

Macquarie Park Floodplain Risk Management Study & Plan



*The November 1984 flood is the largest known flood in the study area.
This photo shows conditions in Ford Street, North Ryde*

Final Report
February 2011

CITY OF RYDE

Macquarie Park Floodplain Risk Management Study & Plan

Final Report
February 2011

Report of City of Ryde's
Macquarie Park Floodplain Management Committee, prepared by



Prepared by:

Bewsher Consulting Pty Ltd
6/28 Langston Place, Epping NSW 2121 Australia
P O Box 352, Epping NSW 1710 Australia
Telephone: (02) 9868 1966. Facsimile: (02) 9868 5759
Web: www.bewsher.com.au E-mail: postmaster@bewsher.com.au
ACN 003137068. ABN 24 312 540 210

The concepts and information contained in this document are the property of Bewsher Consulting Pty Ltd. Use or copying of this document in whole or part without the written permission of Bewsher Consulting Pty Ltd constitutes an infringement of copyright. This report has been prepared on behalf of and for the exclusive use of Bewsher Consulting Pty Ltd's client. Bewsher Consulting Pty Ltd accepts no liability or responsibility whatsoever in respect of any use of or reliance upon this report by any third party.

FOREWORD

In New South Wales the prime responsibility for local planning and the management of flood liable land rests with local government. To assist local government with floodplain management, the NSW Government has adopted a Flood Prone land Policy in conjunction with the *Floodplain Development Manual*.

The Policy is directed at providing solutions to existing flood problems and to ensure that new development is compatible with the flood hazard and does not create additional flood problems.

The Policy sets out four sequential stages in the development of a floodplain management plan:

- 1 Flood Study - Assessment to define the nature and extent of flooding.
- 2 Floodplain Risk Management Study - Comprehensive evaluation of management options with respect to existing and proposed development.
- 3 Floodplain Risk Management Plan - Formal adoption by Council of a management plan for floodplain risks
- 4 Implementation of the Plan - Measures undertaken to reduce the impact of flooding on existing development, and implementing controls to ensure that new development is compatible with the flood hazard.

This Floodplain Risk Management Study and Plan constitutes the second and third stages of the management process for Macquarie Park and has been prepared for the City of Ryde by Bewsher Consulting Pty Ltd.

In broad terms, this Floodplain Risk Management Study has investigated what can be done to minimise the effects of flooding in the Macquarie Park study area and has recommended a strategy in the form of a Floodplain Risk Management Plan.

The City of Ryde has commissioned the study with financial assistance from the NSW Government through the Department of Environment, Climate Change and Water (DECCW). This document does not necessarily represent the opinions of the NSW Government or the Department of Environment, Climate Change and Water.

The assistance of the Floodplain Risk Management Committee, Council and DECCW officers in preparing this report is gratefully acknowledged.

Council adopted this report on 1 February 2011.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	vii
1. INTRODUCTION	1
1.1 BACKGROUND	1
1.2 STUDY AREA	1
1.3 THE GOVERNMENT'S FLOODPLAIN MANAGEMENT PROCESS	3
1.4 REPORT STRUCTURE	4
2. BACKGROUND INFORMATION	5
2.1 DESCRIPTION OF THE CATCHMENT	5
2.2 HISTORY OF FLOODING	9
2.3 SOCIAL PROFILE	15
2.4 HERITAGE	15
3. COMMUNITY CONSULTATION	18
3.1 CONSULTATION PROCESS	18
3.2 FLOODPLAIN MANAGEMENT COMMITTEE	18
3.3 QUESTIONNAIRE	18
3.4 PUBLIC DISPLAY OF INUNDATION MAPS	20
3.5 WEB PAGE ON THE INTERNET	21
3.6 PUBLIC EXHIBITION OF DRAFT REPORT	22
4. FLOOD BEHAVIOUR SUMMARY	22
4.1 EXISTING FLOOD BEHAVIOUR	24
4.2 FLOOD RISK AND OVERLAND FLOW PRECINCTS	25
4.2.1 Introduction	25
4.2.2 Flood Risk Precincts	25
4.2.3 Overland Flow Precinct	26
4.2.4 Floodways	26
4.3 CLIMATE CHANGE SENSITIVITY TEST	28
4.3.1 Background	28
4.3.2 Method	28
4.3.3 Results	29
5. FLOOD DAMAGE ASSESSMENT	31
5.1 FLOOD DAMAGES DATABASE	31
5.2 TYPES OF FLOOD DAMAGE	33
5.3 BASIS OF FLOOD DAMAGES CALCULATIONS	34
5.3.1 Residential	34
5.3.2 Commercial	34
5.3.3 Building Failure	34
5.3.4 Infrastructure	35
5.3.5 Motor Vehicles	35
5.3.6 Social	35
5.4 ECONOMIC ANALYSIS	35
5.5 SUMMARY OF INUNDATION PATTERNS	36
5.6 SUMMARY OF CALCULATED DAMAGES	41

TABLE OF CONTENTS

	Page
6. EVALUATION OF FLOODPLAIN MANAGEMENT MEASURES.....	43
6.1 CULLODEN CREEK CATCHMENT.....	49
6.1.1 Marsfield Park Detention Basin.....	49
6.1.2 Improve Waterloo Road Drainage.....	49
6.1.3 Waterloo Park Detention Basin.....	49
6.2 MARS CREEK CATCHMENT.....	51
6.2.1 Culloden Road (West) Overland Flow Works.....	51
6.2.2 Improve Epping Road Drainage.....	51
6.2.3 Improve Talavera Road Drainage.....	52
6.3 UNIVERSITY CREEK CATCHMENT.....	54
6.3.1 Dunbar Park Detention Basin Enhancements.....	54
6.3.2 Improve Epping Road Drainage.....	56
6.3.3 Improve Talavera Road Drainage.....	56
6.3.4 Improve M2 Drainage.....	57
6.4 SHRIMPTONS CREEK CATCHMENT.....	58
6.4.1 Granny Smith Memorial Park Detention Basin.....	58
6.4.2 Crotoye Place/Danbury Close/Herring Road Area Works.....	59
6.4.3 Mason Street Options.....	61
6.4.4 Cecil Street/Macquarie Place Area Options.....	61
6.4.5 Rocca Street Overland Flow Path.....	61
6.4.6 Heath Street/Stephen Avenue Works.....	62
6.4.7 Santa Rosa Park Overland Flow Path.....	62
6.4.8 Smalls Road Detention Basin.....	67
6.4.9 Fawcett Street Overland Flow Path.....	67
6.4.10 Brendon Street Sag Point Works.....	67
6.4.11 Ford Street Overland Flow Path.....	67
6.4.12 North Ryde Golf Club Detention Basin.....	68
6.4.13 Shrimptons Creek Rehabilitation.....	68
6.4.14 Parklands Road Overland Flow Path.....	69
6.4.15 Peachtree Road Overland Flow Path.....	69
6.4.16 Macquarie Shopping Centre Options.....	70
6.5 INDUSTRIAL CREEK CATCHMENT.....	72
6.5.1 Epping Road Flyover Embankment Options.....	72
6.5.2 Formalise Overland Flow Paths during Redevelopment.....	74
6.5.3 Rogal Place, Fontenoy Road and Tuckwell Place Options.....	75
6.6 PORTERS CREEK CATCHMENT.....	76
6.6.1 Avon Road Options.....	76
6.6.2 Morshead Street – Epping Road Area Options.....	76
6.6.3 ‘Officeworks’ to M2 Drainage Upgrade.....	81
6.6.4 Formalise Overland Flow Paths during Redevelopment.....	81
6.6.5 Improve Access to SES Headquarters.....	82
6.7 LANE COVE CATCHMENT.....	85
6.7.1 Improve Drainage at Pittwater Road Sag Point.....	85
6.7.2 River Avenue VP Scheme.....	85
6.7.3 Improve Access to River Avenue.....	88

TABLE OF CONTENTS

	Page
6.8 OTHER FLOODPLAIN MANAGEMENT MEASURES	89
6.8.1 Voluntary House Raising/Redevelopment	89
6.8.2 Flood-proofing	90
6.8.3 Planning and Development Controls	91
6.8.4 Improve Flood Warning System	91
6.8.5 Improve Emergency Management Planning	92
6.8.6 Improve Public Flood Readiness	94
7. FLOODPLAIN RISK MANAGEMENT PLAN	96
7.1 RECOMMENDATIONS	96
7.2 PRIORITISED MEASURES	96
7.3 FUNDING AND IMPLEMENTATION	97
7.4 ON-GOING REVIEW OF PLAN	98
8. REFERENCES	102
9. GLOSSARY	104
10. FREQUENTLY ASKED QUESTIONS	108

LIST OF APPENDICES

APPENDIX A – FLOOD DAMAGES DATABASE

APPENDIX B – FLOOD DAMAGES SPREADSHEET

**APPENDIX C – EXTRACTS FROM WATER SENSITIVE URBAN DESIGN REPORT
(EDAW, 2009)**

LIST OF TABLES

	Page
TABLE 2.1 – STUDY CATCHMENT AREAS AND STORMWATER ASSETS	5
TABLE 2.2 – CENSUS DATA FOR CITY OF RYDE	16
TABLE 2.3 – HERITAGE ITEMS WITHIN THE STUDY AREA	17
TABLE 3.1 – MEETINGS OF MACQUARIE PARK FLOODPLAIN RISK MANAGEMENT COMMITTEE	19
TABLE 5.1 – INFORMATION PROVIDED BY SURVEYOR	31
TABLE 5.2 – ATTRIBUTES RECORDED IN FLOOD DAMAGES DATABASE	32
TABLE 5.3 – BUILDINGS INUNDATED BY DESIGN EVENT AND STYLE OF INUNDATION	37
TABLE 5.4 – BUILDINGS INUNDATED BY CATCHMENT	37
TABLE 5.5 – INUNDATION DEPTHS FOR RESIDENTIAL BUILDINGS AFFECTED BY THE 100 YEAR FLOOD	39
TABLE 5.6 – INUNDATION DEPTHS FOR COMMERCIAL & INDUSTRIAL BUILDINGS AFFECTED BY THE 100 YEAR FLOOD	39
TABLE 5.7 – 100 YEAR INUNDATION DEPTHS AT MAJOR ROADS	40
TABLE 5.8 – PREDICTED TOTAL FLOOD DAMAGES UNDER EXISTING CONDITIONS	41
TABLE 5.9 – COMPONENTS OF FLOOD DAMAGE FOR THE MACQUARIE PARK STUDY AREA (AAD)	42
TABLE 6.1 – EXPLANATION OF ASSESSMENT SCORES FOR QUALITATIVE ASSESSMENT MATRIX	45
TABLE 6.2 – QUALITATIVE MATRIX ASSESSMENT OF FLOODPLAIN RISK MANAGEMENT OPTIONS	46
TABLE 6.3 – BALANCED ONE HOUR TRAFFIC COUNTS AT ROAD SAG POINTS, YEAR 2007	50
TABLE 6.4 – OVERLAND FLOWS FROM NORTH RYDE GOLF COURSE	68
TABLE 6.5 – BUREAU OF METEOROLOGY WARNING SERVICES OF POTENTIAL BENEFIT IN FLASH FLOOD CATCHMENTS	92
TABLE 7.1 – MACQUARIE PARK FLOODPLAIN RISK MANAGEMENT PLAN	99

LIST OF FIGURES

	Page
FIGURE 1.1 – STUDY AREA	2
FIGURE 1.2 – THE FLOODPLAIN MANAGEMENT PROCESS	3
FIGURE 2.1 – DIGITAL ELEVATION MODEL, MACQUARIE PARK CATCHMENTS	6
FIGURE 2.2 – LONGITUDINAL PROFILES OF SHRIMPTONS CREEK TRIBUTARIES	7
FIGURE 2.3 – LEP2008 ZONES, MACQUARIE PARK CATCHMENTS	8
FIGURE 2.4 – FLOOD PHOTOS FROM MACQUARIE PARK STUDY AREA	10
FIGURE 2.5 – FLOODS EXPERIENCED BY COMMUNITY	13
FIGURE 2.6 – DISTRIBUTION OF GARAGES INUNDATED AND ROADS CUT (FROM QUESTIONNAIRE)	14
FIGURE 3.1 – COMMUNITY VIEWS OF FLOODPLAIN MANAGEMENT OPTIONS	19
FIGURE 3.2 – MACQUARIE PARK WEB-PAGE	21
FIGURE 4.1 – FLOOD RISK AND OVERLAND FLOW PRECINCTS	27
FIGURE 4.2 – CLIMATE CHANGE SENSITIVITY TEST	30
FIGURE 5.1 – TYPES OF FLOOD DAMAGE	33
FIGURE 5.2 – BUILDINGS INUNDATED IN EVENTS UP TO THE 100 YEAR FLOOD	38
FIGURE 5.3 – ESTIMATED FLOOD DAMAGES BY DESIGN EVENT	42
FIGURE 6.1 – CULLODEN CREEK CATCHMENT PHOTOS	50
FIGURE 6.2 – MARS CREEK CATCHMENT PHOTOS	53
FIGURE 6.3 – UNIVERSITY CREEK CATCHMENT PHOTOS	55
FIGURE 6.4 – PROPOSED WORKS AT DANBURY CLOSE AND HERRING ROAD	60
FIGURE 6.5 – SHRIMPTONS CREEK CATCHMENT PHOTOS	63
FIGURE 6.6 – PROPOSED WORKS AT ROCCA STREET AND SANTA ROSA PARK	66
FIGURE 6.7 – INDUSTRIAL CREEK CATCHMENT PHOTO	72
FIGURE 6.8 – HYDRAULIC EFFECT OF EPPING ROAD FLYOVER, INDUSTRIAL CREEK	73
FIGURE 6.9 – PORTERS CREEK CATCHMENT PHOTOS	77
FIGURE 6.10 – PORTERS CREEK FLOOD PROFILE FROM MORSHEAD STREET TO EPPING ROAD	79
FIGURE 6.11 – MODELLED 100 YEAR HYDROGRAPHS FOR OVERLAND FLOW AT WICKS ROAD UNDERPASS	82
FIGURE 6.12 – OPTIONS FOR IMPROVING ACCESS TO AND FROM SES HEADQUARTERS	84
FIGURE 6.13 – PROFILE AT PITTWATER ROAD SAG POINT	86
FIGURE 6.14 – LANE COVE CATCHMENT PHOTOS	87
FIGURE 6.15 – MODELLED 100 YEAR HYDROGRAPH FOR LANE COVER RIVER NEAR RIVER AVENUE	88
FIGURE 6.16 – MACQUARIE UNIVERSITY PHOTOS	93
FIGURE 7.1 – RECOMMENDED MEASURES	101

EXECUTIVE SUMMARY

Bewsher Consulting Pty Ltd are specialist flood risk management consultants who were commissioned by the City of Ryde, with financial assistance from the Department of Environment, Climate Change and Water (DECCW), to prepare a Floodplain Risk Management Study and Plan for the Macquarie Park study area. This area consists of the Mars Creek, Shrimptons Creek, Industrial Creek, Porters Creek and Lane Cove catchments, as well as the floodplain of the Lane Cove River itself downstream from Fullers Bridge next to River Avenue.

The study was overseen by the Macquarie Park Floodplain Risk Management Committee, which includes councillors and staff from the City of Ryde, officers from DECCW, the State Emergency Service (SES), the Transport Construction Authority (formerly the Transport Infrastructure Development Corporation), AMP Capital (owners of Macquarie Shopping Centre), Macquarie University, Macquarie Goodman, and a number of community representatives.

Principal Outcomes

The principal elements of this study include:

- ▶ A description of the study area including a history of flooding (**Chapter 2**);
- ▶ A summary of the community consultation undertaken for this study (**Chapter 3**);
- ▶ A summary of the *Macquarie Park Flood Study*, the estimation of Flood Risk Precincts and an Overland Flow Precinct used for planning and development control, and the report of a climate change sensitivity test (**Chapter 4**);
- ▶ Definition of the flood problem by construction of a Flood Damages Database, which quantifies flood damages and records information on existing potentially flood affected properties within the study area; it was found that 101 dwellings are subject to mostly shallow above-floor inundation in the 100 year event; the average annual damages are calculated as \$3.9M (**Chapter 5**);
- ▶ A detailed evaluation of potential floodplain management measures to reduce flood damages to existing development (**Chapter 6**);
- ▶ A recommended Floodplain Risk Management Plan (FRMP) for the Macquarie Park catchments (**Chapter 7**).

The Floodplain Risk Management Plan

The Macquarie Park FRMP is presented in **Table 7.1** and **Figure 7.1**. The recommended measures have been selected from a range of available measures, after an assessment of the impacts of flooding, as well as environmental, social and economic considerations.

The recommended measures have been categorised into high, medium-high, medium, medium-low or low priorities, which reflects the ease with which the measure can be implemented and the value for money:

High Priority

- ▶ Maintain integrity of existing Dunbar Park detention basin;
- ▶ Scoping study to assess feasibility of enlarging detention basin in Macquarie Uni to improve Talavera Road drainage at University Creek;
- ▶ Routinely maintain drainage pits, especially in the catchment above the Doig Avenue shops;
- ▶ Brendon Street sag point works;
- ▶ Rehabilitate Shrimptons Creek riparian corridor;
- ▶ Study to address micro-scale influences on inundation regime at Rogal Place/ Fontenoy Road/ Tuckwell Place, Macquarie Park;
- ▶ Remove shrubs from entrance to 'Officeworks' culvert inlet and maintain as short grass cover (*property owner*);
- ▶ Arrange MOU between SES, Council and Hills Motorway to ensure emergency access to and from SES LHQ via Porters Creek Depot (*SES*);
- ▶ Continue and promote the River Avenue VP scheme, and remove three dwellings with a high flood risk from the floodplain (*Office of Strategic Lands*);
- ▶ Arrange MOU between SES and Northern Suburbs Crematorium to ensure emergency access to River Avenue via Quebec Road (*SES*);
- ▶ Add planning matrix for Macquarie Park to draft floodplain management DCP provisions;
- ▶ Prepare City of Ryde Local Flood Plan (*SES*);
- ▶ Prepare Macquarie University Flood Emergency Plan (*MU*);

- ▶ Prepare Macquarie Shopping Centre Flood Emergency Plan (*AMP Capital*); and
- ▶ Consolidate flood data into Council's GIS.

Medium-High Priority

- ▶ Overland flow works in Danbury Close/Herring Road area including VP of one property; and
- ▶ Prepare a brochure summarising potential flood-proofing techniques and distribute.

Medium Priority

- ▶ Improve Waterloo Road drainage by lowering downslope ground levels;
- ▶ Create detention basin at Waterloo Park;
- ▶ Improve Epping Road drainage at Mars Creek by lowering median strip and downslope verge;
- ▶ Improve Epping Road drainage at University Creek by lowering median strip;
- ▶ Overland flow works in Santa Rosa Park;
- ▶ Create detention basin at North Ryde Golf Club;
- ▶ Overland flow works at rear of Peachtree Road units;
- ▶ Consider opportunities to increase conduit capacity through Macquarie Centre during redevelopment;
- ▶ Install debris control structure upstream of Shrimptons Creek culvert at Waterloo Road;
- ▶ Improve Pittwater Road drainage by lowering downslope ground levels;
- ▶ Invite owners of two properties to redevelop in flood-compatible manner with \$50K Government subsidy;
- ▶ Provide flood certificates at regular intervals; and
- ▶ Prepare FloodSafe brochure for Macquarie Park (*SES*).

Medium-Low Priority

- ▶ VP five properties upslope of Epping Road flyover embankment and redevelop; and
- ▶ VP at least four properties upslope of Epping Road at Porters Creek and redevelop.

Low Priority

- ▶ Improve Talavera Road drainage at Mars Creek by drainage upgrade;
- ▶ Overland flow works in Rocca Street including VP of one property;
- ▶ Formalise Industrial Creek overland flow paths during redevelopment;
- ▶ Upgrade drainage between Officeworks and M2 during redevelopment; and
- ▶ Formalise Porters Creek overland flow paths during redevelopment.

Funding

The total capital cost of implementing the Plan is estimated to be \$10.7M, with \$65K annual maintenance costs. The timing of proposed works will depend on overall budgetary commitments of Council and the availability of funds from other sources. It is envisaged that the Plan would be implemented progressively over a 5 to 10 year time frame.