WANDAL ROAD

JARDINE STREET

STAGE 2

STAGE 1

UNIT 1
1 BED UNIT
102SQM
(TYPE A)

UNIT 2
2 BED UNIT
125SQM
(TYPE B)

UNIT 3
2 BED UNIT
125SQM
(TYPE B)

UNIT 4
2 BED UNIT
125SQM
(TYPE B)

UNIT 5
2 BED UNIT
125SQM
(TYPE B)

UNIT 6
2 BED UNIT
144SQM
(TYPE C)

PRIVATE YARD 120sqm
PRIVATE YARD 78sqm
PRIVATE YARD 78sqm
PRIVATE YARD 78sqm
PRIVATE YARD 98sqm
PRIVATE YARD 125sqm

SOLID PRIVACY FENCE
FIRE WALL
BINS
min 1200ht SOLID FENCE
ALUMINUM POOL FENCE
LANDSCAPING
1800ht SOLID PRIVACY FENCE

VIS 1
VIS 2
VIS 3

NEIGHBORING DWELLING

NEIGHBORING SHED

3980 600 7580 180 9150 600 600 9150 180 9150 600 9150 2140
2700 1500
4750
4448
6000 6000 7767
2100 3255 1945 4291 2300

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/132-2018

Dated: 13 November 2020

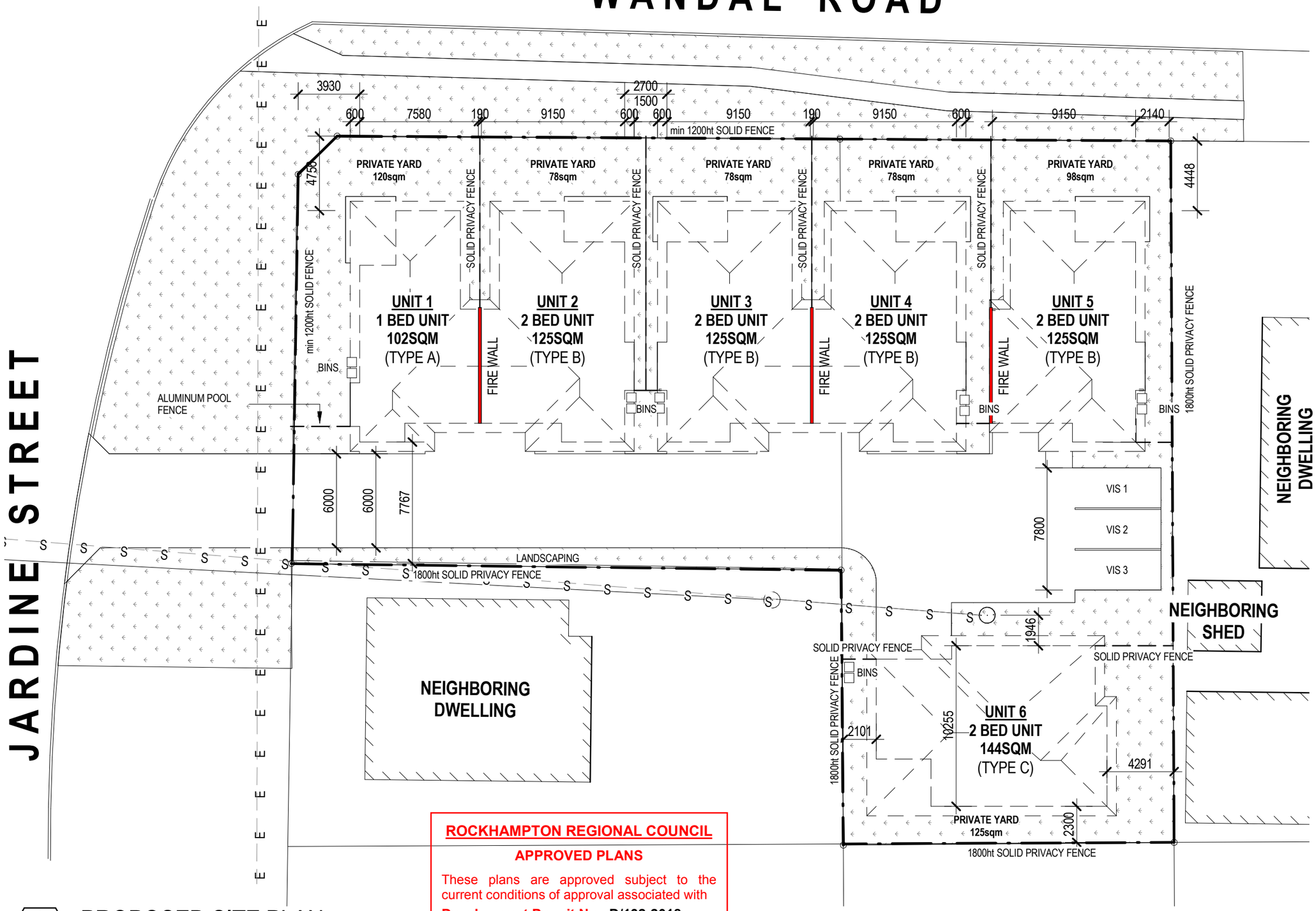
1 PROPOSED SITE PLAN
1 : 250 @ A1

Project Details:
PROPOSED DEVELOPMENT
BOYD HALL
99 WANDAL ROAD, ROCKHAMPTON

Drawing Title:
Staging Plan

Scale: 1 : 250
Date: OCT 2020
Drawn:
Rev: A

Drawing No.
7158-01-STG



1 PROPOSED SITE PLAN

1 : 250 @ A1

ROCKHAMPTON REGIONAL COUNCIL

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These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/132-2018

Dated: 31 May 2019

DO NOT SCALE DRAWING

ALL DIMENSION IN MILLIMETERS

No:	Description:	Date:
2	REVISED DA PLANS	10.03.19

REVISIONS

ISSUED FOR

PRELIMINARY

Project Details:

PROPOSED DEVELOPMENT

BOYD HALL

99 WANDAL ROAD, ROCKHAMPTON

Drawing Title:

PROPOSED SITE PLAN

dezignelements BUILDING DESIGNERS

0407 271 336 M

info@dezignelements.com.au E

QBCC No: 1247120 BDAQ No: 0001677

Scale:	1 : 250	Rev:	2
Date:	JAN 15		
Drawn:	Author		

Project No:	Drawing No:
17_040	A-02

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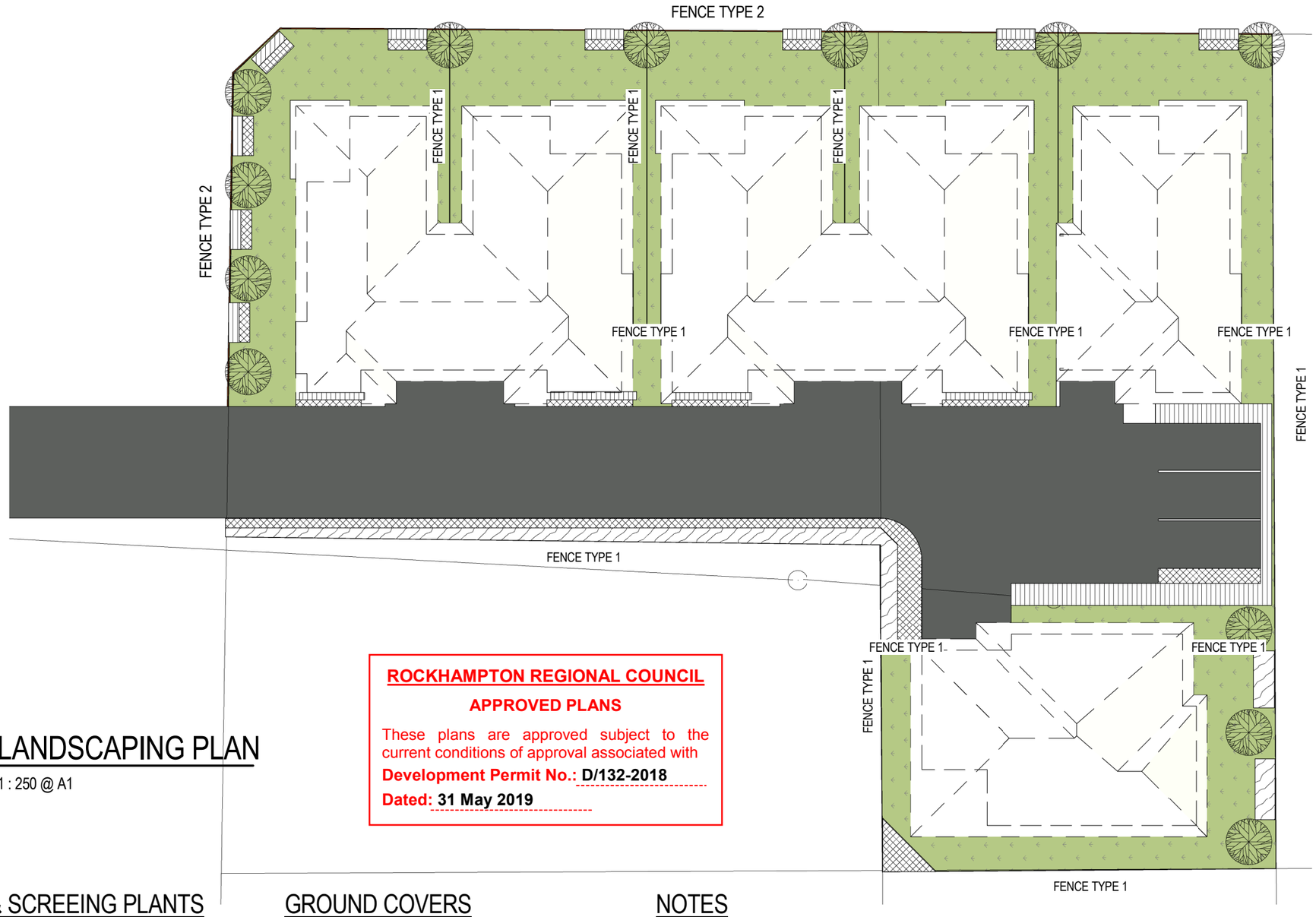

1 LANDSCAPING PLAN

1 : 250 @ A1

ROCKHAMPTON REGIONAL COUNCIL

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Dated: 31 May 2019

SHRUBS & SCREEING PLANTS

- SEASIDE DAISY (hymenocallis littoralis) - mature ht 0.5m
- SPIDER LILY (aryllidaceae hymenocallis littoralis) - mature ht 0.9m
- FIREFLASH (heliconia) - mature ht 0.6m-1.5m
- MOCK ORANGE (murraya paniculata) - mature ht 2.0m-3.0m

OR APPROVED EQUALS

GROUND COVERS

- BROAD LEAD BUFFALO (stenotaphrum secundatum) - sir walter lawn on min 100mm top soil
- CONCRETE DRIVEWAY
- EXPOSED AGG CONCRETE PEDESTRIAN PATH 950wide

NOTES

- ALL GARDEN BEDSTO HAVE 200mm min TOP SOIL
- PROVIDE POLYPIPE IRRIGATION SYSTEM WITH SPRAY HEADS MIN 900cts AND DRIP FEEDERS TO TREETS
- ALL GARDEN BEDS TO HAVE 100x15 CCA TREATED PINE EDGE STIP WITH FIXING STAKES 900min
- PROVIDE BARK FINES MULCH TO ALL GARDEN BEDS 75tk
- RW (RETAINING WALL)

FENCES

FENCE 1 - VERTICAL TIMBER PAILING OR COLORBOND FENCE
FENCE 2 - SOLID FENCE

DO NOT SCALE DRAWING
ALL DIMENSION IN MILLIMETERS

REVISIONS

No:	Description:	Date:
2	REVISED DA PLANS	10.03.19

ISSUED FOR
PRELIMINARY

Project Details:
PROPOSED DEVELOPMENT
BOYD HALL
99 WANDAL ROAD, ROCKHAMPTON

Drawing Title:
LANDSCAPING PLAN

dezignelements BUILDING DESIGNERS
0407 271 336 M
info@dezignelements.com.au E
QBCC No: 1247120 BDAQ No: 0001677

Scale:	As indicated	Rev:	10/03/2019 10:11:35 AM
Date:	JAN 15	2	
Drawn:	NJB		
Project No:	17_040	Drawing No:	A-03

Floor Area's	
LOCKABLE	93.06 m²
PATIO:	7.68 m²
PORCH:	1.05 m²
TOTAL:	**101.79 m²**

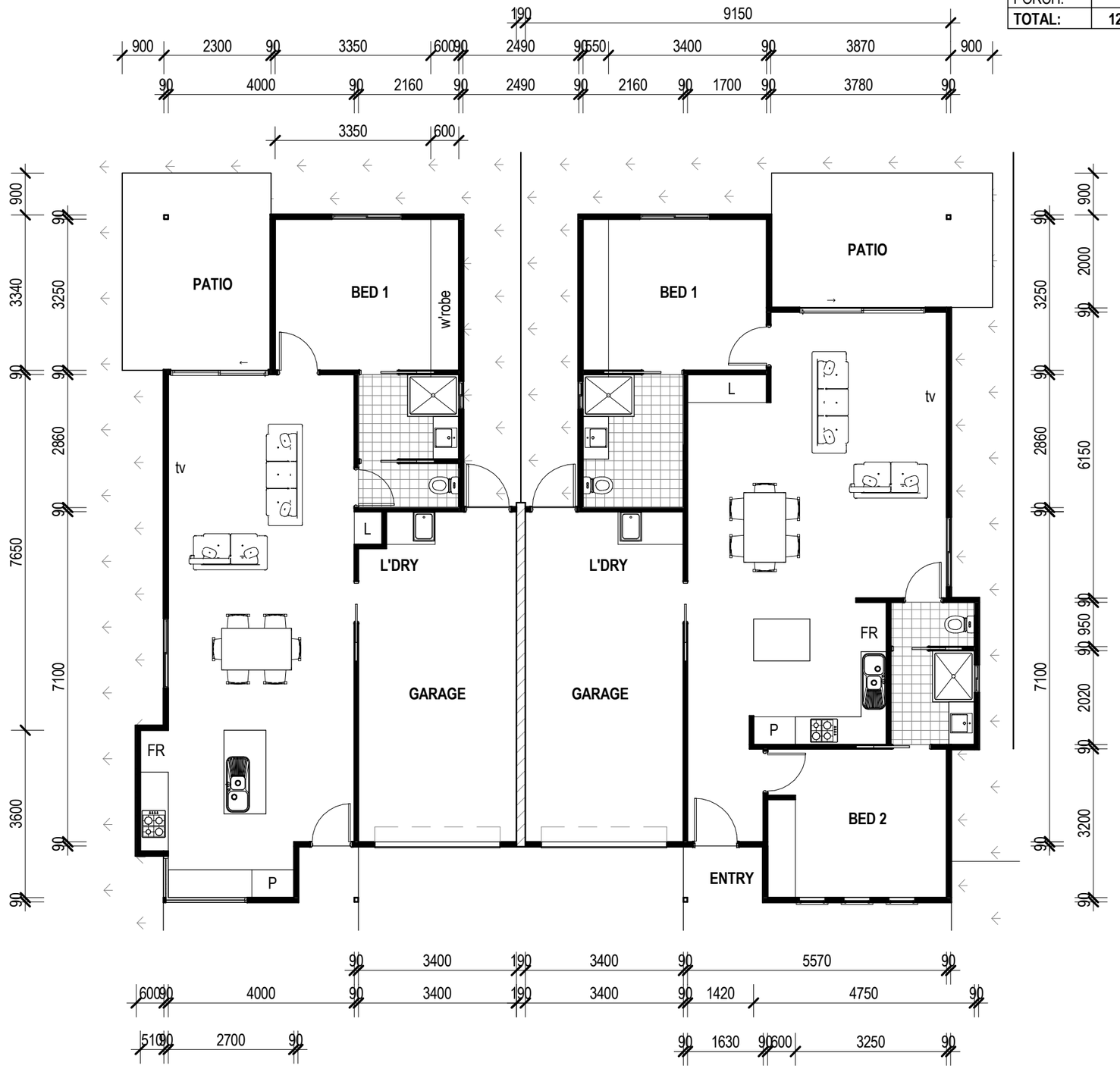
+ 5.88 m² CONCRETE

TYPE A
1 BED OPTION

TYPE B
2 BED OPTION

Floor Area's	
LOCKABLE	115.85 m²
PATIO:	7.65 m²
PORCH:	1.93 m²
TOTAL:	**125.43 m²**

+ 6.06 m² CONCRETE



1 FLOOR PLAN - TYPE A & B

1 : 100 @ A1

DO NOT SCALE DRAWING
ALL DIMENSION IN MILLIMETERS

REVISIONS

No:	Description:	Date:
2	REVISED DA PLANS	10.03.19

ROCKHAMPTON REGIONAL COUNCIL

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Dated: 31 May 2019

ISSUED FOR

PRELIMINARY

Project Details:

PROPOSED DEVELOPMENT

BOYD HALL

99 WANDAL ROAD, ROCKHAMPTON

Drawing Title:

FLOOR PLAN - TYPE A & B

dezignelements BUILDING DESIGNERS

0407 271 336 M

info@dezignelements.com.au E

QBCC No: 1247120 **BDAQ No: 0001677**

Scale:	1 : 100	Rev:
Date:	JAN 15	2
Drawn:	NJB	

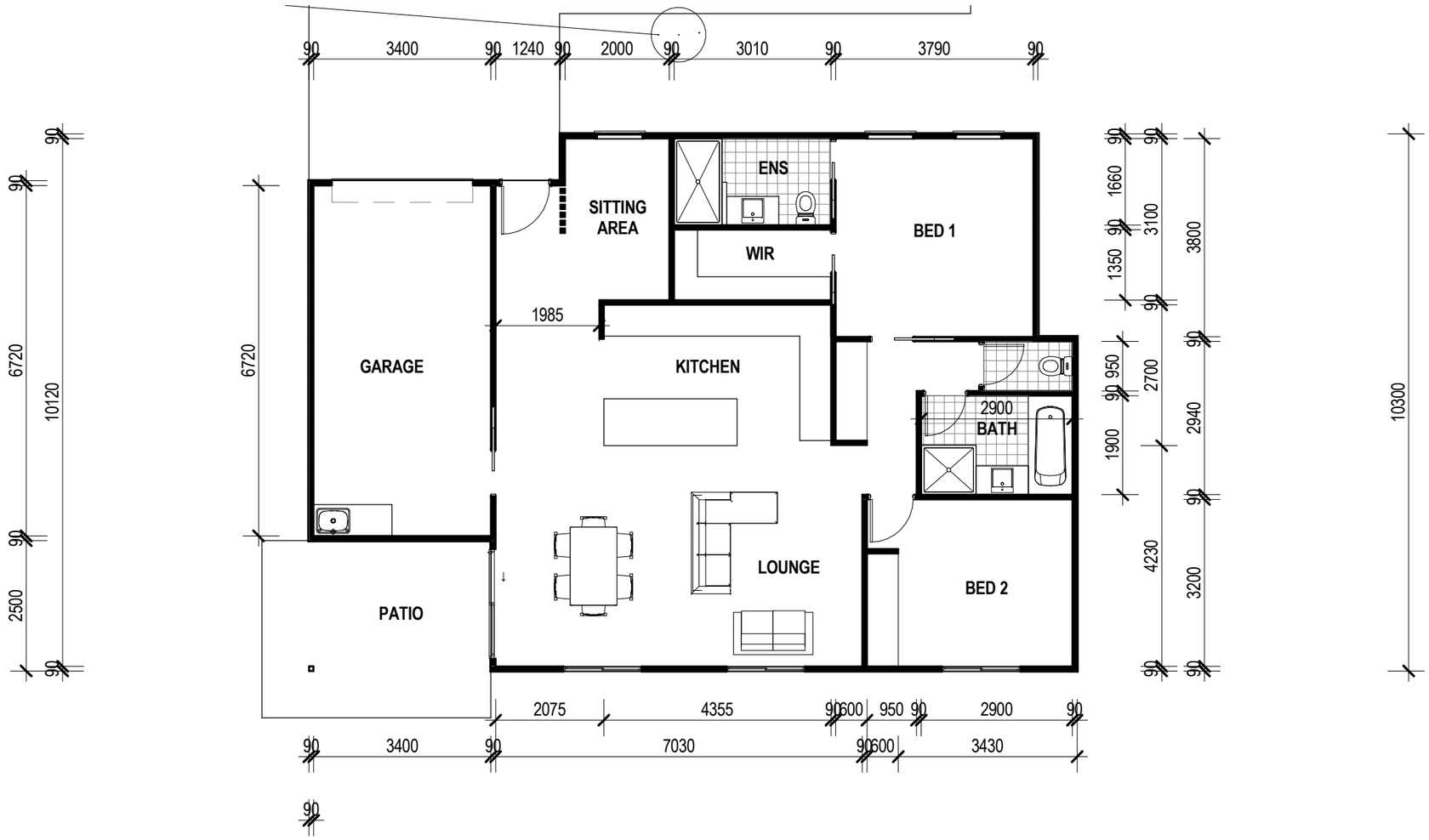
Project No:	Drawing No:
17_040	A-04

10/03/2019 10:11:35 AM

Floor Area's	
LOCKABLE	135.6 m²
PATIO:	8.6 m²
PORCH:	1.16 m²
TOTAL:	**145.36 m²**

+ 6.38 m² CONCRETE

TYPE C
2 BED OPTION



ROCKHAMPTON REGIONAL COUNCIL

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Development Permit No.: D/132-2018

Dated: 31 May 2019

1 FLOOR PLAN - TYPE C

1 : 100 @ A1

DO NOT SCALE DRAWING

ALL DIMENSION IN MILLIMETERS

No:	Description:	Date:
2	REVISED DA PLANS	10.03.19

REVISIONS

ISSUED FOR

PRELIMINARY

Project Details:

PROPOSED DEVELOPMENT

BOYD HALL

99 WANDAL ROAD, ROCKHAMPTON

Drawing Title:

FLOOR PLAN - TYPE C

dezignelements BUILDING DESIGNERS

0407 271 336 M

info@dezignelements.com.au E

QBCC No: 1247120 **BDAQ No: 0001677**

Scale:	1 : 100	Rev:	2
Date:	JAN 15		
Drawn:	NJB		
Project No:	17_040	Drawing No:	A-05

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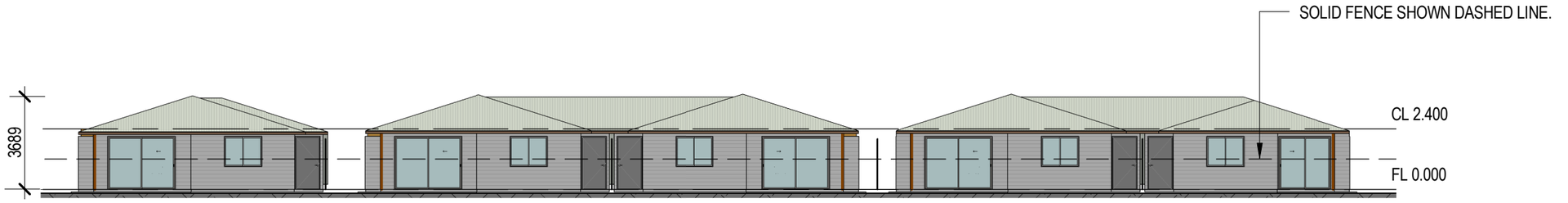
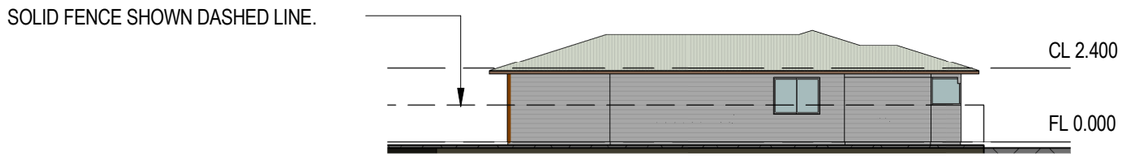


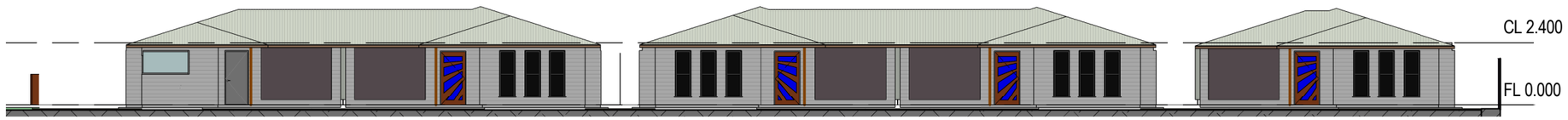
1 WANDAL ROAD ELEVATION

1 : 200 @ A1



2 JARDINE STREET ELEVATION

1 : 200 @ A1



3 DRIVEWAY ELEVATION - UNITS 1-4

1 : 200 @ A1

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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Development Permit No.: D/132-2018

Dated: 31 May 2019

DO NOT SCALE DRAWING

ALL DIMENSION IN MILLIMETERS

No:	Description:	Date:
2	REVISED DA PLANS	10.03.19

REVISIONS

ISSUED FOR

PRELIMINARY

Project Details:

PROPOSED DEVELOPMENT

BOYD HALL

99 WANDAL ROAD, ROCKHAMPTON

Drawing Title:

ELEVATION

dezignelements BUILDING DESIGNERS

0407 271 336 M

info@dezignelements.com.au E

QBCC No: 1247120 BDAQ No: 0001677

Scale:	1 : 200	Rev:
Date:	JAN 15	2
Drawn:	Author	

Project No:	Drawing No:
17_040	A-06

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ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/132-2018

Dated: 31 May 2019

Engineering Infrastructure Report

6 Unit Development, 93-99 Wandal Road, Rockhampton

PREPARED FOR BT BUILDERS (QLD) PTY LTD

18-002072 | 3 December 2018

Calibre Professional Services Pty Ltd
55 070 683 037

DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
A	03.12.18	Development Application	MD	CS	 Chris Shields RPEQ 9347

Contents

Tables

Figures

Appendices

1 Introduction

Calibre has prepared this Engineering Infrastructure Report in support of the Material Change of Use (MCU) Application on behalf of our client BT Builders (QLD) Pty Ltd. This report relates to works associated with the proposed 6 Unit Development planned for the site of 93 – 99 Wandal Road in the suburb of Wandal, Rockhampton.

93 - 99 Wandal Road is currently vacant land and is located on the corner of Wandal Road and Jardine Street, Rockhampton. The site is currently two separate titles as Lot 67 on RP600739 and Lot 1 on RP605655.

The development proposal includes construction six (6) units over four (4) stand-alone buildings. Five (5) of the units consist of a two (2) bedroom configuration, whilst one (1) is planned as a one (1) bedroom units. The units share a common driveway accessing off Jardine Street with off-street visitor parking provided.

This report intends to address the Civil Engineering Infrastructure for the proposed development including sewer reticulation, water reticulation, stormwater management and address access and parking for the project. The report will demonstrate that the development will not negatively impact on existing services, buildings and infrastructure surrounding the subject site through engineered solutions.

The locality of the subject site can be seen in the following illustration.

Figure 1 Locality Image

2 Sewer Reticulation

The existing site currently has access to Rockhampton Regional Council's sewage infrastructure which will be maintained as part of this development.

An existing gravity system currently services the site and crosses the site through Lot 67 on RP600739 (93 Wandal Road). According to Rockhampton Regional Council's Geographical Information System (GIS), this gravity sewer main is a 150mm diameter comprising of an Earthenware material type. GIS information also shows that there is an existing sewer manhole located within the 93 Wandal Road lot (Lot 67 on RP600739). Access to this manhole will be maintained as part of the development and an assessment of the development proposal against Council's Building Over/Adjacent to Sewer Policy is included in Section 2.1 of this report. The following snapshot from RRC's GIS system show the existing sewer services.

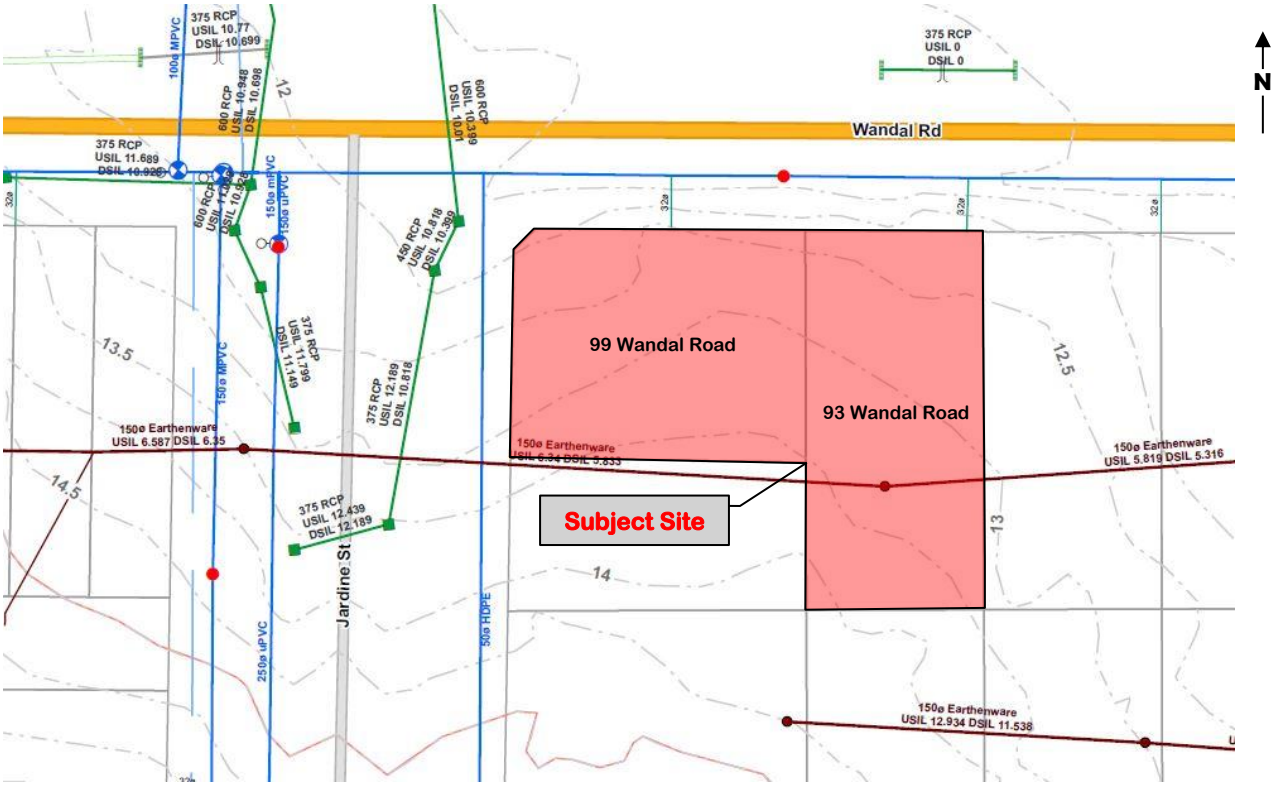


Figure 2 Existing Sewer Infrastructure Layout

With the 93-99 Wandal Road development being comprised of two (2) residential allotments in the existing scenario, this has been taken into consideration when determining the sewer loadings on the existing sewer system. These existing allotments would generate loads on the sewer system and therefore the difference in loadings between the existing residential lots and the proposed 6 unit development have been calculated.

The sewerage loads for the existing two (2) residential lot scenario and the proposed 6 Unit (1 x 1 bedroom and 5 x 2 bedroom) Development have been calculated in accordance with the Capricorn Municipal Development Guidelines (CMDG) - Design Specifications - D12 Sewerage Reticulation. As per table D12.C.01 - *(Design EP's per development type)* from the aforementioned design specifications, the equivalent persons (EP's) were calculated based on the rates within this table. The design Average Dry Weather Flow (ADWF) of 540L/ET/d from the CMDG design specification D12 has been utilised based on an EP per ET of 2.7. This means that the ADWF also equates to 200L/EP/d.

In accordance with CMDG specification D12, the Peak Dry Weather Flow (PDWF) is 2.5 times the ADWF. Using a density of 2.7 EP/lot or 1 ET/lot (existing) and 1.3 EP/unit or 0.5 ET/unit (proposed) as per Table D12.C.01 of the CMDG, the data in the following table has been calculated to determine the sewer loadings from the development:

Table 1 Sewer Demands Existing and Proposed

Scenario	Unit	No of Units	ET	EP	ADWF - Litres per day (540L/ET/d x ET)	PDWF (2.5 x ADWF)	WWF (5 x ADWF)
Existing	Detached Residential	2	2.00	5.40	1,080 L/d (0.013 L/s)	2,700 L/d (0.03 L/s)	5,400 L/d (0.06 L/s)
Proposed	1 Bedroom Units	1	0.5	1.30	1,620 L/d (0.019 L/s)	4,050 L/d (0.05 L/s)	8,100 L/d (0.09 L/s)
	2 Bedroom Units	5	2.50	6.50			
		Difference	**+1**	**+2.4**	**+540 L/d (+0.006 L/s)**	**+1350 L/d (+0.020 L/s)**	**+2700 L/d (+0.030 L/s)**

Investigation into the existing sewer infrastructure servicing the site has identified that the grade of the sewer main downstream of the site is approximately 0.66% based off Council's GIS information. Based on a maximum 60% depth of flow of the 150mm diameter main, the partial maximum (PWDF) pipe flow at capacity for this Earthenware main is approximately 8.3L/s. Given the proposed minimal increase in sewer loadings, the increase has been calculated to be 0.24% of the existing pipes available capacity. This percentage is expected to have a negligible effect upon the Council's existing infrastructure sewer network, and therefore no upgrades will be required.

The proposed connection point to the existing sewer network is the existing sewer manhole near unit 6 on the subject site. All proposed internal sanitary drainage (if required) will be documented during the detailed design phase by a suitably qualified person (Hydraulic Engineer), and all appropriate approvals sought from Rockhampton Regional Council (RRC).

2.1 Building Over/Adjacent to Sewer Policy

An assessment of the development against Council's Building Over, Adjacent to Sewerage Infrastructure policy has been undertaken given the location of the existing sewer infrastructure through the subject site.

The proposed units as part of the development are defined a 'Class 1' buildings being that they are single dwelling with a fire-resisting wall between each unit. Unit 6 as part of the development is proposed on the southern portion of the site and is in close proximity to the existing sewer main. The proposed development layout can be viewed in Appendix A of this report.

In accordance with Council's Building Over, Adjacent to Sewerage Infrastructure policy and the referenced Queensland Development Code MP1.4 (Building Over or Near Relevant Infrastructure), 'Class 1' buildings are considered to be an acceptable outcome for building over or near sewer infrastructure. Also, given that the existing sewer main is at a depth of around 7m, we believe that the loads from the unit building structure will have negligible impact to the existing sewer.

An existing sewer manhole is located near Unit 6 of the proposed development. According to detailed survey, this manhole is approximately 7.3m deep. The building (Unit 6) has been positioned so that a 1.5m radius clear space from the centre of the manhole is achieved to the edge of the building eave. This has been demonstrated in the drawing cross section provided in Appendix B. Further to this, adequate vehicular access to the manhole is obtained from the shared common driveway of the development.

Therefore, we believe that the development meets the acceptable outcome of the Queensland Development Code MP1.4 and also complies with Council's Building Over, Adjacent to Sewerage Infrastructure policy.

3 Water Reticulation

Existing council water infrastructure is located in the vicinity of the subject site. Rockhampton Regional Council's Geographical Information System (GIS) has identified that a 150mm diameter water main is located on the site frontage of Wandal Road and is of an mPVC material type. A 50mm dia. HDPE main is located on the Jardine Street frontage which is connected to the 150mm dia. main via a tee connection.

An existing main spring fire hydrant is currently located in the road reserve of Wandal Road near the common boundary of 93 Wandal Road and 99 Wandal Road. Therefore, we believe adequate fire hydrant coverage is provided to the site in the existing scenario with no upgrades required for fire hydrant accessibility as part of the proposed works.

Considering that the existing site is situated on two (2) residential allotments, the water demand from these allotments has been taken into consideration and any increase in water demand from the proposed six (6) unit development has been considered and analysed in this report.

The water supply loads have been calculated in accordance with the Capricorn Municipal Development Guidelines (CMDG) – Design Specifications – D11 Water Reticulation. Using a design Average Daily Consumption of 500 L/EP/d from the CMDG specification D11 and a design demand rate of 3 EP per lot (existing) and 2.5 EP per Unit (proposed) from Table D11.32.01 of the CMDG, the following table shows the Average Daily Consumption for the existing and the proposed cases:

Table 2 Water Demands Existing and Proposed

Scenario	Unit	No of Units	EP	Average Daily Consumption - Litres per day (500L/EP/d x EP)	Mean Day Max Month (1.4 x AD)	Max Day (1.89 x AD)
Existing	Detached Residential	2	6.00	3,000 L/d (0.035 L/s)	4,200 L/d (0.049 L/s)	5,670 L/d (0.066 L/s)
Proposed	Six (6) Units	6	15.00	7,500 L/d (0.087 L/s)	10,500 L/d (0.122 L/s)	14,180 L/d (0.164 L/s)
		Difference	**+9**	**+4,500 L/d (+0.052 L/s)**	**+6,300 L/d (+0.073 L/s)**	**+8,510 L/d (+0.098 L/s)**

Therefore as evident in the table above, due to the proposed development an increase in average daily consumption of 0.052 L/s is apparent, or 9 additional equivalent persons (EP). A standard residential dwelling is considered to have 3 EP / ET, so the increase in water demand due to this development is equivalent to around three (3) residential dwellings.

Given that the existing water infrastructure in Wandal Road is currently a 150mm diameter water main (as shown in the below image), we believe that there will negligible impact to this main from the demand increase as part of this development. Therefore, it is proposed that no upgrades will be required to the existing water infrastructure.

The site currently has two water service connections for each of the allotments respectively. One of these connections is proposed to be disconnected as part of the proposed works.

The internal water reticulation (if required) and appropriate size for the water service connection for the six (6) units will be detailed by a suitably qualified person (Hydraulic Engineer) during the detailed design phase, and all appropriate approvals sought from Rockhampton Regional Council (RRC).

Please see the image below for the water infrastructure in the vicinity of the subject site.

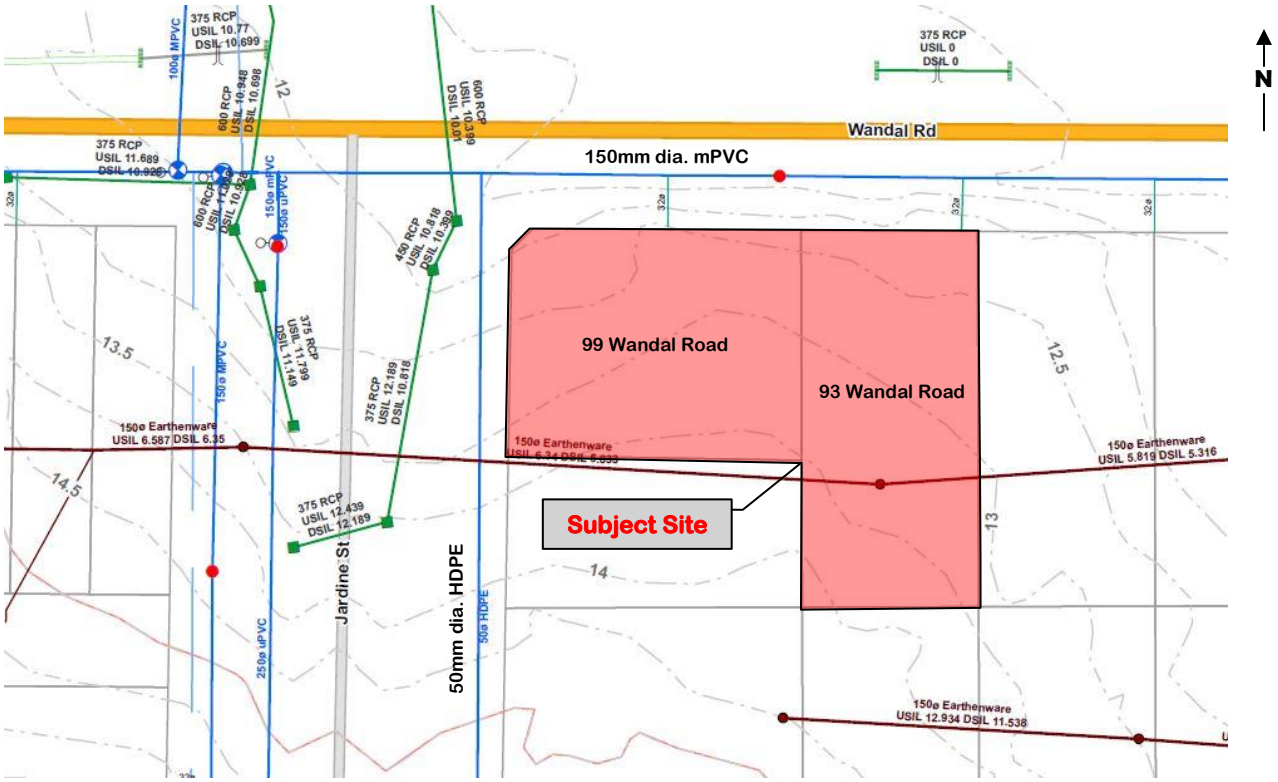


Figure 3 Existing Water Infrastructure Layout

4 Access and Parking

The site currently has frontage to Wandal Road and Jardine Street, where 99 Wandal Road gains access from Jardine Street with a vehicular crossover installed via a break in the upstand of the kerb and channel. 93 Wandal Road currently has access to Wandal Road with a vehicular crossover in place by the way of pre-cast concrete kerb arches over the existing kerb and channel. Both Wandal Road and Jardine Street corridors are asphalt sealed with kerb and channel to control stormwater runoff.

Wandal Road is currently a State Controlled Road under the jurisdiction of the Transport and Main Roads Queensland, defined as road corridor number 511. Wandal Road provides a road link between Rockhampton and Ridgelands. Jardine Street is a Council controlled road corridor and is specified as a Minor Urban Collector under Rockhampton Regional Council's road hierarchy mapping.

As part of the development proposal, a common driveway is proposed off Jardine Street in a similar location to the existing crossover. This driveway will service all six (6) units proposed. This crossover has been positioned to the south as much as possible to increase the separation between the Wandal Road / Jardine St intersection and the new access.

As there will be no vehicle access to Wandal Road in the proposed scenario, the existing vehicle crossover to Wandal Road is intended to be removed as part of the development works. This will be documented as part of further detailed design phases of the project.

Three (3) visitor car parking spaces are proposed on-site. Further, each individual unit of the six (6) proposed has a covered lock-up garage. The off-street car parks will be designed to cater for a B99 standard vehicle in accordance with AS2890.1, Australian Standard for Off Street Car Parking facilities.

The proposed car park layout plan and vehicle turnpaths of a B99 vehicle entering and exiting the site via Jardine Street can be seen in Appendix C.

Refuse collection for the proposed development is proposed to be via Rockhampton Regional Council's standard kerbside collection service. Therefore, analysis of any garbage truck manoeuvring on the site has not been considered.

4.1 Traffic Generation

The traffic generation for the development will be minimal due to the small increase in traffic as a result of the proposed six (6) unit development.

In the existing scenario the site is situated over two residential allotments, so therefore traffic generation from the two allotments has been considered in the analysis. For the proposed scenario, the six (6) unit development has been considered as medium density for the purposes of traffic generation analysis.

Typical traffic generation rates for the existing and proposed traffic uses have been determined using the RTA's Guide to Traffic Generating Developments Version 2.2 dated October 2002. The RTA guide has been used in accordance with Transport and Main Roads Guide to Traffic Impact Assessment – Section 8.2.1 dated September 2017.

The following table summarises the traffic generation for the site in the existing and proposed scenarios based on traffic generation rates for the RTA suggestions:

Table 3 Traffic Generation Calculations

Scenario	Use	Generation Rate			Generation		
		Peak Hour (vph)	Daily (vpd)	Source	Number	Total (vph)	Total (vpd)
Existing	Residential - Dwelling	0.85	9.0	RTA	2	1.7	18.0
Proposed	Residential – Medium Density	0.50	5	RTA	6	3	30.0
				Difference		**+ 1.3**	**+ 12**

As evident in the table above, the proposed development based on the generation rates suggested by the RTA will increase the traffic generation by 1.3 vehicles per hour or 12 vehicles per day. These suggested numbers are considered to be a conservative approach and the increases are considered minor. We believe that this development will have negligible impact to the external road corridors of Jardine Street and Wandal Road given the higher order road hierarchy of the two road corridors being a minor urban collector and state controlled road respectively.

5 Stormwater Management

5.1 Stormwater Quantity

An analysis has been undertaken for the stormwater management strategy of the development to ensure that no adverse impacts occur to adjacent and downstream properties and infrastructure from the proposed 6 Unit Development.

The Queensland Urban Drainage Manual 2017 (QUDM) has been utilised in order to determine the hydrology changes from the development. XP-RAFTS software has been utilised to calculate stormwater runoff for each catchment and an analysis of the pre-development and post-development flow rates has been undertaken.

5.1.1 Existing System

The subject site is part of a wider urbanised catchment within the suburb of Wandal. The upper end of this catchment has been determined to be half of the Lanigan Street road reserve which runs east-west.

The subject site generally falls to the north with the site's legal point of discharge being identified as ***Wandal Road***. There are two defined stormwater flow paths that have been assessed as part of this report which ultimately discharge to a concrete base swale drain on the eastern side of the Southside United Sports Club. This report assess the stormwater runoff to the existing Jardine Park drainage infrastructure (east of the Southside United Sports Club).

The following parameters have been set to a form of a basis of the catchment characteristics of the existing scenario:

- The greater catchment is relatively steep with grades averaging at approx. 6%, where the upper part of the catchment is the steepest area at 10% average slope;
- Council's GIS information confirms that there is currently existing piped drainage infrastructure to convey runoff to the outlet of the catchment;
- With the above points in mind, the pipe flow travel time of the existing infrastructure would be similar to that of the kerb flow running parallel to the pipe drainage;
- The existing road network is comprised of wide road carriageways with high crowns and can therefore convey runoff from the respective contributing catchments.

The following image shows the wider catchments divided into sub-catchments for the analysis.

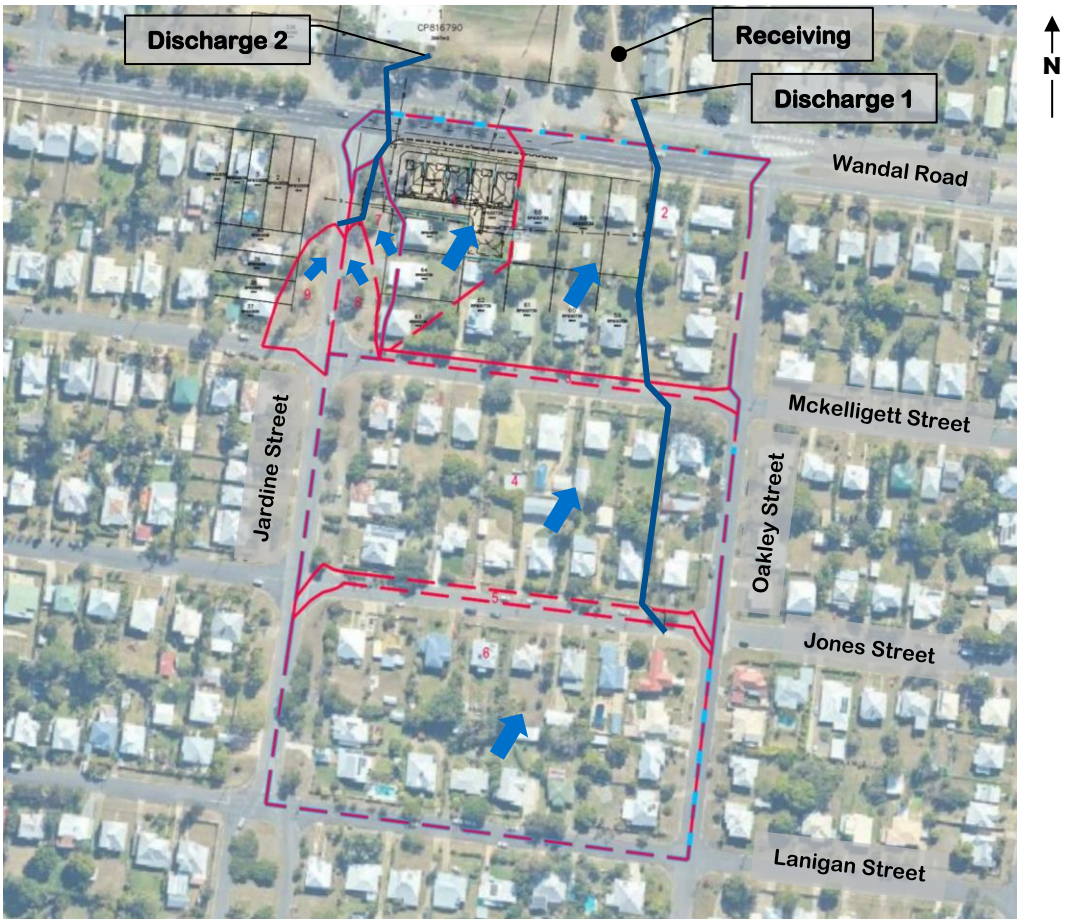


Figure 4 Pre Development Site Discharge

For the purposes of stormwater analysis, the separate piped stormwater infrastructure has been referred to as Discharge 1 and Discharge 2 respectively. As shown in Figure 4 above, the stormwater network has been defined as follows:

Discharge 1: Eastern piped stormwater network

Discharge 2: Western piped stormwater network

Receiving: Jardine Park Concrete Base Stormwater Channel. Discharge 1 and Discharge 2 converge at the receiving point, where the stormwater has been analysed to this point.

5.1.2 Catchment Details

The fraction impervious values have been determined based on existing site details for each catchment and the following table details the catchment area with the fraction impervious value assigned respectively.

Table 4 Existing Catchment Details

Catchment ID	Catchment Area (m^2)	Average Slope (%)	Fraction Impervious (%)	Pervious Manning's Roughness (n)	Impervious Manning's Roughness (n)	Discharge Location
1	5,291	1.0	40.00	0.020	0.050	Discharge 1
2	12,974	1.0	40.00	0.020	0.050	Discharge 1
3	807	0.5	100.00	0.020	0.050	Discharge 1
4	19,245	2.5	60.00	0.020	0.050	Discharge 1
5	1,199	0.5	100.00	0.020	0.050	Discharge 1
6	20,562	3.5	60.00	0.020	0.050	Discharge 1
7	1,046	2.0	20.00	0.020	0.050	Discharge 2
8	1,017	2.0	40.00	0.020	0.050	Discharge 2
9	1,446	2.0	35.00	0.020	0.050	Discharge 2

5.1.3 Design Rainfall Data

The adopted design rainfall intensities were sourced from the Bureau of Meteorology IFD data system for the area of Rockhampton in which the subject site is situated. The rainfall temporal pattern adopted is that suggested in Australian Rainfall and Runoff.

5.1.4 Peak Flow Calculations

The peak flow runoff from the existing site area was considered at Discharge 1, Discharge 2 and the Receiving point of discharge as part of the greater catchment.

Existing Council underground piped stormwater networks are located in close proximity to the site. The eastern stormwater network currently caters for runoff from the development site and neighbouring properties.

The XP-RAFTS model considers the peak runoff from the development site and the flows experienced on the stormwater system from the wider catchment. The node configuration adopted in the model for the pre-development scenario can be seen in the following image. Appropriate lag times between nodes were assigned based on kerb and channel flow times and pipe flow travel times where applicable. The overland flow time between Discharge 2 and the Receiving point of discharge has also been considered as part of this analysis.

The lag times adopted between the applicable catchments have been included in Appendix G of this report.

In accordance with Table D5.04.2 of the Capricorn Municipal Development Guidelines (CMDG) – D5 Design Guideline, the Minor System has been determined to be the 1 in 5 year event (18% AEP), and the Major System is the 1 in 100 year event (1% AEP) for Urban Residential.

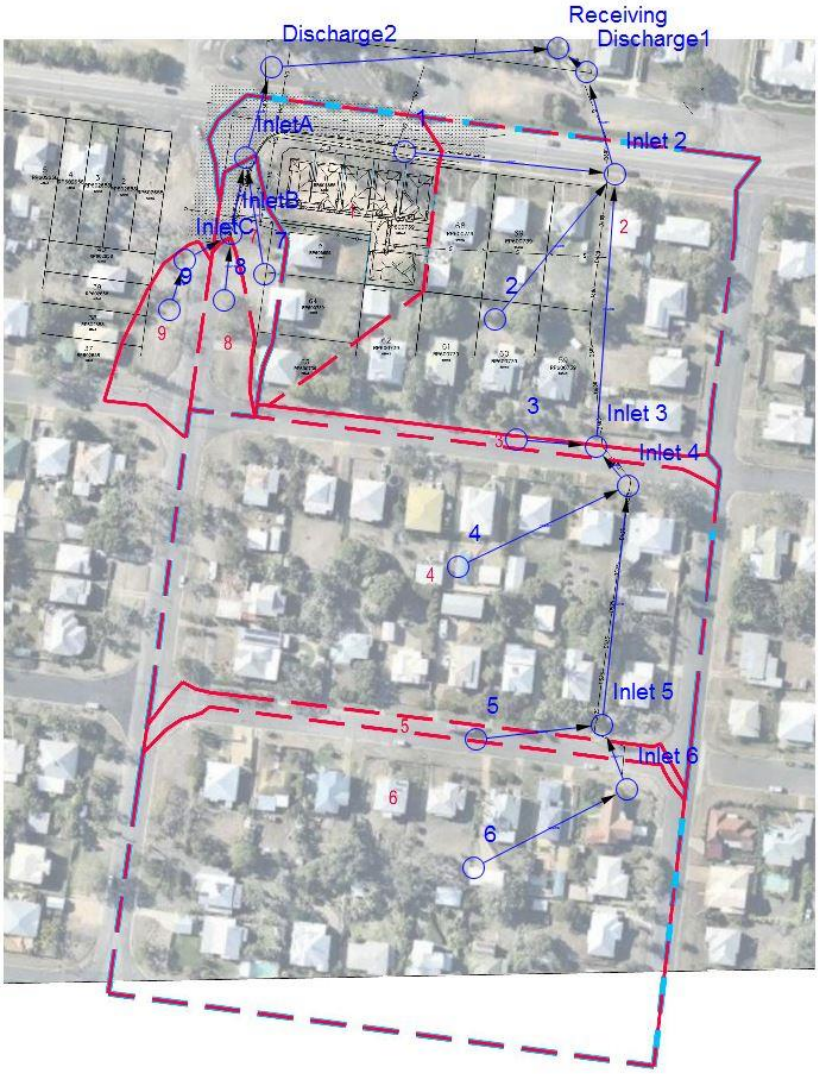


Figure 5 Pre-Development XP-RAFTS Model Configuration

The existing peak flow rates for Discharge 1, Discharge 2 and the Receiving Point of Discharge can be seen in the following table, for each given return period.

Table 5 Existing Peak Flow Rates

Return Period AEP (%)	Peak Flow Rate (m^3/s)		
	Discharge 1	Discharge 2	Receiving (Jardine Park Channel)
63% AEP (Q1)	0.157	0.006	0.157
39% AEP (Q2)	0.259	0.009	0.259
18% AEP (Q5)	0.633	0.023	0.632
10% AEP (Q10)	1.056	0.051	1.073
5% AEP (Q20)	1.887	0.105	1.918
2% AEP (Q50)	3.083	0.167	3.150
1% AEP (Q100)	4.654	0.259	4.774

5.2 Proposed System

The proposal includes the construction of a 6 unit complex with an associated common driveway on the subject site. The discharge locations currently present on site will be generally maintained, however we do propose that a portion of the site and external catchment discharges to the existing underground pipe network to the west. The proposed stormwater catchments for the development can be seen in the image below.

Figure 6 Post Development Site Discharge

5.2.1 Catchment Details

The fraction impervious values have been determined based on proposed site details for each catchment and the following table details the catchment area with the fraction impervious value assigned respectively.

Table 6 Proposed Catchment Details

Catchment ID	Catchment Area (m^2)	Average Slope (%)	Fraction Impervious (%)	Pervious Manning's Roughness (n)	Impervious Manning's Roughness (n)	Discharge Location
1a	1,820	1.0	50.00	0.020	0.050	Discharge 2
1b	1,125	1.0	80.00	0.020	0.050	Discharge 1
1c	515	1.0	100.00	0.020	0.050	Discharge 2
1d	1,831	1.0	60.00	0.020	0.050	Discharge 1
2	12,974	1.0	40.00	0.020	0.050	Discharge 1

Catchment ID	Catchment Area (m^2)	Average Slope (%)	Fraction Impervious (%)	Pervious Manning's Roughness (n)	Impervious Manning's Roughness (n)	Discharge Location
3	807	0.5	100.00	0.020	0.050	Discharge 1
4	19,245	2.5	60.00	0.020	0.050	Discharge 1
5	1,199	0.5	100.00	0.020	0.050	Discharge 1
6	20,562	3.5	60.00	0.020	0.050	Discharge 1
7	1,046	2.0	20.00	0.020	0.050	Discharge 2
8	1,017	2.0	40.00	0.020	0.050	Discharge 2
9	1,446	2.0	35.00	0.020	0.050	Discharge 2

5.2.2 Peak Flow Calculations

The peak flow runoff from the proposed site was considered at Discharge 1, Discharge 2 and the Receiving point of discharge as part of the greater catchment, similar to the existing site analysis.

The node configuration adopted in the model for the pre-development scenario can be seen in the following image. Appropriate lag times between nodes were assigned based on kerb and channel flow times and pipe flow travel times where applicable. The lag time assigned between each applicable catchment can be found in Appendix G of this report.

In accordance with Table D5.04.2 of the Capricorn Municipal Development Guidelines (CMDG) – D5 Design Guideline, the Minor System has been determined to be the 1 in 5 year event (18% AEP), and the Major System is the 1 in 100 year event (1% AEP) for Urban Residential.

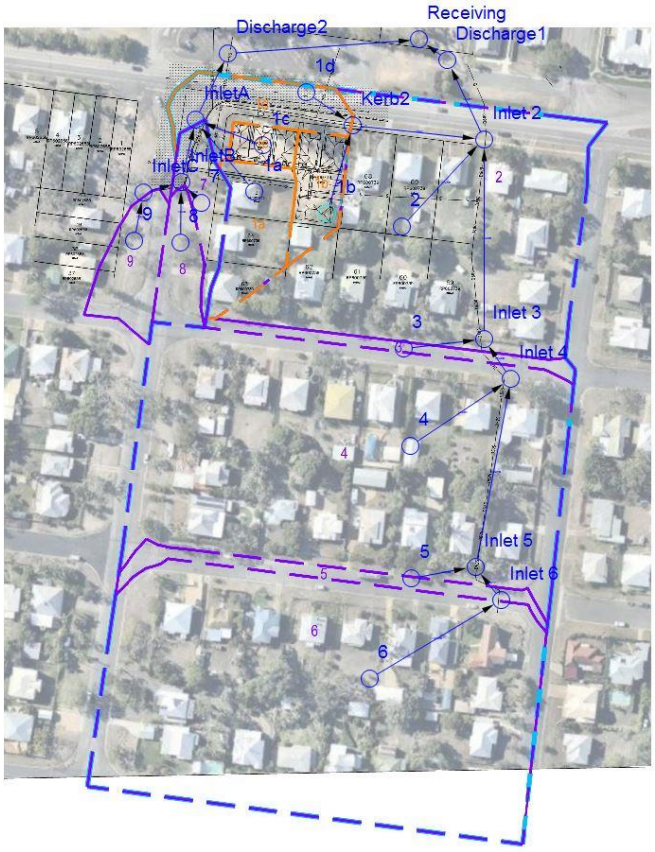


Figure 7 Post-Development XP-RAFTS Model Configuration

The proposed peak flow rates for each of the analysis nodes of Discharge 1, Discharge 2 and Receiving can be seen in the following table, for each given return period.

Table 7 Proposed Peak Flow Rates

Return Period AEP (%)	Peak Flow Rate (m^3/s)		
	Discharge 1	Discharge 2	Receiving (Jardine Park Channel)
63% AEP (Q1)	0.157	0.012	0.157
39% AEP (Q2)	0.259	0.020	0.259
18% AEP (Q5)	0.632	0.049	0.632
10% AEP (Q10)	1.050	0.094	1.087
5% AEP (Q20)	1.873	0.185	1.935
2% AEP (Q50)	3.043	0.294	3.163
1% AEP (Q100)	4.543	0.432	4.748

5.3 Summary of Existing and Proposed Peak Flow Rates

The Peak Flow Rates determined for the existing system and proposed system have been summarised in the following table for each return period. The results shown are for the ***Receiving*** point of discharge only. The flow increase (if any) for each return period due to the proposed development is also seen in the following table.

Table 8 Summary of Pre and Post Development Flow Rates*

Return Period AEP (%)	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)	% Increase (m^3/s)
63% AEP (Q1)	0.157	0.157	0.000
39% AEP (Q2)	0.259	0.259	0.000
18% AEP (Q5)	0.632	0.632	0.000
10% AEP (Q10)	1.073	1.087	0.014
5% AEP (Q20)	1.918	1.935	0.017
2% AEP (Q50)	3.150	3.163	0.013
1% AEP (Q100)	4.774	4.748	-0.026

*Peak Flow Rates shown are for the Receiving point of discharge (existing Jardine Park concrete base channel)

As can be seen above, at the Jardine Park Concrete Base Channel, the proposed development site has extremely minimal impact to the peak flow rates in all return periods. In fact, a slight decrease in peak flow rate is apparent for a 1% AEP event in the post-development scenario. This is mainly due to the split of the proposed catchment and the kerb flow / pipe flow travel times in the adjacent road corridors allowing for peaks to be non-coincidental in the developed situation.

The peak flow discharging to Wandal Road (Discharge 1) directly has reduced as a result of the proposed catchment configuration. The following table summarises this for each return period.

Table 9 Summary of Pre and Post Development Flow Rates – Wandal Road (Discharge 1)

Return Period AEP (%)	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)	% Increase (m^3/s)
63% AEP (Q1)	0.157	0.157	0.000
39% AEP (Q2)	0.259	0.259	0.000
18% AEP (Q5)	0.633	0.632	-0.001
10% AEP (Q10)	1.056	1.050	-0.006
5% AEP (Q20)	1.887	1.873	-0.014
2% AEP (Q50)	3.083	3.043	-0.040
1% AEP (Q100)	4.654	4.543	-0.111

It is acknowledged that there will be a slight increase in peak flow rate for the stormwater network linked to Discharge 2. This is due to diverting Catchments 1a and 1c to Discharge 2, from Discharge 1. However, Discharge 1 and Discharge 2 converge at the Receiving node. The following table shows the increase of runoff in each return period to the pipe network for Discharge 2.

Table 10 Summary of Pre and Post Development Flow Rates – Jardine St Pipe Network (Discharge 2)

Return Period AEP (%)	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)	% Increase (m^3/s)
63% AEP (Q1)	0.006	0.012	0.006
39% AEP (Q2)	0.009	0.020	0.011
18% AEP (Q5)	0.023	0.049	0.026
10% AEP (Q10)	0.051	0.094	0.043
5% AEP (Q20)	0.105	0.185	0.080
2% AEP (Q50)	0.167	0.294	0.127
1% AEP (Q100)	0.259	0.432	0.173

An analysis of the existing Jardine Street (western) stormwater network identifies that the catchment for this network is relatively small in comparison to the eastern Stormwater system. The pipe crossing Wandal Road as part of the Jardine Street stormwater system according to Council's GIS information is a 600mm diameter RCP at a gradient of approx. 1.1%.

The capacity of a 600mm diameter RCP at a grade of 1.1% is approximately $0.729m^3/s$. Please note that this does not consider any head or hydraulic gradient to convey runoff through the pipe which means that this pipe capacity is a conservative approach. As shown in the table above, the 1% AEP runoff for the 600mm diameter pipe to Discharge 2 is $0.432m^3/s$. This identifies that the existing pipe outlet has the capacity to convey the 1% AEP runoff from the given catchment underground in the pipe system.

Therefore, we believe that given the above calculations provided, the development does not require any stormwater mitigation devices. Runoff to the Wandal Road kerb and channel has been reduced and the underground pipe system in Jardine Street has the capacity to cater for the proposed development discharge.

5.3.1 Stormwater Management Proposal

The proposed stormwater management solution will consist of the building roofwater within Catchment 1C being connected to an underground pipe system to discharge to Jardine Street pipe stormwater system. The roofwater from Catchment 1b will be connected to the Wandal Road kerb and channel.

The external catchment 1a will be conveyed overland via the common driveway to an underground pipe system which will connect to the Jardine Street pipe network.

The upper part of Catchment 1b will be conveyed through the site to the road reserve of Wandal Road similar to the existing scenario, ensuring adequate freeboard is provided to the proposed dwellings.

The stormwater management plan for the site can be seen in Appendix F of this report.

5.4 Stormwater Quality

The stormwater quality assessment for the development has been based on the requirements listed in the State Planning Policy – July 2017 under the Water Quality section. With the proposed six (6) Unit Development, we believe no Stormwater Quality Improvement Devices (SQID's) will be required with these works.

The site is less than 2500m^2 of area as per the land area threshold requirements for Stormwater Quality in the State Planning Policy. Therefore, we believe that no Stormwater Quality measures or improvement devices are required to be implemented as part of this development at 93-99 Wandal Road.

6 Electricity and Telecommunications

Existing Electrical and Telecommunications infrastructure is located within the vicinity of the subject site in the road reserves of Wandal Road and Jardine Street. Any electrical reticulation design for the proposed internal works will be completed by a qualified Electrical Engineer.

According to Dial Before you Dig information obtained, the site currently has access to telecommunications services, electrical infrastructure and reticulated gas installed in the Jardine Street road corridor.

All proposed works will be designed and constructed in accordance with the RRC requirements and the specification of the relevant authorities, and all connections to live electrical, telecommunications and gas systems will be carried out at the Developer's expense.

7 Conclusion

There appears to be no insurmountable engineering infrastructure difficulties with the proposed six (6) unit development at 93-99 Wandal Road, Rockhampton. A review of the services proposed for this development and their impact on surrounding services, indicates that there is no impediment to development.

The unit development can be adequately serviced by the existing water and sewer networks, and access can be gained via the existing road corridor of Jardine Street. Electrical and telecommunication services are also available within the vicinity of the site.

Stormwater Management for the proposed development has been considered and included in this report addressing the Stormwater Quantity and Quality for the site.

Minor alterations in the design may eventuate from future applications, however the fundamentals of the design strategy ensure that service provisions will not pose a serious constraint to development.

If you should have any questions regarding this report, please do not hesitate to contact the Calibre Office in Rockhampton on (07) 4961 4200.

6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix A Proposed Site Plan

BT BUILDERS (QLD) PTY LTD

N

EXISTING WATER MAIN

WANDAL ROAD

JARDINE STREET

EXISTING 1.2m WIDE CONCRETE FOOTPATH.

EXISTING VEHICLE ACCESS TO BE REMOVED AND FOOTPATH LEVELS TO BE ADJUSTED ACCORDINGLY.

EXISTING STORMWATER ROAD GULLY INLET

PROPOSED CROSSOVER TO JARDINE STREET

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

1
RP605655
948m2

2
RP605655
630m2

67
RP600739
948m2

68
RP600739
946m2

EXISTING GRAVITY SEWER LINE

PROPOSED COMMON DRIVEWAY

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- OH — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- S — EXISTING GRAVITY SEWER MAIN AND MANHOLE
- GAS — EXISTING GAS RETICULATION MAIN
- T — EXISTING TELECOMMUNICATIONS LINE
- W — EXISTING WATER MAIN
- // — PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED PATHWAYS
- 13.250 — EXISTING CONTOURS

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK001 - PROPOSED SITE PLAN

0 0.625 2.5
0 1.25 5.0m

1:125 (A1)
1:250 (A3)

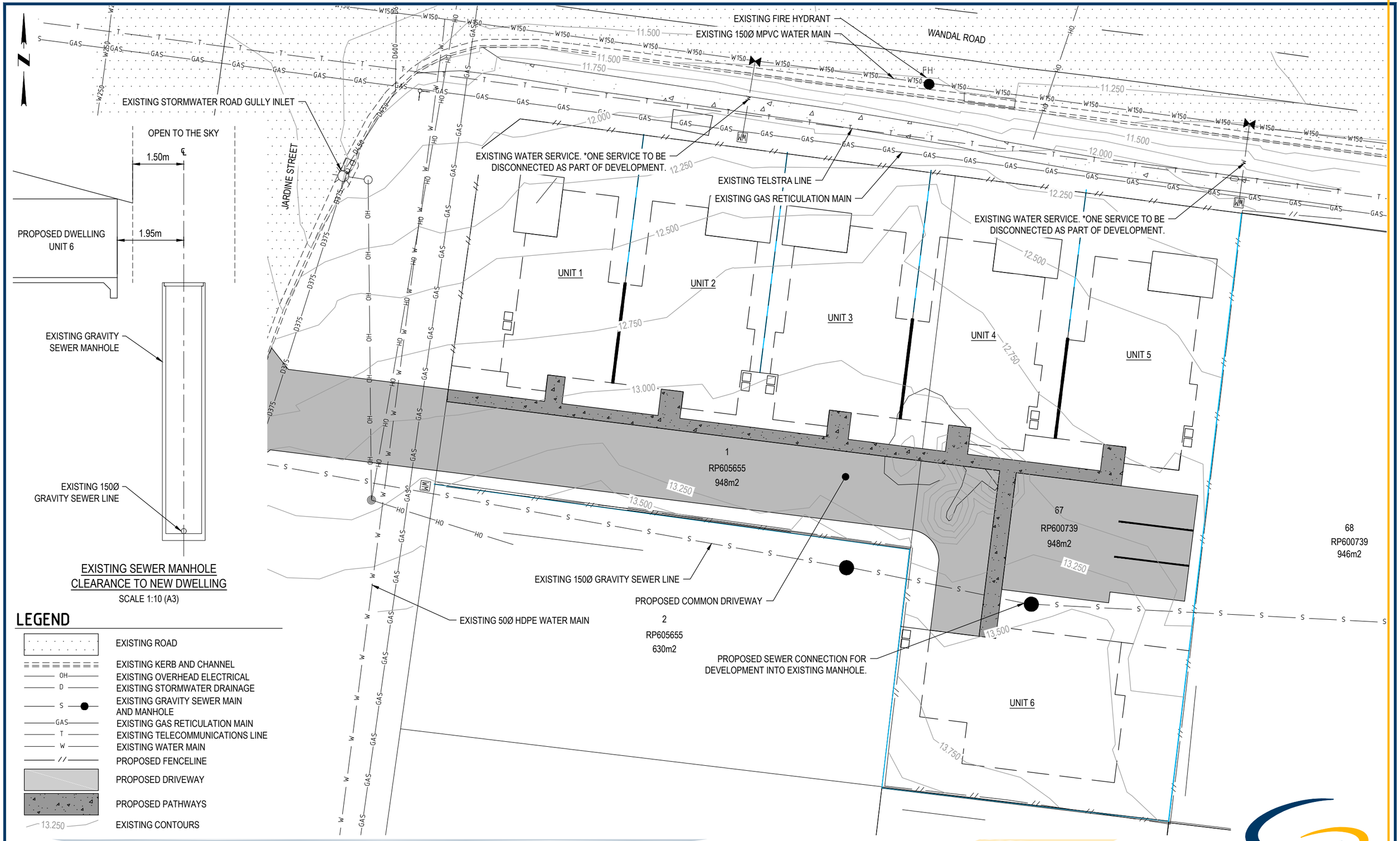
calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 30.11.18
DRAWN: MJD

6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix B Services Plan

BT BUILDERS (QLD) PTY LTD



EXISTING SEWER MANHOLE CLEARANCE TO NEW DWELLING

SCALE 1:10 (A3)

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- OH — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- S — EXISTING GRAVITY SEWER MAIN AND MANHOLE
- GAS — EXISTING GAS RETICULATION MAIN
- T — EXISTING TELECOMMUNICATIONS LINE
- W — EXISTING WATER MAIN
- // — PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED PATHWAYS
- 13.250 — EXISTING CONTOURS

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK002 - SERVICE CONNECTION PLAN

calibre

0 0.625 2.5
0 1.25 5.0m
1:125 (A1)
1:250 (A3)

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 30.11.18
DRAWN: MJD

6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix C Turnpath Plan

BT BUILDERS (QLD) PTY LTD

EXISTING STORMWATER ROAD GULLY INLET

JARDINE STREET

EXISTING 1.2m WIDE CONCRETE FOOTPATH.

EXISTING WATER MAIN

WANDAL ROAD

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

1
RP605655
948m2

2
RP605655
630m2

67
RP600739
948m2

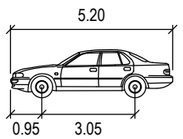
68
RP600739
946m2

PROPOSED CROSSOVER TO JARDINE STREET

PROPOSED COMMON DRIVEWAY

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- EXISTING OVERHEAD ELECTRICAL
- EXISTING STORMWATER DRAINAGE
- EXISTING GRAVITY SEWER MAIN AND MANHOLE
- EXISTING GAS RETICULATION MAIN
- EXISTING TELECOMMUNICATIONS LINE
- EXISTING WATER MAIN
- PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED PATHWAYS
- EXISTING CONTOURS



CAR B99

Width	:	1.94
Track	:	1.84
Lock to Lock Time	:	6.0
Steering Angle	:	33.5

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK003 - TURNPATH PLAN

0 0.625 2.5
0 1.25 5.0m

1:125 (A1)
1:250 (A3)

calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 30.11.18
DRAWN: MJD

6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix D Existing Catchment Plan

BT BUILDERS (QLD) PTY LTD

DISCHARGE 2

EXISTING JARDINE PARK STORMWATER CHANNEL

DISCHARGE 1

WANDAL ROAD

JARDINE STREET

MCKELLIGETT STREET

OAKLEY STREET

JONES STREET

LANIGAN STREET

1 2 3 4 5 6 7 8 9

D600 D525 D375

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- OH — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- S — EXISTING GRAVITY SEWER MAIN AND MANHOLE
- GAS — EXISTING GAS RETICULATION MAIN
- T — EXISTING TELECOMMUNICATIONS LINE
- W — EXISTING WATER MAIN
- // — PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED PATHWAYS
- 13.250 — EXISTING CONTOURS
- EXISTING CATCHMENT BOUNDARY
- FLOW PATH ARROW

CATCHMENT DETAILS		
ID	AREA	UNIT
1	5291	m²
2	12974	m²
3	807	m²
4	19245	m²
5	1199	m²
6	20562	m²
7	1046	m²
8	1017	m²
9	1446	m²

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK004 - EXISTING CATCHMENT PLAN

0 3.125 12.5m
0 6.25 25.0m

1:625 (A1)
1:1250 (A3)

calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 30.11.18
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6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix E Proposed Catchment Plan

BT BUILDERS (QLD) PTY LTD

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- OH — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- S — EXISTING GRAVITY SEWER MAIN AND MANHOLE
- GAS — EXISTING GAS RETICULATION MAIN
- T — EXISTING TELECOMMUNICATIONS LINE
- W — EXISTING WATER MAIN
- // — PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED PATHWAYS
- 13.250 — EXISTING CONTOURS
- PROPOSED CATCHMENT BOUNDARY
- PROPOSED SITE CATCHMENT BOUNDARY
- FLOW PATH ARROW

CATCHMENT DETAILS		
ID	AREA	UNIT
1a	1820	m²
1b	1125	m²
1c	515	m²
1d	1831	m²
2	12974	m²
3	807	m²
4	19245	m²
5	1199	m²
6	20562	m²
7	1046	m²
8	1017	m²
9	1446	m²

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK005 - PROPOSED CATCHMENT PLAN

0 3.125 12.5m
0 6.25 25.0m

1:625 (A1)
1:1250 (A3)

calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 30.11.18
DRAWN: MJD

6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix F Stormwater Management Plan

BT BUILDERS (QLD) PTY LTD

EXISTING STORMWATER ROAD GULLY INLET. NEW STORMWATER TO CONNECT TO THIS SYSTEM.

PROXIMITY TO EXISTING LIGHT POLE TO BE ASSESSED DURING THE DETAILED DESIGN PHASE.

SERVICE CLEARANCES TO BE FURTHER ASSESSED DURING THE DETAILED DESIGN PHASE.

NEW STORMWATER TO CONNECT TO WANDAL ROAD KERB AND CHANNEL.

WANDAL ROAD

JARDINE STREET

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

1
RP605655
948m2

2
RP605655
630m2

67
RP600739
948m2

68
RP600739
946m2

NOTE:
1.INTERNAL STORMWATER LAYOUT SHOWN INDICATIVE ONLY AND SUBJECT TO CHANGE DURING THE DETAILED DESIGN PHASE.
2. STORMWATER NETWORK TO BE SIZED DURING THE DETAILED DESIGN PHASE.

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- OH — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- S — EXISTING GRAVITY SEWER MAIN AND MANHOLE
- GAS — EXISTING GAS RETICULATION MAIN
- T — EXISTING TELECOMMUNICATIONS LINE
- W — EXISTING WATER MAIN
- // — PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED PATHWAYS
- 13.250 — EXISTING CONTOURS
- PROPOSED STORMWATER LINE
- PROPOSED STORMWATER INLET
- FLOW PATH ARROW

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK006 - STORMWATER MANAGEMENT PLAN

0 0.625 2.5
0 1.25 5.0m

1:125 (A1)
1:250 (A3)

calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 30.11.18
DRAWN: MJD

6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD, ROCKHAMPTON

Appendix G Stormwater Calculations

BT BUILDERS (QLD) PTY LTD

Runoff

Travel Times

Catchment 6 - 5

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	525	mm
Hydraulic Radius - R	0.13125	m
Slope (S)	5.0	%
Velocity (V)	4.442	m/s
Pipe Network Length (L)	10.0	m
Pipe Travel Time	0.038	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 5 - 4

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	525	mm
Hydraulic Radius - R	0.13125	m
Slope (S)	5.0	%
Velocity (V)	4.442	m/s
Pipe Network Length (L)	103.0	m
Pipe Travel Time	0.386	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 4 - 3

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	600	mm
Hydraulic Radius - R	0.15	m
Slope (S)	5.0	%
Velocity (V)	4.856	m/s
Pipe Network Length (L)	15.0	m
Pipe Travel Time	0.051	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 3 - 2

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	600	mm
Hydraulic Radius - R	0.15	m
Slope (S)	5.0	%
Velocity (V)	4.856	m/s
Pipe Network Length (L)	99.0	m
Pipe Travel Time	**0.340**	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 1 - 2

Kerb and Channel Flow (QUDM)

Length of Gutter Flow (L)	59.0	
Slope of Gutter (S)	0.45	
Time of Gutter Flow (t)	**2.2**	mins

$$t = 0.025\,L / S^{0.5} \text{ (minutes)}$$

Catchment Kerb1 - Kerb2

Kerb and Channel Flow (QUDM)

Length of Gutter Flow (L)	52.0	
Slope of Gutter (S)	0.45	
Time of Gutter Flow (t)	**1.9**	mins

$$t = 0.025\,L / S^{0.5} \text{ (minutes)}$$

Catchment 1a - Kerb1

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.011	PVC
Avg. Assumed Pipe Size (Diameter)	225	mm
Hydraulic Radius - R	0.05625	m
Slope (S)	2.0	%
Velocity (V)	1.887	m/s
Pipe Network Length (L)	26.0	m
Pipe Travel Time	**0.230**	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 8 - 7

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	375	mm
Hydraulic Radius - R	0.09375	m
Slope (S)	3.0	%
Velocity (V)	2.750	m/s
Pipe Network Length (L)	30.0	m
Pipe Travel Time	**0.182**	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 9 - 8

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	375	mm
Hydraulic Radius - R	0.09375	m
Slope (S)	3.0	%
Velocity (V)	2.750	m/s
Pipe Network Length (L)	12.0	m
Pipe Travel Time	**0.073**	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment 7 - Discharge2

Pipe Flow Travel Time (QUDM)

Description	Value	Unit
Manning's roughness coefficient (n)	0.013	RCP
Avg. Assumed Pipe Size (Diameter)	600	mm
Hydraulic Radius - R	0.15	m
Slope (S)	3.0	%
Velocity (V)	3.761	m/s
Pipe Network Length (L)	41.0	m
Pipe Travel Time	**0.182**	mins

$$V = (1/n).R^{2/3}.S^{1/2}$$

Catchment Discharge2 - Receiving

Friend's Equation (QUDM)

Description	Value	Unit
Overland Sheet Flow Path Length (L)	82	m
Horton's Surface Roughness Factor (n)	0.035	
Upstream RL	11.000	m
Downstream RL	9.500	m
Slope of Surface (S)	1.8	%
Overland Flow Time (t)	**14.4**	mins

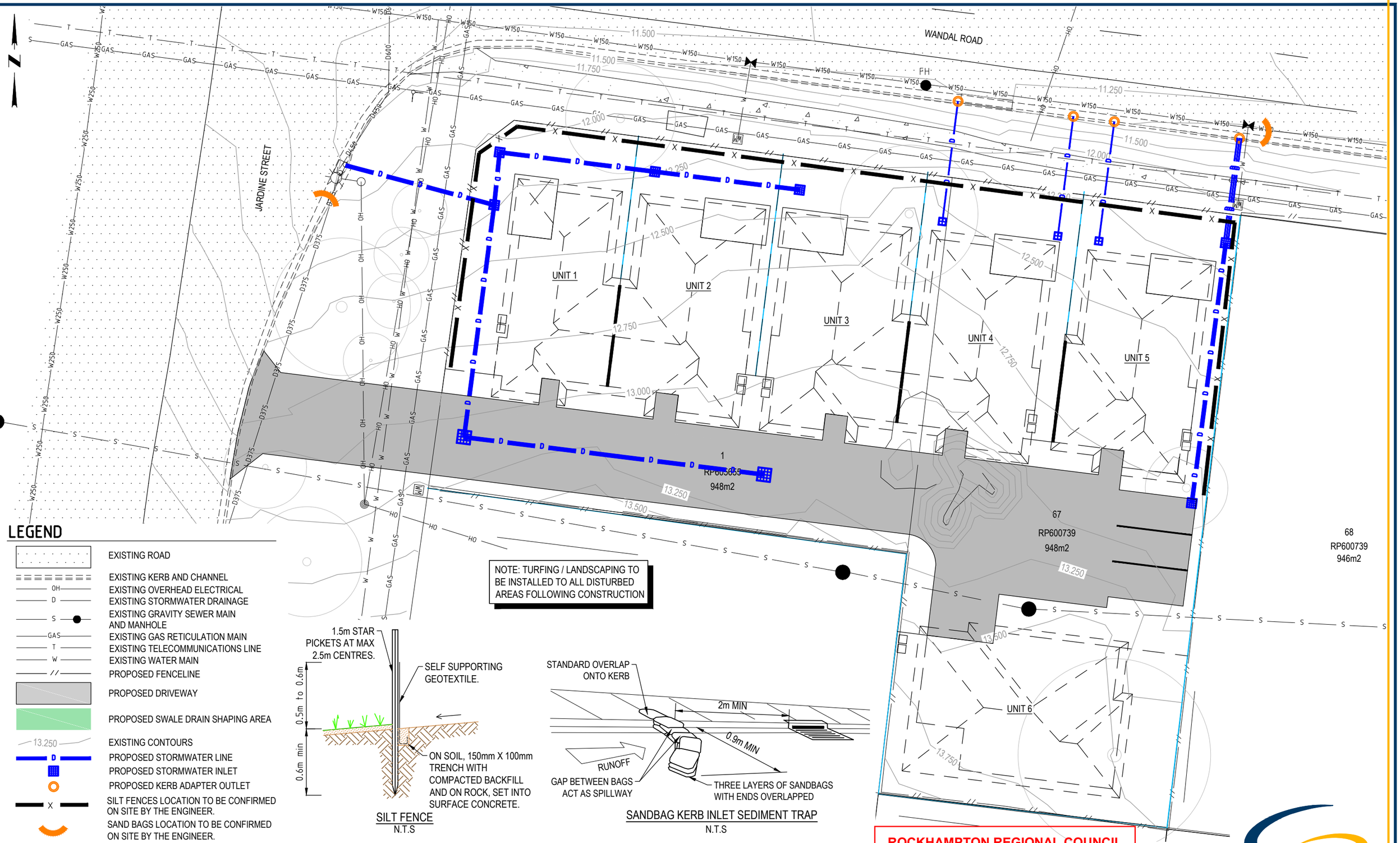
$$t = (107n\,L^{0.333})/S^{0.2}$$

CONTACT US

CALIBRE PROFESSIONAL SERVICES PTY LTD
55 070 683 037

2/74 Victoria Parade Rockhampton, Queensland 4700
PO Box 1580 Rockhampton, QLD 4700
+61 7 4961 4200

WWW.CALIBREGROUP.COM



NOTE: TURFING / LANDSCAPING TO BE INSTALLED TO ALL DISTURBED AREAS FOLLOWING CONSTRUCTION

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- OH — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- S — EXISTING GRAVITY SEWER MAIN AND MANHOLE
- GAS — EXISTING GAS RETICULATION MAIN
- T — EXISTING TELECOMMUNICATIONS LINE
- W — EXISTING WATER MAIN
- // — PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED SWALE DRAIN SHAPING AREA
- 13.250 — EXISTING CONTOURS
- D — PROPOSED STORMWATER LINE
- PROPOSED STORMWATER INLET
- PROPOSED KERB ADAPTER OUTLET
- X — SILT FENCES LOCATION TO BE CONFIRMED ON SITE BY THE ENGINEER.
- SAND BAGS LOCATION TO BE CONFIRMED ON SITE BY THE ENGINEER.

SILT FENCE
N.T.S

SANDBAG KERB INLET SEDIMENT TRAP
N.T.S

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/132-2018

Dated: 31 May 2019

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK007 - PRELIMINARY EROSION AND SEDIMENT CONTROL PLAN

0 0.625 2.5
0 1.25 5.0m
1:125 (A1)
1:250 (A3)

calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 1 DATE: 22.02.19
DRAWN: AB

EXISTING STORMWATER ROAD GULLY INLET. NEW STORMWATER TO CONNECT TO THIS SYSTEM.

600X600 GRATED INLET

PROXIMITY TO EXISTING LIGHT POLE TO BE ASSESSED DURING THE DETAILED DESIGN PHASE.

SERVICE CLEARANCES TO BE FURTHER ASSESSED DURING THE DETAILED DESIGN PHASE.

PROPOSED SHAPING TO FORM SWALE. REFER DETAIL

NEW STORMWATER TO CONNECT TO WANDAL ROAD KERB AND CHANNEL.

WANDAL ROAD

JARDINE STREET

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

900X900 GRATED INLET

900X900 GRATED INLET

600X600 GRATED INLET

1
RP605655
948m2

2
RP605655
630m2

67
RP600739
948m2

68
RP600739
946m2

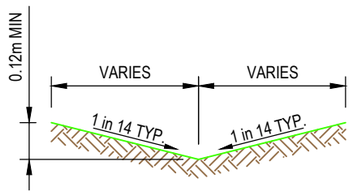
ROAD CROWN

PROPOSED ROAD TO HAVE "V" CHANNEL PROFILE

LEGEND

- EXISTING ROAD
- EXISTING KERB AND CHANNEL
- EXISTING OVERHEAD ELECTRICAL
- EXISTING STORMWATER DRAINAGE
- EXISTING GRAVITY SEWER MAIN AND MANHOLE
- EXISTING GAS RETICULATION MAIN
- EXISTING TELECOMMUNICATIONS LINE
- EXISTING WATER MAIN
- PROPOSED FENCELINE
- PROPOSED DRIVEWAY
- PROPOSED SWALE DRAIN SHAPING AREA
- EXISTING CONTOURS
- PROPOSED STORMWATER LINE
- PROPOSED STORMWATER INLET
- PROPOSED KERB ADAPTER OUTLET
- FLOW PATH ARROW
- STORMWATER STRUCTURE ID

NOTE:
1. INTERNAL STORMWATER LAYOUT SHOWN INDICATIVE ONLY AND SUBJECT TO CHANGE DURING THE DETAILED DESIGN PHASE.
2. STORMWATER NETWORK TO BE SIZED DURING THE DETAILED DESIGN PHASE.
3. SIZING SHOWN IS PRELIMINARY ONLY



PRELIMINARY SWALE TYPICAL SECTION
N.T.S

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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Development Permit No.: D/132-2018

Dated: 31 May 2019

18-002072 - 6 UNIT DEVELOPMENT, 93-99 WANDAL ROAD

SK006 - STORMWATER MANAGEMENT PLAN

calibre

ROCKHAMPTON BRANCH
REFERENCE: 18-002072
REV: 2 DATE: 22.02.19
DRAWN: MJD/AB

0 0.625 2.5
0 1.25 5.0m
1:125 (A1)
1:250 (A3)