Travers

bushfire & ecology

bushfire protection assessment

Residential
Independent Living
seniors housing

Lot 21 DP 100643
72 Glendower Street
Gilead

for
Site Compatibility Certificate

December 2021
(Ref: 19HOPE002

Bushfire Protection Assessment

Residential care facility and
**independent living seniors housing **
(Site compatibility certificate)

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

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File:	19HOPE002

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

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EXECUTIVE SUMMARY

A bushfire assessment has been undertaken for a proposed Seniors Living residential development project within Lot 21 DP 100643 located at 72 Glendower Street Gilead. The development proposes similar facilities to the existing Gilead Retirement Village, located within the adjacent Lot 2 DP 1065919.

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. As such this 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).

Figure X1 – Master plan development layout

The determination of asset protection zones has been identified by using an alternate solution approach and modelled using *Flamesol* software to insure radiant heat flux levels do not exceed 10 K/wm^2. The alternate solution proposes a radiant heat shield barrier on the northern and western aspects.

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

TABLE OF CONTENTS

Introduction 1

A bushfire assessment has been undertaken for a proposed 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 similar facilities within Lot 21, asset protection zones and access road – see Figure 1.4 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.

The determination of asset protection zones has been identified by using an alternate solution approach and modelled using *Flamesol* software to insure radiant heat flux levels do not exceed 10 K/wm^2. The alternate solution proposes a radiant heat shield barrier on the northern and western aspects.

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 will occur within Lot 21 whilst 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 was previously grazing land and has been subject to regeneration processes since 2002. Figure 1.3 below depicts the vegetation state in 1990.

Figure 1.3 - Aerial photo date 1990

Schedule 1 shows the proposed development and bushfire protection measures, including APZs at a larger scale than Figure 1.4. 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 approved by DA consent in 2006 - see Figure 1.4 and the darker green colour which occurs in the lower half of Lot 21. The land is zoned Rural RU2 and is grazed by goats similar to the NSW RFS recent hazard action in southwest Sydney.

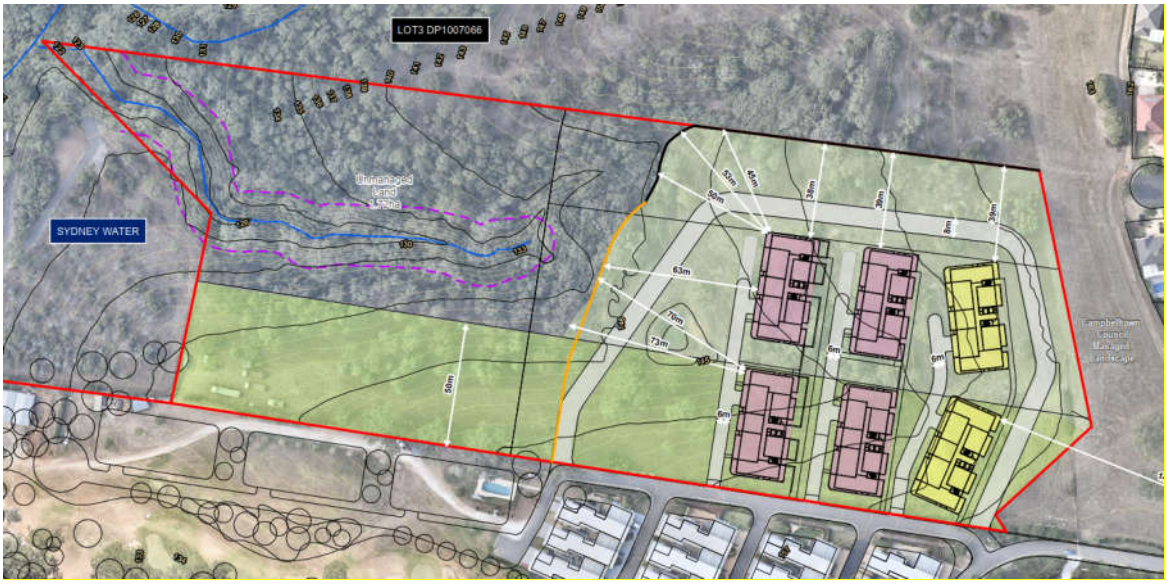

Figure 1.4 – development footprint and the new asset protection zone proposed for Lot 21 (*David Benson Architecture*)

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* (December 2021)
- 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)
- Ecological BDAR (*Hayes Environmental* (2021)
- Koala Assessment report by (*Biolink* 2021)
- Koala Occupancy and Habitat by (*Biolink* 2021)
- Campbelltown Local Environmental Plan (2011)
- *Planning for Bush Fire Protection 2019 (PBP) (RFS).*
- *NearMap* aerial photography (2020)
- Topographical data DLPI of NSW 1:25,000
- Australian Standard *Construction of buildings in bushfire-prone areas (AS3959)*

Inspections of the proposed development site and surrounds were undertaken by John Travers on many occasions between 2005 and November 2021 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 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 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 1.5. This type of development triggers a formal assessment by Council in respect of the RFS policy entitled *Planning for Bush Fire Protection 2019 (PBP).*

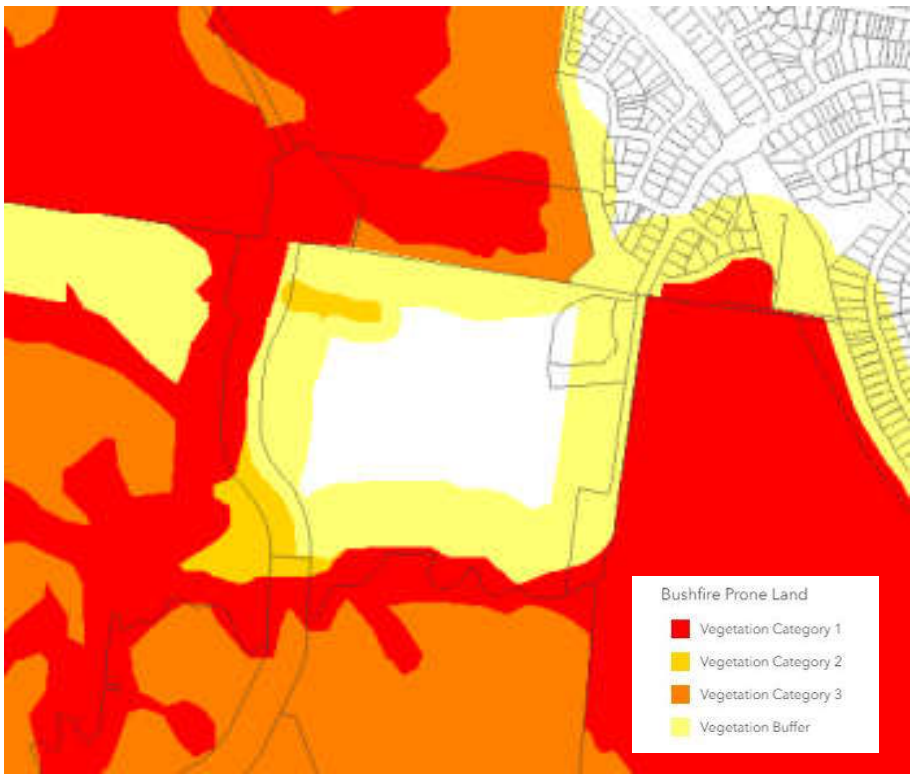

Figure 1.5 – Bushfire prone land map (January 2021)

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 defendable 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;

- Biodiversity constraints assessment by *Travers bushfire & ecology* in December 2021
- Biodiversity development assessment report by *Hayes Environmental* in November 2021
- Koala assessment by *Biolink* in June 2021
- Koala occupancy and habitat by *Biolink* in December 2021

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 Woodand* 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 comprised principally of saplings (see Figure 2.2) amongst a dense array of the tall (tree formation) bushy weed namely African Olive (small tree). This weed grows to about 10m and has 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 and associated fuel loads 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 - but with higher aerial fuels.

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 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.

We sought surveyors assistance and four (4) 'long sections' were prepared by the surveyor – see Figure/s 2.3 - 2.6.

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

Table 2.1 - Slope gradient of the Long Sections by the *surveyor*

Aspect	Length of section from surveyor (m)	Height differences in section (m)	Slope gradient (% / deg)
Long Section 1	44.65	146.719 - 144.024 = 2.695	6.04% / 3.45 deg down slope
Long Section 2	75.00	142.587 - 140.40 = 1.437	1.92 % / 1.1 deg down slope
Long Section 3	78.93	128.641 - 136.430 = 7.789	9.87 % / 5.64 deg down slope
Long Section 4	58.55	140.867 - 144.206 = 3.339	5.70 % / 3.26 deg down slope

2.2.1 Long section calculations

Long section calculations are derived by measuring the slope of the hazard using a surveyor's line which graphically shows the 'slope variations of the slope along a measured chainage'. The long section graphic at Figure 2.2 depicts three (3) rows in the graphic. The bottom row is the chainage measured in metres. The second row (above) is the existing ground level in metres. The upper third row is the (final) design level. We have selected the edge of the APZ that being left of the proposed road on the graph – see Figure 2.3. By reading the curve of the graph you can readily identify the effective slope and then measure that extent by reviewing the chainage under the two end points of the (your) effective slope. Remember not to add the APZ area in that assessment as you are measuring hazard only.

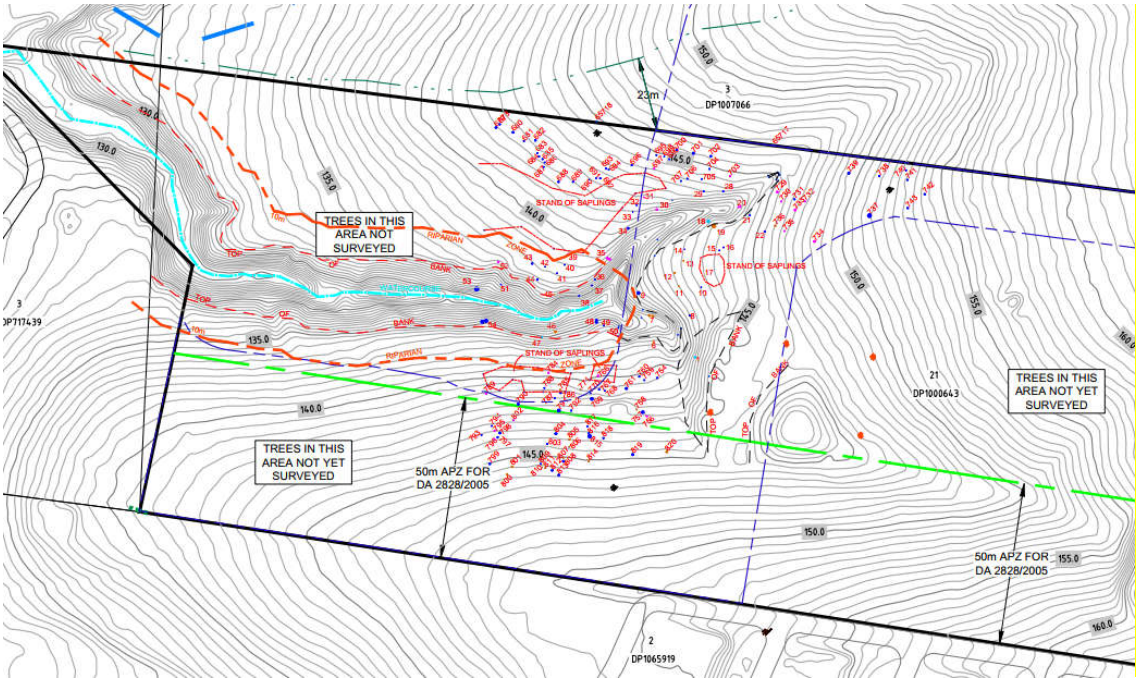

Figure 2.2 – slope gradient for the western aspect

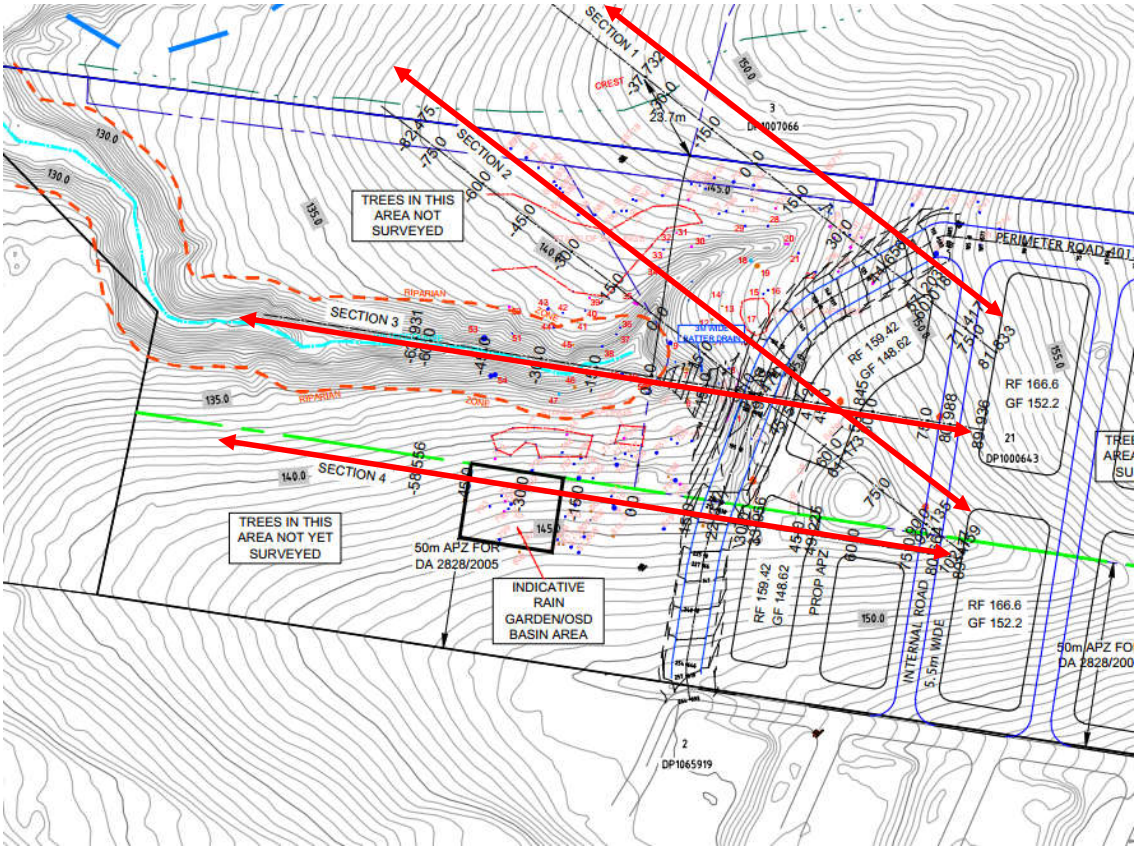

Figure 2.3 – Location of the four (4) long sections from JMD (surveyors) survey plan (October 2020) Th top red line is Long Section 1 and the remaining Long Sections extends in a southerly direction.

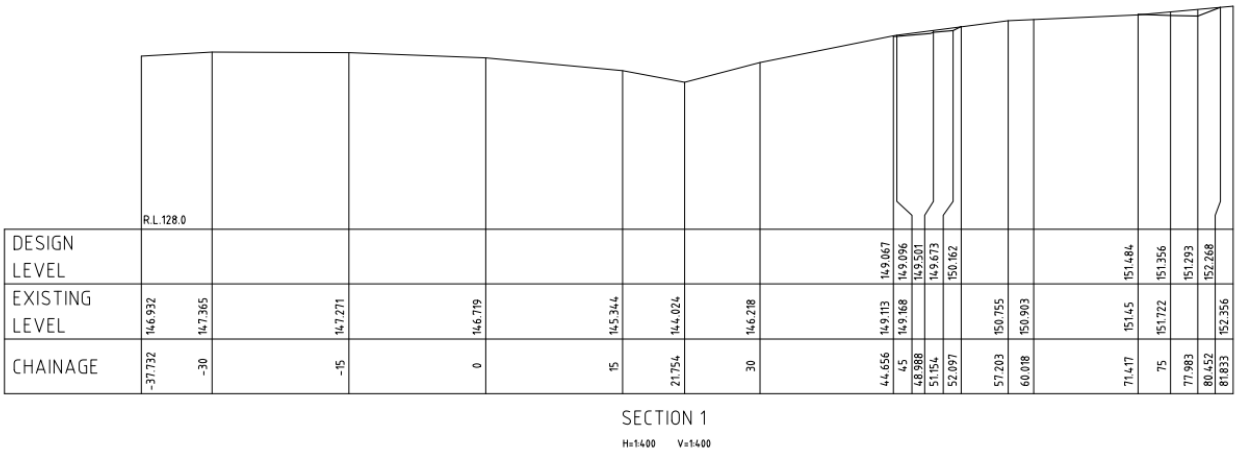

Figure 2.4 – Long Section no 1

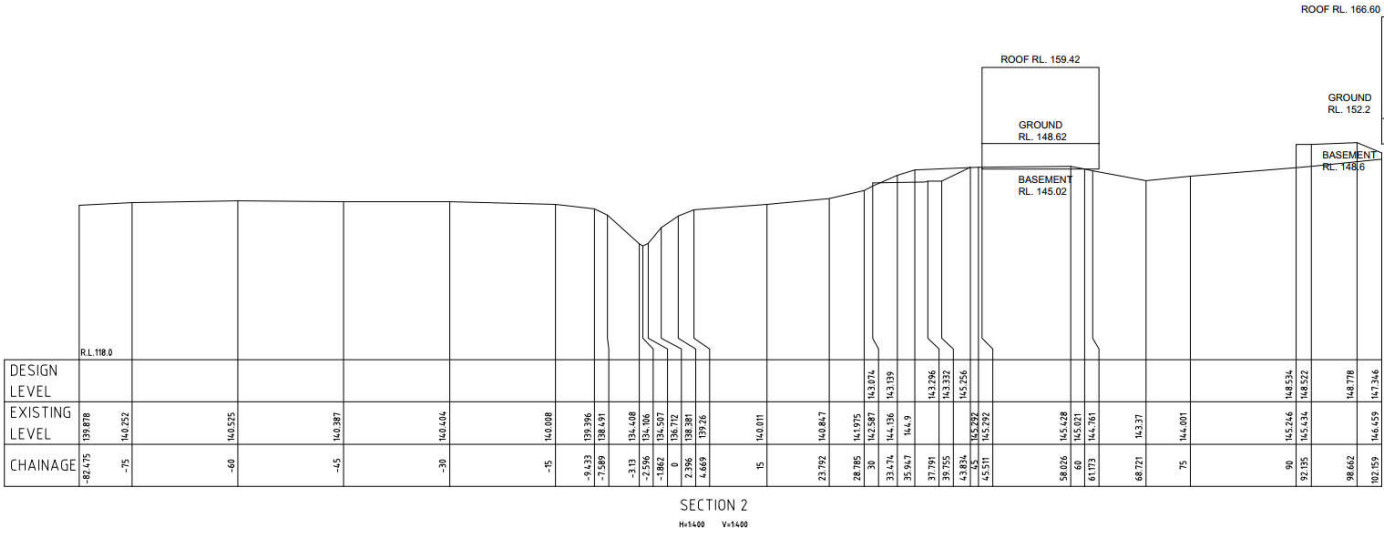

Figure 2.5 – Long Section no 2

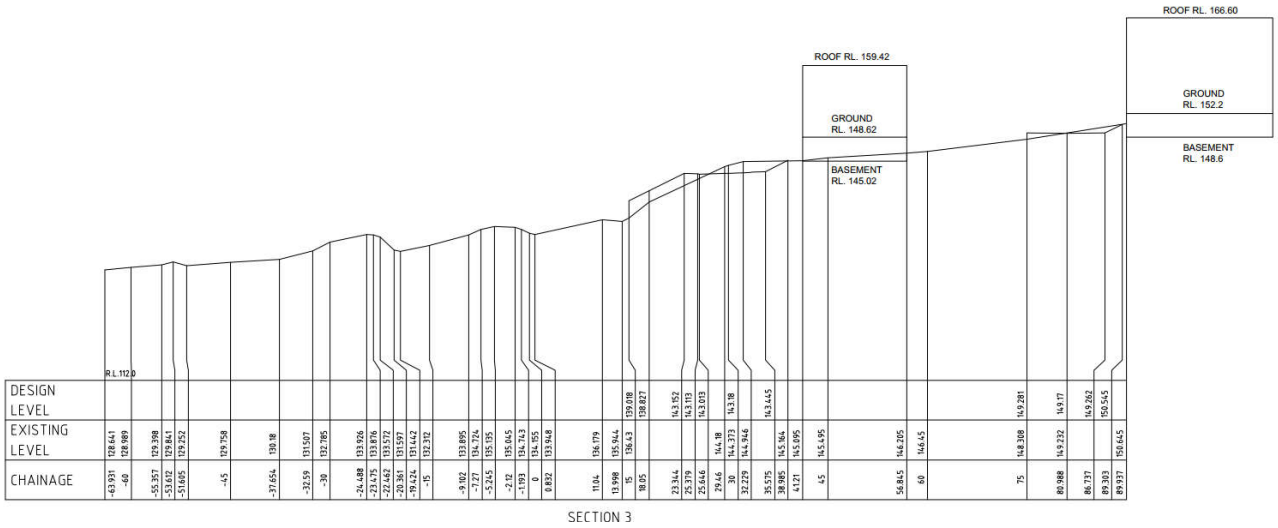

Figure 2.6 – Long Section no 3

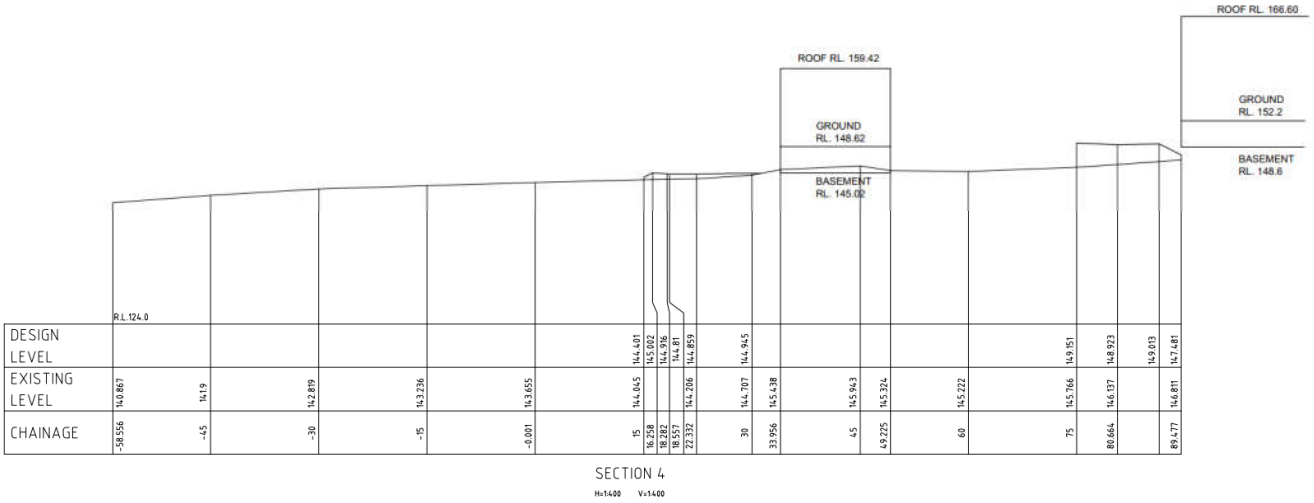

Figure 2.7 – Long Section no 4

Note: A3 versions of the long sections are provided at Appendix 2.

2.2.1 Additional slope calculations

Two additional slope gradients were derived using *Mecone Mozaic (2021) Lidar data* – see Figure 2.8 & 2.9; and Table 2.2.

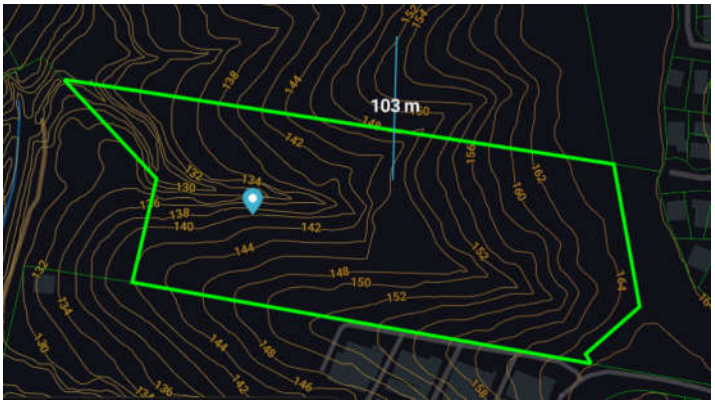

Figure 2.8 – North/South line slope assessment from Lot 21 into Lot 3

Figure 2.9 – Northwest slope validation from Building R4 out 101m

Table 2.2 – Summary of slope gradients of Figures 2.8 & 2.9 above by *Lidar*

Aspect	Length in hazard (m)	Elevation (m)	Calculation of gradient (deg)
North (as per Figure 2.8)	100	152-147.5 = 4.5	2.58 deg **upslope**
Northwest see Figure 2.9 which represents the northwesterly 50m dimension shown on Figure 2.11 below	140	146-134 = 12.0	4.90 deg down slope

2.2.1 Site Slope - west to east axis)

The west to east site slope is shown in Figure 2.10 and by the calculation shown - as 6.63 degrees. The north to south site slope is taken in the modelling as zero degrees.

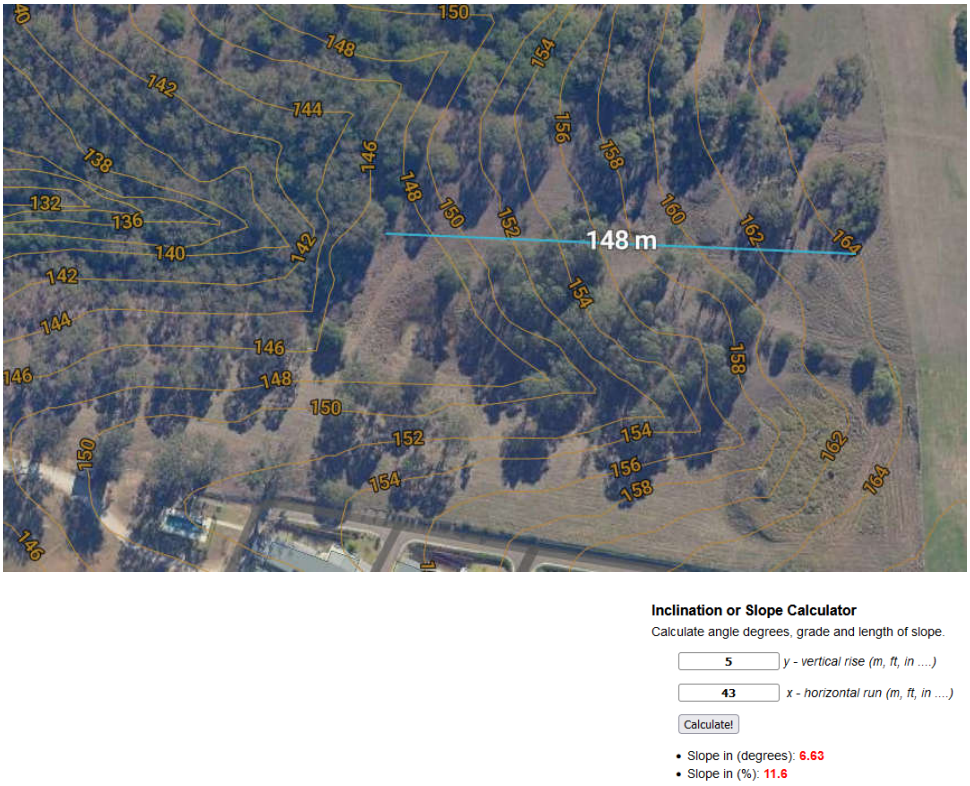

Figure 2.10 – West to east axis of the Site Slope

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 calculated by applying Method 2 of AS3959 and permitted by PBP 2019 (Section A1.8) using *Flamesol* radiant heat shield software to determine the required APZ dimensions and radiant heat shield heights for the western and northern aspects.

- The western radiant heat shield is **4.0m** high metal fence – see orange coloured line in Figure 2.11.

- The northern radiant heat shield is a **3.2m** high metal fence – see black coloured line in Figure 2.11.

Figure 2.11 – APZ location; and location of the 3.2m high radiant heat barrier (black line is the northern barrier) and the 4.0 high radiant heat barrier (Orange line is the western barrier) - see Schedule 1 for larger scale plans after page 34)

Table 2.3 – Bushfire attack radiant heat calculations

Long sections (from surveyor)	Aspect	Slope (deg)	Vegetation formation	APZ (metres)	Radiant heat *(k/Wm²)*	Computer output
1	Northwest	3.45 down	Forest	**50**	**9.38**	Table 2.4
2	Northwest	1.11 down	Forest	**70**	**4.92**	Table 2.5
3	West	5.64 down	Forest	**63**	**7.51**	Table 2.6
4	West	3.26 down	Forest	**73**	**4.94**	Table 2.7
See Fig 2.8	North	3.43 **up**	Forest	**38**	**9.02**	Table 2.8
See Fig 2.9	Northwest	2.58 down	Forest	**53**	**8.34**	Table 2.9
Similar to Fig 2.9	Northwest	3.21 down	Forest	**50**	**9.77**	Table 2.10

The buildings are at different heights as they rise up the slope - as can be seen at Figure 2.12.

- Building identification numbers are indicated in Figure 2.13.
- The actual upper heights of the buildings are shown in Figure 2.14 and are the 'above the designed finished ground level'.
- Heights of the base for each building are provided on the architects plans for each elevation – see Appendix 1; and note on each plan bottom left the RL for that number which indicates the ground level height in metres. The base elevation of H1 building is 144.70 whilst the base elevation for R3 & R4 is 147.80.
- Each level has a finished height difference of approx' 3.0m.

H1	162.90m
R3 & R4	169.50m
R1 & R2	176.30m
V1 & V2	168.40m

- The modelled 'receiver elevation' of R3 & R4 is taken from the top of the building which is shown on Figure 2.14.

- The height of R3 & R4 above edge of the hazard is calculated as 169.50m minus 144.70m = 24.80m.

- The height of H1 (radiant heat shield barrier) is 162.90m minus 144.70m = 18.2m.

Therefore, for modelling purposes the radiant heat shield barrier is 18.2m shielding a building which is 24.80m at roof level located on a generalised slope of 7 degrees. Buildings R3 & R4 are therefore 6.60m higher in elevation than B1.

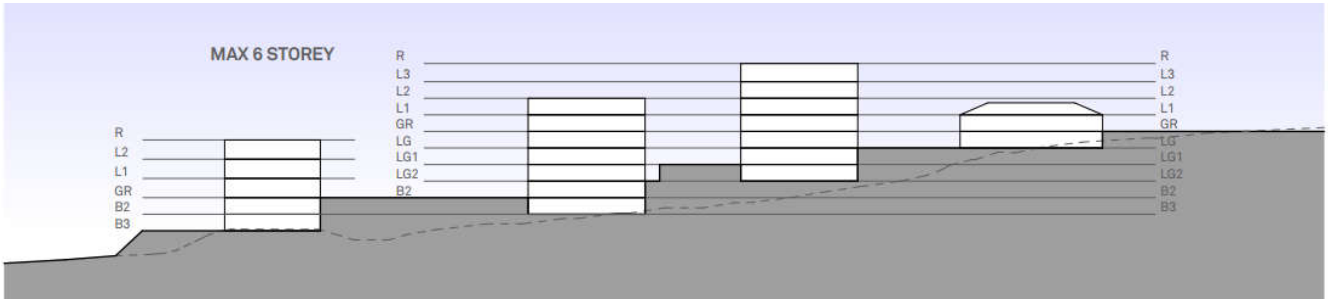

Figure 2.12 – location of the buildings up the slope (from west to east)

Figure 2.13 – numbering of each building

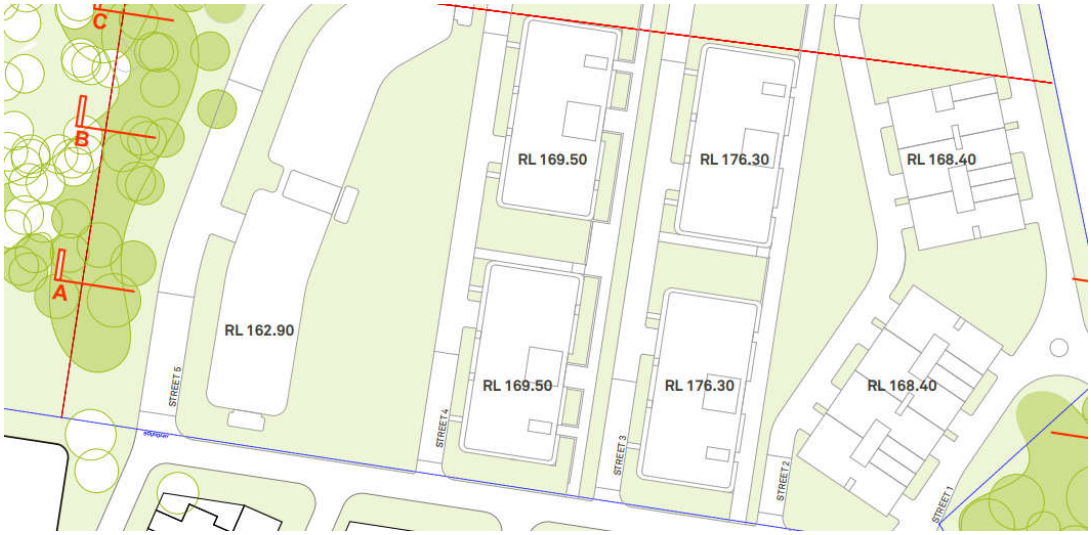

Figure 2.14 – elevation (in metres) above ground for each roof height

Table 2.4 – Section 1, West aspect modelled output

Radiant heat flux affection upon SPD structures as shown in Figure 2.11
*based on 50m APZ and utilising a **3.2m** radiant heat barrier*
Hazard slope gradient of 3.45^0 and site slope of 0^0.

Calculated December 17, 2021, 10:17 am (RHBc v.1.4)

Section 1- Northwest

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	2.13 km/h
Vegetation classification	Forest	Flame length	16.85 m
Understorey fuel load	14 t/ha	Flame angle	77 °
Total fuel load	24.97 t/ha	Panel height	16.41 m
Vegetation height	n/a	Elevation of receiver	8.199999999999999 m
Effective slope	3.45 °	Effective barrier height	4 m
Site slope	0 °	Fire intensity	27,499 kW/m
Distance to vegetation	50 m	Transmissivity	0.78
Flame width	100 m	Viewfactor	0.1394
Windspeed	n/a	Radiant heat flux	12.16 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0318
Flame temperature	1,200 K	Adjusted viewfactor	0.1075
Actual barrier height	4 m	Adjusted radiant heat flux	9.380000000000001 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

Table 2.5 – Section 2, West aspect modelled output

Radiant heat flux affection upon SPD structures as shown in Figure 2.11
*based on 70m APZ and utilising a **3.2m** radiant heat barrier*
Hazard slope gradient of 1.1^0 and site slope of 0^0.

Calculated December 17, 2021, 12:45 pm (RHBc v.1.4)

Section 2 - Western aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	3.23 km/h
Vegetation classification	Forest	Flame length	25.25 m
Understorey fuel load	25 t/ha	Flame angle	74 °
Total fuel load	35 t/ha	Panel height	24.27 m
Vegetation height	n/a	Elevation of receiver	12.13 m
Effective slope	1.11 °	Effective barrier height	4 m
Site slope	0 °	Fire intensity	58,568 kW/m
Distance to vegetation	70 m	Transmissivity	0.759
Flame width	100 m	Viewfactor	0.1281
Windspeed	n/a	Radiant heat flux	10.86 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0191
Flame temperature	1,200 K	Adjusted viewfactor	0.109
Actual barrier height	4 m	Adjusted radiant heat flux	9.24 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

Table 2.6 – Section 3, West aspect modelled output

*Radiant heat flux affection upon SPD structures as shown in Figure 2.11 based on 63m APZ, radiant heat barrier of **4.0m** hazard slope of 5.64^0 and site slope of 7^0.*

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Calculated December 17, 2021, 12:36 pm (RHBc v.1.4)

Section 3

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	2.47 km/h
Vegetation classification	Forest	Flame length	19.1 m
Understorey fuel load	14 t/ha	Flame angle	84 °
Total fuel load	24.97 t/ha	Panel height	18.99 m
Vegetation height	n/a	Elevation of receiver	1.76 m
Effective slope	5.63 °	Effective barrier height	4 m
Site slope	7 °	Fire intensity	31,963 kW/m
Distance to vegetation	63 m	Transmissivity	0.763
Flame width	100 m	Viewfactor	0.1108
Windspeed	n/a	Radiant heat flux	9.449999999999999 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0228
Flame temperature	1,200 K	Adjusted viewfactor	0.08799999999999999
Actual barrier height	4 m	Adjusted radiant heat flux	7.51 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

Table 2.7 – Section 4, Western aspect modelled output

*Radiant heat flux affection upon SPD structures as shown in Figure 2.11 based on 45m APZ and utilising a **4.0m** radiant heat barrier from the Building B1. Hazard slope gradient of 3.26^0 and site slope of 7^0.*

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Calculated December 17, 2021, 12:48 pm (RHBc v.1.4)

Section 4 - West

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	2.1 km/h
Vegetation classification	Forest	Flame length	16.67 m
Understorey fuel load	14 t/ha	Flame angle	87 °
Total fuel load	24.97 t/ha	Panel height	16.64 m
Vegetation height	n/a	Elevation of receiver	0 m
Effective slope	3.26 °	Effective barrier height	4 m
Site slope	7 °	Fire intensity	27,141 kW/m
Distance to vegetation	73 m	Transmissivity	0.753
Flame width	100 m	Viewfactor	0.077
Windspeed	n/a	Radiant heat flux	6.48 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0182
Flame temperature	1,200 K	Adjusted viewfactor	0.0587
Actual barrier height	4 m	Adjusted radiant heat flux	4.94 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

Table 2.8 – Section 5, Northern aspect modelled output

Radiant heat flux affection upon SPD structures as shown in Figure 2.11
*based on 38m APZ and utilising a **3.2m** radiant heat wall.*
Hazard slope gradient of -3.33^0 and site slope of 0^0.

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Calculated December 17, 2021, 4:00 pm (RHBc v.1.4)

Northern aspect

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	1.33 km/h
Vegetation classification	Forest	Flame length	11.67 m
Understorey fuel load	14 t/ha	Flame angle	79 °
Total fuel load	24.97 t/ha	Panel height	11.46 m
Vegetation height	n/a	Elevation of receiver	5.73 m
Effective slope	-3.33 °	Effective barrier height	3.2 m
Site slope	0 °	Fire intensity	17,224 kW/m
Distance to vegetation	38 m	Transmissivity	0.799
Flame width	100 m	Viewfactor	0.1379
Windspeed	n/a	Radiant heat flux	12.32 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0368
Flame temperature	1,200 K	Adjusted viewfactor	0.101
Actual barrier height	3.2 m	Adjusted radiant heat flux	9.02 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

Table 2.9 – Section 6, Northwestern aspect modelled output

*Radiant heat flux affection upon SPD structures as shown in Figure 2.11 based on 50m APZ and utilising a **3.2m** radiant heat wall. Hazard slope gradient of 2.58^0 and site slope of 7^0.*

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Calculated December 17, 2021, 4:09 pm (RHBc v.1.4)

Northwest

Radiant Heat Barrier calculator - AS3959-2018			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	2 km/h
Vegetation classification	Forest	Flame length	16.04 m
Understorey fuel load	14 t/ha	Flame angle	85 °
Total fuel load	24.97 t/ha	Panel height	15.98 m
Vegetation height	n/a	Elevation of receiver	1.48 m
Effective slope	2.58 °	Effective barrier height	3.2 m
Site slope	7 °	Fire intensity	25,897 kW/m
Distance to vegetation	53 m	Transmissivity	0.775
Flame width	100 m	Viewfactor	0.1199
Windspeed	n/a	Radiant heat flux	10.38 kW/m²
Heat of combustion	18,600 kJ/kg	Viewfactor of barrier	0.0235
Flame temperature	1,200 K	Adjusted viewfactor	0.0964
Actual barrier height	3.2 m	Adjusted radiant heat flux	8.34 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

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 10*kW/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
radiant heat levels of greater than 10kW/m² (calculated at 1200K) will not be experienced on any part of the building.	*the building is provided with an APZ in accordance with Table A1.12.1 in Appendix 1*	Complies using the RFS approved alternative solution approach Method 2 (as outlined within AS3959) for the western and southern aspects.
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised	*APZs are located on lands with a slope less than 18 degrees*	Complies
APZs are managed and maintained to prevent the spread of fire to the building *the APZ is provided in perpetuity*	*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;* *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*	Complies

Development within the APZ

Other development is permissible within the proposed asset protection zones as shown on Figure 3.1 but only where that development is allied to ILU's such as;

- Infrastructure - Car parks, roads, water pump devices, electrical substations, dams, detention basins ect'.
- Functional allied assets – garages, sheds, car ports, storage facilities - but only when they are >6m from a dwelling.
- Other development – such as management facilities (office).

Figure 3.1 – location of APZ's

Where other forms of development are required then they are considered by the RFS in PBP as Other Development (refer to PBP section 8 on page 73 and onwards);

Arising from the fact that Special Protection Developments, such as being proposed within Lot 21, are subject to the largest APZ dimensions prescribed by PBP then it follows that other forms of development are permitted to could occur - simply because – those types of development require less distance to the hazard.

For example, where a special protection development may require a 60m APZ it is the case that a normal residential dwelling would only require an APZ dimension between 24-29m from the same forest vegetation community (when on a level slope).

The reason is simple. The Special Protection Development uses a much tougher formulae to determine the APZ dimension as compared to a residential dwelling. Equally, a commercial development would require a much reduced APZ dimension then the dwelling because there is no overnight accommodation permitted in commercial facilities – so the risk is less and evacuation is simpler.

Then there is the building construction requirements. In terms of building construction, the Special Protection Development must be constructed to BAL 12.5 of *AS3959 construction of buildings in bushfire prone areas*, whilst a residential dwelling can be constructed to a higher classification such as BAL 29 or even BAL 40 or BAL FZ if there is no subdivision involved.

Therefore, in conclusion, the APZ for the proposed ILU development in Lot 21 may have a combination of other development types within the proposed APZ – as long as those APZ dimensions are complying to PBP from either a *deemed to satisfy* approach or a *performance based solution* approach.

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 21, Lot 2 and in Council's existing APZ managed land to the east (Lot 19) 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.

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. Internal roads are dead end due to slope at the northern end of the rod sections. Arising from the passive land use being proposed external parking on the 8m wide perimeter road is not required. 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
	SFPP access roads are two-wheel drive, all-weather roads	Complies

Performance criteria	Acceptable solutions to RFS	Compliance comments
Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation		
	access is provided to all structures	Complies
	access roads must provide suitable turning areas in accordance with Appendix 3; and	Complies
	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.	Complies
	traffic management devices are constructed to not prohibit access by emergency services vehicles	Complies
the capacity of access roads is adequate for firefighting vehicles	*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.*	Complies
there is appropriate access to water supply	*hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression*	Complies
	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	Complies
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	*there are two-way sealed roads; minimum 8m carriageway width kerb to kerb; parking is provided outside of the carriageway width;* *hydrants are to be located clear of parking areas;* *there are through roads, and these are linked to the internal road system at an interval of no greater than 500m;* *curves of roads have a minimum inner radius of 6m;* *the maximum grade road is 15 degrees and average grade of not more than 10 degrees; the road crossfall does not exceed 3 degrees; and a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.*	Complies
non-perimeter access roads are designed to allow safe access and egress for firefighting vehicles while occupants are evacuating	*minimum 5.5m carriageway width kerb to kerb;* *parking is provided outside of the carriageway width;* *hydrants are located clear of parking areas; there are through roads, and these are linked to the*	Complies

Performance criteria	Acceptable solutions to RFS	Compliance comments
	internal road system at an interval of no greater than 500m; *curves of roads have a minimum inner radius of 6m;* *the maximum grade road is 15 degrees and average grade of not more than 10 degrees;* *the road crossfall does not exceed 3 degrees;* *a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided*	

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
an adequate water supply for firefighting purposes is installed and maintained	*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*	Complies
water supplies are located at regular intervals. *the water supply is accessible and reliable for firefighting operations*	*fire hydrant spacing, design and sizing comply with the relevant clauses of AS 2419.1:2005;* *hydrants are not located within any road carriageway; and* *reticulated water supply to SFPPs uses a ring main system for areas with perimeter roads*	Complies
flows and pressure are appropriate	*fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005*	Can be a condition of consent
the integrity of the water supply is maintained	*all above-ground water service pipes external to the building are metal, including and up to any taps*	Can be a condition of consent
water supplies are adequate in areas where reticulated water is not available	*a connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure;* *a 65mm Storz outlet with a ball valve is fitted to the outlet;*	Can be a condition of consent

	ball valve and pipes are adequate for water flow and are metal; *supply pipes from tank to ball valve have the same bore size to ensure flow volume;* *underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank;* *a hardened ground surface for truck access is supplied within 4m of the access hole;* *above-ground tanks are manufactured from concrete or metal;* *raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959);* *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* *underground tanks are clearly marked* *tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters;* *all exposed water pipes external to the building are metal, including any fittings;* *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**	

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)

Performance criteria	*Acceptable solutions*	*Complies*
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings.	*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.*	Can be made a condition of consent.

	All fixed gas cylinders are to be kept clear of flammable materials and located on the non-hazard side of the development.	Can be made a condition of consent.
	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.	Can be made a condition of consent.
	Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.	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*
location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	*where practicable, electrical transmission lines are underground;* *where overhead, electrical transmission lines are proposed as follow:* • *lines are installed with short pole spacing (30m),* • *unless crossing gullies, gorges or riparian areas;* *and* *no part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines.*	Yes Yes
location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings	*reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used;* *all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side;* *connections to and from gas cylinders are metal;* *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;* *polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used;* *above-ground gas service pipes external to the building are metal, including and up to any outlets from any combustible material, so they do*	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
A Bush Fire Emergency Management and Evacuation Plan is prepared	*Bush Fire Emergency Management and Evacuation Plan is prepared consistent with the:* *The NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan;* *NSW RFS Schools Program Guide;* *Australian Standard AS 3745:2010 Planning for emergencies in facilities; and* *Australian Standard AS 4083:2010 Planning for emergencies – Health care facilities (where applicable).* *the Bush Fire Emergency Management and Evacuation Plan should include planning for the early relocation of occupants.* *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.*	*can be made a condition of consent.*
appropriate and adequate management arrangements are established for consultation and implementation of the Bush Fire Emergency Management and Evacuation Plan	*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* *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*	can be made a condition of consent.

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 proposal is a master plan approach to facilitate the development of Independent Living Units and the construction of roads to service the zone.

The development will occur within Lot 21 adjacent to the existing Gilead Retirement Village, located at Lot 2 DP 1065919, supports an approved independent living seniors housing and associated support services.

The assessment has been determined using an alternate solution by modelling the bushfire threat using *Flamesol* software. The relevant results, as shown on Table 2.3 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; as required by PBP 2019.

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 29/11/21, shall be managed as an inner protection area (IPA) as outlined within Appendix 4 of *Planning for Bush Fire Protection 2019*.

Recommendation 2 – A minimum 3.2m high radiant heat shield made of non-combustible materials shall be constructed within 1m of the northern property boundary; whilst a 4.0m high radiant heat shield made of non-combustible materials shall be constructed on the western APZ boundary to the physical extent as shown on Schedule 1 of the *Travers bushfire & ecology* plan dated 30 September 2020.

Recommendation 3 – The provision of water, electricity and gas shall comply with Section 6.8.3 of *PBP 2019.*

Recommendation 4 – 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 space to the 8m width.

Recommendation 5 – 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 6 – The existing Bush Fire Emergency Management and Evacuation Plan shall be amended to deal with the development; and also be prepared or amended to be 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 7 – 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*.

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

Legend

Aerial source: Nearmap

- Lot boundary (source: CAD)
- Contour 1m (sourec: LiDAR)
- Creekline (source: LPI & CAD)
- 10-12m riparian buffer

Indicative Asset Protection Zone (APZ)

- APZ (1.70ha)
- Approved APZ (2006 (1.75ha)
- 3.2m Radiant Heat Barrier
- 4m Radiant Heat Barrier

Proposed development

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

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	DATE & ISSUE NUMBER	SCALE & COORDINATE SYSTEM
Glendowner St, Gilead 19HOP02_BF001	21/12/2021 Issue 1 SC	1:1,500 @A3 GDA 1994 MGA Zone 56

TITLE

Proposed Development & APZ Area Lot 21

Document Path: N:\GIS STORAGE\N Drive\19HOP02_GlendownerSt_Gilead\MXDs\19HOP02_BF001.mxd

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Appendix 1
Architects Plans

A1

4.0_CONCEPTUAL SITE PLANNING

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021

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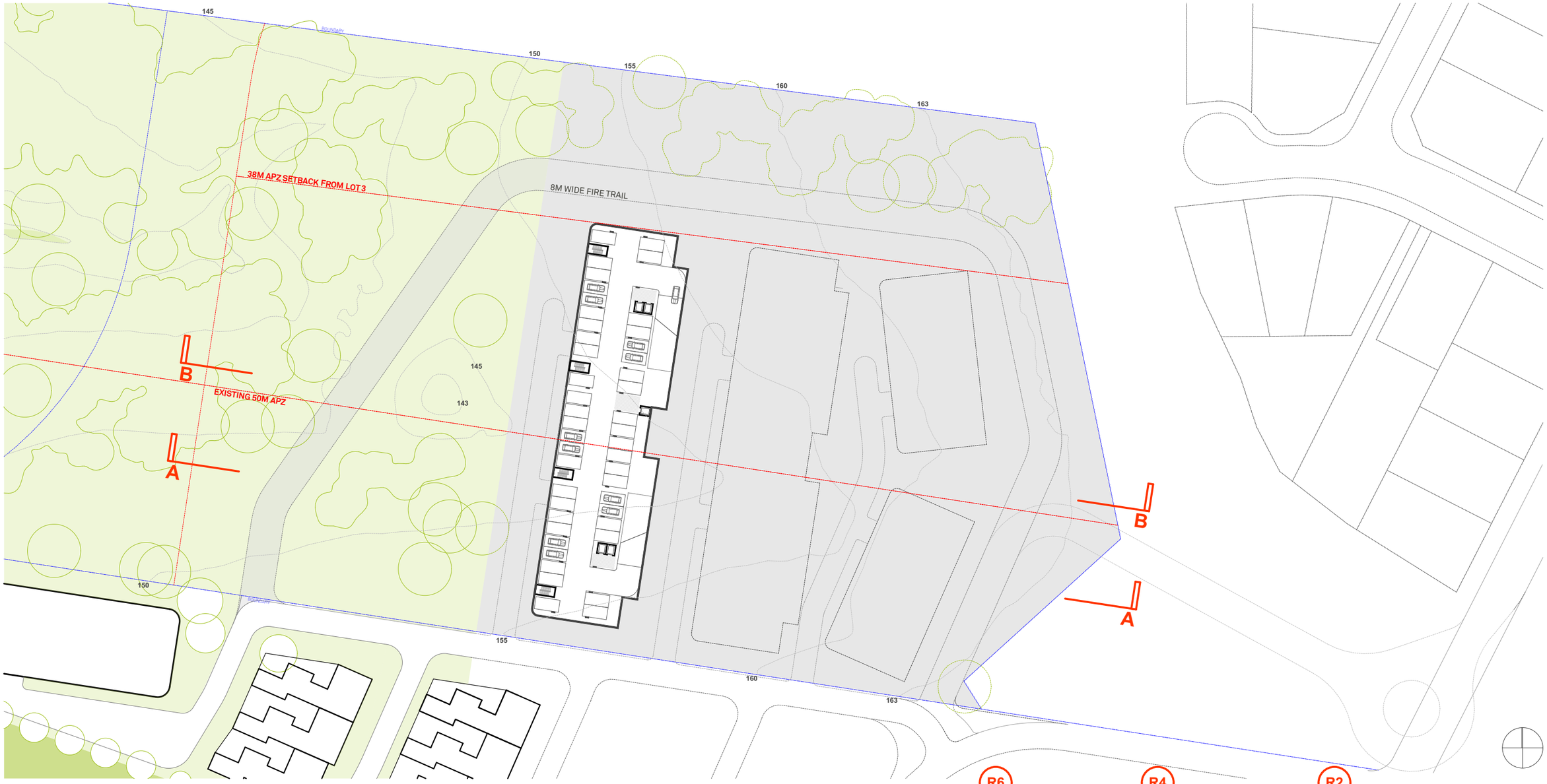
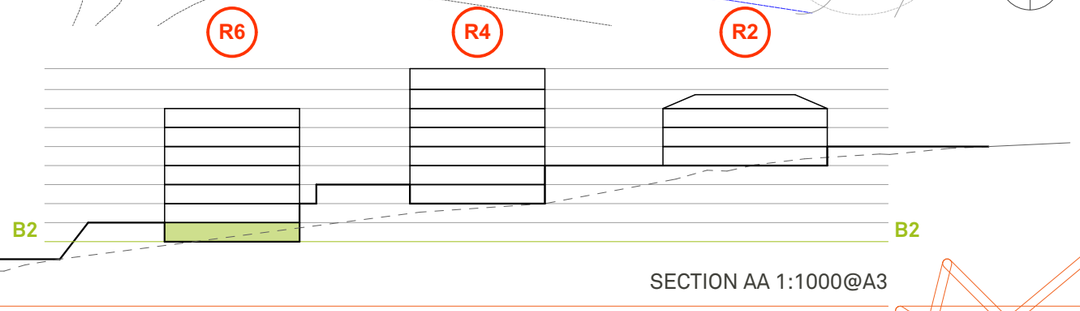
4.1 BASEMENT 2 PLAN





SECTION AA 1:1000@A3

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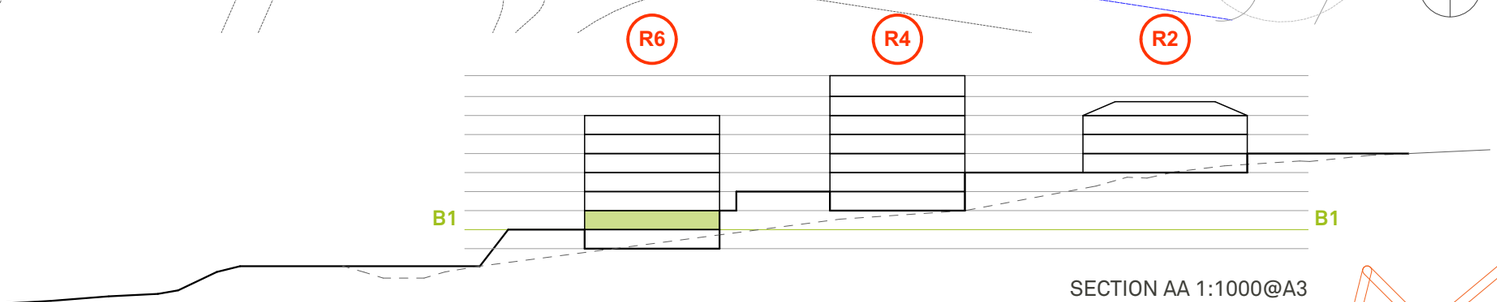
4.2 BASEMENT 1 PLAN

BASEMENT 1 _ RL 150.900



BASEMENT 1 PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021 REV A

21

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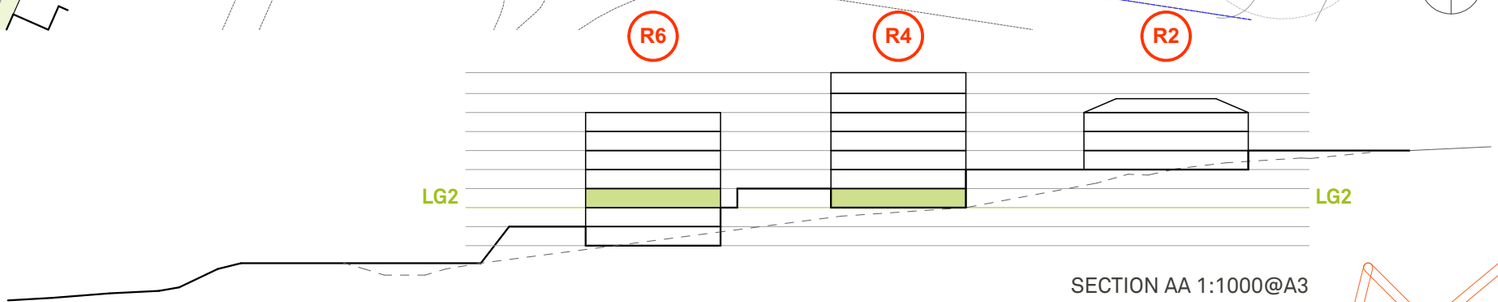
4.3 LOWER GROUND 2 PLAN

LOWER GROUND 2 _ RL 154.000



LOWER GROUND 2 PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
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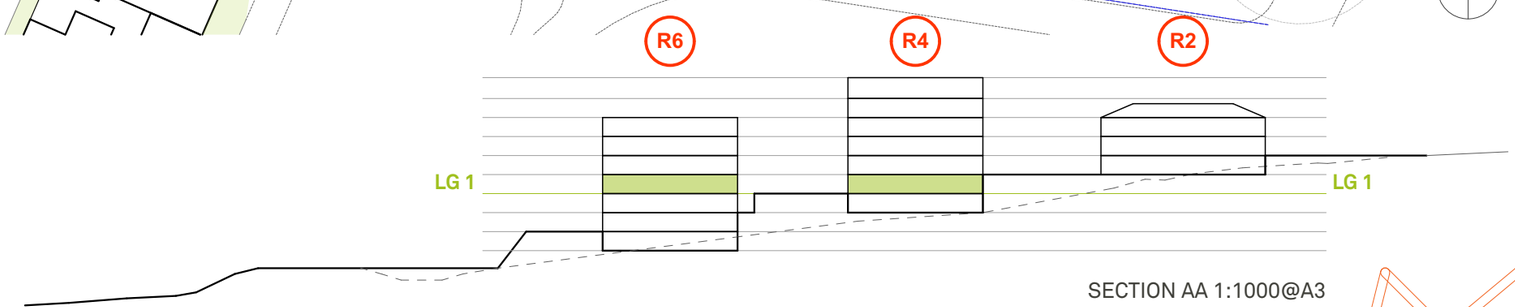
4.4 LOWER GROUND 1 PLAN

LOWER GROUND 1 _ RL 157.100



LOWER GROUND 1 PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

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4.5 LOWER GROUND PLAN

LOWER GROUND _ RL 160.200

LOWER GROUND PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021 REV A

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

P. + 61 2 9818 0777
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W. www.bensonmccack.com

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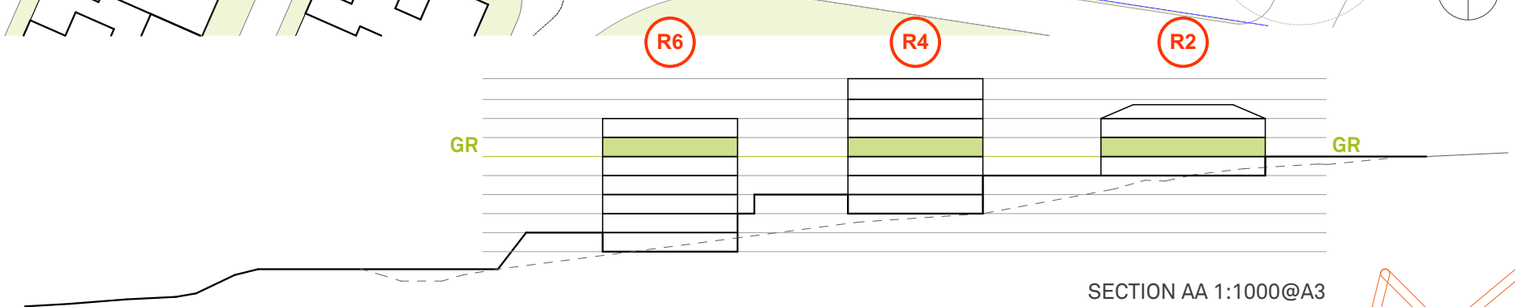
4.6 GROUND FLOOR PLAN

GROUND FLOOR _ RL 163.300



GROUND FLOOR PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021 REV A

25

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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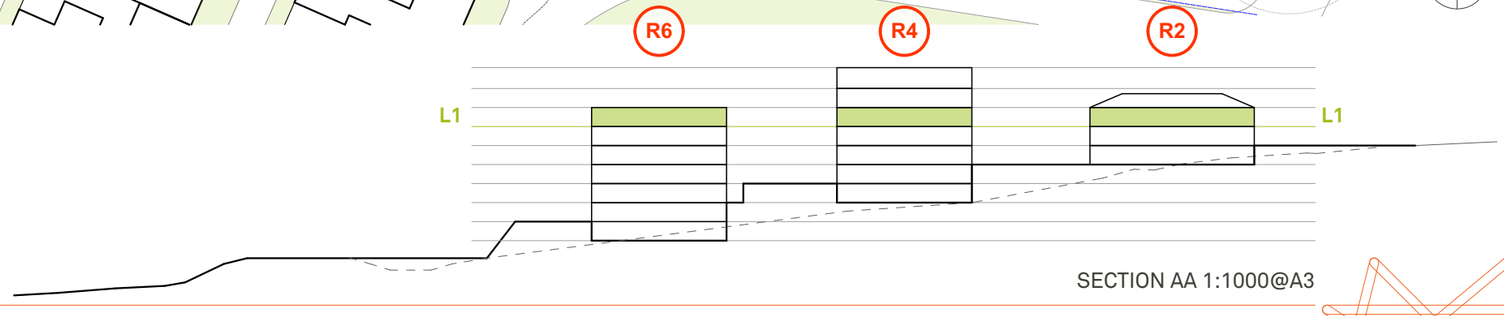
4.7 FIRST FLOOR PLAN

LEVEL 1 _ RL 166.400

LEVEL 1 FLOOR PLAN - 1:1000 @ A3



SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021 REV A

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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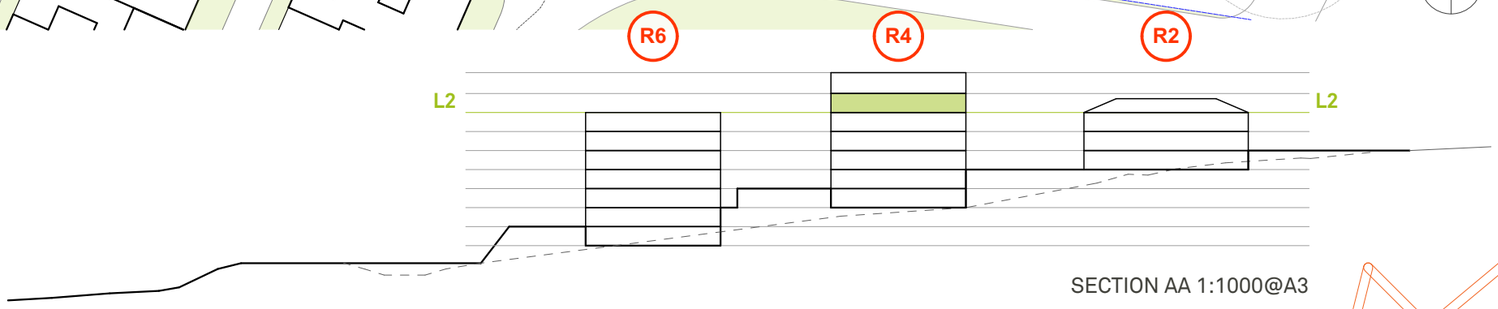
4.8 SECOND FLOOR PLAN

LEVEL 2 _ RL 169.500



LEVEL 2 FLOOR PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021 REV A

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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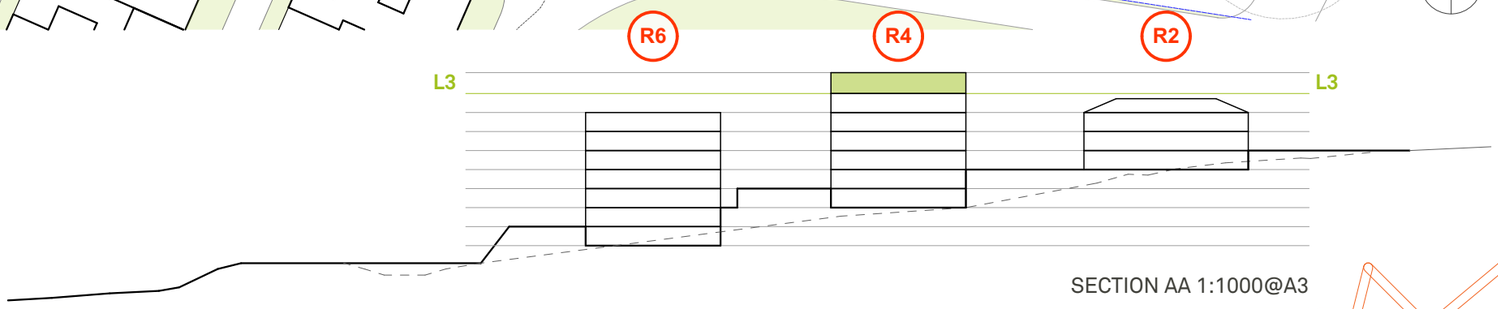
4.9 THIRD FLOOR PLAN

LEVEL 3 _ RL 172.600



LEVEL 3 FLOOR PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

LOT 21 MOUNT GILEAD ESTATE
DECEMBER 2021 REV A

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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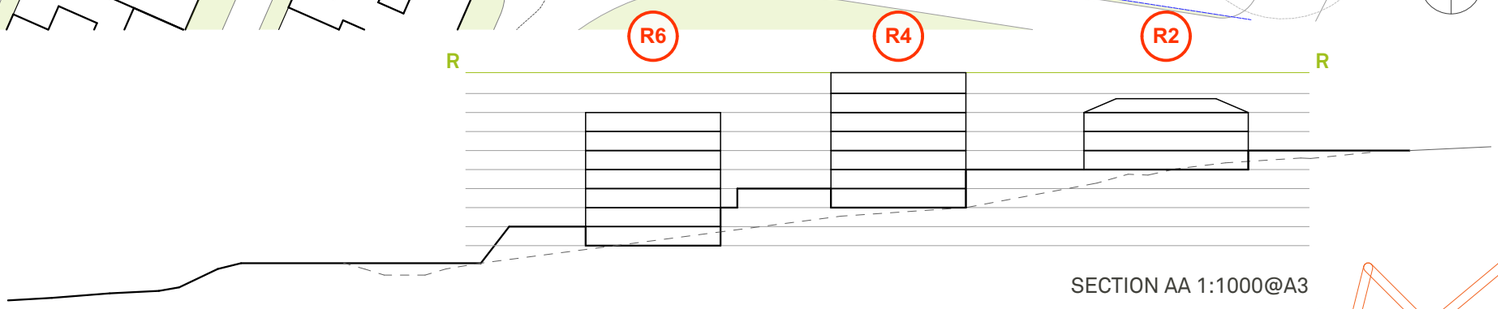
4.10 ROOF PLAN

ROOF _ VARIES



ROOF PLAN - 1:1000 @ A3

SECTION AA 1:1000@A3

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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4.11 PEDESTRIAN ACCESS PLAN

PEDESTRIAN ACCESS PLAN
1:1000 @ A3

ACCESS TO AND FROM EXISTING CLUBHOUSE

ACCESS FROM EXISTING MOUNT GILEAD ESTATE STREET NETWORK

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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F. + 61 2 9818 0778
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4.12 TRAFFIC ACCESS PLAN

TRAFFIC ACCESS PLAN
1:1000 @ A3

TWO WAY STREET NETWORK

MOUNT GILEAD ESTATE ENTRY / EXIT

ILU BASEMENT PARKING ACCESS POINT

TRAFFIC GO SLOW ZONE

EMERGENCY VEHICLE PERIMETER ROAD

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

P. + 61 2 9818 0777
F. + 61 2 9818 0778
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4.13 LANDSCAPE AREAS

LANDSCAPE AREA PLAN
1:1000 @ A3

DEEP SOIL PLANTING

PLANTING OVER STRUCTURE

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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E. enquiries@bensonmccormack.com
W. www.bensonmccack.com

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4.14 BUILDING SEPERATION

BUILDING SEPERATION PLAN
1:1000 @ A3

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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F. + 61 2 9818 0778
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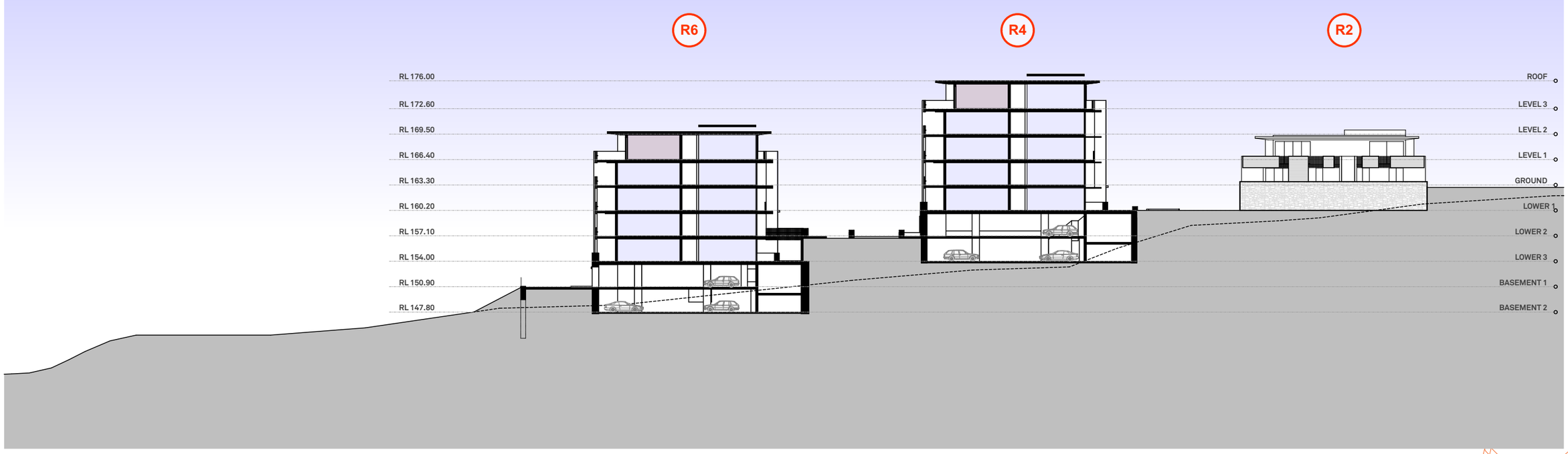
4.15 SITE SECTIONS AA + BB

SECTION BB



SECTION AA

SITE SECTIONS - 1:500 @ A3

STUDIO 5, 505 BALMAIN RD
LILYFIELD NSW 2040
ABN: 76 129 130 285
RN: 7536

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F. + 61 2 9818 0778
E. enquiries@bensonmccormack.com
W. www.bensonmccack.com

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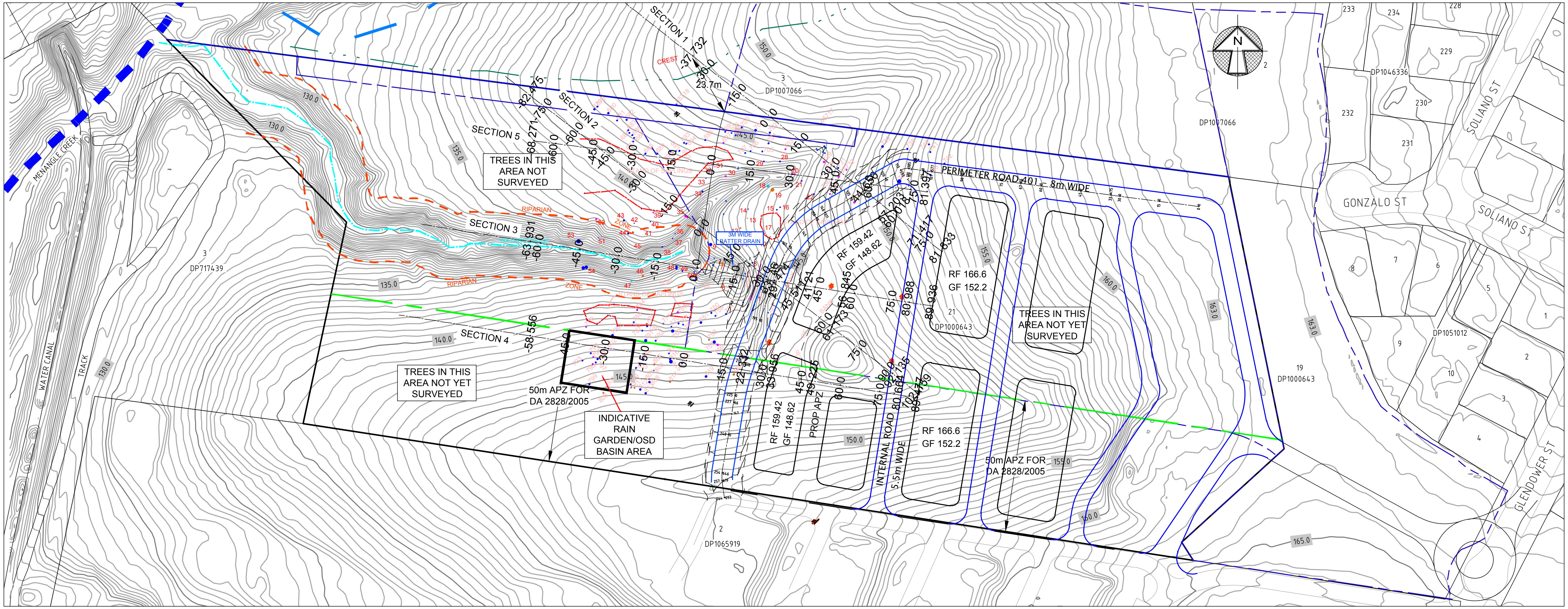
Surveyors long sections

A2

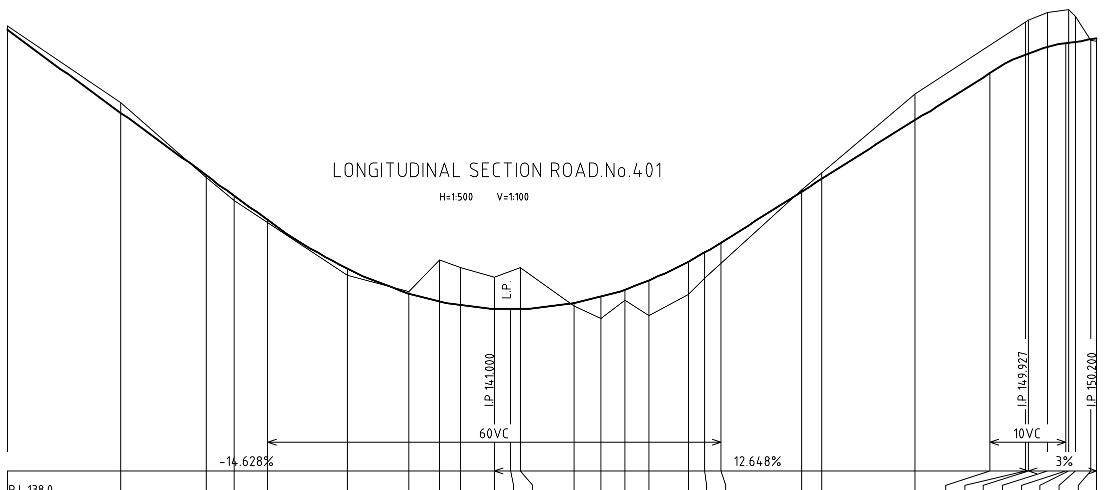


0 15 30 45 60 75 150

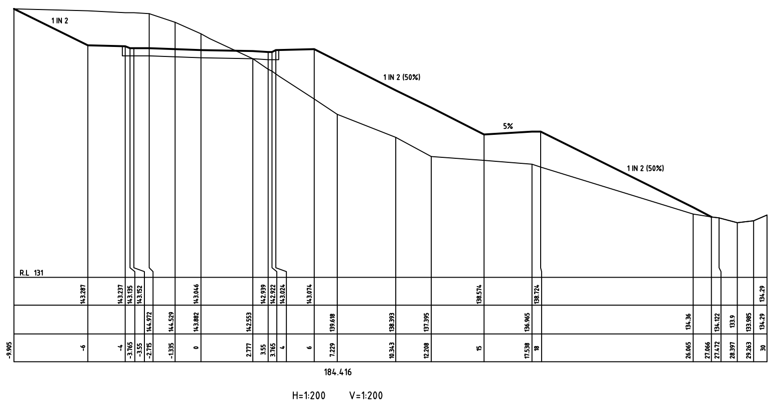
SCALE :- 1 : 1500 Metres (A1)

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



CHAINAGE	DESIGN LEVEL	EXISTING LEVEL
120	150.423	150.542
135	148.229	148.503
146.312	146.574	146.508
150	146.035	145.911
154.416	145.389	
165	144.095	143.925
173.108	143.448	143.504
177.191	143.236	144.325
180	143.134	144.126
184.416	143.046	143.882
186.595	143.035	
187.794	143.038	144.14
195	143.196	143.113
198.453	143.355	142.782
201.651	143.55	143.256
204.848	143.792	142.863
210	144.28	143.411
212.238	144.53	143.856
214.416	144.794	
225	146.133	146.181
227.66	146.469	146.657
240	148.03	148.738
250	149.295	
254.646	149.778	150.642
255	149.807	150.677
257.62	149.978	150.878
260	150.077	
260.306	150.086	150.96
261.228	150.114	150.794
263.247	150.175	150.157
264.094	150.2	150.129



ISSUE E_15-02-2021_SECTION 5 ADDED
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

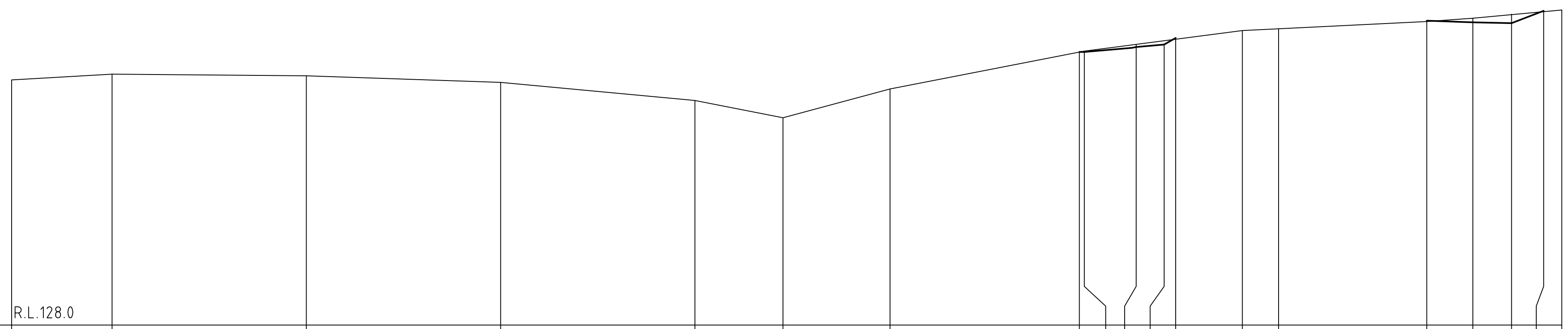
The ratio shown on this plan relates to the original plan, produced by JMD only. Any photocopying or printing from digital files provided (particularly PDF files) may significantly alter the ratio of the plan.

Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:1500	Project : LOT 21 IN DP1000643	Sheet 1 of 6 sheets
Origin of Levels :	Date of Survey : 13/7/2020	PRELIMINARY ROAD LAYOUT- RD 401	Ref: 18100(21)R2
	Designed By : T.H.		
Datum : AHD	Approved : T.H. 22/7/2020	Locality : GILEAD	L.G.A. : CAMPBELLTOWN

JMD Development Consultants

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

CAD Ref: s:\jobs\18\18100\18100 - lot 21\eng\cad\18100r1-prelim rds\cad\18100(21)roads.dwg



DESIGN LEVEL								149.067	149.096	149.501	149.673	150.162			151.484	151.356	151.293	152.268	
EXISTING LEVEL	146.932	147.365	147.271	146.719	145.344	144.024	146.218	149.113	149.168				150.755	150.903	151.45	151.722			152.356
CHAINAGE	-37.732	-30	-15	0	15	21.754	30	44.656	45	48.988	51.154	52.097	57.203	60.018	71.417	75	77.983	80.452	81.833

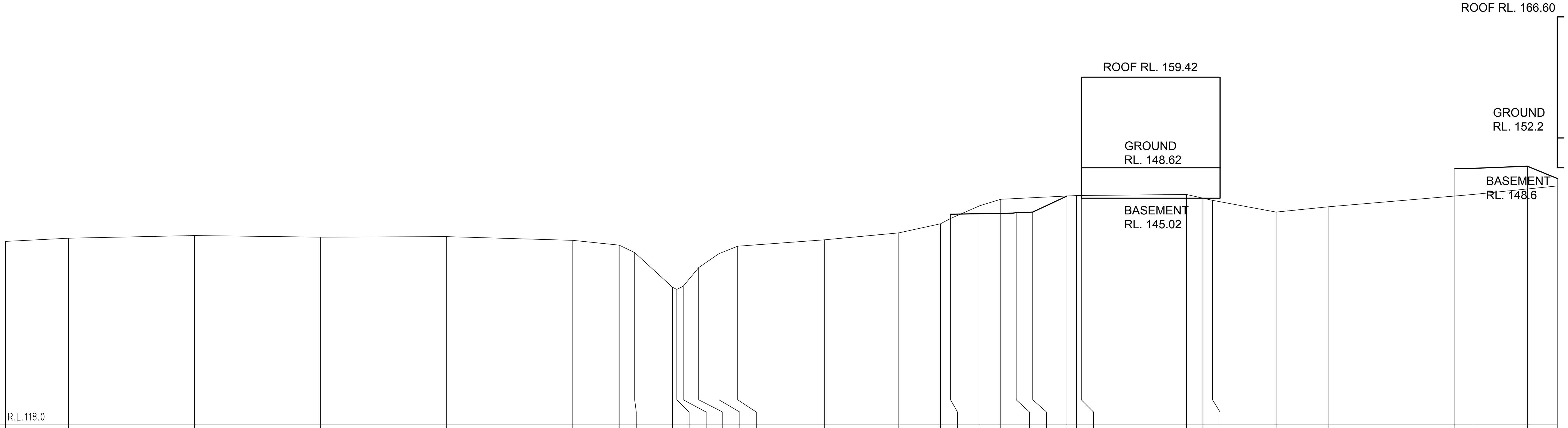
SECTION 1

H=1:400 V=1:400

SCALE :- 1 : 400 Metres (A1)

ISSUE D_15-02-2021_SHEET NUMBERING UPDATED
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

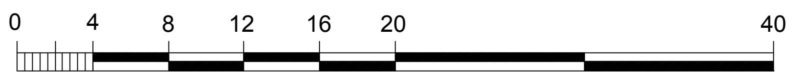
Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:400 NATURAL	JMD Development Consultants	John M. Daly & Associates PTY LTD A.B.N. 88051977989	Project : LOT 21 IN DP1000643
Origin of Levels :	Date of Survey : 13/7/2020		Surveying Engineering Project Management Licensed Water Service Co ordinators	SECTION 1
	Designed By : T.H.		32 Iolanthe Street P.O. BOX 25 CAMPBELLTOWN N.S.W. 2560	Sheet 2 of 6 sheets
Datum : AHD	Approved : T.H. 22/7/2020		PH. (02) 4625 5055 FAX (02) 4628 2013 email: admin@jmd.com.au	Ref: 18100(21)R2
				Locality : GILEAD
				L.G.A. : CAMPBELLTOWN
				CAD Ref: s:\jobs\18\18100\18100 - lot 21\eng\cad\18100r1-prelim rds\cad\18100(21)roads.dwg



CHAINAGE	EXISTING LEVEL	DESIGN LEVEL
-82.475	139.878	
-75	140.252	
-60	140.525	
-45	140.387	
-30	140.404	
-15	140.008	
-9.433	139.396	
-7.589	138.491	
-3.13	134.408	
-2.596	134.106	
-1.862	134.507	
0	136.712	
2.396	138.381	
4.669	139.26	
15	140.011	
23.792	140.847	
28.785	141.975	
30	142.587	143.074
33.474	144.136	143.139
35.947	144.9	
37.791		143.296
39.755		143.332
43.834		145.256
45	145.292	
45.511	145.292	
58.026	145.428	
60	145.021	
61.173	144.761	
68.721	143.37	
75	144.001	
90	145.246	148.534
92.135	145.434	148.522
98.662		148.778
102.159	146.459	147.346

SECTION 2

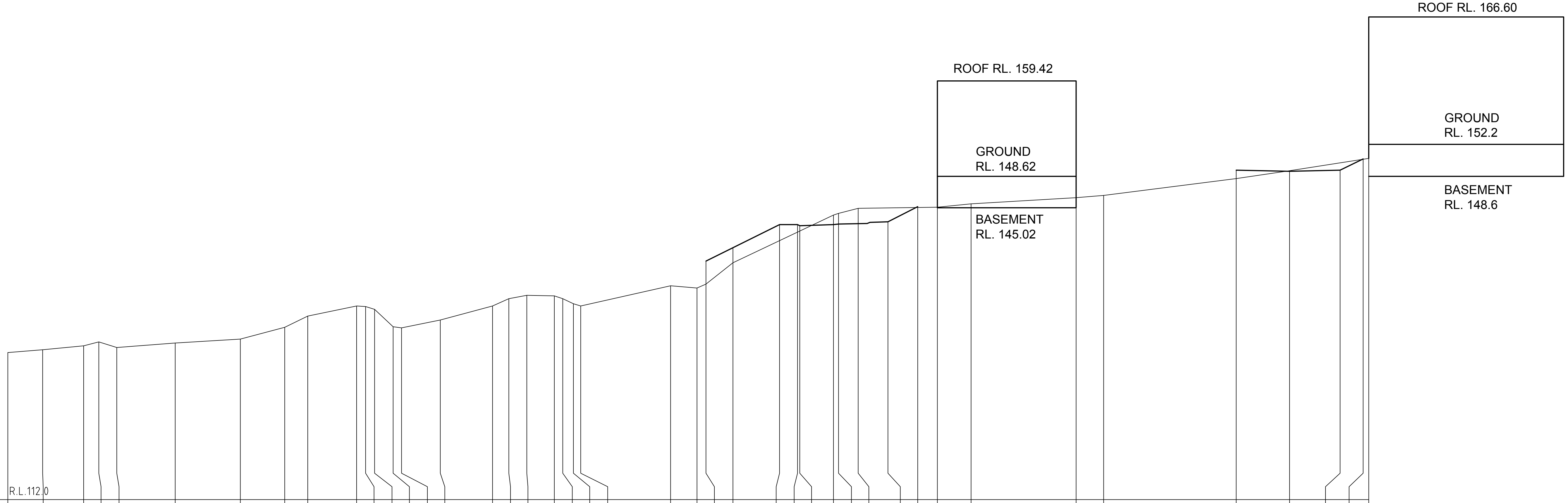
H=1:400 V=1:400



SCALE :- 1 : 400 Metres (A1)

ISSUE C_15-02-2021_SHEET NUMBERING UPDATED
ISSUE B_26-10-2020_SECTION REMOVED, SECTION 2 ADDED & REGISTER UPDATED
ISSUE A_16-10-2020_SHEET ADDED

Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:400 NATURAL	JMD Development Consultants	John M. Daly & Associates PTY LTD A.B.N. 88051977989	Project : LOT 21 IN DP1000643	Sheet 3 of 6 sheets
Origin of Levels :	Date of Survey : 13/7/2020		Surveying Engineering Project Management Licensed Water Service Co ordinators	SECTION 2	Ref: 18100(21)R2
	Designed By : T.H.		32 Iolanthe Street P.O. BOX 25 CAMPBELLTOWN N.S.W. 2560		
Datum : AHD	Approved : T.H. 22/7/2020		PH. (02) 4625 5055 FAX (02) 4628 2013 email: admin@jmd.com.au	Locality : GILEAD / L.G.A. : CAMPBELLTOWN	CAD Ref: s:\jobs\18\18100\18100 - lot 21\eng\cad\18100r1-prelim rds\cad\18100(21)roads.dwg



CHAINAGE	DESIGN LEVEL	EXISTING LEVEL
-63.931		128.641
-60		128.989
-55.357		129.398
-53.612		129.841
-51.605		129.252
-45		129.758
-37.654		130.18
-32.59		131.507
-30		132.785
-24.488		133.926
-23.475		133.876
-22.462		133.572
-20.361		131.597
-19.424		131.442
-15		132.312
-9.102		133.895
-7.27		134.724
-5.245		135.135
-2.12		135.045
-1.193		134.743
0		134.155
0.832		133.948
11.04		136.179
13.998		135.944
15	139.018	136.43
18.05	138.827	
23.344	143.152	
25.379	143.113	
25.646	143.013	
29.46		144.18
30	143.18	144.373
32.229		144.946
35.575	143.445	
38.985		145.164
41.21		145.095
45		145.495
56.845		146.205
60		146.45
75	149.281	148.308
80.988	149.17	149.232
86.737	149.262	
89.303	150.545	
89.937		150.645

SECTION 3

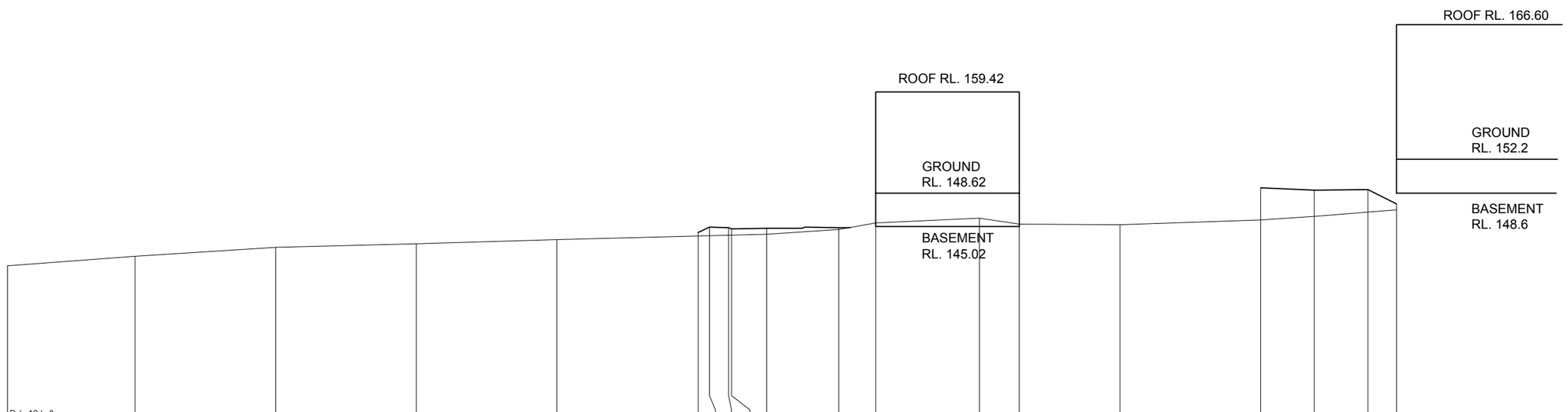
H=1:400 V=1:400

0 4 8 12 16 20 40

SCALE :- 1 : 400 Metres (A1)

ISSUE D_15-02-2021_SHEET NUMBERING UPDATED
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	JMD Development Consultants	John M. Daly & Associates PTY LTD A.B.N. 88051977989	Project : LOT 21 IN DP1000643	Sheet 4 of 6 sheets
Origin of Levels :	Date of Survey : 13/7/2020		Surveying Engineering Project Management Licensed Water Service Co ordinators	SECTION 3	Ref: 18100(21)R2
	Designed By : T.H.		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		
Datum : AHD	Approved : T.H. 22/7/2020			Locality : GILEAD L.G.A. : CAMPBELLTOWN	CAD Ref: s:\jobs\18\18100\18100 - lot 21\eng\cad\18100r1-prelim rds\cad\18100(21)roads.dwg



	R.L.124.0																						
DESIGN LEVEL						144.401	145.002	144.916	144.81	144.859	144.945						149.151		148.923		149.013		147.481
EXISTING LEVEL	140.867	141.9		142.819		143.236		143.655		144.045			144.206		144.707	145.438		145.943		145.324		145.222		145.766		146.137			146.811
CHAINAGE	-58.556	-45		-30		-15		-0.001		15	16.258	18.282	18.557	22.332	30	33.956		45		49.225		60		75		80.664			89.477

SECTION 4

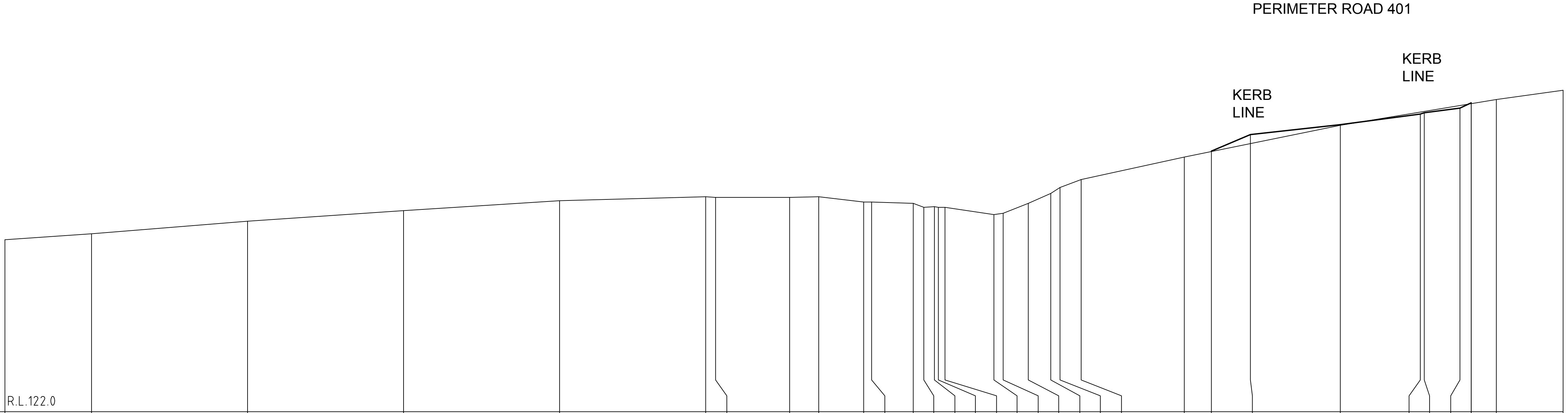
H=1:400 V=1:400

0 4 8 12 16 20 40

SCALE :- 1 : 400 Metres (A1)

ISSUE B_15-02-2021_SHEET NUMBERING UPDATED
ISSUE A_26-10-2020_SHEET ADDED

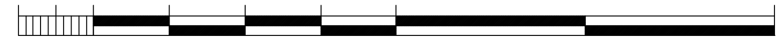
Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:400 NATURAL	JMD Development Consultants	John M. Daly & Associates PTY LTD A.B.N. 88051977989 Surveying Engineering Project Management Licensed Water Service Co ordinators 32 Iolanthe Street P.O. BOX 25 CAMPBELLTOWN N.S.W. 2560 PH. (02) 4625 5055 FAX (02) 4628 2013 email: admin@jmd.com.au	Project : LOT 21 IN DP1000643		Sheet 5 of 6 sheets
Origin of Levels :	Date of Survey : 13/7/2020			SECTION 4		Ref: 18100(21)R2
	Designed By : T.H.					
Datum : AHD	Approved : T.H. 22/7/2020			Locality : GILEAD	L.G.A. : CAMPBELLTOWN	CAD Ref: s:\jobs\18\18100\18100 - lot 21\eng\cad\18100r1-prelim rds\cad\18100(21)roads.dwg



CHAINAGE	DESIGN LEVEL	EXISTING LEVEL
-68.271		138.479
-60		139.078
-45		140.269
-30		141.301
-15		142.217
-0.946		142.599
0		142.526
7.088		142.543
9.889		142.646
14.23		142.108
15		142.105
18.964		141.979
19.972		141.587
20.98		141.634
21.372		141.574
21.989		141.614
26.729		140.921
27.621		141.049
30		141.996
32.185		142.931
33.081		143.503
35.097		144.297
45		146.424
47.58	147.03	
51.366	148.562	
60	149.521	149.47
67.655	150.533	
68.087	150.686	
71.487	151.138	
72.589	151.61	
75		151.95
81.397	152.932	152.864

SECTION 5

H=1:400 V=1:400



SCALE :- 1 : 400 Metres (A1)

ISSUE A_15-02-2021_SHEET ADDED

Client: AUSTRALIAN RETIREMENT HOLDINGS	Ratio (A3) : 1:400 NATURAL	JMD Development Consultants	John M. Daly & Associates PTY LTD A.B.N. 88051977989	Project : LOT 21 IN DP1000643
Origin of Levels :	Date of Survey : 13/7/2020		Surveying Engineering Project Management Licensed Water Service Co ordinators	SECTION 5
	Designed By : T.H.		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	Locality : GILEAD
Datum : AHD	Approved : T.H. 15/02/2021			L.G.A. : CAMPBELLTOWN

Sheet 6 of 6 sheets

Ref: 18100(21)R2

CAD Ref: s:\jobs\18\18100\18100 - lot 21\eng\cad\18100r1-prelim rds\cad\18100(21)roads.dwg