STORMWATER MANAGEMENT PLAN

FOR

CNR OF ELIZABETH DRIVE & BONNYRIGG AVENUE, BONNYRIGG

PROPOSED BULKY GOODS RETAIL DEVELOPMENT

REPORT NO. R01291-WQ
REVISION C

JULY 2015

C&M Consulting Engineers Pty Ltd
Suite 26, 11-13 Brookhollow Avenue, Baulkham Hills, NSW, 2153
P (02) 9680 3100 F (02) 9634 6989

PROJECT DETAILS

Property Address: Corner of Elizabeth Drive & Bonnyrigg Avenue, Bonnyrigg

Development Proposal: Bulky Goods Retail Development

REPORT CERTIFICATION

Report prepared by:

WILLIAM WEBB
Civil Engineer
B.E.(Civil),DipEngPrac

Report reviewed by:

ANTHONY MANCONE
Civil Engineer
B.E.(Civil)Hons., MIEAust, CPEng,
NPER(Civil), NPER (Building Services)

DISCLAIMER

C & M Consulting Engineers Pty Ltd should be consulted to ascertain the suitability of the information contained herein if any third party wishes to utilise this report or any of the information contained in this report. C & M Consulting Engineers Pty Ltd accepts no responsibility or liability for the application of the contents of this report by any party not authorised to use of this report for their purposes.

DOCUMENT CONTROL

REVISION	ISSUE DATE	ISSUED TO	ISSUED FOR
A	JANUARY 2015	JOHN R BROGAN & ASSOCIATES	INFORMATION
B	FEBRUARY 2015	JOHN R BROGAN & ASSOCIATES	INFORMATION
		FAIRFIELD CITY COUNCIL	APPROVAL
C	JULY 2015	JOHN R BROGAN & ASSOCIATES	INFORMATION
		FAIRFIELD CITY COUNCIL	APPROVAL

TABLE OF CONTENTS

1. INTRODUCTION

This report has been prepared to support the Development Application for the proposed bulky goods retail development at the corner of Elizabeth Drive and Bonnyrigg Avenue, Bonnyrigg.

The scope of this report includes a comprehensive assessment of the requirements for stormwater management for the development of the site. Accordingly, this report includes findings of the assessment and proposes a strategy for the best practice of stormwater management for the proposed site.

The report describes the principles and operation of the proposed stormwater systems as well as the primary components of the drainage system. As the assessment is required under the conditions of consent, the final form of layout may need to be revised during its assessment for the future Construction Certificate Application for the development.

The following information and documents were used for this investigation:

- Fairfield City Wide Development Control Plan (2013)
- Fairfield City Urban Area On-Site Detention Handbook (1997)
- "Australian Runoff Quality – A Guide to Water Sensitive Urban Design", Engineers Australia (2006)
- "Australian Rainfall and Runoff – A Guide to Flood Estimation", Institute of Engineers, Australia (1987)

2. STORMWATER MANAGEMENT

2.1 Background

The objective is to provide stormwater controls, which ensure that the proposed development does not adversely impact on the stormwater flows and water quality of flow paths within, adjacent and downstream of the site.

Increased impervious surfaces and alteration of the natural topography due to land development has the potential to increase peak storm flows and tend to concentrate these flows. This has the potential to impact on flood regimes and erosion of the downstream drainage system.

To avoid any adverse impact on the downstream drainage systems, the site stormwater system is required to be planned correctly to ensure safe conveyance of flows through the site and within the capacity of the downstream trunk drainage systems.

2.2 Key Issues

The key issues and the mitigating measures to be employed within the proposed development site are:

- **Water Quantity** – Increased impervious surfaces (such as roofs, driveways, etc) have the potential to increase the stormwater flows from the site during storm events. To avoid impacting on the downstream drainage system, the site stormwater system has been planned to safely convey the flows through the site and within the capacity of the downstream system.

- **Water Quality** – Urban developments have the potential to increase gross pollutants, sediments and nutrient concentrations in storm water runoff. To limit impact on the downstream water quality, pollution control measures will be provided at each storm water outlet prior to discharging to the downstream drainage system.

2.3 The Site

The site is located at the corner of Elizabeth Drive and Bonnyrigg Avenue, Bonnyrigg. It is bound by Bonnyrigg Avenue to the South East, Elizabeth Drive to the South West, an existing Bunnings Warehouse to the North East and Clear Paddock Creek to the North West. The site is made up of two lots, one of which is currently developed as a bus depot. (Refer to **Figure 1**).

Figure 1 - Aerial Photo of Existing Site
(Source: nearmap.com)

The land generally falls away to the North West of the site towards Clear Paddock Creek.

The proposed development comprises of a multistorey Bunnings Warehouse with under croft car parking.

2.4 Design Guidelines

The site based stormwater management and planning elements are to be designed and constructed in accordance with the following:

Water Quantity

Guidelines: Fairfield City Council DCP Chapter 8A (2013)
Fairfield City Urban Area On-Site Detention Handbook (1997)

The proposed development increases the total impervious area of the existing area and therefore may increase the flow and discharge rate of flow to the downstream waterway. Therefore, on-site detention (OSD) is required to maintain the existing discharge flows.

Water Quality

At present, Fairfield City Council does not have a policy for stormwater quality. As such, this report has been limited to the Water Quantity requirements.

2.5 Objectives and Targets

Compatible with the legislation, policy and requirements, the objectives and targets for stormwater management are as provided in Table 11.

Table 1 - Stormwater Management Objectives

STORMWATER MANAGEMENT	OBJECTIVES	TARGET
Quantity	▪ The existing runoff flow regimes for the full storm events should be maintained, and provide safe conveyance system for the major storm events.	▪ Limit post development flow from the proposed development site to less than or equal to predevelopment flows for all storm events up to and including the 1% AEP storm event.

2.6 Overall Strategies

The proposed stormwater management strategies to manage runoff to ensure no detriment to the receiving environments have been divided into both short and long term strategies as summarised in Table 22.

Table 2 - Stormwater Management Strategies

STRATEGY	DESCRIPTION
Short Term Strategies	Short term strategies generally refer to control of soil and water erosion control during the construction phase. The primary risk occurs while soils are exposed during construction works when suspended sediment and associated pollutants can be washed into downstream waterways. The strategies to prevent this potential degradation include adequate provision of sediment and erosion control measures that should be documented prior to commencement of the works in a Soil and Water Management Plan (SWMP). The controls will limit movement of sediment in disturbed areas, and will be designed to remove sediment from runoff prior to discharge from site.
Long Term Strategies	The main measures to be implemented are the installation of rainwater tanks to collect roof water for water re-use.

This report addresses the long term impacts of the development. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with the Construction Certificate Application.

3. STORMWATER QUANTITY CONTROL

3.1 Introduction

The main criterion for the stormwater quantity control is to ensure that the post-developed peak flows do not cause detriment to the downstream waterways.

3.2 Proposed Drainage System

The drainage system for the proposed development will be designed to collect the majority of concentrated flows from impermeable surfaces such as access ways, parking areas and buildings. Where possible (and practical), runoff from pervious areas will also be collected. The layout of the proposed drainage system can has been attached to this report as Appendix A.

The drainage system proposed for the development includes:

- A pipe network system to collect minor storm runoff from areas;
- Overland flow paths to carry major storms through the site;
- An on-site detention (OSD) storage tank with orifice and weird control;
- A rainwater tank as per the water balance calculations.

3.2.1 *Rainwater Tank Requirements*

Bunnings Warehouse adopts a Water Sensitive Urban Design (WSUD) strategy in their developments to reduce the loadings placed on water and wastewater infrastructure. Bunnings has its own policy to replace a minimum of 90% of potable water for use on the garden nursery and toilet flushing.

Based on comparable observation on other Bunnings stores, the water usage for the outdoor nursery is between 0.5mm and 1.5mm per dry day based on season. For the modelling purpose, 1.5mm per day for the whole nursery area is used. For the nursery area of 1658m^2, the maximum daily demand used in the modelling is therefore 2.5m^3/day.

Although there are public toilets in Bunnings, the majority of users are staff. It has been estimated that 30 occupants using a number of WCs at 30L/day/person would account for about 900L per day.

A list of ratios comparing roof area to rainwater tank volume has been calculated to assist in determining the most efficient rainwater tank capacity and estimate the potable water savings based on demands. These ratios are listed in Table 3.

Table 3 – Roof Area to Rainwater Tank Volume Ratios

ROOF AREA DRAINING TO TANK (m^2)	VOLUME OF RAINWATER TANK REQUIRED (m^3)
4000	75
3500	80
3000	95
2500	115
2000	145

The rainwater tank has been sized using this water balance modelling approach which has been attached to this report as Appendix B.

3.2.2 *On-Site Stormwater Detention Requirements*

On-site stormwater detention (OSD) is required for this development site as per Chapter 8A of the Fairfield City Wide Development Control Plan and Urban Area On-Site Detention Handbook. The OSD was sized using the runoff routing software DRAINS. The predevelopment catchment for the site was assumed to be undeveloped with 100% of the area being pervious. The total site discharge was then limited to the predevelopment flow rate for the 20% AEP, 5% AEP and 1% AEP storm events. In addition to this, the PSD for the 9 hour 1% AEP storm was limited to 140 litres/second/hectare.

For the proposed development, it is recommend that OSD be provided in the form of a detention tank with orifice and weir control. It is proposed to provide a minimum volume of 685m^3 as a detention tank located below the under croft floor level towards the Northern corner of the site.

The DRAINS model set up model and inputs (01291_Bunnings Bonnyrigg_Drains - C.drn) can be found in Appendix C.

3.2.3 *Request for More Information:*

In Fairfield City Council's request for more information letter dated 15th May 2015; a number of issues were raised pertaining to the proposed stormwater management system and On-Site Detention. These points are explored below:

3.2.3.1 Easement & Right to Drain

Currently, the site stormwater discharges into a Council owned 750mm diameter reinforced concrete pipe sitting within an easement running parallel to the North-East boundary. As Council is benefitted to drain by this easement, it is proposed to maintain the existing point of discharge via the kerb inlet pit at the North-East boundary corner.

3.2.3.2 Receiving Stormwater System

The existing Council 750mm pipe was incorporated into the DRAINS model to analyse the capacity of the receiving stormwater drainage network. The upstream catchment was estimated to be 4 hectares using a combination of LiDAR data, Council supplied drainage maps, survey information and inspection of the sites topography.

As per the requests of Council's development engineers, the results of the DRAINS model indicate that the system is capable of conveying the subject site's 1:5 year ARI discharge without causing any overflows within the receiving stormwater network.

Email correspondence with Council has been attached to this report as Appendix D.

3.2.3.3 Outlet & Backwater Effects

Fairfield City Council previously engaged SKM to conduct a flood study for Orphan School Creek, Green Valley Creek and Clear Paddock Creek. The findings of this report for the 100 year ARI Flood Contours have been attached as Appendix E.

The 100 year flood level at Elizabeth Drive is listed as RL 40.84 in Table D-1. The flood level at the drainage network outlet point would be an interpolation between RL 40.84 and approximately RL 39.50 by inspection of the contours. However, the invert of the proposed OSD tank (RL 41.85) is more than 1m higher than the most conservative flood level of RL 40.84 at Elizabeth Drive. As a result, there should not be any backwater effects on the OSD tank due to the downstream water level in the 1:100 year flood event.

3.2.3.4 Overland Flow Paths

Flood modelling was undertaken by Cardno to determine the overland flow conditions surrounding the proposed development. It was estimated that a peak external overland flow rate of 450L/s would be experienced at the low point in Bonnyrigg Avenue in the 1:100 year storm event. An inflow hydrograph was

applied to a 900mm x 900mm pit within the DRAINS model to simulate the external flows entering the site.

It is currently proposed to capture the external overland flow at the low point of ramp No.2 with a series of large grated surface inlet pits and direct the stormwater into the OSD tank with a 600mm reinforced concrete pipe.

Openings shall be provided within the concrete parapet surrounding the goods receiving area to allow emergency overland flows out of the goods receiving area and into the OSD tank should the box gutters become blocked.

The remainder of overland flows will generally be directed around and away from the building footprint. The remaining flows will be directed toward the landscaped areas and into the surrounding road reserves.

4. RECOMMENDATIONS

The proposed development of the subject site could potentially lead to significant changes in water quantity as well as quality if a water sensitive urban design approach is not adopted as part of the development strategy. The traditional stormwater management and investigation that only considers impacts of flooding and flood mitigation is a thing of the past. Stormwater management practices must now also consider water quality, aquatic habitats, riparian vegetation, recreation, aesthetic and economic issues.

The key strategies to be adopted for this development include the following:

1. A pipe network system to collect minor storm runoff from surface areas which will minimise nuisance flooding;

2. On-Site Detention will be provided for the development in the form of a minimum 685m^3 detention tank with orifice and weir control;

3. A rainwater harvesting and retention system to allow rainwater reuse while at the same time providing improvement to the quality of stormwater runoff from the site and also providing some level of stormwater detention.

The results from the investigations and modelling for this project that have been summarised in this report indicate that the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

APPENDIX A

CONCEPT CIVIL ENGINEERING DRAWINGS

APPENDIX B

WATER BALANCE MODELLING

PROJECT:	**BUNNINGS WAREHOUSE, BONNYRIGG**
RAINFALL DATA:	**NEAREST STATION - BANKSTOWN FROM 1982 TO 1991**
DESIGNER	**WW**
DATE:	**4-Feb-15**

ROOF AREA (Ha)	0.3	
NON-ROOF AREA (Ha)	0	
FRACTION IMPERVIOUS	0	
PERVIOUS LOSS COEFF	0	30% lost
Max Tank/pond Capacity (m3)	95	
Average Surface Area (m2)	0	
Pond base area (m2)	0	
Average Infiltration rate (mm/hr)	0	
Porosity of soil (%)	5%	
Usage:		
Total Number of occupants	30	
Toilet Flushing (l/d/person)	30	
Laundary (l/d/person)	0	
Other usage (l/d/person)	0	
Total Domestic Usage (m3/d)	0.90	
Irrigation Area (m2)	1658	
Max Irrigation Rate (mm/day)	1.5	<= Summer
No irrigation if rainfall > (mm)	1	
Max Irrigation Usage (m3/d)	2.487	
Daily Infiltration (m3)	0.00	
% Irrigation water re-collected	0	

SUMMARY RESULTS

Average Annual Rainfall (mm)	1011

Total No. Days:	3652
Total # days with empty tank	266
Percentage:	7.3%
Total # days with overflow/full tank	452
Percentage:	12.4%

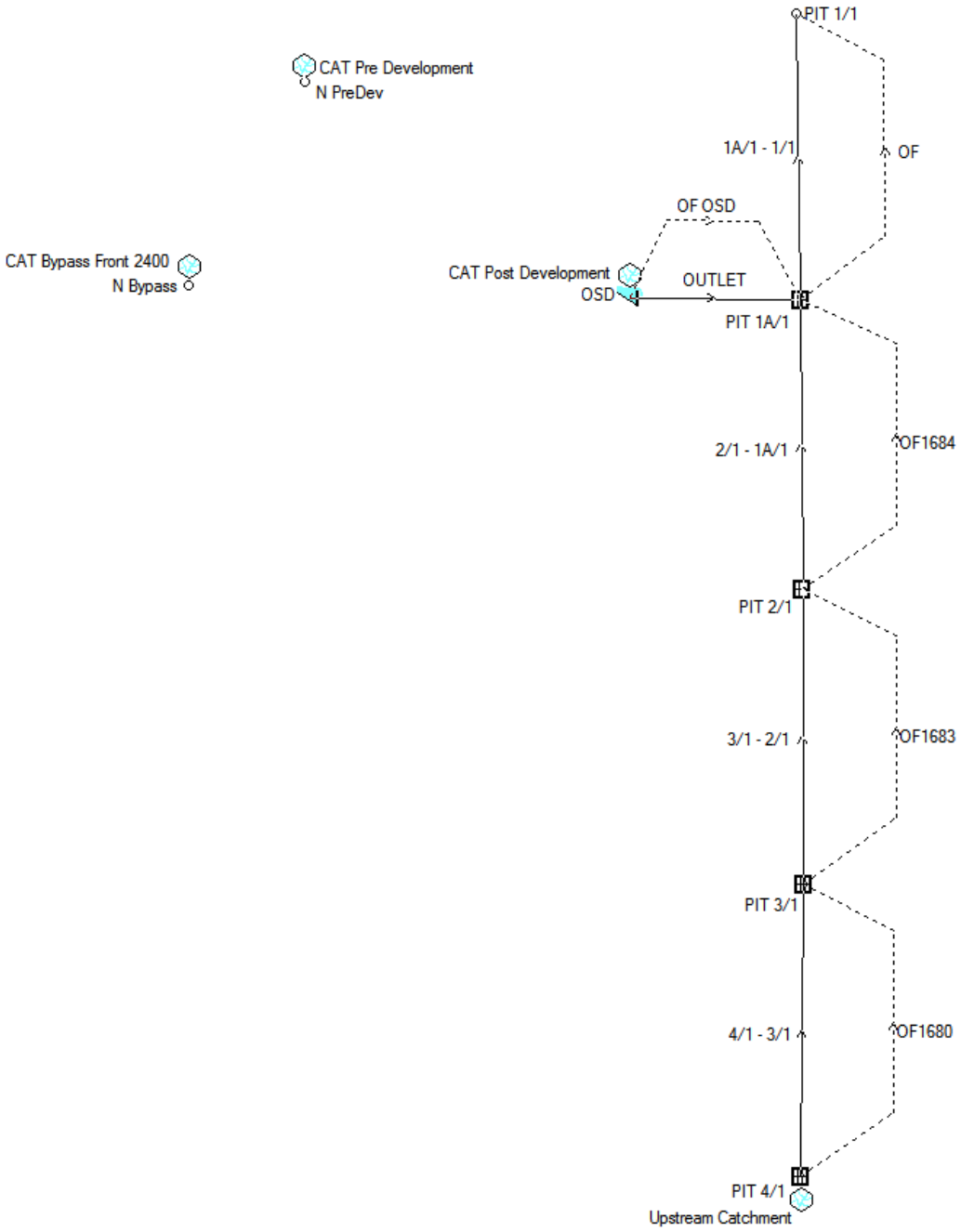
Total Annual Runoff Collected (KL)	3033
Average Annual Rainwater Usage (KL)	930
% Reuse	30.6%
Total Average Annual Water Demand (KL)	1024
Average Annual Portable Water Required (KL)	94
Portable Water Usage (%)	9.2%

Roof Area to Volume Ratios	
Roof Area	Volume
4000	75
3500	80
3000	95
2500	115
2000	145

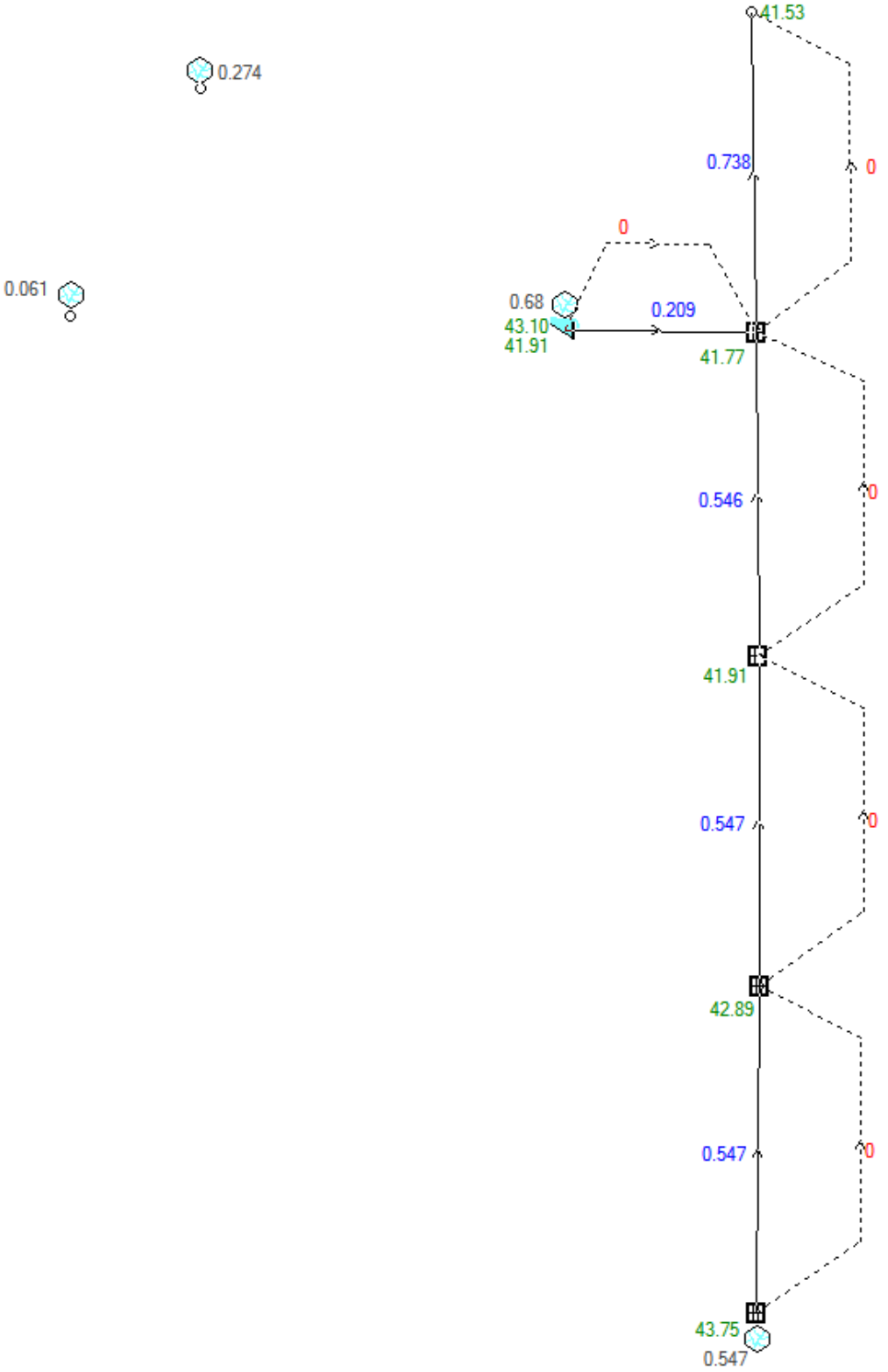
APPENDIX C

DRAINS MODEL AND RESULTS

DRAINS MODEL – 20% AEP



DRAINS RESULTS – 20% AEP

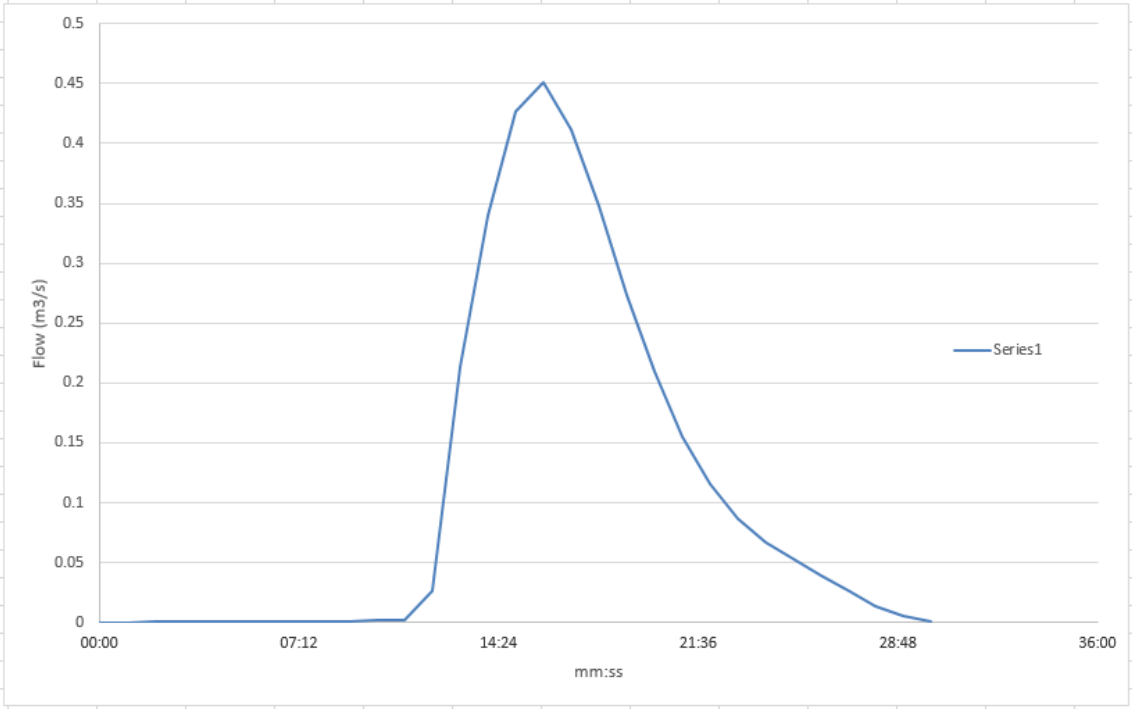


INFLOW HYDROGRAPH FOR 1% AEP EXTERNAL OVERLAND FLOW

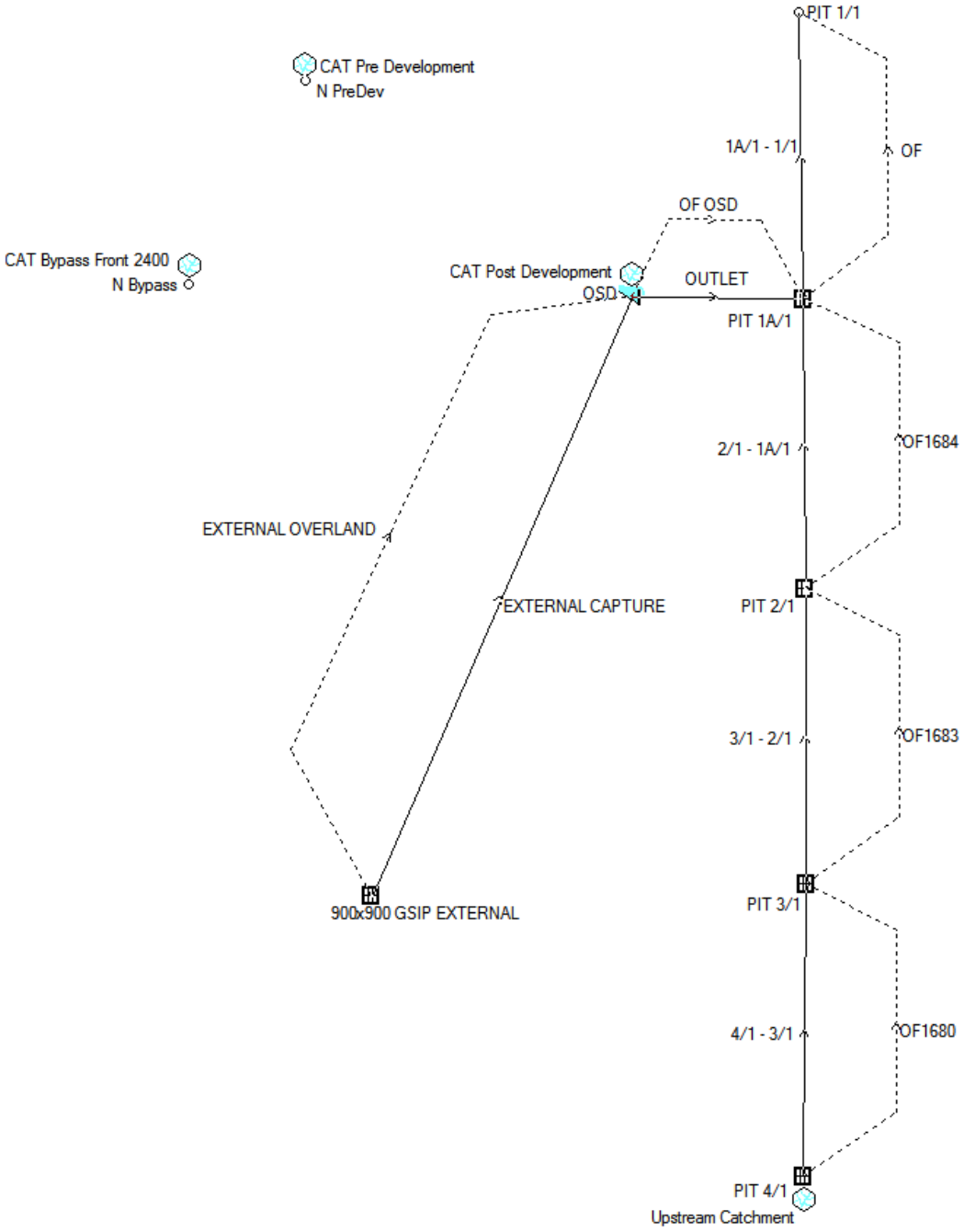
Overflow hydrograph across new Bunnings driveway near Bonnyrigg Avenue lowpoint.

100y ARI 30 minute duration

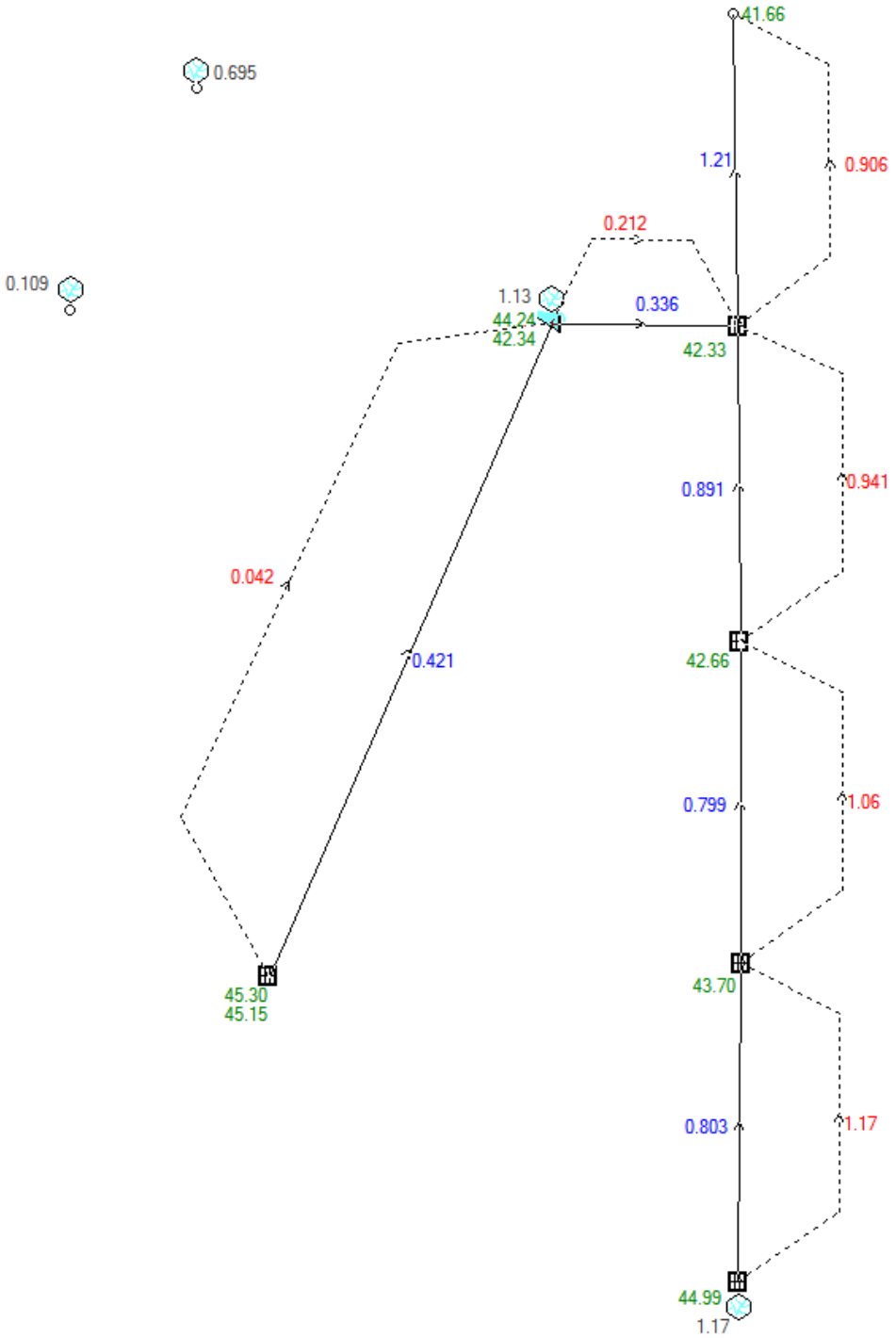
	Design with pipes Inlets, Eff. Disch.(m³/s)			
00:00	0	peak Q =	0.450423	10
01:00	0			20
02:00	0.00141			30
03:00	0.00048			40
04:00	0.000417			
05:00	0.000485			
06:00	0.001476			
07:00	0.001488			
08:00	0.001481			
09:00	0.001462			
10:00	0.001631			
11:00	0.001966			
12:00	0.026993			
13:00	0.213716			
14:00	0.339872			
15:00	0.426696			
16:00	0.450423			
17:00	0.41155			
18:00	0.347523			
19:00	0.273739			
20:00	0.209764			
21:00	0.155378			
22:00	0.115761			
23:00	0.086622			
24:00	0.06666			
25:00	0.052757			
26:00	0.038984			
27:00	0.026308			
28:00	0.014187			
29:00	0.005725			
30:00	0.000755			



DRAINS MODEL – 1% AEP & EXTERNAL OVERLAND FLOW



DRAINS RESULTS – 1% AEP & EXTERNAL OVERLAND FLOW



APPENDIX D

EMAIL CORRESPONDENCE WITH COUNCIL

William Webb

From: William Webb
Sent: Wednesday, 8 July 2015 1:57 PM
To: Johnny Su
Cc: 'JBazergy@fairfieldcity.nsw.gov.au'
Subject: DA No: 71.1/2015 - Bunnings Bonnyrigg

Dear Johnny,

We are in the process of finalising the updated reports and associated plans in response to Council's request for more information letter dated 15th May 2015.

As a result of our meetings with Council on the 27th May and the 22nd of June; the following points were clarified with yourself and Mr Bazergy;

1. The point of discharge for the site is currently via a kerb inlet pit and 750mm Council owned RCP within an easement running along the North-East boundary corner. Council's development engineers agreed that the discharge point could be maintained as Council is benefitted to drain by the easement.

2. A DRAINS model be provided showing that the existing 750mm pipe within the easement and receiving outlet has adequate capacity for the 1:5 year Bunning's site discharge.

Could you please confirm in writing that the above points were agreed upon as I will be attaching this email as an appendix to the stormwater management report.

Kind regards,

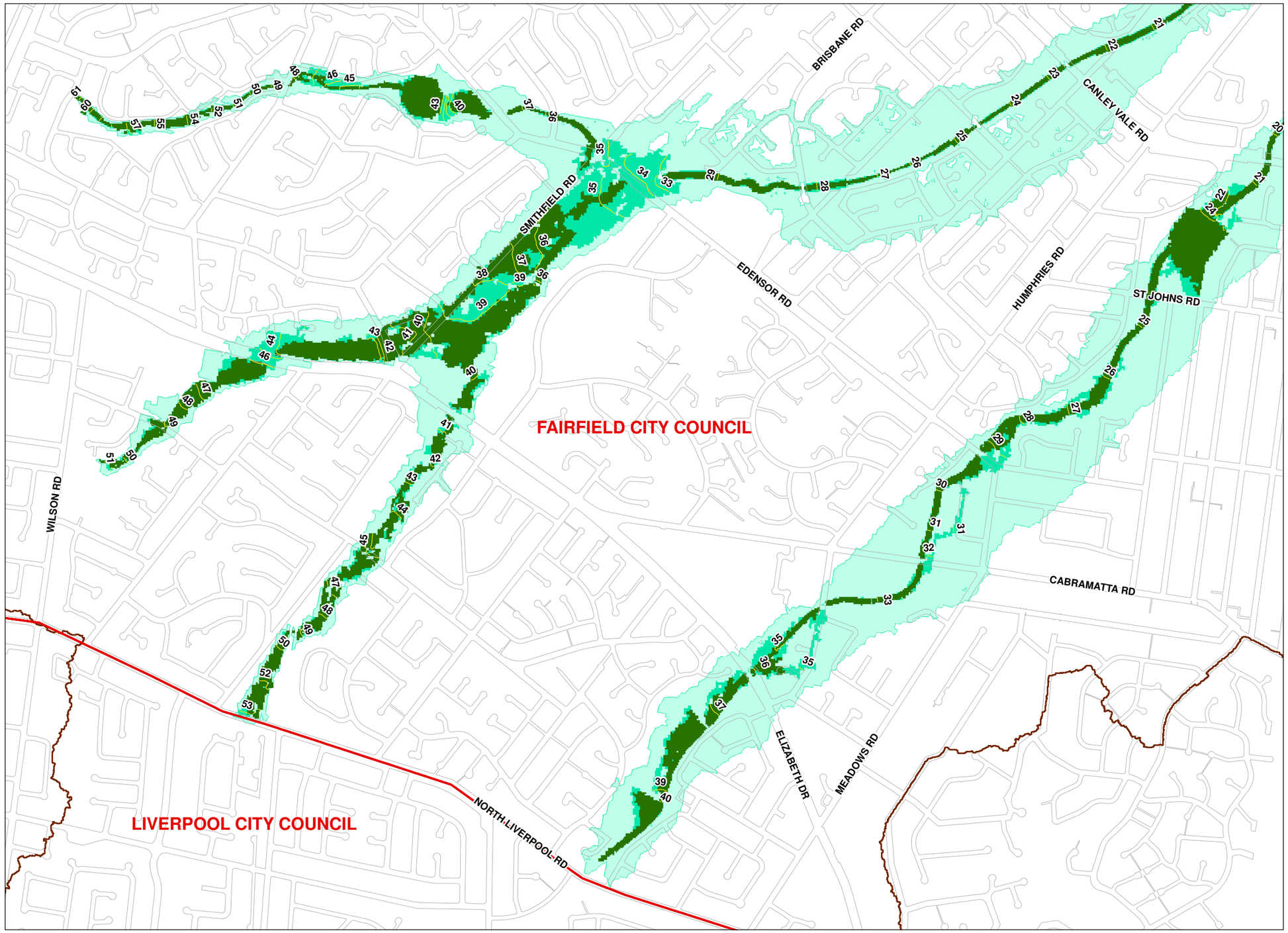
William Webb
Civil Engineer
C & M Consulting Engineers Pty Ltd

A: Suite 26, 11-13 Brookhollow Avenue, Baulkham Hills, NSW, 2153
P: PO Box 7849, Baulkham Hills BC, NSW, 2153
T: 9680 3100
F: 9634 6989
Mb: 0448 887 743

E: william@cmce.com.au

APPENDIX E

SKM INUNDATION MAP & FLOOD LEVELS



Legend

- 19 — 100 year ARI Flood 1m Contour (m AHD)
- LGA Boundary
- Three Tributaries Catchment Boundary
- 20 year ARI Flood Extent
- 100 year ARI Flood Extent
- PMF Extent

Roads: LPI_NSW_Road_corridor
LGA Boundary: LPI_NSW_LGA_2007

N

0 500
Metres

A3 1:14,000

NOTE:
The extent of flood inundation shown is approximate only. Mapping does not include local stormwater flooding.

SINCLAIR KNIGHT MERZ SKM
FAIRFIELD CONSULTING SERVICES
A Division of Fairfield City Council

Figure 5-4 Flood Inundation Map - Sheet 3

Flood Study for Orphan School Creek, Clear Paddock Creek and Green Valley Creek

GDA_1994_MGA_Zone_56

January 22, 2008
I:\ENVR\Projects\EN01664\Deliverables\Figures\EN01664_Fig 5_4_Flood_Mapping_Sheet_3_gr_V3.mxd

Table D-1 Peak Water Level at Selected Locations

Location*	20 year ARI Event	50 year ARI Event	100 year ARI Event	PMF Event
Orphan School Creek				
OSC Railway Parade	8.06	8.25	8.46	11.58
OSC Sackville Street	10.35	10.53	10.64	12.69
OSC Sackville Gauge	10.66	10.89	11.02	13.10
100m D/S of OSC GVC confluence	12.11	12.31	12.45	14.69
OSC Cumberland Highway	14.27	14.47	14.63	18.05
OSC King Road U/S face	18.33	18.59	18.75	21.75
OSC King Road D/S face	18.06	18.28	18.43	20.91
OSC Bulls Road	21.63	21.73	21.83	24.26
OSC Fairfield GC	26.87	27.01	27.17	28.09
OSC Christie Street	28.52	28.58	28.65	29.57
OSC Moonlight Rd	29.34	29.42	29.61	31.79
OSC Canley Vale Rd Tway	31.10	31.25	31.56	34.67
OSC Mimosa Road	39.19	39.46	39.56	40.66
OSC Sweethaven Road	40.01	40.30	40.46	42.80
OSC Belfield Road	45.34	45.60	45.85	48.49
Clear Paddock Creek				
CPC Kembla Street	18.78	18.96	19.08	22.44
CPC Canley Vale Road	22.42	22.51	22.59	25.78
CPC Canberra Street	24.37	24.46	24.54	27.53
CPC Brisbane Road	27.95	28.02	28.16	31.28
CPC Edensor Ck Edensor Road	35.42	35.48	35.56	36.39
CPC Edensor Ck Sweethaven Road	35.70	35.78	35.90	37.55
CPC Edensor Ck Bosnjak U/S basin	42.78	43.11	43.23	43.94
CPC Edensor Ck Bosnjak D/S basin	37.72	37.75	37.81	39.17
CPC Edensor Ck Swan Street	48.33	48.44	48.53	50.13
CPC D/S Basin C	34.73	35.62	35.74	37.31
CPC Basin C	38.70	38.96	39.04	39.90
CPC Kalang Road Basin	43.06	43.15	43.21	44.19
CPC Wilson Ck Elizabeth Drive	45.56	45.92	46.07	47.04
CPC Henty Ck Elizabeth Drive	40.20	40.70	40.84	43.22
CPC Henty Ck Brown Road	46.21	46.26	46.30	47.18
CPC Wilson Ck Simpson Road	49.37	49.37	49.43	50.43
CPC Henty Ck Tway	49.17	49.27	49.30	50.09

* Water levels at road crossing locations reported for upstream face, unless stated otherwise.