PLANNING AND DEVELOPMENT COMMITTEE

19 JUNE 2017

APPENDICES RELATING TO

PDC17/22 PLANNING PROPOSAL (R16-5) - SOUTHLAKES ESTATE, DUBBO

APPENDIX 1	Original Planning Proposal - October 2016
APPENDIX 2	Amended Planning Proposal - April 2017
APPENDIX 3	Hill PDA Third Party Review - South East Neighbourhood Centre

PLANNING PROPOSAL

PROPOSED REZONING OF R2 LAND AND AMENDMENTS TO THE MINIMUM LOT SIZE WITHIN THE SOUTH EAST URBAN RELEASE AREA

MAAS GROUP PROPERTIES

OCTOBER 2016

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October 2015

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August & September 2016

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Prepared by Envirowest Consulting Pty Ltd
September 2016

APPENDIX E
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Prepared by Ozark Environmental & Heritage Management Pty Ltd
May 2015

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CONTAMINATION INVESTIGATION STUDY
Prepared by Envirowest Consulting Pty Ltd
September 2016

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Prepared by Ozark Environmental & Heritage Management Pty Ltd
June 2015

Executive Summary

The intention of the Planning Proposal (PP) is to create a planning regime that supports development of the land in a generally consistent manner to that of the existing Southlake's Estate. The PP would provide greater flexibility and choice in residential land and housing product and the provision of a public recreation area within and adjacent to a realigned drainage corridor and the provision of a new neighbourhood centre within the south east urban release area of Dubbo from that currently available under the homogenous residential zoning regime of the *Dubbo Local Environmental Plan 2011 (LEP)*.

The proposed rezoning and subsequent changes to the minimum allotment size of the LEP would facilitate a Master Planned Neighbourhood that would provide;

- Greater flexibility and choice in residential land and housing product within the south east urban release area and the greater residential market of Dubbo. In particular, increasing the medium density and housing choice options in proximity to proposed local collector roads, recreation areas and commercial zones;
- An additional neighbourhood business centre supporting additional local business opportunities in convenient locations for the future residents of the south east of Dubbo; and
- Public recreation areas within and adjacent to the realigned drainage corridor providing opportunities for passive and active recreation for residents of the south east of Dubbo through the landscaped corridor that incorporates cycle ways, footpaths, decorative lakes and parklands.

It is anticipated that primarily the PP would facilitate;

- A combination of single and two storey low density development with some higher building heights achieved upon larger medium density development;
- A neighbourhood business centre of a similar building height to that of surrounding development adjoining and with direct pedestrian and road links to public recreation land and the local road network;
- A retail GFA greater than 1,000m^2 providing the consent authority has considered the economic impact of proposed retail development is satisfied that the development will not have an impact on the commercial hierarchy of Dubbo;
- A retail centre which permits the provision of a gym or like use as defined under the DLEP as recreation facility (indoor);
- Varied infrastructure designed to provide stormwater management integrated into the design of proposed landscaped recreation areas; and
- Recreation and suitable landscaped areas to enhance the amenity of the local area.

This PP affects the *Land Zoning Map – Sheet LZN_008B* and the *Minimum Lot Size Map – Sheet LSZ_008B* of the *Dubbo Local Environmental Plan 2011* (DLEP). In particular, the PP affects three (3) separate land holdings (Lot 503 DP 1152321, Lot 12 DP 1207280 & Lot 399 DP 1199356) within the South East of Dubbo bounded by Boundary Road to the north, Henessy Road to the south Sheraton Road to the east and the existing Southlakes Estate to the west.

This PP seeks to rezone:

- part of the existing R2 – Low Density Residential land to R1 - General Residential land;
- part of the existing R2 – Low Density Residential land to B1 - Neighbourhood Centre;
- part of the existing R2 – Low Density Residential land to RE1 – Public Recreation by the realignment of the existing drainage corridor land (Lot 503 DP 1152321);

The PP seeks to amend the minimum lot sizes for the land affected by the amended rezoning, as follows:

- The southern portion of R2 zoned land to comprise a minimum lot size range of 600m^2 to 4000m^2;

- R1, RE1 & B1 zoned land comprise no minimum lot size;

The R1 and B1 land have been chosen to facilitate higher density residential land options and commercial use land options adjacent to or within close proximity to public recreation land, walkways, and drainage reserves. It is envisioned that the PP would assist in providing a more flexible development suite and potential subdivision layout for each future site within the indicative lot layout of the PP than that currently achievable under the homogenous R2 zoned land.

Due to the minor nature of the proposal, approval of the planning amendments is sought from the Director-General of the Department of Planning as part of the Gateway Determination.

Details of the proposal's compliance with all applicable strategic, regional, and local planning instruments, state environmental planning policies, and ministerial directions are contained in the body of this report.

This PP has been prepared in accordance with the NSW Department of Planning's (DoP) advisory documents *'A Guide to Preparing Local Environmental Plans'* and '*A Guide to Preparing Planning Proposals'.*

Background

1.1 INTRODUCTION

Maas Group Properties have prepared this PP to support a proposed amendment to the *Dubbo Local Environmental Plan 2011*. This PP affects the *Land Zoning Map – Sheet LZN_008B* and the *Minimum Lot Size Map – Sheet LSZ_008B* of the *Dubbo Local Environmental Plan 2011* (DLEP). In particular, the PP affects three (3) separate land holdings (Lot 503 DP 1152321, Lot 12 DP 1207280 & Lot 399 DP 1199356) within the South East of Dubbo bounded by Boundary Road to the north, Henessy Road to the south Sheraton Road to the east and the existing Southlakes Estate to the west.

This land is nearing readiness for development as the existing residential estate of Southlakes progress east towards the property boundary.

The proposed rezoning and subsequent changes to the minimum allotment size of the LEP would facilitate a Master Planned Neighbourhood that would provide;

- Greater flexibility and choice in residential land and housing product within the south east urban release area and the greater residential market of Dubbo. In particular, increasing the medium density and housing choice options in proximity to proposed local collector roads, recreation areas and commercial zones;
- An additional neighbourhood business centre supporting additional local business opportunities in convenient locations for the future residents of the south east of Dubbo; and
- Public recreation areas within and adjacent to the realigned drainage corridor providing opportunities for passive and active recreation for residents of the south east of Dubbo through the landscaped corridor that incorporates cycle ways, footpaths, decorative lakes and parklands.

It is anticipated that primarily the PP would facilitate;

- A combination of single and two storey low density development with some higher building heights achieved upon larger medium density development;
- A neighbourhood business centre of a similar building height to that of surrounding development adjoining and with direct pedestrian and road links to public recreation land and the local road network;
- A retail GFA greater than 1,000m^2 providing the consent authority has considered the economic impact of proposed retail development is satisfied that the development will not have an impact on the commercial hierarchy of Dubbo;
- A retail centre which permits the provision of a gym or like use as defined under the DLEP as recreation facility (indoor);
- Varied infrastructure designed to provide stormwater management integrated into the design of proposed landscaped recreation areas;
- Recreation and suitable landscaped areas to enhance the amenity of the local area.

This PP affects the *Land Zoning Map – Sheet LZN_008B* and the *Minimum Lot Size Map – Sheet LSZ_008B* of the *Dubbo Local Environmental Plan 2011* (LEP).

The proposal is considered to be of a minor nature and in this respect approval is sought from the Director-General of the Department of Planning as part of the Gateway Determination.

Details of the proposal's compliance with relevant strategic, regional, and local planning instruments, state environmental planning policies, and ministerial directions are contained in the following sections.

1.2 SCOPE OF REPORT

This PP has been prepared in accordance with the NSW Department of Planning's advisory documents *'A Guide to Preparing Local Environmental Plans'* and *'A Guide to Preparing Planning Proposals'*. The latter document requires the PP to be provided in four (4) parts, those being;

- *Part 1* – A statement of the objectives or intended outcomes of the proposed LEP;
- *Part 2* – An explanation of the provisions that are to be included in the proposed LEP;
- *Part 3* – The justification for those objectives, outcomes, and provisions and the process for their implementation;
- *Part 4* – Mapping; and
- *Part 5* – Details of the community consultation that is to be undertaken on the Planning Proposal.

It is noted that Part 4 would be confirmed following a Gateway Determination of this Planning Proposal by the NSW Department of Planning and Environment.

1.3 STRUCTURE

This PP is provided in the following structure;

- **Section 2** provides an overview of the subject site; the development intent; and development constraints;
- **Section 3** provides a statement of the objective and explanation of provisions of the PP;
- **Section 4** provides justification regarding the need for the PP; outlines its relationship to strategic planning strategies; and overviews the environmental, economic, and social impacts of the proposal;
- **Section 5** provides the proposed mapping amendments relating to the Planning Proposal area; and
- **Section 6** details how community consultation is to be undertaken with respect to the PP.

Overview

2.1 THE SUBJECT SITE

2.1.1 SITE DESCRIPTION AND LOCATION

This Planning Proposal (PP) affects a portion of land known identified as Lot 399 DP 1199356, Lot 12 DP 1207280 & Lot 503 DP 1152321 within the South East Urban Release Area of Dubbo bounded by the future extension of Boundary Road to the north, Henessy Road and its future extension to the south and the eastern extent of the Southlakes Estate to the west and Sheraton Road to the east.

This land is nearing readiness for development as the existing residential estate development of Southlakes progress east towards the property. This land is located within the visible transition and eastern edge of Dubbo's South Eastern Urban Development Precinct, being the Sheraton Road and Hennessy Road corridors.

Plate 1 provides an aerial view of the land relative to the city of Dubbo and surrounding development which is the subject of this PP.

Plate 1: Aerial view of the subject land, Dubbo City and surrounding development (source: www.maps.sixnsw.gov.au)

2.2 DEVELOPMENT INTENT

The intention of the Planning Proposal (PP) is to provide;

- Greater flexibility and choice in residential land and housing product within the south east urban release area and the greater residential market of Dubbo. In particular, increasing the medium density and housing choice options in proximity to proposed local collector roads, recreation areas and commercial zones;

- A neighbourhood business centre to compliment the south east urban release area with retail services and providing additional local business opportunities; and

- Public recreation areas within and adjacent to the realigned drainage corridor providing opportunities for passive and active recreation for residents of the south east of Dubbo through the landscaped corridor that incorporates cycle ways, footpaths, decorative lakes and parklands

It is anticipated that primarily the PP would facilitate;

- A combination of single and two storey low density development with some higher building heights achieved upon larger medium density development;
- A neighbourhood commercial centre complimenting the surrounding urban release area and its development adjoining and with direct pedestrian and vehicle links to public recreation land and the local road network;
- A retail GFA greater than 1,000m^2 providing the consent authority has considered the economic impact of proposed retail development is satisfied that the development will not have an impact on the commercial hierarchy of Dubbo;
- A retail centre which permits the provision of a gym or like use as defined under the DLEP as recreation facility (indoor);
- Varied infrastructure integrated with the future road and landscaped recreation areas;
- Landscaped recreation spine through the estate that enhances the amenity and connectivity of the estate, its residents and all the various uses within.

2.2.1 EXISTING ZONE REGIME AND PERMISSIBILITY

The existing Land Zoning Map – Sheet LZN_008B describes a land zoning regime for the site of R2 – Low Density Residential with RE1 – Public Recreation Area for Lot 503 being the existing land used to convey overland stormwater through the site.

The current R2 zoning application across the south east precinct results in a large expanse of land area with a predominantly homogenous residential development potential and without a broad choice of building types supported by a future neighbourhood centre.

The nearest local 'business' centres are approximately 2km to the north and west from the sites north western corner (via either Boundary Road and Wheelers Lane) with other business zoned land located along the Mitchell Highway (Cobra Street) to the east and west.

The B1 Local Centre Zone land use table is a closed table and does not permit the use of land zoned B1 for use as a 'recreation facility (indoor). A DLEP B1 land use table extract is provided below:

Zone B1 Neighbourhood Centre

1 Objectives of zone

- To provide a range of small-scale retail, business and community uses that serve the needs of people who live or work in the surrounding neighbourhood.

- To ensure the growth of each neighbourhood centre is consistent with the commercial hierarchy of the City of Dubbo.

2 Permitted without consent

Environmental protection works; Home-based child care; Roads

3 Permitted with consent

Amusement centres; Boarding houses; Business premises; Car parks; Child care centres; Commercial premises; Community facilities; Educational establishments; Entertainment facilities; Environmental facilities; Function centres; Health consulting rooms; Home businesses; Home industries; Home occupations; Information and education facilities; Medical centres;

Neighbourhood shops; Passenger transport facilities; Places of public worship; Respite day care centres; Shop top housing; Signage; Tourist and visitor accommodation; Veterinary hospitals; Waste or resource transfer stations; Water reticulation systems

4 Prohibited

Advertising structures; Bed and breakfast accommodation; Bulky goods premises; Cellar door premises; Farm stay accommodation; Garden centres; Hardware and building supplies; Kiosks; Landscaping material supplies; Markets; Office premises; Plant nurseries; Pubs; Restricted premises; Roadside stalls; Rural supplies; Timber yards; Vehicle sales or hire premises; ***Any other development not specified in item 2 or 3***

Plate 2 below details the current land zoning regime within the South East Precinct.

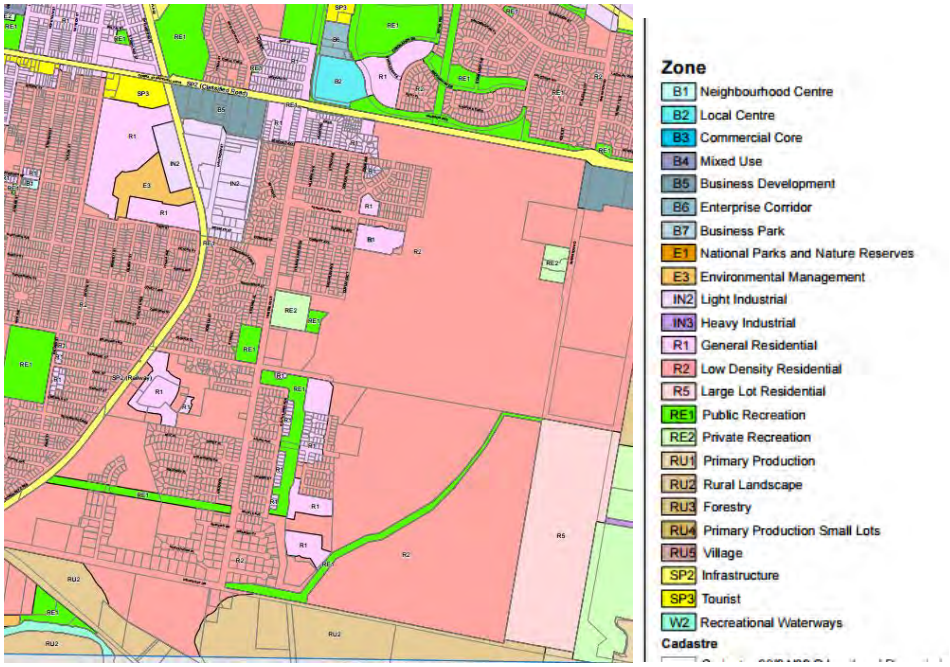

Plate 2: DLEP 2011 Zoning Map LZN_008B extract (Source: www.legislation.nsw.gov.au)

Additional local provisions also apply to the shops in Zone B1 Neighbourhood Centre as prescribed by Clause 7.12 of DLEP the objective of this clause is to maintain the commercial hierarchy of Dubbo by encouraging retail development of an appropriate scale within neighbourhood centres. Subclause (2) does not allow Council to grant development consent to retail development that will exceed a GFA of 1,000m^2. Clause 7.12 extract of the DLEP is provided below:

7.12 Shops in Zone B1 Neighbourhood Centre

(1) The objective of this clause is to maintain the commercial hierarchy of Dubbo by encouraging retail development of an appropriate scale within neighbourhood centres.

(2) Despite any other provision of this Plan, the consent authority must not grant development consent to development for retail premises on land within Zone B1 Neighbourhood Centre if the gross floor area of the development will exceed 1,000 square metres.

(3) Before granting consent to development for the purpose of shops having a gross floor area of 500 square metres or greater, in either one separate tenancy or any number of tenancies, the consent authority must consider the economic impact of the proposed development and be satisfied that the proposed development will not have an adverse impact on the commercial hierarchy of Dubbo.

2.2.2 EXISTING MINIMUM LOT SIZE RESTRICTIONS

Upon viewing the LEP Minimum Lot Size Map – Sheet LSZ_008B the predominant minimum lot size for the majority of R2 zoned land upon the site is 600m^2 with a minimum lot size of 4000m^2 for land adjoining Henessy Road.

Southlakes Estate

The existing residential land within the developed Southlakes Estate is comprised of:

- R1 zoned Land adjoining the stormwater 'lakes' system with no minimum lot size;
- R1 zoned land adjoining the stormwater 'lakes' system with a minimum lot size of 300m^2;
- R2 zoned land adjoining the creek lake system and also generally comprising the majority of the sites land mass with a minimum lot size of 600m^2;
- R2 zoned land in the southern portion of the site north of Hennesy Road with a minimum lot size of 2000m^2

Business and Recreation Land

No minimum lot size is applicable for business zoned land or public recreation land consistent with the general provisions of the LEP as detailed upon the current LEP minimum lot size map shown in Plate 3 below.

The current minimum lot size application across the south east precinct results in a large expanse of land area with a predominantly homogenous residential development potential in the form of standard low density residential subdivision.

Plate 3 below details the current minimum subdivision allotment size regime permissible under the LEP within the South East Precinct. The site is outlined in red.

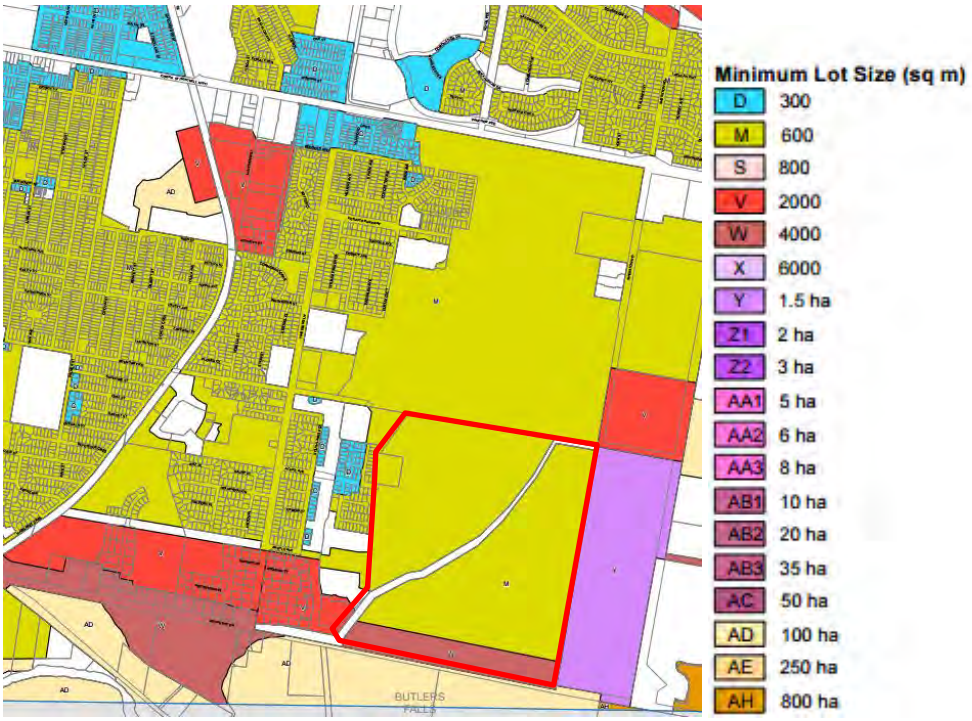

Plate 3: DLEP 2011 Minimum Lot Size Map LSZ_008B extract (Source: www.legislation.nsw.gov.au)

2.2.3 PROPOSED ZONE REGIME

The intention of the rezoning is to provide;

- A combination of single and two storey low density development with some higher building heights achieved upon larger medium density development;
- A neighbourhood commercial centre complimenting the surrounding urban release area and its development adjoining and with direct pedestrian and vehicle links to public recreation land and the local road network;
- A retail GFA greater than 1,000m^2 providing the consent authority has considered the economic impact of proposed retail development is satisfied that the development will not have an impact on the commercial hierarchy of Dubbo;
- A retail centre which permits the provision of a gym or like use as defined under the DLEP as recreation facility (indoor);
- Varied infrastructure integrated with the future road and landscaped recreation areas;
- Landscaped recreation spine through the estate that enhances the amenity and connectivity of the estate, its residents and all the various uses within.

Plate 4 below shows the proposed zoning amendments within the South East Precinct.

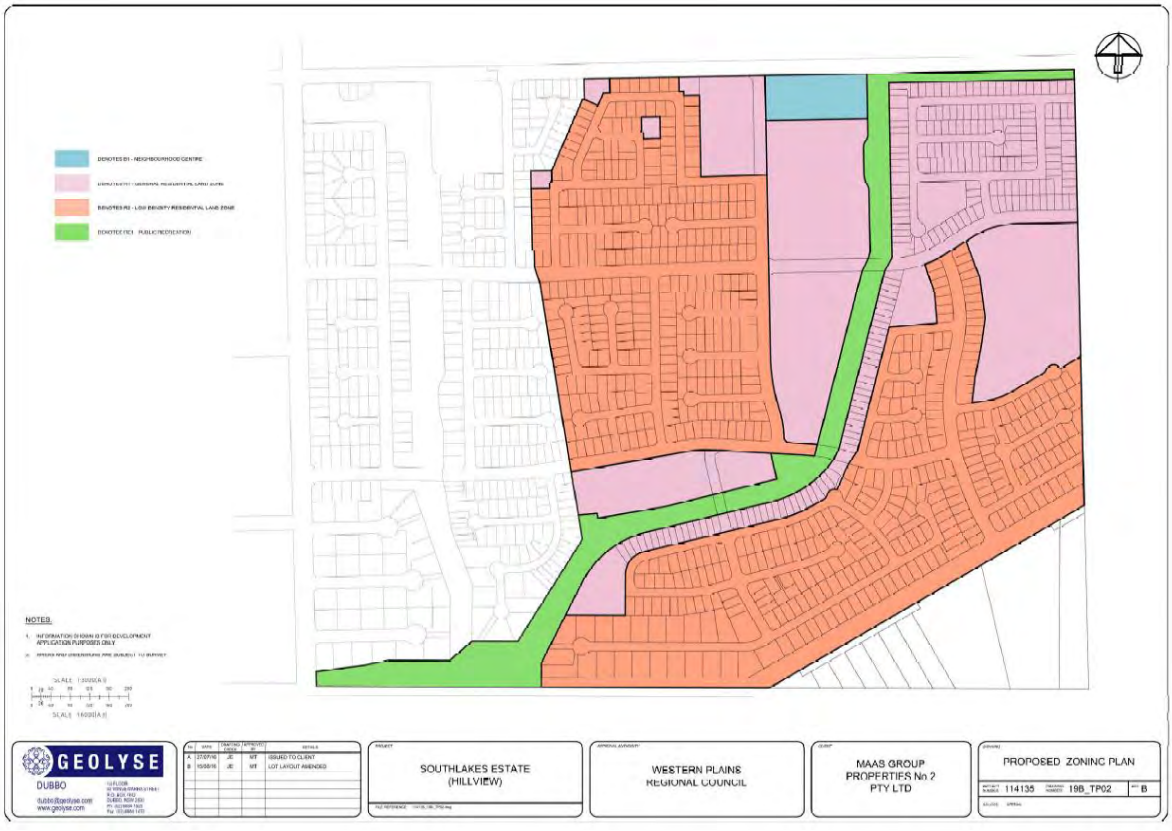

Plate 4: Proposed zoning plan extract (Geolyse Pty Ltd 114135_19B_TP02)

The proposed zoning regime has been developed to;

- Provide a for a variety of housing types and densities;
- Provide higher density residential living adjacent to or within close proximity to neighbourhood shops, public recreation land, cycle ways, walkways, and drainage reserves;
- Provide low density housing within a landscaped setting on the fringe of the Dubbo urban area;

- Provide a range of small-scale retail, business and community uses that serve the needs of people who live or work within the immediate surrounding neighbourhood whilst ensuring the economic viability of the Dubbo CBD and surrounding business zones
- Provide land for infrastructure and related uses;
- Provide land to be used for public open space and recreational purposes; and
- Enhance existing drainage infrastructure land and its surrounding natural environment for recreational use.

2.2.4 PROPOSED MINIMUM LOTS SIZE REQUIREMENTS

In accordance with the Land Zoning Map LZN_008B and Lot Size Map LSZ_008B of the *Dubbo Local Environmental Plan 2011* (LEP), the identified R1 – General Residential land is accompanied by no minimum lot size and a minimum lot size of 450m^2 and the majority of the identified R2 – Low Density Residential land is accompanied by a minimum lot size of 600m^2 with the remaining R2 land having a minimum lot size of 800m^2 and 2000m^2. No minimum lot size applies to RE1 or B1 zoned land of the LEP generally consistent with that immediately to the west.

The proposed B1 zone is approximately 19,500m^2 in area with approximate dimensions of 209.5m (Boundary Road frontage) and 93m (drainage reserve frontage).

Plate 5 below shows the proposed minimum lot size amendments within the South East Precinct.

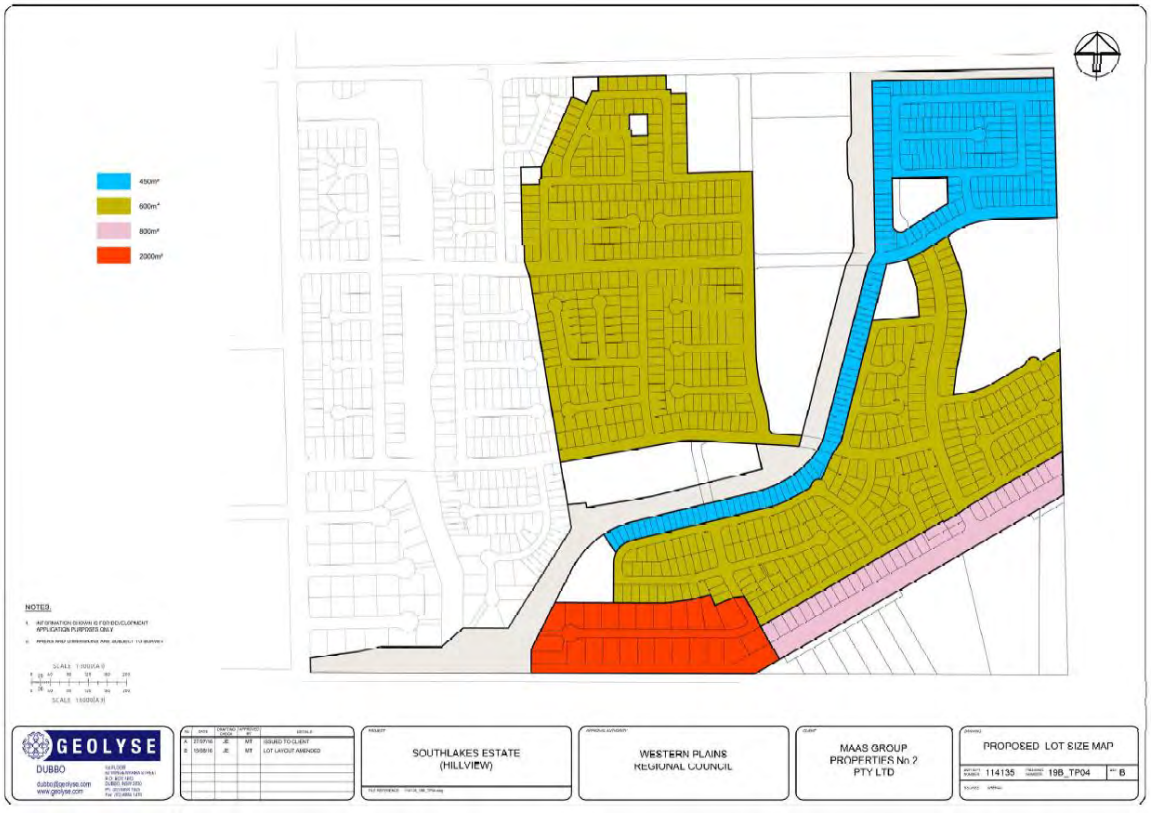

Plate 5: **Proposed lot size plan extract (Geolyse Pty Ltd 114135_19B_TP04)**

As stated above, the intention of the amendment to the minimum allotment size for residential zoned land is to provide greater flexibility and choice in residential land and housing product within the south east land release areas and the greater residential market of Dubbo.

As the future development of these sites would facilitate the establishment of different types of residential development and lots beyond that currently achievable under the LEP land zoning and lot size provisions.

No minimum lot size is provided for B1 and RE1 zoned land consistent with current minimum lot size requirements under the *Dubbo Local Environmental Plan 2011.*

In this regard an amendment to the abovementioned Land Zoning and Lot Size provisions of the LEP would be required in order for the future development of these sites to be permissible and compliant.

2.2.5 ANTICIPATED DEVELOPMENT TYPOLOGIES

It is anticipated that primarily the PP would facilitate a combination of single and two storey development with the majority of development being single storey in height.

The following types of housing to be provided within the R1 zoned land would be:

1. Traditional medium density (multi dwelling housing) development generally in the form of attached 2 bedroom single storey dwellings approximately 4 to 6 dwellings long.

2. Small lot housing (attached and semi-detached dwellings), generally where divided by through roads and drainage corridors and in the form of attached and detached dwellings with minimal private curtilage upon local through roads.

3. Integrated house and land development (Multi dwelling housing, attached dwellings, semi-detached dwellings, and dwellings) with private roads, open space and community facilities.

It is anticipated that the R1 zoned areas would be developed with a mix of all forms of housing ranging from the traditional medium density housing to integrated house and land development.

It is envisaged that the R2 zoned areas would be developed with a mix of traditional house and land development with larger lot living located along the southern fringe.

It is anticipated that the B1 zoned land would be developed with a local neighbourhood business centre that provides a range of supporting retail uses centred around a supermarket with associated parking, loading and unloading, and landscaped areas.

It is envisaged that the RE1 zoned land would be landscaped with a range of vegetation and developed with decorative lakes children's playground and footpaths to provide active and passive recreation areas for residents.

Examples of concept development designs have been compiled to give Council an understanding of the general form and style of development anticipated for the proposed zones are provided at **Appendix A**.

2.2.6 PROPOSED DEVELOPMENT OBJECTIVES

The development of the land is to be developed generally in accordance with the following objectives

- Provide for a neighbourhood centre, attached dwellings and multi dwelling housing in areas of increased amenity including land adjoining or opposite:
    - Neighbourhood centre shops;
    - Parks and open space; and
    - Drainage land corridor.
- Provide opportunities for community open space integrated into the subdivision design.
- Provide opportunities for an increased range of smaller residential lot sizes and varied housing product to the community whilst not preventing the development of detached, single storey dwellings and provide options to make these housing options easier to deliver.
- Provision of local roads including loop roads and laneways for traffic circulation through these areas.

It is noted that future development would be required to be designed in accordance with the objectives of the Dubbo Local Environmental Plan 2011 and Dubbo Development Control Plan 2013, in particular

the development controls for privacy, noise, streetscape amenity and parking provision would be maintained.

In addition to the above objectives it is anticipated that each land use zone would be developed with consideration to the following general objectives:

R1 zoned land

- Provide housing with access to the landscaped 'lakes' corridor which facilitates an active recreation link between the residential zoned land and the neighbourhood centre;
- Provide both local loop roads and lane ways through the larger land areas to create an efficient subdivision layout with effective vehicle and pedestrian circulation;
- Provide varied lot sizes and housing product opportunities integrated with community facilities and open space areas upon larger land areas;
- Provide varied medium density housing options upon smaller land areas including those adjoining and adjacent to opens space and commercial areas;

The market is considered able to provide sufficient varied housing product that is attractive, modern, of good design, employs standard sustainable design provision and is suitably landscaped to ensure an attractive and well-designed development without detriment to future resident's amenity.

It is noted this development is currently being developed within existing R1 zoned land within Southlakes.

R2 zoned land:

- Provide housing with access to the landscaped 'lakes' corridor which facilitates an active recreation link between the residential zoned land and the neighbourhood centre;
- Provide local roads with a mix of traditional grid and some cu-de-sac formation through the majority of the land area to create an efficient subdivision layout with effective vehicle and pedestrian circulation and a range of streetscape typologies;
- Provide varied lot sizes and housing product opportunities with the allotments generally increasing in size as they progress from north to south of the site.

The market is considered to continue to provide attractive, modern, of good design, low density housing products that are suitably landscaped which when the land is full developed would provide for an attractive and well-designed estate.

It is noted this development is currently being developed within existing R2 zoned land within Southlakes.

B1 zoned land:

- Provide a neighbourhood commercial centre with a range of uses to service the daily needs of residents of area;
- Provide a neighbourhood centre with direct access to the adjoining 'lakes' corridor which provides an effective pedestrian link between the neighbourhood centre and the residential zoned land;
- Provide a neighbourhood centre separated from adjoining residential use areas through adjoining roads and landscaped corridor;
- Provide a neighbourhood centre which maintains the commercial hierarchy of Dubbo by providing retail development of an appropriate scale;
- Provide a neighbourhood centre of between 5,000m^2 and 6000m^2 which accommodates a supermarket of at least 3500m^2 and ancillary supporting retail outlets including a gym;
- Provide a neighbourhood centre with direct access to Boundary Road to confirm its identity as the local neighbourhood centre for the urban release area.

The market is considered to provide attractive, modern, good design, commercial development appropriate to surrounding residential and landscaped recreation areas as demonstrated within supporting Economic Impact Assessment prepared by MacroPlan Dimasi dated October 2015 at Appendix B.

It should be noted that the MacroPlan Dimasi assessment includes the recent closure of the full size IGA supermarket within Orana Mall. This amendment within the Dubbo market place adds to the undersupply of supermarket floor space by approximately 3000m^2 (being the floor space of the Super IGA Store previously accounted for in Councils economic impact assessments) resulting in additional capacity within the economy for the provision of an additional supermarket.

RE1 zoned land:

- Provide a landscaped drainage corridor with decorative shallow lakes system through the landscape;
- Provide passive and active recreation areas for use by residents of the area in the form of a children's playground, cycleways, footpaths and bridges meandering through and over a central drainage corridor;
- Provide a landscaped corridor that facilitates additional pedestrian and cycle permeability through the area to adjoining major public transport corridors of Boundary Road, Henessy Road, Wheelers Lane, Sheraton Road including the future freight way;
- Provide a connection through the residential estate to the local neighbourhood centre and adjoining residential estates.

The industry is considered duly able to provide good infrastructure and landscaped areas that would achieve the above objectives as generally designed and detailed within the servicing strategy provided at Appendix C.

2.2.7 SERVICES

A servicing strategy has been prepared and includes the provision of future local roads, water, sewer, stormwater mains infrastructure to support the future development consistent with the required service providers design requirements and similar to that of surrounding arrangements of the urban release area.

In general, telecommunications, roads, power and water service mains are being constructed/extended from the existing mains located to the west within Boundary Road, Wheelers Lane, Argyle Avenue, Azure Avenue and Henessy Road with sewer and stormwater being extended and augmented from their respective downstream mains and would be generally located within the proposed drainage corridor.

The land is to be serviced by all available reticulated utilities, including power, telephone, gas, water and sewerage as are available in the greater locality. Necessary provision and upgrading where required to facilitate the development is acknowledged and generally detailed within the servicing strategy provided at Appendix C. All services would conform to the requirements of the relevant service authority.

2.2.8 TRAFFIC & TRANSPORT CONSIDERATION

R1 and R2 zoned land:

The supporting Traffic Study prepared by Geolyse dated August 2016 and provided at Appendix C calculates the predicted traffic generation rates for the estate once developed in accordance with that indicated upon the masterplan plans numbered 114135_19B_TP02 & TP04.

Once fully constructed the proposed residential estate will be provided with east/west and north/south local collector/spine roads that link to the surrounding local collector roads of Boundary Road, Hennessy Drive and Wheelers Lane

The study identifies additional vehicle trips are not considered to have an adverse impact upon traffic congestion within the surrounding road network and generally result in service levels of A and B for the roads of Boundary Road, Wheelers Lane and their respective intersections as modelled using SIDRA.

It is considered that the surrounding and future road network is of sufficient capacity to cater for the future increase in vehicle trips once developed.

B1 zoned land:

The Neighbourhood Centres would comprise a super market and supporting small retail shops as being like uses that would generate similar trip rates.

The supporting traffic study identifies that the proposed site would be of sufficient area for the provision of onsite parking, loading and unloading and circulation areas.

Once fully constructed the proposed site would provide sufficient area for onsite parking and vehicle circulation that connects to the adjoining road network.

The increase in additional vehicle trips are not considered to have an adverse impact upon traffic congestion within the surrounding road network as they would be designed and constructed to support the additional vehicle trips generated from such development. It is considered that the future surrounding road network is of sufficient capacity to cater for the increase in vehicle trips once developed.

2.3 ENVIRONMENTAL CONSIDERATION

2.3.1 TOPOGRAPHY AND SOILS

The subject site has a gradual slope from north east to south west generally following the existing drainage route through the site. The landform contains trees scattered across the site however is predominantly cleared and maintained for agricultural grazing. Some stormwater drainage has been constructed and runoff is directed into the existing drainage corridor network being an informal open grass overland flow path / channel which ultimately discharges to the designed and partially built southern drainage channel of Southlakes Estate.

The land subject of this PP, is located within the Talbragar Valley Subregion of the Brigalow Belt South Bioregion. Within this subregion Morgan and Terrey (1992) describe the soil environment as;

"Thin stony loams and texture contrast soils over most of the landscape with deeper sands and brown earths on valley floors".

This soil type is consistent with being able to sustain urban development such as residential development subject to design improvements to ensure soil salinity and erosion impact are minimised as detailed below.

2.3.2 SALINITY AND GROUNDWATER

The proposal would have the potential to increase the density of development across the subject sites of varying degree depending upon the proposed zone. The land is mapped by the DLEP 2012 Natural Resource Biodiversity Map Groundwater Vulnerability Map – Sheet CL_008 as being of 'Moderately High Vulnerability'. The development intention for these sites being for a majority of residential with supporting neighbourhood centre development and road and stormwater management infrastructure. The resultant development would manage stormwater collection and disposal in a controlled fashion reducing the threat to the contamination of groundwater or exacerbation of soil salinity.

A *Groundwater and Salinity Study* by Envirowest Consulting has been prepared for the future residential layout of the site and is provided at Appendix D. The objective of this report was to provide detailed information including mitigating options (if required) in relation to dryland and urban salinity processes and groundwater. The report assesses the existing salinity conditions of the soil and groundwater and determine the impact of the development on groundwater.

Generally, the report concludes that the development is suitable for the site and intended development to the area and is of a scale and location in the landscape that is not considered to be high risk and measures are recommended to ensure intended development mitigates any adverse impacts.

2.3.3 FLORA AND FAUNA

As described within the supporting *Ecological Assessment* prepared by Ozark Pty Ltd and provided at Appendix E the site is completely cleared, ploughed and disturbed with few isolated trees.

No known threatened species or ecological communities have been identified as being currently present on these sites. The study identified that the that the vegetation noted upon the site is likely to have been derived from one of the three EECs listed under the TSC Act. In accordance with the TSC Act the 'precautionary principle' has been adopted and an Assessment of Significance has been completed for each to characterise the potential impacts.

Assessments of significance are included within the supporting ecological assessment and having given consideration to the ecology within the subject site, the report concludes the Proposal is:

- Unlikely to significantly affect any of the listed threatened species, fauna populations or communities.
- Unlikely to augment or significantly contribute to any of the National or State listed Key Threatening Processes, if the appropriate safeguards regarding the control of potential vertebrate pests are effectively applied.
- Unlikely to significantly affect any RAMSAR wetland or CAMBA, ROKAMBA or JAMBA listed species;
- Unlikely to significantly affect local hydrology.
- Consistent with ESD principles with regard to fauna, would not adversely affect the local biodiversity and no issue of intergenerational or value added matters are relevant in this instance.

The report concluded that the proposed activity should not be considered to constitute a significant impact and, as such, no Species Impact Statement (SIS) is warranted. No Koala Habitat Management Plan pursuant to SEPP 44 should be required.

2.3.4 BUSHFIRE

Reference is made to Dubbo City Council's Bushfire Prone Land Map which indicates the level of fire risk for properties. In accordance with this Map, the subject land is not identified as being located on bush fire prone land.

2.3.5 FLOODING

The proposed rezoned land is not identified as being within a flood planning area as identified by the *Dubbo Local Environmental Plan 2011.* In this regard the proposed rezoning and the lands future development would not be affected by potential flooding nor result in adverse impact upon the immediate locality.

2.3.6 CONTAMINATION

The soils contained in the area of land proposed for rezoning under this Planning Proposal are of similar quality to that present within the bounds of the adjoining Southlakes Estate. Each of these site have previously been assessed and considered as suitable for residential use and development by past planning rezoning and current development applications across their land.

Notwithstanding, a *Contamination Investigation Study* was conducted by Envirowest Consulting Pty Ltd for the land to ensure the land is suitable for its intended use. The contamination investigation was prepared in accordance with the Contaminated Land Management Guidelines referenced by *State Environmental Planning Policy No. 55 - Remediation of Land*. The final conclusion of the Contamination Investigation Report is as follows:

- The site has a land-use history of grazing;

- There is no evidence of orchards, mines, sheep dips, mixing sheds or contaminating industrial activities on the site;
- The contamination status of the site was assessed from a soil sampling and laboratory analysis program. The soil sampling program did not detect elevated levels of the analysed metals, OCP or TRH. The levels of all substances evaluated were below the EPA investigation threshold for residential and recreational land-use with access to soil. In conclusion no contamination was found;
- Several stockpiles were located across the site. The stockpiles consisted of soil and timber and trace general refuse. No asbestos was identified in the stockpiles on site. The stockpiles are an amenity hazard.

The subject site is therefore suitable for the future residential and recreational activities land uses.

2.4 SOCIAL AND CULTURAL CONSIDERATION

2.4.1 ABORIGINAL ARCHAEOLOGY

An *Archaeological Survey* was conducted by Mr Jim Kelton in August 1995 covering all of the Southlakes Estate, as well as the majority of the land adjacent to Southlakes Estate / Keswick on the Park Estate.

The *Archaeological Survey* was conducted on behalf of Dubbo City Council, in order to assess the potential impacts of the proposed residential developments of the area on local Aboriginal Cultural Heritage, within the terms of the New South Wales *National Parks and Wildlife Act 1974* and the *Environmental Planning and Assessment Act 1979*.

Keltons survey identified the presence of one (1) site located adjacent to the southern boundary of the site which is identified and recorded upon the AHIMS database.

Notwithstanding the above survey Ozark Environmental Management and Heritage conducted an *Aboriginal Archaeological Assessment* of the land to determine the presence and potential impact of the proposal upon aboriginal heritage significance of the area. The assessment is provided at Appendix G.

The survey identified that the land is not likely to contain additional items and that the significance of the existing item is considered 'low'. In this respect and having regard to the indicative lot layout and likely servicing strategy the existing item is likely to require removal through the issue of an AHIP.

It should be noted that if, during the further development of the site, any artefact, potential site or objects of Aboriginal Cultural Heritage Significance are uncovered, works will cease immediately pending referral for an investigation by the NSW National Parks and Wildlife Service in accordance with *the National Parks and Wildlife Act 1974*.

2.4.2 EUROPEAN HERITAGE

The land immediately to the south contains a locally listed heritage item identified by the DLEP as a 'Old Dubbo Homestead'. As the item is segregated by an existing road corridor, future freight way and the Eulomogo Creek it is anticipated that the proposed rezoning and amendments to the minimum allotment size would not adversely impact upon the item and that any future development of this land would not require consideration of the Heritage Item.

The remaining sites do not contain any locally listed heritage items as identified by the DLEP. In this regard the proposed rezoning is not considered to adversely affect the heritage significance of the locality.

Intent and Provisions

3.1 OBJECTIVE

The intention of the Planning Proposal (PP) is to create a planning regime that supports development of the land in a generally consistent manner to that of the existing Southlake's Estate. The PP would provide greater flexibility and choice in residential land and housing product and the provision of a public recreation area within and adjacent to a realigned drainage corridor and the provision of a new neighbourhood centre within the south east urban release area of Dubbo from that currently available under the homogenous residential zoning regime of the Dubbo Local Environmental Plan 2011 (LEP).

3.2 EXPLANATION OF PROVISIONS

This PP affects *Land Zoning Map – Sheet LZN_008B* and *Minimum Lot Size Map – Sheet LSZ_008B* of the DLEP.

This PP seeks to rezone a part of the existing R2 – Low Density Residential land within the South East Precinct of Dubbo as shown upon supporting plans **114135_19B_TP02 & TP04 prepared by Geolyse Pty Ltd** in particular rezone;

The proposed rezoning and subsequent changes to the minimum allotment size of the LEP would facilitate a Master Planned Neighbourhood that would provide;

- Greater flexibility and choice in residential land and housing product within the south east urban release area and the greater residential market of Dubbo. In particular, increasing the medium density and housing choice options in proximity to proposed local collector roads, recreation areas and commercial zones;
- An additional neighbourhood business centre supporting additional local business opportunities in convenient locations for the future residents of the south east of Dubbo; and
- Public recreation areas within and adjacent to the realigned drainage corridor providing opportunities for passive and active recreation for residents of the south east of Dubbo through the landscaped corridor that incorporates cycle ways, footpaths, decorative lakes and parklands.

It is anticipated that primarily the PP would facilitate;

- A combination of single and two storey low density development with some higher building heights achieved upon larger medium density development;
- A neighbourhood business centre of a similar building height to that of surrounding development adjoining and with direct pedestrian and road links to public recreation land and the local road network;
- A retail GFA greater than 1,000m^2 providing the consent authority has considered the economic impact of proposed retail development is satisfied that the development will not have an impact on the commercial hierarchy of Dubbo;
- A retail centre which permits the provision of a gym or like use as defined under the DLEP as recreation facility (indoor);
- Varied infrastructure designed to provide stormwater management integrated into the design of proposed landscaped recreation areas;
- Recreation and suitable landscaped areas to enhance the amenity of the local area.

The R1 and B1 land have been chosen to create higher density residential and commercial use land adjacent to or within close proximity to public recreation land, children's playground, walkways and cycleways in an effort to facilitate a flexible subdivision layout for each site than that currently achievable under the homogenous zoning and minimum allotment regime of the LEP.

Justification

The overarching principles that guide the preparation of PP's are:

- The level of justification should be proportionate to the impact the PP would have;
- It is not necessary to address a question if it is not considered relevant to the PP; and
- The level of justification should be sufficient to allow a Gateway determination to be made with confidence that the LEP can be finalised within the timeframe proposed.

The following justification addresses each relevant question applicable to the PP to ensure confidence can be given to the Gateway determination.

4.1 NEED FOR THE PLANNING PROPOSAL

4.1.1 RESULT OF ANY STRATEGIC STUDY OR REPORT

The PP is not a result of a strategic study or report but rather the current demand of housing choice and residential land product and the need to provide additional local recreation and a local neighbourhood centre within South East Dubbo.

Current land release areas of Dubbo are heavily focused upon delivering the standard R2 – Low Density land and house package yet limited focus exists on delivering medium density options or larger land size.

The existing land supply within the varied zoning regime of the current Southlakes Estate is likely to be exhausted and developed with varied housing product in the near future.

The proposed rezoning seeks to provide a regime for how the land would be developed in the future to create a master planned neighbourhood with a neighbourhood centre and passive and active landscape recreation areas which also serve a dual function of drainage.

Having regard to these current market forces and the reality of housing choice and residential land product within Dubbo it is considered that there is sufficient demand upon the housing market to warrant the expansion of the existing R1 – General Housing zone and continue to vary minimum lot size requirements of both the R1 and R2 zone of the LEP to assist the facilitation of housing choice and varied residential land product centred around a neighbourhood shopping centre within the South East of Dubbo.

The proposed zoning and minimum allotment regime is selected having regard to the lands proximity to public recreation areas, drainage reserve, cycleway and walkways and their proximity to supporting road and infrastructure networks including public transport services. The allotment plan is also focused toward the proposed neighbourhood centre and with regard to the required infrastructure that would support the increased density and commercial development options.

4.1.2 BEST MEANS OF ACHIEVING THE OBJECTIVES OR INTENDED OUTCOMES, OR IS THERE A BETTER WAY

The desired range of housing choice and the provision of neighbourhood commercial development is not comprehensively permissible within the R2 zone and is further limited by the minimum lot size restriction in accordance with the provisions of the DLEP 2011.

The submission of a PP to amend the existing zoning and lot size requirements represents the best method of achieving the desired outcome.

4.2 RELATIONSHIP TO STRATEGIC PLANNING FRAMEWORK

4.2.1 CONSISTENT WITH THE OBJECTIVES AND ACTIONS OF THE APPLICABLE REGIONAL OR SUB-REGIONAL STRATEGY

There are no overriding Regional or Sub-regional strategies that directly relate to the South East Urban Release Area and its future development within the Dubbo Regional LGA or Central West Region.

4.2.2 CONSISTENT WITH COUNCIL'S LOCAL STRATEGY OR OTHER LOCAL STRATEGIC PLAN

South-East Dubbo Residential Urban Release Area Stage 1 Structure Plan

As detailed within the Structure Plan this is the first component of a staged process that aims to ensure residential development opportunities continue to be delivered in Dubbo and in particular the South-East Residential Urban Release Area.

The role of the Plan is to set the overall direction for development in the South-East Residential Urban Release Area, inform land use decisions in the LEP and allow the developers of the Southlakes Estate to pursue a partial development of the Estate having regard to overall infrastructure and servicing constraints.

The objectives of the plan are to

- Identify the opportunities and constraints of the land and the anticipated needs of the community;
- Broadly indicate the likely future development potential of the study area;
- Enable the characteristics of the study area to determine the most appropriate location and form for development;
- Provide a broad context of the consideration, by Council, of individual rezoning submissions within the study area; and
- Establish a vision and set of development objectives which future development proposals will be required to meet;

The Plan provides forty (40) 'Strategic Residential Growth Principles' which have been considered during the preparation of this PP. The principles and a comment having regard to the PP is provided within the following table:

Strategic Residential Growth Principles	Comment
1. *Higher density residential development is encouraged at key locations in the Estate that ensure residents will have a high level of access to public transport, facilities, services and amenity;*	The intent of the allotment regime is to have higher densities located in close proximity to the Neighbourhood Centre and local collector roads of the estate.
2. Seniors housing is encouraged to be provided in locations and formats that provide for integration with residential neighbourhoods, areas of public open space and neighbourhood centre development;	The master plan details some larger parcels in close proximity to the neighbourhood centre and lake system would be suitable for this type of development
3. *Dual occupancy development is encouraged and promoted on land with an area greater than 900m^2 and a frontage of greater than 17m*	Noted.

4. *Dual occupancy development is specifically suited and encouraged as an efficient and effective urban design outcome for corner lots which allows each unit to have a separate frontage and address to a different street;*	Noted.
5. *Small format and small lot housing in the R1 general Residential zone should be provided with a zero lot line on one side boundary to encourage design quality and protect the amenity of residents;*	Noted.
6. *Council will prepare a Residential Design Guide for the use of the Dubbo Development Industry that will encourage site-responsive design and variety of housing offer;*	Noted.
7. *Where applicable and practicable, the provision of shop top housing is encouraged as a mechanism to further activate residential and commercial lands and add further variability in development types;*	The master plan details some larger parcels in close proximity to the neighbourhood centre and lake system would be suitable for this type of development
8. *Small format and integrated housing is encouraged where it can adequately mix with residential neighbourhoods and actively encourage social inclusion*	Noted.
9. *Any future amendment to the Dubbo local environmental plan 2011 to introduce a commercial zoning to facilitate a neighbourhood centre be required to include a maximum floor space limitation to limit the size and configuration of any commercial development to a neighbourhood scale*	The master plans Neighbourhood Centre would be developed and designed to service the needs and add to the amenity of the residents of the Southlakes whilst operating as a viable retail facility without detriment to the CBD of Dubbo and Orana Mall.
10. *Any Planning Proposal to introduce a commercial zone to allow for neighbourhood centre development will be required to provide an economic impact assessment which provides an assessment of such a proposal on the Dubbo Central District, the Orana Mall Market Place and other neighbourhood centres*	An economic impact assessment has been undertaken and is provided at Appendix B.
11. *A variety of access provisions are to be provided to the neighbourhood centre development including facilities for walking, cycling onsite public transport provision and suitable parking for private cars*	A variety of access provisions are provided to neighbourhood centre as it would be connected via walkway/cycleway through the lake system. Sufficient area would be provided on site for parking of vehicles and public transport services.
12. *Any neighbourhood centre development will be of a local scale which will not impact the residential amenity of development.*	Noted, preliminary concept facades are provided at Appendix A.
13. *Residential subdivision establishes a clear urban structure and hierarchy that promotes the creation of*	The master plans layout provides various links to the lakes system reserve through the estate which is

active neighbourhoods and encourages alternative forms of transport;	provided with footpaths and cycleways. The road system would be serviced with footpaths and cycleways along local collector roads linking all use areas within the estate.
14. *The natural attributes of the land should be used and reinforced in subdivision design through the placement of visible key landmark features such as parks and other focal points;*	Noted.
15. *The natural topography of the land shall be used in the design of residential subdivision. The natural site topography is an important design feature to add variation and interest to residential neighbourhoods.*	Noted.
16. *Residential subdivision shall optimise outlook and proximity to public community facilities*	Noted.
17. *Residential allotments shall be provided with a range of lot frontages which actively promotes streetscape variance and allow variation in the size and style of residential housing.*	The master plan has been designed to incorporate a range of lot frontages to assist the promotion of varied streetscapes
18. *Any residential subdivision should comply with the minimum internal connectivity index score of 1.3*	The master plan achieves a connectivity index of 1.18.
19. *Residential development shall not be provided backing onto areas of open space and should be separated by a road or other key access point unless the development provides a suitable level of access to open space areas in accordance with the requirements of Western Plains Regional Council, has open and transparent fencing and promotes living areas fronting open space.*	The master plan details allotments backing onto open space areas of which these lots would be provided within open and transparent fencing and promotes living areas overlooking the public open space.
20. *Any embellishment of current or future lands for the purposes of public open space over and above the requirements of the Dubbo Section 94 Contributions Plan – Open Space and Recreation Facilities shall be at the cost of the developer.*	Noted.
21. *Any developer undertaking embellishment in accordance with Strategic Growth principle 20 shall be required to enter into an appropriate agreement/s with Council in respect of long term maintenance.*	Noted.
22. *Public access and movement shall be maintained across and throughout areas of public open space.*	The master plan includes a footpath and cycleway plan through the public open space.
23. *In any situation where an allotment may have one of its boundaries to public open space, any fencing of this boundary shall be of an open and transparent nature.*	Fencing adjoining the public open space area would be of an open and transparent nature.
24. *The pedestrian and cycleway shall maintain legibility and ease of access to promote safe walking and cycling*	Noted.

25. *Not existent*	Noted.
26. *New growth areas have a variety of destinations within walking or cycling distance and the density of residential development supports the provision of required infrastructure.*	The masterplan provides a connection to all use areas within the estate.
27. *A movement network is created of streets with bicycle lanes that allows the safe interaction and movement for all road users.*	The master plan includes a bicycle network through the estate integrated with the road design.
28. *Major public transport access is provided throughout the land including connections to the Dubbo Central Business District;*	The master plan details suitable connections both existing and new via local collector roads throughout the estate and ultimately to the Dubbo CBD.
29. *A hierarchy of interconnected streets is established that gives safe, convenient and clear access points within and beyond individual subdivisions in the subject area;*	The master plan and supporting traffic study provides a safe and convenient street layout through the site and to adjoining land.
30. *The design of access and movement systems in the area ensures environmental impacts associated with groundwater and salinity are avoided or minimised;*	Noted.
31. *The access and movement system shall ensure the design of future subdivisions provides for energy efficient lot layouts and building orientation.*	The master plan provides a lot layout that has regard to topographical features and their influence upon required supporting infrastructure whilst also trying to achieve an energy efficient lot layout.
32. *Dubbo is maintained as a 10-minute city.*	The traffic study identifies service levels of key intersections to be of levels A and B demonstrating the efficiency of the surrounding road network.
33. *Based on the information included in Figure 20, the balance of the Hillview land (Southlakes Estate) shall only be developed to the location as shown in Figure 20. Land situated in the Stage 2 Structure plan area will require the preparation of an Infrastructure and Servicing Strategy for the overall land area.*	The proposed master plan excludes Stage 2 land.
34. *The Infrastructure and Servicing Strategy referred to in Principle 33 above shall be prepared by the owners of the subject lands.*	This is provided at Appendix C.
35. *The Cardno Keswick Drainage Review, August 2010 (Report No. W4823-1) is the adopted strategy for the provision of stormwater infrastructure to service the subject lands. Any developer seeking a variance to the regime included in the Strategy shall be required to prepare an independent stormwater drainage strategy that can detail how the projected stormwater volumes*	Stormwater management is provided within the Appendix C.

can be managed on the subject lands and through to receiving waters. Council is under no specific requirement to approve any alternative stormwater drainage strategy.	
36. *Any future site specific Development Control plan for the Southlakes lands shall be required to include a detailed section providing overall infrastructure principles and information explaining how residential development is proposed to be serviced in accordance with Councils adopted policies, plans and practices.*	Noted. The provisions of the existing Dubbo DCP would be transposed for future development.
37. *Land degradation and clearing is minimised and natural assets are maintained or enhanced.*	Noted.
38. *Development meets the 'improve or maintain test' by avoiding impacts to areas of high conservation value and providing offsets for unavoidable impacts.*	The site does not comprise areas of high ecological conservation value refer to Appendix F.
39. *Any future development application for subdivision across the subject site will provide a detailed and comprehensive Salinity Study and Salinity and Groundwater Management Plan.*	Already, assessed and provided at Appendix D.
40. *The Fuzzy Box Woodland Endangered Ecological Community contained in Keswick shall be protected from development and enhanced with further plantings and an appropriate management and maintenance regime.*	The site is not located within 'Keswick' and does not comprise areas of high ecological conservation value refer to Appendix F.

Having regard to the above consideration of the Structure Plans Strategic Residential Growth Principles the master plan and supporting reports are considered to be consistent with the Structure Plan.

Dubbo City Urban Development Strategy - Residential Areas Development Strategy 1996-2015

The purpose of the Dubbo City Residential Areas Development Strategy 1996-2015 (Strategy) is *"to provide a spatial, servicing and development control framework that will assure the timely provision of residential development opportunities which fit the needs of Dubbo and the region it services"*. The Strategy was designed to protect land for future residential development and to facilitate the servicing, staging, and release of this land.

The Strategy divides the Dubbo LGA into thirteen (13) separate precincts including seven urban precincts. The subject site falls within the 'South East Precinct'. The Strategy sets a goal to *'Identify and protect the established residential neighbourhoods and ensure a sufficient supply of suitable land to meet the future residential development needs of the city.'* The strategy also recognises this precinct as being very significant to Dubbo due to the precinct being the last extensive area for prospective residential development east of the Macquarie River.

The proposed rezoning would be consistent with the strategy for the following reasons:

- An amended R1 and R2 zone and minimum lot size distribution would facilitate the timely provision of residential development that fits the current needs of Dubbo and the region it services;
- The intent of the PP is to meet the residential housing choice needs of Dubbo;
- The intent of the PP is to ensure a neighbourhood centre and community would be established;
- Development of this allotment would continue to complete the eastward phase of suburban development of Dubbo as the market changes and progresses;
- The sites are located within the visible transition/eastern edge of urban development, being the Sheraton Road and Hennessy Road corridors;

- The future construction and the resultant development would have due consideration to the local environmental constraints;
- It is anticipated that the PP would ensure the Dubbo Construction & Development Industry and the Dubbo Real Estate Industry would be provided with a secure and diverse residential and additional commercial land supply that is anticipated to last beyond 5 years;

Dubbo City Planning & Transportation Strategy 2036

The Dubbo City Planning and Transportation Strategy 2036 has been designed to provide guidance regarding the construction of roads and pedestrian pathways in Dubbo City. The 'Context' of the Plan states that the Strategy is to be considered in future strategic land use planning decisions.

The 'Context' also states that the Strategy does not represent the adopted Strategic Land Use Policy for the City and its future growth. In this regard, and due to the fact that the land is located within an expanding part of the residential area of Dubbo, the PP is considered to be generally accommodated within the scheduling, expectations and recommendations of this strategy. Detailed considerations of the PP against the recommendations of the strategy is not considered warranted.

It should be noted that the strategy makes the following statements to which the PP is considered to remain consistent:

"Residential Development in Dubbo is planned in three sectors, the South East Sector, the North West Sector and the South West Sector.

The Density of existing residential areas is approximately 7.8 dwellings per hectare; this is a gross figure including roads, schools and local community facilities including open space.

Should development continue at this density, the three sectors could accommodate 10,500 dwellings, sufficient until about 2050.

The scheduling for the three sectors if described in Table 2.1 and the location is described in Figure 5.1. …"

4.2.3 CONSISTENT WITH APPLICABLE STATE ENVIRONMENTAL PLANNING POLICIES

Orana Regional Environmental Plan No. 1 – Siding Spring Observatory

The only regional/sub-regional strategy relating to the Dubbo Local Government Area is the *Orana Regional Environmental Plan No.1 – Siding Spring Observatory*. As the Siding Spring Observatory is located more than 100 kilometres away in Coonabarabran, the future proposed development of the site is not considered to be of a scale that would have the potential to cause an adverse effect upon the operations of the Observatory.

State Environmental Planning Policy No. 21 – Caravan Parks

The change in zoning would enable 'manufactured home estate' development as caravan parks are a permitted use within the R1 land use table subject to development consent being granted. If the land were to be developed in this manner such development would be required to ensure it achieves the relevant provisions of this plan. The PP does not include provisions that contradict or hinder the application of this policy. It is not the development intention of these sites to the developed as a caravan park.

State Environmental Planning Policy No. 36 – Manufactured Home Estates

The change in zoning would enable 'manufactured home estate' development as caravan parks are a permitted use within the R1 land use table subject to development consent being granted. If the land were to be developed in this manner such development would be required to ensure it achieves the relevant provisions of this plan. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

An Ecological Assessment provided at Appendix E has been prepared which assesses the impact of the proposal upon ecological communities and or their habitats.

The report concluded that the proposed activity should not be considered to constitute a significant impact and, as such, no Species Impact Statement (SIS) is warranted and no Koala Habitat Management Plan pursuant to SEPP 44 should be required. In this respect the suitability of this site for residential and commercial purposes is considered suitable.

State Environmental Planning Policy No. 55 – Remediation of Land

Clause 6 of the *State Environmental Planning Policy No. 55 – Remediation of Land* requires the issue of contamination and remediation to be considered in zoning or rezoning proposals. A contamination investigation has been prepared for the subject land which found the land to be suitable for its intended development. In this respect the suitability of this site for residential and commercial purposes is considered suitable.

State Environmental Planning Policy No. 64 – Advertising and Signage

The change in zoning would enable limited business uses subject to development consent form Council. If signage were to form part of a future development application the provisions of *State Environmental Planning Policy No. 64 – Advertising and Signage* would apply and the development would need to ensure the relevant provisions of the policy are achieved. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy No 65 – Design Quality of Residential Flat Development

The change in zoning would enable 'Residential Flat Buildings' and 'Shop Top Housing' development of the land subject to development consent being granted. If the land were to be developed in this manner such development would need to ensure it achieves the relevant provisions of this plan. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy (Affordable Rental Housing) 2009

The provisions of *State Environmental Planning Policy (Affordable Rental Housing) 2009* would continue to apply to the land with future development under this plan being subject to development consent being granted. If the land were to be developed in this manner such development would need to ensure it achieves the relevant provisions of this plan. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

The provisions of *State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004* would continue to apply to residential affected development in accordance with the provisions of this policy. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004

The provisions of *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004* would continue to apply to the land with future development under this plan being subject to development consent being granted. If the land were to be developed in this manner such development would need to ensure it achieves the relevant provisions of this plan. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

The provisions of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008* would continue to apply to the land generally consistent with that achievable under the current land zoning. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy (Infrastructure) 2007

The provisions of *State Environmental Planning Policy (Infrastructure) 2007* would continue to apply consistent with that achievable under the current zoning. The PP does not include provisions that contradict or hinder the application of this policy.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The site is not located within any identified resource areas, potential resource areas or transitional areas. There are no known existing mines, petroleum production operations or extractive industries are in the area of the PP or within its vicinity. Given existing development on the site and within the immediate locality the PP would be of minor significance and would not further restrict development potential or create land use conflict beyond existing arrangements.

4.2.4 CONSISTENT WITH APPLICABLE S117 (2) MINISTERIAL DIRECTIONS – 3.1 RESIDENTIAL ZONES

The Minister for Planning and Infrastructure, under Section 117(2) of the EP&A Act 1979 issues directions that local Councils must follow when preparing PP's for new Local Environmental Plans. The directions cover the following broad categories:

1. Employment and Resources
2. Environment and Heritage
3. Housing, Infrastructure and Urban Development
4. Hazard and Risk
5. Regional Planning
6. Local Plan Making

The following section provides an assessment of the PP against the relevant Section 117 directions. Note this section provides the objectives of the relevant direction, a full copy of the directions can be viewed at:

http://www.planning.nsw.gov.au/planningsystem/local.asp.

The following discussion demonstrates the PP's consistency with the relevant Section 117 directions.

Direction 1.1 – Business and Industrial Zones

Ministerial Direction 1.1 – Business and Industrial Zones is applicable as the PP would rezone land for local employment opportunities. The objectives of this direction are to encourage employment growth in suitable locations, protect employment land in business and industrial zones and support the viability of identified strategic centres.

The PP is supported by an economic impact assessment prepared by MacroPlan Dimasi provided at Appendix B and demonstrates that the proposed commercial area would encourage employment growth, not result in adverse impact upon the commercial viability of the Dubbo CBD and Orana Mall and protect existing employment lands of Dubbo.

Direction 1.3 – Mining, Petroleum Production and Extractive Industries

Ministerial Direction 1.3 – Mining, Petroleum Production and Extractive Industries is not applicable as the PP affected land does not prohibit the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials or restricting the potential development of such by permitting a land use that is likely to be incompatible with such development.

It is noted that the sites are currently zoned for residential use and are provided with a buffer of existing residentially zoned land.

Direction 2.1 – Environment Protection Zones

Ministerial Direction 2.1 – Environment Protection Zones does apply to the PP as The Keswick on the Park Estate is mapped by the DLEP 2012 Natural Resource Biodiversity Map NRB_008 as being of 'high' biodiversity significance. The area is known to contain an Endangered Ecological Community (EEC). The site is currently vacant of any vegetation and is currently being constructed for low density residential dwellings. The PP is not considered to adversely affect the EEC.

Direction 2.3 – Heritage Conservation

Ministerial Direction 2.3 – Heritage Conservation is applicable as the PP affected land includes items, areas, objects and places of environmental heritage significance and indigenous heritage significance.

The PP is considered consistent with the objectives of this direction as the existing identified heritage items and the relevant development considerations of the DLEP would remain unaffected by the PP. all future development would require due consideration in accordance with these provisions.

Direction 3.1 – Residential Zones

Ministerial Direction 3.1 – Residential Zones is applicable as the PP proposes to redistribute the residential zones across the site.

The PP is considered consistent with the objectives of this direction as the redistributed rezoning and amended minimum lot sizes;

- Would encourage a variety and choice of housing types to provide for the existing and future housing needs of Dubbo;
- Would make more efficient use of existing and future infrastructure and services of Dubbo;
- Would reduce the consumption of land for housing and associated urban development on the fringe of Dubbo; and
- It is anticipated that future development would be of 'good design' having regard to current modern housing and infrastructure development and construction requirements.

As stated above the PP is located in an area that contains adequate access to services such as sewerage, and water as well as public transport facilities. The future development of the site would make efficient use of these existing services and would reduce the need for additional development to take place upon the urban fringe of Dubbo.

Direction 3.3 – Home Occupations

Ministerial Direction 3.3 – Home Occupations is applicable as the proposed R1 General Residential zone permits dwelling houses. The objective of this direction is to encourage the carrying out of low-impact small business in dwelling houses The PP maintains existing provisions that enable 'home occupations' to be carried out without the need of development consent.

Direction 3.4 – Integrating Land Use and Public Transport

Ministerial Direction 3.4 – Integrating Land Use and Public Transport is applicable as the PP would rezone land for urban residential purposes.

In accordance with the following, the rezoning of the subject site for urban residential purposes must be consistent with the aims and objectives of the following documents.

"A planning proposal must locate zones for urban purposes and include provisions that give effect to and are consistent with the aims, objectives and principles of:

(a) Improving Transport Choice – Guidelines for planning and development (DUAP 2001), and

(b) The Right Place for Business and Services – Planning Policy (DUAP 2001)".

With reference to the abovementioned documents, future occupants of each estate would have access to existing and planned public transport nodes which would traverse these sites and South East Dubbo.

The provision of dwelling house developments in a location serviced by public transport is imperative as future residents would use such services as one of their main means of transportation around Dubbo.

The development of these sites as opposed to other sites in the LGA would negate the need for new transport routes such as new bus routes and road facilities on the urban fringe.

Direction 4.3 – Flood Prone Land

Ministerial Direction 4.3 – Flood Prone Land is not applicable as the PP affected land as detailed upon plans prepared by Geolyse Pty ltd numbered 114135_19B_TP02 and TP04 is not identified as flood prone land by the LEP.

Direction 6.1 – Approval and Referral Requirements

Ministerial Direction 6.1 – Approval and Referral Requirements applies to all Planning Proposals forwarded for Gateway Determination by a local authority.

The proposed rezoning does not include provisions that would trigger a need for concurrence, consultation, or referral to the State Government.

Direction 6.2 – Reserving Land for Public Purposes

Ministerial Direction 6.2 – Reserving Land for Public Purposes applies as this PP would realign and rezone land for public recreation purposes. The objectives of this direction are simply to facilitate the provision of public services and facilities by reserving land for public purposes and to facilitate the removal of reservations of land for public purposes where the land is no longer required for acquisition.

The PP would result in additional land being provided to the public for recreation purposes as a result of the realigned dual public use stormwater channel design accommodating stormwater from the site and upstream catchments (and incorporating suitable freeboard to residential land) and the recreation needs i.e. cycleways, playground and landscaped areas for use by the general public

Direction 6.3 – Site Specific Provisions

Ministerial Direction 6.3 – Site Specific Provisions applies to all Planning Proposals forwarded for Gateway Determination by a local authority.

The PP does not propose to create any site specific development standards in addition to those currently within the principal environmental planning instrument other than to also provide a minimum allotment size of 600m^2 consistent with surrounding R2 zoned land and no minimum allotment size for R1 zoned land, that is consistent with other R1 zoned land within Dubbo.

4.3 ENVIRONMENTAL, SOCIAL AND ECONOMIC IMPACTS

4.3.1 IS THERE ANY LIKELIHOOD THAT CRITICAL HABITAT OR THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS, WILL BE ADVERSELY AFFECTED AS A RESULT OF THE PROPOSAL?

The land is mapped by the DLEP 2012 Natural Resource Biodiversity Map Groundwater Vulnerability Map – Sheet CL_008 as being of 'Moderately High Vulnerability'. The development intention for this land is for residential development with supporting neighbourhood centre development and road and stormwater management infrastructure. The resultant development would manage stormwater

collection and disposal in a controlled and engineered fashion in accordance with relevant experts' advice and recommendations reducing the threat to groundwater.

An Ecological Assessment provided at Appendix E has been prepared which assesses the impact of the proposal upon ecological communities and or their habitats.

No known threatened species or ecological communities have been identified as being currently present on these sites. The study identified that the that the vegetation noted upon the site is likely to have been derived from one of the three EECs listed under the TSC Act. In accordance with the TSC Act the 'precautionary principle' has been adopted and an Assessment of Significance has been completed for each to characterise the potential impacts.

Assessments of significance are included within the supporting ecological assessment and having given consideration to the ecology within the subject site, the report concludes the Proposal is:

- Unlikely to significantly affect any of the listed threatened species, fauna populations or communities.
- Unlikely to augment or significantly contribute to any of the National or State listed Key Threatening Processes, if the appropriate safeguards regarding the control of potential vertebrate pests are effectively applied.
- Unlikely to significantly affect any RAMSAR wetland or CAMBA, ROKAMBA or JAMBA listed species;
- Unlikely to significantly affect local hydrology.
- Consistent with ESD principles with regard to fauna, would not adversely affect the local biodiversity and no issue of intergenerational or value added matters are relevant in this instance.

The report concluded that the proposed activity should not be considered to constitute a significant impact and, as such, no Species Impact Statement (SIS) is warranted. No Koala Habitat Management Plan pursuant to SEPP 44 should be required.

The PP does not affect the existing DLEP 2012 'Additional Local Provisions' for consideration of Natural Resource – biodiversity and Groundwater vulnerability.

4.3.2 ARE THERE ANY OTHER LIKELY ENVIRONMENTAL EFFECTS AS A RESULT OF THE PLANNING PROPOSAL AND HOW ARE THEY PROPOSED TO BE MANAGED?

The parcels of land proposed for rezoning largely consist of vacant grassland of no particular environmental value. No known threatened species or ecological communities are present on each site.

The PP does not propose to amend the flood prone land of the Eulomogo Creek in the south east extent of the site and does not proposed to impact by way of earthworks or road corridors within 80m of the existing creek line.

Any future development of these areas would require due consideration of relevant environmental impacts be undertaken during a development application if Council required assurance whether the land is suitable for the proposed use.

4.3.3 HAS THE PLANNING PROPOSAL ADEQUATELY ADDRESSED ANY SOCIAL AND ECONOMIC EFFECTS?

Due to the site's location within a residential area, the land has adequate access to public transport and due to its location to the Dubbo CBD and the Orana Mall, it is anticipated that a future property owners would be within a reasonable vicinity of any required medical, educational, and retail services and

facilities along with all transport means, including trains, coaches and planes to neighbouring towns and cities.

Additionally, with the inclusion of the proposed Neighbourhood Centre zone it is anticipated that future residents would be within a reasonable distance of future permissible medical and retail services and facilities should they occupy this site once developed.

The PP is supported by an economic impact assessment prepared by MacroPlan Dimasi provided at Appendix B and demonstrates that the proposed commercial area would encourage employment growth, not result in adverse impact upon the commercial viability of the Dubbo CBD and Orana Mall and protect existing employment lands of Dubbo.

4.4 STATE AND COMMONWEALTH INTERESTS

4.4.1 ADEQUATE PUBLIC INFRASTRUCTURE FOR PROPOSAL?

Adequate public infrastructure would be available to all future allotments. The lots would have the capacity to be serviced by sewer, water, and stormwater infrastructure and would each be connected to electricity and telecommunications infrastructure from the surrounding existing service mains designed and installed to service the development of these estates.

As detailed above the land would enjoy reasonable access to public transport and are within close proximity of any required medical, educational, and retail services and facilities and all transport means, including trains, coaches and planes to neighbouring towns and cities.

4.4.2 VIEWS OF STATE/COMMONWEALTH PUBLIC AUTHORITIES CONSULTED IN ACCORDANCE WITH THE GATEWAY DETERMINATION?

The views of state and commonwealth public authorities would be ascertained during the formal course of this PP in accordance with the comments contained in the future Gateway Determination.

Required Instrument Amendments

5.1 AMENDED MAPPING REQUIRED

The following DLEP maps would be amended as part of the PP;

- Land Zoning Map LZN_008B of the DLEP 2011 with regard to the new R1 – General Residential and B1 Neighbourhood Centre zoned land and the amended R2 – Low Density Residential and amended RE1 – Public Recreation a zoned land as shown upon supporting plan **114135_19B_TP02 prepared by Geolyse Pty Ltd**; and
- Lot Size Map LSZ_008B of the DLEP 2011 with regard to the new R1 General Residential and B1 Neighbourhood Centre zoned land and the amended R2 – Low Density Residential zoned land. In particular the amended minimum lot sizes would be as show upon supporting plan **114150_19B_TP04 prepared by Geolyse Pty Ltd.**

The following clauses and schedules of the DLEP would be amended as part of the PP;

- Part 7 Additional Local Provisions clause 7.12 Shops in Zone B1 Neighbourhood Centre by amending subclause (2) to allow Council to grant consent to retail development that would exceed 1,000 square meters where such development maintains the objective of Clause 7.12 being to maintain the commercial hierarchy of Dubbo by encouraging retail development of an appropriate scale within neighbourhood centres. Suggested amended wording is provided as follows:

(2) Development for the purposes of retail premises on land within Zone B1 Neighbourhood Centre that exceeds 1,000 square meters of Gross Floor Area may be carried out but only with development consent.

- Schedule 1 Additional Permitted Uses. In particular the inclusion of an additional use within the proposed B1 zone located upon Boundary Road bounded by Sheraton Road to the east and Wheelers Lane to the west being development for the purposes of recreation facility (indoor);

Community Consultation

6.1 TYPE OF COMMUNITY CONSULTATION REQUIRED

Section 5.5.2 of 'A Guide to Preparing Local Environmental Plans' identifies two different exhibition periods for community consultation;

- Low Impact Proposals – 14 days; and
- All other Planning Proposals (including any proposal to reclassify land) – 28 days.

The Guide describes Low Impact Proposals as having the following attributes;

- *A 'low' impact planning proposal is a planning proposal that, in the opinion of the person making the gateway determination, is;*
    - o *Consistent with the pattern of surrounding land use zones and/or land uses;*

The proposed amendments to the zoning and minimum lot sizes of these site generally accords with Council's local strategies and policies as detailed above and would be consistent with other R1, R2, B1 and RE1 zoned land within the Dubbo.

- o *Consistent with the strategic planning framework;*

Responses have been provided within section 4.2 of this report detailing the proposal's compliance with relevant local, regional and state planning strategies, policies, and ministerial directions.

- o *Presents no issues with regard to infrastructure servicing;*

The future residential development of these sites would have access to sewer, water, and stormwater services, and would be connected with electricity and telecommunications facilities.

- o *Not a principle LEP; and*

Not relevant.

- o *Does not reclassify public land.*

The PP does not seek to reclassify existing public land.

In accordance with the responses to the above 'Low Impact Proposals' guide, the PP is considered to be of low impact as it does not seek to reclassify land and is considered consistent with the Southlakes Structure Plan, the objectives of the LEP and the EP & A Act. Respectfully, it is therefore requested that a community consultation period of 14 days be applied to the exhibition of this PP.

Reference s

Morgan and Terrey. 1992, Nature Conservation in Western New South Wales. National Park Association, Sydney.

NSW Department of Planning (DoP). 2009a, A Guide to Preparing Local Environmental Plans, DoP, Sydney.

NSW Department of Planning (DoP). 2009a, A Guide to Preparing Planning Proposals, DoP, Sydney.

Section 117 Directions Issued by the Minister for Planning dated 1 July 2009 updated 14 April 2016

Drawings

Appendix A

EXAMPLE CONCEPT DESIGNS

Shallow lake with adjoining public reserve area.

Landscaped gardens and reserve furniture within reserve area.

Landscaped lake system with meandering footpaths and cycleway

Detached Dwellings backing onto the lake system

Potential Dual Occupancy Development

Master Planned community with local through roads / access ways

Master Planned community with local through roads directly connected to bushland reserves

Master Planned community with local loop road, central community facilities and open space areas

Attached and multi-unit dwellings fronting community facilities and open space areas

Attached dwellings fronting landscaped pathways through the subdivision

Internal community facilities adjoining residential dwellings.

Internal landscaped areas adjoining residential dwellings.

Landscaped entrance to a Master Planned community delineating between the local road and community areas.

Envisaged Typical Neighbourhood Centre Facades and Street Presentation

Appendix B

ECONOMIC IMPACT ASSESSMENT

Prepared by MacroPlanDimasi

October 2016

Appendix C

SERVICING STRATEGY & TRAFFIC STUDY

All prepared by Geolyse Pty Ltd

August & September 2016

Appendix D

GROUNDWATER AND SALINITY STUDY

Prepared by Envirowest Consulting Pty Ltd

September 2016

Appendix E

ECOLOGICAL ASSESSMENT

Prepared by Ozark Environmental & Heritage Management Pty Ltd

May 2015

Appendix F

CONTAMINATION INVESTIGATION STUDY

Prepared by Envirowest Consulting Pty Ltd

September 2016

Appendix G

ABORIGINAL ARCHAEOLOGICAL ASSESSMENT

Prepared by Ozark Environmental & Heritage Management Pty Ltd

June 2015

East Dubbo, NSW

Economic Impact Assessment

September 2015

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Executive summary

This report presents an independent assessment of the economic impacts and net community benefits relating to the proposed neighbourhood centre being considered in the proposed Hillview residential estate, located in East Dubbo. The following key points summarise our analysis:

Proposed development/masterplan

- The proposed Hillview estate could potentially accommodate in the order of 1,300 – 1400 residential lots, as well as an identified area 38,000 sq.m (i.e. 3.8 hectares) for the neighbourhood centre, located in the central north of the estate.

- No detailed development plans for the neighbourhood centre have been prepared at this stage, however we have been asked to examine the market need, timing and potential economic impacts associated with a full-scale supermarket at the subject site, as well as supporting specialty retail and ancillary non-retail uses.

Hill PDA Dubbo Commercial Floorspace Inventory Analysis 2014 (CFIA)

- The CFIA report identifies the Dubbo CBD as the dominant retail precinct in Dubbo, estimated to contain more than 80,000 sq.m of occupied retail floorspace, serving a regional population of almost 100,000 persons. In addition to this broad regional trade area, the Dubbo CBD retail offer also services tourists to the city and region, as well as the Dubbo CBD workforce, estimated at 4,500 – 5,000 workers.

- The CFIA report showed that there is an under-supply of supermarket floorspace in the Dubbo LGA that is estimated to reach 3,600 – 4,800 sq.m by 2026, and the CFIA report also illustrates a significant under-supply of specialty food stores and other personal and household goods retailing – i.e. the types of retail that might be considered at the proposed neighbourhood centre.

East Dubbo main trade area

- The proposed East Dubbo neighbourhood centre would serve the significant residential growth area in south-east Dubbo area that generally includes the area south of the Mitchell Highway and south-east of Tamworth Street.

- The main trade area population is estimated at 6,800 as at June 2015, including 2,400 residents within the key primary sector.

- The main trade area is expected to absorb the lion's share of total Dubbo population growth over the next 10 – 15 years. We therefore estimate the main trade area population could reach around 10,400 by 2031, reflecting average annual growth of 2.7%, or around 200 - 240 persons per annum.

- The total annual retail expenditure generated by the main trade area population is estimated to growth by around 80% by 2031, in real terms, or around 3.8% per annum, increasing from $88.5 million to $161 million by 2031.

Tourism

- According to Tourism Research Australia, in 2013 Dubbo LGA accommodated around 8,700 international visitors (150,000 visitor nights); around 420,000 domestic overnight visitors (940,000 visitor nights) and around 420,000 domestic day-trippers.

- If total visitor nights are taken together, including an allocation for domestic day-trippers, the visitor market for the Dubbo LGA equates to a year-round, equivalent daily population of about 3,500 – 4,000 persons.

Supermarket market gap and development opportunity

- The Hill PDA CFIA 2014 report indicated that there was an under-supply of supermarket floorspace in the Dubbo LGA, in the order of 2,800 sq.m as at 2011. Accounting for the recent addition of the 1,857 sq.m Aldi supermarket in 2014, the estimated under-supply of supermarket floorspace is estimated to reach 3,600 – 4,800 sq.m by 2026.

- Given the main trade area (i.e. East Dubbo) is likely to accommodate the lion's share of future residential dwelling growth in Dubbo, we consider that a central location in the main trade area (i.e. the subject site) would be a very appropriate location for an additional supermarket in Dubbo.

- There are no supermarket facilities in the identified main trade area, and based on the current population, there is an estimated market gap of supermarket floorspace equivalent to 2,800 sq.m. This market gap is estimated to increase to around 4,100 sq.m by 2026 and 5,000 sq.m by 2031.

- Our analysis indicates that a supermarket of at least 3,500 sq.m could be supported at the subject site before 2021, and we recommend that a total neighbourhood centre of around 5,000 – 6,000 sq.m (retail and ancillary non-retail) could be supported at the subject site, with a strong focus on convenience.

Impacts on the Dubbo retail/commercial centres hierarchy

- Because a significant market gap for supermarket facilities is identified across the Dubbo LGA by 2026 (in the order of 3,800 – 4,600 sq.m), and given the main trade area population generates supermarket floorspace demand of 3,460 sq.m by 2021 and in excess of 4,000 sq.m by 2026, the provision of additional supermarket facilities into the Dubbo retail hierarchy is expected to be comfortably absorbed without any detrimental trading impacts.

- Estimated impacts, modelled in the year 2019/20, across the network of centres in east and south-east Dubbo and the Dubbo CBD are generally expected to average less than 5% (i.e. an average of 4.7%).

- Specific impacts on the Dubbo CBD are expected to be minor, at around 3%, due to the distance of the Dubbo CBD from the subject site, particularly relative to Orana Mall; the significant volume of retail critical mass in the CBD; the additional and unique customer segments served by the CBD – including workers and tourists; and the different role and function performed by the CBD retail offer.

- The greatest impacts are expected to be absorbed by Orana Mall, which is trading exceptionally strongly, and is currently undergoing expansion. We estimate impacts in the order of 8.3%, in the year 2019/20. With 4 – 5 years' worth of growth in the market as well as additional sales from its current expansion, this impact would mean that Orana Mall would be still be achieving sales around 8.5% above its current reported trading volumes, in real terms, in the year of the proposed East Dubbo development.

- Impacts on the smaller neighbourhood centres south of the Mitchell Freeway (including the Tamworth Street and Boundary Road centres) are expected to be minor/moderate, in the order of 3% – 6%, as these centres are not directly competitive with the proposed development as they do not provide full-scale supermarket facilities.

- In summary, our impact analysis shows that there is no prospect that any existing centre will suffer any impact which will threaten its ability to provide a level of service at least equivalent to that which each is providing at 2014/15. Indeed, if the proposed neighbourhood centre is developed around 2019/20, all centres will have had the benefit of 4 – 5 years' of market growth, and even with the new centre added to the network, these centres would be trading at levels significantly above current trading volumes in real terms.

Employment creation

- We estimate the proposed development of a neighbourhood centre at the subject site could potentially result in 169 net jobs onsite and a further 68 jobs across the broader economy.

- Furthermore the construction phase of the project will support temporary construction employment as well as multiplier employment across the broader economy. We estimate that 167 construction jobs per year could be created during the construction of the project, including 64 created directly and a further 103 resulting from multiplier induced effects.

Other net community benefits

- The proposed development will result in additional economic and community benefits including:
  - Increased choice and amenity for the population of the main trade area as well as likely increased competition for the benefit of consumers.
  - More convenient access to new food and grocery shopping facilities, and other supporting retail and non-retail services, to serve both the current residents of the main trade area and future residents.
  - Reduced travels distances, leading to savings on time and fuel for main trade area residents, due to a much better provision of food and grocery shopping facilities at the local level.
  - Reinforcing the retail/centres hierarchy in the Dubbo LGA by providing additional convenience retail to service a growing residential growth area, without reducing the level of service provision anywhere else, particularly within the Dubbo CBD.
  - Opportunities for small businesses to open premises within the neighbourhood centre.
  - Providing jobs near people's homes and consequent economic multiplier impacts, which will boost the local economy.

Introduction

This report presents an independent assessment of the economic impacts and net community benefits relating to a proposed neighbourhood centre being considered in the proposed Hillview residential estate, located in East Dubbo, in the Dubbo Local Government Area (LGA).

This report has been prepared under instruction from Geolyse and is presented in six sections as follows:

- **Section 1** reviews the local and regional context of the subject site, provides an overview of the proposed masterplan being considered in the planning proposal and provides an overview of key strategic documents of relevance to retail/centre development in the Dubbo LGA.
- **Section 2** examines the potential trade area that could be served by the proposed neighbourhood centre; provides estimates of current and anticipated population levels within the trade area; analyses the socio-demographic profile of the trade area population; and assesses the current and future estimated retail expenditure volumes generated by trade area residents. This section also provides an overview of the tourism market in Dubbo and the Dubbo CBD workforce market.
- **Section 3** examines the competitive environment within which the proposed East Dubbo neighbourhood centre would operate, including relevant proposed competitive facilities.
- **Section 4** assesses the market gap for supermarket floorspace within the defined main trade area, and across the broader Dubbo LGA.
- **Section 5** provides a recommendation as to the appropriate scale/mix of retail at the subject site; presents an assessment of potential sales that could be achieved by the proposed retail development; analyses the likely trading impacts on the surrounding retail/centres hierarchy; and then discusses the implications of these impacts.
- **Section 6** examines the net community benefits associated with the proposed development, including employment generation and other economic and social benefits.

Section 1: Site context and proposed development

1.1 Regional and local context

The proposed neighbourhood centre subject site is located in the central north of the proposed Hillview Estate, which is situated in the south-eastern part of Dubbo, in the Dubbo Local Government Area (LGA). Dubbo is located approximately 400 km north-west of Sydney, and around 150km north of Orange and 120km north Parkes, as shown on Map 1.1.

The Dubbo LGA contains more than 40,000 residents, but serves a much broader regional catchment, in excess of 100,000 persons, providing regional level health, business/commercial, retail, entertainment, sporting and civic facilities.

Dubbo's largest industry of employment is health care and social assistance, which employs around 16% of the city's workforce, providing hospital and allied health services to the broader Orana and North Western regions of NSW. The retail sector, which employs 13% of Dubbo's workforce, is the second largest industry in the city, followed by public administration, manufacturing, construction and agriculture. The city's economic base is diversified and the city does not rely on any single dominant industry of employment.

Dubbo benefits from flow-on impacts from the major mining projects, as the city is well positioned as a growing mining services centre with many established and emerging mining and exploration project across the surrounding region. A recent approval was granted for the Alkane Dubbo Zirconia Project (DZP) to the south of the city, which is expected to help drive employment and population growth in the city. Approximately 250 permanent jobs are expected to be created in addition to around 300 – 400 temporary construction jobs, in addition to flow-on multiplier jobs in ancillary industries.

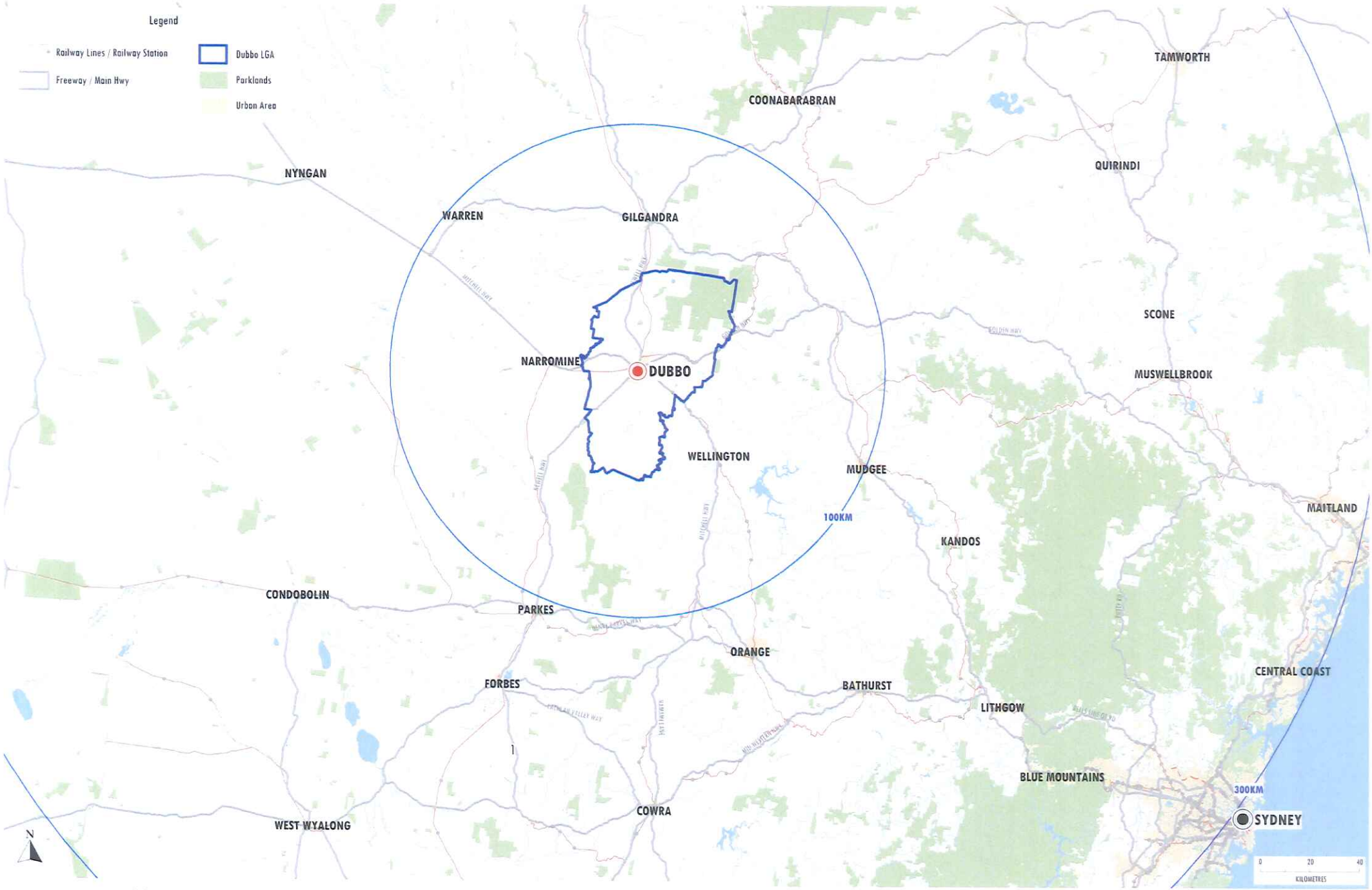
A major upgrade of the Dubbo Hospital is currently underway, and will secure Dubbo as the major rural referral centre and acute care hospital for specialty services to meet the growing demands in Dubbo and surrounding areas.

The redevelopment will provide a combination of new purpose built infrastructure and refurbishment works for the highest priority clinical services and is expected to help attract and retain highly skilled staff and improve the amenity for patients and carers.

Dubbo Council continues to look for ways to improve its CBD and the city more generally. Two of the larger infrastructure projects underway at the moment include the Darling Street redevelopment and the Dubbo sewerage treatment plant upgrade. A Masterplan is in place for the creation of a major regional parkland called Regand Park, in the south of the city.

The neighbourhood centre subject site forms part of the Hillview Estate masterplan area that is the subject of a planning proposal to enable urban development, outlined on Map 1.2 and in Figure 1.1. The Hillview Estate extends from the Southlakes Estate to the west, and adjoins Keswick Estate to the immediate north. Magnolia Grove Estate and Macquarie View Estate to the west are other future growth areas nearby.

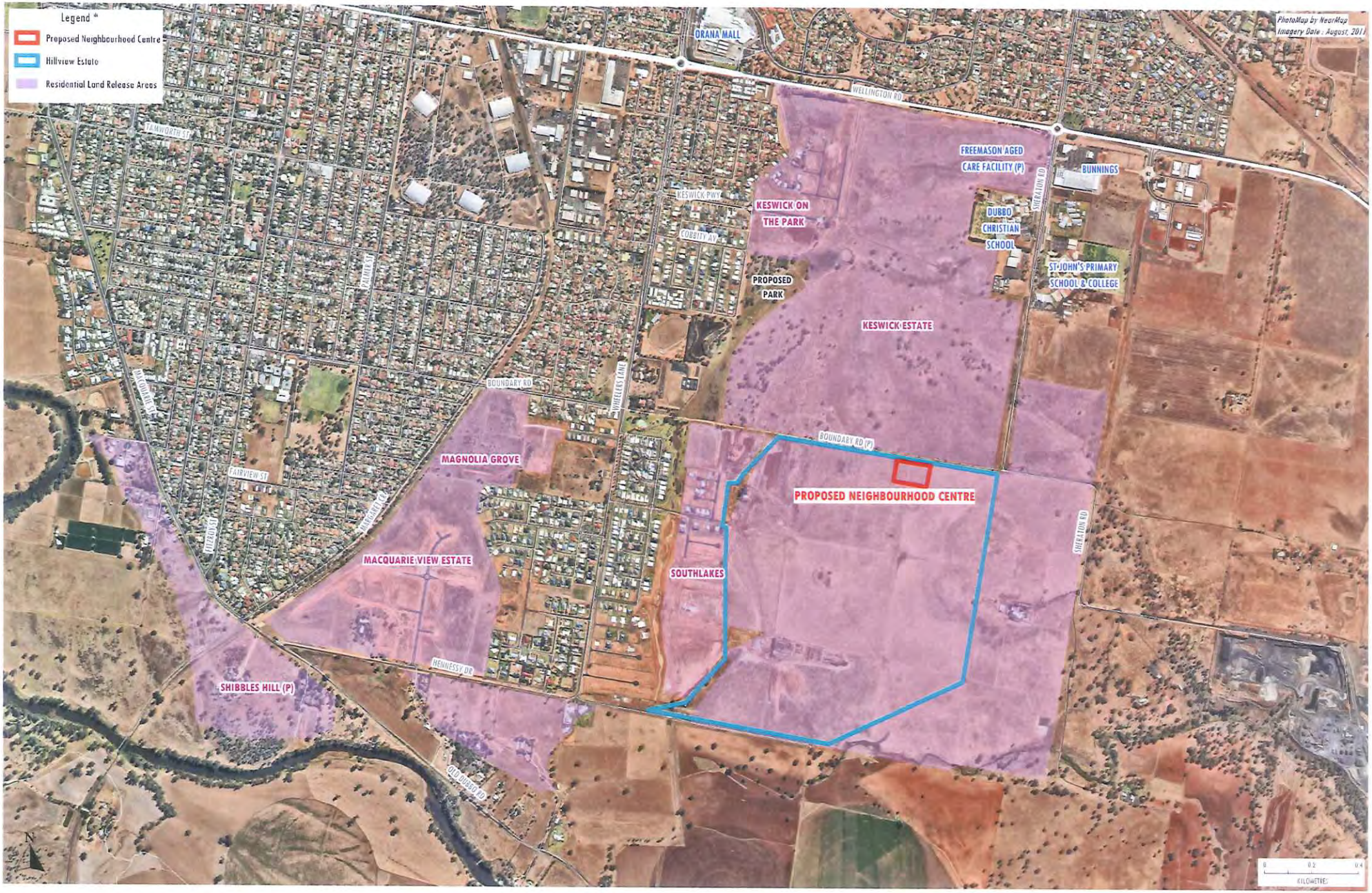
Existing facilities in the surrounding area include Freemason Aged Care facility, Dubbo Christian School, St John's Primary School and College, and a bulky goods precinct fronting the Mitchell Highway Road at the intersection of Sheraton Road, that includes a Bunnings Warehouse, Pet Barn as well as a service station.



Map 1.1: Dubbo

Regional context

MacroPlanDimasi



Map 1.2: East Dubbo Neighbourhood Centre

Site location

MacroPlanDimasi

1.2 Proposed Masterplan

The Hillview Estate Masterplan area is outlined on Figure 1.1, and includes the land identified east of Southlakes Estate, bounded to the north by the proposed Boundary Road, to the south by Hennessey Road.

The proposed Hillview estate could potentially accommodate in the order of 1,300 – 1,400 residential lots, as well as an identified area 38,000 sq.m (i.e. 3.8 hectares) for the neighbourhood centre, located in the central north of the estate.

No detailed development plans have been prepared at this stage for the neighbourhood centre, however we have been asked to examine the market need, timing and potential economic impacts associated with a full-scale supermarket at the subject site, as well as supporting specialty retail and ancillary non-retail uses.

NOTES
1. THE OVERLAY OF THE FLOOD MODELLING DATA IS APPROXIMATE ONLY.
2. FLOOD MODELLING DATA SHOWN IS FROM FIGURE 9 OF REPORT 59915164-4.0\BCP (3rd JUNE 2015) PREPARED BY CARDNO.

LEGEND

B1	NEIGHBOURHOOD CENTRE
R1	GENERAL RESIDENTIAL
R2	LOW DENSITY RESIDENTIAL
RE1	PUBLIC RECREATION
L	DECORATIVE LAKE

SCALE 1:3000(A1)
0 20 40 80 120 160 200
SCALE 1:6000(A3)

Figure 1.1

No	DATE	DRAFTING CHECK	PM CHECK	DETAILS
A	26/02/15	NS	RT	ISSUED TO CLIENT
B	05/06/15	EG	SG	EULOMOGO CREEK FLOOD MODELLING OVERLAID

CHECKED/APPROVED	NAME	DATE
APPROVED	STEVE GUY	05/06/2015
SURVEY	-	-
DESIGNER	-	-
DRAFTING	NS, EG	05/06/2015

APPROVAL AUTHORITY
DUBBO CITY COUNCIL
70 CHURCH STREET
DUBBO
NSW, 2830

CLIENT: MAAS GROUP PROPERTIES PTY LTD
PROJECT: HILLVIEW CONCEPT PLAN

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DRAWING: CONCEPTUAL LOT LAYOUT
PERMANENT MARK: | RL: | DATUM: A.H.D.
PROJECT NUMBER: 114135 | DRAWING SHEET: 02B_TP01 | ORIGINAL: A1
AUTOCAD FILE: | 12D/CIVILCAD FILE: | REVISION: B
STATUS: ISSUED FOR REVIEW | SHEET TP01 OF TP01

1.3 Strategic planning overview

There are two key documents of relevance that we have reviewed to in order to understand the retail/centres hierarchy of Dubbo and the potential role and function of an additional neighbourhood centre as part of the proposed Hillview Estate.

Dubbo Retail Demand Review 2009 (plus Addendum 2011)

The Dubbo Retail Demand Review (Retail Review) was prepared by Hill PDA in 2009 and an associated addendum was prepared in 2011 (the Retail and Commercial Demand Review Addendum) as part the planning for the retail and commercial centres in the development of the Dubbo Local Environmental Plan (LEP) 2011.

These reports were updated in 2014, when Hill PDA undertook its Dubbo Commercial Floorspace Inventory Analysis (CFIA) in 2014. We have referred to the Dubbo Retail Demand Review and the Dubbo CFIA for estimates of retail floorspace supply and future growth in the residential estates across Dubbo.

Dubbo Commercial Floorspace Inventory Analysis 2014 (CFIA) 2014

The Dubbo CFIA report was prepared by Hill PDA in January 2014 as part of the update of the Dubbo Commercial Areas Development Strategy (CADS). The CFIA specifically involved:

- An updated inventory of the commercial centres;
- An updated retail demand/supply analysis (i.e. an update of the Retail Demand Review 2009 and Retail and Commercial Demand Review 2011);
- A comparative assessment of Dubbo retail/commercial areas with other regional NSW towns.

The key points from the CFIA of relevance to this economic impact assessment report and the provision of neighbourhood centre facilities as the East Dubbo subject site are outlined below:

- Chapter 4 of the report includes a relatively contemporary assessment of the quantum and mix of retail and commercial floorspace within the business zoned precincts in Dubbo

(zoned B1 – B3). We have generally relied on these figures in our analysis, as well as the supply estimates in the previous Hill PDA reports, and we have also undertaken our own site inspections, in August 2015.

- Chapter 5 of the report examines the centres hierarchy as defined in the Dubbo LEP 2011. The centres hierarchy is outlined below:
  - Dubbo CBD (Zoned B3 – Commercial Core)
  - Orana Mall (Zoned B2 – Local Centre)
  - Neighbourhood centres (Zoned B1 – Neighbourhood Centre)
  - Bulky goods retail (Zoned B5 – Business development)
- The Dubbo CBD is the dominant retail precinct in Dubbo, accommodating more than 81,000 sq.m of occupied retail floorspace, a further 74,700 sq.m of commercial floorspace and 81,200 sq.m of other floorspace (i.e. clubs, hotels, motels etc).
- At the time this report was prepared the Aldi supermarket on Talbragar Street had not yet been constructed, and is now operational. This means that the Dubbo CBD now contains around 83,000 sq.m of occupied retail floorspace, of which around 66,000 sq.m is 'traditional retail' (i.e. excluding bulky goods floorspace of 17,000 sq.m).
- A DA consent had been granted for a 12,500 sq.m shopping centre at the corner of Macquarie Street and Bultje Street in the Dubbo CBD, however this DA has since been abandoned.
- Chapter 6 included an assessment of the trade area served by the retail facilities in Dubbo. Hill PDA defines a main trade area that consists of a population of almost 100,000 persons, with the Dubbo LGA identified as the primary sector with a population in excess of 40,000 persons.
- Chapter 6 then examines the current and future estimated growth in retail expenditure, and retail floorspace demand, by retail category and store type/retail format, over the period 2011 to 2026, and then compares this with the supply of retail floorspace by store

type/retail format. This section assesses the outcomes under two potential population growth scenarios.

- Page 61 of the CFIA showed that there was an under-supply of supermarket floorspace in the Dubbo LGA in the order of 2,800 sq.m as at 2011. Accounting for the 1,857 sq.m Aldi supermarket which opened in 2014, the estimated under-supply of supermarket floorspace is estimated to reach 3,600 – 4,800 sq.m by 2026. (Note: the range represents the market gap under the two potential population growth scenarios).

- P.61 (Tables 28 and 29) also illustrate a significant under-supply of specialty food stores and other personal and household goods retailing, i.e. the types of retail that might be considered at the proposed neighbourhood centre.

- Chapter 8 brings the findings of the report together and discusses the preferred scenario for the Dubbo retail hierarchy and raises a series of questions for consideration as part of subsequent stakeholder discussions.

- Hill PDA recommends that the Dubbo CBD be supported to the greatest extent possible and that additional retail development should be accommodated in this centre, as opposed to Orana Mall, where appropriate.

- However, no clear direction is provided as to where the additional supermarket floorspace identified in the market gap analysis should be accommodated. A question is raised as to whether the CBD would be the preferred location; additional space in existing neighbourhood centres; or new centre development.

We note that the Dubbo CBD already accommodates two full-line supermarkets, with both the major operators, Coles and Woolworths, represented as well as an Aldi supermarket at the north-eastern periphery of the CBD.

Therefore, in our view, future full-line supermarket facilities would be most appropriately located to the major residential growth area of Dubbo, which would still allow the Dubbo CBD to be the primary focus for additional higher order retail development.

Section 2: Trade area analysis

This section of the report examines the potential trade area that could be served by the proposed neighbourhood centre; provides estimates of current and anticipated population levels within the trade area; analyses the socio-demographic profile of the trade area population; and assesses the current and future estimated retail expenditure volumes generated by trade area residents. This section also provides an overview of the tourism market in Dubbo and the Dubbo CBD workforce market.

2.1 Trade area definition

The extent of the trade area or catchment that is served by any shopping centre or retail facility is shaped by the interplay of a number of critical factors. These factors include:

- The relative attraction of the centre, in comparison with alternative competitive retail facilities. The factors that determine the strength and attraction of any particular centre are primarily its scale and composition (in particular the major trader or traders that anchor the centre); its layout and ambience; and carparking, including access and ease of use.
- The proximity and attractiveness of competitive retail centres. The locations, compositions, quality and scale of competitive retail facilities all serve to define the extent of the trade area which a shopping centre is effectively able to serve.
- The available road network and public transport infrastructure, which determine the ease (or difficulty) with which customers are able to access a shopping centre.
- Significant physical barriers which are difficult to negotiate, and can act as delineating boundaries to the trade area served by an individual shopping centre.

The trade area estimated to be served by the proposed neighbourhood centre at Hillview Estate has been defined taking into consideration all of the above factors, in particular the following:

- The lack of full-scale supermarket facilities in south Dubbo, limited to the 1,030 sq.m IGA supermarket in the Tamworth Street neighbourhood centre.
- Orana Mall, which limits the extent of the trade area to the north. The only other supermarkets in eastern Dubbo of any scale are the two supermarkets at Orana Mall (i.e. Woolworths and Supa IGA).
- The Dubbo CBD, which includes the Coles anchored Dubbo Square, the Woolworths anchored Riverdale SC, and significant street based retail and higher order retail, limits the extent of the trade area to the west.
- The central position of the subject site within the Hillview Estate on the future Boundary Road, which is expected to be a key east-west road in the locality, granting excellent accessibility to local residents.
- The Macquarie River to the south, and the road network in the region. In particular we note that for residents in south Dubbo who would use Old Dubbo Road, the proposed neighbourhood centre would be their closest supermarket based shopping centre.

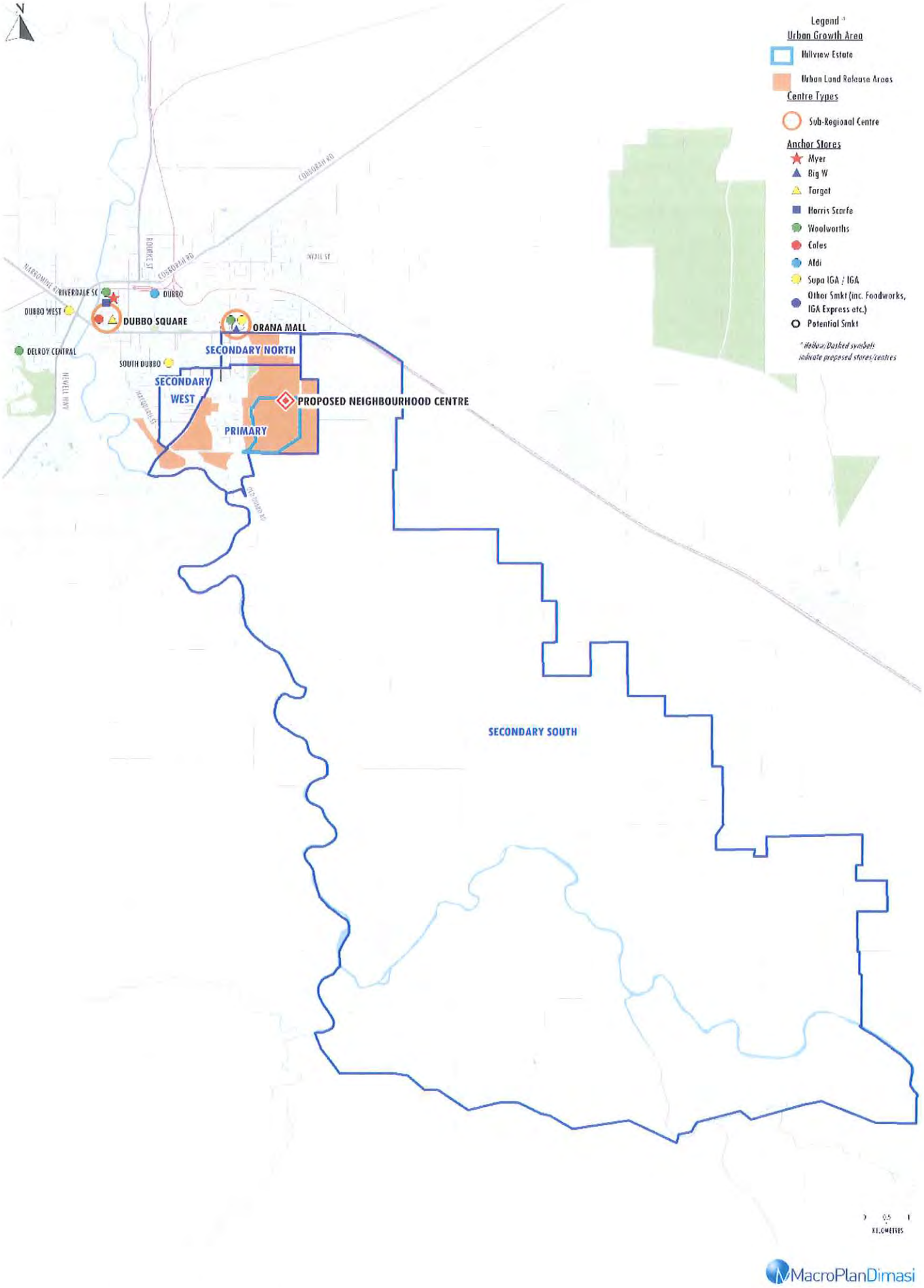
The trade area is defined to include one primary sector and three secondary sectors, described as follows (refer Map 2.1 and Map 2.2 (zoomed in)):

- The **primary sector** is generally bounded by Sheraton Road to the east, Hennessy Drive and Macquarie River to the south, and Margaret Crescent and the railway line to the west. This sector includes the Hillview Estate (inc. the subject site), as well as Magnolia Grove Estate, Southlakes Estate, Dubbo Residential Estate/Macquarie View Estate and parts of the future Keswick Estate.
- The **secondary west sector** is generally bounded by High Street to the north, Margaret Crescent and the rail line to the east and Fitzroy Street to the west.

- The **secondary north sector** extends north from the primary sector and is generally bounded by Wellington Road to the north, Wheelers Lane to the west, and Sheraton Road to the east.

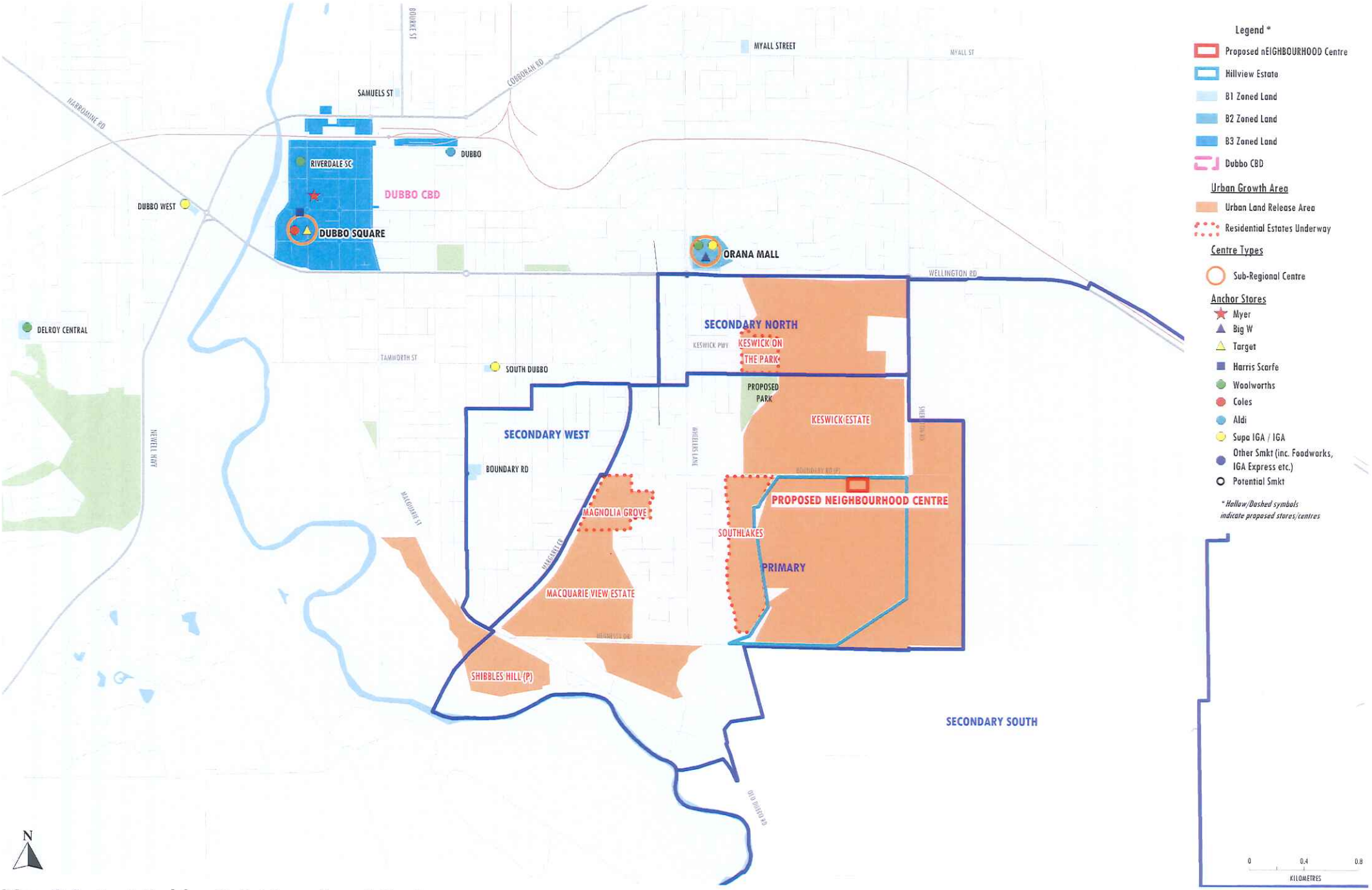
- The **secondary south sector** extends south from the primary sector, including the rural residential area south-west of Dubbo, stretching towards Ponto generally accessible from Old Dubbo Road and bounded by the Macquarie River to the west.

The primary sector and three secondary sectors combined are referred to as the main trade area in the remainder of this report.



Map 2.1: East Dubbo Neighbourhood Centre

Trade area and competition



Map 2.2: East Dubbo Neighbourhood Centre

Trade area and competition (Close up)

MacroPlanDimasi

2.2 Trade area population

Table 2.1 details the current and projected population levels within the main trade area. This information has been collected from a range of sources, including the following:

- Australian Bureau of Statistics (ABS) Census of Population and Housing (2006 and 2011);
- ABS Dwelling Approvals Data (2010–14);
- ABS Estimated Residential Population Data (ERP) (2011-14);
- NSW Department of Planning and Environment (2014);
- Dubbo City Council (2014); and
- Other investigations of future residential development, undertaken by this office.

The main trade area population is estimated at 6,800 as at June 2015, including 2,400 residents within the key primary sector. Over the most recent inter-censal period (2006-2011), the main trade area population increased at an average rate of 2.4% per annum, or around 130 residents per annum.

The main trade area includes most of the new greenfield residential estates in south Dubbo, which are all at various stages of the development pipeline. The following major estates are located in the defined main trade area, and will be the key drivers of future population growth in the trade area:

- Hillview Estate (primary sector): which has the capacity to accommodate around 1,300-1,400 residential lots upon completion.
- Southlakes Estate (primary sector): which could accommodate approximately 450 dwellings.
- Keswick Estate (primary & secondary north sector): which has capacity for up to 1,500 lots of which around 200 have been developed to date.

- Magnolia Estate (primary): could contain around 300 lots upon completion, with 18 dwellings developed to date.

- Macquarie View (primary): is understood to have capacity for approximately 250 dwellings. Development within this estate has recently begun, and is expected to pick-up over the medium term. Additional dwellings are proposed adjacent to Macquarie View, as part of the Dubbo Residential Estate.

- Shibbles Hill (primary): is still in the very early planning stages and a development application for this precinct is yet to be lodged. It is understood this development could potentially accommodate up to 250 residential lots.

While the total aggregate dwelling capacity of these identified estates is significant, estimated future population growth in these areas has regard to the total growth expected across the entire Dubbo LGA. According to Table 13 of the Hill PDA, the Dubbo LGA population is projected to grow by around 220 – 250 persons per year to 2026.

Generally, have assumed that these new estates will absorb the lion's share of total Dubbo population growth over the next 10 – 15 years, and we have assumed an average take-up rate of new dwellings in the primary sector of around 50 - 60 dwellings per annum (i.e. about 150 persons per annum), and growth in the secondary north sector of around 40 - 50 persons per annum

Having regard to the above, the main trade area population is estimated to reach 10,400 by 2031, reflecting average annual growth of 2.7%, or 200 – 240 persons per annum.

The primary sector population is estimated to grow at an average annual rate of 5.4% to reach 5,600 persons by 2031.

Table 2.1
East Dubbo trade area population, 2006-2031*

	Estimated population			Forecast population			
Trade area sector	2006	2011	2015	2018	2021	2026	2031
Primary	1,210	1,940	2,420	2,870	3,470	4,520	5,620
Secondary sectors							
• North	894	886	1,006	1,096	1,126	1,176	1,226
• South	460	450	450	450	450	450	450
• West	2,800	2,750	2,910	2,970	3,000	3,050	3,100
Total secondary	4,154	4,086	4,366	4,516	4,576	4,676	4,776
Main trade area	**5,364**	**6,026**	**6,786**	**7,386**	**8,046**	**9,196**	**10,396**

	Average annual growth (no.)					
Trade area sector	2006-11	2011-15	2015-18	2018-21	2021-26	2026-31
Primary	146	120	150	200	210	220
Secondary sectors						
• North	-2	30	30	10	10	10
• South	-2	0	0	0	0	0
• West	-10	40	20	10	10	10
Total secondary	-14	70	50	20	20	20
Main trade area	**132**	**190**	**200**	**220**	**230**	**240**

	Average annual growth (%)					
Trade area sector	2006-11	2011-15	2015-18	2018-21	2021-26	2026-31
Primary	9.9%	5.7%	5.8%	6.5%	5.4%	4.5%
Secondary sectors						
• North	-0.2%	3.2%	2.9%	0.9%	0.9%	0.8%
• South	-0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
• West	-0.4%	1.4%	0.7%	0.3%	0.3%	0.3%
Total secondary	-0.3%	1.7%	1.1%	0.4%	0.4%	0.4%
Main trade area	**2.4%**	**3.0%**	**2.9%**	**2.9%**	**2.7%**	**2.5%**

**As at June*
Source: ABS Census 2011; NSW DPE 2014; Dubbo City Council/Hill PDA; MacroPlan Dimasi

2.3 Socio-demographic profile

Table 2.2 illustrates the socio-demographic profile of the main trade area population, compared with benchmarks for non-metropolitan NSW and Australia, based on data from the 2011 ABS Census of Population and Housing, with the key highlights as follows:

- The average per capita and per household incomes of the main trade area are 5.3% and 13.9% above the non-metropolitan NSW averages, respectively. The primary sector and secondary south sector population is particularly affluent, with per household incomes 29.3% and 70% above the non-metropolitan NSW average, respectively.

- The average age of the main trade area, at 36.4 years, is significantly younger than the non-metropolitan NSW average of 40.2 years, driven by the high proportion of children and low proportion of residents aged 50+ years, particularly in the primary and secondary north sector.

- The proportion of home ownership of the main trade area population (70.4%) is on par with the non-metropolitan NSW average (70.6%). The primary sector has a particularly high proportion of households (50.1%) with mortgages (i.e. in the process of buying their own), compared with the non-metropolitan NSW average of 31.9%.

- Australian born residents account for 93.7% of the main trade area population, which is significantly higher than the proportion of Australian born residents in non-metropolitan NSW (88.7%).

- Traditional families (i.e. couples with dependent children) are the most prevalent family type in the main trade area, accounting for 46.9% of households, as compared with 40.7% of households in non-metropolitan NSW. The primary sector has a particularly high proportion of traditional families (57%).

The main trade area population is characterised by relatively high incomes, high home ownership levels and a prevalence of traditional families, as compared with the non-metropolitan NSW average. There is also a high proportion of Australian born residents in the main trade area.

Table 2.2
East Dubbo main trade area - socio-demographic profile, 2011

Census item	Primary sector	Secondary sectors North	Secondary sectors South	Secondary sectors West	Main TA	Non-metro NSW avg.	Aust. avg.
Per capita income	$32,131	$25,324	$38,876	$30,749	$31,148	$29,574	$34,467
Var. from Non-metro NSW benchmark	*8.6%*	*-14.4%*	*31.5%*	*4.0%*	*5.3%*		
Avg. household income	$91,804	$70,908	$120,515	$72,476	$80,858	$70,977	$88,205
Var. from Non-metro NSW benchmark	*29.3%*	*-0.1%*	*69.8%*	*2.1%*	*13.9%*		
Avg. household size	2.9	2.8	3.1	2.4	2.6	2.4	2.6
Age distribution (% of population)							
Aged 0-14	25.1%	25.3%	23.4%	20.4%	22.7%	19.4%	19.3%
Aged 15-19	6.8%	8.2%	10.7%	7.9%	7.7%	6.6%	6.5%
Aged 20-29	11.7%	15.6%	6.8%	12.2%	12.0%	10.8%	13.8%
Aged 30-39	15.6%	13.5%	10.1%	10.9%	12.8%	11.3%	13.8%
Aged 40-49	14.8%	13.0%	18.0%	12.5%	13.7%	13.4%	14.2%
Aged 50-59	11.2%	11.0%	15.4%	12.0%	11.8%	13.9%	12.8%
Aged 60+	14.8%	13.4%	15.7%	24.2%	19.3%	24.5%	19.6%
Average age	34.4	32.3	35.9	38.8	36.4	40.2	37.9
Housing status (% of households)							
Owner (total)	73.0%	64.6%	89.8%	67.3%	70.4%	70.6%	68.7%
• Owner (outright)	23.0%	23.4%	47.2%	35.9%	30.8%	38.8%	32.9%
• Owner (with mortgage)	50.1%	41.1%	42.6%	31.4%	39.5%	31.9%	35.8%
Renter	26.4%	35.4%	10.2%	32.1%	29.2%	28.4%	30.4%
Other	0.5%	0.0%	0.0%	0.6%	0.5%	0.9%	0.9%
Birthplace (% of population)							
Australian born	92.4%	93.3%	97.9%	94.3%	93.7%	88.7%	74.0%
Overseas born	7.6%	6.7%	2.1%	5.7%	6.3%	11.3%	26.0%
• Asia	3.8%	3.0%	0.0%	1.7%	2.5%	1.7%	8.6%
• Europe	1.7%	0.7%	0.9%	2.2%	1.8%	6.8%	10.5%
• Other	2.2%	3.0%	1.2%	1.8%	2.0%	2.8%	7.0%
Family type (% of households)							
Couple with dep't children	57.0%	49.4%	61.5%	39.0%	46.9%	40.7%	45.3%
Couple with non-dep't child.	6.3%	8.1%	8.0%	5.9%	6.4%	7.0%	7.7%
Couple without children	17.9%	13.1%	20.1%	23.4%	20.5%	25.7%	23.0%
One parent with dep't child.	9.7%	17.1%	3.0%	13.4%	12.1%	10.6%	9.2%
One parent w non-dep't child.	1.2%	4.6%	2.7%	3.2%	2.7%	3.5%	3.5%
Other family	1.0%	1.0%	0.0%	0.7%	0.8%	0.9%	1.1%
Lone person	6.7%	6.7%	4.7%	14.3%	10.7%	11.7%	10.2%

Source: ABS Census of Population & Housing, 2011; MacroPlan Dimasi

2.4 Retail expenditure capacity

MacroPlan Dimasi estimates retail expenditure capacity generated by the main trade area residents based on information sourced from Market Data Systems (MDS), which utilises a detailed micro simulation model of household expenditure behaviour for all residents of Australia. The model takes into account information from a wide variety of sources including the regular ABS Household Expenditure Surveys, national accounts data, Census data and other information. We consider MarketInfo data to be an accurate measure of available retail expenditure and it is widely relied on in the retail industry.

Total retail expenditure is detailed in a number of categories, as follows:

- Take-home food and groceries – goods typically sold in supermarkets and specialty fresh food stores.
- Packaged liquor – packaged beer, wine and spirits such as those purchased at bottle-shops and liquor outlets.
- Food catering – cafes, take-away outlets and restaurants, including liquor consumed on such premises.
- Apparel – clothing, footwear, fashion and accessories.
- Household Goods – giftware, electrical, computers, furniture, homewares, and hardware goods.
- Leisure – sporting goods, music, DVDs, games, books, newsagents and film processing/photography.
- General Retail –pharmaceutical goods, cosmetics, toys, florists, mobile phones.
- Retail Services – retail services such as key cutting, shoe repairs, hair and beauty.

Chart 2.1 shows the estimated retail expenditure capacity per person for residents of the identified main trade area for the year 2014/15, and compares these estimates with the average for non-metropolitan NSW and Australia. Spending estimates are presented inclusive of GST. The following points are noted:

- Total estimated retail expenditure per capita is on par with the non-metropolitan NSW average.
- Per capita expenditure on fresh food and other food and groceries, key categories of relevance to supermarkets, is around 2-3% below the non-metropolitan NSW average.

Table 2.3 presents estimates of total retail spending generated by the main trade area population, by trade area sector, over the period from 2015 to 2031. Spending forecasts are presented inclusive of GST and in constant 2014/15 dollars.

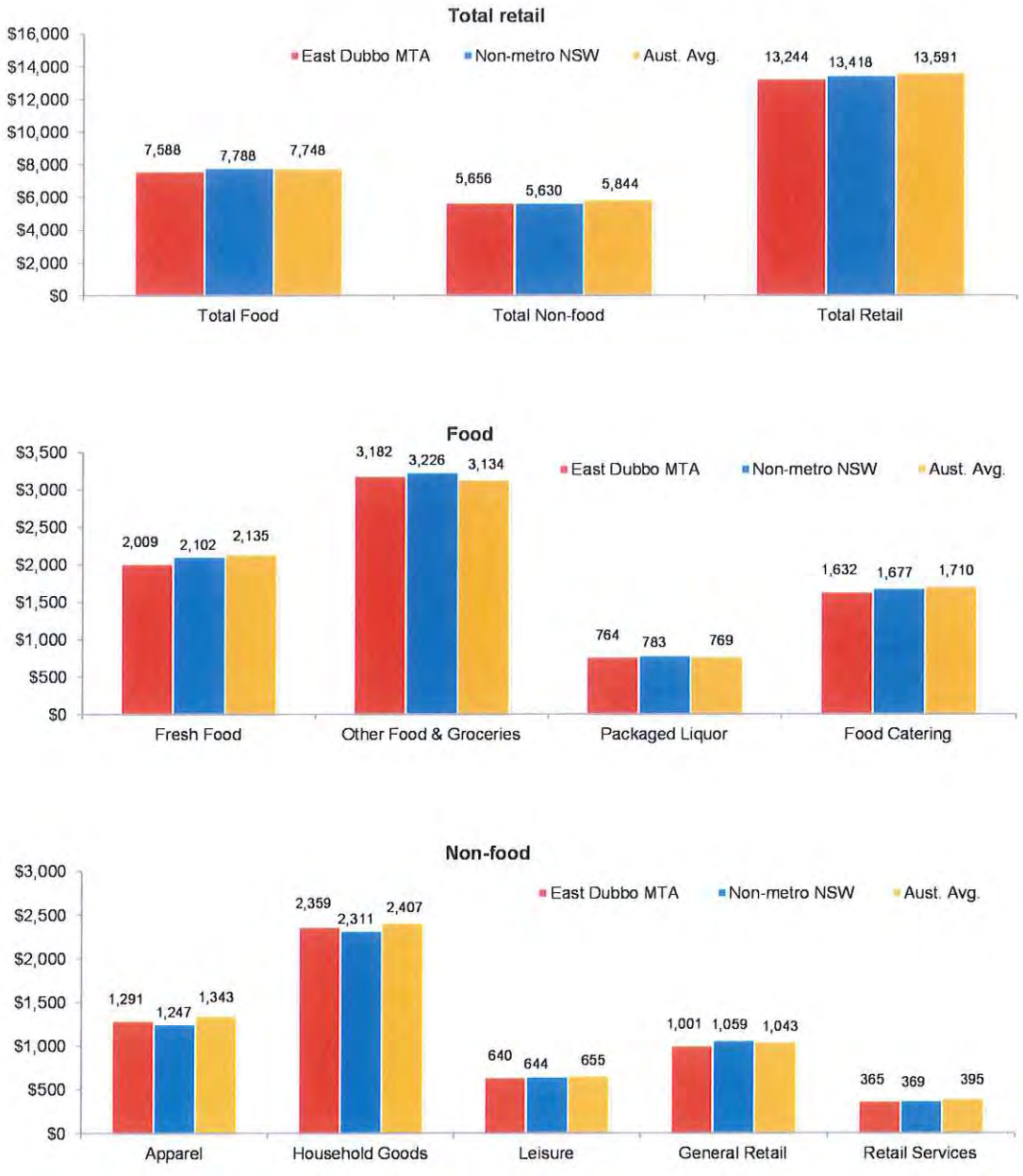
The retail expenditure market is expected to grow from about $88.5 million in 2015 to $160.8 million by 2031, an increase of more than 80% at an average annual growth rate of 3.8%. The average annual growth rate of 3.8% comprises two components, as follows:

- Residential population growth, which is expected to average 2.7% per annum;
- Real growth in per capita retail expenditure, which is expected to average 1.0% per annum over the forecast period; and

The total retail expenditure capacity of primary sector residents is expected to grow at 6.6% per annum, from $31.4 million at 2015 to $86.7 million by 2031, an increase of 180%.

Table 2.4 presents projections of spending for the main trade area by retail category. FLG expenditure (take-home food and groceries including packaged liquor) is estimated at $39.8 million in 2015, and accounts for 45% of all retail expenditure in the trade area. FLG expenditure by trade area residents is forecast to increase to $73.1 million by 2031, reflecting average annual growth of 3.9%.

Chart 2.1
East Dubbo trade area - retail spending per person, 2014/15*



*Including GST
Source: MarketInfo; MacroPlan Dimasi

Table 2.3
East Dubbo main trade area - retail expenditure ($M), 2015-2031*

Year ending June	Primary sector	Secondary sectors			Main TA
		North	South	West	
2015	31.4	11.6	6.2	39.3	88.5
2016	33.5	12.1	6.2	40.1	91.9
2017	35.8	12.5	6.3	40.8	95.4
2018	38.2	13.0	6.4	41.4	99.0
2019	41.0	13.4	6.4	42.0	102.8
2020	44.1	13.6	6.5	42.6	106.8
2021	47.4	13.9	6.5	43.2	111.1
2022	50.8	14.2	6.6	43.8	115.5
2023	54.2	14.5	6.7	44.4	119.8
2024	57.8	14.8	6.8	45.1	124.4
2025	61.6	15.1	6.8	45.7	129.2
2026	65.7	15.4	6.9	46.4	134.4
2027	69.7	15.7	7.0	47.1	139.4
2028	73.6	16.0	7.1	47.8	144.4
2029	77.7	16.3	7.2	48.5	149.6
2030	82.1	16.6	7.2	49.2	155.1
2031	86.7	16.9	7.3	49.9	160.8
Average annual growth ($M)					
2015-2031	3.5	0.3	0.1	0.7	4.5
Average annual growth (%)					
2015-2031	6.6%	2.4%	1.1%	1.5%	3.8%

**Constant 2014/15 dollars & including GST*
Source: MarketInfo; MacroPlan Dimasi

Table 2.4
East Dubbo main trade area - retail expenditure by category ($M), 2015-2031*

Year ending June	FLG	Food catering	Apparel	Household goods	Leisure	General retail	Retail services	**Total retail**
2015	39.8	10.9	8.6	15.8	4.3	6.7	2.4	88.5
2016	41.4	11.4	8.9	16.3	4.4	6.9	2.5	91.9
2017	43.0	11.9	9.2	16.9	4.6	7.2	2.6	95.4
2018	44.6	12.4	9.5	17.5	4.7	7.4	2.7	99.0
2019	46.4	12.9	9.9	18.2	4.9	7.7	2.8	102.8
2020	48.2	13.5	10.2	18.9	5.1	7.9	2.9	106.8
2021	50.2	14.1	10.6	19.6	5.3	8.2	3.1	111.1
2022	52.2	14.8	11.0	20.4	5.4	8.5	3.2	115.5
2023	54.2	15.4	11.4	21.1	5.6	8.8	3.3	119.8
2024	56.3	16.1	11.8	21.9	5.8	9.1	3.4	124.4
2025	58.6	16.8	12.2	22.7	6.0	9.4	3.6	129.2
2026	60.9	17.6	12.6	23.6	6.2	9.8	3.7	134.4
2027	63.2	18.3	13.0	24.4	6.5	10.1	3.8	139.4
2028	65.5	19.1	13.5	25.2	6.7	10.4	4.0	144.4
2029	68.0	19.9	13.9	26.1	6.9	10.7	4.1	149.6
2030	70.5	20.7	14.4	27.0	7.1	11.1	4.3	155.1
2031	73.1	21.6	14.8	28.0	7.3	11.5	4.4	160.8
Average annual growth ($M)								
2015-2031	2.1	0.7	0.4	0.8	0.2	0.3	0.1	4.5
Average annual growth (%)								
2015-2031	3.9%	4.4%	3.4%	3.7%	3.4%	3.4%	3.8%	3.8%

**Constant 2014/15 dollars & including GST*
Source: MarketInfo, MacroPlan Dimasi

Retail expenditure category definitions:

- FLG: take-home food and groceries, as well as packaged liquor.
- Food catering: expenditure at cafes, take-away food outlets and restaurants.
- Apparel: clothing, footwear, fashion accessories and jewellery.
- Household goods: giftware, electrical, computers, furniture, homewares and hardware goods.
- Leisure: sporting goods, music, DVDs, computer games, books, newspapers & magazines, stationery and photography equipment.
- General retail: pharmaceutical goods, cosmetics, toys, florists, mobile phones and pets.
- Retail services: hair & beauty, optical goods, dry cleaning, key cutting and shoe repairs.

2.5 Tourism market Dubbo LGA

Dubbo is a major regional destination in the Orana/North West region of NSW, and is a popular tourist destination, particularly around school holidays. The Western Plains Zoo is an iconic piece of tourism infrastructure, and as a major regional city, Dubbo supports major regional sporting events for schools etc and cultural events.

According to Tourism Research Australia, in 2013 Dubbo LGA accommodated around 8,700 international visitors (150,000 visitor nights); around 420,000 domestic overnight visitors (940,000 visitor nights) and around 420,000 domestic day-trippers.

If total visitor nights are taken together, including an allocation for domestic day-trippers, the visitor market for the Dubbo LGA equates to a year-round, equivalent daily population of about 3,500 – 4,000 persons.

Most of the tourism accommodation in Dubbo is provided within the Dubbo CBD and around western Dubbo. Therefore the Dubbo CBD retailers, including restaurants, cafes etc would be the primary destination for much of this tourist population.

2.6 Dubbo CBD worker market

According to the NSW Bureau of Transport statistics, approximately 8,000 workers worked in the travel zone (TZ7489) encompassing the Dubbo CBD, which extends south of the Mitchell Highway to the Macquarie River and includes Orana Mall and is bound by the railway line to the north.

According to the Hill PDA CFIA report, in addition to the 80,000 sq.m of occupied retail floorspace within the Dubbo CBD, there is a further 74,000 – 75,000 sq.m of commercial floorspace and more than 80,000 sq.m of other floorspace (inc. accommodation, community facilities, auto sales etc).

Based on this floorspace, we estimate there to be in the order of 4,500 – 5,000 workers in the Dubbo CBD. This customer segment would generally be unique to Dubbo CBD retailers, which would remain unaffected by the provision of additional retail facilities in East Dubbo.

Section 3: Competition

This section of the report examines the competitive environment within which the proposed East Dubbo neighbourhood centre would operate, including all proposed competitive facilities.

Table 3.1 summarises the surrounding network of traditional retail facilities/centres (i.e. not bulky goods centres) of relevance to the proposed East Dubbo neighbourhood centre, while the previous Map 2.1 illustrates their locations.

3.1 Existing retail hierarchy

There are currently no supermarket based or higher order facilities within the identified main trade area. The surrounding retail hierarchy of Dubbo is summarised as follows:

Dubbo CBD (B3 - Commercial Core)

The Dubbo CBD includes the area zoned B3 – Commercial Core, generally including the area bounded by the Mitchell Highway, Bligh Street, the railway line to the north and including the area stretching east along Talbragar Street to include the Aldi supermarket.

The Dubbo CBD contains an estimated 82,000 – 83,000 sq.m of occupied retail floorspace, of which an estimated 17,000 sq.m is defined as 'bulky goods' retail by Hill PDA in Table 11 of its CFIA report 2014. Dubbo CBD contains a further 74,000 sq.m of non-retail commercial floorspace as well as other community, leisure, accommodation facilities (e.g. pubs, motels, library etc). Most of the retail floorspace is generally oriented around Macquarie Street, and the key components of the CBD include:

- **Dubbo Square**: is a 12,500 sq.m (retail GLA) sub-regional shopping centre, with its own dedicated car-parking, anchored by a Target discount department store and a 3,723 sq.m Coles supermarket. The centre contains about 38 supporting specialty retail and ancillary non-retail tenants.

- **Riverdale Shopping Centre:** is a 4,100 sq.m (retail GLA) centre two blocks north of Dubbo Square, which is anchored by a 2,727 sq.m Woolworths supermarket, and contains around 10 specialty shops and a Reading Cinema complex.

- The remainder of the Dubbo CBD retail offer is provided around Macquarie Street and some of the east-west streets, and includes a mix of cafes, restaurants, take-away sops, general non-food retail (i.e. chemists, newsagents, apparel/fashion, discount variety stores), retail services (i.e. optometrists, hairdressers etc) as well as other non-retail shopfront uses banks, real estate agents, accountants, health insurance, medical centres/allied health facilities. Major/mini-major anchor tenants include Myer, Harris Scarfe and Dick Smith, to name a few.

The Dubbo CBD is the dominant retail and commercial centre in Dubbo, and serves a regional catchment, in the order 100,000 persons. Our field inspections indicated that while there are some vacancies in the heart of the CBD, the CBD is a vibrant, attractive retail destination and provides many elements that are not available elsewhere in Dubbo, i.e. cafes/restaurants, department stores, boutique fashion. Furthermore, the CBD is where a significant amount of tourist accommodation is located and it also supports a daily workforce of around 4,000 – 5,000.

Orana Mall (B2 – Local Centre)

Orana Mall is a 20,400 sq.m sub-regional shopping centre anchored by a Big W discount department store, as well as a 3,880 sq.m Woolworths and a 2,487 sq.m IGA supermarket. Orana Mall has recently gone undergone refurbishment works, including significant additional car-parking and a small expansion of retail floorspace is currently underway. This expansion is likely to consist of around 25 - 30 specialty stores (i.e. net addition of 2,500 sq.m), including Bed Bath N Table and a large The Reject Shop tenancy, as part of a new southern mall.

According to the Shopping Centre Council Little Guns 2014 publication, Orana Mall reported moving annual turnover (MAT) of $181.5 million for the year to September 2014, at around $8,600 per sq.m, including specialty MAT per sq.m of $11,000 per sq.m. These are very strong trading levels, with the centre ranked 9th in Australia for specialty sales per sq.m for all centres of a similar type, and 19th for total centre MAT.

B1 - Neighbourhood centres

There are 8 identified B1 – Neighbourhood Centre zoned precincts across Dubbo, including two south of the Mitchell Highway, i.e. the Tamworth Street centre and Boundary Road centre.

- **Tamworth Street**: contains an estimated 2,500 sq.m of retail floorspace, including a 1,030 sq.m IGA supermarket (which provides around 8 – 10 trolleys), and 12 supporting specialty tenants including a newsagent, bottle-shop, hairdresser, chemist and a café.
- **Boundary Road:** includes approximately 800 – 900 sq.m of retail floorspace including a small convenience store, chemist, florist, take-away shops and a Mexican restaurant, as well as a 500 sq.m medical centre and the South Dubbo Tavern.

There are two supermarket based neighbourhood centres in west Dubbo. Delroy Central is a relatively new Woolworths anchored shopping centre with around 3,800 sq.m (retail GLA) in Delroy Park, and there is strip retail precinct oriented along the Mitchell Highway near the intersection of the Newell Highway, that contains a small 577 sq.m IGA supermarket and around 20 specialty tenancies. These centres are of very limited relevance to current and future residents in the identified East Dubbo main trade area.

The remaining neighbourhood centres across Dubbo are very small, generally including a handful of tenancies totalling less than 1,000 sq.m, e.g. Bourke Street, Samuel Street, and Myall Street. The Websdale Road neighbourhood centre is undeveloped, although a small development has previously been approved for this site, which we understand has since been abandoned.

3.2 Proposed/planned retail developments

We expect new small scale improvements and additions to the retail network in the CBD, consistent with the Dubbo City Council's strategic direction to revitalise the CBD. Indeed, a new boutique retail development is planned for the currently vacant building at 188 Macquarie Street at the intersection of Wingewarra Street.

A DA approval exists for the development of the **Victoria Park Centre**, at 154 – 174 Talbragar Street, west of the Aldi supermarket. This development has approval for 3,100 sq.m of retail floorspace and is planned to include 11 specialty tenancies (ranging between 140 and 976 sq.m) and three outdoor eating areas.

Our site inspections indicated that construction had yet to begin on this development. Given the scale and proposed tenancies, it is clear that this development is small scale and if it proceeds, will not contribute to meeting the need for convenient full-scale supermarket facilities in the large growth area in south-east Dubbo.

Table 3.1
East Dubbo - schedule of competing retail facilities

Centre	Retail* GLA (sq.m)	Major traders	Dist. by road from East Dubbo (km)
B3 - Commercial Core			
Dubbo CBD	*66,000*		5.8
• Dubbo Square	12,500	Target, Coles	
• Riverdale SC	4,100	Woolworths	
• Other	49,400	Myer, Harris Scarfe, Aldi	
• Victoria Park (p)	3,000		
B2 - Local centre			
Orana Mall	*20,400*		2.8
• Existing	20,400	Big W, Woolworths, IGA	
• Under construction	2,500	n.a.	
B1 - Neighbourhood centres			
Boundary Road	900	n.a.	2.5
Tamworth Street	2,500	IGA	3.5
Myall Street	730	n.a.	4.8
West Dubbo	2,000	IGA	6.8
Delroy Central	3,800	Woolworths	8.6

**Traditional retail floorspace*
Source: Dubbo City Council; Hill PDA; Property Council of Australia; MacroPlan Dimasi

Section 4: Supermarket market gap

This section of the report assesses the market gap for supermarket floorspace within the defined main trade area, and across the broader Dubbo LGA.

4.1 Supermarket floorspace provision: Main trade area

To assess the market demand for potential retail facilities at the subject site, we have examined the current and future demand for supermarket floorspace generated by the trade area population and compared this with the existing and proposed supply of such floorspace.

To estimate the supermarket floorspace demand generated by the main trade area population, the available supermarket related expenditure is translated into an estimate of supportable/required supermarket floorspace. Floorspace estimates are generated by applying appropriate thresholds of turnover levels per sq.m of floorspace, normally referred to as retail turnover densities (RTD), to the available expenditure volume.

Across Australia, including in NSW, the share of FLG expenditure directed to supermarkets in households in non-capital city locations is typically much higher than in state capital cities, especially Sydney, for a variety of reasons – including generally lower income levels, less multi-cultural populations, more limited provisions of non-supermarket retail options such as independent fresh food stores and fresh food markets, and higher rates of provision of supermarket floorspace per capita, i.e. supply.

This is evidenced by a comparative assessment of the rates of supermarket floorspace provision per capita in capital cities compared with non-capital city areas. In metropolitan Sydney, for example, there is around 262 sq.m of supermarket floorspace per 1,000 residents, while across the balance of NSW, there is around 394 sq.m per 1,000 residents.

Across the Dubbo LGA, there is an estimated 449 sq.m of supermarket floorspace provided per 1,000 residents. This is not an unusually high level of supermarket floorspace provision. Several towns across NSW report rates of provision in excess of 500 sq.m per 1,000 residents.

Table 4.1 compares the demand for supermarket floorspace generated by residents of the main trade area with the existing, and proposed, supply of supermarket floorspace, outlining the estimated current and future market gap for supermarket floorspace within the main trade area. For the purposes of calculating the estimated gap we have undertaken the following steps:

- Estimated the current and future population within the defined main trade area.
- Estimated per capita expenditure on take-home food, packaged liquor and groceries (FLG) using MarketInfo data.
- Allowed for 75% of FLG expenditure to be directed to supermarkets. This estimate is consistent with national benchmarks for comparable areas (i.e. regional and non-metropolitan areas throughout Australia), and allows for the remaining 25% to be allocated to smaller foodstores (e.g. small Friendly Grocers), food specialty stores and other general retail stores. We consider this to be a conservative assumption, for a non-metropolitan location, i.e. it is likely to understate the real demand for supermarket floorspace.
- Multiplied per capita FLG expenditure directed to supermarkets, by the trade area population, to determine the total available FLG expenditure pool directed to supermarkets.
- Allowed for 6% of supermarket sales turnover to comprise of general merchandise (i.e. non-food), which is typical across national supermarkets.

- Estimated the likely retention of available expenditure for each trade area sector. To do so, we have first allowed for an outflow of 25% of total supermarket expenditure, i.e. 75% of supermarket expenditure generated by main trade area residents is estimated to be retained within the trade area.

- We have then allowed for inflow from customers who live beyond the main trade area, which we have estimated at be about 10%. The consequential outcome of these assumptions is that there is a net outflow of 15% (i.e. a net retention rate of 85%). This is considered reasonable, if not conservative, allowing for the supermarkets at nearby Orana Mall.

- Applied an RTD for supermarkets of $9,500 per sq.m in 2015, which represents a successful and profitable average trading level for supermarket retailers. This RTD reflects our analysis earlier that showed non-capital city/non-metropolitan locations such as Dubbo typically have a higher than average provision of supermarket floorspace per capita - and thus the average trading levels of supermarkets in these locations tends to be lower than national averages.

- We have also allowed for some real growth in this RTD, averaging around 0.5% per annum from 2015.

- We note that Hill PDA adopts an RTD for supermarket retailing of $9,500 per sq.m in its CFIA 2014 report, although expressed in $2011 dollars. We have therefore also included a scenario in Tables 4.1 that models the resultant supermarket floorspace demand assuming an RTD of $10,000 per sq.m, to present the outcome under a very conservative scenario.

- We have provided evidence in Appendix 1 of this report as to why we consider an RTD of $9,500 per sq.m to be appropriate for assessing potential supermarket floorspace demand.

Table 4.1
East Dubbo main trade area - Est. supermarket floorspace market gap (2015 - 2031)

Factor	2015	2018	2021	2026	2031
Population and supermarket expenditure					
Main trade area (MTA) population	6,786	7,386	8,046	9,196	10,396
FLG Spend per capita* ($)	$5,956	$6,132	$6,332	$6,716	$6,876
Total FLG exp. ($M)	$40.4	$45.3	$50.9	$61.8	$71.5
FLG expenditure to smkts at 75% ($M)	$30.3	$34.0	$38.2	$46.3	$53.6
6% of smkt sales from GM ($M)	$1.9	$2.2	$2.4	$3.0	$3.4
Total smkt exp. MTA residents ($M)	**$32.2**	**$36.1**	**$40.7**	**$49.3**	**$57.0**
MTA containment ratio	75%	75%	75%	75%	75%
Beyond trade area capture rate	10%	10%	10%	10%	10%
Total available smkt exp. in MTA ($M)	**$26.9**	**$30.1**	**$33.9**	**$41.1**	**$47.5**
Supermarket floorspace demand and market gap					
RTD @ $9,500 increasing at 0.5% p.a.	$9,500	$9,643	$9,789	$10,036	$9,500
Supportable smkt floorspace (sq.m)	2,829	3,123	3,461	4,092	5,003
Supermarket supply (sq.m)**	0	0	*3,500*	3,500	3,500
*- East Dubbo Neighbourhood Centre****			*3,500*	*0*	
Total supermarket gap (sq.m)	**2,829**	**3,123**	**-39**	**592**	**1,503**
Assuming RTD of $10,000 per sq.m	**2,687**	**2,966**	**-212**	**387**	**1,253**

**Constant 2014/15 dollars & including GST*
***No supermarkets within the identified main trade area*
**** Assumes the proposed development at the subject site occurs around 2019/2020*
Source: MarketInfo; MacroPlan Dimasi

Table 4.1 shows that the estimated supermarket floorspace demand generated by the main trade area population, based on the above methodology, is 2,800 sq.m at 2015, and is projected to increase to around 5,000 sq.m by 2031, an increase of 2,200 sq.m

Given there is no supermarket floorspace supply within the main trade area, the estimated market demand of 2,000 sq.m equates to a **market gap of 2,800 sq.m**, increasing to around **4,100 sq.m by 2026 and 5,000 sq.m by 2031**, assuming no additional supermarket facilities are added within the main trade area.

The provision of a new supermarket of **at least** 3,500 sq.m at the subject site, assumed to occur before 2021, would fill this identified gap and would cater for future demand growth.

4.2 Supermarket floorspace provision: Dubbo LGA

As identified earlier, the Hill PDA CFIA 2014 report indicated that there was an under-supply of supermarket floorspace in the Dubbo LGA, in the order of 2,800 sq.m as at 2011.

Accounting for the new 1,857 sq.m Aldi supermarket which opened in 2014, the estimated under-supply of supermarket floorspace is estimated to reach 3,600 – 4,800 sq.m by 2026.

No clear direction is provided as to where the additional supermarket floorspace in Dubbo should be accommodated, however, the CFIA report clearly endorses the addition of another supermarket in the Dubbo LGA.

Given the main trade area (i.e. East Dubbo) is likely to accommodate the lion's share of future residential dwelling growth in Dubbo, we consider that a central location in the main trade area would be a very appropriate location for an additional supermarket in Dubbo.

4.3 Escape expenditure

We do not suggest that all of the supermarket demand generated by main trade area residents will or necessarily should be retained within the main trade area. There are inevitably outflows of expenditure from any trade area, just as there are inflows from tourists/passers-by/residents of other areas. Assessing the market gap provides a broad indication as to whether a community has convenient access to a sufficient quantum and range of supermarket facilities.

The estimation of the market gap is also useful in enabling reasonable conclusions to be drawn as to the likely impact of any particular new development.

Section 5: Economic impacts

This section of the report provides a recommendation as to the appropriate scale/mix of retail at the subject site; presents an assessment of potential sales that could be achieved by the proposed retail development; analyses the likely trading impacts on the surrounding retail/centres hierarchy; and then discusses the implications of these impacts.

5.1 Recommended scale and mix

The analysis contained in this report indicates that a supermarket of at least 3,500 sq.m could be supported at the subject site by 2021.

Across Australia single supermarket anchored shopping centres typically support around 1,300 – 1,500 sq.m of specialty retail floorspace and around 500 - 600 sq.m of mini-major floorspace, in addition to a supermarket anchor. Typical single supermarket centres tend to also support an additional 500 – 1,000 sq.m of other uses, which could include travel agents, post offices, gyms, childcare, medical uses, professional suites, banks etc.

In some established locations, with high volumes of surrounding activity, and limited competition, the provision of specialty retail could be significantly larger than this, while in other locations a supermarket centre may only support a handful of specialty tenants.

Delroy Central is a good example of the type of neighbourhood shopping centre that we envisage at the subject site, although with a larger supermarket anchor than Delroy Central, a larger provision of specialty floorspace and non-retail uses could be potentially be sustained at the proposed subject site.

In this context, and given the centre's proposed location on the planned main east-west road in the locality, we recommend that a centre of around 5,000 – 6,000 sq.m (retail and ancillary non-retail) could be supported at the subject site, with a strong focus on convenience.

5.2 Estimated sales potential

Tables 5.1 and 5.2 summarise the retail sales potential and required market shares of the proposed East Dubbo neighbourhood centre, assuming a centre of around 5,000 sq.m of retail floorspace is provided.

The analysis in Section 4 of this report showed that a supermarket could be supported at the subject site by 2021. In order to estimate the potential trading impacts on the surrounding retail hierarchy, we have assumed that the proposed development would have its first full year of trade in the year 2019/20 (i.e. built by June 2019). Future sales estimates are presented in constant 2014/15 dollar terms and include GST.

In estimating the sales potential for the proposed retail development we have had regard to all of the information set out in the previous sections of the report, and in particular the following:

- The existing provision and estimated trading levels of supermarkets across the surrounding region.
- The current and future population within the main trade area, and in particular, the FLG expenditure capacity generated by this population.

As shown in Table 5.1, we estimate that the proposed development will achieve a sales volume in the order of $38.4 million at 2019/20, expressed in constant 2014/15 dollar terms, including estimated supermarket sales of $32.4 million (at approximately $9,250 per sq.m).

Table 5.1
East Dubbo - Estimated retail sales potential by store type, 2019/20*

Tenant	GLA (sq.m)	Est. sales ($M)	($/sq.m)
Supermarket	3,500	32.4	9,250
Specailty retail	1,000	6.0	6,000
Total retail	**4,500**	**38.4**	**8,528**
Non-retail	500 - 1,000		

**Constant 2014/15 dollars & including GST*
Source: MacroPlan Dimasi

Table 5.2 presents the estimated market shares which the proposed development would be required to achieve in order to deliver the sales potential estimated in Table 5.1.

Overall, the development is expected to achieve a market share of total available retail expenditure within the main trade area of around 32%, consisting of a 39% market share from the primary sector and 27.5% market share from the secondary sectors. This means that around 68% of main trade area expenditure would be directed to other centres across the Dubbo retail hierarchy, equivalent to around $68 - 69 million.

We estimate that beyond trade area expenditure (including tourists/visitors and other non-trade area residents in the region) would contribute to around 10% of total sales for the centre.

Table 5.2
East Dubbo - Estimated market shares, 2019/20*

Trade area	Est. sales ($M)			Distribution of sales			Est. Market share	
	Super market	Spec.	Total	Super market	Spec.	Total	Total retail exp. ($M)	% Mkt share
Primary	14.6	2.7	17.3	45.0%	45.0%	45.0%	44.1	39.2%
Secondary sectors								
• North	2.8	0.5	3.3	8.5%	8.5%	8.5%	13.6	23.9%
• South	2.1	0.4	2.5	6.5%	6.5%	6.5%	6.5	38.5%
• West	9.7	1.8	11.5	30.0%	30.0%	30.0%	42.6	10.0%
Total secondary	14.6	2.7	17.3	45.0%	45.0%	45.0%	62.7	27.5%
Main TA	**29.1**	**5.4**	**34.5**	**90.0%**	**90.0%**	**90.0%**	**106.8**	**32.3%**
Sales from beyond TA	3.2	0.6	3.8	10.0%	10.0%	10.0%		
Total centre sales	**32.4**	**6.0**	**38.4**	**100%**	**100%**	**100%**		

**Constant 2014/15 dollars & including GST*
Source: MarketInfo, MacroPlan Dimasi

5.3 Purpose of assessing trading impacts

The purpose of an impact assessment is to provide guidance as to whether or not there is likely to be a net community benefit or disbenefit from any proposed development. In particular, if there is a real possibility of some existing facilities potentially being impacted to such a degree that they may be lost to the community and if the service or services provided by those facilities are not at the very least replaced by the proposed new facilities, then a community disbenefit could result.

In order to understand whether any particular centre may be impacted to the extent that its continued viability may be in question, we have estimated specific retail impacts that we expect across the surrounding competitive network if the proposed supermarket based development at the Wallsend subject site were to proceed as planned.

These estimates provide indications as to whether the scale of the proposed retail development is reasonable and whether any surrounding centres are likely to be at risk to the extent that the community would suffer a net disbenefit, attributable to the proposed retail development.

In considering likely trading impacts on any individual centre or individual retailer, it must first be acknowledged that such estimation can only realistically expect to provide a broad indication of likely outcomes, since there are many factors which can change in response to any new retail development, and which will have a bearing on the consequent outcomes. The competitive response of each relevant centre or trader is one such factor, as are further redevelopments/improvements which one or more of the competitive network of centres might implement.

5.4 Impacts methodology

The following factors are typically considered when assessing the potential impacts of a new supermarket based development on each existing facility or centre:

- The distance of the (impacted) centre, or retail precinct, by road, from the proposed development.
- The size of the centre or precinct, in terms of total retail floorspace.
- The amount of supermarket floorspace, and brands of these supermarkets.
- The role and function of the centre or precinct.
- Relative accessibility and relative convenience compared with the proposed retail development.
- The estimated performance of the centre/precinct (in current sales) and future performance (in the impact year), accounting for any future developments in the region that may also impact on the future sales of existing centres.
- The share of available expenditure which the centre/precinct attracts from the identified main trade area of the proposed development. A centre may not be situated in the identified trade area of the proposed development but its main trade area may extend to include parts, or all, of the trade area. For example, the trade area for large regional shopping centre typically includes several hundred thousand persons. Such a trade area is likely to include (partially or completely) trade areas for smaller convenience based centres, sub-regional centres, retail strips and stand-alone supermarkets.

The following key principles are then relied on when assessing the dollar (and percentage) impacts that are likely to be absorbed by existing facilities/centres:

- The greatest impacts are typically absorbed by the closest comparable centres. For example, a new Woolworths supermarket is generally likely to impact the closest nearby Woolworths supermarket to the greatest extent, followed by impacts on other

comparable large supermarkets (e.g. Coles), and at the lower end of the spectrum, by smaller scale supermarkets/food stores, which serve much more limited roles.

- Impacts on small scale, local supermarkets/food stores, tend to be relatively smaller in scale, as these stores normally attract a small market share of available main trade area expenditure and perform a different role and function in the hierarchy, often serving the local walkable catchments surrounding them, and/or serving more specialised/discerning needs (e.g. specialty food stores).

Table 5.3 presents a summary of the key metrics for the surrounding centres of relevance to the proposed development. This table includes the following:

- Column (1) shows the distance of each centre or store from the subject site.
- Column (2) shows the amount of retail floorspace at the centre and column (3) shows the amount of supermarket floorspace at the centre.
- Column (4) outlines the brand/s of key supermarket tenants at the centre.
- Column (5) outlines the estimated sales for the year 2014/15.
- Column (6) presents an estimate of the *proportion* of sales for each centre that is generated from the main trade area population. This provides the starting point for the allocation of sales redirected to the new development at the subject site.
- Column (7) presents an estimate, for each centre, of the *volume* of sales generated from the defined main trade area. **Column (7) is calculated by multiplying Column (6) by Column (5).** This column represents the total amount estimated to be spent by residents of the main trade area at each identified centre.
- Column (8) shows, for each centre, the proportion of sales drawn by the centre from the main trade area as a percentage of the total sales drawn from the main trade area by all identified centres in the analysis. **Column (8) is calculated by dividing each entry in Column (7) by the sum total of Column (7).**

Table 5.3
East Dubbo - Estimated sales distribution of specific centres, 2014/15*

Centre	Distance from site (km) (1)	Floorspace (sq.m) Total GLA (sq.m) (2)	Smkt. GLA (sq.m) (3)	Supermarket Brand (4)	Est. centre sales ($M) (2014/15) (5)	Est. % sales drawn from MTA (%) (6)	Est. % sales drawn from MTA ($M) (7)	Share of available MTA retail exp. to identified centres (%) (8)
Higher order centres								
Dubbo CBD (B3 zone)	5.8	66,000	8,320	WOW, Coles, Aldi	410.7	10.0%	41.1	43.4%
Orana Mall (B2 zone)	2.8	20,400	6,370	WOW, IGA	186.4	22.5%	41.9	44.3%
Neighbourhood centres								
Boundary Rd (B1 zone)	2.5	900	0	n.a.	5.4	40.0%	2.2	2.3%
Tamworth Street (B1 zone)	3.5	2,500	1,030	IGA	23.8	40.0%	9.5	10.0%
Total		**89,800**	**15,720**		**626.3**	**15.1%**	**94.7**	**100.0%**

Source: Marketinfo; Shopping Centre News; PCA; MacroPlan Dimasi

Table 5.4 builds upon the analysis in Table 5.3, setting out an assessment of the likely order of trading impact on each of the identified centres, showing:

- The estimated floorspace (GLA) and sales volume for each centre as at 2014/15.
- The estimated sales volume for each centre at 2019/20 assuming no development at the subject site.
- The estimated sales volume for each centre at 2019/20 after allowing for the proposed development at the subject site at 2019/20
- The consequent estimated trading impact, measured both as a sales volume and a percentage impact, on each centre.
- The estimated post-impact sales performance at 2019/20 as compared with current (2014/15) sales for each centre.

Table 5.4
East Dubbo - Estimated impacts on specific centres, 2019/20*

Centre	GLA (sq.m)	Est. sales (2014/15) $M	Est. Sales (2019/20) Without dev. $M	Est. Sales (2019/20) With dev. $M	Est. Impacts (2019/20) Distrubtion of impacts (%)	Est. Impacts $M	Est. Impacts %	% sales diff. vs. 2014/15
Higher order centres								
Dubbo CBD (B3 zone)	66,000	410.7	449.0	436.1	35.0%	-12.9	-2.9%	6.2%
Orana Mall (B2 zone)	20,400	186.4	220.7	202.3	50.0%	-18.4	-8.3%	8.5%
Neighbourhood centres								
Boundary Rd (B1 zone)	900	5.4	6.3	6.1	0.5%	-0.2	-2.9%	12.5%
Tamworth Street (B1 zone)	2,500	23.8	27.5	25.9	4.5%	-1.7	-6.0%	9.0%
Sub-total	**89,800**	**626.3**	**703.5**	**670.4**	**90.0%**	**-33.1**	**-4.7%**	**7.0%**
Other centres/BTA					10.0%	-3.7		
Total est. sales potential new centre					**100.0%**	**36.8**		

Source: Marketinfo; Shopping Centre News; PCA; MacroPlan Dimasi

In summary, the impact assessment shows the following:

- Specific impacts on the Dubbo CBD are expected to be minor, at around 3%, due to the distance of the Dubbo CBD from the subject site, particularly relative to Orana Mall; the significant volume of retail critical mass in the CBD; the different role and function performed by the CBD retail offer; and the additional and unique customer segments served by the CBD – including workers and tourists. Indeed, the tourist market in Dubbo provides an additional equivalent population of 3,500 – 4,000 persons and the Dubbo CBD supports a daily workforce of around 4,000 – 5,000 workers.

- The greatest impacts are expected to be absorbed by Orana Mall, which is trading exceptionally strongly, and is currently undergoing expansion. We estimate impacts in the order of 8.3%, in the year 2019/20. With 4 – 5 years' worth of growth in the market as well as additional sales from its current expansion, this impact would mean that Orana Mall would be still be achieving sales around 8.5% above its current reported trading volumes, in real terms, in the year of the proposed East Dubbo development.

- Impacts on the smaller neighbourhood centres south of the Mitchell Freeway (including the Tamworth Street and Boundary Road centres) are expected to be minor/moderate, in the order of 3 – 6%, as these centres are not directly competitive with the proposed development as they do not provide full-scale supermarket facilities.

5.5 Implications

Because a significant market gap for supermarket facilities is identified across the Dubbo LGA by 2026 (in the order of 3,800 – 4,600 sq.m), and given the main trade area population generates supermarket floorspace demand in excess of 3,460 by 2021 and 4,000 sq.m by 2026, the provision of additional supermarket facilities into the Dubbo retail hierarchy is expected to be comfortably absorbed without any detrimental trading impacts.

Estimated impacts, modelled in the year 2019/20, across the network of centres in east and south-east Dubbo and the Dubbo CBD are generally expected to average less than 5% (i.e. an average of 4.7%).

In summary, our impact analysis shows that there is no prospect that any existing centre will suffer any impact which will threaten its ability to provide a level of service at least equivalent to that which each is providing at 2014/15.

Indeed, if the proposed neighbourhood centre is developed around 2019/20, all centres will have had the benefit of 4 – 5 years' of market growth, and even with the new centre added to the network, these centres would be trading at levels significantly above current trading volumes in real terms.

Section 6: Employment and other community impacts

This section of the report examines the net community benefits associated with the proposed development, including employment generation and other economic and social benefits.

6.1 Estimated employment impacts

The development of the proposed retail component of the development at the subject site will result in additional on-going employment on site, as well as further jobs throughout the supply chain, including those in industries servicing the retail tenants at the site, such as transport workers, wholesalers and the like.

Furthermore, the construction phase of the project will support temporary construction related employment, and additional temporary jobs through the broader economic supply chain (i.e. multiplier impacts).

In estimated the various employment benefits, we have relied upon various data sources including information from supermarket operators, the ABS, state and local government agencies, as well as 30 years of experience in preparing assessments of this nature.

Table 6.1 illustrates the estimated net increase in direct on-site retail employment that could potentially be created if the proposed development at the subject site were to proceed. An estimated 178 jobs could be created on site once the neighbourhood centre development is fully operational.

Allowing for some minor impacts on employment across other retail centres in the hierarchy, estimated to be in the order of 5%, the overall net employment that could potentially be created is estimated to be in the order of 169 jobs.

Table 6.1
East Dubbo - Estimated employment levels

Type of use	Estimated employment per '000 sq.m	GLA (sq.m)	Employment (persons)
Supermaket	30	3,500	105
Specialty shops	40	1,000	40
Non-retail	33	1,000	33
Total development		**5,500**	**178**
Net increase[1]			**169**

1. Excludes non-retail components
1. Net increase includes an allowance for reduced employment levels at impacted centres, estimated at 5% of the total increase
Source: MacroPlan Dimasi

Table 6.2 provides an estimate of the total additional employment that could be created as a result of the proposed development, including both on-going direct and indirect (multiplier induced) employment from the construction phase of the project.

Table 6.2
East Dubbo - estimated future additional centre employment levels*

Original stimulus	Direct employment (long-term)	Direct employment (const'n period)	Supplier employment multiplier effects	Total	
On-site employment[1]	169		68	237	
Construction of project ($15m. est. capital costs)		64	103	167	Job years[2]

** Employment totals include both full-time and part-time work*
1. Indicates the estimated number of net additional ongoing jobs as a result of the proposed development
2. Indicates the estimated number of jobs over the life of the construction project, for the equivalent of one year.
Source: ABS, MacroPlan Dimasi

To calculate the likely total economic stimulus that can be attributed to the proposed retail facility, both due to the direct employment which it will create, and also due to its construction, we have had regard to ABS Australian National Accounts Input/output multipliers.

Based on assumed construction costs of around $15 million (in $2014/15), and an expected development timeframe of one year, the construction phase of the project is estimated to sustain about 167 jobs per annum, including around 64 jobs created directly and a further 103 jobs resulting from multiplier induced effects.

As previously outlined, direct net employment resulting from the proposed supermarket is expected to be 169 jobs, which could potentially lead to a further 68 multiplier induced jobs across the broader economy.

6.2 Other economic/social impacts

The proposed development at the subject site would generate a range of other economic benefits, in particular the following:

- Increased choice and amenity for the population of the main trade area as well as likely increased competition for the benefit of consumers.
- More convenient access to new food and grocery shopping facilities, and other supporting retail and non-retail services, to serve both the current residents of the main trade area and future residents.
- Reduced travels distances, leading to savings on time and fuel for main trade area residents, due to a much better provision of food and grocery shopping facilities at the local level.
- Reinforcing the retail/centres hierarchy in the Dubbo LGA by providing additional convenience retail to service a growing residential growth area, without reducing the level of service provision anywhere else, particularly within the Dubbo CBD.
- Opportunities for small businesses to open premises within the neighbourhood centre.
- Providing jobs near people's homes and consequent economic multiplier impacts, which will boost the local economy.

Appendix 1: National Average Supermarket Retail Turnover Density (2014)

When assessing the appropriate level of supermarket floorspace provision for a region, a suitable threshold that covers the likely trading performance for all types of supermarkets, including those in smaller local centres and independent supermarkets, is considered appropriate.

We consider than an average trading level of $9,500 per sq.m, which would be a very successful and profitable average trading level, is a suitable benchmark to use when determining the appropriate provision of supermarket floorspace in an area – particularly if the key objective of planning is to maximise net community benefit, as we suggest it should be.

Table A.1 shows the average RTD for all the major supermarket operators operating in Australia and provides an estimate of the average RTD as at 2014. As shown, the average RTD was approximately $9,800 per sq.m. This average has been calculated as follows:

- Estimated supermarket sales generated by Woolworths supermarkets based on reported total sales figures from the company's 2014 Annual Report.
- Estimated Coles' sales based on reported sales in its 2014 Annual Report, adjusted to exclude liquor sales for the reasons identified above.
- Estimated sales at Aldi and independent supermarkets (e.g. IGA) for the year 2013, using available industry information for these retailers. Aldi reported $5.3 billion in sales for calendar 2013 and $6 billion for calendar year 2014.
- Calculated the number of stores for each supermarket retailer using Annual Reports, store websites, field inspections and industry publications.

- Calculated an average store size (total store leasable area, not just trading area) using available proprietary information, plus information from Annual Reports, field inspections and industry publications.

Table A1
Australian Supermarkets - Estimated average sales per sq.m ($/sq.m) (2014)*

Heading	Est. Sales ($b)**	No Stores	Avg. Size	Avg RTD ($/sq.m)
Coles	24.2	762	3,250	9,762
Woolworths	34.3	933	3,400	10,820
Aldi	5.7	366	1,250	12,459
Other (i.e. independents)***	12.8	1,359	1,300	7,217
Total supermarkets > 500 sq.m.	**76.9**	**3,420**	**2,302**	**9,774**

** Includes GST*
***Est. sales exclude packaged liquor*
**** Stores greater than 500 sq.m*
Source: Wesfarmers; Woolworths Limited; Master Grocers Association; ASIC; MacroPlan Dimasi

As shown, Woolworths and Aldi are the best performing retailers on a dollar per sq.m basis, followed by Coles. On average independent supermarkets perform at much lower levels than Woolworths, Coles and Aldi, averaging sales of around $7,200 per sq.m.

Applying an average RTD around, or in excess of, the current national average for all supermarkets (i.e. approx. $9,800 per sq.m) to determine the appropriate provision of supermarket floorspace for the area, would mean that on average all supermarkets should be trading extremely profitably.

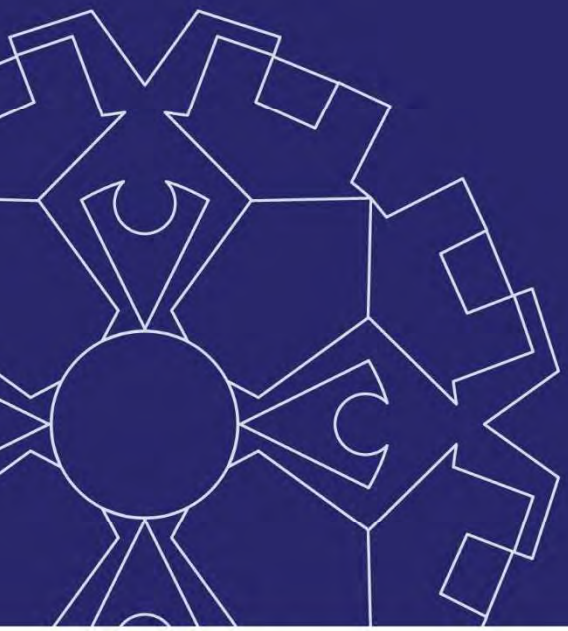
By implication, were Council to adopt such an approach, which would then mean that a key objective of Council's policy in regards to supermarket floorspace provision would be to help deliver maximum retailer profitability, largely at the expense of greater potential net community benefit. It is strongly arguable that the current situation, reflecting a gross under-provision of modern supermarket facilities within the defined main trade area, and necessitating a very high level of escape spending to supermarkets located well beyond the area, is creating considerable community disbenefit.

Community benefits include increased choice, competition, improved accessibility, reduced travel times/distances, and employment creation, all of which are achieved by a greater, within reason, rather than a lesser provision of floorspace

SERVICING STRATEGY
SOUTHLAKES ESTATE DUBBO

PREPARED FOR
MAAS GROUP PROPERTIES PTY LTD

SEPTEMBER 2016



• Civil, Environmental & Structural Engineering • Surveying • Environmental • Planning • Architecture

SERVICING STRATEGY

SOUTHLAKES ESTATE DUBBO

PROPOSED RESIDENTIAL SUBDIVISION

LOT 12 IN DP1207280 AND LOT 399 IN DP1199356

PREPARED FOR:

MAAS GROUP PROPERTIES NO. 2 PTY LTD

SEPTEMBER 2016

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Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

All information contained within this report is prepared for the exclusive use of Maas Group Properties No. 2 Pty Ltd to accompany this report for the land described herein and is not to be used for any other purpose or by any other person or entity. No reliance should be placed on the information contained in this report for any purposes apart from those stated therein.

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APPENDICES

APPENDIX A
Stormwater Management Strategy Prepared by Geolyse

Executive Summary

1.1 INTRODUCTION

Maas Group Properties intends to develop a residential subdivision on land to the east of the existing Southlakes Estate subdivision. The extension to Southlakes Estate will complement the existing Southlakes subdivision and have major access points connecting via Azure Avenue and Argyle Avenue to Wheelers Lane and the wider road network.

It is intended that approximately 1,475 dwelling sites be created in the extension to Southlakes Estate and will comprise residential allotments and medium density allotments.

This Servicing Strategy will assess the overall development of the extension of Southlakes Estate and also make provisions for the extension of the sewerage reticulation to the north and east of Southlakes to allow the future development of adjoining lands contained within the sewerage catchment.

The objective for preparing the Servicing Strategy is to determine an economic means of providing the required infrastructure to the subdivision area to allow the development of the land for residential and commercial purposes.

The Servicing Strategy will assess the provision of sewerage reticulation and the water reticulation network necessary to service the approximately 1,475 dwelling sites within the subdivision.

A separate Stormwater Drainage Report has been prepared and is appended to this Servicing Strategy Report to assess the drainage requirements of the subdivision particularly in relation to the trunk drainage corridor through the subdivision and discharging to the proposed detention basin to be constructed on the southern side of Hennessy Drive.

1.2 SEWERAGE RETICULATION

It is intended that approximately 1,475 dwelling sites be created in the subdivision comprising residential allotments and medium density allotments.

In general, the dwelling sites will comprise the following allocations:

Residential allotments	910 lots
Medium density dwelling units	565 units
Total dwelling sites	1,475 dwellings

Based on the criteria outlined in the *NSW Public Works Department Manual of Practice Sewer Design*, the estimated sewage generation from the extension to Southlakes Estate can be calculated as approximately 1,287 ET.

An allowance has also be made to account for the future development of the neighbourhood precinct in the northern section of the site and an allocation of 20 ET's will be made and thus the total estimated sewage generation from the subdivision is approximately 1,307 ET.

Many of the proposed dwelling lots that are located along the eastern extents of the existing Southlakes Estate can be serviced by the extension of existing gravity sewerage mains from the current subdivision. Approximately 250 dwelling lots can be serviced in this way.

The servicing of the remaining sewage generated from the extension of Southlakes Estate will require the provision of a major gravity sewerage main connecting to the Keswick Sewage Pump Station. The gravity connection to the sewage pump station will service approximately 1,057 ET. In order to provide a buffer for the possible increase of dwelling density within the proposed subdivision, an additional

approximate 10% allowance should be added to the estimated ET's connecting to the Keswick Sewage Pump Station.

Therefore, the total ET allocation from the extension of Southlakes Estate draining to the Keswick pump station should be increased to approximately 1,165 ET.

Also located within the sewage catchment draining to the Keswick Sewage Pump Station is a parcel of land located further to the east of the extension of the Southlakes subdivision. The land to the east is owned by Mr and Mrs Ringland and is currently Zoned R5.

Assessment of this parcel of land indicates that approximately 300 residential lots generating an additional 300 ET can be developed.

Dubbo City Council's Keswick Estate is located to the north of the extension to Southlakes Estate and sewage generated by the future development of this land will drain through the Southlakes sewerage reticulation system to the Keswick pump station.

Discussions with Council staff indicate that approximately 650 lots can be developed and an allowance of 720 ET will be made for the future development of the section of Keswick Estate within the sewage catchment.

There is an additional parcel of land to the north east of Southlakes Estate situated at the intersection of Sheraton Road and the extension of Boundary Road owned by Mr Neil O'Connor. Based on an assessment of the expected lot yield from this parcel of land, an allowance of 60 ET will be made.

On the basis of the overall sewage catchment draining to the Keswick Sewage Pump Station, the reticulation mains within the extension of Southlakes Estate and the Keswick pump station will need to cater for the following sewage loadings:

Southlakes Estate extension	1,165 ET
Future Ringland subdivision	300 ET
Future Keswick subdivision	720 ET
Future O'Conner subdivision	60 ET
Total Sewage Loading	2,245 ET

In general, a 225mm diameter and a 300mm diameter sewer main will be provided in the southern section of the subdivision draining from east to west to cater for the majority of the future development of land to the east (Ringland).

The major gravity sewer main draining from north to south will comprise a 300mm diameter connection to the land to the north of Boundary Road (Keswick) subsequently increasing downstream to 375mm diameter, 450mm diameter and 525mm diameter sewer mains.

The 300mm diameter and 525mm diameter trunk sewer mains join at the southern end of the subdivision. When the trunk mains combine, the gravity connection to the inlet manhole at the Keswick pump station will require the construction of a 600mm diameter sewer main to transfer the expected 2,245 ET's generated from within the overall sewage catchment to the pump station.

The 600mm diameter sewer main is required due to grade limitations from the invert level of the inlet manhole and the provision of cover where the trunk sewer main crosses the eastern and western drainage channels within the drainage corridor.

All gravity sewer mains within the subdivision will be designed in accordance with Council's design criteria in terms of minimum depth, sewer main grading and ET capacity.

1.3 WATER RETICULATION

For the expected development of 1,475 dwellings, the following water demands can be estimated:

Peak Instantaneous Demand	148 L/s
Peak Daily Demand	3.86 ML

Dubbo City Council has carried out a WATSYS analysis on the overall water reticulation network for the greater south eastern section of the area encompassing Southlakes Estate, the proposed extension of Southlakes Estate, Holmwood Estate, Magnolia Estate and Macquarie View Estate.

Council's most recent WATSYS analysis of the area was carried out in May 2016.

Whilst Council's reticulation model indicates the use of water mains with a minimum size of 150mm diameter, Council has advised that the minimum water main size that may be used in selected cul-de-sacs within the subdivision is 100mm diameter.

However, a water reticulation network to service the extension of Southlakes Estate has been determined generally in accordance with Council's WATSYS model with the minimum size of the water reticulation mains generally to be 150mm diameter as modelled by Council.

1.4 INDICATIVE SERVICING PLANS

Indicative servicing plans for sewerage and water reticulation to service the extension of Southlakes Estate have been prepared and are indicated on **Drawings C001 to C005** located in the **Drawings** Section of this Report.

1.5 STORMWATER DRAINAGE

The Stormwater Management Strategy presents an assessment of the proposed stormwater management strategy for the extension of the Southlakes Estate residential subdivision proposed by Maas Group Properties. The results show that the proposed stormwater management system results in a slightly higher peak discharge from the site at Hennessy Drive than that determined by Cardno. However, given the location of the Southlakes Estate at the lower end of the catchment and the designed bypass on the Hennessy Drive basin it is not expected that the modelled increase in flows will have any detrimental effect on flooding downstream of the site.

It is proposed to construct a minor/major drainage system for the extension of Southlakes Estate with the minor system consisting of stormwater pits and pipes that would convey minor flows to the drainage reserve running through the site. Major flows would be conveyed along road reserves and drainage easements to the drainage reserve running through the site. In accordance with the overall stormwater strategy for the catchment no on-site detention is proposed within the Southlakes Estate. All system components would be subject to further detailed assessment and design during the engineering design phase, based on the principles outlined in this assessment.

1.6 CONCLUSION

This Servicing Strategy has determined the infrastructure requirements necessary for the proposed extension of Southlakes Estate. The Servicing Strategy has determined the overall framework for the effective provision of services to the subdivision.

The Servicing Strategy has provided the design guidelines for the provision of services to the subdivision in a staged manner and forms the basis for the future detailed design of the services for the extension to Southlakes Estate.

Introduction

2.1 BACKGROUND

Maas Group Properties intends to develop a residential subdivision on land to the east of the existing Southlakes Estate subdivision. The extension to Southlakes Estate will complement the existing Southlakes subdivision and have major access points connecting via Azure Avenue and Argyle Avenue to Wheelers Lane and the wider road network.

It is intended that approximately 1,475 dwelling sites be created in the extension to Southlakes Estate and will comprise residential allotments and medium density allotments.

An open space corridor will be created along the central drainage line that separates the subdivision generally from the north east to the southwest of the site. The drainage corridor will be embellished with a series of decorative lakes similar to the lakes that have been developed along the existing drainage corridor in Southlakes Estate.

The drainage corridor within the extension to Southlakes Estate is known as the eastern channel whilst the drainage corridor within the existing Southlakes Estate is known as the western channel.

This Servicing Strategy will assess the overall development of the extension of Southlakes Estate and also make provisions for the extension of the sewerage reticulation to the north and east of Southlakes to allow the future development of adjoining lands contained within the sewerage catchment.

The objective for preparing the Servicing Strategy is to determine an economic means of providing the required infrastructure to the subdivision area to allow the development of the land for residential and commercial purposes.

The Servicing Strategy will assess the provision of sewerage reticulation and the water reticulation network necessary to service the approximately 1,475 dwelling sites within the subdivision.

A separate Stormwater Drainage Report has been prepared and is appended to this Servicing Strategy Report to assess the drainage requirements of the subdivision particularly in relation to the trunk drainage corridor through the subdivision and discharging to the proposed detention basin to be constructed on the southern side of Hennessy Drive.

2.2 SITE LOCATION

The Hillview property is located approximately 4km south east of the Dubbo central business district and is accessed from the north via Cobra Street and Wheelers Lane and the south via Hennessy Drive and Wheelers Lane.

The subdivision site is described as Lot 12 in DP1207280 and Lot 399 in DP1199356. Lot 12 has an area of approximately 2.27ha and Lot 399 has an area of approximately 128.5ha for a total development area of approximately 130.77ha.

The site is bounded by Southlakes Estate to the west, Boundary Road to the north, Hennessy Drive to the south and privately owned land to the east.

Boundary Road to the east of Wheelers Lane is currently unformed and Dubbo City Council proposes to extend Boundary Road to the east to connect with Sheraton Road whilst Hennessy Drive will be extended to provide a freight corridor extending further to the east and connecting to the Mitchell Highway via Basalt Drive.

Currently the site is accessed from Wheelers Lane via Azure Avenue through Southlakes Estate and crossing the western channel via a culverted bridge. Work is currently underway to construct an

additional culverted bridge again crossing the western channel and extending Argyle Avenue to the Hillview property.

The location of the proposed extension to Southlakes Estate is indicated on **Drawing D001** located in the **Drawings** Section of this Report.

2.3 STUDY METHODOLOGY

In order to prepare the Servicing Strategy for the provision of infrastructure for the extension of Southlakes Estate, the following worktasks will be carried out:

i) Determination of development densities in the nominated land use zones to assess loading demands for sewage equivalent tenements (ET's) with expected water usage demands for the subdivision.

ii) Determination of additional sewage ET allowances to be made for the future development of lands to the north and east of the extension of Southlakes Estate.

iii) Determination of the sewerage catchment limits based on depth limitations for connection of a gravity main to the Keswick Sewage Pump Station to service the subdivision.

iv) Determination of a gravity sewerage reticulation system to service the subdivision lot layout and the adjoining lands draining to the Keswick Sewage Pump Station.

v) Determine the water usage demands for the various areas of the Southlakes subdivision to estimate the total peak instantaneous demand required to service the subdivision.

vi) Determine a water reticulation layout to service the subdivision generally is accordance with the WATSYS reticulation modelling previously carried out by Dubbo City Council for the greater south eastern section of the area encompassing Southlakes Estate, the proposed extension of Southlakes Estate, Holmwood Estate, Magnolia Estate and Macquarie View Estate.

vii) Preparation of the Servicing Strategy Report to document the investigations carried out to determine the infrastructure requirements for the proposed extension to Southlakes Estate. The Servicing Strategy will provide sufficient design guidelines for the future provision of services in a staged manner and will form the basis of the future detailed design of each service.

In summary, the Servicing Strategy will determine the overall framework for the effective provision of services to the subdivision with the required sewerage and water supply networks.

Proposed Development and Design Loadings

3.1 PROPOSED DEVELOPMENT

The site for the extension of the Southlakes Estate subdivision comprises Lot 12 in DP1207280 and Lot 399 in DP1199356. Lot 12 has an area of approximately 2.27ha and Lot 399 has an area of approximately 128.5ha for a total development area of approximately 130.77ha.

It is intended that approximately 1,475 dwelling sites be created in the subdivision comprising residential allotments and medium density allotments.

In general, the dwelling sites will comprise the following allocations:

Residential allotments	910 lots
Medium density dwelling units	565 units
Total dwelling sites	1,475 dwellings

The concept Master Plan for the proposed extension to Southlakes Estate is indicated on **Drawing D002** located in the **Drawings** Section of this Report.

3.2 SEWAGE DESIGN CRITERIA

3.2.1 SOUTHLAKES ESTATE SEWAGE GENERATION

The estimated sewage generation from the expected 1,475 dwellings to be developed within the subdivision can be determined based on the design criteria outlined in the *NSW Public Works Department Manual of Practice Sewer Design* where the following generation rates will apply:

Residential dwelling house	1 ET per dwelling
Medium density dwelling unit	2/3 ET per unit

Based on this criteria, the estimated sewage generation from development of 1,475 dwellings in the extension to Southlakes Estate can be calculated as approximately 1,287 ET.

An allowance should also be made to account for the future development of the neighbourhood precinct in the northern section of the site and an allocation of 20 ET's will be made and thus the total estimated sewage generation from the subdivision is approximately 1,307 ET.

Many of the proposed dwelling lots that are located along the eastern extents of the existing Southlakes Estate can be serviced by the extension of existing gravity sewerage mains from the current subdivision. Approximately 250 dwelling lots can be serviced in this way.

The servicing of the remaining sewage generated from the extension of Southlakes Estate will require the provision of a major gravity sewerage main connecting to the Keswick Sewage Pump Station. The gravity connection to sewage pump station will service approximately 1,057 ET. In order to provide a buffer for the possible increase of dwelling density within the proposed subdivision, an additional approximate 10% allowance should be added to the estimated ET's connecting to the Keswick Sewage Pump Station.

Therefore, the total ET allocation from the extension of Southlakes Estate draining to the Keswick pump station should be increased to approximately 1,165 ET.

3.2.2 ADDITIONAL SEWAGE CATCHMENTS

Also located within the sewage catchment draining to the Keswick Sewage Pump Station is a parcel of land located further to the east of the extension of the Southlakes subdivision. The land to the east is owned by Mr and Mrs Ringland and is currently Zoned R5.

Assessment of this parcel of land indicates that approximately 300 residential lots generating an additional 300 ET can be developed.

Dubbo City Council's Keswick Estate is located to the north of the extension to Southlakes Estate and sewage generated by the future development of this land will drain through the Southlakes sewerage reticulation system to the Keswick pump station.

Discussions with Council staff indicate that approximately 650 lots can be developed and an allowance of 720 ET will be made for the future development of the section of Keswick Estate within the sewage catchment.

There is an additional parcel of land to the north east of Southlakes Estate situated at the intersection of Sheraton Road and the extension of Boundary Road owned by Mr Neil O'Connor.

Based on an assessment of the expected lot yield from this parcel of land, an allowance of 60 ET will be made.

3.2.3 TOTAL CATCHMENT SEWAGE GENERATION

On the basis of the overall sewage catchment draining to the Keswick Sewage Pump Station, the reticulation mains within the extension of Southlakes Estate and the Keswick pump station will need to cater for the following sewage loadings:

Southlakes Estate extension	1,165 ET
Future Ringland subdivision	300 ET
Future Keswick subdivision	720 ET
Future O'Conner subdivision	60 ET
Total Sewage Loading	2,245 ET

3.2.4 INDUSTRIAL CANDIDATE AREA NO. 1

In 1997, Terra Sciences (now Geolyse) prepared a servicing strategy on behalf of Dubbo City Council for an industrial precinct known as Industrial Candidate Area No. 1.

Industrial Candidate Area No. 1 is located to the south east of the urban area of Dubbo and comprises a total area of approximately 750 ha. The site is bounded by the Mitchell Highway to the north, Eulomogo Creek to the south and a portion of Sheraton Road to the west.

At the time of the preparation of the servicing strategy in 1997, the Industrial Candidate Area was to contain approximately 108 industrial lots ranging in size from 3,000m^2 up to approximately 7.0 ha. The section of the land to be developed in the Industrial Candidate Area was located closer to and was to have access from the Mitchell Highway and fell within three distinct catchments in terms of the provision of sewerage infrastructure.

Approximately one third of the developable area in the northwest section of the site was to be serviced by a gravity sewer main connecting to an existing Council sewer main located on the eastern side of Sheraton Road in the general vicinity of the former Caravan Park located in Sheraton Road and St Johns Primary School.

The remainder of the developable land within the Candidate Area was to be serviced by two (2) small sewage pump stations that discharged into the end of the gravity sewerage network connecting to the Sheraton Road sewer main.

To date, the Sheraton Road sewer main has been extended eastwards in association with the development of Bunnings on Sheraton Road and into the subdivision known as the Blueridge Business Park. The Blueridge development generally encompasses the initial section of Industrial Candidate Area No. 1 that was capable of being serviced by a gravity sewer main.

At this point in time, the remainder of the Industrial Candidate Area can be serviced in accordance with the original 1997 servicing strategy with the provision of sewerage reticulation and infrastructure independent to the proposed development of the extension of Southlakes Estate.

3.3 WATER DEMAND CRITERIA

The water demand criteria normally used for the design of water reticulation systems to service subdivisions is based on standard criteria outlined in the *NSW Public Works Department Water Supply Investigation Manual,* namely:

Peak Instantaneous Demand	0.15 L/s/tenement
Peak Daily Demand	5,000 L/day/tenement

However, in Dubbo City Council's *AUSPEC-1 Part D11 Water Reticulation*, the Peak Instantaneous Demand is taken to be 0.10 L/s/tenement.

Additionally, water supply authorities are moving away from the adoption of a peak daily demand of 5,000 L per day per tenement. Peak Daily Demands in the range of 2,000 L per day to 3,000 L per day are commonly used.

For the assessment of the Peak Daily Demand for the extension to Southlakes Estate a demand of 3,000 L/day/resident tenement and 2,000 L/day/medium density unit will be adopted.

For the expected development of 1,475 dwellings in the extension of Southlakes Estate, the following water demands can be estimated:

Peak Instantaneous Demand	148 L/s
Peak Daily Demand	3.86 ML

It should be noted that the irrigation of the landscaped areas of the subdivision, particularly the drainage corridors will be assumed to occur at night or at other off peak times and thus the irrigation demand is not included in the Peak Instantaneous Demand calculated for the subdivision.

Proposed Servicing Infrastructure

4.1 SEWERAGE RETICULATION

The extension of Southlakes Estate will be serviced by gravity sewerage reticulation mains connecting to either extensions of the existing sewerage reticulation from within Southlakes Estate to the west or by draining via trunk sewerage mains to the Keswick Sewage Pump Station located in Hennessy Road to the south west of the subdivision.

As indicated previously, the Southlakes sewerage reticulation mains will also be sized to cater for the expected development of land located to the east (Ringland) and to the north (Keswick and O'Connor) of the extension of Southlakes Estate. To enable these land parcels to be serviced by gravity reticulation to the Keswick pump station, the sewerage mains within the extension of Southlakes will need to be increased in size to cater for the additional sewage generation.

In general, a 225mm diameter and a 300mm diameter sewer main will be provided in the southern section of the subdivision draining from east to west to cater for the majority of the future development of land to the east (Ringland).

The major gravity sewer main draining from north to south will comprise a 300mm diameter connection to the land to the north of Boundary Road (Keswick) subsequently increasing downstream to 375mm diameter, 450mm diameter and 525mm diameter.

The 300mm diameter and 525mm diameter trunk sewer mains join at the southern end of the Southlakes subdivision. Where the trunk mains combine, the gravity connection to the inlet manhole at the Keswick pump station will require the construction of a 600mm diameter sewer main to transfer the expected 2,245 ET's generated from within the overall sewage catchment to the pump station.

The 600mm diameter sewer main is required due to grade limitations from the invert level of the inlet manhole and the provision of cover where the trunk sewer main crosses the eastern and western drainage channels within the drainage corridor.

An alignment for the 600mm diameter sewer main has been determined and a preliminary longitudinal section of the sewer main prepared.

Following discussions with Council's staff it has been confirmed that the original design of the Keswick Sewage Pump Station allowed for the development of the Hillview land and other land within the sewage catchment and can cater for the additional loading generated by approximately 2,245 ET's from within the catchment.

Details of the overall sewerage reticulation and the 600mm diameter trunk sewerage main are indicated on **Drawing C002, Drawing C003** and **Drawing C004** located in the **Drawings** Section of this Report.

The provision of the sewerage infrastructure to service the Southlakes Estate subdivision and the connections external to the site will be subject to detailed engineering design at the appropriate phase of the project.

4.2 WATER RETICULATION

Dubbo City Council has carried out a WATSYS analysis on the overall water reticulation network for the greater south eastern section of the area encompassing Southlakes Estate, the proposed extension of Southlakes Estate, Holmwood Estate, Magnolia Estate and Macquarie View Estate.

Council's most recent WATSYS analysis of the area was carried out in May 2016.

The water reticulation network for the development area determined by Council is indicated on **Drawing D003** located in the **Drawings** Section of this Report.

Whilst Council's reticulation model indicates the use of water mains with a minimum size of 150mm diameter, Council has advised that the minimum water main size that may be used in selected cul-de-sacs within the subdivision is 100mm diameter.

A water reticulation network to service the extension of Southlakes Estate has been determined generally in accordance with Council's WATSYS model with the minimum size of the water reticulation mains generally to be 150mm diameter as modelled by Council.

4.3 INDICATIVE SERVICING PLANS

Indicative servicing plans for sewerage reticulation and water reticulation to service the extension of Southlakes Estate have been prepared and are indicated on **Drawings C001 to C005** located in the **Drawings** Section of this Report.

The sewerage reticulation plans provide for the future servicing of lands located to the north and east of the extension of Southlakes Estate and provide a gravity trunk sewerage main connecting to the Keswick Sewage Pump Station.

4.4 STORMWATER DRAINAGE

A Stormwater Management Strategy for the proposed subdivision has been prepared and is attached in **Appendix A.**

The Report presents an assessment of the proposed stormwater management strategy for the extension of the Southlakes Estate residential subdivision proposed by Maas Group Properties. The results show that the proposed stormwater management system results in a slightly higher peak discharge from the site at Hennessy Drive than that determined by Cardno. However, given the location of the Southlakes Estate at the lower end of the catchment and the designed bypass on the Hennessy Drive basin it is not expected that the modelled increase in flows will have any detrimental effect on flooding downstream of the site.

It is proposed to construct a minor/major drainage system for the extension of Southlakes Estate with the minor system consisting of stormwater pits and pipes that would convey minor flows to the drainage reserve running through the site. Major flows would be conveyed along road reserves and drainage easements to the drainage reserve running through the site. In accordance with the overall stormwater strategy for the catchment no on-site detention is proposed within the Southlakes Estate. All system components would be subject to further detailed assessment and design during the engineering design phase, based on the principles outlined in this assessment.

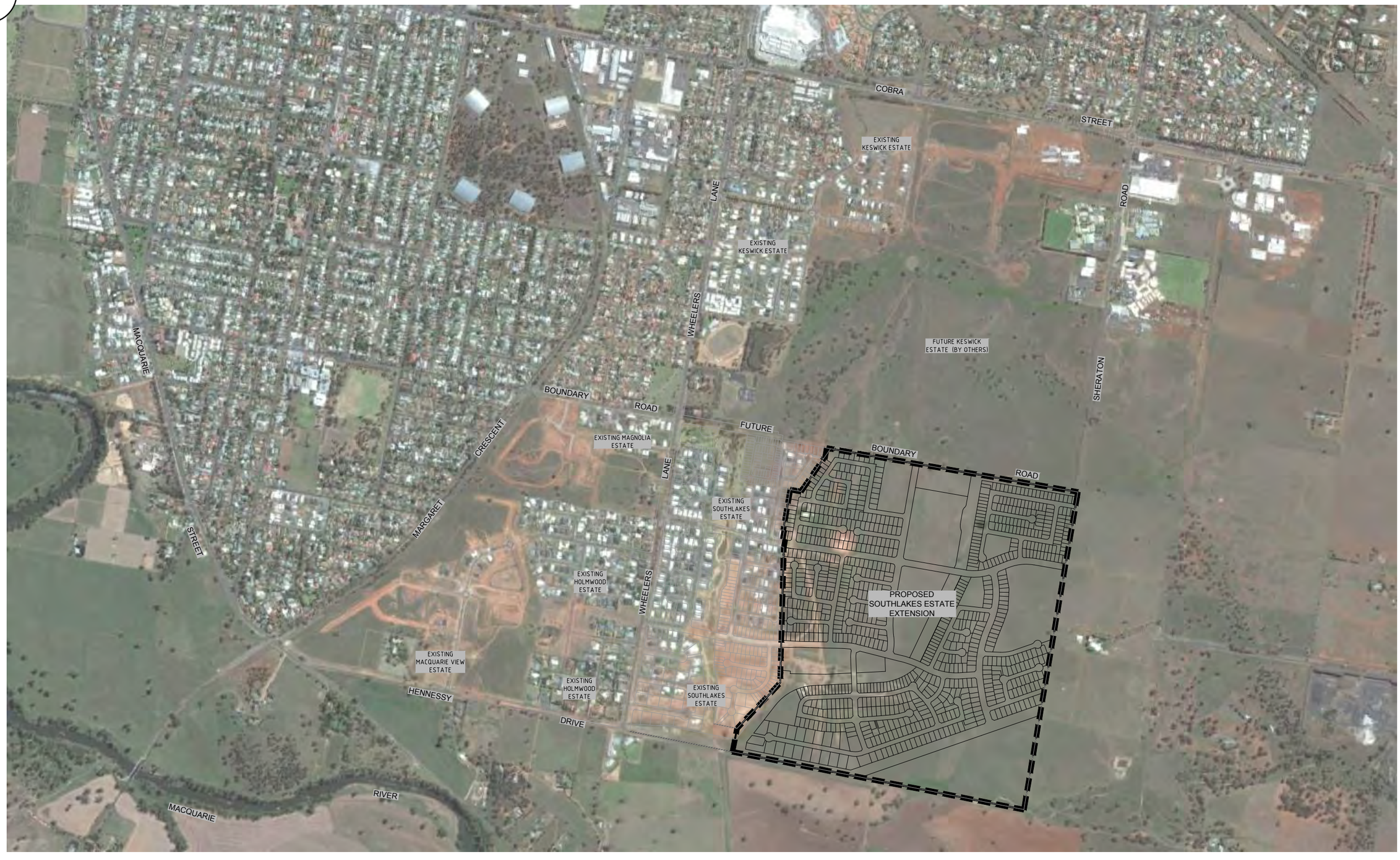
References

NSW Public Works Department Manual of Practice Sewer Design
NSW Department of Public Works

NSW Public Works Department Manual of Practice Sewer Pump Station Design
NSW Department of Public Works

NSW Public Works Department Water Supply Investigation Manual
NSW Department of Public Works

Drawings



REV.	DATE	DFTD.	APPD.	DETAILS
A	25/02/16	EG	SJH	ISSUED FOR REPORT
B	02/09/16	EG	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE

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0 100 200 300 400 500 600 700

SCALE 1:15000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY
WESTERN PLAINS REGIONAL COUNCIL

CLIENT
MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT
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PROPOSED RESIDENTIAL SUBDIVISION
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DRAWING
SITE LOCALITY

PROJECT NUMBER 114135	DRAWING FILE 114135_13B_D001-D003.dwg	SIZE A1
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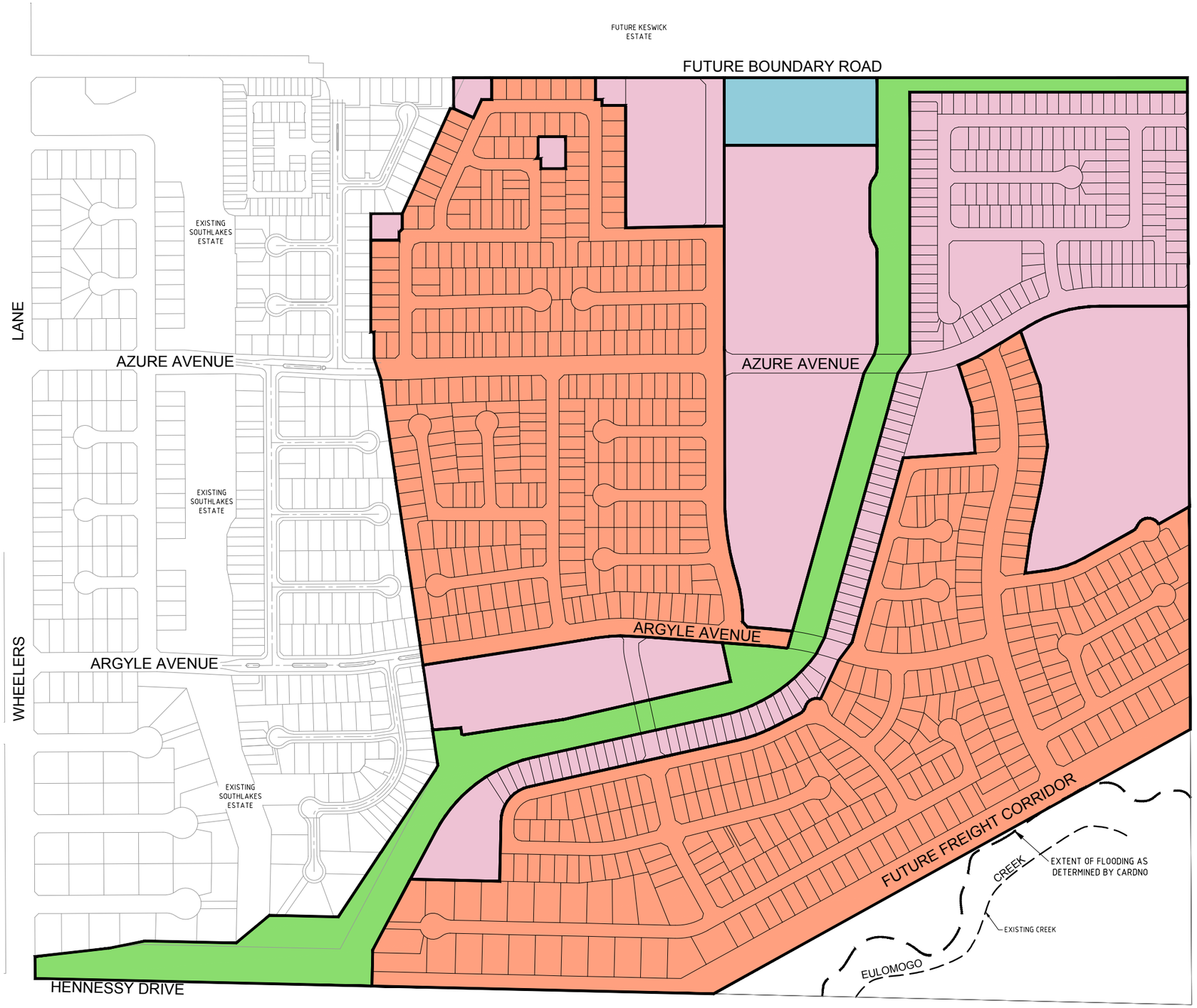
IMAGE SOURCE GOOGLE EARTH		
STATUS ISSUED FOR REPORT	SHEET D001 OF D003	



NOTES

1. INFORMATION SHOWN IS FOR DEVELOPMENT APPLICATION PURPOSES ONLY.
2. AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY.

DENOTES B1 - NEIGHBOURHOOD CENTRE

DENOTES R1 - GENERAL RESIDENTIAL LAND ZONE

DENOTES R2 - LOW DENSITY RESIDENTIAL LAND ZONE

DENOTES RE1 - PUBLIC RECREATION

REV.	DATE	DFTD.	APPD.	DETAILS
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	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE

SCALE 1:3000 (A1)

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0 50 100 150 200 250 300

SCALE 1:6000 (A3)

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DRAWING
CONCEPT MASTER PLAN

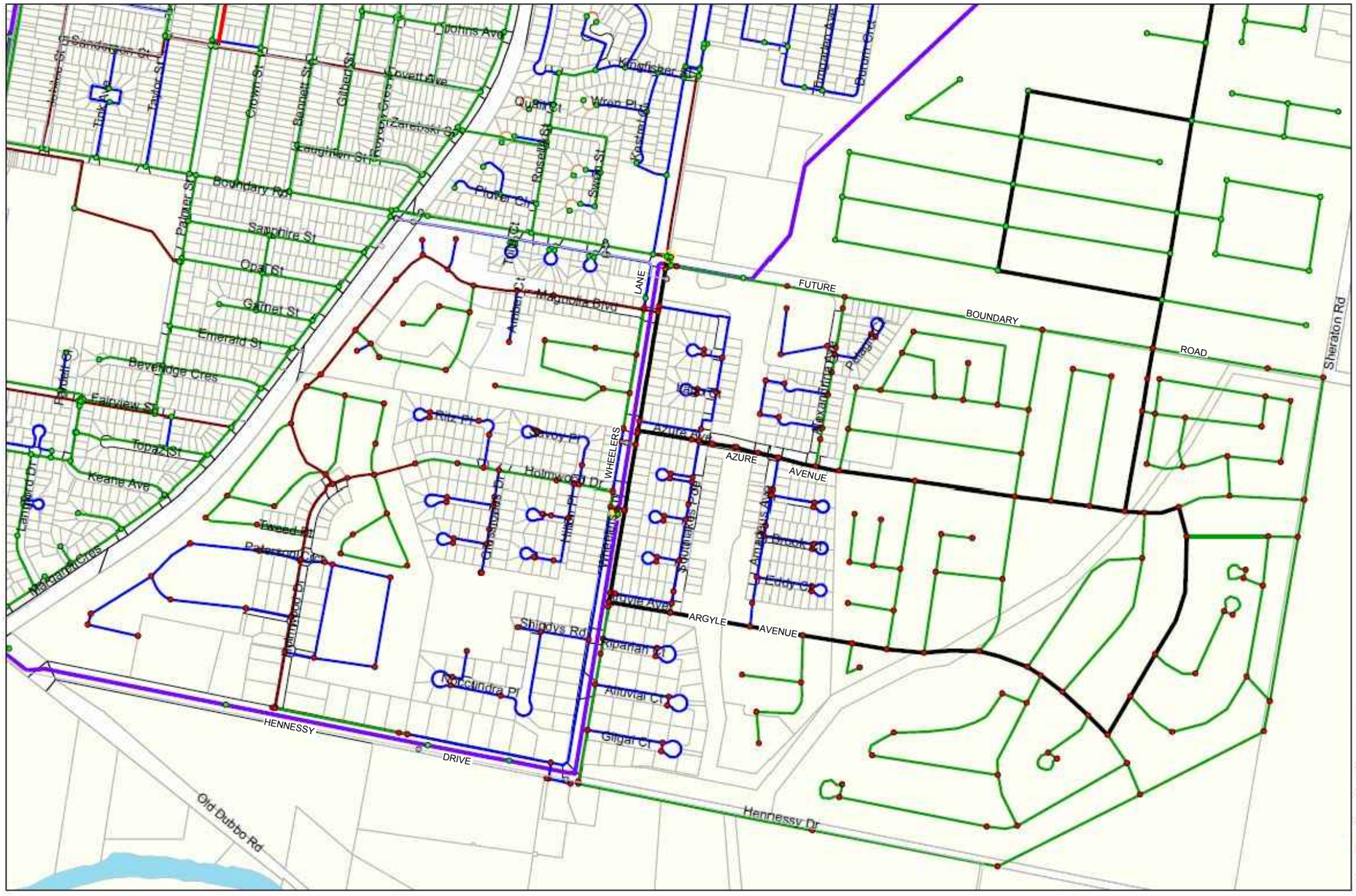
PROJECT NUMBER 114135 | DRAWING FILE 114135_13B_D001-D003.dwg | SIZE A1

SURVEY MARK - | R.L. - | DATUM A.H.D. | SET 13B

IMAGE SOURCE

STATUS ISSUED FOR REPORT | SHEET D002 OF D003

Hydraulic Model Analysis



● Holmwood Dr PRV Future Water Model Layout

Date: 23/05/2016

Please note: All the dead end water mains need to closed loop to prevent water quality issues.

REV.	DATE	DFTD.	APPD.	DETAILS
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	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE

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APPROVAL AUTHORITY: WESTERN PLAINS REGIONAL COUNCIL

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PROJECT: SOUTHLAKES ESTATE EXTENSION
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DRAWING: WESTERN PLAINS REGIONAL COUNCIL'S FUTURE SOUTHLAKES ESTATE WATER MODEL

PROJECT NUMBER 114135 | DRAWING FILE 114135_13B_D001-D003.dwg | SIZE A1

SURVEY MARK - | R.L. - | DATUM A.H.D. | SET 13B

IMAGE SOURCE WESTERN PLAINS REGIONAL COUNCIL

STATUS ISSUED FOR REPORT | SHEET D003 OF D003

SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION
MAAS GROUP PROPERTIES No. 2 PTY LTD
SERVICING STRATEGY PLANS FOR SEWER & WATER RETICULATION

SCHEDULE OF DRAWINGS	
DRAWING	TITLE
C001	TITLE SHEET & SITE LOCALITY
C002	SEWER RETICULATION SERVICING PLAN
C003	CONCEPT SEWER MAIN ALIGNMENT FOR CONNECTION TO THE KESWICK SPS
C004	CONCEPT 600mm Ø SEWER MAIN LONGITUDINAL SECTION
C005	WATER RETICULATION SERVICING PLAN

SITE LOCALITY
NOT TO SCALE

REV.	DATE	DFTD.	APPD.	DETAILS
A	24/02/16	EG	SJH	ISSUED FOR REPORT
B	13/04/16	EG	SJH	COUNCIL AMENDMENTS & ISSUED FOR REPORT
C	02/09/16	EG/NS	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	GEOLYSE	SP/NM	2016
DESIGN	114135 EG Sewer Servicing Rev A.project	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE

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APPROVAL AUTHORITY
WESTERN PLAINS REGIONAL COUNCIL

CLIENT
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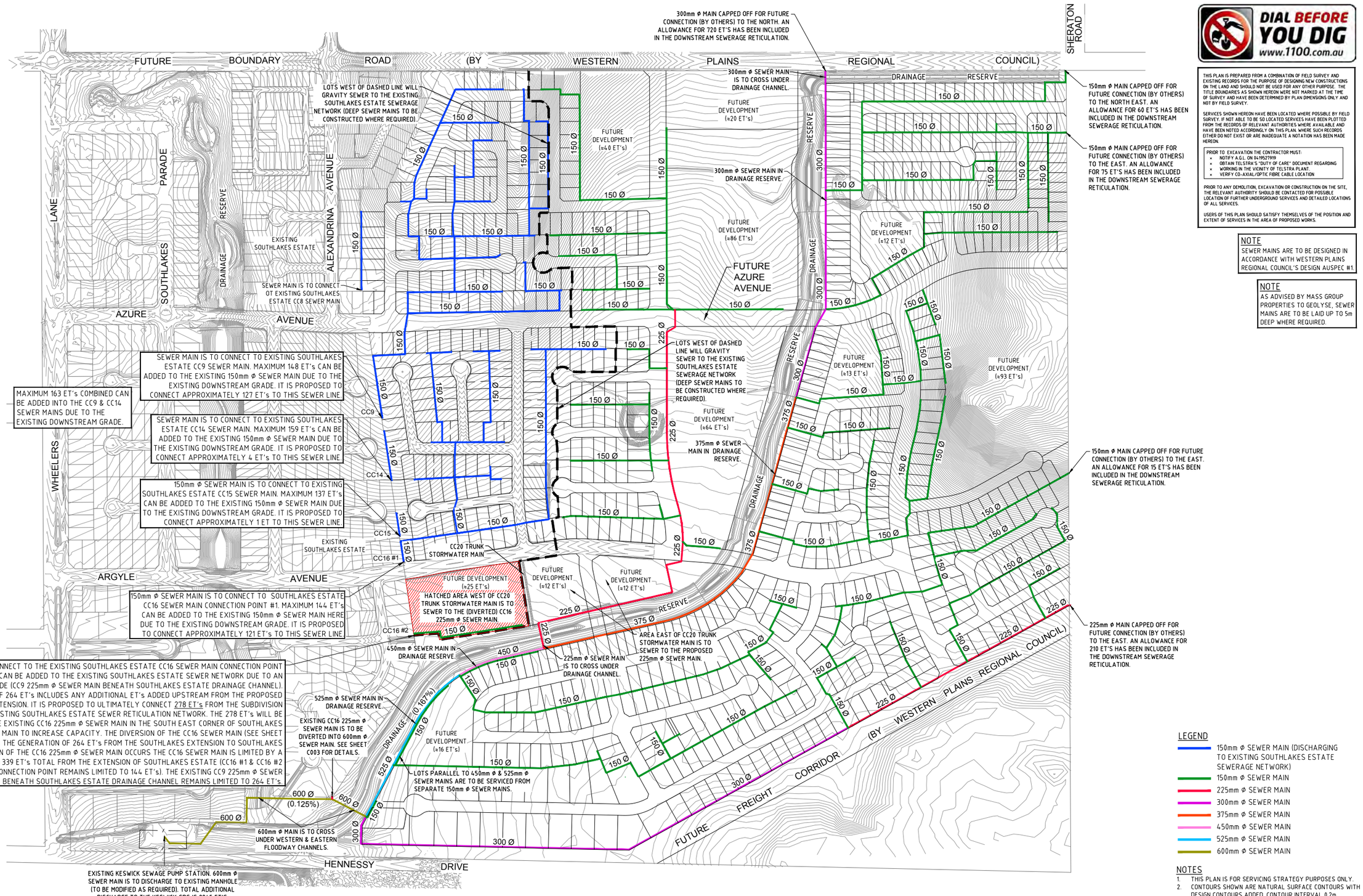
DRAWING
TITLE SHEET & SITE LOCALITY

PROJECT NUMBER 114135	DRAWING FILE 114135_12C_C001-C005.dwg	SIZE A1
SURVEY MARK REFER TO GEOLYSE SURVEY R.L. - DATUM A.H.D.		SET 12C
IMAGE SOURCE GOOGLE EARTH		
STATUS ISSUED FOR REPORT	SHEET C001 OF C005	



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THIS PLAN IS PREPARED FROM A COMBINATION OF FIELD SURVEY AND EXISTING RECORDS FOR THE PURPOSE OF DESIGNING NEW CONSTRUCTIONS ON THE LAND AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE. THE TITLE BOUNDARIES AS SHOWN HEREON WERE NOT MARKED AT THE TIME OF SURVEY AND HAVE BEEN DETERMINED BY PLAN DIMENSIONS ONLY AND NOT BY FIELD SURVEY.

SERVICES SHOWN HEREON HAVE BEEN LOCATED WHERE POSSIBLE BY FIELD SURVEY. IF NOT ABLE TO BE SO LOCATED SERVICES HAVE BEEN PLOTTED FROM THE RECORDS OF RELEVANT AUTHORITIES WHERE AVAILABLE AND HAVE BEEN NOTED ACCORDINGLY ON THIS PLAN. WHERE SUCH RECORDS EITHER DO NOT EXIST OR ARE INADEQUATE A NOTATION HAS BEEN MADE HEREON.

PRIOR TO EXCAVATION THE CONTRACTOR MUST:
- NOTIFY A.G.L. ON 0419527999
- OBTAIN TELSTRA'S "DUTY OF CARE" DOCUMENT REGARDING WORKING IN THE VICINITY OF TELSTRA PLANT.
- VERIFY CO-AXIAL/OPTIC FIBRE CABLE LOCATION

PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, THE RELEVANT AUTHORITY SHOULD BE CONTACTED FOR POSSIBLE LOCATION OF FURTHER UNDERGROUND SERVICES AND DETAILED LOCATIONS OF ALL SERVICES.

USERS OF THIS PLAN SHOULD SATISFY THEMSELVES OF THE POSITION AND EXTENT OF SERVICES IN THE AREA OF PROPOSED WORKS.

NOTE
SEWER MAINS ARE TO BE DESIGNED IN ACCORDANCE WITH WESTERN PLAINS REGIONAL COUNCIL'S DESIGN AUSPEC #1.

NOTE
AS ADVISED BY MASS GROUP PROPERTIES TO GEOLYSE, SEWER MAINS ARE TO BE LAID UP TO 5m DEEP WHERE REQUIRED.

LEGEND
- 150mm ø SEWER MAIN (DISCHARGING TO EXISTING SOUTHLAKES ESTATE SEWERAGE NETWORK)
- 150mm ø SEWER MAIN
- 225mm ø SEWER MAIN
- 300mm ø SEWER MAIN
- 375mm ø SEWER MAIN
- 450mm ø SEWER MAIN
- 525mm ø SEWER MAIN
- 600mm ø SEWER MAIN

NOTES
1. THIS PLAN IS FOR SERVICING STRATEGY PURPOSES ONLY.
2. CONTOURS SHOWN ARE NATURAL SURFACE CONTOURS WITH DESIGN CONTOURS ADDED. CONTOUR INTERVAL 0.2m.
3. ALL PROPOSED SERVICES SHOWN ARE INDICATIVE ONLY & ARE SUBJECT TO DETAILED CIVIL DESIGN.
4. FUTURE LOT & ROAD LAYOUT SHOWN IS INDICATIVE ONLY & SUBJECT TO CHANGE BY THE DEVELOPER & APPROVAL FROM WESTERN PLAINS REGIONAL COUNCIL.

REV.	DATE	DFTD.	APPD.	DETAILS
A	24/02/16	EG	SJH	ISSUED FOR REPORT
B	13/04/16	EG	SJH	COUNCIL AMENDMENTS & ISSUED FOR REPORT
C	02/09/16	EG/NS	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	GEOLYSE	SP/NM	2016
DESIGN	114135 EG Sewer Servicing Rev A.project	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE
SCALE 1:3000 (A1)
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SCALE 1:6000 (A3)
DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY: WESTERN PLAINS REGIONAL COUNCIL
CLIENT: MAAS GROUP PROPERTIES No. 2 PTY LTD
PROJECT: SOUTHLAKES ESTATE EXTENSION
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Fax. (02) 6884 1470

DRAWING: SEWER RETICULATION SERVICING PLAN

PROJECT NUMBER 114135	DRAWING FILE 114135_12C_C001-C005.dwg	SIZE A1
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IMAGE SOURCE		
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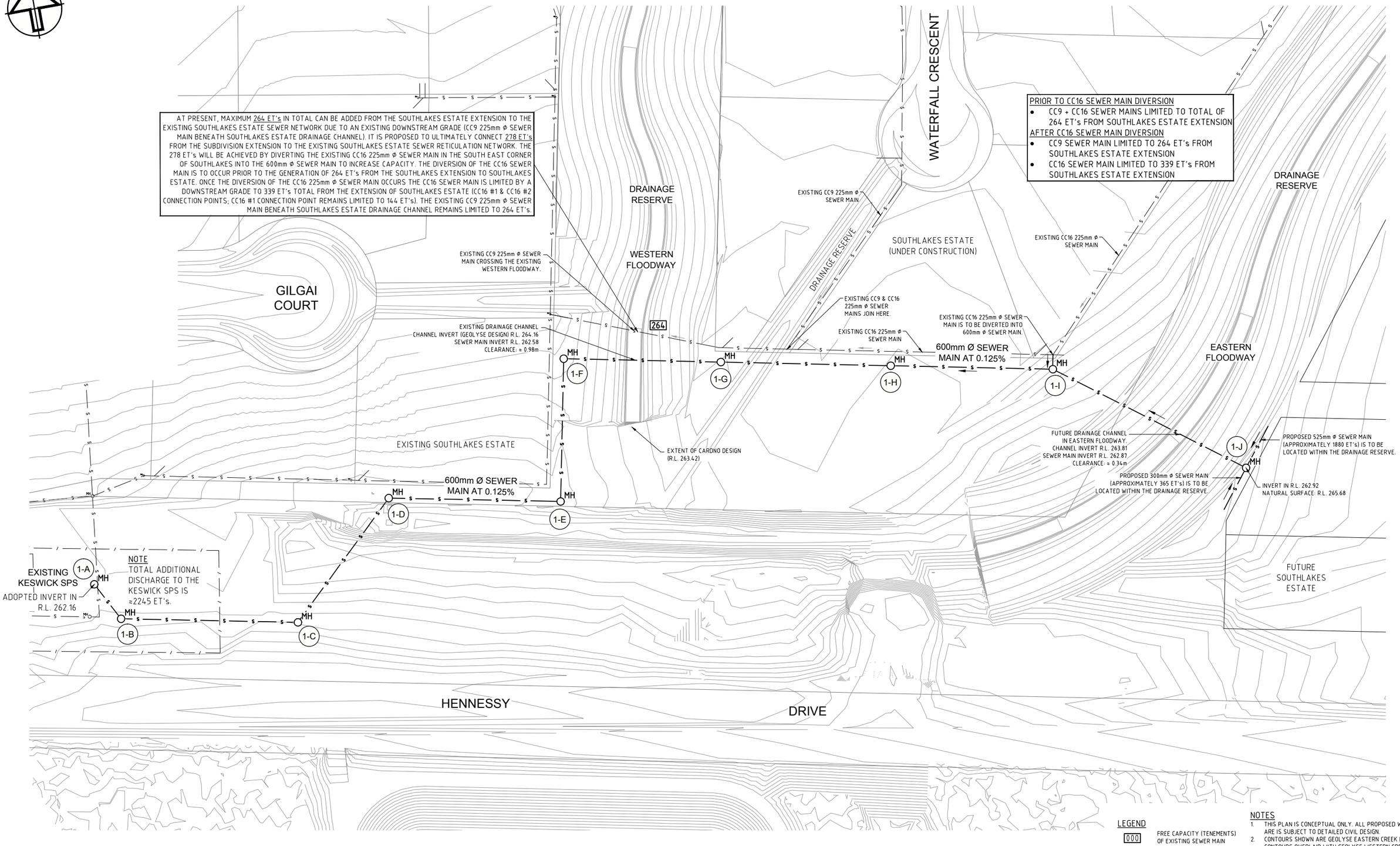

LEGEND

000	FREE CAPACITY (TENEMENTS) OF EXISTING SEWER MAIN
—s—	PROPOSED SEWER MAIN
—s—	EXISTING SEWER MAIN

NOTES
1. THIS PLAN IS CONCEPTUAL ONLY. ALL PROPOSED WORKS ARE IS SUBJECT TO DETAILED CIVIL DESIGN.
2. CONTOURS SHOWN ARE GEOLYSE EASTERN CREEK DESIGN CONTOURS OVERLAID WITH GEOLYSE WESTERN CREEK DESIGN CONTOURS & CARDNO DESIGN CONTOURS PROVIDED TO GEOLYSE BY WESTERN PLAINS REGIONAL COUNCIL.
3. CONTOUR INTERVAL 0.2m.

REV.	DATE	DFTD.	APPD.	DETAILS
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	FILE	INITIALS	DATE
SURVEY	GEOLYSE	SP/NM	2016
DESIGN	114135 EG Sewer Servicing Rev A.project	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE
SCALE 1:500 (A1)
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SCALE 1:1000 (A3)
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APPROVAL AUTHORITY
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CLIENT
MAAS GROUP PROPERTIES No. 2 PTY LTD
PROJECT
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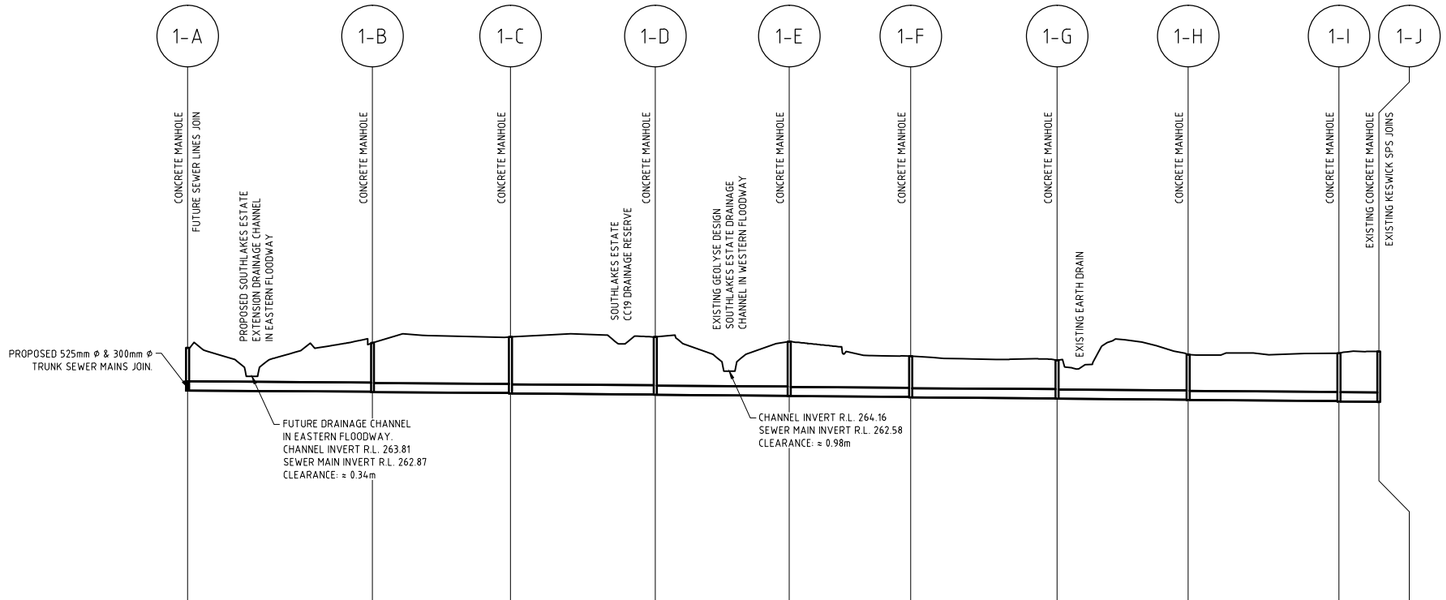
DRAWING
CONCEPT SEWER MAIN ALIGNMENT FOR CONNECTION TO THE KESWICK SPS

PROJECT NUMBER 114135	DRAWING FILE 114135_12C_C001-C005.dwg		SIZE A1
SURVEY MARK REFER TO GEOLYSE SURVEY	R.L. -	DATUM A.H.D.	SET 12C
IMAGE SOURCE			
STATUS ISSUED FOR REPORT	SHEET C003 OF C005		



EQUIVALENT TENEMENTS	2245 ET'S	2245 ET'S	2245 ET'S	2245 ET'S	2245 ET'S	2245 ET'S	2245 ET'S	2245 ET'S	2245 ET'S
PIPE LENGTH (m)	60.317	45.004	47.217	43.675	39.667	47.770	42.743	49.151	13.022
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PIPE SIZE (mm)	600mm Ø TYTON 'XTREME' DICL PIPE	600mm Ø	600mm Ø	600mm Ø TYTON 'XTREME' DICL PIPE	600mm Ø	600mm Ø	600mm Ø	600mm Ø	600mm Ø
DATUM R.L. 231.000									
DEPTH TO INVERT	2.797	3.192 / 3.222	3.658 / 3.688	3.747 / 3.777	3.533 / 3.563	2.660 / 2.690	2.487 / 2.517	2.943 / 2.973	3.115 / 3.145	3.218 / 3.236
INVERT LEVEL	262.886	262.810 / 262.780	262.724 / 262.694	262.635 / 262.605	262.550 / 262.520	262.471 / 262.441	262.381 / 262.351	262.298 / 262.268	262.206 / 262.176	262.160 / 262.142
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LINE 1

HORIZONTAL SCALE 1:1000 (A1) 1:2000 (A3)
VERTICAL SCALE 1:200 (A1) 1:400 (A3)

REV.	DATE	DFTD.	APPD.	DETAILS
A	24/02/16	EG	SJH	ISSUED FOR REPORT
B	13/04/16	EG	SJH	COUNCIL AMENDMENTS & ISSUED FOR REPORT
C	02/09/16	EG/NS	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	GEOLYSE	SP/NM	2016
DESIGN	114135 EG Sewer Servicing Rev A.project	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE

HORIZONTAL SCALE 1:1000 (A1) 1:2000 (A3)

0 20 40 60 80 100
0 5 10 15 20

VERTICAL SCALE 1:200 (A1) 1:400 (A3)

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APPROVAL AUTHORITY
WESTERN PLAINS REGIONAL COUNCIL

CLIENT
MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT
SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION
WATER & SEWER RETICULATION SERVICING STRATEGY

GEOLYSE
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DRAWING
CONCEPT 600mm Ø SEWER MAIN LONGITUDINAL SECTION

PROJECT NUMBER 114135	DRAWING FILE 114135_12C_C001-C005.dwg	SIZE A1
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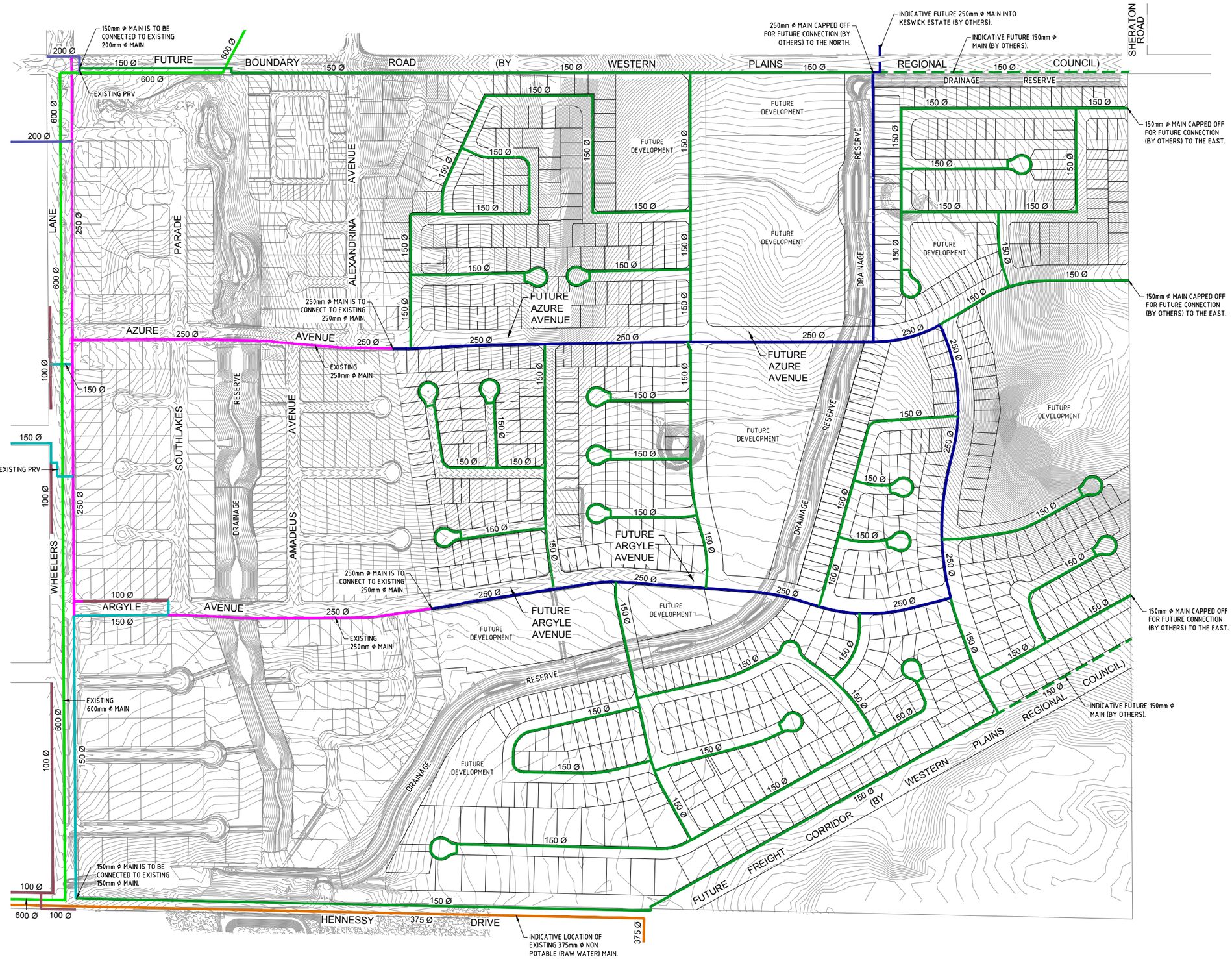
IMAGE SOURCE		
STATUS ISSUED FOR REPORT	SHEET C004 OF C005	



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SERVICES SHOWN HEREON HAVE BEEN LOCATED WHERE POSSIBLE BY FIELD SURVEY. IF NOT ABLE TO BE SO LOCATED SERVICES HAVE BEEN PLOTTED FROM THE RECORDS OF RELEVANT AUTHORITIES WHERE AVAILABLE AND HAVE BEEN NOTED ACCORDINGLY ON THIS PLAN. WHERE SUCH RECORDS EITHER DO NOT EXIST OR ARE INADEQUATE A NOTATION HAS BEEN MADE HEREON.

PRIOR TO EXCAVATION THE CONTRACTOR MUST:
- NOTIFY A.G.L. ON 0419527199
- OBTAIN TELSTRA'S "DUTY OF CARE" DOCUMENT REGARDING WORKING IN THE VICINITY OF TELSTRA PLANT.
- VERIFY CO-AXIAL/OPTIC FIBRE CABLE LOCATION

PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, THE RELEVANT AUTHORITY SHOULD BE CONTACTED FOR POSSIBLE LOCATION OF FURTHER UNDERGROUND SERVICES AND DETAILED LOCATIONS OF ALL SERVICES.

USERS OF THIS PLAN SHOULD SATISFY THEMSELVES OF THE POSITION AND EXTENT OF SERVICES IN THE AREA OF PROPOSED WORKS.

NOTE
HYDRANTS & STOP VALVES ARE TO BE PROVIDED BY THE DEVELOPER AS REQUIRED BY WESTERN PLAINS REGIONAL COUNCILS DESIGN AUSPEC #1.

NOTE
WATER MAIN SIZES ARE BASED UPON WATER NETWORK MODELLING CARRIED OUT BY WESTERN PLAINS REGIONAL COUNCIL & PROVIDED TO GEOLYSE IN MAY 2016 HOWEVER COUNCIL HAS SINCE ADVISED THAT THE MINIMUM WATER MAIN SIZE THAT MAY BE USED IN SELECTED CUL-DE-SACS IS 100mm DIAMETER.

LEGEND
- 150mm ø WATER MAIN
- 150mm ø WATER MAIN (BY OTHERS)
- 250mm ø WATER MAIN
- 250mm ø WATER MAIN (BY OTHERS)
- EXISTING 100mm ø WATER MAIN
- EXISTING 150mm ø WATER MAIN
- EXISTING 200mm ø WATER MAIN
- EXISTING 250mm ø WATER MAIN
- EXISTING 375mm ø NON POTABLE WATER MAIN
- EXISTING 600mm ø WATER MAIN
- PRV PRESSURE REDUCING VALVE

NOTES
1. THIS PLAN IS FOR SERVICING STRATEGY PURPOSES ONLY.
2. CONTOURS SHOWN ARE NATURAL SURFACE CONTOURS WITH DESIGN CONTOURS ADDED. CONTOUR INTERVAL 0.2m.
3. ALL PROPOSED SERVICES SHOWN ARE INDICATIVE ONLY & ARE SUBJECT TO DETAILED CIVIL DESIGN.
4. FUTURE LOT & ROAD LAYOUT SHOWN IS INDICATIVE ONLY & SUBJECT TO CHANGE BY THE DEVELOPER & APPROVAL FROM WESTERN PLAINS REGIONAL COUNCIL.

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SURVEY	GEOLYSE	SP/NM	2016
DESIGN	114135 EG Sewer Servicing Rev A.project	EG	01/09/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	01/09/16

MASTER SCALE
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SCALE 1:6000 (A3)
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APPROVAL AUTHORITY: WESTERN PLAINS REGIONAL COUNCIL
CLIENT: MAAS GROUP PROPERTIES No. 2 PTY LTD
PROJECT: SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION
WATER & SEWER RETICULATION SERVICING STRATEGY

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DRAWING: WATER RETICULATION SERVICING PLAN

PROJECT NUMBER 114135	DRAWING FILE 114135_12C_C001-C005.dwg		SIZE A1
SURVEY MARK REFER TO GEOLYSE SURVEY	R.L. -	DATUM A.H.D.	SET 12C
IMAGE SOURCE			
STATUS ISSUED FOR REPORT	SHEET C005	OF C005	

Appendix A

STORMWATER MANAGEMENT STRATEGY PREPARED BY GEOLYSE

STORMWATER MANAGEMENT STRATEGY

PROPOSED RESIDENTIAL SUBDIVISION

SOUTHLAKES ESTATE EXTENSION, DUBBO

PREPARED FOR:

MAAS GROUP PROPERTIES PTY LTD

AUGUST 2016

GEOLYSE

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Report Title:	*Stormwater Management Strategy*
Project:	*Proposed Residential Subdivision*
Client:	*Maas Group Properties Pty Ltd*
Report Ref.:	*114135_REO_003B.docx*
Status:	*Final*
Issued:	*30 August 2016*

Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

All information contained within this report is prepared for the exclusive use of Maas Group Properties Pty Ltd to accompany this report for the land described herein and is not to be used for any other purpose or by any other person or entity. No reliance should be placed on the information contained in this report for any purposes apart from those stated therein.

Geolyse Pty Ltd accepts no responsibility for any loss, damage suffered or inconveniences arising from, any person or entity using the plans or information in this study for purposes other than those stated above.

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Introduction

1.1 BACKGROUND

Geolyse Pty Ltd has been commissioned by Maas Group Properties to prepare a Stormwater Management Strategy to accompany a Development Application (DA) for a proposed Residential Subdivision over land described as Lot 12 in DP 1207280 & Lot 399 in DP 1199356 at 'Southlakes Estate', Dubbo.

1.2 SITE LOCATION

The site is described as Lot 12 in DP 1207280 and Lot 399 in DP 1199356 and is located at 'Southlakes Estate' approximately 4 kilometres south east of the Dubbo Central Business District. The land has a total combined area of approximately 130 hectares. The subject land is bounded by the future extension of Boundary Road to the north, Hennessy Road and its future extension to the south and the eastern extent of the existing 'Southlakes Estate' to the west.

The subject area is largely cleared of native vegetation, featuring open grasslands and gentle slopes. Other features on the site include two (2) existing stock dams.

1.3 PURPOSE OF REPORT

The purpose of this report is to outline the proposed stormwater management strategy for the development of the residential subdivision. It also presents preliminary design and sizing information for key components of the water management strategy for the development of the residential subdivision.

1.4 REPORT STRUCTURE

This report is presented in four sections:

- **Section 1** provides a brief background and presents the report objectives;
- **Section 2** provides background information and details the assessment methodology;
- **Section 3** presents the results of the system and modelling and an outline of the major system components; and
- **Section 4** presents the conclusions and recommendations.

Background Information

2.1 PROPOSED DEVELOPMENT

The subject site has been identified by the developer as a suitable location for the development of a neighbourhood centre, R2 general residential lots, R1 low density residential lots, and public recreation areas.

Vehicular access will be available from Azure Avenue, Argyle Avenue, the future extension of Boundary Road and the future extension of Hennessy Road.

The overall layout of the proposed development is indicated on **Drawing No. 114135_06B_C001**.

2.2 EXISTING STORMWATER DRAINAGE

The site lies within the catchment of the Eulomogo Creek which ultimately drains to the Macquarie River southwest of the site. The site is at the lower end of the catchment and as a result stormwater flows from the catchment upstream of the site need to be managed as they pass through the site. The internal catchment boundaries are indicated in **Drawing No. 114135_06B_C002.** Further details on these catchments are outlined in **Section 2.3.1 – Sub Catchment Definition**.

A drainage reserve has been created across the site that runs from the intersection of Boundary and Sheraton Roads in the north east corner to the south west corner at Hennessy Road. The site is currently undeveloped with only 2 farm dams and associated contour banks influencing the natural flows across the site.

2.3 SYSTEM MODELLING

2.3.1 EXISTING STUDY

Cardno prepared the *Keswick Drainage Review- Assessment of Trunk Drainage Requirements* report in 2010 for Dubbo City Council. The Cardno report modelled the entire catchment upstream of Hennessy Road, including the Southlakes Estate extension site. The Cardno report provided peak flows at the outlet of the Southlakes Estate extension site for the existing and post development scenarios (including stormwater detention basins immediately upstream of the Southlakes Estate extension site).

Cardno kindly provided hydrograph and peak flow data to enable Geolyse to replicate their modelling and factor in the expected flows from the upstream catchment.

The Cardno report looked at the trunk drainage requirements for the whole catchment which included a detention basin on the south side of Hennessy Road and detention basins immediately upstream of the Southlakes Estate extension site. Council provided the design drawings for the proposed Hennessy Road detention basin which were also prepared by Cardno. The Cardno report did not include any detention basins within the Southlakes Estate extension site and as a result detention within the Southlakes Estate extension site was not modelled by Cardno.

2.3.2 STORMWATER QUANTITY

The performance of the proposed stormwater management system was assessed using the XP-RAFTS hydrological model. This model is able to:

- Model spatial and temporal variations in storm rainfall across the catchment;
- Model variations in catchment characteristics;

- Model storage routing effects in drainage lines and basins; and
- Calculate discharge hydrographs at any required location in the catchment.

The analytical technique used in XP-RAFTS involves the division of the catchment into a number of sub-catchments. Sub-catchment outlets are located at the junction of drainage lines, at the site of dams or retarding basins, at points corresponding to significant changes in catchment characteristics, or at any other point of interest.

Data is required on the area and connection sequence of the sub-catchments, together with average catchment slopes, the impervious percentage, and the rainfall data for the design storm being modelled. Additional data is required to model rainfall losses and channel or pipe flow. This information is entered in several different forms depending on the data availability and the degree of refinement desired for the analysis. For this assessment the rainfall losses were modelled as initial and continuing losses.

Model Scenarios

Two catchment models were developed:

- Scenario 1- Post-development- 50% impervious for developed areas within the Southlakes Estate extension (as modelled in the Cardno report)
- Scenario 2- Post-development – 60% impervious for R2 low density residential, 80% impervious for R1 general residential and 95% impervious for the neighbourhood centre within the Southlakes Estate extension.

Sub-Catchment Definition

For both scenarios the site was split into the catchments shown in **Drawing No. 114135_06B_C002.**. Catchment parameters were determined from available contour plans.

Cardno provided 100 year ARI hydrographs for the outlets of the proposed detention basins upstream of the Southlakes Estate extension (Sheraton Basin and Boundary Road Basin). The hydrographs were loaded into the model to represent the expected flows from upstream of the site.

Channel Routing

Channel lagging was adopted to model travel times between sub-catchments. The lag time was estimated by considering the distance travelled and adopting an average velocity of 1m/s.

Rainfall Losses

The following initial and continuing losses (as adopted in the Cardno report) were used in the model:

Pervious	Initial loss	16.5 mm
	Continuing loss	5.5 mm/hr
Impervious	Initial loss	1.0 mm
	Continuing loss	0 mm/hr

Design Storms

The catchment was modelled for the 100yr Average Recurrence Interval (ARI) design storm. Design rainfall intensity/frequency/duration (IFD) data and storm temporal patterns were derived using the procedures set out in Australia Rainfall and Runoff (Institution of Engineers Australia, 1997).

Design storm durations from 30 minutes to 12 hours were modelled to determine the critical storm duration. (i.e. the storm that produced the highest peak flow) for both undeveloped and developed cases.

Stormwater Management Strategy

3.1 CONCEPTUAL STORMWATER MANAGEMENT STRATEGY

3.1.1 STORMWATER MANAGEMENT OBJECTIVES

The objectives adopted for stormwater management at the site are to:

- provide safe and efficient stormwater conveyance through the Southlakes Estate extension; and
- protect downstream drainage systems against construction and long term impacts.

3.1.2 CONCEPTUAL LAYOUT

The conceptual stormwater management system for the site is shown on **Drawing 114135_06B_C003**. Preliminary sizing of the main system components has been undertaken to demonstrate that it can meet the proposed stormwater management objectives. The final system is subject to further detailed assessment during the detailed design stage to ensure it complements the proposed development layout.

The site drains generally in a south westerly direction with developed areas discharging to the drainage reserve at road crossings or other locations determined by the existing contours.

The conceptual stormwater management system includes the following major components.

Pipe and Open Drain System

The stormwater conveyance system would comprise of pipes and grassed open drains. Generally, pipes would be used for the interlot drainage system and road drainage where kerb and guttering is proposed. Discharge from the pipe system would generally be directly into the drainage reserve.

The drainage reserve was also modelled as an open channel similar in cross section to that designed for the existing Southlakes Estate to the west of the site. Decorative lakes were also included in the model at key locations. A HEC-RAS model was created to confirm that the expected flows in the channel would be contained within the channel.

Pipes would be used as required to convey flow beneath roads. The interlot and roadway pipe systems would be designed to convey peak discharge for a 1 in 10 year ARI storm in accordance with Council requirements. Open drains would be designed to convey overland flow at a safe depth and velocity and with a minimum freeboard of 500 mm.

Three culvert crossings under Azure Avenue, Argyle Avenue and an unnamed road (below Argyle Ave) will also be required. **Table 3.1** gives the preliminary sizing of these culverts to ensure they can convey the expected 100year ARI peak storm flows without overtopping the roads.

Table 3.1 – Preliminary Culvert Crossing Sizing

Crossing Location	Culvert Size
Azure Avenue	3 x 2.1m x 1.2m Reinforced Concrete Box Culvert
Argyle Ave	5 x 2.4m x 1.2m Reinforced Concrete Box Culvert
Unnamed Road (below Argyle Ave)	5 x 2.4m x 1.2m Reinforced Concrete Box Culvert

Constructed Detention Basins

It is not proposed to provide any stormwater detention within the Southlakes Estate site as the Cardno report had not included detention within the site.

3.2 STORMWATER MODELLING RESULTS

3.2.1 PEAK SITE DISCHARGE

As no stormwater detention is proposed within the site the peak flows discharging from the site were compared to the peak flows provided by Cardno. A summary of the peak flows estimated by Cardno and the two scenarios modelled by Geolyse are provided in **Table 3.1** below.

The final configuration of the proposed stormwater management system is subject to detailed design at which stage some adjustment to the design levels may occur. The design objectives would however remain unchanged.

Table 3.2 – Peak 100 year ARI flows at Hennessy Road

Cardno Report (m^3/s)	Geolyse Scenario 1 (m^3/s)	Geolyse Scenario 2 (m^3/s)
21.72	22.80	25.56

The figures in **Table 3.1** show that the Geolyse Scenario 1 model correlates well with the figure provided by Cardno (both assume 50% impervious for developed areas). The peak flow reported for Geolyse Scenario 2 shows an increase of 2.76 m^3/s (12%) over Geolyse Scenario 1 and an increase of 3.84 m^3/s (18%) over the Cardno report figure.

The Geolyse Scenario 2 more accurately reflects the expected impervious percentages within the Southlakes Estate development. Given the location of the Southlakes Estate at the lower end of the catchment and the designed bypass of the proposed Hennessy Road basin from the eastern floodway it is not expected that the modelled increase in flows will have any detrimental effect on flooding downstream of the site or operation of the Hennessy Roade basin.

3.2.2 DRAINAGE RESERVE CHANNEL

A concept design of the proposed drainage reserve channel was prepared using available digital elevation data to allow preliminary hydraulic modelling and channel sizing to be undertaken. The concept channel design was based on the channel design prepared for the existing Southlakes Estate to the west of the Southlakes Estate extension. A typical section of the concept drainage reserve channel is shown on **Drawing 114135_06B_C003**.

A HEC RAS model was prepared based on the concept design of the drainage reserve channel to allow preliminary hydraulic modelling of the expected flows to be undertaken. The HEC RAS model assumed a minimum downstream water level of 264.34m AHD as this is the 1 in 100 year ARI design peak Hennessy Road basin water level as shown on the Cardno drawing 4937-CD076 Rev 01.

The hydraulic profile of the expected 100 year ARI flow within the concept drainage reserve channel design is shown below in **Figure 1**.

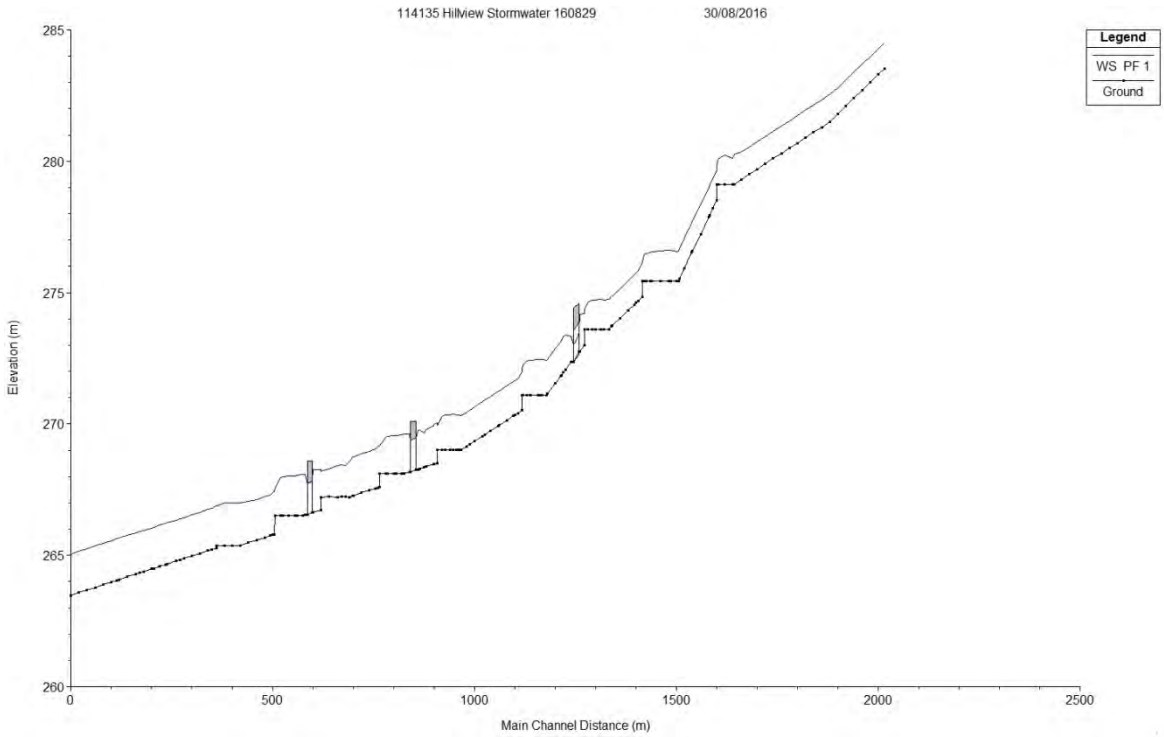

Figure 1: Concept HEC RAS Hydraulic Profile

Depths of flow in the drainage reserve channel ranged from 0.73 m to 1.64 m with a minimum freeboard of 500 mm maintained throughout. Peak velocities ranged from 0.62 - 2.80 m/s.

The preliminary hydraulic modelling showed that the expected flows from Scenario 2 were contained within the concept design drainage reserve channel and the culverts were not overtopped.

Conclusion

This report presents an assessment of the proposed stormwater management strategy for the Southlakes Estate residential subdivision proposed by Maas Group Properties. The results show that the proposed stormwater management system results in a slightly higher peak discharge from the site at Hennessy Road than that provided by Cardno. However, given the location of the Southlakes Estate at the lower end of the catchment and the designed bypass on the Hennessy Road basin it is not expected that the modelled increase in flows will have any detrimental effect on flooding downstream of the site.

It is proposed to construct a minor/major drainage system for the Southlakes Estate with the minor system consisting of stormwater pits and pipes that would convey minor flows to the drainage reserve running through the site. Major flows would be conveyed along road reserves and drainage easements to the drainage reserve running through the site. In accordance with the overall stormwater strategy for the catchment no on-site detention is proposed within the Southlakes Estate. All system components would be subject to further detailed assessment and design during the engineering design phase, based on the principles outlined in this assessment.

References

Institute of Engineers, 1997 *Australian Rainfall and Runoff Volume 1*

Cardno, 2010. Keswick Drainage Review- Assessment of Trunk Drainage Requirements (Report No. W4823-1)

Drawings

LEGEND

B1	NEIGHBOURHOOD CENTRE
R1	GENERAL RESIDENTIAL
R2	LOW DENSITY RESIDENTIAL
RE1	PUBLIC RECREATION
	SOUTHLAKES ESTATE EXTENSION BOUNDARY

REV.	DATE	DFTD.	APPD.	DETAILS
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B	25/08/16	AJD	PPO	REVISED CATCHMENTS - ISSUED FOR INFORMATION

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ENGINEERING/ SURVEYING APPROVAL		PPO	25/08/16

DRAWING SCALE

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0 50 100 150 200 250 300

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APPROVAL AUTHORITY: DUBBO CITY COUNCIL

CLIENT: MAAS GROUP PROPERTIES PTY LTD

PROJECT: SOUTHLAKES ESTATE EXTENSION CONCEPT

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DRAWING: PROPOSED SITE LAYOUT

PROJECT NUMBER 114135	DRAWING FILE 114135_06B_C001-C003.dwg	SIZE A1
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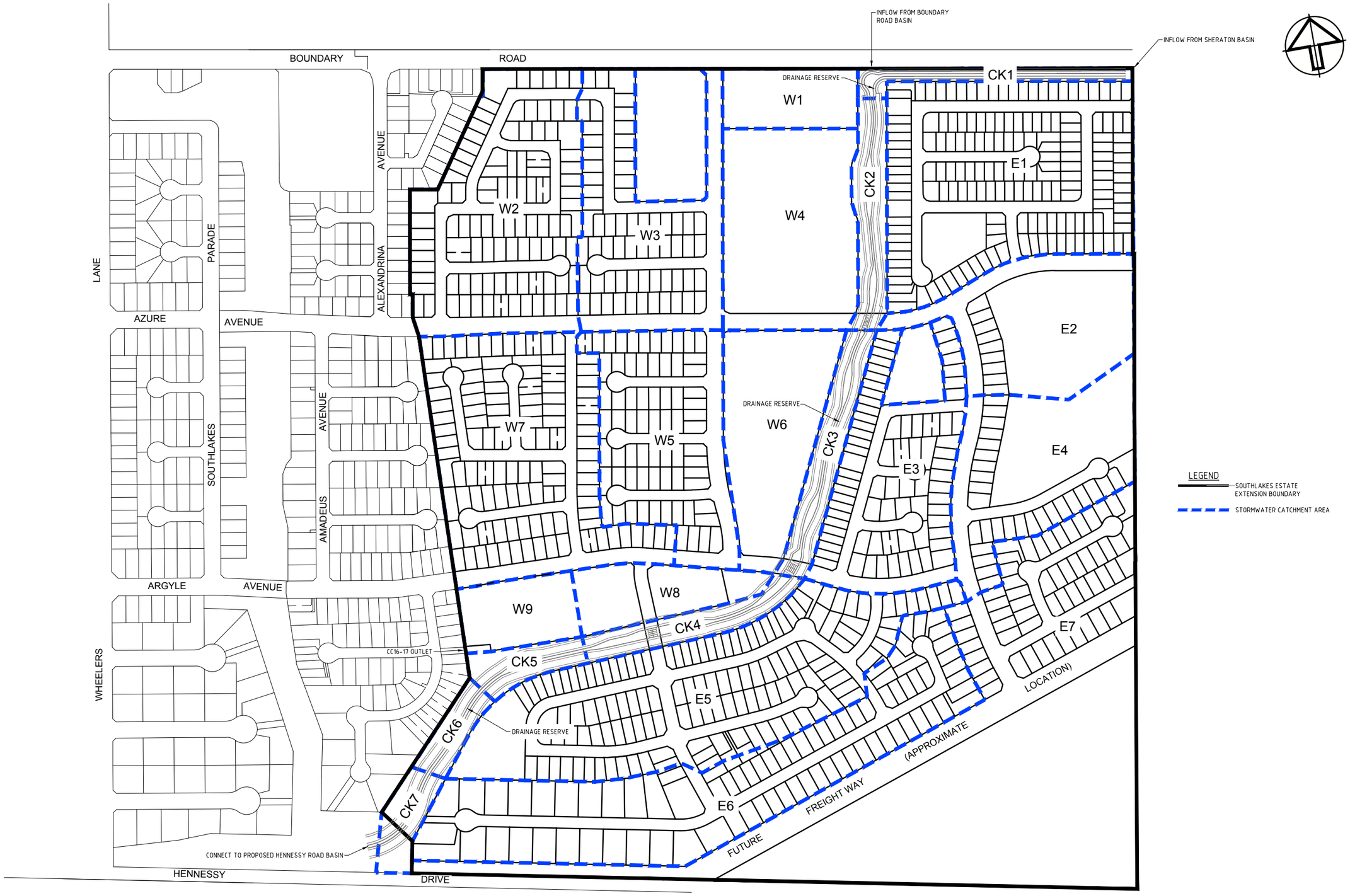

REV.	DATE	DFTD.	APPD.	DETAILS
A	24/02/16	BH	AW	ISSUED FOR INFORMATION
B	25/08/16	AJD	PPO	REVISED CATCHMENTS - ISSUED FOR INFORMATION

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	114135_04B_CREEK_SYSTEM_DESIGN.project	AJD	25/08/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		PPO	25/08/16

DRAWING SCALE

SCALE 1:3000 (A1)

0 50 100 150 200 250 300

0 50 100 150 200 250 300

SCALE 1:6000 (A3)

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DRAWING: CONCEPT STORMWATER CATCHMENTS

PROJECT NUMBER 114135 | DRAWING FILE 114135_06B_C001-C003.dwg | SIZE A1

SURVEY MARK - | R.L. - | DATUM A.H.D. | SET 06

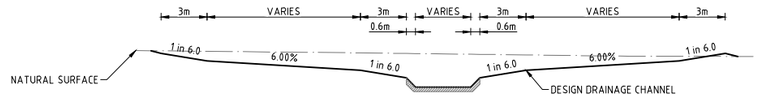
IMAGE SOURCE

STATUS FOR INFORMATION | SHEET C002 OF C003

LEGEND

- CONCEPT DRAINAGE RESERVE CHANNEL
- CONCEPT CHANNEL CENTRELINE
- HILLVIEW ESTATE BOUNDARY

THIS PLAN IS FOR CONCEPT DEVELOPMENT PURPOSES ONLY AND SHALL NOT BE USED FOR CONSTRUCTION . THE FINAL DESIGN IS SUBJECT TO DETAILED ENGINEERING DESIGN AND COUNCIL APPROVAL



STANDARD WIDTH CHANNEL TYPICAL SECTION 1
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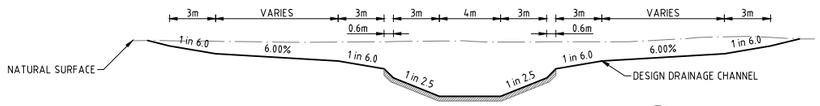
SCALE 1:400 (A3)



DECORATIVE LAKE CHANNEL TYPICAL SECTION 2
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REV.	DATE	DFTD.	APPD.	DETAILS
A	24/02/16	BH	AW	ISSUED FOR INFORMATION
B	25/08/16	AJD	PPO	REVISED CATCHMENTS - ISSUED FOR INFORMATION

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	114135_04B_CREEK_SYSTEM_DESIGN.project	AJD	25/08/16
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		PPO	25/08/16

DRAWING SCALE

SCALE 1:3000 (A1)

0 50 100 150 200 250 300

SCALE 1:6000 (A3)

0 50 100 150 200 250 300

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY: DUBBO CITY COUNCIL

CLIENT: MAAS GROUP PROPERTIES PTY LTD

PROJECT: SOUTHLAKES ESTATE EXTENSION CONCEPT

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DRAWING: CONCEPT DRAINAGE RESERVE CHANNEL

PROJECT NUMBER 114135	DRAWING FILE 114135_06B_C001-C003.dwg	SIZE A1
SURVEY MARK -	R.L. - DATUM A.H.D.	SET 06
IMAGE SOURCE		
STATUS FOR INFORMATION	SHEET C003 OF C003	

TRAFFIC STUDY
SOUTHLAKES ESTATE DUBBO

PREPARED FOR
MAAS GROUP PROPERTIES PTY LTD

AUGUST 2016

TRAFFIC STUDY

SOUTHLAKES ESTATE DUBBO

PROPOSED RESIDENTIAL SUBDIVISION
LOT 12 IN DP1207280 AND LOT 399 IN DP1199356

PREPARED FOR:

MAAS GROUP PROPERTIES NO. 2 PTY LTD

AUGUST 2016

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Report Title:	*Traffic Study*
Project:	*Southlakes Estate Dubbo*
Client:	*Maas Group Properties No. 2 Pty Ltd*
Report Ref.:	*114135_TRS_002*
Status:	*Final*
Issued:	*31 August 2016*

Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

All information contained within this report is prepared for the exclusive use of Maas Group Properties No. 2 Pty Ltd to accompany this report for the land described herein and is not to be used for any other purpose or by any other person or entity. No reliance should be placed on the information contained in this report for any purposes apart from those stated therein.

Geolyse Pty Ltd accepts no responsibility for any loss, damage suffered or inconveniences arising from, any person or entity using the plans or information in this study for purposes other than those stated above.

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Executive Summary

1.1 INTRODUCTION

Maas Group Properties intends to develop a residential subdivision on land to the east of the existing Southlakes Estate subdivision. The extension to Southlakes Estate will complement the existing Southlakes subdivision and have major access points connecting via Azure Avenue and Argyle Avenue to Wheelers Lane and the wider road network.

It is intended that approximately 1,475 dwelling sites be created comprising residential allotments and medium density allotments.

The Hillview property is located approximately 4km south east of the Dubbo central business district and is accessed from the north via Cobra Street and Wheelers Lane and the south via Hennessy Drive and Wheelers Lane.

The subdivision site is described as Lot 12 in DP1207280 and Lot 399 in DP1199356. Lot 12 has an area of approximately 2.27ha and Lot 399 has an area of approximately 128.5ha for a total development area of approximately 130.77ha.

The site is bounded by Southlakes Estate to the west, Boundary Road to the north, Hennessy Drive to the south and privately owned land to the east.

1.2 TRAFFIC STUDY

Under State Environmental Planning Policy SEPP (Infrastructure) 2007, the proposed subdivision for the extension of Southlakes Estate is classified in accordance with the requirements set out in Schedule 3 of Clause 104 of the SEPP.

On this basis, a Traffic Study will need to be prepared to assist in the planning approval process for the development.

This Traffic Study will address the following issues:

- Traffic generated by the development of the extension of Southlakes Estate
- Access to and from the subdivision via existing roads, new roads and the connection of the subdivision roads to the wider road network
- Impact on the operation, safety and amenity of the surrounding road network
- Recommendations for the implementation of Local Area Traffic Management (LATM) devices throughout the subdivision

The Traffic Study will be prepared in accordance with the requirements outlined in the NSW Roads and Traffic Authority's (RTA) *Guide to Traffic Generating Developments.*

1.3 EXISTING TRAFFIC VOLUMES

The estimated Year 2026 AADT traffic volumes on the subject roads are summarised below:

- Wheelers Lane north of Boundary Road 9,678 vehicles per day
- Wheelers Lane south of Boundary Road 9,108 vehicles per day
- Boundary Road west of Wheelers Lane 6,555 vehicles per day

The estimated Year 2026 peak hour traffic volumes on the subject roads are summarised below:

- Wheelers Lane north of Boundary Road 1,204 vehicles per hour
- Wheelers Lane south of Boundary Road 992 vehicles per hour
- Boundary Road west of Wheelers Lane 896 vehicles per hour

1.4 PROPOSED DEVELOPMENT

The site for the extension of the Southlakes Estate subdivision comprises Lot 12 in DP1207280 and Lot 399 in DP1199356. Lot 12 has an area of approximately 2.27ha and Lot 399 has an area of approximately 128.5ha for a total development area of approximately 130.77ha.

It is intended that approximately 1,475 dwelling sites be created in the subdivision comprising residential allotments and medium density allotments.

In general, the dwelling sites will comprise the following allocations:

Residential allotments	910 lots
Medium density dwelling units	565 units
Total dwelling sites	1,475 dwellings

1.5 TRAFFIC GENERATION

The daily traffic generated by the extension of Southlakes Estate can be estimated as set out below:

Number of residential dwellings:	910 dwellings
Daily vehicle trips:	11 per dwelling
Number of residential daily trips:	10,010 trips per day
Number of medium density dwellings:	565 dwellings
Daily vehicle trips:	6 per dwelling
Number of medium density daily trips:	3,390 trips per day
Total daily vehicle trips:	10,010 trips + 3,390 trips = 13,400 trips per day

Not all trips generated by the proposed extension to Southlakes Estate will be external to the subdivision. A proportion of the generated trips will be for internal travel purposes such as visiting friends or neighbours, recreation areas or a potential commercial precinct.

The RTA estimate that approximately 25% of daily and peak hour vehicle trips are internal to the subdivision (RTA, 1993) and therefore the adjusted external daily vehicle trips generated by the subdivision is:

External daily vehicle trips: 13,400 trips x 0.75 = 10,050 trips per day.

The external trip generation of 10,050 trips per day has been used to assess the potential impacts of the development of the subdivision on the surrounding road network.

The peak hour traffic generated by the extension of Southlakes Estate can be estimated as set out below:

Number of residential dwellings:	910 dwellings
Peak hour vehicle trips:	1 per dwelling
Number of residential peak hour trips:	910 trips per hour

Number of medium density dwellings:	565 dwellings
Peak hour vehicle trips:	0.5 per dwelling
Number of medium density peak hour trips:	283 trips per day
Total peak hour vehicle trips:	910 trips + 283 trips = 1,193 trips per hour

As with the daily trip generation, the RTA estimate that 25% of the peak hour trip generation are internal to the subdivision. Therefore, the adjusted external peak hour trips generated by the subdivision is:

External peak hour trips: 1,193 trips x 0.75 = 895 trips per hour.

The external trip generation of 895 trips per hour has been used to assess the potential impacts of the development of the subdivision on the surrounding road network.

1.6 TRAFFIC IMPACT SUMMARY

The impact of the additional traffic generated by the extension of Southlakes Estate on the surrounding road network has been assessed in terms of:

i) Traffic Volume for both the Daily and Peak Hour traffic generation;

ii) Intersection Operation; and

iii) Road Safety.

SIDRA modelling has been undertaken to assess the operation of various intersections on the surrounding road network.

1.6.1 TRAFFIC GENERATION AND ROADWAY CAPACITY

The estimated external daily traffic generation from the extension to Southlakes Estate is 10,050 trips per day and the external peak hour traffic generation is 895 trips per hour.

The increase in daily traffic volumes on Wheelers Lane north and Wheelers Lane south is 46% and 61% respectively.

The increase in peak hour traffic volumes on Wheelers Lane north and Wheelers Lane south is 33% and 50% respectively.

The increase in daily traffic volumes on Boundary Road west is 38%.

The increase in peak hour traffic volumes on Boundary Road west is 25%.

The operational capacity of Wheelers Lane north following the development of the extension of Southlakes Estate is 44%, for Wheelers Lane south the operational capacity is 82% and for Boundary Road west is 93%.

All roads are operating below the operational capacity at a Level of Service B and the impact of the additional traffic generated by the extension of Southlakes Estate in the Year 2026 is not significant in terms of the volume of post development traffic using Wheelers Lane and Boundary Road, noting that the existing estimated traffic volumes on the subject roads do not take into account redistribution of traffic patterns once the connection of Boundary Road through to Sheraton Road is constructed.

1.6.2 INTERSECTION MODELLING

The operation of the following intersections have been assessed using the SIDRA computer modelling program:

- Wheelers Lane and Argyle Avenue
- Wheelers Lane and Azure Avenue
- Boundary Road the north south access road

The SIDRA modelling determined that all movements at each intersection was operating at a Level of Service A.

1.6.3 CONCLUSION

The implementation of the recommendations of this Traffic Study during the approval and development of the extension of Southlakes Estate will see the operation of the development with the integration of the generated traffic into the surrounding road network.

Introduction

2.1 BACKGROUND

Maas Group Properties intends to develop a residential subdivision on land to the east of the existing Southlakes Estate subdivision. The extension to Southlakes Estate will complement the existing Southlakes subdivision and have major access points connecting via Azure Avenue and Argyle Avenue to Wheelers Lane and the wider road network.

It is intended that approximately 1,475 dwelling sites be created comprising residential allotments and medium density allotments.

An open space corridor will be created along the central drainage line that separates the subdivision generally from the north east to the southwest of the site. The drainage corridor will be embellished with a series of decorative lakes similar to the lakes that have been developed along the existing drainage corridor in Southlakes Estate. The drainage corridor within the extension to Southlakes Estate is known as the eastern channel whilst the drainage corridor within the existing Southlakes Estate is known as the western channel.

A Development Application has been prepared for Council's approval to develop Stage 1 of the extension to Southlakes Estate comprising approximately 35 allotments. This Traffic Study will assess the overall development of the extension of Southlakes Estate including Stage 1 of the development.

Therefore Council will have a single Traffic Study relating to the development of the overall subdivision rather than separate traffic studies addressing Stage 1 and the balance of the subdivision individually.

2.2 SITE LOCATION

The Hillview property is located approximately 4km south east of the Dubbo central business district and is accessed from the north via Cobra Street and Wheelers Lane and the south via Hennessy Drive and Wheelers Lane.

The subdivision site is described as Lot 12 in DP1207280 and Lot 399 in DP1199356. Lot 12 has an area of approximately 2.27ha and Lot 399 has an area of approximately 128.5ha for a total development area of approximately 130.77ha.

The site is bounded by Southlakes Estate to the west, Boundary Road to the north, Hennessy Drive to the south and privately owned land to the east.

Boundary Road to the east of Wheelers Lane is currently unformed and Dubbo City Council proposes to extend Boundary Road to the east to connect with Sheraton Road whilst Hennessy Drive will be extended to provide a freight corridor extending further to the east and connecting to the Mitchell Highway via Basalt Drive.

Currently the site is accessed from Wheelers Lane via Azure Avenue through Southlakes Estate and crossing the western channel via a culverted bridge. Work is currently underway to construct an additional culverted bridge again crossing the western channel and extending Argyle Avenue to the Hillview property.

The location of the proposed extension to Southlakes Estate is indicated on **Drawing TS01** located in the **Drawings** Section of this Report.

2.3 TRAFFIC STUDY

Under State Environmental Planning Policy SEPP (Infrastructure) 2007, the proposed subdivision for the extension of Southlakes Estate is classified in accordance with the requirements set out in Schedule 3 of Clause 104 of the SEPP.

On this basis, a Traffic Study will need to be prepared to assist in the planning approval process for the development.

This Traffic Study will address the following issues:

- Traffic generated by the development of the extension of Southlakes Estate
- Access to and from the subdivision via existing roads, new roads and the connection of the subdivision roads to the wider road network
- Impact on the operation, safety and amenity of the surrounding road network
- Recommendations for the implementation of Local Area Traffic Management (LATM) devices throughout the subdivision

The Traffic Study will be prepared in accordance with the requirements outlined in the NSW Roads and Traffic Authority's (RTA) *Guide to Traffic Generating Developments.*

The methodology for the preparation of the Traffic Study is outlined in the following Section of the Report.

2.4 TRAFFIC STUDY METHODOLOGY

In carrying out the preparation of the Traffic Study, three (3) broad issues will need to be addressed as outlined below:

(a) Existing Site and Traffic Conditions

- Subdivision location;
- Road network hierarchy surrounding the development;
- Existing site access;
- Existing roadway capacity; and
- Existing traffic flow

(b) Proposed Subdivision

- Residential subdivision development concepts;
- Internal and external traffic design principles; and
- Connectivity to the surrounding road network.

(c) Traffic Impact of the Proposed Subdivision

- Traffic generation from the proposed subdivision;
- Traffic distribution within and external to the subdivision and the connection to Wheelers Lane, Boundary Road and Hennessy Drive;
- Impact of the traffic generated from the subdivision on existing traffic parameters; and
- Local area traffic management.

In order to satisfactorily address all the relevant traffic issues for the proposed subdivision, the following work tasks will need to be carried out:

1. Review all available background data, community concerns and traffic history relating to the area around the subdivision site.

2. Determine the traffic generating potential of the proposed subdivision, calculation of peak hour and daily traffic volumes and the distribution of the generated traffic within the subdivision and onto the surrounding road network to determine post development traffic volumes on the road network.

3. Assessment of the impact of the additional traffic generated by the development of the subdivision on the surrounding road network. The traffic impact assessment will carried out in terms of:

    - Road capacity;
    - Road safety;
    - Intersection operation; and
    - Access requirements.

4. Determination of a schedule of required works that may be necessary to alleviate any potential impacts caused to the surrounding road network by the development of the subdivision.

In summary, this Traffic Study will assess the existing traffic movements on the road network surrounding the development site, the expected traffic volumes generated by the proposed subdivision of the Hillview property, the effect of the generated traffic on the surrounding road network and the determination of a safe and efficient means of providing access to the subdivision to cater for the additional traffic volume.

Consideration of SEPP (Infrastructure) 2007

Schedule 3 of State Environmental Planning Policy (Infrastructure) 2007 classifies developments based upon the potential to generate additional traffic onto the surrounding road network.

Developments listed in Schedule 3 of SEPP (Infrastructure) require referral to the Roads and Maritime Services (RMS) by the consent authority. The consent authority is required to take into consideration any submission that the RMS provides in response to the notice of the development.

In addition, the consent authority must consider, pursuant to Clause 104 (3) of SEPP (Infrastructure), the accessibility of the site and any potential traffic safety, road congestion or parking implications of the proposed development.

Based on Schedule 3, the classification of the proposed extension to the Southlakes subdivision is outlined in Column 2 and states:

Subdivision of Land	*200 or more allotments where the subdivision includes the opening of a public road*

As the proposed extension to the Southlakes subdivision will generate approximately 1,475 dwelling sites, Dubbo City Council will need to refer the application to the RMS as part of the development approval process.

Existing Traffic Conditions

4.1 ROAD NETWORK HIERARCHY

The Roads and Traffic Authority (1984) proposes four basic road classes as the basis for the functional hierarchy of a road network.

A functional classification take into account the relative balance of the traffic mobility function and amenity/access functions of streets and roads and defines the purpose of a road within the context of a road network.

The four road classes are arterial, sub-arterial, collector and local roads and are defined below.

- **Arterial Roads**

  Roads whose main function is to carry through traffic from one region to another forming the principal means of communication for major traffic movements.

- **Sub-Arterial Roads**

  Those roads which supplement the arterial roads in providing for through traffic movement to an individually determined limit that is sensitive to both roadway characteristics and adjoining land uses.

- **Collector Roads**

  Roads that distribute traffic between the arterial roads and the local street system and provide access to adjoining property.

- **Local Roads**

  Subdivisional roads whose main traffic function is to provide access to adjoining property.

An assessment of the classification of the roads leading to and surrounding the development site is indicated in **Table 4.1**.

Table 4.1 – Existing Road Classification

Road	Classification
Wheelers Lane north of Boundary Road	Sub – Arterial Road
Wheelers Lane south of Boundary Road	Sub – Arterial Road
Boundary Road west of Wheelers Lane	Sub – Arterial Road
Boundary Road east of Wheelers Lane	Not currently classified
Hennessy Drive west of Wheelers Lane	Collector Road
Hennessy Drive east of Wheelers Lane	Not currently classified
Azure Avenue	Local Road
Argyle Avenue	Local Road

4.2 EXISTING ROAD CONDITIONS

The existing configuration, conditions and intersection facilities of the road network leading to and surrounding the development site are outlined in this Section of the Traffic Study.

Wheelers Lane North of Boundary Road

Wheelers Lane north of the intersection with Boundary Road comprises two (2) configurations as outlined below:

- From the intersection of Boundary Road to the northern boundary of the Dawson Park Greyhound Racing Complex Wheelers Lane has kerb and gutter on the western side of the road and is unkerbed on the eastern side of the road. The roadway comprises two (2) southbound lanes each a minimum of 3.5m wide, two (2) northbound lanes each a minimum of 3.5m wide and a 4m wide parking lane on the western side of the road.

- From the northern boundary of Dawson Park Wheelers Lane is kerb and guttered on both sides of the road. The roadway comprises two (2) southbound lanes each a minimum of 3.5m wide, two (2) northbound lanes each a minimum of 3.5m wide and a 4m wide parking lane on the both the eastern and western sides of the road.

  From south of the intersection of Wheelers Lane and Kingfisher Street the roadway transitions to the northbound and southbound carriageways separated by a wide concrete median. The concrete median allows for protected right turns at a number of intersections along Wheelers Lane.

Wheelers Lane is speed limited at 60km/hr.

Wheelers Lane South of Boundary Road

Wheelers Lane to the south of the intersection with Boundary Road transitions to a southbound lane and a northbound lane. On the eastern side of Wheelers Lane is a central drainage/landscaped area separating the service road providing access to the allotments in Southlakes Estate fronting the Wheelers Lane road reserve.

The western side of Wheelers Lane is kerb and guttered along the frontage of Magnolia Estate and Holmwood Estate. When the Mary's Veil subdivision is developed, the western side of Wheelers Lane will be kerb and guttered on the western side for its full length between Boundary Road and Hennessy Drive.

The Wheelers Lane carriageway along the frontage of Holmwood Estate comprises a 6m wide travel lane and parking lane on the western side (for northbound traffic) and a 4m wide travel lane on the eastern side (for southbound traffic).

At the approach to the intersection with Hennessy Drive, Wheelers Lane transitions to a unkerbed carriageway with a 3.5m wide travel lane in each direction.

Wheelers Lane is speed limited at 60km/hr.

Boundary Road

Boundary Road east of the Dubbo to Molong rail crossing has kerb and gutter on the northern side with sections of kerb and gutter recently having been constructed along the frontage of Magnolia Estate on the southern side of Boundary Road. East of Magnolia Estate, the southern side of Boundary Road is also kerb and guttered.

The main section of the carriageway in Boundary Road is approximately 16m wide. The carriageway comprises a parking/bicycle lane 3m wide, an eastbound and westbound travel lane each 3.5m wide and a central turning median at 3.0m wide.

Boundary Road west of the Dubbo to Molong rail crossing is kerb and guttered both sides with a bitumen sealed width of approximately 14m. The carriageway comprises an eastbound and westbound travel lane each of approximately 3.5m with a parking lane/bicycle lane approximately 3.5m each side.

Boundary Road is speed limited at 50km/hr.

Boundary Road east of Wheelers Lane is an unformed road.

Hennessy Drive

Hennessy Drive west of the intersection with Wheelers Lane is a two lane two way carriageway with a bitumen seal width of approximately 8m. The road is centreline marked and also has considerable sections of the roadway with double barrier lines to prevent overtaking.

The recently developed Macquarie View Estate incorporates a new intersection of Holmwood Drive and Hennessy Drive consisting of a left turn lane for eastbound traffic and a right turn for westbound traffic in Hennessy Drive to access the subdivision.

A service road parallel to Hennessy Drive on the northern side provides access to lots in Holmwood Estate and Macquarie View Estate that front Hennessy Drive.

Hennessy Drive is speed limited at 60km/hr.

Hennessy Drive east of the intersection with Wheelers Lane is bitumen sealed to a width of 6m and apart from the area around the intersection with Wheelers Lane is not line marked.

Azure Avenue

Azure Avenue provides a major connection through the northern section of the existing Southlakes Estate to the land to be developed to the east.

Azure Avenue has a variable pavement width along it length comprising in general:

- Kerb and guttered both sides with a 6.2m wide parking and travel lane for both eastbound and westbound traffic separated by a 5m wide landscaped median.

- A bridge over the creek line with a sealed width of 8m kerb to kerb.

Each side of the bridge, the roadway transitions from the wider sections through the narrowing at the bridge.

The configuration of the Azure Avenue carriageway provides a high standard roadway with separated travel lanes capable of catering for increased traffic volumes accessing the extension of Southlakes Estate.

Argyle Avenue

Argyle Avenue provides a major connection through the southern section of the existing Southlakes Estate to the land to be developed to the east.

Argyle Avenue has a variable pavement width along it length comprising in general:

- Kerb and guttered both sides with a 6.2m wide parking and travel lane for both eastbound and westbound traffic separated by a 5m wide landscaped median.

- A bridge over the creek line with a sealed width of 8m kerb to kerb.

Each side of the bridge, the roadway transitions from the wider sections through the narrowing at the bridge.

At this stage, the roadway over the bridge in Argyle Avenue is not operational, pending approval from Council for the adjoining subdivision works. However, the configuration of the Argyle Avenue carriageway provides a high standard roadway with separated travel lanes capable of catering for increased traffic volumes accessing the extension of Southlakes Estate.

Intersection of Wheelers Lane and Boundary Road

The intersection of Wheelers Lane and Boundary Road is controlled by a Give Way sign on the Boundary Road leg of the intersection with a concrete median island providing separation of the traffic streams. Whilst the intersection technically is a four way intersection, the eastern leg of Boundary Road is poorly formed and not currently in regular use. The intersection currently operates as a Tee intersection with the Wheelers Lane traffic having the right of way.

For eastbound traffic in Boundary Road a dedicated left turn lane and right turn lane is provided to access Wheelers Lane.

For northbound traffic in Wheelers Lane a dedicated left turn lane is provided to access Boundary Road.

For southbound traffic in Wheelers Lane a dedicated right turn lane is provided to access Boundary Road whilst there is a separate southbound lane for through traffic.

Intersection of Wheelers Lane and Southlakes Parade

The intersection of Wheelers Lane and Southlakes Parade forms a standard Tee intersection and is controlled by a Give Way sign on the Southlakes Parade leg of the intersection with the Wheelers Lane traffic having the right of way.

The threshold of the Southlakes Parade leg of the intersection is paved. The service road parallel to Wheelers Lane is also accessed to the south from this intersection.

Intersection of Wheelers Lane and Magnolia Boulevard

The intersection of Wheelers Lane and Magnolia Boulevard is controlled by a concrete median on the Magnolia Boulevard leg of the intersection and complies with the give way priorities at a Tee intersection with the Wheelers Lane traffic having the right of way.

Intersection of Wheelers Lane and Azure Avenue

The intersection of Wheelers Lane and Azure Avenue forms a standard Tee intersection and complies with the give way priorities at a Tee intersection with the Wheelers Lane traffic having the right of way.

Whilst the intersection pavement in Azure Avenue is wide, the central median is located beyond the paved threshold on the Azure Avenue leg of the intersection and a double barrier line extends from the paved threshold into the intersection. The service road parallel to Wheelers Lane is also accessed to the south from this intersection.

Intersection of Wheelers Lane and Holmwood Drive

The intersection of Wheelers Lane and Holmwood Drive is controlled by a double barrier line on the Holmwood Drive leg of the intersection and complies with the give way priorities at a Tee intersection with the Wheelers Lane traffic having the right of way.

Intersection of Wheelers Lane and Argyle Avenue

The intersection of Wheelers Lane and Argyle Avenue forms a standard Tee intersection and complies with the give way priorities at a Tee intersection with the Wheelers Lane traffic having the right of way.

Whilst the intersection pavement in Argyle Avenue is wide, the central median is located beyond the threshold on the Azure Avenue leg of the intersection and a double barrier line is to be extended from

the median into the intersection when the bridge over the creek line is opened to traffic. The service road parallel to Wheelers Lane is also accessed to the south from this intersection.

Intersection of Wheelers Lane and Shindys Road

The intersection of Wheelers Lane and Shindys Road is controlled by a double barrier line on the Shindys Road leg of the intersection and complies with the give way priorities at a Tee intersection with the Wheelers Lane traffic having the right of way

Intersection of Wheelers Lane and Hennessy Drive

The intersection of Wheelers Lane and Hennessy Drive comprises a swept 90 degree bend. The roadway in both Wheelers Lane and Hennessy Drive is centreline marked with a double barrier line and the roadways are edgeline marked.

The eastern leg of Hennessy Drive intersects the main intersection at an approximate angle of 90 degrees at the apex of the curve of the Wheelers Lane intersection.

Intersection of Azure Avenue and Southlakes Parade

The intersection of Azure Avenue and Southlakes Parade is controlled by a roundabout. The roundabout has single approach and departure lanes on all legs of the intersection with concrete splitter islands incorporated into the main central medians of both roads.

Various photographs of the roads described in this Section of the Traffic Study and contained in the **Plates** Section of this Report.

4.3 EXISTING ROADWAY CAPACITY

The provision of roads within an urban area provides four main functions:

i) to cater for moving vehicles;
ii) to cater for parked vehicles;
iii) to cater for pedestrians and bicycle traffic; and
iv) to allow for development and to provide access to adjoining property.

In carrying out the above functions, a road must also be capable of handling the traffic demands placed on it. Roads have varying capacities dependent on the function they are performing. The United States Highway Capacity Manual defines capacity as follows:

> *"Capacity is the maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction (or in both directions for a two-lane or three-lane highway) during a given time period under prevailing roadway and traffic conditions."*

The physical characteristics of a roadway such as lane width, alignment, frequency of intersections etc make up the prevailing roadway conditions.

Based upon its capacity and a driver's expectations of the operational characteristics of a traffic stream is a qualitative measure denoted as the level of service of a road.

Level of service definitions combine such factors as speed, travel time, safety, convenience and traffic interruptions and fall into six levels of service categories ranging from A down to F.

The *AUSTROADS Guide to Traffic Engineering Practice* describes Level of Service A as:

> *"A condition of a free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the*

traffic stream is extremely high and the general level of comfort and convenience provided is excellent."

The *AUSTROADS Guide to Traffic Engineering Practice* describes Level of Service B as:

"A condition of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is a little less than with Level of Service A"

The categories are graduated from Level of Service A down through six levels to Level of Service F that is a zone of forced flow. The amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdowns occur and queuing and delays result.

Based on the physical configurations of the surrounding road network, observations of traffic movements and the methodology outlined in Part 2 *Roadway Capacity* of *AUSTROADS Guide to Traffic Engineering Practice*, the capacity and Level of Service of the surrounding roads can be determined as indicated in **Table 4.2**.

Table 4.2 – Roadway Capacity and Level of Service

Road	Level of Service	Two Way Hourly Capacity
Wheelers Lane north of Boundary Road	Level of Service B	3,600 veh/hour
Wheelers Lane south of Boundary Road	Level of Service B	1,800 veh/hour
Boundary Road	Level of Service B	1,200 veh/hour
Azure Avenue	Level of Service B	1,200 veh/hour
Argyle Avenue	Level of Service B	1,200 veh/hour
Hennessy Drive	Level of Service B	1,200 veh/hour

4.4 AVAILABLE TRAFFIC DATA

Site specific traffic data was not collected on roads surrounding the Southlakes Subdivision for the preparation of this Traffic Study. However, a number of sources were used to collate the available traffic data for use in determining potential impacts on the surrounding road network, including:

i) Traffic Impact Assessment for Southlakes DA4 (Geolyse, July 2012)

ii) Dubbo City Council – hourly traffic volumes for the modelled road network

The available traffic data for the Annual Average Daily Traffic and Peak Hour Traffic will be outlined in the following Sections of this Report.

4.5 ANNUAL AVERAGE DAILY TRAFFIC

The Geolyse July 2012 Traffic Report assessed the development of an additional 224 lots in Southlakes Estate and distributed the generated traffic volumes onto the surrounding road network. Turning movement counts were undertaken at the intersection of Wheelers Lane and Boundary Road and the proportional volumes at the intersection were used to distribute the additional traffic onto the road network.

The July 2012 Traffic Report determined the following post development AADT traffic volumes on the subject roads:

- Wheelers Lane north of Boundary Road 7,335 vehicles per day

- Wheelers Lane south of Boundary Road 6,903 vehicles per day
- Boundary Road west of Wheelers Lane 4,968 vehicles per day

As the post development traffic volumes were determined for the Year 2012 and the expected completion date for the full development of the extension to Southlakes Estate may take 10 years, it would be reasonable to carry out the assessment of the impact on the surrounding road network for the Year 2026.

On this basis, the Year 2012 traffic volumes shall be adjusted by the application of a growth factor of 2% per annum to account for the increase in traffic volumes over time.

The estimated Year 2026 AADT traffic volumes on the subject roads are summarised below:

- Wheelers Lane north of Boundary Road 9,678 vehicles per day
- Wheelers Lane south of Boundary Road 9,108 vehicles per day
- Boundary Road west of Wheelers Lane 6,555 vehicles per day

It should be noted that the estimated Year 2026 AADT traffic volumes based on the July 2012 Traffic Report do not take into account the redistribution of traffic patterns following the extension of Boundary Road through to Sheraton Road.

However, the estimated AADT provides a basis for the further assessment of the potential impacts of traffic generated by the proposed extension to Southlakes Estate.

4.6 PEAK HOUR TRAFFIC

The Geolyse July 2012 Traffic Report determined post development peak hour traffic volumes generated from Southlakes Estate on the surrounding road network.

The July 2012 Traffic Report determined the following post development peak hour traffic volumes on the subject roads:

- Wheelers Lane north of Boundary Road 912 vehicles per hour
- Wheelers Lane south of Boundary Road 752 vehicles per hour
- Boundary Road west of Wheelers Lane 679 vehicles per hour

Similarly, the Year 2012 traffic volumes shall be adjusted by the application of a growth factor of 2% per annum to account for the increase in traffic volumes over time.

The estimated Year 2026 peak hour traffic volumes on the subject roads are summarised below:

- Wheelers Lane north of Boundary Road 1,204 vehicles per hour
- Wheelers Lane south of Boundary Road 992 vehicles per hour
- Boundary Road west of Wheelers Lane 896 vehicles per hour

It should be noted that the estimated Year 2026 peak hour traffic volumes based on the July 2012 Traffic Report do not take into account the redistribution of traffic patterns following the extension of Boundary Road through to Sheraton Road.

However, the estimated peak hour traffic volumes provides a basis for the further assessment of the potential impacts of traffic generated by the proposed extension to Southlakes Estate.

The traffic data provided by Council assesses the peak hour traffic volume on the extension of Boundary Road through to Sheraton Road. For the Year 2026, the estimated peak hour traffic volume between Wheelers Lane and Alexandrina Avenue is approximately 511 vehicles per hour.

Traffic Impact of the Proposed Development

5.1 PROPOSED SUBDIVISION

The site for the extension of the Southlakes Estate subdivision comprises Lot 12 in DP1207280 and Lot 399 in DP1199356. Lot 12 has an area of approximately 2.27ha and Lot 399 has an area of approximately 128.5ha for a total development area of approximately 130.77ha.

It is intended that approximately 1,475 dwelling sites be created in the subdivision comprising residential allotments and medium density allotments.

In general, the dwelling sites will comprise the following allocations:

Residential allotments	910 lots
Medium density dwelling units	565 units
Total dwelling sites	1,475 dwellings

The concept Master Plan for the proposed extension to Southlakes Estate is indicated on **Drawing TS02** located in the **Drawings** Section of this Report.

5.2 TRAFFIC GENERATION

The Roads and Traffic Authority's *Guide to Traffic Generating Developments* publishes data on the traffic generating potential of various developments ranging from residential subdivisions, commercial premises, retail premises and industrial developments.

For residential subdivisions, the *Guide to Traffic Generating Developments* indicates that the following range of traffic generation for daily vehicle trips and weekday peak hour vehicle trips as indicated below:

- Dwelling Houses
  Daily vehicle trips = 9 per dwelling
  Weekday peak hour vehicle trips = 0.85 per dwelling
- Medium Density Residential Dwellings
  Smaller units and flats (up to 2 bedrooms)
  Daily vehicle trips = 4 to 5 per dwelling
  Larger units and townhouses (3 or more bedrooms)
  Daily vehicle trips = 5 to 6.5 per dwelling
  Weekday peak hour vehicle trips = 0.5 to 0.65 per dwelling

Dubbo City Council has had discrete traffic assessment carried out on selected streets within the City by TEC Pty Ltd that indicates the traffic generation rates attributable to dwelling houses in Dubbo are higher than the generation rates determined by the RTA.

The applicable traffic generation rates to be used in this Traffic Study are summarised below:

- Dwelling Houses
  Daily vehicle trips = 11 per dwelling
  Weekday peak hour vehicle trips = 1.0 per dwelling

- Medium Density Residential Dwellings
  Daily vehicle trips = 6 per dwelling
  Weekday peak hour vehicle trips = 0.5 per dwelling

Based on the adopted traffic generation rates and the proposed dwelling sites throughout the subdivision, the daily and peak hour traffic generation for the extension of Southlakes Estate is set out in the following Section of this Report.

5.2.1 DAILY TRAFFIC GENERATION

The daily traffic generated by the extension of Southlakes Estate can be estimated as set out below:

Number of residential dwellings:	910 dwellings
Daily vehicle trips:	11 per dwelling
Number of residential daily trips:	10,010 trips per day
Number of medium density dwellings:	565 dwellings
Daily vehicle trips:	6 per dwelling
Number of medium density daily trips:	3,390 trips per day
Total daily vehicle trips:	10,010 trips + 3,390 trips = 13,400 trips per day

Not all trips generated by the proposed extension to Southlakes Estate will be external to the subdivision. A proportion of the generated trips will be for internal travel purposes such as visiting friends or neighbours, recreation areas or a potential commercial precinct.

The RTA estimate that approximately 25% of daily and peak hour vehicle trips are internal to the subdivision (RTA, 1993) and therefore the adjusted external daily vehicle trips generated by the subdivision is:

External daily vehicle trips: 13,400 trips x 0.75 = 10,050 trips per day.

The external trip generation of 10,050 trips per day will be used to assess the potential impacts of the development of the subdivision on the surrounding road network.

5.2.2 PEAK HOUR TRAFFIC GENERATION

The peak hour traffic generated by the extension of Southlakes Estate can be estimated as set out below:

Number of residential dwellings:	910 dwellings
Peak hour vehicle trips:	1 per dwelling
Number of residential peak hour trips:	910 trips per hour
Number of medium density dwellings:	565 dwellings
Peak hour vehicle trips:	0.5 per dwelling
Number of medium density peak hour trips:	283 trips per day
Total peak hour vehicle trips:	910 trips + 283 trips = 1,193 trips per hour

As with the daily trip generation, the RTA estimate that 25% of the peak hour trip generation are internal to the subdivision. Therefore, the adjusted external peak hour trips generated by the subdivision is:

External peak hour trips: 1,193 trips x 0.75 = 895 trips per hour.

The external trip generation of 895 trips per hour will be used to assess the potential impacts of the development of the subdivision on the surrounding road network.

5.3 TRAFFIC DISTRIBUTION

Traffic generated by the development of the extension to Southlakes Estate will access the subdivision via the following external road connections:

- Wheelers Lane and Azure Avenue
- Wheelers Lane and Argyle Avenue
- The future extension of Boundary Road and Alexandrina Avenue
- The future extension Boundary Road and the main north south internal road linking Argyle Avenue and Azure Avenue
- Argyle Avenue and a new road connection to the future extension of Hennessy Drive
- Provision for the extension of Azure Avenue through to land located to the east of the extension to Southlakes Estate.

The travel paths taken by the future residents of the subdivision to access the external road network are subjective and will be dependent on trip destination and purpose.

Major attractors for the residential traffic are the CBD area of Dubbo for work and shopping purposes, Orana Mall for shopping purposes and once the extension of Boundary Road is completed, the school precinct in Sheraton Road and Bunnings will be an attractor.

A subjective assessment of the traffic distribution external to the subdivision via the various connections to the external road network is set out below in estimated percentage terms of the total traffic generation, noting that the assumption is made that all extensions to the surrounding road network have been completed:

- Wheelers Lane and Azure Avenue 30%
- Wheelers Lane and Argyle Avenue 25%
- Boundary Road and Alexandrina Avenue 10%
- Boundary Road and north south road 25%
- Argyle Avenue through to Hennessy Drive 10%

Based on the estimated percentages, the daily traffic and peak hour traffic volumes distributed to the surrounding road network is set out in **Table 5.1**.

Table 5.1 – Traffic Volume Distribution to the External Road Network

Road	Percentage Distribution	Daily Traffic Volume (trips per day)	Peak Hour Traffic Volume (trips per hour)
Wheelers Lane and Azure Avenue	30%	3,016	267
Wheelers Lane and Argyle Avenue	25%	2,512	224
Boundary Road and Alexandrina Avenue	10%	1,005	90
Boundary Road and north south road	25%	2,512	224
Argyle Avenue to Hennessy Drive	10%	1,005	90
Totals	**100%**	**10,050**	**895**

The distribution of the traffic volumes onto the external road network is indicated on **Drawing TS03** located in the **Drawings** Section of this Report.

5.4 IMPACT OF GENERATED TRAFFIC

The impact of the additional traffic generated by the extension of Southlakes Estate on the surrounding road network will be assessed in terms of:

i) Traffic Volume for both the Daily and Peak Hour traffic generation;

ii) Intersection Operation; and

iii) Road Safety.

SIDRA modelling will be undertaken to assess the operation of various intersections on the surrounding road network.

5.4.1 PROPOSED ROAD UPGRADES

Discussions have been held with staff of Dubbo City Council regarding the proposed road upgrades that are to be carried out on the surrounding road network.

The proposed road upgrades will include:

- Construction of a roundabout at the intersection of Wheelers Lane and Boundary Road.
- Extension of Boundary Road through to Sheraton Road.
- Construction of a roundabout at the intersection of Boundary Road and Alexandrina Avenue.

The general details of the proposed road upgrades are summarised below.

1. The roundabout to be constructed at the intersection of Wheelers Lane and Boundary Road is a large diameter roundabout with 2 circulating lanes within the roundabout. Each approach leg to the roundabout will comprise 2 lanes whilst the departure legs to Boundary Road will comprise a single lane. The departure legs to Wheelers Lane will comprise 2 lanes.

   Concrete splitter islands will be provided on each leg to separate the approach and departure lanes of the roundabout.

2. The upgrade of Boundary Road between Wheelers Lane and Alexandrina Avenue will comprise a single lane in each direction, will include an on road cycle lane and a concrete separation median between the travel lanes. In general, no access will be available to land fronting this section of Boundary Road following the upgrade.

   From the intersection of Alexandrina Avenue through to Sheraton Road, Boundary Road will be upgraded to a rural road standard with a single lane in each direction and tabledrains outside the carriageway of the road.

3. The roundabout to be constructed at the intersection of Boundary Road and Alexandrina Avenue is a large diameter roundabout with 1 circulating lane within the roundabout. The approach leg to the roundabout from the western end of Boundary Road will comprise 2 lanes whilst all other approach and departure legs to the roundabout will comprise a single lane.

   Concrete splitter islands will be provided on each leg to separate the approach and departure lanes of the roundabout.

5.4.2 TRAFFIC VOLUME

Based on the Average Daily Traffic and Peak Hour traffic volumes on Wheelers Lane and Boundary Road as outlined in **Section 4.5** and **Section 4.6**, the impacts of the traffic generated by the extension of Southlakes Estate has been assessed.

A comparison of the existing daily and peak hour traffic volumes on the subject roads and the post development traffic volumes is indicated in **Table 5.2**.

Table 5.2 – Comparison of Existing and Post Development Traffic Volumes

Road	Estimated Year 2026 Traffic Volume	Post Development Traffic Volume	Percentage Increase
Wheelers Lane north of Boundary Road – Daily Traffic Volume	9,678 trips per day	14,100 trips per day	46%
Wheelers Lane north of Boundary Road – Peak Hour Traffic Volume	1,204 trips per hour	1,597 trips per hour	33%
Wheelers Lane south of Boundary Road – Daily Traffic Volume	9,108 trips per day	14,636 trips per day	61%
Wheelers Lane south of Boundary Road – Peak Hour Traffic Volume	992 trips per hour	1,483 trips per hour	50%
Boundary Road west of Wheelers Lane – Daily Traffic Volume	6,555 trips per day	9,067 trips per day	38%
Boundary Road west of Wheelers Lane – Peak Hour Traffic Volume	896 trips per hour	1,120 trips per hour	25%
Boundary Road east of Wheelers Lane – Daily Traffic Volume	NA	3,517 trips per day	NA
Boundary Road east of Wheelers Lane – Peak Hour Traffic Volume	NA	314 trips per hour	NA
Hennessy Drive – Daily Traffic Volume	NA	1,005 trips per day	NA
Hennessy Drive – Peak Hour Traffic Volume	NA	90 trips per hour	NA

The increase in daily traffic volumes on Wheelers Lane north and Wheelers Lane south is 46% and 61% respectively.

The increase in peak hour traffic volumes on Wheelers Lane north and Wheelers Lane south is 33% and 50% respectively.

The increase in daily traffic volumes on Boundary Road west is 38%.

The increase in peak hour traffic volumes on Boundary Road west is 25%.

A comparison will be made with the post development peak hour traffic volumes on each road with the actual traffic volume capacity of the road in its current configuration.

Based on the roadway capacities determined in **Section 4.3** of this Traffic Study, a comparison of the post development peak hour traffic volume and the actual road capacity is indicated in **Table 5.3**. The operational capacity is the percentage of actual volume capacity that the road is functioning at.

Table 5.3 – Post Development Peak Hour Capacity

Road	Post Development Peak Hour Capacity Year 2026	Road Capacity at a Level of Service B (Refer to Section 3.3)	Operational Capacity
Wheelers Lane north	1,597 vehicles per hour	3,600 vehicles per hour	44%
Wheelers Lane south	1,483 vehicles per hour	1,800 vehicles per hour	82%
Boundary Road west	1,120 vehicles per hour	1,200 vehicles per hour	93%

The operational capacity of Wheelers Lane north following the development of the extension of Southlakes Estate is 44%, for Wheelers Lane south the operational capacity is 82% and for Boundary Road west is 93%.

All roads are operating below the operational capacity at a Level of Service B and the impact of the additional traffic generated by the extension of Southlakes Estate in the Year 2026 is not significant in terms of the volume of post development traffic using Wheelers Lane and Boundary Road, noting that the existing estimated traffic volumes on the subject roads do not take into account redistribution of traffic patterns once the connection of Boundary Road through to Sheraton Road is constructed.

5.4.3 INTERSECTION ASSESSMENT

The operation of the following intersections will be assessed using the SIDRA computer modelling program:

- Wheelers Lane and Argyle Avenue
- Wheelers Lane and Azure Avenue
- Boundary Road the north south access road

The operation of the intersections of Wheelers Lane and Boundary Road and Boundary Road and Alexandrina Avenue will not be assessed for this Traffic Study as Council has had extensive modelling of the operation of these intersections carried out in developing the detailed design of the roundabouts to be constructed at these intersections.

5.4.3.1 Wheelers Lane and Argyle Avenue

The operation of the intersection of Wheelers Lane and Argyle Avenue will be assessed for the nominal peak hour using the SIDRA modelling program.

The intersection turning movements for the peak hour traffic generated from the extension of Southlakes Estate are indicated on **Drawing TS04** in the **Drawings** Section of this Report.

A summary of the SIDRA modelling for the operation of the intersection on Wheelers Lane is indicated in **Table 5.4**.

The SIDRA modelling results for the assessment of this intersection are included in **Appendix A.**

Table 5.4 – Wheelers Lane and Argyle Avenue Intersection Operating Parameters

Scenario	Vehicles on Movement	Average Delay (seconds)	95% Queue Length (vehicles)	Overall Level of Service (LOS)
Nominal Peak Hour				
Argyle Avenue Westbound				
Left Turn into Wheelers Lane	31 vehicles per hour	8.7	0.8	LOS A
Right Turn into Wheelers Lane	122 vehicles per hour	9.0	0.8	LOS A
Wheelers Lane Northbound				
Right Turn into Argyle Avenue	31 vehicles per hour	8.5	0.5	LOS A
Straight Through Northbound	100 vehicles per hour	0.7	0.5	LOS A
Wheelers Lane Southbound				
Left Turn into Argyle Avenue	122 vehicles per hour	7.5	0.0	LOS A
Straight Through Southbound	100 vehicles per hour	0.0	0.0	LOS A

All movements at the intersection operate at a Level of Service A and thus will operate satisfactorily for the development of the extension to Southlakes Estate.

5.4.3.2 Wheelers Lane and Azure Avenue

The operation of the intersection of Wheelers Lane and Azure Avenue will be assessed for the nominal peak hour using the SIDRA modelling program.

The intersection turning movements for the peak hour traffic generated from the extension of Southlakes Estate are indicated on **Drawing TS05** in the **Drawings** Section of this Report.

A summary of the SIDRA modelling for the operation of the intersection on Wheelers Lane is indicated in **Table 5.5**. The SIDRA modelling results for the assessment of this intersection are included in **Appendix A.**

Table 5.5 – Wheelers Lane and Azure Avenue Intersection Operating Parameters

Scenario	Vehicles on Movement	Average Delay (seconds)	95% Queue Length (vehicles)	Overall Level of Service (LOS)
Nominal Peak Hour				
Azure Avenue Westbound				
Left Turn into Wheelers Lane	41 vehicles per hour	10.8	1.8	LOS A
Right Turn into Wheelers Lane	192 vehicles per hour	11.1	1.8	LOS A
Wheelers Lane Northbound				
Right Turn into Azure Avenue	41 vehicles per hour	9.2	1.0	LOS A
Straight Through Northbound	180 vehicles per hour	1.5	1.0	LOS A

Table 5.5 – Wheelers Lane and Azure Avenue Intersection Operating Parameters

Scenario	Vehicles on Movement	Average Delay (seconds)	95% Queue Length (vehicles)	Overall Level of Service (LOS)
Wheelers Lane Southbound				
Left Turn into Azure Avenue	192 vehicles per hour	7.5	0.0	LOS A
Straight Through Southbound	180 vehicles per hour	0.0	0.0	LOS A

All movements at the intersection operate at a Level of Service A and thus will operate satisfactorily for the development of the extension to Southlakes Estate.

5.4.3.3 Boundary Road and the North South Access Road

The operation of the intersection of Boundary Road and the north south access road will be assessed for the nominal peak hour using the SIDRA modelling program.

The intersection turning movements for the peak hour traffic generated from the extension of Southlakes Estate are indicated on **Drawing TS06** in the **Drawings** Section of this Report.

A summary of the SIDRA modelling for the operation of the intersection on Wheelers Lane is indicated in **Table 5.6**. The SIDRA modelling results for the assessment of this intersection are included in **Appendix A.**

Table 5.6 – Boundary Road and Access Road Intersection Operating Parameters

Scenario	Vehicles on Movement	Average Delay (seconds)	95% Queue Length (vehicles)	Overall Level of Service (LOS)
Nominal Peak Hour				
Access Road Northbound				
Left Turn into Boundary Road	56 vehicles per hour	9.9	0.7	LOS A
Right Turn into Boundary Road	56 vehicles per hour	10.2	0.7	LOS A
Boundary Road Eastbound				
Right Turn into Access Road	56 vehicles per hour	9.0	1.4	LOS A
Straight Through Eastbound	255 vehicles per hour	1.3	1.4	LOS A
Boundary Road Westbound				
Left Turn into Access Road	56 vehicles per hour	7.5	0.0	LOS A
Straight Through Westbound	255 vehicles per hour	0.0	0.0	LOS A

All movements at the intersection operate at a Level of Service A and thus will operate satisfactorily for the development of the extension to Southlakes Estate.

5.4.4 LOCAL AREA TRAFFIC MANAGEMENT

The proposed subdivision of the extension of Southlakes Estate will extend the design concepts included in the development of the subdivision to date. The design of the subdivision has incorporated various influencing factors relating to topography, drainage and connection to the existing road network.

The need to provide safe and efficient traffic movement within the subdivision coupled with the amenity of the residential areas is of importance in developing the subdivision layout.

The Traffic Authority of NSW (1985) states that the main traffic related principles to be observed in the design of a residential subdivision are:

- To provide a safe environment for pedestrians, cyclists and motorists;
- To ensure convenient vehicular access to properties for residents, visitors, service and emergency vehicles;
- To reduce traffic conflicts, both vehicular and pedestrian;
- To give priority to through traffic on major roads, segregated where possible from pedestrian activity;
- To ensure that the road layout will accommodate public transport; and
- To provide a suitable residential environment. This includes limitation of noise generated by traffic and the provision of landscaping that does not compromise safety nor impede traffic movement.

The lot layout and road pattern developed for the extension of Southlakes Estate provides many residential areas that form quiet neighbourhood precincts consisting of cul-de-sacs running off roadways linking the main thoroughfares through the site.

Intersections have been predominantly designed as T-junctions and will be subject to the usual Give Way priority for the through traffic. A large roundabout will be provided at the 4-way intersection created at the eastern end of Azure Avenue with two smaller roundabouts to be provided at four way intersections in the southern section of the subdivision.

The major thoroughfares through the subdivision will include central medians to provide separation of the travel lanes and to control the turning movements of vehicles into and out of the side street network.

Good sight distance is provided at all intersections and the design geometry of the roads will ensure that both the vertical and horizontal alignment provides for the safety of both vehicular traffic and pedestrians.

A series of paved footpaths will be provided throughout the subdivision to provide pedestrian refuges at the crossing points of the roads and to provide linkages to the cycleway network along the creekline within the subdivision.

The Local Area Management Plans for both Traffic and Pedestrians are indicated on **Drawing TS07** and **Drawing TS08** located in the **Drawings** Section of this Report.

5.4.5 TRAFFIC IMPACT SUMMARY

The impact of the additional traffic generated by the extension of Southlakes Estate on the surrounding road network has been assessed in terms of:

i) Traffic Volume for both the Daily and Peak Hour traffic generation;

ii) Intersection Operation; and

iii) Road Safety.

SIDRA modelling has been undertaken to assess the operation of various intersections on the surrounding road network.

5.4.5.1 Traffic Generation and Roadway Capacity

The estimated external daily traffic generation from the extension to Southlakes Estate is 10,050 trips per day and the external peak hour traffic generation is 895 trips per hour.

The increase in daily traffic volumes on Wheelers Lane north and Wheelers Lane south is 46% and 61% respectively.

The increase in peak hour traffic volumes on Wheelers Lane north and Wheelers Lane south is 33% and 50% respectively.

The increase in daily traffic volumes on Boundary Road west is 38%.

The increase in peak hour traffic volumes on Boundary Road west is 25%.

The operational capacity of Wheelers Lane north following the development of the extension of Southlakes Estate is 44%, for Wheelers Lane south the operational capacity is 82% and for Boundary Road west is 93%.

All roads are operating below the operational capacity at a Level of Service B and the impact of the additional traffic generated by the extension of Southlakes Estate in the Year 2026 is not significant in terms of the volume of post development traffic using Wheelers Lane and Boundary Road, noting that the existing estimated traffic volumes on the subject roads do not take into account redistribution of traffic patterns once the connection of Boundary Road through to Sheraton Road is constructed.

5.4.5.2 Intersection Modelling

The operation of the following intersections have been assessed using the SIDRA computer modelling program:

- Wheelers Lane and Argyle Avenue
- Wheelers Lane and Azure Avenue
- Boundary Road the north south access road

The SIDRA modelling determined that all movements at each intersection was operating at a Level of Service A.

Recommendations

The impact of the additional traffic generated by the extension of Southlakes Estate on the surrounding road network has been assessed in terms of:

i) Traffic Volume for both the Daily and Peak Hour traffic generation;

ii) Intersection Operation; and

iii) Road Safety.

SIDRA modelling has been undertaken to assess the operation of various intersections on the surrounding road network.

The estimated external daily traffic generation from the extension to Southlakes Estate is 10,050 trips per day and the external peak hour traffic generation is 895 trips per hour.

The increase in daily traffic volumes on Wheelers Lane north and Wheelers Lane south is 46% and 61% respectively.

The increase in peak hour traffic volumes on Wheelers Lane north and Wheelers Lane south is 33% and 50% respectively.

The increase in daily traffic volumes on Boundary Road west is 38%.

The increase in peak hour traffic volumes on Boundary Road west is 25%.

In completing the assessment of the impact of the additional traffic generated by the extension of Southlakes Estate, the following recommendations are made:

- The increase in traffic volumes on the roads surrounding Southlakes Estate will not change the classifications of the roads under a functional road hierarchy.
- The post development peak hour traffic on Wheelers Lane north is 44% of the operational capacity of the road at a Level of Service B
- The post development peak hour traffic on Wheelers Lane south is 82% of the operational capacity of the road at a Level of Service B.
- The post development peak hour traffic volume on Boundary Road west is 93% of the operation capacity of the road at a Level of Service B.
- The intersection of Wheelers Lane and the Boundary Road is to be developed as a major roundabout in accordance with the construction plans prepared by Council.
- The intersection of Boundary Road and Alexandrina Avenue is to be developed as a roundabout in accordance with the construction plans prepared by Council.
- The intersections modelled using SIDRA all operate at a Level of Service A.
- Local Area Traffic Management facilities for vehicles and pedestrians are to be installed as outlined in **Section 5.4.4** of this Traffic Study.
- The design and construction of all recommended facilities are to be carried out in accordance with the appropriate standards, codes and requirements of Dubbo City Council.

The implementation of the recommendations of this Traffic Study during the approval and development of the extension of Southlakes Estate will see the operation of the development with the integration of the generated traffic into the surrounding road network.

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Drawings

REV.	DATE	DFTD.	APPD.	DETAILS
A	03/06/16	EG	SJH	ISSUED FOR REPORT
B	02/09/16	EG	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	-	-
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	02/09/16

MASTER SCALE

SCALE 1:7500 (A1)

0 100 200 300 400 500 600 700

0 100 200 300 400 500 600 700

SCALE 1:15000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY
WESTERN PLAINS REGIONAL COUNCIL

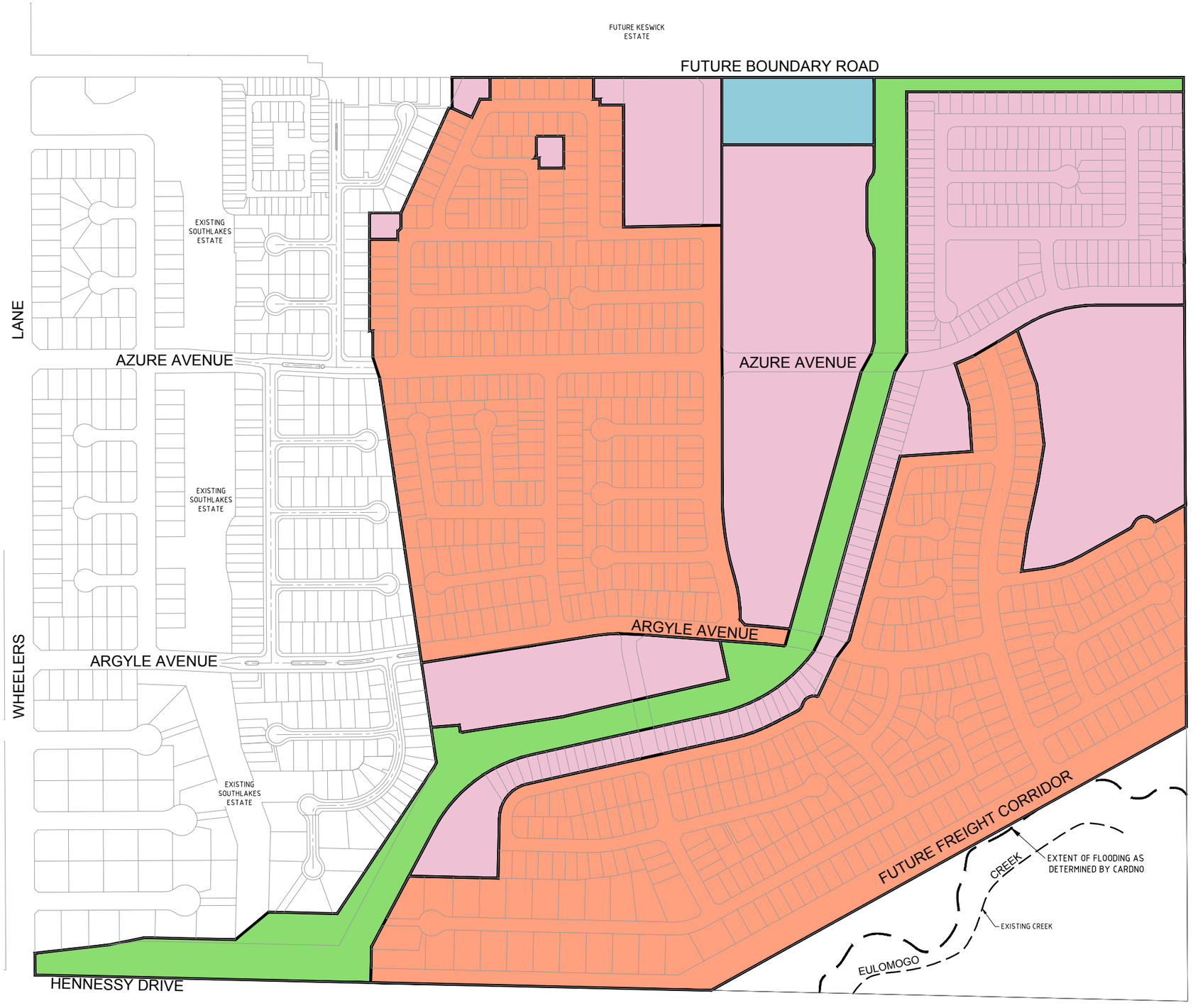
CLIENT
MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT
SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION

GEOLYSE
DUBBO
dubbo@geolyse.com
www.geolyse.com
1st FLOOR
62 WINGEWARRA STREET
P.O. BOX 1842
DUBBO, NSW 2830
Ph. (02) 6884 1525
Fax. (02) 6884 1470

DRAWING
SITE LOCALITY

PROJECT NUMBER 114135	DRAWING FILE 114135_15B_TS01-TS08.dwg	SIZE A1
SURVEY MARK -	R.L. - DATUM A.H.D.	SET 15B
IMAGE SOURCE GOOGLE EARTH		
STATUS ISSUED FOR REPORT	SHEET TS01 OF TS08	



NOTES

1. INFORMATION SHOWN IS FOR DEVELOPMENT APPLICATION PURPOSES ONLY.
2. AREAS AND DIMENSIONS ARE SUBJECT TO SURVEY.

DENOTES B1 - NEIGHBOURHOOD CENTRE

DENOTES R1 - GENERAL RESIDENTIAL LAND ZONE

DENOTES R2 - LOW DENSITY RESIDENTIAL LAND ZONE

DENOTES RE1 - PUBLIC RECREATION

REV.	DATE	DFTD.	APPD.	DETAILS
A	03/06/16	EG	SJH	ISSUED FOR REPORT
B	02/09/16	EG	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	-	-
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	02/09/16

MASTER SCALE

SCALE 1:3000 (A1)

0 50 100 150 200 250 300

0 50 100 150 200 250 300

SCALE 1:6000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY: WESTERN PLAINS REGIONAL COUNCIL

CLIENT: MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT: SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION

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Fax. (02) 6884 1470

DRAWING: CONCEPT MASTER PLAN

PROJECT NUMBER 114135 | DRAWING FILE 114135_15B_TS01-TS08.dwg | SIZE A1

SURVEY MARK - | R.L. - | DATUM A.H.D. | SET 15B

IMAGE SOURCE

STATUS ISSUED FOR REPORT | SHEET TS02 OF TS08

NOTE
1. INFORMATION SHOWN IS FOR DEVELOPMENT APPLICATION PURPOSES ONLY. LOT LAYOUT IS SUBJECT TO CHANGE.

REV.	DATE	DFTD.	APPD.	DETAILS
A	03/06/16	EG	SJH	ISSUED FOR REPORT
B	02/09/16	EG	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	-	-
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	02/09/16

MASTER SCALE

SCALE 1:3000 (A1)

0 50 100 150 200 250 300

0 50 100 150 200 250 300

SCALE 1:6000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY
WESTERN PLAINS REGIONAL COUNCIL

CLIENT
MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT
SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION

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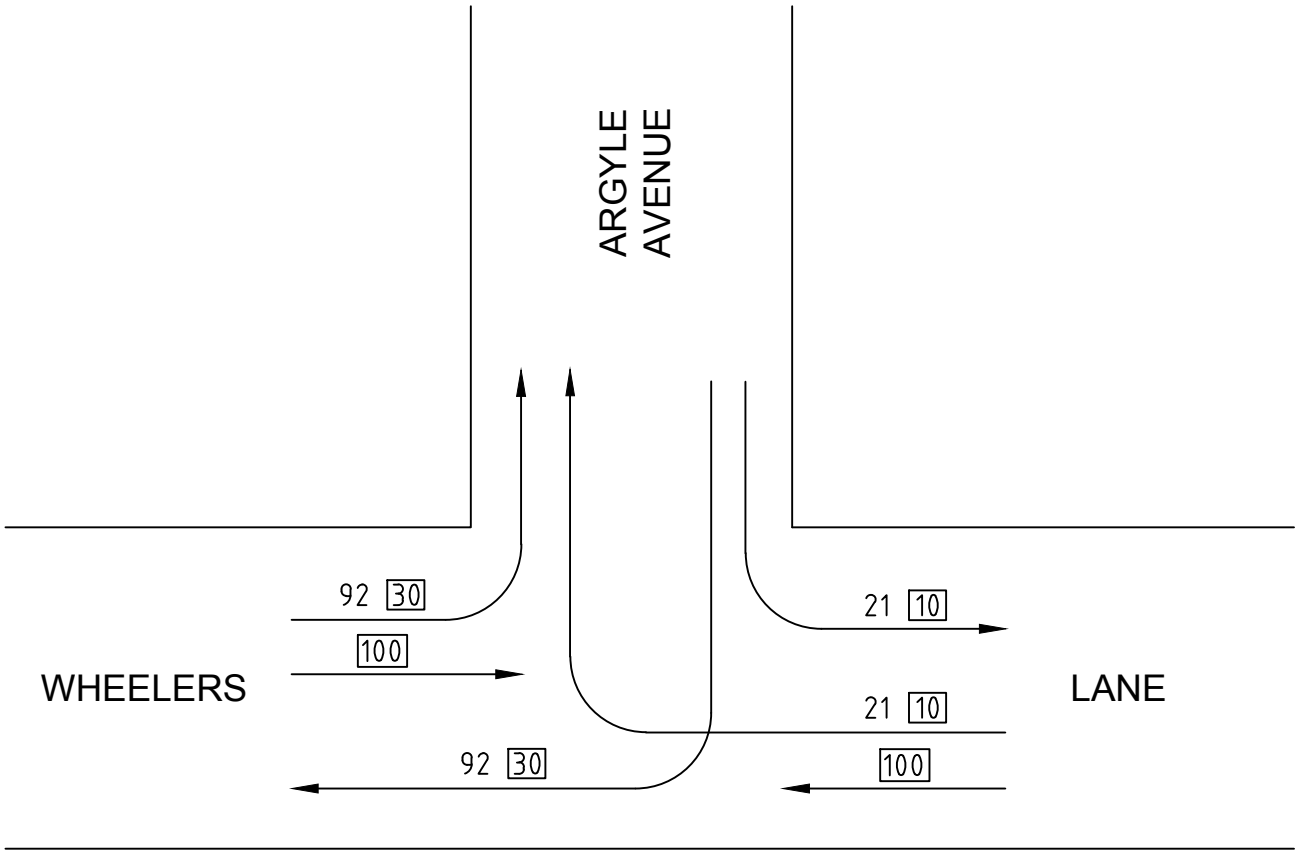
DRAWING
EXTERNAL TRAFFIC DISTRIBUTION

PROJECT NUMBER 114135	DRAWING FILE 114135_15B_TS01-TS08.dwg	SIZE A1
SURVEY MARK -	R.L. - DATUM A.H.D.	SET 15B
IMAGE SOURCE		
STATUS ISSUED FOR REPORT	SHEET TS03 OF TS08	

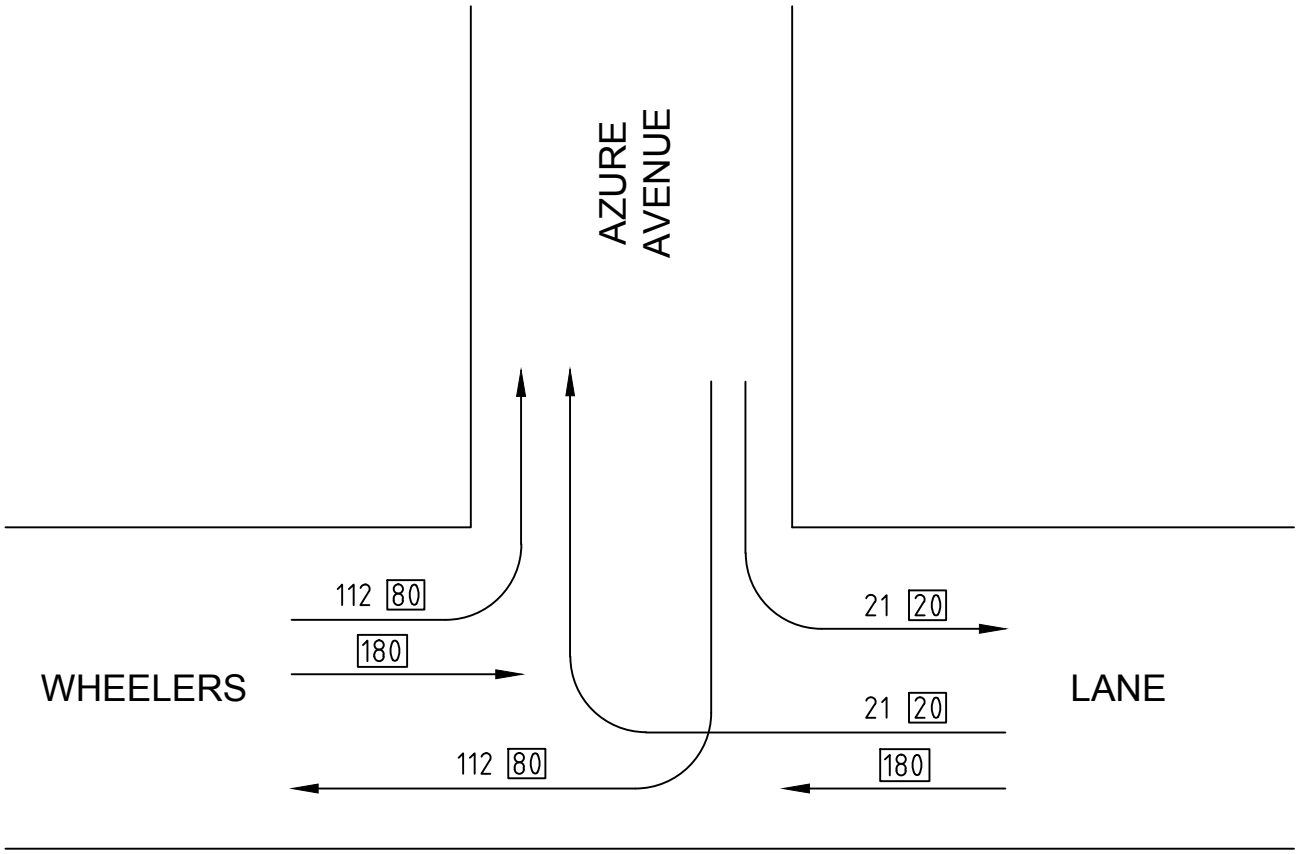


NOMINAL PEAK HOUR TURNING MOVEMENTS

20 DENOTES NOMINAL PEAK HOUR TURNING MOVEMENTS
10 NUMBERS IN BOXES DENOTE EXISTING TURNING MOVEMENTS

GEOLYSE

DRAWING TS04
INTERSECTION TURNING MOVEMENTS
AT WHEELERS LANE AND ARGYLE
AVENUE INTERSECTION
DATE: 02/09/2016
REF: 114135_15B_TS01-TS08.dwg



NOMINAL PEAK HOUR TURNING MOVEMENTS

20 DENOTES NOMINAL PEAK HOUR TURNING MOVEMENTS

10 NUMBERS IN BOXES DENOTE EXISTING TURNING MOVEMENTS

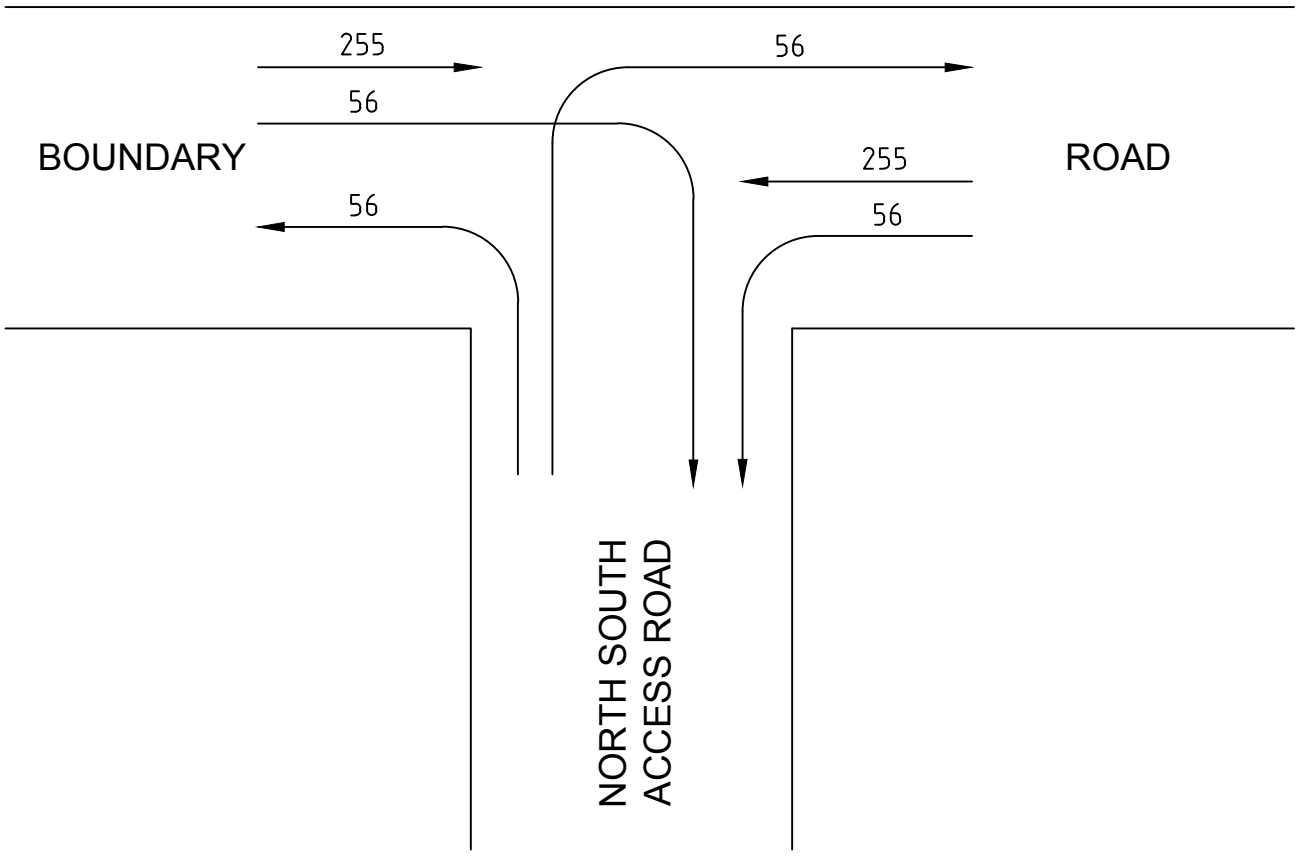
GEOLYSE

DRAWING TS05

INTERSECTION TURNING MOVEMENTS AT WHEELERS LANE AND AZURE AVENUE INTERSECTION

DATE: 02/09/2016

REF: 114135_15B_TS01-TS08.dwg



NOMINAL PEAK HOUR TURNING MOVEMENTS

20 DENOTES NOMINAL PEAK HOUR TURNING MOVEMENTS

GEOLYSE

DRAWING TS06

INTERSECTION TURNING MOVEMENTS AT BOUNDARY ROAD AND NORTH SOUTH ACCESS ROAD INTERSECTION

DATE: 02/09/2016

REF: 114135_15B_TS01-TS08.dwg

LEGEND

EXISTING/PROPOSED KERB/MEDIANS

NOTES

1. THIS PLAN IS FOR DEVELOPMENT APPLICATION PURPOSES ONLY.
2. FUTURE STAGE LOT & ROAD LAYOUT SHOWN IS INDICATIVE ONLY & SUBJECT TO FUTURE DEVELOPMENT APPLICATIONS.

REV.	DATE	DFTD.	APPD.	DETAILS
A	03/06/16	EG	SJH	ISSUED FOR REPORT
B	02/09/16	EG	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	-	-
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	02/09/16

MASTER SCALE

SCALE 1:3000 (A1)

0 50 100 150 200 250 300

0 50 100 150 200 250 300

SCALE 1:6000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY: WESTERN PLAINS REGIONAL COUNCIL

CLIENT: MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT: SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION

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DRAWING

LOCAL AREA ROAD TRAFFIC MANAGEMENT PLAN

PROJECT NUMBER 114135	DRAWING FILE 114135_15B_TS01-TS08.dwg	SIZE A1
SURVEY MARK -	R.L. - DATUM A.H.D.	SET 15B
IMAGE SOURCE		
STATUS ISSUED FOR REPORT	SHEET TS07 OF TS08	

LEGEND

- EXISTING FOOTPATH OR CYCLEWAY
- PROPOSED 2.5m WIDE CYCLEWAY
- PROPOSED 1.5m WIDE FOOTPATH
- EXISTING/PROPOSED PRAM RAMP

NOTES

1. THIS PLAN IS FOR DEVELOPMENT APPLICATION PURPOSES ONLY.
2. FUTURE STAGE LOT & ROAD LAYOUT SHOWN IS INDICATIVE ONLY & SUBJECT TO FUTURE DEVELOPMENT APPLICATIONS.

REV.	DATE	DFTD.	APPD.	DETAILS
A	03/06/16	EG	SJH	ISSUED FOR REPORT
B	02/09/16	EG	SJH	CLIENT AMENDMENTS & ISSUED FOR REPORT

	FILE	INITIALS	DATE
SURVEY	-	-	-
DESIGN	-	-	-
DRAINS/ HEC-RAS MODELLING	-	-	-
ENGINEERING/ SURVEYING APPROVAL		SJH	02/09/16

MASTER SCALE

SCALE 1:3000 (A1)

0 50 100 150 200 250 300

0 50 100 150 200 250 300

SCALE 1:6000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY: WESTERN PLAINS REGIONAL COUNCIL

CLIENT: MAAS GROUP PROPERTIES No. 2 PTY LTD

PROJECT: SOUTHLAKES ESTATE EXTENSION
PROPOSED RESIDENTIAL SUBDIVISION

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DUBBO, NSW 2830
Ph. (02) 6884 1525
Fax. (02) 6884 1470

DRAWING: LOCAL AREA PEDESTRIAN TRAFFIC MANAGEMENT PLAN

PROJECT NUMBER 114135	DRAWING FILE 114135_15B_TS01-TS08.dwg	SIZE A1
SURVEY MARK -	R.L. - DATUM A.H.D.	SET 15B
IMAGE SOURCE		
STATUS ISSUED FOR REPORT	SHEET TS08 OF TS08	

Plates

Plate 1: Wheelers Lane southbound approaching the intersection with Boundary Road

Plate 2: Intersection of Wheelers Lane and Boundary Road

Plate 3: Intersection of Wheelers Lane and Boundary Road

Plate 4: Boundary Road westbound

Plate 5: Boundary Road eastbound

Plate 6: Left turn lane from Wheelers Lane into Boundary Road

Plate 7: Intersection of Wheelers Lane and Magnolia Boulevard

Plate 8: Intersection of Wheelers Lane and Southlakes Parade

Plate 9: Intersection of Wheelers Lane and Azure Avenue

Plate 10: Service road parallel to Wheelers Lane

Plate 11: Intersection of Wheelers Lane and Holmwood Drive

Plate 12: Wheelers Lane southbound at the approach to the intersection with Shindys Road

Plate 13: Intersection of Wheelers Lane and Argyle Avenue

Plate 14: Intersection of Wheelers Lane and Hennessy Drive

Plate 15: Hennessy Drive east of Wheelers Lane

Plate 16: Hennessy Drive east at intersection with Wheelers Lane

Plate 17: Hennessy Drive westbound

Plate 18: Roundabout at the intersection of Azure Avenue and Southlakes Parade

Plate 19: Bridge over the creek line on Azure Avenue

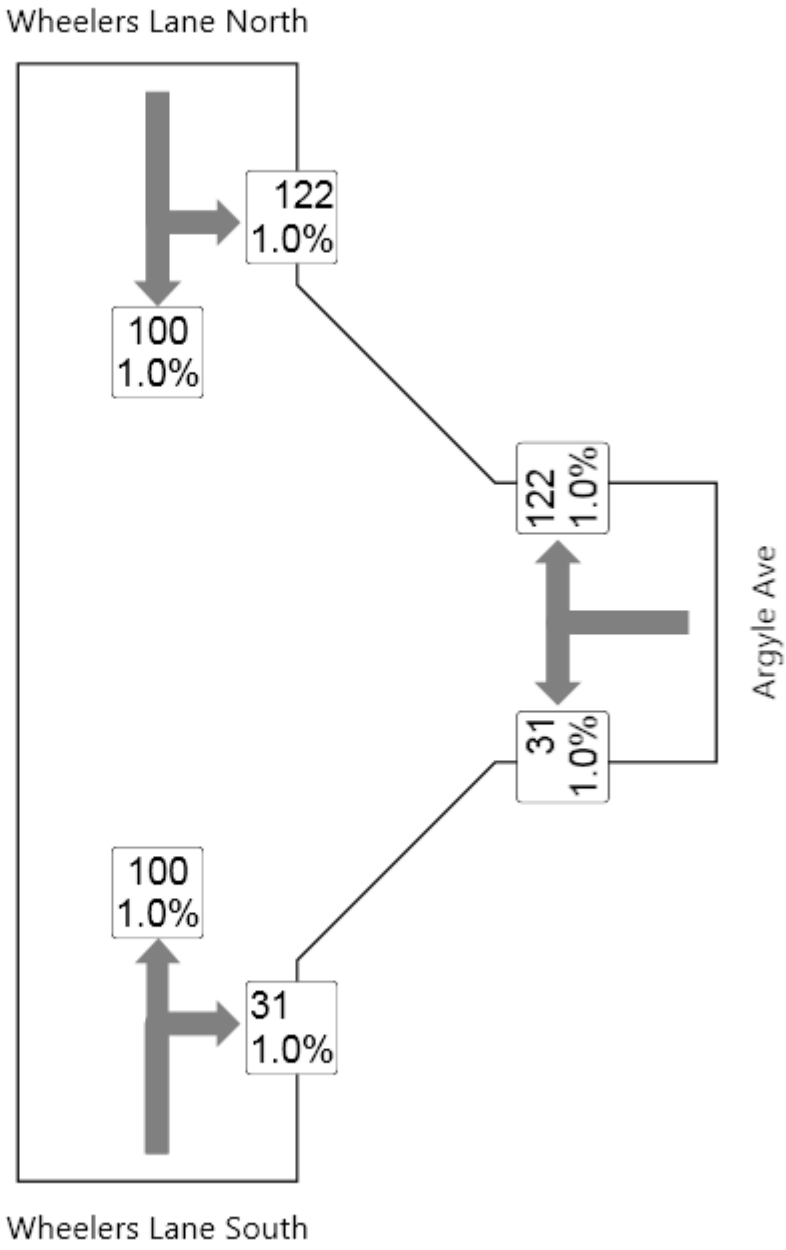
Plate 20: Typical road carriageway in Azure Avenue

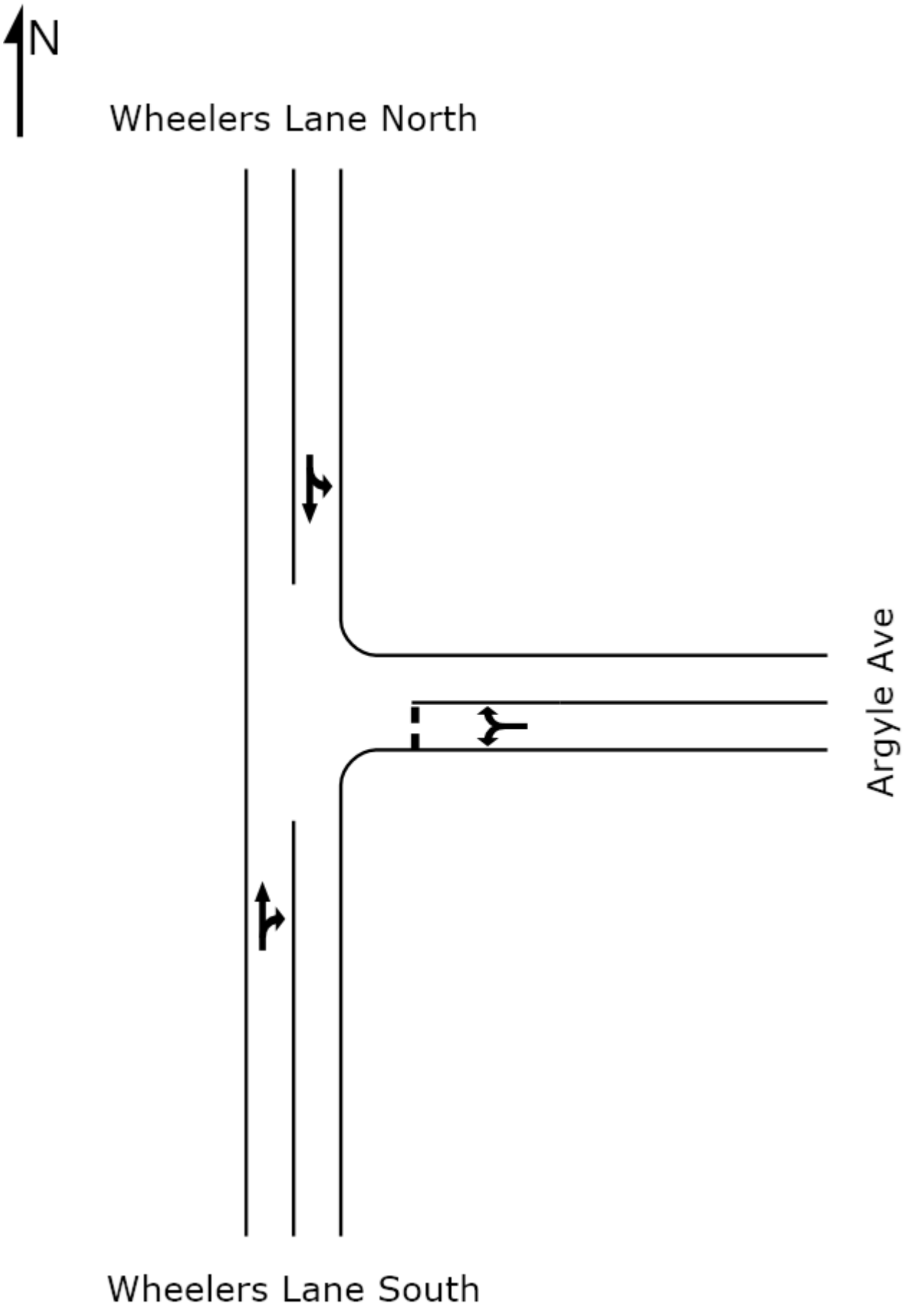
Plate 21: Typical road carriageway in Argyle Avenue

Plate 22: Bridge over the creek line in Argyle Avenue

Appendix A

SIDRA MODELLING RESULTS


Wheelers Lane North
122
1.0%
100
1.0%
122
1.0%
Argyle Ave
31
1.0%
100
1.0%
31
1.0%
Wheelers Lane South

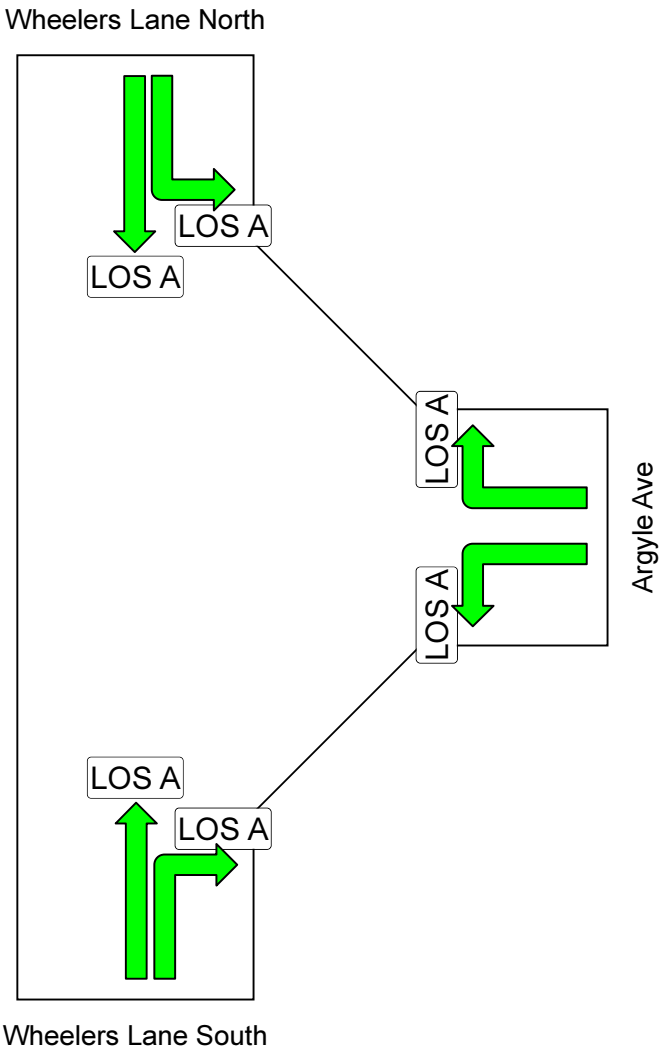

N
Wheelers Lane North
Argyle Ave
Wheelers Lane South

LEVEL OF SERVICE

Site: Post Development - 30 AUG 2016

Level of Service Method: Delay (RTA NSW)

WHEELERS LANE - ARGYLE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Level of Service

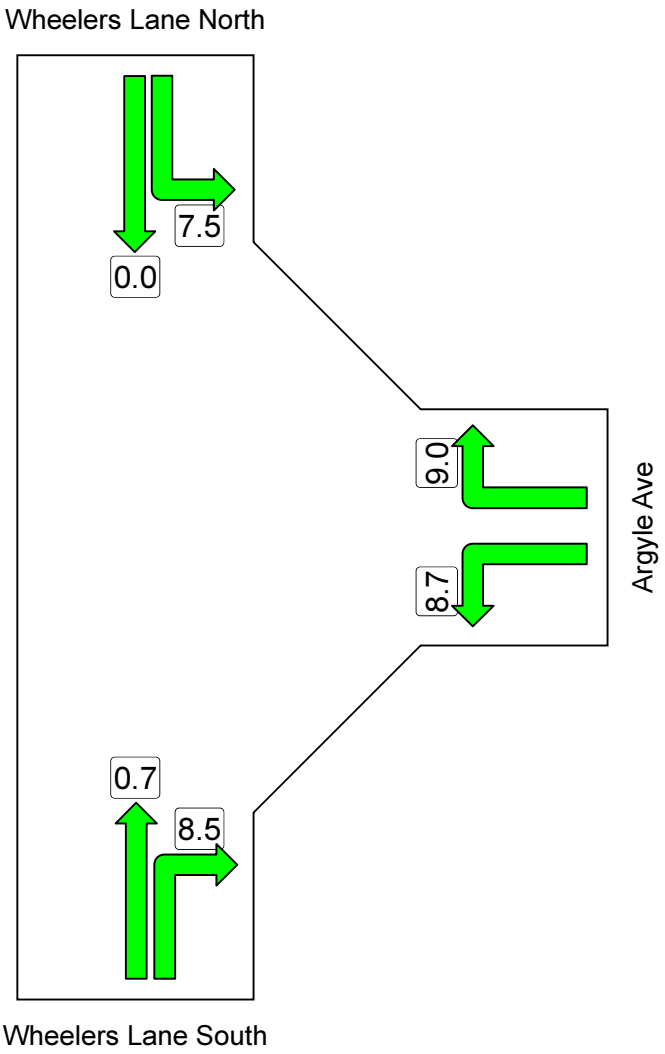
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Continuous

DELAY (AVERAGE)

Site: Post Development - 30 AUG 2016

Average control delay per vehicle, or average pedestrian delay (seconds)

WHEELERS LANE - ARGYLE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Continuous

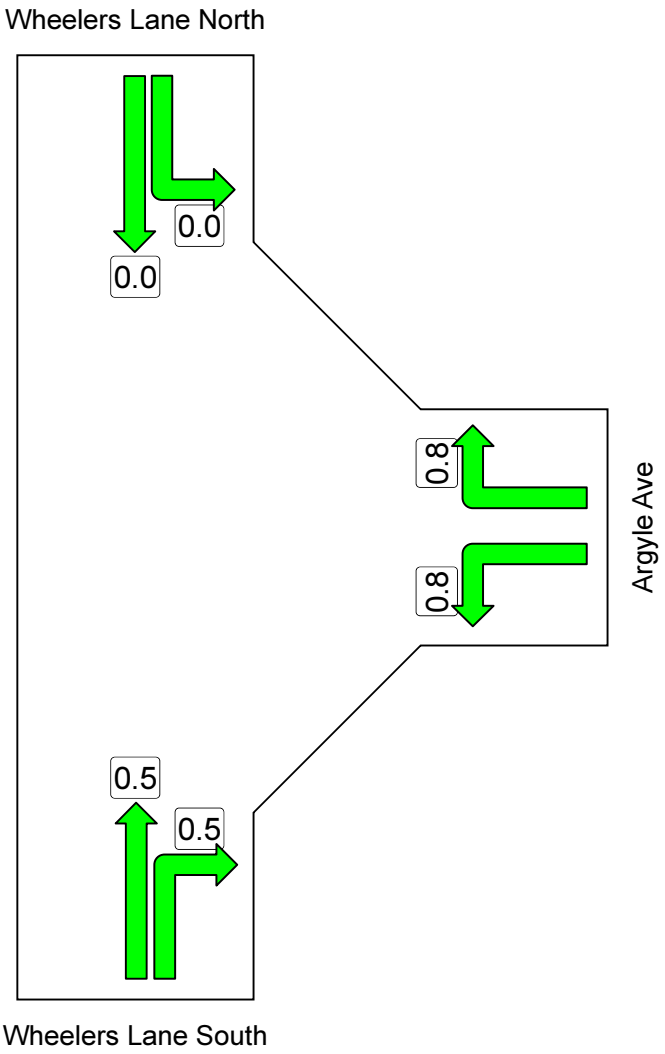
Level of Service Method used in this display: Delay (RTA NSW)

QUEUE

Site: Post Development - 30 AUG 2016

Largest 95% Back of Queue for any lane used by movement (vehicles)

WHEELERS LANE - ARGYLE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Queue Storage Ratio

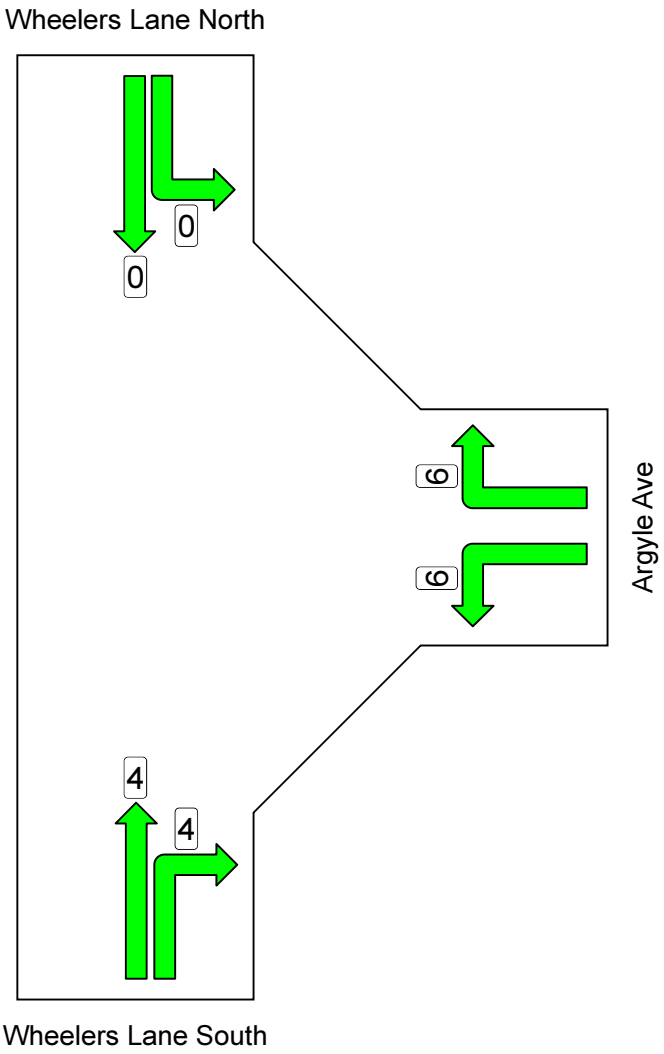
[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0] Continuous

QUEUE DISTANCE

Site: Post Development - 30 AUG 2016

Largest 95% Back of Queue for any lane used by movement (metres)

WHEELERS LANE - ARGYLE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Queue Storage Ratio

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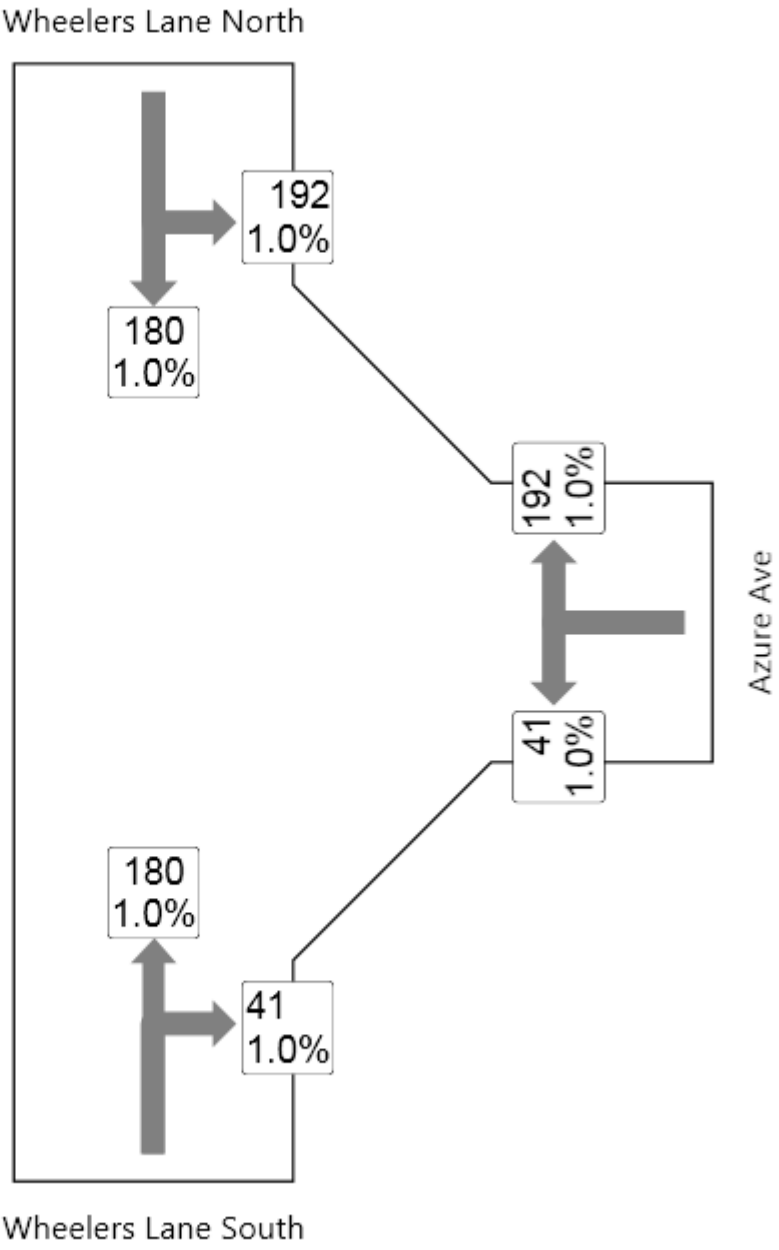
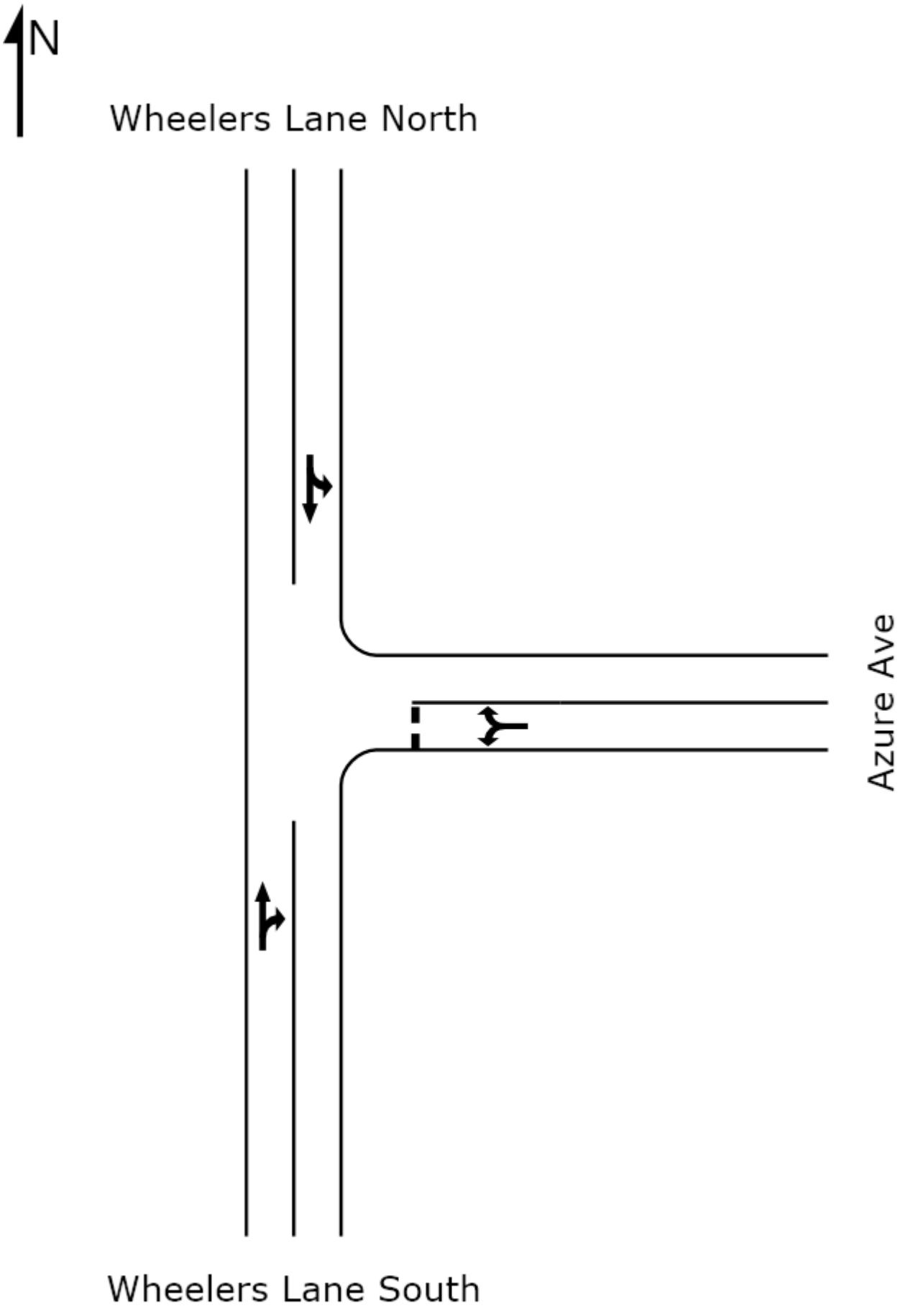

Wheelers Lane North
192
1.0%
180
1.0%
192
1.0%
Azure Ave
41
1.0%
180
1.0%
41
1.0%
Wheelers Lane South

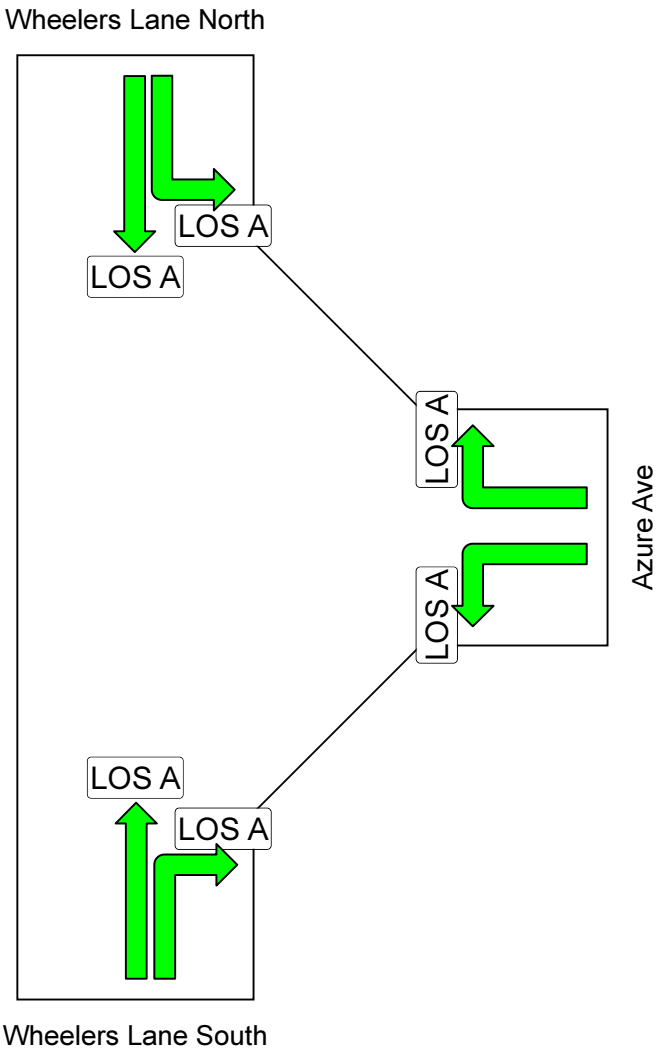

N
Wheelers Lane North
Azure Ave
Wheelers Lane South

LEVEL OF SERVICE

Site: Post Development -30 Aug 2016

Level of Service Method: Delay (RTA NSW)

WHEELERS LANE - AZURE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Level of Service

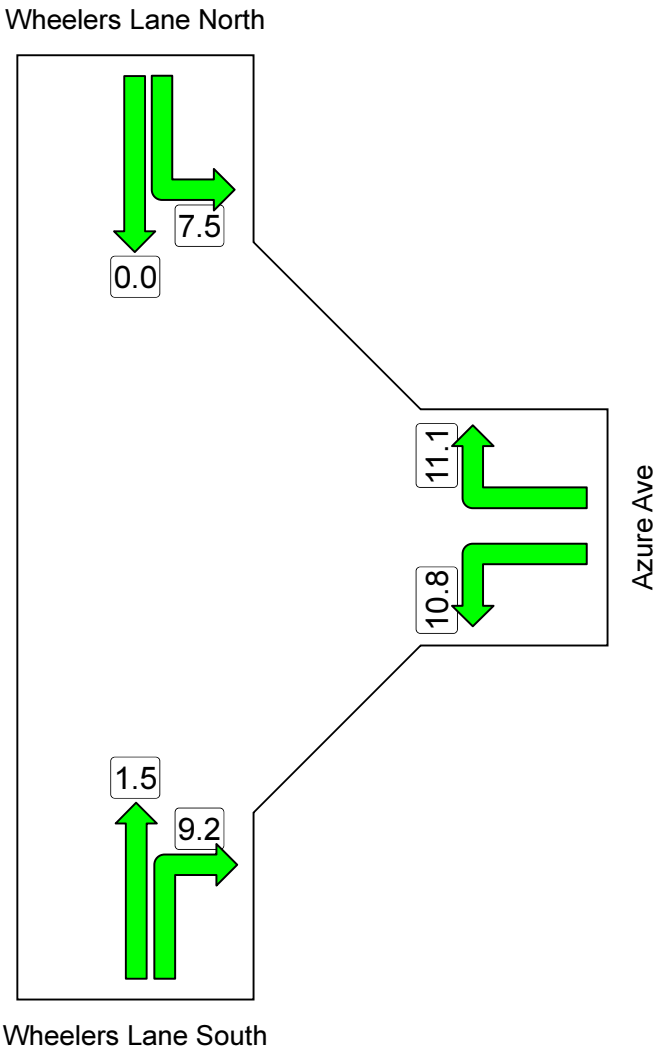
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Continuous

DELAY (AVERAGE)

Site: Post Development -30 Aug 2016

Average control delay per vehicle, or average pedestrian delay (seconds)

WHEELERS LANE - AZURE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Continuous

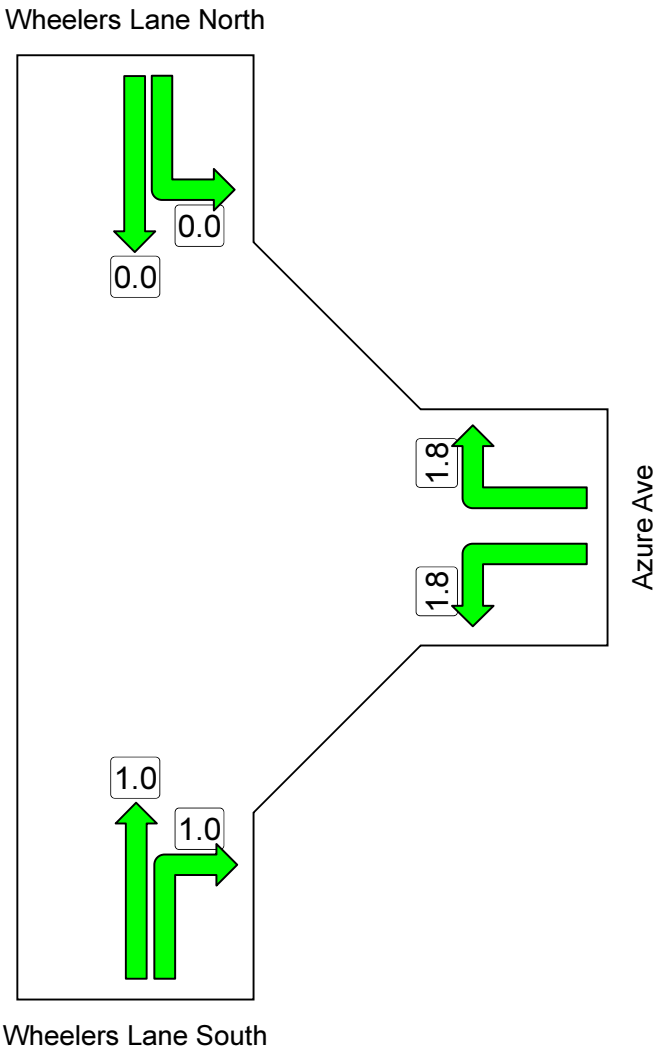
Level of Service Method used in this display: Delay (RTA NSW)

QUEUE

Site: Post Development -30 Aug 2016

Largest 95% Back of Queue for any lane used by movement (vehicles)

WHEELERS LANE - AZURE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Queue Storage Ratio

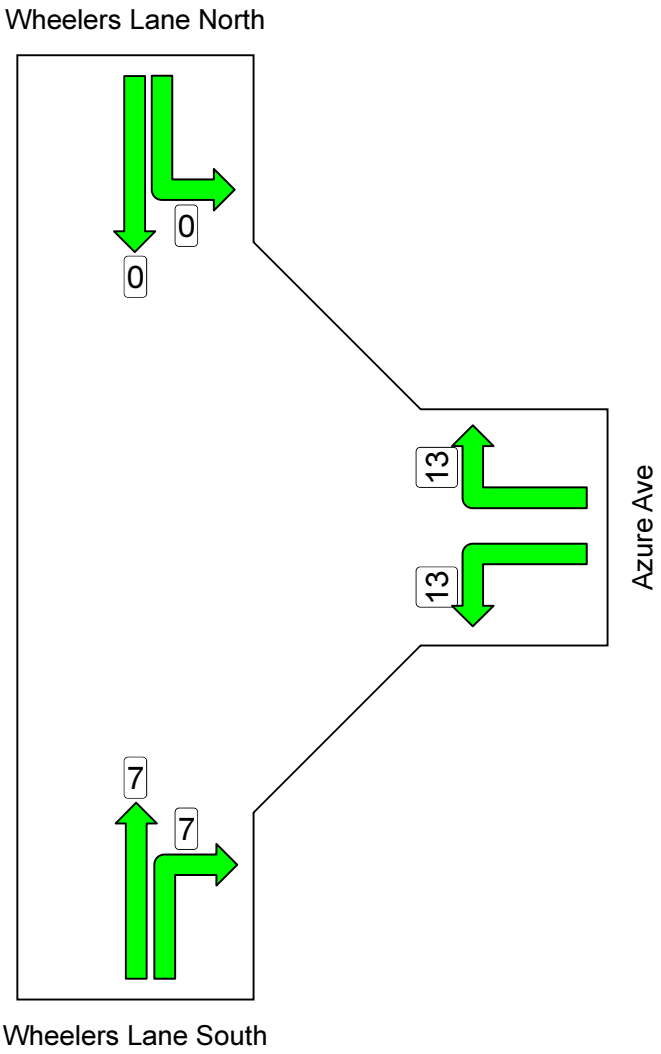
[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0] Continuous

QUEUE DISTANCE

Site: Post Development -30 Aug 2016

Largest 95% Back of Queue for any lane used by movement (metres)

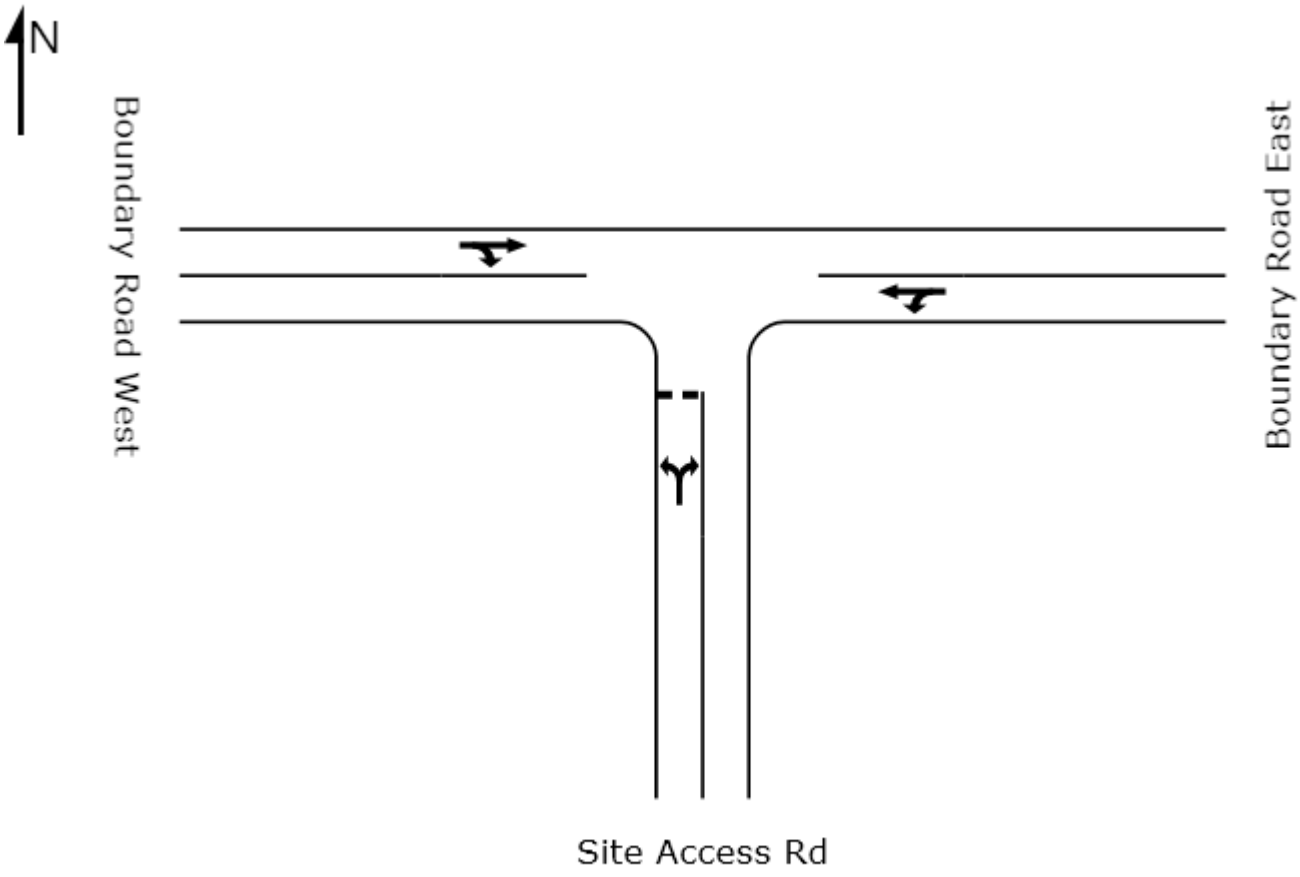
WHEELERS LANE - AZURE AVE INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0] Continuous

Boundary Road West
255
1.0%
56
1.0%
255
1.0%
56
1.0%
Boundary Road East
56
1.0%
56
1.0%
Site Access Rd

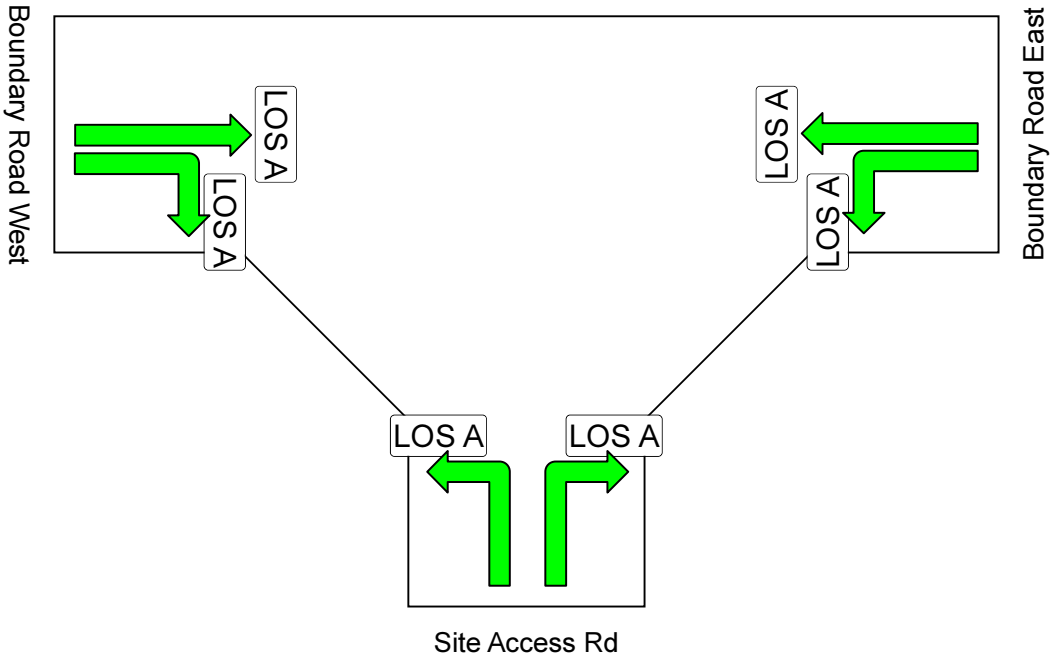

N
Boundary Road West
Boundary Road East
Site Access Rd

LEVEL OF SERVICE

Site: Post Development - 30 AUG 2016

Level of Service Method: Delay (RTA NSW)

BOUNDARY ROAD - SITE ACCESS ROAD INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Level of Service

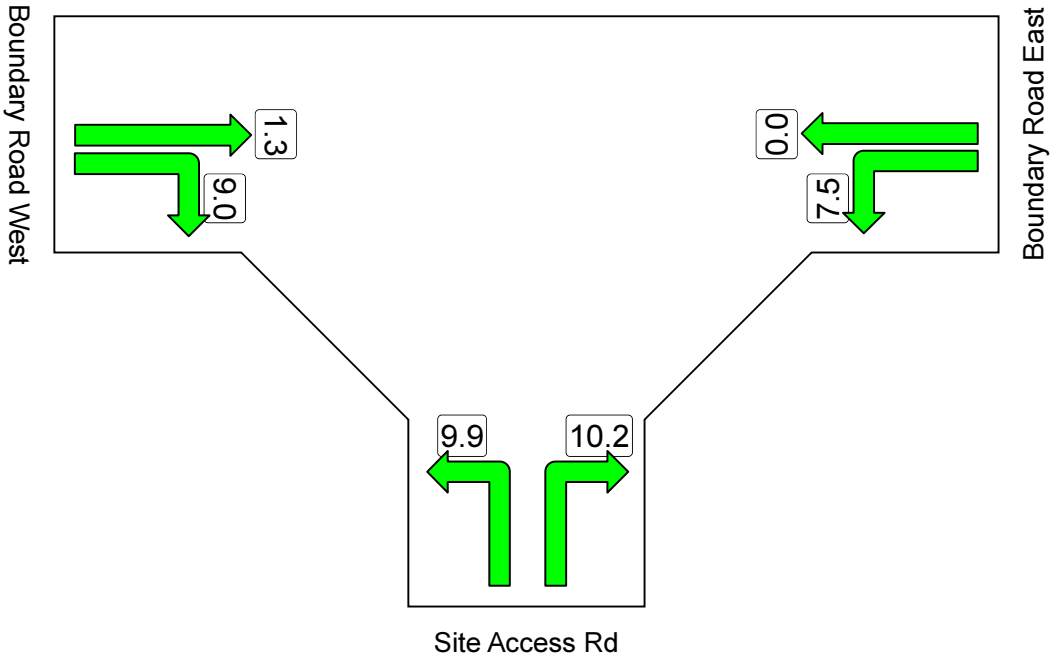
LOS A | LOS B | LOS C | LOS D | LOS E | LOS F | Continuous

DELAY (AVERAGE)

Site: Post Development - 30 AUG 2016

Average control delay per vehicle, or average pedestrian delay (seconds)

BOUNDARY ROAD - SITE ACCESS ROAD INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Continuous

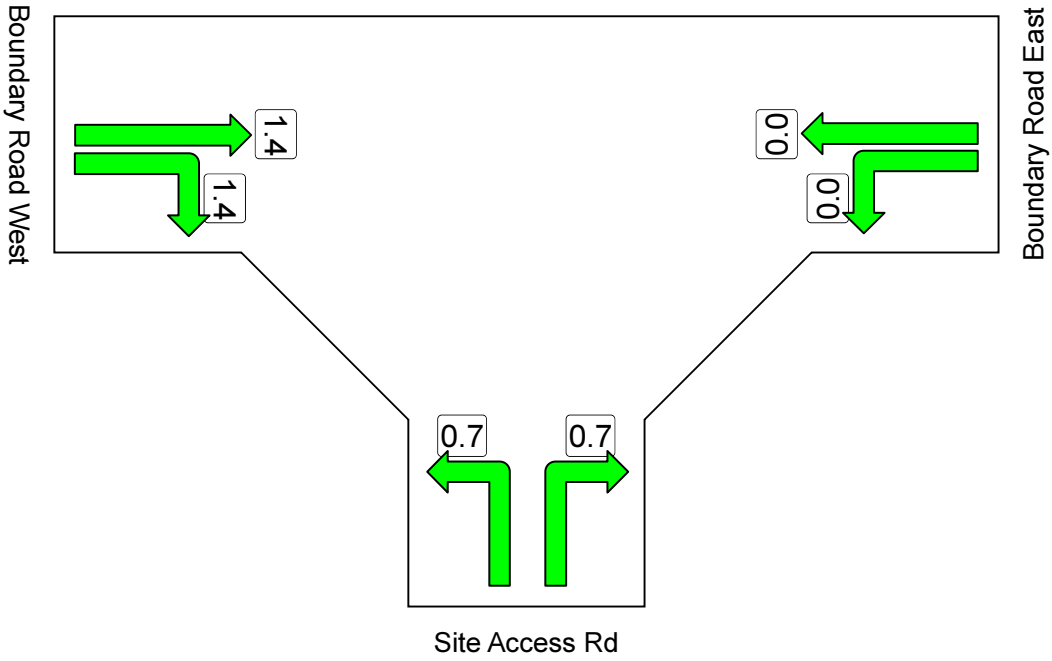
Level of Service Method used in this display: Delay (RTA NSW)

QUEUE

Site: Post Development - 30 AUG 2016

Largest 95% Back of Queue for any lane used by movement (vehicles)

BOUNDARY ROAD - SITE ACCESS ROAD INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Queue Storage Ratio

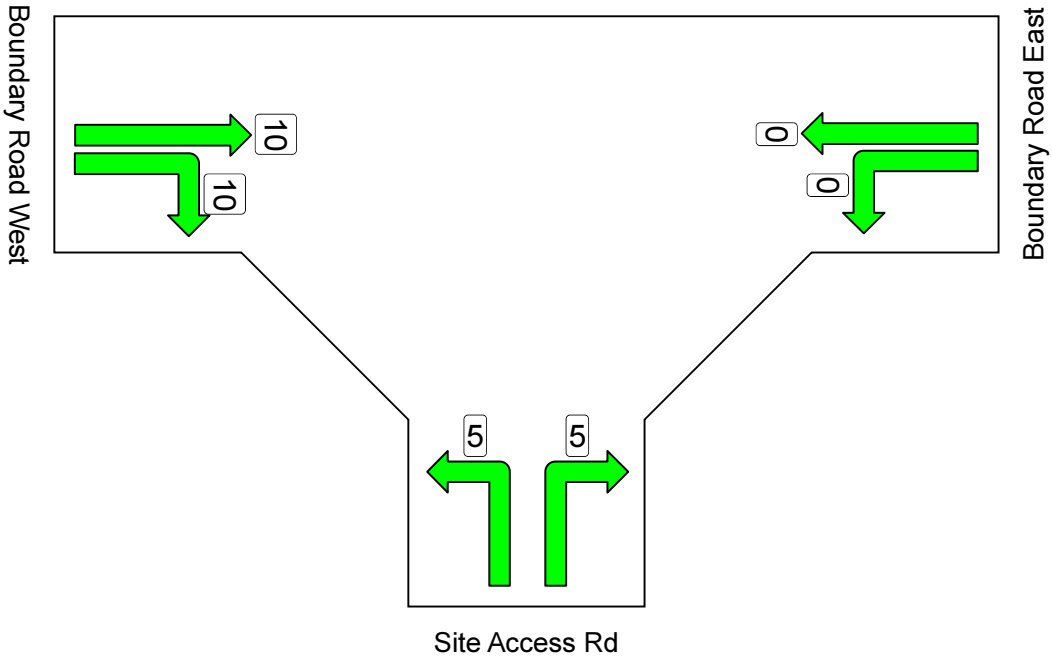
[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0] Continuous

QUEUE DISTANCE

Site: Post Development - 30 AUG 2016

Largest 95% Back of Queue for any lane used by movement (metres)

BOUNDARY ROAD - SITE ACCESS ROAD INTERSECTION
Giveway / Yield (Two-Way)



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0] Continuous

Groundwater and salinity study

Hillview Estate Lot 399 DP1199356 & Lot 503 DP1152321 Dubbo NSW

Ref: R5737s3
Date: 8 September 2016

Envirowest Consulting *Pty Ltd* ABN 18 103 955 246
• 9 Cameron Place, PO Box 8158, Orange NSW 2800 • Tel (02) 6361 4954 •
• Fax (02) 6360 3960 • Email admin@envirowest.net.au • Web www.envirowest.net.au •

Environmental
Geotechnical
Asbestos
Services

Client:	Maas Group c/- Geolyse Pty Ltd PO Box 1842 Dubbo NSW 2830
Assessor:	Dave Langston BNEWS Environmental Scientist
Checked by:	Leah Desborough BEnvSc Senior Environmental Scientist
Authorising Officer:	Greg Madafiglio PhD Senior Environmental Scientist
Report number:	R5737s3
Date:	8 September 2016

Executive summary

Background

A residential subdivision is proposed for *Hillview Estate* Lot 399 DP1199356 and Lot 503 DP1152321 Dubbo NSW. The subdivision design will include residential lots, access roads and parklands with ponds and waterways. A groundwater salinity assessment is required as part of the development process.

Objectives of the investigation

A site investigation was undertaken to assess the existing salinity conditions of the soil and groundwater and determine the impact of the development on groundwater.

Investigation

A soil and groundwater investigation was undertaken of the site. An initial investigation and desktop review was undertaken to collect existing information on groundwater on and around the site and the likelihood of salinity across the site. A detailed investigation was undertaken on 23 and 24 April and 7 and 8 May 2015.

The detailed site investigation included landscape description, soil investigation, laboratory analysis and groundwater investigation. The soil profile investigation was undertaken by constructing 69 boreholes up to 12m in depth. Representative soil samples were collected and analysed for pH, electrical conductivity, colour, dispersion, texture, chlorides and exchangeable sodium percentage.

The investigation results and proposed development were evaluated to identify impacts and recommend management outcomes to minimise impact on salinity occurrence. Soil moisture levels under land-use scenarios were modelled using rainfall data to estimate infiltration. Soil moisture and infiltration was simulated by the CLASS U3M-1D model with daily rainfall inputs from 1980 to 2014. Surface water flow containing sediment, nitrogen and phosphorus were modelled using Chafer (2003).

The impact of the development on water infiltration on the site was discussed and best practice procedures recommended which will minimise the effects on groundwater.

Conclusions

The site had a pasture grazing land-use. No bare areas resulting from sheet erosion or salinity were identified. The risk of erosion is low

Soils on the site comprised topsoil of dark brown to brown silty clay to sandy clay loam. Subsoils were yellowish red to reddish brown fine sandy clay loam, sandy clay, light to medium clay to silty sand with increasing weathered basalt cobble and weathered rock with depth. Basalt cobbles and weathered rock consisting of quartz sandstone and olive basalt were encountered from varying depths over the site between 0.2 to 12.0m. The Dubbo (LEP) maps indicate the site is located within a vulnerable groundwater area.

The majority of the site is located within the Old Dubbo Road Hydrogeological Landscape (HGL). Lithology of the Old Dubbo Road HGL consists of Napperby Formation comprising siltstone thinly interbedded with fine to medium grained lithic quartz and minor conglomerates. This has been overlaid by colluvial and alluvial weathered basalt. The Old Dubbo Road HGL is generally non-saline.

An area in the north eastern section of the site is located in the Dubbo Basalt HGL. Lithology of the Dubbo Basalt HGL consists of Cainozoic basalt comprising in situ Olivine rich alkali basalt with

some colluvial material and quartzite derived from the underlying sandstone and siltstone. The investigation identified saline strata in the Dubbo Basalt HGL.

A small hillock is located within the north eastern section. The hillock comprises rounded quartz sandstone with hematite cementing and is expected to be part of the Purlawaugh Formation which is mapped to the north east of the site. The sandstone provides a geological contrast with the overlaying basalt and may provide potential sites for salt discharges at the sandstone/basalt interface.

Subsoils in the majority of the site were classified as non-saline to slightly saline. These areas correspond with the Old Dubbo Road HGL. Saline subsoils were identified in two boreholes (BH20 and BH8) located in the north eastern section at depths greater than 1m. Soil electrical conductivity generally increased with depth in the north east section. The location of saline soil corresponds with the Dubbo Basalt HGL.

Infiltration of groundwater over most of the site will not result in mobilisation of salts. Groundwater was encountered in MW1 located in the north eastern section of the site from 8.12m. Electrical conductivity of groundwater taken from MW1 was 4.6dS/m which under the Dubbo City Urban Salinity Implementation Plan is classed as moderately saline. No groundwater was identified in MW2 and MW3 to a depth of 10m on light clay.

No groundwater discharge areas were identified on the site. Potable and stock supply bores have been constructed in the locality. Bores in the locality generally have water bearing zones greater than 10m in gravels and sands. The majority of Dubbo City Council monitoring bores have been dry since the start of monitoring. Highly saline groundwater has been identified in one groundwater monitoring bore located west of the site.

Modelling of soil moisture levels over the past 34 years indicated variations in infiltration occur with the amount of rainfall pre and post development. Most land uses do not contribute to groundwater recharge in the CLASS U3M model. Overwatering of lawn has potential to increase recharge. The amount of irrigated lawn will be small over the area and quantity will not be significant. Over the site the infiltration will be reduced in the development. Reduced soil moisture is a result of the increase in runoff due to impermeable areas (roads, roofs, driveways) and increase in deep rooted vegetation extracting soil moisture from depth. The establishment of trees in strategic areas will offset any additional infiltration from lawn over watering.

The risk of groundwater contamination from the proposed land-use is equal or lower to the current land-use. Nitrogen contributions will decrease as a result of smaller available areas for fertilisation and a decrease in animal waste; domestic pet waste will generally be disposed off-site. Phosphorous and sediment contributions will also decrease and reduce the impact on site. Washing of cars on permeable areas will not be a significant contributor to nutrient levels. Reuse of greywater will be small volumes of unregulated use or larger volumes which require specific conditions or use of regulation by Council. Conditions of use and regulation will ensure overwatering does not occur.

No impact on groundwater including contamination and changed groundwater levels is expected from the development if recommendations are adopted. The development will not impact on quantity or quality of both unconfined and confined aquifers.

Recommendations

An Electromagnetic survey of the north eastern section of the site will provide data on the location of the sandstone/basalt interface. The location of the geological interface should be used to incorporate the planting of deep rooted vegetation into the final design of the subdivision.

Planning and development controls are recommended to prevent mobilisation of salt in the soil and groundwater resulting in on and off-site impacts. Controls include:

- Planting of trees in areas of lithological/hydrological interfaces as identified by the electromagnetic (EM) survey to minimise mobilisation of salt in the soil by rising groundwater tables.
- Establishment of parkland areas with native species which do not require irrigation
- Plantings of deep rooted vegetation along roads
- Plantings of deep rooted vegetation throughout the parkland
- Piping of surface water off-site
- Stormwater retention basins lined with an impermeable layer
- Design road levels similar to natural soil levels to minimise excavations
- Earthworks comprising cut should be minimised
- Excavated material with elevated salinity should be backfilled, utilised as fill under roads or disposed to landfill

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1. Introduction

A residential subdivision is proposed for *Hillview Estate* Lot 399 DP1199356 and Lot 503 DP1152321 Dubbo NSW. The subdivision will include residential lots, access roads and parklands with settling ponds and waterways. A groundwater and salinity assessment is required as part of the development process.

2. Scope of work

Envirowest Consulting Pty Ltd was commissioned by Geolyse on the behalf of the Maas Group, to undertake a groundwater investigation and salinity study of Lot 399 DP1199356 and Lot 503 DP1152321 Dubbo NSW. The objective was to assess the existing conditions and possible future impact of the proposed development on soil, groundwater and salinity.

3. Site identification

Address	Lot 399 DP1199356 and Lot 503 DP1152321 Dubbo NSW
Client	c/ Geolyse PO Box 1842 Dubbo NSW 2830
Deposited plans	Lot 399 DP1199356 and Lot 503 DP1152321
Universal grid reference	UTM Zone 55H, E654135m, N6427637m
Locality map	Figure 1
Site plan	Figure 2
Photographs	Figure 14
Area	Approximately 136 hectares
Dates of inspection and assessment	23 and 24 April and 7 and 8 May 2015

4. Proposed development

The proposed development is a residential subdivision. The subdivision design has not been finalised. The proposed lots will have hard surface areas comprising roofs and driveways where rainfall will run-off into stormwater pipes and permeable areas comprising lawns and gardens where less infiltration into the soil will occur. Roads, footpaths and a stormwater system will be constructed throughout the estate. The dwellings will be serviced by town sewer. The existing dams on the property will be remediated and a new drainage line and retention basins created to transfer stormwater off the estate to Eulomogo Creek.

5. Site condition and surrounding environment

5.1 Land-use

The current land-use is stock grazing on semi-improved pasture. The site is currently vacant.

5.2 Vegetation

The site has been cleared of native tree species. Eucalypts occur along the northern boundary and pepper tree, white cedar trees and casuarina trees have generally been planted as isolated species across the site. A small exotic tree nursery for landscaping on the adjoining subdivision. Pasture species are native grasses and legumes with weeds. The weed species include Paterson's curse, cat head, fleabane, clover, saffron thistle, couch grass, flatweed and khaki weed.

5.3 Topography

The site is predominantly located on a mid-slope. A basalt ridge occurs in the north western section. A hillock is located in the north eastern section. Aspect is predominantly south east and slopes are gently inclined and generally less than 6%. Elevation ranges between 268 and 289 metres above sea level. The lowest elevation occurs on the southern boundary where Eulomogo Creek traverses the site. No groundwater seepage or discharge areas were observed on the site.

5.4 Soils and geology

The majority of the site is located within the Bunglegumbie Soil Landscape. The north eastern section of the site is located within the Wongarbon Soil Landscape (Murphy *et al.* 1998).

Soil in the Bunglegumbie landscape consists of red podzolic soils, non-calcic brown soils and yellow podzolic soils. Soils typically comprise dark reddish brown sandy loam over a yellowish red light sandy clay loam. Soil in the Wongarbon Soil Landscape (Muphy *et al.* 1998) consists of Euchrozems and red and brown cracking clays.

Lithology of the majority of the site is Napperby Formation comprising siltstone thinly interbedded with fine-medium grained lithic quartz sandstone with minor conglomerate. Lithology of the north eastern section is Cainozoic Basalt comprising tholeiite, alkali basalt and alkali ultramafic (Colquhoun *et al.*1997). The site inspections and borehole construction identified the hillock in the north eastern section comprised of rounded quartz sandstone with strong hematite cementing possibly reworked volcanic. The sandstone is expected to be part of the Purlawaugh Formation which has been mapped north east of the site. The hillock is expected to be an isolated plug that provides a geological contrast for groundwater movement.

Soils on the site comprised topsoil of dark brown to brown silty clay to sandy clay loam. Subsoils were yellowish red to reddish brown fine sandy clay loam, sandy clay, light to medium clay to silty sand with increasing weathered basalt cobble and weathered rock with depth. Basalt cobbles and weathered rock consisting of quartz sandstone and olive basalt were encountered from varying depths over the site between 0.2 to 12.0m.

5.5 Surface water

Two dams have been formed within the site and are fed by the natural slope of the site forming a shallow drainage line running north to south-south west. Contour banks formed across the site direct surface water flows into the drainage line. Surface water over the site predominantly flows south east and into the Eulomogo Creek.

The Eulomogo Creek empties into the Macquarie River approximately 1.1km west of the site.

5.6 Groundwater

The Australian Natural Resources Atlas identifies the site within the Upper Macquarie Alluvium Groundwater Management Unit. The management unit has an area of 414km^2 with approximately 17.95 GL consumed per year. Average salinity levels are greater than 1500mg/L.

Two bores are located on the site. The bores have been constructed to depths greater than 15m.

A search of the NSW DPI groundwater database located 71 bores within 2km of the site. These bores are predominantly located to the south and south west. A number of bores are licensed for monitoring and form part of the Dubbo City Council salinity network. The DCC monitoring bores are located in unconfined clay to sandy clays to depths of less than 15m. Other bores are licensed for domestic, stock and public/municipal supplies and have water bearing zones at depths greater than 15m.

Public/municipal bores and a domestic bore are located adjacent the Macquarie River. The groundwater in these bores is influence by flows from the Macquarie River.

6. Groundwater and soil salinity investigation

The groundwater and soil salinity investigation comprised a desktop study, field assessment and soil analysis. The desktop study included a review of soil landscape maps, hydro-geological landscapes and groundwater databases. Soil moisture modelling was also undertaken.

The field assessment included an initial site investigation and detailed profile descriptions and soil analysis in a grid pattern over the site. The soil and landscape information collected provided an adequate description of the physical processes on the site to enable salinity issues to be identified and managed. The frequency of tests undertaken was in accordance to the frequency in Table 1 of Lillicrap and McGhie (2002) for moderately intensive construction.

6.1 Soil landscape maps

Soil landscape data was reviewed for information regarding soil types in the locality, occurrence of salinity, erosion and sodic soils.

6.2 Hydro-geological landscapes

Dubbo City Council (2013c) has developed hydro-geological landscapes for the locality. Hydro-geological landscape data (Figure 3) was reviewed for information regarding the groundwater aquifer including lithology, aquifer type, recharge and discharge characteristics.

6.3 Groundwater

Shallow groundwater has been identified on the site in MW1 at a depth greater than 8m. The deep groundwater within the Upper Macquarie Alluvium Groundwater Management Unit is at a depth of greater than 15m in a confined aquifer.

An investigation of registered bores in the area was undertaken to determine the depth and salinity of the groundwater. Groundwater information was found from a review of the NSW Primary Industries website and Dubbo City Council Salinity Network.

The groundwater was divided into deep and shallow groundwater. Deep groundwater is located in river gravels and sands at depths greater than 15 metres. The shallow groundwater is expected to generally be unconfined in a local aquifer controlled by drainage lines and/or lithological contrasts within the site.

Water criteria for salinity are presented in Tables 1 and 2. The conversion from EC (dS/m) to total dissolved solids or TDS (mg/L) is undertaken by applying the conversion factor of 640 for an average concentration of salts present (Lillicrap and McGhie 2002).

Table 1. Drinking water criteria for salinity (ADWG 2004)

Criteria	EC (dS/m)	Total dissolved solids -Salinity (mg/L)
Good quality drinking water	0.78	500
Acceptable based on taste	0.78-1.56	500-1000
Unsatisfactory taste	1.56	Greater than 1000
Seawater	Greater than 55	-

Table 2a. Total dissolved solids of water for agricultural use (Reid 1990)

Class	Description	Total dissolved solids -Salinity (mg/L)
1	Low salinity	0-175
2	Medium salinity	175-500
3	High salinity	500-1500
4	Very high salinity	1500-3500
5	Extremely high salinity	>3500

Table 2b Guidelines on salinity class determination (Dubbo City Council Urban Salinity) Plan)

Electrical conductivity (dS/m)	Salinity class
>15	Extreme
6-15	High
2-6	Moderate
0-2	Low

6.4 DLWC groundwater vulnerability mapping

The NSW Department of Land and Water Conservation have undertaken groundwater vulnerability mapping of the Dubbo locality (Piscope and Dwyer 2001). The vulnerability mapping utilises the DRASTIC technique which is a composite description of all the major geologic and hydro-geologic factors that affect and control groundwater movement into, through and out of an area. It involves the overlaying of various hydro-geological settings via a Geographical Information System (GIS). Each hydro-geological setting describes topography, soil type, bedrock type, estimate of rainfall and net recharge depth to watertable (DTWT), aquifer yield, relative conductivity and any particular features associated with the setting that are available. Groundwater vulnerability is classified into high, moderately high, moderate, low moderate and low (Figure 4).

6.5 Dubbo LEP (2011) groundwater vulnerability map

The Dubbo LEP (2011) Natural Resource – Groundwater vulnerability map describes the areas within the Dubbo City Council area where groundwater is considered vulnerable to depletion and contamination as a result of development (Figure 5).

Under the Dubbo City Urban Salinity Implementation plan the site is located in the Old Dubbo Road and Dubbo Basalt hydro-geological landscape which have been classed respectively with an overall salinity hazard of low to moderate.

6.6 Hydraulic model

An unsaturated moisture movement model is appropriate to evaluate the hydraulic flows of the existing and proposed land-use. The moisture model selected was CLASS U3M-1D as released by CRC Catchment Hydrology (Vaze *et al*. 2004).

6.6.1 Inputs

The model inputs are daily rainfall and evaporation. The model used climate data from 1980 to 2014 (SILO) under pre and post land-use scenarios (Table 3) to predict soil moisture and excess soil moisture. The pre development land-use of the development area is comprised of improved pasture. The post development land-use comprised residential lots, roadways and vegetated areas in road reserves. The vegetated areas will be planted to trees as offset for possible over irrigation of lawns.

The model input data was rainfall and evaporation for the inferred climate at Hennessy Road as obtained from SILO. Six land-use scenarios (Table 3) were applied across the time period for pre and post development scenarios in the land-use areas.

Table 3. Land-use in the soil moisture model

Land-use	Pre development (ha)	Post development (ha)	Rainfall parameter
Improved grazing	131	0	100% Rainfall
Urban (Lawns)	0	23	Evaporation plus 1mm/day
Road verges	0	12.6	Rainfall (allowance for road runoff)
Roads	0	25	Run off site
Urban-open space (parkland)	0	58	100% Rainfall in permeable areas
Tree areas	0	12.4	Rainfall plus 1mm/day (allowance for lawn overwatering)
Total	131	131	

Other parameters applied in the model are soil type and depth and default values (Table 4).

Table 4. Model parameters

Parameter	Data/description
Soil profile	Layer 1 1600-3000
	Layer 2 900-1600
	Layer 3 300-900
	Layer 4 0-300 (topsoil)
Land-use	Pasture, lawn, verges – pasture, default climate
Soil hydraulic parameters	Layer 1 Sandy clay
	Layer 2 Light clay
	Layer 3 Sandy clay
	Layer 4 Silty clay loam (topsoil)
	CLASS U3M-1D
Time step	Default
Root distribution	Default

6.6.2 Outputs

The outputs from the model are soil moisture and excess soil moisture by layer in 10 cm increments. Excess soil moisture is the lateral drainage component and is the difference between available moisture and saturated soil moisture.

6.6.3 Nutrient model

A simulation model was developed to predict surface runoff, sediment loss, nitrogen and phosphorus export, pre and post development. Land-use of the site was divided into pasture, sealed roads, residential and road verges. The area for each land-use pre and post development was estimated from site walkover, topographical map, subdivision plans and an aerial photograph. The site was classified into the different land-use areas pre and post development. These areas are summarised in Table 5.

Table 5. Land use areas for nutrient model

Land-use areas (ha)	Pre	Post
Improved grazing	110	0
Disturbed landscapes	19.9	0
Remediated gullies	0	0
Roads (earth)	0.5	0
Roads (sealed)	0	25
Lawns (irrigated)	0	23
Urban	0	58
Road verges	0	12.6
Trees	0	12.4
Total	131	131

Land-use on site are as follows;

- *Improved grazing* is the main pre-development land-use. Superphosphate is regularly applied and clovers and other pasture species sown to improve pasture. The pasture area is assumed to be improved for sediment loss and feed.
- *Disturbed landscapes* refers to the drainage line that has been established with addition of contour banks and minimal earthworks.
- *Remediated gullies* is the section along the drainage line which will be improved post development.
- *Roads (earth)* is a calculation of farm tracks and roads that have been created on site pre development.
- *Roads (sealed)* is a calculation of culverted roads that will be on-site post development.
- *Lawns* were calculated estimating average lot size. Building lots were estimated to have an area of 0.06 ha, it was therefore estimated that on average there could potentially be 0.02 ha of lawn.
- *Urban* refers to community areas or parks.
- *Road verges* were estimated to be approximately 5m wide.
- *Trees* refers to vegetation cover over the site which is recommended.

Sediment, nitrogen and phosphorus export was estimated for low, median and high scenarios for each land-use class as detailed in Appendix 1 (Chafer 2003).

6.7 Initial site investigation

An initial site investigation was conducted by collecting information on vegetation, slope, bare areas and other indicators of salinity at 184 locations across the site (Figure 6). This density is in accordance with the recommendations by Lillicrap and McGhie (2002).

6.8 Detailed profile descriptions and laboratory analysis

Sixty-nine boreholes were constructed with an EVH truck mounted hydraulic drilling rig with solid auger on 23 and 24 April and 7 and 8 May 2015 to provide information on the soil profiles and enable sampling. The boreholes were constructed at various local elevations on the site (Figure 7). Deep boreholes were constructed along the drainage line to a depth of 12m (MW1) and 10m (MW2 and MW3). The deep boreholes were located to intercept shallow groundwater. A 50mm diameter monitoring well was installed in BH20 (MW1), BH44 (MW2) and BH56 (MW3). Five boreholes were drilled up to a depth of 9 metres. Soil samples were collected from eight boreholes at 100mm, 200mm, 300mm, 500mm, and 500mm intervals to the depth of the borehole and are expected to provide an adequate description of subsoil salinity conditions.

The soil profile was described for colour, texture and moisture. Representative soil samples were analysed for pH, electrical conductivity and dispersion. Two representative topsoil and two representative subsoil samples were analysed for chlorides and exchangeable sodium percentage.

Soil electrical conductivity (EC) results of the 1:5 (soil:water suspension) were converted to saturated extracts (ECe). EC values are converted to ECe by using a multiplier factor (Charman and Murphy, 1991), which is dependent on the soil texture (Table 6). Saline soils are defined as those with an electrical conductivity (ECe) greater than 4 dS/m (Charman and Murphy, 2001). Soil salinity ratings and effects on plant growth are presented in Table 7.

Table 6. ECe texture based conversion factors (Charman and Murphy 2001)

Soil texture	Conversion factor
Loamy sand, clayey sand, sand	23
Sandy loam, fine sandy loam, light sandy clay loam	14
Loam, loam fine sandy, silt loam, sandy clay loam	9.5
Clay loam, silty clay loam, fine sandy clay loam	8.6
Sandy clay, silty clay, light clay	7.5
Light medium clay, medium clay, heavy clay	5.8

Table 7. Soil salinity ratings based on ECe readings

Salinity rating	ECe (dS/m)*	Effects on Plants
Non saline (NS)	0-2	Salinity effects negligible
Slightly saline (SS)	2-4	Very salt sensitive plant growth restricted
Moderately saline (MS)	4-8	Salt sensitive plant growth restricted
Highly saline (HS)	8-16	Only salt tolerant plants unaffected
Extremely saline (ES)	>16	Only extremely tolerant plants unaffected

*ECe - Electrical conductivity of a saturated extract

Soil with ECe below 2 dS/m will have negligible effects on plant growth and soil stability. Soil with ECe of between 2 and 4 dS/m may restrict very salt sensitive plant growth. Soil with ECe between 4 and 8 dS/m will restrict the growth of salt sensitive plants.

Samples were analysed for dispersion using the Emerson aggregate test. Table 8 details the eight dispersion classes.

Table 8. Emerson dispersion classes

Class	Description
1	Highly dispersive (slakes, complete dispersion)
2	Moderately dispersive, slakes, some dispersion
3	Slightly dispersive, slakes, some dispersion after remoulding
4	Non-dispersive, slakes, carbonate or gypsum present
5	Non-dispersive, slakes, dispersion in shaken suspension
6	Non-dispersive, slakes, flocculates in shaken suspension
7	Non-dispersive, no slaking, swells in water
8	Non-dispersive, no slaking, does not swell in water

Representative soil samples were collected from the topsoil and subsoil and analysed for chloride and sodicity. Chloride criteria for corrosiveness to building material are presented in Table 9 and are an extract from AS2159-1995 Piling – design and installation.

Aggressive soils criteria for salinity and sulfate impacts on building structures are presented in Australia Standard AS2870-2011 (Appendix 2). The AS2870 standard also describes requirements to mitigate salinity and sulphate on footings.

Table 9. Chloride corrosiveness to building materials (AS2159-1995 Piling – design and installation)

Concrete piles		Steel piles	
Chlorides in water (mg/kg)	Soil conditions for low permeability soils or all soils above groundwater	Chlorides in water (mg/kg)	Soil conditions for low permeability soils or all soils above groundwater
<2,000	Non-aggressive	<1,000	Non-aggressive
2,000-6,000	Non-aggressive	1,000-10,000	Non-aggressive
6,000-12,000	Mild	10,000-20,000	Mild
12,000-30,000	Moderate	>20,000	Moderate
>30,000	Severe		

Sodicity is expressed as a percentage of the cation exchange capacity or exchangeable sodium percentage (ESP). Ranking of sodicity is presented in Table 10 (Lillicrap and McGhie 2002). An ESP of less than 5% indicates a non-sodic soil, ESP of between 5 and 15% indicates a sodic soil and an ESP of greater than 15% indicates a highly sodic soil.

Table 10. Ranking of exchangeable sodium percentage

Exchangeable sodium percentage	Ranking
<5%	Non-sodic
5-15%	Sodic
>15%	Highly sodic

7. Results and discussion

7.1 Soil landscape maps

The majority of the site is located within the Bunglegumbie Soil Landscape. The north eastern section of the site is located within the Wongarbon Soil Landscape (Murphy *et al.* 1998).

Soil in the Bunglegumbie landscape consists of red podzolic soils, non-calcic brown soils and yellow podzolic soils. Parent material is relatively old and weathered alluvium. Soil salinity problems are absent. Erosion hazard is low on slopes less than 3%.

Soil in the Wongarbon landscape consists of euchrozems and red and brown cracking clays. Parent material is basalt. Soil salinity occurs as isolated areas along drainage lines, depression

and footslopes. Soils are slightly to moderately erodible with erosion hazard increasing on slopes of 3 to 8% when cultivated or surface cover is low.

7.2 Hydro-geological landscapes

The majority of the site is located within the Old Dubbo Road Hydro-geological Landscape with the north eastern section with the Dubbo Basalt Hydro-geological Landscape (DCC2013c). The site and associated hydro-geological landscapes are depicted in Figure 3.

Lithology of the Old Dubbo Road Hydro-geological Landscape consists of Napperby Formation comprising siltstone thinly interbedded with fine to medium grained lithic quartz and minor conglomerates. This is overlaid by colluvial and alluvial weathered basalt. The Old Dubbo Road HGL is generally non-saline. Small areas of salinity which do occur are transient as water flows remove salt that may accumulate from adjacent hydro-geological landscapes. Groundwater flow is unconfined to semi-confined flows in consolidate rock and unconfined flow in unconsolidated colluvium. Water electrical conductivity is low.

An area in the north eastern section of the site is located in the Dubbo Basalt Hydro-geological Landscape. Lithology of the Dubbo Basalt Hydro-geological Landscape consists of Cainozoic basalt consisting of in situ Olivine rich alkali basalt with some colluvial material and quartzite derived from the underlying sandstone and siltstone. Soil salinity is isolated at areas along drainage lines, at the intersection with the Purlewaugh formation depressions and footslopes. Saline soils also occur due to local perching of the water table. Groundwater flow is unconfined to semi-confined in consolidated fractured rock. Groundwater salinity is fresh to marginal.

A sandstone horizon was identified as a hillock within the Dubbo Basalt Hydro-geological Landscape during the site inspection and borehole construction (Figure 8). The sandstone comprised rounded quartz sandstone with a strong hematite cementing possible reworked volcanic. Purlawaugh Formation comprising siltstone, mudstone, sandstone and ironstone has been mapped north east of the site. The lithology of the hillock is expected to be part of the Purlawaugh Formation. The sandstone unit and mapped basalt provides a geological contrast for groundwater movement.

7.3 Groundwater

7.3.1 OEH registered bores

Seventy one registered water abstraction bores were identified within a 2km radius of the site on the NSW Government Department of Primary Industries website (2015) (Figure 8). Data known about each bore from the Department of Primary Industries website is summarised in Appendix 3. Bores are predominantly located to the south and south west of the site.

Eighteen bores form part of the Dubbo City Council salinity network and as such have been constructed to intersect shallow unconfined groundwater. The characteristics of these bores are discussed in Section 7.4. The remainder of the bores are licenced for domestic, stock, public/municipal and monitoring.

Water-bearing zones (WBZ's) and standing water levels were recorded for approximately 45 bores. The Department of Primary Industries website shows that SWL's and WBZ's in bores (for which data was recorded) were at depths greater than 10m (Appendix 3 and Figure 9). The water bearing zones are located in gravel, sand, silt and clay.

A salinity description was recorded for fourteen bores. All were considered to contain non-saline water, with descriptions of 'good', '0-500ppm' and 'fresh'. '

7.3.2 Dubbo City Council salinity network

Eight Dubbo City Council (DCC) monitoring bores are located at less than 1km from the site and ten are located between 1 and 2km west to north of the site (Figure 10 and Appendix 4). Bore depths ranged from 3m to 15m with water bearing zones located in unconfined regolith comprising clay. The majority of bores have been dry since monitoring begun in March 2005. Bores containing water at the time of sampling had low to extremely high levels of total dissolved solids with levels ranging between 192mg/L to 16128mg/L (Appendix 4).

The closest bores to the site are identified as DCC19, DCC20 and DCC115 (Figure 10). DCC19 is located on the north eastern boundary corner of the site and has a depth of 3m. DCC20 is located on the south west boundary of the site and has a depth of 15m. DCC115 is located to the north west of the site and has a depth of 9m. DCC19 and DCC20 have generally been dry or too shallow to bail since monitoring began in March 2005 indicating groundwater in the north eastern section of the site is greater than 3m and in the south western section greater than 15m. Standing water levels in DCC115 has ranged from 5.4m to dry. Electrical conductivity was less than 0.5dS/m with total dissolved solids at less than 320mg/L. DCC115 has not been monitored since February 2012 due to access restrictions.

Standing water levels in Dubbo City Council (DCC) monitoring bores within 2km of the site in October to December 2014 ranged between 1.41m and 8.54m and more than half were dry (Tables 11 and Figure 10). Electrical conductivity of groundwater ranged from moderate (DCC64, November 2014) to very high (DCC62, December 2014).

7.3.3 On-site groundwater

Groundwater was encountered in MW1 at a depth of 8.6 metres in extremely weathered rock. The standing water level was 8.12m and total electrical conductivity of 4.64 dS/m (2,969mg/L) which is considered moderately saline.

MW1 was located in the northern section of the site (Figure 7) adjacent the shallow drainage line which flows through the site north to south- south west. It is expected to be near the lithological contact between the medium-grained lithic sandstone and tertiary basalt.

MW2 was located in the south western section of the site within the shallow drainage line. Groundwater was not encountered to the drilling depth of 10m. MW3 was located in the central section of the site (Figure 7). Groundwater was not encountered to the drilling depth of 10m.

Unconfined groundwater may occur along the drainage line following periods of high rainfall.

7.4 Groundwater vulnerability

The Department of Land and Water Conservation (Piscope and Dwyer 2001) identifies the majority of the site as having a moderately high groundwater vulnerability rating (Figure 4). The southern section of the site and land to the south and along the Macquarie River have a high groundwater vulnerability rating. Land adjacent the north eastern boundary has a low groundwater vulnerability rating.

7.5 Dubbo LEP (2011) groundwater vulnerability map

The Dubbo LEP (2011) identifies the site in a moderately high groundwater vulnerability area (Figure 5). Areas to the south west and along the Macquarie River have a high groundwater vulnerability rating. No groundwater vulnerability rating applies to land to the north east.

Table 11. Dubbo City Council salinity network

Sampling location (see Figure 10)	Depth (m)	Date sampled	Standing water level (m)	EC dS/m	Total dissolved solids (EC x 640) mg/L
DCC18	15	Oct-14	Dry	-	-
		Nov-14	4.87	1.57	1,004
		Dec-14	4.51	1.70	1,088
DCC19	3	Oct-14	Dry	-	-
		Nov-14	2.85	TSTB	-
		Dec-14	2.80	TSTB	-
DCC20	15	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC21	15	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC42	2	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC44	6	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC45	9	Oct-14	Dry	-	-
		Nov-14	7.95	1.35	864
		Dec-14	7.90	1.34	858
DCC49	15	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC53	9	Oct-14	Dry	-	-
		Nov-14	8.84	TSTB	-
		Dec-14	8.54	1.87	1,197
DCC58	15	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC59	3	Oct-14	Dry	-	-
		Nov-14	1.41	0.73	467
		Dec-14	1.36	0.60	384
DCC62	9	Oct-14	2.70	4.63	2,963
		Nov-14	2.45	4.81	3,078
		Dec-14	2.34	4.89	3,130
DCC64	3	Oct-14	Dry	-	-
		Nov-14	1.84	0.49	313
		Dec-14	1.73	0.54	345
DCC87	6	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC111	6	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-
DCC115	9	Oct-14	No access	-	-
		Nov-14	No access	-	-
		Dec-14	Dry	-	-
DCC116	3.5	Oct-14	No access	-	-
		Nov-14	No access	-	-
		Dec-14	Dry	-	-
DCC124	15	Oct-14	Dry	-	-
		Nov-14	Dry	-	-
		Dec-14	Dry	-	-

TSTB- too shallow to bail