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Our Ref: X13353
Your Ref: Area 20
Contact: Peter Lee

15 December 2014

The Secretary
Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

Attention: The Secretary

Public Exhibition - Changes to Planning Controls in Area 20

Reference is made to the public exhibition for proposed changes to the planning controls in the Area 20 Precinct. This submission has been prepared on behalf of Capital Corporation Pty Ltd as the developer of properties on the corner of Rouse and Cudgegong Rd, Rouse Hill.

1. Subject Site

The subject site is located on the corner of Rouse and Cudgegong Rd, being Lots 116, 121 and 122 in Deposited Plan 208203 known as no. 60 Cudgegong Rd, 99 and 107 Rouse Rd. The site is zoned R3 Medium Density Residential with a strip of land along the Rouse Rd frontage as land reserved for SP2 – Infrastructure – Local Drainage.

This submission is making representation to seek to remove the SP2 Local Drainage affectation as an alternative drainage strategy has been proposed with the trunk drainage located in the Rouse Road reserve.

2. Background

Capital Corporation Pty Ltd are developing the site for medium density development and have lodged with Blacktown Council Development Applications for the facilitating subdivision (DA 14-2198) and Integrated Development for 62 abutting dwellings (DA 14-2306) which are under assessment by the Council. A copy of the site plan for the Stage 1 DA for residential development is attached to this submission.

Figure 1: Extract from Zoning Map outlining Subject Site

Part of the development package included a concept design for the trunk drainage along Rouse Rd. Attached to this submission is a copy of Brown Consulting – Rouse Road Trunk Drainage report dated November 2014.

2.1 Rouse Road Trunk Drainage

The Brown Consulting Rouse Road Trunk Drainage report proposed that:

- The drainage channel shown in the Area 20 Indicative Layout Plan be replaced by a pipeline within the road reserve of Rouse Rd;
- The report presented hydrological and hydraulic modelling used to design the pipeline within the Rouse Rd reserve between Cudgegong Road and the site's eastern boundary;

The proposed Rouse Rd pipe has been sized to convey the stormwater from the developed catchment without increasing the discharge rate in the road carriageway.

The hydrological modelling has demonstrated the viability of replacing the drainage easement/channel with a pit and pipe network within the Rouse Rd reserve. The drainage line consists of pipes and culvert designed to convey the 100 year ARI flows of the Rouse Road catchments.

The drainage report and accompanying plans have been submitted to Blacktown Council with DA 14-2306 demonstrating that the drainage channel is no longer required and that all the necessary drainage can be accommodated within the Rouse Road reserve.

2.2 Not Flood Prone Land

The drainage channel along Rouse Rd is not Flood Prone Land as shown on the Area 20 – North West Growth Centre Development Control Map. The Rouse Rd frontage is not within an area identified as a creek or tributary under the Water Management Act, accordingly there is no reason for the drainage channel should the drainage be located within the road reserve.

2.3 Area 20 Precinct – Section 94 Contribution Plan No. 22

Blacktown Council has adopted a Section 94 Contribution Plan No. 22 for Area 20 Precinct. The Contribution Plan identifies under Water Management Facilities – Second Ponds Creek Catchment that the site requires the following local drainage infrastructure:

- Item S2.2 – 3x3600x900 culvert under future road - $278,600
- Item S2.3 – 34m wide landscaped open channel - $2,058,000

This submission is highlighting that Blacktown Council no longer needs the 34m drainage channel together with land acquisition costs, which represents a significant saving from the Section 94 Contributions Plan.

In addition, the Section 94 Contribution Plan is on the basis for Water Management Facilities that Sydney Water was the agency in Area 20 for regional stormwater detention basins for Second Ponds Creek. It is understood that the change to Area 20 planning controls include Blacktown Council taking over responsibility from Sydney Water for trunk drainage and detention. This is an increased burden on the Section 94 Contribution Plan and Council will be required to amend the Contributions Plan.

Accordingly, reducing the Section 94 obligations by removing the land acquisition costs for the 34m drainage channel will greatly assist Council's further Section 94 obligations.

3. Specific SEPP Amendment

On the basis that Trunk Drainage can be accommodated within the Rouse Road reserve, there is no drainage reasons for Blacktown Council to acquire and construct a 34m wide drainage channel on the subject site. The alternate trunk drainage treatment for piped drainage within the road reserve removes the Section 94 obligation on Council to acquire drainage channel at residential land rates and as such there is a substantial Section 94 cost saving. This is particularly relevant as Council has to account for increased Section 94 costs as a result of the transfer of Sydney Water's obligation to Council.

The specific amendment is seeking to remove the SP2 Local Drainage reservation from the site as the drainage can be accommodated within the road reserve. With the removal of the SP2 reservation, the whole of the site should be zoned R3 – Medium Density Residential.

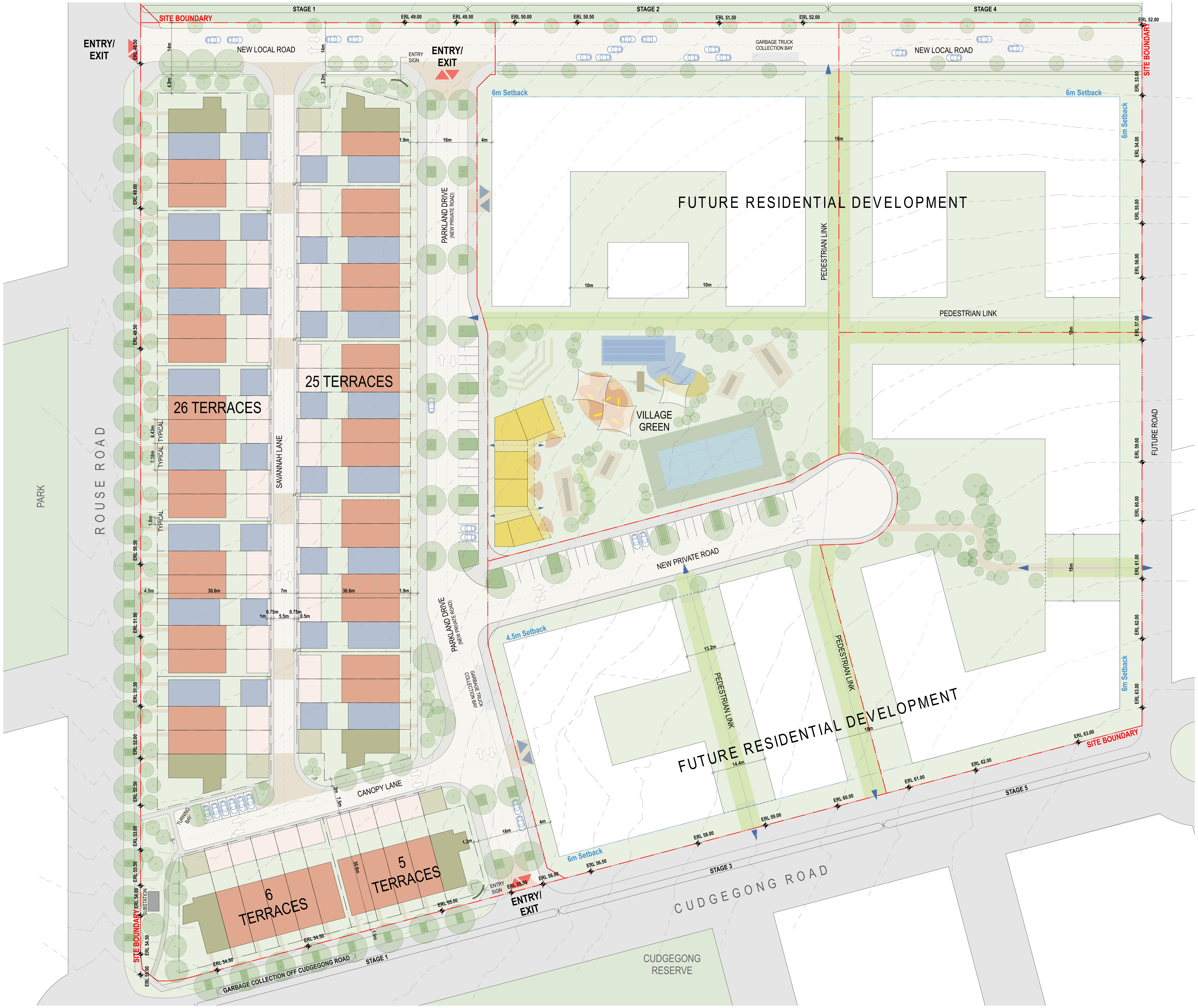
The Department are requested to consider this submission and amend the Land Reservation Acquisition Map. Should you have any questions, please contact me on (02) 8808 5000.

Yours Sincerely
Calibre Consulting

Peter Lee
Planning - Manager

ATTACHMENTS
1. DA 14-2306 – Site Plan for Stage 1 DA 62 abutting dwellings
2. Rouse Road Trunk Drainage Report November 2014

COPIES
1. Blacktown City Council – Chris Shannon – Manager Strategic & Precinct Planning



LEGEND

- FUTURE STAGE 2 COMMUNITY FACILITIES
- FUTURE RESIDENTIAL APARTMENT BUILDINGS
- PEDESTRIAN LINK
- SEMI-PRIVATE / CONTROLLED PEDESTRIAN LINK
- SITE VEHICLE ENTRY / EXIT
- BASEMENT CARPARK ENTRY / EXIT
- LP LIGHT POLE
- TERRACE TYPE 01 (TCET01) 3 BED
- TERRACE TYPE 02 (TCET02) 3 BED + SECONDARY DWELLING OVER GARAGE
- TERRACE TYPE 03 (TCET03) 4 BED
- GARBAGE TRUCK COLLECTION BAY

NOTES

DLCS Quality Endorsed Company ISO 9001:2008, Registration Number 20476
Nominated Architect: Nicholas Turner 6695, ABN 86 064 084 911

CLIENT

Capital Corporation

Rev.	Date	Approved by	Revision Notes
H	14.11.14	SC	DA SUBMISSION

Project Title
Parkland Estate, Rouse Hill
Cudgegong Road / Rouse Road Rouse Hill NSW 2155

Drawing Title
Overall Site Plan

Scale: **1:500@A1**
Project No.: **14039**
Drawn by: **CM**
North
Status: **DA Submisison**
Dwg No.: **DA-105-010**
Rev: **H**

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BROWN

Rouse Road Trunk Drainage

Concept Design

For Development Application

CAPITAL CORPORATION

Prepared for Capital Corporation Pty Ltd

Revision D – November 2014

Reference Number: X13353

Water & Environment

COMMERCIAL IN CONFIDENCE

Brown Consulting (NSW) Pty Ltd
PO Box 8300
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Ph: (02) 8808 5000

2014

DOCUMENT CONTROL

X13353 Rouse Road Trunk Drainage.docx

Issue	Date	Issue Details	Author	Checked	Approved
A	May 2014	Issued for Development Application	KT	RP	RP
B	June 2014	Addition of catchment details included	KT	RP	RP
C	November 2014	For client review and comment	KT	KL	PG
D	November 2014	Issued for Development Application	KT	KL	PG

Table of Contents

1. Introduction 2

1.1 Site Description 2
1.2 Existing Catchments 3
1.3 Developed Catchments 3

2. Hydrological Modelling 5

2.1 Hydrological Modelling Parameters 5
2.2 Modelling Results 6

3. Rouse Road Hydraulic Capacity 7

3.1 Rouse Road Drainage Capacity 7
3.2 Rouse Road Pipe Requirements 8

4. Conclusion 10

5. References 11

6. Glossary of Terms 12

Tables

Table 1 – Fraction Impervious Values Adopted (Blacktown City Council, 2012) 5
Table 2 – Manning's 'n' Roughness Coefficients (JWP, 2010) 6
Table 3 – 100 Year ARI Existing and Post-Development Peak Flows (No Detention) 6
Table 4 – Rouse Road Drainage Capacity 8
Table 5 – Rouse Road Drainage Requirements – Developed Catchments 8
Table 6 – Rouse Road Drainage Requirements – 20% Increase in Developed Catchments 9

Figures

Figure 1 – Area 20 Precinct Indicative Layout Plan 2
Figure 2 – Existing Rouse Road Catchments 3
Figure 3 – Developed Rouse Road Catchments 4
Figure 4 – Rouse Road Pipe Sections 7

Appendices

Appendix A Rouse Road Drainage Indicative Layout

Appendix B Rouse Road Drainage Long Section – Developed Scenario

Appendix C Rouse Road Drainage Long Section – Increased Developed Scenario

1. Introduction

Brown Consulting (NSW) Pty Ltd has been engaged by Capital Corporation Pty Ltd to undertake a concept design of stormwater drainage along Rouse Road to support the development of land at the South Eastern corner of Rouse Road and Cudgegong Roads, Rouse Hill and the upgrade of a 300 m long section of Rouse Road.

This report:

- » Proposes that the drainage easement shown in the Area 20 Indicative Layout Plan (Figure 1) be replaced by a pipeline within the road reserve of Rouse Road.
- » Presents hydrological and hydraulic modelling used to design the pipe within the Rouse Road reserve between Cudgegong Road and the development site's eastern extent.

1.1 Site Description

The site is located in the North West Growth Centre - Area 20 Precinct of Blacktown City Council as shown in Figure 1. The site is legally defined as Lots 116, 121 & 122 DP 208203 and is zoned medium density residential and trunk drainage.

The site drains to Rouse Road which grades to the east towards Seconds Ponds Creek. An existing Sydney Water detention basin on Rouse Road provides stormwater detention for the Road and the site as part of a regional detention basin strategy for Area 20.

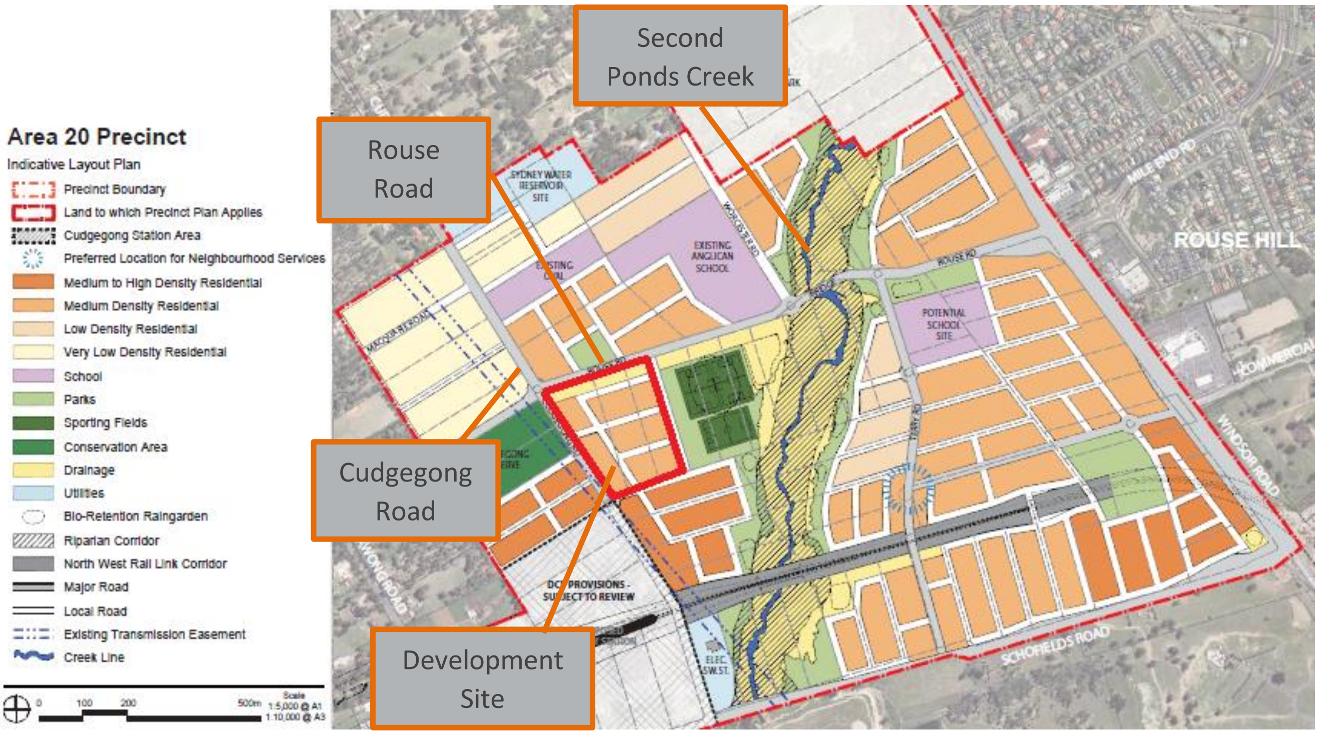

Figure 1 – Area 20 Precinct Indicative Layout Plan

1.2 Existing Catchments

The existing catchments draining to Rouse Road along the length of the proposed development is shown in Figure 2. The terrain data adopted for catchment delineation was based on a topographic three-dimensional 5 metre Digital Elevation Model (DEM) generated from contour data sourced from the NSW Department of Lands.

Figure 2 – Existing Rouse Road Catchments

1.3 Developed Catchments

The developed catchments and flow directions are shown in Figure 3.

Catchment 5 is assumed to drain to Rouse Road. While there is no proposed drainage easement through the existing oval, topography will not likely facilitate the diversion of this catchment to the east and down Worcester Road.

Figure 3 – Developed Rouse Road Catchments

2. Hydrological Modelling

Hydrologic modelling has been carried out to determine the flow rates at Rouse Road and design trunk drainage along Rouse Road to cater for future flow rates associated with development in accordance with current zoning shown in the ILP (Figure 1).

The modelling also allows a contingency for developments at higher densities than the ILP indicates.

Hydrological modelling was undertaken for three scenarios:

- Existing catchment conditions.
- Developed catchment conditions in accordance to the Area 20 Precinct ILP.
- Sensitivity analysis assuming that the total areas draining to Rouse Road were increased by 20% during earthworks and development.

2.1 Hydrological Modelling Parameters

The hydrologic analysis for this study was undertaken using rainfall-runoff flood routing software *XP-RAFTS*. The modelling allows comparison of pre-development and the post-development catchment conditions to observe the effect that future development will have on stormwater flow rates in Rouse Road.

The existing catchment is characterised by natural vegetation and pervious areas. Development will include a mix of low and medium density residential development comprising roofs, paved footpaths and upgraded roads. These surfaces will contribute more stormwater to the Rouse Road reserve than is currently the case.

The *XP-RAFTS* modelling was undertaken with catchments subdivided into separate sub-catchments with pervious and impervious fractions. The impervious fractions used in the *XP-RAFTS* model are provided by the *Engineering Guide for Development – 2005* (Blacktown City Council, 2012) and are shown in Table 1.

Table 1 – Fraction Impervious Values Adopted (Blacktown City Council, 2012)

Zoning	Impervious Fraction (%)
Public Recreation Areas	50
New Residential Lots	80
Medium Density Residential Lot	85
Road Reserves	95

The roughness parameters adopted for the *XP-RAFTS* modelling are taken from *Area 20 Precinct, Rouse Hill Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design Techniques* (JWP, 2010). The roughness parameters are shown in Table 2.

Table 2 – Manning's 'n' Roughness Coefficients (JWP, 2010)

Surface Type	Roughness Coefficient (n)
Existing Pervious	0.035
Urban Pervious	0.025
Urban Impervious	0.015

An Australian Representative Basins Model (ARBM) loss model was adopted for purposes of *XP-RAFTS* modelling. The loss parameters adopted are provided by the *Engineering Guide for Development – 2005* (Blacktown City Council, 2012).

2.2 Modelling Results

The *XP-RAFTS* model for the three catchment scenarios was run to produce the 100 year ARI peak flow rates. The results are presented in Table 4 at critical locations along the stormwater pipe shown in Figure 4. The Rouse Road pipeline and road drainage capacity will need to have capacity to safely convey these flows.

Table 3 – 100 Year ARI Existing and Post-Development Peak Flows (No Detention)

Pipe Section	Contributing Catchments	Existing Peak Flow (m^3/s)	Development Peak Flow (m^3/s)	Increased Development Peak Flow (m^3/s)
Section 1	1	2.84	5.44	6.51
Section 2	1 + 2 + 5	2.92	6.30	7.52
Section 3	1 + 2 + 3 + 5	4.85	7.26	8.67
Section 4	1 + 2 + 3 + 4 + 5	5.78	7.84	9.37
Section 5	1 + 2 + 3 + 4 + 5 + All Development Site	7.44	10.57	12.69

Figure 4 – Rouse Road Pipe Sections

Note that Section 5 has not been sized as part of this study but flows have been included to assess increase in flood hazard.

3. Rouse Road Hydraulic Capacity

3.1 Rouse Road Drainage Capacity

The existing capacity of Rouse Road was set as a 100 year ARI conveyance flow objective for the ultimate development scenario. All flows exceeding this capacity would be piped within the corridor.

The method for calculating the drainage capacity of roads is provided by in the *Engineering Guide for Development – 2005* (Blacktown City Council, 2012). The carriageway capacity is dependent on the carriageway width and longitudinal slope. The proposed Rouse Road carriageway width is 11 m and the longitudinal slope varies. As such, the carriageway capacity varies over the length of the road. Rouse Road is separated into five sections as shown in Figure 4 above.

The drainage capacity of Rouse Road was calculated in accordance with to the *Engineering Guide for Development – 2005* (Blacktown City Council, 2012). The results are presented in Table 4.

Table 4 – Rouse Road Drainage Capacity

Rouse Road Pipe Section	Rouse Road Slope (%)	Rouse Road Capacity (m^3/s)
1	4.3	2.5
2	2.8	2.0
3	1.5	1.5
4	1.5	1.5

3.2 Rouse Road Pipe Requirements

The proposed Rouse Road Pipe has been sized to convey the stormwater from the developed catchment without increasing the discharge rate in the Road carriageway.

A DRAINS hydraulic model was developed to size the proposed Rouse Road pipe. Flows were applied to pipe network and pipe dimensions adjusted until the surface flow in Rouse Road was suitable. A requirement of the Rouse Road alignment has prevented raising the road deck to accommodate pipes greater than 900mm in height along pipe section 3 and 4.

The pipe is to have the capacity summarised in Table 5 below.

Table 5 – Rouse Road Drainage Requirements – Developed Catchments

Rouse Road Pipe Section	Modelled Drainage Capacity (m^3/s)	Drainage Dimension (mm)
1	2.5	1200 Diameter RCP
2	4.4	1200 Diameter RCP
3	5.1	1200 Diameter RCP
Pit 1\6 to Pit 1\7	7.1	1800 (W) x 900 (H) RCBC
Pit 1\7 to Pit 1\8	6.6	1800 (W) x 900 (H) RCBC
Pit 1\8 to Pit 1\9	8.6	3600 (W) x 900 (H) RCBC
Pit 1\9 to Pit 1\10	8.4	3600 (W) x 900 (H) RCBC
Pit 1\10 to Pit 1\11	10.1	3600 (W) x 900 (H) RCBC

Another *DRAINS* model was developed to size the proposed Rouse Road pipe with a 20% increase of all catchments. This scenario accounts for potential increased areas being drainage to the road under future developments. The results are summarised in Table 6.

Table 6 – Rouse Road Drainage Requirements – 20% Increase in Developed Catchments

Rouse Road Pipe Section	Modelled Drainage Capacity (m^3/s)	Drainage Dimension (mm)
1	2.5	1200 Diameter RCP
2	5.1	1200 Diameter RCP
3	5.2	1200 Diameter RCP
Pit 1\6 to Pit 1\7	7.6	1800 (W) x 900 (H) RCBC
Pit 1\7 to Pit 1\8	7.3	2100 (W) x 900 (H) RCBC
Pit 1\8 to Pit 1\9	9.1	3600 (W) x 900 (H) RCBC
Pit 1\9 to Pit 1\10	8.5	3600 (W) x 900 (H) RCBC
Pit 1\10 to Pit 1\11	11.1	3600 (W) x 900 (H) RCBC

The Rouse Road indicative drainage layout is shown in Appendix A. The long sections for the developed scenario and the 20% increased developed catchments are provided in Appendix B and Appendix C respectively.

4. Conclusion

Hydrological modelling has demonstrated the viability of replacing the drainage easement with a pit and pipe network within the Rouse Road reserve. The drainage line consists of pipes and culverts designed to convey the 100 year ARI flows of the Rouse Road catchments.

A sensitivity analysis was undertaken to consider potential catchment increases. Changes in the catchments can be caused by regrading associated with future developments. The sensitivity analysis shows that larger drainage pipes and culverts sizes may be required.

The culverts adopted reflect that the deck of Rouse Road cannot be significantly raised and these have been documented in drawings to support the Development Application (DA) for stage 1 of the proposed medium density residential subdivision at 60 Cudgegong Road and 99 and 107 Rouse Road, Rouse Hill.

5. References

Blacktown City Council. (2012). *Developer Handbook for Water Sensitive Urban Design.* Sydney. Australia: Blacktown City Council.

Blacktown City Council. (2012). *Engineering Guide for Development - 2005.* Sydney, Australia: Blacktown City Council.

JWP. (2010). *Area 20 Precinct, Rouse Hill Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design Techniques* . Sydney, Australia: JWP.

6. Glossary of Terms

Afflux	The rise in water level upstream of a hydraulic structure such as a bridge or culvert, caused by losses incurred from the hydraulic structure.
Australian Height Datum	National survey datum corresponding approximately to mean sea level.
Annual Exceedance Probability	The chance of a flood of a given size or larger occurring in any one year, generally expressed as percentage probability. For example, a 100 year ARI flood is a 1% AEP flood. An important implication is that when a 1% AEP flood occurs, there is still a 1% probability that it could occur the following year.
Average Recurrence Interval	Is the long term average number of years between the occurrence of a flood as big as, or larger than the selected flood event.
Catchment	The catchment at a particular point is the area of land which drains to that point.
Design floor level	The minimum (lowest) floor level specified for a building.
Design flood	A hypothetical flood representing a specific likelihood of occurrence (for example the 100 year or 1% probability flood). The design flood may comprise two or more single source dominated floods.
Development	Existing or proposed works which may or may not impact upon flooding. Typical works are filling of land, and the construction of roads, floodways and buildings.
Discharge	The rate of flow of water measured in terms of volume over time. It is not the velocity of flow which is a measure of how fast the water is moving rather than how much is moving. Discharge and flow are interchangeable.
Digital Terrain Model	A three-dimensional model of the ground surface that can be represented as a series of grids with each cell representing an elevation (DEM) or a series of interconnected triangles with elevations (TIN).
Effective warning time	The available time that a community has from receiving a flood warning to when the flood reaches their location.
Flood	Above average river or creek flows which overtop banks and inundate floodplains.
Flood awareness	An appreciation of the likely threats and consequences of flooding and an understanding of any flood warning and evacuation procedures. Communities with a high degree of flood awareness respond to flood warnings promptly and efficiently, greatly reducing the potential for damage and loss of life and limb. Communities with a low degree of flood awareness may not fully appreciate the importance of flood warnings and flood preparedness and consequently suffer greater personal and economic losses.
Flood behaviour	The pattern / characteristics / nature of a flood.
Flooding	The State Emergency Service uses the following definitions in flood warnings: *Minor flooding:* causes inconvenience such as closing of minor roads and the submergence of low level bridges

	Moderate flooding: low-lying areas inundated requiring removal of stock and/or evacuation of some houses. Main traffic bridges may be covered. *Major flooding:* extensive rural areas are flooded with properties, villages and towns isolated and/or appreciable urban areas are flooded.
Flood frequency analysis	An analysis of historical flood records to determine estimates of design flood flows.
Flood fringe	Land which may be affected by flooding but is not designated as a floodway or flood storage.
Flood hazard	The potential threat to property or persons due to flooding.
Flood level	The height or elevation of flood waters relative to a datum (typically the Australian Height Datum). Also referred to as “stage”.
Flood liable land	Land inundated up to the probable maximum flood – flood prone land.
Floodplain	Land adjacent to a river or creek which is inundated by floods up to the probable maximum flood that is designated as flood prone land.
Flood Planning Levels	Are the combinations of flood levels and freeboards selected for planning purposes to account for uncertainty in the estimate of the flood level.
Flood proofing	Measures taken to improve or modify the design, construction and alteration of buildings to minimise or eliminate flood damages and threats to life and limb.
Floodplain Management	The coordinated management of activities which occur on flood liable land.
Floodplain Management Manual	A document by the NSW Government (2001) that provides a guideline for the management of flood liable land. This document describes the process of a floodplain risk management study.
Flood source	The source of the flood waters.
Floodplain Management Standard	A set of conditions and policies which define the benchmark from which floodplain management options are compared and assessed.
Flood standard	The flood selected for planning and floodplain management activities. The flood may be an historical or design flood. It should be based on an understanding of the flood behaviour and the associated flood hazard. It should also take into account social, economic and ecological considerations.
Flood storages	Floodplain areas which are important for the temporary storage of flood waters during a flood.
Floodways	Those areas of the floodplain where a significant discharge of flow occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if they are partially blocked, would cause significant redistribution of flood flows, or a significant increase in flood levels.
Freeboard	A factor of safety usually expressed as a height above the flood standard. Freeboard tends to compensate for the factors such as wave action, localised hydraulic effects and uncertainties in the design flood levels.
Geographical Information System	A form of computer software developed for mapping applications and data storage. Useful for generating terrain models and processing data for input into flood estimation models.

High hazard	Danger to life and limb; evacuation difficult; potential for structural damage, high social disruption and economic losses. High hazard areas are those areas subject to a combination of flood depth and flow velocity that are deemed to cause the above issues to persons or property.
Historical flood	A flood which has actually occurred – Flood of Record.
Hydraulic	The term given to the study of water flow in rivers, estuaries with coastal systems.
Hydrograph	A graph showing how a river or creek's discharge changes with time.
Hydrology	The term given to the study of the rain-runoff process in catchments.
Low hazard	Flood depths and velocities are sufficiently low that people and their possessions can be evacuated.
Management plan	A clear and concise document, normally containing diagrams and maps, describing a series of actions that will allow an area to be managed in a coordinated manner to achieve defined objectives.
Map Grid Australia	A national coordinate system used for the mapping of features on a representation of the earth's surface. Based on the geographic coordinate system 'Geodetic Datum of Australia 1994'.
Peak flood level, flow or velocity	The maximum flood level, flow or velocity occurring during a flood event.
Probable Maximum Flood	An extreme flood deemed to be the maximum flood likely to occur at a particular location.
Probable Maximum Precipitation	The greatest depth of rainfall for a given duration meteorologically possible over a particular location. Used to estimate the probable maximum flood.
Probability	A statistical measure of the likely frequency or occurrence of flooding.
Riparian Zone	Areas that are located adjacent to watercourses. Their definition is vague and can be characterised by landform, vegetation, legislation or their function.
Runoff	The amount of rainfall from a catchment which actually ends up as flowing water in the river of creek.
Stage hydrograph	A graph of water level over time.
Velocity	The speed at which the flood waters are moving. Typically, modelled velocities in a river or creek are quoted as the depth and width averaged velocity, i.e. the average velocity across the whole river or creek section.
Water Sensitive Urban Design	An approach to planning and design of urban development that aims to minimise the negative impacts on the natural water cycle. This design philosophy aims to protect the health of aquatic ecosystems by integrating "natural" features into the stormwater, water supply and sewage management of a development.

Appendices

Appendix A – Rouse Road Drainage Indicative Layout and Long Section

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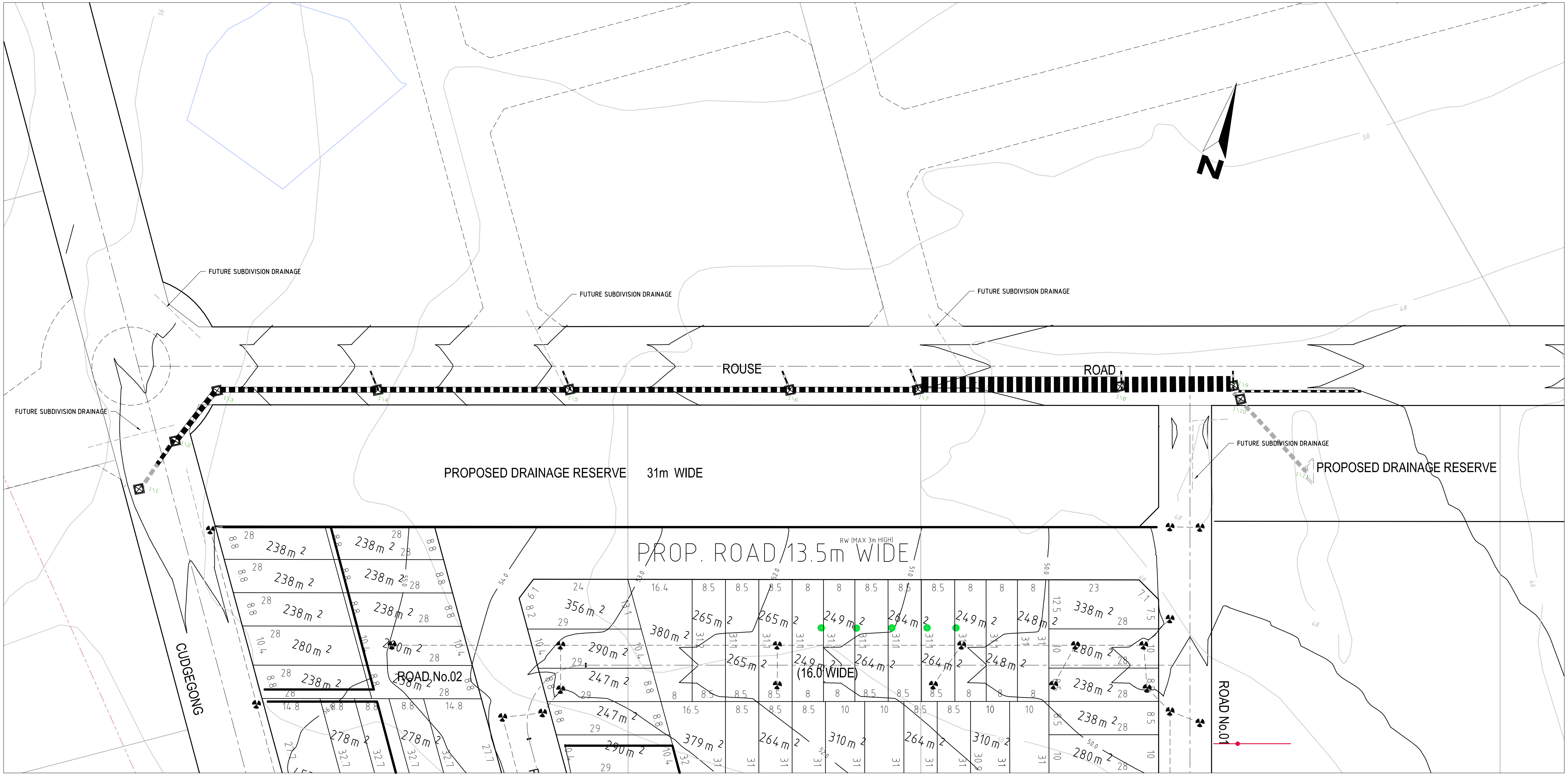


LEGEND

- DESIGN CONTOURS
- EXISTING CONTOURS
- PIT
- STORMWATER DRAINAGE NETWORK (ROAD)
- STORMWATER DRAINAGE (FUTURE)

ISSUE FOR INFORMATION

BROWN Smart Consulting

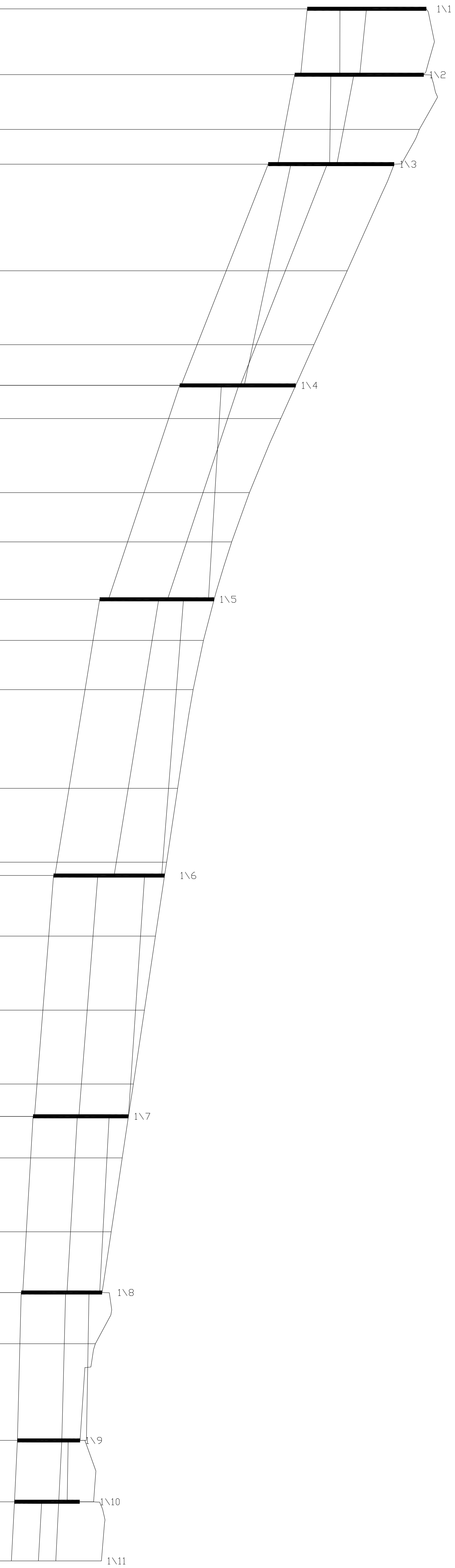
0 5 10 15 20 25 30 35 40 45 50
SCALE 1:500 (A1) SCALE 1:1000 (A3)

TITLE
CNR CUDGEGONG & ROUSE ROADS
PIPE CONCEPT DESIGN
DRAINAGE LAYOUT

DRAWING	DATE	REV
X13353-SK01	11/11/2014	01

Appendix B – Rouse Road Drainage Long Section – Developed Scenario

Chainage	Invert Level	Surface Level	HGL	Datum	Grade	Size	Flow
0	52.874	55.29	53.537	Datum EL 44	1.00%	1200mm	544L/s
	52.740		53.534				
13.37	52.620	55.239	53.353		1.90%	1200mm	2436L/s
24.46		55.15					
	52.275		53.330				
31.52	52.079	54.64	52.540				
53.14		53.69			3.93%	1200mm	3626L/s
68.14		53.01					
	50.314		51.596				
76.39	50.284	52.64	51.131				
83.14		52.33					
98.14		51.70			3.33%	1200mm	4395L/s
108.14		51.34					
	48.837		50.869				
119.80	48.660	50.985	50.362				
128.14		50.77					
138.14		50.56			1.62%	1200mm	5065L/s
158.14		50.24					
173.14	47.752	50.02	49.919				
175.83	47.722	49.977	49.571				
188.14		49.79			0.79%	1.8 x 0.9mm	7114L/s
203.14		49.57					
218.14		49.34					
	47.336		49.244				
224.70	47.306	49.24	48.851				
233.14		49.12			0.58%	1.8 x 0.9mm	6558L/s
248.14		48.89					
	47.097		48.661				
260.45	47.067	48.71	48.442				
270.83		48.57			0.25%	3.6 x 0.9mm	8615L/s
	46.991		48.390				
290.45	46.991	48.26	48.019		0.50%	3.6 x 0.9mm	8394L/s
	46.929		47.999				
302.89	46.929	48.255	47.482		0.50%	3.6 x 0.9mm	10066L/s
	46.869		47.416				
314.89							



Appendix C – Rouse Road Drainage Long Section – Increased Developed Scenario

Datum EL 44

Chainage	Invert Level	Surface Level	HGL	Grade	Size	Flow
0	52.874	55.29	53.736	1.00%	1200mm	557L/s
	52.740		53.733			
13.37	52.620	55.239	53.508	1.90%	1200mm	2514L/s
24.46		55.15				
	52.275		53.557			
31.52	52.079	54.64	52.569	3.93%	1200mm	4059L/s
53.14		53.69				
68.14		53.01				
	50.314		51.941			
76.39	50.284	52.64	51.314	3.33%	1200mm	5109L/s
83.14		52.33				
98.14		51.70				
108.14		51.34				
	48.837		50.985			
119.80	48.660	50.985	50.453	1.62%	1200mm	5209L/s
128.14		50.77				
138.14		50.56				
158.14		50.24				
173.14	47.752	50.02	49.985			
175.83	47.722	49.977	49.618	0.79%	1.8 × 0.9mm	7558L/s
188.14		49.79				
203.14		49.57				
218.14		49.34				
	47.336		49.244			
224.70	47.306	49.24	48.888	0.58%	2.1 × 0.9mm	7296L/s
233.14		49.12				
248.14		48.89				
	47.097		48.729			
260.45	47.067	48.71	48.485	0.25%	3.6 × 0.9mm	9122L/s
270.83		48.57				
	46.991		48.433			
290.45	46.991	48.26	48.098	0.50%	3.6 × 0.9mm	8524L/s
	46.929		48.074			
302.89	46.929	48.255	47.519	0.50%	3.6 × 0.9mm	11129L/s
	46.869		47.454			
314.89