DATE PLOTTED: 14 September 2017 8:28 AM BY: JESS SHAW

XREFs: XR-R2017033-DCDB Stocklands Area; XR-R2017033-DBYD-RRC As Con; XR-R2017033-CI-EXISTING 1u-1m; XR-RO_DA100_B-1u-1m
CAD File: P:\Other BU's & Misc\R2017033\R2017033-CI-SK01-SK03.dwg

FH
Tynan St
100ø mPVC
24
150ø Concrete
USIL 15.555
DSIL 13.116
37
150ø Concrete
USIL 13.066
DSIL 12.753
BRUCE HIGHWAY
FH
- AMENITIES AREA - NUMBER OF TOILETS LIKELY TO EXCEED THE CODE ALLOWANCE BY 1 OR 2 TOILETS FOR MALE AND FEMALE.
- FURTHER, THERE WILL BE A PARENTS ROOM WHICH WILL HAVE 2 TOILETS.

RETAIN THIS SECTION OF SEWER

Moores Creek Rd
Moores Creek Rd
225ø
USIL 0
DSIL 0
150ø CI
225ø Concrete
USIL 11.945
DSIL 11.899
FH
450ø MSCL
225ø Concrete
USIL 11.589
DSIL 11.962
FH
331
331
100ø AC
100ø MPVC
FH
RAMP 1:60 APPROX
AMENITIES
JOINS R2017033-CI-SK03
150ø Concrete
USIL 12.76
DSIL 12.62
225ø Concrete
USIL 12.462
DSIL 12.199
150ø Concrete
USIL 13.468
DSIL 12.895
150ø Concrete
USIL 12.911
DSIL 12.538
NORTH

LEGEND
- ABANDON WATER MAIN
- NEW WATER MAIN
- ABANDON SEWER
- NEW SEWER
- ABANDON STORMWATER DRAIN
- NEW STORMWATER DRAINAGE
- SERVICE CONFLICT BETWEEN SEWER AND PROPOSED SUPPORT COLUMN

ROCKHAMPTON REGIONAL COUNCIL
These plans are approved subject to the current conditions of approval associated with Development Permit No. D/69-2017
Dated 20-11-2017

PLAN VIEW
SCALE 1: 250

0 5 10 15 20 25m
SCALE 1:250 @A1

Cardno
Shaping the Future
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101 High Street
North Rockhampton, QLD 4701
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Web: www.cardno.com.au

STOCKLAND TRUST MANAGEMENT LTD
STOCKLAND ROCKHAMPTON
PROPOSED EXPANSION
PLAN VIEW - SHEET 1 OF 2

Datum	Date	Scale	Size
AHD	08/06/2017	AS SHOWN	A1

Drawing Number: R2017033-CI-SK02
Revision: C

DATE PLOTTED: 15 September 2017 2:59 PM BY: ADELE WILLETT

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CAD File: N:\PROJECTS 2017\R2017033-STOCKLANDS-DA ASSISTANCE\DESIGN & TECHNICAL\DRAWINGS\02 - SKETCHES\R2017033\R2017033-CI-SK01-SK03.dwg

2/1

JOINS R2017003-CI-SK02

CINEMA LOBBY AMENITIES & TICKETING

RAMP 1:60 APPROX

100ø MPVC

FH

150ø Concrete USIL 13.313 DSIL 12.8

150ø Concrete USIL 12.774 DSIL 12.503

150ø Concrete USIL 13.573

150ø Concrete USIL 12.911 DSIL 12.538

LOADING DOCK

RETAIN EXISTING SEWER UNDER CINEMA GROUND FLOOR LOBBY

331

S

W

MOORES CREEK

NORTH

LEGEND

- ABANDON WATER MAIN
- NEW WATER MAIN
- ABANDON SEWER
- NEW SEWER
- ABANDON STORMWATER DRAIN
- NEW STORMWATER DRAINAGE
- SERVICE CONFLICT BETWEEN SEWER AND PROPOSED SUPPORT COLUMN

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Dated 20-11-2017

PLAN VIEW
SCALE 1: 250

0 5 10 15 20 25m
SCALE 1:250 @A1

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STOCKLAND TRUST MANAGEMENT LTD
STOCKLAND ROCKHAMPTON
PROPOSED EXPANSION
PLAN VIEW - SHEET 2 OF 2

Datum	Date	Scale	Size
AHD	08/06/2017	AS SHOWN	A1

Drawing Number	Revision
R2017033-CI-SK03	C

PRINT DATE: 13 June, 2017 - 4:34pm BY: BEN CAREY

NORTH

Legend

- Site Boundary
- Existing Alignment
- Proposed Alignment
- Stormwater Pit
- Storage Node

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Dated 20-11-2017

CAD FILE: O:\4231-17036_Stockland\Rockhampton\ACAD\Rockhampton_Stockland_Figures.dwg
XREFs:

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Date: 13/06/2017

Scale: 1:1,000

0 10 20 30 40m

Size: A3

423117_036_R1VA
Project Reference

1
Revision

Figure 3

Proposed Pipe Realignment

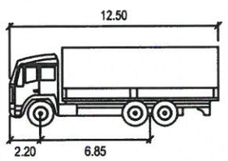
Rockhampton Stockland Restaurant Cinema Precinct
Stormwater Management Plan
Rockhampton Stockland

DATE PLOTTED: 22 May 2017 11:51 AM BY : RYAN WOODS

CONCEPT ONLY

SWEPT PATH LEGEND

- VEHICLE BODY
- FRONT TIRES
- VEHICLE PATH
- VEHICLE CLEARANCE (300mm)
- VEHICLE



HRV

	Meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 36.6

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Dated 20-11-2017

0 2 4 6 8 10 12 14 16 18 20m
4 3 2 1
SCALE 1:400 @ A3

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Fortitude Valley, QLD 4006
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Web: www.cardno.com.au

Rockhampton Stockland
Proposed Dock Access Review
Swept Path Analysis - 12.5m HRV

Drawn	Date	Scale	Size
R.Woods	22/05/2017	1:400	A3

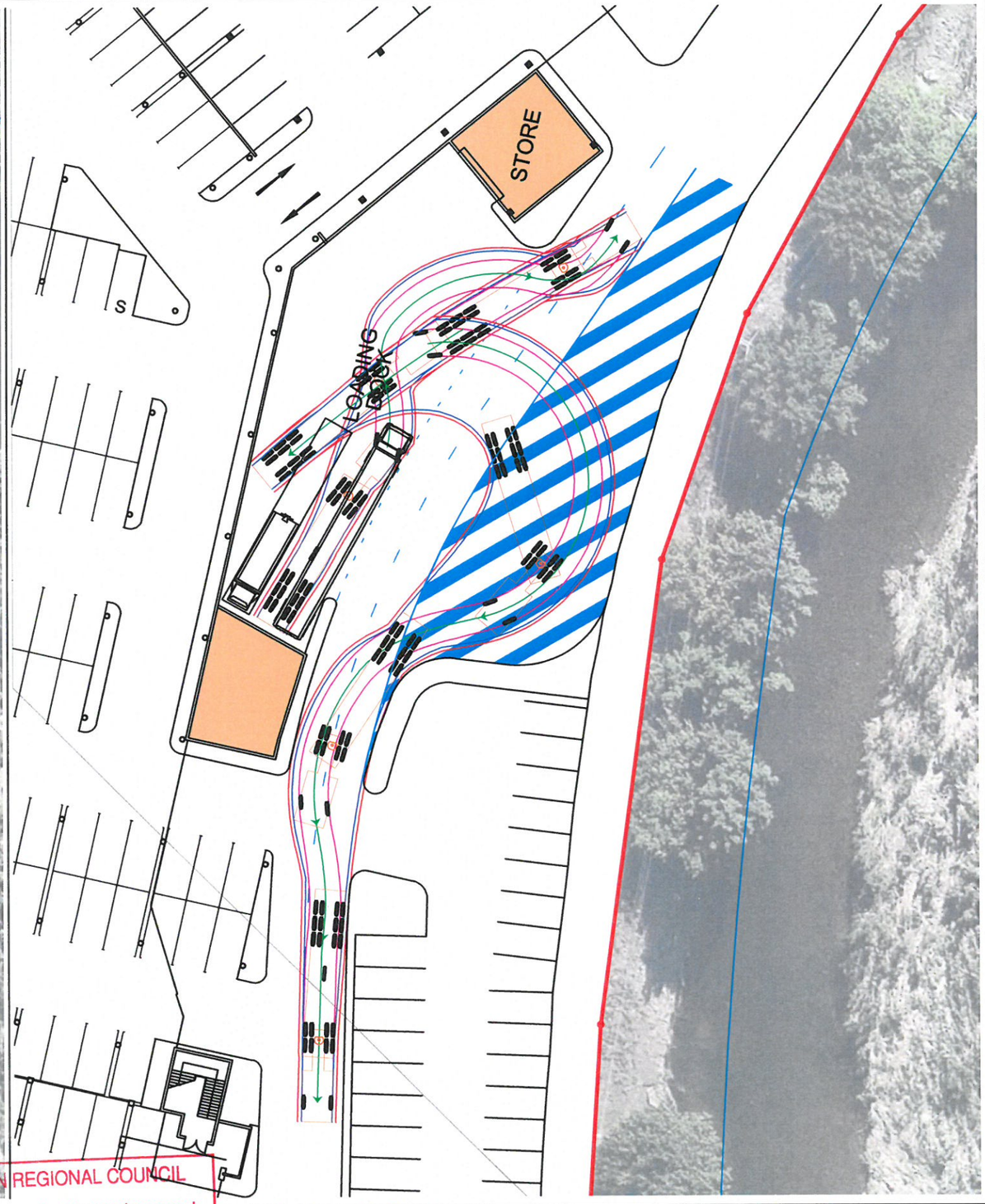
Drawing Number: CEB06360 - SK05
Revision: B

CAD File: G:\CEB06360 - Rockhampton Stockland Traffic Study\6360 - ACAD\CEB06360 - SK05_SK05 - B.dwg

Imagery supplied by nearmap, July 2015

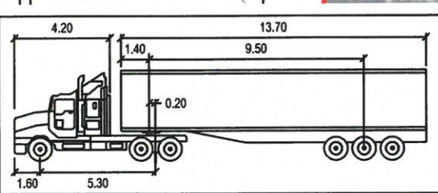
DATE PLOTTED: 22 May 2017 11:51 AM BY : RYAN WOODS

CONCEPT ONLY



SWEPT PATH LEGEND

- VEHICLE BODY
- FRONT TIRES
- VEHICLE PATH
- VEHICLE CLEARANCE (300mm)
- VEHICLE



19M AV

	Meters
Tractor Width	: 2.50
Trailer Width	: 2.50
Tractor Track	: 2.50
Trailer Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 27.7
Articulating Angle	: 70.0

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Dated 20-11-2017

0 2 4 6 8 10 12 14 16 18 20m
SCALE 1:400 @ A3

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Rockhampton Stockland
Proposed Dock Access Review
Swept Path Analysis - 19m AV

Drawn	Date	Scale	Size
R.Woods	22/05/2017	1:400	A3

Drawing Number: CEB06360 - SK06
Revision: B

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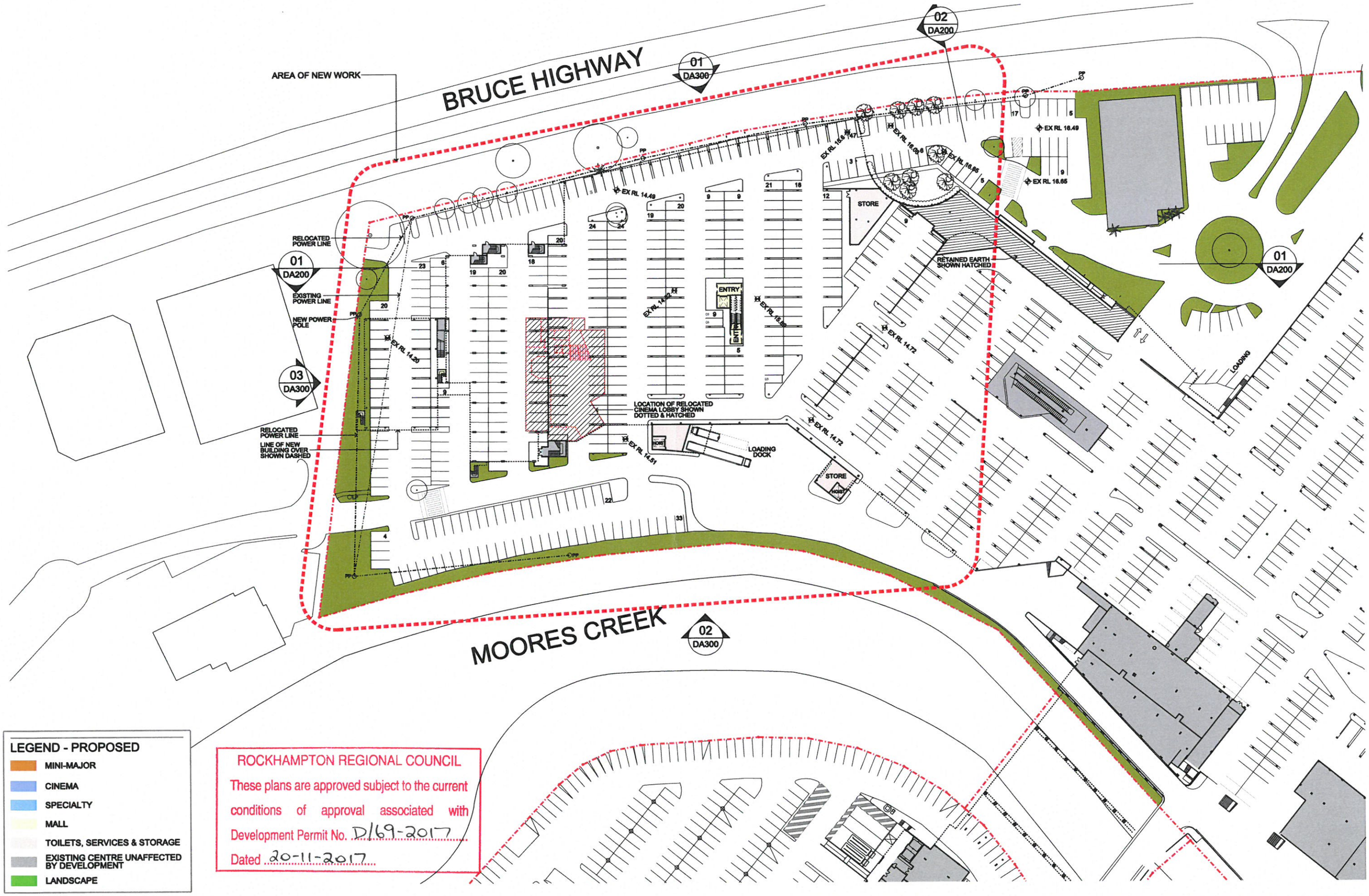
Imagery supplied by nearmap, July 2015



LEGEND - PROPOSED

- MINI-MAJOR
- CINEMA
- SPECIALTY
- MALL
- TOILETS, SERVICES & STORAGE
- EXISTING CENTRE UNAFFECTED BY DEVELOPMENT
- LANDSCAPE

ROCKHAMPTON REGIONAL COUNCIL
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Dated 20-11-2017

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Commercial Design Group
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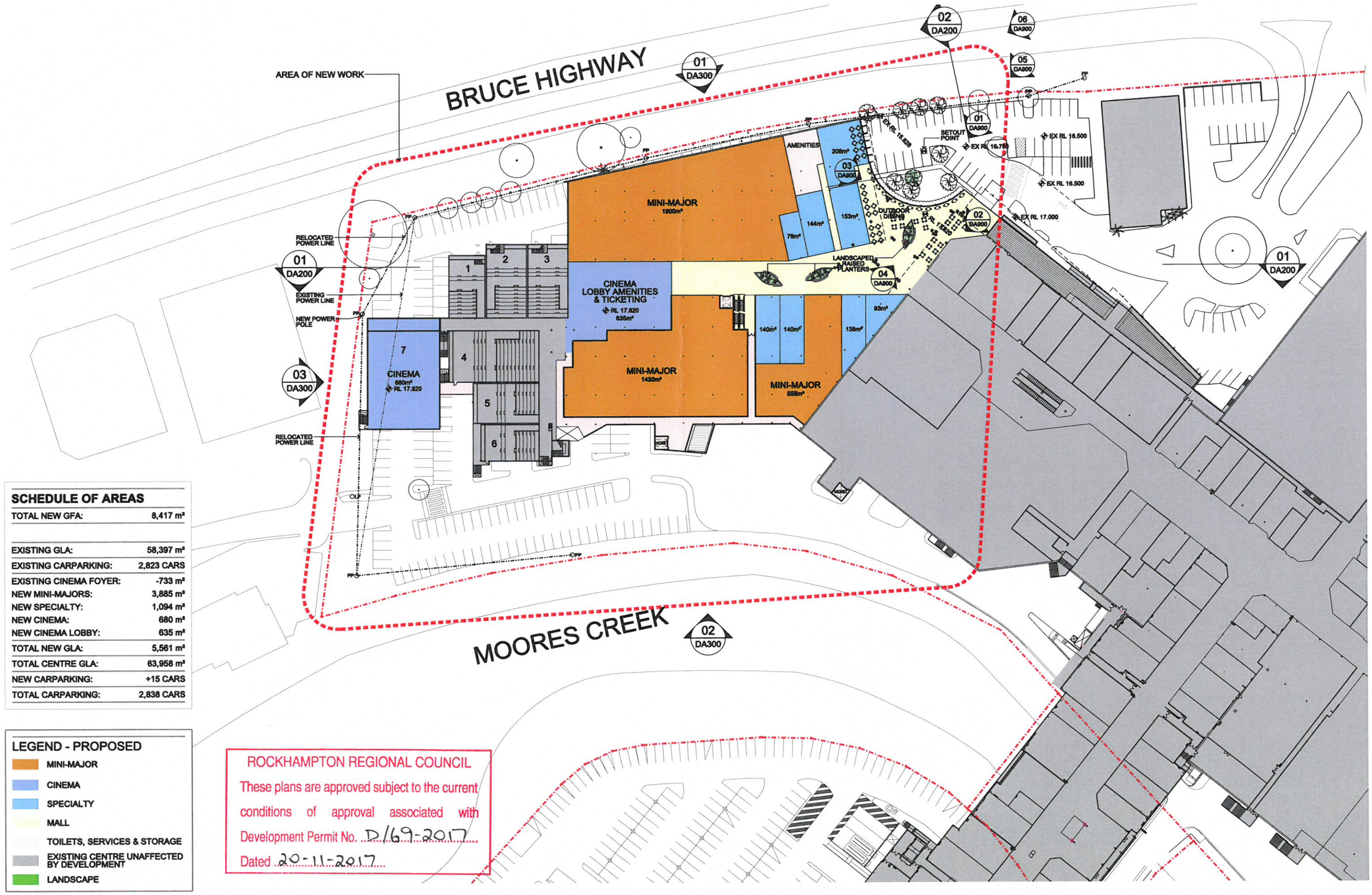
Fax: 02 8988 2000

REVISION:
A For Information 09.06.17
B For Information 14.06.17

STATUS: DA Submission
AUTHOR: RR
DATE: 14.06.17
SCALE: 1:500 @ A1
0m 10m 20m 30m 40m

PROJECT: **Stockland ROCKHAMPTON**
Restaurant Cinema Precinct
120-331 Yaamba Road, North Rockhampton QLD 4701
TITLE: **Proposed Carpark Level Plan**

PROJECT NUMBER: 17-07-04-RO
DRAWING NUMBER: **DA100-B**



SCHEDULE OF AREAS

TOTAL NEW GFA:	8,417 m²
EXISTING GLA:	58,397 m²
EXISTING CARPARKING:	2,823 CARS
EXISTING CINEMA FOYER:	-733 m²
NEW MINI-MAJORS:	3,885 m²
NEW SPECIALTY:	1,094 m²
NEW CINEMA:	680 m²
NEW CINEMA LOBBY:	635 m²
TOTAL NEW GLA:	5,561 m²
TOTAL CENTRE GLA:	63,958 m²
NEW CARPARKING:	+15 CARS
TOTAL CARPARKING:	2,838 CARS

LEGEND - PROPOSED

- MINI-MAJOR
- CINEMA
- SPECIALTY
- MALL
- TOILETS, SERVICES & STORAGE
- EXISTING CENTRE UNAFFECTED BY DEVELOPMENT
- LANDSCAPE

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Dated 20-11-2017

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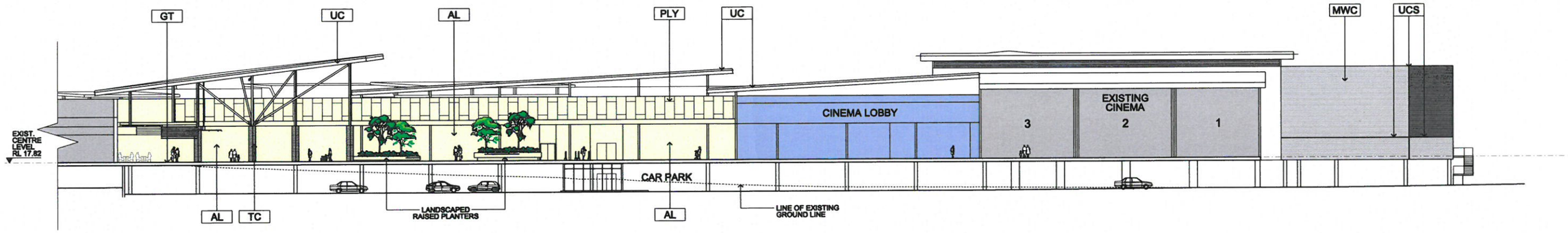
STATUS: DA Submission
AUTHOR: RR
DATE: 14.06.17
SCALE: 1:500 @ A1
0m 10m 20m 30m 40m

PROJECT: Stockland ROCKHAMPTON
Restaurant Cinema Precinct
120-331 Yaamba Road, North Rockhampton QLD 4701
TITLE: Proposed Retail Level Plan

PROJECT NUMBER: 17-07-04-RO
DRAWING NUMBER: DA101-B



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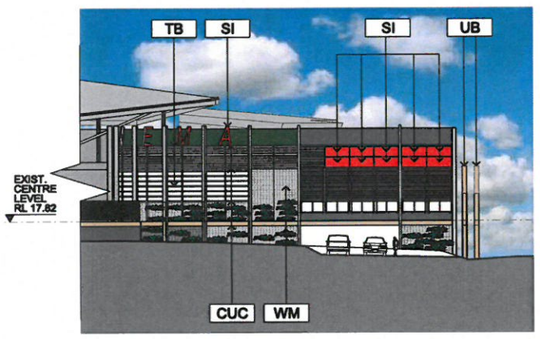

02 ELEVATION
Scale 1:250

ROCKHAMPTON REGIONAL COUNCIL
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Dated 20-11-2017

LEGEND

	EXISTING CENTRE UNAFFECTED BY DEVELOPMENT
AL	ALUMINIUM FRAMED GLASS SHOPFRONT
CUC	CURVED 200UC CHANNEL CROSS BEAM
ESB	STEEL BALUSTRADE TO MATCH EXISTING DETAIL
GT	PATTERNED GRANITE FLOOR TILE & CAPPING TO MATCH EXISTING
MWC	METALLIC COLORBOND CUSTOM ORB PROFILE WALL CLADDING
PC	PRECAST CONCRETE PANEL - PAINT FINISH
PLY	PLYWOOD FACINGS
RBW	SMOOTH RENDERED BLOCKWORK WALL - PAINT FINISH
RC	REINFORCED CONCRETE COLUMN - PAINT FINISH
SI	ILLUMINATED 3D SIGNAGE
TB	100x100 HWD TIMBER BATTEN SUNSCREEN PANEL SET IN STEEL ANGLE FRAME
TC	TIMBER CLAD PANELS TO MATCH EXISTING
TH	100x50 HWD TIMBER BATTEN SUNSCREEN HOODS SET IN STEEL ANGLE FRAME OVER BLACK SHADE CLOTH
UB	NOMINAL 410UB COLUMN WITH 275x75 HWD TIMBER INSERTS EACH SIDE
UC	NOMINAL 310UC ROOF FASCIA CHANNEL & UPSTAND LEG
UCS	NOMINAL 100 SHADOWLINE RECESS IN WALL CLADDING
WM	BLACK STAINLESS STEEL WOVEN MESH PANEL SET IN STEEL ANGLE FRAME

LEGEND - PROPOSED

- MINI-MAJOR
- CINEMA
- SPECIALTY
- MALL
- TOILETS, SERVICES & STORAGE
- EXISTING CENTRE UNAFFECTED BY DEVELOPMENT
- LANDSCAPE

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REVISION:
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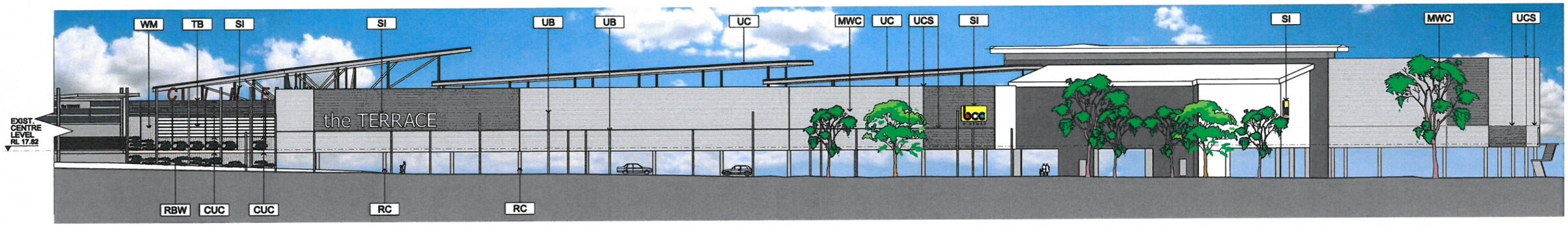
B For Information 14.06.17

STATUS: DA Submission
AUTHOR: RR
DATE: 14.06.17
SCALE: 1:250 @ A1
0m 5m 10m 15m 20m

PROJECT: Stockland ROCKHAMPTON
Restaurant Cinema Precinct
120-331 Yaamba Road, North Rockhampton QLD 4701
TITLE: Proposed Section & Elevation

PROJECT NUMBER: 17-07-04-RO
DRAWING NUMBER: DA200-B



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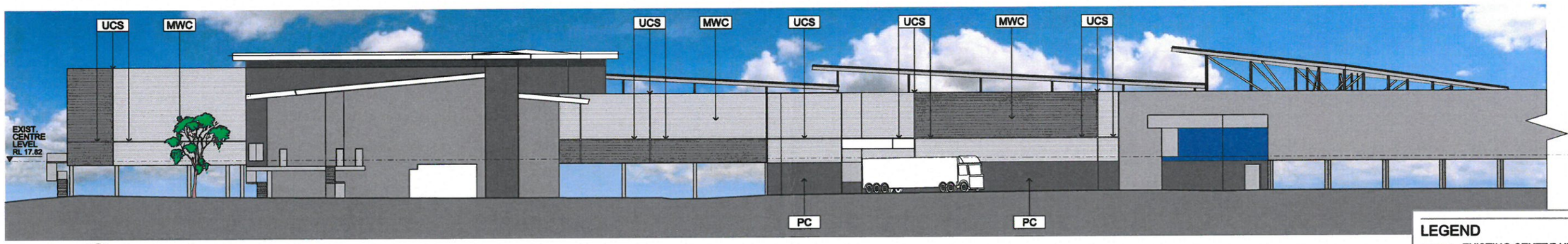

02 ELEVATION 02
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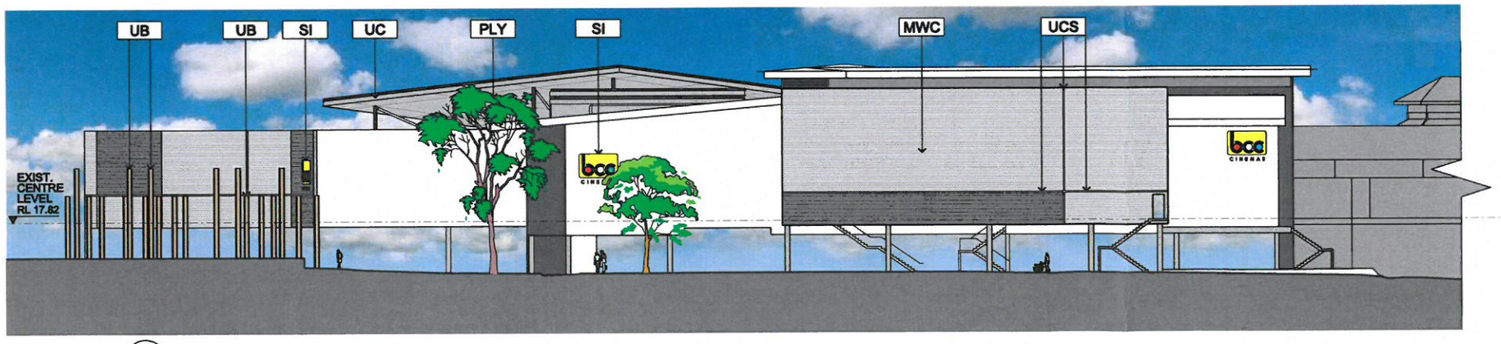

03 ELEVATION 03
Scale 1:250

LEGEND

	EXISTING CENTRE UNAFFECTED BY DEVELOPMENT
AL	ALUMINIUM FRAMED GLASS SHOPFRONT
CUC	CURVED 200UC CHANNEL CROSS BEAM
ESB	STEEL BALUSTRADE TO MATCH EXISTING DETAIL
GT	PATTERNED GRANITE FLOOR TILE & CAPPING TO MATCH EXISTING
MWC	METALLIC COLORBOND CUSTOM ORB PROFILE WALL CLADDING
PC	PRECAST CONCRETE PANEL - PAINT FINISH
PLY	PLYWOOD FACINGS
RBW	SMOOTH RENDERED BLOCKWORK WALL - PAINT FINISH
RC	REINFORCED CONCRETE COLUMN - PAINT FINISH
SI	ILLUMINATED 3D SIGNAGE
TB	100x100 HWD TIMBER BATTEN SUNSCREEN PANEL SET IN STEEL ANGLE FRAME
TC	TIMBER CLAD PANELS TO MATCH EXISTING
TH	100x50 HWD TIMBER BATTEN SUNSCREEN HOODS SET IN STEEL ANGLE FRAME OVER BLACK SHADE CLOTH
UB	NOMINAL 410UB COLUMN WITH 275x75 HWD TIMBER INSERTS EACH SIDE
UC	NOMINAL 310UC ROOF FASCIA CHANNEL & UPSTAND LEG
UCS	NOMINAL 100 SHADOWLINE RECESS IN WALL CLADDING
WM	BLACK STAINLESS STEEL WOVEN MESH PANEL SET IN STEEL ANGLE FRAME

ROCKHAMPTON REGIONAL COUNCIL
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Dated 20-11-2017

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B For Information 14.06.17

STATUS: DA Submission
AUTHOR: RR
DATE: 14.06.17
SCALE: 1:250 @ A1
0m 5m 10m 15m 20m

PROJECT: Stockland ROCKHAMPTON
Restaurant Cinema Precinct
120-331 Yaamba Road, North Rockhampton QLD 4701
TITLE: Proposed Elevations

PROJECT NUMBER: 17-07-04-RO
DRAWING NUMBER: DA300-B

AREA OF NEW WORK

BRUCE HIGHWAY

MOORES CREEK

LEGEND - LANDSCAPE

- FLOWERING CLIMBING PLANTS
- EXISTING TREES TO BE RETAINED
- EXISTING TREES TO BE REMOVED
- NEW LARGE ESTABLISED FEATURE TREES
- DENSE LOW LEVEL LANDSCAPING

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Dated 20-11-2017

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Fax: 02 8988 2000

REVISION:

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B	For Information	14.06.17

STATUS: DA Submission

AUTHOR: RR

DATE: 14.06.17

SCALE: 1:500 @ A1

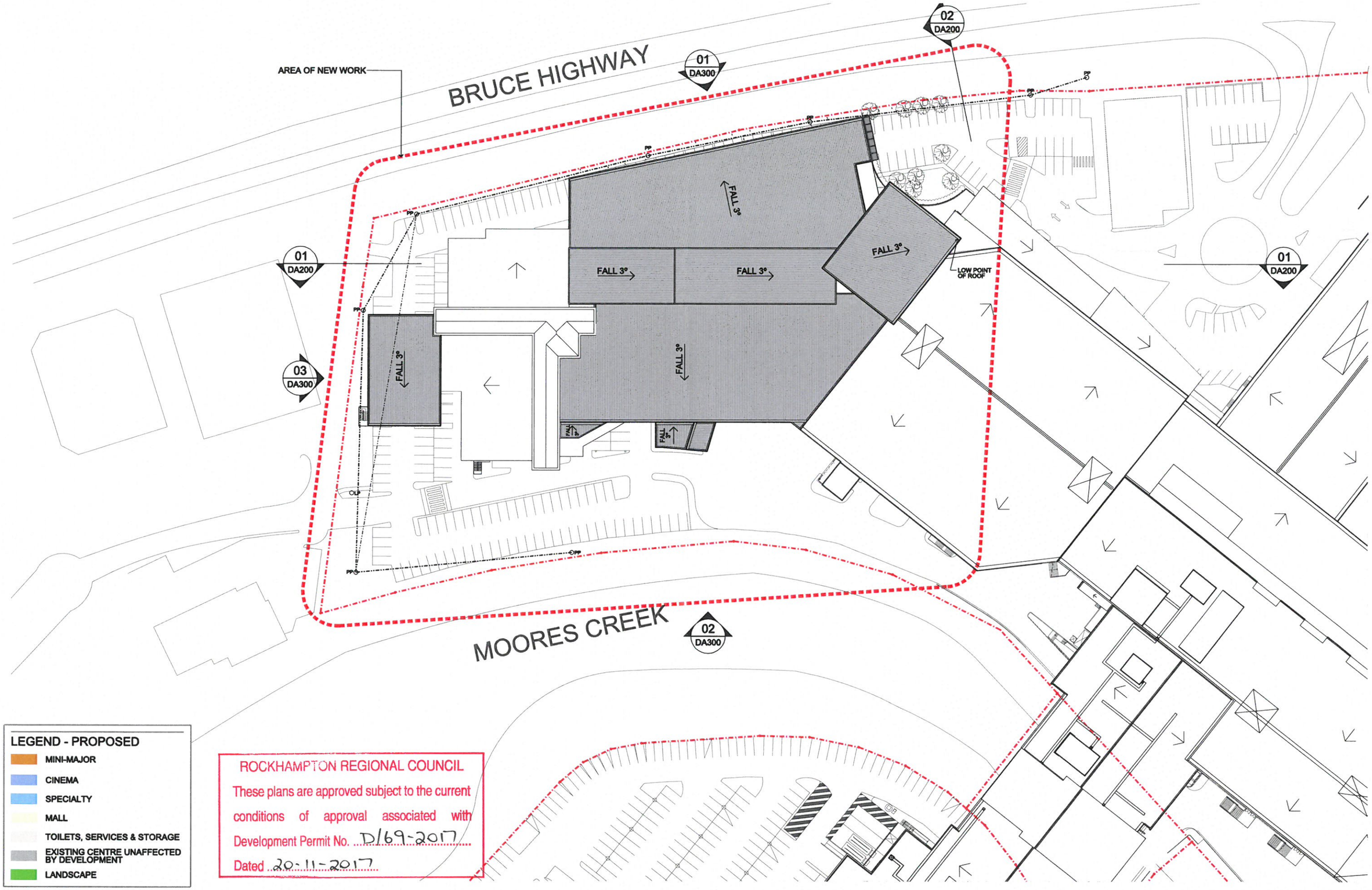
0m 10m 20m 30m 40m

PROJECT: **Stockland ROCKHAMPTON**
Restaurant Cinema Precinct
120-331 Yaamba Road, North Rockhampton QLD 4701

TITLE: **Proposed Landscape Plan**

PROJECT NUMBER: 17-07-04-RO

DRAWING NUMBER: **DA600-B**



LEGEND - PROPOSED

- MINI-MAJOR
- CINEMA
- SPECIALTY
- MALL
- TOILETS, SERVICES & STORAGE
- EXISTING CENTRE UNAFFECTED BY DEVELOPMENT
- LANDSCAPE

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DATE: 14.06.17
SCALE: 1:500 @ A1
0m 10m 20m 30m 40m

PROJECT: **Stockland ROCKHAMPTON**
Restaurant Cinema Precinct
120-331 Yaamba Road, North Rockhampton QLD 4701
TITLE: **Proposed Roof Plan**

PROJECT NUMBER: 17-07-04-RO
DRAWING NUMBER: **DA102-B**

331 Yaamba Road, Park Avenue

APPENDIX E

CIVIL ENGINEERING RESPONSE

Cardno
Shaping the Future

Stockland Rockhampton - Restaurant Cinema Precinct

Engineering Report

R2017033

Prepared for
Stockland

22 June 2017

Cardno
Shaping the Future

Contact Information

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ABN 57 051 074 992

PO Box 3174
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Nth Rockhampton QLD 4740

Telephone: 07 49247500
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Document Information

Prepared for	Stockland
Project Name	Engineering Report
File Reference	170620 Engineering Report
Job Reference	R2017033
Date	20 June 2017
Version Number	1

Author(s):	Cameron Franklin Business Manager- Rockhampton	Effective Date	22 June 2017
Approved By:	Chris Hegarty Senior Engineer	Date Approved:	22 June 2017

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	June 2017	Draft Report		

Table of Contents

Appendices

1 Introduction

This engineering report forms part of a Development Application to extend the existing Rockhampton Shopping Fair Centre at 331 Yaamba Road, Park Avenue.

The Applicant proposes to extend the existing shopping centre to connect with the existing cinema complex. Redevelopment of the entry lobby to the cinema complex is proposed at retail mall level and at basement car parking level. A new screening room is also proposed.

The report describes the infrastructure services (Sewer, Water and Electrical) to be assessed for the proposed development and certain engineering aspects pertaining to these services that would be of interest to the authorities assessing the application.

The lot is currently described as Lot 201 on SP236447 and Lot 1 on SP203617 and is currently occupied by Rockhampton Shopping Fair Centre. The portion of the lot pertaining to this Development Applications is currently a ground level carpark (between the main shopping centre and the cinema complex) at the north-western corner of the site. Access into the carpark is obtained from Aquatic Place and Moores Creek Road.

2 Proposal Plans

Enclosed as Appendix 'A' are the Concept Proposal Plans for the development. The proposed Gross Floor Area of the development is 8,417m^2 (Reference Stockland Commercial Design Group Drawing DA101B).

Drawings detailing the existing services and possible conflict points for the new development have been enclosed in Appendix 'B'.

3 The Subject Land

The subject land is occupied by the Rockhampton Shopping Fair.

This overall land is Lot 201 on SP236447 and Lot 1 on SP203617 at 331 Yaamba Road, Park Avenue is bounded by:

> Yaamba Road to the east

> High Street to the south

> Bruce Hwy/Moores Ck Road to the West

The proposed development site for the extension is currently an existing ground level carpark. The carpark is bounded by the shopping centre to the north and the cinema complex to the south west.

4 Acid Sulphate Soils

4.1 Rockhampton Region Planning Scheme

The subject land is wholly contained within the Rockhampton Region Planning Scheme (2015) Acid Sulfate Soils Overlay with surface elevation between 5m and less than 20m AHD.

The subject land varies from about 10m AHD to 15m AHD.

Performance outcome P01 of the Acid Sulfate Soils Overlay Code states that Development must:

a. *confirm the presence or otherwise of acid sulfate soils prior to development occurring; and*
b. *where the presence of acid sulfate soils is confirmed an acid sulfate soils investigation report is included with a development application to identify:*
    (i) *the location*
    (ii) *the depth; and*
    (iii) *the maximum actual and potential acidity of acid sulfate soils likely to result from disturbance.*

Further site investigation will be necessary to confirm the presence or otherwise of acid sulfate soils.

4.2 Australian Soil Research Information System

The Australian Soil Resource Information System (ASRIS) provides online access to available soil and land resource information in Australia. The following link refers.

http://www.asris.csiro.au/mapping/viewer.htm

The ASRIS records the subject land as Acid Sulfate Soil Class BN(p4) with an Acid Sulfate Soil Probability recorded as "*Low probability of occurrence*".

4.3 Previous Site Investigations

Previous investigation work carried out by Cardno Construction Sciences on the subject land associated with construction of the new road and floorspace link over Moores Creek (circa 2006) encountered largely weathered rock. No testing for acid sulfate soils was carried out at the time.

5 Water Supply

5.1 Water Supply & Reticulation

5.1.1 Existing Water Network

Existing asset information from Rockhampton Regional Council shows that there is an existing 150mm cast iron water main extending from Cowap St across Moores Creek Road into the site. A water meter assembly connects to this main and feeds an internal 100mm Asbestos Cement main. The water main assembly is shown in Figure 1.

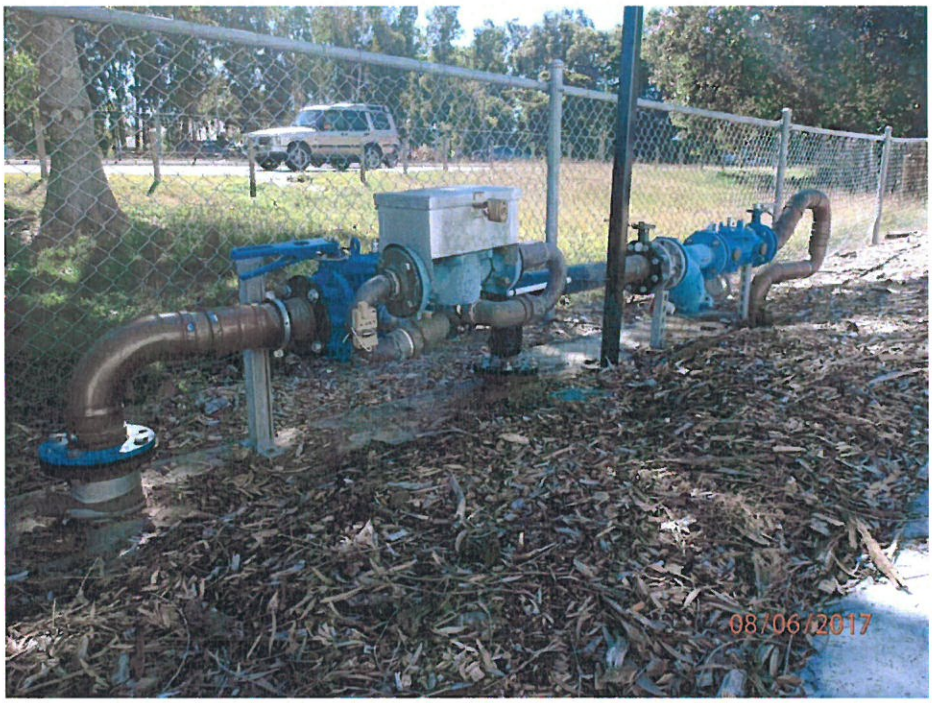

Figure 1: Water Meter Assembly immediately to the north of the existing Cinema building

The site is serviced by the Yaamba Rd Reservoir or a series of connections from the 600mm diameter Trunk water main in Yaamba Rd and Musgrave Street to the reticulation network.

Table 1 Yaamba Rd Reservoir

Location	Capacity (ML)	TWL (m AHD)	Bottom (m AHD)
Yaamba Rd	13.7	69.9	63.5

The subject site varies from about 10m AHD to 15m AHD so ample water pressure is available during normal supply conditions..

An existing 450mm diameter Mild Steel Cement Lined (MSCL) main is also located along the Moores Creek Road frontage but this main is a large diameter trunk rising main and connections to this main will not be permitted.

Existing main locations and diameters and their location in relation to the proposed works have been shown on the services layout plans R2017033-CI-SK01 & SK02 Rev B.

Figure 2 following shows the general water and sewerage services in the vicinity of the proposed works.

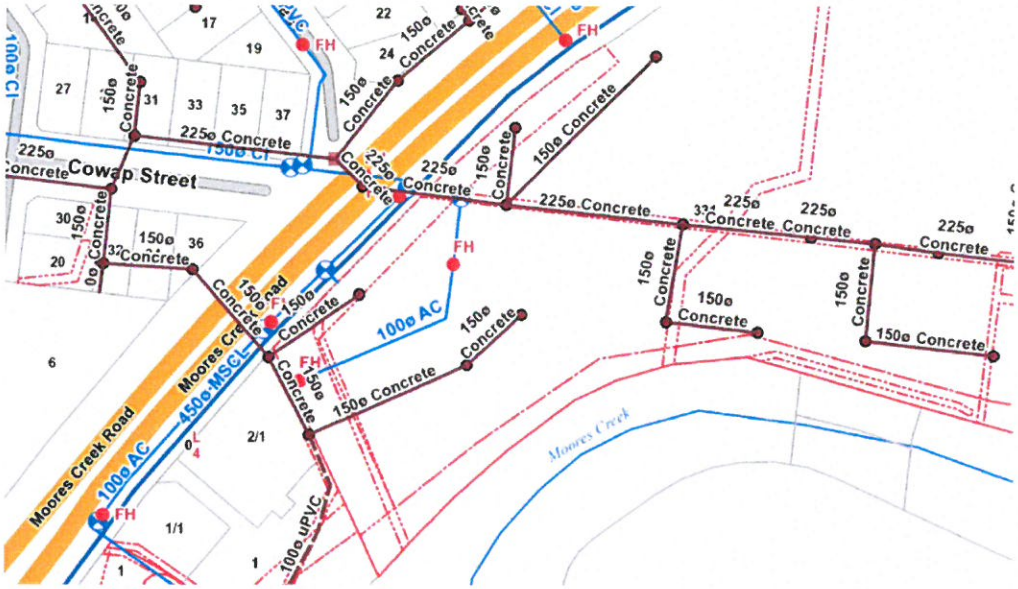

Figure 2: Water and Sewerage mains in the vicinity of the proposed works.

5.1.2 Estimated Additional Water Network Loading

In order to determine the internal water main sizing (and any potential external water main upgrades), the additional demand loading in the form of number of equivalent persons (EP) must be determined. The number of equivalent persons (EP) for the site has been determined in accordance with the *Capricorn Municipal Development Guidelines (CMDG)* as follows:

Table 2 Additional Development Water Loading

Additional Gross Lettable Floor Space (m^2) Note 1	EP per 10,000m^2 Gross Lettable floor space Note 2	Estimated Additional EP
5,561m^2	650	361

Note 1:.Area is drawn from Stockland Plan Project No. 17-07-04-RO, Drawing No DA101-B dated 14/06/17.

Note 2: cmdg.com.au , D11 Water Supply Network Design and Construction , Appendix C Table D11.C.01. A figure of 650EP per 10,000m^2 lettable floor space which is mid way between the range of 500EP and 800EP in Table D11.C.01.

The above determination of additional EP is a preliminary estimate only and will need to be refined once floor areas are confirmed after detailed design and further details of the proposed uses are determined.

5.1.3 External network upgrades

The need for external water network upgrades is unknown.

Once additional demand loadings for the proposed development have been confidently determined then Rockhampton Regional Council will need to be commissioned to carry out water network analysis. This will determine if any external network upgrades are necessary. Rockhampton Regional Council do not provide the water network model to third parties to carry out analysis.

5.1.4 Fire Fighting

There are already water storage tanks and booster pump supply systems on site for fire fighting supply purposes. It is likely that these facilities will require upgrade to meet the fire fighting requirements for the development.

6 Sewerage

6.1 Sewerage Reticulation

6.1.1 Existing Sewerage Network

An existing 225mm diameter concrete trunk main traverses the site. This main is covered by a sewerage easement. This main links to a series of larger downstream trunk sewerage mains which feed to a SP009 Hadgraft St Pump Station which pumps directly to the North Rockhampton Sewage Treatment Plant. The 225mm diameter concrete trunk sewer is at an average depth of about 2.5m below the proposed car park level through the site of the proposed expansion works.

There are a series of smaller 150mm diameter concrete mains on the site which link to the 225mm diameter concrete trunk main. The average depth of the 150mm mains is about 1.2m below the proposed car park level. The 150mm mains are not covered by sewerage easements.

Existing sewerage main locations and diameters have been shown on the services layout plans R2017033-CI-SK01 & SK02 Rev B.

The design of the shopping centre expansion will need to ensure that:

- Access to existing sewerage access chambers is maintained in the ground level carpark. Alternatively, access chambers may be relocated where acceptable sewerage grades can be achieved; and
- Building footings are constructed such that no additional loading are placed onto existing concrete sewerage pipes. These concrete pipes are likely to be brittle. Normal requirements for footing construction are that they should extend to the existing sewerage pipe invert and be located no closer than 2m to the existing sewer.

6.1.2 Estimated Additional Sewerage Network and Loadings

Additional sewerage loadings are considered identical to water loadings for preliminary design.

6.1.3 External Sewerage Network Upgrades

The need for external sewerage network upgrades is unknown.

The available capacity in the existing 225mm diameter trunk sewer and the downstream sewerage network will need to be investigated.

Once additional demand loadings for the proposed development have been confidently determined then Rockhampton Regional Council will need to be commissioned to carry out sewerage network analysis. This will determine if any external network upgrades are necessary. Rockhampton Regional Council do not provide the sewerage network model to third parties to carry out analysis.

7 Electricity

7.1 Electrical Supply & Reticulation

7.1.1 Existing Electrical Network

Further investigation is required to determine if amended supply capacity is available without further re-augmentation of the Ergon network.

Building Service engineers are required to confirm if the existing switch board requires any alteration in order to facilitate additional circuitry and capacity.

8 Conclusion

This report describes the infrastructure required (water, sewerage and electrical) to service the proposed development extension at 331 Yaamba Road, Park Avenue, North Rockhampton. From these investigations, we anticipate that infrastructure services will be able to be adequately provided. On the basis that the detailed upgrading works and additional assessments as outlined herein are carried out, it is our opinion that no significant engineering difficulties would prevent the proposed extension of the Rockhampton Shopping Fair with the Restaurant Cinema Precinct.

331 Yaamba Road, Park Avenue

APPENDIX F

STORMWATER MANAGEMENT PLAN

ROCKHAMPTON REGIONAL COUNCIL
These plans are approved subject to the current conditions of approval associated with Development Permit No. D/69-2017
Dated 20-11-2017

Cardno
Shaping the Future

Stockland Rockhampton Restaurant Cinema Precinct

Stormwater Management Plan

423117_036_R1V1

Prepared for
Stockland

21 June 2017

Cardno
Shaping the Future

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Document Information

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Approved By: Rick Dennis

Date Approved: 21 June 2017

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	21/062017	For Submission	G. Paxton	R. Dennis

Table of Contents

Tables

Figures

1 Introduction

This Stormwater Management Plan (SMP) has been prepared by Cardno for the proposed Stockland Rockhampton Restaurant Cinema Precinct for Stockland. The site is located at 331 Yaamba Road, Berserker, described as Lot 201 SP236447 and is illustrated in Figure 1.

The proposed development layout, included in the Reference Drawings, consists of extensions to the shopping centre, with the new development areas located on piers with underlying carpark.

This report assesses the stormwater quantity and quality requirements of the proposed development, adhering to the requirements of Rockhampton Regional Council (Council) *Stormwater Management Code* (RRC, 2017). Responses to the code are provided in Appendix A.

2 Quantity Assessment

The proposed development will not increase the runoff occurring from the current site, as there is no significant earthworks occurring nor increase is impervious area. However, an existing stormwater pipe will have to be realigned outside of the proposed building front print, as requested by Council within the pre-lodgement meeting conducted 19 April 2017.

The existing pipe alignment is illustrated in reference drawings, and includes a 0.9 m RCP draining the Cowap and Tynan Street catchment to the north, through the site and into Moores Creek to the south. Therefore to ensure no adverse impact external to the site as a result of the proposed pipe realignment, a XPSWMM (Version 2016) hydrologic / hydraulic model was setup, as below.

2.1 Hydrology

The catchment extent currently collected by the proposed re-aligned pipe network is approximately 21.4 ha and illustrated on Figure 2. These extents were determined from Aerial Laser Survey (ALS), supplied by Department Natural Resources & Mines (DNRM) and Council supplied stormwater network layouts.

The adopted fraction impervious values for each land use type are listed in Table 2-1 and were derived from *Queensland Urban Drainage Manual* (DNRM, 2013). Adopted model losses are detailed in Table 2-2 below.

Table 2-1 Adopted Land Use Impervious Fractions

Land Use	Impervious
Residential (incl. internal roads)	65%
Road Reserves	90%
Commercial Areas	100%
Open Space / Park	0%

Table 2-2 Adopted Losses

Loss	Pervious	Impervious
Initial (mm)	20	2
Continuing (mm/hr)	10	0

Intensity Frequency Duration (IFD) parameters adopted are in accordance to the *Stormwater Drainage Design Guidelines* (CMDG, 2017). The 10% Annual Exceedance Probability (AEP) was simulated with storm durations from 15 to 120 minutes. In accordance to the Guidelines, the re-aligned pipe is the convey 10% AEP storm event, and based on the above parameters equates to a peak flow of 7.5 m^3/s. This flow was validated to a Rational Method calculated and will be assessed in the below hydraulic model.

2.2 Hydraulics

To demonstrate that the new alignment would result in the same, or improved, efficiency of flow and result in no adverse impact to the upstream stormwater network, both pre- and post-developed alignments were modelled, as illustrated on Figure 3. It is noted the full network upstream of the site was disregarded as the scope of this assessment is to ensure a maintenance or reduction in Hydraulic Grade Line (HGL) elevation at the junction upstream of the realignment.

Existing pipe details were supplied by Council and included in the reference drawings. Structure losses are as per QUDM (DNRM, 2013). A Manning's 'n' of 0.013, indicative of the roughness in a RCP, was adopted for all stormwater pipes. Free outflow tailwater condition has been assumed as interaction with Moores Creek is not expected given the divergent catchment responses.

Existing network details, from the point of change, can be seen in the below table:

Table 2-3 Existing Pipe Details

Pipe ID	RCP Size (m)	Upstream Invert (mAHD)	Downstream Invert (mAHD)	Slope (%)	Bend Loss
2	0.9	11.309	11.259	0.09	-
3	0.9	11.009	10.959	1.29	0.3 (22.5°)
4	0.9	10.959	10.809	1.48	-
5	0.9	10.809	10.369	0.41	-

Two 22.5° bends were incorporated into the developed model to alignment the pipe to avoid the footprint of the extension. The details for this network can be seen in the below table.

Table 2-4 Developed Pipe Details

Pipe ID	RCP Size (m)	Upstream Invert (mAHD)	Downstream Invert (mAHD)	Slope (%)	Bend Loss
2	0.9	11.309	11.259	0.09	-
6	0.9	11.259	11.000	1.18	0.3 (22.5°)
7	1.05	11.000	10.369	0.60	0.3 (22.5°)

Based on the above arrangement the HGL reduces 0.4 m at Pipe 2, and therefore results in a drainage improvement for the upstream system

3 Quality Assessment

A pollutant analysis using the eWater's Model for Urban Stormwater Improvement Conceptualisation (MUSIC) v6.2.1 to assess the treatment requirements to meet reductions as specified by the State Planning Policy (DILGP, 2016).

Modelling has been carried out in accordance with the '*MUSIC Modelling Guidelines Version 1.0*' (WbD, 2010). 6 minute rainfall from Rockhampton Aero (Station 39083), commercial land use parameters and a split catchment approach were adopted.

Catchments were defined from development plans included in the reference drawings. Only the new roof are created by the development has been considered with areas defined below and illustrated on Figure 4.

Table 3-1 Adopted Land Use Impervious Fractions

Sub-catchment	Area (ha)
Roof A	0.478
Roof B	0.292
Roof C	0.070

Due a lack of available space for a bio-retention basin, proprietary systems have been incorporated. For the purpose of this assessment, Stormwater 360 devices were used, with the following required to meet the required reduction targets:

> 2 / EnviroPod for Roof A;

> 2 / EnviroPod for Roof B;

> 2 / EnviroPod for Roof C; and

> 16 / 690 mm PSorb chamber.

Appendix B includes data sheets for these products. Parameters for these devices were adopted was per manufacture recommendations.

The pollutant loads and treatment effectiveness from the proposed treatment train is shown in Table 3-2 below.

Table 3-2 MUSIC Results

Pollutant	Source Load (kg/yr)	Residual Load (kg/yr)	Reduction (%)	Required (%)
Total Suspended Solids	174	25.9	85.1	85
Total Phosphorus	1.04	0.315	69.7	60
Total Nitrogen	18.8	9.34	50.3	45
Gross Pollutants	146	0	100	90

With suitable operation and maintenance it is expected the adopted treatment train will meet the performance shown above.

4 Conclusion

This SMP has been prepared by Cardno for the proposed Stockland Rockhampton Restaurant Cinema Precinct for Stockland. This report assesses the stormwater quantity and quality requirements of the proposed development, adhering to the requirements of Council's *Stormwater Management Code* (RRC, 2017). Responses to the code are provided in Appendix A.

The proposed development will not increase the runoff occurring from the current site, as there is no significant earthworks occurring nor increase in impervious area. However, an existing stormwater pipe will have to be realigned outside of the proposed building front print. The proposed pipe realignment is expected to improve drainage conditions upstream of the site.

Pollutant impact modelling indicated that a proprietary treatment train such as Stormwater 360 devices can ensure reduction requirements are met.

5 Qualifications

This report has been prepared by Cardno for Stockland and specifically for the proposed Stockland Rockhampton Restaurant Cinema Precinct. The analysis and overall approach was specifically catered for the particular project requirements, and may not be applicable beyond this scope. For this reason any other third parties are not authorised to utilise this report without further input and advice from Cardno.

The report is based on the following information provided by others:

> ALS supplied by DNRM;

> Stormwater network information supplied by Council; and

> Development layouts completed by Stockland.

The accuracy of the report is dependent upon the accuracy of this information.

Whilst this report accurately assesses catchment hydrologic and hydraulic performance, using industry standard theoretical modelling techniques and engineering practices, actual future observed catchment flows, levels and extent of inundation may vary from those predicted herein. It is for this reason that flood freeboards are adopted.

6 References

Capricorn Municipal Development Guidelines (CMDG), 2017. Stormwater Drainage Design;

Department of Energy and Water Supply (DEWS), 2013. Queensland Urban Drainage Manual – Third Edition;

Department of Infrastructure, Local Government and Planning (DILGP), 2016. State Planning Policy;

Rockhampton Regional Council (RRC), 2017. Stormwater Management Code;

Water by Design (WBD), 2010. MUSIC Modelling Guidelines Version 1.0

ATTACHMENT

B

TRAFFIC ENGINEERING RESPONSE – PREPARED BY CARDNO

Cardno
Shaping the Future

Our Ref: CEB06360 Letter 2017-09-20:TA
Contact: Andy Johnston

21 September 2017

Stockland
Level 4, 99 Melbourne Street
South Brisbane QLD 4101

Attention: Peter Anderson

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Dear Peter,

STOCKLAND ROCKHAMPTON CENTRE EXPANSION
RESPONSE TO ROCKHAMPTON REGIONAL COUNCIL INFORMATION REQUEST

Cardno was commissioned to provide traffic engineering advice in relation to the proposed redevelopment of the Stockland Rockhampton centre to expand and redevelop the cinema precinct. A traffic impact assessment was prepared to support the development application. Rockhampton Regional Council issued an Information Request (reference D/69-2017), dated 27 July 2017. Cardno has prepared this letter to address the traffic-related issues identified in the Information Request.

For ease of reference Cardno has reproduced the traffic related items followed by the relevant response below.

Item 1)

Please provide a sensitivity analysis to run an alternate distribution of traffic with more share of traffic (40% instead of 30%) within close proximity to the proposed expansion that is through the High Street / Aquatic Place intersection and its impact on High Street /Aquatic Place roundabout and High Street - Alexandra Street / Moores Creek Road intersection.

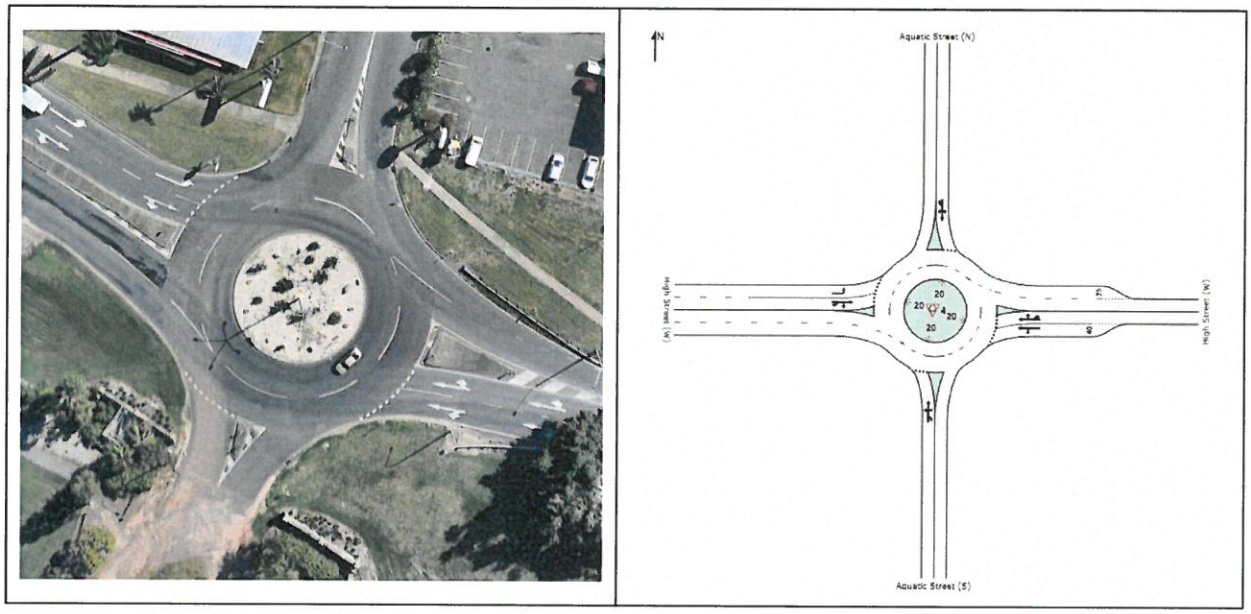
Cardno Response

In response to item 1, a sensitivity analysis was prepared to test the alternate traffic distribution proposed by Council. The High Street/Aquatic Place and High Street/Alexandra Street/Moores Creek Road intersections were reanalysed in SIDRA and the results are outlined in the following sections.

High Street / Aquatic Place Intersection

The current configuration of this intersection is a roundabout arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 1-1.

Figure 1-1 Current and SIDRA Assessed Layout – High Street / Aquatic Place Intersection



The results of the SIDRA assessment, for all development scenarios, are summarised in Table 1-1.

Table 1-1 SIDRA Outputs – High Street / Aquatic Place Intersection

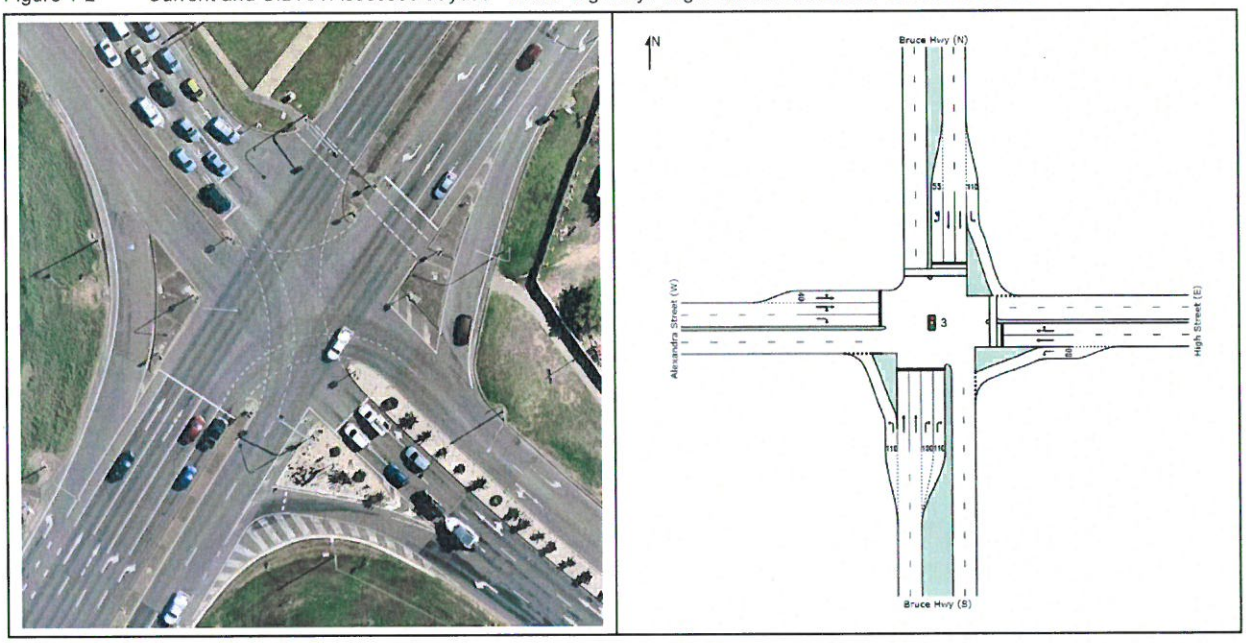
Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Critical Delay	95th%tile Queue	DOS	Critical Delay	95th%tile Queue
Original Assessment						
2018 With Development	0.408	6.8	21.7	0.585	7.9	40.2
2028 With Development	0.423	6.7	23.4	0.605	8.0	45.1
Sensitivity Assessment						
2018 With Development	0.422	6.9	22.6	0.599	8.0	42.6
2028 With Development	0.438	6.8	24.5	0.619	8.3	47.8

The additional trips through the redistribution of traffic for the proposed development resulted in a small increase in degree of saturation, critical delay and queuing compared to the original assessment. The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.85 for roundabouts), for all development scenarios.

Bruce Highway / High Street / Alexandra Street Intersection

The current configuration of this intersection is a four-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 1-2.

Figure 1-2 Current and SIDRA Assessed Layout – Bruce Highway / High Street / Alexandra Street Intersection



The results of the SIDRA assessment, for all development scenarios, are summarised in Table 1-2.

Table 1-2 SIDRA Outputs – Bruce Highway / High Street / Alexandra Street Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
Original Assessment						
2018 With Development	0.782	46.1	256.0	0.760	46.7	175.2
2028 With Development	0.954	62.8	390.1	0.858	51.5	226.8
Sensitivity Assessment						
2018 With Development	0.782	46.2	256.0	0.767	46.8	174.7
2028 With Development	0.958	63.8	390.5	0.862	51.4	221.2

Similar to the original assessment all development scenarios are within the typical performance thresholds (DOS ≤ 0.9 for signals) except for 2028 with development Thursday PM peak. High levels of queuing are consistent with the original assessment particularly the east approach exceeding queue storage lengths.

The above intersection assessment includes a 2% p.a. growth rate on the state controlled road network and is considered to be a conservative assumption. Thus, a sensitivity analysis was undertaken to test the lower growth rate of 1% p.a. on the Bruce Highway which is representative of historic trends and population data.

Sensitivity Analysis

Table 1-3 SIDRA Outputs – Bruce Highway / High Street / Alexandra Street Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
Original Assessment						
2018 With Development	0.770	46.3	235.5	0.770	46.9	176.1
2028 With Development	0.895	54.0	300.7	0.823	49.5	199.1
Sensitivity Assessment						
2018 With Development	0.763	46.1	233.1	0.760	46.8	172.2

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2028 With Development	0.896	53.8	301.5	0.822	49.4	199.2

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.9 for signals), for all development scenarios. Queuing on the east approach is contained within the lane storage with no queue blockage on the High Street/Aquatic Place intersection. Therefore, the more representative growth rate of 1% p.a. on Bruce Highway indicates the additional traffic will perform within operating thresholds.

After redistributing traffic to the High Street/Aquatic Place access for the proposed expansion, the additional impacts on the High Street/Aquatic Place and High Street/Alexandra Street/Moores Creek Road intersections are negligible.

Item 2)

Please model the High Street / Musgrave Street and the High Street / Site Access to the Kmart intersection together preferably in SIDRA. It seems the queue length along High Street between Musgrave Street and the access to the Kmart exceeds the available length of 170 metres in 2028 with the proposed development. Please model these intersections as a network to understand the impact of the High Street / Musgrave Street intersection queues on the High Street / access to the Kmart intersection and propose solutions.

Cardno Response

In response to Item 2, Cardno updated the SIDRA analysis to network the High Street/Musgrave Street and High Street/Site Access intersections. Rockhampton Regional Council has particularly noted that the queue length from the High Street/Musgrave Street intersection along High Street exceeds the queue storage of 170m to the High Street/Site Access intersection. Networking the intersections better reflect any potential queuing issues that may be present. The results for the networked intersections are summarised in Table 1 and Table 2.

Figure 1-1 High Street / Musgrave Street and High Street / Site Access Intersections

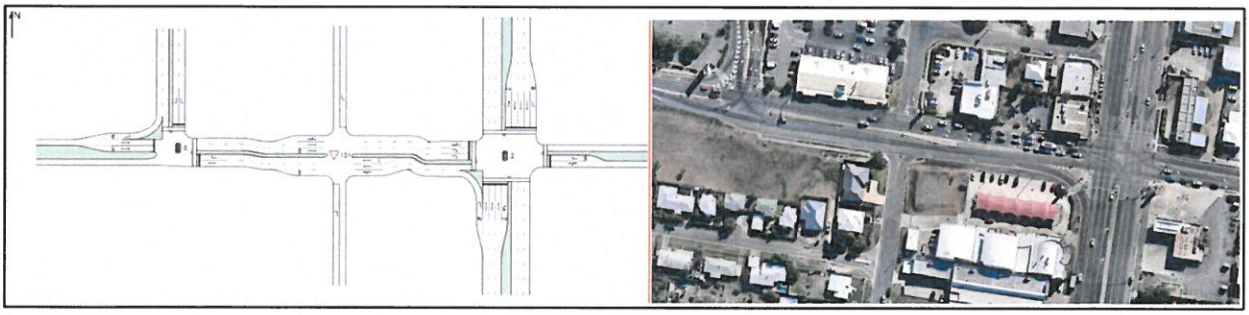


Table 1 SIDRA Outputs – High Street / Musgrave Street Intersection

Scenarios	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2028 With Development						
South Approach	0.891	48.1 sec	165.7 m	0.743	41.6 sec	107.3 m
East Approach	0.869	70.2 sec	119.9 m	0.749	63.0 sec	113.0 m
North Approach	0.481	47.7 sec	67.4 m	0.563	48.7 sec	83.3 m
West Approach	0.878	59.2 sec	155.0 m	0.749	52.6 sec	129.3 m

Table 2 SIDRA Outputs – High Street / Site Access Intersection

Scenarios	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2028 With Development						
East Approach	0.561	8.1 sec	39.4 m	0.459	8.9 sec	28.4 m
North Approach	0.295	15.2 sec	27.0 m	0.404	16.3 sec	38.7 m
West Approach	0.545	19.3 sec	44.7 m	0.482	16.5 sec	42.5 m

Queuing on the west approach at the High Street/Musgrave Street intersection will reach a maximum of 165.7m in the Thursday PM peak period. This maximum queuing will not reach the queue storage of the west approach which is 170m. As the queue is contained within the storage, the operation of the High Street/Site Access will not be compromised by potential queue spillback. Additionally, the DOS is below the maximum desirable capacity threshold.

Summary

In summary, all of the traffic related queries raised in the Information Request dated 27 July 2017 were considered as part of the assessment for the material change of use application. The analysis results as outlined in the Traffic Impact Assessment dated June 2017 indicate that the existing intersection forms are suitable to accommodate the proposed expansion of the centre.

Furthermore, the analysis conducted to respond to Council's information request indicate that the higher (40%) distribution utilising the Aquatic Place access does not create a significantly worse impact on the network. Additionally, the network analysis for the High Street / Musgrave Street and High Street / Site Access intersections indicates that there will be no queuing issues between these intersections.

Therefore, Cardno does not believe that there is any reason, from a traffic and transport perspective, to reject this application.

Yours sincerely,

Andy Johnston
Team Leader - Traffic Engineering
for Cardno
Direct Line: +61 7 3877 6931
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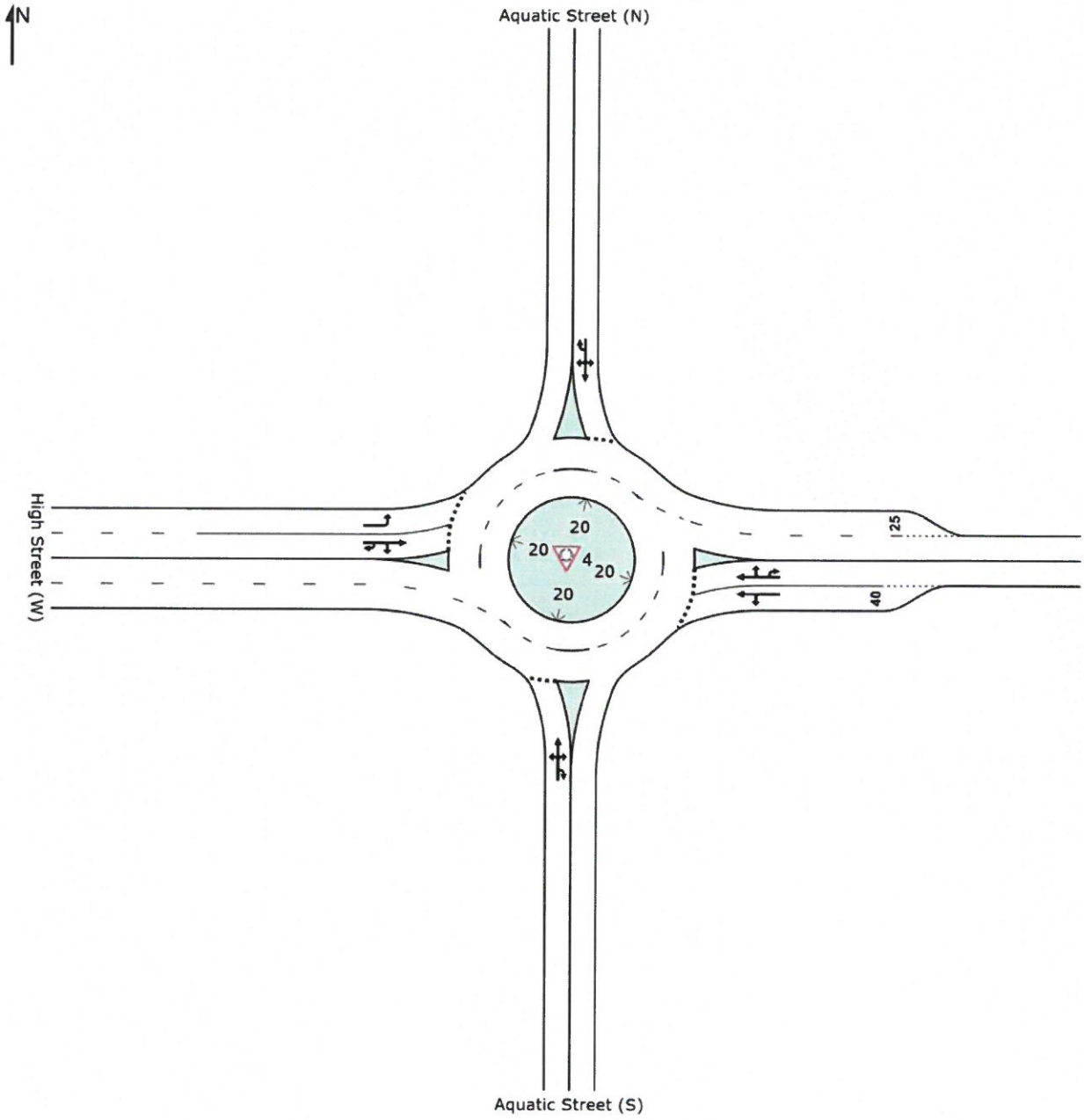
Enc: SIDRA outputs

SITE LAYOUT

Site: 4 [2017 BG Saturday Peak]

Intersection: High Street/Acquatic Place
Scenario: 2017 AM Peak
Configuration: Existing
Roundabout



Organisation: CARDNO (QLD) PTY LTD | Created: Wednesday, 20 September 2017 11:13:29 AM
Project: G:\CEB06360 - Rockhampton Stockland Traffic Study\6360 - Analysis\6360 - SIDRA\CINEMA EXPANSION\Council RFI\High St-Aquatic Pl.sip7

LANE SUMMARY

Site: 4 [2018 W Dev Saturday Peak]

Intersection: High Street/Acquatic Place
Scenario: 2017 AM Peak
Configuration: Existing
Roundabout

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Aquatic Street (S)													
Lane 1[d]	11	0.0	738	0.014	100	3.6	LOS A	0.1	0.4	Full	25	0.0	0.0
Approach	11	0.0		0.014		3.6	LOS A	0.1	0.4				
East: High Street (W)													
Lane 1[d]	347	1.0	1131	0.306	100	5.5	LOS A	1.6	11.6	Short	40	0.0	NA
Lane 2	320	0.5	1043	0.306	100	8.0	LOS A	1.6	11.3	Full	200	0.0	0.0
Approach	666	0.8		0.306		6.7	LOS A	1.6	11.6				
North: Aquatic Street (N)													
Lane 1[d]	538	1.0	897	0.599	100	7.1	LOS A	6.0	42.6	Full	115	0.0	0.0
Approach	538	1.0		0.599		7.1	LOS A	6.0	42.6				
West: High Street (W)													
Lane 1[d]	522	0.0	1367	0.382	100	4.9	LOS A	2.2	15.6	Full	115	0.0	0.0
Lane 2	483	0.0	1254	0.385	100	5.1	LOS A	2.2	15.4	Full	115	0.0	0.0
Approach	1005	0.0		0.385		5.0	LOS A	2.2	15.6				
Intersection	2220	0.5		0.599		6.0	LOS A	6.0	42.6				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 4 [2018 W Dev Thursday Peak]

Intersection: High Street/Acquatic Place
Scenario: 2017 PM Peak
Configuration: Existing
Roundabout

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Aquatic Street (S)													
Lane 1[d]	6	0.0	794	0.008	100	4.0	LOS A	0.0	0.2	Full	25	0.0	0.0
Approach	6	0.0		0.008		4.0	LOS A	0.0	0.2				
East: High Street (W)													
Lane 1[d]	324	0.3	1212	0.268	100	5.2	LOS A	1.4	9.5	Short	40	0.0	NA
Lane 2	301	0.0	1125	0.268	100	6.9	LOS A	1.3	9.3	Full	200	0.0	0.0
Approach	625	0.2		0.268		6.0	LOS A	1.4	9.5				
North: Aquatic Street (N)													
Lane 1[d]	374	0.6	885	0.422	100	5.8	LOS A	3.2	22.6	Full	115	0.0	0.0
Approach	374	0.6		0.422		5.8	LOS A	3.2	22.6				
West: High Street (W)													
Lane 1	408	0.0	1280	0.319	100	4.7	LOS A	1.7	11.6	Full	115	0.0	0.0
Lane 2[d]	523	0.0	1441	0.363	100	4.8	LOS A	2.1	14.4	Full	115	0.0	0.0
Approach	931	0.0		0.363		4.7	LOS A	2.1	14.4				
Intersection	1937	0.2		0.422		5.3	LOS A	3.2	22.6				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 4 [2028 W Dev Saturday Peak]

Intersection: High Street/Acquatic Place
Scenario: 2017 AM Peak
Configuration: Existing
Roundabout

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Aquatic Street (S)													
Lane 1[d]	11	0.0	720	0.015	100	3.7	LOS A	0.1	0.4	Full	25	0.0	0.0
Approach	11	0.0		0.015		3.7	LOS A	0.1	0.4				
East: High Street (W)													
Lane 1[d]	372	1.0	1128	0.330	100	5.6	LOS A	1.8	12.9	Short	40	0.0	NA
Lane 2	343	0.5	1039	0.330	100	7.9	LOS A	1.8	12.5	Full	200	0.0	0.0
Approach	715	0.8		0.330		6.7	LOS A	1.8	12.9				
North: Aquatic Street (N)													
Lane 1[d]	538	1.0	869	0.619	100	8.3	LOS A	6.8	47.8	Full	115	0.0	0.0
Approach	538	1.0		0.619		8.3	LOS A	6.8	47.8				
West: High Street (W)													
Lane 1	522	0.0	1267	0.412	100	5.0	LOS A	2.5	17.2	Full	115	0.0	0.0
Lane 2[d]	529	0.0	1367	0.387	100	5.0	LOS A	2.3	16.0	Full	115	0.0	0.0
Approach	1051	0.0		0.412		5.0	LOS A	2.5	17.2				
Intersection	2315	0.5		0.619		6.3	LOS A	6.8	47.8				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 4 [2028 W Dev Thursday Peak]

Intersection: High Street/Acquatic Place
Scenario: 2017 PM Peak
Configuration: Existing
Roundabout

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Aquatic Street (S)													
Lane 1[d]	6	0.0	775	0.008	100	4.1	LOS A	0.0	0.2	Full	25	0.0	0.0
Approach	6	0.0		0.008		4.1	LOS A	0.0	0.2				
East: High Street (W)													
Lane 1[d]	351	0.3	1213	0.289	100	5.2	LOS A	1.5	10.6	Short	40	0.0	NA
Lane 2	325	0.0	1123	0.289	100	6.8	LOS A	1.5	10.4	Full	200	0.0	0.0
Approach	676	0.2		0.289		6.0	LOS A	1.5	10.6				
North: Aquatic Street (N)													
Lane 1[d]	374	0.6	852	0.438	100	6.4	LOS A	3.5	24.5	Full	115	0.0	0.0
Approach	374	0.6		0.438		6.4	LOS A	3.5	24.5				
West: High Street (W)													
Lane 1	408	0.0	1259	0.324	100	4.7	LOS A	1.7	11.8	Full	115	0.0	0.0
Lane 2[d]	573	0.0	1447	0.396	100	4.8	LOS A	2.4	16.5	Full	115	0.0	0.0
Approach	981	0.0		0.396		4.7	LOS A	2.4	16.5				
Intersection	2037	0.2		0.438		5.4	LOS A	3.5	24.5				

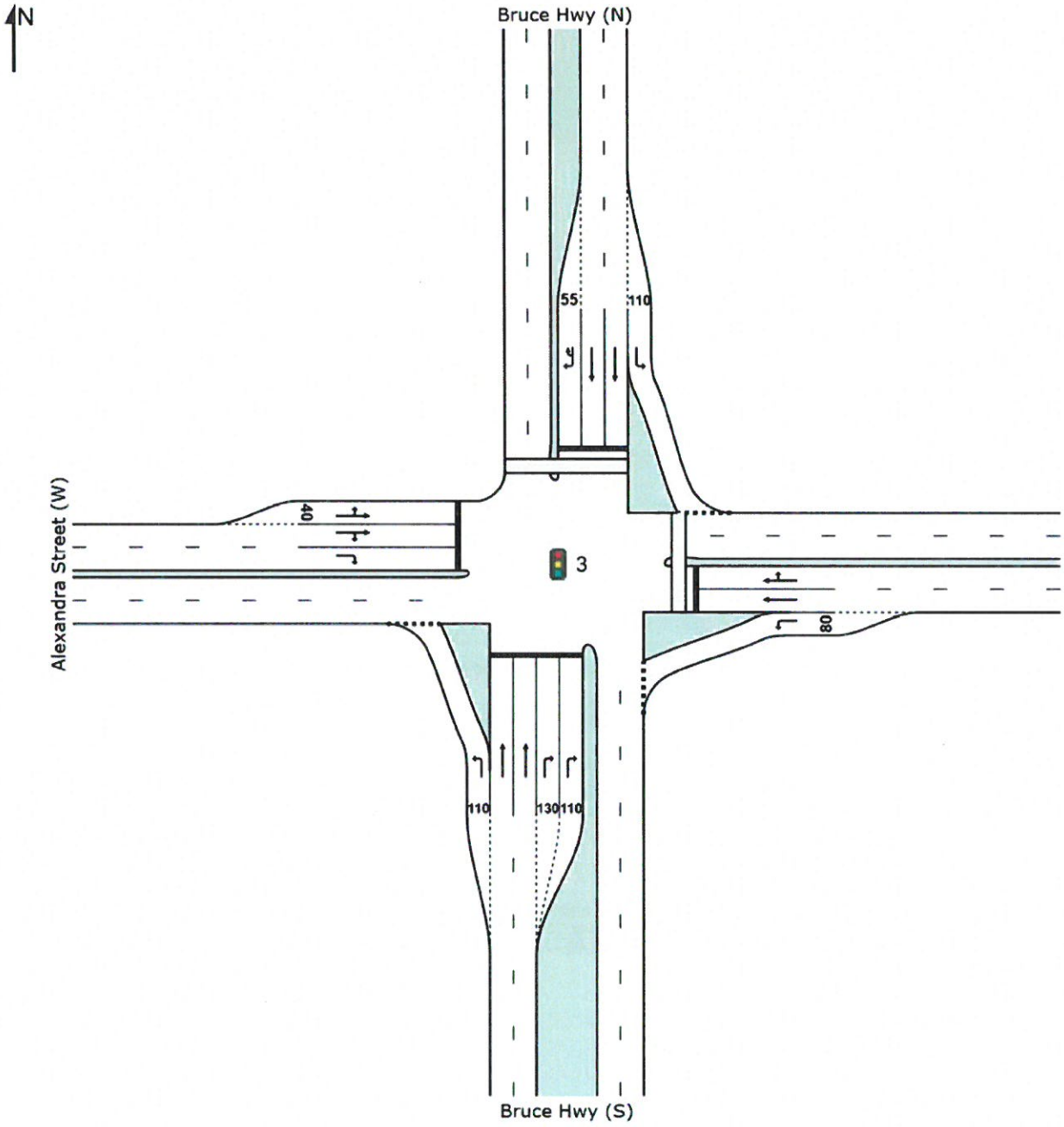
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

SITE LAYOUT

Site: 3 [2017 BG Saturday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2012 Saturday AM Background Traffic Only
Configuration: Existing
Signals - Fixed Time Coordinated



Organisation: CARDNO (QLD) PTY LTD | Created: Wednesday, 20 September 2017 11:05:58 AM
Project: G:\CEB06360 - Rockhampton Stockland Traffic Study\6360 - Analysis\6360 - SIDRA\CINEMA EXPANSION\Council RFI\High St-Alexandra St.sip7

LANE SUMMARY

Site: 3 [2018 W Dev Saturday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Saturday AM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Bruce Hwy (S)													
Lane 1	251	3.0	1414	0.177	100	9.5	LOS A	3.7	22.6	Short	110	0.0	NA
Lane 2	370	2.0	834	0.444	100	31.5	LOS C	18.7	114.2	Full	500	0.0	0.0
Lane 3	370	2.0	834	0.444	100	31.5	LOS C	18.7	114.2	Full	500	0.0	0.0
Lane 4	290	0.0	384	0.756	100	68.6	LOS E	20.5	122.9	Short	130	0.0	NA
Lane 5	290	0.0	384	0.756	100	68.6	LOS E	20.5	122.9	Short	110	0.0	NA
Approach	1571	1.4		0.756		41.7	LOS C	20.5	122.9				
East: High Street (E)													
Lane 1	400	0.0	1173	0.341	100	16.5	LOS B	12.1	72.8	Short	80	0.0	NA
Lane 2	213	2.0	308	0.690	100	65.2	LOS E	14.9	91.4	Full	110	0.0	0.0
Lane 3	209	1.6	302	0.690	100	67.7	LOS E	14.7	89.5	Full	110	0.0	0.0
Approach	821	0.9		0.690		42.1	LOS C	14.9	91.4				
North: Bruce Hwy (N)													
Lane 1	111	0.0	1098	0.101	100	12.5	LOS A	2.2	13.1	Short	110	0.0	NA
Lane 2	417	3.0	548	0.760	100	52.7	LOS D	27.9	172.2	Full	500	0.0	0.0
Lane 3	371	3.0	488[1]	0.760	100	51.7	LOS D	24.2	149.8	Full	500	0.0	0.0
Lane 4	76	0.0	106	0.712	100	86.8	LOS F	5.8	35.0	Short	55	0.0	NA
Approach	973	2.4		0.760		50.4	LOS D	27.9	172.2				
West: Alexandra Street (W)													
Lane 1	174	0.0	338	0.514	100	61.4	LOS E	11.1	66.6	Short	40	0.0	NA
Lane 2	185	0.6	360[1]	0.514	100	60.2	LOS E	11.7	70.6	Full	365	0.0	0.0
Lane 3	173	4.0	337	0.514	100	65.2	LOS E	11.0	68.6	Full	370	0.0	0.0
Approach	532	1.5		0.514		62.2	LOS E	11.7	70.6				
Intersection	3897	1.6		0.760		46.8	LOS D	27.9	172.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2018 W Dev Thursday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Thursday PM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Bruce Hwy (S)													
Lane 1	382	5.0	1406	0.272	100	9.9	LOS A	6.1	38.7	Short	110	0.0	NA
Lane 2	643	3.0	880	0.731	100	34.9	LOS C	37.7	233.1	Full	500	0.0	0.0
Lane 3	567	3.0	775[1]	0.731	100	32.9	LOS C	31.3	193.6	Full	500	0.0	0.0
Lane 4	252	0.0	396	0.635	100	64.5	LOS E	16.8	100.9	Short	130	0.0	NA
Lane 5	252	0.0	396	0.635	100	64.5	LOS E	16.8	100.9	Short	110	0.0	NA
Approach	2096	2.6		0.731		36.9	LOS C	37.7	233.1				
East: High Street (E)													
Lane 1	347	0.0	1090	0.319	100	19.4	LOS B	11.7	70.2	Short	80	0.0	NA
Lane 2	216	0.0	286	0.757	100	69.2	LOS E	15.8	94.9	Full	110	0.0	0.0
Lane 3	213	0.0	282	0.757	100	71.0	LOS F	15.6	93.5	Full	110	0.0	0.0
Approach	777	0.0		0.757		47.4	LOS D	15.8	94.9				
North: Bruce Hwy (N)													
Lane 1	65	2.0	1096	0.060	100	12.4	LOS A	1.2	7.6	Short	110	0.0	NA
Lane 2	422	5.0	554	0.761	100	52.1	LOS D	28.1	177.2	Full	500	0.0	0.0
Lane 3	382	5.0	502[1]	0.761	100	51.2	LOS D	25.0	157.6	Full	500	0.0	0.0
Lane 4	64	0.0	84	0.763	100	90.2	LOS F	5.1	30.4	Short	55	0.0	NA
Approach	934	4.4		0.763		51.6	LOS D	28.1	177.2				
West: Alexandra Street (W)													
Lane 1	214	0.0	291[1]	0.734	100	63.4	LOS E	14.3	85.6	Short	40	0.0	NA
Lane 2	217	1.1	296[1]	0.734	100	63.5	LOS E	14.4	87.4	Full	365	0.0	0.0
Lane 3	247	4.0	337	0.734	100	69.1	LOS E	17.0	106.1	Full	370	0.0	0.0
Approach	678	1.8		0.734		65.5	LOS E	17.0	106.1				
Intersection	4484	2.4		0.763		46.1	LOS D	37.7	233.1				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2028 W Dev Saturday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Saturday AM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bruce Hwy (S)													
Lane 1	276	3.0	1387	0.199	100	10.1	LOS A	4.4	27.3	Short	110	0.0	NA
Lane 2	407	2.0	796	0.511	100	34.7	LOS C	21.8	133.4	Full	500	0.0	0.0
Lane 3	407	2.0	796	0.511	100	34.7	LOS C	21.8	133.4	Full	500	0.0	0.0
Lane 4	317	0.0	396	0.801	100	70.5	LOS F	23.1	138.6	Short	130	0.0	NA
Lane 5	317	0.0	396	0.801	100	70.5	LOS F	23.1	138.6	Short	110	0.0	NA
Approach	1724	1.4		0.801		43.9	LOS D	23.1	138.6				
East: High Street (E)													
Lane 1	438	0.0	1107	0.396	100	19.3	LOS B	15.2	91.5	Short	80	0.0	NA
Lane 2	232	2.0	282	0.822	100	72.9	LOS F	17.7	108.1	Full	110	0.0	3.4
Lane 3	228	1.6	277	0.822	100	75.5	LOS F	17.4	105.8	Full	110	0.0	1.5
Approach	898	0.9		0.822		47.4	LOS D	17.7	108.1				
North: Bruce Hwy (N)													
Lane 1	121	0.0	1060	0.114	100	13.5	LOS A	2.6	15.6	Short	110	0.0	NA
Lane 2	458	3.0	561	0.816	100	55.9	LOS D	32.2	199.2	Full	500	0.0	0.0
Lane 3	407	3.0	498[1]	0.816	100	55.0	LOS D	28.0	172.9	Full	500	0.0	0.0
Lane 4	83	0.0	165	0.502	100	78.4	LOS F	6.0	35.8	Short	55	0.0	NA
Approach	1068	2.4		0.816		52.5	LOS D	32.2	199.2				
West: Alexandra Street (W)													
Lane 1	185	0.0	316[1]	0.586	100	61.9	LOS E	11.9	71.6	Short	40	0.0	NA
Lane 2	201	0.4	342[1]	0.586	100	60.5	LOS E	12.9	77.5	Full	365	0.0	0.0
Lane 3	198	4.0	337	0.586	100	66.1	LOS E	12.8	80.0	Full	370	0.0	0.0
Approach	583	1.5		0.586		62.9	LOS E	12.9	80.0				
Intersection	4273	1.6		0.822		49.4	LOS D	32.2	199.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2028 W Dev Thursday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Thursday PM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Bruce Hwy (S)													
Lane 1	419	5.0	1386	0.302	100	10.5	LOS A	7.4	46.9	Short	110	0.0	NA
Lane 2	631	3.0	705[1]	0.896	100	47.3	LOS D	42.9	265.1	Full	500	0.0	0.0
Lane 3	699	3.0	781[1]	0.896	100	47.1	LOS D	48.8	301.5	Full	500	0.0	0.0
Lane 4	275	0.0	433	0.635	100	62.2	LOS E	18.2	108.9	Short	130	0.0	NA
Lane 5	275	0.0	433	0.635	100	62.2	LOS E	18.2	108.9	Short	110	0.0	NA
Approach	2300	2.6		0.896		44.1	LOS D	48.8	301.5				
East: High Street (E)													
Lane 1	380	0.0	1007	0.377	100	24.1	LOS B	15.1	90.3	Short	80	0.0	NA
Lane 2	237	0.0	273	0.867	100	77.5	LOS F	18.7	112.2	Full	110	0.0	6.7
Lane 3	233	0.0	269	0.867	100	79.4	LOS F	18.4	110.6	Full	110	0.0	5.5
Approach	849	0.0		0.867		54.1	LOS D	18.7	112.2				
North: Bruce Hwy (N)													
Lane 1	72	2.0	1054	0.068	100	13.0	LOS A	1.4	8.8	Short	110	0.0	NA
Lane 2	460	5.0	524[1]	0.878	100	64.9	LOS E	35.5	223.6	Full	500	0.0	0.0
Lane 3	422	5.0	481[1]	0.878	100	64.4	LOS E	32.0	201.8	Full	500	0.0	0.0
Lane 4	71	0.0	84	0.852	100	93.7	LOS F	5.8	34.9	Short	55	0.0	NA
Approach	1025	4.4		0.878		63.1	LOS E	35.5	223.6				
West: Alexandra Street (W)													
Lane 1	228	0.0	273[1]	0.836	100	68.3	LOS E	16.1	96.8	Short	40	0.0	NA
Lane 2	233	1.0	279[1]	0.836	100	68.2	LOS E	16.4	99.6	Full	365	0.0	0.0
Lane 3	282	4.0	337	0.836	100	74.3	LOS F	20.8	129.8	Full	370	0.0	0.0
Approach	743	1.8		0.836		70.5	LOS F	20.8	129.8				
Intersection	4918	2.4		0.896		53.8	LOS D	48.8	301.5				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2018 W Dev Saturday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Saturday AM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Bruce Hwy (S)													
Lane 1	251	3.0	1414	0.177	100	9.5	LOS A	3.7	22.6	Short	110	0.0	NA
Lane 2	374	2.0	834	0.448	100	31.6	LOS C	18.9	115.6	Full	500	0.0	0.0
Lane 3	374	2.0	834	0.448	100	31.6	LOS C	18.9	115.6	Full	500	0.0	0.0
Lane 4	290	0.0	384	0.756	100	68.6	LOS E	20.5	122.9	Short	130	0.0	NA
Lane 5	290	0.0	384	0.756	100	68.6	LOS E	20.5	122.9	Short	110	0.0	NA
Approach	1578	1.4		0.756		41.7	LOS C	20.5	122.9				
East: High Street (E)													
Lane 1	400	0.0	1169	0.342	100	16.5	LOS B	12.2	73.0	Short	80	0.0	NA
Lane 2	213	2.0	308	0.690	100	65.2	LOS E	14.9	91.4	Full	110	0.0	0.0
Lane 3	209	1.6	302	0.690	100	67.7	LOS E	14.7	89.5	Full	110	0.0	0.0
Approach	821	0.9		0.690		42.1	LOS C	14.9	91.4				
North: Bruce Hwy (N)													
Lane 1	111	0.0	1098	0.101	100	12.5	LOS A	2.2	13.1	Short	110	0.0	NA
Lane 2	420	3.0	548	0.767	100	53.1	LOS D	28.3	174.7	Full	500	0.0	0.0
Lane 3	374	3.0	488[1]	0.767	100	52.1	LOS D	24.6	152.3	Full	500	0.0	0.0
Lane 4	76	0.0	106	0.712	100	86.8	LOS F	5.8	35.0	Short	55	0.0	NA
Approach	981	2.4		0.767		50.7	LOS D	28.3	174.7				
West: Alexandra Street (W)													
Lane 1	174	0.0	338	0.514	100	61.4	LOS E	11.1	66.6	Short	40	0.0	NA
Lane 2	185	0.6	360[1]	0.514	100	60.2	LOS E	11.7	70.6	Full	365	0.0	0.0
Lane 3	173	4.0	337	0.514	100	65.2	LOS E	11.0	68.6	Full	370	0.0	0.0
Approach	532	1.5		0.514		62.2	LOS E	11.7	70.6				
Intersection	3911	1.6		0.767		46.8	LOS D	28.3	174.7				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2018 W Dev Thusday Peak]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Thursday PM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bruce Hwy (S)													
Lane 1	382	5.0	1404	0.272	100	9.9	LOS A	6.1	38.7	Short	110	0.0	NA
Lane 2	545	3.0	696[1]	0.782	100	33.2	LOS C	30.0	185.2	Full	500	0.0	0.0
Lane 3	678	3.0	867	0.782	100	36.8	LOS C	41.4	256.0	Full	500	0.0	0.0
Lane 4	252	0.0	384	0.655	100	65.5	LOS E	17.0	101.9	Short	130	0.0	NA
Lane 5	252	0.0	384	0.655	100	65.5	LOS E	17.0	101.9	Short	110	0.0	NA
Approach	2108	2.6		0.782		37.8	LOS C	41.4	256.0				
East: High Street (E)													
Lane 1	347	0.0	1089	0.319	100	19.4	LOS B	11.7	70.1	Short	80	0.0	NA
Lane 2	216	0.0	286	0.757	100	69.2	LOS E	15.8	94.9	Full	110	0.0	0.0
Lane 3	213	0.0	282	0.757	100	71.0	LOS F	15.6	93.5	Full	110	0.0	0.0
Approach	777	0.0		0.757		47.4	LOS D	15.8	94.9				
North: Bruce Hwy (N)													
Lane 1	65	2.0	1099	0.059	100	12.4	LOS A	1.2	7.6	Short	110	0.0	NA
Lane 2	426	5.0	567	0.751	100	50.8	LOS D	28.0	176.5	Full	500	0.0	0.0
Lane 3	386	5.0	514[1]	0.751	100	49.9	LOS D	24.9	156.7	Full	500	0.0	0.0
Lane 4	64	0.0	96	0.668	100	87.0	LOS F	4.9	29.6	Short	55	0.0	NA
Approach	941	4.5		0.751		50.2	LOS D	28.0	176.5				
West: Alexandra Street (W)													
Lane 1	214	0.0	291[1]	0.734	100	63.4	LOS E	14.3	85.6	Short	40	0.0	NA
Lane 2	217	1.1	296[1]	0.734	100	63.5	LOS E	14.4	87.4	Full	365	0.0	0.0
Lane 3	247	4.0	337	0.734	100	69.1	LOS E	17.0	106.1	Full	370	0.0	0.0
Approach	678	1.8		0.734		65.5	LOS E	17.0	106.1				
Intersection	4504	2.4		0.782		46.2	LOS D	41.4	256.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2028 W Dev Saturday Peak - 150 CT]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Saturday AM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Bruce Hwy (S)													
Lane 1	276	3.0	1384	0.199	100	10.3	LOS A	4.6	28.2	Short	110	0.0	NA
Lane 2	447	2.0	770	0.580	100	37.3	LOS C	25.2	154.2	Full	500	0.0	0.0
Lane 3	447	2.0	770	0.580	100	37.3	LOS C	25.2	154.2	Full	500	0.0	0.0
Lane 4	317	0.0	371	0.854	100	76.8	LOS F	24.5	146.7	Short	130	0.0	NA
Lane 5	317	0.0	371	0.854	100	76.8	LOS F	24.5	146.7	Short	110	0.0	NA
Approach	1804	1.4		0.854		47.1	LOS D	25.2	154.2				
East: High Street (E)													
Lane 1	438	0.0	1073	0.408	100	20.9	LOS B	16.1	96.4	Short	80	0.0	NA
Lane 2	232	2.0	269	0.862	100	77.0	LOS F	18.3	111.9	Full	110	0.0	6.5
Lane 3	228	1.6	264	0.862	100	79.6	LOS F	18.0	109.5	Full	110	0.0	4.6
Approach	898	0.9		0.862		50.3	LOS D	18.3	111.9				
North: Bruce Hwy (N)													
Lane 1	121	0.0	1072	0.113	100	13.5	LOS A	2.6	15.7	Short	110	0.0	NA
Lane 2	496	3.0	586[1]	0.847	100	56.6	LOS E	35.8	221.2	Full	500	0.0	0.0
Lane 3	452	3.0	534[1]	0.847	100	56.0	LOS D	32.0	197.7	Full	500	0.0	0.0
Lane 4	85	0.0	199	0.427	100	74.8	LOS F	5.9	35.6	Short	55	0.0	NA
Approach	1154	2.5		0.847		53.2	LOS D	35.8	221.2				
West: Alexandra Street (W)													
Lane 1	194	0.0	331[1]	0.586	100	62.2	LOS E	12.6	75.5	Short	40	0.0	NA
Lane 2	192	0.5	328[1]	0.586	100	60.3	LOS E	12.2	73.8	Full	365	0.0	0.0
Lane 3	197	4.0	337	0.586	100	66.1	LOS E	12.8	79.9	Full	370	0.0	0.0
Approach	583	1.5		0.586		62.9	LOS E	12.8	79.9				
Intersection	4440	1.6		0.862		51.4	LOS D	35.8	221.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

LANE SUMMARY

Site: 3 [2028 W Dev Thursday Peak - 150 CT]

Intersection: Bruce Highway/Alexandra Street/High Street
Scenario: 2017 Thursday PM
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Optimum Cycle Time - Shortest Queue)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Bruce Hwy (S)													
Lane 1	419	5.0	1389	0.302	100	10.7	LOS A	7.6	48.2	Short	110	0.0	NA
Lane 2	695	3.0	729[1]	0.953	100	65.1	LOS E	55.5	343.3	Full	500	0.0	0.0
Lane 3	769	3.0	807[1]	0.953	100	64.5	LOS E	63.2	390.5	Full	500	0.0	0.0
Lane 4	275	0.0	446	0.618	100	61.2	LOS E	18.0	107.9	Short	130	0.0	NA
Lane 5	275	0.0	446	0.618	100	61.2	LOS E	18.0	107.9	Short	110	0.0	NA
Approach	2433	2.7		0.953		54.7	LOS D	63.2	390.5				
East: High Street (E)													
Lane 1	380	0.0	961	0.395	100	26.3	LOS B	16.0	95.8	Short	80	0.0	NA
Lane 2	237	0.0	247	0.958	100	97.1	LOS F	21.2	127.4	Full	110	0.0	18.3
Lane 3	233	0.0	243	0.958	100	99.1	LOS F	20.9	125.6	Full	110	0.0	17.0
Approach	849	0.0		0.958		66.0	LOS E	21.2	127.4				
North: Bruce Hwy (N)													
Lane 1	72	2.0	1050	0.068	100	13.0	LOS A	1.4	8.9	Short	110	0.0	NA
Lane 2	500	5.0	529[1]	0.947	100	81.5	LOS F	44.1	277.6	Full	500	0.0	0.0
Lane 3	469	5.0	496[1]	0.947	100	81.4	LOS F	40.9	257.5	Full	500	0.0	0.0
Lane 4	71	0.0	84	0.852	100	93.7	LOS F	5.8	34.9	Short	55	0.0	NA
Approach	1112	4.5		0.947		77.8	LOS F	44.1	277.6				
West: Alexandra Street (W)													
Lane 1	228	0.0	273[1]	0.835	100	68.2	LOS E	16.1	96.8	Short	40	0.0	NA
Lane 2	234	1.0	280[1]	0.835	100	68.2	LOS E	16.4	99.6	Full	365	0.0	0.0
Lane 3	282	4.0	337	0.835	100	74.2	LOS F	20.8	129.8	Full	370	0.0	0.0
Approach	743	1.8		0.835		70.5	LOS E	20.8	129.8				
Intersection	5138	2.5		0.958		63.8	LOS E	63.2	390.5				

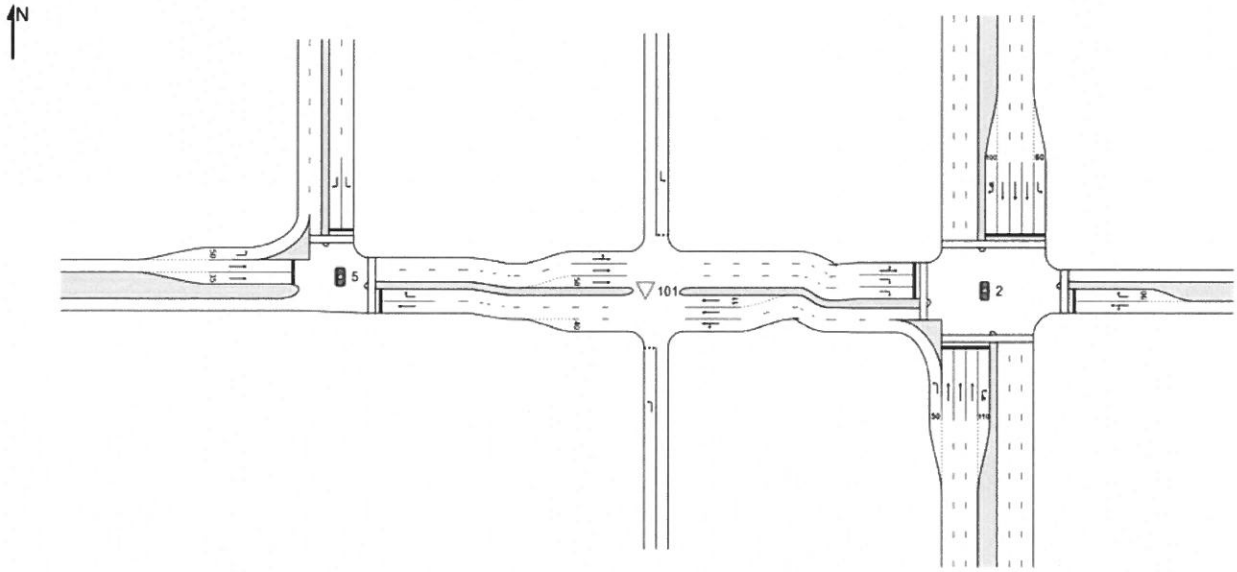
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

NETWORK LAYOUT

Network: N101 [2028 BG With Dev Thurs PM Peak]

New Network



SITES IN NETWORK	
Site ID	**Site Name**
2	Musgrave/High 2028 W Dev Thursday Peak
5	2028 W Dev Thursday Peak - High/Site
101	2028 BG With Development Thurs PM Peak - Import

Organisation: CARDNO (QLD) PTY LTD | Created: Wednesday, 20 September 2017 11:12:42 AM
Project: G:\CEB06360 - Rockhampton Stockland Traffic Study\6360 - Analysis\6360 - SIDRA\CINEMA EXPANSION\Council RFI\High St Network.sip7

LANE SUMMARY

▽ Site: 101 [2028 BG With Development Sat AM Peak - Import]

Network: N101 [2028 BG With Dev Sat AM Peak]

Stockland Rockhampton Centre Expansion
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Victoria Place (S)															
Lane 1	27	0.0	27	0.0	1283	0.021	100	5.7	LOS A	0.1	0.6	Full	500	0.0	0.0
Approach	27	0.0	27	0.0		0.021		5.7	LOS A	0.1	0.6				
East: High Street (East)															
Lane 1	64	0.0	64	0.0	1923	0.033	26[6]	1.6	LOS A	0.0	0.0	Full	95	0.0	0.0
Lane 2	247	0.0	247	0.0	1950	0.127	100	0.0	LOS A	0.0	0.0	Full	95	0.0	0.0
Lane 3	247	0.0	247	0.0	1950	0.127	100	0.0	LOS A	0.0	0.0	Short	11	0.0	NA
Approach	558	0.0	558	0.0		0.127		0.2	NA	0.0	0.0				
North: Victoria Place (N)															
Lane 1	56	0.0	56	0.0	799	0.070	100	4.4	LOS A	0.2	1.4	Full	50	-33.1[N3]	0.0
Approach	56	0.0	56	0.0		0.070		4.4	LOS A	0.2	1.4				
West: High Street (West)															
Lane 1	171	0.0	171	0.0	1385	0.124	100	1.0	LOS A	0.0	0.0	Full	75	-28.3[N3]	0.0
Lane 2	241	0.0	241	0.0	1950	0.124	100	0.0	LOS A	0.0	0.0	Full	75	0.0	0.0
Lane 3	241	0.0	241	0.0	1950	0.124	100	0.0	LOS A	0.0	0.0	Short	50	0.0	NA
Approach	654	0.0	654	0.0		0.124		0.3	NA	0.0	0.0				
Intersection	1295	0.0	1295	0.0		0.127		0.5	NA	0.2	1.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 1.2 %
Number of Iterations: 10 (maximum specified: 10)

6 Lane under-utilisation due to downstream effects
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

LANE SUMMARY

▽ Site: 101 [2028 BG With Development Thurs PM Peak - Import]

⊕⊕ Network: N101 [2028 BG With Dev Thurs PM Peak]

Stockland Rockhampton Centre Expansion
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Victoria Place (S)															
Lane 1	53	0.0	53	0.0	1278	0.041	100	5.7	LOS A	0.2	1.1	Full	500	0.0	0.0
Approach	53	0.0	53	0.0		0.041		5.7	LOS A	0.2	1.1				
East: High Street (East)															
Lane 1	66	0.0	66	0.0	1928	0.034	26[6]	1.2	LOS A	0.0	0.0	Full	95	0.0	0.0
Lane 2	255	0.0	255	0.0	1950	0.131	100	0.0	LOS A	0.0	0.0	Full	95	0.0	0.0
Lane 3	255	0.0	255	0.0	1950	0.131	100	0.0	LOS A	0.0	0.0	Short	11	0.0	NA
Approach	577	0.0	577	0.0		0.131		0.1	NA	0.0	0.0				
North: Victoria Place (N)															
Lane 1	45	0.0	45	0.0	611	0.074	100	4.3	LOS A	0.2	1.1	Full	50	-50.0[N3]	0.0
Approach	45	0.0	45	0.0		0.074		4.3	LOS A	0.2	1.1				
West: High Street (West)															
Lane 1	134	0.0	134	0.0	1062	0.126	100	0.9	LOS A	0.8[N] 5	5.4[N5]	Full	75	-45.0[N3]	0.0
Lane 2	247	0.0	247	0.0	1950	0.126	100	0.0	LOS A	0.0	0.0	Full	75	0.0	0.0
Lane 3	247	0.0	247	0.0	1950	0.126	100	0.0	LOS A	0.0	0.0	Short	50	0.0	NA
Approach	627	0.0	627	0.0		0.126		0.2	NA	0.8	5.4				
Intersection	1302	0.0	1302	0.0		0.131		0.5	NA	0.8	5.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.3 %
Number of Iterations: 10 (maximum specified: 10)

6 Lane under-utilisation due to downstream effects
N3 Capacity Adjustment due to downstream lane blockage determined by the program.
N5 Continuous Lane results determined by Back of Queue values of downstream lanes.

LANE SUMMARY

Site: 2 [Musgrave/High 2028 W Dev Saturday Peak]

Network: N101 [2028 BG With Dev Sat AM Peak]

Intersection: Musgrave Street/High Street
2017 AM Peak
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Network Cycle Time - User-Given)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Musgrave Street (S)															
Lane 1	262	2.0	262	2.0	1831	0.143	100	5.6	LOS A	0.0	0.0	Short	50	0.0	NA
Lane 2	283	1.0	283	1.0	413	0.685	100	48.1	LOS D	17.7	107.3	Full	270	0.0	0.0
Lane 3	283	1.0	283	1.0	413	0.685	100	48.1	LOS D	17.7	107.3	Full	270	0.0	0.0
Lane 4	283	1.0	283	1.0	413	0.685	100	48.1	LOS D	17.7	107.3	Full	270	0.0	0.0
Lane 5	248	0.0	248	0.0	334	0.743	100	57.2	LOS E	16.4	98.4	Short	110	0.0	NA
Approach	1360	1.0	1360	1.0		0.743		41.6	LOS D	17.7	107.3				
East: High Street (E)															
Lane 1	283	1.6	283	1.6	452	0.626	100	55.9	LOS E	18.5	113.0	Full	185	0.0	0.0
Lane 2	241	0.0	241	0.0	322	0.749	100	71.4	LOS E	17.3	103.9	Short	90	0.0	NA
Approach	524	0.9	524	0.9		0.749		63.0	LOS E	18.5	113.0				
North: Musgrave Street (N)															
Lane 1	139	0.0	139	0.0	334	0.416	100	55.9	LOS E	8.2	49.1	Short	60	0.0	NA
Lane 2	233	1.0	233	1.0	413	0.563	100	46.6	LOS D	13.7	83.3	Full	120	0.0	0.0
Lane 3	233	1.0	233	1.0	413	0.563	100	46.6	LOS D	13.7	83.3	Full	120	0.0	0.0
Lane 4	233	1.0	233	1.0	413	0.563	100	46.6	LOS D	13.7	83.3	Full	115	0.0	0.0
Lane 5	123	1.9	123	1.9	323	0.381	100	52.3	LOS D	6.9	41.9	Short	100	0.0	NA
Approach	960	1.0	960	1.0		0.563		48.7	LOS D	13.7	83.3				
West: High Street (W)															
Lane 1	337	1.2	337	1.2	450	0.749	100	46.6	LOS D	21.3	129.3	Full	95	0.0	33.1
Lane 2	172	2.0	172	2.0	317	0.542	100	58.5	LOS E	10.7	65.6	Full	95	0.0	0.0
Lane 3	172	2.0	172	2.0	317	0.542	100	58.5	LOS E	10.7	65.6	Full	95	0.0	0.0
Approach	681	1.6	681	1.6		0.749		52.6	LOS D	21.3	129.3				
Intersection	3525	1.1	3525	1.1		0.749		48.8	LOS D	21.3	129.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 1.2 %
Number of Iterations: 10 (maximum specified: 10)

LANE SUMMARY

Site: 2 [Musgrave/High 2028 W Dev Thursday Peak] **Network: N101 [2028 BG With Dev Thurs PM Peak]**

Intersection: Musgrave Street/High Street
2017 AM Peak
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Network Cycle Time - User-Given)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Musgrave Street (S)															
Lane 1	269	4.0	269	4.0	1806	0.149	100	5.7	LOS A	0.0	0.0	Short	50	0.0	NA
Lane 2	259	0.0	259	0.0	296[1]	0.877	100	55.2	LOS E	17.3	103.8	Full	270	0.0	0.0
Lane 3	353	0.0	353	0.0	403	0.877	100	56.6	LOS E	25.8	154.8	Full	270	0.0	0.0
Lane 4	353	0.0	353	0.0	403	0.877	100	56.6	LOS E	25.8	154.8	Full	270	0.0	0.0
Lane 5	372	1.1	372	1.1	417	0.891	100	57.9	LOS E	27.3	165.7	Short	110	0.0	NA
Approach	1607	0.9	1607	0.9		0.891		48.1	LOS D	27.3	165.7				
East: High Street (E)															
Lane 1	288	1.8	288	1.8	408	0.706	100	59.8	LOS E	19.6	119.9	Full	185	0.0	0.0
Lane 2	247	0.0	247	0.0	285	0.869	100	82.4	LOS F	19.6	117.7	Short	90	0.0	NA
Approach	536	0.9	536	0.9		0.869		70.2	LOS E	19.6	119.9				
North: Musgrave Street (N)															
Lane 1	120	0.0	120	0.0	322	0.373	100	56.6	LOS E	7.0	42.3	Short	60	0.0	NA
Lane 2	191	2.0	191	2.0	398	0.481	100	46.7	LOS D	11.0	67.4	Full	120	0.0	0.0
Lane 3	191	2.0	191	2.0	398	0.481	100	46.7	LOS D	11.0	67.4	Full	120	0.0	0.0
Lane 4	191	2.0	191	2.0	398	0.481	100	46.7	LOS D	11.0	67.4	Full	115	0.0	0.0
Lane 5	84	10.2	84	10.2	400	0.210	100	42.0	LOS D	3.8	25.3	Short	100	0.0	NA
Approach	778	2.6	778	2.6		0.481		47.7	LOS D	11.0	67.4				
West: High Street (W)															
Lane 1	357	2.1	357	2.1	407	0.878	100	56.5	LOS E	25.3[N4]	155.0[N4]	Full	95	0.0	50.0
Lane 2	161	2.0	161	2.0	281	0.572	100	62.2	LOS E	10.4	63.6	Full	95	0.0	0.0
Lane 3	161	2.0	161	2.0	281	0.572	100	62.2	LOS E	10.4	63.6	Full	95	0.0	0.0
Approach	678	2.1	678	2.1		0.878		59.2	LOS E	25.3	155.0				
Intersection	3599	1.5	3599	1.5		0.891		53.4	LOS D	27.3	165.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.3 %
Number of Iterations: 10 (maximum specified: 10)

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N4 Average back of queue has been restricted to the available queue storage space.

LANE SUMMARY

Site: 5 [2028 W Dev Thursday Peak - High/Site]

Network: N101 [2028 BG With Dev Thurs PM Peak]

Intersection: High Street/Kmart
2017 AM Peak
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 65 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
East: High Street (E)															
Lane 1	505	0.0	505	0.0	900	0.561	100	5.9	LOS A	6.6	39.4	Full	75	0.0	0.0
Lane 2	104	19.0	104	19.0	364	0.287	100	18.6	LOS B	2.1	14.9	Full	75	0.0	0.0
Approach	609	3.2	609	3.2		0.561		8.1	LOS A	6.6	39.4				
North: Site Access															
Lane 1	93	2.0	93	2.0	1042	0.089	100	8.8	LOS A	1.3	8.1	Full	65	0.0	0.0
Lane 2	194	0.0	194	0.0	657	0.295	100	18.3	LOS B	4.5	27.0	Full	65	0.0	0.0
Approach	286	0.6	286	0.6		0.295		15.2	LOS B	4.5	27.0				
West: High Street (W)															
Lane 1	166	1.0	166	1.0	1844	0.090	100	5.6	LOS A	0.0	0.0	Short	50	0.0	NA
Lane 2	262	0.0	262	0.0	480	0.545	100	23.7	LOS C	7.5	44.7	Full	200	0.0	0.0
Lane 3	262	0.0	262	0.0	480	0.545	100	23.7	LOS C	7.5	44.7	Short	35	0.0	NA
Approach	689	0.2	689	0.2		0.545		19.3	LOS B	7.5	44.7				
Intersection	1585	1.5	1585	1.5		0.561		14.3	LOS B	7.5	44.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 2.3 %
Number of Iterations: 10 (maximum specified: 10)

LANE SUMMARY

Site: 5 [2028 W Dev Saturday Peak - High/Site]

Network: N101 [2028 BG With Dev Sat AM Peak]

Intersection: High Street/Kmart
2017 AM Peak
Configuration: Existing
Signals - Fixed Time Coordinated Cycle Time = 65 seconds (User-Given Cycle Time)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
East: High Street (E)															
Lane 1	411	1.0	411	1.0	894	0.459	100	5.6	LOS A	4.7	28.4	Full	75	0.0	0.0
Lane 2	135	7.0	135	7.0	358	0.377	100	19.0	LOS B	2.8	18.0	Full	75	0.0	0.0
Approach	545	2.5	545	2.5		0.459		8.9	LOS A	4.7	28.4				
North: Site Access															
Lane 1	120	0.0	120	0.0	1000	0.120	100	9.9	LOS A	1.9	11.2	Full	65	0.0	0.0
Lane 2	265	0.0	265	0.0	657	0.404	100	19.1	LOS B	6.5	38.7	Full	65	0.0	0.0
Approach	385	0.0	385	0.0		0.404		16.3	LOS B	6.5	38.7				
West: High Street (W)															
Lane 1	245	0.0	245	0.0	1857	0.132	100	5.6	LOS A	0.0	0.0	Short	50	0.0	NA
Lane 2	261	0.0	261	0.0	540	0.482	100	21.7	LOS C	7.1	42.5	Full	200	0.0	0.0
Lane 3	261	0.0	261	0.0	540	0.482	100	21.7	LOS C	7.1	42.5	Short	35	0.0	NA
Approach	766	0.0	766	0.0		0.482		16.5	LOS B	7.1	42.5				
Intersection	1697	0.8	1697	0.8		0.482		14.0	LOS B	7.1	42.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 1.2 %
Number of Iterations: 10 (maximum specified: 10)

Traffic Impact Assessment

Stockland Rockhampton Centre Expansion

CEB06360 | 002

Prepared for
Stockland

June 2017

Cardno
Shaping the Future

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Document Control

Version	Date	Description of Revision	Author Initials	Author Signature	Reviewer Initials	Reviewed Signature
1	31/05/2017	Draft for client review	TTA		ASJ	
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Version	Reason for Issue / Stage of Deliverable	Approver Initials	Approved Signature	Approved Release Date
1	Client Review	ASJ		19/06/2017
2	DA Issue			

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Appendices

1 Introduction

1.1 Background

Cardno has been engaged by Stockland to undertake a Traffic Impact Assessment (TIA) for the proposed redevelopment of the Cinema precinct at the Stockland Shopping Centre, located 3km north-east of Rockhampton City. The redevelopment is intended to comprise of refurbishment and upgrade of the existing cinema and 4,979sq.m of additional retail connecting the main centre building to the cinema.

The DA masterplan is provided at Appendix A.

1.2 Scope

The objective of this Traffic Impact Assessment (TIA) is to understand the traffic and transport issues associated with the proposed cinema redevelopment. The TIA will support the Development Application (DA) process and provides the relevant approval authorities, including the Department of Transport and Main Roads (TMR) and Rockhampton Regional Council (RRC), the opportunity to adequately consider any traffic or transport related impacts.

The main aspects of this TIA relate to the following:

- Traffic impacts generated by the proposed development
- Impact on the external traffic and transport services

Cardno have been engaged to undertake the following tasks to complete this assessment:

- Review project background and previous related traffic assessment documentation
- Commission traffic counts at centre access intersections
- Determine current base traffic and projected traffic levels for the development
- Develop a desktop model of the local road network
- Assess the development traffic impacts at the key intersections
- Assess the impacts of the proposed development on the existing Public and Active Transport network

1.3 References

The following resources were referred to in the preparation of the report:

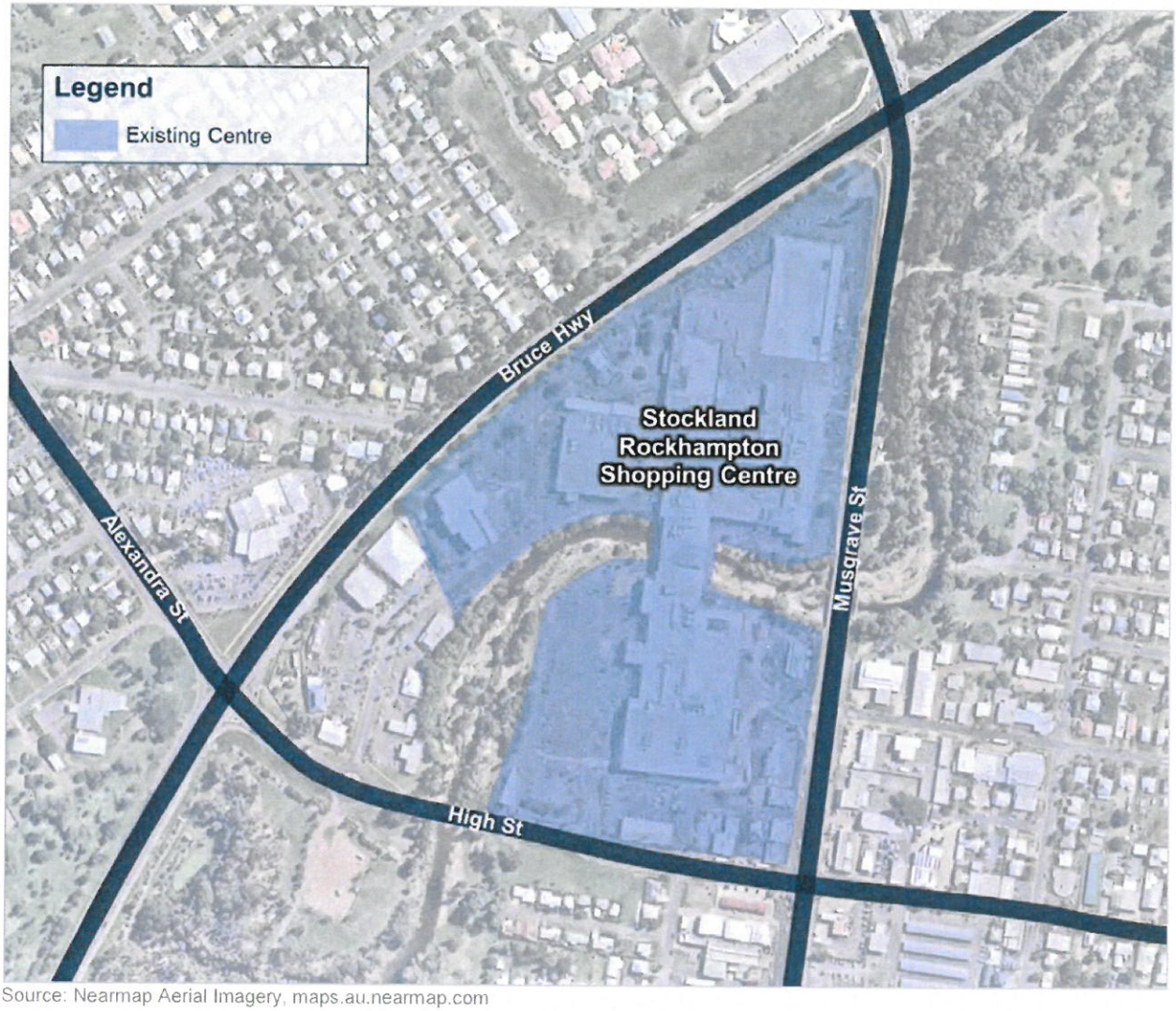
- *AS2890.1:2004 Parking Facilities Part 1: Off-street Car Parking,* Australian Standards, 2004
- *Rock e Plan: Rockhampton Region Planning Scheme,* Rockhampton Regional Council, 2015
- *Guide to Traffic Generating Developments: Updated Traffic Surveys,* Roads and Maritime Services (RMS), NSW Government, August 2013
- *Guideline for Assessment of Road Impacts of Developments,* Department of Transport and Main Roads, April 2006

2 Existing Situation

2.1 Rockhampton Centre

Rockhampton Centre is located in Rockhampton's north-eastern suburbs, and comprises 55,005 sq.m gross leasable area (GLA) of retail and 3,392 sq.m GLA of cinema for a total centre GLA of 58,397 sq.m.

Figure 2-1 Stockland Rockhampton Centre Location



Source: Nearmap Aerial Imagery, maps.au.nearmap.com

2.2 Local Road Network

The site has frontage along Musgrave Street to the east, High Street to the south and the Bruce Highway to the west. Table 2-1 reports the key characteristics of the local road network.

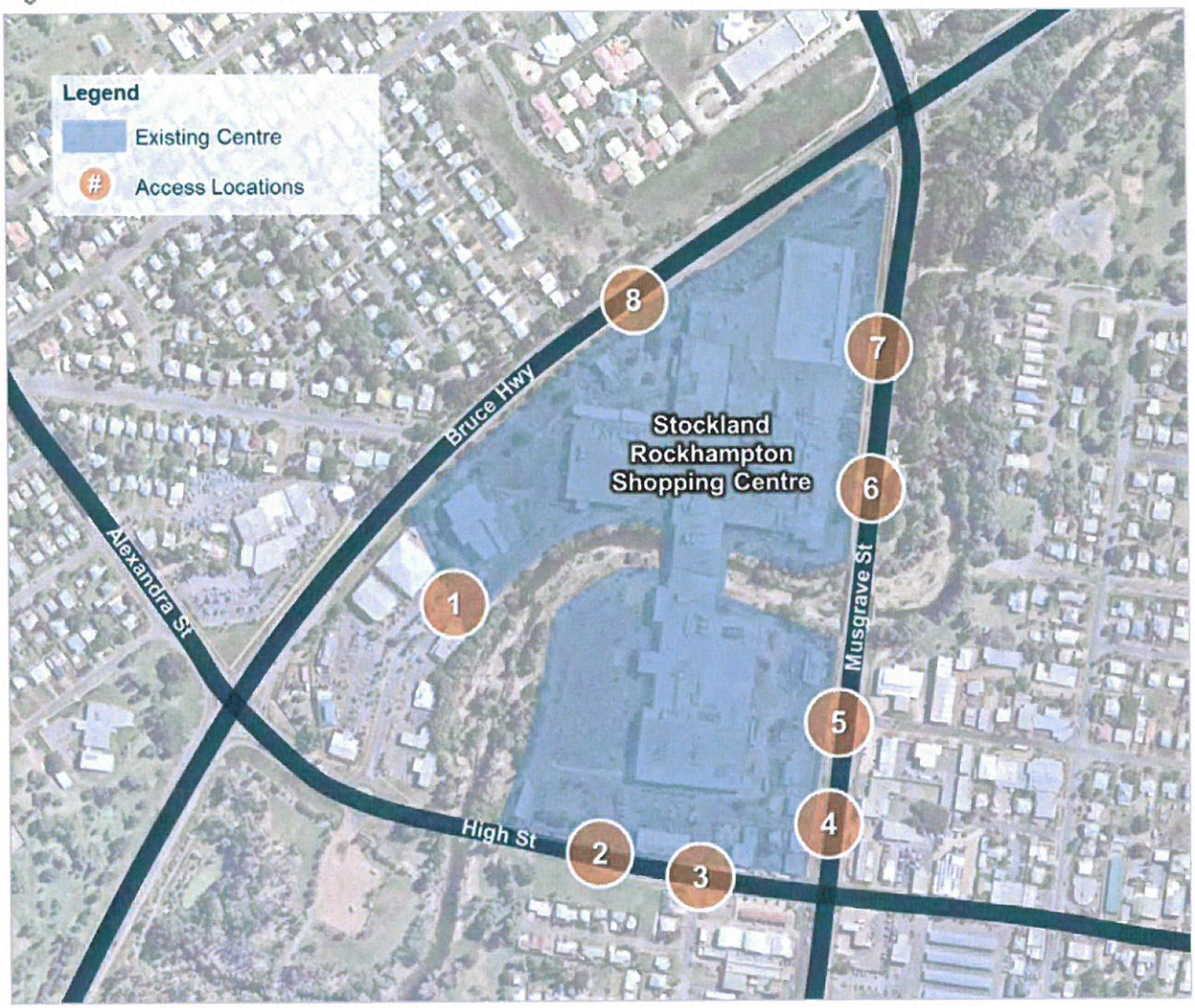
Table 2-1 Local Road Network Hierarchy

Road	Authority	Classification	Posted Speed Limit	Typical Form
Bruce Hwy (Moores Creek Road)	TMR	Highway	40km/h	Four lane divided
High St	RRC	Urban Arterial Road	60km/h	Two / Four lane divided
Musgrave St (Rockhampton-Yeppoon Road)	TMR	State Controlled Road	60km/h	Four lane divided
Aquatic Place	RRC	Urban Access Place	50km/h	Two lane undivided

2.3 Parking and Access

Access to the site is currently provided via eight locations around the perimeter of the site, each shown on Figure 2-2.

Figure 2-2 Access Locations to Site



Source: Nearmap Aerial Imagery, maps.au.nearmap.com

Table 2-2 describes the forms of these identified access points.

Table 2-2 Centre Access Intersections

ID	Location	Form
1	Aquatic Place/Stockland Access	Two way link section
2	High Street	Signalised three way
3	High Street/Victoria Place	Left in/Left out
4	Musgrave Street/Blanchard Street	Left in/Left out
5	Musgrave Street/Clifton Street	Signalised four way
6	Musgrave Street/Cowap Street	Signalised three way
7	Musgrave Street	Left in/Left out
8	Bruce Highway	Left in/Left out

2.4 Active Transport Connections

Figure 2-3 illustrates the active transport infrastructure surrounding the centre. External pathways connect the boundary of the site along the major roads. In addition, there are extensive pedestrian crossings through the site.

Figure 2-3 Active Transport Network Infrastructure

Source: Nearmap Aerial Imagery, maps.au.nearmap.com

2.5 Public Transport Connections

2.5.1 Public Bus Services

Stockland Rockhampton Centre provides a bus interchange on-site, located between the High Street signalised access and the Musgrave Street / Clifton Street signalised access intersection, as shown on Figure 2-4. Additional bus stops are provided on Musgrave Street.

Figure 2-4 Bus Interchange Location – Rockhampton Centre

Source: Nearmap Aerial Imagery, maps.au.nearmap.com

Table 2-3 summarises the current bus routes, frequencies, and major destinations.

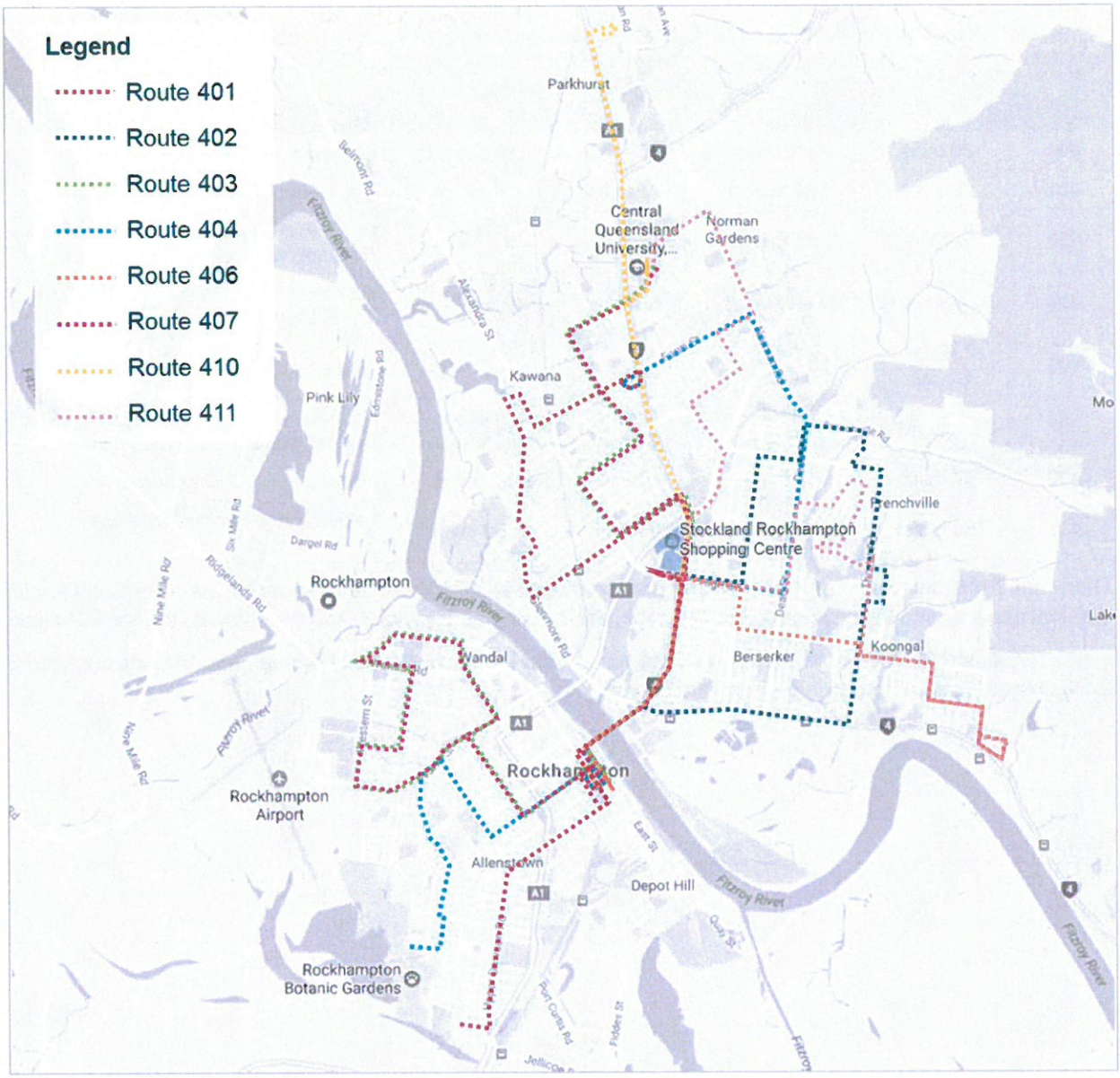
Table 2-3 Bus Routes that Operate To/From Stockland Rockhampton Centre

Route	Inbound		Outbound		Major Stops
	7-9am	3-6pm	7-9am	3-6pm	
401	30 mins	20-60 mins	30 mins	20-60 mins	Glenmore, City Centre, The Range
402	60 mins	60 mins	60 mins	60 mins	City Centre, Koongal, Frenchville
403	8:43am	60 mins	8:35am	45 – 60 mins	CQU, Park Avenue, City Centre, Base Hospital, Wandal
404	30 – 60 mins	30 – 60 mins	60 mins	30 – 45 mins	Glenmore, Base Hospital, City Centre, The Range, Norman Gardens
406	7:48am, 8:53am	3:38pm, 3:56pm	8:10am	60 mins	Lakes Creek, City Centre, Koongal
407	30 – 45 mins	3:13pm, 5:13pm	7:34am, 8:55am	3:55pm, 5:55pm	West Rockhampton, City Centre, CQU, Base Hospital, Park Avenue, Wandal
410	60 mins	60 mins	60 mins	60 mins	Parkhurst, CQU, City Centre
411	60 mins	60 mins	60 mins	60 mins	Lakes Creek, Koongal, Norman Gardens, CQU

There are 7 bus services which provide connections between Stockland Rockhampton and City Centre, with frequent services into the city during the AM peak, and arriving at Stockland Rockhampton during the PM peak.

Figure 2-5 illustrates the areas serviced by the bus routes, and subsequently the neighbourhoods connected to Stockland Rockhampton via a direct bus service.

Figure 2-5 Bus Route Network



Source: qconnect / Sunbus timetables

3 Proposed Development

3.1 Summary of Expansion

The proposed expansion is intended to comprise of an additional 215 seat theatre as part of the existing cinema and 4,979 sq.m GLA of retail. A summary of the existing and proposed expansion yields is provided in Table 3-1.

Table 3-1 Centre Yields - Existing and Proposed Expansion

Land Use	Existing Yield	Proposed Expansion	Total Centre
Retail	55,005 sq.m	4,979 sq.m	**59,984 sq.m**
Cinema	954 seats / 3,392 sq.m	215 seats / 601 sq.m*	**1,169 seats / 3,993 sq.m***
Total	**58,397 sq.m**	**5,580 sq.m**	**63,997 sq.m***

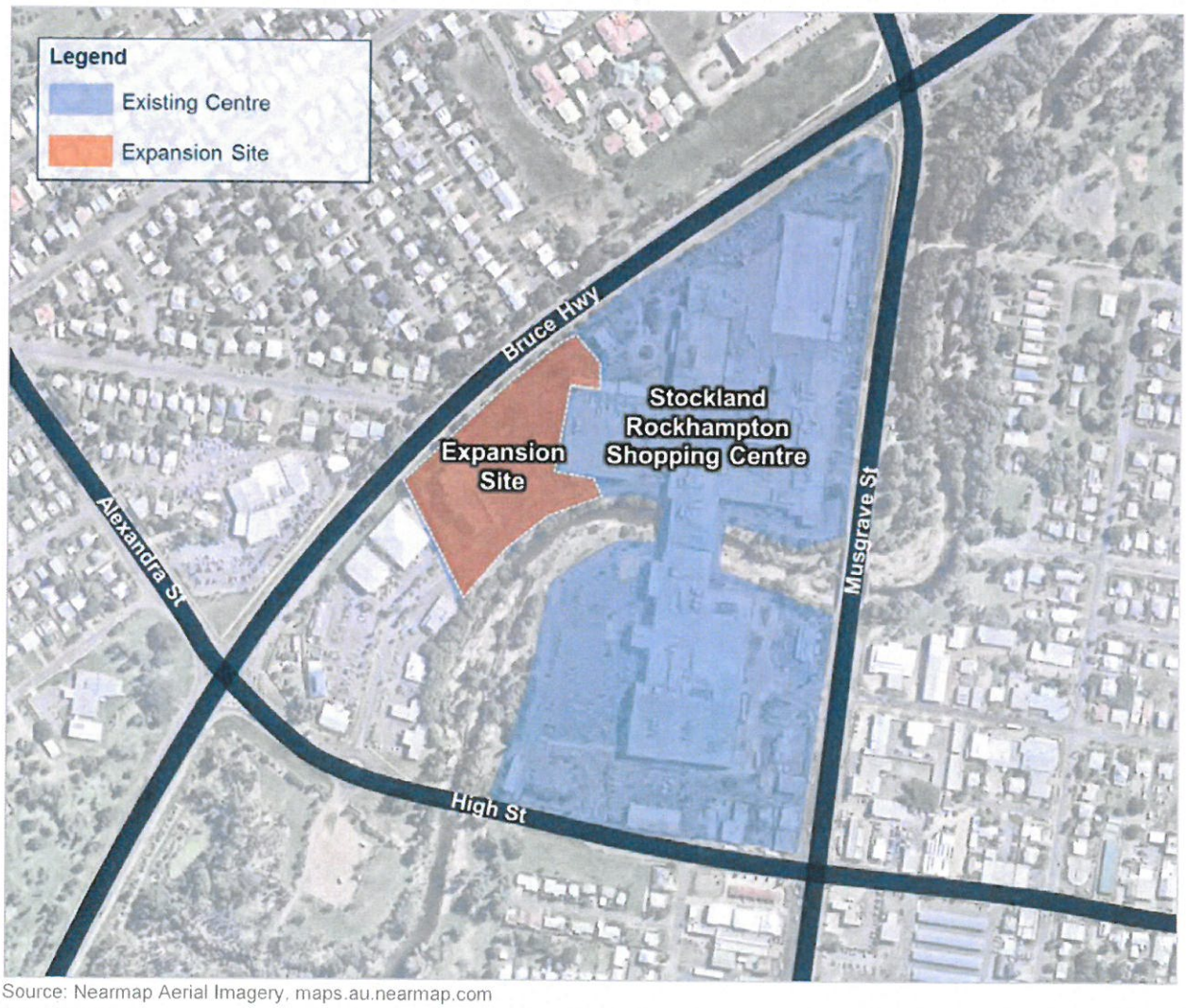
3.2 Proposed Development Expansion

The proposed expansion comprises of the following land uses:

- 215 additional seat Cinema
- 4,979 sq.m GLA Retail

The expansion is located on the north-western side of the existing site, which will be positioned over the existing car parking resulting in an overall gain of 47 spaces. Figure 3-1 illustrates the location of the proposed expansion.

Figure 3-1 Site Location – Proposed Development Expansion

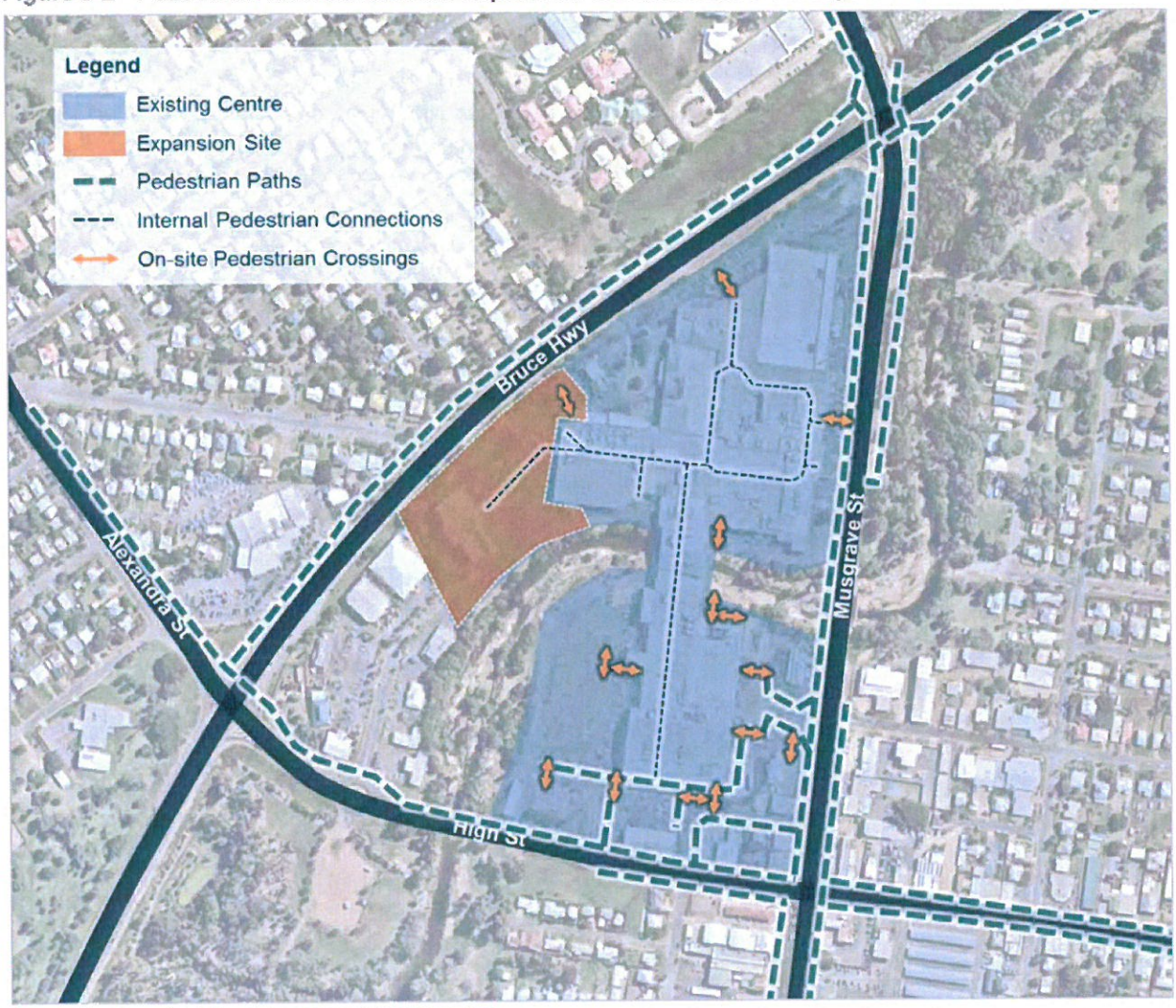


Source: Nearmap Aerial Imagery, maps.au.nearmap.com

3.3 Active Transport Connections

Figure 3-2 illustrates the pedestrian access routes between the existing cinema and the active transport network. The existing active transport infrastructure lacks formal connections between the main centre and the cinema. Cinema patrons with a trip purpose at the centre currently need to walk through the car park to gain access to the centre entrances or the cinema. One of the benefits of the proposed development will be to enable a more comfortable, convenient route through air conditioned mall space for centre patrons to visit the cinema, and vice versa.

Figure 3-2 Pedestrian Access between Expansion Site and Active Transport Infrastructure



Source: Nearmap Aerial Imagery, maps.au.nearmap.com

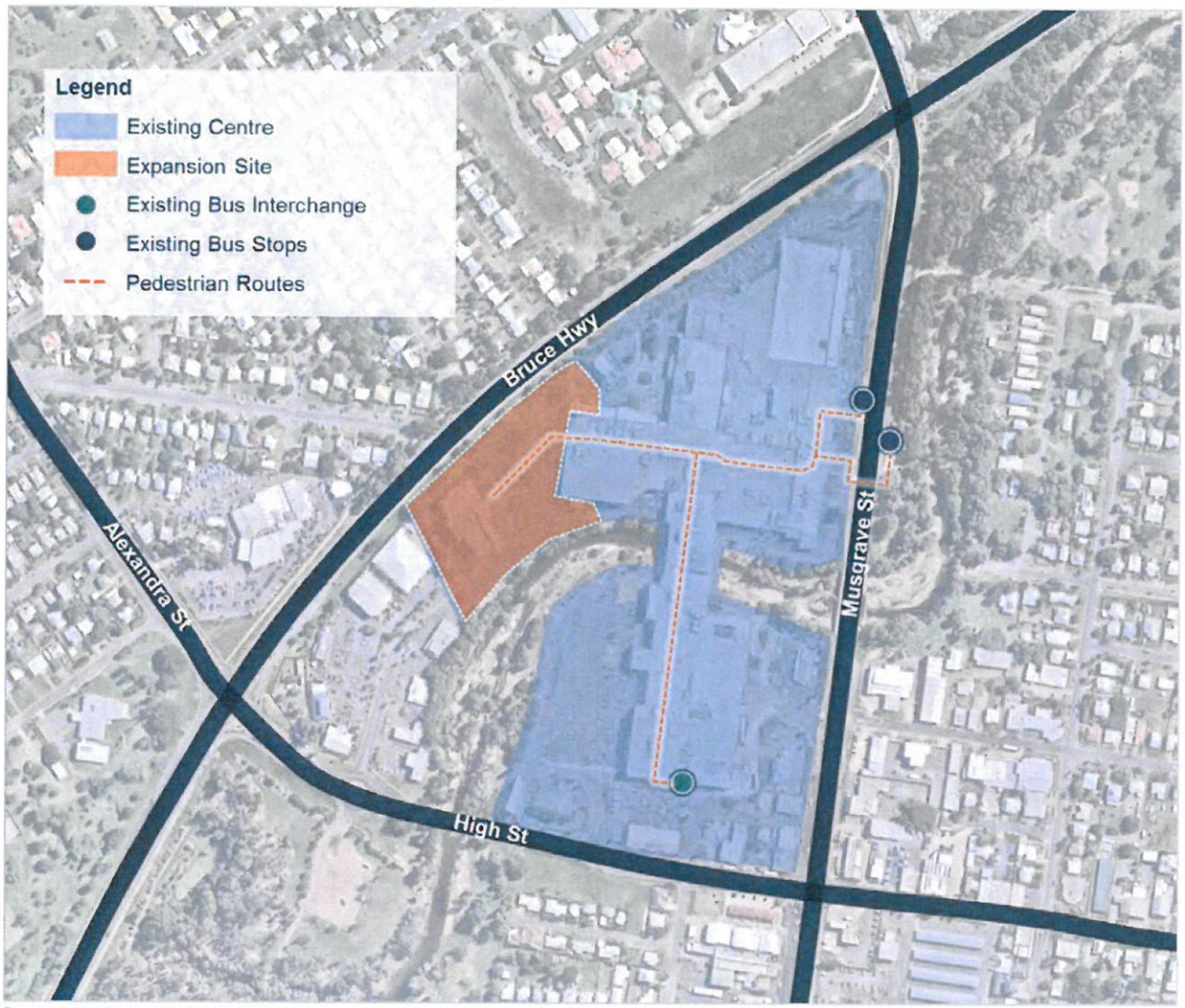
3.4 Public Transport Connections

3.4.1 Public Bus Services

The existing bus interchange on-site, located between the High Street signalised access and the Musgrave Street / Clifton Street signalised access intersection, will provide sufficient bus services to cater for the proposed expansion.

Pedestrian access from the bus interchange and external bus stops to the expansion will be provided through the centre, which will provide the most desirable route for pedestrians, as illustrated in Figure 3-3.

Figure 3-3 Pedestrian Access between Expansion Site and Bus Stop



Source: Nearmap Aerial Imagery, maps.au.nearmap.com

4 Development Impact

4.1 Existing Traffic Movements

4.1.1 Background Traffic Surveys

Traffic surveys were carried out by Austraffic, on Thursday 4th May between 4:00pm and 7:00pm, and Saturday 6th May between 10:00am and 1:00pm, at the following twelve locations:

1. Bruce Highway / Musgrave Street - signalised intersection
2. Musgrave Street / Cowap Street - signalised access intersection
3. Musgrave Street / Clifton Street - signalised access
4. Musgrave Street / Blanchard Street - left in/left out access
5. Musgrave Street / High Street - signalised intersection
6. High Street / Site Access - left in/left out access
7. High Street/Site Access - signalised access
8. High Street / Aquatic Place - roundabout access
9. Bruce Highway / High Street - signalised intersection
10. Bruce Highway / Site Access - left in/left out access
11. Aquatic Place – entry and exit
12. Musgrave Street / Site Access - left in/left out access

These locations are shown in Figure 4-1.

Figure 4-1 Traffic Survey Locations

Source: Nearmap Aerial Imagery, maps.au.nearmap.com

A review of the traffic surveys was undertaken, and the common peak hour period for the centre was identified for all surveyed intersections, as follows:

- Thursday Peak: 4:30 pm – 5:30 pm.
- Saturday Peak: 11:15 am – 12:15 pm.

4.1.2 Peak (85th Percentile) Generation Assessment

In order to assess the peak demand scenario for Stockland Rockhampton Centre, annual daily door count data was used to illustrate the pedestrian flow at the centre and to identify the 85th percentile busiest shopping day of the week. Given that Thursdays and Saturdays are generally considered the busier days of the week, the 85th percentile Thursday and Saturday were both identified from the door count data. Raw patronage data has not been reported due to commercial sensitivities.

The 85th percentile Thursday or Saturday corresponds to the 85% busiest Thursday or Saturday of the annual profile of daily door count data, where the top 15% of the data has been excluded. This assessment approach is a standard traffic engineering approach which accounts for all, but the highest outliers of the busiest trading periods. These outliers generally occur over the week before Christmas or a public holiday where designing for these occurrences would mean a significant over supply the rest of the year.

Cardno has reviewed the Stockland Rockhampton door count data for May 2016 to May 2017. The door counts from the survey days were included in the data set to accurately capture the relationship between the survey day traffic generation and the 85th percentile busiest Thursday and Saturday for the centre.

Figure 4-2 and Figure 4-3 show the FY 2016/17 annual trading profile, along with the equivalent survey date trading volume, and the 85th percentile trading volume for the existing Rockhampton centre.

Figure 4-2 Existing Stockland Rockhampton Centre Patronage and 85th%ile (Thursday)

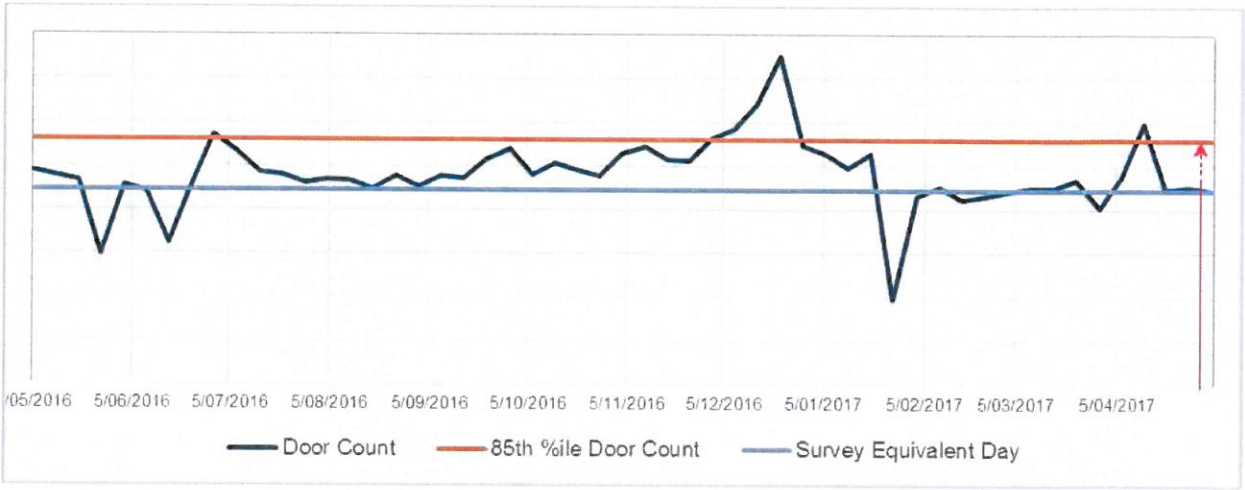
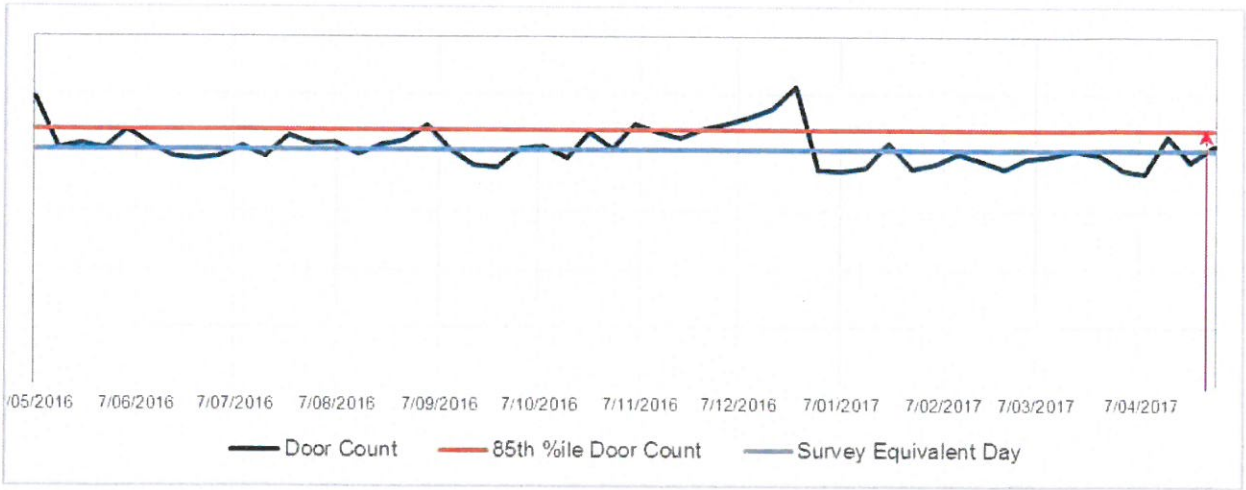


Figure 4-3 Existing Stockland Rockhampton Centre Patronage and 85th%ile (Saturday)



The figures illustrate and confirm that the 85th percentile Thursday and Saturday represent the busiest day over the year, with the exception of the peaks during the Easter and Christmas holidays.

The 85th percentile trading factor was estimated by comparing the patronage for the survey days to the relevant 85th percentile trading patronage. Therefore, the following factors were devised to apply to the traffic survey volumes, in order to determine an 85th percentile traffic generation for the existing centre:

- **1.26** for Thursday peak hour volumes.
- **1.09** for Saturday peak hour volumes.

By applying the 85th percentile factor to the traffic survey peak volumes, a baseline traffic generation rate for the existing centre was identified, as shown in Table 4-1.

As the surveys will have captured the trips for the retail and cinema combined, the assessment has separated the two uses. Trips for the existing cinema have been calculated from previous data received from Stockland on the operation of the site. More detail for this is provided in section 4.2.2.

The retail component of the centre has been estimated as the difference between the overall centre traffic and the cinema. All uses have been factored for the 85th percentile trading.

Table 4-1 Existing Peak Hour Traffic Generation

	Thursday Peak	Saturday Peak
Surveyed Site Traffic Generation – In	1,255 vph	1,831 vph
Surveyed Site Traffic Generation – Out	1,310 vph	1,645 vph
Surveyed Site Traffic Generation - Total	**2,565 vph**	**3,476 vph**
85th %ile Factor – Overall centre	1.26	1.09
85th %ile Centre Traffic Generation	**3,236 vph***	**3,776 vph***
Cinema		
Surveyed Cinema Trips (refer section 4.2.2)	96 vph	92 vph
85th %ile Factor – Cinema (refer section 4.2.2)	1.36	1.07
Factored 85th %ile Cinema Traffic Generation	**131 vph**	**98 vph**
Retail		
85th %ile Retail Traffic Generation	**3,105 vph**	**3,678 vph**
Existing Site GLA – Retail	55,005 sq.m	55,005 sq.m
85th %ile Retail Traffic Generation Rate	**5.64 vph / 100 sq.m**	**6.69 vph / 100 sq.m**

Note * difference in values due to rounding of 85th percentile factor

As reported, the existing retail trip generation for the centre is estimated at 5.48 vph/100sq.m for Thursday and 6.50 vph/100sq.m for Saturday.

4.2 Development Trip Generation

4.2.1 Retail Centre

The retail centre adopted a different methodology to identify the generation rate, as that used for the proposed cinema. The traffic generation rate of a retail centre is significantly influenced by the operation and scale of the centre in question.

Therefore, the new retail precinct has been considered as a direct increase in GLA of the existing centre. This is a common assumption, which aligns with many expansions to shopping centres, providing activities other than solely retail.

As a result of the broader range of uses and activities at the centre, the duration of trips to the centre are extended, and trips with multiple purposes are combined into one trip. Therefore, this creates a phenomenon whereas the floor area expands, the generation rate, per square metre, reduces.

The NSW Roads and Maritime Services (RMS) *Guide to Traffic Generating Developments* (updated August 2013), provides a table of traffic generation rates for shopping centres dependant on the size of the centre. This data can be extrapolated into a curve to determine the traffic generation of a particular size centre.

To consider the variance in shopping centre trading patterns between NSW and Queensland, the 85th percentile traffic generation rate for the existing Stockland Rockhampton Centre (derived in Section 4.1.2), has been used to calibrate the generation curves specified in the RMS guide, to reflect the actual trading patterns identified for the Stockland Rockhampton Centre.

Using the calibrated curve, the traffic generation of the new retail precinct expansion has been determined by increasing the GLA along the calibrated curve.

Figure 4-4 and Figure 4-5 illustrate the actual and calibrated generation curves for the Thursday and Saturday trading respectively, and where the existing centre and proposed expansion lie on the calibrated curve.

Figure 4-4 Thursday Peak Generation Profile

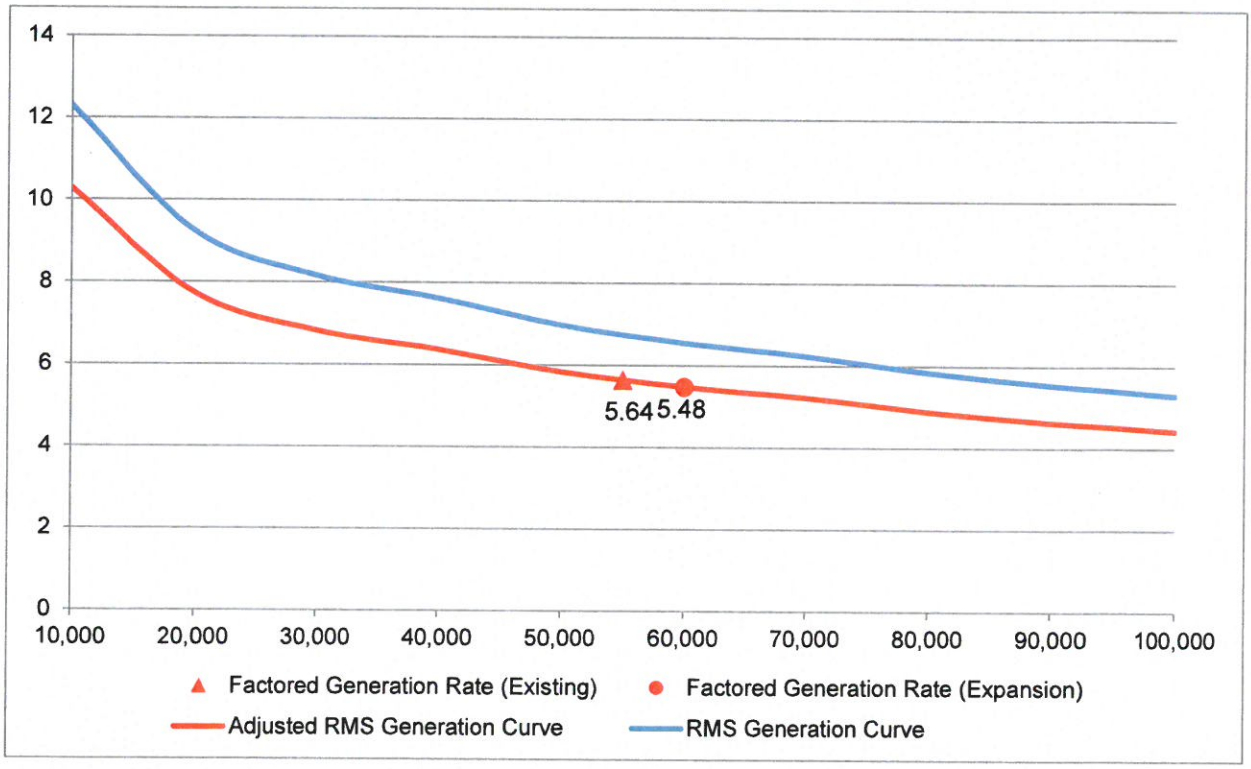
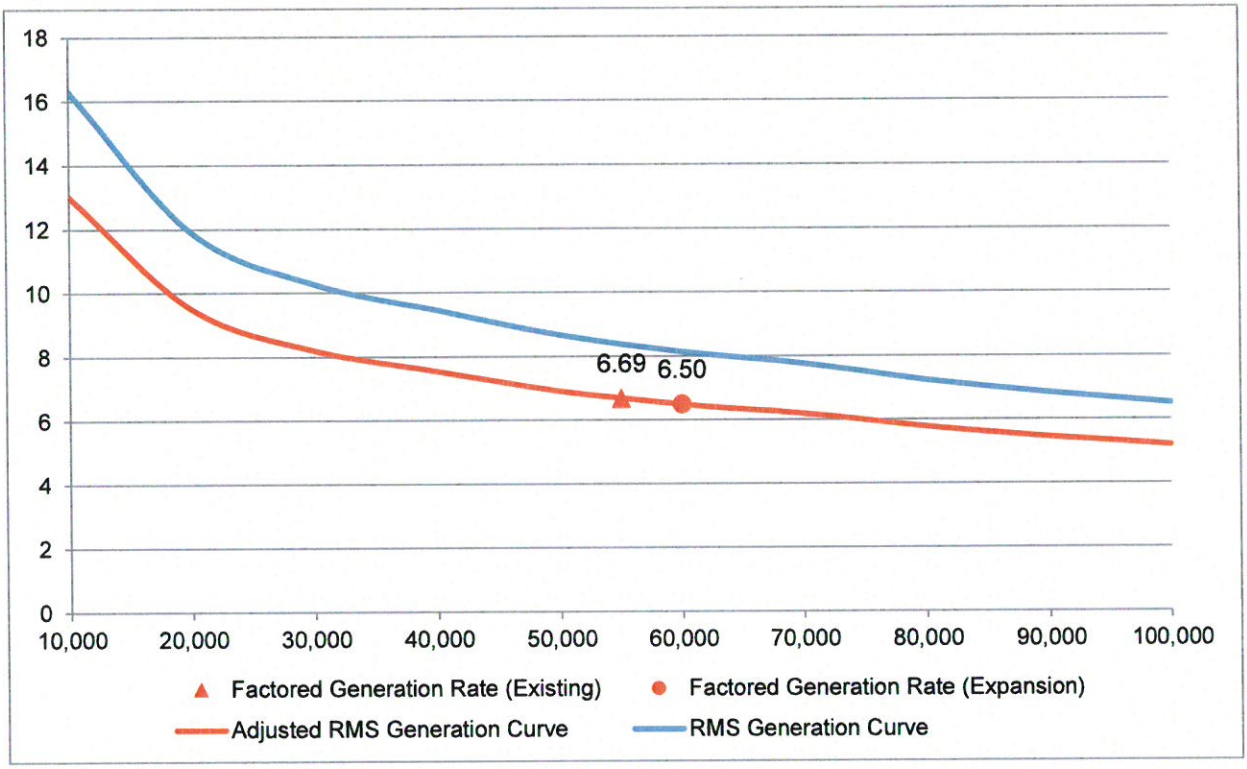


Figure 4-5 Saturday Peak Generation Profile



The estimated traffic generation for the proposed retail expansion is summarised in Table 4-2.

Table 4-2 Trip Generation Estimation – Proposed Retail Expansion

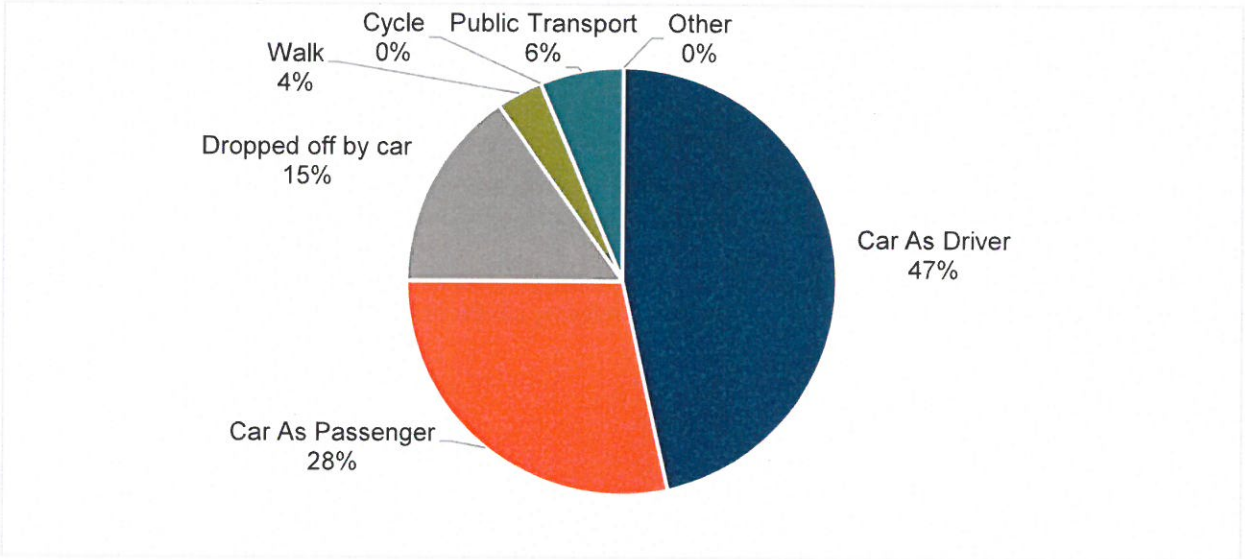
	Thursday Peak	Saturday Peak
Existing 85th %ile Traffic Generation (55,005 sq.m GLA)	3,105 vph	3,678 vph
85th %ile Traffic Generation Rate (59,984 sq.m GLA)	5.48 vph / 100m^2	6.50 vph / 100m^2
85th %ile Traffic Generation (59,984 sq.m GLA)	3,288 vph	3,897 vph
Additional Trips from Centre Increase (4,979 sq.m)	**183 vph**	**219 vph**

4.2.2 Cinema

In order to identify typical travel behaviour for cinema patrons, Cardno conducted travel interview surveys with patrons of the Rockhampton cinema on Thursday 12 June 2014 and Saturday 14 June 2014. The survey questions focused on mode of travel to the cinema, and whether patrons combined the trip to the cinema with other purpose, such as shopping or dining. Hourly ticket sale data from the cinema was also collected over a three week period to establish the actual number of trips generated by the cinema and establish the mode of travel during the peak. This sale data was collected in May 2014.

The results of the travel survey indicated that the majority of patrons arrived by private vehicle, however many arrived as a passenger. Figure 4-6 illustrates the breakdown of travel to the cinema by mode. With consideration of this, approximately 47% of patrons drove to the cinema (i.e. generates one vehicle trip), and approximately 15% of patrons were dropped off at the cinema (i.e. generates two vehicle trips; one trip in and one trip out). This gives a total of 77% of cinema patrons generating new vehicle trips.

Figure 4-6 Travel to Rockhampton Cinema by Mode



It is expected that a number of patrons would intend to combine their trip to the cinema with other purposes, such as shopping or dining. As shopping and other leisure facilities are easily accessible for cinema patrons, it is likely that patrons will combine trip purposes. However, to ensure a conservative assessment is undertaken, the assumption of no cross-utilisation has been adopted.

To be consistent with the traffic survey data, the peak periods adopted for the whole centre have also been adopted to establish the cinema generation.

Table 4-3 summarises the new trips associated with the proposed cinema, during the same peak periods adopted for the whole centre.

Table 4-3 Cinema Patron Trips – Proposed Cinema

Day	Peak Period^	Peak Hour Selected*	Patrons	New Vehicle Trips %	Vehicle Trips
Thursday	4:00pm – 7:00pm	6:00pm – 7:00pm	125	77%	96 vph
Saturday	10:00am – 2:00pm	12:00pm – 1:00pm	119	77%	92 vph

Note ^ Peak period selected for 3 to 4 hours around the centre peak to capture variation in show times, * Chosen as the peak hour of ticket sales within the peak period

The patronage of the average May Thursday and Saturday were calculated to estimate the 85th percentile factor for the cinema traffic generation, using the same methodology as the centre 85th percentile factor. As the ticket sale data was an average of three weeks of sale data, the factor compared the average Thursday and Saturday in May to the 85th percentile Thursday and Saturday, respectively.

The following factors were devised to apply to the cinema traffic volumes:

- **1.36** for Thursday peak hour volumes.
- **1.07** for Saturday peak hour volumes.

Table 4-4 outlines the factored cinema trips.

Table 4-4 Cinema Patron Trips – Proposed Cinema

Day	Cinema Vehicle Trips	85th Percentile Factor	Factored Cinema Vehicle Trips
Thursday	96 vph	1.36	**131 vph**
Saturday	92 vph	1.07	**98 vph**

Based on the existing 954 seats at the cinema, the trip rate for the cinema is calculated as follows:

- **0.137 vph/seat** for Thursday peak hour
- **0.103 vph/seat** for Saturday peak hour

4.2.3 Total Centre Expansion

Table 4-5 summarises the increase in traffic generation as a result of the overall proposed centre expansion.

Table 4-5 Proposed Trip Generation Estimation –Expansion

Land Use	GFA / Screens	Generation Rate		Trips	
		Thursday	Saturday	Thursday	Saturday
Cinema	215 seats	0.137 vph / seat	0.103 vph / seat	29 vph	22 vph
Retail	4,979 sq.m	5.48 vph / 100m^2	6.50 vph / 100m^2	183 vph	219 vph
Total	-	-	-	**212 vph**	**241 vph**

Therefore, the expansion as a whole is expected to generate an additional 212 vph during the Thursday PM peak and 241 vph during the Saturday peak above the existing centre traffic.

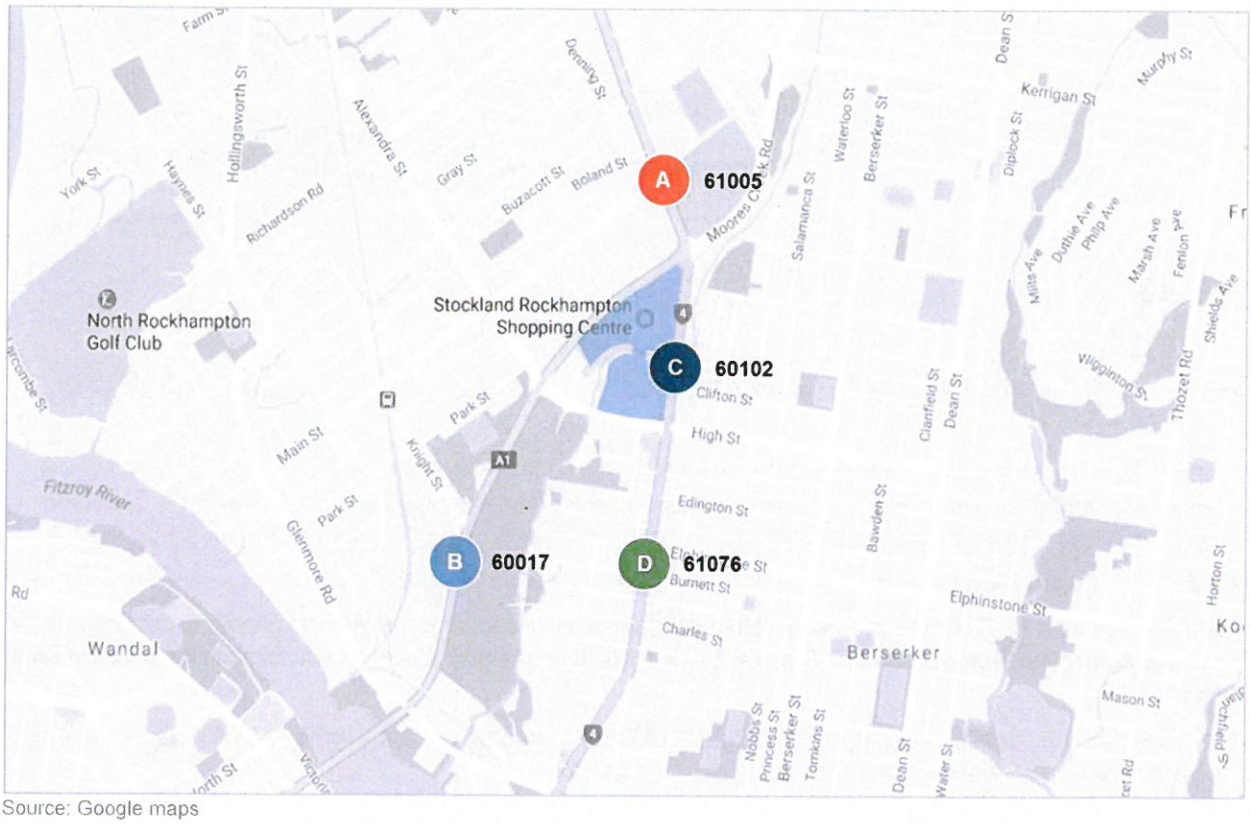
4.3 Traffic Growth Rate

A traffic growth rate of 2.0% per annum has been adopted for the Bruce Highway (Moores Creek Road) and Musgrave Street. With regards to the lower-order roads (High Street, Clifton Street), it has been assumed that 1% per annum traffic growth will be representative of the future growth. This rate has been adopted for based on previous agreements with the Department of Transport and Main Roads in Rockhampton.

4.3.1 Historic Growth Rate

Cardno analysed TMR's historic AADT data for four sites near the development, as indicated on Figure 4-7.

Figure 4-7 AADT Sites



Source: Google maps

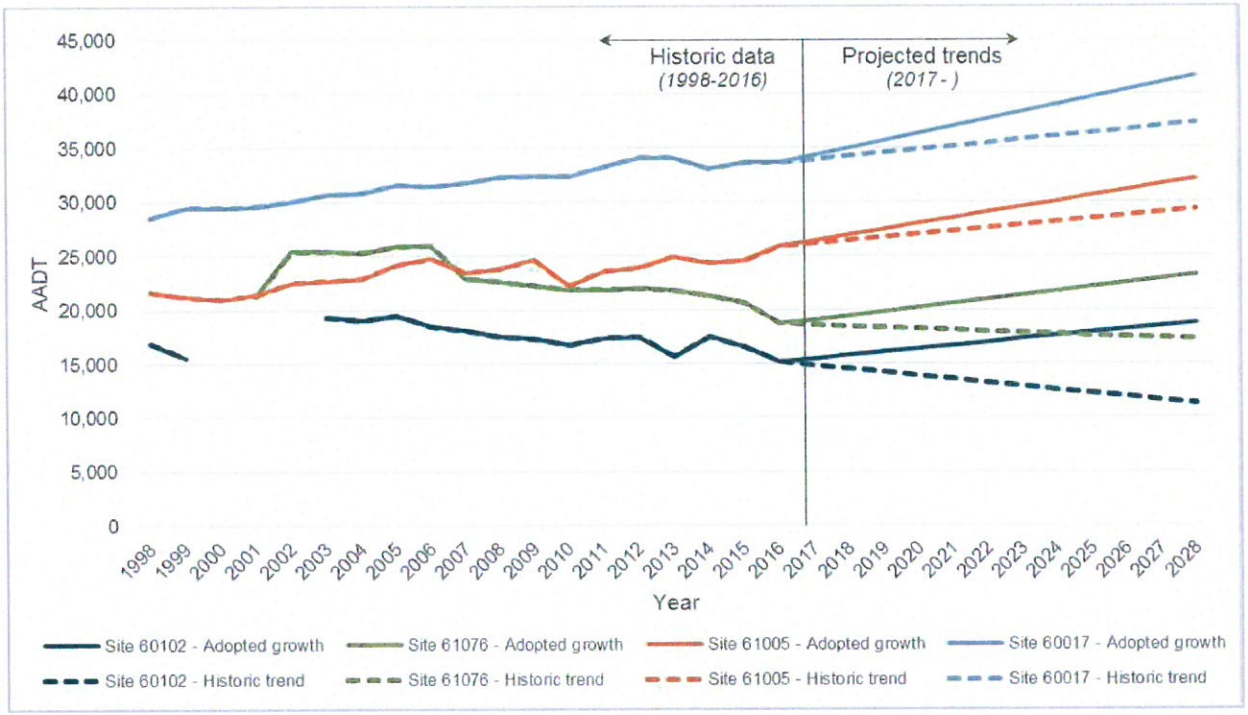
The historical data ranged from 1998 to 2016. The average annual growth rate for each of the sites was calculated. These values are reported in Table 4-6. It was shown that for the Bruce Highway (sites A and B), the average historic growth rate was in the order of 1%. While for Musgrave Street (sites C and D), the growth rate has been shown to be negative indicating a decrease in background traffic. Notably, all growth rates are much lower than the 2.0% growth adopted for the assessment.

Table 4-6 Population - ABS Census Statistics – Rockhampton

Site ID		Location	Average Annual Growth Rate (1998-2016)	Adopted Annual Growth Rate
A	61005	Bruce Highway: at Boland St	1.08%	2.00%
B	60017	Bruce Highway: 100m Sth Knight St	0.92%	2.00%
C	60102	Musgrave Street: Sth Moores Ck	-2.14%	2.00%
D	61076	Musgrave Street: at Elphinstone St	-0.66%	2.00%

Figure 4-8 presents a comparison to the future AADT volumes when adopting the average historic growth rate as per Table 4-6 against the adopted 2.0% growth rate. It illustrates the vast overestimation of the adopted growth rate, with between 10% and 67% inflation above the projected historic trend at the 2028 design horizon.

Figure 4-8 AADT Comparison – Historic Trend vs Adopted Growth Rate

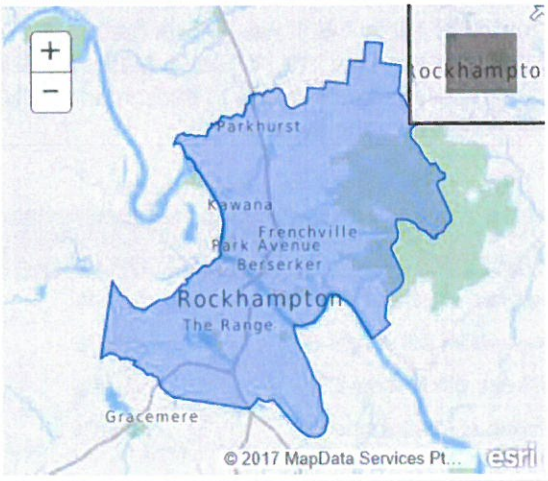


4.3.2 Population Growth

Population growth for Rockhampton was also investigated to understand the historic growth in the area. Data from the Australian Bureau of Statistics (ABS) and the Queensland Government Statistician's Office was referenced.

The ABS Census data was analysed to understand the historic population growth in Rockhampton city. Figure 4-9 illustrates the study area for the population values.

Figure 4-9 ABS Census Study Area – Rockhampton City



Source: Australian Bureau of Statistics

Table 4-7 reports the recorded population for the Rockhampton study area from the 2001, 2006 and 2011 censuses. The annual growth rate between each of the five year periods was calculated. As shown in the table, the growth rates were estimated as 0.31% p.a. between 2001 and 2006 and 0.50% p.a. between 2006 and 2011.

Table 4-7 Population - ABS Census Statistics – Rockhampton

Year	Census Population	Annual Growth Rate
2001	57,864	
2006	58,749	0.31%
2011	60,216	0.50%

Additionally, the Queensland Government's population projections were referred to in order to understand the state government's expectation of population growth in Rockhampton. The projections extend to 2036.

As reported in Table 4-8, the annual growth rates for these projections are in the range of 1.3% to 1.7% when compared to the 2011 base year. However, when looking forward from the 2016 projection, which is the closest baseline to the 2017 base survey year, the growth rates are in the order of 1.0% to 1.1%.

The study period for the traffic assessment (2017 to 2028) is most closely represented by the growth between 2016 and 2026, which is 1.0% p.a..

Table 4-8 Population Projections - Queensland Government – Rockhampton LGA

Year	Census Population	Annual Growth Rate (2011 base year)	Annual Growth Rate (2016 base year)
2011	78,939	-	-
2016	85,701	1.7%	-
2021	90,013	1.4%	1.0%
2026	94,647	1.3%	1.0%
2031	99,321	1.3%	1.1%
2036	104,100	1.3%	1.1%

Source: Projected population, by local government area, 2011 to 2036 (medium series), Queensland Government Statistician's Office

The main findings from these various data sources is that growth in Rockhampton has been and is predicted to be in the order of 1% or less. Therefore, the adopted traffic growth rate of 2.0% p.a. on the state controlled road network is considered to be a gross overestimation of the baseline traffic growth. However, following on from previous discussions with TMR, Cardno will adopt the 2.0% p.a. growth rate for the assessment to remain conservative.

4.4 Distribution

4.4.1 Access Distribution

The access distribution observed in the traffic surveys has generally been adopted to represent the distribution of the additional traffic associated with the proposed expansion. However, given the proposed expansion is located in the north-eastern corner of the site, it has been assumed that 50% of expansion traffic will utilise the two closest access points, being the left in/left out on the Bruce Highway and the Aquatic Place entrance.

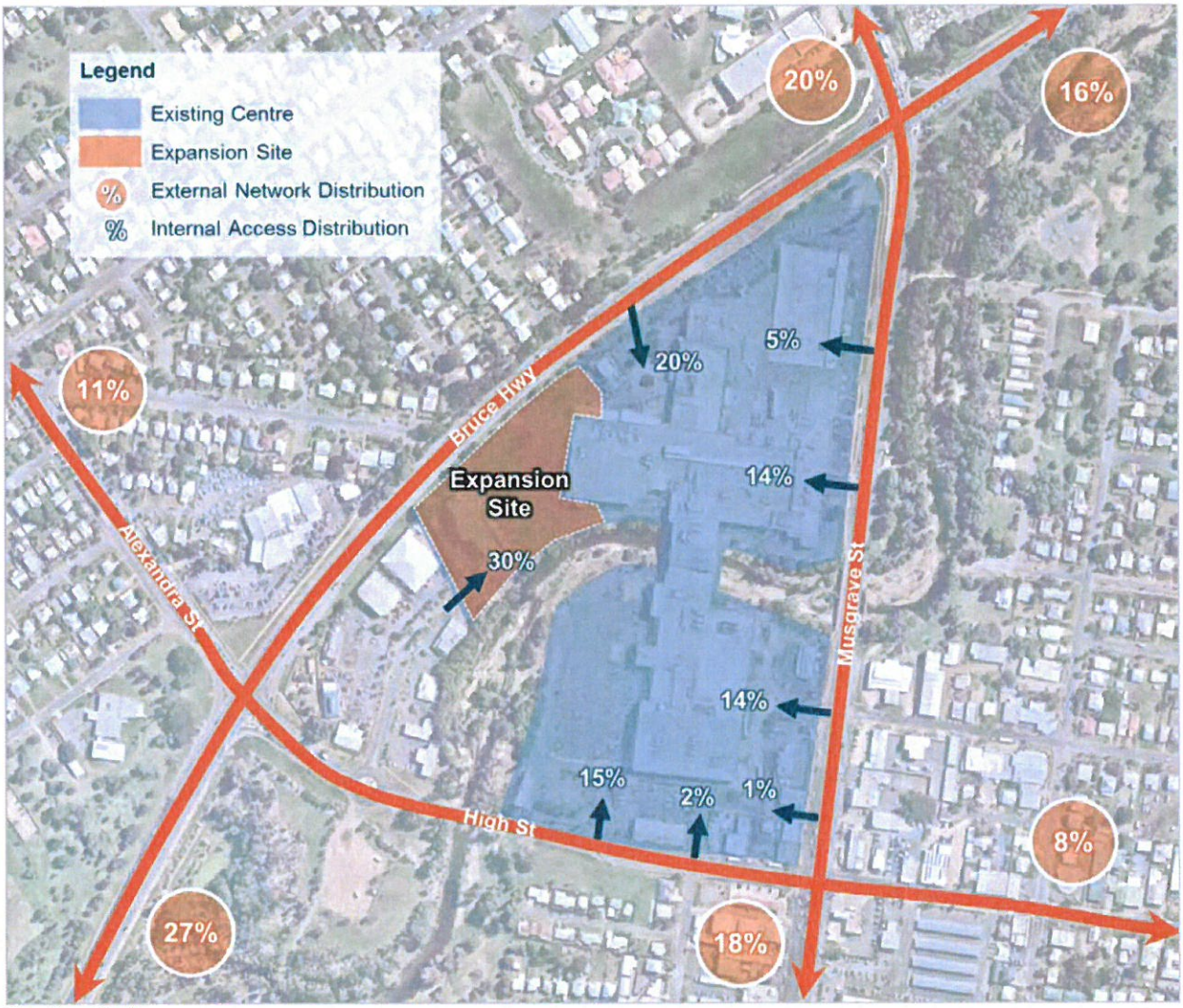
4.4.2 External Distribution

A review of the traffic survey data has been undertaken, in order to establish an approximate distribution of expansion traffic passing through the three external intersections:

1. Bruce Highway / Musgrave Street - signalised intersection
2. Musgrave Street / High Street - signalised intersection
3. Bruce Highway / High Street / Alexandra Street - signalised intersection

The following distribution assumptions, as illustrated on Figure 4-10, have been drawn from the traffic surveys and adopted for the assessment of the expansion traffic.

Figure 4-10 Expansion Traffic Distribution



Directional Split

4.4.3 Directional Distribution

The arrival / departure splits for trips associated with the existing centre and proposed expansion have been adopted from the existing centre travel patterns, estimated from the survey data. The adopted rates are shown in Table 4-5.

Table 4-9 Adopted Directional In / Out Split

Time Period	IN	OUT
Thursday	50%	50%
Saturday	50%	50%

5 Intersection Assessment

5.1 Assessed Intersections

For this assessment, the following intersections have been assessed and are illustrated on Figure 5-1:

1. Bruce Highway / Musgrave Street - signalised intersection
2. Musgrave Street / Cowap Street - signalised access intersection
3. Musgrave Street / Clifton Street - signalised access
4. Musgrave Street / High Street - signalised intersection
5. High Street / Site Access - signalised access
6. High Street / Aquatic Place - roundabout access
7. Bruce Highway / High Street / Alexandra Street - signalised intersection
8. Bruce Highway / Site Access – left in left out access

Figure 5-1 SIDRA Assessment Locations

Source: Nearmap Aerial Imagery, maps.au.nearmap.com

It is noted that the minor access points (left in/left out) have not been analysed in SIDRA.

5.2 Assessment Scenarios

The following scenarios have been assessed for the proposed expansion development:

- 2017 Background Traffic.
- 2018 Background Traffic.
- 2028 Background Traffic.
- 2018 With Development Expansion (*Year of Opening).*
- 2028 With Development Expansion *(10 year Design Horizon).*

The background, development, and design traffic volumes have been included at Appendix B.

The SIDRA analysis files for all intersections are provided at a file share link, found at Appendix C.

5.3 SIDRA Assessment Criteria

The performance of each study intersection was analysed using SIDRA Intersection 7 (SIDRA) which 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 and delays. Simplistically, DOS is a measure of the proportion of traffic entering an intersection relative to the intersection's capacity. Table 5-1 provides the defined DOS intervention thresholds for intersections.

Table 5-1 Thresholds for Intersection Performance

Intersection Control	DOS Threshold
Signals	less than or equal to 0.90
Roundabout	less than or equal to 0.85
Priority-controlled	less than or equal to 0.80

Source: TMR *Guidelines for Assessment of Road Impacts of Development* (2006)

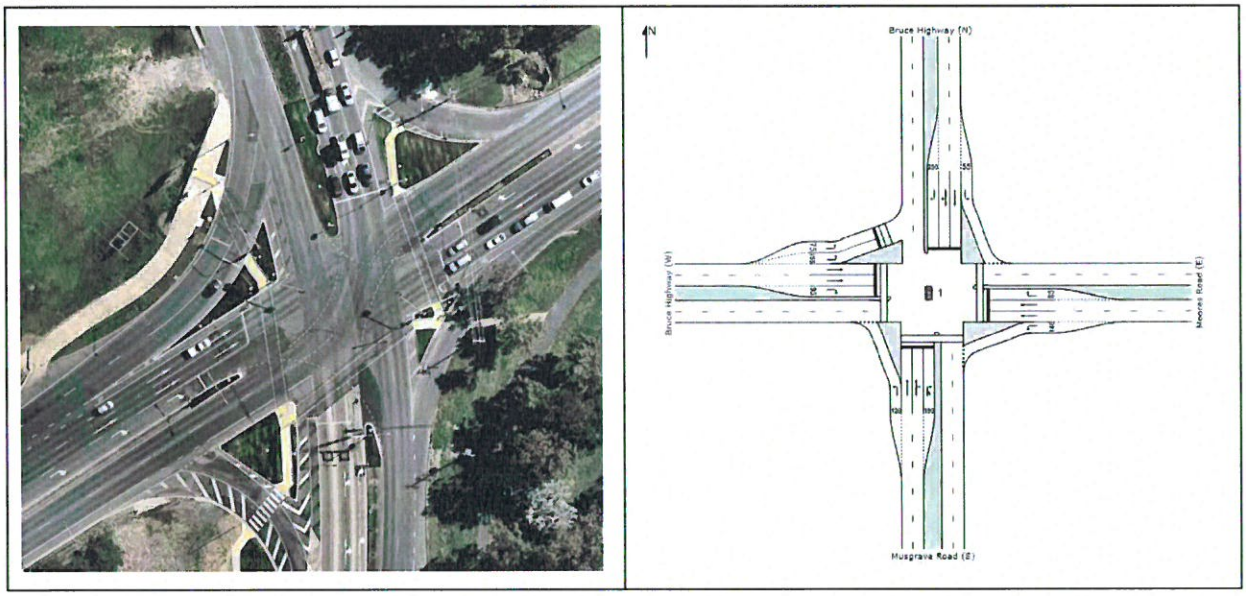
The guideline notes that a DOS exceeding the values indicated in Table 5-1 identifies that an intersection is nearing its practical capacity and upgrade works may be required. Above these threshold values, users of the intersection are likely to experience rapidly increasing delays and queuing.

5.4 Operational Assessment Results

5.4.1 Bruce Highway / Musgrave Street Intersection

The current configuration of this intersection is a four-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-2.

Figure 5-2 Current and SIDRA Assessed Layout – Bruce Highway / Musgrave Street Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-2.

Table 5-2 SIDRA Outputs - Bruce Highway / Musgrave Street Intersection

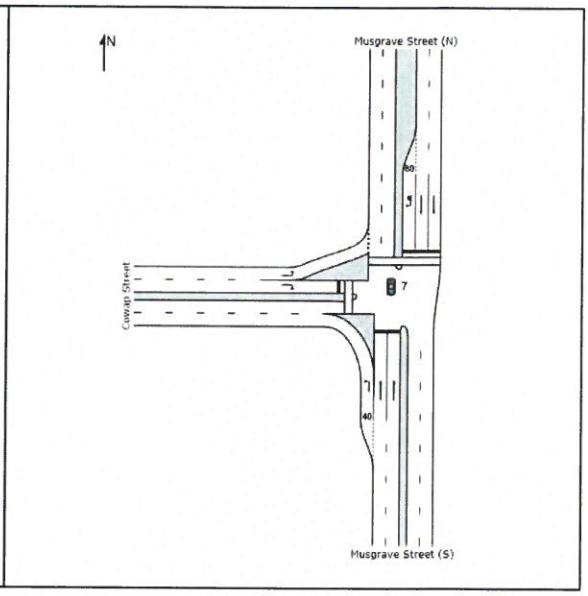
Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.712	46.4	141.4	0.663	44.7	123.4
2018 Background	0.728	46.6	144.8	0.678	44.9	127.4
2028 Background	0.878	53.4	201.7	0.820	48.2	177.7
2018 With Development	0.741	46.9	146.7	0.701	45.1	131.2
2028 With Development	0.887	55.0	206.5	0.834	48.8	183.9

The results of the analysis indicate that the four-way signalised arrangement operates within the typical performance thresholds (DOS ≤ 0.90 for signalised), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios.

5.4.2 Musgrave Street / Cowap Street Intersection

The current configuration of this intersection is a three-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-3.

Figure 5-3 Current and SIDRA Assessed Layout – Musgrave Street / Cowap Street Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-3.

Table 5-3 SIDRA Outputs – Musgrave Street / Cowap Street Intersection

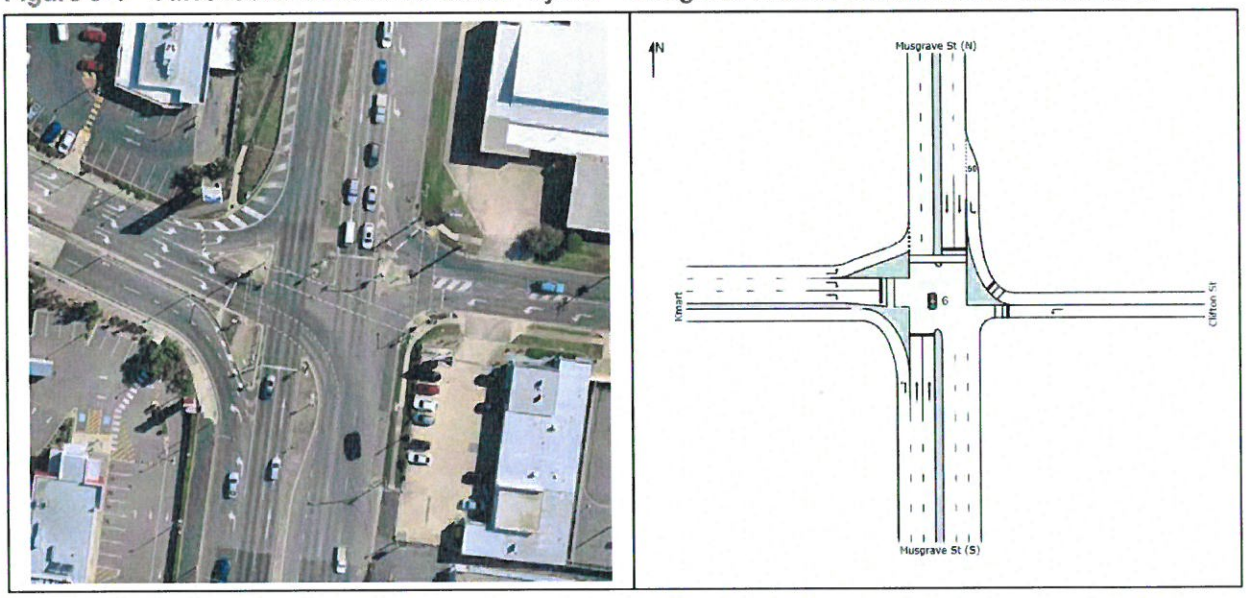
Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.420	4.6	27.9	0.536	10.8	81.0
2018 Background	0.428	4.5	27.9	0.534	10.5	79.8
2028 Background	0.499	3.7	27.9	0.507	6.3	47.7
2018 With Development	0.442	4.9	29.7	0.550	10.6	83.6
2028 With Development	0.514	4.1	29.7	0.517	6.4	49.4

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.90 for signals), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios.

5.4.3 Musgrave Street / Clifton Street Intersection

The current configuration of this intersection is a four-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-4.

Figure 5-4 Current and SIDRA Assessed Layout – Musgrave Street / Clifton Street Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-4.

Table 5-4 SIDRA Outputs – Musgrave Street / Clifton Street Intersection

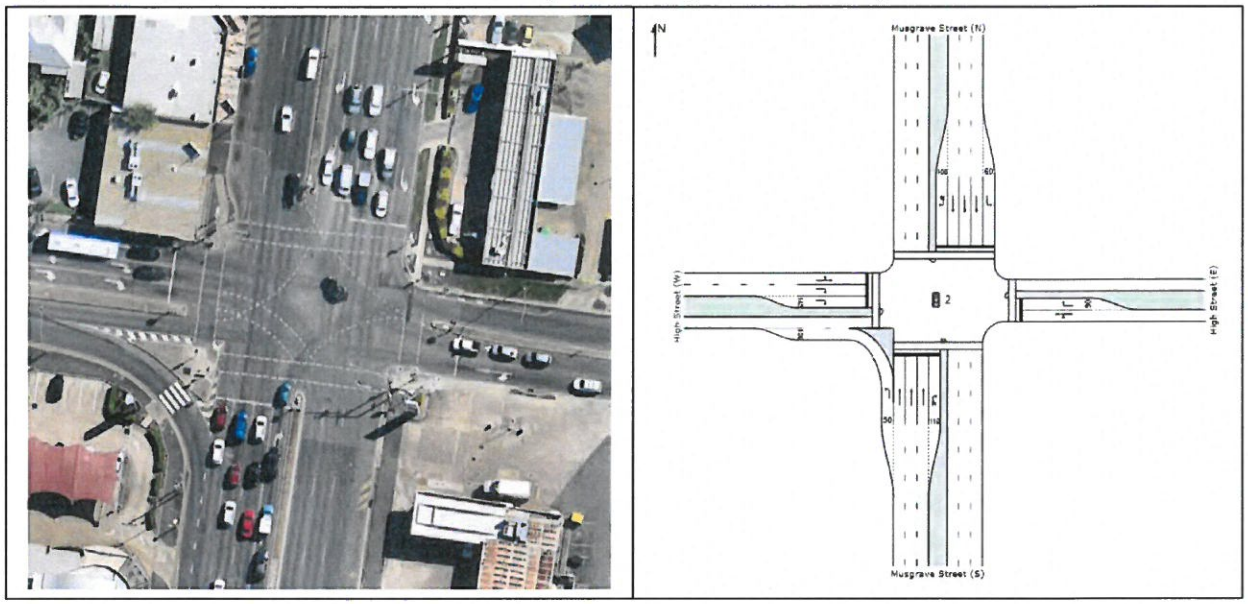
Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.306	5.6	22.6	0.275	5.6	22.9
2018 Background	0.312	5.6	22.6	0.281	5.5	22.9
2028 Background	0.373	5.1	22.6	0.336	5.1	22.9
2018 With Development	0.317	5.6	23.6	0.286	5.6	24.1
2028 With Development	0.378	5.2	23.6	0.342	5.2	24.1

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.90 for signals), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios.

5.4.4 Musgrave Street / High Street Intersection

The current configuration of this intersection is a four-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-5.

Figure 5-5 Current and SIDRA Assessed Layout – Musgrave Street / High Street Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-5.

Table 5-5 SIDRA Outputs – Musgrave Street / High Street Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.763	47.6	117.5	0.633	49.1	100.9
2018 Background	0.770	47.8	119.4	0.638	49.2	104.5
2028 Background	0.876	52.6	159.5	0.742	46.4	116.1
2018 With Development	0.781	50.2	132.8	0.663	46.7	102.6
2028 With Development	0.891	53.4	165.7	0.749	48.8	129.3

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.90 for signals), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios. It should be noted that queuing on Thursday blocks the left in/out access to the Stockland Centre off High Street seen in Figure 5-6.

Figure 5-6 Peak Queuing on High Street/Site Access and Musgrave Street/High Street

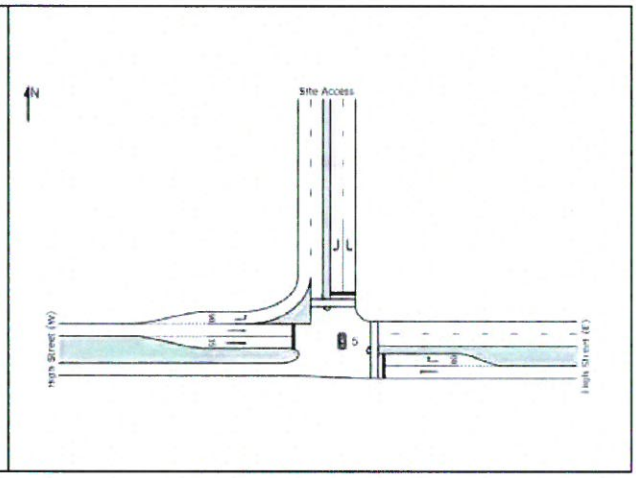
Thursday PM Peak Queues

Saturday Midday Peak Queues

5.4.5 High Street / Site Access Intersection

The current configuration of this intersection is a four-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-7.

Figure 5-7 Current and SIDRA Assessed Layout – High Street / Site Access Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-6.

Table 5-6 SIDRA Outputs – High Street / Site Access Intersection

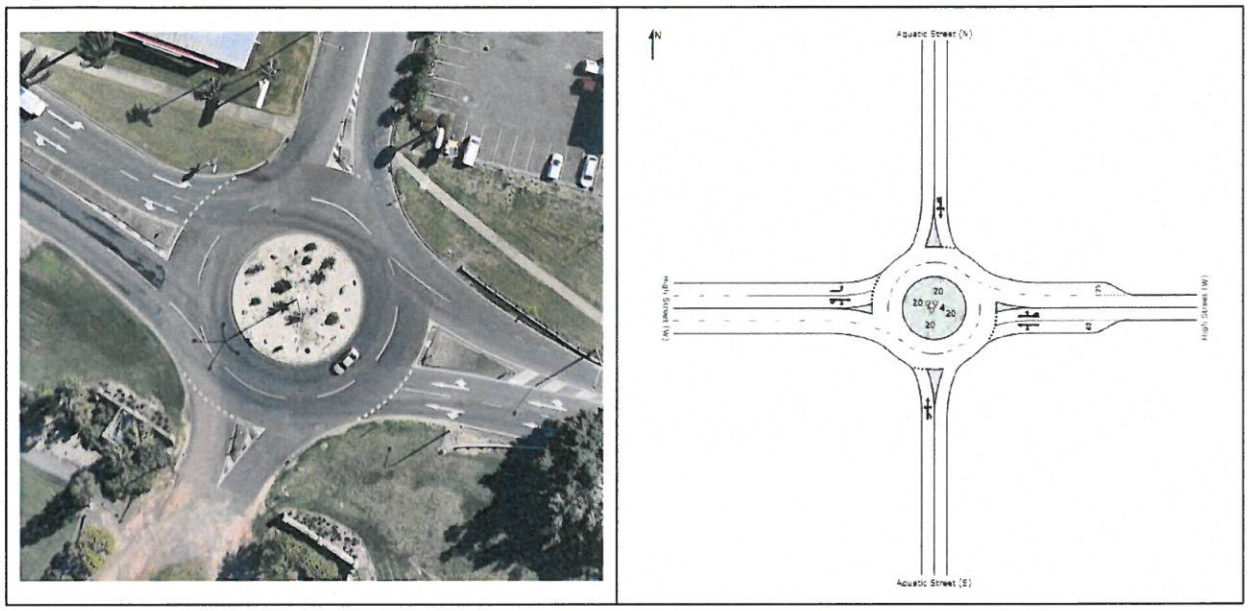
Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.492	13.5	38.2	0.418	13.7	36.6
2018 Background	0.497	14.0	38.6	0.422	13.8	36.6
2028 Background	0.546	14.3	43.1	0.464	13.9	40.6
2018 With Development	0.512	14.1	40.3	0.441	13.8	38.7
2028 With Development	0.561	14.3	44.7	0.482	14.1	42.5

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.90 for signals), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios.

5.4.6 High Street / Aquatic Place Intersection

The current configuration of this intersection is a roundabout arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-8.

Figure 5-8 Current and SIDRA Assessed Layout – High Street / Aquatic Place Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-7.

Table 5-7 SIDRA Outputs – High Street / Aquatic Place Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Critical Delay	95th%tile Queue	DOS	Critical Delay	95th%tile Queue
2017 Background	0.364	6.6	18.5	0.533	7.6	31.7
2018 Background	0.366	6.6	18.7	0.534	7.6	32.0
2028 Background	0.379	6.5	20.2	0.551	7.5	35.8
2018 With Development	0.408	6.8	21.7	0.585	7.9	40.2
2028 With Development	0.423	6.7	23.4	0.605	8.0	45.1

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.85 for roundabouts), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios.

Although the SIDRA results suggest the intersection has capacity remaining, Council advised (advice from Stuart Harvey, email dated 24 May 2017) that the intersection has been identified in the Plans for Trunk Infrastructure as requiring an upgrade subject to future demand, in conjunction with a required duplication of the High Street bridge. The operational results of the roundabout indicate that the existing form will be suitable for the design horizon scenario.

Analysis of the adjacent Bruce Highway / High Street / Alexandra Street, however, indicates that queues on High Street will extend through to the High Street / Aquatic Place intersection. The extent of the queues are illustrated on Figure 5-9. As shown, the Thursday PM peak is the critical period, where queues are shown to extend through the roundabout in both the background and with development scenarios.

Figure 5-9 Peak Queuing on High Street/Aquatic Place and Bruce Highway/High Street

Thursday PM Peak Queues

Saturday Midday Peak Queues

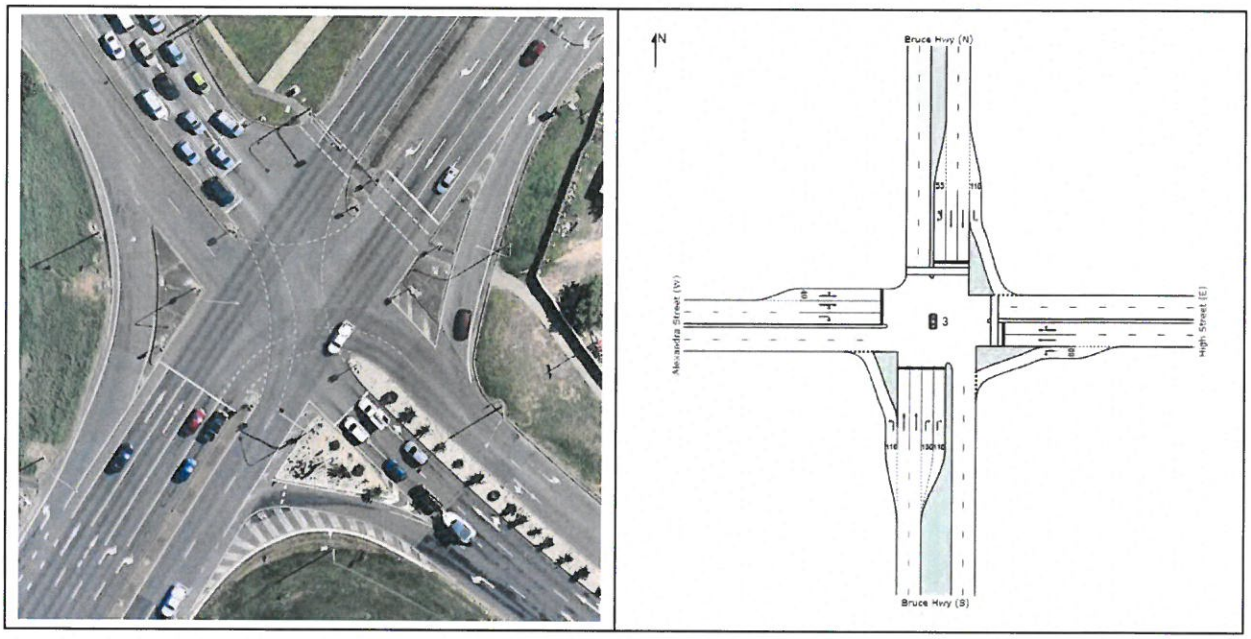
The upgrade of the High Street / Aquatic Place intersection to signals will allow the queueing impacts to be controlled through signal co-ordination with the Bruce Highway / High Street / Alexandra Street Intersection, in addition to the other signalised intersections along High Street.

With respect the queuing on Aquatic Place, the Saturday peak period indicates that the queue extends past the existing access to Bob Jane T-Mart, which is shown to occur in the 2028 background scenario regardless of the development. The impact of the development traffic is minimal, with an additional 10m queuing expected. It is recommended that a 'Keep Clear' section be provided at the access to ensure turning movements are not blocked by the queue.

5.4.7 Bruce Highway / High Street / Alexandra Street Intersection

The current configuration of this intersection is a four-way signalised arrangement. The aerial and SIDRA assessed layout are illustrated on Figure 5-10. TMR has advised via email (from Greg McTier, dated 17 May 2017) that 'new works are to occur at this intersection in the next few weeks. These works include the provision of a new pedestrian crossing across High Street.' As these works are planned for the immediate future, the modelled intersection includes the new crossing and the associated signal phasing.

Figure 5-10 Current and SIDRA Assessed Layout – Bruce Highway / High Street / Alexandra Street Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-8.

Table 5-8 SIDRA Outputs – Bruce Highway / High Street / Alexandra Street Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.737	43.3	212.7	0.742	46.0	166.0
2018 Background	0.763	45.5	233.3	0.740	46.0	168.8
2028 Background	0.951	61.6	390.4	0.835	50.0	215.9
2018 With Development	0.782	46.1	256.0	0.760	46.7	175.2
2028 With Development	0.954	62.8	390.1	0.858	51.5	226.8

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.9 for signals), for all assessed scenarios except the 10 year forecasts. The future background traffic and future with development traffic scenarios both exceed the performance thresholds.

High levels of queuing for the 10 year future scenarios are noted on the east approach on High Street. Queuing exceeds approach lane distances and spills back to the adjacent roundabout intersection on High Street and Aquatic Place as illustrated in Figure 5-9. The addition of the development traffic to the 2028 background traffic increases the queuing by 10.8m (approximately 2 vehicle lengths), which is not considered significant.

Additionally, with the inclusion of the proposed expansion traffic, the average delay is not significantly impacted when compared to the background scenario, indicated by the 1.2 second increase in average delay.

5.4.7.2 Sensitivity Analysis – Growth Rate

As discussed in section 4.3, the adoption of a 2% p.a. growth rate on the state controlled road network is considered to be a conservative assumption. Thus, a sensitivity analysis was undertaken to test the lower growth rate of 1% p.a. on the Bruce Highway which is representative of historic trends and population data.

The assessed configuration of this intersection is as per the layout shown in Figure 5-10. The results of the sensitivity assessment, for all assessed scenarios, are summarised in Table 5-9.

Table 5-9 SIDRA Outputs – Bruce Highway / High Street / Alexandra Street Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Average Delay	95th%tile Queue	DOS	Average Delay	95th%tile Queue
2017 Background	0.737	43.3	212.7	0.742	46.0	166.0
2018 Background	0.751	43.5	219.0	0.749	46.2	168.2
2028 Background	0.882	52.0	289.0	0.798	48.5	190.2
2018 With Development	0.770	46.3	235.5	0.770	46.9	176.1
2028 With Development	0.895	54.0	300.7	0.823	49.5	199.1

The results of the analysis indicate that the current form of the intersection operates within the typical performance thresholds (DOS ≤ 0.9 for signals), for all assessed scenarios.

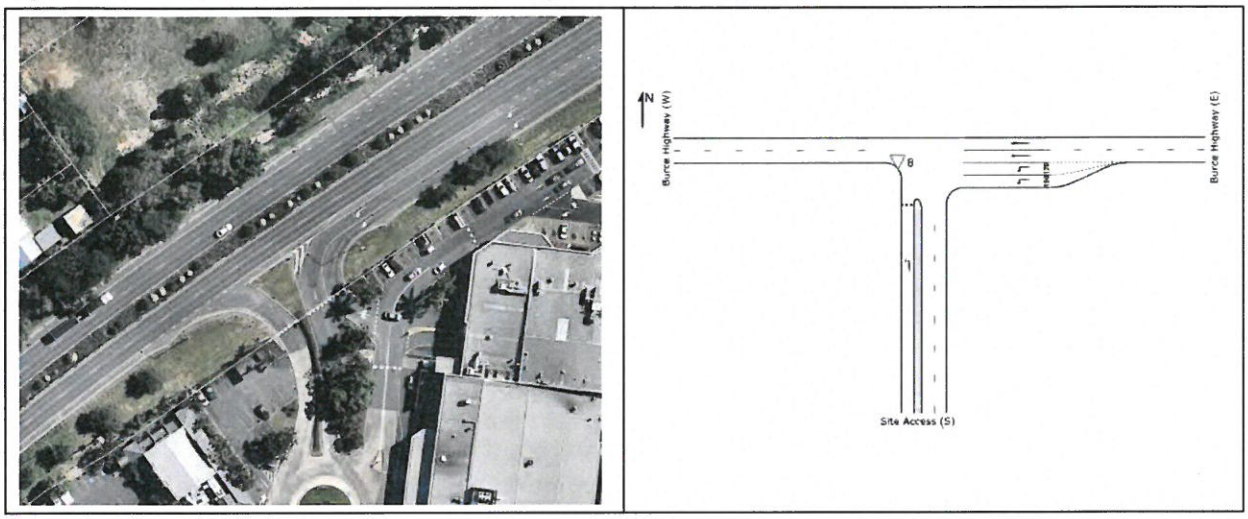
Furthermore, the impact of queuing on the eastern leg of the intersection will be reduced, with no queue blockage at the adjacent High Street / Aquatic Place intersection for both without and with development scenarios.

With the inclusion of the proposed expansion traffic, the average delay is not significantly impacted when compared to the background scenario, indicated by the 2 second increase in average delay. Therefore, the more representative growth rate of 1% p.a. on Bruce Highway indicates that the intersection will perform within capacity thresholds at the design horizon with the development traffic.

5.4.8 Bruce Highway / Left in Left out Access

The existing left in left out access at the Bruce Highway accommodates two left turn lanes into the site and one left turn lane exiting the site. The aerial and SIDRA assessed layout are illustrated on Figure 5-11.

Figure 5-11 Current and SIDRA Assessed Layout – Bruce Highway / Left in Left Out Intersection



The results of the SIDRA assessment, for all assessed scenarios, are summarised in Table 5-10.

Table 5-10 SIDRA Outputs - Bruce Highway / Left in Left Out Intersection

Scenario	Thursday PM Peak			Saturday AM Peak		
	DOS	Critical Delay	95th%tile Queue	DOS	Critical Delay	95th%tile Queue
2017 Background	0.217	6.2	3.4	0.209	6.2	4.6
2018 Background	0.221	6.2	3.5	0.213	6.2	4.6
2028 Background	0.264	6.8	3.8	0.255	6.8	5.0
2018 With Development	0.222	6.3	4.2	0.214	6.3	5.5
2028 With Development	0.265	6.9	4.6	0.256	6.9	6.0

The results of the analysis indicate that the existing arrangement operates within the typical performance thresholds (DOS ≤ 0.90 for signalised), for all assessed scenarios. It is noted that with the inclusion of the proposed expansion traffic, the average delay and 95th percentile queue are not significantly impacted, when compared to the background scenarios.

5.4.9 Summary

An assessment of the development traffic generation has indicated that the key intersections will operate within acceptable capacity thresholds with the exception of the Bruce Highway / High Street / Alexandra Street intersection. However, this intersection will exceed capacity thresholds in the background traffic scenario, regardless of the development traffic.

The addition of development traffic at this intersection is expected to be 1.9% and 2.5% of the 2028 background traffic volumes for the Thursday and Saturday peaks, respectively. This is not considered to be a significant impact and therefore, mitigation of the development impact is not considered to be reasonable.

6 Car Parking Study

6.1 Parking Requirement

As per discussions in the pre-lodgement meeting with Council on 19th April 2017, the following minimum parking rates were agreed upon:

- Shopping Centre - 4.1 spaces per 100 sq.m of gross leasable floor area; and
- Theatre (extension) – one (1) space per five (5) seats; or one (1) space per fifteen (15) sq.m of gross floor area, whichever is greater.

Based on the proposed yield, Table 6-1 outlines the minimum parking requirement.

Table 6-1 Minimum Parking Requirement

Land Use	Yield	Parking Rate	Parking Requirement
Shopping Centre	55,005 + 4,979 = 59,984 sq.m	4.1 spaces/100 sq.m	**2,459 spaces**
Cinema	954 + 215 = 1169 seats or 3,993 sq.m*	Greater of: 1 space per 5 seats or 1 space per 15 sq.m	Greater of: 234 spaces or **266 spaces**
Total	**63,977 sq.m**		**2,725 spaces**

Therefore, the minimum parking required for the expanded centre is 2,725 spaces.

6.2 Parking Provision

The centre currently provides for 2,823 spaces with a net centre GLA of 55,005 sq.m excluding the cinema. The proposed expansion is intended to comprise of an additional 215 seat theatre as part of the existing cinema and 4,979 sq.m GLA of retail.

The development proposes a net increase of 15 spaces, bringing the total provision post-expansion to 2,838 spaces. This equates to a parking rate of 4.73 spaces per 100 sq.m excluding cinema GLA and 4.44 spaces per 100 sq.m GLA including cinema GLA.

This provision meets the minimum requirement of 2,725 spaces, as indicated in Table 6.1, and exceeds the minimum parking rate of 4.1 spaces per 100 sq.m, therefore the proposed plans are deemed to provide sufficient parking for the overall centre post expansion.

7 Servicing Provision

7.1 Design Servicing Vehicles

Servicing will be provided as part of the expansion area, with a loading area located at the existing ground floor parking area north of Aquatic Place. This loading area will service the cinema and additional retail areas of the expansion.

The loading area has been designed to be separate from the main parking area, with a wall enclosing the space on the northern side. Access by service vehicles will be via Aquatic Place, with vehicles reversing into the loading zone and driving forward to exit.

A swept path assessment has indicated that servicing will be achieved for the following vehicles:

- Heavy rigid vehicle (HRV)
- 19.0m Articulated Vehicle (AV)

The swept paths are attached at Appendix D. It is shown that the HRV and AV will be able to access the loading area and exit the site without impacting on parking spaces. Service vehicles will be fully enclosed within the loading area, therefore the parking aisle will be kept clear for customer vehicle movements. The parking area to the immediate south of the loading zone has been amended to ensure the service vehicle movements do not impact on parking.

8 Summary and Conclusions

Cardno has been engaged by Stockland to undertake a Traffic Impact Assessment (TIA) for the proposed expansion of Stockland Rockhampton Centre, located 3km north-east of Rockhampton City. The redevelopment is intended to comprise of refurbishment and upgrade of the existing cinema and 4,979sq.m of additional retail connecting the main centre building to the cinema. The expansion is located on the north-western side of the existing site, which will be positioned over the existing car park.

Analysis was carried out to determine the existing centre generation and anticipated increase in generation as a result of the proposed expansion. The potential impact on the centre has been reviewed, with a focus on the operation of the access intersections and the parking provision.

8.1 Development Impact

The existing and proposed development has been assessed during a peak period, considered as the 85th percentile period which matches the top 15% busiest time period of the shopping year. The following conclusions have been made from the assessment:

- The existing traffic survey data indicates the Thursday and Saturday peak generation volumes for the centre are 2,565 vph and 3,476 vph, respectively.
- By applying the 85th percentile factor, the Thursday and Saturday peak generation volumes for the centre become 3,236 vph and 3,776 vph.
- The retail and cinema components of the traffic generation were separated to differentiate the projected trip generation for the two uses
- Regarding the retail component, the 85th percentile factor was used to calibrate the standard RMS generation curves for a shopping centre. The existing retail trip generation of 3,105 vph and 3,678 vph for the Thursday and Saturday peak periods, respectively, will be increased to 3,288 vph and 3,897 vph. This equates to an additional 183 vph and 219 vph for the Thursday and Saturday peak periods, respectively
- Regarding the cinema component, the 85th percentile factor was used to calibrate the existing cinema generation which was estimated from patron surveys and ticket sale data. The existing cinema trip generation of 131 vph and 98 vph for the Thursday and Saturday peak periods, respectively, will be increased to 160 vph and 120 vph. This equates to an additional 29 vph and 22 vph for the Thursday and Saturday peak periods, respectively
- Therefore, the total expansion will result in an additional 212 vph and 241 vph for the Thursday and Saturday peak periods, respectively.

8.2 Traffic Impact

The intersection assessment was undertaken for the eight key intersections including four external intersections, three signalised site access intersections and one left in left out access intersection, during the Thursday and Saturday peak periods. The following conclusions have been made from the assessment:

- The assessment adopted a 2% p.a. growth rate for the state controlled road network which is considered conservative but requested by TMR
- The site access intersections operate within acceptable capacity thresholds with the expansion traffic
- The external intersections operate within acceptable capacity thresholds with the exception of the Bruce Highway / High Street / Alexandra Street intersection which was shown to exceed capacity thresholds at the 2028 without and with development scenarios
- A sensitivity analysis for this intersection testing the impact of a lower growth rate of 1% p.a. on the state controlled road network indicates that the intersection will remain within acceptable capacity thresholds at the 2028 design horizon for both without and with development scenarios
- Queuing was shown to spill back from the Bruce Highway / High Street / Alexandra Street intersection to block the High Street / Aquatic Place intersection, however this is expected to be an issue in the background scenario, with the development traffic causing minimal impact. Sensitivity analysis for the 1% p.a. growth rate scenario has indicated that queues will be contained with storage lengths.

Overall, the assessment indicates that the access intersections operate sufficiently with the inclusion of the proposed expansion and do not cause a significantly detrimental impact to the existing road network. While the Bruce Highway / High Street / Alexandra Street intersection is expected to exceed capacity thresholds, this

is expected to occur in the background scenario and therefore mitigation works are not considered to be the responsibility of the developer.

8.3 Parking Impact

The centre currently provides for 2,823 spaces. Plans for the expansion indicate that a net gain of 15 spaces will be provided. This brings the total provision post-expansion to 2,838 spaces, which equates to an overall parking rate of 4.73 spaces per 100 sq.m excluding cinema GLA and 4.44 spaces per 100 sq.m GLA including cinema GLA.

This is in excess of the minimum parking rates outlined by Council which results in a parking requirement of at least 2,725 spaces. Therefore, the proposed parking provision is considered sufficient for the expansion.