



Travers

bushfire & ecology

bushfire protection assessment

Rezoning Application
Lot 1 DP 1139826
Ralston Avenue, Belrose

Under Section 117(2) Direction No 4.4
of the EP&A Act

December 2012
(REF: A11127B)

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

EXECUTIVE SUMMARY

A bushfire protection assessment has been undertaken for the proposed rezoning located at Lot 1 DP 1139826, Ralston Avenue, Belrose.

The site is identified within Warringah Local Environmental Plan (LEP) 2011 as 'deferred land' and as such LEP 2000 applies until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into Warringah's standard LEP 2011.

It is proposed that the developable area of the site will be rezoned to accommodate a variety of residential dwellings that will meet the existing and likely future housing demand within the local area. The Concept Plan Report and indicative development concept plan provides for approximately 169 lots, which are anticipated to be an average of 600m². The actual dwelling mix and type will be determined at the development application stage.

The balance of the developable area of the site will comprise the public open space, stormwater management and asset protection zones (APZ) for bushfire protection. Each of these elements has been designed in an integrated manner to enable the recreational use of these spaces and to utilise the natural landscape as a defining element of the visual character and mitigate any potential impacts on water quality.

This report identifies matters for consideration for the planning proposal and highlights the required bushfire protection measures (including asset protection zones (APZs) for future development under the *Environmental Planning and Assessment Act 1979, Section 117 Direction 4.4* and in accordance *Planning for bush fire protection 2006 (PBP)* and *Community Resilience Practice Note 2/12 Planning Instruments and Policies*.

The key principle for the proposal is to ensure that future development is capable of complying with *PBP*. Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, specifying minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments in hazardous areas and the inappropriate placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the surrounding forest and heath vegetation communities resulting in possible ember attack, radiant heat and potentially flame attack. The previous fire history of the surrounding landscape is such that considerable planning focus has been undertaken for traffic design, asset protection, emergency management, fire trail construction, hazardous fuels management, building construction standards, water management and peripheral land management on land owned by the land owner. The bushfire risk posed to the rezoning proposal however can be mitigated by a suite of bushfire protection measures which when implemented can be managed in perpetuity.

Upon final design engagement with recommendations made within this report the future development of these lands in accordance with the attached bushfire protection plan (Schedule 1) will provide compliance with the planning principles of *Planning for bush fire protection 2006* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*.

The final report will be much enlarged and make greater discussion on the points raised above.

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GLOSSARY OF TERMS

APZ	asset protection zone
<i>BCA</i>	<i>Building Code of Australia</i>
BSA	Bushfire Safety Authority
FDI	Fire Danger Index
IPA	inner protection area
<i>LEP</i>	<i>Local Environmental Plan</i>
OPA	outer protection area
<i>PBP</i>	<i>Planning for bush fire protection, 2006</i>
<i>NSW RFS</i>	<i>NSW Rural Fire Service</i>
SFPP	special fire protection purpose
<i>AS3959 (2009)</i>	<i>Australian Standard – Construction of buildings in bushfire-prone areas.</i>

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Introduction

1

Travers bushfire & ecology has been requested by *Mathews Civil* to undertake a bushfire protection assessment for the proposed rezoning located at Lot 1 DP 1139826, located at the end of Ralston Avenue, Belrose.

The proposal is located on land mapped by *Warringah Council* as being bushfire prone. *Direction 4.4, Planning for bush fire protection* identifies matters for consideration for planning proposals that will affect, or are in proximity to land mapped as bushfire prone.

As such the proposal is subject to the requirements of Section 117(2) of the *Environmental Planning and Assessment Act 1979 (EP&A Act)* which requires Council to consult with the Commissioner of the *NSW Rural Fire Service* and to take into account any comments by the Commissioner.

1.1 Aims of the Assessment

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the landscape
- Undertake a bushfire attack assessment in accordance with *PBP*
- Provide advice on planning principles, including the provision of perimeter roads, asset protection zones (APZs) and other specific fire management issues
- Review the potential to carry out hazard management over the landscape, taking into consideration the proposed retention of trees within the final development plans.

1.2 Project Synopsis

It is proposed that the developable area of the site will be rezoned to accommodate a variety of residential dwellings that will meet the existing and likely future housing demand within the local area. The Concept Plan Report and indicative development concept plan provides for approximately 169 lots, which are anticipated to be an average 600m². The actual dwelling mix and type will be determined at the development application stage.

The balance of the developable area of the site will comprise the public open space, stormwater management and asset protection zones (APZ) for bushfire protection. Each of these elements has been designed in an integrated manner to enable the recreational use of these spaces and to utilise the natural landscape as a defining element of the visual character and mitigate any potential impacts on water quality.

In addition to the proposed development area, the proponent is offering an approximate 118 ha protection offset surrounding the development to be retained and is likely to be rezoned as Environmental Protection. The land proposed for conservation includes the areas immediately surrounding the Belrose Waste Management Facility and extensive sandstone escarpment slopes immediately adjoining Garigal National Park. The proposed offset area is an ecological significant landscape which is known to contain threatened flora, fauna and sensitive vegetation areas and is subject to a separate report.

The proposal includes an indicative concept plan (as depicted within Figure 1.1) and as such the bushfire constraints have been highlighted and asset protection zones (APZ) have been recommended, based on this plan. Recommendations have also been made for future road and fire design, fuels management, traffic management, emergency management, building construction, water supply and peripheral land management.

1.3 Information Collation

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

- Warringah Local Environmental Plan 2011
- Warringah Local Environmental Plan 2000
- Flora and Fauna Assessment, 2012 prepared by *Travers bushfire & ecology*
- *Google* aerial photography
- Topographical maps *DLPI of NSW 1:25,000*
- *Planning for bush fire protection 2006 (NSW RFS)*
- Australian Standard 3959 *Construction of buildings in bush fire prone areas*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies.*

An inspection of the proposed development site and surrounds was undertaken by John Travers on several occasions in 2011 and 2012 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

1.4 Site Description

The site is located at Lot 1 DP 1139826, Ralston Avenue, Belrose (refer Figure 1.2).

The proposed development area is located on a plateau area of approximately 17 ha. The development area is proposed to be accessed from residential areas to the east via Ralston and Wyatt Avenue.

The remaining perimeter to the north, west and south is gentle to steep sloping sandstone escarpments that consist of a variety of vegetation formations ranging from forest to heathland communities.

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

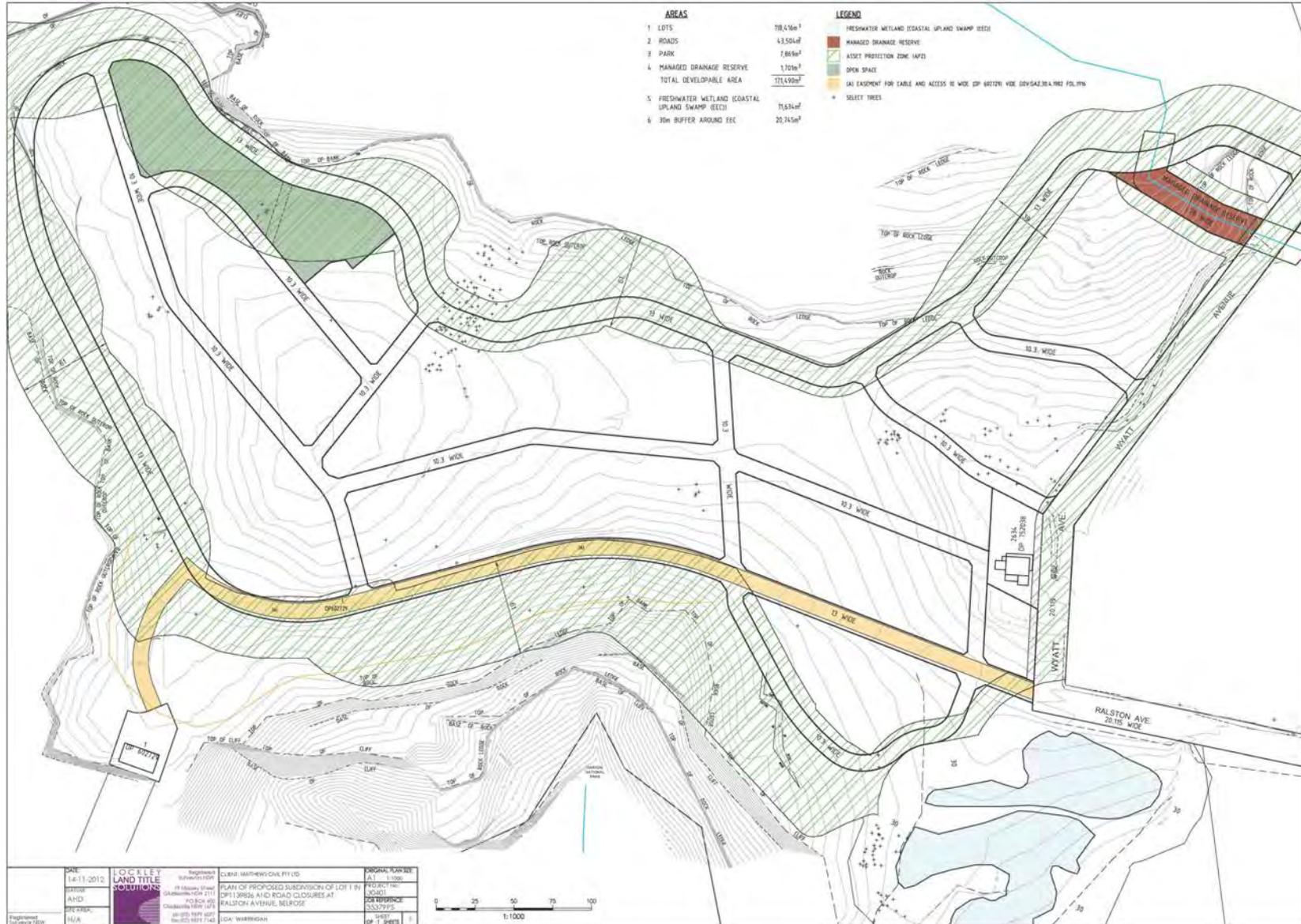


Figure 1.1 indicative concept plan

Table 1.1 – Site features

Location	Lot 1 DP 1139826
Size	Approximately 17ha (development land only)
Local government area	Warringah
Grid reference	333600E 6266800N
Elevation	Approximately 150-170m AHD
Topography	Situated upon a plateau area with minor slopes, increasing near the northern and southern subdivision boundary.
Geology and soils	Geology; Sandstone Soils; Lambert Soil Landscape, Somersby Soil Landscape and Hawkesbury Soil Landscape
Catchment & drainage	French's Creek (to the south) and Fireclay Creek (to the north) into Middle Harbour Creek.
Vegetation	Coastal Sandstone Heath and Sydney Sandstone Ridgetop Woodland (predominately)
Existing land use	Private land and residential
Clearing	Clearing for the existing residence and asset protection zones, and any road, track and existing electrical structure



Figure 1.2: Aerial Appraisal of investigation area

1.5 Legislation and Planning Instruments

1.5.1 Environmental Planning and Assessment Act 1979 (EP&A Act) and bushfire prone land.

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the *Building Code*

of Australia. The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

Bushfire prone land maps provide a trigger for the development assessment provisions. The proposed rezoning is located on land that is mapped by *Warringah Council* as being bushfire prone (refer Figure 1.3).

PBP (pg 4) stipulates that if a proposed amendment to land use zoning or land use affects a designated bushfire prone area then the Section 117(2) Direction No 4.4 of the *EP&A Act* must be applied. This requires Council to consult with the Commissioner of the *NSW RFS* and to take into account any comments by the Commissioner and to have regard to the planning principles of *PBP* (detailed within Section 1.5.3).

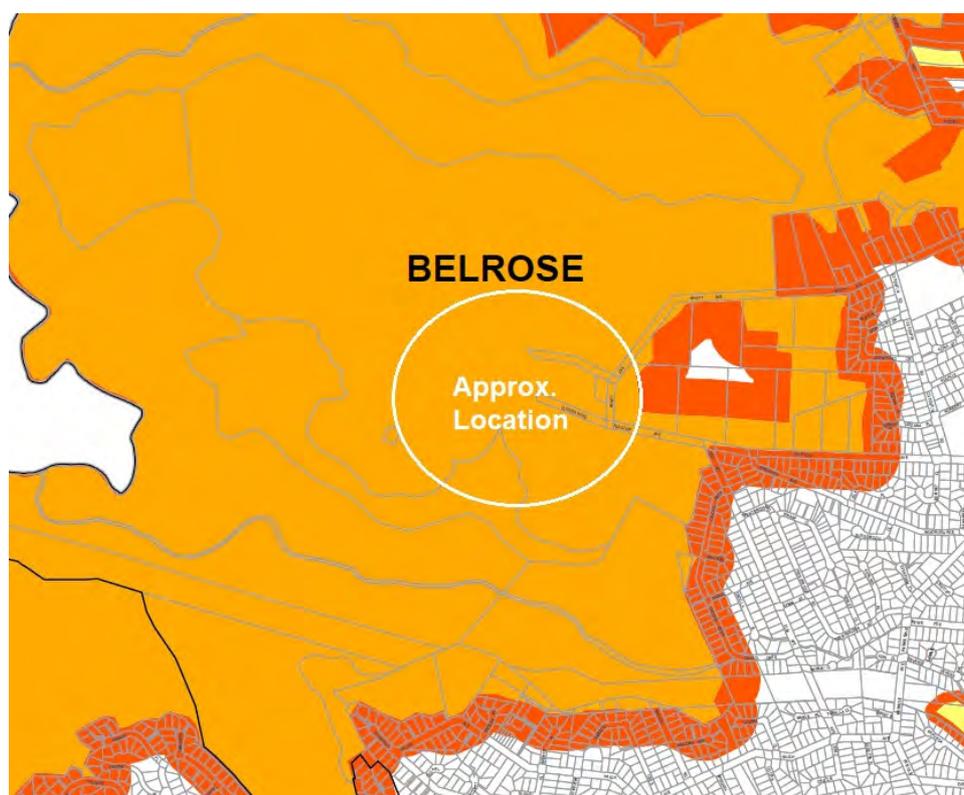


Figure 1.3: Bushfire Prone Land Map
(Source: *Warringah Council*)

1.5.2 Local Environmental Plan (LEP)

A LEP provides for a range of zonings which list development that is permissible or not permissible, as well as the objectives for development within a zone.

The site is identified on the *Warringah LEP 2011 Land Application Map* as a 'deferred matter'. LEP 2000 applies to all deferred land until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into *Warringah's* standard LEP 2011.

Warringah Local Environmental Plan (LEP) 2000

The site is zoned under *Warringah LEP 2000* as Locality C8 – Belrose North (refer Figure 1.4). The land surrounding the property to the north, south and west is zoned under the current LEP 2011 as E1 – National Parks and Reserves.

The proposal seeks to amend the *LEP 2000* and contribute to the planning process to bring this land into Warringah’s standards LEP. The proposal is to rezone the central development area as residential whilst maintaining the land surrounding the development as an offset area likely to be rezoned as Environmental Protection.

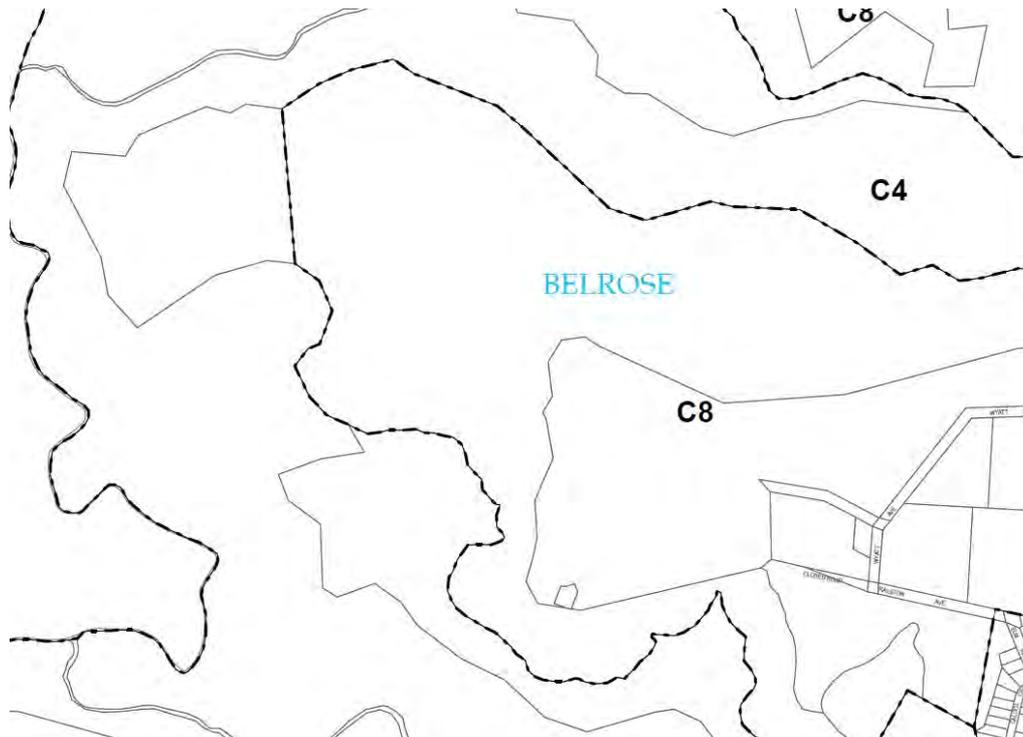


Figure 1.4: Warringah LEP 2000
(Source: Warringah Council website)

The proposal, including the provision of APZs, would seek to comply with the objectives of the proposed rezoning.

1.5.3 Planning for bush fire protection 2006 (PBP)

Bushfire protection planning requires the consideration of the *NSW RFS* planning document entitled *Planning for bush fire protection 2006 (PBP)*. *PBP* provides planning principles for rezoning to residential land as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment.

PBP outlines the following planning principles that must be achieved for all rezoning proposals:

1. Provision of a perimeter road with two way access which delineates the extent of the intended development.
2. Provision, at the urban interface, for the establishment of adequate asset protection zones for future housing
3. Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads
4. Minimising the perimeter of the area of land interfacing the hazard, which may be developed
5. Introduction of controls which avoid placing inappropriate developments in hazardous areas, and
6. Introduction of controls on the placement of combustible materials in asset protection zones.

In addition to the above, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas.

The proposed rezoning has been assessed in compliance with the following measures to ensure that future development is capable of complying with *PBP*:

- Asset protection zones
- Building construction and design
- Access arrangements
- Water supply and utilities
- Landscaping
- Emergency arrangements

1.5.4 Building Code of Australia (BCA) and the Australian Standards AS3959 - 2009

The *BCA* is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The *BCA* outlines objectives, functional statements, performance requirements and deemed-to-satisfy provisions. For residential dwellings these include Class 1, 2 and 3 buildings. The construction manual for the deemed-to-satisfy requirements is the *Australian Standard AS3959 2009*.

Although consideration of *AS3959* is not specifically required in a rezoning proposal, this report (Section 3.2) provides the indicative setbacks for each dwelling construction level and can be used in future planning for master plans and / or subdivision proposals.

1.6 Environmental & Cultural Constraints

1.6.1 Environmental Constraints

The proposed development is in accord with the ecological constraints and offset analysis prepared by *Travers bushfire & ecology* (November 2012) – see ‘survey effort’ constraints plan at Figure 1.4.

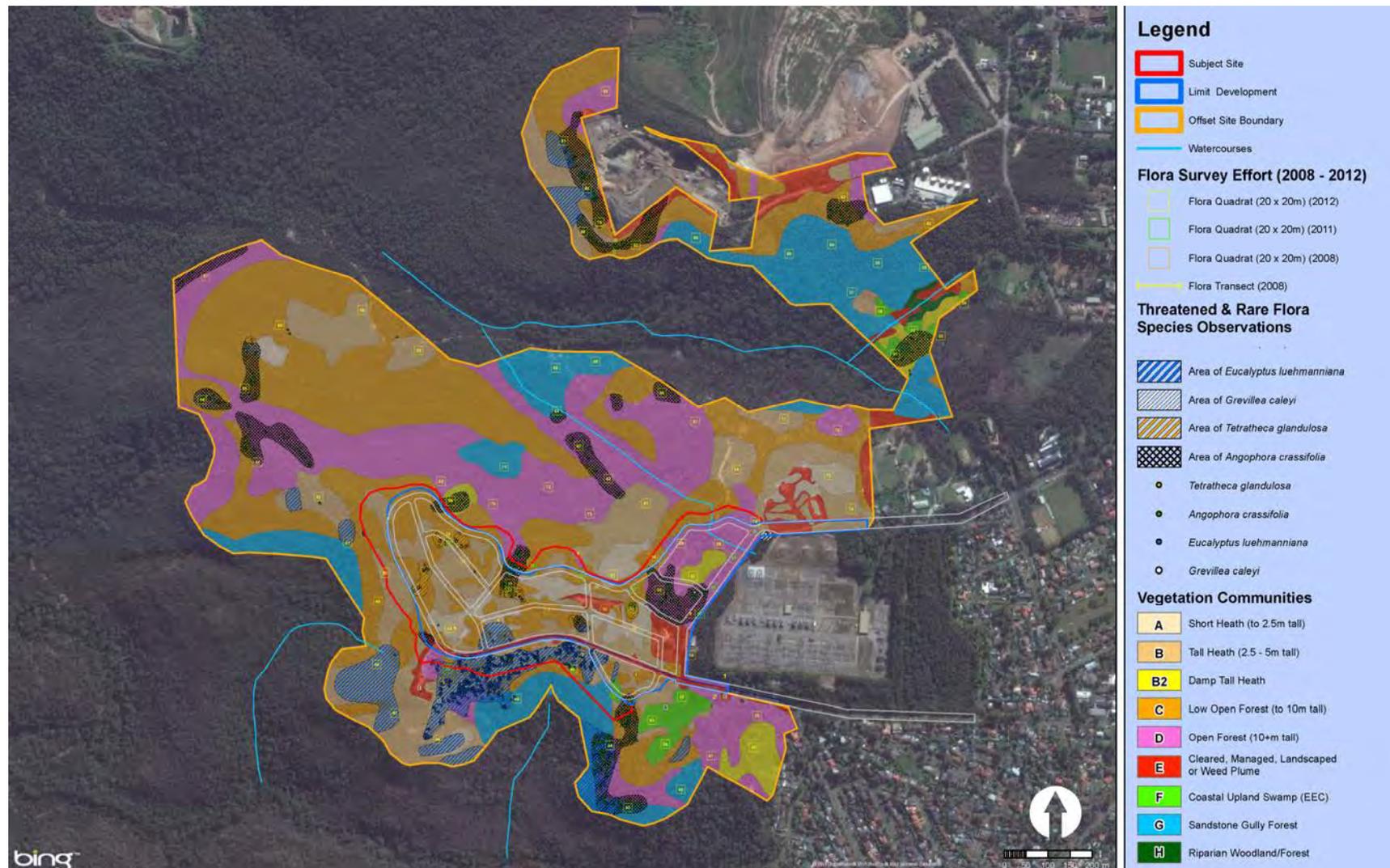


Figure 1.4: Vegetation Communities, Flora & Fauna Survey Effort
 (Source: Travers bushfire & ecology, 2012)



Bushfire Threat Assessment

2

To assess the bushfire threat and to determine the required width of an asset protection zone for a development, a review of the elements that comprise the overall threat needs to be completed.

PBP provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuels

PBP guidelines require the identification of the predominant vegetation 'formation' in accordance with David Keith (2004) to determine APZ distances for subdivision developments. However, when determining construction standards in accordance with *AS3959 – Construction in bushfire-prone areas* AUSLIG Pictorial Analysis is used to determine the vegetation, and hence APZ setbacks and building construction standards (refer Section 3.2 of this report).

The hazardous vegetation is calculated for a distance of at least 140 metres from a proposed development boundary and is summarised within Table 2.1 below.

Table 2.1 – Vegetation Descriptions

Vegetation Community (TBE, 2012)	Vegetation Formation (David Keith & PBP)	AUSLIG Pictorial Analysis (AS3959, 2009)
Short Heath	Short heath	Shrubland
Tall Heath & Damp Tall Heath	Tall heath	Scrub
Low Open Forest	Dry sclerophyll Forest	Forest
Open Forest	Dry sclerophyll Forest	Forest
Cleared, managed, landscaped, weed plume	N/A	N/A
Coastal Upland Swamp	Freshwater wetland	Scrub
Sandstone Gully Forest	Dry sclerophyll Forest	Forest

These vegetation formations and their location are depicted within Schedule 1 attached.

Generally forest vegetation is located on the periphery of the proposed development boundary to the north, south and east. Pockets of tall heath vegetation are also present particularly to the south-west. The freshwater wetland formation (Coastal Upland Swamp) is located in the south-east of the development lands.

The following photographs depict the hazardous vegetation surrounding the site.



Photo 1 – Low open forest



Photo 2 – Coastal Upland Swamp with fringing low open forest in the background.

2.2 Effective Slope

The effective slope is assessed for a distance 100 metres. Effective slope refers to that slope which provides the most effect upon likely fire behaviour. A mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined.

The effective slope within the hazardous vegetation is variable but is summarised as:

- Level to upslope within the narrow strip of forest vegetation between the electrical substation and the development lands in the east
- $>18^{\circ}$ downslope within the forest to the south, west and north-west
- Varying slope of between 0–5 and up to 10 degrees to the north-east.

2.3 Bushfire Attack Assessment

A Fire Danger Index (FDI) of 100 has been used to calculate bushfire behaviour on the site using forest vegetation located within the Greater Sydney region.

Table 2.2 below provides a summary of the bushfire attack assessment and the minimum required asset protection zones in compliance with BAL 29 building construction standards (AS3959, 2009). It is our experience that BAL has market resistance due to cost of construction (\$15,000-\$25,000).

We suggest that BAL 19 be considered but this would require larger APZ's to be provided in order to offset higher construction costs. We estimate BAL 19 costs to be \$10,000 - \$18,000 for two storey construction). See Section 3.2 below for further details. Remember we are talking here about those dwellings located on the actual perimeter of the development not the internal dwellings.

Table 2.2 – Bushfire attack assessment

Super lot ID	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required (BAL 29 - equivalent)	Compliance
1 - 3	East	Forest	Level to upslope	25 metres	Yes
4	South-east	Tall Heath	0 - 5 ^o D	15 metres	Yes
4 5	South-west South	Forest	$>18^{\circ}$ D	61 metres	Yes
6	South	Forest	5 - 10 ^o D	39 metres	Yes
6	West	Forest and Tall Heath/ Shrub	$>18^{\circ}$ D	61 metres	Yes

Super lot ID	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required (BAL 29 - equivalent)	Compliance
6 & 7 (includes open space)	North	Forest	>18 ° ^D	61 metres	Yes
7	North-east	Forest	0 - 5 ° ^D (for 30m)	32 metres	Yes (minimum APZ of 32 metres is provided for the effective slope whilst maintaining a separation of 80m from >18 degree slope)
8	North (western portion)		11 ° ^D (for 20m)		
8	North (eastern portion)	Forest	>18 degrees	61 metres	Yes
9	North	Tall Heath / Scrub	15-20 ° ^D	21 metres	Yes
2	North-west				
1	North-west	Forest	5 - 10 ° ^D	39 metres	Yes
1	North or South	Internal Riparian Corridor	Level	11 metres	Yes (based on rainforest classification with fire run potential of less than 50 metres)

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

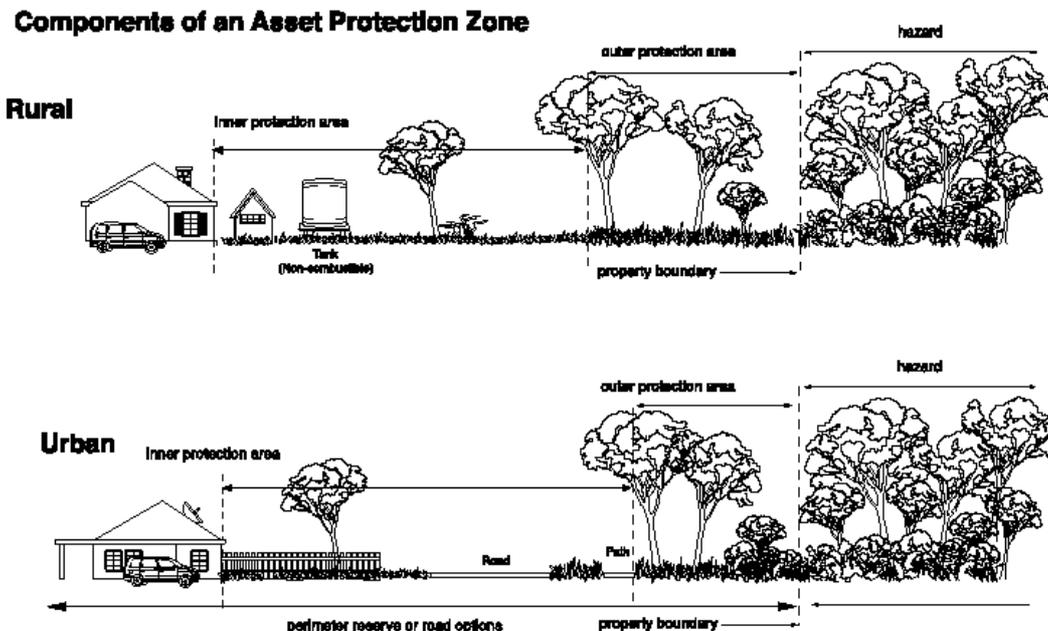


Specific Protection Issues

3

3.1 Asset Protection Zones (APZs)

APZs are areas of defensible space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, an *inner protection area* (IPA) and an *outer protection area* (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA cannot be used for habitable dwellings but can be used for all external non-habitable structures such as pools, sheds, non-attached garages, cabanas, etc. A typical APZ and therefore defensible space is graphically represented below:



Source: RFS, 2006

Note: Vegetation management as shown is for illustrative purposes only. Specific advice is to be sought in regard to vegetation removal and retention from a qualified and experienced expert to ensure APZs comply with the RFS performance criteria.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 29 kW/m^2 for residential subdivision developments. This rating assists in determining the size of the APZ in compliance with PBP to provide the necessary *defendable space* between hazardous vegetation and a building.

Table 3.1 outlines the proposals compliance with the performance criteria for APZ's.

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

Performance Criteria	Acceptable Solutions	Compliance with PBP
Radiant heat levels at any point on a proposed building will not exceed 29kW/m ²	APZs are provided in accordance with Appendix 2 APZs are wholly within the boundary of the development site	Yes - refer Table 2.2. APZ's provided exceed the minimum requirements of Appendix 2. The APZ's have been determined based on BAL 29 (AS3959)
APZs are managed and maintained to prevent the spread of fire towards the building	In accordance with the requirements of <i>Standards for Asset Protection Zones (NSW RFS 2005)</i>	Yes – Can be made a condition of consent at development application stage
APZ maintenance is practical , soil stability is not compromised and the potential for crown fires is negated	The APZ is located on lands with a slope of less than 18 degrees.	Yes – APZ's are generally situated on slopes of less than 18 degrees. There are a select few areas where the slopes appear to exceed 18 degrees, these areas are rock ledges and can be incorporated into APZ management.

3.2 Building Protection

The construction of buildings in bushfire prone areas is subject to stringent rules pertinent to the building envelope being located on the non-hazardous side of the APZ. The role of the APZ is to provide a safe space to separate the hazard from the building.

In terms of future subdivision approval the minimum APZ must be provided in accordance with Appendix 2 of *PBP*. The APZs provided in Table 2.2 (Section 2.3) of this report exceed these requirements, whilst also considering the final building setbacks as per AS3959 (2009).

Although not required in terms of rezoning the following advice in relation to building construction levels can be used for future planning and development design.

The *NSW RFS* has released an interim amendment to *PBP 2006* in the form of Appendix 3. This amendment follows the adoption on 1 May 2010 of *AS3959 (2009)* through the *Building Code of Australia (BCA) 2010*. This appendix, in conjunction with Table 2.4.2 of *AS3959 (2009)*, is used to determine construction considerations when building on bushfire prone land.

The construction classification system is based on five (5) bushfire attack levels (BAL). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19 and BAL 12.5 (*AS3959 (2009) – Construction of buildings in bushfire prone areas*). The lowest level, BAL 12.5, has the longest APZ distance while BAL–FZ has the shortest APZ distance. These allow for varying levels of building design and use of appropriate materials which affects costs. This means that BAL 12.5 is much cheaper than BAL 29 when constructing a dwelling. However the length of the APZ's for BAL 12.5 would be too long and a compromise would be BAL 19 being used as a satisfactory development aspiration,

Table 3.2 provides an indication of the BALs that are likely to apply for future building construction. These BAL levels are for planning purposes only and will be assessed / confirmed prior to building construction stage.

Table 3.2 – Determination of Bushfire Attack Level (BAL)

Super lot ID	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Provided	Construction Standards
1 - 3	East	Forest	Level to upslope	25 metres	BAL 29 (25-<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
4	South-east	Tall Heath	0 - 5 ° D	15 metres	BAL 29 (11-<17m) BAL 19 (17-<25m) BAL 12.5 (25-<100m)
4 5	South-west South	Forest	>18 ° D	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
6	South	Forest	5 - 10 ° D	39 metres	BAL 29 (21-<31m) BAL 19 (31-<43m) BAL 12.5 (43-<100m)
6	West	Forest and Tall Heath/ Shrub	>18 ° D	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
6 & 7 (includes open space)	North	Forest	>18 ° D	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
7 8	North-east North (western portion)	Forest	0 - 5 ° D (for 30m) 11 ° D (for 20m) >18 degrees	32 metres	BAL 29 (32-<43m) BAL 19 (43-<57m) BAL 12.5 (57-<100m)
8	North (eastern portion)	Forest	>18 degrees	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
9 2	North North-west	Tall Heath / Scrub	15-20 ° D	21 metres	BAL 29 (21-<31m) BAL 19 (31-<43m) BAL 12.5 (43-<100m)
1	North-west	Forest	5 - 10 ° D	39 metres	BAL 29 (21-<31m) BAL 19 (31-<43m) BAL 12.5 (43-<100m)
1	North or South	Internal Riparian Corridor	Level	11 metres	BAL 29 (11-<16m) BAL 19 (16-<23m) BAL 12.5 (23-<100m)

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

3.3 Hazard Management

The asset protection zone includes the land within the proposed development lots, the perimeter roads as well as the residual land external to the development lots.

Whilst the owner or occupier of each development lot will be required to manage the APZ to the specifications of the development consent documentation e.g. Council's / NSW RFS approval, it is the residual land that surrounds the concept development plan which will require careful planning to ensure APZ works are carried out and maintained in perpetuity.

The portion of the bushfire asset protection zones that are located external to future private lots will be located on various land tenures, for example, public roadways, parklands as well as residual private lands. It is envisaged the latter will be managed by way of a positive covenant entered into at DA stage.

A fuel management plan will need to be prepared and adopted to provide assurance that all APZ's will be managed in perpetuity.

Together with peripheral fire trails located external to the development landscape there will be a need to apply a permanent *strategic bushfire management zone* (SBMZ) between those trails and the developments asset protection zones. This landscape will require regular burning (every 7 years) in line with the *bushfire environmental assessment code*. The SBMZ will link directly to the *Warringah bushfire risk management plan* which is prepared by Council and the RFS and other larger land owners. This document is the government's risk plan that determines future works to minimise bushfire risk to communities and environmental assets e.g. creeks and species).

The construction and ongoing management of the APZs will require compliance with the *NSW RFS guidelines Standards for Asset Protection Zones (RFS, 2005)* whilst all future landscaping construction will need to comply with Appendix 5 of *PBP*.

A summary of the guidelines for managing APZs are attached as Appendix 1 to this report.

3.4 Access for Fire Fighting Operations

Future residential development within the site will require access Ralston and Wyatt Avenue in the east to connect with the existing public road structure of Belrose. The two way road system is critical to bushfire planning be successful in any emergency event.

Road hierarchy must be designed to achieve sufficient traffic flow in order to enable an emergency evacuation in quick time and the proposed road system achieves that aspiration.

Table 3.3 outlines the performance criteria and acceptable solutions for future public roads within future subdivision design.

Given the extent of the surrounding bushland it is recommended that the existing fire trail network be upgraded to provide a peripheral trail system some 100 metres external to the outer edges of the asset protection zones.

Interim recommendations for fire trail extensions are depicted within Schedule 1.

Table 3.3: Performance criteria for public roads (*PBP* guidelines pg. 20)

Performance Criteria	Acceptable Solutions	Compliance
Fire fighters are provided with safe all weather access to structures (thus allowing more efficient use of fire fighting resources)	Public Roads are two -wheel drive, all weather roads.	Compliant
Public road widths and design that allow safe access for fire fighters while residents are evacuating an area	<p>Urban perimeter roads are two way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb) allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 3.4 below.</p> <p>Perimeter road is linked with the internal road system at an interval of no greater than 500 metres in urban areas.</p> <p>Traffic management devices are constructed to facilitate access by emergency services.</p> <p>Public roads have a cross fall not exceeding 3 degrees.</p> <p>All roads are through roads. If unavoidable dead end roads are not more than 200 metres in length, incorporate a minimum 12 metre outer radius turning circle, sign posted dead end and direct traffic away from the hazard.</p> <p>Curves of roads (other than perimeter) have a minimum inner radius of 6 metres and are minimal in number to allow for rapid access and egress.</p> <p>The minimum distance between inner and outer curves is 6 metres.</p> <p>Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees.</p> <p>Minimum vertical clearance of 4 metres above the road at all times.</p>	<p>Compliant - The concept plan depicts a perimeter road which ranges in road reserve width of 10.3m wide in the southeast and 13 metres wide in the south, north and west.</p> <p>Can be made compliant - Carriageway widths are required to be 8 metres wide and plans will need to replicate this. All perimeter public roads must be 8 metre wide carriageway. This width enables sufficient capability for fire trucks passing when cars are parked on roadsides. The road cross-sections as shown in the traffic report as well as the urban concept plan and water management/utility services have overall road reserves capable of achieving the RFS carriageway widths.</p> <p>Compliant - The internal roads have a reserve width of 10.3m however these internal roads act as traffic conduits in an emergency and traffic capability is an integral component of bushfire protection planning. Table 3.4 below is taken from PBP and provides the necessary pavement widths. In the case of non perimeter roads a minimum of 6.5 m is required.</p> <p>Compliant - The perimeter road will be linked with the internal road network at intervals of less than 500 metres.</p> <p>Compliant - There are no dead end roads.</p>
The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles	The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles (15 tonnes for reticulated water and 28 tonnes for all other areas). Bridges clearly indicate load rating.	Compliant
Roads that are clearly sign posted (with easily distinguishable names) and	Public roads >6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water.	Complaint – can be made a condition of consent

Performance Criteria	Acceptable Solutions	Compliance
buildings / properties that are clearly numbered.	<p>Public roads 6.5 - 8 metres wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water.</p> <p>Public roads <6.5 metres wide provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.</p> <p>One way only public access are no less than 3.5 metres wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.</p>	
There is clear access to reticulated water supply. Parking does not obstruct the minimum paved width	<p>Parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within parking bays.</p> <p>Public roads directly interfacing the bushfire hazard are to provide roll top kerbing to the hazard side of the road.</p>	Complaint – can be made a condition of consent

Table 3.4: Road design minimum widths for public roads that are not perimeter roads required by the RFS

Curve radius (inside edge) (metres width)	Swept Path requirements (metres width)	Single lane (metres width)	Two way (metres width)
<40	3.5	4.5	8.0
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

3.5 Water Supplies

Town reticulated water supply will be available to the future development in the form of an underground reticulated water system.

Table 3.5 outlines the performance criteria and acceptable solutions for reticulated water supply.

Table 3.5: Performance Criteria for reticulated water supplies (PBP guidelines pg. 27)

Performance criteria	Acceptable Solutions
Water supplies are easily accessible and located at regular intervals	<p>Reticulated water supply to urban subdivision uses a ring main system for areas with perimeter roads.</p> <p>Fire hydrant spacing, sizing and pressures comply with AS2419.1 - 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles.</p> <p>Hydrants are not placed within any road carriageway</p> <p>All above ground water and gas pipes external to the building are metal, including and up to taps.</p> <p>The provisions of parking on public roads are met.</p>

3.6 Gas

Table 3.6 outlines the required performance criteria for the gas supply.

Table 3.6: Performance Criteria for Reticulated Water Supplies (PBP guidelines pg. 27)

Performance criteria	Acceptable Solutions
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings	<p>Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS 1596 – 2002 and the requirements of relevant authorities. Metal piping is to be used.</p> <p>All fixed gas cylinders are to be kept clear of flammable materials to a distance of 10 metres and shielded on the hazard side of the installation.</p> <p>If gas cylinders are to be kept close to the building the release valves must be directed away from the building and at least 2 metres away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal.</p> <p>Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.</p>

3.7 Electricity

Table 3.7 outlines the required performance criteria for electricity supply.

Table 3.7: Performance criteria for electricity services (PBP guidelines pg. 27)

Performance criteria	Acceptable Solutions
<p>Location of electricity services limit the possibility of ignition of surrounding bushland or the fabric of buildings</p> <p>Regular inspection of lines in undertaken to ensure they are not fouled by branches.</p>	<p>Where practicable, electrical transmission lines are underground</p> <p>Where overhead electrical transmission lines are proposed:</p> <ul style="list-style-type: none"> • Lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas: and • No part of a tree is closer to a power line than the distance set out in accordance with the specification in <i>Vegetation Safety Clearances</i> issued by <i>Energy Australia</i> (NS179, April 2002).

3.8 Evacuation

Evacuation capability is a critical when considering bushfire planning for new residential developments. Given the inherent bushfire risk posed to future development, close examination of evacuation routes have been undertaken such that all perimeter roads, connections to internal roads are many and external egress to the main road has opportunity for not clogging and causing restrictions in good traffic fluidity for any uncontrolled evacuations.

The egress roads of Ralston Avenue and Wyatt Avenue are both 20m in width and are capable of providing a fluid traffic flow in times of emergency. It is recommended that Ralston Road and Wyatt Avenue (the primary evacuation routes from the subdivision) utilise the widest possible pavement width within the existing 20m road reservation. A pavement width of 13-15 metres would suffice.

The main road intersection/s onto Forest Road are controlled by lights and their long length provides a significant zone of protection for residents of the new development zone when and or if they are evacuating their homes.



Conclusion & Recommendations

4

4.1 Conclusion

A bushfire protection assessment has been undertaken for the proposed rezoning located at Lot 1 DP 1139826, Ralston Avenue, Belrose.

The key principle for the proposal is to ensure that future development is capable of complying with *PBP*. Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, specifying minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments in hazardous areas and the inappropriate placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the surrounding forest and heath vegetation communities resulting in possible ember attack, radiant heat and potentially flame attack.

The past fire history of the surrounding landscape is such that considerable planning focus has been undertaken for traffic capability, asset protection, emergency management, fire trail construction, hazardous fuels management, building construction standards, water management and peripheral land management on land owned by the land owner. The bushfire risk posed to the rezoning proposal however can be mitigated if a full suite of bushfire protection measures (including APZs) are implemented and managed in perpetuity.

Upon final design engagement with recommendations made within this report the future development of these lands in accordance with the attached bushfire protection plan (Schedule 1) will provide compliance with the planning principles of *Planning for bush fire protection 2006* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*.

Future development on site is to comply with the following planning principles.

Table 4.1: Planning Principles

Planning Principles	Recommendations
Provision of a perimeter road with two way access which delineates the extent of the intended development.	The concept development plan provides for a perimeter road with two way access and two alternate egress routes to the east onto Ralston and Wyatt Avenues.
Provision, at the urban interface, for the establishment of adequate asset protection zones for future housing	APZ's have been recommended in compliance with BAL 29 (AS3959, 2009).
Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads	Future subdivision design is to allow for the minimum APZ's as recommended within Table 2.2 and as depicted within Schedule 1 attached.

Planning Principles	Recommendations
Minimising the perimeter of the area of land interfacing the hazard, which may be developed	The concept plan has minimised the perimeter exposed to bushfire to the extent available. This is restricted by topography and other environmental constraints. The development site will be adjoined by an electrical substation in the east reducing the bushfire threat posed from this aspect.
Introduction of controls which avoid placing inappropriate developments in hazardous areas	Proposed future development will consist of residential dwellings and is appropriate for the level of bushfire risk.
Introduction of controls on the placement of combustible materials in asset protection zones.	Compliant –can be made a condition of consent.

The following recommendations are provided to ensure that future residential development is in accord with or greater than the requirements of *PBP*.

4.2 Recommendations

Recommendation 1 - APZs are to be provided to the future residential development. APZs are to be measured from the exposed wall of the any dwelling toward the hazardous vegetation. The minimum APZ must be achievable within all lots fronting the bushfire hazard as nominated in Table 2.2 and also as generally depicted in Schedule 1.

Recommendation 2 - A detailed *fuel management plan* will need to be prepared to manage all asset protection zones not located within urban allotments and or public roads i.e. public parklands and external residual private land retained by the proponent. Fuel management within the APZs will need to be maintained by regular maintenance in accordance with the guidelines provided in Appendix 1, and as advised by the *NSW RFS* in their publications.

Recommendation 3 – Peripheral lands to the development should be designated as a *bushfire strategic management zone* for a width of approximately 100m and edged by a fire trail. This zone should be linked into the *Warringah bushfire risk management plan* as a permanent zone for protecting the community.

Recommendation 4 - Building construction standards are to be applied for future residential dwellings in accordance with *Australian Standard AS3959 Construction of buildings in bushfire prone areas (2009)* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 of *PBP*.

Recommendation 5 – Public access roads are to comply with the acceptable solutions provided within Section 4.1.3 of *PBP* (refer Section 3.4 of this report).

Recommendation 6 – A fire trail system should be designed and constructed in order to link with existing peripheral trails (if possible) to ensure the ongoing management of the peripheral landscape (see Rec' 3 above) is maintained in both fire management terms and environmental protection terms.

Recommendation 7 - Water, electricity and gas supply is to comply with the acceptable solutions as provided within Section 4.1.3 of *PBP* (refer Sections 3.5, 3.6 & 3.7 of this report)

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Plan of Bushfire Protection Measures

S1

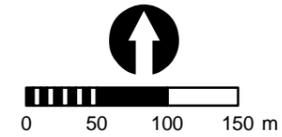
Minimum APZ's provided are based on BAL29 construction which will impact on building costs



Legend

- Subdivision boundary
- Super Lot (created by TBE)
- Proposed roads
- Site boundary
- Concept firetrails
- Asset Protection Zone
- Vegetation Formations**
- Short Heath (to 2.5m tall)
- Tall Heath (2.5 - 5m tall)
- Forest
- Cleared, Managed, Landscaped or Weed Plume
- Freshwater Wetland (Coastal Upland Swamp (EEC))
- Area of *Grevillea caleyi*
- Riparian Corridor (20m width)

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



PROJECT Belrose	REFERENCE A12079_F005_A	
SCALE 1:5,000 @ A3	DATE (ISSUE) 04.12.12	TITLE Schedule 1 - Bushfire Protection Measures



Management of Asset Protection Zones

A1

The *NSW Rural Fire Service (RFS)* advises that when living in a bushfire prone environment asset protection zones are required to be provided between hazardous fuels and a dwelling.

The *NSW RFS* provides basic advice in respect of managing asset protection zones in several documents namely *Planning for bush fire protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

Asset protection zones (APZs) provide a level of defensible space between the hazard and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (e.g. dwelling). They act to significantly lessen the impact of intense fire. The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

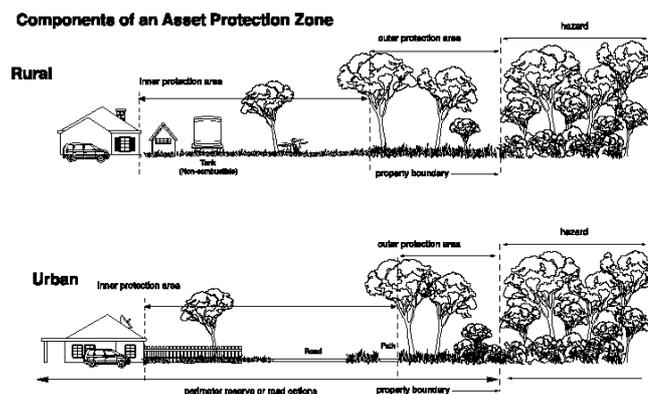
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 – Fuel Layers

Fuel Layer Name	Location of Layer in vertical Column	Type of Fuel
Ground Fuels	Below ground level	Peatmoss (always below the surface)
Surface Fuels	0-200 mm	Litter layer (leaves & twigs)
Aerial Fuels	200 – 3000 mm	Shrubs and grasses
Canopy Fuels	> 3000 mm	Tree canopy

The APZ can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA) – see figure below.

The IPA is managed as a fuel free zone while the OPA is managed as a fuel reduced zone. This means that the fuel free zone has little fuel available to be consumed in the event of a fire whilst the fuel reduced zones has less than normal fuel levels that could be consumed in the event of a fire.



Inner Protection Area (IPA)

This area is *almost free* of all fuels and usually takes the form of grassy areas, car parks, roads, concrete areas, tracks or trails. It does not imply or require the wholesale removal of every tree and or shrub.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

This zone also provides a safe fire fighting position and is operationally important for implementation of clear fire control lines.

Grasses may occur within an IPA if they are generally no higher than 50-75mm. Above this height, fuel weights tend to increase exponentially and consequentially cause greater flame heights and therefore fire intensity

Shrubs may occur within an IPA in the form of clumping amidst open grassy areas. The design of the clumping will be dependent on species selection and spatial density. For example the larger the shrubs the less clumping may occur in a given area.

As a general, rule trees are allowed within an IPA but only where those trees are at least 5 metres away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0 – 4 t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m² (10mx10m) can have up to 20% of this area composed of shrubs.

If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

Shrub cover	Fuel Weight
10-30 %	2.5 tonnes / ha
35-50 %	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

Presence of Trees within an Inner Protection Area

A tree may occur within an IPA if the canopy does not form a link with shrubs. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a 'tall open forest' where the trees are generally above 20 metres in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually < 5 metres) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the APZs. It is for this reason that vegetation such as Forest Oaks are usually excluded from an IPA.

Similarly in 'open forests' the height of the forest is sufficiently removed from the shrub layer. As a general rule trees are allowed within an IPA where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a westerly aspect.

In respect of trees that can be located in an IPA Table 2 provides guidelines.

Table 2 – Tree Density in Inner Protection Area

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
Within 5 metres	No trees	No trees
Between 5-10 metres	One tree per 100 m ²	2 trees per 100 m ²
Between 10-20 metres	<10 tree per 400 m ² .	<10 trees per 400 m ²

Outer Protection Area (OPA)

This zone is designed to stop the development of ‘intense’ fires and the transmission of ‘severe’ radiated heat.

The OPA assumes all trees will remain but with either a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities the shrub layer may not require modification.

The fire fighting advantage will manifest in reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as *Forest Oaks* (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

In most cases the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an OPA is between 4-6 t/ha.

Managing the APZ

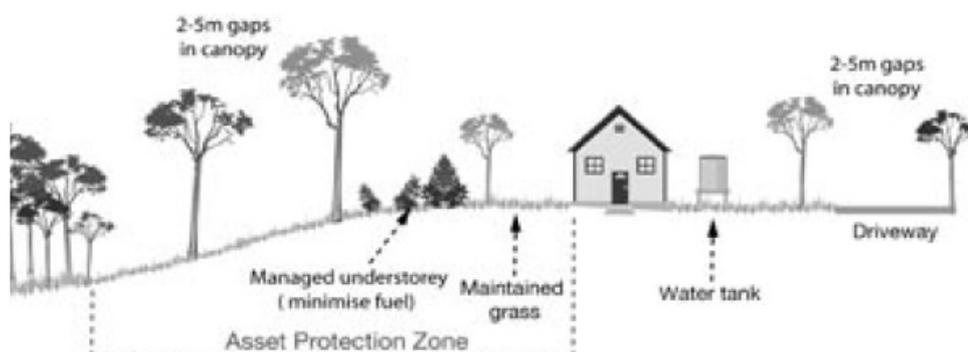
Fuel management within the APZs should be maintained by regular maintenance such as

- Mowing grasses regularly - Grass needs to be kept short and, where possible, green.
- Raking or manual removal of fine fuels - Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.
- Removal or pruning of trees, shrubs and understorey - The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.
- Tree or tall shrubs may require pruning upon dwelling completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a dwelling in a bushfire prone landscape requires specific attention to day to day management and owners and or occupier should be made aware that whilst landscaping can contribute to a way of life and environmental amenity the accumulated.

In addition, the following general APZ planning advice should be followed:

- Ensure that vegetation does not provide a continuous path to the house.
- Plant or clear vegetation into clumps rather than continuous rows.
- Prune low branches two metres from the ground to prevent a ground fire from spreading into trees.
- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile; and
- The following *NSW RFS* illustrative diagram depicts one version of an ideal situation. Specific advice is to be sought from qualified experts to ensure that the implemented APZs meet the *performance criteria* of APZs.



Figures courtesy of NSW RFS 2006.

**PROPOSED REZONING FOR
RESIDENTIAL SUBDIVISION
RALSTON AVENUE, BELROSE**

***Assessment of Traffic
Implications***

December 2012

Reference 12085

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FIGURE 4	TRAFFIC CONTROLS
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FIGURE 6	PROJECTED TRAFFIC DISTRIBUTION

1. INTRODUCTION

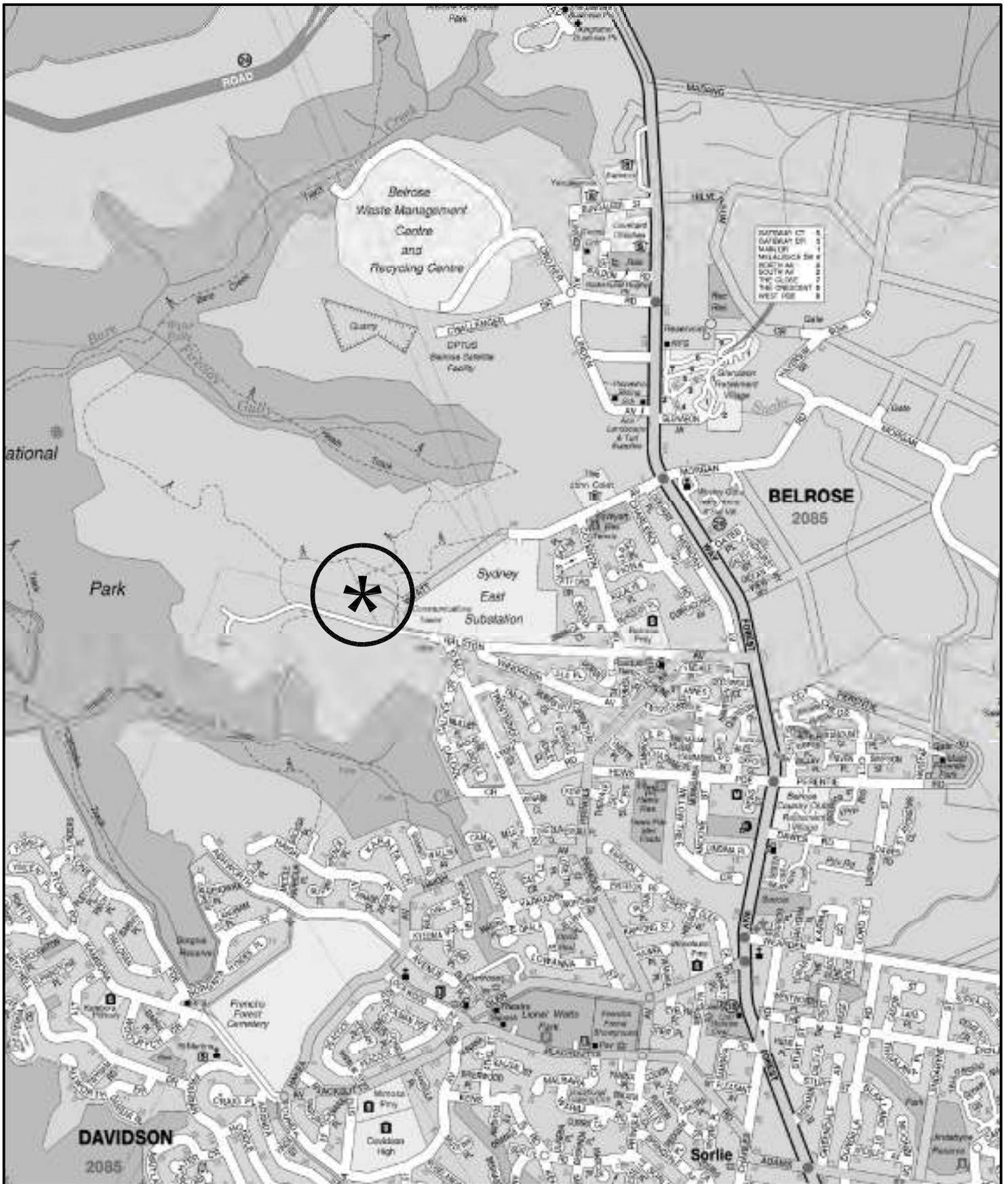
This report has been prepared to accompany a Draft Planning Proposal to Warringah Council for a proposed rezoning to permit a residential development on a site within the Metropolitan Local Aboriginal Land Council (MLALC) landholding located to the west of Forest Way at Belrose (Figure 1).

The Belrose area represents a highly desirable locality for residential development due to the convenient proximity to shopping facilities, public transport services and schools as well as sporting facilities, open space/bushland areas and the northern peninsula beaches. Subdivisions have been occurring in the area for the past 40 years and whilst this has slowed in the past decade or so there have been some developments along the eastern side of Forest Way in that time.

Virtually all available land zoned for residential development in the area has been exhausted while there are other areas which present logical and easy potential extensions to the existing urban development without adverse environmental implications. A section of the large MLALC landholding presents such an opportunity subject to rezoning.

The envisaged development which is the subject of the application represents a further small extension immediately to the west of the earlier subdivisions. The proposal will potentially provide approximately 169 low density residential lots with new roads, involving an extension of existing collector roads which link to the 'higher order' roads of Forest Way, Warringah Road and Mona Vale Road.

The purpose of this report is to provide an assessment of potential road and traffic related implications of the envisaged development.



LEGEND



LOCATION

FIG 1

2. ENVISAGED DEVELOPMENT

2.1 SITES AND CONTEXT

The development site (Figure 2) is part of Lot 1 DP602729 which occupies a large irregular shaped total landholding of 135.3 ha located to the west of Forest Way (see Deposited Plan reproduced overleaf). The undulating site is largely Hawkesbury sandstone shrub and bushland apart from some cleared areas and tracks. The landholding is bounded to the west by the large Garigal National Park which spans the upper reaches of Middle Harbour Creek and its off shoots Bare Creek, Frenchs Creek and Fireclay Gully.

The site is adjoined by the Sydney East Substation

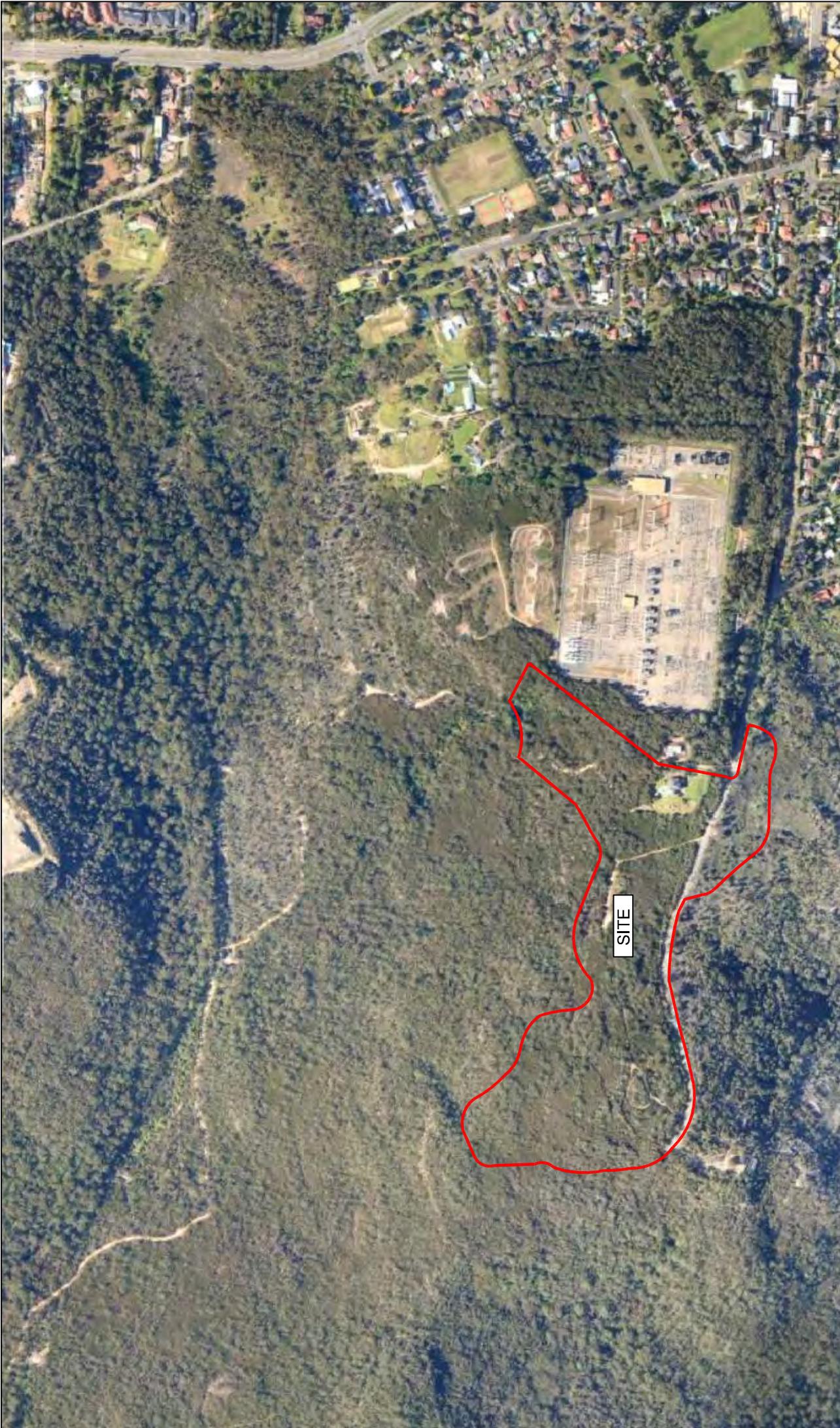
Also located in the vicinity are:

- The John Colet School
- The Belrose Satellite Facility
- Belrose Waste Management Centre

The existing urban development extending each side of Forest Way generally contain residential and rural residential properties together with aged persons accommodation and schools.

2.2 ENVISAGED SUBDIVISION

The envisaged development (subject to rezoning approval) would largely reflect the nature of the existing adjoining residential lands to the east with a road system including the construction of the existing unmade sections of Ralston Avenue and Wyatt Avenue.



LEGEND

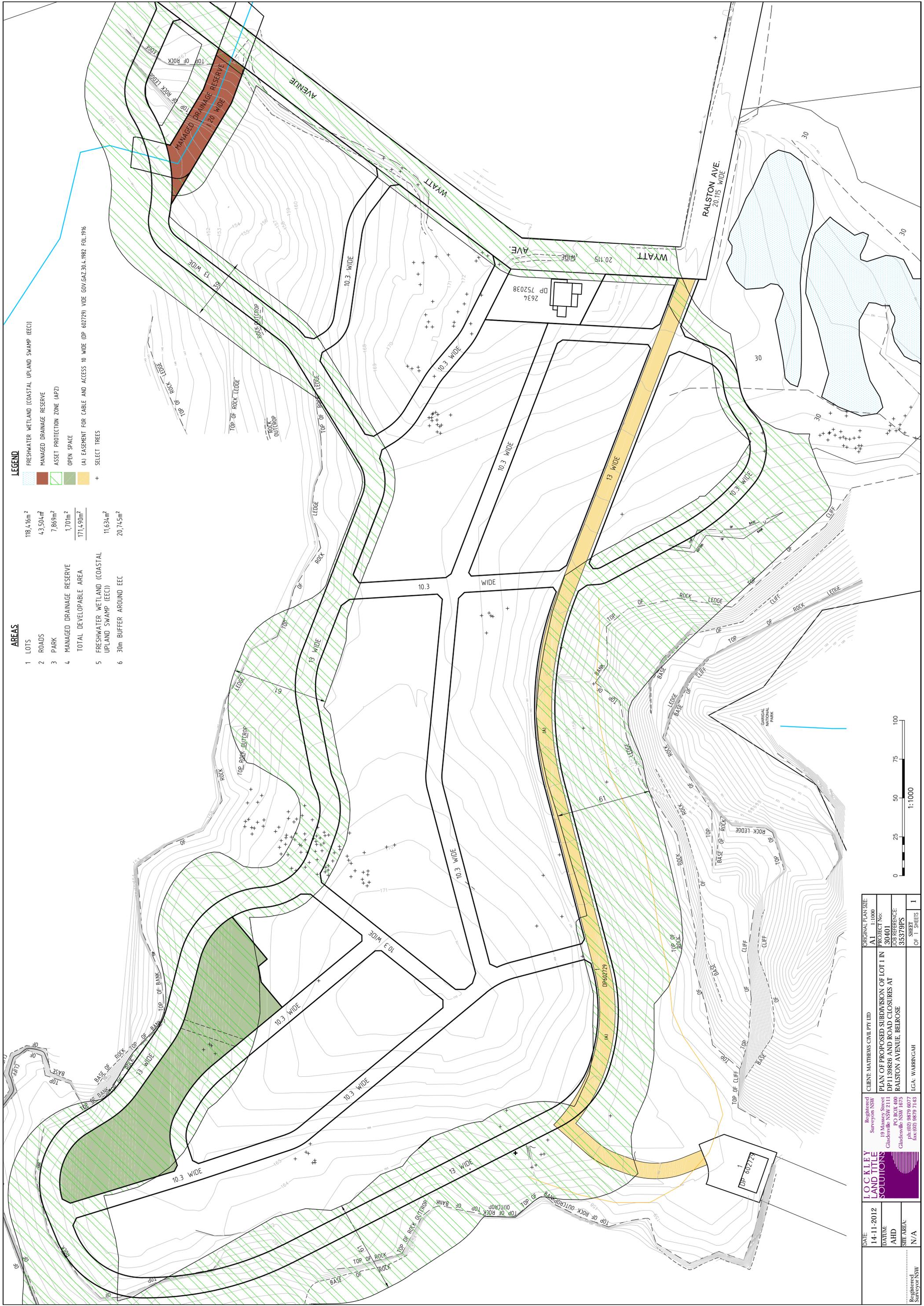


SITE

FIG 2

The proposed development will provide the potential for residential lots with normal frontage set back to the new road system. The site will retain significant open space areas in various forms along roads which will have a somewhat curvilinear alignment.

Details of the envisaged outcome are provided on the plan prepared by Lockley Land Title Solutions which accompany the Rezoning Application and are reproduced in part overleaf.



AREAS

1	LOTS	118,416m ²
2	ROADS	43,504m ²
3	PARK	7,869m ²
4	MANAGED DRAINAGE RESERVE	1,701m ²
	TOTAL DEVELOPABLE AREA	171,490m ²
5	FRESHWATER WETLAND (COASTAL UPLAND SWAMP (ECC))	11,634m ²
6	30m BUFFER AROUND ECC	20,745m ²

LEGEND

	FRESHWATER WETLAND (COASTAL UPLAND SWAMP (ECC))
	MANAGED DRAINAGE RESERVE
	ASSET PROTECTION ZONE (APZ)
	OPEN SPACE
	(A) EASEMENT FOR CABLE AND ACCESS 10 WIDE (DP 602729) VIDE GOV.GAZ.30.4.1982 FOL.1916
	SELECT TREES

DATE:	14-11-2012	REGISTERED SURVEYORS NSW	10 Mares Street Gladstone NSW 2111	PO BOX 100 Gladstoneville NSW 1675	ph:(02) 9879 6077	fax:(02) 9879 7143	
DATUM:	AHD	CLIENT:	MATTHEWS CIVIL PTY LTD	PROJECT No:	30401	JOB REFERENCE:	35379PS
SITE AREA:	N/A	PLAN OF PROPOSED SUBDIVISION OF LOT 1 IN DP1159826 AND ROAD CLOSURES AT RALSTON AVENUE, BELROSE		ORIGINAL PLAN SIZE:	A1	SCALE:	1:1000
						SHEET:	1
						OF 1 SHEETS	1



3. ROAD NETWORK AND TRAFFIC CONDITIONS

3.1 ROAD NETWORK

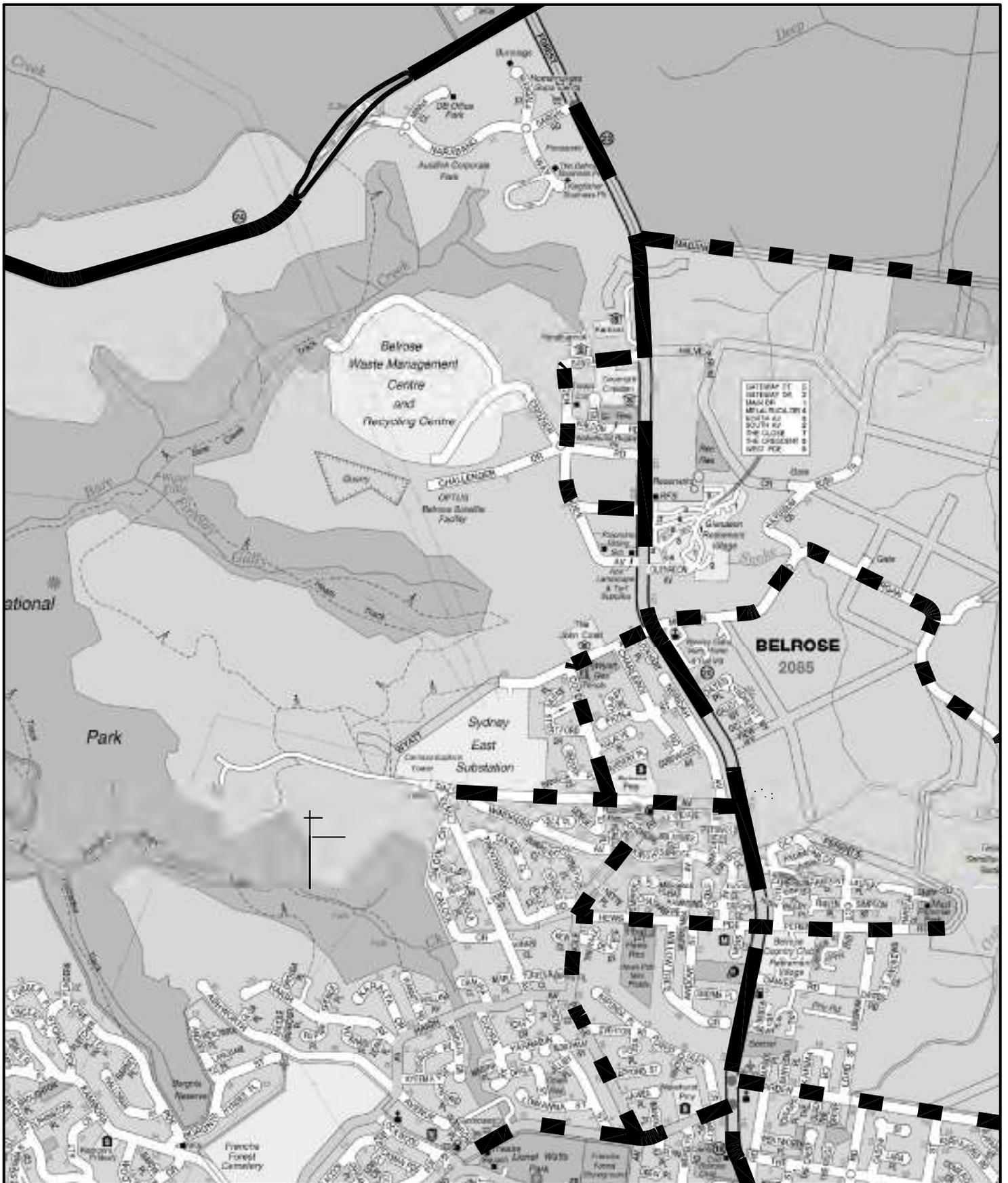
The road network serving the site (Figure 3) comprises:

- * *Warringah Road* – a State Road and arterial route connecting between Pittwater Road at Brookvale across Roseville Bridge to Pacific Highway at Chatswood
- * *Forest Way* – a State Road and sub-arterial route connecting between Warringah Road and Mona Vale Road
- * *Glen Street, Weardon Road, Hew Parade and Perentie Road* – collector road connecting off Forest Way to the east and west
- * *Ralston Road, Cotentin Road and Wyatt Avenue* – a collector road route connecting between Forest Way
- * *Crozier Road, Linden Avenue* – a minor collector road route connecting to Forest Way

3.2 ROAD GEOMETRY

The roadways in the vicinity of the sites have normal 20m wide road reservations however the form of the road carriageways varies as follows:

- Ralston Avenue – 12.8m wide roadway with kerb and gutter both sides except for the western end. The roadway is generally straight and level with a slight downgrade generally from west to east.



LEGEND

-  ARTERIAL
-  SUB-ARTERIAL
-  COLLECTOR



ROAD NETWORK

FIG 3

- Wyatt Avenue – 12.8m wide roadway with kerb and gutter both sides except for the section west of Cotentin Road where there is no northern kerb and the pavement reduces to 8.5m. The roadway is generally straight and level except for the western part which has a slight downgrade to the west

3.3 TRAFFIC CONTROLS

The traffic controls, which have been applied to the road system serving the site, (Figure 4) comprise:

- * the roundabout at the intersection of Ralston Avenue and Pringle Avenue
- * the traffic signal control at the of Forest Way/Wyatt Avenue and Morgan Road intersection including right arrow phasing (See Appendix A for details)
- * the traffic signals at the Forest Way/Crozier Road intersection including right turn arrow phasing (See Appendix A for details)
- * the traffic signals at the Forest Way/Hews Parade/Perentie Road intersection
- * the marked footcrossings on Ralston Road (wombat) and on Cotentin Road adjacent to the primary school
- * the traffic calming measures on Elm Avenue including roundabout and raised platforms controls
- * the roundabout at the Crozier Road/Linden Avenue intersection
- * the central median island along Forest Way restricting access movements at Linden Avenue to left turn IN/OUT (See Appendix A for details)
- * The GIVE WAY control on Ralston Avenue at Forest Way (See Appendix A for details) with partial 'seagull' treatment (ie centre storage for cars turning right out of Ralston Avenue)

- * the 50 kmph School Zone speed limit on the local and collector roads with 40 kmph limits in the vicinity of schools
- * the marked footcrossing on Wyatt Avenue at the John Colet School

3.4 TRAFFIC CONDITIONS

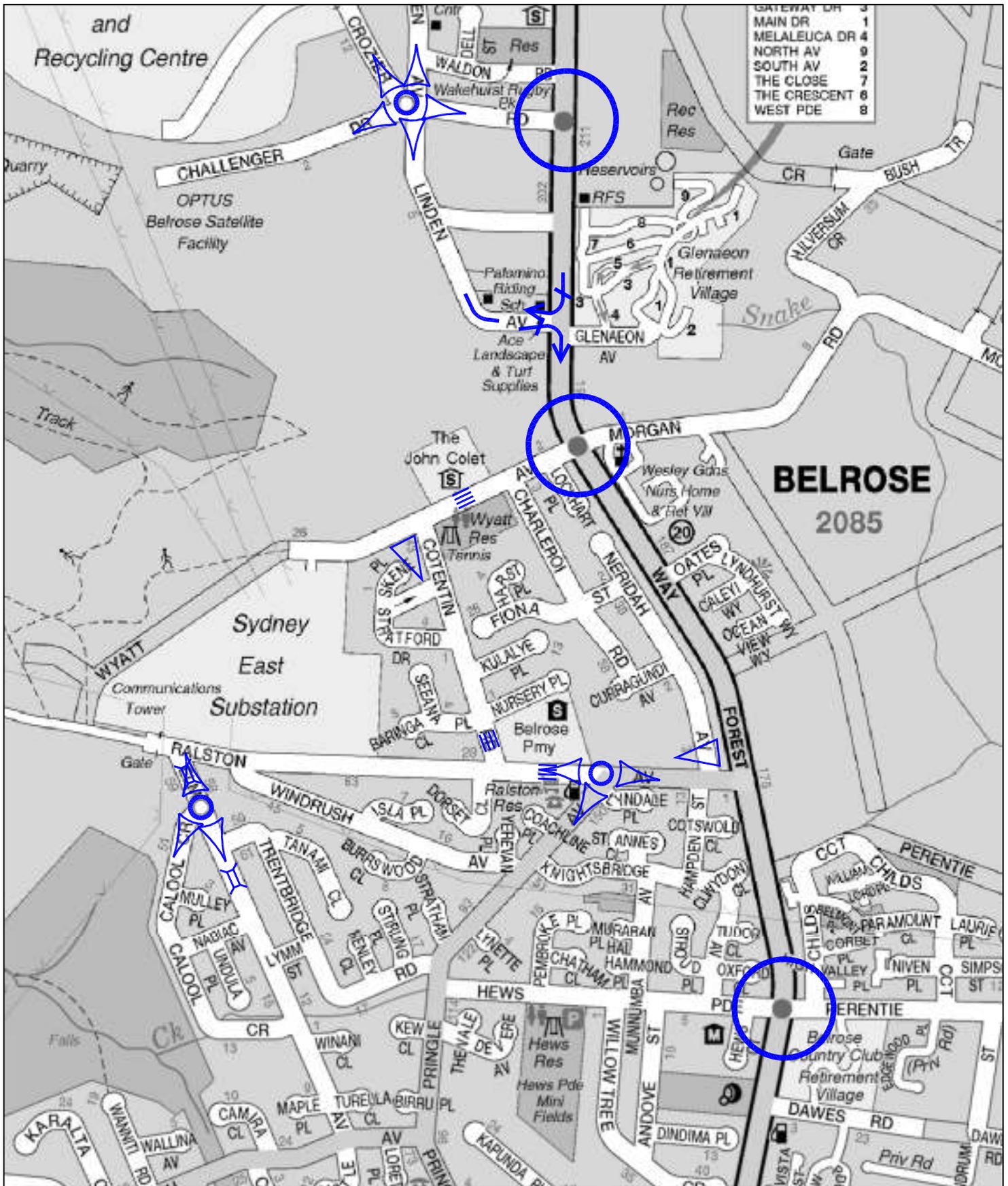
An indication of traffic conditions on the road system serving the area is provided by data¹ published by RMS and the results of surveys undertaken as part of this study. The data published by RMS is expressed in terms of Annual Average Daily Traffic (AADT) and the latest data is provided in the following:

	AADT
Forest Way north of Frenchs Forest Road	75,379
Warringah Road west of Hilmer Street	78,279
Wakehurst Parkway south of Frenchs Forest Road	19,798

Surveys have been undertaken at the principal access intersections along Forest Way relative to the sites during the morning and afternoon peak traffic periods in early August 2012. The results of those surveys are provided in the following and summarised in Figure 5.

		AM	PM
Forest Way	Northbound	1316	1248
	Left Turn	92	84
	Southbound	1284	1259
	Right Turn	120	204
Ralston Avenue	Right Turn	24	31
	Left Turn	252	136
<hr/>			
Forest Way	Northbound	1459	1352
	Right Turn	62	20
	Left Turn	47	12
	Southbound	1369	1439
	Right Turn	97	41
	Left Turn	124	44

¹ *Traffic Volume Data for Sydney Region
Roads and Traffic Authority of NSW*



LEGEND

-  TRAFFIC SIGNAL CONTROL
-  ROUNDABOUT
-  RESTRICTED TURNING MOVEMENT



TRAFFIC CONTROLS

FIG 4

Wyatt Avenue	Eastbound	25	8
	Right Turn	53	27
	Left Turn	68	36
Morgan Road	Westbound	35	11
	Right Turn	136	72
	Left Turn	43	57
Forest Way	Northbound	1735	1492
	Left Turn	28	32
	Southbound	1444	1524
	Right Turn	252	33
Crozier Road	Right Turn	145	108
	Left Turn	20	21

The operational performance of the intersections on Forest Way with the existing morning and afternoon peak volumes has been assessed using the SIDRA program. The results of that assessment are provided in Appendix B and summarised in the following while the criteria for interpreting the SIDRA results are provided overleaf.

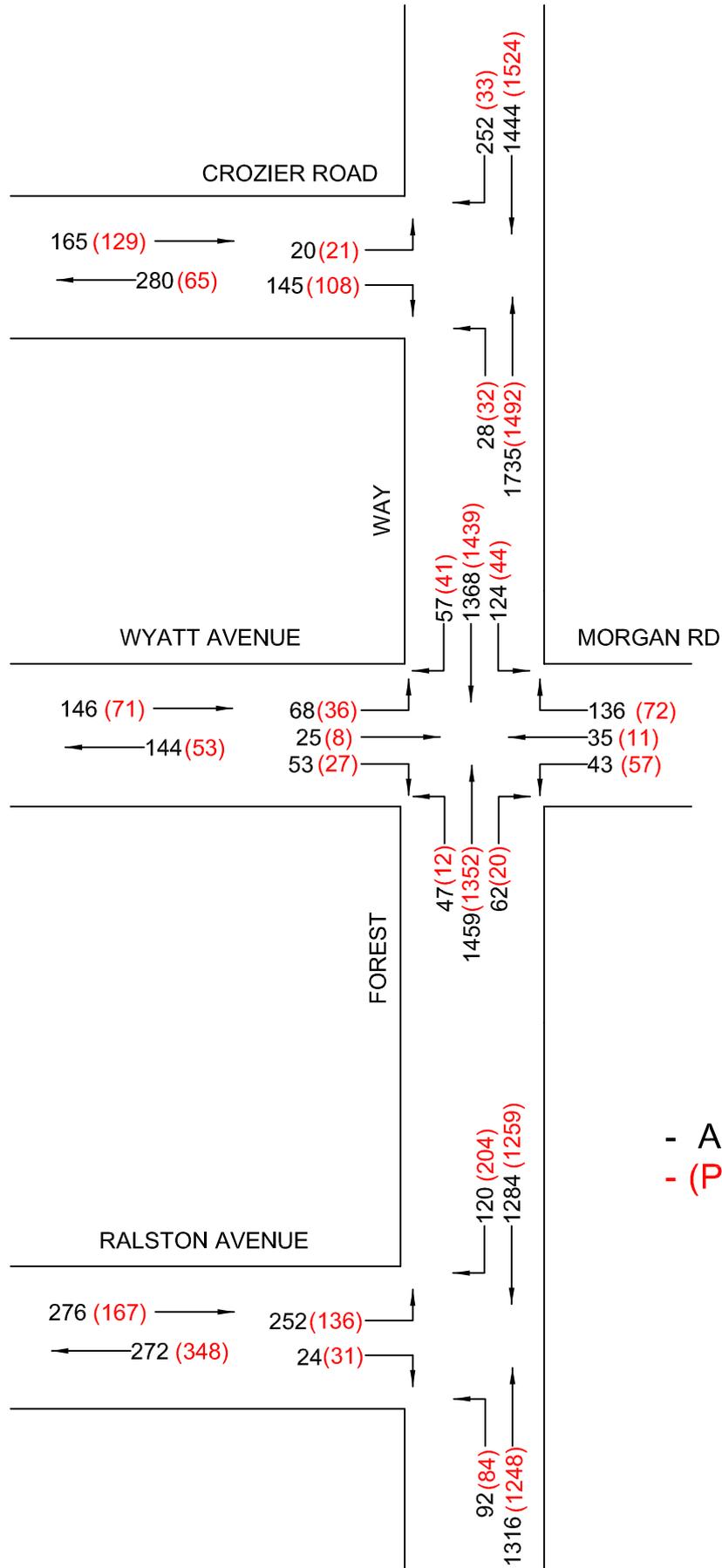
	AM		PM	
	LOS	AVD	LOS	AVD
Wyatt Avenue	A	12.5	A	11.3
Ralston Avenue	A-F	16.0	A-F	20.8

The results indicate that the Wyatt Avenue intersection operates satisfactorily but the Ralston Avenue intersection does not however the later results simply reflects the way that SIDRA models the delay for the right turn movement out of Ralston Avenue (which does not have full regard for the gaps provided by the adjacent traffic signals) and does not take account of the 'partial seagull' arrangement.

3.5 TRANSPORT SERVICES

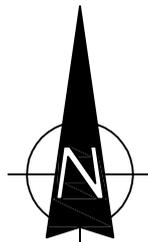
Public transport services in the vicinity of the site are provided by the bus routes operated by Forest Coach Lines, including:

- * Routes 270, L70 and 284 which run along Forest Way



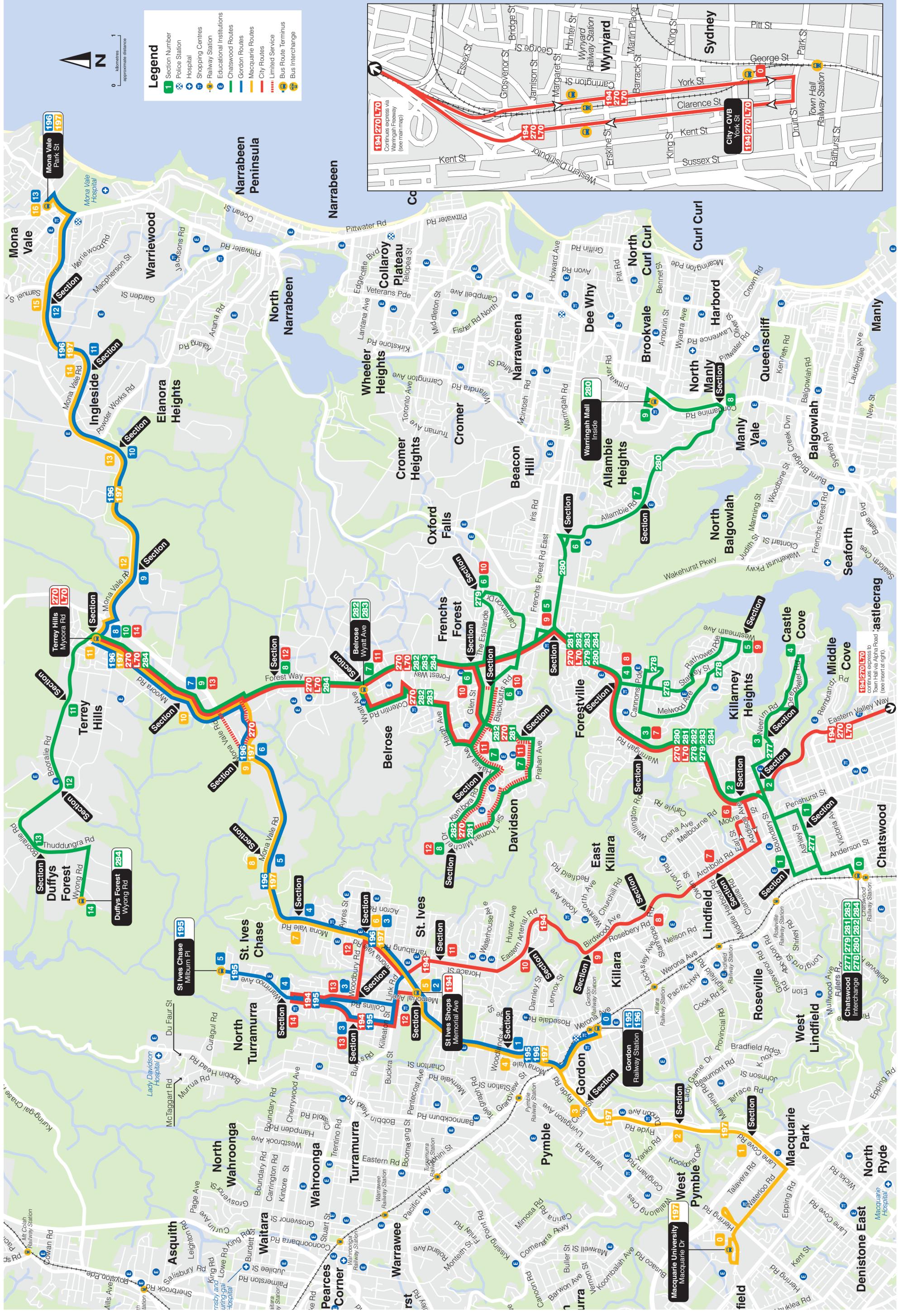
- AM
- (PM)

LEGEND



EXISTING PEAK TRAFFIC VOLUMES

FIG 5



- * Routes 270, 283 and 282 which run along the Wyatt Avenue, Cotentin Road, Ralston Avenue and Pringle Avenue route

Criteria for Interpreting Results of SIDRA Analysis

1. *Level of Service (LOS)*

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good	Good
'B'	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
'C'	Satisfactory	Satisfactory but accident study required
'D'	Operating near capacity	Near capacity and Accident Study required
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
'F'	Unsatisfactory and requires additional capacity	Unsatisfactory and requires other control mode

2. *Average Vehicle Delay (AVD)*

The AVD provides a measure of the operational performance of an intersection as indicated on the table below which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (ie inner city conditions) and on some roads (ie minor side street intersecting with a major arterial route).

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode

3. *Degree of Saturation (DS)*

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**² both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

¹ the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs

4. ENVISAGED DEVELOPMENT ROAD SYSTEM

4.1 ROAD SYSTEM

The envisaged development road system reflects the objectives of permeability and ESD housing outcomes avoiding the characteristics of a standard 'grid' pattern. The proposed roadways will have a slightly curvilinear alignment reflecting the undulating terrain.

The envisaged road configurations will reflect the Auspec criteria as specified in Council's LEP.

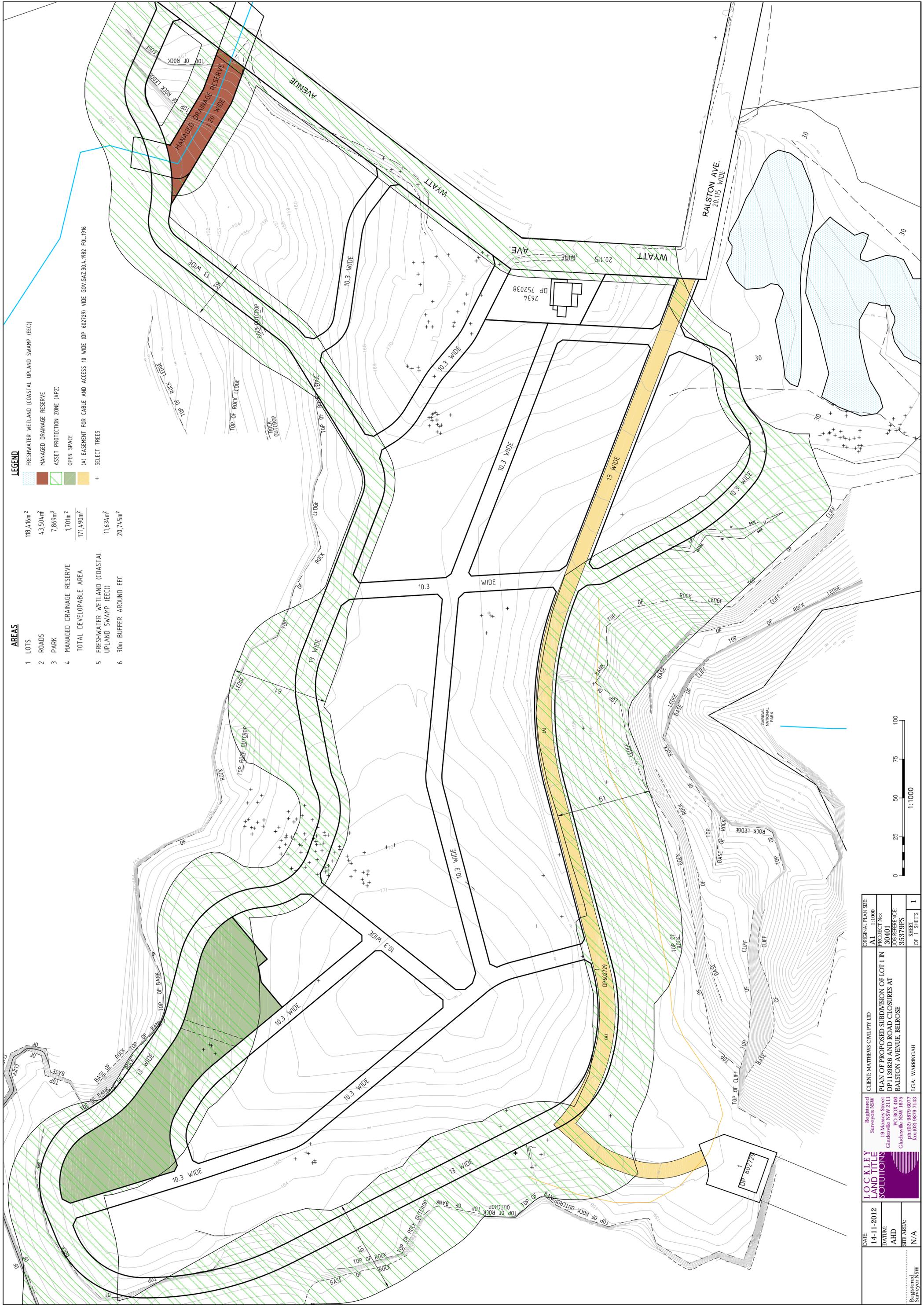
- * Distributor/Collector Function – 20 metre wide reserve, 13 metre wide roadway with footway and verges
- * Perimeter Road Function – 13 metre wide reserve, 7 metre wide roadway with footway, verge and swale
- * Local Street/Access Function - 10.5 metre wide reserve, 6 metre wide roadway and verges

4.2 ACCESS CONNECTIONS

The access connections to the existing road system will comprise:

- * construction of Ralston Avenue from the existing termination to Wyatt Avenue
- * construction of Wyatt Avenue from the existing termination to Ralston Avenue

These access connections represents suitable, appropriate and easily understood road arrangements.



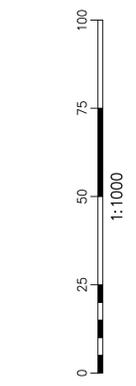
AREAS

1	LOTS	118,416m ²
2	ROADS	43,504m ²
3	PARK	7,869m ²
4	MANAGED DRAINAGE RESERVE	1,701m ²
	TOTAL DEVELOPABLE AREA	171,490m ²
5	FRESHWATER WETLAND (COASTAL UPLAND SWAMP (EEC))	11,634m ²
6	30m BUFFER AROUND EEC	20,745m ²

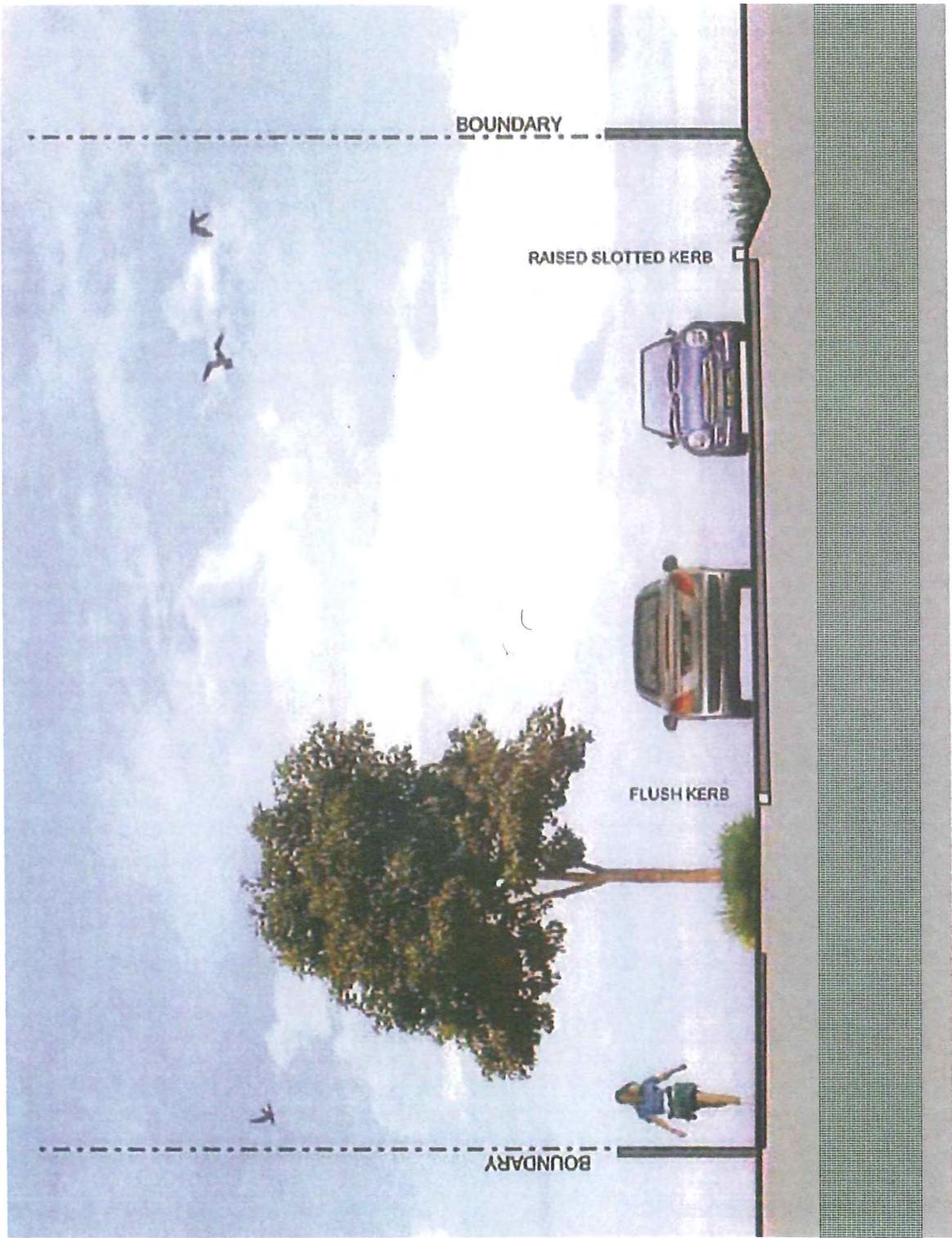
LEGEND

	FRESHWATER WETLAND (COASTAL UPLAND SWAMP (EEC))
	MANAGED DRAINAGE RESERVE
	ASSET PROTECTION ZONE (APZ)
	OPEN SPACE
	(A) EASEMENT FOR CABLE AND ACCESS 10 WIDE (DP 602729) VIDE GOV.GAZ.30.4.1982 FOL.1916
	SELECT TREES

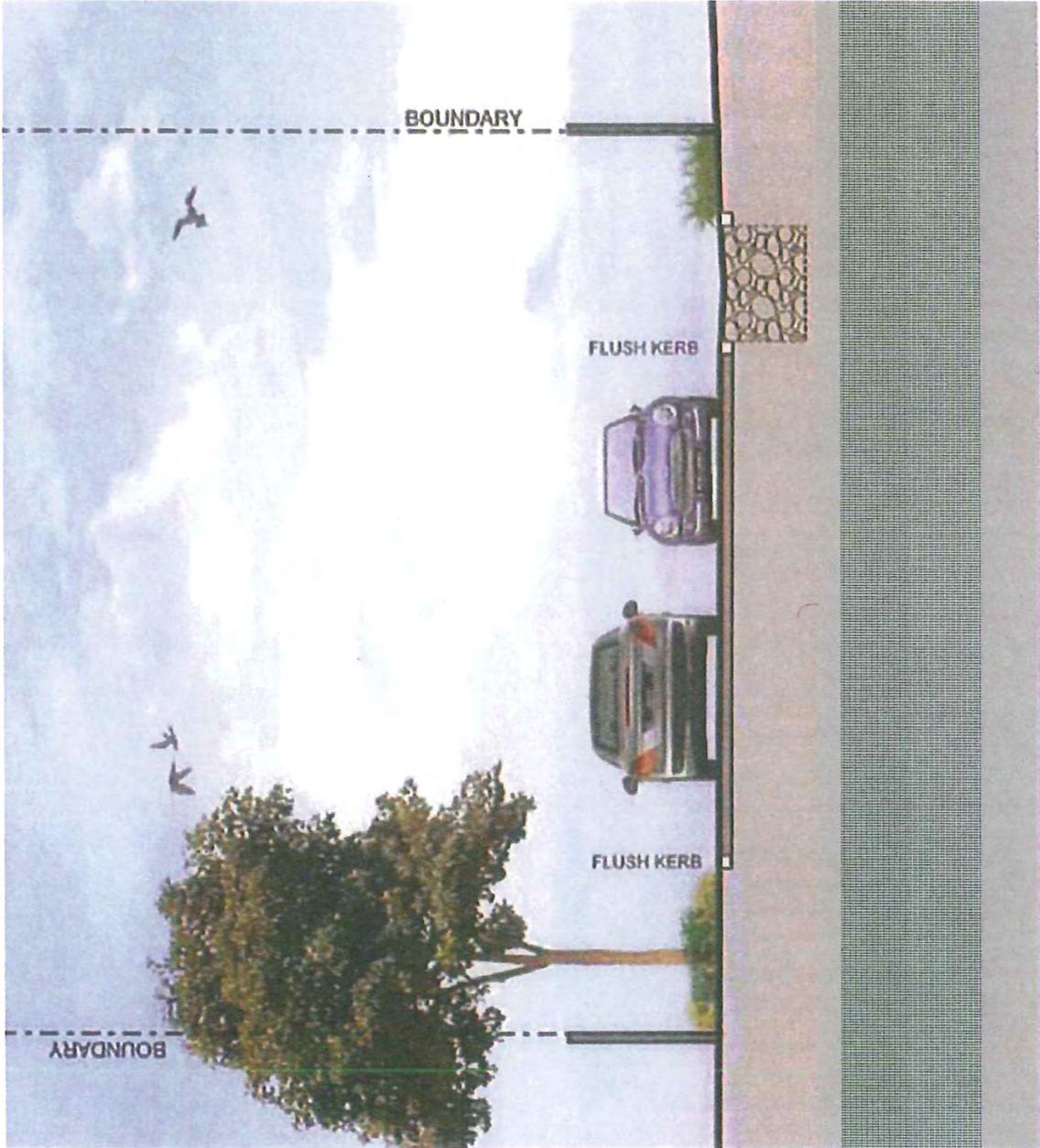
DATE:	14-11-2012	REGISTERED SURVEYORS NSW	10 Mares Street Gladstone NSW 2111	PO BOX 100 Gladstone NSW 1675	ph:(02) 9879 6077	fax:(02) 9879 7143	
DATUM:	AHD	CLIENT:	MATTHEWS CIVIL PTY LTD	ORIGINAL PLAN SIZE:	A1	1:1000	
SITE AREA:	N/A	PROJECT:	PLAN OF PROPOSED SUBDIVISION OF LOT 1 IN DP1159826 AND ROAD CLOSURES AT RALSTON AVENUE, BELROSE	PROJECT No.:	30401	JOB REFERENCE:	35379PS
		SHEET:	1	OF 1 SHEETS			



LOCK KILBY
LAND TITLE
SOLUTIONS



PERIMETER ROAD



LOCAL STREET

5. TRAFFIC IMPLICATIONS

5.1 TRAFFIC GENERATION

The RMS Development Guidelines* provide generic criteria in relation to the assessed traffic generation of single residential dwellings as follows:

Single Dwellings

'Outer Sydney area, new dwellings, large lots, poor public transport'

- 0.85 vtpH (peak hour)

Medium Density dwellings

'Villas, townhouse, semi-detached and other medium density

2 and 3 bed – 0.5 to 0.65 vtpH'

However unlike the other landuse categories dealt with in the Guidelines, and particularly the various forms of residential development, there is no supporting "Survey and Assessment" analysis to indicate where this longstanding Single Dwelling criteria was derived from. The RMS document also identifies that some 25% of residential subdivision trips are "internal" involving local shops, schools and local social/sporting visits.

TTPA have undertaken many of the studies commissioned by the former RTA to derive the traffic generation of various landuses for incorporation into the now RMS Development Guidelines. In 2003, TTPA undertook a major assessment of single dwelling residential development (Glenmore Park Stage 1) which comprised some 5,600 dwellings on the western outskirts of Sydney. An extract from that study is provided in Appendix C with the conclusion that the peak traffic generation of this very large existing residential precinct (which has geographical/transport similarities to the Belrose site) is some 0.65 vtpH per dwelling.

* *Guide To traffic Generating Development*
RTA NSW December 2002

It is also noted that road network assessments recently undertaken for the State Governments Growth Centres planning have adopted a peak traffic generation rate for single dwelling (ie North West Growth Centres) of 0.57 vtpd per dwelling. There are schools and shops located within the precinct (ie without need to access Forest Way which would indicate a moderate “internal” containment of generated trips however in order to assess the traffic generation implications for the access roadways and provide a robust assessment of the access intersection on Forest Way, a peak traffic generation rate of 0.65 vtpd per dwelling has been adopted (ie without internal discount) with peak directional splits of 80/20 and 25/75 (ie AM and PM). Thus the projected traffic generation outcome with completed development on the envisaged lots is as follows:

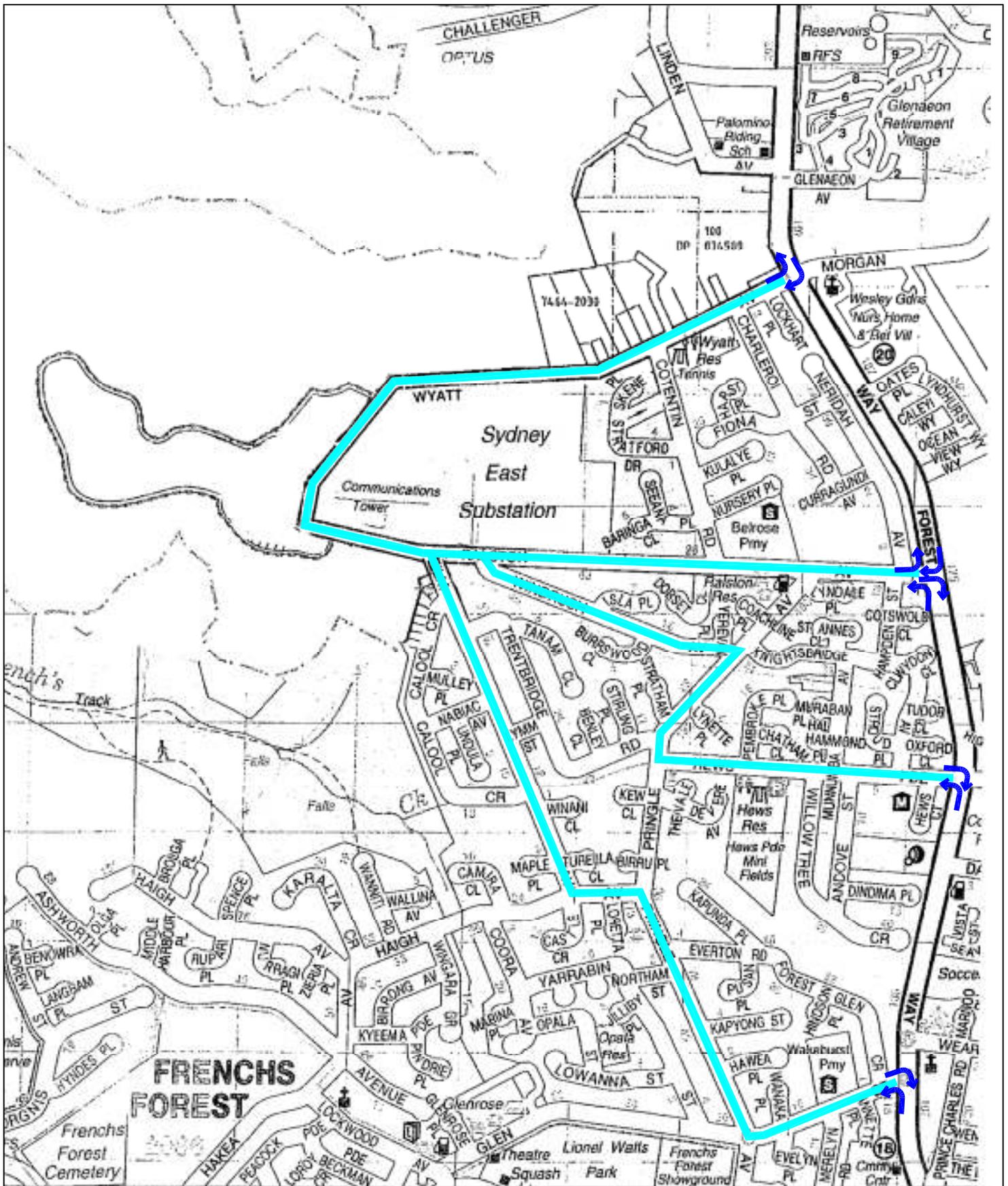
	AM		ON	
169 Lots @ 0.65-110 vtpd	20	90	82	28

However a +15% sensitivity factor has been applied to the projected peak generation to reflect a robust assessment (ie 125 vtpd).

There are a number of routes available for the generated traffic movements to approach and depart the sites as indicated on Figures 6 however it is unlikely that any significant movements will result along the Elm Avenue/Pringle Avenue and Hews Parade/Pringle Avenue/Windrush Avenue routes due to:

- The relative indirectness
- The general free flowing movements on the relevant section of Forest Way and signal “green time” priority

The directional distribution can be gauged by the existing movement patterns at the access intersections (Figure 6) as follows:



LEGEND



PROJECTED TRAFFIC DISTRIBUTION

FIG 6

	AM		ON	
To the North	60%	(60)	60%	(19)
To the South	40%	(40)	40%	(14)
From the North	65%	(17)	75%	(69)
From the South	35%	(8)	25%	(23)

On this basis the projected additional movements at the access intersections consequential to development on the subdivision Lots during the peak periods is as follows:

Intersection with Forest Way		AM	PM
Wyatt Avenue	RT IN	10	69
	LT OUT	50	15
Ralston Avenue	RT IN	6	9
	LT IN	4	13
	RT OUT	10	10
	LT OUT	10	4
Hews Parade	RT OUT	15	1
	LT IN	2	5
Glen Street	RT OUT	15	1
	LT IN	2	5
Total		125	125

It is proposed to modify the Forest Way \ Ralston Avenue intersection to formalise a “seagull” island arrangement.

The operational performance of the Wyatt Avenue and Ralston Avenue intersections with these additional volumes has been assessed using SIDRA. The volumes distributed to the Hews Parade and Glen Street intersections are quite minor being less than 1vt each 2 cycles of the signals and therefore not perceptible in terms of traffic modelling. The results of that assessment are provided in Appendix B and summarised in the following:

	AM		ON	
	LOS	AVD	LOS	AVD
Wyatt Avenue	B	17.0	A	12.7
Ralston Avenue	A-D	6.6	A-D	8.4

5.2 TRAFFIC IMPACT

It is apparent that the projected traffic generation consequential to the proposed development will not have any adverse traffic implications.

5.3 TRAFFIC RELATED ENVIRONMENTAL IMPLICATIONS

Environmental Capacity

The RMS Guide to Traffic Generating Developments and the AMCORD Model Code specify the following 'Environmental Capacity Performance Standards' for residential streets:

	Max Speed	Max Vpd
Distributor/Collector Street	50 kmph	3000 (environmental goal) 5000 (max)
Local Street	40 kmph	2000 (environmental goal) 3000 (max)
Minor/Access Street	25 kmph	1000 (environmental goal)

Ralston Avenue and Wyatt Avenue (east of Cotentin Road) are minor collector roads and the projected traffic volume circumstances are as follows:

	EXISTING	FUTURE
Wyatt Avenue		
East of Cotentin Road	2070 vpd	2745 vpd
West of Cotentin Road	200 vpd	800 vpd
Ralston Avenue		
East of Cotentin Road*	5315 vpd	5645 vpd
West of Cotentin Road	500 vpd	830 vpd

* Consequential to location of school and shopping centre

It is apparent that the traffic generated by the proposed development will not result in any compromise to the environmental capacity of any existing roads in the area.

Road Geometry

The proposed road geometry reflects a contemporary subdivision which responds appropriately to the terrain, access for service vehicles and buses. It is noted that the Bush Fire Assessment which has been undertaken in relation to the proposed development has concluded that the nature, width and layout of the proposed road system is suitable and appropriate for any potential evacuation for a bush fire event.

Traffic Management

The principal issues of traffic management are:

* **Vehicle Speed**

A statutory 50 kmph speed limit will apply however the road geometry and traffic management measures will constrain speeds to approximately 40 kmph

* Management

The long curvilinear collector road through the Ralston Avenue Section will require speed control devices in the form of:

- roundabouts at major intersections (Wyatt Avenue/Ralston Avenue)
- mid block 'slow point' with raised platforms

* Conflict

Four way intersections and 'Y' junctions will require clarifying GIVE WAY signage

6. SERVICING, PEDESTRIANS AND CYCLISTS

6.1 SERVICING

The subdivision roads will facilitate the movements of service vehicles and particularly garbage removal.

The road widths and arrangement will accommodate the movements of 'large rigid trucks' and would accord with Council's design requirements.

6.2 PEDESTRIANS

Suitable and appropriate provision will be made for pedestrians in the design with:

- * footpath along the lot frontages
- * suitable sight distances
- * pathway system with linkages
- * suitable street lighting.

6.3 CYCLISTS

There is no existing bicycle facility which would connect to the development. The proposal will however make suitable and appropriate provision for cyclists with:

- * A 2.5m wide shared footway along the distributor/collector roads
- * suitable street lighting

6.4 BUS SERVICES

It could be anticipated that the existing bus service using Ralston Avenue, Cotentin Road and Wyatt Avenue would be extended by the service provider to encompass the full Ralston Avenue/Wyatt Avenue loop providing services within 400m of the new Lots.

7. CONSTRUCTION TRAFFIC MANAGEMENT

It is inevitable that the consent for the proposed development to be constructed will have a requirement for the preparation and submission of a detailed Construction Traffic Management Plan.

The basis to the management of construction vehicles will be to limit these movements to/from Forest Way via Ralston Avenue and Wyatt Avenue. These are existing minor collector roads which are suitable for the movement of construction vehicles.

Ralston Avenue and Wyatt Avenue are relatively straight and level and are of a suitable standard of construction to accommodate heavy vehicles. The existing traffic signals at the Forest Way and Wyatt Avenue intersection will assist with vehicle access while the roundabout and raised marked footcrossing on Ralston Avenue will suitably constrain vehicle speeds at the potential conflict points. Traffic Control Plans will be prepared and submitted in relation to any works requiring to be undertaken on Ralston Avenue or Wyatt Avenue and there is no other apparent need for mitigation measures.

8. CONCLUSION

The proposed rezoning to permit a residential development at Belrose will provide for the of addition of high quality housing in a desirable location while retaining appropriate open space areas. The envisaged development will have an access road system which accords with Council's Development Design Specification.

The proposed development would comprise approximately 169 dwellings and the 'traffic outcome' will be satisfactory in relation to:

- * road/intersection capacity implications
- * traffic related environmental implications
- * traffic management and safety implications.

APPENDIX A

INTERSECTION IMAGES



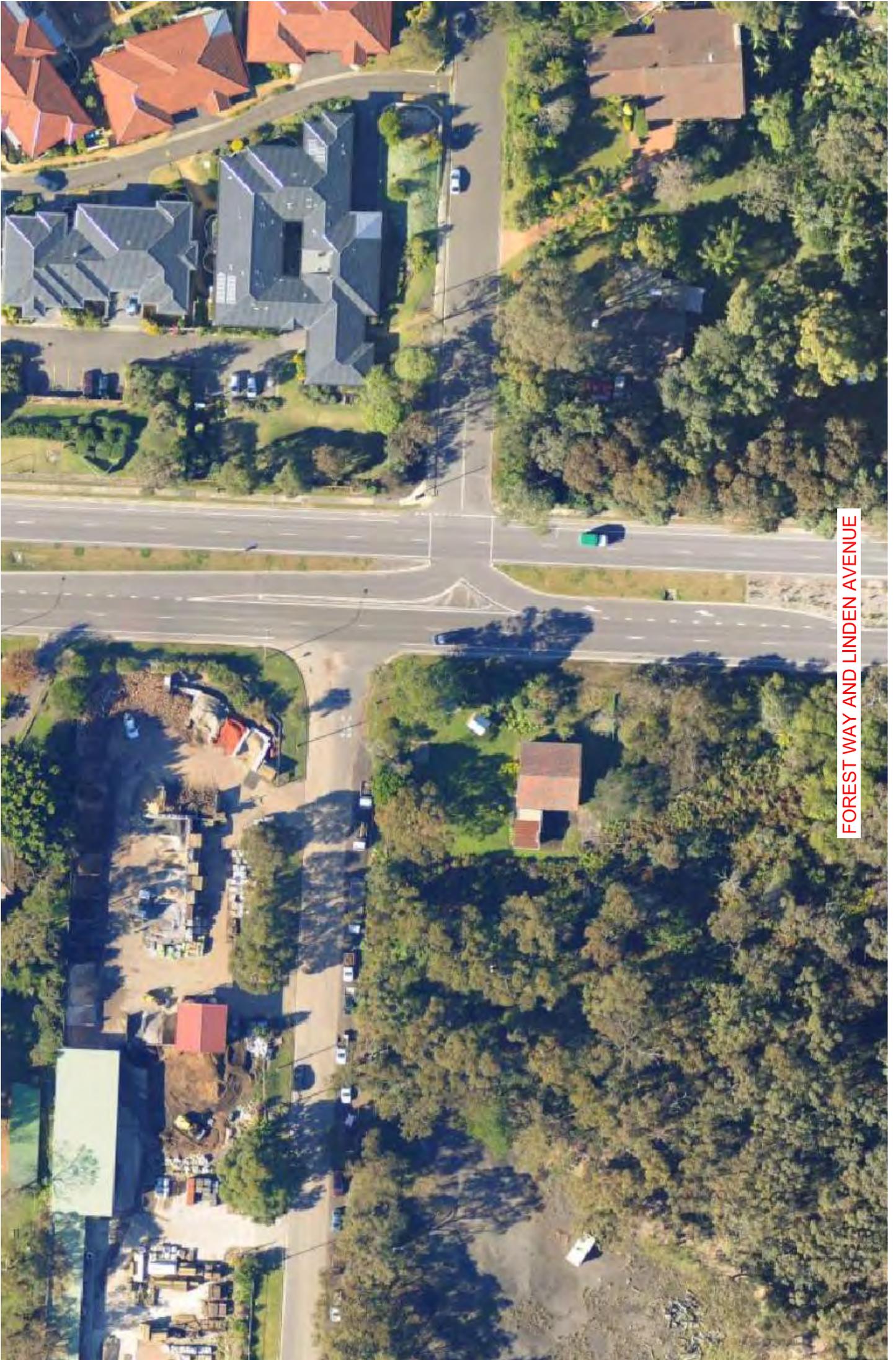
FOREST WAY AND RALSTON ROAD



FOREST WAY AND WYATT AVENUE



FOREST WAY AND CROZIER ROAD



FOREST WAY AND LINDEN AVENUE

APPENDIX B

SIDRA RESULTS

MOVEMENT SUMMARY

Site: Existing AM Peak

Ralston St x Forest Highway
Existing AM Peak
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	92	2.0	0.050	8.8	LOS A	0.0	0.0	0.00	0.68	53.1
2	T	1316	2.0	0.342	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		1408	2.0	0.342	0.6	LOS A	0.0	0.0	0.00	0.04	68.7
North: Forest Way (N)											
8	T	1284	2.0	0.222	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
9	R	120	2.0	0.506	29.3	LOS C	2.7	19.0	0.87	1.05	34.8
Approach		1404	2.0	0.506	2.5	LOS C	2.7	19.0	0.07	0.09	64.9
West: Ralston Ave											
10	L	252	2.0	0.609	21.8	LOS B	4.3	30.3	0.85	1.16	35.0
12	R	24	2.0	1.000 ⁴	1643.1	LOS F	7.0	49.9	1.00	1.63	1.4
Approach		276	2.0	1.000	162.8	LOS F	7.0	49.9	0.86	1.20	11.1
All Vehicles		3088	2.0	1.000	16.0	NA	7.0	49.9	0.11	0.17	46.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

⁴ x = 1.00 due to minimum capacity

MOVEMENT SUMMARY

Site: Existing PM Peak

Ralston St x Forest Highway
Existing PM Peak
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	84	2.0	0.046	8.8	LOS A	0.0	0.0	0.00	0.68	53.1
2	T	1248	2.0	0.324	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		1332	2.0	0.324	0.6	LOS A	0.0	0.0	0.00	0.04	68.8
North: Forest Way (N)											
8	T	1259	2.0	0.218	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
9	R	204	2.0	0.782	38.4	LOS C	6.0	43.1	0.93	1.27	30.2
Approach		1463	2.0	0.782	5.4	LOS C	6.0	43.1	0.13	0.18	60.0
West: Ralston Ave											
10	L	136	2.0	0.305	16.3	LOS B	1.6	11.2	0.74	0.96	38.2
12	R	31	2.0	1.000 ⁴	1638.5	LOS F	8.5	60.4	1.00	1.87	1.4
Approach		167	2.0	1.000	317.4	LOS F	8.5	60.4	0.79	1.13	6.3
All Vehicles		2962	2.0	1.000	20.8	NA	8.5	60.4	0.11	0.17	42.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

⁴ x = 1.00 due to minimum capacity

MOVEMENT SUMMARY

Site: Future AM Peak

Ralston St x Forest Highway
 Future AM Peak
 Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	96	2.0	0.111	8.8	LOS A	0.0	0.0	0.00	0.95	53.1
2	T	1316	2.0	0.313	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		1412	2.0	0.313	0.6	LOS A	0.0	0.0	0.00	0.06	68.7
North: Forest Way (N)											
9	R	126	2.0	0.534	30.2	LOS C	2.9	20.5	0.88	1.06	34.4
Approach		126	2.0	0.535	30.2	LOS C	2.9	20.5	0.88	1.06	34.4
West: Ralston Ave											
10	L	262	2.0	0.634	22.4	LOS B	4.6	32.6	0.86	1.18	34.7
12	R	34	2.0	0.318	48.3	LOS D	1.4	9.7	0.92	1.01	25.0
Approach		296	2.0	0.634	25.4	LOS D	4.6	32.6	0.87	1.16	33.2
All Vehicles		1834	2.0	0.634	6.6	NA	4.6	32.6	0.20	0.31	55.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Future PM Peak

Ralston St x Forest Highway
 Future PM Peak
 Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	97	2.0	0.106	8.8	LOS A	0.0	0.0	0.00	0.93	53.1
2	T	1248	2.0	0.298	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		1345	2.0	0.298	0.6	LOS A	0.0	0.0	0.00	0.07	68.6
North: Forest Way (N)											
9	R	213	2.0	0.829	43.3	LOS D	7.1	50.5	0.95	1.34	28.3
Approach		213	2.0	0.830	43.3	LOS D	7.1	50.5	0.95	1.34	28.3
West: Ralston Ave											
10	L	140	2.0	0.316	16.5	LOS B	1.7	11.8	0.75	0.96	38.1
12	R	41	2.0	0.414	55.9	LOS D	1.8	13.0	0.93	1.04	23.1
Approach		181	2.0	0.412	25.4	LOS D	1.8	13.0	0.79	0.98	33.2
All Vehicles		1739	2.0	0.830	8.4	NA	7.1	50.5	0.20	0.32	53.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Existing AM Peak

Wyatt x Forest Way
 AM Existing Peak
 Signals - Fixed Time Cycle Time = 140 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	47	2.0	0.831	12.8	LOS A	15.0	106.6	0.29	1.27	50.2
2	T	1459	2.0	0.831	4.0	LOS A	15.0	106.9	0.29	0.26	60.5
3	R	62	2.0	0.790	83.1	LOS F	6.0	43.0	1.00	0.78	18.3
Approach		1568	2.0	0.831	7.4	LOS A	15.0	106.9	0.31	0.31	55.6
East: Wyatt Ave											
4	L	43	2.0	0.240	61.1	LOS E	6.1	43.6	0.90	0.78	22.1
5	T	35	2.0	0.240	53.4	LOS D	6.1	43.6	0.90	0.70	20.8
6	R	136	2.0	0.537	66.3	LOS E	10.3	73.2	0.96	0.80	20.9
Approach		214	2.0	0.536	63.1	LOS E	10.3	73.2	0.94	0.78	21.1
North: Forest Way											
7	L	124	2.0	0.825	12.7	LOS A	14.5	103.1	0.28	1.16	50.1
8	T	1368	2.0	0.826	3.9	LOS A	14.6	103.7	0.28	0.26	60.6
9	R	57	2.0	0.726	82.5	LOS F	5.6	39.7	1.00	0.76	18.4
Approach		1549	2.0	0.826	7.5	LOS A	14.6	103.7	0.31	0.35	55.5
West: Wyatt Ave											
10	L	68	2.0	0.585	39.4	LOS C	5.3	37.7	0.90	0.77	27.8
11	T	25	2.0	0.585	31.7	LOS C	5.3	37.7	0.90	0.70	26.5
12	R	53	2.0	0.184	63.1	LOS E	4.4	31.6	0.91	0.75	21.5
Approach		146	2.0	0.585	46.7	LOS D	5.3	37.7	0.90	0.75	24.9
All Vehicles		3477	2.0	0.831	12.5	LOS A	15.0	106.9	0.37	0.38	48.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
 Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
 Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	64.1	LOS F	0.2	0.2	0.96	0.96
P3	Across E approach	53	25.2	LOS C	0.1	0.1	0.60	0.60
P5	Across N approach	53	64.1	LOS F	0.2	0.2	0.96	0.96
P7	Across W approach	53	25.2	LOS C	0.1	0.1	0.60	0.60
All Pedestrians		212	44.7				0.78	0.78

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS F. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: Existing PM Peak

Wyatt x Forest Way
 PM Existing Peak
 Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	12	2.0	0.814	18.2	LOS B	23.3	165.9	0.50	1.16	45.7
2	T	1352	2.0	0.818	9.4	LOS A	23.3	166.0	0.50	0.45	52.0
3	R	20	2.0	0.273	85.4	LOS F	2.2	15.7	0.97	0.70	18.0
Approach		1384	2.0	0.818	10.6	LOS A	23.3	166.0	0.50	0.46	50.7
East: Wyatt Ave (E)											
4	L	57	2.0	0.387	62.2	LOS E	5.6	40.1	0.88	0.76	21.7
5	T	11	2.0	0.387	54.5	LOS D	5.6	40.1	0.88	0.67	20.5
6	R	72	2.0	0.268	69.4	LOS E	6.3	44.6	0.93	0.77	20.3
Approach		140	2.0	0.387	65.3	LOS E	6.3	44.6	0.90	0.76	20.9
North: Forest Way (N)											
7	L	44	2.0	0.769	12.2	LOS A	9.7	69.0	0.20	1.47	50.2
8	T	1439	2.0	0.772	3.3	LOS A	11.8	83.8	0.20	0.25	61.6
9	R	41	2.0	0.198	66.2	LOS E	3.5	25.3	0.84	0.74	21.5
Approach		1524	2.0	0.772	5.3	LOS A	11.8	83.8	0.22	0.29	58.7
West: Wyatt Ave (W)											
10	L	36	2.0	0.186	39.6	LOS C	2.8	19.9	0.85	0.74	27.7
11	T	8	2.0	0.186	31.9	LOS C	2.8	19.9	0.85	0.64	26.5
12	R	27	2.0	0.101	67.4	LOS E	2.5	18.1	0.90	0.72	20.7
Approach		71	2.0	0.186	49.3	LOS D	2.8	19.9	0.87	0.72	24.4
All Vehicles		3119	2.0	0.818	11.3	LOS A	23.3	166.0	0.39	0.40	49.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
 Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
 Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P3	Across E approach	53	23.5	LOS C	0.1	0.1	0.56	0.56
P5	Across N approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P7	Across W approach	53	30.1	LOS D	0.1	0.1	0.63	0.63
All Pedestrians		212	48.0				0.78	0.78

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS F. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: Future AM Peak

Wyatt x Forest Way
 AM Future Peak
 Signals - Fixed Time Cycle Time = 140 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	47	2.0	0.878	17.3	LOS B	25.9	184.2	0.51	1.17	46.7
2	T	1469	2.0	0.876	8.5	LOS A	25.9	184.7	0.51	0.48	53.0
3	R	62	2.0	0.677	80.2	LOS F	5.9	41.9	1.00	0.77	18.8
Approach		1578	2.0	0.876	11.6	LOS A	25.9	184.7	0.53	0.51	49.6
East: Wyatt Ave											
4	L	43	2.0	0.240	61.1	LOS E	6.1	43.6	0.90	0.78	22.1
5	T	35	2.0	0.240	53.4	LOS D	6.1	43.6	0.90	0.70	20.8
6	R	136	2.0	0.537	66.3	LOS E	10.3	73.2	0.96	0.80	20.9
Approach		214	2.0	0.536	63.1	LOS E	10.3	73.2	0.94	0.78	21.1
North: Forest Way											
7	L	124	2.0	0.869	16.9	LOS B	24.6	175.2	0.50	1.10	46.6
8	T	1374	2.0	0.868	8.1	LOS A	24.8	176.4	0.50	0.46	53.3
9	R	67	2.0	0.732	80.7	LOS F	6.3	45.1	1.00	0.77	18.7
Approach		1565	2.0	0.868	11.9	LOS A	24.8	176.4	0.52	0.53	49.2
West: Wyatt Ave											
10	L	118	2.0	0.868	48.5	LOS D	8.6	61.0	0.91	0.89	25.0
11	T	25	2.0	0.868	40.8	LOS C	8.6	61.0	0.91	0.82	23.7
12	R	53	2.0	0.169	61.1	LOS E	4.4	31.0	0.89	0.75	21.9
Approach		196	2.0	0.867	50.9	LOS D	8.6	61.0	0.90	0.84	23.9
All Vehicles		3553	2.0	0.876	17.0	LOS B	25.9	184.7	0.57	0.55	43.5

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
 Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
 Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	64.1	LOS F	0.2	0.2	0.96	0.96
P3	Across E approach	53	27.0	LOS C	0.1	0.1	0.62	0.62
P5	Across N approach	53	62.2	LOS F	0.2	0.2	0.94	0.94
P7	Across W approach	53	27.0	LOS C	0.1	0.1	0.62	0.62
All Pedestrians		212	45.1				0.79	0.79

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS F. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: Future PM Peak

Wyatt x Forest Way
 PM Future Peak
 Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forest Way (S)											
1	L	12	2.0	0.814	18.2	LOS B	23.5	167.6	0.50	1.16	45.6
2	T	1356	2.0	0.820	9.4	LOS A	23.6	167.7	0.50	0.45	52.0
3	R	20	2.0	0.273	85.4	LOS F	2.2	15.7	0.97	0.70	18.0
Approach		1388	2.0	0.820	10.6	LOS A	23.6	167.7	0.51	0.46	50.7
East: Wyatt Ave											
4	L	57	2.0	0.193	62.2	LOS E	5.6	40.1	0.88	0.77	21.7
5	T	11	2.0	0.193	54.5	LOS D	5.6	40.1	0.88	0.68	20.5
6	R	72	2.0	0.303	69.4	LOS E	6.3	44.6	0.93	0.77	20.3
Approach		140	2.0	0.303	65.3	LOS E	6.3	44.6	0.90	0.76	20.9
North: Forest Way											
7	L	44	2.0	0.775	12.3	LOS A	9.9	70.4	0.21	1.47	50.3
8	T	1448	2.0	0.776	3.3	LOS A	12.0	85.4	0.21	0.25	61.6
9	R	110	2.0	0.530	69.0	LOS E	9.0	63.8	0.92	0.78	20.9
Approach		1602	2.0	0.776	8.1	LOS A	12.0	85.4	0.26	0.32	54.7
West: Wyatt Ave											
10	L	51	2.0	0.391	39.2	LOS C	3.7	26.0	0.86	0.74	27.8
11	T	8	2.0	0.390	31.5	LOS C	3.7	26.0	0.86	0.64	26.6
12	R	27	2.0	0.101	67.4	LOS E	2.5	18.1	0.90	0.72	20.7
Approach		86	2.0	0.391	47.3	LOS D	3.7	26.0	0.87	0.73	25.0
All Vehicles		3216	2.0	0.820	12.7	LOS A	23.6	167.7	0.41	0.41	48.2

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).
 Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).
 Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P3	Across E approach	53	23.5	LOS C	0.1	0.1	0.56	0.56
P5	Across N approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P7	Across W approach	53	30.1	LOS D	0.1	0.1	0.63	0.63
All Pedestrians		212	48.0				0.78	0.78

Level of Service (Aver. Int. Delay): LOS E. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS F. LOS Method for individual pedestrian movements: Delay (HCM).

APPENDIX C

EXTRACT FROM TRAFFIC STUDY

**PROPOSED
GLENMORE PARK STAGE 2**

***Assessment of Traffic, Transport and
Parking Implications***

September 2003

Reference -0338

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5.2 EXISTING GLENMORE PARK

The 2001 Census established that there were some 5,447 occupied dwellings in the existing Glenmore Park development at the time of the survey.

Access to and from the surrounding Arterial Road network (ie The Northern Road and Mulgoa Road) from the existing development is restricted to the Glenmore Parkway and Garswood Road intersection. This circumstance and the circuitous internal road layout provides the relatively unique situation where it is possible to establish the vehicle trip generation rate of the estate without the complication of non-related external through movements. An assessment of the AM and PM peak hour movements at the 3 'access' intersections from the 'June' survey indicate the following IN/OUT movements from the Glenmore Park Estate.

	Total Movements	IN	OUT
AM Peak	3,278	835	2,443
PM Peak	3,645	2,636	1,009

(NB The earlier survey provided similar results to the June survey being within $\pm 2\%$ of the total movements)

On the conservative estimate that there have been some 200 dwellings built and occupied since the undertaking of the 2001 Census (ie 5,647 dwellings), the traffic movements indicated above translate to the following external trip generation rates for the estate and the peak period IN vs OUT ratios.

	Total (vtph)	IN (%)	OUT (%)
AM Peak	0.58	25	75
PM Peak	0.65	72	28

5.3 ORIOLE STREET CATCHMENT

The street layout within the existing Glenmore Park development provided an opportunity to undertake a 'sensitivity test' of the published RTA generation rate and the rates established in Section 5.2. To ascertain the traffic generation rate of residential only development, a survey was carried out of the vehicle movements in the AM (7.00 –9.00am) and PM (4.00 - 6.30pm) peak period travelling to/from Oriole Street at its intersection with Woodlands Drive. This intersection is the only means of vehicular access to some 340 residences and is an area of the estate which is fully developed with no new residential construction activity currently taking place.

The results of the survey indicate the following movements to/from Oriole Street.

**LOCATION: ORIOLE STREET/WOODLANDS DRIVE
(SURVEY PERIOD – 19TH MAY 2003)**

		AM Peak (7.45 – 8.45am)	PM Peak (5.15 – 6.15pm)
Oriole Street (OUT)	Left	24	11
	Right	118	51
Woodlands Drive (IN)	Left	8	35
	Right	34	132
Total		184	229

On the assumption that of the 340 residences within the surveyed area, approximately 6% (20 residences) were unoccupied, the traffic movements represent an AM and PM peak generation of 0.58 vehicle trips per hour per residence and 0.72 vehicle trips per hour per residence respectively.

From the assessment it is apparent that the RTA published trip generation rate for residential development of 0.85 vtpd is not a true reflection of the circumstances which prevail at Glenmore Park. On the basis that the trip generation rate attained from the Oriole Street assessment also includes a component of 'internal' trips (say 6%), the data from this analysis and that of the 'whole' of Glenmore Park would suggest that an external trip generation rate of 0.65 vtpd per dwelling in the peak periods is a far more accurate interpretation of the existing traffic activity generated by the Glenmore Park Estate.

Application of this rate to the various phases of the proposed development indicates the following likely AM and PM peak vehicle movements:

Phase	0.65 vtpd	AM Peak *		PM Peak *	
		OUT (80%)	IN (20%)	OUT (25%)	IN (75%)
1	144	115	29	36	108
2	150	120	30	37	113
3	165-199	132-159	33-40	41-50	124-149
4	135-142	110-114	25-28	34-35	101-107
5	124	120	96	24	30
6	135	108	27	34	101
Total	849-890	681-712	168-178	212-222	637-668

The modelling undertaken of the existing circumstances at the intersection of Mulgoa Road/Glenmore Parkway and The Northern Road/Glenmore Parkway (refer to Section 3.3) confirmed on-site observations that both intersections operate satisfactorily with spare capacity during the AM and PM peak periods.

To establish the impact of the proposed development on these two intersections an assessment was undertaken of the following 2 development scenarios:



-  _E3 - Environmental Management Zone
-  _R2 - Residential Zone 2
-  _RE1 - Recreational Zone 1

Image © 2012 Sinclair Knight Merz

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Revision
Site Plan

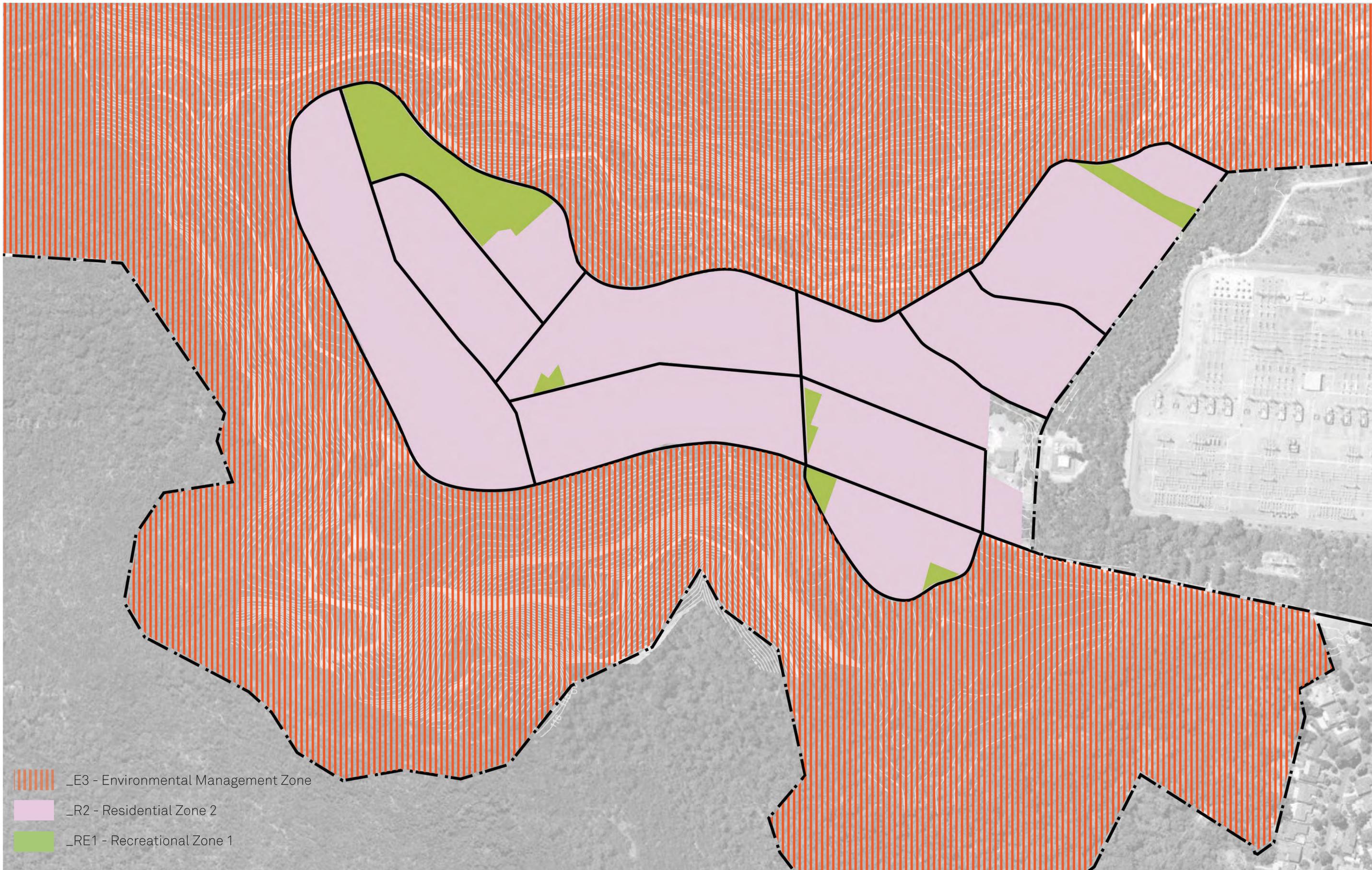
Date
15 March 2013

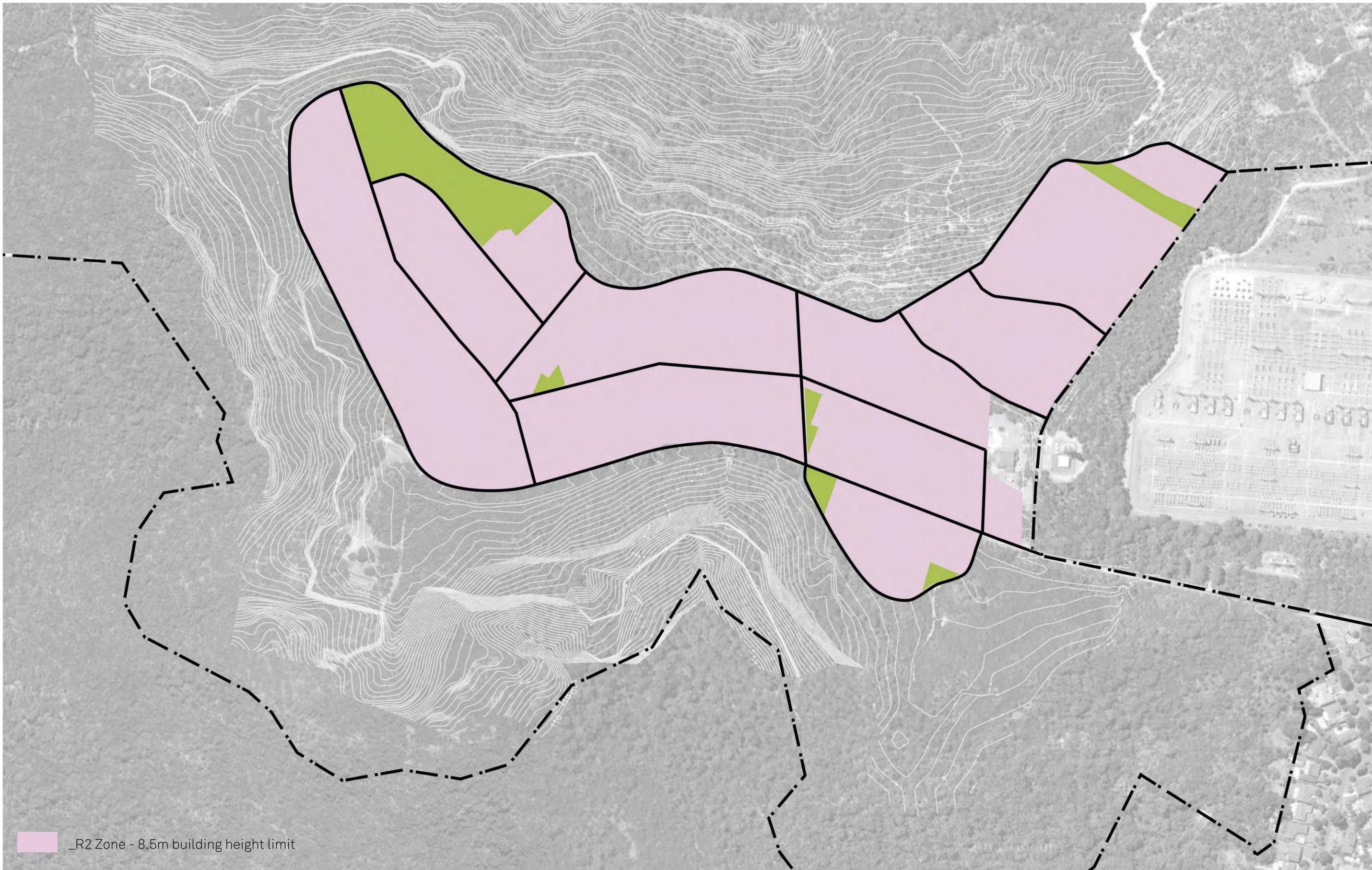
Scale
NTS

Client
Matthews Civil Pty Ltd

Project Name
Ralston Avenue
Belrose, NSW

Drawing
01





 _R2 Zone - 8.5m building height limit



Revision
Building Height Plan

Date
14 March 2013

Scale
NTS

Client
Matthews Civil Pty Ltd

Project Name
Ralston Avenue
Belrose, NSW

Drawing
03



Residential Development
Ralston Avenue, Belrose

Economic Impact
Assessment

PREPARED FOR

Matthews Civil Pty Ltd

November 2012

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QUALITY CONTROL

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1. EXECUTIVE SUMMARY

This Study examines the potential economic impacts which could eventuate from the proposed rezoning of the site (the 'Subject Site') in Belrose North, located within Warringah Local Government Area.

The Subject Site has been deferred from the Warringah Local Environmental Plan (LEP) 2011 pending further analysis by the NSW Department of Planning and Infrastructure (DoPI). The landowners of the Subject Site are seeking a future zoning in the Warringah LEP 2011 which would facilitate residential development. Although plans are at an early stage, it is anticipated that if a rezoning is secured approximately 169 detached residential dwellings would be developed on the Subject Site.

The purpose of this Study is to quantify at a high-level (and based on the provisional concept plans) the potential economic impact which could eventuate from the proposed rezoning.

In economic terms, the Subject Site is uncleared, undeveloped and does not generate any economic benefit to the local, Subregional or Metropolitan economy. As such, all of the potential economic benefits associated with the proposed development would be net additional. The Subject Site is used informally for recreation and local access however this is not considered a quantifiable economic benefit in this instance given that the land is privately owned and not part of the Garigal National Park.

The potential positive economic benefits of the proposed development can be summarised as follows:

- A contribution towards housing supply, housing mix and assisting to ease house price inflation;
- Creating additional retail expenditure available to be captured by existing centres in the local area such as Ralston Avenue Belrose, Glenrose Small Village Centre and Sorlie Road Frenchs Forest Neighbourhood Centre;
- Supporting jobs in surrounding centres and the provision of additional retail floorspace which would benefit both existing and new residents;
- Creating jobs directly and indirectly during the construction process; and
- Creating significant direct and indirect capital investment in Warringah LGA, the North East Subregion and the Sydney Metropolitan Area.

We should note that there may be some short-term adverse economic impact during the construction process resulting from increased traffic locally. This potential adverse impact would likely be insignificant and would be mitigated as far as possible.

POTENTIAL ECONOMIC IMPACTS OF PROPOSAL

ADDITIONAL DWELLINGS	+169
ADDITIONAL RETAIL EXPENDITURE FROM RESIDENTS (2017)	+\$9m
DIRECT CAPITAL INVESTMENT	\$98m
PROJECT'S TOTAL ECONOMIC MULTIPLIER DIRECT AND INDIRECT	\$281m
JOB YEARS SUPPORTED DURING CONSTRUCTION DIRECT AND INDIRECT	1,611
ADDITIONAL RETAIL EXPENDITURE FROM CONSTRUCTION WORKERS	+\$1m

Note: All prices in \$2009

2. INTRODUCTION

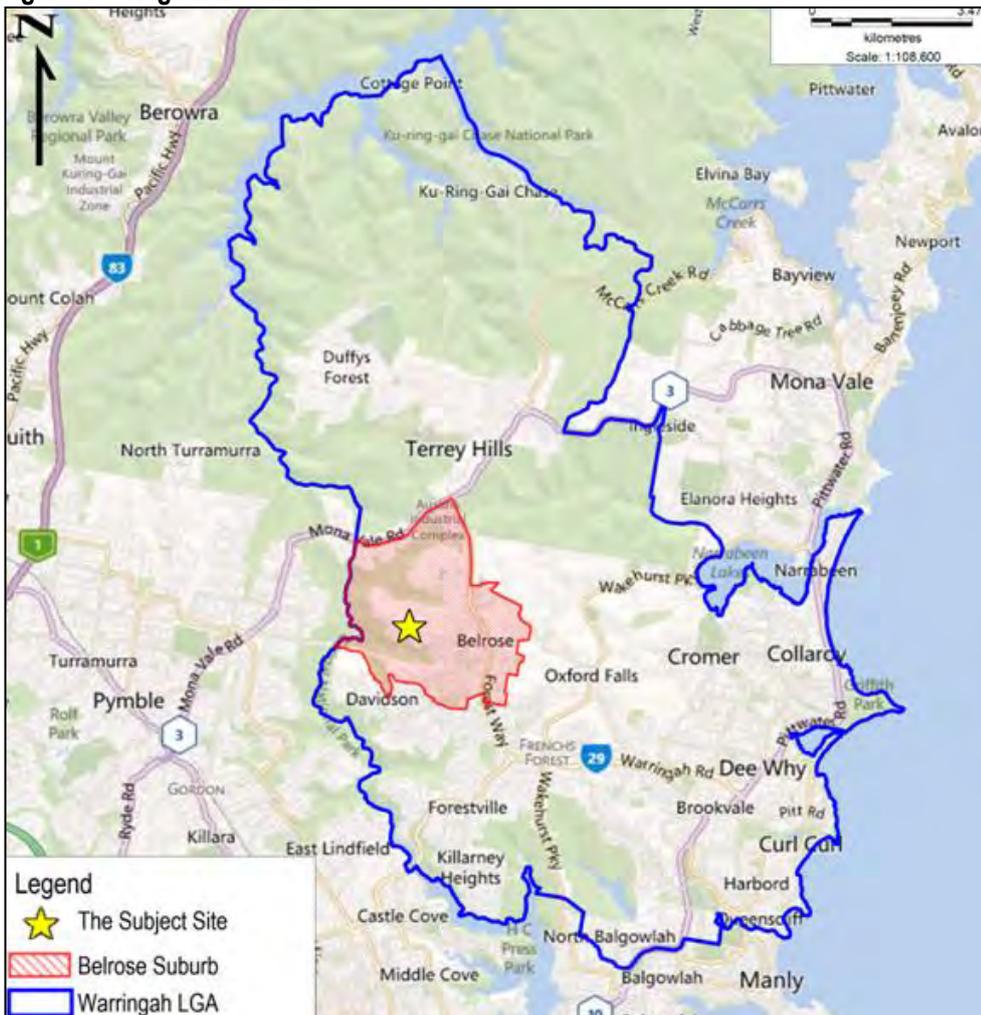
2.1 Study Background

Matthews Civil Pty Ltd is seeking to rezone a site in Belrose North for residential purposes. The site which is subject to the rezoning (the 'Subject Site') is situated adjacent to Ralston Avenue in Warringah Local Government Area (LGA). The Subject Site is currently uncleared, undeveloped and constitute private land used informally for local access and recreation.

The landowners are seeking a rezoning of the Subject Site which would permit residential uses to be developed. This would facilitate the construction of approximately 169 residential plots on the Subject Site. These would comprise single detached dwellings. This housing estimate is preliminary and is based on the concept plan available at the time of this report.

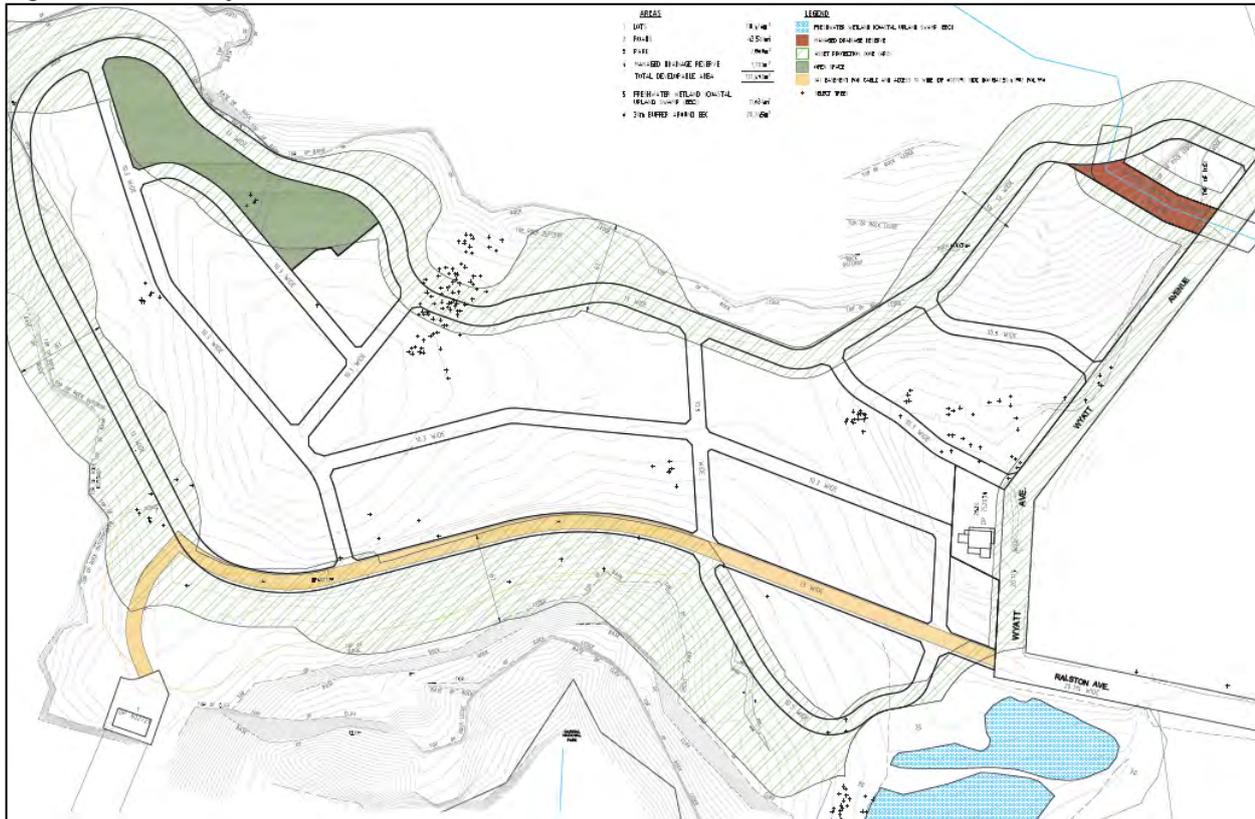
The location of the Subject Site is depicted in Figures 1 and 2.

Figure 1 - Regional Context



Source: Map produced by Hill PDA using MapInfo 11.0 software and Microsoft Bing (c) 2011 Microsoft Corporation

Figure 2 - The Subject Site



Source: Plan of Proposed Subdivision of Lot 1 in DP1139826 and Road Closures at Ralston Avenue, Belrose, Lockley Land Title Solutions (24/09/2012)

2.2 Subject Site Designation

The Subject Site is proposed to be zoned E3 Environmental Management in the draft Warringah Local Environmental Plan (LEP) 2009. As a response to submissions made by the landowners objecting to the proposed zoning, the Subject Site, together with another site at Oxford Valley Falls, was subsequently deferred from the Warringah LEP 2011 (which has been made) to enable more detailed investigation into the most appropriate zoning and land use controls.

The Subject Site is classified as 'Deferred Land' in accordance with the Warringah LEP 2011. The deferral means the current range of permissible land uses contained in the Warringah LEP 2000 have been retained. The Subject Site is subject to a 'Locality C8 Belrose North' zoning in the Warringah LEP 2000. Housing is identified as a Category Two Land Use within this zoning i.e. development which may be consistent with the desired future character of the Locality, provided that such development is limited to new detached style housing at low density.

2.3 Purpose of the Study

Hill PDA has been commissioned to undertake three separate reports exploring the implications of a proposed residential zoning on the Subject Site. These reports are:

- An Economic Impact Assessment;
- A Social Impact Assessment; and
- A Housing Demand Analysis.

We understand that a broader consultant team has been engaged to review other impacts such as environmental issues, planning, traffic and transport. These aspects are not the subject of this report.

This report comprises the Economic Impact Assessment (hereafter referred to as the EIA) which considers the potential economic implications of the proposed zoning and subsequent development only. This is based on the provisional concept plans.

Note that it does not comprise a full economic cost-benefit analysis.

2.4 Study Structure

To assess the potential economic impacts associated with the rezoning, the EIA is set out in the following manner:

- Chapter 3 undertakes a review of planning policies and strategies which are relevant considerations to the EIA;
- Chapter 4 quantifies the economic impacts of the proposed rezoning on the Subject Site;
- Chapter 5 considers the economic multipliers and construction related economic impacts from the proposed rezoning; and
- Chapter 6 concludes the Study by considering the overall economic impact of the proposed development from the community perspective.

3. PLANNING & POLICY REVIEW

This Chapter considers the context of the proposed rezoning by examining relevant planning policies, strategies and documents. Note that only aspects which relate directly to economic impacts are considered.

3.1 State Planning Policies and Strategies

NSW 2021- A Plan to Make NSW Number One (2011)

The NSW 2021 Plan aims to rebuild the NSW economy, provide quality services, renovate infrastructure, restore government accountability and strengthen NSW's local environment and communities. The Plan comprises five key strategies. The main strategy of relevance to this Study is "*Rebuild the Economy*" which seeks to secure new jobs and ensure that more land is made available for housing in order to support economic growth.

The NSW 2021 plan sets a target of +60,000 jobs in Sydney by 2021, and +25,000 new dwellings in Sydney per year to 2021. Housing development opportunities within the Sydney Metropolitan Area will play a key role in the future economic growth of NSW. Housing is thus recognised as a major contributor towards economic development.

Metropolitan Plan for Sydney 2036 (2010)

The Metropolitan Plan for Sydney sets the strategic direction for Sydney towards 2036. It sets targets for additional dwellings and employment in the Sydney Metropolitan Area by Subregion. The Warringah LGA is situated in the North East Subregion within which +29,000 additional dwellings and +23,000 additional jobs are targeted between 2006 and 2036.

A new Metropolitan Strategy is being developed by the DoPI for Sydney. A discussion paper entitled "Sydney Over the Next 20 Years' (May 2012) has been published for public consultation. This paper recognises the need for an additional +570,000 homes and +600,000 jobs in Sydney between 2010 and 2031. The discussion paper acknowledges that to enhance economic activity there is a need to attract and retain skilled labour by, amongst other measures, building upon economic infrastructure. Economic infrastructure includes housing.

Draft North East Subregional Strategy (2007)

The draft Subregional Strategy includes specific dwelling and employment targets for the Warringah LGA. Over the 2001 to 2031 period +10,300 additional dwellings and +12,500 additional jobs are targeted within the Warringah LGA.

3.2 Local Planning Policies and Strategies

Draft Warringah Housing Strategy (2011)

This document has not been adopted by Warringah Council ('Council') and therefore its content is for reference purposes only. The draft Strategy recognises that housing affordability is a key issue locally, resulting from strong demand for houses coupled with reduced supply of low cost housing.

The draft Strategy identifies a number of locations across the LGA where the +10,300 additional houses targeted in the draft Subregional Strategy are expected to be accommodated. The Subject Site is not identified as forming part of these sites.

Warringah Local Environmental Plan 2011

The Subject Site is classified as 'Deferred Land' in accordance with the Warringah LEP 2011. It is stated that all deferred land remains under the provisions of Warringah LEP 2000 until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into the Warringah LEP 2011.

Warringah Local Environmental Plan 2000

The Subject Site is identified as forming part of Locality C8 'Belrose North' in the Warringah Local LEP 2000. The Desired Future Character of the Locality is identified as follows:

"The present character of the Belrose North locality will remain unchanged except in circumstances specifically addressed as follows.

The natural landscape including landforms and vegetation will be protected and, where possible, enhanced. Buildings will be grouped in areas that will result in the minimum amount of disturbance of vegetation and landforms and buildings which are designed to blend with the colours and textures of the natural landscape will be strongly encouraged.

Development will be limited to new detached style housing conforming with the housing density standards set out below and low intensity, low impact uses

A dense bushland buffer will be retained or established along Forest Way. Fencing is not to detract from the landscaped vista of the streetscape.

Development in the locality will not create siltation or pollution of Middle Harbour."

Housing is identified as a Category Two Land Use i.e. development which may be consistent with the desired future character of the Locality, provided that such development is limited to new detached style housing at low density.

4. ECONOMIC IMPACT OF HOUSING

This Chapter considers the economic impacts associated with the development of 169 residential lots on the Subject Site which would be facilitated by the proposed rezoning. For the purposes of this EIA we have assumed that the development would accommodate 524 residents once it is fully developed and occupied. This is based on applying the average household size of separate dwellings in the Warringah LGA sourced from the 2011 ABS Census (3.1 persons per dwelling¹) to the 169 residential lots envisaged.

Note that we have assumed that these new residents would be new to the Belrose suburb i.e. they would be residents from the wider Warringah LGA, North East Subregion, Sydney Metropolitan Area and beyond. Where there is internal movement within the Belrose suburb it is assumed that backfill of existing housing would occur, leading to a net population increase from all of the proposed dwellings.

4.1 Housing Impacts

As discussed in Hill PDA's Housing Demand Study, industry sources report that Sydney is experiencing its lowest rate of housing growth in 50 years² with the gap between housing demand and supply worsening. According to Deloitte Access Economics, NSW has slumped from contributing more than one third of new housing in Australia to less than a fifth in a single decade, with little indication that this trend will change in the short term. To exemplify this point, between 2007 and 2008 only 15,000 additional dwellings were built in the Sydney Statistical Division in comparison to 32,000 between 1999 and 2000³.

Housing completions in NSW peaked in 1999-2000 and have since fallen by 47%⁴. Over the same period, private completions across Australia increased by 26% implying that NSW is not keeping pace with other States in terms of housing developments. This adversely impacts upon the economic competitiveness of NSW.

Previous work undertaken by Council (draft Warringah Housing Strategy 2011) recognises that a lack of housing supply within the Warringah LGA has negatively contributed towards housing affordability issues. Data compiled by Housing NSW indicates that the Warringah LGA has a "high" need for affordable housing and states that:

*"...it is virtually impossible for lower income households to purchase housing in Warringah and while it has been this way for some years, affordability is tighter now than it was a number of years ago."*⁵

Vacancy rates for housing are very low, another feature of tight supply. The table below indicates the number of dwelling completions over the 2000 to 2010 period in the Warringah LGA.

¹ Note: This is calculated using Table D31 Dwelling Structure of the 2011 ABS Community Profiles and based on 30,677 separate dwellings housing 94,025 residents

² Source: Rents to soar as housing crisis worsens, Daily Telegraph March 25, 2009

³ Source: Metropolitan Strategy Review, Sydney Towards 2036, NSW Government

⁴ Source: NSW Treasury

⁵ Source: Information on Warringah Housing Market, Housing NSW

Table 1 - Residential Dwelling Completions (2000 to 2010)

	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	Total (00-10)
Warringah	535	696	994	722	588	695	431	357	226	239	5,483

Source: Metropolitan Development Program 2010/11 Report North East, NSW Department of Planning and Infrastructure (August 2011)

A total of 5,483 dwellings were completed in the Warringah LGA between 2000/01 and 2009/10. Dwelling completions have declined consistently over this period with the 08/09 and 09/10 periods recorded the lowest number of completions overall. Combined, total completions for the 08/09 and 09/10 period (465 dwellings) equate to less than half (47%) of the total dwellings completed in the peak of 02/03 (994 dwellings). Furthermore, the number of dwellings completed over the five years post-2005 (1,948) equate to just 55% of the dwellings completed over the five years pre-2005 (3,535).

In summary, housing completions in the Warringah LGA are declining despite a need to increase supply in order to assist in easing affordability in the housing market and to meet aspirational housing targets.

The downturn in housing supply has a number of short and long term impacts on the local and wider economy including:

- Impact on house prices and inflation – A mismatch between housing supply and demand has led to sustained house price growth in NSW. Sydney has persistently had the highest house prices in the country, with the median house price in Sydney for the December 2011 quarter being \$527,000 compared to \$485,000 in Melbourne for the same period⁶. The latest data available from Housing NSW indicates that median prices for non-strata dwellings in the Warringah LGA (\$900,000) are well above average for Sydney (\$580,000) by some \$320,000 or 55%⁷ in the March 2012 quarter;
- Labour supply and population growth – Restrained housing supply and higher house prices have been shown to reduce overseas migration and increase interstate out-migration. This in turn impacts upon population growth rates. Research has found that periods of relatively high house prices in NSW have been associated with a decline in the share of total Australian migration⁸. Lower population growth directly and indirectly impacts upon the economic growth of NSW⁹. Indeed the Metropolitan Plan for Sydney 2036 states that “*housing is strongly linked to economic performance and the ability to provide employers with a strong labour force*”; and
- Impact on the construction industry – A reduction in housing supply has resulted in a direct impact on the construction industry. The decline in building investment has contributed to the under-performance of the NSW economy relative to other States¹⁰. For example, a 2010 study prepared by BIS Shrapnel and the Urban Taskforce found that the construction of an additional 8,000 dwellings per annum would have directly increased gross state product by an estimated 0.5-0.6 per cent per annum¹¹.

In the context of the above the proposed development would:

⁶ Source: House Price Indexes: Eight Capital Cities, ABS (June 2012)

⁷ Source: Rents and Sales Report Issue 100, Housing NSW (August 2012)

⁸ Source: NSW Treasury, See 2011-12 Budget Paper 6, page 2-6

⁹ Source: NSW Treasury

¹⁰ Source: NSW Treasury

¹¹ Source: BIS Shrapnel/Urban Taskforce, Going Nowhere: How the planning system and development levies are ruining NSW, 2010

- Increase the supply of dwellings available in the Warringah LGA by 169 dwellings. Whilst the dwellings proposed would likely not be within the affordable range for low or very low income households, they will nevertheless contribute towards a mix of housing locally. Increasing the mix of housing is particularly important in the context of recent dwelling completions in the Warringah LGA. ABS data indicates that the number of units in the Warringah LGA increased by +3,192 (or 22%) between 2001 and 2011 whilst the number of separate dwellings increased by +602 (2%) over the same period. Units are the most affordable dwelling types so an increase in unit development is good for affordability, but an increase in the number separate dwellings should also be supported to ensure that a range of housing types are available to cater for all sectors of the market and overall supply is increased. This is particularly important in the context of the socio-demographic analysis provided in Appendix 1 of the EIA which indicates that the proportion of family households in both Belrose and Warringah LGA increased between 2006 and 2011 (by 2.2 percentage points and 1.9 percentage points respectively) based on ABS Census data¹². Detached dwellings are particularly suitable for families;
- Increase the availability of residential accommodation and in doing so help to ease house price inflation resulting from constrained supply;
- Support the economic performance of the Warringah LGA by increasing the potential for workers in the LGA to live locally and thus increase job containment rates. In doing so it would assist in ensuring that labour supply and population growth is not constrained by a lack of housing to accommodate workers locally. This is particularly important given the presence of the Austlink Business Park 2km to the north of the Subject Site¹³;
- Contribute towards meeting the housing targets for the Warringah LGA, the North East Subregion and broader Sydney; and
- Support the construction industry by providing employment during the construction process (examined in Chapter 4).

4.2 Retail Demand and Sustainability

Using the Hill PDA retail expenditure model¹⁴ we estimate that residents of the Warringah LGA generate retail expenditure of \$14,853 per capita in 2012¹⁵.

We have taken 2017 as the base year at which time the economic impact of the proposed development is assessed i.e. the assumed point at which it is completed and fully occupied. In reality the development and release of residential dwellings may be phased over a number of years dependent upon market demand, which may push the completion date back a number of years. However in the absence of any information on likely phasing we have adopted 2017 as base year for the purposes of this EIA.

The following table calculates total retail expenditure resulting from the estimated residential population in 2017. It includes an allowance for per capita retail expenditure to increase by 1.2% per annum from 2012 reflecting

¹² See Table A1.3, Appendix 1

¹³ Source: Googlemaps

¹⁴ Note: Based on Marketinfo 2009 data and the ABS Household Expenditure Survey 2003-04 (the latest available survey)

¹⁵ Note: Includes an allowance of 1.2% per annum growth in retail expenditure per capita

historic growth trends and current market conditions. Household expenditure by commodity type derived from Marketinfo 2009 has been equated to expenditure by retail store types using the results of the ABS Retail Survey (1998-99 Cat No. 8624.0 - the latest available data).

Table 2 - Household Expenditure by Retail Store Type for New Residents

	2017
Expenditure Per Capita by Retail Store Type (\$m2009)	18,862
Estimated Additional Resident Population	524
Retail Store Type (\$m2009)	
Supermarkets & Grocery Stores	2.4
Specialty Food Stores	0.8
Fast-Food Stores	0.7
Restaurants, Hotels and Clubs*	0.8
Department Stores	0.7
Clothing Stores	0.5
Bulky Goods Stores	1.2
Other Personal & Household Goods Retailing	1.2
Selected Personal Services**	0.3
TOTAL	8.6

* Turnover relating only to consumption of food and liquor (excludes all other types of revenue such as accommodation, gaming and gambling). ** Selected Personal Services includes hair and beauty, laundry, clothing hire and alterations, shoe repair, optical dispensing, photo processing and hire of videos.

Note: distribution of expenditure between different store types is assumed to be consistent with that for existing residents in the Warringah LGA, sourced from Marketinfo 2009 and the ABS Household Expenditure Survey 2003-04

The 524 residents on the Subject Site would generate in the order of \$9m in retail expenditure in 2017 (\$2009). Given that no retail facilities would be provided as part of the development, all of this expenditure would be directed towards existing and future retail facilities in the wider area.

The following table applies target retail turnover rates (\$/sqm) to estimated retail spend. This allows the amount of retail floorspace which be supported as a direct result of new residents to be determined.

Table 3 - Retail Floorspace Demand from New Residents on Site (sqm gross lettable area)

Retail Store Type	Target Turnover (\$/sqm) [^]		F'space Demand (sqm)
	2012	2017	2017
Supermarkets & Grocery Stores	10,000	10,304	232
Specialty Food Stores	7,500	7,728	104
Fast-Food Stores	7,500	7,728	89
Restaurants, Hotels and Clubs*	4,500	4,637	182
Department Stores	3,500	3,606	202
Clothing Stores	5,000	5,152	91
Bulky Goods Stores	3,500	3,606	325
Other Personal & Household Goods Retailing	4,500	4,637	263
Selected Personal Services**	3,200	3,297	86
TOTAL	-	-	1,573

[^] 2012-based target turnover. Benchmark turnover rates derived from various sources including Urbis Retail Averages, ABS Retail Survey 1998-99 escalated at CPI to \$2009, Shopping Centre News, Hill PDA and various consultancy studies. Target turnovers are assumed to increase by 0.6% per annum reflective of historic growth trends and current market conditions * Turnover relating only to consumption of food and liquor (excludes all other types of revenue such as accommodation, gaming and gambling). ** Selected Personal Services includes hair and beauty, laundry, clothing hire and alterations, shoe repair, optical dispensing, photo processing and hire of videos.

We estimate the \$9m of additional retail expenditure generated by residents on the Subject Site would support approximately 1,600sqm of retail floorspace in 2017. This would increase year-on-year subsequently reflecting real retail expenditure increases.

By applying indicative job ratios to the retail store types identified in Table 3¹⁶ we estimate that new residents could directly support 56 retail-related jobs in the LGA. Additional jobs over and above this level would also be supported in retail services and support services such as banks, estate agents, travel agents, medical services, schools and so on. This is further to the industries which the new residents themselves will be employed in the LGA.

The nearest centres to the Subject Site, and therefore the centres most likely to benefit from this additional expenditure, are:

- Ralston Avenue Belrose Neighbourhood Centre located 1km by road or a 2 minute drive to the east of the Subject Site¹⁷. The centre contains a total of 1,210sqm¹⁸ of retail and commercial floorspace which includes an IGA supermarket (600sqm);
- Glenrose Small Village Centre located 3km by road or a 5 minute drive to the south¹⁹. This centre is currently undergoing redevelopment which will see an expanded Woolworths supermarket in addition to an ALDI foodstore, mini-major and specialty retail floorspace;
- Sorlie Road Frenchs Forest Neighbourhood Centre located 3km by road or a 6 minute drive to the south east²⁰. This centre provides approximately 1,620sqm²¹ shopfront floorspace in 6 retail units;
- Mimosa Neighbourhood Centre located 3km by road or a 6 minute drive to the south²². This is a small neighbourhood centre contains 7 retail units and 430sqm of shopfront floorspace²³;
- Frenchs Forest Small Village Centre located 4km by road or a 7 minute drive to the south east²⁴. This centre comprises the purpose-built Forestway Shopping Centre containing 9,600sqm shopfront floorspace²⁵; and
- Terrey Hills Small Village Centre located 5km by road or a 6 minute drive to the north-east²⁶. This centre provides localised shopping facilities including an IGA supermarket.

In addition to these centres, although it is not a defined centre in planning policy terms the Belrose SupaCenta is situated approximately 4km by road or a 4 minute drive to the north of the Subject Site²⁷. The SupaCenta provides in the order of 33,500sqm gross lettable area of retail floorspace²⁸ and there are a number of other bulky goods retailers adjacent. These facilities would also benefit from the additional retail expenditure generated by new residents on the Subject Site.

¹⁶ Sourced from the ABS Retail Census and Hill PDA

¹⁷ Source: Googlemaps

¹⁸ Hill PDA (February 2011)

¹⁹ Source: Googlemaps

²⁰ Source: Googlemaps

²¹ Hill PDA (February 2011)

²² Source: Googlemaps

²³ Hill PDA (February 2011)

²⁴ Source: Googlemaps

²⁵ SCN Mini-Guns 2011

²⁶ Source: Googlemaps

²⁷ Source: Googlemaps

²⁸ DA approved floorspace

4.3 Traffic and Other Issues

The proposed development would generate minor additional volumes of traffic locally. Unmitigated, this could lead to additional local congestion, travel times and pollution. Additional travel time is an economic cost in that the lost time could be better allocated to a more economically beneficial use. Additional traffic may also lead to additional costs for households in terms of petrol, vehicle maintenance etc. Notwithstanding this, we note the findings of the Traffic Study by Transport and Traffic Planning Associates which indicates that the proposed subdivision *'will not have any adverse traffic implications'*²⁹ and *'will not result in any compromise to the environmental capacity of any existing roads in the area'*³⁰.

The proposed development would also create additional demand for infrastructure (refuse collection, sewerage etc) and public services (policing, hospitals etc). However, the development would also require Section 94, developer contribution or other agreements to mitigate these impacts.

This EIA does not comprise an economic cost benefit analysis which would require detailed quantification of these issues. For the purposes of this EIA we have assumed that any negative impacts on traffic, services and the like are mitigated by monetary contributions through a Section 94, developer contribution or other agreements. As such, the net impact on traffic and other issues resulting from the proposed development is assumed to be nil.

4.4 Planning and Policy Impacts

As a result of increasing housing supply, the proposed rezoning and the subsequent development would have the following positive economic impacts on policies identified in Chapter 3:

- Supporting the objective of the NSW 2021- A Plan to Make NSW Number One (2011) to rebuild the economy in NSW by ensuring that more land is made available for housing. Housing is identified as a major contributor towards economic growth. It would also support the economy by supporting new jobs locally as outlined in Section 4.2. The NSW 2021 Plan seeks to provide an additional +60,000 jobs and +25,000 housing in Sydney per annum to 2021;
- Assisting to reach the targets of +29,000 additional dwellings in the North West Subregion between 2006 and 2036 as identified in the Metropolitan Plan for Sydney 2036 (2010). In doing so it would contribute towards economic development in the North East Subregion and the wider Sydney Metropolitan Area. Supporting jobs off-site would also assist the North East Subregion in achieving the target of +23,000 additional jobs by 2036; and
- Assisting to achieve the housing targets for the Warringah LGA set in the draft North East Subregional Strategy (2007) and the draft Warringah Housing Strategy (2011). These target +10,300 additional dwellings in the LGA between 2001 and 2031. It would also contribute towards the target of +12,500 additional jobs in Warringah LGA by 2031 set in the draft Subregional Strategy.

²⁹ Source: Page 14, Traffic Study, Transport and Traffic Planning Associates

³⁰ Source: Page 15, Traffic Study, Transport and Traffic Planning Associates

5. DEVELOPMENT IMPACTS

This Chapter examines the economic impact of the development itself in terms of multiplier effects, construction related employment and investment stimuli.

Because the proposal is for a rezoning only and concept plans are still being developed no Capital Investment Value (CIV) has yet been calculated. For the purpose of this EIA we have assumed that the average cost of each residential plot (including servicing, infrastructure, landscaping, materials and construction) in the context of local topography would be in the order of \$580,000³¹. Based on 169 lots being provided this would equate to total CIV of approximately \$98m. We have used this CIV to calculate potential development impacts

5.1 Construction Multiplier Effects

The construction industry is a significant component of the economy accounting for 7.3% of Gross Domestic Product (GDP) and employing almost one million workers across Australia³². The industry has strong linkages with other sectors, so its impacts on the economy go further than the direct contribution of construction. Multipliers refer to the level of additional economic activity generated by a source industry.

There are two types of multipliers:

- **production induced:** which is made up of:
 - first round effect: which is all outputs and employment required to produce the inputs for construction; and
 - an industrial support effect: which is the induced extra output and employment from all industries to support the production of the first round effect; and
- **consumption induced:** which relates to the demand for additional goods and services due to increased spending by the wage and salary earners across all industries arising from employment.

The source of the multipliers adopted in this report is ABS and Australian National Accounts: Input-Output Tables 1996-97 (ABS Catalogue 5209.0). These tables identify first round effects, industrial support effects and consumption induced multiplier effects at rates of \$0.466, \$0.438 and \$0.962 respectively to every dollar of construction.

The proposed development equates to some \$98m in direct CIV. The table below calculates economic multipliers associated with this CIV.

³¹ Based on Rawlinsons and Hill PDA's Industry experience

³² Source: IBIS World Construction Industry Report 2011

Table 4 - Economic Multipliers

	Direct Effects	Production Induced Effects		Consumption Induced Effects	Total
		First Round Effects	Industrial Support Effects		
Output multipliers	1	0.466	0.438	0.962	2.866
Output (\$million)	\$98	\$46	\$43	\$94	\$281

* Source: ABS Australian National Accounts: Input-Output Tables 1996-1997 (ABS Pub: 5209.0).

The estimated \$98m direct construction cost will support a further \$89m of activity in production induced effects and \$94m in consumption induced effects. Total economic activity supported by the construction facilitated by the proposed rezoning is therefore approximately \$281m.

Note that the multiplier effects are national, and not necessarily local. The ABS states that:

“Care is needed in interpreting multiplier effects; their theoretical basis produces estimates which somewhat overstate the actual impacts in terms of output and employment. Nevertheless, the estimates illustrate the high flow-on effects of construction activity to the rest of the economy. Clearly, through its multipliers, construction activity has a high impact on the economy.”

In particular the multiplier impacts can leave the impression that resources would not have been used elsewhere in the economy had the development not proceeding. In reality many of these resources would have been employed elsewhere. It should also be noted, as stated in the NSW Treasury guidelines, that:

“Direct or flow on jobs will not necessarily occur in the immediate vicinity of the project – they may be located in head office of the supplier or in a factory in another region or State that supplies the project”³³.

Nevertheless, economic multiplier impacts represent additional value add to the Australian economy resulting from this proposed development.

5.2 Construction Employment

It is estimated that four full time construction positions over 12 months are created for every one million dollars of construction work undertaken³⁴. Based on the proposed development’s estimated construction cost of \$98m, approximately 392 job years³⁵ will be directly generated.

Table 5 - Employment Generation

	Direct Effects	Production Induced Effects		Consumption Induced Effects	Total
		First Round Effects	Industrial Support Effects		
Multipliers	1	0.33	0.45	2.33	4.11
Employment No. per \$million	4.00	1.32	1.80	9.32	16.44
Total job years created	392	129	176	913	1,611

Source: ABS Australian National Accounts: Input-Output Tables 1996-1997 (ABS Pub: 5209.0).

³³ Source: Office of Financial Management Policy & Guidelines Paper: Policy & Guidelines: Guidelines for estimating employment supported by the actions, programs and policies of the NSW Government (TPP 09-7) NSW Treasury

³⁴ IBIS World Construction Industry Report 2011

³⁵ Note – One job year = one full time job for one full year

The 1996-97 ANA Input-Output Tables identified employment multipliers for first round, industrial support and consumption induced effects of 0.33, 0.45 and 2.33 respectively for every job year in direct construction. Including the multiplier impacts the proposed development will therefore have potential to generate 1,611 job years directly and indirectly.

5.3 Retail Demand

Construction workers on site would generate demand for additional retail floorspace. Workers spend on average between \$2,000 to \$3,000 per annum (\$2012) on retail goods and services close to their place of work³⁶. This will be spent predominately on convenience-related expenditure such as lunches, coffees, snacks etc.

We have assumed that:

- Workers on average spend \$2,500 per annum close to their place of work (\$2012);
- Worker spending will increase in line with real retail growth at 1.2% per annum; and
- Construction occurs between 2014 and 2016 and jobs would be distributed evenly across the three year period.

Based on this approach we estimate that construction workers would generate in the order of \$1m in retail expenditure over the construction period. This would be available to be captured by centres in the surrounding area such as Ralston Avenue Belrose Neighbourhood Centre, Glenrose Small Village Centre and Sorlie Road Frenchs Forest Neighbourhood Centre.

5.4 Other Construction Impacts

The construction process may lead to short-term negative impacts locally such as increased traffic related to site-works, noise during construction and so on, although only a minority of these impacts would be economic. We assume that the development process would take necessary steps to minimise the extent of any impacts on traffic by ensuring deliveries take place outside of peak periods. This is standard practice in the construction industry.

5.5 Investment Stimulus

Where a significant property investment decision has been made it is generally viewed as a strong positive commitment for the local area. Such an investment can in turn stimulate and attract further investment.

The proposed rezoning would not lead to further development of residential plots adjacent to it given that it comprises a spot rezoning and residential uses are not permissible on adjacent land. However in supporting the provision of additional jobs in retail and other industries and by increasing the amount of retail expenditure locally, it would support the commercial viability of providing new retail and other floorspace in existing centres. This would benefit new and existing residents alike.

³⁶ Based on Hill PDA's experience which indicates that around 15- 20% of household income is spent close to workers place of work. This is variable and highly dependent on the range of retail facilities provided locally.

Increasing choice in the residential market would also increase the attractiveness of the Warringah LGA as a place for people to live, particularly in light of the area's constrained housing market. This in turn would support economic competitiveness and may encourage investment in existing and new industries in the LGA in which new residents would be employed.

5.6 Planning and Policy Impacts

As a result of supporting jobs and investment during the construction process, the proposed rezoning and the subsequent development would have the following positive economic impacts on the policies reviewed in Chapter 3:

- Support rebuilding of the economy encouraged by the NSW 2021- A Plan to Make NSW Number One (2011) by providing investment and support for jobs both during the construction process and post-development in the local and wider area;
- Assisting the North East Subregion to provide an additional +23,000 new jobs between 2006 and 2036 as targeted in the Metropolitan Plan for Sydney 2036 (2010) and the +12,500 additional jobs in Warringah LGA targeted in the draft North West Subregional Strategy (2007) by:
 - supporting employment during the construction process;
 - increasing the amount of retail expenditure locally to support centres;
 - increasing demand for jobs to employ new residents; and
 - Supporting additional jobs in support services like schools and hospitals.

6. ECONOMIC IMPACT ASSESSMENT

6.1 Level of Impacts

Based on the above analysis, the tables below provide an assessment of the economic impact which the proposed development would have.

Table 6 - Assessment Rating Levels

Rating Level	Description
Significant Negative	Impacts with serious, long term and possibly irreversible effects leading to serious damage, degradation or deterioration of the environment and community. Requires a major re-scope of concept, design, location, justification, or requires major commitment to extensive management strategies to mitigate the effect.
Moderate Negative	Impacts may be short, medium or long term in duration and most likely to respond to management actions.
Slight Negative	Impacts have minimal effect, could be short term, can be mitigated and would not cause substantial detrimental effects. May be confined to a small area.
Neutral	No discernible or predictable positive or negative impact.
Slight Positive	Impacts have minimal effect, could be short term. May be confined to a small area.
Moderate Positive	Impacts may be short, medium or long term in duration. Positive outcome may be in terms of new opportunities and outcomes of enhancement or improvement.
Significant Positive	Impacts resulting in substantial and long term improvements or enhancements to the existing environment and community.

Source: Adapted from the Strategic Merit Test, National Guidelines for Transport System Management in Australia (2nd Edition)

Table 7 - Summary of Potential Economic Impacts (With and Without Mitigation)

Issue	Consideration	Comment	Rating of Impact	Rating of Impact with Mitigation
Housing Supply	Will the project improve housing supply in the area?	Yes, it will: <ul style="list-style-type: none"> Contribute 169 dwellings towards achieving the housing target for the Warringah LGA, the North East Subregion and the Sydney Metropolitan Area and in doing so support economic growth. Assist to ensure that dwelling completions, which have been declining over the last ten years, keep pace with the high demand for housing in the LGA. Support the economic performance of the Warringah LGA by providing new housing to meet all aspects of the labour market. 	Moderate Positive	None required
	Will the project improve housing choice?	Yes, it will assist the LGA to provide new detached dwellings. Analysis of ABS data indicates that the provision of separate dwellings over the 2001 to 2011 period (+602) has been modest compared to the number of new units (+3,192) constructed over the same period. There is a need to ensure that all sectors of the housing market are catered for by new development, particularly for families which account for a growing proportion of households in the Warringah LGA.	Moderate Positive	None required
	Will the project improve housing affordability?	Yes, it will assist to ease house price inflation and affordability locally. The latest data indicates that median house prices in the Warringah LGA are 43% above average for Sydney. Although the proposed development would not be affordable for lower income households, increasing supply of all types of dwellings will have a positive impact on housing price inflation.	Slight Positive	None required
Business and industry	Does the project impact (either directly or indirectly) on	Yes, new households would generate approximately \$9m of retail expenditure in 2017 (\$2009) which would be available to support existing centres in the surrounding area such as Ralston Avenue Belrose Neighbourhood Centre, Glenrose Small Village Centre and Sorlie Road	Significant Positive	None required

Issue	Consideration	Comment	Rating of Impact	Rating of Impact with Mitigation
	businesses/ commercial enterprises?	Frenchs Forest Neighbourhood Centre. This could directly support around 1,600sqm of retail floorspace, the provision of which would benefit existing and new residents alike.		
	Are there any impacts on local traffic?	For the purposes of this Study we have assumed that any additional demand on road infrastructure could be mitigated by design or construction management measures and/ or confined to short-term. There may be some short-term adverse economic impact during the construction process resulting from increased traffic locally, although it is likely that this would be mitigated.	Moderate Negative	Slight Negative
	Are impacts on businesses likely to have flow on effects for employees?	Yes, it would support additional jobs in a range of industries locally and further afield post-development as a result of additional retail expenditure and demand for retail and support services. During the development process construction jobs would be support on site and multiplier impacts would support other jobs in the broader economy.	Moderate Positive	None required
	Is the project likely to have direct or indirect effects on the local economy?	Yes, by: <ul style="list-style-type: none"> • Providing a CIV of an estimated \$98m directly which would support a further \$89m in production induced effects and \$94m in consumption induced effects. Total economic value of the development project would be around \$281m. • Supporting an estimated 392 jobs years directly during construction and a further 1,219 in production and consumption induced effects. This would equate to 1,611 job years being supported overall; • Supporting the provision of an additional \$1m of retail expenditure available to be captured by retail facilities locally as a result of construction workers on-site; • Supporting the provision of an \$9m of retail expenditure in 2017 (\$2009) from new residents; and • Providing a stimulus for investment in nearby centres and supporting the economic role of the Warringah LGA as a place in which to live and work. 	Significant Positive	None required

From an economic perspective, the Subject Site does not generate any quantifiable economic benefits at the current time; that is they do not contribute towards the economic growth or development of the Warringah LGA, the North East Subregion or the Sydney Metropolitan Area. On this basis, all of the economic benefits associated with the proposed rezoning constitute net additional benefits.

This EIA does not constitute an economic cost benefit analysis and we have therefore assumed that any costs associated with the development in terms of increased demands on infrastructure, public services, servicing and so on would be mitigated by requisite monetary contributions to State and Local government.

6.2 Conclusions

In economic terms, the Subject Site is uncleared, undeveloped and does not generate any economic benefit to the local, Subregional or Metropolitan economy. As such, all of the potential economic benefits associated with the proposed development would be net additional. The Subject Site is used informally for recreation and local access however this is not considered a quantifiable economic benefit in this instance given that the land is privately owned and not part of the Garigal National Park.

There may be some short-term adverse economic impact during the construction process resulting from increased traffic locally. This potential adverse impact would likely be insignificant and would be mitigated as far as possible. Aside from this, the potential positive economic benefits of the proposed development can be summarised as follows:

- A contribution of 169 dwellings towards housing supply, housing mix and assisting to ease house price inflation;
- Creating additional retail expenditure of \$9m from residents (in 2017) and \$1m from workers during the construction process available to be captured by existing centres in the local area such as Ralston Avenue Belrose, Glenrose Small Village Centre and Sorlie Road Frenchs Forest Neighbourhood Centre;
- Supporting jobs in surrounding centres and the provision of additional retail floorspace which would benefit both existing and new residents;
- Supporting an estimated \$281m in direct and indirect capital investment and supporting 1,611 jobs years directly and indirectly during the construction process; and
- Creating significant direct and indirect capital investment in Warringah LGA, the North East Subregion and the Sydney Metropolitan Area.

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4. This report and its attached appendices are based on estimates, assumptions and information provided by the Client or sourced and referenced from external sources by Hill PDA. While we endeavour to check these estimates, assumptions and information, no warranty is given in relation to their reliability, feasibility, accuracy or reasonableness. Hill PDA presents these estimates and assumptions as a basis for the Client's interpretation and analysis. With respect to forecasts, Hill PDA does not present them as results that will actually be achieved. Hill PDA relies upon the interpretation of the Client to judge for itself the likelihood of whether these projections can be achieved or not.
5. Due care has been taken to prepare the attached financial models from available information at the time of writing, however no responsibility can be or is accepted for errors or inaccuracies that may have occurred either with the programming or the resultant financial projections and their assumptions.
6. This report does not constitute a valuation of any property or interest in property. In preparing this report Hill PDA has relied upon information concerning the subject property and/or proposed development provided by the Client and Hill PDA has not independently verified this information except where noted in this report.
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This valuation is prepared on the assumption that the lender or addressee as referred to in this valuation report (and no other) may rely on the valuation for mortgage finance purposes and the lender has complied with its own lending guidelines as well as prudent finance industry lending practices, and has considered all prudent aspects of credit risk for any potential borrower, including the borrower's ability to service and repay any mortgage loan. Further, the valuation is prepared on the assumption that the lender is providing mortgage financing at a conservative and prudent loan to value ratio.

**Appendix 1 - SOCIO-DEMOGRAPHIC ANALYSIS BASED ON ABS
CENSUS DATA**

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

The following Appendix provides a resident and labour force profile of the Belrose suburb based on ABS Census data. Where appropriate, data from the Warringah Local Government Area (LGA) and the Greater Sydney Area has also been presented for benchmarking purposes. For the purposes of the analysis undertaken in this Appendix, the Belrose suburb, the Warringah LGA and Greater Sydney Area comprise the Study Area.

Note that the boundaries of the Belrose suburb were refined between the 2006 and 2011 ABS Censuses. As such, the data is not directly comparable. Data for the Belrose suburb from 2006 and 2011 has been included nonetheless as it provides a useful indicator of the broad demographic changes which have occurred over the 2006 to 2011 period.

A1.1 Population

Population Growth

According to ABS Census data the population of the Belrose suburb declined between 2006 and 2011 after having increased between 2001 and 2006. Between 2006 and 2011 the number of people living in the Belrose suburb declined by 120 people which equates to an annual average decline of -0.3% (pro-rata). This annual growth rate was significantly lower than that recorded over the same period for both Warringah LGA and Greater Sydney (1.0% and 1.3% pro-rata respectively).

Table A1.1 – Population Growth for Study Area (2001-2011)

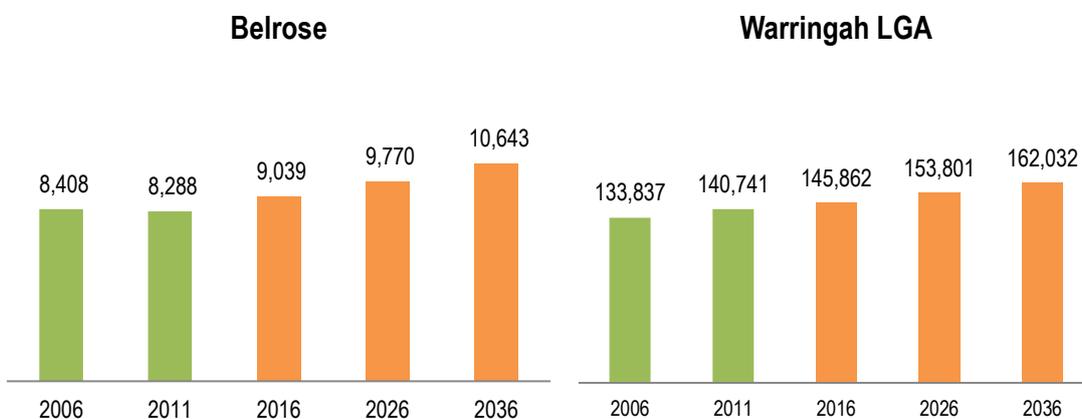
	2001	2006	2011	# Change 06-11	% Change 06-11	Average Annual Growth Rate 2006-2011 (%)
Belrose	7,585	8,408	8,288	-120	-1.4%	-0.3%
Warringah LGA	127,613	133,837	140,741	+6,904	+5.2%	+1.0%
Greater Sydney	3,948,015	4,119,190	4,391,674	+272,484	+6.6%	+1.3%

Source: ABS Census 2011

Population Forecasts

In contrast to recent historic trends, the NSW Bureau of Transport Statistics (BTS) expects the resident population of Belrose to grow at a rate similar to that of the broader Warringah LGA (around 0.7% annually).

Figure A1.1 – Population Growth for the Belrose suburb and the Warringah LGA (2006 – 2036)



Source: ABS 2006 and 2011 and Bureau of Transport Statistics 2009 Forecasts

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

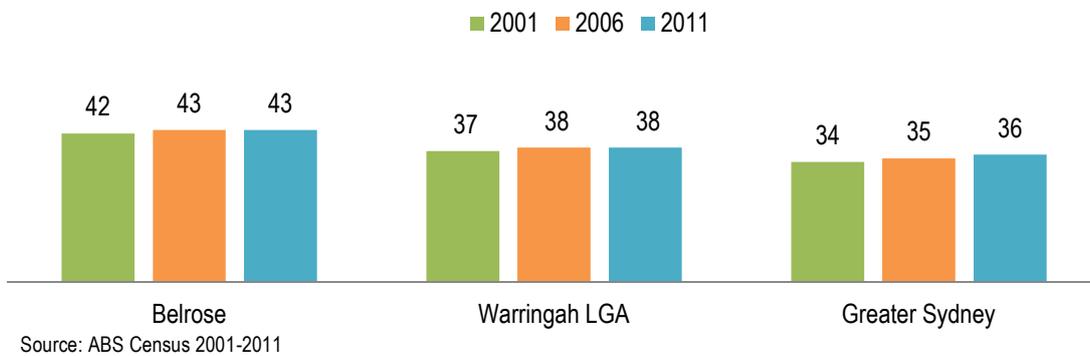
Based on these projections (Figure A1.1), the population of the Belrose suburb is expected to increase by more than 2,355 people between 2011 and 2036. The Warringah LGA will accommodate nearly 21,291 additional residents over the same period.

A1.2 Age

Median Age

Figure A1.2 illustrates that the population in the Study Area has aged over the 2001 to 2011 period with the median age increasing. The median age for residents in the Belrose suburb of 43 years (2011) is older than that of residents living in both the Warringah LGA (38 years) and Greater Sydney (36 years). The older resident population in the Belrose suburb reflects the presence of substantial aged care accommodation within the suburb. This is evident in the two retirement villages located within Belrose itself, namely Uniting Care Ageing Northern Sydney Region Community Care and Wesley Gardens Aged Care.

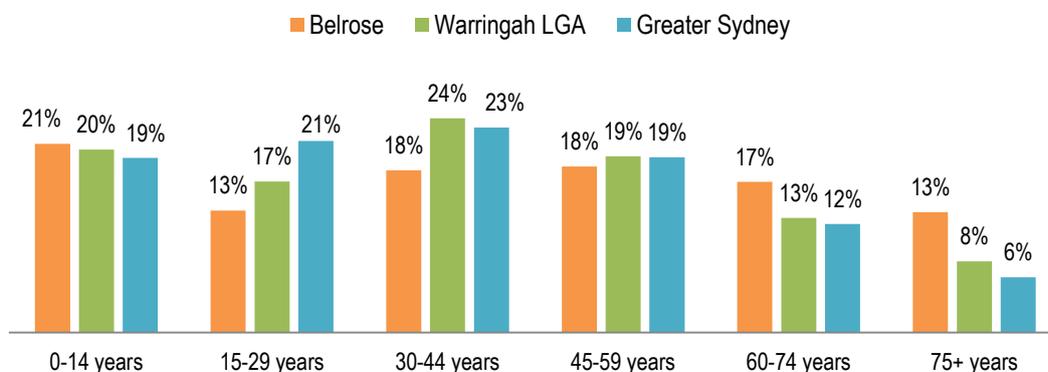
Figure A1.2 – Median Ages for the Study Area (2001 – 2011)



Age Distribution

The predominant age cohort in the Belrose suburb in 2011 was 0-14 years which comprised 21% of total population. The proportion of residents aged over 45 years in the Belrose suburb (48%) was significantly higher than for the Warringah LGA (40%) and Greater Sydney (37%), as was the proportion of persons aged 75+ years.

Figure A1.3 – Age Distribution for the Study Area (2011)



Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

Forecast Age Distribution

Consistent with nationwide trends the resident population of the Belrose suburb is forecast to age over the 2011-2036 period (Table A1.2). By 2036 the BTS anticipates that the number of residents in the Belrose suburb aged 75+ years will grow by 626 persons (58%) compared to their 2011 level. This compares to an increase of just 290 persons (17%) aged 14 years or younger over the same period. It is important to note that persons aged within the 15-29 years age cohort are also expected to experience a 42% increase between 2011 and 2036.

Table A1.2 – Forecast Age Distribution for the Belrose suburb (2016-2036)

Belrose	2011	2016	2021	2026	2031	2036	% change 2011-2036
0-14 years	1,718	1,769	1,800	1,854	1,923	2,008	17%
15-29 years	1,110	1,399	1,472	1,513	1,534	1,576	42%
30-44 years	1,478	1,702	1,724	1,795	1,856	1,920	30%
45-59 years	1,513	1,722	1,795	1,810	1,832	1,867	23%
60-74 years	1,371	1,360	1,391	1,440	1,493	1,549	13%
75+ years	1,097	1,087	1,200	1,357	1,519	1,723	58%
Total	8,287	9,040	9,382	9,770	10,156	10,643	2,356

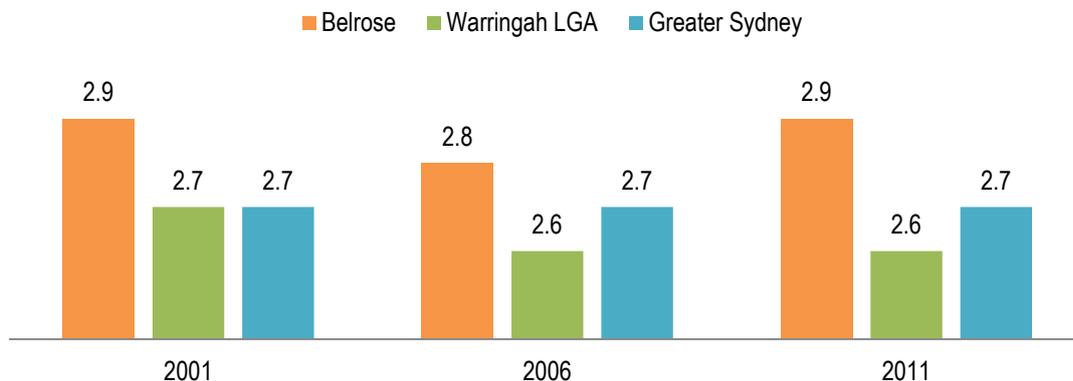
Source: ABS 2011 and Bureau of Transport Statistics 2009 Forecasts

A1.3 Households

Household Occupancy Rates

Households in the Belrose suburb were on average larger than those across both the LGA and Greater Sydney (Figure A1.4) based on 2011 ABS Census data. In 2011 the typical household size was 2.9 persons in the Belrose suburb, 2.6 in the wider LGA and 2.7 for Greater Sydney. The larger average household size within the Belrose suburb can be attributed to the higher proportion of families households with children located in the suburb.

Figure A1.4 – Household Occupancy Rates for the Study Area (2001, 2006 and 2011)



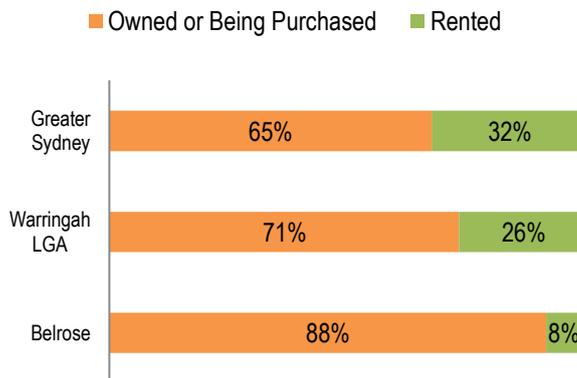
Source: ABS Census 2001, 2006, 2011

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

Home Ownership

Figure A1.5 shows that nearly 90% of households in the Belrose suburb either owned or were in the process of purchasing their home at the time of the 2011 ABS Census. This is substantially higher than that recorded for both the LGA (71%) and Greater Sydney (65%). In 2011 the proportion of households renting in the Belrose suburb was 8% which was around a third of that recorded for the wider LGA (24%) and a quarter of that for Greater Sydney (36%). In the ten years between 2001 and 2011 home ownership rates within the Belrose suburb remained relatively stable.

Figure A1.5 – Home Ownership for the Study Area (2011)

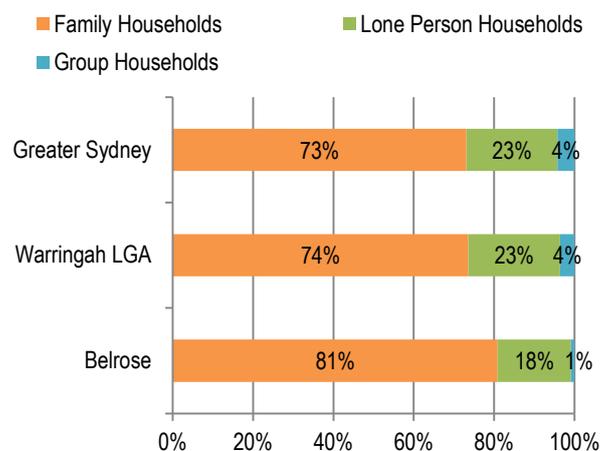


Source: ABS Census 2011

Household Structure

Figure A1.6 demonstrates that the proportion of family households in the Belrose suburb was higher than that recorded for the LGA and Greater Sydney in 2011. Since 2001 the proportion of family households in the Belrose suburb has remained steady which is consistent with trends in the LGA and Greater Sydney.

Figure A1.6 – Household Structure for the Study Area (2011)



Source: ABS Census 2011

Family Type

According to the 2011 ABS Census the most common family type in the Belrose suburb was couples with children (55%). This was higher than that recorded for the wider LGA (51%) and Greater Sydney (49%). The Belrose suburb contained a low proportion of one parent families (9%) whilst the proportion of families without children was comparable to that recorded for the LGA and Greater Sydney.

Since 2006 the proportion of couple families with children has increased within the Belrose suburb and the wider LGA (+2.2 percentage points and +1.9 percentage points respectively). This positive increase is in contrast to the negative growth within this category experienced by Greater Sydney (-0.3 percentage points). The Belrose suburb and the Warringah LGA experienced negative growth within the couple without children category since 2006 (-1.9 percentage points and -1.6 percentage points respectively) in contrast to the slightly positive growth experienced by Greater Sydney (+0.3 percentage points).

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

In 2011 the average number of children per family within the Belrose suburb (1.9 children) and the Warringah LGA (1.8) was comparable to that for Greater Sydney (1.9).

Table A1.3 – Family Types for the Study Area (2006-2011)

	2011 ABS Census			Change since 2006 ABS Census (percentage points)		
	Belrose	Warringah LGA	Greater Sydney	Belrose	Warringah LGA	Greater Sydney
Couple family w. children (%)	55.3%	50.7%	48.9%	+2.2	+1.9	-0.3
Couple family w/o children (%)	34.6%	35.5%	33.5%	-1.9	-1.6	+0.3
One parent family (%)	9.1%	12.4%	15.7%	-0.3	-0.1	+0.1
Other family (%)	1.0%	1.4%	1.9%	-0.1	-0.2	-0.1
Average children per family	1.9	1.8	1.9			

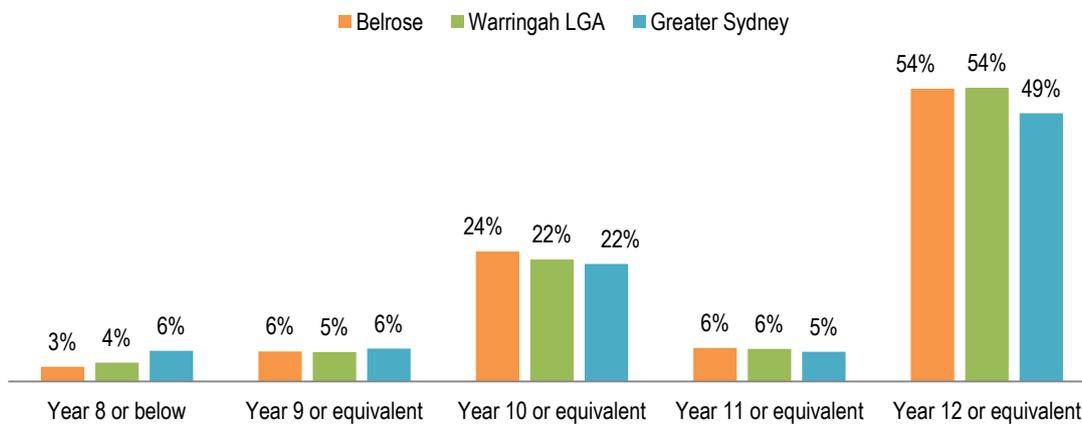
Source: ABS Census 2006 and 2011

A1.4 Education Attainment

Highest Year of School Completed

Education attainment levels of residents of the Belrose suburb improved since 2001 and remained above that of Greater Sydney (Figure A1.7) at the time of the 2011 ABS Census. In 2006 nearly 50% of the Belrose suburb's residents had completed year 12 compared to 49% across Greater Sydney.

Figure A1.7 – Highest Year of School Completed for the Study Area (2006)



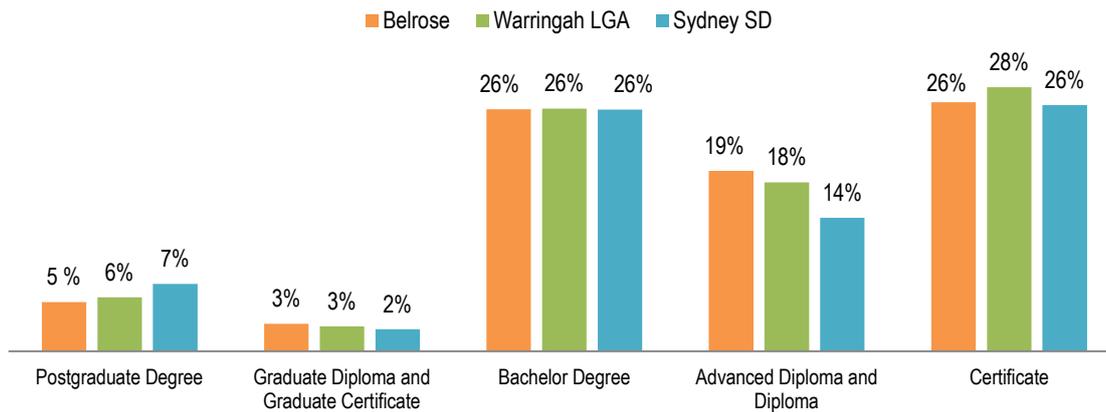
Source: ABS Census 2006

Non-School Qualifications

In 2006 the proportion of the Belrose suburb's residents with a tertiary qualification (34%) was comparable to the LGA (32%) and Greater Sydney (35%). Since 2001 the proportion of the Belrose suburb's and the Warringah LGA's residents with non-school qualifications increased dramatically. Between 2001 and 2006 the proportion of residents within the Belrose suburb with a certificate level qualification increased by 35 percentage points (44% to 79%). This increase was sustained across the wider LGA and Greater Sydney, mainly be due to the inadequately described / not stated category having being reduced in proportion between the census dates.

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

Figure A1.8 – Highest Year of School Completed for the Study Area (2006)



Source: ABS Census 2006

A1.5 Income

Household Weekly Incomes

The suburb of Belrose was relatively affluent with household incomes (\$1,782) well above the median recorded by Greater Sydney in 2011 (\$1,447). Furthermore 51% of households in 2011 earned more than \$1,400 per week compared to 42% of households across Greater Sydney.

Figure A1.4 – Weekly Household Income for the Study Area (2006-2011)

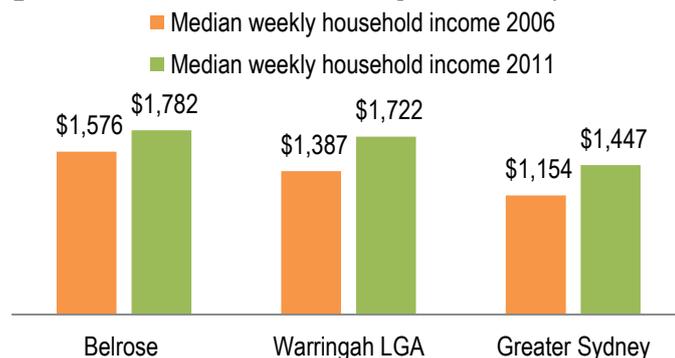
	2011 ABS Census			Change since 2006 ABS Census (percentage point)		
	Belrose	Warringah LGA	Greater Sydney	Belrose	Warringah LGA	Greater Sydney
Median weekly household income	\$1,782	\$1,722	\$1,447	-	-	-
\$0-\$349	6%	7%	9%	-2	-3	-4
\$400-\$799	17%	16%	19%	+4	+1	+1
\$800-\$1,399	17%	20%	22%	-1	-	+1
\$1,400-\$2,499	23%	23%	21%	+1	+1	-1
\$2,500+	28%	25%	21%	+1	+4	+5

Source: ABS Census 2006-2011

Individual Weekly Incomes

Figure 9 shows the median individual weekly incomes of residents living in Belrose was higher than the wider LGA and Greater Sydney. In 2011 the median individual income in the Belrose suburb was \$60 more than for the LGA and \$335 higher than the Greater Sydney area. Between 2006 and 2011 household incomes in Belrose increased by 13%. This increase was almost half the rate increase

Figure A1.9 – Individual Weekly Incomes (2006 and 2011)



Source: ABS Census 2006 and 2011

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

experienced for the wider LGA and Greater Sydney (24% and 25% respectively).

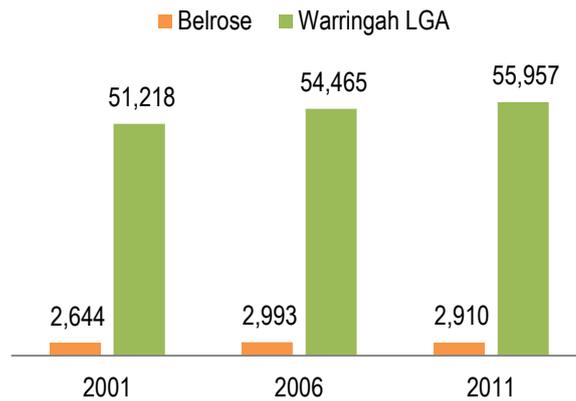
A1.6 Dwellings

Dwelling Growth

Over the 2006 to 2011 period the number of dwellings within the Belrose suburb declined by 83. This decline in dwellings may have influenced the suburb's population decline of 120 persons over the same period.

This decline in dwellings is in contrast to the dwelling growth experienced over the wider LGA which grew by additional 1,492 dwellings over the 2006 to 2011 period.

Figure A1.10 – Dwelling Growth for the Belrose suburb and the Warringah LGA (2001-2011)

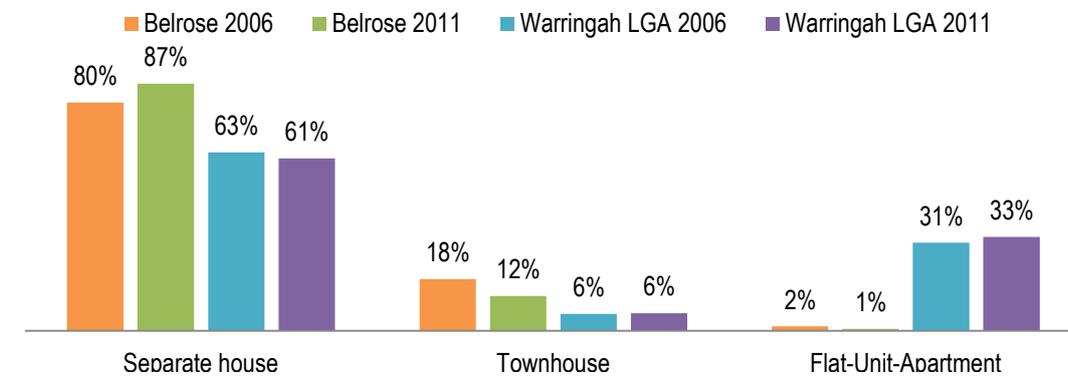


Source: ABS Census 2011

Dwelling Type

According to the 2011 ABS Census separate (detached) houses continue to be the most prevalent form of dwellings in the Belrose suburb. Since 2006 the proportion of separate houses in the Belrose suburb increased by 7 percentage points whilst the proportion of townhouses and units decreased by 6 percentage points and 1 percentage points respectively. In contrast the Warringah LGA witnessed a decrease in detached houses over the 2006 to 2011 period (-2 percentage points) although this category remains the dominant dwelling type within the LGA. The LGA also experienced a slight growth in townhouses (+0.3 percentage points) and a 2 percentage point increase in units.

Figure A1.11 – Dwelling Type for the Study Area (2011)



Source: ABS Census 2006 and 2011

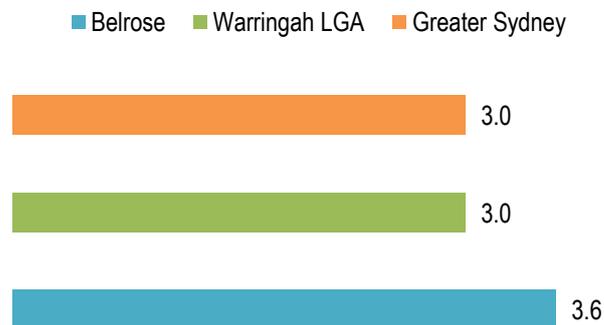
Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

Number of Bedrooms

Dwellings in the Belrose suburb were on average larger than those for the wider LGA and Greater Sydney based on the 2011 ABS Census. According to the 2011 ABS Census dwellings in the Belrose suburb averaged 3.6 bedrooms compared to 3 bedrooms for the LGA and Greater Sydney.

The greater average number of bedrooms in the Belrose suburb can be attributed to the high number of detached dwellings within the suburb.

Figure A1.12 – Number Bedrooms per Dwelling for the Study Area (2011)



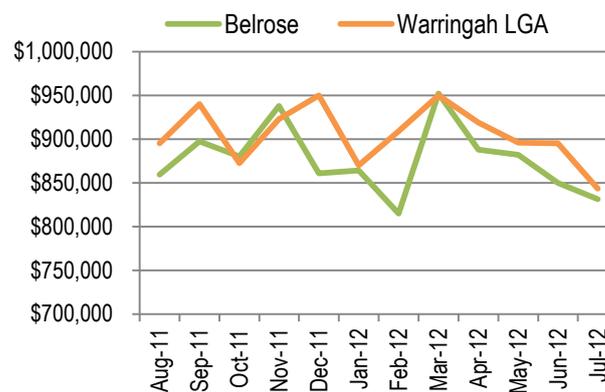
Source: ABS Census 2011

A1.7 Housing Costs

Housing Prices

Median house prices within the Belrose suburb tended to be slightly lower than the median for the Warringah LGA based on the 2011 ABS Census. Despite a fall in prices from November 2011 to February 2012, house prices in the Belrose suburb rebounded sharply between February and March 2012 to be comparable to the wider LGA median.

Figure A1.13 Housing Prices for the Belrose suburb and the Warringah LGA (2011-2012)



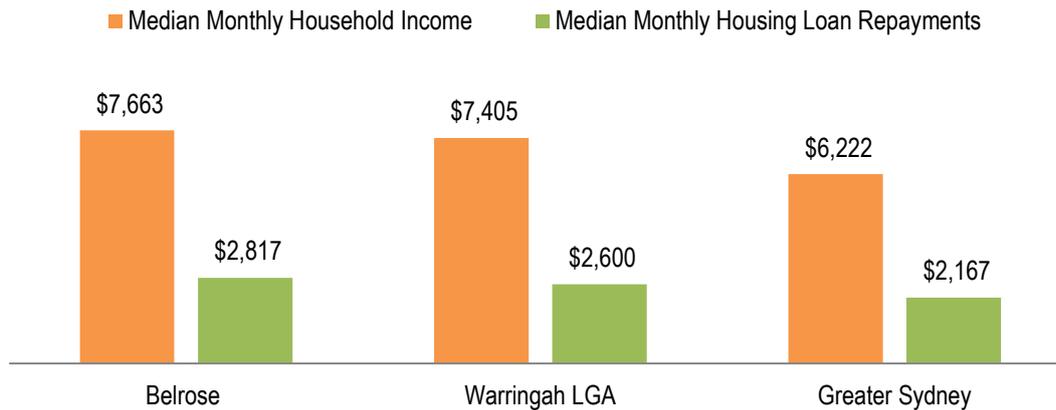
Source: RP Data

Housing Costs and Affordability

Compared to the Warringah LGA and Greater Sydney's, residents in the Belrose suburb tended to have a larger mortgage and use a greater proportion of their household income to service it. According to the 2011 ABS Census the median monthly mortgage was \$2,817 in the Belrose suburb and households were using 37% of their income to service it (Figure A1.14). Within the LGA the median monthly mortgage was \$2,600 which represented 35% of households' median income. Across Greater Sydney the median monthly mortgage was \$2,167 which represented 35% of median household incomes.

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

Figure A1.14 – Monthly Household Income and Mortgage Repayments for the Study Area (2011)

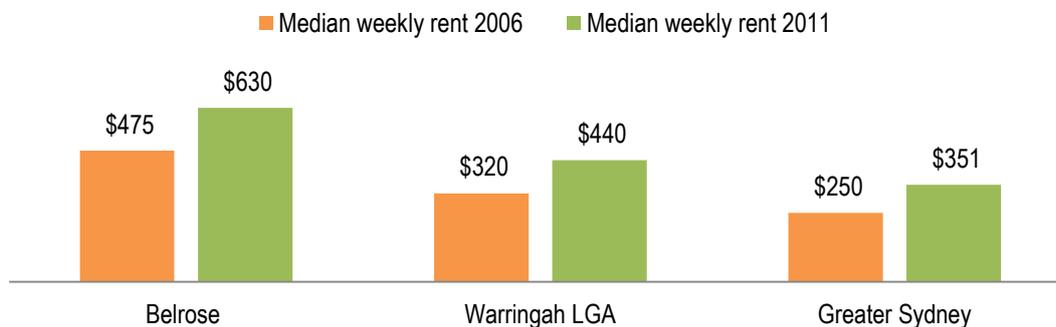


Source: ABS Census 2011

Rental Costs and Affordability

Over the 2006 to 2011 period the median weekly rent in the Belrose suburb increased by 33% from \$475 to \$630, this increase was below that of Warringah and Greater Sydney which increased by 38% and 40% respectively. Although the Belrose suburb rental market increased by a smaller percentage, the median weekly rent paid within the Belrose suburb remained higher than both the Wider LGA and Greater Sydney

Figure A1.15 Median Weekly Rent (2006-2011)



Source: ABS Census 2006 and 2011

A1.8 Index of Advantage and Disadvantage

Notwithstanding the analysis provided above, it is important to note that a review of weekly household incomes alone may not accurately shed light on the affluence of a resident population. By way of example, a review of weekly incomes alone fails to consider an area with an ageing population and thereby an area with a high level of retirees who have left the workforce yet still have a substantial asset base. Accordingly we have applied the Socio Economic Index for Areas (SEIFA) as an alternative means of assessing the socio economic character of Belrose.

The SEIFA³⁷ is produced by the Australian Bureau of Statistics and compares geographic areas (LGAs and derived suburbs) with respect to advantage and disadvantage. The SEIFA, Index of Socio Economic

³⁷ The SEIFA data based on the 2011 ABS Census will be available from 28 March 2013.

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

Disadvantage and Advantage (the 'Index') is derived from the attributes of an area's residents such as income, educational attainment, rate of unemployment and labour force skill. Accordingly, the SEIFA shows where the affluent (as opposed to just high income earning) live; where disadvantaged (as opposed to the unemployed) live; and where the highly skilled and educated (as opposed to the tertiary educated people) live. The findings can be used to facilitate research into the relationship between socio economic status and various health and educational outcomes to determine areas that require funding and services and to identify new business opportunities. The Index refers to the area in which a person lives, not to the socioeconomic situation of the particular individual. For the Index, every geographic area in Australia is given an SEIFA score which shows how disadvantaged that area is compared with other areas in Australia. *Higher scores* on the Index occur when the particular geographic area has higher family incomes and a more skilled labour force. A higher score means that an area is more advantaged and accordingly a lower score indicates that an area is more disadvantaged.

The below figure shows the SEIFA Index of Relative Socio-economic Advantage and Disadvantage (2006) indicating the top 10 rated suburbs within Warringah LGA, the lowest 3 rated suburbs within the LGA and a comparison to the lowest and highest scoring that a suburb attained within Australia.

On this basis, the SEIFA Index of Relative Socio-economic Advantage and Disadvantage (2006) found that Belrose was ranked 8th in the top 10 suburbs with a SEIFA score of 1160. This score places Belrose within the 98th percentile ranking of suburbs within Australia (i.e. top 2% most advantaged suburb in Australia).

Figure A1.16 – SEIFA Index of Advantage / Disadvantage – Sample of Suburbs (2006)



Source: ABS Census 2006

A1.9 Summary of Findings

Since 2006 the suburb of Belrose has experienced a decline in its resident population (-120) and dwelling stock (-83 dwellings). Demographic analysis revealed residents of Belrose generally live in larger households and are increasingly educated, white collar and affluent in comparison to the average for Greater Sydney. Workforce participation rates amongst this relatively advantage community are high and levels of unemployment low.

Whilst residents of Belrose tend to be on average older, the predominant age group in 2011 was 0-14 years which constitutes 21% of the local population. Belrose has also become more family orientated, with the proportion of family households increasing by 2% since 2006.

Appendix 1: Socio-Demographic Analysis Based on ABS Census Data

With regard to built form, Belrose has a large proportion of detached dwellings which contain more people and bedrooms than the average for Greater Sydney. Home ownership levels in Belrose (87%) are also significantly higher than the average for Greater Sydney (65%).

In summary the Belrose is a well-established family orientated suburb inhabited by relatively advantaged, educated and affluent residents.