

Our Ref: 18BGC02B2: NVD/JT
Council Ref: DA2017/0388
RFS Ref: D17/2229

Monday 24th June, 2019

Beach Construction
PO Box 1122
LEICHHARDT NSW 2040

Attention: Mr C Murphy



Dear Cooper

**Re: Bushfire assessment in support of a Section 4.55 application
8 Narabang Way, Belrose**

Travers bushfire & ecology has been engaged to prepare an updated bushfire protection assessment to assess the BAL levels applicable for the proposed industrial development at the above address.

In particular this assessment seeks to amend the following Conditions 3 – 6 provided by the NSW RFS via their letter dated 28th July 2017.

Condition 3 – The northern elevation of the building, including Units 66, 67, 68, 69, 70, 84, 85, 86, 87 & 88 shall comply with Section 3 and 9 (BAL FZ) of Australian Standard AS3959 – 2009....

Condition 4 – The adjoining units 64, 65, 71, 82, 83 & 89 shall comply with Section 3 and 8 (BAL 40) of Australian Standard AS3959 – 2009....

Condition 5 – The southern elevation of the building, including units 57, 58, 59, 60, 73, 74, 75 & 76 shall comply with Section 3 and 8 (BAL 40) of Australian Standard AS3959 – 2009....

Condition 6 – The remainder of the middle units shall comply with Section 3 and 7 (BAL 29) of Australian Standard AS3959 – 2009....

Travers bushfire & ecology prepared a bushfire protection assessment report for the site in April 2017 (Ref: A14038). This report recommended a variety of BAL ratings for the industrial development varying from BAL FZ for the caretaker's residence in the north-east, BAL 40 for the southern façade and BAL 29 & 19, 12.5 based on the buildings location and separation from hazard vegetation.

The following provides further assessment following a thorough review of the full set of architectural plans prepared by *Figgis + Jefferson Tepa Pty Ltd* (dated 1/3/2019), drawing no 3656 CD and the inherent shielding opportunities created by the earthworks associated with the development. As depicted in Figure 1 the first and second floor have been cut into the hill and are located 2.75m below ground level. This coupled with the shielding offered by the existing building to the east has the effect of reducing the BAL affectation and allowing the stepping down of BAL ratings to a number of the industrial units.



Figure 1: Shielding opportunities offered by earthworks/ retaining walls.

Development proposal

By way of background the approved development consists of a series of industrial units with small mezzanine offices and a level of storage units on the ground floor. The three (3) storey building is a Class 8 (includes Class 5, 7a and 7b) with a Class 4 caretaker's sole occupancy unit on the second floor located in the north-east.

The occupants of the industrial units are typical office people who are expected to be of any age, with the storage units transiently occupied. The caretakers unit will be permanently occupied.

The industrial units on the second floor open to a driveway area. These units are serviced by a large roller shutter/door and a loading area for vehicles.

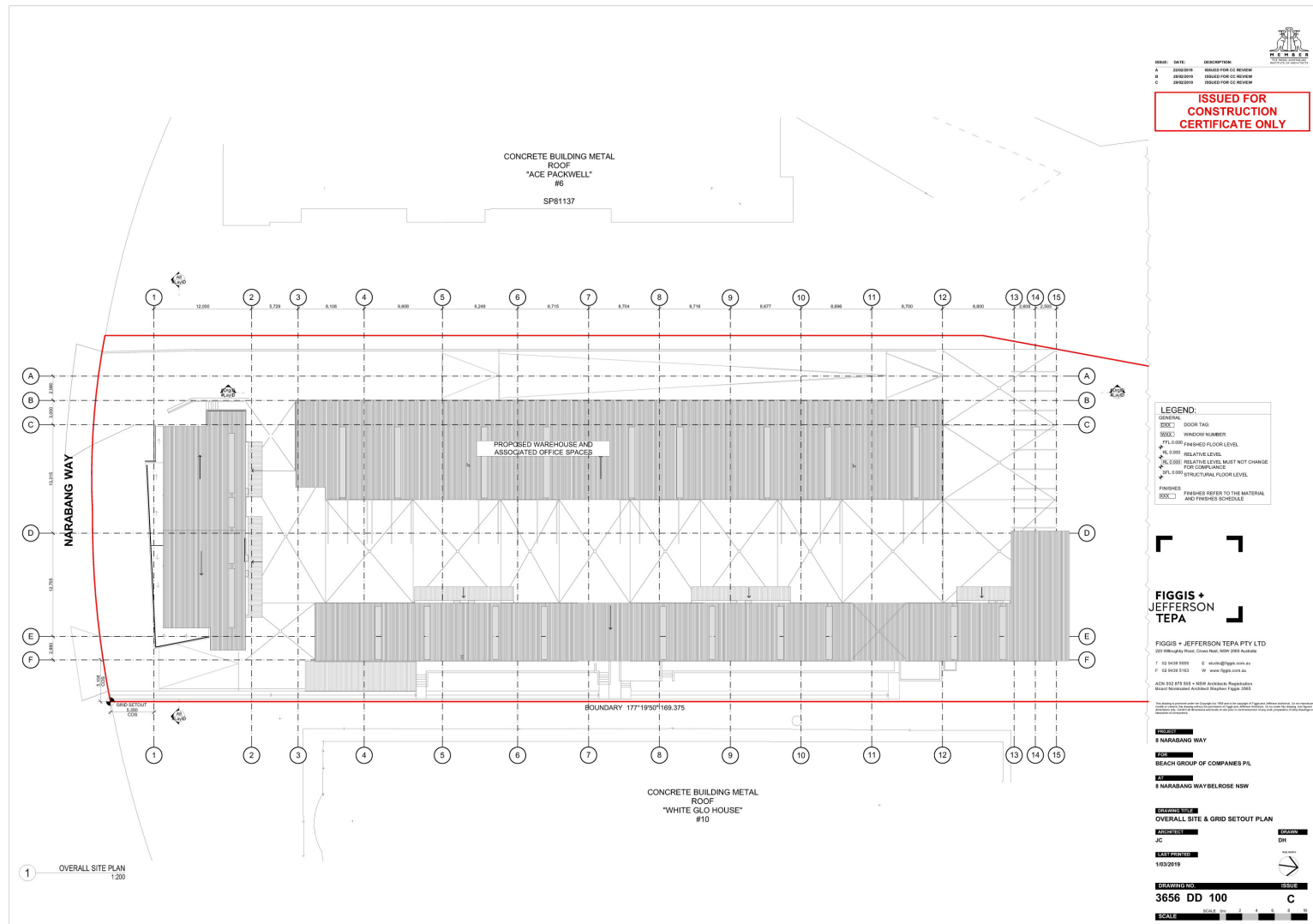


Figure 2 – Overall Site plan

Planning for Bushfire Protection

PBP stipulates that applications that are not residential / rural subdivision, SFPPs or residential infill should:

- note the range of available bushfire protection measures;
- satisfy the aims and objectives of *PBP*; and
- propose a appropriate combination of bushfire protection measures, with evidence that the intent of each measure is satisfied.

Building construction standards are one of the bushfire protection measures identified in *PBP* and is the subject of this Section 4.55 application.

To satisfy the aims and objectives building construction standards seek to:

- afford occupants of the building with adequate protection from the exposure of bushfire; and
- prevent direct flame contact and material ignition.

The performance criteria in relation to construction standards is to:

- demonstrate that the proposed building can withstand bush fire attack in the form of wind, smoke, embers, radiant heat and flame contact.

In NSW, the construction of buildings in bushfire prone areas relates to Classes 1, 2, 3, 4 and Class 9 buildings or a Class 10a building or deck associated with the aforementioned building classes. The design and construction manual for the deemed to satisfy requirements is the Australian Standard AS3959 *Construction of buildings in bushfire-prone areas 2009* (AS3959). These classes of buildings must therefore be constructed in accordance with AS3959.

The National Construction Code (*NCC*) does not provide for any bushfire specific performance requirements for commercial and industrial buildings (Classes 5–8) and, as such, AS3959 does not apply as a set of deemed to satisfy provisions.

The general fire safety construction provisions outlined in the *NCC* for Class 5 – 8 buildings are generally taken as acceptable solutions as it provides for increased fire protection measures (when compared to normal residential development) in the form of fire rated walls between industrial units, sprinkler systems and overall masonry construction.

Bushfire Assessment

To assess the bushfire threat that is likely to occur and thus affect the subject site, a review of the elements that comprise the overall threat needs to be completed. These elements include the potential hazardous landscape that may affect the site, the subsequent extent of the bushfire risk and the expected level of vulnerability that is likely to affect occupants and / or fire fighters.

Hazardous fuels

The existing hazardous vegetation posing a bushfire threat to the building includes:

- Sandstone Gully Forest (Forest) located within the site and external to the sites northern boundary. This forest vegetation is associated with a bushland corridor which extends to the north-east and west.

The threat posed by the vegetation to the north-eastern aspect is reduced by the potential flame width. This vegetation width has been reduced to 10m due to its location on the top of a retaining wall and the presence of the existing industrial building to the south and APZ within the northern portion of our site (refer Schedule 1).

In addition the threat posed to the north-west is reduced to a 'remnant forest' due to the size and shape of the vegetation to this aspect which reduces the fire run potential to <50m.

- Forest vegetation located beyond Narabang Way to the south.

Effective slope

The effective slope within the hazardous forest vegetation is summarised as follows;

- Level within the forest to the north-east (reduced flame width 10m)
- 11 degrees upslope within the forest to the north
- 7 degrees upslope within the remnant forest to the north-west
- 12 degrees downslope beyond Narabang way to the south
- 15 degrees downslope beyond Narabang way to the south-east
- 8 degrees downslope beyond Narabang way to the south-west

Bushfire attack assessment

A number of design fires have been calculated based on the inputs provided above. These design fires are summarised in the following Tables 1 – 6. Table 7 provides a summary of the bushfire attack assessment and the BAL level that will apply to each of the units within the industrial development. Table 7 should be read in conjunction with Figures 3-5 and Schedule 1.

Please note that the BAL's depicted in Schedule 1 attached are based on an alternative solution approach. BAL levels and compliance with AS3959 (2009) are not required under the NCC for Class 8 buildings. However in this circumstance and to ensure compliance with the aims and objectives of PBP, BAL ratings are recommended to apply to the vulnerable elements of the building (i.e. windows and doors) exposed and in direct line of bushfire attack (i.e. flame or radiant heat attack). The internal units or elevations (shielded from bushfire attack) will have a BAL 12.5 rating applied to prevent the entry of airborne embers. This includes the western and northern elevations of the first floor units which are shielded and located below natural ground level as well as the northern and western elevations of Level 1 (also shielded).

The standard shielding requirements outlined in AS3959 (2009) – Clause 3.5 have not been applied in this circumstance. This requirement states that buildings can only step down one level of construction. Whilst this applies to Class 1 – 4 buildings (i.e. smaller size than an industrial building) in this circumstance the building is 110m in length and will be exposed to varying levels of radiant heat and flame exposure over this entire length.

The BAL levels have been provided to the most exposed elements of the building and acknowledges that the fire safety construction provisions outlined in the NCC for Class 5 – 8 buildings are generally taken as acceptable solutions to provide increased fire protection measures (when compared to normal residential development). This includes fire rated walls provided between each of the units which is designed to contain fire within the unit and to prevent the spread of fire into the remainder of the facility.

Design Fire Scenarios

The following outlines the potential fire scenarios for a bushfire impacting upon the industrial building from the north, north-east, north-west, south, south-east and south-west.

Design Fire 1 (north-east)

The results of the Design Fire 1 are summarised within the following bushfire attack assessment with locations depicted in Schedule 1 attached. Two (2) outputs have been calculated, based on BAL FZ and BAL 19. This assessment has been undertaken using a performance based assessment (Appendix B of AS3959). The results of the assessment, provided below, were prepared using the bushfire attack assessor (BFAA) developed by Newcastle Bushfire Consulting.

Table 1 – Design Fire (DF) 1

Design Fire 1 characteristics	
<i>Vegetation formations (as per Planning for Bushfire Protection (2006) within a 140m radius of the site was determined were as</i>	
Vegetation type <ul style="list-style-type: none"> Proximity 	Forest downgraded to a flame width of 10m based on the location of the vegetation (on top of a 2m high retaining wall) with the width restricted due to the presence of an industrial building to the south and the APZ on our property.
Fuel Load (predominant vegetation)	20/25 tonnes per hectare (RFS, 2006)
<i>The 'effective slope...within the hazard which most significantly affects fire behaviour of the site in regards to the vegetation found (RFS, 2006) has been calculated for a distance of 100 within the hazardous vegetation.</i>	
Slope within vegetation	Level
APZ provided	6 – 18.7m

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 18/06/2019 Assessment Date: 12/06/2019

Site Street Address: 8 Narabang Way (industrial), Belrose

Assessor: Mr Admin; admin

Local Government Area: Warringah

Alpine Area: No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: A Design Fire 1 (Flame Zone)

Vegetation Information

Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	0 Degrees	Vegetation Slope Type:	Level
Surface Fuel Load(t/ha):	20	Overall Fuel Load(t/ha):	25

Site Information

Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m)	Default	APZ/Separation(m):	18.6

Fire Inputs

Veg./Flame Width(m):	10	Flame Temp(K)	1090
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Calculation Parameters

Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100

Program Outputs

Category of Attack:	FLAME ZONE	Peak Elevation of Receiver(m):	6.22
Level of Construction:	BAL FZ	Fire Intensity(kW/m):	31000
Radiant Heat(kW/m2):	14.48	Flame Angle (degrees):	42
Flame Length(m):	18.6	Maximum View Factor:	0.222
Rate Of Spread (km/h):	2.4	Inner Protection Area(m):	19
Transmissivity:	0.858	Outer Protection Area(m):	0

Run Description: B Design Fire 1 (BAL 19)

Vegetation Information

Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	0 Degrees	Vegetation Slope Type:	Level
Surface Fuel Load(t/ha):	20	Overall Fuel Load(t/ha):	25

Site Information

Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m)	Default	APZ/Separation(m):	18.7

Fire Inputs

Veg./Flame Width(m):	10	Flame Temp(K)	1090
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Calculation Parameters

Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100

Program Outputs

Category of Attack:	MODERATE	Peak Elevation of Receiver(m):	6.22
Level of Construction:	BAL 19	Fire Intensity(kW/m):	31000
Radiant Heat(kW/m2):	14.28	Flame Angle (degrees):	42
Flame Length(m):	18.6	Maximum View Factor:	0.219
Rate Of Spread (km/h):	2.4	Inner Protection Area(m):	19
Transmissivity:	0.858	Outer Protection Area(m):	0

Design Fire 2 (north)

The results of the Design Fire 2 are summarised within the following bushfire attack assessment with locations depicted in Schedule 1 attached. One (1) output has been calculated (i.e. BAL 19) and is overridden by the higher BAL rating determined for Design Fire 3. This assessment has been undertaken using a performance based assessment (Appendix B of AS3959). The results of the assessment, provided below, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*.

Table 2 – Design Fire (DF) 2

Design Fire 2 characteristics	
<i>Vegetation formations (as per Planning for Bushfire Protection (2006) within a 140m radius of the site was determined were as</i>	
Vegetation type	Forest
• Proximity	
Fuel Load (predominant vegetation)	20/25 tonnes per hectare (RFS, 2006)
<i>The 'effective slope...within the hazard which most significantly affects fire behaviour of the site in regards to the vegetation found (RFS, 2006) has been calculated for a distance of 100 within the hazardous vegetation.</i>	
Slope within vegetation	11 degrees upslope
APZ provided	18m

Run Description: C Design Fire 2 (BAL 19)			
<u>Vegetation Information</u>			
Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	11 Degrees	Vegetation Slope Type:	Upslope
Surface Fuel Load(t/ha):	20	Overall Fuel Load(t/ha):	25
<u>Site Information</u>			
Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m)	Default	APZ/Separation(m):	18
<u>Fire Inputs</u>			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
<u>Calculation Parameters</u>			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
<u>Program Outputs</u>			
Category of Attack:	MODERATE	Peak Elevation of Receiver(m):	4.93
Level of Construction:	BAL 19	Fire Intensity(kW/m):	14512
Radiant Heat(kW/m2):	18.06	Flame Angle (degrees):	73
Flame Length(m):	10.3	Maximum View Factor:	0.282
Rate Of Spread (km/h):	1.12	Inner Protection Area(m):	18
Transmissivity:	0.842	Outer Protection Area(m):	0

Design Fire 3 (north-west)

The results of the Design Fire 3 are summarised within the following bushfire attack assessment with locations depicted in Schedule 1 attached. Two (2) outputs has been calculated based on BAL 29 with BAL 19 applying to portions of the building located over 9m from the fire source. This assessment has been undertaken using a performance based assessment (Appendix B of AS3959). The results of the assessment, provided below, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*.

Table 3 – Design Fire (DF) 3

Design Fire 2 characteristics	
<i>Vegetation formations (as per Planning for Bushfire Protection (2006) within a 140m radius of the site was determined were as</i>	
Vegetation type <ul style="list-style-type: none">Proximity	Open Forest – downgraded to Remnant Forest due to size and shape of vegetation parcel which provides a fire run of less than 50m from the western aspect.
Fuel Load (predominant vegetation)	8/10 tonnes per hectare (RFS, 2006)
<i>The 'effective slope...within the hazard which most significantly affects fire behaviour of the site in regards to the vegetation found (RFS, 2006) has been calculated for a distance of 100 within the hazardous vegetation.</i>	
Slope within vegetation	7 degrees upslope
APZ provided	6.5 – 9m

Run Description: D Design Fire 3 (BAL 29)			
<u>Vegetation Information</u>			
Vegetation Type:	Remnant Vegetation	Vegetation Group:	Remnant Vegetation
Vegetation Slope:	7 Degrees	Vegetation Slope Type:	Upslope
Surface Fuel Load(t/ha):	8	Overall Fuel Load(t/ha):	10
<u>Site Information</u>			
Site Slope	0 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	Default	APZ/Separation(m):	6.5
<u>Fire Inputs</u>			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
<u>Calculation Parameters</u>			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
<u>Program Outputs</u>			
Category of Attack:	HIGH	Peak Elevation of Receiver(m):	2.32
Level of Construction:	BAL 29	Fire Intensity(kW/m):	3060
Radiant Heat(kW/m2):	26.01	Flame Angle (degrees):	67
Flame Length(m):	5.05	Maximum View Factor:	0.388
Rate Of Spread (km/h):	0.59	Inner Protection Area(m):	6
Transmissivity:	0.881	Outer Protection Area(m):	0
Run Description: E Design Fire 3 (BAL 19)			
<u>Vegetation Information</u>			
Vegetation Type:	Remnant Vegetation	Vegetation Group:	Remnant Vegetation
Vegetation Slope:	7 Degrees	Vegetation Slope Type:	Upslope
Surface Fuel Load(t/ha):	8	Overall Fuel Load(t/ha):	10
<u>Site Information</u>			
Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m)	Default	APZ/Separation(m):	9
<u>Fire Inputs</u>			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
<u>Calculation Parameters</u>			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
<u>Program Outputs</u>			
Category of Attack:	MODERATE	Peak Elevation of Receiver(m):	2.43
Level of Construction:	BAL 19	Fire Intensity(kW/m):	3060
Radiant Heat(kW/m2):	18.53	Flame Angle (degrees):	74
Flame Length(m):	5.05	Maximum View Factor:	0.28
Rate Of Spread (km/h):	0.59	Inner Protection Area(m):	9
Transmissivity:	0.87	Outer Protection Area(m):	0

Design Fire 4 (south)

The results of the Design Fire 4 are summarised within the following bushfire attack assessment with locations depicted in Schedule 1 attached. One (1) output has been calculated, based on BAL 29. This assessment has been undertaken using a performance based assessment (Appendix B of AS3959). The results of the assessment, provided below, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*.

Table 4 – Design Fire (DF) 4

Design Fire 1 characteristics	
Vegetation formations (as per Planning for Bushfire Protection (2006) within a 140m radius of the site was determined were as	
Vegetation type <ul style="list-style-type: none"> Proximity 	Forest
Fuel Load (predominant vegetation)	20/25 tonnes per hectare (RFS, 2006)
The 'effective slope...within the hazard which most significantly affects fire behaviour of the site in regards to the vegetation found (RFS, 2006) has been calculated for a distance of 100 within the hazardous vegetation.	
Slope within vegetation	12 degrees downslope
APZ provided	39m

Run Description: F Design Fire 4			
<u>Vegetation Information</u>			
Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	12 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	20	Overall Fuel Load(t/ha):	25
<u>Site Information</u>			
Site Slope	0 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	Default	APZ/Separation(m):	39
<u>Fire Inputs</u>			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
<u>Calculation Parameters</u>			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
<u>Program Outputs</u>			
Category of Attack:	HIGH	Peak Elevation of Receiver(m):	16.04
Level of Construction:	BAL 29	Fire Intensity(kW/m):	70951
Radiant Heat(kW/m2):	28.59	Flame Angle (degrees):	56
Flame Length(m):	38.7	Maximum View Factor:	0.465
Rate Of Spread (km/h):	5.49	Inner Protection Area(m):	39
Transmissivity:	0.809	Outer Protection Area(m):	0

Design Fire 5 (south-east)

The results of the Design Fire 5 are summarised within the following bushfire attack assessment with locations depicted in Schedule 1 attached. One (1) output has been calculated, based on BAL 19. This assessment has been undertaken using a performance based assessment (Appendix B of AS3959). The results of the assessment, provided below were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*.

Table 5 – Design Fire (DF) 5

Design Fire 1 characteristics	
Vegetation formations (as per Planning for Bushfire Protection (2006) within a 140m radius of the site was determined were as	
Vegetation type <ul style="list-style-type: none"> Proximity 	Forest
Fuel Load (predominant vegetation)	20/25 tonnes per hectare (RFS, 2006)
The 'effective slope...within the hazard which most significantly affects fire behaviour of the site in regards to the vegetation found (RFS, 2006) has been calculated for a distance of 100 within the hazardous vegetation.	
Slope within vegetation	15 degrees downslope
APZ provided	60m

Run Description: G Design Fire 5	
<u>Vegetation Information</u>	
Vegetation Type: Forest	Vegetation Group: Forest and Woodland
Vegetation Slope: 15 Degrees	Vegetation Slope Type: Downslope
Surface Fuel Load(t/ha): 20	Overall Fuel Load(t/ha): 25
<u>Site Information</u>	
Site Slope 0 Degrees	Site Slope Type: Level
Elevation of Receiver(m) Default	APZ/Separation(m): 60
<u>Fire Inputs</u>	
Veg./Flame Width(m): 100	Flame Temp(K) 1090
<u>Calculation Parameters</u>	
Flame Emissivity: 95	Relative Humidity(%): 25
Heat of Combustion(kJ/kg) 18600	Ambient Temp(K): 308
Moisture Factor: 5	FDI: 100
<u>Program Outputs</u>	
Category of Attack: MODERATE	Peak Elevation of Receiver(m): 20.11
Level of Construction: BAL 19	Fire Intensity(kW/m): 87268
Radiant Heat(kW/m2): 18.68	Flame Angle (degrees): 59
Flame Length(m): 46.92	Maximum View Factor: 0.319
Rate Of Spread (km/h): 6.76	Inner Protection Area(m): 60
Transmissivity: 0.771	Outer Protection Area(m): 0

Design Fire 6 (south-west)

The results of the Design Fire 6 are summarised within the following bushfire attack assessment with locations depicted in Schedule 1 attached. One (1) output has been calculated, based on BAL 19. This assessment has been undertaken using a performance based assessment (Appendix B of AS3959). The results of the assessment, provided below were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*.

Table 6 – Design Fire (DF) 6

Design Fire 1 characteristics	
Vegetation formations (as per Planning for Bushfire Protection (2006) within a 140m radius of the site was determined were as	
Vegetation type <ul style="list-style-type: none"> Proximity 	Forest
Fuel Load (predominant vegetation)	20/25 tonnes per hectare (RFS, 2006)
The 'effective slope...within the hazard which most significantly affects fire behaviour of the site in regards to the vegetation found (RFS, 2006) has been calculated for a distance of 100 within the hazardous vegetation.	
Slope within vegetation	8 degrees downslope
APZ provided	48m

Run Description: H Design Fire 6	
<u>Vegetation Information</u>	
Vegetation Type: Forest	Vegetation Group: Forest and Woodland
Vegetation Slope: 8 Degrees	Vegetation Slope Type: Downslope
Surface Fuel Load(t/ha): 20	Overall Fuel Load(t/ha): 25
<u>Site Information</u>	
Site Slope 0 Degrees	Site Slope Type: Level
Elevation of Receiver(m) Default	APZ/Separation(m): 48
<u>Fire Inputs</u>	
Veg./Flame Width(m): 100	Flame Temp(K) 1090
<u>Calculation Parameters</u>	
Flame Emissivity: 95	Relative Humidity(%): 25
Heat of Combustion(kJ/kg) 18600	Ambient Temp(K): 308
Moisture Factor: 5	FDI: 100
<u>Program Outputs</u>	
Category of Attack: MODERATE	Peak Elevation of Receiver(m): 13.75
Level of Construction: BAL 19	Fire Intensity(kW/m): 53838
Radiant Heat(kW/m2): 16.02	Flame Angle (degrees): 66
Flame Length(m): 30.09	Maximum View Factor: 0.27
Rate Of Spread (km/h): 4.17	Inner Protection Area(m): 48
Transmissivity: 0.781	Outer Protection Area(m): 0

Table 7 – Bushfire attack assessment

Building Level	Unit No.	Aspect	Vegetation formation within 140m of development	Effective slope of land	APZ provided (m)	BAL level applicable (refer to Note 1)
Ground Floor	Units 1-6	South	Forest	12 ^{oD}	39	BAL 29
	N/A Underground and / or no windows	North, west & south	N/A	N/A	N/A	N/A
First Floor	Units 57-59	South	Forest	12 ^{oD}	39	BAL 29
	N/A Underground and / or no windows	East	N/A	N/A	N/A	N/A
	Unit 59	West	Forest	12 ^{oD}	39	BAL 29
	Unit 73	South-west	Forest	8 ^{oD}	>48	BAL 12.5 (refer Note 1)
First Floor Mezzanine	Office Units 57-59	South	Forest	12 ^{oD}	39	BAL 29
	Office unit 57	South-east	Forest	12 ^{oD}	39	BAL 29
	Office unit 44, 71, 72 & Units 44, 73, 72, 71, 70	South-east	Forest	15 ^{oD}	>60	BAL 19
	Unit 69	North-east	Forest (reduced flame width 10m)	Level	<18.6	BAL FZ
	Office 69 & 70	North-east	Forest (reduced flame width 10m)	Level	>18.7	BAL 19

Building Level	Unit No.	Aspect	Vegetation formation within 140m of development	Effective slope of land	APZ provided (m)	BAL level applicable (refer to Note 1)
	Unit 60, 73, 61 - 64	South-west	Forest	8 ^{oD}	>48	BAL 12.5 (refer Note 1)
Second Floor	Units 74 - 76	South	Forest	12 ^{oD}	39	BAL 29
	N/A no windows	East & West	N/A	N/A	N/A	N/A
	Unit 77 - 85,	Eastern elevation of internal units	Forest	11 ^{oD}	>18m plus shielding	BAL 12.5 (refer Note 1)
	Unit 87 - 91	Western elevation of internal units	Forest	11 ^{oD}	>18m plus shielding	BAL 12.5 (refer Note 1)
Second Floor Mezzanine	Office Units 74-76	South	Forest	12 ^{oD}	39	BAL 29
	Office unit 74	South-east	Forest	12 ^{oD}	39	BAL 29
	Office unit 87-91 & Units 88-91	South-east	Forest	15 ^{oD}	>60	BAL 19
	Caretakers unit & Unit 69 & 87	North-east	Forest (reduced flame width 10m)	Level	<18.6	BAL FZ
	Caretakers Unit	South	Forest (reduced flame width 10m)	Level	<18.6	BAL 40 (based on shielding)
	Units 77-84	South-west	Forest	8 ^{oD}	>48	BAL 19
	Unit 85	North-west	Remnant Forest (refer Note 2)	7 ^{oU}	6.5-9	BAL 29

*Notes: * Slope is either 'U' meaning upslope or 'C' meaning cross slope or 'D' meaning downslope*

Note 1: BAL 12.5 applies to these units to prevent the entry of embers. These units are shielded from flame / radiant heat due to their location either below ground level and the shielding offered by the retaining walls or the shielding offered by the outer facades of the building.

Note 2: *PBP* describes remnant vegetation as a parcel of vegetation with a size of less than 1ha or a shape that provides a potential fire run directly towards a building not exceeding 50m. The vegetation to the north-west exhibits these qualities (i.e. run of less than 50m) and therefore the threat posed is considered low and APZ setbacks for this aspect are the same as for the rainforest category outlined in *PBP*.

Building construction

The warehouse is a Class 8 building use with FRL's for the ground floor storage area at 240 minutes and the first and second floors in the building to 120 minutes.

The walls between the industrial units and between the industrial units and the common driveway areas will achieve the FRL of at least 120/120/120.

All of the perimeter walls and floors of the industrial units will be concrete/masonry in design. I.e. this applies to the walls between units, the walls to the common driveway and all floors in the building.

Wall type consists of a mixture of precast concrete (150mm – 175mm) and concrete block (140mm – 190mm) with fire resistance levels of 120/120/120 and 240/240/240.

The roof is located over the industrial units only and is non-combustible. There is no roof over the driveway portions. The industrial units are separated with concrete walls.

The most vulnerable parts of the industrial building in terms of bushfire impact are the roof, windows and doors and therefore the BAL ratings outlined in Table 7 (and depicted in the following figures) should apply to the units. In addition a BAL 29 rating is to apply to the roof of Building A & Building B. BAL FZ applies to the caretakers Unit & Unit 87 with the remainder of the building roof complying with BAL 29 (refer Schedule 1 attached).

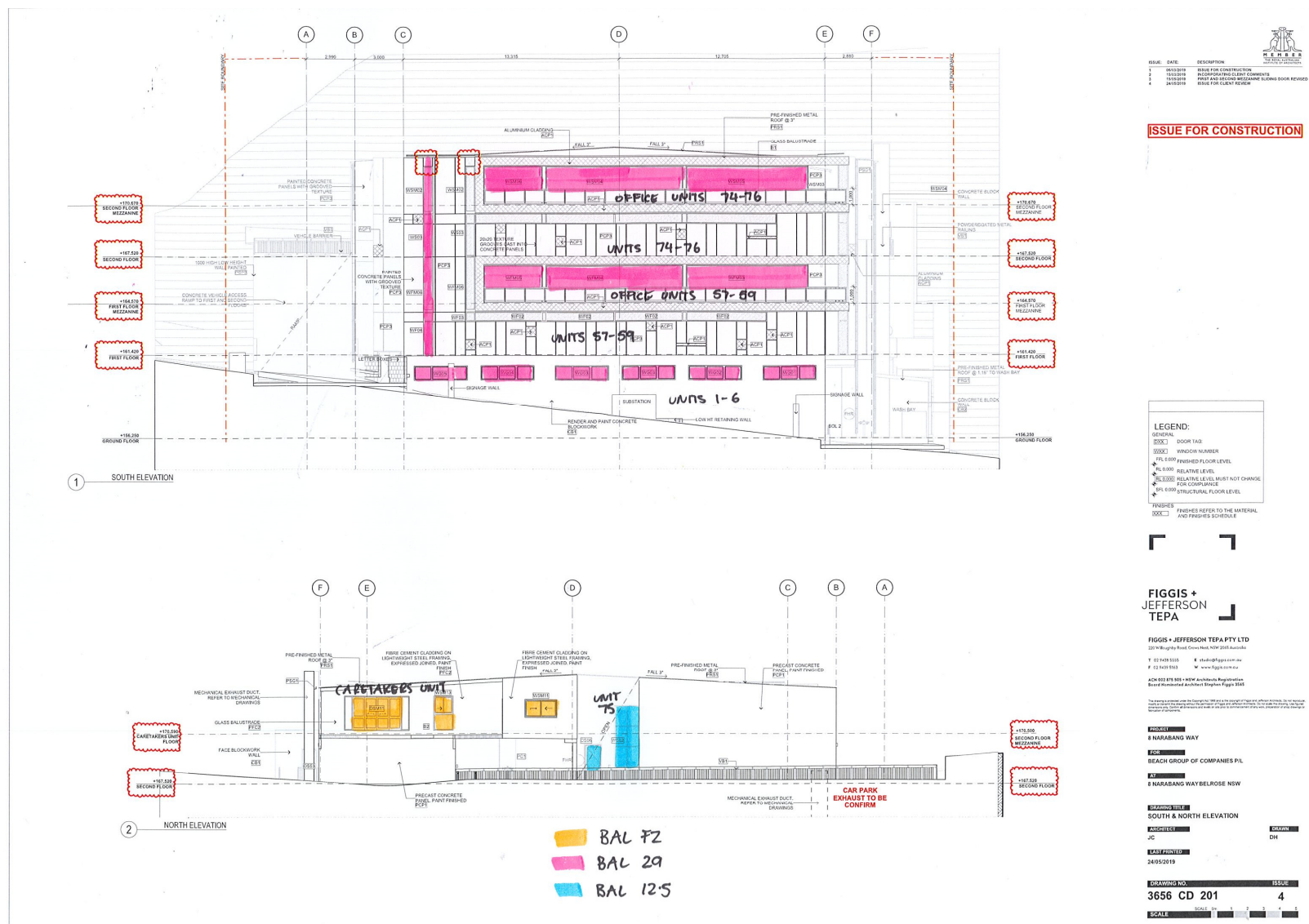
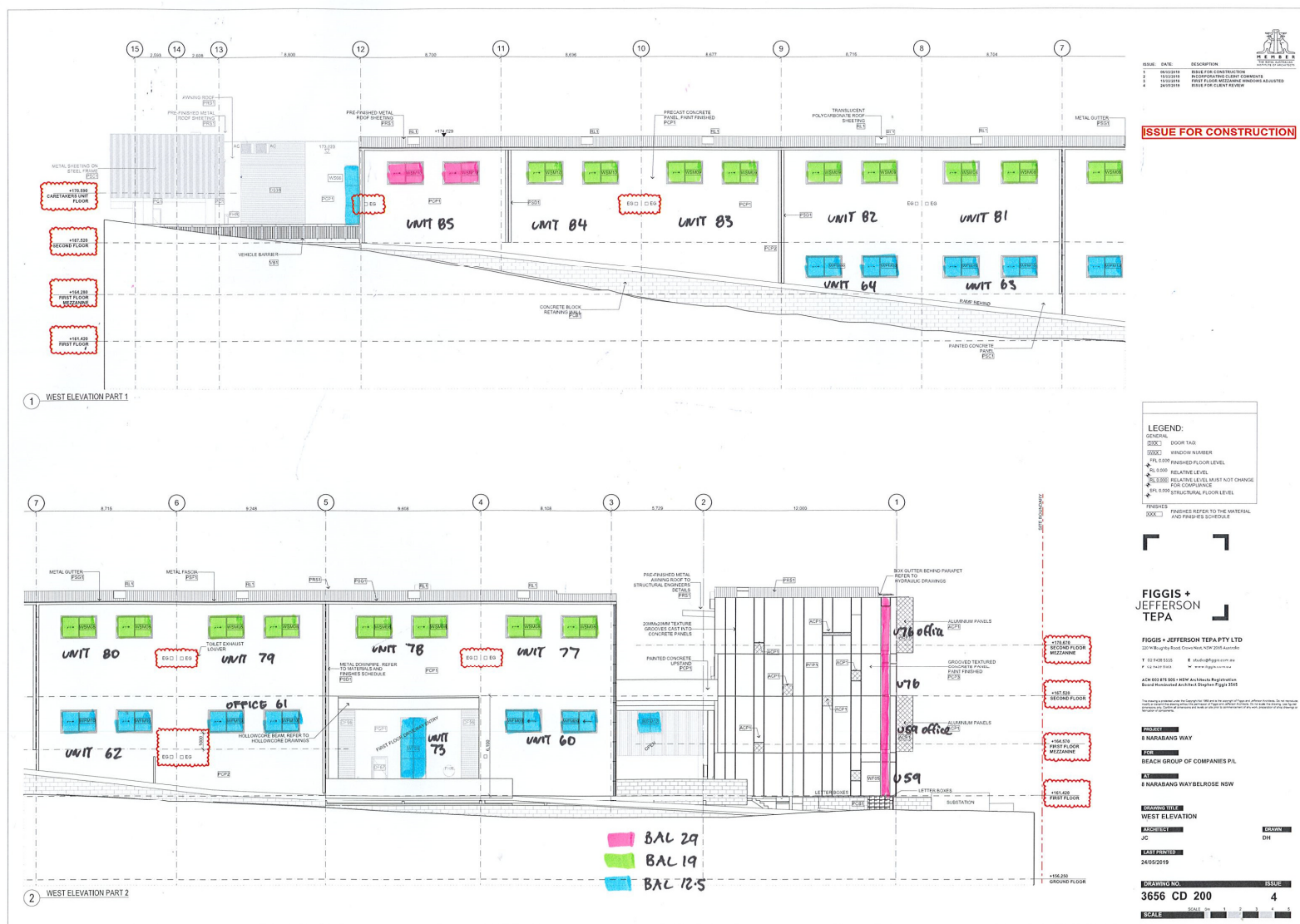
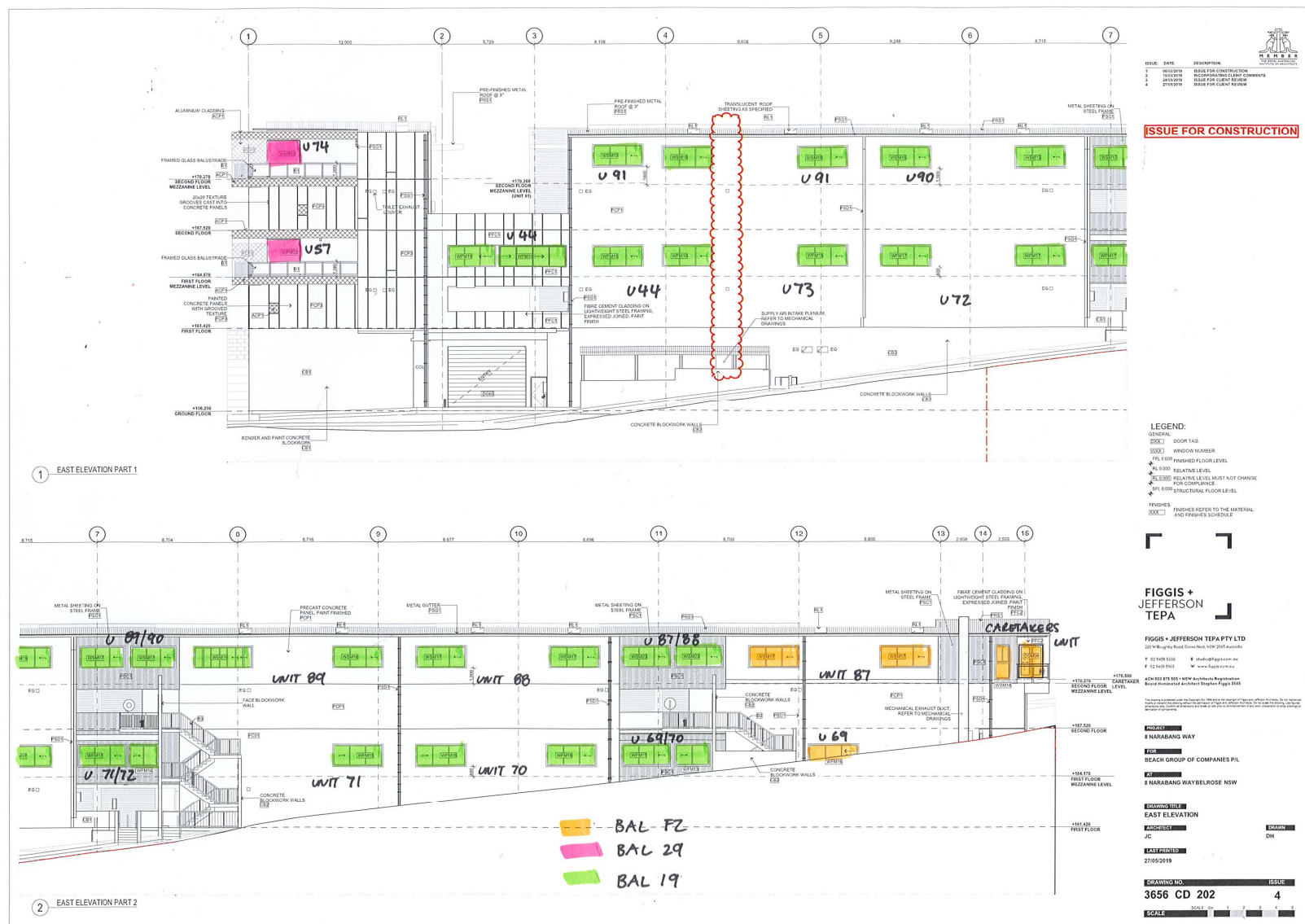


Figure 3 – South & North Elevations





Recommendations

The following BAL ratings are recommended to apply to the vulnerable elements of the building (i.e. windows and doors) exposed and in direct line of bushfire attack (i.e. flame or radiant heat attack). The internal units or elevations (shielded from bushfire attack) will have a lower rating applied to prevent the entry of airborne embers and in acknowledgement that fire rated walls are provided between each of the industrial units.

The following BAL ratings also take into account the shielding opportunities created by the earthworks associated with the development with the first and second floor cut into the hill and located 2.75m below ground level. This coupled with the shielding offered by the existing building to the east has the effect of reducing the BAL affectation and allowing the stepping down of BAL ratings to a number of the industrial units.

The following changes to the current conditions are recommended and are to apply only to the external windows / doors (not to the internal windows / doors);

Condition 3 – The northern external elevation of the building, including the **Caretakers Unit and the eastern elevation of Unit 87 & 69** ~~Units 66, 67, 68, 69, 70, 84, 85, 86, 87 & 88~~ shall comply with Section 3 and 9 (BAL FZ) of Australian Standard AS3959 – 2009....

Condition 4 – The external elevations of the adjoining units **44, 87 – 91, 70-73, 77-84** ~~64, 65, 71, 82, 83 & 89~~ shall comply with Section 3 and **6 & 8** (BAL **19 40**) of Australian Standard AS3959 – 2009....

Condition 5 – The southern external elevation of the building, including Units **1 – 6, 57, 58, 59, 60, 73, 74, 75 & 76, the eastern external elevation of the building including Units 57 & 74 and western external elevation of Unit 59, 76 & 85** shall comply with Section 3 and **7 & 8** (BAL **29 40**) of Australian Standard AS3959 – 2009....

Condition 6 – The remainder of the middle units **(external facades) on the second floor and the western external elevation, including Units 60-64** shall comply with Section 3 and **5 & 7** (BAL **12.5 29**) of Australian Standard AS3959 – 2009....

Condition 7 - The southern external elevation of the Caretakers Unit shall comply with Section 3 and 8 (BAL 40) of Australian Standard AS3959 – 2009....

In addition a BAL 29 rating is to apply to the roof of Building A & Building B. BAL FZ applies to the caretakers Unit & Unit 87 with the remainder of the building roof complying with BAL 29 (refer Schedule 1 attached).

Should you require further information or choose to utilise our services again, please do not hesitate to contact Nicole van Dorst or the undersigned on 4340 5331 or info@traverseecology.com.au.

Yours faithfully



John Travers

BA Sc. / Ass Dip / Grad Dip / BPAD-Level 3-15195 (FPA)

Managing Director – **Travers bushfire & ecology**

Attachment 1 – Schedule 1 Bushfire Protection Measures



**Travers bushfire & ecology employs a
Bushfire Planning and Design (BPAD) Accredited Practitioner**

John Travers and Nicole van Dorst are BPAD consultants. Both are certified by the Fire Protection Association. FPA Australia administers the Bushfire Planning and Design (BPAD) Accreditation Scheme. The Scheme accredits consultants who offer bushfire assessment, planning, design and advice services. It accredits practitioners who meet criteria based on specific accreditation and competency requirements, including a detailed knowledge of the relevant planning, development and building legislation for each State and Territory. Through the Accreditation Scheme, BPAD Accredited Practitioners are recognised by industry, regulators, fire agencies, end-users and the community as providers of professional bushfire assessment, planning, design and advice services. The Scheme provides an enhanced level of confidence for government and the community that practitioners are accredited by a suitably robust scheme that is administered by the peak national body for fire safety. Note: L3 is the highest level and L1 is the lowest level.

