ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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

Development Permit No.: D/134-2024

Dated: 20 January 2025

IMPORTANT NOTE

This plan was prepared to accompany an application to Rockhampton Regional Council and should not be used for any other purpose.

The dimensions and areas shown hereon are subject to field survey and also to the requirements of council and any other authority which may have requirements under any relevant legislation.

In particular, no reliance should be placed on the information on this plan for any financial dealings involving the land.

This note is an integral part of this plan.

client

Parkhurst Holdings Pty Ltd

project

11 Breakspear Street, Gracemere

plan of

Reconfiguration Plan

1 Lot into 5 Lots

(With Nearmap Underlay)

rpd

Lot 1 on RP615290

lga

Rockhampton Regional Council

issue	date	details	authorised
A	26-08-2024	Initial Issue	RJKF
-	-	-	-

created

capricornsurveygroupcq
SURVEYING & PLANNING SOLUTIONS
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scale: **1:600 @ A3**

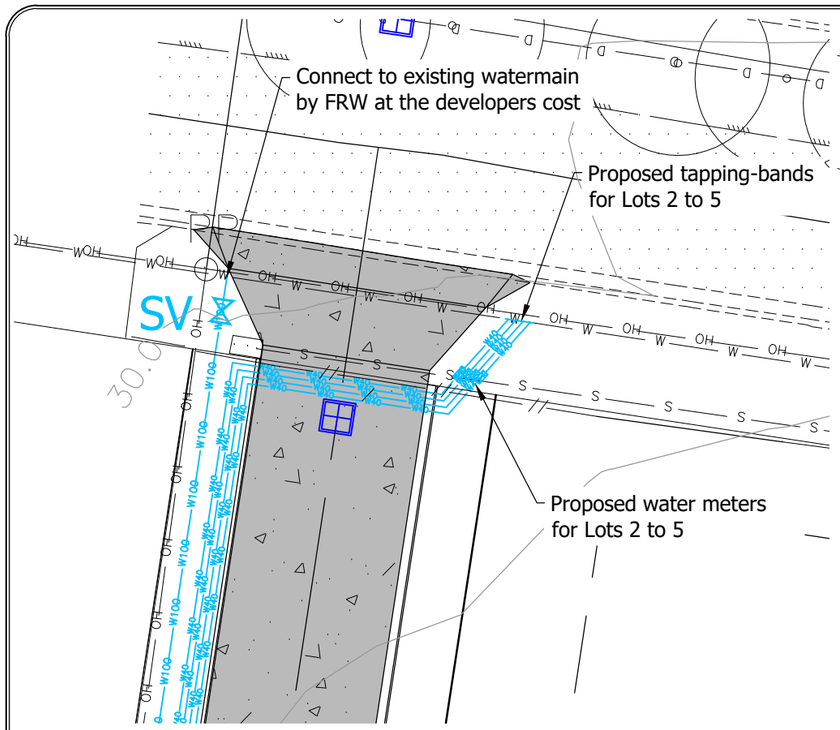
datum: **-**

sheet no.: **1 of 1**

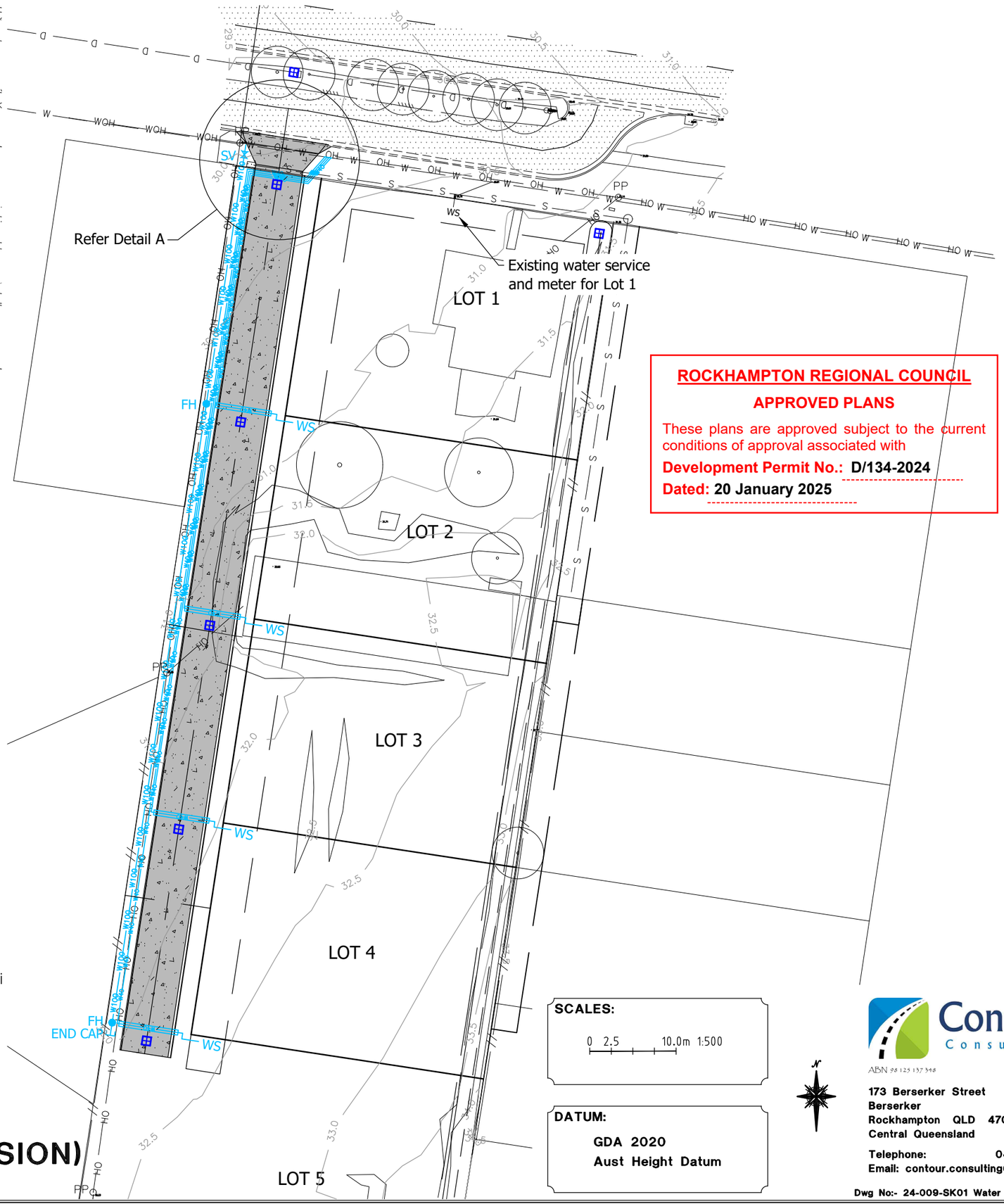
cad file: **9438-01-ROL-A**

plan no.: **9438-01-ROL**

issue: **A**



DETAIL A



WATER RETICULATION LEGEND

- Existing Roadway
- New Concrete Driveway
  Refer Pavement Details
- Existing Water Reticulation Main
- Existing Water Fire Hydrant
- Existing Water Sluice Valve
- New 100mm dia. mPVC Class 16 Water Reticulation Main
  Refer CMDG Std Dwgs W-040 and W-041
- New Water Fire Hydrant
  Refer CMDG Std Dwg W-060, W-061, W-061A and W-062
- New Water Sluice Valve
  Refer CMDG Std Dwg W-060, W-061, W-061A and W-062
- New 40mm dia. Water Service Pipe and Enveloping Conduit
  Refer CMDG Std Dwg W-090, W-090A and W-091
- Existing Contours

ROCKHAMPTON REGIONAL COUNCIL

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Development Permit No.: D/134-2024

Dated: 20 January 2025

SCALES:

0 2.5 10.0m 1:500

DATUM:

GDA 2020
Aust Height Datum

Contour Consulting
ABN 98 125 137 348
173 Berserker Street
Berserker
Rockhampton QLD 4701
Central Queensland
Telephone: 0418 125 259
Email: contour.consulting@bigpond.com

Dwg No:- 24-009-SK01 Water Reticulation Plan

BREAKSPEAR ST (5 LOT SUBDIVISION)

PROPOSED WATER RETICULATION

ROCKHAMPTON REGIONAL COUNCIL

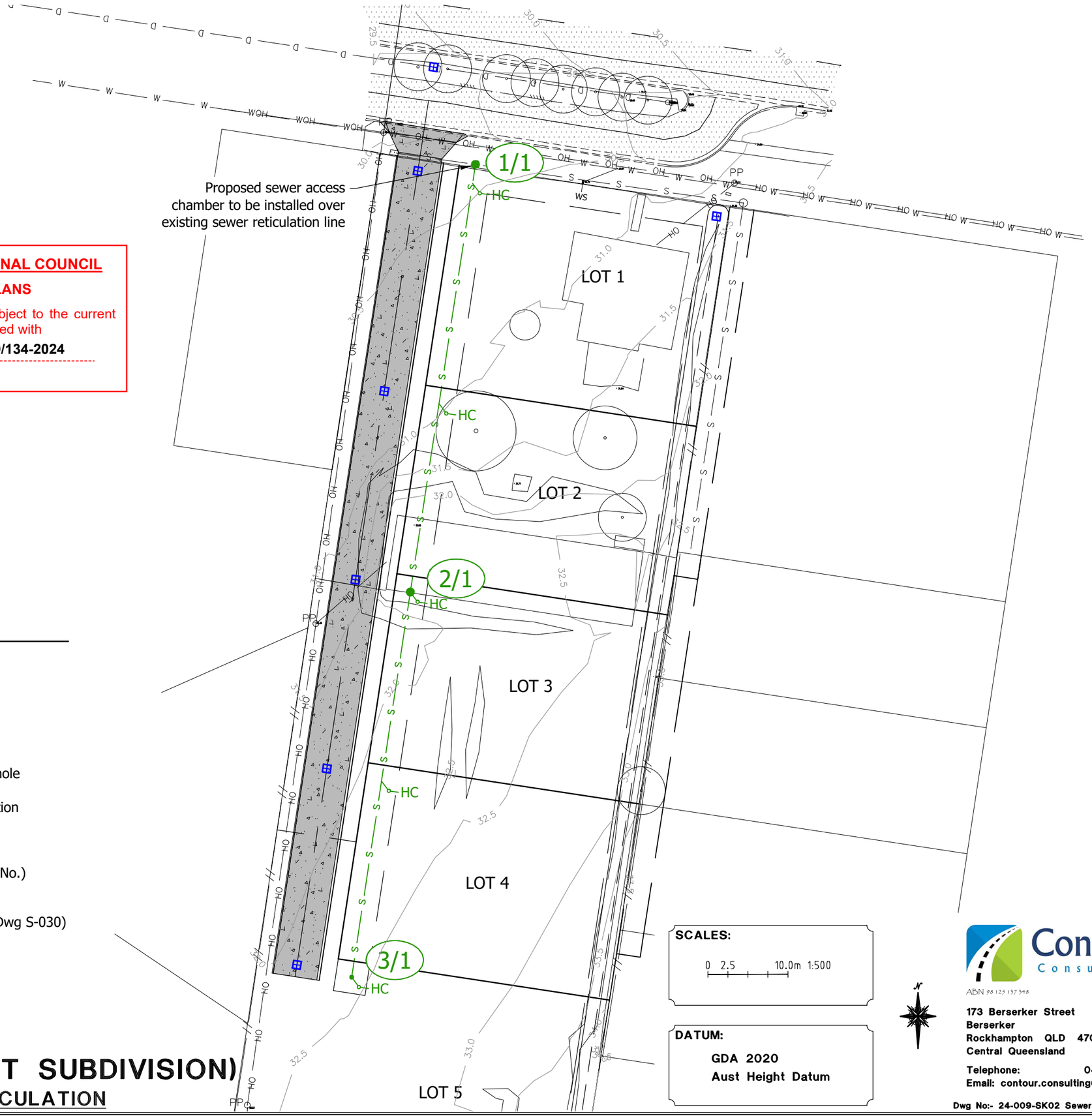
APPROVED PLANS

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

Development Permit No.: D/134-2024

Dated: 20 January 2025

Proposed sewer access chamber to be installed over existing sewer reticulation line



SEWERAGE LEGEND

- Existing Roadway
- New Concrete Driveway
  Refer Pavement Details
- Existing Sewer Main and Manhole
- Existing Sewer House Connection
- New Sewer Main and Manhole
  (Manhole No. and Sewer Line No.)
- New Sewer House Connection
  (Refer details and CMDG Std Dwg S-030)
- New Sewer Easement
  (Refer Surveyors Plans)
- Existing Contours

SCALES:

0 2.5 10.0m 1:500

DATUM:

GDA 2020
Aust Height Datum

BREAKSPEAR ST (5 LOT SUBDIVISION)

PROPOSED SEWER RETICULATION

Contour Consulting
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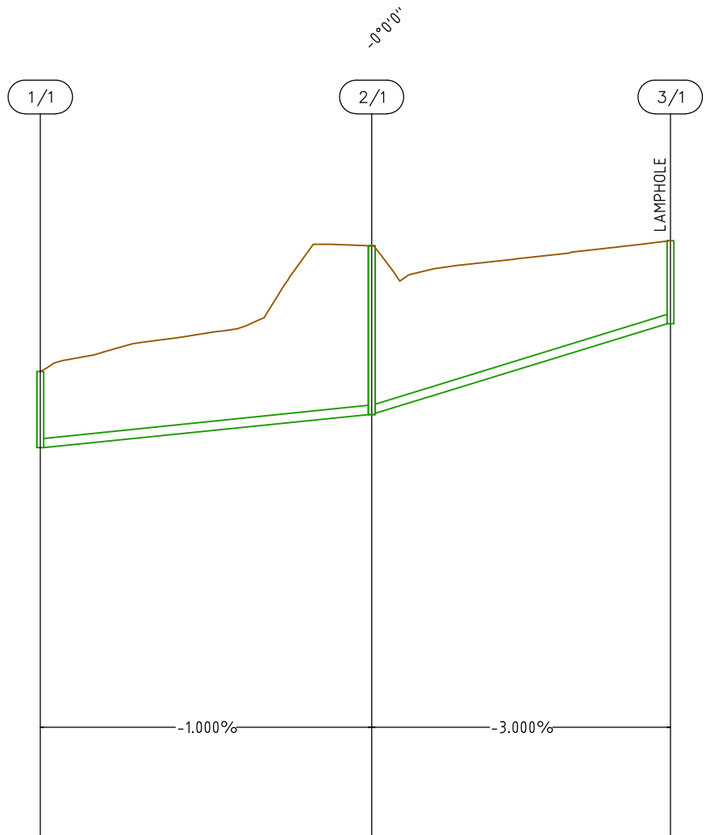
Dwg No:- 24-009-SK02 Sewer Reticulation Plan



GRADE %		-1.000%	-3.000%
PIPE SIZE (mm) & CLASS		150 SN8	150 SN8
DRAINAGE LINE		Sewer Line 1	
DATUM		21.000	
DEPTH TO INVERT	1.283	1.243 / 2.750	2.730 / 1.352
			1.352
INVERT LEVEL	29.018	29.058 / 29.598	29.618 / 31.079
			31.079
DESIGN SURFACE LEVEL		30.301	32.349
			32.432
EXISTING SURFACE LEVEL		30.301	32.349
			32.432
CHAINAGE	0.000	54.048	102.746

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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Development Permit No.: D/134-2024

Dated: 20 January 2025

BREAKSPEAR ST (5 LOT SUBDIVISION)

PROPOSED SEWER RETICULATION

SCALES:

0 2.5 10.0m 1:500

DATUM:

GDA 2020

Aust Height Datum

Contour Consulting

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Dwg No:- 24-009-SK03 Sewer Long Section Plan

CONCEPTUAL STORMWATER MANAGEMENT PLAN

Proposed Residential Subdivision

11 Breakspear Street, Gracemere

Lot 1 on RP615290

For Parkhurst Holdings Pty Ltd

27 November 2024

File No: OSK6891-0002-A

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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

Development Permit No.: D/134-2024

Dated: 20 January 2025

DOCUMENT CONTROL SHEET

Title:	Conceptual Stormwater Management Plan
Document No:	OSK6891-0002-A
Original Date of Issue:	27 November 2024
Project Manager:	Aaron Pianta
Author:	Ben Grant
Client:	Parkhurst Holdings Pty Ltd
Client Contact:	Russell Schirmer – Contour Consulting
Client Reference:	11 Breakspear Street, Gracemere
Synopsis:	This *Conceptual Stormwater Management Plan* describes the existing site characteristics, and corresponding stormwater quantity management controls to be implemented during the construction and operational phase of the development.

Reviewed by RPEQ	Reg. No.	Signed	Date
Aaron Pianta	10423		27 November 2024

Revision/Checking History			
Revision No	**Date**	**Checked By**	**Issued By**
A	27 November 2024	Thomas Watt	Ben Grant

Distribution		
Recipient	**No of Copies**	**Method**
Russell Schirmer – Contour Consulting	1	PDF

The information contained within this report is provided in good faith in the belief that no information, opinions or recommendations made are misleading. All comments and opinions given in this report are based on information supplied by the client, their agent and third parties.

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background

OSKA Civil Consultants has been commissioned by Parkhurst Holdings Pty Ltd to prepare a Conceptual Stormwater Management Plan (CSWMP) to support a Development Application for the proposed residential subdivision situated at 11 Breakspear Street, Gracemere.

The subject site is described as Lot 1 on RP615290 and has a total site area of 0.5772ha.

This report has been prepared in response to Item 3 of the Information Request from Rockhampton Regional Council (Ref: D/134-2024) dated 8 October 2024.

1.2 Scope

This CSWMP details the conceptual 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 system;
- Provide a conceptual design of stormwater infrastructure including stormwater quantity management controls;
- Demonstrate stormwater runoff is conveyed through the site to a Lawful Point of Discharge (LPOD) in accordance with the Queensland Urban Drainage Manual (QUDM); 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), Queensland Water Quality Objectives (2009), Rockhampton Regional Council (RRC) Planning Scheme (2015) and Capricorn Municipal Development Guidelines (2020)*.

2.0 SITE DESCRIPTION

2.1 Location

The subject site is located on 11 Breakspear Street, Gracemere. The site fronts Breakspear Street to the north and has existing residential properties to the south, east and west. The site covers a total combined area of 0.5772ha, with details as summarised in Table 1 and as located in Figure 1.

Table 1: Site Description

Client	Lot and Property Description	Street Address
Parkhurst Holdings Pty Ltd	*Lot 1 on RP615290*	*11 Breakspear Street, Gracemere*

Figure 1: Locality Plan (Source: Nearmap)

2.2 Site Topography

The existing site generally grades to the north-west at approximately 3-4% with spot heights ranging from approximately RL 30.25m AHD to 34.00m AHD. Based on the provided survey and aerial information, any stormwater runoff from roof and ground surfaces drains to private properties to the west with all runoff ultimately conveyed to Breakspear Street.

Further information of the existing site contours and services has been re-produced within the OSKA Consulting Group, Existing Contour & Services Plan (Ref: OSK6891/SK001/A) included as Appendix A.

2.3 Vegetation and Land Use

The subject site currently consists of an existing residential dwelling and detached shed. The majority of the site is covered in grass with a few trees scattered across the site. Access to the site is gained via an existing dirt driveway to the north from Breakspear Street.

An aerial photograph taken on the 3 June 2024 of the subject site is included in Figure 2.

Figure 2: Aerial Image of the Site (Source: Nearmap – Image taken 3 June 2024)

2.4 Proposed Development

The proposed development for the site consists of a five (5) lot residential subdivision with lot areas typically ranging between 817-954m^2 and one larger lot at 2,332m^2. Access to the proposed development will be from the north via a proposed access easement from Breakspear Street which will provide access to all lots.

Refer to Appendix B for further proposed layout details prepared by Capricorn Survey Group CQ, Reconfiguration Plan (Ref: 9438-01-ROL).

2.5 Proposed Conceptual Drainage

It is proposed that the captured roof water from each of the new lots be diverted to proposed stormwater detention tanks. The stormwater connection to the Lawful Point of Discharge (LPOD) is conceptual at this stage. The captured flows within each tank are to be piped to the proposed drainage network within the access easement and discharged to a proposed manhole within Breakspear Street.

2.6 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 23.4375 (S) and Longitude 150.4625 (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.

3.0 DATA

Data which has been sourced or provided, in order to prepare this report for the site, was gathered from the following sources:

- Existing contour and services plan re-produced as OSKA Consulting Group, Existing Contour & Services Plan (Ref: OSK6891/SK001/A) included as Appendix A;
- Proposed site layout provided by Capricorn Survey Group CQ, Reconfiguration Plan (Ref: 9438-01-ROL) included as Appendix B;
- LIDAR data for the subject site sourced from Australian Government Elevation and Depth Foundation Spatial Data (ELVIS), Date Source: 2015, DEM Data;
- Information Extracted from Rockhampton Regional Council's - Interactive Mapping Portal;
- Rainfall and Meteorological 2016 IFD Data by the Australian Bureau of Meteorology; and
- Aerial Imagery by Nearmap (Accessed on 23 October 2024).

4.0 SITE HYDROLOGY

4.1 Background

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

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.

4.2 Pre-Development

4.2.1 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 4,917m^2. Any stormwater on ground surfaces is conveyed as sheet flow through the subject site towards the western boundary with all flows ultimately conveyed to Breakspear Street.

The pre-development catchment has been sized based on the post-development catchment. The pre and post-development catchments are less than the subject site area as the proposed access easement (855m^2) has been excluded from the peak flow rate analysis and only the future lot areas will be assessed.

The existing Point of Discharge (EPOD) for the subject site (for analysis in accordance with QUDM), is the private properties to the west.

The catchment area and LPOD for the subject site are shown on OSKA Consulting Group, Pre-Development Catchment Plan (Ref: OSK6891/P001/A) included as Appendix C.

4.2.2 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 467m^2 of impervious surfaces, which equates to a fraction impervious (fi) of 0.09. Using a one hour, ten-year rainfall intensity ($^1I_{10}$) of 64.0 mm/hr, a C_{10} value of 0.61 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%, 18%, 10%, 5%, 2% and 1% (corresponding to the 2, 5, 10, 20, 50 and 100-year Average Recurrence Interval (ARI) storms).

Table 2: Pre-Development Coefficient of Runoff

Catchment	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
Pre	0.52	0.58	**0.61**	0.64	0.71	0.74

4.2.3 Time of Concentration

The Time of Concentration (TOC) for the pre-development catchment has been calculated in accordance with QUDM Section 4.6.6 – Overland Flow. Friend's Equation ($t = (107*n*L^{0.333})/S^{0.2}$) 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	Total t_c
Pre-Development Catchment	0.492	Average grassed surface	Horton's (n) = 0.035 L = 80m Slope = 5.16% t = 11.6 mins	12 mins

4.2.4 Design Flow Rates

Pre-development peak flow rates have been estimated 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 estimate the subject site's design peak flow rates. The pre-development peak flows for the subject site are presented in Table 4.

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

Pre							
Annual Exceedance Probability	**AEP**	0.5EY	0.2EY	10%	5%	2%	1%
Coefficient of Runoff	**C**	0.52	0.58	0.61	0.64	0.71	0.74
Area of Catchment (ha)	**A**	0.492	0.492	0.492	0.492	0.492	0.492
Average Rainfall Intensity (mm/h)	**I**	110	133	153	175	206	230
Peak Flow Rate (m^3/s)	**Q**	**0.078**	**0.106**	**0.128**	**0.155**	**0.199**	**0.232**

4.3 Post-Development

4.3.1 Catchment Definition and Lawful Point of Discharge

The post-development scenario has been analysed as described in the pre-development scenario with a single internal catchment and has a total contributing area of 4,917m^2.

As mentioned in the pre-development section, the catchment area is less than the subject site area as the proposed access easement (855m^2) has been excluded from the peak flow rate analysis. The flow rate analysis will only include the future lot areas which will consist of a typical roof area of 300m^2 and the remaining lot areas to consist of 25% impervious ground area. Noting that proposed Lot 1 is to maintain the existing dwelling which has a smaller roof area of 200m^2.

Stormwater collected from the roof areas of each lot shall be conveyed via downpipes directly to individual detention tanks. The captured flows within the tanks are to discharge to the proposed stormwater pit and pipe system within the access easement along the western boundary. Runoff from ground and road areas will be captured and conveyed via an internal network of pits and pipes within the access easement along the western boundary. All captured flows within the pit and pipe system are to be discharged into a proposed manhole (the site's LPOD) over the existing stormwater main within Breakspear Street.

The post-development catchment area and LPOD are detailed on OSKA Consulting Group, Post-Development Catchment Plan (Ref: OSK6891/P002/A) included as Appendix D.

4.3.2 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 layout plans, the post-development catchment has approximately 2,279m^2 of impervious surfaces which equates to a fraction impervious (fi) of 0.46. Using a one-hour, ten-year rainfall intensity ($^1I_{10}$) of 64.0 mm/hr, a C_{10} value of 0.74 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%, 18%, 10%, 5%, 2% and 1% (corresponding to the 2, 5, 10, 20, 50 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	0.63	0.70	**0.74**	0.78	0.85	0.89

4.3.3 Time of Concentration

The Time of Concentration for the post-developed catchment has been calculated in accordance with QUDM Table 4.6.3 – Recommended roof drainage system travel times.

In accordance with Table 4.6.3 of QUDM, the post-development catchment will have a time of concentration that will incorporate five (5) minutes of the roof to downpipes time plus two (2) minutes of pipe flow. This equates to a total travel time of seven (7) minutes.

4.3.4 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 x 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

Post							
Annual Exceedance Probability	**AEP**	0.5EY	0.2EY	10%	5%	2%	1%
Coefficient of Runoff	**C**	0.63	0.70	0.74	0.78	0.85	0.89
Area of Catchment (ha)	**A**	0.492	0.492	0.492	0.492	0.492	0.492
Average Rainfall Intensity (mm/h)	**I**	131	159	182	208	244	272
Peak Flow Rate (m^3/s)	**Q**	**0.112**	**0.152**	**0.184**	**0.221**	**0.284**	**0.330**

4.4 Change in Flow Rates

The difference in peak flow rates calculated from the total pre and post-developed site as estimated via The Rational Method, is detailed in Table 7.

Table 7: Change in Peak Flow Rates Estimation – Rational Method

Annual Exceedance Probability	**AEP**	0.5EY	0.2EY	10%	5%	2%	1%
Pre-Developed Peak Flow Rate (m^3/s)	**Q**	0.078	0.106	0.128	0.155	0.199	0.232
Post-Developed Peak Flow Rate (m^3/s)	**Q**	0.112	0.152	0.184	0.221	0.284	0.330
Change in Peak Flow Rate (m^3/s)	**Q**	**+0.034**	**+0.046**	**+0.056**	**+0.066**	**+0.085**	**+0.098**

The Rational Method assessment has demonstrated that an increase in peak flow rates discharging from the site is anticipated due to the proposed development. Therefore, On-Site Detention (OSD) will be required to mitigate flows to the pre-development rates.

4.5 External Catchments

The subject site and the surrounding area were examined to determine if any external catchments will contribute to the subject site. The site was deemed to contain one (1) influencing external catchment to the east of the subject site. The development will propose to capture and convey the external catchment flows along the eastern site boundary with a grassed swale. The captured flows within the swale will discharge into a proposed inlet pit in the north-eastern corner of the site and discharge to the proposed manhole within Breakspear Street.

Further information on the external catchments' area, flows and the proposed drainage strategy will be undertaken in the sections below.

4.5.1 Catchment Definition and Lawful Point of Discharge

The external catchment has been analysed as a singular catchment with a total contributing area of 3,610m^2. Any stormwater runoff from the external catchment is conveyed as sheet flow across the eastern site boundary and through the subject site towards private property to the west of the site. Note the roof areas have been excluded from the external catchment area as it is assumed all roof flows are captured and conveyed into the existing rear allotment drainage system within Easement A-B on SP151219 and Easement C-F on SP187130.

The external catchment area and EPOD/LPOD are shown on the OSKA Consulting Group, Pre-Development Catchment Plan (Ref: OSK6891/P001/A) & OSKA Consulting Group, Post-Development Catchment Plan (Ref: OSK6891/P002/A) included as Appendix C and D respectively.

4.5.2 Coefficient of Runoff

The coefficient of runoff (C year) was determined based on the fraction impervious (f_i) method as specified in QUDM. Using the latest aerial imagery of the site and surrounding area, the external catchment has approximately 542m^2 of impervious surfaces which equates to a fraction impervious (fi) of 0.15. Using a one-hour, ten-year rainfall intensity ($^1I_{10}$) of 64.0 mm/hr, a C_{10} value of 0.64 has been adopted for the external catchment.

The following external catchment Coefficients of Runoff (as shown in *Table 8*) 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%, 10%, 5% and 1% (corresponding to the 2, 10, 20 and 100-year ARI storms).

Table 8: External Catchment Coefficient of Runoff

Catchment	C_2	C_{10}	C_{20}	C_{100}
EXT A	0.54	**0.64**	0.67	0.76

4.5.3 Time of Concentration

The Time of Concentration for the external 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. Refer to Table 9 for the calculated Time of Concentration for the external catchment.

Table 9: External Catchment Time of Concentration

Catchment	Catchment Area (ha)	Catchment Properties	Time of Concentration	
			Overland flow Friend's Equation	Total t_c
External Catchment	0.361	Average grassed surface	Horton's (n) = 0.035 L = 47.50m Slope = 2.63% t = 11.16 mins	11 mins

4.5.4 Design Flow Rates

Design storm flow rates have been calculated for standard storms with an ARI of 2, 10, 20 and 100 years for the external catchment using design rainfall intensities from the Bureau of Meteorology. The Rational Method ($Q = 2.78 \times 10^{-3}$ CIA) has been used to calculate the design flow rates. The peak flow rates for the external catchment are presented in Table 10.

Table 10: External Catchment Peak Flow Rates

External Catchment					
Average Recurrence Interval	**ARI**	2	10	20	100
Coefficient of Runoff	**C**	0.54	0.64	0.67	0.76
Area of Catchment (ha)	**A**	0.361	0.361	0.361	0.361
Average Rainfall Intensity (mm/h)	**I**	114	158	181	238
Peak Flow Rate (m^3/s)	**Q**	**0.062**	**0.101**	**0.121**	**0.182**

4.5.5 External Catchment Conveyance

The external catchment flows are to be conveyed by a swale along the eastern boundary to direct flows around the development and into the existing stormwater main within Breakspear Street.

To demonstrate that the proposed swale is capable of conveying the external catchments 1% AEP flow rates around the site, the proposed swale has been sized utilising the Manning's equation (9.1), $Q = \frac{A}{n} \times R^{\frac{2}{3}} \times S^{\frac{1}{2}}$, from QUDM to ensure that it is sized to an adequate capacity to accommodate and safely convey the external flows.

Refer to Table 11 for the calculated swale capacity.

Table 11: Swale Flow Capacity

Swale Parameters	External Catchment
Swale Depth, d (m)	0.225
Freeboard (m)	0.100
Base Width, W (m)	0
Top Width (m)	2.60
Bank Slope (Ratio of V:H)	1:4
Manning's Roughness, n	0.032 (turf)
Longitudinal Grade, S	1.70% (0.017m/m)
Q - Flow Rate (m^3/s)	**0.188**
Design Flow Rate (m^3/s)	0.182

For further information on the external catchment stomrwater network, refer to the OSKA Consulting Group, Conceptual Stormwater Management Plan (Ref: OSK6891/P003/B) & Conceptual Stormwater Management Details (Ref: OSK6891/P004/B) in *Appendix E.*

5.0 STORMWATER QUANTITY ASSESSMENT

5.1 Background

The proposed development will 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 or adverse impacts as a result of potential increased post-development runoff, on neighbouring properties and/or authorities stormwater infrastructure.

5.2 Objective

In accordance with RRC's requirements and typical industry-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 events up to the 1% AEP design storm event, during the post-developed scenario.

This objective shall be demonstrated via a suitable hydrologic and hydraulic modelling package, by detaining site runoff from the subject site within proposed above ground detention tanks on each lot.

5.3 Hydraulic Model

An estimation of the required detention volume to mitigate any increase in total site discharge rates has been undertaken using the DRAINS software programme.

A DRAINS model has been adopted at the preliminary planning stage to ensure that the above ground detention tanks volumes are 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 roof areas of each lot (300m^2) being conveyed to the individual proposed above ground detention tanks with the remaining road and ground areas of each lot (3,517m^2 total) bypassing the proposed tanks. The existing dwelling on Lot 1 is to be maintained and as such the roof area for this lot will be 200m^2 instead of the 300m^2 used for the other 4 lots. As previously mentioned, the proposed access easement (855m^2) has been excluded from the flow rate assessment with only the future lot areas included in the assessment.

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. The adopted sub-catchment areas for the site, time of concentration and fraction imperviousness, for the pre and post-development have been tabulated in *Table 12.*

Note that roof gutters are to be designed to convey the major event (up to the 1% AEP) into the detention tanks.

The pre and post-development catchment area and LPOD are detailed on OSKA Consulting Group, Pre-Development Catchment Plan (Ref: OSK6891/P001/A) and on OSKA Consulting Group, Post-Development Catchment Plan (Ref: OSK6891/P002/A) included respectively as *Appendix C and D*.

Table 12: Adopted Sub-catchment Parameters

Pre-Development Sub-Catchments			
DRAINS Sub-Catchment ID	***Total Area (ha)***	***Time of Concentration (mins)***	***Fi (%)***
Pre	**0.4917**	**7 (Imp) 12 (Perv)**	**9.50**
Post-Development Sub-Catchments			
DRAINS Sub-Catchment ID	***Total Area (ha)***	***Time of Concentration (mins)***	***Fi***
Post (total)	**0.4917**	**7 (Imp) 12 (Perv)**	**46.35**
Post (Lot 1)	0.0200	6	100
Post (Roof Area for each Lot 2-5)	0.0300	6	100
Post (bypass)	0.3517	7 (Imp) 12 (Perv)	25

The TOC values calculated in the Rational Method calculations in Section 4 for the pre and post-development scenarios were adopted and varied between the impervious and pervious areas of the catchments. The roof areas adopted a time of concentration of 6 minutes. The 39%, 18%, 10%, 5%, 2% and 1% AEP design storm events were analysed for all standard durations ranging from 5 minutes to 120 minutes. The critical duration for the combined peak site discharge was determined to be the 15 and 10 minute storms for the pre-development and post-development scenarios respectively.

The peak discharge rates for the site calculated by the DRAINS model are shown in *Table 13*.

Table 13: Anticipated Peak Site Discharge Rate – Extracted from DRAINS Model (m^3/s)

	Peak Flow Rate Discharge (m^3/s)					
Design AEP Events	**39%**	**18%**	**10%**	**5%**	**2%**	**1%**
Pre-development	0.074	0.100	0.124	0.150	0.191	0.230
Post-development (unmitigated)	0.106	0.143	0.170	0.205	0.258	0.300

The DRAINS assessment results shown in Table 13 supports the Rational Method in Section 4 in confirming that an increase in peak flow rates discharging from the site is anticipated. Therefore, On-Site Detention is required to mitigate flows to pre-development conditions.

5.4 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 14: Adopted Detention Tank Parameters (each lot)

Minimum Detention Area:	4.00m^2
Detention Tank Internal Height:	2.00m
Low Flow (at invert of tank)	Ø50mm Orifice
High Flow (at 1.75m above tank invert)	Ø100mm Orifice
Consolidated Outlet Pipe	Ø150mm @ 1% grade
1% AEP (Q100) Water Level:	1.92m
Required Detention Volume:	8.00m^3

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

Table 15: Comparison of Pre-Development and Mitigated Flow Rates – Extracted from DRAINS

Annual Exceedance Probability	**39%**	**18%**	**10%**	**5%**	**2%**	**1%**
Pre-Development Peak Flow Rate (m^3/sec)	0.074	0.100	0.124	0.150	0.191	0.230
Mitigated Peak Flow Rate (m^3/sec)	0.073	0.098	0.118	0.141	0.178	0.228

The hydrograph for the critical duration of the Mitigated 1% AEP storm event compared against the pre and post-development is shown in *Figure 3.*

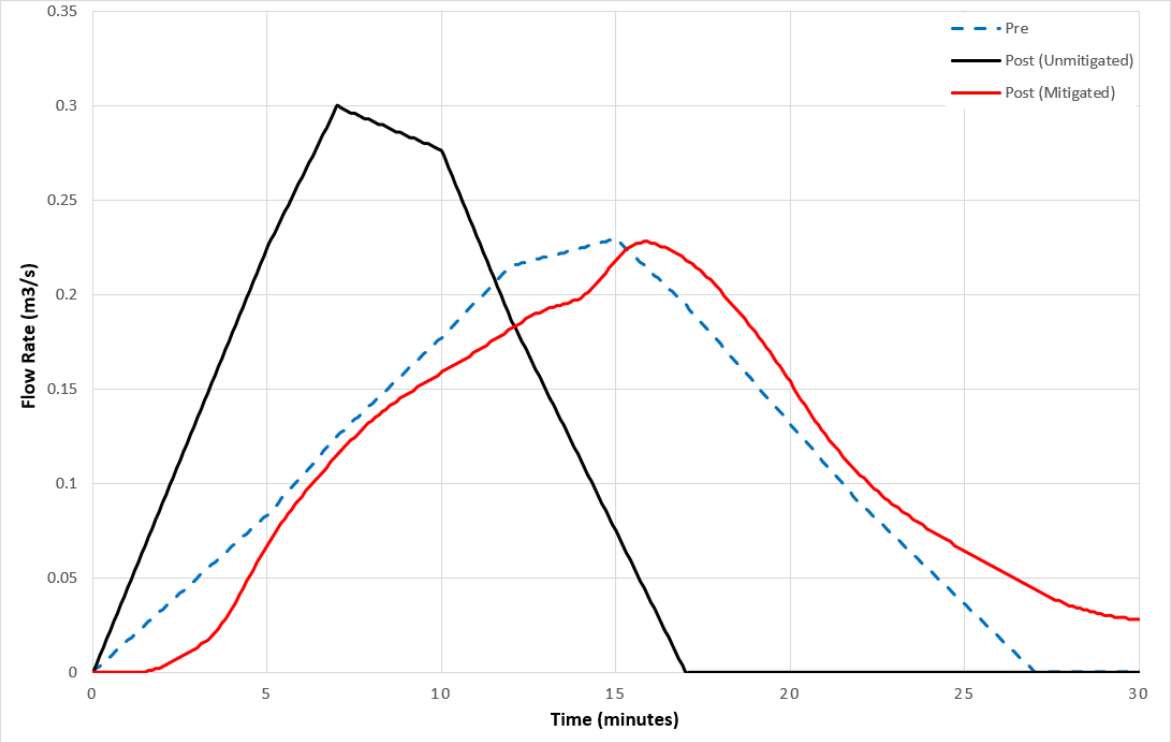

Figure 3: Pre, Post and Mitigated Flow Rates for the 1% AEP Design Storm Event

As demonstrated in the results displayed in *Table 15 and Figure 3*, 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 DRAINS model has determined that a minimum total of 8m^3 of storage per lot is required for runoff attenuation and is to be provided in the form of an above ground detention tank on each lot. The above ground detention tanks are to be fitted with an outlet configuration (low and high flow outlets) as detailed in *Table 14* to satisfy the mitigation requirements. Refer to the OSKA Consulting Group, Conceptual Stormwater Management Plan (Ref: OSK6891/P003/B) & Conceptual Stormwater Management Details (Ref: OSK6891/P004/B) in *Appendix E* for details of the tank's arrangement and indicative location. The final location onsite and construction levels will be determined at the detailed design stage.

A copy of DRAINS model used in this report can be made available to Council upon request.

6.0 CONCLUSIONS

OSKA Civil Consultants has been commissioned by Parkhurst Holdings Pty Ltd to prepare a Conceptual Stormwater Management Plan (CSWMP) to support a Development Application (DA) to the Rockhampton Regional Council (RRC) for the proposed residential subdivision situated at 11 Breakspear Street, Gracemere. 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 the development and satisfies the requirements of the Rockhampton Regional Council 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 DRAINS 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 above ground detention tanks connected to the roof areas on each lot. The captured flows from the tanks are to be piped to the proposed stormwater drainage within the access easement along the western boundary before discharging into the proposed manhole within Breakspear Street. A minimum total tank area of 8.00m^3 was modelled demonstrating adequate mitigation of post-developed flows resulting in no additional or actionable nuisance to downstream properties or infrastructure.

APPENDIX

A

OSKA Consulting Group, Existing Contour & Services Plan (Ref: OSK6891/SK001/A)

LEGEND

- 80.0 — EXISTING SURFACE CONTOURS
- SITE BOUNDARY
- EXISTING EASEMENT
- S — EXISTING SEWER MAIN (FROM COUNCIL RECORDS)
- W — EXISTING WATER MAIN (FROM COUNCIL RECORDS)
- SWD — EXISTING STORMWATER PIPE (FROM COUNCIL RECORDS)

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

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A	ISSUED FOR REPORT	BG	19-11-24

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SIGNED

DATE

OSKA CONSULTING GROUP

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CLIENT
PARKHURST HOLDINGS PTY LTD

PROJECT
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11 BREAKSPEAR STREET
GRACEMERE, QLD, 4702

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TITLE
EXISTING CONTOUR AND SERVICES PLAN

DRAWING NUMBER
OSK6891-SK001

REVISION
A

APPENDIX

B

Capricorn Survey Group CQ, Reconfiguration Plan (Ref: 9438-01-ROL)

IMPORTANT NOTE

This plan was prepared to accompany an application to Rockhampton Regional Council and should not be used for any other purpose.

The dimensions and areas shown hereon are subject to field survey and also to the requirements of council and any other authority which may have requirements under any relevant legislation.

In particular, no reliance should be placed on the information on this plan for any financial dealings involving the land.

This note is an integral part of this plan.

client

Parkhurst Holdings Pty Ltd

project

11 Breakspear Street, Gracemere

plan of

Reconfiguration Plan

1 Lot into 5 Lots

(With Nearmap Underlay)

rpd

Lot 1 on RP615290

lga

Rockhampton Regional Council

issue	date	details	authorised
A	26-08-2024	Initial Issue	RJKF
-	-	-	-

created

capricornsurveygroupcq
SURVEYING & PLANNING SOLUTIONS
07 4927 5199 | reception@cgcq.com.au | 132 Victoria Parade, Rockhampton QLD 4700

scale: **1:600 @ A3**

datum: **-**

sheet no.: **1 of 1**

cad file: **9438-01-ROL-A**

plan no.: **9438-01-ROL**

issue: **A**

APPENDIX

C

OSKA Consulting Group, Pre-Development Catchment Plan (Ref: OSK6891/P001/A)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- EXT EXTERNAL STORMWATER CATCHMENT I.D.
- 80.0 EXISTING SURFACE CONTOURS
- EPOD EXISTING POINT OF DISCHARGE
- FLOW DIRECTION
- SITE BOUNDARY
- EXISTING EASEMENT

EXISTING SERVICES LEGEND

- EXISTING SEWER MAIN (FROM COUNCIL RECORDS)
- EXISTING WATER MAIN (FROM COUNCIL RECORDS)
- EXISTING STORMWATER PIPE (FROM COUNCIL RECORDS)

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (m²)
A	5772
EXT	3610
TOTAL	5772

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

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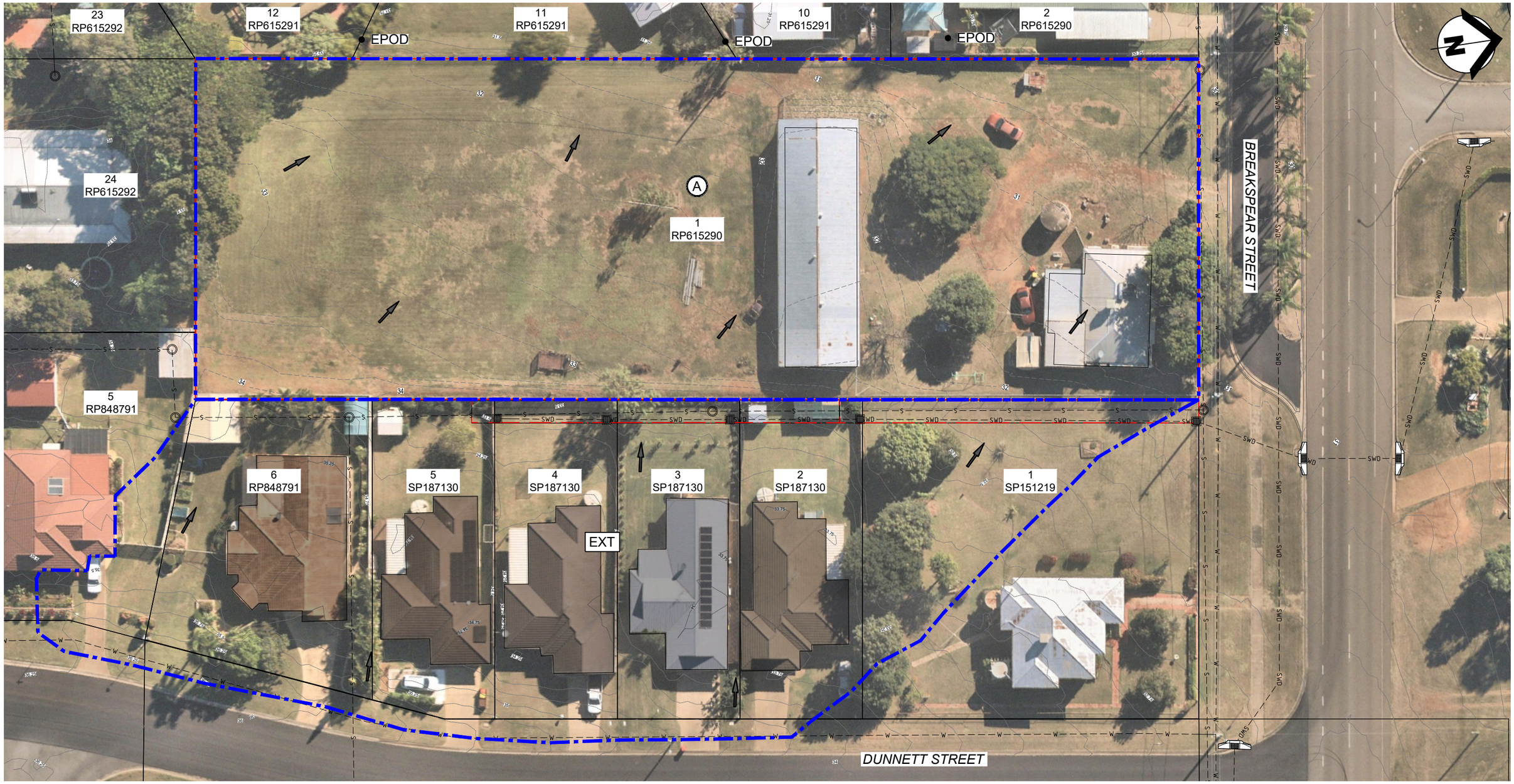

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TITLE
PRE-DEVELOPMENT CATCHMENT PLAN

DRAWING NUMBER
OSK6891-P001

REVISION
A

APPENDIX

D

OSKA Consulting Group, Post-Development Catchment Plan (Ref: OSK6891/P002/A)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- EXT EXTERNAL STORMWATER CATCHMENT I.D.
- 80.0 EXISTING SURFACE CONTOURS
- LPOD LAWFUL POINT OF DISCHARGE
- FLOW DIRECTION
- SITE BOUNDARY
- EXISTING EASEMENT

EXISTING SERVICES LEGEND

- EXISTING SEWER MAIN (FROM COUNCIL RECORDS)
- EXISTING WATER MAIN (FROM COUNCIL RECORDS)
- EXISTING STORMWATER PIPE (FROM COUNCIL RECORDS)

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (m²)
A	5772
EXT	3610
TOTAL	9382

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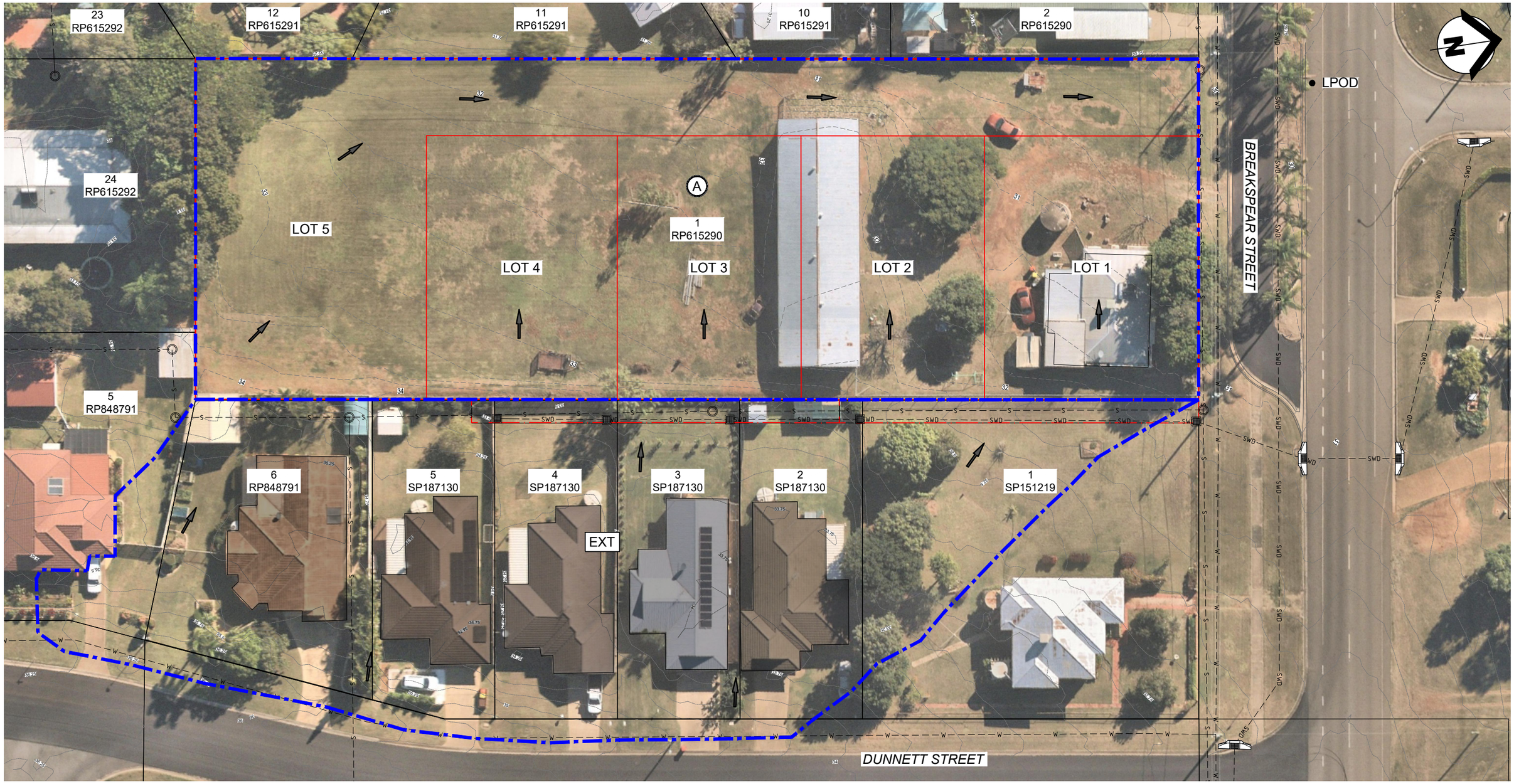

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APPENDIX

E

OSKA Consulting Group, Conceptual Stormwater Management Plan (Ref: OSK6891/P003/B) & Conceptual Stormwater Management Details (Ref: OSK6891/P004/B)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- 80.0 — EXISTING SURFACE CONTOURS
- LPOD — LAWFUL POINT OF DISCHARGE
- SITE BOUNDARY
- PROPOSED EASEMENT
- EXISTING EASEMENT
- FLOW DIRECTION
- PROPOSED STORMWATER TANK
- SWD — PROPOSED STORMWATER PIPE
- PROPOSED SWALE
- PROPOSED FIELD INLET
- PROPOSED STORMWATER MANHOLE
- PROPOSED ACCESS EASEMENT

EXISTING SERVICES LEGEND

- S — EXISTING SEWER MAIN (FROM COUNCIL RECORDS)
- W — EXISTING WATER MAIN (FROM COUNCIL RECORDS)
- SWD — EXISTING STORMWATER PIPE (FROM COUNCIL RECORDS)

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

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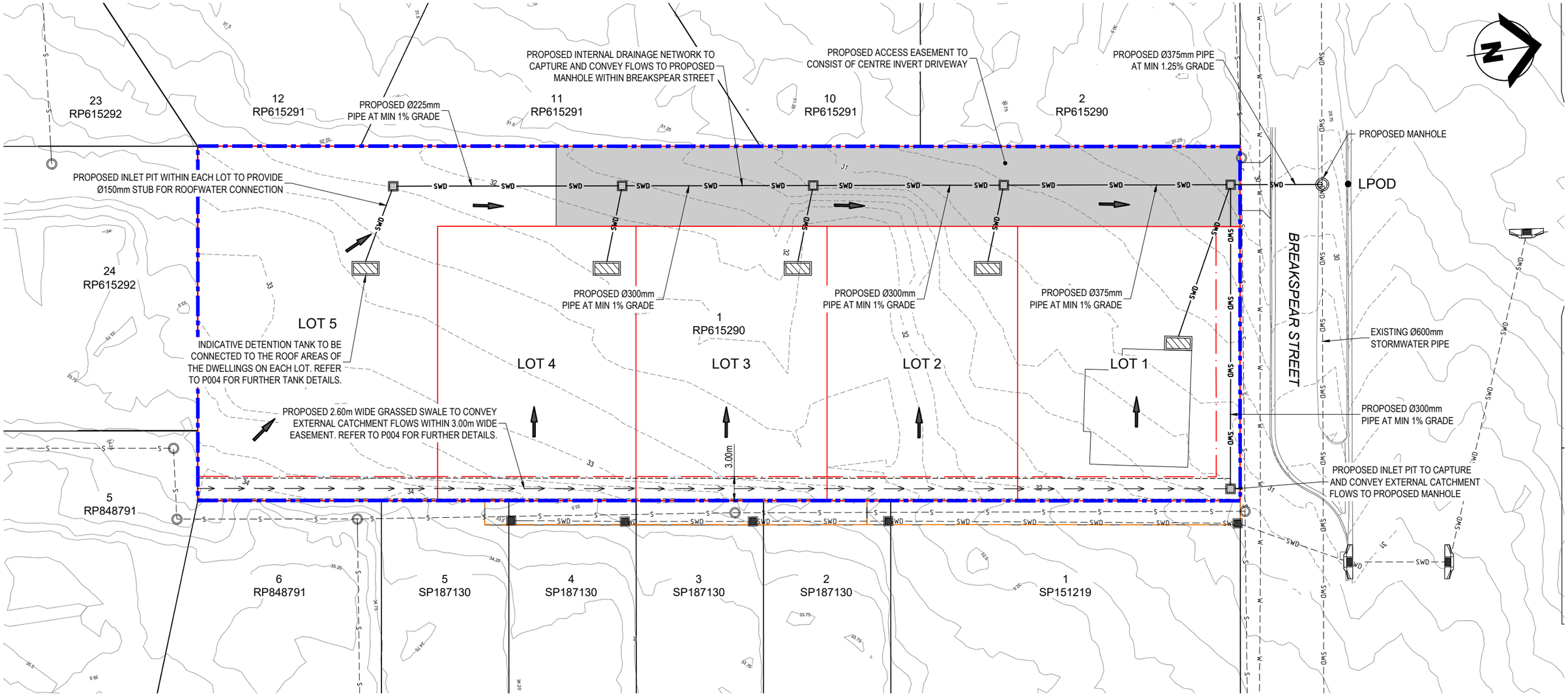

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CONCEPTUAL STORMWATER MANAGEMENT PLAN

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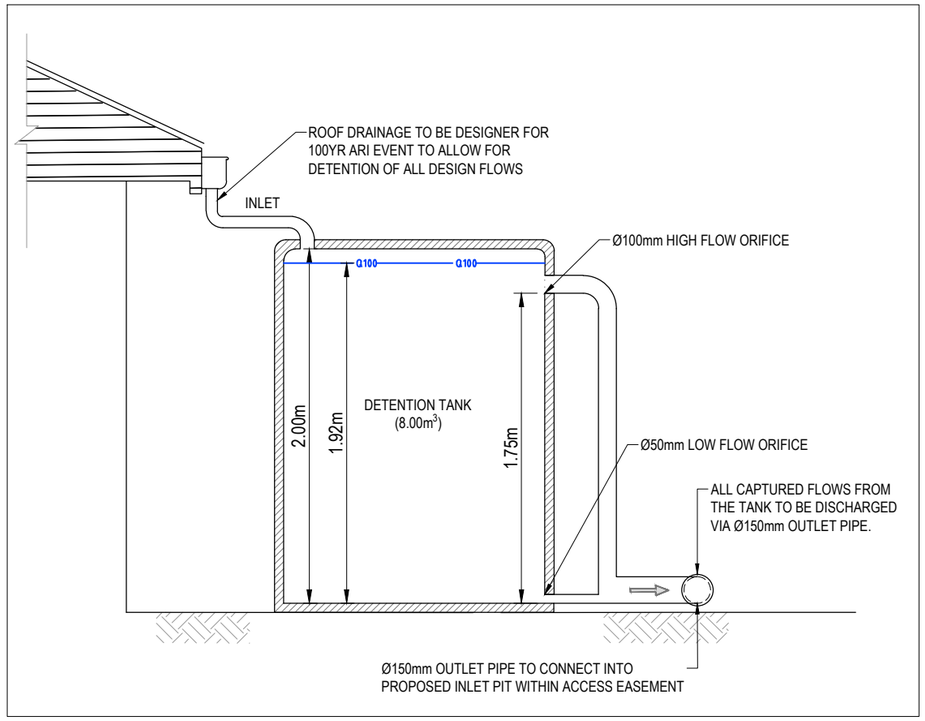

PROPOSED STORMWATER DETENTION TANK
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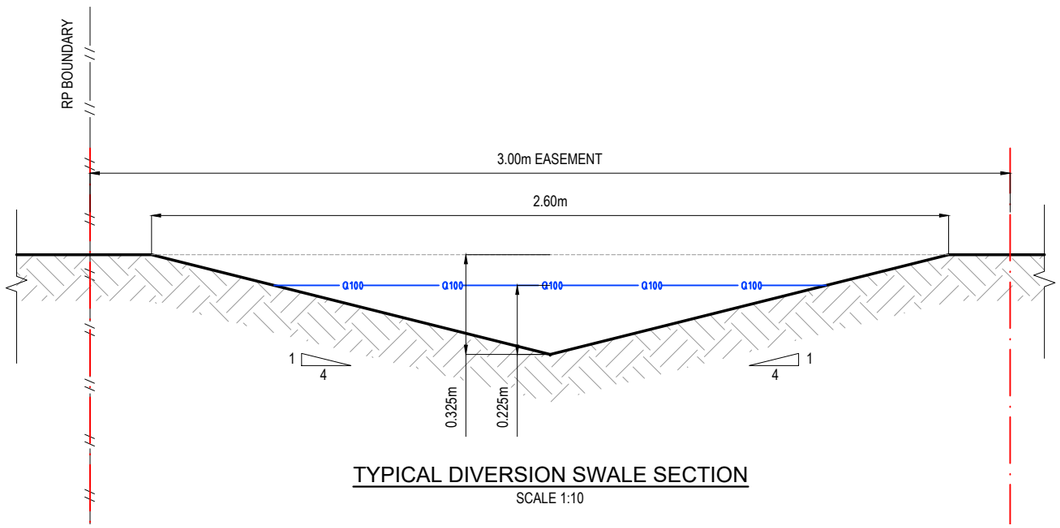

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