



MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

**Parramatta City Council
Auburn City Council
Bankstown City Council**



**Duck River Catchment
Floodplain Risk Management
Plan**

Final Report



Duck River Catchment Floodplain Risk Management Plan

FINAL REPORT

for

Parramatta City Council
Auburn City Council
Bankstown City Council

by

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1 INTRODUCTION

1.1 CONTEXT OF STUDY

The NSW Government has a Flood Policy that is directed at providing solutions to existing flooding problems in developed areas, and ensuring that new developments are compatible with the flood hazard and do not exacerbate existing flooding or create additional flooding problems in other areas. Under the Policy, the management of flood prone land remains the responsibility of local government. To facilitate this, the NSW Government published the "Floodplain Development Manual: the management of flood liable land," (the Manual), to provide guidance to Councils in the implementation of the Policy. The NSW Government also provides funding in support of floodplain management programs.

The Manual describes a floodplain risk management process comprising the following stages:

<i>1 Flood Study</i>	Determines the nature and extent of the flood problem for the full range of flood events
<i>2 Floodplain Risk Management Study</i>	Evaluates management options for the floodplain with respect to both existing and future development.
<i>3 Floodplain Risk Management Plan (This Report)</i>	Involves formal adoption by Council of a plan of management for the floodplain.
<i>4 Implementation of the Plan</i>	Involves construction of flood mitigation works, where viable, to protect existing development. Uses planning controls to ensure that future development, including redevelopment, is compatible with flood hazards.
<i>5 Review of Plan</i>	Review of plan to ensure it remains current and appropriate. A review is normally carried out after 10 years.

Parramatta, Auburn and Bankstown City Councils have prepared this report with financial assistance from the NSW Government through its Floodplain Management Program. The preparation of this report has been overseen by the Office of Environment and Heritage; however this report does not necessarily represent the opinions of the NSW Government or the Office of Environment and Heritage.

1.2 BACKGROUND

In early 2009, Parramatta City Council (PCC), Bankstown City Council (BCC) and Auburn City Council (ACC) developed a partnership to manage flooding across the Duck River Catchment. It was agreed that PCC would be the lead Council, and be responsible for administering contractual arrangements for the project.

In April 2009, PCC put out a request for quotation for the Duck River Catchment Floodplain Risk Management Study and Plan (FRMS&P) (hereafter "The Study" and "The Plan"). In May 2009, PCC engaged consultants Molino Stewart to prepare the Study and Plan. The Study brings together the relevant data from previous studies into a comprehensive set of possible management measures for the three Councils participating in the project. Some relevant data was also commissioned during the Study preparation to fill data gaps.

The Plan (this report) considers the information in the Study and provides a guide as to the actions the three Councils of the Duck River Catchment intend to reduce the risks of flooding in the Catchment. The Plan should be read in conjunction with the following reports:

- Duck River and Duck Creek Flood Study Review (WMAWater, 2010).
- Duck River Stormwater Catchment Flood Study and addendum (Bewsher/BMT WBM, June 2007 and BMT WBM addendum of 2009) and Wolumba Stormwater Catchment Study (BMT WMB, 2010).

2 THE NEED FOR THE PLAN

2.1 OBJECTIVES

The overall objective of this Plan is to develop a long-term approach to the study area that addresses the existing and future flood risks in accordance with the general desires of the community and in line with the principles and guidelines laid out in the Manual. This will ensure that the following broad needs are met:

- Reduce the flood hazard and risk to people and property, now and in the future;
- Protect, maintain and where possible enhance the river and floodplain environment; and
- Ensure floodplain risk management decisions integrate the social, economic and environmental considerations.

2.2 THE STUDY AREA

The Duck River catchment covers an area of approximately 42 square kilometres and incorporates parts of the Auburn, Bankstown, Holroyd and Parramatta Local Government Areas (LGA's). Apart from its own catchment, Duck River also receives flows from Duck Creek, Little Duck Creek and A'Becketts Creek, which are all located in PCC LGA. The study area for this consultancy covers only the PCC, BCC and ACC (LGAs) (see Figure 1). Holroyd City Council (HCC) elected not to participate in the study, therefore the upper section of A'Becketts Creek is not included in the Plan.

The Duck River catchment generally flows north/south with the eastern and western sides being moderately sloping; it becomes flatter towards the downstream reach from Parramatta Road to its confluence with Parramatta River near Silverwater Bridge. The Duck River catchment is heavily urbanised.

The catchment areas of the major sections of Duck River are:

- The upper Duck River catchment (approximately 9 km²) within BCC LGA;
- The lower Duck River catchment (approximately 17 km²) within PCC and ACC LGAs;
- The Duck Creek and Little Duck Creek catchments (approximately 9 km²) within PCC and HCC LGAs; and
- The A'Becketts Creek catchment (approximately 7 km²) within PCC and HCC LGAs.

The Duck River commences in the suburb of Yagoona West in BCC LGA and the drainage path travels in a northerly direction through the suburbs of Birrong and Sefton before crossing under the Sydney Water pipeline (SWP) which forms the boundary between BCC and PCC/ACC LGAs. Within BCC the catchment is generally residential, with some industrial development occurring between the railway and the SWP.

Two sub-catchments have been defined within BCC - that of Duck River and the smaller sub-catchment of Wolumba.

The headwaters of the Duck River catchment within BCC LGA drain by overland flow and a pit and pipe network. As the catchment area increases, the pipes discharge to either concrete lined drainage channels or the natural creek of the Duck River. There are approximately five kilometres of open channel system with the channel / creek becoming wider as the upstream catchment increases. At road crossings and the railway crossing the creek is constrained by culverts.

Downstream of the SWP, the channel is in a semi natural state (unlined) and it is crossed by several bridges and pipelines. PCC is on the western side and ACC on the east. In places the channel is deeply incised and anecdotal evidence suggests that, in places, the floodplain has been filled or

landscaped for sporting fields or areas of open space. The main channel is vegetated to varying extents and in places extensive bank re-vegetation has occurred. In the lower parts the channel is lined by mangroves.

In this reach, the Duck River corridor contains regionally significant areas of natural bushland and wildlife habitat, interspersed amongst numerous sports fields and areas of open space used for passive recreation (Norford, Hislop, Everley, Progress, Oriole and Mona Parks, Ray Marshall Reserve, Horylck Reserve, Rosnay Golf Course and the Auburn Botanic Gardens).

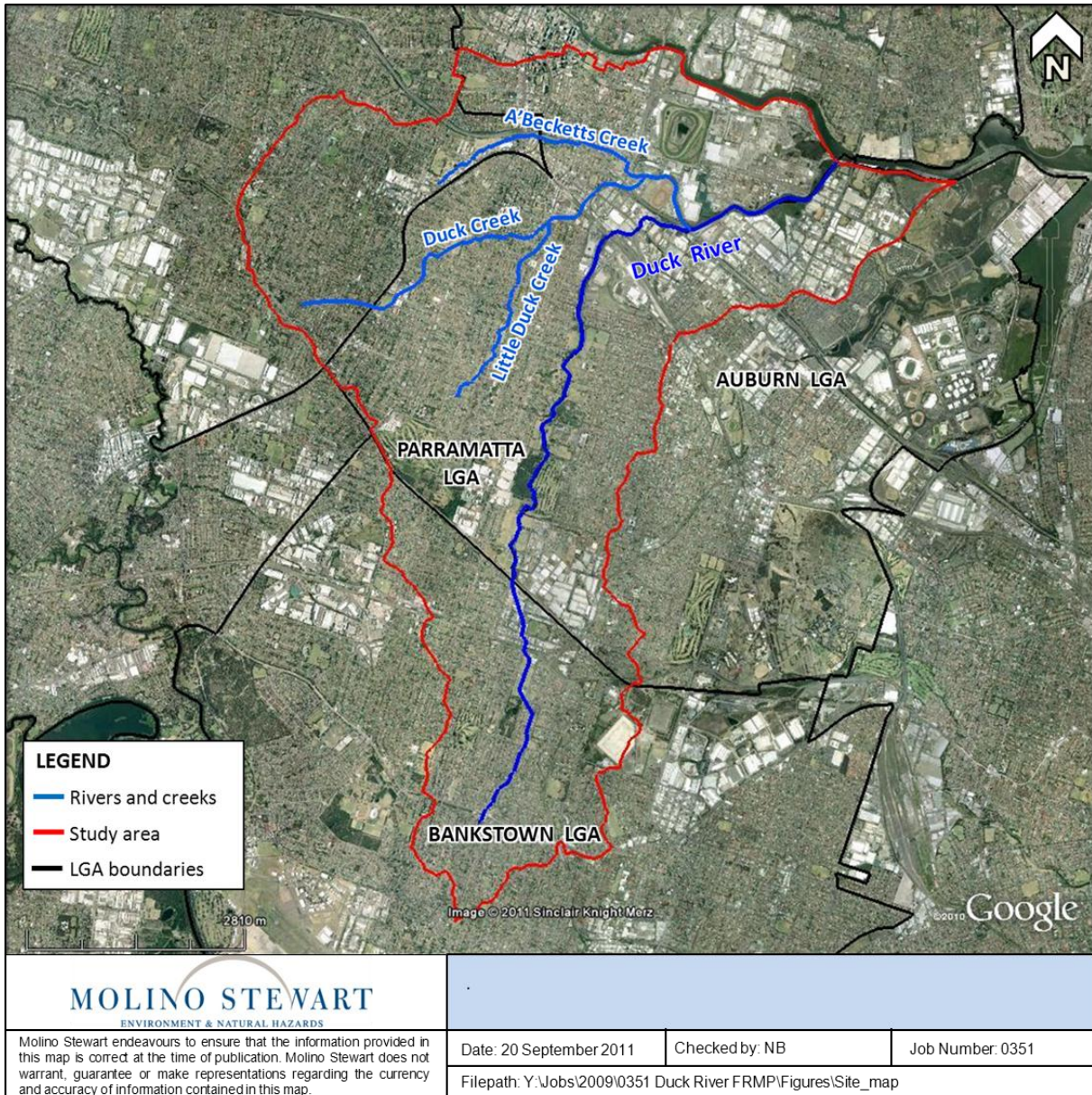


Figure 1 - Duck River Floodplain Risk Management Study - Study Area

In the lower reaches, the river corridor is a more urbanised landscape and has significant commercial and industrial areas including Camellia and South Granville. The residential areas encroach on the fringes of the floodplain with industrial developments fronting the channel from upstream of the Main Western Railway to its junction with the Parramatta River upstream of Silverwater Road.

The Duck River catchment within ACC is divided into smaller (unnamed) sub-catchments. The catchment has mixed industrial and residential area. The main industrial areas that contribute to the catchments are Regents Park industrial park, Clyde marshalling yard and Silverwater.

Development within the catchment is predominately detached residential developments with higher density villa and unit developments in parts. There is considerable industrial development in the lower parts and scattered commercial development throughout.

The catchment west of the main Southern Railway is within HCC. Duck Creek and Little Duck Creek have similar sized catchments to their confluence upstream of the main southern railway. Both catchments are largely occupied by medium to high density residential areas (Reference 2) and drained by lined open channels. The channel transitions from concrete lined to natural downstream of the M4 Western Motorway.

A'Becketts Creek is within the PCC LGA downstream of the western rail line as it passes under the M4 Western Motorway. The land to the north of the creek is largely medium to high density residential with the land to the south medium density residential with commercial developments along Parramatta Road. The creek is lined upstream of the Carlingford railway line. Downstream of the Carlingford railway A'Becketts Creek joins with Duck Creek and further downstream it joins the Duck River.

2.3 FLOOD DATA

There have been a number of previous Flood Studies within the Duck River catchment and while these earlier studies provided significant input to the work recorded in this Report, the principal sources of flood data and mapping was based on Duck River and Duck Creek Flood Study Review (WMAWater 2010), Duck River Stormwater Catchment Flood Study and addendum (Bewsher/BMT WBM, June 2007 and BMT WBM addendum of 2009) and Wolumba Stormwater Catchment Flood Study (BMT WBM 2010).

The following sections provide a short summary of these flood studies.

2.3.1 Flood Studies

a) Parramatta / Auburn

As part of the Duck River Floodplain Risk Management Study, a review of the previous Flood Studies was undertaken. The principal reasons for this review were to ensure:

- Consistency in the approach within the Parramatta City Council and Auburn Council local government areas (LGA); and
- Results were compatible with the approach adopted within BCC LGA.

The Flood Study Review revealed some inconsistencies within the existing studies and models because they had been carried out by different organisations for different purposes over more than 20 years. Modelling techniques and technologies have changed substantially over that time. Following detailed analysis and resolution of the identified issues, WMAwater established a TUFLOW hydraulic model for the main channel of Duck River and Duck Creek within PCC and ACC LGAs which is consistent with the model and assumptions used for the recently completed Flood Study for the Duck River and Wolumba catchments in Bankstown LGA.

b) Bankstown

BMT WBM was commissioned by BCC through Bewsher Consulting to undertake a stormwater runoff study of the Duck River catchment within BCC. They were also subsequently commissioned by BCC to do a similar study for the Wolumba catchment.

The studies included the development of relevant computer models within the catchment, which will assist Council in managing flooding within the catchments.

The first stage of the study focused on the MIKESTORM model development – to determine the flow rates and water levels in the pits and pipes stormwater runoff system as well as providing approximations of overland flood flows.

The second stage of the study focused on the TUFLOW hydraulic model development. TUFLOW includes the computing capabilities of the MIKESTORM model with the additional capability of two-dimensional mapping of the flood results. The model outputs and scale as well as the computing intensity of the TUFLOW model make it a suitable tool for floodplain management purposes.

The two models included all the stormwater pits and pipes in the catchment, the creeks and open drains, and the floodplain topography and characteristics. It determined the flood extents, water levels and velocities for the 1 year, 2 year, 5 year, 10 year, 20 year, 50 year and 100 year average recurrence interval (ARI) flood events and the PMF for the Duck River catchment. The Wolumba study looked at the 20, 50, 100, 200, 500 1000 year ARI flood events and the PMF. Provisional flood hazards were defined for the 100 year flood event.

The Flood Studies within BCC were deemed to be “fit for purpose”.

c) Overall

The Bankstown models by BMT WMB and the PCC / ACC model prepared by WMAWater have been deemed suitable for application to the Floodplain Risk Management process. These effectively constitute the first stage of the Floodplain Risk Management Process, supersede the previous Flood Studies for Parramatta and provide the basis for the future management of the floodplain.

The lower catchment model considers inundation from overtopping of the main channels only (i.e., mainstream flooding) and does not consider inundation within the local catchments (overland flooding) which contribute to the main channel system. The modelling in the Bankstown LGA considers both.

2.3.2 Flood Mechanisms

Based on the available information, site observations and experience in similar catchments, flooding within the study area occurs as a result of three main mechanisms:

- Flow in excess of the pit and pipe networks being conveyed along roads and overland flowpaths to natural low points, ultimately reaching the open channels (termed overland flooding in this report). Flooding may be exacerbated by inadequate or blocked local drainage systems and restrictions in overland flow paths such as buildings or fences;
- Overtopping of the main channels and spreading into the overbank areas (termed mainstream flooding in this report), this may be exacerbated by blockage of bridges and culverts along the main channel; and
- Elevated water levels in the Parramatta River.

2.3.3 Historical Flood Information

There is extensive documentation of past flooding within the catchment, mainly within PCC contained within previous studies of the Duck River catchment. The key sources of information include the 1986 Lower Parramatta River Study and the 1991 Duck Creek SWC No. 35 Catchment Management Study. While there are many measured levels throughout the catchment, they only relate to three floods: April 1969; April 1974 and August 1986.

2.4 EXISTING FLOODPLAIN RISK MANAGEMENT MEASURES

2.4.1 Property Modification

Within all three LGAs, the predominant existing floodplain risk management measure is an application of property modification through various planning controls and conditions. These controls include restrictions on the type of properties that can be built in the more flood affected parts of the catchment, and building modifications such as raising minimum floor levels above 1 in 100 year flood levels.

2.4.2 Flood Behaviour Modification

There are few measures in the catchment which can modify (reduce or divert) floods. One example of such a measure is within the Parramatta LGA, where a section of Granville Park was recently modified to act as a retarding basin which benefits the properties immediately downstream.

Historically, there has been significant channelisation of the creeks/river and while this has had some benefit for the more common floods, this has also encouraged development close to the channels, resulting in inundation of development in larger floods and limited scope to enhance channel capacity.

2.4.3 Flood Preparedness

With regard to managing human responses to flooding as a means of mitigating their impacts, Bankstown LGA has its own local Flood Plan but there is no specific SES Local Flood Plan that covers the Duck River catchment and no systematic community education program has been implemented.

3 PROPOSED MANAGEMENT MEASURES

Council engaged Molino Stewart in May 2009 to undertake the Floodplain Risk Management Study and the development of a Duck River Catchment Floodplain Risk Management Study & Plan. The Study brought together the relevant data from previous studies into a comprehensive set of management measures for three of the LGAs with a stake in this catchment.

Based on detailed assessment of Floodplain Risk Management Options within the Floodplain Risk Management Study, it is recommended that the following actions be adopted by the relevant Councils:

3.1 ALL COUNCILS

Response Modification Measures – work with SES to establish a community education program containing some or all of the following actions:

- Participation of communities with councils and emergency agencies in the design, implementation and evaluation of community flood education programs
- Ongoing and planned learning through a local community flood education plan to plan for, understand and respond to flooding. This includes SES actions such as “FloodSafe” brochures and more detailed information packages.
- Household and business emergency plans as key outputs of the learning
- Community flood education linked to other strategies in flood management.
- Post-flood learning to evaluate the impact of community education programs and improve general community resilience to future floods.

In addition to the planning and response to flooding, the education program should also advise residents where areas that will not be affected by floodwaters are located so that they can seek refuge there during floods, and also allow SES or others to establish emergency shelters in flood free areas. It should also include the concept of risk management and the meaning of Council’s risk categories.

3.2 AUBURN

3.2.1 Flood Modification

No specific measures proposed. Consideration be given to the installation of bollards at bridges/culverts and the installation of flood height indicators at creek crossings.

3.2.2 Property Modification:

- Consider a Voluntary Purchase and Voluntary House raising scheme;
- Incorporate the findings of the Flood Study review into the Planning documents to advise residents accordingly.
- Convert current risk precincts to true risk precincts.

3.2.3 Environmental Measures:

These measures apply to a combined Parramatta City/Auburn City Councils approach and are shown in Figure 13 and Figure 14 in the Floodplain Risk Management Study.

a) Ongoing Management:

- The wetland on the southern bank of Duck River at the end of Millennium Circuit , Silverwater;
- The eastern bank of Duck River between Parramatta Road and the railway line;
- The eastern and western side of Duck River between the rail line and Duck River Reserve (adjacent to Manchester Road Auburn);
- Bangor Park;
- Peter Hislop Park (ongoing maintenance riparian edge);
- Princes Park (ongoing maintenance).

b) Revegetation and Expansion:

- The riparian corridor adjacent to the channel in Silverwater Park;
- The narrow riparian strip between Holker Street and Giffard Street Silverwater;
- The narrow riparian strip west of the factory north of the intersection of the M4 motorway and Junction Street Silverwater;
- Bangor Park (revegetation between Manchester Road and Mona Street);
- Duck River Reserve (additional revegetation west of existing vegetation toward pathway);
- Auburn Community Picnic Area (widen riparian vegetation);
- Auburn Public Golf Course (revegetation of riparian edge);
- End of Melissa Street Regents Park (area suitable for further investigation).

3.3 PARRAMATTA

3.3.1 Flood Modification:

Investigate in detail the use of Woodville Golf Course as a retarding basin.

Consideration be given to the installation of bollards at bridges/culverts and the installation of flood height indicators at creek crossings.

3.3.2 Property Modification:

- Consider a Voluntary Purchase and Voluntary House raising scheme for some of the properties most affected by the 1 in 5 year and 1 in 20 year ARI flood events;
- Consider an amendment to current open space plans to allow the purchase of extremely flood liable properties in the Guildford Road, Mountford Street, Bury Road and West Street Guildford precinct for use as open space;
- Incorporate the findings of the Flood Study review into the Planning documents to advise residents accordingly.
- Convert current risk precincts based on hazard mapping to true risk precincts taking all factors as listed in the Floodplain Development Manual into account.

3.3.3 Environmental Measures:

These measures apply to a combined Parramatta City/Auburn City Councils approach and are shown in Figure 13 and Figure 14 in the Floodplain Risk Management Study.

a) Ongoing Management:

- The park at the confluence of Duck Creek and Duck River on the northern bank of Duck River adjacent to the M4 motorway;
- Northern bank of Duck River between the river and the Shell Oil site;
- The eastern and western side of Duck River between the rail line and Duck River Reserve (adjacent to Manchester Road Auburn);
- Duck River Reserve;
- Horlyck Reserve (rehabilitation of riparian vegetation adjacent to Mona Street);
- Ray Marshall Reserve (riparian edge);
- Everley Park (from Wellington Road to Everley Road ongoing management for biodiversity values);

b) Revegetation and Expansion:

- The triangle park within the Shell site on the northern bank of Duck River, opposite the end of Carnarvon Street, Silverwater;
- The northern bank of Duck River at the confluence with Duck Creek, adjacent to a factory on Shirley Street;
- Duck River Reserve (additional revegetation west of existing vegetation toward pathway);
- Ray Marshall Reserve (small area suitable for revegetation at the end of Chiswick Road);
- Norford Park (triangle area at the southern end suitable for revegetation);

As with the investigation or implementation of Flood Modification Measures, it is essential to ensure that appropriate environmental impact assessments are undertaken at the scoping stage of all recommended measures in order to identify and protect environmental values present on each site.

3.4 BANKSTOWN COUNCIL

3.4.1 Flood Modification Measures:

- Investigate in detail the use of Sefton Golf Course as a retarding basin. This has the secondary benefit of potentially allowing an increase in on-site storage for watering the course.
- Investigate the potential to upgrade the culverts under the Sydney Water pipeline (Munro and Helen Streets); and
- Investigate the potential to convert Band Hall Reserve into a “wet basin” in conjunction with environmental enhancement measures. This will need to be undertaken in consultation with Sydney Water which owns the open channel asset.
- Consideration be given to the installation of bollards at bridges/culverts and the installation of flood height indicators at creek crossings.

In investigating or implementing these measures, it is essential to ensure that appropriate environmental impact assessments are undertaken at the scoping stage of all recommended measures in order to identify and protect environmental values present on each site.

3.4.2 Property Modification Measures:

- Confirm floor levels or properties potentially affected by above floor flooding in flood events less than the 20 year flood event.

- Consider a Voluntary Purchase and Voluntary House raising scheme for properties that have floor levels affected by up to the 20 year ARI flood event;
- Convert current risk precincts to true risk precincts.

3.4.3 Environmental Measures:

Significant revegetation works (with locally endemic native species) would be required to achieve biodiversity links along Duck River, a number of specific reserves have been identified as suitable for further investigation. These are listed below and shown in Figure 15 of the Floodplain Risk Management Study.

- Jensen Park (additional canopy cover on reserve edges);
- Duck River canal edges (weed removal, rehabilitation and revegetation of canal edges between Munro Street and Clapham Road Sefton)
- Jim Ring Reserve (additional canopy cover adjacent to the Duck River Channel and along Woods Road and Gascoigne Road on the edge of the reserve);
- Jim Ring Reserve (revegetation of small triangle reserve at the northern end of Jim Ring Reserve adjacent to Wellington Road;
- Jim Ring Reserve (revegetation of triangle behind Birrong Bowling and Sports Club between Duck River and Rodd Street Birrong);
- Maluga Passive Park (ongoing management for biodiversity values and passive recreation);
- Duck River canal edges between Rodd Street and Band Hall Reserve (introduction of native canopy cover);
- Band Hall Reserve (comprehensive revegetation of the Duck River riparian corridor to the full extent of the reserve). This will need to be undertaken in consultation with Sydney Water which owns the open channel asset;
- Duck River canal between Ferrier Road and Hume Highway (introduction of native canopy cover adjacent to canal);
- Duck River canal edges between Ferrier Road and Auburn Road (introduction of native canopy cover);
- O'Neill Park (introduction of native canopy cover adjacent to Duck River channel, rehabilitation and revegetation of native vegetation on reserve edges);
- End of Martha Street Yagoona (revegetation with native vegetation on small triangle reserve adjacent to Scout Hall);
- Gazzard Park Yagoona (revegetation of reserve edges with native canopy cover);
- Rose Park Sefton (rehabilitation/revegetation of Duck River open and piped channel diagonally across the park from Woods Road to Rose Street;
- Sefton Golf Course (use of native species in landscaping);
- Walshaw Park Bass Hill (revegetation of north east corner of park with native species, introduction of native canopy species around edge of the reserve;
- Herbert Crabtree Reserve (expansion of native revegetation ongoing management for biodiversity values, introduction of native canopy along the boundary of the reserve to link with Walshaw Park.
- Naturalisation of the Duck River channel and riverbank in selected areas of Jim Ring Reserve and Band Hall Reserve

As with the investigation or implementation of Flood Modification Measures, it is essential to ensure that appropriate environmental impact assessments are undertaken at the scoping stage of all recommended measures in order to identify and protect environmental values present on each site.

Furthermore, as many of these sites are connected by narrow easements along Duck River between private properties, it is not practical to create a continuous biodiversity corridor along Duck River without risking exacerbating flooding along these narrow reaches. It would therefore be worthwhile to investigate means by which private land owners might be encouraged to plant endemic species in their gardens to create vegetated links between the above listed locations in the more confined reaches of the Duck River.

4 COSTS, PRIORITIES & IMPLEMENTATION PLAN

4.1 COSTS

The major Flood Modification and Property Modification Measures recommended in this Plan have significant cost implications.

The costs of converting either Woodville or Sefton Golf Courses to a retarding basin would be in the order of \$1.25M each, subject to the geo-technical conditions under any structure built to contain or convey water. With some benefits flowing from either project, the detailed investigation of such work is recommended and only once all issues are known and addressed should a final decision be made to undertake these projects. An initial budget allocation of \$50,000 would aim to cover additional investigations – the major budget allocation would be required if the decision is taken to implement the works.

The long-term costs associated with a broad-scale Voluntary Purchase or Voluntary House Raising scheme are significant – estimated at \$40M for residential properties affected by the 1 in 5 year ARI flood alone in Parramatta and Bankstown. Accordingly, the most appropriate approach would be to adopt a general program of Voluntary Purchase for properties that most satisfy a Purchase Criteria to be developed and that any purchases be made on an “as-comes” basis.

Funding for any of the environmental measures would have to be found from either Council's operational or special budgets e.g. stormwater levy. A further detailed investigation of all sites is necessary to determine the priorities for any implementation of these measures, and should ultimately be prioritised by Council.

The costs associated with the Response Modification measures are relatively minor and should be accommodated within normal operational budgets. However, Councils could alternatively apply for grant funding under the State Floodplain Program to undertake these measures.

4.2 FUNDING REQUIREMENTS

Government financial assistance could be sought to fund the detailed studies associated with the investigations into the retention basins at either Woodville or Sefton Golf Courses as these detailed studies could be seen as an extension of the Floodplain Risk Management Study.

Government financial assistance could also be sought to fund the detailed investigation of Voluntary Purchase activities, especially when presented as a specific study into the hazard and risk associated with a property in the potential floodway (in ACC & PCC) or high risk precinct (in BCC) of Duck River or its tributaries.

As indicated above, the costs of implementing the response modification measures and any environmental measures generally fall within the normal operations of all Councils however there may be a requirement for internal budgetary arrangements to ensure all measures are implemented. Government assistance could also be sought to fund these activities.

4.3 PRIORITIES

The priorities for the range of measures, both immediate and long-term, are set out in Table 1 below.

The Long-term Priority indicates actions beyond 12 months from adoption of the Plan. Where N/A is shown, it is expected that the indicated measure will have been completed within 12 months. On-going priority indicates a measure that requires regular review and upgrading, particularly should a flood occur. Where TBD is used, implementation of the measure will depend on earlier investigations.

Table 1 - Floodplain Risk Management Measures – Priorities

Floodplain Management Measure	Council/Agency	Initial priority	Long-term Priority
<i>Response Modification Measures – community education program</i>	ACC, BCC, PCC, Sydney Water	High / on-going	On-going
<i>Regular monitoring and maintenance of creek channels, both concrete lined and natural</i>	ACC, BCC, PCC, Sydney Water	High / on-going	On-going
<i>Woodville Golf Course as a retarding basin</i>	PCC	High	TBD
<i>Investigate establishment of a Voluntary Purchase program</i>	PCC	Medium	TBD
<i>Review current open space plans to account for floodways.</i>	PCC	High	High
<i>Review planning documents for consistency.</i>	ACC, BCC, PCC	High	High
<i>Convert current risk precincts to true risk precincts.</i>	ACC, BCC, PCC	Medium / Low	Medium
<i>Environmental Measures downstream of pipeline</i>			
<ul style="list-style-type: none"> <i>Maintenance and Ongoing Management</i> 	PCC / ACC	Medium	Medium
<ul style="list-style-type: none"> <i>Revegetation and Expansion:</i> 	PCC / ACC	Medium	Medium
<i>Sefton Golf Course – constructing a retarding basin</i>			
<ul style="list-style-type: none"> <i>Further Investigation</i> 	BCC	High	N/A
<ul style="list-style-type: none"> <i>Implementation</i> 	BCC	-	TBD
<i>Investigate structural integrity of Sydney Water supply pipeline at Munro Street, Sefton during flood events. Liaise with Councils with results if actions necessary.</i>	Sydney Water	High	TBD
<i>Investigate locations to install bollards and / or debris control structures to prevent culvert & open channel blockages.</i>	ACC, BCC, PCC	Medium	N/A
<i>Investigate locations to install flood depth markers.</i>	ACC, BCC, PCC	Medium	TBD

Floodplain Management Measure	Council/Agency	Initial priority	Long-term Priority
<i>Evaluate community views on the conversion of Band Hall Reserve into an “environmental enhancement/basin.” If there is sufficient community support for this option, investigate the flood benefits provided by this option and its financial feasibility</i>	BCC, Sydney Water	Low	TBD
<i>Investigate establishment of a Voluntary Purchase program, including</i>			
<ul style="list-style-type: none"> • <i>Accurately surveying floor levels of properties that have provisionally been identified to be affected by the 10 year ARI flood event.</i> 	BCC	High	High
<ul style="list-style-type: none"> • <i>Developing criteria for properties to be included on the Voluntary Purchase program.</i> 	BCC	High	High
<i>Environmental Measures upstream pipeline</i>			
<ul style="list-style-type: none"> • <i>Maintenance and Ongoing Management</i> 	BCC	Medium	High
<ul style="list-style-type: none"> • <i>Revegetation and extending existing vegetation</i> 	BCC	Medium	High

4.4 IMPLEMENTATION OF THE MANAGEMENT PLAN

A management plan is never truly finished.

Social and economic circumstances change and flooding behaviour may be substantially altered by future measures adopted in other areas of the catchment. A management plan represents the 'best' appraisal of existing and likely future circumstances at the time it is 'adopted'. For this reason, we do not speak of 'final' but rather of 'adopted' management plans, that is, plans that have been adopted for the immediate future. Management plans should be reviewed regularly (say every 5 years or after each major flood, or where circumstances change that impact on the relevance of the management plan) to ensure that their provisions remain appropriate.

The adopted management plan should be complementary to the Local Flood Plan. Existing, future and continuing flood risk cannot be effectively dealt with if this does not occur, or if the SES is left out of the overall management process. Review of either plan should not be undertaken without reference to the other plan and the relevant authority. Changes in the Floodplain Risk Management plan should be reflected in the local floodplain risk management policy.

It is envisaged that the Plan would be implemented progressively over a 5 to 10 year timeframe. The timing of the proposed works will depend on the overall budgetary commitments of each Council, and the availability of funds from other sources (e.g. State Government, potential section 94 contributions etc.).