BATHURST
REGIONAL COUNCIL

STORMWATER MANAGEMENT PLAN

For

THE CITY OF BATHURST

CURRENT AT: - 5 November 2004

BATHURST
REGIONAL COUNCIL

Stormwater Management Plan

for the

City of Bathurst
within
Bathurst Regional Council Local Government Area

Amalgamation Addendum

The following document was originally developed in 2000 upon a directive from The Environmental Protection Authority.

The original study area encompassed the Bathurst City Council Local Government Area.

At that point in time Bathurst City Council existed and was surrounded by the predominantly rural Local Government Area of Evans Shire Council.

In 2003 it became necessary to review the document to ensure its currency. During the period of review the NSW State Government dissolved Bathurst City and Evans Shire Councils. The newly formed **Bathurst Regional Council** was then formed, comprising of Bathurst City Council and 85% of the Evans Shire Council area.

At the time of review, the works required in the previous Evans Shire have not been identified, and Council continues to operate under the separate management plans and planning instruments of the previous individual Councils.

Therefore all references to Bathurst City Council and Evans Shire Council should be read as Bathurst Regional Council for the interim.

COVER: - Hector Park Wetlands Frog Habitat

The Environment Protection Authority considers that stormwater runoff from urban areas adversely impacts on the quality of the environment in New South Wales. With this in mind, the Environment Protection Authority exercised its powers under the Protection of the Environment Administration Act 1991, issuing notices to all Councils encompassing urban areas with populations exceeding 1,000 people, requiring the preparation of a Stormwater Management Plan.

The details regarding what was expected to be contained in the plans and a suggested methodology for preparing the Stormwater Management Plans was provided by the Environment protection Authority in the notice issued to Councils and in the draft document "Managing Urban Stormwater: Council Handbook" (1997).

Bathurst City Council has adopted a different approach to the Stormwater Management Planning process, considering that approximately 65% of the Local Government Area can be considered non-urban and that Bathurst is experiencing a sustained high growth rate. This Plan concentrates on stormwater management for the entire Local Government Area, which ensures that issues not typically encountered in an urban situation (eg. erosion, agricultural land runoff, etc) can be addressed.

The primary purpose of the Stormwater Management Plan is:

To improve the management of stormwater within the Bathurst City Council area, which will translate to an overall ecological, social and economical improvement of local waterways and catchments.

One of the major focal points of the preparation of the Stormwater Management Plan has been the consultation and involvement of relevant government departments, local interest / action groups, and the community as a whole. Council has involved these parties in each significant step of the Stormwater Management planning process, seeking opinions, feedback, suggestions, information and comments.

The first exercise in the preparation of the Stormwater Management Plan, was the collection and presentation of all information relevant to Stormwater Management. This included a general catchment description, physical, social, ecological and waterway characteristics and identifying potential sources of pollution and existing stormwater management.

The next, and most important exercise, was the consultation. From this process, the values placed on various aspects of the stormwater system were identified, along with issues that require addressing and possible causes of these issues. This information, along with the stormwater management objectives developed, was used to develop potential management options to address the identified issues.

These options were then assessed with respect to their anticipated cost effectiveness and ranked from most cost effective to least cost effective. This information was then translated into an implementation strategy, detailing estimated costs of implementing each management option and a tentative timeframe for implementation.

Council anticipates that a significant proportion of the costs associated with implementing management options will be met by grant funds, in kind contributions and community input / involvement. In addition, it is important to recognise that the funding of management options proposed to be partially or totally funded by Council, is ultimately at the discretion of Council.

Finally, mechanisms have been documented to enable monitoring and reporting of the implementation of the Stormwater Management Plan. This, in conjunction with regular reviews of the implementation strategy and the entire Stormwater Management Plan document will ensure that any new information can be incorporated, new issues addressed and community attitude changes are catered for.

Document Amendments Register

Update: 1 May 2004

Date	Description & Page No. / Figure / Appendix
20 April 2000	Draft for Public Comment
8 August 2000	Final Draft for EPA comment and Expert Review (Revision A)
19 September 2001	FINAL PLAN (Adopted by Bathurst City Council)
15 April 2002	Amendment as requested by EPA
20 May 2002	Endorsement by EPA
5 November 2004	Review and Update of implementation strategy

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Part A

Introduction

1. Background

On April 24 1998, the New South Wales Environment Protection Authority (EPA) issued a legal direction under Section 12 of the Protection of the Environment Administration Act 1991 to all local government's in New South Wales. The legal direction (copy contained in Appendix A) required Council's to prepare a Stormwater Management Plan (SMP) for all urban areas with a resident population exceeding 1,000 people. The aim of the legal direction is to reduce the impacts on the State's waterways from urban stormwater runoff.

This SMP concentrates on stormwater management for the entire Bathurst City Local Government Area. The approach of focusing on stormwater management for just the urban areas for Bathurst is inappropriate, considering Bathurst's sustained high growth rate and that approximately 65% of the Local Government Area can be considered non-urban. This approach will also address issues not typically encountered in an urban situation (i.e. erosion, agricultural land runoff, etc).

This is the first SMP prepared for the Bathurst City Council Local Government Area. There are currently no other plans or reports that provide a framework for stormwater management on this scale. Section 94 Contribution Plans exist for some of the sub-catchments within the Council area. The information contained in these plans will be incorporated into this document.

2. Abbreviations

AHD	Australian Height Datum
BCC	Bathurst City Council
CBD	Central Business District
EPA	New South Wales Environmental Protection Authority
ESD	Ecologically Sustainable Development
LGA	Local Government Area
SMP	Stormwater Management Plan

3. Purpose

The primary purpose of the SMP is:

To improve the management of stormwater within the Bathurst City Council area, which will translate to an overall ecological, social and economical improvement of local waterways and catchments.

The SMP:

- Describes the catchment (and sub-catchments)
- Identifies existing catchment conditions
- Establishes the value of the catchment
- States appropriate management objectives
- Identifies management issues
- Evaluates potential management practices
- Establishes stormwater management objectives for new developments
- Contains implementation strategies for stormwater management measures
- Presents a performance monitoring program
- Describes a mechanism for reporting on the implementation of the plan

The SMP is a product of over 12 months of information gathering, compilation of available and current data on the catchment area (being the Bathurst City Local Government Area) and consultation between Council departments.

4. SMP Preparation Process

4.1 General

The SMP preparation process has been carried out in accordance with the draft EPA document "Managing Urban Stormwater: Council Handbook" (1997).

4.2 Stakeholder Consultation

This SMP has been prepared in consultation with a number of stakeholder groups, namely:

- Roads and Traffic Authority
- Environment Protection Authority (EPA)
- Department of Land and Water Conservation (DLWC)
- National Parks and Wildlife Service (NPWS)
- NSW Agriculture
- Fisheries NSW
- NSW Health
- Rail Services Authority
- Evans Shire Council
- Kelso High School Streamwatch
- Boundary Road Landcare
- Bathurst Tidy Towns
- Macquarie Rivercare
- Central West Catchment Management Committee

In addition, the community as a whole was given three separate opportunities to assist in the preparation of the SMP

The consultation program is presented in more detail in Part C of this document.

Part B

Catchment Description

5. General Catchment Description

Bathurst City is located approximately 200 km west of Sydney at the junction of the Mid-Western, Mitchell and Great Western Highways to the west of the Great Dividing Range. The location of Bathurst in relation to the regional surroundings is shown on Figure B1.

Bathurst is situated near the top of the Macquarie River Catchment and is the first major city that the Macquarie River flows through. The Macquarie River Catchment is also situated in the headwaters of the Murray-Darling Basin, which drains approximately one seventh of the total area of Australia.

The area covered by the Bathurst City Local Government Area is 239.64 square kilometers. Within this area, widely diverse ranges of land uses occur including broad-acre and intensive agriculture, educational, recreational, flora and fauna reserves, commercial, industrial, rural-residential and residential.

The urban areas of Bathurst are concentrated into five areas, being:

Bathurst - situated approximately in the centre of the Local Government Area (on the western side of the Macquarie River) and consisting of the vast majority of the residential and commercial premises.

Kelso - situated to the east of Bathurst (on the eastern side of the Macquarie River) and mostly consisting of residential premises and industrial areas.

Raglan - a village situated further to the east that is mostly residential but contains one of Bathurst's major industries.

Perthville - a village to the south of Bathurst that is mostly residential, and

Eglinton - a village to the north west of Bathurst, again, being mostly residential.

Bathurst is one of the oldest settlements in Australia, being declared a town site in 1815 by Governor Macquarie. Bathurst was declared a city in 1885. The city is currently experiencing growth at the rate of approximately 2.0%, which is one of the fastest growth rates in Australia at the present time.

The Bathurst Local Government Area is presented in Figure B2.

Figure B1 – Regional Surroundings

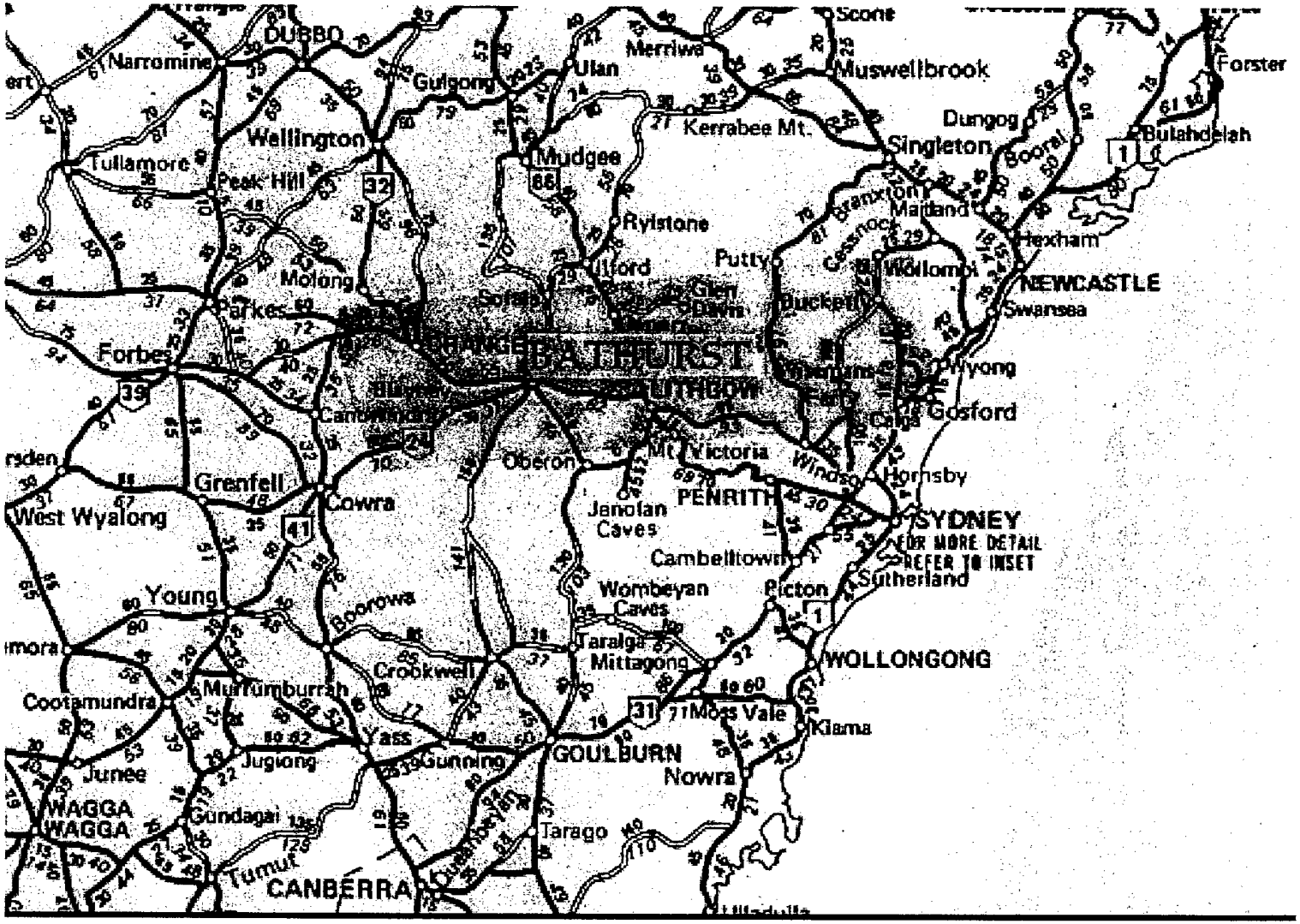
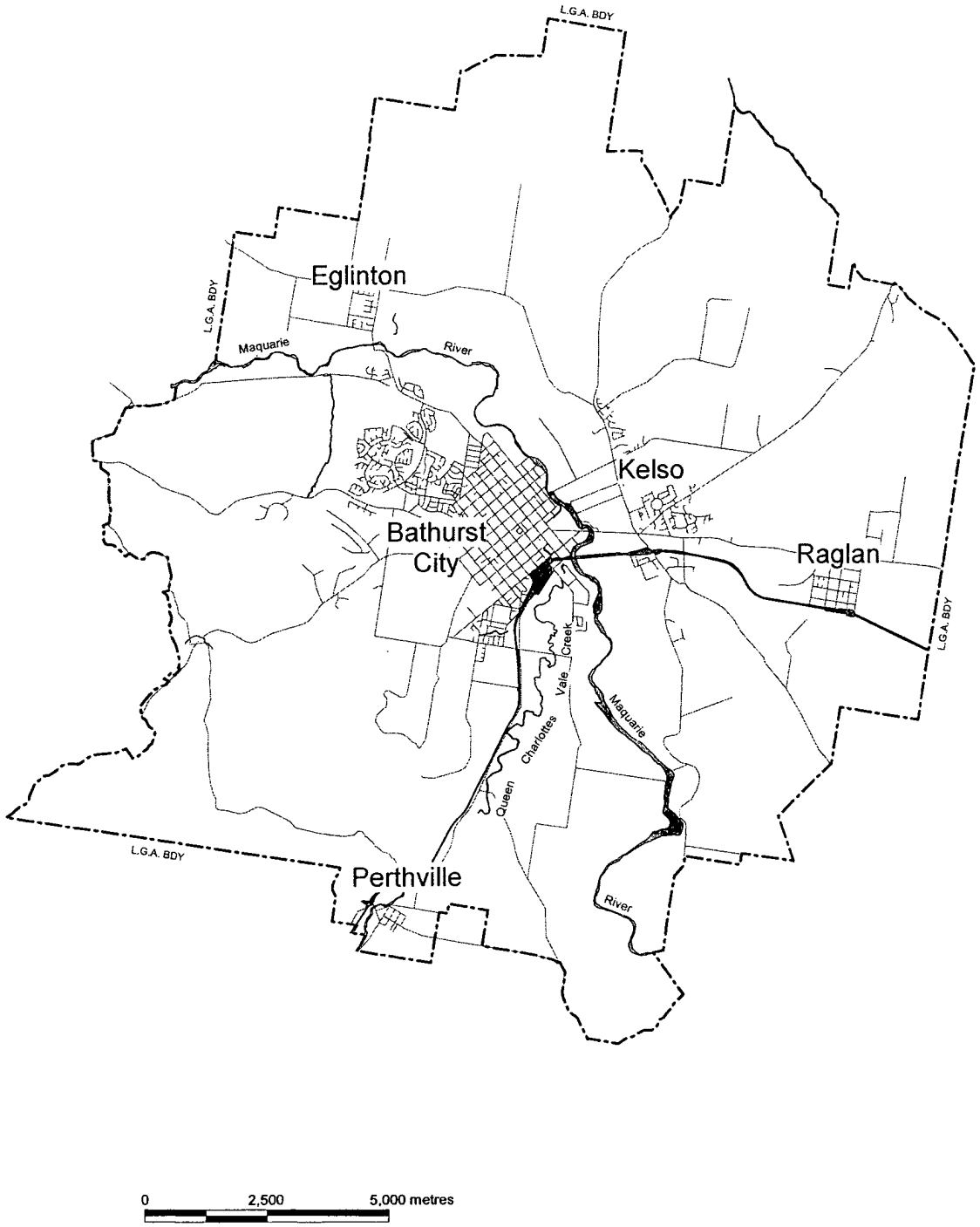


Figure B2 – Bathurst City Local Government Area



6. Physical Characteristics of Catchment

6.1 Climate

Rainfall and pan evaporation data has been collected the Bathurst Agricultural Research Station since 1908 and 1972 respectively.

Generally, rainfall in the region follows a seasonal pattern with the higher mean rainfall occurring in the summer months. As expected, evaporation levels are at their highest also during the summer months. A summary of the rainfall and evaporation data is presented below in Table B1.

High intensity rainfall events and storms are more common during the months of October to February, with December typically having the most intense rainfall events.

Table B1 - Monthly Mean Rainfall & Pan Evaporation Data

Month	Mean Rainfall (mm)	Pan Evaporation (mm)
January	70	211
February	55	165
March	50	140
April	42	84
May	42	50
June	45	33
July	48	37
August	49	56
September	46	78
October	60	121
November	57	159
December	62	211
TOTAL	**626**	**1345**

Temperatures in the Bathurst region vary from very warm to hot in the summer months to cool to cold in the winter months. Mean maximum and minimum temperatures (as measured at the Agricultural Research Station) are presented below in Table B2.

Table B2 - Monthly Mean Maximum & Minimum Temperatures

Month	Mean Maximum (°C)	Mean Minimum (°C)
January	27.6	13.3
February	27.1	13.3
March	24.3	10.6
April	20.3	6.1
May	15.5	3.2
June	12.1	1.1
July	11.1	-0.3
August	12.8	0.9
September	15.6	2.9
October	19.5	6.1
November	22.7	8.4
December	26.0	10.9
Annual Average	**19.6**	**6.4**

Observed wind speeds and directions follow distinct seasonal patterns. Summer and Autumn experiences a relatively even distribution of wind direction with a slight dominance of winds originating from the south-east. High wind speeds are relatively rare during this period with the majority of wind speeds measured falling between 1 and 20 kilometres per hour.

During Winter, a strong dominance of winds originating from the south-west is obvious. High wind speeds are also rare in this period, however, a higher frequency of wind speeds between 11 and 30 kilometres per hour is apparent.

Spring winds are also dominated from the south-west. As for winter, a higher frequency of wind speeds between 11 and 30 kilometres per hour is apparent. In addition, winds exceeding 51 kilometres per hour usually occur during Spring.

6.2 Topography

Within the 239.64 square kilometers covered by the Bathurst City Council area, elevations vary from 635m AHD adjacent to the Macquarie River at the north-western boundary of Bathurst City, to 879m AHD directly to the south of Mount Panorama.

The majority of Bathurst City is situated on undulating to gently rolling terrain (slopes ranging from 2.5% to 7.5%), mostly around 700m AHD.

The other main topographical features present within the Bathurst City area are:

The floodplain, which covers approximately 20 square kilometers and dissects the urban areas of Bathurst. This area of Bathurst receives relatively regular major flooding. Elevations on the floodplain fall from 660m AHD to 635m AHD over the length of the Macquarie River through the Council area. The average slopes on the floodplain is approximately 0.5%.

The line of high hills stretching from the north-east of Perthville to Mount Panorama to Mount Stewart. These hills have elevations ranging from 757m AHD to 879m AHD and slopes typically between 8% to 15%, reaching 22% around Bald Hill and Richardson's Hill to the south of Mount Panorama.

6.3 Geology

The dominant geological unit in the Bathurst City Council area is Bathurst Granite, which underlies the entire Council area. Two other minor geological units occur, being the alluvial deposits in the vicinity of the floodplain and a tertiary basalt cap that is present on the peak of Mount Panorama.

The Bathurst Granite generally comprises of medium to coarse grained and massive granodiorites and adamellites.

6.4 Soils

According to information prepared by the Soil Conservation Service (now part of DLWC), Bathurst has six (6) different soil types identified within the City boundaries. They are described below, in decreasing order of dominance.

Bathurst - Covering approximately 60% of Bathurst City, this soil landscape comprises of non-calcic brown soils on midslopes and yellow solodic soils on lower slopes and drainage lines. This soil landscape is moderately to slowly permeable and is moderately to highly erodible. The Bathurst soil landscape typically exhibits severe sheet and rill erosion on the midslopes (after cultivation) and severe gully erosion in drainage depressions.

Raglan - Covering approximately 20% of the Council area, this soil landscape comprises mainly of red solodic soils on upper and midslopes and yellow solodic soils on lower slopes and drainage depressions. Some areas on non-calcic brown soils also occur on crests. The Raglan soil landscape is slowly permeable and highly erodible. Moderate to very severe gullies (greater than 3m deep) have been observed to form in this soil landscape.

Macquarie - Alluvial soils comprising of Macquarie River prairie soils, Belubula River alluvial sands and minor areas of Macquarie River earthy loams and Campbells River black earths, cover approximately 15% of Bathurst City. Soils in this landscape are generally moderately to highly permeable with low erodibility. Erosion observed in this soil landscape is mostly limited to areas directly adjacent to permanent watercourses.

Panorama - The Panorama soil landscape occurs in a small area (approx. 3% of the area of Bathurst City) around Mount Panorama. Krasnozems are dominant soil type in this soil landscape with Wiesenboden occurring in depressions. These soils are moderately to slowly permeable with a low erodibility. Minor gullying has been observed in cleared areas of this soil landscape.

Pinnacle - Shallow krasnozem soils constitute all of this relatively small soil landscape situated to the east and south of Mount Panorama. No specific data has been obtained, however, krasnozems typically are highly permeable and moderately erodable. Moderate sheet erosion has been observed in these areas.

Pine Mountain - comprising of a very small area to the south-west of Mount Panorama, the Pine mountain landscape constitutes of siliceous sands and sandy earths. This soil type is highly permeable with a low to moderate erodibility. Moderate sheet erosion is typically associated with this soil landscape.

6.5 Infrastructure

Bathurst is situated at the junction of the Great Western Highway, Mitchell Highway and the Mid Western Highway. The City itself has a well developed road system with 256 km of sealed roads and 46 km of unsealed roads. The vast majority of the unsealed roads are within the villages of Perthville and Raglan and also the Mount Panorama area.

Bathurst is also serviced by an airport that accommodates various domestic flights, which are mainly to and from Sydney. Several aircraft charter companies are also based at the airport.

The Main Western Railway passes through Bathurst from Sydney on its way to Broken Hill. Along this line is a major railway yard, however, the majority of this area is no longer utilised.

All of the residents of Bathurst have access to the standard 240 Volt, 50 Hertz electricity supply. The industries of Bathurst mostly require different voltages and the relevant infrastructure (transformers, etc) has been put in place by the local electricity distributor, Advance Energy.

Bathurst is fully serviced by a local telephone service, provided by Telstra, and long distance telephone service, provided by a variety of carriers. Bathurst is also well serviced by mobile phone networks provided by Telstra, Optus and, more recently, Vodafone.

Natural gas is currently available in all residentially developed areas excluding Perthville and recent rural-residential developments to the west of Bathurst.

All the urban areas, including the villages, are connected to Bathurst's reticulated water supply which is sourced from either Ben Chifley Dam or the Winburndale dam . In addition, some of the rural / residential areas are also connected to the reticulated water supply. Those areas not connected to the City's water supply utilise rainwater tanks or groundwater bores.

Sewer is also connected to all urban areas, including the villages. The sewer service does not extend to the rural/residential areas though. These areas, along with the rural areas, utilise on-site waste water treatment systems (septic tanks, absorption trenches / beds, spray irrigation units, etc).

Council's stormwater system services the areas of Bathurst and Kelso fully and partially services Raglan, Eglinton and Perthville. Stormwater drainage in rural-residential and rural areas mainly follows natural drainage lines with some piping and channeling. The stormwater system is discussed in greater detail in the sections following.

7. Social Characteristics of Catchment

7.1 Population

The population of Bathurst at the 1996 census was 28,842. This number consisted of 14,258 males and 14,584 females. Based on the Australian Bureau of Statistics growth rate of 1.99%, the projected population of Bathurst (at the end of 1997) is approximately 29,420. The median age of a Bathurstian is 29.

The vast majority of the population of Bathurst resides in private dwellings. At 1996, there were 9,950 occupied private dwellings, 876 unoccupied (under construction, awaiting owners/tenants, etc), private dwellings and 61 non-private dwellings (hotels, motels, prisons, hospitals, etc.). This gives a total of 10,887 dwellings within Bathurst City.

7.2 Land Use

7.2.1 Residential

Approximately 20% of the Bathurst Local Government Area is zoned 2(a) Residential. There are significant portions of land west of Llanarth and North of Kelso that are zoned residential, but are as yet undeveloped. These areas have been designated for future residential expansion.

The areas zoned for residential use within close proximity of the Central Business District typically consist of high density housing (units, flats, terraces and townhouses). This trend changes as the distance from the CBD increases, where free-standing dwellings comprising the vast majority of housing.

7.2.2 Rural Residential

Approximately 2% of the Bathurst Local Government is zoned 1(c) Rural Residential.

There are two main areas occupied by rural residential developments being:

- the area between the Mitchell Highway and the Mid Western Highway to the west of Bathurst (comprising of the area known as Robin Hill), and;

- an area between the Oberon Road and White Rock Road to the east of Bathurst.

7.2.3 Commercial

Approximately 2% of the Bathurst Local Government Area is zoned for commercial uses (i.e. zoned 3(a) General Business or 3(b) Service Business).

The main commercial area of Bathurst is bounded by Rankin, Bentinck, Piper and Durham Streets, with a smaller commercial centre located nearby in Keppel Street. All of the larger retailers (Big W, Woolworth's, Coles, Kmart, etc) are located in this area in addition to the vast majority of the smaller, more specialised retailers.

Smaller commercial areas are situated in the following locations:

Kelso, near the intersection of Boyd Street and Allambie Boulevard;
Windradyne, near the intersection of Suttor Street and Colville Street
Stewart Street, between Rocket Street and Lambert Street.

There are also numerous "corner store" type establishments spread throughout the entire Council area.

7.2.4 Industrial

Approximately 1% of the Bathurst Local Government Area is zoned 4(a) Industrial.

Major industries in Bathurst include:

Uncle Ben's of Australia - one plant for pet food manufacture
Devro Teepak - two plants for sausage casing manufacture
Simplot - two plants for manufacture of canned and frozen food

The areas zoned 4(a) are concentrated in three areas being south east of Kelso, west of Bathurst (known as the Trade Centre) and south of Bathurst on the Vale Road.

7.2.5 Agriculture

Approximately 63% of the Bathurst Local Government Area is zoned for agricultural purposes (either 1(a) General Rural, 1(b) Market Garden or 1(d) Rural Special Purpose). The vast majority of the area zoned 1(b) Market Garden, which totals 20.8km^2 (or 8.7% of the LGA) is situated on the floodplain.

Areas zoned for agricultural purposes are typically utilised for grazing, with some cropping occurring (with canola becoming particularly popular in the region). Some market gardening of various fruits and vegetables also occur in these areas.

7.2.6 Special Uses

Approximately 4% of the Bathurst Local Government Area is zoned 5(a) Special Uses

The majority of the area zoned for Special Uses is located in two separate areas, being:

West of Bathurst, incorporating the Bathurst Goal, Agricultural Research Station, Charles Sturt University, Land Information Centre, St Stanislaus' College, and;

The Bathurst Aerodrome, east of Bathurst.

Other areas zoned for special uses include the Base Hospital, Cemetery, Council Depot and the former gasworks site.

7.2.7 Recreational

Approximately 2% of the Bathurst Local Government Area is zoned for recreational purposes (either 6(a) Local recreation or 6(b) Regional Recreation).

These areas include all the local parks and reserves throughout Bathurst (which is zoned for local recreation) and the Mt. Panorama area (which is zoned for regional recreation).

Significant areas within this zoning include:

- the Sir Joseph Banks Nature Park, situated at the summit of Mount Panorama. The reserve is home to many native species of plant and animals, which also incorporates some significant eucalyptus re-growth areas, and

- the Blayney Road Common, situated on the southern side of the Mid Western Highway. The reserve is progressively being rehabilitated with new native plantings and other works.

7.2.8 Others

Approximately 6% of the Bathurst Local Government Area is not zoned. These areas include roads, rail lines and the Macquarie River.

7.3 Water Related Recreation Areas

Bathurst has two large public pools within its boundaries. One being the Council owned and operated Olympic Pool with the other being a 25m indoor pool operated by a local fitness centre.

The Bicentennial Peace Park, whilst not primarily a water recreation area, can be considered a water related recreation area as the Macquarie River forms a major feature of this park. Located on Stanley Street, this park is one of the more popular picnic and recreation areas in Bathurst.

There are various other parts of the Macquarie River that are used for recreational, along with the various creeks within Bathurst, however, these are not formal recreation areas.

8. Ecological Characteristics of the Catchment

There has been no detailed study carried out to specifically determine flora and fauna present both in and adjacent to the Macquarie River. The following information has been pieced together from various sources and studies to provide some information.

8.1 Aquatic Flora

Very little information exists as to the types of aquatic flora present in the Macquarie River through Bathurst.

Some information obtained from a fish survey carried out as part of the Environmental Impact Statement for the upgrading and augmentation of Ben Chifley Dam. Survey sites included upstream of the Water Filtration Plant, downstream of the Water Filtration Plant and downstream of the WWTW.

This information indicates that there are very few to no floating macrophytes in this section of the Macquarie. The submerged macrophytes consist of the geneses *Vallisneria, Potamogeton* and *Myriophyllum*. Of the surface macrophytes, *Juncus* and *Cyprus* geneses were represented and only species of the genus *Eleocharis* were recorded in the rushes. Algae was also noted to be present.

8.2 Aquatic Fauna

The survey mentioned in Section 8.1 yields some information in relation to fish numbers and diversity in the Macquarie River.

The three main species encountered were Brown Trout (*Salmo trutta*), Rainbow Trout (*Oncorhynchus mykiss*) and Redfin (*Perca fluviatilis*). Other species recorded were the Mosquito Fish (*Gambusia holbrooki*), Galaxias (*Galaxius olidus*) (being the only native species of fish) and Goldfish (*Carassius auratus*).

NSW Fisheries have also supplied Council with a list of fish species likely to occur in the Macquarie River and tributaries in the Bathurst City LGA, which is presented below:

Table B3 - Fish Species Likely to be Present

Common Name	Scientific Name	Native / Exotic
Flathead Gudgeon	*Philypndon grandiceps*	Native
River Blackfish	*Gadopsis marmoratus*	Native
Freshwater Catfish	*Tandanus tandanus*	Native
Australian Smelt	*Retropinna semoni*	Native
Golden Perch	*Macquaria ambigua*	Native
Murray Cod	*Maccullochella macquariensis*	Native
Trout Cod	*Maccullochella peeli peeli*	Native
Silver Perch	*Bidyanus bidyanus*	Native
Mountain Galaxias	*Galaxias olidus*	Native
Brown Trout	*Salmo trutta*	Exotic
Rainbow Trout	*Oncorhynchus mykiss*	Exotic
Redfin	*Perca fluviatilis*	Exotic
Mosquito Fish	*Gambusia holbrooki*	Exotic
Goldfish	*Carasius auratus*	Exotic
Common Carp	*Cyprinus carpio*	Exotic

To Council's knowledge, no studies have been carried out to examine amphibian and macroinvertebrate populations present along the Macquarie River, within the LGA.

8.3 Riparian Zone Flora

A flora and fauna assessment was carried out as part of the planning process for the proposed levee construction in Bathurst. This assessment covered the most heavily urbanised area of Bathurst City, but did not address the areas outside this. The findings were as follows:

There are no distinct native vegetation communities due to previous farming practices and indiscriminant clearing of native riparian vegetation. As a result, scattered remnant River She-oaks (*Casuarina cunninghamiana*) and native tree and shrub species (planted for landscaping) are found in the riparian zone.

The riparian areas are dominated by willows, especially Weeping Willow (*Salix babylonica*), White Willow (*S. alba*) and Crack Willow (*S. fragilis*). The understorey areas are typically dominated by introduced weeds including Fennel (*Foeniculum vulgare*), Blackberry (*Rubus ulmifolius*), Dock (*Rumex spp.*) and Thistles (*Circium spp.*).

The grasses present in the riparian areas include Wallaby Grass (*Danthonia spp.*), Poa species, Summer Grass (*Digitaria singuinalis*), Paspalum (*Paspalum dilatatum*) and Windmill Grass (*Chloris sp.*).

Four threatened species are listed on the National Parks and Wildlife Atlas of NSW Wildlife as being present in the region. These are Red Stringy Bark (*Eucalyptus cannonii*), Silver Leaved Mountain Gum (*E. pulverulenta*), *Persoonia marginata* and *Pultenea aristata*. Due to the degraded nature of the riparian zone, these species are unlikely to be present in this area. No further species listed on Schedule 1 or 2 of the *Threatened Species Conservation Act 1995* have been cited as occurring in the riparian zone.

8.4 Riparian Zone Fauna

As stated in Section 8.3 above, the flora and fauna assessment for the proposed levee construction covered the most heavily urbanised area of Bathurst City, but did not address the areas outside this. The findings were as follows:

The habitat value and potential is low to very low. Therefore, the likelihood of highly specialised or sensitive species of fauna being present is accordingly very low.

Terrestrial mammals would be limited to feral predators and the more common mammal species (rabbit, hare, rat). In addition, common native species would also be expected to be present (eg. the Short-beaked Echidna, Brush Tail Possum and several species of insectivorous bats). The Platypus and the Water Rat are also likely to be present in these areas.

Several bird species are present including Pacific Black Ducks, White Faced herons, Dusky Moorhens, Dotterels and a range of small native and exotic birds.

Five threatened species were identified on the National Parks and Wildlife ROTAP database as being in the region. These are the Regent Honeyeater (*Xanthomyza phtygia*), Glossy Black Cockatoo (*Calyptorhynchus lathimi*), Turquoise Parrot (*Neophema pulchella*), Powerful Owl (*Ninox strenuan*) and the Koala (*Phascolarctos cinereus*).

The habitat present in the riparian areas of the Macquarie is not suited to the bird species mentioned above. In addition, there is no suitable forest or woodland habitat to support Koalas. Therefore, the presence of these threatened species in the riparian area is considered unlikely.

8.5 Urban Bushland Areas

Due to farming practices in the region, the vast majority of the original native bushland has been degraded.

The only significant area of remnant vegetation remaining extends from the southern slopes of Mount Panorama, to the junction of Boundary Road and the Mid-Western Highway, terminating at the Blayney Road Common. Dominant trees in this vegetation includes Yellow Box (*Eucalyptus melliodora*), Redgum (*E. blakelyi*), Ribbon Gum (*E. viminalis*) and Apple Box (*E. bridgesiana*). Introduced species of flora such as blackberry, exotic fruit trees, African boxthorn and spear thistle are scattered throughout this area.

Fauna in this area is believed to consist of between 3 and 6 species of amphibians, 6 to 12 species of reptiles and between 60 to 90 species of birds (mainly dominated by Pardolotes and Wattlebirds / Honeyeaters). Six mammal species were identified, of which four were introduced species.

Some of the park reserve areas around Bathurst have partially regenerated due to natural progression and tree planting. These areas are generally small and vegetation in these areas is mostly sparse. These areas cannot be considered to be significant urban bushland areas.

9. Waterway Characteristics of Catchment

9.1 Stormwater Transport System

9.1.1 Physical Characteristics

The following major watercourses flow into the Macquarie River (in order from upstream to downstream) as it passes through the Bathurst City Council area:

- Queen Charlottes Vale Creek;
- Old Vale Creek;
- Jordan Creek;
- Rosehill Creek;
- Raglan Creek
- Saltram Creek;
- Sawpit Creek and;
- Kellosheil Creek;

Of these watercourses, Jordan Creek, Raglan Creek, Rosehill Creek, Old Vale Creek and Sawpit Creek receive runoff from heavily developed areas. The remainder drain partially developed / semi rural / rural areas.

The majority of the stormwater transport system within the Bathurst City Local Government Area consists of natural channels. Within the urban areas, the stormwater transport system is generally engineered (concrete pipes and channels) with some short sections remaining as natural channels.

9.1.2 Water Quality

Very little information exists in regard to the quality of the water within the transport system.

Kelso High School Streamwatch has undertaken sampling and analysis for various parameters that may provide some insight into the water quality issues for particular water courses. This data was not available for use at the time of writing, but it is anticipated that this data would be incorporated into the Stormwater Management Plan

9.2 Receiving Water Bodies

9.2.1 Physical Characteristics

The main receiving water body for the Bathurst City Local Government Area is the Macquarie River. The Macquarie River forms at the junction of the Fish River and the Campbells River approximately three kilometers north east of the southern most point of the Bathurst local government area. The river flows generally from the south east to the north west, dissecting the Council area.

From Bathurst, the Macquarie River extends some four hundred kilometers in a north westerly direction. The Macquarie River joins with the Barwon River half way between Walgett and Brewarrina that in turn joins with the Bogan River and the Culgoa River to form the Darling River approximately forty kilometers east of Bourke.

The Macquarie River, is generally a slow flowing, meandering river with sand and gravel base and banks. Through Bathurst, there are some steep embankments that are subject to erosion at peak flows, which was demonstrated during the floods of 1986, 1990 and 1998.

9.2.2 Water Quality

Bathurst City Council carries out water quality monitoring of the Macquarie River at the following five points, which are shown on Figure B4 below:

- The Water Filtration Plant
- The George Street Low Level Bridge
- Edgells Lane
- Rankens Bridge
- Apex Park

The monitoring has been carried out from September 1994 to the present time. Monitoring is carried out on a monthly basis. A summary of the results presented below in Table B4.

Table B4 - Macquarie River Monitoring Results Summary

Water Filtration Plant

Parameter	Faecal Coliforms	Total Phosphorus	Total Nitrogen	Dissolved Oxygen	NFR	pH	Temperature	Conductivity	Turbidity
Units	CFU/100 mL	mg/L	mg/L	mg/L	mg/L		C	mS/cm	NTU
Mean	187	0.32	2.24	8.78	68.54	7.74	14.2	0.20	30.39
Std Dev	161	0.51	1.78	2.26	80.63	0.3	4.7	0.05	36.93
Median	144	0.06	1.76	8.9	32.4	7.69	14.9	0.182	13.5
Max	830	2.10	7.56	14.20	387	8.52	24.0	0.32	122
Min	0	0	0	3.66	0	6.89	6.3	0.13	1.0

Edgells Lane

Parameter	Faecal Coliforms	Total Phosphorus	Total Nitrogen	Dissolved Oxygen	NFR	pH	Temperature	Conductivity	Turbidity
Units	CFU/100 mL	mg/L	mg/L	mg/L	mg/L		C	mS/cm	NTU
Mean	1529.5	0.78	3.84	8.35	71.53	7.7	14.7	0.23	33.3
Std Dev	4015.	0.89	2.99	2.54	82.5	0.35	5.1	0.10	40.23
Median	517	0.41	3.08	8.67	23.5	7.66	15.1	0.21	16.5
Max	30800	3.65	11.0	14.1	292.0	8.64	28.2	0.6	153
Min	20	0	0	1.4	0	7.03	7.1	0.14	0

Rankens Bridge

Parameter	Faecal Coliforms	Total Phosphorus	Total Nitrogen	Dissolved Oxygen	NFR	pH	Temperature	Conductivity	Turbidity
Units	CFU/100 mL	mg/L	mg/L	mg/L	mg/L		C	mS/cm	NTU
Mean	826	0.73	3.63	8.36	65.74	7.71	15.10	0.26	35.22
Std Dev	1072	0.79	3.02	2.7	79.46	0.40	5.32	0.10	40.19
Median	375	0.385	3.08	8.75	12.8	7.64	15.3	0.222	20
Max	5520	3.04	14	14.5	282.0	9.07	28.0	0.50	136
Min	0	0	0	2.4	0	6.91	6.3	0.14	1.0

Apex Park

Parameter	Faecal Coliforms	Total Phosphorus	Total Nitrogen	Dissolved Oxygen	NFR	pH	Temperature	Conductivity	Turbidity
Units	CFU/100 mL	mg/L	mg/L	mg/L	mg/L		C	mS/cm	NTU
Mean	744.4	0.64	3.91	8.81	69.97	7.73	14.74	0.26	33.5
Std Dev	1133	0.69	3.96	2.43	82.77	0.35	4.91	0.09	38.57
Median	315	0.38	3.04	9.1	18.4	7.73	15.3	0.245	16.5
Max	6960	3.50	27.02	15.2	277.0	8.49	26.7	0.5	134
Min	0	0	0	3.5	0	7.05	7.5	0.14	2.0

Low Level Bridge

Parameter	Faecal Coliforms	Total Phosphorus	Total Nitrogen	Dissolved Oxygen	NFR	pH	Temperature	Conductivity	Turbidity
Units	CFU/100 mL	mg/L	mg/L	mg/L	mg/L		C	mS/cm	NTU
Mean	270.63	0.35	2.32	9.43	64.96	7.88	14.66	0.21	38.15
Std Dev	355.44	0.59	1.84	2.30	78.52	0.39	5.2	0.05	51.66
Median	156	0.095	1.88	9.65	23.6	7.85	15.2	0.195	17
Max	1960	3.65	7.48	14.70	393	9.30	25.7	0.34	207
Min	0	0	0	3.45	0	7.0	6.9	0.14	2.0

Notes: NFR = Non Filterable Residue

ANZECC Recommended Guidelines

Parameter	Faecal Coliforms	Total Phosphorus	Total Nitrogen	Dissolved Oxygen	NFR	pH	Temperature	Conductivity	Turbidity
Units	CFU/100 mL	mg/L	mg/L	mg/L	mg/L		C	mS/cm	NTU
Value	Median <150	Site Specific	Site Specific	> 6		6.5 - 9.0	N/A	< 1.5	<10% change from seasonal mean concentration

Based on the above information, the water quality of the Macquarie River appears to decrease slightly as it passes through Bathurst. When comparing the monitoring results from the monitoring point furthest upstream (Water Filtration Plant) to the monitoring results furthest downstream (Apex Park), the impact of the City of Bathurst on Macquaire River water quality is minimal.

9.3 Fluvial Geomorphology

The Macquarie River, from Bathurst through to Dubbo, is characteristic of the middle reaches of a river system. That is, the river has:

- moderate sinuosity ("winding");
- moderate width;
- moderate bed slopes;
- moderate flow velocities, and;
- moderate bed shear stress.

The substrate of the Macquarie River through Bathurst (sands and gravels) is also indicative of the middle reaches of a river system. There does not appear to be a significant nett supply or transport of sediments during normal flow periods in the Macquarie River as it passes through Bathurst. Although, localised bank erosion has occurred in some areas, especially where the riparian vegetation has been removed on the outside of the bends.

Whilst the Macquarie River has formed a floodplain through Bathurst, it is not considered extensive when compared to the floodplains on the Macquarie River near Quambone and Carinda. The presence of relatively small floodplains is another trait typical of the middle reaches of a river system.

9.4 Surface Hydrology

The Council area can be split up into sixteen sub-catchments. The location and boundaries of these sub-catchments are shown on the copy of the map (prepared by the Land Information Centre) accompanying this management plan.

A brief description of each sub-catchment is presented below. The term "development" that is used below refers to urban development. It is recognised that sub-catchment areas described as "undeveloped" may be vulnerable to other issues not related to urban development (such as erosion and sedimentation).

9.4.1 Raglan Creek

Raglan Creek is the largest sub-catchment area within Bathurst. It receives drainage from Raglan and Kelso and also forms part of the floodplain. The area is partially developed, however, it has been earmarked for significant residential development in the short to medium term. The land use of the area is split between residential, industrial and agricultural.

Raglan Creek drains into Macquarie River a little over 1km east of Eglinton.

9.4.2 Sawpit Creek

As for Raglan Creek, the Sawpit Creek area is partially developed, receiving drainage from Stewart, Windradyne and Abercrombie. This area has also been earmarked for significant residential development in the short to medium term. The land use of this area is primarily residential and agricultural with some rural residential developments in the headwaters.

Sawpit Creek drains into Macquarie River approximately 1km south west of Eglinton

9.4.3 Hawthornden Creek

This area is also partially developed, but with no substantial residential expansion planned in the short to medium term. This area receives runoff from Mount Panorama and South Bathurst. Land use is split between rural residential at headwaters, to agricultural on middle reaches to residential to industrial immediately prior to discharge into Queen Charlottes Vale Creek approximately 2 km south of the Bathurst Post Office.

9.4.4 Jordan Creek

This area is almost totally developed with the exception of the upper reaches. This area encompasses the centre of Bathurst and surrounding residential areas. Land use in the headwaters range from agricultural to rural residential.

Jordan Creek drains into Macquarie River where approximately 1km north of the Bathurst Post Office

9.4.5 Old Vale Creek

This relatively small area is essentially totally developed. This area also receives drainage from the commercial centre of Bathurst, the Showground and a small amount of parkland. Commercial and residential land uses dominate in this area.

The Old Vale Creek drains into Macquarie River 0.5 kilometres north west of Bathurst Post Office.

9.4.6 Queen Charlotte's Vale Creek

This large, mostly undeveloped area, is utilised primarily for agricultural purposes. The only significant area of residential development is the village of Perthville. Part of this area also extends outside the boundaries of the Bathurst City Local Government Area.

This creek drains into Macquarie River approximately 1km south east of the Bathurst Post Office.

9.4.7 Evans Plains Creek South

This area is primarily an undeveloped catchment area that is almost exclusively used for agricultural purposes.

This area drains into the Evans Plains Creek at various points adjacent to the Mid Western Highway.

9.4.8 Evans Plains Creek North

Similar to the Evans Plains Creek South area, this sub-catchment is also almost totally undeveloped and utilised for agricultural purposes.

This area also drains at various points adjacent to the Mid Western Highway.

9.4.9 Spring Creek

This sub-catchment is also an undeveloped area. It receives drainage from the west side of Mount Panorama, travelling from the south, to the north, before draining into Evans Plains Creek. Part of this area also extends outside the Bathurst City Local Government Area.

This area is primarily used for agricultural purposes.

9.4.10 White Rock

This area incorporates some small pockets of rural residential development, but for the most part, is utilised for agricultural purposes.

This area drains into the eastern side of the Macquarie River at various points along the river's path through the southern portion of the Local Government Area.

9.4.11 South Macquarie

This area is almost totally undeveloped and mostly used for agricultural purposes. This area forms the majority of the floodplain through Bathurst.

There is no specific watercourse that drains to the Macquarie River in this area, however, the entire area would drain to the river via overland or subsurface flow.

9.4.12 Llanarth/Abercrombie

This area is currently partially developed, with plans for significant growth in short to medium term. The land use in this area is split between residential and agricultural.

This area drains into the Macquarie River at various points in the stretch between the Waste Water treatment Works and Rankens Bridge.

9.4.13 Rosehill Creek

This area is the smallest by area and is virtually totally developed. The area is primarily used for residential purposes (Edgell Heights). Rosehill Creek is also the watercourse to which the treated effluent from the Waste Water Treatment Works is discharged.

Rosehill Creek drains into Macquarie River 2km north-north-west of Bathurst Post Office

9.4.14 Saltram Creek

This area is mostly undeveloped. The upper reaches are undeveloped with the lower reaches receiving runoff from part of Eglinton. Land use in this area is primarily agricultural with some residential use. A portion of this area extends beyond the Bathurst City boundaries.

Saltram Creek drains into the Macquarie River at Rankens Bridge.

9.4.15 Kelloshiel Creek

This area is very similar to Saltram Creek, being mostly undeveloped with the exception of Eglinton in the lower reaches. More than half of this area is located outside the Bathurst City Local Government Area.

Kelloshiel Creek drains into the Macquarie River 1.5 km west of Eglinton.

9.4.16 Winburndale South

An essentially undeveloped with the exception of some rural residential development adjacent to the Local Government Area boundary. The use of this area is primarily agricultural.

Runoff from this area drains into the Winburndale Rivulet, adjacent to the northern boundary of Bathurst City.

Figure B3

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Evans Shi

Sub-Catch

9.5 Potential Sources of Pollution

9.5.1 Point Sources

The most obvious potential point source of pollution within Bathurst City is the Waste Water Treatment Works (WWTW). The WWTW's capacity has recently increased from 36,000 equivalent population (EP) to 55,000 EP to cope with the continued growth of the city. The plant utilises a Biological Nutrient Removal system that provides superior nutrient reduction in the treated effluent. All sewerage is treated to a tertiary level prior to release into the Macquarie River.

Council also has in place a Trade Waste Policy which controls the discharge of liquid wastes to the sewer system. All of the 4 Category A dischargers (high volume, high oil & grease, NFR and BOD loads) and all of the 163 Category B dischargers (low volume, low to medium oil, grease, hydrocarbon loads) have Trade Waste Agreements.

Council also operates a liquid waste treatment plant at the Waste Water Treatment Works. The plant can accept septic wastes and oily washdown water wastes. These wastes are treated using a combination of separation, settlement, decanting, aerobic/anaerobic digestion with some residues being transported to specialist liquid waste disposal companies.

A summary of the effluent quality discharged from the Waste Water Treatment Works to the Macquarie River is presented below in Table B5.

Table B5 - Summary of Waste Water Treatment Works Outlet Results

Parameter	pH	NFR	Total P	Total N	BOD5	O&G	Faecal Coliforms
Units	-	Mg/L	mg/L	mg/L	mg/L	mg/L	CFU/100mL
Mean	7.74	5.27	2.53	8.00	9.09	<5	187
SD	0.22	3.28	1.09	3.14	6.34	N/A	365
Max	8.23	10.8	5	13.5	33	5.4	1460
Min	7.38	0.4	1.05	2.5	3	<5	0

Notes: NFR = Non Filterable Residue
P = Phosphorous
N = Nitrogen
BOD5 = five day Biochemical Oxygen Demand
O&G = Oil and Grease
SD = Standard Deviation

Based on the results obtained from the routine monitoring of the Waste Water Treatment Works outlet, the quality of the effluent released is high. The effluent has comparable pH and concentrations of NFR, and Faecal coliforms to the receiving waters. The effluent also contains very low concentrations of oil and grease and low concentrations of nitrogen and phosphorous.

Commercial and industrial activities in Bathurst are also a potential point source of pollution. A review of the Environment Protection Authority Licences for the area reveals that there are nine licences have been issued for discharge or potential discharge of effluent off site.

Council holds three Environment Protection Authority Licences, for the Waste Water Treatment Works, the Water Filtration Plant and the Bathurst Waste Management Centre.

Another potential point source of pollution are contaminated sites. Currently, there are no sites listed as being "Significant Risk of Harm" sites within the Bathurst City Local Government Area.

The chemical contamination on a site has the potential to be transported from the site, either directly by the action of wind or water, or indirectly by percolation into groundwater and re-emergence into surface waters. The likelihood for the migration of chemical contaminants is dependent upon several factors including site use, site surfacing, drainage systems, soil types and depth to groundwater.

A point source that the NSW EPA have identified as requiring specific attention are sewer overflows. It should be noted that there are no purpose built sewer overflows points within Bathurst City. It is acknowledged that in any sewerage system, there will be stormwater inflow. Council is undertaking continual investigations and works to minimise the amount of stormwater entering the sewerage system. In addition, there has been no sewerage overflows reported in the past two years that can be attributable to stormwater inflow solely (i.e. a blockage is always associated). These overflows are typically small and localised. Therefore, the risk posed to receiving waters from sewerage contaminated stormwater is considered to be negligible.

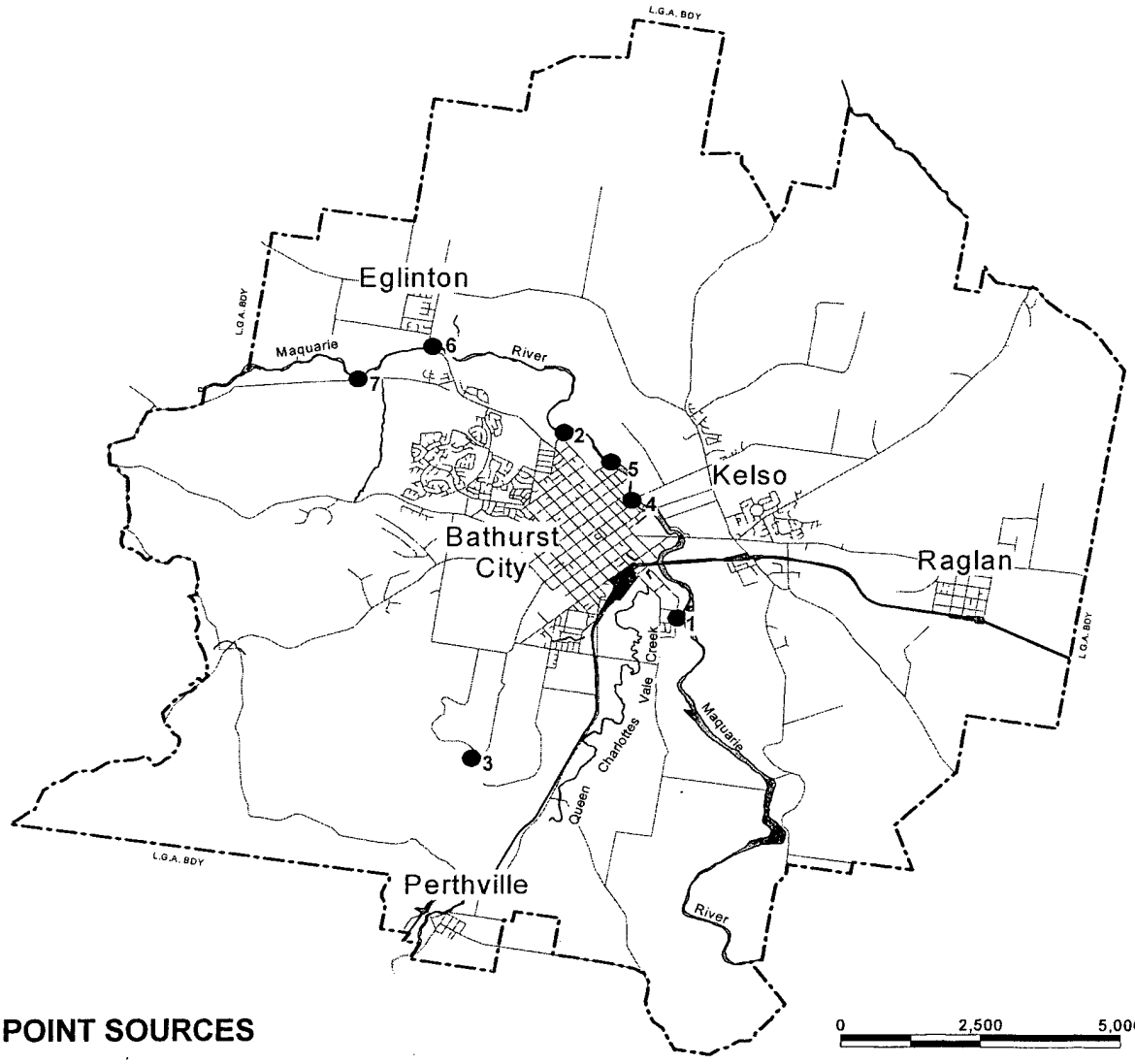
9.5.2 Non-point Sources

One of the most significant non-point source of pollution within the Council area is runoff from the urban areas, particularly, runoff from impermeable surfaces. Runoff from impermeable surfaces can typically contain sediment, nutrients, oxygen demanding substances, pH altering substances, micro-organisms, toxins, heavy metals and oils / surfactants. Council's stormwater system intercepts the vast majority of runoff from impermeable surfaces.

Development sites can also be a significant contributor to non-point source pollution. Poor erosion and sediment control practices by developers and builders can lead to severe erosion of the building / development site and subsequent sedimentation in the stormwater system or in the receiving waters.

As the majority of the land surrounding the urban areas is used for agricultural purposes, runoff from these areas, especially after ploughing or fertilising, is another non-point source of pollution. Nutrients and sediment are considered the main pollutants from agricultural runoff. This runoff is usually conveyed by overland flow or flow through drainage depressions / gullies.

Another potential non-point source of pollution in the Council area can be the effluent generated from on site domestic waste water treatment systems. When these systems are inadvertently located in soils with very high or very low permeability, or when large quantities of oils, greases or even water are disposed to the system, effluent high in nutrients; and possibly pathogens and viruses may be transported by runoff or via the groundwater into waterways.



1. POINT SOURCES

1. Water Filtration Plant
2. Wastewater Filtration Plant
3. Water Management Centre

2. WATER MONITORING SITES

2. Wastewater Filtration Plant
4. George Street Low Level Bridge
5. Edgells Lane
6. Rankens Bridge
7. Apex Park

Figure B4 – Major Pollution Sources and Water Quality Monitoring Sites

9.6 Existing Stormwater Management

9.6.1 Structural

There is 114.5 km of engineered continuous drainage (i.e. pipes or concrete channels) with 2.7 km of culverts that are typically individual sections to allow stormwater drainage under roads. The remaining stormwater flow paths are either natural or semi-natural channels.

In addition, there is also an extensive network of constructed and proposed retarding basins in the developed catchments. The object of these basins is to reduce and delay the peak flows associated with storms and heavy rainfall events.

Also, Bathurst City Council currently has three Gross Pollutant Traps (GPT):

- situated on an unnamed watercourse that flows into Sawpit Creek, which receive runoff from the developed areas of Windradyne.
- situated on Jordan Creek, on the eastern side of Durham Street, which receives runoff from the developed areas within central Bathurst.
-
- situated on Old Vale Creek, on the Northern boundary of the Bathurst Showground, which receives runoff from the developed areas within central Bathurst.

9.6.2 Non-structural

Council currently has four Section 94 contributions plans relating either wholly or partly to stormwater drainage. They are:

- Sawpit Creek (East)
- Robin Hill
- Raglan Creek
- Jordan Creek

These plans detail the aims for the respective catchment areas, the works required to meet these aims and how the works will be scheduled and funded.

In addition to the Section 94 plans for drainage that Bathurst City Council have developed, there are numerous studies that have been undertaken that are relevant to stormwater drainage, catchment management, flood management and land capability. A few of these major studies include:

- Jordan Creek Catchment Study (1977) - Soil Conservation Service of NSW
- Interim report on Improvements to Jordons (sic) Creek 1977 -Rankine and Hill
- Assessment of Strategies to Stabilise, Revegetate and Manage Upper Jordans and Poor Mans Gullies (1992)

- Land Resources and Land Use Study - Poor Man's Hollow Catchment Bathurst (1980) - Soil Conservation Service of NSW

- Land Resources and Land Use Study - Raglan Creek Catchment Bathurst (1981) - Soil Conservation Service of NSW

- Land Resources Study - City of Bathurst (1978) - Soil Conservation Service of NSW

- Urban Capability Study - Raglan (1978) - Soil Conservation Service of NSW

- Urban Capability Study - Eglinton (1978) - Soil Conservation Service of NSW

- Urban Capability Study - Stewart/Llanarth Subdivision (1975) - Soil Conservation Service of NSW

- Land Resources and Land Use Study - Poor Man's Hollow Catchment Bathurst (1980)- Soil Conservation Service of NSW

- City of Bathurst Floodplain Management Plan (1993) - Willing and Partners

- Bathurst City Agricultural Land Suitability (1984)

In addition, Council has produced two guidelines that address the environmental management issues associated with development. The first is aimed at single lot type developments (i.e. construction of a dwelling, extensions, etc.), with the second dealing with the issues associated with larger developments (i.e. residential estate construction, industrial construction, etc). The appropriate document is made available to the developer at the Development Approval stage.

Part C

Objectives, Values, Issues and Causes

10. Stormwater Management Objectives

10.1 Ecologically Sustainable Development

Stormwater management in the Bathurst City Council Local Government Area is to be based on ecologically sustainable development (ESD) principles. ESD requires the effective integration of economic and environmental considerations in the decision making process. ESD can be achieved through the implementation of the following principles and programs:

- The precautionary principle - namely, if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- Inter-generational equity - namely, that the present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations.
- Conservation of biological diversity and ecological integrity.

10.2 Short-term Objectives

The short term objectives for stormwater management in the Bathurst City Council Local Government Area will be as follows:

- Additional catchment information to be obtained on a continual basis
- Litter is to be trapped from high litter generation areas, including the Central Business District, Kelso Industrial Area and Bathurst Industrial Park.
- Erosion and high levels of Suspended Solids are to be addressed in Jordan Creek by the installation of a wetland and other structures,
- The riparian vegetation is to be restored along parts of the Macquarie River within the LGA,
- Willow trees are to be removed from the Old Vale Ck and Hawthornden Ck.
- The impact of new subdivisions upon the aquatic environment is to be reduced.
- Improved valuation and pricing of environmental resources.

10.2.1 New Developments

Council wishes to reduce the impact of new developments have on the natural environment.

There are a number of short term objectives with regard to new developments within Council's LGA. These objectives are be listed below:

10.2.1.1 Design Phase

The design phase of any development is the most critical phase since poor design can result in damage to the natural environment. Accordingly, Councils objectives for the Design Phase of new developments are as follows:

- Alterations to natural flow paths should be minimised,
- Multiple use of stormwater facilities are to be encouraged where in line with other management objectives,
- Re-use of stormwater for non potable purposes maximised,

- Use of vegetated flow paths maximised,
- Protection of existing natural watercourses, wetlands and riparian corridors,
- Impact of stormwater discharging into urban bushland areas to be minimised.

10.2.1.2 Construction Phase

There are a number of environmental controls that Council currently has in place for during the construction phase of a new development. The land developer is required to comply with the determination of the Development Application for the subject land, whereby the environmental and other development controls are provided.

At the very minimum, the land developer will be required to provide a Soil and Water Management Plan. This is a document which outlines what treatment will need to be carried out to ensure that there will not be any pollution of water leaving the site, nor any erosion either on or downstream of the subject site. During the construction phase, inspections are carried out by Council Officers to ensure that the Soil and Water Management Plan is implemented correctly.

Qualitative stormwater management objectives for the construction phase of a development are listed below:

- Soil erosion due to the development is to be minimised by the use of appropriate erosion control measures.
- Litter is to be contained on site in such a manner that minimises the possibility of polluting stormwater.
- Liquid fuels, oils and other chemicals are to be stored in such a manner which minimises the possibility of polluting stormwater.

10.2.1.3 Post Construction Phase

Council recognises that different developments will generate quite differing pollutant loads. Rather than stipulate quantitative controls for the retention of pollutants, Council requires any pollutant (eg Phosphorus, Nitrogen, sediment, litter, hydrocarbons) to be retained using current best practice technology.

Further, Council will need to undertake appropriate maintenance of sedimentation control devices, retention basins, gross pollutant traps and other structures to ensure that the total effect upon the natural environment is minimised.

10.3 Long-term Objectives

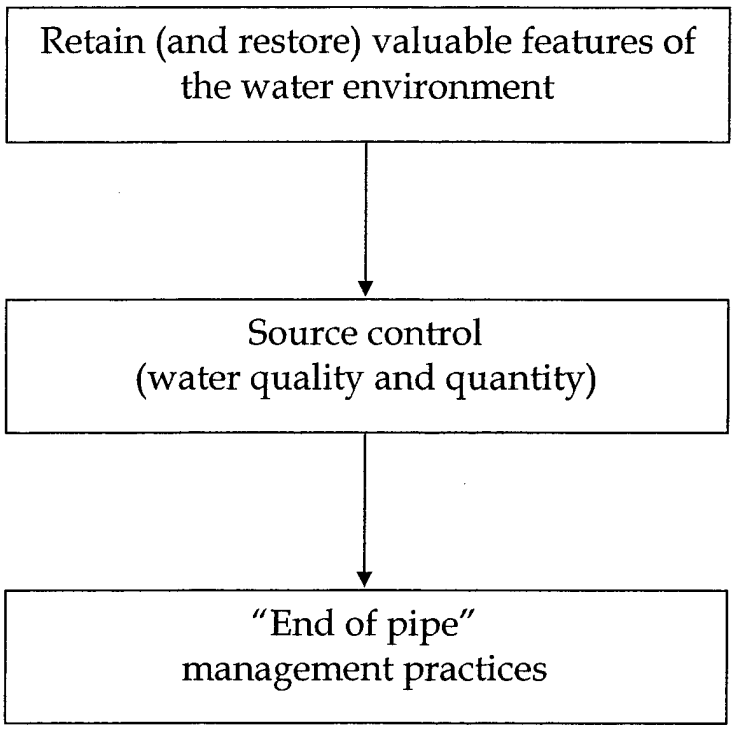
The long term objectives for stormwater management in the Bathurst City Council Local Government Area will be as follows:

- All aquatic and riparian habitats will be restored and maintained utilising species native to the area.
- The visual amenity of the entire stormwater system will be maximised.
- Opportunities to maximise multiple uses of stormwater facilities will be explored and, where appropriate, employed.
- All of the above objectives will be met in a cost effective manner, so as to maximise the stormwater benefits achieved from actions funded by the citizens of Bathurst.

11. Stormwater Management Options Hierarchy

The EPA have published a hierarchy of management principles that is compatible with Ecologically Sustainable Development, as presented below:

Figure C1 – Stormwater Management Hierarchy



The options selected for addressing stormwater management issues were based on the Stormwater Management Hierarchy. This hierarchy preserves the valuable features of the water environment and promotes cost-effective stormwater management by controlling stormwater at the source and only proposing "end of pipe" techniques for the residual impacts that cannot be cost effectively mitigated by source control.

12. Identification of Potential Management Options

Numerous options are available to Council for addressing the stormwater management issues identified. These issues can be split into two main groups, being:

- Non-Structural, and;
- Structural

12.1 Non-Structural

Non-structural management options involve intervention or activities through education, awareness and controls that attempt to encourage responsible behaviour and sustainable development. Examples of non-structural management include:

- Education / awareness programs;
- Planning controls;
- Site auditing;
- Review of management practices (Council operations, etc.), and;
- Studies and assessments.

12.2 Structural

As the name suggests, structural management options involve the construction of a range of structures with a specific design purpose(s). Examples of structural management include:

- Litter collection devices (booms, baskets, traps, nets, etc);
- Sediment traps;
- Constructed wetlands;
- Bank stabilisation;
- Vegetation planting, and;
- Sand filters.

The table of potential management options following has been split into two parts, one containing management options identified as part of the Stormwater Management Planning process with the other containing works/actions previously identified by Council, some of which have been drawn from existing Section 94 Contributions Plans for stormwater drainage.

Table C1 – Stormwater Management Options (Identified as Part of SMP Process)

Options	
Reference	Description
O1	Community education and awareness campaign, drawing upon education resources / materials provided by the NSW EPA (where available).
O2	Continual review of location / number / type of litter bins, especially at recreation areas in close proximity to stormwater drainage channels.
O3	Regulatory action (fines, orders, etc.).
O4	Review street sweeping in CBD.
O5	Undertake industry auditing programs in conjunction with education / awareness campaign
O6	Ordering upgrading of stormwater management systems for those considered inadequate.
O7	Review Council works operations to minimise impact on stormwater
O8	Require contractors to comply with the same level of minimal impact as Council.
O9	Removal of willows on watercourses with replacement by native species.
O10	Review Council mowing and pruning activities.
O11	Signage at known illegal dumping "hot spots"
O12	"Dob in a dump" program
O13	Patrol of illegal dumping "hot spots", taking appropriate legal action against offenders
O14	Co-ordination between local environmental groups and Council for removal of weeds and revegetation of areas with native species
O15	Adopting "water sensitive design" criteria for new trunk drainage
O16	Modeling of base and peak flows in all sub-catchments
O17	Identification and mapping of erosion areas
O18	Review and enforce agistment guidelines
O19	Review Council use of pesticides / herbicides
O20	Develop a riverine management plan
O21	Planting of native species of trees / shrubs on nature strips and trunk drainage in new developments.
O22	Subcatchment salinity hazard ratings
O23	Identification of salinity "hotspots"
O24	Review Council's monitoring program of Macquarie River with a view to expand parameters.
O25	Have Development Application from potentially polluting developments assessed by Council's Environmental Officer.
O26	Combining of existing Section 94 Contribution Plans into one plan dealing with works on a sub-catchment basis.
O27	"Adopt-a-Creek" program with local schools to provide monitoring information to input into planning and design process.
O28	Investigation of sub-catchments and identification of significant issues for each that require management

Table C2 – Stormwater Management Options (Previously Identified by Council)

Options	
Ref	**Description**
O29	Installation of Gross Pollutant Trap(s) in outlets of subcatchments with high litter loads, namely:
	a) Near St Pat's Sporting Club.
	b) Gilmour Street, north of Tandora Street West.
	c) Lee Street
	d) Adrienne Street
	e) Bathurst Industrial Park
	f) O'Connell Road
	g) Old Vale Creek
	h) Sawpit Creek
O30	Audit Council owned properties to determine if any pose a Significant Risk of Harm to human health or the surrounding environment.
O31	Provision of waste oil disposal facility at Bathurst Waste Management Centre.
O32	Fit Gross Pollutant Traps with oil separators, in particular:-
	a) Lee Street
	b) Adrienne Street
	c) Bathurst Industrial Park
	d) O'Connell Road
O33	Investigate provision of green waste collection service to residences
O34	Review of Council builder / developer environmental management guidelines
O35	Require compliance with reviewed guidelines as a DA condition
O36	Requiring land capability assessments at rezoning stage
O37	Construction of retarding basins in problem areas, in particular:-
	a) Hector Park
	b) Near Ennis Way
	c) Sawpit Creek near outlet into Macquarie River
	d) McLennan Close
	e) Near "Fairfield", Laffing Waters Lane
	f) Upstream of Wentworth Drive
	g) Cnr Marsden land and Gilmour Street
	h) Between Rosemont Ave and Willow Dr
	i) Hughes Street
	j) Beyers Place
	k) Bonner Street
	l) Adrienne Street
	m) Bathurst Industrial Park
	n) Corner Lee Street and O'Connell Road
	o) O'Connell Road
O38	Monitoring and maintenance of dog poop bins in leash free areas
O39	Preparation of Management Strategy for domestic waste water treatment system use
O40	Identify areas of significant native vegetation for preservation and potential corridors from Biodiversity Strategy prepared by Council's Environmental Officer
O41	Review of Council's Tree Preservation Order system
O42	Council use of minimal amounts of slow release fertiliser
O43	Erection and maintenance of appropriate warning signs adjacent to public access point to watercourses, retarding basins, etc.
O44	Construction of Hector Park Wetlands project
O45	Appoint Litter Control Officer to patrol and where necessary clean stormwater drains, streets and footpaths of litter.

13. Consultation on Values, Issues and Causes

13.1 Program

The consultation program for the Stormwater Management Plan commenced in mid April 1999 and progressed through to the end of June 1999.

The first stage of the consultation process involved presenting information on the Stormwater Management Plan to the various village meetings

In addition, information was also presented at a Discussion Forum held by Council.

At all of these meetings, a survey was made available to allow residents to give their feedback on what they saw as the main issues with stormwater management, the causes of these issues, and how Council should prioritise its efforts to address these issues. A copy of the survey is contained in Appendix B.

This survey was also made available at the Council Chambers for any member of the public to complete from the start of the consultation process to the end of September 1999.

In addition, several meetings were held with various other groups who have either direct or indirect concerns with stormwater management. State Government departments were also invited to a group to put forward their views on stormwater management

Once the information from the surveys and meetings was compiled, a draft Issues Report was prepared and offered for public review and comment. In addition, copies of the Issues Report was also sent to those groups directly involved in the initial consultation program for their review and comment. This process spanned from 18 February 2000 to 10 March 2000.

Comments received from the public display of the Issues Report were assessed and where appropriate, incorporated into the information for the stormwater Management Plan. Based on what the community identified as the most important issues, management strategies were developed, evaluated and ranked. Specific management options were detailed which, along with the information previously obtained, formed the draft SMP.

The draft SMP was then put on public display for comment from 18 February 2000 to March 10 2000. Comments received were considered and where appropriate, included in the Issues Report.

From the Issues Report, the various management options were formulated and evaluated, forming the basis of the draft Stormwater Management Plan. This was placed on public display from 01 July 2000 to 31 July 2000. Comments received were considered and where appropriate included in the final Stormwater Management Plan submitted to the NSW Environment Protection Authority for approval.

13.2 Participation

13.2.1 Survey Responses

A total of 50 responses were received to the survey. The majority of the responses came from the groups that had a direct or indirect interest in stormwater management.

13.2.2 Resident Meetings

Raglan residents - 13 April 1999
Eglinton residents - 14 April 1999
Perthville residents - 20 April 1999

Discussion Forum - 5 May 1999.

13.2.3 Interest Group Meetings

Meetings were held with the following groups:

- Streamwatch (Kelso High School) - 7 June 1999
- Boundary Road Landcare - 10 June 1999
- Bathurst Tidy Towns - 10 June 1999
- Macquarie Rivercare - 11 June 1999
- Central West Catchment Management Committee - 23 June 1999

The following groups were invited to participate in the program, but chose not to either due to the group being inactive at that time, fully occupied with other issues or deciding that Stormwater Management did not concern them:

- East Bathurst Flood mitigation Group
- Chamber of Commerce
- Saltram Creek Landcare

13.2.4 Government Departments Meeting

A meeting was scheduled on 29 June 1999 for the following State Government departments to participate in the consultation program:

- NSW Environment Protection Authority
- Roads and Traffic Authority
- Department of Land and Water Conservation
- National Parks and Wildlife Service
- NSW Agriculture
- Fisheries NSW
- NSW Health
- Rail Services Authority
- Evans Shire Council

Of the above groups, the NSW Environment Protection Authority, Roads and Traffic Authority and the Department of Land and Water Conservation were represented at the meeting.

Apologies / responses to the survey were received from NSW Health, Rail Services Authority and NSW Agriculture.

No response was received from the other government departments.

13.2.5 Public Review of Issues Report

The Issues Report was placed on public display between 18 February to 10 March 2000. Copies of the full Issues Report, Summary Issues Report (which had a section dedicated for comments) and the Sub-catchment Map were displayed at the Civic Centre, Bathurst City Library, Bathurst City Centre and Bathurst Central (the latter two being the main shopping districts in Bathurst). A box was also provided at each location for comments could be left as opposed to hand delivering or posting the comments to Council.

In addition, copies of the above documents were posted out to all parties involved in the initial interest group consultation.

The public exhibition of the Issues Report was publicised in the Western Advocate on 19 February, 26 February and 4 March 2000 as well on local radio stations 2BS and B-Rock FM throughout the exhibition period.

13.2.6 Public Review of Draft SMP

The Draft SMP was placed on public display between 1 July to 31 July 2000. Copies of the full Issues Report, Summary Issues Report (which had a section dedicated for comments) and the Sub-catchment Map were displayed at the Civic Centre and the Bathurst City Library A box was also provided at each location for comments could be left as opposed to hand delivering or posting the comments to Council.

In addition, copies of the above documents were posted out to all parties involved in the initial interest group consultation.

The public exhibition of the Issues Report was publicised in the Western Advocate on 1 and 8 July, 2000 as well on local radio stations 2BS and B-Rock FM throughout the exhibition period.

13.3 Results

13.3.1 Survey

The following sections summarise the results of the completed surveys. All raw data from the survey

Raw data obtained from the survey is presented in Appendix C

13.3.2 Additional Information

In addition to the survey information, additional information / comments were offered by the following groups:

Central West Catchment Management Committee – This group provided a Position Statement for Urban Stormwater Management to Council. This paper detailed ten specific points for urban stormwater management:

- Fostering water quality and flow regimes which meet community and environmental needs and values;
- That the community expects water quality to be of a high standard;
- That water quality is currently not meeting these expectations at all locations at all times;
- That urban stormwater runoff is a key issue in its own right for the Central West Catchment;
- Supporting the NSW Government's Waterways Package, of which the Stormwater Management Planning process forms part of;
- That consultation with the community to determine local values and issues is encouraged;
- Recommending that Council utilise the Regional Landcare Facilitator for developing consultation programs;
- Supporting the integration of education, planning and engineering solutions in addressing stormwater issues;
- Encouraging Council to apply for grant funding for stormwater projects and report progress on these projects to the Committee, and;
- That the Committee will monitor the implementation of the Urban Stormwater Management Plan across the entire catchment.

Kelso High School Streamwatch – Concerns were raised on three specific issue, being:

- Sewerage overflows into Raglan Creek during storms / heavy rain;
- The flow rates and volumes of stormwater runoff passing through the drainage network located between Bradwardine Road and Durham Street, and;
- The amount of litter present in all watercourses throughout Bathurst.

NSW Environment Protection Authority – Three specific areas of comments were provided by the NSW Environment Protection Authority:

- Council should not be solely dependent upon engineering solutions to stormwater issues. There should be a focus on source control / prevention as a first priority.
- Council should more actively fine people observed littering or disposing of wastes illegally, possibly via a notified campaign.
- Rural subdivisions may require more planning in determining adequate stormwater systems and land capability. The EPA suggested that this should occur at the subdivision stage, not at the Development Application stage.

Department of Land and Water Conservation – This government body provided extensive comments on a range of issues"

- Council should aim its development control at decreasing runoff from residential subdivisions and fully considering downstream impacts and cumulative effects.
- That individual house site erosion and sedimentation protection measures be mandatory with significant enforcement and penalties for non-compliance.
- Unsealed road shoulder should either be extended to the gutter / table drain or otherwise, the use of grasses swales should be considered.

- Progressive stabilisation / rehabilitation of existing gullies and other erosion areas should continue.
- That specific Development Approval condition(s) governing waste management for various projects be drafted and implemented.
- That developers should supply water reticulation to rural residential areas to limit the possibility of overloading septic tanks by excess volumes of water.

Roads and Traffic Authority - The other major stakeholder in stormwater management agreed with the comments made by the Department of Land and Water Conservation and the New South Wales Environment Protection Authority. It was further added that detailed plans should be prepared to manage material spills due to road accidents. Specifically, these plans should specify who is responsible for certain actions and what actions are required.

13.3.3 Comments Received from Public Review of Issues Report

Formal responses were received from the following:

Australian Trust for Conservation Volunteers (ATCV)
ATCV congratulated Council on preparing the Issues Report stating that "...it sets the framework for the effective management of urban water quality issues."

ATCV recommended that the objectives and issues identified in the report be considered as the basis of the draft action plan (Stormwater Management Plan).

Bathurst and District Tidy Towns Association
BDTTA commented that the Issues Report "...covers all issues relevant to the Community." They also stated that they looked forward to seeing the report evolve into an action plan.

Department of Land and Water Conservation
The Department of Land and Water Conservation stated that "...issues raised by this Department have been addressed adequately in this report.

The Department of Land and Water Conservation also offered assistance in developing the stormwater management strategies.

Evans Shire Council
Evans Shire Council "...can provide no input at this time." Council stated that it concurs with the short and long term objectives and has offered to provide any information that may be of assistance.

Macquarie Rivercare
Macquarie Rivercare provided extensive comments on the draft Issues Report. The group commented that "overall, the issues are thorough, the catchment well covered and community liaison proficient."

The majority of the comments offered by Macquarie Rivercare were in relation to the Action Planning process. These comments were addressed in the draft Stormwater Management Plan.

Useful comments were also provided about the clarification of some information presented and for the correction of some small errors contained in the draft document.

NSW National Parks and Wildlife Service
The NPWS stated that they had "...no comment to make on the proposal at this stage." The Service also indicated that they would be willing to comment on further plans and proposals

NSW Fisheries
NSW Fisheries provided valuable information to Council regarding fish species likely to occur in the Macquarie River and tributaries in the Bathurst area. They also made comment on the clarification on the term "undeveloped" relating to sub-catchment areas.

NSW Agriculture
NSW Agriculture stressed the importance of having the rural community on side if Council wants to meet the long term goals set. The Department has also offered to assist Council once the details of the plan are finalised.

13.3.4 Comments Received from Public Review of Draft SMP

Formal responses were received from the following:

NSW National Parks and Wildlife Service
The NPWS stated that they had "...no comment to make on the proposal at this stage." The Service also indicated that they would be willing to comment on further plans and proposals

Mid Western Public Health Unit
The Mid Western Public Health Unit "raises no objections" to the Plan in their formal response to the invitation to comment.

Department of Land and Water Conservation
The Department of Land and Water Conservation prepared a detailed response, identifying some further potential management options that were not highlighted previously, namely:

- Identification and mapping of erosion areas;
- Salinity hazard ratings for subcatchments;
- Preparation of a riverine management plan for all streams and tributaries for the management of riparian and streambank areas.
- Grazing management of agricultural lands

The DLWC also suggested installation of piezometers in subcatchments classified as high risk for salinity problems and expanded water quality monitoring into the tributaries of the Macquarie River

The Department of Land and Water Conservation also continued its offer of assistance in preparation and implementation of the plan.

14. Identified Catchment Values

The responses of the surveys were examined to determine the catchment values where respondents placed the highest and lowest values. The results are summarised below.

Table C3 - Identified Catchment Values

Catchment value	Value
Ecological	
Water quality	Very High
Aquatic/riparian flora	High
Aquatic/riparian fauna	High
Social	
Public health and safety	High
Recreation	Medium
Amenity	Medium
Economic	
Irrigation	Low

Almost all respondents to the survey identified water quality as a major issue within Bathurst. It is fair to translate from this that the respondents highly value water quality in the area. Water quality also effects, either directly or indirectly, all the other values identified.

15. Stormwater Management Issues & Causes

15.1 Environmental Issues

Based on the survey results, and from additional information supplied by various groups, environmental issues, ranked from most important to least important, are presented below:

- Gross pollution (bottles, plastic, glass, cigarette butts and other litter)
- Petrol, oil and grease pollution
- Organic matter (leaves, lawn clippings mulch, etc) inflow
- Illegal dumping of wastes
- Weed infestation (especially willows)
- Erosion
- Pesticide/herbicide pollution
- Loss of riverine health
- Sediment deposits
- Bacteria and pathogen pollution
- Loss or degradation of native vegetation
- Nutrient enrichment (mainly nitrogen and phosphorous)
- Heavy metal pollution
- Suspended sediments
- Salinity

15.2 Social Issues

Based on the survey results, and from additional information supplied by various groups, social issues, ranked from most important to least important, are presented below:

- Safety of system
- Linking stormwater to recreational facilities
- Poor visual appearance of stormwater system
- Impact on irrigators

15.3 Managerial Issues

Based on the survey results, and from additional information supplied by various groups, managerial issues, ranked from most important to least important, are presented below:

- Control of polluting developments by Council
- Stormwater design and planning

15.4 Possible Causes and Linked Management Options

Presented below is a Table C4 which shows issues with the corresponding possible causes, based on the survey results and on the additional information. "Natural" causes (i.e. atmospheric deposition, baseline erosion, soil chemistry processes, etc.) have been ignored as these processes would occur in an undeveloped catchment.

This plan is concerned with managing the man-made issues of stormwater management.

Also shown on this table are objectives as identified through the SMP process and from BCC observations. Refer to Tables C1 & C2 above for an explanation of these management options.

Table C4 - Issues, Causes and linked management options

Category	Issue	Possible Cause(s)	Management options
Environmental	Gross pollution	Littering	O1,O4,O11,O27,O29,O40,O45
		Deliberate pollution / illegal dumping	O3,O12
		Location / number of litter bins	O2
		Lack of regulatory enforcement	O13
		Recycling systems / services	O14
	Petrol, oil and grease pollution	Deliberate pollution / illegal dumping	O1,O3,O5,O30,O31,
		Cars and other motor vehicles (road runoff)	O32
	Organic matter inflow	Littering	O27,O33,O38,O40,O45
		Deliberate pollution / illegal dumping	O1,O3,O5
		Vegetation management	O10,O20,O21,O34
		Storm / flood debris	O14, 29
	Illegal dumping of wastes	Lack of education/awareness	O1
		Lack of regulatory enforcement	O13
	Weed infestation	Deliberate pollution / illegal dumping	O3,O5,O12,O33
		Vegetation management	O9,O21
		Planning / maintenance	O20,O29
	Erosion	Planning / maintenance	O17,O20,O41
		Development / growth	O25,O26,O36
		Flow management	O16,O28,O37
		Grazing management of agisted lands	O18
	Pesticide/herbicide pollution	Agricultural land runoff	O1
		Chemical use	O1,O40,O41
	Loss of riverine health	Vegetation management	O9,O34,O40,O41,O42
		Planning / maintenance	O35
		Development / growth	O25,O26,O36
		Erosion / sedimentation	O17,O29,O40
		Flow management	O16,O26,O28

Table C4– Issues, Causes and linked management options (cont.)

Category	Issue	Possible Cause(s)	Management options
Environmental (cont.)	Sediment deposits	Vegetation management	O9
		Development / growth	O15,O25
		Erosion / sedimentation	O17,O29,O40
		Flow management	O16,O28
	Bacteria and pathogen pollution	Deliberate pollution / illegal dumping	O1,O3,O5,O30
		Agricultural land runoff	O1,O18
		Septic tanks	O39
		Dog and other animal droppings	O38
	Loss or degradation of native vegetation	Vegetation management	O9,021
		Planning / maintenance	O20
		Erosion / sedimentation	O17,O29,O40
		Development / growth	O25,O26,O36
	Nutrient enrichment	Deliberate pollution / illegal dumping	O1,O3,O12
		Erosion / sedimentation	O17,O29,O40
		Agricultural land runoff	O18,O37
		Chemical use	O1,O19
		Septic tanks	O39
		Car washing in street	O1
	Heavy metal pollution	Deliberate pollution / illegal dumping	O1,O3,O30
		Cars and other motor vehicles	O31,O32
	Suspended sediments	Erosion / sedimentation	O17,O29,O40
		Flow management	O16,O28
	Salinity	Rising groundwater	O22,O23
		Development / growth	O20,O25,O26
		Vegetation management	O21,O41

Table C4 - Issues, Causes and linked management options (cot)

Category	Issue	Possible Cause(s)	Objectives
Social	Safety of system	Planning / maintenance	O6,O7,O8,O43
		Flow management	O16,O28
		Storm / flood debris	O29
	Linking stormwater to recreational facilities	Planning / maintenance	O15
		Sufficient areas supplied	O20,O40
	Poor visual appearance of stormwater system	Littering	O1,O2,O3,O4,O27,O29,O45
		Deliberate pollution / illegal dumping	O1,O3,O11,O12
		Vegetation management	O9,O21,O41
		Planning / maintenance	O7,O20,O41
		Erosion / sedimentation	O17,O29,O40
		Development / growth	O25,O26,O36,O39
	Impact on irrigators	Deliberate pollution / illegal dumping	O1,O3,O11,O12
		Erosion / sedimentation	O17,O29,O40
		Agricultural land runoff	O1,O18,O22,O23,O37
		Chemical use	O1,O19
Managerial	Control of polluting developments by Council	Planning / maintenance	O6,O7,O25,O30
		Lack of regulatory enforcement	O3,O8,O35
	Stormwater design and planning	Planning and maintenance	O6,O7,O15,O43
		Development / growth	O16,O26,O28,O34,O35

Part D

Evaluation of Potential Management Options

16. Methodology

The large number of potential management practices identified require ranking for implementation purposes. It is difficult to directly compare these options as they have a large cost range, varying social and environmental benefits and, in some cases, fundamentally different in approach (structural and non-structural).

The ranking methodology has been based on the methodology published by the NSW EPA in Managing Urban Stormwater: Council Handbook. This methodology takes into account the above differences and aims to provide a transparent approach to the evaluation process whilst avoiding assumptions.

The outcomes of the evaluation may need to be altered in some cases when considering the Stormwater Management Hierarchy and local / new knowledge.

16.1 Costs

The estimated cost of each potential management option is divided into capital and annual operation. To provide a uniform scoring system between capital and annual costs, a Net Present Value (NPV) analysis was performed on annual costs using a design life (or expenditure period) of 50 years and a discount rate of 7%. Subsequently, those annual costs that had an NPV that was equal to capital costs were assigned equal scores.

A table of scores and costs is presented below, in Table D1.

Table D1 – Ranking of Costs

Capital Cost	Operation cost (annual)	Score
<5,000	<350	1
5,001 - 10,000	351 - 700	2
10,000 - 15,000	701 - 1,050	3
15,001 - 20,000	1,051 - 1,400	4
20,001 - 30,000	1,401 - 2,100	5
30,001 - 40,000	2,101 - 2,800	6
40,001 - 50,000	2,801 - 3,500	7
50,001 - 70,000	3,501 - 4,900	8
70,001 - 100,000	4,901 - 7,000	9
100,001 - 130,000	7,001 - 9,100	10
130,000 - 180,000	9,101 - 12,600	11
180,001 - 270,000	12,601 - 18,900	12
270,000 - 360,000	18,901 - 25,200	13
360,001 - 700,000	25,201 - 35,000	14
700,000 - 1,000,000	35,001 - 49,000	15
>100,000,001	>49,001	16

The Cost Index (CI) is calculated by averaging the two scores for the potential management option being assessed.

16.2 Benefits

Five separate benefits were assessed as part of the evaluation process, being:

- **Community Expectation** - The pollutant / risk most likely to be targeted or reduced by the implementation of the management option, which are shown in Table D2 below. The top 10 community expectations have been ranked according to responses from the consultation process, identified in Appendix C.

Table D2 Community Expectations and associated benefits

Issue	Score
Gross pollution	10
Illegal Dumping	9
Petrol, Oil and Grease pollution	8
Erosion of watercourses	8
Organic Matter	6
Weed infestation of watercourses	5
Pesticide and/or herbicide pollution	4
Sediment deposits	3
Bacteria and pathogen pollution	3
Loss or degradation of aquatic habitats	3

(Note: those issues that were ranked equally by the community are assigned an equal score in the above table.)

- **Harm** - The reduction of harm of the pollutant / risk on water quality, ecosystem health and public health, due to the implementation of management options. These have been identified by Council, in Table D3 below:

Table D3 Reduction of Harm and associated benefits

Pollutant / Risk	Score
Litter	1
Nutrients	2
Sediments	3
Bacteria	4
Oil and Grease	5
Organic matter	6
Heavy metals	7
Toxins	8
Loss of Biodiversity	9
Public safety / All	10

- **Pollutants / Risks Addressed** - Reflecting the number of issues that the management option would address if adopted, shown in Table D4 below:

Table D4 Number of Pollutants / risks Addressed and associated benefits

Number	Score
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

- **Effectiveness** - The effectiveness of the management option in addressing the target pollutant / risk, as shown in Table D5 below.

Table D5 Effectiveness of option and associated benefits.

Structural (%)	Non-structural	Score
<10	Low	1
11-20		2
21-30		3
31-40		4
41-50	Medium	5
51-60		6
61-70		7
71-80		8
81-90		9
91-100	High	10

- **Proportion of Catchment** - The percentage of the catchment area that can potentially benefit from implementation of the management option, as shown in Table D6 below.

Table D6 Proportion of catchment treated and associated benefits.

Area (%)	Score
<10	1
11-20	2
21-30	3
31-40	4
41-50	5
51-60	6
61-70	7
71-80	8
81-90	9
91-100	10

The Benefit Index (BI) is calculated from the average of the benefit scores for the potential management option being assessed.

16.3 Benefit-Cost Ratio (BCR)

The Benefit-Cost Ratio is then calculated according the to below simple formula:

$$BCR = \frac{BENEFIT\ INDEX(BI)}{COST\ INDEX\ (CI)}$$

16.4 Limitations

The limitations of this evaluation methodology should be noted:

- Some options may not readily lend themselves to this process;
- Whilst the most important factors have been included in the assessment, it is impossible to assess all possible factors;
- Some options may have a higher priority in other areas (eg. waste management, public amenity, public health and safety). The options have been assessed relative to stormwater management issues.
- The scores assigned to the benefit factors are subjective, and;
- The scores assigned to the cost factors are based on preliminary estimates;

17. Evaluation and Ranking

The following pages list the potential management options in order of highest BCR to lowest, shown in Table D7 below.

The calculations for the BCR for each potential option in contained in Appendix D.

Table D7 - Ranking of Potential Management Options

Option Ref	Rank	Option Description	Benefit-Cost Ratio
O34	1	Review of Council builder / developer environmental management guidelines	6.20
O35	1	Require compliance with reviewed guidelines as a DA condition	6.20
O8	3	Require contractors to comply with the same level of minimal impact as Council.	5.40
O10	3	Review Council mowing and pruning activities.	5.40
O19	5	Review Council use of pesticides / herbicides	4.80
O36	5	Requiring land capability assessments at rezoning stage	4.80
O18	7	Review and enforce agistment guidelines	4.40
O15	8	Adopting "water sensitive design" criteria for new trunk drainage	4.20
O23	8	Identification of salinity "hotspots"	4.20
O6	10	Ordering upgrading of stormwater management systems for those considered inadequate.	4.00
O28	11	Investigation of sub-catchments and identification of significant issues for each that require management	3.90
O7	12	Review Council works operations to minimise impact on stormwater	3.60
O24	12	Review Council's monitoring program of Macquarie River with a view to expand parameters.	3.60
O5	14	Undertake industry auditing programs in conjunction with education / awareness campaign	3.40
O41	15	Review of Council's Tree Preservation Order system	3.33
O31	16	Provision of waste oil disposal facility at Bathurst Waste Management Centre.	3.30
O42	17	Council use of minimal amounts of slow release fertiliser	3.00
O22	18	Subcatchment salinity hazard ratings	2.80
O17	19	Identification and mapping of erosion areas	2.00
O30	20	Audit Council owned properties to determine if any pose a Significant Risk of Harm to human health or the surrounding environment.	1.90
O4	21	Review street sweeping in CBD.	1.80
O27	22	"Adopt-a-Creek" program with local schools to provide monitoring information to input into planning and design process.	1.75
O39	23	Preparation of Management Strategy for domestic waste water treatment system use	1.70
O43	24	Erection and maintenance of appropriate warning signs adjacent to public access point to watercourses, retarding basins, etc.	1.68
O40	25	Identify areas of significant native vegetation for preservation and potential corridors from Biodiversity Strategy prepared by Council's Environmental Officer	1.60
O1	26	Community education and awareness campaign, drawing upon education resources / materials provided by the NSW EPA (where available).	1.44
O11	27	Signage at known illegal dumping "hot spots"	1.36

O12	28	"Dob in a dump" program	1.24
Option Ref	**Rank**	**Option Description**	**Benefit-Cost Ratio**
O2	29	Continual review of location / number / type of litter bins, especially at recreation areas in close proximity to stormwater drainage channels.	1.13
O14	30	Co-ordination between local environmental groups and Council for removal of weeds and revegetation of areas with native species	1.08
O21	31	Planting of native species of trees / shrubs on nature strips and trunk drainage in new developments.	1.05
O33	32	Investigate provision of green waste collection service to residences	1.02
O26	33	Combining of existing Section 94 Contribution Plans into one plan dealing with works on a sub-catchment basis.	0.95
O25	33	Have DA from potentially polluting developments assessed by Council's Environmental Officer.	0.95
O32a	35	Oil separator – Lee Street	0.90
O32b	36	Oil separator – Adrienne Street	0.87
O32c	36	Oil separator – Bathurst Industrial Park	0.87
O32d	36	Oil separator - O'Connell Road	0.87
O20	39	Develop a riverine management plan	0.84
O38	40	Monitoring and maintenance of dog poop bins in leash free areas	0.80
O3	40	Regulatory action (fines, orders, etc.).	0.80
O16	42	Modeling of base and peak flows in all sub-catchments	0.77
O9	43	Removal of willows on watercourses with replacement by native species.	0.57
O13	44	Patrol of illegal dumping "hot spots", taking appropriate legal action against offenders	0.52
O29c	45	Gross Pollutant Trap -Lee Street	0.46
O29h	45	Gross Pollutant Trap - Sawpit Creek	0.46
O29a	46	Gross Pollutant Trap - Near St Pat's Sporting Club.	0.44
O29b	46	Gross Pollutant Trap - Gilmour Street, north of Tandora Street West.	0.44
O29d	46	Gross Pollutant Trap - Adrienne Street	0.44
O29e	46	Gross Pollutant Trap - Bathurst Industrial Park	0.44
O29f	46	Gross Pollutant Trap - O'Connell Road	0.44
O29g	52	Gross Pollutant Trap - Old Vale Creek	0.42
O37d	53	Retarding basin - McLennan Close	0.37

Option Ref	Rank	Option Description	Benefit-Cost Ratio
O44	54	Construction of Hector Park Wetlands project	0.35
O37i	55	Retarding basin – Hughes Street	0.31
O37l	56	Retarding basin - Adrienne Street	0.29
O37m	58	Retarding basin - Bathurst Industrial Park	0.29
O37b	58	Retarding basin - Near Ennis Way	0.27
O37g	60	Retarding basin - Cnr Marsden land and Gilmour Street	0.27
O37e	60	Retarding basin - Near "Fairfield", Laffing Waters Lane	0.26
O37h	60	Retarding basin - Between Rosemont Ave and Willow Dr	0.26
O37j	60	Retarding basin - Beyers Place	0.26
O37k	60	Retarding basin - Bonner Street	0.26
O37n	60	Retarding basin - Corner Lee Street and O'Connell Road	0.26
O37o	60	Retarding basin - O'Connell Road	0.26
O45	66	Appoint Litter Control Officer to patrol and where necessary clean stormwater drains, streets and footpaths of litter.	0.25
O37a	66	Retarding basin - Hector Park	0.25
O37f	68	Retarding basin - Upstream of Wentworth Drive	0.24
O37c	69	Retarding basin - Sawpit Creek near outlet into Macquarie River	0.22

Part E

Implementation Strategy

18. Implementation Strategy

18.1 General

To ensure that the stormwater management options are employed, an implementation strategy has been prepared, as shown in Table E1.

Each stormwater management option contains information relating to:

Option Reference – this cross-references to the stormwater management option references in Parts C and D.

Option Description – a summary of the stormwater management option description as presented in Parts C and D.

Rank – ranking as per the Benefit-Cost Analysis conducted in Part D

Timetable for expenditure – Detailing estimated expenditure (capital and maintenance) on the management actions for the next three financial years. Large capital projects, such as retarding basins will not be complete within this timeframe, however an estimate for these works are incorporated.

This information can be input into Council's Management Planning process. The elected members of Council can then decide on the allocation of funds for the implementation of the nominated management actions. Capital and Annual expenditure figures for the budget years 2002/2003 and 2003/2004 are currently incorporated in Council's Management Plan.

18.2 Implementation Order

The order for the implementation strategies generally follows that of the Benefit-Cost Ranking. There are some actions that depend on others being completed first (i.e. oil separators on gross pollutant traps) and the implementation order has been amended accordingly.

Some actions identifies also overlap into other areas (i.e. waste management, recreational, etc). Some of these actions have higher priorities in these areas when compared to the Stormwater Management Plan. The implementation schedule of the proposed actions has been altered from the Benefit Cost ranking in some cases to reflect this.

To ensure that these actions are able to be carried out, Council will be proactive in obtaining State and Federal Grants, and will commit funding as appropriate in Council's Management Plan.

18.3 Presented Expenditure

The expenditure presented is the estimated total cost of implemented the management options identified. It is important to note that funding for the implementation of the management options will not be funded 100% by Council. It is anticipated that a significant proportion of the funding will be sourced from grants, in kind contributions, community input / involvement, and Section 94 Development Contributions.

The variable nature of Section 94 Contributions and other grants present difficulty in determining an implementation schedule of works, beyond the years shown in Table E1 below. It is also important to note that management options proposed to be partially or totally funded by Council that funding is dependant upon Council voting the necessary funds from the Management Plan.

Table E1 - Stormwater Management Implementation Strategy (Superseded – Refer to Appendix F)

Action			Financial Year and Expenditure							
Ref	Description	Rank	2001 – 2002		2002 - 2003		2003 - 2004		Future	
			Capital	Annual	Capital	Annual	Capital	Annual	Capital	Annual
O34	Review environmental management guidelines	1	$1,000							
O35	Require compliance with guidelines	1	nil	nil	nil	nil	nil	nil		
O8	Contractor compliance to same standard	3	nil	nil	Nil	nil	nil	nil		
O10	Review Council mowing/pruning activities	3	$1,000							
O36	Land capability at rezoning	5	nil	nil	Nil	nil	nil	nil		
O23	Identification of salinity "hotspots"	6			$1,000	nil	nil	nil		
O6	Order upgrading of inadequate systems	7			nil	nil	nil	nil		
O19	Review Council use of pesticides/herbicides	7	$1,000							
O28	Investigation of sub-catchments	9	$15,000							
O7	Review Council works	10	$3,000							
O15	Adopting "water sensitive design"	10	nil	nil	nil	nil	nil	nil		
O18	Review and enforce agistment guidelines	10	500	nil	nil	nil	nil	nil		
O24	Review monitoring of Macquarie River	10	$1,000							
O41	Review of tree preservation orders	14	$1,000							
O22	Subcatchment salinity hazard ratings	15			$9,000	nil	nil	nil		
O5	Undertake Industry auditing programs	16			$10,000					
O31	Waste oil disposal facility	16	$15,000	$1,000		$1,000		$1,000		
O30	Significant Risk of Harm assessments	18			$15,000					
O42	Minimise Council use of fertiliser	19	nil	nil	nil	nil	nil	nil		
O27	"Adopt a creek"	20		$3,000		$3,000		$3,000		
O40	Biodiversity Strategy	21			$50,000					
O43	Safety warning signs	21			$7,000	$1,000		$1,000		
O39	Domestic waste water management strategy	22			$15,000					
O17	Identification and mapping of erosion areas	23			$10,000	nil	nil	nil		
O1	Community education and awareness	24		$5,000		$5,000		$5,000		
O14	Co-ordinate removal with community group	25				$5,000		$5,000		
O21	Planting of native species	26		$13,500		$13,500		$13,500		

Action		Rank	Financial Year and Expenditure							
Ref	Description		2001 – 2002		2002 - 2003		2003 - 2004		Future	
			Capital	Annual	Capital	Annual	Capital	Annual	Capital	Annual
O26	Combining existing Section 94 plans	26			$20,000	$5,000		$5,000		
O25	EO to assess potentially polluting DA	26		$7,000		$7,000		$7,000		
O12	"Dob in a Dump" program	29		$5,000		$5,000		$5,000		
O20	Riverine management plan	30					$50,000	$1,500		
O4	Review of street sweeping in CBD	31	$1,000							
O16	Modeling of flows in sub-catchments	32				$25,000		$25,000		
O38	Dog poop bins	33		$4,000		$4,000		$4,000		
O11	Waste dumping prohibited signs	34			$7,000	$1,000		$1,000		
O33	Trial green waste collection service	35			$60,000					
O32a	Oil separator – Lee Street	36					$30,000	$3,000		
O32a	Oil separator – Lee Street	37					$30,000	$3,000		
O32a	Oil separator – Lee Street	37					$30,000	$3,000		
O32a	Oil separator – Lee Street	39					$30,000	$3,000		
O9	Removal of willows on watercourses	40			$15,000	$100,000		$100,000		
O2	Continual review of litter bins	41		$5,000		$5,000		$5,000		
O37d	Retarding basin – McLennan Close	42			$61,000	$2,600		$2,600		
O44	Construction of Hector Park Wetlands project$^{\Psi}$	43							$375,000	$15,000
O37i	Retarding basin – Hughes Street	44							$88,000	$3,800
O37l	Retarding basin - Adrienne Street	45							$116,000	$4,900
O37m	Retarding basin - Bathurst Industrial Park	46							$110,000	$4,700
O3	Regulatory action	47		$2,500		$2,500		$2,500		
O37b	Retarding basin - Near Ennis Way	48							$125,000	$5,300
O37g	Retarding basin - Cnr Marsden Lane	49							$155,000	$6,600
O29c	Gross Pollutant Trap – Lee Street	50					$121,500	$8,000		
O29h	Gross Pollutant Trap - Sawpit Creek	50							$121,500	$8,000
O37e	Retarding basin - Near "Fairfield"	50							$165,000	$7,000
O37h	Retarding basin - Rosemont Ave and Willow Dr	50							$165,000	$7,000
O37j	Retarding basin - Beyers Place	50							$132,000	$5,600
O37k	Retarding basin - Bonner Street	50							$149,000	$6,300

Action Ref	Description	Rank	Financial Year and Expenditure							
			2001 – 2002		2002 - 2003		2003 - 2004		Future	
			Capital	Annual	Capital	Annual	Capital	Annual	Capital	Annual
O37n	Retarding basin - Cnr Lee St and O'Connell Rd	50							$165,000	$7,000
O37o	Retarding basin - O'Connell Road	50							$165,000	$7,000
O37a	Retarding basin - Hector Park	58							$167,000	$7,100
O29a	Gross Pollutant Trap - St Pat's Sporting Club.	59							$121,500	$8,000
O29b	Gross Pollutant Trap - Gilmour Street.	59							$121,500	$8,000
O29d	Gross Pollutant Trap - Adrienne Street	59							$121,500	$8,000
O29e	Gross Pollutant Trap - Bathurst Industrial Park	59							$121,500	$8,000
O29f	Gross Pollutant Trap - O'Connell Road	59							$121,500	$8,000
O37f	Retarding basin - Upstream of Wentworth Dr	59							$200,000	$8,500
O29g	Gross Pollutant Trap – Old Vale Creek	65					$155,000	$8,000		
O37c	Retarding basin - Sawpit Creek	66							$275,000	$12,000
O45	Litter Collection Officer	67	$40,000	$40,000		$40,000		$40,000		
O13	Patrol of illegal dumping "hot spots"	68				$7,000		$7,000		
Total Expenditure			**$79,000**	**$86,000**	**$280,000**	**$232,600**	**$446,500**	**$262,100**	**$3,281,000**	**$147,800**

Ψ - Whilst the Hector Park Wetlands project is ranked low in Benefit-Cost terms, the potential benefits gained from raising community awareness of stormwater issues from undertaking this project is significant. The project also represents an opportunity to form partnerships to undertake other management options as detailed above. Accordingly, it is proposed to seek grant funding for this project as no funds are available in the next three years to undertake the project in partnership with various local community and government organisations.

19. Framework For Plan Implementation

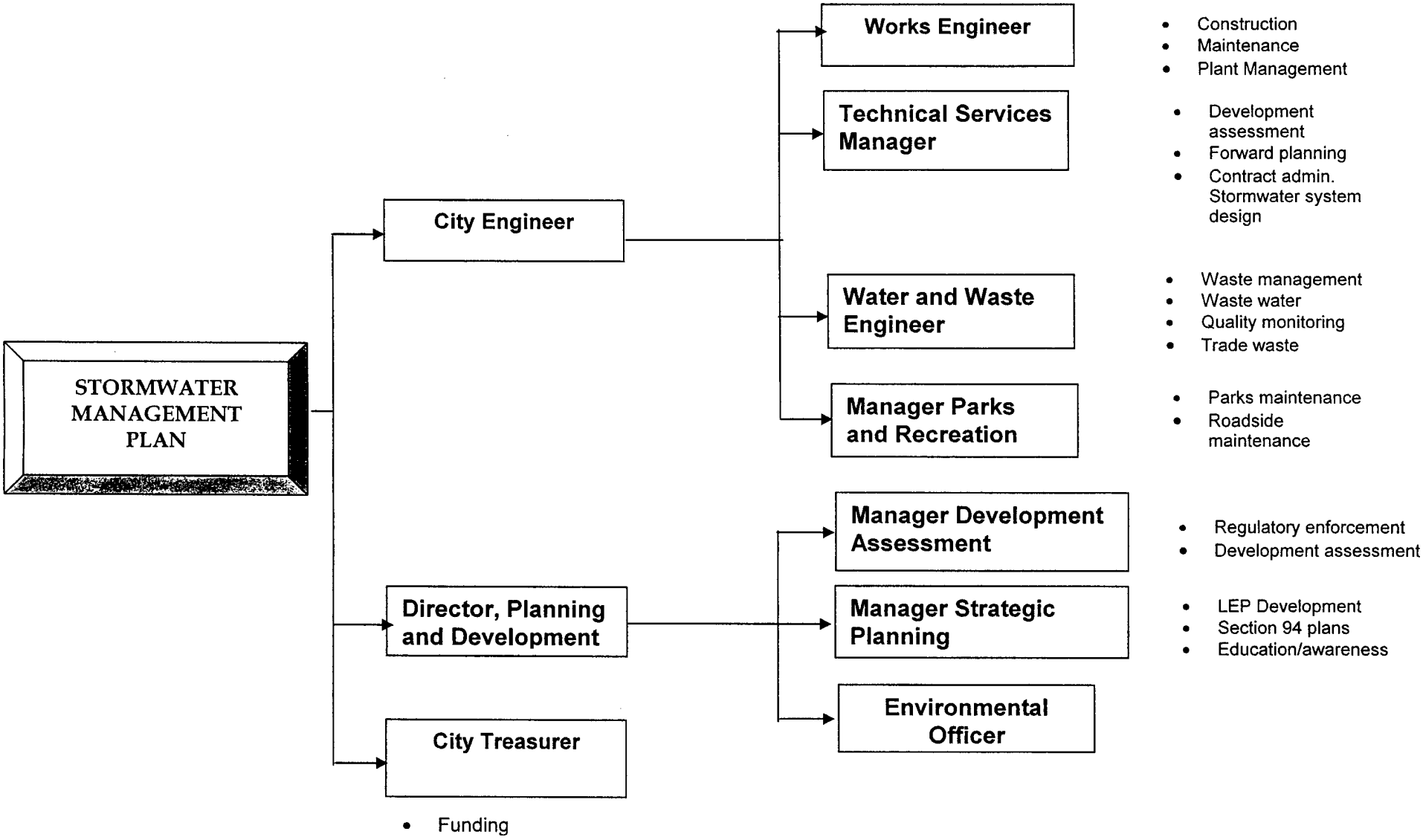
The person primarily responsible for the administration, implementation and reporting of the SMP will be City Engineer. The Environmental Officer will be responsible for monitoring the effectiveness of the SMP and to conduct appropriate environmental monitoring.

A representation of the implementation framework, along with the functions of each in relation to stormwater management is presented below, in Figure E1.

It is also important to ensure that the SMP meets the community expectations in future years with regards to values, issues, causes and management actions. To ensure that this occurs, an annual Discussion Forum will be held, preferably prior to the revision of the implementation strategies / SMP document so that any items raised can be considered for inclusion.

In addition, Council will always be open to input from the community, interest groups and government departments regarding the SMP, particularly in relation to management action.

Figure E1 – Implementation Framework



Part F

Monitoring, Reporting and Revision

20. Monitoring

20.1 General

Monitoring is the most important feedback mechanism to determine the effectiveness of the management measures implemented. Without a monitoring program, there is no way to measure the effectiveness of implemented measures and no data to assist in decisions regarding altering, introducing or abandoning various management strategies.

Council proposes to undertake four main types of monitoring to gauge the effectiveness of management measures employed by the SMP, being:

- Water quality;
- Observation; and
- Biological

20.2 Water quality

As previously outlined, Council currently undertakes monthly water quality monitoring at six points along the Macquarie River through Bathurst. It is proposed to continue this pattern of monitoring with some alterations to the parameters. In addition to the parameters already analysed, it is proposed to introduce the following:

- Suspended solids
- Ammonia
- Nitrogen Oxides
- Reactive Phosphorous
- Chlorophyll-a

The frequency of the monitoring is proposed to continue on a monthly basis.

20.3 Observation

In addition to the collection of water samples for testing, Council will also undertake observation based monitoring water quality monitoring. In addition to recording the location, date, time, weather and flow conditions required for the water quality monitoring, information regarding the following may be recorded:

- Litter;
- Foam;

- Surface scum/oil;
- Algae;
- Odour;
- Clarity;
- Organic matter;
- Aquatic plants;
- Condition of vegetation;
- Fish (if any visible)
- Bank erosion, and
- Sedimentation.

In addition, the Council complaints system will also be used to identify any problem areas with regard to any of the above.

It is also proposed to receive feedback on observations in various parts of the stormwater drainage system from Streamwatch groups. Currently, there is one active group that resides with Kelso High School. Council will encourage other schools to be involved in the Streamwatch program and "adopt" a watercourse near the school.

20.4 Biological

Whilst not a quantitative method of monitoring, biological monitoring can be a useful indicator to water health. Large invertebrates in particular can be very sensitive to subtle changes in water quality.

Again, Streamwatch have a relatively simple, low cost method of undertaking this type of monitoring that can yield useful data to the water quality in a particular area. Council will be actively encouraging these programs to be adopted by schools in the area.

20.5 Plan Implementation

Monitoring of the plan implementation will be conducted via the reporting process that is outlined in the following section.

21. Reporting

21.1 State of the Environment Report

The main way of reporting progress in implementing the SMP will be via the State of the Environment Reporting.

The State of the Environment Report is a statutory obligation under the Local Government Act 1993. Council is required to prepare a comprehensive report every four years with a supplementary report in the years in between.

The State of the Environment Report can contain detailed information about implemented / completed stormwater management works/actions and monitoring results.

21.2 Information with Council Rates Notice

Significant achievements and results can also be published in the Council newsletter that is sent to ratepayers on a quarterly basis. Due to space constraints, the newsletter will only be able to convey a summary of the more significant achievements of the implementation of the SMP.

One drawback with this method is that the newsletter does not reach all residents of Bathurst, especially those who reside in rental accommodation.

21.3 Reports to Council

An annual report can be submitted to Council in conjunction with annual discussion forum proposed. The report would detail what works/actions completed, what are in progress and what works/actions are proposed. Also, results of the monitoring would also be presented to demonstrate the effectiveness (or otherwise) of the management measures implemented.

Councillors could also be informed of significant achievements or accomplishments with the SMP via the monthly Councillor's Briefing.

21.4 Other Publicity

Other forms of publicity that can be used for reporting purposes include:

- **Editorials / Press releases**– Local media have expressed an interest in the past for stories about Council and community activities that have benefits for the environment. Council can keep the local media informed about its stormwater management activities and achievements with further information supplied upon request. This method of publicity is particularly effective in raising awareness about an issue or issues.

- **Advertisements / Public Notices** – Paid notices can also be used, especially in the advising of the proposed annual Discussion Forum. This method can also be used for making announcements in relation to official openings / functions, special announcements, educational material, etc.

- **Displays** – Typically organised for special events and/or days (i.e. World Environment Day, Local Government Week, Water Week, etc.), this method can also be effectively linked to education campaigns. If located in high pedestrian traffic areas on traditionally busy days, the exposure can be high.

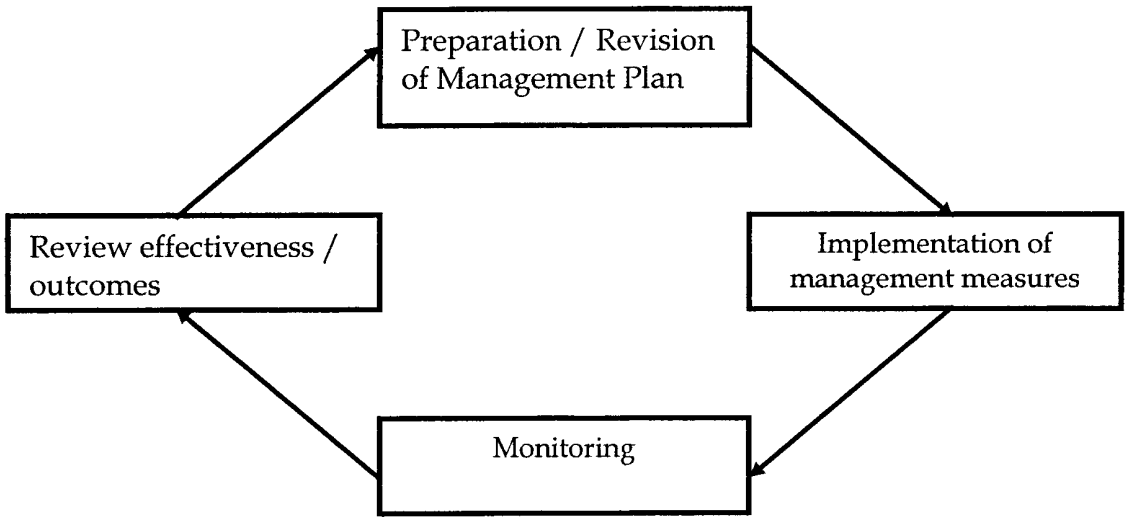
- **Web Page** – Council, via its web page, can provide information on significant achievements, monitoring results, photographs and any other information that can be accessed by anyone with internet access from around the world. Documents arising from the stormwater management process can also be made publicly available by this method

22. Revision

22.1 General

As with any environmental management plan, continuous improvement and revision is vital to the ongoing success to the SMP. This "continuous improvement" cycle is represented below:

Figure F1 – Environmental Management Cycle



Factors taken into account in the continuous improvement process include:

- new information;
- new technologies;
- new issues / causes;
- changed community attitudes, and;
- effectiveness of implemented management measures.

22.2 Implementation Strategy

As the implementation of management measures occur on a financial year basis, then the implementation strategy is accordingly required to be reviewed and re-issued on the same basis. Ideally, this revision should be conducted in conjunction with the preparation of Council's Works Program, which in turn should be reflected in Council's Draft Management Plan that is submitted to Council for consideration.

Completed works/actions are to be removed from the implementation strategies and inserted into Appendix E of this document with the actual cost and completion date for the implementation noted.

22.3 SMP Document

To ensure that the values, issue, causes and objectives are still relevant, the entire SMP document must be revised at regular intervals. This should take place:

- once significant new information is obtained, or;
- every 3 years.

A review of the entire SMP is scheduled to be conducted after the relevant sub-catchment issues and possible causes are identified and after obtaining more water quality information in each sub-catchment area (proposed to be after 30 June 2002).

In reviewing the SMP document, items to be considered should include, but not necessarily be limited to:

- results from monitoring carried out in the time prior to the revision, indicating the effectiveness of management actions implemented;
- achievement (or otherwise) of short term objectives;
- additional objectives that may be required;
- any issues not previously addressed or possible causes not previously identified;
- development of additional management options, and ;
- community attitude changes.

Part G

References and Appendices

23. References

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24. Appendix List

Appendix A

Section 12 Direction

Appendix B

Survey

Appendix C

Raw Data from Survey

Appendix D

Benefit-Cost Ratio Calculations

Appendix E

Completed Works / Actions

Appendix A
Section 12 Direction

REGISTERED MAIL

EPA

Environment Protection Authority
New South Wales

Bathurst City Council
Russell Street
Bathurst NSW 2795

P0 Box 1135 Chatswood I'ISW 2057
Tel .02. 9795 5000 Fax .02. 9325 5678

Attn: General Manager

Our Reference:

Your Reference:

DIRECTION UNDER SECTION 12 OF THE PROTECTION OF THE ENVIRONMENT ADMINISTRATION ACT 1991

The Environment Protection Authority (the EPA) considers that stormwater runoff from urban areas adversely impacts on the quality of the environment in New South Wales and believes that the preparation of Stormwater Management Plans will provide for more effective management of urban stormwater, thereby contributing to environment protection.

The EPA therefore directs under Section 12 of the Protection of the Environment Administration Act 1991 Bathurst City Council to prepare a Stormwater Management Plan (the Plan) for urban areas within Council's local government area in accordance with the following conditions:
Environment Stormwater government

1. The Plan must be prepared in cooperation with other Stormwater Managers within the local government area;

2. The Plan must be prepared in consultation with air relevant stakeholders, including the community, any relevant Catchment Management Committees or Trusts, the Environment Protection Authority and the Department of Land and Water Conservation;

3. The Plan must take into consideration the findings and recommendations of any relevant catchment, estuary or floodplain management plan, or Healthy Rivers Commission report;

4. The Plan must contain, but need not be limited to, the following:

   (a) A brief description of the urban area(s) and associated waterways, including climate, topography, water quality, streamflow, aquatic ecosystems and habitats, riparian vegetation, point sources of pollution, major sewer overflows and urban bushland areas;

   (b) Clearly defined stormwater management objectives for both existing and

proposed urban areas;

(c) Identification of stormwater management problems and issues;

(d) An evaluation of potential stormwater management practices (both non-structural and structural) to address the identified problems and issues;

(e) An Implementation Strategy, which includes prioritisation of specific management actions to be implemented by each stormwater manager in the local government area and a tentative timeframe for their implementation;

(f) A monitoring program to assess the effectiveness of the Plan, and identify any necessary refinements;

(g) A mechanism for reporting the effectiveness of the Plan to stakeholders, including the community; and

(h) A program for the process management regulations revising the Plan and linking its implementation and future review to of Council state of the environment reporting and council planning prescribed in the Local Government Act 1993 and related

6. The Plan must be submitted to the EPA within 2 years of the date of this Direction;

7. For the purposes of this direction:

(a) the definitions of "Catchment Management Committee" and "Catchment Management Trust' are to be taken as those in the Catchment Management Act 1989;

(b) "Stormwater Manager" includes local councils and State Government agencies or trading enterprises with a significant responsibility for stormwater or land management within the local government area;

(c) "Urban Area" is defined as any town or city with a resident population that exceeds 1,000 people.

Neil Shepherd
Director General

Per

P B YATES
Director - Special Operations Projects
(by Delegation)

24 April1998

Appendix B
Survey

Bathurst City Council Stormwater Management Plan
Attitudes Survey

1. Stormwater Management Issues

The first question seeks to identify what you see as the major issues in relation to stormwater management. An issue is an end result that may come about from a variety of sources or causes. The following is a list of possible issues that relate to stormwater management in Bathurst.

Please identify what you consider are the top seven (7) stormwater management issues by ranking the corresponding boxes 1 through 7, in order of importance (1 being most important and seven being least important). Preference should be given to issues you see and experience rather than see or hear in the media. If you feel that there is an issue that has been left out, please feel free to include it at the bottom of the list and rank its importance.

	Sediment deposits in ponds, lakes, streams, creeks and rivers
	Poor visual appearance of stormwater system
	Heavy metal pollution
	Fine soil particles suspended in waterways
	Organic matter (leaves, lawn clippings, mulch, etc) washing into waterways
	Linking of stormwater systems to recreational facilities (eg. lakes, wetland parks, etc.)
	Bacteria and pathogen pollution
	Nutrient (mainly nitrogen and phosphorous) enrichment
	Stormwater system design and planning by Council
	Gross pollution (bottles, plastic, glass, cigarette butts and other litter)
	Petrol, oil and grease pollution
	Illegal dumping of wastes on watercourses
	Loss or degradation of aquatic habitats (eg. concreting / piping natural drainage lines)
	Safety of the stormwater system (eg. Flash flooding, high water speeds, etc).
	Pesticide and/or herbicide pollution
	Loss or degradation of riparian vegetation (vegetation adjoining a stream or river, etc.)
	Control of stormwater polluting developments by Council
	Weed infestation of watercourses (especially willows)
	Impact on irrigators from using poor quality water
	Erosion of watercourses
	Others -

2. Causes of Stormwater Issues

With the top three (3) issues that you have identified, please indicate what you believe are the causes of these issues. You can nominate up to three (3) causes for each issue, in order of importance.

Number 1 Issue

Cause 1 _____

Cause 2 _____

Cause 3 _____

Number 2 Issue

Cause 1 _____

Cause 2 _____

Cause 3 _____

Number 3 Issue

Cause 1 _____

Cause 2 _____

Cause 3 _____

3. Council Priority for Actions

Finally, please indicate in what priority Council should focus its efforts in managing stormwater issues (1 being highest priority, 8 being the lowest priority).

	Undertake education programs on stormwater issues
	Undertake a review of Council's planning controls for stormwater polluting developments
	Taking regulatory action against stormwater polluters (orders, fines, court action, etc)
	Placing signage along watercourses and on stormwater pits
	Construction of engineered structures (eg. gross pollutant traps, sediment traps, etc.)
	Undertake restoration of degraded waterways (eg. native species plantings, erosion controls, etc)
	Take action to preserve pristine (undegredated) waterways (eg. development controls, fencing)
	Other -

Thank you for participating. Your input will assist Council in formulating a Stormwater Management Plan that meets the needs and expectations of the Bathurst community.

Appendix C
Raw Data From Survey

Key

Issue

1 Sediment deposits in ponds, lakes, streams, creeks and rivers
2 Poor visual appearance of stormwater system
3 Heavy metal pollution
4 Fine soil particles suspended in waterways
5 Organic matter (leaves, lawn clippings, mulch, etc) washing into waterways
6 Linking of stormwater systems to recreational facilities (eg. lakes, wetland parks, etc.)
7 Bacteria and pathogen pollution
8 Nutrient (mainly nitrogen and phosphorous) enrichment
9 Stormwater system design and planning by Council
10 Gross pollution (bottles, plastic, glass, cigarette butts and other litter)
11 Petrol, oil and grease pollution
12 Illegal dumping of wastes on watercourses
13 Loss or degradation of aquatic habitats (eg. concreting / piping natural drainage lines)
14 Safety of the stormwater system (eg. flash flooding, high water speeds, etc).
15 Pesticide and/or herbicide pollution
16 Loss or degradation of riparian vegetation (vegetation adjoining a stream or river, etc.)
17 Control of stormwater polluting developments by Council
18 Weed infestation of watercourses (especially willows)
19 Impact on irrigators from using poor quality water
20 Erosion of watercourses

Action

1 Undertake education programs on stormwater issues
2 Undertake a review of Council's planning controls for stormwater polluting developments
3 Taking regulatory action against stormwater polluters (orders, fines, court action, etc)
4 Placing signage along watercourses and on stormwater pits
5 Construction of engineered structures (eg. gross pollutant traps, sediment traps, etc.)
6 Undertake restoration of degraded waterways (eg. native species plantings, erosion controls, etc)
7 Take action to preserve pristine (undegredated) waterways (eg. development controls, fencing)

Responses to Issues

	Issue (refer to Key)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Community /																				
Discussion Forum	2					7		4	1			3		6			5			
5	7					5	6		1					2				3		4
					1	7			6	3		5		4				2		
	1				5			2				4	3		6		7			
					7		6		1			2			3		4			5
Council Chamber																				
1								1		3	2	4	7		6	5				
KHS Streamwatch																				
24										1	7	5	6		4			2		3
	5				6					3	2	1						4		7
	4				2	1	3			5	6		7							
			6		5		3	4		2	1									7
		1			3			2						6		5		4		7
		2				1	4					3			6	7			5	
		6	2							1				4						7
							2	1		3	4	5						6		7
	2		4		3					6		7			5					1
					3					2		7		6	5			1		4
				6						2	7		1			3		4		5
					4		7	6		1	2				3				5	
	5				4	3				1	6	7				2				
			3		6	5	4			1	2	7								
					2					1	3	4	5			6		7		
			6		3	5	7			1	2	4								
	5		4		7					2	1				3					6
			4		3		7			2	1				5		6			
			4		3				7	1	2				5			6		
	6		1		5		4			7	2				3					
										1	7	6	5		4			2		3
	3								7		6				5		4	1		2
							5			1	2	3			4			7		6
										1	7	5	6		4				2	3
Bx Tidy Towns																				
4							7			1		5	2	3		6				4
				5	2					1						4		3		
	4						2			1		2				6	3	5		7
					3					1	4	5	7			6		2		

Responses to Issues (continued)

	Issue (refer to Key)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Boundary Road																				
Landcare	1									4		7	6			2		3		5
9				7	1					3	4	5		6		2				
	4										7		1	6	5	2		3		
	2									1	6	3			4			5		7
						4				1		2					3			
						4		5	6	7			1					2		3
			5						6	2	3	4		1						7
		7	5			2				1			6				3			4
					2			1		3		4		7				5		6
Macquarie																				
Rivercare					5		6		2	7		3			4		1			
3								2		1	3	4	5		6	7				
		5		3	2					1							4	7		6
Mid Western																				
Health							1	6	7	2		5				3	4			
RSA																				
	3							5		7			4	6	1					2
EPA																				
	7				2			1		4	6	3					5			
Agriculture																				
				6	1			2		3				5				7		4
No. 1 issues	2	1	1	0	3	2	1	4	3	20	3	1	3	1	1	0	1	2	0	1
No. 2 issues	3	1	1	0	6	1	2	4	1	7	8	3	1	1	0	4	0	5	1	2
No. 3 issues	2	0	1	1	7	1	2	0	0	7	3	6	1	1	4	2	3	4	0	4
No. 4 issues	3	0	4	0	2	2	3	2	0	2	3	7	1	2	6	1	4	3	0	5
No. 5 issues	3	1	2	1	4	3	1	2	0	1	0	8	3	1	6	2	2	3	2	3
No. 6 issues	1	1	2	2	2	0	3	2	3	1	5	1	4	6	4	4	1	2	0	4
No. 7 issues	2	1	0	1	2	2	4	0	3	4	5	5	3	1	0	2	1	4	0	8
TOTAL RESPONSES	16	5	11	5	26	11	16	14	10	42	27	31	16	13	21	15	12	23	3	27

From above, Top 10 Community Identified issues are:

Issue	RANK
Gross pollution	1
Illegal Dumping	2
Petrol, Oil and Grease pollution	3
Erosion of watercourses	3
Organic Matter	4
Weed infestation of watercourses	5
Pesticide and/or herbicide pollution	6
Sediment deposits	8
Bacteria and pathogen pollution	8
Loss or degradation of aquatic habitats	8

Identification of Issues:

Action	Weighting *
1	2
2	1
3	2
4	1
5	2
6	2
7	2

*Weightings assigned objectively by Bathurst City Council

	Issue																			
Action Rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	4	2	2	0	6	4	2	8	6	40	6	2	6	2	2	0	2	4	0	2
2	3	1	1	0	6	1	2	4	1	7	8	3	1	1	0	4	0	5	1	2
3	4	0	2	2	14	2	4	0	0	14	6	12	2	2	8	4	6	8	0	8
4	3	0	4	0	2	2	3	2	0	2	3	7	1	2	6	1	4	3	0	5
5	6	2	4	2	8	6	2	4	0	2	0	16	6	2	12	4	4	6	4	6
6	2	2	4	4	4	0	6	4	6	2	10	2	8	12	8	8	2	4	0	8
7	4	2	0	2	4	4	8	0	6	8	10	10	6	2	0	4	2	8	0	16

	Issue																						
Value	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	No. "Y"	sum	Score
Water Quality	Y		Y	Y	Y		Y	Y		Y	Y	Y								Y	10	363	36.3
Aquatic Fauna/Flora													Y		Y	Y		Y			5	129	25.8
Public Health and Safety														Y							1	23	23.0
Recreation						Y															1	19	19.0
Amenity		Y							Y												2	28	14.0
Irrigation																			Y		1	5	5.0

Note: Community Values were determined by assigning each community identified issue into six (6) categories set subjectively by Council. Each issue was included once only, where in fact many of the identified community issues cross over into numerous Values.

Score	Assigned Value
> 30	Very High
20 - 30	High
10-20	Medium
< 10	Low

Note: The above Assigned Values were determined by Council in a such a way as to separate the importance of each Community Value.

Value	Assigned Value
Water Quality	Very High
Aquatic Fauna/Flora	High
Public Health and Safety	High
Recreation	Medium
Amenity	Medium
Irrigation	Low

• Causes of Issues

Occurrence	Cause
19	Deliberate pollution / illegal dumping
7	Location/number of litter bins
15	Lack of education/awareness
7	Development/growth
20	Littering
17	Vegetation management
2	Sewerage or septic surcharge / overflow / failure
9	Poor planning/maintenance
3	Cars and other motor vehicles
5	Agricultural land runoff
4	Chemical use
3	Storm / flood debris
4	Flow management
3	Lack of recycling systems/services
7	Erosion/sedimentation
6	Lack of regulatory enforcement
1	Septic tanks

Responses to Actions

	Actions (refer to Key)						
	1	2	3	4	5	6	7
Community /							
Discussion Forum	4	6	5	7	1	2	3
	2	3	7	4	5	1	6
Council Chamber							
	3	2	1	7	4	5	6
KHS Streamwatch							
	7	6	2	4	1	3	5
	1	7	3	2	5	4	6
	2	1	4	3	7	6	5
	5	7	6	1	4	3	2
	3	4	1	5	6	7	2
	5	4	3	6	2	1	7
	4	5	3	7	6	2	1
	6	7	2	1	5	4	3
	3	7	6	5	4	1	2
	2	3	1	7	6	5	4
	4	2	1	7	3	5	6
	2	3	1	7	6	5	4
	4	6	3	7	1	2	5
	6	4	5	3	1	7	2
	4	5	6	7	1	2	3
	5	1	2	4	7	3	6
	7	6	2	5	4	1	3
	6	4	3	1	7	2	5
	1	7	2	5	6	3	4
	7	6	2	4	1	3	5
Bx Tidy Towns							
	3	4	5	7	6	1	2
	1				3	2	4
	3	4	5	7	6	1	2
Boundary Road							
Landcare	1	2	4	7	6	3	5
	4	6	5	1	3	2	7
	6	4	1	7	5	3	2
	1	7	5	2	3	4	6
	3	7	2	5	1	4	6
	3	1	4	5	6	7	2
	5	1	4	6	2	3	7
	6	4	2	7	3	1	5
	4	7	1	6	2	3	5
Macquarie Rivercare							
	7	3	4	6	1	2	5
	4	3	6	5	2	1	7

Responses to Actions (continued)

Mid Western Health							
	7	4	3	5	1	2	6
RSA							
	1	4	6	7	3	2	5
EPA							
	3	2	1	5	4	6	7
Agriculture							
	3	5	7	2	1	6	4
No. 1 priority	6	4	8	4	10	8	1
No. 2 priority	4	4	8	3	4	10	8
No. 3 priority	9	5	6	2	6	9	4
No. 4 priority	8	10	5	4	5	4	5
No. 5 priority	4	3	6	9	4	4	10
No. 6 priority	5	6	5	4	9	3	8
No. 7 priority	5	8	2	14	3	3	5
TOTAL RESPONSES	41	40	40	40	41	41	41

Appendix D

Benefit – Cost Ratio Calculations

Estimated Costs of Management Options

Options	Costs ($)	
Ref	Capital / One off	Maintenance / ongoing
O1	0	5000
O2	2000	2000
O3	0	2500
O4	0	1000
O5	10000	0
O6	0	0
O7	3000	0
O8	0	0
O9	15000	100000
O10	1000	0
O11	7000	1000
O12	0	5000
O13	0	7000
O14	0	5000
O15	0	0
O16	0	25000
O17	10000	0
O18	500	0
O19	1000	0
O20	50000	1500
O21	0	13500
O22	9000	0
O23	1000	0
O24	1000	0
O25	0	7000
O26	20000	5000
O27	0	3000
O28	15000	0
O29		
O29a	121500	8000
O29b	121500	8000
O29c	121500	8000
O29d	121500	8000
O29e	121500	8000
O29f	121500	8000
O29g	155000	8000
O29h	121500	8000

Options	Costs ($)	
Ref	Capital / One off	Maintenance / ongoing
O30	15000	0
O31	15000	1000
O32		
O32a	30000	3000
O32b	30000	3000
O32c	30000	3000
O32d	30000	3000
O33	60000	0
O34	1000	0
O35	0	0
O36	0	0
O37		
O37a	167000	7100
O37b	125000	5300
O37c	275000	12000
O37d	61000	2600
O37e	165000	7000
O37f	200000	8500
O37g	155000	6600
O37h	165000	7000
O37i	88000	3800
O37j	132000	5600
O37k	149000	6300
O37l	116000	4900
O37m	110000	4700
O37n	165000	7000
O37o	165000	7000
O38	0	4000
O39	15000	0
O40	50000	0
O41	1000	0
O42	0	0
O43	7000	1000
O44	375000	15000
O45	40000	40000
O46	1200000	15000

Benefit-Cost Ratio Calculations

Options	Costs			Benefits						BCR
Ref	Capital	Maintenance	CI	Community Expectations	Harm	No.	Effectiveness	Proportion	BI	
O1	1	2	1.50	10	1	10	5	10	7.20	1.44
O2	1	1	1.00	10	1	1	2	3	3.40	1.13
O3	1	1	1.00	9	1	1	1	2	2.80	0.80
O4	1	1	1.00	10	1	3	3	1	3.60	1.80
O5	3	1	2.00	9	5	7	10	3	6.80	3.40
O6	1	1	1.00	0	5	7	5	3	4.00	4.00
O7	1	1	1.00	0	3	4	10	10	5.40	3.60
O8	1	1	1.00	0	3	4	10	10	5.40	5.40
O9	4	10	7.00	3	9	1	10	4	5.40	0.57
O10	1	1	1.00	0	6	1	10	10	5.40	5.40
O11	2	1	1.50	9	1	1	5	1	3.40	1.36
O12	1	2	1.50	9	1	1	10	10	6.20	1.24
O13	1	2	1.50	9	1	1	1	1	2.60	0.52
O14	1	2	1.50	3	9	1	10	4	5.40	1.08
O15	1	1	1.00	3	3	5	5	5	4.20	4.20
O16	1	5	3.00	0	10	2	10	5	5.40	0.77
O17	3	1	2.00	8	3	1	1	7	4.00	2.00
O18	1	1	1.00	4	3	3	5	7	4.40	4.40
O19	1	1	1.00	4	8	1	10	1	4.80	4.80
O20	8	1	4.50	0	9	4	1	7	4.20	0.84
O21	1	3	2.00	3	9	4	8	10	6.80	1.05
O22	2	1	1.50	0	9	1	1	10	4.20	2.80
O23	1	1	1.00	0	9	1	1	10	4.20	4.20
O24	1	1	1.00	0	2	5	1	10	3.60	3.60
O25	1	2	1.50	0	4	7	1	7	3.80	0.95
O26	5	2	3.50	0	3	8	10	10	6.20	0.95
O27	1	1	1.00	3	9	8	10	5	7.00	1.75
O28	4	1	2.50	0	9	10	10	10	7.80	3.90

Benefit-Cost Ratio Calculations

O29										
O29a	10	2	6.00	10	1	1	9	1	4.40	0.44
O29b	10	2	6.00	10	1	1	9	1	4.40	0.44
O29c	10	2	6.00	10	1	1	9	2	4.60	0.46
O29d	10	2	6.00	10	1	1	9	1	4.40	0.44
O29e	10	2	6.00	10	1	1	9	1	4.40	0.44
O29f	10	2	6.00	10	1	1	9	1	4.40	0.44
O29g	10	2	6.00	10	1	1	9	1	4.40	0.42
O29h	10	2	6.00	10	1	1	9	2	4.60	0.46
O30	4	1	2.50	0	8	5	5	1	3.80	1.90
O31	4	1	2.50	8	6	1	8	10	6.80	3.30
O32										
O32a	6	1	3.50	10	5	1	9	2	5.40	0.90
O32b	6	1	3.50	10	5	1	9	1	5.20	0.87
O32c	6	1	3.50	10	5	1	9	1	5.20	0.87
O32d	6	1	3.50	10	5	1	9	1	5.20	0.87
O33	8	1	4.50	10	6	1	5	1	4.60	1.02
O34	1	1	1.00	0	3	8	10	10	6.20	6.20
O35	1	1	1.00	0	3	8	10	10	6.20	6.20
O36	1	1	1.00	0	3	4	10	7	4.80	4.80
O37										
O37a	10	2	6.00	0	3	2	7	1	2.60	0.25
O37b	10	2	6.00	0	3	2	7	1	2.60	0.27
O37c	10	3	6.50	0	3	2	7	1	2.60	0.22
O37d	8	1	4.50	0	3	2	7	1	2.60	0.37
O37e	10	2	6.00	0	3	2	7	1	2.60	0.26
O37f	10	2	6.00	0	3	2	7	1	2.60	0.24
O37g	10	2	6.00	0	3	2	7	1	2.60	0.27
O37h	10	2	6.00	0	3	2	7	1	2.60	0.26
O37i	9	1	5.00	0	3	2	7	1	2.60	0.31

Benefit-Cost Ratio Calculations

O37j	10	2	6.00	0	3	2	7	1	2.60	0.26
O37k	10	2	6.00	0	3	2	7	1	2.60	0.26
O37l	10	1	5.50	0	3	2	7	1	2.60	0.29
O37m	10	1	5.50	0	3	2	7	1	2.60	0.29
O37n	10	2	6.00	0	3	2	7	1	2.60	0.26
O37o	10	2	6.00	0	3	2	7	1	2.60	0.26
O38	1	1	1.00	3	4	2	5	1	3.60	0.80
O39	4	1	2.50	3	4	3	10	7	3.40	1.70
O40	8	1	4.50	3	9	1	10	10	6.40	1.60
O41	1	1	1.00	3	9	1	10	10	5.00	3.33
O42	1	1	1.00	6	2	1	10	1	3.00	3.0
O43	2	1	1.50	3	10	1	5	1	4.20	1.68
O44	10	4	7.00	0	3	5	7	1	4.60	0.35
O45	7	7	7.00	3	1	1	5	2	2.00	0.25

Appendix E
Completed Works / Actions

Schedule of Completed Management Actions

Option Ref	Option Description	Actual Cost ($)	Completion Date
O45	Appoint Litter Collection Officer		2001/02
O30	Significant Risk of Harm assesments		2002/03
O39	Domestic Waste Water Management Strategy		2002/03
O44	Construction of Hector Park Wetlands	$363,000	2002/03
O37a	Retarding Basin – Hector Park	$200,000	2002/03
O17	Identification and Mapping of Erosion Areas (As part of Vegetation Management Plan - $80,000)		2002/03
O20	Riverine Management Plan (As part of Vegetation Management Plan - $80,000)		2002/03
O29g	Gross Pollutant Trap – Old Vale Creek	$80,000	2002/03

Appendix F
Revised Implementation Strategy

Appendix F - Revised Stormwater Management Implementation Strategy				Financial Year and Expenditure							
Action Ref	Description	Rank	Comment	2004 – 2005		2005 - 2006		2006 - 2007		Future	
				Capital	Annual	Capital	Annual	Capital	Annual	Capital	Annual
O34	Review environmental management guidelines	1			$1,000		$1,000		$1,000		
O35	Require compliance with reviewed guidelines	1		nil	nil	nil	nil	nil	nil		
O8	Contractor compliance to same standard	3	SP	nil	nil	nil	nil	nil	nil		
O10	Review Council mowing/pruning activities	3		nil	nil	nil	nil	nil	nil		
O36	Require land capability study at rezoning	5	SP	nil	nil	nil	nil	nil	nil		
O23	Identification of salinity "hotspots"	6		nil	nil	nil	nil	nil	nil		
O6	Order upgrading of inadequate systems	7	SP	nil	nil	nil	nil	nil	nil		
O19	Review Council use of pesticides/herbicides	7		nil	nil	nil	nil	nil			
O28	Investigation of sub-catchments	9		$15,000							
O7	Review Council works to minimse impact	10		nil	nil	nil	nil	nil	nil		
O15	Adopting "water sensitive design"	10		nil	nil	nil	nil	nil	nil		
O18	Review and enforce agistment guidelines	10		nil	nil	nil	nil	nil	nil		
O24	Review monitoring of Macquarie River	10		$1,000							
O41	Review of tree preservation orders	14		nil	nil	nil	nil	nil	nil		
O22	Subcatchment salinity hazard ratings	15		nil	nil	nil	nil	nil	nil		
O5	Undertake Industry auditing programs	16				$10,000					
O31	Waste oil disposal facility	16	WMC								
O42	Minimise use of fertiliser	19	SP								
O27	"Adopt a creek"	20			$3,000		$3,000		$3,000		
O40	Biodiversity Strategy	21		nil	nil	nil	nil	nil	nil		
O43	Safety warning signs	21				$7,000	$1,000		$1,000		
O26	Combining existing Section 94 plans	26				$20,000	$5,000		$5,000		
O25	EO to assess potentially polluting DA	26			$7,000		$7,000		$7,000		
O12	"Dob in a Dump" program	29			$5,000		$5,000		$5,000		
O21	Planting of native species	26			$13,500		$13,500		$13,500		
O4	Review of street sweeping in CBD	31		nil	nil	nil	nil	nil	nil		
O16	Modeling of base flows in sub-catchments	32					$25,000		$25,000		

Action Ref	Description	Rank	Comment	2004 – 2005		2005 - 2006		2006 - 2007		Future	
				Capital	Annual	Capital	Annual	Capital	Annual	Capital	Annual
O38	Monitor & Maintain Dog poop bins	33			$4,000		$4,000		$4,000		
O11	Waste dumping prohibited signs	34				$7,000	$1,000		$1,000		
O33	Trial green waste collection service	35	WMC								
O32a	Oil separator – Lee Street	36	OSD							$30,000	$3,000
032b	Oil separator – Addreienne Street	37	OSD							$30,000	$3,000
032c	Oil seperator - Bathurst Industrial Park	38	OSD							$30,000	$3,000
032d	Oil seperator - O'Connell Road	39	OSD							$30,000	$3,000
O9	Removal of willows on watercourses	40		$73,000		$76,000		$80,000			
O2	Continual review of litter bins	41			$5,000		$5,000		$5,000		
O37d	Retarding basin – McLennan Close	42								$61,000	$2,600
O37i	Retarding basin – Hughes Street	44								$88,000	$3,800
O37l	Retarding basin - Adrienne Street	45								$116,000	$4,900
O37m	Retarding basin - Bathurst Industrial Park	46	BIP		$4,700		$4,700		$4,700		
O3	Regulatory action	47			$5,000		$5,000		$5,000		
O37b	Retarding basin - Near Ennis Way	48								$125,000	$5,300
O37g	Retarding basin - Cnr Marsden Lane	49								$155,000	$6,600
O29c	Gross Pollutant Trap – Lee Street	50								$121,500	$8,000
O29h	Gross Pollutant Trap - Sawpit Creek	50								$121,500	$8,000
O37e	Retarding basin - Near "Fairfield"	50								$165,000	$7,000
O37h	Retarding basin - Rosemont and Willow Dr	50		$165,000	$7,000		$7,000		$7,000		
O37j	Retarding basin - Beyers Place	50								$132,000	$5,600
O37k	Retarding basin - Bonner Street	50								$149,000	$6,300
O37n	Retarding basin - Cnr Lee St and O'Connell Rd	50								$165,000	$7,000
O37o	Retarding basin - O'Connell Road	50								$165,000	$7,000
O37a	Retarding basin - Hector Park	58			$7,100		$7,100		$7,100		
O29a	Gross Pollutant Trap - St Pat's Sporting Club.	59								$121,500	$8,000
O29b	Gross Pollutant Trap - Gilmour Street.	59								$121,500	$8,000
O29d	Gross Pollutant Trap - Adrienne Street	59								$121,500	$8,000
O29e	Gross Pollutant Trap - Bathurst Industrial Park	59								$121,500	$8,000
O29f	Gross Pollutant Trap - O'Connell Road	59								$121,500	$8,000

Action Ref	Description	Rank	Comment	2004 – 2005		2005 - 2006		2006 - 2007		Future	
				Capital	Annual	Capital	Annual	Capital	Annual	Capital	Annual
O37f	Retarding basin - Upstream of Wentworth Dr	59								$200,000	$8,500
O29g	Gross Pollutant Trap – Old Vale Creek	65			$8,000		$8,000		$8,000		
O37c	Retarding basin - Sawpit Creek	66								$275,000	$12,000
O45	Appoint Litter Collection Officer	67			$40,000		$40,000		$40,000		
O13	Patrol of illegal dumping "hot spots"	68			$7,000		$7,000		$7,000		
N100	Respond to stormwater pollution complaints	-									
N101	Implement Vegetation Management Plan	-			$40,000		$40,000		$40,000		
N102	Develop Stormwater management complaint System	-									
N103	Conduct complete revision to incorporate Bathurst Regional Council Local Government Area	-									
Total Expenditure				**$254,000**	**$177,300**	**$120,000**	**$209,300**	**$80,000**	**$209,300**	**$2,766,500**	**$144,600**

Legend:
BIP - Works incorporated within Development
OSD - On site Developer Requirement (Cancelled)
SP - Standard Practice (Bathurst City Council)
WMC - Waste Management Centre (Facility available at)

N1xx - New Actions included in 2003/04 review