



Travers

bushfire & ecology

bushfire protection assessment

Residential
Independent Living
seniors housing

Lot 21 DP 100643 and Lot 3 DP 1007066
72 Glendower Street
Gilead

October 2021
(Ref: 19HOPE002)



Bushfire Protection Assessment

Residential care facility and
independent living seniors housing

Lot 21 DP 100643 and Lot 3 DP 1007066
72 Glendower Street, Gilead

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EXECUTIVE SUMMARY

A bushfire assessment has been undertaken for a proposed commercial and Seniors Living residential development project within Lot 21 DP 100643 located at 72 Glendower Street Gilead.

The existing Gilead Retirement Village, located at Lot 2 DP 1065919, supports an approved independent living seniors housing and associated support services.

The development proposes building structures within Lot 21, a new road within Lot 19 DP 100643 in the northeast and asset protection zones occurring mostly within Lot 21, Lot 2 DP 1065919 in the south and a smaller proportion on the adjacent land to the north, namely Lot 3 DP 1007066 to the north – see Figure X 1 below.

The bushfire assessment has been undertaken in accordance with the controls and principles identified within *Planning for bushfire protection 2019* published by the NSW Rural Fire Service (RFS). The RFS identifies Seniors Living development as 'special protection development' and requires a higher level of bushfire protection in order that the elderly or handicapped persons can either reside on site safely for be evacuated from the site safely.

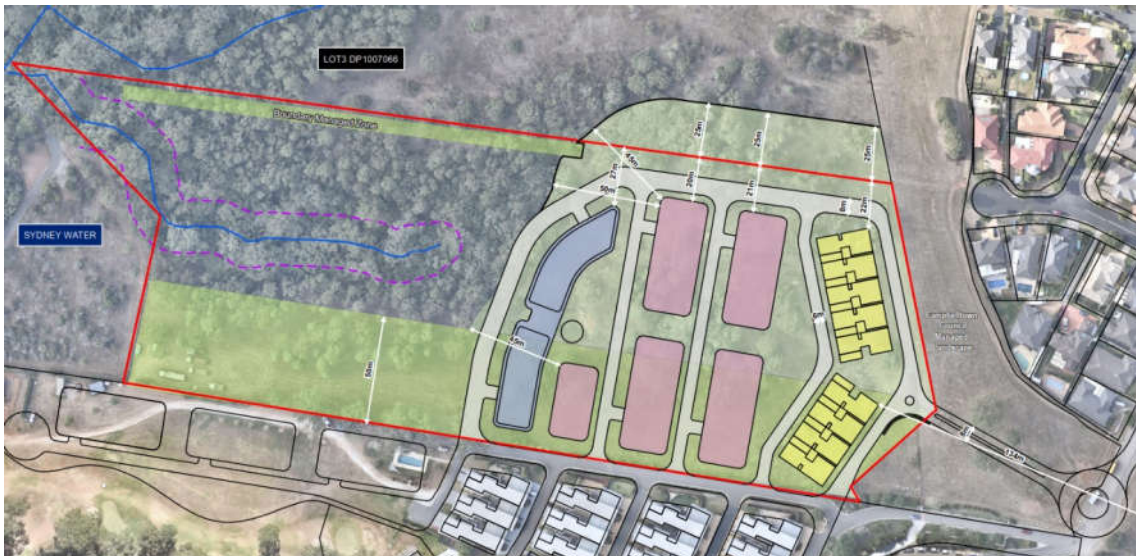


Figure X1 – Master plan showing the commercial buildings in blue and the residential buildings in pink and yellow

The assessment has been determined using an alternate solution by modelling the bushfire threat using *Flamesol* software. The relevant results indicate the proposed asset protection zones provide the required level of defendable space in order to achieve less than 10 kWm^2 impact upon the residential structures.

All other bushfire protection measures, as required by PBP 2019, have been considered in reference to the performance standards of PBP 2019 and comply with those standards.

GLOSSARY OF TERMS

APZ	asset protection zone
AS1596	<i>Australian Standard – The storage and handling of LP Gas</i>
AS2419	<i>Australian Standard – Fire hydrant installations</i>
AS3745	<i>Australian Standard – Planning for emergencies in facilities</i>
AS3959	<i>Australian Standard – Construction of buildings in bushfire-prone areas 2009</i>
BAL	bushfire attack level
BSA	bushfire safety authority
DA	development application
EEC	endangered ecological community
<i>EP&A Act</i>	<i>Environmental Planning & Assessment Act 1979</i>
FDI	fire danger index
ha	hectare
IPA	inner protection area
m	metres
NCC	<i>National Construction Code</i>
OPA	outer protection area
<i>PBP</i>	<i>Planning for Bush Fire Protection 2006</i>
<i>RF Act</i>	<i>Rural Fires Act 1997</i>
RMS	Roads and Maritime Services
RFS	NSW Rural Fire Service
SFPP	special fire protection purpose
<i>TSC Act</i>	<i>Threatened Species Conservation Act 1995</i>

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Introduction

1

A bushfire assessment has been undertaken for a proposed commercial and Seniors Living residential development project within Lot 21 DP 100643 located at 72 Glendower Street Gilead.

The existing Gilead Retirement Village, located at Lot 2 DP 1065919, supports an approved independent living seniors housing and associated support services.

The development proposes building structures within Lot 21, a new road within Lot 19 DP 100643 in the northeast and asset protection zones occurring mostly within Lot 21, Lot 2 DP 1065919 in the south and a smaller proportion on the adjacent land to the north, namely Lot 3 DP 1007066 to the north – see Figure 1.3 below.

The bushfire assessment has been undertaken in accordance with the controls and principles identified within *Planning for bushfire protection 2019* published by the NSW Rural Fire Service (RFS). The RFS identifies Seniors Living development as 'special protection development' and requires a higher level of bushfire protection in order that the elderly or handicapped persons can either reside on site safely for be evacuated from the site safely.

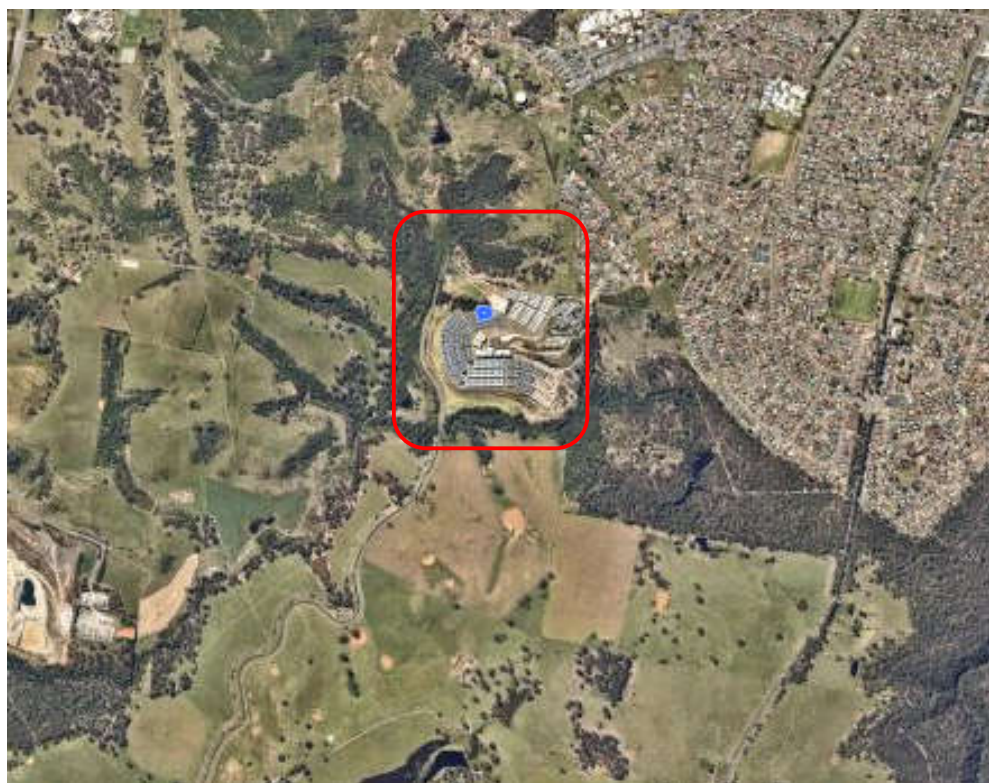


Figure 1.1 - Location plan (*Nearmaps*)

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- respond to the matters raised by the RFS in early 2020
- review the bushfire threat to the landscape
- undertake a bushfire attack assessment in accordance with *PBP*
- provide advice on mitigation measures, including the provision of APZs, construction standards and other specific fire management issues
- review the potential to carry out hazard management over the landscape.



Figure 1.2 – Location plan of affected allotments

1.2 Project synopsis

The development proposal is a master plan approach to facilitate the;

1. Development of Independent Living Units within the existing Gilead Retirement Village.
2. Construction of a new road entry that resolves local traffic issues.
3. Create a conservation zone on the retained vegetation with Lot 21.

The development is a combination of commercial and residential – see Figure 1.3 where the commercial is shown in blue colour and the residential IPU's are shown in a pink colour and the residential units are shown in a yellow colour. The development will occur within Lot 21 whilst

Lot 3 to the north will provide a proportion of the asset protection as will Lot 2 DP 1065919 in the south via the existing development – see Figure 1.3.

The existing Gilead Retirement Village, located at Lot 2 DP 1065919, supports an approved independent living seniors housing and associated support services. The landscape within Lot 2 has been mostly cleared arising from past grazing practices including roads and other allied structures. The land within Lot 21 has been previously cleared and is in a revegetation phase. Similarly, Lot 3 was previously cleared and is in a revegetation phase.

It is intended to retain the majority of the vegetation within Lot 21 as conservation land subject to a plan of management and create a similar conservation zone within Lot 3 in response to the loss of trees for the proposed APZ in Lot 3.

Land to the north is being secured via a long term lease. The Applicant is aware that the RFS will require any lease to be fully descriptive of its intentions for ongoing fuel management, funding and obligations. Schedule 1 shows the proposed development and bushfire protection measures, including APZs at a larger scale than Figure 1.3.

Land to the east within Lot 19 is owned and managed by Campbelltown City Council and is managed to an APZ standard to protect the urban landscape to the immediate east.

Land within Lot 21 has an existing 50m wide APZ and can be seen below in Figure 1.3 as a darker green above the red southern boundary of Lot 21. This was approved by Council and the RFS in 2006.

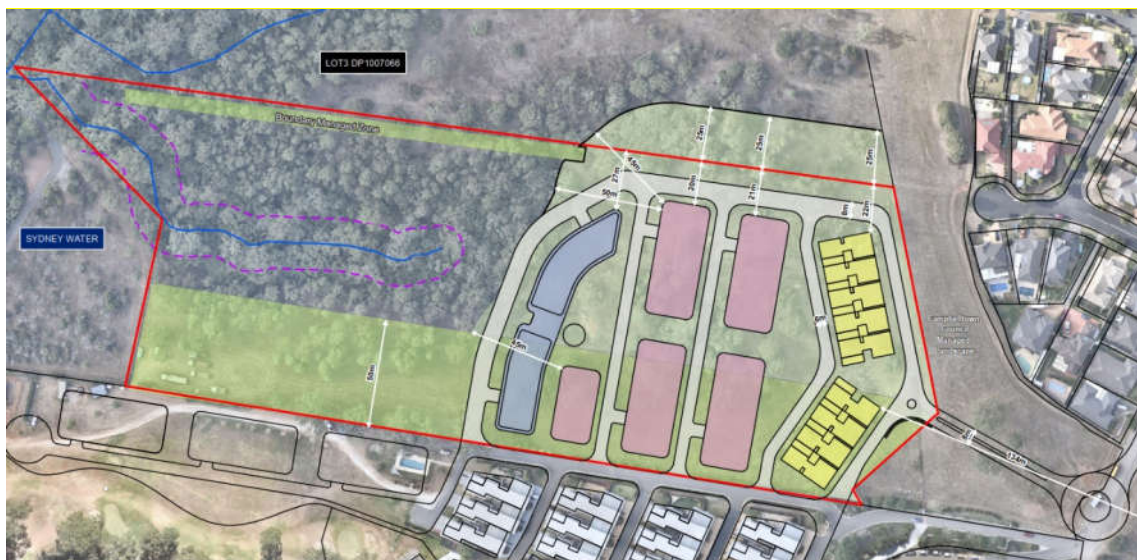


Figure 1.3 – development footprint and the new asset protection zone proposed for Lot 21 (*David Benson Architecture*)

1.3 Information collation

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Site design plans prepared by *Benson McCormack Architecture* dated 28th August 2020
- Survey 'gradient long sections' prepared by surveyors *JMD & Associates* (October 2020)
- Tree survey prepared by surveyors *JMD & Associates* (July 2020)
- Fluvial Geomorphology report by *Strategic Environmental & Engineering Consulting* (SEEC) Pty Ltd (July 2020)
- Koala Assessment report by Biolink (June 2021)
- Campbelltown Local Environmental Plan (2011)
- *NearMap* aerial photography (2020)
- Topographical data DLPI of NSW 1:25,000
- Australian Standard *Construction of buildings in bushfire-prone areas* (AS3959)
- *Planning for Bush Fire Protection 2019 (PBP)* (RFS).

Inspections of the proposed development site and surrounds were undertaken by John Travers on many occasions between 2005 and August 2020 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use.

The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

1.4 Site description

The landscape within Lot 21 and Lot 3 is composed of native vegetation over the majority of the western portion and a cleared grass landscape with clumps of trees over the eastern portion – see Figure 1.2 above.

The topography of both lots is varying between mostly undulating and relatively steep within the development envelope proposed for the Independent Living Units. The gully will be filled with fill material sourced from the existing development infrastructure works occurring to the south within Lot 2.

Detailed survey has been undertaken by the project surveyor *JMD & Associates* based on the needs of the bushfire assessment. This has included;

- Detailed pick up and numbering of all trees within the proposed APZ.
- Detailed contour survey with on-ground techniques not using Lidar.
- Preparation of survey long sections to derive correct slope accuracy.

1.5 Legislation and planning instruments

1.5.1 Environmental Planning and Assessment Act (EP&A Act)

The proposed development is located on land mapped by Campbelltown City Council as being bushfire prone – see Figure 1.4.

This type of development triggers a formal assessment by Council in respect of the RFS policy entitled *Planning for Bush Fire Protection 2019 (PBP)*.

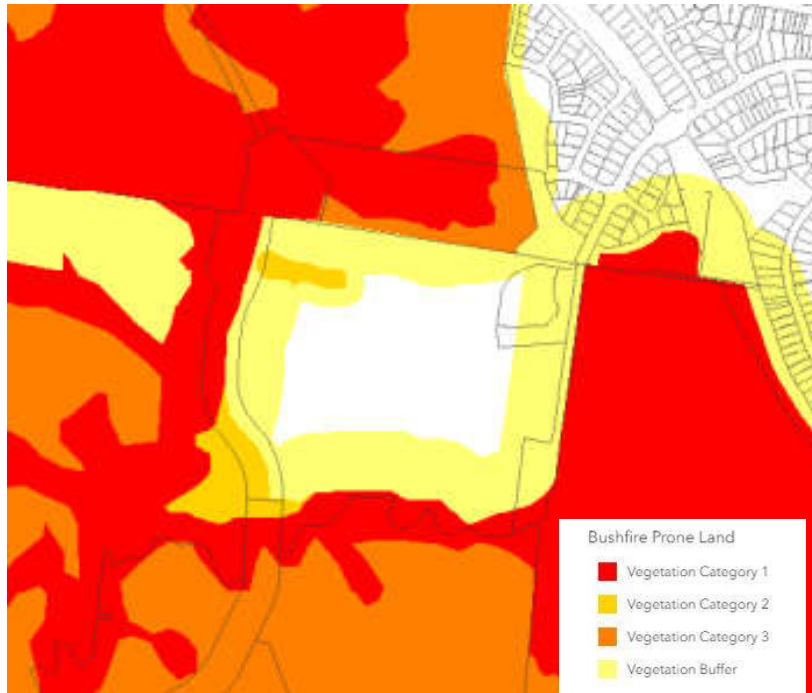


Figure 1.4 – Bushfire prone land map (January 2021)

1.5.2 Rural Fires Act 1997 (RF Act)

This type of development is an integrated development under Section 4.46 of the *Environmental Planning & Assessment Act*.

Section 100B of the *Rural Fires Act 1007 (RF Act)* states that the Commissioner is required to issue a BSA for a special fire protection purpose (SFPP) development when it occurs on bushfire prone land.

1.5.3 Planning for Bush Fire Protection 2019 (PBP)

Bushfire protection planning requires the consideration of the RFS planning document entitled *PBP*. *PBP* provides planning controls for building in bushfire prone areas as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment. More specifically, the aims and objectives for all development located on bushfire prone land should:

1. *afford buildings and their occupants protection from exposure to a bush fire;*
2. *provide for a defensible space to be located around buildings;*
3. *provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;*

4. *ensure that appropriate operational access and egress for emergency service personnel and occupants is available;*
5. *provide for ongoing management and maintenance of BPMs; and*
6. *ensure that utility services are adequate to meet the needs of firefighters.*

As the aged care development is a type of development regarded by the RFS as a SFPP development, PBP requires additional objectives to be considered. These include the need to:

7. *minimise levels of radiant heat, localised smoke and ember attack through increased APZ, building design and siting;*
8. *provide an appropriate operational environment for emergency service personnel during firefighting and emergency management;*
9. *ensure the capacity of existing infrastructure (such as roads and utilities) can accommodate the increase in demand during emergencies as a result of the development; and*
10. *ensure emergency evacuation procedures and management which provides for the special characteristics and needs of occupants.*
11. *The nature of SFPP developments means that occupants may be more vulnerable to bushfire attack for because they may;*
 - *they may be less aware in relation to bush fire impacts.*
 - *they may have reduced capacity to evaluate risk and respond adequately to the bush fire threat.*
 - *they may present operational difficulties for evacuation and or management.*
 - *they may be more vulnerable to stress and anxiety arising from bush fire threat and smoke.*
 - *there may be significant communication barriers.*
 - *supervision during a bush fire may be difficult; and*
 - *they may be unfamiliar with the area.*

In addition, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas. The proposal has been assessed in compliance with the following measures:

- *asset protection zones*
- *building construction and design*
- *access arrangements*
- *water supply and utilities*
- *landscaping, and*
- *emergency management arrangements.*

1.5.4 National Construction Code (NCC) and the Australian Standard AS3959 Construction of buildings in bushfire-prone areas 2009 (AS3959)

The *NCC* outlines objectives, functional statements, performance requirements and deemed to satisfy provisions. In NSW, construction in bushfire prone areas applies to Classes 2, 3, 4 and 9b buildings or a Class 10a associated with Classes 2, 3, 4 & 9b buildings. The construction manual for the deemed to satisfy requirements is the *AS3959*.

1.6 Environmental and cultural constraints

Native vegetation within the study area is commensurate with Cumberland Plain Woodland which is listed within the NSW *BC Act* (2016) as a Critically Endangered Ecological Community.

It is also commensurate with Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest which is also listed within the Commonwealth *EPBC Act* (1999) as a Critically Endangered Ecological Community.

Ecological reports have been prepared inclusive of;

- Ecological assessment (Bdar) by *Hayes Environmental* in June 2021
- Koala Assessment by *Biolink* in June 2021
- Biodiversity Constraints Assessment by *Travers bushfire & ecology* in 2020.



Bushfire Threat Assessment

2

To assess the bushfire threat and to determine the required width of an APZ for a development, a review of the elements that comprise the overall threat needs to be completed. *PBP* provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack.

These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuels

PBP guidelines require that bushfire hazards should be calculated for a distance of at least 140m from a proposed building envelope or a property boundary.



Figure 2.1 – Aerial appraisal of hazards (source: NearMap)

The RFS also requires that the hazardous vegetation be identified correctly when considering using an alternative solution and in that regard the hazardous vegetation to the west and south

is classified by OEH as PCT 850 *Grey Box Forest Red Gum woodland on Shale of the southern Cumberland Plain, Sydney Basin Bioregion - Cumberland Plain Woodland*.

Ocean Shores to Desert Dunes (David Keith, 2004) at (Pp 86) advises this community is a *Coastal Valley Grassy Woodland* formation.

The RFS comprehensive fuel descriptor publication (*Comprehensive vegetation fuel loads*) advise the fuels of that community (*Coastal Valley GW*) equate to 10.0 / 18.07 tonnes per hectare.

The tree survey undertaken by the surveyors reveal the trees density is low and comprised, predominantly of saplings (see Figure 2.2) amongst a more dense array of the tall bushy weed African Olive (small tree). This had infested the CPW assemblage and changed its structural formation. The African Olive is now being removed by a specialist bush regeneration firm *Toolijooa*.

Arising from the fact that the vegetation community is in an early regeneration phase formation we have felt uncomfortable about using that vegetation description so we have assigned a higher fuel load of 14 / 24.97 t/ha based on the forest assemblage of *Cumberland dry sclerophyll forest* due to its similar constituent tree species being Forest Red Gum and their occurrence on occasional shale-gravel soils – see Pp 126/127 of *Ocean Shores to Desert Dunes* (David Keith, 2004). This community represents a similar low surface fuel structure equivalent to the natural grassy woodland.

2.2 Effective slope

The slope gradient of the hazard vegetation is assessed for a distance of up to 100m. The slope that is best determined as effecting the likely behaviour is the effective slope. A mean average slope may not in all cases provide sufficient information such that an appropriate bushfire behaviour assessment can be determined. To determine the effective slope that could impact the commercial and/or residential structures it was necessary to seek several long sections from the surveyor in order to understand slope characteristics.

Figure 2.2 below indicates the complexity of the contour lines and the variety of elevations and aspects that can have a distinct bearing on determining the bushfire impact.

It was therefore found that four (4) long sections were required to be prepared by the surveyor – see Figure/s 2.3 - 2.6. A fifth long section was derived from *Nearmaps* elevation showing the north south slope gradient – see Figure 2.7.

Figure 2.3 indicates the location of the sections and the general pattern of contours that affect those long sections.

- Figure 2.4 depicts the long section gradient for Long Section 1.
- Figure 2.5 depicts the long section gradient for Long Section 2.
- Figure 2.6 depicts the long section gradient for Long Section 3.
- Figure 2.7 depicts the long section gradient for Long Section 4.

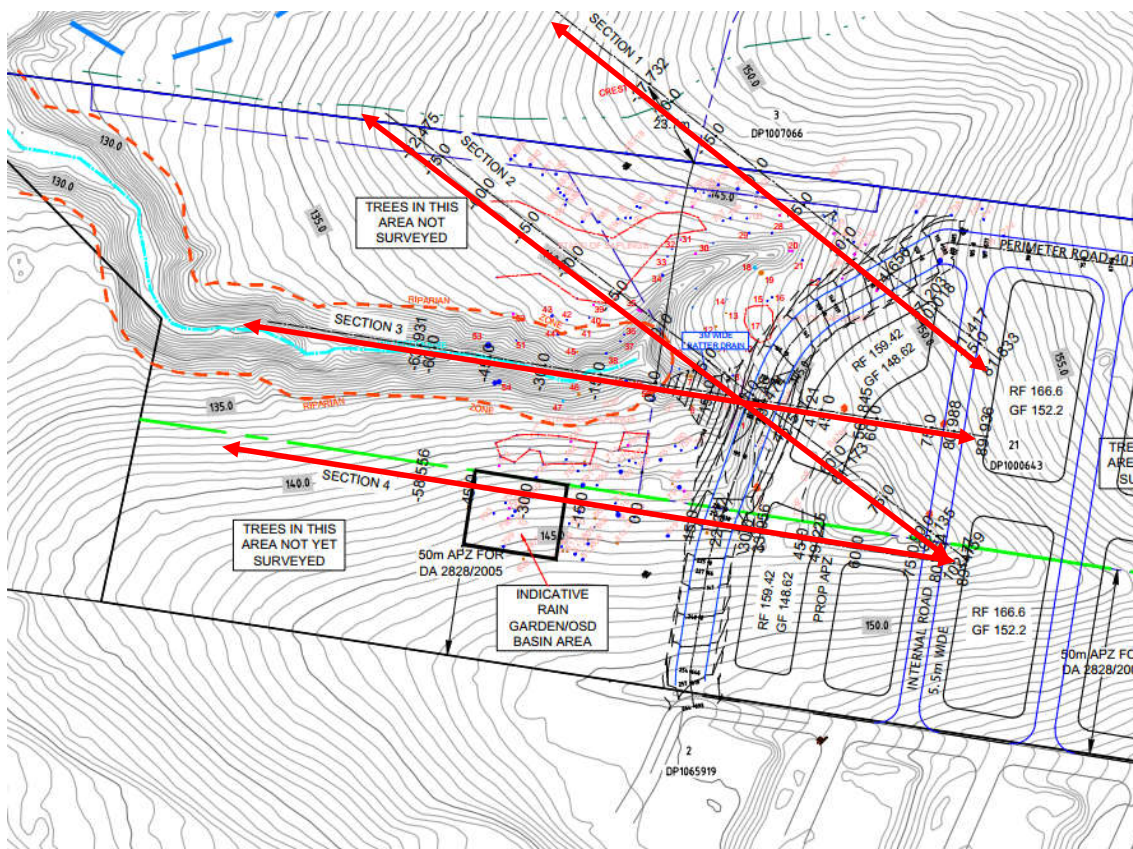
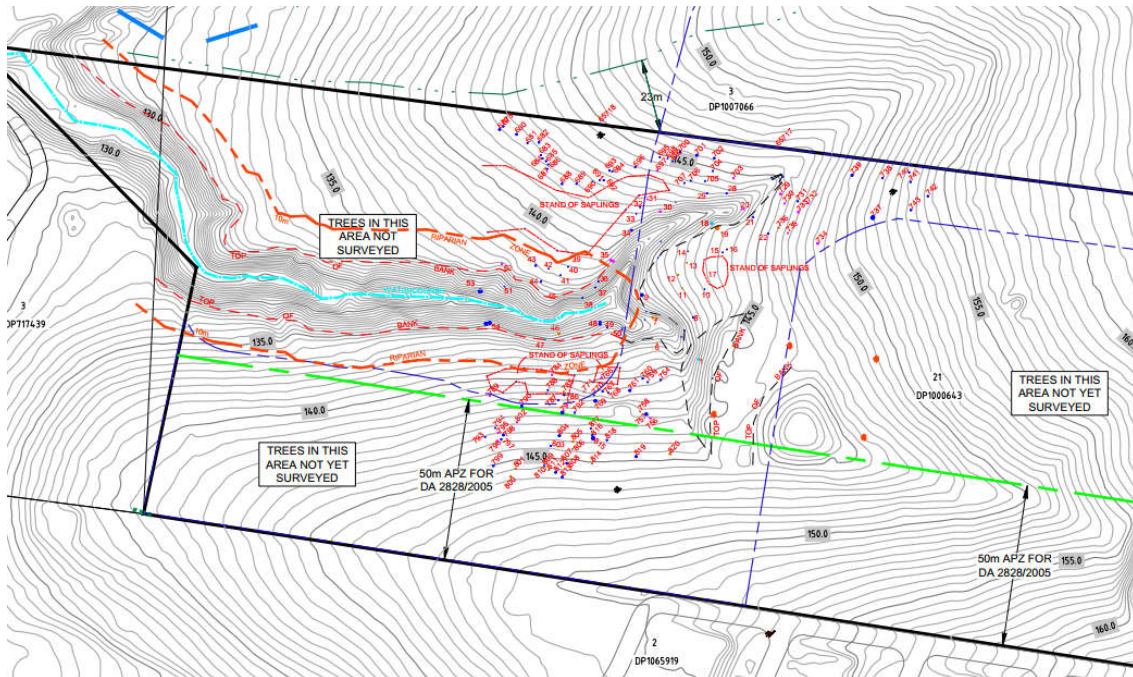


Figure 2.3 – Location of the four (4) long sections from JMD survey plan (October 2020)



Figure 2.4 – Long Section no 1

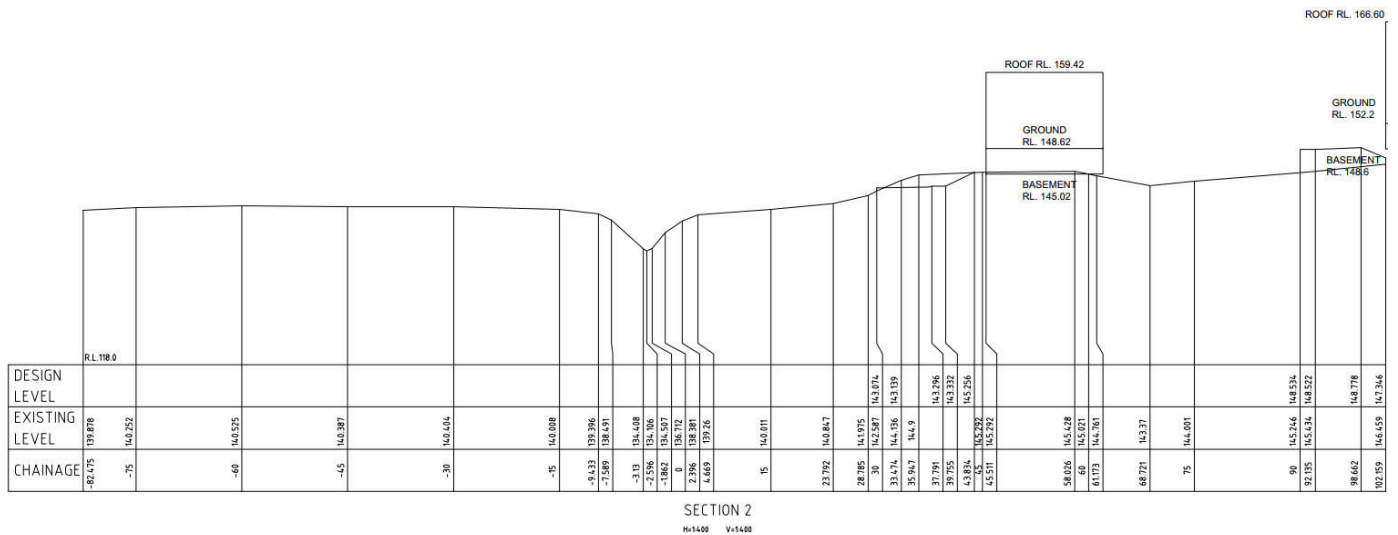


Figure 2.5 – Long Section no 2

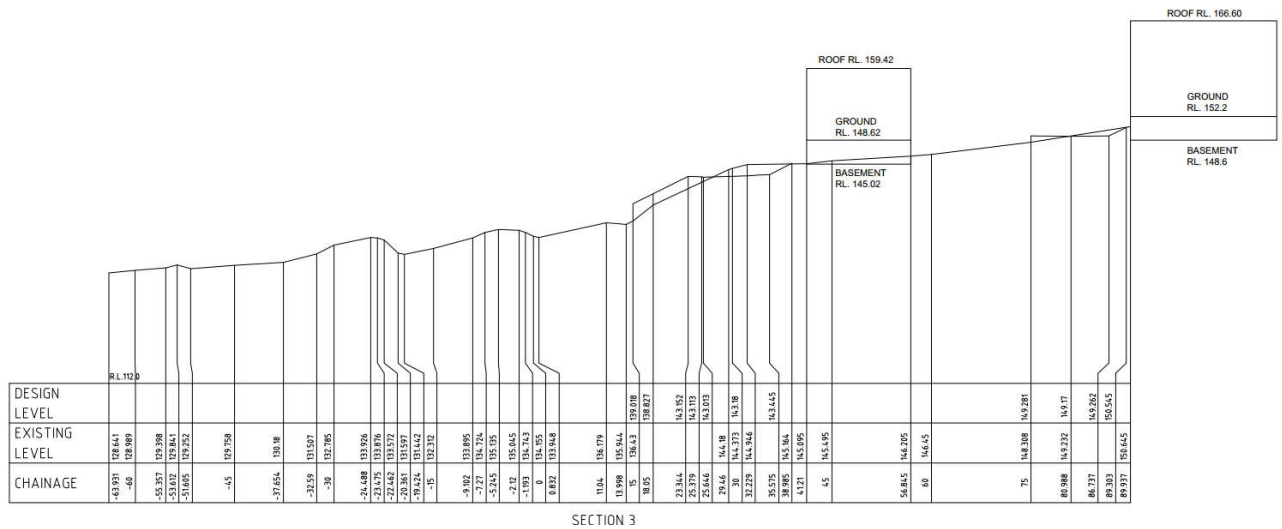


Figure 2.6 – Long Section no 3

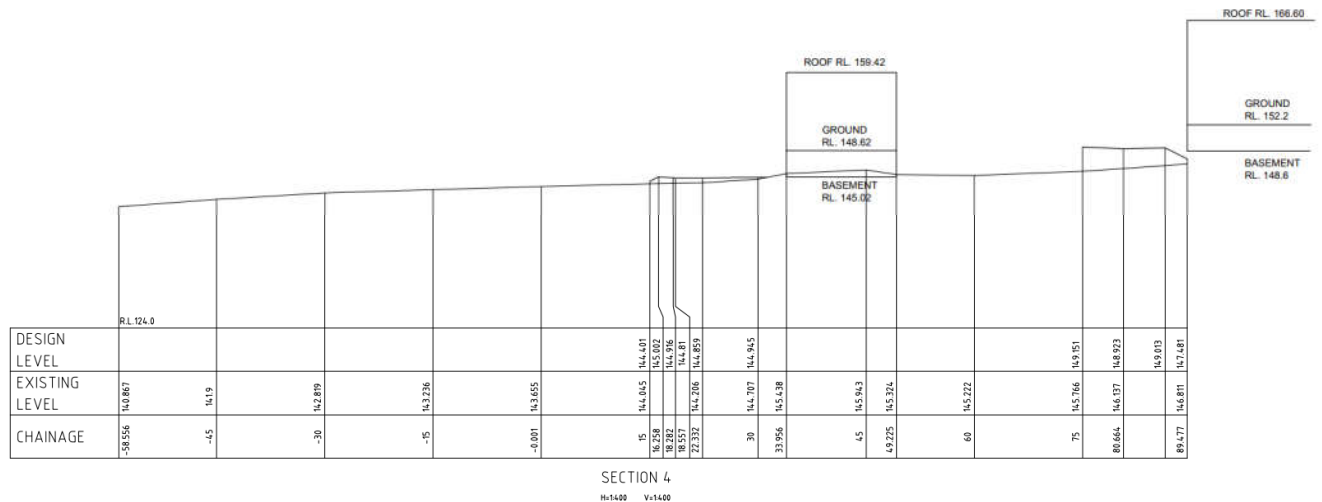


Figure 2.7 – Long Section no 4

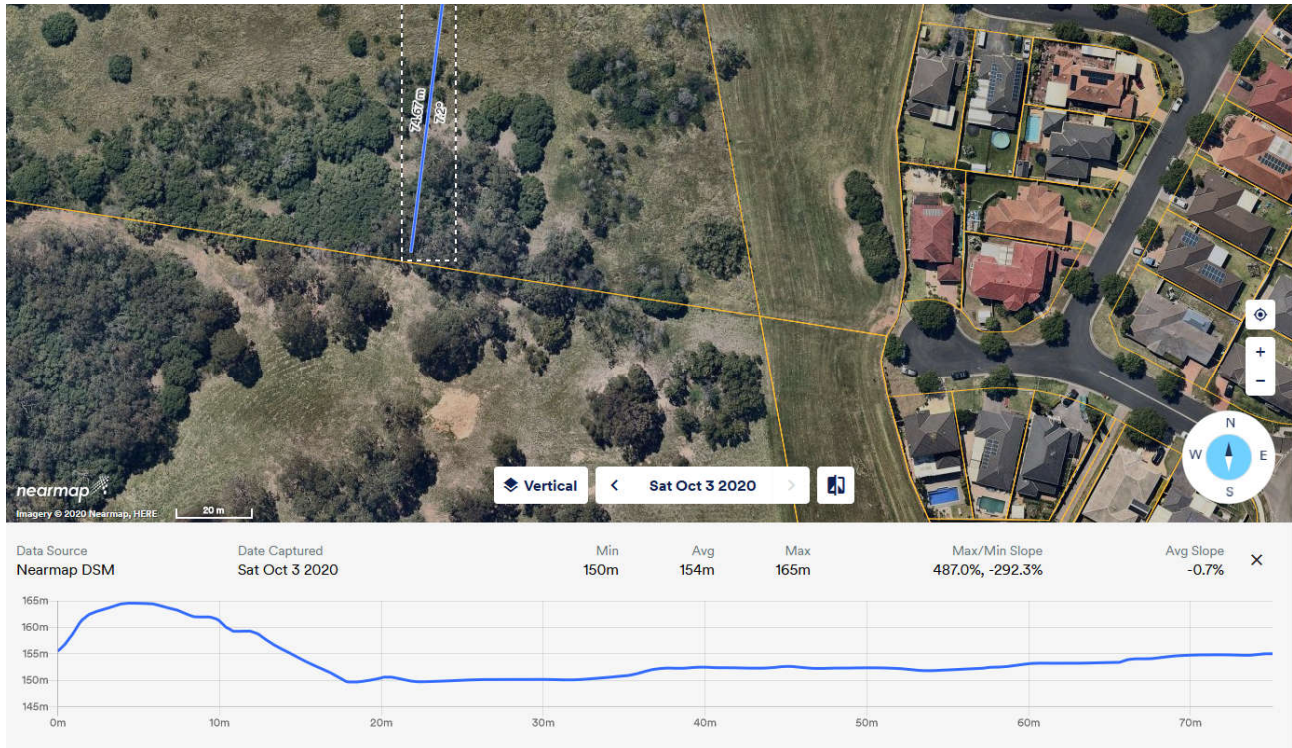


Figure 2.8 – Long Section no 5 for North/South line (north of Lot 21) Source: Nearmaps Oct 2020

Table 2.1 - Slope gradient of the Long Sections

Long Section	Length of section (m)	Height differences in section (m)	Slope gradient (% / deg)
1	36.732	146.93 - 144.02 = 2.910	-7.92 % / -4.53 deg upslope
2	82.475	139.878-136.712 = 3.158	-3.83 % / -2.19 deg upslope
3	63.931	128.641-134.155 = 5.514	8.62 % / 4.93 deg downslope
4	58.556	140.867-143.65 = 2.980	5.09 % / 2.91 deg downslope
5	74.67	155-155 = 0	-0.07% / -0.037 deg upslope

2.3 Bushfire attack assessment

A fire danger index (FDI) of 100 has been used to calculate bushfire behaviour on the site based on its location within the Greater Sydney region. Table 2.3 provides a summary of the bushfire attack assessment and the minimum required APZs (i.e. to ensure radiant heat <10 kWm^2).

The bushfire attack assessment has used an alternative solution approach as provided by AS3959 Method 2 and PBP 2019 (Section A1.8) and calculated using *Flamesol* radiant heat shield software to determine the required height for the western and northern aspects.

- The western radiant heat shield is a commercial building – see blue coloured structures in Figure 2.9.
- The northern radiant heat shield is a 2.5m high metal fence – see location in Figure 2.9.

Table 2.2 – Conversion of Long Section location to aspect (see Figure 2.3) and the relevant Table number below between pages 20-24

Section	Aspect	Slope gradient (deg)	See Table #
Section 1	North west	4.53 deg upslope	2.4
Section 2	North west	2.19 deg upslope	2.5
Section 3	West	4.93 deg downslope	2.6
Section 4	West	2.91 deg downslope	2.7
Section 5	North	0.037 deg upslope	2.8

Table 2.3 – Bushfire attack level

Aspect	Vegetation formation	APZ (in metres)	Radiant heat (in k/Wm^2)	Computer output
Northwest 4.53 deg upslope	Forest	45	6.99	Table 2.4
Northwest 2.19 deg upslope	Forest	40	7.17	Table 2.5
West 4.93 deg downslope	Forest	50	9.48	Table 2.6
West 2.91 deg downslope	Forest	45	8.84	Table 2.7
North 0.037 degrees upslope	Urban	45	10.01	Table 2.8
East	Managed grass for 40m then urban dwellings	100	Nil	N/A

Note; 20-21m of the 45m Northsouth APZ is located within Lot 21 whilst 25m of the APZ is located in the adjoining land (Lot 3). A lease is being sought from the landowner.



Figure 2.9 – location of the 2.5m high radiant heat barrier (black line that forms the northern edge of the green APZ) and the SPD structures (in pink & yellow) - see Schedule 1 for larger scale after page 34

Table 2.4 – Section 1, North western aspect modelled output

Radiant heat flux affection upon SPD structures as shown in Figure 2.3 based on 57m APZ and utilising a 2.5m radiant heat wall provide by the commercial building. Hazard slope gradient of -4.53° and site slope of 7°.



Calculated October 29, 2020, 8:05 am (RHBc v.1.3)

Section 1 - Northwestern aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	1.22 km/h
Vegetation classification	Forest	Flame length	10.98 m
Surface fuel load	14 t/ha	Flame angle	88 °
Overall fuel load	24.97 t/ha	Panel height	10.97 m
Vegetation height	n/a	Elevation of receiver	0 m
Effective slope	-4.53 °	Effective barrier height	2.5 m
Site slope	7 °	Fire intensity	15,855 kW/m
Distance to vegetation	45 m	Transmissivity	0.785
Flame width	100 m	Viewfactor	0.1029
Windspeed	n/a	Radiant heat flux	9.039999999999999 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0232
Flame temperature	1,200 K	Adjusted viewfactor	0.07969999999999999
Actual barrier height	2.5 m	Adjusted radiant heat flux	6.99 kW/m²
		Bushfire Attack Level	BAL-12.5

Rate of Spread - McArthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Table 2.5 – Section 2, North western aspect modelled output

Radiant heat flux affection upon SPD structures as shown in Figure 2.3 based on 86m APZ and utilising a 2.5m radiant heat wall provide by a blade wall between two commercial buildings. Hazard slope gradient of -2.19° and site slope of 7°.



Calculated October 29, 2020, 8:13 am (RHBc v.1.3)

Section 2 – Northwestern aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	1.44 km/h
Vegetation classification	Forest	Flame length	12.38 m
Surface fuel load	14 t/ha	Flame angle	86 °
Overall fuel load	24.97 t/ha	Panel height	12.35 m
Vegetation height	n/a	Elevation of receiver	1.26 m
Effective slope	-2.19 °	Effective barrier height	5 m
Site slope	7 °	Fire intensity	18,634 kW/m
Distance to vegetation	40 m	Transmissivity	0.794
Flame width	100 m	Viewfactor	0.135
Windspeed	n/a	Radiant heat flux	11.98 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0541
Flame temperature	1,200 K	Adjusted viewfactor	0.0808
Actual barrier height	5 m	Adjusted radiant heat flux	7.17 kW/m²
		Bushfire Attack Level	BAL-12.5

Rate of Spread - McArthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Table 2.6 – Section 3, Western aspect modelled output

*Radiant heat flux affection upon SPD structures as shown in Figure 2.3
based on 74m APZ, hazard slope of 4.93° and site slope of 7°.*



Calculated October 29, 2020, 8:20 am (RHBc v.1.3)

Section 3 Western aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	2.36 km/h
Vegetation classification	Forest	Flame length	18.34 m
Surface fuel load	14 t/ha	Flame angle	82 °
Overall fuel load	24.97 t/ha	Panel height	18.16 m
Vegetation height	n/a	Elevation of receiver	2.94 m
Effective slope	4.93 °	Effective barrier height	5 m
Site slope	7 °	Fire intensity	30,455 kW/m
Distance to vegetation	50 m	Transmissivity	0.78
Flame width	100 m	Viewfactor	0.1485
Windspeed	n/a	Radiant heat flux	12.94 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0396
Flame temperature	1,200 K	Adjusted viewfactor	0.1089
Actual barrier height	5 m	Adjusted radiant heat flux	9.48 kW/m²
		Bushfire Attack Level	BAL-12.5

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Table 2.7 – Section 4, Western aspect modelled output

*Radiant heat flux affection upon SPD structures as shown in Figure 2.3
based on 40m APZ and utilising a 2.5m radiant heat wall.
Hazard slope gradient of 2.91° and site slope of 0°.*



Calculated October 29, 2020, 8:23 am (RHBC v.1.3)

Section 4 Western aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	1.95 km/h
Vegetation classification	Forest	Flame length	15.69 m
Surface fuel load	14 t/ha	Flame angle	84 °
Overall fuel load	24.97 t/ha	Panel height	15.61 m
Vegetation height	n/a	Elevation of receiver	2.28 m
Effective slope	2.19 °	Effective barrier height	5 m
Site slope	7 °	Fire intensity	25,209 kW/m
Distance to vegetation	45 m	Transmissivity	0.786
Flame width	100 m	Viewfactor	0.1466
Windspeed	n/a	Radiant heat flux	12.89 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.046
Flame temperature	1,200 K	Adjusted viewfactor	0.1006
Actual barrier height	5 m	Adjusted radiant heat flux	8.84 kW/m²
		Bushfire Attack Level	BAL-12.5

Rate of Spread - McArthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Table 2.8 – Section 5, Northern aspect modelled output

*Radiant heat flux affection upon SPD structures as shown in Figure 2.3
based on 45m APZ and utilising a 2.5m radiant heat wall.
Hazard slope gradient of -0° and site slope of -7°.*



Calculated: October 29, 2020, 7:47 am (RHBC v.1.3)

Section 5- Northern aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	1.68 km/h
Vegetation classification	Forest	Flame length	13.91 m
Surface fuel load	14 t/ha	Flame angle	72 °
Overall fuel load	24.97 t/ha	Panel height	13.23 m
Vegetation height	n/a	Elevation of receiver	12.14 m
Effective slope	0 °	Effective barrier height	2.5 m
Site slope	-7 °	Fire intensity	21,673 kW/m
Distance to vegetation	45 m	Transmissivity	0.789
Flame width	100 m	Viewfactor	0.1367
Windspeed	n/a	Radiant heat flux	12.05 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.023
Flame temperature	1,200 K	Adjusted viewfactor	0.1136
Actual barrier height	2.5 m	Adjusted radiant heat flux	10.01 kW/m²
		Bushfire Attack Level	BAL-12.5

Rate of Spread - McArthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005



Specific Protection Issues

3

3.1 Asset protection zones

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 10kW/m^2 for SFPP developments. This rating assists in determining the size of the APZ in compliance with Appendix 2 of *PBP* to provide the necessary defendable space between hazardous vegetation and a building. Table 3.1 outlines the proposal's compliance with the performance criteria for APZs.

Table 3.1 – Performance criteria for asset protection zones (*PBP* guidelines pg. 19)

Performance criteria	Acceptable solutions	Complies
<i>radiant heat levels of greater than 10kW/m^2 (calculated at 1200K) will not be experienced on any part of the building.</i>	<i>the building is provided with an APZ in accordance with Table A1.12.1 in Appendix 1</i>	Complies using the RFS approved alternative solution approach Method 2 (as outlined within AS3959) for the western and southern aspects.
<i>APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised</i>	<i>APZs are located on lands with a slope less than 18 degrees</i>	Yes
<i>APZs are managed and maintained to prevent the spread of fire to the building</i>	<i>the APZ is managed in accordance with the requirements of Appendix 4 of this document, and is wholly within the boundaries of the development site;</i>	Yes
<i>the APZ is provided in perpetuity</i>	<i>APZ are wholly within the boundaries of the development site; and other structures located within the APZ need to be located further than 6m from the refuge building</i>	Mostly yes however in regard to part of the northern APZ within Part Lot 21; and partly within Lot 3. The latter will be assured via a legal long term lease and an 88b on the title. This will in accord with S3.2.5 of PBP 2019

3.2 Building protection

Building construction will accord with BAL 12.5 of AS3959 of AS3959.

3.3 Hazard management

Hazard management will occur within Lot 3, Lot 21, Lot 2 and in Council's land to the east in accord with;

- *PBP 2019 Appendix 4 and*
- *Standards for Asset Protection Zones (RFS, 2019)*

Works will be undertaken by staff or contractors on a rotational basis in accord with a formal bushfire management plan for the whole of Lot 21 and the required portion of Lot 3 in the north.

3.4 Access

Access will comply with *PBP 2019 Table 6.8.2*.

The internal road (6m) layout provides recirculation routes from the 8m wide perimeter road – see Figure 3.1 which creates a new access and egress road through a new roundabout which then leads eastwards onto Glendower Rd.

Table 3.2 provides detail regarding vehicular access required by the RFS.

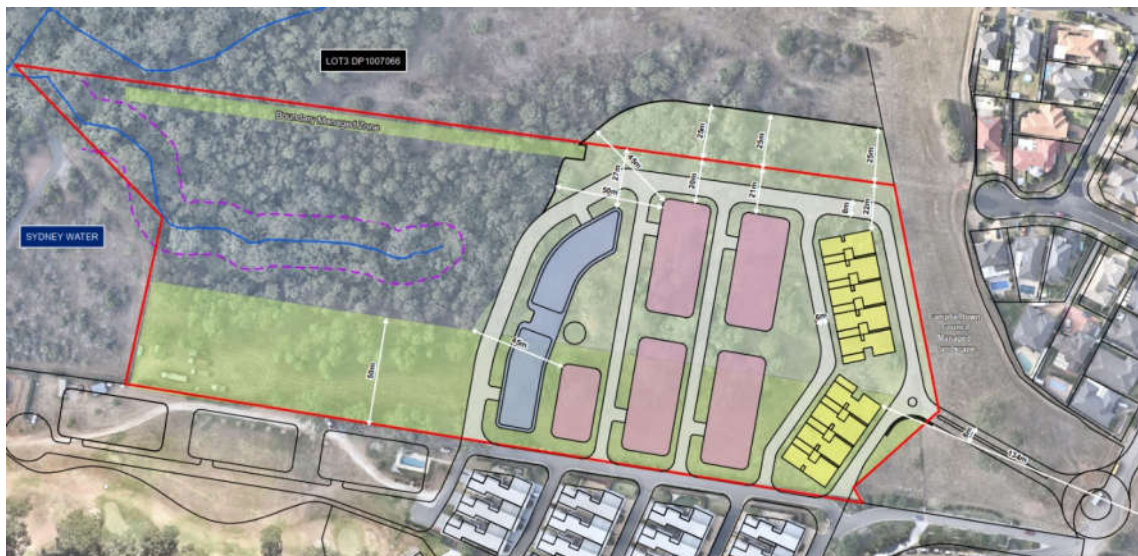


Figure 3.1 – Access design

Table 3.2 – Performance criteria for vehicular access (*PBP* guidelines pg. 57)

Intent of measures: to provide safe operational access for emergency services personnel in suppressing a bush fire, while residents are accessing or egressing an area.

Performance criteria	Acceptable solutions to RFS	Compliance comments
<i>Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation</i>	<i>SFPP access roads are two-wheel drive, all-weather roads</i>	Yes
	<i>access is provided to all structures</i>	Yes
	<i>access roads must provide suitable turning areas in accordance with Appendix 3; and</i>	Yes

Performance criteria	Acceptable solutions to RFS	Compliance comments
	<i>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.</i>	Yes
	<i>traffic management devices are constructed to not prohibit access by emergency services vehicles</i>	Yes
<i>the capacity of access roads is adequate for firefighting vehicles</i>	<i>the capacity of road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges and causeways are to clearly indicate load rating.</i>	Yes
<i>there is appropriate access to water supply</i>	<i>hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression</i>	Yes
	<i>hydrants are provided in accordance with the relevant clauses of AS2419.1:2005; and there is suitable access for a Category 1 fire appliances to within 4m of the static water supply where no reticulated supply is available</i>	Yes
<i>perimeter access roads are designed to allow safe access and egress for firefighting vehicles while occupants are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface</i>	<i>there are two-way sealed roads;</i> <i>minimum 8m carriageway width kerb to kerb;</i> <i>parking is provided outside of the carriageway width;</i> <i>hydrants are to be located clear of parking areas;</i> <i>there are through roads, and these are linked to the internal road system at an interval of no greater than 500m;</i> <i>curves of roads have a minimum inner radius of 6m;</i> <i>the maximum grade road is 15 degrees and average grade of not more than 10 degrees;</i> <i>the road crossfall does not exceed 3 degrees; and a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</i>	Yes Yes Yes Yes Yes
<i>non-perimeter access roads are designed to allow safe access and egress for firefighting vehicles while occupants are evacuating</i>	<i>minimum 5.5m carriageway width kerb to kerb;</i> <i>parking is provided outside of the carriageway width;</i> <i>hydrants are located clear of parking areas;</i> <i>there are through roads, and these are linked to the internal road system at an interval of no greater than 500m;</i> <i>curves of roads have a minimum inner radius of 6m;</i>	Yes Yes Yes

Performance criteria	Acceptable solutions to RFS	Compliance comments
	<i>the maximum grade road is 15 degrees and average grade of not more than 10 degrees;</i> <i>the road crossfall does not exceed 3 degrees;</i>	Yes
	<i>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided</i>	Yes
		Yes

3.5 Water supplies

Town reticulated water supply is available to the proposed development in the form of an underground reticulated water system. Table 3.3 outlines the proposal's compliance with the performance criteria for reticulated water supply.

Table 3.3 – Performance criteria for reticulated water supplies (PBP guidelines pg. 59)

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

Performance criteria	Acceptable solutions	Complies
<i>an adequate water supply for firefighting purposes is installed and maintained</i>	<i>reticulated water is to be provided to the development, where available; or a 10,000 litres minimum static water supply for firefighting purposes is provided for each occupied building where no reticulated water is available</i>	Yes
<i>water supplies are located at regular intervals.</i>	<i>fire hydrant spacing, design and sizing comply with the relevant clauses of AS 2419.1:2005;</i>	Yes
<i>the water supply is accessible and reliable for firefighting operations</i>	<i>hydrants are not located within any road carriageway; and</i>	Yes
	<i>reticulated water supply to SFPPs uses a ring main system for areas with perimeter roads</i>	Yes
<i>flows and pressure are appropriate</i>	<i>fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005</i>	Yes
<i>the integrity of the water supply is maintained</i>	<i>all above-ground water service pipes external to the building are metal, including and up to any taps</i>	Yes
<i>water supplies are adequate in areas where reticulated water is not available</i>	<i>a connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure;</i>	Yes
	<i>a 65mm Storz outlet with a ball valve is fitted to the outlet;</i>	Yes
	<i>ball valve and pipes are adequate for water flow and are metal;</i>	Yes

	<i>supply pipes from tank to ball valve have the same bore size to ensure flow volume;</i>	Yes
	<i>underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank;</i>	N/A
	<i>a hardened ground surface for truck access is supplied within 4m of the access hole;</i>	N/A
	<i>above-ground tanks are manufactured from concrete or metal;</i>	N/A
	<i>raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959);</i>	N/A
	<i>unobstructed access is provided at all times; tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters; and</i>	N/A
	<i>underground tanks are clearly marked</i>	N/A
	<i>tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters;</i>	Can be conditioned
	<i>all exposed water pipes external to the building are metal, including any fittings;</i>	Can be conditioned
	<i>where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; any hose and reel for firefighting connected to the pump shall be 19mm internal diameter; and fire hose reels are constructed in accordance with AS/NZS 1221:1997, and installed in accordance with the relevant clauses of AS 2441:2005</i>	N/A
		Can be conditioned

3.6 Gas

Table 3.4 outlines the required performance criteria for the proposal's gas supply.

Table 3.4 – Performance criteria for gas supplies (PBP guidelines pg. 60)

<i>Performance criteria</i>	<i>Acceptable solutions</i>	<i>Complies</i>
<i>Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings.</i>	<i>Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS1596 and the requirements of relevant authorities. Metal piping is to be used.</i>	Complies - can be made a condition of consent.
	<i>All fixed gas cylinders are to be kept clear of flammable materials and located on the non-hazard side of the development.</i>	Complies - can be made a condition of consent.

	<i>If gas cylinders are to be kept close to the building the release valves must be directed away from the building and away from any combustible material, so that they do not act as a catalyst to combustion.</i>	Complies - can be made a condition of consent.
	<i>Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.</i>	Complies - can be made a condition of consent.

3.7 Electricity

Table 3.5 outlines the required performance criteria for the proposal's gas supply.

Table 3.5 – Performance criteria for gas supplies (PBP guidelines pg. 60)

Performance criteria	Acceptable solutions	Complies
<i>location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.</i>	<p><i>where practicable, electrical transmission lines are underground;</i></p> <p><i>where overhead, electrical transmission lines are proposed as follow:</i></p> <ul style="list-style-type: none"> <i>lines are installed with short pole spacing (30m),</i> <i>unless crossing gullies, gorges or riparian areas;</i> <p><i>and</i></p> <p><i>no part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines.</i></p>	<p>Yes</p> <p>Yes</p>
<i>location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings</i>	<p><i>reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used;</i></p> <p><i>all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side;</i></p> <p><i>connections to and from gas cylinders are metal;</i></p> <p><i>if gas cylinders need to be kept close to the building, safety valves are directed away from the building and at least 2m away not act as a catalyst to combustion;</i></p> <p><i>polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used;</i></p> <p><i>above-ground gas service pipes external to the building are metal, including and up to any outlets from any combustible material, so they do</i></p>	Can be made a condition of consent

3.8 Emergency and evacuation planning

Table 3.6 outlines the required performance criteria for the proposal's emergency procedures

Table 3.6 – Performance criteria for emergency and evacuation planning
(PBP guidelines pg.60)

Performance criteria	Acceptable solutions	Complies
<i>A Bush Fire Emergency Management and Evacuation Plan is prepared</i>	<p><i>Bush Fire Emergency Management and Evacuation Plan is prepared consistent with the:</i></p> <p><i>The NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan;</i></p> <p><i>NSW RFS Schools Program Guide;</i></p> <p><i>Australian Standard AS 3745:2010 Planning for emergencies in facilities; and</i></p> <p><i>Australian Standard AS 4083:2010 Planning for emergencies – Health care facilities (where applicable).</i></p> <p><i>the Bush Fire Emergency Management and Evacuation Plan should include planning for the early relocation of occupants.</i></p> <p><i>Note: A copy of the Bush Fire Emergency Management and Evacuation Plan should be provided to the Local Emergency Management Committee for its information prior to occupation of the development.</i></p>	<i>can be made a condition of consent.</i>
<i>appropriate and adequate management arrangements are established for consultation and implementation of the Bush Fire Emergency Management and Evacuation Plan</i>	<p><i>an Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and staff in developing and implementing an Emergency Procedures Manual; and</i></p> <p><i>detailed plans of all emergency assembly areas including on site and off-site arrangements as stated in AS 3745:2010 are clearly displayed, and an annually emergency evacuation is conducted</i></p>	<i>can be made a condition of consent.</i>



Conclusion & Recommendations

4

4.1 Conclusion

A bushfire assessment has been undertaken for the development project within Lot 21 in accordance with the controls and principles identified within *Planning for bushfire protection 2019*.

The development is a combination of commercial and residential structures as the purpose of providing a residential land use which the RFS identifies a special protection development and for that reason requires a higher level of protection in order that the frail or elderly or handicapped persons can either reside on site safely or be evacuated from the site safely.

The assessment has been determined using an alternate solution by modelling the bushfire threat using *Flamesol* software. The relevant results, as shown on Table 1 herein, indicate the proposed asset protection zones provide the required level of defendable space in order to achieve less than 10 kWm^2 impact upon the residential structures. All other bushfire protection measures, as required by PBP 2019, have been considered in reference to the performance standards of PBP 2019 and fully comply with those standards.

The following recommendations should be made conditions of development consent.

4.2 Recommendations

Recommendation 1 – At the commencement of building works and in perpetuity the APZ, as depicted in Schedule 1 – Bushfire Protection Measures prepared by *Travers bushfire & ecology* ref: 19HOPE002, dated 29/10/20, shall be managed as an inner protection area (IPA) as outlined within Appendix 4 of *Planning for Bush Fire Protection 2019*.

Recommendation 2 – The provision of water, electricity and gas shall comply with Section 6.8.3 of *PBP 2019*.

Recommendation 3 – The proposed perimeter access road on the northern and western aspect shall be constructed to 8.0m in width as per PBP 2019. Parking space, if required, would be additional.

Recommendation 4 – Internal road access can be constructed to 5.5m wide as provided by PBP 2019. Parking spaces, should they be required on the roadway, would require additional road width.

Recommendation 5 – A Bush Fire Emergency Management and Evacuation Plan shall be prepared for the construction buildings consistent with *Development Planning - A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan December 2014* and *Australian Standard AS3745 2010 Planning for Emergencies in Facilities*.

Recommendation 6 – The proposed buildings shall comply with Sections 3 and 5 (BAL 12.5) *Australian Standard AS3959-2018 Construction of buildings in bush fire-prone areas* or NASH

Standard (1.7.14 updated) *National Standard Steel Framed Construction in Bushfire Areas – 2014* as appropriate and section A3.7 Addendum Appendix 3 of *Planning for Bush Fire Protection 2019*.

Recommendation 7 – A minimum 2.5m high radiant heat shield made of non-combustible materials shall be constructed along the northern property to the physical extent as shown on Schedule 1 of the *Travers bushfire & ecology* plan dated 30 September 2020.

REFERENCES

- Australian Building Codes Board (2019) – *National Construction Code Class 1 and Class 10 Buildings Housing Provisions Volume 2*
- Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research
- Councils of Standards Australia AS3959 (2009) – *Australian Standard Construction of buildings in bushfire-prone areas*
- Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change
- Rural Fire Service (2006) - *Planning for bushfire protection – a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service
- Rural Fire Service (2006) - Bushfire Attack Software on RFS web site
- Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack*. RFS Development Control Service



Plan of Bushfire Protection Measures

S1



DISCLAIMER - CAD (REF:1901A MASTER PLAN - OPTION 1.dwg received non geo-referenced. Verification required prior to commencement of works.)

Legend

- Lot boundary (source: CAD)
- Potential development area (20,509m²)
- Contour 1m (source: LiDAR)
- Creekline (source: LPI & CAD)
- 10-12m riparian buffer

- 2.5m high Radiant Heat barrier
- Indicative Asset Protection Zone (APZ)**
- APZ
- Approved APZ (2006)

Proposed development

- Independant Living Units (SFPP)
- High rise residential
- Commerical
- Internal road network

Aerial source: Nearmap

0 20 40 m

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

PROJECT & MXD REFERENCE

Glendown St, Gilead
19HOP02_BF001

DATE & ISSUE NUMBER

25/01/2021
Issue 1

SCALE & COORDINATE SYSTEM

1:1,500 @A3
GDA 1994 MGA Zone 56

TITLE

Proposed Development & APZ Area Lot 21

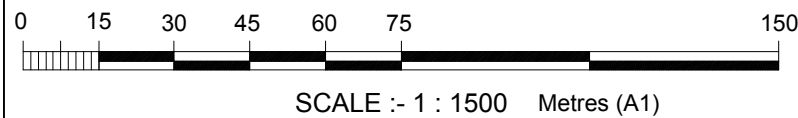
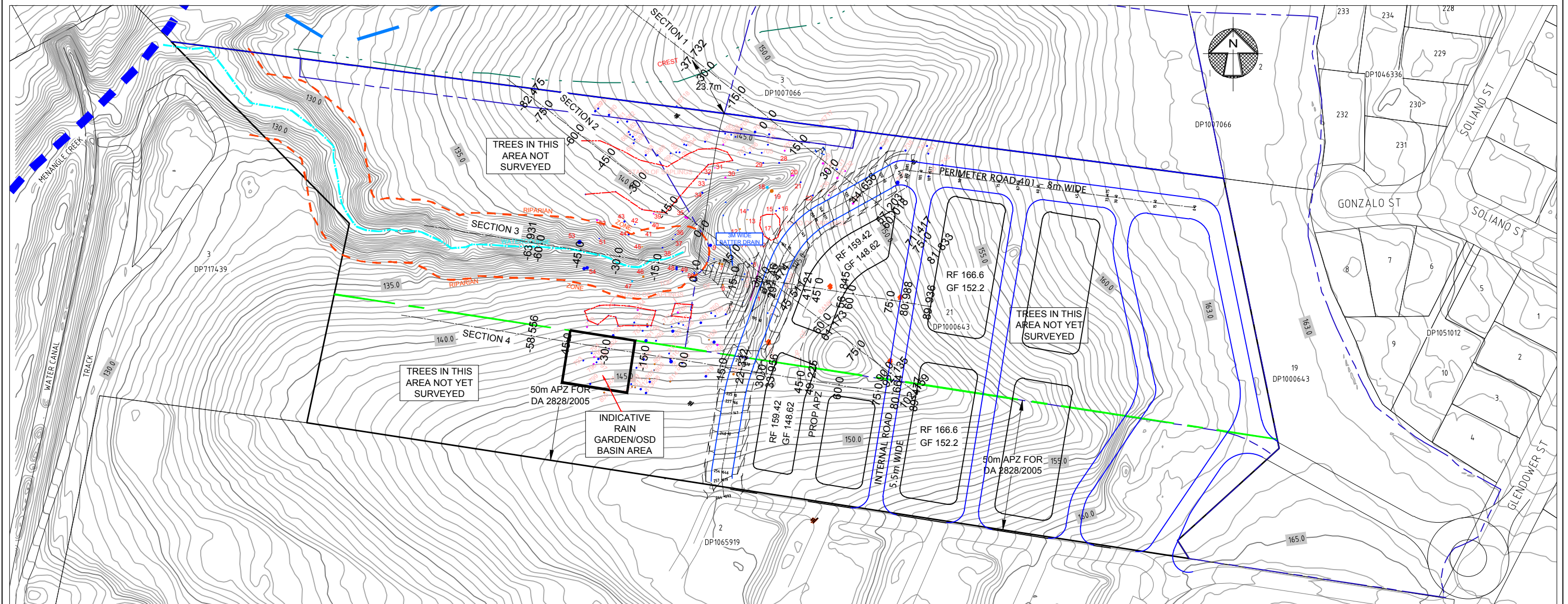
www.traverseecology.com.au

Document Path: N:\GIS STORAGE\N Drive\19HOP02_GlendownSt_Gilead\MXD\19HOP02_BF001.mxd



Surveyors long sections

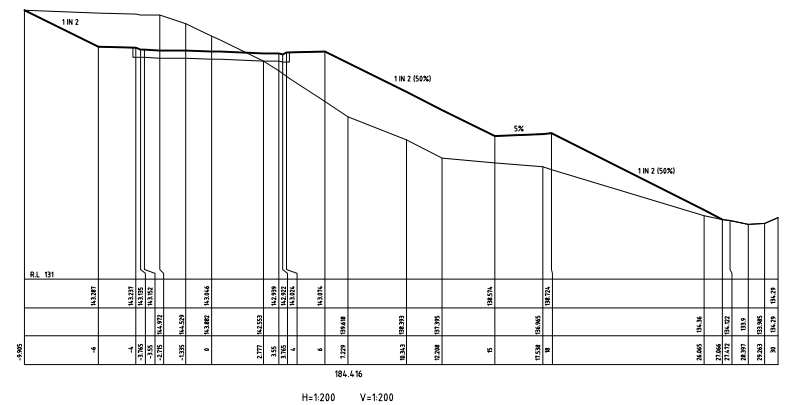
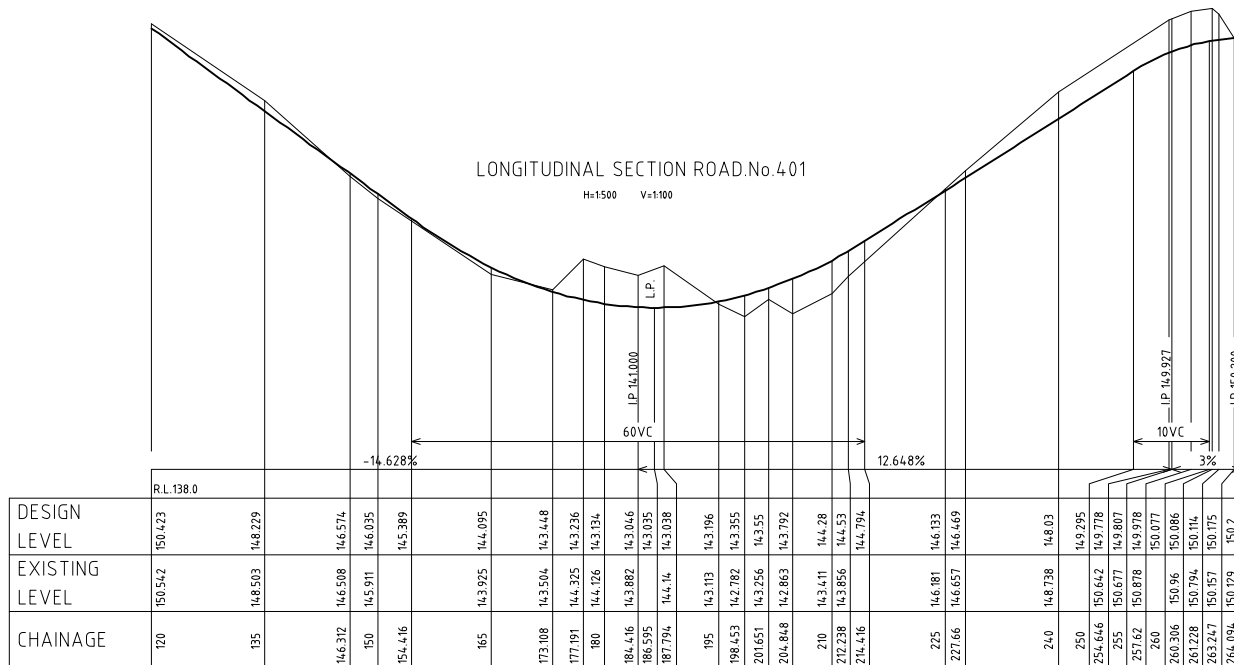
A1



LEGEND	
—	DENOTES MENANGLE CREEK
—	DENOTES LIMIT OF APZ FOR DA 2828/2005
—	DENOTES SITE BOUNDARY
760	DENOTES TREE NUMBER
- - -	DENOTES APPROX. LOCATION OF CREST OF SPUR
- - -	DENOTES PROPOSED APZ DETERMINED BY TRAVERS ECOLOGY 20-07-2020
- - -	DENOTES UNNAMED WATERCOURSE
- - -	DENOTES EXTENT OF 10m WIDE RIPARIAN ZONE

ISSUE D_26-10-2020_BUILDING ENVELOPE REMOVED & SECTIONS ADDED
ISSUE C_16-10-2020_INDICATIVE BUILDING ADDED
ISSUE B_13-08-2020_RIPARIAN ZONES AND APZ UPDATED
ISSUE A_04-08-2020_ISSUED FOR DISCUSSION

Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:1500
Origin of Levels :	Date of Survey : 13/7/2020
Datum : AHD	Designed By :
	Approved : T.H. 22/7/2020



John M. Daly & Associates PTY LTD
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email: admin@jmd.com.au

Project :	LOT 21 IN DP1000643	Sheet 1 of 5 sheets
Locality : GILEAD	L.G.A. : CAMPBELLTOWN	Ref: 18100(21)R2
CAD Ref: s:\jobs\18100\18100 - lot 21\eng\cad\18100\1-prelim rds\cad\18100\21\roads.dwg		

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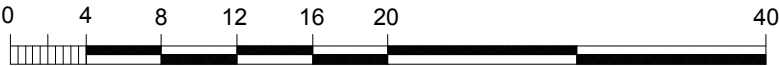


Appendix 2



SECTION 1

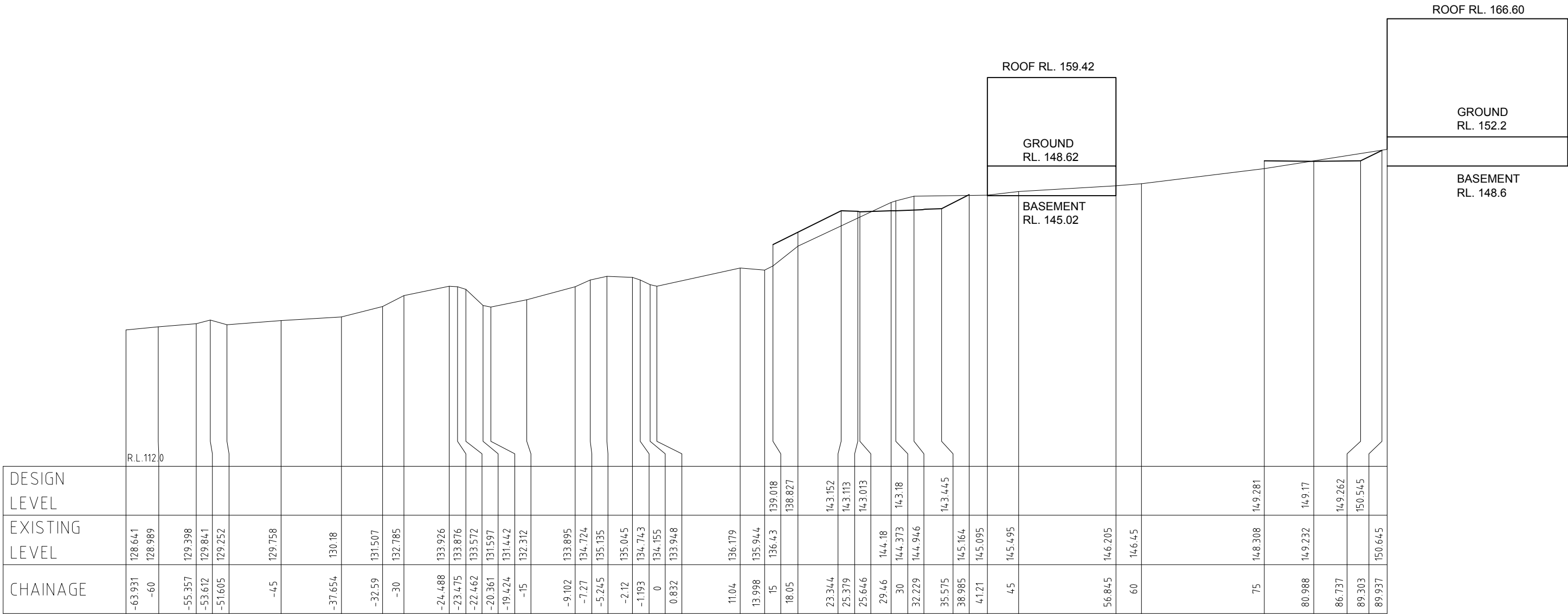
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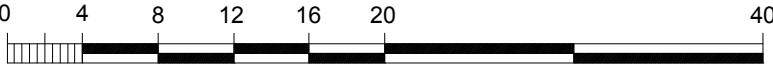
ISSUE C_26-10-2020_SECTION REMOVED & SECTION 1 ADDED ISSUE B_16-10-2020_SECTION 3 MOVED TO NEW SHEET ISSUE A_04-08-2020_ISSUED FOR DISCUSSION										SCALE :- 1 : 400 Metres (A1)									
Client: AUSTRALIAN RETIREMENT HOLDINGS		Ratio (A3) : 1:400 NATURAL			John M. Daly & Associates PTY LTD A.B.N. 88051977989 Surveying Engineering Project Management Licensed Water Service Co ordinators 32 Iolanthe Street PH. (02) 4625 5055 P.O. BOX 25 FAX (02) 4628 2013 CAMPBELLTOWN N.S.W. 2560 email: admin@jmd.com.au				Project : LOT 21 IN DP1000643						Sheet 2 of 5 sheets				
Origin of Levels :		Date of Survey : 13/7/2020							SECTION 1						Ref: 18100(21)R2				
Designed By :		Approved : T.H. 22/7/2020																	
Datum : AHD													Locality : GILEAD		L.G.A. : CAMPBELLTOWN		CAD Ref: s:\jobs\1818100\18100 - lot 21\eng\cad\18100\1-prelim rds\cad\18100\21\roads.dwg		

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SECTION 3

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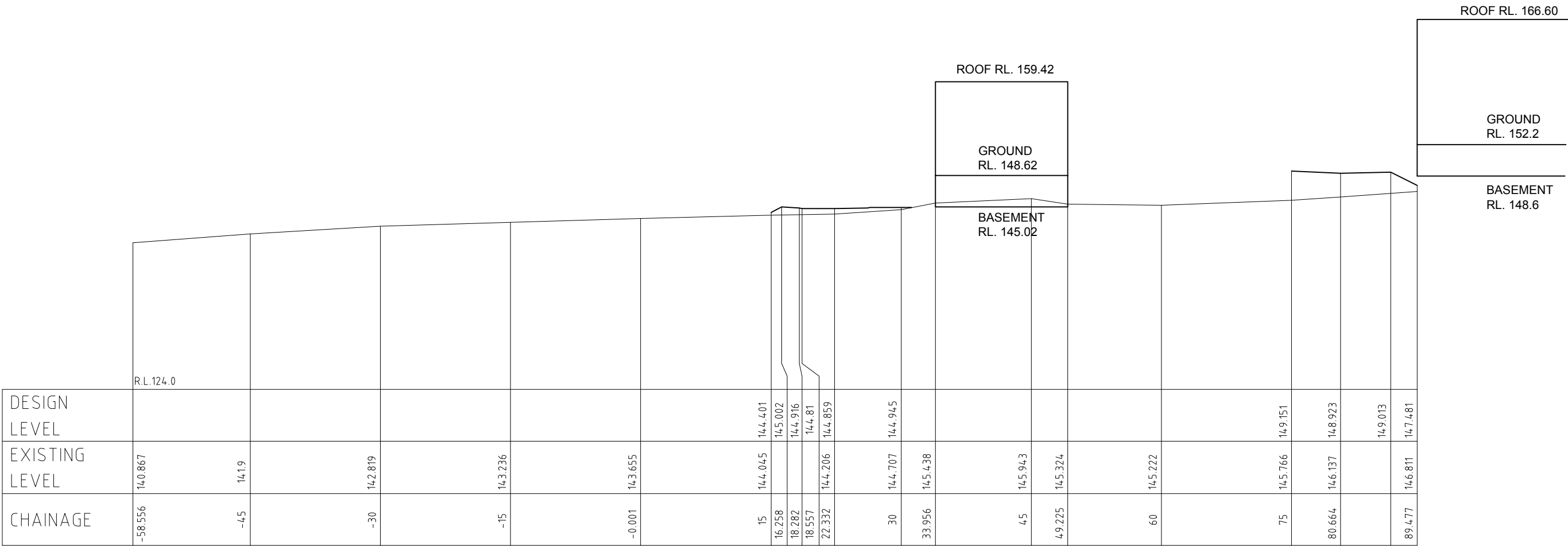


SCALE :- 1 : 400 Metres (A1)

ISSUE C_26-10-2020_SECTION REMOVED & SECTION 3 ADDED
ISSUE B_16-10-2020_BUILDING ENVELOPE ADDED
ISSUE A_04-08-2020_ISSUED FOR DISCUSSION

Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:400 NATURAL		John M. Daly & Associates PTY LTD A.B.N. 88051977989 Surveying Engineering Project Management Licensed Water Service Co ordinators 32 Iolanthe Street P.O. BOX 25 CAMPBELLTOWN N.S.W. 2560 PH. (02) 4625 5055 FAX (02) 4628 2013 email: admin@jmd.com.au	Project : LOT 21 IN DP1000643		Sheet 4 of 5 sheets
Origin of Levels :	Date of Survey : 13/7/2020			SECTION 3		Ref: 18100(21)R2
Datum : AHD	Designed By :					
	Approved : T.H. 22/7/2020			Locality : GILEAD	L.G.A. : CAMPBELLTOWN	CAD Ref: s:\jobs\1818100\18100 - lot 21\eng\cad\18100\1-prelim rds\cad\18100\21\roads.dwg

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SECTION 4
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ISSUE A_26-10-2020_SHEET ADDED					
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Origin of Levels :	Date of Survey : 13/7/2020			SECTION 4	Ref: 18100(21)R2
	Designed By :				
Datum : AHD	Approved : T.H. 22/7/2020			Locality : GILEAD L.G.A. : CAMPBELLTOWN CAD Ref: s:\jobs\181\18100\18100 - lot 21\eng\cad\18100\1-prelim rds\cad\18100\21\roads.dwg	

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