PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2019/1087/1

Date: 25th June 2020

Queensland Government

Conceptual Stormwater Management Plan

Subdivision – 15 & 19-67 Pub Lane, Greenbank

Prepared for: Shopping Centres Australasia Property Group

Date: 9 April 2020

Prepared by: Anthony Raadschelders

Ref: 29875_CI_001_C

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WOOD & GRIEVE ENGINEERS

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Revision

Revision	Date	Comment	Prepared By	Approved By
A	31/10/19	Issued for Approval	BM/AR	AR
B	1/11/19	Minor updates	AR	AR
C	10/04/20	ROL changes	AR	AR

Site Address: 15 and 19-67 Pub Lane, Greenbank

Real Property Description: Lot 5 on SP214051

Proposed Development: Subdivision (1 into 2)

Client: Shopping Centres Australasia Property Group (SCA)

Local Authority: Economic Development Queensland (EDQ)

Authority Reference #:

Anthony Raadschelders RPEQ 19881

For and on behalf of

Wood & Grieve Engineers

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Contents

1. Introduction

Wood & Grieve Engineers have been commissioned by Shopping Centres Australasia Property Group (SCA) to prepare this Stormwater Management Plan (SMP) for the proposed 1 into 2 subdivision of the property situated at 19-67 Pub lane, Greenbank. The site's Real Property Description is 5 on SP214051.

This SMP outlines the Conceptual level stormwater servicing strategy to support the Development Application for the proposed subdivision being lodged with the with the Minister of Economic Development of Queensland (MEDQ).

It is noted that no new uses are proposed on the subject site as part of the current application. As such, subsequent discussion and reporting is based on maintaining the current stormwater quantity discharge regime and continuing to meet the applicable stormwater management obligations for the existing shopping centre that currently utilises the subject site for their stormwater management.

1.1.1 Purpose

The purpose of this SBSMP is to evaluate the quantity and quality of stormwater associated with the proposed development and relocation of the bio-retention basin, so as to demonstrate to MEDQ that an appropriate stormwater management strategy can be accommodated.

The SBSMP specifically addresses the following items for both the construction and operational phases of the development:

- An appropriate stormwater quality management strategy can be implemented that meets Water Sensitive Urban Design (WSUD) best management practices, state and local government planning and guideline requirements,
- An appropriate stormwater quantity management strategy can be implemented to that ensure that the developed site's stormwater runoff meets Council requirements, and
- Maintenance of water quality treatment devices.

It is noted that this report is specifically associated with demonstrating maintaining non-worsening of the stormwater condition of the subject site, associated with the subject application, ie a reconfiguration of a lot (ROL). As no uses or works are proposed as part of the subject development proposal, this report will demonstrate that only impacted measures will be relocated to accommodate the proposed development without impacting on the stormwater condition as it leaves the site. No additional measures or mitigations are required nor proposed as part of this applications.

2. Existing Site Characteristics

2.1 Property Detail

Address:	19-67 Pub Lane, Greenbank
Real Property Description:	Lot 5 on SP214051
Total Site Area:	9.964ha

As can be seen in the aerial photo below, the site is bounded by the existing shopping centre to the East, Pub Lane to the South and the Brisbane – Sydney Rail Line to the West. There are existing rural-residential properties along the northern boundary.

Figure 2-1: Site Location Plan (Source: Nearmap 2019)

2.2 Existing Site Conditions & Improvements

The existing Shopping Centre is located on the adjacent Lot 1 east of the subject site against Teviot Rd. The subject site, located on Lot 5 is undeveloped, but has an on-site sewage treatment system, evapotranspiration area, and an existing stormwater detention basin which services the existing shopping centre located in the existing drainage easements.

2.3 Proposed Development

The development will consist of a Reconfiguring of a Lot (ROL) to create 2 Lots. The new Lot 8 is subject to further approvals for any future uses. It is noted that an existing Development Approval exists for the Development of proposed Lot 7 with EDQ (Ref: DEV2016/813) The proposed development can be seen in Appendix A.

2.4 Topography

A detailed surface survey was conducted by Lawson Surveys on 1 April 2016, which is included as a background to the development layout in Appendix A.

It shows that the surface generally grades away from the Teviot Rd/ Pub Lane intersection towards the basin in the north-western corner of the site. The site is generally a platform for the existing shopping centre, from which it is battered down to the gently graded existing surface, which is on average about 2-3%.

3. Flooding/ Overland Flow Impacts

3.1 Known Existing Flooding/ Overland Flow Paths

Logan City Council (LCC) flood mapping indicates that the subject site is not affected by inundation overlays associated with a river, creek, tidal surge or overland flow path (attached in Appendix B). This has been previously confirmed as part of previous applications with Department of Infrastructure, Local Government and Planning (DILGP). Therefore, no further Flood Impact Study or investigation is suggested to be required as part of this application.

3.2 External Catchment

By examining contours of the surrounding area, it has been established that there are external catchments that impact on the proposed development site. The external catchment is limited to flows from the existing shopping centre and road batters in Pub Lane. It is reflected in the catchment plans in Appendix D. The catchment is approximately 4.187ha and arrives at the existing detention basin via overland flow and an existing swale drain running along the northern boundary of the site, which directs stormwater flow towards the existing detention basin. To accommodate these flows, it is proposed to utilise, and divert as necessary, the existing overland flow path to the existing discharge point at the rail corridor on the western boundary of the site.

4. Stormwater Quantity

4.1 Existing Stormwater Regime

The site survey demonstrates that the site drainage is towards the north-western corner of the site. This has been verified by a site visit on 10 June 2016. The site discharges as overland flow to the rail corridor on the western boundary of the site, which is then conveyed across the rail corridor via an existing pipe culvert.

There is an existing detention basin located at the north-western boundary of the site, which was constructed to mitigate the increase in peak discharges from the site resulting from the Greenbank Shopping Centre development. The Operational Works drawings for this basin are included in Appendix C.

4.1.1 Pre-Development Peak Stormwater Condition

An existing detention basin is currently located in the north-western corner of the site. It was constructed to mitigate the stormwater quantity impacts associated with the development comprising the existing shopping centre development. The subject application relates to subdividing Lot 5 on SP214051, for a future use unrelated to the shopping centre or its planned expansions. As the existing detention basin is located in Proposed Lot 8, it is proposed to relocate the facility to Proposed Lot 7, which is the proposed lot for the proposed shopping centre expansion development (DEV2016/813). As such the relocated detention basin will be to continue mitigate the increase of peak discharges from the site resulting in those flows associated with the existing shopping centre.

Therefore, for the purposes of this report, the pre-development condition is taken to refer to the undeveloped condition of the subject site prior to the development of the existing shopping centre area. The subsequent assessment will demonstrate that the relocated basin will maintain the development obligations required associated with the construction of the existing shopping centre.

Rational Method Calculations (in Appendix E) have been undertaken to provide peak flow rates to compare against the DRAINS model which has been utilised to calculate the pre-development peak flow rates for the catchment.

The rainfall intensities utilised in the stormwater calculations have been calculated for the site's coordinates using the ARR16 Very Frequent Design Rainfall Intensity, gathered from the Bureau of Meteorology. The 1hr rainfall intensity for a 10% AEP ($^{1}I_{10}$) for this site location is 57.7 mm/hr.

By undertaking an overall site investigation and looking at historical aerial photography, the undeveloped site can be generally categorised as rural. As such, a Fraction Impervious of 0.0 has been determined. The pre-development f_i and C_{10} values as per the QUDM have been evaluated and are listed below in Table 4-1**.**

Table 4-1: Catchment Un-developed Parameters

Catchment	Catchment's Development Category	Fraction Impervious (f_i)	Coefficient of Discharge (C_{10})
Undeveloped Site	Rural	0.0	0.7

The undeveloped peak flows for the Catchments for both DRAINS and the Rational Method are summarised in the following Table 4-2 and Table 4-3.

The rainfall temporal patterns from Australian Rainfall and Runoff (ARR16) were utilised in the DRAINS model. The ILSAX hydrological method has been used with 1mm storage or impervious surfaces and 5mm storage for pervious surfaces.

Table 4-2: Undeveloped Peak Flows – Rational Method

AEP (ARI yrs)	39% (2yr)	18% (5yr)	10% (10yr)	5% (20yr)	2% (50yr)	1% (100yr)
Total Catchment	1.457	2.264	2.828	4.567	5.755	6.625

Table 4-3: Pre-development Peak Flows – DRAINS Model

AEP (ARI yrs)	39% (2yr)	18% (5yr)	10% (10yr)	5% (20yr)	2% (50yr)	1% (100yr)
Total Catchment	2.27	3.32	3.88	4.68	5.52	6.27

As demonstrated by Table 4-2 and Table 4-3 above, the Rational Method calculations and DRAINS model yield similar values and are considered comparable. As such, the DRAINS values shall be adopted as the peak flow rates for the undeveloped site condition for the purposes of the subsequent analysis.

4.2 Lawful Point of Discharge

It is a requirement that every development must have a lawful point of stormwater discharge. It is proposed to maintain the existing lawful point of discharge which is the overland flow path located on the western boundary that discharges to the adjacent rail corridor. Refer to the Conceptual Stormwater Management Plan in Appendix D for the locations.

4.3 Proposed Stormwater Management Strategy

4.3.1 Catchment Description

Similar to the Pre-development Stormwater Condition Assessment in Section 4.1, the proposed Stormwater condition that will subsequently be assessed relates to the developed condition of the existing shopping centre development. No new uses have been considered nor are proposed as part of the subject development application.

The pre and post-development catchment areas are summarised in Table 4-4 below and on the drawing within Appendix D.

Table 4-4: Pre & Post-development Catchments

Catchment Name	Pre-development (Ha)	Post-development (Ha)	Change (Ha)
Site Catchment	14.151	14.151	0
Total	14.151	14.151	0

The Coefficients of Discharge have been determined in accordance with QUDM, utilising the Development Layout Plan. The f_i and C_{10} values have been evaluated and are listed below in Table 4-5.

Table 4-5: Catchment Post-development Parameters

Catchment	Fraction Impervious (f_i)	Coefficient of Discharge (C_{10})
Existing Shopping Centre	0.85	0.84
Existing Undeveloped Site	0.0	0.7

The Coefficient of Runoff (C_y) for the various ARI events is evaluated by using the frequency factor and C_{10} values established above.

Rational Method Calculations (in Appendix E) have been undertaken to provide peak flow rates to compare against the DRAINS model which has been utilised to calculate the unmitigated post-development peak flow rates for the catchment. The unmitigated post-development peak flows for the Catchments for both DRAINS and the Rational Method are summarised in Table 4-6 and Table 4-7 following.

Table 4-6: Unmitigated Post-development Peak Flows – Rational Method

AEP (ARI yrs)	63% (1yr)	39% (2yr)	18% (5yr)	10% (10yr)	5% (20yr)	2% (50yr)	1% (100yr)
Total Catchment	1.299	1.579	2.453	3.063	3.715	4.771	5.525

Table 4-7: Unmitigated Post-development Peak Flows – DRAINS Model

AEP (ARI yrs)	63% (1yr)	39% (2yr)	18% (5yr)	10% (10yr)	5% (20yr)	2% (50yr)	1% (100yr)
Total Catchment	2.58	3.57	4.74	5.42	6.38	7.13	8.03

As demonstrated by Table 4-6 and Table 4-7, the DRAINS model yields consistently greater values than the Rational Method calculations. This is owing to the partial area affects being considered in the DRAINS model. As such, the DRAINS model shall be utilised for subsequent analysis.

4.3.2 Proposed Stormwater Management Strategy

The flow comparison in Section 4.3.1 demonstrates that peak flow rates are worsened from pre-development conditions as a result of the existing shopping centre development. Therefore, a detention basin facility is required to be retained on the site as part of the proposed subject development. As noted in Section 4.1, the existing detention basin is proposed to be relocated to Proposed Lot 7, immediately adjacent to the existing shopping centre. This is proposed to be an interim measure to ensure the site's current obligations are maintained as a result of the proposed ROL.

It is noted that subsequent developments, for example EDQ ref 2016/813, will require the further alteration of the stormwater detention facilities within the existing shopping centre and Proposed Lot 7. These future alterations are not the subject of this development and report. Further, it is acknowledged that this management strategy is different to the approved stormwater management strategy in the Development Permit for the shopping centre expansion. As such, prior to commencement of the development of the shopping centre, a Change of Approval application to accommodate this change to the existing approved Stormwater Management Strategy will be required. However, this shall form a separate application, and is not the subject of this report.

Therefore, as part of the subject development, relocate and modify the current detention basin to accommodate existing attenuation requirements as a result of the existing shopping complex.

The proposed Conceptual Stormwater Management Strategy has been prepared based on these investigations. The Stormwater Management Plan and Details have been included in Appendix D.

4.3.3 Proposed Temporary Stormwater Attenuation

A new temporary detention basin has been proposed directly adjacent to the north west boundary of the existing shopping complex development, in order to mitigate the stormwater flows resulting from the existing development. The basin's details are shown in the drawings in Appendix D and are summarised subsequently below. The subsequent design is preliminary only and is subject to further optimisation and design development as part of the operational works process.

A hydraulic assessment has been undertaken to evaluate stormwater detention and outlet control requirements for each storm event to demonstrate that pre-development flow rates as established in Section 4.1.1 have been achieved in the post-development site condition. The DRAINS model established in Section 4.3.1 for the unmitigated post-development condition has been utilised to undertake mitigated post-development scenario modelling.

The proposed basin is designed to collect all runoff up to a 1% AEP from the existing shopping complex development. The basin also incorporates some bio-retention area and its associated extended detention depth as outlined in Section 0. The basin has the following proposed properties:

Max Detention Volume:	1,753m³
Max Detention Depth:	1.19m (RL65.74m AHD)
Detention Base level:	RL 64.553m AHD
Min Bund Level:	RL 66.10m AHD
Min. Freeboard:	0.3m
Low level Outlet:	1/ 525mm RCP @ RL 64.55m AHD
High Level Spillway:	1 x 5m weir at RL 65.5m AHD
(Stepped Weir)	1 x 10m weir at RL 65.7m AHD

The proposed outlet configuration has the following modelled rating curve as shown in Figure 4-1.

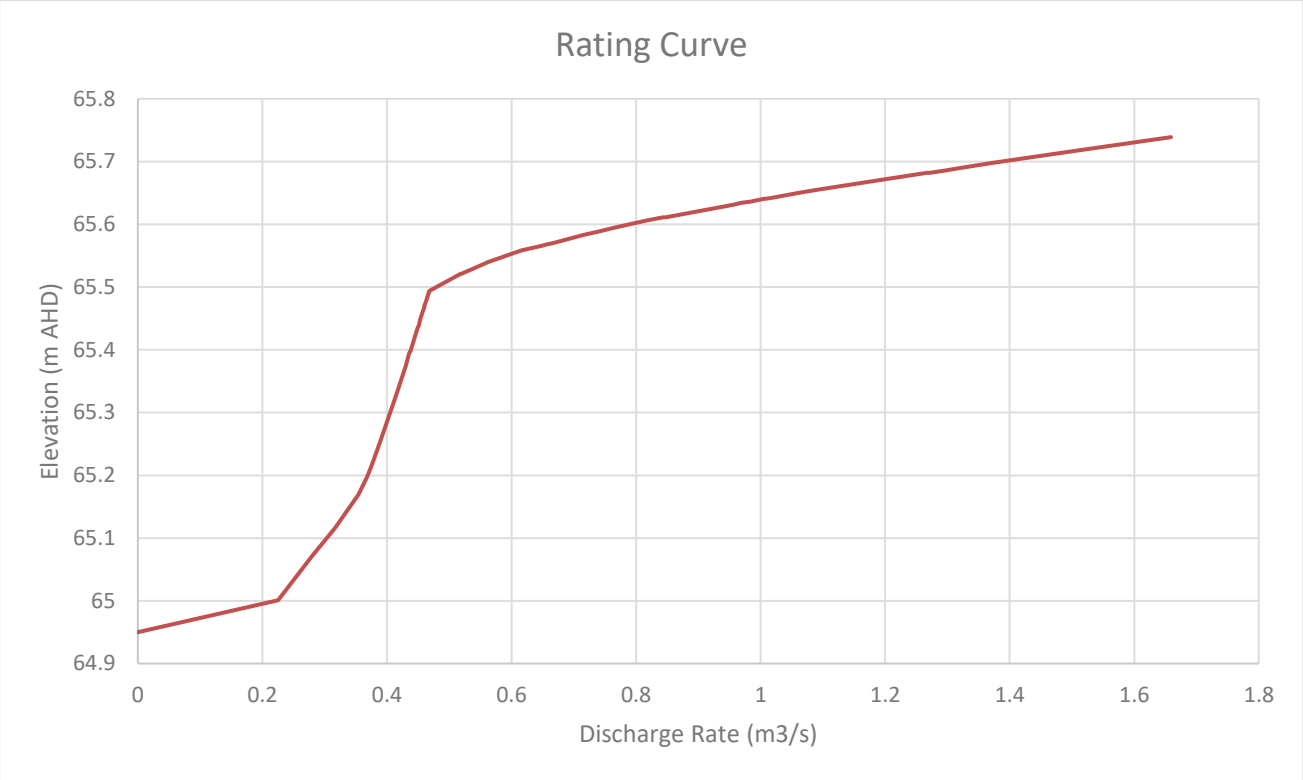


Figure 4-1: Basin Outlet Rating Curve

The proposed detention basin has been modelled with a Storage Volume vs Height profile as shown in Figure 4-2 below. Please note that the below Volume vs Height graph does not include the storage available within the upstream pipe and pit system, and as such, it is a conservative approximation of the available total system storage thus providing a factor of safety for the system design.

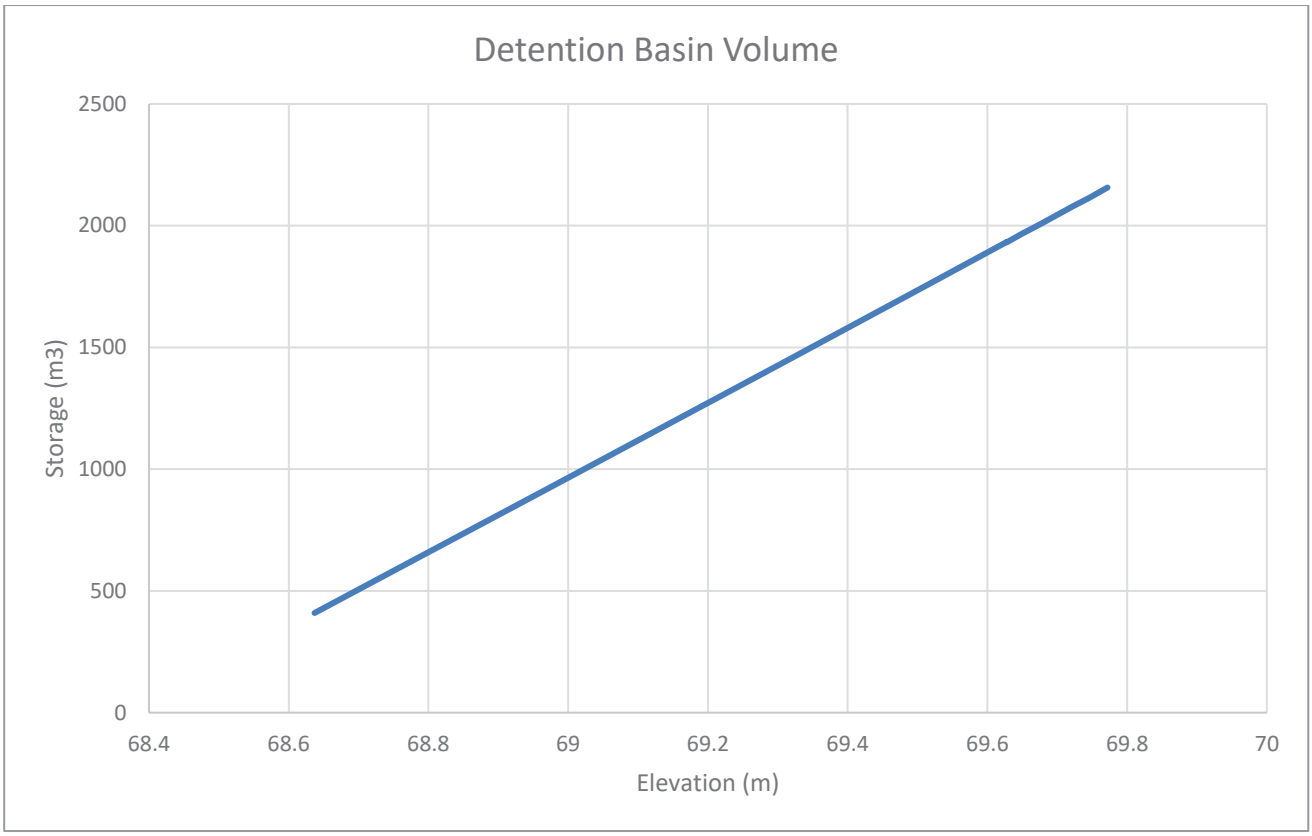


Figure 4-2: Basins' Stage - Storage Relationships

The proposed basin has been designed such that the minimum freeboard of 0.3m can be achieved in the critical 1% AEP storm event. This is in accordance with QUDM's requirements.

4.3.4 Mitigated Post Development Condition

The proposed stormwater quantity management strategy was modelled using a DRAINS model as established in the earlier sections. The model has demonstrated that the mitigated post-development peak flow rates do not exceed the undeveloped condition's peak flow rates as established by Section 4.1.1 for each storm event between 39% to 1% AEP and standard duration from 1 min to 168 hours.

The peak undeveloped and post-development runoff hydrographs for the critical 1% AEP event as established by DRAINS can be seen following in Figure 4-3. The graph clearly shows the effect of the proposed detention device by illustrating the reduction of post-development inflow to outflow for the 100yr ARI event.

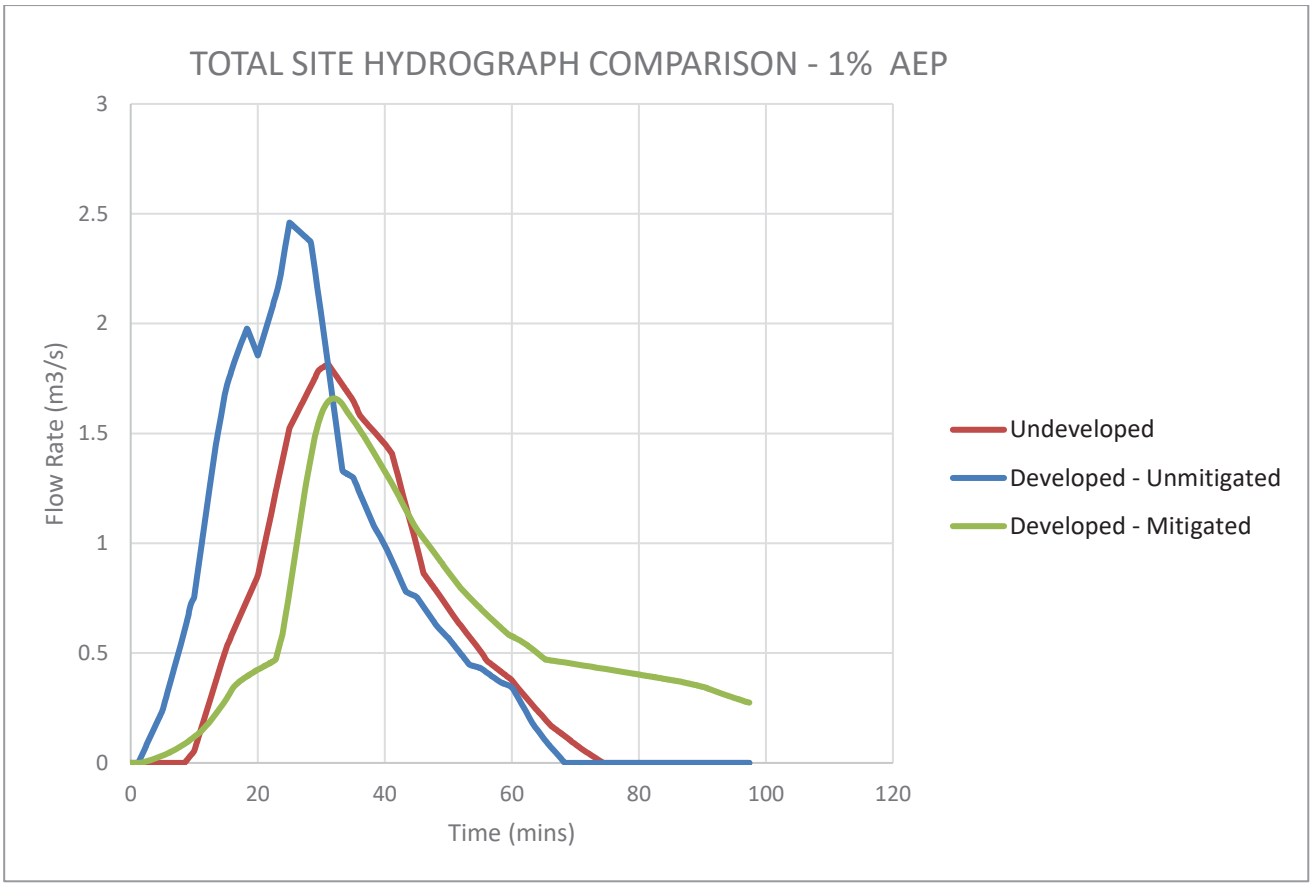


Figure 4-3: Total Site Hydrograph Comparison, 1% AEP (100yr ARI)

The results of the proposed detention basin and stormwater quantity management strategy have been summarised in Table 4-8 below, with the DRAINS model results for the critical duration for each event seen in Appendix E.

Table 4-8: Total Site Mitigated Results Summary for Various ARI Events, Critical Durations

Avg Exceedance Probability (AEP) (ARI yrs)	39% (2yr)	18% (5yr)	10% (10yr)	5% (20yr)	2% (50yr)	1% (100yr)
Peak Undeveloped Flows (m^3/s)	2.03	3.00	3.54	4.28	5.10	5.76
Peak Mitigated Post-development Flows (m^3/s)	1.84	2.63	3.2	4.01	4.93	5.66
Total Increase†	-0.19	-0.37	-0.34	-0.27	-0.17	-0.10

† negative denotes reduction in mitigated post-development peak flow rates

As such, it has been demonstrated that the proposed stormwater quantity management strategy as depicted in the drawings in Appendix D adequately meets the requirements in relation to stormwater quantity for the site.

5. Site-based Stormwater Quality Management Plan

5.1 Stormwater Management Strategy – Operational Phase

The subject development is associated with a ROL only, and no uses are proposed. The stormwater quality management objectives of the site are:

a. Maintain the current development permit obligations associated with the existing shopping centre

b. Demonstrate that the water quality objectives for the proposed development can be achieved.

The existing shopping centre did not have any stormwater quality obligations that were required to be met with on-site facilities. While the Development Permit could not be sourced due to its age, the Operational Works drawings for the Roads and Drainage component were. These are included in Appendix C. It demonstrates that the existing basin had no bioretention facilities incorporated into it. As such, it is not proposed to incorporate any stormwater quality treatment measures associated with the existing shopping centre development.

As noted in Section 2.3, no new uses are proposed as part of the subject application. These future developments are subject of separate applications. Specifically:

- Proposed Lot 7 – The proposed lot for the shopping centre expansion. The shopping centre expansion is the subject of an existing EDQ Development Approval (Ref: DEV2016/813). The stormwater quality measures associated with this development will be constructed as part of this development in accordance with its approvals. It is acknowledged that a Change Application is required to the existing Development Approval to accommodate the stormwater quality management within Proposed Lot 7 (instead of the currently documented location within the Proposed Lot 8 footprint).
- Proposed Lot 8 – No new uses are proposed as part of the subject development. These shall be by separate application by others. It is therefore proposed that as part of the future development application over Proposed Lot 8, that any Stormwater Quality Management requirements associated with this future development are assessed and mitigated as part of its application by others.

Therefore, no stormwater quality measures are required, nor proposed as part of the subject proposed development.

5.2 Acid Sulphate Soils

Acid Sulphate Soils are typically encountered in Holocene sediment and below 5m AHD. The lowest area of the proposed works associated with the development is at an approximate RL 61m AHD, with the deepest excavation expected to be to approximately RL 60m AHD.

The deepest excavation is not expected to be below RL 5m AHD, the natural surface is not below RL 20m AHD, and the site is not subject to Council's or Qld Government's ASS mapping. As such, acid sulphate soils are not expected to be a development issue.

5.3 Erosion and Sediment Control (ESC) – Construction

An Erosion and Sediment Control (ESC) Management Plan has been prepared by the Contractor as part of their Construction Environmental Management Plan. It will need to demonstrate that the proposed development can accommodate the necessary devices to mitigate the sediment and erosion risks associated with the construction phase of the development. The plan has been prepared with reference to the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control. Prior to works commencement on-site, the ESC Plans will be reviewed, amended and endorsed by a Certified Professional in Erosion and Sediment Control (CPESC).

6. Conclusion

This Site Based Stormwater Management Plan has been prepared for the proposed subdivision of the the property situated at 15-67 Pub Lane, Greenbank, Qld.

This report has demonstrated that the the existing stormwater detention basin can be relocated into Proposed Lot 7 and continue to meet the stormwater quantity development permit obligations of the existing shopping centre.

It has further been demonstrated that no stormwater quality treatment measures are required to either:

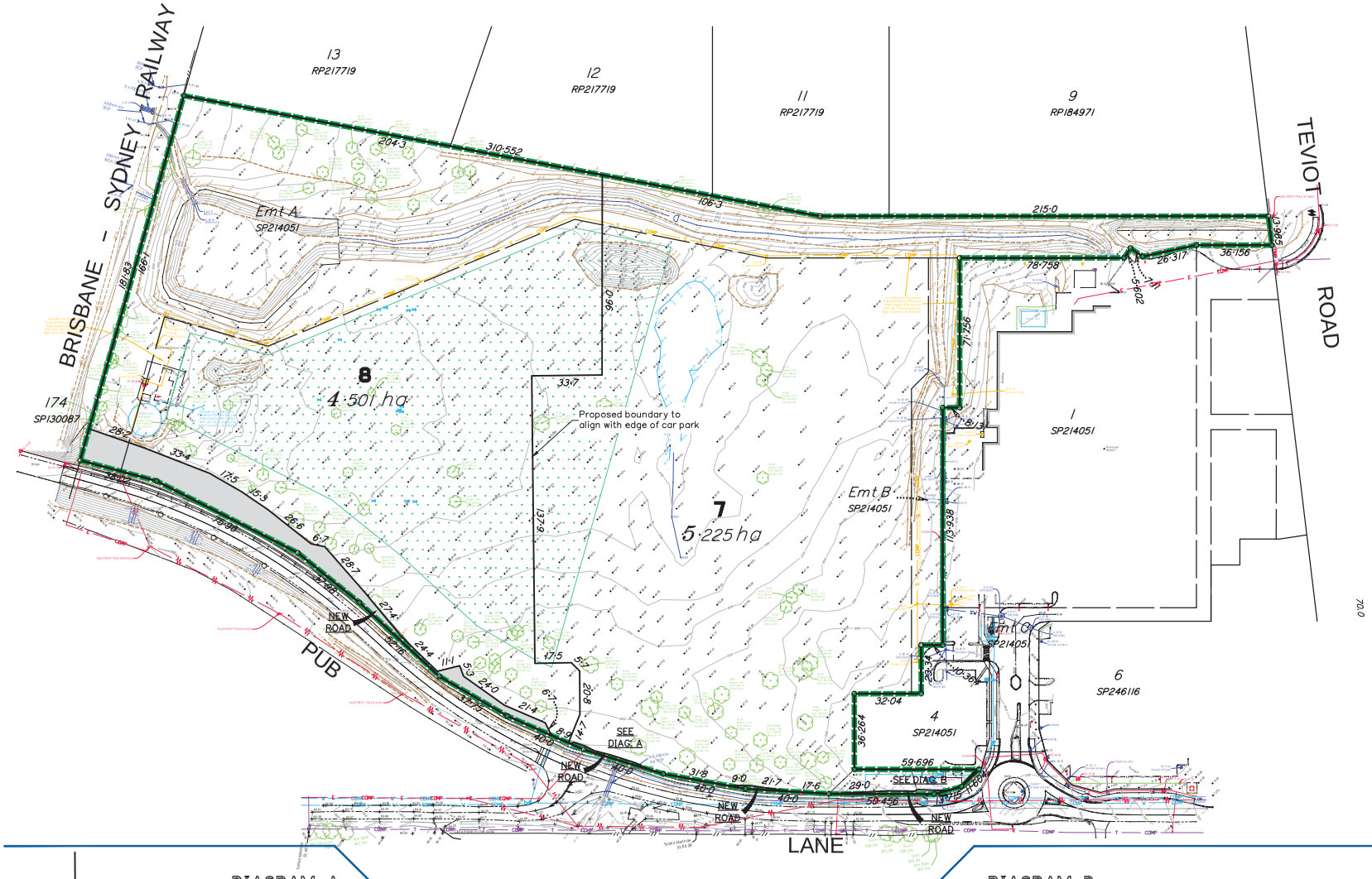
- Maintain the current development permit obligations associated with the existing shopping centre, or
- Achieve the water quality objectives for future developments on Proposed Lot 7 or 8. These shall be constructed as required as part of their respective approvals.

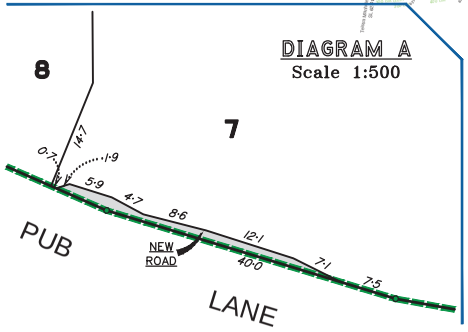
We therefore request that MEDQ supports the Development Application for this site.

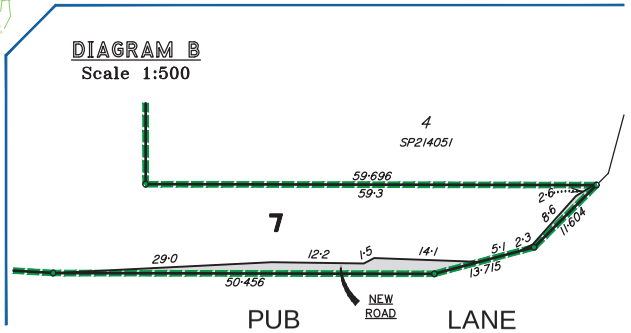
Appendix A - Existing Detailed Site Survey and ROL Layout

A2 1070 Rev A by DTS dated 15/10/19

Statistics	
Total Area of Subdivision	9.964 Ha
Number of Lots	2
Total Area of New Road	2380 m²
Contour Interval	1.0 m







Notes

This plan has been prepared by DTS as a proposal plan and should not be used for any other purpose. The information contained on this plan is approximate only, has not been verified and may be subject to change. The intellectual property on this plan remains the property of DTS. The contours shown on this plan have been derived from Detail Survey by others.

Issue	Revision	Int	Date
A	Original Issue	AV	15/10/19

LEGEND

- Subject Site
- New Road in accordance with EDQ Approval DEV2015/644

NOTE:
Proposed boundary dimensions have been rounded to the nearest 0.1m and are subject to survey.

New Road is to be provided in accordance with EDQ approval DEV2015/644.

SUBDIVISION PROPOSAL PLAN

15 & 19-67 Pub Lane, Greenbank

Description	Lot 5 on SP214051
Local Authority	Logan City Council
Client	SCA Property Group

SCALE 1:1500 @ A2

20 0 20 40 60 80

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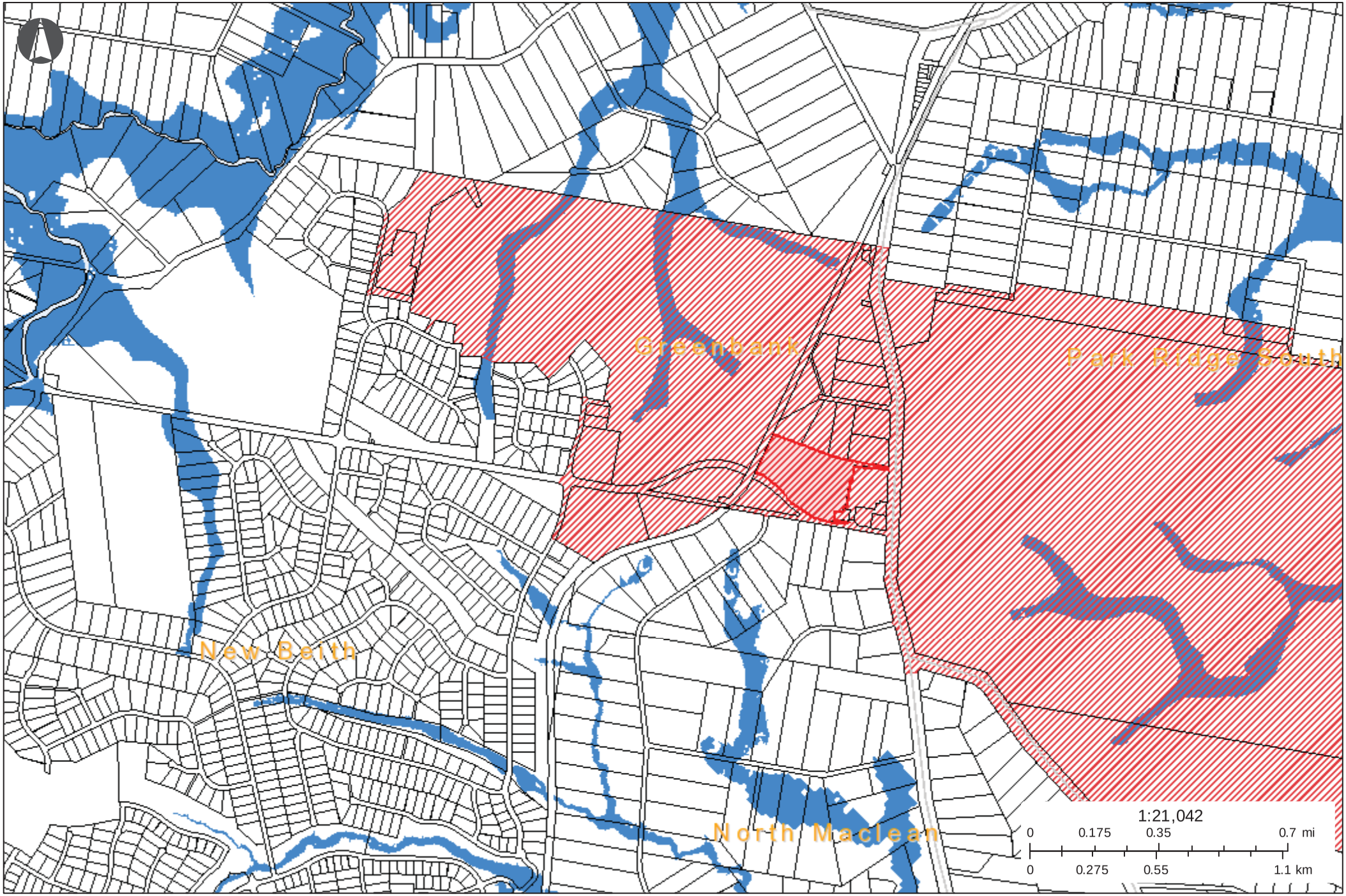
Date	15/10/2019	Drawing	A2 1070
Project	BNE190650	Revision	A
Drawing File	B190650P1.dwg	Sheet	1 of 1

Appendix B - Authority Flood Mapping

- LCC Flood search results

Logan City Council - Logan Planning Scheme 2015

LCC flooding overlay



Printed: October 10, 2019

Appendix C - Existing Operational Works Drawings

File: 563960-1

Doc No:

Action: E Calvi ☐

Application: Ow/351/2008

Description: Stormwater Drawings

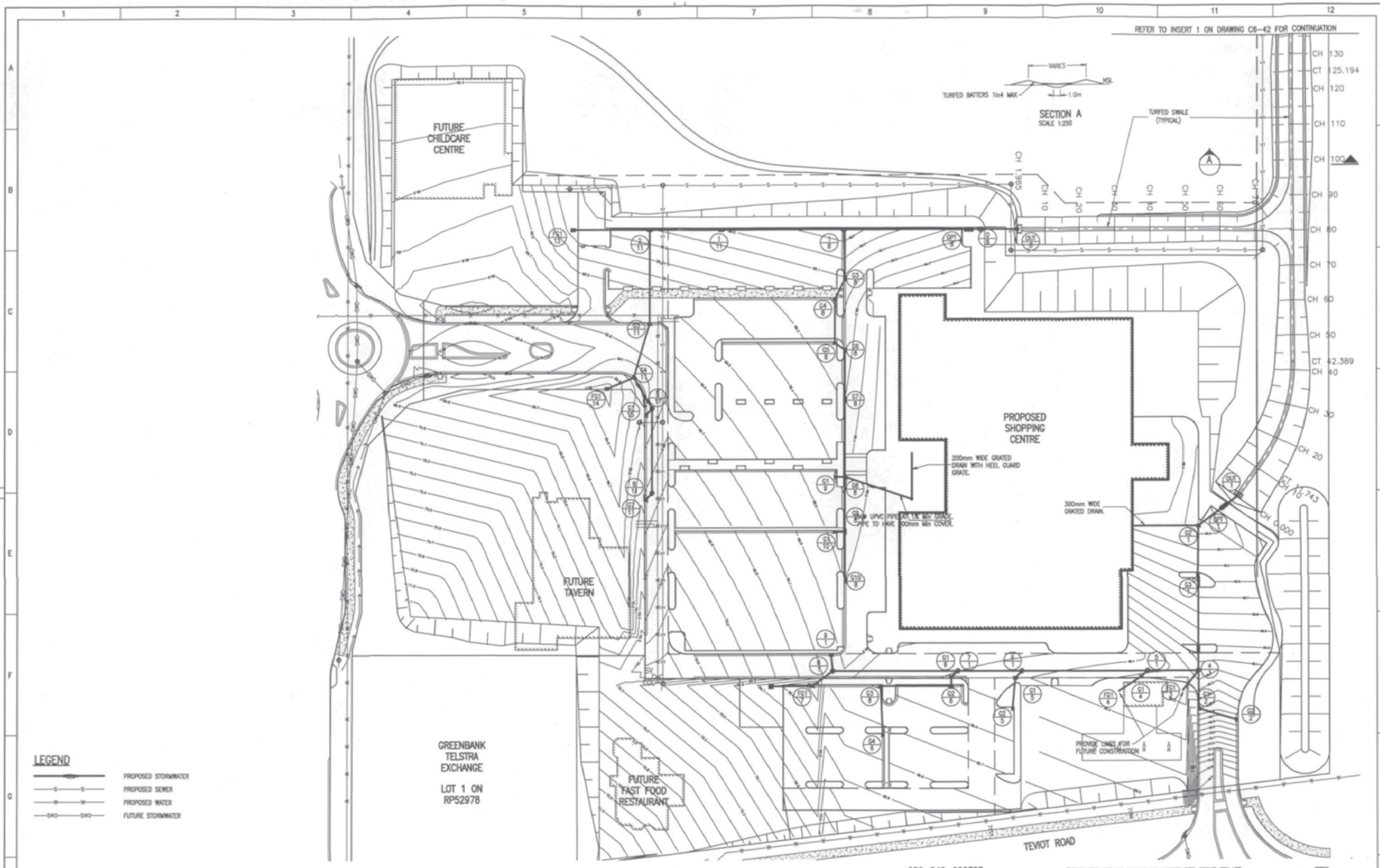
☐ Internet Ready

Scanned Date

Received by
Customer Service Unit

Date: / / 2008

By:



020-040-000392

SIGNED FOR AND ON BEHALF OF ROBERT BIRD GROUP PTY LTD _____ RPEQ _____

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS.
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE.

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Rev	Revision Description	By	App	Date
T1	TENDER ISSUE	LR	WM	17.08.07
T2	TENDER ISSUE FOR REVIEW	LR	WM	31.08.07
A1	OPERATIONAL WORKS APPROVAL	SB	AL	1.10.07
A2	OPERATIONAL WORKS APPROVAL	AK	WM	30.11.07
A3	OPERATIONAL WORKS APPROVAL	AR	WM	06.12.07
A4	RE-ISSUED FOR COUNCIL APPROVAL	AJ	AL	20.02.08
C1	FOR CONSTRUCTION	AK	AL	21.02.08
C2	FOR CONSTRUCTION	AK	AL	10.03.08
C3	FOR CONSTRUCTION	TT	AL	24.06.08

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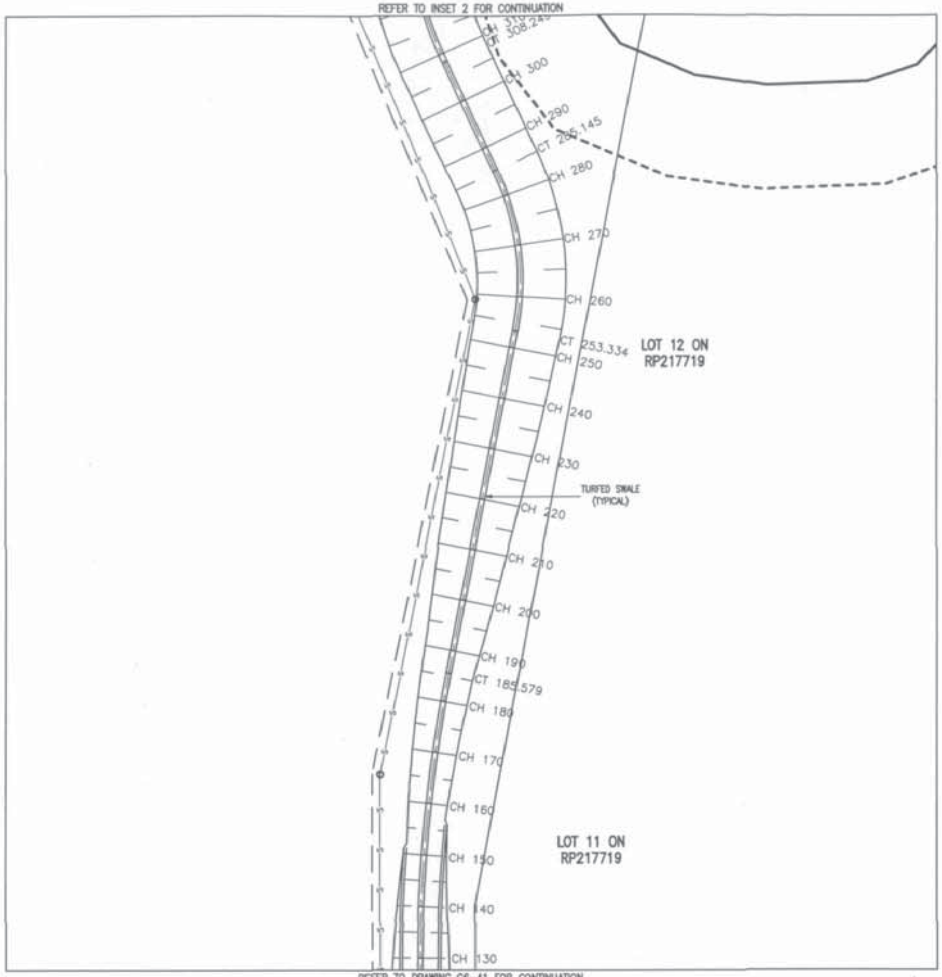
Client: KILCOR PROPERTIES PTY LTD

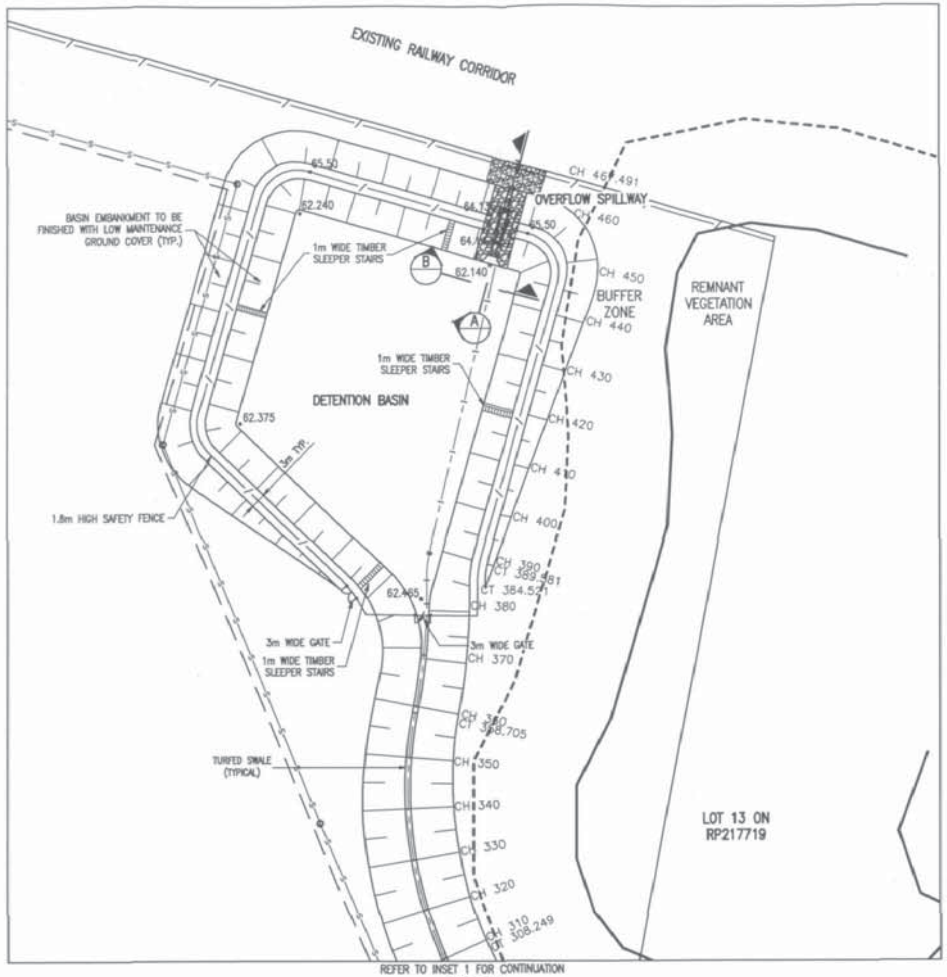
Title: INTERNAL STORMWATER DRAINAGE LAYOUT PLAN SHEET 1 OF 2

Project: PUB LANE SHOPPING CENTRE STAGE 1

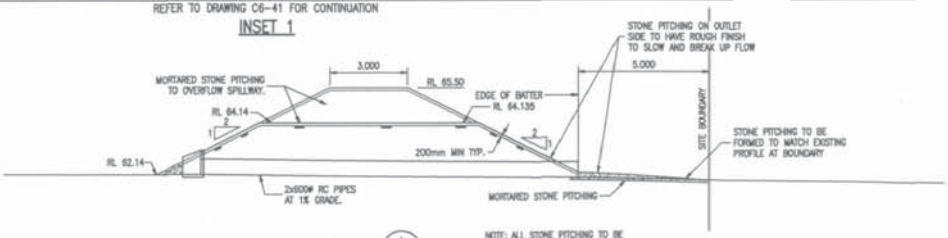
APPROVED FOR CONSTRUCTION

Date	Design	Checked
17.08.07	LR/SB	APL
Scale @ A1	Drawn	Approved
1:500	AK/AK	AL
Job Number	Drawing Number	Revision
06128	C6-41	C3





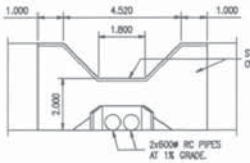
INSET 1



SECTION A
SCALE 1:100

NOTE: ALL STONE PITCHING TO BE MINIMUM 200mm THICK.

INSET 2



SECTION B
SCALE 1:100

LEGEND

- PROPOSED STORMWATER
- PROPOSED SEWER
- PROPOSED WATER
- FUTURE STORMWATER

020-040-000392

SIGNED FOR AND ON BEHALF OF ROBERT BIRD GROUP PTY LTD _____ RPEQ _____

SCALE 1:500
0 10 20 30 m

Rev	Revision Description	By	App	Date
T1	TENDER ISSUE	LR	WM	17.08.07
T2	TENDER ISSUE FOR REVIEW	LR	WM	31.08.07
A1	OPERATIONAL WORKS APPROVAL	SB	AL	1.10.07
A2	OPERATIONAL WORKS APPROVAL	AK	WM	30.11.07
A3	OPERATIONAL WORKS APPROVAL	AK	WM	06.12.07
A4	RE-ISSUED FOR COUNCIL APPROVAL	AK	AL	20.02.08
C1	FOR CONSTRUCTION	AK	AL	21.02.08
C2	FOR CONSTRUCTION	AK	AL	10.03.08
C3	FOR CONSTRUCTION	TT	AL	24.06.08

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Web Site: www.robertbird.com

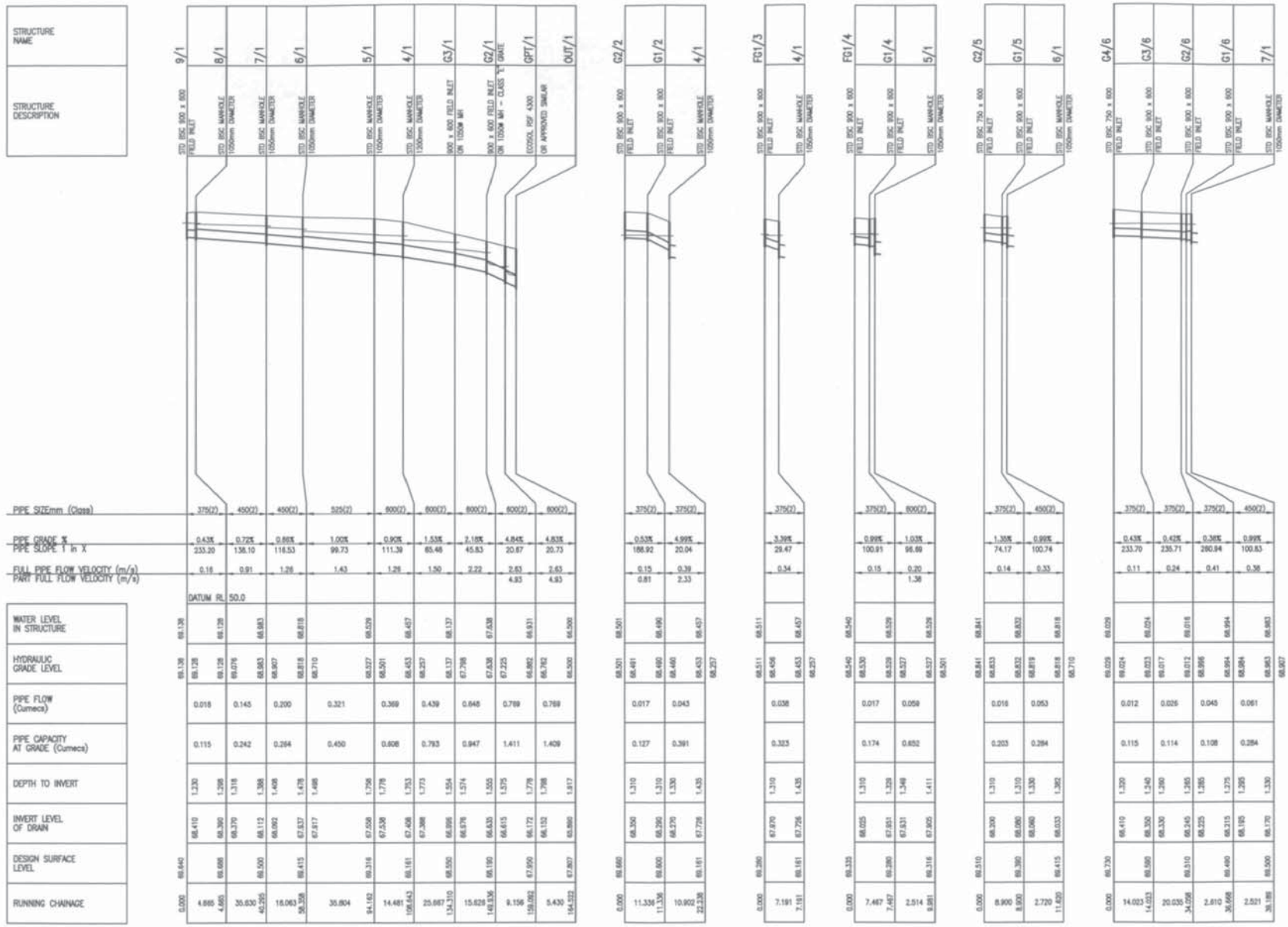
Client: KILCOR PROPERTIES PTY LTD

Title: INTERNAL STORMWATER DRAINAGE LAYOUT PLAN SHEET 2 OF 2

Project: PUB LANE SHOPPING CENTRE STAGE 1

APPROVED FOR CONSTRUCTION

Date	Design	Checked
17.08.07	LR/SB	APL
Scale @ A1	Drawn	Approved
1:500	AM/AK	AL
Job Number	Drawing Number	Revision
06128	C6-42	C3



DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS

REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

SCALE 1:100V, 1:1000H.

0 1 2 3 4 5 m 1:100 VERT.
0 10 20 30 40 50 m 1:1000 HORZ.

Rev.	Revision Description	By	App.	Date
T1	TENDER ISSUE FOR REVIEW	LR	WM	31.08.07
A1	OPERATIONAL WORKS APPROVAL	AK	WM	1.10.07
A2	OPERATIONAL WORKS APPROVAL	AK	WM	30.11.07
A3	OPERATIONAL WORKS APPROVAL	AR	WM	06.12.07
A4	STORMWATER AMENDED	JJ	AL	20.02.08
C1	FOR CONSTRUCTION	AK	AL	21.02.08
C2	FOR CONSTRUCTION	AK	AL	10.03.08
C3	FOR CONSTRUCTION	TT	AL	24.06.08

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Client: KILCOR PROPERTIES PTY LTD

020-040-000392

SIGNED FOR AND ON BEHALF OF ROBERT BIRD GROUP PTY LTD _____ RPEQ _____

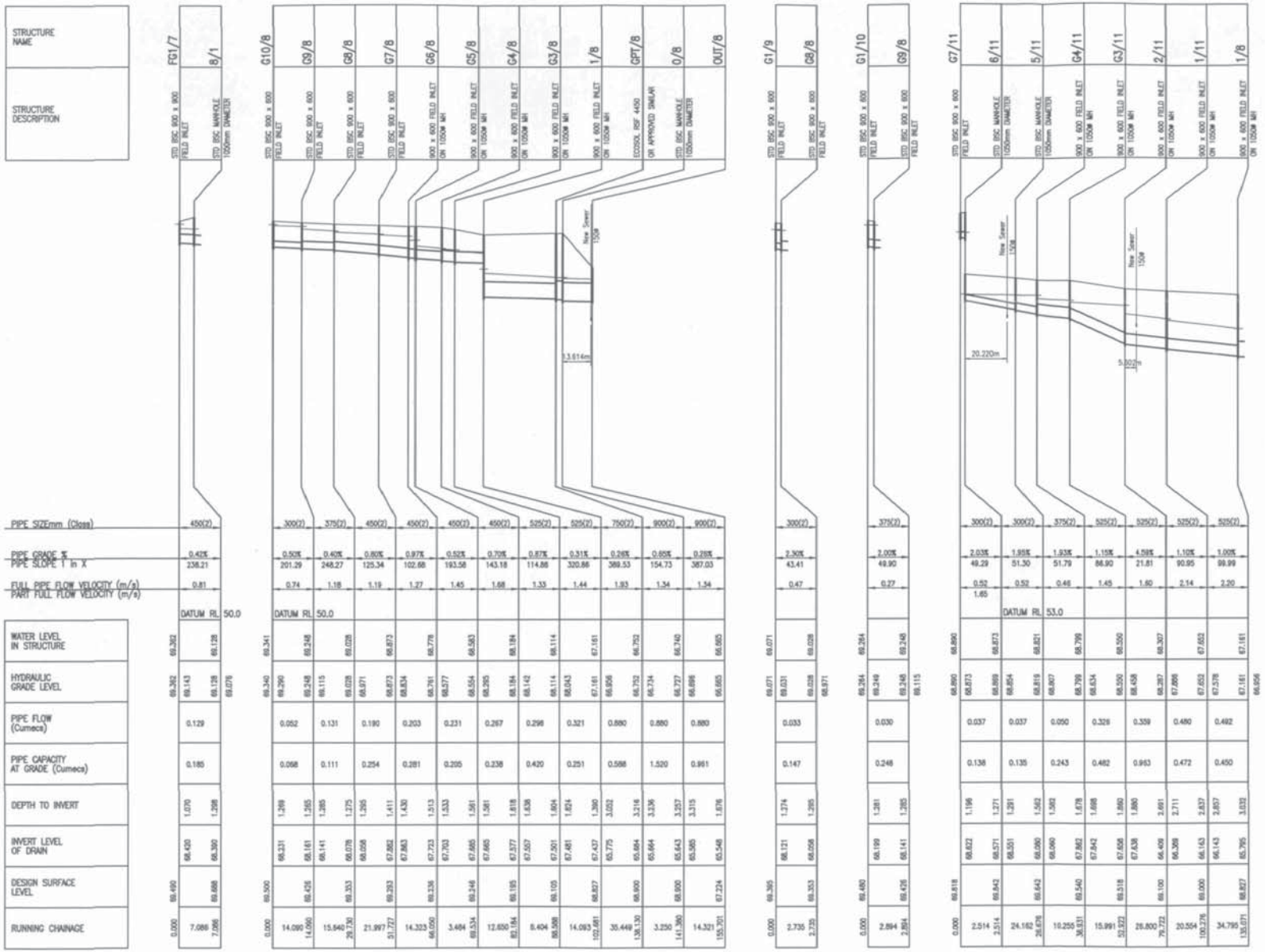
Title: INTERNAL STORMWATER DRAINAGE LONGSECTIONS SHEET 1 OF 3

Project: PUB LANE SHOPPING CENTRE STAGE 1

APPROVED FOR CONSTRUCTION

Date	Design	Checked
29/08/07	JJ	TT
Scale @ A1	Drawn	Approved
----------	JJ	AL

Job Number	Drawing Number	Revision
06128	C6-51	C3



020-040-000392

SIGNED FOR AND ON BEHALF OF ROBERT BIRD GROUP PTY LTD _____ RPEQ _____

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

SCALE 1:100V, 1:1000H.
0 1 2 3 4 5 m 1:100 VERT.
0 10 20 30 40 50 m 1:1000 HORIZ.

Rev	Revision Description	By	Appd	Date
T1	TENDER ISSUE FOR REVIEW	LR	WM	31.08.07
A1	OPERATIONAL WORKS APPROVAL	AK	WM	1.10.07
A2	OPERATIONAL WORKS APPROVAL	AK	WM	30.11.07
A3	OPERATIONAL WORKS APPROVAL	AR	WM	06.12.07
A4	STORMWATER AMENDED	JH	AL	20.02.08
C1	FOR CONSTRUCTION	AK	AL	21.02.08
C2	FOR CONSTRUCTION	AK	AL	10.03.08
C3	FOR CONSTRUCTION	TT	AL	24.06.08

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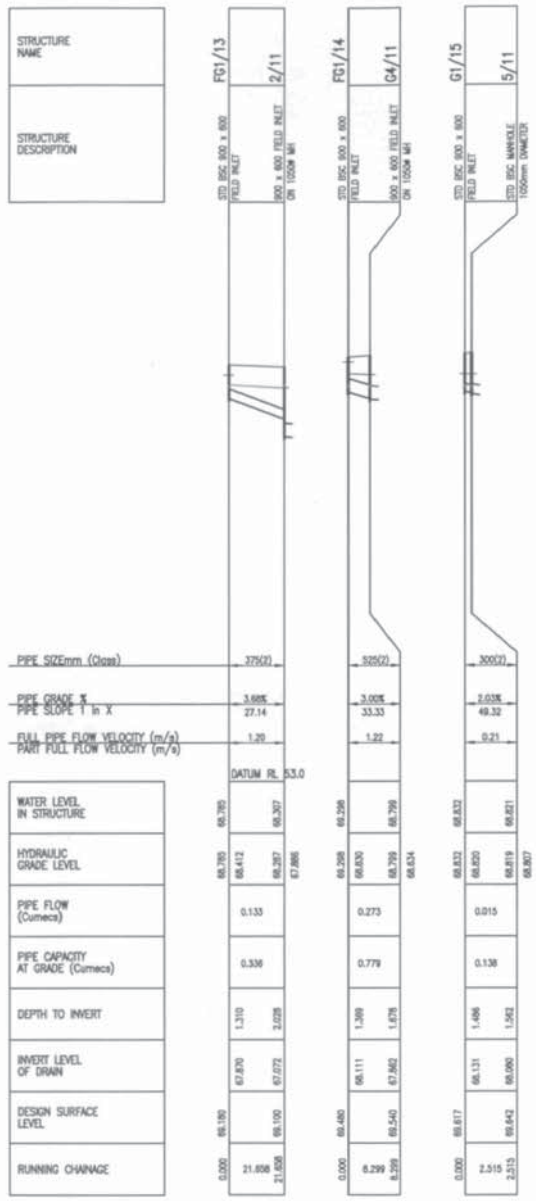
Client: KILCOR PROPERTIES PTY LTD

Title: INTERNAL STORMWATER DRAINAGE LONGSECTIONS SHEET 2 OF 3

Project: PUB LANE SHOPPING CENTRE STAGE 1

APPROVED FOR CONSTRUCTION

Date	Design	Checked
29/08/07	LR	TT
Scale @ A1	Drawn	Approved
———	SB	AL
Job Number	Drawing Number	Revision
06128	C6-52	C3



DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS

REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

SCALE 1:100V, 1:1000H.

0 1 2 3 4 5 m 1:100 VERT.
0 10 20 30 40 50 m 1:1000 HORZ.

Rev.	Revision Description	By	App.	Date
T1	TENDER ISSUE FOR REVIEW	LR	WM	31.08.07
A1	OPERATIONAL WORKS APPROVAL	AK	WM	1.10.07
A2	OPERATIONAL WORKS APPROVAL	AK	WM	30.11.07
A3	OPERATIONAL WORKS APPROVAL	AR	WM	06.12.07
A4	STORMWATER AMENDED	JJ	AL	20.02.08
C1	FOR CONSTRUCTION	AK	AL	21.02.08
C2	FOR CONSTRUCTION	AK	AL	10.03.08
C3	FOR CONSTRUCTION	TT	AL	24.06.08

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Web Site: www.robertbird.com

020-040-000392

Client: KILCOR PROPERTIES PTY LTD

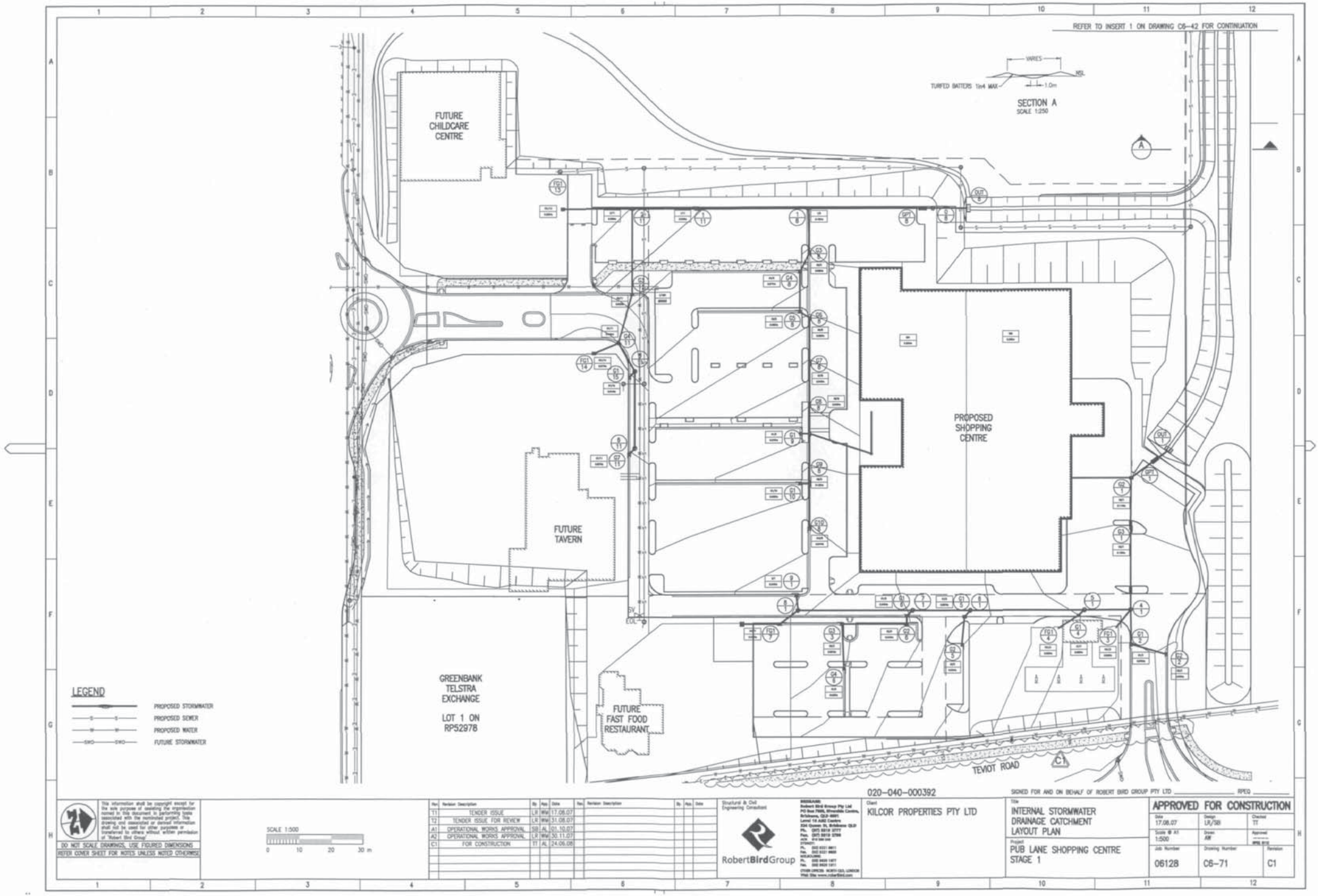
SIGNED FOR AND ON BEHALF OF ROBERT BIRD GROUP PTY LTD _____ RPEQ _____

Title: INTERNAL STORMWATER DRAINAGE LONGSECTIONS SHEET 3 OF 3

Project: PUB LANE SHOPPING CENTRE STAGE 1

APPROVED FOR CONSTRUCTION

Date	Design	Checked
29/08/07	LS	TT
Scale @ A1	Drawn	Approved
———	SB	AL
Job Number	Drawing Number	Revision
06128	C6-53	C3



020-040-000392

SIGNED FOR AND ON BEHALF OF ROBERT BIRD GROUP PTY LTD _____ RPEQ _____

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

SCALE 1:500
0 10 20 30 m

Rev	Revision Description	By	App	Date
T1	TENDER ISSUE	LR	WM	17.08.07
T2	TENDER ISSUE FOR REVIEW	LR	WM	31.08.07
A1	OPERATIONAL WORKS APPROVAL	SB	AL	01.10.07
A2	OPERATIONAL WORKS APPROVAL	LR	WM	30.11.07
C1	FOR CONSTRUCTION	TT	AL	24.06.08

Structural & Civil Engineering Consultant

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Client
KILCOR PROPERTIES PTY LTD

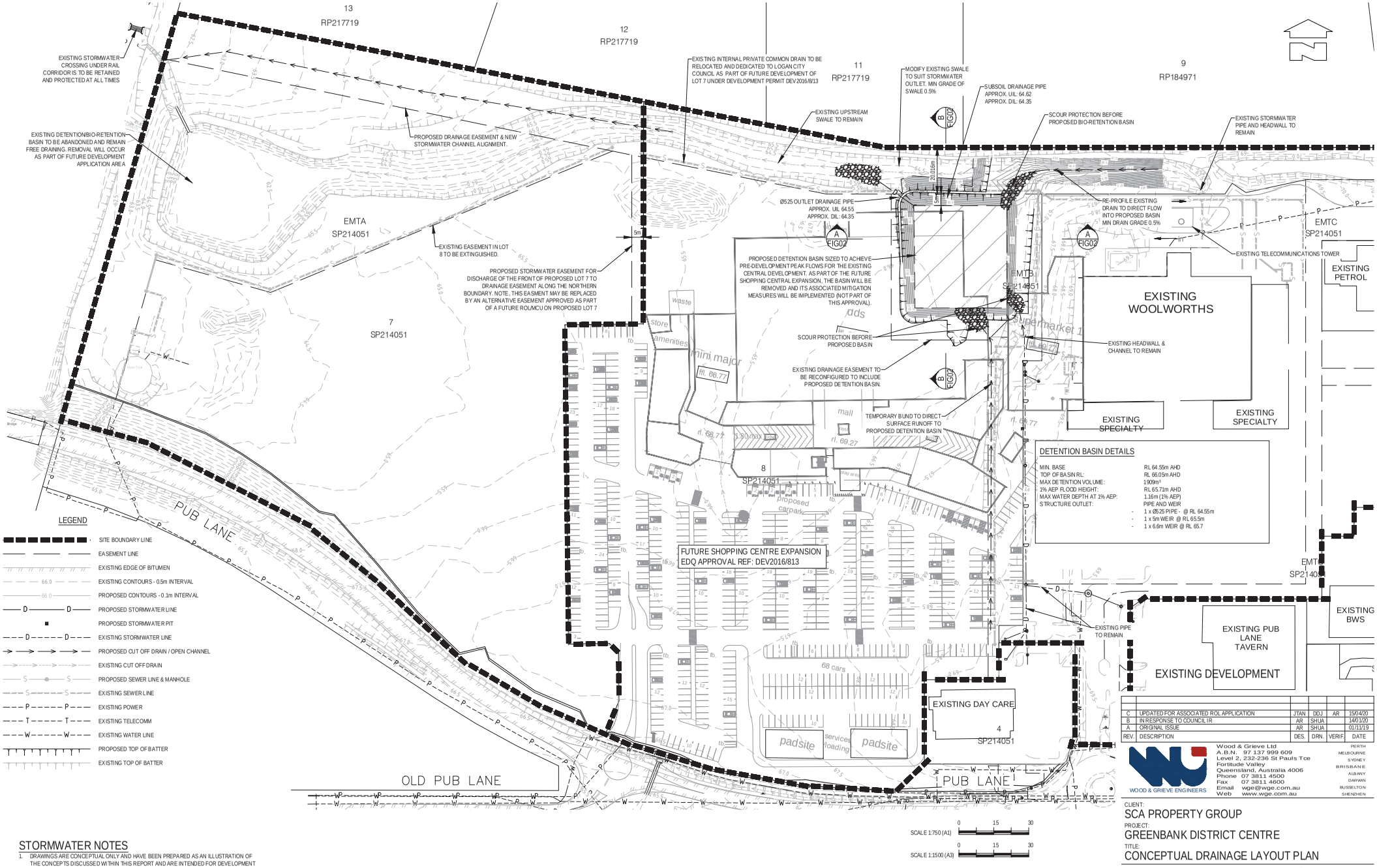
Title
INTERNAL STORMWATER DRAINAGE CATCHMENT LAYOUT PLAN

Project
PUB LANE SHOPPING CENTRE
STAGE 1

APPROVED FOR CONSTRUCTION

Date	Design	Checked
17.08.07	LR/SB	TT
Scale @ A1	Drawn	Approved
1:500	AM	----
Job Number	Drawing Number	Revision
06128	C6-71	C1

Appendix D - Engineering Drawings



STORMWATER NOTES

1. DRAWINGS ARE CONCEPTUAL ONLY AND HAVE BEEN PREPARED AS AN ILLUSTRATION OF THE CONCEPTS DISCUSSED WITHIN THIS REPORT AND ARE INTENDED FOR DEVELOPMENT APPROVAL PURPOSES ONLY.
2. WHERE LEVELS OR SIZES OF ANY WORKS ARE SHOWN, THESE ARE INDICATIVE ONLY TO DEMONSTRATE THE CAPABILITY OF THE SERVICING OPTION PROPOSED AND ARE SUBJECT TO DETAILED DESIGN (OPERATIONAL WORKS DESIGN). THIS IS TO BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST VERSIONS OF THE AUTHORITY STANDARDS, AUSTRALIAN STANDARDS AND OTHER INDUSTRY REFERENCE DOCUMENTS AT TIME OF DESIGN.
3. DRAWINGS ARE NOT INTENDED TO BE USED FOR TENDER, ESTIMATING OR CONSTRUCTION.
4. STORMWATER TREATMENT AND DETENTION SYSTEMS ARE CONCEPTUAL ONLY AND SUBJECT TO THE SPECIFIC DESIGN REQUIREMENTS OF THE LOCAL AUTHORITY, QUDM AND HEALTHY WATERWAYS.

REV.	DESCRIPTION	DES.	DRN.	VERIF.	DATE
C	UPDATED FOR ASSOCIATED ROL APPLICATION	JTAN	DDJ	AR	15/04/20
B	IN RESPONSE TO COUNCIL IR	AR	SHUA		14/01/20
A	ORIGINAL ISSUE	AR	SHUA		01/11/19

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WOOD & GRIEVE ENGINEERS
PERTH MELBOURNE SYDNEY BRISBANE ALBANY DARWIN BUSSELTON SHENZHEN

CLIENT: SCA PROPERTY GROUP

PROJECT: GREENBANK DISTRICT CENTRE

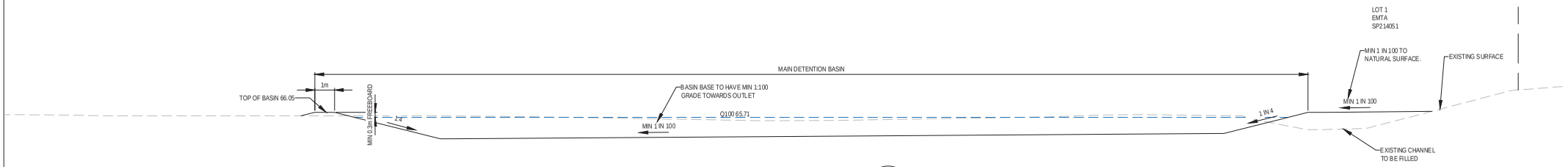
TITLE: CONCEPTUAL DRAINAGE LAYOUT PLAN

PRELIMINARY ONLY

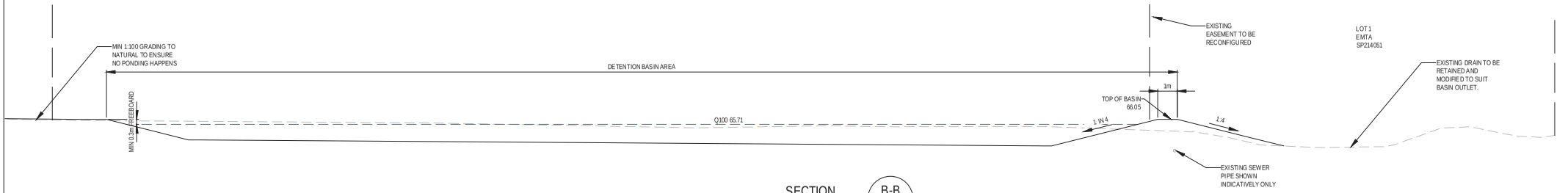
APP No : -	COUNCIL : GREATER FLAGSTONE PDA
AUTHORISED:	VERIFIED : - -
	APPROVED FOR TENDER - -
-	APPROVED FOR CONSTRUCTION : - -

PROJECT No.	DRAWING No.	REVISION
29875-BRI-C-DA-	FIG01	C

P:\29879\Project Documentation\Civil\Reports\ROL mission\Current\29875 C PLAN (FIG01-02) DRAINAGE LAYOUT PLAN.dwg



SECTION A-A
SCALE 1:100 (A1)
1:200 (A3)
FIG01



SECTION B-B
SCALE 1:100 (A1)
1:200 (A3)
FIG01

REV.	DESCRIPTION	DES.	DRN.	VERIF.	DATE
B	UPDATED FOR ASSOCIATED ROL APPLICATION	JTAN	DDJ	AR	15/04/20
A	FOR APPROVAL	AR	SHUA		01/11/19

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ALBANY
DARWIN
BUSSELTON
SHENZHEN

CLIENT:
SCA PROPERTY GROUP

PROJECT:
GREENBANK DISTRICT CENTRE

TITLE:
CONCEPTUAL BASIN DETAILS

PRELIMINARY ONLY

APP No : -
COUNCIL : GREATER FLAGSTONE PDA
AUTHORISED:
VERIFIED : - -
APPROVED FOR TENDER - -
APPROVED FOR CONSTRUCTION : - -

PROJECT No. **29875-BRI-C-DA-**
DRAWING No. **FIG02**
REVISION **B**

P:\29875\Project Documentation\Civil\Reports\ROL mission\Current\29875 C PLAN (FIG01-02) DRAINAGE LAYOUT PLAN.dwg

Appendix E - Stormwater Quantity Calculations

- Rational Method Calculation

WOOD & GRIEVE ENGINEERS

NOW PART OF Stantec

Rational Method Calculation

Brisbane Civil
(07) 3811 4500

Project: Greenbank Shopping Centre Extension
Title / Description:

Project No: 29875
Revision: A

By: BM
Date: 2/10/2019

Catchment	Description	Catchment Characteristics			Time of Concentration													Tc (min)
					T (Standard Inlet)		T (Overland Sheet)				T (Pipe/Channel)				T (Velocity Based)			
		Area (Ha)	Category/ Fraction impervious (f_i)	C_{10}	Slope (%)	T (SI)	Horton's 'n'	L (m)	S (%)	T (OS)	Fall (m)	L (m)	Δ	T (P/C) (mins)	Avg. V (m/s)	L (m)	T (VB) (mins)	
EX1	Undev	4.284	Open Space / Pa	0.7			0.035	100	3	**13.93**					0.7	300	**7.14**	**21.08**
EX2	Undev (Curre	9.927	Open Space / Pa	0.7			0.035	100	3	**13.93**					0.7	400	**9.52**	**23.46**
Total Undev	**Base Case**	14.211		0.7			0.035	100	3	**13.93**					0.8	500	**10.42**	**24.35**
EX1	Dev (current)	4.284	0.85	0.84		**5**									1.5	300	**3.33**	**8.33**
EX2	Undev (curre	9.927	Open Space / Pa	0.7			0.035	100	3	**13.93**					0.7	400	**9.52**	**23.46**
Total Dev		14.211	0.26	0.7422														**23.46**

WOOD & GRIEVE ENGINEERS

NOW PART OF Stantec

Rational Method Calculation

Brisbane Civil
(07) 3811 4500

Project: Greenbank Shopping Centre Extension
Title / Description:

Project No: 29875
Revision: A

By: BM
Date: 2/10/2019

Catchment	Description	Peak Flow Rates by Average Recurrence Interval (ARI)																		
		63% AEP/ 1yr ARI			39% AEP/ 2yr ARI			18% AEP/ 5yr ARI			10% AEP/ 10yr ARI			5% AEP/ 20yr ARI			2% AEP/ 50yr ARI			1% AEP/ 100yr ARI		
		C_1	I_{1yr,t_c} (mm/hr)	Q_1 (m^3/s)	C_2	I_{2yr,t_c} (mm/hr)	Q2 (m^3/s)	C_5	I_{5yr,t_c} (mm/hr)	Q_5 (m^3/s)	C_{10}	I_{10yr,t_c} (mm/hr)	Q_{10} (m^3/s)	C_{20}	I_{20yr,t_c} (mm/hr)	Q_{20} (m^3/s)	C_{50}	I_{50yr,t_c} (mm/hr)	Q_{50} (m^3/s)	C_{100}	I_{100yr,t_c} (mm/hr)	Q_{100} (m^3/s)
EX1	Undev	0.56	59.07	**0.394**	0.595	67.56	**0.479**	0.665	93.81	**0.743**	0.7	111.20	**0.927**	0.735	127.99	**1.120**	0.805	150.34	**1.441**	0.84	166.91	**1.670**
EX2	Undev (Current	0.56	55.69	**0.861**	0.595	63.70	**1.046**	0.665	88.53	**1.625**	0.7	105.01	**2.029**	0.735	121.32	**2.461**	0.805	142.25	**3.160**	0.84	157.87	**3.660**
Total Undev	Base Case	0.56	54.42	**1.204**	0.595	62.25	**1.463**	0.665	86.54	**2.274**	0.7	102.69	**2.840**	0.735	157.96	**4.587**	0.805	181.72	**5.779**	0.84	200.48	**6.653**
EX1	Dev (current)	0.672	88.03	**0.705**	0.714	100.53	**0.855**	0.798	139.67	**1.327**	0.84	165.67	**1.657**	0.882	191.00	**2.006**	0.966	224.67	**2.585**	1	249.33	**2.969**
EX2	Undev (current	0.56	55.69	**0.861**	0.595	63.70	**1.046**	0.665	88.53	**1.625**	0.7	105.01	**2.029**	0.735	121.32	**2.461**	0.805	142.25	**3.160**	0.84	157.87	**3.660**
Total Dev		0.594	55.69	**1.306**	0.631	63.69	**1.588**	0.705	88.52	**2.466**	0.742	105.00	**3.079**	0.779	121.31	**3.735**	0.854	142.24	**4.796**	0.891	157.85	**5.554**

Design with
community in mind

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