

A stylized topographic map with green contour lines is positioned on the left side of the page, extending from the top left towards the bottom left.

Goulburn Mulwaree Residential Settlement Strategic Bushfire Study

Goulburn Mulwaree Council

DOCUMENT TRACKING

Project Name	Goulburn Mulwaree Residential Settlement Strategic Bushfire Study
Project Number	21SUT19881
Project Manager	Deanne Hickey
Prepared by	Deanne Hickey / Scott Chrystal / Erin Hodgkin
Reviewed by	Nathan Kearnes (FPAA BPAD Certified Practitioner: BPAD23575-L3)
Approved by	Nathan Kearnes (FPAA BPAD Certified Practitioner: BPAD23575-L3)
Status	Final
Version Number	v7
Last saved on	15 November 2023

This report should be cited as 'Eco Logical Australia 2023. *Goulburn Mulwaree Residential Settlement Strategic Bushfire Study*. Prepared for Goulburn Mulwaree Council.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Goulburn Mulwaree Council.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Goulburn Mulwaree Council. The scope of services was defined in consultation with Goulburn Mulwaree Council, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information. Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 2.8.1

Contents

Executive Summary	6
1. Introduction	7
1.1 Study Area	7
1.2 Investigation Areas	7
1.3 Aims and Objectives	9
1.4 Bushfire Prone Land Status	9
2. Legislative Framework	22
2.1 Legislation	22
2.1.1 NSW Environmental Planning and Assessment Act (1979)	22
2.1.2 Rural Fires Act 1997 (RF Act)	23
2.2 Assessment Approach	23
2.3 Assessment Framework	25
3. Bushfire Landscape Risk Assessment	28
3.1 Bushfire Hazard	28
3.1.1 Vegetation	28
3.1.2 Slope	28
3.2 Bushfire Risk Considerations	32
3.2.1 Bushfire Weather	32
3.2.2 Potential Bushfire Behaviour	33
3.2.3 Fire History	34
3.2.4 Bushfire Catchment, Spread and Ignition	34
3.3 Summary of Landscape Bushfire Risk Assessment	34
4. Land Use Assessment	46
4.1 Land Use Evaluation	46
4.1.1 Chapter 5 of PBP – Residential and Rural Residential Subdivision	46
4.1.2 Chapter 7 of PBP - Residential Infill Development	46
4.2 Risk Profile	46
4.2.1 Feasibility of Asset Protection Zones	47
4.3 Summary of land use evaluation	48
5. Access, Egress and Evacuation	58
5.1 Access	58
5.2 Evacuation	58
5.2.1 Early Offsite Evacuation	59

5.2.2 Access to Safer Places	59
5.2.3 Low risk development outcomes	60
5.3 Emergency services	60
5.4 Evaluation of Access, Egress and Evacuation	70
6. Infrastructure and Adjoining Land	71
6.1 Water	71
6.2 Electricity and gas	71
6.3 Telecommunications	72
6.4 Adjoining Land	72
7. Evaluation	73
8. Conclusion	83
9. References	84
Appendix A - Access Specifications	86
Appendix B – Neighbourhood Safer Place Criteria	89
Appendix C – Asset Protection Zone Specifications	90
Appendix E – Services Requirements	91

List of Figures

Figure 1: Goulburn LGA and towns identified for potential residential settlement	11
Figure 2: Goulburn Investigation Areas (source GMC)	12
Figure 3: Contemplated residential settlement area – Goulburn East	13
Figure 4: Contemplated residential settlement area – Goulburn South	14
Figure 5: Contemplated residential settlement area – Goulburn West	15
Figure 6: Marulan Investigation Areas	16
Figure 7: Contemplated residential settlement area – Marulan and Tallong	17
Figure 8: Contemplated residential settlement area – Towrang	18
Figure 9: Contemplated residential settlement area – Bungonia	19
Figure 10: Contemplated residential settlement area – Lake Bathurst	20
Figure 11: Contemplated residential settlement area – Tarago	21
Figure 12: Bushfire Prone Land across the study area	27
Figure 13: Vegetation formation across the Study Area	30
Figure 14: Slope across the Study Area	31
Figure 15: Directional Fire intensity modelling based on FFDI 101, South-west to North-east winds	40
Figure 16: Directional Fire intensity modelling based on FFDI 39, South-east to South-west winds	41
Figure 17: Directional Fire intensity modelling based on FFDI 51, North-east to South-east winds	42
Figure 18: Mapped wildfire history within the study area (Source: NPWS and RFS)	43
Figure 19: Fire frequency within the study area – 1951/1952 fire season to 2019/2020 season	44
Figure 20: Fire Extent and Severity Mapping 2019-2020 Fire Season (DPE, 2022)	45
Figure 21: Vegetation and Slope Constraints – Goulburn	51
Figure 22: Vegetation and Slope Constraints – Marulan	52

Figure 23:Vegetation and Slope Constraints – Talong	53
Figure 24:Vegetation and Slope Constraints – Towrang.....	54
Figure 25:Vegetation and Slope Constraints – Bungonia.....	55
Figure 26: Vegetation and Slope Constraints – Lake Bathurst.....	56
Figure 27: Vegetation and Slope Constraints – Tarago.....	57
Figure 28: Existing Neighbourhood Safer Places.....	62
Figure 29: Fire stations in close proximity to the investigation areas	63
Figure 30: Evacuation routes from Bungonia.....	64
Figure 31: Evacuation routes from Lake Bathurst.....	65
Figure 32: Evacuation routes from Marulan	66
Figure 33: Evacuation routes from Tallong	67
Figure 34: Evacuation routes from Tarago.....	68
Figure 35: Evacuation routes from Towrang.....	69

List of Tables

Table 1: Towns and villages identified for assessment of residential uplift	8
Table 2: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019).....	25
Table 3: Risk Assessment Framework	26
Table 4: Vegetation formation and fuel loads for vegetation types in the study area.....	29
Table 5: Evaluation of Bushfire Landscape.....	36
Table 6: APZ dimensions for residential development	48
Table 7: Land Use Evaluation for the Investigation Areas	49
Table 8: Existing NSPs in close Proximity	59
Table 9: Fire stations within proximity to investigation areas	60
Table 10: Access, Egress and Evacuation Evaluation of each locality	70
Table 11: Evaluation of proposal against strategic planning requirements of PBP	74
Table 12: General access requirements (adapted from Table 5.3b of PBP)	86
Table 13: Perimeter Road requirements (adapted from 5.3b of PBP).....	87
Table 14: Non-perimeter road requirements (adapted from Table 5.3b of PBP).....	87
Table 15: Property access requirements (adapted from Table 5.3b of PBP).....	88
Table 16: Assessment Criteria for a Neighbourhood Safer Place (RFS 2017)	89
Table 17: Principles for Site Identification (RFS 2017)	89
Table 18: APZ requirements and compliance (adapted from Table 5.3a of PBP).....	90
Table 19: Landscaping requirements and compliance (adopted from Table 5.3a of PBP)	90
Table 20: Water supply requirements (adapted from Table 5.3c of PBP)	91
Table 21: Assessment of requirements for the supply of Electricity services (adapted from Table 5.3c of PBP)	91
Table 22: Assessment of requirements for the supply of gas services (adapted from Table 5.3c of PBP)	91

Abbreviations

Abbreviation	Term
AS	Australian Standard
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BC Act	<i>Biodiversity Conservation Act 2016</i>
BFPL	Bush Fire Prone Land
BFPV	Bush Fire Prone Vegetation
BFRMP	Bush Fire Risk Management Plan
BFRMC	Bush Fire Risk Management Committee
CDC	Complying Development Certificate
DA	Development Application
DPE	Department of Planning and Environment
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
FDR	Fire Danger Rating
FFDI	Forest Fire Danger Index
GEV	Generalised Extreme Value
GMC	Goulburn Mulwaree Council
GSC	Greater Sydney Commission
LEP	Local Environmental Plan
LGA	Local Government Area
NP	National Park
NSP	Neighbourhood Safer Place
NSW	New South Wales
PBP	Planning for Bushfire Protection (2019)
RF Act	Rural Fires Act 1997
RFS	Rural Fire Service
SCA	State Conservation Area
SWS	Static Water Supply
URA	Urban Release Area

Executive Summary

This study presents a high-level evaluation of the suitability of residential settlement areas contemplated by Goulburn Mulwaree Council (GMC) with regard to bushfire risk and bushfire protection. There are seven towns and villages being investigated for future growth of residential settlement, and these investigation areas are the focus of this study. This study is for informative purposes and pending the outcome of this study, and any others, undertaking further planning for each investigation area may be required.

Each investigation area was considered against the bushfire strategic planning requirements of *Planning for Bushfire Protection* (PBP) 2019. In undertaking this assessment, a Strategic Bushfire Study was prepared to comply with the requirements set out in Chapter 4 (*Strategic Planning*) of PBP. This Strategic Bushfire Study examines whether the proposal for each investigation area 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 investigation areas, along with the feasibility for the provision of bushfire protection measures within the identified areas. In consideration of the investigation areas for potential residential settlement growth 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 the bushfire protection requirements set out in PBP.

As the assessment detailed herein is for the purpose of early planning, and not for submission as a planning proposal, each investigation area was assessed as having the potential to comply with the strategic bushfire planning requirements of Chapter 4 of PBP, subject to further assessment against the strategic planning principles and “inappropriate development” exclusion requirements of PBP.

The outcomes of this assessment determine that for each investigation area, bushfire protection measures can be achieved by future residential development, including the provision of asset protection zones and access for evacuation and egress.

Key recommendations for future planning are identified in Section 7 of this report and include the consideration of additional Neighbourhood Safer Place’s (NSP) by the Bushfire Risk Management Committee in liaison with Council when rezoning is considered (e.g., the use of Tallong Public School as an NSP to provide additional resilience to the school and general community), access connections, evaluations of the capacity of existing evacuation routes and potential for upgrades. Confirmation from relevant emergency management authorities regarding the adequacy of existing emergency management should also be sought. A feasibility assessment of static water supply requirements for bushfire should also be considered to improve the potential for each investigation area to comply with strategic bushfire planning requirements of Chapter 4 of PBP.

1. Introduction

This Strategic Bushfire Study (SBS) has been prepared to evaluate future residential settlement options, being considered by Goulburn Mulwaree Council (GMC). This study provides an assessment of the investigation areas for future residential growth in regard to the strategic planning principles outlined in *Planning for Bushfire Protection* (PBP) (NSW RFS 2019). The investigation areas have been identified as part of early planning, and it is anticipated that once residential settlement areas are confirmed, intended land use outcomes will be enabled via amendment to the Goulburn Mulwaree Local Environment Plan (LEP) and/or Development Control Plan (DCP). Specific development outcomes would then be facilitated via the development application (DA) process, and if occurring on bushfire prone land (BFPL), would be subject to the relevant requirements set out in PBP, with further and more detailed assessment.

1.1 Study Area

Goulburn Mulwaree Council is located in the Southern Tablelands region of New South Wales, approximately 190 km southwest of Sydney (Figure 1). Agricultural land uses dominate the landscape, with the western portion of the LGA primarily rural grassland. Bungonia National Park and State Conservation Area are located within the eastern portion of the LGA, supporting remnant vegetation. The areas being considered for future residential settlement growth, primarily occupy land currently zone for rural landscape (RU2), rural transition (RU6) and rural villages (RU5).

1.2 Investigation Areas

GMC have identified seven localities where future residential settlement is being considered, some of which are comprised of multiple investigation areas (Table 1). Identification of these areas and insight into current constraints and their impacts on future settlement will assist Council in future planning, including investment in infrastructure.

It is understood that future residential settlement would be delivered by a number of mechanisms, including changes to minimum lot sizes to facilitate subdivision and infill development and rezoning.

The Urban and Fringe Housing Strategy (Elton, 2020) outlines recommendations for future land use typologies within Goulburn and Marulan (summarised in Table 1) to facilitate residential housing supply. In these areas, a more targeted approach to residential growth is envisaged, primarily via rezoning. For the village areas, recommendations from the Goulburn Mulwaree Strategy 2020 (Parsons Brinckerhoff, 2006) seek the adoption of minimum lot sizes, which would facilitate a lower level of residential growth, via infill development and subdivision. These recommendations for village areas include the following minimum lot sizes:

- R1 General Residential: 700 square metres
- R2 Low Density Residential: 1,000 square metres
- R5 Large Lot Residential: 2,000 square metres (served); 10 hectares (unserved)
- RU1 Primary Production: 100 hectares
- RU2 Rural Landscape: 100 hectares
- RU5 Village: 1,500 square metres (residential, detailed site investigation required)

- C2 (formerly E2) Environmental Conservation: 100 hectares
- C3 (formerly E3) Environmental Management: 100 hectares
- C4 (formerly E4) Environmental Living: 10 hectares

In addition, to the above, a housing strategy has also been adopted for Tarago Village, and information detailed in this study has been considered in this high level review.

Table 1: Towns and villages identified for assessment of residential uplift

Locality	Sub-Investigation Areas	Map	Proposal	Change Mechanism
Goulburn	12 as listed below	Figure 3 to Figure 5	Low density residential Large lot residential Approximately 7500 dwellings	Facilitated by rezoning and changes to minimum lot size
Run-O Waters		Figure 2 to Figure 5	Low density residential and large lot residential. Includes existing serviced urban release area	Facilitated by rezoning RU6 to R2 for the urban release area and R5 for large lot residential
Middle Arm West		Figure 2 to Figure 5	Low density residential on existing urban fringe	Primarily facilitated by rezoning from RU6 to R2
Middle Arm URA		Figure 2 to Figure 5	Low density residential – Includes existing serviced urban release area	n/a
Middle Arm East		Figure 2 to Figure 5	Low density residential on existing urban fringe	Primarily facilitated by rezoning from RU6 to R2
Bradfordville		Figure 2 to Figure 5	Infill development	Organic renewal under current permissibility
Kenmore		Figure 2 to Figure 5	Low density residential on existing urban fringe	Primarily facilitated by rezoning from SP2 to R2
Gorman Rd		Figure 2 to Figure 5	Large lot residential to be serviced by SWS	Facilitated by rezoning of RU6 to R5 with minimum lot size >2 ha.
Mt Gray		Figure 2 to Figure 5	Large lot residential to be serviced by SWS	Facilitated by rezoning of RU6 to R5 with minimum lot size >2 ha.
Mountain Ash		Figure 2 to Figure 5	Large lot residential to be serviced by SWS	Facilitated by rezoning of RU6 to R5 with minimum lot size MLS >2 ha
Brisbane Grove		Figure 2 to Figure 5	Large lot residential to be serviced by SWS (unserved)	Facilitated by rezoning of RU6 to R5 with minimum lot size >2ha
Baw Baw		Figure 2 to Figure 5	Future urban expansion once other opportunities exhausted	Facilitated by future rezoning to R2
Sooley		Figure 2 to Figure 5	Primarily retain as RU6 to prevent fragmentation, supported by SWS	Facilitated by rezoning RU6 to R2 in south east.

Locality	Sub-Investigation Areas	Map	Proposal	Change Mechanism
			R2 low density in the south eastern area adjoining existing residential area	Future potential changes to R5 and minimum lot size to facilitate infill large lot development.
Marulan	3 as listed below	Figure 2 and Figure 7	Low density residential	~1350 dwellings
Marulan East		Figure 2 and Figure 7	Large lot residential opportunities	Facilitated within existing village by revising minimum lot size
Marulan North and URA		Figure 2 and Figure 7	Low density residential	Facilitated by rezoning RU6 to R2 with urban release area considered to guide DCP controls
Tallong	1	Figure 76	Rezoning to RU5 Village or R5 large lot residential, supported by SWS	Facilitated by rezoning RU6 to RU5/R5, with consideration to minimum lot size decreasing to 1 ha/ 4000m ²
Towrang	1	Figure 7	Amendment of minimum lot size within existing RU5 village land use zone, supported by SWS	Facilitated amending minimum lot size from 2ha to 1ha/ 4000m ²
Bungonia	1	Figure 98	Rezoning to RU5 Village or R5 large lot residential, supported by SWS	Facilitated by rezoning RU6 to RU5/R5, with consideration to minimum lot size decreasing to 1 ha/ 4000m ²
Lake Bathurst	1	Figure 9	Potential growth within RU5 village, supported by SWS	Growth subject to minimum lot size requirements for subdivision under current zoning (1500 m ²).
Tarago	1	Figure 10	Area 1 – currently RU2 rural landscape, supported by SWS	Facilitated by rezoning RU6 to RU5, with consideration to minimum lot size 4000m ²

SWS – STATIC WATER SUPPLY

1.3 Aims and Objectives

The aim of this study is to review the potential residential settlement growth areas in relation to the strategic planning requirements of PBP. The key objective is to undertake a Strategic Bushfire Study as per the strategic planning principles, 'inappropriate development' exclusion requirements and assessment considerations outlined in PBP. The outcomes of this study will assist Council with further planning within the investigation areas for future residential settlement opportunities.

1.4 Bushfire Prone Land Status

The subject land is currently mapped as bushfire prone land on the GMC Bushfire Prone Land (BFPL) map as published by the Department of Planning and Environment (DPE) on the NSW planning portal (DPE, 2022) (Figure 12). BFPL mapping is based on three categories of Bushfire Prone Vegetation (BFPV):

- Vegetation Category 1: Forest, woodlands, heaths (tall and short), forested wetlands and timber plantations, where ≥ 1 ha or < 1 ha when within 100m of other bush fire prone vegetation. A 100 m buffer is applied to this vegetation category.
- Vegetation Category 2: Rainforests (of any size); and lower risk vegetation parcels < 1 ha, or < 2.5 ha when > 100 m from other BFPV, as prescribed in section 7.1.1 of the guideline (RFS, 2015). A 30m buffer is applied to this vegetation category.
- Vegetation Category 3: Grasslands, freshwater wetlands, semi-arid woodlands, arid shrublands where ≥ 1 ha or < 1 ha when within 100m of other bush fire prone vegetation. A 30 m buffer is applied to this vegetation category.

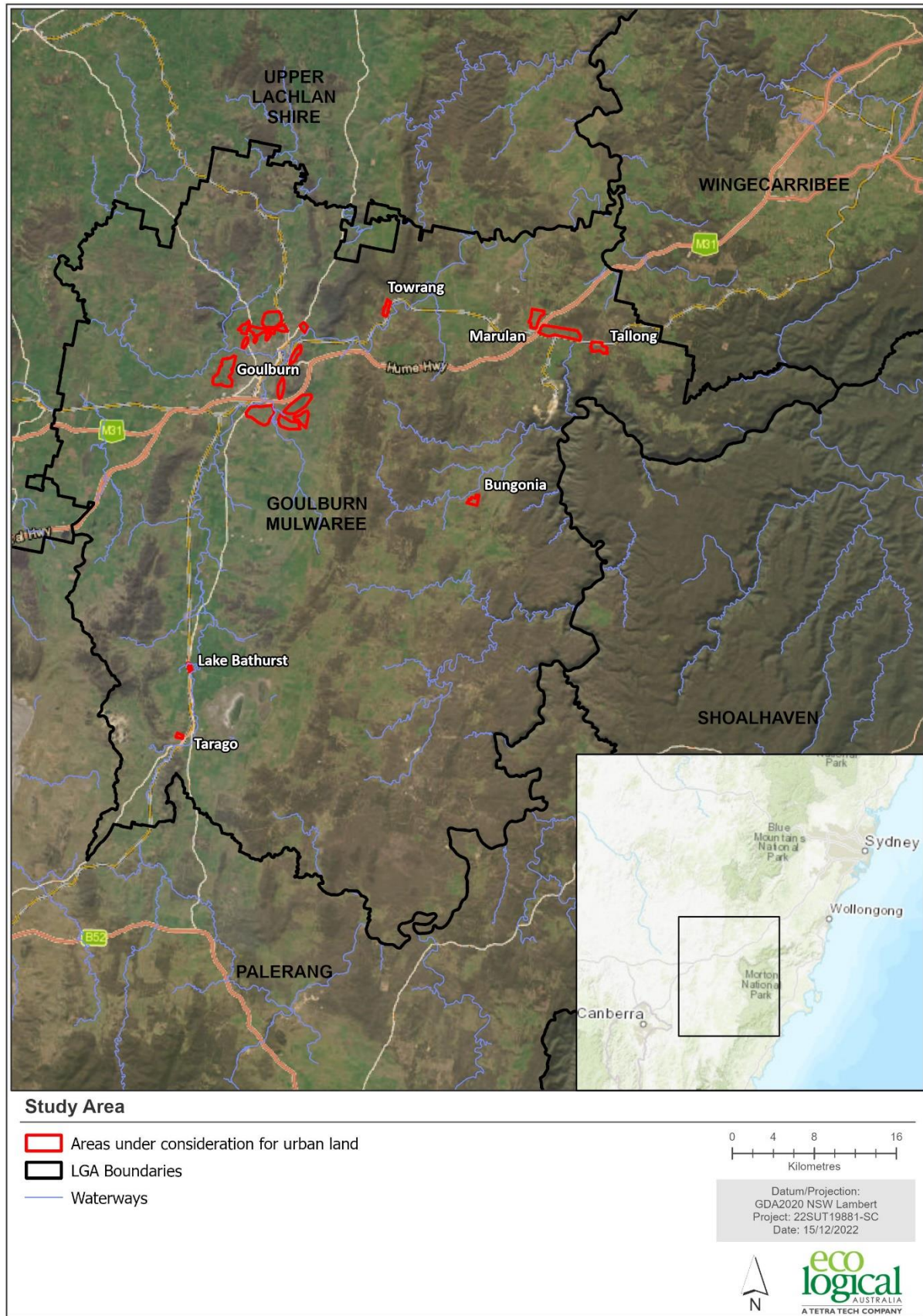


Figure 1: Goulburn LGA and towns identified for potential residential settlement

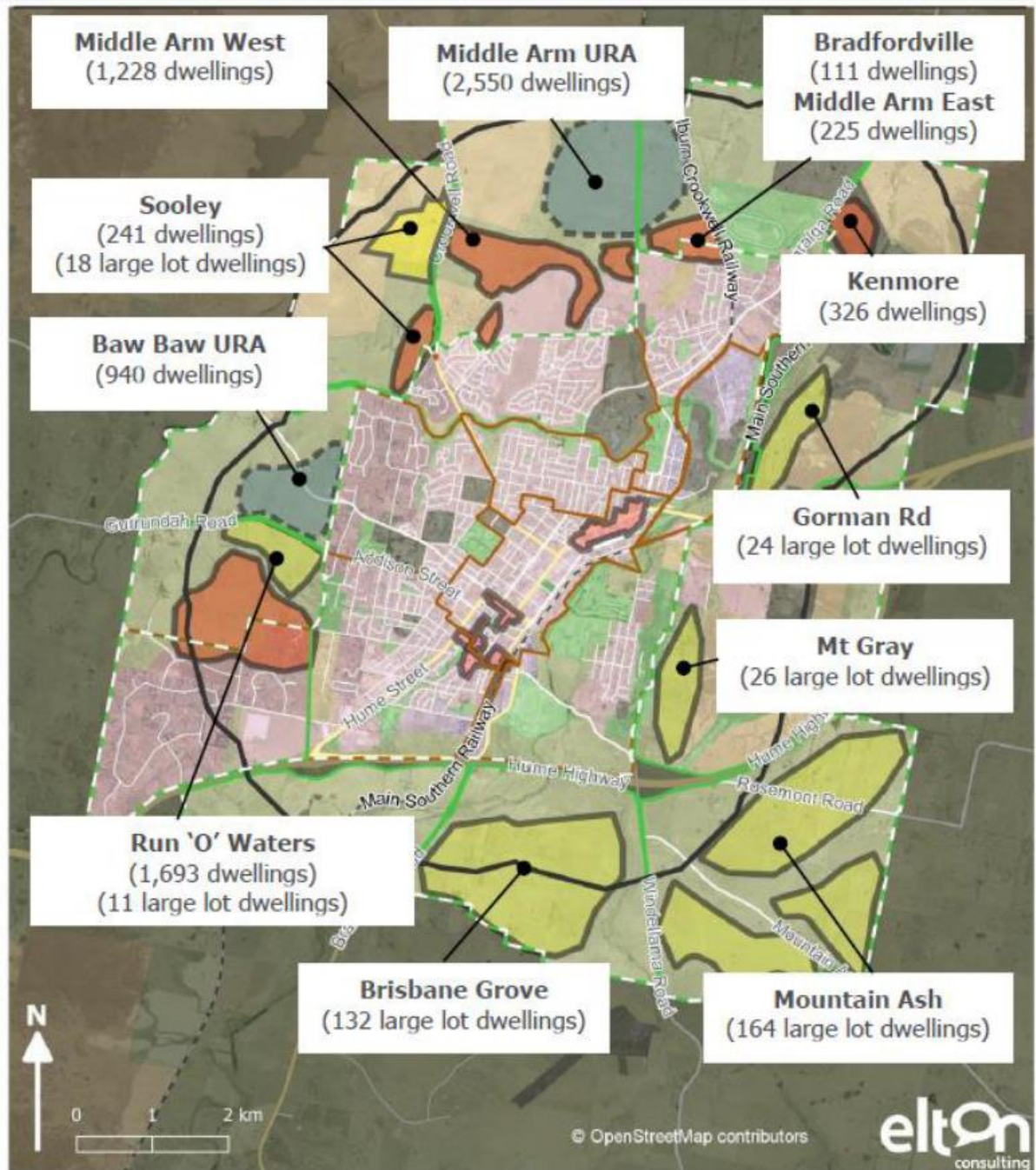


Figure 2: Goulburn Investigation Areas (source GMC)

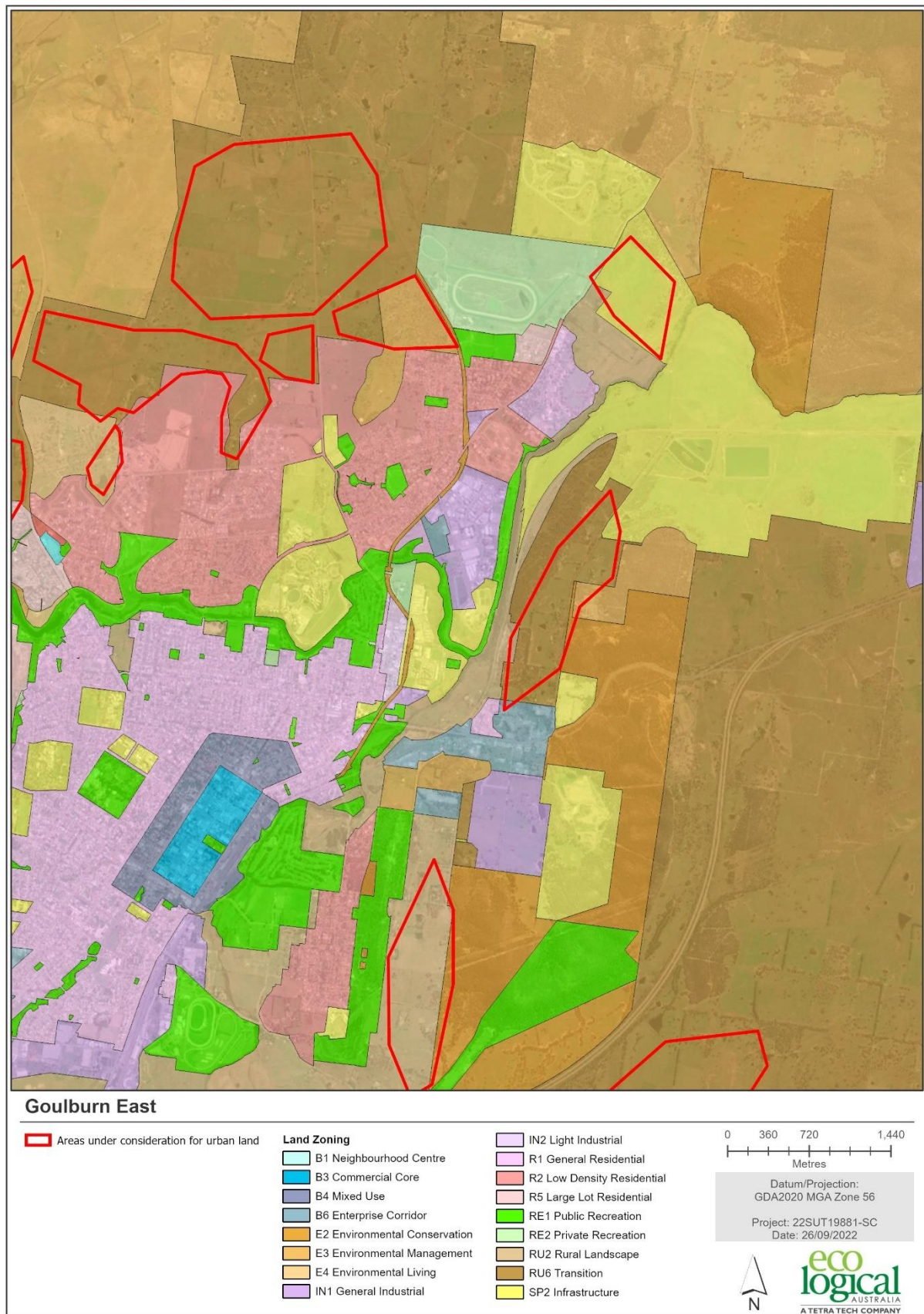


Figure 3: Contemplated residential settlement area – Goulburn East

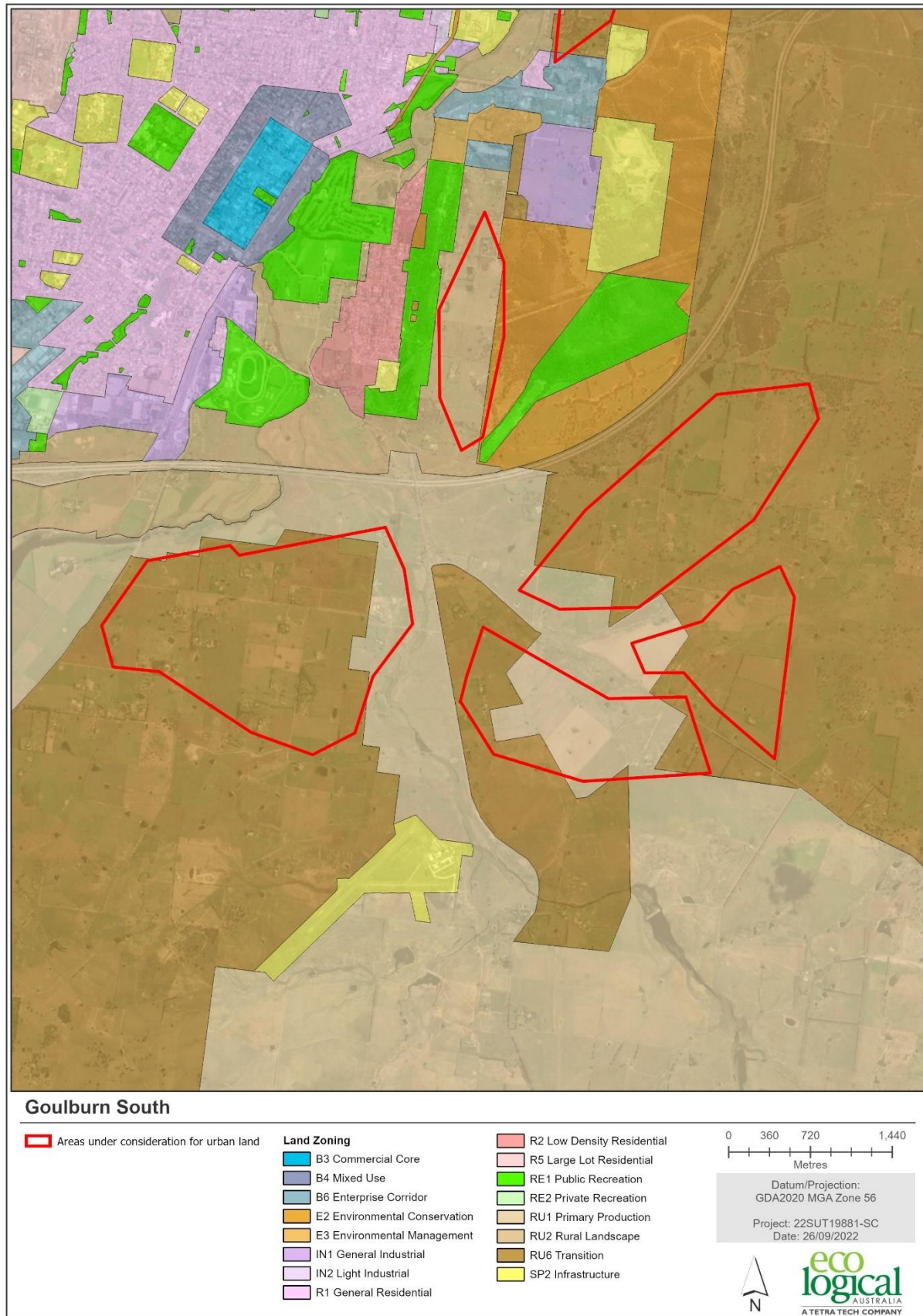


Figure 4: Contemplated residential settlement area – Goulburn South

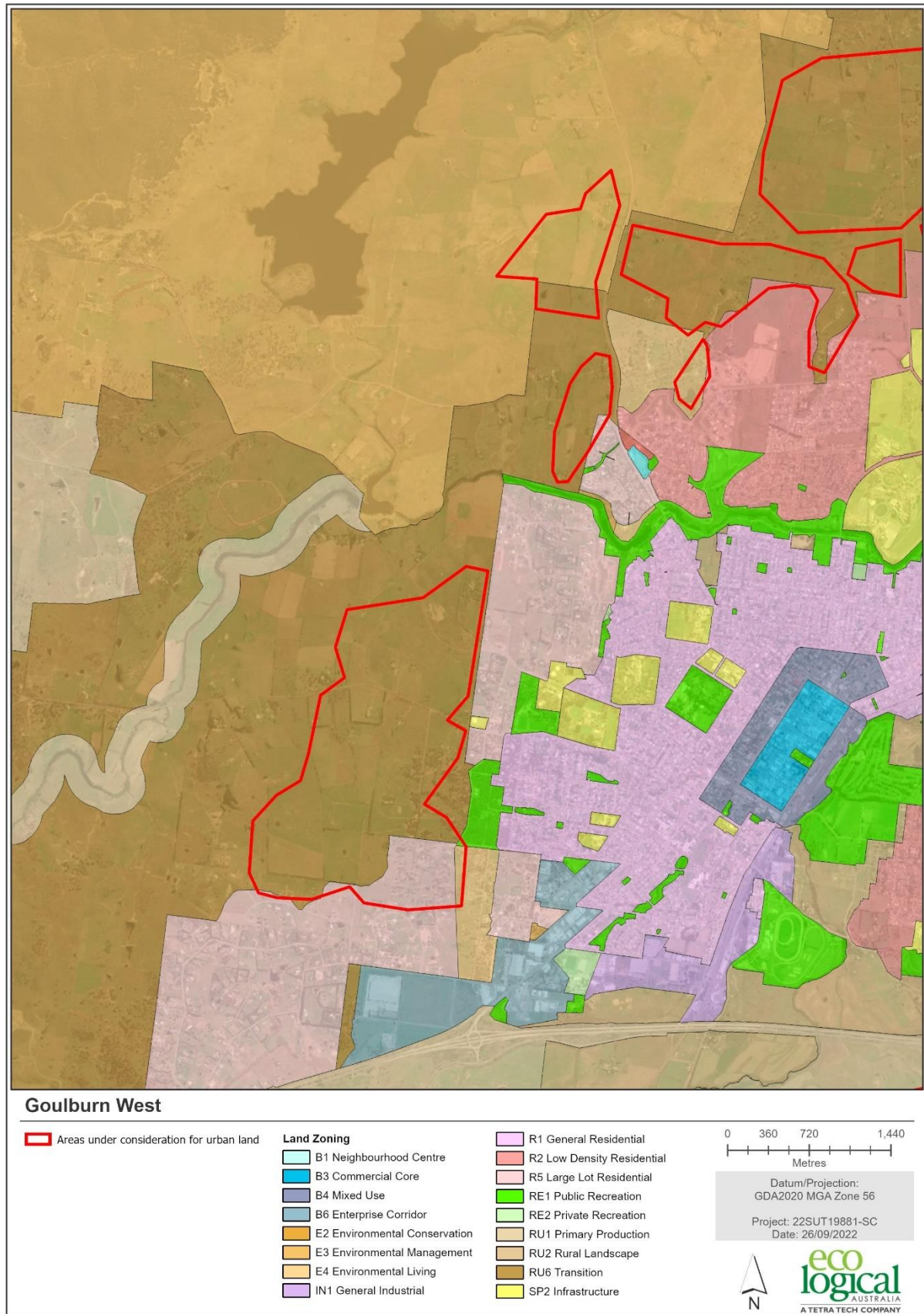


Figure 5: Contemplated residential settlement area – Goulburn West

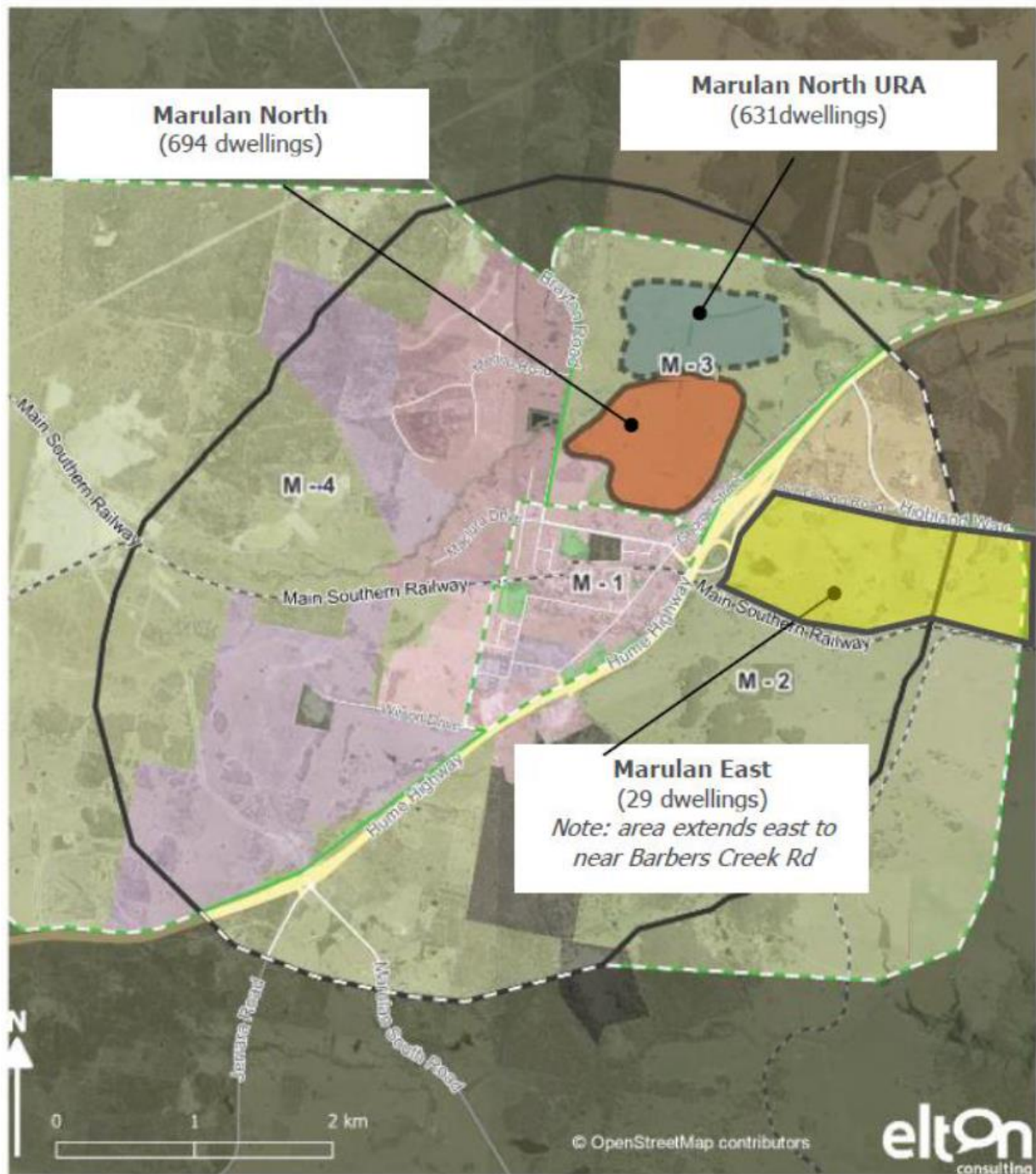


Figure 6: Marulan Investigation Areas

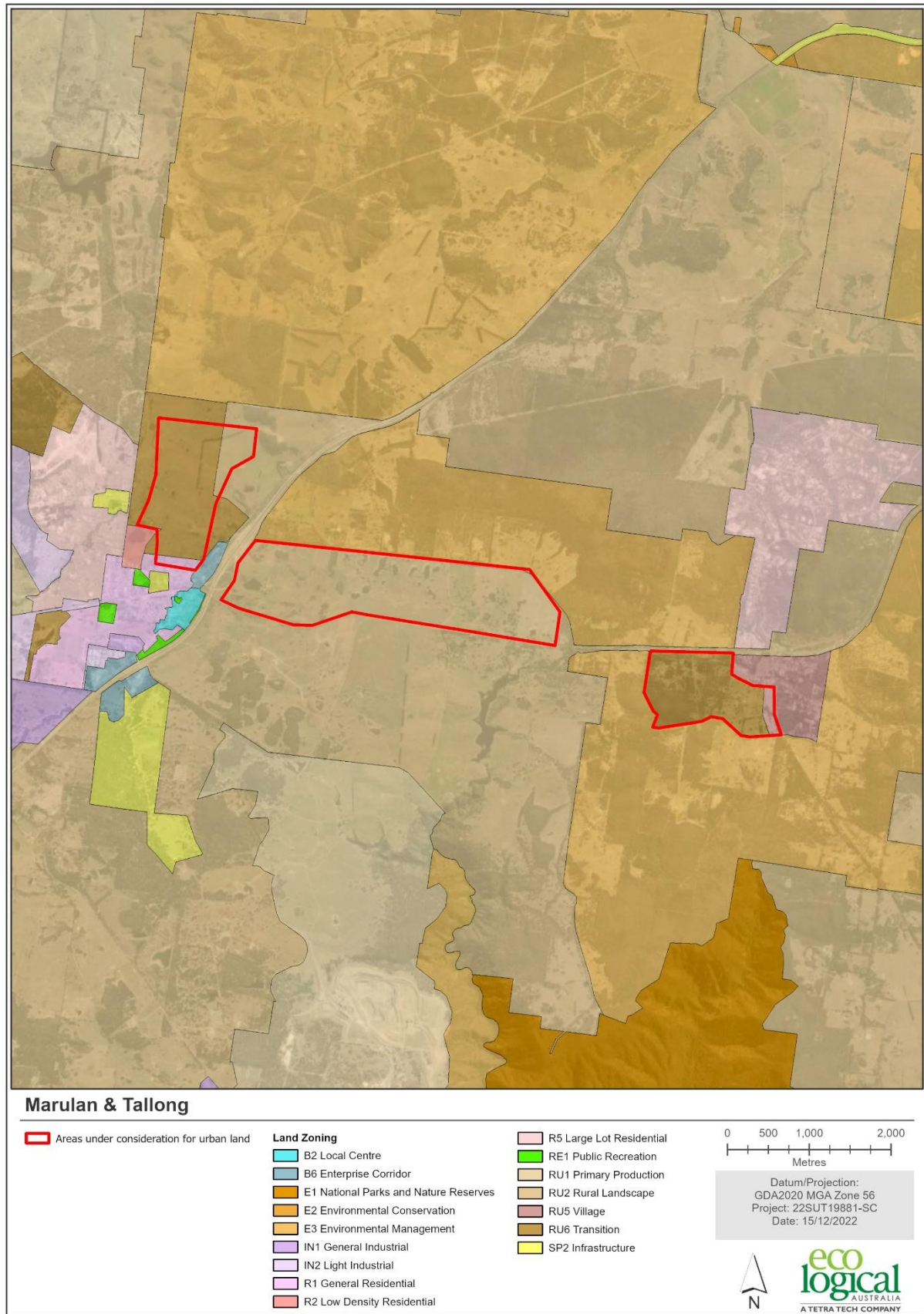


Figure 7: Contemplated residential settlement area – Marulan and Tallong

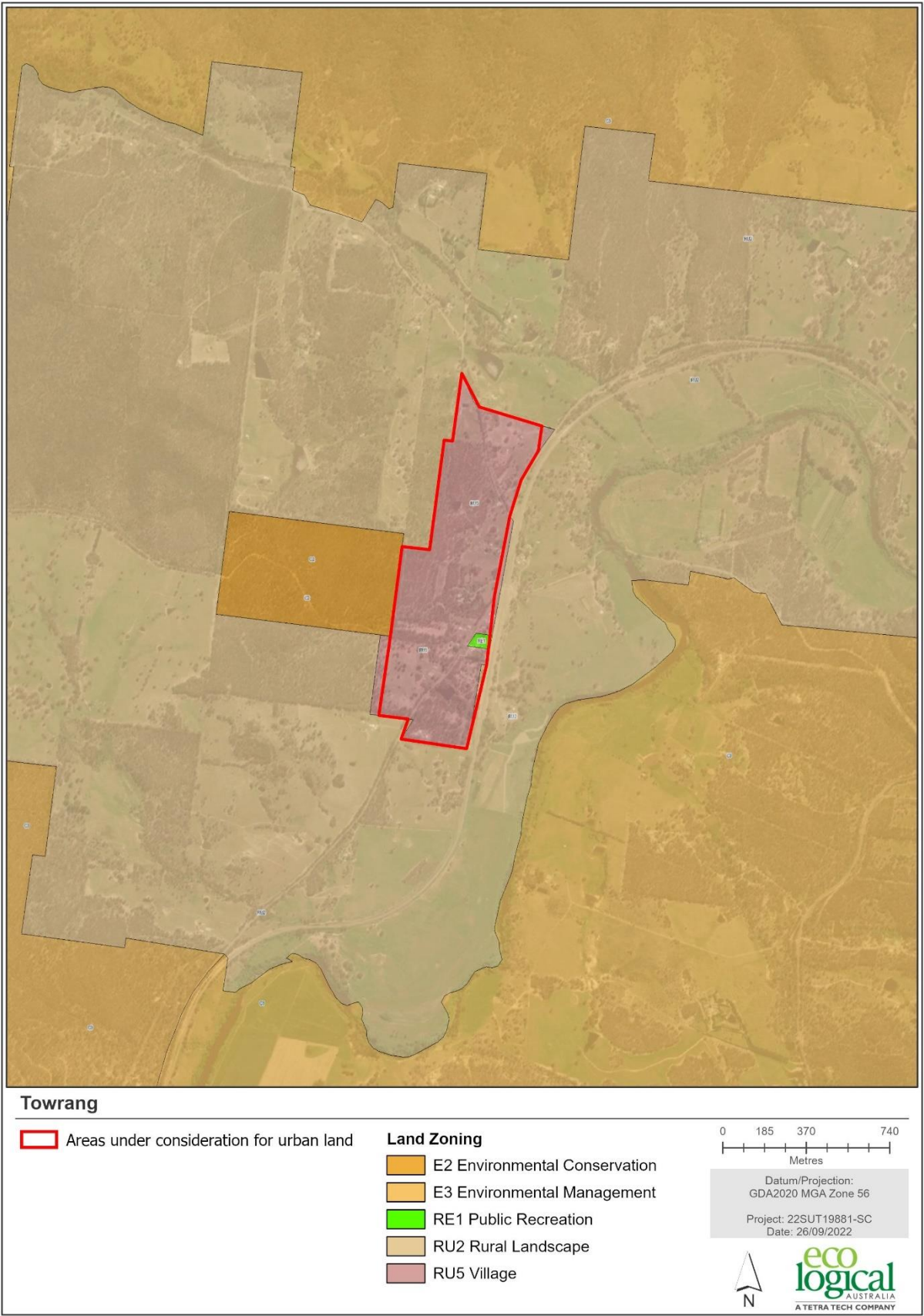


Figure 8: Contemplated residential settlement area – Towrang

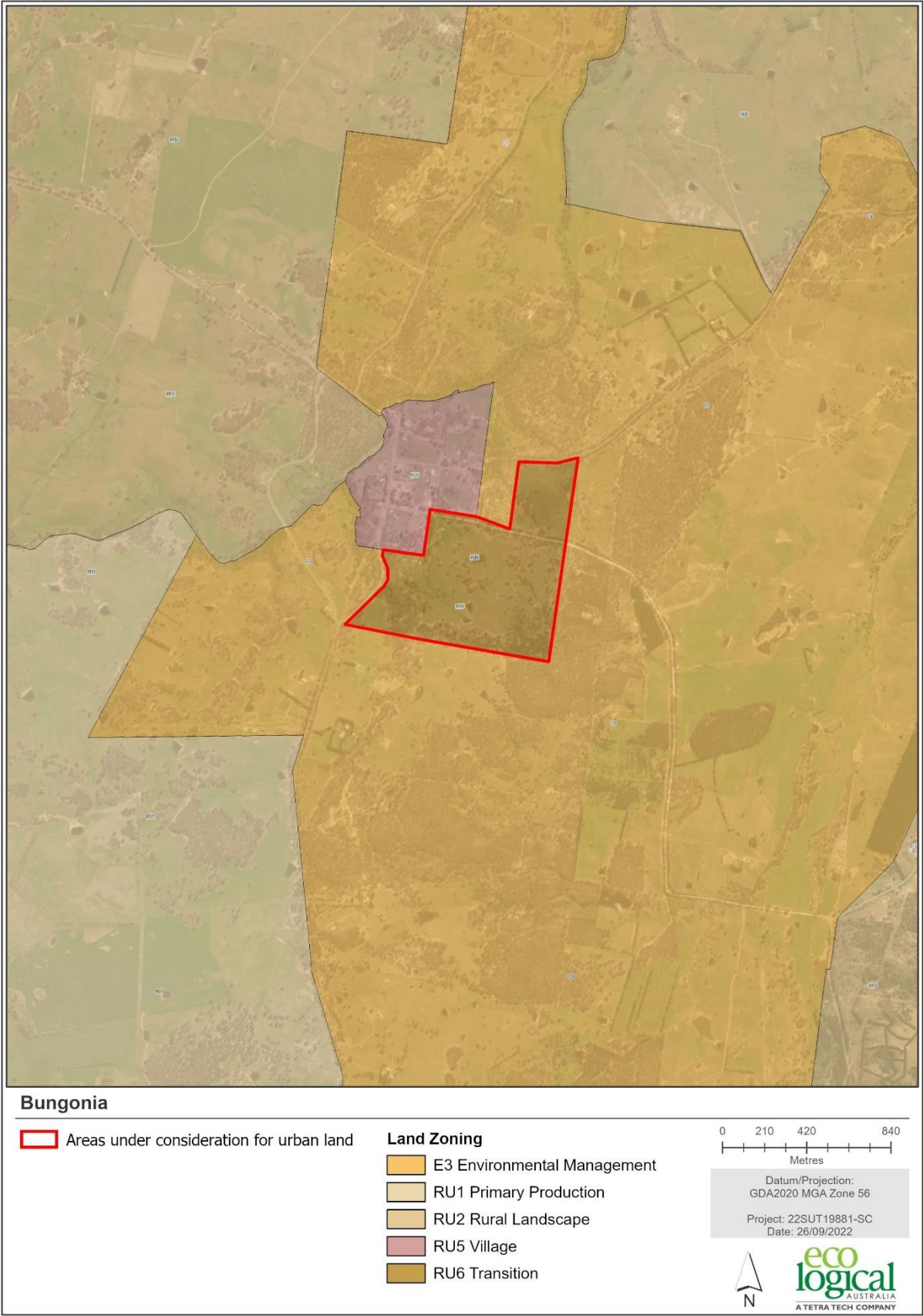


Figure 9: Contemplated residential settlement area – Bungonia

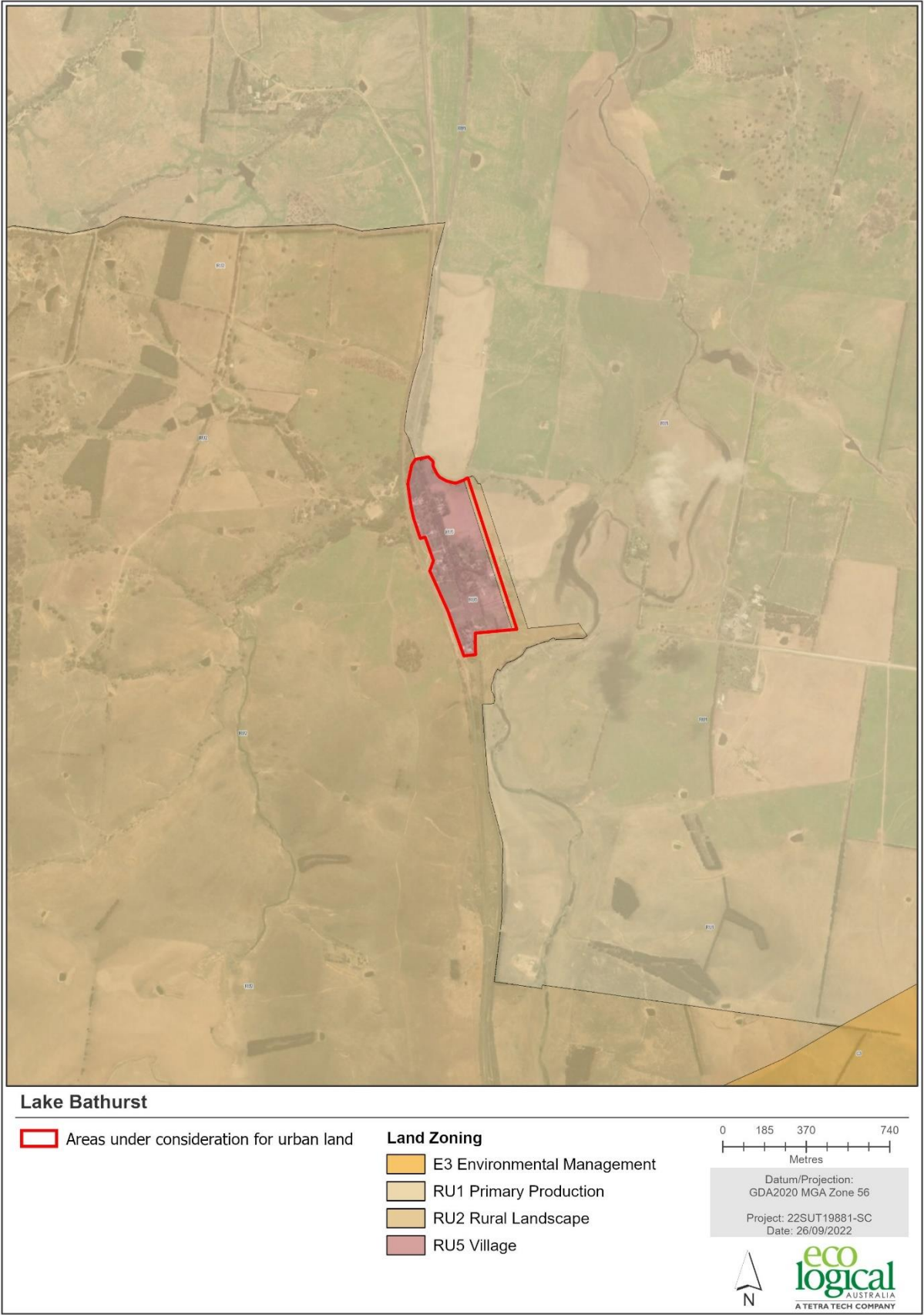


Figure 10: Contemplated residential settlement area – Lake Bathurst

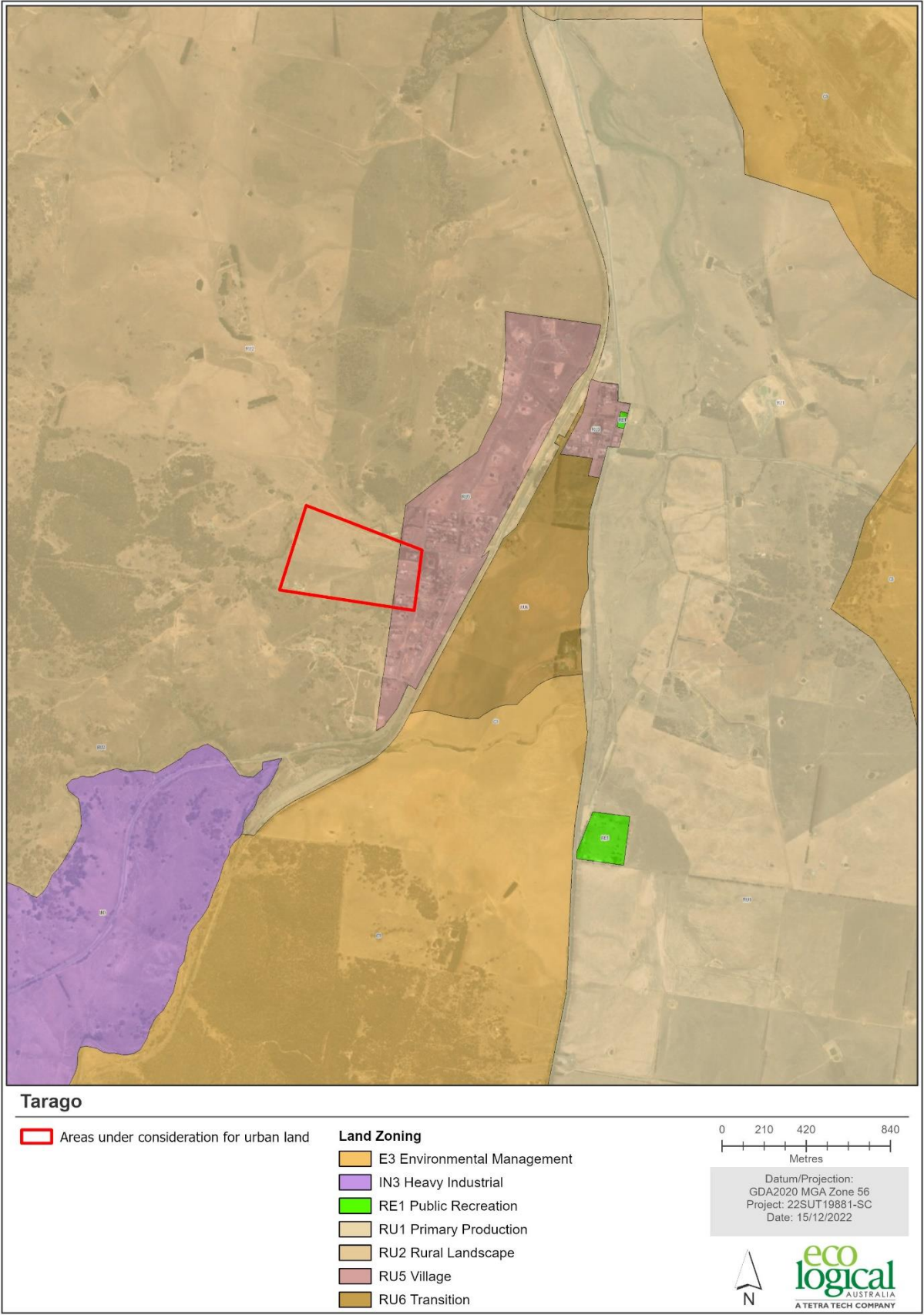


Figure 11: Contemplated residential settlement area – Tarago

2. Legislative Framework

2.1 Legislation

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 evaluate whether the proposal adheres 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.

2.1.1 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 the residential settlement, 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.*
- Transport and Infrastructure SEPP
 - Clause 2.16 requires consideration to PBP for development on BFPL
- Section 4.14 relates to infill and other development.
 - 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
 - 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):
 - Applicable to subdivision, with specific requirements in Chapter 5 of PBP.
 - Applicable to SFPP developments, with specific requirements in Chapter 6 of PBP; and
 - Requires a bushfire safety authority under Section 100b of the *RF Act*.
- Section 3.1 relates to strategic or local planning.
 - 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.

2.1.2 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.

2.2 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 any LEP amendment that may arise as planning for future residential settlement in the Council is progressed. Chapter 4 of PBP prescribes the completion of a Strategic Bushfire Study, which provides the opportunity to assess whether proposed land uses 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 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 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 contemplated residential settlement growth areas 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 2 below.

Table 2: 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 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.

2.3 Assessment Framework

Any further planning pursuits for residential settlement within the identified investigation areas will likely need to be supported by rezoning and/or other amendments (e.g., minimum lot size, permitted uses etc.) to the applicable LEP, and in some cases the DCP (e.g., building heights, street scapes etc.). Residential land uses contemplated and permissible under changes to the LEP / DCP are subject to various aspects of PBP, when occurring on BFPL. Chapter 7 of PBP outlines the bushfire protection requirements for infill development, including performance criteria identified for APZs, building construction standard, access and infrastructure. Chapter 5 of PBP outlines the bushfire protection requirements for residential subdivision, including performance criteria identified for APZs, access and infrastructure. Pending the typology of future development, the criteria outlined in these Chapters of PBP will be applicable, and therefore considered in the ability for future development within each investigation area to comply, however as the focus of growth is for residential settlement, Special Fire Protection Purpose (SFPP) development has not been considered.

Investigation of the suitability of future development contemplated, or permissible following LEP amendment, involves evaluation of a complex and large array of bushfire-related issues and concepts. Therefore, prioritisation of first principle bushfire risk considerations is critical. As such, the bushfire assessment framework detailed in Table 3 will guide this study. Any 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 study acknowledges that the outcome of any development on BFPL includes a level of residual risk and explores the acceptability of that level of residual risk.

Table 3: Risk Assessment Framework

Risk Consideration	Context	Required Outcome
Residual 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	Assessed risk exposure is appropriately reduced, development can occur with an appropriate level of safety on BFPL
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
Life Protection and Evacuation	An appropriately low residual risk to human life is fundamentally important in bushfire protection. Early offsite evacuation is the nationally accepted safest means for protection of life. However, logistical challenges of offsite evacuation can be high, and need to be overcome without any additional demand on emergency services. Therefore, multiple life protection options provide the lowest residual risk.	Effective early offsite evacuation that is not reliant on the assistance of emergency services should be provided. Additional refuge options such as access to a safer place or refuge should be considered for increased resilience
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.	Future development or uplift should contribute to the emergency management response rather than provide additional demand on resources.
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 and therefore should not be relied on for the protection of life and property in a strategic planning context.	There should be no reliance on fuel management of adjoining lands. Capacity for perimeter roads and asset protection zones should be provisioned during strategic planning.

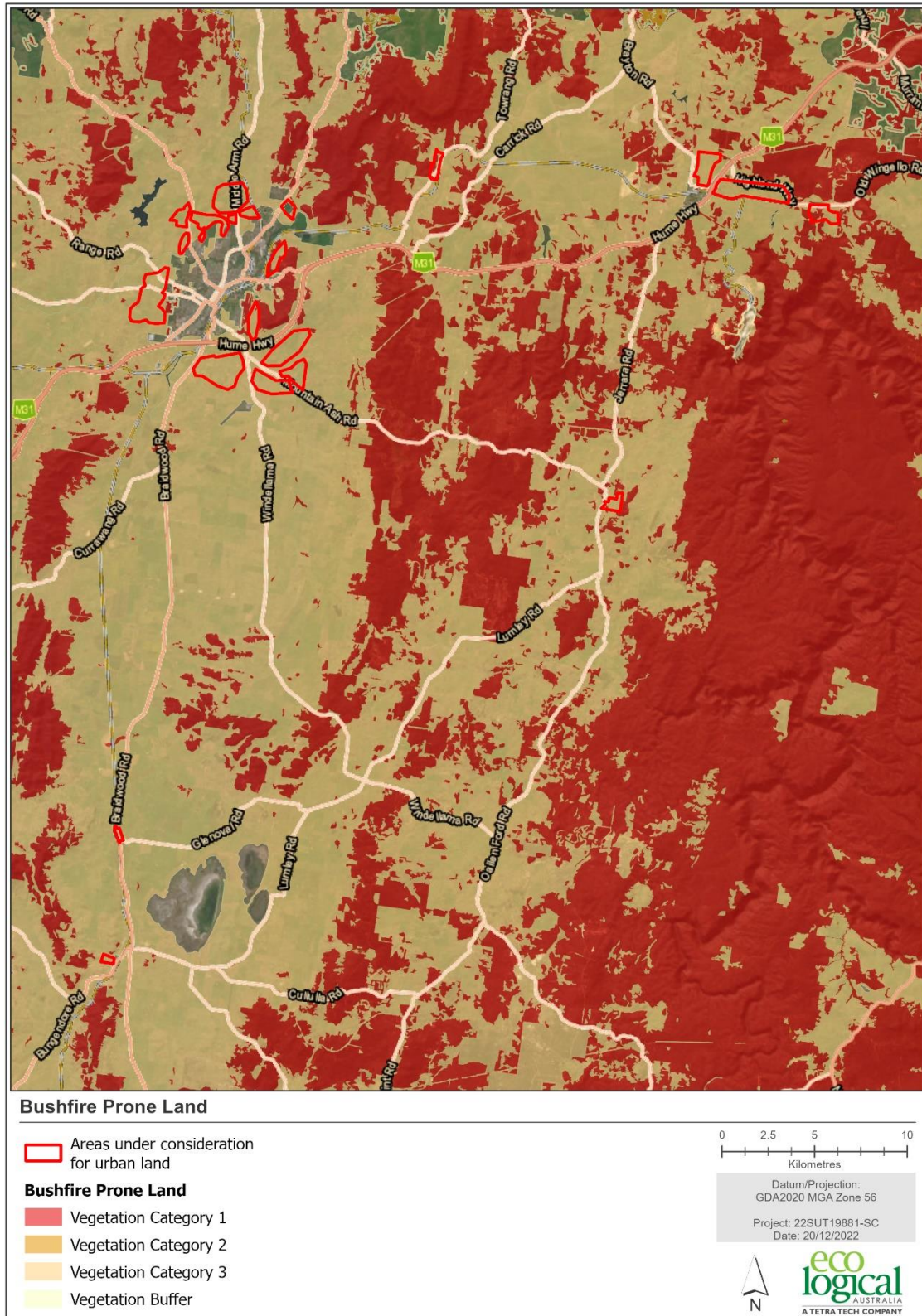


Figure 12: Bushfire Prone Land across the study area

3. Bushfire Landscape Risk Assessment

The investigation areas are situated within a broader bushfire landscape, however most sites are primarily influenced by Category 3 Vegetation as indicated in the BFPL maps. Nevertheless, an evaluation of the bushfire hazard within a 5-kilometre assessment area was undertaken for each site, as detailed below. This includes evaluation of the vegetation, slope and bushfire weather pertaining to the broader landscape, and the combined influence on potential fire behaviour, along with the fire history within the broader landscape.

3.1 Bushfire Hazard

The bushfire hazard has been classified using the methodology prescribed by PBP, through assessment of vegetation, slope and bushfire weather.

3.1.1 Vegetation

Vegetation formations within and surrounding each investigation are shown in Figure 13 based off the State Vegetation Type Mapping (DPE, 2022) with areas of grassland included from high level desktop assessment. The landscape adjoining the investigation areas is primarily dominated by grassland vegetation under various forms of management, with remnant forest vegetation also present, generally separated from the investigation areas and mostly in steeper lands. Remnant patches of grassy woodland are also found proximal to some investigation areas, however, are also generally separated or small and isolated.

A summary of the relationship between PBP hazard class, vegetation formation and fuel load within the study area and surrounds is shown in Table 4. It is important to note, that rural grassland for agricultural purists has conservatively been included as “grassland”, however given that much of these areas are undergoing various levels of mixed-management practices, it is expected that the fuel load for these areas would be lower than the PBP prescribed value shown in Table 4.

3.1.2 Slope

Slope across the broader study area has been generated from a Digital Elevation Model (DEM), established using 2 m contours.

Figure 14 shows the slope across the broader study area. Elevated slopes are generally present in the eastern portion of the LGA, with more gently sloped lands located centrally and to the west.

Table 4: Vegetation formation and fuel loads for vegetation types in the study area

Vegetation Formation	Fuel Load (t/ha) ¹	Keith Class
Forest	36.1	Central Gorge Dry Sclerophyll Forests Hunter-Macleay Dry Sclerophyll Forests South East Dry Sclerophyll Forests Southern Tableland Dry Sclerophyll Forests Sydney Hinterland Dry Sclerophyll Forests Sydney Montane Dry Sclerophyll Forests Northern Hinterland Wet Sclerophyll Forests Southern Tableland Wet Sclerophyll Forests Southern Escarpment Wet Sclerophyll Forests
Forested Wetlands	15.1	Eastern Riverine Forests
Freshwater Wetlands	4.4	Coastal Heath Swamps Montane Bogs and Fens Montane Lakes
Grasslands*	6	Not native vegetation (pasture) Temperate Montane Grasslands
Grassy and Semi-arid Woodland	20.2	Southern Tableland Grassy Woodlands Tableland Clay Grassy Woodlands
Heathlands	36.9	Southern Montane Heaths
Rainforests	13.2	Dry Rainforests Northern Warm Temperate Rainforests

¹FROM TABLE A1.12.8 OF PBP; ²BASED ON SVTM (DPE, 2022)

*GRASSLAND INCLUSION FROM DESKTOP ASSESSMENT

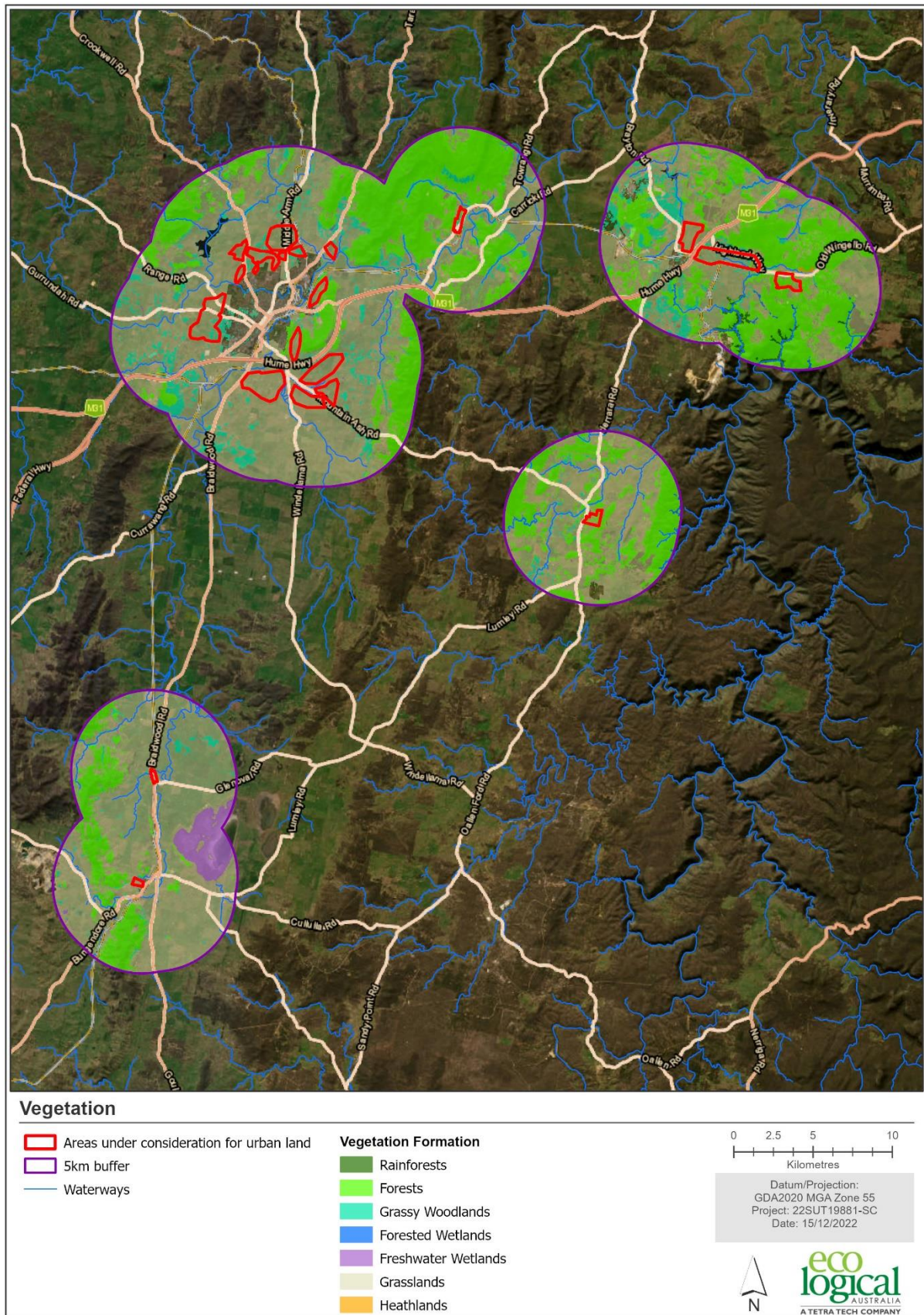


Figure 13: Vegetation formation across the Study Area

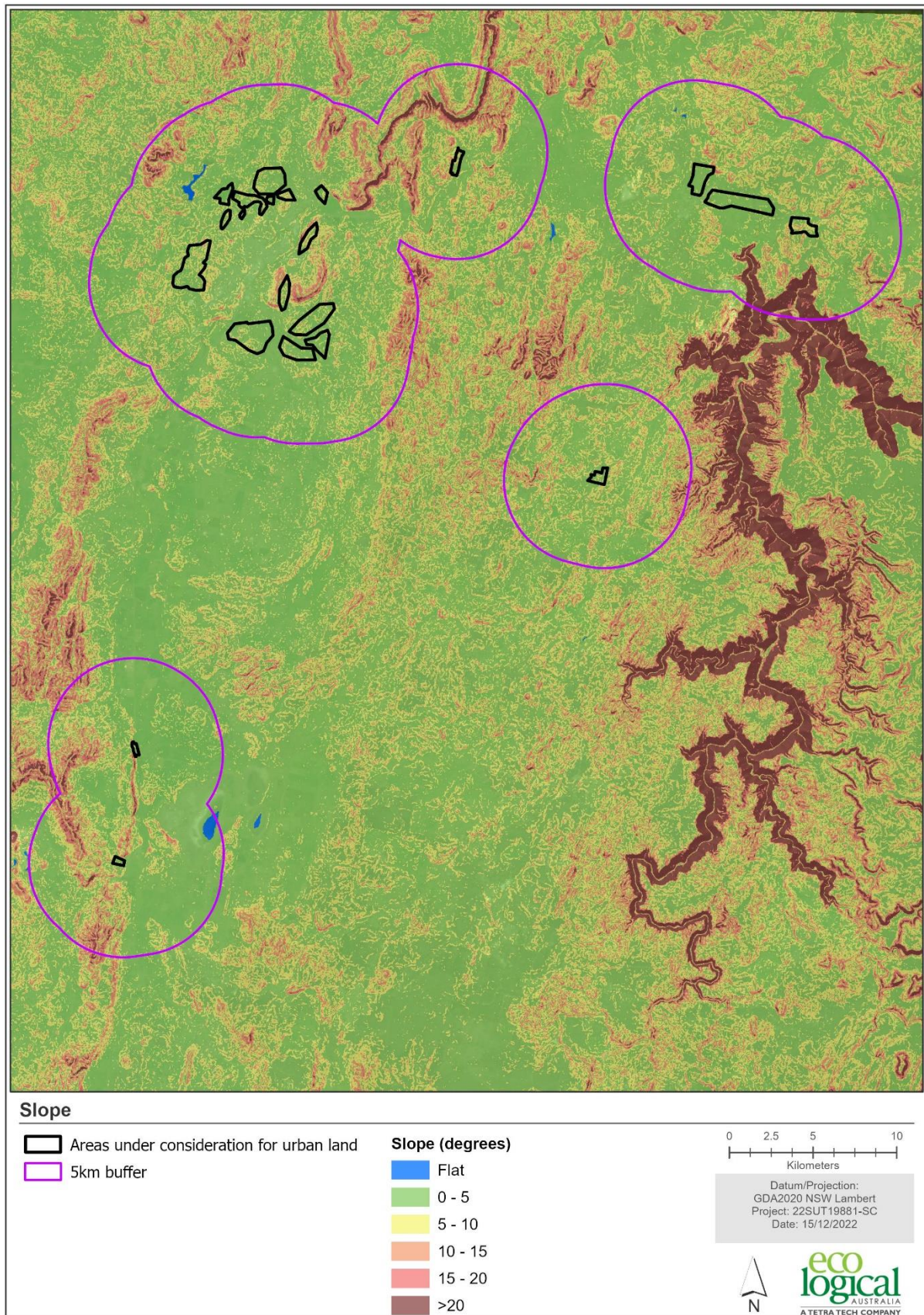


Figure 14: Slope across the Study Area

3.2 Bushfire Risk Considerations

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

3.2.1 Bushfire Weather

The study area is located within the Southern Tablelands Bush Fire Management Committee (BFMC) area. Within the BFMC area, the climate is temperate to cool, characterised by cool winters and warm to hot summers. As per the Southern Tablelands Bush Fire Risk Management Plan (BFRMC, 2019) average rainfall is highly variable, with reduced levels generally experienced during summer months. Favourable bushfire weather is generally experienced from October through to March /April when prevailing north to north-westerly westerly winds are experienced. Southerly and easterly winds are also common during the bushfire season and can elevate the risk from bushfire due to wind change in the late afternoon.

Days where an FDI of 50 or higher has been recorded, has occurred on average, about 2 days per year based on data analysed from the National Bushfire Weather Data set for Canberra Airport weather station (station number 070351) (Lucas 2010). Weather data developed by Lucas (2010) under the National Historical Fire Weather Dataset (1980-2020) incorporates the daily Forest Fire Danger Index (FFDI), where suitable inputs are available from over 70 weather stations across Australia. Data from the Canberra Airport weather station (the closest weather station within the National Historical Fire Weather Dataset) was analysed to determine the maximum FFDI for a 1 in 50-year event, being the accepted recurrence period for land use planning (RFS 2019).

PBP identifies that the applicable FDI for the subject land is FDI 100. The FDI 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 Canberra 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 Canberra 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-east to South-east (clockwise); South-east to South-west (clockwise); and South-west to North-east (clockwise). The following directional FFDIs were identified through the GEV analysis of the historic weather records (1980 to 2020) for Canberra Airport:

- Maximum FFDI for wind directions from the north-east to south-east (NE-SE) was 51;
- Maximum FFDI for wind directions from the south-east to south-west (SE-SW) was 39 and
- Maximum FFDI for wind directions from the south-west to north-east (SW-NE) was 101.

This analysis indicates that there is variation in the potential likelihood and consequence of bushfire attack from different directions toward the investigation areas. 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. Areas exposed to bushfire attack at lower FFDI have a lower (but still significant) risk profile.

Where investigation areas are exposed to hazards in the north east to south west sector, they are more likely to be subject to higher FFDI conditions, whilst areas exposed to other directions are likely be exposed to bushfire attack at lower FFDIs. However, following the provision of bushfire protection measures (APZs, perimeter roads etc.), the opportunity for higher intensity fires occurring without any level of mitigation or moderation is unlikely.

3.2.2 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 northerly to north-westerly winds
- Moving upslope on steeper vegetated areas
- Burning within forest and heath vegetation exhibiting higher fuel loads

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 potential fire intensities, and it is important to note that the probability of these occurring is not considered, nor are other factors like fire development, the effects of fuel management, change in weather, or the impact fire suppression activities. While bushfire intensity can be used as a determinant of risk to life and property and the controllability of bushfires, these models also 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.

3.2.2.1 Fire Intensity Modelling Outcomes

Based on the outcomes of the GEV analysis of the historic weather records (see Section 3.2.1) elevated fire intensities are most likely to occur under prevailing south-west to north-easterly winds, accompanied by elevated FFDI, with an FFDI of 101 the analysed maximum in the available record. Based on this, directional fire intensity modelling was undertaken for SW-NE scenario and FFDI 101 (Figure 15). Under this scenario, where there are steeper forested areas or tall heath exposed to SW-NE conditions, they are more likely to experience higher fire intensities, as evident in Figure 15. Fire transfer would generally occur in an easterly direction under these conditions.

Figures 14 and 15 also demonstrate that reduced fire intensities are likely to occur under lower FFDIs associated with SE-SW and NE-SE winds and associated bushfire weather conditions.

It is important to note that fire intensity models are likely to overestimate the fuel load for rural grassland vegetation, where a fuel load of 6 t/ha has been applied. Therefore, it is likely that fire intensity outputs for rural grassland present outcomes that are elevated in comparison to conditions likely to be experienced on the ground, in many cases.

3.2.3 Fire History

The available mapped fire history record (Figure 18) and corresponding analysis of fire frequency (Figure 19) provides good insight into the areas that have been subject to broader landscape fires, and those areas subject to repeated fire. Although the mapped record may not contain all smaller fires, it does demonstrate that the investigation areas have generally been subject to a very low level of landscape scale fire activity. In particular, areas located in the western portion of the LGA have not been subject to any mapped fires. Areas situated to the east of the LGA have been exposed to a low fire frequency of fire based on the mapped fire history, and none in recent decades.

The availability of Fire Extent and Severity Mapping (FESM) for the 2019/20 season (Figure 20) provides further insight to past fires in the locality, and in the case of 2019/20, within a significant fire season. As evident in the mapping, post analysis of burnt areas during the 2019/20 fires indicated that areas of extreme fire severity did occur in the eastern portion of the LGA. However, these areas are predominantly associated with forest vegetation and slopes in Bungonia National Park and State Conservation Area, not where the investigation areas are located, which were not directly impacted by fire during this significant fire season.

3.2.4 Bushfire Catchment, Spread and Ignition

The broader LGA is situated within a large fire catchment, with potential fire pathways extending beyond 10 kilometres, however for most investigation areas, these pathways are fragmented by rural lands with minimal canopy cover and rural grasslands under various levels of management, along with fuel breaks provided by roads and other fuel free areas. Fire spreading from the west would generally be through grassland environments. For the eastern portion of the LGA there are potential fire pathways extending from the forested areas of Bungonia National Park (NP) and State Conservation Area (SCA). However, fires approaching from the east are moderated by a downslope approach into rural land and increasing fragmentation of canopy vegetation.

Potential sources for fire ignition as documented by the Southern Tablelands BFMC Risk Management Plan include both human and natural sources including:

- Lightning strikes during storms, particularly during the bush fire season.
- Escapes from legal burns in rural areas
- Escapes from illegal burns mainly in rural areas
- Human error – e.g. farm machinery, welding etc. and cigarette butts on highways
- Arson – urban areas

3.3 Summary of Landscape Bushfire Risk Assessment

In evaluating the investigation areas contemplated for residential settlement growth, key to this assessment was thus understanding variations in the risk profile across the LGA. Therefore, this assessment examined the bushfire hazard, bushfire weather, fire behaviour and fire history to evaluate the landscape risk and these outcomes for each investigation area are presented in Table 5.

The assessment identified there is potential for bushfire attack to occur in multiple directions and over extended fire runs. However, there are fire advantages that assist in lowering the risk to a level more favourable for fire management and response, as well as the land uses contemplated. This is due to several factors including:

- Bushfire weather analysis that demonstrates lower FDIs in the SE-SW and NE-SE direction, thus lessening the risk profile of lands primarily exposed to fire attack from these directions (e.g. in the eastern areas).
- Demonstrated minimal intrusion of past landscape scale fires to investigation areas.
- Fragmented canopy within the urban area of Goulburn and also within the central and western portions of the LGA, lessening the possibility of significant fire intrusion into the investigation areas.

There are however areas that are of elevated risk from bushfire and therefore well considered planning for any changes to existing land uses is required. This could include limiting the level of uplift to proposed densities that can be supported by evacuation capacity and adequate emergency management, along with ensuring local infrastructure, such as water supply and road infrastructure is in place before planning changes are made.

Table 5: Evaluation of Bushfire Landscape

Locality	Bushfire Weather and Potential Fire Behaviour	Mapped Fire History	Landscape Evaluation
Goulburn	<p>Sites situated to east of the Wollondilly River are exposed to lower fire intensities. Southern and western areas are exposed to moderate fire intensities due to conservative consideration of rural pasture as grassland.</p> <p>Fire pathways are predominantly associated with rural lands, with minimal exposure to wooded vegetation in the broader landscape and therefore the potential for canopy fires of higher intensity/severity to transfer to site is heavily mitigated.</p> <p>More favourable bushfire conditions from the NE-SW are moderated by the presence of rural lands in this direction.</p>	<p>No mapped fire history within or surrounding Goulburn investigation areas.</p>	<p>The sites are generally well separated from wooded vegetation, as a result of the existing land uses. This separation is advantageous in moderating the level of risk exposure.</p> <p>The presence of managed agricultural land also promotes reduced fuel load, moderating the potential for fast moving and high intensity grassland fires that cannot be mitigated. Fragmentation from these managed agricultural lands, as well as roads and waterways, disrupt fire pathways and reduce opportunity for large scale canopy fires.</p>
Marulan	<p>The presence of woodland vegetation is likely to have a moderating effect on fire intensity, as supported by fire intensity mapping.</p> <p>Forest hazard to the north and east is generally upslope, which moderates fire behaviour and also reduces the influence of favourable weather conditions (i.e. northerly winds).</p> <p>Areas mapped as moderate fire intensity generally correspond to grassland areas, however, as these lands are under various management practices for agriculture, fire intensities are likely to be lower and shorter in duration due to reduced fuel load.</p> <p>Most fire pathways are fragmented, due to surrounding rural land uses and fire pathways from the north are disrupted by roads and waterway.</p>	<p>Low fire frequency, with only one fire on the mapped record (1964 fire season) impacting the Marulan investigation area.</p>	<p>Although the Marulan investigation area is situated in a landscape where remnant vegetation is present, the level of risk exposure is moderated by the typology of the hazard. The potential for high intensity fires is moderated by fragmentation of landscape and existing fire breaks provided by roads and managed lands.</p> <p>Additionally, the wooded vegetation hazard is generally situated upslope from the investigation areas, which will also moderate fire pathways.</p> <p>Therefore, the level of risk exposure is not beyond the application of standard bushfire protection measures as per PBP.</p>

Locality	Bushfire Weather and Potential Fire Behaviour	Mapped Fire History	Landscape Evaluation
Tallong	<p>While the Tallong investigation area is adjacent to areas of remnant vegetation, the influence of this vegetation on fire behaviour is moderated. The forest hazard north of the railway line is upslope from the proposed investigation area, and while this vegetation could transfer fire south under favourable conditions (i.e. northerly winds), fire intensity mapping indicates potential fires would be of low fire intensity.</p> <p>Fragmented remnant vegetation to the east, south and west is also likely to correspond to fires of lower intensity due to the upslope position of this vegetation from the investigation area and/or exposure to weather conditions less favourable for elevated fire intensities.</p>	<p>Low fire frequency, with only one fire on the mapped record (1964 fire season) impacting the Tallong investigation area. The nearby 2019/20 fire did not reach the site, and the fragmented vegetation fringing the conservation area and NP was mapped to be of low severity in the FESM analysis.</p>	<p>Based on the outcomes of the bushfire weather and behaviour analysis, the level of risk exposure is not beyond the application of standard bushfire protection measures as per PBP.</p> <p>While the Tallong investigation area is situated in a landscape where remnant vegetation is present, fragmentation of the canopy, along with lower FFDI conditions from the NE to SW, provides fire mitigation advantages.</p> <p>Recent fire activity (2019/2020) as shown in the FESM mapping, provides an example of how potential fires approaching from the southeast are moderated by the topography and increasing fragmentation, along with the lower FFDI conditions that are expected in this direction.</p>
Towrang	<p>To the east of the Towrang investigation area, high fire intensities are unlikely given the presence of rural grassland, terrain and exposure to lower FFDI conditions.</p> <p>To the west, remnant wooded vegetation is present upslope, and lower fire intensities are generally expected as shown in the modelled fire intensity mapping.</p> <p>While there is potential for fire pathways along the vegetated corridor of the Tarlo River, and national park, these pathways are fragmented by agricultural land under various forms of management, resulting in a narrow vegetated corridor that does not support extended fire runs.</p>	<p>Mapped fire history shows one fire (1964 season) occurred immediately north, however without impact to the investigation area.</p>	<p>Based on the outcomes of the bushfire weather and behaviour analysis, the level of risk exposure is not beyond the application of standard bushfire protection measures as per PBP.</p> <p>To the west, potential fire activity is on a downslope approach to the site, which would have a moderating influence of the speed and intensity of fire spread.</p> <p>To the east, the investigation area is well separated from remnant vegetation present in the narrow riparian corridor and is coupled with reduced fire intensities expected from this direction. Based on the outcomes of the weather analysis, the potential for landscape fires from this direction is reduced.</p>

Locality	Bushfire Weather and Potential Fire Behaviour	Mapped Fire History	Landscape Evaluation
Bungonia	<p>While the Bungonia investigation area is situated in close proximity to the NP and SCA to the west, the site is generally well separated from the broader landscape. This separation is due to the large presence of agricultural land, along with fragmented forest vegetation on more gentle slopes.</p> <p>In general, fire pathways connecting to small areas of remnant vegetation are narrow and do not connect to the broader landscape hazard within Bungonia SCA or NP.</p> <p>Based on the hazard typology and terrain, lower fire intensities are generally anticipated, with fire intensity mapping conservatively applying grassland fuel loads.</p>	<p>Only one fire has been recorded in the mapped fire history (1984 fire season). The more recent 2019/20 fire was generally contained in the SCA.</p>	<p>Although the Bungonia investigation area is situated in a landscape where remnant vegetation is present, the level of risk exposure is moderated by the typology of the hazard. The potential for higher intensity fires is moderated due to fragmentation of landscape and disruption to fire pathways provided by fire breaks provided by agricultural lands.</p> <p>Additionally, fire approaching from the east is likely to be burning under lower FFDI, thus moderating the potential severity of fire attack from this direction.</p> <p>Therefore, the level of risk exposure is not beyond the application of standard bushfire protection measures as per PBP.</p>
Lake Bathurst	<p>This investigation area is predominantly surrounded by agricultural land. The closest remnant vegetation with potential to carry canopy fire is situated to the west.</p> <p>With consideration to the slope and aspect, which promotes a downslope approach to the site, along with the presence of agricultural land, fires approaching from the west would be of lower intensity due to moderation of the relief and varying management of rural lands.</p> <p>Fire pathways to the east are highly disrupted by agricultural lands and the presence of Lake Bathurst. Lower fire intensities are generally anticipated, with fire intensity mapping, conservatively applying grassland fuel loads.</p>	<p>No mapped fire history within or surrounding the investigation area.</p>	<p>Based on the outcomes of the bushfire weather and behaviour analysis, the risk exposure of the site is considered well moderated, particularly given the downslope approach for fire activity under north, north westerly winds and fragmented nature of wooded vegetation, which is well set back from the site.</p> <p>The presence of agricultural land under varying management would likely reduce the speed of approach in comparison to a typically fast moving grassland fire, further moderating the exposure risk.</p>

Locality	Bushfire Weather and Potential Fire Behaviour	Mapped Fire History	Landscape Evaluation
Tarago	<p>Similar to Lake Bathurst, this investigation area is predominantly surrounded by agricultural land. The closest remnant vegetation with potential to carry canopy fire is situated to the west and south. With consideration to the slope and aspect, which promotes a downslope approach to the site, along with the presence of agricultural land, fires approaching from the west would be of lower intensity due to moderation by the relief and varying management of rural lands.</p> <p>Fire pathways to the east are highly disrupted by agricultural lands and the presence of Lake Bathurst. Lower fire intensities are generally anticipated, with fire intensity mapping conservatively applying grassland fuel loads</p>	No mapped fire history within or surrounding the investigation area.	<p>Based on the outcomes of the bushfire weather and behaviour analysis, it is not expected that significant landscape fire would result in exposure beyond a level that can be mitigated.</p> <p>The presence of agricultural land under varying management levels significantly moderates the hazard landscape, moderating the exposure risk.</p>

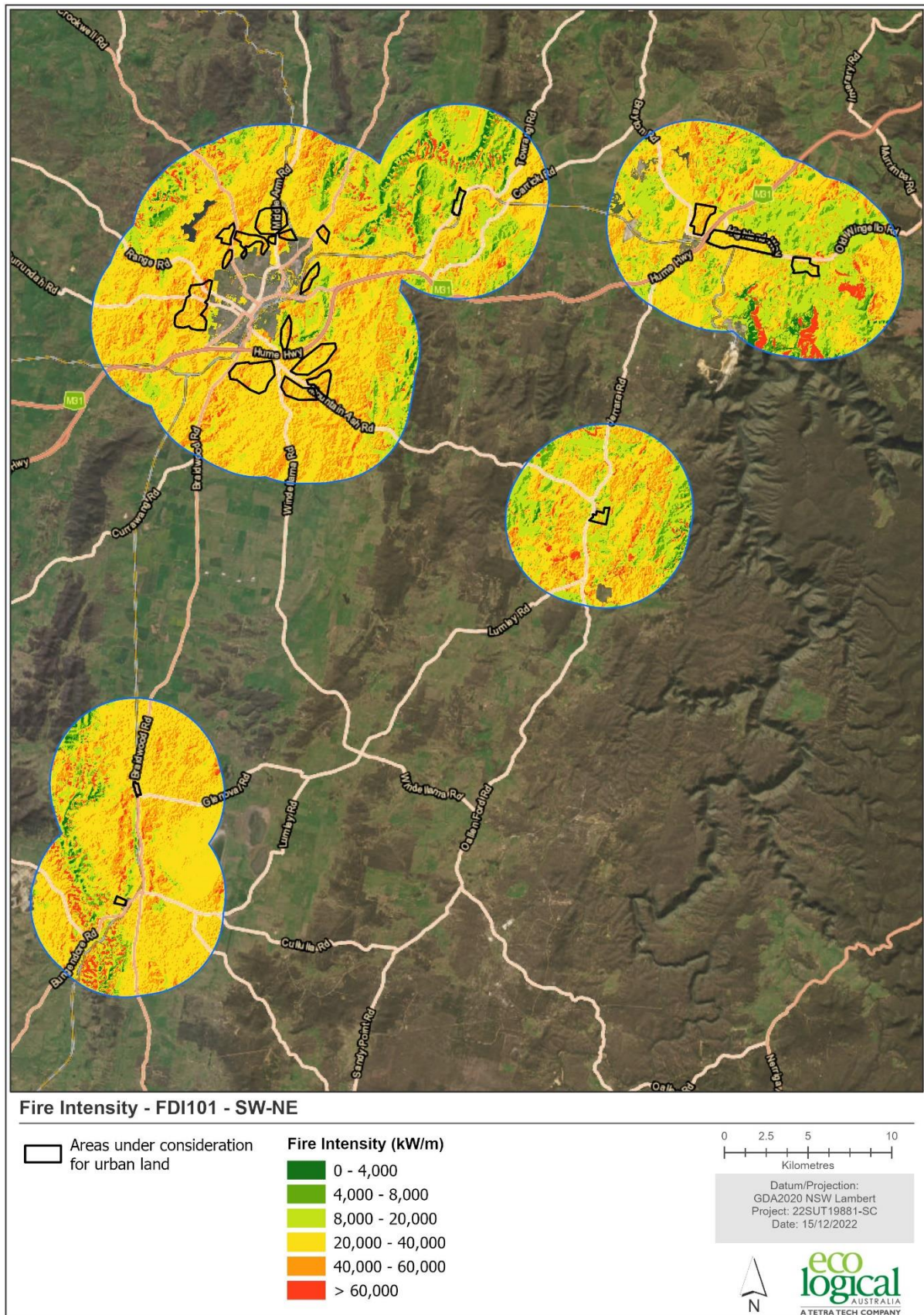


Figure 15: Directional Fire intensity modelling based on FFDI 101, South-west to North-east winds

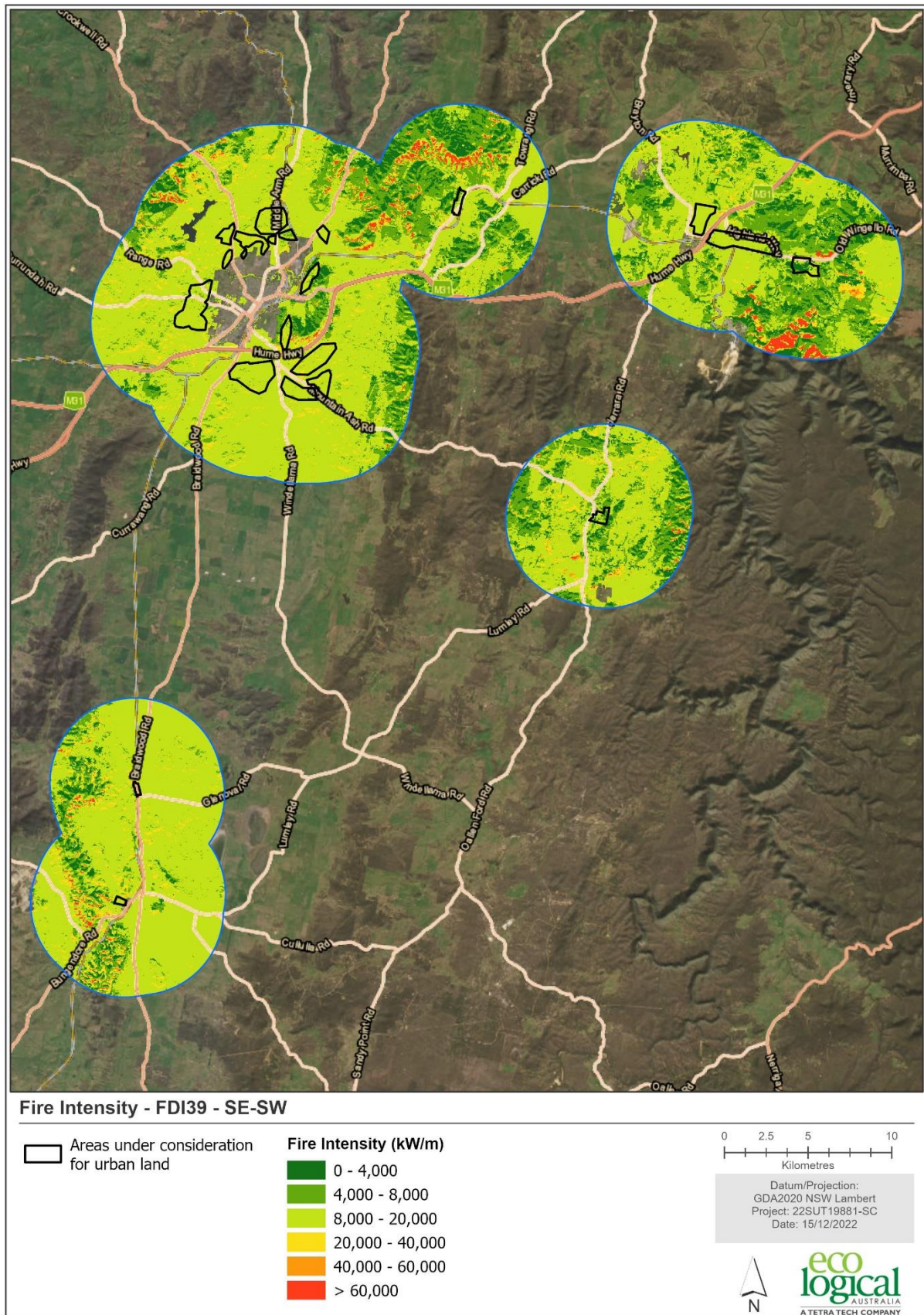


Figure 16: Directional Fire intensity modelling based on FFDI 39, South-east to South-west winds

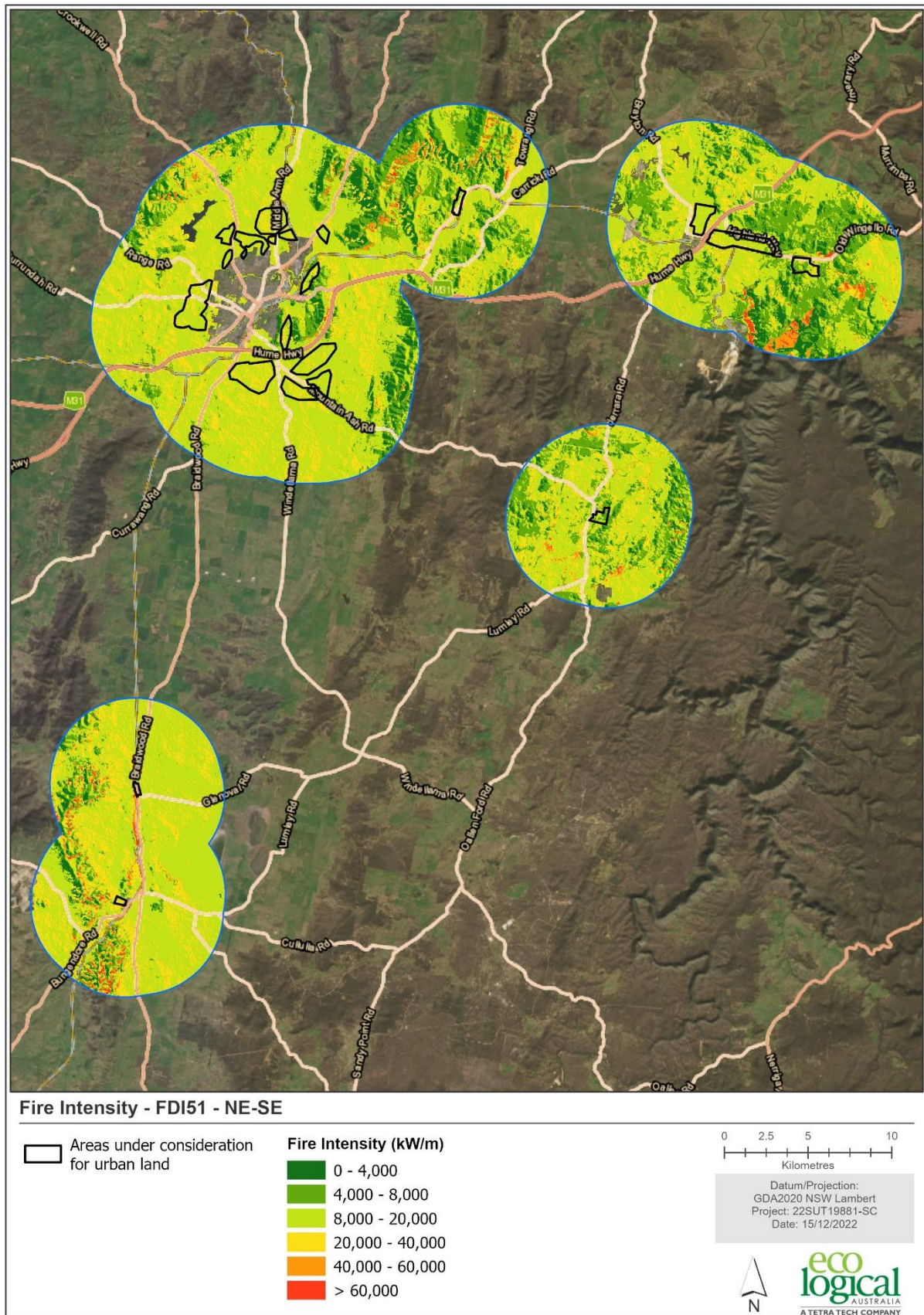


Figure 17: Directional Fire intensity modelling based on FFDI 51, North-east to South-east winds

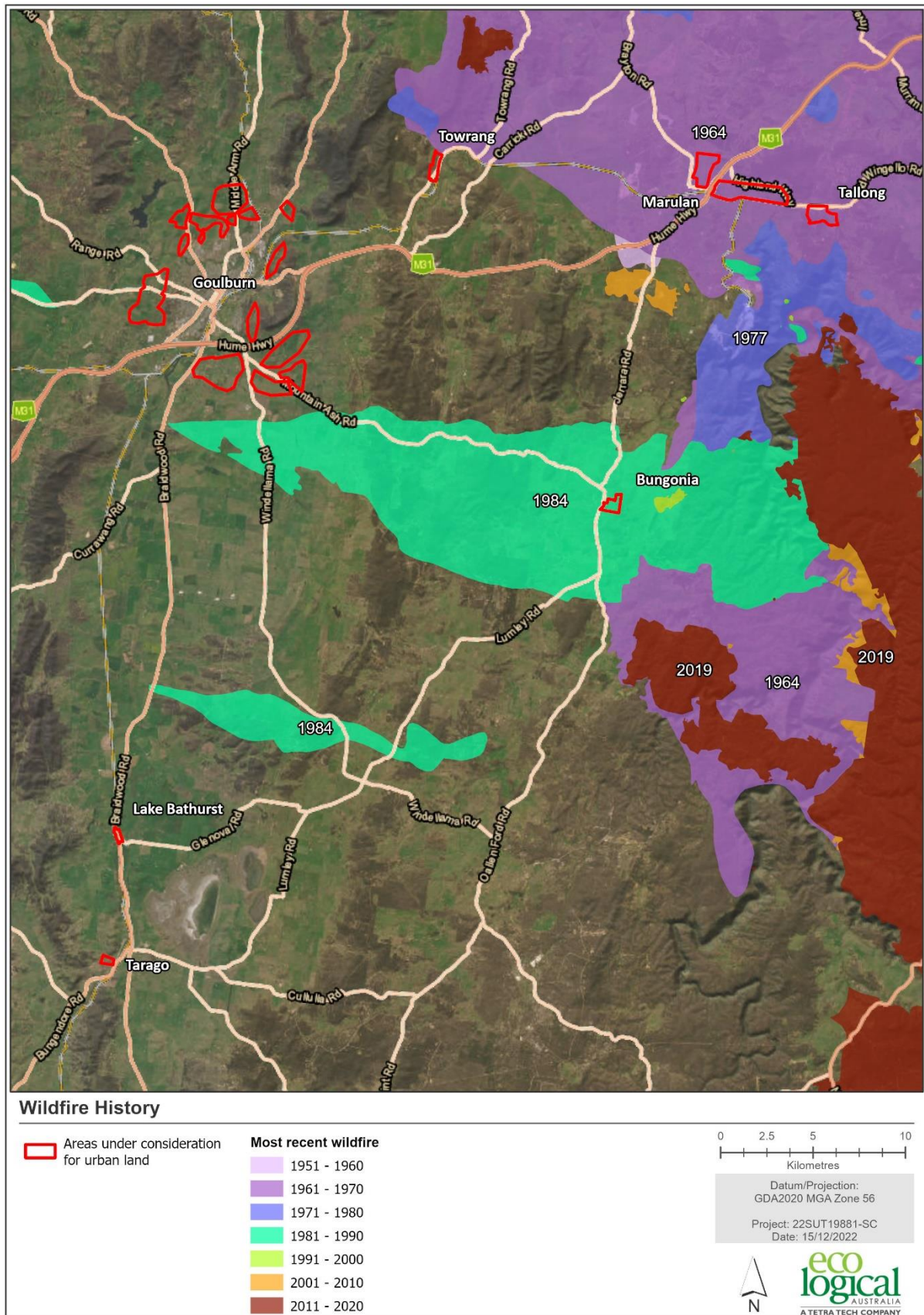


Figure 18: Mapped wildfire history within the study area (Source: NPWS and RFS)

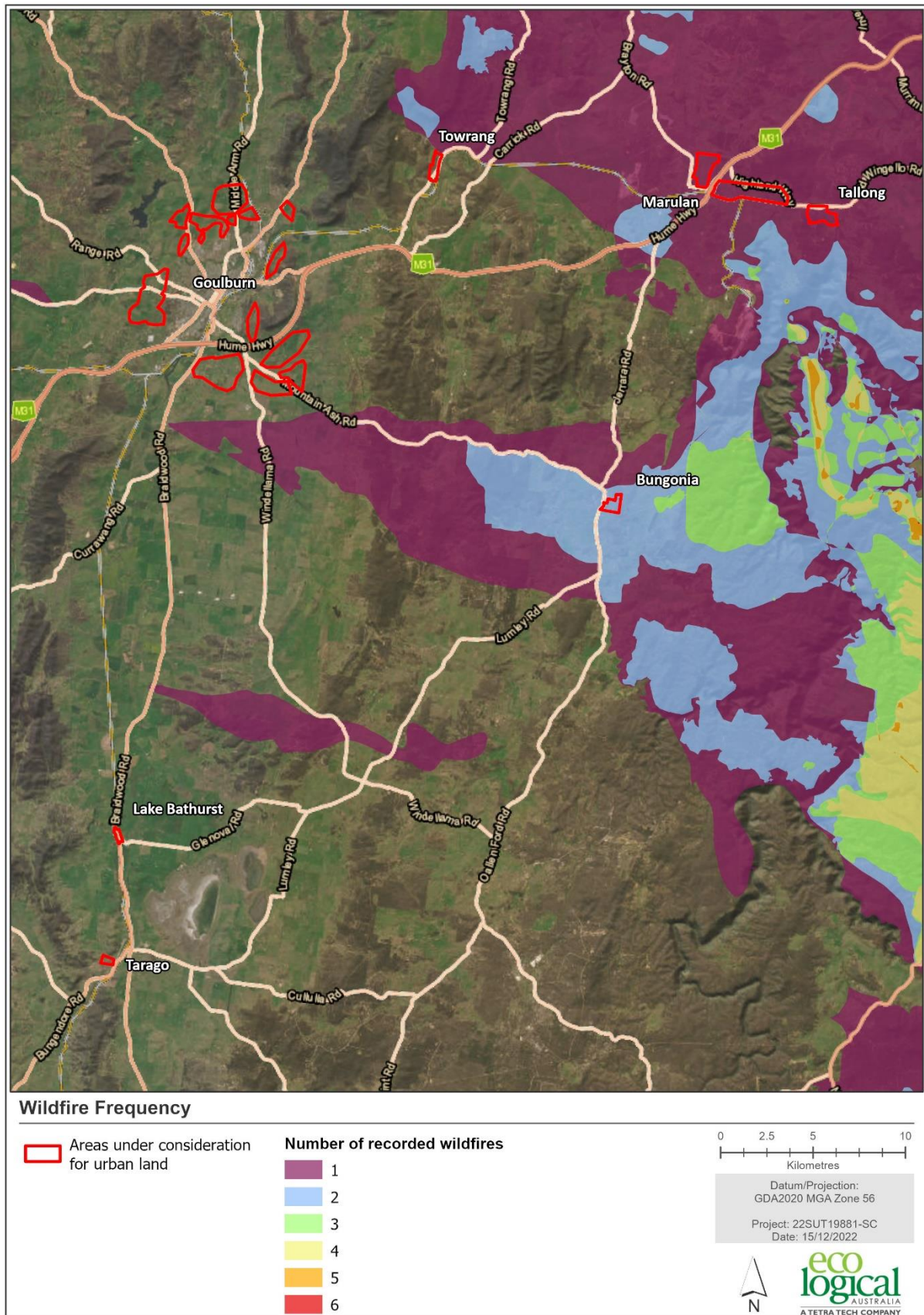


Figure 19: Fire frequency within the study area – 1951/1952 fire season to 2019/2020 season

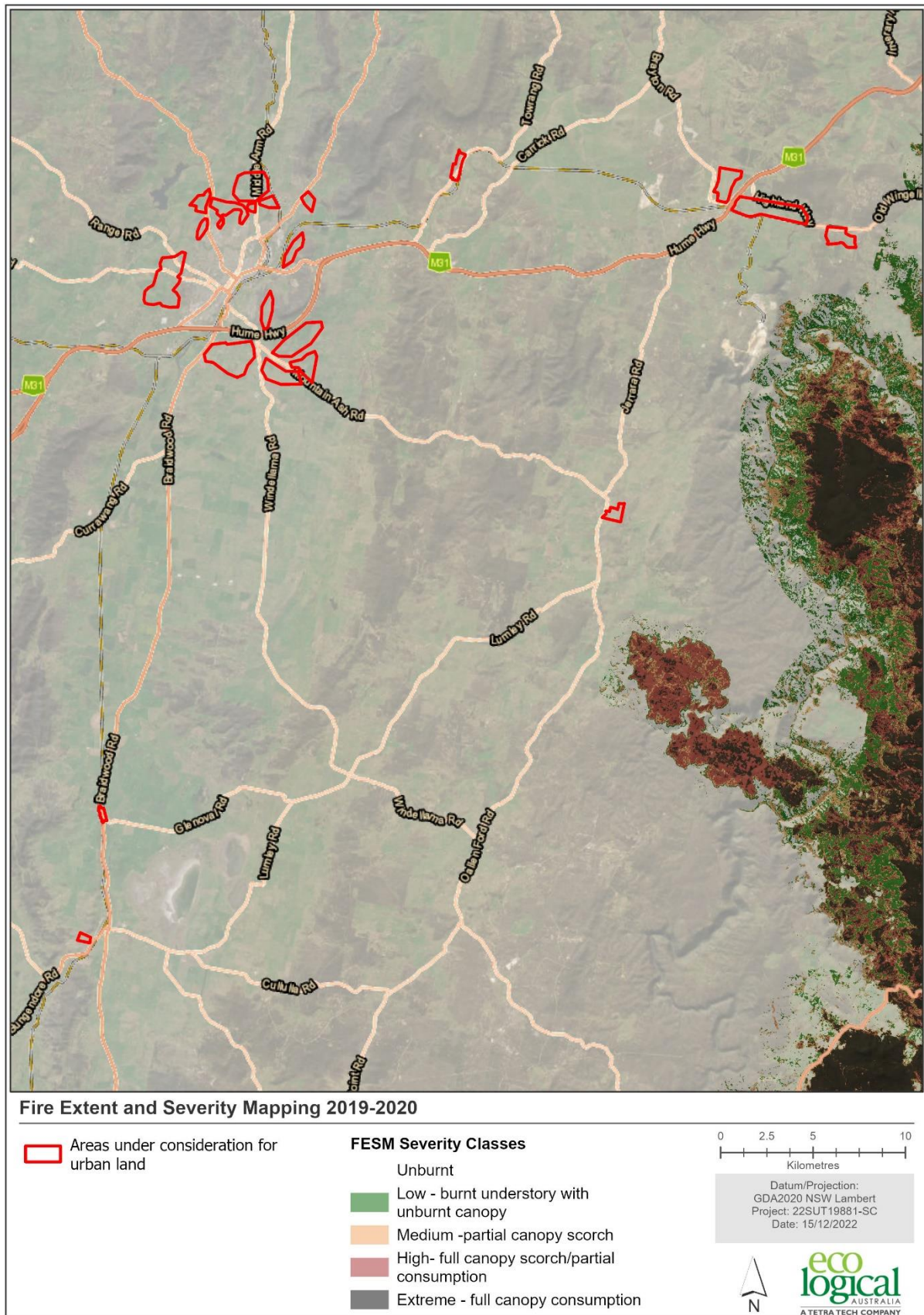


Figure 20: Fire Extent and Severity Mapping 2019-2020 Fire Season (DPE, 2022)

4. Land Use Assessment

PBP outlines broad principles and assessment considerations for strategic planning proposals. It also specifies that bushfire protection measures (BPMs) need to be considered at the strategic planning stage, to ensure that the future development can comply with PBP, as per the specified BPMs in Chapters 5-8 of PBP. This land use assessment therefore considers the risk profile for each investigation area and the suitability for residential land uses, along with the feasibility to meet APZ requirements.

4.1 Land Use Evaluation

Future development on BFPL will need to satisfy the performance criteria identified in PBP for residential land uses. It is expected that future land uses enabled through LEP/DCP amendments to enable residential settlement will 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.

4.1.1 Chapter 5 of PBP – Residential and Rural Residential Subdivision

Within the Goulburn investigation areas and Marulan, it is anticipated that future land uses will be subject to the requirements outlined in Chapter 5 of PBP. Following rezoning 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;
- 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 associated firefighting equipment (i.e., pump and hose) for each dwelling in addition to any reticulated water supplies; and
- Provision of access and infrastructure requirements according to Table 5.3b of PBP.

4.1.2 Chapter 7 of PBP - Residential Infill Development

For infill residential redevelopment, suitability in relation to accommodating the requirements outlined in Chapter 7 of PBP was considered, including the following provisions:

- Provision of compliant APZs;
- Provision of access and infrastructure requirements according to Table 7.3b of PBP, including compliant SWS.

4.2 Risk Profile

The feasibility for future development within the investigation areas to comply with the bushfire protection measures identified within PBP is a fundamental consideration in determining the residual risk profile. Whilst bushfire protection measures and their performance criteria 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 following:

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

4.2.1 Feasibility of Asset Protection Zones

The feasibility for APZs is a key bushfire protection measure and based on the landscape assessment of vegetation and slope, APZ dimensions that may apply to future development in the study area are listed in Table 6. Future residential development contemplated for the residential settlement growth areas will need to meet the applicable APZ dimensions for vegetation type and slope combinations.

Whilst BPM and their performance criteria are a benchmark for the approval of a development, at a strategic level the minimum requirements for approval are under the PBP Acceptable Solutions for residential development (i.e. to meet a maximum Radiant Heat Flux (RHF) or 29 kW/m²) (Table 6).

The following considerations will apply for any future development:

- For any revegetation, *Planning for Bushfire Protection* (PBP) allows for vegetation to be classified as 'Low Hazard' and excluded from assessment based on patch size (i.e. <1 ha), width (i.e. <20 m) and proximity. Importantly, the separation distance between these patches needs to meet or exceed the distances detailed in A1.10 of PBP (see below). If assessed as a low threat exclusion the provision of bushfire protection measures such as an Asset Protection Zone (APZ) setback is not required.
- Vegetation within required Asset Protection Zones should be managed as either an inner protection area (see A4.1.1 of PBP), or where applicable pending the outcome of assessment of required APZs, an outer protection area (see A4.1.2 of PBP).
- All APZs are assumed to be on land less than 18 degrees – slope constraints identified in Figures 19 – 25 will need to be considered.

For future infill development on bushfire prone land, APZ feasibility is considered at the DA/CDC stage. However, the implementation of compliant APZs within the identified precincts is not considered a limitation. Nor is there any part of the land-use assessment that suggests proposed settlement areas are inappropriate development under the Strategic Planning Principles or exclusion criteria within PBP in relation to the feasibility of APZs.

Table 6: APZ dimensions for residential development

Vegetation Formation	PBP Slope Class	Residential APZ (BAL-29) ¹
Forest	Upslope/Flat	24 m
	0-5° downslope	29 m
	5 -10° downslope	36 m
	10-15° downslope	45 m
	15-20° downslope	56 m
Woodland	Upslope/Flat	12 m
	0-5° downslope	16 m
	5-10° downslope	20 m
	10-15° downslope	25 m
	15-20° downslope	32 m
Low Hazard (Rainforest)	Upslope/Flat	11 m
	0-5° downslope	14 m
	5-10° downslope	18 m
	10-15° downslope	23 m
	15-20° downslope	30 m
Grassland	Upslope/Flat	10 m
	0-5° downslope	12 m
	5-10° downslope	13 m
	10-15° downslope	15 m
	15-20° downslope	17 m

¹ Table A1.12.2 from PBP 2019, ² Table A1.12.1 from PBP

4.3 Summary of land use evaluation

The location and type of land uses proposed is generally considered consistent with the strategic planning principles, with regard to the ability for bushfire protection measures to be provided.

Table 7 below provides a summary of the land use evaluation for the differing development types contemplated. The land use evaluation has considered potential for residential land with consideration to:

- The risk profile of the site
- The potential for compliant bushfire protection measures for large lot residential development and within planned low density residential areas.

Table 7: Land Use Evaluation for the Investigation Areas

Locality	Bushfire Landscape	Capacity for Bushfire Protection
Goulburn	Generally surrounded by grassland, with smaller areas of grassy woodland. Rural land uses often reduce the fuel loads and in combination with roads, introduce breaks to fuel connectivity. Typically undulating terrain. Some forest vegetation in the landscape but separated from the sites.	Activation primarily via rezoning and planned subdivision and therefore mechanism for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision.
Marulan	Immediate surrounds generally dominated by grassland and fragmented woodland. Rural land uses often reduce the fuel loads and in combination with roads, introduce breaks to fuel connectivity. Typically undulating terrain proximal to the site. Fragmented woodland and forest vegetation is located in the broader landscape but separated from the site, with forest more prevalent to the north east, east and south east, on more rugged terrain. Forest vegetation to the north is upslope.	General capacity for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision.
Tallong	Rural grassland / fragmented forest landscape. Some connectivity to more extensive forest areas to the south but less connectivity to the north and less extensive forest to the west. Vegetation hazard is generally upslope from proposed settlement area.	General capacity for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision. Rezoning to RU5 or R5 is not considered to trigger the 'inappropriate development' considerations of PBP, subject to confirmation via traffic study of suitable capacity to evacuate future properties on BFPL and confirmation of emergency management adequacy for the proposed increased in residential density (to be advised by relevant authorities)
Towrang	Rural forest landscape to the west and woodland /rural grassland to the east. Landscape connectivity to large expanse of forest vegetation to the west increases the bushfire risk context of this site, however the hazard is upslope of the proposed settlement area, moderating any potential fire attack.	General capacity for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision. Decrease in the minimum lot size to 1ha or 4000m ² is not considered to trigger the 'inappropriate development' considerations of PBP, subject to confirmation via traffic study of suitable capacity to evacuate future properties on BFPL and confirmation

Locality	Bushfire Landscape	Capacity for Bushfire Protection
		of emergency management adequacy for the proposed increased in residential density (to be advised by relevant authorities).
Bungonia	<p>Rural grassland / fragmented forest landscape.</p> <p>Bungonia SCA situated to the east and forest hazard to the west, however both these areas are well separated from the site.</p>	General capacity for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision. Proposal is not considered to trigger the 'inappropriate development' considerations of PBP, subject to confirmation via traffic study of suitable capacity to evacuate future properties on BFPL and confirmation of emergency management adequacy for the proposed increased in residential density (to be advised by relevant authorities).
Tarago	Dominated by rural grassland landscape, with Tallaganda NP further south. Rural land uses often reduce the fuel loads and in combination with roads, introduce breaks to fuel connectivity. Typically undulating terrain.	General capacity for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision.
Lake Bathurst	Dominated by rural grassland landscape, with fragmented forest vegetation within the locality but large separation from the site. Rural land uses often reduce the fuel loads and in combination with roads, introduce breaks to fuel connectivity. Typically undulating terrain.	General capacity for APZs, access and infrastructure to be implemented as per the requirements of PBP for Residential and Rural Residential subdivision.

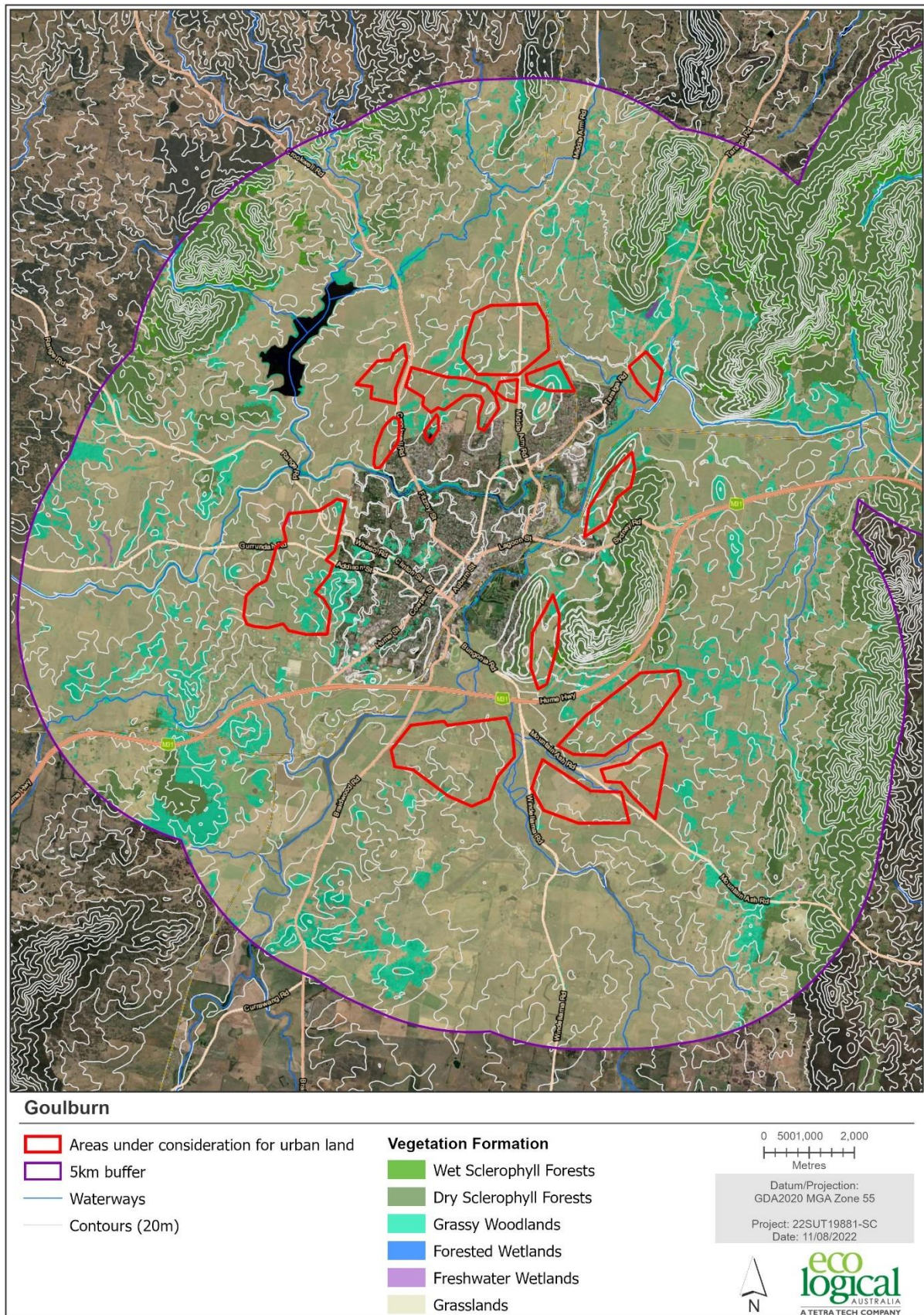


Figure 21:Vegetation and Slope Constraints – Goulburn

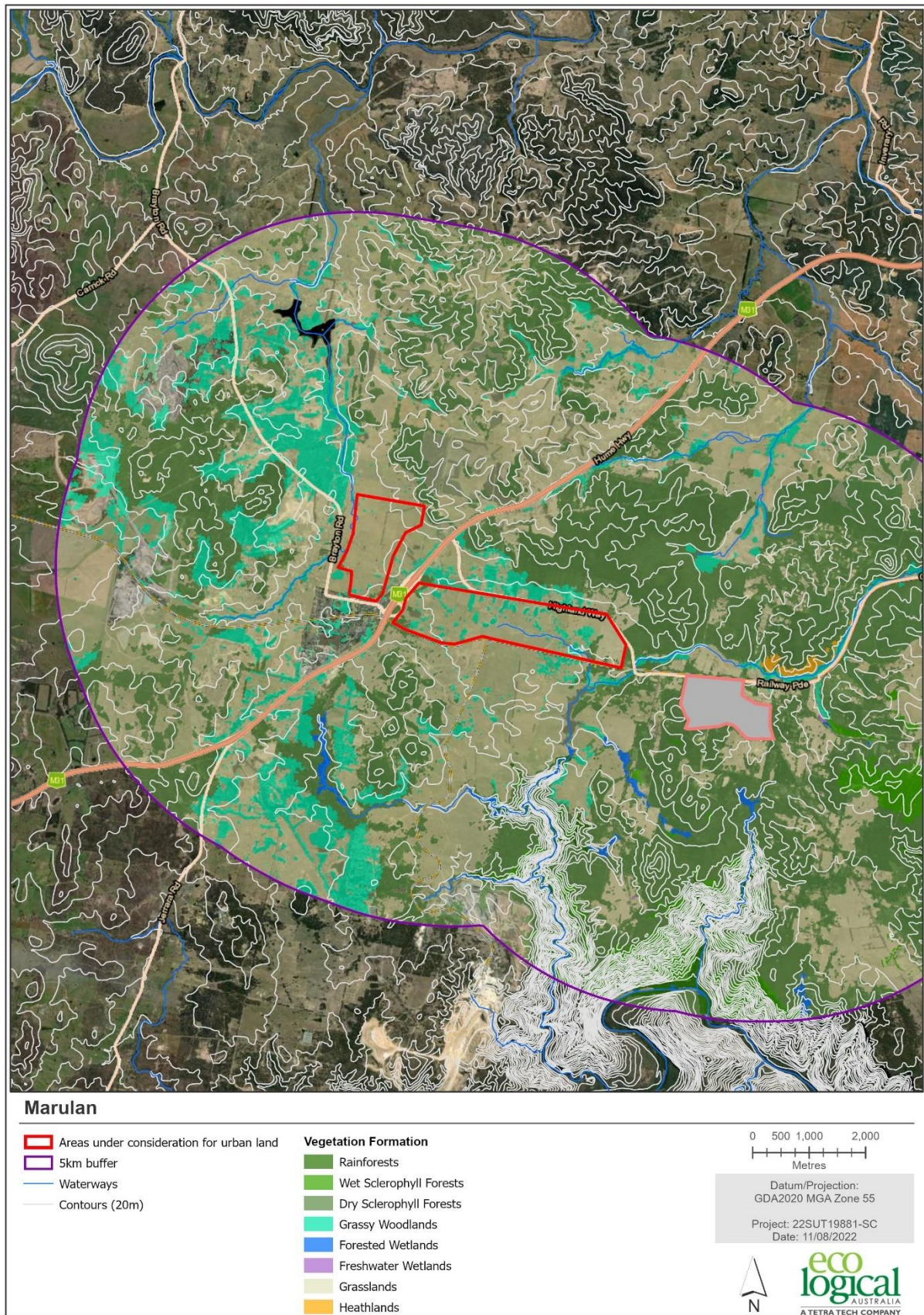


Figure 22:Vegetation and Slope Constraints – Marulan

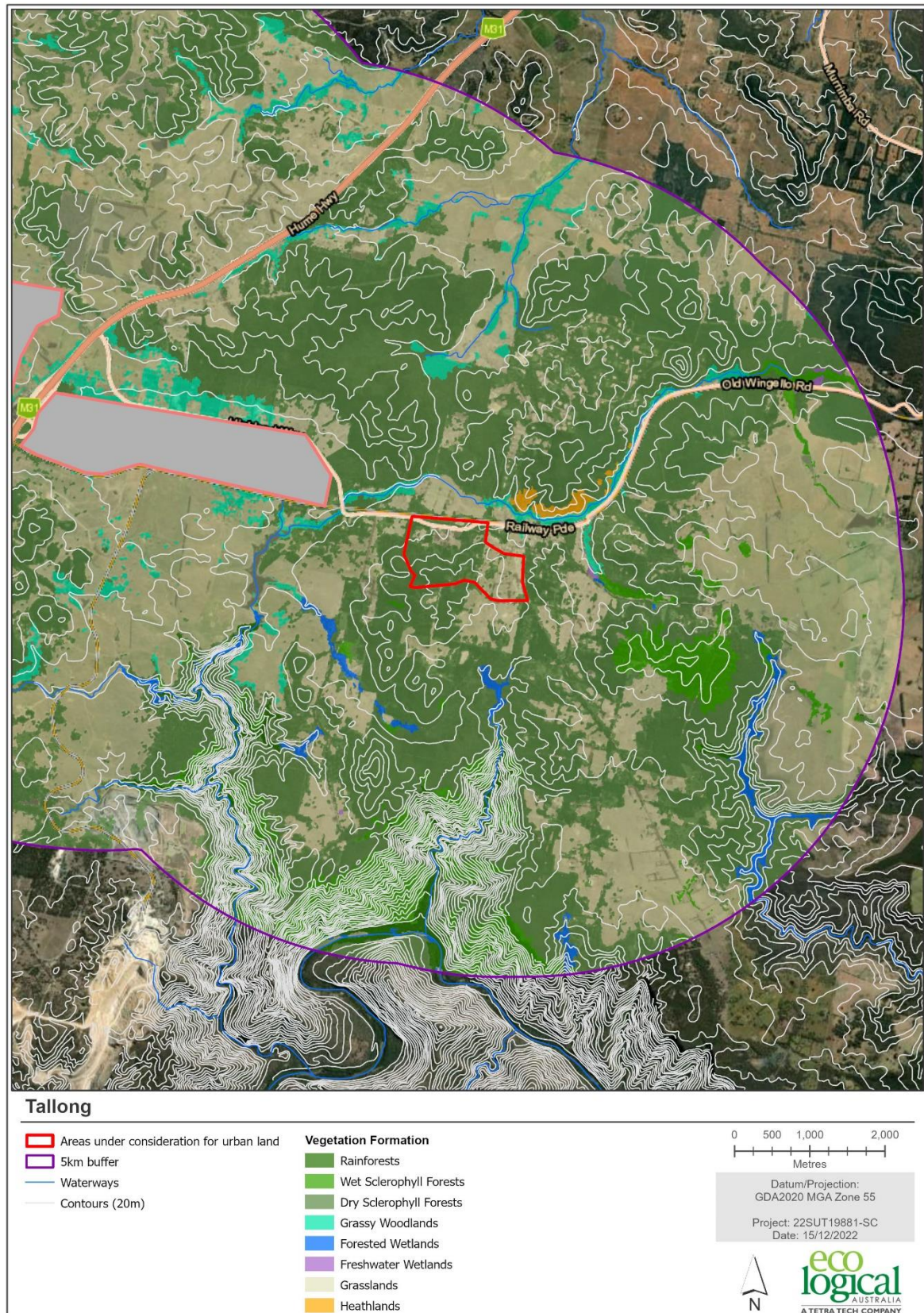


Figure 23:Vegetation and Slope Constraints – Talong

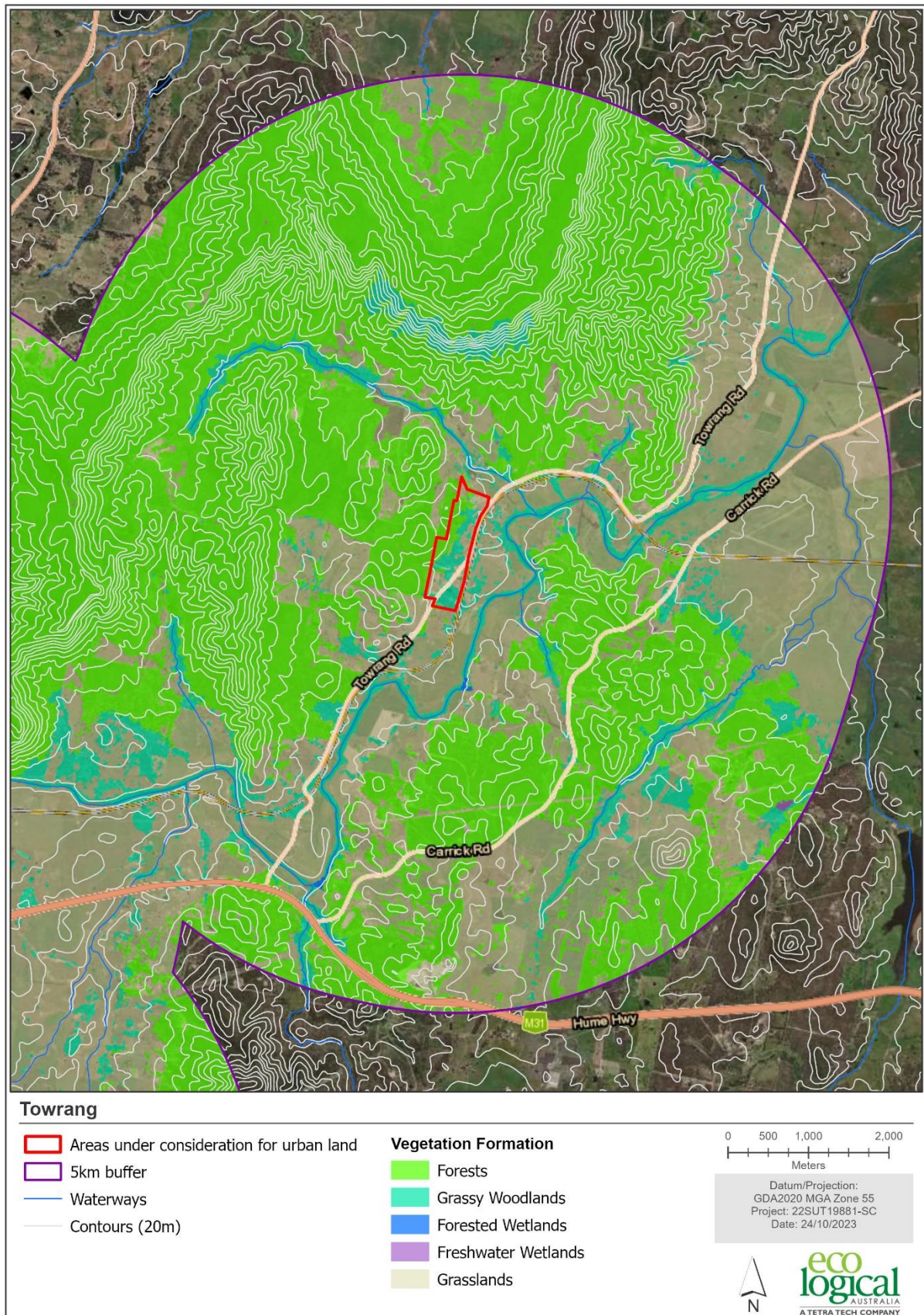


Figure 24:Vegetation and Slope Constraints – Towrang

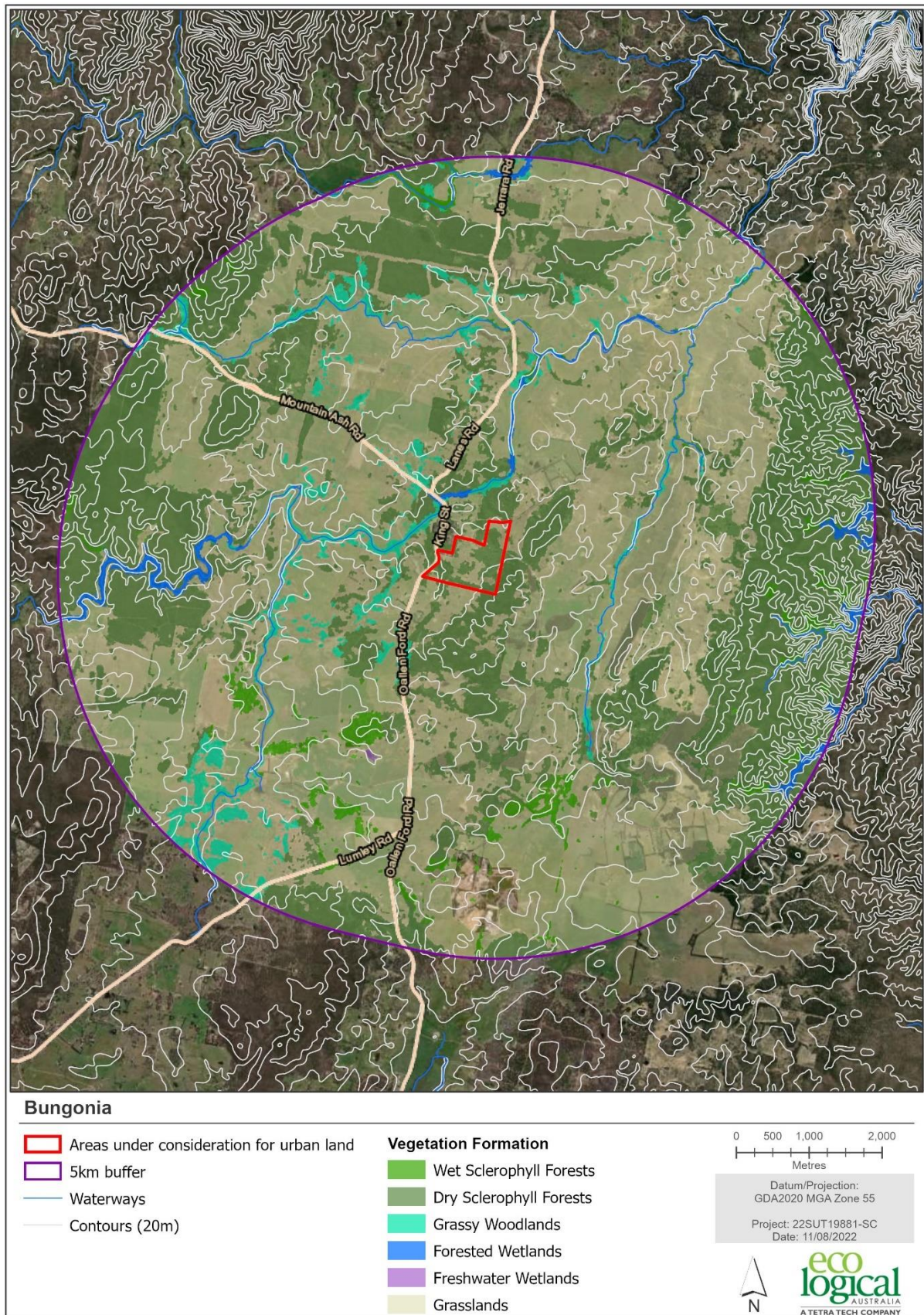


Figure 25:Vegetation and Slope Constraints – Bungonia

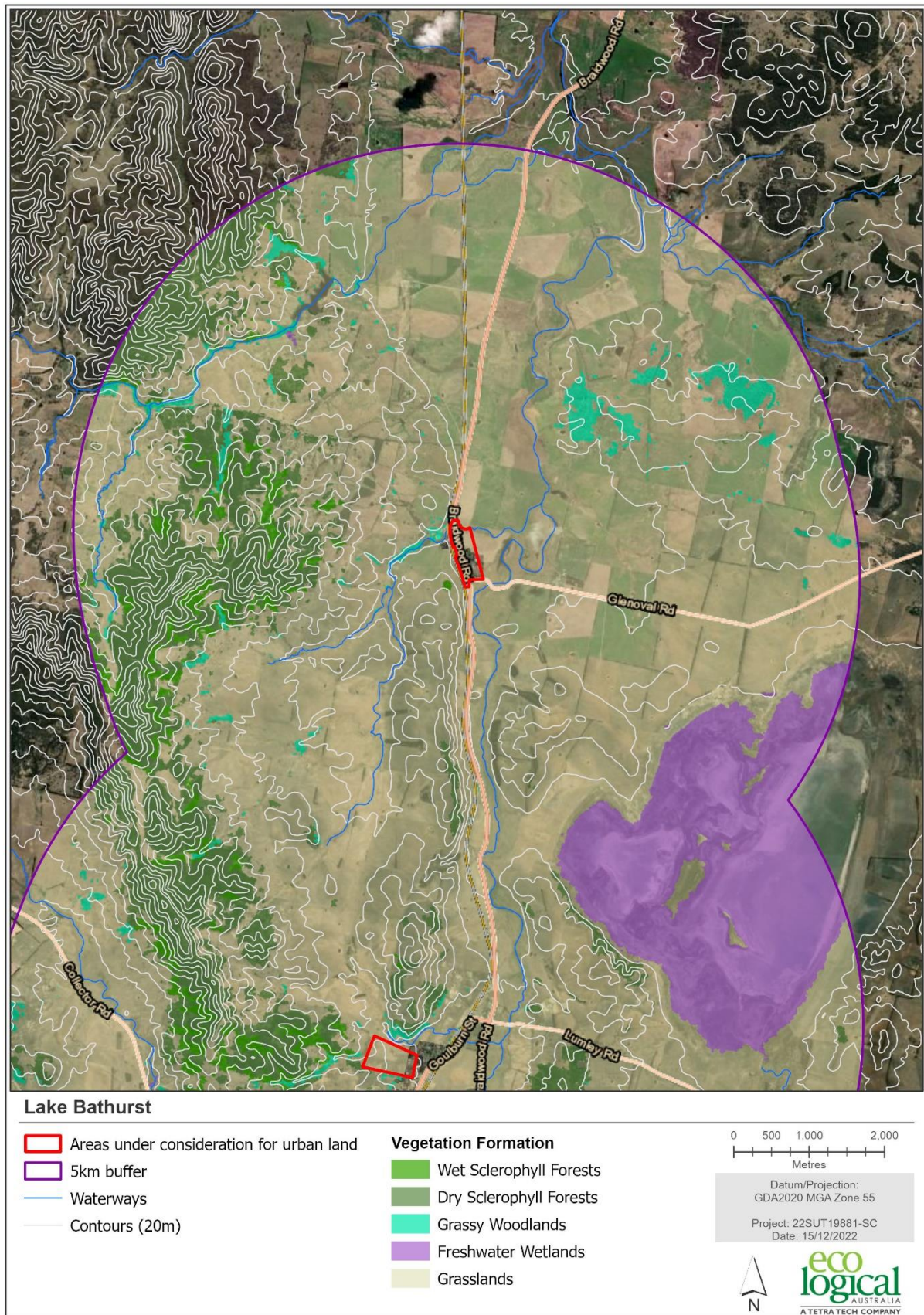


Figure 26: Vegetation and Slope Constraints – Lake Bathurst

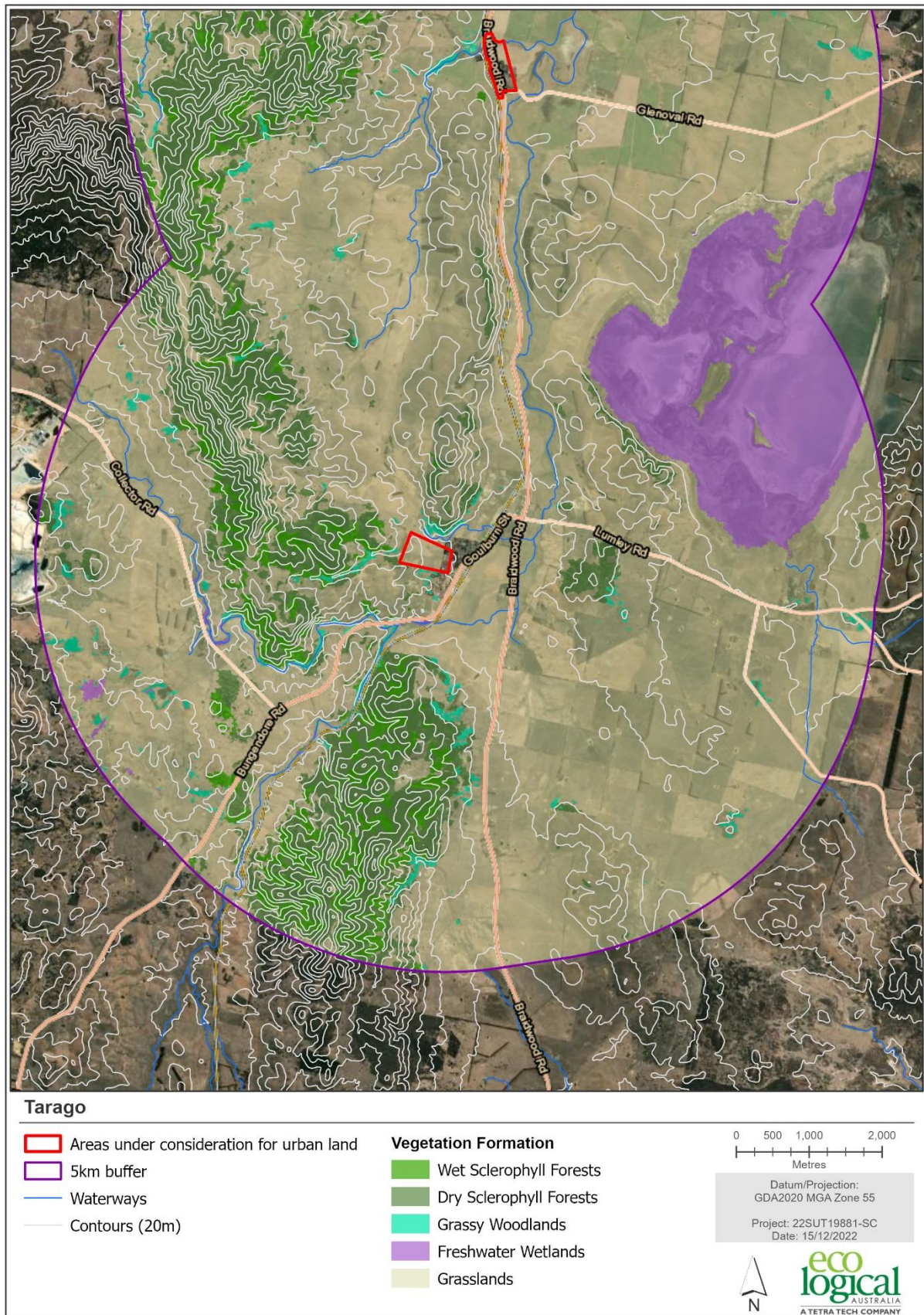


Figure 27: Vegetation and Slope Constraints – Tarago

5. Access, Egress and Evacuation

In evaluating opportunity for residential settlement, consideration to the provision of adequate infrastructure associated with access, emergency evacuation and firefighting is required as per the strategic planning principles outlined in PBP. This includes determination if the exclusion requirements for “inappropriate development” apply with consideration to access. Future development may be considered inappropriate where:

- 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 is within an area of high bushfire risk where density of existing development may cause evacuation issues for both existing and new occupants.

The above aspects were considered for each investigation area, along with specific considerations for access, evacuation and emergency service as outlined below in sections 5.1 to 5.3, and outcome of evaluation is presented in section 5.4.

5.1 Access

The strategic planning requirements of PBP prescribe the following assessment considerations for access:

- capacity of the proposed road network to deal with 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;
- the potential for development to be isolated in the event of a bushfire.

Planning for residential settlement also presents an opportunity for improvement of road infrastructure. In Goulburn and Marulan where subdivision is likely to facilitate higher uplift, there is opportunity for the provision of sealed roads with development. In the village areas where uplift is more likely to proceed organically via infill development, infrastructure upgrades would be Council led. Of note for future works are requirements outlined in PBP which include provision of access roads that:

- Are all weather
- Meet minimum road width requirements
- Meet specified gradient requirements
- Provide adequate clearance

Further details are provided in Appendix A, which includes specifications as per PBP.

5.2 Evacuation

While the risk of a significant bushfire necessitating the need for complete evacuation is low for the investigations area, it is an important consideration for strategic planning. Key considerations in relation to evacuation are provision for:

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

5.2.1 Early Offsite Evacuation

Evacuation is a necessary component of bushfire planning for the protection of life. Strategic 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.

Key routes for the village investigation areas and Marulan are highlighted in Figures 30 to 35.

5.2.2 Access to Safer Places

Whilst early 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 access to safer place options is particularly important to support community resilience under rapid onset bushfire attack scenarios where evacuation is not achievable or not able to be undertaken due to safety concerns.

Consideration of NSPs provides one mechanism for increasing accessibility to safer places. Typically, NSPs provide a temporary refuge and include a building or an open space that may provide for improved protection of human life during the onset and passage of a bushfire (RFS 2017). While it is noted that any new NSPs should be put forward by the regional Bush Fire Management Committee (BFMC) and endorsed by the NSW RFS Commissioner, it is recommended that investigation into the suitability of new NSPs occur in parallel with future planning proposals.

The criteria and principles for NSPs are documented in RFS (2017) and included in Appendix B. Once endorsed, to ensure ongoing suitability and management, NSPs are included on the asset list in the regional Bush Fire Risk Management Plan (BFRMP).

There are existing NSPs within the Goulburn Mulwaree LGA, as detailed in Table 8 and shown in Figure 28. It is also expected that Goulburn CBD would be utilised by evacuating residents.

Table 8: Existing NSPs in close Proximity

Neighbourhood Safer Place	Suburb	Type
Marulan Public Hall	Marulan	Built
Tony Onions Oval	Marulan	Open Space
Yarra RFS Shed	Yarra	Built
Wakefield Park	Goulburn	Open Space
Tarago Sports Ground	Tarago	Open Space
Wingello	Wingello	Open Space

[^] Accessed from <https://www.rfs.nsw.gov.au/plan-and-prepare/neighbourhood-safer-places>

5.2.3 Low risk development outcomes

In combination with early off-site evacuation and capacity for safe on-site refuge, the risk level of the potential development outcomes across the sites warrants consideration with respect to evacuation demand. With consideration to the scale of potential residential settlement within Goulburn and Marulan, it is likely that the majority of residential allotments facilitated through subdivision will no longer be bush fire prone (i.e., greater than 100 m from remaining hazards) and therefore future development in these areas would have a low bushfire risk. Low risk development outcomes are also likely in the villages, pending the minimum lot size planned for these areas, and the management of agricultural land.

5.3 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. Consideration of the increase in demand for emergency services;
- b. Emergency evacuation planning; and
- c. Evacuation adequacy assessment.

In regard to the demand for emergency services, ELA reviewed existing services in proximity to the site and note that there are existing RFS brigades close by as shown in Figure 29 and compiled in Table 9. Additional Fire and Rescue NSW (FRNSW) resources are also stationed at Goulburn. All proposed settlement areas, with the exception of Lake Bathurst, are supported by RFS or FRNSW stations. Despite this, further resources may be required from the potential development that may be realised, and this should be further discussed with emergency services. It is important to review any proposed increased residential densities based on the outcome of any advice from relevant emergency management authorities.

Table 9: Fire stations within proximity to investigation areas

Station
Rural Fire Service
Goulburn Mulwaree RFS Fire Control Centre
Tarlo RFS
Gundary RFS
Yarra RFS
Pomeroy RFS
Towrang RFS
Marulan RFS
Tallong RFS
Bungonia RFS
Tarago RFS

Station
Windellama RFS
Fire and Rescue NSW
Goulburn FRNSW

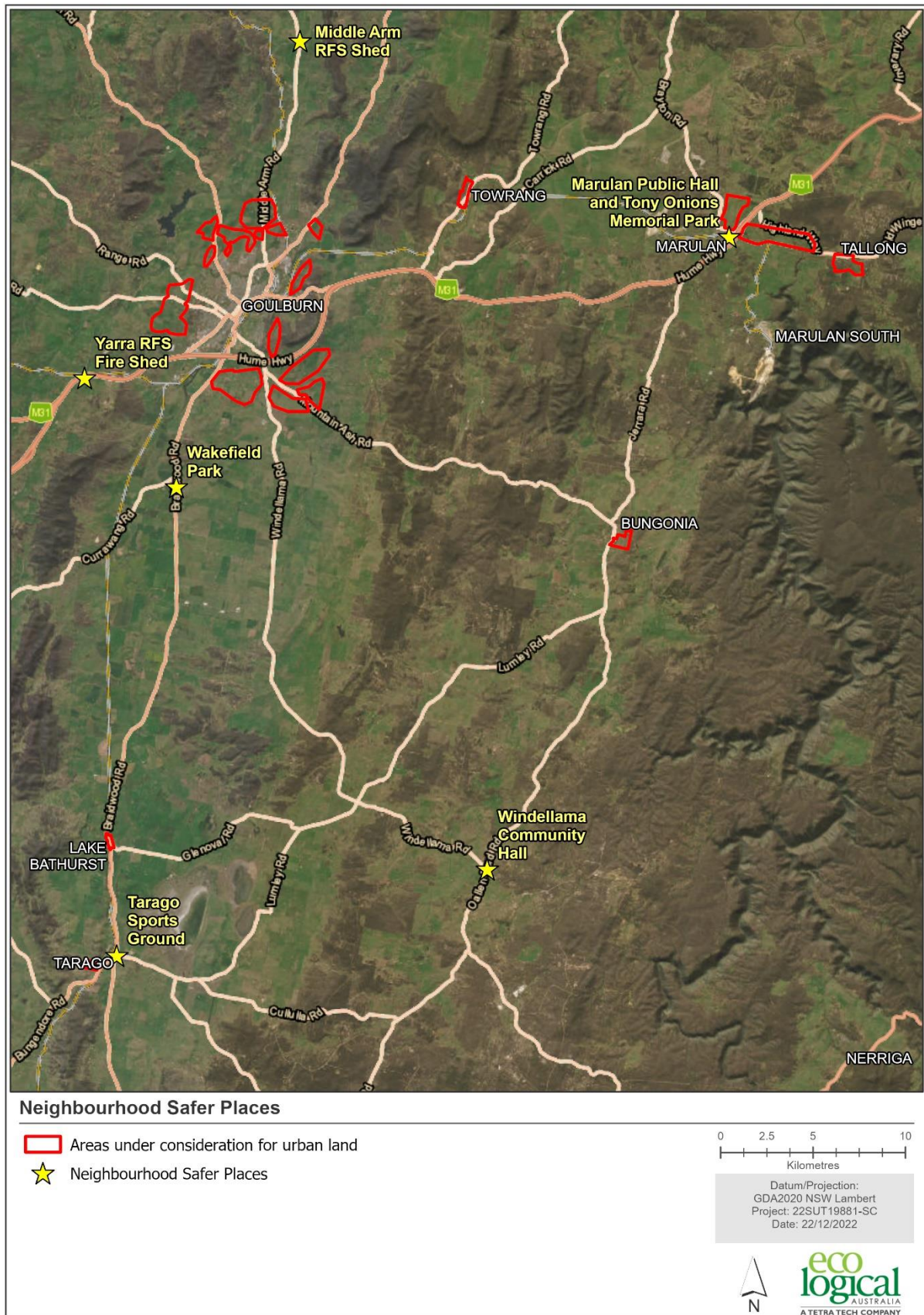


Figure 28: Existing Neighbourhood Safer Places

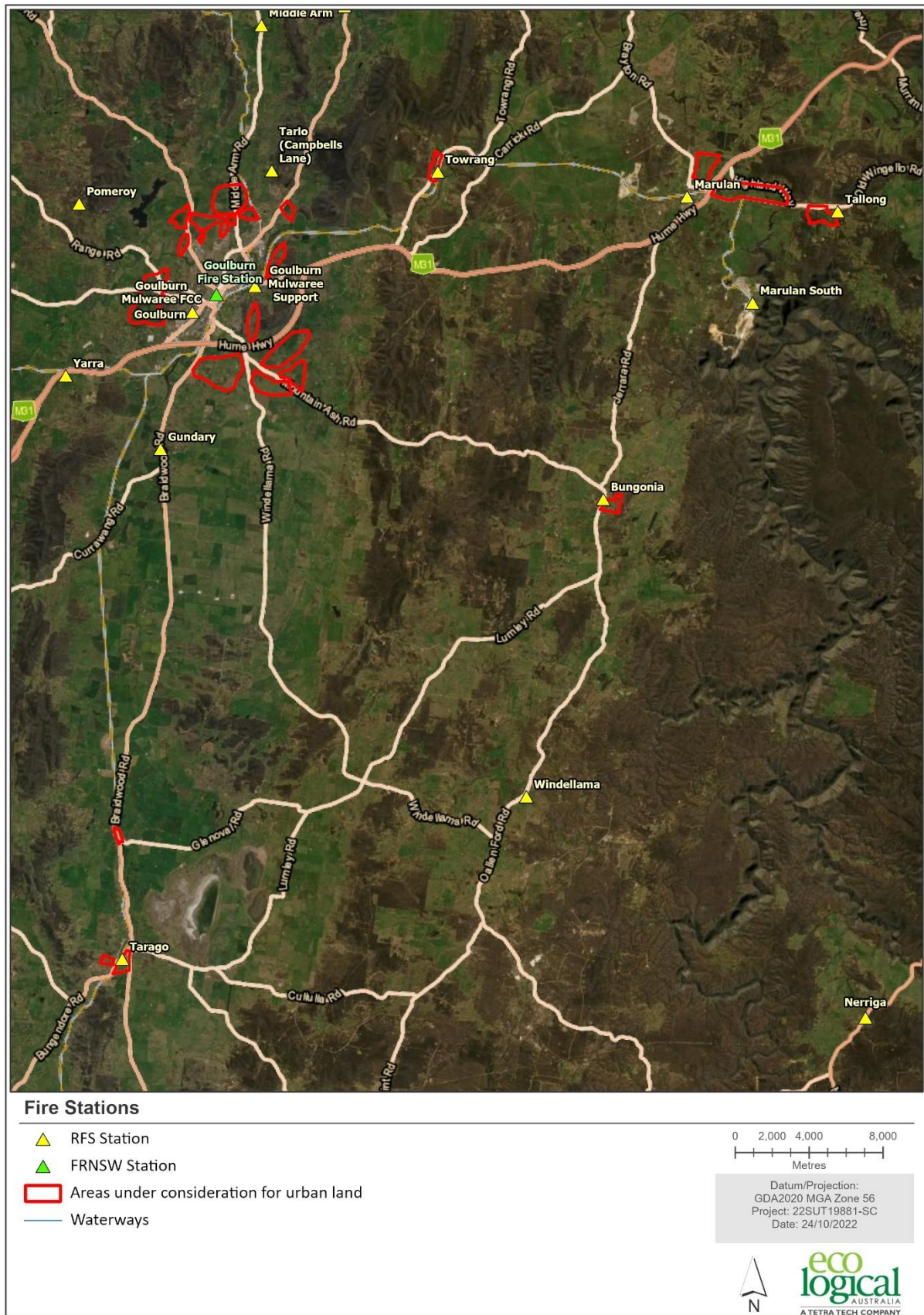


Figure 29: Fire stations in close proximity to the investigation areas



Figure 30: Evacuation routes from Bungonia



Figure 31: Evacuation routes from Lake Bathurst

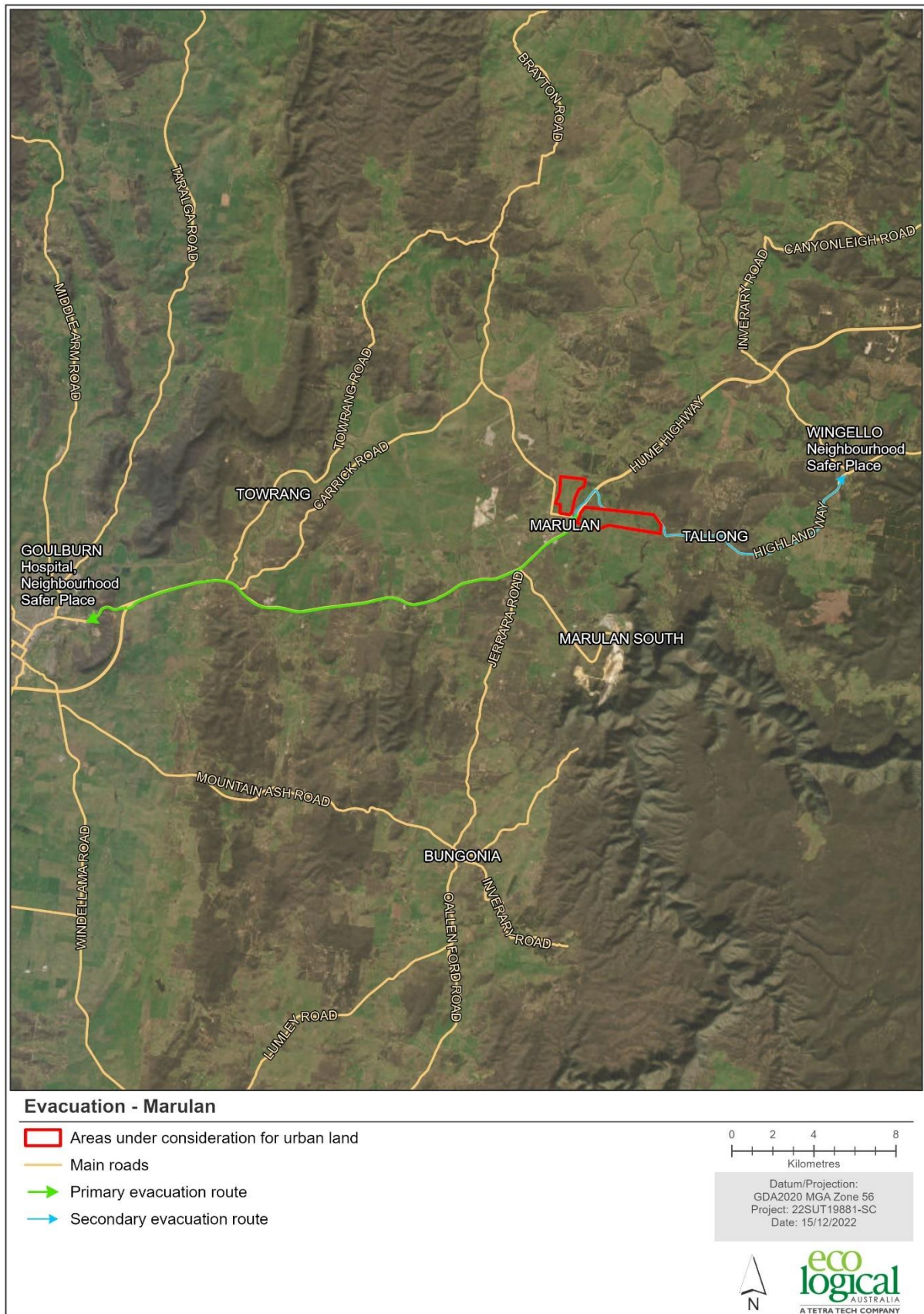


Figure 32: Evacuation routes from Marulan



Figure 33: Evacuation routes from Tallong

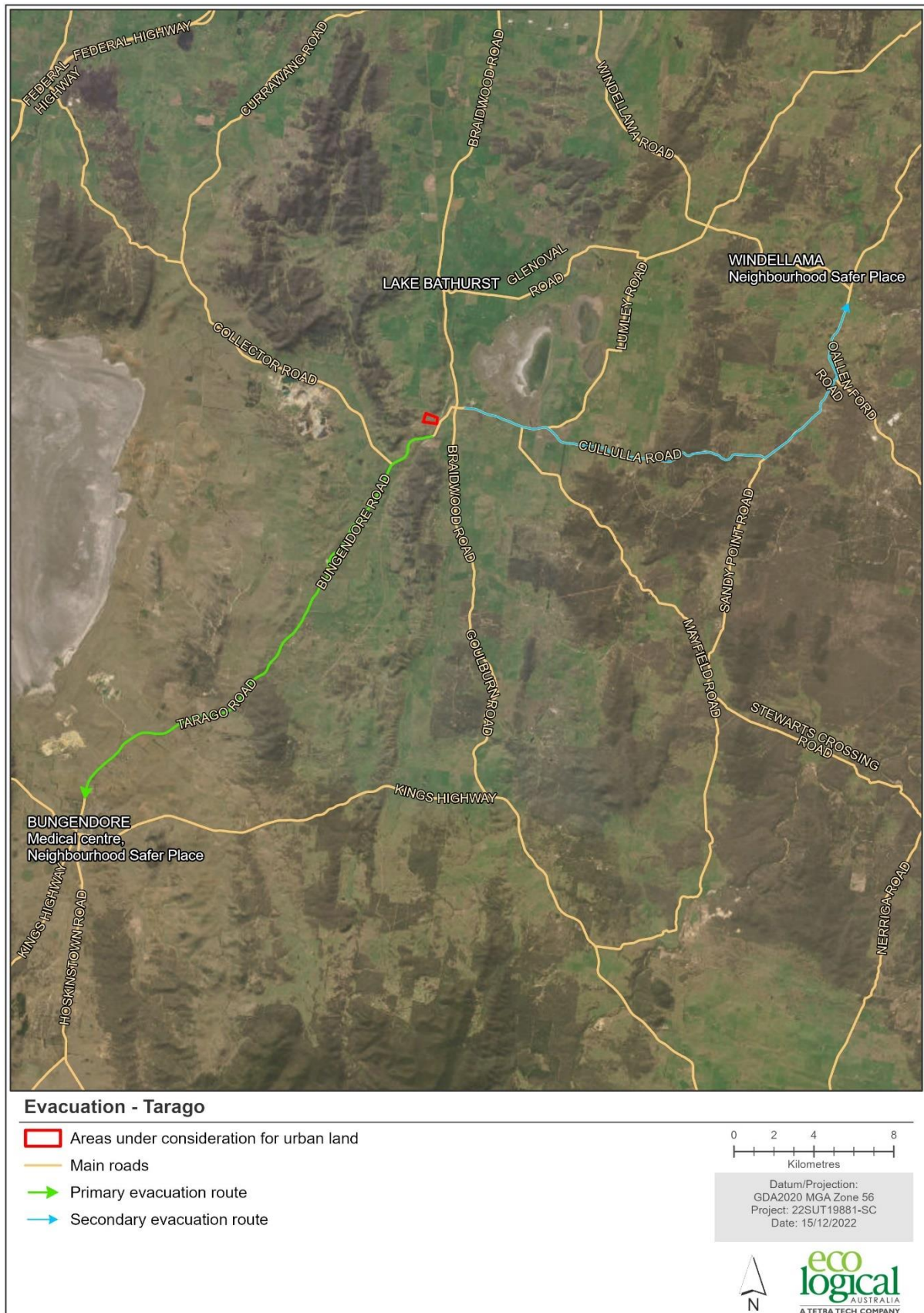


Figure 34: Evacuation routes from Tarago

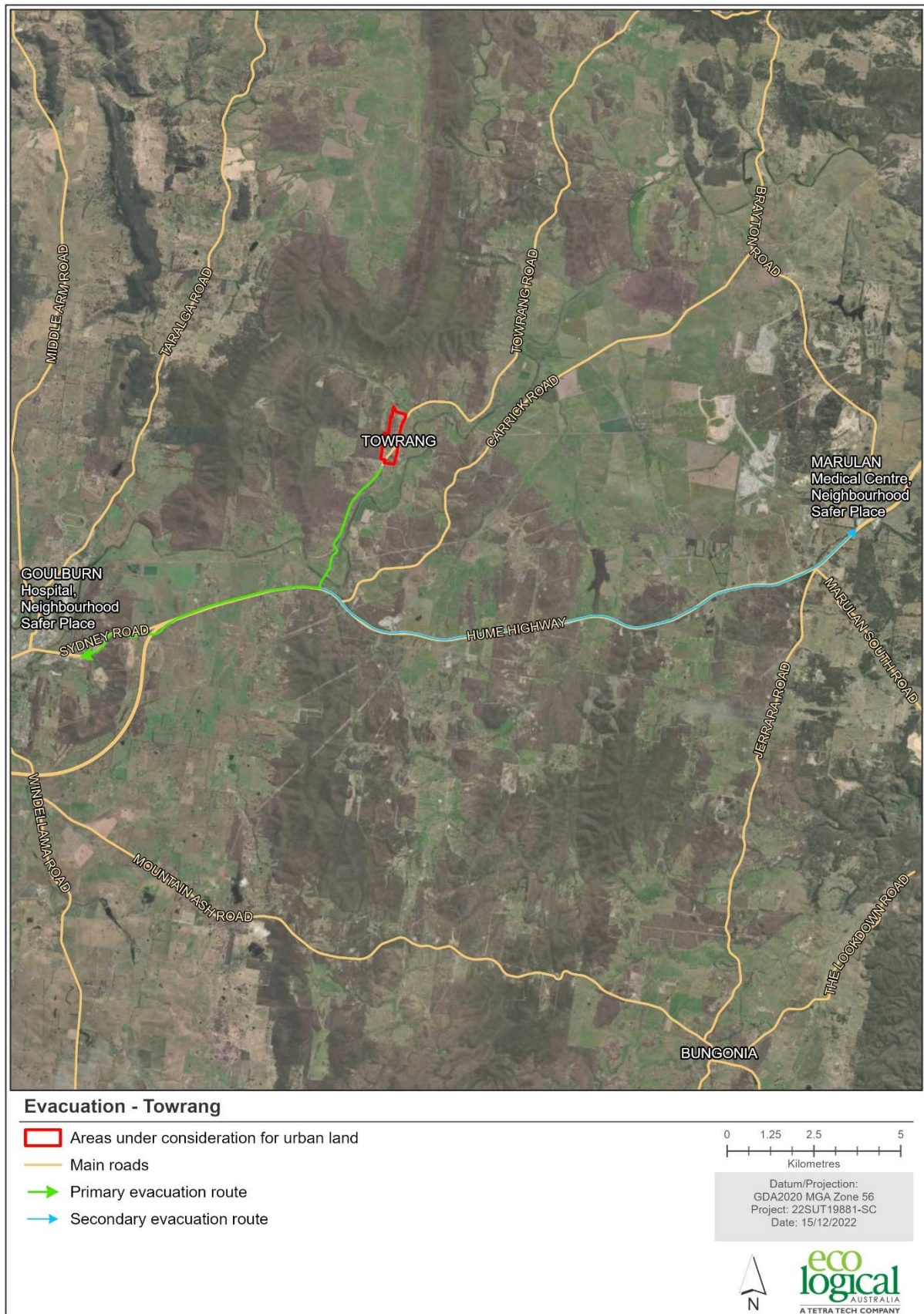


Figure 35: Evacuation routes from Towrang

5.4 Evaluation of Access, Egress and Evacuation

The evaluation of current access, egress and evacuation conditions for each investigation area is outlined in Table 10.

Table 10: Access, Egress and Evacuation Evaluation of each locality

Locality	Access, Egress and Evacuation
Goulburn	<p>Evacuation to Goulburn CBD, with access routes unlikely to be impacted by any significant landscape fire.</p> <p>Consideration to second access point for future development on Gorman Rd recommended.</p> <p>High potential for low-risk development outcomes.</p> <p>Serviced by existing RFS and FRNSW stations.</p>
Marulan	<p>Marulan Western investigation area - Evacuation to Marulan town centre via sealed access (Highland Way) with routes unlikely to be impacted by any significant landscape fire.</p> <p>Marulan Eastern investigation area - Evacuation west to Marulan town and Goulburn, or East to Tallong and Wingello via sealed access (Highland Way). Future planning recommended to consider access connection to the south to provide additional egress options.</p> <p>Existing NSP in Marulan.</p> <p>Consideration to road capacity, at Marulan Rail Bridge.</p> <p>Low risk development outcomes achievable, particularly in Marulan West.</p>
Tallong	<p>Evacuation west to Marulan (NSP) and Goulburn, or East to Wingello (NSP).</p> <p>Future planning recommended to consider connection to south for added resilience.</p> <p>There is currently no NSP in Tallong, however access to NSP in Marulan and Wingello. There is a potential for Tallong Public School to provide refuge in liaison with BFMC if rezoning is proposed.</p>
Towrang	<p>Evacuation route southwest to Goulburn or south east to Marulan, via sealed roads. Both options require travel south, however evacuation north along Towrang Rd to Wollondale possible if south option not available.</p> <p>No NSP in Towrang, however access to Marulan NSP or Goulburn CBD readily available.</p>
Bungonia	<p>Direct egress to Bungonia village.</p> <p>Multiple routes for offsite evacuation including north to Marulan (NSP), north-west to Goulburn CBD, South to Windellama (NSP), south-east to Tarago.</p> <p>Recommendation for future planning to consider road capacity and infrastructure of evacuation routes.</p> <p>Recommended exploration of potential NSP in liaison with BFMC in Bungonia Village for added resilience.</p>
Tarago	<p>Multiple evacuation routes - primary options include north to Lake Bathurst and Goulburn CBD and south-west to Bungendore.</p> <p>Onsite NSP.</p>
Lake Bathurst	<p>No onsite NSP, however offsite evacuation options including north to Goulburn CBD and south to Tarago NSP.</p>

6. Infrastructure and Adjoining Land

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.

6.1 Water

To comply with PBP, future development should ideally 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. Where future development is not supplied by reticulated water, a static water supply for firefighting purposes is required on site for each occupied building in accordance with the capacities outlined in PBP.

It is understood that as per Council’s DCP (Chapter 3.18), any lots equal to or less than 2000m² must be serviced by reticulated water and therefore all lots to be rezoned around Goulburn and Marulan (excluding those proposed as rural residential lots with 2ha+ minimum lot sizes) will be serviced with town water.

It is understood that the village investigation areas are not serviced by reticulated water systems and provision of reticulated water to these areas is also not planned. Therefore, the level of increased residential densities contemplated should be at a level that can be supported by the static water supply afforded, and this supply should be adequate for both general residential uses and firefighting, as detailed in PBP. Generally, the static water supply requirements for large lot residential is not considered to be a limiting constraint with dam supply or water tank supply viable options acceptable under PBP.

Whilst static water supply can be delivered centrally for low density and rural residential subdivision as per PBP, it is recommended that the provision of a reticulated system for high yield subdivisions (i.e. where 700m² residential lots or lower, medium density residential such as multi dwelling housing or residential flat buildings are proposed) and urban release areas should be prioritised. This may require broader infrastructure consideration from Council and technical input.

6.2 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 are detailed in PBP. The acceptable solution requirements for these services are expected to be achievable for future development within the investigation areas.

6.3 Telecommunications

While not a requirement addressed in PBP, it is recommended that communication infrastructure is reviewed and mechanisms to support communication facilities are in place, particularly for proposed low density residential subdivision and contemplated urban release areas.

6.4 Adjoining Land

For any future development within areas contemplated for residential settlement, adherence to PBP is required, and should not require changes to existing bushfire management practices on adjoining land, this includes the provision of APZ's wholly within the Subject Land or provided by public roads. Based on this requirement, there are no concerns regarding the impact of the proposal on adjoining land.

7. Evaluation

This section evaluates the residential settlement growth areas 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 respond 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, and is summarised in Table 2. 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 proposal against the strategic requirements is provided in Table 11.

Table 11: Evaluation of proposal against strategic planning requirements of PBP

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
Goulburn	Low density residential, Large lot residential - approx 7500 dwellings	See below	See below	
Run-O Waters	Low density residential and Large lot residential. Includes existing serviced urban release area	Facilitated by rezoning RU6 to R2 for the urban release area and R5 for large lot residential	<p>Risk: Moderated risk profile by existing residential land to south and mixed managed rural lands to North and West, resulting in limited woody vegetation to carry fires of elevated intensity toward the investigation area.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress: Not considered a constraint to future urban development, with capacity for perimeter roads with subdivision and egress to Goulburn CBD</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water not considered a constraint residential development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection.</p>	<p>Low density residential and large lot residential development not considered to trigger the 'inappropriate development' considerations as per the strategic planning principles of PBP.</p> <p>Staging of low-density residential development via an urban release area with DCP controls to be considered, as recommended in the strategy.</p>
Middle Arm West	Low density residential on existing urban fringe	Primarily facilitated by rezoning from RU6 to R2	<p>Risk: Moderated risk profile by existing residential land to south and mixed managed rural lands to North and West, resulting in limited woody vegetation to carry fires of elevated intensity toward the investigation area.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress: Not considered a constraint with capacity for perimeter roads with subdivision and egress to Goulburn.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to low density residential development.</p>	<p>Low density residential not considered to trigger the 'inappropriate development' considerations as per the strategic planning principles of PBP.</p> <p>Staging of low-density residential development via an urban release area with DCP controls to be considered, as recommended in the strategy</p>

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
			Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection.	
Middle Arm URA	Low density residential – Includes existing serviced urban release area	n/a		
Middle Arm East	Low density residential on existing urban fringe	Primarily facilitated by rezoning from RU6 to R2	<p>Risk: Moderated risk profile by existing residential land to south and mixed managed rural lands to North and West, resulting in limited woody vegetation to carry fires of elevated intensity toward the investigation area.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress: Not considered a constraint with capacity for perimeter roads with subdivision and egress to Goulburn.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to low density residential development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection.</p>	Low density residential not considered to trigger the ‘inappropriate development’ considerations as per the strategic planning principles of PBP. Staging of low-density residential development via an urban release area with DCP controls to be considered, as recommended in the strategy
Bradfordville	Low density residential development	Infill development	Permissible development under existing zoning and generally not BFPL	Low density residential not considered to trigger the ‘inappropriate development’ considerations as per the strategic planning principles of PBP.
Kenmore	Low density residential on existing urban fringe	Primarily facilitated by rezoning from SP2 to R2	Risk: Wooded vegetation on sloped land is present to the north west of the area, however moderation of this fire pathway by	Low density residential development via an urban release area with DCP

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
			<p>suitable bushfire protection measures is not considered unachievable.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress/Emergency Services: Not considered a constraint with capacity for perimeter roads with subdivision and egress to Goulburn.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to low density residential development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection.</p>	<p>controls to be considered, as recommended in the strategy.</p> <p>Extent of URA should be guided by further analysis to determine the best suited location within the investigation area for residential development</p>
Gorman Rd	Large lot residential	Facilitated by rezoning of RU6 to R5 with minimum lot size 2 ha	<p>Risk: Fragmented wooded vegetation within and adjoining the investigation area, somewhat moderated by existing rural development to west, and east. The area has not been subject to large bushfires as indicated by the fire history and further moderation of the hazard is not considered unachievable.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible within MLS 2 ha lots, however vegetation removal may be required.</p> <p>Access/Egress: Gorman Road is via a central spine road, which in some sections is adjacent to hazard. To the north, Gorman Road becomes a private access road at the railway crossing.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection.</p>	<p>Large lot residential not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP.</p> <p>Liaison with Southern Tablelands Bushfire Risk Management Committee regarding APZ/SFAZ opportunities to support hazard management and risk moderation.</p> <p>Exploration of opportunity for a refuge opportunity north along Gorman Road.</p>

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
Mt Gray	Large lot residential	Facilitated by rezoning of RU6 to R5 with minimum lot size 2 ha.	<p>Risk: Contemplated uplift area is situated within an area where there is wooded vegetation to the west and east, with the latter heavily fragmented by traversing roads. Hazard is generally situated upslope from investigation area and the area has not been subject to large bushfires as indicated by the fire history and further moderation of the hazard is not considered unachievable.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress: Existing perimeter roads are in place adjacent to both hazards, and egress in more than one direction is feasible, including to Goulburn East and Goulburn CBD.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection.</p>	Large lot residential not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP.
Mountain Ash	Large lot residential	Facilitated by rezoning of RU6 to R5 with minimum lot size >2 ha.	<p>Risk: Generally, within a moderated risk landscape, dominated by a rural landscape. Fragmented woody vegetation to the north is separated by the Hume Highway.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress: Existing road network affording egress in more than one direction, including Goulburn CBD.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection</p>	Large lot residential not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP.

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
Brisbane Grove	Large lot residential (unserved)	Facilitated by rezoning of RU6 to R5 with minimum lot size >2ha (unserved large lots)	<p>Risk: Generally, within a moderated risk landscape, dominated by a rural landscape. Fragmented woody vegetation to the north west is separated by the Hume Highway.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress Existing road network affording egress in more than one direction and access to Goulburn CBD.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection</p>	Large lot residential not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP.
Baw Baw	Future urban expansion once other opportunities exhausted	Facilitated by future rezoning to R2	<p>Risk: Generally, within a moderated risk landscape, dominated by a rural landscape with Lake Sooley providing significant fire mitigation advantage from landscape fires from NW.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress More than one egress option to Goulburn CBD.</p> <p>Infrastructure: Situated within the Goulburn urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land, nor reliant on adjoining land for bushfire protection</p>	Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP.

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
Sooley	Primarily retain as RU6 to prevent fragmentation, R2 low density in the south eastern area adjoining existing residential area	Facilitated by rezoning RU6 to R2 in south east. Future potential changes to RU5 and minimum lot size to facilitate infill large lot development.	<p>Risk: Generally, within a moderated risk landscape, dominated by a rural landscape with sparse woodland.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress to Goulburn CBD expected to occur via new connections to Chinaman's Land and Crookwell Road.</p> <p>Infrastructure: Situated within the urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land.</p>	<p>Low density residential development via an urban release area not considered to trigger the 'inappropriate development' considerations as per the strategic planning principles of PBP.</p> <p>Large lot development as proposed not considered to trigger the 'inappropriate development' considerations as per the strategic planning principles of PBP.</p>
Marulan	Low density residential, approx. 1350 dwellings			
Marulan East	Large lot residential opportunities	Facilitated within existing village by revising minimum lot size to 10ha.	<p>Risk: Generally, within a bushfire landscape, featuring rural land and wooded vegetation to the north and east, moderated by a downhill approach to the north, and separation provided by Highland way.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible.</p> <p>Access/Egress to Marulan CBD (east) and Tallong (west) via Highland Way.</p> <p>Infrastructure: Provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land</p>	<p>Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP.</p>

Locality		Proposal	Mechanism	Summary of Suitability	Evaluation
Marulan and URA	North	Low density residential		Risk: Generally, within a bushfire landscape, featuring rural land and wooded vegetation to the north and west. Hume Highway to the East provides a substantial fire mitigation advantage, as to would future development in Marulan East.	Low density residential development via an urban release area with DCP controls to be considered, as recommended in the strategy. Extent of URA should be guided by further analysis to determine the best suited location within the investigation area for residential development.
			Facilitated by rezoning RU6 to R2 with urban release area considered to guide DCP controls	Land Use: Provision of bushfire protection measures for future development considered feasible. Access/Egress to Marulan CBD (south), with future subdivision to support perimeter roads and provision of multiple route options. Infrastructure: Provision of reticulated water and infrastructure not considered a constraint to development. Adjoining Land: Contemplated development would not increase the risk on adjoining land.	
Tallong		Potential growth within RU6 rural transition	Growth subject to minimum lot size requirements for subdivision under current provisions by amending minimum lot size from 10ha to > 4000m ² .	Risk: Generally, within a bushfire landscape, featuring rural land and remnant vegetation, however the typology of the hazard does not present unachievable bushfire protection requirements Uplift would provide additional resilience to existing public school, and general community resilience. Land Use: Provision of bushfire protection measures for future development considered feasible with vegetation removal likely. Access/Egress to Marulan (west) or Wingello (north east). Exploration of southern access recommended to provide alternate route. Consideration with BFRMC feasibility of the school to provide an NSP. Infrastructure: Provision of static water infrastructure not considered a constraint to development. Adjoining Land: Contemplated development would not increase the risk on adjoining land.	Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP and consideration of the following: 1. Consider capacity of Highland Way is sufficient for level up uplift 2. Feasibility of southern access 3. Recommend exploration of NSP opportunities (e.g. School) with BFRMC.

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
Towrang	Potential growth within RU5 village	Growth subject to minimum lot size requirements for subdivision under current zoning (2 ha).	<p>Risk: Generally, within a bushfire landscape, featuring rural land and wooded vegetation to the west, moderated by a downhill approach and existing rural development.</p> <p>Land Use: Provision of bushfire protection measures for future development not considered unachievable.</p> <p>Access/Egress south east to Goulburn via Towrang Road. Potential for secondary egress option north along Towrang Road to a safer place, subject to recommendation from BFRMC</p> <p>Infrastructure: Provision of static water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land</p>	Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP and recommend exploration of NSP opportunities for egress to the north with BFRMC.
Bungonia	Potential growth within RU6 rural transition	Growth subject to minimum lot size requirements for subdivision under current provisions by amending minimum lot size from 10ha to > 4000m ² .	<p>Risk: Generally, within a bushfire landscape, featuring rural land and fragmented wooded vegetation, with Bungonia State Conservation further east.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible, however vegetation removal likely.</p> <p>Access/Egress to Goulburn CBD (north west) and Marulan (north). Consideration with BFRMC provision of NSP within the village.</p> <p>Infrastructure: Provision of static water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land</p>	Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP and: <ol style="list-style-type: none"> 1. exploration of road capacities to ensure egress is feasible with the level of uplift 2. Recommend exploration of NSP opportunities with BFRMC.

Locality	Proposal	Mechanism	Summary of Suitability	Evaluation
Lake Bathurst	Potential growth within RU5 village	Growth subject to minimum lot size requirements for subdivision under current zoning (1500 m ²).	<p>Risk: Generally, within a largely moderated bushfire landscape, featuring rural land.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible,</p> <p>Access/Egress via Braidwood Rd North to Goulburn CBD and South to Tarago which is also supported by a NSP.</p> <p>Infrastructure: Provision of static water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land</p>	Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP
Tarago	Area 1 – currently RU2 rural landscape	Facilitated by rezoning RU6 to RU5, with consideration of minimum lot sizes ranging from 2000 - 4000m ² ."	<p>Risk: Generally, within a largely moderated bushfire landscape, featuring rural land.</p> <p>Land Use: Provision of bushfire protection measures for future development considered feasible,</p> <p>Access/Egress via Braidwood Road North to Bungendore, however Tarago is also supported by an NSP.</p> <p>Infrastructure: Provision of reticulated water and infrastructure not considered a constraint to development.</p> <p>Adjoining Land: Contemplated development would not increase the risk on adjoining land</p>	Large lot residential development not considered to trigger the 'inappropriate development' considerations subject to infill development meeting the requirements of PBP

8. Conclusion

In evaluating the areas contemplated for residential settlement growth against the bushfire strategic planning requirements of PBP, this assessment is based on our understanding of the growth contemplated and current hazards influencing the locations. The evaluation considers the merits for future residential development and potential for consistency with the strategic planning principles of PBP, with consideration to the following aspects:

- Future development will not pose or be subjected to an unacceptable risk; or provide for 'inappropriate development' outcomes;
- Adequate bushfire protection measures can be provided to reduce the residual risk to an appropriate level; and
- Future development will not adversely affect existing development or adjoining landowners and their ability to undertake bushfire management.

Based on the outcomes of this assessment, it is considered that the increased residential densities proposed in each area to facilitate future residential settlement growth have the potential to comply with the strategic bushfire planning requirements of Chapter 4 of PBP, subject to the following recommendations:

- The proposed level of increased residential densities for all areas, but in particularly Tallong, Towrang and Bungonia should be supported by a traffic study demonstrating evacuation capacities that can support increased residential densities, and confirmation of emergency management adequacy by relevant agencies.
- Further consideration to the capacity of evacuation routes and confirmation that identified routes can support increased residential densities on bush fire prone land.
- Sealed, two-way access should be the objective for any road upgrades.
- Provision of an additional access connection for Tallong and Marulan East.
- Consideration to second access point for future development on Gorman Rd (Goulburn)
- Consideration to any limitation for access along Highland Way e.g., passing under Marulan Rail Bridge.
- Feasibility for static water supply for fire-fighting requirements in investigation areas, where reticulated water is not provisioned or required under the DCP.
- Discussion with emergency services in regard to further resources required within the district resulting from the potential development.
- Liaison with the Southern Tablelands Bushfire Risk Management Committee regarding the merit of any new NSPs, and further parallel investigations where recommended by the BFRMC for Tallong Public School, Bungonia Village and Towrang for added resilience.

9. References

- Department of Planning, Industry and Environment (DPIE). 2020. NPWS Fire History - Wildfires and Prescribed Burns, accessed via seed.nsw.gov.au
- 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.
- Elton Consulting. (2020). Urban Fringe Housing Strategy. Prepared for Goulburn Mulwaree Council.
- Goulburn Mulwaree Council (2022). Tarago Village Housing Strategy. Adopted 21 June 2022 (Resolution 2022/215).
- Industry Safety Steering Committee 3 (ISSC3). 2016. *ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets*. ISSC3, Sydney.
- 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.
- NSW National Parks and Wildlife (NPWS) Fire History - Wildfires and Prescribed Burns, Department of Planning, Industry and Environment. Accessed from <https://datasets.seed.nsw.gov.au/dataset/fire-history-wildfires-and-prescribed-burns-1e8b6>
- NSW Rural Fire Service (RFS). 2014. *Development Planning Guide to Developing a Bush Fire Emergency Management and Evacuation Plan*. RFS, Sydney.
- NSW Rural Fire Service (RFS). 2015. *Guide for Bush Fire Prone Land Mapping v5b*. RFS, Sydney.
- NSW Rural Fire Service (RFS). 2016. *NSW RFS Fire Trail Standards, Version 1.1*. RFS, Sydney.
- NSW Rural Fire Service (RFS). 2017. *Neighbourhood Safer Places – Guidelines for the identification and inspection of neighbourhood safer places in NSW*. RFS, Sydney.
- NSW Rural Fire Service (RFS). 2019. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, and Developers*. RFS, Sydney.
- Parsons Brinckerhoff (2006). Goulburn Mulwaree Strategy. Prepared for NSW Department of Planning and Goulburn Mulwaree Council.

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 – 2), AS 3959-2018. SAI Global, Sydney.

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

Southern Tablelands Bush Fire Management Committee (BFMC). 2019 *Southern Tablelands Fire Management Committee Bush Fire Risk Management Plan*. Approved by NSW Bush Fire Coordinating Committee.

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 12: General access requirements (adapted from Table 5.3b of PBP)

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
Firefighting vehicles are provided with safe, all-weather access to structures.	Property access roads are two-wheel drive, all-weather roads;
	Perimeter roads are provided for residential subdivisions of three or more allotments;
	Subdivisions of three or more allotments have more than one access in and out of the development;
	Traffic management devices are constructed to not prohibit access by emergency services vehicles;
	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;
	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;
	Where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road;
The capacity of access roads is adequate for firefighting vehicles.	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;
	One way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.
There is appropriate access to water supply.	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.
	Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression;
	Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2017 – Fire hydrant installations system design, installation and commissioning; and
	There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.

Table 13: Perimeter Road requirements (adapted from 5.3b of PBP).

Performance Criteria	Acceptable Solutions
Access roads are designed to allow safe access and egress for 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>Are two-way sealed roads;</p> <p>Minimum 8 m carriageway width kerb to kerb;</p> <p>Parking provided outside of the carriageway width;</p> <p>Hydrants are located clear of parking areas;</p> <p>There are through roads, and these are linked to the internal road system at an interval of no greater than 500 m;</p> <p>Curves of roads have a minimum inner radius of 6 m;</p> <p>The maximum grade road is 15 degrees and average grade is 10 degrees;</p> <p>The road crossfall does not exceed 3 degrees;</p> <p>A minimum vertical clearance of 4 m to any overhanging obstructions, including tree branches, is provided.</p>

Table 14: Non-perimeter road requirements (adapted from Table 5.3b of PBP)

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	<p>Minimum 5.5 m width kerb to kerb;</p> <p>Parking is provided outside of the carriageway width;</p> <p>Hydrants are located clear of parking areas;</p> <p>Roads are through roads, and these are linked to the internal road system at an interval of no greater than 500 m;</p> <p>Curves of roads have a minimum inner radius of 6 m</p> <p>The road crossfall does not exceed 3 degrees;</p> <p>A minimum vertical clearance of 4 m to any overhanging obstructions, including tree branches, is provided.</p>

Table 15: Property access requirements (adapted from Table 5.3b of PBP)

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
Firefighting vehicles can access the dwelling and exit the property safely.	There are no specific access requirements in an urban area where an unobstructed path (no greater than 70 m) is provided 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 70 kph) that supports the operational use of emergency firefighting vehicles. In circumstances where this cannot occur, the following requirements apply:
	Minimum 4 m carriageway width;
	In forest, woodland and heath situations, rural property access roads have passing bays every 200 m that are 20 m long by 2 m wide, making a minimum trafficable width of 6 m at the passing bay;
	A minimum vertical clearance of 4 m to any overhanging obstructions, including tree branches;
	Provide a suitable turning area in accordance with Appendix 3;
	Curves have a minimum inner radius of 6 m and are minimal in number to allow for rapid access and egress;
	The minimum distance between inner and outer curves is 6 m;
	The crossfall is not more than 10 degrees;
	Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads;
	A development comprising more than three dwellings has access by dedication of a road and not by right of way.
	Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5 m), extend for no more than 30 m 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.

Appendix B – Neighbourhood Safer Place Criteria

Table 16: 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 ² ; 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 ² ; 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 17: 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.

Appendix C – Asset Protection Zone Specifications

Table 18: APZ requirements and compliance (adapted from Table 5.3a of PBP)

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
Potential building footprints will not be exposed to radiant heat levels exceeding 29 kW/m ² on each proposed lot.	APZs are provided in accordance with Tables A1.12.2 and A1.12.3 based on the FDI.
APZs are managed and maintained to prevent the spread of a fire towards the building.	APZs are managed in accordance with the requirements of Appendix 4 of PBP.
The APZ is provided in perpetuity.	APZs are wholly within the boundaries of the development site.
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	APZs are located on lands with a slope less than 18 degrees.

Table 19: Landscaping requirements and compliance (adopted from Table 5.3a of PBP)

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
Landscaping is managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.	Landscaping is in accordance with Appendix 4 of PBP; and Fencing is constructed in accordance with Section 7.6 of PBP.

Appendix E – Services Requirements

Table 20: Water supply requirements (adapted from Table 5.3c of PBP)

Performance Criteria	Acceptable Solution
Adequate water supplies is provided for firefighting purposes.	Reticulated water is to be provided to the development where available; A static water supply and hydrant supply is provided for non-reticulated developments or where reticulated water supply cannot be guaranteed; and Static water supplies shall comply with Table 5.3d of PBP.
Water supplies are located at regular intervals; and The water supply is accessible and reliable for firefighting operations.	Fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1 (SA 2005); Hydrants are not located within any road carriageway; and 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 the relevant clauses of AS 2419.1 (SA 2005).
The integrity of the water supply is maintained.	All above-ground water service pipes are metal, including and up to any taps; and Above-ground water storage tanks shall be of concrete or metal.

Table 21: Assessment of requirements for the supply of Electricity services (adapted from Table 5.3c of PBP)

Performance Criteria	Acceptable Solution
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 (30 m), unless crossing gullies, gorges or riparian areas; and No part of a tree is closer to a power line than the distance set out in ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets (ISSC3 2016).

Table 22: Assessment of requirements for the supply of gas services (adapted from Table 5.3c of PBP)

Performance Criteria	Acceptable Solution
Location and design of gas services will not lead to ignition of surrounding	Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 – The Storage and handling of LP gas, the requirements of relevant authorities, and metal piping is used;

Performance Criteria	Acceptable Solution
bushland or the fabric of buildings.	<p>All fixed gas cylinders are kept clear of all flammable materials to a distance of 10 m and shielded on the hazard side;</p> <p>Connections to and from gas cylinders are metal;</p> <p>Polymer-sheathed flexible gas supply lines are not used; and</p> <p>Above-ground gas service pipes are metal, including and up to any outlets.</p>

