Conclusion

As this study indicates, provision of overall open space within Ambarvale/Rosemeadow is considered adequate for current levels and to meet future population growth as a result of the proposed rezoning without generating additional demands in terms of open space requirements. That said, there will need to be ongoing discussions between Councils, Government agencies and community members in relation to mis-matched pressure on open space which results in certain areas being over-utilised and others being under-utilised. There are indications that, with effective planning and engagement, an appropriate balance of uses can be achieved. To take this a step further, an appropriate balance or diversity of uses will derive other positive benefits, in particular ensuring greater visual surveillance and less anti-social behaviour in relation to open space use. As this report outlines, positive community engagement around open space planning and improvement can also engender positive effects in terms of community-building around and community 'stewardship' of open space.

While engagement will be designed to address the needs of existing residents, any such processes will also need to meet the needs of incoming residents, hence the inclusion of a demographic overview of adjacent Fairfield and Liverpool Councils to more effectively target future stakeholder consultations regarding open space planning and provision.

The proposed rezoning is likely to engender benefits particularly in relation to an increased social mix leading to greater diversity and opportunities for community-building; affordable housing in a market where entry can be constrained and decreased opportunities for crime and anti-social behaviour (through improved design and street layout). These benefits can be embellished through the provision of employment and training opportunities for local young people during the construction phase, as well as the investigation by agencies of longer –term opportunities for traineeships and employment of young people in an area of high unemployment in regard to the maintenance of open space – not just in relation to playing fields, but also in relation to maintenance of road verges, bushland, etc.

Appendix C Stormwater Assessment

STORM_CONSULTING

Ambarvale & Rosemeadow

Preliminary Stormwater Plan

Report Prepared for:
Housing NSW

Project No. 1088

Prepared by:
STORM CONSULTING PTY LTD

Document Verification

Project title	Ambarvale & Rosemeadow	ACN 080 852 231 ABN 73 080 852 231
Document title	Preliminary Stormwater Plan	Project number 1088
Description		
Client Contact	Tom Goode (Urbis), Tina Chappell (Housing NSW)	

	Name	Signature	Issue:	Date
Prepared by	David Stone		C	14/10/10
Checked by	Mal Brown			
Issued by	David Stone			
Filename	X:\1088 Ambarvale & Rosemeadow Rezoning\Reports\1088 AmbRose SWReport v3a.docx			

Document History

	Issue A		Issue B		Issue C	
Issue to:	Date	No. Copies	Date	No. Copies	Date	No. Copies
Tom Goode	12/5/2010	.pdf	13/5/2010	.pdf	14/10/2010	.pdf

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1.0 INTRODUCTION

1.1. Background and Context

STORM CONSULTING (STORM) was engaged by Urbis/Housing NSW to prepare a Preliminary Stormwater Plan for areas within Rosemeadow and Ambarvale, NSW. The study area comprises the Rosemeadow and Ambarvale Estates, constructed in 1982.

A masterplan has been developed for both precincts yielding 170 lots at Rosemeadow and 453 lots at Ambarvale. This involves connection and upgrading of existing roads, civil works, upgrading of existing dwellings, creation of new lots, Torrens title subdivision, landscaping of gateway locations and rezoning of open space.

1.2. Report Objectives

The objective of this preliminary stormwater report is to provide sufficient information to allow assessment of the project under the Gateway Process. The Gateway Process, implemented by the NSW Government in July 2009, is used to give an early determination of project viability and as such the reporting is at a relatively high level. Sufficient detail is required to show that residential development is feasible.

As agreed with Council, no detailed modelling is required as part of the Planning Proposal for the Gateway assessment. This preliminary report is considered sufficient to show that the stormwater objectives can be achieved.

1.3. Scope

The following tasks were undertaken as part of this study:

- Site visit to inspect drainage features;
- Review of existing information;
- Liaison with Council to ascertain their stormwater requirements;
- Assessment of flow paths (drainage easements and overland flow path locations) and the adequacy of these to convey flood flows;
- Assessment of suitable areas for detention requirements with the aim of maintaining existing flow conditions;
- Assessment of suitable types of water quality treatment measures;
- Opportunities and constraints analysis of all this information in relation to environmental, social and economic impacts (multi-criteria assessment).

2.0 STORMWATER TARGETS

The proposed development is a combination of new development and redevelopment of existing housing. The objectives from a stormwater perspective are therefore not straightforward and will vary for the different development areas.

For **new development** in open space areas, appropriate targets are:

- Maintain peak flows at existing levels by providing detention;
- Provide water quality treatment measures to meet current NSW best practice. These targets (expressed as load reductions from developed levels) are currently:
  - 85% Total Suspended Solids
  - 65% Total Phosphorus
  - 45% Total Nitrogen
    (Managing Urban Stormwater – Environmental Targets, Consultation Draft 2007, DECCW)

For the **redevelopment** of existing housing areas:

- Peak flows will not be significantly altered and therefore detention should not be required;
- Stormwater quality will not be significantly altered and therefore stormwater treatment measures should not be required;
- Where the existing system is found to have problems (e.g. frequent flooding is occurring), it may be appropriate to consider implementing increased pipe capacity, detention and/or stormwater quality where appropriate opportunities exist.

Drainage design should be undertaken in accordance with '*Campbelltown (Sustainable City) Development Control Plan Volume 2 – Engineering Design for development*'.

3.0 AMBARVALE

3.1. Site Description

The proposed development area is situated at the top of a catchment which drains through Nurra Reserve and then flows into Park Central Wetlands, before ultimately discharging to the Georges River. It is bounded by Dickens Road to the east and south, Copperfield Drive to the west and Nurra Reserve to the north (Refer Figure 1).

There are two main arms of the proposed development, referred to here as the Eastern Arm and Western Arm.

The stormwater system for minor events consists of a piped drainage system. Major flood flows are conveyed overland, generally in the same corridor as the piped drainage system through open space areas. Detention for major flood flows is provided in a series of sports fields at Ambarvale Sports Complex, upstream of Park Central Wetlands.

3.2. Site Visit

A site visit was used to visually assess the stormwater features of the proposed development area at Ambarvale.

Both the eastern and western arms have similar drainage characteristics consisting of a piped drainage network and overland flow path generally running along the invert of a shallow valley.

The location of stormwater pits at the surface was used to infer the location of the existing piped drainage network. No detailed survey was undertaken and no information on the drainage network was available from Campbelltown City Council or Housing NSW.

The visible stormwater pits were observed to be in variable condition, ranging from good to significantly damaged and/or containing significant debris (e.g. car tyres). There was evidence of overland flows and/or surcharging at a number of pits.

Overland flow paths in the grassed areas were well maintained. Within the channel downstream of the proposed development there were significant amounts of rubbish/debris.

	Site Investigation Photographs
Existing conditions	 Plate 1: Eastern Arm (looking north east/downstream from Dickens Rd)  Plate 2: Western Arm (looking south west/upstream from approx. Steerforth Way)

	 Plate 3: Channel Downstream of South Western Arm (western edge of Nurra Reserve)
Drainage Infrastructure	 Plate 4: Typical Stormwater Pit in Nurra Reserve  Plate 5: Typical Stormwater Pit in Existing Road

3.3. Opportunities and Constraints

3.3.1. Stormwater Conveyance and Detention

The major stormwater constraint for this site is the location of the existing flow paths running through the invert of the valley for both development arms. In addition, the conversion of grassed open space to residential development will increase both the peak flows and total runoff volume which will need to be appropriately controlled.

Future studies will need to confirm the capacity of the existing pipe network and its ability to convey any increased flow generated by the development. The overland flow path properties needed to convey flood flows will also need to be determined. Depending on the final road alignment, both the pipe network and overland flow paths may be able to be contained within the road corridor or, if not, drainage easements will need to be provided. It is recommended that the

Detention, in order to maintain peak flows at their existing levels, is likely to be needed within the development. There may be sufficient capacity in the existing detention basins at the Ambarvale Sporting Complex to provide some or all of this. However, anecdotal evidence suggests they are already at capacity and may be undersized for existing development. Options for detention include individual On-Site Detention (OSD) tanks within the proposed lots, although this is not preferred by Council, or a detention basin at the downstream extents. Detention can also be included with stormwater quality treatment measures.

3.3.2. Stormwater Quality

For areas of new development, in order to meet stormwater quality requirements, appropriate treatment measures will be required. These can consist of source controls and/or 'end of line' measures. Source controls are incorporated within lots and the road network and 'end of line' measures are located at the downstream extents of the development.

Source controls can include measures such as tree pits and/or raingardens which can be incorporated into the road design. 'End of line' measures can include measures such as bioretention basins or wetlands at the downstream extents of the development. (Refer Appendix B for examples)

The downstream extents of the development provide good opportunities for 'end-of line' measures. Further investigation could also be undertaken into locating treatment measures further downstream at the northern end of Nurra Reserve.

For areas of redevelopment the opportunities for retrofitting stormwater quality measures are limited and generally much more expensive. However, opportunities may exist, such as during road reconstruction, to cost-effectively provide some source controls.

4.0 ROSEMEADOW

4.1. Site Description

The proposed development area is bounded by Copperfield Drive to the east, Cleopatra Drive to the north and Julius Road to the west and south (Refer Figure 2). The area currently consists of single dwelling residential lots with the exception of approximately 1.6 Ha of grassed open space in the south western corner.

The drainage system is divided roughly in half. The southern half of the site drains in an easterly direction towards Copperfield Drive, to a point just north of Thomas Rose Drive, and is then piped approximately 150 m before discharging into a concrete lined open channel in Rosemeadow Reserve. The northern half of the site drains in a north easterly direction towards the intersection of Cleopatra Drive and Copperfield Drive where it discharges into a concrete lined open channel. The two open channels combine a short distance downstream in Rosemeadow Reserve. The combined channel eventually discharges into Georges River.

4.2. Site Visit

A site visit was used to visually assess the stormwater features of the proposed development area at Rosemeadow.

The piped stormwater network conveys minor storm flows within the site. Overland flows are generally conveyed within the road corridors. A minor overland flow path exists in the open space area, conveying flows to Copperfield Drive. No significant problems with the system were observed.

No detailed survey was undertaken and limited information on the drainage network was available from Housing NSW. No information was available from Council.

	Site Investigation Photographs
	 Plate 1: Proposed Development of Open Space – Looking East from Julius Road

Plate 2: Proposed Development of Open Space – Looking West from Copperfield Drive

Plate 3: Copperfield Drive

Plate 4: Julius Road

Plate 5: Concrete Lined Drainage Channel in Rosemeadow Reserve

4.3. Opportunities and Constraints

4.3.1. Stormwater Conveyance and Detention

The conversion of 1.6 Ha of open space to residential development will increase both the peak flows and total runoff volume which will need to be appropriately controlled.

Future studies will need to confirm the capacity of the existing pipe network and its ability to convey any increased flow generated by the development (models will need to be submitted to Council for assessment). The majority of increased flows will be in the southern half of the development where the open space is proposed to be developed. This area drains to Copperfield Drive near Thomas Rose Drive. At the eastern end of the open space area a drainage easement or conveyance within the road corridor for overland flows will need to be provided.

Detention, in order to maintain peak flows at their existing levels, may be needed within the development. There are currently no detention facilities downstream of the development. Options for detention include individual On-Site Detention (OSD) tanks within the proposed lots, a detention basin at the low point (eastern end) of the open space area or potentially a facility in Rosemeadow Park could be investigated. Detention can also be included with stormwater quality treatment measures.

4.3.2. Stormwater Quality

For the new development area, in order to meet stormwater quality requirements, appropriate treatment measures will be required. These can consist of source controls and/or 'end of line' measures. Source controls are incorporated within lots and the road network and 'end of line' measures are located at the downstream extents of a development.

Source controls can include measures such as tree pits and/or raingardens within the road corridor. 'End of line' measures can include items such as bioretention basins or wetlands at the eastern end of the new development area. (Refer Appendix B for examples)

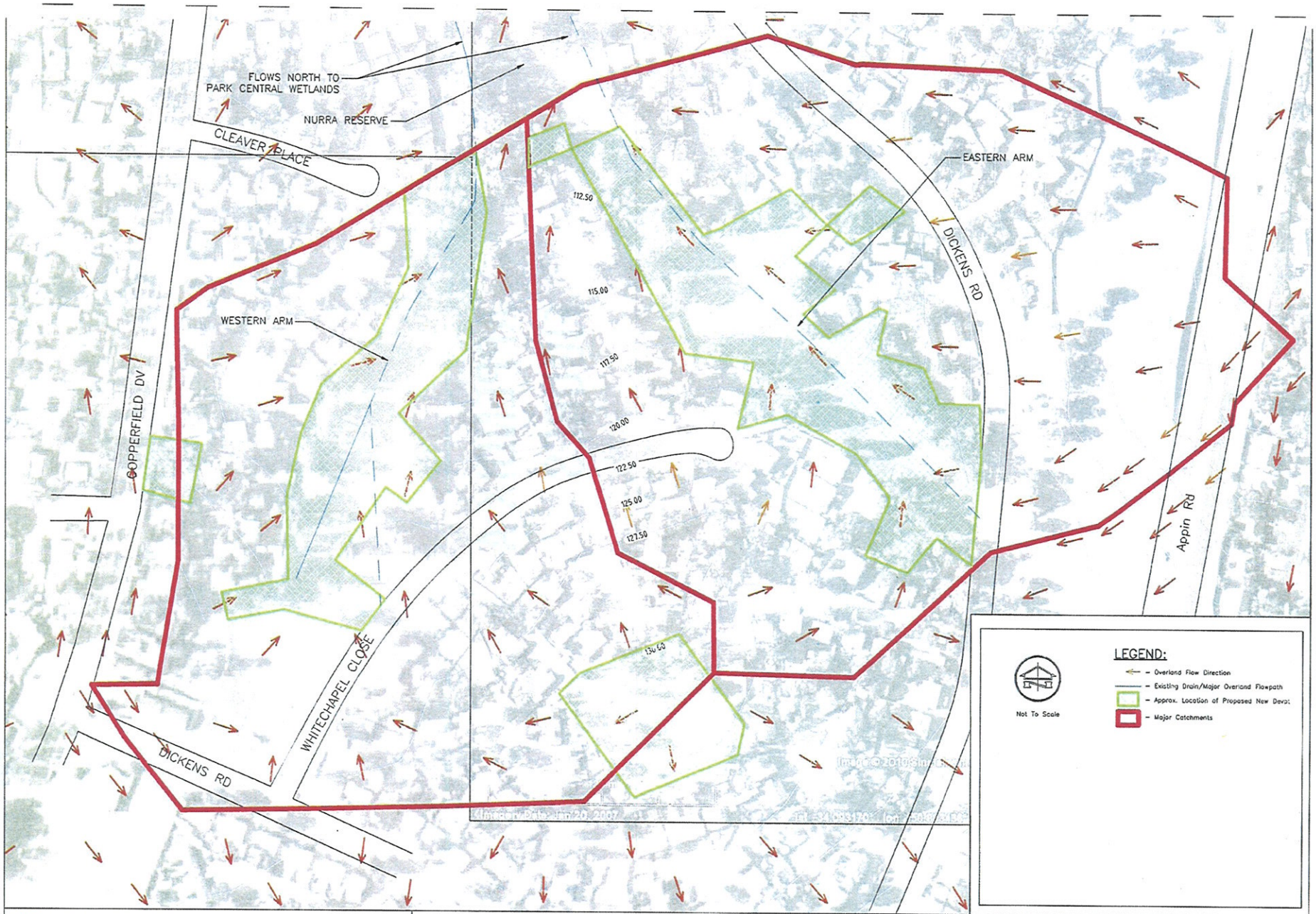
For areas of redevelopment, the opportunities for retrofitting stormwater quality measures are limited and generally much more expensive. However, opportunities may exist, such as during road reconstruction, to cost effectively provide some source controls.

4.4. CONCLUSION AND RECOMMENDATIONS

Both of the proposed development areas have no significant constraints that would prevent the proposed level of residential development occurring. There are a number of opportunities to provide stormwater conveyance, detention and stormwater quality treatment at both sites.

Further detailed investigations and assessment will be required as part of the rezoning and subdivision DA. These will need to identify limitations in the capacity of the existing stormwater system and determine any upgrades required. Investigations could also be extended to determine if there is capacity in existing detention structures to provide for some of the increased flows as a result of the open space development.

APPENDIX A
FIGURES



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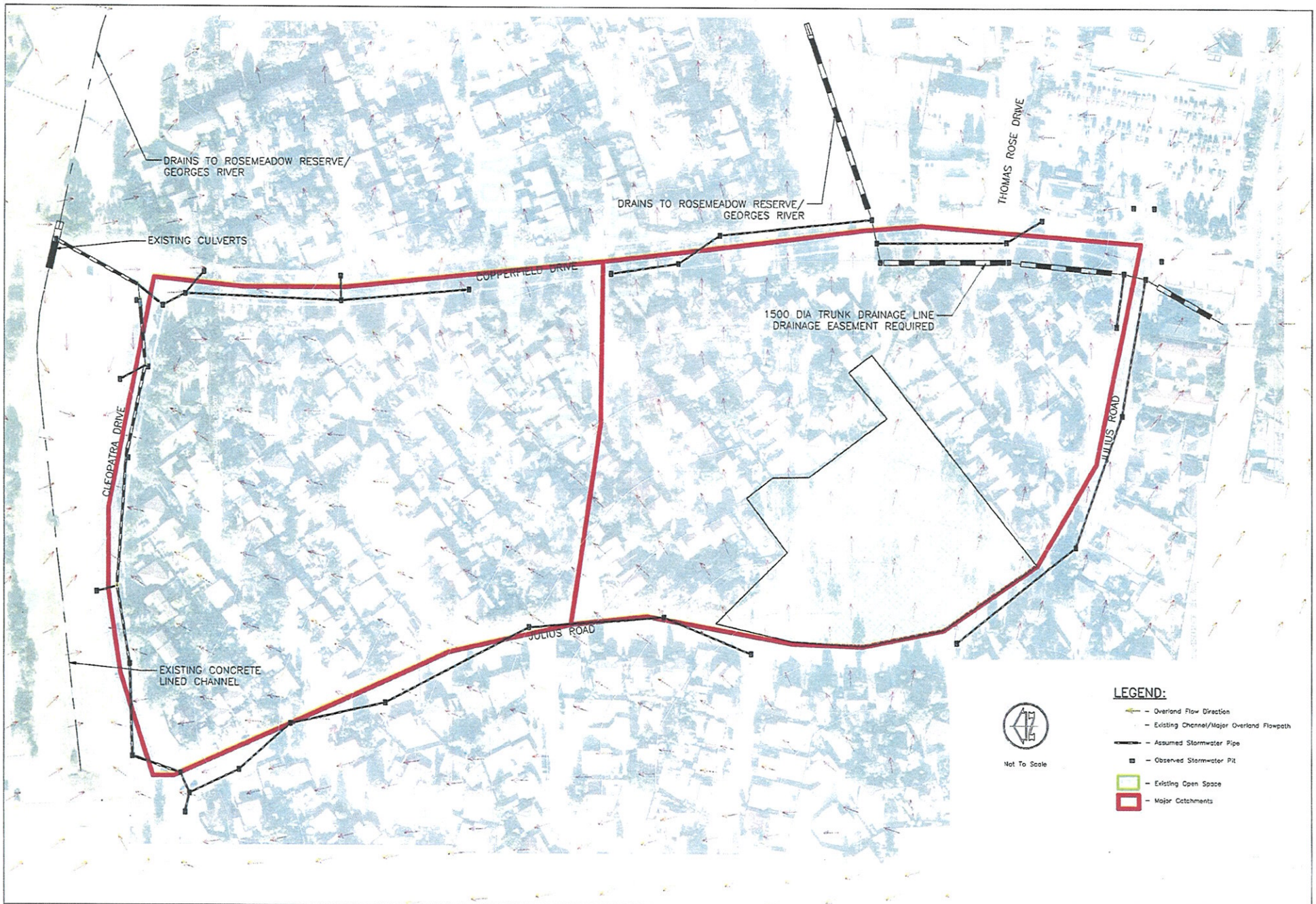
AMBARVALE CATCHMENT PLAN

Date 10.05.10

Figure 1



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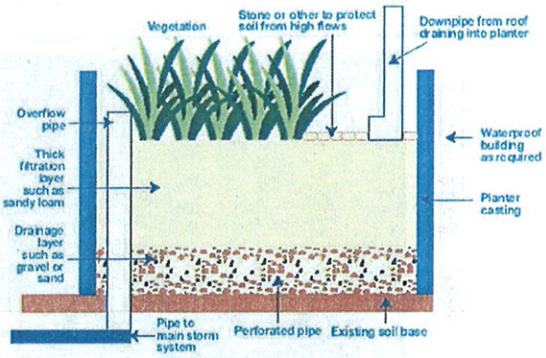
ROSEMEADOW CATCHMENT PLAN

Date 13.10.10

Figure 2

APPENDIX B
WATER QUALITY OPTIONS

System Type	Photographic examples
Source controls, rainwater tanks and rain gardens	 
Linear systems (bioretention trenches along roads)	

Pocket type systems (bioretention areas where road reserve allows)	 
End of Line Systems (wetlands and filter systems, the lower photo is of a sand filter that surcharges)