Bushfire Development Report

for the Officer South Employment Precinct

Prepared for
the Victorian Planning Authority

February 2023

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Cover image: Looking west across the middle of the precinct from Lower Gum Scrub Creek on the eastern precinct boundary.

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Glossary

AS 3959-2018	*AS 3959-2018 Construction of buildings in Bushfire Prone Areas.* Australian standard invoked by the National Construction Code and Victorian building regulations for the assessment of BALs and the design and construction of defined building classes in a BPA.
BAL	*Bushfire Attack Level* - A means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire e.g. a building constructed to a BAL-12.5 standard is designed to be exposed to radiant heat not exceeding 12.5 kW/m^2.
BMO	*Bushfire Management Overlay* - A planning scheme provision used to guide the development of land in areas of high bushfire hazard. The BMO applies to areas where there is potential for extreme bushfire behaviour, such as a crown fire and extreme ember attack and radiant heat
BPA	*Bushfire Prone Area* - An area that is subject to, or likely to be subject to, bushfire attack as determined by the Minister for Planning.
Bushfire	An unplanned fire burning in vegetation; sometimes referred to as wildfire. A generic term which includes grass fires, forest fires and scrub fires.
Bushfire attack	Attack by wind, burning embers, radiant heat or flame generated by a bushfire.
Bushfire hazard	A specific source of potential damage or harm, typically consisting of three key elements; vegetation, weather and topography.
Bushfire risk	The chance or probability of damage or harm if exposed to a bushfire hazard and the severity of the impact i.e. consideration of the likelihood and consequences of impacts from bushfire.
CSC	*Cardinia Shire Council.*
Classified vegetation	Vegetation deemed to be a bushfire hazard in accordance with the Bushfire Management Overlay (BMO) and/or AS 3959-2018 *Construction of buildings in bushfire prone areas*.
CFA	*Country Fire Authority*
Defendable space	An area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire.
DELWP	The former *Department of Environment, Land Water and Planning.* The responsibilities of this Dept. are now split across the Department of Energy,

	Environment and Climate Action (DEECA) and the Department of Transport and Planning (DTP).
Effective slope	The slope of the land (gradient, measured in degrees) under the classified vegetation which most influences the bushfire attack. The slope is determined on the basis of the fire moving towards the building and the rate of spread of the fire and not solely on the basis of the relative elevation of the vegetation.
Ember attack	Attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.
EVC	*Ecological Vegetation Class* - The standard unit for classifying vegetation types in Victoria. EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range and, although differing in species, have similar habitat and ecological processes operating.
FFDI	*Forest Fire Danger Index* – A numerical index representing the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression, according to various combinations of air temperature, relative humidity, wind speed and both the long- and short-term drought effects.
FRV	*Fire Rescue Victoria*
PSP	*Precinct Structure Plan* – Strategic masterplans for local areas that usually cater for between 5,000 to 30,000 people, 2,000 to 10,000 jobs or a combination of both. They are the 'blueprint' for localised development and investment that will occur over many years, and will incorporate any relevant directions already outlined in a higher level Framework Plan.
RHF	*Radiant heat flux* - The heat transfer rate per unit area from thermal (electromagnetic) radiation, expressed as kilowatts per metre squared. Calculated or measured for a specific surface to determine the radiant heat received by that surface from flames associated with a bushfire.
VPA	*Victorian Planning Authority*

1 Executive summary

- The Officer South Employment Precinct (OSEP) area is in a relatively low bushfire risk landscape.
- Alternative locations for development in the Cardinia LGA, that are likewise outside BMO areas, have a similar relatively low bushfire risk and would not result in a significantly lesser risk than future growth in the OSEP.
- Bushfire behaviour with the potential for neighbourhood-scale destruction is not credible.
- The surrounding landscape is dominated by flat or almost flat land that will not exacerbate fire behaviour.
- No part of the study area or the land for over 2km around it is affected by the BMO or a Schedule to the BMO.
- To the north, west, southwest and east, much of the land around the precinct is currently, and will increasingly become, designated as non-BPA land.
- Once developed with reliably low threat and non-vegetated areas, most of the precinct will meet the criteria for future excision from the BPA, creating a large area safe from bushfire attack for existing and future residents.
- The only appreciable bushfire hazard within at least 2.5km is Grassland.
- Areas of higher hazard vegetation likely to be retained or created in the two creek corridors will be relatively small, isolated and narrow. They will, therefore, not pose a significant threat if new and existing development is sufficiently setback from them the distances identified in this report.
- In most cases, the proposed conservation reserves will provide enough separation distance to ensure development is not exposed to RHF above 12.5kW/m^2; this assumes, however, that a minimum 19m perimeter road is provided between the conservation reserves and development, to ensure separation from any Grassland hazard in the reserves and, in places, supplement the higher hazard Forest or Scrub setback distances.
- Interface areas where development setbacks will be required include:
  - between unmanaged vegetation in the conservation areas, along the Cardinia and Lower Gum Scrub Creeks, and development adjacent to them;
  - the Urban Growth Boundary along the southern and south-eastern edge of the precinct that interfaces with the permanent Grassland hazard; and
  - development abutting potentially hazardous drainage reserves and WSUD features.
- Layout and subdivision design that implements the setbacks will ensure that no BAL construction standard will result that is higher than the maximum BAL-12.5 outcome stipulated in the settlement planning strategies of Clause 13.02-1S.
- It should be noted that the only land use areas anticipated to contain buildings of a class that would require a BAL, are those designated residential and the two areas identified for potential schools.
- Service lanes or roads separating the Princes Freeway from development within the precinct should also be considered, as vegetation within the freeway reserve may pose a hazard which

could be ignited by an accident or other ignition source and threaten any abutting development.

- Scaled, illustrative design cross sections for areas that interface a permanent hazard, should be prepared as part of the PSP, to show the interface layout with development setbacks, including any proposed roads and landscaping.
- There are no apparent biodiversity impacts associated with the findings of this bushfire assessment.
- Development of the precinct can satisfy the objective and all strategies of Clause 13.02-1S, which aim to prioritise protection of human life.
- Accordingly, acceptable bushfire safety will be achieved and the state planning policy objective for bushfire in the Cardinia Planning Scheme will be met, if the measures identified in this report are implemented. There are no apparent barriers to this being achievable.

2 Introduction

This Bushfire Development Report has been prepared for the Victorian Planning Authority (VPA). It assesses the bushfire risk to the Officer South Employment Precinct (OSEP) and identifies how the Precinct Structure Plan (PSP) and future development within the precinct can respond to the risk and comply with the applicable planning and building controls that relate to bushfire, specifically the objectives and strategies of the Planning Policy Framework (PPF) at Clause 13.02-1S *Bushfire Planning*.

The VPA, in conjunction with stakeholders, are currently preparing the OSEPSP to guide future industrial and commercial development, and residential growth in the precinct. Approximately 52% of the study area will be a State Significant Industrial Precinct and 19% will comprise Regionally Significant Commercial Areas (RSCA). It is anticipated that the net developable area in the RSCA part of the precinct will be approximately 82% commercial and 18% residential (VPA, 2022a) (see Figure 2).

The purpose of this report is to assess the bushfire risk to the precinct and its suitability for development and, if appropriate, identify mechanisms to mitigate the bushfire risk to an acceptable level.

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

- *Local planning for bushfire protection,* Planning Practice Note 64 (DELWP, 2015a);
- *Design Guidelines, Settlement Planning at the Bushfire Interface* (DELWP, 2020a);
- *Bushfire State Planning Policy Amendment VC140,* Planning Advisory Note 68, (DELWP, 2018); and in relation to assessing landscape risk,
- *Planning Permit Applications – Bushfire Management Overlay,* Technical Guide (DELWP, 2017a).

3 Overview of precinct

The OSEP is located in the Shire of Cardinia, in Melbourne's south east growth corridor, approximately 58km (50mins travel) by road from the Melbourne CBD (Google Earth online, 2022) (see Figure 1). The precinct comprises 1,069ha of land, bounded generally by the Princes Freeway to the north, Cardinia Creek to the west and southwest, Lower Gum Scrub Creek to the east and Patterson Road and the Urban Growth Boundary (UGB) to the south.

The Draft Place Based Plan showing the arrangement of proposed land uses is provided as Figure 2. The precinct is anticipated to provide 22,000 jobs (to 2061), approx. 1600 dwellings and a population of 5,000 people (VPA, 2022).

Whilst the precinct is designated as a Bushfire Prone Area (BPA), much of the land around it to the north, west, southwest and east is currently, and will increasingly become, designated as non-BPA land. No part of the precinct, or any land for over 2km around it, is covered by the Bushfire Management Overlay (BMO) (see Map 1).

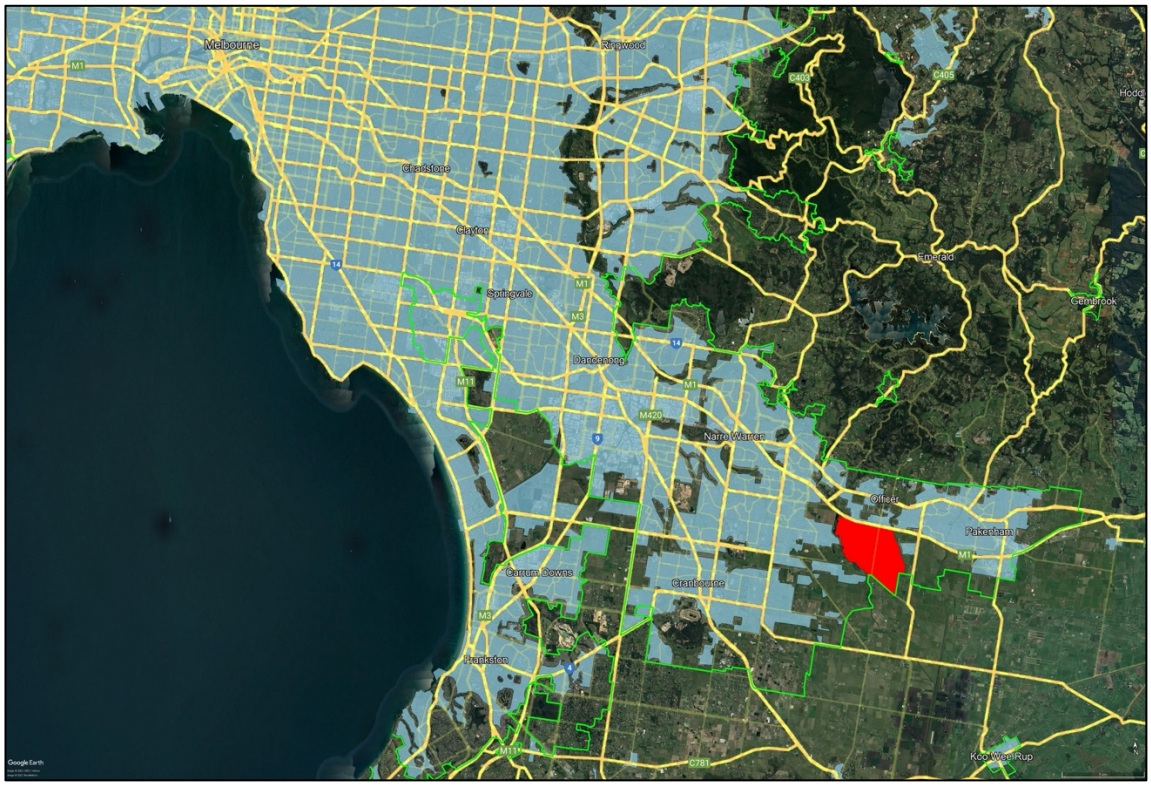


Figure 1 - OSEP location with non-Bushfire Prone Areas shown in light blue shading and the UGB shown in green outline.

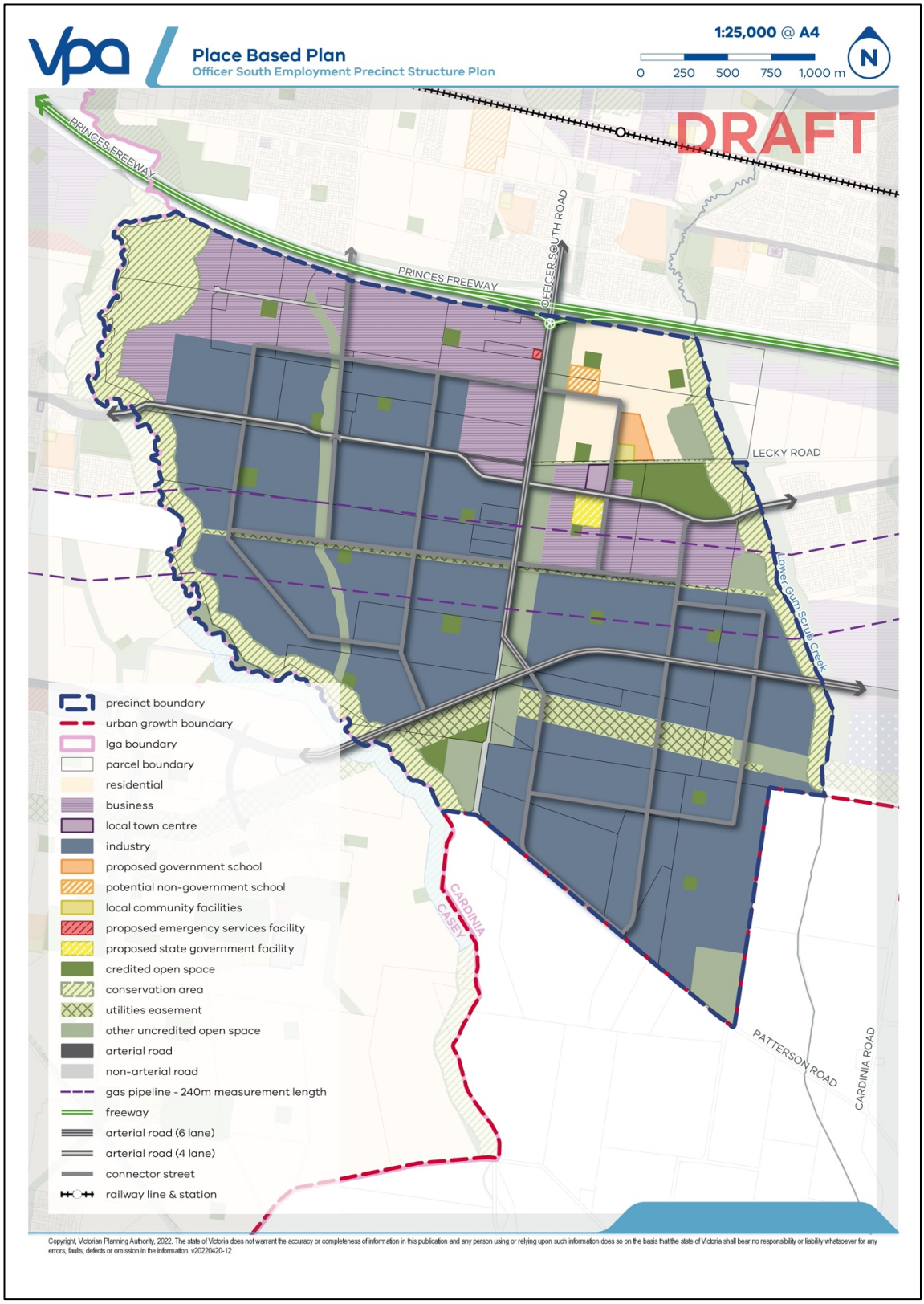


Figure 2 - Draft Place Based Plan for the OSEP (VPA, 2022b)[1].

[1] N.B. the Draft Place Based Plan shown in Figure 2 and in maps within this report, is a working draft version and will show slight variations in land use arrangements and transport networks to the final PSP.

4 Bushfire planning and building controls

This section summarises the applicable planning and building controls that relate to bushfire.

4.1 Planning provisions

Clause 13 *Environmental Risks and Amenity* in the Planning Policy Framework (PPF) has two key provisions pertinent to bushfire.

4.1.1 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. 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'* (Cardinia Planning Scheme, 2022).

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 Australasian Fire and Emergency Service Authorities Council (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 in the PPF supports the adoption of a precautionary and conservative approach to assessing and responding to bushfire risk. Fire weather is discussed further in Section 5.4.

4.1.2 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*' (Cardinia Planning Scheme, 2018). 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'* (Cardinia Planning Scheme, 2018).

Key strategies are stipulated in Clause 13.02-1S, which require regional growth plans, precinct structure plans and planning scheme amendments to assess the bushfire hazard and respond with 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.

This study assesses the bushfire hazard in accordance with hazard identification and assessment strategies of Clause 13.02-1S and identifies the bushfire protection measures that will be required for future development in accordance with the settlement planning strategies. It is considered that development in the OSEP can appropriately prioritise the protection of human life and meet the objective of Clause 13.02-1S. Key features to achieve this are appropriate subdivision design, including lot layout, perimeter roads and separation from hazardous vegetation. Minimum separation distances should ensure future dwellings and other development will not be exposed to RHF above 12.5kW/m^2, which is commensurate with a BAL-12.5 construction standard.

The maximum 12.5kW/m^2 safety threshold is required in settlement planning as the upper limit for acceptable risk. Responsible authorities must '*Not approve 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 3959-2018*' (Cardinia Planning Scheme, 2018).

A detailed response to the strategies in Clause 13.02-1S and recommendations for development are provided in Section 6.2.

4.1.3 Clause 21.02-4 Bushfire management

The Municipal Strategic Statement (MSS) states that '*Areas within the Cardinia Shire, particularly north of the Princes Highway, are prone to bushfires due to the topography and vegetation cover*' (Cardinia Planning Scheme, 2020). It contains the following objective for Bushfire management; '*To recognise that areas in the municipality are prone to bushfire and to minimise the potential risk to life, property and the environment* (Cardinia Planning Scheme, 2020). The following strategies to achieve the objective are identified:

'*Subdivision*

- *Ensure that the siting and design of subdivisions has fully considered the impact of existing slope, aspect and vegetation in terms of risks of bushfire, particularly with regard to the location of building envelopes.*

Siting and design

- *Ensure that the siting and design of houses and other accommodation in high risk bushfire areas minimises the potential risk of loss of life or property from wildfire, particularly in terms of the existing slope, aspect and vegetation.*
- *Ensure all development has appropriately designed access for emergency vehicles.*
- *Ensure development provides adequate access to water.*
- *Encourage the use of roads as a buffer between housing and bushland.*

Fuel reduction

- *Encourage the use of controlled burning to reduce ground fuel levels and to help maintain healthy and diverse forests and woodlands consistent with the Ecological Vegetation Class (EVC).*
- *Support the implementation of the Cardinia Municipal Fire Prevention Plan, 2016 and Cardinia Municipal Wildfire Preparedness Plan 2005'* (Cardinia Planning Scheme, 2020).

Section 5 identifies that the location is not one of high bushfire risk and Section 6 shows how future development can appropriately mitigate the relatively low risk to meet the objective of, and in accordance with the applicable strategies in, Clause 21.02-4.

4.1.4 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. However, in bushfire affected areas, it states that the protection of human life must be prioritised over all other policy considerations (Cardinia Planning Scheme, 2022b).

4.2 Bushfire Prone Area (BPA)

BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning. The precinct is currently designated as a BPA, however, as development occurs, most, or all of the precinct, will be excised from the BPA.

Note that land not within the BPA is defined as an area of low bushfire hazard, where the extent, configuration and/or management of vegetation results in low potential for bushfire spread (DELWP, 2019).

Areas of very high or extreme hazard in a BPA, where there is potential for extreme bushfire behaviour, such as a crown fire and extreme ember attack and radiant heat, are covered by the BMO (DELWP, 2019). Figure 1 and Map 1 show the extent of BPA and BMO coverage in and around the precinct and the surrounding broader landscape. No part of the precinct, or land for over 2km around it, is affected by the BMO.

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code (NCC), require bushfire protection standards for class 1, 2 and 3[2] buildings, 'Specific Use Bushfire Protected Buildings'[3] and associated class 10A buildings[4] or decks. The applicable performance requirement in the NCC is:

> *'A building that is constructed in a designated bushfire prone area must, to the degree necessary, be designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the —*
>
> *(a) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and*
>
> *(b) intensity of the bushfire attack on the building'* (ABCB, 2020).

Compliance with *AS 3959-2018 Construction of buildings in bushfire prone areas* (Standards Australia, 2020) is 'deemed-to-satisfy' the performance requirement[5].

Applicable classes of buildings in a BPA must be constructed to a minimum Bushfire Attack Level (BAL)-12.5, or higher as determined by a site assessment, planning permit, 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 3959-2018, which range from BAL-LOW, which has no bushfire construction requirements, to BAL-FZ (Flame

[2] 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.
[3] Specific Use Bushfire Protected Buildings are defined in the Victorian *Building Regulations 2018,* they generally comprise 'vulnerable' uses and include schools, kindergartens, childcare facilities, aged care facilities and hospitals.
[4] Class 10a buildings are defined in the NCC as non-habitable buildings including sheds, carports, and private garages.
[5] For Class 1 and associated Class 10a buildings, the *NASH Standard for Steel Framed Construction in Bushfire Areas* (NASH, 2021) is also deemed to satisfy the performance requirement.

Zone) where flame contact with a building is expected (see Appendix A for an explanation of BALs).

In a BPA not subject to the BMO, larger developments and certain vulnerable uses, including applications for subdivision of more than 10 lots, are required by Clause 13.02-1S to:

- *'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'* (Cardinia Planning Scheme, 2018).

There are no significant obstacles to future development in the OSEP complying with the applicable strategies at Clause 13.02-1S and the building regulations invoked in a BPA. BAL-LOW land, where the BPA has been removed within the precinct, will be created as reliably low threat and non-vegetated areas are created as development progresses. The only land use areas anticipated to contain buildings of a class that would require a BAL, are those designated residential and the two areas identified for potential schools.

DELWP review and excise areas from the BPA approximately every 6 months, particularly in growth areas where the hazard is removed as urban development occurs.

Land becomes eligible for excision if it satisfies statewide hazard mapping criteria, including that the land needs to be:

- At least 300m from areas of classified vegetation (except grassland) larger than 4ha in size; and
- At least 150m from areas of classified vegetation (except grassland) 2 to 4ha in size; and
- At least 60m from areas of unmanaged grassland more than 2ha in size (DELWP, 2015b).

For isolated areas of vegetation greater than 1ha but less than 2ha, the shape of the area and connectivity to any other hazardous vegetation is a further consideration (DELWP, 2015b).

4.3 Other controls

4.3.1 Zoning

Except for several small areas of Public Conservation and Resource Zone (PCRZ) along the Cardinia Creek corridor to the west, the zoning of the precinct is Urban Growth Zone (UGZ). Terramatrix is not aware of any proposed re-zonings, however it is assumed some may occur to facilitate uses in the proposed industrial, commercial, or mixed-use parts of the precinct.

Neither the existing, nor any likely new, zones are likely to have appreciable bushfire safety implications.

It is noted that in many growth areas, schedules to the zone include a requirement that an application for subdivision includes a Site Management Plan that addresses bushfire risk during and, where necessary, after construction, including:

- The staging of development and the likely bushfire risks at each stage;
- An area of land between the development edge and non-urban areas consistent with the separation distances specified in AS 3959-2018, where bushfire risk is managed;
- The land management measures to be undertaken by the developer to reduce the risk from fire within any surrounding rural or undeveloped landscape to protect residents and property from the threat of grassfire and bushfire; and
- How adequate opportunities for access and egress will be provided for early residents, construction workers and emergency vehicles.

This requirement helps to ensure that bushfire risk is managed during the construction period and given the potential for grassfire risk to and within the OSEP, including during the construction period, it would be prudent to require this measure as a condition of subdivision permits.

4.3.2 Overlays

Some land in the precinct, associated with the Cardinia and Lower Gum Scrub Creeks, is affected by the Floodway Overlay. Similarly, the Land Subject to Inundation Overlay applies to largely a narrow strip of land along Officer South Road. Other parts of the precinct are affected by the Heritage Overlay, Environmental Significance or Public Acquisition Overlays.

None of the existing, or any potential future, overlay controls are considered to have appreciable implications for bushfire safety.

The nearest area of Bushfire Management Overlay (BMO) coverage occurs approximately 2.2km to the north of the precinct.

5 Bushfire hazard 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 (Cardinia Planning Scheme, 2018). 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 within approximately 1 kilometre from a site;*
- *Neighbourhood conditions - meaning conditions within 400 metres of a site; and,*
- *The site for the development'* (Cardinia Planning Scheme, 2018).

This section includes an assessment of the hazard at the:

- Broader landscape scale, considering conditions beyond 1km and up to 20km around the site;
- The local and neighbourhood scale up to 1km around the site; and
- The site scale up to 150m around the precinct boundaries, including classifying vegetation and topography to determine future BAL construction standards that could be achieved within the precinct.

Note that the BPA coverage invokes AS 3959-2018 *Construction of buildings in bushfire prone areas* to determine an applicable BAL(s), which requires assessment of the vegetation and topography up to 100m around a building or site (Standards Australia, 2020). For vulnerable uses and larger developments in a BPA, a 150m assessment zone may be required (DELWP, 2018a). Whilst the bushfire risk to the precinct is relatively low, as a precaution for strategic planning purposes, a 150m assessment area has been applied at the site scale.

Figure 3 shows a 10km and 20km buffer around the precinct, Map 1 shows a 5km and 10km buffer around the precinct, Map 2 shows the 1km local and 400m neighbourhood assessment areas, and Map 3 shows the 150m site assessment area around the precinct. Map 3 also shows a 100m BAL assessment area around development areas that are likely to contain buildings that require a BAL.

5.1 Broader landscape scale conditions

5.1.1 Location description and context

The OSEP is located alongside the western boundary of the Shire of Cardinia, in Melbourne's southeast growth corridor. It is approximately 58km by road from the Melbourne CBD (Google Earth online, 2022) (see Figure 3).

The precinct comprises 1,069ha of land that is part of the Officer and Officer South localities and is bounded generally by the Princes Freeway to the north, Cardinia Creek to the west and southwest, Lower Gum Scrub Creek to the east and Patterson Road and the UGB to the south.

The Draft Place Based Plan, showing the arrangement of proposed land uses, is provided as Figure 2. The precinct is anticipated to provide 22,000 jobs (to 2061), approx. 1600 dwellings and a population of 5,000 people (VPA, 2022).

West of the Cardinia Creek is the Casey City Council LGA. Situated as they are in Melbourne's southeast growth corridor, Cardinia and Casey are two of the six fastest growing LGAs in Victoria as land is transformed from predominantly pasture to residential, commercial and industrial land uses.

The landscape to the south comprises flat, or relatively flat, pasture. Native vegetation is confined to small and sparse patches including narrow remnants along waterways and drainage lines. As the land to the south and southeast is outside the UGB, it will likely stay in its current state for the foreseeable future. The landscape to the north, east, west and southwest, however, is being rapidly developed into urban-residential/commercial land, as neighbouring PSPs in those directions are completed and implemented (see Figure 4).

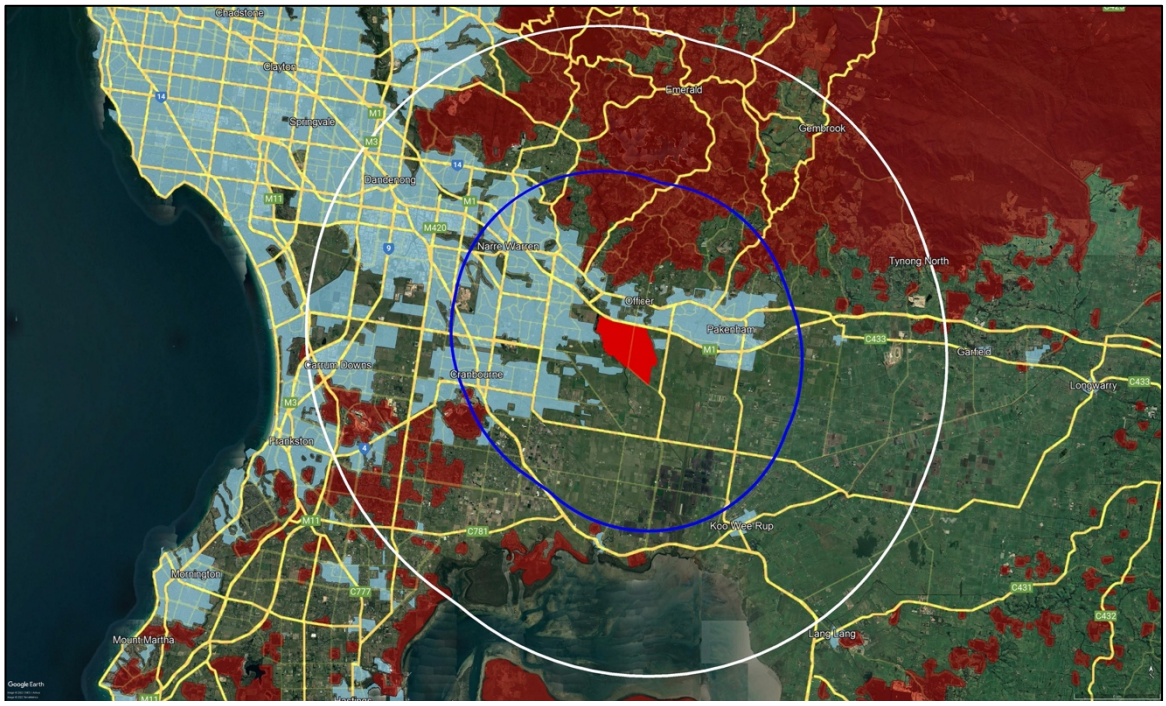


Figure 3 - Location and broad landscape context of the precinct. A 10km buffer is shown in blue outline, a 20km buffer in white outline. Non-BPA land (i.e. low hazard BAL-LOW areas) is shown in light blue shading and BMO/BMO schedule areas are shown in red.

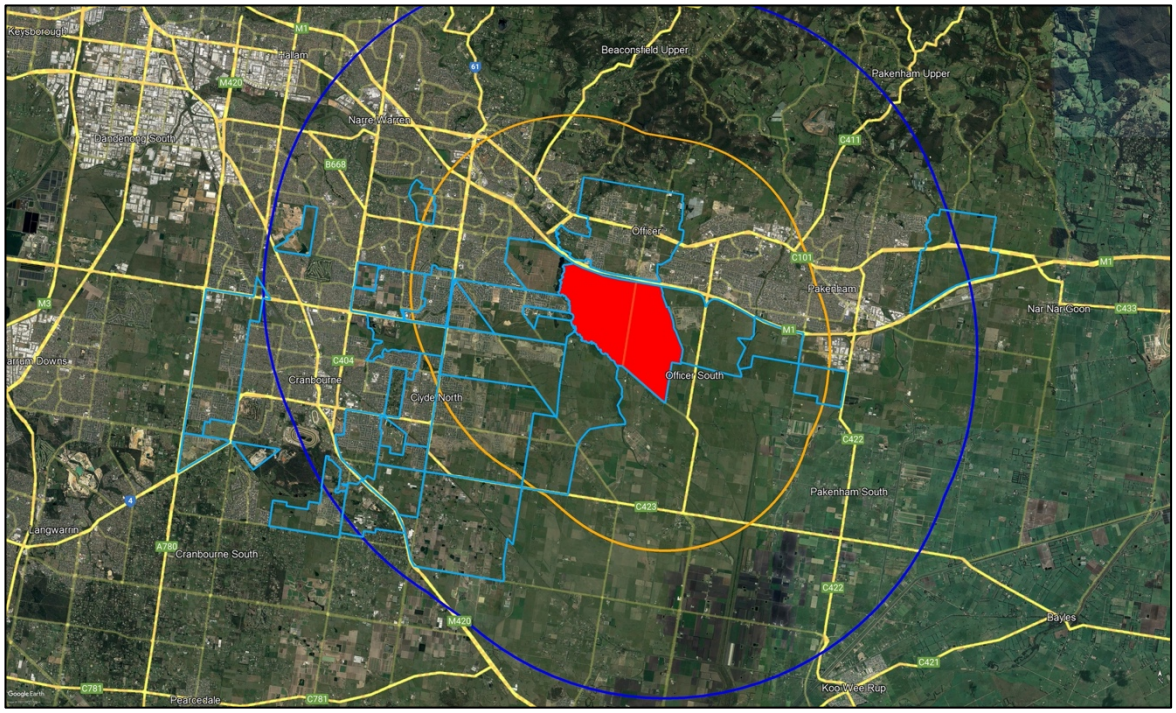


Figure 4 - OSEP (in red) with surrounding PSP boundaries, denoting existing and future growth areas, shown in light blue outline. A 5km buffer of the OSEP is shown in orange outline and a 10km buffer is shown in dark blue outline.

5.1.2 Broader landscape risk type

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, 2017a).

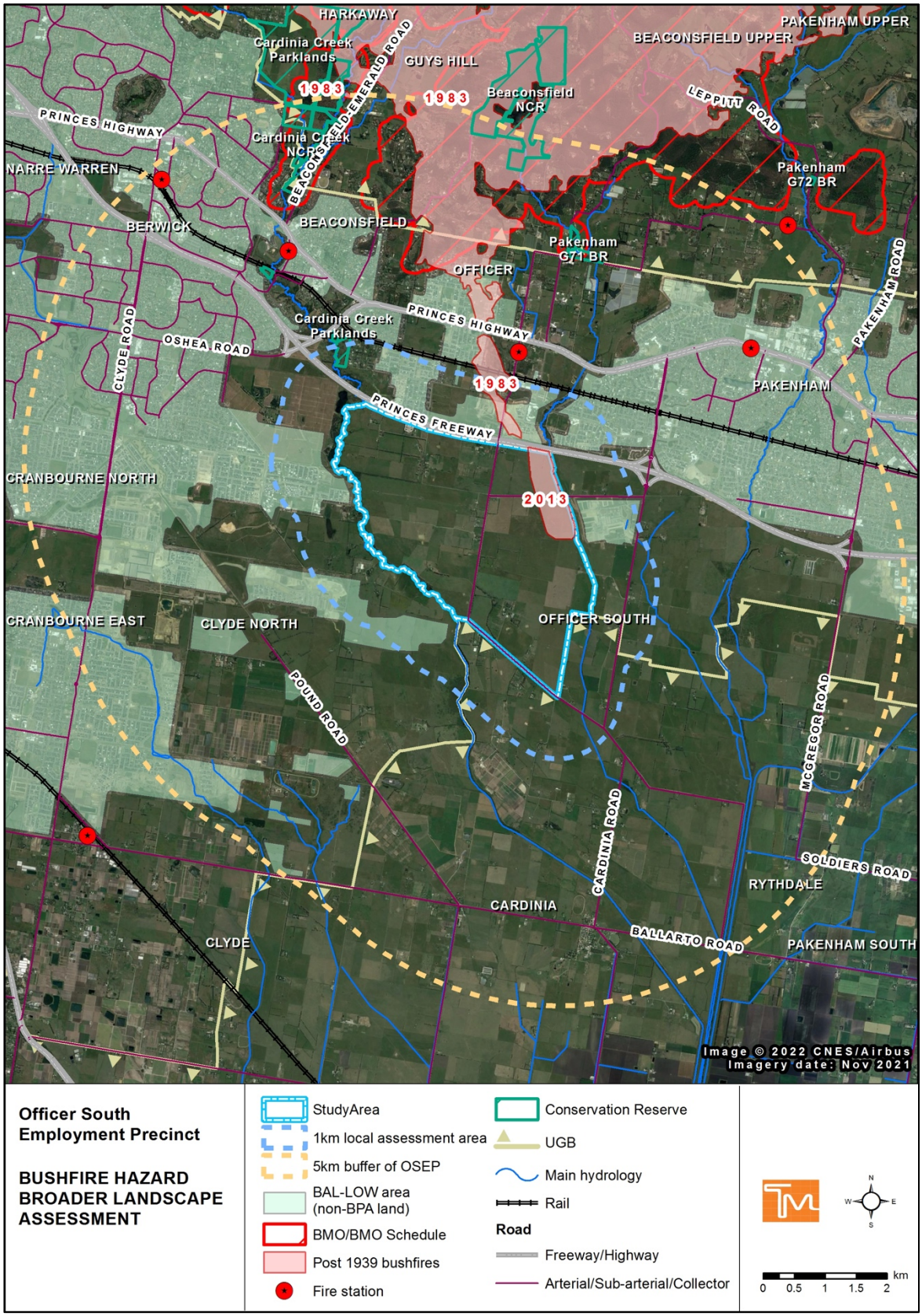
The four types range from low risk landscapes, where there is little hazardous vegetation beyond 150m of a site and extreme bushfire behaviour is not credible, to extreme risk landscapes with limited or no evacuation options and where fire behaviour could exceed BMO/AS 3959-2018 presumptions (see Table 1).

Table 1 - 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.* • *Evacuation options are limited or not available.* • *Fires have hours or days to grow and develop before impacting.*
I N C R E A S I N G R I S K →			

The characteristics of the OSEP best accord with those of the lesser risk Landscape Types 1 and 2. The risk rises into the higher hazard Type 3 landscape, but that is over 2.5km away to the north only. Within 2.5km of the precinct, there is little hazardous vegetation except for Grassland. The areas of trees and shrubs that occur are small and confined to relatively narrow strips along the Cardinia Creek, other drainage lines and roadsides. They do not pose a significant hazard that could generate large-scale fire behaviour. Bushfire behaviour with the potential for neighbourhood-scale destruction is not credible. A large grassfire could approach from the south-southeast, but access to places of relative safety is readily available in the existing and new development areas, and southerly approaches do not typically coincide with severe fire weather conditions.

Much of the land around the precinct, including to the west, southwest and northwest that are the directions associated with higher threat fire weather, is not designated as a BPA. The nearest areas of higher hazard vegetation with bushfire risk potential are the patches of Forest and Woodland that occur approximately 2.5km to the north, including the Beaconsfield Nature Conservation Reserve, the Cardinia Parklands and Cardinia Nature Conservation Reserve, and other patches of remnant vegetation scattered across private properties to the north of the UGB. The higher risk associated with these areas is denoted by the BMO coverage (see Figure 3 and Map 1).



Map 1 - Bushfire hazard broader landscape map.

5.1.3 Regional bushfire assessments and strategies

Metropolitan Bushfire Management Strategy 2020

Strategic bushfire management planning in Victoria is jointly delivered by Forest Fire Management Victoria (FFMVic), Country Fire Authority (CFA), Emergency Management Victoria (EMV) and local governments. A key output is a Bushfire Management Strategy for each of the six planning regions. Each strategy informs more detailed operational-level planning, including municipal fire prevention planning, the CFA and FFMVic joint fuel management program, and readiness and response planning.

The OSEP is in the region covered by the Metropolitan Bushfire Management Strategy. No specific issues in the strategy are identified pertaining to the precinct. House loss modelling shows the precinct is in a least risk part of the region (DELWP, 2020b).

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 Cardinia Shire Council LGA. It does not identify any bushfire issues for the precinct or wider area and notes that development will occur around the Officer, Pakenham and Beaconsfield townships as part of the southeast growth corridor. The RBPA identifies, however, that the Officer precinct to the north of the OSEP, across the Princes Freeway, is within a 'Bushfire landscape of consideration' (DPCD, 2012).

Cardinia Shire Council Municipal Fire Management Plan (MFMP) and Municipal Emergency Management Plan (MEMP)

There is no specific information in the Cardinia City Council MFMP pertinent to the precinct or this assessment, however the risk of fire on residential assets in the Officer locality is rated as 'High', based on a 'Minor' consequence rating and an 'Almost Certain' likelihood rating (CSC, 2016).

The MEMP identifies the risk of Bushfire/Grassfire for the Shire is High (CSC, 2019).

5.2 Local and neighbourhood conditions

5.2.1 Risk factors

There are no significant risk factors in the landscape within the 1km local or 400m neighbourhood areas defined in the hazard assessment strategies of Clause 13.02-1S. The hazard comprises Grassland in and around the precinct, and small, typically narrow patches of Scrub and Forest that are mainly associated with the Cardinia Creek, but also occur along other drainage lines and roadsides, including Officer South and Patterson Roads (see Figure 11 and Figure 12).

The topography is flat and will not exacerbate fire behaviour. The wind speed and degree of curing (moisture content) of available fuels will be the key drivers of fire intensity and rate of spread.

5.2.2 Bushfire scenarios

Fire history data shows that a small grassfire burnt south from the Princes Freeway reserve through the precinct in March 2013. On 'Ash Wednesday' in 1983 the large established bushfire that burnt south through Upper Beaconsfield, crossed the Princes Highway but did not reach the precinct (see Map 1 and Map 2).

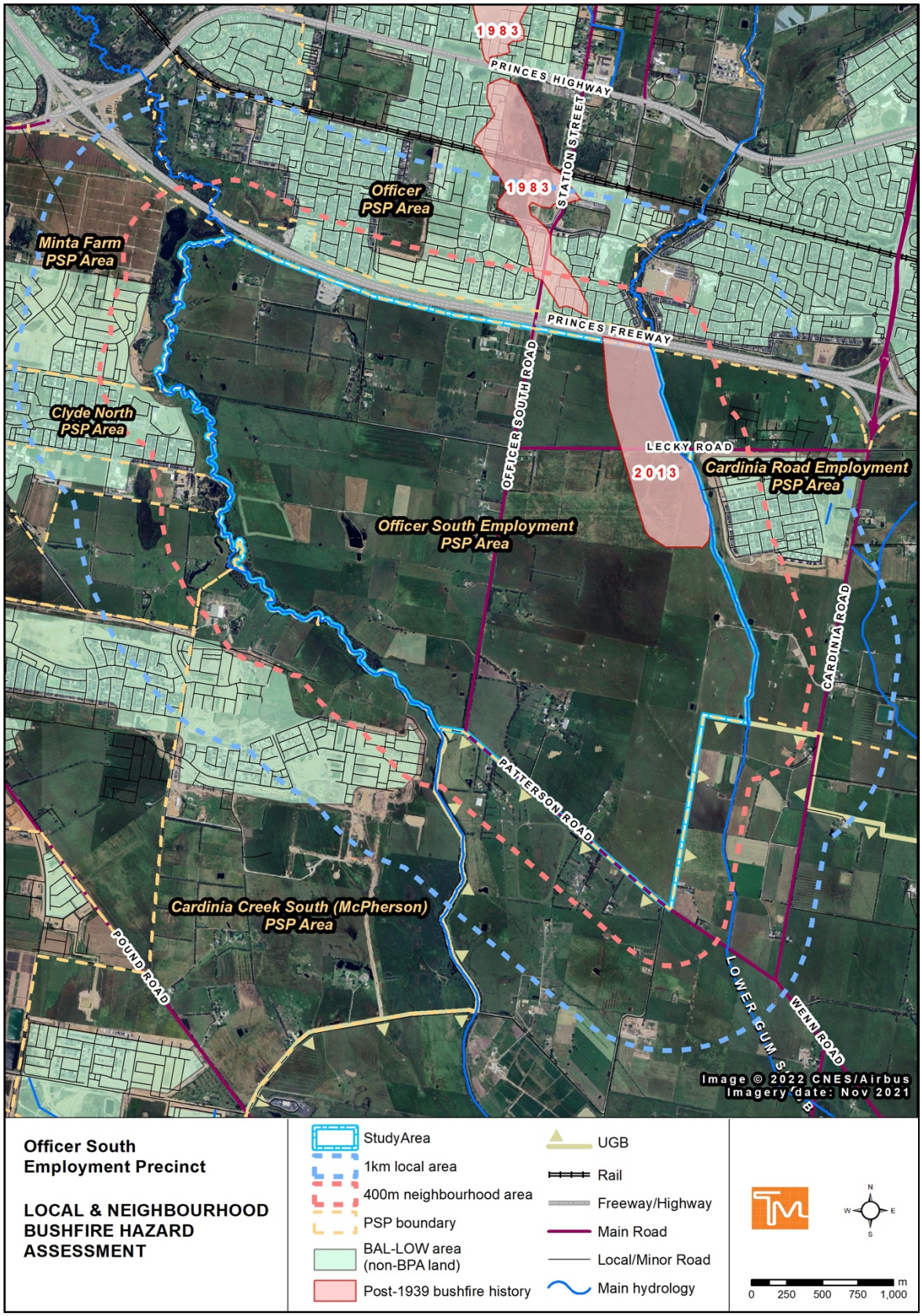
Fires from the north, west or southwest are the directions of highest threat, which are typically associated with the predominant wind direction during severe or higher fire danger weather in Victoria (Long, 2006). The pattern and scale of existing and future residential and commercial development in these directions has significantly lessened the risk however, and the impacts associated with an Ash Wednesday-type scenario would be confined to smoke and potentially, low levels of embers landing in the precinct.

Under the influence of strong southerly winds, a grassfire impacting from the south or southwest of the precinct could be larger and fast moving. However, as the Cardinia Creek South (McPherson) PSP is completed, the risk from the southwest will abate significantly. The residual risk of a grassfire from the south, outside the urban growth area (i.e. beyond the UGB; see Map 3) will remain, as will the risk of a higher intensity fire occurring in remnant or re-established vegetation along the Cardinia Creek, Lower Gum Scrub Creek or other area within or adjacent to the precinct that contains 'unmanaged' vegetation.

The risk from both these scenarios is also low however, and can be acceptably mitigated by providing appropriate setbacks for development from the unmanaged vegetation, including perimeter roads to assist in fire fighting where a permanent bushfire hazard interface occurs, a reticulated hydrant system as subdivision occurs, and BAL construction standards for buildings if required by the building regulations (see Section 4.2).

Note that whilst grassfires can be fast, unpredictable and life threatening, they do not typically generate significant ember attack or intensities that would contribute to penetration and destruction of an established residential area.

Note also that as identified in Section 6, non-BPA land will be created across much of the precinct once reliably low threat and non-vegetated areas are established as development commences. Access for people in the precinct will be readily available to these reliably low threat or non-vegetated areas that can function as places of relative safety from bushfire.



Map 2 - Bushfire hazard local and neighbourhood assessment map.

5.3 Site scale conditions

The AS 3959-2018 site assessment methodology is invoked by Clause 13.02-1S to assess the bushfire risk at the site scale, and by the building regulations to determine BAL construction standards for defined classes of buildings in a BPA. It requires classification of the vegetation and topography within 100m of a site or building.

Whilst the bushfire risk to the precinct is low, as a precaution for strategic planning purposes, a 150m assessment area around the precinct boundary has been applied for the site scale assessment (see Map 3 and Map 4). DELWP guidelines state that for vulnerable uses and larger developments in a BPA, a 150m assessment zone may be required (DELWP, 2018a).

A 100m BAL assessment area is also shown in Map 3, to identify the potential for classified vegetation to occur within 100m of buildings that are likely to require a BAL, i.e. those areas proposed for residential or school use in the Place Based Plan.

5.3.1 Vegetation

Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective and is classified in accordance with the AS 3959-2018 methodology.

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 should be based on the likely fire behaviour that it will generate and, for settlement planning purposes, the long-term structure of the vegetation in its mature state.

At this early stage in the OSEP, the extent and types of vegetation that may be retained or created in the OSEP is not able to be determined definitively. Accordingly, based on existing vegetation including EVC mapping provided to Terramatrix, and the potential for future regeneration or revegetation, assumptions have been made to illustrate potential (indicative) development setbacks. These assumptions are:

- A hypothetical 50m of Forest being retained or created each side of Cardinia Creek;
- A hypothetical 30m of Scrub being retained or created each side of Lower Gum Scrub Creek; and
- Grassland occurring between the Forest or Scrub and the edge of the proposed Conservation Reserve.

The indicative setbacks are shown in Map 3, Map 4, Map 5 and Map 6 to illustrate the distances future development would need to be from the two vegetated creek corridors and the proposed conservation reserve, to meet the settlement planning safety threshold in Clause 13.02-1S. This threshold requires development to occur in low risk locations where radiant heat will be less than 12.5kW/m^2. Setbacks are also shown in Map 3 from the permanent Grassland interface along the

southern and south-eastern precinct boundary that comprises the UGB. A table of possible vegetation types and commensurate setback distances is provided for other areas of existing or potential future vegetation (see Table 3).

Note that along Cardinia Creek, the mapping assumes the highest hazard Forest group applies. In reality, large areas of the conservation reserves along both creeks will likely be managed for Growling Grass Frog habitat[6] and comprise the less hazardous Grassland or Scrub vegetation types, in which case lesser setbacks would apply (see Table 3).

Similarly, the likely most hazardous classification of Scrub has been adopted for Lower Gum Scrub Creek, when vegetation along this creek may actually comprise lesser hazard Shrubland or Grassland.

The arbitrary 50m and 30m widths shown either side of the creeks allow for possible natural recruitment or active revegetation but in places it underestimates the extent of vegetation present and the setbacks would need to apply from the edge of the unmanaged vegetation (see Map 5, Map 6 and Figure 17).

EVC mapping provided to Terramatrix has been used to derive AS 3959 vegetation groups and the descriptions of potential classified vegetation (see Map 4).

Forest

Areas of remnant treed vegetation with a well-developed shrubby understorey and overall tree canopy cover greater than 30%, accord best with the AS 3959-2018 Forest group. The Forest comprises the Open Forest or Low Open Forest vegetation types, which typically have a canopy of trees to 30 m high, with 30-70% overall foliage cover including an understorey of sclerophyllous low trees and tall scrubs (Standards Australia, 2020). Whilst Forest typically has a canopy of Eucalypts it includes pine plantations and in places mature pine trees dominate the tree canopy along Cardinia Creek (see Figure 5).

Vegetation mapped as *EVC 83 - Swampy Riparian Woodland* has been allocated to the Forest group. Swampy Riparian Woodland has a 20% benchmark tree canopy cover and the descriptions of this vegetation class is:
'Woodland to 15 m tall generally occupying low energy streams of the foothills and plains. The lower strata are variously locally dominated by a range of large and medium shrub species on the stream levees in combination with large tussock grasses and sedges in the ground layer' (DSE, 2004a).

[6] Both conservation reserves are part of Conservation Area 36 'Growling Grass Frog Corridors, South Eastern Growth Corridor' in the Biodiversity Conservation Strategy for Melbourne's Growth Corridors (DEPI, 2013).

Figure 5 - Area of Forest along Cardinia Creek, west of Patterson Road, that is dominated by pine trees.

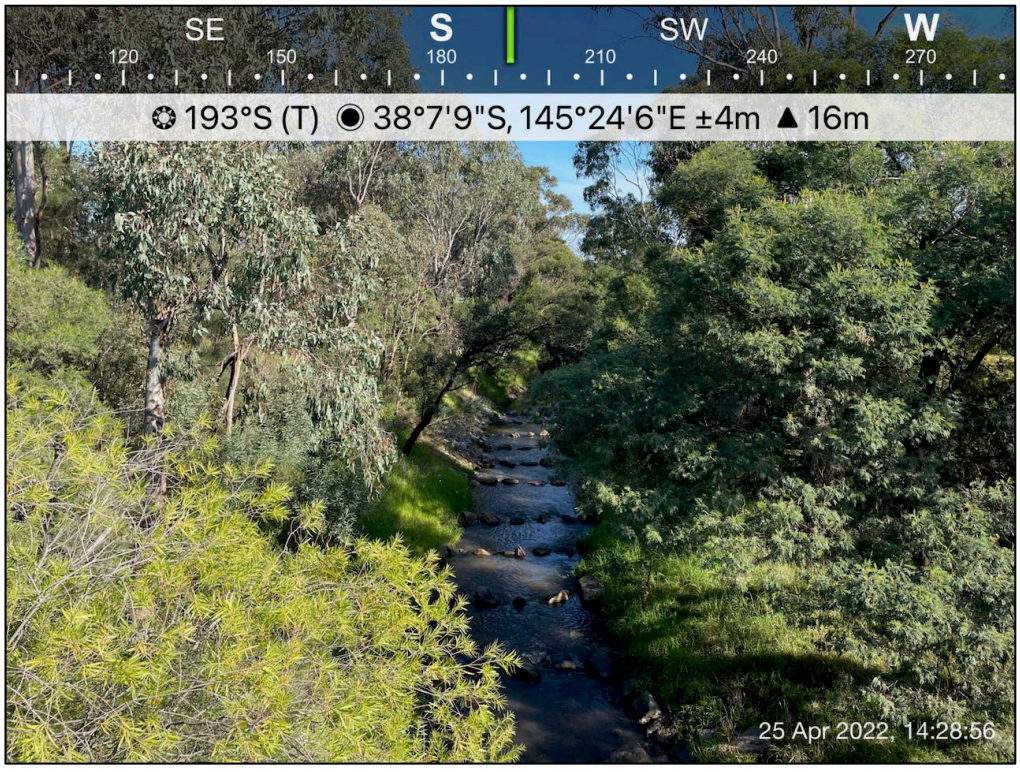


Figure 6 - Forest along Cardinia Creek, south of the precinct.

Woodland

Where overall foliage cover in the canopy is less than 30%, and shrubs in the understorey are sparse, vegetation may comprise Woodland, which has the following typical characteristics: '*Trees up to 30 m high; 10%–30% foliage cover dominated by eucalypts and/or callitris with a prominent grassy understorey. May contain isolated shrubs*' (Standards Australia, 2020). The following mapped EVCs are most likely to comprise Woodland.

EVC 55 Plains Grassy Woodland – 20% benchmark tree canopy cover

'An open, eucalypt woodland to 15 m tall occurring on a number of geologies and soil types. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer' (DSE, 2004b).

EVC 937 Swampy Woodland – 15% benchmark tree canopy cover

'Open eucalypt woodland to 15 m tall with ground-layer dominated by tussock grasses and/or sedges and often rich in herbs. Occurs on poorly drained, seasonally waterlogged heavy soils, primarily on swamp deposits but extending to suitable substrates within some landscapes of sedimentary origin' (DSE, 2004c).

Scrub

Some areas of shrub-dominated vegetation along the Cardinia Creek, and small areas along Lower Gum Scrub Creek, may accord best with the AS 3959-2018 classification of Scrub (see Figure 7 and Figure 8), comprising the Closed Scrub vegetation type, which is defined as: '*Found in wet areas and/or areas affected by poor soil fertility or shallow soils; >30% foliage cover. Dry heaths occur in rocky areas. Shrubs >2 m high. Typical of coastal areas and tall heaths up to 6 metres in height. May be dominated by Banksia, Melaleuca or Leptospermum with heights of up to 6 metres'*. The Scrub group also includes the Open Scrub vegetation type, which is defined as '*Shrubs greater than 2 m high; 10–30% foliage cover with a mixed species composition'* (Standards Australia, 2020).

This classification matches the description for *EVC No. 53 Swamp Scrub,* which is *'Closed scrub to 8 m tall at low elevations on alluvial deposits along streams or on poorly drained sites with higher nutrient availability. The EVC is dominated by Swamp Paperbark Melaleuca ericifolia (or sometimes Woolly Tea-tree Leptospermum lanigerum) which often forms a dense thicket, out-competing other species. Occasional emergent eucalypts may be present. Where light penetrates to ground level, a moss/lichen/liverwort or herbaceous ground cover is often present. Dry variants have a grassy/herbaceous ground layer'* (DSE, 2004d).

Where the height of Scrub exceeds 6m or has a dominant taller tree canopy, the Forest classification and setbacks should be adopted. Note that if scrub-like vegetation comprises shrubs on average less than 2m high at maturity, the vegetation is classified as Shrubland.

Figure 7 - Scrub along Lower Gum Scrub Creek, south of Lecky Road in the east of the OSEP.

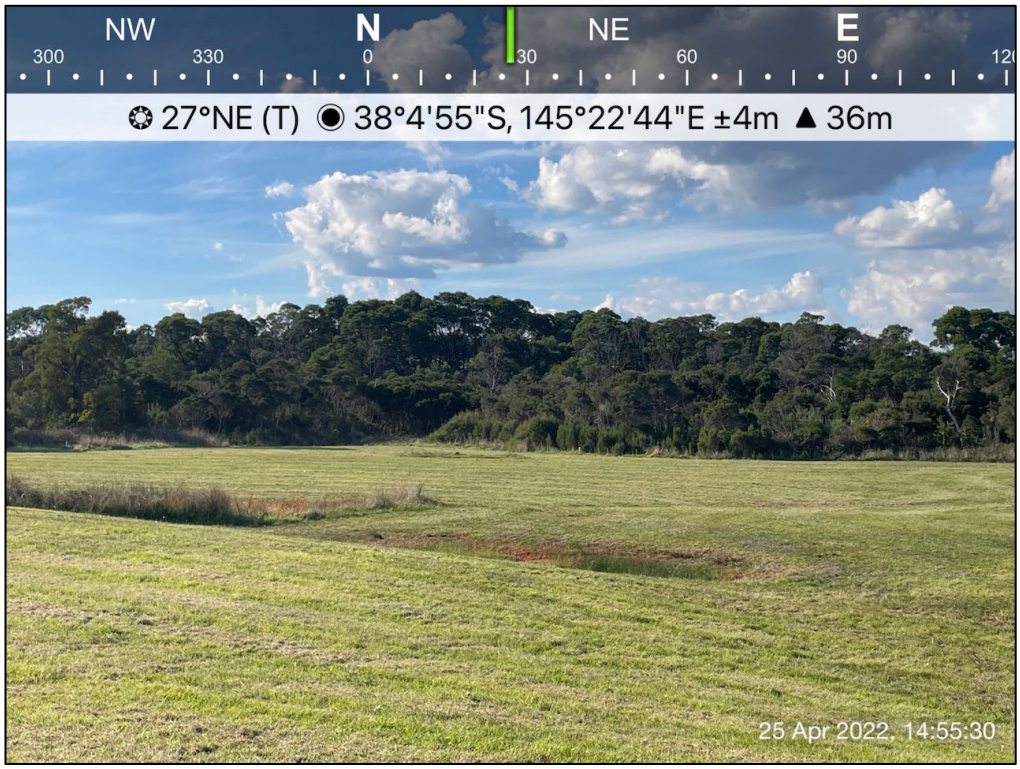


Figure 8 – Looking across Growling Grass Frog habitat at Scrub and Forest vegetation along Cardinia Creek, from west of the precinct in the Minta Farm PSP area.

Grassland

Areas of grassy vegetation with an overstorey foliage cover of less than 10%, are classifiable in the Grassland group of AS 3959-2018, which is defined as '*All forms* (of vegetation except tussock moorlands) *including areas with shrubs and trees, if the overstorey foliage cover is less than 10%*' (Standards Australia, 2020). Grassland includes open woodland, pasture and cropland except for non-curing crops.

Grassland vegetation is considered hazardous, and therefore classifiable, when it is unmanaged i.e. >100mm tall. A conservative and precautionary approach should be adopted, of assuming grassland areas will be unmanaged and classifiable unless they are reasonably assured to be managed in perpetuity, in a low threat state, no more than 100mm high. However, if any grassland areas are mown or slashed and maintained in a low threat state during the fire danger period, they may meet one or more of the exclusion criteria and not be classifiable (see Section 5.3.2).

It is considered reasonable to assume that all Growling Grass Frog habitat that does not comprise Scrub, and where tree canopy cover is less than 10%, will comprise no more of a hazard than classified Grassland. This is consistent with guidelines for the management and enhancement of areas to create or improve Growling Grass Frog habitat, as stipulated in the *Growling Grass Frog Habitat Design Standards* (DELWP, 2017b).

These standards stipulate that 50% of terrestrial habitat within 10m of a wetland should be maintained as low, grassy vegetation no higher than 100mm. From 10m and up to 100m where possible, it should comprise short, mown grass. Tree and shrub cover within 100m of a wetland should not exceed 10% (DELWP, 2017b). On this basis, many areas of Growling Grass Frog habitat may in fact comprise low threat vegetation.

A Grassland, or possibly Shrubland, classification could be applicable to areas identified as *EVC 821 Tall Marsh* or *EVC 136 Sedge Wetland* that are not likely to be inundated by water and therefore cannot be deemed low threat.

EVC 821 Tall Marsh: '*Occurs on Quaternary sedimentary geology of mainly estuarine sands, soils are peaty, silty clays, and average annual rainfall is approximately 600 mm. It requires shallow water (to 1 m deep) and low current-scour, and can only tolerate very low levels of salinity. Closed to open grassland/sedgeland to 2-3 m tall, dominated by Common Reed and Cumbungi. Small aquatic and semi-aquatic species occur amongst the reeds*' (DSE 2007).

EVC 136 Sedge Wetland: '*Occupies seasonal wetlands and consists of generally treeless vegetation dominated by sedges. May contain a fringe of shrubs and isolated shrubs may also be present throughout. Usually of low diversity in central areas, but richer on verges and in some more ephemeral forms of the EVC*' (DSE 2004e).

Figure 9 – Grassland to the south of precinct, south of Patterson Road.

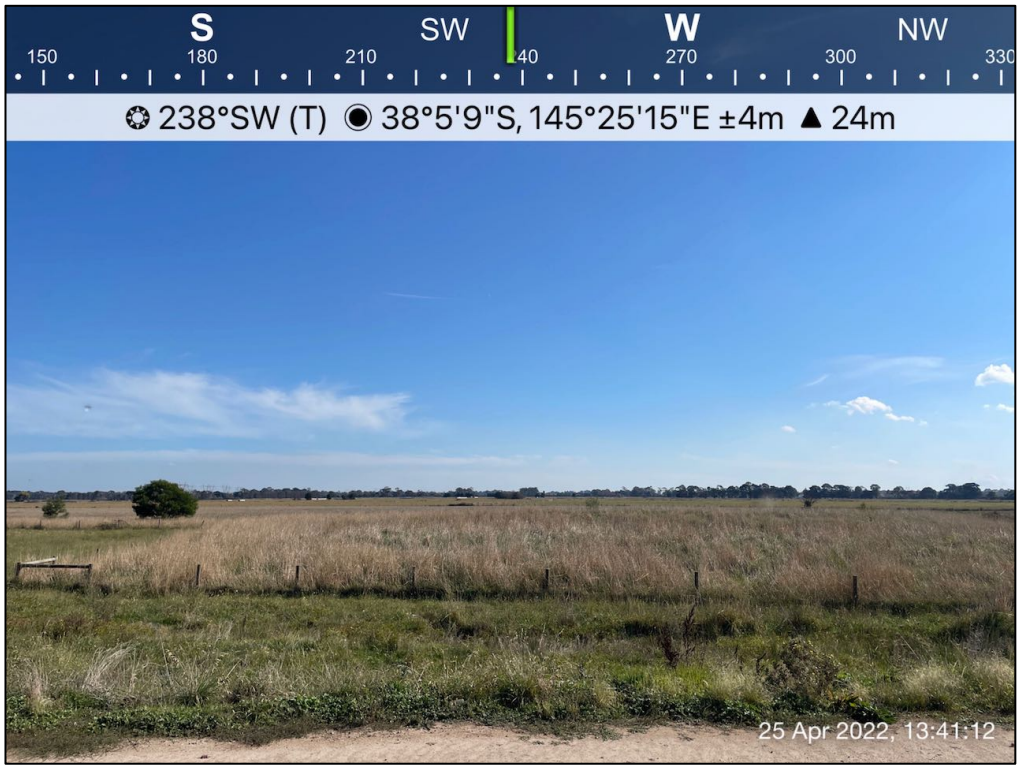
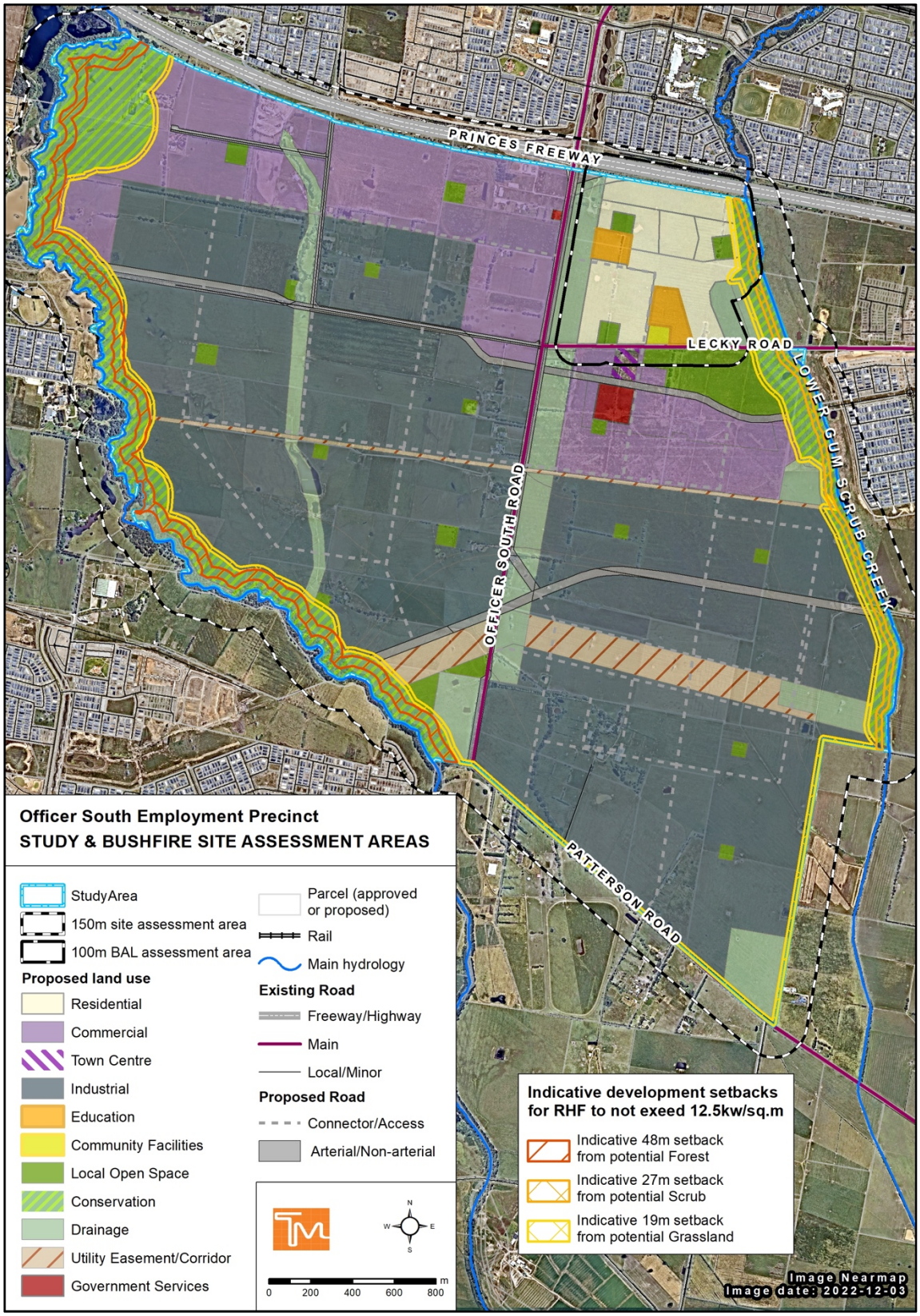


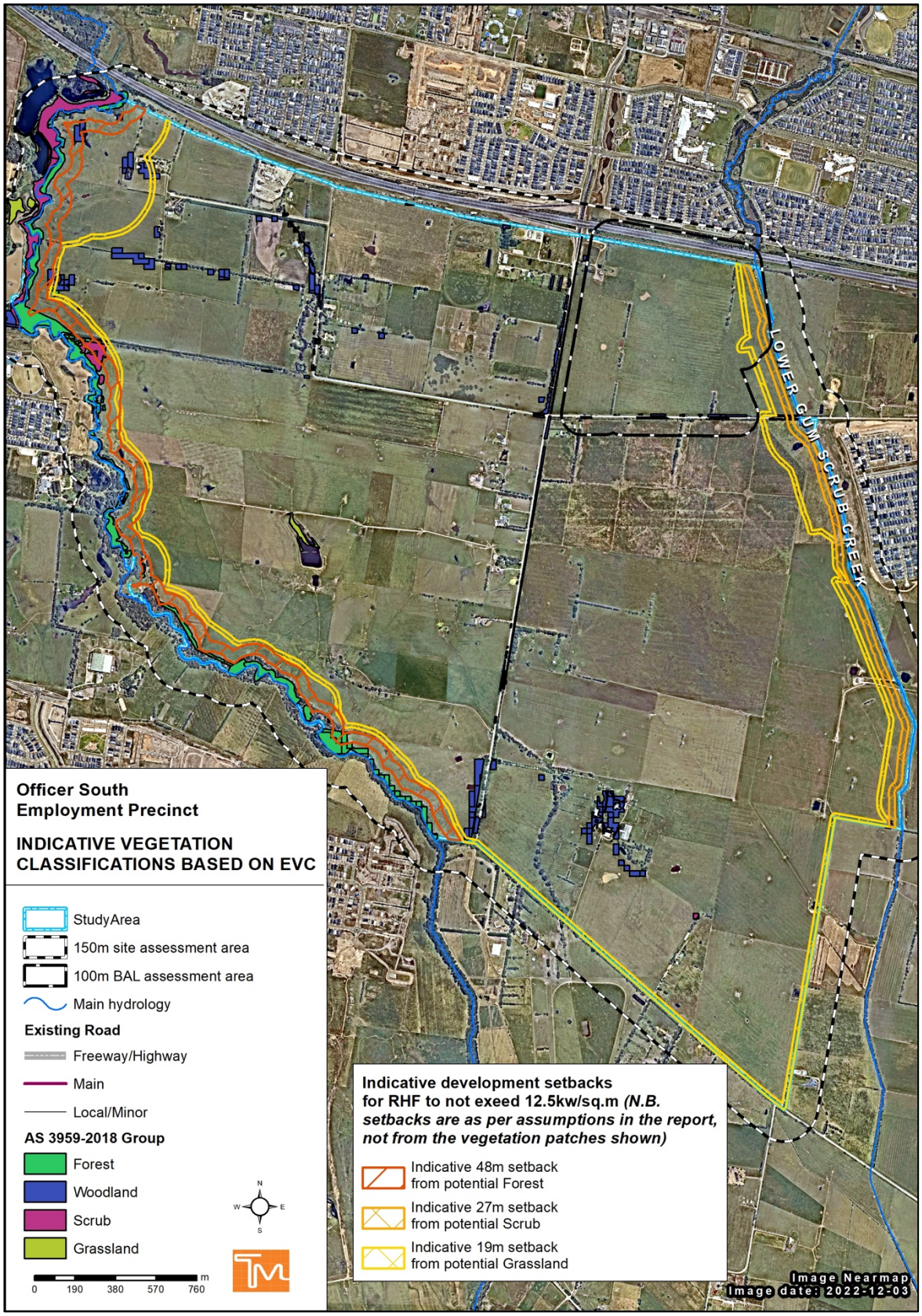
Figure 10 – Looking west-southwest from the eastern boundary of the precinct, at flat Grassland which dominates the OESP and will be an interim hazard as the precinct is developed.

Figure 11 - Looking west along Lecky Road within the precinct. Vegetation in the road reserve may be potentially classifiable as Woodland if it is retained, but for determining future BALs may meet one or more of the exclusion criteria for low threat vegetation.

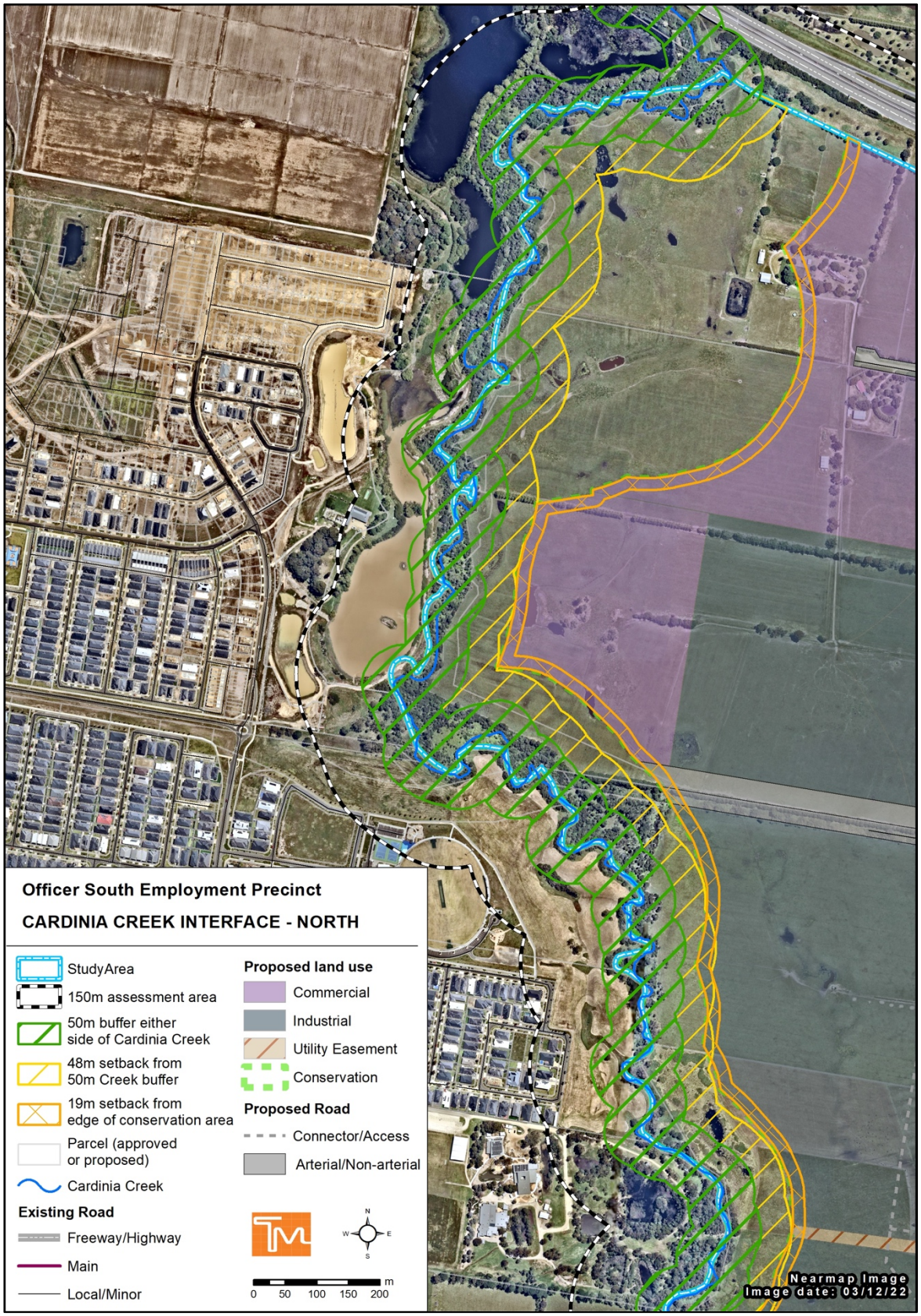
Figure 12 - Looking south at Scrub along the drainage line east of Officer South Road.



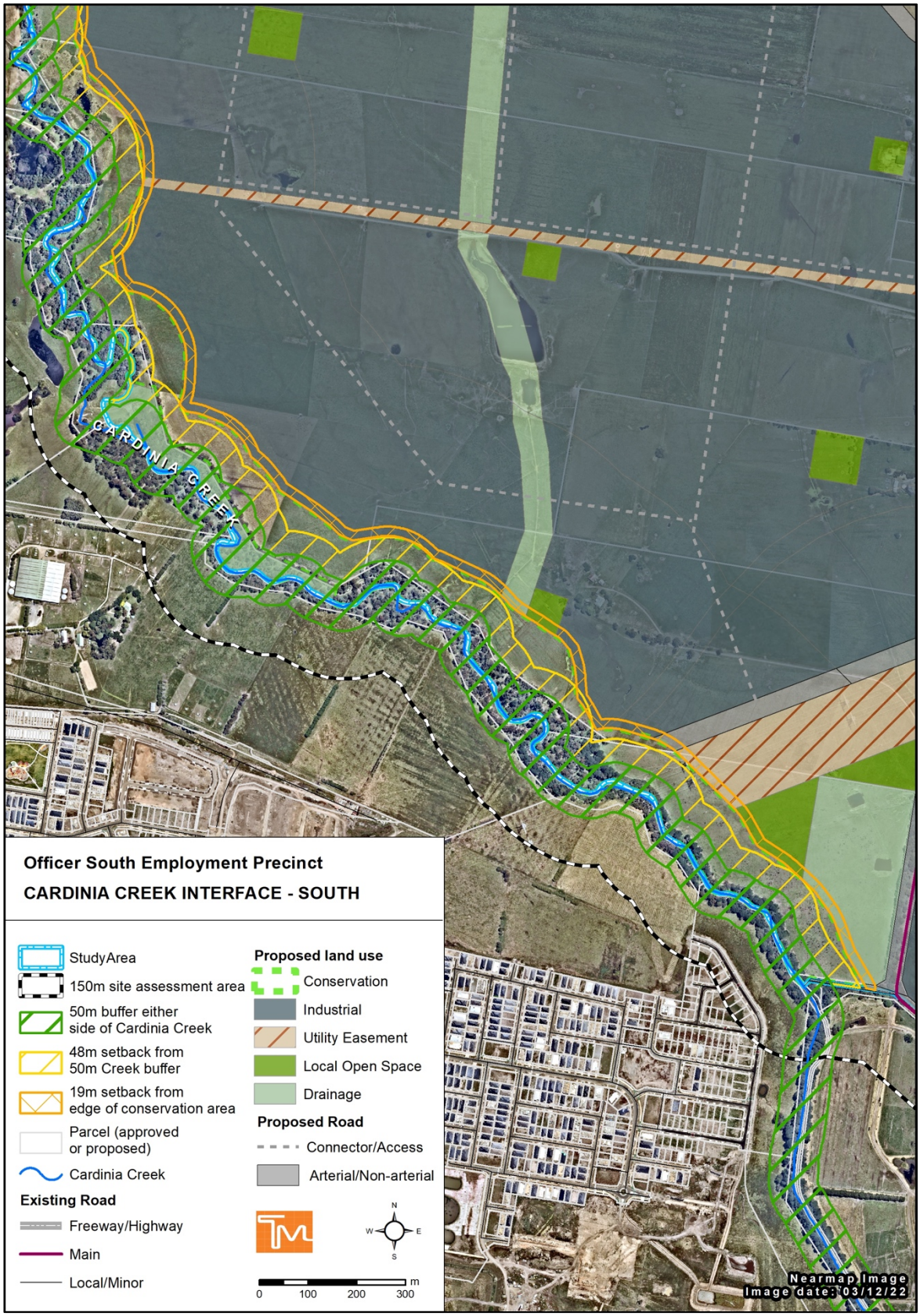
Map 3 - Site assessment map, showing Indicative development setbacks, the 150m site assessment area and likely 100m BAL assessment area around parts of the OSEP that will likely contain buildings requiring a BAL (see Section 4.2).



Map 4 - Classified vegetation groups derived from EVC mapping *(N.B. indicative only)*.



Map 5 – Northern Cardinia Creek interface, showing potentially classifiable existing vegetation and indicative development setbacks.



Map 6 - Southern Cardinia Creek interface, showing potentially classifiable existing vegetation and indicative development setbacks.

5.3.2 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification and be deemed non-hazardous for determining BALs, 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 100m from the site.

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

(c) Multiple areas of vegetation less than 0.25 ha 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.

NOTES:

1 *Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).*

2 *A windbreak is considered a single row of trees used as a screen or to reduce the effect of wind on the leeward side of the trees'* (Standards Australia, 2020).

It is reasonable to assume that land in the residential, industrial and commercial parts of the precinct will be either non-vegetated or comprise low threat vegetation such as maintained lawns, cultivated gardens, streetscapes and other landscaped areas. It is also assumed that the proposed local parks will be managed in a low threat state.

The proposed drainage reserves may, however, not be low threat. The structure, size and setback from development of any vegetation within them, and how the vegetation is managed during the fire danger period, will determine whether they are non-hazardous vegetation.

Retarding basins to mitigate the flood threat or other water sensitive urban design (WSUD) features with managed grass, reliably open water or wet areas and little or no vegetation, may be deemed low threat. Large, seasonally inundated wetlands or WSUD features that may be dry and vegetated during the fire danger period could, however, comprise classifiable vegetation.

Figure 13 – Low threat and non-vegetated land in the residential area under development and abutting Lower Gum Scrub Creek, in the neighbouring Cardinia Road Employment Precinct, east of the OSEP.

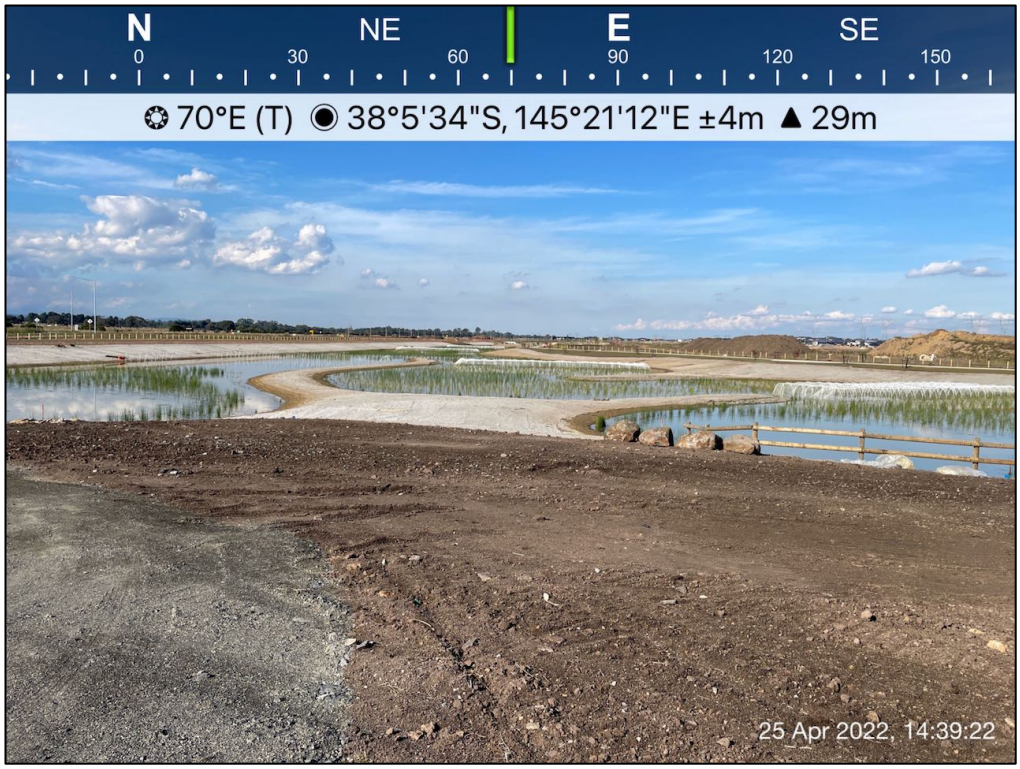


Figure 14 – Recently constructed wetland in the Thompsons Road PSP area west of the OSEP. WSUD features may be non-vegetated or low threat during the construction period but hazardous upon completion.

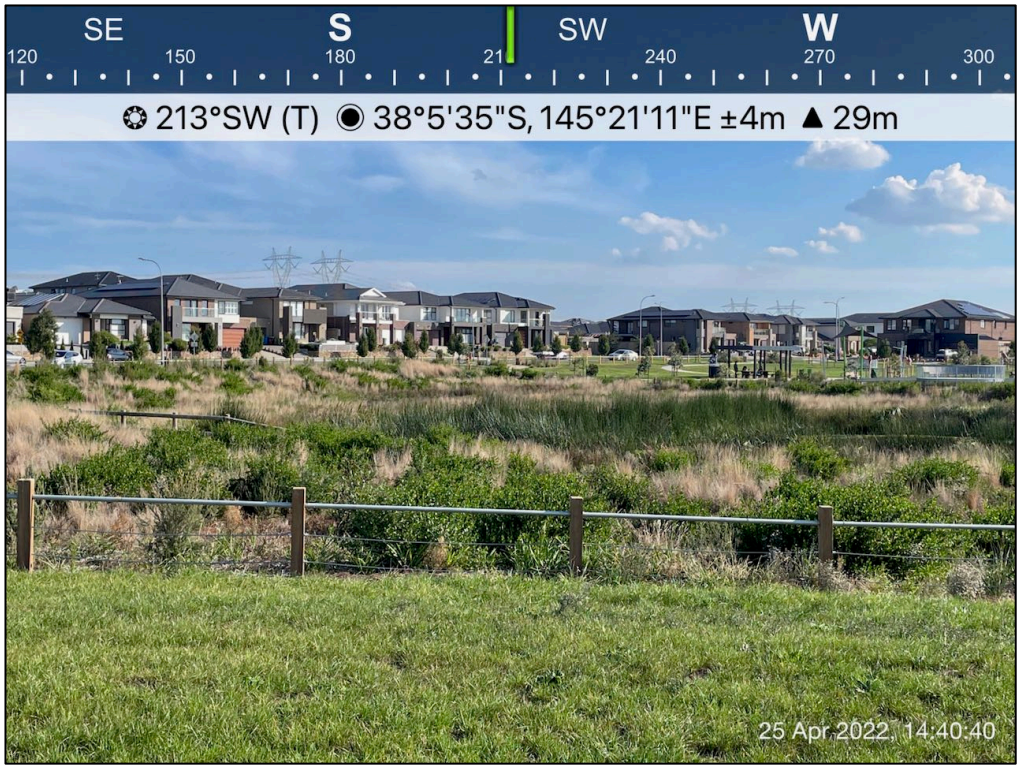
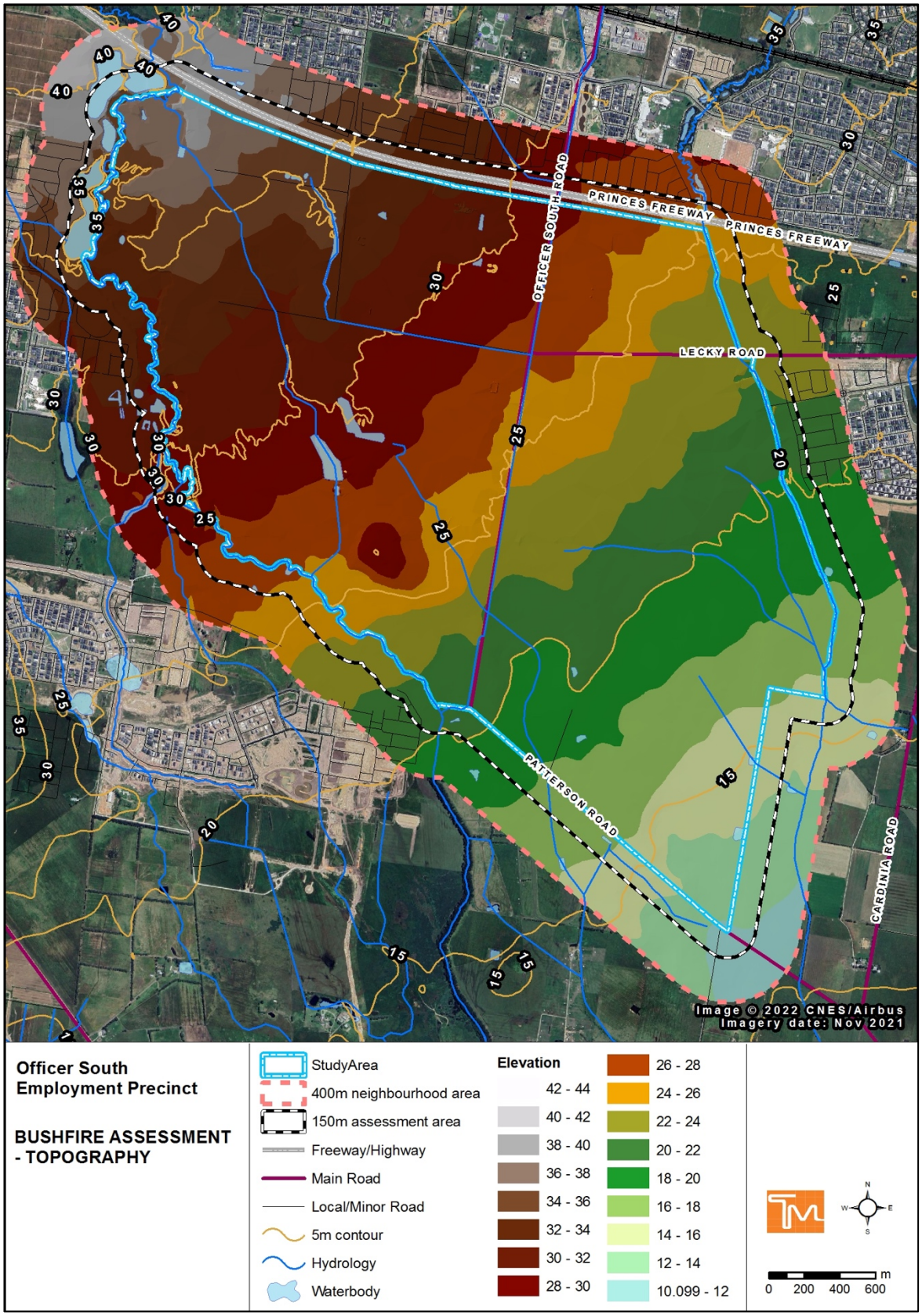


Figure 15 – Established WSUD feature separated from development by a perimeter road, in the Thompsons Road PSP area west of the OSEP.

Figure 16 – Managed Grassland and Growling Grass Frog habitat area between the Cardinia Creek and abutting residential development, west of the site in the Minta Farm PSP area.



Map 7 - Topography.

5.3.3 Topography

AS 3959-2018 requires that the 'effective slope' be identified to determine the BAL and applicable development setback distances from classified vegetation. This is the slope of the land *under classified vegetation* 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 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˚[7].

The OSEP slopes generally from the northwest down to the southeast, on a uniform and very gentle gradient of less than 1˚ (see Map 7). For the purposes of this bushfire assessment, land in the precinct and surrounding landscape is more or less flat, without any significant changes in elevation that would appreciably influence bushfire behaviour. Some steep and deep creek embankments occur either side of the Cardinia Creek, but they not considered a contributor to the effective slope as they are short and would not appreciably influence the rate of spread of a fire in the creek corridor.

Therefore, for the purposes of determining BALs and building-vegetation setback distances for future development, the applicable slope class for all vegetation types is likely to be 'All upslopes and flat land'.

5.4 Fire weather

The Forest Fire Danger Index (FFDI) and the Grassland Fire Danger Index (GFDI) represent the level of bushfire threat based on weather (and fuel) conditions. An FFDI 100/GFDI 130 is applied in non-alpine areas of Victoria by the building system, to establish a BAL based on building setback distances from classified vegetation in accordance with AS 3959-2018.

The indices were also used for predicting fire behaviour including the difficulty of suppression, forecasting Fire Danger Ratings (FDRs) and determining an appropriate level of preparedness for emergency services. However, since September 2022 the FFDI/GFDI have been replaced by the Fire Behaviour Index (FBI) as a new Australian Fire Danger Rating System (AFDRS) for determining FDRs in all jurisdictions. Table 2 displays the new FDRs, their FBI range, the anticipated fire behaviour and recommended actions for each FDR.

[7] For downslope gradients over 20˚ and up to 30˚, the detailed 'Method 2' procedure of AS 3959-2018 is used to determine the BAL.

Note that the new AFDRS and FBIs do not correlate directly with the FFDI/GFFDI indices applied in the planning and building system. However, the benchmark FFDI 100 used to represent a 'one size fits all' model of extreme fire weather conditions (and the threshold for the previous 'Code Red' FDR), can be considered analogous to the new FBI 100 'Catastrophic' FDR. Note that these extreme conditions have been exceeded during significant fire events, including at some locations in Victoria on 'Black Saturday' 2009. Therefore, it is important to note that this FDR threshold is not necessarily the *worst-case* conditions for any particular location, including the OSEPSP area.

Additionally, as identified in Section 4.1.1, in southern and eastern Australia since the 1950's there has been an increase in the length of the fire weather season and an increase in extreme fire weather (CSIRO/BOM, 2022). The trend of a longer fire season and increased number of dangerous fire weather days is projected to continue. Climate change is contributing to these changes in fire weather including by affecting temperature, relative humidity and associated changes to the fuel moisture content (CSIRO/BOM, 2022).

The Melbourne Metropolitan Bushfire Management Strategy also states that in Victoria climate change is forecast to extend the length of the fire danger period, make bushfires larger, more severe and frequent, and increase the frequency of days of elevated fire danger (DELWP, 2020b).

Climate change trends associated with the risk of bushfire, support the adoption of a precautionary and conservative approach in identifying and responding to the risk. However, as CFA and DELWP have no published policy on FFDI recurrence intervals there is no compelling reason to apply a different FFDI/GFDI from the FFDI 100/GFDI 130 threshold used throughout non-Alpine areas of Victoria in the planning and building system[8].

[8] In Alpine areas of Victoria an FFDI 50 applies for determining BALs using Method 1 of AS 3959-2018.

Table 2 - Fire Danger Ratings (Victoria State Government, 2022).

Forest 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.

6 Planning and design response

This section identifies how future development in the precinct can respond to the bushfire risk. It includes an assessment against the objective and strategies of Clause 13.02-1S, published guidance on settlement planning and the building regulations applicable to construction in a BPA.

6.1 DELWP Settlement Planning Guidelines

This section provides a summary assessment of how the proposal can incorporate the DELWP *Design Guidelines for Settlement Planning at the Bushfire Interface* (DELWP, 2020) as appropriate. The section structure and headings follow that of the guidelines.

6.1.1 Settlement form and structure

Considering the bushfire hazard in directing growth

The state planning policy for bushfire at Clause 13.02-1S stipulates that settlement planning must identify the bushfire hazard at a range of scales, assess the risk and direct growth to low risk areas (Cardinia Planning Scheme, 2018). The emphasis in the policy on the primacy of human life requires settlement planning to consider a range of factors including:

- The likely size and intensity of a bushfire and whether it may cause neighbourhood destruction;
- The availability of alternative locations for settlement growth;
- Access to places of relative safety where people can take refuge from a bushfire; and
- The emergency management response to bushfire and structural fires (DELWP 2020a).

This report has assessed the bushfire hazard in relation to broader landscape considerations, neighbourhood and local conditions, and conditions at the site scale. Extreme bushfire behaviour with the potential for neighbourhood-scale destruction is not credible. The surrounding landscape is flat, or almost flat, for at least 2.5km and, therefore, not conducive to significant bushfire behaviour. The dominant bushfire hazard within at least 2.5km is Grassland. Whilst grassfires can be fast, unpredictable and life threatening, they do not typically generate significant ember attack or intensities that would contribute to penetration and destruction of a residential area. There are areas of higher hazard vegetation with bushfire risk potential, comprising Forest and Woodland patches, but they occur at least 2.5km to the north. The Princes Freeway along the northern OSEP boundary and the Officer PSP area to the north, provide a substantial buffer from this higher risk landscape.

Alternative locations for residential growth in the Cardinia LGA, that are likewise outside BMO areas, have a more or less similar, relatively low bushfire risk and would not result in a significantly lesser bushfire risk than future growth in the OSEP.

The location enables quick access to large urban areas of relative bushfire safety and a fast and well-resourced emergency service response can be expected. An area within the precinct is identified in the Draft Place Based Plan for emergency management services which, it is assumed, will include a fire station (see Figure 2).

Large areas of non-BPA (BAL-LOW) land occur around the OSEP and will likely be extended over most of the precinct once reliably low threat and non-vegetated areas are created by future development. The existing and future BAL-LOW areas are immediately accessible and provide places of relative safety from bushfire.

The distribution of land uses in the settlement

The proposed land uses in the precinct are primarily industrial and commercial. The area proposed for conventional urban-residential development is sited against the lesser risk eastern interface, well away from the permanent Grassland interface in the south and southeast, and will be surrounded by residential development in neighbouring precincts. Whilst it abuts the proposed Lower Gum Scrub Creek conservation area, this creekline vegetation is unlikely to pose more than a local Scrub hazard and appropriate setbacks from the conservation area can acceptably mitigate any risk.

The proposed schools are sited in the same lesser risk location as the residential land use area.

Lot sizes in settlement layout

Smaller lot sizes can offer bushfire safety advantages, if the lot size is small enough that it creates an urban area that contains only low threat vegetation and non-vegetated areas with resultant limited potential for bushfire to spread through it. In a study of bushfire penetration into the urban fringe at Bendigo on Black Saturday 2009, March *et al*. (2011) concluded that small residential lots acted as a barrier to fire penetration as there was much greater fragmentation of bushfire fuels by non- or low-flammability features, such as domestic use areas, driveways, paths, roads, cultivated gardens etc. Larger semi-rural (>4,000m^2) lots offered no such advantage, and the performance of the large residential (800-3,999m^2) lots was closer to the semi-rural than to the residential lots.

Conversely, studies have found a correlation between house loss in a bushfire and proximity to other houses, due to the potential for 'house-to-house' ignitions or other heavy 'urban' fuels igniting and posing a threat from flame, radiant heat and ember attack to adjacent or nearby dwellings (Price and Bradstock, 2013; Blanchi and Leonard, 2005).

DELWP guidelines consider that in bushfire interface areas lot sizes between 800m^2 and 1,200m^2 provide a good balance between the risk of larger lots retaining more vegetation within a residential area, and smaller lots providing an increased risk of house-to-house ignitions or increased house losses from ember attack due to the higher housing density (DELWP, 2020).

Given the low risk location of the OSEP, as identified in this report, there is no justification for requiring larger lot sizes in any parts of the precinct to meet the DELWP suggested optimal lot size. All the precinct is suitable for higher density conventional urban residential development or industrial/commercial uses on a range of lot sizes.

Vegetated areas within a settlement

As identified in Section 5.3.2, most of the land in the precinct can be expected to be either non-vegetated or comprise low threat vegetation such as maintained lawns, cultivated gardens, streetscapes and other landscaped areas.

It is also reasonable to assume that any proposed local parks will be managed in a low threat state.

The proposed drainage reserves may, however, not be low threat. The structure, size and setback from development of any vegetation within them, and how the vegetation is managed during the fire danger period, will determine whether they are deemed to be non-hazardous vegetation. Irrespective, it is recommended that minimum 19m development setbacks be provided from them, which is the minimum setback distance required for BAL-12.5 construction from Grassland and Shrubland. This should be provided in the form of a perimeter road (see Section 6.1.2).

Retarding basins to mitigate the flood threat or other water sensitive urban design (WSUD) features with managed grass, reliably open water or wet areas and little or no vegetation, may be deemed low threat. Large, seasonally inundated wetlands or WSUD features that may be dry and vegetated during the fire danger period could, however, comprise classifiable vegetation. Accordingly, it is recommended that minimum 19m development setbacks also be provided from them, in the form of a perimeter road.

6.1.2 The settlement interface

Applying the required development setbacks

To satisfy key settlement planning strategies of Clause 13.02-1S development, especially future dwellings and other buildings requiring a BAL (see Section 4.2), must be sufficiently setback[9] from classified vegetation to ensure no more than a BAL-12.5 construction standard applies (see Figure 17 and Appendix A).

[9] 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).

The strategies aim to strengthen the resilience of settlements and communities and prioritise protection of human life, including by:

- *'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*[10] *under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).*
- *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 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009)'* (Cardinia Planning Scheme, 2018).

The BAL-12.5 building setback distances required in response to potential classified vegetation in the applicable 'All upslopes and flat land' slope class (see Section 5.3.3) are provided in Table 3 below and indicative locations for these setbacks are shown in Map 3, Map 5 and Map 6.

Table 3 – Minimum building/vegetation setback distances for BAL-12.5

Slope class	Vegetation	Setback distance
All upslopes and flat land	Grassland and Shrubland	19m
	Scrub	27m
	Woodland	33m
	Forest	48m

Lots that back onto an area of permanent hazard should be avoided. Setbacks can be achieved by one or more of the following measures:

- Roads between classified vegetation and development (lots);
- Defined building envelopes to provide some, or all, of a setback within lots; and
- Non-vegetated land and/or managed vegetation within any reserve, to achieve the setback within the perimeter of the reserve, rather than external to the reserve.

The indicative setbacks shown in the maps, identify that in most cases the proposed conservation reserves will provide enough separation distance from most areas of hazardous vegetation along the creeks, to ensure development is not exposed to RHF above 12.5kW/m^2. This assumes, however, that a minimum 19m perimeter road is provided between the conservation reserves and development, to ensure separation from any Grassland hazard in the reserves and, in places, supplement the Forest or Scrub setback distances.

[10] Note that the first strategy is to ensure RHF is less than 12.5kW/m^2 (author's emphasis). The second strategy stipulates a maximum BAL-12.5 construction standard (which allows for RHF up to and including 12.5kW/m^2). It is assumed the intent of both strategies to ensure that BAL-12.5 is a maximum construction standard for settlement planning, which is consistent with the wording of the latter strategy and the criteria and setback distances for BAL-12.5 in AS 3959-2018.

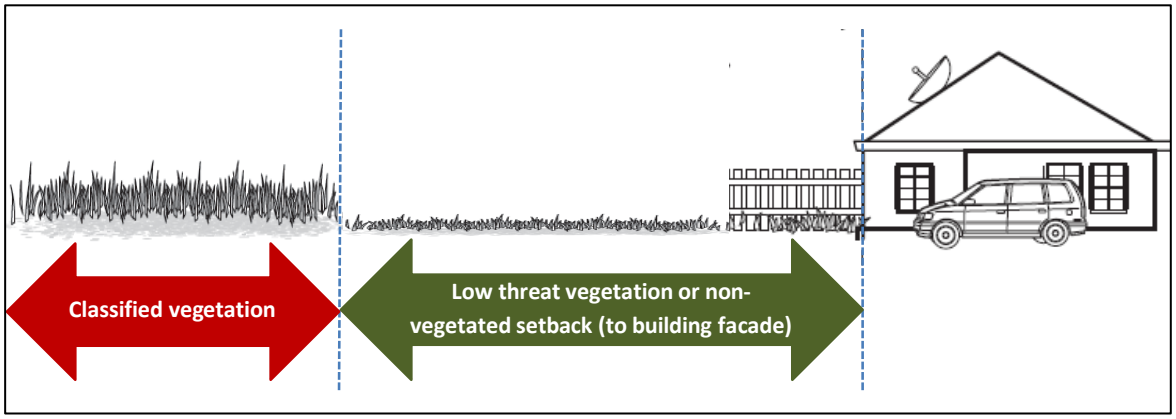


Figure 17 - Illustration of a building-classified vegetation setback (adapted from CFA, 2013).

Designing the settlement interface

Well-designed interfaces should provide a hard, non-vegetated edge to an area of hazard and achieve a minimum BAL-12.5 setback between development/lots (or at least the buildings on them) and an area of hazardous vegetation. This should be in the form of a perimeter road with or without associated low threat public open space (see Figure 18). The interface areas where development setbacks in accordance with Table 3 will be required include:

- The area between unmanaged vegetation in the conservation areas alongside the two creeks and the development adjacent to them;
- The UGB along the southern and south-eastern edge of the precinct, which interfaces with the permanent Grassland hazard; and
- Development abutting potentially hazardous drainage reserves and WSUD features.

Service lanes or roads separating the Princes Freeway and development within the precinct should also be considered as vegetation within the freeway reserve may pose a hazard which could be ignited by an accident or other ignition source and threaten any abutting development.

Scaled, illustrative design cross section(s) for areas that interface a permanent hazard, should be provided in the PSP to show the interface layout with development setbacks, including any proposed roads and landscaping.

Designing access and egress

Subdivision design should provide good access/egress for emergency vehicles. A conventional urban-residential road layout in accordance with the standards at Clause 56-06 will provide appropriate access. Additional guidance is provided in the CFA document '*Design Requirements, Vehicle Access and Water Supply Requirements in Residential Developments*' (CFA, 2022).

Perimeter roads are a highly desirable access feature to achieve or contribute to BAL setbacks, separate future development from hazardous vegetation with a 'hard' non-vegetated edge and facilitate property protection and fire fighting (see Figure 18). Patterson Road, which runs along

part of the southern boundary, could function as a perimeter road if vegetation in the road reserve is managed in a low threat state.

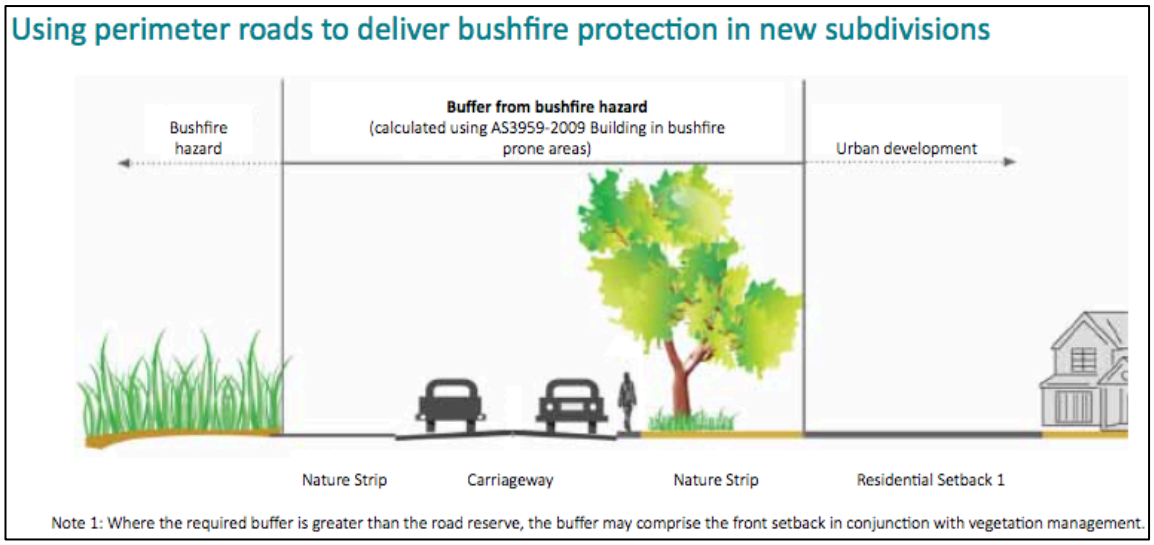


Figure 18 - Illustration of a perimeter road to provide required development setbacks (DELWP, 2015a).

6.1.3 Bushfire protection measures across a settlement

Vegetation management

As an urban growth precinct in a low risk location, with little hazardous vegetation within or adjacent to the precinct, it can be assumed that the majority of vegetation will be low threat and no specific overlay controls or other planning mechanisms for vegetation control are considered necessary. The one key exception is the need to manage the temporary Grassland hazard within the precinct during the construction period.

In many growth areas, schedules to the zone require that an application for subdivision includes a Site Management Plan that addresses bushfire risk during and, where necessary, after construction, including:

- The staging of development and the likely bushfire risks at each stage;
- An area of land between the development edge and non-urban areas consistent with the separation distances specified in AS 3959-2018, where bushfire risk is managed;
- The land management measures to be undertaken by the developer to reduce the risk from fire within any surrounding rural or undeveloped landscape to protect residents and property from the threat of grassfire and bushfire; and
- How adequate opportunities for access and egress will be provided for early residents, construction workers and emergency vehicles.

This requirement should be incorporated into the PSP.

Inspection of properties during the fire danger period via the Municipal fire hazard inspection program and, if required, the issuing of fire prevention notices for non-compliance, will provide an additional protective measure to prevent long grass creating a hazard on lots.

Building construction standards

Layout and subdivision design must ensure that no BAL construction standard will result that is higher than the minimum BAL-12.5 that applies in a BPA, and which is invoked as a safety threshold for settlement planning by Clause 13.02-1S. The setbacks for BAL-12.5 construction are provided in Table 3 and indicatively shown in the mapping.

BAL-LOW land within the precinct, where the BPA designation has been removed, will be created once reliably low threat and non-vegetated areas are established that are sufficiently distant from hazardous vegetation. No BAL will be required for any buildings outside the BPA.

The only land use areas anticipated to contain buildings of a class that would require a BAL, are those designated residential and the two areas identified for potential schools (see Figure 2).

Fences and other localised fuel sources

As an urban growth precinct in a low risk location, with little hazardous vegetation within or adjacent to the precinct, no specific fence or other fuel controls or mechanisms are considered necessary, beyond those that exist already in the planning controls and building regulations. Non-combustible fences (e.g. steel/colorbond), however, could be encouraged on the permanent interfaces as they can provide useful protection against grassfire impacts.

6.2 Clause 13.02-1S Bushfire Planning

The following sub-sections provide a summary response about how development in the precinct can respond to the objectives and strategies for bushfire safety in the PPF at Clause 13.02-1S.

6.2.1 Protection of human life strategies

Clause 13.02-1S requires that the priority be given to protection of human life.

Prioritising the protection of human life over all other policy considerations

As identified in the hazard assessment in Section 5, the OSEP is in a relatively low bushfire risk location at the site, local and wider landscape scales. The protection of human life can be prioritised by bushfire resilient design and layout of development as identified in this report, and the application of the existing building regulations for construction in a BPA. Measures to achieve this are recommended in this report as appropriate, for inclusion in the structure plan.

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.

The hazard assessment identified that the OSEP is in a relatively low bushfire risk location. All future development should, and can, be setback sufficiently from any hazardous vegetation such that it will not be exposed to RHF above 12.5kW/m^2 and, therefore, the risk will be mitigated to an acceptably low level.

The nearest locations where human life can be better protected from the effects of bushfire are the existing urban areas immediately adjacent to the precinct, including many that are not in the BPA.

Once developed with reliably low threat and non-vegetated areas, most of the precinct will meet the criteria for future excision from the BPA, creating a large area of safety from bushfire attack for existing and future residents in the 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 for development in the precinct.

6.2.2 Bushfire hazard identification and assessment strategies

Clause 13.02-1S-1 requires that the bushfire hazard be identified, and 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 potential hazards 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* (DELWP, 2015a), *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DELWP, 2018) and in relation to landscape risk, *Planning Permit Applications – Bushfire Management Overlay,* Technical Guide (DELWP, 2017a).

The type and extent of potentially hazardous vegetation within and around the precinct has been identified. Classification is based on the anticipated long-term state of the vegetation, 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.

Publicly available 1m contour data for the area was accessed, which along with the site assessment, determined that the land is essentially flat and therefore the topography is benign from a bushfire perspective.

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 as discussed in Section 5.4.

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 4.2) and is shown in Figure 1, Map 1 and Map 2. This is based on the most recent BPA mapping for the state, which was gazetted 17th August 2022.

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

BMO coverage reflects current mapping in the Cardinia Planning Scheme. No part of the study area or the land for over 2km around it is affected by the BMO or a Schedule to the BMO (see Figure 3 and Map 1).

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 broader landscape, local, neighbourhood and site scales (see Section 5).

The characteristics in the landscape between 1km and out to at least 20km around the site have been considered in accordance with guidance about assessing risk for planning scheme amendments provided in the Planning Advisory Note 68 (DELWP, 2018) and Planning Practice Note 64 (DELWP, 2015a) (see Figure 3 and Map 1).

Local and neighbourhood conditions have been assessed at distances of 1km and 400m around the precinct respectively (see Figure 3 and Map 2).

At the site scale, a 150m assessment area has been applied around the precinct boundary, and a 100m BAL assessment area around areas likely to contain buildings that require a BAL. The site assessment follows the AS 3959-2018 methodology for classifying vegetation and topography (see Map 3).

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

Terramatrix aware some consultation has occurred during the preparation of this report, and that this report is anticipated to be provided to the CFA/FRV for comment and their views will be incorporated into the final report.

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 used in this report as appropriate and bushfire protection measures have been identified commensurate with the risk. Relevant regional bushfire plans and strategies have been identified, reviewed and incorporated into this assessment.

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.

The risk can be deemed to be acceptably mitigated such that development can proceed if the objectives and strategies of Clause 13.02-1S are successfully implemented as identified in this report.

6.2.3 Settlement planning strategies

Clause 13.02-1S requires that 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 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).

The precinct is a relatively low risk location with the characteristics of BMO Broader Landscape Types 1 and 2. Applicable distances for dwellings or other buildings to be setback from classifiable vegetation, such that RHF is calculated to not exceed 12.5kW/m^2 and where, therefore, BAL 12.5 buildings could potentially be sited, have been identified.

Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.

The nearest locations where human life can be better protected from the effects of bushfire are the existing developed areas immediately adjacent to the precinct, including large areas that are not in the BPA (see Map 2). There is ready access to these areas from the OSEP.

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 or future residents, their property or community infrastructure, if development is setback from hazardous vegetation to enable BAL-12.5 construction. A reticulated hydrant system for fire fighting will be provided in conjunction with access/egress for emergency vehicles and residents via a typical urban road network, with perimeter roads where lots abut a permanent Grassland hazard.

The risk to existing residents will be reduced by the development of additional low threat or non-vegetated land that would accompany development of the precinct.

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.

As identified previously, this report appropriately assesses and addresses the risk at a range of scales. Whilst grassfires can be fast, unpredictable and life threatening, they do not typically generate significant ember attack or intensities that would contribute to penetration of an established urban area that would result in neighbourhood destruction.

Areas of higher hazard vegetation likely to be retained or created in the two creek corridors will be relatively small, isolated and narrow. They will, therefore, not pose a significant threat if new and existing development is sufficiently distant from them as identified in this report.

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

Assessment of multiple alternative locations is beyond the scope of this report, so other potential low risk development locations have not been considered as part of the study.

However, as a precinct in a designated growth corridor, bushfire risk has presumably been one of the factors considered prior to the designation of the precinct as a growth area suitable for urban/industrial/commercial development. As concluded in this report the bushfire risk to this, and other nearby precincts, is relatively low and able to be mitigated by the standard bushfire controls that currently exist in the planning and building system.

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 3959-2018'

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

6.2.4 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

The Biodiversity Conservation Strategy for Melbourne's Growth Corridors (DEPI, 2013) identified biodiversity impacts associated with development of the precinct. The time stamped EVC mapping has been considered in this report as shown in Map 5 and Map 6 and discussed in the vegetation assessment in Section 5.3.1.

Terramatrix is aware that at least one other biodiversity assessment in relation to Growling Grass Frog habitat has been undertaken for an area within the precinct.

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

6.2.5 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'* (Cardinia Planning Scheme, 2018).

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'* (Cardinia Planning Scheme, 2018).

Future development can achieve acceptable bushfire safety if the measures identified in this report are implemented. There are no apparent barriers to this being achievable.

7 Conclusion

This study has assessed the bushfire hazard in and around the OSEP, in accordance with Clause 13.02-1S in the Cardinia Planning Scheme, the AS 3959-2018 methodology invoked by the Victorian planning and building system, and additional guidance provided in DELWP planning and advisory notes, including:

- *Local planning for bushfire protection,* Planning Practice Note 64 (DELWP, 2015a);
- *Design Guidelines, Settlement Planning at the Bushfire Interface* (DELWP, 2020a);
- *Bushfire State Planning Policy Amendment VC140,* Planning Advisory Note 68, (DELWP, 2018); and in relation to assessing landscape risk,
- *Planning Permit Applications – Bushfire Management Overlay,* Technical Guide (DELWP, 2017a).

The OSEP is in a relatively low bushfire risk landscape. Alternative locations for development in the Cardinia LGA, that are likewise outside BMO areas, have a more or less similar, relatively low bushfire risk and would not result in a significantly lesser bushfire risk than future growth in the OSEP.

Bushfire behaviour with the potential for neighbourhood-scale destruction is not credible. The surrounding landscape is dominated by flat, or almost flat, land that will not exacerbate fire behaviour. No part of the study area or the land for over 2km around it is affected by the BMO or a Schedule to the BMO.

To the north, west, southwest and east, much of the land around the precinct is currently, and will increasingly become, designated as non-BPA land. Once developed with reliably low threat and non-vegetated areas, most of the precinct will meet the criteria for future excision from the BPA, creating a large area of safety from bushfire attack for existing and future residents in the area.

The only appreciable bushfire hazard within at least 2.5km is Grassland. Areas of higher hazard vegetation likely to be retained or created in the two creek corridors will be relatively small, isolated and narrow. They will, therefore, not pose a significant threat if new and existing development is sufficiently setback from them the distances identified in this report.

In most cases, the proposed conservation reserves will provide enough separation distance to ensure development is not exposed to RHF above 12.5kW/m^2. This assumes, however, that a minimum 19m perimeter road is provided between the conservation reserves and development, to ensure separation from any Grassland hazard in the reserves, and in places, supplement the higher hazard Forest or Scrub setback distances.

Interface areas where development setbacks will be required include:

- Between unmanaged vegetation in the Conservation areas alongside the Cardinia and Lower Gum Scrub Creeks and the development adjacent to them;
- The UGB along the southern and south-eastern edge of the precinct, which interfaces with the permanent Grassland hazard; and
- Development abutting potentially hazardous drainage reserves and WSUD features.

Layout and subdivision design that implements the setbacks will ensure that no BAL construction standard will result that is higher than the maximum BAL-12.5 outcome stipulated in the settlement planning strategies of Clause 13.02-1S. Note that the only land use areas anticipated to contain buildings of a class that would require a BAL, are those designated residential and the two areas identified for potential schools.

Service lanes or roads separating the Princes Freeway and development within the precinct should also be considered, as vegetation within the freeway reserve may pose a hazard which could be ignited by an accident or other ignition source and threaten any abutting development.

Scaled, illustrative design cross sections for areas that interface a permanent hazard, should be prepared as part of the PSP, to show the interface layout with development setbacks, including any proposed roads and landscaping.

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

Development of the precinct can satisfy the objective and all strategies of Clause 13.02-1S, which aim to prioritise protection of human life. Accordingly, acceptable bushfire safety will be achieved and the state planning policy objective for bushfire in the Cardinia Planning Scheme will be met, if the measures identified in this report are implemented. There are no apparent barriers to this being achievable.

8 Appendices

8.1 Appendix A: BAL construction standards

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 4kW/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 12.5kW/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 19kW/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 29kW/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 42kW/m^2 ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (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 45kW/m^2 ignition of timber in 20 seconds (without piloted ignition).

Adapted from Standards Australia, 2020.

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