Bushfire Safety
CONSULTING

Fire Management Plan

Jindowie Development

Subdivision Application WAPC (150834)
Lot 1 Yanchep Beach Road
Yanchep
City of Wanneroo
August 8, 2015
Prepard for: Australand Property Group

Subdivision Proposal (WAPC 150834)
Lot 9100 Yanchep Beach Road
Yanchep
City of Wanneroo

Front Cover Photo: Aerial photograph of development site

Prepared for: Australand Properties

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Table of Contents

Executive Summary

This Fire Management Plan (FMP) has been prepared following the assessment of the western portion of Lot 1 Yanchep Beach Road, Yanchep in the City of Wanneroo. An approved FMP was developed for the site in March 2014 by Bushfire Safety Consulting Pty Ltd. A redesign of subdivision stages 19 and 20 has triggered the requirement to update the original FMP.

The study site for this assessment includes the updated subdivision (previously stages 19 and 20) and the approved subdivision stages 11-15 in Lot 1 Yanchep Beach Road, Yanchep (WAPC 147696). The site also includes the triangular portion of land in the north west corner of the site adjacent to Yanchep Beach Road and the MRS railway Reserve.

The area has been re-assessed for vegetation class and bushfire hazard rating levels. **It has been determined that the proposed development will fall within the acceptable level of risk, i.e. BAL-29 and lower and will be sited a minimum of 20 metres from all areas of classified vegetation**.

Areas of classified vegetation have been clearly identified surrounding the site, which require AS3959 construction standard compliance for all residential dwellings within 100 metres.

Currently, the site's bushfire hazard levels are rated as predominantly low because it has been cleared of most vegetation in preparation for the residential development.

All areas of Public Open Space (POS) except one will be landscaped and managed as parklands and reserves. Scrub vegetation will be retained in one POS area.

The bushfire hazard south of the site in Bush Forever site No.289 will pose a long term threat to the development. Temporary hazard exists immediately to the west while Yanchep Beach Road provides a low fuel buffer between the site and fuels to the north. A perimeter Building Protection Zone will ensure the predicted radiant heat flux exposure levels remains below BAL-29 for all exposed dwellings.

Access and egress from the site will adequately service the development with tow main intersections with Yanchep Beach Road.

Reticulated water is available at the site and hydrants will be spaced according to Department of Fire and Emergency Services and Water Corporation Standards

This Plan includes a Table on page 25 showing responses to the Performance Criteria outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).
Both the City of Wanneroo and the Department of Fire and Emergency Services have a public education program to raise the community's awareness to its responsibilities regarding preparing homes for a bushfire attack and what to do if an event occurs.

If there is a bushfire within or near the site, implementing this Fire Management Plan will reduce the threat to residents, visitors and fire fighters.

1. Introduction

The site subject to this Fire Management Plan (FMP) is a portion of Lot 1 Yanchep Beach Road, Yanchep and includes Lot 9010 Yanchep Beach Road in the City of Wanneroo. The site is owned by the Department of Housing (Landcorp) and the applicant is Australand Properties. It is bounded by Yanchep Beach Road to the north, the MRS Railway Reserve to the west, a developing residential subdivision (WAPC 147696) immediately to the east and a 'Bush Forever site No.289.' to the south. The site is It is located 56 kilometres north of the Perth CBD and is on the eastern edge of existing residential development in Yanchep (Appendix A).

The subject site is zoned Urban Development under the District Structure Plan No. 2.

A FMP was developed and approved for the site in 2014 and subdivision of stages 11-15 in Lot 1 Yanchep Beach Road, Yanchep (WAPC 147696) remain unchanged. The proposed subdivision redesign is outlined in Appendix C which has been granted subdivision approval pending a number of conditions are met by correspondence dated 20 October, 2014. Condition number 8 reads:

"An updated fire management plan based on the current subdivision design being prepared, approved and relevant provisions implemented during subdivisional works, in accordance with the WAPCs Guideline Planning for Bushfire Protection Edition 2, May 2010 (in particular Appendix 3) to the specifications of the local government and/or the Department of Fire and Emergency Services. (Local Government)"

In addition to this Condition number 9 reads:

"A notification, pursuant to section 70A of the Transfer of Land Act 1893 is to be placed on the Certificate of title of each affected lot(s), as recommended in the updated fire management plan (attached). Notice of this notification is to be included on the diagram or plan of survey (deposited plan). This notification is to state as follows: 'The lot(s) is/are subject to a fire management plan."

This Fire Management Plan (FMP) has been prepared on behalf of Australand in consultation with CLE Town Planning and Design to respond to this subdivision condition.

It achieves this by providing responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

The proposed subdivision has evolved from the higher level Local Structure Plan (LSP) No. 76, dated November 2010 which encompasses Lots 1 and 2 Yanchep Beach Road in Yanchep (Appendix B).

Community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals. When implemented, the planning and building controls outlined in this plan will reduce the risk to people and property. How people interpret the risk, prepare and maintain the property and buildings and what decisions and actions they take (i.e. evacuate early or stay and defend or other) greatly influence the outcome in a bushfire.

1.1 The Proposal

Subdivision approval has been granted and the original FMP approved for stages 11-15 (WAPC 147696). This area has been entirely cleared and is currently under residential development in the eastern half of the site (Appendix B). The proposed subdivision subject to the new conditions is outlined in Appendix C and includes 2 group housing sites, 3 areas of public open space and residential lots.

Three main categories of housing are proposed including

- Single housing (R30 Code) on traditional lots
- Medium density lots, and
- High density lots (group and multiple dwellings).

Two POS areas will be landscaped and managed as parklands and reserves, the 7333m² POS area in the south west of the site will largely retain scrub vegetation.

1.2 Objectives

The purpose of this FMP is to address bushfire management issues within the proposed development. If there is a bushfire within or near the site, implementing the FMP will reduce the threat to residents, property and emergency response personnel.

Achievable and measurable goals of this plan include ensuring:

- The development is located in an area where the bushfire hazard does not present an unreasonable level of risk to life and property;
- Vehicular access to the development is safe if there is a bushfire occurring;
- Water is available to the development so that life and property can be protected from bushfire;
- The development is sited to minimise the effects of a bushfire; and
- The development design will minimise the effects of a bushfire.

This document sets out the roles and responsibilities of the developer, residents and tenants, the City of Wanneroo, Department of Fire and Emergency Services (DFES) and the Water Corporation. It is important that the measures and procedures outlined in this FMP are reviewed as necessary.

This FMP includes:

- A description of the site, the surrounding area, fire climate and bushfire history;
- A summary of research into the related effects of a bushfire;
- A bushfire hazard assessment;
- Means of addressing vehicular access;
- Siting of buildings to include building protection and hazard separation zones;
- Water supply; and
- Maps and plans of fire reduction measures.

2. Statutory and Policy Framework

Relevant key legislation, policy and guidelines include the following:

2.1 Bush Fires Act

The Act sets out provision to reduce the dangers resulting from bushfires; prevent, control and extinguish bushfires and for other purposes. The Act addresses various matters including prohibited burning times, enabling Local Government to require landowners and/or occupiers to plough or clear fire breaks, to control and extinguish bushfires and establish and maintain permanent fire fighters and volunteer bush fire brigades.

The Act also applies to land throughout Western Australia that is managed by the Department of Environment and Conservation (DEC). Sections 39 and 45 provide authorised CALM Act officers with powers to suppress fires in and near forests and Crown Land. Other sections provide for authorised CALM Act officers to enforce the provisions of the Bush Fires Act. The Bush Fires Act does not affect the provisions of the CALM Act and the Bush Fires Act does not generally bind the DEC.

The provisions of the Bush Fires Act can be enforced in addition to this FMP.

2.2 State Planning Policy No. 3.4 Natural Hazards and Disasters

The objectives of this policy are to:

- Include planning for natural disasters as a fundamental element when preparing all statutory and non-statutory planning documents, specifically town planning schemes and amendments, and local planning strategies, and;
- Use these planning instruments to minimise the adverse effects of natural disasters on communities, the economy and the environment.

The Policy determines those areas that are most vulnerable to bushfire and where development is appropriate and not appropriate. The provisions and requirements contained in Planning for Bush Fire Protection Guidelines - Edition 2 (WAPC et al. 2010) are used in this determination.

2.3 Planning for Bush Fire Protection Guidelines (2010)

DFES, the Western Australian Planning Commission (WAPC) and the Department of Planning (DEP) prepared these guidelines. The document is the foundation for fire risk management planning on private land in Western Australia.

The document addresses important fire risk management and planning issues and sets out performance criteria and acceptable solutions to minimise the risk of bushfires in new subdivisions and developments. It addresses management issues including location, design, the development site, vehicular access and water availability.

2.3 Draft State Planning Policy 3.7 Planning for Bushfire Risk Management and draft Planning for Bushfire Risk Management Guidelines (2014)

The Department of Planning have recently released draft *State Planning Policy 3.7 Planning for Bushfire Risk Management* (2014) and the draft *Planning for Bushfire Risk Management Guidelines* (2014). The requirements of these documents are largely accommodated within this FMP.

The draft *State Planning Policy 3.7 Planning for Bushfire Risk Management* (2014) is intended to inform and guide decision makers, referral authorities and proponents to achieve acceptable bushfire protection outcomes, including expectations at the different stages of planning.

The draft *Planning for Bushfire Risk Management Guidelines* (2014) provides an update on *Planning for Bush Fire Protection Guidelines - Edition 2* (WAPC *et al*, 2010) to ensure necessary bushfire management measures are incorporated into proposed development.

4. Description of the Area

Yanchep is an outer coastal suburb of Perth and is located 56 km north of the Perth CBD. The first dwellings constructed in the area occurred in 1972 and the marina at Two Rocks was completed 2 years later. The population of the area grew substantially from the early 1990s and rapid growth has occurred from 2006 with a large number of new dwellings being added to the area (City of Wanneroo Community Profile 2013).

Major features in the area include Yanchep National Park east of the site and the Yanchep Golf Course north of Yanchep Beach Road. The site is bordered to the south by Bush Forever Site No.289 and to the west by the MRS railway reserve.

4.1 Description of the Subject Land

The site includes the approved subdivision area (WAPC 147696) which is currently under development in the eastern half of the site (Appendix B) and the proposed subdivision (Appendix C). The assessment area also includes the portion of land in the north west corner adjacent to the intersection of Yanchep Beach Road and the MRS Railway Reserve. The entire site has been largely cleared, vegetation is only retained in two POS areas, the larger of which will be landscaped in a low threat condition, while the smaller area with scrub will be retained.

The assessment area around the site includes scrub, woodland and shrubland vegetation. The site has undulating slopes generally less than 5°.

4.2 Climate and Fire Weather

The behaviour of bushfires is significantly affected by weather conditions and they burn more aggressively when high temperatures combine with low humidity and strong winds.

In Perth and surrounding coastal areas, the fire risk is greatest from summer through autumn when the moisture content in vegetation is low. Summer and autumn days

with high temperatures, low humidity and strong winds are particularly conducive to the spread of fire. This threat is increased if thunderstorms develop, accompanied by lightning and little or no rain.

Research indicates that virtually all house losses occur during severe, extreme or catastrophic conditions (i.e. when the Fire Danger Index is over 50) (Blanchi et al. 2010).

The Bureau of Meteorology website[1] states that extreme fire weather conditions in the Perth region typically occur with strong easterlies or north-easterly winds associated with a strong high to the south of the state and a trough offshore. Easterly winds represent about 60 per cent of extreme fire weather days (events) compared to less than 5 per cent associated with southerly winds. About 15 per cent of Perth events occurred in a westerly flow following the passage of a trough.

Very dangerous fire weather conditions often follow a sequence of hot days and easterly winds that culminate when the trough deepens near the coast and moves inland. Winds can change from easterly to northerly and then to westerly during this sequence of climatic events.

Data from the Bureau of Meteorology research station at Swanbourne (45 km south of the study site) indicate the area experiences warm dry summers and cool wet winters (Figure 1), and is classified as a Mediterranean climate. Mean maximum temperatures vary from 31 degrees Celsius in February to 18 degrees Celsius in July.

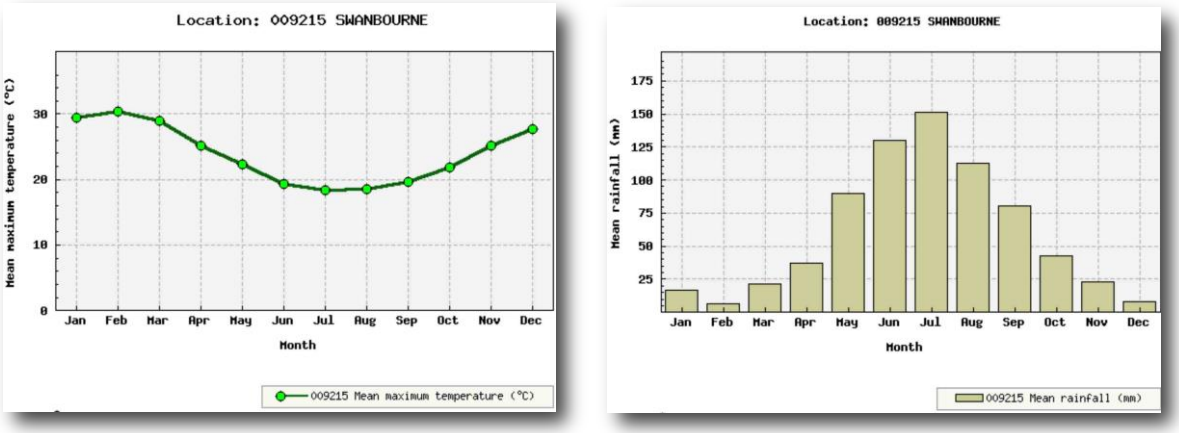

Figure 1: Mean maximum recorded temperatures and mean rainfall for Swanbourne Meteorology Station between 1993 and 2010

[1] www.bom.gov.au/weather/wa/sevwx/perth/bushfires.shtml

The site is 2 kilometres from the coast and is significantly influenced by land and sea breezes. These are created by the daily heating and cooling of the land surface next to the ocean. The sea breeze occurs when the air over the land heats up and becomes more buoyant and rises, denser moist air over the ocean then flows inland. Sea breezes can strengthen prevailing wind, reduce it or even reverse it, depending on the strength and direction of the two airstreams (Cheney and Sullivan 2008).

Data from the Bureau of Meteorology weather station at Swanbourne indicate that the predominant winds in the summer months at 3pm near the study site are south-westerly (Figure 2). Wind strength, direction and frequency of the south-west wind are clearly dominant and occur 70-80 per cent of the time. Winds from the west and south-east occur approximately less than 10% of the time.

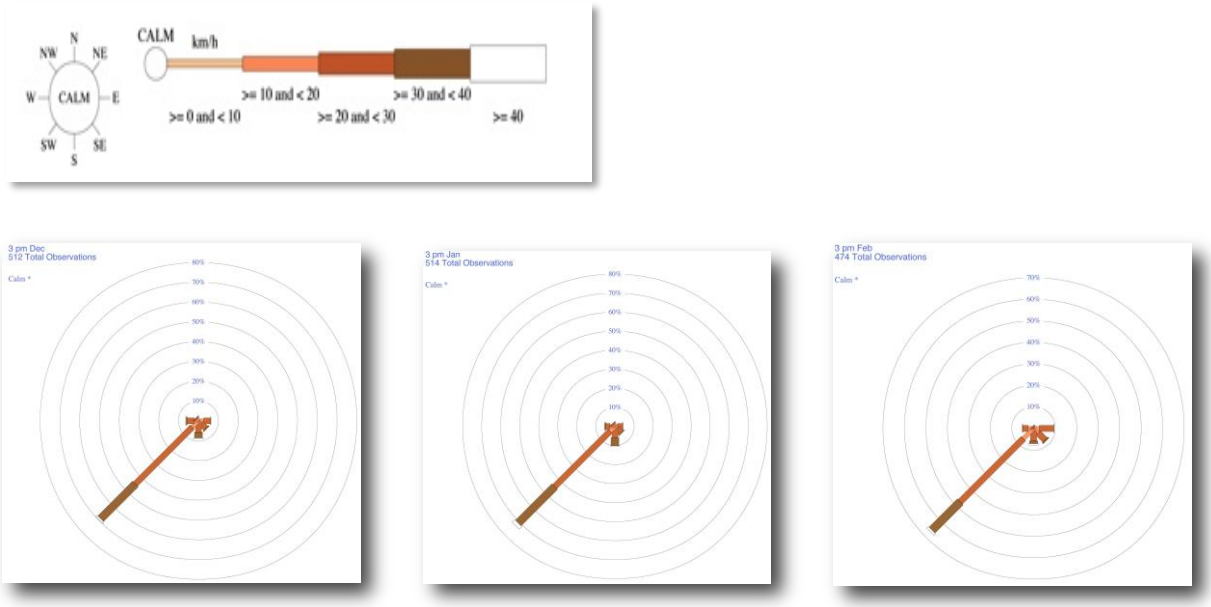

Figure 2: Rose of wind direction and wind speed in km/hr for December, January and February between 1993 and 2010 at Swanbourne Bureau of Meteorology Station

Interpreting Figure 2 - Wind speed vs Direction Plot

Wind roses summarize the occurrence of winds at a location, showing their strength, direction and frequency. The percentage of calm conditions is represented by the size of the centre circle - the bigger the circle, the higher is the frequency of calm conditions. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Eight directions are used. The branches are divided into segments of different thickness and colour, which represent wind speed ranges in that direction. Speed ranges of 10 km/hr are used. The length of each segment within a branch is proportional to the frequency of winds blowing within corresponding range of speeds from that direction (BOM 2010).

4.3 Bushfire Fuels

The site has minimal bushfire fuels as most of the vegetation has been removed. One POS area in the south west corner will retain scrub vegetation, while the other POS areas will be landscaped and pose no long term threat to the development.

Shrubland, grassland and scrub vegetation occur in the bushforever site south of the area and the MRS railway reserve contains woodland and scrub. Eucalypt and Banksia woodland trees also occur north of Yanchep Beach Road. Permanent bushfire fuels (and hazard) will be restricted to Bush Forever site No. 289 to the south of the site and some areas north of Yanchep Beach Road. Temporary hazard occurs west of the site in the MRS railway reserve however the timing of development is unknown.

4.4 Assets

When the proposed subdivision is fully developed it will contain over 171 new residential dwellings and two group housing areas. Assets most at risk will be residential lots within 100 metres of bushland and unmanaged fuels. The assets under greatest threat from a bushfire are exposed to the highest Bushfire Attack Level (BAL) rating and this is further assessed in section 6.4 Siting of Development.

4.5 Access

The subdivisions will be serviced by two public road intersections with Yanchep Beach Road and public roads will be located around the perimeter of the entire site.

All public roads within the subdivision will be sealed and constructed to minimum standards required to provide good access and egress for residents and fire appliances. A perimeter road exists between all areas of bushfire hazard and all private lots/dwellings. This perimeter public road system separates residents and visitors from bushfire hazard areas, as well as allowing access for fire appliances.

4.6 Water Supply

Reticulated water will be provided to the entire development. Fire hydrants will be spaced to Water Corporation and DFES standards and provide emergency services access to an adequate water supply.

4.7 Bushfire History

Fires have been common on the Swan Coastal Plain for thousands of years, the anthropological and historical evidence suggests that Aborigines regularly burnt this area (Abbott 2003).

Bushfires are common in the City of Wanneroo. In the 2009/10 financial year, the volunteer fire brigades attended 132 fires (City of Wanneroo 2010).

More recent bushfire history includes:

- 4 January 2012, a fire started between Wanneroo Road and Marmion Avenue north of the site. A bushfire warning was issued for people in the eastern parts of Alkimos and western parts of Carabooda.
- 21 January 2011, a large bushfire near Yanchep National Park threatened lives and homes.

Given that bushfires are common in the City of Wanneroo, this FMP plays a critical role in ensuring that the development of the land is appropriately mitigated from fire risk and threat.

5. Bushfire Hazard Assessment

Assessing bushfire hazards at a strategic level takes into account the predominant class of vegetation on the site and surrounding area for a minimum of 100 metres. The vegetation class map for the site and surrounding area for a minimum of 100 metres is shown in Appendix F and G. Fuel layers in a typical forest environment can be broken-down into five segments as shown in Figure 3. These defined fuel layers are used in the following descriptions regarding vegetation types, fuel structure and bushfire hazard levels.

Figure 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

5.1 Vegetation Type and Structure

The site assessment undertaken for this study identified five broad vegetation types on and surrounding the site as shown and mapped in Appendix D. The vegetation types identified broadly include woodland, shrubland, scrub, open woodland and unmanaged grassland.

The site itself has been cleared and is largely unvegetated except for an area of woodland which has been previously planted in rows and contains a grassy understorey (Figure 4). Scrub vegetation occurs in the south western POS area and continues into the railway reserve and south of the site into the bushforever reserve. Scrub vegetation also occurs at the base of sand dunes in the zone between shrubland and unmanaged grassland. Scrub vegetation has been planted in the MRS railway reserve on the western perimeter. It achieves heights of 3 metres and predominately consists of Acacia species with areas of low Banksia trees (Figure 5).

Grassland vegetation occurs south of the site in the dune swale area between the site boundary and the shrubland vegetation (Figure 6).

Shrubland vegetation occurs primarily on the side of the sand dune system to the south of the site. It occupies a distinct zone between the unmanaged grass fuels and the low shrubland vegetation at the top of the Dunes (Figure 7). The shrubland grades into low shrubland at the peak of the sand dune south of the site (Figure 8).

Woodland vegetation is concentrated north of Yanchep Beach Road and consists of Eucalypt and Banksia trees with a grassy and shrubland understorey (Figure 9). Some woodland also occurs in the MRS railway reserve.


Figures 4 and 5 – plantation woodland which will be retained as a managed POS area (left) and scrub vegetation which is dominated by Acacia species and some Banksias species (right)


Figures 6 and 7 – unmanaged grassland in the dune swales south of the site (left) and shrubland on the side of sand dunes (right)


Figures 8 and 9 – Low shrubland at the peak of the sand dunes to the south of the site (left) and the Euclaypt and Banksia woodland vegetation north of Yanchep Beach Road (right)

5.1.1 Vegetation in POS areas

The Subdivision Plans outlines the location of three POS areas (Appendix C). Existing mature trees (Figure 4) will be largely retained in the northern POS area in a landscaped parkland due to the management of understorey fuels. The POS Area in the south west of the site will retain scrub vegetation and will be a long term threat to the development.

5.2 Slope

The site has been largely levelled for the development. The distinctive topographical feature at the site is the large sand dune system that runs in an east- west direction immediately south of the site.

Effective slope underneath vegetation immediately surrounding the site is upslope for most of the perimeter vegetation south and west of the site. Effective slope under the woodland vegetation north of Yanchep Beach Road is also generally upslope apart from when the land falls downslope into the golf fairway.

The contour lines on the subdivision plan can be seen in Appendix C.

5.3 Bushfire Hazard – Pre Development

The vegetation class maps (Appendix D) outline the dominant vegetation types on the study site and in the surrounding area (for a minimum of 100 metres). Descriptions of the vegetation types, structure and fuel layers are outlined in Section 5.1 Vegetation Type and Structure.

The bushfire hazard assessment levels were determined using Appendix 1 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). The study site has bushfire hazard ratings of extreme and moderate, however there are also areas of moderate and low hazard.

The extreme hazard occurs where scrub and woodland vegetation occurs.

Moderate hazard occurs in areas of shrubland, open woodland and unmanaged grassland fuels.

Low bushfire hazard areas occur where the vegetation has been cleared such as from most of the site, Yanchep Beach Road, the golf course and Yanchep Golf Estate.

The current bushfire hazard rating map for the site is attached as Appendix E.

6. Fire Mitigation Strategies

This report adopts an acceptable solution and performance-based system of control for each bushfire hazard management issue. This approach is consistent with Appendix 2 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). The management issues are;

- Location of the development;
- Vehicular Access;
- Water;
- Siting of the development; and
- Design of the development.

Acceptable solutions are proposed for four out of the five management issues and each illustrates a means of satisfactorily meeting the corresponding performance criteria. A performance-based approach is proposed for the remaining management issue.

6.1 Element: Location of the Development

Intent
To ensure that development/intensification of land use is located in areas where bush fire hazard does not present an unreasonable level of risk to life and property.

Acceptable Solution
Bushfire hazard levels are rated as moderate and extreme on the development site due to the existing vegetation. There are similar bushfire hazards immediately to the west, south and east. Yanchep Beach Road borders the northern perimeter providing a low fuel corridor between the development site and bushfire hazards further north.

Permanent residual hazard will remain in the Bush Forever site south of the site. Vegetation immediately to the east of the site is proposed for development and is under the same land ownership (i.e. the Department of Housing).

The maximum Bushfire Attack Level (BAL) for any dwelling in the development is predicted to be BAL-19. And this will only apply to some dwellings on the south and western perimeter. The vast majority of dwellings within 100 metres of classified vegetation will be exposed to BAL-12.5 (or ember attack).

Construction standards will be increased to align with the designated BAL rating to offset the requirement for a Hazard Separation Zone (HSZ). The site will be provided

with an adequate water supply and has good perimeter vehicular access to protect assets and fight fires. All exposed dwellings should be constructed to AS3959 standards.

6.2 Element: Vehicular Access

Intent
To ensure vehicular access serving a subdivision development is safe if a bushfire occurs.

Background
The proposed road layout can be clearly seen in the proposed subdivision plan (Appendices C). There are a total of two intersections with Yanchep Beach Road which borders the northern perimeter of the site within the proposed subdivision (WAPC 150834) and the existing approved subdivision (WAPC 147696).

The site has a perimeter public road system ensuring dwellings are separated from bushfire hazard and fire appliances have access between bushfire hazard and residential dwellings

The proposed road network does include a two 6 metre wide laneways to primarily provide access to the rear of residential lots.

This proposal complies with the performance criteria by applying the following acceptable solutions;

Acceptable Solution A2.1: Two Access Routes
The road network outlined in the subdivision plan (Appendix C) highlights the interconnected loop road system including two intersections with Yanchep Beach Road when considered with the approved subdivision (WAPC 147696).

Acceptable Solution A2.2: Public Roads
All proposed public roads within the site will comply with the minimum public road standards,

The public road standards which will be achieved are;

- Minimum trafficable surface: 6 metres;
- Horizontal clearance: 6 metres;
- Vertical clearance: 4 metres;
- Maximum grades: 1 in 8;
- Maximum grades over <50 metres: 1 in 5;

- Maximum average grade: 1 in 7;
- Minimum weight capacity: 15 tonnes;
- Maximum crossfall: 1 in 33; and
- Minimum inner radius of curves: 12 metres.

Acceptable Solution A2.3: Cul-de-sacs (including dead-end roads)

One cul-de-sac is proposed at the site. It will be constructed to the following standards:

- Maximum length: 200 metres;
- Minimum trafficable surface: 6 metres;
- Horizontal clearance: 6 metres;
- Maximum grades: 1 in 8;
- Maximum grades over 50 metres: 1 in 5;
- Maximum average grade: 1 in 7;
- Minimum weight capacity: 15 tonnes;
- Maximum crossfall: 1 in 33;
- Minimum inside radius of curves: 12 metres; and
- Turn around area requirements - including 21 metre diameter head.

6.3 Element: Water

Intent
To ensure water is available to the development to enable life and property to be defended from bushfire.

Acceptable Solution: Reticulated Area
The area is provided with a reticulated water supply, together with fire hydrants that will meet the specifications of the Water Corporation Design Standard DS 63 and DFES. Residential dwellings (Class 1a) require fire hydrants to be sited within (or every) 200 metres in areas of land zoned residential.

The developer is to provide detailed hydrant plans to the City of Wanneroo and the DFES local fire station for monitoring. The Water Corporation is responsible for all hydrant repairs.

Fire services require ready access to an adequate water supply during fire emergencies.

6.4 Element: Siting of the Development

Intent
To ensure the siting of the development minimises the level of bushfire impact.

Background
The site has been extensively cleared and levelled to accommodate the development.

Three areas of Public Open Space (POS) are proposed within the new subdivision site. The POS area in the south west of the site will retain natural vegetation, the other POS Areas will not be a threat to the development and will be landscaped as such.

The vegetation currently surrounding the site is considered as a long term threat except for the small area of woodland and open woodland east of the approved subdivision (WAPC 147696) which will be removed to create a mineral earth surface.

It is important that the site has an adequate perimeter Building Protection Zone to manage risk from permanent and temporary bushfire hazard external to the site.

Vegetation that does not trigger a BAL assessment according to the Australian standard (AS3959-2009) includes one or a combination of the following:

- Vegetation of any type more than 100 metres from the site;
- Single areas of vegetation less than 1 hectare in area and not within 100 metres of other areas of vegetation being classified;
- Multiple areas of vegetation less than 1 hectare in area and not within 20 metres of the site or each other;
- Strips of vegetation less than 20 metres wide(measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 metres of the site or each other, or other areas of vegetation being classified;
- Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops, and
- Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parkland, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and wind breaks.

Acceptable Solution A4.1 : Hazard Separation

The proposed development is separated from all bushfire hazards by a minimum building protection zone of 20 metres. This is achieved by ensuring a perimeter building protection zone is established around the entire site adjacent to hazards. Although a 100 metre separation is not achieved, all dwellings will have constructions

standards increased to comply with a BAL rating of BAL-29 or lower under AS3959.

Acceptable Solution A4.3 Building Protection Zone (BPZ)

One of the most important fire protection measures influencing the safety of people and property is to create a BPZ between buildings and bushfire hazard. The BPZ is a low fuel area immediately adjacent to a building. Non-flammable features such as irrigated landscapes, gardens, driveways, roads, and maintained parks and reserves can form parts of a BPZ.

World first research into land management and house losses during the Black Saturday Victorian bushfires concluded that the action of private landholders who managed fuel loads close to their houses was the single most important factor in determining house survival when compared with other land management practices such as broad scale fuel reduction burning remote from residential areas (Gibbons et al. 2012).

Creating a perimeter BPZ will ensure vegetation and fuels within close-proximity to dwellings are managed to reduce predicted levels of radiant heat flux and improve the survival of buildings.

The creation of the BPZ will ensure the predicted radiant heat flux exposure levels remains at or below a maximum of BAL – 29 on all exposed perimeter dwellings in the development.

Managing vegetation in the BPZ has two main purposes - to reduce;

- Direct flame contact and radiant heat from igniting the building during the passage of a fire front; and
- Ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.

The perimeter BPZ and the temporary staging BPZ must be established and maintained to the following standards:

- Perimeter BPZ Width: 20 metre minimum and as outlined in Appendix F and within the lot boundary and adjacent road reserves;
- Fuel load: reduced to and maintained at 2 tonnes per hectare;
- All tree crowns (or clumps of crowns) are a minimum of 10 metres apart;
- All trees to have lower branches pruned to a height of 2 metres;
- All tall shrubs or trees are not to be located within 2 metres of a building (including windows);
- No tree crowns or foliage is to be within 2 metres of any building. This includes existing trees and shrubs and new plantings;

- All fences and sheds are constructed of non-combustible materials (i.e. Colorbond, brick or limestone);
- All shrubs to contain no dead material within the plant;
- No tall shrubs are to be in clumps within 3 metres of the building; and
- No trees are to contain dead material in the crown or on the bole.

Alternative Solution A4.4: Hazard Separation Zone (HSZ)

A Hazard Separation Zone (HSZ) is an additional fuel managed zone to create further separation between dwellings and bushfire hazard. It can extend out to 100 metres from buildings. In the subdivision proposal, a full 100m HSZ does not fit within the design of the proposed development. The requirement for a HSZ is offset by an increase in construction standards and compliance with AS3959-2009.

The following Bushfire Attack Level (BAL) assessment demonstrates that the proposed BPZ combined with increased dwelling construction standards will achieve acceptable levels of risk for the development.

By achieving this standard it will be possible to construct dwellings to an appropriate standard (i.e. BAL-29 or less) under the Australian Standard (AS 3959-2009: Construction of Buildings in Bushfire-Prone Areas).

Acceptable Solution A4.5: Reduction in bush fire attack level due to shielding

A reduction in the bushfire attack level due to shielding could be achieved on the walls of many dwellings facing away from the source of the bushfire attack. For example, the east facing walls on dwelling adjacent to the MRS railway reserve vegetation could be shielded from, the source of the bushfire attack and exposed to a lower BAL rating consistent with AS3959. A site specific BAL assessment will identify what walls are shielded.

6.4.1 Building Siting and Predicted Bushfire Attack Levels

The AS 3959-2009 standard comprises six categories of BAL and these categories are based on heat flux exposure thresholds.

The method for determining the BAL involves a site assessment of vegetation and local topography. The assumed Fire Danger Index (FDI) for Western Australia is 80. The BAL identifies the appropriate construction standard that applies as a minimum standard in Construction of Buildings in Bushfire-Prone Areas (AS 3959-2009).

Methodology and Assumptions

The following indicative BAL assessment for ten example dwelling locations on the perimeter of the site (see Appendix G & Table 1) was determined using the methodology in Appendix A of AS 3959-2009. This methodology is also outlined in the Planning for Bush Fire Protection Guidelines.

The criteria to determine the BAL is outlined as follows:

Designated FDI : 80
Flame Temperature: 1090
Slope : Flat, downslope and upslope (See Table 1)
Vegetation Class : Scrub, grassland and woodland
Setback distances : 20- 100 metres (see Table 1)

Area of classified vegetation	Vegetation Class	Setback Distance	Effective Slope (°)	BAL Rating
North of Yanchep Beach Road	Woodland	40-100 metres	Flat to Upslope	BAL-12.5
MRS Railway Reserve and Bushforever Site	Scrub	20-27 metres	Upslope	BAL-19
		27-100 metres	Upslope	BAL-12.5
		20-22 metre	Downslope 0-5	BAL-29
		22-31 metres	Downslope	BAL-19
	Woodland	20-<29 metres	Upslope	BAL-19
		29-100 metres	Upslope	BAL-12.5
	Grassland	20-50 metres	Upslope	BAL-12.5

Table 1: Indicative Bushfire Attack Level (BAL) Assessment for exposed dwellings as identified in Appendix G

Two lots sited on the western perimeter with the Railway Reserve are exposed to a predicted radiant heat flux of BAL-29. Twenty three lots are predicted to be exposed to BAL-19 and all remaining lots within 100 metres of classified vegetation are predicted to be exposed to BNAL-12.5. The indicative BAL ratings are outlined in Appendix G.

The vast majority of lots are not exposed to bushfire attack levels that require any additional construction standards.

A Bushfire Attack Level of BAL-12.5 means the risk is considered to be low. It is expected that the construction elements will be exposed to a radiant heat flux not greater than 12.5kW/m^2. There is a risk of ember attack and burning debris ignited by

wind borne embers and a likelihood of exposure to radiant heat (Standards Australia 2009). The recommended construction Sections are 3 and 5 in AS 3959-2009.

A Bushfire Attack Level of BAL-19 means the risk is considered to be moderate. It is expected that the construction elements will be exposed to a radiant heat flux not greater than 19kW/m^2. There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat (Standards Australia 2009). The recommended construction Sections are 3 and 6 in AS 3959-2009.

A Bushfire Attack Level rating of BAL-29 means that there is an increased risk of ember attack and burning debris impacting buildings, as well as the likelihood of exposure to an increased level of radiant heat (AS 3959). The risk is considered to be high. It is expected that the construction elements will be exposed to a heat flux not greater than 29 kW/m^2. In this case, the recommended construction sections in AS 3959 are 3 and 7.

This indicative assessment demonstrates that all proposed dwellings will fall within the acceptable level of risk (i.e. BAL-29 and lower).

Lots within 100 metres of the eastern perimeter are not exposed to predicted bushfire attack mechanisms that warrant increased construction standards because vegetation will be managed within 100 metres of this interface.

6.4.2 Landscaping Considerations

Landscaping can both assist in the survival of the building and is a determining factor in its destruction. Landscaping can protect buildings by forming a barrier or deflector for wind borne debris and radiant heat. It can also bring the fire directly to the building, so a degree of care needs to be exercised when selecting and locating landscaping.

All plants will burn under the right conditions and plants do not attain a ‘fire resistance level’ that meets requirements of the Building Code of Australia. Placing plants too close to a building, under timber decks or next to windows will provide a direct threat to the building. Having a clearance around the building will achieve the desired effect of creating a break between the vegetation and the building. A pathway around buildings may be one way to achieve this requirement. Landscaping can then be established at a suitable distance from the building.

6.5 Design of the Development

Performance Criteria
The design of the development is appropriate to the level of bushfire hazard that applies to the site.

Acceptable Solution
All on-site development is to comply with the performance criteria or acceptable solutions 1 to 4 in the "Planning for Bushfire Protection" Guidelines. The buildings are to comply with AS 3959-2009: Construction of Buildings in Bushfire-Prone Areas if required. The City of Wanneroo has the responsibility of ensuring dwellings meet this standard.

The predicted highest BAL level for any dwelling is BAL-29. BAL ratings will be re-assessed at building license stage and all exposed dwellings will have risk mitigated by compliance with the Australian Standard AS3959-2009.

6.6 Public Education and Community Awareness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The 30 page booklet 'Prepare, Act, Survive' provides excellent advice on preparing for and surviving the bushfire season. Other downloadable brochures include 'Fire Danger Ratings and what they mean for you' and 'Bushfire Warnings and what you should do'.

Information available on the City of Wanneroo website regarding fire, keeping your home safe from fire and total fire bans, as well as volunteer bush fire brigade information is available on their website:
http://www.wanneroo.wa.gov.au/Residents/Our_Place_-_Community_Safety/Fire

6.7 Community Fire Refuges and Fire Safer Areas

There are no designated Community Fire Refuges in the City of Wanneroo, however, at the time of an emergency, the relevant authorities can select an evacuation centre and DFES, the City and Police will provide this information to residents.

A predetermined centre cannot be nominated because there are no purpose built structures (such as bunkers) designed to withstand the impacts of a bushfire. This

means the location of an evacuation centre is not determined until the position of the fire and the characteristics of a specific event are considered by authorities. There would be nothing more dangerous than sending residents to a centre which is in the direct path of a fire.

The safest place to be during a bushfire is away from it. Where to go is an important element when people are relocating during a time of emergency (NSW Rural Fire Service 2004). The preferred option for residents is to designate a destination that is not in a bushfire-prone area and will be safe to travel to before a bushfire attack.

Those who find themselves threatened by a bushfire need options (VBRC 2009). This may be because their plan to leave is no longer possible because they cannot reach a place away from the fire front, or their plan to defend their property fails. Residents may also be caught away from their home when a bushfire threatens.

There are many areas within the City of Wanneroo including landscaped open spaces and urban areas that are not bushfire-prone, but they have not been declared. Obviously a non-bushfire-prone area can provide a safe location for people during a bushfire, but there are no official criteria in Western Australia to determine these areas.

As there is no specific criteria to guide this process, DFES's general advice is that when residents' household bushfire survival plans have failed, go to a safer place such as a local open space or building where people may go to seek shelter from a bushfire (FESA 2010).

7. Conclusion

This Plan provides acceptable solutions and responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). However, community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals.

The planning and building controls outlined in this plan will reduce the risk of bushfire to people and property. It will not remove all risk. How people interpret the risk, prepare and maintain their properties and buildings and the decisions and actions they take (i.e. evacuate early or stay and defend or other) greatly influence their personal safety. Residents need to be self-reliant and not expect warnings or assistance from emergency services.

7.1 Compliance Checklist

Performance Criteria and Acceptable Solutions

Element	Question	Answer
1: Location	Does the proposal comply with the performance criteria by applying acceptable solution A1.1?	Yes
2: Vehicular access	Does the proposal comply with the performance criteria by applying acceptable solution A2.1?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.2?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.3?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.4?	Not Applicable

Element	Question	Answer
2: Vehicular access	Does the proposal comply with the performance criteria by applying acceptable solution A2.5?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.6?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.7?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.8?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.9?	Not Applicable
	Does the proposal comply with the performance criteria by applying acceptable solution A2.10?	Not Applicable
3: Water	Does the proposal comply with the performance criteria by applying acceptable solution A3.1?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A3.2?	Not Applicable.
	Does the proposal comply with the performance criteria by applying acceptable solution A3.3?	Not Applicable

Element	Question	Answer
4: Siting of the Development	Does the proposal comply with the performance criteria by applying acceptable solution A4.1?	Yes - Construction standards are increased to align with site bushfire attack level if required and BAL-29 is not exceeded .
	Does the proposal comply with the performance criteria by applying acceptable solution A4.2?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A4.3?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A4.4?	No - However the proposal does satisfactorily comply with performance criterion P4 because building construction standards are to be increased to comply with AS 3959-2009 to offset the requirement for a Hazard Separation Zone if required. Construction standards will achieve a maximum of BAL-29.
	Does the proposal comply with the performance criteria by applying acceptable solution A4.5?	Yes, individual dwelling walls could be shielded , a site specific assessment will determine compliance

Element	Question	Answer
5: Design of the Development	Does the proposal comply with the performance criteria by applying acceptable solution A5.1?	No - However the proposal does comply with the performance criterion P5 because building construction standards will be increased to comply with AS 3959-2009 to offset the reduced HSZ. BAL-29 is not exceeded.
	Does the proposal comply with the performance criteria by applying acceptable solution A5.2?	Yes - The proposal complies as the development will meet the performance criteria because of compliance with AS 3959 and BAL-29 is not exceeded.

Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge

Rohan Carboon

06/08/2015

8. Implementing the Fire Management Plan

8.1 Developer's Responsibilities

To maintain a reduced level of risk from bushfire, the developer's responsibilities are to:

- Install the public roads and cul-de-sac to standards outlined in Element 6.2 Vehicular Access
- Lodge a Section 70A Notification on each Certificate of Title exposed to AS 3959 construction standards, proposed by this development. The notification shall alert purchasers and successors in title, to these exposed lots, of the responsibilities of the Fire Management Plan and bushfire building construction requirements;
- Comply with the City of Wanneroo Fire Control Notice as published, on all vacant land;
- Landscape the identified POS areas to ensure low bushfire hazard levels;
- Establish and maintain the perimeter Building Protection Zones to standards including the BPZ within the POS area with retained Scrub;
- Ensure 100 metres of vegetation is managed from the perimeter of each construction stage within the overall development site to ensure temporary hazard does not threaten any subdivision stage;
- Ensure 100 metres of vegetation is managed from the eastern perimeter of the site to ensure temporary hazard does not threaten dwellings until such time as the hazard is permanently removed;
- Install reticulated water supply and hydrants to Water Corporation, DFES and City of Wanneroo standards;
- Provide detailed hydrant plans is to the City of Wanneroo and DFES local fire station for monitoring.
- Supply a copy of this Fire Management Plan and The Homeowners Bush Fire Survival Manual, Prepare, Act, Survive (or similar suitable documentation) and the City of Wanneroo's Fire Control Notice to each lot owner subject to AS 3959 construction standards.

8.2 Property Owners' / Occupiers Responsibilities

The owners/occupiers of the site, as created by this proposal, are to maintain a reduced level of risk from bushfire, and will be responsible for undertaking, complying and implementing measures to protect their own assets (and people under their care) from the threat and risk of bushfire. Site owners and occupiers' will be responsible for:

- Ensuring that all lots comply with City of Wanneroo's Fire Control Notice;
- Maintain each property in good order to minimise bushfire fuels;

- Ensure that where hydrants are located, they are not obstructed and remain visible at all times;
- Have individual lots re-assessed at building license stage to determine the accurate BAL assessment and construction standard for lots within 100 metres of classified vegetation
- Ensuring construction of dwellings complies with AS 3959 if required; and
- If dwellings are subject to additional construction in the future such as renovations, AS3959 compliance is required.

8.3 City of Wanneroo's Responsibilities

The responsibility for compliance with the law rests with individual property owners and occupiers and the following conditions are not intended to unnecessarily transfer some of the responsibilities to the City of Wanneroo.

The City of Wanneroo shall be responsible for:

- Providing fire prevention and preparedness advice to landowners upon request;
- Monitoring bush fuel loads in road reserve sites and liaising with relevant stakeholders to maintain fuel loads at safe levels;
- Maintaining public roads to appropriate standards and ensuring compliance with the City of Wanneroo Fire Control Notice;
- Review the Fire Management Plan as necessary;
- Ensuring dwellings are constructed to AS 3959 where applicable; and
- Endorsing a section 70A notification on the new Certificate of Title for all lots within 100m of "classified vegetation" affected by this Fire Management Plan that states "the Lots are subject to a Fire Management Plan"

8.4 Department of Fire and Emergency Services Responsibilities

- Conduct an initial inspection of hydrants and conduct routine inspections.

8.5 Water Corporation Responsibilities

- Repair water hydrants as needed.

9. References

Abbott, I. (2003). Aboriginal fire regimes in south-west Western Australia: evidence from historical documents. Pages 119-146 in I. Abbott and N. Burrows, editors. Fire in ecosystems of south-west Western Australia: impacts and management. Backhuys, Leiden, The Netherlands.

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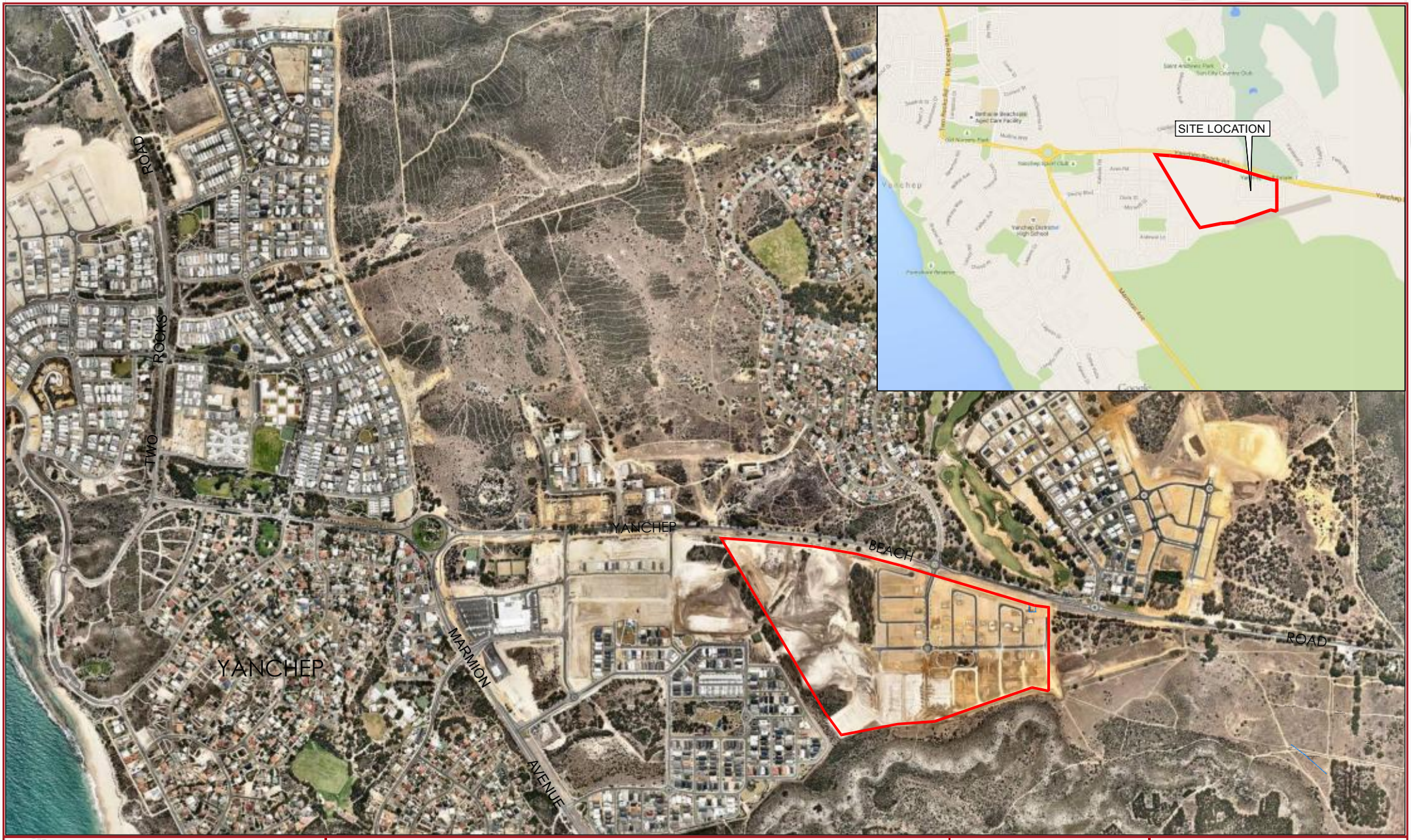

APPENDIX A:
SITE LOCATION PLAN

LOT 1 YANCHEP BEACH ROAD
YANCHEP
City of Wanneroo

LEGEND:
SUBJECT LAND.....

NORTH

0 100 200 300m

SCALE 1:15 000 @ A4
DATE: JULY 2015
Base mapping supplied by Nearmap & Google Maps

Bushfire Safety
CONSULTING
BUSHFIRE SAFETY CONSULTING
PO BOX 84 STONEVILLE WA 6081
Mbl: 0429 949 262
www.bushfiresafety.net

Appendix B
SITE PLAN

LOT 1 YANCHEP BEACH ROAD
YANCHEP
CITY OF WANNEROO

SOURCE:
PHOTOGRAPHY FROM NEARMAP

LEGEND

SUBJECT LAND.....

NORTH

0 20 40 60 80 100 120 140 160m

NOT TO SCALE @ A3
DATE: JULY 2015
Base mapping supplied by CLE Town Planning & Design

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WAPC APPROVAL
147243

YANCHEP BEACH ROAD

MRS RAILWAY RESERVE

ALIGNMENT

GH 1
2456m²

POS
1.9242ha

POS
7333m²

POS
1476m²

GH 2
1698m²

Future Subdivision

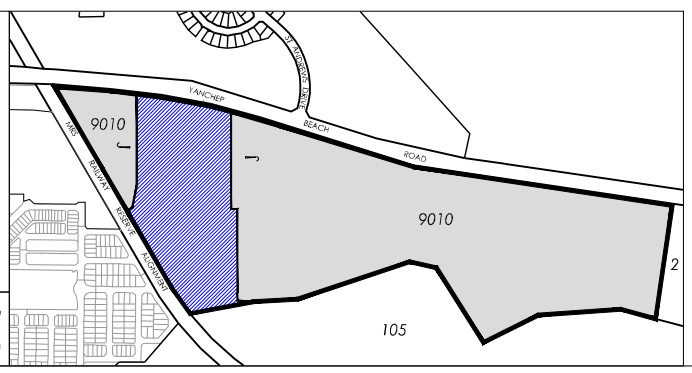
Lot 9010 (56.99ha)
Subject Area Boundary
Subject Area (12.90ha)
Balance Lot
- Lot 9010 (44.09ha)

Yield

Residential	-	172 lots
Balance	-	1 lots
Total	-	173 lots

All road carriageway detail depicted on this Plan including pavements, road treatments, medians and parking are for illustrative purposes only and are subject to final engineering design and any relevant approvals. The detail reflects the intent of the road network standards preferred for this subdivision.

All dimensions and areas depicted on this Plan are subject to pre-cast and final survey and will vary from the figures shown.



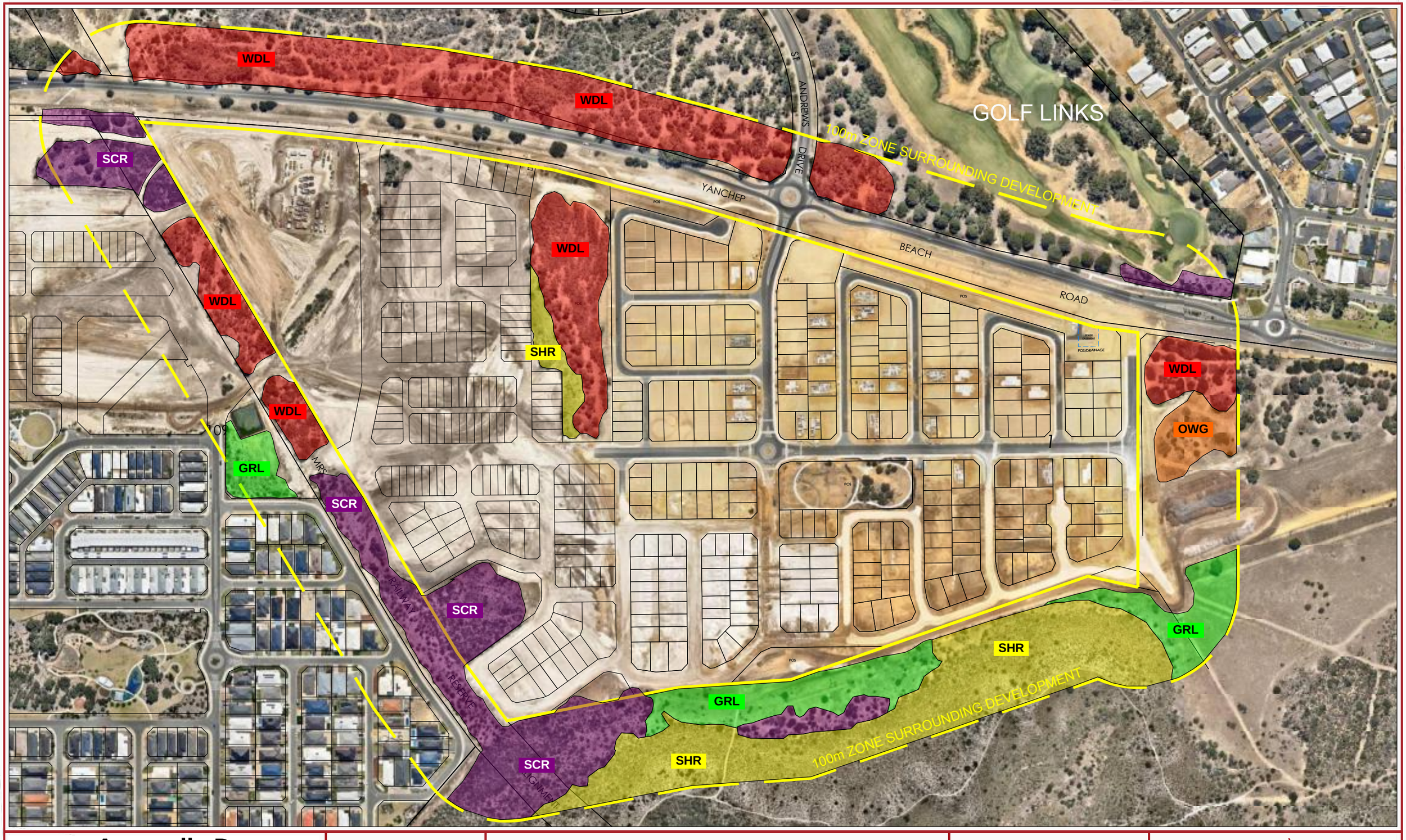
CLE TOWN PLANNING + DESIGN

PROPOSED SUBDIVISION
Lot 9010 Yanchep Beach Road, Yanchep
City of Wanneroo

APPENDIX C

plan no: 2125-182D-01
scale: 1:2000@A3, 1:1000@A1
date: 03.10.2014

T:(+618) 9382 1233 F:(+618) 9382 1127
E: admin@cleplan.com.au
www.cleplan.com.au
L2-36 ROWLAND STREET SUBIACO WA 6008
PO BOX 796 SUBIACO WA 6904



Appendix D
VEGETATION CLASSIFICATION

LOT 1 YANCHEP BEACH ROAD
YANCHEP
CITY OF WANNEROO

SOURCE:
PHOTOGRAPHY FROM NEARMAP

LEGEND

SUBJECT LAND		GRASSLAND	GRL
WOODLAND	WDL	OPEN WOODLAND/ GRASSLAND	OWG
SCRUB	SCR		
SHRUBLAND	SHR		

ALL OTHER AREAS ARE MINERAL EARTH, DEVELOPED OR MANAGED LANDSCAPES

NORTH

0 20 40 60 80 100 120 140 160m

NOT TO SCALE @ A3
DATE: JULY 2015
Base mapping supplied by CLE Town Planning & Design

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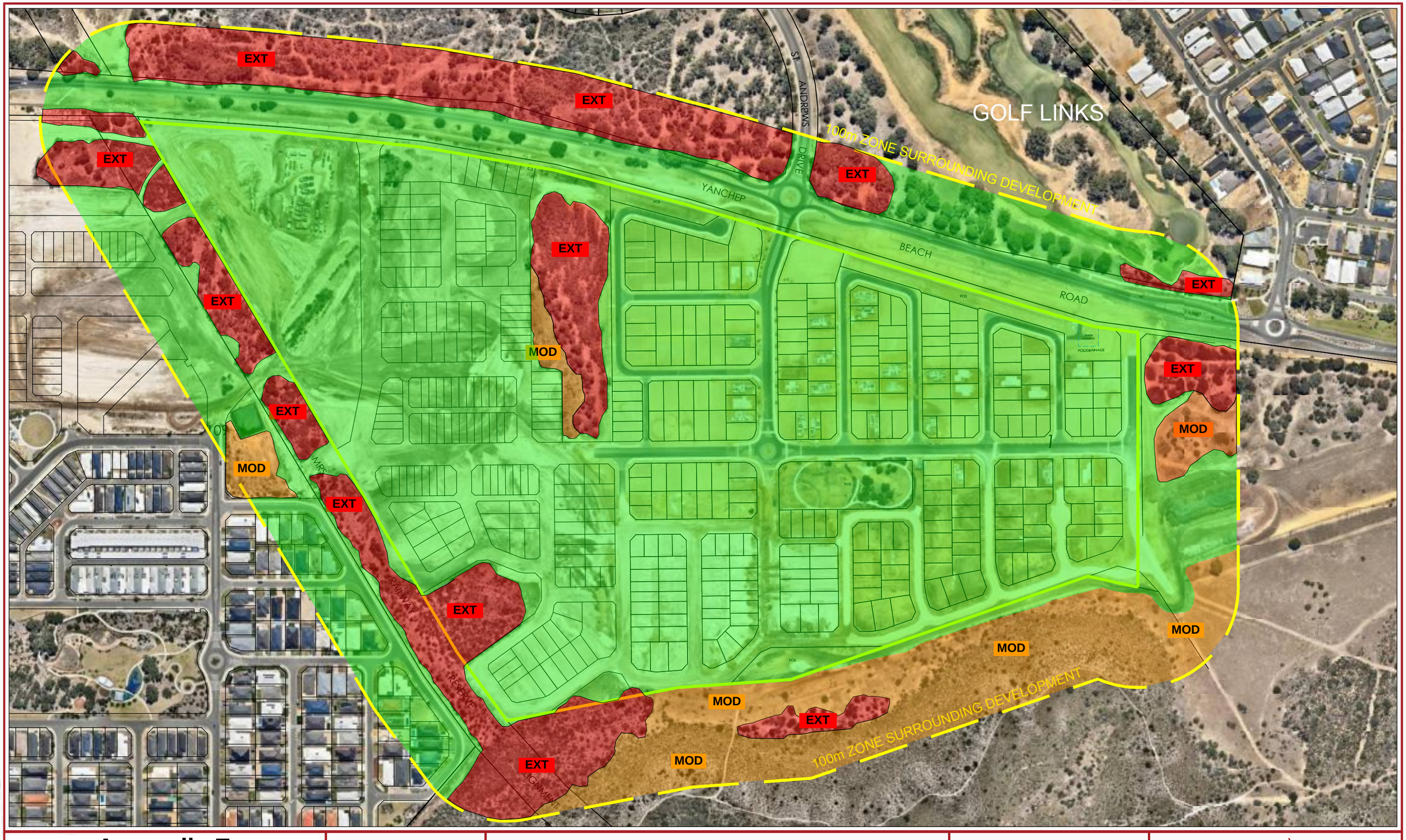

Appendix E
BUSHFIRE HAZARD RATING

LOT 1 YANCHEP BEACH ROAD
YANCHEP
CITY OF WANNEROO

SOURCE:
PHOTOGRAPHY FROM NEARMAP

LEGEND

SUBJECT LAND.....

EXTREME..... EXT

MODERATE..... MOD

LOW..... LOW

NORTH

0 20 40 60 80 100 120 140 160m

NOT TO SCALE @ A3
DATE: JULY 2015
Base mapping supplied by CLE Town Planning & Design

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Appendix F
BUILDING PROTECTION ZONE

LOT 1 YANCHEP BEACH ROAD
YANCHEP
CITY OF WANNEROO

SOURCE:
PHOTOGRAPHY FROM NEARMAP

LEGEND

SUBJECT LAND.....		GRASSLAND.....	GRL
WOODLAND.....	WDL	OPEN WOODLAND/ GRASSLAND.....	OWG
SCRUB.....	SCR	BUILDING PROTECTION ZONE....	BPZ
SHRUBLAND.....	SHR		

NORTH

0 20 40 60 80 100 120 140 160m

NOT TO SCALE @ A3
DATE: JULY 2015
Base mapping supplied by CLE Town Planning & Design

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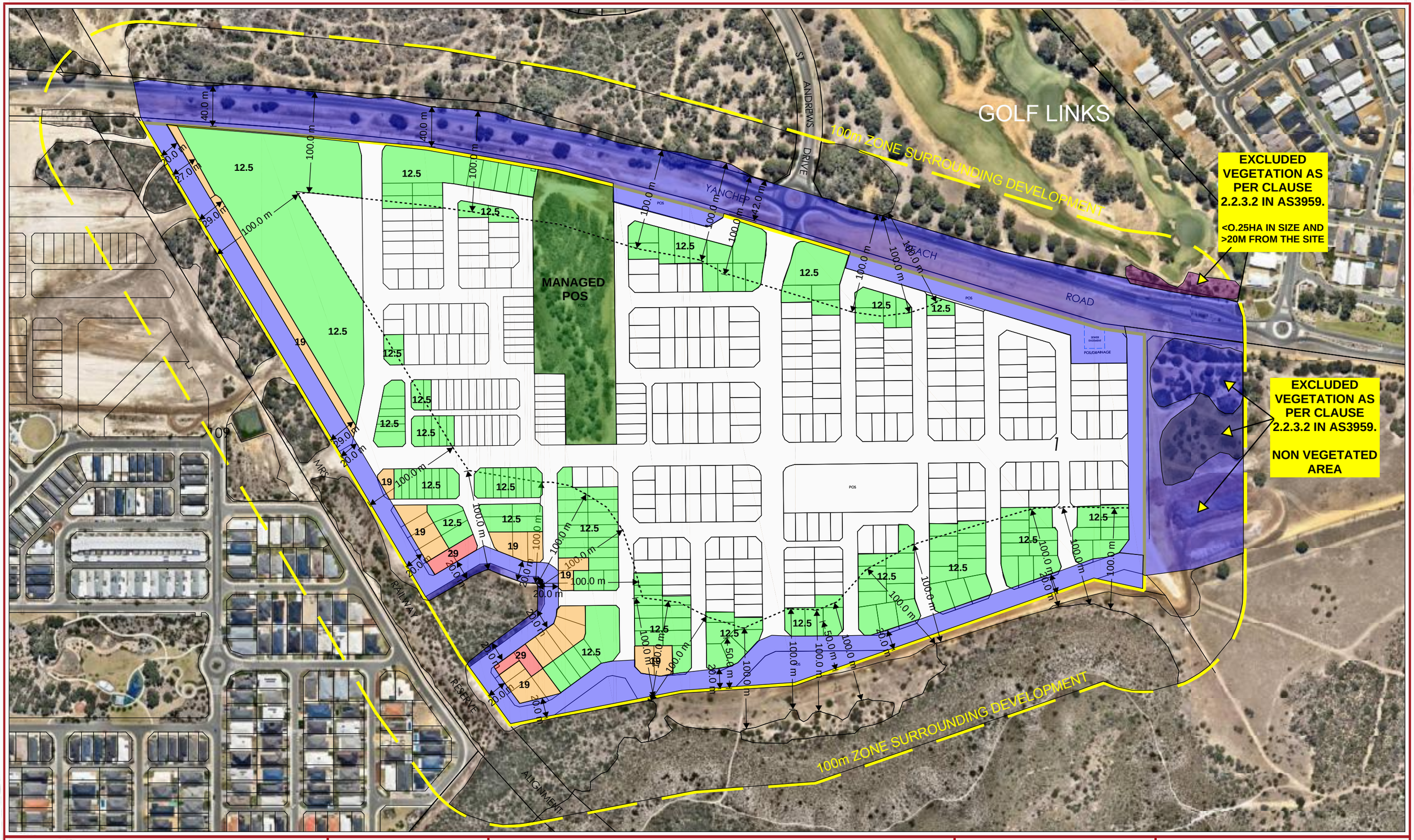

Appendix G
INDICATIVE BAL RATINGS

LOT 1 YANCHEP BEACH ROAD
YANCHEP
CITY OF WANNEROO

SOURCE:
PHOTOGRAPHY FROM NEARMAP

LEGEND

SUBJECT LAND.....

BUILDING PROTECTION ZONE.... BPZ

BAL-29..... 29

BAL-19..... 19

BAL-12.5..... 12.5

NORTH

0 20 40 60 80 100 120 140 160m

NOT TO SCALE @ A3
DATE: JULY 2015
Base mapping supplied by CLE Town Planning & Design

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