

# Stormwater System Management Planning

A Guide for Local Government in Tasmania

September 2016



## Contents

1. Introduction .....	3
1.1 Stormwater Planning Context.....	3
1.2 Legislative Background .....	3
1.3 State Stormwater Strategy.....	4
1.4 Urban Drainage Act 2013.....	4
1.5 Stormwater System Management Plan .....	5
1.6 What is an 'urban area'? .....	5
1.7 What is a Catchment? .....	6
1.8 Responsibility for Preparation of Stormwater System Management Plan.....	7
1.9 Overview of this Document .....	7
2. Content of Stormwater System Management Plans .....	8
2.1 Overview of Plan Content .....	8
2.2 Stormwater System Management Plan Objectives .....	8
2.3 Description of Study Catchment .....	9
2.4 Description of Existing Stormwater System.....	9
2.5 Identification of Risks, Issues and Opportunities.....	10
2.6 Identification of Strategies and Outcomes .....	11
2.7 Costs, Benefits and Funding Arrangements.....	12
2.8 Priorities and Timeframes.....	12
2.9 Responsibilities .....	12
2.10 Communication and Consultation .....	13
2.11 Review of the Stormwater System Management Plans .....	13
3. Preparing the Plan Contents .....	14
3.1 Plan Preparation .....	14
Figure 3.1 Stormwater System Management Plan Preparation Process.....	15
3.2 Identifying Strategies .....	16
3.3 Determining Relative Priorities.....	16
3.4 Cost Apportionment between Local Government Bodies in a Catchment.....	17
3.5 Timeframe for Preparing and Implementing the Plan.....	17
Table 3.1 Worksheet Template for Presentation of Work Priorities for a Catchment .....	18
Abbreviations.....	19
References .....	20

## 1. Introduction

In Tasmania, stormwater management systems are increasingly receiving greater attention from Local Government in step with communities' growing awareness of the critical impact stormwater has on our economic, environmental and social activities within the urban landscape.

The purpose of this document is to provide guidance to Local Government within Tasmania on meeting the requirements of the Urban Drainage Act 2013, and to propose a framework for the development of Stormwater System Management Plans (SSMP's) for urban catchments within the State.

### 1.1 Stormwater Planning Context

The primary aim of an urban stormwater management system is to minimise economic, environmental and social impacts of flooding and water quality degradation caused by stormwater runoff in our communities.

To achieve best practise urban stormwater management in Tasmania, a council should develop catchment-based Stormwater System Management Plans with consideration given to the following core principles:

1. Understand the level of risk in its public stormwater system within the urban area;
2. Apply a risk management framework for flood mitigation and stormwater renewal works based on analysis of defined flood events;
3. Ensure stormwater systems are planned, designed and built with appropriate consideration of stormwater management principles by making better use of the statutory development and planning system;
4. Build resilience and consider climate change impacts to address future demands on the urban stormwater system;
5. Integrate stormwater management into the urban water cycle to achieve the goals of social, environmental and economic sustainability;
6. Enhance community awareness of, and participation in, the appropriate management of stormwater.

### 1.2 Legislative Background

In Tasmania there are several pieces of legislation, policy and regulations that are relevant to stormwater system management. These include the:

- [Urban Drainage Act 2013](#);
- [Local Government Act 1993](#);
- *Local Government By-Laws*;
- [Local Government \(Building and Miscellaneous Provisions\) Act 1993](#);

- [Environmental Management & Pollution Control Act 1994](#);
- [Building Act 2016](#);
- [State Policy on Water Quality Management \(1997\)](#);
- [State Stormwater Strategy \(2010\)](#); and
- [Plumbing Regulations 2014](#) and [Building Regulations 2014](#).

Of particular relevance to stormwater systems are the State Stormwater Strategy and the *Urban Drainage Act 2013*.

### 1.3 State Stormwater Strategy

The State Stormwater Strategy re-affirms recommendations of the Tasmanian State Policy on Water Quality Management 1997 which emphasises the need to manage stormwater at source and highlights the importance of managing stormwater in new developments at both the construction and operational stages.

The State Policy on Water Quality Management 1997 requires that Local Governments prepare and implement stormwater management plans where stormwater is prejudicing, or has significant potential to prejudice the achievement of water quality objectives. Whilst this State Government policy has been in place for some time, there has been limited active follow up or assistance in its implementation.

### 1.4 Urban Drainage Act 2013

The *Urban Drainage Act 2013* ("the Act") requires that all Tasmanian Councils develop Stormwater System Management Plans (SSMPs) for the urban areas within their municipalities. Tasmanian councils have to complete the task by 19th Dec 2019 to satisfy the requirements of the Act. The Act states that a SSMP must specify:

- a) plans for the management of any assets used for the delivery of a stormwater service;
- b) the level of risk from flooding for each urban stormwater catchment in the public stormwater system; and
- c) any other matters prescribed in the regulations or that the council considers appropriate.

Most councils in Tasmania have already prepared their stormwater asset management plans as required by the *Local Government Act 1993*, and the regulations for the Urban Drainage Act have not yet been released. Therefore, the main focus for councils in developing the SSMPs at this stage is to *quantify the level of risk and to consider their priorities in relation to urban stormwater management*.

In addition to the requirement to prepare SSMPs the Act explicitly states at Section 12 that "*a council that provides stormwater services must maintain and make publicly available maps showing all public stormwater systems within the urban area of its municipal area, including those portions of waterways that have a primary role in transporting stormwater*".

## 1.5 Stormwater System Management Plan

The purpose of requiring that local councils develop Stormwater System Management Plans (SSMPs) is to ensure an appropriate level of understanding and management of the flood risk and public stormwater systems within all urban drainage catchments. The templates and associated guidance presented in this document are aimed at providing a consistent Local Government framework for management of stormwater in urban catchments across Tasmania.

It is likely that SSMPs will also be used as the basis for developing and prioritising incoming capital works, forecasting and preparing budgets, and specifying cost apportionment arrangements between councils, State Government and other stakeholders e.g. developers.

In order to achieve the desired outcomes articulated above, SSMPs should:

- set out clearly the objectives for managing stormwater in urban catchments;
- identify flood plains and associated impacts within individual urban catchments;
- identify actions, both structural and non-structural, required to manage the identified flood plains and to mitigate the impacts on the council and its affected communities;
- provide a justification for any proposed catchment flood studies, works, measures or actions;
- estimate capital and recurrent costs of proposed studies, works, measures or actions, and to assign priorities and timeframes to each of them;
- define the obligation of the relevant parties in funding, implementing and communicating the plans.

## 1.6 What is an 'urban area'?

The *Urban Drainage Act 2013* specifies that each council needs to develop a Stormwater System Management Plan for the urban areas of its municipal area.

There is no definition of 'urban' specified within the Act. As a guide and in the interests of achieving consistency in interpretation and application of the Act, councils may find the following discussion useful (though not finite) when defining the urban area(s) of their municipalities.

The terms 'towns' and 'cities' have long been used to describe urban areas. This is supported by dictionary definitions for the term 'urban'. Generally, the built up 'urban' areas in towns and cities will be readily identifiable. There may, however, be cases where locations of urban environments exist in areas that are outside formalised township/city boundaries.

Other indices (or a combination of these) which may assist councils to identify and define their 'urban' areas for purpose of determining their SSMP areas could include:

- Within the recognised speed limits which define a built up area for the purpose of road traffic management;
- Township boundary signage;
- Areas serviced by formalised street lighting;

- ABS definition for urban centre/locality (used to define urban centre/locality for the collection of census data) - which recognises population clusters of 1000 or more people as an urban centre and between 200 – 999 people as a locality. It further draws on a density of at least 200/km<sup>2</sup> for urban centres and expressly excludes from relevance the use of Local Government administrative boundaries (i.e. City of....) as being relevant in defining urban centres/localities.
- Definitions and references to 'urban' areas within councils planning schemes;
- Areas covered by relevant zones or land use categories within council planning schemes; and/or
- Reference to other relevant/related council's policies which may include reference to 'urban' areas.

In addition, there will be cases where councils will have accumulated knowledge of stormwater events affecting residential areas which do not necessarily fall into recognised urban areas. These areas will need to be looked at distinctly and stormwater management planning considered based on the level of risk posed and the first stated objective of the *Urban Drainage Act 2013*, namely, 'to protect people and property by ensuring that stormwater services, infrastructure and planning are provided so as to minimise the risk of urban flooding due to stormwater flows' (s.4).

## 1.7 What is a Catchment?

For the purpose of preparing a sensible plan, it is recommended that the areas for which Stormwater System Management Plans are developed should be complete hydrological catchments.

The boundaries of catchment areas may be determined from contour maps, council records, aerial photographs and field inspections. When determining a catchment area the following issues and guidelines should be considered (*Queensland Urban Drainage Manual (QUDM)*, 2013):

- Where the contributing catchment includes existing subdivided areas, the location of existing drainage works needs to be determined, either by field inspection, council records, or from 'As Constructed' drainage plans.
- In urbanised catchments, ridgelines should not automatically be adopted as catchment boundaries because pipe drainage systems may collect and carry stormwater across these natural catchment boundaries.
- The catchment area should take into account likely future road layouts and road drainage patterns if the contributing catchment includes areas subject to future development.
- Roads, fences and pathways may significantly alter catchment boundaries. Property fencing and sound-control fencing can either block or significantly alter the direction of surface runoff.
- The effective catchment area of the minor drainage system may be different from the catchment area of the major drainage system. In some cases the piped drainage system may discharge to a location different from that of the overland flow.
- In small urban catchments, the effective catchment boundary may be governed by the location of allotment boundaries.

## 1.8 Responsibility for Preparation of Stormwater System Management Plan

Stormwater System Management Plans are to be prepared by the relevant individual council or jointly by councils within a hydrological catchment.

## 1.9 Overview of this Document

This document provides a concise framework for the preparation of Stormwater System Management Plans for urban areas within and across Local Government municipal boundaries in Tasmania.

It contains:

- A description of the aims, principles, legislative background of an SSMP
- A description of the required content to be presented in an SSMP  
(See Chapter 2 [Content of Stormwater System Management Plans](#))
- A description of the techniques to be used for preparing some specific aspects of the SSMP's content (See Chapter 3: [Preparing the Plan Contents](#))
- Contents and templates that can be used to guide the preparation of the Plan.

## 2. Content of Stormwater System Management Plans

### 2.1 Overview of Plan Content

Stormwater System Management Plans are to contain the following:

- An **identification of objectives and outcomes** for management of stormwater in the designated urban area/s;
- A **description of the catchment** to which the plan applies, including a definition of the urban area;
- A **description of the existing public stormwater system**, including identification of current condition and ownership of assets where known;
- An **identification of stormwater management problems and opportunities** for achieving outcomes for public and environmental benefit in the urban areas/s;
- An **identification of strategies** to meet specified management objectives for the urban area/s;
- **Determination of capital and maintenance (including recurring) costs** associated with identified management strategies;
- An **assessment of the benefits to be derived by implementation** of proposed management strategies;
- **Prioritisation** of the strategies and a **timeframe** for implementation;
- **Assignment of responsibilities** for implementing the strategies and meeting any costs;
- A **communication / consultation strategy** for the Plan;

The following sections describe in more detail the minimum content required in the SSMP under each of these elements.

### 2.2 Stormwater System Management Plan Objectives

When determining the objectives of a Stormwater System Management Plan, the broader objectives of the *Urban Drainage Act 2013* should be taken into account:

- a) to protect people and property by ensuring that stormwater services, infrastructure and planning are provided so as to minimise the risk of urban flooding due to stormwater flows; and
- b) to provide for the safe, environmentally responsible, efficient and sustainable provision of stormwater services in accordance with the objectives of the Resource Management and Planning System of Tasmania, as set out in Schedule 1 of the Act.

The specific objectives of an SSMP should be relevant and responsive to the problems and opportunities identified for the urban/catchment areas that are the subject of the Plan. In addition, the objectives of the Plan should articulate measurable goals for the management of stormwater within the catchment.

As a minimum, the objectives are to set goals for:

- an acceptable level of protection of the community and both private and public assets from flooding;
- Sustainable management of stormwater infrastructure, including renewal, upgrade, extension and maintenance.
- desirable planning outcomes associated with new development, open space, recreation and amenity;
- Adoption of consistent standards for stormwater infrastructure.

It is important to note that the long term impact of stormwater on both the natural and built environments is a function of the extent to which stormwater management is integrated into the overall urban planning process; therefore although not explicitly required to meet the objectives of the Act, consideration may also be given to include:

- management of the quality of runoff and its effect on receiving waters, both terrestrial and marine where relevant;
- extent of beneficial use of stormwater runoff;
- desirable end-state values for watercourses and riparian ecosystems.

### 2.3 Description of Study Catchment

The Stormwater System Management Plan is to contain a clear description of the area to which the Plan applies. This may be provided by a scaled map delineating the catchment boundaries and broader 'urban area' boundary in relation to features such as roads, contours, allotment boundaries and other land marks.

In defining its 'urban area' for the purposes of the SSMP, a council may take into consideration the characteristics of urban areas discussed above at [1.6 'What is an urban area?'](#)

Within the determined urban area/s, the catchment/s for which a Stormwater System Management Plan is to be prepared must be complete hydrological catchments.

The catchment may also be described in terms of land use, development trends, climate; impacts of climate change, water levels in receiving waters, and provide an assessment of soils and underlying geology and how they may affect the hydrological processes.

### 2.4 Description of Existing Stormwater System

Prior to preparation of a Stormwater System Management Plan, a council is to have assembled sufficient information regarding stormwater infrastructure assets within the urban area/s (including those owned by other parties, where relevant), such that information regarding the location, nature, type and size of these assets are readily available; preferably, within a geographical information system (GIS) format. This will satisfy the requirements of Section 11 of the *Urban Drainage Act 2013* to maintain, and make available, a map of the public stormwater system.

## 2.5 Identification of Risks, Issues and Opportunities

Identification of risk issues and opportunities for outcomes of public and environmental benefit associated with stormwater management in the urban area/s is to be undertaken. This is to be based on analysis using accepted hydrological, hydraulic, water quality and yield modelling techniques as described in publications such as *Australian Rainfall and Runoff (ARR)* (1987 and with reference to the development and release of ARR2015 and revision project reports) and *Australian Runoff Quality (ARQ)*.

As a minimum, the risk issues and opportunities to be assessed are to include:

- The potential for flooding within and downstream of the urban area/s and catchments;
- Identify overland flow paths;
- The nature and impact of flooding on properties and the potential for economic loss, environmental impact and public safety issues;
- The positive and negative impacts of future development on flooding;
- Opportunities for better managing flood risk (where such risk is identified), including infrastructure upgrades and non-structural flood mitigation measures such as flood warning and preparedness and better integration between stormwater management, land use planning and preventative maintenance.

Although not explicitly required by the Act, it would be beneficial to improving stormwater management should consideration also be given to:

- Stormwater quality issues within streams and receiving waters both within the urban areas, the catchment/s and downstream from the catchment/s;
- Opportunities for stormwater harvesting and re-use;
- Opportunities for environmental enhancement in association with construction of stormwater infrastructure including managing stormwater to enhance water dependent ecosystems where feasible.

The level of protection or Level of Service (LoS) provided by a stormwater drainage system is defined by the frequency with which stormwater flows will exceed its capacity and at which point flood damage may be expected to occur. This is usually defined as its Annual Recurrence Interval (ARI), or Annual Exceedence Probability (AEP), which is a statistic, based on historical rainfall records, indicating the average number of years between events of such a magnitude.

Determination of a suitable level of protection (LoP) is required to assess the capacity of drainage system and its associated flood risk and as a design target for potential upgrades. Flood risk can be measured during a Defined Flood Event (DFE). The DFE in Australia has historically been set at the 100 Year ARI or 1% AEP, critical storm event.

Ideally the LoP or LoS should be developed through engagement with the community on their willingness to pay for any increase in the standard of service provided, with an understanding that different intervention options have different costs and benefits associated with them.

Further discussion on developing and adopting an appropriate LoS for a Public Stormwater System, can be found in the recent publication *Practice Note 5 Stormwater Drainage* (IPWEA, 2011).

The results of analyses of the above points should be supported by input from council staff and elected members (refer [Paragraph 2.10](#) below).

## 2.6 Identification of Strategies and Outcomes

A coordinated and multi-objective strategy involving studies (if needed), works and actions is to be developed and described in the Stormwater System Management Plan. Sufficient analysis needs to be undertaken to demonstrate that the proposed strategy will achieve the outcomes defined in [Paragraph 2.2](#) above in a cost effective and sustainable manner.

It is possible that as a part of the development of the strategy, the objectives set out in Paragraph 2.2 may need to be modified to achieve a cost effective, feasible solution that takes in account constraints within the catchment and other socio-political factors.

Strategies may include structural or non-structural responses to flood risk, the implementation of planning controls and/or construction of stormwater treatment facilities. In developing the proposed strategies, consideration is to be given to the works and actions required at an allotment, local and catchment scale.

Examples of stormwater management strategies include:

- Planning scheme development requirements;
- Detention and retention systems for flow management – on site or on stream;
- Infrastructure upgrades;
- Gross Pollutant Traps and other structures;
- Flood mitigation works;
- Community education;
- Stream management – flow management , scour management;
- Water quality improvement - source and stream treatment systems.

The strategy is to clearly define linkages to the Council's Planning Scheme and regional Natural Resources Management Plan(s) and is to identify any amendments to the Planning Scheme (or any amendments being contemplated) necessary to ensure that stormwater is properly managed in the urban area/s, including beneficial use where feasible.

There are many examples of stormwater management and planning guidelines within Australia that provide quality information on potential stormwater strategies and mitigation measures that may be employed, for example the Tasmanian Subdivision Guidelines (LGAT, 2013); Queensland Urban Drainage Manual (Queensland Government, 2013); the NSW Floodplain Development Manual (NSW Government, 2005); and Stormwater Management Manual (Dept. of Water WA, 2007).

It is envisaged that IPWEA Tasmania in collaboration with LGAT will develop and publish a Tasmania focussed stormwater management manual over the next couple of years in lieu of any State government funded publications.

## 2.7 Costs, Benefits and Funding Arrangements

The costs of implementing the multi-objective strategy described in Paragraph 2.6 are to be clearly set out in the plan. The costs are to be broken down into the various elements of the plan and are to include the capital costs and also a desirable timeframe for investment, along with any recurring costs, including maintenance needs, flood warning and preparedness programs.

Benefits produced as a result of implementing the Stormwater System Management Plan are to be identified. It is anticipated that the benefits that will be able to be quantified will include reductions in flood damage and stormwater use and qualitative benefits such as environmental improvements and improvements in water quality.

Funding arrangements for any proposed works and their maintenance are to be identified by the Council and linked to the asset management plan and financial management strategy.

## 2.8 Priorities and Timeframes

Priorities are to be assigned to the actions and strategies identified in the Stormwater System Management Plan . The highest priorities are for works and measures that address reduction of flood hazard and protect lives and the community from property damage.

A program for complete implementation of the strategies identified in the SSMP is to be scheduled considering the following

<u>Strategy Type</u>	<u>Suggested Timeframe</u>
Non-structural/flood preparedness	2-5 years
Planning controls	2-5 years
Higher priority structural flood mitigation	10 years
Low priority structural flood mitigation	10-20 years

Assignment of project priorities is discussed in more detail in [Paragraph 3.3](#) below.

## 2.9 Responsibilities

Responsibilities for actions identified in the Stormwater System Management Plan are to be clearly defined.

Where partner organisations and community groups are expected to be involved, the responsibilities of these organisations are also to be defined.

## 2.10 Communication and Consultation

It is expected that as a part of the preparation of a Stormwater System Management Plan, the staff and elected members, the local community, and the relevant NRM Board and other relevant government agencies will be consulted in relation to the perceived stormwater management problems and opportunities within the area, and the proposed solutions to those problems.

The nature and methods of consultation adopted for the preparation of the SSMP will vary depending on factors such as:

- the size of the catchment/s;
- the nature and complexity of stormwater management issues;
- the nature of the adopted management strategies; and
- the impact of the strategies on the local community.

The processes and outcomes of consultation carried out during the preparation of the SSMP are to be documented.

The SSMP will not be considered to have been finalised until this consultation has been carried out to the satisfaction all parties involved in the development of the SSMP.

## 2.11 Review of the Stormwater System Management Plans

It is anticipated that the Stormwater System Management Plans will be 'living documents' that are periodically reviewed to take account of current knowledge, changing conditions within the catchment and changing community attitudes to the management of stormwater and other water resources making up the urban water cycle.

To ensure that this occurs, it is expected that a SSMP would be reviewed at least every 5 years (or aligned to review of councils' asset management plans) and that the proposed works and strategies to be adopted for the subsequent 10 year period will be identified in the Asset Management Plan.

It is recognised that despite the best planning, on occasion, proposed works within a catchment need to be modified or elevated in priority as a result of unforeseen circumstances. Amendment of a council's SSMP may be appropriate to account for these circumstances, provided that the proposed changes are consistent with the overall strategy and properly integrate with existing or proposed infrastructure, including any SSMP for an adjoining catchment.

### 3. Preparing the Plan Contents

This section provides a more detailed description of the processes/methods that are to be used for preparing certain portions of the Stormwater System Management Plan.

#### 3.1 Plan Preparation

A flow chart showing the process for commencement, preparation and approval of a Stormwater System Management Plan for a catchment is shown in [Figure 3.1](#) below.

Preparation of the SSMP is to be undertaken by appropriately qualified personnel, having experience in stormwater and catchment management. It is envisaged that the preparation process will essentially follow the sequential order of items set out in [Chapter 2](#) of this Guide. It is recognised, however, that the process of setting management objectives, developing strategies to achieve these objectives and then testing these strategies against physical, financial, environmental and social constraints may involve a number of iterations. Once the elements of the proposed strategy have been determined, funding arrangements, priorities, timeframes for implementation and responsibilities are to be defined.

Throughout the SSMP preparation process it is envisaged that an appropriate consultation process will be carried out. The manner and extent of consultation is expected to vary from catchment to catchment, however it is anticipated there is a consistency, in terms of format, methodology, assumptions and mitigation strategies, across all the SSMPs prepared by the same Council, and in most instances the final SSMP should be adopted/endorsed by the Council itself.

## STORMWATER MANAGEMENT PLAN DEVELOPMENT

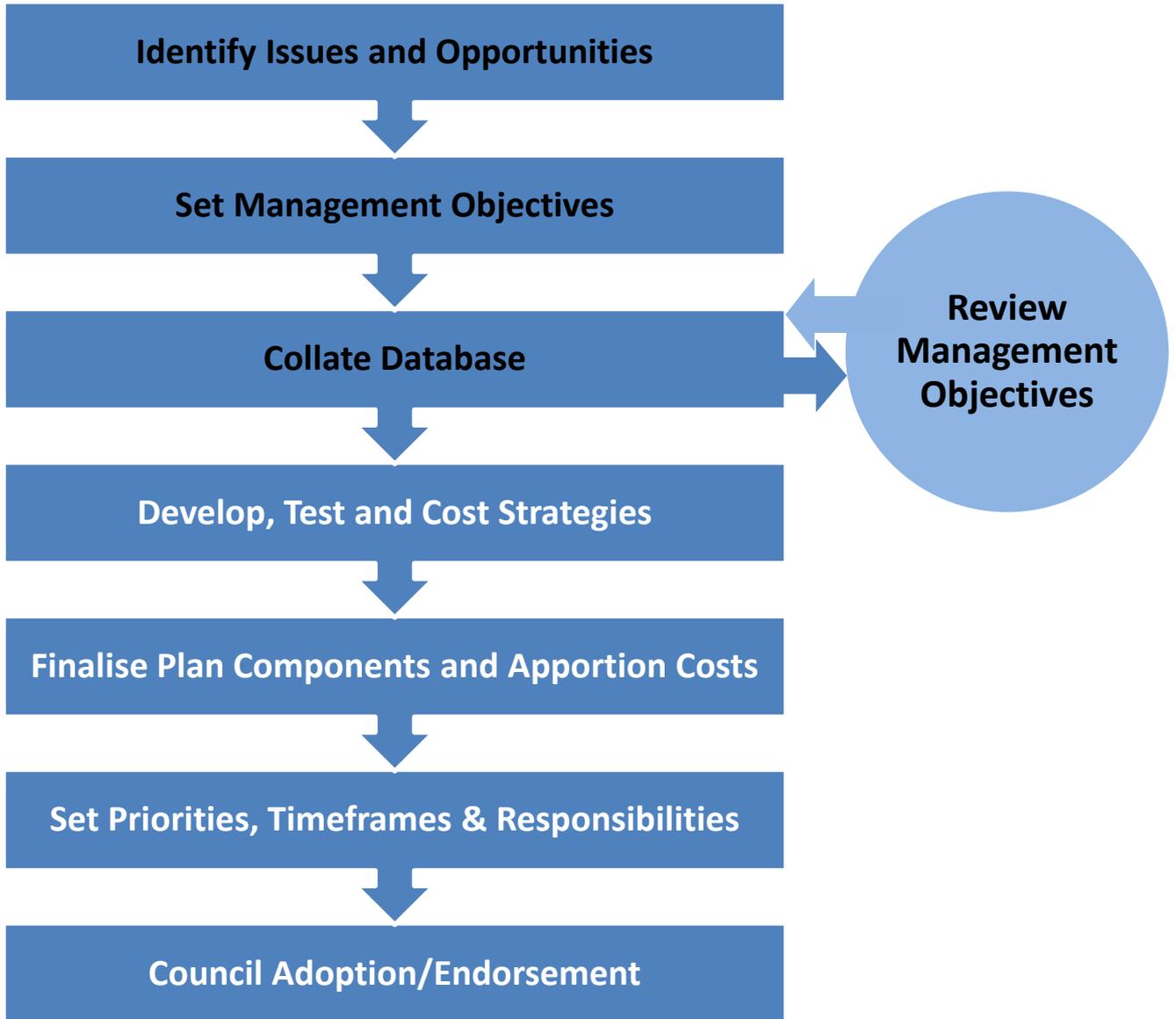


Figure 3.1 Stormwater System Management Plan Preparation Process

### 3.2 Identifying Strategies

A multi-objective approach to the management of stormwater from urban areas should be adopted in which:

- flood risk to existing and future development is minimised;
- stormwater harvesting and re-use opportunities are maximised;
- adverse impacts on watercourses and receiving waters are reduced; and
- desirable development planning outcomes associated with urban landscape, open space, recreation and amenity are achieved.

Due to the varying nature of urban catchments and the existing level of development in many of these catchments, the degree to which these objectives can be achieved in any particular catchment will also vary. Similarly, appropriate strategies to achieve these objectives will vary from catchment to catchment.

A number of documents have been published nationally in which strategies for management of stormwater to achieve various outcomes are described. These strategies may involve devices or planning controls implemented at the allotment level, works constructed on minor catchments or larger regional scale facilities.

This guideline neither advocates nor precludes any particular management strategy. However, any strategy that is recommended within the Stormwater System Management Plan must be shown to meet the specified objectives for management of stormwater in that catchment in a reliable, sustainable and cost effective manner which achieves the outcomes for flood management and other objectives where feasible.

### 3.3 Determining Relative Priorities

Priorities for the various actions identified within a catchment are to be set as a part of the preparation of the Stormwater System Management Plan. In assessing priorities, highest priority is to be given to those actions that address reduction of flood hazard and protect life and property.

The information contained within the SSMP will be used to assess the relative priority of projects between catchments. As a result, information describing the anticipated outcomes of implementation of any proposed works should be presented in a consistent manner within each of the Plans.

To assist in presentation of this information, a standard worksheet for summarising the benefits associated with implementation of the proposed works is shown in [Table 3.1](#).

This worksheet can be included in the SSMP, listing each of the projects identified within the Plan (and across Plans), ranked in order of priority. For each project, costs (both capital and recurring) and key benefits should be calculated using the same methodology and presented in a consistent way.

For those projects having a flood mitigation benefit, tangible benefits can be stated in terms of a quantifiable measure, such as reduction in average annual flood damage (AAD) or reduction in number of properties affected by flooding. Where such a measure has not been determined, a qualitative assessment of the impact of the work should be provided.

For those projects having a stormwater harvesting benefit, the benefits can be stated in terms of a quantifiable measure such as the amount of stormwater harvested in an average year. Where such a measure has not been quantified, a qualitative assessment of the impact of the work should be provided.

Other benefits derived from the project are to be rated using a subjective ranking (high/medium/low) with an accompanying description which provides the basis for the assigned ranking.

### **3.4 Cost Apportionment between Local Government Bodies in a Catchment**

If a Stormwater System Management Plan covers a catchment that spans more than one municipal area, it is suggested that all costs, capital and ongoing expenditure, associated with specific projects identified in the SSMP be estimated. The agreed apportionment of these costs between local councils and other funding bodies (where known) is to be set out in the SSMP for each project.

### **3.5 Timeframe for Preparing and Implementing the Plan**

It is expected that all the Stormwater System Management Plans should be completed by the end of 2019 as per the date required by the *Urban Drainage Act 2013*. All projects and strategies documented in the completed SSMP should specify a start date (subject to funding) and an estimated completion date. This information will show the relevant council's expectations for progressing the SSMP's content.

**Stormwater System Management Plan - Project Priority and Benefits Worksheet**

Priority	Project/Activity Title	Capital Cost (\$)	Recurrent Cost (\$ / annum)	Flood Mitigation Benefit		Water Harvesting Benefit		Water Quality Benefit		Other Benefits	
				Measure Used ?	Quantification or Description of Benefit	Measure Used ?	Quantification or Description of Benefit	Rating	Qualitative Description of Benefit	Rating	Qualitative Description of Benefit
				(D) - AAD Reduction (P) - Properties Affected (Q) - Qualitative		(V) - Volumetric (Q) - Qualitative		(H) - High (M) - Medium (L) - Low		(H) - High (M) - Medium (L) - Low	
1											
2											
3											
4											
5											
6											

Table 3.1 Worksheet Template for Presentation of Work Priorities for a Catchment

## Abbreviations

AAD	Average Annual Damage (Flooding)
GIS	Geographical Information System
QUDM	Queensland Urban Drainage Manual
SSMP	Stormwater System Management Plan

## References

*Australian Rainfall and Runoff* and *Australian Runoff Quality*

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Urban Water Resources Centre (2005), 'Water Sensitive Urban Design: A Handbook for Australian Practice', University of South Australia in association with the Stormwater Industry Association and the Australian Water Association, April 2005