



C12176.1 - River Pump
 Option 1

Compiled by FL Project No. _____
 Date 20/04/15 Sheet No. 1

$$\text{Storage} = 380 \text{ kL}$$

$$\text{pump hrs} = 22 \text{ hr/day}$$

$$\therefore \text{Flow} = \frac{380000}{22 \times 3600} = 4.8 \text{ L/s} \approx 5 \text{ L/s}$$

$$\text{Intake RL} = 569 \text{ m}$$

$$\text{Tank RL} = 614 \text{ m}$$

$$\therefore \Delta H = 45 \text{ m}$$

$$\text{Rising Main} = \phi 100 \quad K = 0.3 \text{ mm (incl. fittings)}$$

$$\text{Length} = 560 \text{ m}$$

$$\text{Hydraulic gradient} = 0.6 \%$$

$$\therefore \Delta H_{\text{pipe}} = \frac{0.6}{100} \times 560 = 3.36 \text{ m}$$

$$\therefore \text{Total } \Delta H = 3.36 + 45 \text{ m} = 48.36 \text{ m} \approx 49 \text{ m}$$



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Option 2

Compiled by KL Project No. C12176.1
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Storage = 32 KL (Blue Steel Tank 37,574)

pump hrs = 22 hrs / day

$$\therefore \text{Flow} = \frac{37574}{22 \times 3600} = 0.5 \text{ L/s} = 8 \text{ L/s gpm}$$

Intake RL = 569 m

Tank RL = 614 m

$\therefore \Delta H = 45 \text{ m}$

Rising Main = $\phi 40$

Length = 610 m

hydraulic gradient = $\frac{0.9}{100}$

$$\therefore \text{H.L. pipe} = \frac{0.9}{100} \times 610 = 5.5 \text{ m}$$

$$\therefore \text{Total } \Delta H = 5.5 + 45 \text{ m} = 50.5 \text{ m} = 166 \text{ ft}$$



Option 3

Compiled by FL Project No. _____

Date 20/04/15 Sheet No. 3

$$\text{Storage} = 405 \text{ KL} \quad \text{or } 2 \times 221604 \text{ L (Blue steel)}$$

$$\text{pump hrs} = 22 \text{ hr/day}$$

$$\therefore \text{Flow} = \frac{221604 \times 2}{22 \times 3600} = 5.6 \text{ L/s} = 89 \text{ gpm}$$

$$\text{Intake RL} = 569 \text{ m}$$

$$\text{Tank RL} = 614 \text{ m}$$

$$\therefore \text{AH} = 45 \text{ m}$$

$$\text{Rising Main} = \phi 125$$

$$\text{Length} = 610 \text{ m}$$

$$\text{hydraulic gradient} = 0.25\%$$

$$\therefore \text{HL pipe} = \frac{0.25}{100} \times 610 = 1.5 \text{ m}$$

$$\therefore \text{Total AH} = 1.5 + 45 = 46.5 \text{ m} = 153 \text{ ft}$$

Appendix E COST ESTIMATES

Energy Costs Calculation					
Option	Pump kW	Energy / yr (kWh)	Energy Cost \$/kwh	Energy Cost \$/yr	
1	5.5	121	0.2	\$24.20	
2	0.75	6,023	0.2	\$1,204.50	
3	5.5	6,050	0.2	\$1,210.00	
Water Charge Calculation					
Option 1					
Items	Qty	Unit	Rate	Amount	Comment
Water access entitlement	0.38	\$/ML	\$726.20	\$275.96	One off fee
Application fee for a licence to take water	1	\$/licence	\$160.30	\$160.30	One off fee
Total (One off fee)				\$436	One off fee
Annual administration fee for a licence to take water	1	\$/licence	\$415.70	\$415.70	Annual fee
Water abstraction charge	380	\$/kL	\$0.27	\$102.60	Annual fee
Utilities Regulation charge	1	\$/licence	\$1,000	\$1,000.00	Annual fee
Total (annual)				\$1,518	Annual fee
Option 2					
Items	Qty	Unit	Rate	Amount	Comment
Water access entitlement	12	\$/ML	\$726.20	\$8,714.40	One off fee
Application fee for a licence to take water	1	\$/licence	\$160.30	\$160.30	One off fee
Total (One off fee)				\$8,875	One off fee
Annual administration fee for a licence to take water	1	\$/licence	\$415.70	\$415.70	Annual fee
Water abstraction charge	12000	\$/kL	\$0.27	\$3,240.00	Annual fee
Utilities Regulation charge	1	\$/licence	\$1,000	\$1,000.00	Annual fee
Total (annual)				\$4,656	Annual fee
Option 3					
Items	Qty	Unit	Rate	Amount	Comment
Water access entitlement	12.38	\$/ML	\$726.20	\$8,990.36	One off fee
Application fee for a licence to take water	1	\$/licence	\$160.30	\$160.30	One off fee
Total (One off fee)				\$9,151	One off fee
Annual administration fee for a licence to take water	1	\$/licence	\$415.70	\$415.70	Annual fee
Water abstraction charge	12380	\$/kL	\$0.27	\$3,342.60	Annual fee
Utilities Regulation charge	1	\$/licence	\$1,000	\$1,000.00	Annual fee
Total (annual)				\$4,758	Annual fee



BUSHFIRE RISK ASSESSMENT

FOR THE

VILLAGE OF THARWA

AUSTRALIAN CAPITAL

TERRITORY

Australian Bushfire Protection Planners Pty Limited.

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BUSHFIRE RISK ASSESSMENT

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AUSTRALIAN CAPITAL

TERRITORY

Assessment Number	Document	Preparation Date	Issue Date	Directors Approval
B131971	Final	12.6.2013	18.6.2013	<i>G.L.Swain</i>

EXECUTIVE SUMMARY

Australian Bushfire Protection Planners Pty Ltd (ABPP) has been engaged by Brown Consulting [ACT] Pty Ltd, on behalf of the Environment and Sustainable Development Directorate [ESDD], to undertake a study into the bushfire risk to the existing development within the Tharwa Village in the Australian Capital Territory [ACT].

The purpose of the study is to identify the existing bushfire protection measures which are in place, including the provision of Asset Protection Zones, access and water supplies for fire-fighting operations and determine the adequacy of these measures and then provide recommendations on measures which should be implemented to address the deficiencies in the protection of the Village against future bushfires.

Section 1 of this report outlines the background to the assessment and describes the site and details the site inspection carried out on the 26th January 2013.

Section 2 of the report provides a description of the site and the precinct [study area] it is contained within. It examines the topography as well as the vegetation both within and external to the site. **Section 3** examines the context of bushfire risk within the ACT.

Section 4 looks at the two elements of risk – *likelihood* which is described as the chances of a bushfire occurring, and *consequence*, the impact of the bushfire when it occurs. It outlines a range of factors influencing bushfire risk and identifies the broad strategies to manage the risk.

An understanding of the parameters examined in the bushfire risk assessment is provided in **Section 5** of the report. This contains background information on the:

- fire history of the area including the bushfire of 2003;
- ignition and fire sources;
- climate and weather;
- wind and fire paths;
- slope;
- bushfire fuels;
- assessment of the fuel hazard;
- likelihood of each fire scenario;
- description of the Asset Interface Classification;
- risk statement; and
- summary of the bushfire risk to the existing Village.

The summary of the bushfire risk describes the level of risk to the existing Village from severe/catastrophic bushfires approaching from the northwest, west and southwest, being the predominant fire paths likely to impact on the Village.

Section 6 provides recommendations on the measures required to be introduced to improve the safety of the Village against the risk of bushfire. These measures include:

- The creation and management of formal Asset Protection Zones to the Village, including arrangements with the adjoining Lessees / Government Departments on the provision and maintenance of the Outer Asset Protection Zones;
- Access provisions for fire-fighting operations including the establishment of 'perimeter' fire access trails to the northwest and south west of the Village;
- An upgrade of the existing fire-fighting water supply;
- Construction standards for new buildings and for modifications to existing buildings; and
- Evacuation planning.

Section 7 reviews the residual risk to the Village, following implementation of the recommended bushfire protection measures.

The conclusion to the study is outlined in **Section 8** of the report and identifies that Tharwa is an isolated rural village which was exposed to catastrophic bushfire events in the 2003 Canberra Bushfires. The study has identified that the existing water supply available for bushfire and structural [asset] fire-fighting is inadequate and that the Strategic Bushfire Management Plans' reliance on the hazard and risk being mitigated through land management practices [grazing] on adjacent leased and Government lands does not address the level of risk to the Village and its occupants.

Best practice bushfire protection measures are required to be implemented to achieve improved protection of the Village similar to that provided to the Uriarra Village.

This requires an urgent upgrade of the fire-fighting water supply to the Village and implementation and ongoing maintenance of fire protection zones and access trails on adjoining land to the extent as recommended in this report. It is also important that the residents of the Village understand the need to maintain low fuel loads within the Village and provide improved protection against ember attack.

Whilst it is recognised that these measures will not reduce the level of risk significantly, due to the historical nature of bushfire risk in the local area, they will improve the protection of the Village against future wildfire events.



Graham Swain,
Managing Director

Australian Bushfire Protection Planners Pty Limited.

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SECTION 1

INTRODUCTION

1.1 Background.

Brown Consulting [ACT] Pty Ltd has been engaged by ESDD to undertake the Tharwa Infrastructure Capacity Study.

The study area is situated between Nass Road to the southwest and the existing development within the north-western portion of the Village, the Murrumbidgee River to the northeast, with abuttal to the existing rural blocks on the north-western and south-eastern boundary and contains approximately 170 hectares and has been divided into five sites for the study. Figure 1 on Page 8 shows the details of the Tharwa Infrastructure Capacity Study area and the five sites being studied.

The Tharwa Infrastructure Capacity project involves:

- Phase 1 – Document the existing infrastructure and associated capacities in the Tharwa study area including carrying out a SWOT analysis; and
- Phase 2 – Examine options for upgrading the infrastructure to facilitate the **three** master plan scenarios prepared by ESDD.

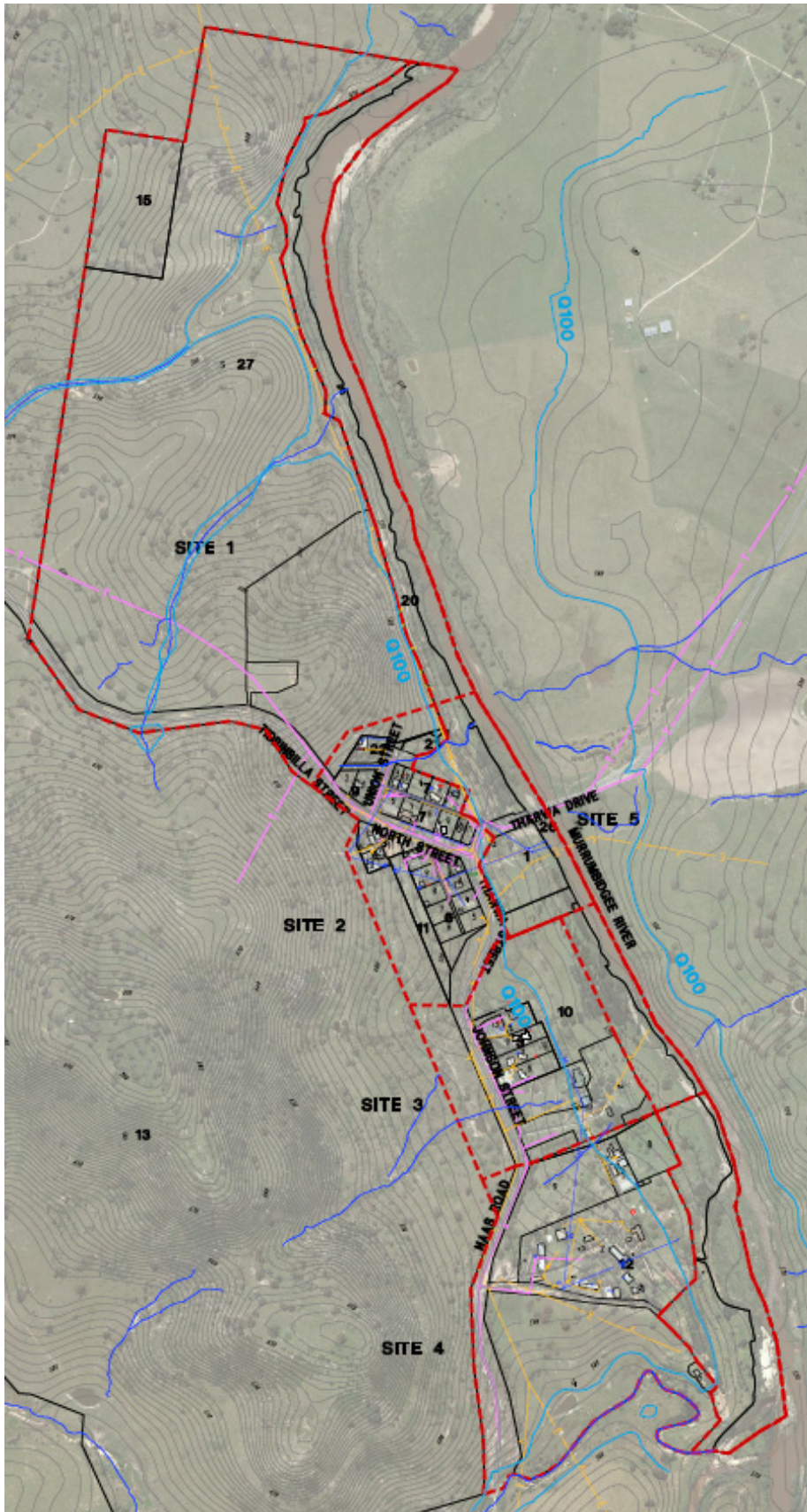
The three master plans (established by ESDD) include:

- A. No change to current land use zones and controls with minimal population variation;
- B. Some changes to current land use zones and controls with moderate growth in population; and
- C. Some changes to current land use zones and controls with significant population growth.

Scenario A considers the infrastructure upgrades required to meet the needs of the same population in current locations to sufficient ACT community standards.

Scenario B will consider some growth in the study area in addition to meeting the requirements of Scenario A. This growth will include some minor development in Tharwa Village, expansion of Outward Bound, and the addition of short stay tourist accommodation in Section 4 of the study area. Scenario C will introduce a ‘Uriarra Village’ style residential development in Section 1 of the study area in addition to meeting the requirements of scenarios A and B.

Figure 1 – Tharwa Infrastructure Capacity Study Area.



1.2 Objective of the Study.

The objective of the study is to:

- Identify the level of risk to the Tharwa Village in accordance with best practice bushfire risk management, the requirements of *'Planning for Bushfire Risk Mitigation 2009 ACT'*, any relevant Australian Standards, the Emergency Services Agency's *'Strategic Bushfire Management Plan 2009'* and any recommendations of the Emergency Services Agency [ESA].
- Identify how levels of bushfire risk to the Village can be mitigated.

This report will assess the potential bushfire risk and identify those protection measures required to mitigate that risk. This will include specific recommendations on the provision of Asset Protection Zones, access and water supplies for fire-fighting operations and any other measures deemed to be necessary to protect the Village.

1.3 Bushfire Risk Study Area.

The bushfire risk to the Tharwa Village has been assessed by examining the hazard on the land surrounding the Village including Blocks 1, 2, 4 & 5 in Section 7 to the northwest; the leased grazing land [Block 8 in Section 13] to the west and southwest and the Nature Reserve to the south of the existing Village precinct.

The leased land to the east of the Murrumbidgee River corridor is included in the bushfire risk study area in order to examine the potential risk to the eastern aspect of the Village precinct – Figure 1 – Tharwa Infrastructure Capacity Study Area on Page 7 also represents the extent of the bushfire risk study area for the existing Tharwa Village precinct.

1.4 Site Inspection.

A detailed site inspection was undertaken by Graham Swain of *Australian Bushfire Protection Planners Pty Limited* on the 26.1.2013.

The inspection identified physical features and vegetation communities within the study area; existing land management activities; exposure to severe fire weather and potential fire paths.

1.5 Meeting with [REDACTED]

Mr Swain, Managing Director of Australian Bushfire Protection Planner Pty Limited met with [REDACTED] on the 4th May 2013. This meeting confirmed the extent of the existing water supply, its status in respect to the life span of the system, supply from the river and current/future ownership.

1.6 Meeting with ESA/TAMS.

Mr Swain also met with Mr Nick Lhuede from ESA and Dillon Kendal from TAMS on the 2nd May 2013. This meeting discussed the matters of water supply for fire-fighting operations, existing management of the bushfire risk to the Village, including the provision of hazard reduction measures on the leased land to the southwest and the TAMS management of the reserve lands to the northwest of the Village and within the Murrumbidgee River corridor.

1.7 Scope of Work.

Australian Bushfire Protection Planners Pty Limited has been commissioned to undertake a bushfire risk assessment which relates to Scenario A – i.e. the potential bushfire risk to the existing Tharwa Village and the measures required to address the identified risk.

A separate report will examine the bushfire risk and bushfire protection measures required to address the risk to Scenario B and Scenario C.

The following is an outline of the scope of work undertaken in the assessment of bushfire risk to the Tharwa Village:

- Identify and describe the study area environment;
- Establish the context of the bushfire risk to the Village;
- Identify measures that might assist to reduce bushfire risk to the Village;
- Describe the implementation of the bushfire protection measures having regard to known site constraints.

The assessment is to be undertaken with reference to the following methodology:

(a) Identify the fire scenarios including an assessment of:

- The exposure to possible ignition/fire sources;
- Vegetation type and likely fuel loads and fire hazards arising using the “Overall Fuel Hazard Guide” – Fourth edition (DSE July 2010); and
- The impact of climate and likely fire runs during severe fire danger periods.

(b) Identify and describe the surrounding natural environment and the likelihood of each fire scenario identified (before mitigation):

- The steepness, slope/terrain; and
- Define each level of likelihood stating assumed frequency of event assigned to each level of likelihood.

(c) Identify and describe the consequences of a bushfire (before mitigation):

- Assumed fire impacts / consequence if exposed to fire events; including during severe/catastrophic fire danger periods; and
- Define each level of consequence stating level of impacts.

(d) Risk Mitigation Measures:

❖ ***Provide risk mitigation options following consideration of:***

- The necessary bushfire protection measures in accordance with Australian Standard AS3959-2009 “*Construction of Buildings in Bushfire Prone Areas*” and any addenda or amendments;
- The ACT *Planning for Bushfire Risk Mitigation 2009*; and
- The *Strategic Bushfire Management Plan for the ACT 2009*;

❖ ***Evaluate the mitigation measures with consideration of the following:***

- Protection zone requirements (ember, inner and outer protection zone);
- Building standards;
- Access for Emergency Services Vehicles; and
- Engineering infrastructure including water supply and fire trails.

(e) Evaluate the fire scenarios to establish the residual risk:

- Protection zone requirements (ember, inner and outer protection zone);
- Evaluate the residual risk level following mitigation including the vulnerability of the Village and possible consequences of fire during severe fire danger periods; and
- Rank the fire scenarios in order of risk level.

SECTION 2

DESCRIPTION OF THE VILLAGE & STUDY AREA

2.1 Description of Tharwa Village.

Tharwa Village is located to the southwest of the Canberra suburbs of Gordon and Banks, on the south-western side of the Murrumbidgee River, at the intersection of Tharwa Drive, North Street/Tidbinbilla Road and Tharwa Street/Nass Road – refer to Figure 2 below.

The Village occupies a narrow corridor of land which extends along the south-western side of the river in a south-easterly direction, terminating with the Outward Bound facility located on Blocks 1 & 2 and Block 8 & 9 in Section 12 Tharwa. A single dwelling house on Block 5 extends the existing Village precinct to the southeast of the Outward Bound facility.

Cuppacumbalong Homestead on Block 6 Section 10 adjoins the north-western boundary of the Outward Bound facility with residential development occupying Blocks 6, 7, 9 & 13 in Section 3 adjoining the north-western boundary of Cuppacumbalong Homestead.

Reserve lands within Block 9 Section 10 and within Block 5 Section 1 and along the river corridor [within Block 7] complete the existing landuse between Tharwa Street, Johnson Street/Nass Road and the Murrumbidgee River, southeast from Tharwa Drive.

The north-western portion of the Village contains residential development with an Historic Church on Block 4 Section 6, to the southwest of Tharwa Street; the former Tharwa Public School on Blocks 7 & 8 Section 7 to the northeast of North Street; the Tharwa General Store occupies Block 9 Section 8 with Tennis Courts located on Block 11 Section 8.

Tharwa Community Hall and Public Toilets are located on Block 12 & 14 Section 8 with the Tharwa Rural Fire Station occupying Block 13 Section 8.

Refer to Figure 3 – Block Plan on Page 14. Figure 4 on Page 15 provides an Aerial Photograph of the Tharwa Village.

Figure 2 – Location Plan – Tharwa Village.

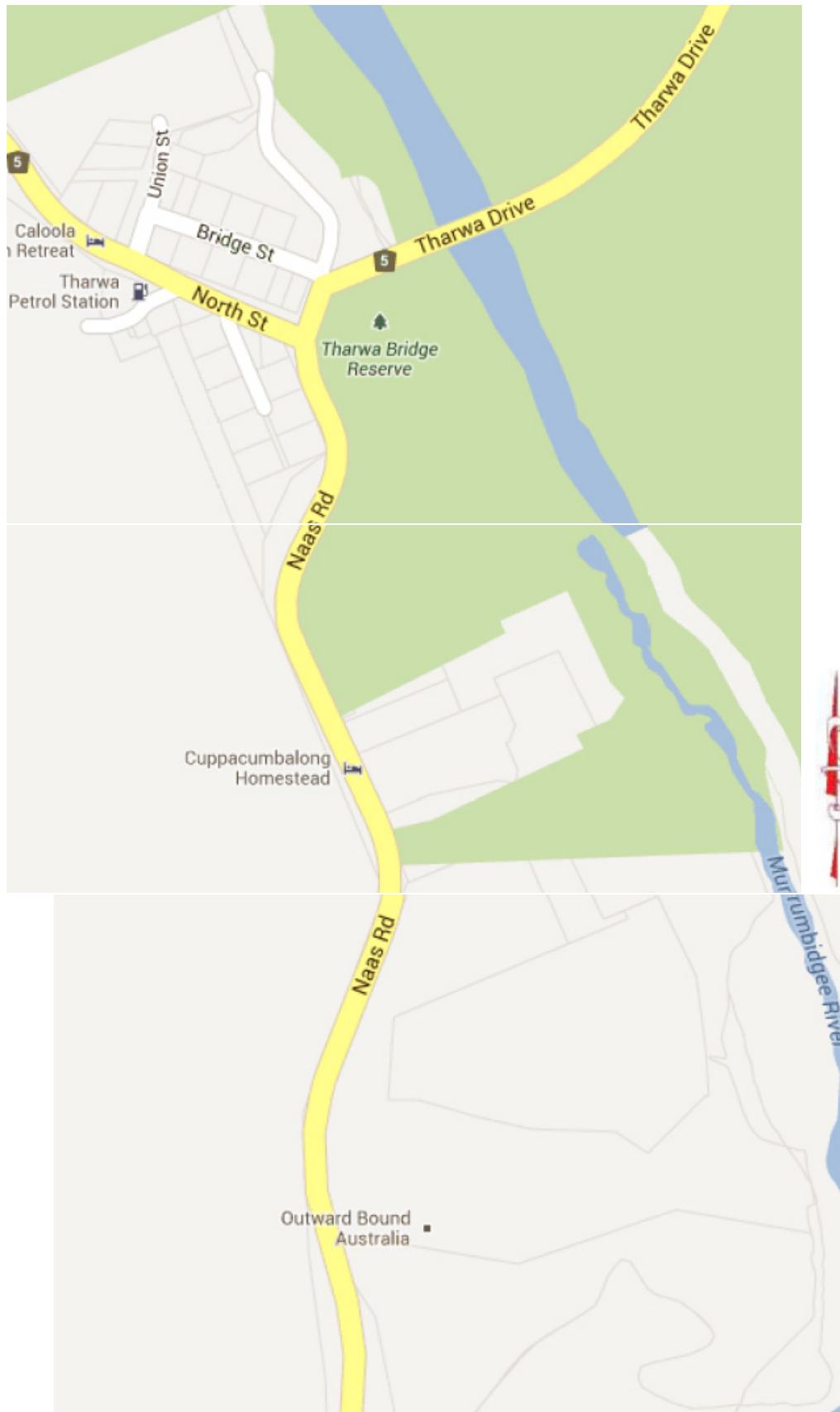


Figure 3 – Tharwa Village Block Plan.

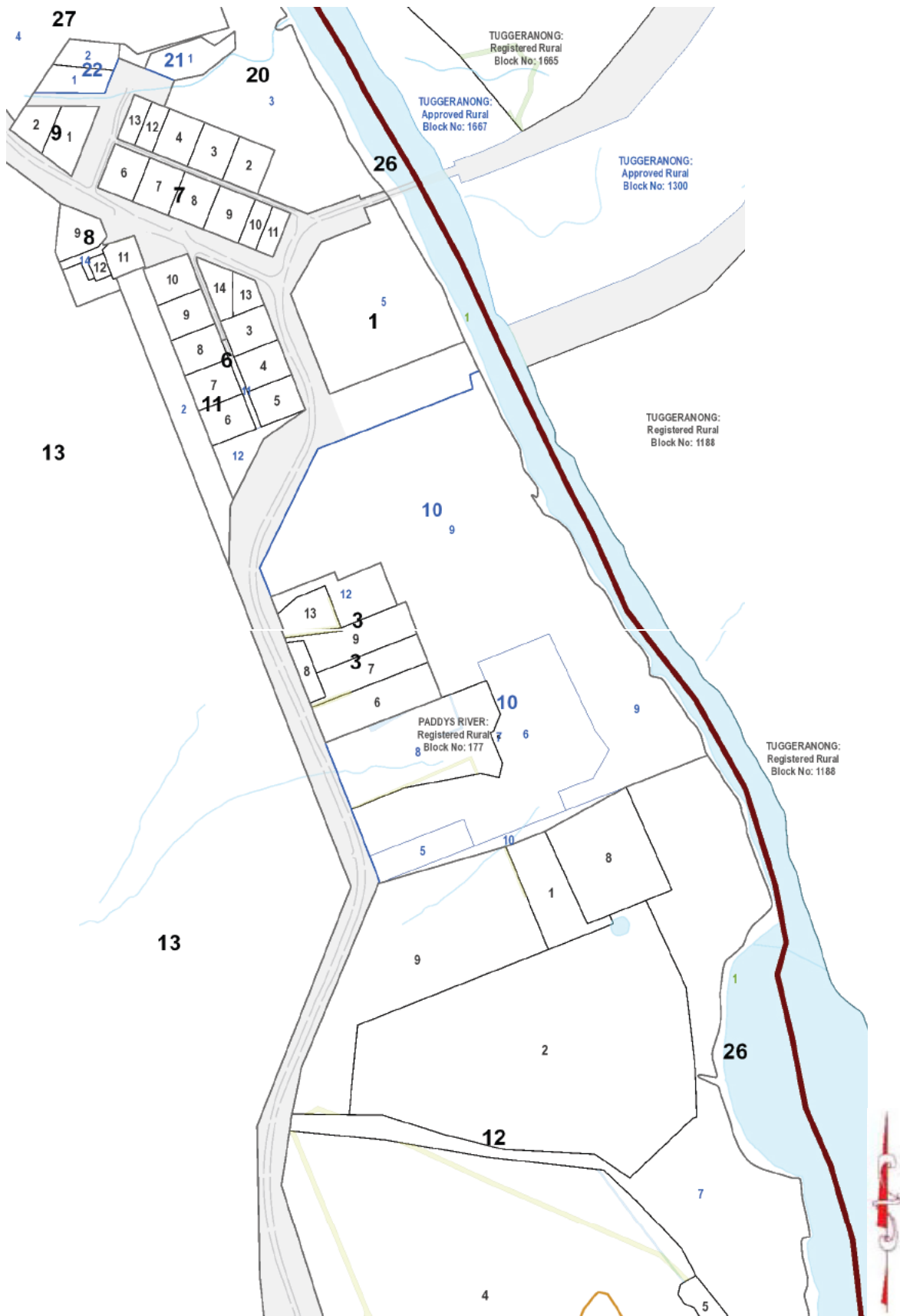


Figure 4 – Aerial Photograph of the Tharwa Village.



2.2 Surrounding Land Use.

The land to the northwest of the Tharwa Village, within Block 4 Section 77 and Block 5 Section 27 is managed by TAMS and is grazed.

The land to the west and southwest of the Village, within Block 8 Section 13 is leased land which is grazed. Further grazing land extends to the south of Spring Station Creek.

The land to the southeast of the Village precinct [the Outward Bound facility] forms part of Block 7 [Nature Reserve] and contains the access road to the cottage on Block 5, located further to the southeast. The land to the southeast of the access road within Block 4 is grazed.

The land to the northeast of the Village, beyond the Murrumbidgee River corridor, forms part of a large agricultural lease holding which is grazed – refer to Figure 4 – Aerial Photograph on Page 15.

2.3 Site Photographs



Photograph No. 1 – Looking to the northwest from the north-western edge of the Tharwa Village precinct showing the access track and vegetation along the south-western side of the Murrumbidgee River.



Photograph No. 2 – Looking west from the previous photographs’ location showing the land and vegetation to the northwest of the Village.



Photograph No. 3 – Looking southwest from the previous photographs’ location showing the unmanaged vegetation within the northern portion of the Village.

Photograph No. 3 – Looking southeast to the dwelling/s on North Street showing the managed river corridor to the northwest of the Tharwa Bridge.





Photograph No. 4 – Looking southeast from Tidbinbilla Road, northwest of the Tharwa Village precinct showing the landform and vegetation on the land to the southwest of the Village precinct.



Photograph No. 5 – Looking to the southeast along the south-western edge of the north-western portion of the Village Precinct showing the land form and vegetation – note the RFS Fire Station is the building on the left.



Photograph No. 6 – Looking to the south along Nass Road showing the land form and vegetation to the southwest of Cuppacumbalong Station and the Outward Bound facility.



Photograph No. 7 – Looking to the east from Tidbinbilla Road showing the landform and vegetation on the land to the northwest of Union Street.



Photograph No. 8 – Looking to the northwest along Clarrie Lane.



Photograph No. 9 – Looking to the northwest showing the managed land within Section 11 at the rear of the blocks on the south-western side of Clarrie Lane.



Photograph No. 10 – Looking to the southwest showing the unmanaged vegetation on the land within Block 8 Section 13, to the west and southwest of the Village.



Photograph No. 11 – Looking to the east from the ridgeline to the southwest of the Village – dwellings are located on Clarrie Lane and Poplar Trees are on the south-western bank of the Murrumbidgee River.



Photograph No. 12 – Looking to the east from the ridgeline to the southwest of the Village – Cuppacumbalong Station is in the centre of the photograph, on the right.



Photograph No. 13 – Looking to the northwest from Smiths Road showing the land to the southeast of the Outward Bound facility – the Cudgenby River is in the foreground.

2.4 Topography.

2.4.1 Within the Tharwa Village.

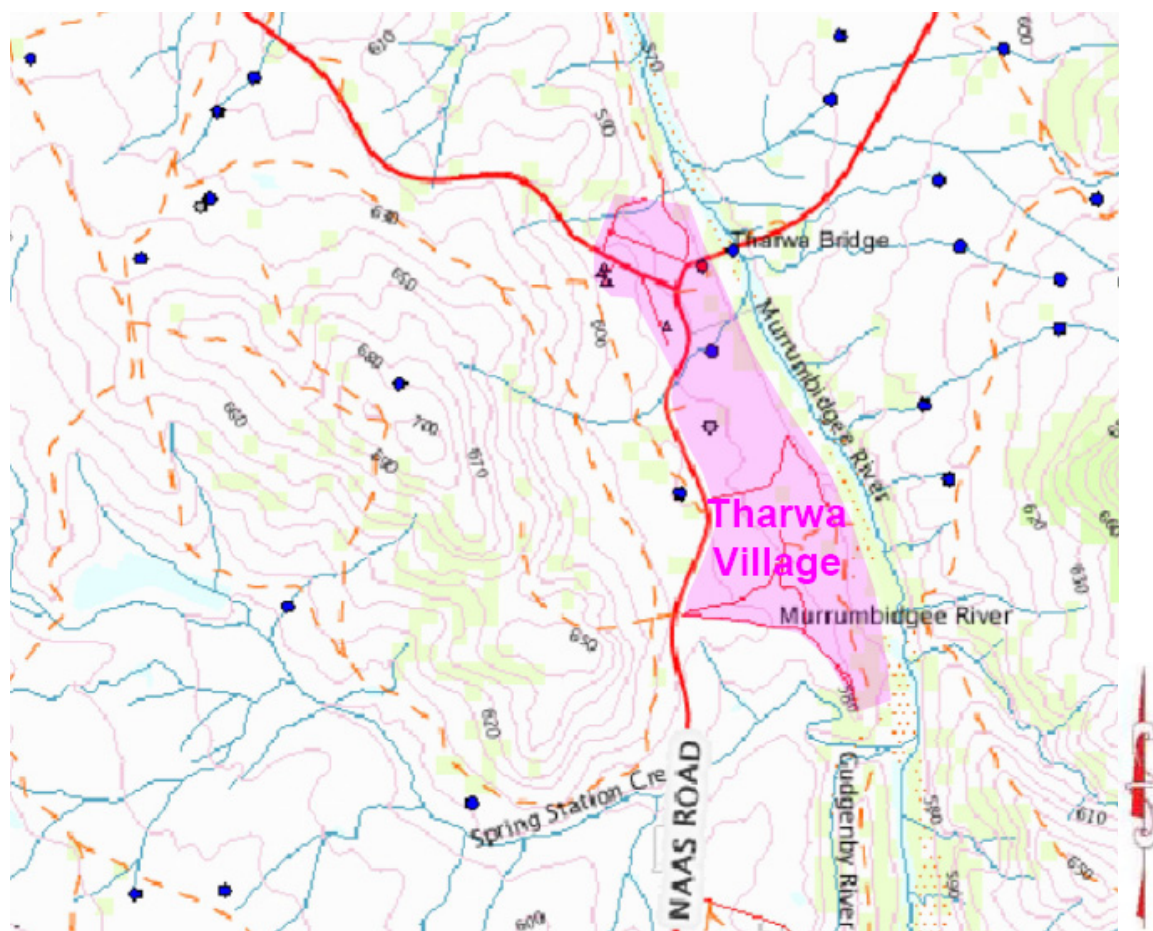
The land within the Tharwa Village is gently undulating with a north-easterly slope towards the Murrumbidgee River corridor.

2.4.2 Beyond the Tharwa Village.

The topography of the land to the northwest, west and southwest of the Village rises to form the low ridgeline which surrounds the Village. Beyond the western and south-western ridgeline the topography is generally undulating, falling to the southwest and west into Spring Station Creek, rising further to the west and southwest to the footslopes of the Brindabella Range.

The land beyond the north-western ridgeline is undulating, falling to the north and northeast towards the Murrumbidgee River corridor. The land to the northeast of the Murrumbidgee River corridor rises to the east to form the ridgeline system which extends along the north-eastern side of the river corridor – refer to Figure 5 – Topographic Map on Page 26.

Figure 5 – Extract from the 1:25,000 Topographic Map.



Contour Intervals 10m

2.5 Vegetation within the Tharwa Village Precinct.

The vegetation on the developed land within the Tharwa Village consists of maintained landscaped gardens. At the date of the site inspection the exception to this was the land within the Cuppacumbalong Homestead which had unmanaged grassland on the land beyond the managed curtilage to the buildings.

The reserve land to the northwest of Tharwa Bridge is managed with partial management of the reserve to the south of the bridge. The remainder of the reserve located along the Murrumbidgee River corridor contains Poplar Trees on the river's edge and grassy Box Woodland with weeds.

2.6 Vegetation on Adjoining Lands.

The vegetation on the land to the northwest, west and southwest of the Village consists of Box Woodland with a grassy understorey which is variously grazed.

The land to the southeast of the Outward Bound facility contains grassland vegetation with remnant trees located in the riparian corridor to Spring Station Creek.

The farming land located to the northeast of the Murrumbidgee River corridor contains Box Woodland with a grassy understory – refer to Figure 4 – Aerial Photograph on Page 15 and the Site Photographs commencing on Page 16.

SECTION 3.

CONTEXT OF THE BUSHFIRE RISK ASSESSMENT

The ACT Government enacted the *Emergencies Act 2004*, as part of its response to the needs identified by the McLeod Inquiry to replace the *Bushfire Act 1936* and sets the legislative basis for bushfire related planning.

Resulting from the changes in legislation, the ACT Planning & Land Authority prepared "*Planning for Bushfire Risk Mitigation*", a guideline adopted under the Territory Plan, that provides guidance to mitigate adverse impacts from bushfires in the ACT.

The Guideline is one of many documents that informs planning and development in the ACT and is taken into account by the ACT Planning & Land Authority when determining development applications and is complementary to the ACT Emergency Services Authority's *Strategic Bushfire Management Plan*, a strategic document outlining measures for the Prevention, Preparedness, Response and Recovery from bushfire in the ACT.

A *Bushfire Prone Area* for the ACT was declared through the *Building Regulations* and came into effect on the 1st September 2004. Under the declaration, all parts of the ACT outside the defined urban area have been designated bushfire prone and the Authority, under Part A (Consideration of Land Use and Development Proposals) of the Territory Plan, can require a site specific bushfire risk assessment to be undertaken during the planning/design process.

SECTION 4

BUSHFIRE RISK

4.1 Introduction.

The Australian Standard AS/NZS ISO 31000 – Health and Safety Risk Management, the ACT Government Enterprise-wide risk management framework and the Emergency Management Australia (EMA) emergency risk management process provide the framework for establishing the context, analysis, evaluation, treatment, monitoring and communication of risk. (3)

Bushfire risk is defined as the chance of a bushfire occurring that will have harmful consequences to human communities and the environment. Bushfire risk is usually assessed through consideration of the likelihood of a bushfire starting and how it will spread through the landscape and the consequence on assets that may be affected by the spread of the bushfire when it occurs.

A range of factors influence bushfire risk – these include:

- The likelihood of human and natural fire ignitions, as influenced by time, space and demographics;
- The potential spread and severity of a bushfire, as determined by fuel, topography and weather conditions;
- The proximity of assets vulnerable to bushfire fuels, and likely bushfire paths; and,
- The vulnerability of assets including natural assets, or their capacity to cope with, and recover from bushfire. (3)

Risk reduction can be achieved by reducing the likelihood of a bushfire, the opportunity for a bushfire to spread or the consequence of a bushfire (on natural and built assets). Bushfire Management should have a clear objective to reduce both the likelihood of bushfires and reduce the negative impacts of bushfires. It should also consider the costs, inconvenience and dangers of measures taken to reduce the risk of bushfires. (3)

4.2 Management Strategies.

The *Strategic Bushfire Management Plan for the ACT – 2009* states that the treatment of bushfire risk is achieved by reducing:

- The likelihood of a bushfire starting;
- The opportunity for a bushfire to spread; and/or
- The consequences of a bushfire [on people, natural and built assets.

SECTION 5

BUSHFIRE RISK ASSESSMENT – THARWA VILLAGE

5.1 Introduction.

An assessment of bushfire risk must firstly define the problem. This involves the identification of the nature and scope of issues to be addressed and defining the possible boundaries for the assessment (*Emergency Risk Management – Applications Guide (EMA Echo Press, 2000) and AS/NZS ISO 3100 - 2009*).

For the purpose of analysing bushfire risks that might emerge in the ACT, a dangerous and damaging fire has the potential to occur when the following conditions prevail:

- Continuous available fuel – fuel at moisture content sufficiently low to enable rapid combustion, arising from drought effects or the maturing and drying, of grasslands;
- Exposure of vulnerable assets. The ‘catchment’ for such fires may be within several hundred metres or many (60-70) kilometres from the asset/s;
- A combination of weather conditions that generate a forest or grass fire danger index of Very High (24) or greater. Prevailing adverse fire weather will have a strong northerly, through south westerly wind influence; and
- An existing fire burning in the landscape is not effectively suppressed.

Tharwa Village is exposed to the risk from bushfires that start within and spread from the land to the northwest, west and southwest – within the Namadgi National Park and adjoining farming lands.

A review of the history of large scale fire events within the ACT identifies that the 1920, 1926 and 1939 fires had the potential to spread across the landscape and impact upon the Tharwa Village with the 1939 bushfire reaching the north-western and south-western edge of the Village.

The Tharwa Village was impacted by the 2003 bushfires with the Village being saved by the actions of the Tharwa Brigade with minor damage occurring to sheds.

The potential for a re-occurrence of the spread of fire from the northwest, west and southwest, out of the Namadgi National Park remains.

The following part of the risk assessment process identifies the potential risk to the Tharwa Village precinct by examining:

- Fire History;
- Exposure to possible ignition / fire sources;
- Vegetation type and likely fuel loads and fire hazards arising using the “Overall Fuel Hazard Guide” – Fourth Edition (DSE July 2010);
- The impact of climate and likely fire runs during severe fire danger periods;
- Wind effects; and
- The impact of surrounding land uses and fuel loads.

5.2 Fire History of the ACT.

Natural fires have long been part of the ACT landscape. A combination of inherently inflammable vegetation, dry summers, periodic drought and lightning ignitions, resulted in fires of small and large size, of high and low intensity, with periodic conflagrations that have covered the landscape. Much of the native vegetation in the ACT is subject to periodic fires; particularly the dry forest, woodland and grassland communities, and many are fire-adapted ecosystems. Recurrent bushfires and management burning have shaped the condition of the existing plant communities [*Strategic BFMP 2005*].

The Strategic Bushfire Management Plan for the ACT states: “*The ACT has a history of severe damaging bushfires with large areas burnt in the bushfire seasons of 1919/20; 1925/26; 1938/39; 1951/52; 1978/79; 1982/83; 1984/85; 2000/01 and in 2002/03*”.

A review of the large scale fire history data within the Strategic Fire Management Plan for the ACT 2009 has identified that in 1920 a bushfire burnt through a large area within the Brindabella Ranges, to the west and southwest of the Village. This fire did not impact directly on the Village.

The 1926 bushfire occurred in the same area of the Brindabella Ranges, extending further to the north. This fire also did not reach the Village, being brought under control before impacting on the Tharwa Village precinct. The 1939 bushfire repeated the area of fire source burnt in 1920 and 1926 but this time the fire reached the western/south-western edge of the Village.

The 2003 bushfire resulted in most of the Namadgi National Park being impacted by fire with the fire spreading out of the ranges on the 18th January and destroying many dwellings on the western edge of Canberra. This fire also directly impacted on the Tharwa Village with damage to sheds being the only impact due to the efforts of the Southern [Tharwa] Brigade in combating the fire.

The risk to the Village from similar large scale fire events and local bushfires spreading through unmanaged woodland vegetation on the land to the northwest, west and southwest, remains.

The Murrumbidgee River is likely to prevent the spread of fire from the northeast and southeast impacting directly on the Village with the historical records not identifying these fire paths as a potential risk to the Village.

5.3 Ignition / Fire Sources.

Bushfires, including those in the ACT, are natural or human caused. Human causes can be categorised as:

- Malicious – including arson;
- Careless – such as escaped campfires, children and burning off without a permit; and
- Accidental – uncommon but includes motor vehicle and industrial accidents.

The only common natural cause of bushfires in the ACT is lightning with this ignition source likely to continue to occur within the Brindabella Ranges, to the northwest, west and southwest of Tharwa Village, as experienced in 1920, 1926, 1939, 1983. The record of the 2003 bushfires shows lightning strikes started 160 fires within the Brindabella and Namadgi National Parks.

The vast majority of ACT bushfires are, however, human caused with many classified as arson.

Accidental ignition of the grassy woodland vegetation, especially from agricultural landuse practices within surrounding lease-holdings [e.g. slashing/grinding/welding etc] may also provide an ignition source to cured grassland fuels during periods of drought, spreading under prevailing winds from the northwest, west and southwest, towards the Village.

Ignition of the grassy woodland vegetation on the adjoining farms by embers from fires burning within Namadgi National Park is a high probability.

Malicious fire ignition can occur wherever humans operate. Deliberately lit (arson) fires are probable, including within the unmanaged vegetation found in the Murrumbidgee River corridor reserves.

5.4 Climate and Weather.

The ACT has a relatively dry, continental climate with warm to hot summers and cool to cold winters. The climate of Canberra is strongly influenced by a band of high pressure systems located around the globe at about 30 – 40°S, known as the sub-tropical ridge.

During summer, the sub-tropical ridge is located over southern Australia resulting in warm to hot conditions with winds generally from the east through to northwest.

The average annual rainfall is 629mm with an average of 108 rain days per year with rainfall reasonably evenly distributed throughout the year with the wettest month being October and the driest being June.

Rainfall tends to be influenced by cold fronts during the winter 6 months and thunderstorm activity during the summer 6 months.

While rainfall in most years is reasonably reliable, drier than average years are closely related to El Nino–Southern Oscillation (ENSO) events in the Pacific Ocean and all significant droughts have occurred in El Nino years and these years tend to be significant bushfire seasons as well.

Rainfall across the ACT varies considerably, with much higher rainfall occurring in the ranges to the west and less rainfall to the east.

January is the hottest month with a mean daily maximum temperature of 27°C and an average of 10 days of 30°C or more with 2 days of 35°C or more. Canberra tends to get cooler easterly winds penetrating from the coast during many summer evenings which can sometimes bring cloud in with the moister air.

The highest recorded maximum temperature was 42.2°C on February 1st 1968 followed closely by 41.4°C on the previous day [31st January 1968]. Relative humidity in Canberra is around 37 – 40% at 3pm in summer.

The fire season in the ACT corresponds with the summer months' high temperatures and low rainfall, and can occur from September to April with a proclaimed bushfire danger period from October to March. There is significant variability from year to year. Fire seasons may be serious in three out of every 15 years, but this can vary considerably.

Extreme and uncontrollable bushfires typically occur when the fire danger rating is over 50, a rating of Extreme. Many of the major house loss events have occurred at fire danger ratings over 70, on a scale of 0 to 100.

Analysis of 1951 – 2004 meteorological records identified 105 days of Extreme fire danger from the Forest Fire Danger Index (FFDI) at Canberra airport. These were broken down into the following FFDI ratings:

- 61 days 50 – 59 FFDI;
- 25 days 60 – 69 FFDI;
- 9 days 70 – 79 FFDI;
- 4 days 80 – 89 FFDI; and
- 6 days 90 – 100.

Eighteen percent of January days had Very High FFDI and two percent of January days had Extreme FFDI.

The Very High and Extreme Forest Fire Danger conditions mainly occur between November and March.

[Source SBMP for the ACT].

[The (McArthur) Forest Fire Danger Index (FFDI) was developed in the 1960s by CSIRO scientist A.G. McArthur to measure the degree of danger of fire in Australian forests. The index combines a record of dryness, based on rainfall and evaporation, with daily meteorological variables for wind-speed, temperature and humidity.

A fire danger rating of between 12 and 25 on the index is considered a "high" degree of danger, while a day having a danger rating of over 50 is considered an "Extreme" fire danger day. McArthur used the conditions of the Black Friday fires of 1939 as his example of a 100 rating.

The FFDI on Black Saturday, 7th of February, 2009 – in Victoria, reached as high as 180, the worst fire conditions ever recorded].

Canberra generally is not very windy with, on average, 25 days of strong winds a year. Late Winter/Spring tends to be the windiest time with just over half of these days [13 days] occurring in the four [4] months between August and November.

Wind is an important factor in bushfire behaviour as it influences the rate of spread of the fire front and spreads burning embers / sparks, providing ignition sources for spot fires to distances up to 35 kilometres ahead of the main fire front.

The 2003 bushfires saw winds exceeding 60 kilometres per hour, predominantly from the northwest/west. These winds, coupled with the local winds created by the landform, caused erratic wind behaviour including eddies and down bursts off the higher ranges to the west and southwest of the Village. Frequent changes in wind direction also occurred.

Southerly and south-easterly wind influences also pose a threat of spreading fire towards the south-eastern edge of the Village.

5.5 Slope & Fire Paths.

Slope is a critically important factor when assessing fire risk and likely behaviour. The rate of fire propagation doubles up a slope of 10 degrees (18%) and increases almost fourfold up a slope of 20 degrees (40%).

The rate of progress downslope tends to slow at a corresponding rate however wind direction in the lee of hills/ridgelines tends to be unpredictable and can cause fires to change direction, as experienced during the 2003 bushfires when the fire spread along the river corridor.

The topography of the land adjoining the Village rises to the northwest, west and southwest, placing most of the Village in the 'lee' of the ridgeline and theoretically protected against a rapidly spreading bushfire. The south-eastern portion of the Village precinct [i.e. Outward Bound & Cuppacumbalong Station] is exposed to an upslope fire path from Spring Station Creek, around the end of the higher ridgeline located to the southwest of Nass Road.

The fire behaviour during the 2003 bushfires confirmed that erratic wind patterns negate the overall benefit of the location of the Village in the lee of the ridgeline and that fires will be affected by wind turbulence with spot fire ignition occurring throughout the Village precinct.

Figures 6 & 7 below provide a graphical representation of the potential fire paths likely to impact upon the Village. These figures do not predict the effect of likely wind turbulence similar to that which occurred during the 2003 bushfires.

Figure 6 – Fire Paths – Northwest & Southwest.



Figure 7 – Fire Paths – Southeast & West.



5.6 Bushfire Fuels.

Fuel is a critical element in bushfire risk management, as it is the one factor relating to fire behaviour that can be managed.

There are three 'types' of fuel that contribute to bushfire hazard. They relate to the distribution and nature of combustible material within a vegetated environment and are defined by the DSE Overall Fuel Hazard Guide [Forth Edition, July 2010] as:

- Elevated fuel load
- Surface fine fuels; and
- Bark.

Elevated material is defined as shrubs, heath and suspended material greater than 0.5 metres above ground. The level of bushfire hazard depends on fuel continuity, height, amount of dead material, foliage thickness and flammability of live foliage. Flammability of vegetation is at the highest when composition is fine, it contains a lot of dead material, is dense vertically and horizontally and has low moisture content.

Surface fine fuels are defined as the litter bed and vegetation up to 0.5 metres above the ground.

Grasses add to the surface fine fuels and therefore need to be taken into account when assessing the hazard. The risk is higher where greater depth and volume of litter and surface material are present.

Bark has the potential to travel significant distances in a fire situation (spotting) and act as a ladder between surface fuels and the forest crown. Bark contributes to fire hazard when it is loose and fibrous, present in large quantities and in long loose ribbon forms.

5.7 Assessment of Fuel Hazard.

An overall Fuel Hazard for vegetation within the grassy woodland can be determined from an assessment of the contributing fuel hazards.

The vegetation which will create the most significant fire impact on the Village will be the cured, unmanaged grassy woodland vegetation on the land to the northwest, west and southwest of the Village due to this vegetation being exposed to the effects of hot, dry north-westerly, westerly and south-westerly wind patterns.

5.7.1 Grassy Woodland Vegetation.

Using the methodology provided within the DSE Overall Fuel Hazard Guide, the following Fuel Hazard observation was determined for unmanaged grassy woodland vegetation:

- ***Unmanaged Grassy Woodland vegetation on the land to the northwest, west and southwest of the Village:***

Using the methodology provided within the DSE Overall Fuel Hazard Guide, the following Fuel Hazard observation was determined.

(a) Bark Hazard:

The Woodland vegetation includes Yellow Box Red Gum, which has a smooth trunk and long ribbons of bark into the crown of the tree. Therefore this vegetation has a High Bark hazard.

(b) Elevated Fuel Hazard:

Elevated fuel comprises shrub, heath and suspended material.

The level of hazard depends on the fuel continuity (horizontal and vertical), height, and proportion of dead material, thickness of the foliage and twigs and flammability of the live foliage.

The flammability of the elevated fuel is highest when:

- The foliage, twigs and other fuel particles are very fine (e.g. maximum thickness 1-2 mm)
- The proportion of dead material is high.
- The fuels are arranged with a high level of density and horizontal and vertical continuity that promotes the spread of flame.
- The live foliage has low, live fuel moisture content.

The vegetation type and time lapse since the most recent fire substantially determines the level of elevated fuel hazard.

Site investigation was undertaken to determine the structure of the elevated fuel and an estimated Elevated Fuel Hazard of High – Very High, was determined for the shrub layer within the grassy woodland vegetation.

(c) Surface Fine Fuel Hazard:

Surface Fine Fuel Hazard is assessed by measuring litter-bed height. The Surface Fine Fuel in the grassy woodland vegetation consists of accumulated leaf litter beneath trees and grasses, if the grass not adequately managed to reduce the quantity of biomass within the fuel.

The estimated Surface Fine Fuel Hazard Rating can range from low during periods of drought or where the grass is managed to very high to extreme during periods when abundant fuel is available and cured to greater than 70%.

The Overall Fuel Hazard for unmanaged grassy woodland vegetation on the land to the northwest, west and southwest of the Tharwa Village is very high.

A very high rating prevails for unmanaged grassland fuels to the south and southeast of the Tharwa Village precinct.

5.8 Likely Fire Scenarios.

The historical fire patterns affecting the Tharwa Village indicate the likelihood of northwest, west and southwest fire paths impacting the Village.

The 2003 bushfires also identified that the Village is subject to the affects of wind turbulence created by large fire events burning within the Brindabella and Namadgi National Parks. The effect of such fire events cannot be predicted, however property loss at least is likely unless protection is provided to the Village and measures are implemented within the Village to prevent the ignition of vegetation and the spread of fire through the Village.

- **Fire Scenario 1 - Northwest:**

A fire spreading, under the influence of northwest winds, initially upslope to the ridgeline to the northwest of the Village, spreading downslope and impacting on the properties on the north-western edge whilst spreading embers throughout the remainder of the Village.

This occurrence is possible during consecutive fire seasons when weather conditions are such that the Fire Danger Index is Extreme - Catastrophic (FDI > 50), the grass vegetation is prolific and has reached a state of curing which exceeds 70%.

- **Fire Scenario 2 – West & Southwest:**

A fire spreading, under the influence of westerly and south-westerly winds, initially upslope to the ridgeline to the southwest of the Village precinct, spreading downslope and impacting on the properties on the south-western edge whilst spreading embers throughout the remainder of the Village.

This fire event is likely to result in spot fire ignitions within the Village, spreading upslope to the southwest, against the prevailing wind pattern due to wind eddies and turbulence created on the lee side of the ridgeline.

This occurrence is possible during consecutive fire seasons when weather conditions are such that the Fire Danger Index is Extreme - Catastrophic (FDI > 50), the grass vegetation is prolific and has reached a state of curing which exceeds 70%.

- **Fire Scenario 3 – Southwest and South:**

A fire spreading through the grassy woodland/grassland vegetation on the land to the southwest and south of the southern portion of the Village precinct, burning upslope from Spring Station Creek corridor toward the south-western corner and the southeastern edge of the Village.

This occurrence is possible during consecutive fire seasons when weather conditions are such that the Fire Danger Index is Extreme - Catastrophic (FDI > 50), the grass vegetation is prolific and has reached a state of curing which exceeds 70%.

5.9 Risk Statement.

Australian Standard A.S/NZ ISO: 2009 – ‘Risk Management’ provides a methodology for establishment of risk. Table 1, below, provides a list of qualitative measures of consequence [or impact] of future bushfires on Tharwa Village whilst Table 2 provides a list of qualitative measures of the likelihood of a bushfire impacting upon the Village precinct.

Table 1 – Qualitative Measures of Consequence or Impact.

Level	Descriptor	Detail Description
1	Insignificant	No public safety injuries or impact to buildings
2	Minor	No public safety injuries – minor impact to buildings
3	Moderate	Burns and Respiratory Issues – moderate damage to buildings
4	Major	Death of people exposed to radiant heat & major property damage
5	Catastrophic	Death of people exposed to radiant heat and total destruction of buildings

Table 2 – Qualitative Measures of Likelihood.

Level	Descriptor	Detail Description
A	Almost Certain	Is expected to occur during severe – catastrophic fire danger periods
B	Likely	Will probably occur during severe – catastrophic fire danger periods
C	Possible	May occur during severe – catastrophic fire danger periods
D	Unlikely	Unlikely to occur during severe – catastrophic fire danger periods
E	Rare	Will rarely occur during severe – catastrophic fire danger periods

Table 3 provides a qualitative risk analysis matrix – used to determine the level of risk in Table 4.

Table 3 – Qualitative risk analysis matrix

Likelihood	Risk Rating				
	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A – almost certain	High	High	Extreme	Extreme	Extreme
B – likely	Moderate	High	High	Extreme	Extreme
C – possible	Low	Moderate	High	Extreme	Extreme
D – unlikely	Low	Low	Moderate	High	Extreme
E – rare	Low	Low	Moderate	High	High

Table 4 provides a statement of risk for each fire scenario that has been identified as having the potential of impacting the Tharwa Village prior to mitigation measures, and assigns risk levels reflecting identified levels of likelihood and consequences for a ‘worst case’ fire occurrence which may occur during high, extreme and catastrophic fire weather conditions.

Table 4 – Bushfire Risk Register – Severe Bushfire Event – if high levels of combustible fuels/unmanaged vegetation exist in the landscape.

The Risk What can happen?	The consequences of an event happening Consequences Likelihood		Adequacy of existing protection measures	Consequence Rating	Likelihood Rating	Level of Risk	Risk Priority
Fire Scenario 1: A fire burning through the grassy woodland vegetation under north-westerly winds	Catastrophic	Likely	Does not address current standards	5 [Catastrophic]	B [Likely]	Extreme risk rating	1
Fire Scenario 2: A fire burning through the grassy woodland vegetation under westerly & south-westerly winds	Catastrophic	Likely	Does not address current standards	5 [Catastrophic]	B [Likely]	Extreme risk rating	1
Fire Scenario 3: A fire burning towards the southern end of the Village, spreading through the grassy woodland/grassland vegetation under south-westerly and southerly winds	Catastrophic from the SW	Possible	Does not address current standards	5 [Catastrophic]	C [Possible]	Extreme risk rating	2
	Major from the south	Possible		4 [Major]	C [Possible]	Extreme risk rating	

5.10 Summary of Bushfire Risk.

The 2003 bushfires confirmed that Tharwa Village is exposed to an extreme level of risk from a major fire event that occurs within and spreads from the Brindabella and Namadgi National Parks.

5.11 Asset Interface Classification [AIC].

The ACT Rural Fire Service/ESA have developed a methodology for determining the classification of potential exposure of development to severe bushfires and introduces Asset Interface Classification [AIC], which is defined as the boundary between an asset and the bushfire paths that approach it. The AIC is determined by an assessment of:

- The maximum fire size an asset may be subject to;
- The part of the fire [head, flank, back] an asset maybe subject to recognizing the major fire threat from the north and west;
- The fire run length criteria and the length of fire run.

The following table provides an Asset Interface Classification [AIC], at a broader scale for the urban edge of Canberra;

Table 5: Asset Interface Classification

Aspect of Fire Run	Length of Fire Run to Asset Interface (through unmanaged vegetation)		
	<100	100 – 350	>350
N	Secondary	Primary	Primary
NW	Secondary	Primary	Primary
W	Secondary	Primary	Primary
SW	Lee	Secondary	Primary
S	Lee	Secondary	Secondary
SE	Lee	Lee	Lee
E	Lee	Lee	Secondary
NE	Lee	Lee	Secondary

Table 6 provides the results of an examination of the Asset Interface Classification at a precinct level for the Tharwa Village.

Table 6: Asset Interface Classification – Precinct Assessment.

Aspect of Fire Run	Length of Fire Run to Asset Interface (through unmanaged vegetation)		
	<100m	100 – 350m	>350m
Northwest Unmanaged grassy woodland vegetation > 350m wide fire path			Primary
West & Southwest – Unmanaged grassy woodland vegetation > 350m wide fire path			Primary
South – Unmanaged grassland vegetation > 350m wide fire path			Secondary

Table 6 identifies that the north-western, western and south-western aspects to the Tharwa Village have a primary Asset Interface Classification whilst the southern aspect has a Secondary Asset Interface Classification.

SECTION 6

BUSHFIRE PROTECTION MEASURES.

6.1 Introduction.

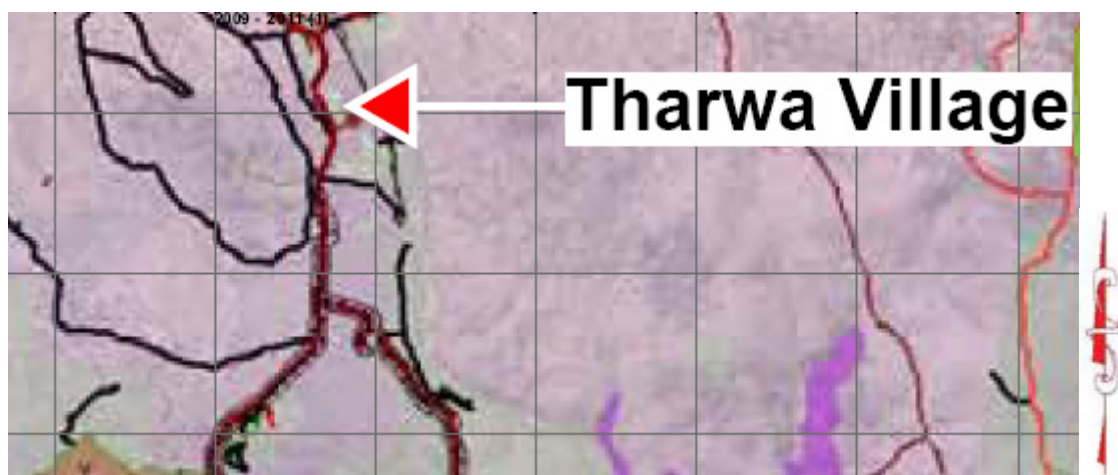
The following sections of this report examine the existing bushfire protection measures provide recommendations on the measures required to address the bushfire risk and the requirements of *Planning for Bushfire Risk Mitigation 2009* and the *Strategic Bushfire Management Plan for the ACT – 2009*.

6.2 Asset Protection Zones.

The Tennent Regional Fire Management Plan of the *Strategic Bushfire Management Plan for the ACT – 2009* identifies that the Tharwa Village is located in an area in which the land management strategy is defined as “Rural Lands” with the “*treatment of these lands being the result of general rural production / agricultural activities which may include grazing, harvesting or baling undertaken throughout the year. Such treatments provide fuel reduction as an indirect result*”.

Figure 8 below provides an extract from the Tennent Regional Fire Management Plan showing the location of Tharwa Village.

Figure 8 – Extract from Tennent Regional Fire Management Plan showing the location of Tharwa Village.




Legend



Rural Lands.
Treatment in these areas are a result of general rural production / agricultural activities, which may include grazing, harvesting or baling undertaken throughout the year. Such treatments provide fuel reduction as an indirect result.

The plan also shows a number of access tracks throughout the Village precinct and on adjoining land as shown in the legend below:

	Light Unit	To allow the safe passage of light units (4x4 Landcruiser or similar carrying a water tank of 400 – 600 litres). Generally these features will have a width of 3 m of natural, grass, sealed or gravel surface, a maximum grade of 20 degrees, corners of sufficient radius to make 3 point turns by light units unnecessary and with roadside vegetation maintained to allow unimpeded access by light units.
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The Tennent Regional Fire Management Plan identifies that the protection of the Village is provided by the agricultural pursuits undertaken on the adjoining farming land.

However, *Planning for Bushfire Risk Mitigation 2009* and the *Strategic Bushfire Management Plan for the ACT 2009* provide recommendations on the provision of Asset Protection Zones to assets located in a bushfire prone area and which is likely to be subject to bushfire attack, which is the case with the Tharwa Village.

Table 7 provides advice on the deemed-to-satisfy requirements for the provision of an Inner Asset Protection Zone; Outer Asset Protection Zone and Ember Zone to the Village – derived from the *Strategic Bushfire Management Plan for the ACT – Version 2 – 2009*.

Table 7 – Asset Protection Zones to Assets - Strategic Bushfire Management Plan for the ACT – Version 2 – 2009.

Aspect of Fire Run	Length of Fire Run to Asset Interface (through unmanaged vegetation)			Required Asset Protection Zones		
	<100m	100 – 350m	>350m	IAPZ	OAPZ	Ember
Northwest Unmanaged grassy woodland vegetation > 350m wide fire path			Primary	30m	100m	200m
West & Southwest – Unmanaged grassy woodland vegetation > 350m wide fire path			Primary	30m	100m	200m
South – Unmanaged grassland vegetation > 350m wide fire path			Secondary	20m	Nil	50m

The widths identified in Table 7 are based on the assumption that buildings [assets] are constructed to a standard which meets the specifications of A.S. 3959 – 2009 – *Construction of Buildings in Bushfire Prone Areas*.

An inspection of the existing housing stock and other buildings within the Tharwa Village confirmed that none of the buildings complied with the construction requirements of the Standard.

It is recommended that a formal approach to the implementation and management of the deemed-to-satisfy Asset Protection Zones be implemented. This will require agreement from the residents of the Village, TAMS and the neighbouring Lessee to the southwest of the Village in order to achieve the management standards of the Inner and Outer Asset Protection Zones, including the management of the combustible fuels within the Village.

It is also recommended that the width of the Outer Asset Protection Zone be increased to a minimum of 200 metres in order to compensate for the lack of bushfire construction standards to the existing buildings.

Section 9 provides an indicative layout of the recommended Asset Protection Zones which should be introduced to increase the protection to the Village.

6.3 Home Asset Protection Zone [Ember Zone] – Construction Standards to Buildings.

Planning for Bushfire Risk Mitigation 2009 and the *Strategic Bushfire Risk Management Plan for the ACT 2009* requires that there shall be an Ember Zone of 200 metres provided to the north-western, western and south-western edge of the Village where buildings located within 41 metres of the outer edge of the Inner Asset Protection Zone shall be constructed to comply with BAL 19, pursuant to A.S. 3959 – 2009 – ‘*Construction of Buildings in Bushfire Prone Areas*’. For those buildings located between 41 metres and 200 metres from the outer edge of the IAPZ the buildings shall be constructed to comply with BAL 12.5, pursuant to A.S. 3959 – 2009 – ‘*Construction of Buildings in Bushfire Prone Areas*’.

This requirement is predicated on there being a managed Inner Asset Protection Zone and a complying Outer Asset Protection Zone width as required by *Planning for Bushfire Risk Mitigation 2009* and the *Strategic Bushfire Management Plan for the ACT 2009*.

There is also a requirement to provide a 50 metre wide ember zone to the south-eastern edge of the Village where the buildings shall be constructed to comply with BAL 12.5, pursuant to A.S. 3959 – 2009 – ‘*Construction of Buildings in Bushfire Prone Areas*’.

It is therefore recommended that any alterations and additions undertaken to the existing buildings or new buildings erected within the Village be constructed to comply with the requirements of A.S. 3959 – 2009 – ‘*Construction of Buildings in Bushfire Prone Areas*’.

6.4 Access for Fire-fighting Operations.

Access for fire-fighting operations is generally provided off the main road system, including Tharwa Drive, Tidbinbilla Road and Nass Road and the secondary roads including Union Street and Clarrie Lane.

The Rural Lease to the southwest contains an access track which extends off the driveway to the Fire Station, turning to the southeast, running parallel to Clarrie Lane and Johnson Street.

A second access track runs higher on the ridgeline, to the southwest of Clarrie Lane, Johnson Street and Naas Road, exiting onto Naas Road opposite the entry to the Outward Bound facility.

It is recommended that both of these access tracks be ungraded to fire trail standard and maintained. This will require a formal agreement with the Lessee of Block 8 Section 13.

There should also be provided a formal fire trail across the north-western aspect of the Village, connecting Tidbinbilla Road with the access track along the Murrumbidgee River corridor – refer to Section 9.

6.5 Water Supplies for Fire Fighting Operations.

An inspection of the existing non-potable water supply to the Village was undertaken and discussions held with [REDACTED].

[REDACTED] confirmed that prior to the bushfires in 2003 the river supply was depleted and that another 'hole' had to be dug in order to permit supply to be drawn from the river. He also stated that the river flow had been altered by the reconstruction of the Tharwa Bridge – adding to the problems of supply to the pumps.

All of the non-potable water supply systems have exposed poly pipes which are subject to damage from ember attack.

The capacity of the two river pumps and the Outward Bound bore pump is not known, however the Manager of Outward Bound confirmed that their bore and pump is capable of refilling the two tanks overnight, from empty [approximately 200,000 litres].

The size and condition of the piping systems is also not known.

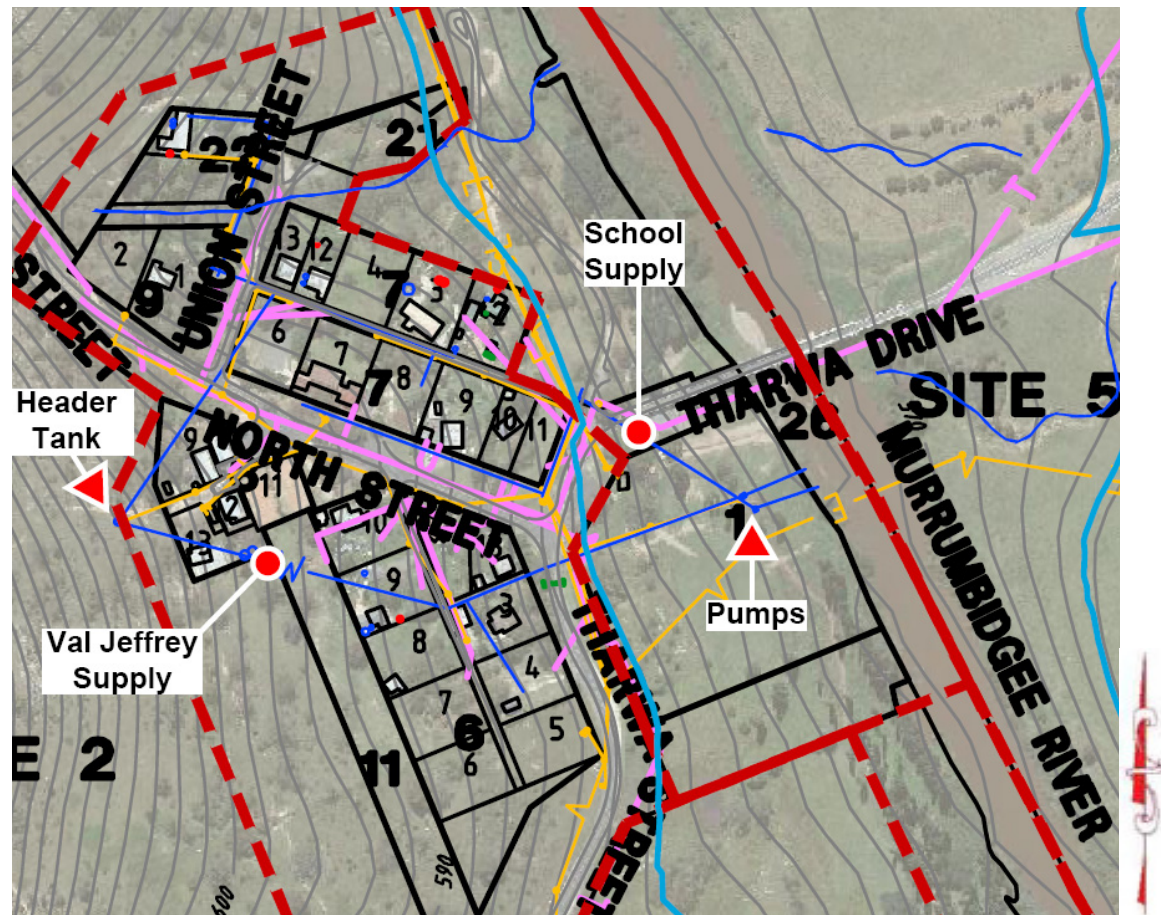
All pumps inspected were powered from the electricity grid with no alternate back up – i.e. diesel powered generator.

Residents pay a fee to [REDACTED] for the use of the water. [REDACTED] also suggested that he would be prepared to transfer the 'ownership' of his system to the ACT Government *“provided that there is no impact on the residents and the Government does the right thing”*.

There are three existing non-potable water supply systems within the Village – refer to Figures 9 & 10 on Page 49.

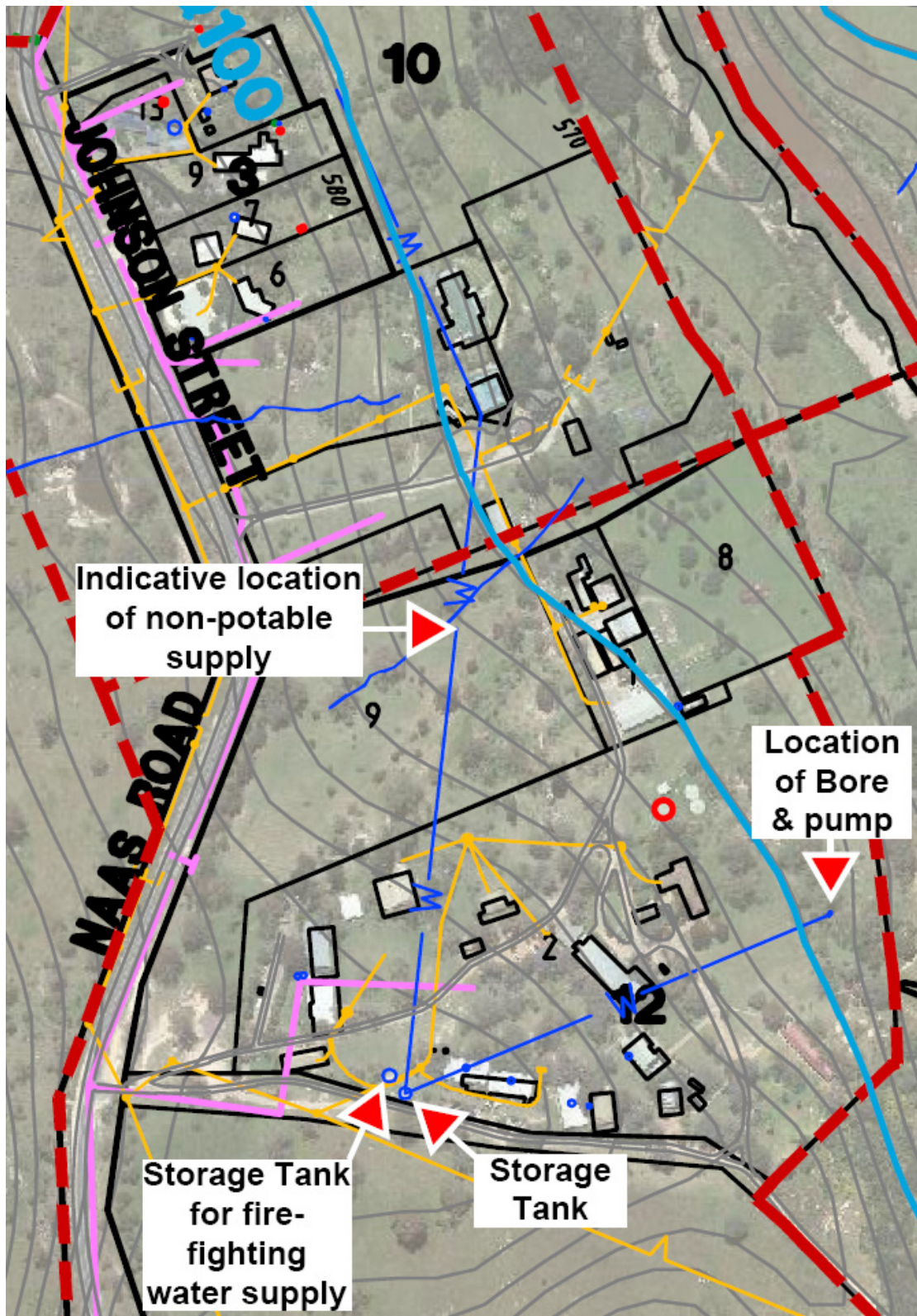
None of the existing systems provide adequate fire-fighting water supplies for bushfire fighting and structure fire-fighting operations, to modern day standards.

Figure 9 – Diagrammatic Plan of the northern water supply layout.



Note: Location of pipes to be confirmed on site.

Figure 10 – Diagrammatic Plan of the southern water supply layout.



Note: Location of pipes to be confirmed on site.

The 'northern system' consists of two systems, with each system drawing water from the Murrumbidgee River. The original system was installed and is operated by [REDACTED] and pumps water from the river to a storage tank located on Block 8 Section 13, adjacent to the rear fence line to the Tharwa Store/Fire Station. From this tank the supply is gravity fed to the existing dwellings on North Street, Union Street, Tharwa Street and Clarrie Lane.

This system is old with the storage tank leaking and the support stand beyond repair and near collapse - refer to photographs below.

The second system was installed to provide non-potable water to the former Tharwa School with onsite storage tanks. Approval has been provided so that the supply pump to this system now operates as a back-up pump to the [REDACTED] system.

The 'southern system' operates from a bore located on the Outward Bound site with storage tanks located adjacent to the south-eastern boundary. The internal supply to Outward Bound is fed from one of these tanks with the supply also extending to the northwest to feed Cuppacumbalong Homestead and the adjoining residential development.

The other tank is a dedicated fire-fighting water supply which feeds a series of outlets located adjacent to the buildings on the site. These outlets are not connected to hoses or hose reels.

Other than the dedicated fire-fighting water supply at the Outward Bound site, the non-potable water supply to the Village does not provide a satisfactory supply suitable for fire-fighting operations.

As part of the Tharwa Infrastructure Capacity Study investigations are being undertaken into the implementation of a reticulated mains water supply to the Tharwa Village.

Should this outcome be achieved the reticulation system installed should comply with A.S. 2419.1 – 2005 in respect to the provision of fire-fighting water supplies, including complying Fire Hydrants. It should also have sufficient capacity in the design to ensure the water supply to the Village is not depleted by 'upstream' draw-off during periods of extreme bushfire weather.

This will require the construction of a header tank, located on the ridgeline to the southwest of the Village with sufficient head height to supply the hydrants and a capacity to service the existing and potential expanded community for at least four [4] days. Formal approval will be required for the placement of the new tank on Block 8 Section 13.

Should this outcome not be achieved the following recommendations should be considered in the upgrade of the existing non-potable water supply:

1. The existing northern system should be amalgamated into a single system with a supply drawn from the Murrumbidgee River.

This system shall be designed and installed to provide non-potable water and a fire-fighting water supply to the existing developed and vacant blocks within the Village [and the potential expansion of the Village to the northwest], except for the Outward Bound facility and the single dwelling on Block 5 Section 12.

The supply point in the river shall be reconstructed to ensure adequate flow to the pump/s during periods of low river flow. The existing pumps shall be examined to determine their adequacy, either singularly or in parallel, to supply sufficient water to a new header tank located higher up the slope so as to increase the head pressure sufficient to satisfy the pressure/supply requirements of hydrants pursuant to A.S. 2419.1 – 2005. [Type F5 standard 45 l/s single standard hydrants at 60 metre intervals].

The capacity of the tank shall be sufficient to supply the existing and potential expanded community for at least four [4] days. Formal approval will be required for the placement of the new tank on Block 8 Section 13.

The pump house/s shall be fitted with ember mesh to prevent ember entry into the building and the surrounding area kept clear of excess combustible material [grasses etc].

An auxiliary diesel power supply shall be provided for back-up electricity supply to the pump/s. All electrical connections shall be shielded against ember attack.

The existing supply line to the header tank shall be checked for leaks and replaced/repared where necessary.

A new supply network shall be installed from the new header tank with hydrants located so that the maximum hose line length to the furthest point of a building is 90 metres, made up of 20 metres from the hydrant to the fire appliance plus 2 x 30m hose lengths and a 10 metre hose [water] stream. Blue hydrant markers shall be placed on the road pavement to indicate the hydrant locations.

All exposed piping and fittings shall be metal with poly lines buried at least 300mm below finished ground level. This requirement shall also apply to the individual non-potable water supply connection to the existing buildings/blocks. Shut off valves shall be installed at the boundary of each block to ensure the integrity of the remainder of the system should a leak occur.

A 'fast fill' point shall be installed at the RFS Station for tanker refilling.

2. The existing supply to the Outward Bound site should be checked and the line to Cuppacumbalong Station and the existing residential blocks disconnected.

All poly lines and fittings which are above ground shall be replaced with metal. Fire hose reels [with protective covers] shall be installed to the outlets located adjacent to the existing buildings.

The poly sheeting to the pump house shall be replaced with steel cladding and the building sealed to prevent ember entry.

The static water supply tank shall be fitted with a 65mm supply line with an outlet, complete with 65mm ball valve, Stortz Coupling and Cap, located outside the boundary fence so as to facilitate easy access for refilling fire appliances.

Photograph No. 14 – [REDACTED] Water Storage Tank.



Photograph No. 15 – Supply points in the Murrumbidgee River - [redacted] and School system



Photograph No. 16 – Pump Sheds on the bank of the Murrumbidgee River - [redacted] on the left and School system on the right – note electrical connection and exposed poly pipe and bushfire fuels



Photograph No. 16 – School Pump enclosure showing exposed pipe work with no protection against ember attack.



Photograph No. 17 – [REDACTED] Pump enclosure showing exposed pipe work with no protection against ember attack.



6.6 Evacuation Planning:

There shall be prepared an Evacuation Plan for the Tharwa Village [including the Outward Bound facility] which shall be submitted to ESA for review.

The Evacuation Plan shall be prepared to address the requirements of Australian Standard A.S. 3745-2002 "*Emergency Control Organisation and Procedures for dwellings, structures and workplaces*" and shall establish the protocols for the relocation of the residents and visitors on advice from the Emergency Services.

SECTION 7

RESIDUAL RISK.

7.1 Introduction.

Table 7 evaluates the residual bushfire risk to the Tharwa Village, following the implementation of the recommended bushfire protection measures.

Table 7 – Bushfire Risk Register & Action Treatment Plan – Severe/Catastrophic Bushfire Event, Post implementation of Protection Measures.

The Risk What can happen?	Consequences / Likelihood of an event happening before mitigation	Risk before mitigation	Strategy to reduce risk	Consequences & Likelihood after mitigation measures applied	Residual Level of Risk	Risk Priority
Fire Scenario 1: A fire burning through the grassy woodland vegetation under north- westerly winds	Catastrophic / Likely	Extreme risk rating	APZs	Major / Likely	Extreme	1
Fire Scenario 2: A fire burning through the grassy woodland vegetation under westerly & south- westerly winds	Catastrophic / Likely	Extreme risk rating	APZs	Major / Likely	Extreme	1
Fire Scenario 3: A fire burning towards the southern end of the Village, spreading through the grassy woodland/grass land vegetation under south-westerly and southerly winds	Catastrophic from the SW / Possible	Extreme risk rating	APZs	Major / Possible	Extreme	1
	Major from the south / Possible	High risk rating		Moderate / Possible	High	2

7.2 Summary of Residual Bushfire Risk.

Table 7 provides a review of the residual level of bushfire risk to the Tharwa Village, post implementation of the recommended Asset Protection Zones, construction standards to new buildings and to alterations and additions to existing buildings and the provision of an upgraded water supply and has found that the level of residual risk remains the same as it was prior to the implementation of the protection measures.

The reason for the lack of reduction in the risk to the Village is due to the exposure the Village has to extreme and catastrophic fire events which will continue to occur in the landscape to the northwest, west and southwest of the Village – resulting from ignition of the vegetation within the Namadgi and Brindabella National Parks.

SECTION 8

CONCLUSION.

Tharwa is an isolated rural village which was exposed to catastrophic bushfire events in the 2003 Canberra Bushfires.

The fact that the Village survived was attributable in large part to the efforts of the Southern [Tharwa] Brigade members.

Fire history statistics indicate that the Village has been exposed to the threat of similar fire events dating back to 1920 with the 1939 bushfire reaching the south-western edge of the Village.

This study has identified that the existing water supply available for bushfire and structural [asset] fire-fighting is inadequate and that the Strategic Bushfire Management Plans' reliance on the hazard and risk being mitigated through land management practices [grazing] on adjacent leased and Government lands does not address the level of risk to the Village and its occupants.

Best practice bushfire protection measures are required to be implemented to achieve improved protection of the Village similar to that provided to the Uriarra Village.

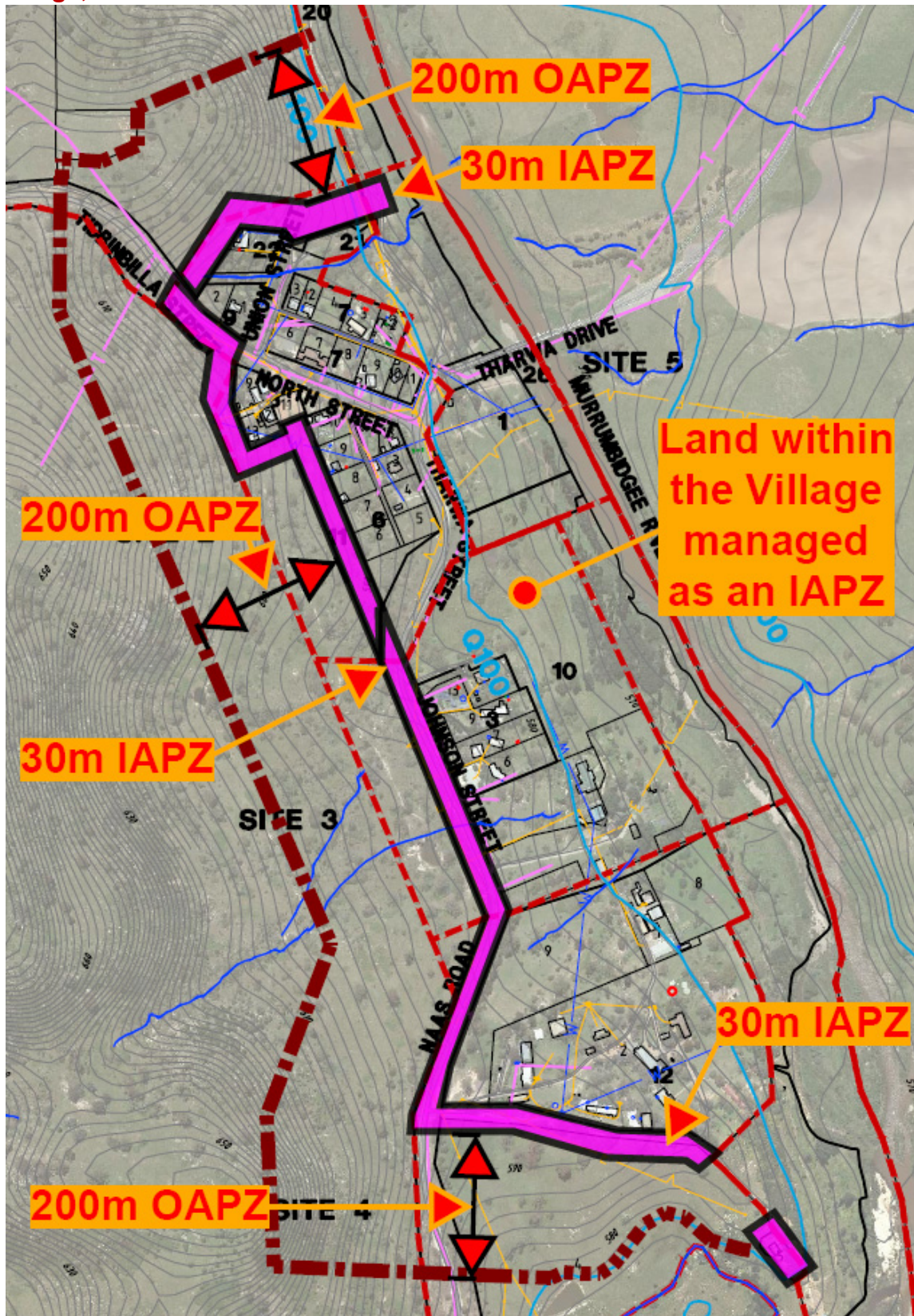
This requires an urgent upgrade of the fire-fighting water supply to the Village and implementation and ongoing maintenance of fire protection zones and access trails on adjoining land to the extent as recommended in this report. It is also important that the residents of the Village understand the need to maintain low fuel loads within the Village and provide improved protection against ember attack.

Whilst it is recognised that these measures will not reduce the level of risk significantly, due to the historical nature of bushfire risk in the local area, they will improve the protection of the Village against future wildfire events.

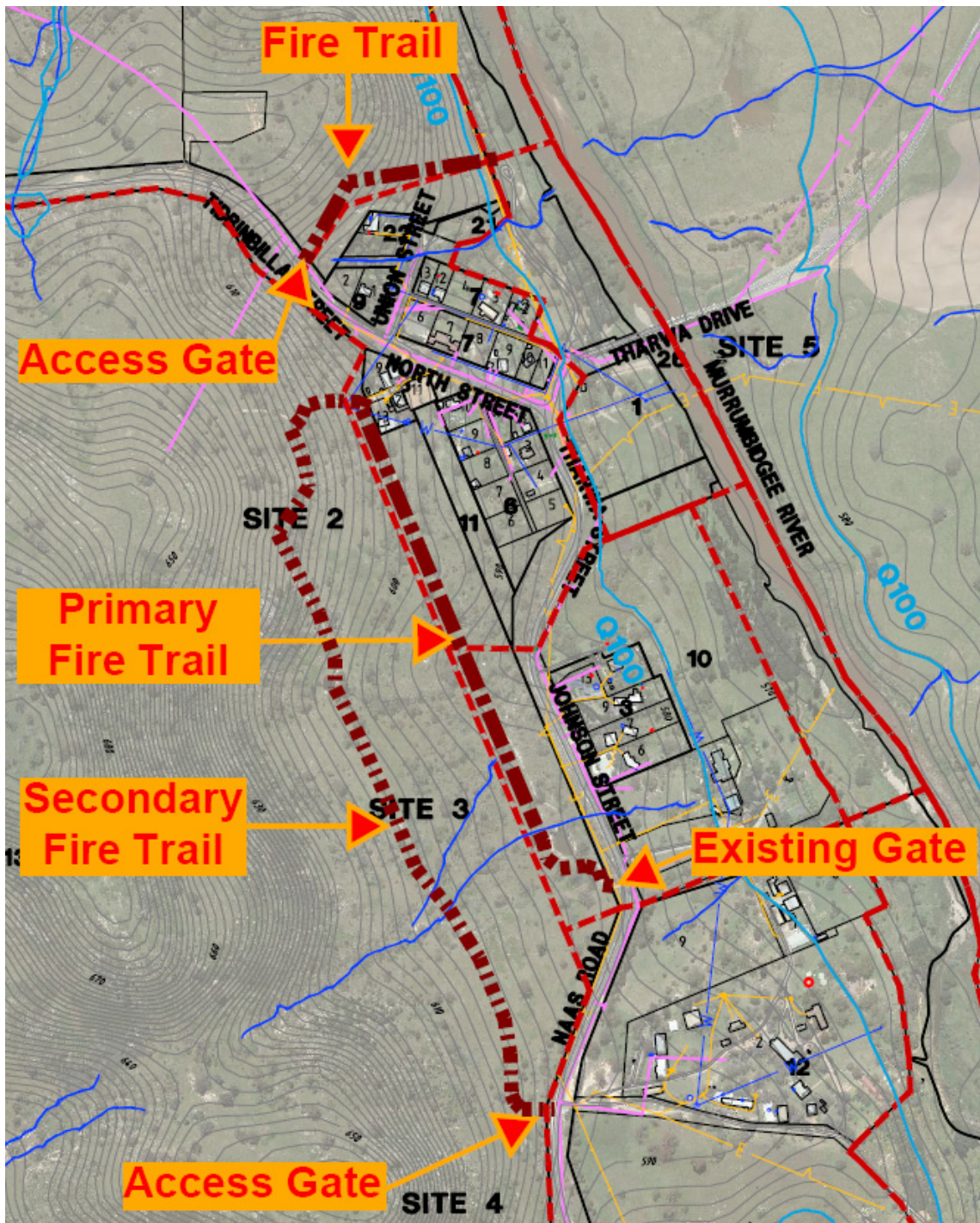


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SECTION 9 – Plan of recommended fire protection measures – Tharwa Village, ACT



Plan of recommended fire trails – Tharwa Village, ACT



REFERENCES:

- Strategic Bushfire Management Plan for the ACT – January 2009;
- The Canberra Spatial Plan – ACT Planning & Land Authority – March 2004;
- Variation 300 of the Territory Plan;
- Precinct Code – Throsby Playing Fields;
- AS/NZ - 4360 : 2004 Risk Management;
- Emergency Risk Management – Applications Guide. (EMA) 2000);
- Overall Fuel Hazard Guide – DSE. July 2010;
- Planning for Bushfire Risk Mitigation - 2009;