BUSHFIRE RISK ASSESSMENT - ST ARNAUD SETTLEMENT

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South Coast Bushfire Consultants

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Version Control

	Name	Date Completed	Comments
Report Version	Kylie Steel Matthew Bailey	23/06/22 21/07/22	Draft - Version 1 Version 2
Field Assessment	Kylie Steel	14/06/22	
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Disclaimer

This report has been made with careful consideration and with the best information available to South Coast Bushfire Consultants at the time of writing. Before relying on information in this report, users should evaluate the accuracy, completeness and relevance of the information provided for their purposes. South Coast Bushfire Consultants do not guarantee that it is without flaw or omission of any kind and therefore disclaim all liability for any error, loss or other consequence that may arise from you relying on any information in this report.

Requirements detailed in this document do not guarantee survival of the buildings or the occupants. The client is strongly encouraged to develop and practice a bushfire survival plan.

Information and assistance including a template for a Bushfire Survival Plan is provided as part of the 'Fire Ready Kit' available through the CFA website at http://www.cfa.vic.gov.au or through your local CFA Regional office.

Conditions of Use

Contents

DEFINITIONS, ABBREVIATIONS AND ACRONYMS

AS 3959-2018	Australian Standard AS 3959 -2018 Construction of buildings in bushfire-prone areas
CFA	Country Fire Authority
Clause	A clause is a provision in the planning scheme
Clause 44.06	Bushfire Management Overlay
Clause 53.02	Planning for Bushfire
Clause 13.02	Environmental Risk – Bushfire
DELWP	Department of Environment, Land, Water and Planning
BAL	Bushfire Attack Level
BPA	Bushfire Prone Area
BMO	Bushfire Management Overlay
FRV	Fire Rescue Victoria
Method 1	Refers to methodology in AS 3959-2018 for determining a BAL with a number of predetermined inputs
SCBC	South Coast Bushfire Consultants
NGS	Northern Grampians Shire
SASP	St Arnaud Structure Plan

BUSHFIRE RISK ASSESSMENT - ST ARNAUD SETTLEMENT

1. INTRODUCTION

This report has been prepared to guide the development of the St Arnaud Structure Plan (SASP) by responding to the surrounding bushfire risk and advise if the proposed growth directions are viable from bushfire risk.

The report responds to the directions by Mesh Planning and Northern Grampians Shire Council (NGSC):

- Review of desktop analysis prepared by Mesh outlining Bushfire constraints.
- Review of Bushfire Management Overlays and Bushfire Prone Risk Areas in the NGSC Planning Scheme and implication of landscape conditions (from above mentioned mapping) to inform constraints in growth direction for SASP.
- Review proposed new growth areas to determine hazard/risk profile.
- Provide specific bushfire risk mitigation recommendations for the township, and in particular, new growth areas.

2. SCOPE OF THE REPORT

This assessment has been prepared to demonstrate how investigation areas A, B and D as detailed in Map 2 below from the Preliminary Spatial Analysis report prepared by Mesh.

Investigation area A comprises the central township zone of St Arnaud and is considered infill development.

Investigation areas B and D are investigation areas for industrial expansion.

Following a consultation meeting on Wednesday 13 July 2022, SCBC were asked to provide comment on areas E, F and G as well as considering areas within C & H delineated by the brown ovals in the presentation prepared by Mesh which are referred to as investigation areas J & K in the report.

3. STUDY AREA

3.1 St Arnaud

St Arnaud has an established urban area bordered by the St Arnaud Regional Park to the west, St Arnaud State Forest to the south and expansive rural land to the north and east.

St Arnaud is known as the Shire's Rural Industrial Hub thanks to its cluster of agribusinesses which consist of animal feeds factories, farm machineries production, broiler farms and piggeries which are generally located on the fringe of the town. The Wimmera Southern Mallee Regional Growth Plan identifies St Arnaud as a regional centre which is to provide important sub-regional goods and services to the smaller rural settlements, particularly the recently commenced mineral sands mine in Donald (*St Arnaud Structure Plan – Draft Emerging Themes March 2022*).

St Arnaud is located in the northern side of the Northern Grampians Shire and is characterised by rolling hills, medium to lower rainfall and is utilised for intensive and broad acre farming.

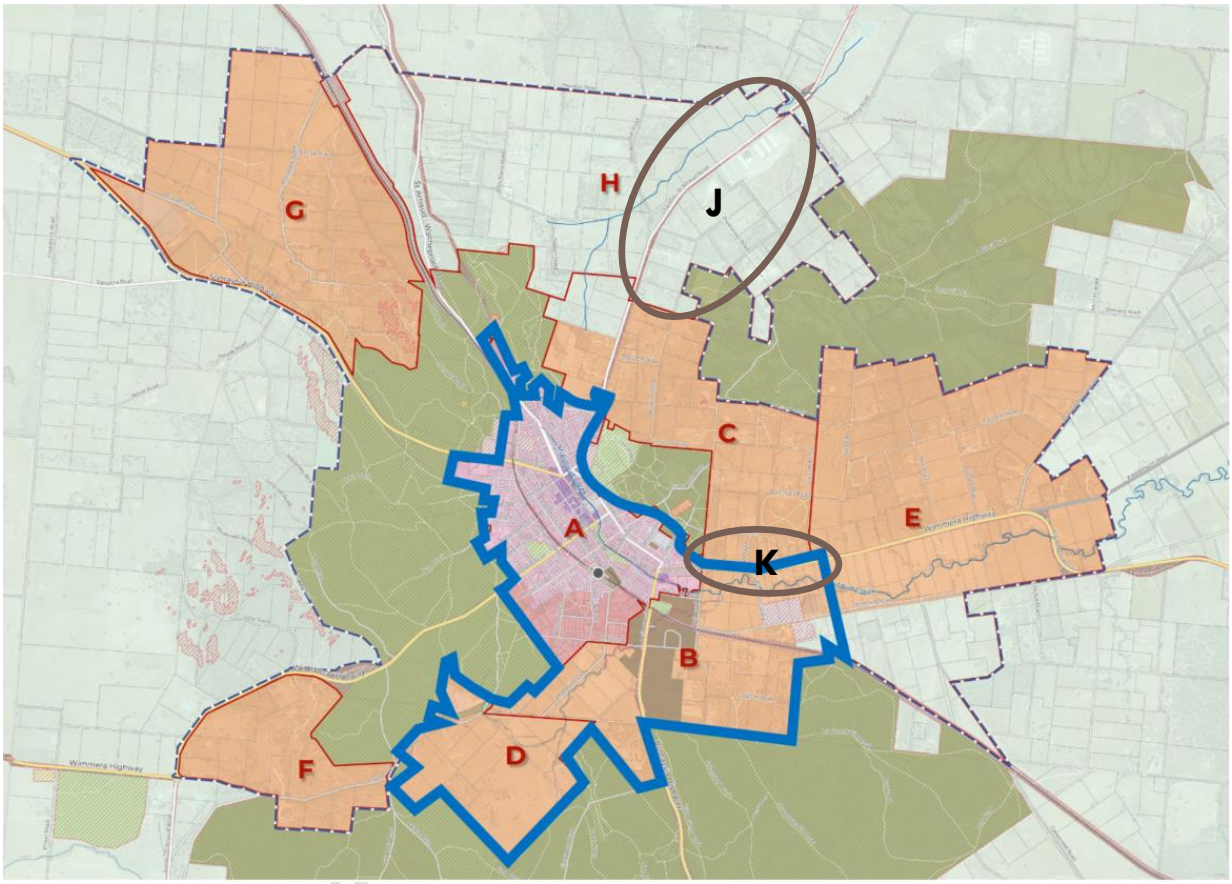
3.2 Preliminary Spatial Analysis

3.2.1 Map 1 – Preliminary Spatial Analysis (Mesh, St Arnaud Preliminary Analysis for Bushfire Report)

3.3 Areas of Investigation

Proposed investigation areas for development/expansion by Mesh Planning are identified in Map 2. Areas A, B & D have been selected as priority areas for development/expansion. As detailed; Area A is earmarked for Infill with Areas B, D, E, F, G, J, K are being investigated for industrial expansion.

3.3.1 Map 2 – Study Area (Mesh, St Arnaud Preliminary Analysis for Bushfire Report)



4. METHODOLOGY

The methodology used to determine the bushfire risk to each of the investigation areas draws on several policies, standards and guidelines. These documents are used to respond to *Clause 13.02-1S Bushfire Planning* from the State Planning Policy Framework (SPPF) and the *Design Guideline: Settlement Planning at the Bushfire Interface (DELWP 2020)*. The settlement planning guidelines has been developed to assist in the creation of responsive settlement planning outcomes that minimise the risk to people from bushfire.

This report uses landscape types to respond to the objectives of *Clause 13.02-1S Bushfire Planning*. The methodology to determine the landscape risk is described in *Planning Permit Applications Bushfire Management Overlay Technical Guide (DELWP 2017)*. Landscape types range from 1 to 4, and consider the likely bushfire scenarios, the potential for neighbourhood scale destruction and the availability and access to safer areas. Landscape types assist in determining the relative risk between investigation areas.

4.1 Landscape Types

Landscape types range - Planning Permit Applications Bushfire Management Overlay – Technical Guide 2017 (DELWP) as a guide to assessing the surrounding landscape risk.

4.1.1 Table 1 - Description of Landscape Types (DELWP 2017)

Description of Landscape Types (DELWP 2017)	
The broader landscape and the potential size or scale of a bushfire is an important consideration in the assessment of a planning application. The likelihood of a bushfire, its severity and intensity, and the potential impact on life and property varies depending on where a site is located in the surrounding landscape. To determine these requirements models are used to predict radiant heat from a fire front based on specific inputs and assumptions. Considering the surrounding landscape in bushfire decisions is important because the accuracy of the models in reflecting bushfire exposure on a particular site, varies in different landscapes. This is because the scale of a bushfire and its potential destructive power is driven by the characteristics of broader landscape, rather than those characteristics within 150 metres of the site.	***Broader Landscape <u>Type One</u>*** • *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.*
	Broader Landscape <u>Type Two</u> • *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.*
	Broader Landscape <u>Type Three</u> • *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 and 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.*
	Broader Landscape Type Four • *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* • *Evacuation options are limited or not available.*

4.2 Design Guidelines

The Victorian State planning policy for bushfire in Victorian planning schemes (Clause 13.02-1S) provides the broad framework for the integration of bushfire policy and provisions into planning schemes.

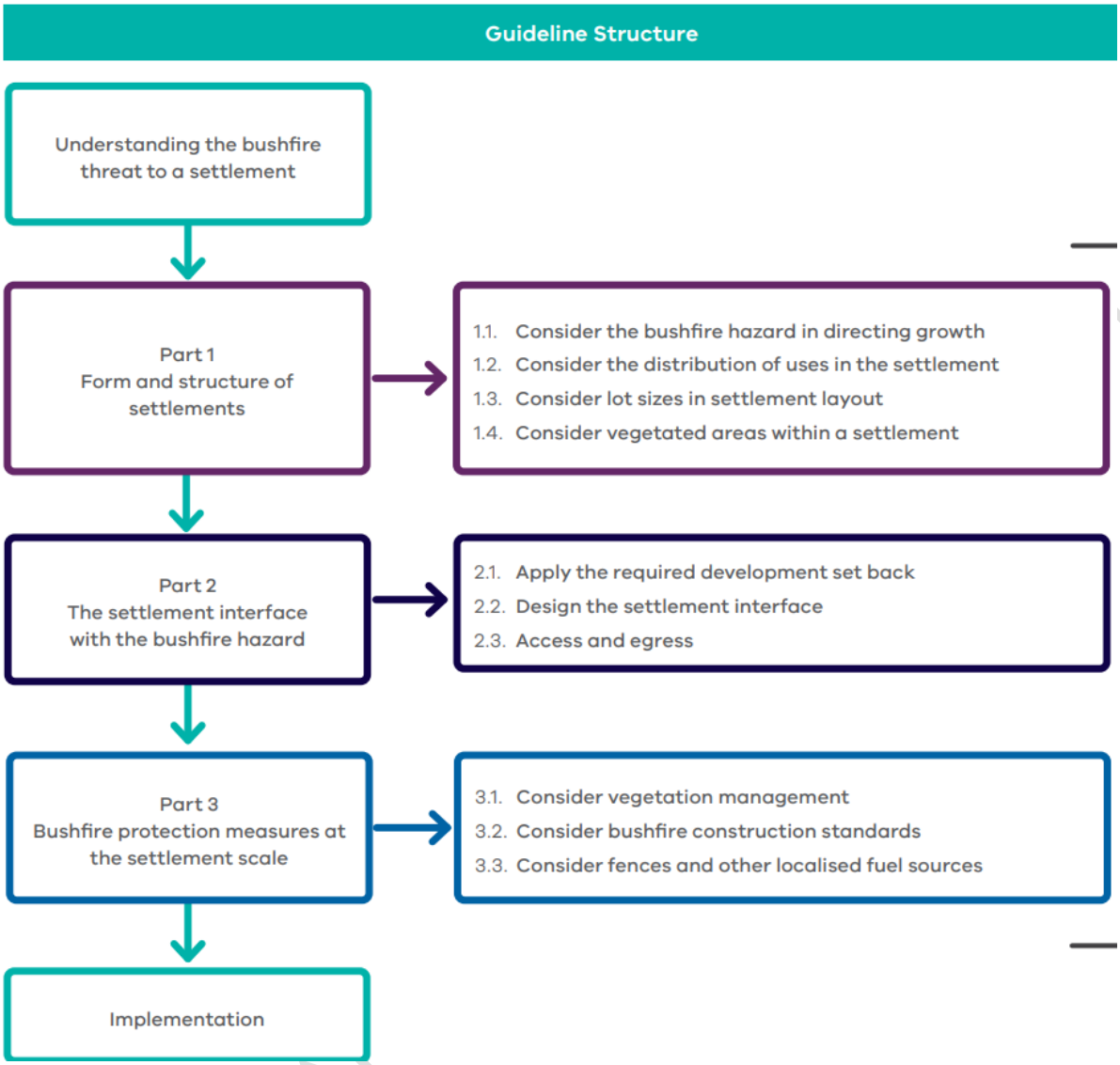
Clause 71.02-3 'Integrated decision making', the State policy for bushfire prioritises the protection of human life in planning decision making. It also places a strong emphasis on proactively planning settlements to enhance their resilience to the impacts of bushfire and grassfire.

The Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) (the Guidelines) can be applied to preparing settlement, structure and land-use framework plans for new and existing communities and is applied to the assessment of the investigation areas surrounding St Arnaud.

It is noted within the guidelines that the principles can be adopted in any bushfire landscape, however, they have been developed to typically address an appropriate design response in a landscape where it has been assessed as Type 1 or 2 in the landscape bushfire assessment.

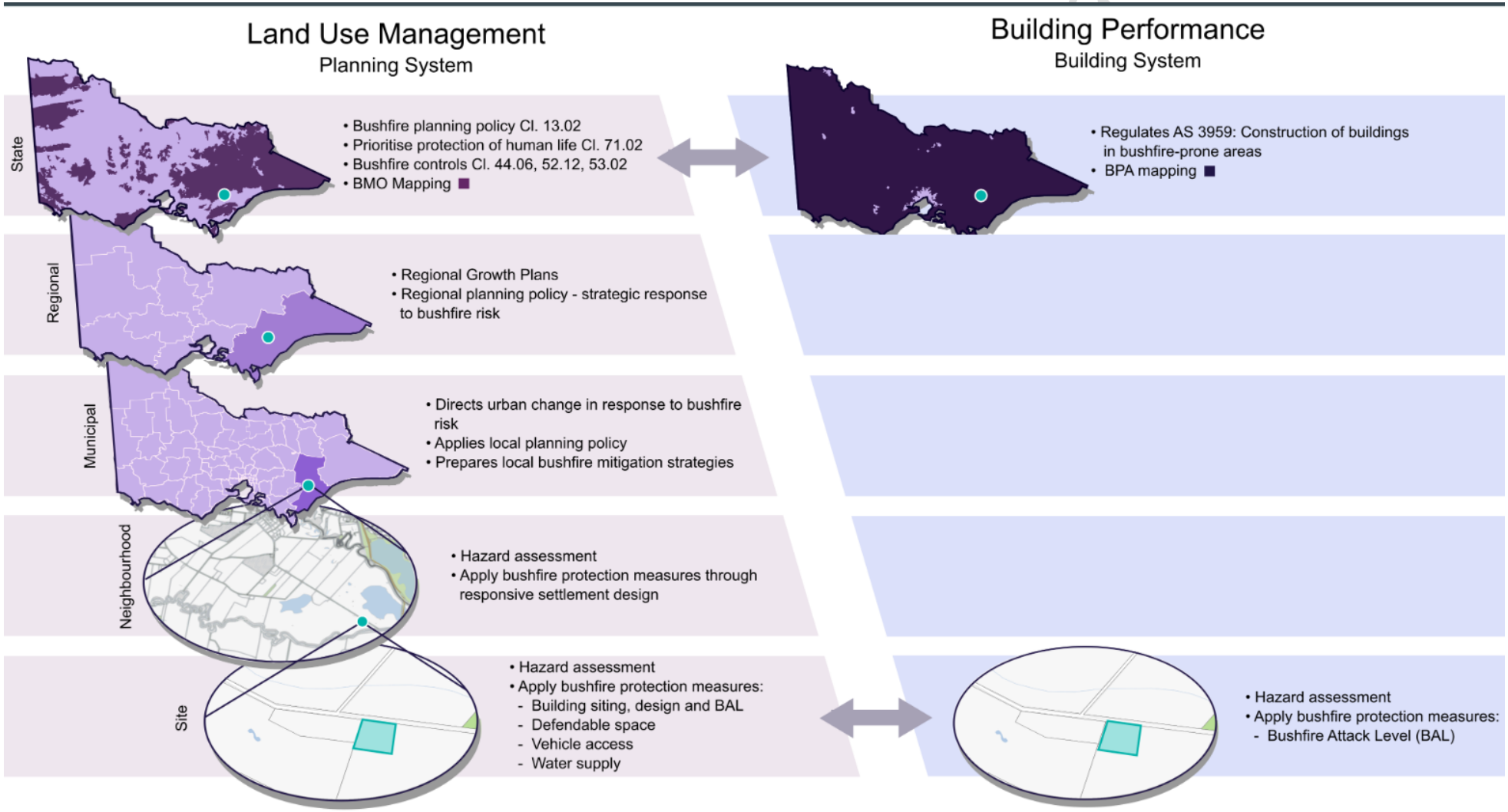
Each investigation area will be assessed against the key considerations of the Guidelines as described in Figure 1.

4.2.1 Figure 1 – Structure and key considerations of the Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020).



5. CONTEXT ON SETTLEMENT PLANNING IN NGS

Figure 2 – Overview of the Integrated Planning and Building Regulatory Framework for Bushfire in Victoria (2022 DELWP).



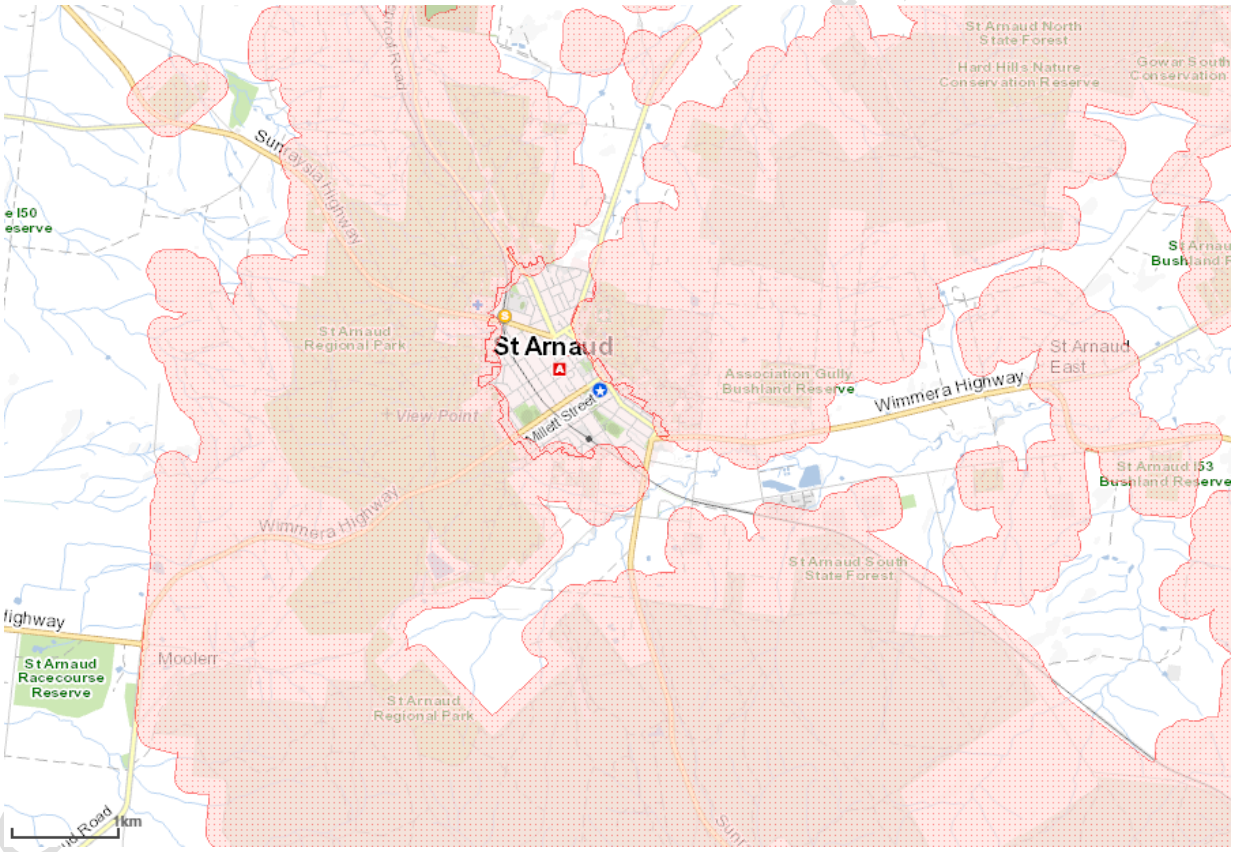
6.2 Bushfire Management Overlay (BMO) and Bushfire Prone Areas (BPA)

The BMO is a planning scheme provision used to guide the development of land in areas of high bushfire hazard. The location, design and construction of development and the implementation of bushfire protection measures must be considered under a BMO. 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.

The BMO Schedule 1 is applied to areas on the perimeter of the township in investigation area A. Schedules contain locally specific bushfire protection measures that replace those set out in the VPP (Clause 44.06 BMO and Clause 53.02). The schedule may also state that a requirement in Clause 53.02 applies.

6.2.1 Map 3a –Bushfire Management Overlay – BMO (DELWP, 2022)

Areas denoted as red in the map below are within the Bushfire Management Overlay (BMO)



The Bushfire Prone Areas (BPA) of the state are designated where there is a moderate bushfire hazard. This is defined as a headfire intensity modelled between 4,000kW/m and 30,000kW/m. This level of hazard informs areas declared as bushfire prone in the building system.

6.2.2 Map 3b - Bushfire Prone Area – BPA (DELWP, 2022)

Areas denoted by light brown in the map below are within the Bushfire Prone Area (BPA)

6. BUSHFIRE HAZARD LANDSCAPE ASSESSMENT

The landscape assessment is important to consider as it defines the context for the site assessment. Vegetation, topography and weather conditions are the three major characteristics that contribute to landscape scale bushfire threat. The intensity and duration of a bushfire is largely influenced by these factors. These broader landscape characteristics strongly impact how a fire is likely to act and its probable size, intensity and destructive power and therefore its level of risk and potential to impact people and safety. In some circumstances the risk from a large bushfire cannot be mitigated, which is why development should be avoided in the areas of highest risk (DELWP 2020).

The Bushfire Hazard Landscape Assessment identifies risks in the surrounding landscape and considers the assessment of bushfire hazards on the basis of:

- Vegetation
- Topography
- Fire Weather
- Bushfire History
- Potential Fire Runs

6.1 Vegetation in the Broader Landscape

The vegetation within the township of St Arnaud is predominantly managed to a low threat condition, however, is surrounded by forest vegetation within various state forests, reserves and private properties to all aspects.

St Arnaud Regional Park is located to the north, west and south west of the existing township area and supports forest vegetation.

Forest vegetation abuts the township area to the east, however, becomes increasingly fragmented with grassland throughout the rural living zone.

The St Arnaud South State Forest is located south of the existing township area and supports forest vegetation. This band of forest vegetation extends approximately 38 km south to Kara Kara National Park.

Grassland becomes the predominant vegetation further north, east and west beyond the St Arnaud Regional Park and rural living zones within the external rural settlement areas of St Arnaud.

6.2 Ecological Vegetation Classes (EVC)

The EVC provides supplementary vegetation data that supports the vegetation type assessments within the report. The EVC is only used as a supplementary reference for vegetation typology. The vegetation type indicates the likely fire behaviour associated within this type of vegetation (ie. grassland fire as opposed to a forest fire) the EVC is used as a guide and does not determine the bushfire risk.

Ecological vegetation classes (EVC) are the standard unit for classifying vegetation types in Victoria for ecological considerations. EVCs are described through a combination of floristic, lifeforms and ecological characteristics. The vegetation in the surrounding landscape is within the Goldfields Bioregion.

The forest vegetation surrounding the site in the St Arnaud Regional Park and St Arnaud South State Forrest is dominated by Box Ironbark Forrest (EVC number 61 shown as biege on map 4). This vegetation is described as '*Occurs in low rainfall areas on gently undulating rises, low hills and peneplains on infertile, often stony soils derived from a range of geologies. The open*

overstorey to 20 m tall consists of a variety of eucalypts, often including one of the Ironbark species. The mid storey often forms a dense to open small tree or shrub layer over an open ground layer ranging from a sparse to well-developed suite of herbs and grasses.'

The vegetation to the north east is predominantly Sandstone Ridge Shrubland syn. Broombush Mallee (EVC 93 – shown as light purple on the map).

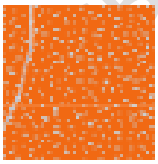
There are scattered areas of Low Rises Grassy Woodland throughout the dominant vegetation types surrounding St Arnaud (EVC 175_61 – shown as orange on the map)

The EVC comes from the State Government's mapping program Naturekit and gives a high level understanding of the vegetation in the surrounding area. Discrepancies regarding dominant vegetation and tree canopy are to be expected. Specific vegetation types need to be truth tested through a thorough site assessment process.

The EVC within Naturekit are consistent with the site based vegetation assessments undertaken in the investigation areas surrounding St Arnaud. The vegetation was found to be dominated by forest, woodland and grassland.

Table 3 below corresponds to Map 4 below and shows the vegetation types in the surrounding landscape. The EVC gives a generalized description of the vegetation class and the benchmark tree canopy cover for that veg type.

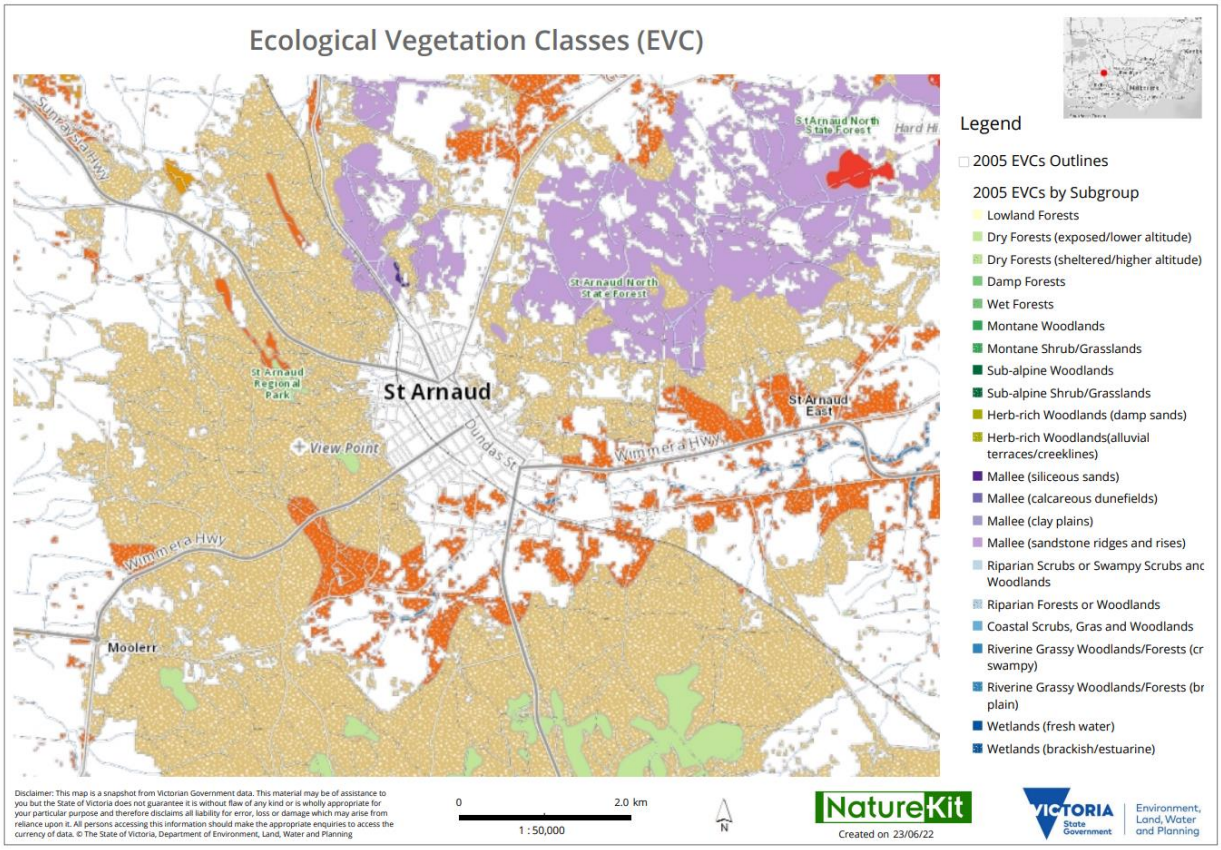
6.2.1 Table 3 – Ecological Vegetation Classes (EVC)

Ecological Vegetation Classes (EVC)	Description	(EVC) Benchmark Tree Canopy Cover
EVC 61: Box Ironbark Forest 	*Occurs in low rainfall areas on gently undulating rises, low hills and peneplains on infertile, often stony soils derived from a range of geologies. The open overstorey to 20 m tall consists of a variety of eucalypts, often including one of the Ironbark species. The mid storey often forms a dense to open small tree or shrub layer over an open ground layer ranging from a sparse to well-developed suite of herbs and grasses.*	*30%*
EVC 175_61: Low Rises Grassy Woodland 	*A variable open eucalypt woodland to 15 m tall over a diverse ground layer of grasses and herbs. The shrub component is usually diverse but sparse in cover. In the Goldfields bioregion, Grassy Woodland occurs on sedimentary soils on the lowest slopes at the interface between the plains and the infertile woodlands of the sedimentary hills.*	*15%*
EVC 20: Heathy Dry Forest	*Grows on shallow, rocky skeletal soils on a variety of geologies and on a range of landforms from gently undulating hills to exposed aspects on ridge tops and steep slopes at a range of elevations. The overstorey is a low, open eucalypt forest, poor in form to 20 m tall with an open crown cover. The understorey is dominated by a low, sparse to dense layer of ericoid-leaved shrubs including heaths and*	*30%*

	peas. Graminoids and grasses are frequently present in the ground layer, but do not provide much cover.	
EVC 93: Sandstone Ridge Shrubland (syn. Broombush Mallee)	*Low open mallee to 3 m tall typically with a tall shrubby understorey, or shrubland with scattered emergent mallees. A good field character for this EVC is the dominance or co-dominance of the tall shrub Melaleuca uncinata in shrubland or as an understorey shrub in Mallee vegetation. Confined to the crests of outcropping Parilla sandstone ridges and also where these ridges are at least partially obscured by a shallow mantle of Lowan sand.*	*30%*
EVC 48: Heathy Woodland	*Spans a variety of geologies but is generally associated with nutrient-poor soils including deep uniform sands (aeolian or outwash) and Tertiary sand/clay which has been altered to form quartzite gravel. Eucalypt-dominated low woodland to 10 m tall lacking a secondary tree layer and generally supporting a diverse array of narrow or ericoid-leaved shrubs except where frequent fire has reduced this to a cover of fire resprouters. Geophytes and annuals can be quite common but the ground cover is normally fairly sparse.*	*15%*

6.2.2 Map 4 – Ecological Vegetation Classes - EVC (DELWP, 2022)

(This map gives an indication of unmanaged fuel loads, it does not show all vegetation types)



6.3 Vegetation Types

The AS 3959-2018 approach uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No.7 Native Vegetation) classification system. According to this method, vegetation can be classified into seven categories. Each category indicates a particular type of fire behavior and these categories or classifications are then used to determine bushfire intensity.

Vegetation Classification	Vegetation Type (AS 3959-2018 Description)	Assumed Total Fuel Load (t/ha)	EVC Classification	Fire behavior characteristics
Forest	***Tall Open Forest/Tall Woodland***: *Trees over 30m high:30%-70% foliage cover (may include understory ranging from rainforest species and tree ferns to low trees and tall shrubs). Found in areas of high reliable rainfall. Typically dominate by eucalypts with sub-dominant tree layer.* ***Open Forest/Low Open Forest***: *Trees 30m high; 30%-70% foliage cover (may include understory of sclerophyllous low trees or shrubs). Typically dominated eucalypts, melaleuca or callistemon (may include riverine and wetland environments) and callitris. Includes eucalypt plantations.* ***Pine Planation***: *Tress 30m in height at maturity, generally comprising Pinus species or other softwood species, planted as a single species for the production of timber.*	*35*	*EVC 61: Box Ironbark Forest* *EVC 20: Heathy Dry Forest*	• *High fuel load* • *Layered arrangement of fuels ie. Surface, near surface, elevated, bark and canopy* • *Cause high intensity bushfires* • *Require large setbacks to achieve BAL 12.5* • *Produces ember load from bark hazards*
Woodland	***Woodland/Low Woodland***: *Trees 10-30m high; 10-30% foliage cover dominated by eucalypts and/or callistris with a prominent grassy*	*25*	*EVC 175_61: Low Rises Grassy Woodland* *EVC 48: Heathy Woodland*	• *High fuel load but not as high as forest* • *Has more separation between fuel loads ie. Surface, near*

	understorey. May contain isolated shrubs.			*surface, bark and canopy.* • *Cause high intensity bushfires* • *Require setbacks to achieve BAL 12.5* • *Produces ember load from bark hazards*
Mallee/Mulga	***Tall shrubland:*** *Vegetation dominated by low trees or tall shrubs (especially eucalupts and acacias) some with a multi-stemmed habit (mallee): usually greater than 2 m in height; <30% foliage cover. Understory of widespread dense low shrubs or sparse grasses and generally found un the arid and simi arid zones, but not within the rangelands.*	*8*	*EVC 93: Sandstone Ridge Shrubland (syn. Broombush Mallee)*	• *Reduced fuel load* • *Reduced bark hazard* • *Dry landscapes* • *Hot and quick fires that flare up quickly*
Grassland	***Open Woodland/Low Open Woodland/Open Shrubland/Low Open Shrubland/Hummock Grassland/Closed Tussock Grassland/Tussock Grassland/Open Tussock/Sparse Open Tussock/Dense Sown Pasture/Sown Pasture/Open Herbfield/Spare Open Herbfield:*** *All forms (expect tussock, moorlands), including situations with shrubs and trees, if the overstorey foliage cover is less than 10%. Includes pasture and cropland.*	*4.5*	*EVC 175_61: Low Rises Grassy Woodland* *Note that EVC 175 might exist as either woodland or grassland, depending on specific land conditions.* *All areas shown in 'white' in Map 4 – Ecological Vegetation Classes - EVC (DELWP, 2022) with the exception of the township area is considered grassland. A significant portion of this grassland is used for farming*	• *Reduced fuel load* • *No bark hazard* • *Grassland fires are particularly influenced by wind strength and seasonal dryness of the grass. They travel quickly but don't burn with the same intensity as a forest or woodland fire.* • *Reduced setbacks to achieve a BAL of 12.5*

			and agricultural purposes.	
Low Threat	*The following vegetation shall be excluded from a BAL assessment:* *(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.* *(c) Multiple areas of vegetation less than 0.25ha in area and not within 20m of the site, or each other of other areas of vegetation being classified vegetation.* *(d) Strips of vegetation less than 20m in width (measured perpendicular to the evaluation exposed to the strip of vegetation) regardless of length and not within 20m of the site or each other, or other areas of vegetation being classified.* *(e) Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.* *(f) Vegetation regarded as low threat due to factors such flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline*	NA	Some of the township area is managed to a low threat condition, however each site should be assessed individually due to ranging site conditions.	• Vegetation generally managed to not sustain a bushfire

	wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.			

6.4 Topography

The Topography of the land surrounding a site is particularly important as the topography influences the rate of spread and intensity of a fire. Fire burns faster uphill, as the slope increases so does the speed of the fire and its intensity. As a general rule for every increase 10° up a slope, the fire will double its speed and conversely down a slope. Fires tend to move more slowly as the slope decreases.

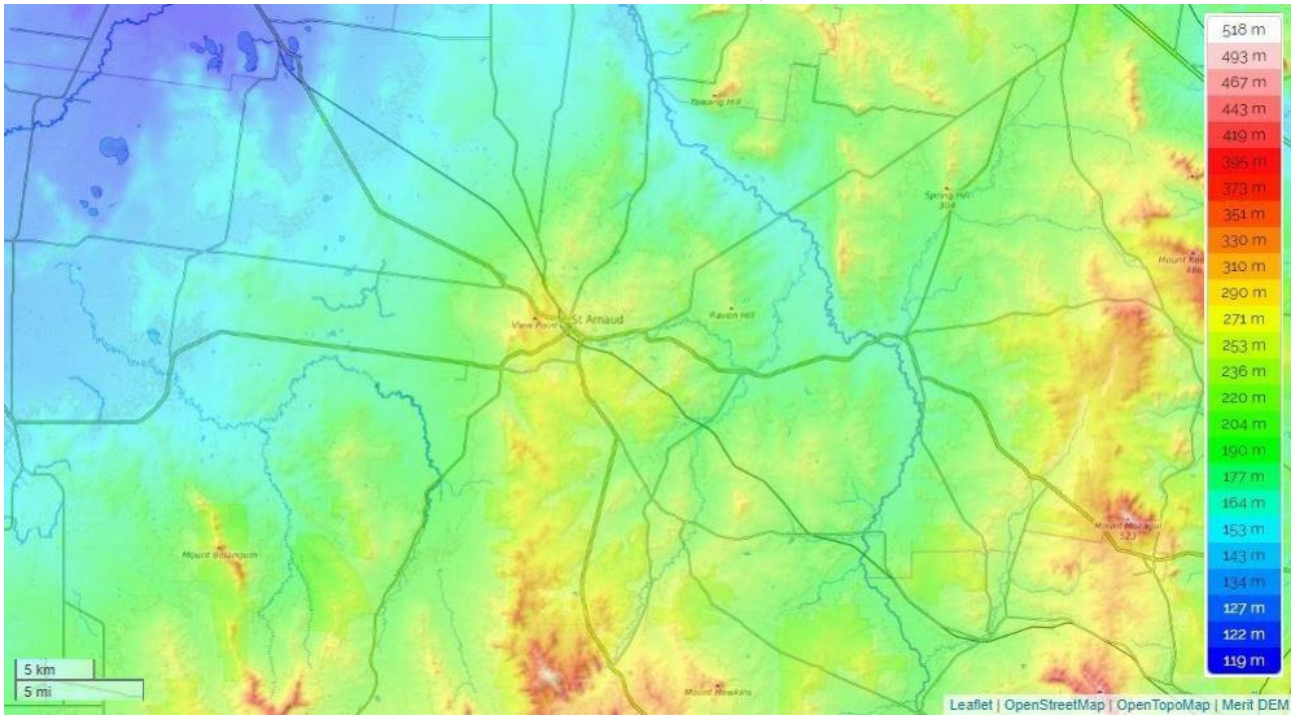
The township area of St Arnaud is surrounded by undulating terrain. The terrain to the north west and west of the township has greater topographical variation as can be seen in Map 5b. This variation and complexity of slopes will enable a more severe bushfire, where ridge lines can launch embers ahead of a fire front.

The investigation areas are located on relatively benign topography and the topographical influences within the investigation areas would not contribute to the intensity of a landscape bushfire.

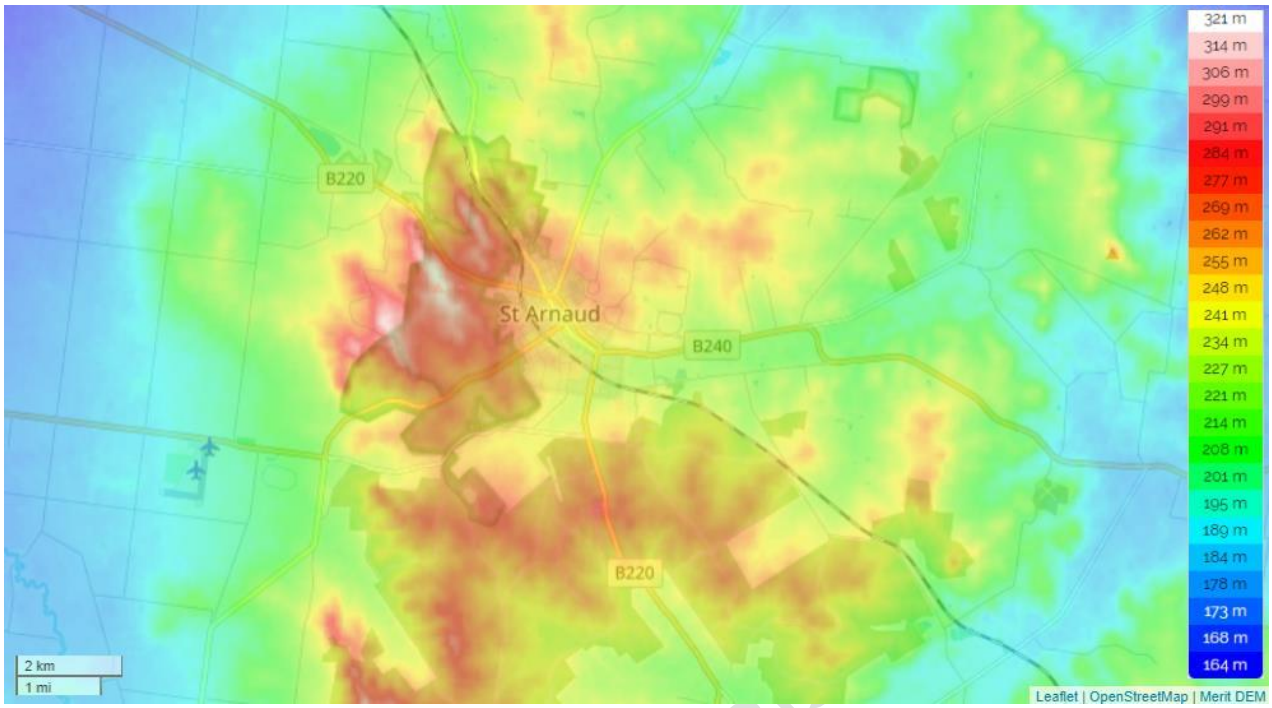
Investigation area D is exposed to forest areas to the north and south on undulating terrain that would enhance the intensity to this location. Particularly from the north.

Investigation area A is more exposed from along the western and northwestern interface of the township.

6.4.1 Map 5a – Topography within the broader landscape (Yamazaki, D et al. 2017)



6.4.2 Map 5b – Topography within 1km of the study sites. (Yamazaki, D et al. 2017)



6.5 Fire Weather

Fire weather analysis indicates the most likely behavior of a landscape bushfire and enables a more detailed consideration of the bushfire hazards surrounding a site.

When modeling the intensity of a landscape bushfire the Forest Fire Danger Index (FFDI) is used as an input into the fire behavior models used to determine the radiant heat exposures as described within this report.

The Forest Fire Danger Index (FFDI) represents the level of bushfire threat based on weather (and fuel) conditions. An FFDI of 100 is applied to be consistent with the building system via AS 3959-2018 and is one of the inputs to determine the defendable space distances and setbacks in the tables in Clause 53.02-5.

An FFDI of 100 is applied to all areas of Victoria except for alpine areas and is used as a benchmark to model extreme fire weather conditions. It is important to note that the FFDI of 100 was exceeded for periods of time at some locations during Black Saturday in 2009.

The climate in the Grampians region is dominated by warm dry summers and cool wet winters, with most rainfall occurring in winter and spring. The bushfire season generally runs from December to April (NGS Municipal Fire Management Plan 2021).

Prevailing weather conditions associated with the bushfire season in the Northern Grampians Shire are warm to hot north westerly winds accompanied by high temperatures and low relative humidity followed by a cool south westerly change.

Under the State Government climate change projections, the Grampians region can expect:

- Year round increases in temperatures.
- Fewer frosts.
- More frequent and intense rain events.
- More hot days and warm spells.
- Less rainfall in autumn, winter, and spring.
- Harsher fire weather and longer fire seasons.

6.6 Bushfire History of the Area

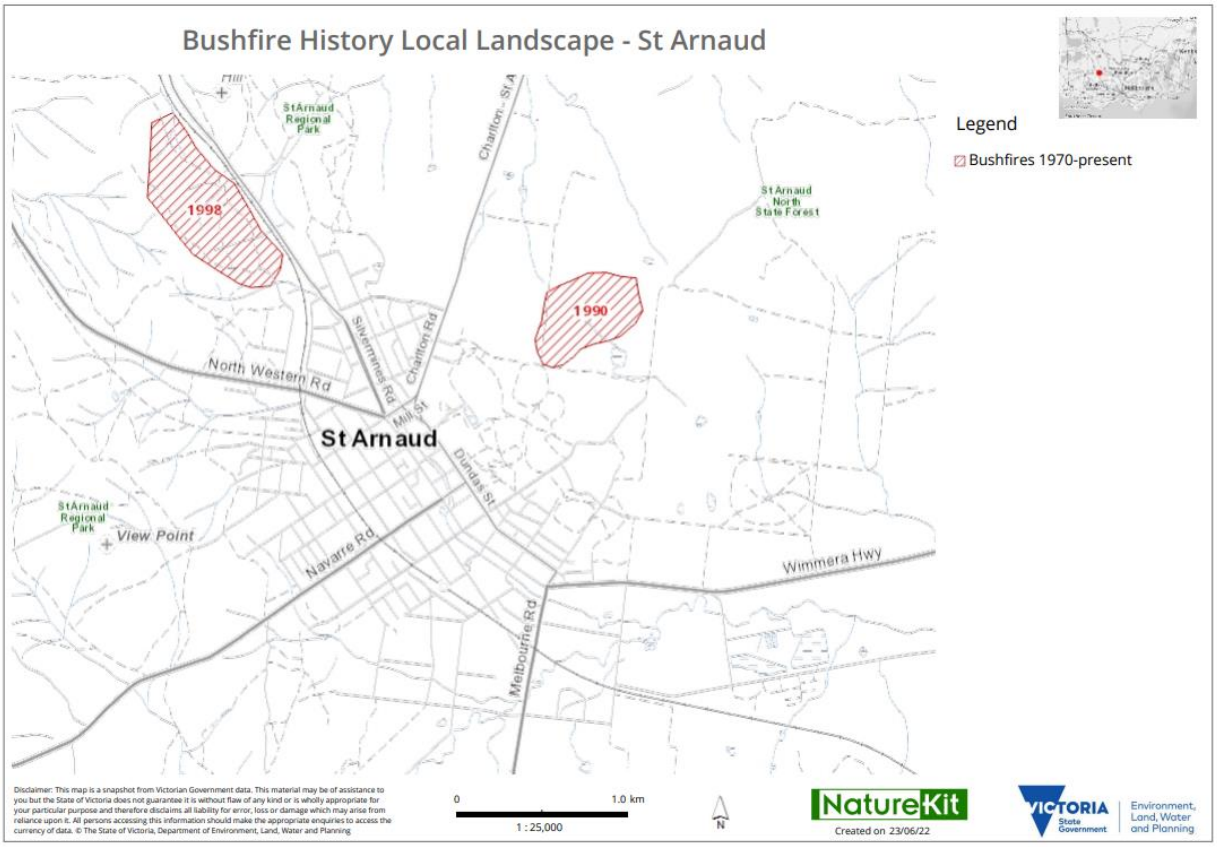
The Northern Grampians Shire Municipal Fire Management Plan (2021) describes the historical occurrence of bushfire within the shire.

> *'Historically, Northern Grampians Shire experiences a major fire once every five to ten years. This is partially due to the municipality being situated in a known lightning belt and agricultural activities including stubble burning practices.*
>
> *Often ignitions occur in remote and difficult to access terrain, allowing the fire to gain momentum. Aging buildings, buildings with shared roof space, and elderly housing stock present a higher fire risk to occupants and residents due to the nature of their construction and the materials used.*
>
> *Major interstate and national transport links traverse the municipality. These have led to the ignition of fires from transport accidents and malfunctions. This characteristic also presents a major risk for hazardous material incidents.'*

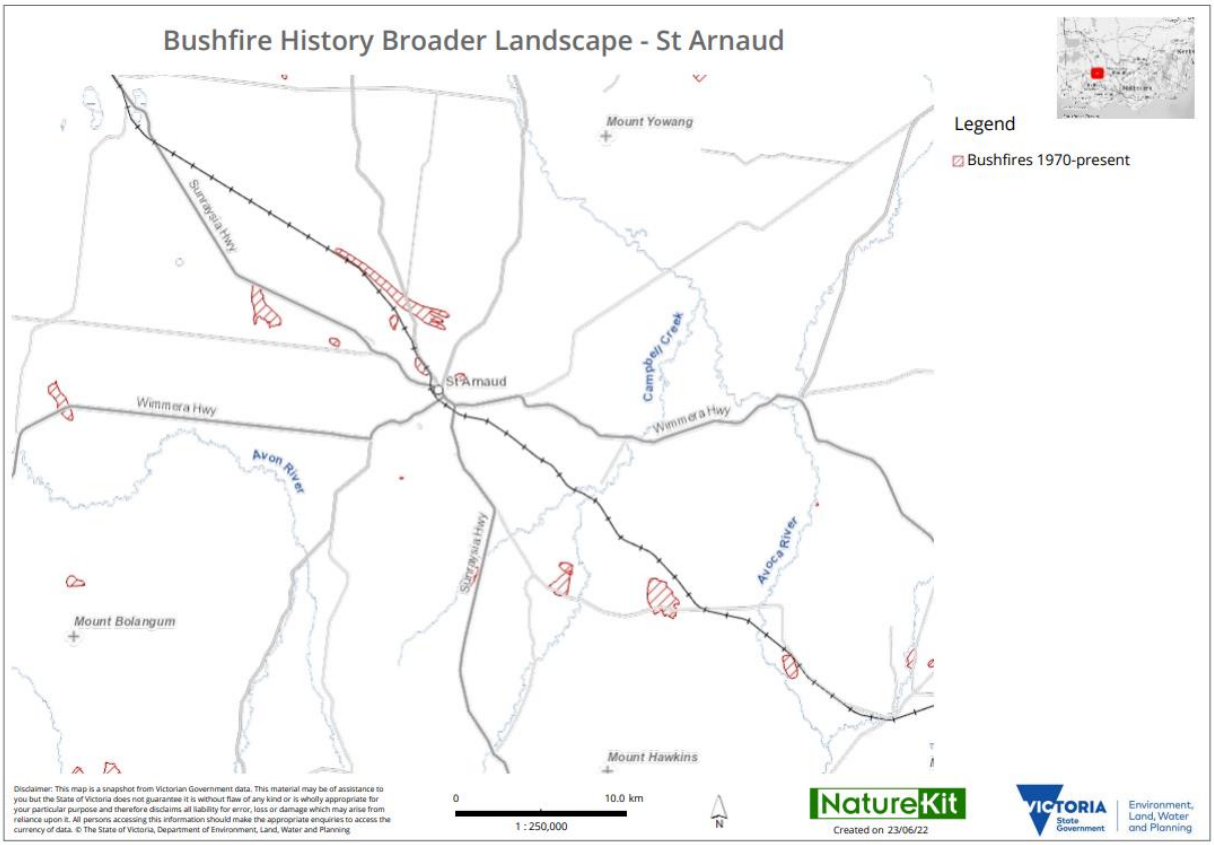
The bushfire history maps identify a number of small bushfires in the forest surrounding the township of St Arnaud. The fires show bushfire footprints consistent with the weather analysis where ignitions have occurred under hot north westerly winds that have then been pushed in a south westerly direction with the introduction of the cold change.

A small fire footprint is identified to the north of the settlement occurring in 1998 and a fire to the northeast in 1990. Given the small fire footprint it is assumed the fires were contained at early stages.

6.6.1 Map 6a – Bushfire History of the surrounding area (DELWP, 2022)



6.6.2 Map 6b – Bushfire History of the broader landscape (DELWP, 2022)



6.7 Bushfire Scenarios

There are a number of bushfire scenarios to consider that would impact the township of St Arnaud due to the extent of forest vegetation in the surrounding landscape.

The forest is dominated by dry forests and the dominant eucalypt species in most of the surrounding forest are ironbark species. The bark hazard of ironbark species is not as high as other types of eucalypts such as stringybarks, however, the dry nature of these forests would create lots of dry and dead material that could act as embers and be launched into the proposed investigation areas.

6.7.1 Table 4 – Bushfire Scenarios

Fire Run Direction	Description
North	A bushfire has the potential to run for approximately 3.5km through forest. The golf course is at the interface area of the north. There is limited access to the forest to the north and suppression would likely be constrained to the major arterial road. The investigation area A and D would be impacted from a fire run from the north. Investigation B would be largely protected from the existing settlement.

North West	A bushfire to the northwest has the potential fire run through forest for approximately 3km. The whole western interface of the township would be exposed to a fire run from the northwest. The topography to the northwest is undulating and the complexity would increase the bushfire severity. All investigation areas are exposed to a north westerly fire run. Investigation area B would have the greatest buffer and setbacks from a north westerly fire front.
South West	A bushfire from the southwest historically correlates with the greatest life and property loss (Black Saturday 2009 and Ash Wednesday 1983). All investigation areas would be exposed to a fire approaching from the southwest. The site with the greatest risk is considered to the investigation area D due to the fire run potential. The interface of the existing settlement area (investigation area A) is exposed from the southwest due to the proximity to the hazard and the complexity of the terrain to the south west of the township. Investigation area B is exposed however there are features within the landscape that may mitigate the exposure. These include the existing farms with modified landscapes including the Piggery and the Broiler Farm.
East	The eastern aspect has not been considered as extreme bushfire weather is not associated with an easterly direction. It is however common in large landscape fires to get embers launched in a north easterly direction under the influence of a south westerly wind. Embers igniting to the east can then start spot fires and possibly be drawn back into a major fire front.

7. DETAILED ASSESSMENT OF EACH INVESTIGATION AREA

7.1 Overview of Investigation areas.

This report reviews investigation areas A, B and D.

Investigation area A is within the township area and is for residential development.

Investigation areas B and D are investigated for industrial expansion.

The sites were found to be within Landscape Type areas 3 and 4 and these are discussed for each of the Investigation areas.

Investigation areas A, B and D were assessed against the Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020). The Guidelines make specific notes to be considered for industrial expansion which applies to investigation areas B and D.

Industrial expansion may include hazardous uses, such as a petrol station or sites that store chemicals or highly flammable fuels. These can present a significant risk during a bushfire and can create toxic smoke and plumes. It is recommended that these sites be located away from the settlement interface and away from locations exposed to a north-west or south-west bushfire.

The Guidelines (DELWP 2020) recommend these sites containing hazardous uses be located on the eastern side of a settlement. This is recommended so that winds will push smoke away rather than towards more populated areas.

The building requirements for residential development differ to the requirements for industrial buildings. The National Construction Code (NCC) calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works.

Industrial buildings are Class 7 and Class 8 Buildings. The construction measures in AS 3959-2018 do not apply to Class 7 and Class 8 industrial and warehouse buildings.

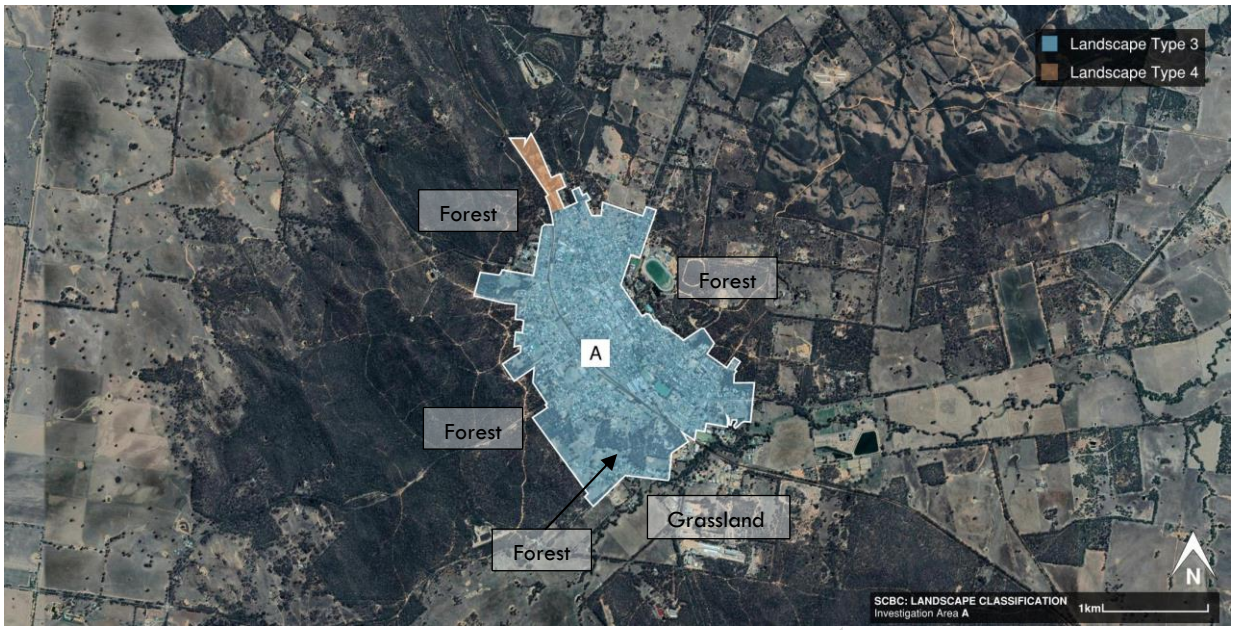
7.2 Investigation Area A

Investigation area A is the existing settlement of St Arnaud with a narrow extension to the north. The largest area of undeveloped land is located to the southwestern interface of the investigation area.

7.2.1 Table 5 - Investigation area A assessment against landscape risk type 3.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape Type Three • *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 and 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 around Investigation area A is dominated by forest vegetation to almost all aspects. There are small areas exposed to grassland to the north and south, however, the settlement is likely to be impacted by both radiant heat at the interface and ember attack throughout the township. The existing housing stock has not been constructed to mitigate the impacts of radiant heat or ember attack and structure-to-structure ignitions within the settlement are likely in the absence of active defense. Neighbourhood scale destruction is likely due to the proximity to the hazards and the age and condition of buildings within the existing settlement. Central areas of investigation area A would likely provide shelter from a bushfire. The vegetation within the township area is largely managed to a low threat condition and access and egress routes to central areas of the township are largely clear of vegetation.
Broader Landscape Type Four • *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* *Evacuation options are limited or not available.*	There is a small area to the north of Investigation area A that is exposed to forest vegetation to the north, northwest and east. Evacuation options are likely to the township to the south, however, the site is at an increased risk due to the limited area to provide separation from the surrounding hazards.

7.2.2 Map 7 - Investigation Area A



7.2.3 Table 6 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area A.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Investigation area A is the existing township of St Arnaud and would be infill development. The greatest bushfire hazard to the existing township is at the interface of unmanaged vegetation at the edge of the township. Extreme bushfire weather is consistent with a north westerly and south westerly winds and these directions also enable the longest fire runs through forest vegetation. There are existing controls to ensure that future development responds to the surrounding bushfire risk. These include the BMO at the interface of the township and the Bushfire Prone Area (BPA) that covers a large portion of the investigation area. Infill development at the interface of the township that complies with the BMO would enhance the resilience of the township boundary as development must manage defendable space around the perimeter of new dwellings. The BPA requires a construction standard but does not require the management of defendable space. Settlement growth into Landscape Type 4 locations is not recommended.

1.2	**Consider the distribution of uses in the settlement.**	Investigation area A largely comprises residential development, the central business area of the town (ie. supermarkets, banks, retail shops etc) and community infrastructure (ie. schools and council buildings).
1.3	**Consider lot sizes in settlement layout.**	An optimum lot size in residential townships from a bushfire perspective is between 800-1,200sq.m. This lot size provides separation between individual structures (ideally 10m to prevent structure-to-structure ignition) and minimises available open space for fuel sources (ie. open paddocks, unmanged gardens, remnant pockets of native vegetation etc). Smaller residential lots less than 800sq.m further limit fuel sources due to a limited area of open space, however, the risk of structure-to-structure fire increases. This is particularly important to consider where infill development of small residential lots allows new dwellings to be built close to buildings that pre-date the requirement to consider the impacts of bushfire. Construction standards to a Bushfire Attack Level (BAL) will provide a level of mitigation against a bushfire, however, these construction standards do not mitigate against structure-to-structure ignitions.
1.4	**Consider vegetated areas within a settlement.**	The residential areas centrally within the township of St Arnaud have highly managed gardens. There is a small area of forest vegetation to the south west of the township that is approximately 19ha in area and is fragmented, but would still enable a fire run of over 600m from the south west. Lexel Creek runs from west to east to the south of the township and contains remnant forest and woodland vegetation along its banks.
Part 2 - The Settlement interface with the bushfire hazard.		
2.1	**Apply the required development set back.**	Infill development at the interface of the township may be close to bushfire hazards and will be required to comply with the BMO. The BMO requires dwellings to be sited to maximise the separation distance between the hazard and it requires an area of defendable space to be managed to mitigate the hazards. Setback distances will vary depending on the surrounding topography and vegetation type which is predominantly forest and grassland. Any new settlement areas within the investigation area are required to maintain a BAL 12.5 setback. Refer to Appendix 1 for BAL 12.5 defendable space setback figures. The setback areas can be achieved through the management of defendable space within property boundaries, roads and managed areas of vegetation such as managed public open space.
2.2	**Design the settlement interface.**	Where infill development is at the settlement interface it will need to comply with the BMO which requires vegetation within the defendable space area to be managed to a low threat condition (as detailed in Clause 53.02-5 table 6).

		It is recommended that BAL 12.5 setback distances are applied to the settlement interface. Refer to Appendix 1 for BAL 12.5 defendable space setback figures.
2.3	**Access and egress.**	Investigation area A is within the existing settlement an access and egress to central areas of the township are established.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	The interface areas of the township are within the BMO and vegetation is required to be managed. Internal areas of the township are not within the BMO and there are no requirements for vegetation management. The vegetation within the existing township is largely managed to a low threat condition.
3.2	**Consider bushfire construction standards.**	All building work must comply with the Building Act 1993, Building Regulations 2006 and the National Construction Code (the NCC) unless specifically exempted. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class 1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. The Standard AS 3959-2018 specifies the requirements for the construction of buildings in bushfire prone areas to improve their resistance to bushfire attack from burning embers, radiant heat, flame contact and combinations of the three attack forms. In addition, the BMO requires construction standards (Fire Resistance Levels) associated with 'outbuildings' (sheds, detached garages etc) that are sited less than 10m from a dwelling.
3.3	**Consider fences and other localised fuel sources.**	When council considers requirements for fencing of new allotments the following should be considered: - Timber fences and brush fencing add to fuel loads throughout a settlement and are discouraged. - Colourbond fences are ideal as they slow the spread of bushfire through a settlement and act to attenuate radiant heat.

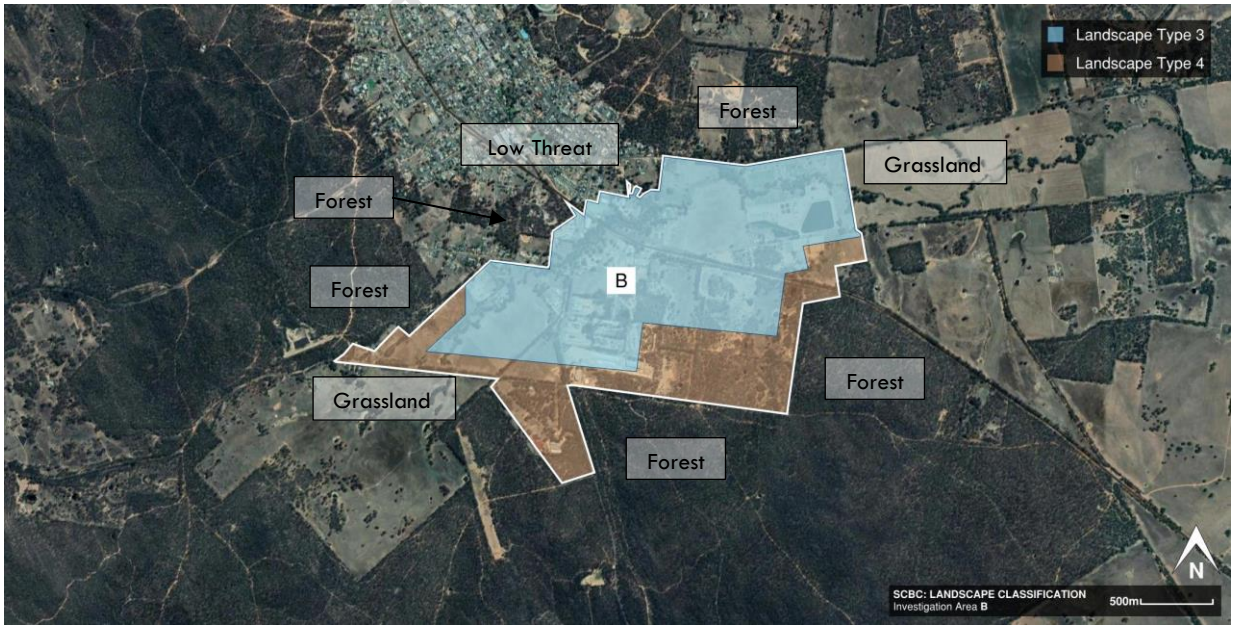
7.3 Investigation Area B

Investigation area B is located to the south and south east of the existing township.

7.3.1 Table 7 - Investigation area B assessment against landscape risk type 3 and type 4.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape Type Three • *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 and 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 areas within investigation area B are largely within the landscape risk type 3 due to the proximity to forest vegetation to the south, south west and west. There are established uses within the site. The landscape supports remnant stands of vegetation and neighbourhood-scale destruction from localized ignitions and ember attack are likely. Access to the central areas of St Arnaud are likely to be achieved.
Broader Landscape Type Four • *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* • *Evacuation options are limited or not available.*	Areas on the outskirts of investigation area B have been classified as a landscape type four as the risk from the south west presents as an extreme risk due to the long fire runs. Evacuation is likely to be achieved to the existing St Arnaud settlement.

7.3.2 Map 8 – Investigation Area B



8.3.3. Table 8 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area B.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development. Investigation area B is located to the south east of the township and is exposed to bushfire hazards from the south west and east. Settlement growth into Landscape Type 4 locations is not recommended.
1.2	**Consider the distribution of uses in the settlement.**	Industrial uses may contain hazardous uses and the Guidelines (DELWP 2020) recommend these sites containing hazardous uses be located on the eastern side of a settlement. This is recommended so that winds will push smoke away rather than towards more populated areas. Investigation area B is located to the south east of the township and would be suitable for hazardous uses from a bushfire perspective. The Investigation area currently contains a Broiler Farm, a Piggery and an established industrial precinct. North of the railway line is the existing sewerage treatment plant.
1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. Larger lots have the capacity for more localised fuel sources due to more open space areas. Vegetation and grassland within these lots may enable a fire to travel through these lots. The interface of forest vegetation in Investigation B is within the BMO which requires vegetation management around the perimeter of buildings. The BMO could address a building within an industrial site as a 'place of work' and defendable space objectives would need to be considered.
1.4	**Consider vegetated areas within a settlement.**	Investigation area B includes areas of remnant vegetation, particularly at the southern and eastern interface adjoining areas of forest vegetation. Lexel Creek runs through the Investigation area and supports a narrow strip of vegetation. This width and density of this vegetation is not considered significant enough to enable an established fire front.
Part 2 - The Settlement interface with the bushfire hazard.		

2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area B would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope. The setbacks are reduced for grassland hazards where a 19m setback is required for flat or upslopes and a 28m setback is required for 10-15° downslopes. Setbacks to the forest vegetation to the south and east would be required.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: '*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).*' The BMO is applied to the interface of Investigation area B and requires all subdivision development of greater than 10 lots to provide a perimeter road.
2.3	**Access and egress.**	Perimeter roads are the preferred design outcome on the settlement interface and where a site abuts or is near a bushfire hazard. A perimeter road enables a no fuel area to form all or part of the interface. Perimeter roads are sometimes required under the BMO, however, they should be considered in all settlement interfaces as appropriate. Investigation area B has the Wimmera Hwy to the north a main arterial road running east to west and the Sunraysia Hwy that runs through the site and extends from St Arnaud to the south.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	The sites within Investigation area B within the BMO are required to manage defendable space around buildings. The BMO requires outbuildings that are not within 10m of a dwelling to provide a defendable space distance of 10m (or to the property boundary) around their perimeter (Outbuildings in the Bushfire Management Overlay (DELWP 2017)). The management of 10m around an industrial building is not sufficient to ensure that vegetation is managed so that radiant heat exposures do not exceed 12.5kW/m^2.

		Additional measures would need to be considered to ensure ongoing vegetation management.
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class 1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat. Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

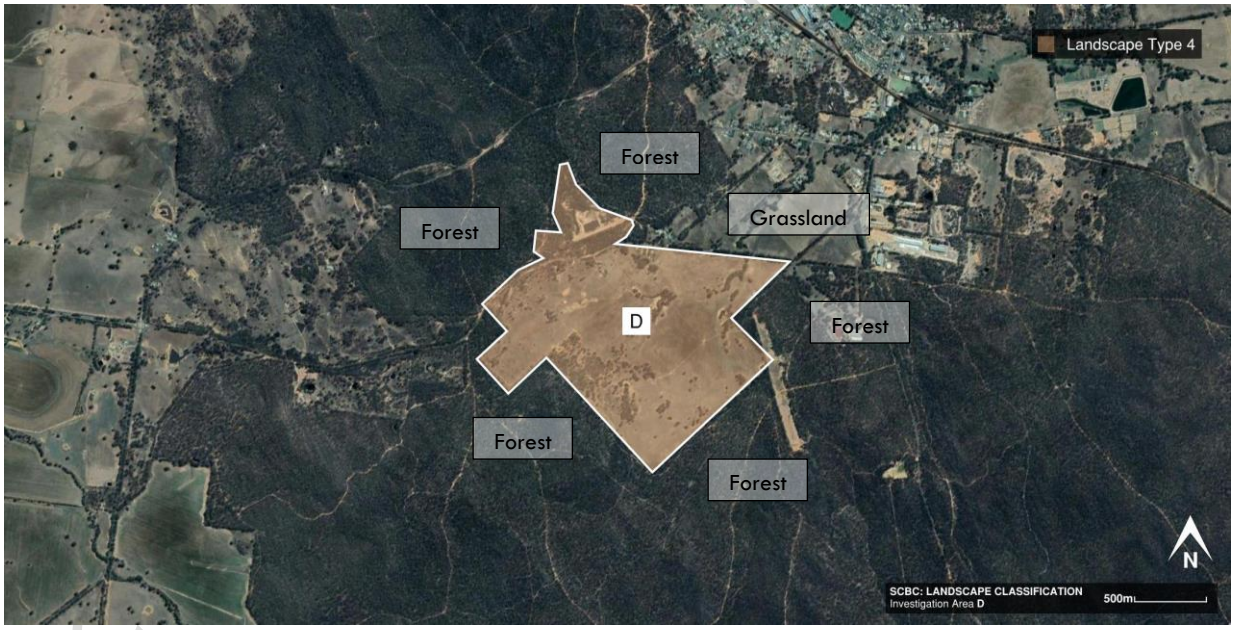
7.4 Investigation Area D

Investigation area D is located to the southwest of the township and although the site is largely cleared of forest it is surrounded by forest vegetation.

7.4.1 Table 9 - Investigation area D assessment against landscape risk type 4.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape Type Four • *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* *Evacuation options are limited or not available.*	Investigation area D is surrounded by forest vegetation to almost all aspects. There is a small area of grassland interface to the east and this provides access to the St Arnaud township. To the south and south west of the site are extensive areas of forest that have hours and potential days to grow and develop. The ember densities impacting the proposed development would be high and this contributes to the bushfire risk to the site.

7.4.2 Map 9 – Investigation Area D



7.4.3 Table 10 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area D.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Victoria's dominant bushfire weather usually arises from the north-west and the south-west. It is under these conditions that Victoria experiences bushfires that have the most impact on settlements and communities. Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development (DELWP 2020). Investigation area D is located to the south west of the existing settlement and is exposed to bushfire hazards to the north-west and south-west. Settlement growth and high intensity industrial uses into Landscape Type 4 locations are not recommended. Development within landscape Type 4 areas can include agriculture uses such as grazing and cropping.
1.2	**Consider the distribution of uses in the settlement.**	Industrial sites may contain hazardous uses and it is recommended that hazardous uses be located away from the settlement interface and away from locations exposed to a north-west or south-west bushfire. Investigation Area D is exposed form both the north-west and south-west aspects. If a site with a hazardous use was located within an industrial development in Investigation area D, south westerly winds would push smoke towards the township of St Arnaud.
1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. Larger lots have the capacity for more localised fuel sources due to more open space areas. Vegetation and grassland within these lots may enable a fire to travel through these lots. The interface of forest vegetation in Investigation D is within the BMO which requires vegetation management around the perimeter of buildings. The BMO could address a building within an industrial site as a place of work and defendable space objectives would need to be considered.
1.4	**Consider vegetated areas within a settlement.**	The vegetation within investigation area D is largely grassland. There are small areas of remnant forest to the northern and southern interface of the site. The greatest issue to this site is the extent of vegetation surrounding the site.
Part 2 - The Settlement interface with the bushfire hazard.		

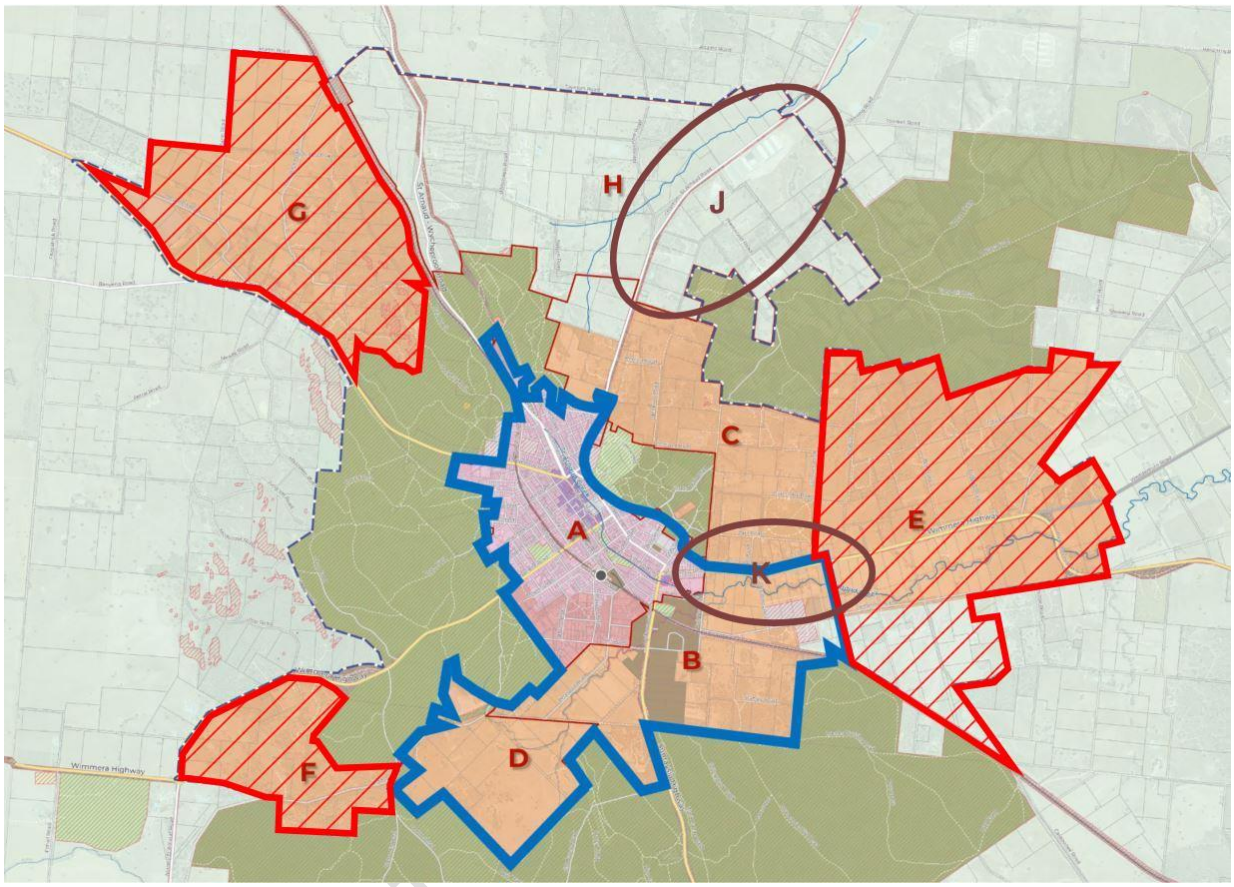
2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area D would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: '*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).*' The BMO is applied to the interface of Investigation area D and requires all subdivision development of greater than 10 lots to provide a perimeter road.
2.3	**Access and egress.**	Perimeter roads are the preferred design outcome on the settlement interface and where a site abuts or is near a bushfire hazard. A perimeter road enables a no fuel area to form all or part of the interface. Perimeter roads are sometimes required under the BMO, however, they should be considered in all settlement interfaces as appropriate. Investigation area D has limited access and egress options as it is surrounded by forest vegetation to the north, west and south. Access and egress along routes with limited vegetation or grassland vegetation would only be achieved in an easterly direction. Bushfire weather is not consistent with an easterly direction; however, multiple access and egress routes are the preferred option. Access to the west to the Wimmera Hwy is possible, however, it would require traveling through forest vegetation.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	The sites within Investigation area D within the BMO are required to manage defendable space around buildings. The BMO requires outbuildings that are not within 10m of a dwelling to provide a defendable space distance of 10m (or to the property boundary) around their perimeter (Outbuildings in the Bushfire Management Overlay (DELWP 2017)). The management of 10m around an industrial building is not sufficient to ensure that vegetation is managed so that radiant heat exposures do not exceed 12.5kW/m^2.

		Additional measures would need to be considered to ensure ongoing vegetation management.
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat. Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

7.5 General Comments regarding other areas of consideration.

Following a consultation meeting on Wednesday 13 July 2022, SCBC were asked to provide comment on areas E, F and G as well as considering areas within C & H delineated by the brown ovals in the presentation prepared by Mesh which are referred to as investigation areas J & K in the report.

7.5.1 Map 10 – Investigation Area E, F, G and industrial specific sites



7.6 Investigation Area E

Investigation area E is located to the east of the township and predominantly supports grassland and is surrounded by a mixture of forest, shrubland, and grassland vegetation.

7.6.1 Table 11 - Investigation area E assessment against landscape risk type 3.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape <u>Type Three</u> • *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 and 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.*	Investigation area E is surrounded by grassland to the east, forest to the southwest and a combination of forest, shrubland and grassland to the north. To the southwest of the site are extensive areas of forest that have hours to grow and develop. The ember densities impacting the proposed development would be high at the interface and moderate centrally within the investigation area.

	Access to the inner township areas of St Arnaud or within a new subdivision is probable.

7.6.2 Table 12 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area E.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Victoria's dominant bushfire weather usually arises from the north-west and the south-west. It is under these conditions that Victoria experiences bushfires that have the most impact on settlements and communities. Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development (DELWP 2020). Investigation area E is located to the east of the existing St Arnaud township and is exposed to bushfire hazards to the north-west and south-west. The hazards to the north west are fragmented and are not considered to be as high as the hazards in the unmodified native forest to the south west.
1.2	**Consider the distribution of uses in the settlement.**	Industrial sites may contain hazardous uses and it is recommended that hazardous uses be located away from the settlement interface. Investigation area E is away from the settlement interface. Investigation area E is located to the east of the township and would be suitable for hazardous uses from a bushfire perspective. The Investigation area currently contains agricultural farmland. West of the investigation area is the existing sewerage treatment plant.
1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. The interface of forest vegetation in Investigation E is within the BMO which requires vegetation management around the perimeter of buildings. The BMO could address a building within an industrial site as a place of work and defendable space objectives would need to be considered.
1.4	**Consider vegetated areas within a settlement.**	The vegetation within investigation area E is largely grassland. There are areas of remnant forest fragmented throughout the site. These areas could enable flare ups or spot fires to develop. Appropriate subdivision design could manage the hazards that these areas of vegetation present. The vegetation at the interface areas would be required to be managed to a low threat condition in accordance with the BMO to mitigate a fire within intensity traveling through the site.

Part 2 - The Settlement interface with the bushfire hazard.		
2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area E would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: *'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).'* The BMO is applied to the interface of Investigation area E and requires all subdivision development of greater than 10 lots to provide a perimeter road.
2.3	**Access and egress.**	Perimeter roads are the preferred design outcome on the settlement interface and where a site abuts or is near a bushfire hazard. A perimeter road enables a no fuel area to form all or part of the interface. Investigation area E has the Wimera Hwy that extends through the middle running east and west and a number of arterial roads (made and unmade) that connect with the highway.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	The sites within Investigation area E within the BMO are required to manage defendable space around buildings. The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: *'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).'*
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized

		flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat. Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

7.7 Investigation Area F

Investigation area F is located to the south west of the township beyond St Arnaud Regional park. The area predominantly exists as grassland with scattered patches of remnant forest and woodland. Area F is surrounded by forest to the north, east and south and grassland to the west.

7.7.1 Table 13 - Investigation area F assessment against landscape risk type 4.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape <u>Type Four</u> • *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* *Evacuation options are limited or not available.*	Investigation area F is surrounded by forest vegetation to the north, east and south aspects. Grassland interacts with the western interface. North, east and south of the site are extensive areas of forest that have hours and potential days to grow and develop. The ember densities impacting the proposed development would be high and this contributes to the bushfire risk to the site.

7.7.2 Table 14 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area F.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Victoria's dominant bushfire weather usually arises from the north-west and the south-west. It is under these conditions that Victoria experiences bushfires that have the most impact on settlements and communities. Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development (DELWP 2020). Investigation area F is located to the southwest of the existing St Arnaud township and is exposed to bushfire hazards to the north and south and grassfire hazards to the west.
1.2	**Consider the distribution of uses in the settlement.**	Industrial sites may contain hazardous uses and it is recommended that hazardous uses be located away from the settlement interface and away from locations exposed to a north-west or south-west bushfire. Investigation Area F is exposed form both the north-west and south-west aspects. If a site with a hazardous use was located within an industrial development in Investigation area F, south westerly winds would push smoke towards the township of St Arnaud.
1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. The entirety of Investigation Area F is within the BMO which requires vegetation management around the perimeter of buildings.
1.4	**Consider vegetated areas within a settlement.**	The vegetation within investigation area F is largely grassland. There are areas of remnant forest fragmented throughout the site particularly close to the forest interfaces and adjacent to the length of Lock Road. The greatest issue to this site is the extent of vegetation surrounding the site.
Part 2 - The Settlement interface with the bushfire hazard.		
2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area F would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: *'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).' The BMO is applied to the entirety of Investigation area F and requires all subdivision development of greater than 10 lots to provide a perimeter road.
2.3	**Access and egress.**	Investigation area F has limited access and egress options as it is surrounded by forest vegetation to the north, east and south. Access and egress along routes with limited vegetation or grassland vegetation would only be achieved in a westerly direction. Bushfire weather is consistent with a westerly direction; however, traveling east require travel through forest vegetation. Access to the west to the Wimmera Hwy is possible, however, it would require traveling through forest vegetation. Lock Road that extends through the middle on the investigation area provides access to east and west directions The Wimmera Highway forms the north and west boundary of Investigation Area F and provides access north east to the township of St Arnaud through forest vegetation and south through grassland.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	Investigation area F is completely within the BMO are required to manage defendable space around buildings.
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat.

		Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

7.8 Investigation Area G

Investigation area G is located to the northwest of the township. The land adjacent to the St Arnaud Regional Park exists as a mixture of forest and woodland. The vegetation increasingly becomes predominantly grassland with some remnant patches of forest vegetation towards the northwest.

7.8.1 Table 15 - Investigation area G assessment against landscape risk type 3.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape Type Three • *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 and 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.*	Investigation area G is surrounded by grassland to the north, west and south and a combination of forest, woodland and shrubland to the southeast. To the southeast of the site are extensive areas of forest that have hours to grow and develop. The ember densities impacting the proposed development would be high from the southeast, however bushfire weather is not consistent with this wind direction. Access to the inner township areas of St Arnaud or within a new subdivision is probable.

7.8.2 Table 16 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area G.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Victoria's dominant bushfire weather usually arises from the north-west and the south-west. It is under these conditions that Victoria experiences bushfires that have the most impact on settlements and communities. Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development (DELWP 2020). Investigation area G is located to the northwest of the existing St Arnaud township and is exposed to bushfire hazards to the southeast.
1.2	**Consider the distribution of uses in the settlement.**	Industrial sites may contain hazardous uses and it is recommended that hazardous uses be located away from the settlement interface and away from locations exposed to a north-west or south-west bushfire. Investigation area G is located to the northwest of the township and is not recommended for hazardous uses.

1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. The interface of forest vegetation in Investigation G is within the BMO which requires vegetation management around the perimeter of buildings. The BMO could address a building within an industrial site as a place of work and defendable space objectives would need to be considered.
1.4	**Consider vegetated areas within a settlement.**	The vegetation within investigation area G is largely grassland except for the southeast corner which is a mixture of forest, woodland and shrub vegetation. The density of vegetation in the northeast portion of Investigation Area G is not considered significant enough to enable an established fire front, however the southeast aspect could establish and sustain a bushfire.
Part 2 - The Settlement interface with the bushfire hazard.		
2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area G would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: '*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).*' The BMO is applied to the interface of Investigation area G and requires all subdivision development of greater than 10 lots to provide a perimeter road.
2.3	**Access and egress.**	Perimeter roads are the preferred design outcome on the settlement interface and where a site abuts or is near a bushfire hazard. A perimeter road enables a no fuel area to form all or part of the interface. Perimeter roads are sometimes required under the BMO, however, they should be considered in all settlement interfaces as appropriate. The Sunraysia highway provides access and egress to the southwest interface of Investigation Area G. There are a number of existing arterial roads (unmade) that connect with the highway. St Arnaud-

		Wycheproof Road can be accessed to the east via one existing road that crosses a trainline.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	The sites within Investigation area E within the BMO are required to manage defendable space around buildings.
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat. Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

7.9 Investigation Area J

Investigation area J is located to the northeast of the existing township.

7.9.1 Table 17 - Investigation area J assessment against landscape risk type 3.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape <u>Type Three</u> • *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 and the site is located in an area that is not managed in a minimum fuel condition.*	The areas within investigation area J are within the landscape risk type 3 due to the proximity to forest vegetation to the south and east. The landscape supports remnant stands of vegetation and neighbourhood-scale destruction from localized ignitions and ember attack are likely.

• *Access to an appropriate place that provides shelter from bushfire is not certain.*	Access to the central areas of St Arnaud are likely to be achieved.

7.9.2 Table 18 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area J.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development. Investigation area J is located to the northeast of the township and is exposed to bushfire hazards from the south and east and grassland hazards to the north and west.
1.2	**Consider the distribution of uses in the settlement.**	Industrial uses may contain hazardous uses and the Guidelines (DELWP 2020) recommend these sites containing hazardous uses be located on the eastern side of a settlement. This is recommended so that winds will push smoke away rather than towards more populated areas. Investigation area J is located to the northeast of the township and would be suitable for hazardous uses from a bushfire perspective.
1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. Larger lots have the capacity for more localised fuel sources due to more open space areas. Vegetation and grassland within these lots may enable a fire to travel through these lots. Investigation area J has sections of land within the BMO which requires vegetation management around the perimeter of buildings. The BMO could address a building within an industrial site as a 'place of work' and defendable space objectives would need to be considered. The subdivision layout should ensure that setbacks ensure that future development does not enable radiant heat exposures greater than a 12.5kW/m^2. The layout should include perimeter roads to provide a permanent fire break around a future development. Smaller lot sizes (less than 0.2ha) could be considered internally within an industrial subdivision within this location. Where land does not fall within the BMO and defendable space is not required to be managed, council could consider an alternative tool to ensure vegetation is managed to a low threat condition.

1.4	**Consider vegetated areas within a settlement.**	Investigation area J includes areas of remnant forest vegetation that generally follow remnant creek lines and property boundaries. This width and density of this vegetation is not considered significant enough to enable an established bushfire front. Setbacks within the investigation area could be nominated to ensure future development is not exposed to radiant heat loads greater than 12.5kW/m^2.
Part 2 - The Settlement interface with the bushfire hazard.		
2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area K would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope. The setbacks are reduced for grassland hazards where a 19m setback is required for flat or upslopes and a 28m setback is required for 10-15° downslopes. Setbacks to the forest vegetation to the south and east would be required.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: '*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).*' The BMO is applied to areas in the northwest, southwest and southeast of Investigation area J and requires all subdivision to provide a perimeter road.
2.3	**Access and egress.**	Perimeter roads are the preferred design outcome on the settlement interface and where a site abuts or is near a bushfire hazard. A perimeter road enables a no fuel area to form all or part of the interface. Perimeter roads are sometimes required under the BMO, however, they should be considered in all settlement interfaces as appropriate. Investigation area J has the Charlton-St Arnaud Road running through the center in a northeast to southwest direction.
Part 3 – Bushfire protection measures at the settlement scale.		

3.1	**Consider vegetation management.**	The sites within Investigation area J within the BMO are required to manage vegetation as defendable space around the perimeter of development. Where land does not fall within the BMO and defendable space is not required to be managed, council could consider an alternative tool to ensure vegetation is managed to a low threat condition.ge defendable space around buildings.
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class 1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works. Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat. Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

7.10 Investigation Area K

Investigation area K is located to the east of the existing township.

7.10.1 Table 19 - Investigation area K assessment against landscape risk type 3.

Landscape Type Description (DELWP 2017)	Site Response
Broader Landscape Type Three • *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.*	The areas within investigation area K are within the landscape risk type 3 due to the proximity to forest vegetation to the north and west. The landscape supports remnant stands of vegetation and neighbourhood-scale destruction from localized ignitions and ember attack are likely.

• *Bushfire can approach from more than one aspect and 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.*	Access to the central areas of St Arnaud are likely to be achieved.

7.10.2 Table 20 – Design Guidelines – Settlement Planning at that Bushfire Interface (DELWP 2020) - Response Investigation Area K.

Part 1 - Form and structure of settlements.		
1.1	**Consider the bushfire hazard in directing growth.**	Directing growth to the east of existing settlements avoids the highest risk aspects and enables the existing settlement to provide a buffer for new development. Investigation area K is located to the east of the township and is exposed to modified forest and woodland vegetation to the north, south and east. The bushfire hazards can be appropriately managed through subdivision design considerations.
1.2	**Consider the distribution of uses in the settlement.**	Industrial uses may contain hazardous uses and the Guidelines (DELWP 2020) recommend these sites containing hazardous uses be located on the eastern side of a settlement. This is recommended so that winds will push smoke away rather than towards more populated areas. Investigation area K is located to the east of the township and would be suitable for hazardous uses from a bushfire perspective.
1.3	**Consider lot sizes in settlement layout.**	Typically, rural industrial lots are larger than a residential lot and they may contain larger lots 0.2ha – 4ha in size. Larger lots have the capacity for more localised fuel sources due to more open space areas. Vegetation and grassland within these lots may enable a fire to travel through these lots. Investigation Industrial K is within the BMO which requires vegetation management around the perimeter of buildings. The BMO could address a building within an industrial site as a 'place of work' and defendable space objectives would need to be considered. Central areas of investigation area K would be suitable for more intensive development with smaller allotments as it is close the existing towhship areas and not located at the interface of unmanaged vegetation with high fuel loads.
1.4	**Consider vegetated areas within a settlement.**	Investigation area K includes areas of remnant forest vegetation particularly the Association Gully Bushland Reserve. A subdivision layout would need to ensure setback distances from this vegetation.

Part 2 - The Settlement interface with the bushfire hazard.		
2.1	**Apply the required development set back.**	A future industrial subdivision development within Investigation area K would need to demonstrate future development is not exposed to radiant heat loads greater than 12.5kW/m^2. A setback from any forest vegetation would need to consider the topography surrounding the site and the fuel load within the adjacent hazard. A setback from forest vegetation could range from 48m where the forest vegetation is on a flat or upslope from the site and up to 82m where the forest is on a 10-15° downslope. The setbacks are reduced for grassland hazards where a 19m setback is required for flat or upslopes and a 28m setback is required for 10-15° downslopes. Setbacks to the forest vegetation to the south and east would be required.
2.2	**Design the settlement interface.**	The settlement interface is required to be managed in meeting the objectives of Clause 13.02-1S which clearly defines the risk threshold for new development that includes: '*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).*' The BMO is applied to the entirety of Investigation area K and requires all subdivision development of greater than 10 lots to provide a perimeter road.
2.3	**Access and egress.**	Perimeter roads are the preferred design outcome on the settlement interface and where a site abuts or is near a bushfire hazard. A perimeter road enables a no fuel area to form all or part of the interface. Perimeter roads are sometimes required under the BMO, however, they should be considered in all settlement interfaces as appropriate. Investigation area K has the Wimmera Hwy running through the center in east to west directions.
Part 3 – Bushfire protection measures at the settlement scale.		
3.1	**Consider vegetation management.**	The sites within Investigation area K within the BMO are required to manage defendable space around buildings. Additional measures would need to be considered to ensure ongoing vegetation management within a future subdivision.
3.2	**Consider bushfire construction standards.**	There are no bushfire construction standards for industrial buildings. The NCC calls upon the *Australian Standard AS 3959–2018 Construction of Buildings in Bushfire Prone Areas* for Class 1, 2 and 3 buildings and associated Class 10a (e.g. deck) building works.

		Industrial buildings are generally constructed from non-combustible materials which provides protection from radiant heat and localized flame contact, however, does not provide protection from ember attack. Buildings are at an increased risk from ember attack where there are gaps to the 'exterior skin' of a building >2mm. Due to the reduced construction standard, vegetation management and setbacks become critical bushfire mitigation measures to an industrial development.
3.3	**Consider fences and other localised fuel sources.**	The use of timber fences and brush fencing should be discouraged or prohibited as they add to fuel loads. Colourbond fences are ideal for small industrial lots, as they slow the spread of bushfire through a settlement and act to attenuate radiant heat. Post and wire fences won't inhibit fire spread, but do not substantially add to fuel loads. They are also easier for firefighting access and would be recommended for larger industrial lots.

7.11 Conclusion

A detailed assessment of investigation areas A, B and D were undertaken including a field assessment and review of the proposed uses in accordance with the information provided by Mesh.

The sites are coved by both the BMO and the BPA to varying extents. All future development would need to ensure it is not exposed to radiant heat loads greater than 12.5kW/m^2 regardless of the bushfire policy impacting the site (ie. BMO or BPA). All development should appropriately treat the interface areas so that vegetation is managed for perpetuity. All future subdivision development for industrial or residential use should consider the requirements for a perimeter road. Infill development in investigation area A would not need to provide a perimeter road.

A summary of each investigation area includes the following:

- Investigation area A is within the existing settlement and was considered for future residential development or infill development. Future residential development within this area would be suitable and the current controls to mitigate bushfire were found to be sufficient to mitigate the surrounding bushfire risk. The optimum lot size within this area is considered to be between 800-1,200 sq. m.
  North of investigation area A is a narrow band of land that is not considered appropriate for further residential development as it was found to be within an area with a landscape risk type four.
- Investigation area B is located south east of the existing township and was found to be within a landscape risk type 3 in central areas and a type 4 at the interface of the forest to the south. Future industrial development could be considered in investigation area B. Development would need to have consideration of the interface areas to mitigate the risk from the surrounding forest vegetation. Lexel Creek runs through the site and supports a narrow strip of vegetation that would have to be considered.
- Investigation area D is surrounded by unmanged forest vegetation and is within a landscape risk type 4. Further development within this location is not considered to meet the bushfire objectives.

Following a consultation meeting on Wednesday 13 July 2022 we investigated a number of additional areas surrounding the township including areas E, F and G and areas K and J as shown in Map 10.

- Investigation area E is located to the east of the existing township and was found to be a landscape risk 3 and would be suitable for future industrial use.
- Investigation area F was found to be a landscape risk 4 and would not meet the required bushfire objectives for future development.
- Investigation area G was found to have a landscape risk 3 and was largely exposed to grassland hazards from the north and west. Investigation area G is located to the northwest of the township and as such a bushfire impacting that site could cause toxic smoke as a result of hazardous uses, is not recommended for hazardous uses to be located to the northwest of existing settlements.
- Investigation area J is located to the northeast of the township and is a landscape risk type 3. This area could meet the bushfire objectives and would be suitable for industrial development.
- Investigation area K is located between area A and E and runs along the creek line. It is exposed to a landscape risk type 3 and is suitable for future industrial development.

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9. APPENDIX

1.1 Appendix 1 – BAL 12.5 Defendable space setbacks

Slope under the classifiable vegetation	**Vegetation Type**		
	Forest	Woodland	Grassland
All Upslopes and flat land (0 degrees)	48m	33m	19m
Downslope >0 to 5 degrees	57m	41m	22m
Downslope >5 to 10 degrees	69m	50m	25m
Downslope >10 to 15 degrees	82m	60m	28m
Downslope >15 to 20 degrees	98m	73m	32m