Contents

Table of Abbreviations

Abbreviation	Explanation
BCC	Banyule City Council
BPEMGs	Best Practice Environmental Management Guidelines
DCMC	Darebin Creek Management Committee
EPA	Environment Protection Authority Victoria
GPT	Gross Pollutant Trap
LPPF	Local Planning Policy Framework
MSS	Municipal Strategic Statement
MWC	Melbourne Water Corporation
NRE	Department of Natural Resources and Environment
SKM	Sinclair Knight Merz
SPPF	State Planning Policy Framework
SWMP	Stormwater Quality Management Plan
YVW	Yarra Valley Water

Melbourne Water has provided 50% funding contribution to the development of this Stormwater Management Plan for the improvement of urban stormwater quality and the protection of waterways and bays.

Melbourne Water

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1. Introduction

Urban drainage systems have been developed to meet the community's need to minimise the threat from flooding. The main focus of development has been on hydraulic and transport capacity. Urbanisation leads to changes in both the quantity and quality of stormwater that is delivered to urban receiving waters but traditionally, little attention or resources have been allocated to considering the environmental impacts of stormwater (VSC, 1999).

The State Government of Victoria, through the Environment Protection Authority Victoria (EPA), Melbourne Water Corporation (MWC) and other agencies, is supporting local Councils in the development of stormwater quality management plans (SWMP) for urban areas in their municipalities. The SWMP process is designed to:

- Generate commitment to a best practice approach;
- Identify priorities based on risk assessment;
- Develop management strategies and actions; and
- Establish a basis for ongoing cooperation and coordination between agencies.

Sinclair Knight Merz (SKM) was contracted by the Banyule City Council (BCC) to assist with the development of a SWMP, which will guide the Council in improving environmental management and quality of stormwater runoff from urban areas throughout the municipality. This document reports on the outcomes of this plan-known as the Stormwater Quality Management Plan.

The SWMP has been developed in a number of stages, as guided by the requirements of the Urban Stormwater: Best Practice Environmental Management Guidelines (Victoria Stormwater Committee, 1999), and involved close consultation with Council and other stakeholders. The outcomes from this process have been compiled into a number of reports:

- **Discussion Paper no. 1 – Threats and Values.** This report provided details of the values of environments that receive urban stormwater runoff and the threats to those values from urban stormwater runoff.
- **Discussion Paper no. 2 – Risk Assessment.** This report described the risk assessment and prioritisation process necessary to determine the priority management issues that would become the focus of actions aimed at improving the quality of urban stormwater runoff.
- **Discussion Paper no. 3 – Priority Management Issues Paper**. A summary of the priority management issues, a description of the process followed to determine management actions and the identification of the priority management actions required to address both priority management issues and Council's management framework issues.

The Discussion Papers summarised above have been revised and compiled into two separate volumes that form the final Stormwater Quality Management Plan for the Banyule City Council:

- **Volume I: Executive Summary** provides an overview of why and how the plan was developed and details management strategies and recommendations that Council can use to improve stormwater management.

- **Volume II: Background** (this report) provides detailed background information that clearly describes the methodology followed and detail on the assessment of threats, values and strategy development and includes all appendices.

1.1 Why develop a Stormwater Management Plan?

When it rains, water runs off from streets, carparks, the roofs of houses and other surfaces into the nearest waterway or wetland. This runoff can enter waterways via a subsurface network of pipes or as surface runoff. Most urban areas have a system of pipes with entry points to drain stormwater, however in outer urban and rural areas there may be no pipes infrastructure and stormwater is drained via open gutters.

Unlike sewage, stormwater is not treated in anyway before it enters waterways. In urban areas, stormwater accumulates pollutants as it flows over hard surfaces. These pollutants include nutrients, sediments, litter, oils and grease and other toxicants, which can negatively impact upon the water quality in urban waterways, and ultimately Port Phillip Bay. As stormwater is not treated prior to entering waterways, activities in the catchment have a direct influence on the quality of stormwater and hence the quality of water in our rivers, creeks, wetlands and bays are affected.

Stormwater runoff has been identified as a major contributor to degradation in many urban environments. As such, the State Government of Victoria, through the Victorian Stormwater Committee (VSC) is supporting local Councils in the development of stormwater management plans for urban areas across Melbourne. The Victorian Stormwater Committee is comprised of EPA, MWC, the Municipal Association of Victoria (MAV) and the Department of Natural Resources and Environment (NRE). The Committee is responsible for the establishment of the Stormwater Agreement (draft), Urban Stormwater Best Practice Environmental Management Guidelines (VSC, 1999) and assisting Councils with the development of stormwater management plans.

The Stormwater Agreement is part of a dynamic process of improving stormwater quality that will continue to evolve with changing understanding and circumstances. The primary purpose of the Stormwater Agreement is to obtain commitment by all of the participants in achieving better outcomes for stormwater quality by:

- Working with common principles of stormwater management;
- Establishment of performance objectives to guide planning and design of stormwater systems;
- Identification of best practice environmental management practices to form a toolkit for stormwater management;
- Strategic application of these tools, in the context of agreed principles and performance objectives, through stormwater management planning;
- Review and refinement of financial and administrative arrangements to deliver the required outcomes in the most cost effective manner; and resolve problems before they become impediments to improved environmental outcomes.

To assist in the development of strategies for stormwater management, the VSC produced the Urban Stormwater: Best Practice Environmental Management Guidelines (VSC, 1999). The guidelines provide guidance in five key areas:

- Environmental performance objectives: defining environmental performance objectives for managing urban stormwater;
- Tools review: describing a range of tools that can reduce sources of stormwater pollution or remove pollutants from stormwater;
- Tools selection: guiding the selection and application of these tools to suit particular situations;
- Best practices: raising awareness of best practices for environmental management of stormwater; and
- Stormwater management plans: providing guidance for developing stormwater management plans.

The objectives of a Stormwater Quality Management Plan are to:

Identify strategies to improve the environmental management of urban stormwater and protect the environmental values and beneficial uses of receiving environments.

1.2 Regulations and Key Authorities

There are a number of regulations and strategies that are important in the context of stormwater management and similarly, a number of organisations have a role in the management of the region's waterways and stormwater. Section 1.2.1 provides a summary of the key regulations and strategies relevant to the Banyule Stormwater Management Plan. Section 1.2.2 describes the key organisations responsible for stormwater management in the Banyule municipality.

1.2.1 Regulations

State Environment Protection Policies

State Environment Protection Policies provide a comprehensive policy framework for environmental protection in Victoria. In addition to provisions that apply statewide, the policy includes a number of regional schedules that set out more detailed provisions for the protection of regional environments.

Policy provisions specifically relevant to the City of Banyule are:

- Schedule F6 (Waters of Port Phillip Bay); and
- Schedule F7 (Waters of the Yarra Catchment).

Schedule F6 promotes integrated management of the Port Phillip Bay catchment and bay activities, and recognises the cumulative effects of different activities on water quality and the need to coordinate planning of land, water and waterway management. A number of provisions are set down with relevance to stormwater management.

Schedule F7 provides attainment measures for the Yarra River and its tributaries. A number of waterways within or adjacent to Banyule have been incorporated into the schedule. A number of attainments are directly relevant to the Banyule region and the management of Stormwater. The main features of the policy are:

- Beneficial uses of the environment;
- Quality objectives that must be achieved in the process of use of the environment; and

- The divisions of the subject area into sections according to use requirements.

Port Phillip and Westernport Regional Catchment Strategy
The regional strategy sets four key objectives for catchment and land protection in the Port Phillip and Westernport region:

- Clear and coordinated responsibilities for the integrated management of five major catchments;
- Initiatives to encourage and support community participation in catchment and land protection;
- A process for setting priorities and allocating funding to on-ground initiatives to address critical degradation problems; and
- A mechanisms to assess and monitor the condition of land and water resources and the effectiveness of land protection measures.

State Planning Policy Framework (SPPF)
The State Planning Policy Framework sets out general principles for land use and development in Victoria, with specific policies under a series of headings. All planning Authorities must heed these State policies. In relation to water quality, the SPPF emphasises the need for a co-operative approach with key stakeholders. Specific policies relevant to stormwater are contained within Section 15 Environment and Section 18 Infrastructure.

Local Planning Policy Framework (LPPF)
In the Local Planning Policy Framework, the planning authority (BCC) brings together its strategic framework in relation to land use and development for the municipality in the Municipal Strategic Statement (MSS) and local policies. Banyule's MSS includes objectives in relation to water quality and stormwater management.

Municipal Strategic Statements contain:
- A profile of key characteristics and the regional context;
- A vision statement identifying overall landuse goals for the municipality;
- Clear policy links to SPPF and the cooperate plan;
- Strategic statements and policies about key issues;
- A future land-use framework;
- An outline of how the municipality intends to implement the MSS; and
- A program for monitoring and review.

1.2.2 Key Organisations responsible for stormwater management

City of Banyule
Banyule City Council is responsible for a number of activities within the Banyule catchment that are linked to stormwater management,. These include:
- Implementation of the Banyule Planning Scheme;
- Management and maintenance of the local drainage system;
- Litter collection on the Council drainage system;
- Cleansing including street sweeping;
- Waste Management Services;
- Road infrastructure and car parks;
- Enforcement of Local Laws;
- Management of Water bodies; and
- Flora and fauna management.

Melbourne Water Corporation (MWC)
Melbourne Water is responsible for the management of all major drains and waterways, generally in catchments greater than 60 hectares in area. The role of the Melbourne Water Corporation in stormwater management includes:

- Strategy management: providing overall direction and strategies for stormwater management in Melbourne;
- Drainage infrastructure standards: setting standards for planning and design of drainage infrastructure to reduce the risks of flooding and protect receiving environments from the impacts of urban development;
- Urban area development: working with local government and developers to plan new drainage infrastructure in developing urban areas; and
- Systems operations: operational responsibility for waterways and the constructed drainage system.

As part of their commitment to stormwater quality improvements in the metropolitan area, Melbourne Water has provided 50% funding for the development of this SWMP, as well as providing resources to assist Council through the development of this plan.

Environment Protection Authority Victoria (EPA)
The EPA is responsible for the protection of the quality of Victoria's environment by application of the statutory powers described in the Environment Protection Act (1971). The role of the EPA in stormwater management includes:

- Establishing environmental standards for urban waterways and bays through State environmental protection policies;
- Establishing programs for achieving environmental standards by encouraging the use of best practices; and
- Facilitating the achievement of goals using regulatory and non-regulatory means and enforcement where necessary.

Port Phillip Catchment and Land Protection Board (CaLP) co-ordinates catchment management activities at a regional level to ensure protection of receiving environments.

2. The stormwater planning process

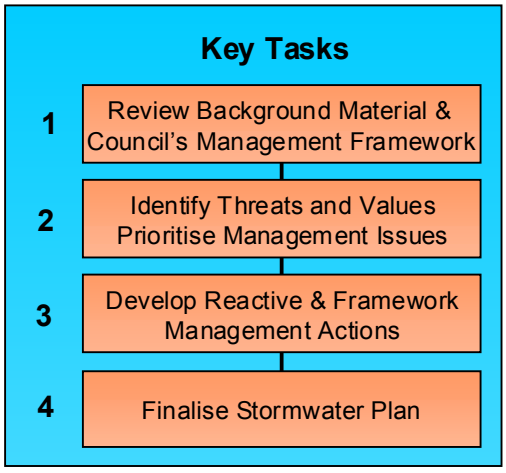
The methodology for developing stormwater management plans has been established by the Victorian Stormwater Committee (EPA, MWC, MAV, NRE) and is defined in Chapter Three of the Urban Stormwater Best Practice Environmental Management Guidelines (VSC, 1999). These Guidelines are being followed in the development of the Banyule City Council SWMP.

The key tasks followed in the development of this SWMP consisted of the:

1) identification and review of background issues;
2) review of local government management and operations as it relates to stormwater management;
3) identification of values of environments receiving urban stormwater;
4) identification of threats to receiving environments from stormwater inputs;
5) risk assessment and prioritisation process to determine the priority stormwater management issues;
6) development of reactive management strategies for managing stormwater that addressed the priority management issue;
7) development of Council management strategies that will lead to an improvement in the ability of Banyule City Council to better manage stormwater quality; and,
8) provision of indicative costings, responsibilities and timelines for implementation of the strategies identified in the SWMP.

These tasks were conducted in four stages as outlined in Figure 2.1. All stages in the process involved stakeholder input with four workshops conducted to discuss each stage of the plan.

■ **Figure 2.1. The stormwater planning process**



The final SWMP is a document that Banyule City Council can use to better manage urban stormwater quality and improve the health of the region's waterways. To be most effective, the plan must:

- Have Council-wide commitment to the plan and its implementation;
- Set priorities for the Council's management of urban stormwater;
- Include clearly stated strategic objectives;
- Incorporate a risk-based assessment of issues and threats;

- Include clear strategies that address priority risks, together with measurable environmental outcomes wherever possible;
- Follow the principle of continuous improvement; and
- Encourage all stakeholders.

This report is **Volume II** of a *Management Plan for the Improvement of Urban Stormwater Quality for Banyule City Council.* It provides the details of the process followed in the development of the stormwater management strategies and background to support the overall Stormwater Management Plan presented in **Volume I**. In particular, this report presents details of the assessment of the values of waterways and wetlands that receive urban stormwater runoff in the Banyule area. It provides an assessment of the threats to those values from stormwater runoff and details of the risk assessment process used to prioritise the key stormwater management issues in the region. This report also provides a review of Council's management framework as it relates to stormwater and environmental management. The review examined Council's strategic documents, planning processes and day to day management activities to identify deficiencies that are impacting on Council's ability to successfully manage stormwater in the region.

Strategies have been developed to address the priority management issues and issues arising from the Council review. Details are provided of the process by which strategies were identified and assessed. The final suite of recommended strategies are those presented in **Volume I** of the Stormwater Management Plan.

3. The Banyule City Council area

The municipality of Banyule is located between 7 and 22 kilometres north-east of central Melbourne. It includes all or parts of the suburbs of Bundoora, Greensborough, St Helena, Eltham North, Watsonia, Watsonia North, Yallambie, Montmorency, Briar Hill, Lower Plenty, Macleod, Rosanna, Viewbank, Heidelberg West, Heidelberg Heights, Bellfield, Ivanhoe, Heidelberg, Ivanhoe East and Eaglemont.

Surrounding municipalities include:

- Darebin City Council (West);
- Whittlesea City Council (North West);
- Nillumbik Shire Council (North East);
- Manningham City Council (South East); and
- Boroondara City Council (South)

With the exception of Whittlesea City Council, all of these councils have or are in the process of developing Stormwater Quality Management Plans.

The Banyule municipality covers an area of approximately 63 square kilometres. The Yarra River and Darebin Creek clearly define its southern and western boundary respectively, and the Plenty River meanders through the municipality from north to south. With the exception of relatively flat land in the Heidelberg West area and the flat alluvial floodplains adjacent to the Yarra and Plenty Rivers, the majority of the municipality's quite strongly dissected topography ranges from gently to steeply undulating (BCC 1998a).

Urban stormwater from Banyule is ultimately discharged to the Yarra River either directly from stormwater runoff via minor tributaries and drains or indirectly from stormwater runoff first entering the Plenty River and Darebin Creek, which subsequently then discharge into the Yarra River.

The following section describes the main environments receiving urban stormwater from BCC catchments and includes an assessment of their environmental, cultural, heritage, amenity, recreational and economic values. A description of the receiving waters follows.

3.1 Receiving Waters

Land within BCC forms an integral part of the regional open space networks associated with the Yarra, Plenty River and Darebin Creek valleys, which provide a recreational and environmental resource for metropolitan Melbourne. It also forms part of the Melbourne Riverlands and Plenty Yarra Community Tourism Association tourist areas, which are notable for their natural and cultural heritage (Banyule City Council 1998a).

There are substantial areas of indigenous vegetation, particularly in the east and north-east of the municipality. The municipality includes several sites of state, regional and local botanical, zoological and habitat significance. The waterway system within

Banyule provides the basis for significant areas of public open space. These are used for active and passive recreation and to protect the natural environment (BCC 1998a).

The Yarra River, Plenty River and Darebin Creek are major waterways providing important habitat for many of the indigenous plants and animals occurring in Banyule. The position of Darebin Creek and Plenty River in terms of the Yarra River and the predominance of urban catchments mean that their health can significantly influence the status of the lower Yarra River. Aquatic studies (Nicol 1998; Reed and Newall 1988; Environment Protection Agency 2000) have generally rated the health of Darebin Creek, Plenty River and the lower Yarra River as degraded.

Even so, the waterways of the Yarra catchment remain important for biodiversity conservation. There are many significant flora and fauna species dependent on the waterways. For example, of the twenty native fish species that occur in the waters of the Yarra catchment, thirteen are considered to be either rare or threatened to some degree (EPA 1999). Platypus are increasingly being recorded in urban waterways, for example the lower Plenty River and Diamond Creek in the adjacent Nillumbik Shire (Thompson Berril Landscape Design 2000). Whist many of these significant species may not currently exist in the waterways of BCC, the waterways provide important links between extant populations, and retain the potential to be recolonised in the future.

Other waterways occurring within Banyule continuing to support habitat remnants include Salt Creek, Donaldsons Creek, Banyule Creek, Yallambie Creek and Sweetwater Creek (BCC 2000). The Yarra River Floodplain incorporates a number of important wetlands. Within Banyule, these include the Banyule flats wetlands, Warringal Swamplands and a number of billabongs within the Yarra Flats Park and Wilson Reserve. Additional wetland areas occur or have been established along the Plenty River, Darebin Creek and within green corridors in the urban environment. The following section provides a description of the major waterways.

3.1.1 Darebin Creek

Darebin Creek rises in Devonian sediments north of Woodstock, then flows south through newer basalt. The creek follows close to the boundary of the basaltic and Silurian sedimentary formations within the creek valley. In some areas the basalt is dissected creating locally significant escarpments. In other areas, prominent Silurian outcrops occur, as at Pine Ridge, Darebin parklands. The soils of the study area are closely related to its geology. Generally, alluvial soils have been deposited in some riverine areas, and clay soils are associated with the Silurian sediments. The total catchment is 129 km^2, of which approximately 50% is urban. The lower sections of Darebin Creek come under the influence of BCC.

Most of the tributaries of the Darebin Creek within the urban area have been put underground. The creek itself has been channelled, cleared, widened or realigned along much of its course (Eyre *et al.* 1992).

The water quality in Darebin Creek is affected by a number of factors, including:
- removal of riparian vegetation;
- litter and debris transported to the creek by the stormwater system;
- deliberate dumping of rubbish and industrial wastes;
- pollutants contained in stormwater;

- spillage of diluted sewerage waters; and
- leachate from old tip and landfill sites and polluted groundwater.

Industrial pollution entering Darebin Creek via the Bell Street Main Drain, which also serves northern industrial and residential areas has a continuous detrimental effect on the ecology of Darebin Creek (EPA 1993). Litter pollution has been noted as a major concern in Darebin Creek (Bullock and Davis, 1995), with shopping centres to the west of the creek (in Darebin City Council) being previously identified as sources.

Duke and Veenstra-Quah (1997) describes the water quality of Darebin Creek as fairly typical of an urban creek. The high levels of nitrogen and phosphorus and the high biochemical oxygen demand show that the water heavily polluted with organic matter. The elevated coliforms and *E. coli* levels also indicate the likelihood of sewage contamination. There is serious heavy metal pollution in some sections of the waterway, Darebin Creek sediments being among the most contaminated within Melbourne (Pettigrove unpublished cited in MW, 1998). Industrial drains and tip leachate are considered the main contributors to toxicant contamination.

Melbourne Water (1998), in reviewing the stream health of Darebin Creek, suggested the greatest impact originates from water quality and sediment. Due to the retention of good habitat diversity, improvements in water quality would be beneficial to the Darebin Creek ecosystems.

3.1.2 Plenty River

The Plenty River rises from the slopes of Mount Disappointment in the Great Dividing Range approximately 50 kilometres north of Melbourne. With a natural catchment of some 351km^2, the Plenty River enters the Yarra River at View Bank. The section of the lower Plenty River downstream from the Greensborough Bypass is entirely enclosed by the BCC. The river downstream of Plenty Gorge Park flows through predominantly developed urban areas of Greensborough, Montmorency and Lower Plenty until its confluence with the Yarra River. Public open space adjoins the lower reaches, such as golf clubs and regional parklands (TBLD 2000).

From a geomorphological perspective, the section of the Plenty River in BCC meanders through a deep (10m) floodplain. This area is subject to frequent flooding, sediment deposition and meander migration. As with most urban streams, the river has responded to changes in hydrology and channel confinements, by incision. This area of the Plenty River is sensitive to future upstream urban development impacts, and if not properly managed, could lead to channel adjustment such as river widening and meander migration.

The primary features of the Plenty River system have been identified as:

- generally good stream morphology;
- disrupted and poor flows in the upper and middle catchments;
- flows of poor water quality in the lower reaches from stormwater runoff;
- excessive litter;
- elevated suspended solids loads; and
- generally highly modified riparian zone and adjacent vegetation communities.

(Source TBLD, 2000 and MW, 1999).

Litter has long been recognised as an issue in the Plenty River, water-borne litter strewn along the river and banks seriously influences public perception of the river as a feature of significance (Melbourne Parks and Waterways, 1994) and can threaten a range of values.

3.1.3 Yarra River

The Yarra River from above the Junction of the Plenty River enters a broad floodplain (part of the Chandler Basin). In this section, the Yarra River displays wide meanders and some significant billabongs still exist, despite extensive land filling in the past (Victorian Government 1991). The flora of the middle Yarra, although much altered by clearing and development and invaded by alien plants, is a valuable resource in terms of genetic, visual diversity and habitat value for local and transient fauna (VG 1991). Before European Settlement, the Yarra River was probably clear except during floods. However its water quality and flow have been greatly reduced by practices such as water diversion, vegetation clearing, sewage and industrial disposal.

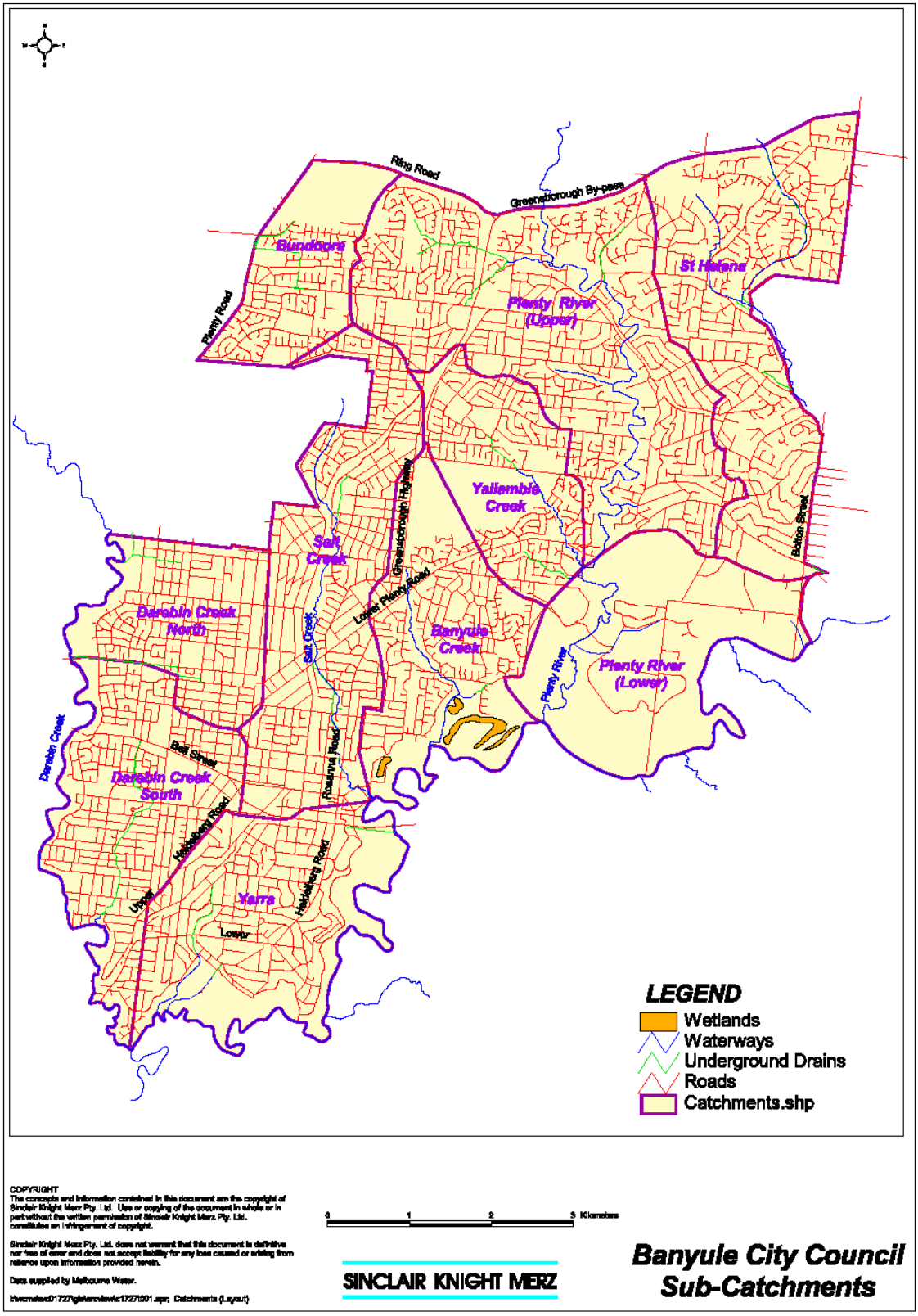
The Yarra River is one of the major natural features of Melbourne, and can be considered as a rich public asset. The landscape is an important attractant to people living in or visiting the area. Recreation planning, such as the Middle Yarra Concept Plan (VG 1991), have placed an emphasis on creating opportunities for the public to enjoy facilities associated with the Yarra River. The importance of the Yarra River for recreation is not only limited to the BCC. Maintenance of the water quality in the Yarra River is imperative for downstream uses such as the Moomba Festival and rowing.

3.2 Sub-catchments

The main urban sub-catchments, land use and receiving environments in BCC are summarised in Table 3.1. Sub-catchments were selected based on their location and their receiving waterways to assist in determining priority issues between locations in BCC. Figure 3.1 provides a map showing the geographic location of the sub-catchments.

■ **Table 3.1. Urban stormwater receiving environments in the study area**

Urban area / subcatchment	Main land use activity	Receiving environment
Bundoora	Residential, commercial, industrial, recreational and new development	Darebin Creek
Plenty River (Upper)	Residential, commercial, recreational and industrial	Binnak Park wetlands, Kalparrin Lake, Plenty River
St Helena	Residential, new development and commercial	Diamond Creek via West Eltham Drain
Yallambie Creek	Residential and new development	Yallambie Creek and Plenty River
Plenty River (Lower)	Residential, new development, agricultural and recreational	Plenty River and Yarra River
Banyule Creek	Residential and recreational	Banyule Creek, Banyule Wetlands and Yarra River
Salt Creek	Residential, new development and commercial	Salt Creek
Darebin North	Industrial, residential and recreational	Darebin Creek
Darebin South	Residential, industrial, commercial and recreational	Darebin Creek and Donaldsons Creek
Yarra	Residential, commercial and recreational	Yarra River and billabongs



■ **Figure 3.1 Map of Banyule City Council and its sub-catchments.**

3.2.1 Bundoora

The Bundoora sub-catchment is located in the north east of BCC. A significant proportion of the sub-catchment currently consists of undeveloped land associated with Parade College. Much of this undeveloped land is targeted for residential development in the near future. This development will require the implementation of appropriate standards to prevent stormwater impacts during development and subsequent inhabitation. The remaining catchment is primarily established residential, with small commercial and industrial centres concentrated on Grimshaw Street. Recreational facilities are associated with Parade College and a number of smaller sporting ovals. Stormwater runoff from the sub-catchment ultimately discharges via underground drainage into Darebin Creek.

There are not any significant waterways in the sub-catchment however a relatively large lake exists in the grounds of Parade College. There is mature vegetation (*Eucalyptus* spp) on an island in the centre of the lake and along a narrow riparian zone (<20m). The lake itself appears to be deep, with minimal aquatic macrophyte growth as a result, thus restricting the current value of the wetland for stormwater treatment. Proposed development for the area intends to remove the lake and create an additional wetland for stormwater treatment further downstream in the catchment.

3.2.2 Plenty River Upper

The Plenty River Upper sub-catchment is located in the mid-northern region of BCC. A variety of landuse activities exist including commercial, industrial, recreational and residential areas. Greensborough shops, located near the Plenty River, are among the largest commercial centres in BCC. These shops have been implicated in the generation of considerable rubbish loads into the Plenty River (TBLD 2000). Minor shopping centres exist in other parts of the sub-catchment (eg: Montmorency). A small industrial area is located south of Para/Greensborough Road. Residential areas dominate the remaining catchment, but significant open space associated with sporting facilities, parks and the Plenty River corridor exists. There is some large open space areas on the river floodplain including Partingtons Flat and Whatmough Park. These areas are primarily used for active recreation and the trail is also popular for cycling and walking (TBLD 2000).

The Plenty River flows directly through the centre of the Plenty River Upper sub-catchment, and a narrow, vegetated public access corridor exists along much of its length. This section of the river is also sensitive to increases in peak flood flows which could lead to the river adjusting through widening and meander migration (TBLD 2000). While the riparian zone contains good structure of indigenous vegetation, there is significant woody weed invasion including elms, poplars and Hawthorn. Recent willow removal works have taken place along much of this section of the Plenty River, but a prevalence of other noxious plant species such as blackberries remain and capture much of the rubbish entering the waterway. Erosion associated with stormwater drains has, and continues to be, a problem at many drainage points. This section of the Plenty River has a high incidence of reported pollution spills. Incidents include sewer overflows, oil, paint, dyes and white foam discharges (TBLD 2000).

Waterbodies have been constructed at Binnak Park and Kalparrin Gardens. These waterbodies have been landscaped for public enjoyment and attract various waterbirds. Issues exist in regards to the effectiveness of these waterbodies in terms of stormwater

treatment (TBLD 2000). Both Binnak Park and Kalparrin Gardens receive stormwater associated with mostly residential areas in the north east of the sub-catchment and the Watsonia shopping strip, prior to these flows entering the Plenty River. The remaining stormwater generated in the sub-catchment enters the Plenty River via various drainage systems.

Instream values of the Plenty River decrease rapidly through the reach and in-stream fauna is generally poor due to the impacts of urban development including untreated stormwater, litter and poor riparian zones. No Platypus have been recorded through this reach but they have been recorded in reaches downstream and upstream (TBLD 2000). The ford crossing at Kalparrin Ave is an historical site (H7922-099).

3.2.3 St. Helena

St. Helena sub-catchment is located along the eastern fringe of the BCC. The majority of the catchment is used for residential purposes, with some medium to small commercial centres also present (eg: St. Helena Market Square). These commercial centres have the potential to generate some litter, for example St. Helena Market square does not have litter baskets in the carpark side entry pits (Rod Hardwick, Sinclair Knight Merz, pers. obs). Some undeveloped land exists in the sub-catchment that will be developed for residential development in the near future, for example near the Metropolitan Bypass and Diamond Creek Road junction. These developments will require the implementation of appropriate standards to prevent stormwater impacts during development and subsequent inhabitation.

Whilst there is not any significant waterways in the St. Helena sub-catchment, stormwater generated from the sub-catchment ultimately discharges into Diamond Creek (Shire of Nillumbik) via sub-surface drains. Platypus have been recorded in Diamond Creek .

A large retarding basin exists at Malcolm Blair Reserve, which may provide an opportunity for wetland construction (retrofit). Most recreational opportunities are associated with sporting ovals and reserves.

3.2.4 Yallambie Creek

The Yallambie Creek sub-catchment is located in the centre of the BCC. The primary landuse is residential, but a significant proportion of the sub-catchment is contained within the Simpson Army Barracks. Development of some land associated with these barracks (eg: Cascades Estate) is currently taking place. Whilst water treatment via wetlands will be constructed as part of this development, poor stormwater management practice associated with this development exists currently and require amending.

Existing stormwater wetlands exist at Streeton Views Estate, and some landscaping has also been performed along Yallambie Creek downstream of Simpson Barracks. A stormwater retention basin exists within the Simpson Barracks (Yallambie Retarding Basin) that may provide an opportunity for retrofitting a smaller outlet and establishing a wetland. An opportunity exists for a wetland near the Plenty River on Castleton drain. The main recreational facilities are associated with sporting facilities and the corridor associated with Yallambie Creek. The Simpson Barracks contains significant stands of native vegetation and habitat.

3.2.5 Plenty River Lower

The Plenty River Lower sub-catchment extends along the lower reaches of the Plenty River and the Yarra River. The majority of the land in the area is undeveloped in terms of commercial and industrial activities with a relatively sparse residential population, especially in the south. Much of the area can be best described as consisting of 'hobby farm' size dwellings, but more intensive residential development has commenced in some locations (eg: Cleveland Court), and could be expected to expand into other parts of the sub-catchment in the near future. Wetlands have already been constructed for some of these developments (eg: Cleveland Court). Much of the lower parts of the sub-catchment still consists of essentially farmland or is managed by Parks Victoria for recreational purposes. Because of the sparsity of housing, there are fewer roads than other parts of the municipality, but some are gravel based and/or do not have guttering. Many of the premises are probably not connected to a reticulated sewerage system, reliant upon septic systems instead.

Much of the region has been cleared of vegetation, but along the Plenty River and the Yarra River significant stands of native vegetation remain. A number of Billabongs are also associated with the Yarra River Floodplain. The open space associated with the Yarra River provides an important recreation focus, with bike trails and other public facilities. A number of golf clubs and other sporting facilities also exist in the region.

The junction of the Plenty River and Yarra Rivers is thought of through oral history as an area where ceremonies between indigenous communities were occasionally held (TBLD 2000). A number of Aboriginal scar trees have been identified in Rosanna Golf Course. There is a mound in the floodplain at the confluence of the Yarra and Plenty rivers which is a potential site of archaeological significance. Yallambie Park is registered as a historically significant landscape. Other historical values in the reach include the Old Lower Plenty Road Bridge and former river crossing at Seymour Road.

3.2.6 Banyule Creek

The Banyule Creek sub-catchment is located in the lower central region of BCC. The majority of the catchment is residential, with a number of small commercial centres associated with the main roads. A significant proportion of the catchment is contained within the Simpson Army Barracks. Stormwater originating in the catchment ultimately enters the Yarra River either through Banyule Creek or directly via sub-surface and surface drains.

The lower reaches of the sub-catchment include the floodplain of the Yarra River. The significant Banyule wetlands exist on this floodplain, along with a number of other Billabongs associated with the Yarra River. Banyule Creek originates and flows through the entire sub-catchment before entering the Yarra River at Banyule Wetland. The main recreational facilities are associated with the parklands and sporting facilities along the Yarra River and Banyule Creek.

3.2.7 Salt Creek

The Salt Creek sub-catchment extends from the edge of La Trobe University to the lower central regions of Banyule City Shire. Much of the catchment is used for residential purposes but a significant commercial centre exists in the lower reaches at

Heidelberg shops, and a number of minor commercial centres also exist (eg: Watsonia, Macleod). Litter issues have been associated with these commercial centres. In the north of the catchment, urban development outside of BCC (Mont Park) has the potential to impact Salt Creek, the major waterway that flows the extent of the catchment. A stormwater management strategy has been developed aiming to reduce any stormwater impacts to Salt Creek (EGIS 2000). The section of Salt Creek downstream of Rosanna Road has been channelled and piped, which has created some flooding issues in the past. Salt Creek is also a major recreational focus, with much of the waterway's margins open space. The majority of stormwater generated in the catchment ultimately enters the Yarra River via Salt Creek, with some minor drains directly entering the Yarra. Retarding basins exist at Harry Pottage reserve and Rosanna parklands.

3.2.8 Darebin Creek North

The Darebin Creek North sub-catchment extends along the western boundary of BCC, with the La Trobe University (City of Darebin) to its north and the Darebin Creek forming its western boundary. Significant industrial activities occur in the northern sections of the sub-catchment and adjacent to Darebin Creek. This industry has been associated with pollution of the Darebin Creek via a number of stormwater drains, and illegal discharges are an ongoing problem. A small wetland exists at a drain downstream of Southern Road, but is poorly maintained by BCC. A triple interceptor is being constructed on the Doherty Road drain to help reduce oil and gross pollutants entering Darebin Creek from the industrial areas in West Heidelberg.

Residential areas exist throughout, and medium sized commercial centres exist along Bell Street that have been suggested to generate litter. Along Darebin Creek bank erosion, bank slumping and the potential for further bank movement exists in relation to a number of drains. All stormwater generated in the sub-catchment ultimately enters Darebin Creek via a number of sub-surface drains. Darebin Creek and the associated corridor are an important recreational focal point in the region.

3.2.9 Darebin Creek South

The Darebin Creek South sub-catchment extends below the Darebin North sub-catchment to the confluence of Darebin Creek and the Yarra River. Darebin Creek denotes its western border. The catchment has a mixture of residential, industrial and commercial landuse. Donaldsons Creek is a major drainage point in the area, and has been associated with litter, pollution events and erosion problems in Darebin Creek itself. Darebin Creek and its associated corridor are an important recreational focal point in the region.

3.2.10 Yarra

The Yarra sub-catchment is located on the lower southern section of BCC, east from the confluence of Darebin Creek and Yarra River. The majority of the catchment is residential, with a number of minor commercial centres concentrated along the Lower Heidelberg Road. Extensive parkland reserve extends along the entire length of the Yarra River, with golf courses and other sporting facilities such as ovals also present. Stormwater drainage at some points flow into billabongs (eg: Wilson reserve), but some direct discharges into the Yarra River also exist. As with much of the Yarra River corridor, numerous billabongs and mature vegetation extends throughout along the river.

4. Values of receiving environments

4.1 Values

The receiving environments described in Chapter 3 have a range of values including ecological, social and cultural, recreational and economic values.

4.1.1 Ecological values

Aquatic, terrestrial and groundwater ecosystems are complex systems with a range of ecological values. They support a diverse range of unique flora and fauna dependent on a range of ecological and hydrological processes and habitat. Interactions between aquatic, terrestrial and groundwater ecosystems are complex, with each dependant on the other for healthy functioning. The protection of these ecosystems, the diversity of communities that inhabit them, and the ecological and hydrological processes that shape these systems, is a critical requirement of stormwater management.

Threats to ecological values from stormwater include changes to hydrological regimes, increased nutrient and other contaminant inputs and loss of habitat value. These impacts threaten native flora and fauna and can lead to a loss of species diversity. The healthy functioning of aquatic, terrestrial and groundwater ecosystems are not only important from an ecological point of view but also underpin other values associated with those ecosystems, such as recreational and economic values.

An inventory of the local flora and fauna and an assessment of the conservation value of indigenous species and habitats has been completed for the vertebrate fauna and habitats with the completion of the NEROC study (BCC 2000) and vegetation studies (Beardsell 2000). A number of highly significant flora and fauna species exist within the region. Banyule still supports a high diversity of indigenous plants, although Banyule now contains less than 10% of its original vegetation cover (Beardsell 2000). Communities best preserved include floodplain riparian woodland and riparian scrub of the Yarra River and seasonal and permanent wetlands of the Yarra Floodplain. High quality remnants of box-stringy bark woodland occur in St Helena Flora Reserve and plains grassy woodland (alluvial plains) occur at Simpson Army Barracks and Harry Pottage Reserve.

4.1.2 Cultural values

There is a range of social and cultural values associated with receiving environments. Indigenous and non-indigenous people have strong cultural attachments with waterways, for spiritual and historical reasons. Many waterways and activities or events associated with that environment form part of the psyche of local communities. These aspects are valued highly by communities.

The land within BCC formed the territory of the Warundjeri Willam, a clan of the Woiwurung language Group. The territory of the Woiwurung extended from the Great Dividing Range south to the Yarra River and the Dandenong Ranges, west to the Maribyrnong River and east to Mt Baw Baw. The waterways and floodplains of the Darebin Creek, Yarra River and Plenty River would have been important sites for Aboriginal communities for food resources (Eyre *et al.* 1992).

European surveys of the region commenced in the 1830's. Agricultural landuse was gradually replaced by urban dwellings. With the opening of the Melbourne to Heidelberg railway line in 1888, a land boom occurred in the area. Following World War 2, residential development rapidly expanded (Eyre *et al.* 1992). The landscapes of the Yarra Flats and Banyule Flats have been considered of significance because of the association with the Heidelberg School of Artists. The landscapes have been recommended to be conserved in order to retain a view of how the area appeared historically (VG 1991).

4.1.3 Amenity and recreational values

Waterways are valued for their visual and landscape amenity and for a range of recreation activities from passive enjoyment of the environment to more active pursuits of swimming and water skiing.

Passive recreational activities are those that involve no contact with the water. They take place on land adjacent to the waterway and include picnicking, walking and visual enjoyment. Secondary contact recreational activities are those where the body is not immersed in the water but where some contact with water may occur. They include activities such as boating, canoeing, wading and fishing. Primary contact recreational activities are those where the whole body can become immersed in the water. These activities include swimming, diving and water skiing.

The type of recreational activity recommended for a particular waterbody depends on the quality of water. Stormwater can have a significant impact on reducing the quality of water in a waterway and severely impact upon the type of recreational activities suitable for that waterway. For example, stormwater can carry significant bacterial contamination at times and this can reduce the recreational value of the receiving waterway.

■ **Table 4.1 Criteria for determining values associated with environments that receive urban stormwater runoff.**

Ranking	Environmental **Instream flora & fauna** **Ecological processes** **Riparian vegetation**	Cultural **Indigenous cultural sites** **Non-indigenous heritage sites**	Amenity **Tourism** **Recreation** **Education**	Economic **Flood prevention** **Tourism**
Very high	Flora & fauna species listed under State or Commonwealth legislation Critical habitat or ecological communities listed under State or Commonwealth legislation Regionally significant habitat or flora/fauna species	Numerous archaeological sites listed on the Aboriginal Affairs Victoria register Numerous sites listed on the Register of the National Estate as 'Historic'	Important for regional tourism Activities include Primary Contact Recreation eg swimming Very high scenic values Used for educational activities eg nature awareness,	High tourist visitation High flooding prevention High asset protection
High	Locally significant habitat or flora/fauna species Drought refuge	High probability of archaeological sites given landform Sites of local historical significance	Important for local tourism Activities include Secondary Contact Recreation eg fishing High scenic values Some educational activities	Moderate tourist visitation Moderate flooding prevention Moderate asset protection
Moderate	Some habitat values Locally significant habitat or species	Low probability of archaeological sites given landform Minor historical significance	Limited recreational values Limited visual amenity	Low tourist visitation Low flooding prevention Low asset protection
Low	Low habitat values No significant flora/fauna Degraded habitat condition	No sites	No recreational values	Limited tourist visitation No flooding prevention No asset protection

The Yarra River and its tributaries are an important focus for recreational activities. Swimming is largely confined in the Yarra River above Dights Falls but SEPP objectives desire the water quality of tributaries such as Darebin Creek and Plenty River to be of sufficient quality to permit primary recreational contact. Canoeing and fishing are also popular pastimes in these waterways (EPA 1999). Passive recreation in the form of walking, cycling and picnicking are also important activities in the environs of the Yarra River and its tributaries. Waterside bike, horse and walking trails are being expanded in response to community demand and such use is increasing public interest in improving water quality and the environs of waterways (EPA 1999).

4.1.4 Economic values

Receiving environments have a range of economic values. They have an intrinsic value as a provider of ecosystem services, for example, as a natural treatment system for the disposal of effluent and in providing drainage and flood mitigation services. They also have a range of more quantifiable economic values as a source of water for irrigation, industrial, stock and domestic supply purposes although in urban waterways these uses are generally not practiced. Many waterways are also the focus of commercial industries such as fishing and tourism.

Stormwater can impact on economic values by reducing water quality and hence resulting in water of insufficient quality for potential uses. Economic loss can result from a reduction in tourism potential through a decline in water quality and consequent loss of recreational value. Many of the values associated with receiving environments listed in the preceding sections can all impact on economic values.

4.1.5 Stormwater as a value

Not only are receiving environments valued for the reasons identified above, but stormwater itself can be considered a valuable resource. In the driest continent on earth, drainage water can provide a reusable resource for irrigation or industrial water supply where appropriate treatment methods are available. The managing of stormwater also provides value, for example urban design techniques now incorporate wetlands and open space for the treatment of stormwater prior to discharge to receiving environments. These wetlands and open spaces provide visual amenity and offer a range of recreational pursuits. Water tanks can also be installed to collect roof runoff for use on gardens and for flushing toilets. This reduces flows in waterways and helps conserve water resources.

4.2 Specific values of receiving environments

The values of specific stormwater receiving environments in Banyule City Council in relation to the broad values listed above have been ranked as low, moderate, high and very high. Table 4.2 presents the value ratings for each sub-catchment. Value ratings have been allocated based on relevant literature (environmental investigations, water quality data and waterway condition, regional strategies and management plans), field inspections, the project steering committee and community workshops.

■ **Table 4.2. Values of receiving environments.**

Receiving Environment	Sub-catchment	Value type	Characteristics	Ranking
Darebin Creek 	Bundoora	Environmental	• Moderate quality habitat • Wetland	High
		Cultural	• Some historical buildings • Non-indigenous connections from the early 1800s	Low
		Amenity	• High visual amenity • High recreational opportunities	Moderate
		Economic	• Residential value • Recreational • Flood protection	Low
Plenty River Kalparrin Lake Binnak Park wetlands 	Plenty River (Upper)	Environmental	• High quality habitat • Significant vegetation communities • Rare and threatened flora and fauna	Very high
		Cultural	• Record of connections with indigenous people. • Non-indigenous connections from the early 1800s • Significant bridges and buildings	High
		Amenity	• High visual amenity • High active and passive recreational amenity	High
		Economic	• Tourism • Flood protection	High
Diamond Creek	St. Helena	Environmental	• High quality habitat • Rare and threatened flora and fauna	High
		Cultural	• Record of connections with indigenous people. • Non-indigenous connections from the early 1800s	Moderate
		Amenity	• Active and passive recreational amenity • High visual amenity	Moderate
		Economic	• Tourism • Flood protection	Low
Yallambie Creek Plenty River 	Yallambie Creek	Environmental	• High quality habitat • Significant vegetation communities • Rare and threatened flora and fauna	Very High
		Cultural	• Record of connections with indigenous people. • Non-indigenous connections from the early 1800s	Moderate
		Amenity	• Active and passive recreational amenity • High visual amenity	High
		Economic	• Tourism • Flood protection	Moderate
Plenty River Yarra River	Plenty River (Lower)	Environmental	• High quality habitat • Significant vegetation communities • Significant wetlands • Rare and threatened flora and fauna	Very High
		Cultural	• Significant record of connections with indigenous people • Non-indigenous connections from the early 1800s	Very High
		Amenity	• Active and passive recreational amenity • High visual amenity	Very High
		Economic	• Tourism • Flood protection	Moderate

Table 4.2 (cont). Values of receiving environments.

Receiving Environment	Sub-catchment	Value type	Characteristics	Ranking
Banyule Creek Banyule Wetlands Yarra River	Banyule Creek	Environmental	• High quality habitat • Significant vegetation communities • Significant wetlands • Rare and threatened flora and fauna	Very high
		Cultural	• Record of connections with indigenous people. • Significant non-indigenous connections from the early 1800s	Very High
		Amenity	• Active and passive recreational amenity • High visual amenity	Very High
		Economic	• Tourism • Flood protection	High
Salt Creek	Salt Creek	Environmental	• Limited habitat values	Moderate
		Cultural	• Record of connections with indigenous people. • Non-indigenous connections from the early 1800s	Moderate
		Amenity	• Active and passive recreational amenity	Moderate
		Economic	• Tourism • Flood protection	Low
Darebin Creek	Darebin Creek North	Environmental	• Instream habitat value • Significant vegetation communities • Rare and threatened flora and fauna	High
		Cultural	• Many records of connections with indigenous people. • Non-indigenous connections from the early 1800s	Very High
		Amenity	• Active and passive recreational amenity • High visual amenity	High
		Economic	• Tourism • Flood protection	Moderate
Darebin Creek Donaldsons Creek	Darebin Creek South	Environmental	• Instream habitat value	High
		Cultural	• Record of connections with indigenous people. • Significant non-indigenous connections from the early 1800s	High
		Amenity	• Active and passive recreational amenity • High visual amenity	High
		Economic	• Tourism • Flood protection	Moderate
Yarra River Billabongs	Yarra	Environmental	• Instream habitat value • Significant vegetation communities • Significant wetlands • Rare and threatened flora and fauna	Very high
		Cultural	• Record of connections with indigenous people. • Significant non-indigenous connections from the early 1800s	High
		Amenity	• Active and passive recreational amenity • High visual amenity	Very High
		Economic	• Tourism • Flood protection	High

Table 4.3 Summary of values of the BCC sub-catchments.

Sub-Catchment	Environmental	Cultural	Amenity	Economic
Bundoora	H	L	M	L
Plenty River (Upper)	VH	VH	H	H
St. Helena	H	M	M	L
Yallambie Creek	VH	M	H	M
Plenty River (Lower)	VH	H	VH	M
Banyule Creek	VH	VH	VH	H
Salt Creek	M	M	M	L
Darebin Creek North	H	VH	H	M
Darebin Creek South	H	H	H	M
Yarra	VH	H	VH	H

VH (Very High), H (High), M (Moderate) and L (Low).

5. Threats to stormwater

5.1 Threats

There is a range of threats from receiving environments to stormwater quality. These threats and the values they impact upon are summarised below.

5.1.1 Sediment

Sediment and soil particles are highly elevated in stormwater. Sediment can enter the stormwater system via a number of pathways. Runoff from bare and disturbed ground (eg: construction sites, development areas, unconfined stockpiles, carparks and paved areas) carries significant quantities of sediment that are washed in to the stormwater system. Sediment can also wash and fall off vehicles; this deposited sediment builds up on road surfaces and subsequently washes into the stormwater system. Erosion of waterways, drains and unsealed roads also result in increased sedimentation and turbidity.

Excess sediment poses a threat to aquatic ecosystems by smothering benthic surfaces and the organisms that inhabit those surfaces. Fine sediment contributes to turbidity that reduces light penetration. Fine particles suspended in the water column can block and/or cause abrasions to fish gills, affecting their breathing capability. Nutrients (particularly phosphorus), heavy metals and other contaminants can be strongly bound to sediment particles and hence these pollutants enter waterways attached to sediment particles where they can threaten aquatic ecosystem health and other beneficial values.

5.1.2 Nutrients

The concentration of the nutrients nitrogen and phosphorus are highly elevated in stormwater. There are several key pathways by which nutrients enter stormwater. As indicated above, phosphorus binds to soil and sediment particles and can enter stormwater via erosion, deposition from the atmosphere and runoff from construction sites. Nutrients can also enter the drainage system via fertiliser in runoff from irrigated areas, parks, gardens and recreational areas, particularly golf courses. Sullage and septic tank effluent can contribute significant nutrient loads to stormwater and receiving waterways. Activities such as washing vehicles in the street and allowing the detergent to drain to the stormwater system can also contribute nutrients to waterways. Dog faeces, particularly where they are deposited near to waterways (eg: along foreshores of rivers and lakes) may also contribute excess nutrients.

Excess nutrients in runoff can contribute to excessive algal and plant growth which create eutrophic conditions that can threaten aquatic ecosystem values. Excessive algal and plant growth also threatens other values by increasing the cost of water treatment and restricting recreational activity. The development of toxic blue-green algal blooms can threaten stock and human health.

5.1.3 Microbiological contamination

Microbiological contamination, namely bacteria, viruses and other pathogens, pose a significant threat to human health, recreational activity and water supply. Microbiological contamination can enter stormwater and waterways via sullage and septic tank discharges in unsewered residential areas. Runoff containing faecal material from accidental and emergency overflows from sewerage systems can also

contribute to microbiological contamination. Infiltration of contaminated stormwater to groundwater aquifers can threaten values associated with groundwater. Within BCC, poorly maintained septics in those parts of the catchment not sewered (Lower Plenty and Montmorency) and sewerage emergency release structures being activated by stormwater could pose microbiological problems.

5.1.4 Organic material

Excessive organic material, including leaves and grass clippings, can enter the stormwater system in runoff. As organic material decomposes it can cause a decline in the oxygen concentration of the water column. A decline in oxygen can negatively impact on aquatic fauna, particularly fish. Seasonal variation in the problems associated with organic matter can result, for example, from the autumn leaf fall of deciduous trees. Such leaf fall can not only present problems in terms of water quality but can clog litter prevention devices such as side entry pits.

5.1.5 Litter

Litter in stormwater can impact on the visual amenity of a waterway, threaten instream fauna and impact on recreational activities and human health. The main sources of litter entering the stormwater system are around shopping centres and schools where rubbish bins overflow, litter is discarded in the street and subsequently washes into the stormwater system or side entry baskets are overflowing and thus ineffective. Litter can also be generated in residential areas, particularly where open 'tub' type recycling bins are used as litter can blow out of these bins, and around construction sites where waste management is often poor.

5.1.6 Heavy metals and other contaminants

Heavy metals and other contaminants such as pesticides, surfactants, oils and grease can all enter stormwater systems in runoff and from accidental and deliberate discharges. All urban land use areas have the potential to contribute heavy metals and other contaminants however, runoff from industrial areas and major roads are the most likely source of these types of contaminants. Heavy metals, oils and grease often become bound in sediments and can threaten aquatic ecosystems. Oil, grease and surfactants (soapy scums) impact on visual amenity and recreational values. Surfactants are though to be associated with the decline in frogs.

5.1.7 Other threats

Other threats from stormwater include impacts on visual amenity by pipes and other stormwater infrastructure. Construction of new stormwater infrastructure, such as pipes and retarding basins, can impact on many values.

Inadequate stormwater system capacity can contribute to flooding and health problems. Increases in the area of impervious pavement result in more runoff generation than would be experienced under natural conditions, thus most urban waterways carry a greater flow during storm events than non-urban streams with similar catchment areas. Increased flow can scour stream beds and banks creating erosion and turbidity problems. Poor infrastructure maintenance or design can result in erosion around pipe outfalls and channels. The Salt Creek Catchment, Weatherlake/Bungay streets catchment and parts of the Lower Plenty are designated as major drainage trouble areas within Banyule (BCC 1998b).

The provision of environmental flows and fish passage in waterways are also important objectives in waterway management. Infrastructure and landuse developments need to ensure these objectives are not compromised by stormwater management.

■ **Table 5.1 Summary of effect of stormwater threats on receiving environments.**

Key pollutants	Effect on receiving environment
Sediments 	• Excess sediment can smother benthic surfaces and the organisms that inhabit those surfaces. • Fine sediment contributes to turbidity that reduces light penetration. • Fine particles suspended in the water column can block fish gills. • Contaminants such as nutrients and heavy metals can be strongly bound to sediment particles. • Excess sediment can block pipes increasing the risk of flooding.
Nutrients	• Excess nutrients in runoff can contribute to excessive algal and plant growth. • Excessive algal and plant growth also threatens other values by increasing the cost of water treatment and restricting recreational activity. • The development of toxic blue-green algal blooms can threaten stock and human health. • Excessive algal growth can be aesthetically unpleasing and impact on recreational and public amenity values.
Litter 	• Litter can impact on the visual amenity of a waterway, threaten instream fauna and impact on recreational activities and human health. • Excess litter can block pipes increasing the risk of flooding.
Organic material 	• As organic material decomposes it can cause a decline in the oxygen concentration of the water column and contribute to offensive odours. • A decline in oxygen can negatively impact on aquatic fauna, particularly fish.
Pathogens	• Microbiological contamination, namely bacteria, viruses and other pathogens, pose a significant threat to human health, recreational activity and water supply.
Heavy metals, oils and grease 	• Heavy metals, oils and grease often become bound in sediments and can threaten aquatic ecosystems. • Oil and grease scums impact on visual amenity and recreational values.
Flow / Erosion 	• Increased discharge and velocity can scour stream beds and banks causing erosion, sedimentation and high turbidity. • Inadequate capacity in the stormwater systems can contribute to flooding. • Poorly constructed pipe outlets can contribute to erosion.

■ **Table 5.1 Summary of landuse activities, pollutants and causes of pollution events.**

Activity/landuse	Key pollutants	Cause
Residential runoff 	Sediments Nutrients Litter Organic material Oils and grease Pathogens Heavy metals Pesticides Surfactants	• Excess fertiliser and pesticide application • Washing cars • Poor waste management • Lawn clippings and leaves • Sediment buildup • Illegal discharges and accidental spills eg motor oil, paints • Unpaved roads and road shoulders • Unvegetated nature strips and swale drains • Dog faeces • Litter • Increased runoff
Industrial runoff 	Sediments Nutrients Litter Organic material Oils and grease Pathogens Heavy metals Pesticides Surfactants	• Sediment buildup from traffic • Illegal discharges and accidental spills • Poor waste management practices • Vehicle washdowns • Unpaved road shoulders • Unvegetated nature strips • Increased runoff
Commercial runoff 	Sediments Nutrients Litter Organic material Oils and grease Pathogens Heavy metals Pesticides Surfactants	• Sediment buildup • Poor waste management practices eg overfull bins and lack of awareness • Illegal discharges and accidental spills • Unpaved road shoulders • Littering • Increased runoff
Construction and development sites 	Sediment Litter Nutrients	• Poor erosion and sediment control on construction sites • Poor work practices eg brick and tile cutting activities, vehicle washdown • Poor building waste management practices
Major highways and arterial roads	Sediment Heavy metals Oils and grease	• Sediment buildup from traffic • Accidental spills • Vehicular deposits (oils, grease brake dust etc)
Unstable & degraded waterways 	Sediment Nutrients Organic material	• Erosion of stream banks • Poorly controlled stock and recreational access • Loss of vegetation • Weed infestation
Sullage and septic tank overflows	Nutrients Pathogens	• Poorly maintained septic systems • Combined stormwater and sullage disposal systems • Poor drainage and wastewater infrastructure maintenance
Sewer overflows	Nutrients pathogens	• Cross contamination between sewerage and stormwater systems • Emergency relief structure overflows • Poor drainage and wastewater infrastructure maintenance
Open spaces, parks and recreational areas	Sediment Nutrients Organic material Litter	• Fertiliser applications • Poor waste and litter management • Grass cuttings

5.2 Specific stormwater threats

The specific stormwater threats in the study area are summarised in

Table 5.2. These threats are grouped according to land use and particular catchment activities. Threats have been assigned a rating according to their significance (ie. very high, high, moderate, low). This rating is based on the potential pollutants or impacts on the values of receiving environments.

■ **Table 5.2. Stormwater threats in the Banyule City Council.**

Sub-catchment	Receiving waters	Activity/Landuse	Issues	Ranking
Bundoora	Darebin Creek	Residential runoff	• Much of the sub-catchment has established dwellings or is undeveloped • Future development at Parade College requires management	High
		Industrial runoff	• Limited industrial activity in catchment • EPA complaints data suggests limited incidence of reports of pollution likely to originate from industry	Moderate
		Commercial runoff	• Limited commercial activity in catchment • Small commercial centres based on Grimshaw Road	Low
		Construction and development sites	• Future development sites proposed for near future (Parade College)	Very High
		Major highways and arterial roads	• Northern Ring Road and Plenty Road on boundaries • Grimshaw Street	Very High
		Unstable & degraded waterways	• Limited number of waterways in which to have instability and resulting sediment input	Low
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Limited incidence of Sewer Overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• Open spaces are relatively limited in extent, and of those present are only moderately utilised and/or are not intensively managed	Low
Plenty River (Upper)	Plenty River Kalparrin Lake Binnak Park wetlands	Residential runoff	• Much of the sub-catchment has established dwellings • Relatively dense housing	High
		Industrial runoff	• Some industry based around Para Road	Moderate
		Commercial runoff	• Greensborough Shops • Montmorency • Number of smaller centres	Very High
		Construction and development sites	• Limited current development sites	Medium
		Major highways and arterial roads	• Greensborough Highway, Diamond Creek Road, Grimshaw Street	Very High
		Unstable & degraded waterways	• Erosion • Weed infestation	Moderate
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Limited incidence of sewer overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• Medium to high extent of open spaces in sub-catchment • High recreation use	High

Table 5.2 (cont). Stormwater threats in the Banyule City Council.

St. Helena	Diamond Creek	Residential runoff	• Much of the sub-catchment has established dwellings or is undeveloped • Future development at Churinga requires management	High
		Industrial runoff	• Limited industrial activity in catchment	Low
		Commercial runoff	• St. Helena Market Shops (no litter baskets) • Smaller commercial centres	High
		Construction and development sites	• Limited current development sites • Future development sites proposed for near future (Churinga)	Very High
		Major highways and arterial roads	• St. Helena Road, Karingal Drive, Fitzsimmons Lane	Moderate
		Unstable & degraded waterways	• Limited number of waterways in which to have instability and resulting sediment input	Low
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Limited incidence of sewer overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• Medium proportion of area	Moderate
Yallambie Creek	Plenty River Yallambie Creek	Residential runoff	• Mixed established and new dwellings (Streeton) or is undeveloped • New housing developments in progress or planned	Very High
		Industrial runoff	• Limited industrial activity in catchment • Army Barracks ?	Low
		Commercial runoff	• Small commercial centres	Low
		Construction and development sites	• New housing developments in progress (Cascades) or planned • High gradient	Very High
		Major highways and arterial roads	• Lower Plenty Road	Moderate
		Unstable & degraded waterways	• Yallambie Creek erosion • Low ? weed infestation	Moderate
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Limited incidence of sewer overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• Medium proportion of area	Moderate

Table 5.2 (cont). Stormwater threats in the Banyule City Council.

Plenty River (Lower)	Plenty River Yarra River	Residential runoff	• Mixed established and new dwellings (Streeton) or is undeveloped • New housing developments in progress or planned • No formal streetscape drainage lines	High
		Industrial runoff	• Limited industrial activity in catchment	Low
		Commercial runoff	• Small commercial centres	Low
		Construction and development sites	• New housing developments in progress (Cleveland) or potential	High
		Major highways and arterial roads	• Main Road	Low
		Unstable & degraded waterways	• Yarra River and Plenty River • Erosion in Plenty River • High weed infestation in Plenty River	Moderate
		Sullage and septic tank overflows	• Relative to other sub-catchments, a high number of residents are reliant on septic systems (>50) and therefore a high potential of septic tank failure exists	High
		Sewer overflows	• Limited incidence of sewer overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• High proportion of area open space but relatively low intensity of recreational use (eg: Golf courses)	High
Banyule Creek	Banyule Creek Banyule Wetlands	Residential runoff	• Much of the sub-catchment has established dwellings or is undeveloped	High
		Industrial runoff	• Limited industrial activity in catchment	Low
		Commercial runoff	• Small commercial centres	Low
		Construction and development sites	• Some current development sites • Dual occupancy and infill	Moderate
		Major highways and arterial roads	• Lower Plenty Road	High
		Unstable & degraded waterways	• Some channelisation in Banyule Creek • Waterway largely managed parkland	Low
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Limited incidence of sewer overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• Medium proportion of area	Low

Table 5.2 (cont). Stormwater threats in the Banyule City Council.

Salt Creek	Yarra River Salt Creek	Residential runoff	• Much of the sub-catchment has established dwellings • Relatively dense housing	High
		Industrial runoff	• Low industrial activity in catchment	Low
		Commercial runoff	• Major commercial centre (Heidelberg Shops) • Number of smaller centres	High
		Construction and development sites	• Limited current development sites within BCC, but some sites in catchment • Dual occupancy and infill	High
		Major highways and arterial roads	• Greensborough Bypass, Lower Plenty Road, Lower Heidelberg Road, Upper Heidelberg Road	Very High
		Unstable & degraded waterways	• Salt Creek erosion • Much of the waterway managed park	High
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Very High, more than 30 spills since 1992	Very High
		Open spaces, parks and recreational areas	• Medium proportion of area o	Moderate
Darebin North	Darebin Creek	Residential runoff	• Established dwellings • Redevelopment of Olympic village • Relatively low proportion of landuse in respect to catchment	High
		Industrial runoff	• Major landuse activity	Very High
		Commercial runoff	• Medium commercial centres associated with Bell Street	Moderate
		Construction and development sites	• Limited current development sites • Potential industrial development	Moderate
		Major highways and arterial roads	• Southern Road, Lower Heidelberg Road, Bell Street	Moderate
		Unstable & degraded waterways	• Unstable banks on Darebin Creek • High weed infestation	High
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• Limited incidence of sewer overflows in the past ten years	Low
		Open spaces, parks and recreational areas	• Medium to high area near Darebin Creek	Moderate

Table 5.2 (cont). Stormwater threats in the Banyule City Council.

Darebin South	Darebin Creek Donaldsons Creek	Residential runoff	• Established dwellings • Relatively high proportion of landuse	High
		Industrial runoff	• Medium landuse activity	Moderate
		Commercial runoff	• Strip commercial centres	High
		Construction and development sites	• Limited current development sites • Dual occupancy and infill	Moderate
		Major highways and arterial roads	• Livingstone Street, Oriel Street, Upper Heidelberg Road	Moderate
		Unstable & degraded waterways	• Unstable banks on Darebin Creek • High weed infestation	High
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• High, more than 20 spills since 1992	High
		Open spaces, parks and recreational areas	• Medium to high area near Darebin Creek	Moderate
Yarra	Yarra River Billabongs	Residential runoff	• Established dwellings • Medium proportion of total landuse, some potential for further residential expansion	Moderate
		Industrial runoff	• Limited extent or intensity	Low
		Commercial runoff	• Medium commercial centres	Moderate
		Construction and development sites	• Limited current development sites	High
		Major highways and arterial roads	• Lower and Upper Heidelberg Road, Burke Road,	Moderate
		Unstable & degraded waterways	• Yarra River and Billabongs	Low
		Sullage and septic tank overflows	• Sewerage infrastructure in place	Low
		Sewer overflows	• High number of incidences, more than 15 spills since 1992	High
		Open spaces, parks and recreational areas	• Medium to high proportion of sub-catchment open area, especially near Yarra River • Popular recreation venues, and corresponding potential for litter etc.	High

The greatest threats to stormwater in the study area are due to:

- **sediment inputs from construction sites and degraded waterways.** Poor management practices can be responsible for high sediment loads during wet weather events. Examples of locations which currently or could in the future pose high threat from development in Banyule include the Cascades Development in Yallambie, the College View development in Bundoora, Cleveland Development in Lower Plenty, and general subdivision of existing lots throughout the catchment, but especially towards the inner city. Examples of degraded waterways include bank slumping along Darebin Creek and erosion along the Lower Plenty River;
- **litter in stormwater runoff**, especially from commercial areas but also other venues such as sporting grounds, major roads and recycling depots. Examples of key trouble spots include the Greensborough shopping centre, Heidelberg shops and Donaldsons Creek;
- **industrial wastes being illegally discharged into stormwater drainage and industrial runoff during wet weather events.** Key locations for problems are various drains draining the West Heidelberg industrial area such as Dougharty Road, Southern Road and DC42 Sparks Reserve Drains. (MW 2000) identifies that Melbourne Water should, as a high priority, investigate a range of measures to manage stormwater and pollution events from the West Heidelberg industrial area including point source investigation, silt, sediment, gross pollutant and oil trapping at or near source and treatment ponds at end of pipe to assist in the management of industrial wastes;
- **runoff from major roads.** A number of major roads could be potential pollution sources during wet weather events, including the Metropolitan Ring Road, Greensborough Highway and Bell/Banksia Street;
- **potential for organic wastes from parks, golf courses and autumn leaf fall.** A number of parks and golf courses exist within Banyule, examples include Kalparrin Gardens, Heidelberg Park, Heidelberg Private Golf Course and Ivanhoe Public Golf course. Nutrient runoff from fertilisers and leachates from old tip sites which have golf courses constructed on them (eg: Ivanhoe and Heidelberg) are a concern;
- **nutrient inputs from residents, new urban developments and open spaces** such as golf courses and sporting ovals. Medium density housing is an increasing feature of Banyule, especially in the inner city suburbs of Ivanhoe and Heidelberg. There are numerous parks and sporting facilities such as ovals and golf courses that may pose threat ; and
- **damage to cultural sites, river banks, riparian vegetation and wetland areas** through degradation by changed flow, erosion and rubbish dumping. Erosion and bank slumping of stream banks and drains are a problem at a number of locations including the Darebin Creek near Bell Street, Salt Creek and the lower Yallambie Creek.

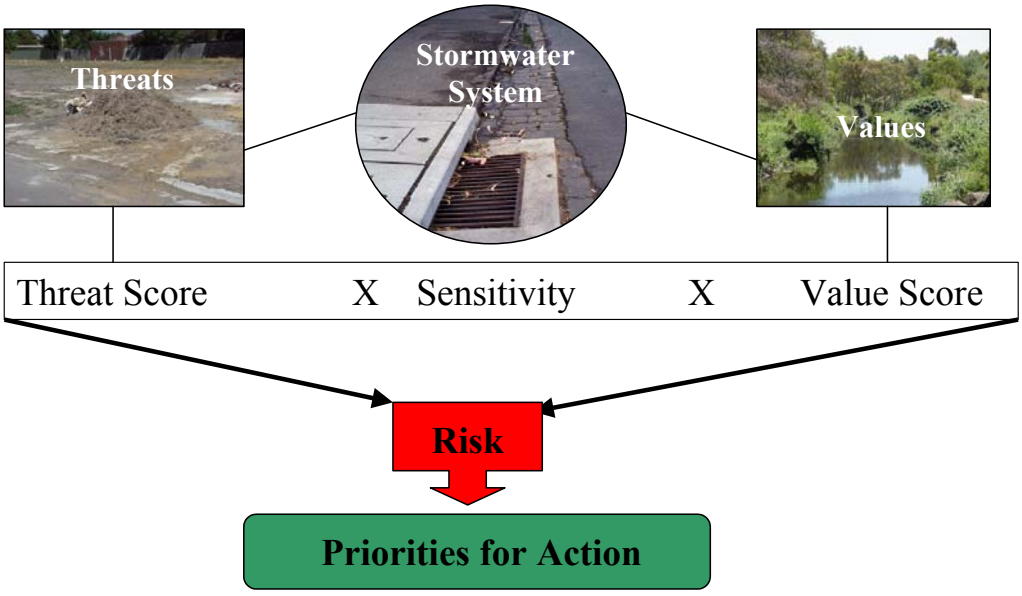
■ **Table 5.3 Ratings of threats to stormwater quality on the receiving sub-catchments.**

Sub-Catchment	Residential	Industrial	Commercial	Construction	Roads	Unstable & degraded waterways	Sullage & septic tanks	Sewer overflows	Open spaces
Bundoora	H	M	L	VH	VH	L	L	L	L
Plenty River (Upper)	H	M	VH	M	VH	M	L	L	H
St. Helena	H	L	M	VH	M	L	L	L	M
Yallambie Creek	VH	L	L	VH	L	M	L	L	M
Plenty River (Lower)	H	L	L	H	L	M	H	L	H
Banyule Creek	H	L	L	M	H	L	L	L	L
Salt Creek	H	L	H	H	H	H	L	VH	M
Darebin Creek North	H	VH	M	M	M	H	L	L	M
Darebin Creek South	H	M	H	M	M	H	L	H	M
Yarra	M	L	M	H	M	L	L	H	H

VH (Very High), H (High), M (Moderate) and L (Low).

6. Risk Assessment and Priority Management Issues

The Victorian Stormwater Committee has prescribed a risk assessment process that must be followed when prioritising management issues for SWMP development. The risk assessment is based on a formula that takes into account the value of the receiving environment, the stormwater threat and a sensitivity factor of the receiving environment to specific threats:



As presented in the previous sections, values and threats have been ranked on a 1 to 4 scale with 1 being low, 2 medium, 3 high and 4 very high. The sensitivity rating is also based on a 1 to 4 scale with 1 being low sensitivity through to 4 being very high sensitivity. The sensitivity factor allows for the fact that some stormwater threats may be high and the value of the receiving environment also high, however the true impact, or sensitivity is low. For example, the threat from industrial runoff is very high, the value of the riparian zone in the receiving environment is also high but the impact of industrial runoff on riparian vegetation is lower than it is for the instream environment. Thus, the riparian vegetation has a lower sensitivity to industrial runoff than the instream environment. Another example of a high threat / value combination with low sensitivity might occur where the impact of the threat occurs downstream of a particular value.

The sensitivity factor is determined individually for each receiving waterway based on expert opinion and knowledge of the specific values and threats for that environment. Guidelines to assist in the determination of the sensitivity factor are summarised in Appendix A.

The risk assessment produces an overall risk score from 1 to 64 for individual threat/value combinations. The higher the risk score, the greater the management priority thus the risk scores are used to identify the highest priority management

issues. In addition, individual risk scores can be summed for each threat and value to produce a total score that identifies the greatest overall threat for a particular receiving environment and the value most threatened.

Priority risks as determined by the risk assessment process are presented Table 6.1. The priority risks, ranked in order of importance, are highlighted by shading. Ranking was achieved firstly through the risk score obtained for each value and threat scenario (ranging up to 64) (see column 1). For those values with equal risk scores, the total overall threat score (see column 3) was then used as a further discriminator to prioritise key threats. Only the threat and value combinations scoring 36 or greater are illustrated in Table 6.1 because of the desire to target priority issues only. Threat and value combinations with scores less than 36 are illustrated in Appendix B.

Within some subcatchments, often two or more values had a relatively high risk score from a particular threat. In these instances, the value with the greatest risk score was used for the ranking in order of priority for management strategies and subsequent values (for the same threat) were made redundant, based on the premise that managing the threat for one value will manage the threat to the remaining values. Those values which fall into the category of being addressed by higher scoring values are denoted by italics and white shading.

The specific management issues for sub catchments are summarised below.

Bundoora

- future urban development at Parade College, has potential to cause sediment and increased runoff issues;
- major arterial roads may generate pollutants such as heavy metals, hydrocarbons and litter;
- expansion of industry may increase the threat associated with illegal discharges into the drainage system, accidental releases and generally poor quality of runoff from such areas during wet weather events.

Plenty River (Upper)

- commercial sources of litter and other wastes, especially from Greensborough Shops, but also minor commercial centres, sporting complexes and railway stations which affect the Plenty River and established wetlands;
- major arterial roads may generate pollutants such as heavy metals, hydrocarbons and litter;
- sediment inputs from subdivision and erosion within Plenty River and undercutting at drainage pipes;
- nutrient inputs from sporting ovals, recreational and residential areas;
- industrial inputs from businesses located near Para Road; and
- faeces associated with pets along the Plenty River trail.

St. Helena

- commercial sources of litter and other wastes from commercial centres, and sporting complexes;
- nutrient and organic matter inputs from a number of managed parklands and residential areas; and
- potential sediment and runoff issues associated with urban development.

Yallambie Creek

- sediment and nutrient inputs from urban development such as the Cascades;
- nutrient and excess runoff from residential areas; and

- erosion associated with stormwater outlets and elevated stormwater peaks.

Plenty River (Lower)

- sediment and nutrient inputs from urban development, septic systems, residential areas and sporting facilities such as golf courses;
- erosion associated with stormwater outlets and elevated stormwater peaks; and
- sediment associated with unsurfaced roads.

Banyule Creek

- channelisation of Banyule creek;
- increased risk from redevelopment and increased housing intensity;
- sediment and nutrient inputs from residential areas;
- Road runoff; and
- erosion associated with stormwater outlets and elevated stormwater peaks.

Salt Creek

- channelisation of Salt creek;
- commercial sources of litter and other wastes from commercial centres, train stations and sporting complexes;
- sediment and nutrient inputs from residential areas;
- major arterial roads may generate pollutants such as heavy metals, hydrocarbons and litter;
- potential sediment inputs from urban development in parts of catchment outside of BCC (Mont Park) as identified by the Darebin City Council Stormwater Management Plan;
- ERS sewer discharges from ERS 189 and 465 (Rosanna Branch Sewer); and
- erosion associated with stormwater outlets and elevated stormwater peaks.

Darebin Creek North

- industrial threats associated with illegal discharges into the drainage system, accidental releases and generally poor quality of runoff from such areas during wet weather events;
- potential for construction sites;
- pollutant inputs from old tips and infill sites;
- sediment and nutrient inputs from residential areas;
- erosion associated with bank slumping;
- litter and pollutants associated with commercial and industrial centres located in Darebin Council as identified in the Darebin City Council Stormwater Management Plan;
- historical landfill sites; and
- residential redevelopments such as subdivision, and associated issues such as increased runoff, sediment, litter etc.

Darebin Creek South

- litter and pollutants associated with commercial and industrial centres located in Darebin City Council such as Northland Shopping Centre;
- litter and pollutants associated with commercial centres, train station and sporting facilities;
- residential redevelopments such as subdivision, and associated issues such as increased runoff, sediment, litter etc;
- industrial threats associated with illegal discharges into the drainage system, accidental releases and generally poor quality of runoff from such areas during wet weather events;
- erosion associated with bank slumping;
- ERS sewer discharges from ERS 150 (Dry Creek Branch Sewer); and

- major arterial roads may generate pollutants such as heavy metals, hydrocarbons and litter.

Yarra

- erosion associated with bank slumping;
- residential redevelopments such as subdivision, and associated issues such as increased runoff, sediment, litter etc;
- major arterial roads generate pollutants such as heavy metals, hydrocarbons and litter;
- ERS sewer discharges from ERS 156 (Ivanhoe Branch Sewer); and
- Nutrient, leachates and organic matter inputs from a number of managed parklands and golf courses (Ivanhoe Golf Course is located on a former tip site) and residential areas.

Table 6.1 Priority risks for the Banyule Stormwater Management Plan.

Score	Rank	Catchment	Threat	Value	Other values
64	1	Plenty River (Upper)	Commercial (litter) (Greensborough Shops, Watsonia Shops, Were St. Shops)	Visual Amenity	Tourism, Environmental (instream and riparian)
64	2	Plenty River (Upper)	Road Runoff (Metropolitan Ring Road, Greensborough Bypass)	Environmental (instream)	Visual Amenity, Recreational amenity, Tourism
64	3	Yallambie Creek	Construction (Cascades Development)	Environmental (instream)	Visual Amenity, Environmental (riparian), Recreational amenity
48	4	Yarra	Construction (General subdivision)	Environmental (instream)	Visual Amenity, Recreational amenity, Tourism
48	5	Plenty River (Lower)	Construction (Cleveland St., Lakeside Drive, new developments?)	Environmental (instream)	Visual Amenity, Recreational amenity, Environmental (riparian)
48	6	Darebin Creek (North)	Industrial (various)	Environmental (instream)	Visual Amenity, Recreational amenity, Tourism
48	7	Yarra	Sewer	Recreational amenity	Environmental (instream), Visual Amenity, Tourism
48		*Plenty River (Upper)*	*Commercial (litter) (Greensborough Shops, Watsonia Shops, Were St. Shops)*	*Tourism*	*Visual amenity, Environmental (instream and riparian)*
48		*Yarra*	*Construction (General subdivision)*	*Visual Amenity*	*Environmental (instream), Recreational amenity, Tourism*
48		*Darebin Creek (North)*	*Industrial (various)*	*Visual Amenity*	*Environmental (instream), Recreational amenity, Tourism*
36	8	Darebin Creek (South)	Degraded Waterways (east bank slumping)	Environmental (instream)	Visual amenity, Recreational amenity
36	9	Darebin Creek (North)	Degraded Waterways (east bank slumping)	Environmental (instream)	Visual Amenity, Recreational amenity
36	10	Plenty River (Lower)	Residential (all areas)	Environmental (instream)	Visual Amenity, Recreational amenity
36	11	Banyule Creek	Residential (all areas)	Environmental (instream)	Visual Amenity, Recreational amenity
36	12	Plenty River (Upper)	Residential (all areas)	Environmental (instream)	Visual amenity
36	13	Banyule Creek	Road Runoff	Environmental (instream)	Recreational amenity
36	14	Salt Creek	Degraded Waterways (Various)	Environmental (instream)	Visual Amenity
36	15	Bundoora	Construction (Parade College Development)	Environmental (instream)	Visual amenity
36	16	Salt Creek	Sewer (see notes on YVW)	Environmental (instream)	Visual amenity
36	17	Salt Creek	Construction (General subdivision)	Environmental (instream)	-
36		*Yarra*	*Construction (General subdivision)*	Recreational amenity	*Environmental (instream), Visual Amenity, Recreational amenity, Tourism*
36		*Plenty River (Lower)*	*Construction (Cleveland St., Lakeside Drive, new developments?)*	*Visual Amenity*	*Environmental (instream), Recreational amenity, Environmental (riparian)*
36		*Plenty River (Lower)*	*Construction (Cleveland St., Lakeside Drive, new developments?)*	*Recreational Amenity*	*Environmental (instream),Visual amenity, Environmental (riparian)*
36		*Darebin Creek (North)*	*Industrial (various)*	*Recreational amenity*	*Environmental (instream), Visual Amenity, Tourism*
36		*Yallambie Creek*	*Construction (Cascades Development)*	*Visual Amenity*	*Environmental (instream), Environmental (riparian), Recreational amenity*
36		*Yarra*	*Sewer (see notes on YVW)*	*Environmental (instream)*	*Recreational amenity, Visual Amenity, Tourism*
36		*Yarra*	*Sewer (see notes on YVW)*	*Visual Amenity*	*Recreational amenity, Environmental (instream), Tourism*
36		*Darebin Creek (South)*	*Degraded Waterways (east bank slumping)*	*Visual Amenity*	*Environmental (instream), Recreational amenity*
36		*Darebin Creek (North)*	*Degraded Waterways (east bank slumping)*	*Visual Amenity*	*Environmental (instream), Recreational amenity*
36		*Plenty River (Lower)*	*Residential (all areas)*	*Visual Amenity (36)*	*Environmental (instream), Recreational amenity*
36		*Plenty River (Lower)*	*Residential (all areas)*	*Recreational amenity (36)*	*Environmental (instream), Visual Amenity*
36		*Banyule Creek*	*Residential (all areas)*	*Visual Amenity*	*Environmental (instream), Recreational amenity*

Priority Risks

Issues addressed by priority risks

■ **Table 6.2 Description of key issues associated with each priority risk.**

Catchment	Threat	Key Value Threatened	Issues
Plenty River (Upper)	Commercial (litter)	Visual Amenity	The Greensborough Shopping Centre and to a lesser degree smaller shopping strips such as Watsonia shops and Were Street shops are a source of litter that is highly visible along the length of the Plenty River. Most of the litter appears to originate from the shopping centres and enter the Plenty River from discharge drains at Kalparrin Avenue, Pope Place and Kempston Street via Kalparrin Lake. Whilst generally not harmful to the environment, such visible litter impacts on the visual amenity and public perception of the 'health' of waterways.
Plenty River (Upper)	Road Runoff	Environmental (instream)	The Metropolitan Ring Road and Greensborough Bypass are major transport arterials, which travel either along the northern (upstream) edge or pass through the Plenty River Upper sub-catchment. Roads can be a source of a range of pollutants such as litter, heavy metals, volatile organics (such as oils and fuel) etc. In addition, roads can lead to sudden and severe impacts as a result of spills of any number of contaminants as a result of accidents. The main identified value potentially impacted by roads is the instream environment. Road contaminants can impact all levels of ecosystem structures to varying degrees and duration, for example the long term effect of exposure to pollutants such as heavy metals to the dramatic and far reaching impact of chemical spills.
Yallambie Creek	Construction (New Development)	Environmental (instream)	The housing construction at Yallambie currently poses significant risks to Yallambie Creek (and subsequently the Yarra River) as a result of sedimentation resulting from stormwater runoff. Minimal controls to prevent erosion and sediment transport are in place, disturbance of the stream bed, soil disturbance and stock piling of soil currently occur. Vehicle movement off the site and lack of wash down facilities may further risk sediment movement into waterways. Construction sites in general may also pose other threats for example as a result of litter, inappropriate storage of chemicals or fuels, human wastes and nutrient inputs. Further development within the Yallambie catchment, such as 'The Grange', may pose future risks unless preventative measures are in place.
Yarra	Construction (General subdivision)	Environmental (instream)	Construction activities associated with the subdivision of existing homes within the Yarra sub-catchment poses stormwater risk to the instream environmental values of the Yarra River and wetlands of the Yarra floodplain. Such construction activities cannot be identified to any specific location but should be considered as a catchment wide issue. Construction itself can cause sedimentation problems as a result of poor practice and other risks such as litter and nutrient inputs. Other impacts of subdivision may result following construction, such as increased stormwater runoff, as a result of greater impervious surfaces and increased potential associated with population growth for poor practices such as littering and washing cars and paints near drainage systems.
Plenty River (Lower)	Construction (New Development)	Environmental (instream)	Existing housing construction at Cleveland Avenue and Lakeside Drive, and the potential for additional housing estates in the future, pose significant risks to the instream environmental values of the Yarra River and Yarra floodplain wetlands as a result of sedimentation resulting from stormwater runoff, and other threats such as litter, inappropriate storage of chemicals or fuels, human wastes and nutrient inputs. Some existing controls such as wetlands are in place but monitoring the effectiveness of these structures and other practices are warranted and the implementation of additional management actions could be justified.
Darebin Creek (North)	Industrial (various)	Environmental (instream)	The Industrial area of West Heidelberg is a recognised problem area for discharge of pollutants into Darebin Creek. A variety of pollutant types may originate in the catchment, but include paints, oils and dyes amongst others. Identifying the exact source of pollutants has been difficult to date because of the sporadic nature of pollution events and the complexity of the drainage systems. Industrial pollutants in particular can affect the instream environmental values of Darebin Creek due to their high toxicity.
Yarra	Sewer	Recreational amenity	Sewerage systems have built in structures called Emergency Relief Structures (ERS) which aim to prevent damage to sewerage systems and 'back flooding' of sewage during wet weather events. Whilst sewerage systems are separate from stormwater systems, infiltration, illegal stormwater connections and other sources of stormwater usually mean that during periods of extreme wet weather (depending on the sewerage system's capacity) ERS are triggered, releasing semi-diluted sewage into stormwater systems and waterways. Within the Yarra Catchment, relatively high frequencies of ERS have been activated in the past ten years. Yarra Valley Water has a program aiming to upgrade these sewerage systems over the next 5 years to address the problem.
Darebin Creek (South)	Degraded Waterways (east bank slumping)	Environmental (instream)	Bank slumping and tunnel erosion high on the eastern bank of Darebin Creek poses a sediment threat and resulting impact to the instream environment of Darebin Creek. The cause of the erosion is likely to be multifaceted but includes a history of infilling, poorly functioning drainage systems, increased surface runoff and loss of vegetation cover. Whilst the problem may be relatively restricted to key areas, the risk of greater immobilisation (and subsequent cost of remediation) is high.

Catchment	Threat	Key Value Threatened	Issues
Darebin Creek (North)	Degraded Waterways (east bank slumping)	Environmental (instream)	Bank slumping and tunnel erosion high on the eastern bank of Darebin Creek poses a sediment threat and resulting impact to the instream environment of Darebin Creek. The cause of the erosion is likely to be multifaceted but includes a history of infilling, poorly functioning drainage systems, increased surface runoff and loss of vegetation cover. Whilst the problem may be relatively restricted to key areas, the risk of greater immobilisation (and subsequent cost of remediation) is high.
Plenty River (Lower)	Residential (all areas)	Environmental (instream)	Residential areas can provide a threat to stormwater quality in a multitude of ways through the day to day activities of the community. Poor practices such as washing cars in gutters, over fertilising lawns, poor garbage management, the application of pesticides and washing paints in drains are but a few of the potential actions residents can do which affect stormwater, and ultimately the downstream environment. Although the Plenty River Lower sub-catchment may not have the population density of other locations within Banyule, the high value of the Yarra River and its associated wetlands increase the impact potential of residential stormwater threats.
Banyule Creek	Residential (all areas)	Environmental (instream)	See above. The Banyule Creek sub-catchment is relatively densely populated, and may be expected to grow with increasing sub-division. Subsequently, the opportunity for residential impacts to stormwater increases. At threat, are the regionally significant Banyule wetlands.
Plenty River (Upper)	Residential (all areas)	Environmental (instream)	See above. The Plenty River upper sub-catchment is relatively densely populated, and may be expected to grow with increasing sub-division. Subsequently, the opportunity for residential impacts to stormwater increases. At threat are the environmental values of Plenty River and wetlands such as Kalparrin Gardens
Banyule Creek	Road Runoff	Environmental (instream)	See above. At threat are the regionally significant Banyule wetlands.
Salt Creek	Degraded Waterways (Various)	Environmental (instream)	See above. Instream bed and bank erosion is a problem in some sections of Salt Creek especially in the upper reaches in the vicinity of Mont Park.
Bundoora	Construction (Parade College Development)	Environmental (instream)	See above. The College Views development is a proposed residential development. Ensuring the development adopts water sensitive designs and best practice stormwater management techniques are important to ensure impacts from sedimentation and other issues are prevented. The Parade College wetland and the upper Darebin Creek are instream environments at risk.
Salt Creek	Sewer (see notes on YVW)	Environmental (instream)	See above.
Salt Creek	Construction (General subdivision)	Environmental (instream)	See above. Instream environmental values of Salt Creek, the Yarra River and Yarra floodplain wetlands are at risk.

7. Council Management Framework Review

Council's day-to-day planning and management activities can have a significant effect on stormwater quality. A review of Council's planning scheme, development approvals, operational and management procedures was undertaken in order to:

- provide a foundation for good stormwater management which will reduce reliance on reactive management issues in the future; and
- identify areas within Council's Management Framework where improvements can be made that will have a beneficial impact on stormwater management and quality, thus reducing impacts on receiving waterways.

This process involved a review of the:

- Banyule Planning Scheme and other key Council documents;
- approval processes and issues within planning, building, environment and engineering departments;
- resourcing, coordination and communication (internal and external);
- infrastructure management;
- waste management and levels of service; and
- local laws, enforcement and regulation.

7.1 Review of Planning Scheme and Key Council Documents

7.1.1 Banyule Planning Scheme

The Banyule Planning Scheme provides significant support for the implementation of a Stormwater Management Plan. It has identified:

- the importance of the waterway system with respect to habitat, open space and drainage and flooding functions;
- that industrial areas adjacent to the Darebin Creek and Plenty River is a concern with respect to the health of the environment and waterway (in relation to Darebin Creek this issue is also expressed as a concern by Darebin Council);
- large areas of the municipality are subject to drainage issues;
- it has nominated a number of strategies it seeks to implement with respect to controlling stormwater discharges and, assessing infrastructure with respect to development potential;
- major objectives for the natural environment are:
    - discouraging land use and development which would have a detrimental effect on Banyule's environmental or conservation values.
    - ensuring that discharges of sediment and litter are minimised and that the quality of surface and ground water is protected.
    - ensuring that stormwater run-off is managed in such a way that, while reductions are sought, any increased volumes can be managed and that the quality of receiving water bodies is protected.
    - ensuring that stormwater and run-off is managed so that flooding is avoided for storms less than the 1 per cent event and the quality of receiving water bodies is protected.
    - ensuring that vegetated buffers are provided around waterways, wetlands and other environmentally sensitive areas, so that their integrity is protected from nearby land uses and impacts.
    - ensuring that areas supporting remnant vegetation and natural habitat are protected.

- encouraging the enhancement of natural habitat and areas supporting remnant vegetation.
- encouraging and providing environmental linkages between areas of natural habitat.
- ensuring that, as far as possible, land use and development do not encourage plant and animal pests.
- encouraging improved water quality and improved stream ecology.
- supporting a regional approach to the management of waterways and catchments.[1]

- Local Planning policies and overlays have been inserted into the Banyule Planning Scheme with respect to waterway, environmental and inundation.

The Municipal Strategic Statement (MSS) has been prepared in accordance with the requirements of the State Government's planning reform program and is derived from the Council's strategic planning work as it relates to land use and development. It provides the foundation for land use and development provisions in the Banyule Planning Scheme and provides the rationale for the development of local policies and guidelines.

In particular the Municipal Strategic Statement (MSS) is strong in its wording with regard to stormwater quality and Banyule City Council should be commended for having this statement so prominent in its MSS. It lays the foundation for implementing the Urban Stormwater Management Plan strategies, in conjunction with other key stakeholders, over the next 10 years.

The MSS identifies that:

"*Stormwater quality is also critical and Melbourne Water, the Environment Protection Authority and Local Government are currently working together to improve the environmental management of stormwater through the establishment of a Stormwater Agreement".* [2]

A review of the Built Environment local policy states that "optimal use should be made of existing infrastructure". This statement is quite pertinent to urban stormwater planning, especially for opportunities of retrofitting or 're-engineering' existing drains or more natural environs such as waterways and wetlands

Strategies related to stormwater quality that are nominated for the Built Environment include:

- ensuring that off-site stormwater discharges are controlled;
- ensuring that off-site wastewater discharges are eliminated; and
- implement Councils 1998 drainage policy.

There is also the ability under the Victoria Planning Provisions to apply a Special Building Overlay to designated land in order to:

- identify land in urban areas liable to inundation by overland flows from the urban drainage system
- ensure that development maintains the free passage and temporary storage of floodwaters, minimises flood damage, is compatible with the flood hazard and

[1] Banyule Planing Scheme, Clause 21.04-5 page 15
[2] Banyule Planning Scheme, Clause 21.04-5 pages 15

local drainage conditions and will not cause any significant rise in flood level or flow velocity; and
- protect water quality.

Melbourne Water has also requested that Council prepare and exhibit an amendment to the Planning Scheme to introduce a Special Building Overlay to apply to land which it has identified as being affected by overland flows in the event of a storm exceeding the design capacity of the underground drainage system. Banyule City Council proposes to prepare and exhibit such an amendment within the next year.

7.1.2 Drainage and Detention Systems Policy

Council has a drainage policy, which was adopted in 1998, and this has been included as a reference document for the Banyule Planning Scheme. Council also has a draft document titled '*Detention Systems Policy and Guidelines'* which has been used by Council's officers, in assessing planning permit conditions for proposed developments. The policy document is based on detention systems that need to be constructed where the existing drainage system is insufficient to accept increased discharge.

Council has been applying this draft Detention Systems Policy and Guidelines to developments over the years, in particular to areas that have drainage infrastructure constraints. The draft policy however is focused towards medium density development and subdivision development. No systems are proposed for dwellings or commercial and industrial developments. Nor does the policy focus on design issues with respect to the treatment of stormwater.

The policy needs to be expanded to include these issues and such a policy needs to be developed as part of this Stormwater Management Plan process. Such a policy needs to be included within the Banyule Planning Scheme to:
- Provide a legal basis for the assessment of developments against this policy; and
- Encourage proponent to submit drainage information with development plans to demonstrate to Council that retention/detention/treatment systems can be designed to contain and treat stormwater and that these systems can be accommodated on site.

7.1.3 Environmental Policy and Strategy

The Environment Policy identifies how development, traffic and pollution are having impacts on Banyule's environment and the policy objectives seek to recognise waterways and wetlands as major assets. The decision guidelines within this policy require the Council to have regard to the *Banyule Environment Policy and Strategy* including the need to address waterways and wetlands. This policy needs to be more prominent in its application to Council's operational activities *i.e.* road construction. At present it is applied to external developers/contractors quite rigorously, but not so rigorously in its own activities.

7.1.4 City Plan 2000 - 2003

City Plan is used in conjunction with other documents such as the Municipal Strategic Statement, the Municipal Public Health Plan and the Council's Financial Strategy. The environmental management objective of the plan is to manage the natural and

built environment to ensure its diversity and well-being for present and future generations. It will do this through:

- Protecting and enhancing its waterways, wetlands, parks and reserves;
- Encouragement of development that is sympathetic to the environment and community needs;
- Developing and delivering sensitive and effective systems for monitoring the environment and controlling pollution; and
- Continuing to provide best practice environmental and waste management services.

The Banyule Stormwater Management Plan will assist Council in achieving some of the above environmental objectives.

7.2 Development Approvals Process

An assessment of the approvals processes has been undertaken through the interview of staff involved in the following areas of:

- development planning;
- strategic planning;
- engineering;
- construction;
- by-laws;
- building;
- waste management;
- environment; and
- operations.

In the City of Banyule, planning approvals are generally limited to situations where site redevelopment is occurring. In other words, the municipality is effectively 'built out' and a large percentage of development represents a recycling of redundant sites or maximising the site potential by placing more dwellings on each site. This is borne out by the statistics that the number of non-separate dwellings (semi-detached, townhouses and units) has been increasing since 1981. In 1996 they comprised approximately 16 per cent of the city's dwellings. Around 66 per cent of new dwellings added to Banyule's housing stock since 1991 have been units and dual occupancies.

There are very limited opportunities in Banyule for broad hectare residential subdivision. At present there are only about 700 vacant, residentially zoned lots available for development, most of which are located in the northern part of the municipality. However, there is considerable scope to provide more dwellings through infill development and the redevelopment of existing residential areas[3].

If this existing and future redevelopment is not managed satisfactorily, through controls Council can place on such development, it can have considerable detrimental impacts on receiving environs.

One of the most significant issues identified with respect to stormwater and planning permit related issues, involves medium density development. The most common

[3] Banyule Planning Scheme Clause 21.02, pages 4/5

problem is that developers do not install stormwater detention systems and simply connect developments to Council's drainage infrastructure. This only exacerbates drainage and flooding issues.

Given that this form of development can have significant stormwater impacts, both from a quality and quantity viewpoint, it is essential that drainage designs to be submitted to Council for approval. Discussion with Council officers has revealed that currently many applicants ignore planning permit conditions, which require drainage designs to be submitted later for Council approval. As part of the USWMP processes should be defined to minimise the ignoring of planning permit conditions for drainage designs.

7.2.1 Construction and Drainage Connections

The construction department is responsible for the inspection of drainage connections via road opening permits issued by the building and engineering departments. Council officers have determined that between 10-15% of developments do not apply for road opening permits. This has been identified by cross-referencing the number of road opening permits with developments that have been constructed throughout the year. As part of the Stormwater Management Plan, processes should be defined to minimise the avoidance of having drainage connections inspected.

7.2.2 Referrals

Under Section 55 of the Planning and Environment Act (1987), referral authorities can require conditions to be placed onto a planning permit. One of the frustrations with this system seems to be co-ordination between Council and the referral authority when a permit condition is not being complied with and needs enforcing.

Referral authorities are aware that they are also involved in the planning approval process and that partnerships between referral authorities and Councils are vitally important to ensure a co-ordinated and consistent approach to enforcement issues associated with planning permits.

Better co-ordination is required by Council and referral authorities to understand each others obligations and review working arrangements, as in the past there have been a number of developments where there has been some confusion over roles in regard to enforcement action.

Referral authorities have an interest in ensuring that their permit conditions are being fulfilled through the planning system under the Planning and Environment Act (1987), but they must understand that Council do not always have the technical skills to ensure permit conditions are being met.

It is therefore important that referral authorities provide the required technical support to Council when required. It is recommended that initially this would involve regular meetings on a quarterly basis between all the referral authorities for the first year and then timings reviewed after that.

7.2.3 Future Barriers

Throughout the process it was noted that a barrier to Banyule City Council achieving some of its stormwater management goals was the Victorian Government's ability to

override Council's planning scheme and permit conditions in relation to quality and quantity of stormwater leaving a development site. This particular matter was raised in relation to the redevelopment of the Austin Hospital site. Discussions should be held between the Local Government Association (which represents all Victorian Councils) and the Victorian Government about not conforming with Best Practice Guidelines.

7.3 Waste Management

Banyule City Council has a number of plans and initiatives related to waste management. Generally Banyule has an excellent understanding of its stormwater and litter management assets and their condition. Funding constraints do not allow all the activities that are required as part of best practice to be undertaken at once. Council realises this and allocates monies on achieving the best outcomes for the allocated funding.

Council have regular cleaning schedules of its rubbish bins and stormwater pits, which are performed by contractors. These have been developed over a long period of time with consideration of the amount of litter being delivered to a particular site. Council also have "hot spot' runs for pits that are cleaned out before storms, to minimise flooding as its primary concern, but this also has another benefit by removing possible nutrient and litter sources prior to a rainfall event.

The only deficiency observed throughout the field inspection phase of the study, was the commercial strips which had bins overflowing. Council should review its cleaning schedules in these areas.

7.4 Resourcing, Coordination and Communication

At present there is no particular group that has the responsibility of implementing the recommended strategies of the Stormwater Management Plan. As a first priority Council should assign responsibility to an appropriate Council Manager. After reviewing Council's structure it is felt that this responsibility should lie with the Strategic Planning Group.

It was also felt that a group should be charged with the detailed implementation of the Stormwater Management Plan. This group would be ideally chaired by Strategic Planning and should have an appropriate representation of all areas responsible with implementing the Plan.

Throughout discussions with Council staff the main issue appears to be one of lack of resources that are applied by Council in areas of enforcement, whether it be planning, engineering, construction or by-laws. Enforcement resources are perceived by staff to be limited and always reactive to complaints rather than being adequately resourced and playing a pro-active and educative role within Council.

The level of construction activity is very high in Banyule (1600 building permits per annum) yet only one officer is involved in this area. The inspection of building developments is also constrained through the private building certification process. Private building surveyors can usually take up to 2-3 weeks to supply Council with building permit data. In most cases this is too late for inspections to be carried out, as earthworks (concrete slabs etc) and drainage connections would have already been

completed within this period. More staff are required to ensure that construction and building activities are carried out according to best practice.

Banyule generally has good internal communications, however there is a gap that requires attention. Operations staff, have on occasions, been handed over assets which they are unfamiliar with in respect to maintenance regimes or design intent (eg: a wetland). It is essential that designers, constructors and maintenance personnel meet regularly to discuss issues such as these and to ensure that adequate handover procedures are documented and in place for assets constructed by both developers and Council staff.

7.5 Regulation and Enforcement

7.5.1 By-laws

Issues associated with building construction (debris, rubbish, sand and cement on roads) is not an area that the By-laws Department regularly enforces given that building construction By-laws have not been implemented. Enforcement action however can be taken under Councils By-law No 1 - *General Local Law.* However fines under By-laws are considered inadequate and do not deter offenders. These fines should be reviewed by Council to ensure that people who are abusing the system are dealt with what the community expects rather than a slap on the wrist approach. The By-laws should identify who would be deemed responsible for any non-compliance-usually the builder is identified-and is responsible for any breaches.

One of the main reasons that enforcement is hard to achieve, in relation to stormwater quality, is the tracking of offenders with respect to non-compliance, i.e. leaving soil and cement over roads and washing similar waste down storm water facilities.

Resources are also limited for enforcement and it is considered that should a building construction by-law be introduced, more staff would need to be employed to address this specific area initially.

In addition to enforcement, more resources should also be used to curb other activities that have major impacts on stormwater. These issues include:

- unconstructed cross-overs;
- illegal filling of land within the flood plain;
- illegal landscaping of nature strips; and
- discharge of grey water to stormwater drains.

7.6 Summary of Priority Management Framework Issues

The priority issues highlighted during the review of Banyule Council's management processes are listed Table 7.1.

Table 7.1 Overview of Council Framework Issues

Function	Management Issues
Planning and Building	❑ There is a lack of stormwater awareness amongst relevant Council staff. Education of Council staff on stormwater quality issues and development of internal referral process checklist is required. ❑ Sediment control for construction sites is required as part of planning permit conditions. Incorporate in process checklist. Note that the Darebin Creek Management Committee (DCMC) is in the process of developing earthworks guidelines for Erosion and Sediment Control within the Darebin Creek Catchment. ❑ There is a need to develop standard conditions relating to sediment, run-off and litter control for subdivision and construction permits. ❑ There is a need to review MSS with respect to stormwater quality management issues in light of the preparation of the Banyule SWMP. ❑ There is a requirement to develop a suitable protocol to ensure that drainage/detention designs be submitted to Council. ❑ There is a need to investigate the possibility of an introduction of an 'Environmental Bond' to deter bad practices.
Strategic Planning	❑ Development of monitoring protocols for non-structural measures for stormwater management initiatives is required (statewide project).
Municipal Laws	❑ Develop a local law for all construction sites which have an impact on stormwater quality (see pilot project between MWC and six councils which is scheduled for completion by March 2003). ❑ Develop a local law for stockpiling on nature strips. ❑ Review penalty framework, for example municipal laws in NSW have fines of $1500 for failing to adhere to erosion and sediment control practices.
Infrastructure Services (Development and Maintenance)	❑ Need to ensure Council's internal workforce is aware of its requirements in relation to stormwater quality when carrying out Council works. ❑ Review litter basket design and maintenance performance. ❑ Review contract specifications to ensure stormwater quality measures are included in external works. ❑ Need education programs for builders relating to building site management (seek ideas and advice from other councils etc). As part of the VSAP construction sites project and education kit and guidelines will be developed which should be utilised by BCC. ❑ Need to educate commercial traders about not dumping wastes in street bins. ❑ Need to review ownership of waterways with Melbourne Water.
Environment & Cultural Planning	❑ Discuss standards of cleaning of litter within waterways with Melbourne Water. ❑ Review lease conditions on Council owned land to ensure herbicide use is appropriately controlled.
Environmental Health	❑ Advocate for provision of sewerage to areas which are currently serviced by septic tanks (eg Lower Plenty & Montmorency).
General	❑ Incorporate a regular forum between strategic/design/construction/maintenance departments to ensure handover of assets is managed more effectively. ❑ Review resourcing capabilities in relation to enforcement for planning, engineering and construction by-laws. There is a need to move from a reactive to a proactive mode and assist with education.

7.7 Links between Council management and priority risks

Many of the issues identified in the risk assessment process and the Council management review are closely linked. Council management can directly influence some of the activities that are creating threats to receiving environment values. For example, tighter controls on planning permit conditions that reduce sediment inputs to the stormwater system will have a major beneficial impact upon the quality of stormwater entering receiving environments. It is important that the linkages between the priority risks and Council management are acknowledged so that strategies within Council will have a direct improvement on stormwater management at the source rather than solely through reactive measures.

All internal staff and external contractors should adhere to Best Practice Management of Stormwater, which includes the production and implementation of erosion and sediment control plans.

Table 7.2 illustrates the link between Council management and priority risks.

■ **Table 7.2 Link between council management and priority risks.**

Priority Issues	Stormwater Management Stratgeies			
	Planning Controls	Council Operations and Management	Education and Awareness	Infrastructure Solutions
Construction - New Development - Re-development	X		X	X
Commercial		X	X	X
Roads		X		X
Industrial	X			X
Sewer	X			X
Degraded Waterways	X	X		X
Residential	X	X	X	

8. Reactive stormwater management strategies

8.1 Strategies

There are two types of stormwater management strategies, **Reactive Management Strategies** (this section) that are developed in response to current threats that relate to priority management issues, and **Management Framework Strategies** (Section 9) that are developed in response to deficiencies identified in the review of Council's management framework.

Reactive Management Strategies can be broadly grouped into the following categories:

- education and awareness;
- structural treatment measures;
- non-structural treatment measures;
- source controls;
- site specific strategies and plans;
- information and data collection; and
- regulation and enforcement.

Management Framework Strategies typically address areas of Council operation related to:

- strategic planning activities;
- planning and local approvals processes;
- service delivery levels and improved operations and management activities;
- opportunities for improved coordination and communication; and,
- training and education programs.

The following sections summarise the Reactive Management Strategies developed to address each priority management issue. For each priority management issue a number of strategies have been developed. Strategies have been categorised according to the following themes:

- planning controls (P);
- operations and management (O);
- regulation and enforcement (R);
- education and training (E);
- coordination and communication (C); and,
- infrastructure solutions and structural control measures (I).

Some of the strategies identified in these categories will be effective at addressing a range of issues or threats in a number of locations across the municipality (eg. education and training, monitoring, regulation and enforcement) while others are specific strategies aimed at addressing specific issues (eg. structural control measures). Some structural measures, for example wetlands and gross pollutant traps, will be effective at addressing a number of threats in the one catchment.

To assist with the development of strategies, a screening process was used. Table 8.1 presents a range of possible strategies within the above themes that could be applied in the Banyule region. Based on these broad strategies, specific strategies were identified for further assessment.

■ Table 8.1. Broad management strategies used in the screening process to identify strategies suitable for the study area.

Threat	Planning	Council Management and Operations	Education and Awareness	Infrastructure
Residential Runoff	▪ Water sensitive urban design for future development ▪ Reduce impediments to composting toilets, household rainwater tanks with toilet or garden reuse, etc	▪ Enforcement/Regulation ▪ Local laws ▪ Street sweeping ▪ Review recycling collections (bin type, frequency) ▪ Review contract wording	▪ Brochures ▪ Waste reduction ▪ Junk mail ▪ School education	▪ Triple interceptor traps ▪ Wetlands ▪ Maintenance of drainage system ▪ Gross Pollutant Traps (GPTs) ▪ Reuse Options
Commercial runoff	▪ Permit conditions eg stormwater plan for large centres ▪ Recycling	▪ Litter collection/patrol ▪ Street sweeping ▪ Strategic bin location and type ▪ Local laws ▪ Enforcement of State litter laws ▪ Monitoring	▪ Brochures ▪ Seminars ▪ Target shoppers and shop owners ▪ Drain stencilling eg yellow fish road program ▪ Sponsorship	▪ GPTs ▪ Wetlands ▪ Litter baskets and bins ▪ Commercial recycling within shopping centres (at shop level) ▪ Oil traps on carparks
Industrial runoff	▪ Enforcement ▪ Fines/notices ▪ Conditions on new development ▪ Licenses to discharge to sewage ▪ Requirements for EMPs ▪ Encouraging EPA to enforce regulations	▪ Audits ▪ Local laws ▪ Emergency response plans ▪ Monitoring	▪ Brochures ▪ Audits ▪ Other awareness campaigns eg Green tick ▪ Regular consultation with specific industries	▪ Triple interceptor traps ▪ Wetlands ▪ Bunding ▪ Sewerage disposal eg bypass mechanisms ▪ GPTs ▪ On site detention and reuse options ▪ Decrease impervious surfaces
Development and Construction	▪ Conditions on permits ▪ Referrals process checklist ▪ Pre-application meetings ▪ Guidelines re application requirements ▪ MSS reviews ▪ Environment bond tied to compliance with conditions ▪ Coordination with other councils for standard guidelines ▪ Water sensitive urban design ▪ EMPs for large developments	▪ Enforcement ▪ Sufficient resources ▪ Dedicated SW officer ▪ Local laws ▪ Esp. for lot scale construction eg litter, sediment ▪ See DOI document ▪ Inspections ▪ Check pits	▪ Builders ▪ Developers ▪ Real estate agents ▪ Purchasers (who could apply pressure on builders, developers eg w.r.t. resources material) ▪ Seminars/workshops ▪ Brochures ▪ Resource material	▪ Silt fences ▪ Hay bales ▪ Detention basins and wetlands ▪ Don't connect to drainage until earth works completed ▪ Stock pile control ▪ Washdown facilities ▪ Toilet facilities
Roads	▪ Link with other agencies eg VicRoads ▪ Road design eg CRCCH, VicRoads	▪ Accident response ▪ Sealing road shoulders ▪ Local laws ▪ Vehicle deposition	▪ Transport industry ▪ VicRoads ▪ Vehicle washdown	▪ Swale drains for unsealed roads ▪ Sediment traps / GPTS / wetlands ▪ Revegetate road shoulders ▪ Pervious pavements

In addition, a range of regulatory and statutory options are available to assist in stormwater management (Table 8.2).

■ **Table 8.2 Regulatory and statutory controls available to assist stormwater management**

Regulatory & Statutory Controls
▪ Environment Protection Act 1970 Works Approvals Licences Research Approvals, Pollution Abatement Notices, Waste transport permits and certificates, Appeal rights
▪ Environmental Protection and Biodiversity Conservation Act (1999)
▪ *Litter Act 1987* (EPA)
▪ *Flora & Fauna Guarantee Act 1980* (NRE)
▪ Environment Protection Regulations (EPA) Transport Prescribed waste Landfills
▪ State Environment Protection Policies (EPA)
▪ Industrial Waste Management Polices (EPA)
▪ Victoria's Litter Reduction Strategy (State Gov.)
▪ Regional Waste Management Groups (EPA)
▪ Codes of Practice
▪ Industry
▪ Government

Once the initial screening process had been conducted specific strategies were identified. An evaluation of the effectiveness of each management action was conducted based on cost, life cycle, area treated, effectiveness, feasibility and multiple benefit:

$$\frac{\text{Capital Cost} + (\text{Ongoing Cost} \times \text{Lifecycle})}{\text{Effective lifecycle} \times \%\ \text{area treated} \times \text{Effectiveness} \times \text{Feasibility} \times \text{Multiple Benefit}}$$

Where:

- **Lifecycle** is the period of time over which an ongoing cost is incurred;
- **Effective lifecycle** is the period of time over which a benefit occurs;
- **% area treated** is the area of a catchment that is treated by the particular action;
- **Effectiveness** is an indication of how effective the action is at treating the particular threat;
- **Feasibility** is an indication of the ability to implement the action given constraints such as location, Council structure etc; and
- **Multiple Benefit** is an indication of the impact the action has on reducing threats in other areas or against other values.

For effectiveness, feasibility and multiple benefit, a qualitative value of Very Low, Low, Moderate, High or Very high is assigned. This corresponds to a quantitative value between 0 and 1. Guidelines for applying the qualitative and quantitative values for different management strategies are provided in the Urban Stormwater Best Practice Environmental Management Guidelines (VSC, 1999).

Costs for structural measures are based on market values for purchase, construction and implementation. Costs for non-structural measures are typically based on hourly rates and estimated time. Council will be able to implement many of the non-structural strategies for less than the estimated cost by modifying existing practices or by using internal resources.

Once values have been assigned an overall effectiveness score is calculated and strategies for a given threat can be assessed against each other. The lower the score the more cost effective an action is. Assessment of strategies is presented in Appendix C. These strategies were workshopped with the community to further refine those suitable for the Banyule region. Based on these discussions and an assessment of the overall effectiveness scores of strategies within each strategy, some strategies were not recommended for implementation. Strategies that passed this screening process have been recommended for implementation.

For each of the priority management issues, recommended strategies are summarised in the following tables (Table 8.3). Provided with each action is an indication of capital and ongoing cost, the authority responsible for implementation and other participating stakeholders, and suggested timeframe for implementation. Where a previously described action addresses a new strategy, linkages are indicated and the costs have not been included, as costs only apply once.

Costs may be significantly reduced if Council staff undertake some of the tasks or by modifying current procedures within Council. The lead agency assigned to each action is not necessarily responsible for the cost, it is just an indication of the agency in the best position to initiate the action.

The establishment of a suitable monitoring program to assess the effectiveness of strategies at improving stormwater quality is required as part of the implementation strategies identified in this Stormwater Quality Management Plan.

■ **Table 8.3. Reactive Management Strategies to address the priority management risks listed in Table 6.1.**

Table legend

- **Theme**:
  - P, Planning
  - O, Operations and management
  - E, Education and training
  - C, Coordination and communication
  - R, Regulation and enforcement
  - I, Infrastructure and structural control measures
- **Business Unit**:
  - PB, Parks and Buildings
  - HA, Health and Aged Services
  - AL, Administration and Law
  - Con, Construction
  - DS, Development Services
  - OP, Operations
  - SED, Strategic and Economic Development
- **Time**: The time (year) from commencement of the plan by which each particular action should be implemented

cc	Action	Action	Theme	Time	Cost		Business Unit	Participating stakeholders
					Capital	Ongoing		
64	**A1**	**Commercial Litter, Plenty River (Upper)**						
	A1.1	Invite Friends Groups to cooperate in monitoring of any GPT and release net rubbish. Groups would contact BCC when rubbish requires removal or other actions such as repairs are required	O, I	1	$0	$0	OP	Friends groups
	A1.2	BCC to encourage 'policing' operations by the EPA and Police under the Victorian Litter Act (1987) towards the public. Warnings instead of fines could be advocated as part of an education campaign	O	1	$2000	$1,000	SED	EPA Police
	A1.3	Annual workshops for waste management and street cleaning personnel, parks, gardens and maintenance staff to ensure their activities are being performed efficiently and effectively	E,O	1	$2000	$2,000	OP	Other Councils
	A1.4	Signage for drain outlets indicating drain number and EPA hotline to highlight link between catchment and litter (see drain inventory for locations). Could be trialed at key locations (eg: Binnak Park, Plenty River near Greensborough Shops etc) prior to expanding	E	1	$5,000	$1,000	OP	EPA MWC
	A1.5	Community education through the production of brochures/advertising etc. highlighting the link between littering and litter entering the waterways	E	1	$10,000	$3,000	SED	MWC /EPA Other Councils
	A1.6	Gross Pollutant Trap (GPT) on Kalparrin Street drain at Plenty River (20J1). Right Bank. (PR/13, diameter 1350) or within Whatmough Park to avoid high flow redispursement of litter and ease of access	I	1	$55,000	$2,000	SED	MWC
	A1.7	GPT at Kempston Street drain before Kalparrin Gardens (vacant area u/s). (M10G12). (Diameter Est. 600mm)	I	1	$60,000	$2,000	SED	MWC
	A1.8	GPT on Joyce Avenue Outfall at Plenty River (M21A1). Right Bank. (PR/22, diameter 675). Access Issue. May be able to be installed in Greensborough carpark	I	2	$45,000	$2,000	SED	MWC
	A1.9	Increase cleaning frequency of litter baskets in side entry pits around Greensborough CBD, Were Street and Watsonia Shops	O	3-5	$0	$4,000	OP	
	A1.10	Release net on Poulter Avenue drain (M21A2). (Diameter Est. 525mm)	I	3-5	$9,400	$1,000	SED	MWC
	A1.11	Release net on Kempston Street drain before Kalparrin Gardens (vacant area u/s). (M10G12). (Diameter Est. 600mm).ONLY if funds limited for a GPT (see A1.9)	I	3-5	$10,200	$1,000	SED	MWC

cc	Action	Action	Theme	Time	Cost		Business Unit	Participating stakeholders
					Capital	Ongoing		
	A1.12	Release net on Patterson Crescent drain (M21A3). (Diameter Est. 750mm)	I	3-5	$12,000	$1,000	SED	MWC
64	**A2**	**Road Runoff (Metropolitan Ring Road, Greensborough Bypass) Plenty River (Upper)**						
	A2.1	Liaise with Vic Roads & ensure water sensitive road design for any upgrades (eg: Wong *et al*, 2000)	O	1	$1,000	$1,000	SED	Vic Roads
	A2.2	Annual workshops for emergency and operations staff regarding management practices etc. for spillage events or other pollution generating road incidents. Use of MWC Standard Work Procedure for Responding to Pollution Incidents and other industry protocols.	E	1	$2,000	$2,000	OP	Industry groups,MWC, EPA, emergency services
	A2.3	Investigate options for retro fitting major highways with grass swales and detention structures designed to isolate spills to improve stormwater quality prior to waterways	I	2-3	$4,000	$0	SED	Vic Roads
	A2.4	Provide signage along major roads highlighting that litter and other runoff ultimately enters the regions waterways	E	2	$3,000	$1,000	SED	Vic Roads
	A2.5	Conduct litter collection activities along freeway, for example as part of a Clean Up Australia Day activity	O	2	$0	$10,000	OP	Vic Roads
	A2.6	Request VicRoads to provide updated emergency response planning and ensure council staff are familiar with any procedures	P	2	$0	$0	OP	Vic Roads
	A2.7	GPT at Kempston Street drain before Kalparrin Gardens (vacant area u/s). (M10G12). (Diameter Est. 600mm)	See Action A1.2					
	A2.8	Provide literature and guidelines to the transport and freight industry highlighting importance of covering loads etc. in order to minimise litter and other pollutants being washed into waterways	P	3	$5,000	$0	SED/OP	Vic Roads
64	**A3**	**Yallambie Creek (Construction)(Cascades Development)**						
	A3.1	Increase fines for developers contravening planning/environmental guidelines and implement where appropriate	O	1	$3,000	$0	AL	
	A3.2	Develop developers referrals checklist indicating the organisations, which are required to review and/or approve any construction activity, in order of sequence	P,O	1	$2,000	$0	DS	
	A3.3	Develop Council referrals check list checklist indicating the council departments, which are required to review and/or approve any construction activity, in order of sequence	P,O	1	$2,000	$0	DS	
	A3.4	Require stream bank silt fences and in-stream bales ASAP (immediate action) at the Cascades Development	I	1	$0	$0	OP	
	A3.5	Workshops for council planning and engineering staff to educate staff on approval process and best management practice	E,O	1	$5,000	$0	DS	
	A3.6	Information workshops for developers, builders, contractors and consultants. Cover aspects such as the approval process, best practice management etc.	E,O	2	$5,000	$0	DS	
	A3.7	Investigate and implement if feasible, retrofit of the Yallambie retarding basin in Simpson Barracks into a wetland for stormwater treatment	I	2	$50,000	$2,000	SED	MWC
	A3.8	Determine applicability of different Water Sensitive Urban Design principles	O	2	$2,000	$1,000	SED	
	A3.9	Distribute guidelines for and require sediment and erosion control plans for all new developments to ensure developers are aware of problems caused by stormwater and management options (see section 9.1)	P,O	2	$5,000	$0	DS	
	A3.10	Increased frequency of audits and inspections of development sites	O	2		$5,000	DS	
	A3.11	Investigate implementation of the code of practice for protection of council assets and control of building sites	E	3	$5,000		Con.	
48	**A4**	**Yarra Construction (General subdivision)**						
	A4.1	Develop developers referrals checklist indicating the organisations which are required to review and/or approve any construction activity, in order of sequence	See Action A3.2					
	A4.2	Develop Council referrals checklist indicating the council departments, which are required to review and/or approve any construction activity, in order of sequence	See Action A3.3					
	A4.3	Review local laws for applicability for stormwater enforcement	O	2	$5,000	$0	AL	
	A4.4	Workshops for council planning and engineering staff to educate staff on approval process and best management practice	See Action A3.5					
	A4.5	Information workshops for developers, builders, contractors and consultants. Cover aspects such as the approval process, best practice management etc.	See Action A3.6					

cc	Action	Action	Theme	Time	Cost		Business Unit	Participating stakeholders
					Capital	Ongoing		
	A4.6	Require developers to clean drainage system & not connect to system until land is stabilised. Council should have a policy or requirement in place so developers bear cost	E,O	2	$3,000	$5,000	Con.	
	A4.7	Infringement notification and enforcement of planning permit conditions	O	2	$2,000	$5,000	DS	
	A4.8	Increased frequency of audits and inspections of development site	See Action A3.10					
	A4.9	Determine applicability of different Water Sensitive Urban Design principles	See Action A3.8					
	A4.10	Distribute guidelines for and require sediment and erosion control plans for all new developments to ensure developers are aware of problems caused by stormwater and management options (see section 9.1)	See Action A3.9					
	A4.11	GPT on Hartland Road Outfall. (M32A9). (YR/13, diameter 825).	I	3	$37,500	$2,000	SED	MWC
	A4.12	GPT on The Boulevard Outfall. (M32B6). (YR/16, diameter 825).	I	3	$37,500	$2,000	SED	MWC
	A4.13	Remediate wetlands near Banksia Street (which have been described as in poor condition due to limited water input and sedimentation) by altering drainage system and installing GPT on Banksia Street Outfall prior to wetlands. (M32C5) (YR/18, diameter 1350)	I	5	$80,000	$2,000	SED	MWC /DNRE
48	**A5**	**Plenty River (Lower) Construction (Cleveland Ave, Lakeside Drive, new developments)**						
	A5.1	Increase fines for developers contravening planning/environmental guidelines	See Action A3.1					
	A5.2	Develop developers referrals checklist indicating the organisations, which are required to review and/or approve any construction activity, in order of sequence.	See Action A3.2					
	A5.3	Develop Council referrals checklist indicating the council departments, which are required to review and/or approve any construction activity, in order of sequence.	See Action A3.3					
	A5.4	Construct wetlands within estates where appropriate	I	5	$0	$3,000	DS	MWC/Devel.
	A5.5	Increased frequency of audits and inspections of development site	See Action A3.10					
	A5.6	Workshops for council planning and engineering staff to educate staff on approval process and best management practice	See Action A3.5					
	A5.7	Information workshops for developers, builders, contractors and consultants using the site as an example	See Action A3.6					
	A5.8	Determine applicability of different Water Sensitive Urban Design principles, especially in relation to open spaces which use herbicides	See Action A3.8					
	A5.9	Require developers to clean drainage system & not connect to system until land is stabilised. Council should have a policy or requirement in place so developers bear cost	See Action A4.6					
	A5.10	Install temporary sediment traps at appropriate drainage outlets if/when new developments are being constructed. Council should have a policy or requirement in place so developers bear cost	E	Ongoing			DS/Con.	Develop.
	A5.11	Develop guidelines for and require sediment and erosion control plans for all new developments	See Action A3.9					
	A5.12	Infringement notification and enforcement of planning permit conditions	See Action A4.7					
48	**A6**	**Darebin Creek (North) Industrial (various)**						
	A6.1	Consult with individual industries on Stormwater Management Issues to ensure implementation of best practice	P	1	$5,000	$0	SED	Industry DCMC
	A6.2	Mark drains in the catchment with identifying codes and EPA hotline numbers to contact so that the public can report on incidences	See Action A1.4					
	A6.3	Workshops for emergency and operations staff regarding emergency procedures, management practices etc.	See Action A2.2					
	A6.4	Workshops on Stormwater Management for Industry representatives. Cover aspects such as the impact of stormwater pollution, best practice management etc.	E,O	1	$3,000	$0	SED	Industry groups DCMC
	A6.5	Require environmental management plans for large industries	P,O	2	$2,000	$0	DS	Industry groups
	A6.6	Encourage better storage practices for waste chemicals etc.	E	2	$2,000	$0	HA	Industry groups
	A6.7	Long term consultation in partnership with EPA/MW/regional waste management groups to target industrial operations		2	$0	$0	OP	EPA MWC DCMC
	A6.8	Site audits and inspections to determine if industry are complying with any regulations and are implementing environmental management plans		2	$3,000	$5,000	SED/Con	
	A6.9	Review environmental management plans		2	$1,000	$5,000	DS	DCMC

cc	Action	Action	Theme	Time	Cost		Business Unit	Participating stakeholders
					Capital	Ongoing		
	A6.10	Monitor effectiveness of GPT at the West Heidelberg Drain (Dougharty Rd)	I	2	$0	$3,000	SED	DCMC
	A6.11	Update emergency response planning and ensure council staff are familiar with any procedures	E	3			BCC	
	A6.12	Treatment device for industrial pollution at DC/1. MWC ASSET (Lillimur Ave). LaTrobe Uni Outfall (M19E9). (Diameter 2100)	I	1	$85,000	$3,000	MWC	BCC DCMC
	A6.13	GPT or other pollutant trap at the Southern Road drain (DC/12, M19D12). 1875mm. X	I	3	$165,000	$3,000	MWC	BCC DCMC
	A6.14	GPT at Lae Street (M31D2). (DC/15, diameter 1050). Note drainage outlet inventory recommendation for diversion, seek MW funding options	I	3	$37,500	$3,000	Con	MW
48	**A7**	**Yarra Sewer**						
	A7.1	Liaison with YVW to identify when and where sewerage upgrade works will be undertaken and where discharge enters waterways	O	1	$0	$0	HA	YVW
48	**A8**	**Darebin Creek (South) Degraded Waterways (east bank slumping)**						
	A8.1	Seek Community involvement in works	O	1	$1,000		SED	MWC DCMC
	A8.2	Seek Melbourne Water Funding	O	1	$1,000		SED	MWC
	A8.3	Revegetate and fence off key erosion locations	I	3	$20,000	$2,000	MWC	BCC
	A8.4	Install new drainage outlets or provide erosion protection at drainage outlets where appropriate as identified in the Inventory of Drainage Outlets	I	3	$50,000		SED	MWC
	A8.5	Undertake waterway management works on the east bank to prevent further bank erosion and bank slumping	I	5	$100,000	$5,000	MWC	BCC
48	**A9**	**Darebin Creek (North) Degraded Waterways (east bank slumping)**						
	A9.1	Seek Community involvement in works	See Action A8.1					
	A9.2	Seek Melbourne Water Funding	See Action A8.2					
	A9.3	Revegetate and fence off key erosion locations	See Action A8.3					
	A9.4	Install new drainage outlets or provide erosion protection at drainage outlets where appropriate as identified in the Inventory of Drainage Outlets	See Action A8.4					
	A9.5	Undertake waterway management works on the east bank to prevent further bank erosion and bank slumping	See Action A8.5					
48	**A10**	**Plenty River (Lower) Residential (all areas)**						
	A10.1	Provide identifying markers on drains to indicate the catchment and EPA hotline	See Action A1.4					
	A10.2	Workshops for waste management and street cleaning personnel, parks, gardens and maintenance staff re: stormwater quality protection	See Action A1.3					
	A10.3	Provide incentive for car washing at centres by providing vouchers etc	E	2	$15,000		OP	
	A10.4	Development educational materials for residents that promote best practice management and encourage waste reduction	P,O	2	$5,000	$2,000	OP	
	A10.5	Promote Waterwatch and Ecorecycle programs through local schools	E	2	$0	$5,000	DS	MW
	A10.6	Revision and enforcement of local laws to highlight stormwater management	See Action A4.3					
	A10.7	Review & assess the types of recycling bins used and potential for litter escape	O,P	2	$5,000		OP	
	A10.8	Media releases to highlight stormwater management issues to the general community	E	3	$0	$1,000	SED	MW
48	**A11**	**Banyule Creek Residential (all areas)**						
	A11.1	Investigate reasons for and against redirecting drainage channels into Banyule Swamp and implementing if found desirable	I	1	$10,000	$1,000	DS	DNRE
	A11.2	Workshops for waste management and street cleaning personnel, parks, gardens and maintenance staff. re: stormwater quality protection	See Action A10.2					
	A11.3	Provide identifying markers on drains to indicate the catchment and EPA hotline	See Action A10.1					
	A11.4	Provide incentive for car washing at centres by providing vouchers etc	See Action A10.3					
	A11.5	Development educational material for residents that promote best practice management and encourage waste reduction	See Action A10.4					
	A11.6	Promote Waterwatch and Ecorecycle programs through local schools	See Action A10.5					
	A11.7	Revision and enforcement of local laws to highlight stormwater management	See Action A10.6					

cc	Action	Action	Theme	Time	Cost		Business Unit	Participating stakeholders
					Capital	Ongoing		
	A11.8	Review & assess the types of recycling bins used and potential for litter escape	See Action A10.7					
	A11.9	Media releases to highlight stormwater management issues to the general community	See Action A10.8					
48	**A12**	**Plenty River (Upper) Residential (all areas)**						
	A12.1	Workshops for waste management and street cleaning personnel, parks, gardens and maintenance staff	See Action A10.2					
	A12.2	Review & assess the types of recycling bins used and potential for litter escape	See Action A10.7					
	A12.3	Provide identifying markers on drains to indicate the catchment and EPA hotline	See Action A10.1					
	A12.4	Provide incentive for car washing at centres by providing vouchers etc	See Action A10.3					
	A12.5	Educate residents about over fertilising and fertilising alternatives such as slow release	P,O	2	$2,000	$2,000	DS	
	A12.6	Promote Waterwatch and Ecorecycle programs through local schools	See Action A10.5					
	A12.7	Revision and enforcement of local laws to highlight stormwater management	See Action A10.6					
	A12.8	Alter the design of Kalparrin Gardens wetland to increase nutrient assimilation efficiency and habitat quality	I	2	$20,000	$3,000	OP	
	A12.9	Media releases to highlight stormwater management issues to the general community	See Action A10.8					
	A12.10	Educational material for residents for car washing, garden practices, encourage waste reduction	E	3	$0	$2,000	SED	
48	**A13**	**Banyule Creek Road Runoff**						
	A13.1	Liaise with Vic Roads & ensure water sensitive road design for any upgrades (eg: Wong *et al*, 2000)	See Action A2.1					
	A13.2	Annual workshops for emergency and operations staff regarding management practices etc.	See Action A2.2					
	A13.3	Investigate options for retro fitting major highways with grass swales and detention structures designed to isolate spills to improve stormwater quality prior to waterways.	See Action A2.3					
	A13.4	Provide signage indicating that litter and other runoff enters the Yarra River catchment	See Action A2.4					
	A13.5	Conduct litter collection activities along roads, for example as part of clean up Australia Days	See Action A2.5					
	A13.6	Request VicRoads to provide updated emergency response planning and ensure council staff are familiar with any procedures	See Action A2.6					
	A13.7	Provide literature and guidelines to the transport and freight industry highlighting importance of covering loads etc. in order to minimise litter and other pollutants being washed into waterways.	See Action A2.8					
48	**A14**	**Salt Creek Degraded Waterways (Various)**						
	A14.1	Seek Community involvement in works	See Action A8.1					
	A14.2	Seek Melbourne Water Funding	See Action A8.2					
	A14.3	Revegetate and fence off key erosion locations	See Action A8.3					
	A14.4	Install new drainage outlets or provide erosion protection at drainage outlets where appropriate as identified in the Inventory of Drainage Outlets.	See Action A8.4					
	A14.5	Identify and undertake waterway management works at erosion locations	See Action A8.5					
36	**A15**	**Bundoora Construction (College View Development)**						
	A15.1	Develop developers referrals checklist indicating the organisations, which are required to review and/or approve any construction activity, in order of sequence.	See Action A3.2					
	A15.2	Develop Council referrals checklist indicating the council departments, which are required to review and/or approve any construction activity, in order of sequence.	See Action A3.3					
	A15.3	Increased frequency of audits and inspections of development sites	See Action A3.10					
	A15.4	Workshops for Council planning and engineering staff to educate staff on approval process and best management practice.	See Action A3.5					
	A15.5	Information workshops for developers, builders, contractors and consultants. Cover aspects such as the approval process, best practice management etc.	See Action A3.6					

cc	Action	Action	Theme	Time	Cost		Business Unit	Participating stakeholders
					Capital	Ongoing		
	A15.6	Require developers to clean drainage system & not connect to system until land is stabilised. Council should have a policy or requirement in place so developers bear cost.	See Action A4.6					
	A15.7	Develop guidelines for and require sediment and erosion control plans for all new developments	See Action A5.11					
	A15.8	Ensure that College View wetland is developed appropriately for stormwater treatment, for example sediment trap and design	O	2	$0	$2,000	DS	Construction Industry
	A15.9	Infringement notification and enforcement of planning permit conditions	See Action A4.7					
	A15.10	Determine applicability of different Water Sensitive Urban Design principles	See Action A4.9					
36	**A16**	**Salt Creek Sewer**						
	A16.1	Liaison with YVW to identify when and where sewerage upgrade works will be undertaken and where discharge enters waterways	See Action A7.1					
36	**A17**	**Salt Creek Construction (General subdivision)**						
	A17.1	Develop developers referrals checklist indicating the organisations, which are required to review and/or approve any construction activity, in order of sequence.	See Action A3.2					
	A17.2	Develop Council referrals checklist indicating the council departments, which are required to review and/or approve any construction activity, in order of sequence.	See Action A3.3					
	A17.3	Increased frequency of audits and inspections of development sites	See Action A3.10					
	A17.4	Workshops for council planning and engineering staff to educate staff on approval process and best management practice.	See Action A3.5					
	A17.5	Information workshops for developers, builders, contractors and consultants. Cover aspects such as the approval process, best practice management etc.	See Action A3.6					
	A17.6	Require developers to clean drainage system & not connect to system until land is stabilised (cost is borne as part of improved audit and inspections process)	See Action A4.6					
	A17.7	Develop guidelines for and require sediment and erosion control plans for all new developments	See Action A5.1					
	A17.8	Infringement notification and enforcement of planning permit conditions	See Action A4.7					
	A17.9	Determine applicability of different Water Sensitive Urban Design principles	See Action A4.9					

A summary of Council's costings for budgeting purposes over the next 5 years is provided in Table 8.4 below.

■ **Table 8.4 Summary of Reactive Management Strategies Costings for Council over a five year period.**

Strategy	Capital	Ongoing
A1 – Commercial litter, Plenty River Upper	$220,600	$20,000
A2 – Road Runoff (Metropolitan Ring Road, Greensborough Bypass) Plenty River (Upper)	$15,000	$14,000
A3 - Yallambie Creek (Construction)(Cascades Development)	$79,000	$8,000
A4 - Yarra Construction (General subdivision)	$165,000	$16,000
A5 - Plenty River (Lower) Construction (Cleveland Ave, Lakeside Drive, new developments)	$0	$3,000
A6 - Darebin Creek (North) Industrial (various)	$303,500	$22,000
A7 - Yarra Sewer	$0	$0
A8 - Darebin Creek (South) Degraded Waterways (east bank slumping)	$52,000	$7.,000
A9 - Darebin Creek (North) Degraded Waterways (east bank slumping)	$0	$0
A10 - Plenty River (Lower) Residential (all areas)	$25,000	$8,000
A11 - Banyule Creek Residential (all areas)	$10,000	$1,000
A 12- Plenty River (Upper) Residential (all areas)	$22,000	$7,000
A13 - Banyule Creek Road Runoff	$0	$0
A14 - Salt Creek Degraded Waterways (Various)	$0	$0
A15 - Bundoora Construction (College Views development	$0	$2,000
A16 - Salt Creek Sewer	$0	$0
A17 - Salt Creek Construction (General subdivision)	$0	$0
TOTAL	**$892,100**	**$108,000**

9. Management Framework Strategies

Based on the review of Council's management framework, a number of recommendations have been made to incorporate Best Practice Stormwater Management into Council's planning and management activities, these are summarised in Table 9.1. Many of these recommendations can be implemented by modifying or improving existing Council planning and management practices. Where recommendations require changes to Council documents (eg the MSS) or planning scheme, these changes can be made when opportunities arise as part of scheduled regular revisions.

■ **Table 9.1 Council management framework strategies.**

■

Purpose	Strategy No.	Action	Priority
Strategy B1 - Assign Accountability for Stormwater Management			
Assign accountability and establish implementation structures	**B1.1**	Council should assign responsibility for implementation of *the Banyule Stormwater Quality Management Plan* to the appropriate Council manager. The area of responsibility nominated by the Steering Committee was Strategic and Economic Unit.	Very High
	B1.2	A *Banyule Stormwater Quality Management Plan* Implementation Committee should be established with representation across Council functions: • The Chair should be the project leader from Strategic and economic Unit. • The group should have high level management support with attendance by appropriate managers as required. • The group should be charged with detailed implementation of the *Banyule Stormwater Management Plan*.	Very High
Ensure that stormwater management plan implementation is taken up across the Council organisation	**B1.3**	The responsible officer and *Banyule Stormwater Quality Management Plan* Implementation Committee should: • Clarify stormwater management roles both internal and external to Council for inclusion in the Corporate Plan. • Assign or confirm and monitor responsibility for implementation tasks. • Refine and monitor task priorities and costings for departments of Council (with managers), allowing for ongoing review. • Review Council practices for best practice. • Seek updated information on external stormwater programs and share this information. • Sponsor forums, education and training programs for Council staff. • Report committee activities and implementation progress on a regular basis, eg. quarterly, to senior management and Council. • Report longer term success of the plan.	Very High
Continue ownership and contribution by Stormwater Initiative partners and other non-Council stakeholders	**B1.4**	Council should initiate cross-catchment accountability for municipal stormwater management plans with other Councils in the relevant catchments.	High
	B1.5	Council should initiate liaison and co-ordination with waterway Friends groups.	High
Design a monitoring program to evaluate the longer term success of the Banyule Stormwater Management Plan	**B1.6**	The responsible officer and *Banyule Stormwater Quality Management Plan* Implementation Committee should monitor waterway quality through the use of existing monitoring data and locally designed methods: • Use Melbourne Water annual reporting for waterways. • Use Melbourne Water incident logs. • Use Waterwatch data • Use EPA via the Pollution Watchline • Use annual clean up records, although these are not specific to waterways. • Visually monitor waterways and water bodies for signs of change, eg. blue-green algae, streambank stability, etc. (by Council or Friends groups). • Identify 'hot spots', priorities and areas where improvements have been	Very High

Purpose	Strategy No.	Action	Priority
		made.	
Make the best use of in-house environmental understanding and expertise	**B1.7**	Council should undertake a skills audit of staff and make best use of relevant skills in the implementation of the *Banyule Stormwater Management Plan*: • In addition to pre-existing skills, use skills and understanding development through attendance at the Stormwater Management Plan Project Working Group. • Assign roles and responsibilities to Council departments and staff, eg. as a point of contact for developers. • Prepare a directory of staff skills. • Identify knowledge gaps and use this information to enhance skills, prepare staff development programs and support multi-tasking of staff.	High
Strategy B2 - Strategic Planning			
Place stormwater management plan actions in their broader strategic context	**B2.1**	Council should incorporate stormwater management plan actions in the Banyule Corporate Plan and other strategic documents as relevant.	Very High
	B2.2	Council should publicise the achievement of environmental improvements including the implementation of stormwater management plan actions: • Raise the profile of the *Banyule Stormwater Quality Management Plan* and related planning efforts, eg catchment management plans, waterway management plans, etc. • Publicise to the organisation, amongst Councillors and in the community.	Very High
Incorporate best practice stormwater management into strategic planning documents	**B2.3**	Council should incorporate relevant information from the *Urban Stormwater Best Practice Environmental Management Guidelines (VSC,1999)* and the *Banyule Stormwater Quality Management Plan* where appropriate. Focus on: • Project design and layout. • Use of public open space buffers along waterways. • Protection of waterway values and flood areas. • Sediment and erosion control structures. • Site development and construction practices. • Use of landscaping species. • Management of ongoing land use operations and activities.	Very High
Use other organisations' expertise in addressing strategic initiatives	**B2.4**	Council should use available resources at NRE, MWC, EPA, Darebin Creek Management Committee, VicRoads, Department of Infrastructure, etc. through referral, co-ordination and partnership.	Very High
Strategy B3 - Integration with Council Projects and Processes			
Council should provide an advocacy and leadership role for best practice implementation	**B3.1**	Council should improve stormwater management outcomes (and by extension the treatment of waterways) in Council's own designs and operations.	Very High
	B3.2	Council should require the use of environmental specifications or formal Environmental Management Plans as appropriate for Council leases, contracts and program activities.	Very High
	B3.3	Council should amend the regular practices of its operations where these can contribute to improved stormwater management outcomes. Eg. Washdown of hard standing areas of maintenance depots, road construction	Very High
Council should instigate a more effective handover of assets procedures	**B3.4**	Council should instigate quarterly meetings between the strategic, design, construction and operations groups to facilitate a more effective handover of both developer and Council constructed assets.	Very High
Strategy B4 - Landuse Management, Planning Scheme and Approvals			
Integrate the stormwater management plan into Council's planning scheme to give it legal status	**B4.1**	Council should amend the Banyule Planning Scheme to give statutory effect to the *Banyule Stormwater Quality Management Plan.*	High – with next Planning Scheme review
Integrate the detention systems policy and guidelines into Council's planning scheme to give it legal status	**B4.2**	Council should formalise the draft *Detention Systems Policy and Guidelines* document and include it into the Banyule Planning Scheme and local planning policies to give it statutory effect.	High – with next Planning Scheme review

Purpose	Strategy No.	Action	Priority
Use the Banyule Stormwater Quality Management Plan to improve the environmental performance of new developments	**B4.3**	Council should establish environmental performance standards for stormwater management as part of the Banyule planning approvals process: • Consider use of an internal checklist. • Focus on both site establishment and the ongoing management of site activities: • Set policy to require a site management plan. This will reduce workload of council staff. Require plan to be endorsed by an independent and registered environmental auditor, • Provide consistency in the approach to be achieved, eg. set policy requirements, use standard assessment forms, use existing information about environmental values, etc.	Very High
	B4.4	Council should co-ordinate this assessment with other council and non-Council statutory approvals, eg. State planning policy requirements, local infrastructure works, Melbourne Water approvals, etc.	Very High
	B4.5	Following the assessment, Council should use best practice stormwater management as a basis for negotiating improved proposals.	Very High
	B4.6	Council should translate best practice stormwater management into standard or tailored conditions on planning approvals.	Very High
	B4.7	Council should modify its engineering or infrastructure specifications to improve subdivision and works design for developments in accordance with best practice stormwater management, eg. requirements of the Urban *Stormwater Best Practice Environmental Management Guidelines (VSC,1999)* and the *Banyule Stormwater Quality Management Plan*.	Very High
Assist developers to understand stormwater management and to achieve best practice solutions	**B4.8**	Council should develop standards for Environmental Management Plans and other plans submitted for planning approval where these are required.	Very High
	B4.9	Council should provide assistance on its other requirements intended to improve the stormwater performance of projects.	Very High
Strategy B5 - Application of Local Laws			
Use a local law where possible to assist local environmental requirements and the Council's enforcement of these	**B5.1**	Council should use a local law to require an Environmental Management Plan to cover all forms of the site construction management, including building locations where no planning approval is required. For example, the Environmental Management Plan would address: • Site landforming and vegetation removal. • Materials delivery, handling and storage. • Sediment and erosion control structures. • Waste products. • Transport vehicles. • Site dewatering.	High
	B5.2	Council should actively support State Government regulation of site development and building construction to reduce off site impacts. Council should fill any gaps in what is regulated or required with a local law. Council should also tap into work already undertaken by the City of Casey under a VSAP funded project on site management plans and subdivisional controls.	High
Use a local law in conjunction with education programs for ongoing land use activities	**B5.3**	Council should use a local law preferably tied to an Environmental Management Plan to cover business and industry site operations. For example: • Materials storage. • Waste management and litter control. • Use of water and fertilisers.	High
	B5.4	Council should use a local law to cover littering across the municipality.	High
	B5.5	During scheduled reviews of Council's local laws, Council should maximise opportunities to integrate stormwater management plan options.	Medium
Assist other parties to understand stormwater management and to achieve best practice solutions	**B5.6**	Council should develop standards for Environmental Management Plans submitted under local laws.	High
Strategy B6 - Council Management Infrastructure/Program Operations			
Incorporate best practice stormwater management into Council projects and processes	**B6.1**	Council to utilise existing environmental expertise in the organisation, or external resources where needed, to improve stormwater management outcomes (and by extension the treatment of waterways) in Council's own designs and operations.	Very High
	B6.2	Council to require use of environmental specifications or formal site specific management plans as appropriate for Council contracts and program activities.	Very High

Purpose	Strategy No.	Action	Priority
	B6.3	Council to amend the regular practice of its operations where these can contribute to improved stormwater management outcomes. Eg. Washdown of hard standing areas of maintenance depots, road construction	Very High
Strategy B7 - Education and Enforcement			
Target actions of business, industry, developers and residents to improve stormwater quality	**B7.1**	Council to create or extend current education and enforcement activities and to target activities identified as high-risk threats in the stormwater management plan. Co-ordinate Council programs.	High
	B7.2	Council to use its inspection and enforcement resources more effectively to improve stormwater management outcomes. Council to review available formal or informal inspection and enforcement resources. Council to reallocate as required to further *Banyule Stormwater Management Plan* Implementation.	Very High
	B7.3	Council to co-ordinate its education and enforcement programs with those of other authorities and organisations.	High
Strategy B8 - Build on Partnerships with other organisations			
Expand alliances with other partners in the Stormwater Initiative	**B8.1**	Council should continue its working relationship with Melbourne Water, the EPA, Darebin Creek Management Committee, neighbouring municipalities and the Municipal Association of Victoria.	Very High
Use co-ordination to secure plan implementation and assistance with any problems	**B8.2**	Council should build on other State Government and community partnership opportunities to implement the *Banyule Stormwater Management Plan.*	Very High
Improve co-ordination across the catchments	**B8.3**	Council should develop cross-catchment opportunities for implementation of the *Banyule Stormwater Management Plan*, eg. co-ordination with adjoining municipalities (especially Darebin)	Very High
Improve co-ordination of development outcomes	**B8.4**	Council should enhance the use of Planning Scheme referral and notice provisions to other authorities and organisations in order to obtain more co-ordinated project outcomes and utilise their skills when requiring better outcomes for stormwater management. This could be achieved by developing a 'map' of the referral process	Very High

9.1 Best practice guidelines and documents

A range of best practice guidelines and documents are available to the Council, other stakeholders and people involved in the development and construction industry to aid in best practice management. There are also organisations that provide regular information on stormwater management issues, seminars and technological advances. The following list provides details on some of these information sources

Guidelines

Cooperative Research Centre for Catchment Hydrology (1998). A decision support system for determining appropriate trapping strategies for gross pollutants. Research Report 98/3 (Available from CRC).

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Useful Internet Pages

CRC for Catchment Hydrology www.catchment.crc.org.au
Department of Infrastructure www.doi.vic.gov.au
Victorian Environment Protection Authority www.epa.vic.gov.au
NSW Environment Protection Authority www.epa.nsw.gov.au
Melbourne Water www.melbournewater.com.au

Current Research

Improving Building & Construction Practices For Stormwater Quality Protection

This 18 month pilot project will develop, test and disseminate a range of education, enforcement and auditing resources to reduce stormwater contaminants from building and construction sites. The pilot sites are located in Melbourne however, the materials and methods will be developed for statewide application and all other councils will be encouraged to join the program.

See VSAP for information

Associations

Stormwater Industry Association Inc. 1800 761 777
(director@stormwater.industry.com)

International Erosion Control Association Australasian Chapter.

10. Implementation and review

The effectiveness of the Banyule Stormwater Quality Management Plan is dependent upon the Council's ability to implement the recommendations of the plan. The following provides a framework for assisting Council by providing guidance on how to resource and co-ordinate the implementation of the Stormwater Quality Management Plan.

10.1 Responsibility for Implementation

Implementation of the Stormwater Quality Management Plan should follow the recommended strategies identified. In order to effectively co-ordinate the implementation of these strategies Council must assign a staff member with responsibility for co-ordinating implementation.

To assist the Co-ordinator, an Implementation Committee should also be established. This committee would ideally consist of representatives from all sections of Council relevant to stormwater management including, planning, engineering and infrastructure, parks and gardens, waste management services and health services. Relevant personnel from outside agencies, such as Melbourne Water and the EPA could also be included in the Implementation Committee's on an as needed basis where there assistance is required, for say joint programs. The Implementation Committees role would be to oversee and co-ordinate the progressive implementation of the plan's strategies or actions at a bi-yearly review.

It is also recommended that council representatives of the project steering committee established for the development of this Stormwater Quality Management Plan be maintained to act in a review role during the implementation of the plan.

10.2 Implementation process

A suggested time frame for implementation has been provided for each of the strategies identified in the Reactive Management Strategies. Typically, low cost strategies have been recommended for immediate implementation while higher costs strategies are recommended for implementation over a longer period of time, depending upon funding availability.

The implementation of strategies can be flexible depending upon funding availability, however it is recommended that a schedule for implementation be established to assist in determining funding requirements over the implementation stages of the plan. This schedule should be reviewed annually and as different funding sources become available.

10.3 Monitoring and review

The effectiveness of the SWMP should be measured with a comprehensive monitoring and review program. There are two levels to this program:

- Monitoring of the implementation of strategies and progress against the plan objectives; and
- Monitoring of the effectiveness of strategies at improving the quality of stormwater runoff and protection and enhancement of the values of receiving environments.

The Implementation-Monitoring Program should establish milestones for implementation progress and should be reviewed on an annual basis. The Project Steering Group can provide a review role for determining the effectiveness of implementation.

Detailed reporting should be conducted to inform the community and other stakeholders of the effectiveness of the strategies in the Stormwater Management Plan. Initially, reporting could be conducted 6-monthly as the plan is implemented and then annually once strategies have been implemented, to report on progress and effectiveness of strategies at addressing stormwater issues.

10.4 Funding options

The full implementation of all strategies identified in the Stormwater Quality Management Plan requires a significant funding commitment. Many of the strategies may be implemented at a cost much reduced from that indicated through modification to current Council procedures and the use of in-house resources.

There is a range of funding options outside of Council's own budget. The Victorian Government through the Victorian Stormwater Action Program (VSAP) is providing grants to local Councils for the implementation of strategies identified in Stormwater Management Plans. This Stormwater Quality Management Plan has been prepared according to VSAP guidelines such that funding can be requested for strategies identified. Funding under the VSAP grants program is available for strategies such as education programs, structural treatment measures, assistance with planning scheme amendments, feasibility studies and monitoring programs with up to 50% of the eligible cost available. Funding is not available for providing salaries to Council staff, however salaries are considered an 'in-kind' contribution.

Many of the activities proposed may provide mutual benefit to waterways and assets managed by Melbourne Water. Additional funding or assistance through technical input should be sought from Melbourne Water on projects considered of relevance, for example the construction of pollutant traps and public education material.

New funding opportunities arise from time to time and the designated stormwater coordinator should ensure they are familiar with all funding options.

11. Summary

The development of Banyule City Council's *Stormwater Quality Management Plan* provides Council with the strategic basis for improved stormwater management and hence improved environmental condition for waterways and wetlands in the Banyule area. The plan has been developed according to the requirements of the Victorian Stormwater Committee and in close consultation with Council officers, Melbourne Water, Environment Protection Authority and other key stakeholders through a rigorous consultative process, which included regular meetings and workshops. This has ensured that the strategies identified in the plan are considered by Council and stakeholders to be the most relevant for addressing urban stormwater issues in the Banyule region. Adherence to the requirements of the Victorian Stormwater Committee also ensures that the plan provides the appropriate support necessary for successful funding for strategies identified in the plan.

The success of the initiatives identified in the plan is dependent on Council's commitment to establish the recommended framework for implementation. The ultimate success of the plan will be evident when stormwater management is fully integrated into Council's management framework.

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Appendix A Sensitivity Criteria

The following tables provide details of the process for determining the sensitivity factor for each threat x value combination in the risk assessment process. These notes provide additional information on the specific criteria used.

- Primary and Secondary Contact Recreation are considered beneficial uses of a waterway under EPA State Environmental Protection Policies. These policies are referred to in determining the sensitivity for each waterway. For example, primary contact recreation activities are those where there is likely to be complete emersion eg swimming, water skiing etc. Secondary contact recreation activities are those where there is likely to be some contact with water but not full emersion eg fishing, boating.
- Water supply is a beneficial use of a waterway under EPA State Environmental Protection Policies. Beneficial uses include potable water supply, stock watering and irrigation.
- The impacts of upstream inflows depend upon the particular pollutants present. The sensitivity from upstream inflows is dependent upon the degree or extent that a particular activity in upstream catchments is occurring and the ability of the stream system to transmit these impacts to downstream reaches.
- Where multiple pollutants are present the impacts can be cumulative so the overall sensitivity of a value from a particular threat or activity increases. For example, the sensitivity of a value to industrial runoff is likely to be higher than the sensitivity to residential runoff because there is a greater probability that industrial runoff will contain a broader range of toxicants.
- The more concentrated a pollutant the greater the sensitivity. For example, the volume of sediment in runoff from construction sites is much greater than that from general residential runoff.

Sediment

Value	Sub-value	Impact	Sensitivity
Environmental	Instream	Overall water quality and instream flora and fauna are generally highly sensitive to sedimentation. The severity of the impact depends upon the current conditions experienced by the community. For example, instream communities in a river with naturally high turbidity and sediment load will be less sensitive to sediment inputs compared to a river or creek with naturally clear waters	Mod. to very high depending on current condition of receiving environment and beneficial use.
	Riparian	Riparian vegetation is generally not impacted upon by sediment load in adjacent waterways. The deposition of sediment on the floodplain during a flooding event can smother vegetation if large loads are present, although sediment deposition also contributes to the fertility of the floodplain by depositing nutrients bound the sediment particles	Low
Cultural	Indigenous	Archaeological sites are generally located high on banks rather than in the stream channel, although fish traps can be located in low lying areas and would be prone to burial if excess sediment is being deposited in the stream channel	Low to Mod. depending upon specific type eg sites located on banks v sites located in the channel
	Non-indigenous	Non-indigenous cultural sites are generally buildings that are not impacted upon be excess sediment	Low
Amenity	Primary Contact Recreation	Primary contact recreation can involve complete emersion in the water. Excess sediment and turbidity can reduce the suitability of a waterway for primary recreation contact.	Mod. to very high depending on beneficial use.
	Secondary Contact Recreation	Secondary and passive recreational activities and visual amenity are compromised by high sediment loads and excessive turbidity	High
	Passive recreation / visual amenity		
Economic	Water supply	Excess sediment and turbidity can severely impact upon the value of water for water supply purposes and results in the increases in treatment costs.	Low to very high depending upon beneficial use.
	Tourism	Clean water for swimming etc is highly valued by tourists.	High
	Flood prevention & asset protection	Excess sediment can accumulate in drains and pipes reducing pipe capacity and contributing to flooding	High to very high depending upon the design capacity of the drainage system and the degree of threat

Litter

Value	Sub-value	Description	Sensitivity
Environmental	Instream	Excessive litter can entangle wildlife but does generally not impact upon instream flora and fauna. The severity of the impact depends upon the likely presence of susceptible species eg platypus, fish, birds.	Mod.
	Riparian	Litter per se does generally not impact upon riparian vegetation, although excessive litter build-up on banks can prevent regeneration and damage plants.	Low to Mod.
Cultural	Indigenous	Litter does not directly impact upon Cultural and heritage sites.	Low
	Non-indigenous		
Amenity	Primary Contact Recreation	Highly sensitive	Low to very high depending on beneficial use
	Secondary Contact Recreation	Highly sensitive	High
	Passive recreation / visual amenity	Excess litter has a very high impact upon the visual amenity of an area.	Very high
Economic	Water supply	Excess litter can impact upon the value of water for water supply purposes and results in the increases in treatment costs.	Low to very high depending on beneficial use
	Tourism	Clean water for recreational activities and amenity is highly valued by tourists.	Very high
	Flood prevention & asset protection	Excess litter can accumulate in drains and pipes reducing pipe capacity and contributing to flooding	High to very high depending upon the design capacity of the drainage system and the degree of threat

Nutrients

Value	Sub-value	Description	Sensitivity
Environmental	Instream	Excessive nutrient can contribute to the development of nuisance plant growth and algal blooms. Blue-green algal blooms can produce toxins that impact upon instream fauna and other values.	Very high
	Riparian	Excess nutrients per se do generally not impact upon riparian vegetation, although high nutrient levels can promote weed growth.	Mod.
Cultural	Indigenous	Cultural and heritage sites are not impacted upon directly by excessive nutrients.	Low
	Non-indigenous		
Amenity	Primary Contact Recreation	Excessive nutrients that contribute to nuisance plant growth can impact upon the ability to use a waterbody for primary and secondary recreation. Blue-green algal blooms result in the closure of waterbodies for all recreation activities where there may be the possibility of contact with humans and other animals.	Low to very high depending on beneficial use
	Secondary Contact Recreation		
	Passive recreation / visual amenity	Nuisance plant growth and algal blooms can impact upon the visual amenity of a waterbody and create odours that detract from passive enjoyment	Very high
Economic	Water supply	Excess nutrients can impact upon the value of water for water supply purposes and results in the increases in treatment costs. Toxins due to blue-green algal blooms can prevent water being used for a range of purposes	Low to very high depending on beneficial use
	Tourism	Clean water for recreational activities and amenity is highly valued by tourists.	Very high
	Flood prevention & asset protection	Excessive plant growth as a result of excess nutrients can potentially block pipes and drains and contribute to flooding problems.	High to very high depending upon the design capacity of the drainage system and the degree of threat

Toxicants (heavy metals, surfactants, oil/grease, pesticides)

Value	Sub-value	Description	Sensitivity
Environmental	Instream	Toxicants can have a particularly severe impact upon instream fauna, even in small concentrations.	Very high
	Riparian	Some toxicants may impact upon riparian vegetation if present in large quantities in overland flow.	Mod.
Cultural	Indigenous	Cultural and heritage sites are not impacted upon directly by toxicants.	Low
	Non-indigenous		
Amenity	Primary Contact Recreation	Excessive toxicants can make water unsuitable for primary and secondary contact recreation and in high concentrations, access to waterbodies for recreation may be restricted.	Low to very high depending on beneficial use
	Secondary Contact Recreation		
	Passive recreation / visual amenity	Toxicants can impact upon the visual amenity of a waterbody and create odours that detract from passive enjoyment (eg oil slicks)	Very high
Economic	Water supply	Toxicants can impact upon the value of water for water supply purposes and results in the increases in treatment costs or prevent water from being used for a range of purposes	Low to very high depending on beneficial use
	Tourism	Clean water for recreational activities and amenity is highly valued by tourists.	Very high
	Flood prevention & asset protection	Excessive toxicants are unlikely to impact upon the ability of the stormwater system to convey flood flows, however highly corrosive material could damage pipes and other infrastructure.	Low

Organic material and other oxygen demanding material

Value	Sub-value	Description	Sensitivity
Environmental	Instream	Excessive organic material depletes oxygen and can be detrimental to instream fauna. Severe oxygen depletion can occur following runoff after long periods of dry weather if there has been a build up of organic material in the stormwater drainage system.	Mod.
	Riparian	High organic material is unlikely to impact upon riparian vegetation	Low
Cultural	Indigenous	Cultural and heritage sites are not impacted upon directly by organic material.	Low
	Non-indigenous		
Amenity	Primary Contact Recreation	Excessive organic material can make water unsuitable for primary and secondary contact recreation at times, although this is dependent upon the buildup of material and the frequency of rainfall events.	Low to very high depending on beneficial use
	Secondary Contact Recreation		
	Passive recreation / visual amenity	Excessive organic material can impact upon the visual amenity of a waterbody and create odours that detract from passive enjoyment (eg oil slicks)	High
Economic	Water supply	Organic material can impact upon the value of water for water supply purposes and results in the increases in treatment costs, especially if the organic material is in a particulate form.	Low to very high depending on beneficial use
	Tourism	Clean water for recreational activities and amenity is highly valued by tourists.	High
	Flood prevention & asset protection	Excessive organic material in its particulate form (leaves branches etc) can block pipes and contribute to flooding.	Very high

Microbiological contamination

Value	Sub-value	Description	Sensitivity
Environmental	Instream	Microbiological contamination can have a range of impacts on instream fauna. Waterfowl, fish and other animals may be susceptible to particular bacteria eg Botulism. The degree of impact depends on the particular pathogen, its source and concentration.	Low to high depending on potential for sewer overflows, septic tank effluent or other sources of contamination
	Riparian	Unlikely to have detrimental impact	Low
Cultural	Indigenous	No detrimental impact	Low
	Non-indigenous		
Amenity	Primary Contact Recreation	Microbiological contamination has a significant impact upon recreational activities. Excessive contamination can impact upon human health and lead to the closure of waterways to certain activities.	Mod. to very high depending on beneficial use and mostly related to rainfall events
	Secondary Contact Recreation		
	Passive recreation / visual amenity	Passive recreation and visual amenity are unlikely to be directly impacted upon by microbiological contamination, although aspects of the environment, such as the presence of waterfowl etc, that contribute to amenity will be impacted upon as indicated above. Depending upon the source of contamination odours can be associated with microbiological contamination.	Mod.
Economic	Water supply	Microbiological contamination can impact upon the value of water for water supply purposes and results in the increases in treatment costs, especially if the organic material is in a particulate form.	Low to very high depending on beneficial use
	Tourism	Clean water for recreational activities and amenity is highly valued by tourists.	High
	Flood prevention & asset protection	Microbiological contamination will not impact upon flood prevention.	Low

Flow and erosion

Value	Sub-value	Description	Sensitivity
Environmental	Instream	Increased flow as a result of rapid runoff can cause bank erosion that contributes to sedimentation and turbidity. Erosion around outfalls also contribute to sedimentation. The impacts are similar to that for sediment.	Mod. to very high
	Riparian	Increased flow and erosion of outlets can have a significant impact upon bank stability and riparian vegetation and channels can become wider or more incised.	Very high
Cultural	Indigenous	Bank erosion can threaten cultural and heritage sites depending upon their exact locations.	Low to very high depending upon location
	Non-indigenous		
Amenity	Primary Contact Recreation	Bank erosion can restrict access and create dangerous conditions that threaten safety for both primary and secondary recreational contact activities.	Low to very high depending on beneficial use
	Secondary Contact Recreation		
	Passive recreation / visual amenity	Excessive bank erosion can threaten pathways and flooding can restrict access at times impacting upon passive recreational opportunities and amenity	Mod. to High
Economic	Water supply	Similar impact to sedimentation	Low to very high depending on beneficial use
	Tourism	Excessive erosion and waterway degradation can reduce tourism potential.	High
	Flood prevention & asset protection	Excessive erosion can threaten public and private assets and contribute to increased maintenance costs.	Very high

Appendix B Risk Assessment Matrices

Bundoora				Residential	Industrial	Commercial	Construction	Roads	Sullage/septic	Sewer	Open spaces	Degraded waterways	**Values most threatened**
				3	**2**	**1**	**4**	**4**	**1**	**1**	**1**	**1**	
VALUE	Environmental	Instream	**3**	9	6	3	36	24	3	3	6	3	**93**
		Riparian	**3**	18	6	3	12	12	3	3	3	3	**63**
	Cultural	Indigenous	**1**	3	2	1	4	4	1	1	1	1	18
		Non-Indigenous	**1**	3	2	1	4	4	1	1	1	1	18
	Amenity	Recreational	**2**	18	4	4	8	8	2	2	4	2	52
		Visual / Passive	**2**	18	4	4	24	8	2	2	4	2	**68**
	Economic	Flood protection	**1**	3	2	1	8	4	1	1	1	1	22
		Tourism	**1**	3	2	1	4	4	1	1	1	1	18
	Greatest threats			**75**	28	18	**100**	**68**	14	14	21	14	

Very high priority | High priority | Moderate priority | Low priority

Plenty River (Upper)				Residential	Industrial	Commercial	Construction	Roads	Sullage/septic	Sewer	Open spaces	Degraded waterways	**Values most threatened**
				3	**2**	**4**	**2**	**4**	**1**	**1**	**3**	**2**	
VALUE	Environmental	Instream	**4**	36	24	32	16	64	4	8	24	16	**224**
		Riparian	**4**	12	8	32	8	16	4	4	24	16	124
	Cultural	Indigenous	**4**	12	8	16	8	16	4	4	12	8	88
		Non-Indigenous	**4**	12	8	16	8	16	4	4	12	16	96
	Amenity	Recreational	**3**	18	12	24	12	24	6	6	18	12	**132**
		Visual / Passive	**4**	24	8	64	16	32	4	8	24	24	**204**
	Economic	Flood protection	**3**	9	6	24	12	12	3	3	9	6	84
		Tourism	**3**	18	6	48	12	24	3	3	9	6	129
	Greatest threats			**141**	80	**256**	92	**204**	32	40	132	104	

Very high priority | High priority | Moderate priority | Low priority

St. Helena				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		Values most threatened
				3		**1**		**2**		**4**		**2**		**1**		**1**		**2**		**1**		
VALUE	Environmental	Instream	**3**		2		2		1		2		2		2		2		2		3	
				18		6		6		24		12		6		6		12		9		**99**
		Riparian	**3**	9	1	3	1	6	1	12	1	6	1	3	1	3	1	6	1	3	1	51
	Cultural	Indigenous	**2**	6	1	2	1	4	1	8	1	4	1	2	1	2	1	4	1	2	1	34
		Non-Indigenous	**2**	6	1	2	1	4	1	8	1	4	1	2	1	2	1	4	1	2	1	34
	Amenity	Recreational	**2**	12	2	2	1	8	2	16	2	4	1	6	3	6	3	8	2	4	2	**66**
		Visual / Passive	**2**	12	2	2	1	8	2	16	2	4	1	4	2	4	2	8	2	6	3	**64**
	Economic	Flood protection	**1**	3	1	1	1	2	1	4	1	2	1	1	1	1	1	2	1	1	1	17
		Tourism	**1**	3	1	1	1	2	1	4	1	2	1	1	1	1	1	2	1	1	1	17
	Greatest threats			**69**		**19**		**40**		**92**		**38**		**25**		**25**		**46**		**28**		

Very high priority | High priority | Moderate priority | Low priority

Yallambie Creek				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		Values most threatened
				4		**1**		**1**		**4**		**1**		**1**		**1**		**2**		**2**		
VALUE	Environmental	Instream	**4**		2		2		1		4		2		3		3		2		3	
				32		8		4		64		8		12		12		16		24		**180**
		Riparian	**4**		2		2		2		2		1		2		2		1		1	
				32		8		8		32		4		8		8		8		8		**116**
	Cultural	Indigenous	**2**	8	1	2	1	2	1	8	1	2	1	2	1	2	1	4	1	4	1	34
		Non-Indigenous	**2**	8	1	2	1	2	1	8	1	2	1	2	1	2	1	4	1	4	1	34
	Amenity	Recreational	**3**	12	1	3	1	6	2	24	2	3	1	6	2	6	2	12	2	6	1	78
		Visual / Passive	**3**	24	2	3	1	9	3	36	3	6	2	6	2	6	2	12	2	18	3	**120**
	Economic	Flood protection	**2**	8	1	2	1	4	2	16	2	2	1	2	1	2	1	4	1	4	1	44
		Tourism	**2**	8	1	2	1	2	1	8	1	2	1	2	1	2	1	4	1	4	1	34
	Greatest threats			**132**		30		37		**196**		29		40		40		64		72		

Very high priority | High priority | Moderate priority | Low priority

Plenty River (Lower)				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		**Values most threatened**
				3		**1**		**1**		**3**		**1**		**3**		**1**		**3**		**2**		
VALUE	Environmental	Instream	**4**		3		4		2		4		3		3		3		3		4	
				36		16		8		48		12		36		12		36		32		**236**
		Riparian	**4**		1		2		2		2		1		1		1		2		2	
				12		8		8		24		4		12		4		24		16		112
	Cultural	Indigenous	**3**		1		1		1		2		1		1		1		2		3	
				9		3		3		18		3		9		3		18		18		84
		Non-Indigenous	**3**		1		1		1		2		1		1		1		2		3	
				9		3		3		18		3		9		3		18		18		84
	Amenity	Recreational	**4**		3		3		3		3		1		3		3		2		3	
				36		12		12		36		4		36		12		24		24		**196**
		Visual / Passive	**4**		3		3		3		3		1		3		3		2		3	
				36		12		12		36		4		36		12		24		24		**196**
	Economic	Flood protection	**2**		2		1		3		2		1		1		1		1		1	
				12		2		6		12		2		6		2		6		4		52
		Tourism	**2**		3		3		3		3		1		2		2		1		1	
				18		6		6		18		2		12		4		6		4		76
	Greatest threats			**168**		62		58		**210**		34		**156**		52		**156**		140		

Very high priority High priority Moderate priority Low priority

Banyule Creek				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		**Values most threatened**
				3		**1**		**1**		**2**		**3**		**1**		**1**		**1**		**1**		
VALUE	Environmental	Instream	**4**		3		4		2		4		3		3		2		2		4	
				36		16		8		32		36		12		8		8		16		**172**
		Riparian	**4**		1		3		1		2		1		1		1		1		3	
				12		12		4		16		12		4		4		4		12		80
	Cultural	Indigenous	**4**		1		1		1		2		1		1		1		1		2	
				12		4		4		16		12		4		4		4		8		68
		Non-Indigenous	**4**		1		1		1		2		1		1		1		1		2	
				12		4		4		16		12		4		4		4		8		68
	Amenity	Recreational	**4**		2		3		3		3		2		2		3		2		3	
				24		12		12		24		24		8		12		8		12		**136**
		Visual / Passive	**4**		3		3		3		2		1		2		2		2		3	
				36		12		12		16		12		8		8		8		12		**124**
	Economic	Flood protection	**3**		2		1		3		3		1		2		1		1		2	
				18		3		9		18		9		6		3		3		6		75
		Tourism	**3**		1		3		3		2		1		1		1		1		3	
				9		9		9		12		9		3		3		3		9		66
	Greatest threats			**159**		72		62		**150**		**126**		49		46		42		83		

Very high priority High priority Moderate priority Low priority

Salt Creek				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		**Values most threatened**
				3		**1**		**3**		**3**		**4**		**1**		**4**		**2**		**3**		
VALUE	Environmental	Instream	**3**		3		4		2		4		3		3		3		2		4	
				27		12		18		36		36		9		36		12		36		**222**
		Riparian	**2**		1		2		2		2		1		2		1		1		2	
				6		4		12		12		8		4		8		4		12		**70**
	Cultural	Indigenous	**2**		1		1		1		1		1		1		1		1		2	
				6		2		6		6		8		2		8		4		12		54
		Non-Indigenous	**2**		1		1		1		1		1		1		1		1		2	
				6		2		6		6		8		2		8		4		12		54
	Amenity	Recreational	**1**		2		2		2		2		2		2		2		2		2	
				6		2		6		6		8		2		8		4		6		48
		Visual / Passive	**2**		3		2		3		2		2		2		2		2		3	
				18		4		18		12		16		4		16		8		18		**114**
	Economic	Flood protection	**1**		2		1		3		4		1		2		2		2		2	
				6		1		9		12		4		2		8		4		6		52
		Tourism	**1**		1		1		1		1		1		1		1		1		1	
				3		1		3		3		4		1		4		2		3		24
Greatest threats				78		28		78		**93**		92		26		**96**		42		**105**		

Very high priority | High priority | Moderate priority | Low priority

Darebin Creek North				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		**Values most threatened**
				3		**4**		**2**		**2**		**2**		**1**		**1**		**2**		**3**		
VALUE	Environmental	Instream	**3**		3		4		1		4		3		3		3		2		4	
				27		48		6		24		18		9		9		12		36		**189**
		Riparian	**3**		2		1		1		1		1		1		1		2		2	
				18		12		6		6		6		3		3		12		18		84
	Cultural	Indigenous	**4**		1		1		1		2		1		1		1		1		2	
				12		16		8		16		8		4		4		8		24		100
		Non-Indigenous	**2**		1		1		1		1		1		1		1		1		2	
				6		8		4		4		4		2		2		4		12		46
	Amenity	Recreational	**3**		2		3		3		3		2		2		2		2		3	
				18		36		18		18		12		6		6		12		27		**153**
		Visual / Passive	**3**		3		4		2		4		3		2		2		2		4	
				27		48		12		24		18		6		6		12		36		**189**
	Economic	Flood protection	**2**		2		1		1		2		1		1		1		1		2	
				12		8		4		8		4		2		2		4		12		56
		Tourism	**2**		2		3		3		3		2		1		1		1		1	
				12		24		12		12		8		2		2		4		6		82
Greatest threats				**132**		**200**		70		112		78		34		34		68		**171**		

Very high priority | High priority | Moderate priority | Low priority

Darebin Creek South				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		**Values most threatened**
				3		**2**		**3**		**2**		**2**		**1**		**3**		**2**		**3**		
VALUE	Environmental	Instream	**3**		3		4		1		4		3		3		3		2		4	
				27		24		9		24		18		9		27		12		36		**186**
		Riparian	**3**		2		1		1		1		1		1		1		2		2	
				18		6		9		6		6		3		9		12		18		87
	Cultural	Indigenous	**3**		1		1		1		2		1		1		1		1		2	
				9		6		9		12		6		3		9		6		18		78
		Non-Indigenous	**3**		1		1		1		1		1		1		1		1		2	
				9		6		9		6		6		3		9		6		18		72
	Amenity	Recreational	**3**		2		3		3		3		2		2		2		2		3	
				18		18		27		18		12		6		18		12		27		**156**
		Visual / Passive	**3**		3		4		2		4		3		2		2		2		4	
				27		24		18		24		18		6		18		12		36		**183**
	Economic	Flood protection	**2**		2		1		1		2		1		1		1		1		2	
				12		4		6		8		4		2		6		4		12		58
		Tourism	**2**		2		3		3		3		2		1		1		1		1	
				12		12		18		12		8		2		6		4		6		80
Greatest threats				**132**		100		105		**110**		78		34		102		68		**171**		

Very high priority | High priority | Moderate priority | Low priority

Yarra				Residential		Industrial		Commercial		Construction		Roads		Sullage/septic		Sewer		Open spaces		Degraded waterways		**Values most threatened**
				2		**1**		**2**		**3**		**2**		**1**		**3**		**3**		**1**		
VALUE	Environmental	Instream	**4**		3		4		3		4		2		3		3		2		4	
				24		16		24		48		16		12		36		24		16		**216**
		Riparian	**4**		2		1		1		1		1		1		1		2		2	
				16		4		8		12		8		4		12		24		8		96
	Cultural	Indigenous	**3**		1		1		1		2		1		1		1		1		2	
				6		3		6		18		6		3		9		9		6		66
		Non-Indigenous	**3**		1		1		1		2		1		1		1		1		2	
				6		3		6		18		6		3		9		9		6		66
	Amenity	Recreational	**4**		3		4		3		3		2		4		4		2		3	
				24		16		24		36		16		16		48		24		12		**216**
		Visual / Passive	**4**		3		4		4		4		3		3		3		2		4	
				24		16		32		48		24		12		36		24		16		**232**
	Economic	Flood protection	**3**		2		1		1		2		1		1		1		1		2	
				12		3		6		18		6		3		9		9		6		72
		Tourism	**3**		2		3		3		3		2		3		3		1		1	
				12		9		18		27		12		9		27		9		3		126
Greatest threats				**124**		70		**124**		**225**		94		62		**186**		**132**		73		

Very high priority | High priority | Moderate priority | Low priority

Appendix C Reactive Management Strategies

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
Risk	**Priority**	**Action**											
64	1	**Commercial Litter, Plenty River (Upper)**											
		Include Friend Groups in **monitoring** of GPT and release net rubbish	O	20	$0	$0	$0	20	VH	20	VH	M	0
		BCC to encourage 'policing' operations under the Victorian Litter Act (1987). Warnings instead of fines could be advocated as part of an education campaign	O	5	$2,000	$1,000	$7,000	100	M	5	VH	L	104
		Workshops for waste management and street cleaning personnel, parks, gardens and maintenance staff	E,O	1	$1,000	$10,000	$11,000	100	H	3	VH	M	116
		Signage for drains indicating drain number and EPA hotline to highlight link between catchment and litter (see drain inventory for locations)	E	5	$5,000	$1,000	$10,000	100	L	5	M	M	267
		Community education	E	2	$20,000	$5,000	$30,000	100	L	5	VH	M	444
		GPT (Model P1512) at Kalparrin Street drain at Plenty River (20J1). Right Bank. (PR/13, diameter 1350) or within Whatmough Park to avoid high flow redispursement of litter and ease of access	I	20	$55,000	$5,000	$155,000	20	VH	20	VH	VH	532
		Increase cleaning frequency of bins within Greensborough CBD	O	5	$0	$10,000	$50,000	80	M	5	VH	M	556
		GPT (Model P0912) at Joyce Avenue Outfall at Plenty River (M21A1). Right Bank. (PR/22, diameter 675). Access Issue. May be able to be installed in Greensborough carpark.	I	20	$37,500	$5,000	$137,500	15	VH	20	VH	VH	629
		GPT (Model P0912) at Kempston Street drain before Kalparrin Gardens (vacant area u/s). (M10G12). (Diameter Est. 600mm).	I	20	$37,500	$5,000	$137,500	15	VH	20	VH	VH	629
		Increase cleaning frequency of litter baskets in side entry pits around Greensborough CBD, Were Street and Watsonia Shops	O	5	$0	$10,000	$50,000	50	M	5	VH	M	889
		Release net at Poulter Avenue drain (M21A2). (Diameter Est. 525mm).	I	10	$9,400	$2,000	$29,400	10	VH	10	VH	L	1210
		Release net at Kempston Street drain before Kalparrin Gardens (vacant area u/s). (M10G12). (Diameter Est. 600mm).ONLY if funds limited for a GPT	I	10	$10,200	$2,000	$30,200	10	VH	10	VH	L	1243
		Release net at Patterson Cresent drain (M21A3). (Diameter Est. 750mm).	I	10	$12,000	$2,000	$32,000	10	VH	10	VH	L	1317
		Install Butt Bins at more locations near entrances to shopping centres	O	5	$10,000	$5,000	$35,000	5	M	5	VH	L	10370

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
64	2	**Road Runoff (Metropolitan Ring Road, Greensborough Bypass) Plenty River (Upper)**											
		Liaise with Vic Roads & ensure water sensitive road design for any upgrades	O	5	$1,000	$1,000	$6,000	100	M	5	VH	L	89
		Workshops for emergency and operations staff	O,E	5	$5,000	$5,000	$30,000	100	H	5	VH	VH	106
		Investigate options for retro fitting major highways with grass swales and detention structures designed to isolate spills	I	1	$10,000	$0	$10,000	100	M	10	L	I	222
		Provide signage indicating that litter and other runoff enters the Plenty River catchment	E	5	$5,000	$1,000	$10,000	100	L	5	M	M	267
		Conduct litter collection activities along freeway	I	20	$0	$10,000	$200,000	100	H	20	VH	M	317
		Update emergency response planning	E	5	$10,000	$2,000	$20,000	100	L	5	VH	L	494
		GPT (eg: Model P0912) at Kempston Street drain before Kalparrin Gardens (vacant area u/s). (M10G12). (Diameter Est. 600mm).	*I*	*20*	*$55,000*	*$5,000*	*$155,000*	*20*	*VH*	*20*	*VH*	*VH*	*532*
		Literature and guidelines for transport and freight industry	P	1	$15,000	$0	$15,000	100	H	1	M	H	612
64	3	**Yallambie Creek (Construction)(Cascades Development)**											
		Increase fines for developers contravening planning/environmental guidelines	O	10	$5,000	$0	$5,000	100	H	10	VH	VH	9
		Develop developers referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Develop Council referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Require silt fences around any soil stockpiles (immediate)	I	1	$5,000	$0	$5,000	50	H	5	L	VH	106
		Require stream bank silt fences and instream bales ASAP	I	1	$5,000	$0	$5,000	50	H	5	L	VH	106
		Workshops for council planning and engineering staff	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Information workshops for developers, builders, contractors and consultants using the site as an example	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Investigate and implement if feasible retrofit of the Yallambie retarding basin in Simpson Barracks into a wetland for stormwater treatment	I	20	$50,000	$5,000	$150,000	85	VH	20	VH	VH	121

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
		Infringement notification and enforcement of planning permit conditions	O	5	$10,000	$10,000	$60,000	100	VH	10	H	H	136
		Distribute guidelines for and require sediment and erosion control plans for all new developments	P,O	10	$20,000	$3,000	$50,000	100	M	10	H	H	204
		Increased frequency of audits and inspections of development site	O	5	$10,000	$20,000	$110,000	100	VH	10	H	H	249
		Circulation of the code of practice for protection of council assets and control of building sites	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
48	4	**Yarra Construction (General subdivision)**											
		Develop developers referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Develop Council referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Review local laws for applicability for stormwater enforcment	O	5	$5,000	$0	$5,000	100	H	5	H	H	29
		Workshops for council planning and engineering staff	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Information workshops for developers, builders, contractors and consultants using the site as an example	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Require developers to clean drainage system & not connect to system until land is stabilised (cost is borne as part of improved audit and inspections process)	E,O	5	$5,000	$5,000	$30,000	100	H	5	VH	M	190
		Infringement notification and enforcement of planning permit conditions	O	5	$10,000	$20,000	$110,000	100	VH	10	H	M	349
		Increased frequency of audits and inspections of development site	O	5	$10,000	$20,000	$110,000	100	VH	10	H	M	349
		Determine applicability of different WSUD principles		1	$5,000	$0	$5,000	100	L	2	H	L	397
		Distribute guidelines for and require sediment and erosion control plans for all new developments	I,O	5	$20,000	$5,000	$45,000	100	L	10	H	M	429
		GPT (Model P0912) at Hartland Road Outfall. (M32A9). (YR/13, diameter 825).	I	20	$37,500	$5,000	$137,500	20	VH	20	VH	VH	472
		GPT (Model P0912) at The Boulevard Outfall. (M32B6). (YR/16, diameter 825).	I	20	$37,500	$5,000	$137,500	20	VH	20	VH	VH	472
		Remediate wetlands near Banksia Street by altering drainage system and installing GPT (Model P1512) at Banksia Street Outfall. (M32C5). (YR/18, diameter 1350). prior to wetlands	I	20	$55,000	$5,000	$155,000	20	VH	20	VH	VH	532

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
48	5	**Plenty River (Lower) Construction (Cleveland St., Lakeside Drive, new developments)**											
		Increase fines for developers contravening planning/environmental guidelines	c	10	$5,000	$0	$5,000	100	H	10	VH	VH	9
		Develop developers referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Develop Council referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Construct wetlands within estates where appropriate	I	20	$50,000	$5,000	$150,000	85	VH	40	VH	VH	61
		Increased frequency of audits and inspections of development site	P,E	10	$15,000	$1,000	$25,000	100	L	20	VH	M	93
		Workshops for general public groups, council planning and engineering staff	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Information workshops for developers, builders, contractors and consultants using the site as an example	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Determine applicability of different WSUD principles		1	$5,000	$0	$5,000	100	L	5	VH	L	123
		Require developers to clean drainage system & not connect to system until land is stabilised (cost is borne as part of improved audit and inspections process)	I	1	$10,000		$10,000	100	VH	1	VH	VH	137
		Install temporary sediment traps at appropriate drainage outlets	E	5	$20,000	$20,000	$120,000	100	VH	10	VH	H	212
		Develop guidelines for and require sediment and erosion control plans for all new developments	P,O	5	$20,000	$3,000	$35,000	100	L	10	H	H	238
		Infringement notification and enforcement of planning permit conditions	E	5	$10,000	$10,000	$60,000	100	M	5	VH	VH	296
48	6	**Darebin Creek (North) Industrial (various)**											
		Consultation with individual industries on Stormwater Management Issues	P	1	$10,000	$0	$10,000	100	H	3	VH	H	76
		Mark drains in the catchment with identifying codes and EPA hotline numbers to contact so that the public can report on incidences.	E	5	$5,000	$1,000	$10,000	100	L	5	VH	VH	82
		Workshops for emergency and operations staff	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
		Workshops for Industry representatives	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Require environmental Management plans for large industries	P,O	1	$5,000	$0	$5,000	100	VH	1	VH	M	123
		Encourage better storage practices	E	1	$2,500		$2,500	100	L	1	VH	M	185
		Long term consultation in partnership with EPA/MW to target industrial operations		5	$5,000	$5,000	$30,000	100	M	5	VH	H	190
		Monitoring to determine effectiveness of all stormwater initiatives	O,E	5	$10,000	$10,000	$60,000	100	H	5	VH	VH	212
		Site audits and inspections		5	$10,000	$20,000	$110,000	100	VH	10	H	M	349
		Review environmental management plans		5	$10,000	$20,000	$110,000	100	VH	10	H	M	349
		Monitor effectiveness of GPT at the West Heidelberg Drain (Dougharty Rd)	I	2	$0	$5,000	$10,000	25	H	2	VH	H	454
		Update emergency response planning	E	5	$10,000	$2,000	$20,000	100	L	5	VH	L	494
		GPT or other pollutant trap at DC/1. MWC ASSET (Lillimur Ave). LaTrobe Uni Outfall (M19E9). (Diameter 2100).	I	20	$100,000	$5,000	$200,000	20	VH	20	VH	VH	686
		GPT or other pollutant trap at the Southern Road drain (DC/12, M19D12). 1875mm. X	I	20	$200,000	$5,000	$300,000	25	H	20	VH	H	1361
48	7	**Yarra Sewer**											
		Liaison with YVW to identify when and where sewerage upgrade works will be undertaken	I	3		$1,000	$3,000	20	L	3	VH	L	617
36	8	**Darebin Creek (South) Degraded Waterways (east bank slumping)**											
		Seek Community involvment in works	O	2	$1,000	$500	$2,000	100	VH	2	VH	VH	14
		Seek Melbourne Water Funding	O	2	$1,000	$500	$2,000	100	VH	2	VH	VH	14
		Revegetate and fence off key erosion locations	I	20	$20,000	$2,000	$60,000	100	H	20	VH	M	95
		Upgrade or install new drainage where appropriate (see Inventory of drainage outlets)	I	10	$50,000	$2,000	$70,000	100	H	10	VH	M	222

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
		Undertake waterway management works on the east bank	I	20	$100,000	$5,000	$200,000	100	H	20	H	M	408
36	9	**Darebin Creek (North) Degraded Waterways (east bank slumping)**											
		Seek Community involvment in works	O	2	$1,000	$500	$2,000	100	VH	2	VH	VH	14
		Seek Melbourne Water Funding	O	2	$1,000	$500	$2,000	100	VH	2	VH	VH	14
		Revegetate and fence off key erosion locations	I	20	$20,000	$2,000	$60,000	100	H	20	VH	M	95
		Inspect all drain outflows along the east bank and upgrade or install new drainage such as corrugated chutes where appropriate	I	10	$50,000	$2,000	$70,000	100	H	10	VH	M	222
		Undertake waterway management works on the east bank	I	20	$100,000	$5,000	$200,000	100	H	20	H	M	408
36	10	**Plenty River (Lower) Residential (all areas)**											
		Provide identifying markers on drains to indicate the catchment and EPA hotline	E	5	$5,000	$1,000	$10,000	100	L	5	VH	VH	82
		Workshops for waste management and street cleaning personel, parks, gardens and maintenance staff	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Provide incentive for car washing at centres by providing vouchers etc	E	5	$15,000	$2,000	$25,000	100	M	5	VH	VH	123
		Development educational material for residents that promote best practice management and encourage waste reduction.	P,O	3	$15,000	$2,000	$21,000	100	M	3	VH	VH	173
		Promote Waterwatch and Ecorecycle programs through local schools	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
		Revision and enforcement of local laws to highlight stormwater management	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
		Review & assess the types of recycling bins used and potential for litter escape	O,P	1	$5,000		$5,000	100	L	1	VH	M	370
		Media releases to highlight stormwater management issues to the general community	E	5	$10,000	$10,000	$60,000	100	M	5	VH	M	533
		GPT (Model P0912) at Lae Street (M31D2). (DC/15, diameter 1050). Note drainage outlet inventory recommendation for diversion, seek MW funding options	I	20	$37,500	$5,000	$137,500	15	VH	20	VH	VH	629
36	11	**Banyule Creek Residential (all areas)**											
		Investigate reasons for and against redirecting drainage channels into Banyule Swamp and implementing if found desirable	I	1	$15,000	$2,000	$17,000	100	VH	20	VH	VH	12

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
		Workshops for waste management and street cleaning personel, parks, gardens and maintenance staff	E,O	1	$10,000	$0	$10,000	100	H	5	VH	M	63
		Provide identifying markers on drains to indicate the catchment and EPA hotline	E	5	$5,000	$1,000	$10,000	100	L	5	VH	VH	82
		Provide incentive for car washing at centres by providing vouchers etc	E	5	$15,000	$2,000	$25,000	100	M	5	VH	VH	123
		Development educational material for residents that promote best practice management and encourage waste reduction.	P,O	3	$15,000	$2,000	$21,000	100	M	3	VH	VH	173
		Promote Waterwatch and Ecorecycle programs through local schools	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
		Revision and enforcement of local laws to highlight stormwater management	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
		Review & assess the types of recycling bins used and potential for litter escape	O,P	1	$5,000		$5,000	100	L	1	VH	M	370
		Media releases to highlight stormwater management issues to the general community	E	5	$10,000	$10,000	$60,000	100	M	5	VH	M	533
36	12	**Plenty River (Upper) Residential (all areas)**											
		Workshops for waste management and street cleaning personel, parks, gardens and maintenance staff	E,O	1	$10,000	$0	$10,000	100	H	5	VH	M	63
		Review & assess the types of recycling bins used and potential for litter escape	O,P	1	$5,000	$0	$5,000	100	L	5	VH	M	74
		Provide identifying markers on drains to indicate the catchment and EPA hotline	E	5	$5,000	$1,000	$10,000	100	L	5	VH	VH	82
		Provide incentive for car washing at centres by providing vouchers etc	E	5	$15,000	$2,000	$25,000	100	M	5	VH	VH	123
		Educate residents about over fertilising and fertilising alternatives such as slow release	P,O	3	$15,000	$2,000	$21,000	100	M	3	VH	VH	173
		Promote Waterwatch and Ecorecycle programs through local schools	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
		Revision and enforcement of local laws to highlight stormwater management	E	5	$5,000	$5,000	$30,000	100	M	5	VH	M	267
		Alter the design of Kalparrin Gardens wetland to increase nutrient assimulation efficiency and habitat	I	10	$20,000	$5,000	$70,000	50	M	10	VH	H	444
		Media releases to highlight stormwater management issues to the general community	E	5	$10,000	$10,000	$60,000	100	M	5	VH	M	533
		Educational material for residents wrt car washing, garden practices, encourage waste reduction	E	5	$20,000	$5,000	$45,000	100	L	5	VH	M	667

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
36	**13**	**Banyule Creek Road Runoff**											
		Liaise with Vic Roads & ensure water sensitive road design for any upgrades	O	5	$1,000	$1,000	$6,000	100	M	5	VH	L	89
		Workshops for emergency and operations staff	O,E	5	$5,000	$5,000	$30,000	100	H	5	VH	VH	106
		Investigate options for retro fitting major highways with grass swales and detention structures designed to isolate spills	I	20	$10,000		$10,000	100	M	20	L	I	111
		Provide signage indicating that litter enters the Yarra River catchment	E	5	$5,000	$1,000	$10,000	100	L	5	M	M	267
		Conduct litter collection activities along roads	I	20		$10,000	$200,000	100	H	20	VH	M	317
		Update emergency response planning	E	5	$10,000	$2,000	$20,000	100	L	5	VH	L	494
		Literature and guidelines for transport and freight industry	P	1	$15,000		$15,000	100	H	1	M	H	612
36	14	**Salt Creek Degraded Waterways (Various)**											
		Seek Community involvment in works	O	2	$1,000	$500	$2,000	100	VH	2	VH	VH	14
		Seek Melbourne Water Funding	O	2	$1,000	$500	$2,000	100	VH	2	VH	VH	14
		Revegetate and fence off key erosion locations	I	20	$20,000	$2,000	$60,000	100	H	20	VH	M	95
		Install new drainage where appropriate (see Inventory of drainage outlets)	I	10	$50,000	$2,000	$70,000	100	H	10	VH	M	222
		Identify and undertake waterway management works at erosion locations requiring structural remediation	I	20	$100,000	$5,000	$200,000	100	H	20	H	M	408
36	15	**Bundoora Construction (Parade College Development**											
		Develop developers referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Develop Council referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Increased frequency of audits and inspections of development sites	P,E	10	$15,000	$1,000	$25,000	100	L	20	VH	M	93
		Workshops for council planning and engineering staff	E,O	1	$0	$10,000	$10,000	100	H	3	VH	M	106
		Information workshops for developers, builders, contractors and consultants using the site as an example	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Require developers to clean drainage system & not connect to system until land is stabilised (cost is borne as part of improved audit and inspections process)	I	1	$10,000		$10,000	100	VH	1	VH	VH	137

Rrisk	Priority	Action Element	Code	Life time yr	Capital cost $	ongoing cost $/yr	total cost$	% catchment	Effectiveness	Effective Life cycle yr	Feasibility	Multiple benefit	Score
		borne as part of improved audit and inspections process)											
		Develop guidelines for and require sediment and erosion control plans for all new developments	P,O	5	$20,000	$3,000	$35,000	100	L	10	H	H	238
		Ensure that Parade College wetland is developed appropriately for stormwater treatment, for example sediment trap and design	O	20	$50,000	$2,000	$90,000	50	VH	10	VH	VH	247
		Infringement notification and enforcement of planning permit conditions	E	5	$10,000	$10,000	$60,000	100	M	5	VH	VH	296
		Determine applicability of different WSUD principles		1	$5,000		$5,000	100	L	2	VH	L	309
36	16	**Salt Creek Sewer**											
		Liaison with YVW to identify when and where sewerage upgrade works will be undertaken, and where discharge enters waterways	I	3		$1,000	$3,000	20	L	3	VH	L	617
36	17	**Salt Creek Construction (General subdivision)**											
		Develop developers referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Develop Council referrals check list	P,O	1	$5,000	$2,000	$7,000	100	VH	5	VH	VH	19
		Increased frequency of audits and inspections of development sites	P,E	10	$15,000	$1,000	$25,000	100	L	20	VH	M	93
		Workshops for council planning and engineering staff	E,O	1	$0	$10,000	$10,000	100	H	3	VH	M	106
		Information workshops for developers, builders, contractors and consultants using the site as an example	E,O	1	$10,000	$0	$10,000	100	H	3	VH	M	106
		Require developers to clean drainage system & not connect to system until land is stabilised (cost is borne as part of improved audit and inspections process)	I	1	$10,000	$0	$10,000	100	VH	1	VH	VH	137
		Develop guidelines for and require sediment and erosion control plans for all new developments	P,O	5	$20,000	$3,000	$35,000	100	L	10	H	H	238
		Infringement notification and enforcement of planning permit conditions	E	5	$10,000	$10,000	$60,000	100	M	5	VH	VH	296
		Determine applicability of different WSUD principles		1	$5,000		$5,000	100	L	2	VH	L	309

Appendix D Steering Committee and Workshop participants

Steering Committee Members		
Carvalho	Caroline	Melbourne Water
Lanza	Simon	City of Banyule
McLeod	Lisa	Environmental Protection Agency
Millard	Rob	City of Banyule
Nechwatal	Janine	Darebin Creek Management Committee
Newell	Ian	City of Banyule
Robaczewski	Andrew	City of Banyule
Vaughan	Pat	City of Banyule
Walker	Scott	City of Banyule
Working Group Members		
Rawson	Sean	Electoral Office - The Mall
Reiter	Keith	City of Boroondara representative
Bates	Cathy	City of Yarra representative
Vermeeren	Stan	Northern Region Waste Management Group
Paras	George	La Trobe University
Dwyer	Marshall	Heidelberg Central Traders Association
Kemp	Cassandra	Mall Traders Association
Dennis	Quentin	Greensborough Plaza
Gibb	Kim	Heidelberg Central Manager
Fox	Russel	Rosanna Shopping Centre
Spink	David	PPK Environment and Infrastructure P/L
Houghton	Bruce	Friends of Plenty River
Owens	Doug	City of Banyule
Soding	Peter	City of Banyule
Choudari	Ramesh	City of Banyule
Walker	Scott	City of Banyule
Clough	Helen	City of Banyule
Maslin	Nicole	City of Banyule
McMillan	Simon	City of Banyule
Pollard	Maree	City of Banyule
Morgan	Margaret	City of Banyule
Callahan	Chris	City of Banyule
Parks	Jeff	City of Banyule
Papas	Di	City of Banyule
Kwasny	Michael	City of Banyule
Vant	Jean	Macleod Progress Association representative
Hocking	Tony	Environmentalist
Ley	Kevin & Alice	Friends of Plenty River
Course	Sue	Darebin Parklands Association
Mallon	Peter	St Helena Market Place
Stock	Bernie	Friends of Plenty River
Roberts	Sue	Friends of Plenty River