BUNDERRA DEVELOPMENT SUPER LOT REZONING STAGE

STORMWATER MANAGEMENT AND WATER QUALITY CONCEPT REPORT FOR Fitzwalter Group

JUNE 2009

ACOR CONSULTANTS PTY LTD

ENGINEERS

MANAGERS

INFRASTRUCTURE PLANNERS

ACN 079 306 246
ABN 26 522 454 721

www.acor.com.au
acor@acor.com.au

Level 1, 24 Falcon St /
PO Box 822
Crows Nest NSW 2065
PH 02 9438 5098
FAX 02 9438 5398

Sydney

Newcastle

Brisbane

Central Coast

Western Sydney

Northern NSW

Adelaide

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Date:
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Prepared:
Ben Strang
Reviewed:
Bjorn Jensen
Approved:
Michael Goodwin

CONTENTS

1. INTRODUCTION

ACOR Consultants P/L has been engaged by Fitzwalter Pty Ltd to perform the conceptual design of the stormwater system to service the Bunderra development. The development will be located on the old Pasminco smelter site near Boolaroo. This report describes and presents results of the analysis for the stormwater system, detention and water quality requirements.

The site is located east of Main Road between Boolaroo and Argenton. This report documents the stormwater master plan for proposed future development within the catchment.

In accordance with Australian Rainfall & Runoff (4th edition), once fully developed the proposed stormwater system will comply with the major/minor principle and will consist of collection pits and underground pipes for minor flow (10yr ARI). Major flows (up to 100yr ARI) in excess of the capacity of the pipe system will be safely conveyed overland in dedicated gutters and swales located within drainage easements.

Stormwater control and treatment is to be provided via a series of three (3) ponding/treatment areas to meet councils and best practice requirements.

It is envisaged that the stormwater infrastructure will be provided via a 2 stage process. The first stage will involve installing infrastructure service the super lots as required by council to allow the site to be sub-divided into a number of super-lots.

The second stage will involve installing infrastructure within each super-lot to satisfy council's requirements for sub-division into the final lot configuration.

This report is primarily concerned with the first stage.

2. SITE OVERVIEW

The development site comprises of 3 distinct sub catchments that drain westwards to existing stormwater culverts, crossing a rail corridor and roads, before eventually entering Cockle Creek. These sub-catchments are generally described as either disused industrial land under various stages of demolition and rehabilitation or undeveloped bushland. The surface comprises sandy clays corresponding to a DRAINS soil type 3 (poor permeability) condition.

Catchment 1 is the southern-most catchment and is 113.41 ha in size split between 7 sub-catchments. The site gradient varies between 5% and 12% sloping towards the west where stormwater flows cross under T.C. Frith Avenue via culverts. A large portion of this catchment (approx 40%) consists of steep bushland with the remaining portions being partially rehabilitated industrial land. Several small water bodies exist within this catchment however for the purpose of the model they have been assumed to be full and as a result will not impede flows.

Catchment 2 is the middle catchment of the system and consists of terrain similar to Catchment 1. It encompasses an area of 19.18 ha split between 3 sub-catchments.

The terrain of the Catchment runs in a similar direction and grade as Catchment 1 and crosses the Great Northern Railway corridor via a 2.9m x 1.2m box culvert.

Catchment 3 is the northern-most of the three catchments that make up the Bunderra site. It is 51.84 ha in size and can be further broken into 7 smaller sub-catchments. The site grading ranges from 2.5% to 16% falling generally to the northwest and culminating to a 2.4m diameter stormwater culvert running under the Great Northern Railway corridor. This catchment currently consists mainly of bushland and industrial stockpiles in various levels of rehabilitation.

The location and extents of Catchments 1, 2 and 3 are shown on the drawing SKC.01 in Appendix A

The fundamental DRAINS model parameters used were :

1. Neighbouring developed sites will provide their own stormwater detention and treatment
2. Soil is type 3 (Sandy Clay)
3. AMC is 3.5 for 100 year ARI and 2.5 for 10 year ARI
4. Storms IDFs as per AR&R (4th edition) Zone 1

3. CATCHMENT AND DETENTION MODELING

The system of each catchment has been modelled in DRAINS using the catchment details as shown in SKC/01 and the Stormwater plan SKC1.02. Rainfall information was generated by DRAINS and is based on parameters supplied to DRAINS from Australian Rainfall and Runoff Volume 2. Refer to Appendix C for a schematic diagram of the model.

The results are as follows:

Catchment 1

Post development Catchment 1 will be composed of a mix of residential area and undeveloped bushland split roughly 60:40. Of the residential zoned land approximately 14% will be comprised of ‘Urban Living’ areas with high density developments, the remaining 46% being conventional residential blocks. This split corresponds to a breakdown of each sub catchment within the residential areas of 45% paved, 20% supplementary and 35% grassed. The bushland areas have been assumed to be 100% pervious and mixed catchments are a blend between the two depending on the breakdown of area.

Water quality for this area will be provided by a wetland area in the south western most corner abutting T.C. Frith Avenue. This section of wetland will provide treatment but no detention as this catchment can drain straight to Cockle Creek via a major culvert running beneath T.C. Frith Avenue. This will cause no negative impacts on existing infrastructure and as such has been approved in principal by Council.

The flows generated from the catchment are shown below.

Recurrence interval	Pre-development Flow	Post-development Flow (No Detention)
10 Year ARI	11.5 m³/s	17.6 m³/s
100 Year ARI	22.2 m³/s	29.1 m³/s

Table 3.5 – Flow Data

Catchment 2

Post development Catchment 2 will be composed of a mix of residential area, commercial and a small area of undeveloped bushland. This will be split roughly 50:50. Of the residential zoned land approximately 5% will be comprised of 'Urban Living' areas with high density developments, the remaining 45% being conventional residential blocks. This corresponds to a breakdown in each sub catchment of 45% paved, 20% supplementary and 35% grassed.

Stormwater will flow to a water treatment / detention basin that will provide primary treatment to the stormwater. This will drain to through an existing culvert running under the Great Northern Railway and there to Cockle Creek via an existing channel through the Golf Course. Detention storage will ensure that flows from the developed catchment will not exceed the capacity of the existing culvert or damage existing downstream infrastructure.

The basin, to be constructed will consists of an open topped detention zone with an earthen dam wall. The base of the detention zone will include water quality wetlands (or similar). The outlet of the detention basin will be via a low level outlet structure and pipe (including trash rack) along with a high level spill way.

The flows generated from the catchment and basin data is shown below.

Recurrence interval	Pre-development Flow	Post-development Flow (Post Detention)
10 Year ARI	2.7 m³/s	2.6 m³/s
100 Year ARI	4.8 m³/s	4.7 m³/s

Table 3.3 – Flow Data

Storage Area	Approx. Volume at RL	TWL During 100yr ARI Event
Basin 1	6500 m³ at RL – 9.5	RL – 9.8

Table 3.4 – Basin Data

Catchment 3

Post development Catchment 3 will be composed of a mix of residential area, light industrial and an undeveloped rehabilitation area. This will be split roughly 30:20:50. This corresponds to a breakdown in each sub catchment of 45% paved, 20% supplementary and 35% grassed. The bushland areas have been assumed to be 100% pervious and mixed catchments are a blend between the two depending on the breakdown of area.

Stormwater will flow to a water treatment / detention basin that will provide primary treatment to the stormwater. This will drain to through an existing culvert running under the Great Northern Railway and there to Cockle Creek via an existing channel through the Golf Course. Detention storage will ensure that flows from the developed catchment will not exceed the capacity of the existing culvert or damage existing downstream infrastructure.

The basin, to be constructed will consists of an open topped detention zone with an earthen dam wall. The base of the detention zone will include water quality wetlands (or similar). The outlet of the detention basin will be via a low level outlet structure and pipe (including trash rack) along with a high level spill way.

The flows generated from the catchment and basin data is shown below.

Recurrence interval	Pre-development Flow	Post-development Flow (Post Detention)
10 Year ARI	6.6 m^3/s	5.5 m^3/s
100 Year ARI	12.1 m^3/s	7.8m^3/s

Table 3.1 – Flow Data

Storage Area	Approx. Volume at RL	TWL During 100yr ARI Event
Basin 1	8450 m^3 at RL – 8.65	RL – 8.452

Table 3.2 – Basin Data

DRAINS Version 2008.07 was used in the analysis.

4. STORMWATER QUALITY

4.1 Water Quality Objectives

The proposed Bunderra development will be designed in accordance with the principles outlined in “Australian Runoff Quality, A Guide to Water Sensitive Urban Design”.

This document outlines Water Quality Objectives which are the ‘Standards’ that describe the quality of stormwater that is required to be achieved prior to its discharge from the development site.

The Water Quality Objectives will be compared to the pollution levels estimated using the Music computer programme at a later design stage. The main pollution levels indicators are:

Total Phosphorus	-45% Reduction of annual load
Total Nitrogen	-45% Reduction of annual load
Total Suspended Solids	-80% Reduction of annual load
Litter/gross pollutants	-70% Reduction of annual load
Oils and grease	-No visible oil flows up to the 3-month ARI peak flows

4.2 Treatment Train Description

The stormwater treatment system will be developed using the principles of Water Sensitive Urban Design (WSUD). As part of the design approach, stormwater treatment measures will be reviewed and incorporated into the modelling process to determine a treatment train most appropriate to the site. A brief description of the system is as follows:

- Trash Trap.
  A Trash Trap is a structure commonly set at the outlet of drainage lines to intercept coarse sediment and litter as it is discharged to the downstream system. Trash and large objects are collected in a trash rack arrangement allowing water to drain easily away. Periodic maintenance is required to empty the accumulated trash. A trash trap is to be placed at the outlet to each treatment zone.

- Grassed Swale / Watercourse
  Swales are grass and or vegetation lined channels used to convey runoff, and are increasingly being used in place of, or in conjunction with, pipe networks. Swales have the advantages of removing particulates, slowing runoff and enhancing infiltration, and can be aesthetically pleasing. The natural watercourses within the site will be revegetated to Department of Water and

Energy requirements to establish these as a permanent treatment zone. This will act as a natural watercourse to provide treatment to runoff as it flows through the site.

- Wetland.
  Constructed Wetlands are designed to mimic the complex set of physical, chemical and biological reactions that are present within naturally occurring waterway systems. These typically contain a permanent water body with extended detention storage above. Wetlands provide treatment to stormwater flows by the processes of filtration, sedimentation, biological uptake and chemical adsorption. For this development wetlands have been proposed to be situated near the outlet of each major catchment. They would be planted with Ephemeral and Macrofilic plant species and maintained as a permanent water body, or otherwise designed.

The location of the stormwater treatment devices will be subject to ongoing design and modelling to suit the specifics of the site.

4.3 Water Quality Modelling and Assumptions

Prior to construction details being prepared water quality modelling and detailed design will be carried out to confirm that the above details will be met.

The design and performance of the treatment train options can be modelled using MUSIC, an industry standard water quality modelling program. MUSIC is not a strict design tool, but rather a decision support program used to run scenarios on particular combinations of stormwater treatment measures using real rainfall data.

5. Drainage Network Infrastructure

In the final development, stormwater flows will be conveyed by a combination of natural water courses, vegetated swales, pipes, pits and culverts.

For the first stage of the development (superlot subdivision) trunk stormwater infrastructure will be constructed. Some of this trunk infrastructure will be permanent, for example:

- Natural water courses
- Pipe work associated with superlot trunk roadways
- Culverts required where stormwater must cross under roads
- Catchment 1 primary drainage reserve at the south end of the site
- Wetlands and detention basins, including outlet facilities and planting

Other infrastructure installed at the first stage will be temporary, for example:

- Grassed swales installed in temporary drainage easements

The temporary infrastructure will be upgraded, replaced or modified as required to suit the final development scheme for each superlot. For example, the developer of each superlot may decide to construct a road along a temporary drainage easement, hereby a system of pipes and pits will be installed to convey the flow.

The location and layout of the proposed stage 1 infrastructure is shown in Appendix B. Drainage easements have been sized to fit a typical V channel swale, roughly vegetated, designed to accommodate 100 Yr ARI flows.

Where major roads are to be constructed a pit and pipe systems will be built as drainage for the immediate surrounding areas using the major/minor principle.

As the development of the site progresses, the drainage servicing for the future road network and individual lots will need to be designed. At that stage the formalised easements over the channels may be revised or removed, however this will be subject to the needs of the future site and Councils requirements for the developer of each superlot.

Future stormwater management design within each superlot will be required to comply with Council and Government requirements. For example, this will likely include rainwater tanks for roofwater recycling.

6. Conclusion

The proposed Bunderra site, following development, will consist of 3 distinct catchments each with a distinct outlet to Cockle Creek.

Flows from Catchment 1 will receive treatment in a wetland system before flowing to Cockle Creek via an easement under T.C. Frith Avenue.

Flows from Catchments 2 and 3 will receive treatment in wetland/detention basins before flowing to Cockle Creek via existing culverts under the railway corridor.

Treatment of stormwater flows will be provided by a treatment train consisting of trash racks, swales and wetlands to achieve standard requirements for stormwater quality.

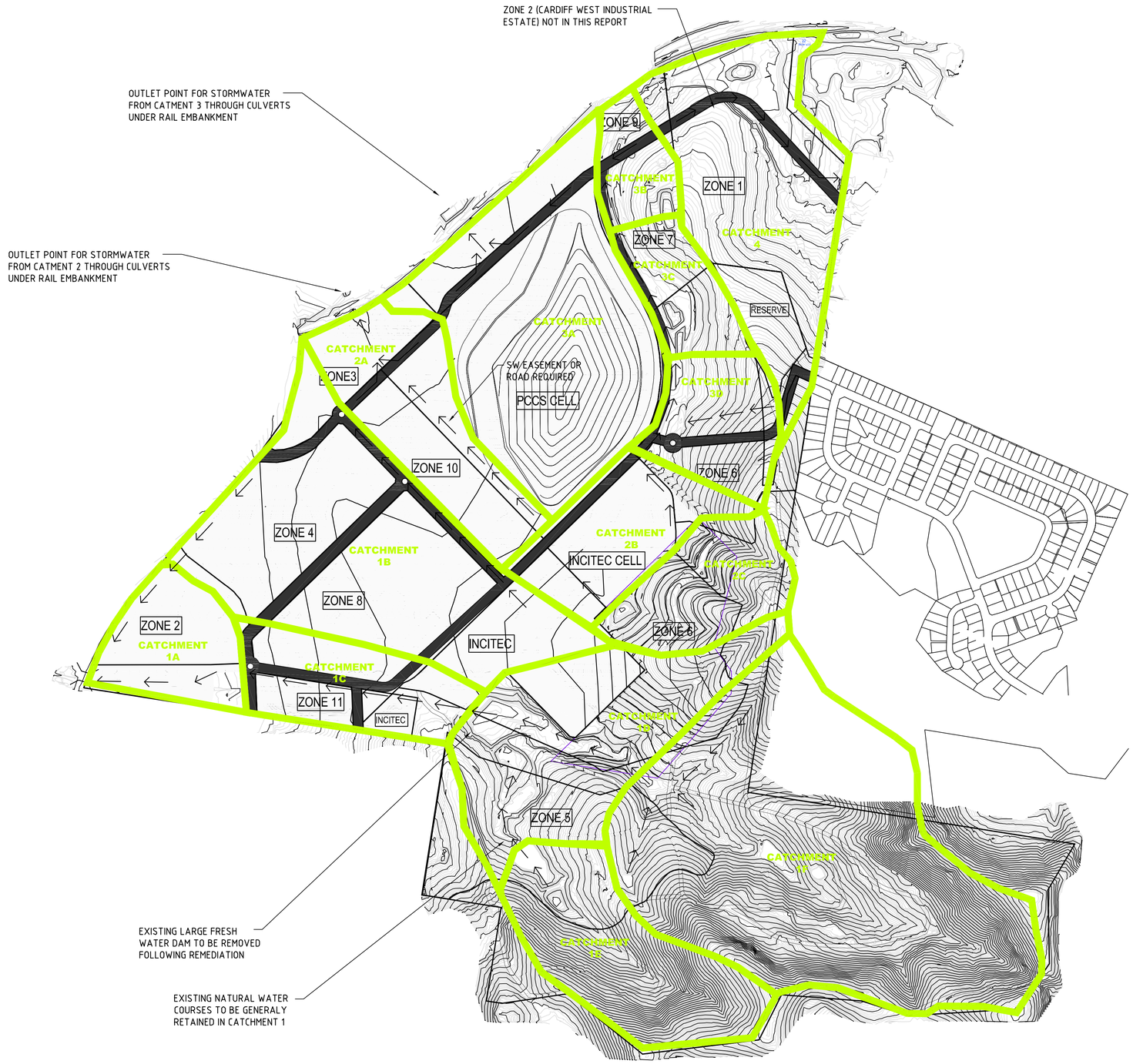
Initially, trunk drainage for the super lots will be provided primarily by stormwater channels with pits and pipes being provided where roads are present.

Final drainage within each superlot will be subject to future design and subsequent approval by Council.

APPENDIX A – CATCHMENT PLAN

LEGEND

- DRAINAGE FLOW PATH
- CATCHMENT BOUNDARY



SUB CATCHMENT DETAILS

CATCHMENT	AREA	Q 10 POST	Q 100 POST
1A	6.74 ha	1.4	2.28
1B	27.51 ha	5.28	8.63
1C	8.56 ha	1.76	2.87
1D	18.21 ha	3.19	5.12
1E	13.1 ha	1.85	3.32
1F	42.75 ha	5.01	8.22
2A	11.67 ha	2.32	3.77
2B	8.96 ha	2.09	3.36
2C	7.88 ha	1.85	2.98
3A	26.17 ha	3.93	7.27
3B	3.82 ha	0.851	1.3
3C	5.03 ha	1.21	1.94
3D	6.8 ha	1.63	2.6

MAJOR CATCHMENT FLOWS

CATCHMENT	Q 10 PRE	Q 10 POST	Q 100 PRE	Q 100 POST
1	11.5 m^3/s	17.6 m^3/s	22.2 m^3/s	29.1 m^3/s
2	2.72 m^3/s	2.64 m^3/s	4.83 m^3/s	4.74 m^3/s
3	6.66 m^3/s	5.5 m^3/s	12.1 m^3/s	7.89 m^3/s

	Q 10 POST		Q 100 POST	
CATCHMENT	Q 10 PRE DETENTION	Q 10 POST DETENTION	Q 100 PRE DETENTION	Q 100 POST DETENTION
1	17.6 m^3/s	17.6 m^3/s	29.1 m^3/s	29.1 m^3/s
2	3.94 m^3/s	2.64 m^3/s	6.34 m^3/s	4.47 m^3/s
3	7.61 m^3/s	5.5 m^3/s	13.07 m^3/s	7.89 m^3/s

NOTE:

1. ALL FLOWS SHOWN ARE DEVELOPED FROM PRELIMINARY MODELLING AND MAY BE SUBJECT TO CHANGE DURING THE DETAILED DESIGN PROCESS.
2. REFER TO DRAWING CK02 FOR PRELIMINARY STORMWATER INFRASTRUCTURE.
3. REFER TO "BUNDERRA DEVELOPMENT - SUPERLOT REZONING STAGE STORMWATER MANAGEMENT AND WATER QUALITY CONCEPT REPORT" BY ACOR CONSULTANTS FOR FURTHER INFORMATION.

NOT FOR CONSTRUCTION

Issue	Description	Date	Drawn	Chkd
B	ISSUED FOR INFORMATION	06.08.09	ASV	BHJ
A	ISSUED FOR REVIEW	12.06.09	ASV	BHJ

0 1cm at full size 10cm

North

Client

FITZWALTER GROUP
LEVEL 1, 41 McLAREN STREET
NORTH SYDNEY NSW 2060
PHONE : 8925 6701
FAX : 8925 6798

Architect

ÂCOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Level 1, 24 Falcon Street
PO Box 822
Crows Nest NSW 2065
PH +61 2 9438 5098
fax +61 2 9438 5398
e-mail acor@acor.com.au

Project

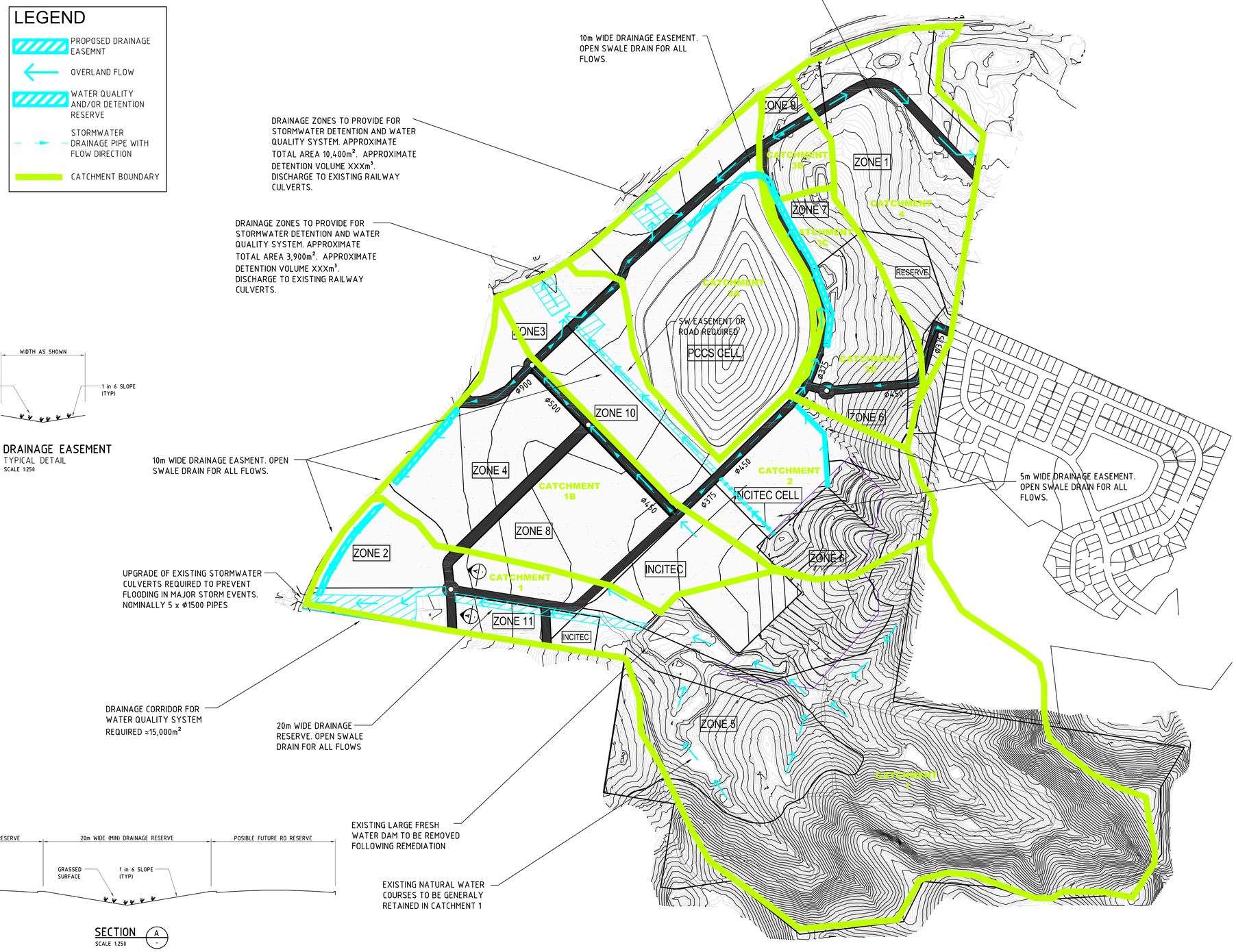
BUNDERRA REDEVELOPMENT
INFRASTRUCTURE WORKS
LAKE ROAD
BOOLAROO NSW 2284

Drawing Title

STORMWATER SERVICES
POST DEVELOPMENT
CATCHMENT PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
A.S.V	JUN 2009	1:5000		
Checked	Project No.		Dwg. No.	Issue
B.H.J	SY08.0685		CK01	B

APPENDIX B – DRAINAGE CONCEPT PLAN



NOTE:

1. PROPOSED INFRASTRUCTURE SHOWN ON THIS PLAN IS PRELIMINARY AND INDICATIVE OF INFRASTRUCTURE TO BE INSTALLED AT THE SUPER LOT SUB DIVISION STAGE. FURTHER INFRASTRUCTURE WORK WOULD BE REQUIRED TO ACHIEVE FINAL DEVELOPMENT CONDITIONS.
2. REFER TO DRAWING CK01 FOR CATCHMENT AND FLOW DETAILS.
3. REFER TO "BUNDERRA DEVELOPMENT - SUPERLOT REZONING STAGE STORMWATER MANAGEMENT AND WATER QUALITY CONCEPT REPORT" BY ACOR CONSULTANTS FOR FURTHER INFORMATION.

NOT FOR CONSTRUCTION

Issue	Description	Date	Drawn	Chkd
B	ISSUED FOR INFORMATION	06.08.09	ASV	BHJ
A	ISSUED FOR REVIEW	26.06.09	ASV	BHJ

1cm at full size

North

Client

FITZWALTER GROUP
LEVEL 1, 41 McLAREN STREET
NORTH SYDNEY NSW 2060
PHONE : 8925 6701
FAX : 8925 6798

Architect

ÂCOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Level 1, 24 Falcon Street
PO Box 822
Crows Nest NSW 2065
PH +61 2 9438 5098
fax +61 2 9438 5398
e-mail acor@acor.com.au

Project

BUNDERRA REDEVELOPMENT
INFRASTRUCTURE WORKS
LAKE ROAD
BOOLAROO NSW 2284

Drawing Title

STORMWATER SERVICES
POST DEVELOPMENT
INFRASTRUCTURE PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
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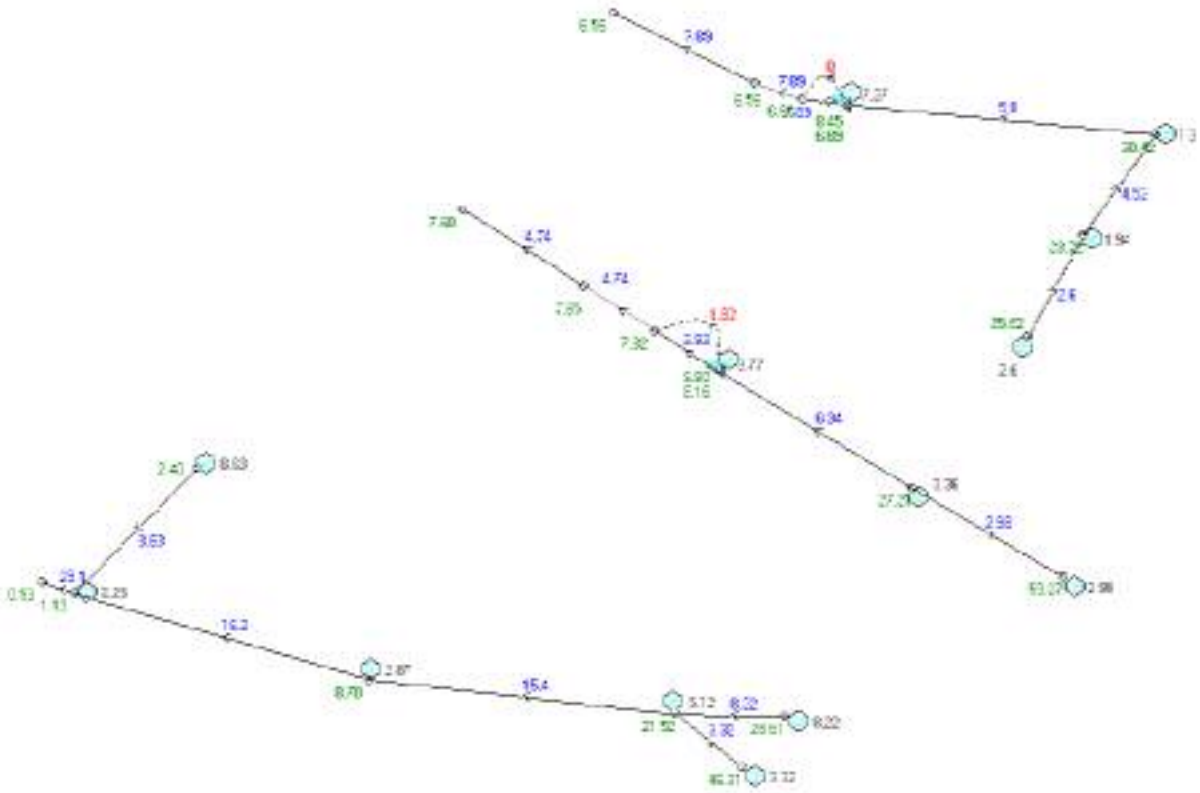
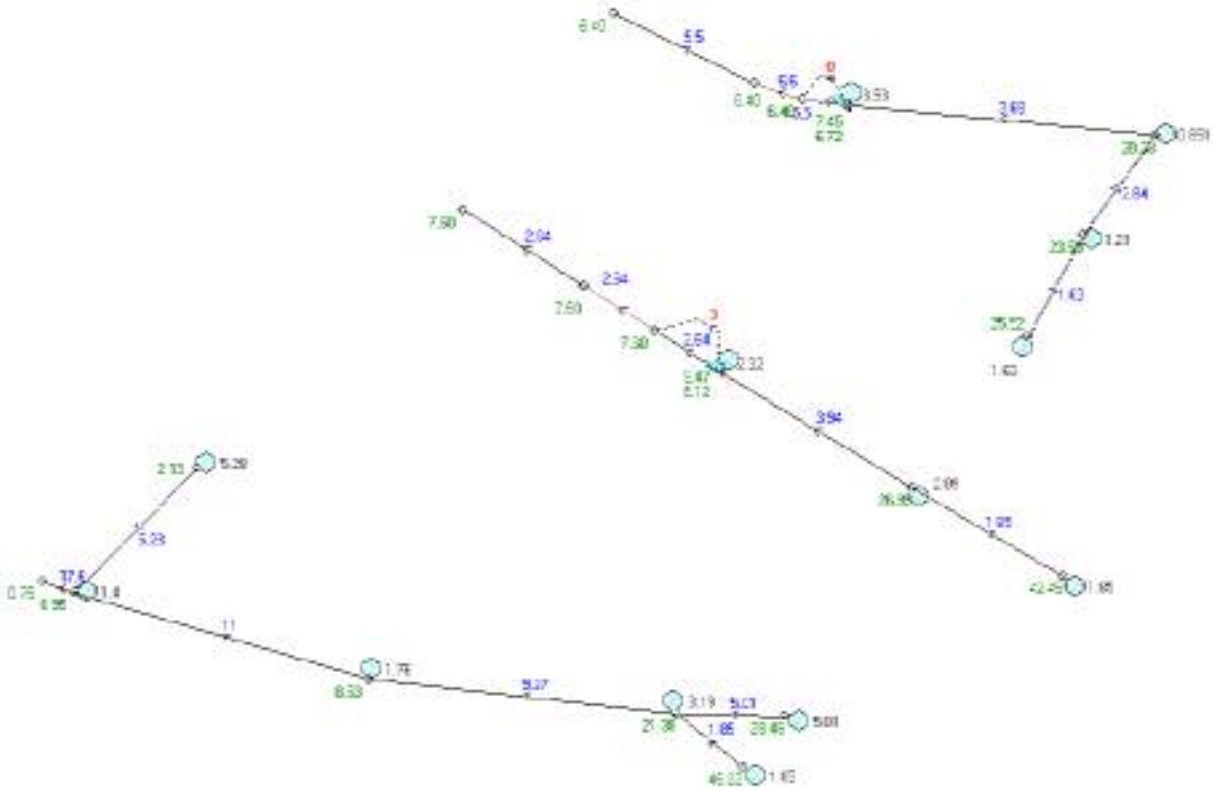
APPENDIX C – DRAINS MODELING



Drains Modelling 100 Yr ARI Flows

- **Additional DRAINS model data is available upon request**



Drains Modelling 10 Yr ARI Flows

- **Additional DRAINS model data is available upon request**