

GREATER SHEPPARTON STORMWATER MANAGEMENT PLAN

REVIEW 2009



Document History

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EXECUTIVE SUMMARY

Greater Shepparton City Council (Council) in association with the Goulburn Broken Catchment Management Authority (GB CMA) and Environment Protection Authority Victoria (EPAV) prepared the Greater Shepparton Stormwater Management Plan (GSSWMP) in 2003 to improve the quality of urban stormwater discharged into local waterways. Implementation of the GSSWMP is proceeding.

In mid 2008 Council staff initiated a review of the GSSWMP to update, simplify it and assess implementation progress. The 2009 review has been led by Council staff and opportunities for public comment and consultation occurred through the Council's established community consultation processes. The review was undertaken as a desktop exercise. It was not intended to be a major exercise.

The GSSWMP addresses general stormwater issues across the entire municipality, and also addresses specific issues in the towns of Shepparton, Mooroopna and Tatura.

Targets are proposed as follows:

- All new development will incorporate stormwater treatment measures designed to achieve the objectives of Victorian Planning Provisions (VPP) Clauses 56-07-4 and 56-08-1.
- Over time, significant existing stormwater outfalls will be fitted with stormwater management structures designed to achieve the objectives of Victorian Planning Provisions (VPP) Clauses 56-07-4 and 56-08-1.

About stormwater

Stormwater includes rainfall collected from roofs as well as road run-off, wash-down water and all other water that discharges into the drainage network, rivers, streams, creeks and lakes from urban areas. Urban stormwater is generally not treated before being discharged to local waterways.

Urban development can have a significant impact on stormwater quality.

Key characteristics of the area

The City of Greater Shepparton situated in the heart of the Goulburn Valley, covers an area of 2,421km² and is the fourth largest provincial centre in Victoria. The major urban centre of Shepparton is located at the confluence of the Goulburn and Broken rivers and at the intersection of the Goulburn Valley and Midland highways.

Greater Shepparton has a current population of 59,000 and is growing at 1.8 per cent per annum and is projected to reach 81,000 by 2030. Seventy seven per cent of the municipality's people live in the main urban centres of Shepparton and Mooroopna.

The Goulburn and Broken river corridors are key natural features in Greater Shepparton.

Much of Shepparton drains directly into the Goulburn River. The southern half of Mooroopna drains to the Goulburn River, whereas the northern region drains into Gemmill Swamp and then into the Goulburn River. Tatura is located within the mosquito depression which eventually drains to the River Murray.

Key documents

Since preparation of the original GSSWMP a number of key policies and guidelines have been developed, including:

- Urban stormwater best practice environmental management guidelines
- State Planning Policy - VPPs
 - Clause 15 – Water Quality Protection
 - Clause 55 – Two or more dwellings on a lot and residential buildings
 - Clause 56 – Sustainable Neighbourhoods
 - Clause 56-07-4 Urban run-off management objectives
 - Clause 56-8-1 - Site management objectives
- Goulburn Broken Water Quality Strategy
- Greater Shepparton 2030
- Municipal Strategic Statement (MSS)
- *Local Law No 1*
- Infrastructure Design Manual
- Design for stormwater outfalls

Implementation progress

Implementation of the plan has seen a number of achievements to date, including the development of:

- The River Connect Program
- Stormwater education programs:
 - TV, radio and newspaper advertisements as well as brochures
- A new stormwater education officer position (funded by Greater Shepparton City, Mitchell Shire and Moira Shire councils, Goulburn Valley Water (Water watch), Goulburn-Murray Water and GB CMA)
- *Local Law No. 1*
- Infrastructure Design Manual
- Domestic Wastewater Management Plan
- Four gross pollutant traps (GPTs)
 - McFarlane Rd, Mooroopna
 - Vaughan St, Shepparton
 - Assim Drive, Shepparton
 - Colliver Rd, Shepparton
- Wetlands at Wanganui, Gordon Drive and Lake Bartlett and Cussen Park rehabilitation
- Water quality monitoring of the Council's lakes with Waterwatch
- A concept design for nine stormwater outfalls in Shepparton and three in Mooroopna

- A computer program known as Storms to assist the Council's audit sites for best practice in stormwater management
- Water Sensitive Urban Design (WSUD)
- Council standard planning permit conditions requiring best practice standards for sediment and litter control
- A working group of key stakeholders to coordinate stormwater management (Includes representatives from Greater Shepparton City, Mitchell Shire and Moira Shire councils, GB CMA, G-MW, GVW and ResourceGV).

Over the next four years GPTs and bioremediation wetlands will be installed at key locations at an estimated cost of \$440,000.

Overall, excellent progress has been made towards implementing the GSSWMP. Non-structural measures, such as planning amendments, local laws and community education programs are in place to ensure new development meets required standards. Structural measures, such as stormwater treatment works, have been planned and are being progressively implemented as funding allows.

Methodology

The original GSSWMP was prepared in accordance with the revised version of chapter three of the *Best Practice Environmental Management Guidelines—Urban Stormwater* (developed by Melbourne Water in 2000). Amongst other things it involved a risk assessment process to identify the priority issues of concern. This included identification of values and threats.

Stormwater priorities

Stormwater priorities have been determined using a risk based methodology that correlates the identified threats and values. This allows identification of the level of risk and the priorities within each catchment.

Priority land uses

Land uses associated with the priority risks include:

- Industrial
- Development
- Building sites
- Residential
- Major roads.

Priority catchments

The priority land uses have been assigned to catchments to develop a sense of both spatial and issue priority for action. Higher priority catchments include northern Shepparton, central Shepparton, and Tatura mosquito depression.

Structural works have been implemented at some of these priority catchments. Further works are planned over the next three to four years.

Risk Management

This plan proposes two main areas of activity to manage the risks identified:

- Structural – works activities directed at specific catchments.

- Non-structural - strategies and actions to be applied widely across the municipality.

The 2003 GSSWMP screened a large number of management measures and developed an implementation plan with over 180 individual actions. These have been substantially simplified and management actions (Table S1) have now been developed around the following themes:

Table S1 Summary of the non-structural measures themes.

Theme	Issues and action
Coordination	Plan adoption Liaison and coordination with relevant agencies and adjoining municipalities Stormwater Management Officer Planning and regulation.
Education and awareness	Stormwater information Public awareness School activities Signage Stormwater training.
Monitoring	Compliance with Local Law No 1 Rates of litter accumulation in GPTs Waterwatch monitoring.
Reporting	Plan implementation progress to council and relevant stakeholders.
Operations	Enforcement: <ul style="list-style-type: none"> • Planning permit conditions • Local Law No 1 Domestic Wastewater Management Plan implementation.

Implementation and coordination

Responsibility for overall coordination of implementation of this plan rests with the Council's General Manager - Sustainable Development. Amongst other things, coordination will involve:

- Integrating plan implementation with other Council activities
- Monitoring and reporting plan implementation
- Regular (three to five year) plan reviews
- Arranging funding for plan implementation, from both internal and external sources.

Implementation plan

Table S2 summarises the actions to be implemented as part of this revised GSSWMP. The actions listed are generally a continuation of activities already in

place. Implementation of structural works, in particular, is subject to funding. To date the cost of these works has been shared with the GB CMA.

Review

It is proposed to review this plan on a three-year rolling basis. The next review is due in 2012-2013.

Program Area	Action	Estimated cost						Comment
		Y1 (08/09)		Y2 (09/10)		Y3 (10/11)		
		Capital \$	O&M \$	Capital \$	O&M \$	Capital \$	O&M \$	
Structural	Install GPT Tom Collins Drive	40,000						
	Install GPT Knight St and rehabilitate Mason St outfall			162,000				
	Install GPT Balaclava Rd Stage 1					94,000		
	Install GPT Balaclava Rd Stage 2							To be undertaken 2011/12
	Gemmill Swamp Bioremediation Wetland, 09/10			200,000				
	Lake Bartlett - stage 2 and 3							tba
	Gordon Drive Wetland - stage 3, 4, and 5							tba
Non Structural	Coordination (including Stormwater Management Officer)		20,000		22,000		25,000	
	Education and awareness		5,000		5,000			
	Monitoring (Waterwatch)		5,000		5,000			
	Reporting							
	Operations (including operation of GPTs installed)				10,000		20,000	
	Operations – DWWMP implementation							
Total		40,000	30,000	362,000	42,000	94,000	45,000	

Table S2 Management Actions Summary.

1. BACKGROUND

Greater Shepparton City Council (Council) in association with the Goulburn Broken Catchment Management Authority (GB CMA) and Environment Protection Authority Victoria (EPAV) prepared a Greater Shepparton Stormwater Management Plan (GSSWMP) (KBR 2003; KBR 2003) in 2003 to improve the quality of urban stormwater discharged into local waterways. Implementation of the GSSWMP is proceeding.

In mid-2008 Council staff initiated a review of the GSSWMP to update, simplify it and assess implementation progress.

The review was undertaken as a desktop exercise. It was not intended to be a major exercise.

The 2009 review of the GSSWMP included:

- Merging of the two volumes of the 2003 Plan (Volume 2 substantially overlapped Volume 1)
- Development of a 2009 Stormwater Management Plan (this document) which condensed, simplified and updated the 2003 GSSWMP, including a revised Implementation Plan
- Preparation of brief overview documents.

Substantial background and detailed information is provided in the two volumes of the 2003 Plan. It is not reproduced in this document.

2. THE PLAN

2.1. Aim

The aim of the GSSWMP is 'to identify actions to improve the environmental management of urban stormwater and protect the environmental values and beneficial uses of receiving environments'. It identifies urban activities that may adversely affect water quality and sets in place strategies to protect water quality and beneficial uses from stormwater runoff.

Its focus is on protecting water quality, and it does not consider hydraulic issues such as the capacity of the drainage system and flooding issues.

The key goal of the GSSWMP is 'to protect and enhance values of the receiving waterways'.

The GSSWMP addresses general stormwater issues across the entire municipality, and also addresses specific issues in the towns of Shepparton, Mooroopna and Tatura.

2.2. Objectives

The objectives of stormwater management in the City of Greater Shepparton are to:

- Maintain and enhance stormwater quality throughout the municipality.
- Protect and improve the important environmental, amenity, economic, hydraulic and cultural values of the waterways in the municipality, including all watercourses and wetlands.
- Provide direction for the application of best practice stormwater management at the design, construction and operational phases of development.
- Encourage integration of on and off-site stormwater management improvements.

(These objectives are consistent with the Council's Municipal Strategic Statement (MSS) at Clause 21 of the Greater Shepparton Planning Scheme) and apply to the entire municipality).

2.3. Targets

Targets can be developed to indicate progress towards achievement of objectives.

Targets are proposed as follows:

- All new development will incorporate stormwater treatment measures designed to achieve the objectives of Victorian Planning Provisions (VPP) clauses 56-07-4 and 56-08-1.
- Over time, significant existing stormwater outfalls will be fitted with stormwater management structures designed to achieve the objectives of Victorian Planning Provisions (VPP) clauses 56-07-4 and 56-08-1.

(See Section 6.2 for relevant VPP objectives).

3. WATER SENSITIVE URBAN DESIGN (WSUD)

Managing the urban water cycle needs to be underpinned by key sustainability principles of water consumption, water recycling, waste minimisation and environmental protection. The integration of urban water cycle management with urban planning and design is known as Water Sensitive Urban Design (WSUD).

Water cycle management covers:

- drinking water
- stormwater run-off
- waterway health
- sewage treatment
- recycling.

One of the key elements of WSUD is the management of urban stormwater, both as a resource and for the protection of receiving water ecosystems. This requires strategic planning and concept designs that are underpinned by sound engineering practices in design and construction. The GSSWMP addresses the stormwater run-off component of WSUD. Design and construction issues have been addressed in the Infrastructure Design Manual (see Section 6.7).

3.1. Urban stormwater

Stormwater includes rainfall collected from roofs as well as road run-off, wash-down water and all other water that discharges into the drainage network, rivers, streams, creeks and lakes from urban areas. Unlike sewage, urban stormwater is generally not treated before being discharged to local waterways.

Urban development can have a significant impact on stormwater quality. The clearing of land and the use of impervious surfaces increases run-off and the transport of pollutants such as sediment, nutrients, pathogens, heavy metals, oil and litter to waterways. The accidental or deliberate discharge of various pollutants from residential, commercial and industrial areas, as well as from roads and other areas, can flow into local drains and waterways. Their individual and cumulative impacts can have a major effect on water quality.

Improved stormwater management is critical in minimising the discharge of pollutants into local waterways. Stormwater management should be based on the following three principles:

- **preservation:** preserve existing valuable elements of the stormwater system, such as natural channels, wetlands and stream-side vegetation
- **source control:** limit changes to the quantity and quality of stormwater at or near the source
- **structural control:** use structural measures, such as treatment techniques or detention basins, to improve water quality and control streamflow discharges.

4. STAKEHOLDER INVOLVEMENT

The 2003 Greater Shepparton Stormwater Management Plan was prepared by Kellogg Brown & Root Pty Ltd (KBR) under the supervision of a Steering Committee comprising representatives of the Council, GB CMA and EPAV. A project working group was also established to act as a reference group, providing input on local issues and management opportunities.

This 2009 draft review has been led by Council staff. The GB CMA has commented on this draft and opportunities for public comment and consultation occurred through the Council's established community consultation processes.

5. MUNICIPAL PROFILE

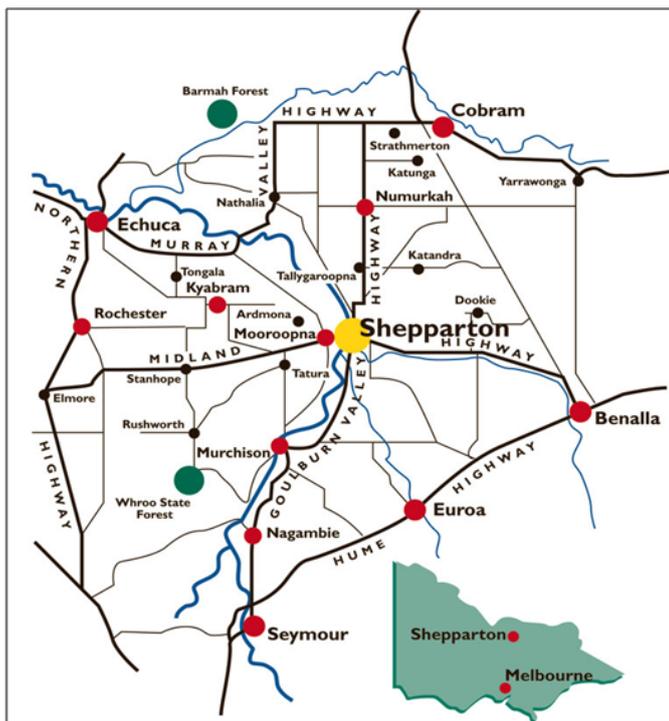


Figure 1: Shepparton Locality Map

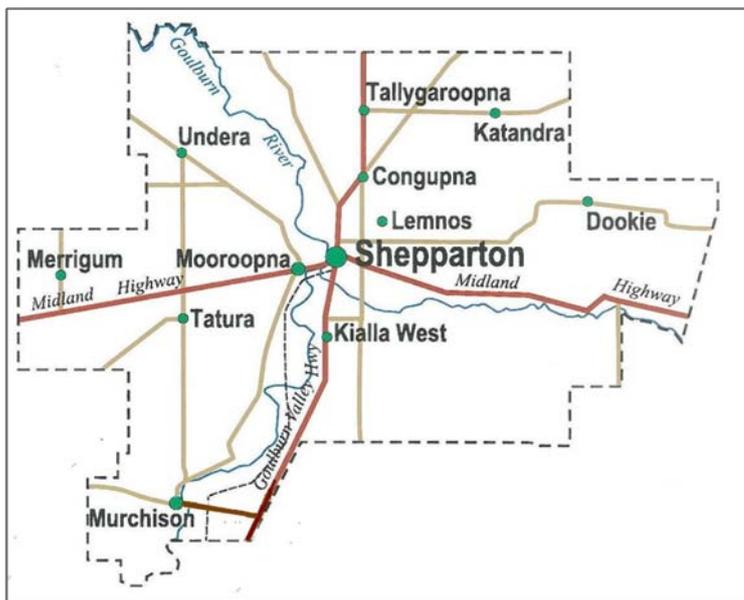


Figure 2 Greater Shepparton Municipal Boundary

5.1. Key characteristics of the area

The City of Greater Shepparton situated in the heart of the Goulburn Valley, covers an area of 2,421km² and is the fourth largest provincial centre in Victoria. The major urban centre of Shepparton is located at the confluence of the Goulburn and Broken rivers and at the intersection of the Goulburn Valley and Midland highways. (Figures 1 and 2).

Greater Shepparton has a current population of 59,000 and is growing at 1.8 per cent per annum and is projected to reach 81,000 by 2030. Seventy seven per cent of the municipality's people live in the main urban centres of Shepparton and Mooroopna. The balance of the population resides in the townships of Tatura, Murchison, Dookie, Merrigum, Congupna, Toolamba, Katandra and Tallygaroopna and in the surrounding rural areas.

It is estimated that the urban areas of Shepparton and Mooroopna will accommodate the majority of additional growth by 2030 (approximately 19,733 persons). By the year 2030, it is estimated that approximately 82 per cent of the City of Greater Shepparton residents (some 66,039 persons) will be residing in these two urban areas with the remainder distributed throughout Greater Shepparton's other town centres such as Tatura, Murchison, Merrigum, Dookie, Congupna, Katandra West, Tallygaroopna, Toolamba, and Undera.

5.2. Key biophysical characteristics and landscape assets

The Goulburn and Broken river corridors are key natural features in Greater Shepparton. Together with roadside areas they provide the most significant stands of remnant vegetation with associated habitat values and also have obvious functions in flood management. Greater Shepparton's agricultural and horticultural industries are reliant on irrigation water and effective water management practices play a key role in the region's development and sustainability.

Shepparton is located on the banks of the Goulburn and Broken rivers, with Mooroopna lying adjacent to the Goulburn River.

Much of Shepparton drains directly into the Goulburn River. However, there are areas around the edge of the town that drain into the rural drainage network while the southern area drains into the Broken River. In addition, there are a number of constructed water features including Victoria Park Lake and Kialla Lakes. These play an important role in the overall stormwater management for their catchments.

The southern half of Mooroopna drains to the Goulburn River, whereas the northern region drains into Gemmill's Swamp and then into the Goulburn River. There are two constructed lakes, Craigmuir Lake and another behind the caravan park, both of which receive stormwater and ultimately discharges to the Goulburn River.

Tatura is located within the mosquito depression. The depression includes two constructed ornamental waterways, Lake Bartlett to the south of the township and Cussen Park which is located north of the township. Lake Bartlett drains to Cussen Park which is the receiving waterway for all the township's stormwater. These waterways eventually drain, via the mosquito depression, to the River Murray.

The waterways are an important part of the municipality with various advisory and community groups having been established to help manage them.

5.3. The future

There are four major growth corridors identified in the Municipal Strategic Statement (MSS). These include the:

- southern corridor to the south of the Broken River at Kialla
- south-east corridor along Poplar Avenue, Shepparton
- north corridor between Verney Road and the Goulburn Valley Highway, Shepparton

- western corridor, to the west of Mooroopna.

The MSS notes that ‘sufficient land is available in and around Shepparton, Mooroopna and Tatura to accommodate residential development within the next fifteen years without encroaching onto agricultural land.’ (City of Greater Shepparton, July 1999.) Growth in these areas has the potential to have a significant impact on stormwater quality.

5.4. Stormwater planning

The Greater Shepparton Stormwater Management Plan is being prepared as part of Council’s commitment to the environment and regional catchment initiatives.

6. KEY DOCUMENTS

Since preparation of the original GSSWMP a number of key policies and guidelines have been developed, including:

6.1. Urban stormwater best practice environmental management guidelines

The Urban Stormwater Best Practice Environmental Management Guidelines (BPEMG) (CSIRO 2006) were developed in 1999 to support the implementation of best practice by all key stakeholders.

The guidelines are the product of considerable research and technical review of a wide range of urban stormwater management issues and measures.

6.2. State planning policy - VPPs

The Victorian Planning Provisions (VPP) form the basis for all local council planning schemes in Victoria.

Clause 15 – Water quality protection

This requires:

- Land use activities potentially discharging contaminated runoff or wastes to waterways to be sited and managed to minimise such discharges and to protect the quality of surface water and ground water resources, rivers, streams, wetlands, estuaries and marine environments.
- Land use and development proposals to minimise nutrient contributions to waterways and water bodies.
- Use of appropriate measures to restrict sediment discharges from construction sites.

Clause 55 - Two or more dwellings on a lot and residential buildings

VPP Clause 55 aims to encourage residential development that is responsive to the site and the neighbourhood. Clause 55-03 (Permeability objectives) aim to reduce the impact of increased stormwater run-off on the drainage system and to facilitate on-site stormwater infiltration.

Clause 56 – Sustainable neighbourhoods

The new residential subdivision provisions (VPP Clause 56) came into effect from 9 October 2006.

The urban run-off management objectives address urban stormwater. The standards to be met include performance objectives set out in the Urban Stormwater Best Practice Environmental Management Guidelines (BPEMs), published by CSIRO in 1999, as amended (See Appendix 1). One of the main ways of meeting these standards is to incorporate Water Sensitive Urban Design (WSUD) elements as part of the drainage system.

Clause 56-07-4 Urban run-off management objectives

- Minimise damage to properties and inconvenience to residents from urban run-off.
- Ensure that the street operates adequately during major storm events and provides for public safety.

- Minimise increases in stormwater run-off and protect the environmental values and physical characteristics of receiving waters from degradation by urban run-off.

Clause 56-8-1 - Site management objectives

- Protect drainage infrastructure and receiving waters from sedimentation and contamination.

This clause requires that a subdivision application must describe how the site will be managed prior to and during the construction period and may set out requirements for managing erosion and sediment and run-off.

6.3. Goulburn Broken water quality strategy

The GB CMA has prepared a water quality strategy for the Goulburn Broken catchment. The key objectives for the strategy are to:

- Minimise the risk of blue green algae outbreaks within the Goulburn Broken catchment thereby protecting aquatic ecosystems, public health, industry and water users.
- Minimise nutrient contributions to the River Murray (and reduce the risk that nutrients from the catchment will cause or contribute to algal blooms downstream).
- Foster regional development (by ensuring the quality of water to industry, agriculture and the community).
- Enhance the riverine environment.
- Minimise/optimize water treatment costs.

Key targets from the strategy for urban stormwater include:

- Reducing loads of phosphorus discharged to streams from stormwater.
- Reducing loads of other pollutants discharged to streams from stormwater.

6.4. Greater Shepparton 2030

Greater Shepparton City Council and the Department of Sustainability and Environment (DSE) have prepared Greater Shepparton 2030 (GSCC 2006), a blueprint for building sustainable economic activity and maximising the quality of life in the municipality over the next 30 years.

This plan will update the previous City of Greater Shepparton Strategy Plan 1996 which formed the basis for the current Municipal Strategic Statement (MSS).

6.5. Municipal strategic statement (MSS)

The MSS is the local strategy component of the Greater Shepparton Planning Scheme. The Council's MSS (revised in March 2007), part of the Greater Shepparton Planning Scheme (www.dse.vic.gov.au/planningschemes/greatershepparton/home.html), notes the following strategic directions will be pursued at clauses 21.04 to 21.08 to achieve the Council's Land Use Planning and Development priorities. The revised MSS links closely to the Greater Shepparton 2030 Strategy.

Clause 21.08 includes the following statement on Urban Stormwater Management:

Council is committed to progressing principles of environmental sustainability within the municipality. Effective stormwater management forms a key

component of this objective. The *Greater Shepparton Stormwater Management Plan (2003) (GSSWMP)* identified the municipality's waterways as being valuable assets, providing important ecological habitats, attractive recreational areas and in some instances contain sites of cultural significance and serve to enhance property values. However, urban areas within the municipality can have an impact on water quality and the values of the waterways. The *GSSWMP* is relevant to the urban areas within the municipality, which includes residential areas, industrial and commercial land use activities, and open space areas. In order to ensure the protection and effective management of the municipality's waterways, particularly those that receive stormwater from urban areas, an overall plan is required.

Utilising existing irrigation drainage infrastructure for urban development should be considered secondary to the implementation of dedicated urban stormwater drainage systems.

Clause 21-08-2 includes as objectives:

- To maintain and enhance stormwater quality throughout the municipality.
- To protect and improve the important environmental, amenity, economic, hydraulic and cultural values of the waterways in the municipality, including all watercourses and wetlands.
- To provide direction for the application of best practice stormwater management at the design, construction and operational phases of development.
- To encourage integration of on and off-site stormwater management improvements.

Clause 21-08-3 lists strategies to achieve objectives for urban stormwater, management:

- Incorporate stormwater management issues in decision making on future development within the municipality.
- Prepare stormwater management plans in accordance with the Greater Shepparton Stormwater Management Plan for all major subdivisions and building construction sites of greater than 1,000m².
- Incorporate best practice measures such as those contained in the Greater Shepparton Stormwater Management Plan and the Urban Stormwater Best Practice Management Guidelines into the design of new developments.
- Protect stormwater quality by minimising the potential for pollutants including sediments, litter, nutrients, toxicants, pathogens and other contaminants to enter the waterways.
- Minimise off-site discharge of stormwater through the use of porous pavements, on-site collection, water conservation and re-use.
- Manage stormwater on a catchment or sub-catchment basis with development design having regard to upstream and downstream requirements.
- Provide stormwater management infrastructure at the time of development by the developer.

- Include interpretive material for wetlands and drainage features as part of the development approvals process.

6.6. Local Law No 1

The Council's *Local Law No 1* includes provision to regulate the impacts of stormwater from construction sites. The Local Law (Part 5.1) states:

Where any building work is being carried out on any land, the owner, builder or appointed agent must ensure that the building site is developed and managed to prevent stormwater pollution through the contamination of run-off by chemicals, sediments, animal wastes or gross pollutants to the satisfaction of Council or an authorised officer. This includes, without limiting the above, the adoption of measures to:

- (a) prevent any mud, dirt, sand, soil or stones being washed into the stormwater system; and
- (b) prevent building clean-up, wash-down or other wastes being discharged offsite or allowed to enter the stormwater system.

Part 3.6 prohibits damage to drains and culverts.

6.7. Infrastructure design manual

The Infrastructure Design Manual (GSCC 2007) has been prepared by Greater Bendigo City, Greater Shepparton City and Campaspe Shire councils.

The primary objectives of the Infrastructure Design Manual are to:

- Clearly document the councils' requirements for the design and development of infrastructure.
- Standardise development submissions as much as possible and thus to expedite the councils' engineering approvals.
- Ensure that minimum design criteria are met in regard to the design and construction of infrastructure within the municipalities.

The manual details stormwater treatment requirements.

6.8. Design for stormwater outfalls

Concept and detailed designs have been prepared for nine Shepparton and three Mooroopna stormwater outfalls (GSCC 2004). They aim to improve water quality and ecological health of the receiving watercourses, the Goulburn and broken Rivers, by designing stormwater treatment facilities that reduce the target pollutants prior to discharge to the river. The target pollutants include suspended solids (TSS), nutrients (total nitrogen (TN), total phosphorous (TP)) and gross pollutants (GP).

The nominated outfalls from Shepparton are located at the end of Balaclava Road, Tom Collins Drive, Mason, Nixon, Fryers, Longstaff and Vaughan Streets, Assim Drive and Colliver Road. The three Mooroopna outfalls are located at Homewood Park, Lenne and Young Streets.

Water quality treatment options were critically reviewed and a preferred option for each outfall was identified. A design and preliminary cost estimate for the preferred option of each outfall were prepared.

The designs have been compared with the environmental objectives as stated in Urban Stormwater Best Practice Environmental Management (BPEM) Guidelines (CSIRO, 1999).

6.9. Other stormwater initiatives

A number of Federal, state and local government initiatives have been undertaken to improve water quality, including the preparation of State Environment Protection Policies and various catchment strategies. The need to improve stormwater quality features prominently in such plans along with the recommendations for councils to prepare their own stormwater plans.

Victorian Stormwater Action Program

In 2000, the State Government established the Victorian Stormwater Action Program (VSAP) and appointed the Victorian Stormwater Advisory Committee to oversee the program. The outcomes of the VSAP were recently reviewed.

Greater Shepparton City Council - Local Environmental Sustainability Priority Statement

The Council's Local Environmental Sustainability Priority Statement lists priority environmental sustainability projects and programs for the Greater Shepparton City Council. Relevant projects include:

ICLEI-Local Governments for Sustainability – Water Campaign – This is an international freshwater management campaign that aims to build capacity in local government to reduce water consumption and improve local water quality.

Stormwater Management Plan (2003) – This plan identifies actions to improve the environmental management of urban stormwater to protect the environmental values and beneficial uses of receiving environments.

Stormwater education officer – Greater Shepparton City, Moira Shire and Mitchell Shire jointly employ a stormwater education officer to address stormwater issues regionally with a major focus on schools and the building industry.

River Connect Coordinator – Greater Shepparton City Council and Goulburn Broken Catchment Management Authority (GB CMA) employ a River Connect coordinator to raise awareness and protection of the Goulburn and Broken rivers.

Priority actions include a review of the Greater Shepparton Stormwater Management Plan and implementation of water quality improvements.

Clearwater

Clearwater was established in 2002 as part of the Victorian Stormwater Action Program. EPAV provided funding and Clearwater was administered through the Municipal Association of Victorian (MAV) and Stormwater Industry Association of Victoria (SIAV).

Clearwater's aim is to accelerate the uptake of sustainable urban water management by providing training, forums, advice and free resources. Clearwater supports the transition to sustainable urban water management by providing:

- training
- forums
- advice
- web-based resources.

7. IMPLEMENTATION PROGRESS

7.1. Achievements to date (2009)

Implementation of this plan has seen a number of achievements to date, including the development of the:

- River Connect Program
- Stormwater education programs
 - TV, radio and newspaper advertisements and brochures
- A new stormwater education officer position (funded by Greater Shepparton City, Mitchell Shire and Moira Shire councils, Goulburn Valley Water (GVW) (Water Watch), Goulburn-Murray Water (G-MW) and GB CMA.
- *Local Law No. 1*
- An Infrastructure Design Manual
- The Domestic Wastewater Management Plan
- Installation of four gross pollutant traps (GPTs)
 - McFarlane Rd, Mooroopna
 - Vaughan St, Shepparton
 - Assim Drive, Shepparton
 - Colliver Rd, Shepparton
- Wetlands at Wanganui, Gordon Drive and Lake Bartlett and Cussen Park rehabilitation
- Water quality monitoring at the Council's lakes with Waterwatch
- Concept design for nine stormwater outfalls in Shepparton and three in Mooroopna
- A computer program known as Storms to assist council to audit sites for best practice in stormwater management
- Water Sensitive Urban Design
- Council standard planning permit conditions requiring best practice standards for sediment and litter control
- A working group of key stakeholders to coordinate stormwater management (includes representatives of the Greater Shepparton Council, Mitchell Shire and Moira Shire councils, GB CMA, G-MW, GVW and ResourceGV).

7.2. Summary of progress

Overall, excellent progress has been made towards implementing the GSSWMP. Non-structural measures, such as planning amendments, local laws and community education programs are in place to ensure all new development meets required standards. Structural measures, such as stormwater treatment works, have been planned and are being progressively implemented as funding allows.

8. METHODOLOGY

The plan was prepared in accordance with the revised version of Chapter 3 of the *Best Practice Environmental Management Guidelines—Urban Stormwater* (developed by Melbourne Water in 2000).

It involved:

- A risk assessment process to identify the priority issues of concern. This included identification of values and threats. Risks with highest scores were assessed as being of highest priority
- A management review to identify current management practices, activities and programmes that contribute to stormwater management within the municipality
- Development of recommendations and an Implementation Plan.

Conceptually, development of the plan is described in Figure 3.

Figure 3 GSSWMP development process



9. STORMWATER CATCHMENTS

In order to prepare the Greater Shepparton Stormwater Management Plan the study area has been divided into 12 catchments (Figures 3 and 4):

- Shepparton (9 catchments)
- Mooroopna (2 catchments)
- Tatura (1 catchment).

These catchments have been developed on the nature of land use, drainage system and the receiving waterway and not directly related to the physical catchment boundary.

Details of each of the catchments and the conditions of the waterway are described in detail in the original GSSWMP.

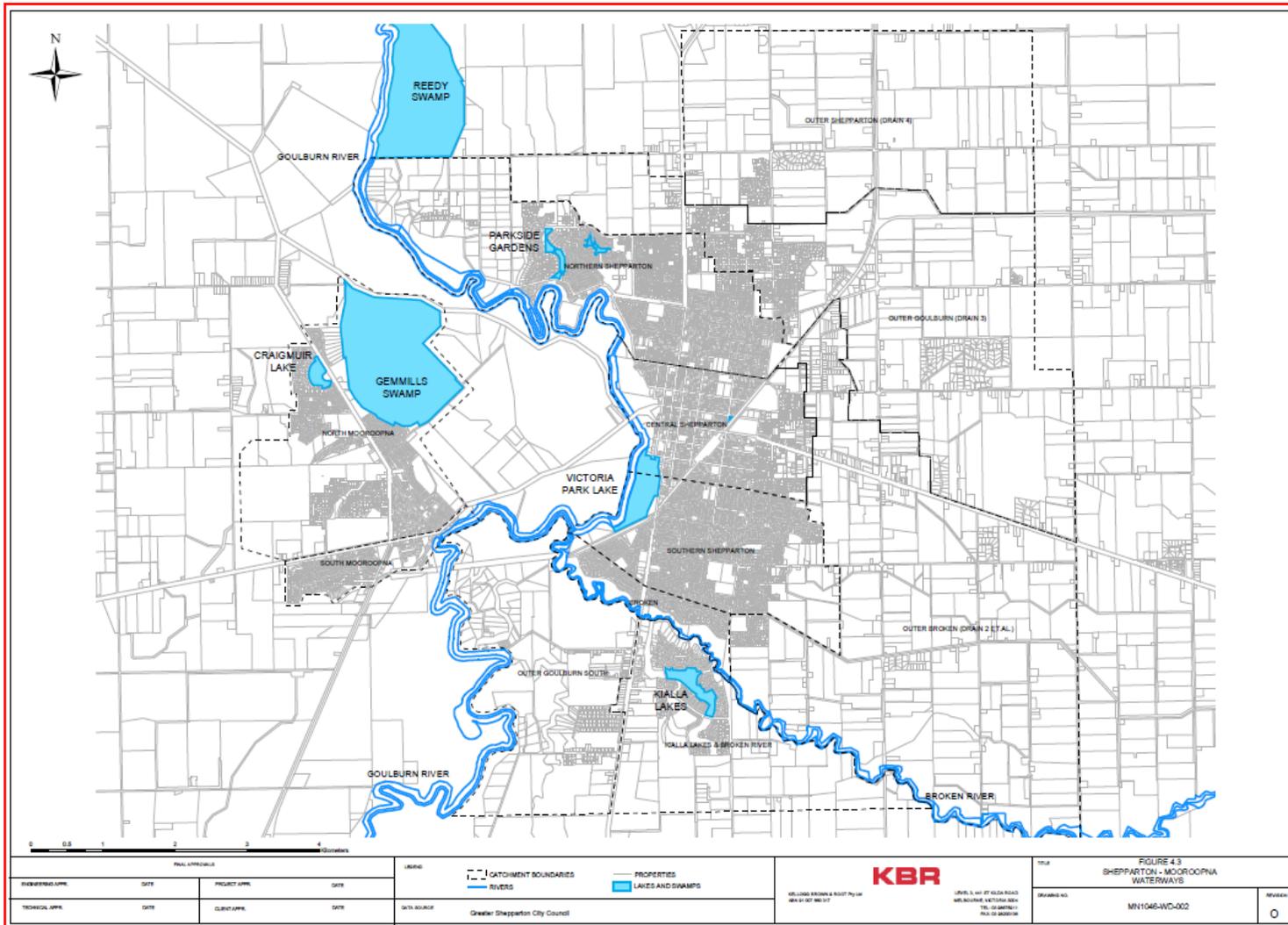


Figure 4 Stormwater catchments – Shepparton and Mooroopna

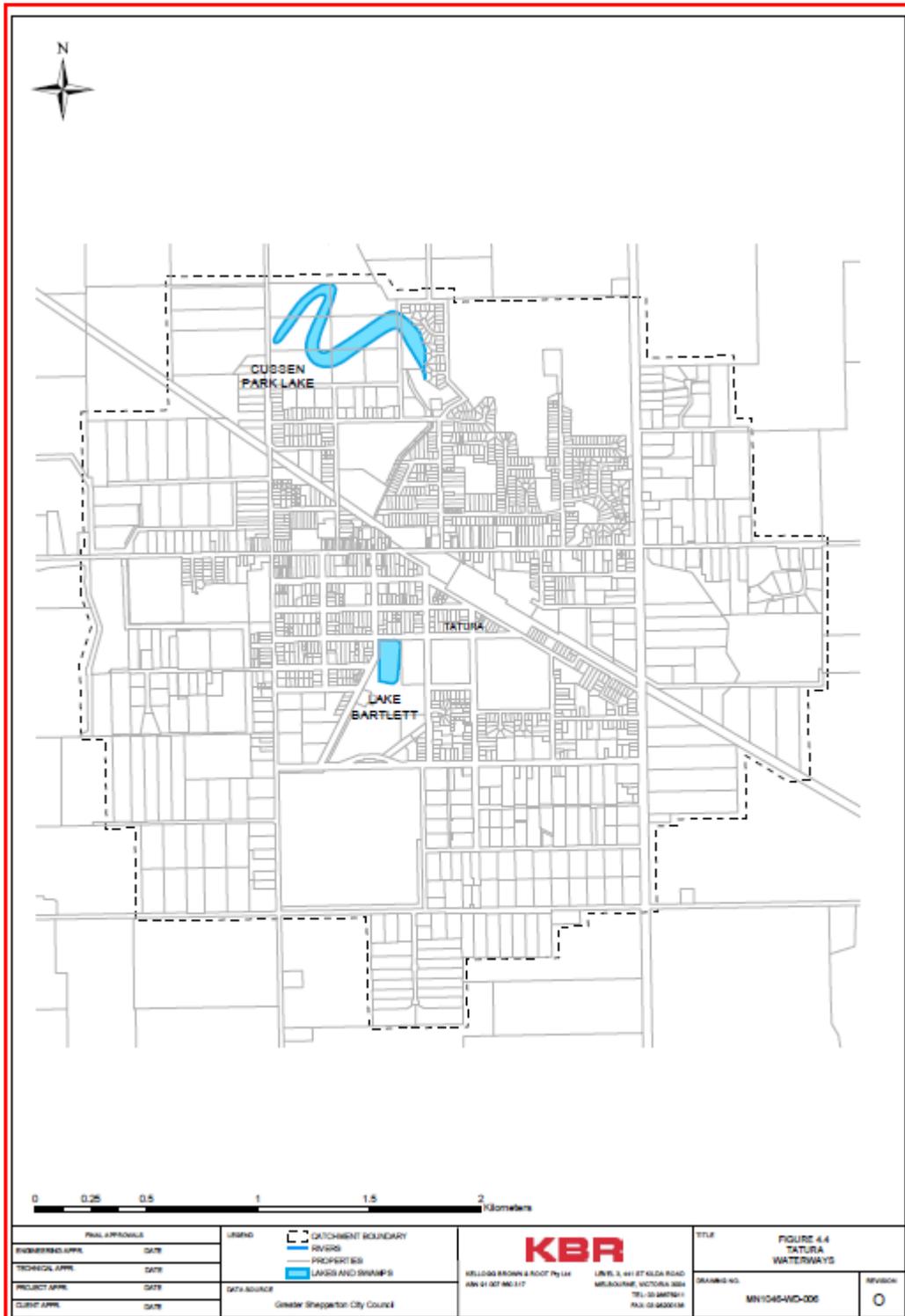


Figure 5 Stormwater catchments - Tatura

10. VALUES TO BE PROTECTED

Values are the properties that make a thing highly regarded, desirable or useful. A range of values to be protected have been identified, including environmental, amenity, cultural, stormwater and economic (Table 1).

To identify priorities, the values have been rated as very high, high, moderate, low or non-existent/not applicable based on a multi criteria analysis (refer original GSSWMP (Vol 2) for further detail). The principal values to be protected by the Greater Shepparton Stormwater Management Plan, and their location, are described in Table 2.

Table 1 Typical waterway values

Value category	Specific types	Description
Environmental	In-stream habitat	In-stream ecological values based on water quality, habitat quality and diversity, flora and fauna species, extent of invasion by exotic species and general in-stream condition and stability.
	Riparian habitat/flora	Waterway condition and ecological values based on extent and quality of remnant (native) vegetation, weed infestation and stability of riparian zone.
Amenity	Recreational amenity	Public access and utilisation for passive and active recreation including shared trails, formal linkages, utilisation for activities involving primary and secondary contact, extent of open space, facilities such as car parks and picnic areas, continuity of open space and visual attractiveness.
	Visual/landscape amenity	Aesthetic appreciation of the natural and built environment including consideration of natural and man made structures, landscapes and places of importance, visual access and relationships to adjacent facilities.
Cultural	European cultural heritage	Places and sites of European Heritage value, possibly including sites of pioneering significance, historical buildings and infrastructure, trails and transport routes.
	Indigenous cultural heritage	Places and sites of Indigenous Heritage value such as artefact scatters, landscape and places of significance (e.g. relating to story telling), ceremonial sites (e.g. Bora rings), campsites and trails.
Stormwater	Flood and conveyance	Contribution to protection against flooding including consideration of waterway capacity, designated floodwalls and flood protection infrastructure (e.g. levees).
	Water quality treatment	Contribution to water quality management (including stormwater). This may include existing wetlands or other infrastructure that has been developed to improve water quality.
Economic	Property and tourism	Property value associated with proximity to water and tourist destinations. These may include values associated with visual amenity, access and enjoyment.
	Extraction and use	Other economic benefits associated with receiving waters (e.g. water supply for irrigation).

Table 2 Waterway values (ratings based on multi criteria analysis in original GSSWMP (Vol 2)).

Value	Northern Shepparton	Central Shepparton	Southern Shepparton	Broken	Outer Broken (Drain 2 et al)	Outer Goulburn (Drain 3)	Outer Shepparton (Drain 4)	Kialla Lakes, Broken River	Outer Goulburn South	Mooroopna North	Mooroopna South	Tatura Mosquito Depression
In-stream habitat	High	High	High	High	High	High	High	High	High	High	High	High
Riparian habitat	High	High	High	High	High	High	High	High	High	Very High	High	High
Recreation	Very High	Very High	Very High	High	Moderate	Low	Moderate	High	Moderate	High	Moderate	Very High
Landscape	Very High	Very High	Very High	Moderate	Moderate	Moderate	Moderate	Moderate	Very High	Very High	High	High
Indigenous cultural heritage	High	High	Moderate	Moderate	Moderate	High	High	Moderate	Moderate	High	High	Low
European cultural heritage	High	High	Low	Low	Moderate	Low	Low	Low	Moderate	Moderate	Very High	Very High
Conveyance	High	High	High	High	Very High	Very High	Very High	High	High	Moderate	High	High
Water quality treatment	Low	Moderate	High	High	Moderate	Moderate	Very High	High	Moderate	High	Moderate	Very High
Property and tourism	High	High	High	Very High	Low	Moderate	Low	Very High	High	Moderate	Low	Moderate
Extraction and use	High	Very High	Very High	Low	Moderate	Moderate	Moderate	Low	High	High	High	High

11. STORMWATER THREATS

Urban development can have a major impact on the quality of stormwater. A stormwater threat, or hazard, is an attribute of stormwater that could potentially adversely affect identified values via some threatening process. For urban stormwater, the threats are often water contaminants and the threatening process is usually associated with runoff and runoff events. Common stormwater threats and threatening processes are described in Table 3.

Table 3 Typical waterway threats

Threat - Key pollutants and impacts	Threatening process	Source of threat
Increased flow, sediment, nutrients, litter, oxygen depleting material, hydrocarbons, pathogens, trace metals, pesticides, surfactants.	Residential land use runoff.	Atmospheric deposition and build-up from traffic, washing cars, fertiliser application, poor waste management (domestic refuse), lawn clippings and vegetation.
Increased flow, sediment, nutrients, litter, oxygen depleting material, hydrocarbons, pathogens, trace metals, pesticides, surfactants.	Industrial land use runoff.	Atmospheric deposition and build-up from traffic, poor waste management, accidental spills and illegal discharges.
Increased flow, sediment, nutrients, litter, oxygen depleting material, hydrocarbons, pathogens, trace metals, surfactants.	Commercial land use runoff.	Atmospheric deposition and build-up from traffic, poor waste management practices.
Sediment, litter, trace metals and hydrocarbons.	Major road runoff.	Atmospheric and vehicular deposition and accumulation.
Sediments, nutrients.	Residential development.	Poor sediment and erosion control, uncontrolled wash down of equipment, deposition of sediment, vehicles and spills from construction process (e.g. concreting).
Sediment and litter.	Building site runoff (lot scale).	Poor management of building site waste and materials. Poor sediment and erosion control, uncontrolled wash down of equipment, deposition of sediment, vehicles and spills from construction process (e.g. concreting).
Sediment, nutrients, oxygen depleting material.	Unstable and degraded waterways.	Poorly controlled stock and recreational access, weed infestation, damage from waterway works, development encroachment, vegetation loss, and eroded and unstable riparian zones.

Threat - Key pollutants and impacts	Threatening process	Source of threat
Reduced flows.	Flow modification.	Extraction of water for agricultural purposes.
Oxygen depleting material, pathogens, sediments, nutrients, litter and surfactants.	Run off from events and markets.	Poor waste management (litter and commercial waste), illegal discharges, atmospheric deposition and build up from traffic and wind blown litter.
Sediment, nutrients, litter and pathogens.	Upstream inflows.	Runoff from upstream catchments, entering via creeks and waterways.
Nutrients, litter, oxygen depleting materials.	Open space runoff (e.g. golf course and sporting grounds).	Wash off of nutrients (fertilisers) and litter from public gardens, parks, sporting facilities, golf courses and discharge of poor quality water from ornamental lakes.
Oxygen depleting material, pathogens, sediments, nutrients, litter, trace metals, hydrocarbons and toxicants.	Runoff from landfill and contaminated sites.	Runoff or leaching from landfills and contaminated sites.
Oxygen depleting material, pathogens and nutrients.	Runoff from unsewered properties.	Infiltration and overflow from sewerage systems and septic tank.
Sediment, nutrients, oxygen depleting material.	Pests.	Weed invasion and feral pests, including carp.
Sediment, nutrients, oxygen depleting material.	Runoff from rural residential areas.	Runoff from unmade roads and septic tanks.
Sediment, nutrients, oxygen depleting material.	Runoff from rural areas.	Runoff from unmade roads, septic tanks and intensive activities such as poultry sheds, landscape suppliers etc.

Source: Chapter 3, Best Practice Environmental Management Guidelines (2000).

To identify priorities, the threats have been rated as very high, high, moderate, low or non-existent/not applicable. The ratings are based on the quantity, type and frequency of the pollutant load generated.

The threats include activities that are currently having an impact on stormwater quality and those that have the potential to impact on stormwater quality, including those activities where management approaches may already be in place to minimise the risks.

Table 4 provides a summary of threats in each catchment. The very high and high stormwater quality threats, by catchment study area, are described in detail the original GSSWMP.

Table 4 Summary of Waterway threats by sub catchment (ratings from original GSSWMP).

Value	Northern Shepparton	Central Shepparton	Southern Shepparton	Broken	Outer Broken (Drain 2 et al)	Outer Goulburn (Drain 3)	Outer Shepparton (Drain 4)	Kialla Lakes, Broken River	Outer Goulburn South	Mooroopna North	Mooroopna South	Tatura Mosquito Depression
Residential	High	Moderate	High	High	High	High	High	High	High	High	Moderate	High
Industrial	Low	Very High	Low	Low	High	High	Low	Moderate	Moderate	Low	Very High	Very High
Commercial	Moderate	Very High	High	Moderate	Moderate	High	Low	Moderate	Moderate	High	High	Moderate
Major roads	Moderate	High	Moderate	High	High	High	High	Moderate	Moderate	High	High	High
Land development	Very High	Moderate	Moderate	Low	High	Very High	High	Moderate	Very High	High	High	Moderate
Building sites	Very High	High	High	Low	Moderate	High	Very High	Moderate	High	High	Moderate	Moderate
Unstable waterways	Low	Low	Low	Moderate	High	High	Low	Moderate	Moderate	High	Low	Low
Flow modification	Low	Moderate	Low	Low	Not applicable	Moderate	Moderate	Moderate	Low	Moderate	Low	High
Markets and events	Not applicable	Moderate	Not applicable	Low	Not applicable	High	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	High
Upstream inflows	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	High
Open space	Moderate	High	High	Moderate	Low	High	High	Moderate	Moderate	High	Low	Moderate
Landfills	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Low
Septic and sewers	Low	Low	Low	Not applicable	Moderate	High	Low	Low	Moderate	Low	Low	Low
Rural residential	Low	Not applicable	Low	Not applicable	Moderate	Low	Moderate	Low	Moderate	Low	Low	Moderate
Rural	Low	Not applicable	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Not applicable	Moderate

12. STORMWATER PRIORITIES

Stormwater priorities have been determined using a risk-based methodology that correlates the threats and values outlined in previous sections. This allows identification of the level of risk and the priorities within each catchment. The methodology used a system based on multiplication of scores assigned to values, threats and sensitivity. Risks with highest scores were assessed as being of highest priority. (Further detail can be found in the original GSSWMP documents).

12.1. Priority land uses

Land uses associated with the priority risks include:

Industrial: industrial land use runoff poses a very high threat to in-stream and extraction/use values of the Goulburn River and Cussen Park ponds in Tatura respectively.

Land development: land development, particularly in the northern and southern growth corridors of Shepparton poses a very high threat to recreation and in-stream values of the Goulburn River.

Building sites: runoff from building sites in northern Shepparton pose a very high threat to recreation and in-stream habitat values of the Goulburn River. Building activity in Central Shepparton and South Shepparton also pose a very high threat to recreation values of the Goulburn River.

Residential: runoff from areas in northern Shepparton and southern Shepparton pose a very high threat to recreation values of the Goulburn River.

Major roads: runoff from major roads poses a very high threat to in-stream habitat and recreation values of the Goulburn River. Similarly, major roads in the Broken catchment pose a very high threat to in-stream habitat values of the Broken River.

Upstream inflows: within the Broken catchment, upstream inflows pose a very high threat to in-stream habitat and recreation values of the Broken River.

12.2. Priority catchments

The priority land uses have been assigned to catchments to develop a sense of both spatial and issue priority for action (Table 5). Higher priority catchments include northern Shepparton, central Shepparton, and Tatura mosquito depression.

Structural works have been implemented at some of these priority catchments and further works are planned over the next three to four years.

Table 5 Catchment priorities

Value	Northern Shepparton	Central Shepparton	Southern Shepparton	Broken	Outer Goulburn (Drain 3)	Outer Broken (Drain 2 et al)	Kialla Lakes, Broken River	Outer Goulburn South	Mooroopna North	Mooroopna South	Tatura Mosquito Depression	Outer Shepparton (Drain 4)
Residential	Very High		Very High								High	
Industrial		Very High				High				Very High	Very High	
Commercial		High										
Major roads		Very High		Very High		High			High	High	High	High
Land development	Very High											High
Building sites	Very High	Very High	Very High									High
Unstable waterways												
Flow modification												
Markets and events											High	
Upstream inflows				Very High							High	
Open space									High			
Landfills												
Unsewered properties												

13. RISK MANAGEMENT

The development and implementation of strategies to address the priority risks will result in an improvement in the quality of stormwater discharged into local waterways.

This plan proposes two main areas of activity to manage the risks identified in Section 12:

- Structural – works activities directed at specific catchments.
- Non structural - strategies and actions to be applied widely across the municipality

There is substantial overlap between the two areas of activity (Table 6).

Table 6 Key attributes of Programs

	Structural works	Non Structural
Education and awareness	✓	✓
Structural treatment measures	✓	
Planning and regulation	✓	✓
Source controls	✓	
Site specific strategies and plans	✓	
Information and data collection	✓	✓
Policy and commitment	✓	✓
Operations	✓	✓
Advocacy		✓

13.1. Structural measures

Structural measures, such as treatment techniques or detention basins, are used to improve water quality and control streamflow discharges. Retrofitting of structural measures to existing outfall structures is often difficult, but is required to address threats. For new developments, structural measures to address stormwater threats can be incorporated into development planning and is a requirement of planning processes.

As noted in Section 6.7 designs have been prepared a total of twelve stormwater outfalls in Shepparton and Mooroopna. A number of stormwater treatment works have been installed at outfalls, including four GPTs (McFarlane Rd, Mooroopna; Vaughan St, Shepparton; Assim Drive, Shepparton; Colliver Rd, Shepparton). It is expected this program will be implemented over time as resources allow.

Wetlands have been constructed at Gordon Drive, Wanganui and Lake Bartlett.

13.2. Non structural measures

Non structural, or source controls, may be used effectively to avoid a number of stormwater impacts. These measures can include land-use planning, education, regulation and operational practices to limit changes to the quality or quantity of urban run-off before it enters the stormwater system. The 2003 GSSWMP screened a large number of management measures and developed an implementation plan with over 180 individual actions. These have been substantially simplified and management actions (Table 8) have now been developed around the following themes:

Table 7 Summary of the non structural measures themes

Theme	Issues and action
Coordination	Plan adoption; Liaison and coordination with relevant agencies and adjoining municipalities; Stormwater Management Officer; Planning and regulation.
Education and awareness	Stormwater information; Public awareness; School activities; Signage; Stormwater training.
Monitoring	Compliance with Local Law No 1; Rates of litter accumulation in GPTs; Waterwatch monitoring.
Reporting	Plan implementation progress to council and relevant stakeholders.
Operations	Enforcement: <ul style="list-style-type: none"> • Planning permit conditions • Local Law No 1 Domestic Wastewater Management Plan implementation.

13.3. Implementation and coordination

Responsibility for overall coordination of implementation of this plan rests with Council's General Manager - Sustainable Development. Amongst other things, coordination will involve:

- Integrating plan implementation with other council activities
- Monitoring and reporting plan implementation
- Regular (3-5 year) plan reviews
- Arranging funding for plan implementation, from both internal and external sources.

13.4. Implementation plan

Table 8 summarises the actions to be implemented as part of this revised GSSWMP. The actions listed are generally a continuation of activities already in place.

Implementation of structural works, in particular is subject to funding. To date the cost of these works has been shared with the GB CMA.

Implementation of the non-structural program centres on the activities of the Council's Stormwater Education Officer and integrating stormwater management actions across current Council activity such as local law enforcement and planning.

13.5. Review

It is proposed to review this plan on a three-year rolling basis. The next review is due in 2012-2013.

Table 8 Management Actions Summary.

Program Area	Action	Estimated cost						Comment
		Y1 (08/09)		Y2 (09/10)		Y3 (10/11)		
		Capital \$	O&M \$	Capital \$	O&M \$	Capital \$	O&M \$	
Structural	Install GPT Tom Collins Drive	40,000						
	Install GPT Knight St and rehabilitate Mason St outfall			162,000				
	Install GPT Balaclava Rd Stage 1					94,000		
	Install GPT Balaclava Rd Stage 2							To be undertaken 2011/12
	Gemmill Swamp Bioremediation Wetland, 09/10			200,000				
	Lake Bartlett - stage 2 and 3							tba
	Gordon Drive Wetland - stage 3, 4, and 5							tba
Non Structural	Coordination (including Stormwater Management Officer)		20,000		22,000		25,000	
	Education and awareness		5,000		5,000			
	Monitoring (Waterwatch)		5,000		5,000			
	Reporting							
	Operations (including operation of GPTs installed)				10,000		20,000	
	Operations – DWWMP implementation							
Total		40,000	30,000	362,000	42,000	94,000	45,000	

14. REFERENCES

- CSIRO (2006). Urban Stormwater: Best Practice Environmental Management Guidelines. Originally published in 1999 but now available electronically.
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APPENDIX 1 – OBJECTIVES FOR ENVIRONMENTAL MANAGEMENT OF STORMWATER

Pollutant	Receiving water objective:	Current best practice performance objective:
Post construction phase:		
Suspended solids (SS)	comply with SEPP (e.g. not exceed the 90th percentile of 80 mg/L) (1)	80% retention of the typical urban annual load
Total phosphorus (TP)	comply with SEPP (e.g. base flow concentration not to exceed 0.08 mg/L) (2)	45% retention of the typical urban annual load
Total nitrogen (TN)	comply with SEPP (e.g. base flow concentration not to exceed 0.9 mg/L) (2)	45% retention of the typical urban annual load
Litter	comply with SEPP (e.g. No litter in waterways) (1)	70% reduction of typical urban annual load (3)
Flows	Maintain flows at pre-urbanisation levels	Maintain discharges for the 1.5 year ARI at pre-development levels
Construction phase:		
Suspended solids	comply with SEPP	Effective treatment of 90% of daily run-off events (e.g. <4 months ARI). Effective treatment equates to a 50 th ile SS concentration of 50 mg/L.
Litter	comply with SEPP (e.g. No litter in waterways) (1)	Prevent litter from entering the stormwater system.
Other pollutants	comply with SEPP	Limit the application, generation and migration of toxic substances to the maximum extent practicable
<p>1 An example using SEPP (Waters of Victoria 1988), general surface waters segment. 2 SEPP Schedule F7—Yarra Catchment—urban waterways for the Yarra River main stream. 3 Litter is defined as anthropogenic material larger than five millimetres.</p>		

Table 2.1 Objectives for environmental management of stormwater.