



Solitary Islands Village Pty Ltd
Site Compatibility Certificate at Lot 1 DP1128964, Mullaway
Drive, Mullaway
Supplementary Bushfire Modelling

April 2019

Table of contents

1.	Introduction.....	1
2.	Existing environment.....	2
2.1	Vegetation.....	2
3.	Proposal	5
3.1	Overview	5
3.2	Design	5
3.3	Vegetation clearing	5
4.	Assessment of Asset Protection Zone (APZ) requirements	6
4.1	Short Fire Run methodology.....	7
4.2	Short Fire Run model input assumptions.....	8
4.3	Transect 1 and 2 - Method 2 and SFR modelling results	8
4.4	Transect 4 - Method 2 modelling results.....	9
4.5	Distances at which BAL <10 is achieved (required APZ width).....	9
4.6	Minimum APZ specifications.....	10
5.	Summary.....	11

Table index

Table 1	APZ performance criteria.....	10
---------	-------------------------------	----

Figure index

Figure 1	Biodiversity Values Map.....	4
Figure 2	Bushfire prone land map with bushfire assessment transects	6
Figure 3	Formerly-mapped bushfire-prone vegetation cleared from NE section of Lot 1	7

Appendices

Appendix A - Fire Protection Association of Australia - Flamesol Radiant Heat Flux and Bushfire Attack Level Calculation Sheets	
Appendix B – Site plan and mapped APZs	

1. Introduction

On 15 February 2019 GHD submitted relevant bushfire assessment information to NSW Department of Planning and Environment (DPE) relating to an application for a Site Compatibility Certificate for a proposed Seniors Living development at Lot 1 DP1128964, Mullaway Drive, Mullaway, NSW (subject land).

In response to our submission of relevant bushfire assessment information, additional information was requested from DPE in order to enable the Regional Panel to determine the impacts on the natural environment.

This Supplementary Assessment includes Australian Standard 3959 Method 2 Bushfire Attack Level modelling to clarify that there is sufficient land area within Lot 1 to provide the required Asset Protection Zones for the development, as would normally be required at development application stage, pursuant to obtaining a Bush Fire Safety Authority from the NSW Rural Fire Service (RFS) for the development.

2. Existing environment

2.1 Vegetation

The site supports 2 similar open forest vegetation communities and one swamp open forest community. All appear to have been modified by thinning of the overstorey, removal of most mature mid-stratum vegetation (some of which remains in windrows), disturbance of the ground layer in parts by grading and grazing and invasion of the remaining ground layer by exotic herbs and grasses.

2.1.1 *Eucalyptus pilularis* (Blackbutt) Open Forest

Structure & Composition

The community is an open forest to around 20 metres tall and generally appears to have been thinned by logging or clearing. It is dominated by Blackbutt, associated species include occasional Pink Bloodwood *Corymbia intermedia*.

Midstratum vegetation is generally absent although there are very occasional trees of Black Oak *Allocasuarina littoralis* and occasional mesophyllous shrubs in less disturbed areas.

Ground layer vegetation consists of sparse grass and herbs with small sclerophyllous shrubs in less disturbed areas, or a dense cover of exotic grasses where more disturbed.

Habitat & Ecology

The community occurs on stony soils on low ridges throughout the study area

The dominance by trees in the late mature and overmature growth stages indicates that the area has never been subjected to broadscale clearing, however the absence of midstratum vegetation, stumps and large woody debris indicates that it has been modified.

The evidence on site suggests that the area has been subjected to a patchy fire regime within the previous 10 years or so, and more severe fires have occurred 50 or more years ago.

Classification & Conservation status

The community falls within the North Coast Wet Sclerophyll Forest class of Keith (2004), albeit in a somewhat stunted form because of the effects of salt wind. The understorey is currently grassy rather than shrubby although there is evidence that it has been shrubby at times in the past.

The Biometric type is 'Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast', with influences from the dry heathy open forests on sandy soils that occur nearby.

The community is not listed as Endangered, Vulnerable or rare either nationally or in the state or LGA.

2.1.2 *Eucalyptus pilularis* – *E. resinifera* (Blackbutt – Red Mahogany) Open Forest

Structure & Composition

The community is an open forest to around 25 metres tall and also dominated by Blackbutt. It is denser and taller than Community 1 and has more mesophyllous shrubs and trees in the understorey.

The associated species include red mahogany *E. resinifera*, Tallowwood *E. microcorys*, Ironbark *E. siderophloia* and Brush Box *Lophostemon confertus*.

Midstratum vegetation includes Red Ash *Alphitonia excelsa* and Cheese Tree *Glochidion ferinandii*.

Ground layer vegetation consists of sparse blady grass and herbs over a mid-dense cover of soft grasses and ferns.

Habitat & Ecology

The community occurs as an ecotone between the drier more exposed Blackbutt of Community 1 and the wetter areas supporting Community 3. It has been treated here as a separate community because of its taller denser tree cover and moister understorey.

The evidence on site suggests that the area has been subjected to a patchy fire regime within the previous 10 years or so, and more severe fires have occurred 50 or more years ago.

Classification & Conservation status

The community falls within the North Coast Wet Sclerophyll Forest class of Keith (2004). The understorey is shrubby although there is still a good cover of grasses, probably because of recent disturbance.

The Biometric type is 'Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast.

The community is not listed as Endangered, Vulnerable or rare either nationally or in the state or LGA.

- 2.1.3 Melaleuca quinquenervia – Eucalyptus tereticornis – Lophostemon suaveolens (Paperbark – Forest Red Gum – Swamp Box) Open Forest

Structure & Composition

The community is dominated by Paperbark on the lower elevations and by Swamp Box on the higher elevations. Forest Red Gum occurs throughout.

Midstratum vegetation is typically sparse to absent although there are occasional stands of both sclerophyllous and mesophyllous shrubs in less disturbed areas.

Ground layer vegetation ranges from sparse grass in the more elevated areas to dense cover of the Sword Sedge *Lepidosperma quadrangulatum* and Native Violet *Viola hederacea* in less disturbed lower areas, , to dense cover of exotic grasses on more disturbed lower areas.

Habitat & Ecology

The community extends from lower areas mapped as alluvial soils (Soil Conservation Service 1979) or as alluvial deposits (Troedson & Hashimoto 2004), where it has an overstorey dominated by Paperbarks and understorey dominated by sedges, to adjoining slopes and low stony rises where the overstorey is dominated by Swamp Box and Pink Bloodwood and the understorey is dominated by grasses. There two overstorey communities form complex intergradations across this part of the study area and it is not possible to reliably separate them for the purpose of mapping.

The dominance by trees in the mature to overmature growth stages indicates that these areas have not been subjected to broadscale clearing, although there is evidence of selective clearing and slashing.

There is evidence of patchy fire within the past 10 years or so but little evidence of older severe fire, especially in the lower parts of this community.

Where the community is dominated by Paperbark it is classified as Coastal Swamp Forest, and where it is dominated by Swamp Box or Forest Red Gum it is classified as Coastal Floodplain Wetland (Keith 2004).

Both of these Biometric communities are listed under the Biodiversity Conservation Act as Endangered Ecological Communities, the Paperbark community as 'Swamp Sclerophyll Forest on Coastal Floodplain' and the Swamp Box community as 'Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion'.

No endangered population or critical habitat is listed for the site.

The site does not contain any biodiversity values mapped by the NSW Government's Biodiversity Values Map and Threshold Tool as shown in Figure 1 below.



4 | **GHD** | Report for Solitary Islands Village Pty Ltd – Supplementary Bushfire Analysis, 2219774

3. Proposal

3.1 Overview

The proposed RACF would offer up to 96 resident rooms, comprising both residential aged care units (64) and independent studio apartments (32) together with 12 x 3 bedroom independent living villas.

The proposal will also include a central administration facility including health and medical care area, pool and gym and laundry facilities for use by on-site residents.

3.2 Design

The RACF component of the proposal would present as a two storey attached townhouse style development with a central administration. The development would have a maximum height of 8.5 m. The independent living villas would be one storey, consistent with the design of the previously approved seniors living development on the site. Although attached, the design has used articulation to give the distinct impression of individual units that is consistent with the neighbouring residential development. The independent living villas would be one storey, consistent with the design of the previously approved seniors development on the site.

The western wings of the RACF development would house the 64 one bedroom suites and administration whilst the eastern wing would accommodate 32 independent studio apartments. The twelve independent living villas would be located south and west of those villas already approved.

3.3 Vegetation clearing

It is anticipated that up to 5ha of vegetation on the site would be modified as part of the proposal. The intention is to maintain as much natural vegetation as possible in order to maintain the aesthetic of the site and its surroundings for the ongoing amenity of future residents. Total clearing of approximately 2.4ha would be required to facilitate the RACF, independent living units, health and medical centre, access roads and car parking areas whilst the remainder would be selectively cleared to ensure compliance with the required asset protection zones and bushfire management for the site (refer Section 4 of this report).

4. Assessment of Asset Protection Zone (APZ) requirements

In our letter dated 15 February 2019, it was noted that the assessment of APZ requirements was undertaken using 6 transects extending in north, east, south and west directions from the proposed building construction footprint within the site, as shown in blue on Figure 2. Transects 3, 5 and 6 are, or will at the time of development be 'managed vegetation' (no longer bushfire prone). Transects 3 and 6 extend toward and into parts of the site which are proposed to be cleared of vegetation cover to facilitate construction. Transect 5 extends through vegetation which has been assessed to be 'managed vegetation' (cleared land with managed grass cover) to the south of the subject land. Therefore when the proposed development occurs the only vegetation along Transects 3, 5 and 6 within 100 metres of buildings will be managed vegetation and therefore no APZ will be required in those locations.



Figure 2 Bushfire prone land map with bushfire assessment transects

In relation to Transects 1, 2 and 4 (Figure 2), GHD conservatively assessed that vegetation along these transects was forest vegetation on an 'upslope' slope classification, and determined from AS3959 Method 1 BAL assessment, that an APZ of 60 metres would be required to separate buildings from bushfire-prone vegetation sufficiently to achieve BAL 10 which applies to Special Fire Protection Purpose developments.

It has since been identified that for the 12 proposed independent living villas in the east of the site there may be insufficient room to fully accommodate a 60m APZ within the boundaries of the subject land.

Noting that Method 1 assessments are simple, look-up table approach (which is by design inherently conservative using worst-case slope and fuel input values), use of more detailed AS3959 Method 2 modelling provides for actual input values for slope and fuel parameters to be used and thus can provide more accurate BAL assessment which is less conservative. The use of Method 2 modelling may establish that a smaller APZ can achieve the BAL 10 performance standard, potentially small enough to be fully accommodated within the boundaries of the

subject land. On this basis, AS3959 Method 2 modelling has been undertaken to determine more refined APZ requirements.

Following the approval of Development Consent No. 700/12 for the seniors living development, Figure 3 shows that significant changes in vegetation cover have occurred on the subject land. Firstly, vegetation in the north-eastern and eastern part of the subject land has now been cleared to construct 34 independent living villas.



Figure 3 Formerly-mapped bushfire-prone vegetation cleared from NE section of Lot 1

It is proposed that vegetation within the subject land (where Transects 1, 2 and 4 are located) will be modified to achieve RFS APZ standards for the proposed development. In relation to Transect 1 and 2, the only 'forest' classified vegetation remaining along those transects is on Lot 1, DP 329303 which constitutes a narrow strip (approximately 80 metres wide) of partially cleared/patchy forest (Eucalypt overstorey, but with a managed, low fuel understorey). The strip of 'forest' classified vegetation on this lot is isolated from other forest vegetation patches in the locality (by the subject land to the south and east, and by adjacent residential dwellings along Mullaway Drive to the north and west). Transect 4 is adjacent to a more extensive patch of 'forest' vegetation adjacent to Darkum Road.

4.1 Short Fire Run methodology

The RFS recognises that the fire behaviour modelling incorporated in AS3959 Method 1 for 'forest' assumes a head fire width at least 100 metres wide, spreading through forest with 25 tonnes per hectare of fuel in the understorey. RFS also recognise that use of the AS3959 methodology, in small or narrow patches of forest incapable of supporting fires of the dimensions assumed by AS3959, "can often result in unrealistic and onerous bushfire protection requirements" (RFS, 2017). Accordingly, the RFS have developed a modified BAL assessment methodology specifically for use in small or narrow bushfire hazard situations which can support fire runs of no more than 150 metres in run length, which the RFS calls *Short Run Fire*

situations. The narrow 80 metre wide isolated strip of vegetation on Lot 1 adjacent to the subject land is most appropriate for assessment using the RFS Short Fire Run (SFR) methodology.

In support of the application for a Site Compatibility Certificate, GHD has undertaken a preliminary assessment of APZ requirements using the RFS SFR methodology. The SFR methodology has been applied for Transects 1 and 2 only, and we have used AS3959 Method 2 for refining APZ requirements for Transect 4.

4.2 Short Fire Run model input assumptions

In accordance with the RFS Short Fire Run methodology guidelines (RFS, 2017), GHD has used the following assumptions (Design Fire Brief) for modelling radiant heat flux exposure and determining appropriate APZ width dimensions for the Short Fire Run situations along Transects 1 and 2 on the subject land.

Vegetation:	Dry Sclerophyll Forest (Shrub/Grass)
Fuel load:	14 t/ha (surface and elevated fuel component only)
Effective Slope:	3 degrees (perpendicular to contours, under vegetation)
Site slope:	0 (between vegetation and buildings being assessed)
FFDI:	80
SFR length:	80 metres
Flame temp:	1200K (as for SFPP development)
Wind speed:	30 km/hr (as prescribed for SFR methodology)
L/B ratio:	2.82 (as per SFR methodology)
Head fire width:	28.4 m
Elevated fuel height:	Medium (<1.4 metres)

4.3 Transect 1 and 2 - Method 2 and SFR modelling results

1. Fully Developed Fire Radiation: 50 metre APZ achieves BAL 10 (RHF = 9.8 km/m²)

Using fully developed fire run assumptions (fire width of 100 metres) with published RFS fuel input values for North Coast Dry Sclerophyll Forest - Shrub/Grass sub-formation (Surface and Elevated Fuel = 14 t/ha; Overall Fuel = 25.93 t/ha), a Radiant Heat Flux < 10,000 kW/m² (BAL 10) is achieved using an APZ of **50 metres**.

2. Short Fire Run Fire Radiation: 32 metre APZ achieves BAL 10 (RHF = 9.96 km/m²)

Using NSW RFS Short Fire Run assumptions calculated for the site (fire width of 28.4 metres) with published NSW RFS fuel input values for North Coast Dry Sclerophyll Forest - Shrub/Grass sub-formation (Surface and Elevated Fuel = 14 t/ha; Overall Fuel = 25.93 t/ha), a Radiant Heat Flux < 10,000 kW/m² (BAL 10) is achieved using an APZ of **32 metres**.

Crown fire spread within the APZ is not a credible possibility due to the non-contiguous nature of scattered tree cover, variable nature of canopy gaps, and high-crown base without understorey ladder fuels. Retention of the existing residual tree cover is desirable from an environmental perspective, to retain habitat for arboreal fauna.

Full FPA Flamesol Method 2 modelling calculation sheets attached at Appendix A.

4.4 Transect 4 - Method 2 modelling results

1. Fully Developed Fire Radiation: 50 metre APZ achieves BAL 10 ($RHF = 9.8 \text{ kW/m}^2$)

Using fully developed fire run assumptions (fire width of 100 metres) with published NSW RFS fuel input values for North Coast Dry Sclerophyll Forest - Shrub/Grass sub-formation (Surface and Elevated Fuel = 14 t/ha; Overall Fuel = 25.93 t/ha), a Radiant Heat Flux < 10,000 kW/m² (BAL 10) is achieved using an APZ of **50 metres**.

Full FPA Flamesol Method 2 modelling calculation sheets attached at Appendix A.

4.5 Distances at which BAL <10 is achieved (required APZ width)

Based on the modelled fireline intensity, a radiant heat flux/BAL of less than 10 is achieved at the following APZ width:

Transect 1:	32 metres
Transect 2:	32 metres
Transect 4:	50 metres

The above SFR and Method 2 modelling-determined APZ dimensions are all able to be achieved in full within the boundaries of the subject land. Accordingly, the APZ performance measures of Planning for Bushfire Protection (RFS, 2006) can be met.

4.6 Minimum APZ specifications

GHD clarifies that relevant SFPP APZ performance criteria are met as specified in Table 1.

Table 1 APZ performance criteria

PBP Performance Criteria	Acceptable solution/Current compliance	Future compliance
Radiant heat levels of greater than 10kW/m ² will not be experienced by occupants or emergency services workers entering or exiting a building	✓ All proposed buildings compliant on the basis of RHF calculations (see RHF calculations at section 2.2 and 2.3) as shown in Appendix B.	Maintenance of APZ will achieve RHF < 10kW/m ² in perpetuity
Issues relating to slope are addressed: maintenance is practical, soil stability is not compromised the potential for crown fires is negated	✓ Compliant Slopes within all APZs are < 5 degrees and readily maintained. Soils stabilised by maintained grass cover and widely spaced tree retention. Zero potential for crown fire or forest fire in APZ (fire in maintained grass understorey only). Elevated (ladder) fuels are absent and retained trees have a high crown-base.	Gentle site slopes and landscaped grassy groundcover are inherently conducive to APZ maintenance in perpetuity
APZs are managed and maintained to prevent the spread of a fire towards the building.	✓ Compliant Limited grass cover in APZ is to be continuously maintained in short condition by mowing or slashing. Canopies of retained trees cannot support fire spread (2-5 metre gaps) and a high crown-base.	APZ maintenance in perpetuity APZ's can be fully contained within Lot 1.
Vegetation is managed to prevent flame contact and reduce radiant heat to buildings, minimise ember-caused ignition and reduce the effect of smoke on residents and fire-fighters	✓ Compliant The only credible bushfire attack mechanism to the proposed new buildings on Lot 1 is ember attack. Ember and smoke impact is minimised through APZ maintenance and AS3959:2009 construction compliance.	Vegetation within APZ is maintained in perpetuity

5. Summary

GHD trusts that the additional AS3959 Method 2 and RFS Short Fire Run modelling and information provided in this supplementary advice satisfies DPE and RFS that the APZ requirements for the proposed seniors living development at the site can be met in full.

It is expected that confirmation of full compliance with objectives Planning for Bushfire Protection will be provided at Development Application stage.

Appendices

Appendix A - Fire Protection Association of Australia - Flamesol Radiant Heat Flux and Bushfire Attack Level Calculation Sheets

Calculated April 3, 2019, 11:21 am (BALc v.4.8)

Fully Developed Fire

Bushfire Attack Level calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	1.65 km/h
Vegetation classification	Forest	Flame length	13.85 m
Surface fuel load	14 t/ha	Flame angle	79 °
Overall fuel load	25.93 t/ha	Panel height	13.6 m
Vegetation height	n/a	Elevation of receiver	2 m
Effective slope	3 °	Fire intensity	22,146 kW/m
Site slope	0 °	Transmissivity	0.78
Distance to vegetation	50 m	Viewfactor	0.1124
Flame width	100 m	Radiant heat flux	9.800000000000001 kW/m ²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

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

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

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated April 3, 2019, 11:25 am (BALc v.4.8)

Short Fire Run

Bushfire Attack Level calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	1.65 km/h
Vegetation classification	Forest	Flame length	13.85 m
Surface fuel load	14 t/ha	Flame angle	67 °
Overall fuel load	25.93 t/ha	Panel height	12.75 m
Vegetation height	n/a	Elevation of receiver	2 m (user defined value)
Effective slope	3 °	Fire intensity	22,146 kW/m
Site slope	0 °	Transmissivity	0.8149999999999999
Distance to vegetation	32 m	Viewfactor	0.1094
Flame width	28.4 m	Radiant heat flux	9.960000000000001 kW/m ²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

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

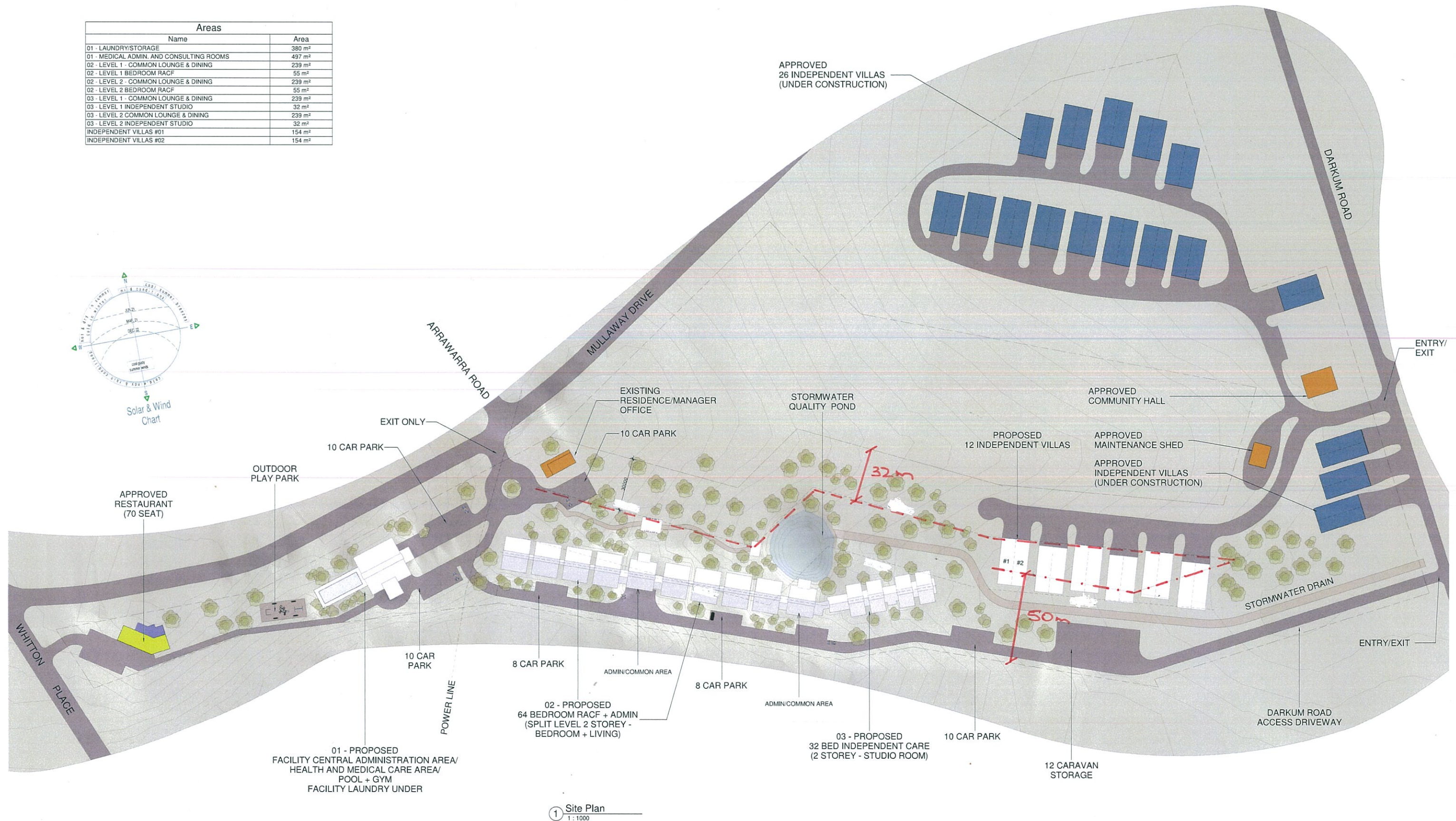
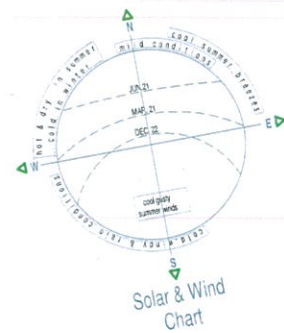
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Flame angle - Douglas & Tan, 2005

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

Appendix B – Site plan and mapped APZs

Areas	
Name	Area
01 - LAUNDRY/STORAGE	380 m ²
01 - MEDICAL ADMIN. AND CONSULTING ROOMS	497 m ²
02 - LEVEL 1 - COMMON LOUNGE & DINING	239 m ²
02 - LEVEL 1 BEDROOM RACF	55 m ²
02 - LEVEL 2 - COMMON LOUNGE & DINING	239 m ²
02 - LEVEL 2 BEDROOM RACF	55 m ²
03 - LEVEL 1 - COMMON LOUNGE & DINING	239 m ²
03 - LEVEL 1 INDEPENDENT STUDIO	32 m ²
03 - LEVEL 2 COMMON LOUNGE & DINING	239 m ²
03 - LEVEL 2 INDEPENDENT STUDIO	32 m ²
INDEPENDENT VILLAS #01	154 m ²
INDEPENDENT VILLAS #02	154 m ²



GHD

Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO BOX 5403 Hunter Region Mail Centre NSW 2310
T: 61 2 4979 9999 F: 61 2 4979 9988 E: ntlmail@ghd.com

© GHD 2019

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Document1

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	P De Mar	B Luffman	<i>B Luffman</i>	S Lawer	<i>S Lawer</i>	08/04/2019

www.ghd.com

