

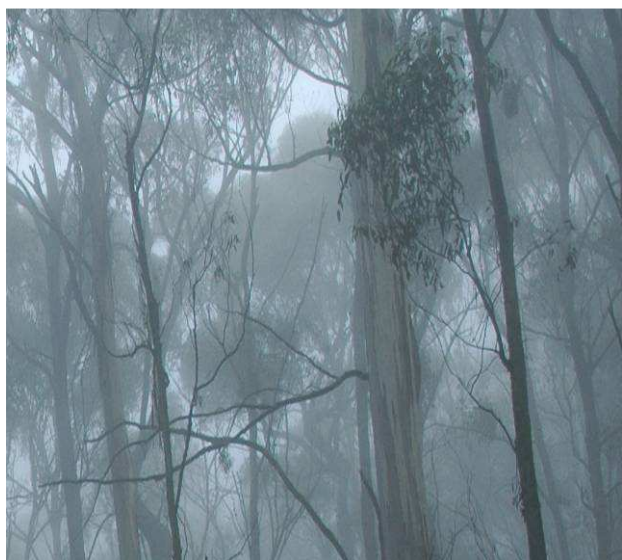


BUSHFIRE PLANNING ASSESSMENT

Calderwood Urban Development Project

Prepared for
Delfin Lend Lease

18 February 2010





Bushfire Planning Assessment

Calderwood Urban Development Project

PREPARED FOR	Delfin Lend Lease
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Abbreviations

ABBREVIATION	DESCRIPTION
APZ	Asset Protection Zone
AS	Australian Standard
DLL	Delfin Lend Lease
DoP	Department of Planning
EA	Environmental Assessment
EP& A Act	<i>NSW Environment Planning & Assessment Act 1979</i>
GCC	Growth Centres Commission
GIS	Geographical Information System
IPA	Inner Protection Area
IRS	Illawarra Regional Strategy
LGA	Local Government Area
LP	Liquid Petroleum
NZS	New Zealand Standard
OPA	Outer Protection Area
PBP	Planning for Bushfire Protection 2006
RFS	NSW Rural Fire Service
SEPP	State Environmental Planning Policy
SFPP	Special Fire Protection Purpose development
WDRA	West Dapto Release Area

1 Introduction

This bushfire planning assessment has been prepared by Eco Logical Australia for the Calderwood Urban Development Project. The Calderwood Urban Development Project is a master planned community development by Delfin Lend Lease. This assessment will accompany a Concept Plan Application under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and a proposal for State significant site listing under Schedule 3 of *State Environmental Planning Policy Major Development 2005* (SEPP Major Development).

1.1 THE PROPOSAL

This Bushfire Planning Assessment has been prepared by Eco Logical Australia Pty Ltd to accompany a Concept Plan Application under Part 3A of the *Environmental Planning & Assessment Act, 1979* (EP&A Act) and a proposal for State significant site listing under Schedule 3 of *State Environmental Planning Policy Major Development 2005* (SEPP Major Development) in relation to the Calderwood Urban Development Project.

The Calderwood Urban Development Project is a master planned community development by Delfin Lend Lease (DLL).

The Calderwood Urban Development Project proposes a mix of residential, employment, retail, education, conservation and open space uses. The development proposes approximately 4,800 dwellings and approximately 50 hectares of retail, education, community and mixed use / employment land. The overall development will accommodate approximately 12,400 people and will deliver an estimated \$2.9 billion in development expenditure and create approximately 8,000 full time equivalent jobs by 2031.

The Calderwood Urban Development Project site is located within the Calderwood Valley in the Illawarra Region. It is approximately 706 hectares in area with approximately 600 hectares of land in the Shellharbour LGA and the balance located within the Wollongong LGA.

The Calderwood Valley is bounded to the north by Marshall Mount Creek (which forms the boundary between the Shellharbour and Wollongong LGAs), to the east by the Macquarie Rivulet, to the south by Johnstons Spur and to the west by the Illawarra Escarpment. Beyond Johnstons Spur to the south is the adjoining Macquarie Rivulet Valley within the suburb of North Macquarie. The Calderwood Urban Development Project land extends south from the Calderwood Valley to the Illawarra Highway. Refer to Location Plan at **Figure 1**.

The Calderwood Valley has long been recognised as a location for future urban development, firstly in the Illawarra Urban and Metropolitan Development Programmes and more recently in the Illawarra Regional Strategy (IRS).

The IRS nominates Calderwood as an alternate release area if demand for additional housing supply arises because of growth beyond projections of the Strategy, or if regional lot supply is lower than expected.

In 2008, the former Growth Centres Commission reviewed the proposed West Dapto Release Area (WDRA) draft planning documents. The GCC concluded that forecast housing land supply in the IRS cannot be

delivered as expected due to implementation difficulties with the WDRA, and the significantly lower than anticipated supply of housing land to market in the Illawarra Region is now been recognised as a reality.

The GCC Review of the WDRA also recognised that there is merit in the early release of Calderwood in terms of creating a higher dwelling production rate and meeting State government policy to release as much land to the market as quickly as possible. Given the demonstrated shortfall in land supply in the Illawarra Region and the WDRA implementation difficulties highlighted in the GCC Report, the release of Calderwood for urban development now conforms to its strategic role under the IRS as a source of supply triggered by on-going delays in regional lot supply. The Calderwood Urban Development Project can deliver about 12% of the IRS' new dwelling target.

Changes in outlook arising from global, national and regional factors influencing investment and delivery certainty, housing supply and affordability and employment and economic development also add to the case for immediate commencement of the Calderwood Project.

1.2 CONCEPT PLAN

Delfin has developed a draft Concept Plan for the site, which delineates broadly the proposed land zones which will be put forward in the Part 3A application to DoP in early February/March 2010. This report provides a bushfire planning assessment of the draft Concept Plan (**Figure 2**). The Concept Plan provides a broad structure plan for the Calderwood Urban Development Site, and incorporates on-site ecological values (including remnant vegetation, riparian and aquatic habitat) into a network of green corridors which will see a combination of conservation, recreation and water sensitive urban design being developed as detailed design continues during implementation.

1.3 PLANNING PROCESS

In April 2008 the Minister for Planning issued terms of reference for the preparation of a Justification Report to address the implications of initiating the rezoning of Calderwood for urban development including associated staging, timing and infrastructure considerations.

In February 2009 the Minister for Planning considered a Preliminary Assessment Report for the Calderwood Urban Development Project that provided justification for the planning, assessment and delivery of the project to occur under Part 3A of the EP&A Act, having regard to the demonstrated contribution that the project will have to achieving State and regional planning objectives.

Subsequently, on the 16 April 2009, pursuant to Clause 6 of SEPP Major Development, the Minister for Planning formed the opinion that the Calderwood Urban Development Project constitutes a Major Project to be assessed and determined under Part 3A of the EP&A Act, and also authorised the submission of a Concept Plan for the site. In doing so, the Minister also formed the opinion that a State significant site (SSS) study be undertaken to determine whether to list the site as a State Significant site in Schedule 3 of SEPP Major Development.

The Part 3A process under the EP&A Act allows for the Calderwood Urban Development Project to be planned, assessed and delivered in an holistic manner, with a uniform set of planning provisions and determination by a single consent authority. Given the scale of the proposal, the Concept Plan and SSS listing provide the opportunity to identify and resolve key issues such as land use and urban form, development staging, infrastructure delivery and environmental management in an integrated and timely manner.

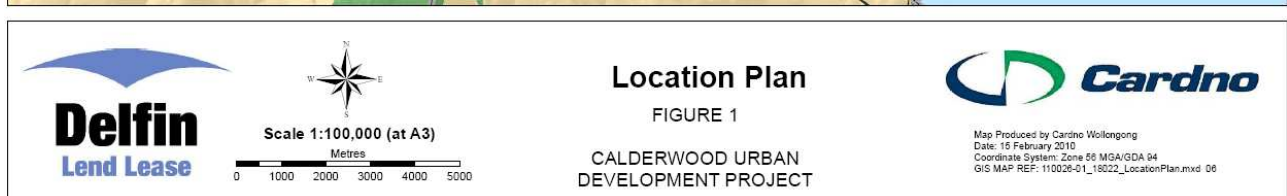
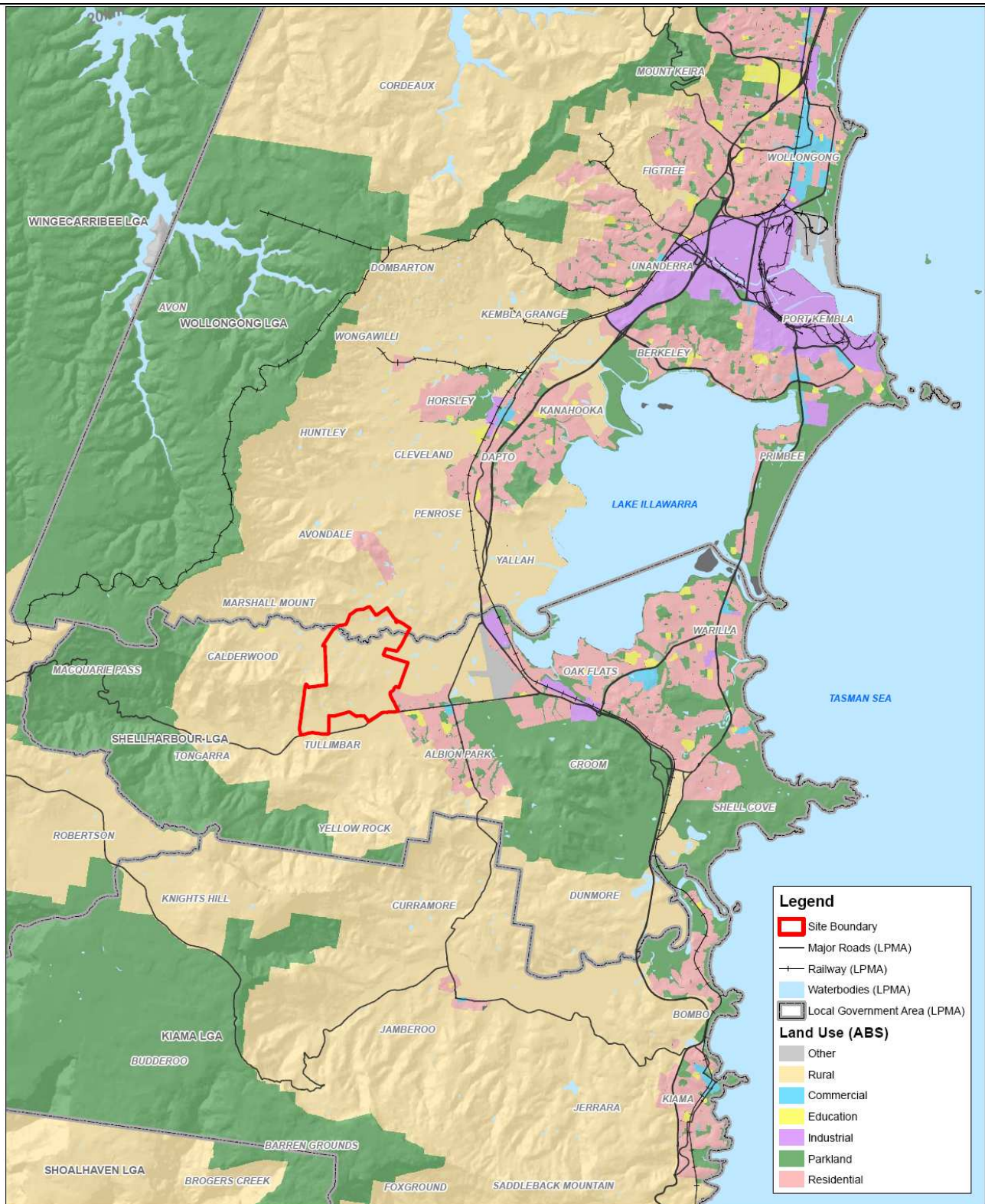


Figure 1: Location of Calderwood study area

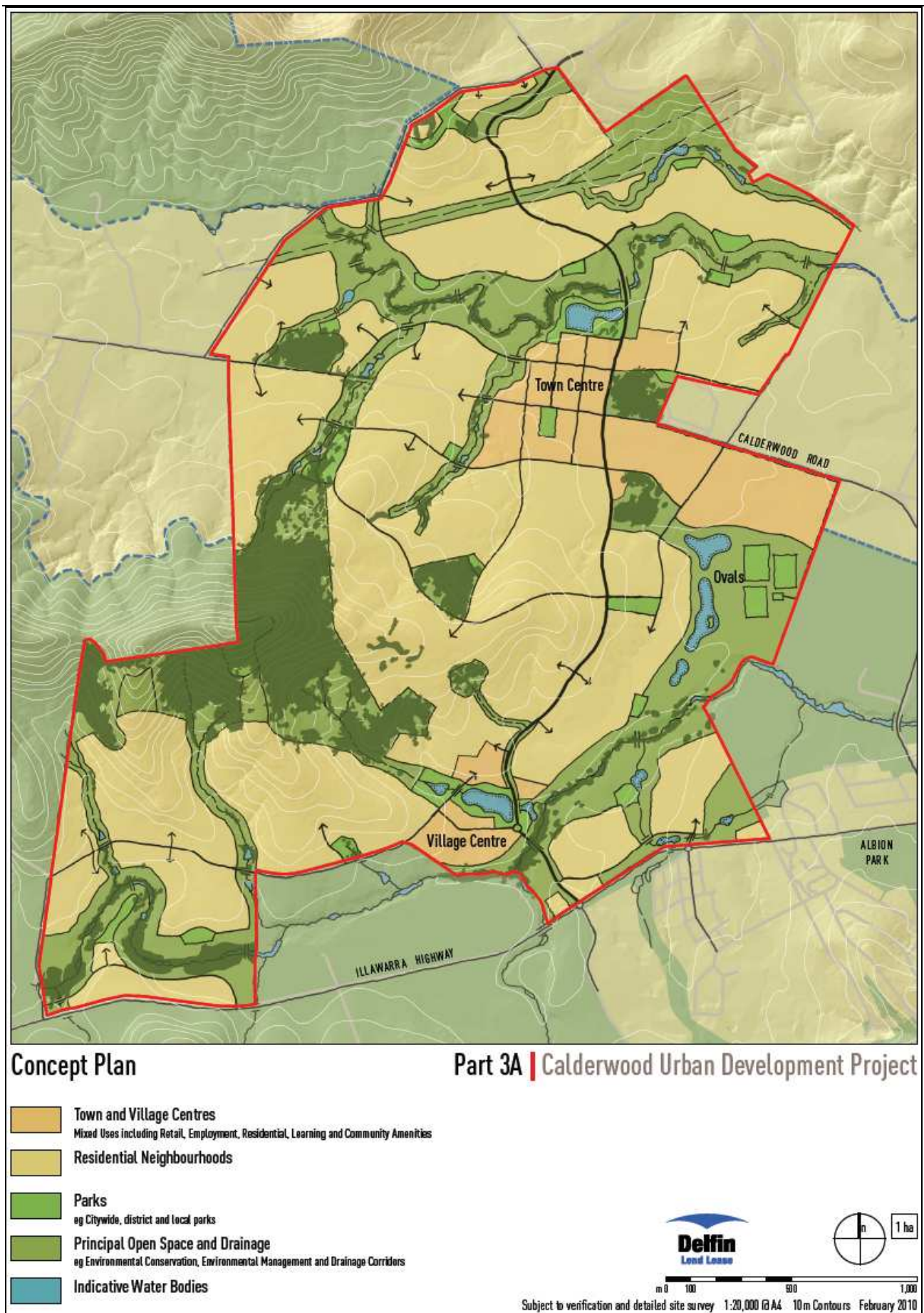


Figure 2: Concept Plan

1.4 REPORT REQUIREMENTS AND OBJECTIVES

This Bushfire Planning Assessment has been prepared to fulfill the Environmental Assessment Requirements issued by the Director General for the inclusion of the Calderwood site as a State Significant Site under SEPP Major Development, and for a Concept Plan approval for the development. Specifically, this Bushfire Planning Assessment addresses the following requirements:

‘Provide an assessment against Planning for Bush Fire Protection 2006. The EA is to identify the ongoing management arrangements of any proposed APZs.’

In accordance with the Director General’s Requirements this Bushfire Planning Assessment has been prepared following consultation with the NSW Rural Fire Service.

Wollongong City Council and Shellharbour City Council identify the study area as containing ‘bushfire prone land’ (refer to Figure 3). Development on bushfire prone land requires an assessment against the NSW Rural Fire Service (RFS) document ‘Planning for Bushfire Protection 2006’ (NSWRFS 2006), referred to as ‘PBP’ within this report.

Objectives of this study are to:

- Provide accurate and detailed information at a master plan scale for Asset Protection Zone (APZ) identification required at bushland interface locations and any internal bushland areas such as specific riparian and habitat corridors in accordance with PBP;
- Provide a guide on the requirements for access in bushfire prone areas which includes road layout, design and construction standards;
- Provide a guide on the requirements for services in bushfire prone areas which includes the provision of a reticulated water supply and the location and installation of hydrants, and electricity and gas;
- Provide detail necessary to assist in the preparation and execution of management and landscaping plans for the appropriate treatment of Asset Protection Zones (APZ) (whether they be in private holding or public reserve) such as roadways and open space; and
- Provide a planning document that can guide the assessment and approval of future subdivision applications through the relevant consent authority.

1.5 METHODOLOGY

This report demonstrates the objectives are achieved by following the methodology within PBP. An overview of the methodology is provided below:

- Literature review of previous work;
- Analysis of proposed Concept Plan;
- Detailed desk-top assessment of bushfire hazard and threat by analysis vegetation mapping and topography on GIS;
- Consultation with RFS;
- Field validation of hazard and threat;

- Formulation of bushfire protection measures such as APZs, access and roads, and the provision of water supply for fire fighting;
- Provision of bushfire protection measures to the Calderwood team as 'constraints' to be accommodated in the Concept Plan; and
- Input in Concept Plan iteration and design.

The assessment of bushfire protection was based on the Specific Objectives for each development type addressed within PBP (i.e. residential, Special Fire Protection Purpose, and employment), taking into account the Standards for Bushfire Protection Measures and compliance with the Acceptable Solutions of PBP.

2 Vegetation and slopes

This section details the environmental characteristics required to make informed decisions on the application of bushfire protection measures. The vegetation, ecological, topographical and land use data provided within this section was used to determine Asset Protection Zone location and dimension as required by the Acceptable Solutions within PBP 2006.

2.1 BUSHFIRE PRONE VEGETATION

The Wollongong and Shellharbour Bushfire Prone Land Maps covering the study area are shown in **Figure 3**. The maps show bushfire prone vegetation within the study area to be Johnstons Spur and three large stands of remnant vegetation in the Shellharbour LGA.

Whilst minor in potential impact, the vegetation that could act as a bushfire hazard is actually more widespread than mapped by the two Councils, and consists of remnant corridors within the riparian areas of Macquarie Rivulet and Marshall Mount Creek, some minor drainage lines and scattered trees amongst pasture.

2.2 VEGETATION TYPES AND COVERAGE

The bushfire hazard currently at the study area can be divided between four main types; Johnstons Spur, four larger stands of remnant vegetation, major riparian corridors of Macquarie Rivulet and Marshall Mount Creek, and scattered minor drainage lines and/or habitat corridors.

The predominant vegetation type within all four types of hazard present within the study area according to PBP (and Keith 2004) is 'Open Forest' (Dry Sclerophyll Forest - Shrub/grass Sub-formation). There are narrow formations of 'Forested Wetlands' along the creek channels and flood benches of the two major riparian corridors and small patches of 'Rainforest' along the sheltered southern slopes and gullies of Johnstons Spur. However these communities are considered to have a minor influence on bushfire threat through the study area and could not be categorised as 'predominant vegetation' in accordance with PBP.

In many instances, the smaller remnants and narrow drainage and habitat corridors mentioned above can be categorised as 'Low Hazard Vegetation' based on size (less than 1 hectare), width (less than 50 m) and isolation (100 m as a guide but can vary depending on orientation and available control points) from other nearby bushland. PBP assigns a predominant vegetation type of 'Rainforest' to 'Low Hazard Vegetation' as a surrogate for lower or limited fire behaviour within smaller remnant areas of bushland.

It is proposed to enhance and maintain the spatial pattern of vegetation as illustrated in the Concept Plan (**Figure 2**). The four types of hazard and categorisation noted above will still apply, but will be present within areas that are not currently displaying native vegetation. An example is the treatment of the two major riparian corridors and the linkages between the corridors and Johnstons Spur. It will be important for these linkages to be designed as to avoid/minimise the creation of additional bushfire hazard.

Development interface boundary locations and adjacent predominant vegetation types are listed within **Table 1** in Section 3.

2.3 SLOPES INFLUENCING FIRE BEHAVIOUR

The topography within and adjacent to the study area can be divided into three classes; the relatively flat coastal plain supporting the two major riparian corridors, the undulating mid-slopes, and the steeper slopes of the escarpment foothills. There is consequently the full range of slopes experienced within the study area and there are development interface locations that fall within all the PBP slopes classes of 'Upslope/Flat', 'Downslope >0°-5°', 'Downslope >5°-10°', 'Downslope >10°-15°', 'Downslope >15°-18°'.

There are some areas on Johnstons Spur that may exceed 18° proximate to the development interface that will require further assessment consideration at future stages. Providing an APZ on slopes greater than 18° or for bushland on slopes greater than 18° is not an Acceptable Solution under PBP. However, there is opportunity for the performance criteria to be achieved in both cases with careful planning. This can be confirmed at detailed design when development at the interface on Johnstons Spur is being considered.

Development interface boundary locations and the effective slopes are listed within **Table 1** in Section 3.

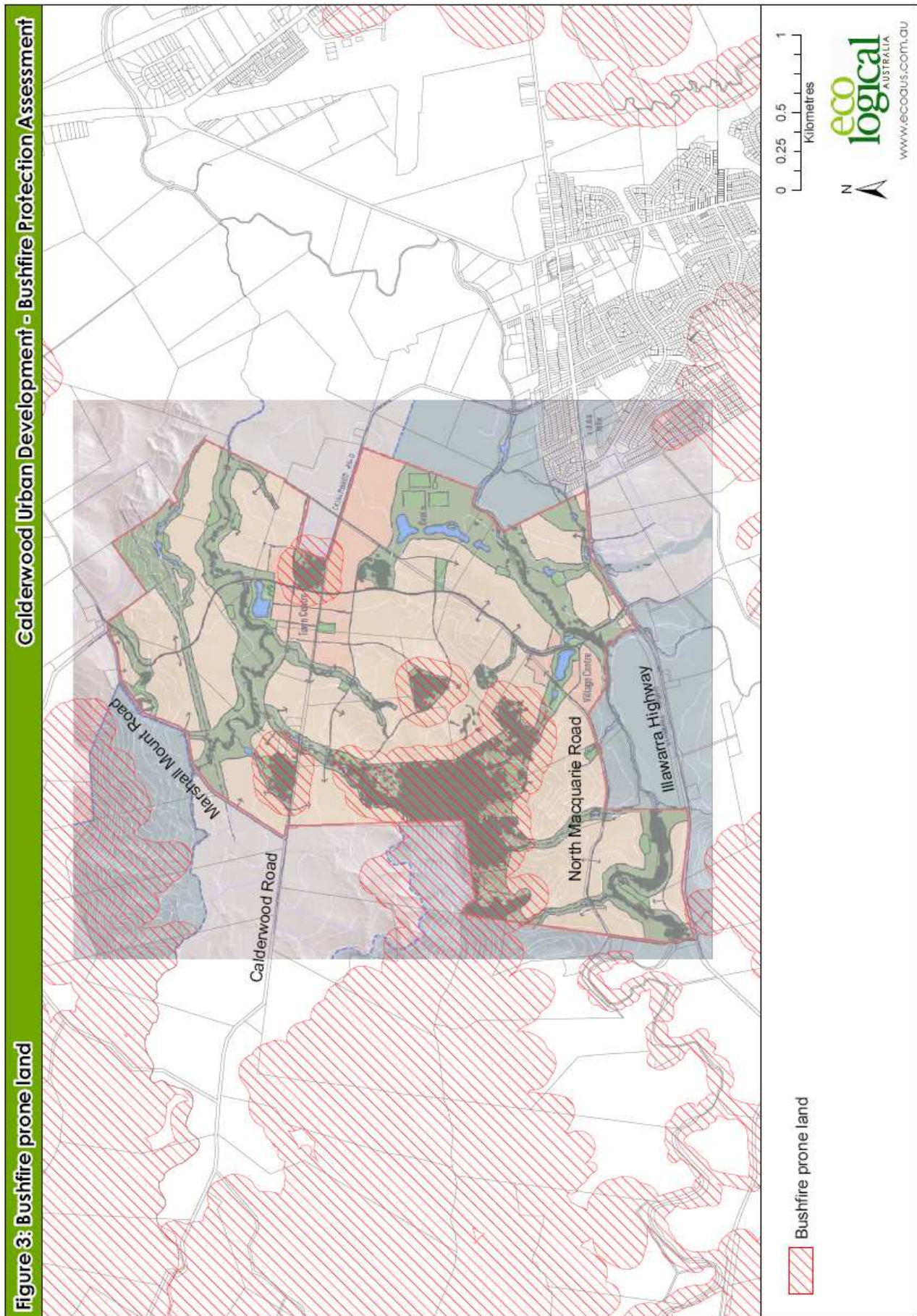


Figure 3: Wollongong and Shellharbour Bushfire Prone Land Maps

3 Bushfire protection measures

This section details the bushfire protection measures recommended for development within the study area required by the Acceptable Solutions of PBP. They are based on the Concept Plan (**Figure 2**) and the data presented in Section 2 and **Table 1** below.

The bushfire protection measures consist of Asset Protection Zones (APZ), building construction standards, access, and services (such as water supply).

3.1 ASSET PROTECTION ZONES (APZ)

This section outlines the location and minimum dimension of Asset Protection Zones (APZ) within the study area.

PBP identifies three groups or types of development, each requiring a different level of bushfire protection, hence requiring a different method of assessment and application of APZs:

- APZ for **residential subdivision** can be based on the Acceptable Solutions contained within Appendix 2, Table A2.4 of PBP;
- APZ for **Special Fire Protection Purpose Development (SFPP)** can be based on the Acceptable Solutions within Appendix 2, Table A2.6 of PBP; and
- APZ for **Class 5 to 8 and 10 buildings (such as commercial and industrial development)** is not specified within PBP, however the Aims and Objectives of PBP is to be satisfied. This includes an appropriate separation from the bushfire hazard in combination with an adequate construction standard to prevent ignition, and the provision of defensible space and adequate access.

As it is proposed to have predominantly housing at the bushland interface areas, this assessment focuses on the bushfire protection standard for residential subdivision, however the detail necessary for the planning of SFPP developments (such as schools and Seniors Living and retirement villages) and other developments (such as shopping centres and employment lands) is also included.

3.1.1 Residential subdivision

Residential subdivision means the subdivision of land for future housing and may include multi-housing developments such as townhouses.

Subdivision of bushfire prone land under Part 3A *Environmental Planning and Assessment Act 1979* requires consultation with the NSW Rural Fire Service based on an assessment of the proposal against PBP. After subdivision, applications for single dwellings will be assessed against PBP.

Appendix 2, Table A2.4 of PBP requires a minimum APZ ranging from 10 m for residential development adjacent 'Low Hazard Vegetation', to 60 m for residential development adjacent the steeper areas of Johnstons Spur. **Table 1** lists the development interface locations of the study area potentially affected by APZs and **Figure 4** maps their location.

3.1.2 Special Fire Protection Purpose (SFPP) developments

Special Fire Protection Purpose (SFPP) developments require a higher standard of bushfire protection due to the potential vulnerability of the occupants and the potential need for assisted evacuation. The *Rural Fires Act 1997* and *Rural Fires Regulation 2002* identify SFPP developments to include a:

- School;
- Child care centre;
- Hospital;
- Hotel, motel or other tourist accommodation;
- Building for mentally incapacitated persons;
- Housing for older people (SEPP Seniors Living) or disability (SEPP 5);
- Group homes (SEPP 9);
- Retirement village;
- Estates under SEPP 36;
- Employment areas solely for employees with disabilities;
- Respite care centres or similar; and
- Accommodation associated with an educational institution.

These types of developments are recognised under Section 100B of the *Rural Fires Act 1997* as integrated development, and therefore a development or project application is to be referred to the NSW Rural Fire Service head office for assessment against PBP and the issuing of a Bush Fire Safety Authority.

Appendix 2, Table A2.6 of PBP requires a minimum APZ ranging from 30 m for SFPP development adjacent 'Low Hazard Vegetation', to 100 m for SFPP development adjacent the steeper areas of Johnstons Spur. **Table 1** lists the development interface locations of the study area potentially affected by APZs and **Figure 4** maps their location.

3.1.3 Other development

The BCA does not provide for any bushfire specific performance requirements for non-habitable buildings such as Class 5, 6, 7, 8 and 10 buildings (which include offices, factories, warehouses and other commercial or industrial facilities), and as such APZs and building construction standards do not apply as a set of deemed to satisfy provisions. The general fire safety constructions provisions are taken as acceptable solutions, but the Aim and Objectives of PBP apply in relation to other matters such as access, water and services, emergency planning, and landscaping/vegetation management.

If the above types of development are proposed near the bushland interface, it is recommended that an APZ compliant with those recommended for residential subdivision are applied for the purpose of Concept Plan approval. A reduction of an APZ could be achieved later dependant on the desired development type/building.

3.1.4 APZ location

The location of APZs is indicated on **Figure 4** at known areas of bushland/development interface. The actual placement of the APZ will depend on the nature of the specific land use at that particular interface segment (also listed in **Table 1**) and does not necessarily need to be 'buffered' from the edge of the Principal Open Space 'green' area on the Concept Plan (**Figure 2**). For example, the 25 m APZ required for residential development adjacent either of the two major riparian corridors could be wholly placed within the outer zones of the corridor if they consist of areas of open space and the APZs do not compromise riparian and other objectives such as public access. Similarly, perimeter public road reserves and minimum building setbacks within lots can contribute to achieving the APZ. This is a detail to be resolved at the detailed design stage in future subdivision applications.

Table 1: APZ calculation, location and dimensions

Interface segment No.	Slope class of most influence ¹	Predominant vegetation community ²	Residential APZ ³	SFPP APZ ⁴	Comment
1 Major riparian corridors	Downslope >0 - 5°	Open Forest	25 m (OPA 10 m)	70 m (OPA 20 m)	<p>The two major riparian corridors of Macquarie Rivulet and Marshall Mount Creek are likely to have a future average corridor of vegetation greater than 50 m in width. If however the corridor of vegetation is less than 50m, then they may be treated as 'Low Hazard Vegetation' as interface segments No. 2 below.</p> <p>The effective slope is determined to be the slope over at least 100 m across slope in the upstream and downstream directions. The steeper and shorter sections measured perpendicular to the contours down stream banks are not considered the slope most significantly influencing fire behaviour.</p>
2 Minor drainage and habitat corridors	Downslope >0 - 5°	'Low Hazard Vegetation'	10 m (OPA not allowed)	40 m (OPA not allowed)	<p>The minor drainage lines and habitat corridors are likely to have a future average corridor of vegetation of less than 50 m in width. Corridors of vegetation less than 50 m in width may be categorised as 'Low Hazard Vegetation'.</p> <p>A downslope class of 0 - 5 degrees has been applied to all riparian corridors as the slope with most significant influence on slope affecting bushfire behaviour along the length of the remnant.</p>
3	Downslope >0 - 5°	Open Forest	25 m (OPA 10 m)	70 m (OPA 20 m)	These segments are outside of riparian and habitat corridors and are influenced by the presence of Open Forest and >0 - 5° downslopes.
4	Downslope >5 - 10°	Open Forest	35 m (OPA 15 m)	85 m (OPA 25 m)	These segments are outside of riparian and habitat corridors and are influenced by the presence of Open Forest and >5 - 10° downslopes.
5	Downslope >10 - 15°	Open Forest	50 m (OPA 25 m)	100 m (OPA 30 m)	These segments are outside of riparian and habitat corridors and are influenced by the presence of Open Forest and >10 - 15° downslopes.

Interface segment No.	Slope class of most influence ¹	Predominant vegetation community ²	Residential APZ ³	SFPP APZ ⁴	Comment
6	Downslope >15 - 18°	Open Forest	60 m (OPA 30 m)	100 m (OPA 25 m)	These segments are outside of riparian and habitat corridors and are influenced by the presence of Open Forest and >15 - 18° downslopes.
7	Upslope / Flat	Open Forest	20 m (OPA 10 m)	60 m (OPA 20 m)	These segments are outside of riparian and habitat corridors and are influenced by the presence of Open Forest and upslopes or flat land.
8	Variable	Unmanaged grassland	10 m (OPA not allowed)	10 m (OPA not allowed)	These segments are on the boundary of the study area and adjacent neighbouring rural lands. They are in areas where it cannot be determined whether neighbouring properties will maintain the management of the grassland through farming practices such as grazing.

¹ Slope class most significantly influencing fire behaviour where the vegetation (bushfire hazard) is found over 100 m from the development boundary.

² Predominant vegetation is the most predominant and problematic vegetation over 140 m from the development boundary.

³ PBP required setback for residential subdivision.

⁴ PBP required setback for Special Fire Protection Purpose (SFPP) development.

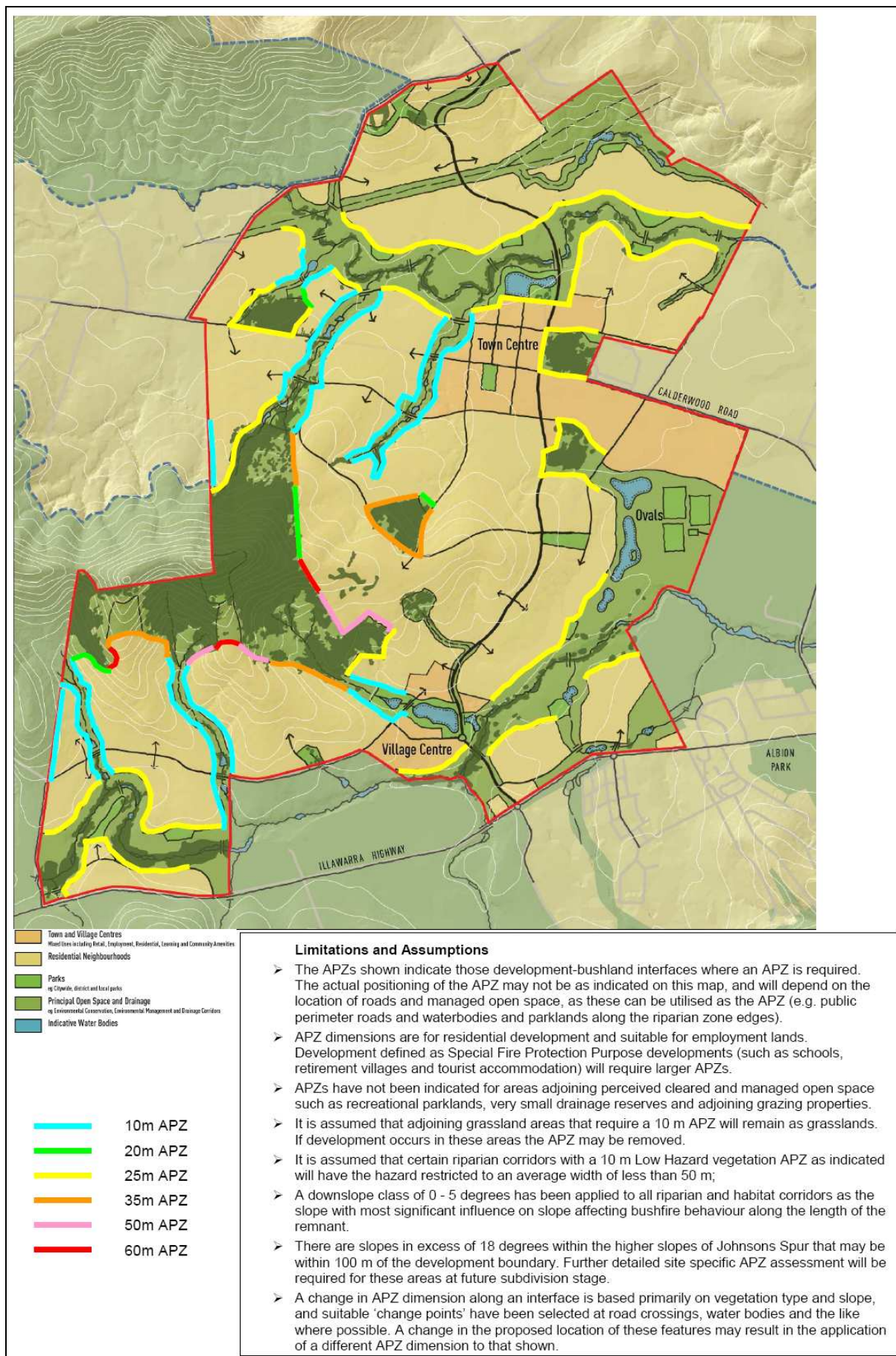


Figure 4: APZ locations and dimensions for Calderwood study area

3.1.5 APZ fuel management

The management of an APZ is to be considered in three ways: firstly, the separation of a building from the bushfire source; secondly, the provision of access or defendable space between the building (asset) and bushfire source; and thirdly, the continual maintenance of fuels within the APZ.

APZs can contain managed vegetation and can be utilised as areas of public open space, recreational areas such as sports grounds, access ways such as roads, and ancillary parts of development such as yards and car parks.

The APZ is to be measured from the edge of the unmanaged bushland to the most external building point of a building. Landscaping within the APZ may differ between the Outer Protection Area (OPA) and Inner Protection Area (IPA). The OPA is a relatively smaller portion of the total APZ and extends from the bushfire source towards the IPA, which is adjacent the building. The purpose of the OPA is to reduce the rate of spread of fire, and reduce the likelihood of crown fire whilst providing a slightly denser tree canopy than the IPA to filter embers. The IPA offers more protection for defendable space and managing heat intensities at the building. The dimension of the OPA depends on the type of development and effective slope. These dimensions are indicated for specific development interface locations in **Table 1**.

The following APZ fuel management specifications can be used as a guide and are deemed as the Acceptable Solutions for APZ management.

- No part of a building is to be within the APZ;
- Mature canopy trees may be within the OPA providing crowns and canopies (which may include small clumps of crowns or a single grove of trees) do not overlap and have an overall canopy cover of less than 30%;
- Mature canopy trees may be within the IPA providing crowns and canopies (e.g. a small clumps of crowns or a single grove of trees) are separated and have an overall canopy cover of less than 15%;
- Understorey saplings, shrubs and groundcovers within both the OPA and IPA are to be managed in the following manner:
 - The saplings provide a sparse scatter of individuals useful for the long-term replacement of canopy species typically retained within the APZ;
 - The saplings and shrubs are limited and well spread out so as not form a contiguous pathway from the bushfire source to a building; and
 - A minimal ground fuel is to be maintained to include either mown/slashed grass, mulch, managed groundcovers, organic matter, bare or sealed ground, providing the final groundcover does not exceed 4 tonnes per hectare of fine fuel (*i.e.* material less than 6 millimetres in diameter). The OPA may have up to 8 tonnes per hectare of fine fuel.

The management of an APZ can differ from that listed above so long as the performance requirements noted can be achieved. The placement and management of built landscaping structures and items within the APZ also requires consideration in accordance with PBP as there is the potential for structures to ignite and act as a lasting and significant radiant heat source after the passage of a fire front.

3.1.6 Perimeter access

The bushland/development interface areas may require perimeter access roads depending on the level of the bushfire threat. These roads should be in the form of a public perimeter roads, and can be in the form of a fire trails in lower threat circumstances or where particular development types and/or densities will allow.

Section 3.3 of this report provides further road design and construction information for perimeter roads and non-perimeter roads.

3.1.7 APZ management responsibility

The management responsibility of the APZ is to be designated to a responsible party whom can ensure the maintenance of the APZ in perpetuity. For the Calderwood study area, this will consist of:

- Individual allotment owners or managers (if leased) for those portions of the APZ within private residential allotments;
- Council where an APZ occurs within a road reserve, parkland or open space dedicated to that Council; and
- Delfin Lend Lease (or other land manager) where an APZ occurs within parkland, open space or a temporary APZ until such time that construction and landscaping is complete and the ownership/management of the land is transferred over to the relevant Council.

3.2 BUILDING CONSTRUCTION

The building construction standard for future buildings is based on the separation distance between the building and the bushfire source, and the vegetation type and slopes, as determined for the APZ. Using Table A3.3 within PBP, this information results in the determination of a 'Category of Bushfire Attack' potentially received by a building within 100 m of the bushfire source. The range of these categories is 'extreme', 'high', 'medium' and 'low'. These categories relate specifically to a level of building construction standard found in AS3959-1999 'Construction of Buildings in Bushfire-prone Areas' (Standards Australia 2000), being Level 3, Level 2, Level 1 and no requirement, respectively.

It is importance to note that AS3959-1999 has been revised to AS3959-2009 and expected to be adopted in NSW in May 2010. It is reasonable to assume that all future development with the study area will be subject to the new Standard (and any future revisions) which follows a similar methodology and provides a comparable outcome.

The assessment of building construction standard is undertaken at the development application stage for a particular building as aspects of the building, its location with respect to the bushfire hazard, the nature of the bushfire hazard, and surrounding development can alter the required level of construction.

3.3 ACCESS

It is recommended that public roads within the Calderwood study area achieve the Acceptable Solutions within PBP as listed in **Table 2** below. Any perimeter fire trails are also recommended to achieve the Acceptable Solutions for fire trails within PBP as listed in **Table 3** below. The performance criterion of the road system is to allow safe access for firefighters while residents are evacuating the area.

Table 2: Accepted solutions for public road design and construction in bushfire prone areas

PBP Public Roads Acceptable Solutions
<ul style="list-style-type: none"> Public roads are two-wheel drive, all weather roads Urban perimeter roads are two-way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb), allowing traffic to pass in opposite directions. Roads that are not perimeter roads can comply with the road widths within Table 4 below. The perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas. Traffic management devices are constructed to facilitate access by emergency services vehicles. Public roads have a cross fall not exceeding 3 degrees. Public roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard. Curves of roads (other than perimeter roads) are a minimum inner radius of six metres and minimal in number, to allow for rapid access and egress. The minimum distance between inner and outer curves is 6 metres. Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient. There is a minimum vertical clearance to a height of 4 metres above the road at all times. The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicated load rating. Public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression. Public roads between 6.5 metres and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression. Public roads up to 6.5 metres wide provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression. One way only public access roads are no less than 3.5 metres wide and provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression. Parking bays are a minimum of 2.6 metres wide from kerb to kerb edge to road pavement. No services or hydrants are located within the parking bays. Public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side.

Table 3: Accepted solutions for fire trail design and construction in bushfire prone areas

PBP Fire Trail Acceptable Solutions	
	<ul style="list-style-type: none"> A minimum carriage way width of four metres with an additional one metre strip each side of the trail (clear of bushes and long grass) is provided. The trail is a maximum grade of 15 degrees if sealed and not more than 10 degrees if unsealed. A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches is provided. The crossfall of the trail is not more than 10 degrees. The trail has the capacity for passing by reversing bays using the access to properties to reverse fire tankers, which are six metres wide and eight metres deep to any gates, with a inner minimum turning radius of six metres and outer minimum radius of 12 metres; and/or a passing bay every 200 metres, 20 metres long by three metres wide, making a minimum trafficable width of seven metres at the passing bay (Note: some short constrictions in the access may be accepted where they are not less than the minimum (3.5 m) and extend to no more than 30 m and where obstruction cannot be reasonably avoided or removed). The fire trail is accessible to firefighters and maintained in a serviceable condition by the owner of the land. Appropriate drainage and erosion controls are provided. The fire trail system is connected to the property access road and/or to the through road system at frequent intervals of 200 metres or less. Fire trails do not traverse a wetland or other land potentially subject to periodic inundation (other than a flood or storm surge). Gates for fire trails are provided and locked with a key/lock system authorised by the local RFS. Fire trail design does not adversely impact on natural hydrological flows. Fire trail design acts as an effective barrier to the spread of weeds and nutrients. Fire trail construction does not expose acid-sulphate soils.

Table 4: Minimum road widths for roads that are not perimeter roads

Curve radius (inside edge)	Swept path width	Single lane width	Two way width
< 40 m	3.5 m	4.5 m	8.0 m
40 – 69 m	3.0 m	3.9 m	7.5 m
70 – 100 m	2.7 m	3.6 m	6.9 m
> 100 m	2.5 m	3.5 m	6.5 m

3.4 SERVICES

3.4.1 Water supply

Reticulated water (e.g. hydrant spacing, sizing and pressures) is to be supplied throughout the development site in accordance with AS 2419-2005 'Fire hydrant installations – System design, installation and commissioning' (Standards Australia 2005). Hydrants are not to be located within any road carriageway and the provisions of parking and hydrant locations in the public road access **Table 2** above are to be met.

3.4.2 Electricity

Where practicable, electrical transmission lines at the bushland interface areas are to be underground. If above ground, they are to be installed with short pole spacing (e.g. 30 metres) and no part of a tree is closer to a powerline than the distance set out in accordance with the specifications in 'Vegetation Safety Clearances' issued by Energy Australia (NS179, April 2002).

3.4.3 Gas

Reticulated or bottled gas is installed and maintained in accordance with AS/NZS1596 'The Storage and Handling of LP Gas' (Standards Australia 2008) and the requirements of relevant authorities.

4 Summary and conclusion

This bushfire planning assessment has been prepared for the Calderwood Urban Development Project; a master planned community development by Delfin Lend Lease and subject to a Concept Plan Application under Part 3A of the *Environmental Planning & Assessment Act 1979* and a proposal for State significant site listing under Schedule 3 of *State Environmental Planning Policy Major Development 2005*.

The Calderwood Urban Development Project site is located within the Calderwood Valley in the Illawarra Region and the project proposes a mix of residential, employment, retail, education, conservation and open space uses.

This report provides a bushfire planning assessment of the draft Concept Plan under the provisions of the NSW Rural Fire Service guidelines 'Planning for Bushfire Protection 2006'. In strict accordance with 'Planning for Bushfire Protection 2006', the primary outcomes of the assessment include;

- An assessment of the bushfire hazard (predominant vegetation and effective slopes);
- Recommended Asset Protection Zones (APZs) for all bushland-development interface locations;
- Recommendations on the management of APZs;
- A guide on the minimum standards for safe access and egress which includes road layout, design and construction standards; and
- A guide on the requirements for services such as water supply for fire fighting.

In conclusion this report provides an assessment against 'Planning for Bushfire Protection 2006' as required fulfilling the Environmental Assessment Requirements issued by the Director General. In the authors' professional opinion the recommendations within this report will provide an appropriate standard of bushfire protection for the Calderwood Urban Development Project consistent with 'Planning for Bushfire Protection 2006'.



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