Prepared by

Department of
Works and Services

West Wyalong Stormwater Management Plan

This Project has been assisted by the New South Wales Government through its Stormwater Trust.

February 2001

Acknowledgements

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Luke Scott of Bland Shire Council prepared this document.

The contribution of the following people to the writing and revising of this report is gratefully acknowledged:

- Frank Zaknich - General Manager, Bland Shire Council.
- Gary Arthur - Director of Works and Services Bland Shire Council.
- David Mitchell - Director of Environment and Community Bland Shire Council.
- Benjamin Falconer - Facilities and Assets Engineer Bland Shire Council.
- Luke Scott - Trainee Engineer Bland Shire Council.
- Mark Leary - District Manager Department of Land & Water Conservation.
- Karen Leary - Landcare Co-ordinator Landcare.
- West Wyalong High School.
- West Wyalong Public School.
- The Wyalong and West Wyalong Community.

Contents

1. Introduction

1.1 Background

The NSW Environment Protection Authority (EPA) has issued a legal direction to all councils to prepare Stormwater Management Plans (SMPs) under Section 12 of the *Protection of the Environment Administration Act*. The plan is specific to urban areas within the Bland Shire Council Local Government Area (LGA). The aim is to improve waterway health and water quality by identifying practical solutions over the short and longer terms to mitigate the environmental impacts of urban stormwater discharges. Bland Shire Council has been assisted in the SMP preparation by a NSW Government grant issued through the Stormwater Trust.

This SMP focuses on stormwater management for the urban area of West Wyalong within the Bland Shire Council LGA. This SMP has been prepared to comply with the EPA's Section 12 Direction whereby Stormwater Management Plans are to be prepared for all urban centres with a population greater than 1000 people. Within the Bland Shire Council LGA, the urban centre of West Wyalong with a population of 2600 people is the only urban settlement meeting this category.

West Wyalong has no natural rivers or creeks, however the stormwater discharges overland into the natural catchment system at the lower end of the Bland Creek catchment (refer to **Figure 1.2** and **Figure 1.4**). This catchment extends into the neighbouring Temora, Weddin and Young Shire Council LGAs. (refer **Figure 1.1** and **Figure 1.3**).

1.2 Purpose of the Stormwater Management Plan

The first purpose of this Stormwater Management Plan is to:

> "improve the management of stormwater within West Wyalong to add to the health and quality of local waterways and catchments."

This SMP will assist Council to identify and explore existing stormwater impacts and reduce the effects of future impacts of stormwater on the environment.

The main objectives of this SMP is to:

- Identify stormwater management values for the West Wyalong catchment.

- Derive stormwater objectives that protect these values.
- Identify issues and causes that may undermine these objectives
- Plan management practices and their timing to meet these issues and problems.

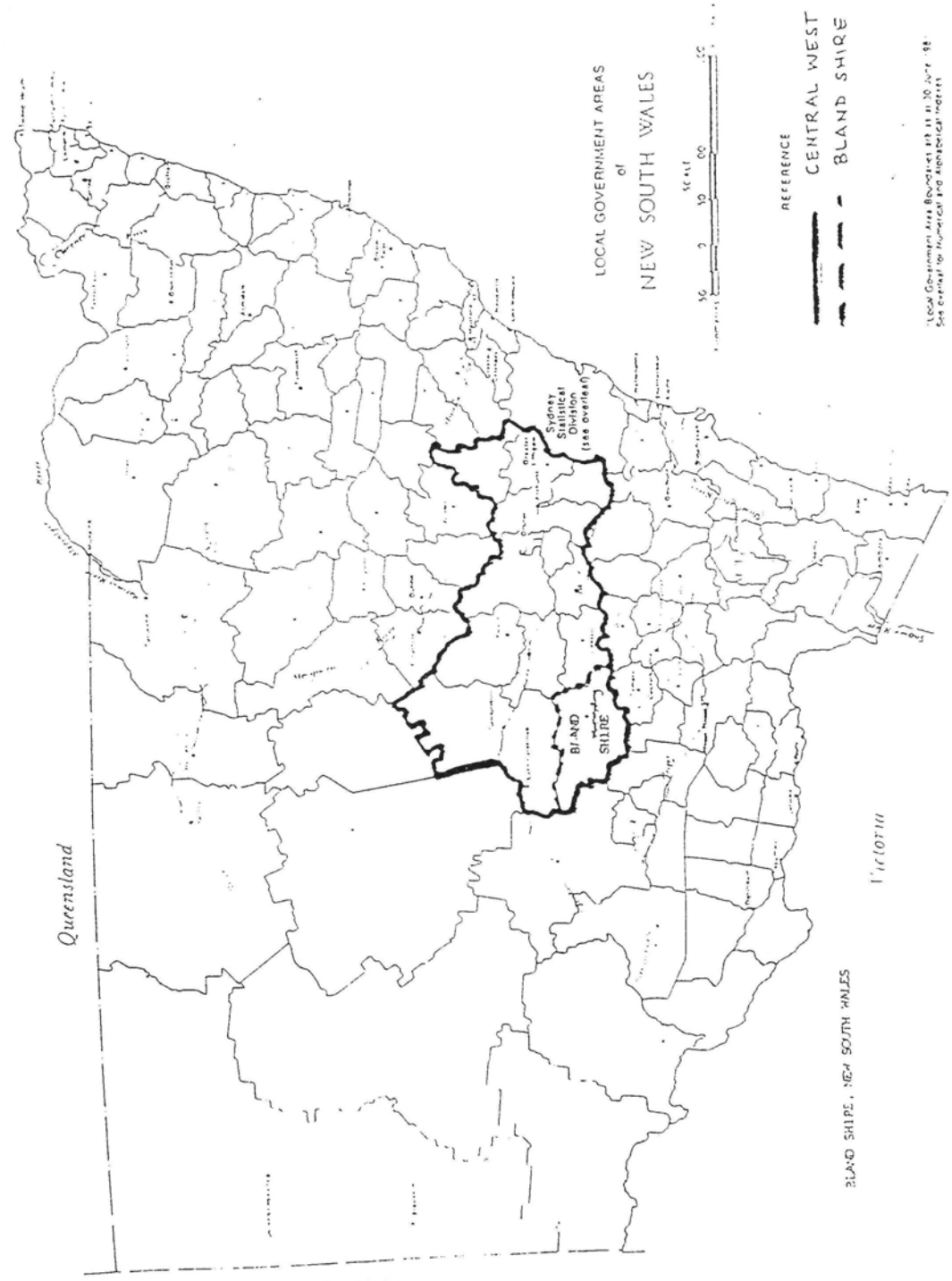


Figure 1.1 Location of Bland Shire Relative to NSW

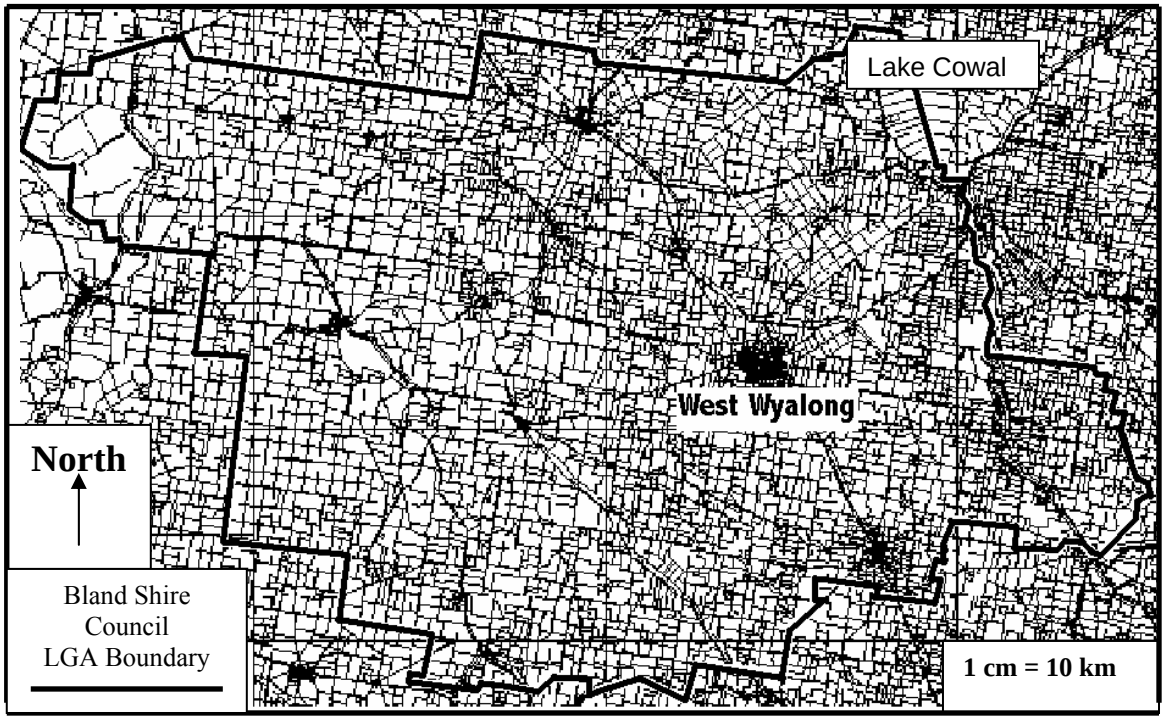


Figure 1.2 Bland Shire Local Government Area

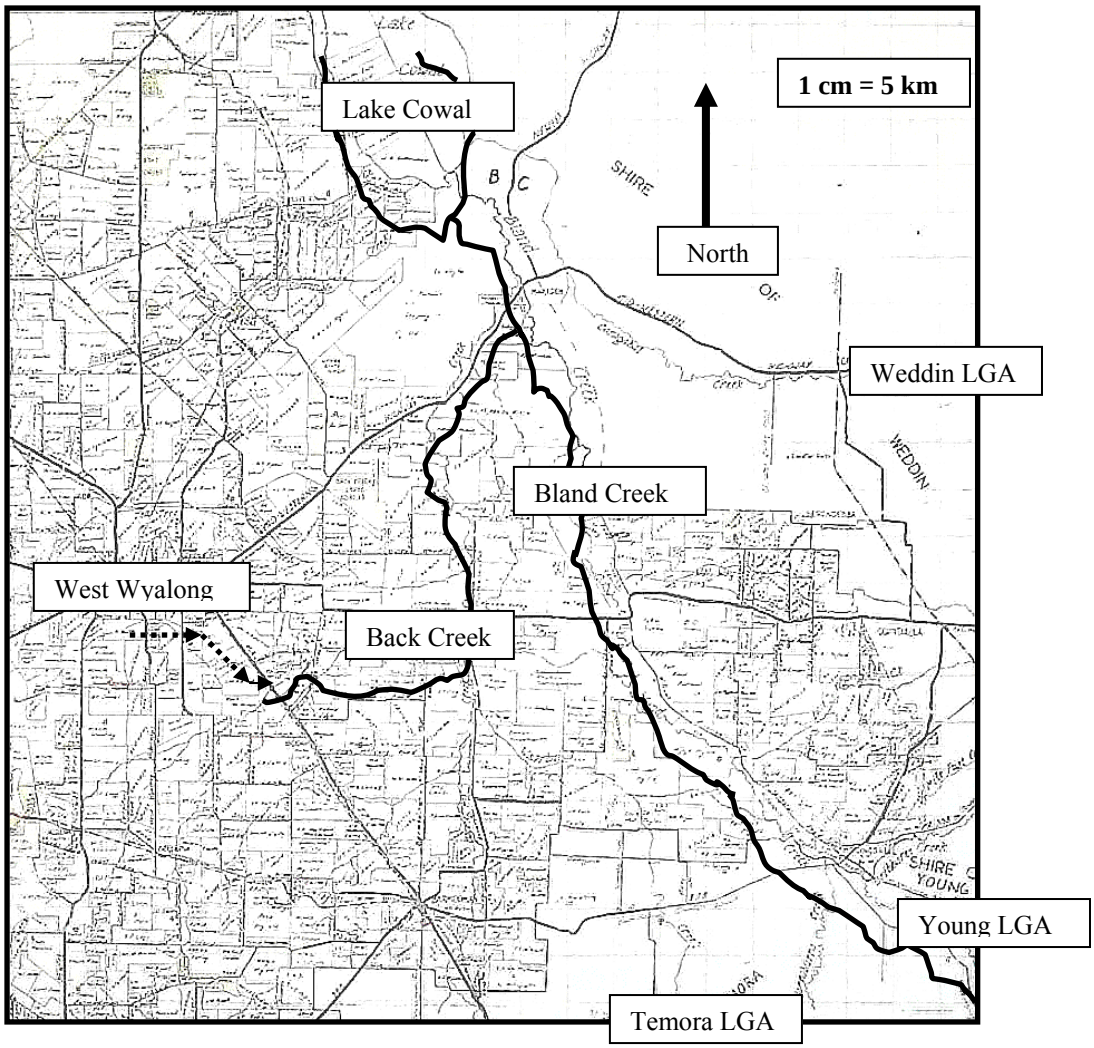


Figure 1.3 Bland Creek Catchment

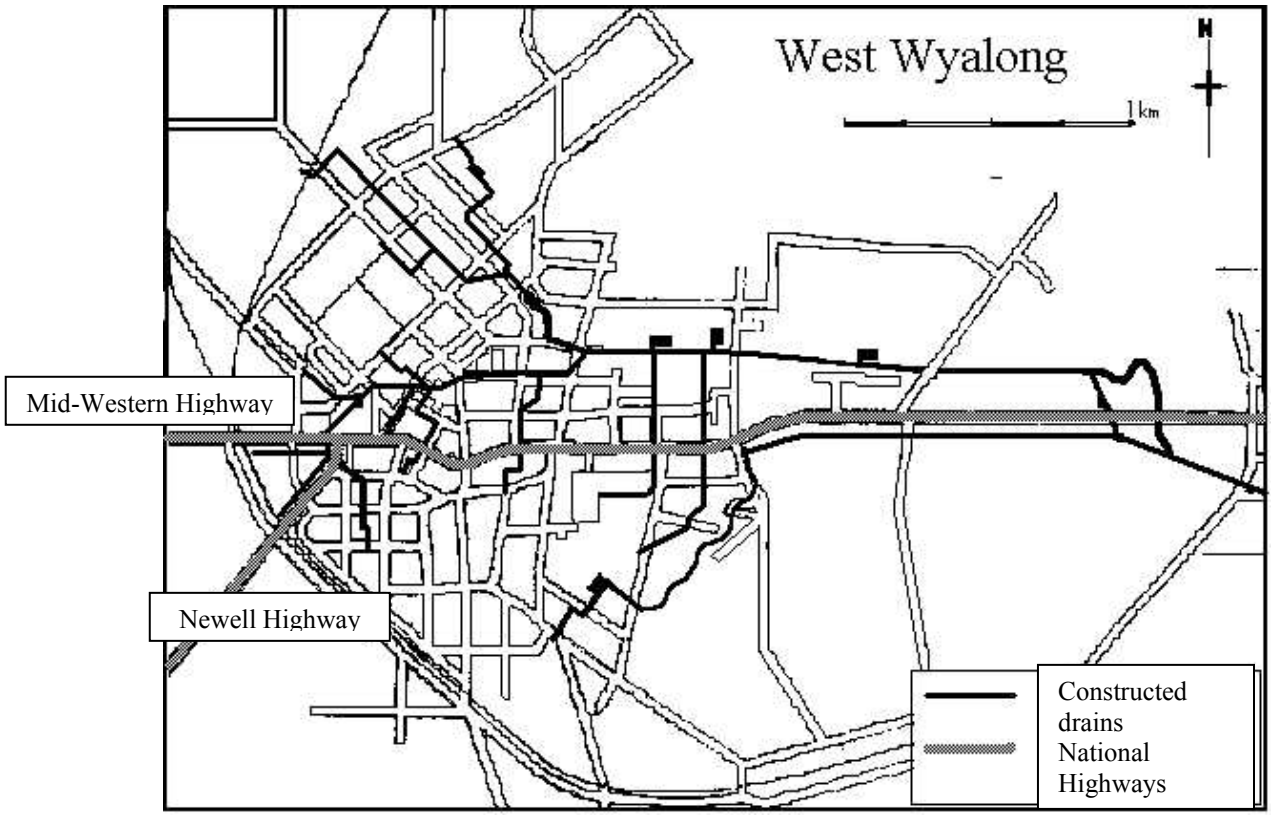


Figure 1.4 West Wyalong Sub-catchment

1.3 Stormwater Management Responsibilities

Stormwater Management within West Wyalong is the primary responsibility of the Bland Shire Council. The RTA manages stormwater for the Newell and Mid Western Highways that run through the urban areas of the town.

Within Bland Shire Council, there are a number of departments who have responsibility for stormwater management within the township. **Figure 1.5** illustrates Bland Shire Council's present structure, listing each department and its responsibility for stormwater management.

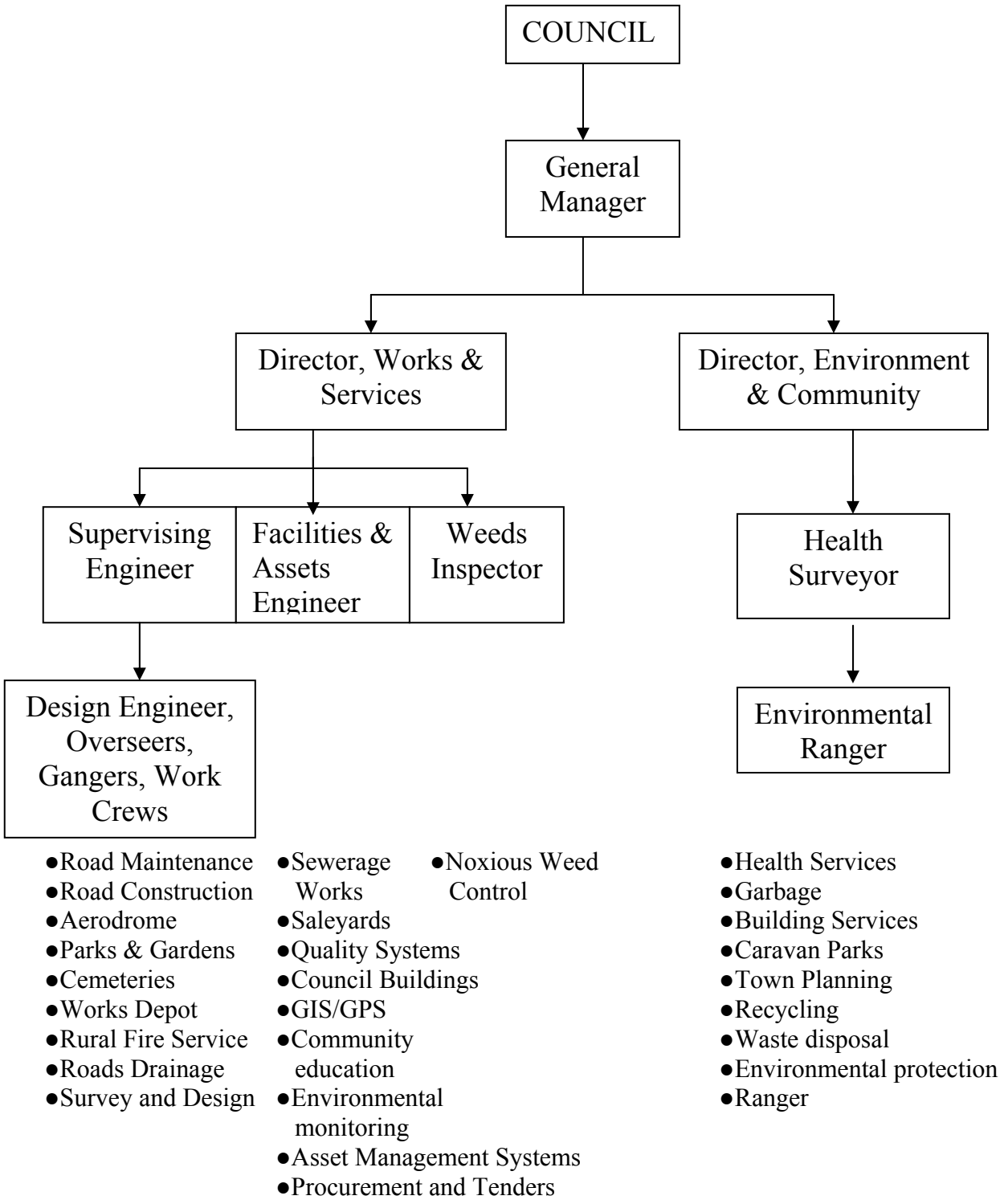


Figure 1.5 Bland Shire Council Structure and Responsibilities.

1.4 SMP Preparation Process

The SMP preparation process is divided into twelve tasks. These tasks are outlined in the EPA document " A Guide to the Stormwater Management Planning Process" included with the "Example Stormwater Management Plan", 1999.

1.5 Stakeholder Consultation

To achieve the objectives of the SMP, it was critical that Council closely consulted with relevant government authorities, community groups and other stakeholders in the preparation process of the SMP.

Consultation through the SMP preparation process included:

- Catchment inspections – 25th October, 2000
  A catchment inspection was held with Council and Department of Land & Water Conservation officers. The main purpose was to view troublesome areas within the urban area. These areas affect stormwater quality or are affected by stormwater.

- Initial questionnaires – 11th December, 2000
  Questionnaires were sent to special interest groups including the Town Advancement Group, Tourism Operators Group, Tidy Towns, Town Inspection Committee, Department of Land & Water Conservation, Back Creek Landcare Group, Apex, Lions, Rotary, West Wyalong Show Society and West Wyalong High School.

- Initial formation of SMP Steering Committee – 13th December, 2000
  The committee consists of Council officers and representatives from the Department of Land & Water Conservation and local Landcare group.

- Advertisements for a stormwater catchment survey in the 'West Wyalong Advocate' to raise public awareness began on January 5, 2001 along with a front-page story on January 16, 2001.

- A town-wide survey sent out on January 21, 2001 to evaluate community values, stormwater management objectives and public knowledge on stormwater issues.

- A public forum held at the Council Chambers on February 8, 2001 to discuss the values and objectives determined in the survey and to raise specific concerns and 'hot spots' within the catchment. The meeting was very well attended. The 'West Wyalong Advocate' reported this meeting on February 16, 2001.

- A meeting of the SMP Steering Committee examined proposed solutions from the survey and added their own to compile a list of options. A final meeting proposed the implementation strategy before reviewing and displaying the final Plan.

1.6 Relevant Existing Plans And Reports

West Wyalong Stormwater Study (1986) by *Sinclair Knight & Partners*
This report identifies the urban catchments, contains some flow calculations and investigates possible solutions to stormwater inundation "hotspots" in the urban drainage system. Some analysis of the two major catchments including sizes, slopes and vegetation present is also supplied.

West Wyalong Stormwater Study Supplementary Report (1987) by *Sinclair Knight & Partners* investigates flow conditions at identified trouble spots and includes calculations and costings of proposals to alleviate the perceived problems. These options have been included in this SMP where relevant.

Hydraulic Analysis of Existing Floodways (1997) by *PPK Environment & Infrastructure* examines the hydraulics of four known floodways within the town area. It identifies flow conditions and includes calculations on peak flows and concentration times. These last three reports relate more to water quantity than quality.

Statement of Environmental Effect of Proposed Ornamental Lake (1987) by *Worthington Civil*. This plan reports on the positive and negative environmental effects of a proposed lake to be filled with run-off from the urban stormwater system. The proposal was not accepted because of questions over the lake's effect on the nearby Mid-Western Highway, health risks from a concentration of pollutants and the need for regular monitoring.

Bland Shire Council Management Plan 1998/2001. It outlines plans to maintain and progressively improve the urban stormwater drainage system by:

- Concreting the main town drain to Cooinda Park
- Providing underground drainage where possible
- Undertaking a stormwater study to determine priorities and prepare a five-year drainage improvement program.

It also calls for a Sewage Management Plan to eliminate any adverse environmental consequences in the waste management system and discusses the operation of the system to treat truck wash wastes from the West Wyalong saleyards.

Bland Shire Council State of the Environment Report, 1999 contains much of the information used in this Plan on topography, soil landscapes, sensitive areas and vegetation. Some maps have also been used.

The Bland Creek Catchment – State of the Catchment, 1995 by *Department of Land & Water Conservation* investigates the condition of the catchment that receives run-off from West Wyalong. It reports a rise in the water table of up to 2 metres that is likely to lead to an increase in dryland salinity.

Lake Cowal Gold Mine Environmental Impact Statement by *North Limited* examines the environment and existing conditions for Lake Cowal, the natural waterbody that ultimately receives urban stormwater run-off for major storm events. Major environmental issues are identified and studies into local flora and fauna are included.

Lake Cowal Land and Water Management Plan, 1999 by *Australian Water Technologies* again examines Lake Cowal's environment and existing conditions. This report expresses particular concern for the future of the lake due to rising nutrient levels and the effect of the Bland Creek catchment, which delivers 48,000 megalitres annually to the Lake's average capacity of 155,000 megalitres. Rising nutrient levels could switch the ecology from macrophyte to algal domination, leading to the collapse of the lake system.

Bland Shire Development Control Plan, 1999 details land use within the town and contains maps of proposed developments that will impact urban stormwater system performance.

Bland Shire Environment Plan 1993 by *Don Fox Planning*. This map shows land use within urban areas and the Shire as a whole.

Integrated Catchment Management in the Murray-Darling Basin 2001-2010 by *Murray-Darling Basin Ministerial Council* examines the current threats to the basin in which West Wyalong is situated. It calls communities and governments to protect the health and productivity of the Murray-Darling Basin from rising salinity, increasing nutrient levels and declining riverine health and terrestrial biodiversity. The goals, values and principles have been noted and incorporated into this Plan where relevant.

2. Catchment Description

2.1 Description of Waterways and Sub catchments

The Shire of Bland is bisected by two major catchments – the Lachlan to the north and the Murrimbidgee to the south. The watercourses are in a predominantly natural condition. (See **Figure 1.2**)

The Bland Creek Catchment is south of Lake Cowal and forms part of a larger catchment feeding Lake Cowal and the Lachlan River. Bland Creek is the main tributary of the catchment, serving an area of around 939,948 hectares. Bland Creek extends into the adjacent Temora, Young and Weddin Shire LGAs. Stormwater flows from West Wyalong through Wyalong, into Back Creek then Bland Creek and eventually into Lake Cowal before overflowing into Nerang Cowal and then to the Lachlan River. Substantial floods are required before flows from the West Wyalong stormwater system reach the extent of the catchment system due to the flatness of terrain. (See **Figure 1.3**)

Most of the land within the broader catchment is used for farming however dams rather than creeks meet the majority of water needs. Irrigation is not a major activity in the catchment. The Lachlan Catchment Management Committee (LCMC) has identified the following areas of concern:

- Groundwater levels rising
- Protection of catchment creeks
- Dryland salinity increasing
- Extent of erosion
- Soil acidification
- Soil structure decline
- Weed invasion and tree decline

Forested areas exist within the catchment, including Back Creek State Forrest, Boxalls State Forest and Wyrra State Forest. Small pockets of natural forested reserves spread throughout the catchment also exist.

The drainage structures within the town catchment consist entirely of constructed gutters, pipes, dams and open drains to convey stormwater. There are no natural rivers or major creeks in the urban area, the nearest features being the constructed main town stormwater drain formed from a natural gully and washaways that run through urban bushland during wet weather. The base stream flow for the West Wyalong catchment is therefore nil, that is, the system is designed to drain fully and is only operational in wet weather (See **Figure 1.4**).

Urban bushland exists in pockets on the fringe of West Wyalong. The major section is the Wyalong State Forest to the north, and a section of Crown Land in the south. The vegetation is in the form of eucalypt mallee scrub.

2.2 Land Use

Table 2.1 Land Use breakdowns for urban areas (km^2)

Urban Area	Urban	Commercial	Industrial	Open Space	Total
West Wyalong	1.94	0.23	0.46	0.39	3.02

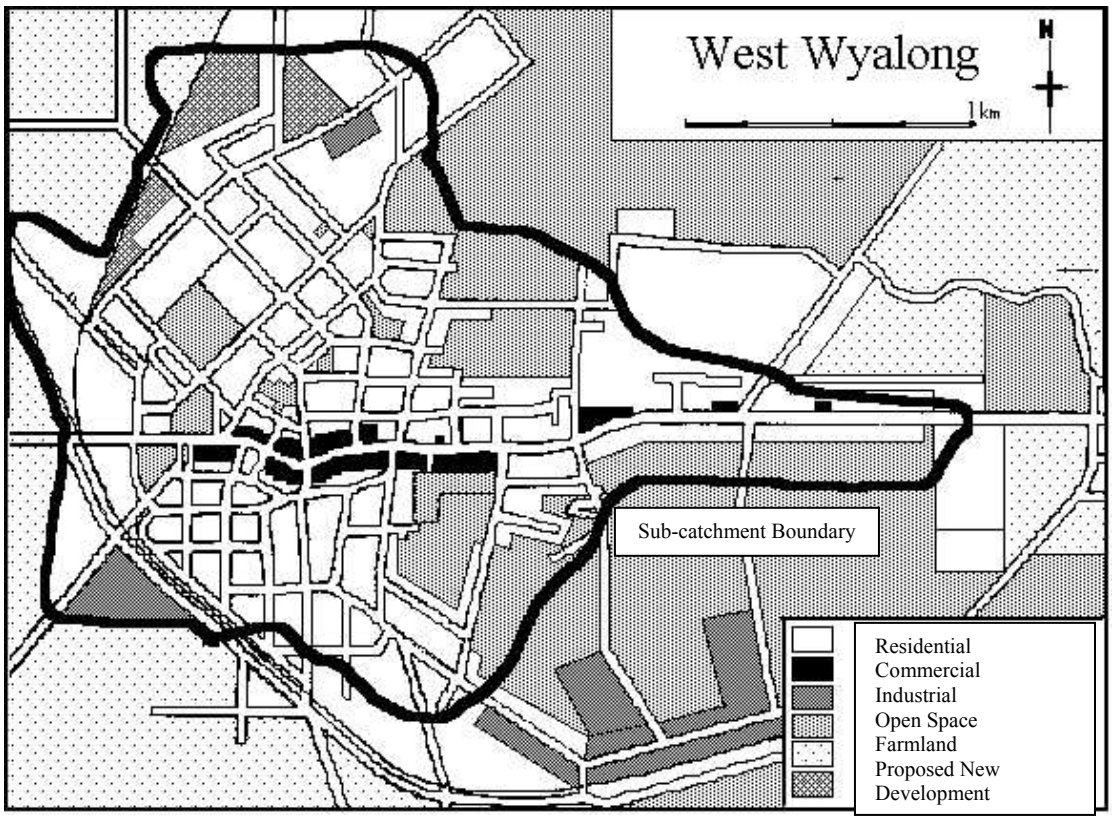


Figure 2.1 Land Use within West Wyalong Urban Area

The primary land use along the stormwater corridors is open space and recreation, with areas of playing fields, parks and reserves. Some of the major open space areas include:

- Cooinda Park
- Perseverance St Oval
- McCann Park
- Holland Park
- Barnardo Park

The major land uses away from the corridor include low to medium density residential areas with the major commercial areas being centred on the Main Street. Industrial areas are located on the southern fringe of town. Two major highways pass through the town, the Mid Western and Newell highways. These highways are the responsibility of the NSW Roads and Traffic Authority (RTA).

The population within West Wyalong is approximately 3450, the vast majority of which are of English speaking backgrounds.

2.2.1 Future Development

A new residential area has been investigated to the northeast of West Wyalong in Russell and Wootten Streets (see **Figure 2.1**). This area of approximately 0.45 km^2 has the potential to increase both pollutant loadings (in the form of litter and nutrients) and overall volume in the West Wyalong drainage system. If approved the increased volume and velocity of water may contribute to flooding at already under-capacity drains.

Stormwater objectives for new urban developments are given in Section 5. These should be applied to the new area at all stages of development.

2.3 Topography

The land in the Bland Shire is best described as undulating flat. The eastern part of the Shire is relatively flat, draining to Lake Cowal. The western end is somewhat hillier. There are some hills and ranges throughout the Shire with the major ranges being the Yalgogrin in the southwest and the Naradhan in the northwest. The Shire varies in altitude from 200m to 496m above sea level.

West Wyalong is at the eastern end of the Shire in the undulating flat section.

2.4 Geology and Soils

The predominant soil type in the west of the Bland Shire is sandy loam, with clayey loams in the east along with some ironstone and granite outcrops. Quaternary alluvial deposits exist between the ridges and plains on the eastern part of the LGA.

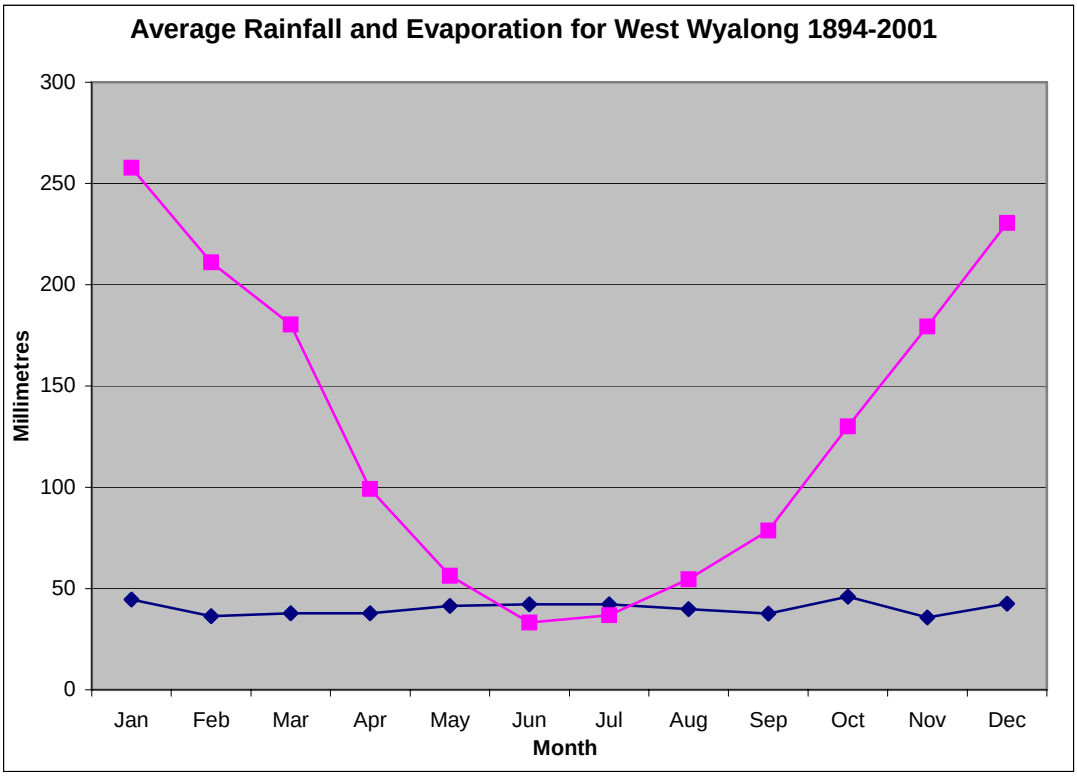
2.5 Climatic Conditions

One meteorological station exists in Wyalong (site no. 073054). It has been operated since 1895. The mean daily maximum temperature is 23.2°C whilst the minimum is 9.8°C. Summer maximums average 31.5°C while winter averages 15°C. The mean annual rainfall is 484.4mm. Long-term average monthly rainfall data is given in **Table 2.1.**

Table 2.1 Average monthly rainfall and evaporation for West Wyalong

Month	Average Rainfall (mm)	Average Pan Evaporation (mm)
January	44.6	257.8
February	36.4	211.1
March	37.8	180.4
April	37.8	99.2
May	41.5	56.4
June	42.3	33.2
July	42.2	36.8
August	39.8	54.6
September	37.7	78.7
October	46.1	130
November	35.8	179.4
December	42.6	230.5
TOTAL:	**484.6**	**1548.1**

Pan figures from station no. 073038.Data measured since 1978



It can be seen that most rain comes during the winter and spring. Summer rainfall is usually in short, heavy downpours that can produce minor short-term flooding in areas of the town and Shire.

2.6 Environmentally Sensitive Areas

Identified areas include Lake Cowal, Bland Creek and tributaries, remnant vegetation, wildlife and habitat corridors, protected lands, Aboriginal sites and areas of extractive industries. Council does not currently keep a register of these sites.

Lake Cowal has been the subject of a gold mining proposal (see *Environmental Impact Statement*). It is a freshwater lake approximately 150 square kilometres in size when full however it may be dry for years at a time. The lakebed is used for cropping and grazing in these periods. Records kept since the 1940s indicate that the lake is substantially full for seven out of every ten years. The Lake has been registered on the National Estate for its wetland significance since 1992. Two hundred and seventy seven bird species are thought to use Lake Cowal, some of which are protected by the JAMBA and CAMBA international bird treaties.

Several environmental pressures have been identified in the Lake area:

- Rapidly rising groundwater
- The prospect of salinisation
- Increased flood frequency since the 1960s due to land use changes
- A lack of recognition of the effects of the Bland system on groundwater.

There are no identified contaminated sites in the urban area but potential sites include garbage depots, night soil depots, mining leases, sewage treatment works, industrial sites and chemical disposal sites.

2.7 Waste Management

Shire waste management consists of landfill and the storage of inert materials. Tree loppings are chipped for mulch and landfill site rehabilitation. There are eight solid waste depots in Bland Shire LGA with no monitoring of leachate. There is limited recycling offered due to high transport costs, low values of recycled products and the low cost of landfill disposal. A kerbside recycling service is offered in West Wyalong, Wyalong, Ungarie and Barmedman.

Reticulated sewerage systems are provided in West Wyalong/Wyalong, Ungarie and Barmedman. Treated effluent is recycled at Ungarie and West Wyalong for irrigation of parks and sporting grounds.

3. Existing Urban Area Conditions

3.1 Stormwater infrastructure

Stormwater infrastructure within West Wyalong consists of a combination of curb and gutter, pipes and constructed open channels, both lined and unlined. This infrastructure conveys stormwater into the town's main drain. There are a few stormwater pollutant traps in the form of grates in the system (Refer to **Figure 1.3**). The purpose of these grates is to collect any large pieces of debris contained in stormwater runoff, thus preventing large debris from entering the main town drain.

3.2 Hydrology and Hydraulics

3.2.1 Hydrologic Modelling

There are no records of flow levels or discharge in the drainage system. An attempt was made during the preparation of this report but failed due to the lack of sizable rainfall events. The Back Creek Landcare group does however have a piezometric network for monitoring salinity and groundwater movement in the area since it receives the urban run-off. Lake Cowal also has such a network, established by North Mining Limited. Both show a substantial increase in groundwater levels, some up to 2 metres above natural levels.

3.2.2 Stream Gauging

No stream gauging has been undertaken.

3.2.3 Hydraulic Modelling

A hydrodynamic model in the form of the Rational Method as used in 'Australian Rainfall and Runoff' was used in the West Wyalong Stormwater Study (Sinclair Knight & Partners, 1986). The model was used to estimate 100, 20, 5 and 2 year storm peak flows. Council was using the method described in "Design floods for small rural catchments in eastern New South Wales" (Pilgrim & McDermott). A further report into four recognised flood areas within the West Wyalong township was modelled by the Rational Method and the ILSAX computer model for the 5, 10 and 100 year ARI peak storm flows (PPK Environment & Infrastructure).

The investigation of flooding is beyond the scope of this report. Details of these calculations can be found in Sinclair et al, 1986 and PPK, 1997.

3.3 Erosion and Sedimentation.

Town drains have concreted inverts and well-grassed batters so there is no sign of erosion. Deposition of sediment from upstream activities forms sand and grit layers throughout the system.

Specific areas of erosion and sedimentation include:

- Erosion from the West Wyalong Primary and High Schools.
- Erosion from Miller's Sand and Gravel.
- Erosion from Crown Land east of Perseverance St.
- Erosion at West Wyalong Tennis Courts.
- Erosion at West Wyalong Saleyards.
- Sedimentation at the entrance to the Sewage Works.
- Sedimentation in the catch drain east of Clear Ridge Rd.

These problems are discussed in further detail in Section 6.

3.4 Water Quality

No formal water quality sampling of stormwater had been undertaken before the preparation of this report. Before this, monitoring had been by visual inspection of the water and plant growth in the dams that receive stormwater. Anaerobic conditions are identified by odour but this has not occurred within living memory of the appropriate caretakers and the West Wyalong community. Seven dams and holding areas receiving stormwater were sampled; the results are shown in **Table 3.1**. Sampling of an actual stormwater flow was not possible due to the shortage of storm events. Regular monitoring of reused treated effluent has been undertaken for many years but this is outside the scope of this report. Sampling sites are shown in **Figure 10.1**.

Table 3.1 Results of Water Quality Analysis as of February 8, 2001.

Test	Units	Saleyard Dam	Caravan Park Dam	McCann Park Dam	Bowling Club Dam	Boundary St Dam	Cooinda Park	Wetlands
Dissolved Oxygen	mg/L	5.5	0.5	0.5	0.6	5.9	1.7	4.1
pH	pH units	7.2	7.2	6.8	6.4	7.1	6.7	6.9
Suspended Solids	mg/L	36	76	46	53	18	22	47
Ammonia	mg/L	0.04	0.80	0.10	0.36	0.02	0.33	0.01
Total Nitrogen	mg/L	1.6	5.4	3.3	5.2	0.86	2.9	1.7
Total Phosphorous	mg/L	0.13	2.5	0.57	0.93	0.12	1.3	0.28
Faecal Coliforms	CFU/ 100mL	68	460	700	100	240	100,000	120
Chlorophyll "a"	µg/L	14	47	970	73	33	21	68

Table 3.2 Range of Typical Pollutant Concentrations in Australian Stormwater

Pollutant	**Dry weather**		**Wet weather**	
	Rural	Urban	Rural	Urban
Suspended solids (mg/L)	3-270	1-350	4-200	
Nutrients (µg/L) Phosphorous Nitrogen Ammonia	 8-810 120-4200	 1-2200 100-11600	 30-1300 230-5100 10-260	 0.12-1.6 600-8600 10-9800
Micro-organisms Faecal coliforms (cfu/100mL)	 10-100	 40-40,000	 700-3000	 4,000-200,000

3.4.1 Water Quality Guidelines

The NSW Government published Water Quality and River Flow Interim Environmental Objectives: Guidelines for River, Groundwater and Water management Committees (EPA, 1999). These define levels of water quality for:

- Primary Contact – swimming, bathing and direct water-contact sports
- Secondary Contact – activities such as boating and fishing
- Visual Use – water used for visual amenity with no direct contact
- Protection of Aquatic Ecosystems
- Production of Edible Fish and Crustacea; and
- Water Associated Wildlife.

All dams that receive stormwater are fenced so primary contact is not encouraged however wading by local children occurs in drains during storm events. Boating is not possible in the system but there is unauthorised fishing of the stocks placed in the dams to keep weed growth down. The waterways have a dual use as walkways/cycleways during dry periods so water stored in dams beside the drains does have some visual amenity. Ecosystems in the dams consist of a few fish, small freshwater crustacea and aquatic insects. Note that no natural (remnant) ecosystem exists as the system is entirely constructed. Ibis usually inhabit a constructed water feature in Cooinda Park and wetlands at the end of the stormwater system and appear to be thriving.

The interim water quality guidelines are listed in **Table 3.3** and have been developed from the Australian Water Quality Guidelines for Fresh and Marine waters (ANZECC, 1992). **Table 3.4** lists the test results of water samples taken February 8, 2001 with the ANZECC recommended limits.

Table 3.3: Ambient Water Quality Guidelines

Parameters	Fresh Water
Total Phosphorus (μg/L)	10-100 (50 commonly adopted)
Total Nitrogen (μg/L)	100-750 (500 commonly adopted)
Ammonia (μg/L)	20-30
Chlorophyll-a (μg/L)	2 –10
Faecal Coliforms (cfu/100mL)	150 (primary recreation) 1000(secondary recreation)
Suspended Solids (mg/L)	<10% change in mean turbidity
Dissolved Oxygen (mg/L)	>6 0r 80-90% saturation
PH	6.5 - 9.0
Oils & Surfactants	No visible films in recreational waters
Increased Water Temperature	<2^{o}C increase

Refer to ANZECC guidelines (ANZECC,1992) for a more detailed description.

Table 3.4: Results from Water Quality Analysis, February 8 2001, with ANZECC Recommended Limits.

Test	Units	Saleyard Dam	Caravan Park Dam	McCann Park Dam	Bowling Club Dam	Boundary St Dam	Cooinda Park	Wetlands	ANZECC Recommended Limits
Dissolved Oxygen	mg/L	5.5	0.5	0.5	0.6	5.9	1.7	4.1	>6 or 80-90% saturation
PH	pH units	7.2	7.2	6.8	6.4	7.1	6.7	6.9	6.5 – 9.0
Suspended Solids	mg/L	36	76	46	53	18	22	47	<10% change in mean turbidity
Ammonia	mg/L	0.04	0.80	0.10	0.36	0.02	0.33	0.01	0.02-0.03
Total Nitrogen	mg/L	1.6	5.4	3.3	5.2	0.86	2.9	1.7	0.1 – 0.75
Total Phosphorous	mg/L	0.13	2.5	0.57	0.93	0.12	1.3	0.28	0.01 – 0.1
Faecal Coliforms	CFU/ 100mL	68	460	700	100	240	100,000	120	150 primary 1000 secondary
Chlorophyll "a"	μg/L	14	47	970	73	33	21	68	2 – 10

3.4.2 Water Quality Sampling

Bland Shire Council in the past has not undertaken water quality monitoring of the stormwater flowing through the main town drain. It is hoped that a monitoring program through 'Stream Watch' will commence in mid 2001. The data collected from this program will allow Council to better identify which pollutants are a problem in the urban stormwater catchment and direct resources to mitigate these problems.

3.4.3 Point Sources of Pollution

Sewage Treatment Plant (STP)
West Wyalong STP discharges treated effluent into a catch drain upstream of Wyalong. This treated effluent water goes through primary and secondary treatment process, then is held in a lagoon for approximately 59 days where it undergoes natural ultraviolet disinfection. The discharge occurs only when the treatment lagoon is full, that is, during significant wet weather. The majority of treated effluent water is used to irrigate local parks. The discharge point is outside the boundaries of the SMP and the STP is outside the scope of this Plan.

Walker's Ag n Vet Services Fertiliser Depot
This store is a source of nitrogen and phosphorus in the West Wyalong catchment. No sampling of run-off has been performed, informal inspection is by observing the occurrence of algae in downstream puddles.

Miller's Sand and Gravel
Run-off from stockpiles and bare areas contribute to sediment amounts in Brown St and further downstream.

3.4.4 Sewer Overflows

Rainfall runoff infiltration into sewers is an issue of concern to the Council particularly in older areas of the town. Inflow to the sewage treatment works on wet days (actual wet weather flow) is two-and-a-half times the inflow during dry weather (actual dry weather flow). It is thought that illegal connections of stormwater downpipes into the sewer network are responsible for most of the increase while leakages through joints and cracks account for the remainder. Sewer overflows or surcharges have occurred during the more extreme storm events when dilution is abundant however it may occur more frequently if further areas upstream are developed.

Approximately 25 properties within the catchment are unsewered, having septic systems instead. These properties occur mainly on the fringe of the town where no sewer network is available for ready connection. Overflows from these septic systems if poorly maintained would add to the nutrient, suspended solids and faecal coliform loads within the waterways. Council is currently considering the extension of the sewerage system to seven of these properties on Railway Road.

3.4.5 Estimated Pollutant Loads

Since no water quality monitoring of actual flows has been done it is impossible or at least highly inaccurate to estimate pollutant loads. A program to calculate this information during the preparation of this report was thwarted by the lack of suitable rainfall events. Refer to Table 3.1 for pollutant concentrations in dams receiving stormwater run-off.

3.4.6 Water Quality Modelling

No water quality modelling has been undertaken.

3.5 Sediment Data

No sediment sampling has been undertaken in the West Wyalong area. Refer to **Table 3.1** for details of suspended solids in dams receiving stormwater run-off.

3.6 Aquatic habitat

Habitat only exists in the form of created structures such as dams and open channels. As such only introduced species such as carp and freshwater crayfish live in the waterways, the lagoons at the West Wyalong STP have been stocked with native species of fish. Moderate numbers of ducks and a few other species of water birds have been sighted on bodies of water throughout the town such as STP lagoons and storage dams. This is because there are no other natural water bodies available.

The open area in front of the sewage works traps large amounts of sediment from Crown land and some rubbish as well. This area contains a rudimentary wetland that has formed by itself in an excavated hole. The unlined catch drain east of Clear Ridge Rd also accumulates litter washed through the town.

3.7 Riparian, Remnant and Foreshore Vegetation

There is no original riparian or foreshore vegetation since there are no natural rivers or creeks in the urban area. Riparian vegetation around the constructed trunk mains consist of some planting of eucalypts on the tops of the batters leading down to sparse native grasses at the drain's edge. Remnant vegetation in the form of mallee scrub is found on the urban fringe in small pockets and on Crown land east of Perseverance St. There is some evidence of weed species growing in eroded land around these areas. Southern areas of the town drain directly through Crown land, contributing to extensive erosion within the remnant vegetation.

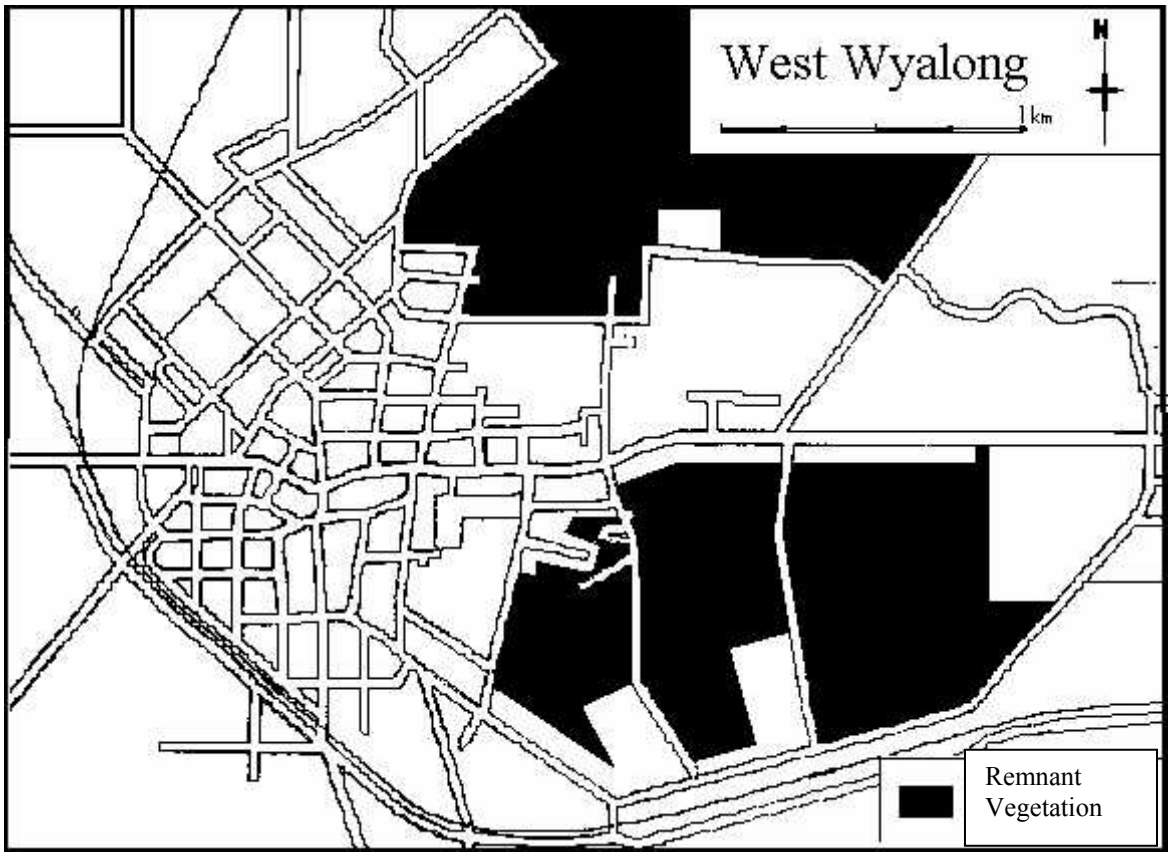


Figure 3.1 Remnant and Riparian Vegetation in West Wyalong

3.8 Current Stormwater Management Practices

Council planning, operation and management activities can influence the environmental impact of stormwater discharges either directly or indirectly, as shown by **Figure 1.4**. Best practice guidelines are most often adopted by continual review of existing procedures and practices.

3.8.1 Developmental Controls

Council can influence stormwater quantity and quality through the use of developmental controls. Existing controls include:

- Requirements for soil and water management plans as part of development and building applications for major developments.
- Inspection of development sites and enforcement of erosion and sediment controls by Council officers. Council's Community and Environment Department has staff that monitor developments.

3.8.2 Stormwater Drainage System

The stormwater drainage system has already been shown in Figure 1.4.

3.8.3 Internal Education and Training

Internal training on soil and water management practices has been held for overseers and site supervisors. The course outlined the principles of soil and water management and how to apply soil and water controls to Council works.

Prior to undertaking major earth moving operations a soil and water management plan must be prepared. The supervisor is required to identify all potential stormwater issues for the site and prepare a plan or sketch of the site showing the soil and water management controls to be put in place. Council engineers approve this form before work commences.

3.8.4 Maintenance

Council's stormwater system maintenance includes:

- Regular inspections of the stormwater system and where necessary cleaning out stormwater pits and pipes and making repairs to the system.
- Responsive cleaning of the urban stormwater system depending on the accumulation of litter, debris, silt etc. Council has identified those areas requiring more frequent cleaning from experience.
- Cleaning of stormwater pollutant traps on an 'as required' basis.

Maintenance of the system is done on an 'as required' basis.

- If debris is reported, Council's maintenance staff removes the debris.
- It is common for staff to inspect the system following large storm events.

Maintenance practices for open space areas (parks, ovals etc) include:

- Slashing of grass in open space and recreation areas on a regular basis. This includes slashing along waterways. Cut grass is not collected and a catcher is not used.
- Use of herbicides as required to remove weeds from open space and recreation areas. The herbicide has been chosen to have minimal environmental impact.
- Application of fertiliser on an 'as required' basis to sporting ovals and parks. Application rates are carefully monitored through soil testing to greatly reduce any nutrient wash off.

Street sweeping is carried out within the commercial areas of West Wyalong at weekly intervals.

- Litterbins are provided within the commercial areas of West Wyalong and at public parks and ovals.
    - The bins within the commercial area are emptied daily.
    - The bins at public parks and ovals are checked daily and emptied 'as required'.

- Council works depot
    - The vehicle washing and refuelling areas are bunded, not allowing wastewater and pollutants to enter the stormwater system.
    - Soil stockpiles are bunded, preventing stormwater runoff from carrying soil into the stormwater system.

3.8.5 Community Programs

At present there are no community programs targeting stormwater awareness and water quality. A local Streamwatch program was carried out in 1996 involving students from West Wyalong High School however no records remain from this time. Council is very keen to revive this program.

The most active community group is Blandcare, although this group mainly focuses on rural land practices. The Town Advancement Group is also involved in the area as it seeks to improve the general look of the town.

These groups can and have played an active role in identifying stormwater issues and implementing stormwater management options.

4. Catchment Values

Catchment values are defined in this SMP to mean:

> "components of the stormwater drainage system and its interacting environment that the community considers valuable"

Catchment values were developed in consultation with Council, government agencies, special interest groups and the community. Council officers set the preliminary values and these were refined by consultation with the Department of Land and Water Conservation, Landcare and other special interest groups. A questionnaire distributed to the West Wyalong High School students and special interest groups gave an early indication of the priorities on the catchment values before a community-wide survey in late January, 2001.

Catchment values can be:

- Ecological
- Social
- Economic

Information from existing Stormwater Management Plans (Phillips et al, 2000) and the EPA was drawn on to set initial catchment values. These values were established following extensive community consultation.

4.1.1 Ecological Values

- Habitat for birds, fish and animals

This covers both the environment immediately around the waterway and in the catchment leading to it.

- Healthy waterways

The health of a waterway is measured in terms of water quality, clarity and condition of the beds and banks.

4.1.2 Social Values

- Public Health and Safety
- Visual appeal

The attractiveness of the drainage system is reduced by pollution and lack of maintenance.

- Recreation

This covers a number of areas:

- Primary – the body is immersed in water eg swimming, diving, water skiing
- Secondary – the body is not immersed but some contact does occur eg boating
- Passive recreation – types of recreation adjacent to the waterway, does not involve contact eg walking, picnics.

- Access to waterways

The degree of use in a multi-purpose drainage system depends on how easily people can access it.

- Education on stormwater issues

The best form of pollution reduction is in educating the public to change destructive habits.

4.1.3 Economic Values

- Possible tourism opportunities

Stormwater facilities can be creatively designed to attract visitors.

- Property values near waterways

The worth of land near waterways can either rise or fall based on the attractiveness of the area.

- Stormwater reuse options

Reuse of stormwater for such things as irrigation reduces the amount discharged into the environment.

- Downstream use

The quality of discharge affects the possible uses for the water downstream, such as watering stock.

4.2 Prioritisation of Catchment Values

The values and their priorities as shown by the town-wide survey are given in **Table 4.1**.

Table 4.1 Values for the West Wyalong urban area

Catchment Value	Average	Rank
Healthy waterways	9.234	1
Public health and safety	8.813	2
Habitat for birds, fish and animals	7.679	3
Stormwater reuse opportunities	7.219	4
Visual appeal	6.359	5
Downstream use	6.234	6
Science and Education	6.000	7
Access to waterways	5.672	8
Property values near waterways	5.359	8
Recreation	5.297	9
Possible tourism opportunities	5.094	10

Table 4.2 Pollutants of Concern to West Wyalong residents

Pollutant	Average	Rank
Fertiliser and pesticide run-off	7.748	1
Sewer leakages and overflows	7.748	2
Oil & grease run-off from service stations	6.689	3
Litter from commercial areas	6.556	4
Litter from schools and residential areas	5.497	5
Cigarette butts	4.768	6
Animal droppings	4.172	7
Sediments (dirt and sand) from erosion	3.775	8
Garden waste, clippings and leaves	2.450	9

5. Stormwater Management Objectives

Stormwater management objectives have been developed to produce the desired catchment values described in Section 4. Long term and short-term (3-5 year) modes are incorporated. The long-term objectives are commitments to a catchment ideal. Short-term objectives are the focus of the actions in this plan.

Stormwater management objectives, for the purpose of this SMP, have been defined as:

> "What we seek to achieve in our management of stormwater to protect and/or achieve the identified catchment values".

5.1 Ecologically Sustainable Development

Stormwater management needs to be consistent with the objective of the National Water Quality Management Strategy, which is 'to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development'. This requires decision-making on the basis of economic and environmental considerations. Key principles of Economically Sustainable Development (ESD), as outlined in the Draft Managing Urban Stormwater Council Handbook (NSW EPA 1997) include:

- The precautionary principle – lack of full scientific certainty is not to be used as a reason to postpone measures to prevent environmental degradation for threats of serious or irreversible damage.

  This SMP aims to develop guidelines promoting appropriate and strict water quality controls before any development begins. These guidelines will be enhanced as more information becomes available. Environmental damage is lessened prevented by the use of best management practices and measures.

- Inter-generational equity – the present generation should ensure that future generations benefit from maintained or improved access to the health, diversity and productivity of the environment.

  The objectives of this SMP aim to reduce the impact of stormwater on the environment to ensure that it is maintained and improved for future generations.

- Improved valuation and pricing of environmental resources

  The method for ranking the stormwater management options in this SMP integrates financial and environmental costs into the final outcome.

- Conservation of biological diversity and ecological integrity – the impact of stormwater on bushland and aquatic environments should be mitigated by the measures proposed in this Plan.

5.1.1 Ecological Objectives

- Protect and restore waterways and habitats
  This includes visual amenity, capacity and erosive potential.

- New developments preserve catchment values
  Run-off from new developments should not be of a volume or quality that is detrimental to the existing system.

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- Ensure runoff quality meets water quality guidelines
  Run-off should comply with the ANZECC guidelines for fresh water.

5.1.2 Social Objectives

- Health and safety unaffected by stormwater
  Stormwater should be conveyed in a way that separates humans from any health risks from pollutants or insect vectors and keeps their property safe.

- Stormwater managers enhance natural catchment
  All decisions on a managerial level should be weighted towards environmental and social responsibility.

- Community involvement in stormwater management
  The ideas and concerns of the population should be paramount in the planning and implementation processes. A well-informed population should understand the impact of stormwater on society and vice-versa.

5.1.3 Economic objectives

- Minimise impact of stormwater
  Inadequate drainage, maintenance and degraded water quality should be high on the list of priorities for attention and action.

- Seek innovative designs for stormwater facilities
  Stormwater channels, retention basins and other infrastructure should be designed with an eye to the future, rather than with a reliance on outdated practices. Multi-purpose and reuse facilities are examples.

The relative importance of these objectives as revealed by the community survey is shown in **Table 5.1**.

Table 5.1 Stormwater Objectives for the West Wyalong Urban Area

Stormwater Objectives	Average	Rank
Health and safety unaffected by stormwater.	7.424	1
Protect and restore waterways and habitats.	7.203	2
Minimise impact of stormwater eg flooding	7.000	3
Ensure runoff quality meets water quality guidelines.	6.977	4
Stormwater managers enhance natural catchment	6.740	5
New developments preserve catchment values.	6.474	6
Community involvement in stormwater management	6.117	7
Improved recreation and appearance	6.077	8
Seek innovative designs for stormwater facilities.	5.432	9

5.2 Short and Long Term Stormwater Management Objectives

Long term and short term (3-5 years) objectives for each of the values are described in **Table 5.2**.

Table 5.2 Stormwater Management Objectives

Waterway Value	Long Term	Short Term
Ecological Values		
Habitat for birds, fish and animals	Protect and restore waterways and habitats. Stormwater managers enhance natural catchment.	1.Reduction of the concentrations of the following pollutants in waterways; Nitrogen reduced to 0.75 mg/L, Phosphorous reduced to 0.1 mg/L & Faecal coliforms reduced to 150 cfu/100mL. 2. Suspended solids load reduced to 45 mg/L. 3. Weed growth controlled in catchment. 4. Frequency of algal blooms in dams reduced.
Healthy waterways	Ensure runoff quality meets water quality guidelines	5. Stormwater velocity reduced to a maximum of 2 m/sec to minimise erosion. 6. Areas of erosion addressed. 7. Pollution point sources addressed As per Objective 1 As per Objective 2 As per Objective 3 As per Objective 4
Social Values		
Public health & safety	Health & safety unaffected by stormwater Minimise impact of stormwater.	8. Identify and alleviate flood problem areas As per Objective 1
Visual appeal	Improved recreation and appearance	9.Litter prevented from leaving main town drainage. No anthropogenic litter greater than 50mm for flows up to 25% of the 1 year ARI peak flow to be visible. As per Objective 3 As per Objective 5 As per Objective 6
Recreation	Improved recreation and appearance	10. Facilities provided for community recreation and picnics.
Access to waterways	Community involvement in stormwater management. Improved recreation and appearance	11. Water quality improvements advertised to the local community on a monthly basis. 12. Reduce hazards such as algae and sediments in system as per Objective 4 and Objective 4.
Education on stormwater issues	Community involvement in stormwater management	13. School students involved in monitoring waterways through “Stream watch”. As per Objective 11.
Economic Values		
Possible tourism opportunities	Seek innovative designs for stormwater facilities.	As per Objective 10
Property values near waterways	New developments preserve catchment values. Minimise impact of stormwater Improved recreation and appearance	As per Objective 1 As per Objective 2 As per Objective 3 As per Objective 8
Stormwater reuse opportunities	Seek innovative designs for stormwater facilities	As per Objective 10 14. Increase reuse network.
Downstream use	Ensure runoff quality meets water quality guidelines	As per Objective 1 As per Objective 2 As per Objective 5

5.3 Stormwater Management Objectives for New Development

Stormwater management objectives for new developments aim to define the outcomes that the Bland Shire Council and/or developer's seek to achieve in the development or redevelopment of land within the West Wyalong urban stormwater catchment. The purpose is to minimise the impact upon receiving waterways and urban bushland.

New developments can be planned with greater stormwater management potential whereas existing areas often face expensive retrofitting. The management of stormwater from new developments will be guided by these objectives.

In the past, stormwater runoff has been treated as a nuisance and was managed solely to minimise the impact of flooding on the urban area. Concrete lined drains were installed to drain the stormwater as quickly and efficiently as possible.

Recently specific control measures have been put in place for new developments. Soil and Water Management Plans must be submitted with Development Applications for developments where the disturbed areas are on a gradient of 15% or more, or have an area greater than 2000m^2. These plans typically focus on reducing erosion during construction stages only. There is no specific level of treatment or water quality set. Council recognises the need for such control measures and their extension into the post-construction (occupational) stages of development.

For each of these stages of development, stormwater management objectives cover qualitative principles adopted to reduce the potential impacts on the environment.

5.4.1 Stormwater Management Objectives – Construction Phase

Sediment eroded from exposed areas or flow paths is the primary stormwater issue during the construction phase. Secondary issues include chemicals (especially fuels and oils) stored on site, and litter from construction activities. **Table 5.3** illustrates the stormwater management objectives for the construction phase of new developments.

Table 5.3 Construction Phase Stormwater Management Objectives for New Developments
Qualitative Objectives – applicable to all new development, including individual building lots.

Suspended solids (sediment)	• Minimise soil erosion and the discharge of sediment through the design, construction and maintenance of control measures such as sediment fences, straw bales and perimeter drains. • Employ all practical measures to minimise soil erosion such as minimising site disturbance, revegetation, and installing downpipes into the stormwater system as soon as possible.
Fuels, oils and other chemicals.	All fuels, oils and other chemicals are stored and used on site to ensure no contamination of stormwater.
Litter	No litter placed in a position where it may be blown or washed off-site.

5.4.2 Stormwater Management Objectives – Post Construction Phase

Different types of land use generate specific stormwater pollutants in significant quantities. Consequently the 'key' pollutants to be addressed from new development, and the control techniques employed, are directly related to the development type. **Table 5.4** ranks the significance of the pollutants likely to be generated by different land uses.

Table 5.4 Ranking of Objectives For New Development

Development Style	Litter	Coarse Sediment	Fine Particles	Total Phosphorous	Total Nitrogen	Hydrocarbons, fuels, oil & grease
Low Density Residential	Y	N	N	Y	Y	N
Commercial, shopping & retail outlets	Y	Y	Y	Y	Y	?
Industrial	Y	Y	Y	?	?	Y
Fast food outlets & restaurants	Y	N	N	N	N	?
Car parks, service stations & wash bays	Y	Y	Y	N	?	Y

Adapted from Upper Parramatta River Stormwater Management Plan, 1999.
Y = key pollutant, needs to be addressed **?** = variable, requires site-specific assessment **N** = not significant

Council recognises that the retention of pollutants is only one part of stormwater management at new development sites. There are a number of qualitative stormwater management objectives that are important to the pursuit of more sustainable stormwater management practices at new development sites. It is recommended that developers adopt the stormwater management principles listed in **Table 5.5** for stormwater management at new development sites.

Table 5.5 Post-Construction Phase Stormwater Management Objectives for New Developments

Qualitative Objectives – applicable to all new development

Run-off volumes and flow rates Stormwater quality	• Impervious areas draining to the stormwater system are minimised. • Reuse of stormwater maximised. • Use of vegetated flow paths maximised. • Use of stormwater infiltration at source where appropriate.
Flow	• Alterations to natural flow paths, discharge points and runoff volumes from the site are to be minimised. • The frequency of flooding should not increase with no increase in the 1.5 and 100-year peak flows.
Amenity	Multiple uses of stormwater facilities.
Urban bushland	Minimise stormwater impact.

6. Stormwater Management Issues

The NSW EPA as defines Stormwater management issues:

> "those factors that currently prevent, or may prevent, stormwater management objectives from being satisfied" (NSW EPA, 1997).

These issues may be:

- environmental
- social and
- managerial

Stormwater issues from the catchment were identified from discussions with stakeholders, Council officers and in existing documentation. Specific "hot spots" were identified through inspections with Council staff and other stakeholders. These "hot spots" with known relationships to stormwater discharges are important to target in this SMP as their improvement will have a direct and noticeable effect on the catchment and the environment.

Stormwater issues and "hot spots" are given in **Table 6.1**. The location of each "hot spot" is shown **on Figure 6.1**.

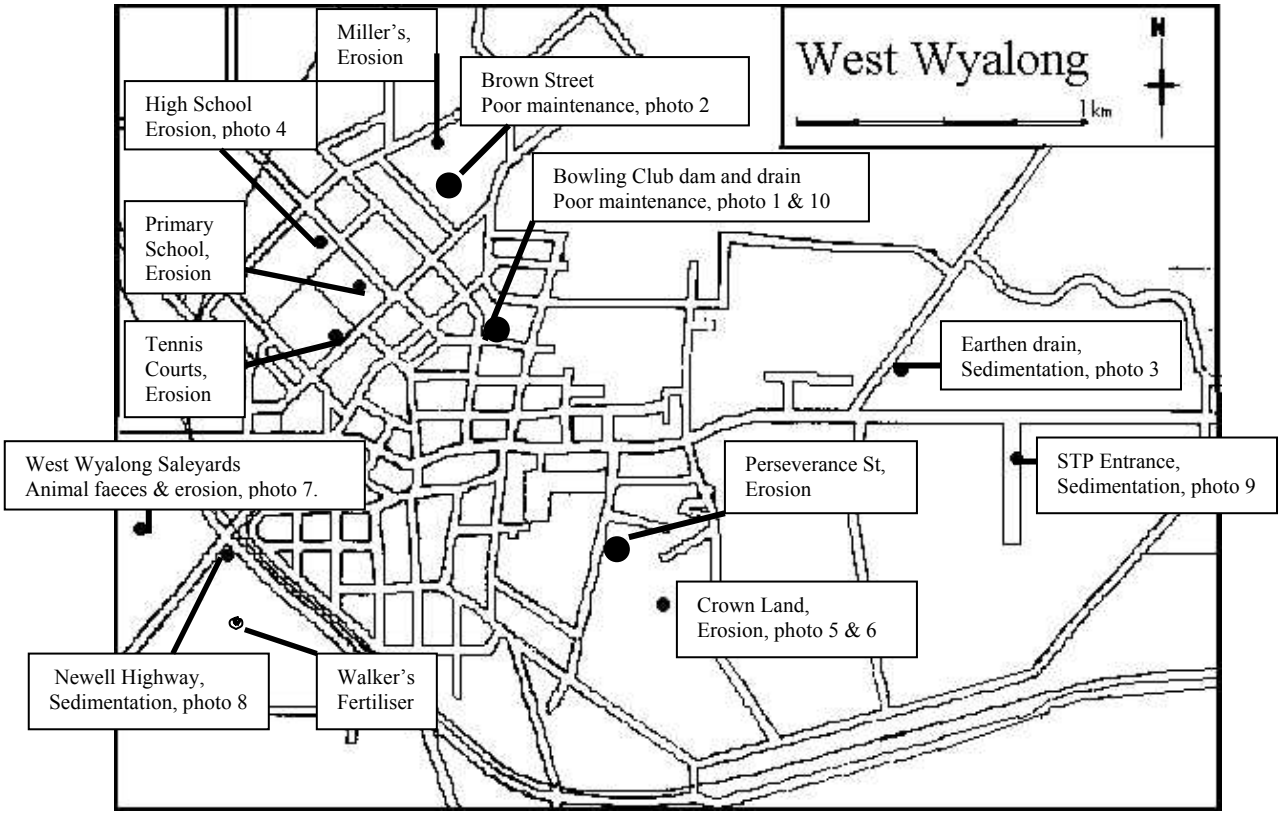

Figure 6.1 Stormwater Quality 'Hot spots' locations for West Wyalong

Table 6.1 Stormwater Quality Issues and 'Hot spots' for West Wyalong

Short Term Management Objective	General Issues	"Hot Spots" and Possible Causes
1.Nitrogen, phosphorous & faecal coliform concentrations in all waterways reduced	Excess fertiliser use in gardens, Washing cars in the street. Sewer overflows Lack of awareness about proper fertiliser usage. No vegetation buffer zones Animal faeces	Weed growth in drains and Crown Land – possibly caused by elevated nutrient levels. Algal blooms in dams. Contributions may come from Walker's fertiliser depot. No water quality objectives for new developments adopted. West Wyalong Saleyards
2. Suspended solids load reduced.	No vegetation buffer zones Erosion due to increased flood flows and stormwater velocity from urbanisation. Poor erosion and sediment controls on developments. Vegetation removed from flow paths.	Tennis Courts – clay courts with small particle size. High School and Primary School – large unvegetated playgrounds. Lower end of Perseverance St and Crown Land – high flow velocity of stormwater over bare ground. Saleyards – rural usage of leased land. Miller's Sand & Gravel – landscaping stockpiles of loam and sand. McCann Park Dam – bank erosion.
3. Weed growth controlled	As per Objective 1	Crown Land – urban stormwater conveys weeds into bushland. Clear Ridge Rd Drain – drain difficult to access & maintain.
4. Frequency of algal blooms in dams reduced.	As per Objective 1	Perseverance St Dam, Bowling Club Dam and Boundary St Dam – nutrient load high in "first flush" stormwater.
5. Stormwater velocity reduced to prevent erosion	Reduced infiltration due to increased impervious areas Concentration of stormwater in drains Removal of riparian vegetation Slashing grass prevents riparian regrowth.	Lower end of Perseverance St & Crown Land – lack of natural flow impeders. No water quantity controls for new developments adopted.
6. Areas of erosion addressed	Removal of vegetation for development Access tracks and road shoulders.	As per Objective 2. Sedimentation Clear Ridge Rd Sedimentation STP entrance Sedimentation Newell Highway
7. Pollution point sources addressed	Discharges from industry. Lack of industry awareness about discharges Lack of staff to audit sites.	Miller's Sand & Gravel – concrete batching plant. Walker's Ag N Vet Services – fertiliser and Ag Chemicals.
8. Identify and alleviate flood problem areas	As per Objective 5.	North St, Brown St & Kurrajong St – existing stormwater channel capacity insufficient for 100yr ARI storm events.
9.Litter prevented from entering main town drain. No anthropogenic litter greater than 50mm for flows up to 25% of the 1 year ARI peak flow to be visible.	Lack of awareness by residents of impact of littering on the environment, where the litter goes and how much is generated General littering (commercial, shops etc) More frequent cleaning of bins and litter traps required	Litter trapped in drains and dams General littering in commercial area. Lack of community education. Lack of litter law enforcement.
10. Facilities provided for community recreation and picnics.	Inadequate funding General lack of water Water quality not up to primary or secondary contact standards Low visual appeal and landscape value of system. Insufficient tying of stormwater system with recreation. Conflict between planning & management objectives.	
11. Water quality improvements advertised to the local community.	Lack of awareness by residents of stormwater issues and how their actions affect water quality. Low public involvement in stormwater management	No effective public education plan in place. No previous SMP or reporting.
12. Reduce hazards such as algae and sediments in system	Inadequate maintenance As per Objective 1 and As per Objective 2	
13. School students involved in monitoring waterways.	Lack of awareness by students about the impacts of urbanisation on the environment. Stormwater issues not in the school curriculum.	Streamwatch Program currently inactive.
14. Increase reuse network	Lack of funding	

Whilst preventing sewer overflows and exfiltration is important in achieving recreation objectives for the waterways, sewer overflows are not generally within the scope of this SMP. It must be noted however that surcharges only occur in extreme storm events when dilution is abundant.

Photograph 1 Bowling Club Dam

Photograph 2 Rear of Brown St

Photograph 3 Drains at Clear Ridge Road

Photograph 4 West Wyalong High School

Photograph 5 Crown Land off Perseverance St

Photograph 6 Erosion from Crown Land

Photograph 7 Erosion at the West Wyalong Saleyards

Photograph 8 Erosion at Showground Road

Photograph 9 Sedimentation at Sewage Works entrance

Photograph 10 Welsh Lane drain

7. Potential Stormwater Management Options

7.1 Stormwater Management Options Hierarchy

The options for addressing 'hot spots' and catchment issues were based on the Stormwater Management Hierarchy shown in Figure 7.1. This hierarchy is compatible with ESD. It aims to preserve the water environment's valuable features, and then promote cost-effective management by focussing on source control as a priority over end-of-pipe solutions. End-of-pipe options are only proposed for impacts that cannot be effectively mitigated at the source.

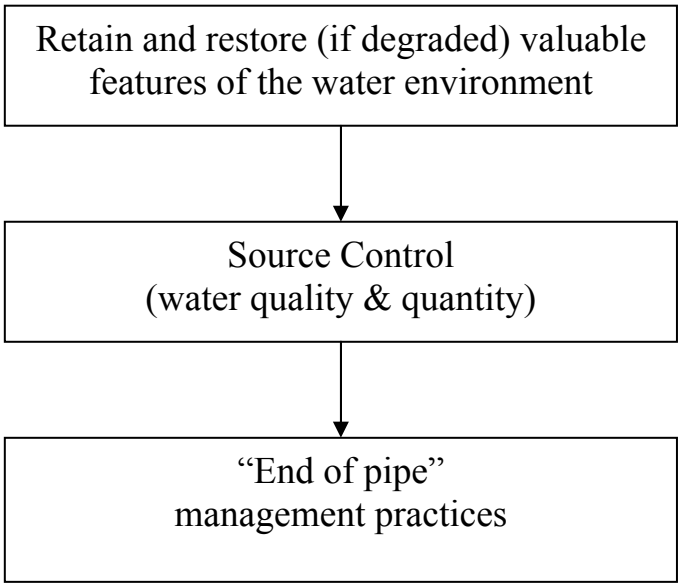

Figure 7.1: Stormwater Management Hierarchy (NSW EPA, 1997)

7.2 Options Selection

A variety of options are available for addressing the issues shown in Table 6.1. The two general types are:

- Non-structural
- Structural

7.2.1 Non-structural Options

Potential non-structural options include:

- Educational campaigns
- Planning controls (eg Council policies and strategies)

- Site Auditing
- Review of management practices
- Studies and assessments
- Others

A general overview of these options is provided below.

Educational Campaigns

Education and participation are the key long-term management goals for stormwater in the community. The whole age spectrum needs to be identified and supplied with appropriate information. This spectrum includes residents, businesses, community groups, schools, developers, environmental groups, youth groups and the media. The most effective long-term method is to influence behaviour in young people. This is best achieved by having stormwater issues taught as part of the school curriculum, beginning at primary school. Inspection of litter in drains and grates, tours of local waterways and participation in revegetation of waterways has the benefit of being a practical interactive part of the curriculum.

An education plan should have the following objectives:

- Promote clear understanding of the problem and solutions. Increasing awareness of how individual behaviour affects the catchment is an important part of this.
- Identify responsibilities and efforts to date.
- Promote community ownership of the problems and solutions; and
- Integrate public feedback into the education program.

Agencies such as NSW EPA, local councils, the Department of Land & Water Conservation and Landcare groups have developed educational programs for a variety of environmental issues. These programs could be adapted and used in Bland Shire Council. Where possible, Council should integrate their programs with existing agency programs.

Having a predominately English-speaking population makes an education plan easier to develop for West Wyalong.

Land Use and Planning Control

The long-term approach to minimising the impacts of stormwater discharges is aided by land use planning. Integrating water quality concerns into the development process via Council policies, guidelines and instruments can ensure that receiving waters are not subject to increased pollution through land use practices. This can be achieved by land zonings that control the type of activity allowed in an area. Treatment methods and construction standards in

Development Control Plans and consent requirements can also regulate the design and reduce the impacts of stormwater discharge on the environment.

Site Auditing

Environmental audits are beneficial for:

- Identifying existing conditions and actions that impact stormwater.
- Raising site operator's awareness of the environmental impact of their activities.
- Implementing best practice management and treatment methods to mitigate those impacts

Audits can be catchment or local area based. The auditing process is described in detail in "Managing Urban Stormwater: Source Control" (NSW EPA) though a brief summary is provided here:

- Catchment based: A broad scale and approximate assessment of pollutant sources and catchment health can then be used to focus subsequent investigations and treatment activities.
- Local area based audit: Environmental conditions or risks are assessed in a smaller study, maybe even on individual premises. It may be an educational, cooperative or strict compliance audit.

Review of Management Practices

Many Council activities may potentially impact stormwater quality at the source eg erosion control measures during maintenance, street cleaning, emptying litter bins, slashing and mowing etc. A review of the current situation is important for ensuring best management practices are minimising the environmental effects of urban stormwater discharges.

A number of stormwater related review approaches are identified in the NSW EPA document "Managing Urban Stormwater: Source Control". These are detailed below and it is up to the organization to decide which is most suitable.

Council could:

- Form a working group of supervisors and field staff to audit existing actions. The advantage is that it involves those who would be responsible for implementing for any recommended changes.
- A team of representatives from separate Councils review each Council's stormwater management. Rotation of the members may ensure that the appropriate specialisations are always present. This method has the advantage of providing new approaches and an outsider's view of local issues.

- Engage an environmental consultant to conduct the review. This minimises Council staff's time commitment and gives the best opportunity for Council to receive expert advice on possible improvements.

7.2.2 Structural Options

Structural options for stormwater management are generally constructed measures that address the immediate stormwater 'hot spot' or 'issue' without addressing the source of the problem.

The NSW EPA document "Managing Urban Stormwater: Treatment Techniques", 1997, contains descriptions of many structural options including:

- Litter traps – eg. baskets, booms, nets, and gross pollutant traps.
- Sediment traps
- Constructed wetlands
- Bank stabilisation – eg. revegetation, rock walls, concrete.
- Vegetation planting
- Grassed swales and infiltration basins
- Sand filters and others

Table 7.1 lists potential options for addressing each of the stormwater management issues and 'hot spots' listed in Table 6.1. These options were developed in cooperation with Council officers and stakeholders and focus on source control where possible.

Table 7.1 Stormwater Management Options

Issue	Options
Weed growth in drains and Crown Land – possibly caused by elevated nutrient levels.	1. Undertake industrial auditing along with industry awareness programs. Areas to focus on include • *Walker's Ag'N'Services* • *Miller's Readymix* • *Fuel depots (these two industries have been included in the auditing as they impact on other stormwater issues but are not directly related to this issue)* 2. Install constructed stormwater wetland to treat urban stormwater from West Wyalong. Investigate suitability of enlarging artificial wetland in front of STP where all flow passes through before heading to Back Creek. Incorporate recreation and education components into the project
Algal blooms in dams. Contributions may come from Walker's fertiliser depot, residential use, sewer surcharging and Council application on parks and the golf course.	See Option 1. 3. Plant macrophyte species and restock with native fish species in a mini-wetlands scheme. 4. Community education campaign to target: • Appropriate fertiliser and pesticide use • Washing of cars in the street • Collection of animal faeces (provide bags at parks) • *Littering (This has been included as it impacts on other stormwater issues, it is not directly related to this issue)* 5. Remove illegal connections from sewerage system. 6. Review Council use of fertilisers and pesticides
No water quality objectives for new developments adopted.	7. Develop a water environment DCP based on objectives for new developments given in Section 5, to obtain appropriate stormwater treatment. Controls may vary between areas. 8. Increased inspection and enforcement of water management controls on construction sites.
Nutrients and coliforms washed from West Wyalong Saleyards	9. Clean out sediment basin to trap runoff.
Sediment from Tennis Courts	12. Install grassed filter sediment trap.
Sediment from High School	11. Stabilise bare earth with vegetation and mulch. Build up levels to form an infiltration basin.
Sediment from Primary Schools	10. Construct a grassed filter area near Dumaresq St. Prevent water from Park St Rec ground entering playground.
Erosion at lower end of Perseverance St	13. Construct lined channel
Crown Land – urban stormwater conveys weeds into bushland.	14. Construct rock riffle zones and low earthen bank sediment traps. 15. Investigate opportunities for revegetation of waterways with local species. Where required, erect fences to restrict access.
McCann Park Dam	16. Convert to a sediment trap by constructing a baffle between the inlet and outlet. See Option 3
Clear Ridge Rd Drain	17. Widen drain by reducing batter slopes to allow easier maintenance. Line drain. See Option 13
Perseverance St Dam	18. Plant macrophyte species in a mini-wetlands scheme.
Bowling Club Dam	19.Convert to a sediment trap by relocating spillway to bank opposite the inlet See Option 3.
Boundary St Dam	20. Convert to a sediment trap by constructing a spillway. See Option 3.
No water quantity controls for new developments adopted.	21. Develop on-site detention requirements for new developments considering 2 year and 100 year ARI. Set specific permissible site discharge values and storage volumes and incorporate outcomes into planning requirements. 22. Encourage use of rainwater tanks in new and existing developments. 23. Prepare Council DCPs for construction of impervious areas including paving and driveways.

Table 7.1 Stormwater Management Options (continued)

Issue	Options
Sedimentation at STP entrance	See Option 2
Sedimentation at Newell Highway	24. Construct sediment trap
North St flooding	25. Reshape North St to widen causeway. Enlarge gutter.
Brown St flooding	26. Increase length of bank behind houses. Lower level of existing dam spillway. Line drain.
Salinity in Kurrajong St	27. Investigate urban salinity in West Wyalong.
Litter trapped in drains and dams	28. Install trash racks at selected locations 29. Incorporate setbacks for vegetated buffer strips in DCPs.
General littering in commercial area	30.Review location of bins and frequency of cleaning.
General lack of water	31. Extend stormwater and effluent reuse system 32. Extend stormwater storage capability See Option 2
Water quality not up to primary or secondary contact standards	See Option 8 See Option 2
Low visual appeal and landscape value of system.	33.Review Council's maintenance of drains and litter traps. See Option 14.
Insufficient tying of stormwater system with recreation.	See Option 2
Conflict between planning & management objectives.	34. Council DCPs make a clear commitment to ESD.
No effective public education plan in place.	See Option 4.
No previous stormwater management plan or reporting.	35. Include Stormwater Management Plan and revisions in annual 'State of the Environment Report' 36. Reporting of water quality monitoring results and amount of trash collected in local newspaper
Lack of awareness by residents of stormwater issues and how their actions affect water quality.	See Option 4 See Option 22
Low public involvement in stormwater management	37. Annual evaluation of community attitudes about stormwater and stormwater pollution activities.
Inadequate maintenance	See Option 27.
Lack of awareness by students about the impacts of urbanisation on the environment. Stormwater issues not in the school curriculum. Streamwatch Program currently inactive.	38. Co-ordinate with schools in the catchment to include stormwater issues in the curriculum. Tours of the local waterways, inspection of rubbish collected in traps and revegetation projects can be included as interactive measures. Develop further with Blandcare representative. 39. Re-establish Streamwatch program through local High School.
Lack of funding	40.Include Stormwater Management Plan in the review of Council Works Program. Investigate sources of local, state and federal funding. 41. Allocate fixed percentage to stormwater projects annually.

8. Evaluation & Analysis of Identified Stormwater Management Options

This section provides an overview of the methods used to rank the suggested management options. These approaches are simple but aim to avoid unknown assumptions. The outcomes can be reviewed and altered in the light of local knowledge and conditions.

Many options were identified and listed in *Section 7*. It is difficult to compare these options because of the different environmental, social and economic parameters over varying time frames. They also vary between structural and non-structural solutions. It must however, be undertaken so that resources are allocated according to priorities. The ranking methodologies detailed below have been used to evaluate and rank the management options. These ranking methodologies have been developed in coordination with Council, the Department of Land & Water Conservation and stakeholders.

8.1 Ranking Method Overview

There are two methods that overlap to produce the final ranking. The first, detailed in the SIA Bulletin for January 2001, is based on the relative strength of the relationships between catchment values, objectives, issues, causes and management options and is based on the formula for developing a weighted average. **Figure 8.1** shows the interactions involved.

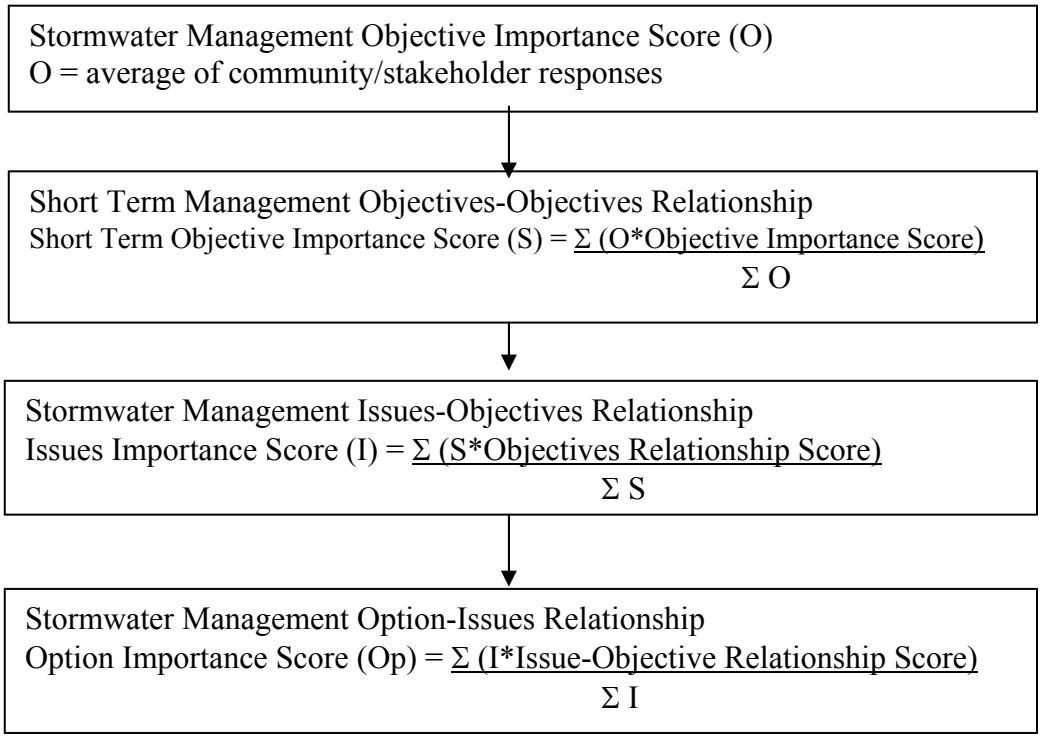

Figure 8.1 Overview of Criteria Used to Rank Stormwater Options

8.1.1 Relationships Method

The relationships method uses a system of interrelated tables containing long-term objectives, short-term objectives, issues and potential options.

- Stormwater Management Objectives Importance Score (O)

These figures on the importance of each catchment value are found by the response of the community/stakeholders in a questionnaire.

- Short term Stormwater Management Objectives- Long Term Objectives Relationship.

This table is constructed by investigating the relationship between each short-term objective and long-term objective identified by the community. Strong relationships are given a rating of 5 down to 1 for weak or non-existent relationships. The Short Term Objective Importance Score (S) is obtained by summing the product of the Stormwater Management Objectives Importance Score with the appropriate Short Term Objective-Objective Relationship Score, and then dividing by the total of the Long Term Stormwater Management Objectives Importance Scores (this gives a weighted average).

- Stormwater Management Issues-Short Term Management Objectives Relationship.

This table is constructed by quantifying the relationship between each issue and short-term objective identified by the community. The Issues Importance Score (I) is obtained by summing the product of the Short Term Objective Importance Score with the appropriate Long Term Objective - Short Term Objective Relationship Score, then dividing by the total of the Short Term Objective Importance Scores.

- Stormwater Management Option-Issues Relationship.

This table is constructed by investigating the relationship between each issue and treatment option identified by the community. The Option Importance Score (Op) is obtained by summing the product of the Issues Importance Score with the appropriate Option-Issues Relationship Score, then dividing by the total of the Issues Importance Scores. The highest option importance score indicates the most important option. This score is used in the development of a final benefit-cost ratio that ties the two methods together.

8.1.2 Cost-Benefit Method

In this second method, each of the stormwater management options have been ranked according to its costs and benefits over a one-year time frame. This method is based on criteria given in the NSW EPA document "Draft Managing Urban Stormwater Council Handbook", 1997, but it has been changed to encourage source control. **Figure 8.2** graphically demonstrates the method.

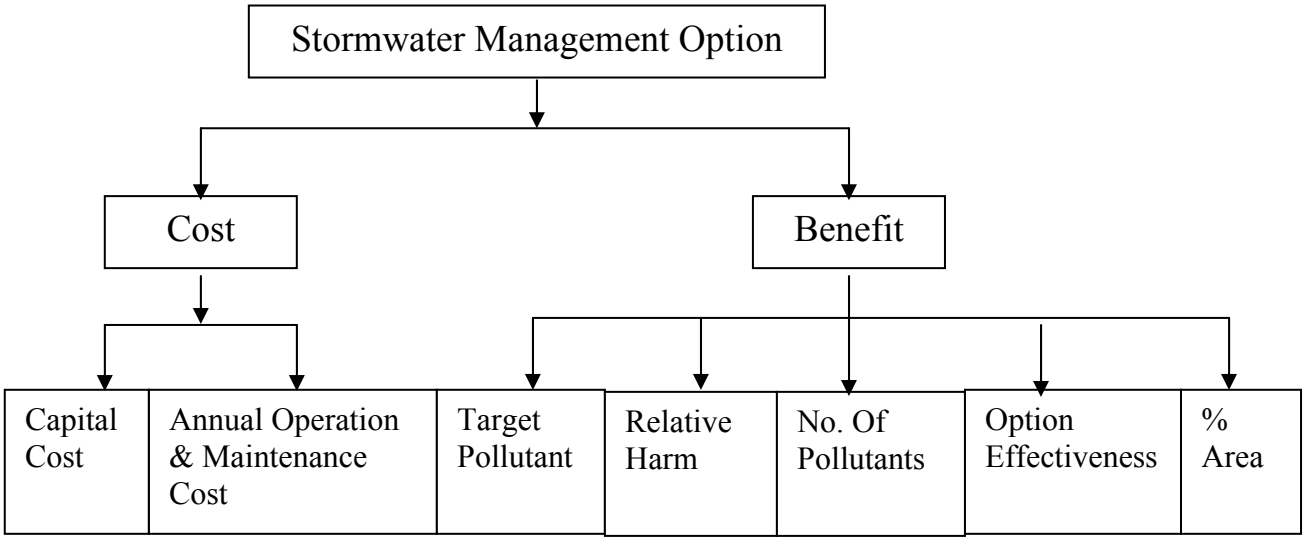

Figure 8.2 Overview of Criteria Used to Rank Stormwater Options

8.2 Options Evaluation

The scores assigned to each cost and benefit category is given below.

8.2.1 Costs

The estimated costs for each option are divided into:

- Capital cost – the estimated initial cost involved to implement the option, including feasibility studies and construction.
- Annual operation and maintenance cost – the estimated annual cost to review, update or maintain the option.

The uncertainty associated with cost estimates meant that a cost range was used to assign a score. These scores were used to calculate a cost index for each option.

The cost ranges and scores are listed in **Table 8.1**. These were developed with Council, the Department of Land & Water Conservation and other stakeholders.

Table 8.1 Ranking of Costs

Capital Cost		Annual Operation & Maintenance Cost	
Estimated Cost ($)	Score	Estimated Cost ($)	Score
< 5,000	1	< 5,000	1
5,000-20,000	2	5,001-10,000	2
20,001-50,000	3	10,001-15,000	3
50,001-100,000	4	15,001-20,000	4
100,001-250,000	5	20,001-30,000	5
250,001-350,000	6	30,001-40,000	6
350,001-500,000	7	40,001-50,000	7
500,001-750,000	8	50,001-70,000	8
750,001-1,000,000	9	70,001-100,000	9
> 1,000,000	10	> 100,000	10

8.2.2 Benefits

The scores assigned to each benefit are summarised in **Table 8.2**.

- *Target Pollutant*: This is the pollutant most likely to be removed/reduced by implementation of the option. The following target pollutants were selected:

    - Sewer leakages & overflows
    - Animal droppings
    - Garden waste, clippings and leaves
    - Sediment from erosion
    - Fertilizer & pesticide runoff
    - Litter from commercial areas
    - Oil & grease run-off
    - Cigarette butts
    - Litter from schools & commercial areas

Each target pollutant was given a score between 1 and 10 reflecting the extent to which the pollutant was perceived to be a problem in the area.

- *Relative Pollutant Harm*: This is the potential harm a pollutant could have on water quality and ecosystem health.

- *Number of Pollutants*: The number of pollutants that an option will reduce/remove.

- *Relative Effectiveness of Option*: This is the effectiveness of the option in addressing the target pollutant in a particular area. Where the option is structural, the effectiveness is the efficiency of removing the target pollutant given as a score between 1 and 10. Where the option is non-structural, the effectiveness has been given qualitatively (i.e. high, medium or low) with a corresponding score of 10, 5 or 1 respectively.

- *% Urban Area*: A score between 1 and 10 was given in line with the percentage area of the catchment that each option would treat. This score must be assigned carefully to avoid bias toward end-of-pipe solutions.

Table 8.2 Ranking of Benefits

Target Pollutants	Score	Relative Harm	Score
Cigarette butts	4.765	Cigarette butts	4
Animal droppings	4.161	Animal droppings	5
Garden waste, clippings and leaves	2.349	Garden waste, clippings and leaves	4
Sediment from erosion	3.691	Sediment from erosion	4
Fertiliser & pesticide runoff	7.785	Fertiliser & pesticide runoff	8
Litter from commercial areas	6.644	Litter from commercial areas	4
Litter from schools & commercial areas	5.503	Litter from schools & commercial areas	4
Oil & grease run-off	6.711	Oil & grease run-off	6
Sewer leakages & overflows	7.785	Sewer leakages & overflows	5
All	9.000	All	9

Table 8.3 Ranking of Benefits

No. Of Pollutants	Score	Effectiveness Of Option		Score	Area	Score
		Structural	Non-Structural		%	
1	1	< 10%	Low	1	< 10%	1
2	2	11-20		2	11-20	2
3	3	21-30		3	21-30	3
4	4	31-40		4	31-40	4
5	5	41-50	Medium	5	41-50	5
6	6	51-60		6	51-60	6
7	7	61-70		7	61-70	7
8	8	71-80		8	71-80	8
9	9	81-90		9	81-90	9
		91-100	High	10	91-100	10

8.3 Ranking of Options

A simple benefit-cost analysis was used to rank the management options. This was adapted from the method given in the EPA document, "Draft Managing Urban Stormwater Council Handbook", 1997.

8.3.1 Benefit-Cost Ratio

To compare the options and prioritise them, a benefit-cost ratio was calculated using the methodology outlined below.

1. *Calculation of Cost Index (CI)*
   The average of the capital and maintenance cost scores gives the CI value. The higher the CI the greater the cost, with a CI of 10 being the highest cost option.

2. *Calculation of Benefit Index (BI)*
   The average of the five benefit scores gives the BI value. The higher the BI the greater the benefit. The calculated BI value is the initial BI value multiplied by the Option Importance Score (Op) calculated from the first method.

3. *Calculation of Benefit-Cost Ratio (BC)*
   This is calculated by dividing the calculated BI by CI. The larger the ratio, the more desirable the option.

Table 8.5 Ranking of Stormwater Management Options

No.	Option Description	Rank
36	Report water quality monitoring and collected trash amounts in 'Advocate'	1
39	Re-establish Streamwatch in local High School	2
38	Include stormwater issues in school curriculum of Primary and High Schools	3
40	Include SMP and revisions in Council Works Program	4
33	Review maintenance of drains and litter traps throughout West Wyalong	5
37	Annual evaluation of community attitudes on stormwater issues	6
41	Allocate fixed percentage to stormwater projects annually	7
7	Develop a water environment DCP based on Section 5.	8
22	Encourage rainwater tanks at new and existing developments	9
30	Review location of bins in commercial areas and frequency of cleaning	10
21	Develop on-site detention requirements for new developments	11
35	Include SMP and revisions in State of the Environment Report	12
1	Undertake industrial audit along with industry awareness programs	13
3	Plant macrophytes and stock with fish in mini-wetlands scheme at Perseverance St Dam	14
4	Community education campaign	15
31	Extend stormwater reuse system to Primary School	16
5	Remove illegal connections from sewerage system	17
23	Prepare Council DCPs for impervious area construction	18
12	Construct a grassed filter strip at Tennis Courts	19
10	Install grassed filter sediment trap at Primary School	20
28	Install trash racks at selected locations	21
6	Review Council use of fertilisers and pesticides	22
18	Plant aquatic species in McCann Park Dam in mini-wetlands scheme	23
2	Extended wetlands next to Newell and Mid-Western Highways.	24
9	Clean out sediment basin at Saleyards to trap runoff	25
29	Incorporate setbacks for vegetated buffer strips in Council DCPs	26
8	Increased inspection of soil & water control on construction sites	27
13	Construct lined channel in Perseverance St.	28
19	Convert Bowling Club Dam to sediment trap by constructing spillway opposite inlet	29
15	Revegetate Crown Land waterways with native species. Fence where necessary	30
27	Investigate urban salinity in West Wyalong	31
24	Construct sediment trap at corner of Showground Rd	32
32	Extend stormwater storage capability	33
14	Construct rock riffle zones and earthen sediment traps in Crown Land	34
17	Reduce batter slopes on Clear Ridge Rd drain to allow maintenance access. Concrete line.	35
34	Council DCPs make a clear commitment to ESD	36
11	Stabilise bare earth at High School with vegetation and mulch. Form infiltration basin	37
16	Convert McCann Park Dam to sediment trap by constructing baffle between inlet and outlet	38
20	Convert Boundary St Dam to sediment trap by constructing spillway	39
26	Increase bank length behind houses in Brown St. Construct concrete drain	40
25	Reshape North St to widen causeway	41

9. Strategy for SMP Implementation

9.1 Implementation Strategies

Council has developed a strategy to ensure that the high priority stormwater management options from *Section 8* are implemented. This strategy is to form part of and input into the Council's works program. This is critical to the success of this SMP.

It is recognised that it is impossible to implement all the options in the short term due to insufficient funding and resources. Implementation has been divided as follows:

- 2001-2002 Options: These are the options that Council anticipates will commence in the 2001-2002 financial year.
- 2002-2003 Options: These options may commence in the next financial year. These options will be reviewed as part of the SMP review and will be included as part of the Works Program if funding is allocated for their implementation.
- Future Projects: These options are not high priorities for funding in 2001-2003. They will be reviewed as part of the SMP review process and can be included in the Council Works Program if external or additional funding becomes available.

Council's implementation strategy is given in **Table 9.1**. Revision should occur annually, as described in *Section 11*. The strategy contains the following information:

- Timeframe: the year that implementation is to commence.
- Option Rank: The priority assigned to the option as part of the ranking process (refer *Section 8*). Options are listed in order of priority, from highest (rank = 1) to lowest.
- Option Number: This is a unique identifier for each option to allow easy cross-referencing between tables.
- Option Description: This is a brief summary of the stormwater management option to be implemented.
- Cost: This is the cost to implement the option.

9.2 Linking the SMP to Council's Planning Process

The link between the SMP and other Council plans and policies is shown in **Figure 9.1**. The actions in the SMP will be incorporated into the Works Program, which is to be reviewed annually.

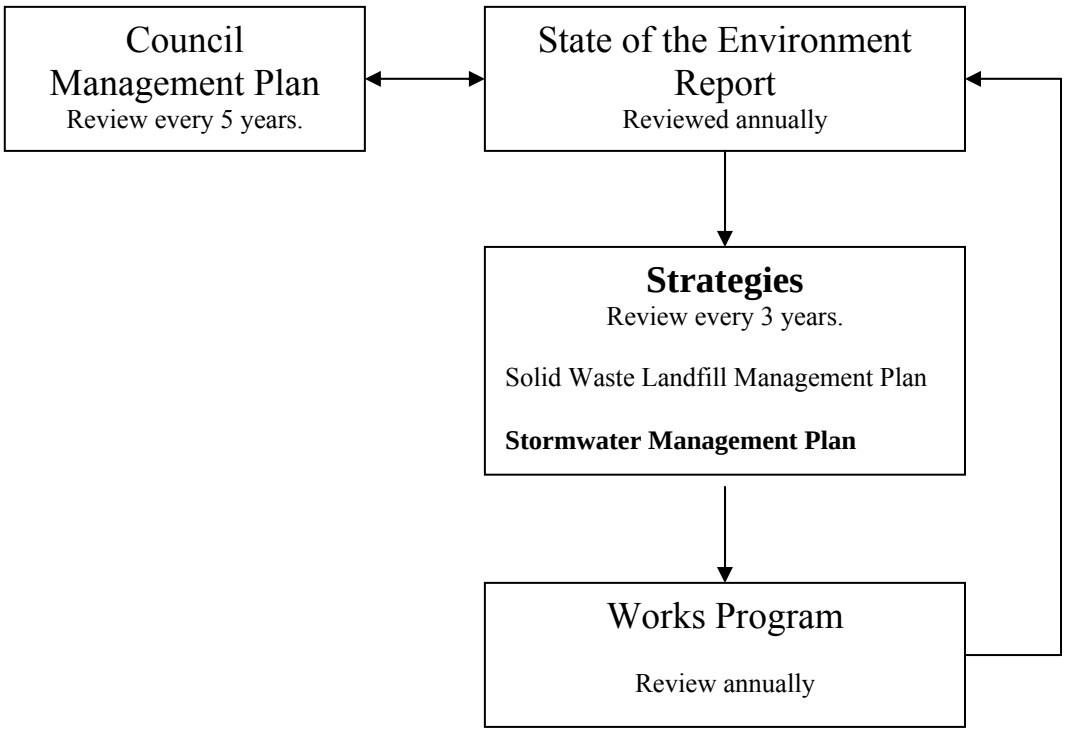

Figure 9.1: Link between SMP and Council's Planning Process

10. Monitoring and Reporting Plan Implementation and Effectiveness

10.1 Management Framework for Plan Implementation

Responsibility for the stormwater system is already held by the Town Inspection Committee, which includes representatives from the Council, Works & Services and Community & Environment departments and the community.

This committee meets every month and can review progress on the SMP implementation as required. Council will be kept up to date on the implementation through the inclusion of the SMP in both the Council Works Program and State of the Environment report. These updates will feed into the SMP review process (refer *Section 11*) and will be used for public reporting of the SMP implementation (refer *Section 10.3*).

10.2 Monitoring

Monitoring is an essential component of the SMP and is aimed at:

- Assessing the degree of Plan implementation
- Assessing the effectiveness of the Plan in meeting the objectives; and
- Allowing progressive improvement and refinement of the Plan.

Monitoring can be achieved by:

- Observation
- Ambient water quality modelling
- Biological monitoring
- Recording progress of Plan implementation

10.2.1 Observation

Observation-based monitoring provides a non-technical indication of:

- A stormwater system's existing conditions;
- The effect of implementing the SMP options on conditions within the stormwater system;
- Areas requiring more scientific monitoring; and
- The need to use water quality control measures/practices.

This monitoring can be performed by council staff and is an effective way of involving the public, particularly school students and the environmental groups.

Regular and consistent monitoring is valuable when the following details are recorded:

- Location
- Flow Conditions
- Date
- Flow Depth
- Time
- Weather Conditions
- Items Identified (see below)

Items that can be identified by this approach include:

- Litter
- Organic Matter
- Foam
- Aquatic Plants
- Surface scum and oil
- Condition of Vegetation
- Algae
- Fish
- Odour
- Bank Erosion
- Water Clarity
- Sedimentation

Sites where it will be beneficial to undertake observational monitoring include:

□ Boundary Street Dam – particularly to identify any changes affecting water quality from upstream rural land practices and any impact on the urban catchment through changes in public awareness.

□ Cooinda Reserve – particularly to identify changes in quantities of litter trapped in the vegetated sections of the drainage channel.

Observational monitoring will also be undertaken where litter traps are installed. The changes in the amount and type of gross pollutants collected will be used to indicate changes in community behaviour in the catchment.

The frequency of inspection will be dependent on the resources at Council's disposal and rainfall patterns. During times of frequent rainfall, inspection may be undertaken on a monthly basis. At other times of the year inspection may be undertaken only after storm events.

In addition, Council proposes to re-establish the Streamwatch Program by approaching local primary and secondary schools to investigate their

willingness to participate in the Streamwatch program. Initial signs of a willingness to commit staff, students and resources by the local primary and secondary schools is very positive. It is hoped that this program can undertake useful observational monitoring of local dams.

10.2.2 Ambient Water Quality Monitoring

Ambient water quality modelling can be used to:

- Establish baseline water quality conditions
- Monitor changes in local and catchment-wide water quality with time as a result of the measures implemented from the SMP.
- Determine the performance of existing stormwater management practices.

At present, ongoing monitoring is undertaken by Council at the Sewage Treatment Plant lagoon, Perserverance St dam and Perserverance St oval.

Monthly samples taken at the lagoon are analysed for the following:

- Suspended solids (SS)
- Biochemical Oxygen Demand (BOD)
- pH

Quarterly samples from Perserverance St dam are analysed for:

- Suspended solids (SS)
- Biochemical Oxygen Demand (BOD)
- pH
- Conductivity
- Total Nitrogen (total N)
- Total Phosphorous (total P)

Yearly samples from Perserverance St Oval are tested for:

- Conductivity
- pH
- Total Nitrogen (total N)
- Total Phosphorous (total P)

Perseverance St Oval is tested since it is irrigated with treated effluent from the STP.

Monitoring will continue at these sites with a view to expanding to at least one other site where no long-term water quality data exists at present. That site would be at the entrance to the STP where all the town's stormwater flows. A rudimentary wetland exists here already. This site would ideally be monitored for the ANZECC guideline pollutants (see **Table 3.1**). Sampling of sites identified by observational monitoring is also a possibility as funds become available.

Baseline water quality data for the town was determined from a sampling regime commissioned especially for this Plan. Sampling points included the Saleyards Dam, Caravan Park Dam, McCann Park Dam, Bowling Club Dam, Boundary St Dam, Cooinda Park and at the STP entrance mentioned previously. These sites are shown in **Figure 10.1**. Results of the sampling were given in **Table 3.1**.

10.2.3 Biological Monitoring

Biological monitoring is useful for the direct assessment of ecosystem health and diversity and involves the collection and testing of freshwater biota from the waterways. This type of monitoring is expensive and suitable mainly for very long-term investigation. Council does not consider this to be an option in the immediate future.

10.3 Reporting

Progress regarding the SMP implementation is to be reported in Council's State of the Environment Report. In particular, results of monitoring programs, outcomes of environmental studies and effectiveness of pollution control devices are to be highlighted. Reporting in the local newspaper as part of a local education campaign is also envisaged.

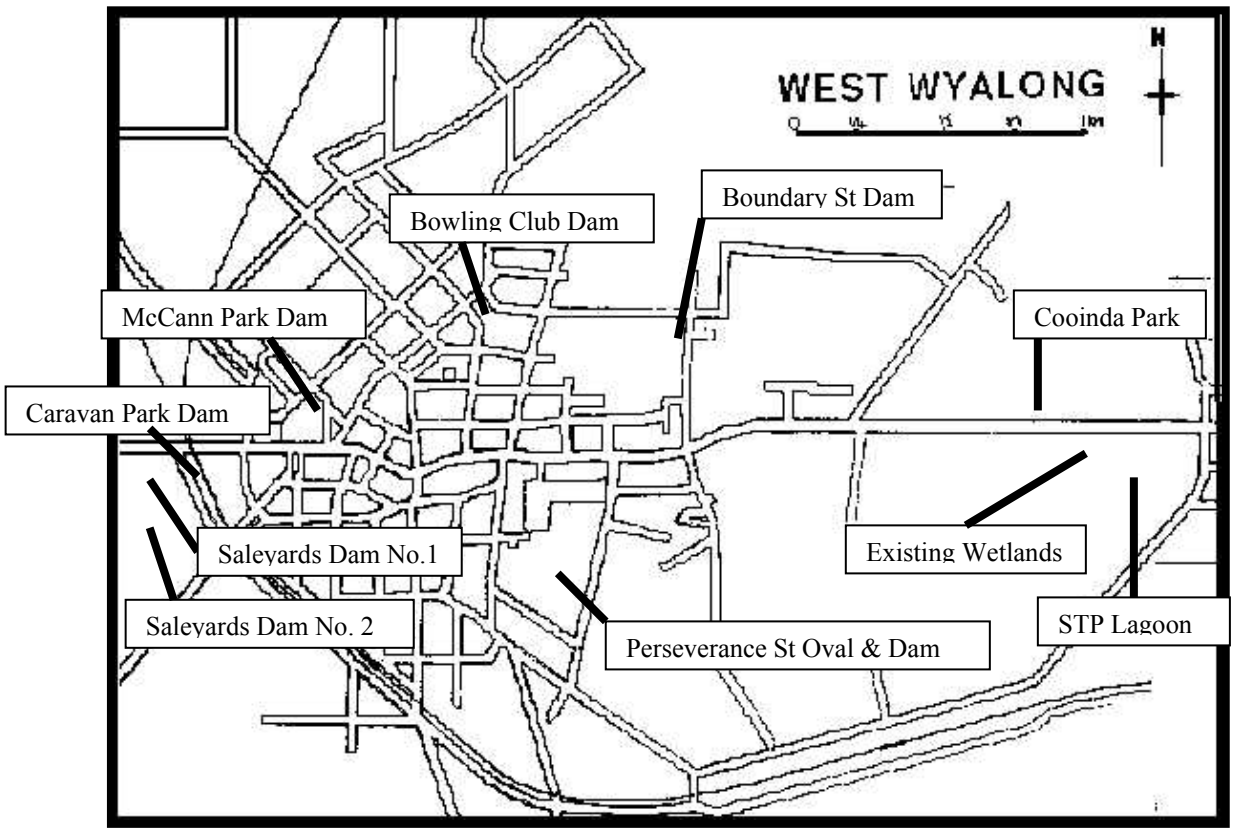

Figure 10.1 Water Quality Monitoring Points

11. Updating of the SMP

Stormwater management is a long-term program that requires continuous improvement. The preparation of this SMP is only the first step of this process. **Figure 11.1** illustrates the stormwater management cycle.

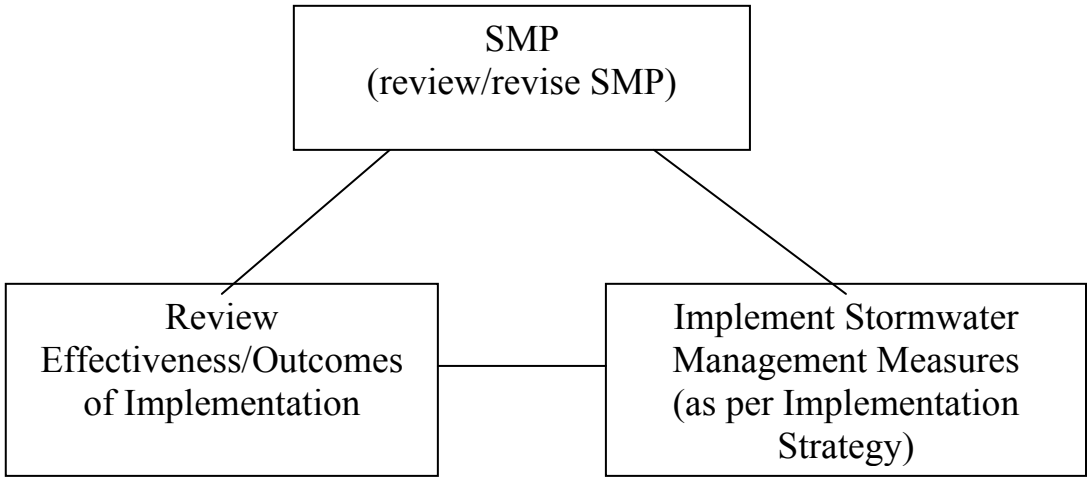

Figure 11.1 – Stormwater Management Cycle

The stormwater management cycle shows how the stormwater management measures are implemented (as in the Implementation Strategy) after the SMP is prepared. The outcomes of the measures are then monitored and reviewed and this process is used to update and revise the SMP. The cycle continues indefinitely.

11.1 Revision of the SMP

There are two methods of revising the SMP over two time frames.

- Revise/re-issue the Implementation Strategies
- Review/revise the SMP document

Each of these will be described in more detail below

11.1.1 Revise/Re-issue Council Implementation Strategies

The implementation strategy forms the basis of the Council's stormwater works program and ensures that stormwater related issues are being addressed in a co-ordinated and cost effective manner.

The implementation strategy will change as works are completed, additional works are required or as new issues arise. The implementation strategies are to be reviewed annually prior to preparation of the Council's Works Program. This is to identify the progress of the works done to date, the works to be implemented in the following year and the funds required for these works.

Review of the strategy should consider:

- Outcomes of any water quality monitoring programs and environmental studies;
- Any additional stormwater management options that need to be included as part of Council's program.

11.1.2 Review/Revise the SMP Document

It is important that the SMP is reviewed and revised regularly to ensure that the issues, objectives and options identified are still relevant and provide the necessary information for Council's works improvement program.

The SMP should be updated as required but at minimum intervals of three years. The Implementation Strategy should be updated more frequently, as discussed above.

When reviewing/revising the SMP, these aspects should be considered:

- Results from any water quality monitoring programs and environmental studies.
- The effectiveness of the options implemented during previous years
- Whether short-term management objectives have been satisfied
- Any additional objectives that are required
- Improved understanding of stormwater issues and impacts within local catchments
- Any issues not previously addressed that need consideration
- Whether additional management options need to be developed.

12. Conclusions

Considerable work has been done on the preparation of this SMP, in consultation with Council, agencies, stakeholders and the community to ensure that this SMP is supported by all stormwater managers and represents their values and concerns.

The major output of this Plan is the Implementation Strategy. It is this strategy that defines the actions to be implemented by the Bland Shire Council LGA to address stormwater issues, the priority of implementation, the implementation timeframe and the estimated costs. The active involvement of Bland Shire in the implementation and future review of this SMP will ensure a lessening of the impacts of stormwater on the environment.

Addressing stormwater within the catchment requires long-term commitment from Councils, agencies, stakeholders and the community. All parties should participate in the process.

13. References/Relevant Documents

- ANZECC (1992) Australian Water Quality Guidelines for Fresh and Marine Waters.

- Australian Water Technologies (1999), Lake Cowal Land and Water Management Plan.

- Bland Shire Council (1999), Bland Development Control Plan.

- Institute of Engineers Australia (1987), Australian Rainfall and Runoff, A Guide To Flood Estimation.

- *DSS Software Program is a Powerful Resource,* p.6, SIA Bulletin, January 2001, Stormwater Industry Association.

- NSW EPA (1997) Draft Managing Urban Stormwater Council Handbook.

- NSW EPA (1999) Water Quality and River Flow Interim Environmental Objectives: Guidelines for River, Groundwater and Water Management Committees.

- NSW EPA (1999) Example Stormwater Management Plan.

- Phillips, B, Anton, G, Boyd, W & Goonatilleke, A (2000), *Community Views On Values, Objectives, Stormwater Issues And Causes*, Willings & Partners.

14. Appendices

Appendix A	**Stormwater Questionnaire**
Appendix B	**Questionnaire Results and Comments**
Appendix C	**Newspaper Article 'West Wyalong Advocate', 16/01/2001**
Appendix D	**Minutes of the Public Forum, 08/02/2001**
Appendix E	**Newspaper Article 'West Wyalong Advocate', 13/02/2001**
Appendix F	**Minutes of the West Wyalong Stormwater Catchment Tour**
Appendix G	**SMP Management Options Computer Output Tables**

Appendix A
Stormwater Questionnaire

Appendix B
Questionnaire Results and Comments

Survey Response

86 surveys returned from 1142 sent to households = 7.5% response rate.
131 surveys from High School students
Total of 217 responses received.

1. What do you use the **town** waterways for?	Total	% of Respondents
Walking/cycling	125	61
Scenic views	20	10
Swimming/wading	0	0
Fishing	4	1
Don't use them	29	14

If you don't use the waterways, please describe why.
Major Responses:

1. No use for them, when I have walked along them they are slimy and slippery.
2. Not suitable or attractive enough.
3. Why do you want to walk in a waterway?
4. At the moment its not very visually appealing.
5. You don't know if you're trespassing or not.
6. What waterway?
7. Uninteresting and boring.
8. Really, who would want to walk in or on West Wyalong waterways (e.g. Green Corridor) because of the rubbish in the waterways?
9. I use caution - slippery after even light rain
10. They're out of the way and slippery with green algae.

How would you rate your level of understanding about stormwater issues?

Level of Understanding	**Average**	**Rank**
Fair	2.067	1
Good	1.733	2
Poor	0.800	3
Excellent	0.400	4

Comments

1. "I think we should get a lake, it would increase tourism and bring more money here e.g. petrol, food, ice and other needs for skiing and fishing."
2. "I think we should get a lake so we don't have to travel to water ski."
3. "We appear to have an ideal catchment area to maintain a lake for recreation, fishing, tourism, and to attract birds and wildlife to Wyalong and West Wyalong. If we created a recreational lake I feel the whole community would be a lot more aware and concerned about pollution and the quality of water filling the lake."
4. "Further enhancement of Rotary Park and Cooinda Park and associated areas."
5. "Pond area between West and Toppy to be developed."

6. "Why not make catchment run into settlement dams or lake similar to (Lake) Centenary at Temora."
7. "Make something out of the catchment."
8. "This town requires a lake. Water could be filtered into the Lake. Our street sweeper leaves too much rubbish as he will not go near trees where leaves are rotting. Shire should encourage water tanks on all houses."
9. "Cooinda Park Sewage site - dam!"
10. Learn true value of recycle.
11. Recycle.
12. More access to Lake Cowal where it finishes and the Bland Creek would be the best thing."
13. With recreation facilities, steps would need to be applied to prevent littering, rubbish, pollution etc.
14. We could win the Tidy Towns Award.
15. Sprays that cockies (farmers) leave laying around the farm i.e. drums not washed out.
16. What is the future of the dams marked "Poison"? Why can't they be emptied and cleaned out to be used for town water storage?
17. Get schools and community groups involved in these areas of stormwater management.
18. "We should all save water."
19. "Not enough rain, make it rain."
20. "Runoff from sausage factory, animal farms and STP."
21. "Flooding from stormwater in and outside of our town, my they sure can be very deep!"
22. "Can't 'The Drain is just for rain' be enforced?"
23. "Clean out the 16 mile tank and stop town flooding."
24. "Perserverance Oval Dam full of algae at very low level."
25. "Dam overflows, Causeways in West Wyalong, Mosquito population."
26. "Periodic flooding of Brown St."
27. " Town needs more information on what stormwater really is and what it does to the town/community."
28. "Stormwater drain that runs under supermarket."
29. "Barnardo Park, litter, build up of dirt and sail grass. Bridge over Grenfell St."
30. "Public access to the creeks and the lake and a few amenities. Most people don't know how to get to the Bland Creek."
31. "In fact I submit that in every section of our town/shire the question of waterway's purity etc. is an ongoing problem as is in any large shire/community."
32. "Large sediment trap e.g. lake near poppet head."
33. "Dam on corner of Grenfell and Monash Streets."
34. "If areas are available and beautiful, people will use them. If people use the areas, they are more likely to respect and take care of areas."

35. "Soil conservation and degradation."
36. "Walkway at Retirement Village."
37. "Sediment from earthworks and road run-off."
38. "Flooding from Brown St."
39. "Cover loads of rubbish going to the tip, including the Shire trucks."
40. "Continuance of work on waterway east of Clear Ridge Rd up to Wyalong."
41. "The inability of Main St to cope with stormwater in a storm."
42. "Another waste of money. Applicable to Metropolitan areas only. Have a crime management plan instead."
43. "The town drainage system via Barnardo Street down through Barnardo Park. The dam outlet in McCann Park . Both are always unhealthily dirty with pollution and are never cleaned by Shire so all these pollutants go into the Green Corridor and into Boundary St collection area. The drain and its outlets under Smith's Supermarket is always choked with rubbish, never cleaned and is a health hazard. Bland Council does not fulfill its obligations re this supermarket drain."
44. "Cleaning out of culvert on Mid Western Highway near Colonial Motel, large amounts of silt and rubbish also flushing of oil under Highway near Public Toilets."
45. "I think a footpath from Main St to supermarket is essential as residents have to walk on the road where traffic is sometimes heavy and when raining they are splashed by passing vehicles."
46. "All the broken glass in the waterway near the bridge in Kurrajong St."
47. "The Green Corridor needs a lot of attention, water lies there and breeds mosquitoes."
48. "Education of community re "Drain is just for rain". Council needs to have more professional info on water quality i.e. by recognised water testing laboratories so it can be monitored by scientifically credible data."
49. "Street crossings of surface water. Sewer main manholes in stormwater runoff areas."
50. "Large tanks to be placed on Hospital and Waratah Retirement Village to catch run-off from roof areas to water lawns and gardens."
51. Protect all of our stormwater, after all its given free.
52. Just let the water go where it has always gone.
53. Control of mosquitoes.
54. The Management Plan would need a 100% broad spectrum review of every aspect of proposed planning/operations.

Appendix C
Newspaper Article 'West Wyalong Advocate', 16/01/2001

Appendix D
Minutes of the Public Forum, 08/02/2001

Stormwater Management Plan

West Wyalong

Community Consultation Notes
Thursday 8 February 2001

Catchment - All collects in main town drain, crosses highway and eventually runs (20 kms) into Lake Cowell, via Bland Lake

Waterways – mostly constructed concrete drains, no natural waterway

Wetlands – basic wetland system already exists, looking at enlarging and designing wetland to control Stormwater through filtration

First 'flush' of water is what contains the most pollution, which is a reason why a lot of fish died after the rain (recently)

It was suggested that the community requires public education explaining the difference between waste, effluent and stormwater and where the different water is used

Brown Street – between houses and trucking yards – block of land for sale which may stop access for Council. Council advised that the easement is used to access the land.

Salinity to be included in Plan as it may be as a result of leaking stormwater – there are many different funding avenues for Salinity as it is a high risk issue at the moment

Issues Identification – there is a lot of crown land which is not being adequately cared for by the Crown

It was suggested that Council could introduce the green waste garbage bin to encourage people to dispose of their grass clippings properly rather than washing into the drain which then goes to Stormwater

Hot Spots (Photos)

- Perserverance Street – worst stormwater quality point because of sediment coming out of land
- Saleyards – all rainfall from golf course washes down to Saleyards
- Treatment Works – all town stormwater runs through the Treatment Works
- Bowling Club Dam – algae, lots of life underneath
- High School/Primary School – second and third in the list of sediment sites
- Boundary Street Dam – very good water quality
- Moriarty Close – sediment, erosion

DLWC Overview

- Sediment problem - saleyards, playgrounds, Perserverance Street
- Saleyards have most direct affect on the town
- Run off water contains pollution and heavy oils
- Riparian vegetation – main creek through sewerage works
- Urban Salinity – accurate data has not been gathered, visual inspection has been undertaken and it was noted that Salinity exists in Main Street and Kurrajong Street
- Weeds – many areas of private and Crown Land have weeds eg cat heads, pattersons curse etc which affect water quality

Catchment Values

Ecological

- Water quality
- Restoration of native bird and animal habitat
- Restoration of native vegetation
- Improving water quality by enlarging wetlands
- Weed control

Social

- Parks and gardens, visually pleasant place
- Making greater use of Wetlands for recreational purposes
- Effects of erosion and visual amenity
- Education opportunities in the wetlands
- Enhance recreation opportunity of green corridor

Economic

- Eco-tourism activities based around the wetlands eg moving caravan park
- Stormwater re-use – opportunities to recycle parts of stormwater
- Farmers using Stormwater run-off via the Barmedman Creek – this must be maintained
- Land degradation caused by erosion

Survey responses

83 responses, 120 school students

Top answers for some of the questions asked:

Catchment Value

Health Waterways
Public health and Safety
Habitat for birds, fish and animals

Stormwater Objectives

Health and safety unaffected by stormwater
Protect and restore waterways and habitats
Minimise impact of stormwater and flooding

Pollutants

Fertilizer and pesticide run-off

Appendix E
Newspaper Article 'West Wyalong Advocate', 13/02/2001

Appendix F
Minutes of the West Wyalong Stormwater Catchment Tour

Catchment Tour for the West Wyalong – Wyalong Urban Stormwater System.

Wednesday October 25, 2000.

Present:

Mr. Merv Penny	Supervising Engineer Bland Shire Council
Mr. Benjamin Falconer	Facilities & Assets Engineer Bland Shire Council
Mr. Greg Ewings	Parks & Gardens Coordinator Bland Shire Council
Mr. Mark Leary	Department of Land & Water Conservation

Apologies:

Mr. Michael Crowe	Treatment Works Supervisor Bland Shire Council
Mr. David Mitchell	Director of Environment & Community
Mr. Glenn Neyland	Noxious Weeds Inspector Bland Shire Council
Mr. Warren Burdack	Saleyards Coordinator Bland Shire Council
Mrs. Karen Leary	Landcare Coordinator

Catchment tour encompassed;

- Areas subject to flooding (i.e. areas where drainage system is not capable of transporting a 1:100 year flood).
- Land where activities on that land promote deteriorated stormwater quality through:
    - Increased nutrient content.
    - Sedimentation of water through activities such as landscape suppliers, earthworks and soil erosion.
    - Inclusion of heavy metals or other pollutants from commercial and industrial activities.
- Possible problems with the sewer mains surcharging in areas close to stormwater channels.
- Aquatic habitats that exist along the stormwater network.
- Problems with the transfer of noxious and other weeds with the stormwater. Also problems with keeping the drainage reserves free from weed infestation.
- Councils existing programs for the maintenance of the drainage network.
- Storage & reuse issues of stormwater.
- Also talked about the benefits of a gross pollutant rack and proposed wetland development.

- Look at and considered existing stormwater reports prepared by consulting engineers.

- Discussed to need for a community education program.

Areas of concern that were identified in the catchment tour are;

- Stormwater from West Wyalong Saleyards to town drainage system (needs sediment basin with filter bed at outlet end).

- Stormwater system that runs from the end of Dumaresq Street to Wootten Street near Monash Lane (Flooding problems with residents on the end of Dumaresq Street).

- Stormwater system running along Monash Lane (Inudation of the rear of blocks along both Monash Street and Dumaresq Street on the Monash Lane Side. Also possible surcharge of sewer system).

- Flows from West Wyalong Public School to drainage system (high levels of sediment, needs sediment trap).

- Flows from West Wyalong High School to drainage system (high levels of sediment, needs sediment trap).

- Flows from West Wyalong tennis Courts to drainage system (high levels of sediment, needs sediment trap).

- Corner of Mid Western Highway and By-Pass Rd needs a sediment trap.

- Brown Street at the rear of properties eastern side (subject to inundation of properties). Needs detention basin to alleviate flood problems.

- Park Street between Monash Street and Brown Street (House on western side subject to flooding).

- Welsh's Lane along Northcott Street to Operator Street (Drainage system capable of handling 1:20 year flood only, old persons units subject to flooding).

- Water from southern catchment (area comprising access road to treatment works through to central road and By-Pass Rd) flows through earth drains only, very high content of sediment. Needs wetlands development to go ahead to remove sediment.

Need to look at;

- Implementing the community education and action programs comprising;
    - Newspaper advertisements calling for public comment.
    - Programs through the local schools (obtain educational documents available through the EPA).
    - Review of Bland Shire Council's complaints register to identify any areas of concern not considered during the catchment tour and previous enquiries.
    - Interact with community groups to promote community involvement in stormwater management (e.g. consult and include Landcare in schools program).

- Check the feasibility of the sediment traps, sediment basins, gross pollutant trap

and wetlands.

- See about planning controls in place for the protection of stormwater quality with David Mitchell.
    - Consider site auditing.
    - On-going review of management practices.

- Consider monitoring and reporting requirements for the stormwater management plan. Check if the implementation of the plan is satisfactory.
    - Can we achieve and maintain what we set out to do?
    - What do we monitor and how often do we monitor?
    - Who do we report to? Do we need a committee?

Appendix G
SMP Management Options Computer Output Tables

Notes

Notes

Address all correspondence to:

General Manager
Bland Shire Council
2 Shire Street
PO Box 21
WEST WYALONG NSW 2671

Telephone: 02 6972 2266
Fax: 02 6972 2145
Email: council@blandshire.nsw.gov.au