buildings, Class 9b early childhood centres, primary and secondary schools, Class 9c residential care buildings, and any Class 4 parts of a building associated with these Class 9 buildings.

[6] Class 10a buildings are defined in the NCC as non-habitable buildings including sheds, carports, and private garages.

(b) take account of the assessed duration and intensity of the fire actions of the design bushfire; and

(c) be designed to prevent internal ignition of the building and its contents; and

(d) maintain the structural integrity of the building for the duration of the design bushfire (ABCB, 2022).

The performance requirement for Class 1, 2 and 3 buildings and associated Class 10a buildings and decks, is deemed to be satisfied by design and construction in accordance with AS 3959-2018 *Construction of buildings in bushfire prone areas* and, for Class 1 buildings and associated decks, the NASH Standard – *Steel Framed Construction in Bushfire Areas* (NASH, 2021).

The Victorian Building Regulations (2018) require that applicable buildings be constructed to a minimum Bushfire Attack Level (BAL)-12.5, or higher as determined by a site assessment or planning scheme requirement.

A BAL is a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact. There are six BALs defined in AS 3959-2019, which range from BAL-LOW, which has no bushfire construction requirements, to BAL-FZ (Flame Zone) where flame contact with a building is expected (see Appendix 1 at Section 7).

There are no obstacles to future development of the Greenvale North PSP (Part 2) complying with the applicable strategies at Clause 13.02-1S (see Section 5.2) and the building regulations invoked by the BPA coverage (see Section 5.1). All dwellings and other buildings requiring a BAL will be built to a BAL-12.5 construction standard in accordance with the Settlement Planning strategies of Clause 13.02-1S.

A small area near the eastern end of the site is outside of the BPA, and no BAL construction standard is required for future dwellings in this area. Following the removal of classified vegetation on the site and the land to the north, parts of the site will be eligible for excision from the BPA and no BAL construction standard will be required for dwellings on lots excised from the BPA. This is not addressed further in this report.

2.5 Other controls

2.5.1 Zoning

Neither the RCZ parent provision or the Schedule 3 to the RCZ have implications for bushfire safety and compliance.

2.5.2 Overlays

The Overlays applying to the site or any part of the site have no reference to bushfire that would restrict development. The nearest BMO coverage is 4.3 km to the south-west.

2.5.3 Greenvale North (R1) Precinct Structure Plan

The Greenvale North (R1) Precinct Structure Plan shows the site as an 'investigation area' which was excluded from the original PSP because of unresolved drainage issues. This area - including the subject site – will be addressed by the Greenvale North Precinct Structure Plan (Part 2), informed by this report.

However, the parent PSP shows a bund to be created along the southern and western boundaries of the site as a continuation of an existing bund to the east, which forms part of the catchment protection mechanism. This bund comprises a raised berm of unmanaged vegetation, and which is topped by a roadway. The bund layout, updated in 2024, is shown on Map 3.

The parent PSP does not address bushfire.

2.6 Fire weather

The Australian Fire Danger Rating System establishes four fire danger rating categories and a numerical Fire Behaviour Index (FBI) that applies to all fuel types across the country. The Victorian planning and building systems, however, still use the previous Forest Fire Danger Index (FFDI) and the Grassland Fire Danger Index (GFDI) to represent the level of bushfire threat based on weather (and fuel) conditions. An FFDI 100/GFDI 130 (equivalent to a Catastrophic fire danger rating under the new system) is applied in non-alpine areas of Victoria, to establish building setback distances from classified vegetation in accordance with AS 3959-2018. The potential fire behaviour and impact under a Catastrophic fire danger rating is summarised in Table 1.

Note that the benchmark of an FFDI 100 represents a 'one size fits all' model of extreme fire weather conditions for the state, but which has been exceeded during some significant fire events, including in Victoria on 'Black Saturday' 2009. Therefore, it is important to note that this is not necessarily the *worst-case* conditions for any location, including the study area.

In southern Australia, since the 1950s there has been an increase in the length of the fire weather season and an increase in extreme fire weather. It is projected that there will be further increase in the number of dangerous fire weather days and a longer fire season for southern and eastern Australia (CSIRO/BOM, 2022). There is a 'high confidence' that climate change will result in a harsher fire weather climate for the Southern Slopes (Vic West) sub-region that the study area is in, with 'high' or 'very high' confidence that there will be more hot days and warm spells and less rainfall (CSIRO/BMO, 2024).

Currently the CFA and DELWP have no published policy on FFDI/GFDI recurrence intervals. There is, therefore, no compelling rationale for applying a different FFDI/GFDI from the 'default' FFDI 100/GFDI 130 threshold currently used throughout non-Alpine areas of Victoria in the planning and building system.

Table 1 - Fire Danger Ratings (Victoria State Government, 2022; BOM 2022).

Fire Behaviour Index	Fire Danger Rating (FDR)	Fire Behaviour	Action
>=100	Catastrophic	If a fire starts and takes hold, lives are likely to be lost.	○ These are the most dangerous conditions for a fire. ○ Your life may depend on the decisions on you make, even before there is a fire. ○ For your survival, do not be in bushfire risk areas. ○ Stay safe by going to a safer location early in the morning or the night before. ○ If a fire starts and takes hold, lives and properties are likely to be lost. ○ Homes cannot withstand fires in these conditions. You may not be able to leave and help may not be available.
50-99	Extreme	Fires will spread quickly and be extremely dangerous.	○ These are dangerous fire conditions. ○ Check your bushfire plan and that your property is fire ready. ○ If a fire starts, take immediate action. If you and your property are not prepared to the highest level, go to a safer location well before the fire impacts. ○ Reconsider travel through bushfire risk areas. ○ Expect hot, dry and windy conditions. ○ Leaving bushfire risk areas early in the day is your safest option.
24-49	High	Fires can be dangerous.	○ There is a heightened risk. Be alert for fires in your area. ○ Decide what you will do if a fire starts. ○ If a fire starts, your life and property may be at risk. The safest option is to avoid bushfire risk areas.
12-23	Moderate	Most fires can be controlled.	○ Stay up to date and be ready to act if there is a fire.

2.7 Regional bushfire risk assessments and plans

Regional Bushfire Planning Assessment (RBPA) Melbourne Metropolitan Region

As part of the response to the 2009 Victorian Bushfires Royal Commission, Regional Bushfire Planning Assessments (RBPAs) were undertaken across six regions that covered the whole of Victoria. The RBPAs provide information about 'identified areas' where a range of land use planning matters intersect with a bushfire hazard to influence the level of risk to life and property from bushfire. The RBPAs state that '*This information should be addressed as part of strategic land use and settlement planning at the regional, municipal and local levels'* (DPCD, 2012).

The *Regional Bushfire Planning Assessment – Melbourne Metropolitan Region* covers the City of Hume LGA. It does not identify any bushfire matters of concern near the site or in the broader Greenvale area (DPCD, 2012).

Hume Municipal Fire Management Plan (MFMP)

The MFMP is aligned with the state level priorities of reducing the number and the severity of bushfires and structure fires and creating a more fire educated and resilient community. The MFMP does not identify any specific fire protection measures undertaken around the Greenvale North PSP (Part 2) area (Hume Shire Council, 2020b).

Safer Together – Strategic Bushfire Management Planning

The Safer Together program aims to reduce the risk of bushfire in Victoria and is a response to the Inspector-General for Emergency Management's *Review of Performance Targets for Fuel Management on Public Land* – including moving from a hectare-based performance target to a risk reduction target.

Strategic bushfire management planning is jointly delivered by Forest Fire Management Victoria (FFMVic), Country Fire Authority (CFA), Emergency Management Victoria (EMV), and local government in consultation with communities (DELWP, 2020a). Fuel management focused strategies have been developed for six regions, with strategies applied in response to the identified bushfire risk (see Figure 2 and Figure 3).

The Greenvale area is not in a Bushfire Risk Engagement Area (i.e. has not been identified as an area in which managing bushfire fuels is most effective in reducing risk), further identifying the area as being of low bushfire risk. The lower identified risk to the site (Figure 2) and the absence of the need for management actions, indicates that the development of the site is appropriate to the level of bushfire risk (however, this may understate the risk as it may also reflect the limited extent of public land that can be managed for bushfire protection).

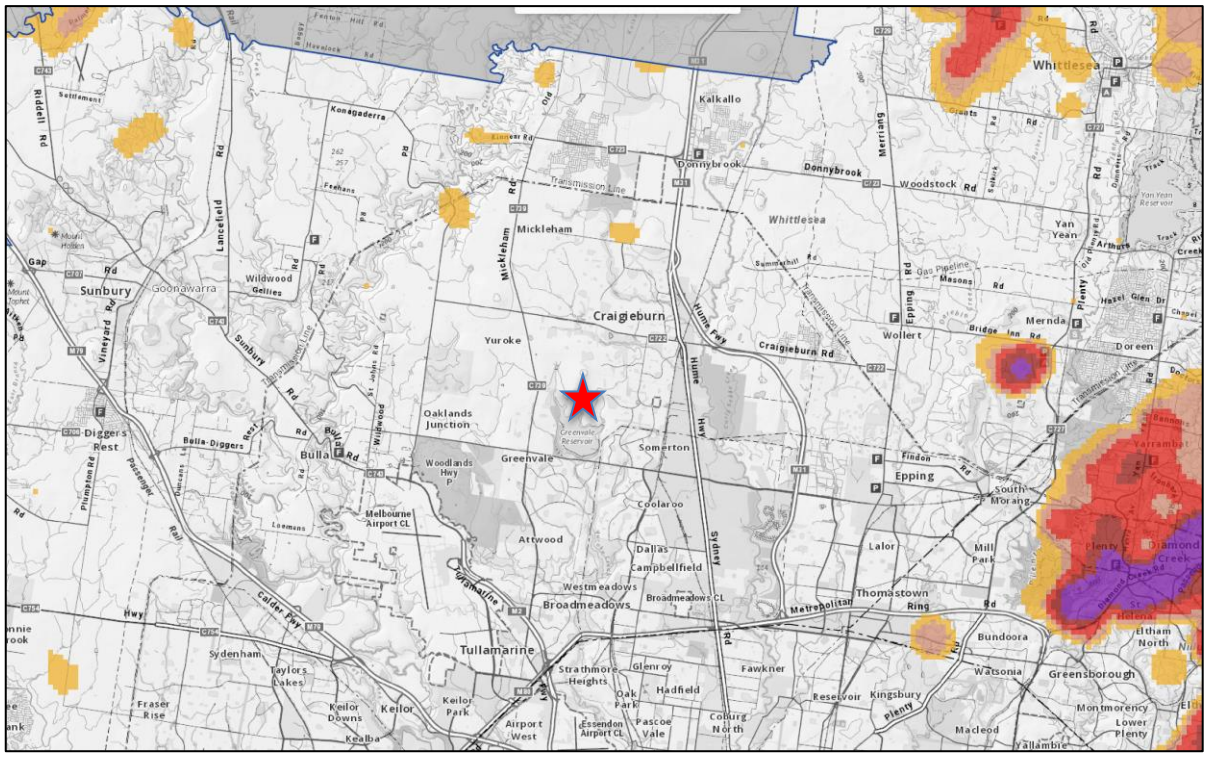

Figure 2 – Risk of house loss (orange is low-intermediate risk, purple the highest risk) with site location shown as red star (FFMV, 2021).

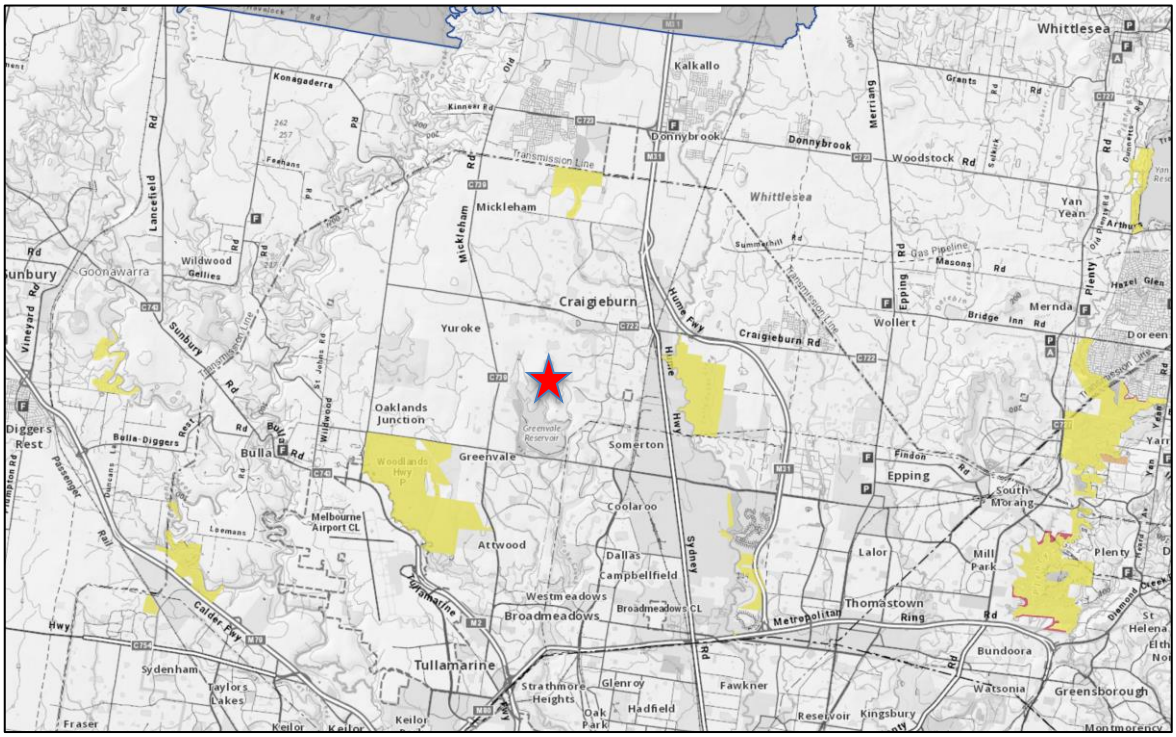

Figure 3 – FFMV fuel management strategy in the Greenvale area with site location shown as red star (FFMV, 2021) (see Table 2 for legend).

Table 2 – Legend to Figure 3.

Fire Management Zone	Legend colour	Aim
Asset Protection Zone		To provide the highest level of localised protection to human life, property, critical infrastructure, the economy and high value community assets. Reduces radiant heat and ember attack through planned burning, mowing slashing or vegetation removal.
Bushfire Moderation Zone		To develop fuel- reduced areas of sufficient width and continuity to reduce the speed and intensity of bushfires. BMZ also aims to provide areas which assist in making bushfire suppression safer and more effective and in improving access and egress. Reduces speed and intensity of bushfires. Supports APZs and protects nearby assets, particularly from ember spotting.
Landscape Management Zone		Management objectives are varied and include fuel reduction and ecological outcomes. Hazard reduction may be undertaken to supplement APZ and BMZ activities, only where deemed necessary by a risk-based approach. Treatments may be undertaken for the active management of ecosystem function and for the management of flora and fauna species. Burning (or absence of burning) will be used to ecosystem resilience across the landscape. Planned burning will be used to reduce overall fuel and bushfire hazard, ecological resilience and particular landscape values.
Planned Burn Exclusion Zone		Exclusion of planned burning from areas intolerant to fire.

3 Bushfire hazard landscape assessment

One of the bushfire hazard identification and assessment strategies in Clause 13.02-1S is to use the best available science to identify the hazard posed by vegetation, topographic and climatic conditions. The basis for the hazard assessment should be:

- *'Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;*
- *Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;*
- *Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and*
- *The site for the development'* (Clause 13.02-1S Hume Planning Scheme).

This section includes a bushfire assessment at:

- The wider landscape scale, for at least 20 km around the site (see Map 1);
- The local landscape scale extending up to 1 km from the site; and
- The neighbourhood scale up to 400 m around the site boundary, to identify any risk arising around the site beyond the 150 m BAL assessment zone (see Map 2).

Note that the current BPA coverage invokes AS 3959-2018, which requires a site assessment of the vegetation and topography up to 150 m around a building (increased to 150 m in accordance with VC 140 (DELWP, 2018)) around a building (where applicable) for the purposes of determining the applicable BAL construction standard for that building (Standards Australia, 2020). This assessment is shown at Section 4 and Map 3.

3.1 Landscape assessment

3.1.1 Landscape – to 20 km

The Greenvale North PSP (Part 2) site at 1170G Mickleham Road is approximately 22 kilometres from the Melbourne CBD, immediately to the north of the Greenvale Reservoir and close to the urban areas of Greenvale, Roxburgh Park and Craigieburn. It is anticipated to become linked to the wider urban area as the Greenvale North (R1) PSP and adjacent PSPs are realised.

The broader landscape comprises predominantly pastoral agricultural land to the north-west. This wider pastoral area is almost cut off from the immediately surrounding undeveloped land by residential areas. To the north, east and south, the existing urban areas of Greenvale, Roxburgh Park and Craigieburn create a large area of low threat land that is outside of the BPA.

To the south, the Greenvale Reservoir is a large non-vegetated area, however the land around the Reservoir is subject to controls that may restrict the management of vegetation, including the reservoir protection mechanism area shown on Map 3. Land to the east is currently under development and there are current development proposals for the land to the north.

In Victoria, the most likely bushfire scenarios for a large landscape fire are an approach from those directions typically associated with the direction of the wind on severe, or higher, fire danger days i.e. approach of bushfire from the north, north-west, west or south-west (Long, 2006).

The site could be impacted by a potentially fast-moving grassfire approaching from the north, north-west, west or south, although in most directions there is little space in which a fire could develop to a significant size. Such a fire can generate high levels of radiant heat but with generally shorter dwell times, flame height and ember generation compared to areas of treed vegetation. The risk of approach by bushfire will be reduced as the properties to the north are developed; but the land immediately to the south and west will likely remain a hazard in perpetuity.

There is an extensive fire history within 20 km (see Map 1). Large grassfires, including within the last decade, have occurred in all directions around the site, however the site itself and the land within 3 km of it has not been directly impacted by fire.

3.1.2 Local – to 1 km and Neighbourhood – to 400 m

Within the 1 km local assessment zone, the landscape reflects the largely suburban nature of the surrounds with a larger proportion of land not in the BPA. Undeveloped land to the north and north-west provides a short-to-medium term avenue for the approach of fire from the broader landscape, however this area will be developed with the realisation of the Craigieburn West PSP.

To the west and south, the permanent bushfire hazard of the Greenvale Reservoir reserve will remain as a hazard in perpetuity. The required setbacks of future development discussed in this report are largely in response to the vegetation in these directions.

Within 400 m, the neighbourhood scale bushfire risk to the site is largely consistent with that for 1 km.

3.1.3 Landscape risk

To assist in assessing landscape risk, four 'broader landscape types', representing different landscape risk levels, are described in the DELWP technical guide *Planning Applications Bushfire Management Overlay*. These are intended to streamline decision-making and support more consistent decisions based on the landscape risk (DELWP, 2017). Whilst no part of the site is covered by the BMO, the landscape types provide a useful description of landscape risk.

The four types range from low risk landscapes where there is little hazardous vegetation beyond 150 m of a site and extreme bushfire behaviour is not credible, to extreme risk landscapes with limited or no evacuation options and where fire behaviour could exceed AS 3959-2018 assumptions (see Table 3).

The immediate landscape around the site has the characteristics of Landscape Type 2, with the site directly adjoining already developed low threat areas and the potential for the approach of fire

limited to the west and south. Land to the north will be developed as part of the Craigieburn West PSP, making the bushfire hazard in this direction an interim issue.

Table 3 - Landscape risk typologies (from DELWP, 2017).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
• *There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation).* • *Extreme bushfire behaviour is not possible.* • *The type and extent of vegetation is unlikely to result in neighbourhood-scale destruction of property.* • *Immediate access is available to a place that provides shelter from bushfire.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition.* • *Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can approach from more than one aspect.* • *The site is located in an area that is not managed in a minimum fuel condition.* • *Access to an appropriate place that provides shelter from bushfire is not certain.*	• *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* • *Evacuation options are limited or not available.*
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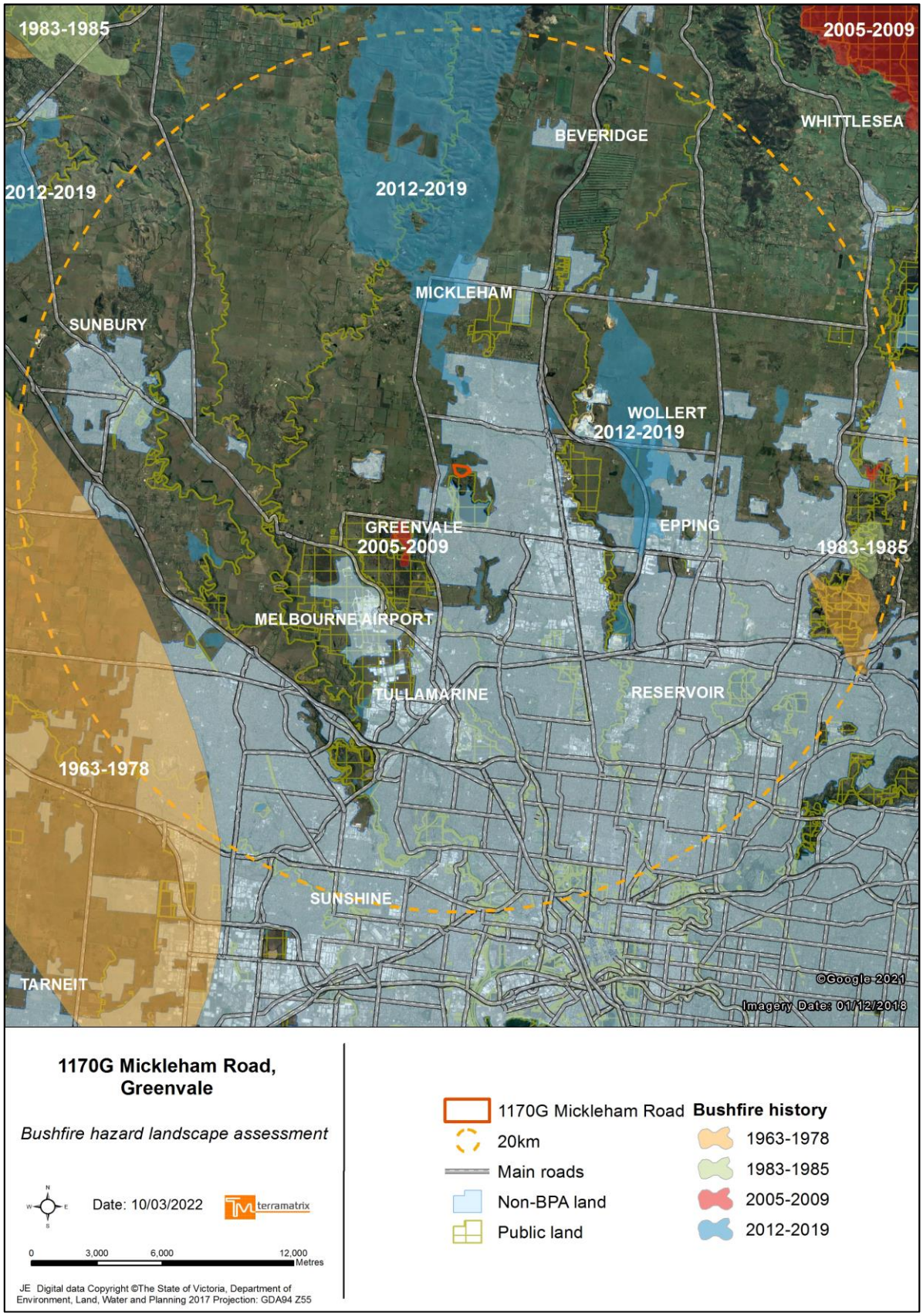
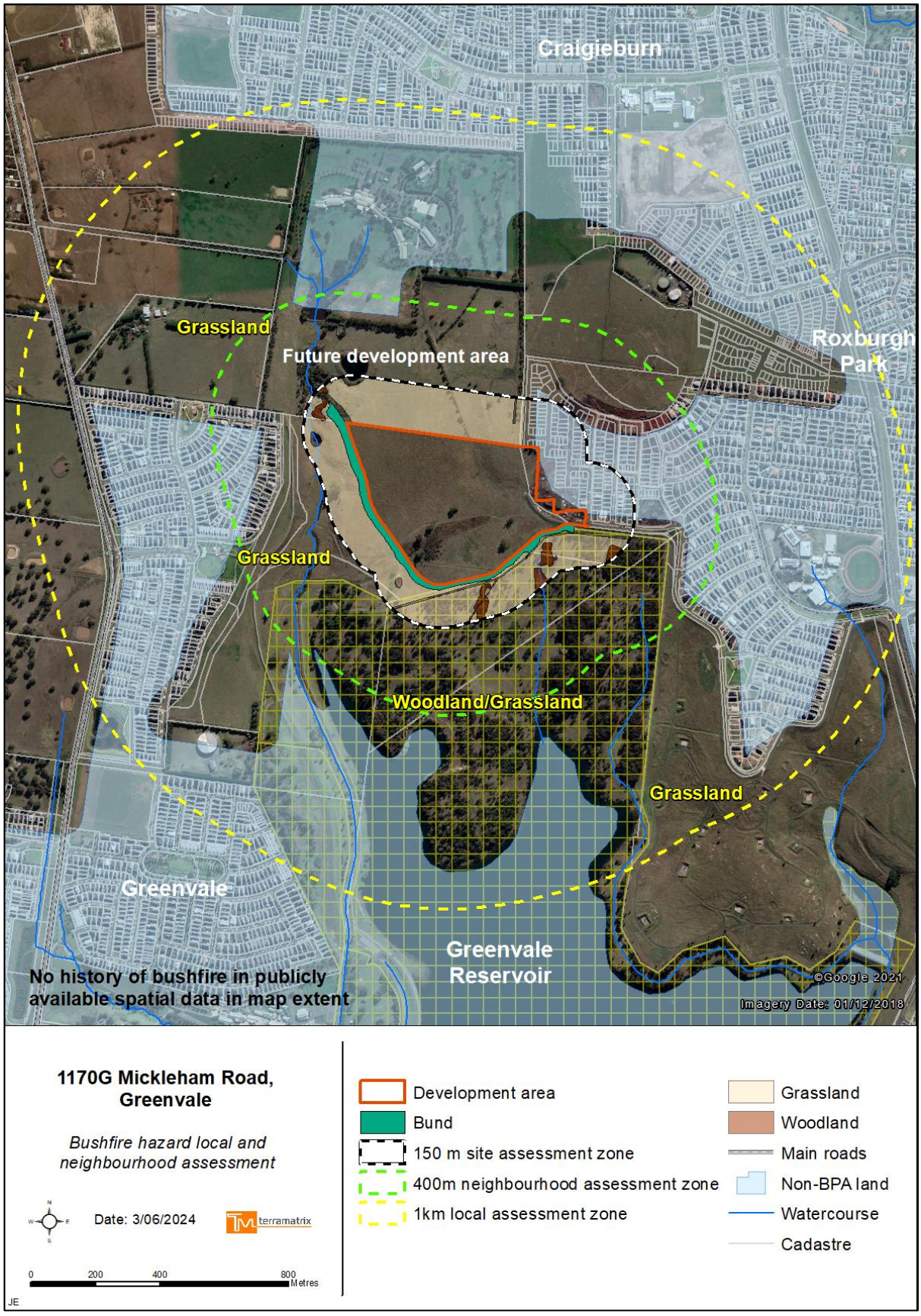


Map 1 - Bushfire hazard landscape assessment plan.



Map 2 - Bushfire hazard assessment plan - local and neighbourhood landscape.

4 Bushfire hazard site assessment

4.1 Vegetation

Vegetation within a 100 m BAL assessment zone around the site has been classified in accordance with the AS 3959-2018 methodology. Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective.

The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. The classification is largely based on the structural characteristics of the vegetation at maturity, but the key determinant should be the likely fire behaviour that it will generate.

The classification is based on the current and likely future state of the vegetation in the short to medium term.

4.1.1 Woodland

Small patches of treed vegetation in the Greenvale Reservoir catchment to the south best accord with the Woodland group of AS 3959-2018. Woodland vegetation comprises areas with trees up to 30 m tall, 10% – 30% foliage cover dominated by eucalypts (and/or callitris) with a prominent grassy understorey, may contain isolated shrubs (Standards Australia, 2020).

The denser areas of trees to the south, generally within a gully running up toward the site, comprise Woodland, and are often contiguous to wider treed areas of lower density. These lower density areas meet the AS 3959-2018 descriptor for Open Woodland, which is in the Grassland vegetation class under AS3959.

4.1.2 Grassland

Vegetation on land to the north, west, south-west and south, including the bund, matches the AS 3959-2018 classification of Grassland, which is defined as all forms of vegetation (except Tussock Moorlands) including situations with shrubs and trees, if overstorey foliage cover is less than 10%. Includes pasture and cropland (Standards Australia, 2020).

Grassland vegetation is considered hazardous and, therefore, classifiable when it is not managed in a minimal fuel condition. Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (e.g. short-cropped grass, to a nominal height of 100 mm) (Standards Australia, 2020). Grassland areas should be assumed to be unmanaged and classifiable unless there is ‘reasonable assurance’ that they will be managed in perpetuity, in a low threat state, e.g. no more than approx. 100 mm high.

Figure 4 – Looking west over Grassland in the Greenvale Reservoir reserve toward Mickleham Road, with Yuroke Creek in the valley in near distance.

Figure 5 – Looking south at Woodland between the site and Greenvale Reservoir.

Figure 6 – Looking south-west at open Woodland classified as Grassland.

4.1.3 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959-2018, if they meet one or more of the following criteria:

a) 'Vegetation of any type that is more than 100 m from the site (or a building).

b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.

c) Multiple areas of vegetation less than 0.25ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.

d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.

e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks' (Standards Australia, 2020).

Low-threat areas excluded from classification include the managed gardens of the nearby properties to the east. Non-vegetated areas include the roads, driveways and structures within the 100 m site assessment zone (see Map 3).

4.2 Topography

AS 3959-2018 requires that the 'effective slope' be identified to determine the BAL and applicable vegetation setback distances. This is the slope of the land under the classified vegetation[7] that will most significantly influence the bushfire attack on a building. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land under the classified vegetation on which a bushfire will be burning uphill in relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5˚ increments from 0˚ up to 20˚.

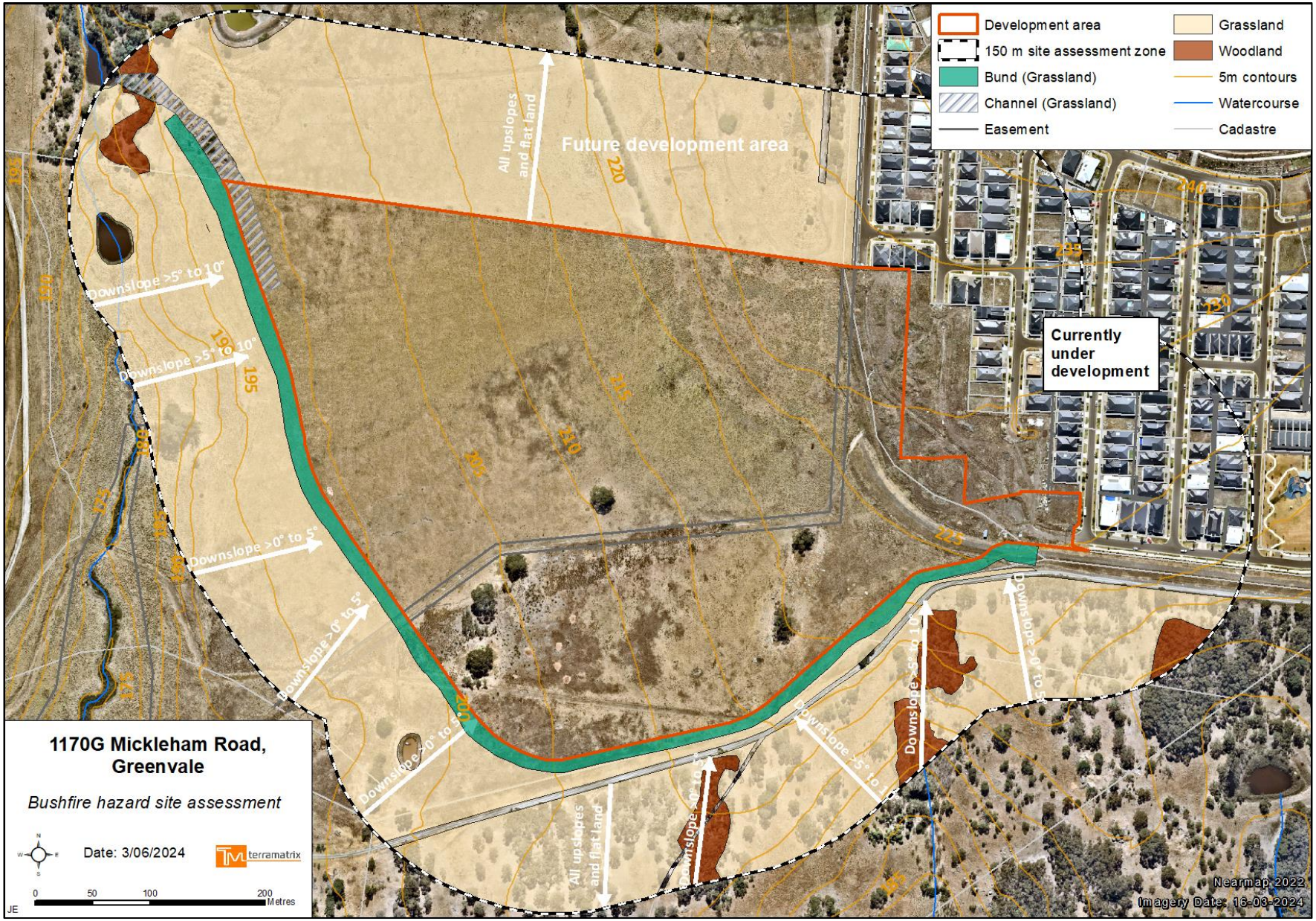
The topography around the site within the 100 m assessment zone is steep in places, with some significant changes in elevation that may exacerbate the bushfire attack (see Map 3).

To the north, in a future development area that temporarily contains a Grassland hazard, the land is generally flat and therefore in the ‘All upslopes and flat land’ slope category.

To the west, the land slopes down from the site boundary to the creek that runs past the western boundary. The creek runs south to the Greenvale Reservoir, with the land between the site and reservoir featuring a ridge and valleys, creating a range of slopes on the southern boundary.

The effective slopes under the classified vegetation to the west and south are in the ‘All upslopes and flat land’, ‘Downslope >0˚ to 5˚’, ‘Downslope >5˚ to 10˚’ and ‘Downslope >10˚ to 15˚’ slope classes (see Map 1).

[7] The slope of the land between the classified vegetation and the building is called the site slope, which in the Method 1 procedure of AS 3959-2018, is assumed to be the same as the effective slope.



Map 3 – Bushfire hazard site assessment.

5 Planning and design response

This section identifies how future development in the Greenvale North PSP (Part 2) can respond to the bushfire risk, including the requirements of Clause 13.02-1S, published CFA and DELWP guidance and the building regulations applicable to construction in a BPA.

5.1 BAL Construction standard

To satisfy the Settlement Planning strategies of Clause 13.02-1S, future dwellings and other buildings requiring a BAL (see Section 2.4), should be sufficiently setback from classified vegetation to enable a BAL-12.5 construction standard.

Building setbacks are measured from the edge of the classified vegetation to the external wall of a building, excluding eaves, roof overhangs and some other building appurtenances[8] (Standards Australia, 2020) (see Figure 7).

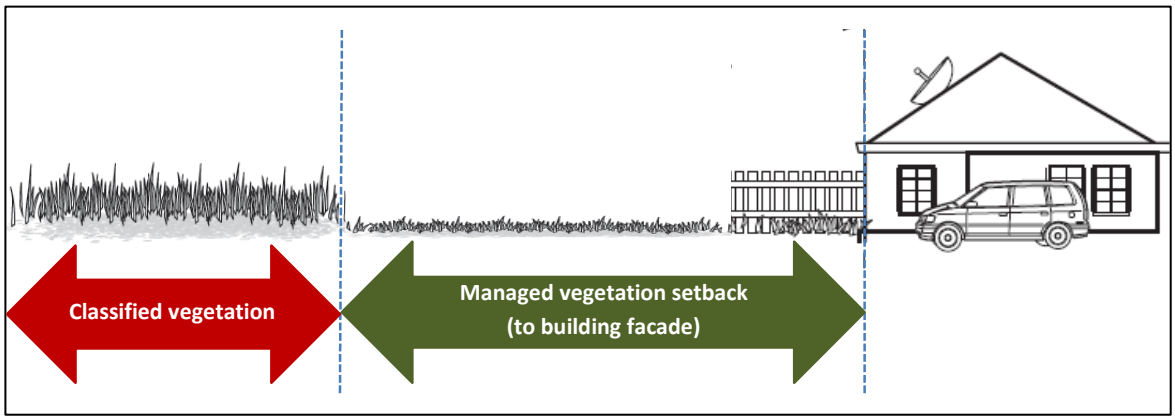


Figure 7 - Example of building-classified vegetation setback (adapted from CFA, 2013).

[8] The setback distance is measured from the edge of the classified vegetation to the external wall of the building, or for parts of the building that do not have external walls (including carports, verandas, decks, landings, steps and ramps), to the supporting posts or columns. The following parts of a building are excluded:

a) Eaves and roof overhangs.
b) Rainwater and domestic fuel tanks.
c) Chimneys, pipes, cooling or heating appliances or other services.
d) Unroofed pergolas.
e) Sun blinds (Standards Australia, 2020).

5.1.1 Building setbacks

The Greenvale North PSP (Part 2) at 1170G Mickleham Road is exposed to classified Grassland to the west and south, and to minor areas of Woodland to the south. The setbacks required in response to Grassland and Woodland for BAL-12.5, based on the hazard assessment in Section 4 and determined using the simple Method 1 procedure of AS 3959-2018, are shown in Table 4 below.

Table 4 - Building setbacks for BAL-12.5.

Vegetation type	Effective slope	Direction	Low threat setback distance
Grassland	All upslopes and flat land	South	19 m
	Downslope >0˚ to 5˚	South-west and south-east	22 m
	Downslope >5˚ to 10˚	West	25 m
	Downslope >10˚ to 15˚	South	28 m
Woodland	Downslope >0˚ to 5˚	South	41 m
	Downslope >5˚ to 10˚	South-east	50 m

Dwellings on lots within the Greenvale North PSP (Part 2) can achieve a BAL-12.5 construction standard in accordance with the Settlement Planning strategies of Clause 13.02-1S if setback the requisite distance from the bushfire hazard.

Low threat setbacks from the bushfire hazard must be provided between the dwellings and the hazard. The setbacks may comprise low threat managed vegetation where ongoing management in perpetuity is assured, or non-vegetated areas such as roads and pathways. Low threat vegetation comprises landscaping designed in accordance with the principles documented in the CFA publication *Landscaping for bushfire* and include the management of grass to less than 100 mm in height.

The setbacks may comprise areas within or external to the site:

- Areas of assuredly managed low threat vegetation
- Non-vegetated areas such as roads or pathways
- Setback of dwellings within lots with gardens managed in a low threat state
- Any combination of the above provided that the required setback distance is created and maintained in a low threat state.

The required setbacks are shown on Map 4 measured from the site boundaries. Setbacks along the southern boundary should be addressed though the provision of a perimeter road on this interface.

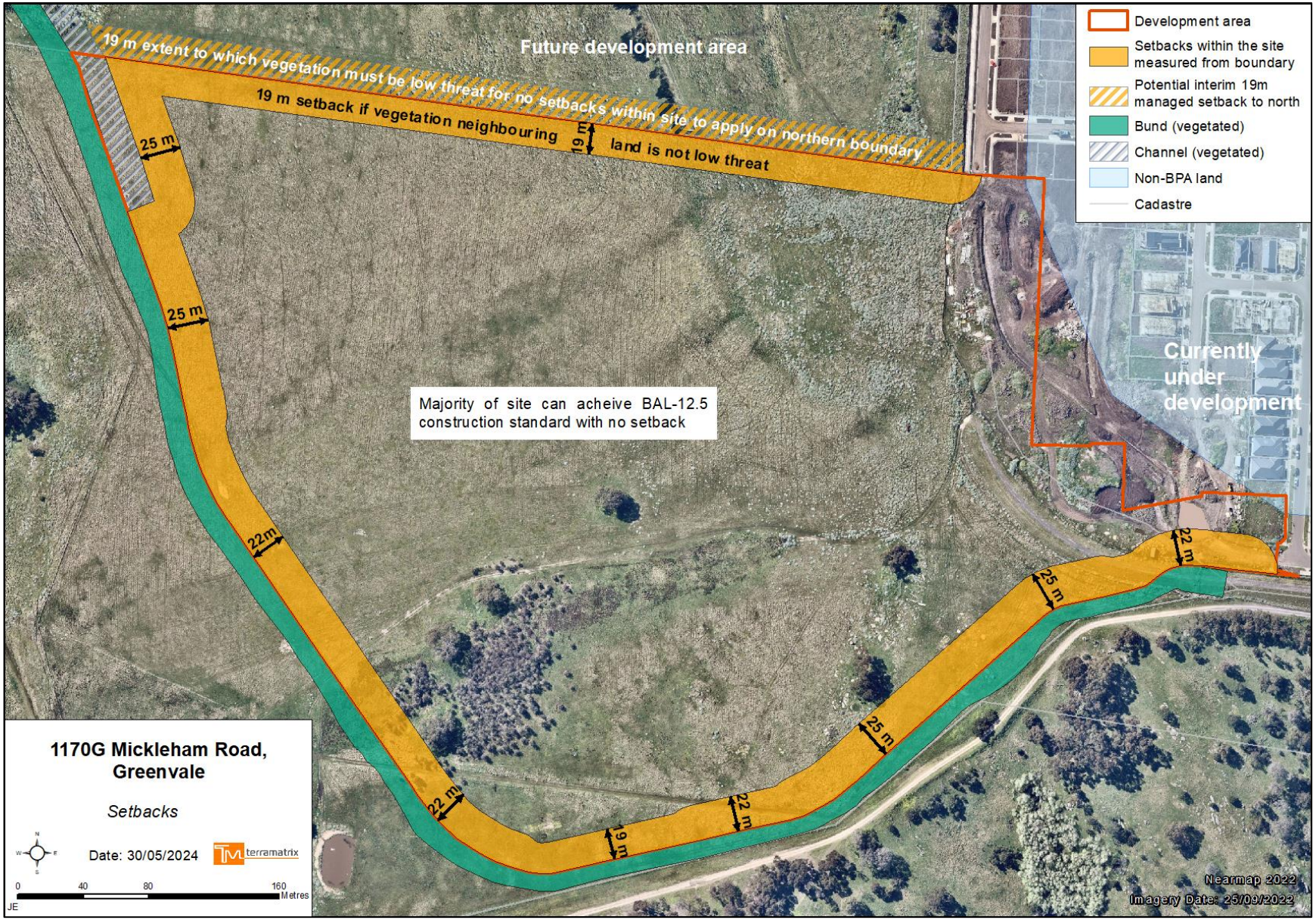
Beyond the site boundary to the north, the future development area currently comprises Grassland vegetation, the presence of which is a temporary issue until that land is developed. The lots abutting

the northern boundary of the site require a 19 m setback from the adjacent Grassland (see solid orange shading on Map 4).

These lots will either be provided with the required 19 m setback on the adjoining land (shown as orange hatching on Map 4) through agreement with the neighbouring landholder, (or though annual issuance of Fire Prevention Notices by the City of Hume) until the Grassland is removed permanently through development, or the construction of dwellings on the affected lots will be delayed until the vegetation has been permanently removed through the anticipated urban development and a BAL-12.5 construction standard can be achieved.

The balance of the site can achieve a BAL-12.5 construction standard without issue, and dwellings in the small area of the site not in the BPA will not require a BAL. Additionally:

- Land within common areas such as easements and reserves must be managed in a low threat state throughout the site in perpetuity.
- Until all lots are developed, vegetation within undeveloped lots must be maintained in a low threat state.



Map 4 – BAL-12.5 setbacks.

5.2 Clause 13.02-1S Bushfire Planning

The applicable strategies at Clause 13.02-1S are detailed in the following sub-sections, and a summary response is provided about how the proposed development can respond to the strategies.

5.2.1 Protection of human life strategies

Priority must be given to the protection of human life.

Prioritising the protection of human life over all other policy considerations

The Greenvale North PSP (Part 2) site is in a low-moderate risk bushfire risk location, with limited landscape risk but some residual site-level risk arising from exposure to vegetation in the Greenvale Reservoir reserve. The risk will reduce further as development occurs within the site and to the north, as the nearby PSPs are realised. The application of the building controls as they relate to bushfire is an appropriate response to the bushfire risk to the site.

Accordingly, the protection of human life can be prioritised by adopting the measures recommended in this report and through application of the building regulations for construction in a BPA, including ensuring future buildings requiring a BAL are located where a BAL-12.5 construction standard can be achieved.

Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.

As identified in Section 3.1, the Greenvale North PSP (Part 2) site is in a low-moderate risk landscape, with only temporary potential for a bushfire to approach from the higher threat direction of the north. However, the hazard to the west and south-west in the Greenvale Reservoir reserve is likely to be permanent. The landscape risk will continue to decrease as surrounding PSPs are realised.

The nearest *lowest* risk locations are the developed urban areas of Greenvale, immediately adjacent to the east that are not in the BPA (see Map 1 and Map 2). Additionally, the wider urban area of greater Melbourne lies to the south, providing a large reliably low threat area.

Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process

This report provides the basis for incorporating bushfire risk into decision making associated with planning development in the site.

The fire authority considers that community resilience to bushfire will be strengthened (and hence, presumably, vulnerability to bushfire will be reduced) when a strategic

planning proposal demonstrates that Clause 13.02-1S strategies have been applied, and where a proposal takes advantage of existing settlement patterns so that new development will not expose the community to increased risk from bushfire.

The CFA provide principles to respond to Clause 13.02-1S including that settlement planning decisions should:

- *'Direct development to locations of lower bushfire risk.*
- *Carefully consider development in locations where there is significant bushfire risk that cannot be avoided.*
- *Avoid development in locations of extreme bushfire risk.*
- *Avoid development in areas where planned bushfire protection measures may be incompatible with other environmental objectives'* (CFA, 2015).

It is considered that the future development of the Greenvale North PSP (Part 2) site can appropriately implement the strategies in Clause 13.02-1S that aim to prioritise protection of human life and will, therefore, meet the CFA strategic planning principles for bushfire.

5.2.2 Bushfire hazard identification and assessment strategies

The bushfire hazard must be identified, and an appropriate risk assessment be undertaken.

Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.

This report identifies the hazard in accordance with the commonly accepted methodologies of AS 3959-2018 and, as appropriate, additional guidance provided in *Planning Practice Note 64 Local planning for bushfire protection* (DEWLP, 2015), *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018) and *Planning Permit Applications Bushfire Management Overlay Technical Guide*[9] (DELWP, 2017).

The type and extent of (hazardous) vegetation within, and up to 400 m around, the site has been identified and classified into AS 3959-2018 vegetation groups. Classification was based on the anticipated long-term state of the vegetation, EVC mapping, aerial imagery, site assessment, published guidance on vegetation assessment for bushfire purposes and experience with the fuel hazard posed by the vegetation types that occur within the region.

GIS analysis of publicly available contour data for the area was undertaken to determine slopes, extending to 100 m around the site (see Map 3).

[9] Although the site is not affected by the BMO, DELWP's BMO technical guide provides useful descriptors and guidance for assessing the bushfire risk at the landscape scale, as discussed in Section 3.1.

In relation to climatic conditions and fire weather, the AS 3959-2018 default FFDI 100/GFDI 130 benchmark used in the Victorian planning and building system, has been applied.

Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.

The extent of BPA coverage has been considered (see Section 2.4) and is shown in Figure 1 and Map 1. This is based on the most recent BPA mapping for the area.

Applying the Bushfire Management Overlay in planning schemes to areas where the extent of vegetation can create an extreme bushfire hazard.

As identified in Section 3, no part of the site is covered by the BMO. This reflects state-wide BMO mapping introduced into the Hume Planning Scheme by amendment GC13, which was gazetted on 3rd October 2017.

Considering and assessing the bushfire hazard on the basis of:

- ***Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;***
- ***Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;***
- ***Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and***
- ***The site for the development.***

The hazard has been assessed and described at the landscape, site, neighbourhood and local scales (see Sections 3 and 4 and Maps 1, 2 and 3).

At the site scale, the assessment follows the AS 3959-2018 methodology applied in a BPA, of classifying vegetation and topography within 100 m of a building, and for this study extending 100 m around the overall site (see Map 3). At the local and neighbourhood scales, the site has been assessed at the 1 km and 400 m scales (see Map 2).

At the broader landscape scale, a 20 km radius around the site has been applied (see Section 3.1 and Map 1) in accordance with guidance about assessing risk for planning scheme amendments in Planning Advisory Note 68 (DEWLP, 2018) and Planning Practice Note 64 (DELWP, 2015).

Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.

The author is not aware of any consultation that may have occurred with the relevant fire authority during the planning process for this site. This report forms part of the consultation process that will occur prior to development.

Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.

DELWP advisory and practice notes, Clause 13.02-1S, and the building regulations invoked by the BPA coverage, specify the general requirements and standards for assessing the risk. These have been applied in this report as appropriate and bushfire protection measures have been identified commensurate with the risk.

Not approving development where a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented.

If the objectives and applicable strategies of Clause 13.02-1S are successfully implemented, as discussed in this report, and the building regulations for construction in a BPA are complied with, then the risk can be deemed to be acceptably mitigated such that development can proceed.

The CFA specify that areas where development should not proceed could include:

- *'Isolated settlements where the size and/or configuration of the settlements will be insufficient to modify fire behaviour and provide protection from a bushfire.*
- *Where bushfire protection measures will not reduce the risk to an acceptable level.*
- *Where evacuation (access) is severely restricted.*
- *Where the extent and potential impact of required bushfire protection measures may be incompatible with other environmental objectives or issues, e.g. vegetation protection, land subject to erosion or landslip'* (CFA, 2015).

None of these criteria or characteristics are applicable to the site.

5.2.3 Settlement planning strategies

Settlement planning must strengthen the resilience of settlements and communities and prioritise protection of human life.

Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).

The applicable distances for dwellings and other buildings to be setback from classifiable vegetation, such that RHF is calculated to not exceed 12.5kW/m^2 and BAL 12.5 dwellings could potentially be sited, have been determined (see Section 5). Except for the northern boundary where a different solution can be applied, future lot layouts must be designed to provide the setbacks necessary to achieve a BAL-12.5 construction standard.

Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.

The nearest *lowest* risk locations are the surrounding urban areas that are not in a designated BPA. These comprise the already developed areas of Greenvale (see Map 1 and Map 2), currently abutting the site to the east. In addition, part of the proposed Greenvale North PSP (Part 2) area is already outside of the BPA (although it is not in a low threat state). This area will likely expand as development proceeds and further areas are excised from the BPA.

Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.

Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reduce bushfire risk overall.

There will be no increase in risk to existing residents or community infrastructure if development achieves setbacks from hazardous vegetation to enable BAL-12.5 construction, provides an appropriate water supply for fire fighting via a conventional reticulated hydrant system and appropriate access/egress for emergency vehicles and residents via a conventional residential road network.

The risk to existing residents of nearby urban areas will be reduced by the development of additional urban residential areas and associated low threat or non-vegetated land. As identified above, this will eventually create BAL-LOW areas with the potential to be excised from the BPA, if they are sufficiently distant from any hazardous vegetation.

Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.

This report appropriately assesses and addresses the risk at a range of scales.

Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.

No alternative low risk development locations have been identified or assessed as part of this study.

Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2009'

If the setback distances from any hazardous vegetation, as identified in this report, are implemented as proposed, then construction can achieve a BAL not exceeding BAL-12.5.

5.2.4 Areas of high biodiversity conservation value

Ensure settlement growth and development approvals can implement bushfire protection measures without unacceptable biodiversity impacts by discouraging settlement growth and development in bushfire affected areas that are of high biodiversity conservation value

There are no apparent additional biodiversity impacts associated with the findings of this bushfire assessment.

5.2.5 Use and development control in a Bushfire Prone Area

Clause 13.02-1S requires that '*In a bushfire prone area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following uses and development:*

- *Subdivisions of more than 10 lots.*
- *Accommodation.*
- *Child care centre.*
- *Education centre.*
- *Emergency services facility.*
- *Hospital.*
- *Indoor recreation facility.*
- *Major sports and recreation facility.*
- *Place of assembly.*
- *Any application for development that will result in people congregating in large numbers* (Clause 13.02-1S Hume Planning Scheme).

It further states that:
'When assessing a planning permit application for the above uses and development:

- *Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts'* (Clause 13.02-1S Hume Planning Scheme).

Development of the site will be able to respond to this strategy and achieve acceptable safety if:

- All dwellings in the Greenvale North PSP (Part 2) and the BPA are built to a BAL-12.5 construction standard in accordance with the Settlement Planning strategies of Clause 13.02-

1S;

- Setbacks of dwellings from classified vegetation can be achieved to enable construction to a BAL-12.5 construction standard for applicable buildings;
- Adequate access and egress for emergency management vehicles can be provided by a residential road network and perimeter accessway for a large part of the boundary length; and
- A reliable water supply for fire fighting is provided, via a conventional reticulated hydrant system, in accordance with the hydrant objective for residential subdivision at Clause 56.09-3 (Hume Planning Scheme, 2014).

6 Conclusion

This report has assessed the bushfire hazard in and around the proposed Greenvale North PSP (Part 2) site at 1170G Mickleham Road, Greenvale, in accordance with Clause 13.02-1S in the Hume Planning Scheme, the AS 3959-2018 methodology invoked by the Victorian building regulations, and additional guidance provided in *Planning Practice Note 64 Local planning for bushfire protection* (DEWLP, 2015), *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018) and, in relation to the landscape hazard assessment, the DELWP technical guide *Planning Permit Applications Bushfire Management Overlay* (DELWP, 2017).

Most of the site is currently a designated BPA; however, no part of the site, or land within 4.3 km around it, is covered by the BMO.

The type and extent of (hazardous) vegetation within, and up to 150 m around the development area, has been identified and classified into AS 3959-2018 vegetation groups, based on aerial imagery and site investigation. The classification is based on the current state of the vegetation and identifies that the hazard is primarily in the Greenvale Reservoir reserve comprising Grassland to the west, south-west and south, and a limited area of Woodland to the south. Grassland also occurs on undeveloped land to the north which comprises a temporary hazard until that land is developed in accordance with the Greenvale North R1 PSP.

The terrain of the surrounding land is steep in places, with some significant changes in elevation that may exacerbate the bushfire attack. The land slopes down to the west toward the Yuroke Creek, and to the south toward the Greenvale Reservoir. For the purposes of determining BALs and vegetation setback distances for future buildings, there are multiple slope classes in all directions where classified vegetation occurs, except to the north where it is consistently upslope.

The landscape is one of low-moderate bushfire risk, with the higher bushfire threat directions to the north and north-west comprising a temporary bushfire hazard, and a permanent hazard to the west and south. Bushfire behaviour can reasonably be expected to be within AS 3959-2018 presumptions and design parameters. Accordingly, it is considered that the risk can be mitigated to an acceptable level and the development can appropriately prioritise the protection of human life, if any buildings that require a BAL are separated from hazardous vegetation to allow a BAL-12.5 construction standard, in accordance with the Settlement Planning strategies of Clause 13.02-1S. This would require a minimum 19 m setback from areas of classified Grassland on the neighbouring land to the north, and up to 25 m to the west, with additional setbacks from areas of Woodland to the south.

Vegetation within the site, on lots and common areas, must be managed in a low threat state. Good access and egress for emergency management vehicles and workers, in the event of a bushfire will be achieved via a conventional urban road network. A reliable water supply for fire fighting can be provided via a reticulated hydrant system in accordance with the hydrant objective for residential subdivision.

7 Appendix 1 – BALs explained

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to…	Comment
BAL-LOW	VERY LOW: There is insufficient risk to warrant any specific construction requirements but there is still some risk.	No specification.	At 4 kW/m^2 pain to humans after 10 to 20 seconds exposure. Critical conditions at 10kW/m^2 and pain to humans after 3 seconds. Considered to be life threatening within 1 minute exposure in protective equipment.
BAL-12.5	LOW: There is risk of ember attack.	A radiant heat flux not greater than 12.5 kW/m^2.	At 12.5 kW/m^2 standard float glass could fail and some timbers can ignite with prolonged exposure and piloted ignition.
BAL-19	MODERATE: There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat.	A radiant heat flux not greater than 19 kW/m^2.	At 19 kW/m^2 screened float glass could fail.
BAL-29	HIGH: There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.	A radiant heat flux not greater than 29 kW/m^2.	At 29 kW/m^2 ignition of most timbers without piloted ignition after 3 minutes exposure. Toughened glass could fail.
BAL-40	VERY HIGH: There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.	A radiant heat flux not greater than 40 kW/m^2.	At 42 kW/m^2 ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (i.e. Flame Zone)	EXTREME: There is an extremely high risk of ember attack and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.	A radiant heat flux greater than 40 kW/m^2.	At 45 kW/m^2 ignition of timber in 20 seconds (without piloted ignition).

Source: derived from AS 3959-2018 (Standards Australia, 2020).

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