Economic Development Queensland

Fitzgibbon Priority Development Area Draft Infrastructure Plan Background Report

May 2022

Queensland Government

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1 Preliminary

1.1 Economic Development Act

The Fitzgibbon Priority Development Area (PDA) was declared on 25 July 2008 under the *Urban Land Development Act 2007* (since repealed and replaced with the *Economic Development Act 2012*). The PDA comprises approximately 295 hectares of land in the northern suburbs of Fitzgibbon, Carseldine, Bald Hills, Taigum and Deagon. The Fitzgibbon PDA is bounded by Cabbage Tree Creek to the south, Telegraph Road to the north, and the Gateway Motorway to the east. A map of the PDA is located in Appendix A.

The Fitzgibbon PDA Development Scheme (development scheme) is applicable to all land within the boundaries of the PDA and PDA-associated land. The development scheme became effective in July 2009. An amendment to the development scheme was approved on 1 April 2010. A further amendment to the development scheme was approved on 21 June 2019.

The Development Charges and Offset Plan (DCOP) provides guidance on infrastructure matters by stating the development charges applicable to development within the PDA, identifying any trunk infrastructure within the water supply, sewerage, stormwater, transport, parks and community facilities networks made necessary by development of the PDA as well as matters relevant to calculating a credit, offset or refund for the provision of trunk infrastructure.

1.2 Purpose of Infrastructure Planning Background Report (IPBR)

This IPBR will assist users of the development scheme and the DCOP by documenting information relevant to:

- the infrastructure planning undertaken for the Fitzgibbon PDA
- the determination of development charges for the Fitzgibbon PDA.

2 Growth projections

2.1 Introduction

The projections of future residential and non-residential growth in the Fitzgibbon PDA provide a consistent basis for the planning of infrastructure to service the PDA. The following section is a summary of the growth projections prepared for the PDA.

2.2 Growth projection years

The Fitzgibbon growth projections were prepared for:

- the base date 2019 and the following projection years:
    - 2021
    - 2026
    - 2031

2.3 Potential development capacity

The potential development capacity that may be achieved on premises within the PDA was calculated based on the type and density of development allowed within the various zones of the development scheme, after taking into account constraints such as flooding and heritage listings, existing development and lot sizes.

Density is expressed within the development scheme as follows:

- For those parts of the PDA zoned for residential development - number of dwellings per hectare
- For those parts of the PDA zoned for non-residential development - plot ratio.

The total number of dwellings calculated for the PDA was distributed between attached and detached dwellings based on the requirements of the development scheme as well as an analysis of current market trends.

The amount of non-residential gross floor area (m² GFA) calculated for the PDA was distributed between office and retail land uses based on the requirements of the development scheme and an analysis of current market trends.

Assumptions about the density, type and timing of growth were initially prepared by the Continuum Group and documented in a report titled Fitzgibbon Urban Development Area – Yield Analysis, dated 12 June 2018. These assumptions were subsequently reviewed by the RPS Group and are documented in a report titled Fitzgibbon PDA Yield Analysis Review, dated 13 May 2019 (Appendix B).

2.4 Development constraints

The potential development capacity of the PDA has been calculated for the developable land within the PDA. A key constraint is flooding, which primarily impacts a portion of the PDA closest to

Cabbage Tree Creek. Flooding across this portion of the PDA is characterised by shallow (typically less than 250mm) conveyance dominated flows. This area has been excluded from the developable area of the site and will remain in a natural state or be used for sports and recreation purposes.

Other constraints, such as existing developments and noise affection from the adjoining railway line are capable of being mitigated and did not impact the potential development yield of the PDA.

2.5 Growth rates

The rate of growth for residential and non-residential development in the PDA was determined by the RPS Group having regard to local market trends. No further growth is projected to occur between 2026 and 2031. As such, the below table show all growth to 2031 which is expected to occur by 2026.

2.6 Growth projection summary

The growth projections for the PDA are summarised in Table 1 and 2**Error! Reference source not found.**.

Table 1 - Residential dwellings and non-residential floor space projections

Column 1 Description	Column 2 Projections by year		
	2019 (base date)	2021	2026
Detached dwellings	715	812	909
Attached/semi-detached dwellings	363	363	696
Retirement facility	0	0	70
Residential care facility (GFA)	0	0	8000
Office (GFA)	27,001	27,001	28,501
Retail (GFA)	1671	1671	4977
Educational facility (GFA)	0	600	800
Community (GFA)	927	927	927

Table 2 - Population and employment projections

Column 1 Description	Column 2 Projections by year		
	2019 (base date)	2021	2026
Population	2545	2802	3780
Employment	350	356	580

3 Demand projections

Growth projections are converted into demand projections to enable infrastructure planning to be undertaken. No further growth is projected to occur between 2026 and 2031.

Networks express demand using different demand units. The demand units used by each local network in the PDA are as follows:

- for the water supply network, equivalent persons (EP)
- for the sewerage network, equivalent persons (EP)
- for the stormwater quantity network, impervious area expressed in hectares (Imp Ha)
- for the transport network, trips per day (trips)
- for the parks and community facilities network, equivalent persons (EP).

The demand generation rates used by each network to convert growth projections into demand are stated in Table 3.

The demand projections for each network are stated in Table 4.

Table 3 - Demand generation rates

Column 1 Development scheme zone / area	Column 2 Demand generation rate for an infrastructure network				
	Water supply network (EP)	Sewerage network (EP)	Stormwater quantity network (Imp Ha / Ha dev area)	Transport network (trips)	Parks and community facilities network (EP)
Detached dwellings	2.65	2.65	50%	6.5	2.65
Attached dwellings	1.79	1.79	60%	4.2	1.79
Retirement facility	1.79	1.79	60%	2	1.79
Residential care facility (m² GFA)	0.006	0.006	90%	0.03	0
Office (m² GFA)	0.0117	0.0117	90%	0.11	0
Retail (m² GFA)	0.018	0.018	90%	1.0	0
Educational facility (m² GFA)	0.0113	0.0113	90%	0.2	0
Community (m² GFA)	0.0039	0.0039	90%	0.1	0
Source	*South East Queensland Water Supply and Sewerage Design and Construction Code (SEQ Code)*	*South East Queensland Water Supply and Sewerage Design and Construction Code (SEQ Code)*	*QUDM (2007)*	*Rates reflect typical industry averages*	*Rates calculated using an occupancy rate of 2.65 and 1.79 persons per dwelling*

Table 4 - Demand projection rates

Existing and projected demand for the water supply network

Column 1 Service catchment	Column 2 Existing and projected demand (EP)		
	2019 (base date)	2021	2026
Fitzgibbon PDA	2894	3158	4360

Existing and projected demand for the sewerage network

Column 1 Service catchment	Column 2 Existing and projected demand (EP)		
	2019 (base date)	2021	2026
Fitzgibbon PDA	2894	3158	4360

Existing and projected demand for the transport network

Column 1 Service catchment	Column 2 Existing and projected demand (trips)		
	2019 (base date)	2021	2026
Fitzgibbon PDA	10,906	11,656	18,937

Existing and projected demand for the parks and community facilities network

Column 1 Service catchment	Column 2 Existing and projected demand (EP)		
	2019 (base date)	2021	2026
Fitzgibbon PDA	2545	2802	3780

Existing and projected demand for the stormwater network

Column 1 Service catchment	Column 2 Existing and projected demand (Imp Ha)		
	2019 (base date)	2021	2026
Fitzgibbon PDA	29	34	44

4 Desired standard of service

4.1 Water supply

Planning for the water supply network has been undertaken in accordance with the design standards for the water supply network stated in the South East Queensland Design and Construction Code.

4.2 Sewerage

Planning for the sewerage network has been undertaken in accordance with the design standards for the sewer supply network stated in the South East Queensland Design and Construction Code.

4.3 Stormwater

The desired standards of service for the stormwater network are adopted to align with those within the Brisbane City Council's Local Government Infrastructure Plan, as maybe amended from time to time. Refer to the Brisbane City Plan, Part 4 for additional detail.

4.4 Transport

EDQ have adopted Brisbane City Council's desired standard of service, as per the Local Government Infrastructure Plan, for all transport networks, as may be amended from time to time.

4.5 Parks and community facilities

EDQ have adopted Brisbane City Council's desired standard of service for the parks and land for community facilities network contained in the Local Government Infrastructure Plan, as may be amended from time to time.

5 Infrastructure planning

5.1 Planning horizon

Infrastructure planning for the Fitzgibbon PDA was undertaken using a planning horizon of 2031. This horizon was chosen to align with the planning horizon of areas surrounding the PDA who are administered by Brisbane City Council and Unity Water.

5.2 Water supply

Planning of water supply infrastructure to service development within the PDA is documented in the following report:

- Fitzgibbon Priority Development Area – Trunk Water and Wastewater Assessment Technical Memo, Calibre, 12 August 2019 (Appendix C)

It has been determined that:

- the existing trunk network has capacity to service the Fitzgibbon PDA and that no augmentations are required to existing infrastructure.
- internal water supply reticulation mains that connect the development to the trunk network will be required.

A determination of whether the identified infrastructure is trunk or non-trunk infrastructure is provided in Table 5.

5.3 Sewerage

Planning of sewerage infrastructure to service development within the PDA is documented in the:

- Fitzgibbon Priority Development Area – Trunk Water and Wastewater Assessment Technical Memo, Calibre, 12 August 2019 (Appendix C)

It has been determined that:

- the existing trunk network has capacity to service the Fitzgibbon PDA and that no augmentations are required to existing infrastructure.
- internal sewerage reticulation mains that connect the development to the trunk network will be required.

A determination of whether the identified infrastructure is trunk or non-trunk infrastructure is provided in Table 5.

5.4 Stormwater

Planning of stormwater infrastructure to service development within the PDA is documented in the:

- Carseldine Urban Village Updated Stormwater Management Plan, DesignFlow, October 2019 (Appendix E).

It has been determined that:

- two bioretention basins and two swales are required to treat stormwater runoff prior to discharge to Cabbage Tree Creek.
- new pipe infrastructure within the site to convey stormwater runoff to the lawful point of discharge will be required.

These infrastructure items have been delivered.

A determination of whether the identified infrastructure is trunk or non-trunk infrastructure is provided in Table 5.

5.5 Transport

Planning of transport infrastructure to service development within the PDA is documented in the:

- Carseldine Urban Village DCOP Traffic Impact Assessment, Cardno, August 2020 (Appendix D)

It has been determined that:

- a number of intersections require/d upgrading to service future development within the PDA. These intersections are:
    - Dorville Road/Zillmere Road
    - Beams Road/Dorville Road
    - Beams Road/Balcara Avenue
- a new non-signalised intersection providing secondary left in-out access to Beams Road will be required;
- a new internal main access road is required;
- new internal local access roads are required; and
- a separated cycleway is required.

All of these infrastructure items expect for the Beams Road/Dorville Road intersection upgrade have been delivered. It is anticipated that the Beams Road/Dorville Road intersection upgrade will be delivered in 2022.

A determination of whether the identified infrastructure is trunk or non-trunk infrastructure is provided in Table 5.

5.6 Parks and community facilities

The PDA development scheme proposes the development of a number of formal and informal recreation areas including a Sports and Recreation Park within precinct 1.

The PDA development scheme also proposes pedestrian movement through the Fitzgibbon Bushland Trail and Cabbage Tree Creek crossing.

the Sprots and recreational Park and improvements to the Cabbage Tree Creed Bushland trail and crossing have been delivered.

A determination of whether the identified infrastructure is trunk or non-trunk infrastructure is provided in Table 5.

Table 5 - Infrastructure funding determination

Infrastructure network	Infrastructure details	Trunk/non-trunk	Funding source
Transport (roads, intersections, pedestrian and cycle paths)	Dorville Road/Zillmere Road intersection upgrade – signalised intersection works/channelised right turn lane.	Trunk	Development charges
	Beams Road/Dorville Road intersection upgrade – roundabout upgrade/channelised left turn lane.	Trunk	Development charges
	Beams Road/Balcara Avenue/Carseldine Urban Village access intersection upgrade – signalised intersection works/channelised right turn lanes/channelised left turn lanes/Carseldine train station access widening.	Trunk	Development charges
	Carseldine Urban Village main access road	Trunk	Development charges
	Carseldine Urban Village main access road cycleway – marked cycle lanes.	Trunk	Development charges
	Beams Road/Left in Left Out secondary access to Carseldine urban village	Non-trunk	Developer
	Internal local access roads (other than main access road).	Non-trunk	Developer
Stormwater (quantity and quality)	Bioretention basin (550 m²) to treat western half of development (precinct 1)	Non-trunk	Developer
	Bioretention basin (250 m²) to treat southern half of development (precinct 1)	Non-trunk	Developer
	Swale – treats northern half of eastern development (precinct 1)	Non-trunk	Developer
	Swale – conveys eastern development discharges to Cabbage Tree Creek	Non-trunk	Developer
Parks and open space	Sports and recreation park (precinct 1)	Trunk	Development charges
	Cabbage Tree Creek pedestrian path and crossing	Non-trunk	Developer
	Other pedestrian paths and bushland/recreation areas	Non-trunk	Developer
Water supply	Internal water reticulation network.	Non-trunk	Developer
Sewerage	Internal sewerage reticulation network	Non-trunk	Developer
Electricity and gas		Other	Developer
Telecommunications		Other	Developer

6 Infrastructure costs

6.1 Cost of land

No future infrastructure (land) is proposed to be acquired for the Fitzgibbon PDA.

6.2 Cost of works

The cost of future infrastructure (works) for each network is stated in Table 6 - Cost of future trunk infrastructure (works).

Table 6 - Cost of future trunk infrastructure (works)

Column 1 Network	Column 2 Report
Water supply	No future trunk infrastructure has been identified.
Sewerage	No future trunk infrastructure has been identified.
Stormwater	No future trunk infrastructure has been identified.
Transport	Future trunk infrastructure has been costed by Cardno using unit rates based on previous construction projects.
Parks and land for community facilities	Future trunk infrastructure has been costed by Economic Development Queensland using unit rates based on previous construction projects.

6.3 On-cost allowance

On-costs represent the owner's project costs and may include:

- survey for the work
- geotechnical investigations for the work
- strategic planning
- detailed design for the work
- project management, procurement and contract administration
- environmental investigations for the work
- portable long service leave payment for a construction contract for the work.

The on-costs allowances that have been applied to infrastructure costs in the PDA are stated in Table 7.

Table 7 - On-cost allowance

Network	On-costs allowance
Water supply	No future trunk infrastructure has been identified.
Sewerage	No future trunk infrastructure has been identified.
Stormwater	No future trunk infrastructure has been identified.

Transport	13%
Parks and community facilities	13%.

6.4 Contingency allowance

A contingency allowance is included in the cost of future infrastructure works to deal with known risks. The contingency allowance typically reduces in accordance with the level of planning undertaken for the infrastructure item. The level of contingency allowance applied for infrastructure works in each network are stated in Table 8.

Table 8 - Contingency allowance

Network	Contingency allowance
Water supply	No future trunk infrastructure has been identified.
Sewerage	No future trunk infrastructure has been identified.
Stormwater	No future trunk infrastructure has been identified.
Transport	20%
Parks and land for community facilities	10%

7 Development charges

Development charges are imposed on development in the PDA to fund trunk infrastructure and other services that have been provided or are planned to be provided to service the PDA. The following charges types make up a development charge and apply to development in the PDA.

- Infrastructure charges

7.1 Funding trunk infrastructure

Infrastructure charges imposed on development within the Fitzgibbon PDA will fund the provision of trunk infrastructure made necessary by development of the Fitzgibbon PDA. Trunk infrastructure is identified in Table 9 - Schedule of works.

7.2 Funding non-trunk infrastructure and other infrastructure

Non-trunk infrastructure and other infrastructure that is made necessary by development of the Fitzgibbon PDA will be delivered and/or funded by parties undertaking development. Non-trunk infrastructure and other infrastructure is identified in Table 5 - Infrastructure funding determination.

Table 9 - Schedule of works

Schedule of future trunk infrastructure works - Transport

DCOP ID	Map number	Infrastructure type	Infrastructure description	Estimated timing	Land cost	Works base cost	Works on-costs	Works contingency	Total works cost[1]	Estimated cost[2]
RD01	2	Signalised intersection.	Dorville Road/Zillmere Road intersection upgrade – signalised intersection works/channelised right turn lane.	2023	N/A	$273,377	$35,539	$61,783	$370,700	$370,700
RD02	2	Intersection.	Beams Road/Dorville Road intersection upgrade – roundabout upgrade/channelised left turn lane.	2023	N/A	$269,205	$34,997,	$60,840	$365,042	$365,042
RD03	2	Signalised intersection.	Beams Road/Balcara Avenue/CUV Access intersection upgrade – signalised intersection works/channelised right turn lanes/channelised left turn lanes/Carseldine train station access widening.	2021	N/A	$606,221	$78,809	$137,006	$822,035	$822,035
RD04	2	Access road	Carseldine Urban Village access road	2021	N/A	$1,444,918	$187,839	$326,551	$1,959,308	$1,959,308
RD05	2	Cycleway	Carseldine Urban Village main access road cycleway – marked cycle lanes.	2021	N/A	$85,689	$11,140	$19,366	$116,194	$116,194

Notes:

1 – The total works cost is the sum of the following: construction cost, construction on costs and construction contingency.

2 – The estimated cost is the sum of the following: land cost and total works cost. This is expressed in current cost terms as at the base date (FY 2021/22).

Appendix A – Fitzgibbon PDA boundary map



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Appendix B – Fitzgibbon PDA yield analysis review

FITZGIBBON PDA

Yield Analysis Review



PR139796
Fitzgibbon PDA
V1.0
13 May 2019

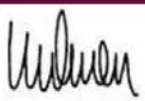
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REPORT

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1 INTRODUCTION

1.1 Brief

RPS has been commissioned by Economic Development Queensland (EDQ) to undertake an economic and market review of work completed to date. This will provide an independent opinion on the key issues of timing, capacity and density within the Fitzgibbon Priority Development Area (PDA).

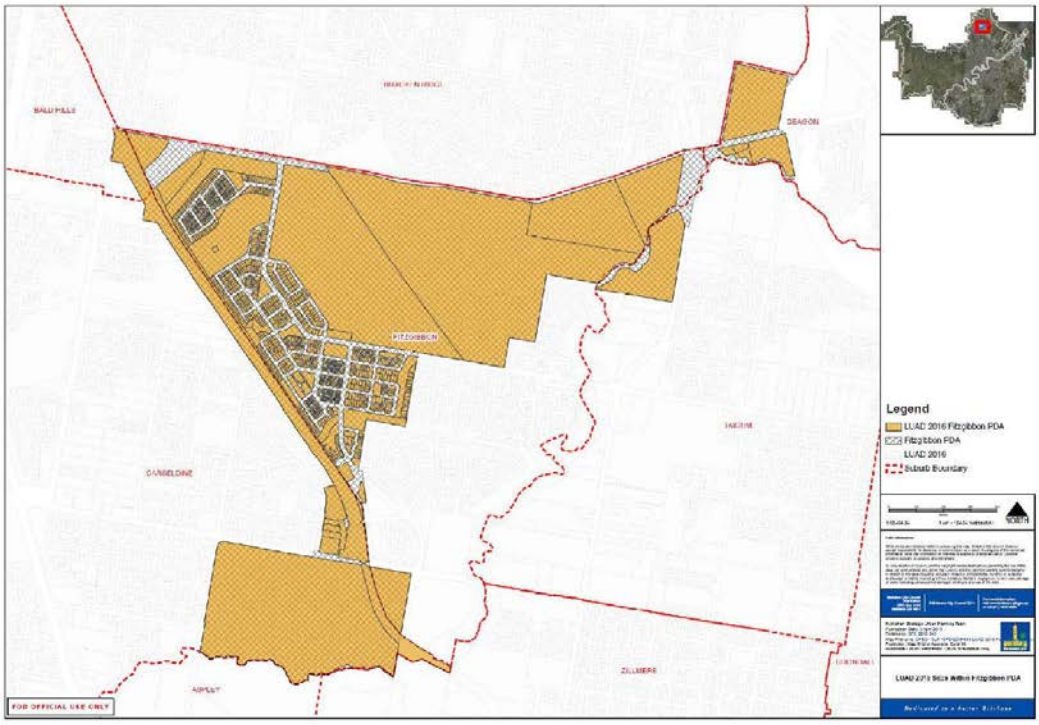
The work program is described as follows:

1. Describe the existing development within the PDA. This will utilise the Land Use Activity Dataset (LUAD) data compiled by Brisbane City Council (BCC).
2. Describe future development within the PDA. This includes all undeveloped sites with the analysis determining if the sites are likely to be developed for residential uses in the short to medium term and providing a concise review of the likely development triggers.
3. Review the ultimate development report prepared by the Continuum Group. This is a peer review of the report with emphasis on the included development assumptions (development type, density, timing, capacity etc.).
4. Review the Master Plan prepared by EDQ. This is a peer review of the report with emphasis on the included development assumptions (development type, density, timing, capacity etc.).
5. Analysis and Conclusions. The findings of the above-noted work program will be assessed in the context of macro and regional economic trends with advice provided to EDQ on the following issues:
   i) The suitably of the development projections contained in the reviewed reports.
   ii) Areas of agreement and disagreement will be noted with RPS providing confirming or alternative projections within our report.
   iii) A brief description of factors that may influence the way future development occurs within the PDA.

2 EXISTING DEVELOPMENT

This utilises the Brisbane City Council (BCC) Land Use Activity Dataset (LUAD) as provided by EDQ. The area referenced is detailed in the following figure:

Figure 1 - Fitzgibbon PDA



2.1 Residential Development

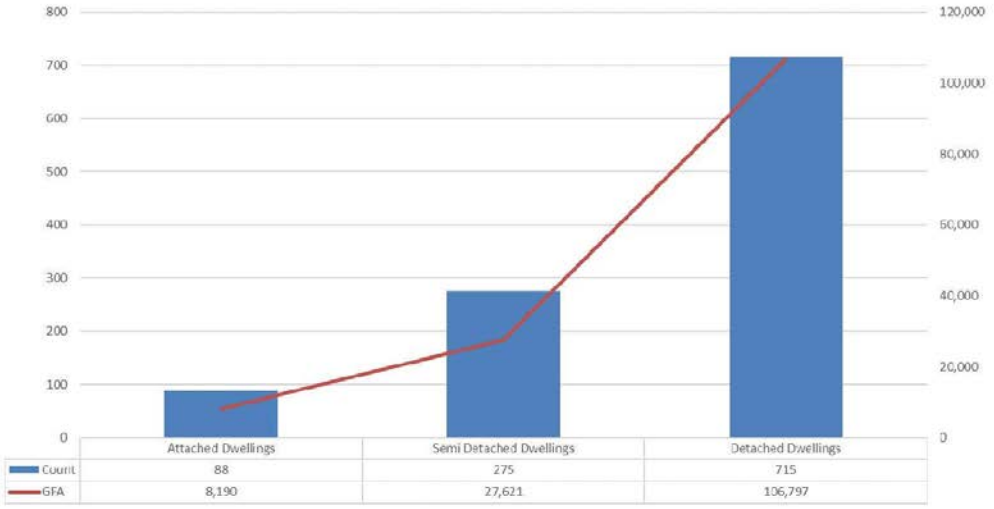
According to the provided BCC LUAD information, there are 1,078 residential dwellings in the PDA. Key features include (refer to Figure 2):

- 66% (715) of the total dwellings are detached
- 26% (275) of the total dwellings are semi-detached
- 8% (88) of the total dwellings are attached.

2.1.1 Market Implications

- The majority of the dwellings (92%) are detached dwellings and ground accessed semi-detached dwellings (e.g. duplex, townhouse etc.).
- 8% of the dwelling stock (88) occurs in 9 properties and are a 'walk up' style of development. These units have a reported average GFA of 93 Sq M.

Figure 2 - Residential Land Uses

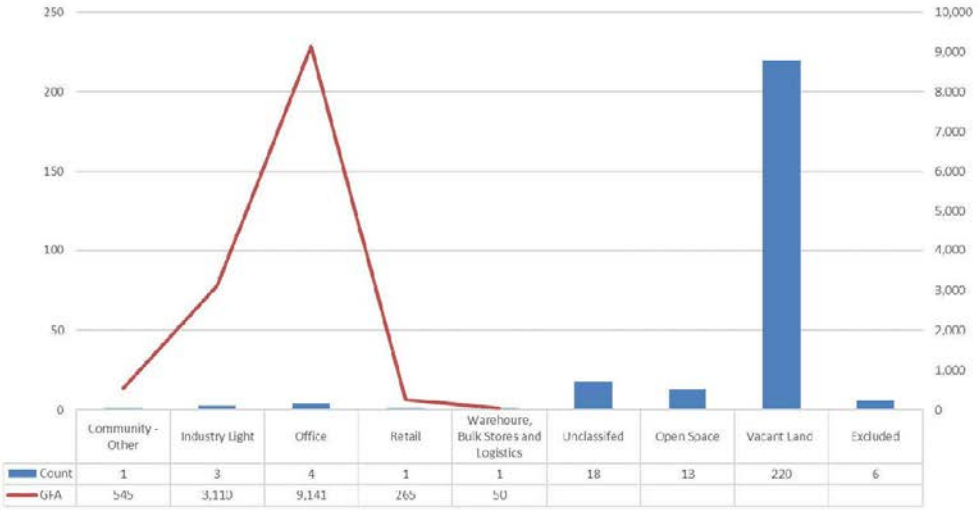


2.2 Other Development

The following Figure provides the details of the other land uses within the Fitzgibbon PDA. Key points include:

- There are 220 areas of vacant land.
- The PDA has a relatively modest amount of retail, warehouse and community space.
- The large areas of office and light industry are attributed to uses that predate the PDA.

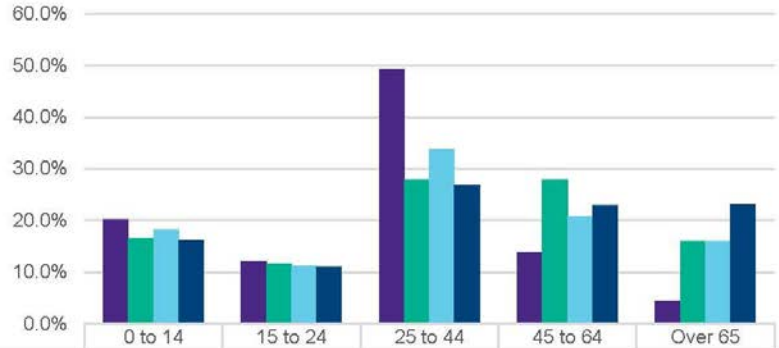
Figure 3 - Other Land Uses



2.3 Demographics

This sub-section provides an analysis of the key demographic features of Fitzgibbon Chase, the area around the Carseldine Station and the two local Statistical Area 2s.

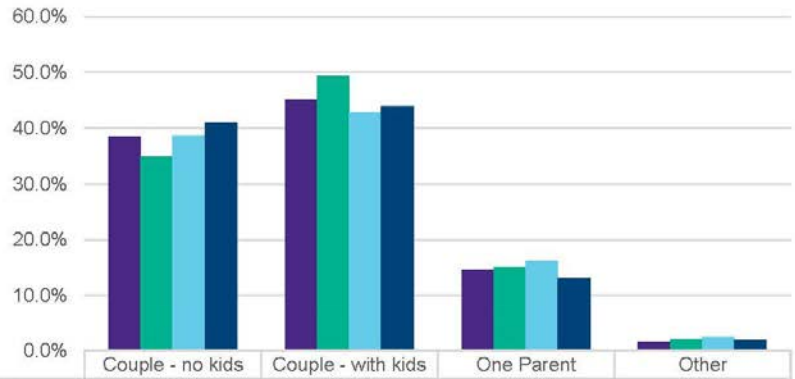
2.3.1 Age Distribution



	0 to 14	15 to 24	25 to 44	45 to 64	Over 65
Fitzgibbon Chase	20.3%	12.1%	49.3%	13.9%	4.3%
Carselidine Station SA1	16.6%	11.6%	27.9%	27.9%	16.0%
Taigum - Fitzgibbon SA2	18.2%	11.2%	33.7%	20.8%	16.0%
Carsledine SA2	16.2%	11.0%	26.8%	23.0%	23.1%

When compared to the surrounding area, Fitzgibbon Chase has an age profile that has a much higher representation of people aged 25 to 44 years and a smaller proportion of residents over the age of 65. This implies the PDA has a concentration of couples and young families.

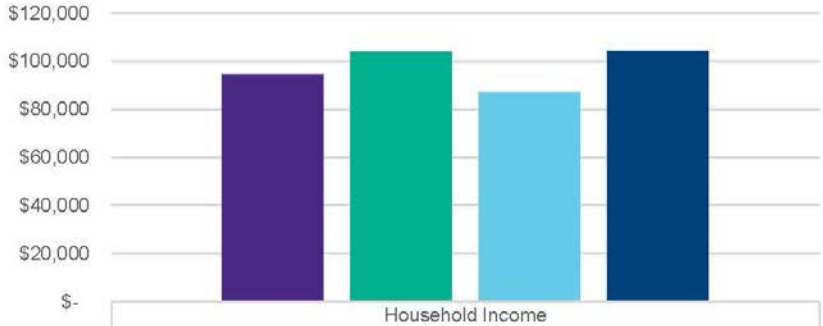
2.3.2 Household Structure



	Couple - no kids	Couple - with kids	One Parent	Other
Fitzgibbon Chase	38.5%	45.2%	14.6%	1.6%
Carselidine Station SA1	34.9%	49.3%	15.1%	2.0%
Taigum - Fitzgibbon SA2	38.6%	42.8%	16.1%	2.3%
Carsledine SA2	41.0%	43.9%	13.2%	1.8%

Couples with children are the dominant group in Fitzgibbon Chase and the area is broadly representative of the local SA2s.

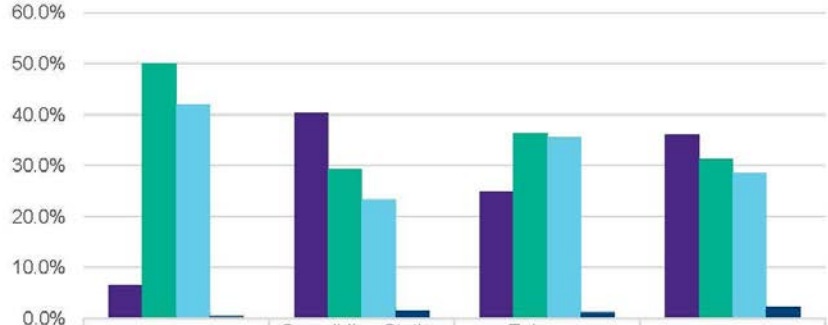
2.3.3 Income



	Household Income
Fitzgibbon Chase	$94,417
Carselidine Station SA1	$103,743
Taigum - Fitzgibbon SA2	$87,051
Carsledine SA2	$104,233

Residents of Fitzgibbon Chase have a household income that 7% higher than the average for the Taigum-Fitzgibbon SA2. When considered with the age profile, this indicates the PDA has a higher proportion of dual-income households and fewer retirees than the balance of the SA2.

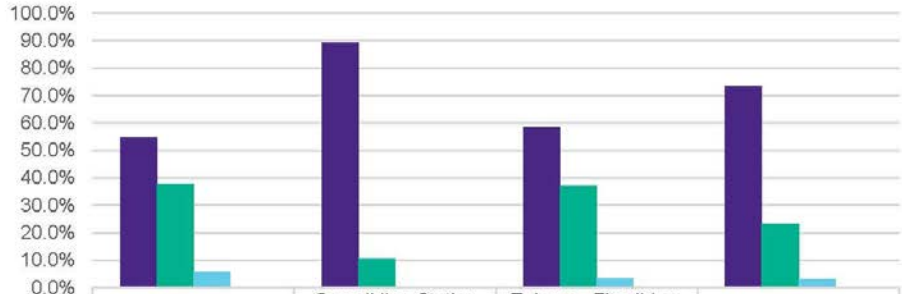
2.3.4 Household Ownership



	Fitzgibbon Chase	Carselidine Station SA1	Taigum - Fitzgibbon SA2	Carsledine SA2
Fully owned	6.6%	40.3%	24.9%	36.0%
Being purchased directly	50.1%	29.4%	36.3%	31.3%
Rented	42.0%	23.4%	35.5%	28.5%
Other Tenure	0.4%	1.5%	1.2%	2.2%

Fitzgibbon Chase has higher rates of rental properties (42%) than the reference areas. As a newly developed suburb, Fitzgibbon Chase also has a very low rate of fully owned dwellings.

2.3.5 Dwelling Structure



	Fitzgibbon Chase	Carselidine Station SA1	Taigum - Fitzgibbon SA2	Carsledine SA2
Separate House	54.7%	89.3%	58.5%	73.5%
Semi Detached	37.8%	10.7%	37.2%	23.2%
Flat or apartment	5.6%	0.0%	3.5%	3.0%
Other	0.0%	0.0%	0.0%	0.0%

Fitzgibbon chase has a similar built form profile as the Taigum-Fitzgibbon SA2.

2.3.6 Conclusion

Demographically, Fitzgibbon Chase is a community with average household incomes, a high proportion of rented properties and a distribution of age and household groups that generally reflects a newly developed area.

2.4 Implications

The residential built form is assessed as being an iterative evolution with a higher proportion of semi-detached dwellings when compared to nearby suburbs. The area has a small proportion of flats and apartments, but these are not supported by enhanced amenity or services.

The ability of the area to support higher densities will be largely linked to the provision of local employment, services and facilities at a level that is greater than the 'typical' outer suburban area. In the absence of higher levels of amenity and services, it is considered unlikely that higher intensity residential product (in the form of 8 storey buildings) will be accepted by the market in the short to medium term. It is anticipated that specialised residential product (in the form of build to rent, aged care or retirement) will be the initial types of higher intensity residential development in outer suburbs like Fitzgibbon.

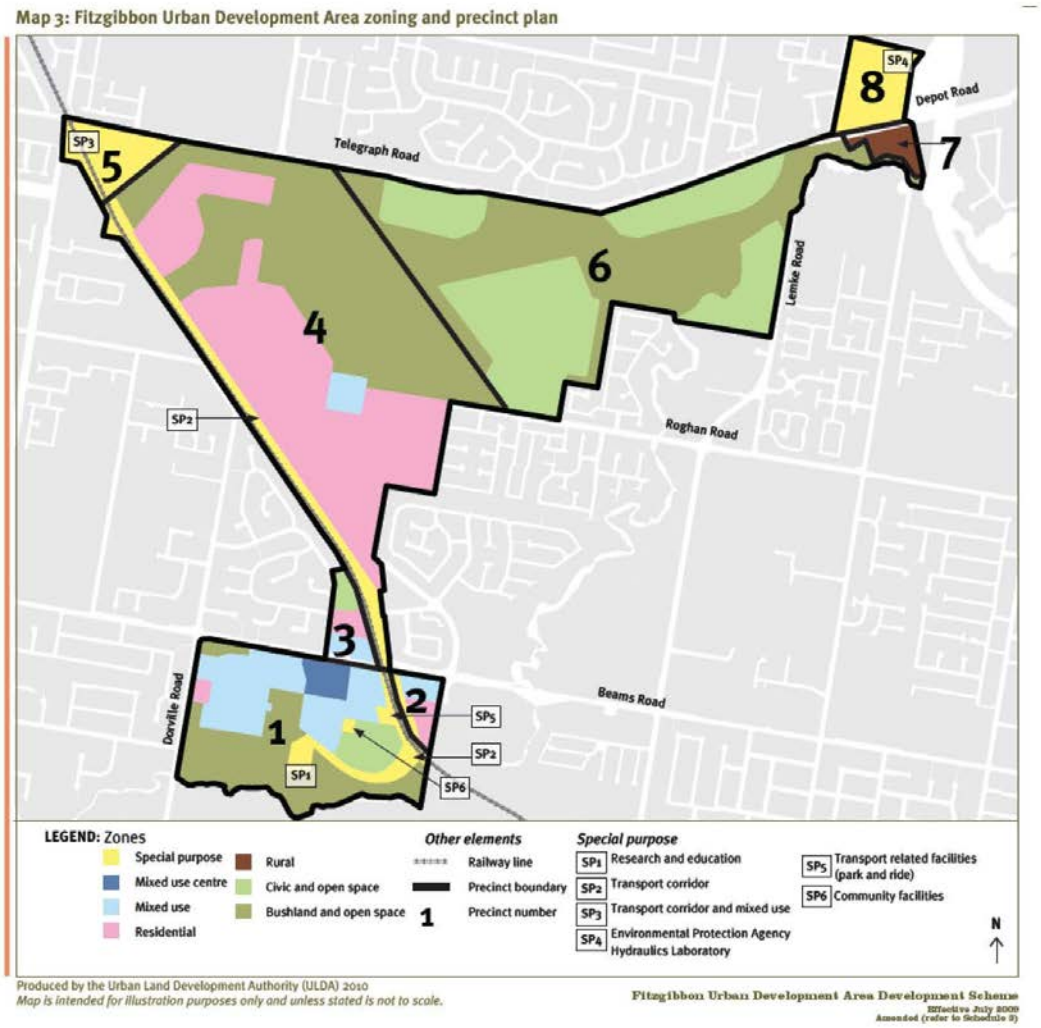
3 FUTURE DEVELOPMENT

The following table describes the precincts identified in the Fitzgibbon Development Scheme with an assessment of the implications for the timing and components of future development. The precincts are detailed in Figure 4 which is Map 3 from the Fitzgibbon Development Scheme.

Table 1 – Development Precincts

Precinct	Development Capacity	Implications
Precinct 1 – A mixed-use precinct with 5 sub-precincts.	Significant remaining development capacity. This precinct is intended to be developed as a residential and mixed-use focus with a substantial amount of office, retail and related uses.	This precinct can be developed in the short to medium term with the provision of marketable residential types. Based on the types of recent residential development in the surrounding areas, these types will include; ground access dwellings and low-rise units with a high proportion of investor/rental stock. Major shifts in market acceptance will need to occur to support the development of high-intensity residential (e.g. 8 storeys) with specialised product expected to be the initial type of this form of development. The development implications will be assessed in this report.
Precinct 2 – A mixed-use and high-intensity residential precinct.	Significant remaining development capacity. This precinct is intended to be developed as a residential and mixed-use focus.	This precinct can be developed in the short to medium term with the provision of marketable residential types. Based on the types of recent residential development in the surrounding areas, these types will include; ground access dwellings and low-rise units with a high proportion of investor/rental stock. Major shifts in market acceptance will need to occur to support the development of high-intensity residential (e.g. 8 storeys) with specialised product expected to be the initial type of this form of development. The development implications will be assessed in this report.
Precinct 3 – A mixed-use precinct.	This area is largely developed and may have the capacity for future redevelopment on selected sites.	The development implications will be assessed in this report.
Precinct 4 – A large precinct with a residential and bushland focus.	Fully developed.	Not assessed as this precinct has no development capacity.
Precinct 5 – Special purpose transport.		Not assessed as this precinct has no development capacity.
Precinct 6 – Bushland and open space.	No residential or commercial development capacity.	Not assessed as this precinct has no development capacity.
Precinct 7 – Rural uses.	No additional residential or commercial development capacity.	Not assessed as this precinct has no development capacity.
Precinct 8 – EPA Lab	No additional residential or commercial development capacity.	Not assessed as this precinct has no development capacity.

Figure 4 – Fitzgibbon Urban Development Area



4 DEVELOPMENT CAPACITY REVIEW

This section provides a review of the 'Fitzgibbon Urban Development Area – Yield Analysis' prepared by the Continuum Group (CG) and dated 12 June 2018.

4.1 Review

The CG memo provides an assessment of likely development yields that will be completed in the period to 2031. The following table provides a review of the CG assessment of the development precincts. Further details are provided in Table 3.

Table 2 – Development Summery CG Memo

CG Report	RPS Response
Precinct 1 – Development of this precinct has yet to occur, and the anticipated yield assessment forms part of the CG report. Refer to Figure 5. The CG report assesses this precinct will host the following new uses by 2031: • Residential dwellings[1] -283 • Residential Units – 596 • Commercial Office 26,159 Sq M • Retail – 6,100 Sq M	The CG report has arrived at these numbers by utilising the controls in the development scheme and other assumptions (such as residential density) to produce an estimated development yield. Some of these types of built form (8 storey unit buildings at 138 dwellings/Ha) have not yet been established in the PDA and will represent a new form of local residential development. The acceptance of this form of development by potential purchasers will rely on a number of factors including the level of local amenity and services, the anticipated sale price and when the product is brought to market.
Precinct 2 – Development of this precinct has yet to occur, and the anticipated yield assessment forms part of the CG report. Refer to Figure 6. The CG report assesses this precinct will host the following new uses by 2031: • Residential Units – 308	The CG report has arrived at these numbers by utilising the controls in the development scheme and other assumptions (such as residential density) to produce an estimated development yield. Some of these types of built form (8 storey unit buildings at 138 dwellings/Ha) have not yet been established in the PDA and will represent a new form of local residential development. The acceptance of this form of development by potential purchasers will rely on a number of factors including the level of local amenity and services, the anticipated sale price and when the product is brought to market.
Precinct 3 – This precinct includes a park, townhouses, small shopping centre and a DTMR commuter car park. CG concludes the sites will not provide additional yield in the reference period due to the underlying value of retail and residential. Also, the car park is unlikely to be redeveloped.	I concur with the conclusions and analysis.

[1] This is assumed by RPS to be a combination of detached and semi-detached dwellings.

CG Report	RPS Response
Precinct 4 – this precinct is fully developed with approximately 1,150 dwellings.	I concur with the conclusions and analysis. I note the CG assessment that this area contains about 1,150 dwellings aligns closely with the 2016 census data (1,074 dwellings) and the BCC LUAD data (1,078 dwellings for the PDA).
Precinct 5 – Indicated as a future bus interchange can be developed for a number of uses (mixed use, community uses, childcare, convenience retail and service industries). CG assesses the precinct will not be developed in the reference period.	I concur with the conclusions and analysis. I consider the development trigger for this site will be the establishment of the intended transport infrastructure. The flow on development triggered by the transport infrastructure is likely to occur after 2031.
Precinct 6 – No further development is intended in this precinct.	I concur with the conclusion.
Precinct 7 – No further development is intended in this precinct.	I concur with the conclusion.
Precinct 8 – No further development is intended in this precinct.	I concur with the conclusion.

Figure 5 – Precinct 1

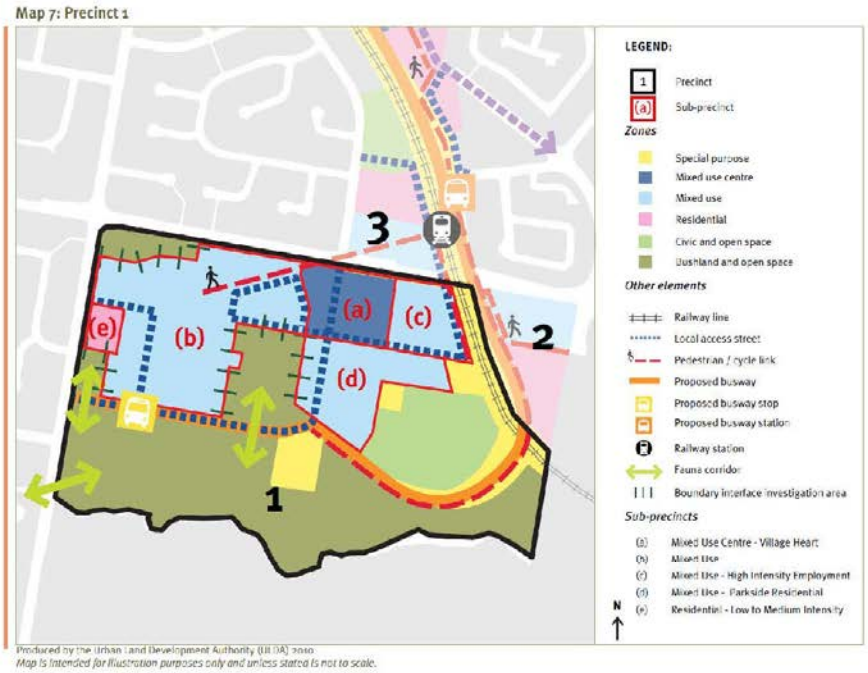


Figure 6 – Precinct 2



4.2 Conclusion

The CG report is considered to be a yield assessment based on the spatial capacity and the published development controls. This type of assessment tends to provide a maximum estimated yield that is unlikely to be delivered while generating a maximum on-site population for infrastructure and other planning purposes. While RPS agrees with much of the assessment provided by CG, there are several differences of opinion.

4.2.1 Precinct 1 - Units

It is considered that 5 and 8 storey residential buildings at densities in excess of 100 dwellings per Ha are unlikely to occur in the period to 2031 as the area lacks higher levels of amenity and services. To date, the PDA has supported a limited amount of walk-up style development, and this is expected to continue for the next 10 plus years. I do not consider the retail and commercial services in the Precinct 1 Main Street will develop to the extent assumed and I consider the market for higher intensity residential will remain minor and limited with 100 dwellings per Ha a useful measure to produce the upper limit density assumptions.

If it is intended to deliver residential densities at the rates assumed in the CG report, the timing of the development would need to be delayed until the regional residential market had evolved to a point to where 5 to 8 storey product in moderately serviced outer suburban locations becomes commonplace. Such a situation is unlikely to occur before 2031. Specialised forms of residential development (build to rent, aged care, retirement, subsidised housing) could be developed at densities greater than 100 dwellings per Ha but the total extent of these types of residential throughout BCC is expected to be relatively modest in the short to medium term.

Reducing the assumed density of units to 100 dwellings per Ha would decrease the calculated yield to about 430 units which is a significant decrease from the yield of 596 units provided in the CG report.

4.2.2 Precinct 1 - Office and Retail

The CG report assumes the core area in Precinct 1 will host 6,100 Sq M of retail and 2,000 Sq M of office space. An additional 24,000 Sq M of new office space is assumed for the area surrounding the Government offices. The development of 8,100 Sq M of retail and office space is very large for a precinct that will have up to 860 local dwellings with adjacent office space. Based on our initial assessment, RPS considers the resident and office population will support up to 1,500 Sq M of retail and office space in the core area of the precinct. It is noted that 1,500 Sq M is the scale of the current Clock Corner retail centre located on Beams Road near the Carseldine station.

Based on current shopping trends, this estimate could also prove to be overly optimistic. A larger retail and office presence in the core area (up to 8,100 Sq M) would require a major retail anchor (i.e. a full line supermarket) to commit to the site.

The assessment of further development of commercial office space in the current Government Office Precinct is beyond the scope of this review.

4.2.3 Precinct 2 - Units

The comments that relate to this precinct are the same as for the units in Precinct 1 (see above). The overall site is projected by CG to have a maximum yield of 308 units but RPS considerers that 233 units (2.33Ha at 100 dwellings per Ha) are a more reasonable assumption. The timing of development on this site is more difficult to assess as it is privately held and hosts a functional business.

5 MASTER PLAN REVIEW

This section provides a review of the Carseldine Urban Village Masterplan. The baseline information is detailed in the following figures. Table 3 provides a comparison with the CG assumptions.

Figure 7 – Carseldine Urban Village Masterplan



Figure 8 – Carseldine Urban Village Development Yield

Precinct 1: Fitzgibbon PDA Development Scheme—Proposed development yield

Carseldine Urban Village – current overall development proposal (as at 12 April 2019)

	Terrace lots	Dwellings*	Apartment lots	Apartment unit numbers	Retirement / Aged care lots	Retirement / Aged care unit number	Land subdivision construction commence	Land subdivision construction complete	Approx. commencement of use (+ 5 months from construction complete)
Stage S							Oct 2018	Aug 2019	Aug 2019
Stage 1	53	70			1	150	Sept 2018	Feb 2020	July 2020
Stage 2	81	106					Dec 2020	Apr 2021	Sept 2021
Stage 3	32	43	3	150			Feb 2022	July 2022	Dec 2022
Stage 4	27	37	1	50			Aug 2022	Nov 2022	Apr 2022
Sub-totals	**193***	**256**	**4**	**200**	**1**	**150**			
No. dwellings	**256**		**200**		**150**				
	606								

* It has been assumed that approximately 30% of the terrace lots will enable a dual occupancy development outcome

However, the **masterplan approval** establishes the following maximum development yields:

Land use	Max. yield
Residential dwellings	606 dwellings
Commercial	15,050m²
Retail	4,000m²
Childcare	100 children

5.1 Review

The Carseldine Urban Village masterplan assesses this precinct will host the following new uses by 2031:

- Residential dwellings[2] -256
- Residential units – 200
- Retirement or aged care units – 150
- Total residential dwellings - 606
- Commercial Office 15,050 Sq M
- Retail – 4,000 Sq M

5.1.1 Residential

The masterplan allows for 606 dwellings with 256 being terrace houses and 350 being a mix of general units and retirement/aged care. This mix and density are considered to be reasonably reflective of the current local residential market and is likely to be developed before 2031.

5.1.2 Commercial Office and Retail

The masterplan assesses that Precinct 1 will host over 15,000 Sq M of office space and 4,000 Sq M of retail. Refer to my comments in Section 4.2.2.

[2] This is assumed by RPS to be a combination of detached and semi-detached dwellings.

6 ANALYSIS AND RECOMMENDATIONS

The CG report and Carseldine Masterplan provide two distinct approaches with different assumption sets. The CG report is more aspirational as it is guided by the controls in the development scheme whereas the Masterplan produces a development scenario for Precinct 1 that is very likely to be delivered by the market in the short to medium term.

The key difference is that the CG report allows for residential development of up to 8 storeys with a density of 138 dwellings per Ha while the Masterplan seeks to deliver units in development parcels of 50 dwellings and a larger (150 unit) retirement aged care development. The approach adopted by the masterplan is considered to be a better fit for the anticipated market conditions over the next 5 to 10 years.

It is considered that 5 and 8 storey residential buildings at densities in excess of 100 dwellings per Ha are unlikely to occur in the period to 2031 as the area lacks higher levels of amenity and services. To date, the PDA has supported a limited amount of walk-up style development, and this is expected to continue for the next 10 plus years. I do not consider the retail and commercial services in the Precinct 1 Main Street will develop to the extent assumed and I consider the market for higher intensity residential will remain minor and limited with 100 dwellings per Ha a useful measure to produce the upper limit density assumptions.

If it is intended to deliver residential densities at the rates assumed in the CG report, the timing of the development would need to be delayed until the regional residential market had evolved to a point to where 5 to 8 storey product in moderately serviced outer suburban locations becomes commonplace. Such a situation is unlikely to occur before 2031. Specialised forms of residential development (build to rent, aged care, retirement, subsidised housing) could be developed at densities greater than 100 dwellings per Ha but the total extent of these types of residential throughout BCC is expected to be relatively modest in the short to medium term.

6.1 Recommendations

On the basis of this review, RPS recommends the following development assumptions:

- Precinct 1 Residential – 606 dwellings as per the Carseldine Masterplan.
- Precinct 2 Residential - 233 dwellings (2.33Ha at 100 dwellings per Ha).
- Precinct 1 Office and Retail – 1,500 Sq M to service the local office and resident population (refer to Section 4.2.2.
- The CG report and Carseldine Masterplan allow for 15,000 to 24,000 Sq M of new office space in the vicinity of the established Government precinct. Review of this part of the site is beyond the scope of this report.

Table 3 – Precinct 1 Comparison

Continuum Group Memo (CG)							Carseldine Urban Village Master Plan (MP)								RPS Comments
Site - per CG memo	Storeys	Residential - dwellings	Residential - Units	Commercial (Sq M)	Retail (Sq M)	Child Care (Sq M)	Stage	Terrace Lots	Dwellings	Apartment Lots	Apartments	Retirement Lots	Retirement Units	Other - All stages	
1	3	19		95			These sites are not included in the masterplan								CG assumes this precinct will develop e a size able office component with the existing office GFA (11,235 Sq M) more than tripling to 35,360 Sq M. I assume this increased is planned to occur by 2031.
2	3			6,945											
3	3			9,330											
4	5			11,235											
5	5			7,755											
6	3	62			3,964		3	32	43	3	150			Commercial - 15,505 Sq M Retail - 4,000 Sq M Childcare - 100 Children	MP has fewer dwellings (19 less) and a similar number of units (6 less) than the CG memo. As the core precinct the MP assumes this area will have 4,000 Sq M of retail which is considerably less than the 6,100 assumed in the CG memo. Assumes 364 Sq M of office.
7	5		36	64	2,136	100									
8	8		120	280											
10	8	36	60	320			2	81	106						MP has 26 more dwellings and no units. Development assumed to commence in 2021. Assumes 800 Sq M of office.
12	8	44	120	500											
9	5 and 8	36	60	320			1	53	70			1	150		MP has fewer dwellings (15 less) and a smaller number of units (60 less) than the CG memo. Assumes 850 Sq M of office.
11	8		200				4	27	37	1	50				
13	8	24		120											
14	8	62		410											
15	5			1,765			This site is not included in the masterplan								CG assumes 1,765 Sq M of office.
	Sub Total	283	596	39,159	6,100	100		193	256	4	200	1	150	Commercial - 15,505 Sq M Retail - 4,000 Sq M Childcare - 100 Children	The MP has a yield assessment that is lower than the CG assumptions for all land uses in the CUV, residential (-31% mainly units), commercial (-40%) and retail (-34%). This does not include the current office and childcare.
Total - New Uses		**283**	**596**	**26,159**	**6,100**	**0**	**Total**	**193**	**256**	**4**	**200**	**1**	**150**		

APPENDIX A – DEMOGRAPHIC PROFILE

Demographic Profile	Fitzgibbon Chase		Carseldine Station SA1		Taigum - Fitzgibbon SA2		Carseldine SA2	
Total Persons	2,502		526		12,153		9,037	
Age								
0 to 4	291	11.7%	29	5.5%	947	7.8%	547	6.1%
5 to 14	212	8.5%	58	11.1%	1,266	10.4%	914	10.1%
15 to 19	82	3.3%	33	6.3%	548	4.5%	445	4.9%
20 to 24	219	8.8%	28	5.3%	813	6.7%	545	6.0%
25 to 34	775	31.2%	66	12.6%	2,286	18.8%	1,273	14.1%
35 to 44	450	18.1%	80	15.3%	1,814	14.9%	1,147	12.7%
45 to 54	218	8.8%	79	15.1%	1,390	11.4%	1,080	12.0%
55 to 64	128	5.2%	67	12.8%	1,144	9.4%	994	11.0%
65 to 74	68	2.7%	56	10.7%	884	7.3%	910	10.1%
75 to 84	37	1.5%	21	4.0%	706	5.8%	699	7.7%
85 years and over	3	0.1%	7	1.3%	361	3.0%	476	5.3%
Language Spoken at Home								
English Only	1,292	54.1%	393	76.0%	7,864	68.6%	6,710	78.3%
Other	1,096	45.9%	124	24.0%	3,647	31.4%	1,855	21.7%
Household Structure								
Couple family with no children	267	38.5%	53	34.9%	1,257	38.6%	1,025	41.0%
Couple family with children under 15	266	38.4%	48	31.6%	1,065	32.7%	728	29.1%
Couple family with no children under 15	35	5.1%	24	15.8%	327	10.0%	363	14.5%
Couple family with children - total	313	45.2%	75	49.3%	1,394	42.8%	1,096	43.9%
One parent family with children under 15	62	8.9%	9	5.9%	269	8.3%	130	5.2%
One parent family with no children under 15	52	7.5%	14	9.2%	259	7.9%	198	7.9%
One parent family	101	14.6%	23	15.1%	525	16.1%	329	13.2%
Other family	11	1.6%	3	2.0%	75	2.3%	45	1.8%
Total Families	693		152		3,258		2,498	
Household Income								
Average Weekly - Sept 2016 $	$ 1,743		$ 1,915		$ 1,607		$ 1,924	
Average Weekly - June 2018 $	$ 1,811		$ 1,990		$ 1,670		$ 1,999	
Average Annual - Sept 2016 $	$ 90,855		$ 99,830		$ 83,768		$ 100,302	
Average Annual - June 2018 $	$ 94,417		$ 103,743		$ 87,051		$ 104,233	
Average Number of Cars	1.45		1.76		1.50		1.75	
Mortgage Repayment - Monthly								
Average Repayment - Sept 2016 $	$ 1,955.61		$ 1,955.10		$ 1,819.47		$ 2,070.00	
Average Repayment - June 2018 $	$ 2,032.27		$ 2,031.74		$ 1,890.79		$ 2,151.14	
Rent - Weekly								
Rent - Sept 2016 $	$ 345.72		$ 381.94		$ 357.88		$ 406.82	
Rent - June 2018 $	$ 359.27		$ 396.91		$ 371.91		$ 422.77	
Persons per Household								
Separate house	2.90		2.72		2.72		2.79	
Semi detached row or terrace house townhouse etc with One storey	1.74		N/A		1.74		1.63	
Semi detached row or terrace house townhouse etc with Two or more storeys	2.14		2.71		2.30		2.31	
Semi detached row or terrace house townhouse etc with Total	2.08		2.43		2.09		2.08	
Flat or apartment In a one or two storey block	N/A		N/A		1.57		1.56	
Flat or apartment In a three storey block	N/A		N/A		2.33		N/A	
Flat or apartment In a four or more storey block	1.45		N/A		1.45		1.21	
Flat or apartment Attached to a house	N/A		N/A		N/A		N/A	
Flat or apartment Total	1.45		N/A		1.52		1.47	
Other dwelling Caravan	N/A		N/A		N/A		N/A	
Other dwelling Cabin houseboat	N/A		N/A		N/A		N/A	
Other dwelling Improvised home tent sleepers out Dwellings	N/A		N/A		N/A		N/A	
Other dwelling House or flat attached to a shop office etc Dwellings	N/A		N/A		N/A		N/A	
Other dwelling Total Dwellings	N/A		N/A		N/A		N/A	
Dwelling structure not stated	2.21		N/A		2.05		2.43	
Total Dwellings	2.43		2.60		2.44		2.58	
Dwelling Structure								
Separate house	545	54.7%	176	89.3%	2,776	58.5%	2,396	79.5%
Semi detached row or terrace house townhouse etc with One storey	126	12.7%	0	0.0%	655	13.8%	278	9.5%
Semi detached row or terrace house townhouse etc with Two or more storeys	264	26.5%	17	8.6%	1,107	23.3%	485	14.9%
Semi detached row or terrace house townhouse etc with Total	376	37.8%	21	10.7%	1,764	37.2%	757	23.2%
Flat or apartment In a one or two storey block	0	0.0%	0	0.0%	90	1.9%	32	1.0%
Flat or apartment In a three storey block	0	0.0%	0	0.0%	15	0.3%	0	0.0%
Flat or apartment In a four or more storey block	56	5.6%	0	0.0%	56	1.2%	71	2.2%
Flat or apartment Attached to a house	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Flat or apartment Total	56	5.6%	0	0.0%	166	3.5%	99	3.0%
Other dwelling Caravan	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other dwelling Cabin houseboat	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other dwelling Improvised home tent sleepers out Dwellings	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other dwelling House or flat attached to a shop office etc Dwellings	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other dwelling Total Dwellings	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Dwelling structure not stated	19	1.9%	0	0.0%	39	0.8%	7	0.2%
Total Occupied Dwellings	996	100.0%	197	100.0%	4,745	100.0%	3,259	100.0%
Occupied private dwellings	996	92.7%	197	92.1%	4,745	94.1%	3,259	93.8%
Unoccupied private dwellings	75	7.0%	15	7.0%	295	5.9%	219	6.3%
Total private dwellings	1,074		214		5,042		3,476	
Dwelling Ownership								
Fully owned	65	6.6%	81	40.3%	1,182	24.9%	1,171	36.0%
Being purchased directly	497	50.1%	59	29.4%	1,721	36.3%	1,019	31.3%
Rented	417	42.0%	47	23.4%	1,683	35.5%	927	28.5%
Other Tenure	4	0.4%	3	1.5%	59	1.2%	73	2.2%
Not Stated	24	2.4%	4	2.0%	103	2.2%	66	2.0%
Total	992		201		4,742		3,257	

Appendix C – Trunk water and wastewater infrastructure assessment technical memorandum

TECHNICAL MEMO

Date:	Monday, 12 August 2019
To:	John Drobec – Principal Project Officer – Economic Development Queensland
From:	Tobias Chalmers – Senior Engineer, Calibre Professional Services Pty Ltd
SUBJECT:	FITZGIBBON PRIORITY DEVELOPMENT AREA – TRUNK WATER & WASTEWATER INFRASTRUCTURE ASSESSMENT

1 INTRODUCTION

Calibre Professional Services Pty Ltd have been engaged by Economic Development Queensland (EDQ) to undertake trunk water and wastewater infrastructure assessment in support of the Fitzgibbon Priority Development Area (PDA). The Fitzgibbon PDA is located within the Brisbane City Council (BCC) local government area with Queensland Urban Utilities (QUU) the responsible distributor-retailer water authority.

This technical memorandum has been prepared to assess the impact that revised development yields will have on trunk water and wastewater infrastructure servicing the PDA.

1.1 Site Description

The PDA is located approximately 12 kilometres from the Brisbane CBD and covers 295-hectares of land in the northern suburbs of Fitzgibbon, Carseldine, Bald Hills, Taigum and Deagon. The Fitzgibbon PDA is bounded primarily by; the Aspley School district to the south, Telegraph Road to the north, and the Gateway Motorway to the east.

To date, over 1,000 dwellings have been delivered in the Fitzgibbon Chase development, which is now complete. This development covered Precinct 4 as noted in the Precinct Location Plan below.

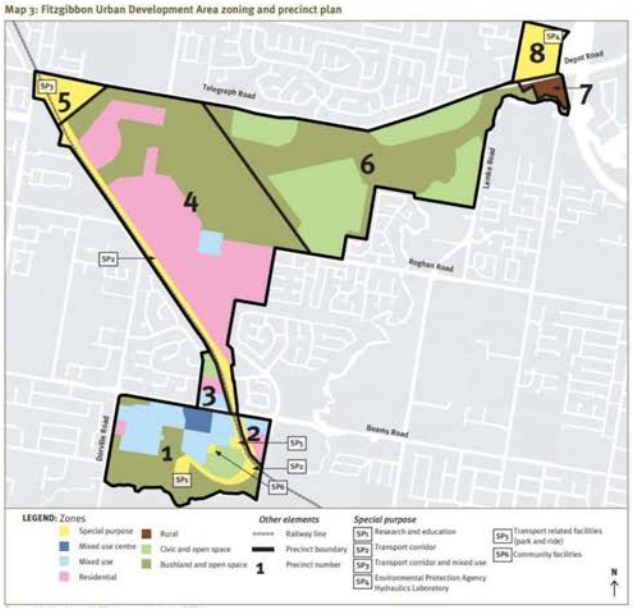


Figure 1-1 – Fitzgibbon PDA Zoning & Precinct Plan *(Source: Fitzgibbon PDA Yield Analysis Review, RPS 2019)*

Precinct 1 and 2 are the focus of this investigation. As illustrated in Figure *1-1*, Precincts 1 and 2 are in the south western corner of the PDA and consist primarily of mixed use, special use and residential land use.

1.2 Background

As part of the initial PDA investigation, a QUU Service Advice Notice (SAN) was issued on 2 March 2017 which provided preliminary advice on available network capacity (Refer Attachment 1). The SAN indicated that the existing water and wastewater network had sufficient capacity to service the proposed development, which at the time of submission consisted of 900 residential dwellings and 70,000m^2 GFA of commercial and community land use.

In support of the proposed Precinct 1 development an Engineering Services Report (ESR) was prepared by Calibre (Ref: 15-003002-WER02, dated August 2017). In June 2018 the ESR was revised to capture the latest proposed layout and development yield which had an ultimate demand of 1,869 Equivalent Population (EP) for water and wastewater. Precinct 2 was not included in this previous investigation.

2 ASSUMPTIONS

The following assumptions has been adopted for this trunk water and wastewater infrastructure assessment:

- Precinct 1 and Precinct 2 development yields remain consistent with those described in the Fitzgibbon PDA Yield Analysis Review (RPS, 2019) and Fitzgibbon Transport Planning Yields included in Attachment 2 (EDQ, 2019).
- Network planning has been undertaken in accordance with the South East Queensland Water Supply and Sewerage Design and Construction Code (SEQ Code).
- Previous QUU SAN is an indication of network capacity only and requires updated advice to verify available capacity with consideration.

3 POPULATION PROJECTIONS

The equivalent population for Precinct 1 and 2 has been estimated in accordance with the South East Queensland Water Supply and Sewerage Design & Construction Code (SEQ Code). Development yields were based on the dwellings and GFAs provided by EDQ (Refer Attachment 2). The population projection for Precinct 1 and 2 is outlined in Table 1.

Table 1: Precinct 1 Development Projection

Development Type	Precinct 1		Precinct 2		Sub-Total	
	Yield	EP	Yield	EP	Yield	EP
Detached Dwelling	256	678.4	0	0.0	256	678.4
Attached Dwelling	350	626.5	233	417.1	583	1043.6
Retail (GFA m^2)	4,000	24	0	0.0	4,000	24
Commercial (GFA m^2)	15,050	90	0	0.0	15,050	90
		Total EP				**1,836**

Precinct 1 and 2 have a total projected demand of 1,836 EP. This is an overall reduction of 33 EP from demands previously assessed (1,869 EP) as part of the ESR produced by Calibre for Precinct 1.

4 SERVICES

Development demands for Precinct 1 and 2 are 138 EP lower than what was previously estimates for Precinct 1. Although demands have reduced for Precinct 1 and 2, development within the region has progressed and subsequently used some of the available capacity within the trunk network. An updated SAN request has therefore been lodged with QUU to define the available network capacity and determine if Precinct 1 and 2 can be serviced by existing trunk infrastructure.

4.1 Water Network

The sites are currently supplied via existing connections to the following QUU infrastructure:

- DN300 MPVC water main along Beams Road;
- DN300 DI water main along Beams Road; and
- DN150 AC water main along Dorville Road.

The existing external infrastructure is outlined on SK001 enclosed within Attachment 3.

As per previous QUU advice discussed in Section 1.2 and provided in Attachment 1, it is expected that there is available capacity to service the development from the DN300 water mains.

4.2 Wastewater Network

The sites are currently over two different catchment areas, which will allow discharge to surrounding trunk mains adjacent to the site:

- Precinct 1 discharging to DN900 Concrete Reinforced gravity main adjacent to Cabbage Tree Creek; and
- Precinct 2 discharging to DN300 Vitrified Clay gravity main adjacent Beams Road.

The existing external infrastructure is outlined on SK002 enclosed within Attachment 4.

As per previous QUU advice discussed in Section 1.2, it is expected that there is available capacity to service each precinct at the proposed discharge locations.

4.3 QUU Service Advice

Existing network capacity information was obtained for QUU through the SAN process. The SAN provided by QUU dated 5 August 2019, enclosed within Attachment 1.

QUU have determined that there is sufficient capacity within the existing water supply network to service the development under peak hour and fire flow conditions.

Additionally, QUU also completed a hydraulic assessment of the wastewater network servicing the site under peak wet weather flow (PWWF) conditions. The assessment indicated that the trunk wastewater gravity mains at the proposed connection locations along Cabbage Tree Creek and in Beams Road have sufficient capacity to service the proposed development.

5 CONCLUSION

Investigation of the water and wastewater servicing strategies for Precinct 1 and 2 reached the following conclusions:

- Precinct 1 has a total projected demand of 1419.2 EP;
- Precinct 2 has a total projected demand of 417.1 EP;
- The total demand for Precinct 1 and 2 is 33 EP lower than previous estimates for Precinct 1 as detailed in the ESR prepared by Calibre in June 2018;
- The QUU SAN issued in March 2017 indicated that the trunk network had sufficient capacity to service the Fitzgibbon PDA; and
- The latest QUU SAN Advice maintains previous advice that there is sufficient capacity to service the Precincts 1 and 2.

If you have any enquiries, please do not hesitate to contact Joshua Goman or the undersigned on (07) 3895 3444.

Yours Sincerely
Calibre Professional Services

Tobias Chalmers
Senior Engineer – Water & Environment

DRAFT

Attachment 1: QUU SAN – March 2017 and August 2019
Attachment 2: Fitzgibbon PDA Transport Yield Planning
Attachment 3: SK001 – Water Infrastructure
Attachment 4: SK002 – Wastewater Infrastructure

DRAFT

ATTACHMENT 1A

Queensland Urban Utilities
GPO Box 2765
BRISBANE QLD 4001
Phone: 07 3432 2200 or 13 26 57
www.urbanutilities.com.au/development-services

2nd March 2017

Mr Joshua Goman
Calibre Consulting
545 Queen Street
Brisbane QLD 4000

Via Email: Joshua.goman@calibreconsulting.co

Dear Mr Goman,

Queensland Urban Utilities Services Advice Notice:

QUU Application Number:	17-SRV-25519
Applicant Name:	Calibre Consulting
Street Address:	490, 511, 521 and 532 Beams Road, and 11, 15, 19, 1/21 and 21 Balcara Avenue, Carseldine
Real Property Description:	Lot 4 on RP80282, Lot 404 on SL12120, Lot 0 on BUP7414, Lot 322 on SP172124, Lot 0 on GTP 1964, Lot 0 on GTP1817, Lot 0 GTP1760 , Lot 4 on RP77418 and Lot 405 on SL12121.

Proposed service connection/alteration/disconnection type:

Drinking water	☑
Non-drinking water	☐
Wastewater	☑

Queensland Urban Utilities provides this Services Advice Notice in response to the request received on **6th February 2017**. In accordance with section 99BRAC(3) of the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009,* this Services Advice Notice provides advice about the proposed connection having regard to the connections policy in the Queensland Urban Utilities Water Netserv Plan, the charges and conditions that may apply to the connection and other relevant matters about the connection. All terms used in this Services Advice Notice are defined by reference to the Queensland Urban Utilities Water Netserv Plan.

This Services Advice Notice does not constitute an application for connection, is not an approval to connect to the Queensland Urban Utilities network(s) and does not bind any future Queensland Urban Utilities' decision if the applicant applies for a connection.

Queensland Urban Utilities understands that the proposed development will consist of 900 residential dwellings and 70,000m^2 GFA of commercial and community use. As per the request for a Service Advice Notice submitted, a **material change of use** will be applied for as part of this development.

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Based on your proposal and discussion with Queensland Urban Utilities officers, the following advice is provided:

Queensland Urban Utilities Services Advice

Infrastructure and Design

Water

The sites are serviced by the property connections from the following water mains:

- 532 Beams Road is serviced via the 300mm diameter mPVC water main on the far side of Beams Road;
- 490 Beams Road is serviced via the 300mm diameter ductile iron water main on the far side of Beams Road; and
- 521, 11, 15, 19 and 21 Balcara Avenue is serviced via the 225mm diameter ductile iron water main on the near side of Balcara Avenue.

There is also a 410mm diameter mild steel trunk water main which traverses the southern end of 532 Beams Road and onto Dorville Road.

Wastewater

The sites are serviced by property connections to the following wastewater catchments:

Northern catchment

- Properties to the north of the subject site (and west of Balcara Avenue) discharge eastwards and into the 225mm diameter wastewater main in Balcara Avenue.
- Flows from this wastewater main are discharged into manhole MH36964 and into the Balcara Ave Sewer Pump Station (SP217).
- Flow from the Balcara Ave Sewer Pump Station is discharged into manhole MH37153 at the intersection of Beams Road Balcara Avenue, and east via the 225mm diameter gravity trunk wastewater main on the south side of Beams Road (known as the Carseldine Branch sewer).
- Flows from the Carseldine Branch sewer are subsequently discharged into the 1050mm diameter Cabbage Tree Creek trunk wastewater main.

Southern catchment

- The subject site can also be serviced by the Cabbage Tree Creek trunk sewer network, which flows from west to east along the northern bank Cabbage Tree Creek and encumbers part of the subject site.

Note that the water and wastewater infrastructure required for the proposed development is to be provided in accordance with QUU requirements, including but not limited to, the *SEQ Water Supply and Sewerage Design and Construction Code* (SEQ WS&S D&C Code, 2013), or current equivalent. Easements will be sought for existing trunk assets contained within private land and not already protected by an easement.

Network Demand and Capacity

Water

An assessment of the water supply available at the site, including computational hydraulic modelling of the network under peak demand and fire flow conditions, has been completed.

The analysis assumes a Peak Hour Demand of 28.7 L/s (corresponding to the details of the proposed development).

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The assessment indicates that the existing water supply has sufficient capacity to service the proposed development in accordance with the *SEQ Water Supply and Sewerage Design and Construction Code, 2013 (SEQ WS&S D&C Code).*

Indicative flow and pressure advice for the existing 300mm diameter water main on Beams Road is provided in Table 1, below.

Table 1: Indicative Flow and Pressure Advice

Assumed Connection Main	Estimated RL Connection (m AHD)	Hydraulic Grade Line (m AHD)			Pressure (kPa) [1]		
		0 L/s	10 L/s	20 L/s	0 L/s	10 L/s	20 L/s
300mm (mPVC) main as constructed in 2015	17.6	63.0	62.3	61.6	445	439	432

Notes: [1] Modelled pressure in supply main, relative to the estimated connection RL (m AHD).

[2] Designers are required to adjust the Hydraulic Grade Line/Pressure model results for site/building RL differences and calculate the extra hydraulic losses from point of connection with the main.

[3] Field performance of cast iron spun or cement lined mains can be variable. Field testing to ascertain actual pressure drops may be advisable.

Disclaimer

Information provided by Queensland Urban Utilities is based on hydraulic modelling ("Hydraulic Modelling Information"). Model results are for the anticipated performance. ***The Hydraulic Modelling Information has not been verified by field measurements and may be inaccurate due to field conditions.***

As such, users relying on Hydraulic Modelling Information do so at their own risk and should make their own independent investigations to verify model outputs.

The Hydraulic Modelling Information does not state nor imply a guaranteed level of service. Designers are referred to Queensland Urban Utilities' Customer Charter and Customer Service Standards for facility hydraulic service considerations. ***Queensland Urban Utilities does not provide a service of minimum flows and pressures to private fire-fighting systems.***

Due to changing operational circumstances, pressure and flows delivered to a service may vary. Designers are advised to make adequate provisions within the fire system installation for the pressure, flow and reliability requirements, for the life of the system.

Wastewater

A hydraulic assessment of the sewerage network servicing the site under peak wet weather flow conditions has been completed.

The analysis assumes a Peak Wet Weather Flow from the development of 36.09 L/s (corresponding to the details of the proposed development).

The assessment indicates that the Carseldine Branch sewer and Cabbage Tree Creek trunk sewers have sufficient capacity to service the proposed development.

Note that a portion of the proposed development area north of Beams Road may need to discharge into the gravity sewer catchment upstream of the Balcara Avenue pump station (SP217). At a preliminary planning stage, it is not known what extent of the development will discharge into this catchment.

- A further assessment of the pump station will be required to confirm that it has sufficient capacity to service the develop precinct which cannot discharge directly into the Carseldine Branch sewer (once the extent of this development area is known).

(Where existing sewer property connections are to be retained) - reuse of an existing property connection must be endorsed and signed off by a Registered Professional Engineer of Queensland (RPEQ). Where investigations determine that a property connection cannot be reused, a new

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connection will be required. Queensland Urban Utilities recommends that investigations be undertaken as soon as practical in order to avoid delays at the end of the project.

Land and Easements

Sewer Main in Private Properties
Please refer to following link for easement requirements:
http://www.urbanutilities.com.au/development-services/our-services/building

Water Main in Private Properties
Please refer to table 5.2 and clause 5.4.4 of *SEQ WS&S D&C Code* for easement requirements.

Infrastructure Integration

No infrastructure integration is required in this instance.

Contributed Assets

No contributing assets are required in this instance.

Infrastructure Charges (as at 1 July 2016)

Infrastructure Charges will be levied in accordance with the Queensland Urban Utilities' Water Netserv Plan (Part A) Charges Schedule applicable at the time the water approval application is lodged.

The following infrastructure charges for water supply and Wastewater infrastructure would apply to the proposed development under the current version of Netserv:

Water
$3,300 per 1 or 2 bedroom dwelling (refer to charges schedule)
$4,620 per 3 bedroom dwelling (refer to charges schedule)
$12 per demand unit commercial (refer to charges schedule)

Wastewater
$6,700 per 1 or 2 bedroom dwelling (refer to charges schedule)
$9,380 per 3 bedroom dwelling (refer to charges schedule)
$24 per demand unit commercial (refer to charges schedule)

Trade Waste

The **proposed development** the subject of this Services Advice Notice has been identified as a potential generator of Trade Waste. Trade Waste is water-borne waste from business, trade or manufacturing premises excluding domestic sewerage, stormwater, and prohibited substances. It is an offence under section 193(1) of the ***Water Supply (Safety and Reliability) Act 2008*** to discharge trade waste into Queensland Urban Utilities' infrastructure without a Trade Waste Approval.

To obtain a Trade Waste Approval, the proponent for the proposed development must submit an application to Queensland Urban Utilities, who will assess and decide the application. Any Trade Waste Approval granted by Queensland Urban Utilities will be subject to Trade Waste Approval conditions and the Queensland Urban Utilities Trade Waste Environmental Management Plan (**TWEMP**).

The TWEMP and an online application form are available on the Queensland Urban Utilities website:

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www.urbanutilities.com.au/business/business-services/trade-waste
For advice on the suitability of waste for discharge to sewer, and likely Trade Waste Approval conditions, you may contact Queensland Urban Utilities Trade Waste section on **13 26 57**.

Proposed trade waste drainage solutions will be assessed for compliance with plumbing and drainage regulations and the requirements of the TWEMP at the time of plumbing compliance assessment. Proposed trade waste solutions that do not meet the requirements in the TWEMP and plumbing and drainage regulations may result in delays to the plumbing compliance process and the issue of a Trade Waste Approval.

Further information is available at the following website:
https://www.urbanutilities.com.au/business/business-services/trade-waste

Connection Application Process

Based on the information provided, it is expected that the following applications will be required to assess the ability to connect to Queensland Urban Utilities networks:

1. Network and/or Property Service Connection – Major Works
The Water Approval will require connection works to be undertaken. You will be able to choose which consultants and contractors to appoint to design and construct the works, including live works (in most cases) and then maintain the works for a specified period (usually 12 months) in accordance with the conditions stated in your Water Approval.

Please note that the information provided within this section is subject to the specific aspects of the development and water application.

Fees and Charges

Queensland Urban Utilities fees and charges are stated in the Queensland Urban Utilities' Water Netserv Plan (Part A) Charges Schedule. The fees and charges that are likely to be associated with these applications are outlined below:

1. Application Phase
Base Application Fee – Property Services Connection $574 (per connection / disconnection / alteration)
Technical Report Review Fee $567 (per report)

2. Design, Construction and Maintenance Phases
Design Approval Fee (reticulation)
Property Service Connection Fee $2,006 (per connection / disconnection / alteration)

Re-checking Amended Plans Fee
Re-checking Amended Plans Fee $567 per plan

Works Inspection Fee (reticulation)
Works Inspection Fee Type A $344 (per inspection)
Works Re-inspection Fee Type A $516 (per inspection)

Notes:
1. The customer may incur additional fees and charges during the approval and works phase, including but not limited to, fees levied by the RPEQ and construction contractor, fees associated with the provision of maintenance / uncompleted works bond(s), re-checking amended plans fees, re-inspection of works fees and infrastructure agreement preparation fees;

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2. The above estimates are indicative only and are subject to review of the detailed application upon lodgement; and
3. Please refer to the QUU *Water Netserv Plan* - for further details / clarifications on Fees and Charges.

Time Frames for Assessment

Connection Assessments (for applications other than Standard Connection)
To be completed within 20 business days of receipt of Properly Made Connection Application (including payment of the relevant assessment fee), or within a further 20 business days of receipt of requested information (unless extended by agreement).

Design Phase
Typically for an application classified as **major works**, the assessment of the design phase is to be completed within 20 business days of receipt of all designs.

Other Guidance

A Build Over Assets application (BOA) is required for this application based on the information supplied by the applicant.

This *Services Advice Notice* is current for a period of two (2) years from the date of issue. Should you wish to proceed with applying for a service connection please lodge your application via Queensland Urban Utilities Development Services Online Lodgement Portal at **http://www.urbanutilities.com.au/development-services**. Please include your Services Advice Notice reference number in your application.

Queensland Urban Utilities may, at its discretion, provide a reduced fee for a service connection application based on this Services Advice Notice if your application is received within 12 months of the date of issue and is substantially in accordance with the proposal upon which this advice was issued.

If you have any questions in relation to this Service Advice Notice, please do not hesitate to contact your account manager, Samantha Yeh, on 07 3855 6678 or Samantha.yeh@urbanutilities.com.au.

Alternatively, please email DCMTenquiries@urbanutilities.com.au.

Yours sincerely

Toby Turner
Senior Engineer
Queensland Urban Utilities

ABN 86 673 835 011

ATTACHMENT 1B

Queensland Urban Utilities
GPO Box 2765
BRISBANE QLD 4001
Phone: 07 3432 2200 or 13 26 57
www.urbanutilities.com.au/development-services

5th August 2019

Economic Development Queensland
c/- Calibre Consulting
545 Queen Street
Brisbane Qld 4000

Via Email: joshua.goman@calibreconsulting.com

Dear Sir/Madam,

Queensland Urban Utilities Services Advice Notice

QUU Application Number:	19-SRV-41287
Applicant Name:	Economic Development Queensland c/- Calibre Consulting
Street Address:	490 Beams Road, Fitzgibbon Qld 4018; 532 Beams Road, Carseldine Qld 4034
Real Property Description:	Lot 4 on RP80282; Lot 322 on SP172124

Proposed service connection/alteration/disconnection type:

Drinking water	☑
Non-drinking water	☐
Wastewater	☑

Queensland Urban Utilities provides this Services Advice Notice in response to the request received on 12th July 2019. In accordance with section 99BRAC(3) of the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009,* this Services Advice Notice provides advice about the proposed connection having regard to the connections policy in the Queensland Urban Utilities Water Netserv Plan, the charges and conditions that may apply to the connection and other relevant matters about the connection. All terms used in this Services Advice Notice are defined by reference to the Queensland Urban Utilities Water Netserv Plan.

This Services Advice Notice does not constitute an application for connection, is not an approval to connect to the Queensland Urban Utilities network(s) and does not bind any future Queensland Urban Utilities' decision if the applicant applies for a connection.

Queensland Urban Utilities understands that the proposed development will consist of a mixed used but predominately residential development in two precincts. **Precinct A** (Lot 322 on SP172124) will comprise 256 detached dwellings, 350 attached dwellings; 4,000m^2 GFA of retail space and 15,050m^2 GFA of commercial space. **Precinct B** (Lot 4 on RP80282) will comprise 233 attached dwellings (EP predictions provided by Calibre Consulting 1st August 2019). As per the

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request for a Service Advice Notice submitted, a material change of use will be applied for as part of this development.

Based on your proposal and discussion with Queensland Urban Utilities officers, the following advice is provided:

Queensland Urban Utilities Services Advice

Infrastructure and Design

The project site is within the Fitzgibbon Priority Development Area (PDA). Development applications for priority development areas are assessed by Economic Development Queensland (EDQ).

The infrastructure funding framework within each PDA is also prescribed and managed by EDQ under an Infrastructure Charges Offset Plan (ICOP). The developer should review the current ICOP and development scheme to understand the broader infrastructure obligations specific to this site.

Water

QUU records indicate that the sites are serviced by property connections from the following water mains:

- 532 Beams Road is serviced via the 410mm diameter mild steel water main in Dorville Road (constructed in 1976);
- 490 Beams Road is serviced via the 300mm diameter ductile iron water main on the far side of Beams Road (constructed in 1992).

The 410mm diameter mild steel trunk water main traverses the southern end of 532 Beams Road and runs north-south along Dorville Road.



Figure 1: Existing infrastructure within the vicinity of the subject site

General Enquiries 13 26 57 | Faults and Emergencies 13 23 64 | www.urbanutilities.com.au

ABN 86 673 835 011

The two precincts are located in two different District Metered Areas (DMA) or water management zones, separated by a boundary valve located on the corner of Balcara Avenue and Beams Road (Figure 3). The water servicing arrangement for the development must avoid creating a cross-connection between the two District Metered Areas.

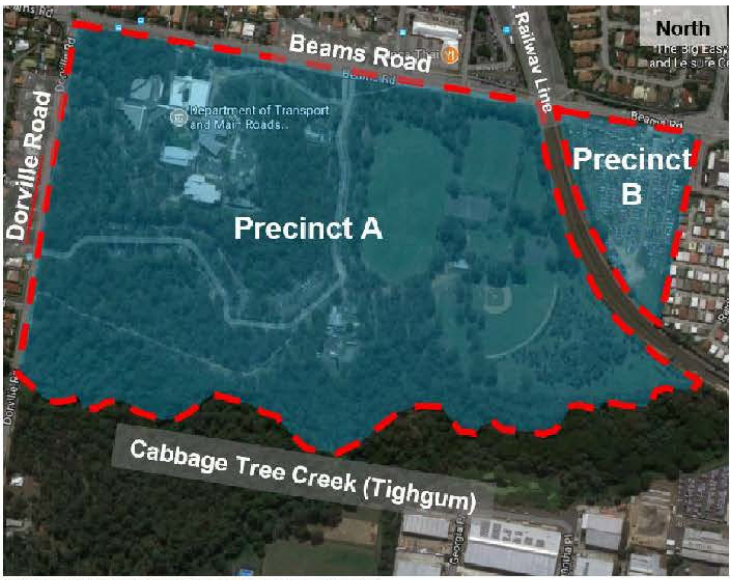


Figure 2: Precincts A and B (defined by the Applicant)



Figure 3: District Metered Areas (DMAs) distinguished by differing coloured shading

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Before endorsing a water servicing arrangement, Queensland Urban Utilities must be informed of the final development details including:

- Ownership of proposed roads within the development (private or future council)
- Whether proposed lots are freehold or under community title scheme
- Whether there will be multiple community title schemes registered within the site.

These details will influence the required water reticulation layout and location of water meters.

Based on the information provided by the applicant, QUU understand the Precinct A will be serviced by connection to both the 300mm diameter MPVC main in Beams Road to the 150mm diameter AC main in Dorville Road, with an internal water main following the alignment of a new road within the site. This general arrangement is acceptable to QUU noting the following:

- The connection to the 300mm diameter main in Beams Road must be made west of boundary valve RV400273 to ensure the development remains in the Carseldine DMA zone.
- The proposed road must be council owned (not private)
- Redundant water connections must be removed.

Precinct B will be serviced by a new connection to the 300mm diameter ductile iron located on the opposite side Beams Road.

Wastewater

QUU records indicate that 490 Beams Road (Lot 4 on RP80282) is not currently connected to the sewer network. A 300mm diameter vitrified clay trunk main traverses the site along the northern property boundary (constructed in 1984).

The existing sewer connection point for 532 Beams Road (Lot 322 on SP172124) is not clear in QUU mapping; however it is expected that the site is serviced by the 825mm diameter trunk main which traverses the southern section of the site adjacent to Cabbage Tree Creek (constructed in 1987) – Refer Figure 1.

Flows from the two trunk mains discharge into the 1050mm diameter Cabbage Tree Creek trunk sewer main in Beams Road and subsequently downstream to Sandgate Treatment Plant.

- Precinct A will be serviced by the existing 825mm diameter trunk main located along the southern site boundary. QUU has already accepted the design for the proposed DN250 PE sewer reticulation extending from the proposed sports field area to existing trunk manhole MH37144 (QUU application 19-PNT-38648).
- Precinct B will be serviced by a new connection to the 300mm diameter trunk infrastructure in located within the site along the Beams Road boundary (either existing manhole MH37193 or MH37174). Direct property connections to trunk sewer manholes are not preferred by QUU. Instead, a short section of sewer reticulation and new maintenance structure will be required.

Note that the water and wastewater infrastructure required for the proposed development is to be provided in accordance with QUU requirements, including but not limited to, the SEQ Water Supply and Sewerage Design and Construction Code (SEQ WS&S D&C Code, 2013), or current equivalent. Easements will be sought for existing trunk assets contained within private land and not already protected by an easement.

Network Demand and Capacity

Water

An assessment of the water supply available at the site, including computational hydraulic

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modelling of the network under peak demand and fire flow conditions, has been completed.

The analysis assumes a Peak Hour Demand of 17.16 L/s for Precinct A and 5.04 L/s for Precinct B (corresponding to the details EP calculations provided by the applicant 1st August 2019).

The assessment indicates that the existing water supply has sufficient capacity to service the proposed development in accordance with the *SEQ Water Supply and Sewerage Design and Construction Code, 2013 (SEQ WS&S D&C Code).*

Indicative flow and pressure advice for the existing mains surrounding the site is provided in Table 1, below.

Table 1: Indicative Flow and Pressure Advice

Assumed Connection Main	Estimated RL Connection (m AHD)	Hydraulic Grade Line (m AHD)			Pressure (kPa) [1]		
		0 L/s	10 L/s	20 L/s	0 L/s	10 L/s	20 L/s
300mm (MPVC) constructed in 2015 in Beams Rd west of Balcara Av	13.61	64.8	64.5	63.9	503	499	493
300mm (ductile iron) constructed in 1992 in Beams Rd east of railway line	12.87	47.9	47.9	47.7	344	343	342
150mm (asbestos cement) constructed in 1985 in Dorville Street	21	64.9	64.5	63.9	430	427	420

Notes: [1] Modelled pressure in supply main, relative to the estimated connection RL (m AHD).

[2] Designers are required to adjust the Hydraulic Grade Line/Pressure model results for site/building RL differences and calculate the extra hydraulic losses from point of connection with the main.

[3] Field performance of cast iron spun (or cement) lined mains can be variable. Field testing to ascertain actual pressure drops may be advisable.

[4] Indicative flow and pressure results assume a background demand of 2/3 Peak Hour has been applied throughout the network.

Disclaimer

Information provided by Queensland Urban Utilities is based on hydraulic modelling ("Hydraulic Modelling Information"). Model results are for the anticipated performance. ***The Hydraulic Modelling Information has not been verified by field measurements and may be inaccurate due to field conditions.***

As such, users relying on Hydraulic Modelling Information do so at their own risk and should make their own independent investigations to verify model outputs.

The Hydraulic Modelling Information does not state nor imply a guaranteed level of service. Designers are referred to Queensland Urban Utilities' Customer Charter and Customer Service Standards for facility hydraulic service considerations. ***Queensland Urban Utilities does not provide a service of minimum flows and pressures to private fire-fighting systems.***

Due to changing operational circumstances, pressure and flows delivered to a service may vary. Designers are advised to make adequate provisions within the fire system installation for the pressure, flow and reliability requirements, for the life of the system.

Wastewater

A hydraulic assessment of the sewerage network servicing the site under peak wet weather flow conditions has been completed.

The analysis assumes a Peak Wet Weather Flow from the development of 18.97 L/s for Precinct A and 5.58 L/s for Precinct B (corresponding to the details EP calculations provided by the applicant 1st August 2019).

ABN 86 673 835 011

The assessment indicates that the localised trunk gravity mains within the site along Cabbage Tree Creek and in Beams Road have sufficient capacity to service the proposed development.

Land and Easements

Sewer Main in Private Properties
Please refer to following link for easement requirements:
https://www.urbanutilities.com.au/development/our-services/easements

Water Main in Private Properties
Please refer to table 5.2 and clause 5.4.4 of *SEQ WS&S D&C Code* for easement requirements.

Infrastructure Integration

No infrastructure integration is required in this instance.

Contributed Assets

No contributing assets are required in this instance.

Trade Waste

The **proposed development** (the subject of this Services Advice Notice) has been identified as a potential generator of Trade Waste. Trade Waste is water-borne waste from business, trade or manufacturing premises excluding domestic sewerage, stormwater, and prohibited substances. It is an offence under section 193(1) of the ***Water Supply (Safety and Reliability) Act 2008*** to discharge trade waste into Queensland Urban Utilities' infrastructure without a Trade Waste Approval.

To obtain a Trade Waste Approval, the proponent for the proposed development must submit an application to Queensland Urban Utilities, who will assess and decide the application. Any Trade Waste Approval granted by Queensland Urban Utilities will be subject to Trade Waste Approval conditions and the Queensland Urban Utilities Trade Waste Environmental Management Plan (**TWEMP**).

The TWEMP and an online application form are available on the Queensland Urban Utilities website: **www.urbanutilities.com.au/business/business-services/trade-waste**

For advice on the suitability of waste for discharge to sewer, and likely Trade Waste Approval conditions, you may contact Queensland Urban Utilities Trade Waste section on **13 26 57**.

Proposed trade waste drainage solutions will be assessed for compliance with plumbing and drainage regulations and the requirements of the TWEMP at the time of plumbing compliance assessment. Proposed trade waste solutions that do not meet the requirements in the TWEMP and plumbing and drainage regulations may result in delays to the plumbing compliance process and the issue of a Trade Waste Approval.

Further information is available at the following website:
https://www.urbanutilities.com.au/business/business-services/trade-waste

Connection Application Process

A formal assessment as to whether your application qualifies as a Standard Connection, Minor Works Approval, or Major Works Approval will be resolved on application for a Water Approval. For the purposes of preliminary advice, and based on the information provided, it is expected that the following applications will be required to assess the ability to connect to Queensland Urban Utilities networks:

ABN 86 673 835 011

1. Network and/or Property Service Connection – Major Works

The Water Approval will require connection works to be undertaken. You will be able to choose which consultants and contractors to appoint to design and construct the works, including live works (in most cases) and then maintain the works for a specified period (usually 12 months) in accordance with the conditions stated in your Water Approval.

Please note that the information provided within this section is subject to the specific aspects of the development and water application.

Fees and Charges

Queensland Urban Utilities fees and charges are stated in the Queensland Urban Utilities' Water Netserv Plan (Part A) Charges Schedule. The fees and charges that are likely to be associated with these applications are outlined below:

1. Application Phase

Base Application Fee – Network (over 50 lots) $2,016 (per service)

2. Design, Construction and Maintenance Phases

Audit and Compliance Fee – Major Works $732 (per service)

Design Approval Fee - Reticulation

Network Connection (over 50 lots) $2,728 (per service)

Design Approval – Network Connection Complex Asset

Design Approval – complex asset $182 per hour (price on application)

Re-checking Amended Plans Fee

Re-checking Amended Plans Fee $450 (per plan page, technical report or other document)

Works Inspection Fee - Reticulation

Works Inspection Fee - Reticulation $365 (per inspection)
Works Re-inspection Fee - Reticulation $547 (per inspection)

Works Inspection Fee – Complex Asset

Works Inspection Fee – Complex Asset $547 (per inspection)
Works Re-Inspection Fee – Complex Asset $822 (per inspection)

Notes:

1. The customer may incur additional fees and charges during the approval and works phase, including but not limited to, fees levied by the RPEQ and construction contractor, fees associated with the provision of maintenance / uncompleted works bond(s), re-checking amended plans fees, re-inspection of works fees and infrastructure agreement preparation fees;
2. Reticulation comprises infrastructure with a diameter of 300mm and below and complex assets comprise treatment, storage, pump facilities and infrastructure with a diameter greater than 300mm.
3. The above estimates are indicative only and are subject to review of the detailed application upon lodgement; and
4. Please refer to the QUU *Water Netserv Plan* - for further details / clarifications on Fees and Charges.

ABN 86 673 835 011

Time Frames for Assessment
Connection Assessments (for applications other than Standard Connection) To be completed within 20 business days of receipt of Properly Made Connection Application (including payment of the relevant assessment fee), or within a further 20 business days of receipt of requested information (unless extended by agreement). **Design Phase** Typically for an application classified as **major works**, the assessment of the design phase is to be completed within 20 business days of receipt of all designs.
Other Guidance
QUU network is protected by the Queensland Development Code MP1.4 Building Over or Near Infrastructure (QDC MP1.4). Please confirm with your Building Certifier whether a Build Over Asset application (BOA) is required.

This Services Advice Notice is current for a period of two (2) years from the date of issue. Should you wish to proceed with applying for a service connection please lodge your application via Queensland Urban Utilities Development Services Online Lodgement Portal at **https://www.urbanutilities.com.au/development**. Please include your Services Advice Notice reference number in your application.

If you have any questions in relation to this Services Advice Notice, please do not hesitate to contact your account manager, Megan Turner on 07 38556254 or megan.turner@urbanutilities.com.au.

Alternatively, please email DCMTenquiries@urbanutilities.com.au.

Yours sincerely

Sajid Imam Syed
Development Assessment Team Leader
Queensland Urban Utilities

ABN 86 673 835 011

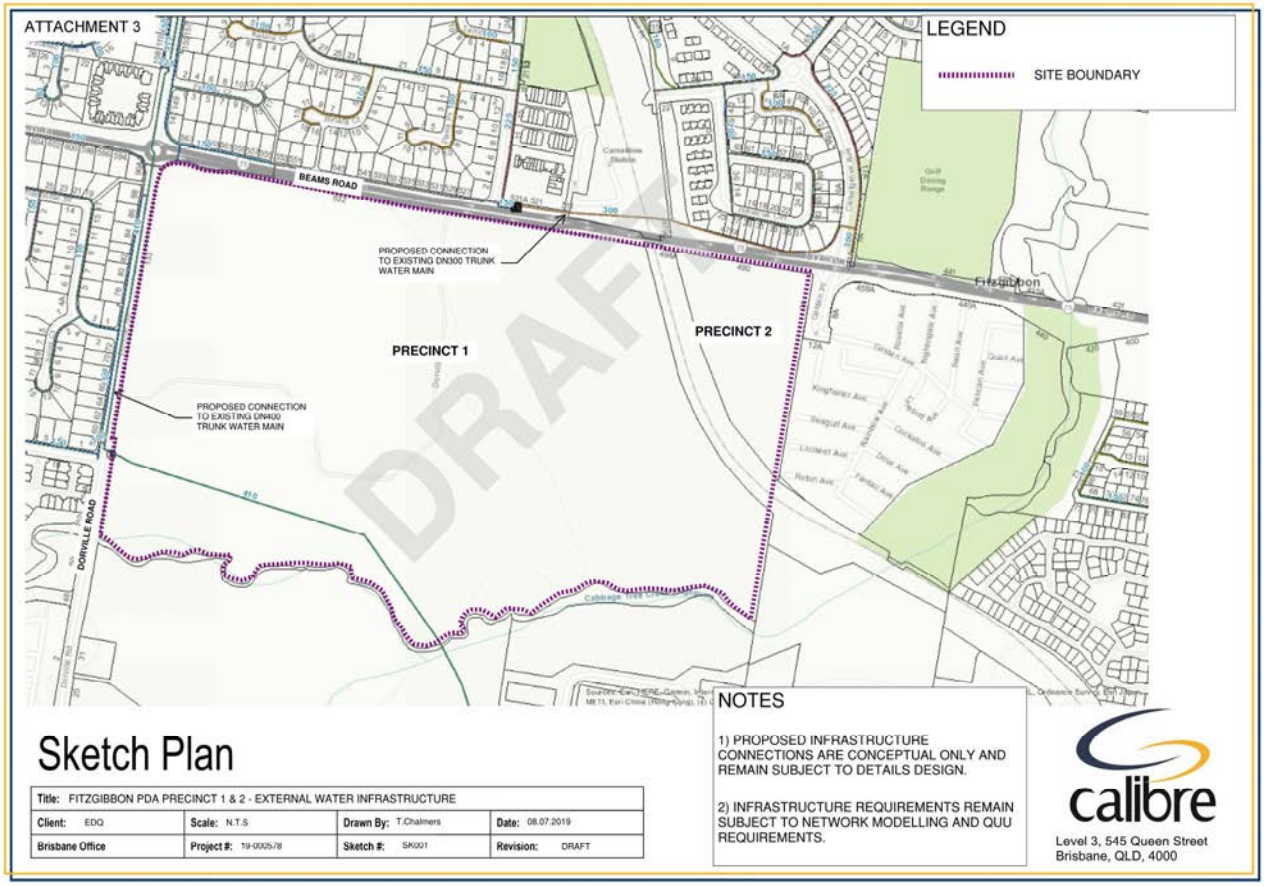
ATTACHMENT 2

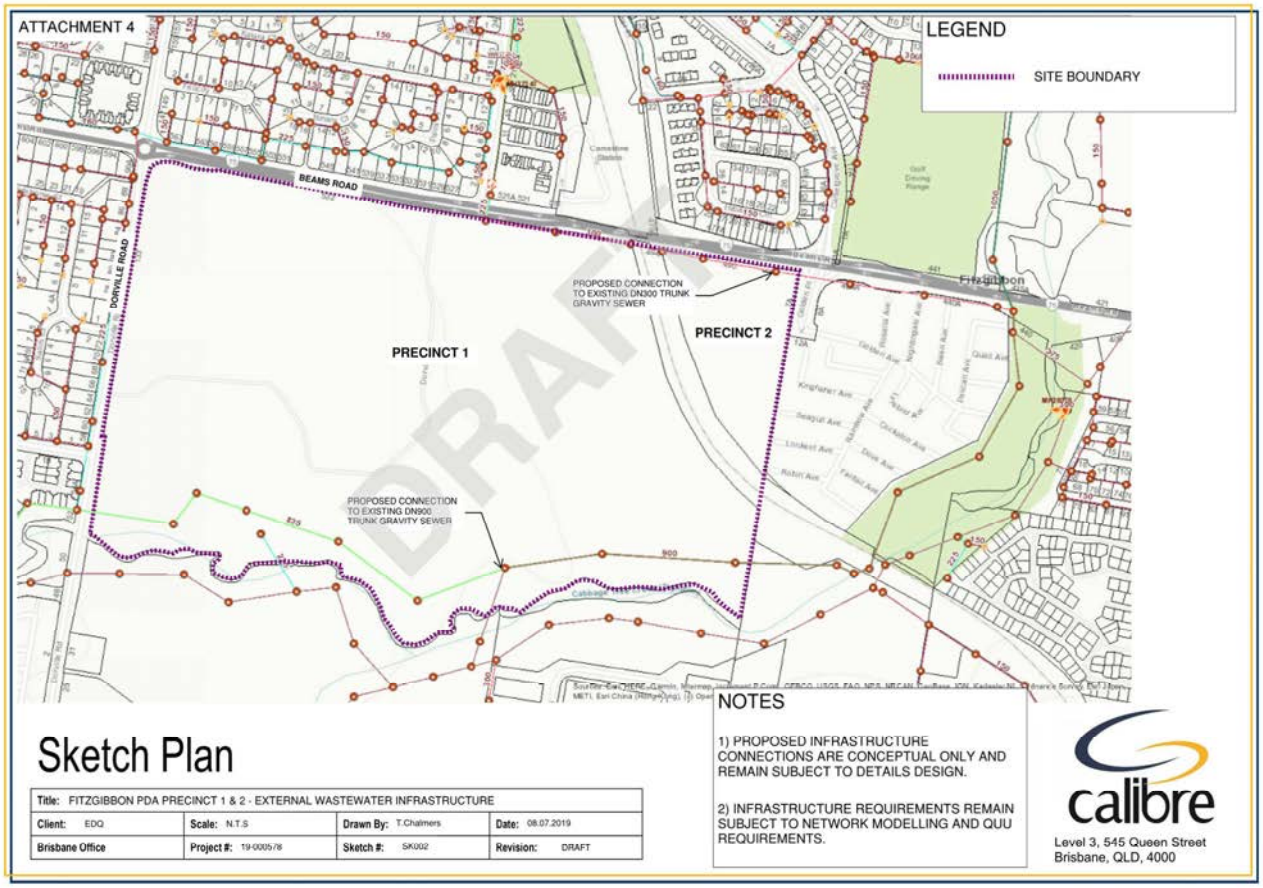
Dwellings and GFA

Plan Area	Development Type	Unit	2016	2021	2026	2031	Ultimate
Precinct 1	Dwellings	Dwellings	0	50	256	256	256
	Multiple dwelling	Dwellings	0	0	350	350	350
	Retail	GFA m2		0	1,200	1,200	6,100
	Commercial	GFA m2			300	300	26,159
	Industry	GFA m2					
	Community Purpose	GFA m2					
	Other	GFA m2					

Plan Area	Development Type	Unit	2016	2021	2026	2031	Ultimate
Precinct 2	Dwelling house	Dwellings				0	0
	Multiple dwelling	Dwellings	0	0	160	233	233
	Retail	GFA m2				0	0
	Commercial	GFA m2				0	0
	Industry	GFA m2				0	0
	Community Purpose	GFA m2				0	0
	Other	GFA m2				0	0

ATTACHMENT 3




ATTACHMENT 4
LEGEND
SITE BOUNDARY
BEAMS ROAD
DORVILLE ROAD
PROPOSED CONNECTION TO EXISTING DN300 TRUNK GRAVITY SEWER
PRECINCT 1
PRECINCT 2
PROPOSED CONNECTION TO EXISTING DN900 TRUNK GRAVITY SEWER
DRAFT
Sketch Plan
Title: FITZGIBBON PDA PRECINCT 1 & 2 - EXTERNAL WASTEWATER INFRASTRUCTURE
Client: EDQ
Scale: N.T.S
Drawn By: T.Chalmers
Date: 08.07.2019
Brisbane Office
Project #: 19-000578
Sketch #: SK002
Revision: DRAFT
NOTES
1) PROPOSED INFRASTRUCTURE CONNECTIONS ARE CONCEPTUAL ONLY AND REMAIN SUBJECT TO DETAILS DESIGN.
2) INFRASTRUCTURE REQUIREMENTS REMAIN SUBJECT TO NETWORK MODELLING AND QUU REQUIREMENTS.
calibre
Level 3, 545 Queen Street
Brisbane, QLD, 4000

Appendix D – Traffic impact assessment

Carseldine Urban Village

DCOP Traffic Impact Assessment

CEB06857



Prepared for
Economic Development Queensland

August 2020

Cardno
Shaping the Future

Document Information

Prepared for	Economic Development Queensland
Project Name	DCOP Traffic Impact Assessment
File Reference	6857 DCOP Traffic Impact Assessment 2020 08 03.docx
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Date	August 2020

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Document Control

Version	Date	Description of Revision	Author Initials	Author Signature	Reviewer Initials	Reviewed Signature
01	21 June 2019	Draft for Client Review	TA	Original signed	ASJ	Original signed
02	4 October 2019	Final	AXS	Original signed	ASJ	Original signed
03	3 August 2020	Revised Final	AXS	Digitally signed by Alice Shi Date: 2020.08.04 10:14:04+10'00'	ASJ	Digitally signed by Andy Johnston Date: 2020.08.03 14:46:47+10'00'

Version	Reason for Issue / Stage of Deliverable	Approver Initials	Approved Signature	Approved Release Date
01	Client Review	ASJ	Original signed	21/06/2019
02	Final with updated costing estimates	ASJ	Original signed	04/10/2019
03	Final with amended development yields	ASJ	Digitally signed by Andy Johnston Date: 2020.08.03 14:46:11 +10'00'	03/08/2020

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Appendix B Cross Section Comparison
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1 Introduction

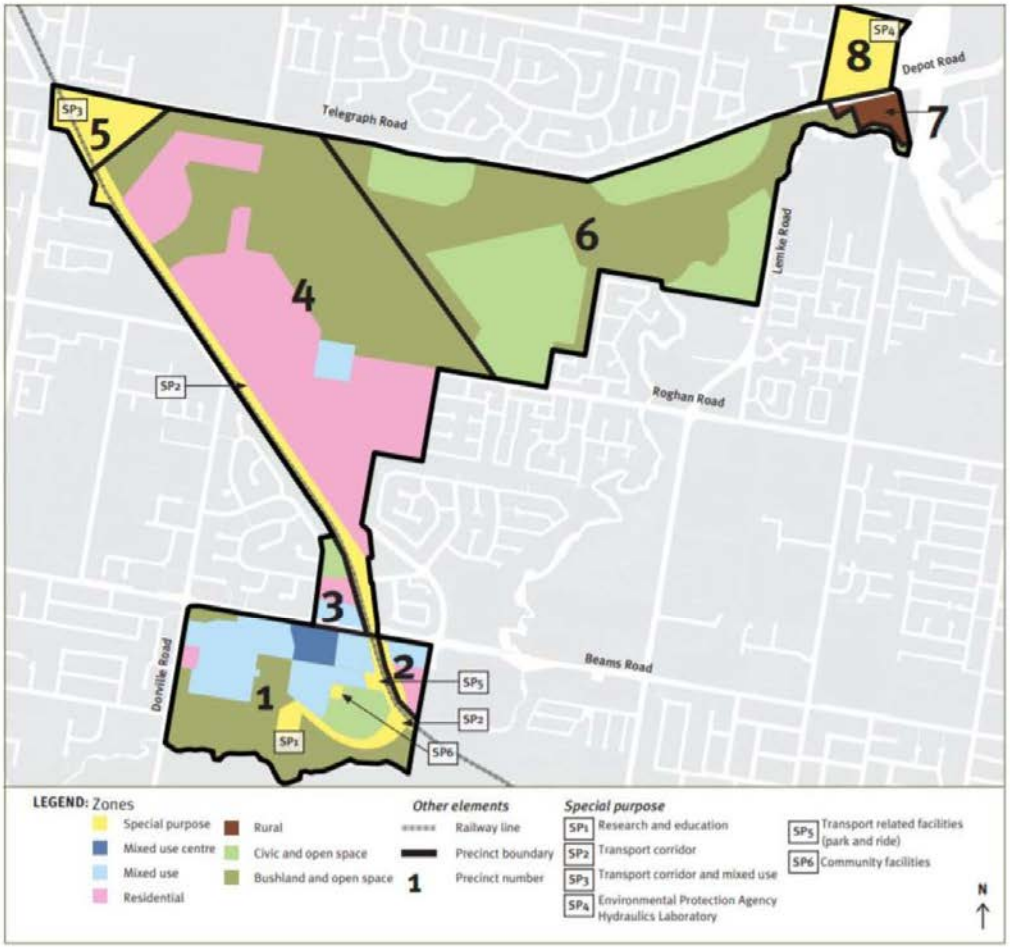
1.1 Background

Cardno has been engaged by Economic Development Queensland to provide traffic and transport advice in relation to the proposed Carseldine Urban Village (CUV) development, which forms Precinct 1 and 2 of the greater Fitzgibbon Priority Development Area (PDA). The intent of Precinct 1 and 2 is to demonstrate world-class planning in an urban village context which includes a mixed use urban village core, substantial employment opportunities, parkland area and sporting facilities.

In 2018, Cardno prepared a traffic impact assessment of the proposed Carseldine Urban Village, encompassing Precinct 1of the Fitzgibbon Urban Development Area (UDA). The assessment focused on assessing the likely development impact of the full CUV development, including timing of potential external intersection upgrades.

Since the preparation of this report, Cardno has been engaged by Economic Development Queensland (EDQ) to reassess the CUV development for updated development yields and additional developable land in Precinct 2 as illustrated in Figure 1-1. This current stage of work focusses on the specific impact of Precinct 1 and 2, to provide an update to the transport assessment to reflect the most recent development yields. Traffic surveys were completed in late 2016 to inform the background traffic volumes.

Figure 1-1 Fitzgibbon Priority Development Area



1.2 Study Intent

The purpose of the report is to document the updated transport impact assessment of Precinct 1 and 2 to inform the external intersection impacts for the CUV development. This includes assessing the external intersections to ensure the traffic impact of the PDA will operate acceptably in the future.

1.3 Report Structure

Given the abovementioned intent, this report has been structured into three main sections, in order to provide a holistic assessment for the PDA. The following broadly outlines the report structure:

- Section 1: Introduction – an introduction to the project
- Section 2: Project Overview – a brief introduction to the context of the study
- Section 3: Traffic Modelling Methodology – overview of the modelling methodology and assumptions adopted, including final results
- Section 4: Intersection Analysis – External Network – discussion of the necessary street cross sections and intersections needed to support the PDA
- Section 5: Transport Network Safety – safety aspects of the transport network internal to the PDA
- Section 6: Infrastructure Cost Estimates – discussion on categorising the upgrade works as trunk or non-trunk infrastructure and an estimate of infrastructure costs
- Section 7: Summary

1.4 References

In preparing this report, the following sources were referenced:

- Australian Bureau of Statistics, *Census Data*, published 2012
- Cardno Eppell Olsen, *Carseldine Urban Village,* 2010
- Institute of Transport Engineers, *Traffic Generation Handbook 8th edition*, 2008
- New South Wales Roads and Traffic Authority, *Guide to Traffic Generating Developments*, October 2002
- New South Wales Roads and Maritime Services, *Guide to Traffic Generating Developments – Updated Traffic Surveys*, August 2013
- Queensland Government, *Connecting SEQ 2031: An Integrated Regional Transport Plan for South East Queensland,* 2011
- Queensland Government, Department of Infrastructure, Local Government and Planning, *Shaping SEQ: South East Queensland Regional Plan 2017*, August 2017
- Urban Land Development Authority, *Fitzgibbon Urban Development Area Development Scheme,* 2011

2 Project Overview

2.1 Existing Land Uses

The land parcel that encompasses the proposed Precinct 1 development is currently partly occupied by existing land uses, as indicated in Figure 2-1. The existing uses feature a Queensland Government Precinct, QUT Testing Facility and child care centre, which have existing accesses on Beams Road and Dorville Road.

Precinct 1 also includes several sporting fields, however these facilities are proposed to be relocated and rejuvenated with additional community uses such as a fitness/play area and dog off leash park. While anecdotal evidence suggests that the sports fields are currently under-utilised, it is intended that these renovated sports facilities will be a core community facility.

The existing land use on the Precinct 2 site is a wrecking yard. It is proposed that this site will be redeveloped for better integration into the Fitzgibbon PDA.

Figure 2-1 Subject Site – Existing Uses



Source: Nearmap.com

2.2 Local Infrastructure

2.2.1 Road Network

The local road network surrounding Precinct 1 and 2 has been captured from the Brisbane City Council *Interactive Mapping* and is displayed below in Figure 2-2 with detailed road characteristics identified in Table 2-1.

Figure 2-2 Surrounding Road Network



Source: Nearmap.com

Table 2-1 Local Road Characteristics

Road Name	Road Classification	Form	Posted Speed Limit	Authority
Beams Road	Arterial Road	4 lanes	60km/hour	BCC
Carselgrove Avenue	Suburban Road	2 lanes	60km/hour	BCC
Dorville Road (South of Beams Road)	District Road	2 lanes	60km/hour	BCC
Dorville Road (North of Beams Road)	Neighbourhood Road	2 lanes	50km/hour	BCC
Balcara Avenue	Neighbourhood Road	2 lanes	50km/hour	BCC
Golden Place	Neighbourhood Road	2 lanes	50km/hour	BCC
Government Precinct Internal Roads	Private Road	2 lanes	N/A	Privately Owned

2.2.2 Public Transport Network

The development site is well serviced by the existing public transport network. The Precinct 1 development is located within a 400m radius of 3 bus stops and Carseldine Train Station, as identified in Figure 2-3. Precinct 2 is also located within 400m of 2 bus stops and Carseldine Train Station. These facilities cater a number of commuter transport routes, as identified in Table 2-2. An overview of key destinations and the frequency of services to/from each during peak periods is provided in Table 2-3.

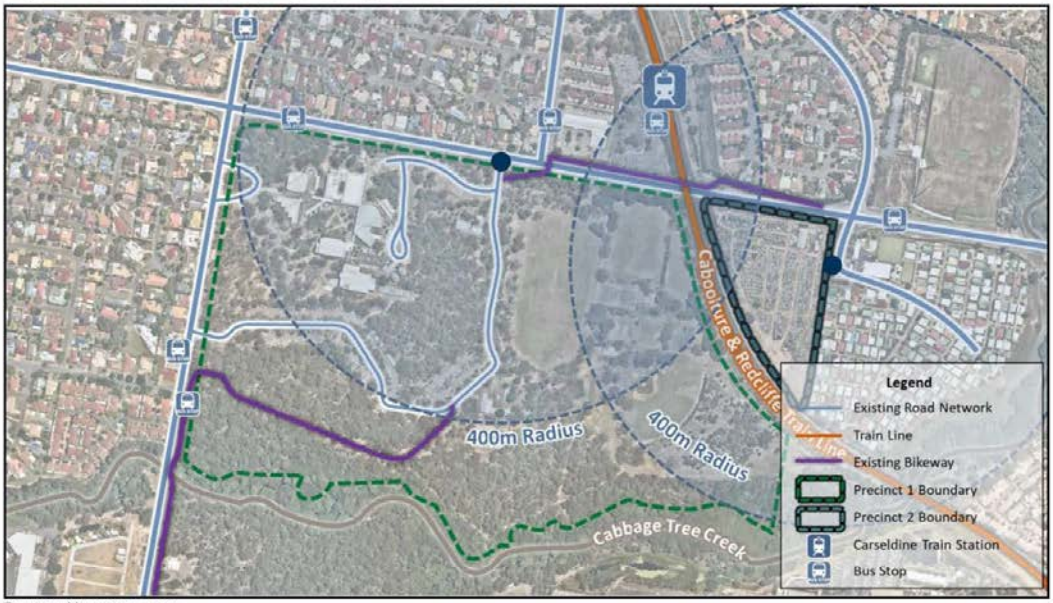
Table 2-2 Public Transport Services – Bus Routes and Train Lines – Within 400m

Bus Routes	Train Lines
329, 335, 340, P341, P344	Kippa-Ring, Springfield Central, Ipswich, Roma Street, Caboolture

Table 2-3 Key Destination Public Transport Frequency – Overview

Key Destination	Approximate Peak Period Frequency
City	10 minutes
Caboolture	15 minutes
Queensland University of Technology (Kelvin Grove)	5 minutes with connections for some services
University of Queensland (St Lucia)	10 minutes with connections for some services
Chermside Westfield	10 minutes with connections for some services

Figure 2-3 Active and Public Transport Overview



Source: Nearmap.com

In summary, the subject sites are sufficiently connected to existing public transport networks, with a number of bus stops and a train station within 400m walking distance of the Precinct 1 and 2 sites. It is anticipated that these existing services will accommodate increased user demand associated with the proposed development.

2.3 Development Proposal

The updated development proposes residential, commercial and retail uses on-site. A summary of the development yield is provided in Table 2-4.

It is noted that the existing facilities on site, including the government office precinct, will be retained in their current capacities. Therefore, should these areas be redeveloped in future, it will be subject to a separate application and hence has not been assessed within this traffic impact assessment.

As indicated in the figure, the subject site is fronted by Beams Road to the north, Dorville Road to the west, and the existing train line to the east. The southern property boundary of CUV is defined by the form of Cabbage Tree Creek.

Table 2-4 Development Yields – Development Scheme

Land Use	Precinct 1 Yield	Precinct 2 Yield
2026		
High Density Residential	210 units	160 units
Retail	2,760 sq.m	-
Retail (supermarket)	1,240 sq.m	
Terrace Dwellings	194 dwellings‡	-
Age Care	200	
Childcare	100 children	
2031		
High Density Residential	210 units	233 units
Retail	2,760 sq.m	-
Retail (supermarket)	1,240 sq.m	-
Terrace Dwellings	194 dwellings‡	-
Age Care	200	
Childcare	100 children	

‡ Terrace dwellings have 2 dwellings per lot

2.3.1 Internal Road Hierarchy

While the road network generally conforms to the Fitzgibbon Development Area Development Scheme, there are some deviations however these are considered to be suitable and appropriate for the overall precinct. The road network proposed in the Development Scheme is illustrated in Figure 2-4. The road network proposed as part of this application is illustrated in Figure 2-5.

Figure 2-4 Development Area Road Network – Fitzgibbon Development Scheme

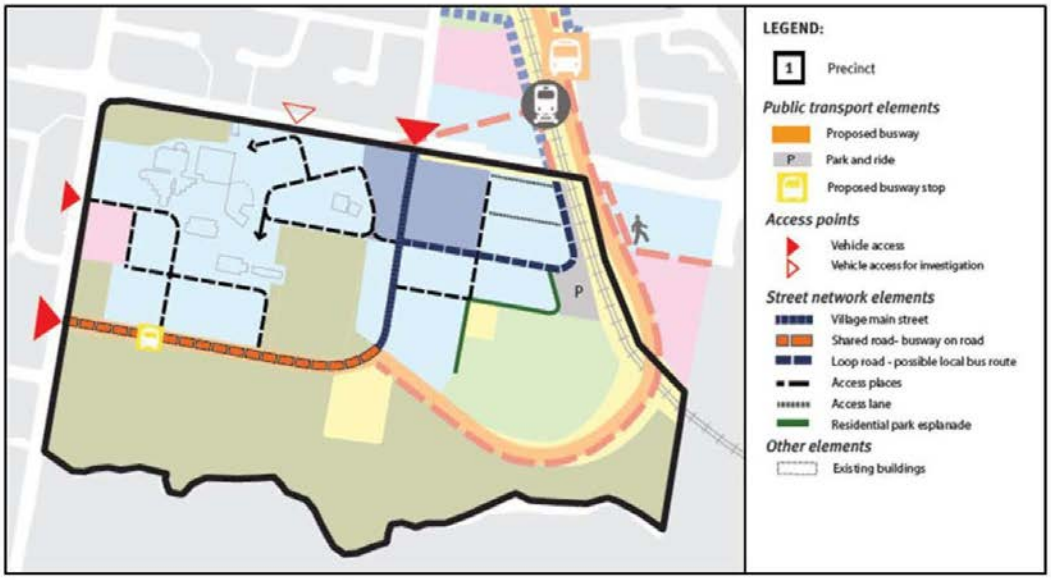


Figure 2-5 Development Area Road Network – Proposed

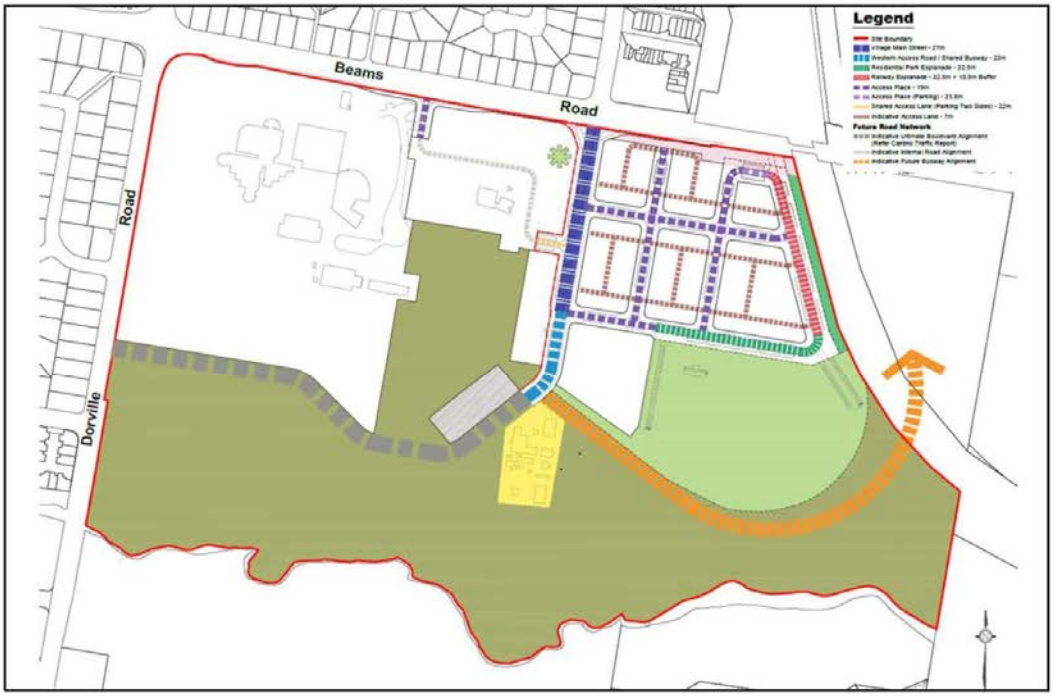


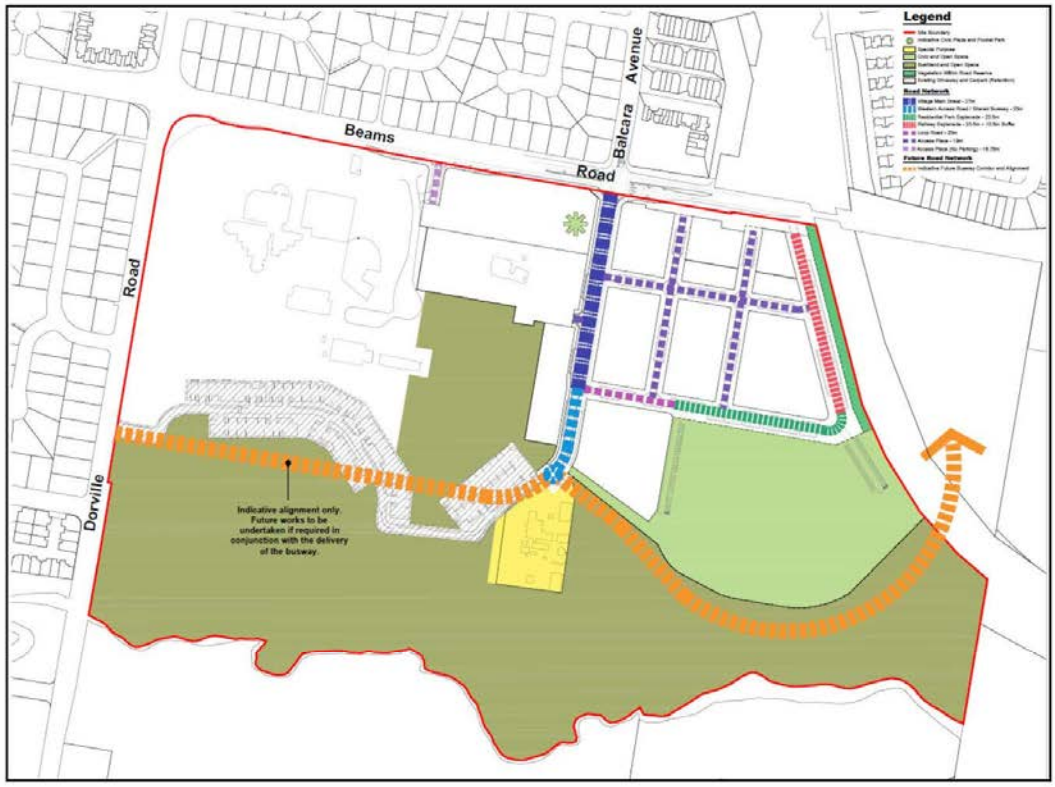
Figure 2-5 also indicates the proposed road classifications. For alignment with BCC's road hierarchy classifications, Cardno has prepared a comparison table summarising the proposed road networks in terms of the BCC road hierarchy classifications.

Table 2-5 Summary of Road Network

Development Scheme Roads	Amended Plan Roads	BCC Road Hierarchy Classifications	Alterations to Cross-Section
Village main street	Village main street	Neighborhood road	✓
Shared road – busway on road	Western access road / shared busway	Neighborhood road	✓
Loop road	Railway esplanade	Local access road	✓
Residential park esplanade	Residential park esplanade	Local access road	
Access places	Access places	Local access road	✓
Access lane	Shared access lane	Local access road	✓

Figure 2-6 illustrates the proposed road network hierarchy as per BCC classifications.

Figure 2-6 Development Area Road Network - Proposed



2.3.2 Dorville Road Connection

The previous assessment of the CUV development illustrated the continuation of the main boulevard through to Dorville Road as an indicative future road on the masterplan. However, correspondence with EDQ has outlined that this assessment will assume this link will not be utilised i.e. all development access will be via Beams Road. The existing uses currently utilising this road will continue to do so, however will be restricted from continuing through to Beams Road via a truncation.

2.3.3 Road Cross Sections

Similarly to the road network, the road cross sections have also been modified from the Development Scheme. However these changes are considered to be suitable and appropriate for the overall precinct.

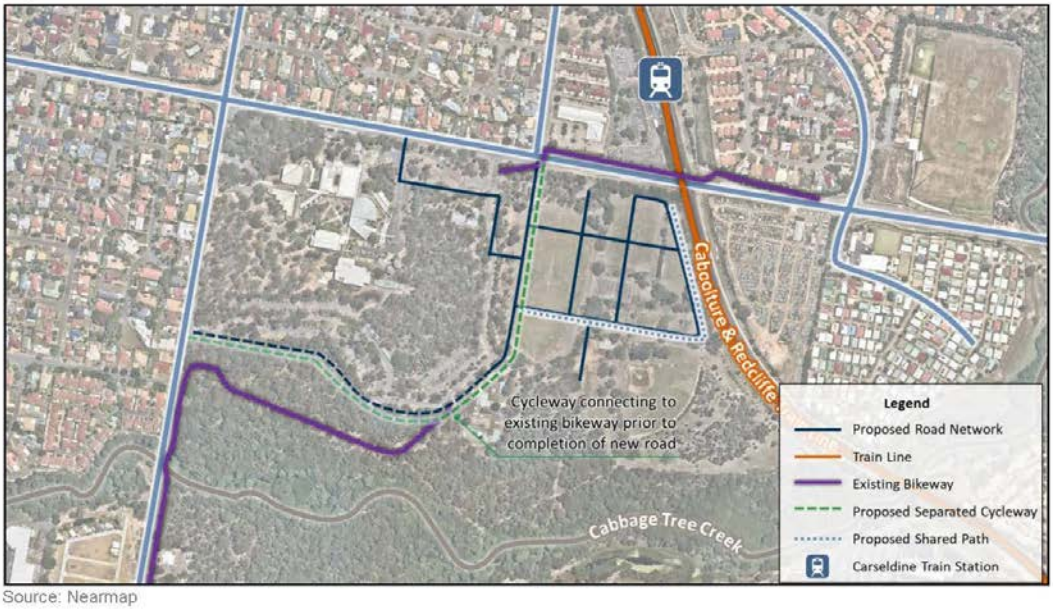
A summary of the cross sections proposed in the Priority Development Area and how these compare to the cross sections in the Development Scheme are identified in Appendix B.

2.3.4 Active Transport Facilities

As part of the development, a separated cycle way will be along the main boulevard connecting Beams Road to Dorville Road. This will strengthen the active transport connections through the site for internal users and external users from the wider community. Figure 2-7 illustrates the proposed cycle facilities for the precinct.

It is noted that prior the separated cycleway will extend to the existing bikeway rather than to the end of the truncated road. This will limit the instances of cyclists unexpectedly coming to the end of an off-road facility and will allow a continuous connection for cyclists using the site as a through route.

Figure 2-7 Proposed Cycle Facilities

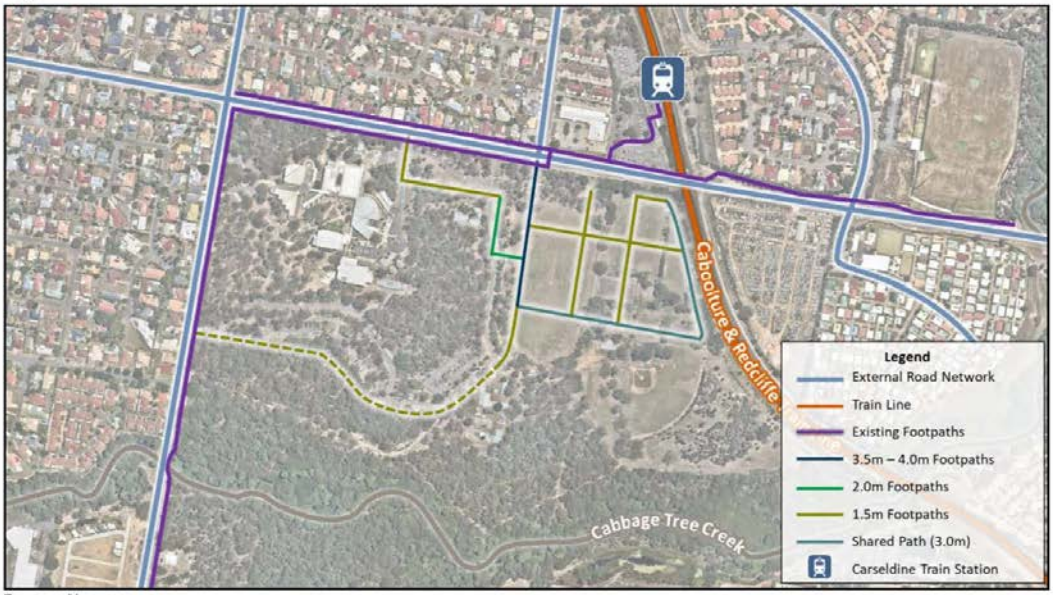


Source: Nearmap

Footpaths will be provided along all new streets with at least 1.5m wide paths on lower order streets and up to 4.0m wide paths on the main boulevard. 3.0m wide shared paths will be provided along the eastern railway corridor, as shown on Figure 2-8.

The footpath connections provided to the Carseldine train station are also illustrated on Figure 2-8.

Figure 2-8 **Pedestrian Facilities**



Source: Nearmap

2.4 Beams Road Open Level Crossing Upgrade

For a significant time the major constraint in the local road network has been the level rail crossing Beams Road, adjacent to the Carseldine Rail Station, as identified in Figure 2-9. In addition to delay associated with this open level crossing caused by halting traffic when trains pass, a bottleneck from four lanes to two (on either side of the crossing) significantly reduces through-traffic capacity in both directions of Beams Road.

Figure 2-9 Beams Road Open Level Rail Crossing



Source: Nearmap.com

The Beams Road Open Level Crossing is a significant project featured in the Brisbane City Council's Priority Infrastructure Plan (PIP) for some time now. The anticipated delivery of this upgrade according to the PIP is between 2021 and 2026, however the Infrastructure Plan featured in the Fitzgibbon Urban Development Area Development Scheme indicates that the development delivered in Precinct 1, 2 and 3 of the PDA will contribute to the cost of the overpass at a rate to be determined through a development agreement and/or special rate or charge.

At the time of writing the Department of Transport and Main Roads (TMR) was investigating the feasibility to build an overpass at the location of the open level crossing to mitigate the existing bottleneck issue. EDQ and TMR are currently in discussions to determine the likely form, construction of the rail infrastructure and impacts of the overpass including on the CUV development, however timelines for the completion of these works are not yet certain.

Given these discussions, the Beams Road Overpass is unlikely to be delivered prior to the construction of Precinct 1 or 2. As a subsequent result of this indicative condition, the traffic impact of Precinct 1 and 2 should not contribute to a significant worsening of the operation of Beams Road at the opening level train crossing, with no vehicle queueing onto the train line from adjacent intersections.

2.4.1 Observations

Observations made by Cardno indicate that the road is blocked-off for passing trains for almost 20 minutes in total during the AM-peak period (7:30 – 8:30). It can be assumed that this is consistent throughout the PM-peak period also. It was also observed that currently the Beams Road / Railway intersection does experience some congestion when the road is blocked for a train-passing, but the traffic clears within 3 minutes of the road re-opening. During the peak-period the traffic can queue back to the nearest intersection on the east-side of the crossing. Fortunately, this intersection assists in mitigating the flow.

Further observations made at this intersection note that traffic is kept waiting unnecessarily. The following scenarios indicate instances where waiting time could be saved;

- Where the train is stationary at the station;
- Where passengers are boarding at the station; and
- Where the arrival and/or departure path of the train does not cross the intersection.

With the expected growth in the area along with the traffic generated by the new development, further traffic mitigation methods must be implemented across this intersection.

2.4.2 Signals Upgrade Proposals

Information provided to EDQ during interdepartmental liaison included the possible upgrade of the Beams Road open level rail crossing, resulted in discussion of possible amendments to the signal timing and a restructuring of the road's cross-section as a solution to mitigating the traffic along Beams Road. These improvements to the signalling alone would have significant improvements to the capacity of Beams Road.

Conservatively, it can be assumed that for an Arterial Road, such as Beams Road, a peak hour volume of approximately 1,800 vehicles can be expected. This is in compliance with Brisbane City Council's road classifications. During the current peak hour trend, where only 67% of the hour is being utilised due to passing trains, the Beams Road / Railway Crossing intersection is in hindsight only allowing about 1,200 vehicles to pass.

With an upgrade of the signal timings to reflect the scenarios outlines in 2.4.1, it is expected to cut time off the traffic's waiting time- maximising the time traffic has to flow at the intersection. This is expected as improved signalling would mean that the crossing would not need to be closed to traffic for significant time periods, for example the crossing would only close when southbound trains leave the station rather than the whole time it is stationary at the station as is currently the case.

Secondly, a possible upgrade of the intersection from two to four lanes would significantly increase the capacity of the intersection.

2.5 Carseldine Rail Station Park n Ride Project

TMR is currently undertaking a business case into the expansion of the existing park n ride facility located on Beams Road, Carseldine which encompasses Precinct 3 of the PDA. This investigation explores an additional site to the north-east fronting Lavender Place as illustrated on Figure 2-10.

The intent of the expansion is to add additional parking spaces to the existing facility and new parking spaces in the additional site, ensuring connection between transport modes.

Figure 2-10 Carseldine Park n Ride Project



3 Traffic Modelling Methodology

3.1 Desktop Modelling

A desktop traffic assessment was prepared for the external access intersections. Following on from the previous assessment, the entire development is assumed to gain entry via Beams Road. In line with the previous Cardno assessment of the CUV development, two access points have been assumed including an all movements access at the Balcara Avenue / Beams Road intersection and a left in-left out at Beams Road as illustrated on Figure 3-1.

Figure 3-1 Development Access



The trip generation, internal trip ratio, in/out split and distribution for each zone identified herein was used to calculate the resultant trips that were assigned to the road network. The volumes were determined at each intersection and assessed in SIDRA Intersection 8.0 to determine appropriate intersection forms and identify any possible mitigation works required to lessen the impact of the proposed development on the external network.

3.1.2 Intersection Degree of Saturation

The performance of each study intersection has been analysed using SIDRA Intersection 8.0 (SIDRA). SIDRA is an industry recognised analysis tool that estimates the capacity and performance of intersections based on input parameters, including geometry and traffic volumes, and provides estimates of an intersection's Degree of Saturation (DOS), queues, delays. Simplistically, DOS is a measure of the proportion of traffic entering an intersection relative to the intersection's capacity. Table 3-1 provides the TMR-defined DOS thresholds.

Table 3-1 Adopted Intersection Performance Thresholds – Degree of Situation

Intersection Treatment	DOS Threshold
Signalised intersections	Less than or equal to 0.90
Roundabouts	Less than or equal to 0.85
Priority controlled intersections	Less than or equal to 0.80

Source: DTMR *Guidelines for Assessment of Road Impacts Development*

The guideline notes that a DOS exceeding the values indicated in Table 3-1 indicates that an intersection is nearing its practical capacity and upgrade works may be required. Above these threshold values, users of the intersection are likely to experience rapidly increasing delays and queueing.

3.1.3 Intersection Critical Delay

Importantly it is noted that DOS is not the only performance indicator and that other measures such as critical delay should also be considered when assessing the performance of an intersection. Other authorities such as the NSW Roads and Maritimes Services (RMS) recommend the use of the critical movement delay for assessing the performance of priority-controlled intersections. The RMS *Guide to Traffic Generating Developments* states that the average delay statistics for the critical movement provides a better indication of intersection performance and safety for priority-controlled intersections and roundabouts than DOS. Table 3-2 provides the RMS-defined delay thresholds.

Table 3-2 Adopted Intersection Performance Thresholds – Degree of Situation

LOS	Level of Service Description	Critical Delay
A	Good Operation	Less than 14 sec
B	Acceptable delays and spare capacity	15 to 28 sec
C	Satisfactory, but accident study required	29 to 42 sec
D	Near capacity and accident study required	43 to 56 sec
E	At capacity, requires or control mode	57 to 70 sec

Source: RMS *Guide to Traffic Generating Developments*

3.2 Trip Generation

Proposed weekday generation rates for each of the proposed land uses has been determined from industry guidelines and best practice as well as first principles. A summary of the resultant vehicle trip generation proposed to be assessed is shown in Table 3-3.

Table 3-3 Adopted Trip Generation Rates

Use	Trip Generation Rate Period			Per	Assumption	Source
	AM Peak	PM Peak	Daily			
High Density Apartments	0.23	0.22	2.18	unit	Average of Rockdale, Liberty Grove and Strathfield (areas with similar characteristics)	RMS – High Density Residential
Mixed Use - Retail	2.46	12.3	121	100m^2	AM taken as 20% of PM rate. Weekday AM trading is minimal in assessed peak.	RMS – Shopping Centre
Mixed Use - Retail (Supermarket)	2.46	12.3	121	100m^2	AM taken as 20% of PM rate. Weekday AM trading is minimal in assessed peak.	RMS – Shopping Centre
Terrace Dwelling	0.575	0.575	5.75	unit	Generation bracket ranged from 0.5-0.65, an average was utilised in this assessment.	RTA – Medium Density Residential
Aged Care	0	0.4	2.1	unit		RMS – Housing for Seniors
Child Care	0.8	0.7	2	child		RTA – Child Care Centre (Long-day care)
Government Precinct (Existing)*	2.1	2.3	13.9	100m^2	Total surveyed AM and PM In/Out movements were divided by existing GFA	Austraffic Surveys – November 2016

* Trips associated with existing uses taken as per surveyed volumes

3.2.1 Mode Share

The development is located within 400m of the Carseldine Train Station as well a number of bus stops which service routes with peak hour frequency of less than 15 minutes. Given this close proximity to public transport, the travel behaviour of residents and visitors to the site is likely to be more heavily weighted towards public transport than other areas of the region.

For comparison, a study of six areas with mixed use development near South East Queensland (SEQ) train stations was undertaken. The study areas were selected based on the distance from the CBD (within 15km), and the mix of surrounding land uses (retail, commercial and residential). These train stations include the following:

- Wynnum
- Carseldine
- Nudgee - Banyo
- Coorparoo
- Corinda
- Sherwood

Census data (2011) was assessed for each of these areas at the Statistical Area 2 (SA2) level to determine the general trend for mode share.

A comparison with the wider SEQ area, which is considered to generally represent the vehicle trip rates adopted as per Table 3-3, was also undertaken. The Department of Infrastructure, Local Government and Planning document Shaping SEQ: South East Queensland Regional Plan 2017 outlines the baseline (2011) mode share for the SEQ region.

Table 3-4 outlines the mode share values calculated for the six study areas, along with the SEQ baseline mode share.

Table 3-4 Mode Share Comparison

Study Area	Mode Share		
	Vehicle	Public Transport	Active Transport
Wynnum	80%	16%	4%
Carseldine	80%	18%	2%
Nudgee - Banyo	78%	17%	5%
Coorparoo	69%	25%	6%
Corinda	70%	25%	5%
Sherwood	66%	28%	6%
Average	***74%***	***21%***	***5%***
SEQ baseline*	**84.4%**	**8.2%**	**7.3%**
Difference	*-10%*	*13%*	*-2%*

* From Shaping SEQ: South East Queensland Regional Plan 2017

As shown, the mode share comparison indicates that the study areas generally have lower vehicle usage (10% lower), higher public transport usage (13% higher) and lower active transport usage (2% lower) compared to the SEQ baseline data.

It is noted that these mode share values relate to daily travel patterns only and are not directly comparable to the peak hour travel behaviour. However, they may provide some indication of general travel patterns for the development particularly as it reaches ultimate build out.

To provide a conservative assessment, Cardno has adopted the vehicle trip rates as outlined in Table 3-3. However, it is likely that the future development will operate with potentially reduced vehicle trips.

3.3 Internal Trips

The proportion of internal trips associated with each of the site uses is shown in Table 3-5. Each land use has been assigned a conservative reduction in trips based on the other land uses proposed within Precinct 1 of the CUV.

Table 3-5 Internal Trip Proportion

Use	Proportion Internal Trips
High Density Apartments	0%
Mixed Use - Retail	10%
Mixed Use - Retail (Supermarket)	30%
Terrace Dwelling	0%
Aged Care	0%
Child Care	20%
Government Precinct (Existing)	0%

3.4 Total Vehicle Trips by Land Use

By applying the trip generation rates identified in Table 3-3 with the internal trip percentage adopted in Table 3-5, a resultant number of vehicle trips is calculated, shown in Table 3-6 and 3-7. Table 3-6 reports the 2026 development scenario while Table 3-7 reports the 2031 development scenario. They include a detailed expansion on the yields which were previously mentioned in Section 2.1, which have now been defined by a specific development category.

Table 3-6 2026 Development Vehicle Trips

Use	Total Yield	Unit of Measure	AM Peak Trips (vph)	PM Peak Trips (vph)	Daily Trips (vpd)
Precinct 1					
High Density Apartments	210	Units	49	46	459
Mixed Use - Retail	2,760 m^2	GFA	61	306	3,006
Mixed Use - Retail (Supermarket)	1,240 m^2	GFA	21	107	1,050
Terrace Dwelling	194	Units	112	112	1,116
Aged Care	200	Units	0	80	420
Child Care	100	Children	64	56	160
Government Precinct (Existing)	15,050 m^2	GFA	322	339	2,092
Precinct 2					
High Density Apartments	160	Units	37	35	349
TOTAL			**666 vph**	**1,080 vph**	**8,651 vpd**

Table 3-7 2031 Development Vehicle Trips

Use	Total Yield	Unit of Measure	AM Peak Trips (vph)	PM Peak Trips (vph)	Daily Trips (vpd)
High Density Apartments	210	Units	49	46	459
Mixed Use - Retail	2,760 m^2	GFA	61	306	3,006
Mixed Use - Retail (Supermarket)	1,240 m^2	GFA	21	107	1,050
Terrace Dwelling	194	Units	112	112	1,116
Aged Care	200	Units	0	80	420
Child Care	100	Children	64	56	160
Government Precinct (Existing)	15,050 m^2	GFA	322	339	2,092
Precinct 2					
High Density Apartments	233	Units	54	50	509
TOTAL			**683 vph**	**1,095 vph**	**8,811 vpd**

3.5 Traffic Distribution

In order to determine the likely traffic distribution on the external road network, a Gravity Model was constructed using data from the 2011 Census completed by the Australian Bureau of Statistics (ABS). A gravity model functions by using the population, in this scenario the number of people employed in the area, (ABS SLA2 reas were referred to) and the travel distance to this area from the site to determine how attractive the journey would be to a resident of this area. This allows for a distribution of work trips to be derived.

To complete the assessment, SA2 regions were categorised into one of four directions based on their proximity to the CUV along the existing road network:

- Northwest along Beams Road;
- Northeast along Beams Road;
- Southwest along Dorville Road and Zillmere Road; and

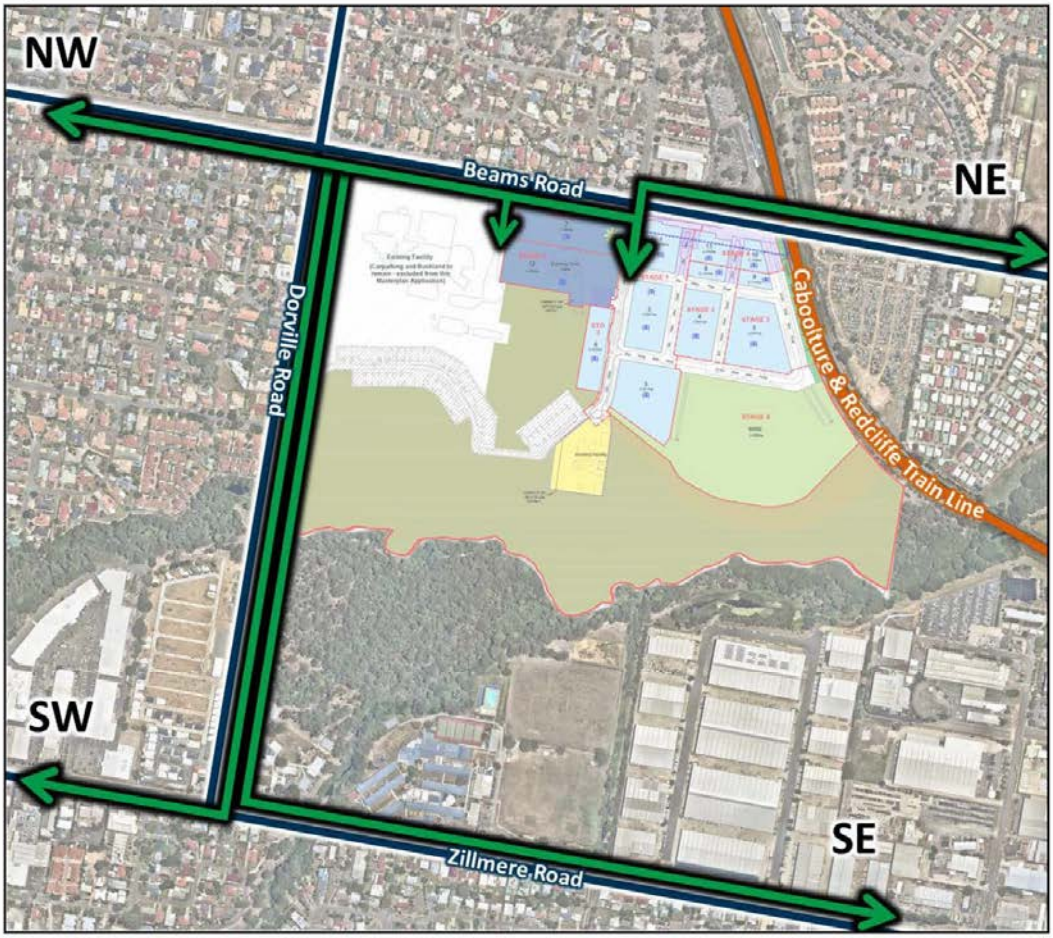
> Southeast along Dorville Road and Zillmere Road.

Table 3-8 **Employed Population Proximate to Carseldine Urban Village**

Land Use	Catchment Proximity	NE	NW	SE	SW	Total
High Density Apartments	25km	91,728	78,900	11,150	355,262	**537,040**
Mixed Use - Retail	10km	25,815	28,086	6,925	26,292	**87,118**
Mixed Use - Retail (Supermarket)	10km	25,815	28,086	6,925	26,292	**87,118**
Terrace Dwelling	25km	91,728	78,900	11,150	355,262	**537,040**
Aged Care	25km	91,728	78,900	11,150	355,262	**537,040**
Child Care	10km	25,815	28,086	6,925	26,292	**87,118**
Government Precinct	25km	91,728	78,900	11,150	355,262	**537,040**

The origins/destinations to/from the site have been split into four directions as shown in Figure 3-2 while the adopted distribution for each use is shown in Table 3-8. The completed gravity model has been included at Appendix C.

Figure 3-2 **Trip Origins/Destinations**



Source: Nearmap.com, Economic Development Queensland

Table 3-9 Traffic Distribution

Use	Northeast	Northwest	South East	Southwest	Total
High Density Apartments	20%	20%	4%	56%	**100%**
Mixed Use - Retail	25%	47%	5%	23%	**100%**
Mixed Use - Retail (Supermarket)	25%	47%	5%	23%	**100%**
Terrace Dwelling	20%	20%	4%	56%	**100%**
Aged Care	20%	20%	4%	56%	**100%**
Child Care	25%	47%	5%	23%	**100%**
Government Precinct	20%	20%	4%	56%	**100%**

3.6 Background Traffic

In order to establish the existing traffic volumes surrounding the site, Cardno commissioned traffic surveys to be undertaken on Tuesday 15 November, 2016 for the following key intersections during the 3-hour AM and PM peak periods, which have been identified on Figure 3-3 with the allocated intersection ID:

- **004** – Beams Road / Dorville Road;
- **029** – Beams Road / Carseldine Government Precinct Access;
- **005** – Beams Road / Balcara Avenue;
- **007** – Beams Road / Carseldine Train Station Access;
- **002** – Dorville Road / Carseldine Government Precinct Access;
- **003** – Dorville Road / Carseldine Government Precinct Drop-off Area;
- **001** – Dorville Road / Zillmere Road; and
- **006** – Beams Road / Carselgrove Avenue / Golden Place.

Figure 3-3 Traffic Survey Locations



Source: Nearmap.com

The data collected from this traffic survey has been adopted in calculating the existing and future traffic volumes to be used in this assessment. Whilst each intersection featured a specific peak period where total traffic movements were at a maximum, the average network peak period was adopted for the assessment. The appointed network peak time was:

- AM Peak Period: 7:30am to 8:30am
- PM Peak Period: 4:30pm to 5:30pm

The background traffic surveys indicate a varying heavy vehicle percentage on each approach of the intersections which range from 2% to 5%, however Cardno has conservatively adopted 5% on all approaches for the purposes of the assessment.

3.7 Growth Rate

In order to gauge historical traffic growth and any driver behavioural patterns, Cardno has compared the surveys conducted in 2016 to those which were utilised in the Cardno Eppell Olsen *Carseldine Urban Village* report dated September 2010. The growth on the external network has been illustrated in Figure 3-4.

Figure 3-4 Traffic Growth between 2010 and 2016



Source: Nearmap.com

Between 2010 and 2016, traffic along Beams Road (east of Dorville Road) experiences a substantial decline, whereas traffic on Dorville Road significantly increases. It is understood that this change in traffic patterns is a result of vehicles diverting their trips from Beams Road to Dorville Road to avoid the delay caused by trains crossing at the open level crossing. The adopted traffic growth rate is provided in Table 3-9.

Table 3-10 Adopted Growth Rate

Item	Value
Growth Rate	2% per annum
Growth Type	Linear
Growth from 2016 to 2031	30%

It is noted that the existing government precinct traffic has been captured in background surveys and will be represented in the baseline scenarios. Due to the complexities in backtracking this traffic throughout the existing network, it is not possible to completely remove this traffic from the existing network before adding it via the new access points. As a result, the assessment is likely to over-represent the volume of traffic at external intersections and therefore a conservative analysis will be presented in the findings.

3.8 Intersection Assessment

3.8.1 Scenarios

Each intersection has be analysed for the AM and PM peak periods, assessing the proposed Precinct 1 and 2 yields and adopting the assumptions detailed herein for the design year 2031.

3.8.2 Key Intersections

The key internal and external access intersections that require assessment are shown in Figure 3-5. Each intersection has been numbered according to the number it was assigned during the desktop modelling process.

Figure 3-5 Key Intersections



Source: Nearmap.com

3.8.3 Intersection Forms and Controls

The assessed intersection forms and controls have been adopted from the most up to date planning material available. Consideration has been given to the traffic volumes on each movement and where required the intersections have been updated to reflect the capacity requirements. The adopted intersection controls are shown in Figure 3-6.

Figure 3-6 Intersection Control Types



Source: Nearmap.com, Economic Development Queensland

4 Intersection Analysis – External Network

A detailed assessment has been undertaken by Cardno to gain an understanding of the operation of the external road network in the absence of the proposed internal road network and with the updated yields proposed in Precinct 1 and Precinct 2 of CUV. Given the location of the development and the turning movements identified in the traffic surveys, detailed intersection analysis has been conducted on the intersections for the with and without development traffic scenarios. Based on the previous assessment conducted by Cardno, only detailed analysis of key intersection has been outlined in this report as identified in Table 4-1.

In order to inform the existing network analysis, the intersection forms have been determined using geometry measured from Nearmap aerial imagery, on site observations, and the most appropriate signal cycle times for the corresponding intersection. The results have been summarised for each intersection to determine if the maximum preferred capacity is reached in the 5-year design horizon without the additional traffic impact imposed by the proposed CUV development.

Each of the assessed intersections have been analysed for two background traffic scenarios and two development scenarios:

- 2026 background traffic only
- 2026 with development
- 2031 background traffic only
- 2031 with development

Table 4-1 Scenarios Tested

ID	Intersection Location	Without Development	With Development	
			2026	2031
001	Dorville Road / Zillmere Road Intersection	✓	✓	✓
004	Beams Road / Dorville Road	✓	✓	✓
005	Beams Road / Balcara Avenue / CUV Access	✓	✓	✓
006	Beams Road / Carselgrove Avenue / Golden Place	✓	✓	✓
007	Beams Road / Carseldine Train Station Access	✓	✓	✓
029	Beams Road / Left in left out	-	✓	✓

The intersection analysis software package SIDRA 8.0 has been utilised in performing the assessment, which provides a detailed summary on the intersection capacity and performance. The traffic turning flow diagrams are presented in Appendix D.

4.2 001 – Dorville Road / Zillmere Road

4.2.1 Existing Form

The existing form of the Dorville Road / Zillmere Road intersection is illustrated on Figure 4-1. Results for the background traffic scenarios are reported in Table 4-2.

Figure 4-2 Dorville Road / Zillmere Road – Existing Intersection Form

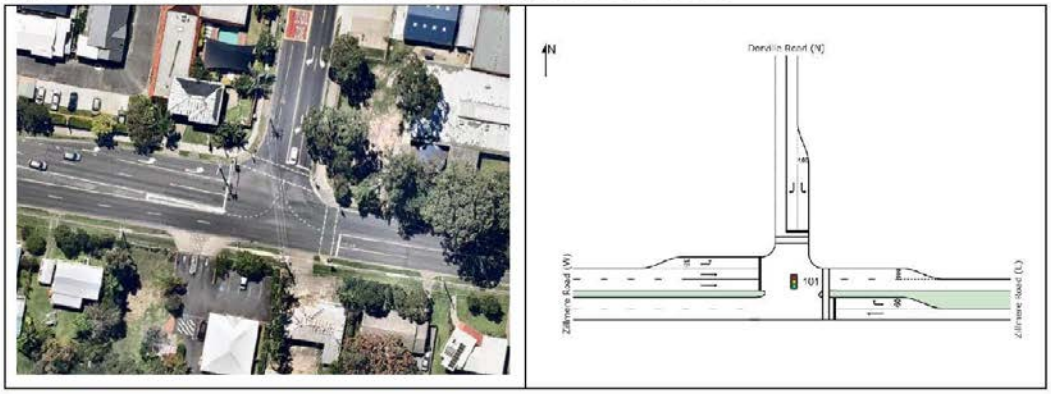


Table 4-2 SIDRA Results – Dorville Road / Zillmere Road Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2016 Background	0.520	31.4 sec	157.4m	0.815	33.3 sec	192.5m
2026 Background	0.641	26.7 sec	166.2m	**1.020**	**72.2** sec	**643.6m**
2031 Background	0.716	24.8 sec	172.4m	**1.107**	**106.9** sec	**850.6m**

Maximum preferred DoS of 0.900 for a signalised intersection

Analysis of the Dorville Road / Zillmere Road signalised intersection indicates that it will reach maximum preferred capacity before 2026, without the additional impact of traffic generated by the proposed development.

4.2.2 Proposed Upgrade Form

The existing (aerial) and proposed upgrade form of the Dorville Road / Zillmere Road intersection is illustrated on Figure 4-2. Results for the traffic scenarios are reported in Table 4-3.

Figure 4-3 Dorville Road / Zillmere Road – Existing and Proposed Intersection Form

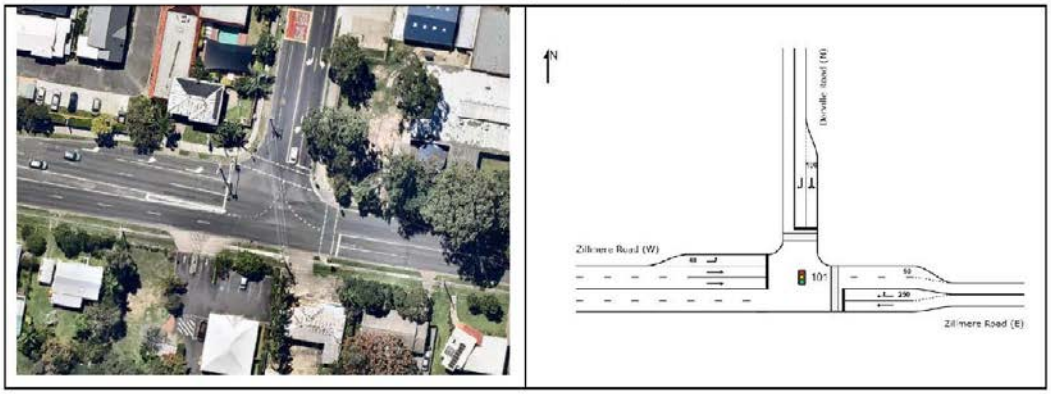


Table 4-3 SIDRA Results – Dorville Road / Zillmere Road Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th % ile Queue	DOS	Delay	95th % ile Queue
2026 BG	0.676	26.6 sec	170.8m	0.773	39.4 sec	317.5m
2026 BG + Dev	0.683	27.4 sec	174.2m	0.896	48.0 sec	427.4m
2031 BG	0.745	24.7sec	172.9m	0.838	31.6 sec	368.7m
2031 BG + Dev	0.772	25.8 sec	172.4m	**0.971**	60.0 sec	559.9m

Maximum preferred DoS of 0.900 for a signalised intersection

The results presented in Table 4-3 indicate that the proposed upgrade for the Dorville Road / Zillmere Road intersection will operate within the thresholds set by DTMR Guidelines for Assessment Road Impacts Development of a maximum DOS of 0.90 for a signalised intersection for all scenarios with the exception of 2031 PM peak with development.

As the DOS of the intersection at the PM peak scenario is still under the capacity limit of 1.0, it is believed that it will not present a major issue. In order to reduce the DOS to below accepted thresholds, a left turn slip lane would be required on the western approach. Following discussions with Council, given the safety risks associated with pedestrians at slip lanes, the operational performance is considered to be acceptable.

4.2.3 Upgrade Timing

The timing of the proposed upgrade form is identified to be necessary before the completion of the 2026 stage of the CUV. Based on approximate timing of all of the development being completed by 2026, it has been identified that the existing form of the signalised intersection will exceed acceptable capacity thresholds at this time. Table 4-3 outlines the results of the threshold scenario for the existing intersection form.

Table 4-4 SIDRA Results – Dorville Road / Zillmere Road Intersection – Upgrade Timing

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th % ile Queue	DOS	Delay	95th % ile Queue
2026 Background + Development	0.661	28.3 sec	173.4m	**1.111**	**117.8 sec**	**804.8m**

At this time, the proposed upgrade form will be required. It is noted that the results for the existing form (refer Table 4-2) indicate that the operation will exceed capacity thresholds sometime prior to 2026 regardless of the inclusion of the development.

4.3 004 – Beams Road / Dorville Road

4.3.1 Existing Form

The existing form of the Beams Road / Dorville Road intersection is illustrated on Figure 4-4. Results for the background traffic scenarios are reported in Table 4-5.

Figure 4-4 Beams Road / Dorville Road – Existing Intersection Form

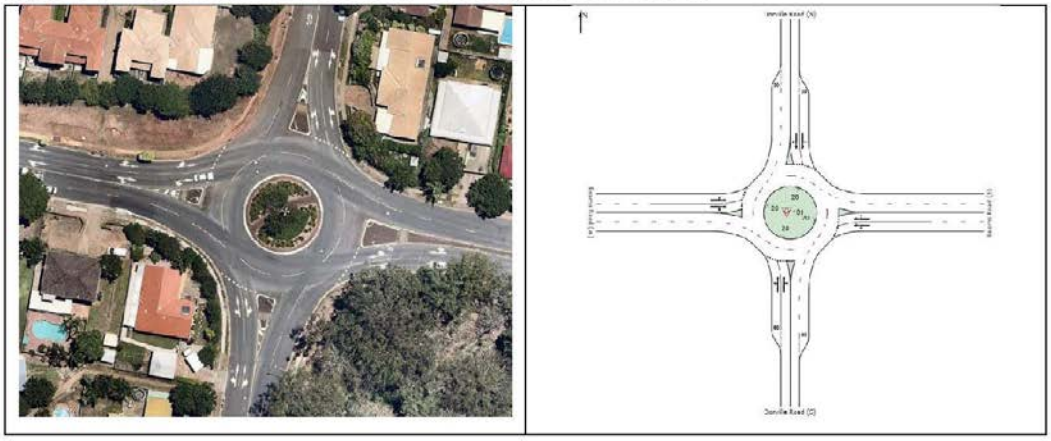


Table 4-5 SIDRA Results – Beams Road / Dorville Road Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2016 Background	0.503	10.3 sec	26.2m	0.616	10.9 sec	32.5m
2026 Background	0.607	15.6 sec	37.5m	0.796	12.7 sec	59.3m
2031 Background	0.691	22.1 sec	57.3m	0.909	18.7 sec	98.6m

Maximum preferred DoS of 0.850 for a roundabout

The results of the Beams Road / Dorville Road intersection analysis has identified that the roundabout will reach maximum preferred capacity prior to the 2031 design horizon under existing network conditions.

4.3.2 Proposed Upgrade Form

The existing (aerial) and proposed upgrade form of the Beams Road / Dorville Road intersection is illustrated on Figure 4-5. Results for the traffic scenarios are reported in Table 4-6.

Figure 4-5 Beams Road / Dorville Road – Existing and Proposed Intersection Form

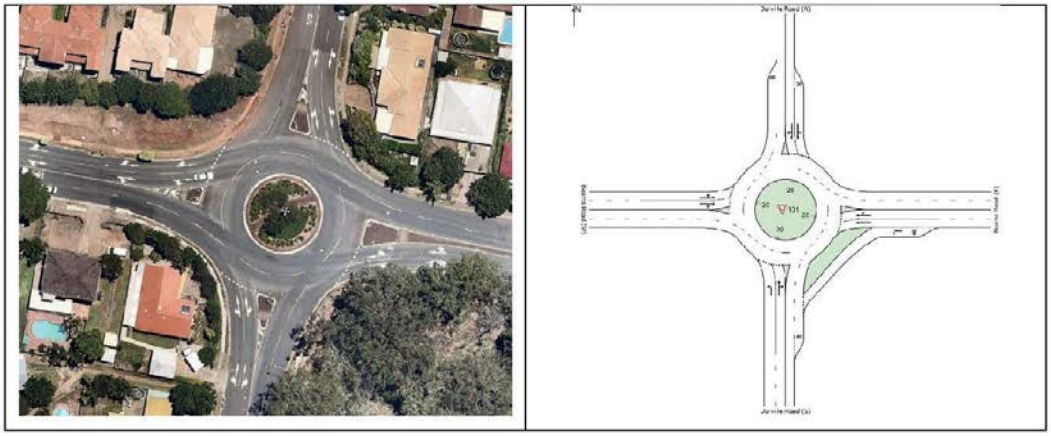


Table 4-6 SIDRA Results – Beams Road / Dorville Road Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th % ile Queue	DOS	Delay	95th % ile Queue
2026 BG	0.605	14.7 sec	36.1m	0.699	12.3 sec	36.0m
2026 BG + Dev	0.639	14.8 sec	39.7m	0.741	14.7 sec	40.3m
2031 BG	0.661	15.8 sec	43.4m	0.443	11.7 sec	15.1m
2031 BG + Dev	0.700	15.9 sec	49.4m	0.831	17.0 sec	55.3m

Maximum preferred DoS of 0.850 for a roundabout

The results presented in Table 4-6 indicate that the proposed upgrade for the Beams Road / Dorville Road intersection will operate within the thresholds set by DTMR Guidelines for Assessment Road Impacts Development of a maximum DOS of 0.85 for a roundabout for all scenarios.

4.3.3 Upgrade Timing

Cardno has identified that the existing form of the intersection will exceed capacity thresholds at completion of the 2026 stage of the development. Table 4-7 reports the results for the threshold scenario for the existing roundabout form.

Table 4-7 SIDRA Results – Beams Road / Dorville Road Intersection – Upgrade Timing

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th % ile Queue	DOS	Delay	95th % ile Queue
2026 BG + Development	0.711	24.9 sec	61.0m	**0.886**	24.9 sec	81.4m

Therefore, prior to completion of the 2026 stage, the proposed upgrade form will be required.

4.4 005 – Beams Road / Balcara Avenue

4.4.1 Existing Form

The existing form of the Beams Road / Balcara Avenue intersection is illustrated on Figure 4-6. Results for the background traffic scenarios are reported in Table 4-8.

Figure 4-6 Beams Road / Balcara Avenue – Existing Intersection Form

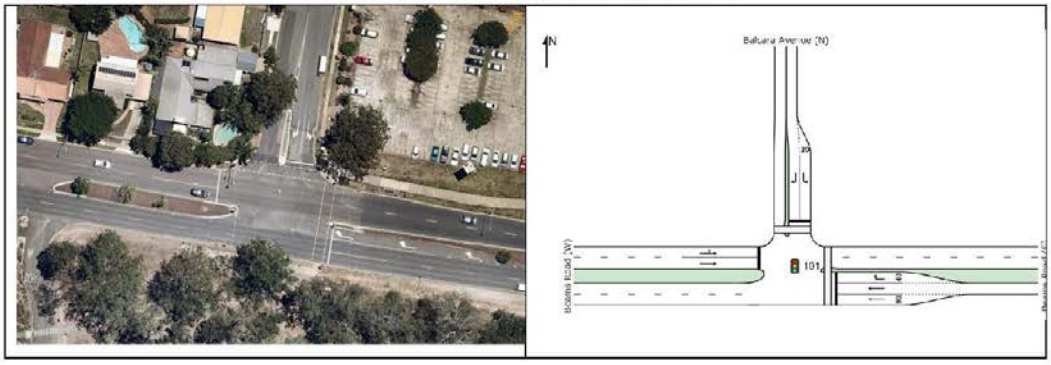


Table 4-8 SIDRA Results – Beams Road / Balcara Avenue Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2016 Background	0.297	12.6	76.3	0.282	14.6	77.8
2026 Background	0.349	11.5	93.3	0.326	13.6	92.7
2031 Background	0.377	11.4	101.1	0.348	13.3	100.1

Maximum preferred DoS of 0.900 for a signalised intersection

The operation of the Beams Road / Balcara Avenue intersection is significantly under maximum preferred parameters, and the ultimate intersection form will be dictated by the additional southern approach for the CUV access.

4.4.2 Proposed Upgrade Form

The existing and proposed form of the Beams Road / Balcara Avenue intersection is illustrated on Figure 4-7. Results for the traffic scenarios are reported in Table 4-9.

Figure 4-7 Beams Road / Balcara Avenue – Existing and Proposed Intersection Form

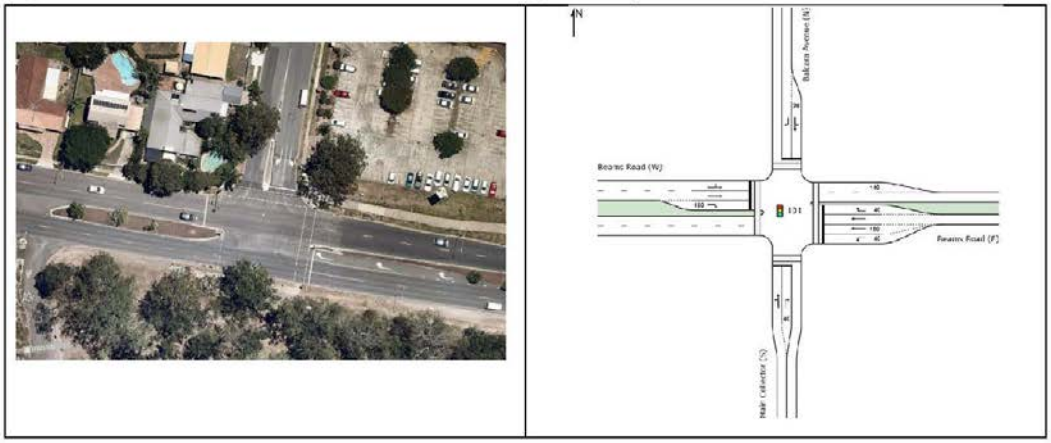


Table 4-9 SIDRA Results – Beams Road / Balcara Avenue Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2026 BG	0.685	27.5 sec	164.7m	0.682	28.3 sec	125.9m
2026 BG + Dev	0.722	30.3 sec	172.0m	0.834	46.0 sec	195.8m
2031 BG	0.739	28.0 sec	183.6m	0.691	28.4 sec	141.4m
2031 BG + Dev	0.751	30.7 sec	194.7m	0.868	48.6 sec	226.7m

Maximum preferred DoS of 0.900 for a signalised intersection

The results presented in Table 4-9 indicate that the proposed upgrade for the Beams Road / Balcara Avenue / CUV Access intersection will operate within the thresholds set by DTMR Guidelines for Assessment Road Impacts Development of a maximum DOS of 0.9 for a signalised intersection for all scenarios.

4.4.3 Upgrade Timing

As the introduction of the fourth approach to this intersection will form part of Stage 1, providing access to this stage and the ultimate development, this upgrade will be required as a matter of functionality for the network. Therefore, the upgrade will be required prior to the completion of the development in 2026.

4.5 006 – Beams Road / Carselgrove Avenue / Golden Place

4.5.1 Existing Form

The existing form of the Beams Road / Carselgrove Avenue / Golden Place intersection is illustrated on Figure 4-8. Results for the background traffic scenarios are reported in Table 4-10.

Figure 4-8 Beams Road / Carselgrove Avenue / Golden Place – Existing Intersection Form



Maximum preferred DoS of 0.900 for a signalised intersection

Table 4-10 SIDRA Results – Beams Road / Carselgrove Avenue / Golden Place Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th % ile Queue	DOS	Delay	95th % ile Queue
2016 Background	0.479	36.0 sec	139.3m	0.358	17.3 sec	97.5m
2026 Background	0.527	36.7 sec	157.2m	0.395	17.6 sec	109.8m
2031 Background	0.624	38.5 sec	195.6m	0.467	18.3 sec	135.7m

The Beams Road / Carselgrove Avenue / Golden Place intersection does not surpass the maximum preferred degree of saturation for a signalised intersection in the 2031 design year for either peak periods. It is worth noting however that the 95th percentile queue of 195.6m in the AM peak occurs on the western approach, and due to the proximity of the Beams Road open level crossing, this will need to be monitored in the 'with development' scenario.

4.5.2 Proposed Upgrade Form

The form of the Beams Road / Carselgrove Avenue / Golden Place intersection does not require any upgrade works to mitigate the impact of the proposed Carseldine Urban Village. Results of the intersection assessment for the 'with development' scenarios has been provided in Table 4-11.

Table 4-11 SIDRA Results – Beams Road / Carselgrove Avenue / Golden Place Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th % ile Queue	DOS	Delay	95th % ile Queue
2026 BG + Dev	0.533	31.4 sec	168.3m	0.607	30.8 sec	191.6m
2031 BG + Dev	0.581	32.3 sec	186.8m	0.763	32.6 sec	199.3m

The intersection operates within maximum preferred thresholds for all design scenarios and does not generate significant delays for motorists. The 95th percentile queue experienced on the western leg is approximately 223m, which does not extend past the open level crossing, as identified in Figure 4-9.

Figure 4-9 Intersection Separation to Train Crossing



Source: Nearmap.com, Economic Development Queensland

4.6 007 – Beams Road / Carseldine Train Station Access

4.6.1 Existing Form

The existing form of the Beams Road / Carseldine Train Station Access intersection is illustrated on Figure 4-10. Results for the background traffic scenarios are reported in Table 4-12.

Figure 4-10 Beams Road / Carseldine Train Station Access – Existing Intersection Form

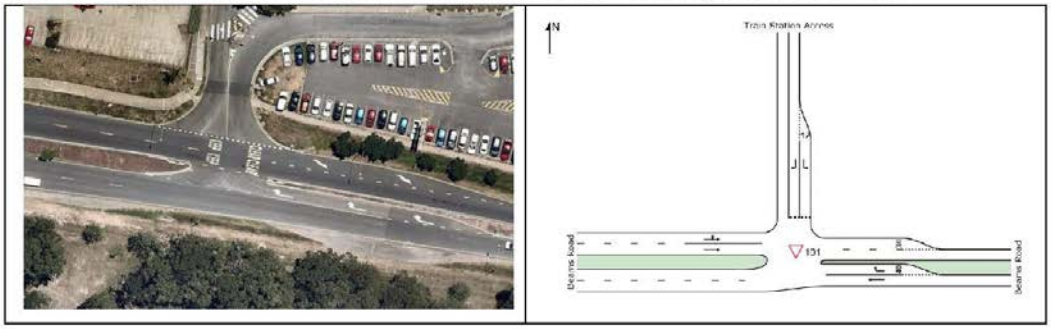


Table 4-12 SIDRA Results – Beams Road / Carseldine Train Station Access Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2016 Background	0.351	36.6 sec	8.6m	0.376	32.7 sec	11.2m
2026 Background	0.482	67.3 sec	14.1m	0.607	63.2 sec	18.6m
2031 Background	0.629	101.9 sec	18.8m	0.787	106.5 sec	26.7m

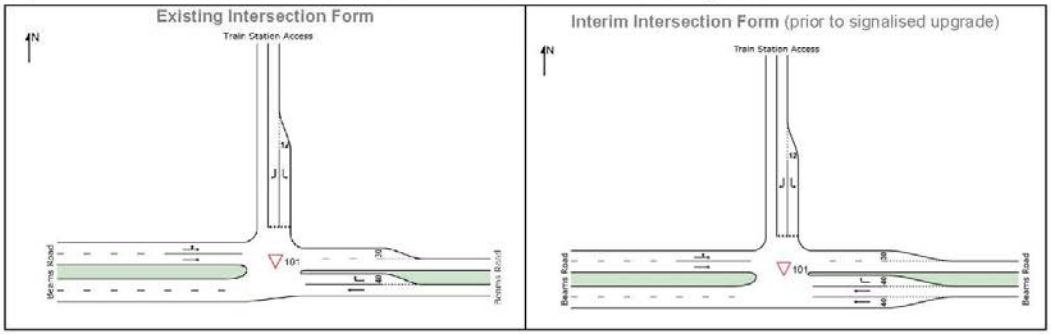
Maximum preferred DoS of 0.800 for an unsignalised intersection

The Beams Road intersection with the Carseldine Train Station Access does not exceed accepted operating parameters by the 2031 design year. The future form and operation of this intersection will be considered when assessing the 'with development' scenario. This access would be removed with the construction of an overpass.

4.6.2 Interim Intersection Form

The existing unsignalised form of the Beams Road / Carseldine Train Station Access intersection operates within performance thresholds for the 2031 design year. However, it is noted that the upgrade proposed for the upstream Beams Road / Balcara Avenue / CUV Access intersection immediately west of the intersection will impact on the form on the Carseldine Train Station Access intersection. This relates to the lengthened through lane extending across this intersection. The form of this is shown on Figure 4-11.

Figure 4-11 Beams Road / Carseldine Train Station Access – Existing and Interim Intersection Form



Results for this form are reporting in Table 4-13.

Table 4-13 SIDRA Results – Beams Road / Carseldine Train Station Access – Interim Form

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2026 BG	0.664	107.3 sec	19.9m	0.736	86.3 sec	23.6m
2026 BG + Dev	**0.803**	**158.2 sec**	26.0m	**1.053**	**233.0 sec**	**59.1m**
2031 BG	**0.888**	**201.5 sec**	31.7m	**0.950**	**170.6 sec**	**41.5m**
2031 BG + Dev	**1.109**	**345.6 sec**	**58.2m**	**1.424**	**522.2 sec**	**129.4m**

The results of the intersection analysis indicate that the interim intersection form will exceed capacity thresholds at the 2026 with development traffic design horizon. This is due to the larger critical gap required for vehicles exiting the train station.

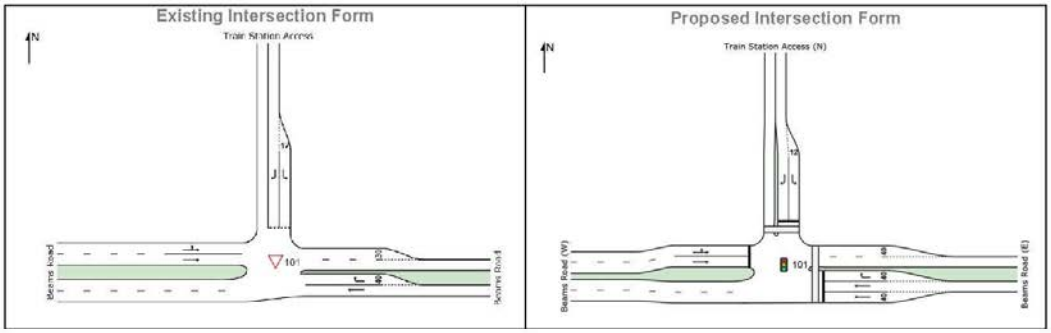
4.6.3 Proposed Upgrade Form

As a result of the proposed development plans adding an additional lane, the interim intersection performance is compromised. Therefore, the Beams Road / Carseldine Train Station Access intersection is to be signalised. Figure 4-12 identifies necessary upgrade works required to accommodate the future traffic of CUV as well as forecast background traffic. These changes include:

- Signalisation of the intersection
- Pedestrian crossings on the northern approach (train station access) and the eastern approach (Beams Road)
- As a result of the lengthened secondary through lane from intersection 005 Beams Road / Balcara Avenue / CUV Access Intersection, a second through lane has been added to the eastern Beams Road approach

Cardno has prepared a concept design sketch for the proposed upgrades, which can be found at Appendix E (dwg no. CEB06857-SK09).

Figure 4-12 Beams Road / Carseldine Train Station Access – Existing and Proposed Intersection Form



SIDRA analysis results have been provided in Table 4-14.

Table 4-14 SIDRA Results – Beams Road / Carseldine Train Station Access

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2026 BG	0.551	10.3 sec	179.4m	0.474	9.9 sec	140.9m
2026 BG + Dev	0.577	10.3 sec	193.9m	0.524	9.8 sec	165.3m
2031 BG	0.593	10.3 sec	203.2m	0.512	9.9 sec	159.0m
2031 BG + Dev	0.620	10.3 sec	220.1m	0.568	9.8 sec	188.7m

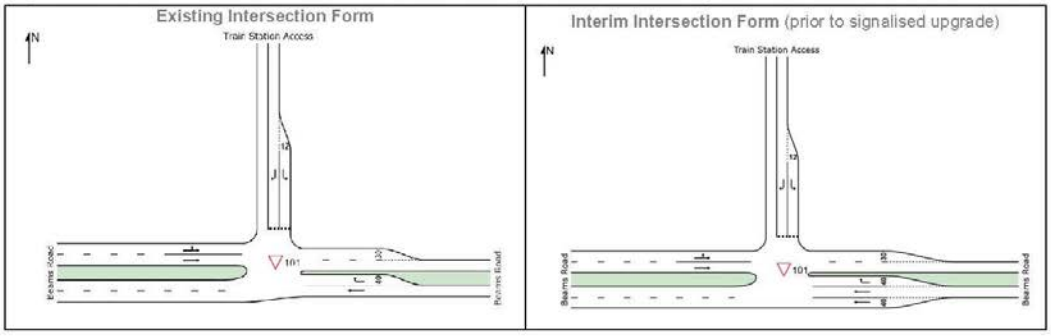
Maximum preferred DoS of 0.900 for a signalised intersection

The results presented in Table 4-14 indicate that the proposed form of the Beams Road / Carseldine Train Station Access intersection will operate within maximum preferred parameters under all design scenarios. Queues on the eastern approach will remain within the 90m storage available before the level crossing.

4.6.4 Upgrade Timing

It is noted that due to the proximity to the Beams Road / Balcara Avenue / CUV Access intersection, the existing form of the Beams Road / Carseldine Train Station Access intersection will be modified as a result of proposed lane lengthening at the access intersection. The interim form of the Beams Road / Carseldine Train Station Access intersection is illustrated on Figure 4-13.

Figure 4-13 Beams Road / Carseldine Train Station Access – Existing and Interim Intersection Form



This form will be able to accommodate the development traffic until Stage 4. Table 4-15 reports the results for the threshold scenario for the interim priority controlled form.

Table 4-15 SIDRA Results – Beams Road / Carseldine Train Station Access (Interim) – Upgrade Timing

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2026 Background + Development	**0.803**	**158.2 sec**	26.0m	**1.053**	**233.0 sec**	**59.1m**

The delays reported relate to the northern approach from the train station car park, being the minor approach. While these are longer than generally accepted, the proposed upgrade will be brought online before the completion of the 2026 stage of the development to control the delays. The SIDRA results for the upgraded form indicate that the average delay at 2031 with development for the northern approach will be reduced to 10.3 seconds.

4.7 029 – Beams Road / Left In Left Out

4.7.1 Existing Form

As this is a new intersection introduced as part of the CUV development, there is no existing form to assess.

4.7.2 Proposed Upgrade Form

The proposed form of the Beams Road / Left in left out intersection is shown on Figure 4-14. Results for the traffic scenarios are reported in Table 4-16.

Figure 4-14 Beams Road / Left In Left Out - Proposed Intersection Form

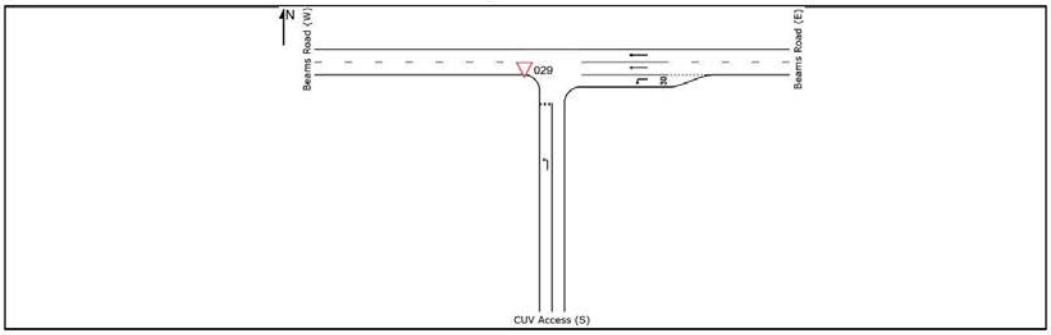


Table 4-16 SIDRA Results – Beams Road / Left In Left Out Intersection

Scenarios	AM Peak			PM Peak		
	DOS	Delay	95th %ile Queue	DOS	Delay	95th %ile Queue
2026 BG + Dev	0.249	5.5 sec	1.5m	0.243	5.5 sec	4.8m
2031 BG + Dev	0.269	5.5 sec	1.6m	0.262	5.5 sec	4.9m

The results presented in Table 4-16 indicate that the proposed form for the Beams Road / Left In Left Out intersection will operate within the thresholds set by DTMR Guidelines for Assessment Road Impacts Development of a maximum DOS of 0.80 for an unsignalised intersection for all scenarios.

5 Transport Network Safety

5.1 Cyclist Safety

In line with current best practice, the development proposes to provide a separated cycleway along the length of the main boulevard connecting Beams Road to Dorville Road. This level of facility is endorsed by the Department of Transport and Main Roads (TMR) through the published Technical Note TN128 Selection and Design of Cycle Tracks (May 2015).

Physically separating cyclists from both vehicles and pedestrians, this limits the risk of conflicts along the route. It is noted that intersection treatments will need to be designed in accordance with TN128 to ensure conflicting movements are managed in the safest manner. With this in mind, it is recommended the number of crossings along this cycleway be reduced to two intersections, with limited access for the laneways which truncate before connecting to the cycleway. Similarly, the treatment at the Beams Road / Balcara Avenue / CUV Access intersection will need to be designed in accordance with TN128 to ensure the safety of all road users will be upheld.

It is noted that prior to connection of the main boulevard through to Dorville Road, the separated cycleway will connect to the existing bikeway path to provide a continuous connection for cyclists passing through the site.

As mentioned above, a shared path is proposed near the sports precinct. This will allow pedestrians and cyclists to move within a shared leisure space.

6 Infrastructure Cost Estimates

6.1 Trunk and Non-Trunk Infrastructure

With respect to the proposed upgrades for the external road network, assessment of the trunk function of the upgrades has been undertaken to determine whether the upgrades should be deemed as trunk or non-trunk.

Under The Minister's Guidelines and Rules (MGR), the LGIP can only identify trunk infrastructure which is defined as 'development infrastructure' in Schedule 2 of the *Planning Act 2016*. Having regard to Schedule 2 of the Act, 'development infrastructure' is defined as:

a. land or works, or both land and works, for—
    i. water cycle management infrastructure, including infrastructure for water supply, sewerage, collecting water, treating water, stream managing, disposing of waters and flood mitigation, but not water cycle management infrastructure that is State infrastructure; or
    ii. transport infrastructure, including roads, vehicle lay-bys, traffic control devices, dedicated public transport corridors, public parking facilities predominantly serving a local area, cycleways, pathways and ferry terminals; or
    iii. public parks infrastructure, including playground equipment, playing fields, courts and picnic facilities; or
b. land, and works that ensure the land is suitable for development, for local community facilities, like—
    i. community halls or centres; or
    ii. public recreation centres; or
    iii. public libraries.

Further guidance regarding what can be included as trunk infrastructure is provided in '*Statutory guideline 03/14 – Local government infrastructure plans*'. Section 2.3 of the guideline provides the following statements:

To assist local governments in making a determination as to whether infrastructure is trunk infrastructure, the following matters should be considered:

> **function** – does the infrastructure provide a distribution function, collection function or service to a wider catchment comprising multiple development sites?
> **number of users** – does it service multiple development sites or catchments of users?
> **development certainty** – can the planning of the infrastructure be undertaken without knowing the details of individual developments? For example, can the infrastructure be planned without knowing the detailed layout for lot reconfigurations or the design of the development?

Additionally, Appendix B of the guideline provides an indicative list of trunk infrastructure. Relevantly, the list includes:

> Transport network – Land or works for:
    - Collector and higher order roads including associated intersections, traffic lights, roundabouts, bridges and culverts;
    - Standard items associated with the road profile of a local government road, including kerb and channelling, lighting, signage, foot and cycle paths and basic verge plantings
    - Pedestrian and cycle paths which perform a city wide or district function
    - Bus stops constructed as part of a local government road specified above.

Based on this, Table 6-1 outlines the proposed upgrades and an initial indication of the trunk infrastructure classification. This should be discussed in conjunction with Council.

Table 6-1 Trunk and Non-Trunk Infrastructure

ID	Proposed Infrastructure	Infrastructure Criteria			Trunk / Non-Trunk
		Function	Number of Uses	Development Certainty	
Intersection Upgrade					
001	Dorville Road / Zillmere Road intersection	▪ Distributor function, a key intersection of a Suburban and District road	▪ Services the wider catchment area of Aspley ▪ Adjacent uses – 2 schools, Aspley Homemaker Centre, industrial precinct, access to Zillmere station park n ride	▪ Upgrade could be implemented regardless of the development and would provide improvement to the road network ▪ Upgrade largely driven by mitigation development impact	Trunk
004	Beams Road / Dorville Road intersection	▪ Distributor function, a key intersection of an Arterial and District road ▪ Major east-west connection between Gympie Road and Sandgate Road	▪ Services the wider catchment area of Carseldine / Fitzgibbon / Taigum	▪ Upgrade could be implemented regardless of the development and would provide improvement to the road network ▪ Requires land resumption on corner of the site	Trunk
005	Beams Road / Balcara Avenue / CUV Access intersection	▪ Collector function, a key intersection of an Arterial and Collector road ▪ Future node of busway corridor ▪ Part of existing bus routes	▪ Community access for neighbourhood retail centre off Balcara Avenue and proposed mixed use precinct as part of development ▪ Future busway corridor servicing the northern Brisbane sector	▪ Dependent on development timing	Trunk
007	Beams Road / Carseldine Train Station Access	▪ Key intersection of an Arterial road and public transport hub	▪ Public transport users encompassing both rail and bus users	▪ Upgrade could be implemented regardless of the development	Non-Trunk
029	Beams Road / Left in left out intersection	▪ Provides access to government precinct	▪ For development use	▪ Dependent on development timing	Non-Trunk
Roads					
	CUV Main Access Road	▪ Collector function within the PDA ▪ Future bus corridor, as part of the planned busway ▪ On-street parking for visitors to mixed use precinct and broader development	▪ Future busway corridor servicing the northern Brisbane sector	▪ Alignment has been generally agreed upon as part of the Development Scheme ▪ Dependent on development timing	Trunk

ID	Proposed Infrastructure	Infrastructure Criteria			Trunk / Non-Trunk
		Function	Number of Uses	Development Certainty	
Active Transport Paths					
	Separated Cycleway along CUV Main Access Road	▪ Connects the missing cycling link from Beams Road to Dorville Road ▪ Provides high quality cycle infrastructure for the area	▪ Predominantly services through trips from cyclists not willing to use Dorville Road and Beams Road	▪ Dependent on development timing although could be delivered regardless of development	Trunk

6.2 Costing Estimates

An opinion of costs for the proposed upgrades have been estimated.

These estimates have been undertaken based on the following assumptions:

- This estimate makes no allowance for acquisition costs, holding charges, legal costs, contributions or communications, electrical and gas services, outside of those specifically outlined above.
- These preliminary quantities and budget estimates are an indicative engineering estimate only. They are based on previous construction works and our engineering experience on similar projects. This estimate is not based on site specific information as no survey or civil design has been undertaken in any form.
- A stormwater allowance has been made based on a basic desktop assessment, without any design work as no stormwater investigation has been undertaken. This cost is to be reviewed following detailed design.
- The costs are subject to alteration following detail design and owing to Local and State Authority and Public Utility Conditions of approval and physical constraints that cannot be defined at this time. An allowance has been made for traffic control, assuming day work only. No allowance has been made for night works, relocation of existing services other than those identified, upgrades to existing infrastructure, environmental and acid sulphate soils treatment.
- 40% Contingency has been allowed for civil works in accordance with the Main Roads Project Cost Estimating Manual, appropriate for a Concept Level design.
- This opinion of costs has been prepared by Cardno (Qld) Pty Ltd ('Cardno') solely for the benefit and use by the Client and to provide the Client with an indication as to the potential costs of the proposed works. In preparing this opinion of costs, Cardno has relied solely upon information available at the time.
- Cardno has used a reasonable level of skill, care and diligence to prepare this preliminary investigation. As such, Cardno cannot warrant the accuracy of the information provided as assumptions will be subject to further site investigations and technical assessment, concept design, alterations owing to Local Authority and Public Utility Conditions of approval and subsequent detailed design. Cardno does not and shall not assume any responsibility or liability for loss whatsoever to the Client or any third party arising out of any use or reliance by any party on this opinion of costs.

The costs are outlined in Table 6-2.

Table 6-2 Opinion of Costs Estimates

ID	Infrastructure Upgrade	Cost Estimate
001	Dorville Road / Zillmere Road intersection	$272,200
004	Beams Road / Dorville Road intersection	$268,046
005	Beams Road / Balcara Avenue / CUV Access intersection	$603,610
029	Beams Road / Left in left out intersection	$259,639
	CUV Main Access Road	$1,438,695
	Separated Cycleway along CUV Main Access Road	$85,320
	Contingency (40%)	*$1,171,004*
	TOTAL	**$4,098,514**

7 Summary

Cardno has been commissioned by Economic Development Queensland (EDQ) to provide traffic and transport advice in relation to the proposed Carseldine Urban Village (CUV) development, which forms Precinct 1 and 2 of the greater Fitzgibbon Priority Development Area (PDA). The proposed development is comprised of a mixed use urban village core providing the community with plentiful employment opportunities and recreational land like sporting facilities and parklands.

Cardno has prepared a Traffic Impact Assessment (TIA) for EDQ. The report identifies potential impacts of the development on the surrounding transport network, inclusive of railway, public transport and active transport considerations.

The impact of the development on key intersections, external to the development, have been outlined within this report;

- Dorville Road / Zillmere Road – upgrade required
- Beams Road / Dorville Road – upgrade required
- Beams Road / Balcara Avenue / CUV Access – upgrade required
- Beams Road / Carselgrove Avenue / Golden Place – no upgrade required
- Beams Road / Carseldine Train Station Access – upgrade required
- Beams Road / Left in left out – provision of new intersection

It was found that for the updated yields, the proposed intersection forms above are sufficient to accommodate for traffic growth and development traffic generation.

Cardno believes that the findings outlined within this TIA are in compliance with standard traffic engineering practices and accurately depict the impacts on the surrounding road networks of the developments.

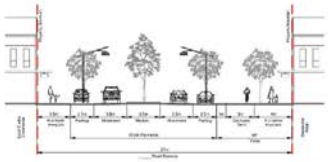
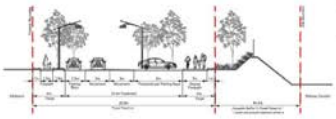
DCOP Traffic Impact Assessment

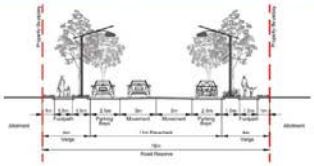
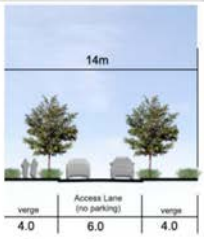
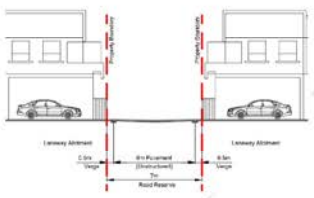
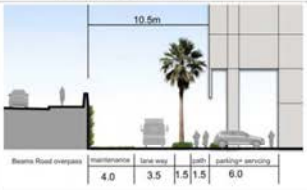
APPENDIX A
DEVELOPMENT MASTERPLAN

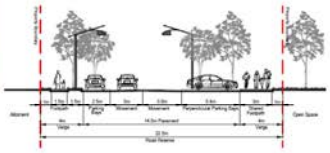
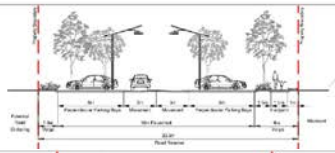
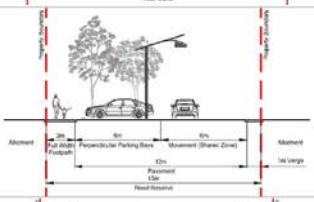
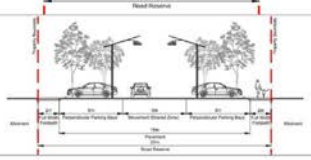

Development Yield (Maximum Density)
Residential Dwellings 606 dwellings
Commercial (sq.m) 15,050 sq.m GFA (13,285m² existing DTMR Facility + 1,765m² within Mixed Use Centre - Village Heart)
Retail (sq.m) 4,000 sq.m GFA
Childcare 100 children
Legend
CARSELDINE URBAN VILLAGE
OVERALL MASTERPLAN
Beams Road
Balcara Avenue
Dorville Road
STAGE 1
STAGE 2
STAGE 3
STAGE 4
STAGE 5
STG 2
Existing Facility
(Carparking and Bushland to remain - excluded from this Masterplan Application)
Existing Facility
9000

DCOP Traffic Impact Assessment

APPENDIX B
CROSS SECTION COMPARISON

Development Scheme	Proposal	Summary of Differences	Comments
 1. Village Main Street		• Reduction of left-side verge from 4m to 3.5m • Reconfiguration of on road cycle lanes to dedicated 2-way 3m separated cycle path on the right-side. • Median resized to 3.5m	• The new configuration of the road cross-section has retained many of its key components and original width of a maximum of 27m. • The proposed cross-section provides a two-way separated cycle way facility. Additionally, the cycle way is provided within the verge, separated from the parking lane. This provides increased cyclist safety as parking vehicles will no longer be crossing the cycle lane to access the parking space and the risk of dooring will be eliminated. • Further, as most connections filter onto the Village Main Street, it is fitting for it to have a full 3.5m and 4m wide footpath on either side of the road reserve. • Lastly, a 3.5m carriageway in either direction will accommodate for larger vehicles and buses.
 2. Western Access Road / Shared Busway		• Reconfiguration of on road cycle lanes to dedicated 2-way 3m separated cycle way alongside a dedicated 1.5m footpath	• The removal of the on road cycle lanes to a 2-way separated path on one-side improves cyclist safety. • Additionally, the cycle way is provided within the verge, separated from the parking lane. This provides increased cyclist safety as parking vehicles will no longer be crossing the cycle lane to access the parking space and the risk of dooring will be eliminated. • Furthermore, as the corridor is intended to be a shared busway, the 3.5m lane widths will be sufficient in accommodating for heavy vehicles. • Lastly, the open space outside the verges have been indicated as possible allotment areas. This space could also be utilised for road widening in future.
 3a. Loop Road	Not proposed to be used	• N/A	• N/A
 3b.Loop Road / Railway Esplanade		• Adoption of 3m shared footpath on the right-side • Reduction of width of carriageway from 7m to 6m • Removal of 1.5m buffer between travel lanes and parking bays • Overall reduction in road reserve width from 25m to 22.5m	• The Railway Esplanade has been configured to encourage active transport use along the corridor. • The provision of a 3m shared footpath along the rail corridor is sufficient width for mixed-active transport use. • The provision of perpendicular parking bays will service the adjacent properties and/or visitor to the civic and open space. • Given the slow speed environment and narrowed travel lanes, risk of conflict between through vehicles and parking vehicles (entering or reversing) will be minimised.

Development Scheme	Proposal	Summary of Differences	Comments
 4. Access Place		• N/A	• No significant changes have been made to the configuration of this corridor. The access place road reserves are primarily designed for residential use. The provision of parking bays and footpaths are intended to be used by adjacent properties. Likewise, the 3m wide lanes are sufficient for local traffic utilisation.
 5. Access Lanes		• Reconfiguration of 4m lane verge to 0.5m	• The lane is intended to service residential dwellings, similar to the operation of a shared driveway. • The configuration of the lane encourages safe and efficient vehicle movements in/out of the block, without obstruction from active travellers or parked cars.
	Not proposed to be used	• N/A	• N/A

Development Scheme	Proposal	Summary of Differences	Comments
		• Removal of 10m buffer to the right-side • Specifications of footpaths sizing within verge: 1.5m pedestrian path to the left and 3m shared path to the right • Movement lanes increased to 6.6m from 6.0m, to accommodate manoeuvring for the 90 degree parking spaces, as per AS2890.5. Additional 0.6m width will be treated as manoeuvring space at the rear of the parking bays. • 90 degree parking space length reduced to 5.4m from 6.0m (shift in length designated as manoeuvring space).	• The Residential Park Esplanade will primarily service the adjacent civic and open space. The parking within the road reserve will be utilised by park visitors. • Coinciding with this, the shared footpath between the carriageway and parkland provides good amenity to the surrounding uses.
6. Residential Park Esplanade			
N/A		• N/A	• The given corridor is planned to be located north of the Railway Esplanade, where further parking will be provided to service the area. • The configuration of the proposed road reserve is safe for all road users and the plan has potential for road widening in future. • Additionally, the corridor runs parallel to Beams Road- this could allow for future road widening.
N/A		• N/A	• The configuration of the proposed road reserve is safe for all road users. • The road being an access lane, also provides perpendicular parking on one side of the road reserve, these spaces will service the surrounding land uses, as will this particular corridor.
N/A		• N/A	• The given corridor is intended to provide connection between the above access lane and the Village Main Street. • Parking spaces will be provided along the lane and will service both nearby residents and other land use establishments along Village Main Street. • Pedestrian foot paths have been provided on either side and will provide access onto Village Main Street.

DCOP Traffic Impact Assessment

APPENDIX C
GRAVITY MODEL

	Lattitude	Longitude
Development	-27.3504	153.023

10km Radius

SA2 Maincode	SA2 5 Digit Code	SA2 Name	Lattitude	Longitude	Direction	Full Population (N)	Employed Population (N)	Distance (T)	N/T	Proportion of Sum
314011382	31382	Albany Creek	-27.3535	152.967	NW	15862	2910	6.9	2298.841	5%
302021027	31027	Aspley	-27.3658	153.019	SW	12448	3710	3	4149.333	9%
302011022	31022	Bald Hills	-27.3084	153.022	NW	6947	1215	6.5	1068.769	2%
302031035	31035	Boondall	-27.3481	153.072	NE	8748	1475	4.6	1901.739	4%
302041041	31041	Bracken Ridge	-27.3173	153.033	NW	16799	2103	5.9	2847.288	6%
302011023	31023	Bridgeman Downs	-27.352	152.994	NW	7637	632	4	1909.25	4%
302041042	31042	Brighton (Qld)	-27.2963	153.054	NE	9011	1288	9.4	958.617	2%
302011024	31024	Carseldine	-27.348	153.018	NW	7767	1335	1.2	6472.5	14%
302021028	31028	Chermside	-27.3839	153.033	SW	8171	12298	6.2	1317.903	3%
302021029	31029	Chermside West	-27.3836	153.012	SW	6122	634	5.4	1133.704	3%
302041043	31043	Deagon	-27.3279	153.059	NE	3460	982	6	576.6667	1%
314011385	31385	Eatons Hill	-27.3409	152.936	NW	7991	857	9.2	868.587	2%
302011025	31025	Everton Park	-27.3995	152.987	NW	8325	1377	8.9	935.3933	2%
302021030	31030	Geebung	-27.3721	153.045	SE	4299	5805	5.1	842.9412	2%
305031123	31123	Grange	-27.4213	153.016	SW	4162	708	9.7	429.0722	1%
314011386	31386	Hills District	-27.3781	152.942	NW	22634	3361	9.2	2460.217	6%
302021031	31031	Kedron - Gordon Park	-27.4074	153.033	SW	12608	4488	7.9	1595.949	4%
302011026	31026	McDowall	-27.3832	152.992	NW	7087	1385	8	885.875	2%
302031038	31038	Northgate - Virginia	-27.381	153.071	NE	6364	10667	8.3	766.747	2%
302031039	31039	Nudgee - Banyo	-27.3639	153.088	NE	8723	5715	5.4	1615.37	4%
302041044	31044	Sandgate - Shorncliffe	-27.3211	153.067	NE	6538	2391	7.8	838.2051	2%
302021032	31032	Stafford	-27.4102	153.01	SW	6041	3770	8.5	710.7059	2%
302021033	31033	Stafford Heights	-27.397	153.01	SW	6779	684	6.4	1059.219	2%
314031394	31394	Strathpine - Brendale	-27.3134	152.987	NW	11126	12911	7.6	1463.947	3%
302041045	31045	Taigum - Fitzgibbon	-27.3413	153.036	NE	8908	1275	3.7	2407.568	5%
302021034	31034	Wavell Heights	-27.3917	153.047	SE	9436	1120	8	1179.5	3%
302041046	31046	Zillmere	-27.3587	153.04	NE	8105	2022	4	2026.25	5%
									44720.16	100%

Direction	Proportion
NE	25%
NW	47%
SE	5%
SW	23%
Total	**100%**

Direction	Proportion
NE	25815
NW	28086
SE	6925
SW	26292
Total	**87118**

	Lattitude	Longitude
Development	-27.3504	153.023

25km Radius

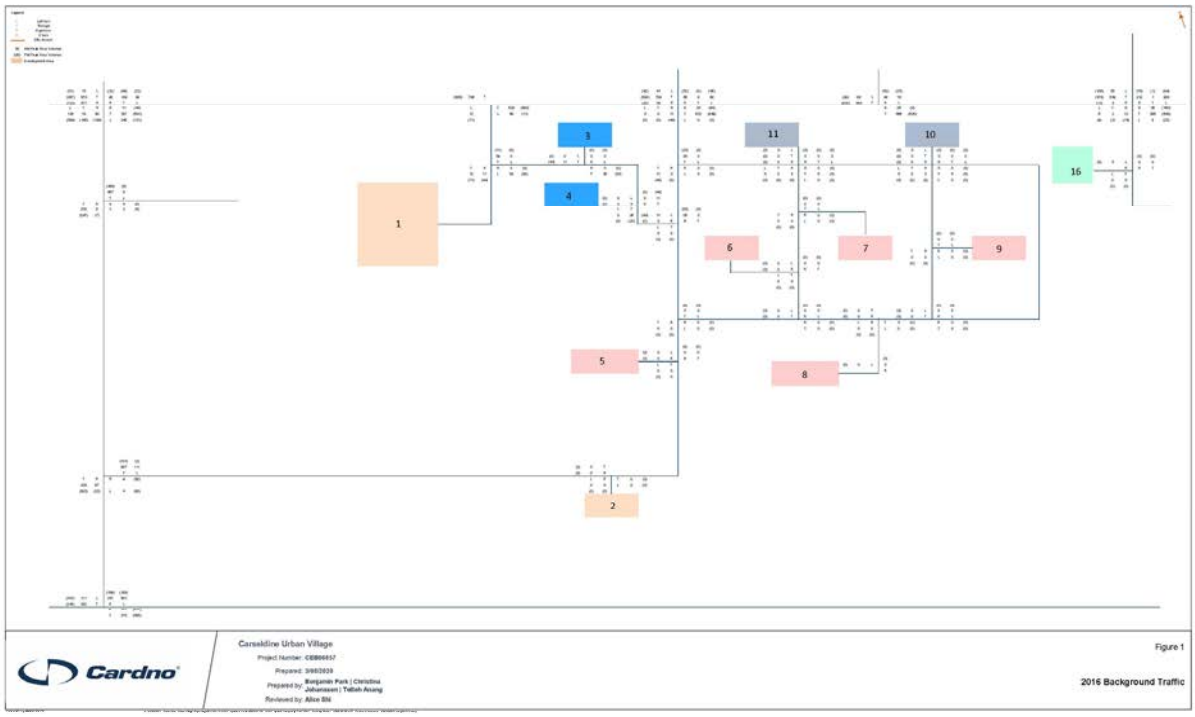
SA2 Maincode	SA2 5 Digit Code	SA2 Name	Lattitude	Longitude	Direction	Full Population (N)	Employed Population (N)	Distance (T)	N/T	Proportion of Sum
314011382	31382	Albany Creek	-27.3535	152.967	NW	15862	2910	6.9	421.7391	1%
305031119	31119	Albion	-27.4335	153.044	SE	2551	4225	11.9	355.042	1%
305031120	31120	Alderley	-27.4251	153	SW	5680	866	10.8	80.18519	0%
303021052	31052	Annerley	-27.5126	153.033	SW	10665	2355	20.7	113.7681	0%
305031121	31121	Ascot	-27.4299	153.065	NE	5166	1352	13.9	97.26619	0%
305041132	31132	Ashgrove	-27.445	152.982	NW	12915	3010	14.6	206.1644	1%
302021027	31027	Aspley	-27.3658	153.019	SW	12448	3710	3	1236.667	3%
305041133	31133	Auchenflower	-27.4744	152.996	SW	5352	3361	18.7	179.7326	0%
302011022	31022	Bald Hills	-27.3084	153.022	NW	6947	1215	6.5	186.9231	0%
305021113	31113	Balmoral	-27.4565	153.069	SW	3828	599	21.4	27.99065	0%
305041134	31134	Bardon	-27.4597	152.978	NW	9255	1301	18.1	71.87845	0%
302031035	31035	Boondall	-27.3481	153.072	NE	8748	1475	4.6	320.6522	1%
302041041	31041	Brocken Ridge	-27.3173	153.033	NW	16799	2103	5.9	356.4407	1%
314031391	31391	Bray Park	-27.2938	152.968	NW	10003	1172	10.9	107.5229	0%
302011023	31023	Bridgeman Downs	-27.352	152.994	NW	7637	632	4	158	0%
302041042	31042	Brighton (Qld)	-27.2963	153.054	NE	9011	1288	9.4	137.0213	0%
302031036	31036	Brisbane Airport	-27.3896	153.118	NE	91	16729	16.8	995.7738	2%
305011105	31105	Brisbane City	-27.4691	153.023	SW	8706	116132	18.5	6277.405	15%
305021114	31114	Bulimba	-27.4495	153.06	SW	5942	2127	21.7	98.01843	0%
313041372	31372	Burpengary	-27.1547	152.951	NW	12963	2870	24.4	117.623	0%
303011047	31047	Camp Hill	-27.4975	153.076	SW	10533	1508	23.7	63.62869	0%
303011048	31048	Cannon Hill	-27.4724	153.096	NE	4509	4540	23.9	189.9582	0%
302011024	31024	Carseldine	-27.348	153.018	NW	7767	1335	1.2	1112.5	3%
302021028	31028	Chermside	-27.3839	153.033	SW	8171	12298	6.2	1983.548	5%
302021029	31029	Chermside West	-27.3836	153.012	SW	6122	634	5.4	117.4074	0%
305031122	31122	Clayfield	-27.418	153.055	NE	10005	2425	11.4	212.7193	1%
313051377	31377	Clontarf	-27.2481	153.082	NE	7911	3108	15.5	200.5161	0%
303021053	31053	Coorparoo	-27.4979	153.061	SW	14946	5347	22	243.0455	1%
314021388	31388	Dakabin - Kallangur	-27.2413	152.992	NW	20427	2667	19.2	138.9063	0%
302041043	31043	Deagon	-27.3279	153.059	NE	3460	982	6	163.6667	0%
313041373	31373	Deception Bay	-27.1798	153.011	NW	21763	4064	20.6	197.2816	0%
302031037	31037	Eagle Farm - Pinkenba	-27.4314	153.097	NE	260	10905	13	838.8462	2%
305021115	31115	East Brisbane	-27.4842	153.048	SW	5598	2539	18	141.0556	0%
314011385	31385	Eatons Hill	-27.3409	152.936	NW	7991	857	9.2	93.15217	0%
304041098	31098	Enoggera	-27.4258	152.975	NW	7684	7096	13.5	525.6296	1%
302011025	31025	Everton Park	-27.3995	152.987	NW	8325	1377	8.9	154.7191	0%
303021054	31054	Fairfield - Dutton Park	-27.5007	153.025	SW	4026	2261	22.9	98.73362	0%
305011106	31106	Forituude Valley	-27.4561	153.035	SW	5216	20109	20	1005.45	2%
302021030	31030	Geebung	-27.3721	153.045	SE	4299	5805	5.1	1138.235	3%
305031123	31123	Grange	-27.4213	153.016	SW	4162	708	9.7	72.98969	0%
303021055	31055	Greenslopes	-27.5057	153.049	SW	8566	5663	21.7	260.9677	1%
305031124	31124	Hamilton (Qld)	-27.4363	153.063	NE	4719	1863	13.8	135	0%
305021116	31116	Hawthorne	-27.4648	153.059	SW	4778	675	19.8	34.09091	0%
305031125	31125	Hendra	-27.4167	153.07	NE	4419	2621	12.4	211.371	1%
305011107	31107	Highgate Hill	-27.4875	153.017	NW	5823	524	18.1	28.95028	0%
314011386	31386	Hills District	-27.3781	152.942	NW	22634	3361	9.2	365.3261	1%
303021056	31056	Holland Park	-27.5192	153.069	SW	7846	1502	24.2	62.06612	0%
303021057	31057	Holland Park West	-27.5266	153.059	SW	5967	545	25	21.8	0%
304031094	31094	Indooroopilly	-27.5062	152.982	SW	11670	6944	23.8	291.7647	1%
305011108	31108	Kangaroo Point	-27.475	153.036	SW	6999	2106	18.6	113.2258	0%
302021031	31031	Kedron - Gordon Park	-27.4074	153.033	SW	12608	4488	7.9	568.1013	1%
305031126	31126	Kelvin Grove - Herston	-27.4501	153.017	SW	7846	16609	13.9	1194.892	3%
304041100	31100	Keperra	-27.4142	152.953	NW	7010	1453	12.4	117.1774	0%
314031392	31392	Lawnton	-27.2817	152.982	NW	5727	2508	10.4	241.1538	1%
313051378	31378	Margate - Woody Point	-27.2494	153.103	NE	11094	1556	17.3	89.9422	0%
302011026	31026	McDowall	-27.3832	152.992	NW	7087	1385	8	173.125	0%
304041101	31101	Mitchelton	-27.4104	152.97	NW	7658	2729	11.7	233.2479	1%
303041068	31068	Moorooka	-27.5348	153.026	SW	9984	2836	23.3	121.7167	0%
305021117	31117	Morningside - Seven Hills	-27.4662	153.077	SW	11433	5235	21.2	246.934	1%
301031017	31017	Murarrie	-27.4499	153.109	NE	3959	10580	21.4	494.3925	1%
314021389	31389	Murrumba Downs - Griffin	-27.2727	153.038	NW	11753	1215	11.3	107.5221	0%
313041375	31375	Narangba	-27.1869	152.918	NW	16222	3068	21.2	144.717	0%
305011109	31109	New Farm	-27.4657	153.046	SW	11728	3375	16.6	203.3133	0%
305031127	31127	Newmarket	-27.435	153.007	SW	4442	1355	11.6	116.8103	0%
305031128	31128	Newstead - Bowen Hills	-27.4483	153.04	SW	7282	15371	14.4	1067.431	3%
305021118	31118	Norman Park	-27.4789	153.064	SW	6001	615	19.6	31.37755	0%
314021390	31390	North Lakes - Mango Hill	-27.234	153.035	NW	19380	5119	14.3	357.972	1%
302031038	31038	Northgate - Virginia	-27.381	153.071	NE	6364	10667	8.3	1285.181	3%
302031039	31039	Nudgee - Banyo	-27.3639	153.088	NE	8723	5715	5.4	1058.333	3%
302031040	31040	Nundah	-27.4	153.063	NE	10387	4066	10	406.6	1%
305041135	31135	Paddington - Milton	-27.4645	152.999	SW	9977	16759	16.8	997.5595	2%
314031393	31393	Petrie	-27.2629	152.975	NW	8501	1904	14.9	127.7852	0%
305041136	31136	Red Hill (Qld)	-27.4524	153.003	SW	5546	1600	13.9	115.1079	0%
313051379	31379	Redcliffe	-27.2264	153.107	NE	9200	4681	19.2	243.8021	1%
313051380	31380	Rothwell - Kippa-Ring	-27.215	153.066	NW	16614	4746	18.4	257.9348	1%
314011387	31387	Samford Valley	-27.358	152.838	NW	10929	1968	21.7	90.69124	0%
302041044	31044	Sandgate - Shorncliffe	-27.3211	153.067	NE	6538	2391	7.8	306.5385	1%
313051381	31381	Scarborough - Newport	-27.2049	153.095	NE	11168	1487	21.8	68.21101	0%
305011110	31110	South Brisbane	-27.4797	153.02	SW	5417	22759	16.7	1362.814	3%
305011111	31111	Spring Hill	-27.4584	153.023	SW	5626	14550	15.2	957.2368	2%
304031096	31096	St Lucia	-27.498	153.005	SW	11194	8606	21.4	402.1495	1%
302021032	31032	Stafford	-27.4102	153.01	SW	6041	3770	8.5	443.5294	1%
302021033	31033	Stafford Heights	-27.397	153.01	SW	6779	684	6.4	106.875	0%
314031394	31394	Strathpine - Brendale	-27.3134	152.987	NW	11126	12911	7.6	1698.816	4%
302041045	31045	Toigum - Fitzgibbon	-27.3413	153.036	NE	8908	1275	3.7	344.5946	1%
304031097	31097	Taringa	-27.4952	152.98	SW	7933	2227	21.1	105.545	0%
303041071	31071	Tarragindi	-27.5262	153.045	SW	9965	901	23.6	38.17797	0%
304041103	31103	The Gap	-27.4451	152.943	NW	15951	2276	16.1	141.3665	0%
301031018	31018	Tingalpa	-27.474	153.129	SW	8540	3232	24.5	131.9184	0%
305041137	31137	Toowong	-27.4808	152.984	SW	10501	8206	19.9	412.3618	1%
304041104	31104	Upper Kedron - Ferny Grove	-27.4139	152.92	NW	9042	1124	18.1	62.09945	0%
302021034	31034	Wavell Heights	-27.3917	153.047	SE	9436	1120	8	140	0%
305011112	31112	West End	-27.4821	153.006	SW	8062	6821	17.1	398.8889	1%
305031129	31129	Wilston	-27.4345	153.018	SW	3870	896	11.2	80	0%
305031130	31130	Windsor	-27.4346	153.031	SW	6388	3001	11.1	270.3604	1%
303021058	31058	Woolloongabba	-27.4929	153.037	SW	4787	12972	20	648.6	2%
305031131	31131	Wooloowin - Lutwyche	-27.4151	153.038	SW	8738	3081	10.4	296.25	1%
303021059	31059	Yeronga	-27.5232	153.009	SW	8385	3324	22.3	149.0583	0%
302041046	31046	Zillmere	-27.3587	153.04	NE	8105	2022	4	505.5	1%
									40926.08	100%

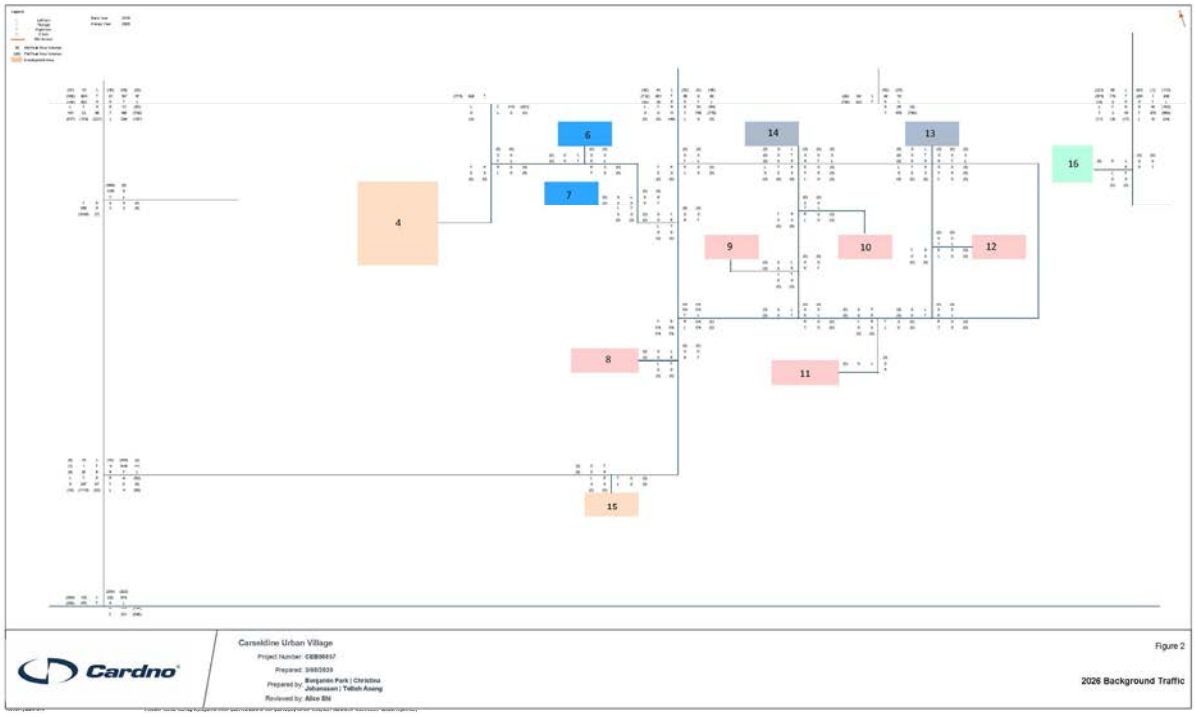
Direction	Proportion
NE	20%
NW	20%
SE	4%
SW	56%
Total	**100%**

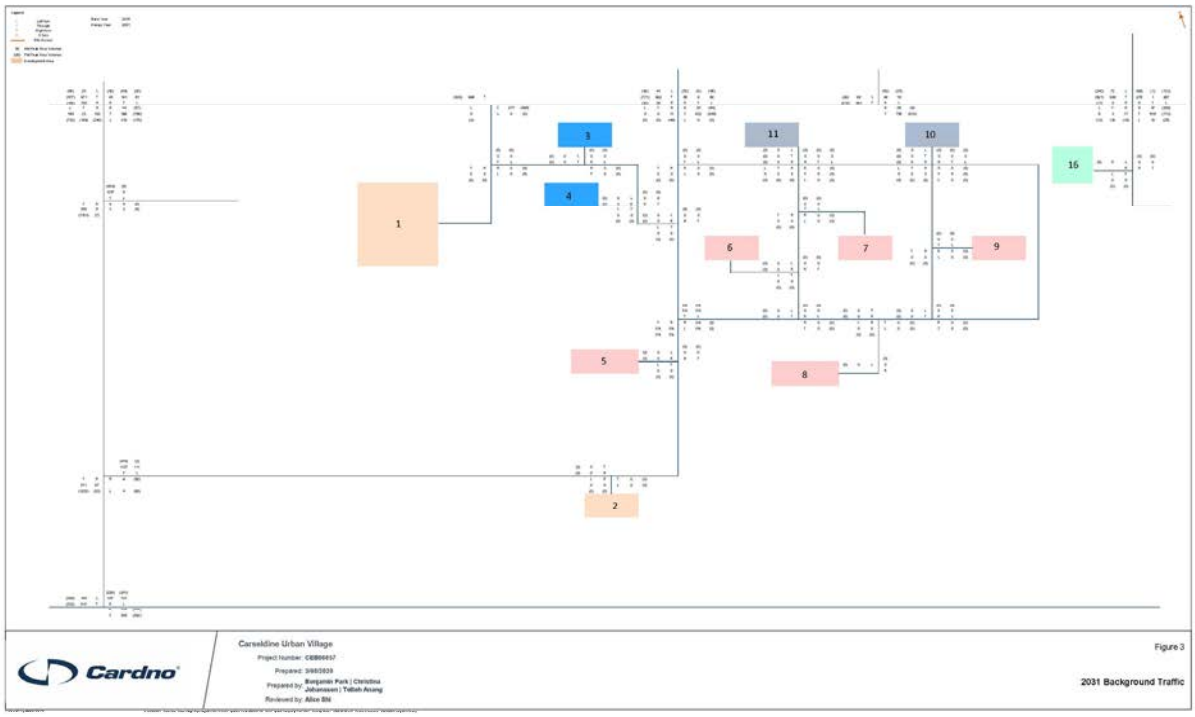
Direction	Proportion
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SW	355262
Total	**537040**

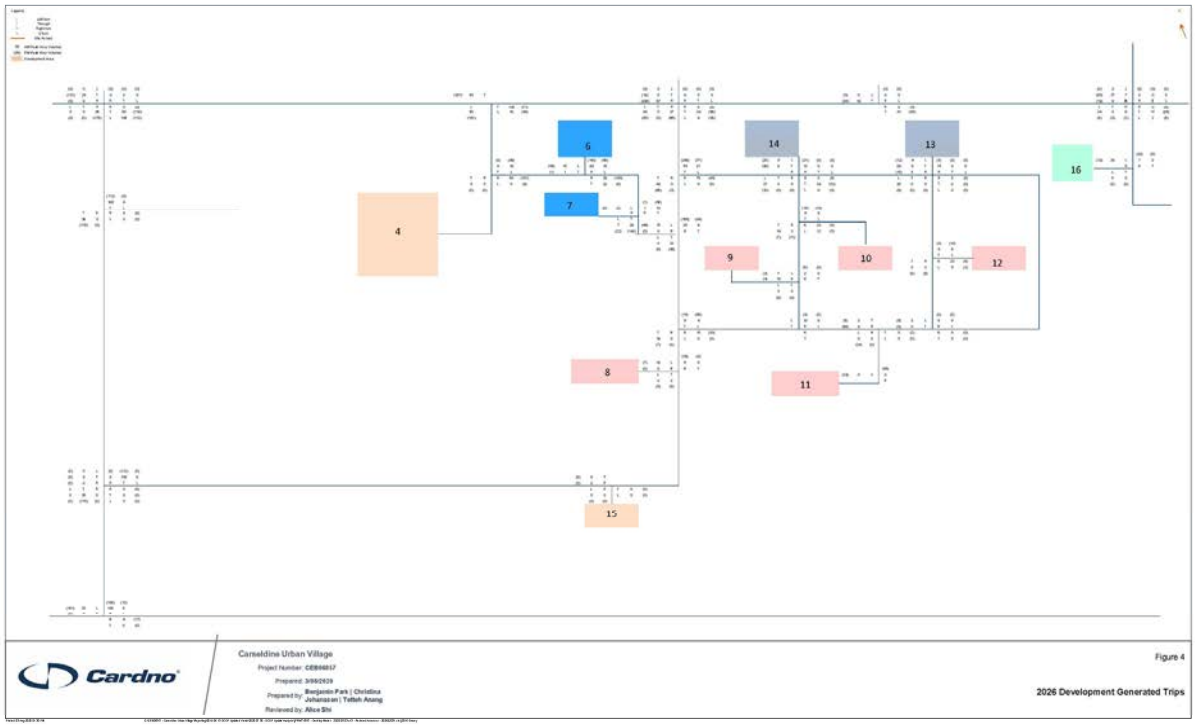
DCOP Traffic Impact Assessment

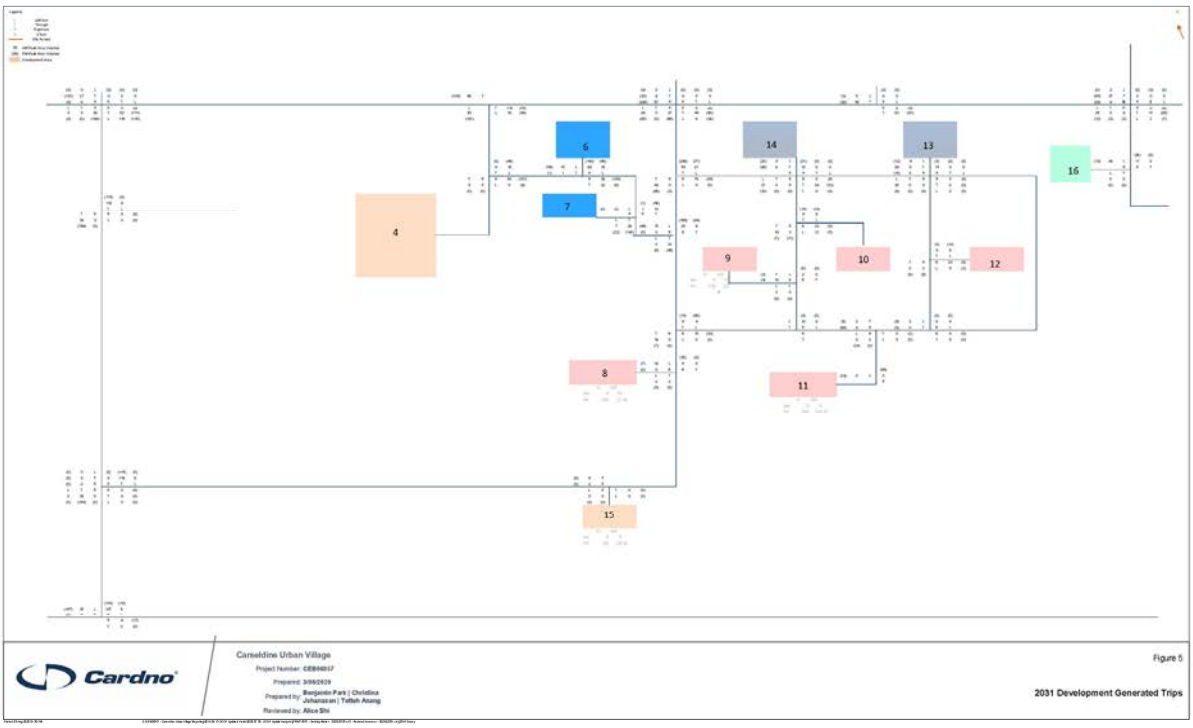
APPENDIX D
TRAFFIC FLOW DIAGRAMS

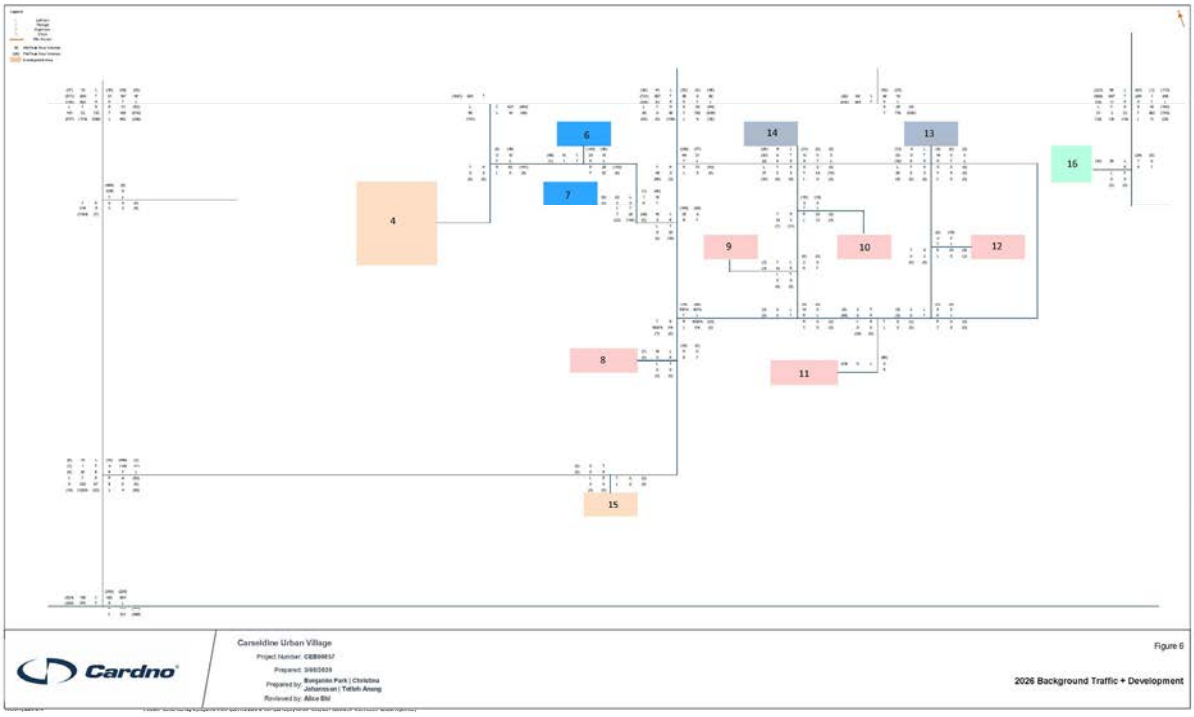

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Careldine Urban Village
Figure 1
2016 Background Traffic

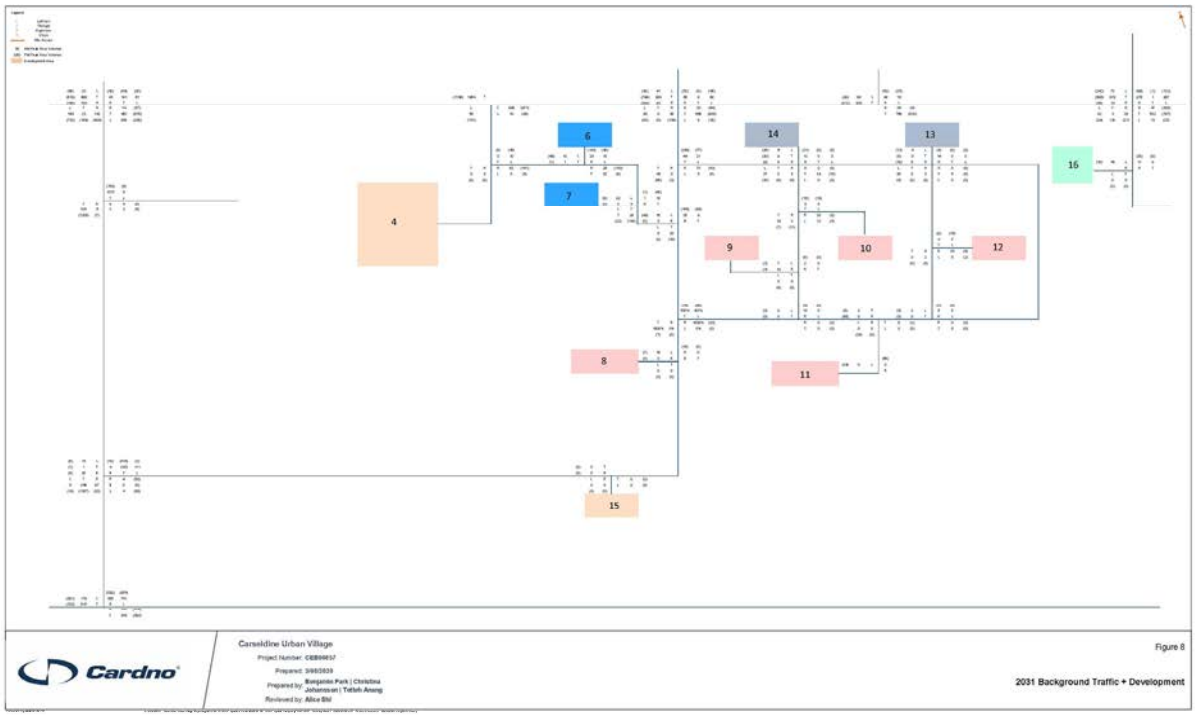

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Cardno
Careldine Urban Village
Figure 2
2026 Background Traffic


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Carseldine Urban Village
Figure 3
2031 Background Traffic


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Carseldine Urban Village
Figure 4
2026 Development Generated Trips

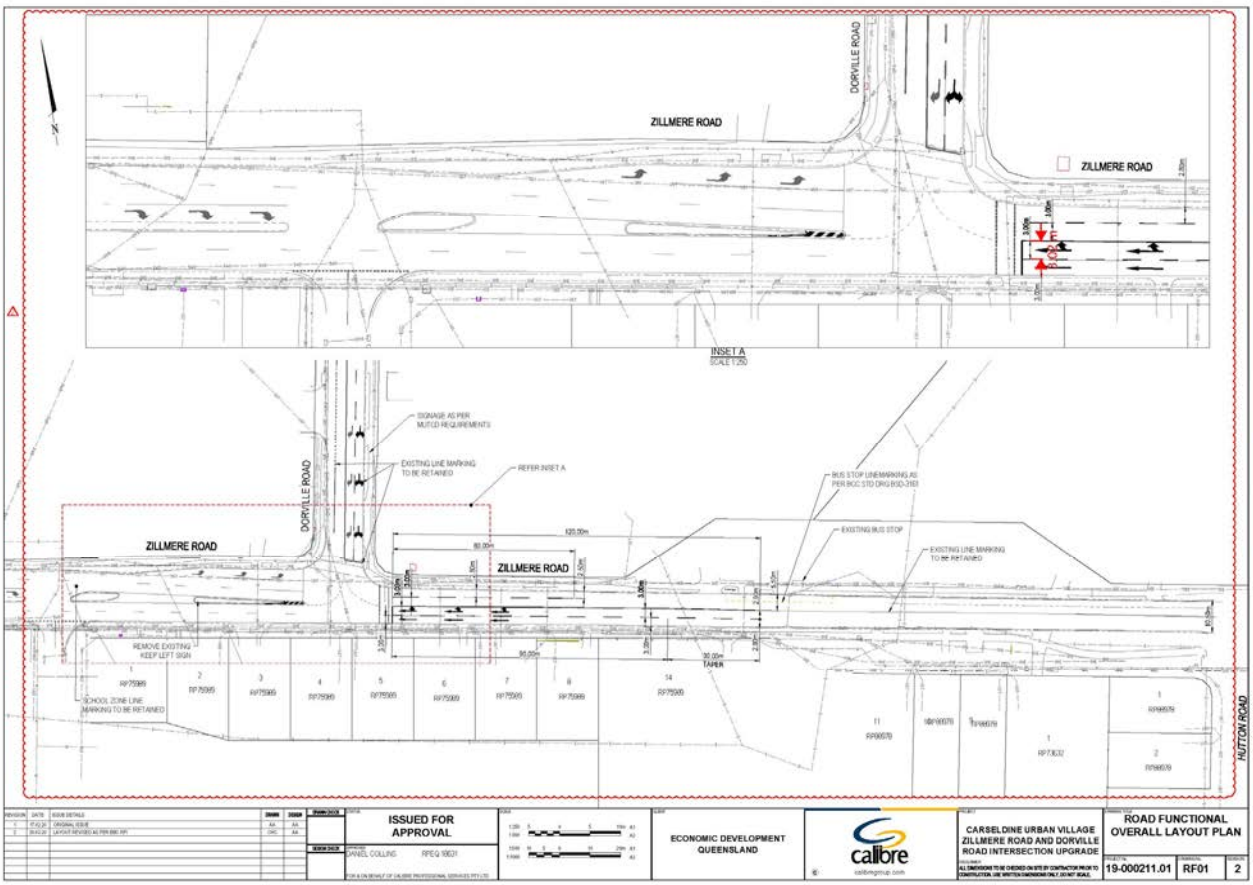

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Carseldine Urban Village
Figure 5
2031 Development Generated Trips

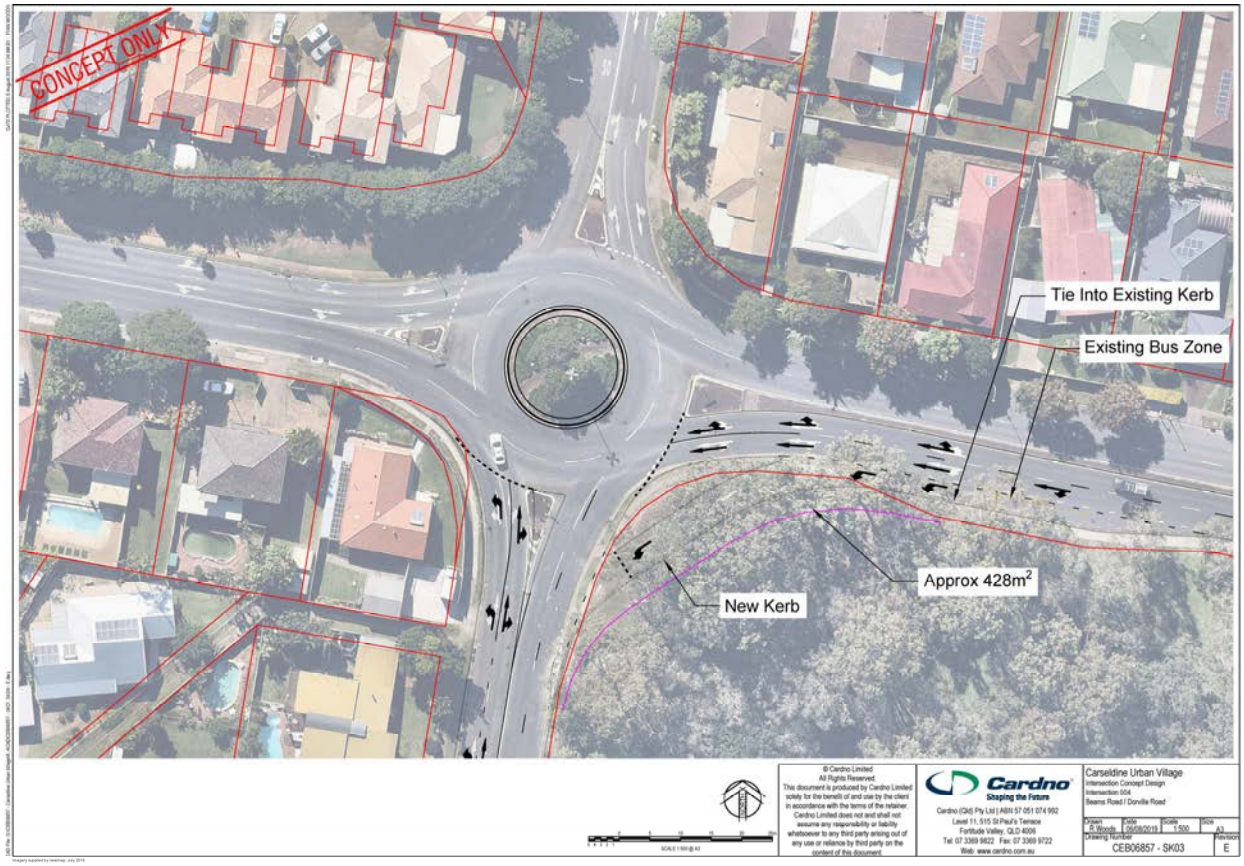

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Cardno
Carseldine Urban Village
Figure 6
2026 Background Traffic + Development

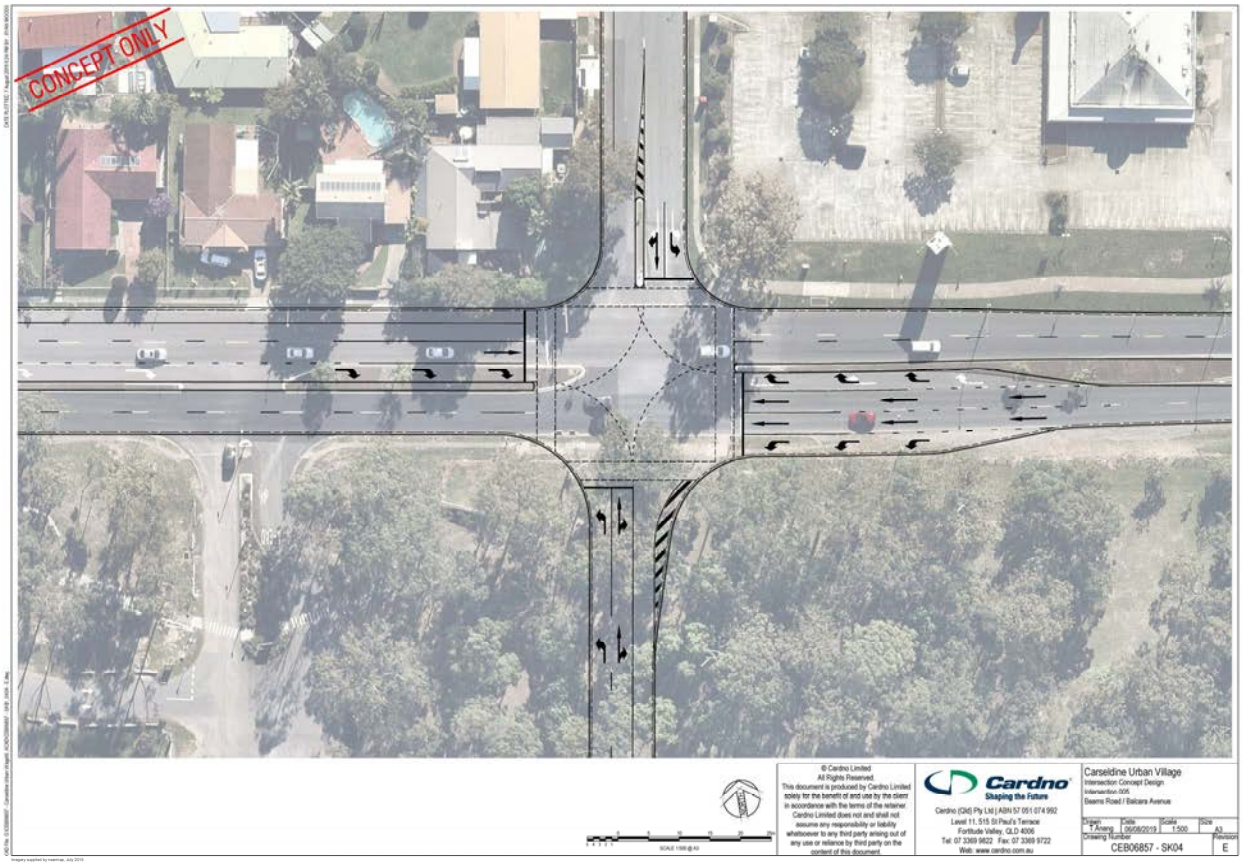

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Cardno
Careldine Urban Village
Figure 8
2031 Background Traffic + Development

DCOP Traffic Impact Assessment

APPENDIX E
CONCEPT DESIGN SKETCHES


ZILLMERE ROAD
DORVILLE ROAD
INSET A
SCALE 1:250
SIGNAGE AS PER MUTCD REQUIREMENTS
EXISTING LINE MARKING TO BE RETAINED
REFER INSET A
BUS STOP LINEMARKING AS PER BCC STD DRG BSD-3183
EXISTING BUS STOP
REMOVE EXISTING KEEP LEFT SIGN
SCHOOL ZONE LINE MARKING TO BE RETAINED
TAPER
HUTTON ROAD
ISSUED FOR APPROVAL
ECONOMIC DEVELOPMENT QUEENSLAND
CARSELDINE URBAN VILLAGE
ZILLMERE ROAD AND DORVILLE ROAD INTERSECTION UPGRADE
ROAD FUNCTIONAL OVERALL LAYOUT PLAN
19-000211.01
RF01
2


CONCEPT ONLY
Tie Into Existing Kerb
Existing Bus Zone
Approx 428m²
New Kerb
Cardno
Carseldine Urban Village
Intersection Concept Design
Intersection 004
Beams Road / Dorville Road
CEB06857 - SK03
E

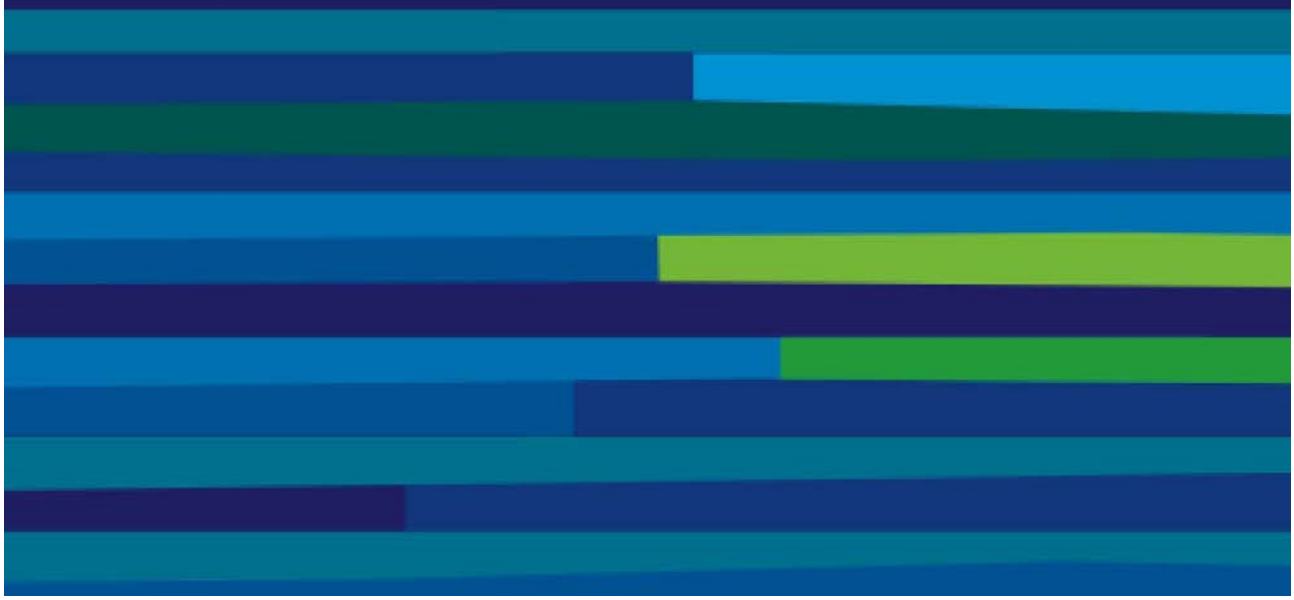

CONCEPT ONLY
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Carseldine Urban Village
Intersection Concept Design
Intersection 005
Beams Road / Balcara Avenue
Drawn
T.Aneng
Date
05/08/2019
Scale
1:500
Size
A3
Drawing Number
CEB06857 - SK04
Revision
E

Appendix E – Stormwater management plan

CARSELDINE URBAN VILLAGE

UPDATED STORMWATER MANAGEMENT PLAN

DesignFlow
Prepared for Economic Development Queensland
October 2019



Document Control Sheet

Report Title:	Carseldine Urban Village – Updated Stormwater Management Plan
Suggested Reference:	Carseldine Urban Village – Updated Stormwater Management Plan (DesignFlow, 2019)
Version:	04
Client:	Economic Development Queensland
Author(s):	Ralph Williams
Reviewed By:	Shaun Leinster
Approved By:	Shaun Leinster RPEQ15637 
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Qualifications & Limitations

In preparing this report, Designflow has relied upon and assumed accurate data provided by Brisbane City Council (BCC) and other sources. Unless otherwise stated in this report, Designflow has not attempted to verify the accuracy or completeness of any such information. The accuracy of this report is reliant upon the accuracy of this information.

This investigation is based upon BCC's established flood model of the Cabbage Tree Creek floodplain. While some refinements have been made to BCC's models to suit the current project, overall the modelling approach and assumptions have been applied consistently with that of the established models. Consequently, the model accuracy limitations of BCC's flood models also generally apply to this investigation.

Modelling for this investigation is based on a design event approach and assumptions that are consistent with current industry practice. It is important to be aware that real world flood events are random and highly variable. Consequently, observed and future flooding characteristics may not reflect those described in this report.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Designflow for use of any part of this report in any other context.

Study results should not be used for purposes other than those for which they were prepared.

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EXECUTIVE SUMMARY

Carseldine Urban Village (Lot 322 on SP172124) is a proposed development on a 45ha site, currently occupied by Queensland Government facilities and community sports fields. The development is currently being undertaken by Economic Development Queensland (EDQ) and involves the creation of lots for a mix of uses including commercial and retail, residential, retirement living and a sporting complex.

This report presents the details of an Updated Stormwater Management Plan for the development to meet the requirements under:

- *State Planning Policy* – SPP (DLGIP, 2017) for the operational stormwater quality objectives;
- *Queensland Urban Drainage Manual* (QUDM) for stormwater quantity management; and
- *Brisbane City Council Planning Scheme*

This report supersedes the previously issued stormwater management plan for the site (DesignFlow, April 2018). This updated stormwater management plan captures the following updates and information that has been made available since the issue of the April 2018 report:

- Updated and approved overall masterplan for the development (source: RPS, October 2019)
- Latest earthworks associated with the development (source: Calibre Consulting, June 2019)
- Existing site pipe drainage survey (completed June 2019 – source: Land Partners)

STORMWATER QUALITY MANAGEMENT

The updated stormwater treatment strategy includes two (2) bioretention basins that treat development runoff prior to discharge to Cabbage Tree Creek:

- Bioretention Basin B1 265m² filter area treating Stages 2, 3 (part of) and S
- Bioretention Basin B2 500m² filter area total treating the remainder of the development (Stages 1,3 (part of), 4 and 5)

These basins are located outside of the Cabbage Tree Creek riparian corridor and will have low impact on existing vegetation. The proposed locations also avoid conflicts with the future busway corridor.

Drainage swales along the eastern boundary of the site and at the southern boundary of the Stage S sports fields also provide additional treatment.

FLOOD MANAGEMENT

Flood impact assessment demonstrates no significant impacts occurring external to the site as a result of development. Some afflux (~50mm) is observed immediately south east of the development boundary, however this afflux occurs within a low-lying flood prone bushland area and is not considered an actionable nuisance.

Improved flood conditions are observed at Beams Road and the rail line at the north-east end of the site. This is because much of the site drainage will be directed to Cabbage Tree Creek. Furthermore, during larger magnitude events, the proposed development fill restricts Cabbage Tree Creek breakout flow from entering this area.

Required mitigation measures to manage flood impacts external to the site include:

- Providing flood storage over the sports field zone for events greater than the 5% AEP (20 year ARI).
- Incorporation of a 1200mm dia pipe with one-way flap valve along the new drainage swale draining the eastern half of the development. This minimizes the impacts of Cabbage Tree Creek flows into the site via this new connection to Cabbage Tree Creek.
- Inclusion of a flood barrier (~1m high) along the eastern boundary of the site. This avoids increases in flood levels along the rail line adjacent to the site.

This report is based on regional flood modelling based upon the Brisbane City Council (BCC) flood model for Cabbage Tree Creek. Updated regional modelling and detailed local modelling will occur as part of continuing design development for the site.

1 SITE CHARACTERISTICS

1.1 SITE LOCATION

The Carseldine Urban Village development is located approximately 14km north of Brisbane. The site is bounded by Beams road to the north, Cabbage Tree Creek to the south, Brisbane rail to the east and Dorville Road to the west.

Figure 1 shows the location of the site.



Figure 1: Locality plan

1.2 CLIMATE

Figure 2 provides a summary of the monthly rainfall based on climate statistics for Brisbane (station No 40223).

The annual average rainfall is 1,190 mm, whilst annual evaporation is approximately 1,950mm. The figure clearly indicates the seasonal nature of rainfall and evaporation with lower rainfall and evaporation periods during the winter months.

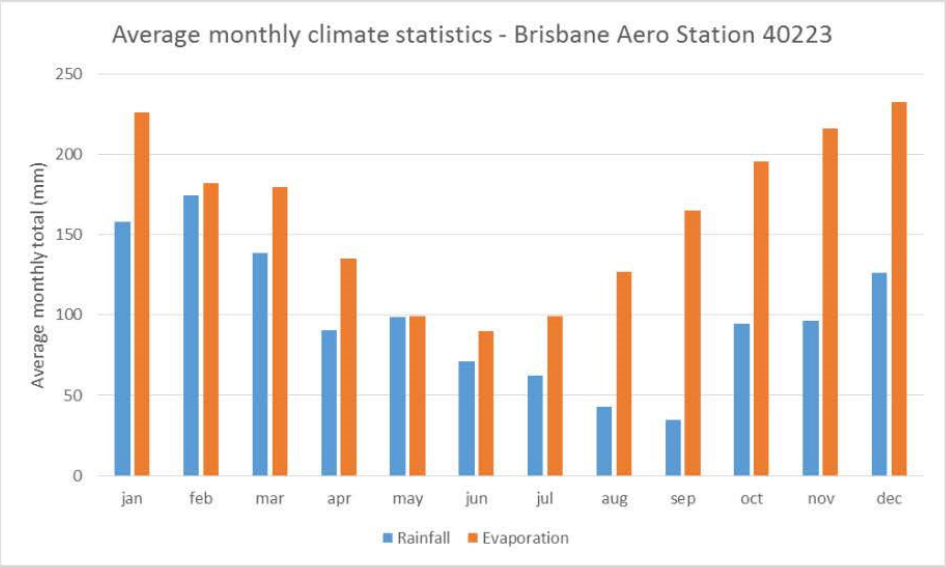


Figure 2 Average monthly climate statistics

1.3 TOPOGRAPHY, CATCHMENTS AND DRAINAGE

Ground levels across the site range from approximately RL28 at the high point located at the north western boundary of the development to approximately RL9.5 at the south eastern corner at Cabbage Tree Creek. Grades across the site are flat to moderate typically ranging from 0.5 to 10%.

The site is characterised by areas of low lying and poorly drained topography. Figure 3 shows the existing topography and general drainage of the current site. The majority of the site drainage is toward Cabbage Tree Creek to the south, whilst the north west section of the site drains northward. Poorly drained areas are also noted at the north east of the site.

Pipe drainage within the site discharges at two (2) outfalls to Cabbage Tree Creek. This drainage system minimises localised site flooding in the more frequent events, when regional flooding from Cabbage Tree Creek does not occur.

In general, the northern bank of Cabbage Tree Creek is higher than adjacent ground levels further north within the site. This means flood flows are initially contained within Cabbage Tree Creek but then break out of the banks of the creek over the high point on the northern bank and inundate low lying and poorly drained areas within the site.

At the north eastern end of the site, low lying areas occur adjacent to the rail line and at the northern boundary of the existing sports fields adjacent to Beams Road. This area appears to be providing an overland flow path for flood flows.

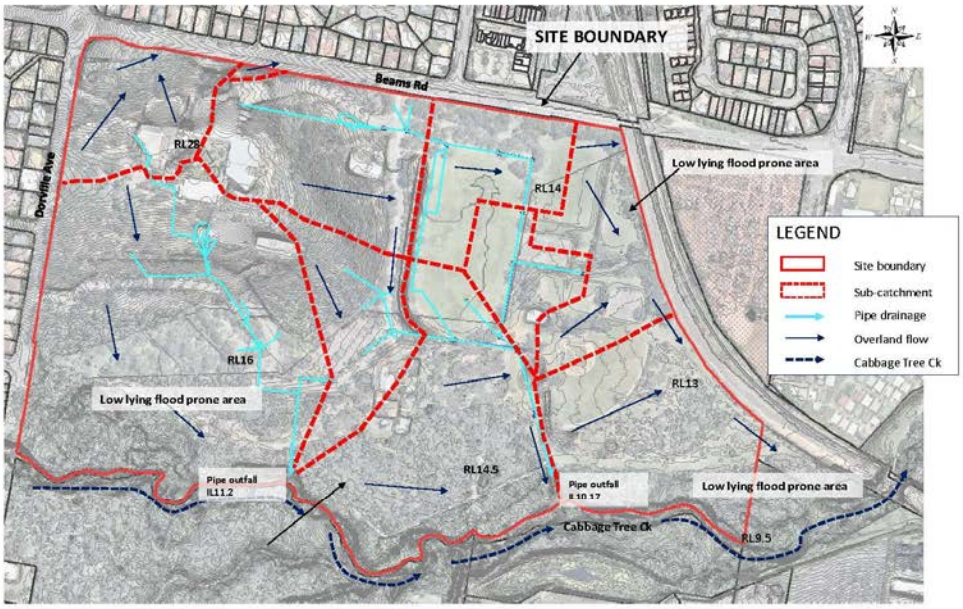


Figure 3: Topography and drainage

1.4 SOILS AND VEGETATION

Soils across the site are generally characterised by alluvial soils comprising surface clayey silt overlying medium to high plasticity silty clay and sandy clay, with interbedded layers of clayey sand, gravelly sand and gravel (SGS, 2017).

The site comprises of sports fields and government buildings in the northern half of the site. Extensive good value bushland occurs in the southern half of the site including the Cabbage Tree Creek riparian corridor (refer Figure 1).

1.5 PROPOSED DEVELOPMENT

The Carseldine Urban Village development is located within a 45ha site. The site includes existing government facilities at the north western end of the development that are to be retained. Existing sports fields at the north eastern corner of the site are to be redeveloped, whilst a new sporting precinct will be constructed at the south eastern corner of the site. A future busway is planned at the southern end of the site. The existing QUT research facility at the southern end of the site is planned to be decommissioned in 2020.

The overall development will include approximately 10.3ha of new commercial and residential development, and an approximated 5 ha of new sporting complex area.

The current development layout for Carseldine Urban Village is shown in Figure 4.



Figure 4 Proposed Carseldine Urban Village development (Source: RPS 2019)

2 STORMWATER DESIGN OBJECTIVES

Stormwater management objectives have been established based on the following:

- *State Planning Policy* (DLGIP, 2017)
- *Queensland Urban Drainage Manual* (2016)
- *Brisbane City Council (BCC) Planning Scheme*

2.1 STORMWATER QUALITY

The stormwater quality management objectives that apply to the operational phase of the development are defined in the State Planning Policy (DLGIP, 2017) which applies load based objectives presented in Table 1.

Table 1 – Stormwater quality objectives

Constituent	Discharge criteria
Total suspended solids (TSS)	80% reduction in post developed mean annual load
Total phosphorous (TP)	60% reduction in post developed mean annual load
Total nitrogen (TN)	45% reduction in post developed mean annual load
Gross pollutants	90% reduction in post developed mean annual load

Construction phase erosion and sediment control objectives are outlined in Table A Appendix 2 of SPP (DLGIP, 2017). Detailed erosion and sediment control plans will be provided with the Operational Works application.

2.2 FLOODING

The flood management objectives applicable to the site are presented in Table 2. Carseldine Urban Village development lies within Brisbane City Council (BCC) mapped City Wide Waterway corridor zone.

Table 2 Flood objectives

Criterion	Design Objective
No worsening hydraulic conditions	No worsening hydraulic impact to be demonstrated external to the site for the critical duration storm for the 39% AEP to 1% AEP events
BCC flood overlay code PO2 Development within a creek/waterway flood planning area	a) Maintains conveyance of flood waters to allow flow and debris to pass predominantly unimpeded through the site b) Does not concentrate, intensify or divert floodwater onto upstream, downstream or adjacent properties c) Will not result in a material increase in flood levels or flood hazard on upstream, downstream or adjacent properties
BCC Flood overlay code PO8 Development for filling or excavation in an area affected by creek/waterway flooding	Does not directly, indirectly or cumulatively cause any material increase in flooding or hydraulic hazard or involve significant redistribution of flood storage from high to lower areas in the floodplain

3 STORMWATER MANAGEMENT STRATEGY

The stormwater management strategy for the Carseldine Urban Village development has been developed based on discussions with EDQ, the design team and field inspections to identify opportunities and constraints.

When developing the strategy, several guiding principles were considered:

- achieve obligations under the *State Planning Policy*, *BCC planning scheme policy* and *Queensland Urban Drainage Manual*
- ensure stormwater management systems are functionally feasible within the constraints of the development and drainage levels
- avoid numerous stormwater management sites
- avoid works within the Cabbage Tree Creek riparian buffer zone
- minimize impacts on existing good value vegetation
- avoid works encroaching into the future busway corridor
- minimize the need for an on-site flood basin, where possible
- utilization of the 10m wide acoustic barrier at the eastern boundary of the site for drainage conveyance and treatment

Figure 5 shows the stormwater management strategy for the Carseldine Urban Village development. The strategy has been developed considering the proposed drainage for the development (source: Calibre Consulting). This includes pipe drainage for minor storm events and overland flows for flows exceeding pipe capacity.

Performance assessments of the proposed management strategy are presented in Section 4 (stormwater quality) and Section 5 (flooding).

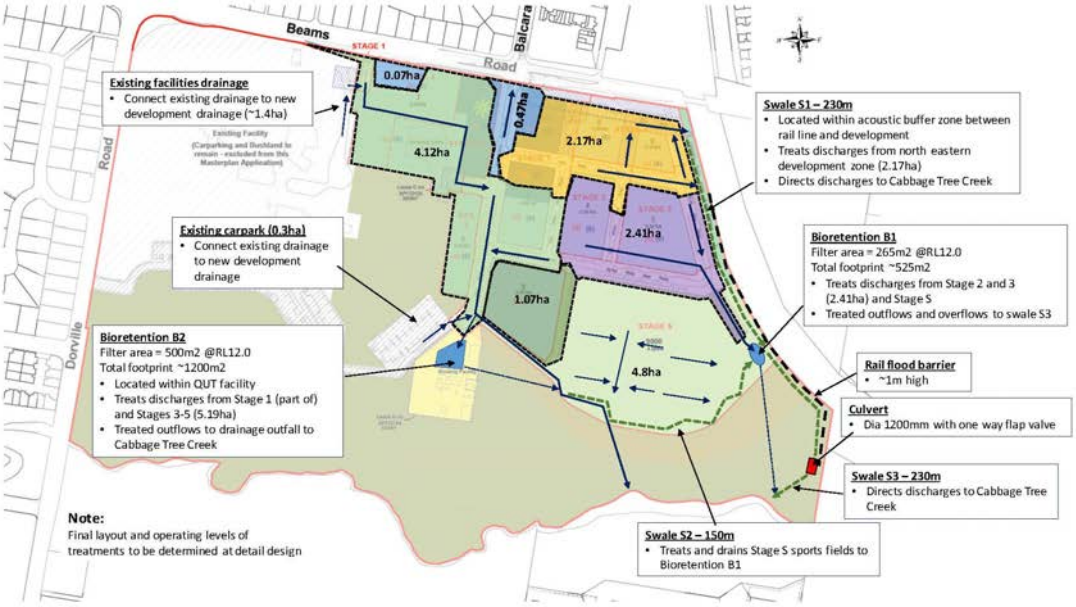


Figure 5 Stormwater Management Strategy Carseldine Urban Village

Table 3 Stormwater treatment elements

ID and Stages Treated	Treatment		Catchment	Comment
	Type	Area/length	ha	
B1 – Stages 2,3 (part of) and S	Bioretention	265m²	2.41	Located within Stage S. Treats discharges from Stage 2 and 3 (part of). Receives treated flows from Stage S sports fields. Treated flows and overflows to swale S3.
B2 – Stages 1 and 3 (part of) and 4-5	Bioretention	500m²	5.19	Located within the QUT facility. Treats Stages 1 and 3 (part of) and Stages 4 and 5. Receives low from diversion from main drainage pipe. Treated outflows to drainage outfall to Cabbage Tree Ck.
S1 – Stages 1, 2 and 3 (part of) and 4	Swale	230m	2.17	Treats north eastern development zone (Stage 1, 2 and 3 (part of) and Stage 4).
S2 – Stage S	Swale	150m	4.8	Treats and drains Stage S sports fields to Bioretention B1
S3 – Stages 1 and 3 (part of) and 2,4 and S	Swale	230m	B1+S1+S2	Conveys eastern development zone discharges to Cabbage Tree Ck. Provides additional treatment for upstream discharges prior to discharge to Cabbage Tree Creek
Stage 1 (part of) – Beams Rd	untreated		0.54	Development treatment upsized to offset this untreated portion of the development
TOTAL			15.11	

3.1 STORMWATER TREATMENT

The treatment strategy includes two (2) bioretention basins treating the development zones as shown in Figure 5. Swales along the southern boundary of the Stage S sports fields and at the eastern boundary of the site will also provide a treatment function prior to discharge to Cabbage Tree Creek.

Two small development areas (0.54ha total) adjacent to Beams Road at the northern end of the development do not report to the treatments proposed. The stormwater treatment proposed as part of this strategy have been sufficiently sized to compensate (i.e. over-treat) for the treatment of this area. Refer to Section 4 for performance assessments.

It should also be noted that the proposed drainage strategy will connect existing drainage from the existing facilities at the north west of the site to drainage that will report to Bioretention basin B2. This provides treatment of an area that previously was untreated.

Bioretention Basin B1

Bioretention Basin B1 (filter area 265m² at RL12.0) treats Stage 2 development and the eastern Stage 3 development and receives treated discharges from the swale (S2) draining Stage S sports fields. This basin is located at the eastern boundary of the site, just south of Stage S carpark. Pipe discharges enter the basin from the development zone via the Stage S carpark.

Treated outflows from the bioretention basin discharge to swale S3. Overflows from the bioretention connect directly to swale S3 via an overflow weir.

Detail designs for this bioretention basin have now been completed and construction is currently underway as part of Stage S works. A general arrangement of the bioretention basin is shown in Figure 6.

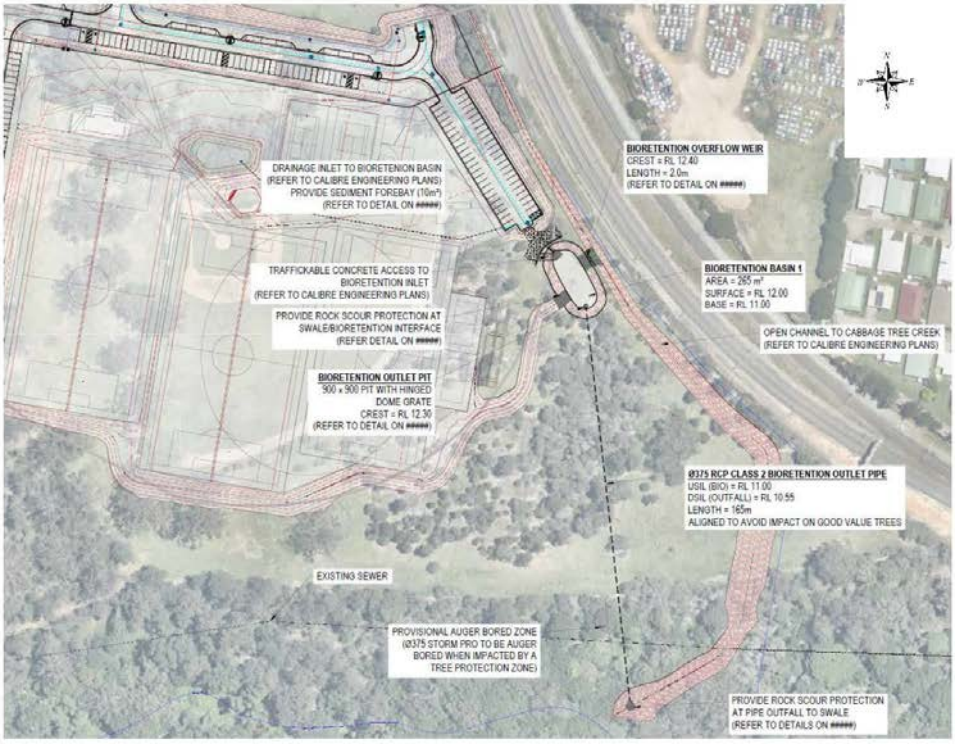


Figure 6 Bioretention basin B1 general arrangement

Bioretention Basin B2

Bioretention Basin B2 (filter area 500m² at RL12.0) treats parts of Stage 1 and 3 (west) development as well as Stages 4 and 5. The basin is proposed to be located within the footprint of the existing QUT research facility at the southern end of the site. This area, covering approximately 6,500m², is due to be decommissioned in 2020.

This treatment site could be incorporated as part of a future stormwater reuse scheme, by directing treated stormwater from the bioretention basin to an adjacent storage pond, which can then be used to supply harvested water for sports field irrigation.

Detail designs have now been completed for this bioretention. A general arrangement is shown in Figure 7.

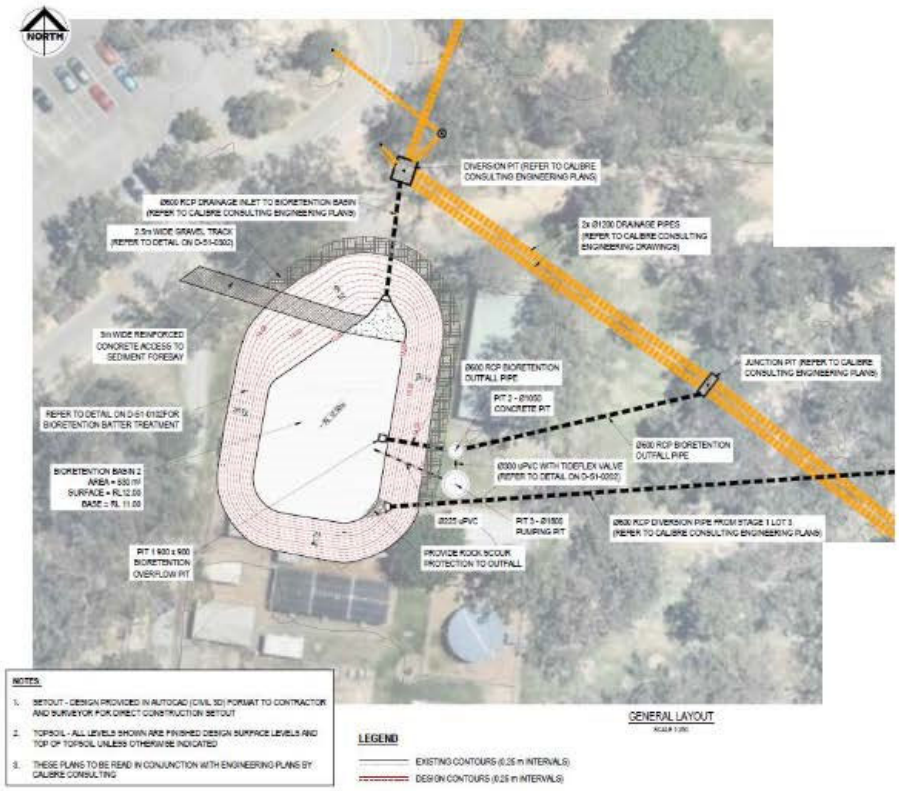


Figure 7 Bioretention basin B2 general arrangement

A diversion pit will direct development low flows to the bioretention basin at the northern end. In addition, a diversion pipe (600mm dia) will direct drainage from Stage 1 Lot 3 (1.07ha) to the bioretention basin at the southern end. High flows will continue to the drainage outfall to Cabbage Tree Creek via twin 1200mm dia pipes.

Treated outflows and bioretention overflows will be piped from the bioretention basin to the proposed 2x1200 mm dia drainage outfall pipes to Cabbage Tree Creek. A dia 1800mm pit is included with the bioretention basin works to facilitate connection to a future stormwater harvest scheme, should this proceed. This will allow the retrofit of future pumping infrastructure within this pit to pump bioretention treated outflows to a future holding pond. Regardless, the bioretention basin can operate under gravity to drain treated flows and overflows to the outfall of Cabbage Tree Creek i.e. the bioretention basin is not reliant on the inclusion of a stormwater harvest scheme and can operate entirely independently and under gravity.

Swale S1 (~230m)

Swale S1 (~230m) represents the drainage reserve formed at the eastern boundary of the development. Drainage from part of Stages 1 to 3 and Stage 4 will discharge to this

drainage reserve. This area is a minimum 10m wide and will be grassed and treed to form a buffer to the rail corridor. Drainage gradients along this zone are typically flat (~0.3%).

Swale S2 (~150m)

Swale S2 receives and treats drainage from the Stage S sports fields and directs this drainage to Bioretention Basin B1. This swale is turfed with 6H:1V batters. Drainage gradients are typically 0.6%.

Swale S3 (~230m)

Swale S3 connects drainage from the eastern half of the development zone to Cabbage Tree Creek. To minimise the impact on vegetation within the Cabbage Tree Creek riparian zone, batter slopes of 3H:1V are used. Drainage gradients along this zone are typically 0.6%. The swale will be vegetated with a mix of groundcovers and riparian vegetation to provide a treatment function and aid stability.

3.2 FLOOD MANAGEMENT

The majority of development runoff is directed southward to discharge to Cabbage Tree Creek. Development earthworks are configured to facilitate overland flows eastward and southward to allow the majority of development drainage to Cabbage Tree Creek. Developed lots are above 1% AEP levels (Q100), however the sports field earthworks allow flooding of the sports fields in events higher than the 5% AEP (Q20) . This aids in offsetting loss of flood storage as a result of development and avoids flood impacts along Cabbage Tree Creek.

A new swale along the eastern boundary of the site drains stormwater from the eastern half of the site to Cabbage Tree Creek. A 1200mm dia culvert is included along this swale with a one-way flap valve to minimise backwatering effects of Cabbage Tree Creek flows into the development from this new swale.

A flood barrier is also included along the eastern boundary of the site to contain development flows within the site and avoid impacts along the rail corridor. This flood barrier can take the form of a low block wall (~1m high) and/or bund and can be incorporated with the future acoustic fence along this boundary. Further details are provided in Section 5.2.2.

4 STORMWATER QUALITY TREATMENT ASSESSMENT

MUSIC modelling was conducted to quantitatively assess the stormwater treatment performance of the proposed stormwater treatment strategy. MUSIC version 6.3 was used for the assessment and the parameters have been established in accordance with the MUSIC Modelling Guidelines for South East Queensland (Water by Design, 2010).

Details of the modelling assumptions, parameters used and results are presented in the following sections.

4.1 MODEL STRUCTURE

The structure of the MUSIC model is shown in Figure 8 with the general data upon which the model is based provided in Table 4.

Catchments have been derived from the proposed masterplan layout, considering the pipe drainage system that would apply (refer to Figure 5 previously). Only areas under development are included in the model.

The model adopts a lumped catchment approach.

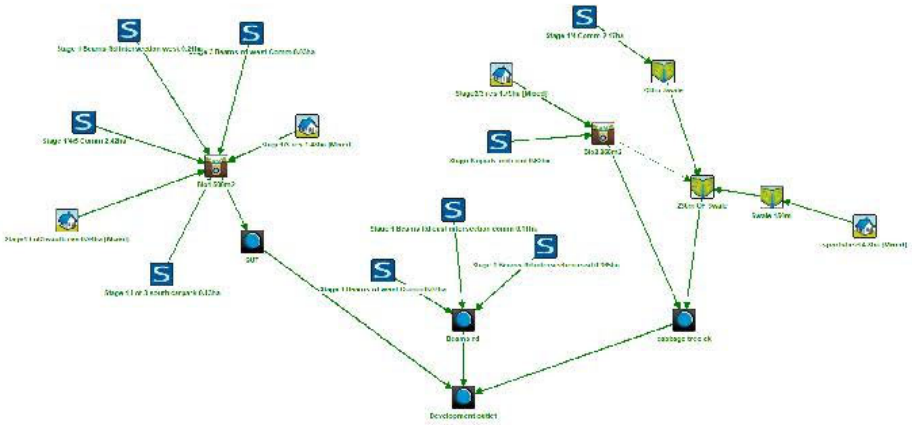


Figure 8 MUSIC model

Table 4 MUSIC model data summary

Parameter	Value
Source Data	
Rainfall data set	1990-1900 – Brisbane Aero Station No. 40223
Modelled time step	6 minute
Mean annual rainfall 1980–1990	1155 mm (for the period used)
Potential evapotranspiration	1,526mm (Table 3.1 Music modelling guidelines for SEQ)
Soil properties (runoff generation parameters)	Table 3.7 Music Modelling Guidelines for SEQ
Pollutant concentrations (base and storm flow concentration parameters)	Table 3.9 Music Modelling Guidelines for SEQ
Percent impervious	Table 3.6 Music Modelling Guidelines for SEQ Residential/mixed use (50dw/ha): 80% impervious Retail/commercial: 90% impervious Road: 90% impervious
Treatment Devices	
Bioretention	Filter media depth = 0.6 m Extended detention depth = 0.3 m Seepage = 0 mm/hr Saturated hydraulic conductivity 200mm/hr TN content[1] 400 mg/kg Orthophosphate content[1] 30mg/kg
Swale	Base width = 1m Top width = 10m Depth = 0.5m (S1 and S2); 1.5m (S3) Vegetation height = 0.05m (S1 and S2); 0.25m (S3) Slope 0.3% (S1); 0.6% (S2 and S3)

Note:

1. Water By Design have recently completed a review of important default values for bioretention basins. In terms of bioretention the parameters adopted are consistent with new values for filter media OP and TN content recently adopted by Healthy Waterways

4.2 RESULTS

The results of the MUSIC modelling are presented in Table 5.

Table 5 Summary of MUSIC modelling – Carseldine Urban Village

Treatment ID	Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction achieved (%)	Water quality objective
CARSELDINE URBAN VILLAGE					
Bio B1 Filter area 265m²	TSS TP TN	5720 10.8 65.6	802 2.2 26.7	86.0 79.7 59.2	Water quality objective applies to the combined site discharge
Bio B2 Filter area 500m²	TSS TP TN	11000 25.0 151	1910 6.08 66.7	82.6 75.7 55.8	
Swale S1 Length = 230m	TSS TP TN	4660 12.2 70.5	535 3.44 50.4	88.5 71.9 28.5	
Swale S2 Length = 150m	TSS TP TN	1570 4.06 32.6	654 2.48 27.6	58.2 39.1 15.3	
Swale S3 Length = 230m	TSS TP TN	1950 7.75 94.5	1200 6.41 86.2	38.4 17.3 8.8	
Stage 1 – Beams Rd 0.54ha untreated	**TSS** **TP** **TN**	1820 3.45 17.4	1820 3.45 17.4	0 0 0	
TOTAL	**TSS** **TP** **TN**	**24700** **55.6** **337**	**4970** **16.3** **181**	**80.0** **70.7** **46.4**	**80** **60** **45**

The results demonstrate that load based objectives are achieved for the Carseldine Urban Village Development with the proposed stormwater treatment strategy.

5 FLOOD ASSESSMENT

Flood modelling has been based on Brisbane City Council (BCC) supplied URBS and TUFLOW regional flood models for Cabbage Tree Creek. These models have been updated as necessary to make suitable for an impact assessment of the Carseldine Urban Village development.

The following describes model updates made to the Council supplied URBS and TUFLOW models to complete assessments on the impacts of the development.

5.1 URBS

URBS has been used to generate flows for the pre-developed and developed case scenarios for incorporation into TUFLOW. The following describes the model updates and assumptions used.

5.1.1 Pre-developed catchments

The Council supplied URBS model includes 70 sub catchments that delineate the approximate 43.1km² Cabbage Tree Creek catchment. URBS catchments covering the Carseldine Urban Village development zone within the Cabbage Tree Creek catchment have been refined to allow better representation of local catchment flooding characteristics in and around the development.

Sub-catchment 29 in the URBS model covers the proposed Carseldine Urban Village development zone. This has been split into 5 sub-catchments (291 to 295) to represent in finer detail site drainage based on existing topography obtained from Council supplied DEM model and ground truthing of current drainage.

Pervious and impervious fractions have been updated for these catchments, together with catchment slopes. Catchment slopes have been updated and estimated using the equal area method for each new sub catchment modelled.

All other URBS catchments have been retained as per the original Council supplied model setup, including catchment slopes.

Figure 9 shows the predeveloped catchments relevant to the Carseldine Urban Village development. Table 6 provides a summary of sub-catchment land uses, areas and slopes modelled in and around the development. URBS model land use is applied by using various land use categories within each sub-catchment. URBS model land use categorisation has been adopted in accordance with the BCC model. Land use categories and associated fractions impervious values are:

- Urban Low Density (10% Impervious)
- Urban Medium Density (50% Impervious)
- Urban High Density (90% Impervious)
- Rural (0% Impervious)

Table 6 Pre-developed catchments

ID	Area	Land use (%)				Catchment
	ha	Low density	Medium density	High density	Rural	Slope %
291	18.63	0%	0%	18.0%	82.0%	1.14
292	6.57	0%	0%	9.7%	90.3%	2.04
293	6.52	0%	0%	3.6%	96.4%	0.63
294	5.09	0%	0%	0%	100%	0.55
295	82.15	0%	19.3%	38.3%	42.4%	0.70
32	36.52	0%	83.3%	3.8%	12.8%	1.30

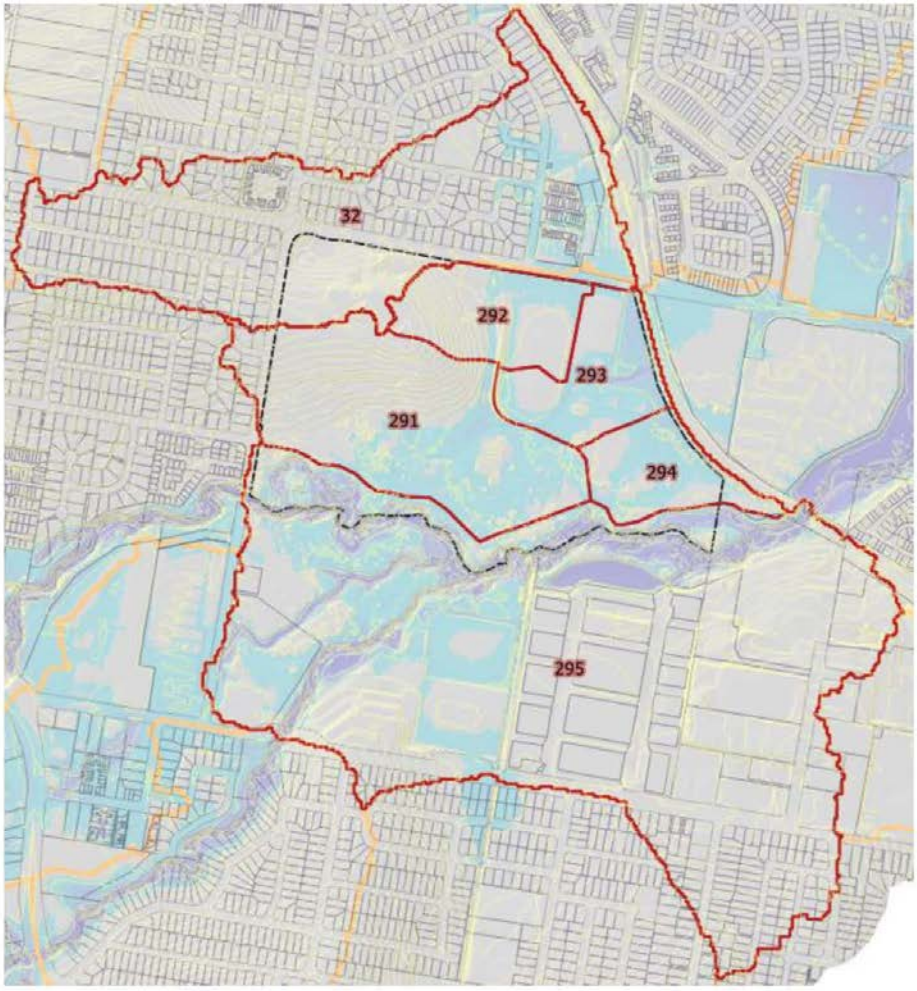


Figure 9 Refined URBS sub-catchments relevant to the development – base case

5.1.2 Developed case catchments

Sub-catchments where development applies were adjusted to represent the proposed development for Carseldine Urban Village. This applies to sub catchments 291, 292, 293, 294 and 32. These sub-catchments are shown in Figure 10.

Catchment land uses have been adjusted to account for the increased impervious area associated with the development. Adjustments to sub-catchment boundaries have also been applied, where necessary to align with the drainage strategy of the developed site.

Sub-catchments 293 and 294 drain southwards to Cabbage Tree Creek via a new drainage swale between the railway line and the development. Sub-catchments 291 and 292 will drain to Cabbage Tree Creek via stormwater pipes that will discharge in the vicinity of the two existing outfalls. The final details of this drainage configuration will be undertaken as part of future detail design phases.

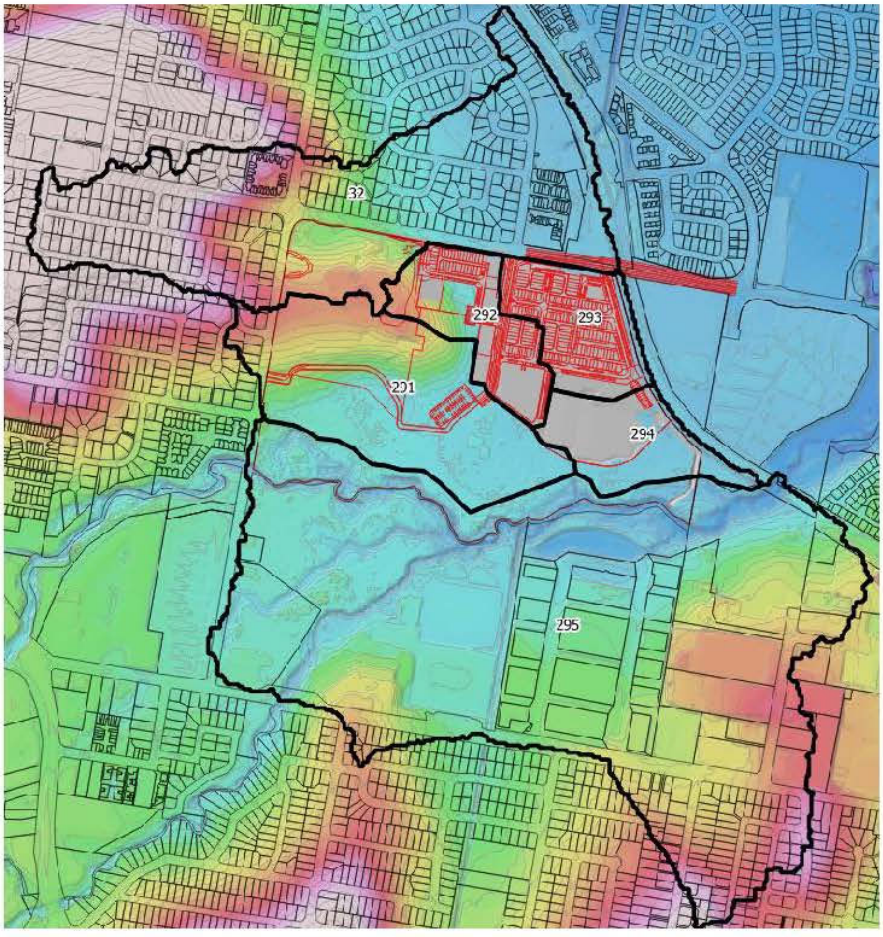


Figure 10 Developed case sub-catchments

Pervious and impervious areas were derived based on expected fraction impervious values for the various land uses. Percent impervious values applied to each land use were based on recommended values in QUDM (2007). The following values have been applied:

- pre-developed vegetation: 0%
- Urban residential: 90%
- Retail/commercial: 90%
- Sports fields: 0%

Modelled catchment areas and slopes for post developed conditions are summarised in Table 7.

Table 7 Carseldine Urban Village development - modelled catchment areas and slopes

ID	Area	Land use (%)				Catchment
	ha	Low density	Medium density	High density	Rural	Slope %
291	17.98	0%	0%	16.11%	83.89%	1.14
292	6.63	0%	0%	88.00%	12.00%	2.04
293	6.47	0%	0%	87.83%	12.17%	0.63
294	6.01	0%	0%	1.78%	98.22%	0.55
295	82.15	0%	19.28%	38.3%	42.4%	0.70
32	36.24	0%	83.98%	3.87%	12.15%	1.30

5.1.3 Rainfall

Design event modelling has been undertaken using Australian Rainfall and Runoff (ARR, 1987) industry standard approach of modelling multiple design rainfall burst durations and extracting the maximum values from these events.

Rainfall parameters were based on the following:

- Temporal Patterns were based on the Australian Rainfall and Runoff (1987) publication. Zone 3 is applied to this site.
- Rainfall Intensity Frequency Duration (IFD) data used is consistent with that used in previous modelling, based on AR&R.

Design storms for the 39%, 20%, 10%, 5%, 2% and 1% AEP events have been modelled for the 60, 90, 120, 180 and 360 minute duration storms.

Design event rainfall is retained as per the Council supplied URBS model.

Rainfall losses and roughness values

Loss rates are retained as per the Council supplied URBS model. The following loss rates are used for the pervious areas for all events modelled:

- initial loss – 10 mm
- continuing loss – 0mm/hr

Zero initial and continuing loss is applied to the impervious fractions.

5.2 TUFLOW

Flood modelling has been carried out using a refined version of BCC's Cabbage Tree Creek TUFLOW model. The following updates have been made to the model for this investigation:

- The model has been updated to a recent version of TUFLOW (2016-03-AE_64 _iSP_w64)
- Inflow hydrographs have been extracted from the refined URBS sub-catchments.
- TUFLOW 'gully' lines have been incorporated to improve model representation of local gullies in the study area. In particular, the existing drain adjacent to the railway has been modelled using a 'gully' line.
- Inflow hydrographs from the refined URBS sub-catchments have been applied using 2d_sa polygons that have been trimmed to control where flows are input to the TUFLOW model.
- The major drainage pipes associated with the two existing outfalls to Cabbage Tree Creek have been incorporated using 1D pipe elements

Existing stormwater drainage pipes and inlets pits within the site have been incorporated into the pre-developed case TUFLOW model as shown in Figure 11. This is based in recent survey of the existing pipe infrastructure (June 2019). Pipe diameters are shown in metres in Figure 11.

All other model parameters and assumptions remain unchanged.

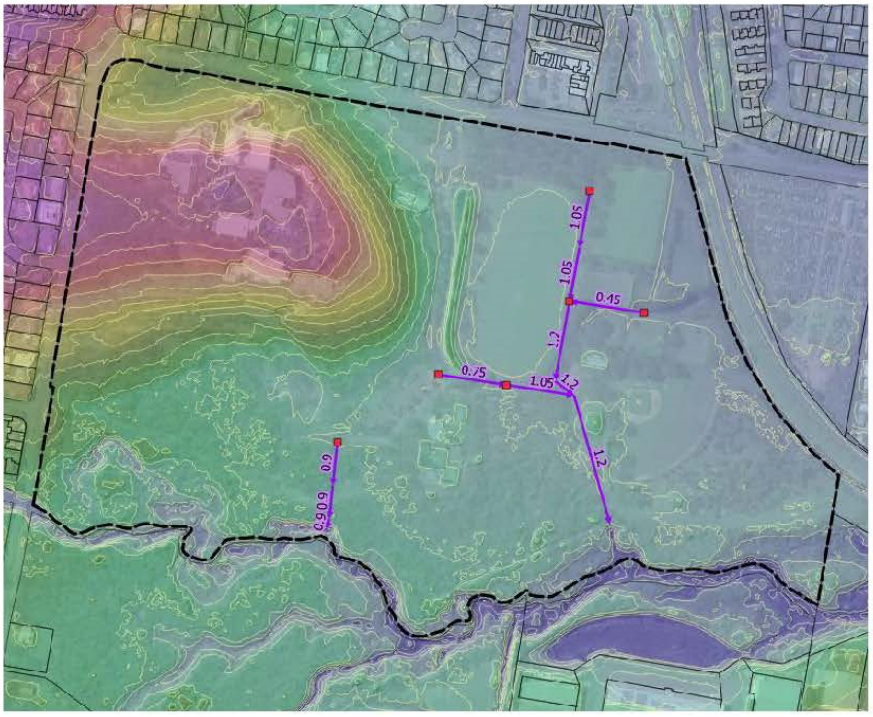


Figure 11 Existing site pipe drainage

5.2.1 Development earthworks

The proposed development has been incorporated into the TUFLOW model based on the latest earthworks design tin provided by the project civil engineers (Calibre Consulting).

5.2.2 Mitigation measures

Extensive iterative model assessments identified the following mitigation measures were required to avoid impacts external to the site:

- Sports field earthworks are designed to allow flooding during less frequent events (5% AEP and above)
- A 1200mm diameter culvert with a flood valve is included along the proposed eastern swale to minimize backwatering from Cabbage Tree Creek into the development via this swale – this minimizes the impacts of Cabbage Tree Creek flows into the site via this new connection to Cabbage Tree Creek.
- The rail corridor external to the property boundary will be protected from any increase in flood levels through the incorporation of an engineered flood barrier (~1m high) along the eastern boundary of the site - this avoids increases in flood levels external to the site adjacent to the rail line.

Details of the above mitigation measures are provided in Figure 12.



Pt ID	Ground Height (mAHD)	1% AEP Peak Flood Level (mAHD)	Suggested rail flood barrier top level mAHD
A	13.0	13.56	13.86
B	12.9	13.78	14.08
C	13.0	13.83	14.13
D	13.1	13.83	14.13
E	13.7	13.83	14.13

Figure 12 Proposed mitigation measures

The proposed rail flood barrier along the eastern boundary can take the form of a low blockwork wall and/or an earthen bund where space permits. This barrier can be combined with the future acoustic fence along the eastern boundary of the site e.g. the bottom of the acoustic fence takes the form of a blockwork wall with the acoustic fence installed above.

The extent and minimum flood levels for the flood barrier are provided Figure 12. This provides a 300mm freeboard to the expected 100 year developed flood levels. It should be noted that the flood barrier extends to the 1200mm dia culvert at the southern end and not to Cabbage Tree Creek to avoid constraining Cabbage Tree Creek flood flows and causing flood impacts downstream. The existing overland flow path at the north eastern end of the site is retained i.e. the rail flood barrier does not extend all to way to Beams Road.

5.3 RESULTS

Table 8 summarises peak flows immediately upstream of the Railway Bridge at Cabbage Tree Creek (reporting point 10), whilst Table 9 summarises peak water levels for pre and post conditions at various reporting location both within and external to the site. Figure 13 provides locations of reporting points.

Appendix A provides flood depth and impact maps for model runs. These include:

- Figure A1: Base case 39%AEP (Q2) flood depth
- Figure A2: Base case 5% AEP (Q20) flood depth
- Figure A3: Base case 1% (Q100) flood depth
- Figure A4: Developed case 39% AEP (Q2) flood depth
- Figure A5: Developed case 5% AEP (Q20) flood depth
- Figure A6: Developed case 1% AEP (Q100) flood depth
- Figure A7: Flood impact map 39% AEP (Q2)
- Figure A8: Flood impact map 20%AEP (Q5)
- Figure A9: Flood impact map 10% AEP (Q10)
- Figure A10: Flood impact map 5% AEP (Q20)
- Figure A11: Flood impact map 2% AEP (Q50)
- Figure A12: Flood impact map 1% AEP (Q100)
- Figure A13: Regional flood impact map 39% AEP (Q2)
- Figure A14: Regional flood impact map 1% AEP (Q100)

Table 8 Peak flows – Cabbage Tree Creek - Railway Bridge (Point 10)

AEP	Peak flow (m^3/s)			Difference
	Pre	Post	Difference	%
39% (Q2)	74.80	74.66	-0.14	-0.2%
20% (Q5)	103.39	103.54	0.15	0.1%
10% (Q10)	122.74	122.59	-0.15	-0.1%
5% (Q20)	146.77	147.19	0.42	0.3%
2% (Q50)	176.57	176.68	0.11	0.1%
1% (Q100)	202.1	202.8	0.70	0.3%

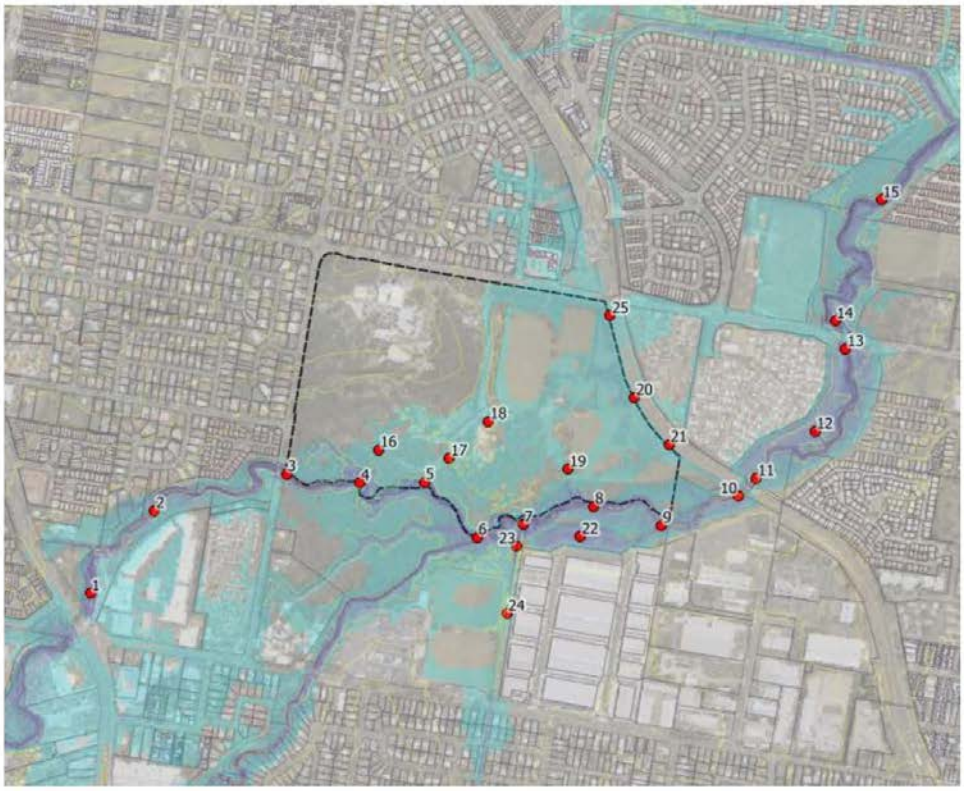


Figure 13 Reporting locations

Table 9 Peak water levels

ID	Water levels (mAHD)																	
	39%AEP			20%AEP			10%AEP			5%AEP			2%AEP			1%AEP		
	pre	post	difference	pre	post	difference	pre	post	difference	pre	post	difference	pre	post	difference	pre	post	difference
1	17.791	17.791	0.000	18.270	18.270	0.000	18.53221	18.5323	0.000	18.804	18.804	0.000	18.999	18.999	0.000	19.077	19.077	0.000
2	16.866	16.866	0.000	17.364	17.364	0.000	17.638	17.639	0.000	17.941	17.942	0.000	18.169	18.169	0.000	18.262	18.262	0.000
3	15.475	15.476	0.001	16.008	16.010	0.002	16.272	16.274	0.001	16.542	16.543	0.001	16.717	16.717	0.000	16.779	16.779	0.000
4	15.165	15.167	0.002	15.693	15.696	0.003	15.953	15.955	0.002	16.217	16.218	0.001	16.372	16.373	0.001	16.428	16.428	0.000
5	14.553	14.557	0.004	15.083	15.090	0.006	15.318	15.322	0.004	15.543	15.545	0.002	15.703	15.705	0.002	15.796	15.797	0.001
6	13.739	13.742	0.003	14.217	14.222	0.006	14.462	14.467	0.005	14.734	14.739	0.005	15.044	15.048	0.004	15.267	15.270	0.003
7	13.387	13.388	0.001	13.831	13.835	0.004	14.064	14.067	0.004	14.331	14.337	0.006	14.635	14.638	0.003	14.875	14.879	0.004
8	12.934	12.932	-0.002	13.306	13.306	-0.001	13.499	13.498	-0.001	13.715	13.718	0.004	13.961	13.964	0.003	14.191	14.197	0.007
9	12.299	12.301	0.002	12.664	12.663	-0.002	12.867	12.859	-0.008	13.126	13.122	-0.004	13.443	13.437	-0.006	13.739	13.740	0.001
10	11.684	11.683	-0.002	12.084	12.086	0.002	12.338	12.335	-0.002	12.692	12.695	0.003	13.098	13.101	0.003	13.462	13.470	0.009
11	11.405	11.402	-0.002	11.799	11.800	0.001	12.039	12.037	-0.002	12.309	12.311	0.002	12.565	12.567	0.002	12.755	12.759	0.004
12	11.134	11.131	-0.003	11.573	11.575	0.001	11.835	11.834	-0.002	12.120	12.122	0.002	12.376	12.378	0.002	12.561	12.565	0.004
13	11.029	11.027	-0.002	11.484	11.485	0.001	11.750	11.748	-0.002	12.035	12.038	0.002	12.286	12.288	0.002	12.464	12.468	0.004
14	10.955	10.953	-0.002	11.395	11.396	0.001	11.643	11.642	-0.002	11.901	11.903	0.002	12.118	12.119	0.002	12.272	12.275	0.003
15	9.854	9.851	-0.003	10.346	10.346	0.001	10.596	10.594	-0.001	10.846	10.848	0.002	11.067	11.071	0.005	11.244	11.245	0.001
16	dry	dry	NA	dry	dry	NA	dry	dry	NA	16.109	16.109	0.000	16.240	16.240	0.001	16.282	16.282	0.000
17	dry	dry	NA	dry	dry	NA	dry	dry	NA	15.037	15.039	0.001	15.148	15.148	0.001	15.206	15.207	0.001
18	dry	dry	NA	dry	dry	NA	dry	dry	NA	dry	dry	NA	14.824	14.753	-0.071	14.919	14.849	-0.070
19	dry	dry	NA	dry	dry	NA	dry	dry	NA	dry	dry	NA	dry	dry	NA	14.252	14.307	0.055
20	12.810	dry	NA	12.911	dry	NA	13.037	dry	NA	13.213	12.865	-0.347	13.426	13.175	-0.251	13.529	13.481	-0.048
21	12.401	dry	NA	12.618	12.041	-0.577	12.791	12.310	-0.482	13.095	12.690	-0.406	13.383	13.122	-0.261	13.520	13.457	-0.063
22	11.961	11.964	0.003	12.720	12.717	-0.003	12.942	12.934	-0.008	13.254	13.254	-0.001	13.692	13.692	0.001	14.024	14.030	0.007
23	13.402	13.403	0.001	13.855	13.861	0.005	14.103	14.107	0.005	14.385	14.390	0.005	14.715	14.718	0.003	14.979	14.984	0.005
24	14.969	14.969	0.000	15.222	15.228	0.006	15.275	15.285	0.010	15.318	15.313	-0.005	15.357	15.358	0.000	15.403	15.403	0.000
25	12.860	dry	NA	13.061	dry	NA	13.118	12.992	-0.126	13.247	13.234	-0.013	13.442	13.401	-0.040	13.518	13.467	-0.051

5.3.1 Peak flows

Peak flows upstream at the Railway Bridge over the range of storm events up to the 1% AEP (100yr ARI) are effectively retained at predeveloped levels (+0.3% to -0.2%). For the 1% AEP a minor increase is observed and represents a 0.3% increase. No adverse impacts downstream of the Bridge are observed in all events tested.

5.3.2 Flood inundation – existing case

Existing case flood inundation maps indicate flooding of low-lying areas at the north eastern corner of the site occurs on a frequent basis. Existing drainage within the site directs this more frequent drainage to the existing drainage outfalls to Cabbage Tree Creek. No flooding of Beams Rd is expected for the more frequent flood events. Figure 14 shows inundation mapping for the minor 39% AEP (2 yr) event.

At the 5% AEP (20 yr ARI event - see Figure 15) breakout from Cabbage Tree Creek occurs along the northern bank at the western end of the site. These breakout flows are then predicted to flow generally in a north-east direction at shallow depths through the site. Inundation in the north-east of the site is constrained west of the rail corridor. Shallow flooding of Beams Road is expected in this case and is anticipated to extend north of Beams Road.

In the 1% AEP event (refer to Figure 16) there is a significant increase in the inundation area of breakout flows through the site. While there is a large increase in the inundation extent, the actual flood depths predicted over most of this area remain typically less than 250mm. Inundation is also predicted to occur across the rail corridor at the north eastern boundary of the site and extends along Beams Road and adjacent existing developed areas to the north and east. Flow depths are noted to be mostly less than 250mm in this case, except for low lying areas adjacent to the rail corridor.

Flooding across the site resulting from Cabbage Tree Creek breakout flows is characterised by shallow (typically less than 250mm), conveyance dominated flows. Consequently, flood storage influences are expected to be minor. For this reason, it would be expected that a loss of floodplain storage in these areas would be unlikely to cause significant adverse flood impacts. This is discussed in the following sections.

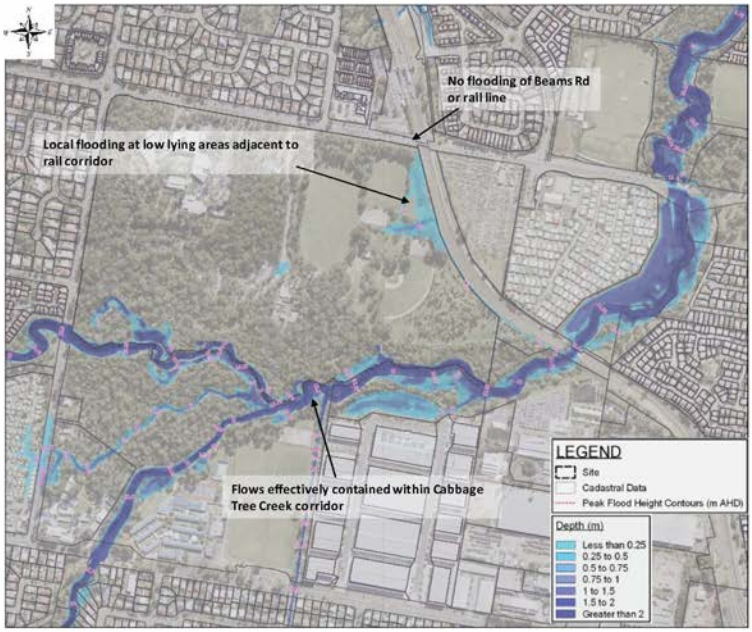


Figure 14 39% AEP flood inundation - existing conditions

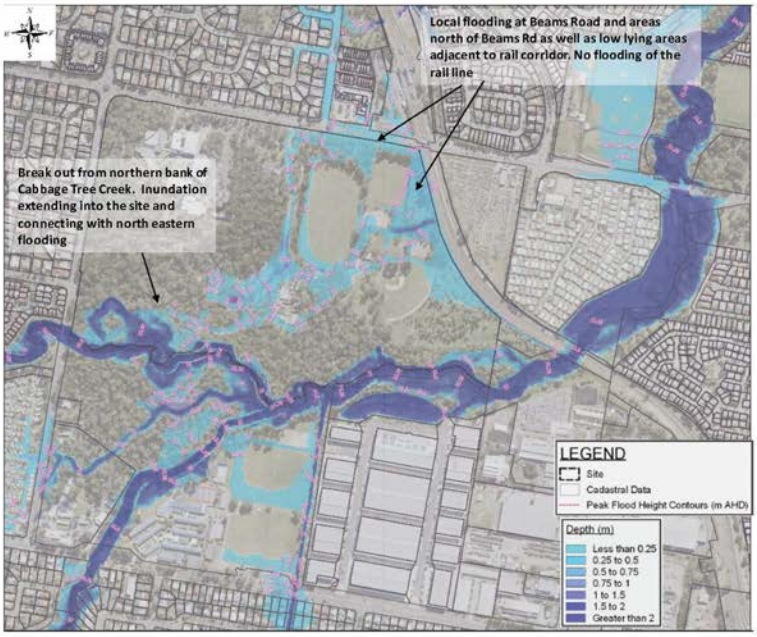


Figure 15 5% AEP flood inundation - existing conditions

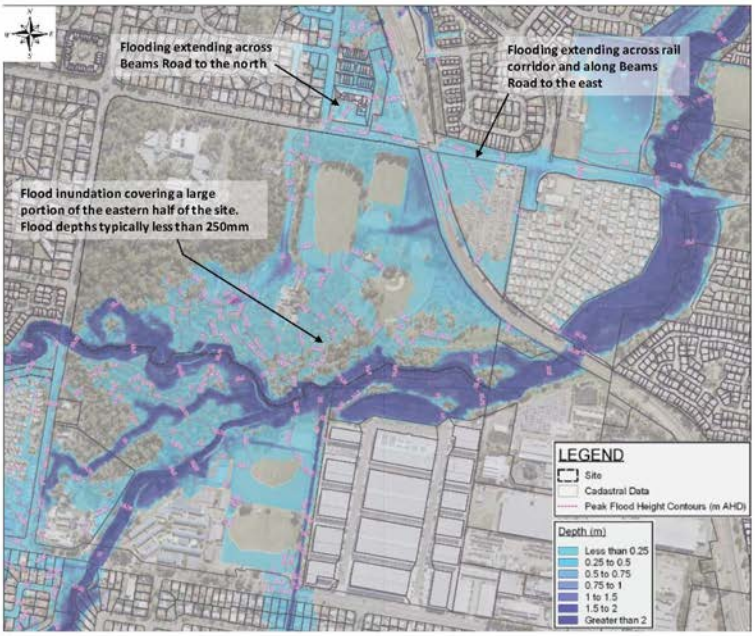


Figure 16 1% AEP flood inundation - existing conditions

5.3.3 Flood impacts

Table 9 previously summarises peak water levels for pre and post conditions at various reporting locations for the 39% AEP to 1% AEP model runs. Flood impacts maps for the 39% AEP to 1% AEP are included in Appendix A.

Flood impact maps demonstrate no significant adverse impacts occurring external to the site as a result of the development, with the proposed mitigation measures included.

Improved flood conditions are observed at Beams Road and the rail line at the north-east corner of the site. This is because much of the site drainage is directed to Cabbage Tree Creek as part of the development. Furthermore, during larger magnitude events, the proposed development filling restricts Cabbage Tree Creek breakout flow from entering this area.

Impacts noted on the afflux maps are typically contained within the site boundary and are associated with flooding of the sports fields (above 5% AEP event) and the operation of the development drainage swales. This is expected. Other low-lying riparian bushland areas already subject to flooding within the site also experience localised increases in flooding south west of the sports fields, however this does not impact on any existing facilities or infrastructure. Increases in flooding within the site as described above help offset loss of flood storage. Commercial and residential lots are protected from flooding during the 1% AEP (100 year ARI) event.

Minor impacts (typically up to 50mm) external to the site at the south eastern boundary are noted, however these occur in a low-lying bushland area currently subject to flooding from Cabbage Tree Creek and is not considered an actionable nuisance.

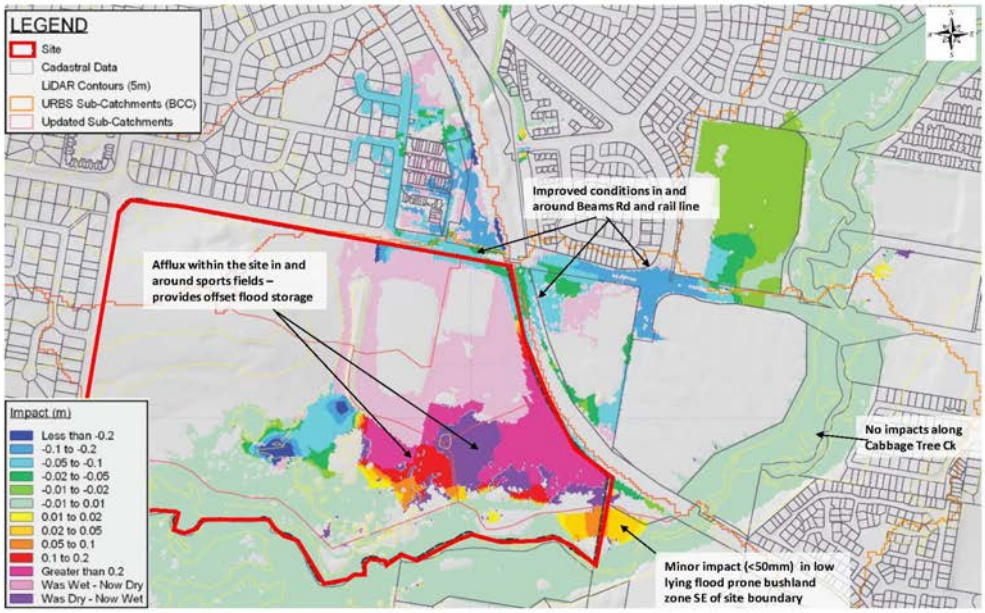


Figure 17 1% AEP flood impacts

5.3.4 Flood storage

An assessment of the impacts of development on flood storage has been completed for the 1% AEP event. This is to review compensatory earthworks, in line with BCC compensatory earthworks planning scheme policy for developments within mapped creek corridors.

Flood storage volumes within the site boundary have been calculated for the existing case and developed case scenarios. Table 10 summarises the estimated flood storage volumes, based on the current model assumptions.

Table 10 Flood storage volumes – 1% AEP

Scenario	Flood storage (m^3)
Existing conditions	44,929
Developed case	38,208
Loss in storage	6,721

Overall, the flood modelling predicts that a loss of flood storage will occur (~15%). Despite this, the modelling also demonstrates that no significant adverse offsite flood impacts are expected to occur along Cabbage Tree Creek and improved flood conditions can be expected at both Beams Road and the rail line at the north east of the site. This is because the storage loss is relatively minor in the context of the regional floodplain and the site largely serves a flood conveyance (or overland flow) function as opposed to a flood storage function for Cabbage Tree Creek floodwaters.

6 MAINTENANCE

WSUD infrastructure such as bioretention basins require ongoing inspection and maintenance to ensure they establish and operate in accordance with the design intent. Potential problems associated with WSUD as a result of poor maintenance include:

- Decreased aesthetic amenity;
- Reduced functional performance;
- Public health and safety risks; and
- Decreased habitat diversity (dominance of exotic weeds).

6.1 MAINTENANCE PLAN

A Maintenance Plan will be required prior to handover of WSUD assets. The plan will provide detailed guidance around maintenance of WSUD assets, as well as frequency of maintenance activities. The manual will include performance inspection checklists. The document will be consistent with the methodologies and principles detailed in Maintaining WSUD Assets (Water by Design, 2012).

The maintenance plan and checklists will be a living document and can be refined where required in collaboration with Council assets and maintenance departments to ensure the structure and frequency of maintenance is consistent with current Council procedures. This will also provide an opportunity for transfer of knowledge in this regard to allow Council to effectively operate the sediment ponds and bioretention basin.

6.1.1 Bioretention basins

Typical maintenance of bioretention systems during operation will involve:

- Routine inspection of the bio-retention system profile to identify any areas of obvious increased sediment deposition, scouring from storm flows, rill erosion of the batters from lateral inflows, damage to the profile from vehicles and clogging of the bio-retention system (evident by a 'boggy' filter media surface).
- Routine inspection of inflows systems, overflow pits and under-drains to identify and clean any areas of scour, litter build up and blockages.
- Removal of sediment where it is smothering the bio-retention system vegetation.
- Repairing any damage to the profile resulting from scour, rill erosion or vehicle damage by replacement of appropriate fill (to match onsite soils) and revegetating.
- Tilling of the bioretention system surface, or removal of the surface layer, if there is evidence of clogging.
- Regular watering/ irrigation of vegetation until plants are established and actively growing.
- Removal and management of invasive weeds (herbicides should not be used).

- Removal of plants that have died and replacement with plants of equivalent size and species as detailed in the plant schedule.
- Pruning to remove dead or diseased vegetation material and to stimulate growth.
- Vegetation pest monitoring and control.

Maintenance should only occur after a reasonably rain free period when the soil in the bioretention system is dry. Inspections are also recommended following large storm events to check for scour and other damage.

7 CONCLUSION

An updated stormwater management strategy has been developed for the Carseldine Urban Village to meet the requirements of the *State Planning Policy* (DLGIP, 2017), QUDM and *Brisbane City Council Planning Scheme*.

STORMWATER TREATMENT

The updated strategy includes two (2) bioretention basins that treat development runoff prior to discharge to Cabbage Tree Creek:

- Bioretention Basin B1 265m² filter area treating Stages 2, 3 (part of) and S
- Bioretention Basin B2 500m² filter area total treating the remainder of the development (Stages 1,3 (part of), 4 and 5)

Drainage swales along the eastern boundary of the site and at the southern boundary of the Stage S sports fields also provide additional treatment.

FLOODING

Flood impact assessment demonstrates no significant impacts occurring external to the site as a result of development. Some afflux (~50mm) is observed immediately south east of the development boundary, however this afflux occurs within a low-lying flood prone bushland area and is not considered an actionable nuisance.

Improved flood conditions are observed at Beams Road and the rail line at the north-east end of the site. This is because much of the site drainage will be directed to Cabbage Tree Creek. Furthermore, during larger magnitude events, the proposed development fill restricts Cabbage Tree Creek breakout flow from entering this area.

Required mitigation measures to manage flood impacts external to the site include:

- Providing flood storage over the sports field zone for events greater than the 5% AEP (20 year ARI)
- incorporation of a 1200mm dia pipe with one-way flap valve along the new drainage swale draining the eastern half of the development – this minimizes the impacts of Cabbage Tree Creek flows into the site via this new connection to Cabbage Tree Creek
- inclusion of a flood barrier along the eastern boundary of the site (~1m high) – this avoids increases in flood levels external to the site adjacent to the rail line

Updated regional modelling and detailed local modelling will occur as part of continuing design development for the site.

8 REFERENCES

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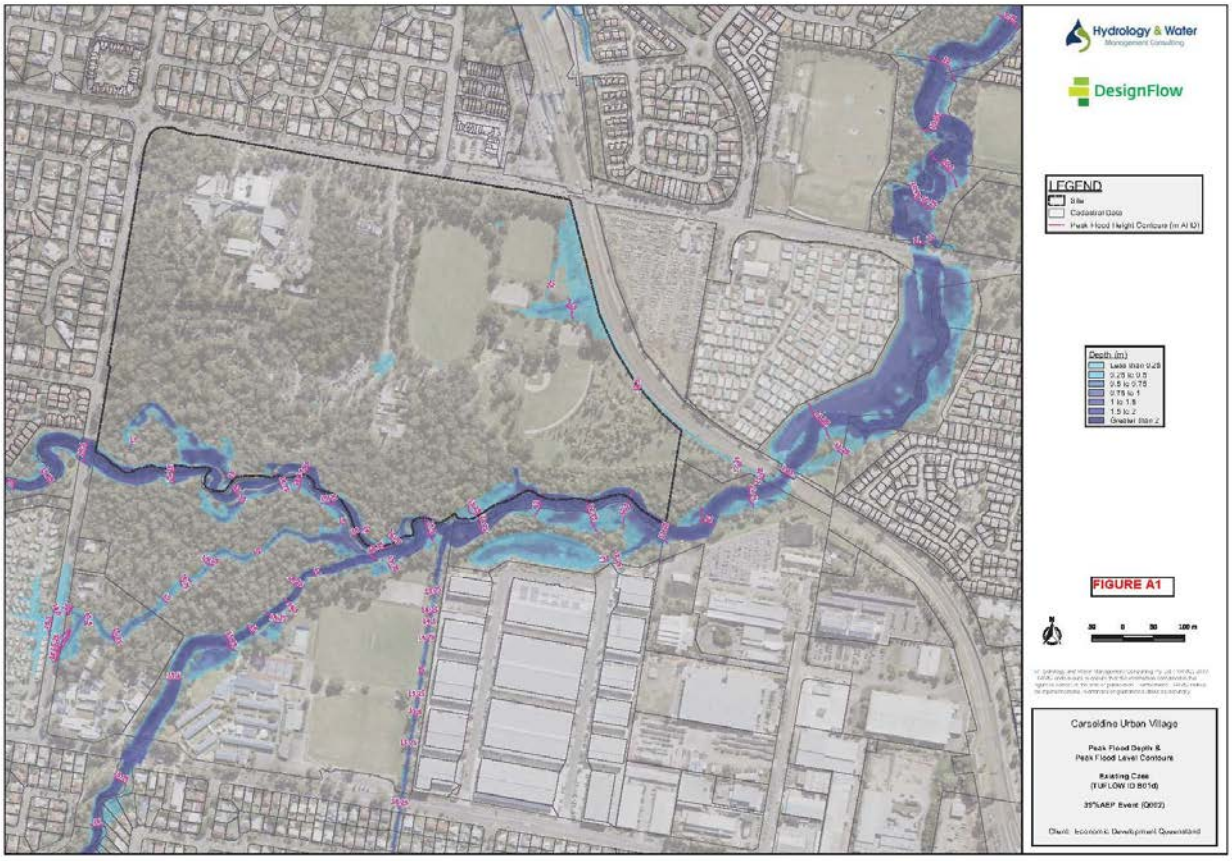
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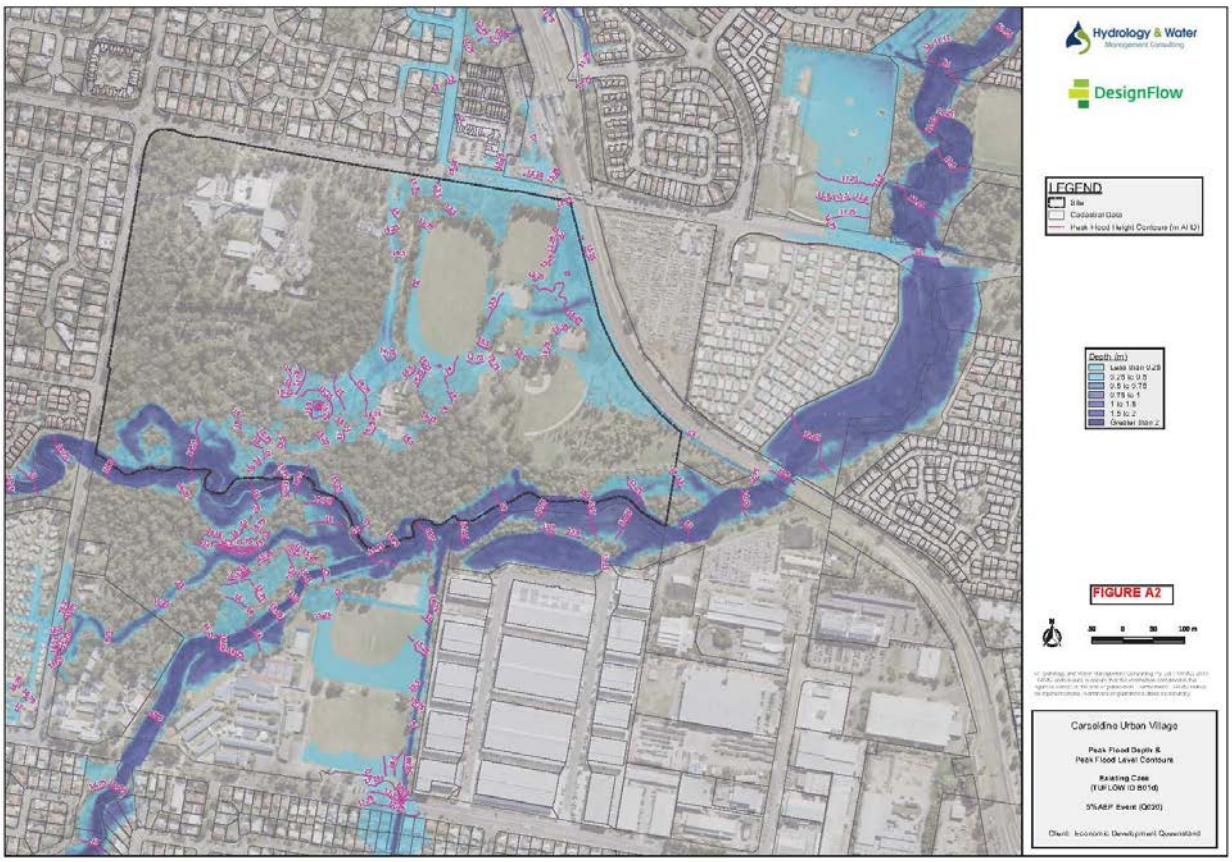
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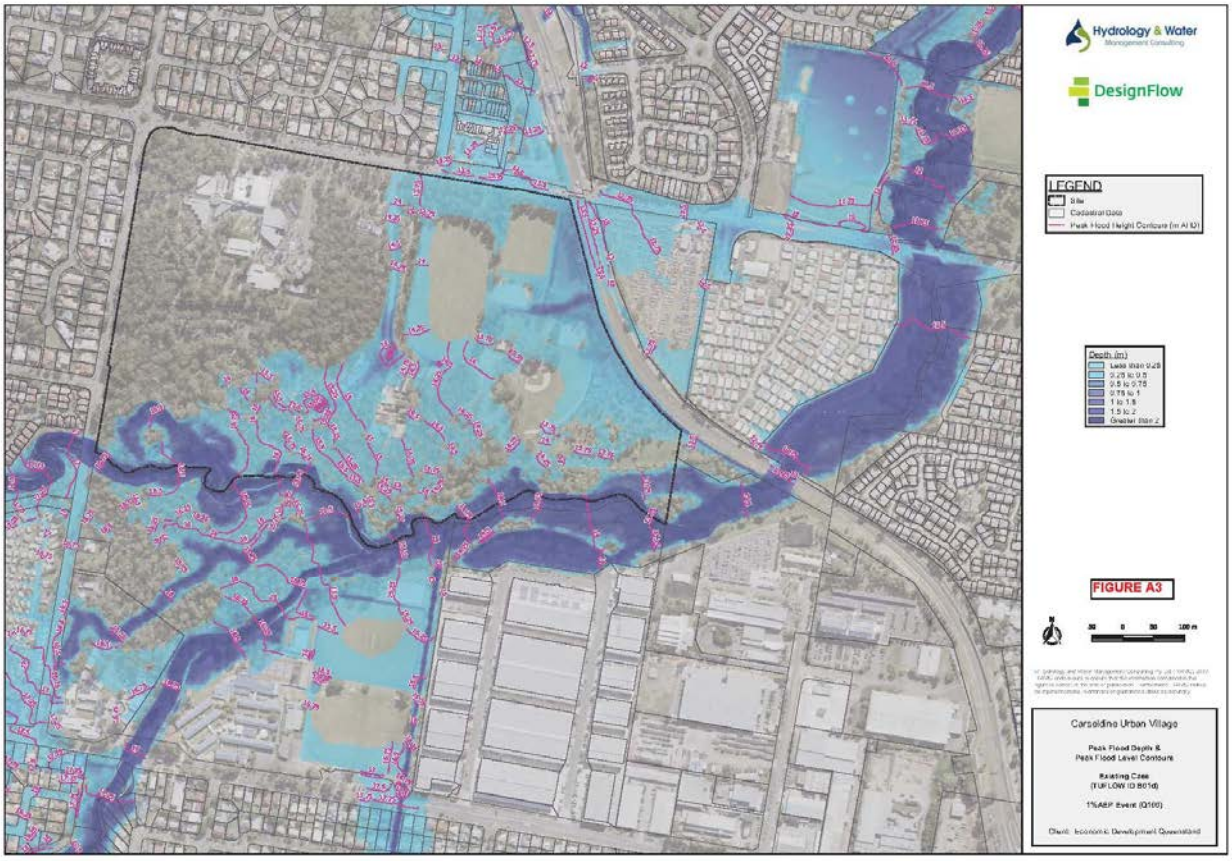
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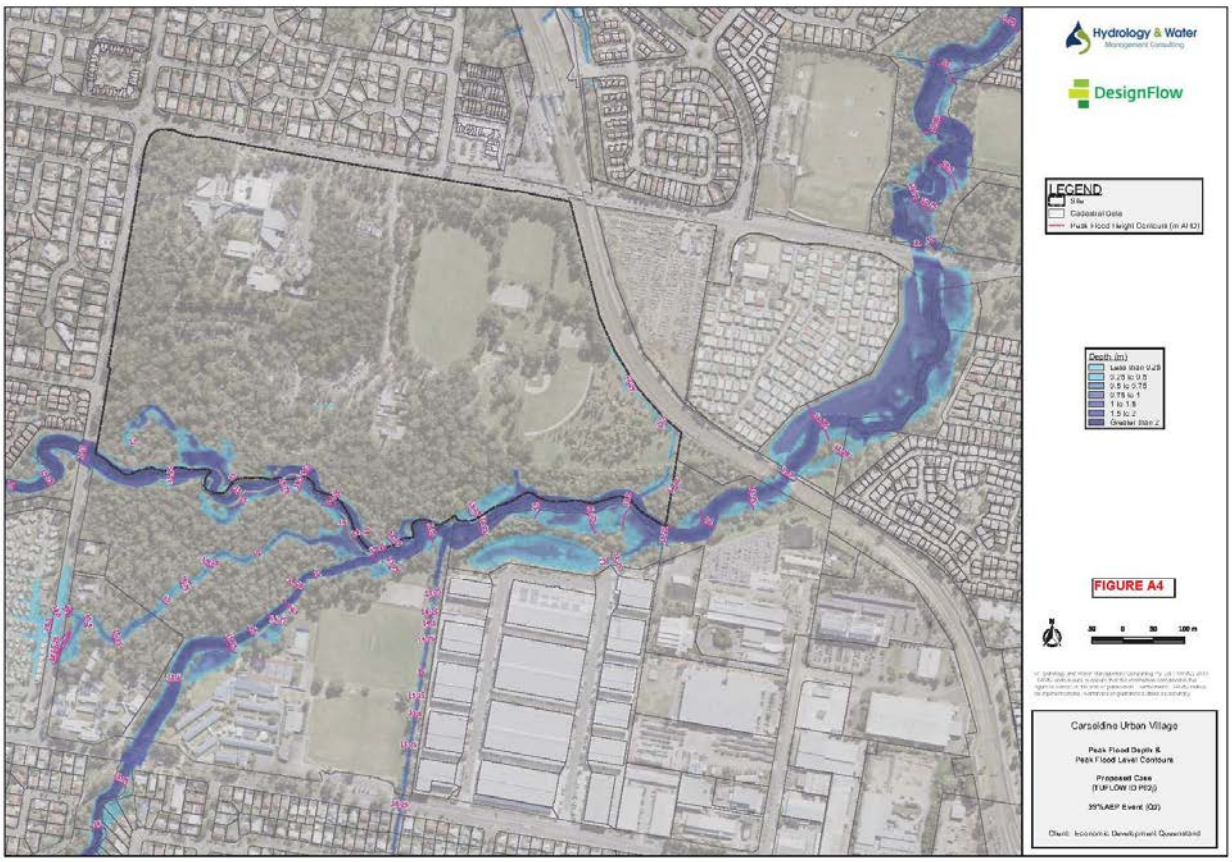
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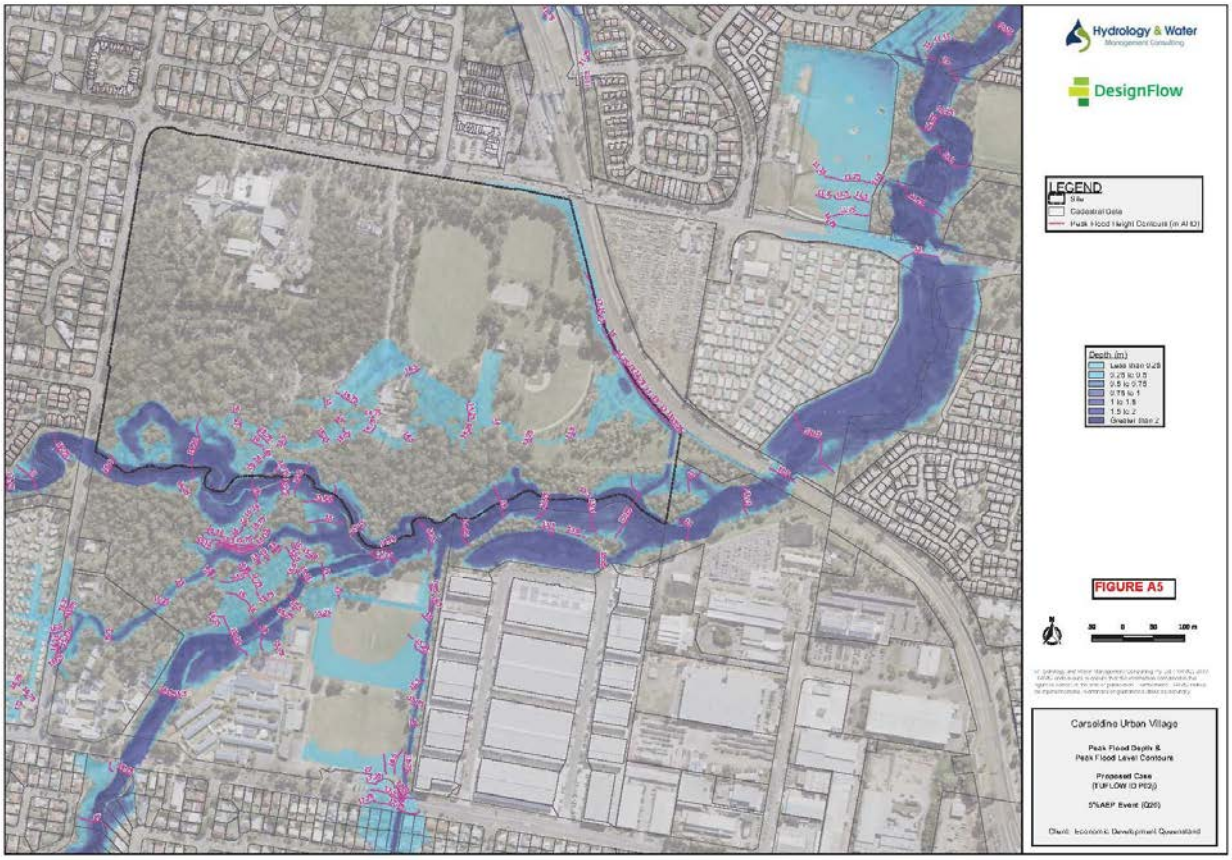
APPENDIX A – TUFLOW MODEL OUTPUTS

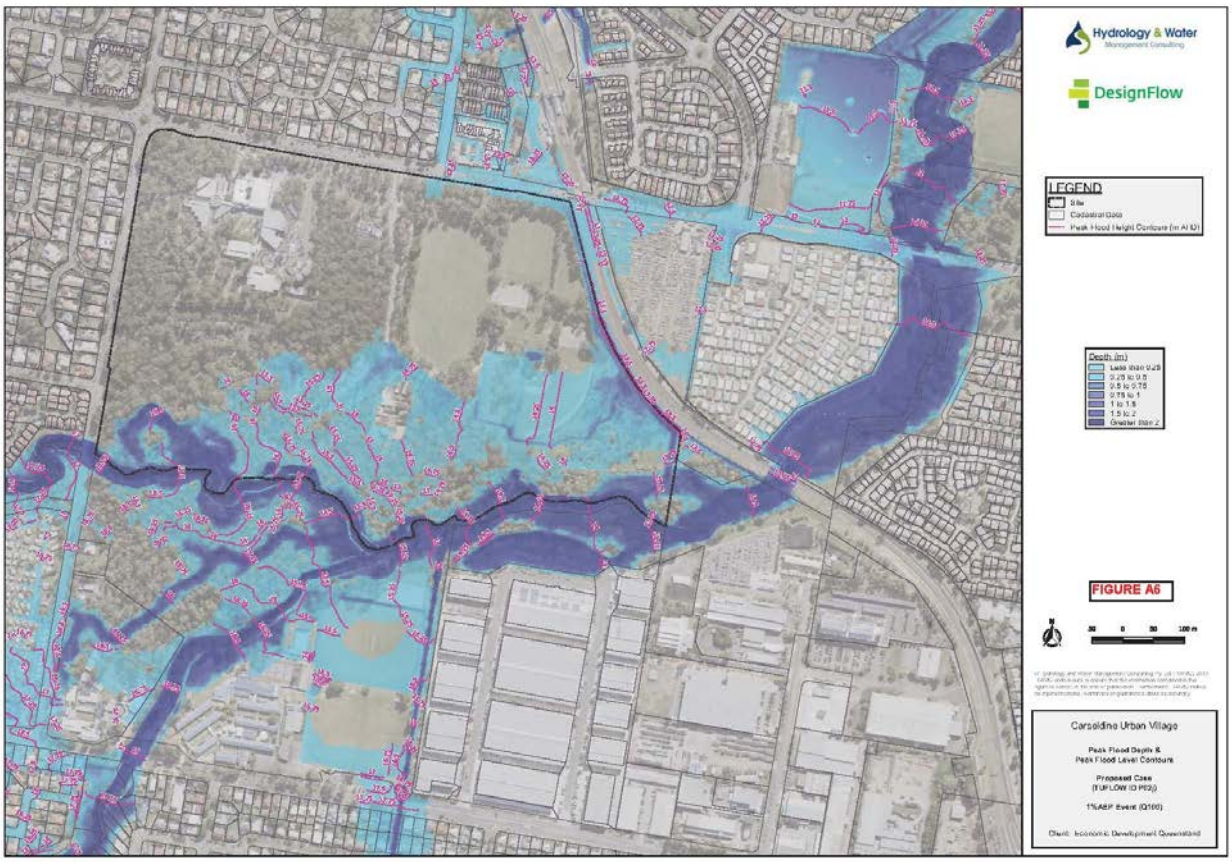

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
Peak Flood Height Contours (m AHD)
Depth (m)
Less than 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
Greater than 2
FIGURE A1
Carseldine Urban Village
Peak Flood Depths &
Peak Flood Level Contours
Existing Case
(TUFLOW ID B01d)
Client: Economic Development Queensland

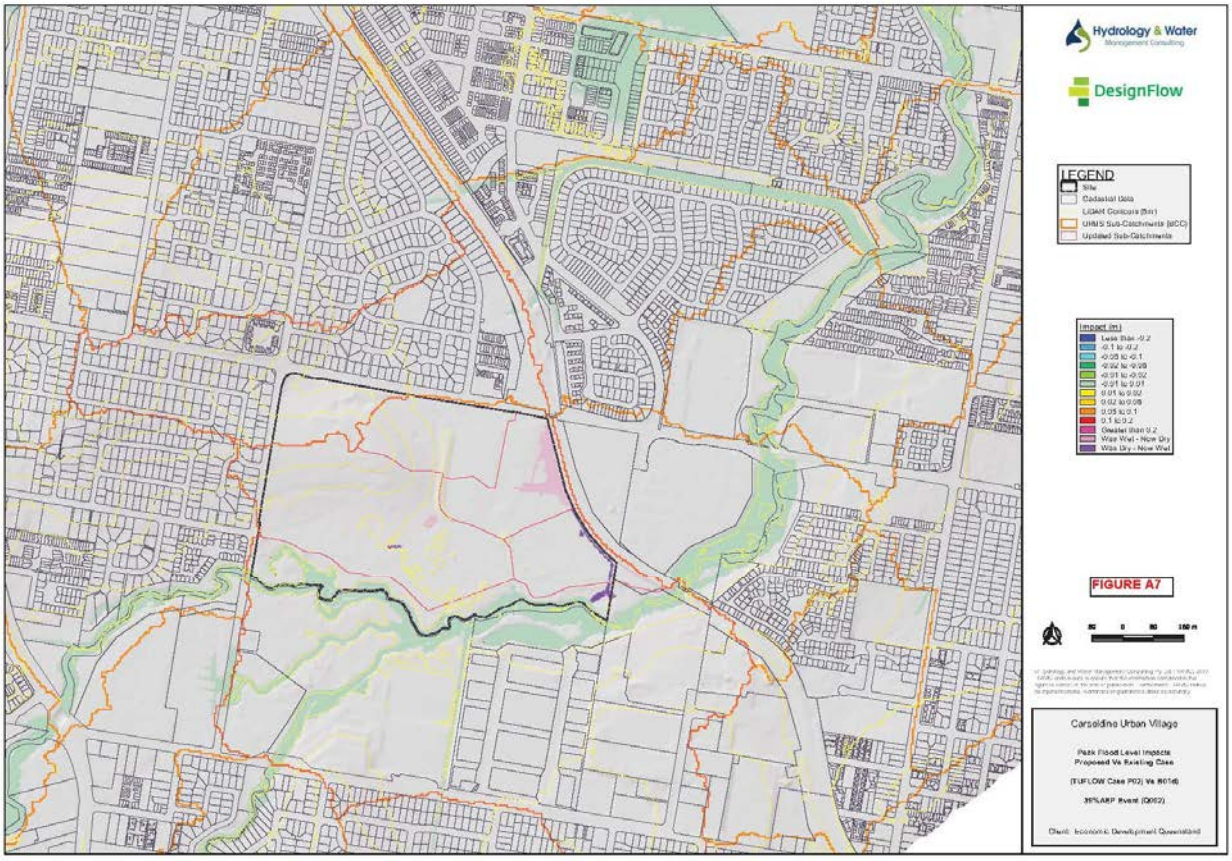

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
Peak Flood Height Contours (m AHD)
Depth (m)
Less than 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
Greater than 2
FIGURE A2
Carseldine Urban Village
Peak Flood Depths &
Peak Flood Level Contours
Existing Case
(TUFLOW ID B01d)
Client: Economic Development Queensland

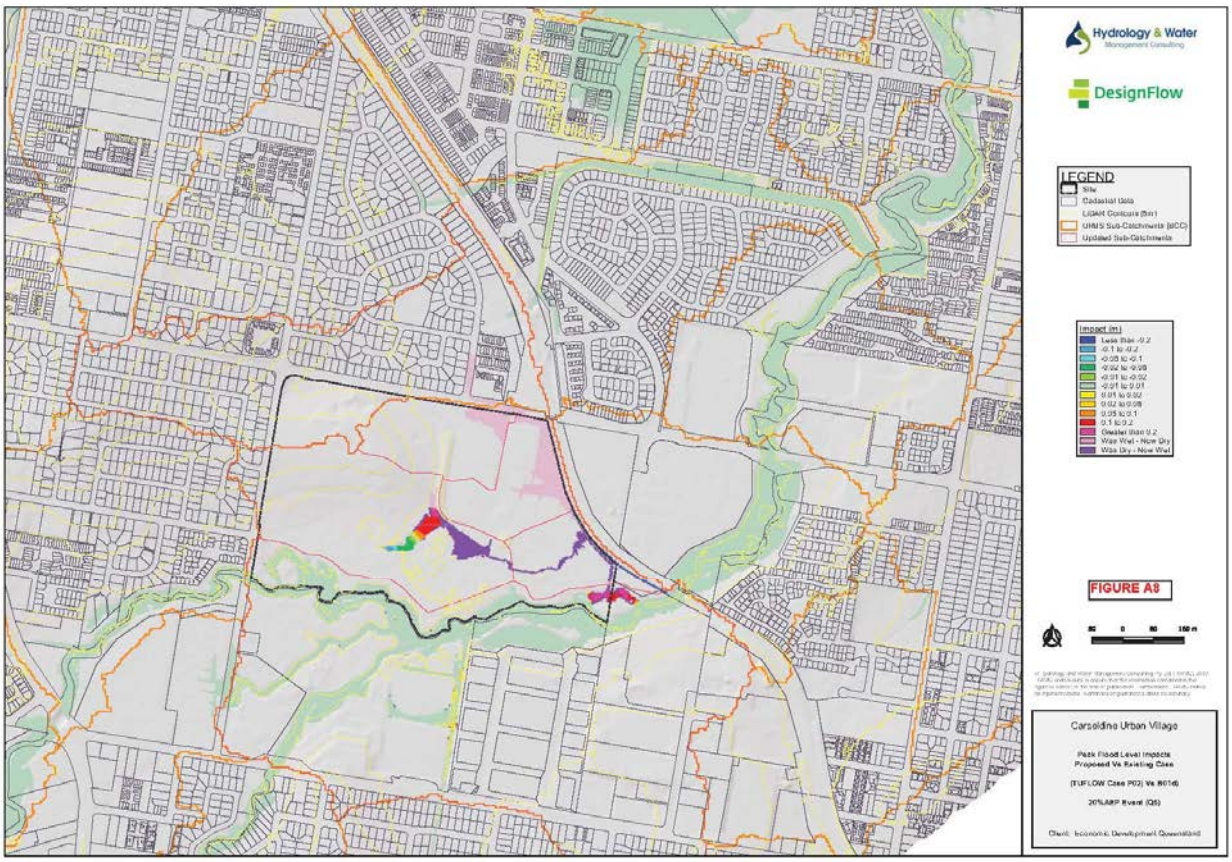

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
Peak Flood Height Contours (m AHD)
Depth (m)
Less than 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
Greater than 2
FIGURE A3
Carseldine Urban Village
Peak Flood Depths &
Peak Flood Level Contours
Existing Case
(TUFLOW ID B01d)
1%AEP Event (Q100)
Client: Economic Development Queensland

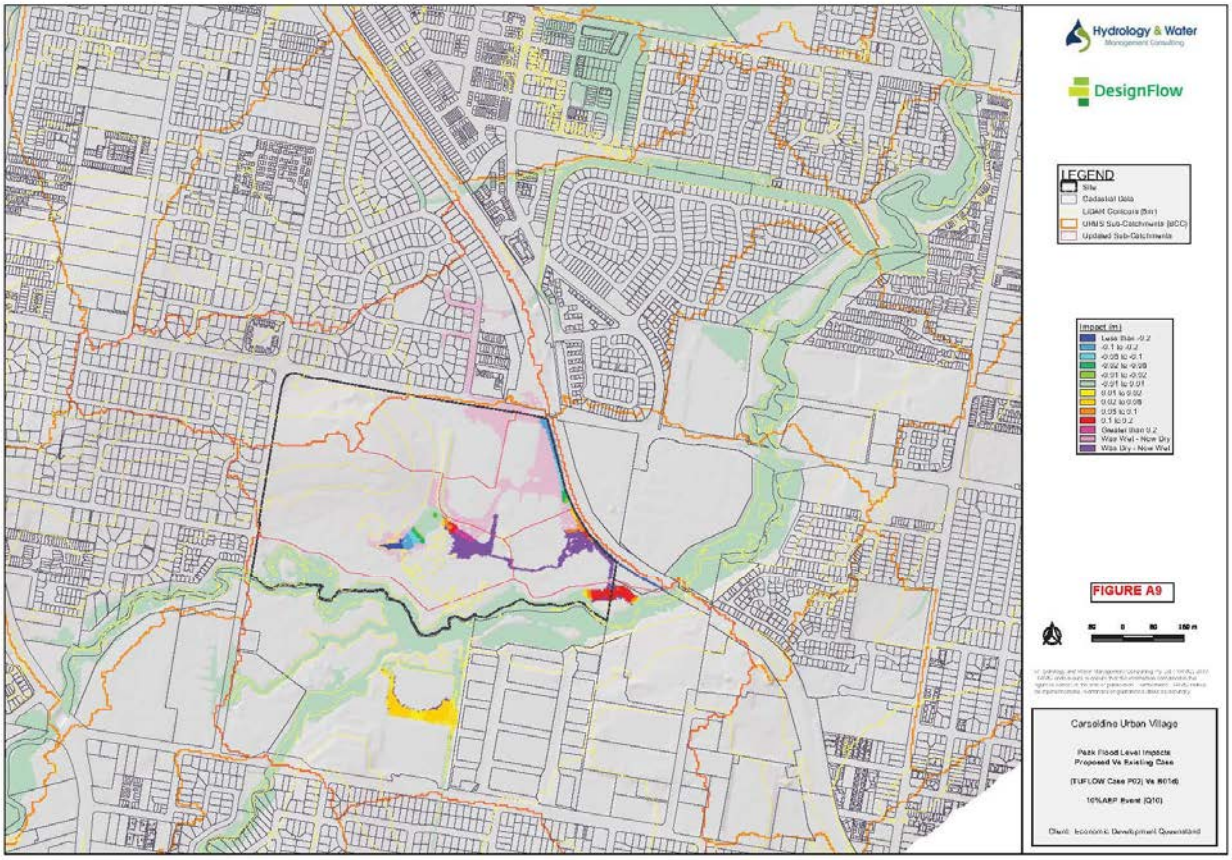

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
Peak Flood Height Contours (m AHD)
Depth (m)
Less than 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
Greater than 2
FIGURE A4
Carseldine Urban Village
Peak Flood Depths &
Peak Flood Level Contours
Proposed Case
(TUFLOW ID P02)
1%AEP Event (Q100)
Client: Economic Development Queensland

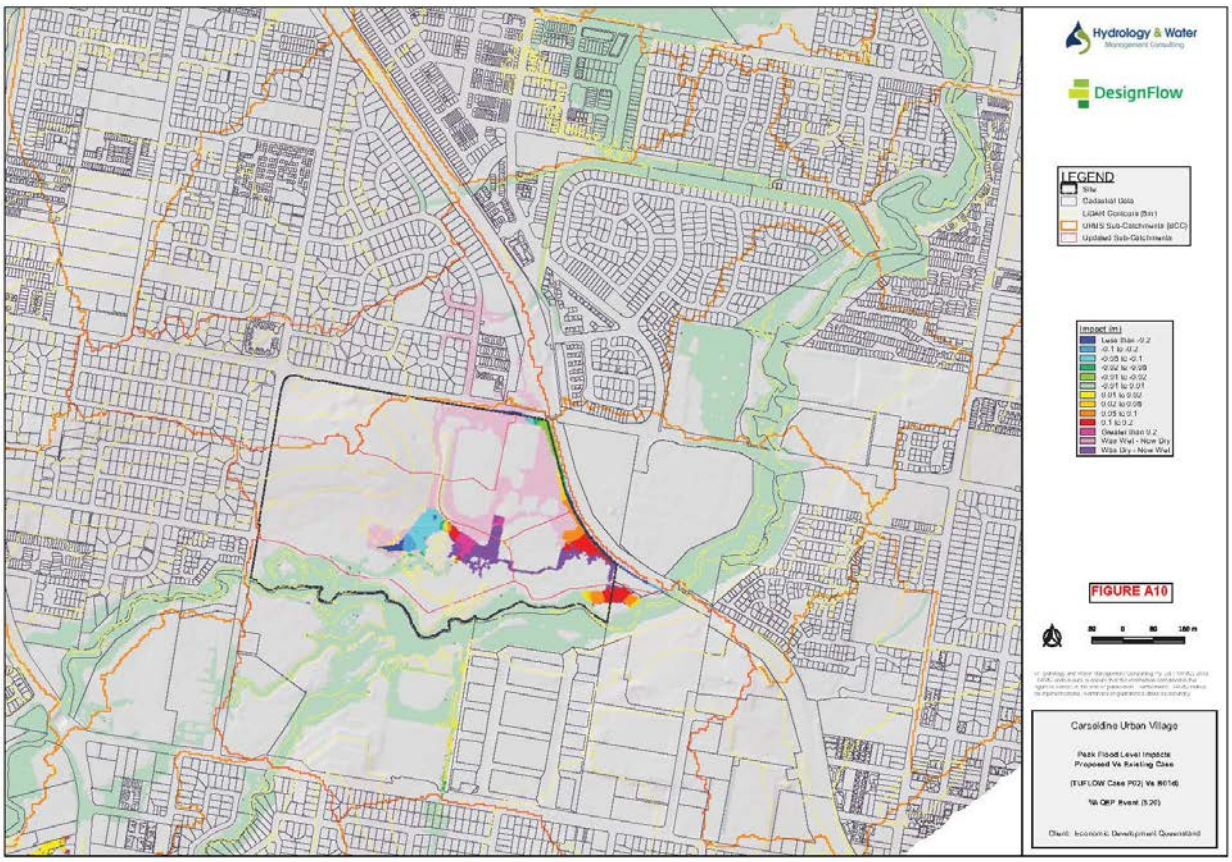

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
Peak Flood Height Contours (m AHD)
Depth (m)
Less than 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
Greater than 2
FIGURE A5
Carseldine Urban Village
Peak Flood Depths &
Peak Flood Level Contours
Proposed Case
(TUFLOW ID P03)
5%AEP Event (Q20)
Client: Economic Development Queensland

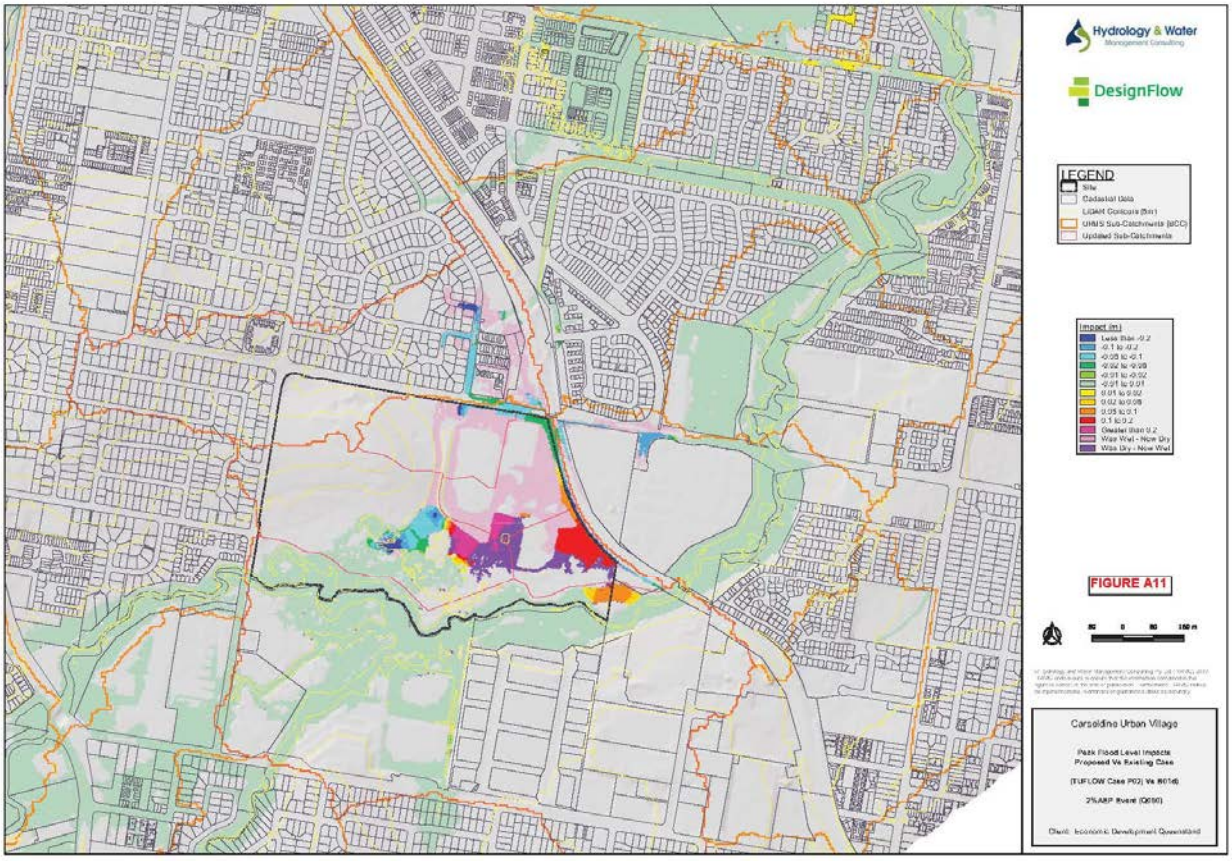

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
Peak Flood Height Contours (m AHD)
Depth (m)
Less than 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
Greater than 2
FIGURE A6
Carseldine Urban Village
Peak Flood Depths &
Peak Flood Level Contours
Proposed Case
(TUFLOW ID P03)
1%AEP Event (Q100)
Client: Economic Development Queensland

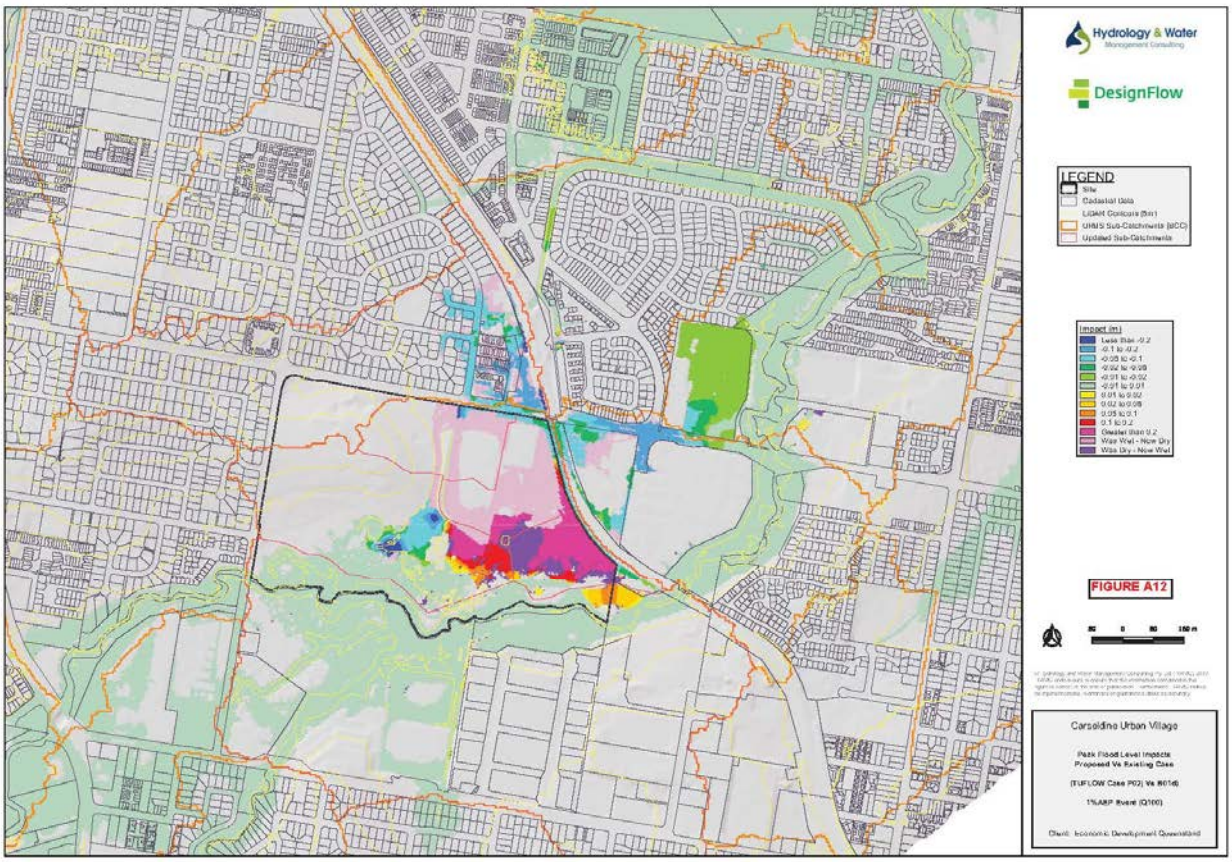

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (5m)
UHMS Sub-Catchments (UCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A7
Carseldine Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs (5014)
Client: Economic Development Queensland

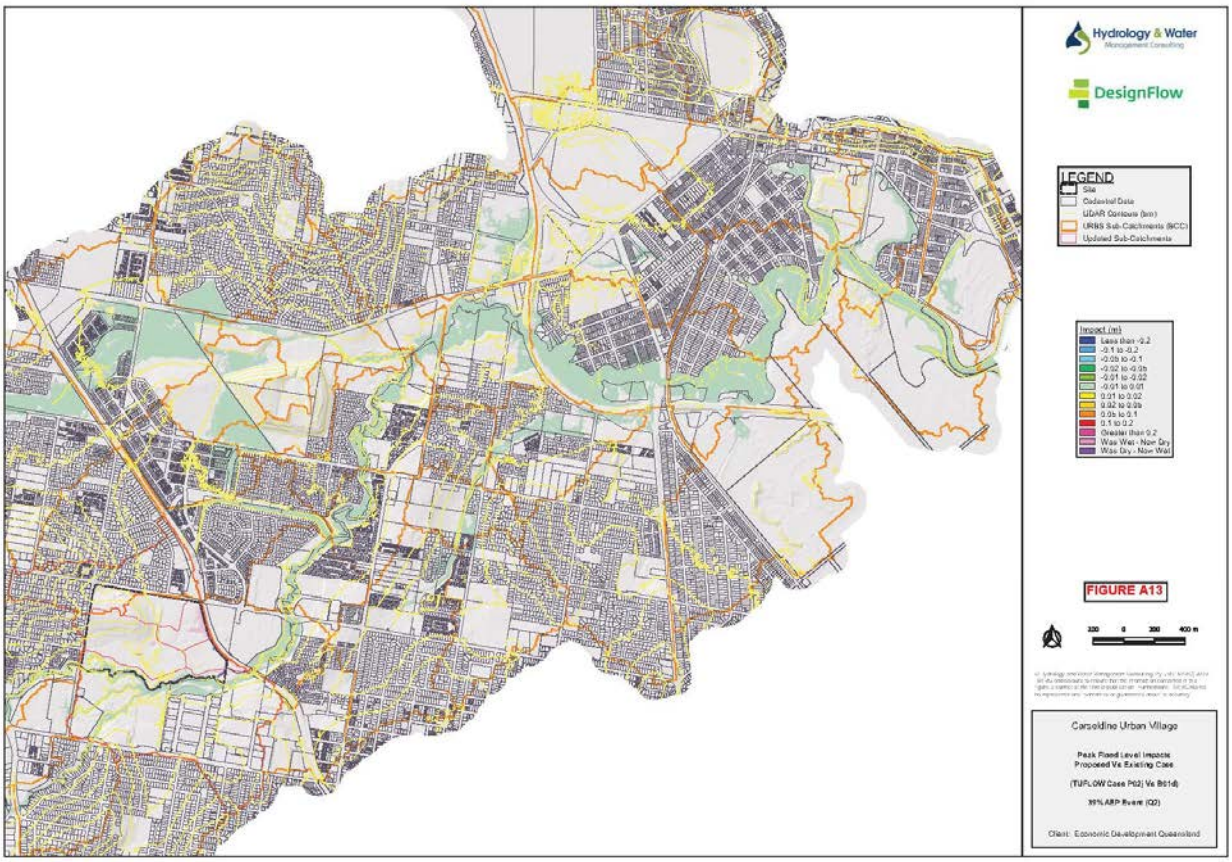

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (5m)
UHMS Sub-Catchments (UCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A8
Carseldine Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs (5014)
Client: Economic Development Queensland

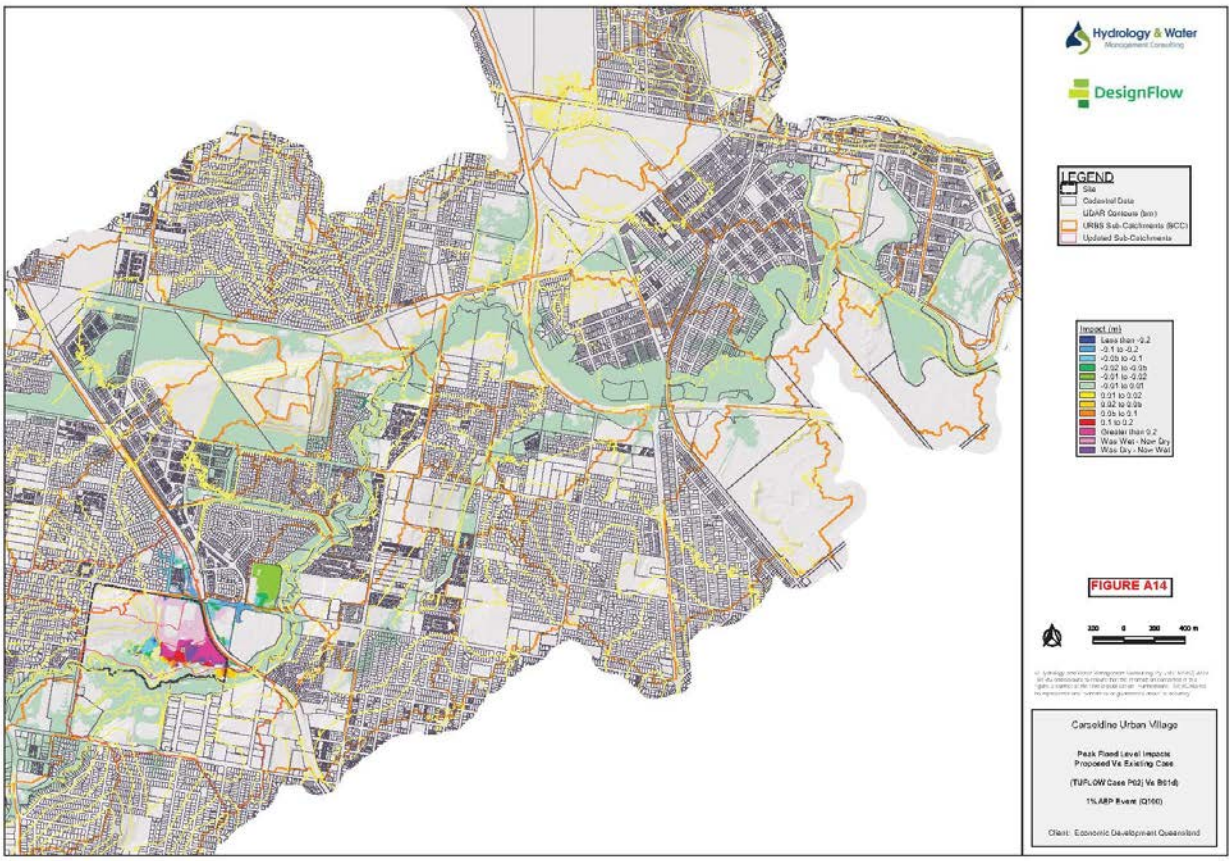

Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (5m)
UHMS Sub-Catchments (MCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A9
Carseldine Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs (5014)
10%AEP Event (Q10)
Client: Economic Development Queensland


Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (5m)
UHMS Sub-Catchments (MCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A10
Carseldine Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs (5014)
1% AEP Event (Q20)
Client: Economic Development Queensland


Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (5m)
UHMS Sub-Catchments (MCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A11
Carseldine Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs 8014b
2%AEP Event (Q50)
Client: Economic Development Queensland


Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (5m)
UHMS Sub-Catchments (MCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A12
Carseldine Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs 8014b
1%AEP Event (Q100)
Client: Economic Development Queensland


Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (1m)
URBS Sub-Catchments (SCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A13
200 0 200 400 m
Caroline Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs B01d)
20% AEP Event (Q2)
Client: Economic Development Queensland


Hydrology & Water
DesignFlow
LEGEND
Site
Cadastral Data
LiDAR Contours (1m)
URBS Sub-Catchments (SCC)
Updated Sub-Catchments
Impact (m)
Less than -0.2
-0.1 to -0.2
-0.05 to -0.1
-0.02 to -0.05
-0.01 to -0.02
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.1
0.1 to 0.2
Greater than 0.2
Was Wet - Now Dry
Was Dry - Now Wet
FIGURE A14
200 0 200 400 m
Caroline Urban Village
Peak Flood Level Impacts
Proposed Vs Existing Case
(TUFLOW Case P02) Vs B01d)
1% AEP Event (Q100)
Client: Economic Development Queensland

More information

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Department of State Development,
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Brisbane Queensland 4001 Australia

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