



Appin (Part) Precinct Plan  
Bushfire Strategic Study

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**Walker Corporation Pty Ltd**

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## DOCUMENT TRACKING

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<b>Project Number</b>	20SUT-16338
<b>Project Manager</b>	Deanne Hickey
<b>Prepared by</b>	Mick George / Deanne Hickey / Scott Chrystal
<b>Reviewed by</b>	Mick George (v1, v2) / Bruce Horkings (v3) / Nathan Kearnes (v4/5) Deanne Hickey (v6)
<b>Approved by</b>	Mick George (v1, v2) / Nathan Kearnes (v3, v4/5/6)
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Template 2.8.1

## Executive Summary

This study evaluated a planning proposal to facilitate rezoning of land owned by Walker Corporation Pty Ltd and other interested parties, located within the Appin Precinct of the Greater Macarthur Growth Area (the broader precinct), and referred to as the Appin (Part) Precinct (the precinct). The proposed rezoning relates primarily to land use zone changes for the purpose of urban development (i.e. low density and medium density residential) along with neighbourhood centres, schools, open space and infrastructure.

The planning proposal to facilitate future urban development within the Appin (Part) Precinct was assessed against the bushfire strategic planning requirements of *Planning for Bushfire Protection* (PBP). In undertaking this assessment, a Strategic Bushfire Study was prepared to comply with the requirements set out in Chapter 4 (*Strategic Planning*) of PBP. The Strategic Bushfire Study examined whether the Precinct Plan contemplated for the Appin (Part) Precinct is appropriate given its bushfire risk exposure context or whether it represents 'inappropriate development' as described by PBP.

The technical assessment compiled for this study considered the broader bushfire landscape and risk profile for the Appin (Part) Precinct, along with the feasibility for the provision of bushfire protection measures within the Precinct Plan. In consideration of the proposal with regard to the strategic planning principles of PBP, the landscape risk assessment included an assessment of the broader bushfire landscape, bushfire weather and potential fire behaviour, while the land use evaluation considered the appropriateness of future land uses and the ability for future development to comply with requirements set out in PBP.

A key outcome of this study is the identification that the precinct is not exposed to a significantly high bushfire risk. This has been determined on the basis that the risk posed by the bushfire hazard on lands adjoining the precinct is moderated by existing and increasing development, along with the discontinuity of the hazard and impedances to fire spread to and within the precinct. In addition, there is a lack of historical precedence of fire spread to and within the precinct, and the bushfire weather analysis demonstrates a reduced risk from the south and east, coupled with bushfire spread and intensity modelling that does not demonstrate an increased risk at a level that cannot be responded to by the provision of bushfire protection measures. In addition, the bushfire hazards that will be retained or rehabilitated on site are narrow, with convoluted fire pathways that limit the potential for external fires to penetrate into the precinct.

A key finding of this study which supports the capacity for urban development within the Precinct Plan, is the ample capacity to afford future development with bushfire protection measures that meet the requirements of PBP. In addition, due to the size of the precinct, much of the proposed urban development within the precinct will be situated outside of 'bush fire prone land', being located greater than 100 m from the hazard, thus outside the areas where bushfire protection measures are formally prescribed by PBP. This further indicates the lower risk context within the precinct.

Preliminary traffic modelling indicates there is capability for early offsite evacuation and stage planning recognises the need for activation to coincide with timings for the delivery of key transport infrastructure. However, given the (part) precinct is not considered to have a significantly high

bushfire risk context and a risk level that is diminishing with other developments occurring in the locality, in combination with the adequate capacity for bushfire protection measures to be provided, and that a large proportion of the precinct (including the broader precinct) will not be bush fire prone following development, it is not expected that large scale evacuation of the precinct in its entirety would be required. However, as an additional bushfire resilience measure, there is ample opportunity for on-site refuge, including for the provision of either built or open space neighbourhood safer places. This capacity allows for differing evacuation and refuge options to be provided to the community, which research into past bushfire incidents indicates is important, and specifically supports community resilience under rapid onset bushfire attack, where evacuation may be unable to be undertaken or unsafe.

As planning progresses, further consideration regarding the approach to hazard assessment in a small number of areas where the effective slope is greater than 20 degrees, should be agreed with the RFS. However, consideration of this matter is not uncommon in bushfire planning, and given the scale of the precinct, there is scope for this to be addressed as stage planning progresses.

The findings of this study in relation to the strategic planning principles of PBP indicate that rezoning within the precinct plan:

- Does not trigger the “inappropriate development” exclusion requirements of PBP;
- That the Acceptable Solution bushfire protection measures within PBP can be met by the future development contemplated and that there is opportunity for protection measures beyond the minimum compliance under PBP;
- Compliance with PBP is not reliant on the intervention/response by emergency services or hazard management on adjoining land;
- The rezoning proposal will not adversely impact the bushfire safety of occupants of nearby existing development and wherever possible, will actually lower the risk.

Given the above, the planning proposal is assessed as compliant with the strategic bushfire planning requirements of Chapter 4 of PBP.



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# 1. Introduction

## 1.1 The Appin Project

Greater Sydney's population is projected to grow to approximately 6.1 million by 2041 – over a million more people than currently live in the region.

The NSW Government has identified Growth Areas as major development areas that will assist in accommodating this growth. The Greater Macarthur Growth Area (**GMGA**) is one such growth area and is a logical extension of the urban form of south-west Sydney. The GMGA is divided into precincts. The Appin Precinct and North Appin Precincts (herein, the broader precinct) are the southernmost land release precincts of the GMGA. The goal is to deliver 21,000+ dwellings.

The land is to be rezoned and released for development to achieve this goal. A submission has been prepared by Walker Corporation Pty Limited and Walker Group Holdings Pty Limited (the **Proponent**) to rezone 1,378 hectares of land (**the site**) within the Appin Precinct from *RU2 Rural Landscape* to the following zones:

- Urban Development Zone
  - Zone 1 Urban Development (UD)
- Special Purposes Zone
  - Zone SP2 Infrastructure (SP2)
- Conservation Zone
  - Zone C2 Environmental Conservation (C2)

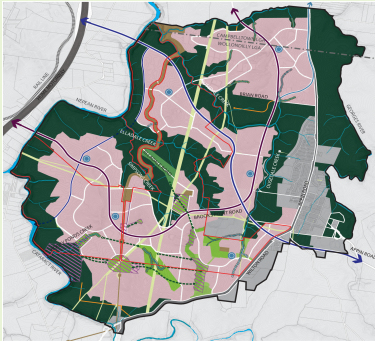
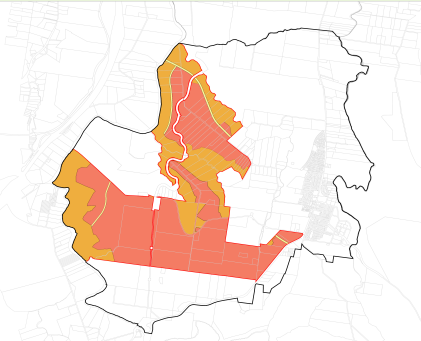
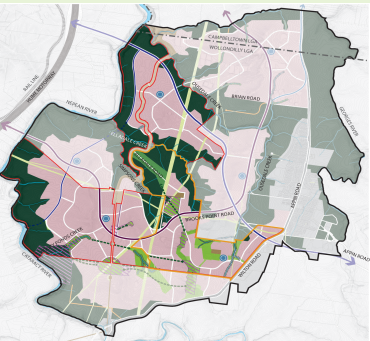
The zonings are shown on the Appin (Part) Precinct Plan (**the precinct plan**). 'The precinct plan' will be incorporated into the *State Environmental Planning Policy (Precincts – Western Parkland City) 2021* and contain the provisions (clauses and maps) that will apply to 'the site.' 'The precinct plan' envisages the delivery of 12,000+ new homes.

A structure plan has been prepared for the site and is shown on the Appin (Part) Precinct Structure Plan (**the structure plan**). It identifies staging and the first stage to be developed – Release Area 1. Release Area 1 is anticipated to deliver 3,500+ dwellings. This structure plan has been considered in a separate addendum report (ELA, 2022).

The submission is aligned with strategic land use planning, State and local government policies and infrastructure delivery. The development potential is tempered by a landscape-based approach that protects the environment and landscape values, shaping the character of new communities. A series of residential neighbourhoods are to be delivered within the landscape corridors of the Nepean and Cataract Rivers, supported by local amenities, transit corridors and community infrastructure.

The submission includes a hierarchy of plans. The plans and their purpose are summarised in Table 1.

**Table 1: Title and Purpose of Plans**

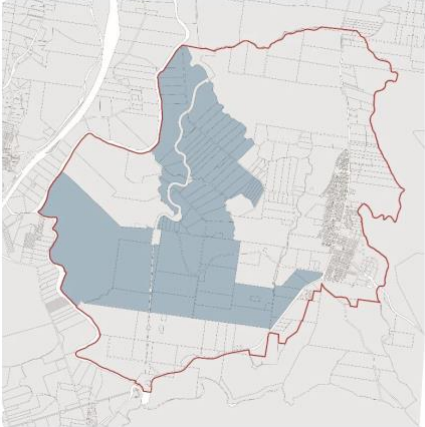
APPIN & NORTH APPIN PRECINCTS INDICATIVE PLAN	APPIN (PART) PRECINCT PLAN ( <i>THE PRECINCT PLAN</i> )	APPIN (PART) PRECINCT STRUCTURE PLAN ( <i>THE STRUCTURE PLAN</i> )
<p>Broader context and for information purposes only. It has no statutory weight. It identifies:</p>	<p>It shows the land proposed to be rezoned and incorporated into a new schedule in the Western Parkland City SEPP 2021.</p>	<p>Structure plan for the site, showing staging of release areas.</p>
<ul style="list-style-type: none"> <li>• Higher-order transport network</li> <li>• Centres hierarchy</li> <li>• School sites</li> <li>• Conservation areas</li> <li>• Residential areas</li> <li>• Cultural sites and connections</li> </ul>	<p>The precinct plan contains the development provisions (clauses and maps) applicable to the site and is used in assessing development applications.</p>	<p>Development is to be generally consistent with the structure plan. It illustrates land use components including (but not limited to):</p> <ul style="list-style-type: none"> <li>• Low and medium-density residential</li> <li>• Retail and employment centres</li> <li>• School</li> <li>• Open space</li> <li>• Drainage network/basins</li> <li>• Transport network</li> </ul>
		
(21,000+ dwellings)	(12,000+ dwellings)	(12,000+ dwellings) (inc. Release Area 1 - 3,500+ dwellings)

Eco Logical Australia Pty Ltd (ELA) have been engaged by the Proponent to prepare a Strategic Bushfire Study to support the Appin (Part) Precinct Plan (**the precinct plan**) and Appin (Part) Precinct Structure Plan (**the structure plan**), with the latter study presented as a separate addendum report (ELA, 2022).

The precinct and structure plan boundaries are Wilton Road to the east, the Nepean River to the west and Ousedale Creek to the north. Refer to Figure 1 and Table 1 for key attributes of the precinct plan and structure plan area.

The Appin (Part) Precinct Plan zones land for conservation, urban development and infrastructure and establishes the statutory planning framework permitting the delivery of a range of residential typologies, retail, education, business premises, recreation areas, and infrastructure services and provides development standards that development must fulfil. Within the proposed urban development zone, 12,000+ dwellings can be delivered (Table 2).

**Table 2: Appin (Part) Precinct – summary of key attributes**

Location	Key Attributes	
	Area	Total - 1,378 ha Walker – 1,248ha Private Ownership – 94ha
	LGA	Primarily Wollondilly LGA
	Proposed Dwellings	12,000+
	Proposed Population	36,000+

The objective of this study is to review the Walker proposal in relation to the strategic planning requirements of PBP. The key aim is to undertake a Strategic Bushfire Study as per the strategic planning principles, ‘inappropriate development’ exclusions and assessment considerations outlined in PBP. The assessment framework guiding this study is outlined in Section 1.5 below.

This study provides assessment of the planning proposal in regard to the strategic planning principles outlined in *Planning for Bushfire Protection (PBP) 2019* (NSW RFS, 2019). This is the first step in the planning pathway, which follows an iterative process, incorporating discussion with key stakeholders via the Technical Assurance Panel (TAP). As the proposal progresses to the development application (DA) stage, detailed design will be finalised.

### 1.2 Study Area

The precinct (Figure 2) is approximately 70 km south-west of the Sydney CBD and 42 km northwest of Wollongong. Appin Village is situated to the east of the precinct boundary and the Nepean River to the west. Douglas Park is located further west and further urban development is contemplated here, with proposed employment lands situated to the north west. The broader precinct joins the planned Gilead precinct to the north, with urban development already commenced. The Campbelltown CBD is situated 16 km to the north. The Wilton growth area is located south of the precinct, with further urban development also contemplated here. The south-eastern and eastern boundaries are adjacent to catchment lands and conservation reserves managed by WaterNSW and NSW National Parks and Wildlife Service . The study area for this assessment is identified in Figure 2.

The area proposed for development, as per the *Greater Macarthur 2040 Plan* (Figure 3), is currently dominated by a rural landscape, with grassland primarily modified for pastoral pursuits. Remnant vegetation within the precinct is generally located within the riparian corridors of the Nepean River to the west, and its tributaries including the Simpson and Elladale Creeks, which separate the northern and southern areas of the precinct.

The focus of this study is the developable area associated with the Walker Corporation Lands (Appin (Part) Precinct, herein referred as the precinct), and includes the following land parcels detailed in

Table 1. These parcels encompass Stage 1, Stage 2, Stage 3 and Stage 4 as per the Staging Plan (Figure 4). With Stages 2a, 3a and 4a not considered in the Walker Lands proposal. For the purpose of this study, the propose urban land within the Walker land parcels is considered the Subject Land.

Once fully activated, the broader precinct will be home to eight planned neighbourhoods housing upward of 20,000 homes (Figure 1), enabled through the vast size of the proposal area, roughly 6 km north to south and over 5 km east to west. Along with residential development, the planned neighborhoods will contain local centers, that support the provision of schools, community facilities and commercial development. As a result of proposed and future development within the precinct, and adjoining lands (South Gilead, Gilead, Menangle, Wilton, Douglas Park), the current rural dominated landscape will be significantly transformed as shown in Figure 1 to an urban dominated landscape.

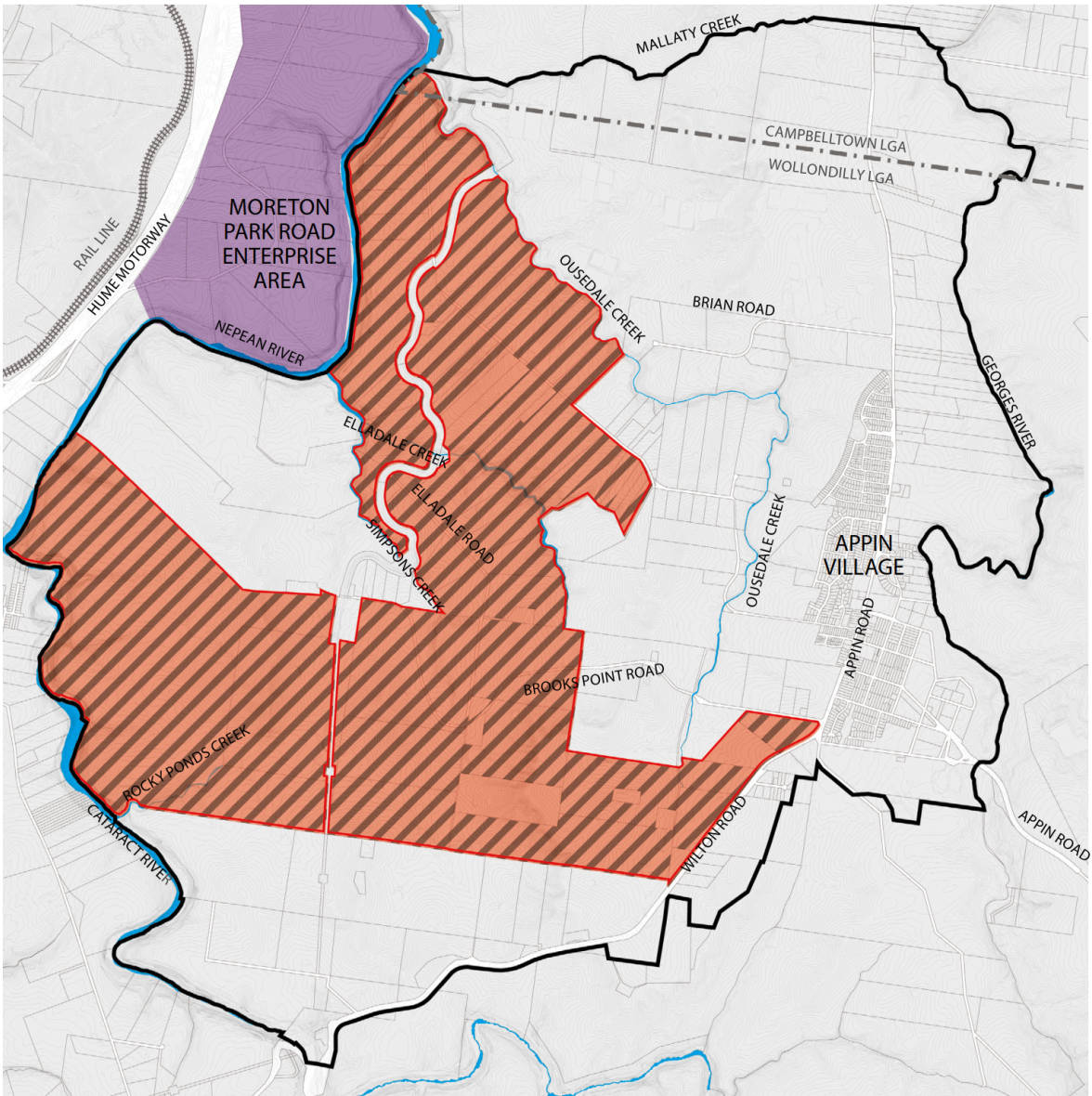
**Table 3: Land parcels within the Walker Corporation Lands**

DP	Lot	DP	Lot	DP	Lot
DP1064019	60, 62	DP563605	9	DP248044	1 to 5
DP557763	6	DP572558	22, 23	DP 32421	1
DP819476	201, 203	DP57337	1	DP 816238	1
DP825014	1 to 5	DP249286	2,4	DP816862	21
DP850925	60	DP752012	26, 28	DP245396	3 to 12
DP123069	9	DP790844	100	DP816861	1
DP209113	2,3,6	DP808057	2	DP242574	21 to 26
DP239247	2,3,5	DP816859	41		

### 1.3 Bushfire Prone Land Status

The Subject Land is currently mapped as bushfire prone land on the Wollondilly Shire Council Bush Fire Prone Land (BFPL) map as published by the Department of Planning and Environment (DPE) on the NSW planning portal (DPE, 2022).





**LEGEND:**

- Appin & North Appin Precincts Boundary
- Appin (Part) Precinct Boundary
- LGA Boundary
- Existing Waterways
- Appin (Part) Precinct
- Walker Land Ownership
- Moreton Park Road Enterprise Area

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**APPIN (PART) PRECINCT**

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Figure 1: Boundary of Appin (Part) Precinct Plan



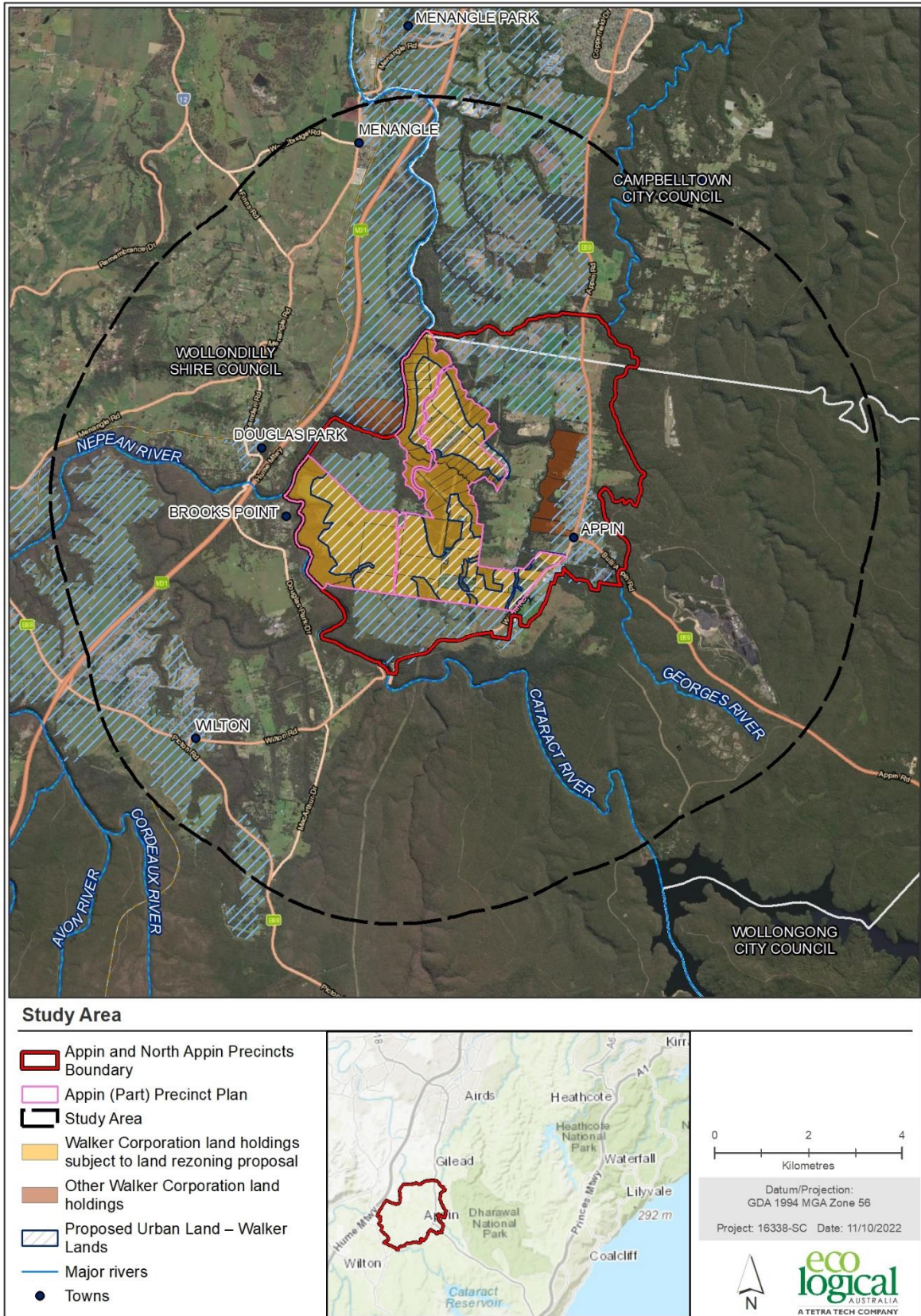


Figure 2: Study area



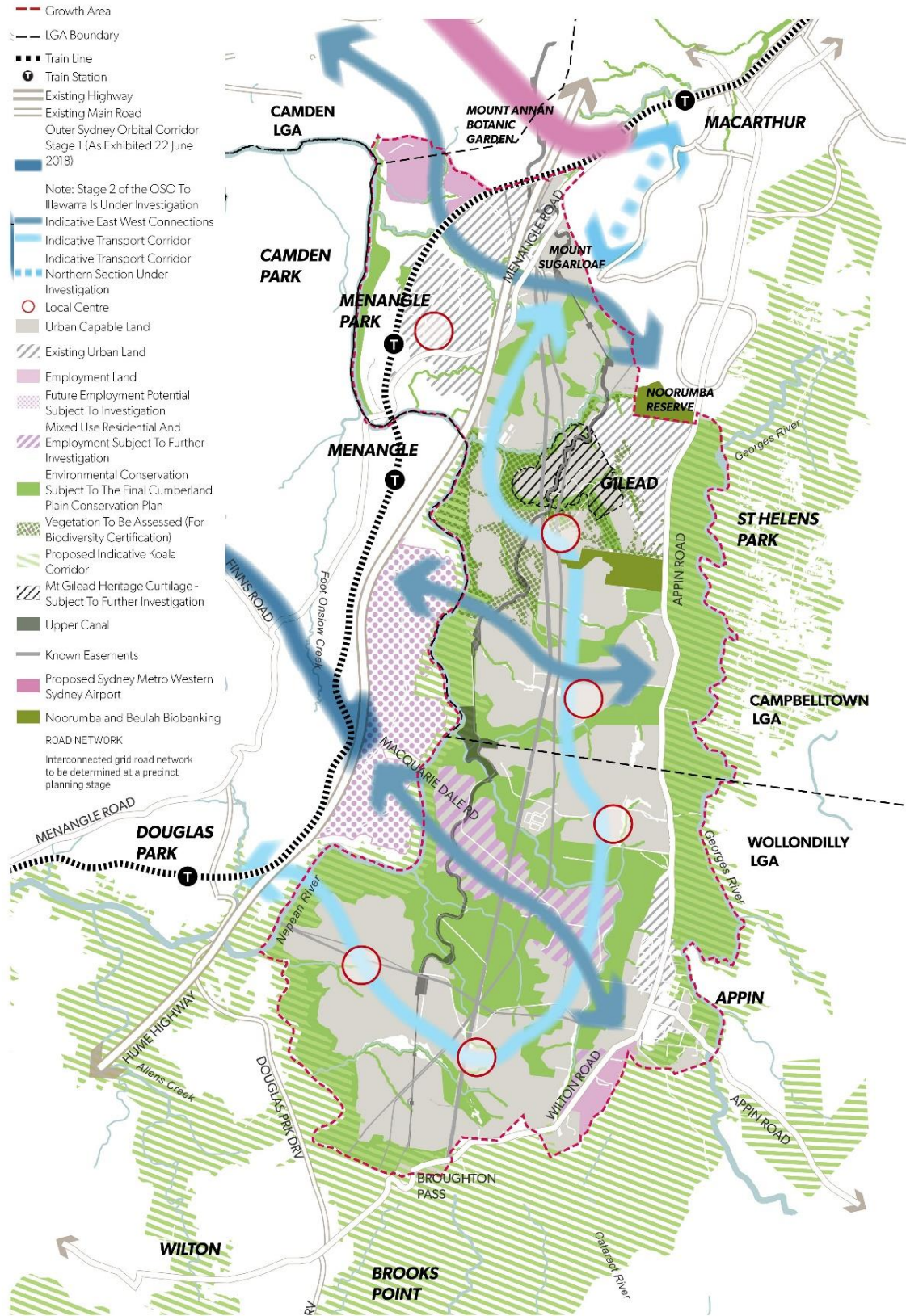
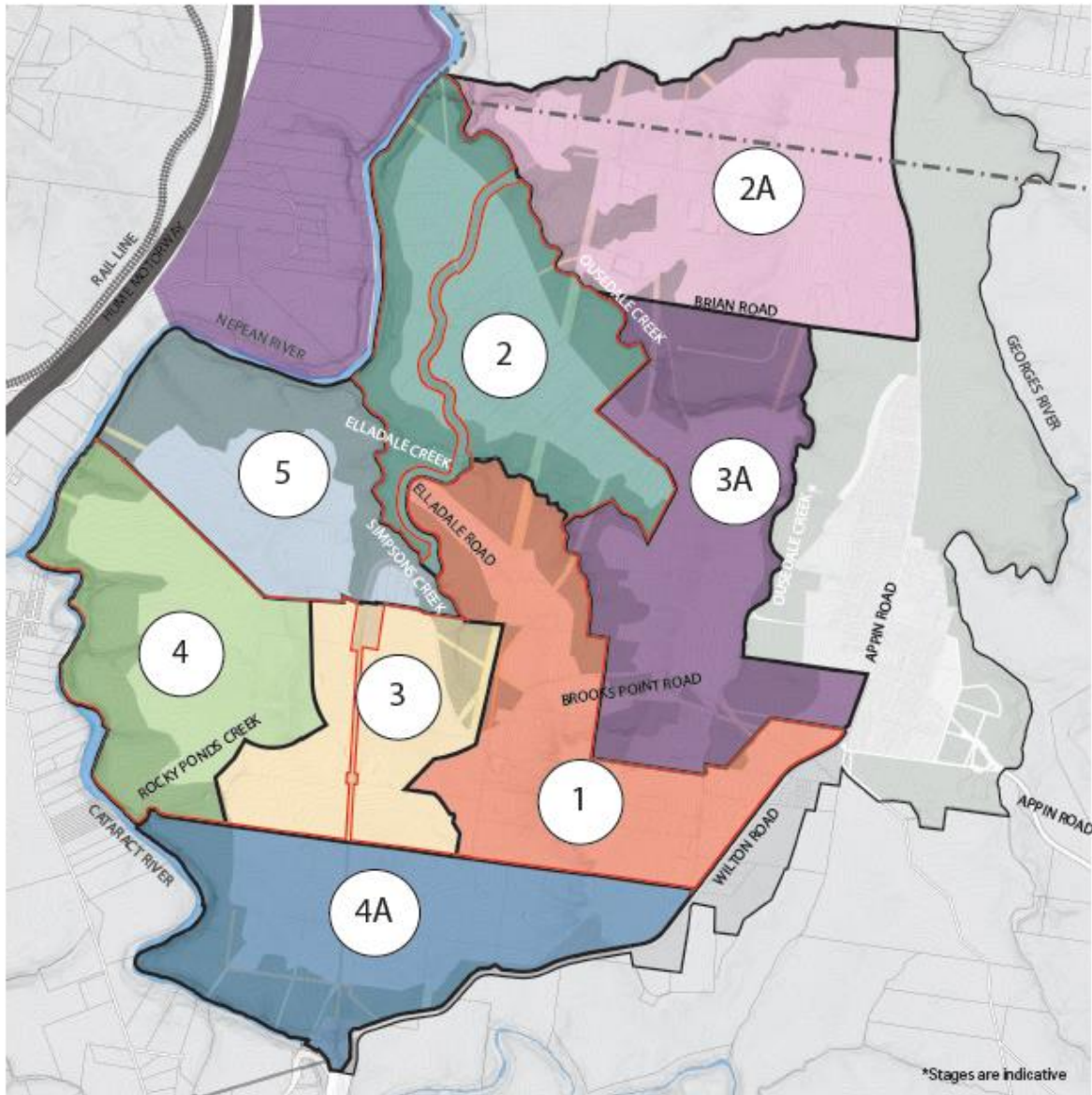


Figure 3: Greater Macarthur Growth Area (DPIE, 2018)



**LEGEND:**

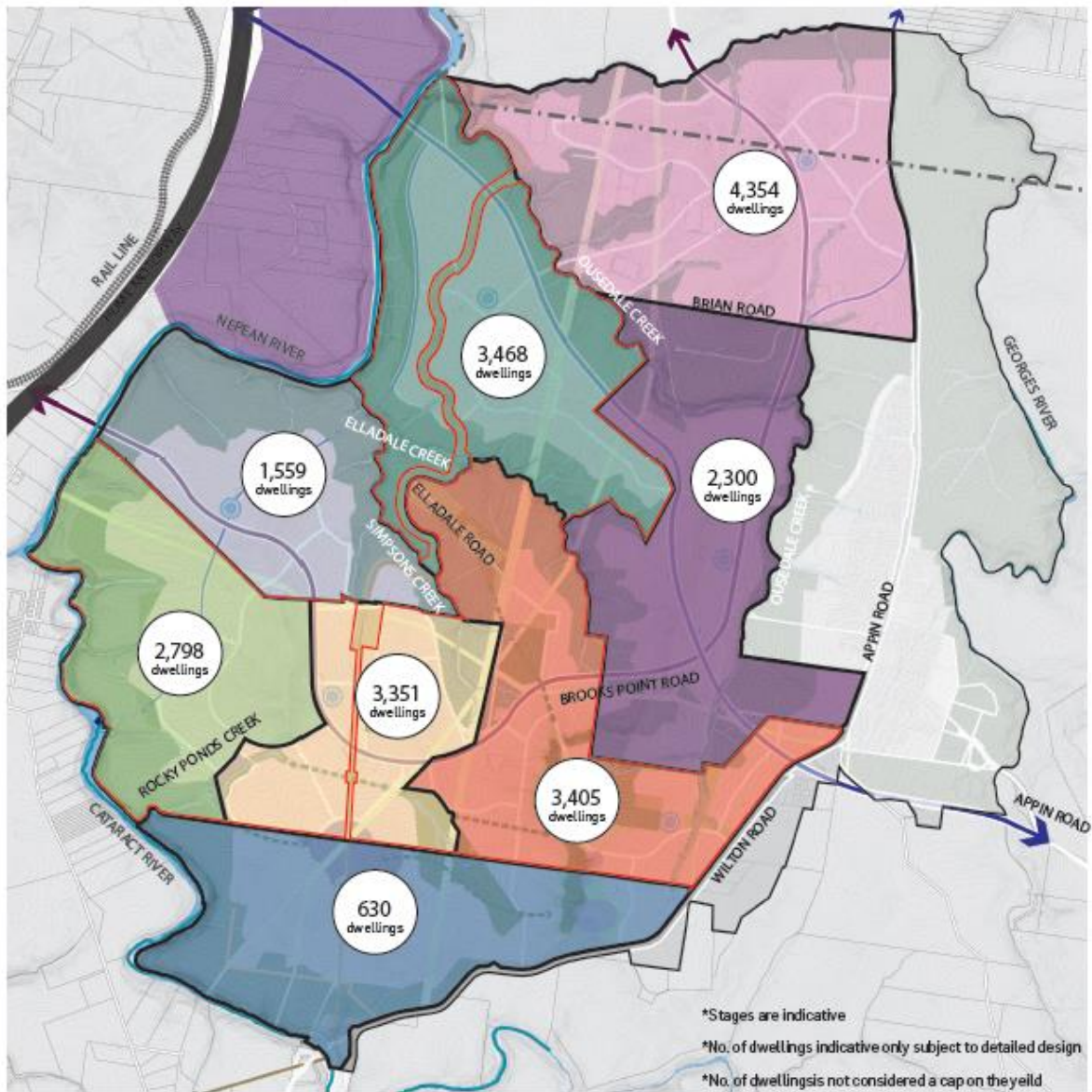
- Appin and North Appin Precincts Boundary
- Existing Rivers
- Stage 1 Area
- Stage 2 Area
- Stage 2A Area
- Stage 3 Area
- Stage 3A Area
- Stage 4 Area
- Stage 4A Area
- Stage 5 Area
- Future Employment Zone

**APPIN AND NORTH APPIN PRECINCTS - STAGING PLAN**

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Figure 4: Appin Staging Plan (Source: Walker Corporation 2022)





**LEGEND:**

- Appin and North Appin Precincts Boundary
- Existing Rivers
- Stage 1 Area
- Stage 2 Area
- Stage 2A Area
- Stage 3 Area
- Stage 3A Area
- Stage 4 Area
- Stage 4A Area
- Stage 5 Area
- Future Employment Zone

**APPIN AND NORTH APPIN PRECINCTS - ESTIMATED DWELLINGS**

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Figure 5: Estimated Dwellings (source: Walker Corporation, 2022)

## 1.4 Legislative Framework

Under the Ministerial Direction 4.3 (Planning for Bushfire Protection) issued under Section 9.1 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), where a proposal includes or is in close proximity to BFPL, the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service (RFS). Therefore, the assessment detailed in this study seeks to outline how the proposal can adhere to the requirements of PBP. The legislative framework guiding the assessment of bushfire risk and the application of bushfire protection measures at the strategic level, includes the NSW *EP&A Act* and the *Rural Fires Act 1997* (RF Act). Key aspects of these instruments are outlined below.

### 1.4.1 NSW Environmental Planning and Assessment Act (1979)

The NSW *EP&A Act* is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments are integrated with the *EP&A Act*, including the *RF Act*. Section 10.3 of the *EP&A Act* requires the identification of BFPL and development of BFPL maps, which act as a trigger for bushfire assessment provisions for strategic planning and development. When investigating the capability of BFPL in relation to Appin, consent authorities must have regard to 9.1 (2) Direction 4.3 – ‘Planning for Bushfire Protection’ of the *EP&A Act*. The objectives of Direction 4.3 are:

- *To protect life, property and the environment from bushfire hazards, by discouraging the establishment of incompatible land uses in bushfire prone areas; and*
- *To encourage sound management of bushfire prone areas.*

Direction 4.3 instructs the consent authority on the bushfire matters which need to be addressed with respect to master planning. This includes:

- Consultation with the Commissioner of the NSW RFS and consideration to any comments made;
- Regard to requirements of PBP; and
- Compliance with numerous bushfire protection provisions where development is proposed.

Further, there are various provisions within the *EP&A Act* that may be applicable to proposals on BFPL, as outlined below:

- Division 3.3 (3.29) of the *EP&A Act* relates to the development of State Environmental Planning Policies (SEPPs) and within these policies, bushfire considerations may apply for example:
  - Codes SEPP (Exempt and Complying Development Codes)
    - Clause 3.4 (2) specifies complying development standards that prescribe compliance with PBP.
  - Housing SEPP
    - Clause 57 related to complying development specifies complying development standards that prescribe compliance with PBP and must not be carried out on land that within BAL-40 or flame zone.

- Clause 96 states *A consent authority must not consent to development under this Part on bush fire prone land unless the consent authority is satisfied the development complies with the requirements of Planning for Bushfire Protection.*
- 
- o Transport and Infrastructure SEPP
  - Clause 2.16 requires consideration to PBP for development on BFPL
- Section 4.14 relates to infill and other development.
  - o Requires that all development on BFPL conforms to the specifications and requirements outlined in PBP, i.e., the specific requirements for residential infill in Chapter 7; and
  - o The consent authority should be satisfied that the development conforms to PBP, or otherwise consult with the RFS Commissioner.
- Section 4.46 relates to integrated development and triggers Section 100B of the *RF Act* and Clause 45 to 47 of the *Rural Fires Regulation 2022* (RF Reg):
  - o Applicable to subdivision, with specific requirements in Chapter 5 of PBP.
  - o Applicable to SFPP developments, with specific requirements in Chapter 6 of PBP; and
  - o Requires a bushfire safety authority under Section 100b of the *RF Act*.
- Section 3.1 relates to strategic or local planning.
  - o Applicable to land use planning that covers large areas and may include a variety of land uses and longer-term development objectives. Specific requirements are outlined in chapter 4 of PBP.

#### 1.4.2 Rural Fires Act 1997 (RF Act)

The *RF Act* is integrated into the *EP&A Act* and triggered by Section 4.46 as outlined above. The key objectives of the *RF Act* are to provide for the:

- *Prevention, mitigation and suppression of bush and other fires;*
- *Co-ordination of bushfire fighting and bush fire prevention;*
- *Protection of persons from injury or death, and property from damage, arising from fires;*
- *Protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires; and*

Protection of the environment by requiring certain activities to be carried out having regard to the principles of ecologically sustainable development.

### 1.5 Existing Bushfire Studies

Existing bushfire studies have been undertaken for the Region, most recently the Greater Macarthur Strategic Bushfire Study prepared for the Department of Planning and Environment (DPE) (ELA, 2021a). Further studies within the Wilton growth area have also been undertaken for the DPE (ELA, 2018).

### 1.6 Assessment Approach

Section 9.1 (2) of the *EP&A Act* triggers consideration of PBP for strategic planning. Chapter 4 of PBP contains strategic planning principles, ‘inappropriate development’ exclusions and assessment considerations required for strategic Appin. Chapter 4 of PBP prescribes the completion of a Strategic

Bushfire Study, which provides the opportunity to assess whether proposed land uses associated with master planning are appropriate in the bushfire risk context. It also provides the ability to assess the strategic implications of future development for bushfire mitigation and management.

The strategic planning principles of PBP are:

- *Ensuring land is suitable for development in the context of bushfire risk;*
- *Ensuring new development on BFPL will comply with PBP;*
- *Minimising reliance on performance-based solutions;*
- *Providing adequate infrastructure associated with emergency evacuation and firefighting operations; and*
- *Facilitating appropriate ongoing land management practices.*

These principles trigger the consideration of bushfire protection measures at the strategic planning stage, to provide an opportunity to consider the suitability of future land uses within the broader bushfire risk setting and that future land uses can meet the aim and objectives of PBP outlined below:

*The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bushfire, while having due regard to development potential, site characteristics and protection of the environment.*

*The objectives are to:*

- i afford buildings and their occupants protection from exposure to a bushfire;*
- ii provide for a defendable space to be located around buildings;*
- iii provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;*
- iv ensure that appropriate operational access and egress for emergency service personnel and residents is available;*
- v provide for ongoing management and maintenance of bushfire protection measures; and*
- vi ensure that utility services are adequate to meet the needs of firefighters.*

In addition, Chapter 4 of PBP prescribes that strategic planning should exclude 'inappropriate development' in bushfire prone areas, where:

- *the development area is exposed to a high bushfire risk and should be avoided;*
- *the development is likely to be difficult to evacuate during a bushfire due to its siting in the landscape, access limitations, fire history and/or size and scale;*
- *the development will adversely affect other bushfire protection strategies or place existing development at increased risk;*
- *the development is within an area of high bushfire risk where density of existing development may cause evacuation issues for both existing and new occupants; and*
- *the development has environmental constraints to the area which cannot be overcome.*

This study therefore assesses the precinct plan in the context of the PBP strategic planning principles, 'inappropriate development' exclusions as well as the assessment considerations identified in Table 4.2.1 of PBP, summarised in Table 4 below.

**Table 4: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019)**

Issue	Summary of Assessment Considerations
Bushfire landscape assessment	A bushfire landscape assessment considers the likelihood of a bushfire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.
Land use assessment	The land use assessment will identify the most appropriate locations within the master plan area or site layout for the proposed uses.
Access and egress	A study of the existing and proposed road networks both within and external to the Appin/master plan area and site layout.
Emergency services	An assessment of the future impact of the new development on emergency services provision.
Infrastructure	An assessment of the issues associated with infrastructure provision.
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bushfire management.

### 1.6.1 Assessment Framework

Precinct planning is the first step in the planning process to facilitate differing land use activities and future development across the site. It presents a plan that enables a variety of topologies facilitating a mixture of residential uses, commercial and enterprise development, infrastructure, open space, public recreation, and conservation.

Future land uses considered within the precinct would be subject to various aspects of PBP, when occurring on BFPL. Table 5 below outlines key PBP considerations for a variety of land uses and associated facilities that future development may be subject to.

**Table 5: PBP Considerations for future land uses**

Future Land Use	Associated Facilities and/or Activities	Key PBP Considerations for future development
Residential Land Use		
Low Density Residential	Low density residential dwellings	Chapter 5 of PBP outlines the bushfire protection requirements for residential subdivision, including performance criteria identified for APZs, access and infrastructure.
Special Fire Protection Purpose	Independent Living and Aged Care Childcare facilities, Hospitals Education facilities	Chapter 6 of PBP outlines the bushfire protection requirements for this type of development, including performance criteria identified for APZs, access and infrastructure.
Non-Residential Land Use		
Commercial	Retail and specialised retail including food services	Section 8.3.10 of PBP (Commercial and Industrial Development) applies to this type of development. Relevant protection measures to meet the aim and objectives of PBP.



Future Land Use	Associated Facilities and/or Activities	Key PBP Considerations for future development
Public Assembly Buildings	Buildings used for public assembly with a floor space area of greater than 500m <sup>2</sup>	Section 8.3.11 (Public Assembly Buildings) applies to this type of development. Relevant developments will be treated as SFPP

Investigation of the suitability for development within an area of interest, involves a complex and large array of bushfire-related issues and concepts. Prioritisation of first principle bushfire risk considerations is critical. Therefore, the following bushfire assessment framework will guide this study.

*1.6.1.1 Residual risk*

All BFPL poses a bushfire risk. Complete removal of bushfire risk is not appropriate or possible in many instances, nor is it a policy setting under PBP. Determining whether the level of residual risk (i.e., the level of risk after application of bushfire protection measures) is a key factor in the strategic assessment of whether a development proposal is appropriate.

Provided the risk exposure is appropriately reduced, development can occur with an appropriate level of safety on BFPL. PBP outlines the measures to achieve bushfire risk reduction generally and establishes the NSW policy setting for appropriate bushfire protection. Experience and research have successfully demonstrated appropriate bushfire protection is feasible within a very wide range of bushfire risk situations. Nevertheless, development on BFPL always has a residual bushfire risk e.g., from burning debris or for offsite evacuation, regardless of the initial risk level and risk treatments. This SBS acknowledges that the outcome of any potential development on BFPL resulting from the precinct plan includes a level of residual risk and explores the acceptability of that risk.

*1.6.1.2 Risk to life versus risk to property*

A lower residual risk is required for the protection of life than that required for the protection of built assets, due to the vulnerability of people exposed to bushfire attack and the pre-eminent value assigned to human life. Assessment of the residual risk has therefore considered life and property risks separately, in the first instance.

*1.6.1.3 Life protection and evacuation*

An appropriately low residual risk to human life is fundamentally important in bushfire protection. Whilst offsite evacuation potentially offers a safer destination, the risks associated with undertaking offsite evacuation (e.g., travel during an emergency) can pose additional risks. Also, the logistical challenges of offsite evacuation can be high and should not become an unacceptable burden on emergency services, and in a strategic planning context, should not adversely impact the demands of the existing emergency service evacuation management.

Early offsite evacuation is the nationally accepted safest means for protection of life and for offsite evacuation to be effective, it should not require the assistance of emergency services. Notwithstanding that early unassisted offsite evacuation is a key risk assessment benchmark in this SBS; experience and research has demonstrated that it is not fail-safe or always feasible. Research and post incident inquiries have also found that providing evacuees options (along with warnings and information) is important to their survival.

Alternative options such as onsite refuge and 'shelter-in-place' are also not fail-safe, but design solutions exist in many situations to lower the residual risk to an appropriate level for both onsite and offsite options. A well-designed combination of the two may achieve the lowest residual risk, even if the onsite options are considered a 'redundancy' in terms of bushfire risk planning.

#### *1.6.1.4 Emergency service response*

The acceptability of proposed development should not be reliant on emergency service response / intervention. However, an emergency service response is a legitimate risk lowering consideration, that can be viewed as a bushfire protection 'redundancy' in a strategic planning context.

#### *1.6.1.5 Adjoining lands*

Whilst fuel management (e.g., hazard reduction burning) lowers bushfire risk under most circumstances, during extreme bushfire attack and with increasing time after a burn, the life and property protection benefit is likely to be minimal. As fuel management programs achieving a satisfactory level of risk reduction cannot be guaranteed, they cannot be relied upon for life and property protection design in a strategic planning context.

## 2. Bushfire Landscape Risk Assessment

The landscape bushfire risk includes assessment of bushfire hazard, potential fire behaviour and bushfire history within a 5 km radius of the precinct boundary, herein called the 'study area'.

### 2.1 Bushfire Hazard

The proposed development is located within a wider bushfire landscape containing BFPV. Assessment of the bushfire hazard is considered below, including details of the hazard assessment, classified using the PBP methodology, through assessment of vegetation, slope and bushfire weather.

#### 2.1.1 Vegetation

The broader study area generally presents within a rural pastoral landscape to the north and north-west, combined with remnant canopy vegetation that closely aligns to riparian corridors associated with the Nepean River and its tributaries to the west, expanding east within the central precinct area. To the south and east, is a consolidated vegetation hazard, associated with land within the Sydney Drinking Catchment and National Parks estate. West of the Nepean River grassland with discontinuous canopy is also present, historically associated with agricultural uses.

Vegetation has been classified into Keith Formations and Keith Class (Keith 2004) and assigned a potential total fuel load (tonnes/hectare) using Table A1.12.8 from PBP.

Figure 6 and Table 6 shows vegetation formation as mapped in the Remnant Vegetation of the western Cumberland subregion mapping (OEH, 2013 VIS\_ID 4207). Unmanaged rural land is also likely to fall into the PBP grassland hazard class and has therefore been included in Figure 6 below.

Desktop review of various mapping datasets including internal vegetation data provided by the client (Walker Corporation, 2020), Vegetation of the Cumberland Plain mapping (OEH, 2013) and Woronora Vegetation Mapping (NPWS, 2003). In addition, site inspections were conducted in 2020 and again in 2022 (Figure 9) to confirm mapping of both vegetation structure and management, to assist the establishment of a bushfire vegetation hazard dataset for the preliminary bushfire hazard assessment in section 3 of this report.

Refinements include the removal of the vegetation hazard within the developable land area, addition of indicative riparian buffers for internal streams, as included in indicative plans and a conservative attribution of these areas as "woodland", unless determined to align to 'low hazard' as per the requirement of PBP. The final extent and formation of vegetation within riparian corridors, retained areas of vegetation and areas to be rehabilitated will be subject to more detailed analysis at the subdivision stage of the planning process, and is not required to be resolved at precinct planning, but rather inform the risk profile and indicative bushfire protection measure requirements (i.e. APZs).

Overall, the vegetation review demonstrates forest vegetation is present on sloping lands and in areas adjacent to the Nepean River and tributaries. On gentler slopes, vegetation demonstrates a more open structure, primarily associated with woodland communities aligned to *Cumberland Plain Woodland* (CPW) and *Shale Sandstone Transition Forest* (SSTF) (PCT 1395). A conservative approach was applied to the transitional PCT 1395, and within the broader study area, the presence of this PCT on sloped lands (10° or above) were elevated to forest for the purpose of this assessment.

Based on the reviewed vegetation mapping, the relationship between vegetation community, class and formation within the study area is summarised in Table 6 and Figure 7.

**Table 6: Vegetation formation and class and fuel allocation for the study area**

Vegetation Formation	Vegetation Class/ Broad Vegetation	Vegetation Community
Freshwater Wetland	Coastal Heath Swamps	PCT 1803: Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin
		PCT 1804: Needlebush - Banksia wet heath swamps on coastal sandstone plateaus of the Sydney basin
		PCT 1824: Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin
Grassland		Artificial Wetland
		Grassland
Rainforest	Dry Rainforest	PCT 877: Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion
Forested Wetland	Eastern Riverine Forests	PCT 1292: Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin Bioregion
	Rainforest+	MU4: Sandstone Riparian Scrub
Woodland	Coastal Valley Grassy Woodlands	PCT 830: Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
		PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
		PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		PCT 850: Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
		PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion
		*with the exception of those areas on sloped land 10° or above, which were elevated to Forest formation.
		Undefined riparian corridor
Weeds/Exotics		
		Urban Exotic/Native
Forest	Sydney Coastal Dry Sclerophyll Forests	PCT 1181: Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion

Vegetation Formation	Vegetation Class/ Broad Vegetation	Vegetation Community	
	Sydney Hinterland Dry Sclerophyll Forests	PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	
		PCT 1777: Red Bloodwood - Scribbly Gum - Silvertop Ash open forest on sandstone ridges of the Woronora Plateau	
		PCT 1787: Red Bloodwood - Scribbly Gum - Stringybark open forest on sandstone ridges along the western side of the Woronora and Hornsby plateaus	
		PCT 1789: Smooth-barked Apple - Blackbutt - Red Bloodwood open forest in enriched sandstone gullies of the western Woronora plateau	
		PCT 1790: Red Bloodwood - Grey Gum - Stringybark open forest on enriched sandstone ridges of the western Woronora plateau and lower Blue Mountains	
			PCT 1081: Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin Bioregion
		Shale Woodland+	MU22: Transitional Shale Dry Ironbark Forest
			MU23: Transitional Shale Stringybark Forest
		Sandstone Gully Forest	MU26: Sandstone Gully Peppermint Forest
			MU28: Western Sandstone Gully Forest
	Sandstone Woodland+	MU29: Exposed Sandstone Scribbly Gum Woodland	
		MU35: Upper Georges River Sandstone Woodland	
		Plantation	
Tall Heath	Upland Swamp*	MU42: Upland Swamps: Banksia Thicket	
		MU44: Upland Swamps: Sedgeland-Heath Complex	
		MU45: Upland Swamps: Fringing Eucalypt Woodland	
	Regenerating Vegetation	MU50: Regenerating Vegetation	
		Undifferentiated Regenerating Shrubs	

\*Assessed conservatively as tall heath +MU aligns with forest formations

### 2.1.2 Future Hazard

As shown in Figure 7, much of the land immediately surrounding the precinct, and further to the north and west is proposed urban land, primarily earmarked for regional growth as part of broader planning. Therefore, along with planned neighborhoods and local centers within the precinct, adjoining lands (including South Gilead, Gilead, Menangle, Wilton, Douglas Park), will also transition from rural holdings to facilitate urban development. As such the extent of the current vegetation hazard will significantly reduced, which provided important context to the hazard profile and land use assessment.

### 2.1.3 Slope

Slope has been identified from a Digital Elevation Model (DEM) generated from 2 m contours and classified into slope classes (see Figure 8).

Within the broader study area, areas exhibiting steeper slopes are generally linked to drainage features, which in some areas are greater than 20 degrees. As these steeper areas represent a higher risk from a fire control perspective, where possible, these areas were validated through rapid site inspection and slope measurement (see Figure 9). Within the stage 1 boundary undulating hills present west of Wilton Road (see Figure 16) present with an effective slope greater than 20 degrees downslope and assessment of the effective slope is further discussed in section 3.3.



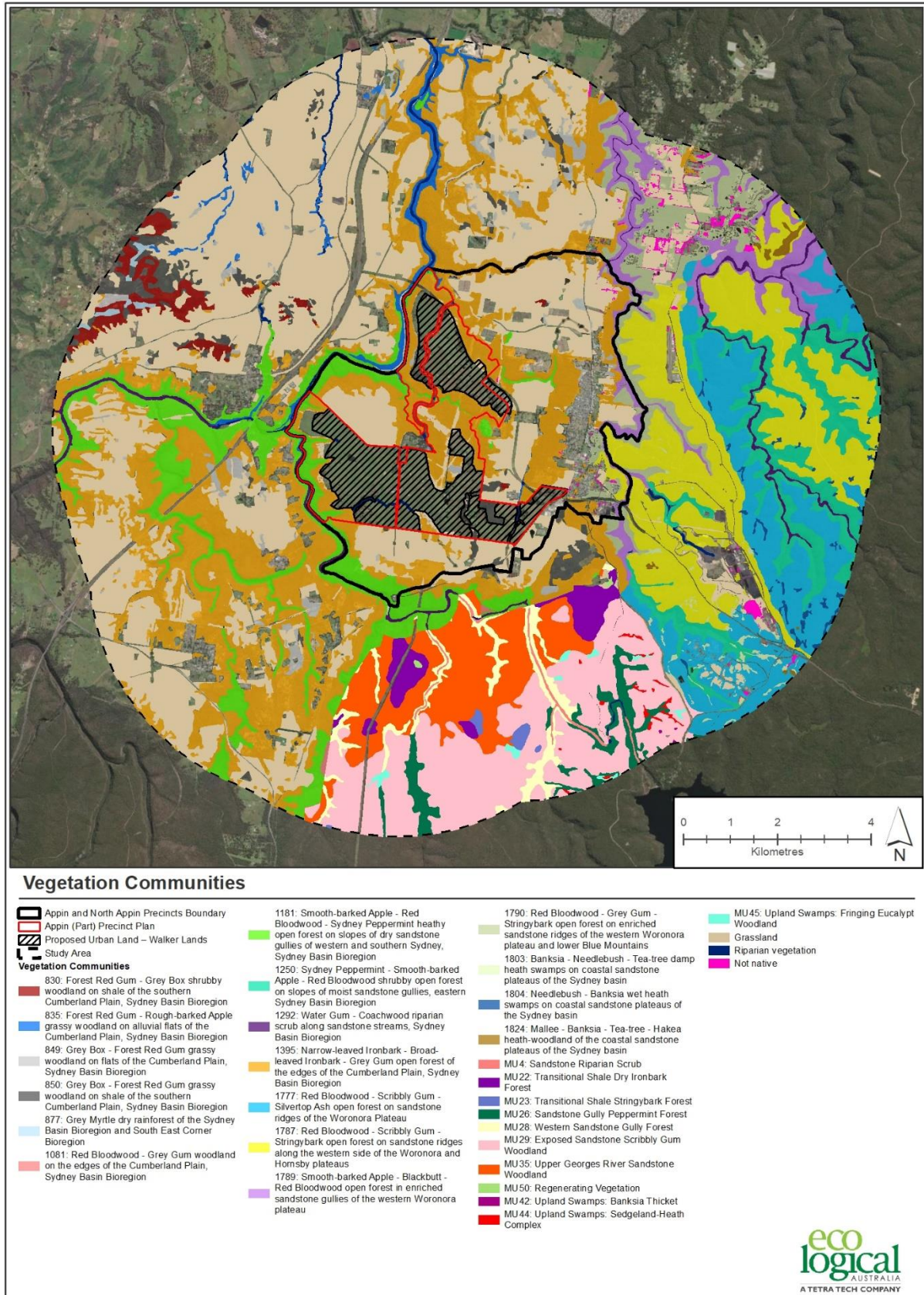


Figure 6: Mapped Vegetation Communities. (Source: Vegetation of the Cumberland Plain mapping (OEH, 2013) and Woronora Vegetation Mapping (NPWS, 2003), Walker Corporation, 2020).



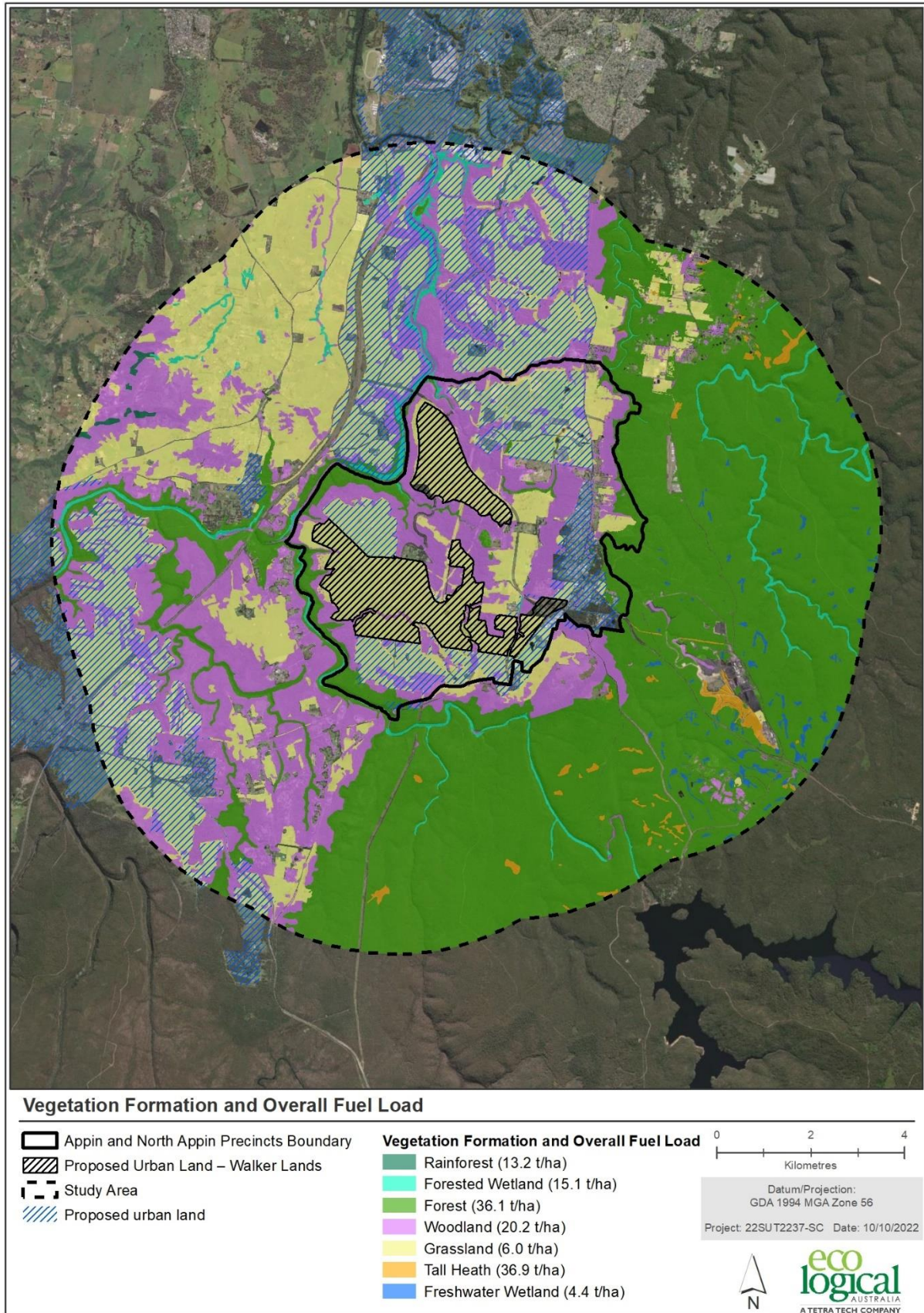


Figure 7: Vegetation Hazard overlay with Future Development



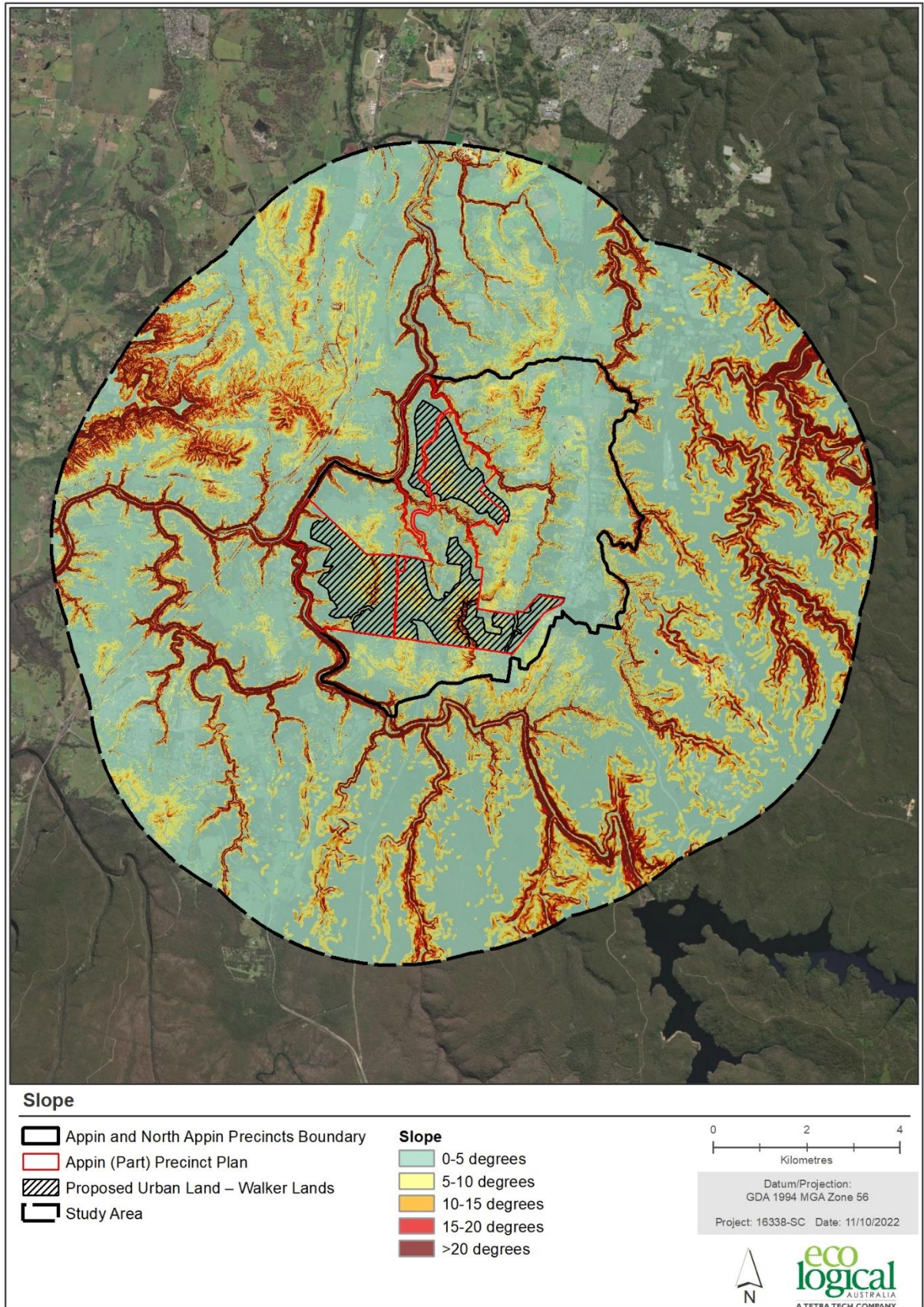
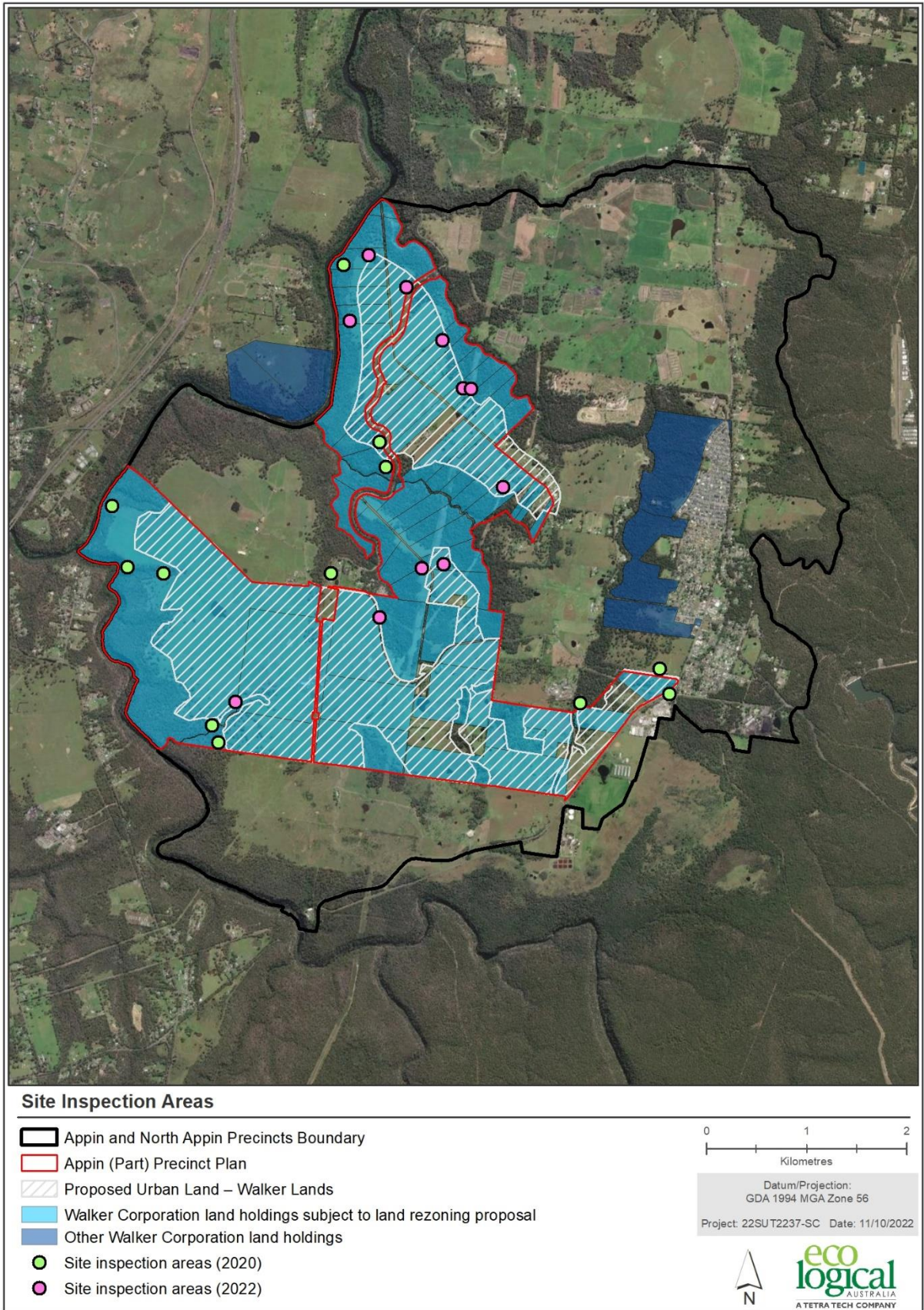


Figure 8: Slope within the study area





**Figure 9: Areas where rapid vegetation validation site inspections were undertaken**

## 2.2 Bushfire Risk Considerations

The following sections outline considerations informing the bushfire risk exposure of the precinct. This includes analysis of bushfire weather and potential fire behaviour, consideration of bushfire catchments and potential fire pathways, and bushfire history.

### 2.2.1 Bushfire Weather

The precinct is situated within the Wollondilly-Wingecarribee Bush Fire Management Committee Area. The climate is variable due to topographic and altitudinal differences throughout the management area (BFMC, 2017). The lower altitudinal areas in the north, where Appin is situated, (as opposed to the highland areas of Bowral and Mittagong), experience a warm temperate climate with maximum rainfall experienced in summer and autumn. While the gazetted bushfire season generally runs from October to March, according to the BFMC Bush Fire Risk Management Plan (BFRMP), bushfire weather can be most prevalent from August to December. This is accompanied by strong southwest to northwest winds and is subject to the influence of climate, including drought and rainfall, and under drier conditions, prevalence extend through to March. Dry lightning storms also occur throughout the bushfire season.

Bushfire weather is often described in terms of the Forest Fire Danger Index (FFDI) and this metric has a direct influence on the intensity of bushfire behaviour, with a higher FFDI corresponding to weather conditions with potential for higher intensity fires. Weather data analysed by Lucas (2010) under the National Historical Fire Weather Dataset (1972-2020) incorporates the daily FFDI, where suitable inputs are available, from over 70 weather stations across Australia. Days of Very High Fire Danger Rating (FDR) or above, occur on average about 9 days per year based on data analysed from the National Bushfire Weather Data set for Sydney Airport weather station (station number 066037) which is the closest suitable weather station to the site in the dataset compiled by Lucas (2010).

For the purposes of PBP, the FFDI required to be used for development assessment for the site, is 100, as identified for the Greater Sydney Region and Wollondilly LGA. The FFDI used by PBP influences certain bushfire protection measures including Asset Protection Zones (APZ) and construction standards via the assessment of the Bushfire Attack Level (BAL).

However, utilising historical data from the Sydney Airport weather station from the National Historical Fire Weather Dataset, and applying the maximum FFDI for a 1 in 50-year event (being the accepted recurrence period for land use planning) provides a better understanding of bushfire weather relevant to the Study Area. To analyse the FFDI for a 1 in 50-year event from the Sydney Airport weather station data, a Generalised Extreme Value (GEV) analysis was undertaken using the process documented by Douglas (2017) and Douglas et al (2014; 2016). The dataset was split into subsets based on identified directions of potential bushfire attack relevant to the site, being North to south-east (clockwise); South-east to South-west (clockwise); South-west to North (clockwise). The following directional FFDIs were identified through the GEV analysis of the historic weather records (1972 to 2020) for Sydney Airport:

- Maximum FFDI for wind directions from the north to south-east was 63;
- Maximum FFDI for wind directions from the south-east to south-west was 46; and
- Maximum FFDI for wind directions from the south-west to north was 116.

This analysis indicates that there is variation in the potential likelihood and consequence of bushfire attack from different directions, toward the proposed urban area as shown in Figure 10. Areas exposed



to bushfire attack at higher FFDI are more likely to be impacted by fire as adverse fire weather will occur more often from those directions and a higher fire intensity is more likely as the weather conditions reach higher FFDI values. For the precinct, aspects exposed to hazards in the south-west to north are more likely to be subject higher FFDI conditions whilst other directions are likely be exposed to bushfire attack at lower FFDIs. However, given the reduced opportunity for extended fire runs from the west due to the narrow or fragmented fire catchments in this direction, and the ability for the proposal and future planning to facilitate bushfire protection measures (APZs, perimeter roads etc), it is considered that there is considerable opportunity to mitigate the exposure to and development of higher fire intensities in this direction. This is further explored in section 2.2.2, with modelled fire intensity mapping further informing this analysis.

### 2.2.2 Potential Bushfire Behaviour

Whilst each bushfire event is different, fire spreads by responding to changes in fuel, terrain, and weather conditions. Therefore, based on weather analysis, landscape conditions and fire history, potential fire behaviour can be determined. It is generally anticipated that a potential fire within the study area and surrounds, would spread more quickly and have the potential for higher intensities when:

- Burning under the influence of north-westerly and south-westerly winds, particularly during warmer summer months;
- Moving upslope in the steeper, vegetated areas particularly in the west and south-west of the proposed development area but also surrounding the Walker Lands in all directions within the study area.

Bushfire intensity prediction has been used to review potential bushfire runs with the potential head fire intensity modelled using fire intensity formulae of McArthur (1967) and Cheney *et. al.* 2012). The fire intensity model is predicting likely fire intensities, the probability of these occurring is not considered. Whilst weather conditions that could support uncontrollable fire intensities occur on average many days every year, the likelihood of a fire being ignited upwind of the proposed development area under those weather conditions may be very infrequent e.g., 50+ years based on analysis of fire history for the area. It is important to note the models do not consider extreme fire behaviour / weather including phenomena such as spotting/fire storm, fire tornado/whirls, lateral vortices, junction zones (jump fires), eruptive fires, conflagrations, downbursts; or pyro-convective events.

#### 2.2.2.1 Fire Intensity Modelling Outcomes

The outcomes of fire intensity modelling for the directional FFDI's determined from weather analysis are shown in Figure 11 (NSW, FFDI 116), Figure 12 (NSE, FFDI 63) and Figure 13 (SESW, FFDI 46).

Based on the outcomes of modelling and assuming the ignition risk is the same throughout the study area, elevated fire intensities are most likely to occur under FFDI 116 and will be most prevalent within the southern and eastern areas of the study area, within the National Parks estate (Dharawal N.P.) and WaterNSW catchments area (south east) and where there is contiguous unmanaged and predominately forest vegetation. However, based on the weather analysis conducted for this study, FFDI of 116 is predominate under south west to north-westerly winds and fires are more likely to move in an easterly direction, thus reducing the likelihood of fire transfer under these conditions from these areas into the study area (i.e. the fires would be burning away from the site). This is further supported by wildfire

history discussed below. Patchy areas of elevated fire intensities are also evident under S-NW conditions, along steeper riparian areas to the west, however once the broader precinct is activated in combination with development planned or contemplated to the west of the site, existing fire pathways from these directions will be considerably reduced. Therefore, potential exposure to elevated fire intensities from this direction are moderated.

Fire intensity modelling also demonstrates that lower fire intensities are expected under N-SE and SE-SW FFDI directional scenarios. Therefore, fires initiating in catchment lands or National Parks estate to the east of the precinct are less likely to approach the site at higher fire intensities, rather higher intensity fires in the catchment are more likely to progress east under S-NW elevated FFDI conditions.

It is also important to note that modelling assumes a fuel load of 6 tonnes/ha for grassland, however as much of this land is actively utilised pastoral lands, the fuel loads are likely to be significantly reduced. Therefore, the actual fire intensity in this area is expected to be lower than predicted, based on a reduced fuel load due to the application of various management practices across these lands (grazing, cropping, irrigation etc). In addition, as much of the grassland surrounding the precinct is proposed for future urban development, further fragmentation of the current hazard state is likely to occur.

### 2.2.3 Bushfire History

The Wollondilly/Wingecarribee Bush Fire Risk Management Plan (BFRMP) (BFMC 2017) identifies the main sources of ignition in BFMC area to be:

- Lightning strikes associated seasonal summer storms;
- Arson, including the dumping of cars in bushland; and
- Pile burns escaped private hazard reduction.

According to the BFRMP, there are on average 400 bush and grass fires each year, many of which progress to major fires, however these larger fires tend to have started within the inhabited areas of the BFMC and followed an easterly direction of travel, impacting on the catchment lands. Most other major fires have been associated with seasonal storms, ignition generally occurring in the western portion of the BFMC area.

Figure 14 shows fire history is present within the broader study area, with mapping compiled from unplanned fire events (wildfire) occurring since 2000 within the fire history data record (NPWS, 2022 and RFS, 2022). As shown, a high proportion of fires have occurred within the vegetated catchment area to the east with fire activity generally not impacting the proposed urban area within the precinct. Whilst this data may not contain all bushfire, the spatial mapping of fire events, it does indicate that the frequency of large wildfire within the Study area is low, with very few areas outside of the catchment lands have been subject to repeated wildfire, as evident in the mapping. Management of the surrounding land along with fire mitigation advantages from infrastructure, existing development and mixed management of rural lands is likely to contribute to the low frequency fire history.

### 2.2.4 Bushfire Catchment and Spread Scenarios

Delineation of fire catchments helps to identify the location and size of potential fire runs and therefore bushfire attack scenarios for different locations within the precinct. This informs assessment of the risk

profile across the site, with exposure to larger fire catchments generally resulting in an elevated bushfire risk.

High level analysis of the potential fire catchments influencing the study area was undertaken as evident in Figure 15. Within the precinct, if fires were to occur under an FDR of Very High or above within the steeper forested areas to the west of the proposed development, there is potential for fire to spread quickly through this vegetation. However, in this area the forest vegetation along the development boundary transitions to woodland and grassland, meaning the fuel load immediately adjoining the subject land and asset protection zones (APZ) would be considerably reduced, resulting in a reduction in fire intensity, which is evident along the periphery of the development area in Figure 11 to 13. Further, the Nepean River and Hume Highway located west of the precinct provide a strategic advantage in managing fires approaching from the west. Coupled with this moderation, are further mitigation advantages that reduce the risk profile in this direction, including the capability for perimeter roads within the precinct, planned east west transport infrastructure which will provide a significant advantage, along with future planned urban development within Douglas Park and Menangle.

Potential fire spread along both the southern and northern boundaries of the southern portion of the precinct is also temporary, with this area earmarked for future development under the Greater Macarthur 2040 plan. Fire pathways from the south-east are shielded from the precinct by Wilton Road (to the south-east) Appin Road and the Appin township itself (to the east). To the north of the site, development of South Gilead and Gilead will significantly alter the bushfire landscape in this direction, with remaining vegetation primarily situated along riparian corridors.

There are other existing advantages to fire mitigation in the landscape, and further advantages can be achieved by the provision of appropriate bushfire protection measures within the subject land. In particular, the subject land can facilitate APZ's without impacting on proposed conservation measures, design mechanisms including perimeter roads, supported by a connected road network. Capacity to ensure the provision of appropriate landscaping controls and management also provide additional bushfire protection measures, particular within the precinct where there may be some rehabilitation or riparian areas.

### 2.3 Summary of landscape bushfire risk assessment

The landscape bushfire risk analysis indicates there is current potential for bushfire attack within the broader study area given the existing presence of BFPV in adjoining areas. The likelihood of this potential bushfire attack is however decreased to the north, west and south-west whereby the limited connectivity to BFPV in the region and limited fuel continuity associated with mixed management practices of rural residential lands. Furthermore, the area to the north-west and west is somewhat overstated in the output of bushfire intensity mapping given the conservative inclusion of pastoral lands as an unmanaged grassland hazard. Whilst bushfires in these areas are technically possible, they likely do not pose a significant risk to the subject land, especially considering the impedances to the spread of any such fires to the subject land.

The residual risk post development of the precinct and adjoining lands is a critical consideration for the acceptability of that risk. The area contemplated by the precinct plan will be considerably different as the activation occurs, with future urban development planned to the north (Gilead), west (Douglas Park and Menangle) and southwest (Wilton), as demonstrated previously in Figure 7. This is of note as this

increased disruption of an already fragmented hazard landscape increases the bushfire resilience from bushfire attack from the SW through to NW. This will have a limiting effect on the exposure of the precinct to landscape scale bushfire from this direction. Therefore, the modelled fire intensity outcomes would be expected to be lower and less likely to be experienced. The area to the south and east of the precinct was identified to pertain the largest consolidated area of higher bushfire hazard, however given the expected easterly movement of fires under elevated bushfire weather and wind conditions in the region, the risk to the subject land is also reduced, along with mitigation advantages, for any lower intensity fire that does approach in this direction.

Analysis of indicates fire history within the surrounding area there is limited mapped fire history within the broader precinct and the precinct, reflecting that the risk to the subject land resulting from the setting of the site, which provides a level of shielding which will serve to restrict fire spread into the site. Other fire mitigation advantages such as waterways, roads and existing management of rural lands would assist in reducing fire spread and intensity. Coupled with ongoing precinct activation, the direct exposure of future development within the Subject Land to a high intensity bushfire beyond a level that can be planned and mitigated for is unlikely.



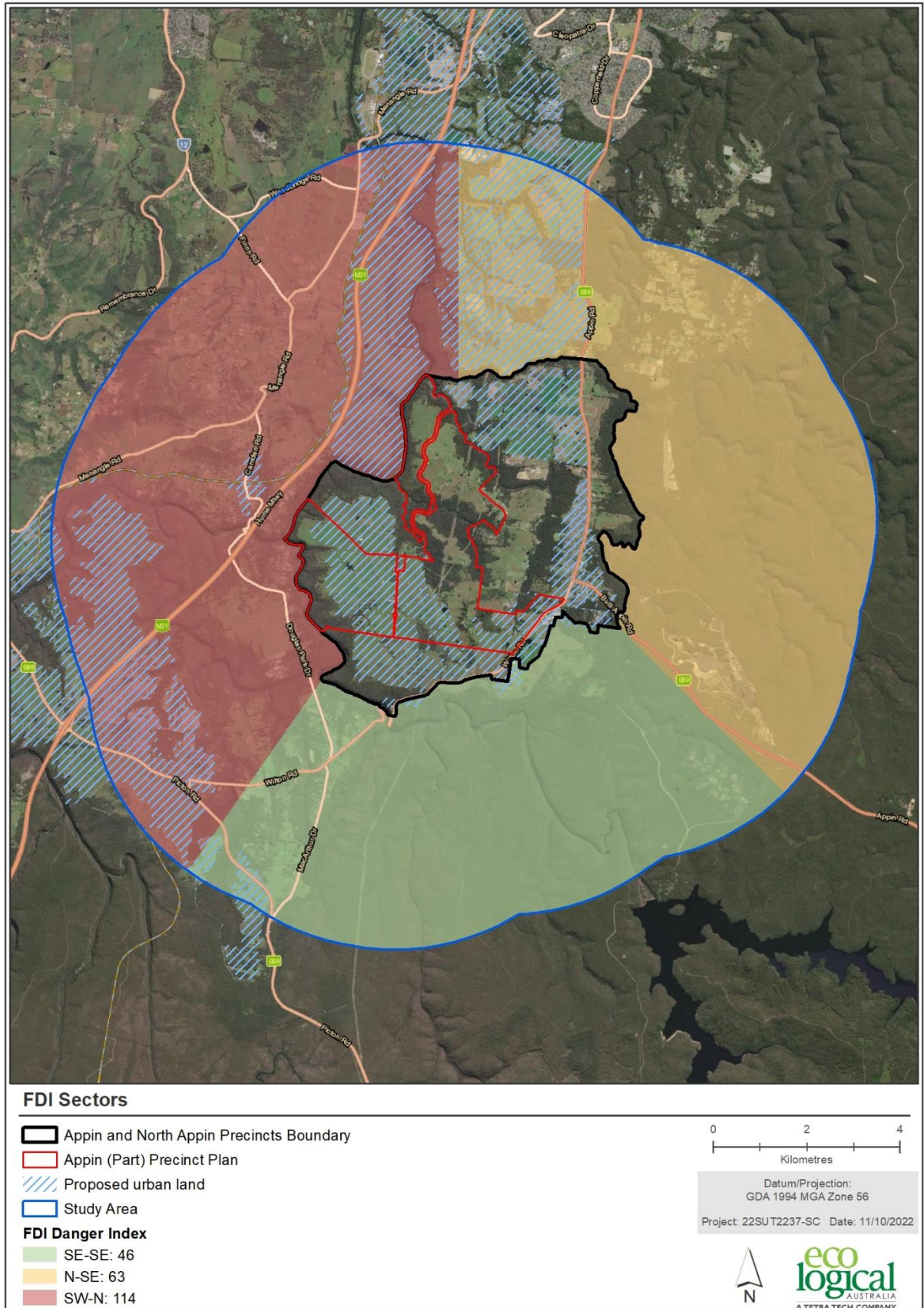


Figure 10: FDI Sectors within 5km buffer of Appin Precinct



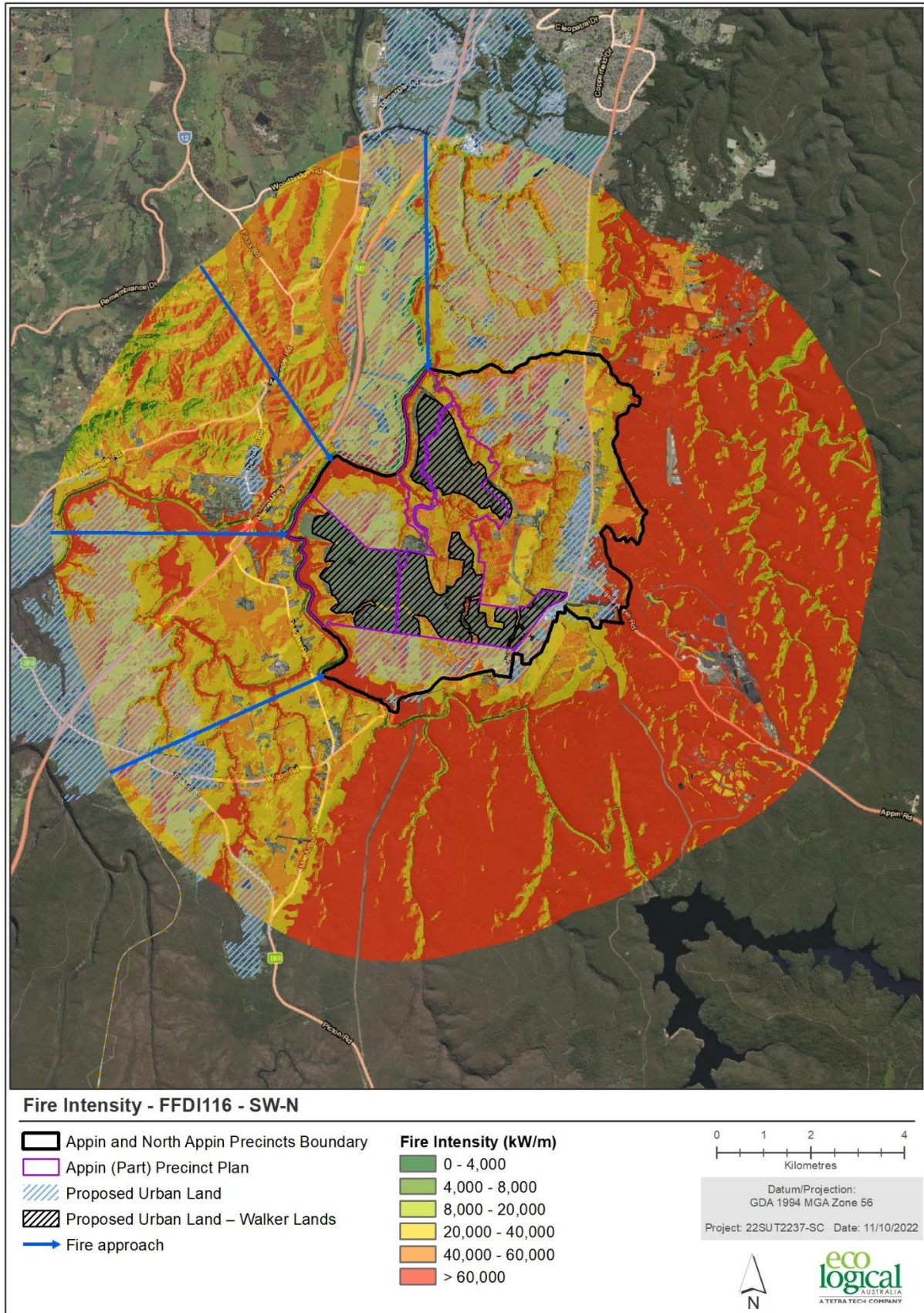


Figure 11: Fire Intensity Model – FFDI 116, SW-N winds



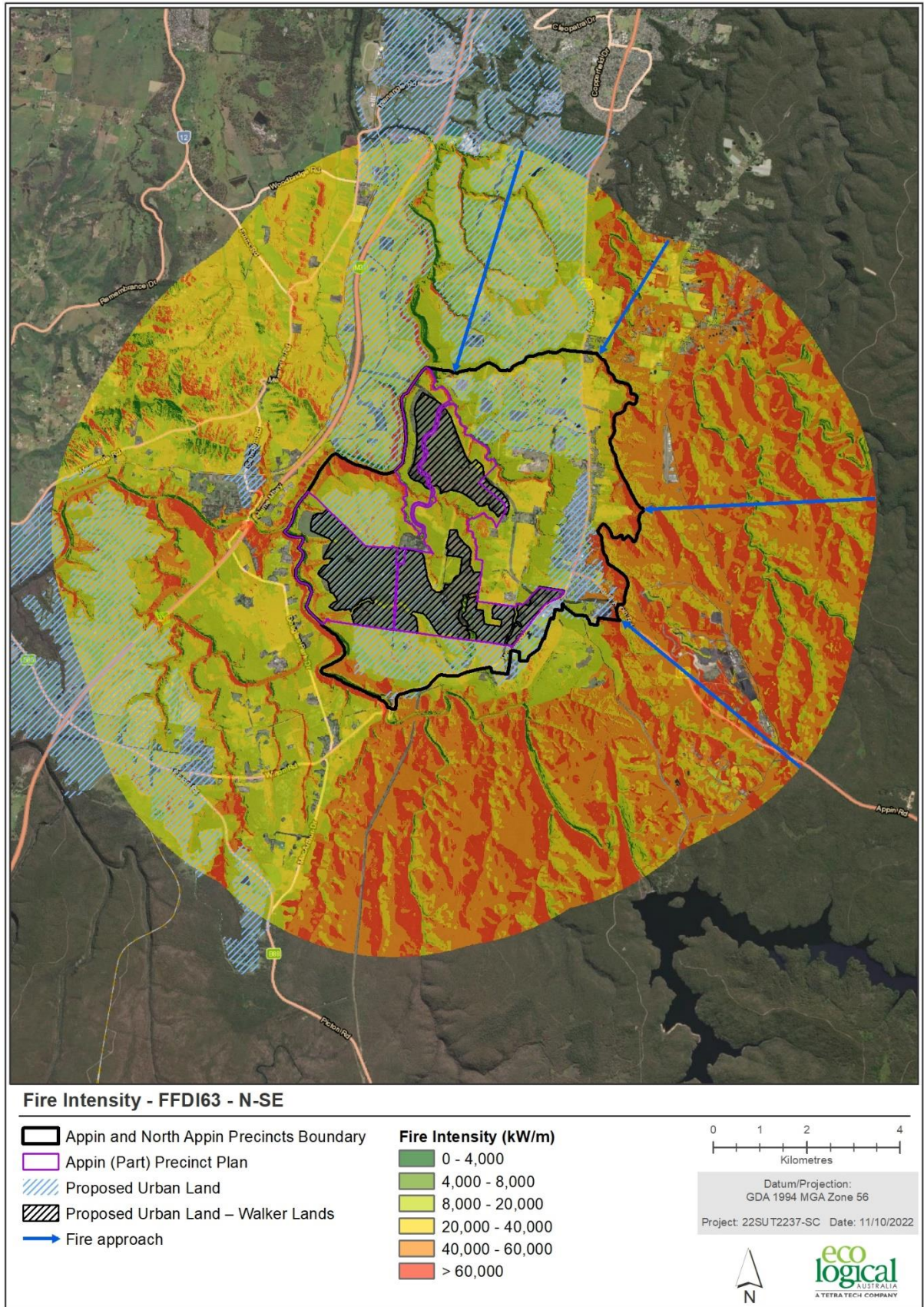


Figure 12: Fire Intensity Model – FFDI 63, N-SE winds



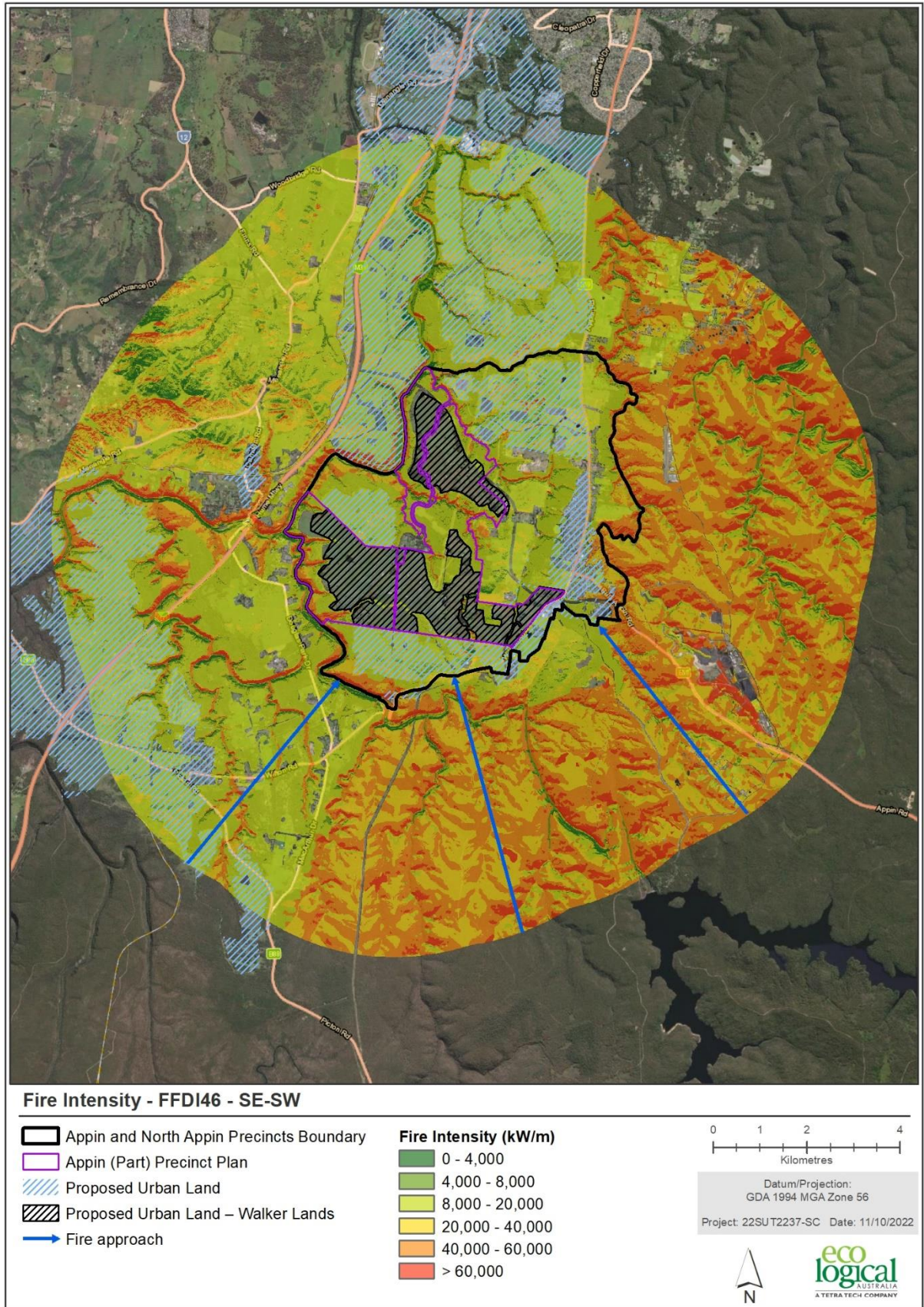


Figure 13: Fire Intensity Model – FFDI 46, SE-SW winds



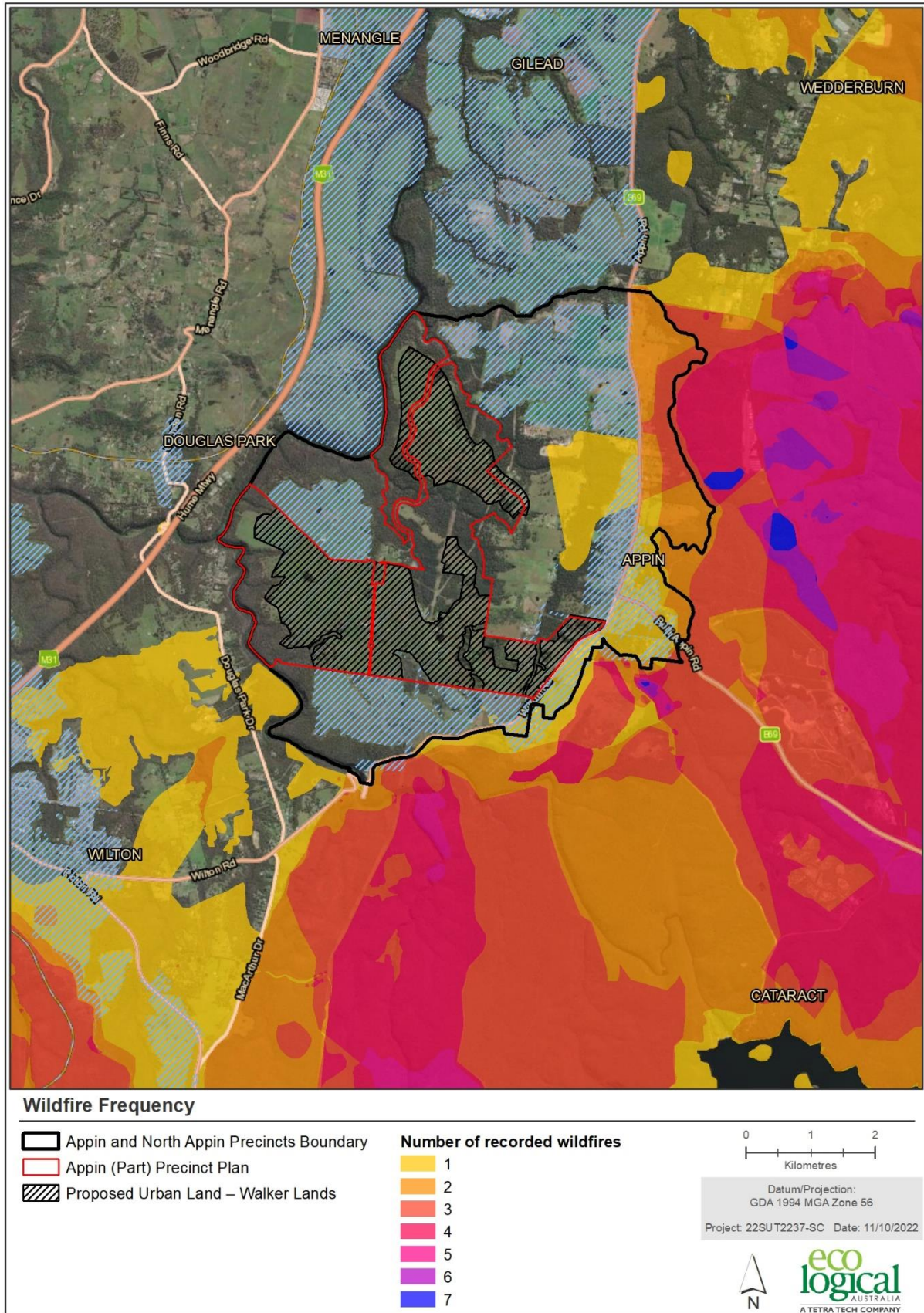


Figure 14: Wildfire history in the study area since 2000



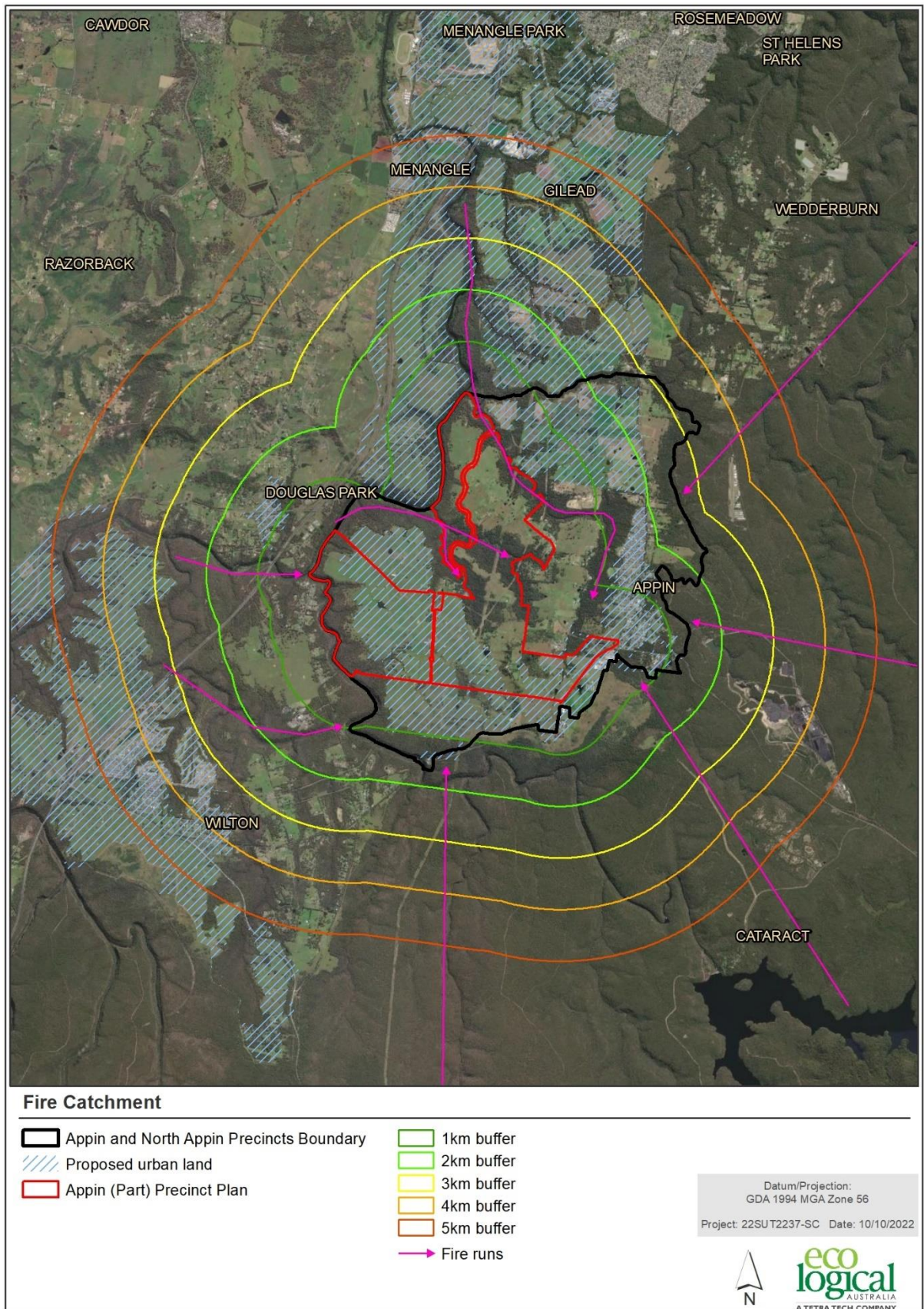


Figure 15: Fire Catchments

### 3. Land Use Assessment

The *EP&A Act* and the *RF Act* are the primary legislative instruments relevant to bushfire planning for the site. PBP is called up by these Acts as the subject land is mapped as bush fire prone land, and it is a critical guide in assessing the bushfire risk suitability of the proposal.

PBP (RFS 2019) outlines broad principles and assessment considerations for strategic planning. It also specifies that bushfire protection measures need to be considered at the strategic planning stage to ensure that the future development can comply with PBP (as specified in Chapters 5-8 of PBP 2019).

The aim and objectives of PBP (RFS 2019) below provide additional guidance for land use assessment within a Strategic Bushfire Study:

*The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.*

The objectives are to:

- i afford buildings and their occupants protection from exposure to a bush fire;*
- ii provide for a defensible space to be located around buildings;*
- iii provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;*
- iv ensure that appropriate operational access and egress for emergency service personnel and residents is available;*
- v provide for ongoing management and maintenance of bush fire protection measures; and*
- vi ensure that utility services are adequate to meet the needs of firefighters.*

#### 3.1 Risk profile

The feasibility of the proposal to comply with the bushfire protection measures identified within PBP is a fundamental consideration of the study. Whilst bushfire protection measures and their performance requirements are a benchmark for approval of a development, a strategic level study needs also to evaluate these measures within the landscape risk context. This Study has therefore considered the:

- The bushfire landscape risk context in consideration of the protection measures for future development and their potential adequacy;
- The type/s of development proposed, and their suitability given the bushfire risk context;
- The pattern and potential bushfire resilience of the bushland interface; and
- Potential cumulative risk associated with proposed development in the locality.

The feasibility of the subject land to provide for APZ, a key bushfire protection measure, is assessed in the following section. This is followed by an evaluation of the proposed land uses.

- Feasibility of Asset Protection Zones

Based on the bushfire hazard assessment, an assessment of the feasibility of PBP compliant APZs has been undertaken. The indicative APZ requirements are shown in Figure 16. in Table 6 and Figure 7.

- includes the minimum dimensions required by the Acceptable Solutions of PBP for residential development (i.e. 29 kW/m<sup>2</sup>) and SFPP development (i.e. 10 kW/m<sup>2</sup>).
- Asset protection zones will need to be managed in perpetuity and it is recommended where an APZ is to be positioned in open space zones, a management plan is established to ensure ongoing APZ maintenance can be achieved. A vegetation management plan will also assist in hazard management along the hazard / APZ interface. Future legislative provisions to achieve management of open space areas should be considered, including the requirement of community title where Council will not be the managing authority. There is opportunity within the subject land to locate APZ and other bushfire protection measures to meet the acceptable solutions within PBP 2019;
- Multiple access and egress points and perimeter roads are feasible within the developable area and there is scope to finalise these through stage planning;
- Complementary and consistent risk management through landscape controls and building design is also feasible; and
- Slopes greater than 20 degrees are present within the hazard assessment area and subject land, however there is capacity for these constraints to be resolved as detailed design progresses to avoid the increased fire behaviour impacts associated with these slopes (see section 3.3.1).

### 3.2 Land use evaluation

Future development on BFPL will need to satisfy the performance criteria identified in PBP for various land uses. At master planning, it is expected that future land uses enabled by the proposal can accommodate the acceptable solutions identified in PBP to minimise reliance on performance solutions at the DA stage. A summary of these requirements is outlined below and evaluated for the master plan in Table 8.

Under the planning pathway identified in PBP and as legislated, the CDC pathway is not possible for subdivision, SFPP development and where the acceptable solutions of PBP cannot be met. Therefore, it is expected that a variety of future land uses will be assessed against the requirements of PBP following the DA pathway.

#### 3.2.1 Residential and Rural Residential Subdivision

Mixed use residential development is envisaged for much of the master plan, and therefore it is anticipated that future residential land uses will be subject to the requirements outlined in Chapter 5 of PBP. Following master plan approval and as part of the DA process, future development will need to demonstrate the suitability of the proposed subdivision. The following provisions will need to be considered:

- Provision of compliant APZs;
- Access and egress within the developable land and along the adjoining public road system shall include safety provisions for attending emergency service vehicles and evacuating residents;
- Future subdivision design shall include perimeter roads separating developable lots from hazardous bushland areas;
- Access is to be ensured for maintenance of APZ and other fire mitigation activities;
- Firefighting water supply; and
- Provision of access and infrastructure requirements according to Table 5.3b of PBP.



### 3.2.2 SFPP Development

Special Fire Protection Purpose (SFPP) provisions will be applicable to future uses such as childcare centres, tourist accommodation, education facilities, hospitals, seniors living, and any other development specified as SFPP under s.100B (6) of the RF Act or Section 46 of the RF Reg. These developments would need to meet the criteria outlined in Chapter 6 of PBP including:

- Increased APZ setbacks as per A1.12.1 of PBP
- Provision of a Bush Fire Emergency Management and Evacuation Plan; and
- Provision of suitable access and utilities according to Tables 6.8a-c of PBP.

These provisions are applicable when seeking the above land uses and will be addressed at future DA stage.

### 3.2.3 Multi-storey residential development

Residential buildings exceeding three storeys in height are considered to be multi-storey buildings by PBP and are required to comply with the performance criteria within Chapter 5, including the requirement for an APZ which meets a threshold of 29 kW/m<sup>2</sup>. In addition, the following issues need to be considered as per Table 8.2.2 of PBP.

- Higher residential densities for evacuation
- Avoiding locating high rise buildings in higher elevations or on ridge tops;
- Increased demand on road infrastructure during evacuation;
- Higher external façade exposed to bushfire attack;
- Additional fuel loading from car and storage facilities;
- Potential for balconies and external features to trap embers and ignite combustible materials;
- Increased exposure to convective heat due to height.

A performance based solution including a bushfire design brief may be required for Development Applications pertaining to multi-storey residential developments on bushfire prone land.

### 3.2.4 Commercial and Industrial Development

As per the National Construction Code (NCC) building classification system (Buildings of Class 5 to 8 under the NCC) such as offices, shops, factories, warehouses, and other commercial or industrial facilities on BFPL have no specific bushfire requirements, and as such *Australian Standard AS 3959-2018* and the *National Association of Steel-framed Housing (NASH) Standard 'Steel Framed Construction in Bushfire Areas 2014'* (NASH, 2014) are not deemed to satisfy (DTS) provisions. However, such developments still need to meet the aims and objectives of PBP and consider the following:

- Provision of appropriate APZ / defensible space;
- Provision of safe access to/from the public road system for egress and evacuation;
- Provision of suitable emergency and evacuation arrangements for occupants;
- Provision of adequate water supply to protect the building, and the location of gas and electricity supplies so they do not contribute to the bushfire risk; and
- Provision for the storage of hazardous materials away from any hazards.



In meeting the objectives of PBP, these developments can apply the APZ requirements for residential. General access and infrastructure requirements listed in Table 7.4a of PBP should also be considered. Where future mixed-use development includes residential development, the bushfire protection measures requirements outlined in Chapter 5 of PBP (for subdivision) or Chapter 7 of PBP (for infill development) will apply. Where future mixed-use development includes SFPP uses, bushfire protection measures should be consistent with the provisions outlined in Chapter 6 of PBP.

### 3.2.5 Section 8.3.11 – Public Assembly Buildings

Where a public building has a floor space greater than 500 m<sup>2</sup> it may be considered an assembly building, and due to the evacuation of a large number of people, this type of development is generally treated as SFPP. This could include future community and recreation facilities. To meet SFPP requirements, future developments of this nature on BFPL would need provisions for APZs that meet a maximum Radiant Heat Flux (RHF) of 10 kW/m<sup>2</sup> and a construction standard of BAL-12.5, along with other requirements as per Section 4.1.2.2.

## 3.3 Feasibility of Asset Protection Zones

Based on the landscape assessment of vegetation and slope, preliminary APZs have been determined to indicate the separation distance required between a structure and the vegetation hazard. This analysis considers the existing vegetation within and adjoining the site. APZ dimensions are provided in Table 6 and Figure 7.

and represent the required minimum setback detailed in PBP (2019). Indicative APZs identified Figure 15 are for a scenario of residential development only, with APZ requirements for special fire protection purposes (SFPP) also listed in Table 7. Final APZ dimensions will be determined based on the final design, proposed land use, vegetation configuration and topography.

The proposed urban land is surrounded by forest, woodland and grassland vegetation with varied management practices. In undertaking this assessment, the following assumptions are made in relation to the proposed APZs:

- Vegetation formation in the assessment is derived from validated vegetation data provided by Walker Corporation, Vegetation of the Cumberland Plain mapping (OEH, 2013) and Woronora Vegetation Mapping (NPWS, 2003), accompanied by rapid site inspection as shown in Figure 8.
- All APZ can be contained within the developable area. As the broader precinct is activated by adjoining and adjacent landowners, it is expected that the APZ requirement may be reduced or removed in some areas of the subject land.
- All APZs within the subject land are assumed to occur on land exhibiting a slope less than 18 degrees as per PBP. This will need to be reviewed as the final site topography is determined.
- The indicative APZ widths proposed are based on PBP 2019, which requires that residential buildings are subject to a maximum heat exposure of no more than 29 kW/m<sup>2</sup>. Best practice is that all residential subdivisions meet this standard. SFPP APZ requirements are determined in Table 7 and will be assessed as the site design progresses, however there is scope for the required separation distances to be achieved within the developable area.
- The addition or rehabilitation of any vegetation within the site (such as for unmanaged public open space and riparian corridors) will influence APZ requirements, if proposed. The final

configuration of these aspects at detailed design will need to be assessed for future development applications.

- Vegetation introduced through landscaping or restoration can avoid additional APZs if:
  - Individual patches of vegetation within 100 m of properties are <0.25 ha per patch;
  - The perpendicular width of linear strips of vegetation is <20 m when measured perpendicular to structures;
  - Any vegetation within 100 m of properties meets the definition of ‘managed vegetation’ under PBP. In general, this means that the vegetation has low flammability, low fuel loads and is structured in a way that avoids the spread of fire.

**Table 7: Indicative APZs Applicable to the Subject Land**

Vegetation Formation	Slope Class	Residential APZ (BAL-29) <sup>1</sup>	Special Fire Protection Purpose (SFPP) APZ <sup>1</sup>
Forest	All upslope and flat	24 m	67 m
	>0-5° downslope	29 m	79 m
	>5 -10° downslope	36 m	93 m
	>10-15° downslope	45 m	100 m
	>15-20° downslope	56 m	100 m
Woodland	All upslope and flat	12 m	42 m
	>0-5° downslope	16 m	50 m
	>5-10° downslope	20 m	60 m
	>10-15° downslope	25 m	72 m
	>15-20° downslope*	32 m	85 m
Grassland	All upslope and flat	10 m	36 m
	>0-5° downslope	12 m	40 m
	>5-10° downslope	13 m	45 m
	>10-15° downslope	15 m	50 m
	>15-20° downslope	17 m	55 m

<sup>1</sup> Assessment according to Table A1.12.1 (SFPP)/A1.12.2 (residential) of PBP 2019. \*Note a slope of 22° downslope was determined for land sloped >20° (see Figure 16), resulting in indicative residential APZ requirement of 40 m (for woodland vegetation) in this area.

### 3.3.1 Hazard on Slopes Greater than 20 degrees

As indicated in Figure 16, there is a small area of hazard where the slope has been measured to be greater than 20 degrees. PBP requires that where ‘Effective slopes are to be assessed on hazards on slopes in excess of 20 degrees will require a detailed performance assessment. This may include a consideration of the potential flame length and its impact on the proposed development’. Therefore, the approach to determining an appropriate APZ in this area to afford future development a radiant heat exposure of less than 29 kW/m<sup>2</sup> will need to be approved by the RFS. However preliminary assessment of the slope has determined the effective slope to be 22° downslope and indicative APZ requirements modelled. As shown in Figure 16, indicative APZ requirements determined from modelling can be accommodated by future development. Given this relates only to a narrow remnant area of

vegetation, which will be surround by urban land with capacity for bushfire protection measures, it is not considered to elevate the risk profile of the precinct.



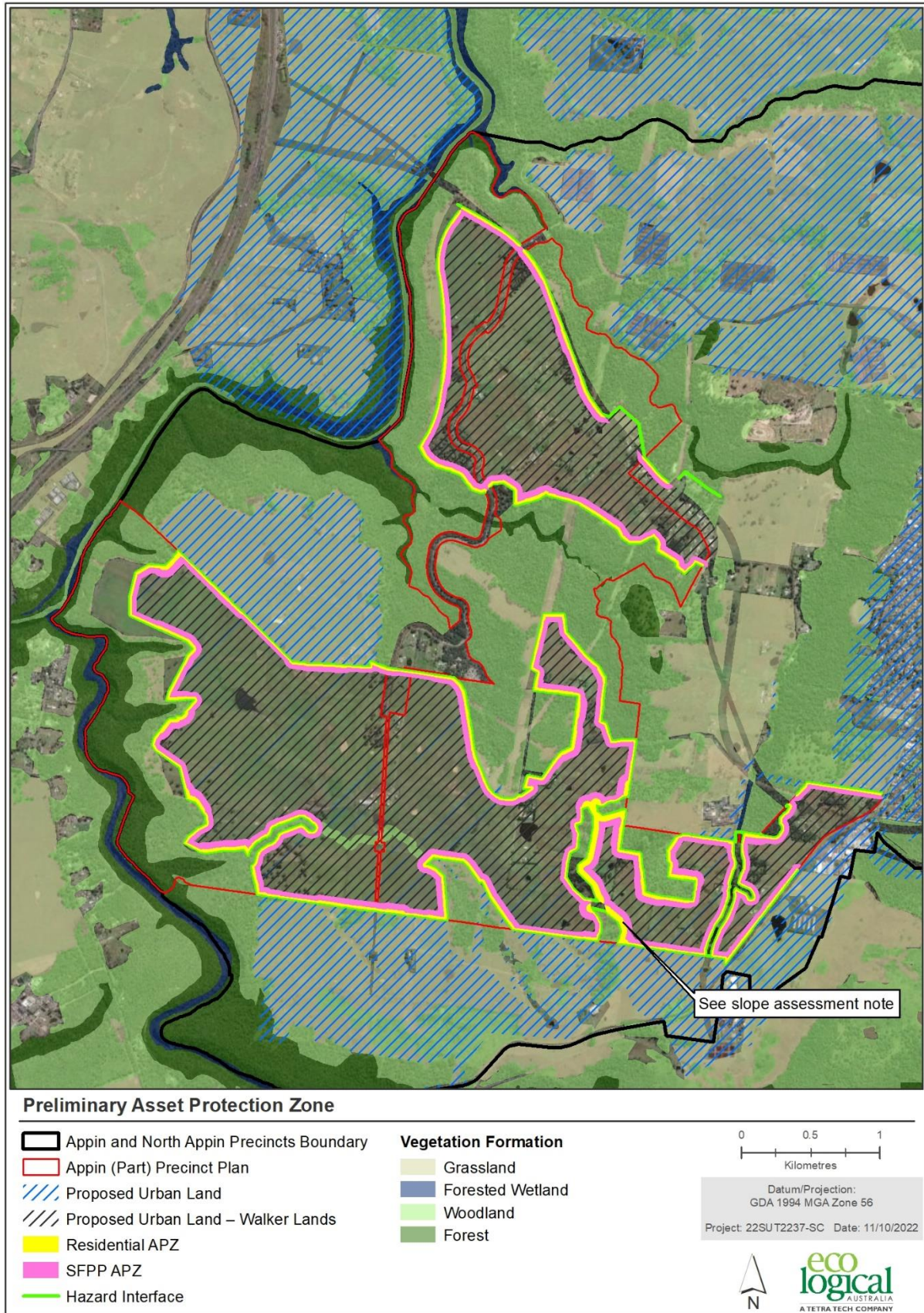


Figure 16: Preliminary Asset Protection Zones \* refer to section 3.3.1 for slope assessment note.



### 3.4 Summary of land use evaluation

The location and type of land uses included proposal are considered appropriate for the site, given the level of bushfire landscape risk, the nature of the subject land, the characteristics of the land uses proposed which follows broader precinct planning principles, and the ability for bushfire protection measures to be provided. It is assumed that more detailed design work will be undertaken to ensure appropriate staging and implementation, in order to meet or exceed the requirements of PBP.

Table 7 below provides a summary of the land use evaluation for differing development types.

**Table 8: Future land use evaluation**

Development Type	Assessment Considerations	Suitability
Residential Subdivision	The land use evaluation has considered potential land uses enabled by the rezoning and with consideration to:	Preliminary analysis indicates differing residential typologies can comply with PBP.
SFPP Development	<ul style="list-style-type: none"> <li>The risk profile of the site</li> <li>Proposed land use zones and permitted uses</li> <li>The most appropriate siting for different land uses based on the risk profile</li> <li>The impact of the siting of these uses on APZ provision</li> </ul>	Requirements for SFPP development have been considered and suitable areas are feasible within the precinct, with suitable areas outside of the SFPP APZ.
Buildings of Class 5 to 8 under the NCC /Section 8.3.10 Commercial and Industrial Development		No specific requirements apply however the aims and objectives of PBP can be achieved for future land uses. Where ground floor retail occurs in conjunction with residential development, then PBP requirements for residential development should apply.
Public Assembly Buildings		Requirements for SFPP development have been considered and there are suitable areas outside of the required SFPP APZ.
Multi-storey residential development		Future development is feasible outside of the 29 kW/m <sup>2</sup> APZ or greater and other relevant considerations can be addressed at site selection stage and subsequently at detailed design phase, therefore future multi-storey development is achievable. Future development will need to consider design aspect and material at detailed design to comply with the requirements in section 8.2.2 of PBP. Given the capacity of the site, these typologies can be located in areas not adjoining hazard, and/or outside of future bush fire prone land.
Staging	The assessment has considered potential land uses enabled by rezoning in regard to staging.	It is achievable for each stage to support bushfire protection measures required for varied typologies, without reliance on adjoining stages.

## 4. Access, Egress and Evacuation

Key to this study is the strategic planning criteria as outlined in Chapter 4 of PBP, which requires consideration to the provision of adequate infrastructure for emergency evacuation and firefighting operations. This includes:

- Capacity of the proposed road network for evacuating residents and responding emergency services, based on the existing and proposed community profile;
- The location of key access routes and direction of travel and; and
- The potential for development to be isolated in the event of a bushfire.

These aspects are considered in the sub sections that follow including a detailed overview relating to the delivery of key road infrastructure to support evacuation as stages are activated.

### 4.1 Access

The broader Appin precinct is a planned growth area under the *Greater Macarthur 2040* (see DPE structure plan in Figure 3) which has provision for various collector roads, sub-arterial roads, public transport corridors and the future Outer-Sydney Orbital connection (Figure 16). Additionally, preliminary planning has afforded early consideration to the inclusion of perimeter roads. Given the scale of the precinct, there is ample capacity for perimeter roads to be provided as planning and detailed design progresses. Therefore, perimeter access meeting the requirements set out in Table 5.3b of PBP is not considered a constraint to the feasibility of the proposal.

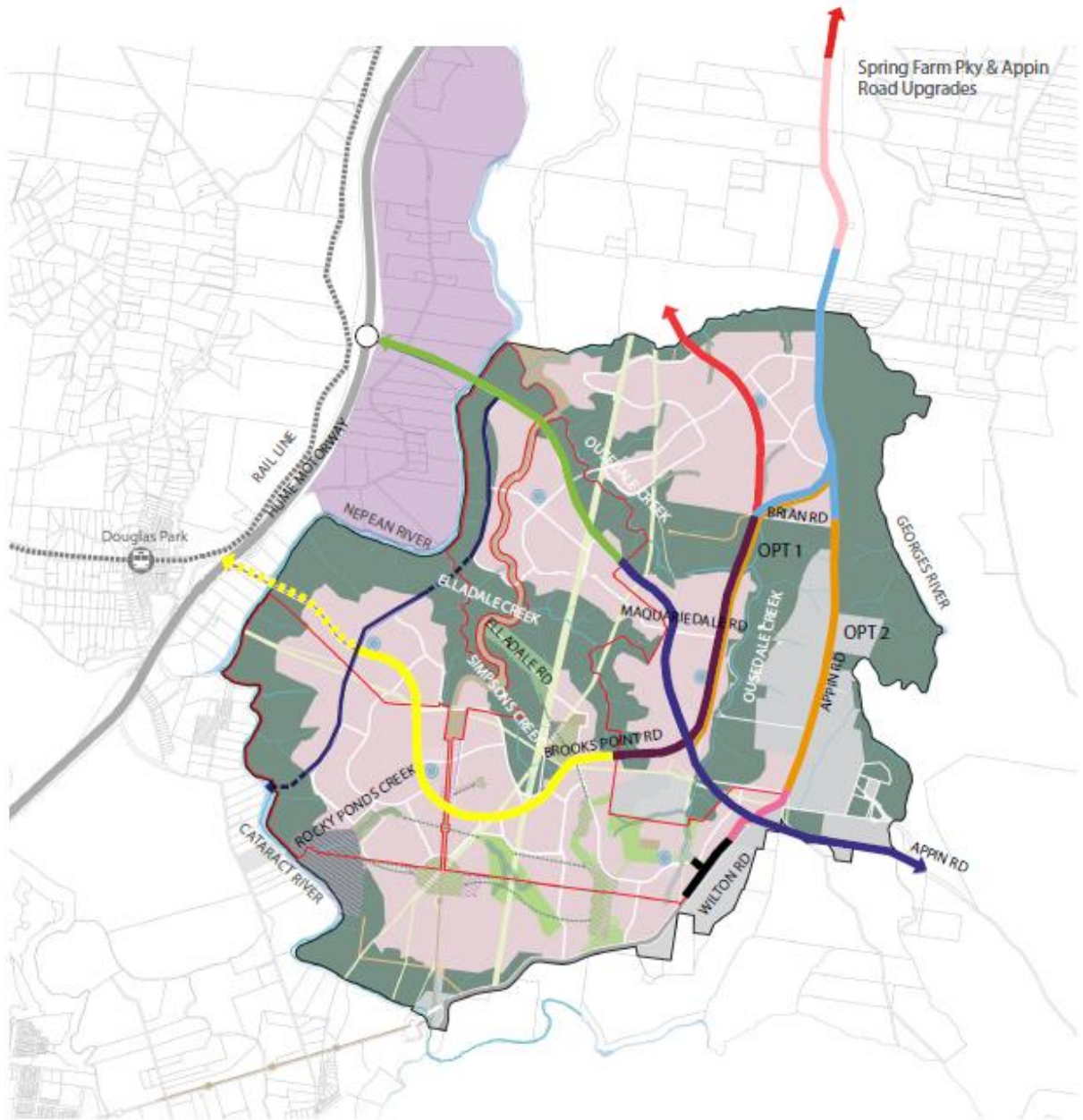
Future development applications will need to address access requirements in more detail as per PBP 2019 (see Table 14 Appendix A) including the provision of:

- A road design that facilitates the safe access and egress for residents and emergency service personnel, including multiple access/egress options for each area; and
- A road design with adequate capacity to facilitate satisfactory emergency evacuation.

#### 4.1.1 Staging of Road Infrastructure

As part of precinct planning, the delivery of road infrastructure has been considered in early staging plans (Figure 4). Table 8 and Figure 17 below highlights the delivery of key road infrastructure in relation to indicative timing for stage activation. These timings and the expected operational capacity of proposed roads and road upgrades has been considered in traffic analysis undertaken by WSP (2022). As these timeframes are best estimates during early planning, as stage planning progresses, timeframes and traffic modelling should be reconfirmed.

The WSP report summarises the access scenarios for each stage which have been used during traffic modelling to test evacuation adequacy. This is further discussed below.



**LEGEND:**

- Appin & North Appin Precincts Boundary
- Appin (Part) Precinct Boundary
- Appin Road Upgrade (Sth Gilead- Nth Appin)
- Transit Corridor (St 3A & St S2)
- Transit Corridor (St 1 & St S2)
- Transit Corridor (St 5 & Moreton Pk)
- East-West Connection Rd (Hume Hwy & St 2)
- East-West Connection Rd (St 2 & Appin Rd)
- North-South Connection Road
- Road Connection (by others)
- Spring Farm Parkway & Appin Road Upgrade (North of Appin - by others)
- Appin Road Upgrade / Bypass Options
- Wilton Road Upgrade - Bypass Option
- Wilton Road Intersection Upgrade
- Hume Highway Interchange

**APPIN & NORTH APPIN PRECINCTS STRATEGIC ROAD NETWORK UPGRADES**

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Figure 17: Road Infrastructure Network (source; Walker Corporation, 2022)

**Table 9: Indicative Road Infrastructure Delivery Timeframes**

Stage	Timing	Road Delivery	
Stage 1	2026	Spring Farm Parkway Extension Appin Rd Upgrade north of Gilead Appin Rd upgrade (South Gilead – Gilead)	
	2027	Appin Rd & Church St signalised intersection	
	2029	Appin Rd upgrade (North Appin - South Gilead) & N-S Transit Corridor (Neighbourhood 1-2A)	
		<u>Option 1</u>	<u>Option 2</u>
Stage 2	2030	Appin Rd upgrade (Appin Town – North)	
	2033	E-W Connection Rd (Neighbourhood 2 - Hume Hwy)	E-W Connection Rd (Neighbourhood 2 - Hume Hwy)
Stage 2A	2033		
	2037		
		<u>Option 1</u>	<u>Option 2</u>
Stage 3	2037/38	Wilton Rd (Neighbourhood 1 – Appin)	
	2038	E-W Connection Rd (Appin Rd - Neighbourhood 2)	E-W Connection Rd (Appin Rd - Neighbourhood 2)
	2040		
Stage 3A	2041	N-S Transit Corridor (Neighbourhood 2A – 3A)	
	2044		
Stage 4	2045/46		
	2050		
Stage 4A	2050		
	2051		
Stage 5	2051/52	N-S Transit Corridor (West - Moreton Park Rd)	
	2055/56		

**\*timeframes are best estimates**

## 4.2 Evacuation

While the risk of a significant bushfire necessitating the need for evacuation of the precinct in its entirety is low, it is nevertheless important that precinct planning affords the provision of multiple options for evacuation. The planned development of precincts provides an opportunity to increase community resilience to bushfire, planned urban development should ensure provision for:

- Early offsite evacuation with multiple options;
- Safe on-site refuge capacity;
- Low risk development outcomes.



These aspects are discussed below in relation to proposed rezoning within the precinct, with consideration to traffic modelling undertaken by WSP (2022). Due to the potential for bushfire impact on some evacuation routes (albeit a lower likelihood), the nature of the evacuation routes, timing and capacity has been considered with regard to staging, road capacity during a bushfire and redundancy.

#### 4.2.1 Early Offsite Evacuation

Evacuation is a necessary component of bushfire planning for the protection of life. Precinct planning should include adequate provision to support offsite evacuation. Key considerations for offsite evacuation are:

- Early offsite evacuation is critical, with late evacuation considered unsafe
- Evacuation should occur away from (or across) the path of a fire, but not towards it
- Roads that could be cut by fire during the evacuation period are not suitable
- The road must be suitable to use in an emergency situation
- Intervention by emergency services should not be relied on for road control or other activities.

While there is potential for fires to initiate external to the precinct, or within retained areas of vegetation, the potential for these fires to cut off all evacuation routes is considered extremely unlikely given there are proposed access routes in multiple directions away from the precinct. Notwithstanding, a conservative approach to traffic modelling has been undertaken by WSP for a range of scenarios for early offsite evacuation.

This includes consideration to the bushfire risk profile and in particular, bushfire weather, directional FFDI analysis and fire intensity modelling, which indicates a moderated risk profile to the south-west to north-west. Therefore, evacuation to the east onto Appin Road and north to Campbelltown was considered the most likely early evacuation scenario. Traffic modelling considered:

- Evacuation for ‘whole of development’
- Evacuation of dwellings within 100 m of the APZ (those considered bushfire prone and more likely to come under bushfire attack)
- Evacuation of early planned stages (Stage 1 and 2)
- Evacuation to a potential Neighbourhood Safer Place (discussed in section 4.2.2)

A summary of evacuation outcomes from the traffic study are collated in Table 9 below, and Figure 18 and Figure 19 demonstrate the capacity of the road network for evacuation traffic from Stage 1 and Stage 2.

**Table 10: Summary of Evacuation Outcomes (source WSP, 2022: page 28)**

Evacuation Scenario	Modelled Evacuation Time
<b>Option 1b Evacuating occupants in dwellings within 100 m of hazard</b>	
Independent Stage by Stage evacuation to Campbelltown via Appin Road	Ranging from 50 minutes to 2 hours per stage to Campbelltown
<b>Option 2a Evacuating Stage 1 – entire stage evacuation</b>	
Appin Road north only	7 hours AM peak; 6 hours PM peak

Evacuation Scenario	Modelled Evacuation Time
Appin Road north and east	3.8 hours AM peak; 2.5 hours PM peak
<b>Option 2b Evacuating Stage 2 – entire stage evacuation</b>	
Appin Road north only	3.3 hours AM peak; 2.7 hours PM peak
Appin Road north and east	2.5 hours AM peak; 2.5 hours PM peak
<b>Option 3a Evacuating Whole development – all stages*</b>	
Appin Road north only	8.5 hours
Appin Road north and east	6.2 hours
Appin Road north plus East-West Connection to the west	5.1 hours
Appin Road north and east plus East-West Connection to the west	4.3 hours

\*includes evacuation of Gilead and South Gilead. Assumption that background traffic ceased due to extremely situation warranting multi-precinct wide evacuation

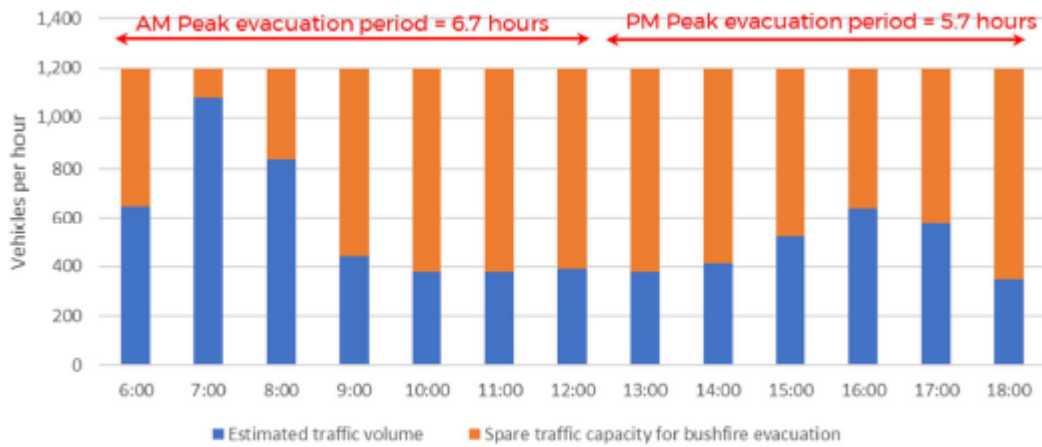


Figure 18: Estimated traffic volume and spare capacity for bushfire evacuation of Stage 1 (source WSP, 2022: Figure 4.1 option 2a)

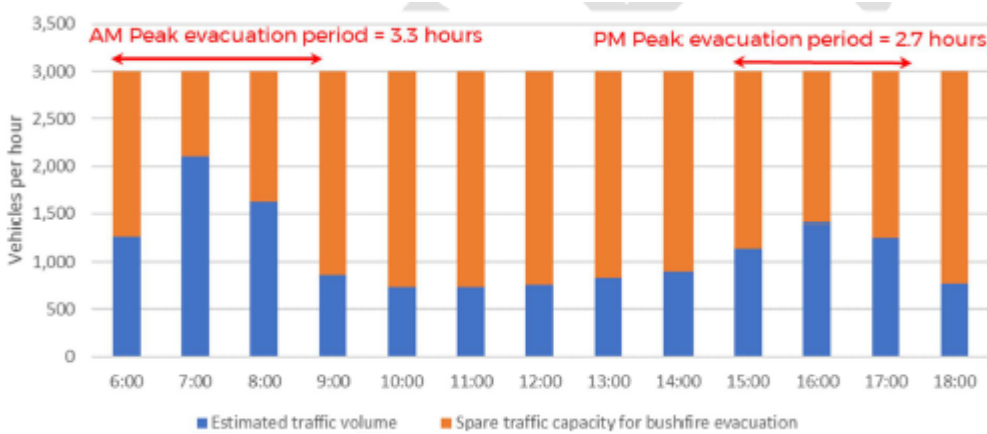


Figure 19: Estimated traffic volume and spare capacity for bushfire evacuation of Stage 2a (source WSP, 2022; Figure 4.2 option 2b)

The outcomes of the evacuation modelling performed by WSP are based on a conservative approach and are likely to overrepresent evacuation demand/constraint, with consideration to the following assumptions not tested by the modelling:

- Baseline traffic volumes were assumed, and no concession for reduced traffic on the road network were assumed (with the exception of Option 3a). For example, it is expected that a proportion of people will avoid travelling to a bushfire area and the baseline volume would be reduced from that used in the modelling, increasing the capacity on the network for evacuation.
- Traffic modelling considers that South Gilead and Gilead precincts are also evacuating, and therefore utilising the road network, however it is considered extremely unlikely that both the Appin and Gilead precincts would need to evacuate at the same time, given the reduced risk profile of the broader landscape.
- The capacity for safe onsite refuge was not considered in offsite evacuation modelling, and it is expected that pressure on the network would be reduced with a reduced number of people likely to evacuate offsite.
- Traffic modelling considered offsite evacuation to be 'outside of the precinct'. Once fully activated, it is expected that town centres within the planned neighbourhoods would be considered for 'on precinct' evacuation or refuge.

#### 4.2.2 Capacity Safe Onsite Refuge

Precinct planning presents an opportunity to adopt mitigation advantages that will afford future development the capacity to build bushfire resilient communities. The rezoning proposal proposed by Walker Corporation, for the precinct presents significant opportunity for the provision of safe onsite refuge. This can be formalised through the provision of Neighbourhood Safer Places (NSP's). Typically, NSPs provide a temporary safer place and include a *building or an open space that may provide for improved protection of human life during the onset and passage of a bush fire* (RFS 2017).

Whilst early offsite evacuation will always be the safest option, research into past bushfire incidents reveals that multiple and varying evacuation and refuge options should be provided to the community. Provision of safe onsite refuge locations is particularly important to support community resilience under rapid onset bushfire attack scenarios, where offsite evacuation may not be able to be undertaken or unsafe. Consideration of NSPs provides one mechanism for evaluation of safer locations for onsite refuge.

NSPs are approved by the NSW RFS and inspected by the regional Bush Fire Management Committee (BFMC). To ensure ongoing suitability and management, NSPs are included on the asset list in the regional Bush Fire Risk Management Plan (BFRMP). While there are no existing NSPs within the Precinct, existing NSPs are present close by in Appin and Rosemeadow (Table 10). There is also significant opportunity for planned community spaces within the precinct to be established as additional NSPs (Figure 20). Figure 20 highlights the capacity for the site to accommodate both built and open space NSPs, with indicative NSP setback requirements modelled for Walker Lands (Stage 1, 2, 3 & 4) and buffered based on the deemed to satisfy requirements for other stages (2A, 3A, 4A & 5).

The criteria and principles for NSPs are documented in RFS (2017) and included in Appendix B. Also presented in Appendix B is stage by stage indicative NSP mapping, demonstrating that not only is there capacity at each stage for safe onsite refuge, but also the decreasing hazard profile as the precinct and broader precinct is activated.



**Table 11: Existing NSPs**

Title	Type	Location	Distance (km)	Direction
Main Street Appin	Open Space	Appin Road, Appin	1	East
Oswald Reserve	Open Space	Oswald Crescent, Rosemeadow	9	North-East

The provision of onsite safe refuge locations by way of an NSP would also reduce the demand for offsite evacuation, particularly unsafe late offsite evacuation. As such, evacuation of occupants in dwellings within 100 m of the hazard to a potential NSP location was also considered in traffic evacuation modelling undertaken by WSP. The outcomes of this aspect of the analysis indicates that this form of occupant movement would provide a relatively quick (5 to 10 minute) (Option 1a) timeframe for relocation to a safer place. This demonstrates the potential value of planning for the provision of onsite safe refuge locations, in the context of rapid onset bushfire attack, where offsite evacuation may be unavailable or unsafe.

#### 4.2.3 Low risk development outcomes

In combination with the proposed capacity for early off-site evacuation and capacity for safe on-site refuge, the risk level of the proposed development outcomes across the precinct warrants consideration with respect to evacuation demand. Figure 21 maps a 100 m buffer from the bushfire hazard interface based on the development contemplated by the Structure Plan, with 100 m being the statutory distance that bushfire protection measures are applied to development within PBP and AS 3959 (i.e. bushfire prone property). This 100 m zone can also be considered as the area of future development that will be the most exposed to any bushfire attack and therefore where there is the greatest need for response by occupants, i.e. consideration of evacuation or refuge.

Given the size and shape of the precinct and planned stages within it, a large proportion of the planned urban land will be greater than 100 m from the closest bushfire hazard and thus not considered bushfire prone and as a result is not expected to be exposed to significant bushfire attack. As such, the developments and occupants located greater than 100m from the hazard will only be exposed to a low risk from bushfire and one which diminishes with distance from the hazard. Given this, in combination with the low bushfire risk exposure of the precinct wholistically, the evacuation or refuge need is primarily considered to be those occupants within 100m of the bushland hazard interface.

Figure 21 illustrates the indicative mapping of urban land within 100m of the hazard interface. Internal buffers are likely to reduce or become redundant as urban land adjacent to internal stages is activated. This includes the:

- Temporary hazard Stage 4a presents to the southern aspects of Stages 1 and 3,
- Temporary hazard Stage 5 presents to northern aspects of Stages 4 and 3
- Temporary hazard Stage 3a presents to the eastern aspect of Stage 2.

### 4.3 Emergency Services

The following is recommended for strategic land use planning to achieve the objectives and strategic planning principles of PBP 2019 relating to emergency management. Strategic emergency management planning is undertaken in collaboration with emergency service organisations within the strategic land

use planning process, to establish preferred future outcomes (i.e. emergency evacuation) that have implications for land use planning, including:

- a. Emergency evacuation planning; and
- b. Evacuation adequacy assessment.

However, as the precinct area is encompassed by broader regional planning mechanisms associated with the Greater Macarthur Growth Area, the provision of adequate infrastructure for emergency management will largely be considered as a component of broader planning. As the precincts are activated, additional emergency services will be required and therefore liaison with relevant government agencies should be initiated to provide understanding of Walker Corporations contribution to these matters. However as this will occur at various stages over a 30-year period, there is scope for existing services to expand resources to meet the growing demand, including the provision of emergency services in planned business areas. Once planned transport connections west across the Nepean River to Douglas Park and Hume Highway to Menangle are activated, there will be increased provision for emergency access.

Currently there are RFS brigades within close proximity including a brigade based at Appin, 1 km East. Additional NSW Fire and Rescue resources stationed at Rosemeadow, located approximately 12 km north. Further Fire and Rescue resources are located at Campbelltown (16 km north), Picton (25 km south-west) and Camden (25 km north-west).

#### 4.4 Evaluation of Access, Egress and Evacuation

The WSP traffic study concludes, that *subject to timely decisions to commence the evacuation, the proposed road network has sufficient capacity to facilitate the evacuation of the number of residents planned in the Appin Development*. Based on this outcome, it is considered appropriate for early off-site evacuation, and coupled with the opportunity for safe onsite refuge, along with low-risk development outcomes as discussed above, the proposal is not considered to be unsuitable for the precinct and consistent with the bushfire strategic planning requirements of PBP.

There are considerations for future iterations of staging to ensure adequate collector roads and sub-arterial roads are operational to facilitate access and egress for evacuation, however as traffic modelling demonstrates suitability for the early stages (Stage 1 and Stage 2) of precinct activation, this is not considered a limiting constraint for future stages. Further, as subsequent stages are initiated, the resilience of the site increases through hazard removal, increased connectivity across the road network, and the capacity for more safe onsite refuge options.

Opportunities to include provision of NSP's or the like in perpetuity through planning mechanisms such as Development Control Plans (DCP) should be explored where practical, as planning progresses.



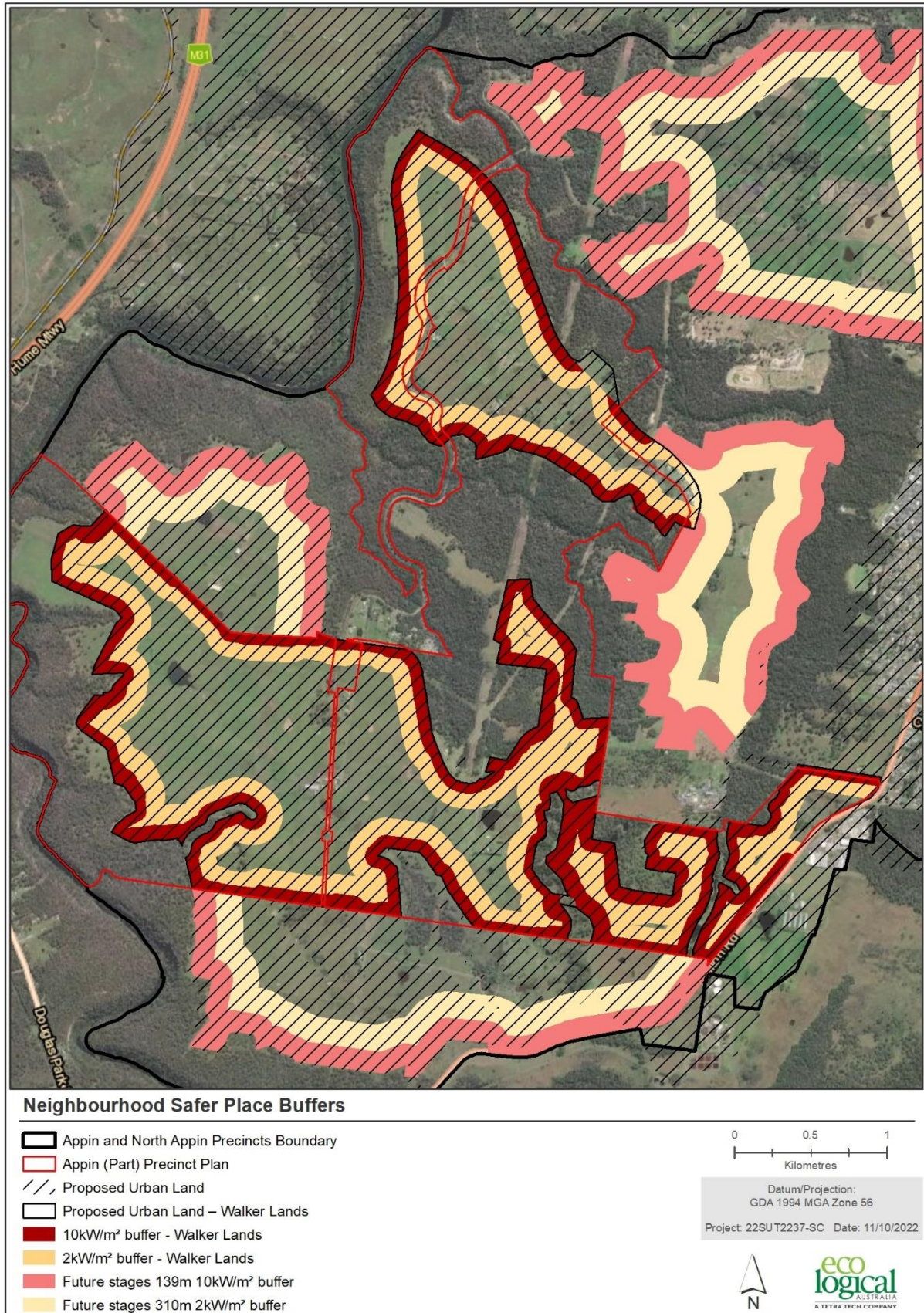


Figure 20: Capacity for Neighbourhood Safer Place



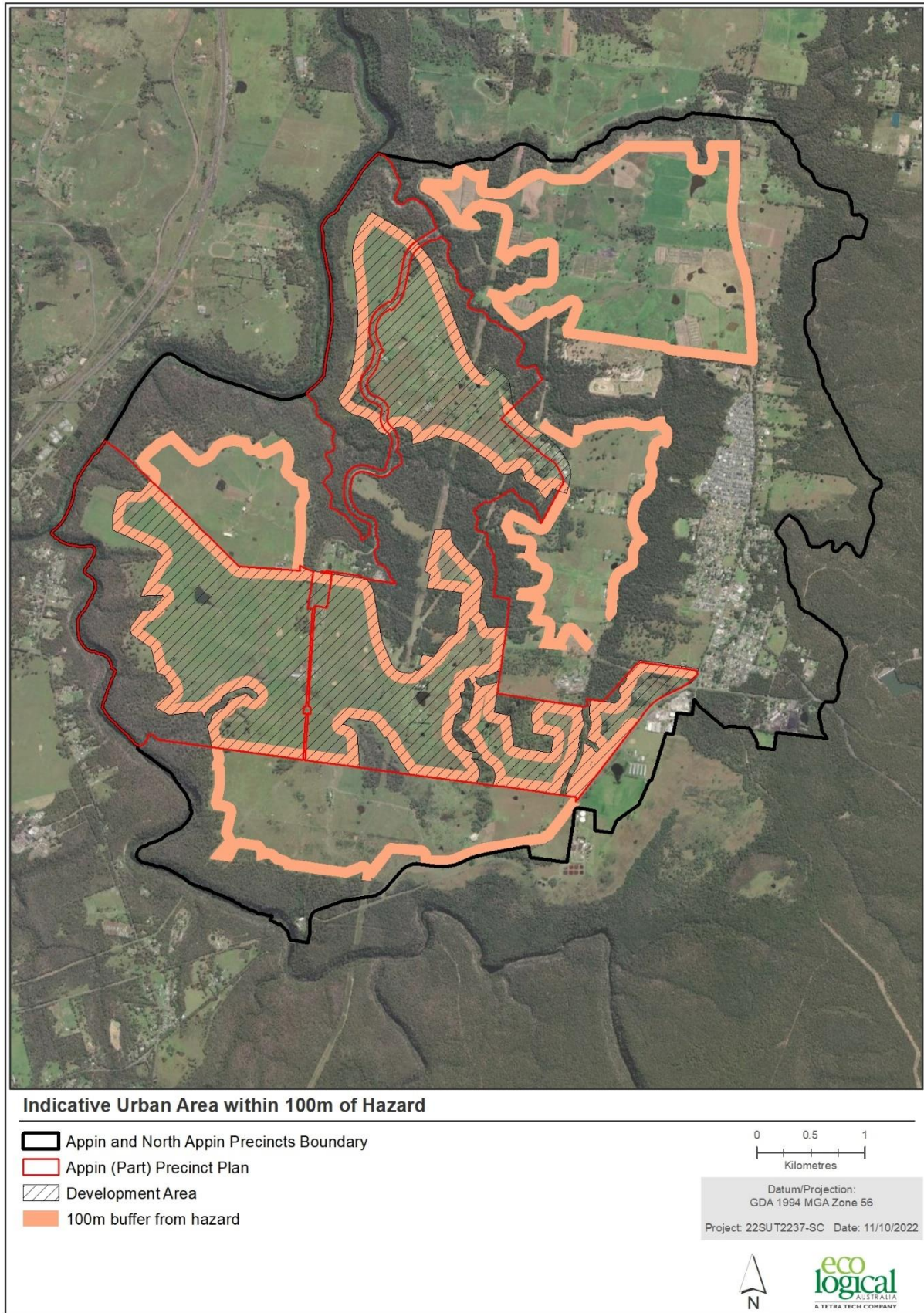


Figure 21: Indicative future bushfire affected area i.e. land within 100 m of hazard

## 4.5 Infrastructure and Adjoining Land

Future development on the Subject Land will need to meet the applicable requirements of PBP relating to infrastructure provision. The general requirements for development are discussed below and are considered achievable for this site. Specific requirements for SFPP developments and subdivision are detailed in PBP.

Strategic planning requirements seek to identify any potential issues associated with infrastructure and utilities. Key considerations on suitability of infrastructure to meet the requirements of PBP include the ability of the reticulated water system to deal with a major bushfire event in terms of pressures, flows, and spacing of hydrants and life safety issues associated with fire and proximity to high voltage power lines, natural gas supply lines, etc. These aspects are explored below and summarised in Appendix C. Table 5.3 and Table 6.8 of PBP detail the acceptable solution requirements.

## 4.6 Water

To comply with PBP, future development should be serviced by a reticulated water supply. Fire hydrant spacing, sizing and pressures should comply with AS 2419.1 – 2005 'Fire hydrant installations – Part 1: System design, installation and commissioning (SA 2005). Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Fire hydrants should not be located within any road carriageway. All above ground water and gas service pipes external to any buildings are to be metal, including and up to any taps. Where reticulated water cannot be provided a static water supply for firefighting purposes is required on site for each occupied building in accord with the capacities outlined in PBP.

Further detail regarding water supply requirements is detailed in PBP and acceptable solution requirements for water supply are expected to be achievable for future development within the subject land.

## 4.7 Electricity and gas

It is expected that future electricity supply to the Subject Land will be underground where possible and compliant with PBP. If existing or future electrical transmission lines to the subject land are above ground, the following requirements apply:

- Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and
- No part of a tree is closer to a line than the distance set out in accordance with the specifications in ISSC3 'Guide for the Management of Vegetation in the Vicinity of Electricity Assets' (ISSC3 2016).

Reticulated or bottled gas is to be installed and maintained in accordance with Australian Standard AS/NZS 1596:2014 'The storage and handling of LP Gas' (SA 2014) and the requirements of relevant authorities (metal piping must be used).

Further detail regarding electricity and gas requirements detailed in PBP. The acceptable solution requirements for these services are expected to be achievable for the future development within the study area contemplated by the Master Plan Application.

#### 4.8 Adjoining Land

Future development contemplated by the Master Plan Application should not compromise any offsite bushfire management works. Given the adherence to PBP that is required, any future development should also not require a change to the bushfire management practices for retained and/or adjoining bushfire prone vegetation. Additionally, there is capacity for all APZ's to be wholly within the Subject Land or provided by public roads. Therefore, there are no concerns regarding the impact of the proposal on adjoining land.



## 5. Evaluation

This section evaluates the proposal, against the bushfire strategic planning requirements of PBP and based upon the assessment findings in the preceding sections, to determine whether:

- The proposal poses an unacceptable risk or provides for inappropriate development;
- Future development can adequately responds to the bushfire threat; and
- Future development can provide adequate bushfire protection measures to reduce the residual risk to an appropriate level.

The evaluation is based upon Chapter 4 of PBP and the Assessment Framework of this Study, as summarised in Table 12. In addition to evaluating the proposal against these matters, the evaluation specifically considers:

- Residual risk - the level of residual risk after the application of bushfire protection measures is a key determinant in the strategic assessment of whether proposed development is appropriate;
- Risk to life - an appropriately low residual risk to human life is fundamental;
- Risk to property – the residual risk to property should meet the Acceptable Solutions within PBP;
- Emergency service response - the acceptability of proposed development should not be reliant on emergency service response / intervention;
- Adjoining lands – future development should not be reliant on fuel management on adjoining lands or effect those landowners’ ability to undertake such works

A summary of the evaluation of the precinct plan proposal against the strategic requirements is provided in Table 12, and a summary of recommendations and/or future considerations for detailed design to ensure the residual risk assessed can be achieved is included in Table 13.

**Table 12: Evaluation of proposal against strategic requirements of PBP**

PBP Strategic Planning Principle	Evaluation
Ensuring land is suitable for development in the context of bushfire risk	<p>The bushfire risk assessment for the proposal demonstrates that the residual bushfire risk context is not considered inappropriate following evaluation against the strategic planning principles of PBP. There is significant capacity for bushfire protection measures and site resilience, including substantial opportunity for onsite safe refuge, and low risk development outcomes which further moderate bushfire risk.</p> <p>In evaluating the residual risk, assessment of the bushfire landscape, including analysis of bushfire weather and fire behaviour along with future fire catchments and pathways was undertaken, intimating reduced exposure potential from the direction most favourable for bushfire conditions (i.e. south west to north) given the fragmented hazard landscape in this direction and reducing risk profile as proposed urban development is activated.</p>
Ensuring new development on BFPL will comply with PBP	<p>New development on BFPL can meet the requirements of PBP. In addition, once activated, only a small proportion of the precinct will remain as BFPL, meaning the majority of the precinct can afford low risk development outcomes, located greater than 100m from the hazard interface.</p>

PBP Strategic Planning Principle	Evaluation
Minimising reliance on performance-based solutions	The acceptable solutions of PBP by way of provision of APZ, access, infrastructure and water supply, can be accommodated for in detailed design, minimising reliance on performance-based solutions. Evaluation of APZ requirements demonstrates there is ample capacity for the provision of compliant APZs, and perimeter roads for development adjacent to the hazard interface.
Providing adequate infrastructure associated with emergency evacuation and firefighting operations	The proposal area is encompassed by broader regional planning mechanisms associated with the Greater Macarthur Growth Area and therefore the provision of adequate infrastructure for emergency management should be considered as a component of broader planning. It is recommended Walker Corporation liaises with relevant government agencies to understand their contribution to this (e.g. monetary or land based).
Facilitating appropriate ongoing land management practices	It is recommended that future hazards are managed under a vegetation plan and APZ management within public spaces is guided by a maintenance plan. Further, the proposal will not compromise management practices on off-site lands or necessitate any change for risk reduction reasons.

**Table 13: Considerations and Recommendations for Future Precinct Planning**

Consideration	Evaluation	Recommendation
Residual risk - the level of residual risk after the application of bushfire protection measures	<p>The precinct is subject to risk from bushfire. However, this is moderated through the capacity of the site to afford bushfire protection measures, evacuation capacity (offsite and onsite), and the decreasing risk profile. Further, an appropriate bushfire protection response can be afforded future development, specifically:</p> <ul style="list-style-type: none"> <li>• APZ requirements are achievable as demonstrated in this assessment.</li> <li>• Perimeter roads are achievable</li> <li>• Evacuation capacity is achievable</li> <li>• Infrastructure provisions are achievable</li> </ul>	<p>Ensure bushfire protection measures are adequately provisioned during detailed design, including temporary measures required until surrounding development is activated. This includes the provision of perimeter roads and APZ adjacent to all hazards.</p> <p>Ensure evacuation capacity as modelled is achievable during staging.</p> <p>Confirmation of modelled APZ dimensions and approach for hazard on slope greater than 20° is required.</p>
Risk to life - an appropriately low residual risk to human life is fundamental	<p>The residual risk to life is not inappropriate given the ability for the site to provide:</p> <ul style="list-style-type: none"> <li>• adequate access for early off-site evacuation,</li> <li>• on site safe refuge capacity; and</li> <li>• low risk development outcomes.</li> </ul> <p>Much of the future development will be located outside of land considered bushfire prone and therefore low risk development outcomes are achievable for much of the precinct.</p> <p>Early off-site evacuation has been demonstrated by traffic modelling along with onsite refuge potential.</p>	<p>As staging progresses, the provision of road infrastructure should align with precinct activation, as considered in this assessment, to support early offsite evacuation.</p> <p>Onsite refuge facilities should be established under an appropriate planning mechanism.</p>
Risk to property – the residual risk to property should meet the Acceptable Solutions within PBP	The acceptable solutions of PBP in relation to property protection measures will be assessed at the DA stage, however property measures are not constrained by the proposal:	Ensure bushfire protection measures are adequately provisioned at all stages of the planning pathway and

Consideration	Evaluation	Recommendation
	<ul style="list-style-type: none"> <li>• APZ requirements are achievable as demonstrated in this assessment</li> <li>• Requirements for services are achievable</li> <li>• Access requirements are achievable</li> <li>• BAL-29 construction is achievable</li> </ul> <p>Once fully activated, the majority of the urban area will not be considered bushfire prone resulting in low risk development outcomes.</p>	<p>compliant provisions are in place at the DA stage.</p>
<p>Emergency service response - the acceptability of proposed development should not be reliant on emergency service response / intervention</p>	<p>The Precinct is part of a planned Growth Area and additional emergency services will need to be provisioned for the development in the context of the broader Greater Macarthur Growth Area holistically. This is led by NSW Government emergency management planning.</p>	<p>Timeframes for emergency service provisions should complement precinct activation and Walker Corporation should engage with NSW Government on this issue.</p>
<p>Adjoining lands – future development should not be reliant on fuel management on adjoining lands or effect those landowners’ ability to undertake such works</p>	<p>Future development is not reliant on adjoining lands, rather development outcomes will result in a lower residual risk for neighbouring properties. Future development will not necessitate change in land management practices due to risk reduction.</p>	<p>Any temporary APZ’s or access provisions should be contained on Walker Lands, unless in agreeance with interested party.</p>



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## 6. Conclusion

This strategic study represents an assessment of a preliminary design that has been guided by DPIE through the *Greater Macarthur 2040 implementation plan*. The study has assessed the bushfire risk to the planning proposal and concludes that the site is in a bushfire landscape that is moderated through various mitigation advantages, with a decreasing risk profile due to planned urban growth, along with the precinct's capacity for the provision of appropriate bushfire protection measures. It has found that the precinct plan proposal put forward to facilitate rezoning of Walker Lands meets the strategic planning principles outlined in PBP and that there is scope for future development to achieve the required bushfire protection measures, including the provision APZs, perimeter roads, along with the implementation of other bushfire mitigation measures. As demonstrated, these measures are achievable during stage activation, and traffic modelling also demonstrates capacity for early offsite evacuation.

The precinct's capacity for bushfire protection measures and mitigation, along with a decreasing risk profile, moderated by precinct activation and the planned development of surrounding growth areas, presents future planned neighbourhoods that have increasing resilience to bushfire.

The proposal is consistent with Ministerial Direction 4.4 (Planning for Bushfire Protection) issued under section 9.1(2) of the *EP&A Act* and the requirements of PBP, however agreement regarding the assessment of land exhibiting slopes greater than 20 degrees should be confirmed before detailed stage planning progresses.

## References

- Bush Fire Management Committee (BFMC). 2017. Wollondilly/Wingecarribee Fire Management Committee Bush Fire Risk Management Plan. Approved by NSW Bush Fire Coordinating Committee.
- Cheney, P.N., Gould, J.S., McCaw, L.W., & Anderson, W.R. 2012. Predicting fire behaviour in dry eucalypt forest in southern Australia. *Forest Ecology and Management*. 280(2012):120-131.
- Department of Planning, Industry and Environment (DPIE). 2018. Greater Macarthur 2040 Plan. Sydney NSW.
- Douglas G. He Y. Yang X. and Morris E.C. 2014. Use of Extreme Value Analysis in Determining Annual Probability of Exceedance for Bushfire Protection Design. Proceedings of the 11th International Association of Fire Science, Christchurch, New Zealand.
- Douglas G., He Y. and Kwok K. 2016. Extreme Value Assessment of Forest Fire Behaviour. Proc. of the Eighth International Seminar on Fire & Explosion Hazards (ISFEH8). Edited by J. Chao, V. Molkov, P. Sunderland, F. Tamanini and J. Torero Published by USTC Press. China.
- Douglas G.B. 2017. Property protection from Extreme Bushfire Events under the Influence of Climate Change. Thesis March 2017.
- Eco Logical Australia (ELA). 2018. Wilton Growth Area Bushfire Strategic Study. Prepared for Department of Planning & Environment.
- Eco Logical Australia (ELA). 2021a. Greater Macarthur Bushfire Strategic Study. Prepared for Department of Planning & Environment.
- Eco Logical Australia (ELA). 2022. Appin (Part) Precinct Plan – Release Area 1, Addendum Bushfire Strategic Study. Prepared for Walker Corporation.
- Industry Safety Steering Committee 3 (ISSC3). 2016. ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Supply Infrastructure. November 2016. NSW.
- Keith, D. 2004. *Ocean Shores to Desert Dunes*. Department of Environment and Conservation, Sydney.
- Lucas, C. 2010. On developing a historical fire weather dataset for Australia. *Australian Meteorological and Oceanographic Journal*. 60: pp 1-14.
- Office of Environment and Heritage (OEH). 2013. Native Vegetation of the Cumberland Plain, 2013 vegetation update.
- McArthur, A. G. 1967. Fire Behaviour in Eucalypt Forests. Department of National Development Forestry and Timber Bureau, Canberra, Leaflet 107.
- National Association of Steel Framed Housing Inc. (NASH). 2014. *Steel Framed Construction in Bushfire Areas 2014*. NASH, Melbourne.

National Parks and Wildlife Service (NPWS). 2003. The Native vegetation of the Woronora, O'Hares and Metropolitan Catchment. Sydney NSW.

National Parks and Wildlife Service (NPWS) 2022. Fire History, downloaded from SEED (seed.nsw.gov.au)

NSW Department of Planning (DPE). 2002 <https://www.planningportal.nsw.gov.au/> (accessed June 2022).

NSW Rural Fire Service (RFS). 2015. Guide for Bush Fire Prone Land Mapping v5b, issued November 2015

NSW Rural Fire Service (RFS). 2017. Neighbourhood Safer Places, Guidelines for the identification and inspection of Neighbourhood Safer Places in NSW, issued April 2017.

NSW Rural Fire Service (RFS). 2019. Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, and Developers issued November 2019.

NSW Rural Fire Service (RFS). 2022. Fire History Record, downloaded from SEED (seed.nsw.gov.au)

Standards Australia (SA). 2005. *Fire hydrant installations - System design, installation and commissioning*, AS 2419.1, Fourth edition 2005, SAI Global, Sydney.

Standards Australia (SA). 2018. Construction of buildings in bushfire-prone areas (including Amendments 1 – 3), AS 3959-2009. SAI Global, Sydney.

Standards Australia (SA). 2014. *The storage and handling of LP Gas*, AS/NZS 1596:2014. SAI Global, Sydney.

Walker Corporation. 2020 Appin Precinct Vegetation mapping, June 2020, prepared by Niche.

WSP, 2022. Appin Development Bushfire Evacuation Study, prepared for Walker Corporation, July 2022.

Wollondilly Local Environment Plan (LEP) 2011. Accessed via [legislation.nsw.gov.au](http://legislation.nsw.gov.au) (June 2022)



## Appendix A Access Specifications

The following access specifications are reproduced from PBP (RFS 2019).

Intent of measures: To provide safe operational access to structures and water supply for emergency services while residents are evacuating an area.

**Table 14: Performance criteria for access for residential and rural residential subdivisions**

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation	<p>property access roads are two-wheel drive, all-weather roads, and</p> <p>perimeter roads are provided for residential subdivisions of three or more allotments; and</p> <p>subdivisions of three or more allotments have more than one access in and out of the development; and</p> <p>traffic management devices are constructed to not prohibit access by emergency services vehicles; and</p> <p>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; and</p> <p>all 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</p> <p>where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; and</p> <p>where access/egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided to an alternate point on the existing public road system.</p>
the capacity of access roads is adequate for firefighting vehicles	the capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/causeways are to clearly indicate load rating.
there is appropriate access to water supply	<p>hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression;</p> <p>hydrants are provided in accordance with AS 2419.1:2005;</p> <p>there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.</p>
access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface	<p>perimeter roads are two-way sealed roads; and</p> <p>8m carriageway width kerb to kerb; and</p> <p>parking is provided outside of the carriageway width; and</p> <p>hydrants are located clear of parking areas; and</p> <p>there are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and</p> <p>curves of roads have a minimum inner radius of 6m; and</p> <p>the maximum grade road is 15° and average grade is 10°; and</p> <p>the road crossfall does not exceed 3°; and</p>

Performance Criteria	Acceptable Solutions
	<p>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</p>
<p>access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating</p>	<p>minimum 5.5m width kerb to kerb; and                      parking is provided outside of the carriageway width; and                      hydrants are located clear of parking areas; and                      roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and                      curves of roads have a minimum inner radius of 6m; and                      the road crossfall does not exceed 3°; and                      a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</p>
<p>firefighting vehicles can access the dwelling and exit safely</p>	<p>No specific access requirements apply in an urban area where a 70 metre unobstructed path can be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles (i.e. a hydrant or water supply).</p> <p>In circumstances where this cannot occur, the following requirements apply:</p> <p>minimum carriageway width of 4m;</p> <p>in forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay; and</p> <p>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches; and</p> <p>provide a suitable turning area in accordance with Appendix 3; and</p> <p>curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress; and</p> <p>the minimum distance between inner and outer curves is 6m; and</p> <p>the crossfall is not more than 10°; and</p> <p>maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads; and</p> <p>a development comprising more than three dwellings has formalised access by dedication of a road and not by right of way.</p> <p>Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m), extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. the gradients applicable to public roads also apply to community style development property access roads in addition to the above.</p>

## Appendix B NSP Criteria

**Table 15: Assessment Criteria for a Neighbourhood Safer Place (RFS 2017)**

Factor	Performance Criteria	Acceptable Solution
Radiant Heat	Building is located and constructed to enhance the chance for survival for humans in attendance from the radiant heat of a bush fire.	Building is situated to prevent direct flame contact, material ignition and radiant heat level of 10kW/m <sup>2</sup> ; or Provide 139 metres separation distance from a bush fire hazard.
	Open Space is located to enhance the chance for survival for humans in attendance from the radiant heat of a bush fire.	Open Space is situated and maintained to prevent direct flame contact, material ignition and radiant heat levels of 2kW/m <sup>2</sup> ; or Provide 310 metres separation distance from a bush fire hazard
Maintenance of the Site and the Land Adjacent	Area between bush fire hazard and the site is maintained to a level that ensures the radiant heat levels at the Building/Open Space meet the Performance Criteria for Radiant Heat.	The site and land adjacent to the site between the Building/Open Space and the bush fire hazard is managed land or maintained in accordance with NSW RFS document Standards for Asset Protection Zones

**Table 16: Principles for Site Identification (RFS 2017)**

Consideration	Principles
Site Selection	An NSP should provide a safer place for the community.
	The community should be moving away from the bush fire hazard to access the NSP over short distances where possible.
	NSP locations should reflect community need and bush fire risk.
Moving to a NSP	An NSP should not be isolated from the community.
	The community should not be impeded from reaching the NSP area in a bush fire situation.
Capacity	Additional NSPs should be sought where it is likely current or potential NSPs cannot accommodate those likely to use it.
	Demand for use of an NSP reflect a community’s level of bush fire preparedness.



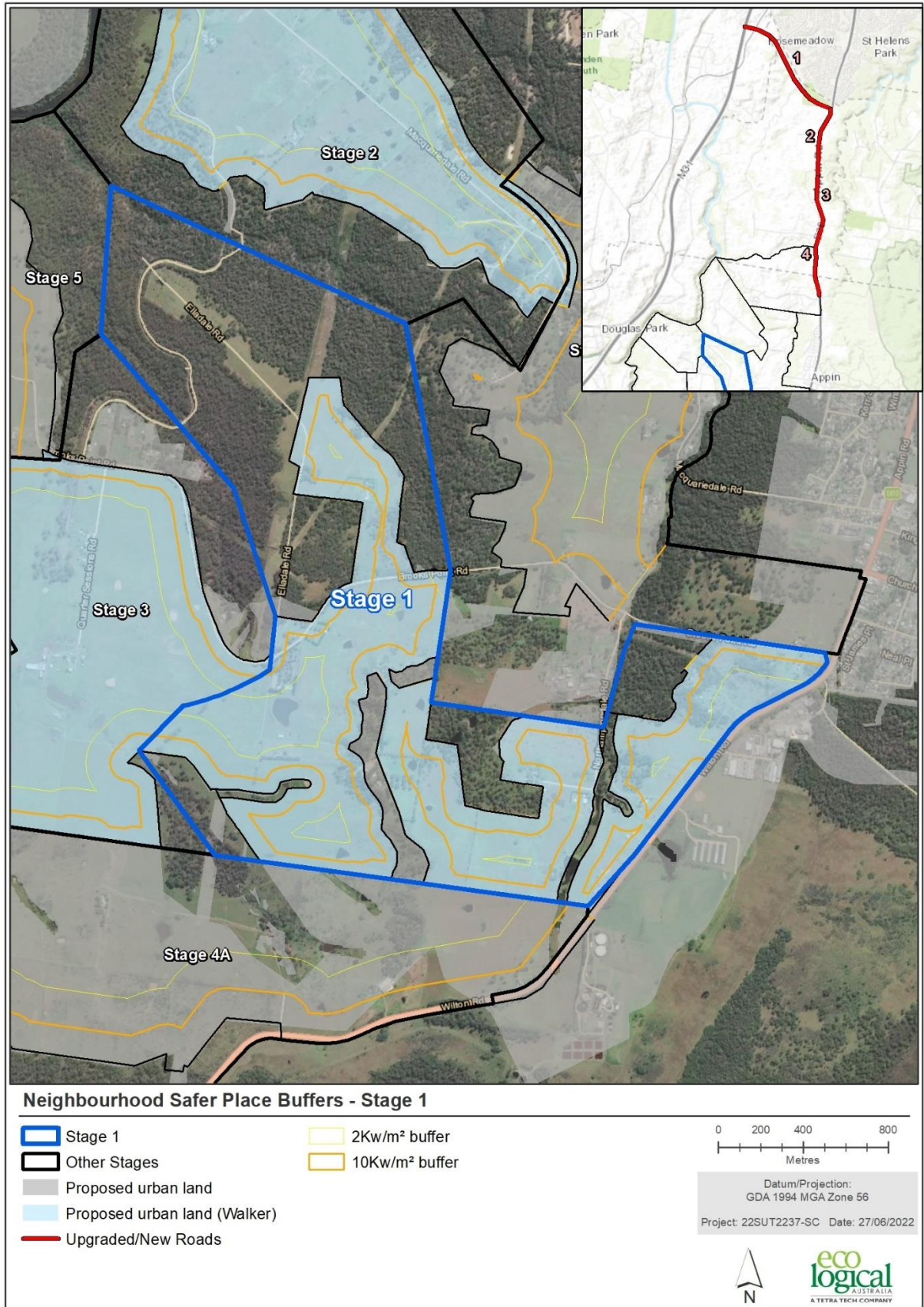


Figure 22: Indicative NSP capacity – Stage 1



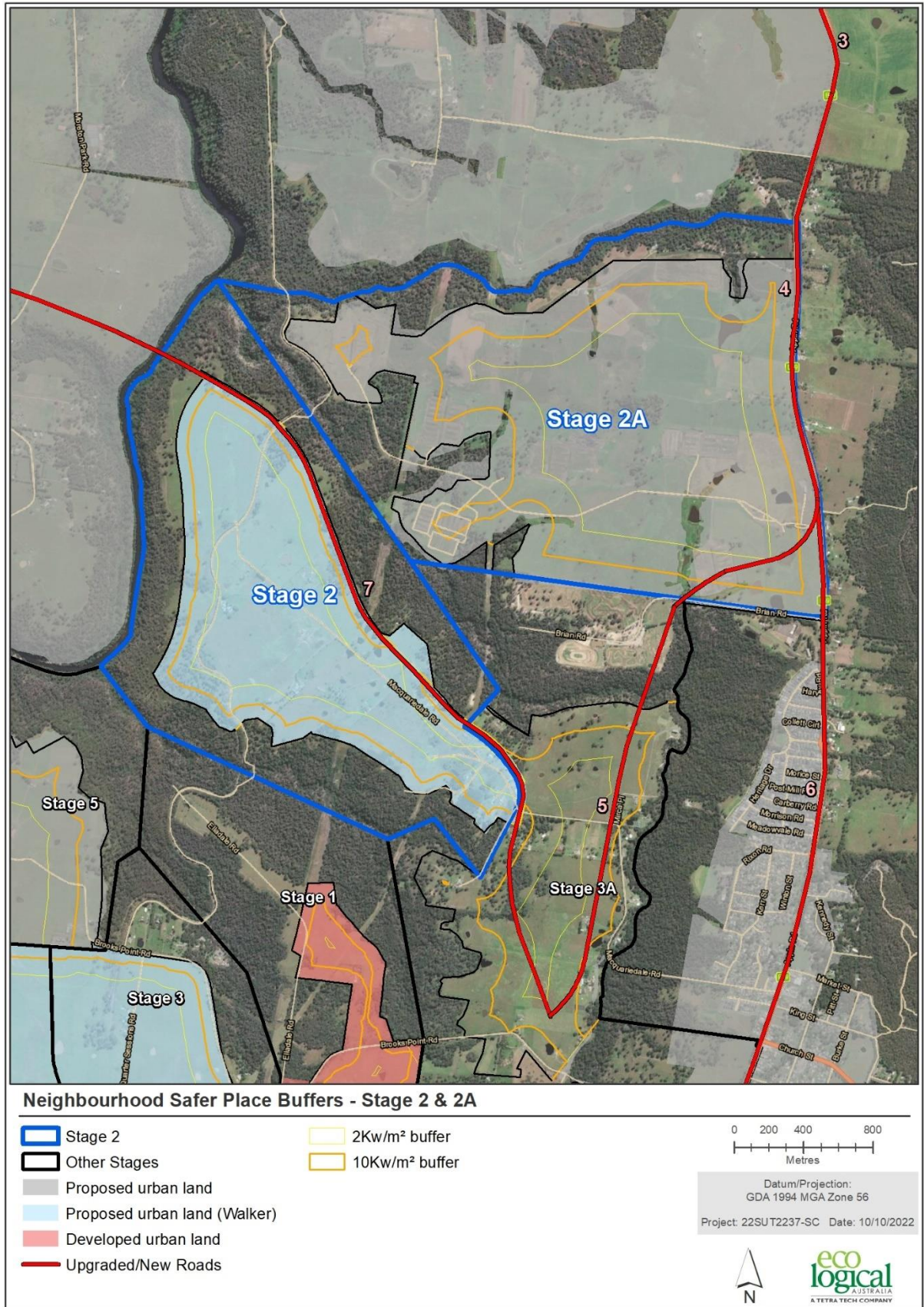


Figure 23: Indicative NSP capacity – Stage 2 & 2A



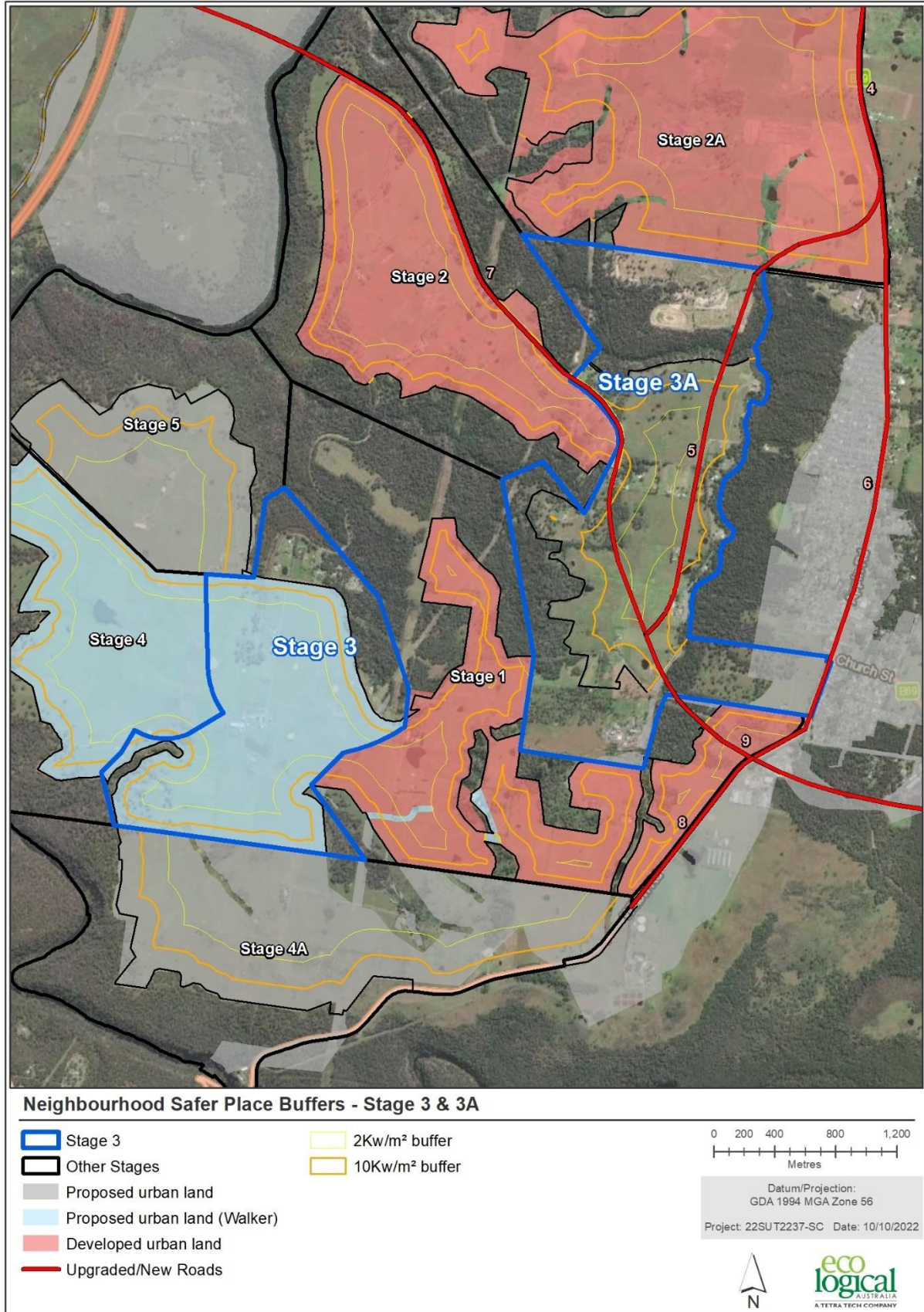


Figure 24: Indicative NSP capacity – Stage 3 & 3A



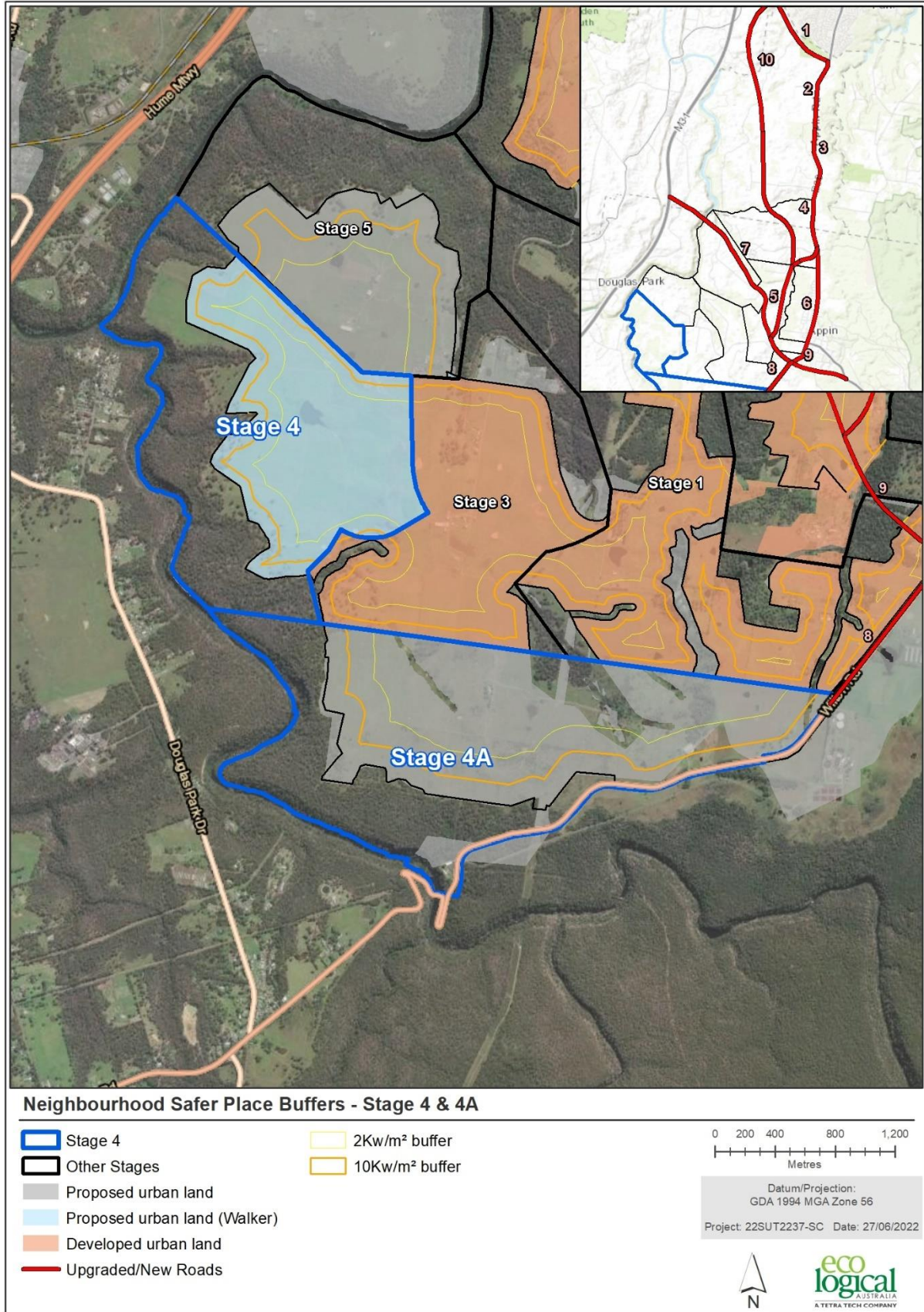


Figure 25: Indicative NSP capacity – Stage 4 & 4A



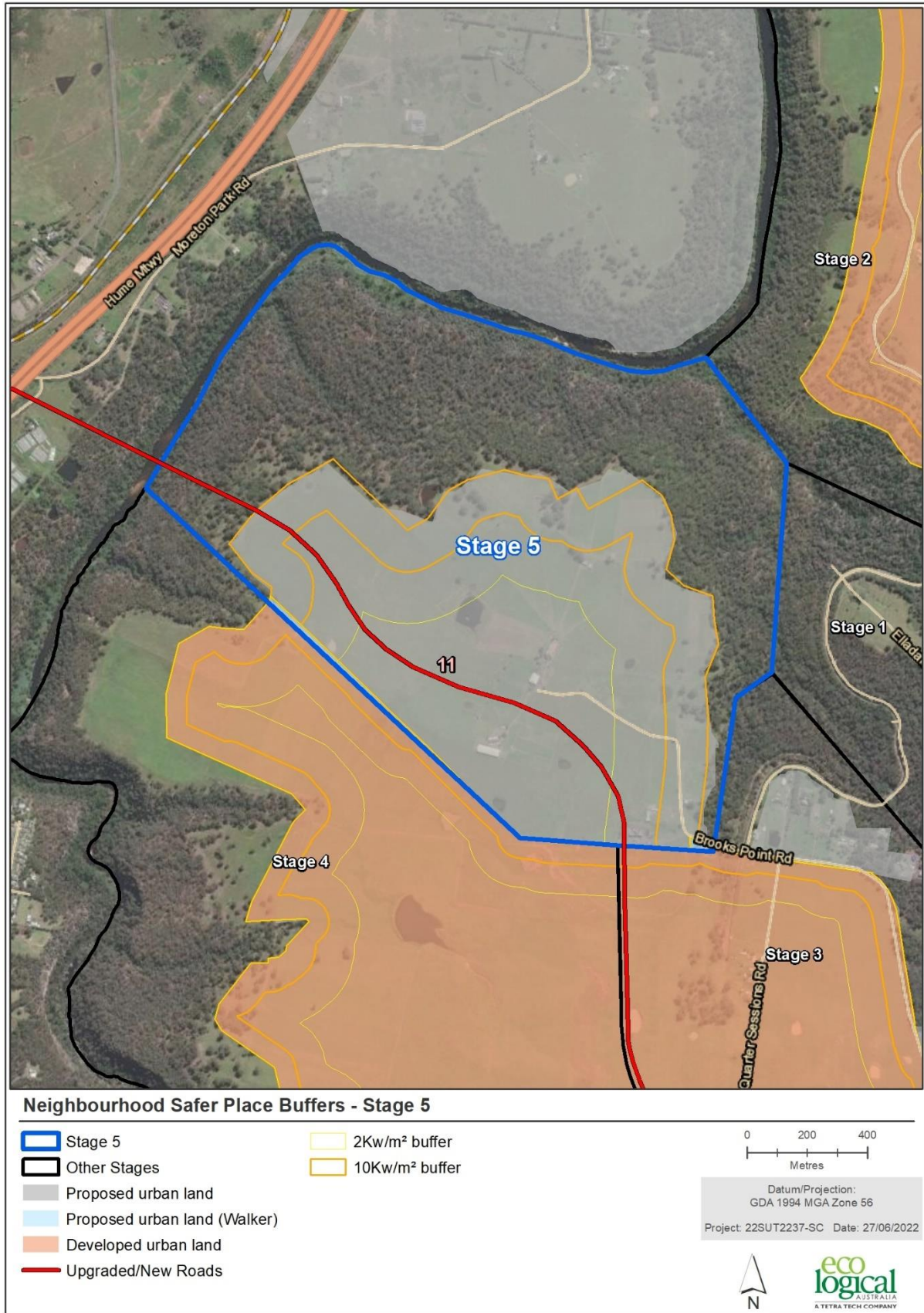


Figure 26: Indicative NSP capacity – Stage 5

## Appendix C : Services Specifications

The following services specifications (provision of water, gas and electricity) are reproduced from PBP (RFS 2019).

Intent of measures: provide adequate services of water for the protection of buildings during and after the passage of a bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.

**Table 17: Performance criteria for services provision for residential and rural residential subdivisions**

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
a water supply is provided for firefighting purposes	reticulated water is to be provided to the development, where available; a static water supply is provided where no reticulated water is available.
water supplies are located at regular intervals	fire hydrant spacing, design and sizing comply with the Australian Standard AS 2419.1:2005;
the water supply is accessible and reliable for firefighting operations	hydrants are not located within any road carriageway; reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.
flows and pressure are appropriate	fire hydrant flows and pressures comply with AS 2419.1:2005.
the integrity of the water supply is maintained	all above-ground water service pipes external to the building are metal, including and up to any taps.
location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings	where practicable, electrical transmission lines are underground; where overhead, electrical transmission lines are proposed as follows: lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; no part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines.
location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used; all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side; connections to and from gas cylinders are metal; polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not used; above-ground gas service pipes are metal, including and up to any outlets.



**Table 18: Water supply requirements for non-reticulated developments or where reticulated water supply cannot be guaranteed (Table 5.3d of PBP)**

Development Type	Water Requirements
Residential lots (<1000m <sup>2</sup> )	5000L/lot
Rural-residential lots (1000-10,000m <sup>2</sup> )	10,000L/lot
Large rural/lifestyle lots (>10,000m <sup>2</sup> )	20,000L/lot
Multi-dwelling housing (including dual occupancies)	5000L/dwelling

