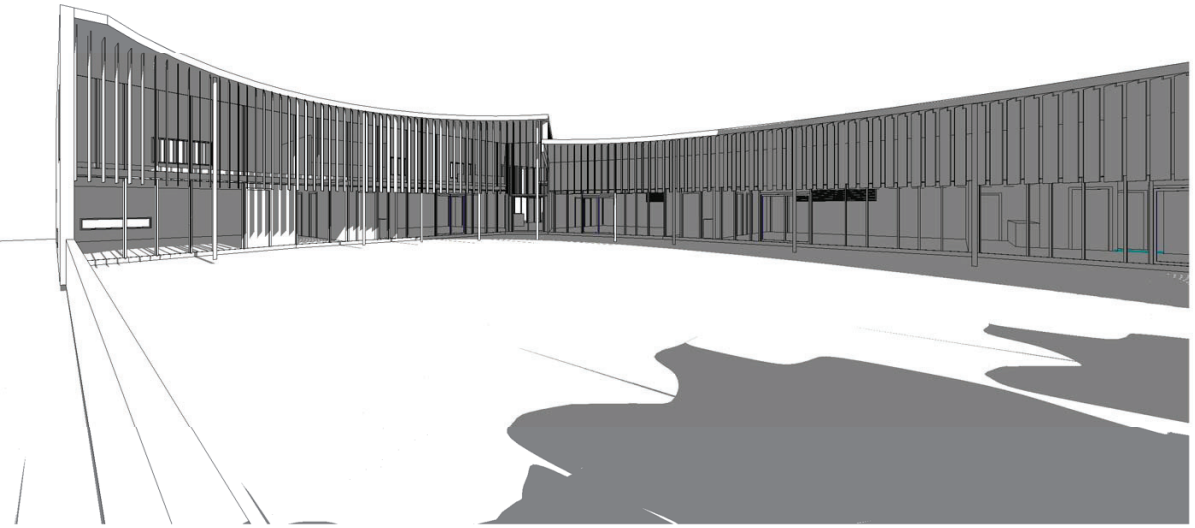

ROCKHAMPTON CHILDCARE CENTRE

NO# 44-50 MAIN STREET

DRAWING LIST

SK000 - COVER PAGE	NTS
SK100 - PROPOSED GROUND PLAN	1:200
SK101 - PROPOSED UPPER PLAN	1:200
SK102 - ROOF PLAN	1:200
SK103 - ELEVATIONS SHEET 1	1:200
SK104 - ELEVATIONS SHEET 2	1:200
SK105 - SECTIONS SHEET 1	1:200
SK108 - CONCEPT RENDER	NTS

SITE DATA

proposal
106 place childcare centre

local authority	Rockhampton Regional Council
site area	2428m2
site cover	698 sqm (28.8%)
building area	
enclosed ground floor	- 649sqm
enclosed upper floor	- 183 sqm
total	- 832 sqm
childcare centre	
no. of children	- 106
no. of activity rooms	- 6
staff	
full time	- 20
external play area	
required	- 742 sqm
provided	- 766 sqm
car parking	
required	- 38
provided	- 31 on site including 1 pwd

ROCKHAMPTON REGIONAL COUNCIL

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Dated: 8 December 2021

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CLIENT: DENE CROCKER

PROJECT: ROCKHAMPTON CCC NO# 44-50 MAIN STREET

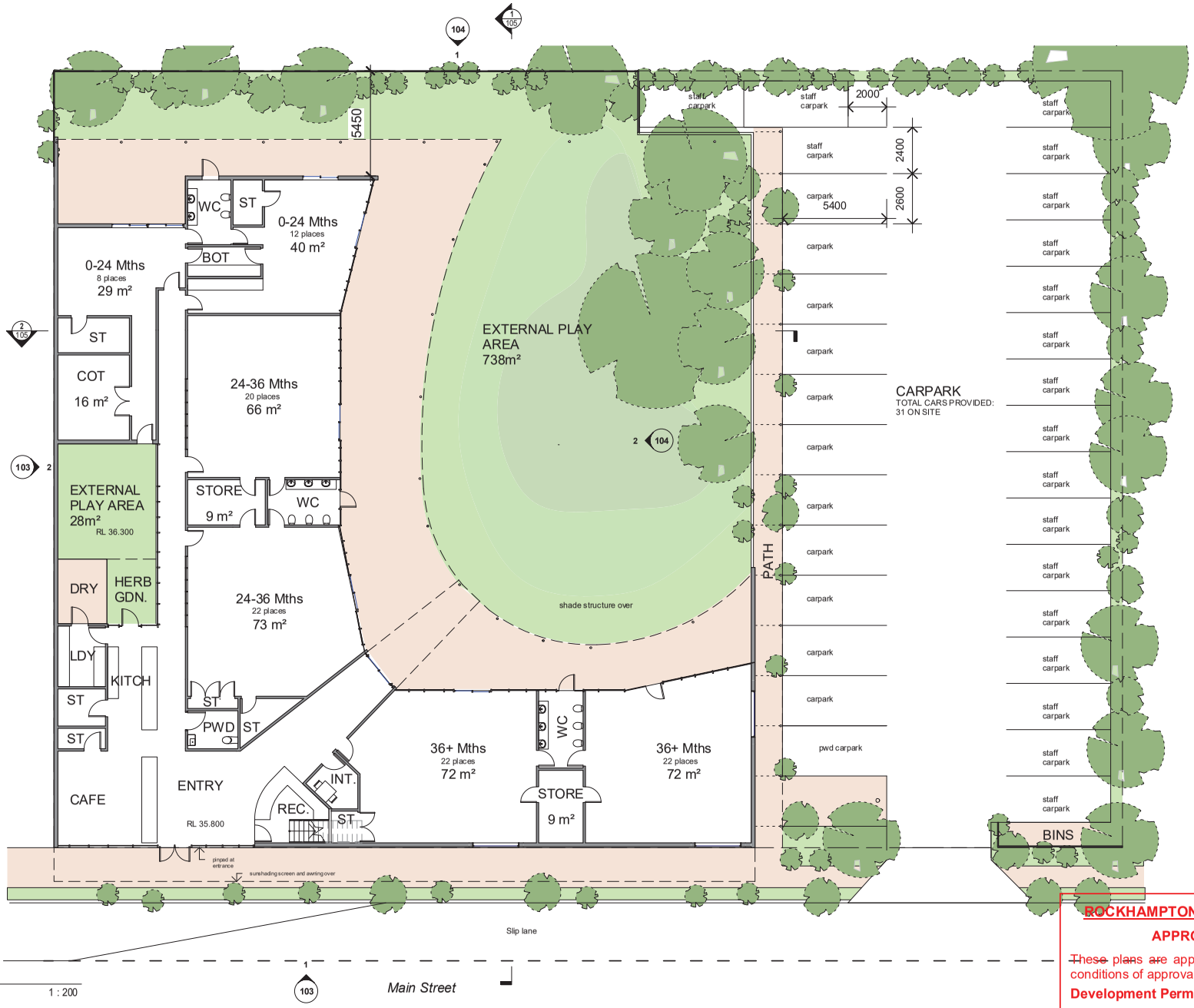
REVISION	DATE
P1	04.12.2015 - DA DRAFT
P2	16.12.2015 - DA DRAFT
A	21.12.2015 - DA SUBMISSION
B	20.05.2021 - DRAFT DA RE-SUBMISSION

DRAWING TITLE: COVER PAGE

SCALE @ A3: 1 : 50

PROJECT No: 1536

SHEET No: SK 000



1 FLOOR PLAN
GROUND 1 : 200

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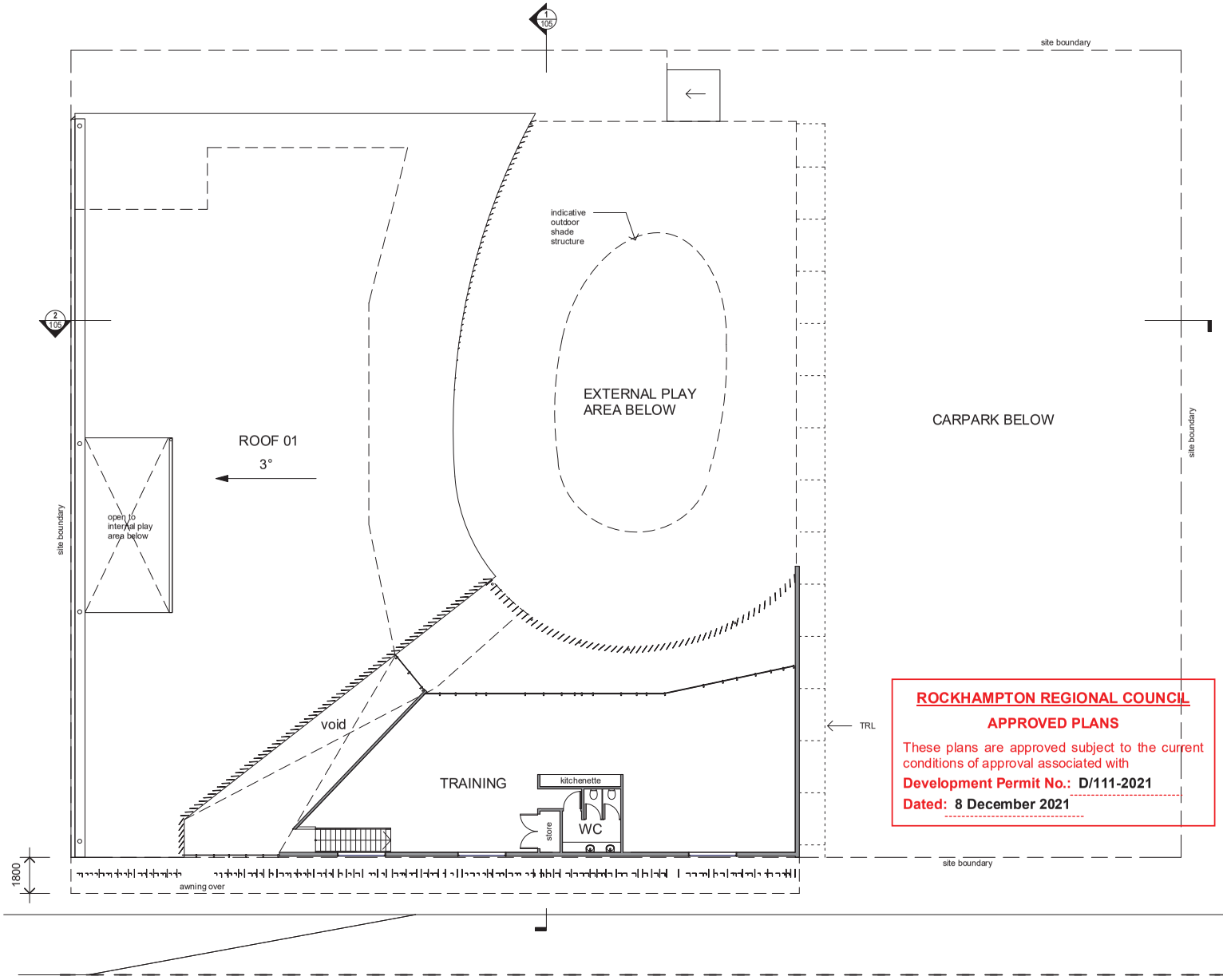
REVISION	DATE
P1	20.11.2015 - Preliminary
P2	04.12.2015 - DA DRAFT
P3	15.12.2015 - DA DRAFT
P4	16.12.2015 - DA DRAFT
P5	18.12.2015 - DA DRAFT UPDATE
A	21.12.2015 - DA SUBMISSION
B	20.05.2021 - DRAFT DA RE-SUBMISSION

DRAWING TITLE
PROPOSED GROUND PLAN

SCALE @ A3	PROJECT No	SHEET No
1 : 200	1536	SK 100



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1 FLOOR PLAN
UPPER 1 : 200

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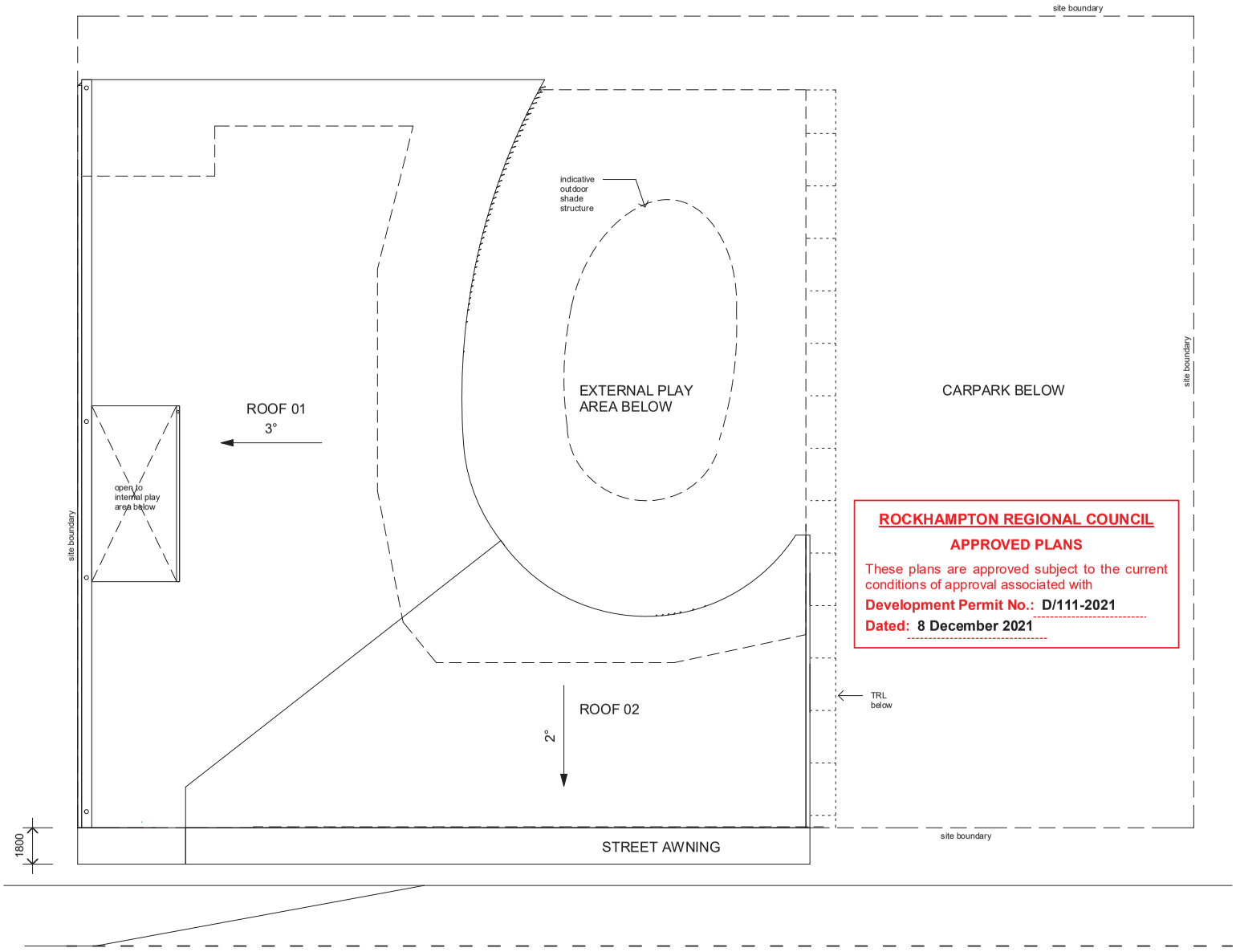
P3	16.12.2015 - DA DRAFT
A	21.12.2015 - DA SUBMISSION
B	20.05.2021 - DRAFT DA RE-SUBMISSION

DRAWING TITLE: PROPOSED UPPER PLAN

SCALE @ A3: 1 : 200 | PROJECT No: 1536 | SHEET No: SK 101



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1 FLOOR PLAN
ROOF 1 : 200

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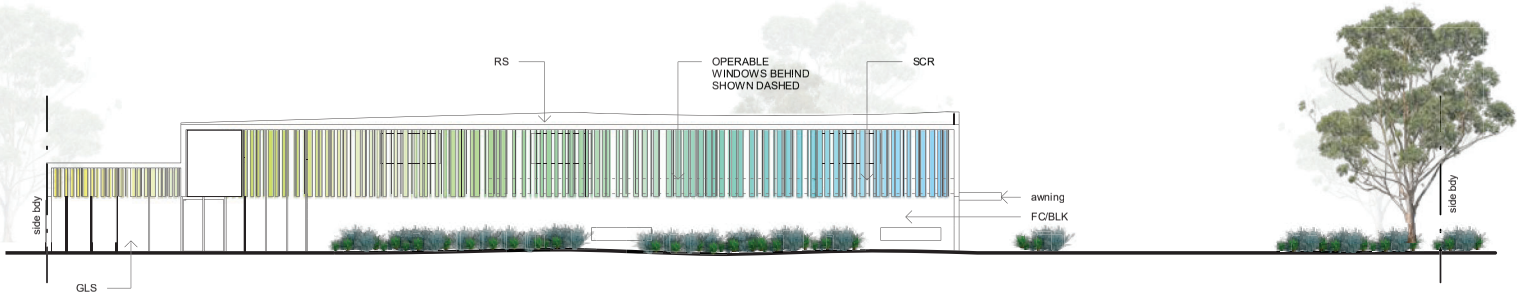
DRAWING TITLE: ROOF PLAN

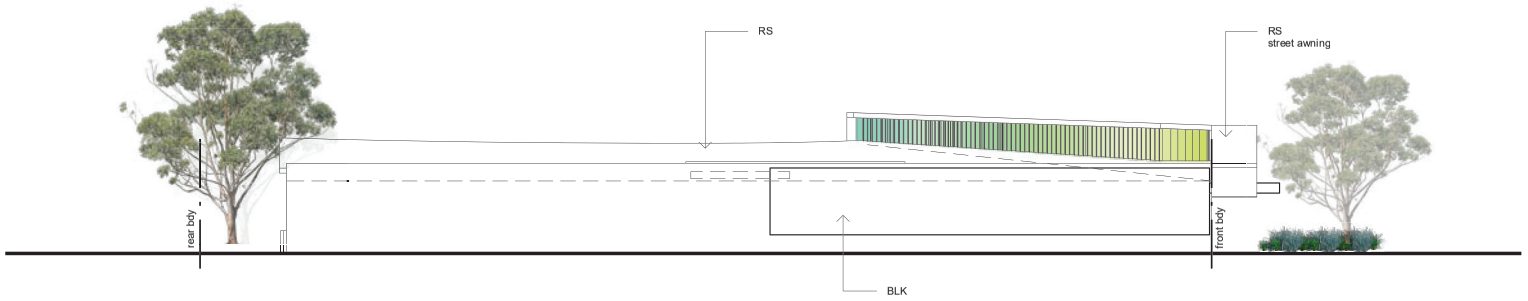
SCALE @ A3: 1 : 200

PROJECT No: 1536

SHEET No: SK 102



1 EASTERN ELEVATION 1 : 200



1 SOUTHERN ELEVATION 1 : 200

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Dated: 8 December 2021

MATERIALS

BLK	Block walling
FC	Fiber Cement Cladding
GLS	Glass
RS	Metal roof sheeting
SCRN	Folded metal screen
TC	Timber Cladding
TRL	Timber framed trellis with vegetation

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PROJECT: ROCKHAMPTON CCC NO# 44-50 MAIN STREET

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DRAWING TITLE: **ELEVATIONS SHEET 1**

SCALE @ A3: As indicated

PROJECT No: 1536

SHEET No: SK 103

1 WESTERN ELEVATION 1 : 200

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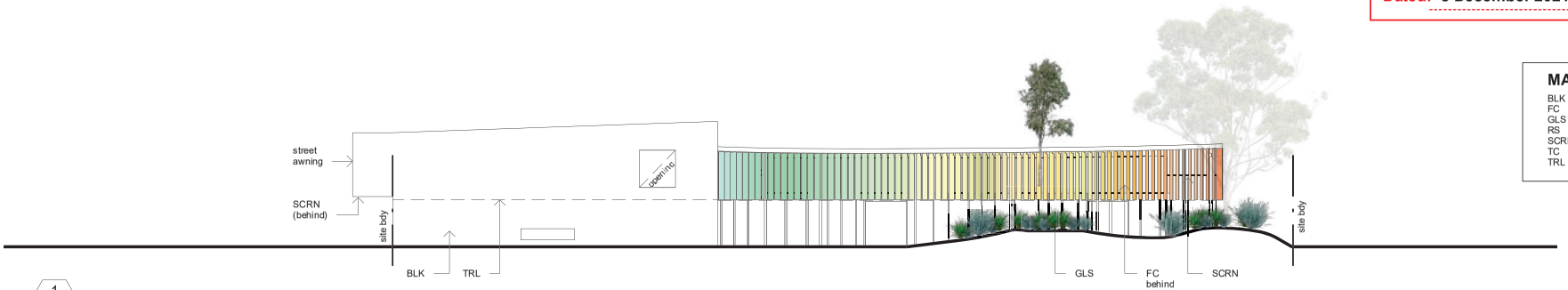

1 NORTHERN ELEVATION 1 : 200

MATERIALS

BLK	Block walling
FC	Fiber Cement Cladding
GLS	Glass
RS	Metal roof sheeting
SCRN	Folded metal screen
TC	Timber Cladding
TRL	Timber framed trellis with vegetation

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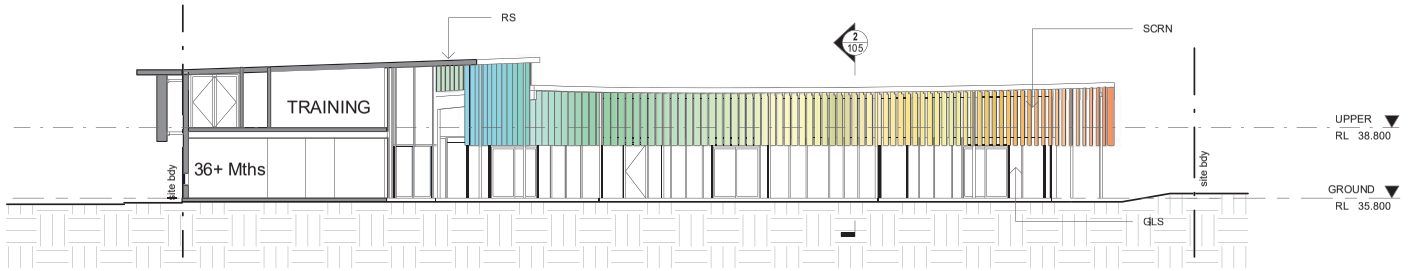
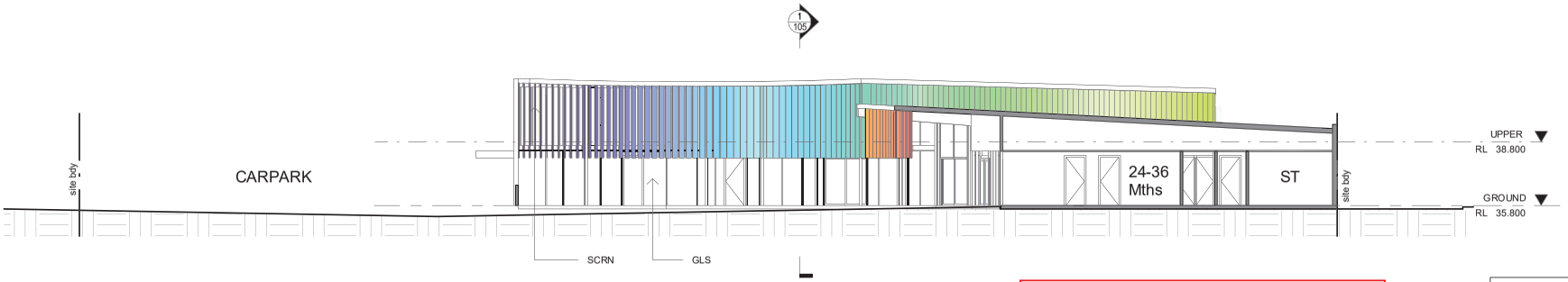
DRAWING TITLE
ELEVATIONS SHEET 2

SCALE @ A3 As indicated | PROJECT No 1536 | SHEET No SK 104



1 SECTION
SECTION 1 1 : 200



2 SECTION
SECTION A 1 : 200

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DRAWING TITLE
SECTIONS SHEET 1

SCALE @ A3 PROJECT No SHEET No
As indicated 1536 SK 105

OSKA CONSULTING GROUP

CONCEPTUAL STORMWATER MANAGEMENT PLAN

Proposed Childcare Centre

Lots 308-311 on RP603517 and Lot 67 on RP605801

46 - 50 Main Street
Park Avenue QLD 4701

For Tiverton Investments Pty Ltd ATF Croker Investment Trust

11 August 2021

File No: OSK3470-0004-A

DOCUMENT CONTROL SHEET

ROCKHAMPTON REGIONAL COUNCIL
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Development Permit No.: D/111-2021
Dated: 8 December 2021

Title:	Conceptual Stormwater Management Plan
Document No:	OSK3470-0004
Original Date of Issue:	18 December 2015
Project Manager:	Jason Webster
Author:	Daisy Pham
Client:	Tiverton Investments Pty Ltd ATF Croker Investment Trust
Client Contact:	Pete Sparkes – Adams and Sparkes Town Planning
Client Reference:	46 - 50 Main Street, Park Avenue
Synopsis:	This *Conceptual Stormwater Management Plan* describes the existing site characteristics and corresponding stormwater quantity and quality management controls to be implemented during the operation phase of the development.

Reviewed by Principal	Reg. No.	Signed	Date
Aaron Pianta	10423		11 August 2021

Revision/Checking History			
Revision No	**Date**	**Checked By**	**Issued By**
Original	18 December 2015	Aaron Pianta	Jamie Lee
DRAFT	5 August 2021	Aaron Pianta	Daisy Pham
A	11 August 2021	Aaron Pianta	Daisy Pham

Distribution		
Recipient	**No of Copies**	**Method**
Pete Sparkes – Adam and Sparkes Town Planning	1	PDF

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background

OSKA Consulting Group has been commissioned by Tiverton Investments Pty Ltd ATF Croker Investment Trust to prepare a *Conceptual Stormwater Management Plan* (CSWMP), to support a Development Application (DA) for the Proposed Childcare Centre situated at 46-50 Main Street, Park Avenue.

The subject site is described as Lots 308 - 311 on RP603517 and Lot 67 on RP605801 and has a total site area of 0.223 ha.

The original version of this CSWMP was approved by Rockhampton Regional Council on 04/02/2016 (Development Permit No D/187-2015). This revision (A) of the report has been prepared to ensure currency of stormwater management principles with Local Authority standards and guidelines as well as to update the modelling, calculation, and design to current standards. Revision A includes a revision in the stormwater management strategy to reflect the changes in the architectural design of the proposed childcare centre.

1.2 Objectives

This CSWMP details the planning, layout and design of the stormwater management infrastructure for both the construction and operational phases of this development.

This CSWMP aims to:

- Establish the required performance criteria for the proposed stormwater quantity and quality improvement systems;
- Provide a conceptual design of stormwater infrastructure including stormwater quality improvement devices;
- Demonstrate the modelled post-development stormwater quality discharging from the site does not adversely impact on the water quality and ecological values of downstream watercourses;
- Demonstrate stormwater runoff is conveyed through the site to a lawful point of discharge (LPOD) in accordance with Queensland Urban Drainage Manual (QUDM) and Council's Land Development Guidelines; and
- Provide reporting and monitoring mechanisms whereby the performance of this system can be measured enabling identification of corrective actions/alterations required to ensure the above-mentioned objectives are maintained.

This CSWMP has been prepared in accordance with the IEAust Australian Runoff Quality: Guide to Water Sensitive Urban Design, Queensland State Planning Policy 2017, IPWEA Queensland Urban Drainage Manual (QUDM) Fourth Edition (2017) and Rockhampton Regional Council – Development Guidelines, Rockhampton Regional Council – Rockhampton Region Planning Scheme Version 2.2 (June 2021).

1.3 Description of the Subject Site

1.3.1 *Location*

The subject site is located on 46-50 Main Street in the suburb of Park Avenue. The site fronts Main Street to the south and is bounded by residential lots to the north, west and east. The site covers 0.223 ha, with details as summarised in *Table 1* and as located in *Figure 1*.

Table 1: Site Description

Client	Lot and Property Description	Street Address
Tiverton Investments Pty Ltd ATF Croker Investment Trust	Lots 308 - 311 on RP603517 and Lot 67 on RP605801	46 - 50 Main Street, Park Avenue, QLD, 4701

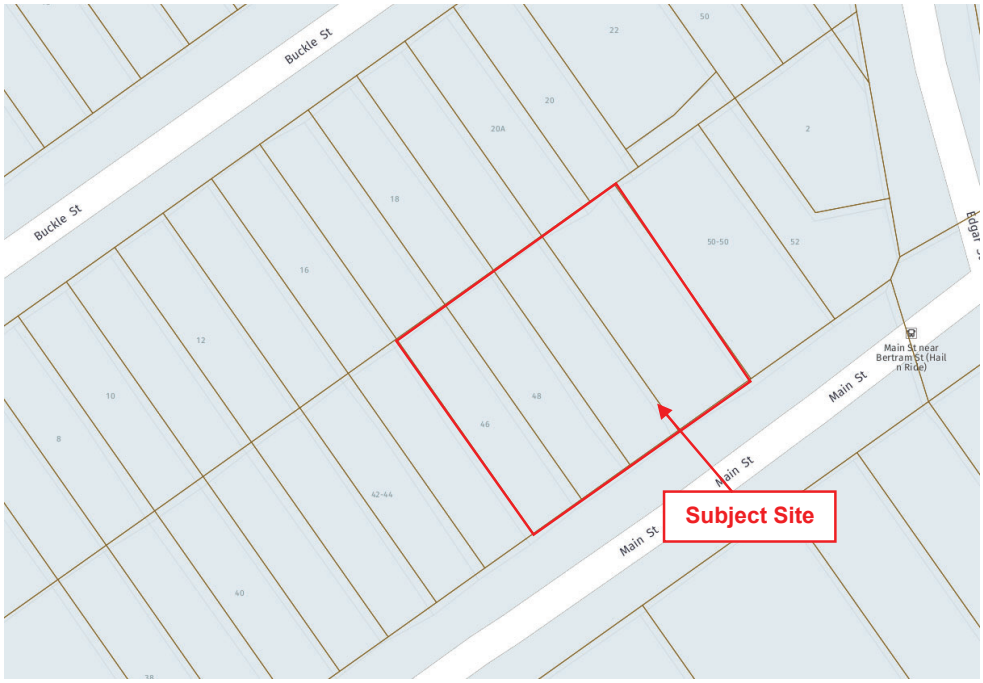


Figure 1: Site Location Plan (Source: Nearmap- Modified)

1.3.2 *Site Topography*

The grades across the site are variable with an average grade of 1.5% across the whole site. Ground levels on the site range from RL 35.8m AHD along the south-eastern boundary to approximately RL 34.8m AHD adjacent to the site's north-western corner.

Refer Richard Jon Knox Ford, Identification Survey, (Ref: R4704) included as Appendix A.

1.3.3 *Vegetation and Land Use*

The proposed development site currently consists of four singular lots. Lots 308 - 311 on RP603517 each contains existing carpark, bare soil with some scattered grass and lot 67 on RP605801 contains single storey house with the remainder being covered by vegetation and grass surface. These lots are being accessed to Main Street from the south and there are fences enclosing each lot. An aerial photograph of the site is illustrated in Figure 2.

Figure 2: Aerial Image of the site – (Source: Nearmap - Image taken on 5 June 2021)

1.3.4 *Description of Proposed Development*

The subject site is proposed to be a two-storey childcare centre including an external play area, with carparking. Access to the developed site will be gained via Main Street.

Refer to Appendix B for the proposed architectural details prepared by Barber Studio, Proposed Ground Plan (Ref: SK-100).

1.3.5 *Proposed Conceptual Drainage*

It is proposed that all captured stormwater from the proposed site area be diverted to proposed detention ponding above the proposed playground and carparking area. The captured flows within the detention ponding are piped to the kerb and channel on Main Street. The proposed drainage regime for the development is to be facilitated by a Building Hydraulics consultant at the detailed design phase.

1.4 IFD Rainfall Data

Rainfall intensity data has been obtained from the Australian Bureau of Meteorology's 2016 Design IFD Rainfall System. The data has been extracted for the nearest grid cell at Latitude 23.3569 (S) and Longitude 150.5101 (E). The IFD data and average rainfall intensities used in this report are in accordance with the procedures outlined in Geosciences Australia, Australian Rainfall and Runoff 2019.

2.0 DATA

The data in the preparation of this report, and information about the site was gathered from the following sources:

- Richard Jon Knox Ford, Identification Survey, (Ref: R4704)
- QLD LIDAR data for the subject site sourced from Elevation and Depth Foundation Spatial Data (ELVIS), Date Source: 2014, 1m DEM Data;
- Proposed site layout provided by Barber Studio, Proposed Ground Plan, (Ref: *SK-100*);
- Rainfall and Meteorological Data 2016 by the Australian Bureau of Meteorology;
- City Plan property report, provided by Rockhampton Regional interactive mapping system; and
- Aerial Imagery by Nearmap.

3.0 SITE HYDROLOGY AND HYDRAULICS

3.1 Background

The following sections define the method and parameters utilised within the hydrologic and hydraulic modelling of the site, in order to establish a simulation of the anticipated flow regime and peak discharge at the Lawful Point of Discharge (LPOD). The modelling has been undertaken in XP-SWMM for both the pre- and post-development scenarios, and a Rational Method calculation has been provided for comparison.

The Rational Method (Section 4.3 of the Queensland Urban Drainage Manual - QUDM 2017) is a suitable estimation technique, given its flexibility in its data requirements and is able to produce satisfactory estimates of peak site discharges based on the following data input:

- specific intensity frequency duration (IFD) data;
- length/type of flow path;
- contributing catchment areas; and
- coefficient of discharge.

3.2 Pre Development

3.2.1 *Catchment Definition and Lawful Point of Discharge*

The pre-development site has been analysed as a singular internal catchment and has a contributing area of 0.223 ha. All stormwater on the site is conveyed as overland flow through the subject site towards the site's northwest boundary.

The catchment area, its existing point of discharge, and LPOD for the subject site are shown on OSKA Consulting Group, Pre Development Catchment Plan (Ref: OSK3470/P001/B) included as Appendix C.

3.2.2 *Coefficient of Runoff*

The pre-development coefficient of runoff (C year) was determined based on the fraction impervious method specified in QUDM. The pre-development catchment, based on the provided survey information, has 0.089 ha of impervious surfaces, which equates to a fraction impervious (fi) of 9%. Using a one-hour, ten-year rainfall intensity (1:10) of 65.40 mm/hr, a C10 value of 0.76 has been adopted for the pre-development catchment.

The following pre-development coefficients of runoff (as shown in Table 2) have been adopted in accordance with QUDM Table 4.5.2, which apply the frequency factors for the standard Annual Exceedance Probability (AEP) design storms of 39%, 20%, 10%, 5%, 2% and 1% (corresponding to the 2, 5, 10, 20, 50 and 100 year Average Recurrence Interval (ARI) storms).

Table 2: Calculated Pre-Development Coefficient of Runoff

Catchment	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
Pre A	0.65	0.72	0.76	0.80	0.87	0.91

3.2.3 *Time of Concentration*

The Time of Concentration for each pre development catchment has been calculated in accordance with QUDM section 4.6.6 – Overland Flow. Friend's Equation (t = (107n L 0.333)/S 0.2) has been used to calculate the initial travel time using sheet flow. Please refer to Table 3 for the calculated time of concentration for the pre development catchment.

Table 3: Pre Development Time of Concentration

Catchment	Catchment Area (ha)	Catchment Properties	Time of concentration		
			Overland flow Friend's Equation	Concentrated Overland Flow	Total t_c
Pre A	0.223	Grassed Surface	Horton's (n) = 0.035 L = 35 m Slope = 5% t = 9 mins	-	9 mins

3.2.4 *Design Flow Rates*

Pre-development peak flow rates have been calculated for the adopted storms using design rainfall intensities from the Bureau of Meteorology IFD Data. The Rational Method ($Q = 2.78 \times 10^{-3}$ CIA) has been used to calculate the required design flow rates for the subject site. The pre development peak flows for the subject site are presented in Table 4.

Table 4: Pre-Development Peak Flow Estimation – Rational Method

Annual Exceedance Probability	AEP	39%	20%	10%	5%	2%	1%
Coefficient of Runoff	C	0.65	0.72	0.76	0.80	0.87	0.91
Area of Catchment (ha)	A	0.223	0.223	0.223	0.223	0.223	0.223
Average Rainfall Intensity (mm/h)	I	123	150	173	199	234	262
Peak Flow Rate (m^3/s)	**Q**	**0.049**	**0.067**	**0.081**	**0.098**	**0.127**	**0.148**

3.3 Post Development

3.3.1 *Catchment Definition and Lawful Point of Discharge*

The post-development scenario has been analysed as the same internal catchment as described in the pre-development scenario and has a total contributing area of 0.223 ha.

Stormwater collected from the site shall be conveyed to detention ponding allocated within the proposed playground and carpark areas before being discharged to the existing kerb and channel on Main Street via kerb adaptors.

The internal building drainage design to facilitate this stormwater strategy is to be designed by the Building Hydraulic Engineer at the detailed design phase.

The post development catchment area and LPOD are detailed on OSKA Consulting Group, Post Development Catchment Plan (Ref: OSK3470/P002/B) included as Appendix D.

3.3.2 *Coefficient of Runoff*

The post-development coefficients of runoff (C year) were determined using the fraction impervious method as specified in QUDM.

Based on the supplied architectural plans, the post-development catchment has approximately 0.156 ha of impervious surfaces, which equates to a fraction impervious (fi) of 70%. Using a one-hour, ten-year rainfall intensity (1:10) of 65.40 mm/hr, a C10 value of 0.83 has been adopted for the post-development catchment.

The following post-development Coefficients of Runoff (as shown in Table 5) have been adopted in accordance with QUDM Table 4.5.2, which apply the frequency factors for the standard Annual Exceedance Probability (AEP) design storms of 39%, 20%, 10%, 5%, 2% and 1% (corresponding to the 2, 10, 20 and 100-year ARI storms).

Table 5: Post-Development Coefficient of Runoff

Catchment	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
Post A	0.71	0.79	0.83	0.87	0.95	1.00

3.3.3 *Time of Concentration*

The Time Of Concentration for the post developed catchments has been calculated in accordance with QUDM Table 4.6.1 – Recommended roof drainage system travel times.

In accordance with Table 4.6.1 of QUDM, the post-development catchment will have a time of concentration that will incorporate 5 minutes.

3.3.4 *Design Flow Rates*

Post-development peak flow rates have been calculated for the adopted storms using design rainfall intensities from the Bureau of Meteorology 2016 IFD Data. The Rational Method ($Q = 2.78 \times 10^{-3}$ CIA) has been used to estimate the required design peak flow rates for the subject site. The post-development peak flows for the subject site are presented in Table 6.

Table 6: Post Development Peak Flow Estimation – Rational Method

Annual Exceedance Probability	**AEP**	39%	20%	10%	5%	2%	1%
Coefficient of Runoff	**C**	0.71	0.79	0.83	0.87	0.95	1.00
Area of Catchment (ha)	**A**	0.223	0.223	0.223	0.223	0.223	0.223
Average Rainfall Intensity (mm/h)	**I**	143	174	200	230	270	301
Peak Flow Rate (m^3/s)	**Q**	**0.062**	**0.085**	**0.103**	**0.124**	**0.160**	**0.186**

3.4 Change in Flow Rates

The difference in peak flow rates calculated from the total pre and post developed site has been analysed via The Rational Method, with the results detailed in Table 7.

Table 7: Change in Peak Flow Rates

Annual Exceedance Probability	**AEP**	39%	20%	10%	5%	2%	1%
Pre Developed Peak Flow Rate (m^3/s)	**Q**	0.049	0.067	0.081	0.098	0.127	0.148
Post Developed Peak Flow Rate (m^3/s)	**Q**	0.062	0.085	0.103	0.124	0.160	0.186
Change in Peak Flow Rate (m^3/s)	**Q**	+0.013	+0.018	+0.022	+0.026	+0.033	+0.038

The proposed development has demonstrated via a Rational Method assessment an increase in peak flow rates discharging from the site, therefore on-site detention is deemed required to mitigate flows to pre development conditions.

3.5 External Catchments

The subject site and the surrounding area were examined to determine if any localised external catchments will contribute to the subjected site.

The site has no influencing localised external catchments.

4.0 STORMWATER QUANTITY ASSESSMENT

4.1 Background

The development of land will potentially increase peak flow rates from the subject site due to increased impervious areas and a reduction in the surface roughness of the site. Accordingly, the following section provides preliminary details of a proposed On-Site Detention (OSD) system to demonstrate no increase in nuisance flows and adverse impacts, as a result of potential increased post-development runoff, on neighbouring properties and/or authorities stormwater infrastructure.

4.2 Objective

In accordance with Rockhampton Regional's requirements and typical standard practices, the following objective has been set for post-development stormwater discharge from the site:

- No net increase in peak flows from the subject site, for all durations up to the 1% AEP design storm event, during the post developed condition.

This objective shall be demonstrated via a suitable hydrologic and hydraulic modelling package by detaining site runoff from the subject site within a proposed detention parking area. An estimation of the required detention volume to mitigate any increase in total site discharge rates has been undertaken using the XP-SWMM software program.

4.3 Hydraulic Model

An estimation of the required detention volume to mitigate any increase in total site discharge rates has been undertaken using the XP-SWMM software programme, in accordance with Australian Rainfall and Runoff 2019 (ARR 2019) Guideline.

A XP-SWMM model has been adopted at the preliminary planning stage to ensure that the detention pond volume is estimated with a higher degree of confidence. As finished site levels and internal pipe levels are still preliminary, this initial calculation is an estimate. However, it has the required level of accuracy to progress the design with confidence.

The model was developed by simulating the pre, post and mitigated catchment layouts and comparing the peak flow rates generated from each scenario. The mitigated catchment consists of the 1% AEP runoff generated from the whole site, including roof, carpark, ground, and landscaping areas. This catchment arrangement provides enough mitigation to demonstrate no increase in the peak flow rates exiting the site when compared to the pre-development scenario.

A range of storm events up to 1% AEP design storm events were analysed for all standard durations ranging from 5 minutes to 360 minutes. The combined peak discharge rates for the site calculated by the XP-SWMM model are shown in Table 8 for both scenarios.

Table 8: Anticipated Peak Site Discharge Rate – Extracted from XP-SWMM Model (m^3/s)

Peak Flow Rate Discharge (m3/s)						
Design AEP Events	**0.5EY**	**0.2EY**	**10%**	**5%**	**2%**	**1%**
Pre Development	0.051	0.065	0.073	0.088	0.111	0.127
Post Development (unmitigated)	0.061	0.078	0.093	0.109	0.129	0.146

The proposed development has demonstrated via a XP-SWMM assessment that an increase in peak flow rates discharging from the site is anticipated, therefore On-Site Detention (OSD) is deemed required to mitigate flows to pre-development conditions.

4.4 Detention volume

The following detention storage parameters were adopted to achieve the target pre-development flow rates, via mitigation of the post-development flow rates.

Table 9: Adopted Detention Pond Parameters

Base of Detention Area:	0 m^2
Top of Detention Area:	840 m^2
Low Flow Outlet	2x100 mm ∅ Pipes
High Flow (Crest above 0.05m from base)	5.5 m length weir
Maximum Water Depth	0.1 m
Required Detention Volume	30 m^3

The 15-minute design storm was determined as the critical storm duration for determining the required volume within the detention pond. A comparison of the pre-development and mitigated flow rates based on the above arrangement are shown in Table 10.

Table 10: Comparison of Pre-Development and Mitigated Flow Rates – Extracted from XP-SWMM

Annual Exceedance Probability	**0.5EY (39%)**	**0.2EY (18%)**	**10%**	**5%**	**2%**	**1%**
Pre-Development Peak Flow Rate (m^3/sec)	0.051	0.065	0.073	0.088	0.111	0.127
Mitigated Peak Flow Rate (m^3/sec)	0.048	0.06	0.068	0.084	0.1	0.114

The hydrograph for the critical duration of the selected storm event is shown in Figure 3

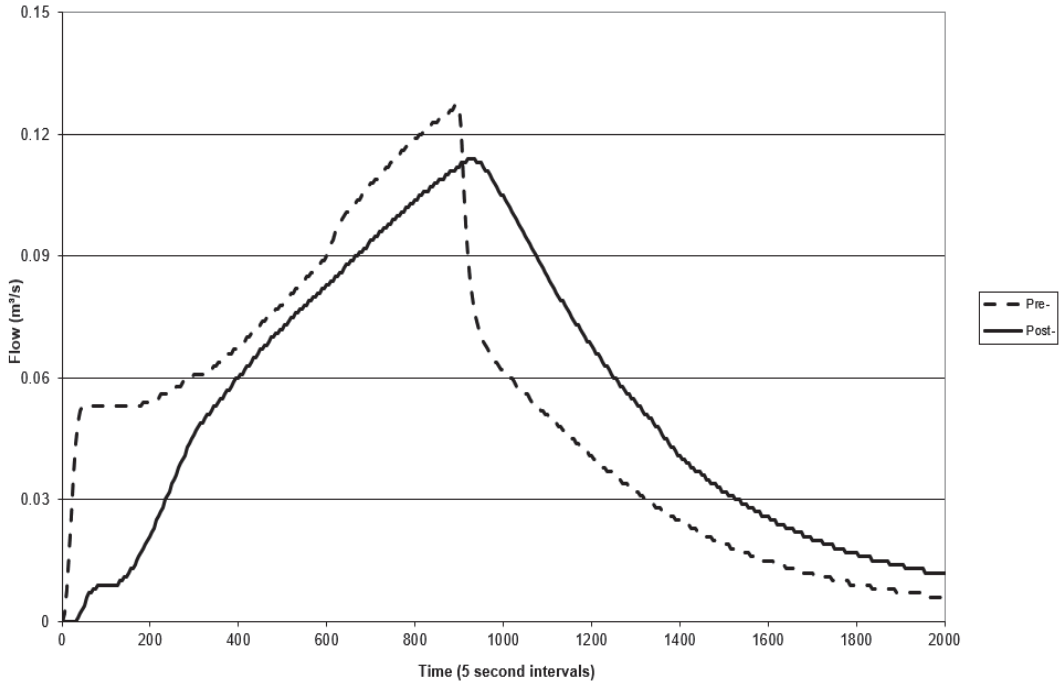


Figure 3: Mitigated Catchment Post Development Flow Rates for 1% AEP storm event

As indicated in Figure 3, the hydrograph mitigated post-development scenario can be seen to be consistent with the pre-development scenario for the subject site. Therefore, it is envisaged that the time to peak and peak flow rates from the proposed development site will be maintained as the existing scenario.

As demonstrated in the results displayed in Table 10, the detention arrangement can be seen to effectively mitigate the post-development flows in the adopted critical design storm AEP events.

The hydraulic analysis using the XP-SWMM model has determined that a minimum total of 30 m³ of storage is required for runoff attenuation and is to be provided in the form of a detention ponding within the proposed playground and carpark areas. The detention ponding area is to be fitted with an outlet configuration (with low and high flow outlets) as detailed in Table 8 to satisfy the mitigation requirements. Refer to OSKA Consulting Group, Stormwater Management Plan (Ref: OSK3470/P003/B) in Appendix E for details of the detention ponding area's arrangement and indicative location. The final location onsite, surface grading and construction levels will be determined at the detailed design stage.

A copy of XP-SWMM model used in this report has been made available as part of the DA submission.

5.0 STORMWATER QUALITY ASSESSMENT

5.1 Background

The development of land has the potential to increase the pollutant loads within stormwater runoff and downstream watercourses. During the construction phase of the development, disturbance to the vegetation on the site has the potential to significantly increase sediment loads entering downstream watercourses. The operational phase of the development will increase the hard surfacing areas of the land use potentially increasing the amount of sediments and nutrients washing from the site.

The following sections describe the predicted increase in pollutant loads generated by the proposed development/construction phase and treatment devices to mitigate the potential increases.

5.2 Construction Phase

A high risk of stormwater pollution will occur from the site during the construction phase due to erosion and sediment transportation off site to the receiving environment. Most of this risk results from construction activities disturbing the site and exposing areas of soil to the direct erosive influence of the environment.

The following section outlines the procedures necessary to minimise erosion and control sediment during construction in accordance with the International Erosion Control Association (IECA) Best Practice ESC Document.

5.2.1 *Key Pollutants*

The key pollutants have been identified for the Construction Phase of this development.

Table 11: Key Pollutants, Construction Phase

Pollutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, material offcuts.
Sediment	Exposed soils and stockpiles during earthworks and building works.
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas.
Toxic Materials	Cement slurry, asphalt primer, solvents, cleaning agents, and wash waters (e.g., from tile works).
Acids or Alkaline substances	Acid sulphate soils, cement slurry and wash waters.

5.2.2 *Sediment and Erosion Control*

Sediment and Erosion Control devices (S&EC) employed on the site shall be designed and constructed in accordance with the International Erosion Control Association (IECA) Best Practice ESC Document as shown on OSKA Consulting Group, Sediment and Erosion Control Plan (Ref: OSK3470/P004/B) and OSKA Consulting Group Sediment and Erosion Control Details (Ref: OSK3470/P005/B) included as Appendix F.

Pre-Construction

- Stabilised site access/exit onto Main Street to the south;
- Sediment fences to be located around the perimeter of the site;
- Sediment trap to be installed in the northern boundary of the site;
- Dust fencing to be installed if required; and
- Educate site personnel to the requirements of Erosion and Sediment Control Plan.

Initial Construction – Bulk Earthworks

- Maintain construction access/exit, sediment fencing, dust fences and all other existing controls as required;
- Construct diversion drains to convey disturbed site run-off to the temporary sediment traps; and
- Confine construction activities to stages to minimise areas of disturbance at any given time.

Second Stage Construction

- Maintain construction access/exit, sediment fencing, dust fences, diversion drain and all other existing controls as required;
- Progressively revegetate finished areas where applicable;
- Divert runoff from undisturbed areas around disturbed areas; and
- Drainage structure protection around field inlets and gully pits.

During construction, all areas of exposed soils allowing dust generation are to be suitably treated. Treatments will include covering the soil and watering. Road accesses are to be regularly cleaned to prevent the transmission of soil on vehicle wheels and eliminate any build-up of typical road dirt and tyre dust from delivery vehicles.

Adequate waste disposal facilities are to be provided and maintained on the site to cater for all waste materials such as litter, hydrocarbons, toxic materials, acids or alkaline substances.

5.2.3 *Water Quality Monitoring and Inspections*

To ensure that the water quality objectives are being met during the construction phase of the development, water quality monitoring shall be conducted. Water quality monitoring shall use a calibrated probe or sampling and testing at a NATA registered laboratory.

Location: Monitoring Station MS1 shown on OSKA Consulting Group, *Sediment and Erosion Control Plan* (Ref: OSK3470/P004/B).

Parameters: Site discharge criteria.

Frequency: Following at least 30 mm of rainfall in a 24-hour period.

The contractor shall be responsible for the inspection and maintenance of all sediment and erosion control devices. Additional controls and review of existing controls shall be undertaken in response to the results of the above-mentioned monitoring program.

5.2.4 *Reporting*

An inspection report shall be written by a suitably qualified and experienced scientist/engineer following each water quality monitoring episode. The report shall include at least the following information:

- Name, address and real property description for the development site;
- Council file reference number (if known);
- Monitoring locations;
- Performance criteria;
- Results for each monitoring location, identifying any breaches of performance criteria;
- Recommended corrective actions to be taken and additional sediment and erosion controls, if required; and
- Inspection reports shall be provided to the contractor for their action and compilation in an on-site register.

If the above-mentioned performance criteria are exceeded and results from the downstream monitoring stations show significant deterioration from upstream results (if applicable), the contractor shall implement all recommendations of the inspection report within one (1) working day of receipt of the report.

5.3 Operational Phase

The proposed development for the subject site does not propose to disturb an area greater than 2500 m² and will result in less than 6 lots. Therefore, it is not assessable under State Planning Policy (SPP), July 2017 and shall not require water quality devices.

Best Management Practices (BMP) are recommended to be implemented by the developer.

6.0 CONCLUSION

OSKA Consulting Group has been commissioned by Tiverton Investments Pty Ltd ATF Croker Investment Trust to prepare a Conceptual Stormwater Management Plan (CSWMP), to support a Development Application (DA) to the Rockhampton Regional for the proposed childcare centre development situated at 46 - 50 Main Street, Park Avenue. This CSWMP intends to provide an optimised stormwater management system that would be compatible and readily integrated into the proposed site use.

This CSWMP details the conceptual planning, layout, and design of the stormwater management infrastructure for both the construction and operational phases of this development and satisfies the requirements of the Rockhampton Regional's Land Development Guidelines.

A hydrological analysis demonstrated that the anticipated post-development peak flow rates discharging from the site are higher than the pre-development flow rates. A hydraulic model was built using the XP-SWMM software program, to estimate the required detention volume and arrangement. The report and stormwater management plan define the preliminary size and layout of the proposed detention ponding. A total detention area of 840 m2 was modelled, which demonstrates no additional or actionable nuisance associated with the increased runoff rate on downstream properties and infrastructure.

A monitoring and maintenance plan for the proposed infrastructure has been included. Sediment and erosion control plans are provided for the construction phase of the development and shall be implemented by the contractor and developer.

The proposed development for the subject site does not propose to disturb an area greater than 2500 m² and will result in less than 6 lots. Therefore, it is not assessable under State Planning Policy (SPP), July 2017 and shall not require water quality devices. Best Management Practices (BMP) are recommended to be implemented by the developer.

APPENDIX

A

Richard Jon Knox Ford,

Identification Survey,

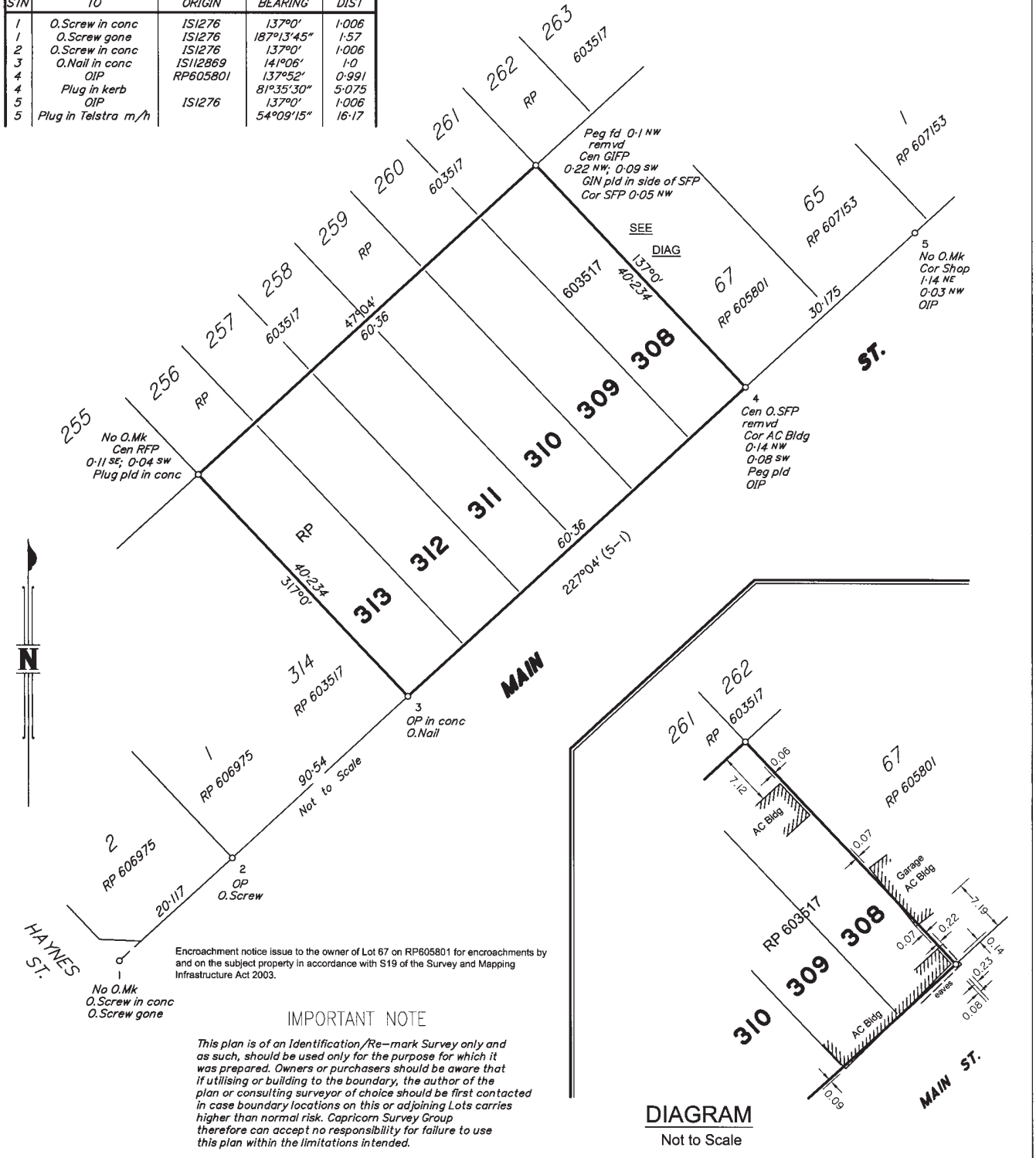
(Ref: R4704)

SURVEY PLAN

Sheet 1 of 1

REFERENCE MARKS

STN	TO	ORIGIN	BEARING	DIST
1	O.Screw in conc	IS1276	137°0'	1·006
1	O.Screw gone	IS1276	187°13'45"	1·57
2	O.Screw in conc	IS1276	137°0'	1·006
3	O.Nail in conc	IS112869	141°06'	1·0
4	OIP	RP605801	137°52'	0·991
4	Plug in kerb		81°35'30"	5·075
5	OIP	IS1276	137°0'	1·006
5	Plug in Telstra m/h		54°09'15"	16·17



Encroachment notice issue to the owner of Lot 67 on RP605801 for encroachments by and on the subject property in accordance with S19 of the Survey and Mapping Infrastructure Act 2003.

IMPORTANT NOTE

This plan is of an Identification/Re-mark Survey only and as such, should be used only for the purpose for which it was prepared. Owners or purchasers should be aware that if utilising or building to the boundary, the author of the plan or consulting surveyor of choice should be first contacted in case boundary locations on this or adjoining Lots carries higher than normal risk. Capricorn Survey Group therefore can accept no responsibility for failure to use this plan within the limitations intended.

DIAGRAM

Not to Scale

CAPRICORN SURVEY GROUP

ROCKHAMPTON & GLADSTONE

Scale 1:500 – Lengths are in Metres.

5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

0 50 mm 100 mm 150 mm

State copyright reserved.

I, Richard Jon Knox Ford, hereby certify that Christopher Stephen Helliwell, Surveying Associate, for whose work I take responsibility, has surveyed the land comprised in this plan and that the plan is accurate, that the said survey was performed in accordance with the Survey and Mapping Infrastructure Act 2003 and Surveyors Act 2003 and associated Regulations and Standards and that the said survey was completed on 24-11-2006.

30-11-06
Date

Cadastral Surveyor

IDENTIFICATION SURVEY of Surround of

Lots 308–313 on RP603517

Scale: 1:500

Format: STANDARD

IS206964

Map Reference: 9051–34334		Orig. Por.: Por 154	
Local Government: Rockhampton C.C.		Locality: Park Avenue	
PARISH: MURCHISON		COUNTY: Livingstone	
Meridian: IS 112869	Ref: R4704	F/N's: NO	Plan Status:

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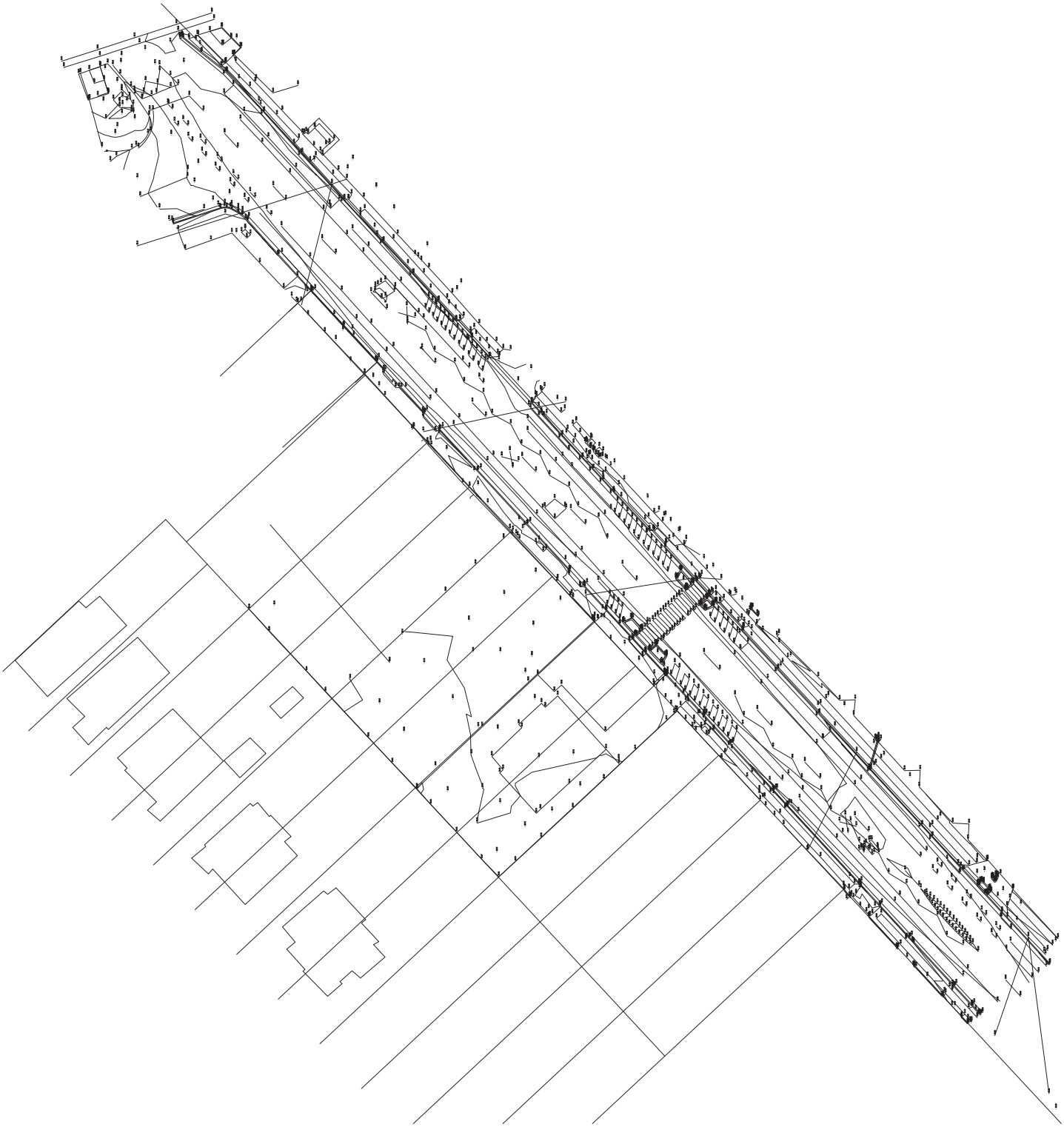


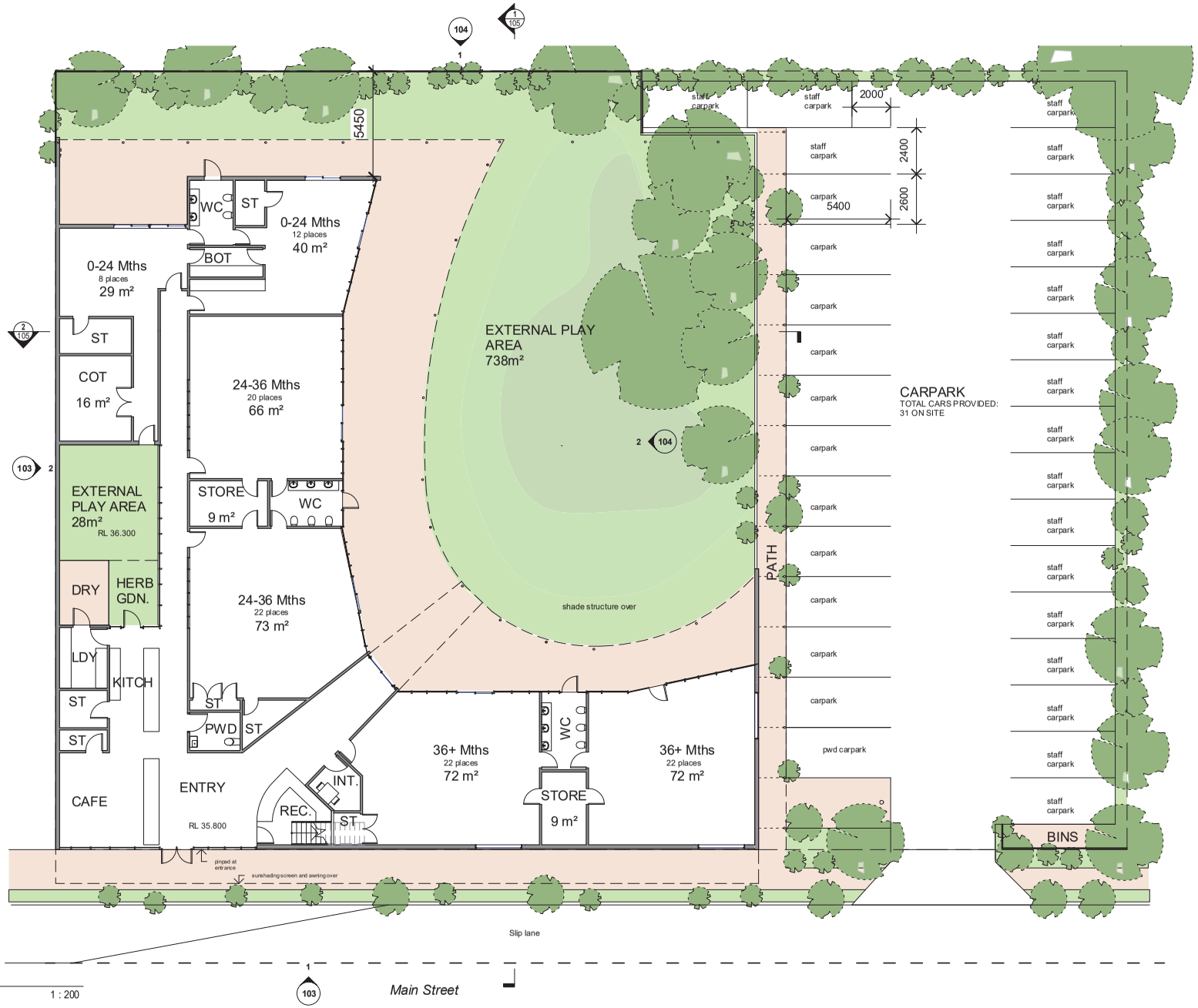
APPENDIX

B

Barber Studio

Proposed *Ground Plan*

(Ref: Ref: SK-100)



1 FLOOR PLAN
GROUND 1 : 200

PRELIMINARY - FOR INFORMATION ONLY - NOT FOR CONSTRUCTION

BABER STUDIO
KIM BABER - Registered Architect
Unit 9/ 173 Boundary St, West End
ABN 73 465 955 132
T: 07 3192 9640

BABER

CHECK ALL DIMENSIONS ON SITE BEFORE FABRICATION OR SETOUT. Do not scale off drawings. Use figured dimensions for construction. Consult architect if uncertain about information contained within drawings and or specification.

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CLIENT
DENE CROCKER

PROJECT ADDRESS
ROCKHAMPTON CCC NO# 44-50 MAIN STREET

REVISION	DATE
P1	20.11.2015 - Preliminary
P2	04.12.2015 - DA DRAFT
P3	15.12.2015 - DA DRAFT
P4	16.12.2015 - DA DRAFT
P5	18.12.2015 - DA DRAFT UPDATE
A	21.12.2015 - DA SUBMISSION
B	20.05.2021 - DRAFT DA RE-SUBMISSION

DRAWING TITLE
PROPOSED GROUND PLAN

SCALE @ A3: 1 : 200
PROJECT No: 1536
SHEET No: SK 100

APPENDIX

C

OSKA Consulting Group

Pre-Development Catchment Plan

(Ref: OSK3470/P001/B)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- A — STORMWATER CATCHMENT I.D.
- FLOW DIRECTION
- -18.0- — EXISTING SURFACE CONTOURS
- POD — POINT OF DISCHARGE

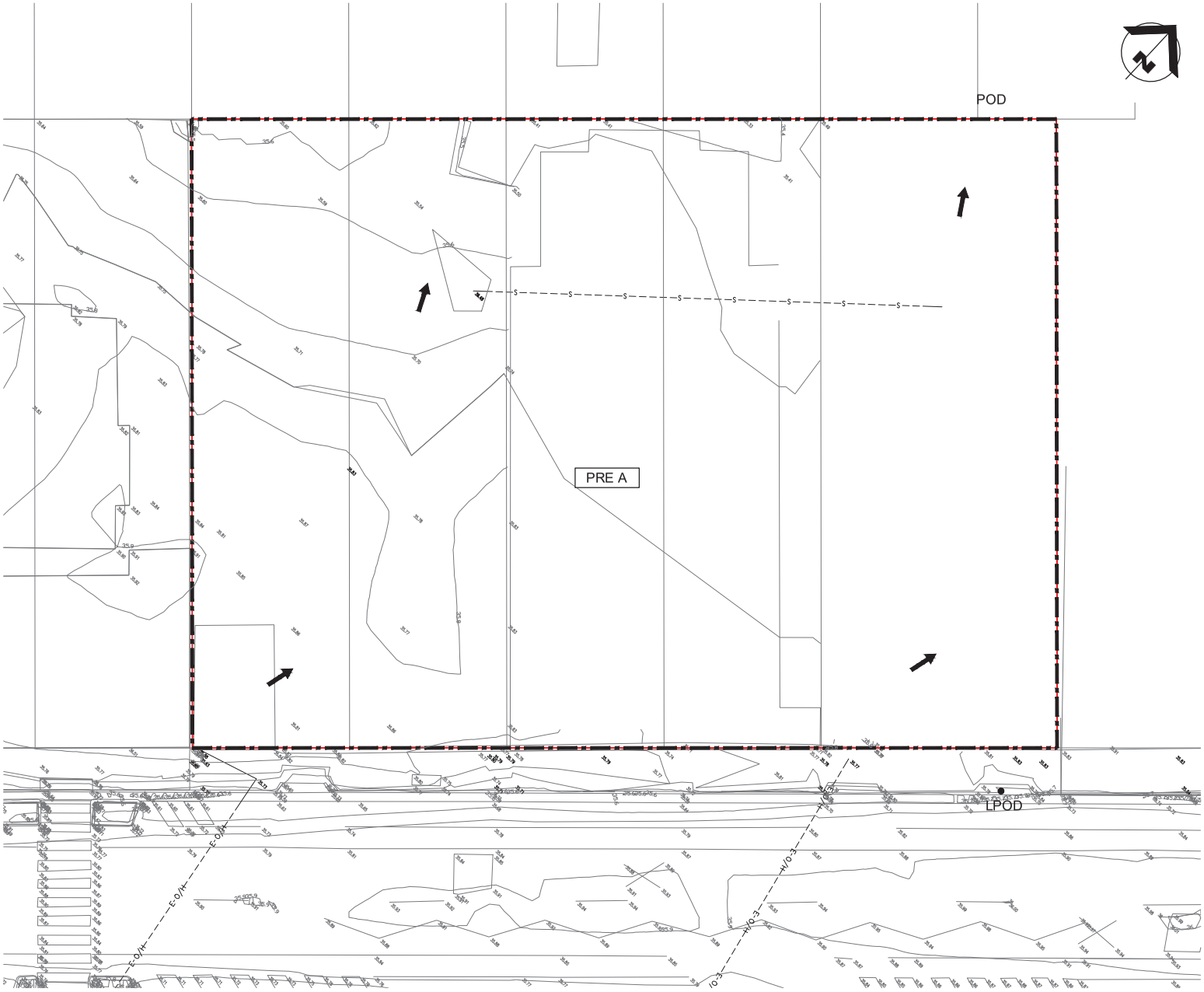
EXISTING SERVICES LEGEND

- ——S—— EXISTING SEWER MAIN (FROM SURVEY)
- ——SRM—— EXISTING SEWER MAIN
- ——W—— EXISTING WATER MAIN (FROM SURVEY)
- ——E-O/H—— EXISTING ELECTRICAL (FROM SURVEY)
- ——TEL—— EXISTING TELSTRA CONDUIT (FROM SURVEY)
- ——SWD—— EXISTING STORMWATER PIPE (FROM SURVEY)
- ——C—— EXISTING COMMUNICATIONS CABLE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (ha)
PRE A	0.223
TOTAL	0.223

REPORT ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS



ISSUE No.	DATE	AMENDMENT
B	11-08-2021	ISSUE FOR REPORT
A	05-08-2021	ISSUE FOR REPORT

OSKA CONSULTING GROUP

CLIENT: TIVERTON INVESTMENTS PTY LTD ATF CROCKER INVESTMENT TRUST

PROJECT: PROPOSED CHILDCARE CENTRE
46 - 50 MAIN STREET
PARK AVENUE, QLD

DESIGN	DRAWN	APPROVED
DP	AWE	AP

TITLE: PRE DEVELOPEMENT CATCHMENT PLAN

SCALE: 1:125 AT A1, 1:250 AT A3 (0, 5, 10m)

PROJECT NO.: OSK3470

DWG NO.: P001

ISSUE: B

APPENDIX

D

OSKA Consulting Group

Post-Development Catchment Plan

(Ref: OSK3470/P002/B)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- A — STORMWATER CATCHMENT I.D.
- FLOW DIRECTION
- -18.0- — EXISTING SURFACE CONTOURS
- ● LPOD — LAWFUL POINT OF DISCHARGE

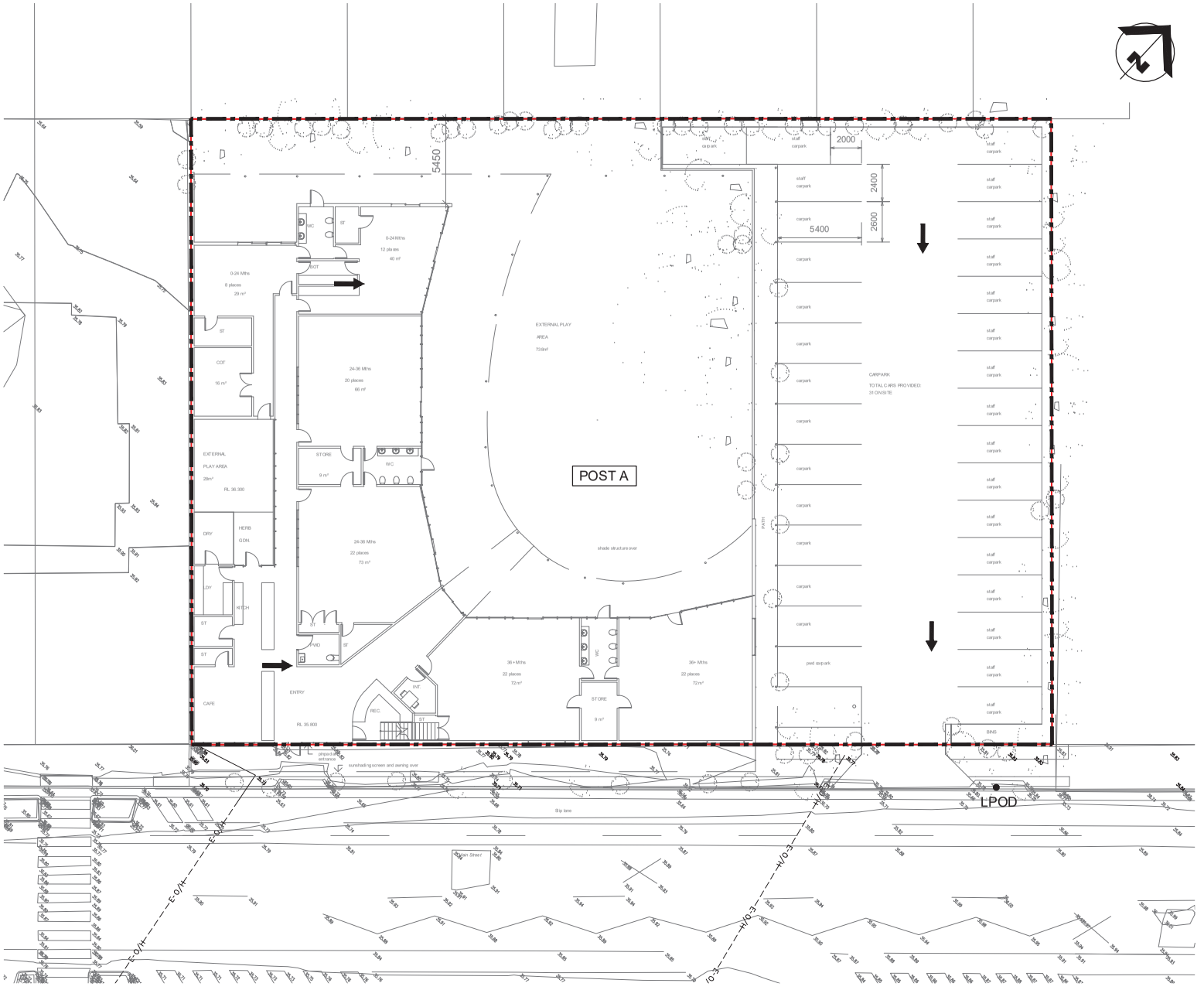
EXISTING SERVICES LEGEND

- —— – – S – – —— EXISTING SEWER MAIN (FROM SURVEY)
- —— – – SRM – – —— EXISTING SEWER MAIN
- —— – – W – – —— EXISTING WATER MAIN (FROM SURVEY)
- —— – – E-O/H – – —— EXISTING ELECTRICAL (FROM SURVEY)
- —— – – TEL – – —— EXISTING TELSTRA CONDUIT (FROM SURVEY)
- —— – – SWD – – —— EXISTING STORMWATER PIPE (FROM SURVEY)
- —— – – C – – —— EXISTING COMMUNICATIONS CABLE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (ha)
POST A	0.223
TOTAL	0.223

REPORT ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS



ISSUE No.	DATE	AMENDMENT
B	11-08-2021	ISSUE FOR REPORT
A	05-08-2021	ISSUE FOR REPORT

OSKA CONSULTING GROUP

CLIENT: TIVERTON INVESTMENTS PTY LTD ATF CROCKER INVESTMENT TRUST	DESIGN: DP	DRAWN: AWE	APPROVED: AP
PROJECT: PROPOSED CHILDCARE CENTRE 46 - 50 MAIN STREET PARK AVENUE, QLD			

TITLE: POST DEVELOPEMENT CATCHMENT PLAN

SCALE: 1:125 AT A1, 1:250 AT A3 (0, 5, 10m)

PROJECT NO.: OSK3470

DWG NO.: P002

ISSUE: B

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- A — STORMWATER CATCHMENT I.D.
- FLOW DIRECTION
- EXISTING SURFACE CONTOURS
- ● LPOD — LAWFUL POINT OF DISCHARGE

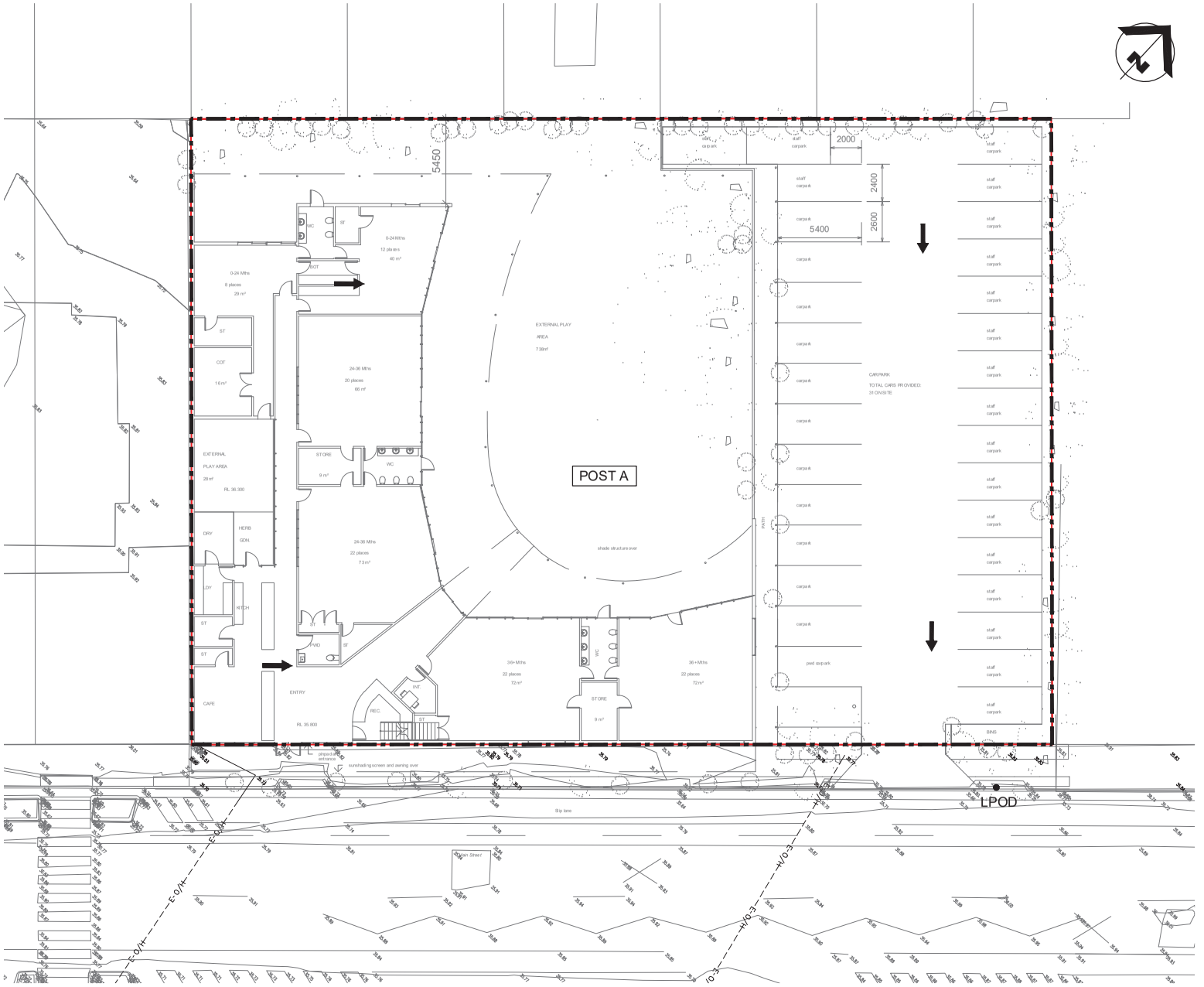
EXISTING SERVICES LEGEND

- EXISTING SEWER MAIN (FROM SURVEY)
- EXISTING SEWER MAIN
- EXISTING WATER MAIN (FROM SURVEY)
- EXISTING ELECTRICAL (FROM SURVEY)
- EXISTING TELSTRA CONDUIT (FROM SURVEY)
- EXISTING STORMWATER PIPE (FROM SURVEY)
- EXISTING COMMUNICATIONS CABLE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (ha)
POST A	0.223
TOTAL	0.223

REPORT ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS



ISSUE No.	DATE	AMENDMENT
A	05-08-2021	ISSUE FOR REPORT

OSKA CONSULTING GROUP

CLIENT: TIVERTON INVESTMENTS PTY LTD ATF CROCKER INVESTMENT TRUST	DESIGN: DP	DRAWN: AWE	APPROVED: AP
PROJECT: PROPOSED CHILDCARE CENTRE 46 - 50 MAIN STREET PARK AVENUE, QLD			

TITLE: POST DEVELOPEMENT CATCHMENT PLAN

SCALE: 1:125 AT A1, 1:250 AT A3 (0 5 10m)

PROJECT NO.: OSK3470

DWG NO.: P002

ISSUE: A

APPENDIX

E

OSKA Consulting Group

Stormwater Management Plan

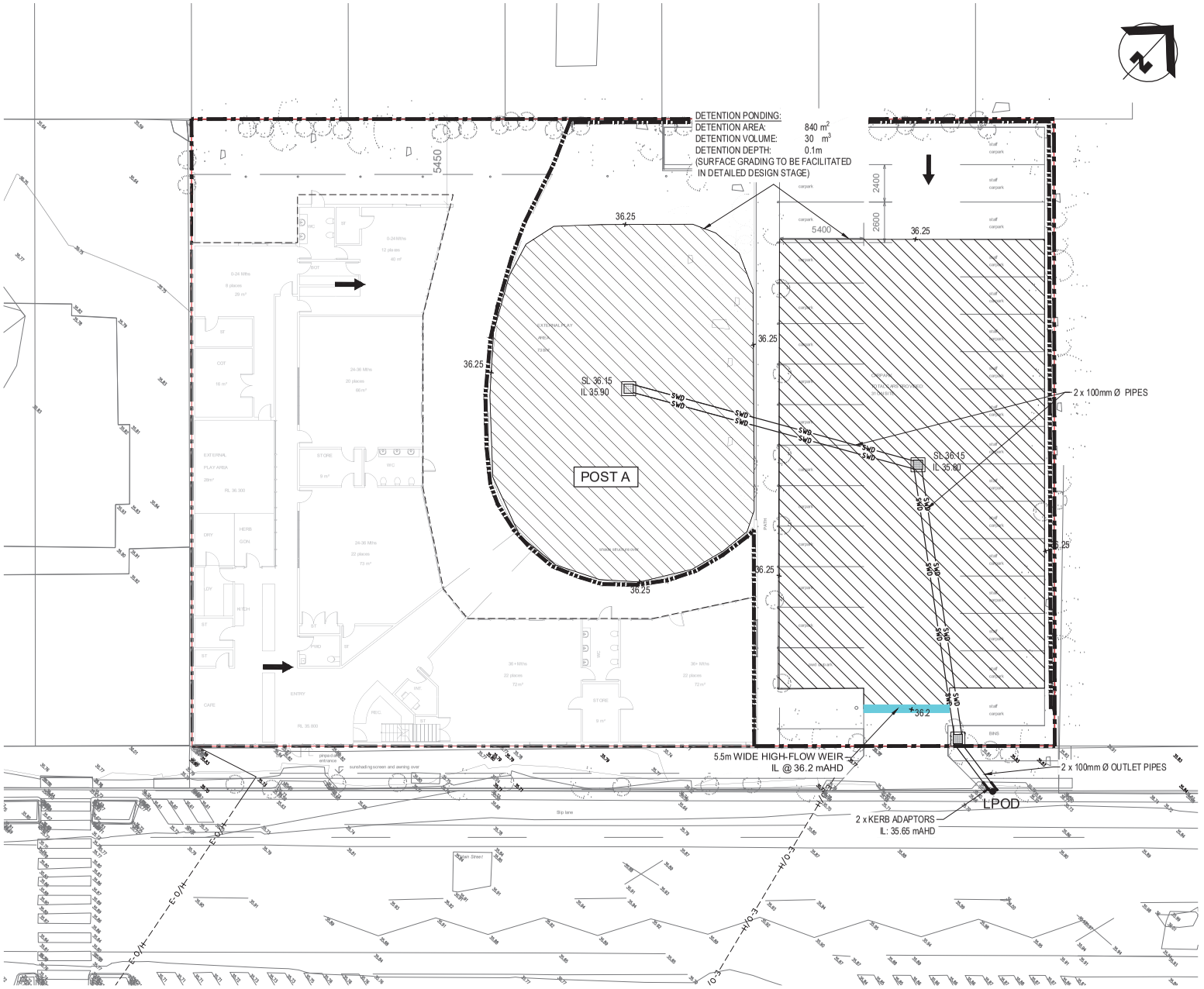
(Ref: OSK3470/P003/B)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- A — STORMWATER CATCHMENT I.D.
- FLOW DIRECTION
- 18.0 — EXISTING SURFACE CONTOURS
- SWD — PROPOSED STORMWATER PIPE
- ROOF LAYOUT
- PROPOSED DETENTION BASIN
- LPOD — LAWFUL POINT OF DISCHARGE
- PROPOSED FIELD INLET
- PROPOSED RETAINING WALL

EXISTING SERVICES LEGEND

- S — EXISTING SEWER MAIN (FROM SURVEY)
- SRM — EXISTING SEWER MAIN
- W — EXISTING WATER MAIN (FROM SURVEY)
- E-O/H — EXISTING ELECTRICAL (FROM SURVEY)
- TEL — EXISTING TELSTRA CONDUIT (FROM SURVEY)
- SWD — EXISTING STORMWATER PIPE (FROM SURVEY)
- C — EXISTING COMMUNICATIONS CABLE



REPORT ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

ISSUE No.	DATE	AMENDMENT
B	11-08-2021	ISSUE FOR REPORT
A	05-08-2021	ISSUE FOR REPORT

OSKA CONSULTING GROUP

CLIENT: TIVERTON INVESTMENTS PTY LTD ATF CROCKER INVESTMENT TRUST	DESIGN: DP	DRAWN: AWE	APPROVED: AP
PROJECT: PROPOSED CHILDCARE CENTRE 46 - 50 MAIN STREET PARK AVENUE, QLD			

TITLE: STORMWATER MANAGEMENT PLAN

SCALE: 1:125 AT A1, 1:250 AT A3 (0, 5, 10m)

PROJECT NO.: OSK3470

DWG NO.: P003

ISSUE: B

APPENDIX

F

OSKA Consulting Group

Sediment and Erosion Control Plan

(Ref: OSK3470/P004/B)

Sediment and Erosion Control Details

(Ref: OSK3470/P005/B)

SEDIMENT & EROSION CONTROL LEGEND

- SITE BOUNDARY
- SF — SEDIMENT FENCE
- S.E.P. — LOCATION OF STABILISED ENTRY/EXIT POINT
- DSP — DRAINAGE STRUCTURE PROTECTION
- FLOW ARROW
- MS1 — WATER QUALITY MONITORING STATION

EXISTING SERVICES LEGEND

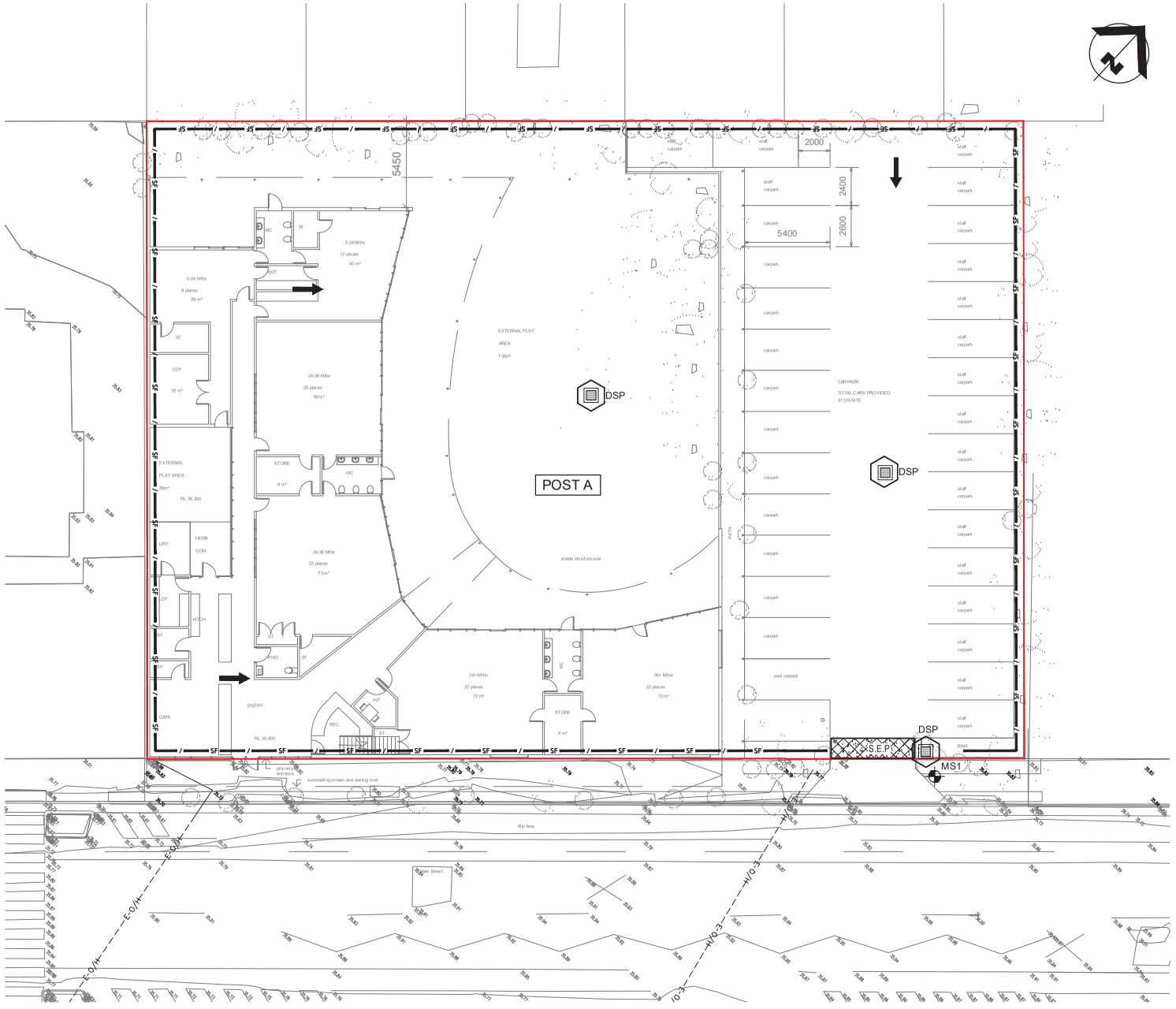
- S — EXISTING SEWER MAIN (FROM SURVEY)
- W — EXISTING WATER MAIN (FROM SURVEY)
- E-O/H — EXISTING ELECTRICAL (FROM SURVEY)
- TEL — EXISTING TELSTRA CONDUIT (FROM SURVEY)
- SWD — EXISTING STORMWATER PIPE (FROM SURVEY)
- C — EXISTING COMMUNICATIONS CABLE
- G — EXISTING GAS (FROM SURVEY)

SEDIMENT AND EROSION CONTROL NOTES

1. THE PROJECT SEDIMENT AND EROSION CONTROL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SITE'S APPROVED STORMWATER MANAGEMENT PLAN.
2. CONSTRUCTION IS TO BE PROGRAMMED TO PROVIDE INSTALLATION OF PERIMETER LANDSCAPING / SURFACE TREATMENTS AS EARLY AS PRACTICAL.
3. THE CONTRACTOR'S WORKS PROGRAM IS TO BE REVIEWED AT THE PRESTART MEETING. ALTERATIONS TO THE PROGRAM MAY BE REQUIRED TO ENSURE SATISFACTORY EROSION AND SEDIMENT CONTROL.
4. SAFETY ISSUES MUST BE CONSIDERED AND MONITORED FOR EACH DEVICE TO THE SATISFACTION OF THE SUPERINTENDENT.
5. SEDIMENT FENCE FILTER FABRIC IS TO BE APPROVED BY THE ENGINEER. FILTER CLOTH AND SHADE CLOTH ARE NOT TO BE USED.
6. SEDIMENTATION MANAGEMENT DEVICES SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES AND MAINTAINED AT A SUITABLE LEVEL/ CONDITION THROUGHOUT CONSTRUCTION.
7. SEDIMENT FENCES ARE TO BE CLEANED OUT WHEN CAPACITY IS REDUCED BY 30%.
8. DRAINAGE STRUCTURE PROTECTION IS TO BE CLEANED FOLLOWING EACH SIGNIFICANT RUNOFF PRODUCING STORM.
9. ACCESS TO THE SITE IS TO BE PROVIDED BY THE CONTRACTOR. APPROVAL IS TO BE OBTAINED FROM COUNCIL FOR THE LOCATION OF THE SITE ACCESS POINT AND WASH DOWN AREA WHICH IS TO BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD. ACCESS TO AND FROM THE SITE IS TO BE VIA THE SHAKEDOWN FACILITY ONLY. ALL VEHICLES ARE TO BE WASHED DOWN PRIOR TO LEAVING THE SITE.
10. THE CONTRACTOR SHALL PROVIDE TEMPORARY DRAINAGE CONTROLS TO DIVERT FLOW FROM UNDISTURBED AREAS AROUND DISTURBED AREAS AND DIRECT FLOW FROM DISTURBED AREAS TOWARD CONTROL DEVICES.
11. SEDIMENT TRAP WILL COLLECT SEDIMENT DURING RUN-OFF EVENTS . DEWATERING OF THIS SEDIMENT TRAP CAN ONLY OCCUR WHEN TSS IS <50MG/L AND PH IS BETWEEN 6.5 - 8.5 IN ACCORDANCE WITH IECA GUIDELINES.

REPORT ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS



ISSUE No.	DATE	AMENDMENT
B	11-08-2021	ISSUE FOR REPORT
A	05-08-2021	ISSUE FOR REPORT

OSKA CONSULTING GROUP

CLIENT: TIVERTON INVESTMENTS PTY LTD ATF CROCKER INVESTMENT TRUST	DESIGN: DP	DRAWN: AWE	APPROVED: AP
PROJECT: PROPOSED CHILDCARE CENTRE 46 - 50 MAIN STREET PARK AVENUE, QLD			

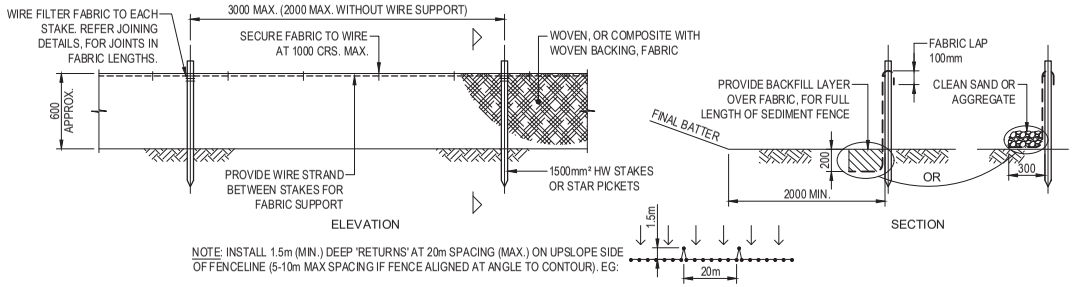
TITLE: EROSION AND SEDIMENT CONTROL PLAN

SCALE: 1:125 AT A1, 1:250 AT A3 (0, 5, 10m)

PROJECT NO.: OSK3470

DWG NO.: P004

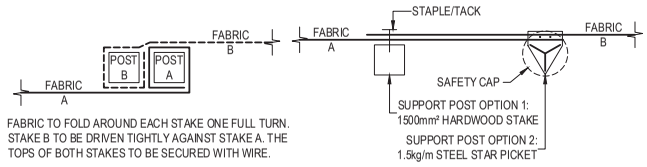
ISSUE: B



NOTE: INSTALL 1.5m (MIN.) DEEP 'RETURNS' AT 20m SPACING (MAX.) ON UPSLOPE SIDE OF FENCELINE (5-10m MAX SPACING IF FENCE ALIGNED AT ANGLE TO CONTOUR). EG:

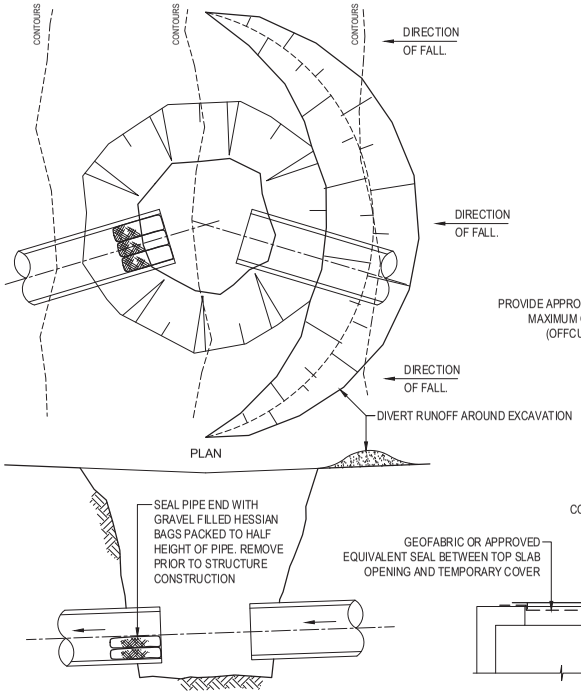
SEDIMENT FENCE DETAILS

N.T.S. —/—SF— DENOTES SEDIMENT FENCE. REFER PLAN FOR LOCATION AND EXTENTS.

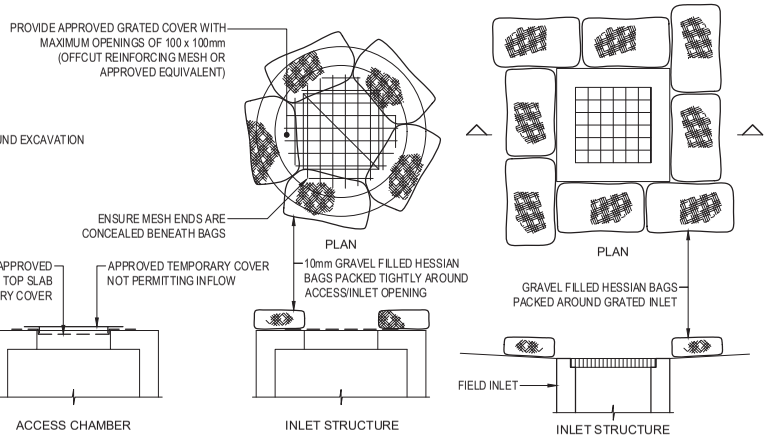


SEDIMENT FENCE FABRIC JOINING DETAILS

N.T.S.



STAGE 1
EXCAVATION AND PIPE INSTALLATION



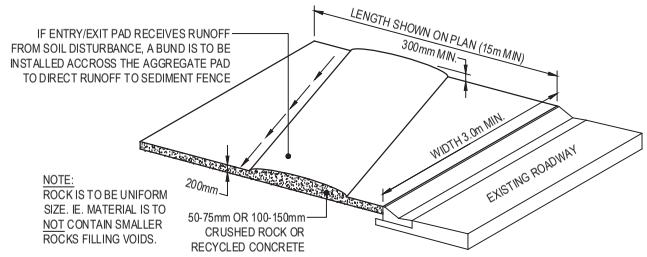
STAGE 2
STRUCTURE COMPLETE UP TO TOP SLAB

STAGE 3
STRUCTURE COMPLETE

ACCESS CHAMBER / INLET STRUCTURE

N.T.S.

DSP DENOTES DRAINAGE STRUCTURE PROTECTION, REFER PLAN FOR LOCATION & EXTENTS.



STABILISED ENTRY/EXIT POINT

N.T.S. OR APPROVED EQUIVALENT

SEP DENOTES STABILISED ENTRY/EXIT POINT, REFER PLAN FOR LOCATIONS.

REPORT ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

ISSUE No.	DATE	AMENDMENT
B	11-08-2021	ISSUE FOR REPORT
A	05-08-2021	ISSUE FOR REPORT

OSKA CONSULTING GROUP

CLIENT: TIVERTON INVESTMENTS PTY LTD ATF CROCKER INVESTMENT TRUST

PROJECT: PROPOSED CHILDCARE CENTRE
46 - 50 MAIN STREET
PARK AVENUE, QLD

DESIGN	DRAWN	APPROVED
DP	AWE	AP

TITLE: EROSION AND SEDIMENT CONTROL DETAILS

SCALE: 1:400 AT A1, 1:800 AT A3 (0, 10, 20, 30, 40m)

PROJECT NO.: OSK3470

DWG NO.: P005

ISSUE: B

fernway
engineering

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Artarmon NSW 2064
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info@fernway.net.au
www.fernway.net.au
ABN 38 475 511 899

ROCKHAMPTON REGIONAL COUNCIL
APPROVED PLANS
These plans are approved subject to the current conditions of approval associated with
Development Permit No.: D/111-2021
Dated: 8 December 2021

15 November 2021

To whom it concerns,

RE: Traffic Assessment for the Proposed Childcare Centre Development at 44-50 Main Street, Park Avenue QLD 4701

Fernway Engineering has been engaged by ADAMS + SPARKES Town Planning to provide a traffic assessment for the proposed childcare centre development at 44-50 Main Street in Park Avenue.

In particular, this assessment responds to Items 1-3 of the Request for Information letter (as shown below) issued by the Rockhampton Regional Council (dated 26th August 2021, Application Reference: D/111-2021).

Traffic

1. Please provide details regarding the traffic generation from the development of the site and any impact to the current traffic volumes on Main Street and nearby roads. A detailed Traffic Impact Assessment report will be required if the traffic generation from the proposed development is greater than 5% of the traffic already using Main Street. The traffic volume comparison must be carried out for peak hour traffic volumes in accordance with the Guidelines for Assessment of Road Impacts of Development (GARID) requirements. All reports to be carried out and signed by an Registered Professional Engineer of Queensland (RPEQ)
2. Proposed slip lane along the development frontage is located within a bus set-down area which is not acceptable. Please provide an alternative solution to achieve safe peak hour traffic movements to and from the development site.
3. There is a bicycle lane on Main Street that needs to be maintained along the frontage of the site. Please provide acceptable solution to satisfy this requirement.

1.0 Existing Conditions

The subject site includes a total area of 2,428m^2 and is located within a mixed-use area in Park Avenue. The site vicinity is characterised by low-density residential uses (to the north) and commercial/retail uses.

Other major traffic generating developments fronting Main Street within the site locality, between Edgar Street and Haynes Street, include the Park Avenue Mall and the St Joseph's school, both of which are located opposite the site. **Figure 1** illustrates the location of the subject site in aerial view.

At the site frontage, Main Street includes an undivided carriageway with one traffic lane in each direction. In addition, each lane includes a delineated cycle path and time-restricted kerbside public parking spaces. Paved pedestrian footpaths are also present on both sides of Main Street. A posted speed limit of 60km/h applies to traffic on Main Road during times outside 7.30am-9am and 2.30pm-4pm on school days (during these times, the school zone speed limit of 40 km/h applies). **Figures 2** and **3** illustrate the school zone speed limit signs within the site locality on Main Street.

The site location is highly accessible by public transport. Bus route 401 (Allenstown, Blackall Street) operates on Main Street at the site frontage and this service is accessible from bus stops located within 150m (a 2-minute walk) of the site (a bus shelter servicing this route is located at the frontage of the site). Timetable for route 401 is shown in **Figure 4**. Further to the above bus service, the Park Avenue train station is located approximately 180m (a 2-minute walk) from the site.

Figure 1: Location of the subject site

Figure 2: Street view for vehicles travelling in southwest direction within the site vicinity on Main Street (December 2020)

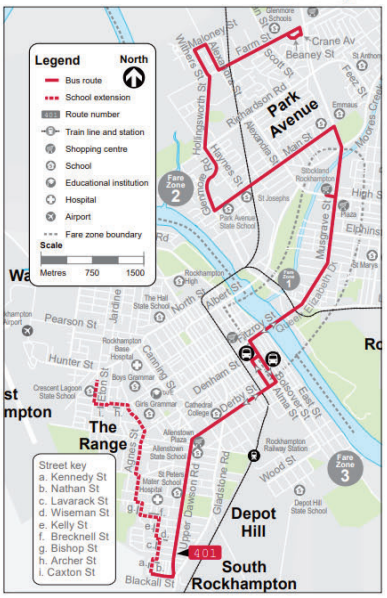
Figure 3: Street view for vehicles travelling in northeast direction within the site vicinity on Main Street (December 2020)

Route
401

Glenmore to The Range via city centre
servicing Park Avenue, city centre and The Range

	Monday to Friday													Saturday			
	am	am	am	am	am	am	pm	pm	pm	pm	pm	pm	pm	am	am	am	am
Glenmore State School (Farm St)	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....	.....	.....	.....	.....	.....
Glenmore State High (Farm St)	7.32	8.02	8.32	9.32	10.32	11.32	**12.32**	**1.32**	**2.32**	**3.05**	**3.32**	**4.32**	.....	8.20	9.20	10.20	11.20
Park Avenue (Maloney St)	7.35	8.05	8.35	9.35	10.35	11.35	**12.35**	**1.35**	**2.35**	**3.10**	**3.35**	**4.35**	.....	8.23	9.23	10.23	11.23
Park Avenue State School	7.40	8.10	8.40	9.40	10.40	11.40	**12.40**	**1.40**	**2.40**	**3.18**	**3.40**	**4.40**	.....	8.28	9.28	10.28	11.28
Stockland Rockhampton	7.48	8.18	8.48	9.48	10.48	11.48	**12.48**	**1.48**	**2.48**	**3.28**	**3.48**	**4.48**	**5.38**	8.36	9.36	10.36	11.36
City centre (Bolsover St)	7.58	8.28	8.58	9.58	10.58	11.58	**12.58**	**1.58**	**2.58**	**3.38**	**3.58**	**4.58**	**5.48**	8.46	9.46	10.46	11.46
Allenstown Square	8.03	8.33	9.03	10.03	11.03	**12.03**	**1.03**	**2.03**	**3.03**	**3.43**	**4.03**	**5.03**	**5.53**	8.51	9.51	10.51	11.51
Allenstown (Blackall St)	8.08	8.38	9.08	10.08	11.08	**12.08**	**1.08**	**2.08**	**3.08**	**3.48**	**4.08**	**5.08**	**5.58**	8.56	9.56	10.56	11.56
Crescent Lagoon State School	.....	.....	.....	.....	.....	.....	.....	.....	**3.14**	.....	.....	.....	.....	.....	.....	.....	.....

	Monday to Friday														Saturday			
	am	am	am	am	am	am	pm	pm	pm	pm	pm	pm	pm	pm	am	am	am	pm
Allenstown (Blackall St)	7.40	8.10	8.40	9.10	10.10	11.10	**12.10**	**1.10**	**2.10**	.....	.....	**3.50**	**4.10**	**5.10**	9.10	10.10	11.10	**12.10**
Allenstown Square	7.45	8.15	8.45	9.15	10.15	11.15	**12.15**	**1.15**	**2.15**	.....	.....	**3.55**	**4.15**	**5.15**	9.15	10.15	11.15	**12.15**
City centre (Denham St)	7.50	8.20	8.50	9.20	10.20	11.20	**12.20**	**1.20**	**2.20**	.....	**3.30**	**4.00**	**4.20**	**5.20**	9.20	10.20	11.20	**12.20**
Stockland Rockhampton	8.00	8.30	9.00	9.30	10.30	11.30	**12.30**	**1.30**	**2.30**	**3.00**	**3.40**	**4.10**	**4.30**	**5.30**	9.30	10.30	11.30	**12.30**
Park Avenue State School	8.06	8.36	9.06	9.36	10.36	11.36	**12.36**	**1.36**	**2.36**	**3.06**	**3.46**	**4.16**	**4.36**	**5.36**	9.36	10.36	11.36	**12.36**
Park Avenue (Maloney St)	8.10	8.40	9.10	9.40	10.40	11.40	**12.40**	**1.40**	**2.40**	**3.10**	**3.50**	**4.20**	**4.40**	**5.40**	9.40	10.40	11.40	**12.40**
Glenmore State High (Farm St)	8.13	8.43	9.13	9.43	10.43	11.43	**12.43**	**1.43**	**2.43**	**3.15**	**3.53**	**4.23**	**4.43**	**5.43**	9.43	10.43	11.43	**12.43**



qconnect www.qconnect.qld.gov.au

your Rockhampton qconnect bus operator
sunbus 4936 2133 www.sunbus.com.au

page 1 of 1

Queensland Government

Figure 4: Timetable for bus route 401

2.0 Details of the Proposed Development

This proposal relates to the construction of a childcare centre within the subject site to accommodate a total of 106 children and 20 full-time staff members. A total of 31 on-site car spaces (including a single disability accessible car space) have been provided on-site, with vehicular access off Main Street.

Figure 5 illustrates the proposed site layout plan.

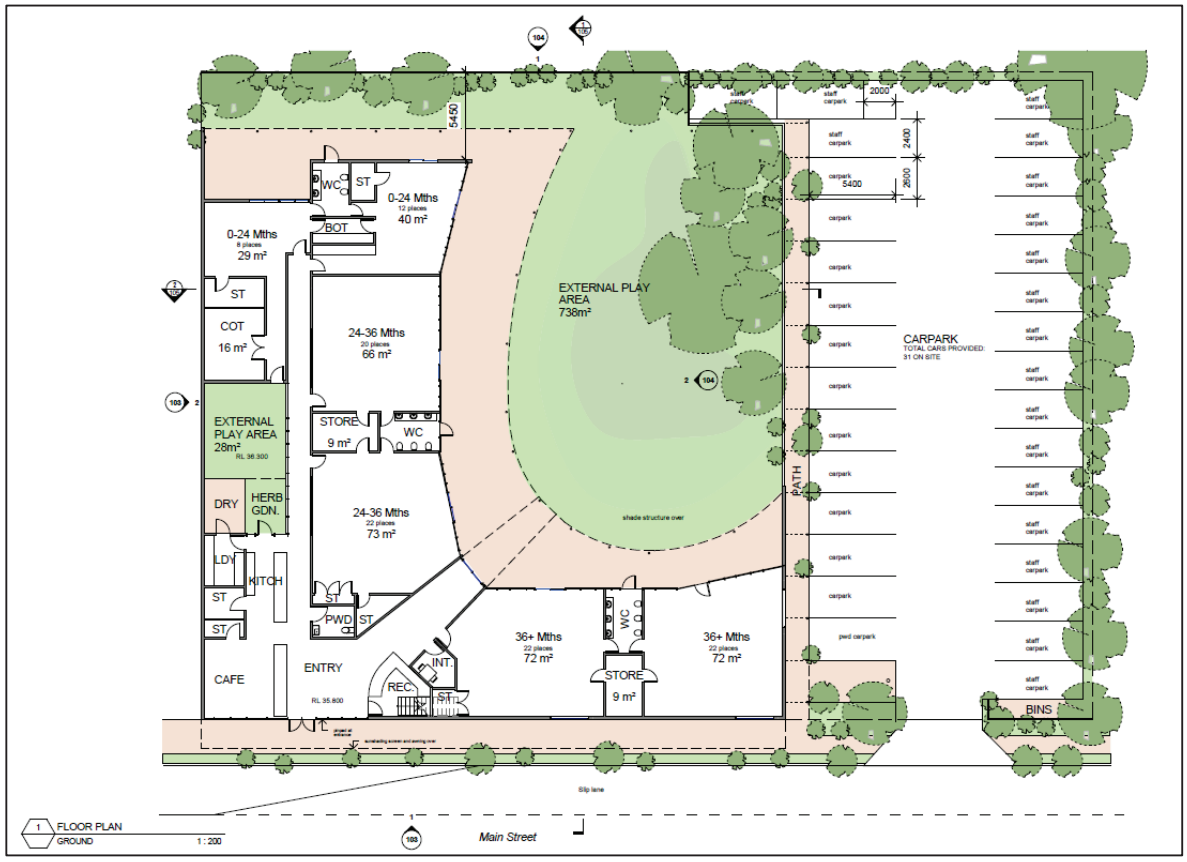


Figure 5: Proposed site layout plan (source: Baber Studio)

3.0 Traffic Generating Potential of the Proposal

The traffic generating potential of the proposed development has been determined using the trips rates for childcare centres presented within the following two sources:

1) The Guide to Traffic Generating Developments (RMS, 2002); and
2) Traffic Generation Data—Site Summary, within the Transport and Main Roads Open Data Portal (accessed at: https://www.data.qld.gov.au/dataset/traffic-generation-data-2006-2019/resource/73079dc1-c34e-44cf-9e9a-8acb13591c1b?view_id=3748fbf3-9779-4f25-89cc-f5b23fdeea6b)

Figure 6 illustrates the childcare centre trip rates summary from the RMS Guide.

Centre Type	Peak Vehicle Trips / Child		
	7.00-9.00am	2.30-4.00pm	4.00-6.00pm
Pre-school	1.4	0.8	-
Long-day care	0.8	0.3	0.7
Before/after care	0.5	0.2	0.7

Figure 6: Trip Rates for Childcare Centres (Excerpt from RMS Guide 2002)

Based on the RMS Guide, for long-day care centres, there are three peak periods for traffic generation – AM peak (generally between 7-9am), Afternoon peak (generally between 2.30-4pm) and PM peak (generally between 4-6pm).

Figure 7 shows the traffic generation data for childcare centres obtained from the Transport and Main Roads Open Data Portal. Note that the average weekday AM peak hour trips have been calculated in two ways: (1) by considering the data available for all sites within QLD, and (2) by considering only the sites within Rockhampton Regional Council. For the PM peak hour, data were only available for the Brisbane City area.

Local Government Area	Variable Units	Variable Value	Start Date	End Date	Weekday Peak Hour Start	Weekday Peak Hour End	Weekday Peak Volume
AM PEAK HOUR							
Brisbane City	Childcare Spaces	75	9/05/2006	23/05/2006	8:00:00	9:00:00	50
Moreton Bay Regional	Childcare Spaces	74	9/05/2006	23/05/2006	8:15:00	9:15:00	56
Brisbane City	Childcare Spaces	75	9/05/2006	23/05/2006	8:00:00	9:00:00	49
Moreton Bay Regional	Childcare Spaces	75	9/05/2006	23/05/2006	7:00:00	8:00:00	48
Brisbane City	Childcare Spaces	75	5/05/2009	11/05/2009	7:45:00	8:45:00	32
Moreton Bay Regional	Childcare Spaces	74	5/05/2009	11/05/2009	8:00:00	9:00:00	42
Brisbane City	Childcare Spaces	75	5/05/2009	11/05/2009	8:15:00	9:15:00	30
Brisbane City	Childcare Spaces	72	4/10/2010	10/10/2010	8:00:00	9:00:00	50
Brisbane City	Childcare Spaces	72	4/10/2010	10/10/2010	8:00:00	9:00:00	53
Brisbane City	Childcare Spaces	72	4/10/2010	10/10/2010	7:45:00	8:45:00	52
Rockhampton Regional	Childcare Spaces	72	22/11/2010	28/11/2010	8:00:00	9:00:00	58
Bundaberg Regional	Childcare Spaces	72	22/11/2010	28/11/2010	8:00:00	9:00:00	46
Bundaberg Regional	Childcare Spaces	72	22/11/2010	28/11/2010	8:00:00	9:00:00	47
Rockhampton Regional	Childcare Spaces	72	22/11/2010	28/11/2010	8:00:00	9:00:00	65
	Total	1027				Total	678
						Peak hour trip rate (AM)	0.660175268
PM PEAK HOUR							
Brisbane City	Childcare Spaces	75	17/05/2009	23/05/2009	17:00:00	18:00:00	30
Brisbane City	Childcare Spaces	72	4/10/2010	10/10/2010	16:00:00	17:00:00	53
Brisbane City	Childcare Spaces	48	4/10/2010	10/10/2010	17:00:00	18:00:00	15
	Total	195				Total	98
						Peak hour trip rate (PM)	0.502564103
AM PEAK HOUR FOR ROCKHAMPTON REGIONAL							
Rockhampton Regional	Childcare Spaces	72	22/11/2010	28/11/2010	8:00:00	9:00:00	65
Rockhampton Regional	Childcare Spaces	72	22/11/2010	28/11/2010	8:00:00	9:00:00	58
	Total	144				Total	123
						Peak hour trip rate (AM)	0.854166667

Figure 7: Traffic generation data for childcare centres (obtained from the TMR open data portal)

Table 1 provides a summary of the trip rates.

Table 1: Peak period trip rates from each source considered

Reference	AM Peak (hourly trip rate)	Afternoon Peak (hourly trip rate)	PM Peak (hourly trip rate)
RMS Guide (2002)	0.80	0.30	0.70
Transport and Main Roads Open Data Portal (all QLD sites)	0.66	-	0.50
Transport and Main Roads Open Data Portal (only the sites within Rockhampton Regional Council)	0.85	-	-

Based on the information presented in **Table 1**, it is evident that the AM peak trip generation rate derived from childcare centres within the Rockhampton Regional Council area provides the highest estimate compared to the rates from the RMS Guide or the rates calculated considering all childcare centre sites in QLD. As such, this higher rate (0.85 trips per child) has been adopted in this study for a conservative assessment.

In relation to the afternoon peak, the only available source is the RMS Guide and therefore that rate was used (0.30 trips per child). For PM peak, the average of the trip rate from the RMS Guide and the rate calculated considering all childcare centre sites in QLD has been used (i.e., 0.6 trips per child).

The application of the above trip rates to the proposed development leads to traffic generation levels summarised in **Table 2**.

Table 2: Traffic generation levels expected from the proposal

Centre Type	No. of Children	Hourly vehicle trips		
		AM	Afternoon	PM
Long-Day Care	106	90	32	64

The above traffic figures were then split into In and Out trips for each peak period. Since the childcare centre trips relate to drop off and pick up activities, a 50% in/50% out split is considered appropriate. However, it is noted that the proposed on-site car park provides 19 staff car spaces. These reflect 19 trips that enter the site in the AM peak and exit the site in the PM peak. Therefore, these 19 trips were deducted from the total AM and PM peak hour trips prior to the application of the 50%/50% splits. **Table 3** shows the in and out split calculated for each peak period.

Table 3: In and out splits established for each peak period

No. of Children	AM		Afternoon		PM	
	In	Out	In	Out	In	Out
106	55 (includes 19 staff trips)	36	16	16	23	42 (includes 19 staff trips)

4.0 Traffic Survey Results

As a part of this assessment, traffic surveys were undertaken at the intersections of Main Street with Haynes Street and Edgar Street. The surveys were carried out on a weekday (outside the school holiday period), between 7-9am and 2-5pm. The detailed traffic survey results are presented in **Attachment A**.

Table 4 summarises the peak directional flows observed in the surveys at Main Street /Edgar Street intersection. The survey results of this intersection have been used for comparison purposes as it is the closest intersection to the subject site. Note that for this intersection, the surveys found the AM peak hour to be between 7.45am to 8.45am and the PM peak hour to be between 2.45pm to 3.45pm.

Table 5 provides a comparison of the surveyed peak period through traffic volumes on Main Street with the expected AM and PM peak hour traffic generation levels from the proposal.

Table 4: Directional flows observed from traffic surveys

Direction on Main Street	AM Peak Hour	PM Peak Hour
Eastbound at the site frontage	377	397
Westbound at the site frontage	456	410
Total through traffic	**833**	**807**

Table 5: Traffic generation potential of the proposal compared with existing traffic

	AM Peak Hour	PM Peak Hour
Current through traffic on Main Street	833	807
Traffic generated by the proposal	90	64
Traffic from the proposal as a % of traffic already using Main Street	**10.80%**	**7.90%**

As can be seen from **Table 5**, the traffic expected from the proposal will represent >5% of the existing traffic on Main Street during both AM and PM peak hour periods.

5.0 Traffic Impact Assessment

The impact of the traffic arising from the proposed development on the existing traffic operations has been assessed in this section. It is noted that for the impact assessment, only the AM peak hour period has been considered as it represents the worst-case scenario (since most traffic will be generated during the AM peak hour and the existing traffic levels on Main Street were observed to be higher in the AM peak hour compared to the PM peak hour).

Figure 8 shows the broader precinct that surrounds the subject site. Based on the positioning of the site relative to Main Street and residential land uses, it can be reasonably assumed that the majority of traffic will enter/exit the site from the east. As such, it was assumed that 70% of traffic will enter/exit from/to east of Main Street, with the remaining 30% of traffic using the west of Main Street. **Table 6** summarises the directional splits of traffic.

Table 6: Directional distribution of traffic

	AM Peak Hour	
	In	**Out**
From/to West (30%)	17	11
From/to East (70%)	38	25
Total	**55**	**36**

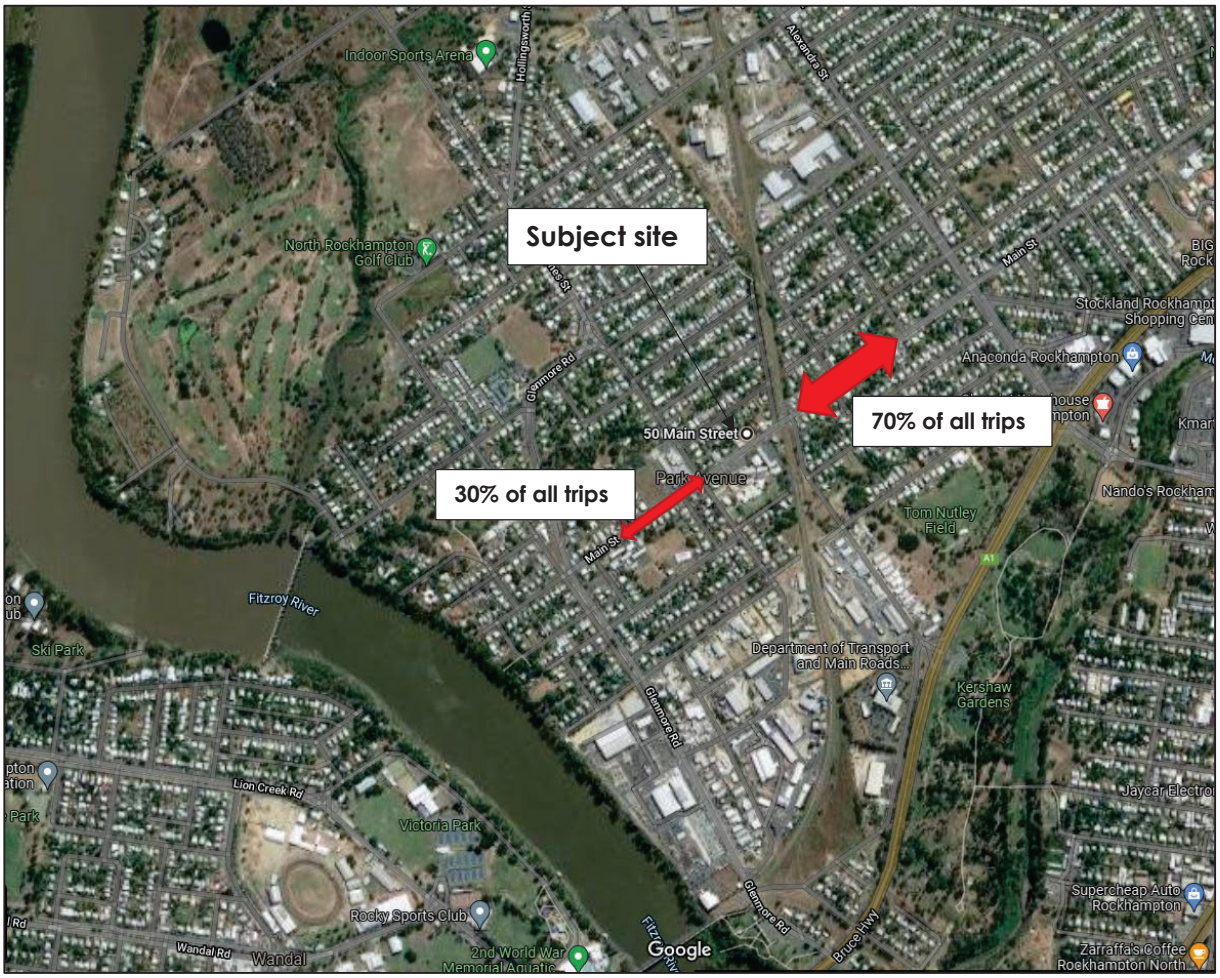


Figure 8: Anticipated directional distribution of traffic from the proposal

In addition, the following two access options for the site were tested with SIDRA intersection models (considering the AM peak hour period, which is the worst-case scenario):

(1) Option 1 - All movements allowed for the site, and

(2) Option 2 - Left in/left out access only.

In addition to the site access point, the performance of the following intersections was also modelled (for the AM peak hour period, which is the worst-case scenario) in SIDRA for both access options:

(1) Main Street/Haynes Street; and

(2) Main Street/Edgar Street.

Figure 9 shows the traffic distribution diagram for the 'All Movement' access option while **Figure 10** shows the traffic distribution diagram for the 'Left In/Left Out' access option. The following are noted in relation to the information presented in these figures:

- The surveyed AM peak hour traffic volumes for the intersections of Main Street with Haynes Street and Edgar Street have been used.
- The proposal generated 'IN' trips are shown highlighted in Red while the 'OUT' trips are shown highlighted in Blue.
- The Park Avenue Mall's access point was not surveyed and therefore indicative traffic movement figures have been used for the development of comparable intersection models. In this regard, and considering the size of this mall's car park, it was assumed to generate 30 entry (20 from east and 10 from the west) and 30 exit (20 to east and 10 to west) trips in the AM peak hour period.

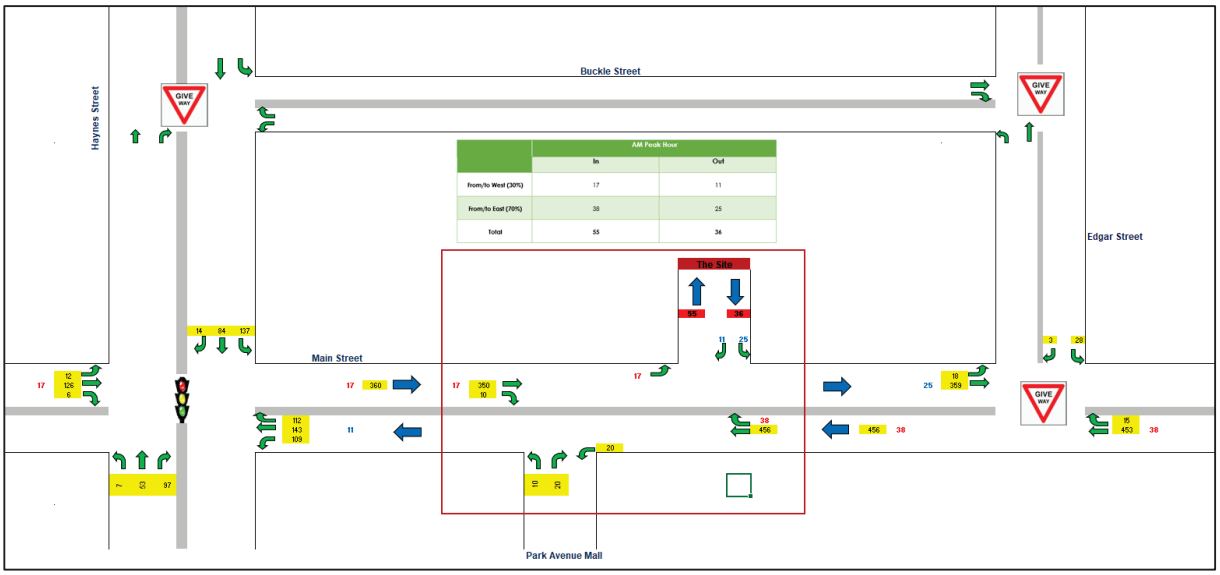


Figure 9: Traffic distribution for the All Movement access option

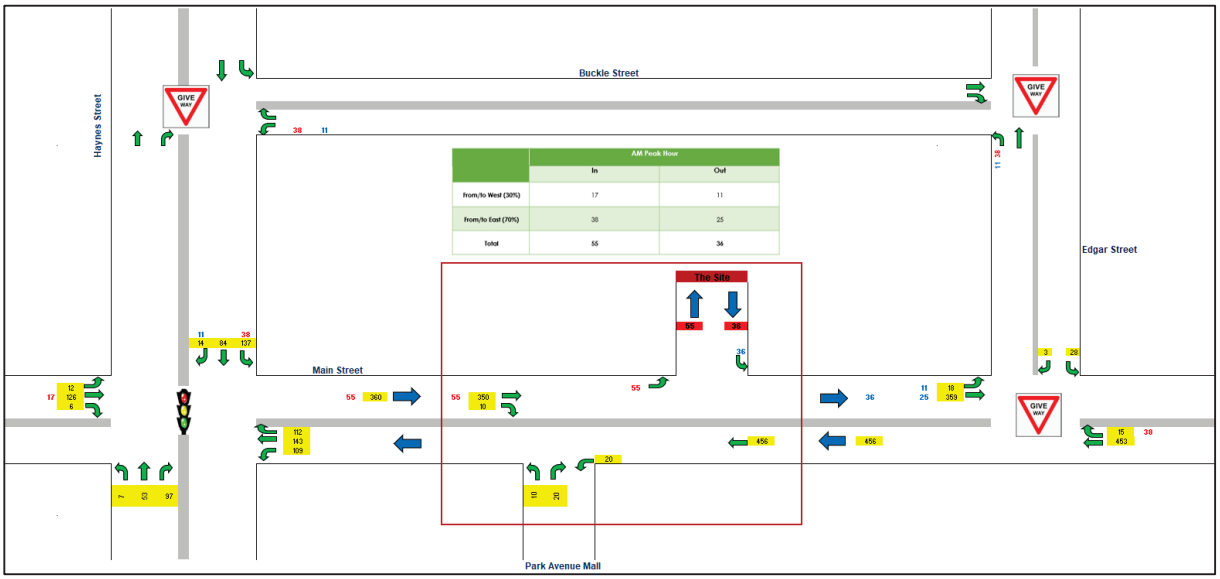


Figure 10: Traffic distribution for the Left In/Left Out access option

5.1 Intersection Model Results

The intersection assessments were undertaken using SIDRA INTERSECTION 6.0 NETWORK software package to determine the Degree of Saturation (DoS), Average Delay (AVD) in seconds and Level of Service (LoS) at the considered intersection.

The key indicator of intersection performance is LoS, where results are placed on a scale from 'A' to 'F', as summarised in **Table 7**.

Table 7: Intersection Level of Service (LoS) criteria

LOS	Traffic Signal / Roundabout	Give Way / Stop Sign / T-Junction Control
A	Good operation	Good operation
B	Good operation, with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but accident study required
D	Operating near capacity	Near capacity and accident study required
E	At capacity; at signals, incidents will cause excessive delays	At capacity, requires other control mode
F	Unsatisfactory and requires additional capacity. Roundabouts require other control mode	Unsatisfactory operation

Further to the LoS, the Average Vehicle Delay (AVD) provides a measure of the operational performance of an intersection as outlined in **Table 8** below, which relates AVD to LOS. The AVDs should be taken as a guide only as longer delays could be tolerated in some locations (i.e., inner-city conditions) and on some roads (i.e., minor side street intersecting with a major arterial route).

Table 8: Relationship between LoS and AVD

LOS	Average Delay per Vehicle (sec/veh)
A	< 14
B	15 to 28
C	29 to 42
D	43 to 56
E	57 to 70
F	> 70

The Degree of Saturation (DoS) is another measure of the operational performance of individual intersections. It is common practice to ensure DoS is less than 0.9. DoS up to 0.8 generally represents satisfactory intersection operation; when DoS exceeds 0.9 the intersection is considered to be approaching capacity, queues usually occur, and mitigation measures may be required.

5.1.1 Site Access Intersection with Main Street

In consideration of the close proximity of the proposed site access point to the access point to Park Avenue Mall, the proposed site access point was modelled as an additional leg at the existing intersection of Main Street with the access point to Park Avenue Mall (with no through traffic between the Park Avenue Mall and the proposed site). For comparison purposes, a base model was developed for the Park Avenue Mall access point's intersection with Main Street. In all models, the vehicle speed limits were set at 40 km/h, in recognition of the school zone speed limits applicable on this stretch of Main Street during the AM peak hour period. **Table 9** summarises the SIDRA intersection model results for each option based on the current traffic volumes.

In addition to the current scenario, the 10-year horizon was also assessed. For this assessment, a moderate growth of 2% (linear, per annum) was applied to through traffic on Main Street. The results of this assessment are presented in **Table 10**. The detailed SIDRA model outputs are presented in **Attachment B**.

Table 9: SIDRA model results for each option considered (based on current traffic)

Option	AM Peak results		
	DoS	**AVD (sec) for the worst movement**	**LoS for the worst movement**
Base case (Park Avenue Mall Access/Main Street intersection)	0.242	8.5 sec (for vehicles turning right out of Park Avenue Mall)	A (for all movements)
All Movement Option (for the Park Avenue Mall/Proposed Site/Main Street intersection)	0.283	10.6 sec (for vehicles turning right out of Park Avenue Mall)	B (for vehicles turning right out of Park Avenue Mall)
Left In/Left Out Access Option (for the Park Avenue Mall/Proposed Site/Main Street intersection)	0.252	10.3 sec (for vehicles turning right out of Park Avenue Mall)	B (for vehicles turning right out of Park Avenue Mall)

Table 10: SIDRA model results for each option considered (for 10-year horizon)

Option	AM Peak results		
	DoS	AVD (sec) for the worst movement	LoS for the worst movement
Base case (Park Avenue Mall Access/Main Street intersection)	0.281	9.7 sec (for vehicles turning right out of Park Avenue Mall)	A (for all movements)
All Movement Option (for the Park Avenue Mall/Proposed Site/Main Street intersection)	0.334	13.0 sec (for vehicles turning right out of Park Avenue Mall)	B (for vehicles turning right out of Park Avenue Mall)
Left In/Left Out Access Option (for the Park Avenue Mall/Proposed Site/Main Street intersection)	0.262	12.5 sec (for vehicles turning right out of Park Avenue Mall)	B (for vehicles turning right out of Park Avenue Mall)

5.1.2 Main Street/Haynes Street Intersection

Table 11 summarises the SIDRA intersection model results for Main Street/Haynes Street intersection for each access option, based on the current traffic volumes. **Table 12** shows the 10-year horizon results for this intersection (with a 2% linear growth per annum, applied to through traffic on Main Street). The detailed SIDRA model outputs are presented in **Attachment B**.

Table 11: SIDRA model results for each option considered (based on current traffic)

Option	AM Peak results		
	DoS	AVD (sec) for the intersection	LoS for for the intersection
Base case	0.585	17.9 sec	B
All Movement Option	0.586	17.8 sec	B
Left In/Left Out Access Option	0.568	18.8 sec	B

Table 12: SIDRA model results for each option considered (based on current traffic)

Option	AM Peak results		
	DoS	AVD (sec) for the intersection	LoS for for the intersection
Base case	0.665	21.9 sec	C
All Movement Option	0.682	22.0 sec	C
Left In/Left Out Access Option	0.686	23.5 sec	C

5.1.3 Main Street/Edgar Street Intersection

Table 13 summarises the SIDRA intersection model results for Main Street/Edgar Street intersection for each access option, based on the current traffic volumes. **Table 14** shows the 10-year horizon results for this intersection (with a 2% linear growth per annum, applied to through traffic on Main Street). The detailed SIDRA model outputs are presented in **Attachment B**.

Table 13: SIDRA model results for each option considered (based on current traffic)

Option	AM Peak results		
	DoS	AVD (sec) for the worst movement	LoS for the worst movement
Base case	0.254	11.8 sec (for vehicles turning right from Main Street)	B
All Movement Option	0.274	12.1 sec (for vehicles turning right from Main Street)	B
Left In/Left Out Access Option	0.286	11.8 sec (for vehicles turning right from Main Street)	B

Table 14: SIDRA model results for each option considered (for 10-year horizon)

Option	AM Peak results		
	DoS	AVD (sec) for the worst movement	LoS for the worst movement
Base case	0.373	14.8 sec (for vehicles turning right from Main Street)	B
All Movement Option	0.398	15.6 sec (for vehicles turning right from Main Street)	C
Left In/Left Out Access Option	0.423	15.1 sec (for vehicles turning right from Main Street)	C

5.2 Insights from SIDRA models

The SIDRA models have revealed the following:

- The traffic generated from the proposed development will have a minor effect on the existing operations of traffic on Main Street at the site frontage. The base case scenario shows that the intersection of Main Street with the Park Avenue Mall currently operates at a LoS A (good operation). The additional traffic due to the proposal will drop this LoS to B (acceptable delays and spare capacity). However, this change in LoS is considered minor and is deemed acceptable since there is no further drop in LoS based on the model for the 10-year horizon.
- The All Movement option will impose 1.9 seconds and 2.7 seconds of average delay to through traffic on Main Street (East leg), in the current and 10-year horizon scenarios, respectively. These translate to the formation of a queue on Main Street (East leg) of 2 vehicles and 3 vehicles, in the current and 10-year horizon scenarios, respectively. This is a result of vehicles turning right into the site waiting for acceptable gaps in eastbound traffic. A 2-3 second average delay is not considered a notable change in traffic operations.
- The Left In/Left Out option would not impose any delays to through traffic on Main Street (East leg) due to the additional traffic generated by the proposal since there

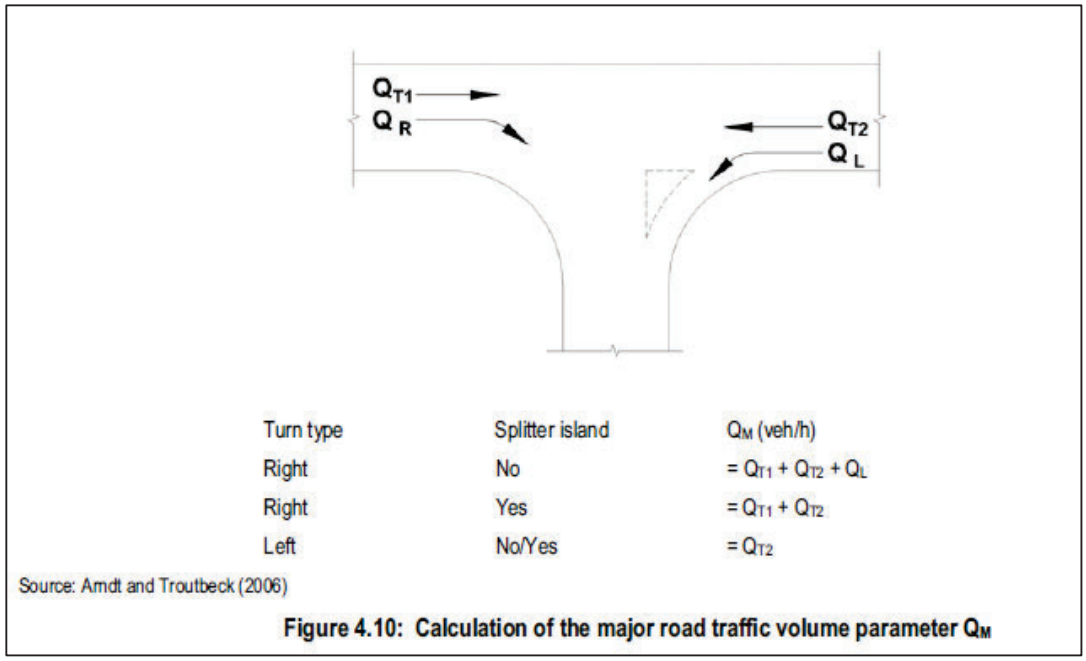
will be no right-turning vehicles under this option. However, the Left In/Left Out option would reroute the vehicles (those entering the site from east and those exiting the site towards west) through a circuitous route that uses Edgar Street, Buckle Street and Haynes Street.

- The Main Street/Haynes Street intersection currently operates at a LoS B and with the proposed development it will continue to operate at this LoS. In the 10 year horizon, the LoS of this intersection drops to LoS C (for both base case and with development traffic scenarios). However, LoS C indicates satisfactory operations and therefore is deemed acceptable.
- The Main Street/Edgar Street intersection currently operates at a LoS B and with the proposed development it will continue to operate at this LoS. In the 10-year horizon, this intersection will operate at LoS B without the development traffic. With the development traffic, the LoS for the 10-year horizon will drop from LoS B to LoS C. However, LoS C indicates satisfactory operations and therefore is deemed acceptable.

6.0 Site Access Assessment

6.1 Site Access Design

As per Council requirements, the site access has been reviewed against the left-turn treatment warrants presented in *Austroads Guide to Road Design – Part 4A: Signalised and Unsignalised Intersections.* When considering these treatments, however, it must be recognised that these warrants are typically intended for 'major' roads with a high speed, high volume environment. Main Road is considered to be a 'high street', with high levels of pedestrian and cyclists movements and vehicle turning movements. As such, high speeds should always be avoided in such environments to maintain safety, and also amenity. As Main Road is neither a high speed, nor a high volume road, the warrants contained in the Austraods guide should be taken as guidance only, and considered within the overall site context. **Figure 11** (extracted from the Austroads Guide) illustrates how the flows are calculated for turn treatment recommendation.



Turn type	Splitter island	Q_M (veh/h)
Right	No	$= Q_{T1} + Q_{T2} + Q_L$
Right	Yes	$= Q_{T1} + Q_{T2}$
Left	No/Yes	$= Q_{T2}$

Source: Arndt and Troutbeck (2006)

Figure 4.10: Calculation of the major road traffic volume parameter Q_M

Figure 11: Traffic flow volume parameters for turn treatments

- Based on the traffic generation calculation presented for the left in/left out access option (the critical scenario) in **Figure 10**, the Q_L parameter which reflects the number of left-turning vehicles (i.e., the vehicles entering the site) in the AM peak hour, is = **55 veh/hr**
- Based on the existing AM peak hour traffic volumes presented in **Figure 10**, the Q_M parameter which reflects the major road traffic volume is = **360 veh/hr**

Figure 12 illustrates the turn treatment recommendation determined through warrants presented in *Austroads Guide to Road Design – Part 4A: Signalised and Unsignalised Intersections.*

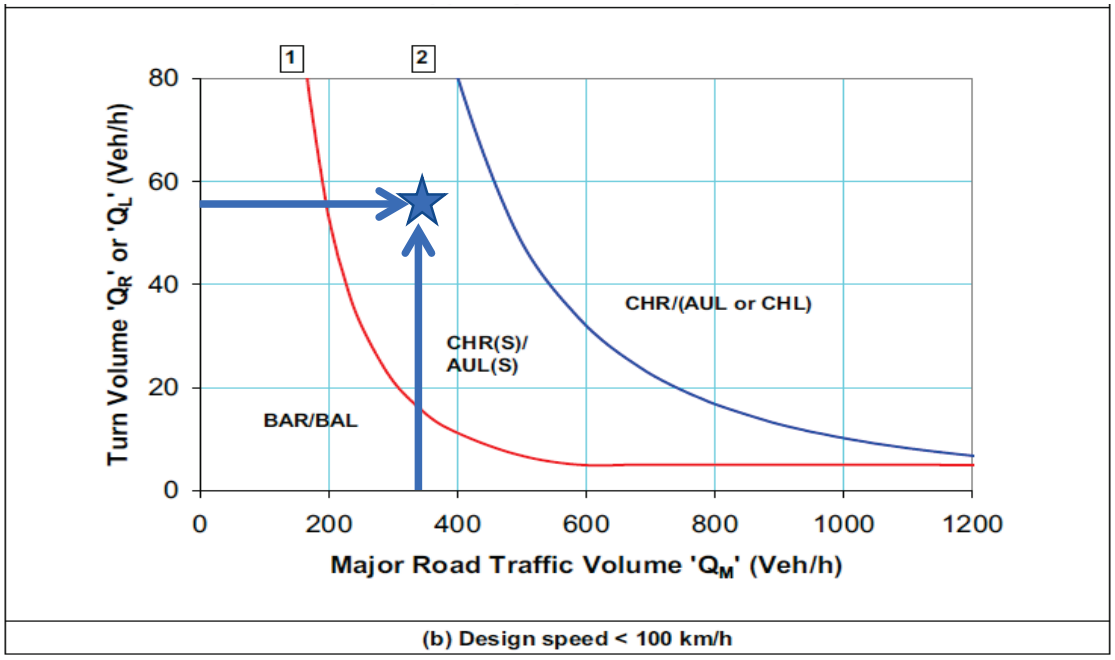


Figure 12: Left turn treatment recommendation based on AustRoads Guide

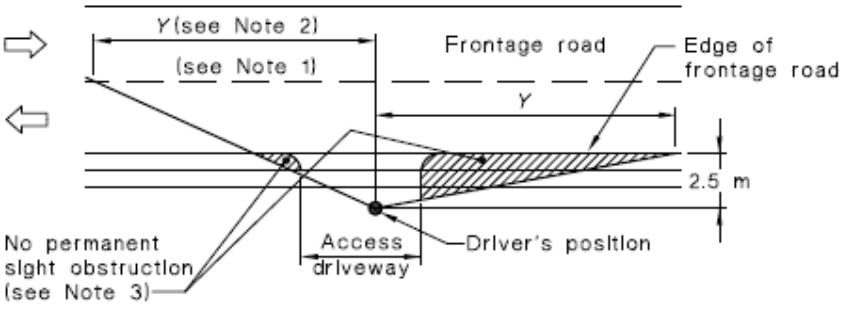
As per **Figure 12**, the AustRoads Guide recommends the provision of an auxiliary short lane on Main Street to facilitate the left-turning vehicles into the site.

Notwithstanding, an auxiliary short lane on Main Street for left-turning vehicles is not considered suitable. Auxiliary lane treatments are recommended in high-speed environments so that turning vehicles can do so safely without any sudden turn

movements that could impact on efficiency and safety of the remaining through traffic using the same lane. In this case, the proposed site access point is located within a low-speed environment - a 40 km/h speed limit applies to vehicles using this stretch of Main Street on school days between 7.30am-9am and 2.30pm-4pm (due to the school zone) and these times overlap with the AM peak traffic period for the site. Furthermore, the immediate environment (<120m radius) of the site includes a railway crossing, two major vehicular access points (for the Park Avenue Mall and St Joseph's school) and a pedestrian crossing. These features, in conjunction with the bus services, cycles lanes and footpaths on either side of Main Street, ensure a low-speed/pedestrian-friendly environment, especially during peak periods. Moreover, the use of such treatments would be out of character with the surrounding road environement, as no similar treatments have been adopted for other significant developments, including the hotels, schools and local shopping centres. As such, no turn treatments are considered necessary, nor appropriate for this proposal. The proposed driveway to the site's car park is two-way and it enables vehicles to enter the site, while another vehicle is exiting the site, without waiting on Main Street which eliminates any queue build-ups.

6.2 Sight Distance Availability for Exiting Vehicles

The sight distance availability for the vehicles exiting the site has been investigated using the recommendations provided in AS 2890.1:2004. **Figure 13** shows the AS 2890.1:2004 criteria.



Frontage road speed (Note 4) km/h	Distance (Y) along frontage road m		
	Access driveways other than domestic (Note 5)		Domestic property access (Note 6)
	Desirable 5 s gap	Minimum SSD	
40	55	35	30
50	69	45	40
60	83	65	55
70	97	85	70
80	111	105	95
90	125	130	Use values from 2nd and 3rd columns
100	139	160	
110	153	190	

Figure 13: Sight distance requirements for vehicles exiting the site

Figure 13 shows a minimum sight distance requirement of 65m and a desirable 5-second gap requirement of 83m for a 60 km/h frontage road speed. Note that the AM peak traffic generation period for the subject site overlaps with the school zone speed limit time and therefore a 40 km/h speed limit is applicable. However, in consideration of the times outside the school zone, the sight distance requirement for 60 km/h frontage road speed has been adopted here for a conservative assessment.

Figure 14 shows the anticipated vehicle egress location from the site. The exiting vehicles will be approximately 8.4m southwest to the northeastern boundary of the site.

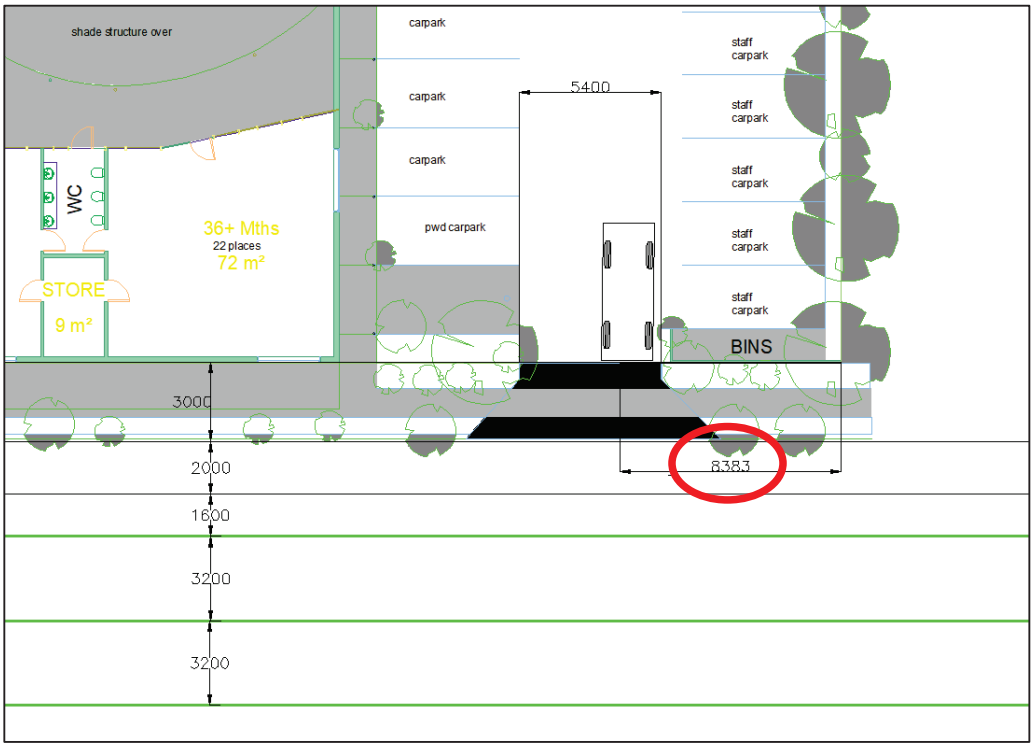


Figure 14: Location of vehicle egress from the site

Figure 15 shows the minimum sight distance requirement of 65m (in Green) and a desirable 5-second gap requirement of 83m (in Red), on both sides of a vehicle exiting the site (this location has been set back by 2.5m from the edge of Main Street, as recommended in AS 2890.1:2004).

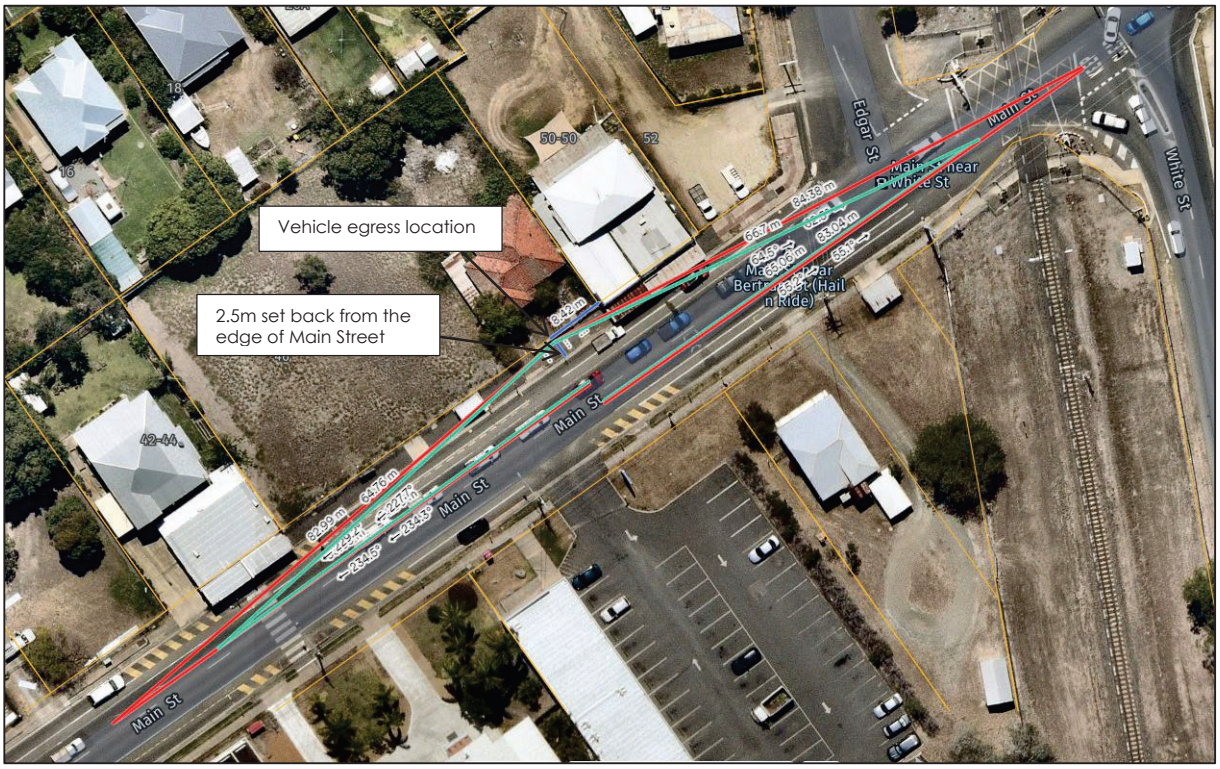


Figure 15: Minimum and desirable safe sight distances for a vehicle exiting the site

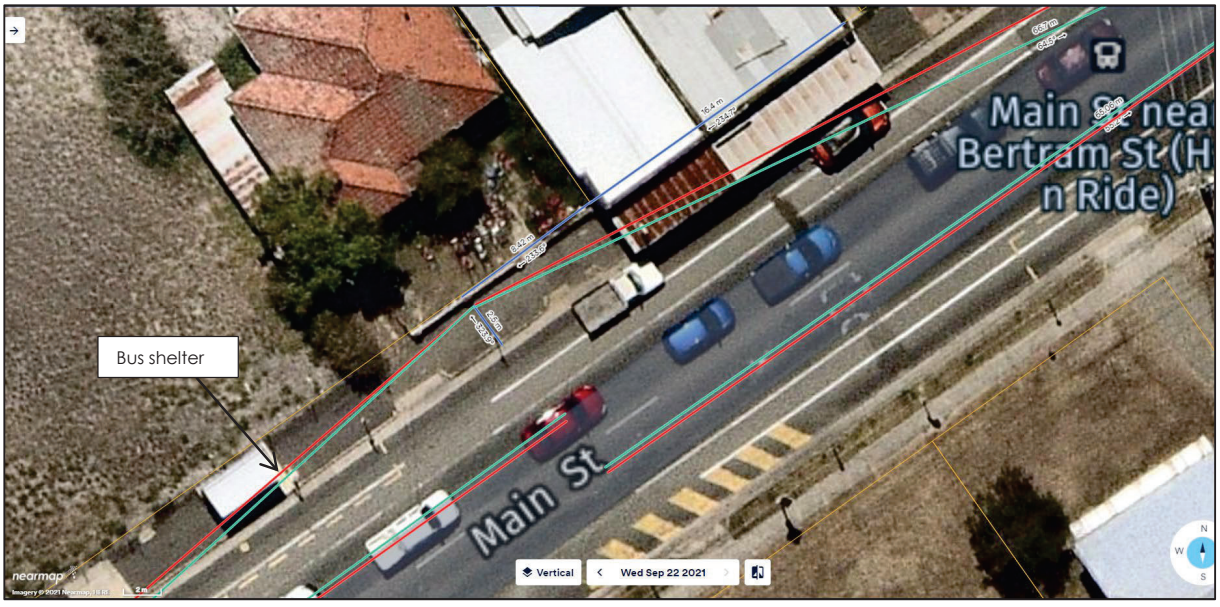


Figure 16: Minimum and desirable safe sight distances for a vehicle exiting the site (zoomed in)

Based on **Figures 15** and **16**, the following are evident:

- The sight lines to the left hand side of a vehicle exiting the site is only applicable if the 'All Movement' access scenario is adopted for the site. There are no permanent obstructions within the sight lines to the left hand side of a driver exiting the site. To avoid any vehicles parked at the kerbside interfering with the sightlines to the left hand side, the drivers can pull up to the edge of the cycle lane by waiting across the kerbside parking lane, prior to checking the sightlines on either side.
- The existing bus shelter is unlikely to obstruct the sightlines to the right-hand side of drivers exiting the site. **Figure 16** shows the location of the bus shelter and based on this aerial image, the sightline for the 5-second gap scenario appears to slightly overlap with the edge of the shelter roof. However, if the bus shelter is 'open' on the sides, this is unlikely to be an issue. In any case, the minimum sight distance requirement of 65m (in Green) is achievable.
- When a bus is parked at the bus shelter, it could obstruct the minimum sight distance to the right-hand side of drivers exiting the site. It is noted that bus route 401 is the only service that uses this bus stop. Based on the timetable for this service presented in **Figure 4**, in the AM peak hour period (7.45am to 8.45am) this route has only one service (the first service start is at 7.32am, next at 8.02am and the next at 8.32am and then at 9.32am). In the PM period, it has services starting at 2.31pm, next at 3.05pm and the next at 3.32pm and then at 4.32pm. Given the low frequency of services during the peak operational periods of the proposed development, and the buses generally being parked at the stop for <1 minute, the potential of a bus obstructing the sightlines of a vehicle exiting the site is considered negligible. In any case, the drivers exiting the site have a responsibility to undertake adequate judgements on the available gaps before entering the traffic stream.

6.3 Managing the Impacts on the Cycleway

The traffic surveys at the Main Street/Edgar Street intersection indicated no bicycle movements in the AM peak hour period. In the PM peak hour period, there were 3 bicycle movements, all of which were in the westbound direction (i.e. using the cycle lane on Main Street, on the other side of the site).

However, in order to mitigate any potential conflicts between cyclists and vehicles accessing the site, a Green colour pavement imprint treatment (similar to that shown in **Figure 17** outside IGA on Main Street) can be recommended for the section of the cycleway that runs across the driveway to the site. This treatment will provide sufficient notice to the cyclists and drivers of the upcoming driveway.

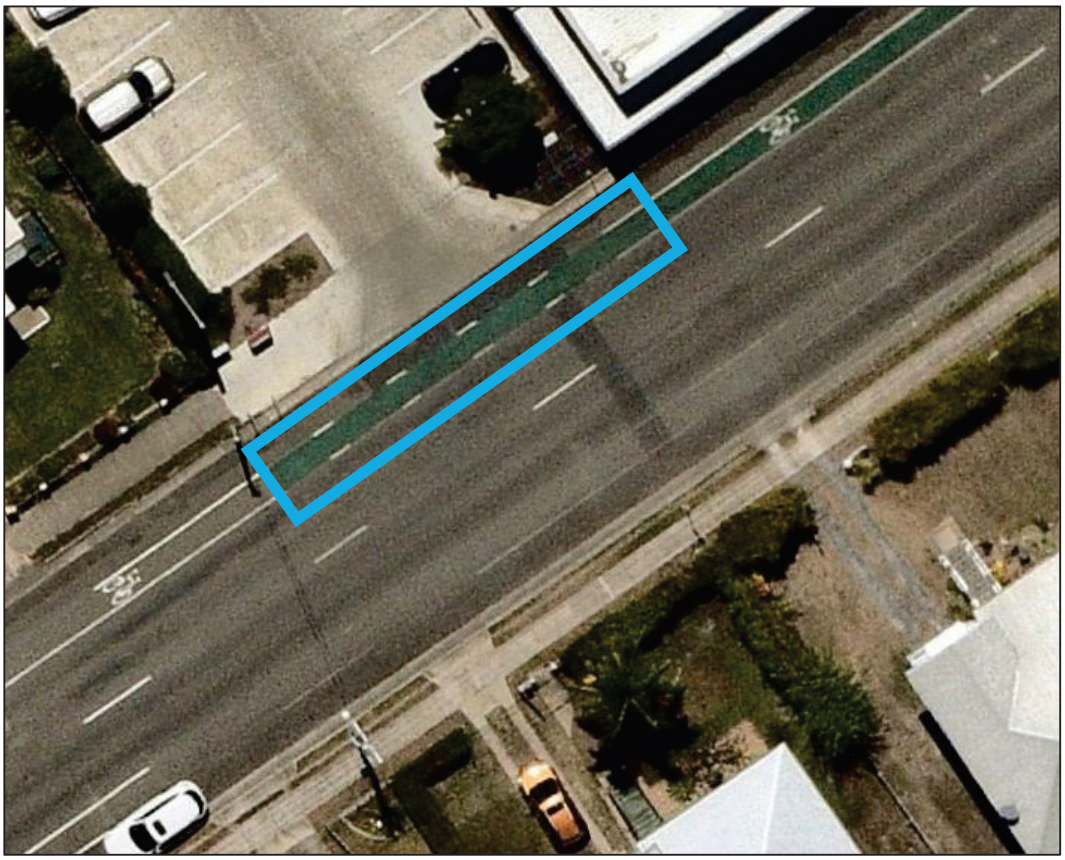


Figure 17: Recommended Green pavement imprint treatment for the cycleway section across the driveway

6.4 Manoeuvrability Conditions of Vehicles

The maneuverability conditions of vehicles at key locations have been tested with swept paths based on a vehicle template for a B85 (85th percentile) passenger vehicle (dimensioned as per AS 2890.1:2004). The following sections present these results. It is noted that the Blue and Cyan colour lines in the swept paths indicate the front and rear tyre tracks of the vehicle, respectively. The Black colour of the swept paths indicate the vehicle body envelop and the Red lines indicate the 300mm vehicle body clearance envelope.

The following dimensions have been adopted for the existing environment on Main Street at the site frontage, based on measurements obtained from high-resolution aerial images:

- Verge/footpath at the site frontage = 3m
- Cycleway = 1.6m
- Traffic lane = 3.2m

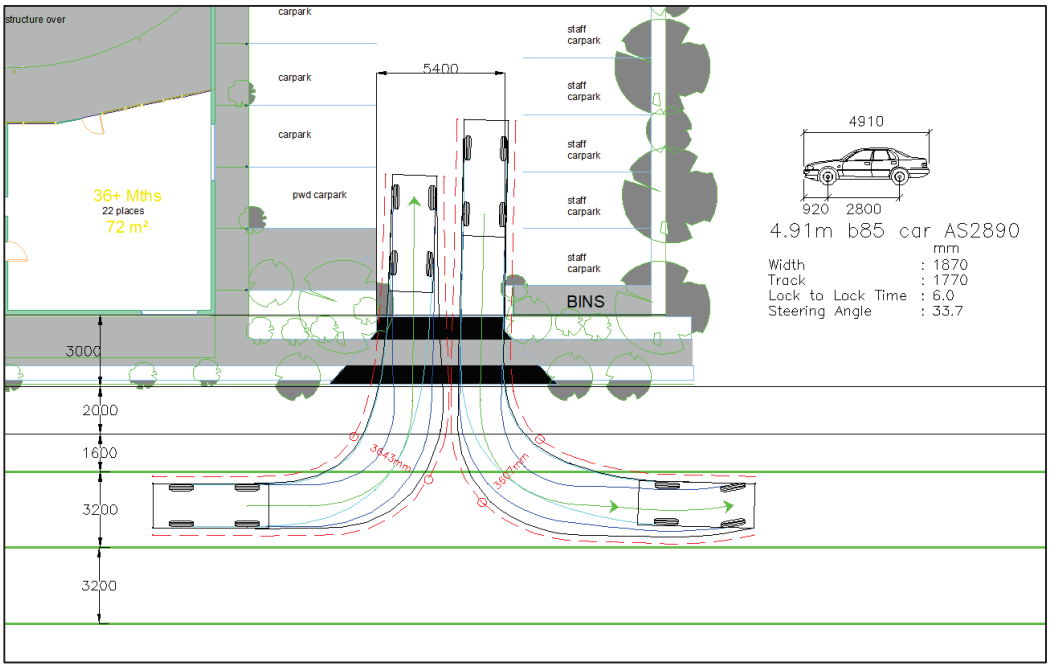


Figure 18: A vehicle turning left in while another turns left out of the site

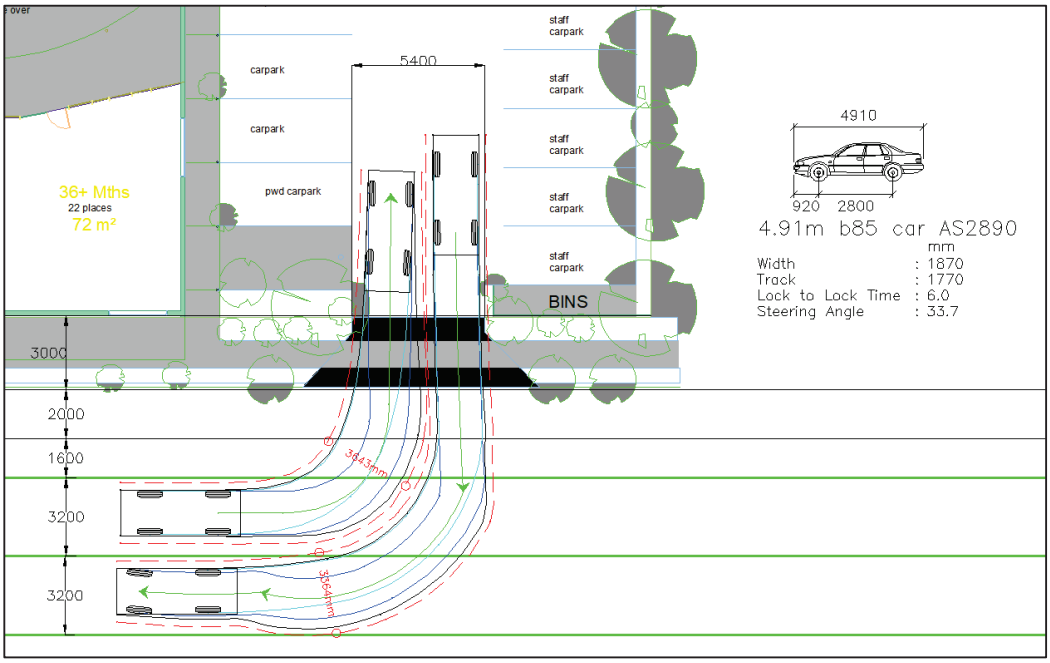


Figure 19: A vehicle turning left in while another turns right out of the site

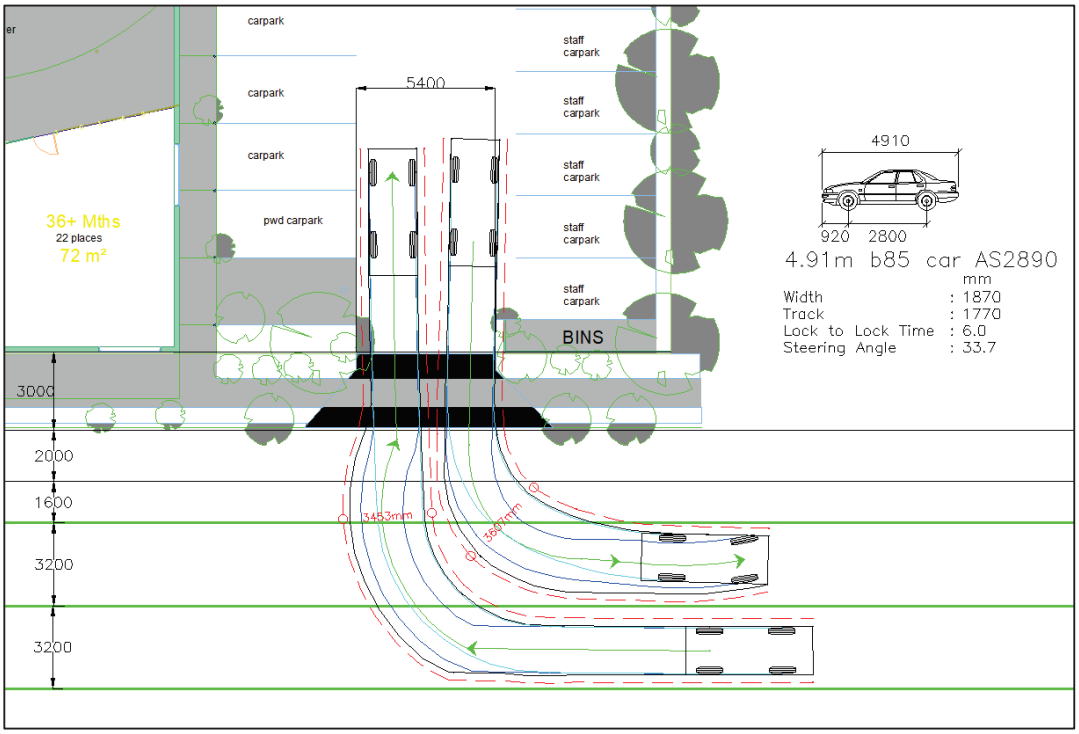


Figure 20: A vehicle turning right in while another turns left out of the site

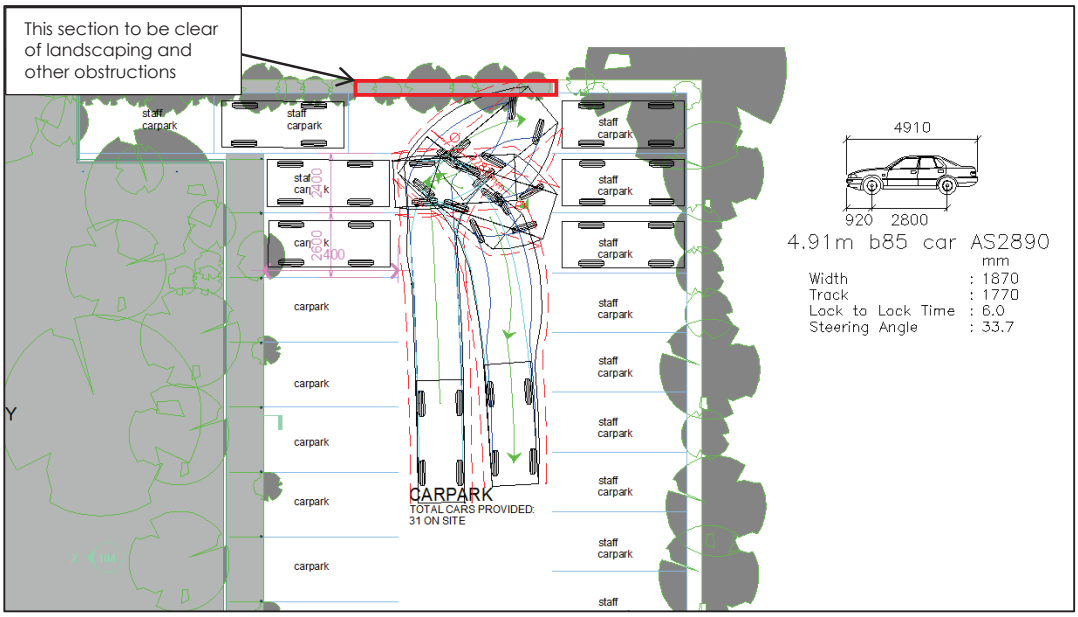


Figure 21: A vehicle turning around within the site when all car spaces are occupied

Based on the above swept path results, the following are evident:

- The site access point can sufficiently accommodate the simultaneous entry and exit of vehicles. This is due to the site access point being well set back from the traffic lanes on Main Street (due to the presence of a wide footpath and a cycleway).
- The current site plans indicate a width of 5.4m for the driveway at the boundary. It is recommended that this width be increased to 5.5m (with 300mm clearance on either side from obstructions higher than 150mm) to comply with AS 2890.1:2004.
- A vehicle can turn around within the on-site car park when other car spaces are occupied. It will require one additional correction. It is recommended to provide further paving, clear of landscaping and other obstructions, for the section at the end of the aisle of the car park (outlined in **Figure 21**).

7.0 Consideration

We trust that the information presented in this technical note satisfactorily addresses the issues raised in the Council RFI letter.

Should you require any further information relating to this assessment, please contact our office.

Yours sincerely,

Christopher J. Saunders

Director | Principal Traffic Engineer

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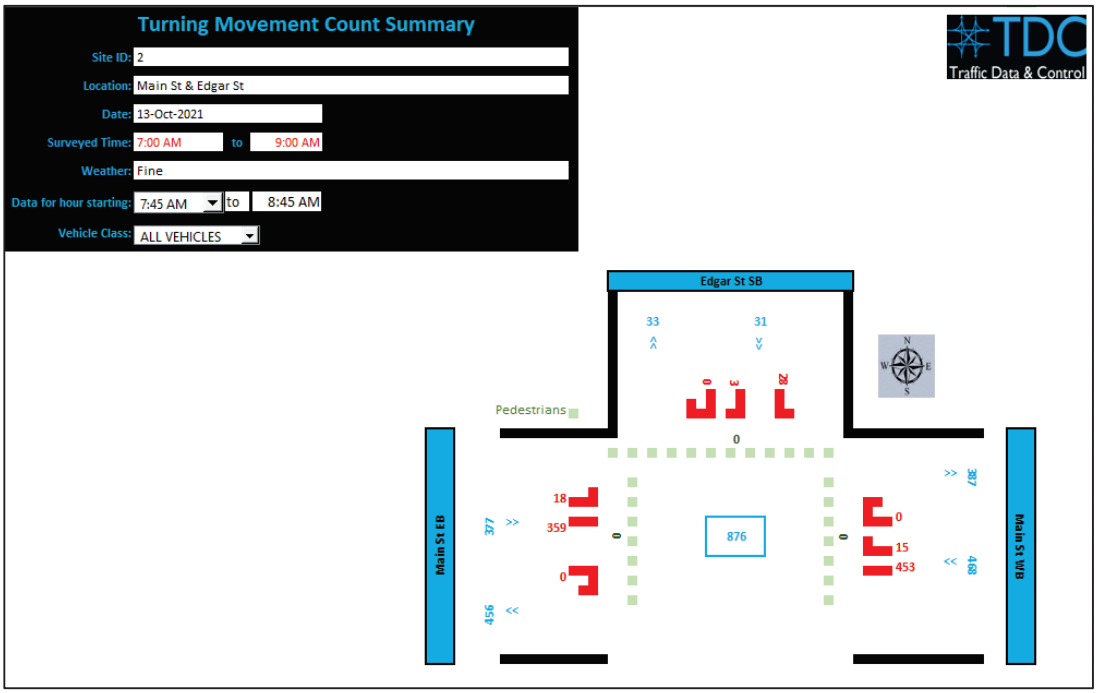
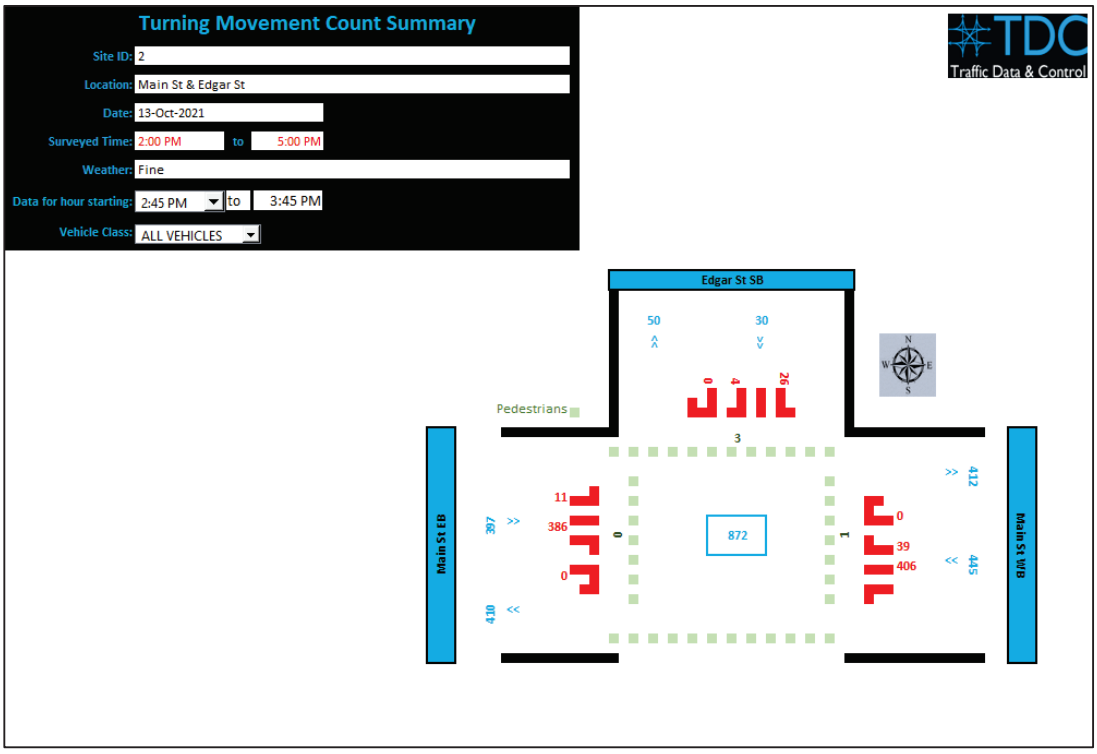
Attachment A: Detailed Traffic Survey Results

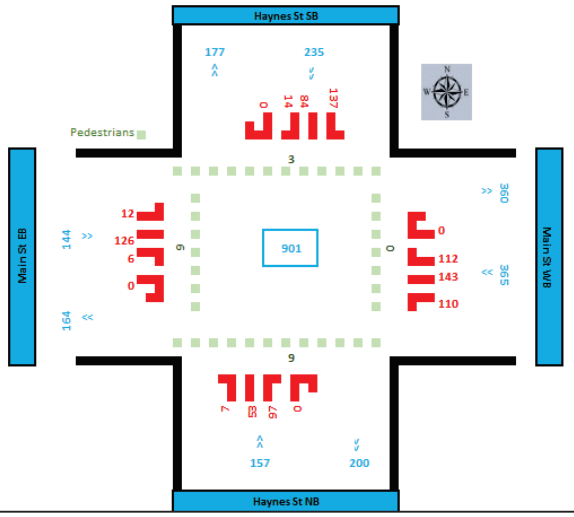




Turning Movement Count Summary

Site ID:	1
Location:	Main St & Haynes St, Park Avenue
Date:	13-Oct-2021
Surveyed Times:	7:00 AM to 9:00 AM
Weather:	Fine
Data for hour starting:	8:00 AM to 9:00 AM
Vehicle Class:	ALL VEHICLES

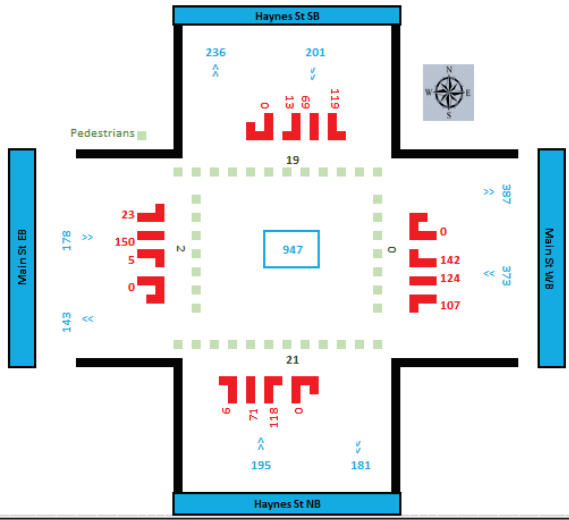
TDC Traffic Data & Control



Turning Movement Count Summary

Site ID:	1
Location:	Main St & Haynes St, Park Avenue
Date:	13-Oct-2021
Surveyed Times:	2:00 PM to 5:00 PM
Weather:	Fine
Data for hour starting:	2:45 PM to 3:45 PM
Vehicle Class:	ALL VEHICLES

TDC Traffic Data & Contro



Attachment B: Detailed SIDRA Model Results

Existing Conditions

Park Avenue Mall Access/Main Street

MOVEMENT SUMMARY

Site: Park Avenue Mall Access/Main Street (existing)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Park Avenue Mall											
1	L2	10	0.0	0.046	8.0	LOS A	0.1	1.0	0.52	0.73	20.3
3	R2	20	0.0	0.046	8.5	LOS A	0.1	1.0	0.52	0.73	20.3
Approach		30	0.0	0.046	8.3	LOS A	0.1	1.0	0.52	0.73	20.3
East: Main Street East											
4	L2	20	0.0	0.242	4.5	LOS A	0.0	0.0	0.00	0.03	39.0
5	T1	436	5.0	0.242	0.0	LOS A	0.0	0.0	0.00	0.03	39.0
Approach		456	4.8	0.242	0.2	NA	0.0	0.0	0.00	0.03	39.0
West: Main Street West											
11	T1	350	5.0	0.194	2.2	LOS A	1.6	11.4	0.56	0.02	31.3
12	R2	10	0.0	0.194	7.2	LOS A	1.6	11.4	0.56	0.02	31.3
Approach		360	4.9	0.194	2.4	NA	1.6	11.4	0.56	0.02	31.3
All Vehicles		846	4.6	0.242	1.4	NA	1.6	11.4	0.26	0.05	33.1

Main Street/Edgar Street

MOVEMENT SUMMARY

Site: Main Street/Edgar Street (existing)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Main Street											
5	T1	453	4.9	0.254	2.2	LOS A	2.3	16.4	0.57	0.04	49.0
6	R2	15	13.3	0.254	11.8	LOS B	2.3	16.4	0.57	0.04	49.0
Approach		468	5.1	0.254	2.5	NA	2.3	16.4	0.57	0.04	49.0
North: Edgar Street											
7	L2	28	3.6	0.030	10.8	LOS B	0.1	0.8	0.41	0.66	46.7
9	R2	3	0.0	0.030	11.2	LOS B	0.1	0.8	0.41	0.66	46.7
Approach		31	3.2	0.030	10.8	LOS B	0.1	0.8	0.41	0.66	46.7
West: Main Street											
10	L2	18	5.6	0.199	9.2	LOS A	0.0	0.0	0.00	0.07	59.3
11	T1	359	3.6	0.199	0.0	LOS A	0.0	0.0	0.00	0.07	59.3
Approach		377	3.7	0.199	0.5	NA	0.0	0.0	0.00	0.07	59.3

All Vehicles	876	4.5	0.254	1.9	NA	2.3	16.4	0.32	0.07	52.9

Main Street/Haynes Street

MOVEMENT SUMMARY

Site: Main Street/Haynes Street (existing)

New Site
Signals - Actuated Cycle Time = 45 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Haynes Street											
1	L2	7	14.3	0.391	24.3	LOS C	2.9	21.5	0.82	0.76	37.4
2	T1	53	1.9	0.391	15.2	LOS B	2.9	21.5	0.82	0.76	37.4
3	R2	97	6.2	0.391	24.7	LOS C	2.9	21.5	0.82	0.76	37.4
Approach		157	5.1	0.391	21.5	LOS C	2.9	21.5	0.82	0.76	37.4
East: Main Street											
4	L2	109	9.2	0.585	21.5	LOS C	6.5	48.2	0.82	0.79	39.5
5	T1	143	7.0	0.585	12.4	LOS B	6.5	48.2	0.82	0.79	39.5
6	R2	112	2.7	0.585	21.9	LOS C	6.5	48.2	0.82	0.79	39.5
Approach		364	6.3	0.585	18.0	LOS B	6.5	48.2	0.82	0.79	39.5
North: Haynes Street											
7	L2	137	5.8	0.397	22.6	LOS C	4.1	30.4	0.79	0.76	38.8
8	T1	84	7.1	0.397	13.4	LOS B	4.1	30.4	0.79	0.76	38.8
9	R2	14	0.0	0.397	23.0	LOS C	4.1	30.4	0.79	0.76	38.8
Approach		235	6.0	0.397	19.3	LOS B	4.1	30.4	0.79	0.76	38.8
West: Main Street											
10	L2	12	0.0	0.196	19.2	LOS B	2.1	15.0	0.67	0.59	43.9
11	T1	126	2.4	0.196	10.0	LOS B	2.1	15.0	0.67	0.59	43.9
12	R2	6	0.0	0.196	19.6	LOS B	2.1	15.0	0.67	0.59	43.9
Approach		144	2.1	0.196	11.2	LOS B	2.1	15.0	0.67	0.59	43.9
All Vehicles		900	5.3	0.585	17.9	LOS B	6.5	48.2	0.79	0.74	39.6

Post Development - All Movement Option

Site Access/Park Avenue Mall Access/Main Street

MOVEMENT SUMMARY

Site: Site Access/Park Avenue Mall Access/Main Street (post dev, all movement)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Avenue Mall											
1	L2	10	0.0	0.064	10.2	LOS B	0.2	1.4	0.60	0.78	17.9
3	R2	20	0.0	0.064	10.6	LOS B	0.2	1.4	0.60	0.78	17.9
Approach		30	0.0	0.064	10.5	LOS B	0.2	1.4	0.60	0.78	17.9
East: Main Street East											
4	L2	20	0.0	0.283	6.4	LOS A	2.3	16.4	0.55	0.07	36.2
5	T1	456	5.0	0.283	1.9	LOS A	2.3	16.4	0.55	0.07	36.2
6	R2	38	0.0	0.283	6.8	LOS A	2.3	16.4	0.55	0.07	36.2
Approach		514	4.4	0.283	2.4	NA	2.3	16.4	0.55	0.07	36.2
North: Proposed Site Access											
7	L2	25	0.0	0.050	7.6	LOS A	0.2	1.2	0.47	0.65	34.6
9	R2	11	0.0	0.050	8.0	LOS A	0.2	1.2	0.47	0.65	34.6
Approach		36	0.0	0.050	7.7	LOS A	0.2	1.2	0.47	0.65	34.6
West: Main Street West											
10	L2	17	0.0	0.204	6.9	LOS A	1.7	12.3	0.58	0.04	36.0
11	T1	350	5.0	0.204	2.4	LOS A	1.7	12.3	0.58	0.04	36.0
12	R2	10	0.0	0.204	7.3	LOS A	1.7	12.3	0.58	0.04	36.0
Approach		377	4.6	0.204	2.8	NA	1.7	12.3	0.58	0.04	36.0
All Vehicles		957	4.2	0.283	3.0	NA	2.3	16.4	0.56	0.10	35.9

Main Street/Edgar Street

MOVEMENT SUMMARY

Site: Main Street/Edgar Street (post dev, all movement)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Main Street											
5	T1	491	4.5	0.274	2.5	LOS A	2.6	18.7	0.61	0.04	48.5
6	R2	15	13.3	0.274	12.1	LOS B	2.6	18.7	0.61	0.04	48.5
Approach		506	4.7	0.274	2.8	NA	2.6	18.7	0.61	0.04	48.5
North: Edgar Street											
7	L2	28	3.6	0.032	11.0	LOS B	0.1	0.8	0.43	0.67	46.6
9	R2	3	0.0	0.032	11.3	LOS B	0.1	0.8	0.43	0.67	46.6
Approach		31	3.2	0.032	11.0	LOS B	0.1	0.8	0.43	0.67	46.6
West: Main Street											
10	L2	18	5.6	0.211	9.2	LOS A	0.0	0.0	0.00	0.06	59.3
11	T1	384	3.4	0.211	0.0	LOS A	0.0	0.0	0.00	0.06	59.3

Approach	402	3.5	0.211	0.4	NA	0.0	0.0	0.00	0.06	59.3
All Vehicles	939	4.2	0.274	2.1	NA	2.6	18.7	0.34	0.07	52.6

Main Street/Haynes Street

MOVEMENT SUMMARY

Site: Main Street/Haynes Street (post dev, all movement)

New Site
Signals - Actuated Cycle Time = 46 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Haynes Street											
1	L2	7	14.3	0.403	25.0	LOS C	3.0	22.2	0.83	0.76	37.0
2	T1	53	1.9	0.403	15.8	LOS B	3.0	22.2	0.83	0.76	37.0
3	R2	97	6.2	0.403	25.4	LOS C	3.0	22.2	0.83	0.76	37.0
Approach		157	5.1	0.403	22.1	LOS C	3.0	22.2	0.83	0.76	37.0
East: Main Street											
4	L2	109	9.2	0.586	21.4	LOS C	6.8	50.0	0.81	0.79	39.7
5	T1	154	6.5	0.586	12.2	LOS B	6.8	50.0	0.81	0.79	39.7
6	R2	112	2.7	0.586	21.7	LOS C	6.8	50.0	0.81	0.79	39.7
Approach		375	6.1	0.586	17.7	LOS B	6.8	50.0	0.81	0.79	39.7
North: Haynes Street											
7	L2	137	5.8	0.406	23.2	LOS C	4.3	31.4	0.80	0.76	38.4
8	T1	84	7.1	0.406	14.0	LOS B	4.3	31.4	0.80	0.76	38.4
9	R2	14	0.0	0.406	23.6	LOS C	4.3	31.4	0.80	0.76	38.4
Approach		235	6.0	0.406	19.9	LOS B	4.3	31.4	0.80	0.76	38.4
West: Main Street											
10	L2	12	0.0	0.211	19.1	LOS B	2.4	16.9	0.66	0.58	44.1
11	T1	143	2.1	0.211	9.9	LOS A	2.4	16.9	0.66	0.58	44.1
12	R2	6	0.0	0.211	19.5	LOS B	2.4	16.9	0.66	0.58	44.1
Approach		161	1.9	0.211	10.9	LOS B	2.4	16.9	0.66	0.58	44.1
All Vehicles		928	5.2	0.586	17.8	LOS B	6.8	50.0	0.78	0.74	39.6

Post Development – Left-in/Left-out Movement Option

Site Access/Park Avenue Mall Access/Main Street

MOVEMENT SUMMARY

Site: Site Access / Park Avenue Mall Access/Main Street (post dev, LILO)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Avenue Mall											
1	L2	10	0.0	0.061	9.9	LOS A	0.2	1.4	0.59	0.77	18.3
3	R2	20	0.0	0.061	10.3	LOS B	0.2	1.4	0.59	0.77	18.3
Approach		30	0.0	0.061	10.2	LOS B	0.2	1.4	0.59	0.77	18.3
East: Main Street East											
4	L2	20	0.0	0.252	4.5	LOS A	0.0	0.0	0.00	0.03	39.8
5	T1	456	5.0	0.252	0.0	LOS A	0.0	0.0	0.00	0.03	39.8
Approach		476	4.8	0.252	0.2	NA	0.0	0.0	0.00	0.03	39.8
North: Proposed Site Access											
7	L2	36	0.0	0.031	5.7	LOS A	0.1	0.8	0.39	0.57	35.6
Approach		36	0.0	0.031	5.7	LOS A	0.1	0.8	0.39	0.57	35.6
West: Main Street West											
10	L2	55	0.0	0.224	7.0	LOS A	1.9	13.8	0.59	0.06	35.9
11	T1	350	5.0	0.224	2.5	LOS A	1.9	13.8	0.59	0.06	35.9
12	R2	10	0.0	0.224	7.4	LOS A	1.9	13.8	0.59	0.06	35.9
Approach		415	4.2	0.224	3.2	NA	1.9	13.8	0.59	0.06	35.9
All Vehicles		957	4.2	0.252	2.0	NA	1.9	13.8	0.29	0.08	37.6

Main Street/Edgar Street

MOVEMENT SUMMARY

Site: Main Street/Edgar Street (post dev, LILO)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Main Street											
5	T1	453	4.9	0.286	2.3	LOS A	2.4	17.3	0.59	0.11	48.5
6	R2	53	3.8	0.286	11.8	LOS B	2.4	17.3	0.59	0.11	48.5
Approach		506	4.7	0.286	3.3	NA	2.4	17.3	0.59	0.11	48.5
North: Edgar Street											
7	L2	28	3.6	0.032	11.0	LOS B	0.1	0.8	0.43	0.67	46.6
9	R2	3	0.0	0.032	11.3	LOS B	0.1	0.8	0.43	0.67	46.6
Approach		31	3.2	0.032	11.0	LOS B	0.1	0.8	0.43	0.67	46.6
West: Main Street											
10	L2	29	3.4	0.217	9.2	LOS A	0.0	0.0	0.00	0.09	59.0
11	T1	384	3.4	0.217	0.0	LOS A	0.0	0.0	0.00	0.09	59.0
Approach		413	3.4	0.217	0.7	NA	0.0	0.0	0.00	0.09	59.0
All Vehicles		950	4.1	0.286	2.4	NA	2.4	17.3	0.33	0.12	52.5

Main Street/Haynes Street

MOVEMENT SUMMARY

Site: Main Street/Haynes Street (post dev, LILO)

New Site
Signals - Actuated Cycle Time = 48 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Haynes Street											
1	L2	7	14.3	0.427	26.3	LOS C	3.2	23.6	0.85	0.77	36.2
2	T1	53	1.9	0.427	17.1	LOS B	3.2	23.6	0.85	0.77	36.2
3	R2	97	6.2	0.427	26.7	LOS C	3.2	23.6	0.85	0.77	36.2
Approach		157	5.1	0.427	23.4	LOS C	3.2	23.6	0.85	0.77	36.2
East: Main Street											
4	L2	109	9.2	0.568	21.6	LOS C	6.8	50.0	0.80	0.78	39.5
5	T1	143	7.0	0.568	12.4	LOS B	6.8	50.0	0.80	0.78	39.5
6	R2	112	2.7	0.568	22.0	LOS C	6.8	50.0	0.80	0.78	39.5
Approach		364	6.3	0.568	18.1	LOS B	6.8	50.0	0.80	0.78	39.5
North: Haynes Street											
7	L2	175	4.6	0.483	23.9	LOS C	5.5	40.1	0.82	0.78	37.7
8	T1	84	7.1	0.483	14.8	LOS B	5.5	40.1	0.82	0.78	37.7
9	R2	25	0.0	0.483	24.3	LOS C	5.5	40.1	0.82	0.78	37.7
Approach		284	4.9	0.483	21.3	LOS C	5.5	40.1	0.82	0.78	37.7
West: Main Street											
10	L2	12	0.0	0.209	19.4	LOS B	2.5	17.5	0.66	0.58	43.9
11	T1	143	2.1	0.209	10.2	LOS B	2.5	17.5	0.66	0.58	43.9
12	R2	6	0.0	0.209	19.7	LOS B	2.5	17.5	0.66	0.58	43.9
Approach		161	1.9	0.209	11.2	LOS B	2.5	17.5	0.66	0.58	43.9
All Vehicles		966	5.0	0.568	18.8	LOS B	6.8	50.0	0.79	0.75	39.0

10 Year Horizon (Base)

Park Avenue Mall Access/Main Street

MOVEMENT SUMMARY

Site: Park Avenue Mall Access/Main Street (10 yrs base)

New Site
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Park Avenue Mall											
1	L2	12	0.0	0.065	9.2	LOS A	0.2	1.5	0.59	0.78	18.9
3	R2	24	0.0	0.065	9.7	LOS A	0.2	1.5	0.59	0.78	18.9
Approach		36	0.0	0.065	9.5	LOS A	0.2	1.5	0.59	0.78	18.9
East: Main Street East											
4	L2	24	0.0	0.281	4.5	LOS A	0.0	0.0	0.00	0.03	39.0
5	T1	523	0.0	0.281	0.0	LOS A	0.0	0.0	0.00	0.03	39.0
Approach		547	0.0	0.281	0.2	NA	0.0	0.0	0.00	0.03	39.0
West: Main Street West											
11	T1	420	0.0	0.227	3.0	LOS A	2.1	14.9	0.64	0.02	30.4
12	R2	12	0.0	0.227	7.9	LOS A	2.1	14.9	0.64	0.02	30.4
Approach		432	0.0	0.227	3.1	NA	2.1	14.9	0.64	0.02	30.4
All Vehicles		1015	0.0	0.281	1.8	NA	2.1	14.9	0.29	0.05	32.4

Main Street/Edgar Street

MOVEMENT SUMMARY

Site: Main Street/Edgar Street (10 yrs base)

New Site
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Main Street											
5	T1	654	5.0	0.373	5.3	LOS A	5.7	41.4	0.81	0.04	45.6
6	R2	23	15.8	0.373	14.8	LOS B	5.7	41.4	0.81	0.04	45.6
Approach		677	5.3	0.373	5.6	NA	5.7	41.4	0.81	0.04	45.6
North: Edgar Street											
7	L2	42	5.7	0.062	12.3	LOS B	0.2	1.6	0.52	0.73	45.4
9	R2	5	0.0	0.062	12.7	LOS B	0.2	1.6	0.52	0.73	45.4
Approach		47	5.1	0.062	12.3	LOS B	0.2	1.6	0.52	0.73	45.4
West: Main Street											
10	L2	28	8.7	0.288	9.2	LOS A	0.0	0.0	0.00	0.07	59.3
11	T1	518	3.7	0.288	0.0	LOS A	0.0	0.0	0.00	0.07	59.3
Approach		546	4.0	0.288	0.5	NA	0.0	0.0	0.00	0.07	59.3
All Vehicles		1270	4.7	0.373	3.7	NA	5.7	41.4	0.45	0.08	50.6

Main Street/Haynes Street

MOVEMENT SUMMARY

Site: Main Street/Haynes Street (10 yrs base)

New Site
Signals - Actuated Cycle Time = 62 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Haynes Street											
1	L2	10	20.0	0.493	30.5	LOS C	5.1	37.3	0.85	0.78	34.0
2	T1	65	3.1	0.493	21.3	LOS C	5.1	37.3	0.85	0.78	34.0
3	R2	118	6.8	0.493	30.9	LOS C	5.1	37.3	0.85	0.78	34.0
Approach		193	6.2	0.493	27.6	LOS C	5.1	37.3	0.85	0.78	34.0
East: Main Street											
4	L2	131	9.2	0.665	25.8	LOS C	10.9	80.8	0.84	0.81	36.7
5	T1	172	7.0	0.665	16.7	LOS B	10.9	80.8	0.84	0.81	36.7
6	R2	135	3.0	0.665	26.2	LOS C	10.9	80.8	0.84	0.81	36.7
Approach		438	6.4	0.665	22.4	LOS C	10.9	80.8	0.84	0.81	36.7
North: Haynes Street											
7	L2	165	6.1	0.433	25.9	LOS C	6.6	48.5	0.78	0.77	36.8
8	T1	102	7.8	0.433	16.7	LOS B	6.6	48.5	0.78	0.77	36.8
9	R2	17	0.0	0.433	26.2	LOS C	6.6	48.5	0.78	0.77	36.8
Approach		284	6.3	0.433	22.6	LOS C	6.6	48.5	0.78	0.77	36.8
West: Main Street											
10	L2	15	0.0	0.223	21.5	LOS C	3.3	23.8	0.64	0.59	42.1
11	T1	152	2.6	0.223	12.3	LOS B	3.3	23.8	0.64	0.59	42.1
12	R2	8	0.0	0.223	21.9	LOS C	3.3	23.8	0.64	0.59	42.1
Approach		175	2.3	0.223	13.6	LOS B	3.3	23.8	0.64	0.59	42.1
All Vehicles		1090	5.7	0.665	21.9	LOS C	10.9	80.8	0.80	0.76	37.0

10 Year Horizon (Post Development - All Movement Option)

Site Access/Park Avenue Mall Access/Main Street

MOVEMENT SUMMARY

▽ Site: Site Access/Park Avenue Mall Access/Main Street (post dev + 10 yrs, all movement)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Park Avenue Mall											
1	L2	10	0.0	0.082	12.6	LOS B	0.3	1.8	0.69	0.83	16.0
3	R2	20	0.0	0.082	13.0	LOS B	0.3	1.8	0.69	0.83	16.0
Approach		30	0.0	0.082	12.8	LOS B	0.3	1.8	0.69	0.83	16.0
East: Main Street East											
4	L2	20	0.0	0.334	7.2	LOS A	3.3	24.1	0.64	0.06	35.7
5	T1	548	5.0	0.334	2.7	LOS A	3.3	24.1	0.64	0.06	35.7
6	R2	38	0.0	0.334	7.7	LOS A	3.3	24.1	0.64	0.06	35.7
Approach		606	4.5	0.334	3.2	NA	3.3	24.1	0.64	0.06	35.7
North: Proposed Site Access											
7	L2	25	0.0	0.061	8.8	LOS A	0.2	1.4	0.53	0.69	19.7
9	R2	11	0.0	0.061	9.3	LOS A	0.2	1.4	0.53	0.69	19.7
Approach		36	0.0	0.061	8.9	LOS A	0.2	1.4	0.53	0.69	19.7
West: Main Street West											
10	L2	17	0.0	0.242	7.8	LOS A	2.3	16.8	0.66	0.03	35.6
11	T1	420	5.0	0.242	3.3	LOS A	2.3	16.8	0.66	0.03	35.6
12	R2	10	0.0	0.242	8.3	LOS A	2.3	16.8	0.66	0.03	35.6
Approach		447	4.7	0.242	3.6	NA	2.3	16.8	0.66	0.03	35.6
All Vehicles		1119	4.3	0.334	3.8	NA	3.3	24.1	0.65	0.09	35.2

Main Street/Edgar Street

MOVEMENT SUMMARY

▽ Site: Main Street/Edgar Street (post dev + 10 yrs, all movements)

New Site
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Main Street											
5	T1	700	4.6	0.398	6.1	LOS A	6.7	48.7	0.87	0.04	44.9
6	R2	23	15.8	0.398	15.6	LOS C	6.7	48.7	0.87	0.04	44.9
Approach		722	5.0	0.398	6.4	NA	6.7	48.7	0.87	0.04	44.9
North: Edgar Street											
7	L2	42	5.7	0.066	12.6	LOS B	0.2	1.7	0.54	0.75	45.1
9	R2	5	0.0	0.066	13.0	LOS B	0.2	1.7	0.54	0.75	45.1
Approach		47	5.1	0.066	12.7	LOS B	0.2	1.7	0.54	0.75	45.1
West: Main Street											

10	L2	28	8.7	0.303	9.2	LOS A	0.0	0.0	0.00	0.07	59.3
11	T1	548	3.5	0.303	0.0	LOS A	0.0	0.0	0.00	0.07	59.3
Approach		576	3.8	0.303	0.5	NA	0.0	0.0	0.00	0.07	59.3
All Vehicles		1345	4.5	0.398	4.1	NA	6.7	48.7	0.48	0.07	50.1

Main Street/Haynes Street

MOVEMENT SUMMARY

Site: Main Street/Haynes Street (post dev + 10 yrs, all movements)

New Site
Signals - Actuated Cycle Time = 62 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Haynes Street											
1	L2	10	20.0	0.493	30.5	LOS C	5.1	37.3	0.85	0.78	34.0
2	T1	65	3.1	0.493	21.3	LOS C	5.1	37.3	0.85	0.78	34.0
3	R2	118	6.8	0.493	30.9	LOS C	5.1	37.3	0.85	0.78	34.0
Approach		193	6.2	0.493	27.6	LOS C	5.1	37.3	0.85	0.78	34.0
East: Main Street											
4	L2	131	9.2	0.682	26.0	LOS C	11.3	83.6	0.85	0.82	36.7
5	T1	183	6.6	0.682	16.8	LOS B	11.3	83.6	0.85	0.82	36.7
6	R2	135	3.0	0.682	26.4	LOS C	11.3	83.6	0.85	0.82	36.7
Approach		449	6.2	0.682	22.4	LOS C	11.3	83.6	0.85	0.82	36.7
North: Haynes Street											
7	L2	165	6.1	0.433	25.9	LOS C	6.6	48.5	0.78	0.77	36.8
8	T1	102	7.8	0.433	16.7	LOS B	6.6	48.5	0.78	0.77	36.8
9	R2	17	0.0	0.433	26.2	LOS C	6.6	48.5	0.78	0.77	36.8
Approach		284	6.3	0.433	22.6	LOS C	6.6	48.5	0.78	0.77	36.8
West: Main Street											
10	L2	15	0.0	0.245	22.3	LOS C	3.8	27.0	0.67	0.60	41.5
11	T1	169	2.4	0.245	13.1	LOS B	3.8	27.0	0.67	0.60	41.5
12	R2	8	0.0	0.245	22.7	LOS C	3.8	27.0	0.67	0.60	41.5
Approach		192	2.1	0.245	14.3	LOS B	3.8	27.0	0.67	0.60	41.5
All Vehicles		1118	5.5	0.682	22.0	LOS C	11.3	83.6	0.80	0.76	36.9

10 Year Horizon (Post Development - Left-in/Left-out Movement Option)

Site Access/Park Avenue Mall Access/Main Street

MOVEMENT SUMMARY

Site: Site Access/Park Avenue Mall Access/Main Street (post dev + 10 yrs, LILO)

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Park Avenue Mall											
1	L2	10	0.0	0.078	12.1	LOS B	0.2	1.7	0.68	0.82	16.3
3	R2	20	0.0	0.078	12.5	LOS B	0.2	1.7	0.68	0.82	16.3
Approach		30	0.0	0.078	12.4	LOS B	0.2	1.7	0.68	0.82	16.3
East: Main Street East											
4	L2	20	0.0	0.301	4.5	LOS A	0.0	0.0	0.00	0.02	39.8
5	T1	548	5.0	0.301	0.0	LOS A	0.0	0.0	0.00	0.02	39.8
Approach		568	4.8	0.301	0.2	NA	0.0	0.0	0.00	0.02	39.8
North: Proposed Site Access											
7	L2	36	0.0	0.033	6.0	LOS A	0.1	0.9	0.43	0.60	35.5
Approach		36	0.0	0.033	6.0	LOS A	0.1	0.9	0.43	0.60	35.5
West: Main Street West											
10	L2	55	0.0	0.262	8.0	LOS A	2.6	19.1	0.68	0.04	35.4
11	T1	420	5.0	0.262	3.5	LOS A	2.6	19.1	0.68	0.04	35.4
12	R2	10	0.0	0.262	8.4	LOS A	2.6	19.1	0.68	0.04	35.4
Approach		485	4.3	0.262	4.1	NA	2.6	19.1	0.68	0.04	35.4
All Vehicles		1119	4.3	0.301	2.4	NA	2.6	19.1	0.33	0.07	37.3

Main Street/Edgar Street

MOVEMENT SUMMARY

Site: Main Street/Edgar Street (post dev + 10 yrs, LILO)

New Site
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Main Street											
5	T1	654	5.0	0.423	5.5	LOS A	6.2	45.2	0.83	0.11	45.2
6	R2	68	5.3	0.423	15.1	LOS C	6.2	45.2	0.83	0.11	45.2
Approach		722	5.0	0.423	6.4	NA	6.2	45.2	0.83	0.11	45.2
North: Edgar Street											
7	L2	42	5.7	0.066	12.6	LOS B	0.2	1.7	0.54	0.75	45.0
9	R2	5	0.0	0.066	13.0	LOS B	0.2	1.7	0.54	0.75	45.0
Approach		47	5.1	0.066	12.7	LOS B	0.2	1.7	0.54	0.75	45.0
West: Main Street											
10	L2	41	5.9	0.311	9.2	LOS A	0.0	0.0	0.00	0.09	59.0
11	T1	548	3.5	0.311	0.0	LOS A	0.0	0.0	0.00	0.09	59.0
Approach		589	3.7	0.311	0.7	NA	0.0	0.0	0.00	0.09	59.0

All Vehicles	1358	4.4	0.423	4.2	NA	6.2	45.2	0.46	0.12	50.3

Main Street/Haynes Street

MOVEMENT SUMMARY

Site: Main Street/Haynes Street (post dev + 10 yrs, LILO)

New Site
Signals - Actuated Cycle Time = 68 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Haynes Street											
1	L2	10	20.0	0.489	31.4	LOS C	5.4	40.0	0.84	0.78	33.5
2	T1	65	3.1	0.489	22.3	LOS C	5.4	40.0	0.84	0.78	33.5
3	R2	118	6.8	0.489	31.8	LOS C	5.4	40.0	0.84	0.78	33.5
Approach		193	6.2	0.489	28.6	LOS C	5.4	40.0	0.84	0.78	33.5
East: Main Street											
4	L2	131	9.2	0.686	28.0	LOS C	12.2	90.0	0.86	0.82	35.5
5	T1	172	7.0	0.686	18.8	LOS B	12.2	90.0	0.86	0.82	35.5
6	R2	135	3.0	0.686	28.4	LOS C	12.2	90.0	0.86	0.82	35.5
Approach		438	6.4	0.686	24.5	LOS C	12.2	90.0	0.86	0.82	35.5
North: Haynes Street											
7	L2	203	4.9	0.476	26.5	LOS C	8.3	61.1	0.77	0.78	36.3
8	T1	102	7.8	0.476	17.3	LOS B	8.3	61.1	0.77	0.78	36.3
9	R2	28	0.0	0.476	26.9	LOS C	8.3	61.1	0.77	0.78	36.3
Approach		333	5.4	0.476	23.7	LOS C	8.3	61.1	0.77	0.78	36.3
West: Main Street											
10	L2	15	0.0	0.250	23.9	LOS C	4.2	30.0	0.67	0.61	40.3
11	T1	169	2.4	0.250	14.8	LOS B	4.2	30.0	0.67	0.61	40.3
12	R2	8	0.0	0.250	24.3	LOS C	4.2	30.0	0.67	0.61	40.3
Approach		192	2.1	0.250	15.9	LOS B	4.2	30.0	0.67	0.61	40.3
All Vehicles		1156	5.4	0.686	23.5	LOS C	12.2	90.0	0.80	0.77	36.1