



CORPORATE DOCUMENT

Stormwater System Management Plan

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STORMWATER SYSTEM MANAGEMENT PLAN

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1. EXECUTIVE SUMMARY

Within the Municipality of Burnie there are two locations that can be considered “Urban Areas” for the purposes of the *Urban Drainage Act 2013*.

Under this legislation Council has an obligation to provide and manage an appropriate stormwater reticulation and to manage potential risks associated with stormwaters.

This Council has mature operational and asset management systems in place to effectively operate the reticulation. There are however opportunities to continue to mitigate community risk, improve system operation and support improved environmental outcomes, associated with stormwater.

From a global urban area perspective there are a range of risks that require some form of management or awareness in respect to the natural environment including climate change, sea level rise, landslip, Impacts on waterway environments.

There are measures, systems and processes in place to consider/provide for such risks.

Of more significance to our local community are risks that can have a direct impact on residents, their property or business and community infrastructure. Such risks can be assessed on a specific catchment basis and generally relate to:

- Localised flooding impacting on persons, property and infrastructure.
- Overland flows.
- Stream flooding.
- Riverine flooding.

The purpose of this Stormwater System Management Plan is to provide a high level understanding of how Council manages its existing stormwater reticulation, opportunities to improve system management and planning for the future, document risks associated with stormwater and our plans to addresses potential risks to the community.

The plan is framed around Council’s stormwater management objectives.

- Document infrastructure performance requirements and standards for stormwater assets and communicate to key stakeholder.
- Fund the maintenance and operation of the stormwater reticulation in accordance with Councils stormwater service level documents.
- Develop the reticulation within the urban areas, to meet user needs for appropriate and safe stormwater disposal.
- To understand systems deficiencies and flooding (localised and broader catchment) risks, and possible mitigation measures.
- Identify priorities for improvement and mitigation activities.

- Develop a plan to progressively improve waterway environment and water quality in the natural systems impacted by stormwater systems.
- Communicate the plan.

This Stormwater System Management Plan has been developed through a review of existing council records and reports, officer knowledge of the systems operation, reference to contemporary stormwater management practices and legislation, and flood studies previously carried out.

The output is an action plan that sets stormwater system management priorities over the next four (4) years.

Key actions are:

- Completion of Romaine Dam raising and flood mitigation project.
- Work with the State Government in regard to flooding modelling for Emu River and Cam River.
- Ridgley Flood Study and commencement of recommendation implementation
- Develop a communications strategy: plan and flood risk (South Burnie).
- Consolidated flood mapping to support future development controls.
- Systems and process improvement.
- Refine forward works programs.

Implementation of the actions will require adequate resources to be allocated.

A future focus of the Stormwater System Management Plan will be waterway management activities.

2. BACKGROUND

Burnie City Council manages an extensive urban stormwater reticulation, within the City itself and within the Ridgley township.

This system comprises:

- Open waterways (forming the urban stormwater system).
- Piped systems.
- Pits for the capture and conveyance of stormwater.
- Ocean and stream outfalls.
- Detention systems.
- Pollutions traps and other such devices.

Outside of the urban area, Council's role in stormwater management relates primarily to road side drainage and providing a passage for natural stream and overland flows, where roads intercept.

What is stormwater and why is it important to manage?

The *Urban drainage Act 2013* (the Act), defines stormwater:

stormwater means run-off water that has been concentrated by means of a drain, surface channel, subsoil drain or formed surface;

The broad reasons why a Council has an interest in stormwater management relate to:

- Council facilitates and plans the development of communities. Development can have impacts on the normal water cycle: water courses are diverted, ground water recharge areas are paved over, the quantity and speed of flows to waters ways can increase or reduce and the receiving environment can be impacted. Appropriate management of stormwater can assist in mitigating some of these negative impacts on the natural systems.
- Infrastructure concentrates and collects rain and overland flows to point discharges. This concentration, if not managed, can present a risk through localised and a broader flooding risk, resulting in damage to public or private property and injury to persons. Understanding the nature and performance of stormwater infrastructure, ensuring consistent approaches to design, construction and maintenance, identify risks and establishing plans to address risks aids in protecting community infrastructure and the residents of the community.
- Pollutants (oils, litter, chemicals) and the like accumulate in the urban environment and are washed into stormwater systems. Works in the catchments can result in silt and sediment mobilisation. Ultimately these materials find their way into receiving waters. These materials impact on water quality and the eco system. Opportunities existing to mitigate the impacts of such materials.

In urban environments stormwater systems have developed over time in response to community needs.

The current legislative framework for urban stormwater management is the *Urban Drainage act 2013*.

Under the Act, Council is a ***stormwater service provider*** (a council or an agent engaged to act on behalf of the council that operates and maintains the public stormwater system within a municipal area). As such Council has responsibility for meeting its obligations under the Act.

The Objectives of the Act are noted below and reflect the discussion above as to why a Council has an interest in managing stormwater:

- 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.

A specific requirement of the Act, is for a Council to develop a Stormwater System Management Plan.

10. Stormwater system management plans

(1) A council must develop a stormwater system management plan for the urban area of its municipal area within 6 years after the day on which this Act commences.

(2) A stormwater system management plan is to specify –

(a) plans for the management of any assets used for the delivery of a stormwater service; and

(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.

In meeting this obligation, best practise urban stormwater management in Tasmania, should aim to 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.

To provide guidance on the framework for a Stormwater System Management Plan a state wide working group, convened by the LGAT, developed a template “Stormwater System Management planning- a guide for Local Government in Tasmania.”

The approach taken by Council generally follows the approach suggested in the stormwater framework. It is noted that this is the first iteration of the BCC plan and is developed as a starting point for future improvement.

This plan for Burnie City Council will consider primarily the management of stormwater and how Council is addressing the various risks associated with Stormwater. While environmental matters are touched upon in this plan, the setting of specific environmental improvement targets and actions to address the targets; are not areas able to be resourced at this point in time. However will be the focus of future iterations of this plan.

In many respects the Stormwater System management plan is an aggregation of a range of current Council practices, plans, policies and the like, reflecting the current management arrangements.

3. OVERVIEW OF PLAN CONTENT

The purpose of developing the framework was to support Councils in meeting the general requirements of the Act, at a core level.

The framework identifies key elements of a stormwater system management plan:

- 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.

This plan prepared by Council addresses the key elements. It is acknowledged that in some areas, particularly in the water quality space, development is required and will be resourced at a latter date.

It is important to note that the development of the framework considered the content of relevant legislation, in addition to the *Urban Drainage Act 2013*, including:

- *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 2000;*
- *State Policy on Water Quality Management (1997);*
- *State Stormwater Strategy (2010); and*
- *Plumbing Regulations 2014 and Building Regulations 2014*

4. STORMWATER MANAGEMENT OBJECTIVES

In the background section of this plan the objectives of the *Act* reproduced. The objectives are very broad.

Reviewing the nature of the Burnie City Council, current stormwater management practices and our current level of maturity in the provision and management of stormwater infrastructure, specific objectives (which are our current focus) have been identified, being:

- Document infrastructure performance requirements and standards for stormwater assets and communicate to key stakeholder.
- Fund the maintenance and operation of the stormwater reticulation in accordance with Councils stormwater service level documents.
- Develop the reticulation within the urban areas, to meet user needs for appropriate and safe stormwater disposal.
- To understand systems deficiencies and flooding (localised and broader catchment) risks, and possible mitigation measures.
- Identify priorities for improvement and mitigation activities.
- Develop a plan to progressively improve waterway environment and water quality in the natural systems impacted by stormwater system

- Communicate the Stormwater System Management Plan.

Achieving these objectives will be a journey that will take some time to complete and it is important that a clear strategy is developed and implemented to guide that journey.

5. DESCRIPTION OF URBAN AREA

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

There is no definition of 'urban' specified within the Act. The Stormwater Systems Management Plan framework provides some guidance as to potential matters to consider in the establishment of the "Urban Area."

In Burnie City Council's case, a stormwater serviced area plan has previously been developed for Burnie City and for Ridgley town ship. This plan originally aligned with the Burnie Water and Sewer district plans (and is referenced as such) as BCC was also the provider of such services.

The service area plan has been modified over time to reflect those properties that have the potential to access a stormwater systems maintained by Council. The serviced area plan is used to support the levying of a stormwater charge.

Attached as **Appendix A** are plans which detail the serviced urban areas and for the purposes of the act these are the Urban Areas.

To support urban stormwater planning urban catchments have been identified. Attached as **Appendix B** is a plan identifying the major urban catchments. These catchments have been used for system modeling purposes, where flood studies have been prepared.

The catchments reflect the major stream systems in the urban areas.

Council does not have a specific management role in respect to the Blythe, Emu or Cam Rivers. Management rests with the State Government and relevant agencies.

In relation to the Cam and Emu rivers, there are some stormwater discharges from Council systems to the rivers.

6. DESCRIPTION OF EXISTING STORMWATER ASSETS

The Stormwater Asset Management Plan for Council documents the stormwater assets managed in the urban areas.

In summary the assets are:

Asset Category	Dimension	Replacement Value
Underground mains – pipes of various sizes	185.8km	\$74,880,636
Pollution Traps	8 of	\$681,718
Entry Pits	17 of	\$1,552,045
Outfalls and Headwalls	13 of	\$96,418
Open Channels	4 of	\$426,183
TOTAL		\$77,637,000

The stormwater asset information is recorded in Councils asset management register. The same information is recorded in graphical format in the GIS system.

Work is required to improve the register, to account for in stream structures such as pond and Dams.

The Urban Drainage Act requires that:

12. Council to maintain maps

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.

This information is recorded on the Council map, which is available on the Council website for viewing.

Under pinning the Asset Management plan are various reference and support documents including:

- Burnie City Council Infrastructure Assets Policy.
- Stormwater Service Level document.
- Relevant industry standard, guidelines and publications.
- Australian rainfall and run off.

7. IDENTIFICATION OF RISK, ISSUES AND OPPORTUNITIES

This section of the plan aims to document matters that are relevant to Burnie in the management of the stormwater system in respect to:

- Risk to the community: current and future impacts.
- System assets and systems management.
- Environment and environmental influences.

Which consequently assists in identifying strategies and actions to consider, with the aim being to more effectively manage risk, address issues or explore opportunities.

As this is a strategy document it is not the intent to undertake a detailed exploration of the matters raised nor is the aim to undertake definitive risk assessments, this will occur as the need arises in respect to specific projects, rather the intent it is to ensure that known and potential future issues are acknowledged, current understanding of such matters is documented and the implications of issues in respect to community safety and level of service are considered.

The exploration will be carried out at two levels:

- System as a whole
- Catchment specific

Level of Service

Council has not developed specific measurable technical or community levels of service for stormwater services at this point in time. Broad community levels of service are noted in Council's stormwater asset management plan, as follows:

- There is an ability to connect their property to the stormwater system.
- The stormwater system is safe and does not damage the environment.
- The communities exposure to flooding is minimised and where there is a resident risk, this is communicated.

A Service Level Document details our approach to operational maintenance and management of stormwater infrastructure.

Council's Subdivision Guideline identifies specific design standards based upon the function of the stormwater system element.

From a technical perspective our aim is to work towards achieving 1 in 100 year flood protection for vulnerable uses e.g. residences, key infrastructure and community service providers e.g. hospital, age care facilities and the like, on the basis that protection of people is the key consideration.

Minimising impact on commercial and industrial areas and non-critical infrastructure, is also the aim of Council, however mitigating strategies need first to be targeted to community safety.

The technical standards applied by Council in managing the stormwater systems are noted elsewhere in this document.

System As A Whole

There are a variety of risks, issues and opportunities that are common across all of the catchments within the urban areas under Council's management, or relate to allied responsibilities of Council associated with the management of stormwater and the potential impact of uncontrolled stormwaters on other assets, agencies, the environment and community.

The table below identifies known matters and provides an overview of how such matters are being managed using existing systems, processes, statutory controls and the like, and indicates potential improvement action and strategies for consideration.

The actions and strategies are further explored in section 8.

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Design Standards Subdivision Guidelines	Establish the design criteria: <ul style="list-style-type: none"> • ARI pipe capacities. • Assists with communication to the community. • Detention requirements / types. Industry accepted design standards and design methodologies are used by Council. Training of staff occurs.	Changes in design standards. Non application of agreed design standards in-house or by third party designers.	BCC	Best practice design office process. Professional development. Peer review and audit of external design.	Existing systems manage this risk.
Resources to Manage Infrastructure	The satisfactory performance of the stormwater systems relies upon appropriate resources being applied to the task and timely intervention.	System performance is impacted by resource or funding gaps.	BCC	Asset management plan and Service Level document. Regular inspection of the assets, their condition and forward works programs.	Current level of resourcing sufficient to meet established service levels.
Climate Change	Changes in rainfall patterns, intensity and frequency are noticeable. Sea level rise and storm surge becoming more relevant matters for consideration.	Design standards do not reflect prevailing weather patterns .Existing system under stress and new system performance not as desired.	BCC	Apply agreed design standard and design methodologies. Peer review. Monitor catchment responses for localised issues.	Document system performance issues as they arise and prioritise improvement work. Review current design ARI's against current rainfall patterns to determine if modification to existing ARI required.

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Development within Catchments	Additional development increases system flows. Development may occur on lands subject to stream, riverine flooding or overland flow.	System performance is impacted. Localised flooding. Exposing new group of people, property and infrastructure to flood risk.	BCC	<p>Individual catchment modeling to understand impacts of additional development (majority of catchments assessed).</p> <p>Review of proposed designs and design criteria.</p> <p>Input in to development approvals process.</p>	<p>Review how/when detention/retention facilities are provided. Develop a policy position.</p> <p>Inundation maps are not part of planning schemes as yet.</p> <p>Development controls related to inundation may be required to be developed.</p>
Sea Level Rise	Linked to climate change. Preparing for impacts associated with sea level rise must occur particularly in regard to new outfall structures, treatment structures and the like.	<p>Catchment hydraulics impacted by sea level rise.</p> <p>Outfall infrastructure performance and asset impacted.</p>	State Government / BCC	<p>Council has no ability to control sea level rise.</p> <p>Tasmanian planning schemes contain “Coastal inundation hazard area” overlays. To guide assessment of the potential risks.</p> <p>Information is reviewed as part of planned stormwater system improvement works.</p> <p>Catchment modelling has allowed for sea level rise in hydraulic assessments.</p>	Continued awareness of this issue.

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Riverine Flooding	<p>Council has no management responsibility for River management .In respect to the “Urban Area” the primary river of concern is the Emu River.</p> <p>On the night of 5 June and 6 June 2016, waters from the Emu river flooded the River road industrial area and inundated Fernglade Road.</p> <p>This resulted in significant impact on businesses on River Road.</p>	<p>Riverine flooding will impact on the function and operation of the City, particularly in areas abutting rivers.</p>	State Government	<p>Calls on the State Government to undertake flood modelling of the Emu River. Note some inundation information is available but rests with the State Government and not widely available.</p> <p>BCC to capture known information and share (with approval) as part of broader communication / consultation with the community on flood risk.</p>	<p>Continue to engage with State Government to better understand Emu river flood implications and inform community.</p>
Waterway Management	<p>Open waterways form the majority of the major flow paths through the urban areas.</p>	<p>Challenges exist in managing appropriate waterways hydraulics, against preserving / enhancing the natural values of the waterways.</p> <p>Waterways are degraded in many locations.</p>	BCC	<p>Existing management regimes in place to inspect the operation and function of waterways.</p> <p>Planning scheme protects waterways and requires permits for works (other than maintenance) in waterways</p> <p>Work procedures and training to minimize impact on waterways.</p> <p>Review of natural values atlas to identify areas of important natural values that require protection</p>	<p>Waterways management plans need to be developed to set appropriate natural values outcomes including improvement plans.</p>

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Land Slide	The Urban area of Burnie has areas of geotechnical instability (potential for landslide)	Stormwater systems in poor repair. Gaps in the stormwater reticulation can drive the use of onsite Soakage systems for stormwater disposal can create situations where landslips can activate and impact the community.	BCC	<p>The Burnie planning scheme incorporates a landslide hazard map, to advise of locations where additional precautions are required to manage various aspect of development, including stormwater management.</p> <p>Applying the required controls supports appropriate stormwater management and landslide risk mitigation.</p> <p>Forward works program identify locations where infrastructure gaps exist.</p> <p>Plumbing controls for new works.</p>	System Development (works program) key to addressing over time.
Infrastructure Gaps	Within the urban areas infrastructure gaps exist within the reticulation. Limits the ability of properties to connect and control concentrated or overland storm flows in local areas.	Concentrate water flow on to neighbouring properties. Potential damage to properties.	BCC	<p>Forward works program identify locations where infrastructure gaps exist.</p> <p>Plumbing controls for new works.</p>	System Development (works program) key to addressing over time.

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Connection to Stormwater Systems	Properties within the urban areas are charged a stormwater removal rate.	Some properties are not able to be connected. Concerns by residents at payment of charge for no service.	BCC	<p>Remission policy in place to provide opportunities to address such concerns.</p> <p>Network expansions noted on forward works program to progressively address such concerns.</p> <p>Project priority based upon identifiable impacts associated with no network provision e.g. uncontrolled overland flows, localised flooding etc.</p>	System Development (works program) key to addressing over time.
Cross Connections	Interconnections exist between the sewer and stormwater reticulation system. These have occurred due to a range of reasons including illegal plumbing works, historical due to lack of stormwater services, emergency overflow provision for the sewerage.	Impacts on sewer reticulation performance and cost. Health risk due to sewerage spills.	BCC / TasWater	<p>Council has progressed an extensive investigation program to identify illegal connections via grant funding from the Australian government. In excess of 300 properties have been treated to remove cross connections. A body of information has been collected which will be passed on to TasWater to support future program related to illegal connections.</p> <p>System gaps identified and necessary new works identified on forward works program.</p> <p>Plumbing regulations provide legislative framework to address no compliances.</p>	Complete knowledge transfer to Tas Water.

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Systems Condition	An assets performance is related to its condition and having in place appropriate regimes to inspect and maintain system performance.	Asset fails to perform. Exposes community to risk progressive failure of assets.	BCC	<p>Council has not progressed to undertaking condition assessments of all of its underground assets , as the costs verses the benefits are not demonstrable.</p> <p>Condition information for critical assets is collected and where necessary CCTV is used to diagnose localised issues.</p> <p>The stormwater AMP and associated service level documents detail the management regimes for Council’s stormwater assets.</p>	Maintaining the existing regime.
Urban Area Flood Maps	Flood modelling and mapping has occurred for much of the Urban areas. Consolidating information in a GIS layer would enable ease of access to information	<p>Known issues or hot spots not documented or knowledge transfer has not occurred.</p> <p>Impacts on response measures.</p>	BCC	<p>Flood information has been consolidated in to a GIS layer. Layer needs to be further developed to be user friendly and incorporate “Hot spots” as noted in Service Level Documents.</p> <p>Information can be used for development of inundation mapping associated with the planning scheme hazard mapping.</p>	Complete flood layer on GIS.
Serviced Areas	Council has identified serviced area maps based on the stormwater reticulation and ability to service for application of the stormwater charge.	There are various “service maps” which may not align with the “Urban Area” resulting in confusion.	BCC	Review the various serviced area map and consolidate to one GIS map layer for reference purposes.	GIS action to progress.

Risk / Issue / Opportunity	Discussion	Risk Concerns	Responsibility	Mitigation Options	Potential Improvements
Water Quality Management	<p>The stormwater system uses a network of existing natural waterways as the trunk drainage system, conveying water to Bass Strait. The natural waterways have been modified over time and include sections of remnant vegetation, modified and degraded natural systems and constructed infrastructure.</p> <p>The quality of the water in the systems is variable as is the quality of stormwater discharged to the systems.</p> <p>Water quality impacts on the health of the natural systems, including at outfall.</p>	<p>Poor water quality impacts/degrades the natural systems. Loss of flora and fauna. Potential impacts on human health.</p> <p>Impacts on potential uses of the systems for recreation, irrigation and the like.</p> <p>Litter and contaminants in the systems.</p>	BCC / State Government	<p>Council has undertaken some work in the past to restore sections of degraded waterways.</p> <p>GPT's have been installed at locations with known concerns re litter and contaminants.</p> <p>Flood studies have considered the existing condition of the natural systems but have focused predominately on flow management imperatives.</p> <p>The State Stormwater Policy focuses on water quality and over time it is believed, there will be a concerted effort to encourage Local Government to implement appropriate strategies to address water quality improvement.</p>	<p>Audit of the natural system to understand the existing situation.</p> <p>Water quality monitoring program.</p> <p>Develop a program to stabilize / improve water quality in the natural systems, while maintaining the desired stormwater management function.</p>
Network Hydraulic Model	Developing a hydraulic model for the overall network aids in future planning and supports decision making processes for new or changes in development.	A full suite of information is not available to support decision making.	BCC	Flooding modeling and assessment of the trunk drainage lines has occurred to inform decision making. Minor lines are assessed as required to support development assessments or understand localised flooding issues.	No current need to develop a whole of system network model. The work to date, and future planned works will address information needs.

Catchments

Within the urban area there are a number of discrete catchments that can be identified from a stormwater management perspective.

In essence each of the catchments are self-contained stormwater systems, that can be defined by geographic features, generally ridge lines and valleys. As noted in section 5 and illustrated on the plan attached as **Appendix B**.

In this section we discuss more fully how the risk of flooding is managed, or proposed to be managed in each of the catchments, and actions required to be progressed to mitigate flood risk.

Flood in the context of the catchment will consider:

- Stream flooding: individual catchments.
- Overland flows.
- Localised flooding.

Catchment	Description	Flood Study	Flood Issues	Infrastructure and Infrastructure Limitations	Potential Improvements
Chasm Creek	Catchment 0.2km ² . Fully piped network.	No flood study conducted to date. No identified need at present.	Inlet structure at the south end of the community can block and cause overtopping. Limited impact on the community.	Inlet to system needs to be regularly maintained.	Hot spot location noted in service level document.
Bass Strait One (1)	Catchment 0.6km ² . Number of outfalls to Bass Strait. Fully piped network	No flood study conducted to date. No identified need at present	No specific issues noted. Focus on maintaining inlet clearance for inlet structure at south end of the catchment.	No specific issues noted.	Hot spot location noted in Service Level Document.
Emu River	Catchment 2.2km ² . Riverine system with abutting commercial / industrial development in the lower reaches.	No flood study by Council. State Government has undertaken an inundation study and provided a map recently. BCC has no detail on the study specifics.	Significant flooding of the River road industrial area occurred 5/6 June 2016. No previous history of significant flooding at this location. A potential influence on the extent of flooding was a significant log jam on the Emu River rail bridge. Stormwater outfalls provided a conduit for backflow of river waters to low points, prior to the river overflowing its confines.	Lower reaches of the river has a number of bridge crossings and a weir storage immediately down stream of Fernglade Reserve. Weir in not managed by BCC. Tidal influence ;performance of outfall drains to the river impacted	State Government to be requested to undertake an assessment of the flood risk in River Road and share details of the flood modelling. Including the effect of log jams on the TasRail bridge. Assess opportunities to install flood / storm flaps on outfall pipes to the river to reduce incidence of backflow.

Catchment	Description	Flood Study	Flood Issues	Infrastructure and Infrastructure Limitations	Potential Improvements
Emu Bay 1	Catchment 0.6km ² . Predominately the former Tas Paper facility (large industrial complex).	No flood study conducted to date. No identified need at present. As part of the Tas Paper site subdivision an assessment of stormwater service needs was carried out.	No known flood issues.	No identified issues.	Incorporate stormwater assessment within the catalogue of stormwater information relevant to the catchment.
Romaine Creek / Alexander Creek	Combined catchment of 2.6km ² . Rural/open catchment, passing through heavily developed residential / commercial / light industrial area. Large dam in lower half of the catchment.	Detailed Flood study undertaken in 2009 by Hydro Tasmania Consulting. Dam Safety studies for Romaine Dam	Flooding in South Burnie commercial early 2009 was a cause for community concern. Previous instances of flooding had also been recorded. Romaine dam crested at the eastern end of the wall in 2009. Overland flooding noted in the western part of the catchment. Related to undeveloped lands draining on to adjacent subdivisions.	Outfall pipe through South Burnie does not have the capacity to manage the 1 in 100 year flood flow. Studies on Romaine dam noted an opportunity to use the Dam as a 1 in 100 year storm flow detention system. Dam assessed as High A consequence category. Triggered need to upgrade the Dam spill way to pass a 1 in 1000 year flood flow. Dam safety emergency management plan developed. Staged upgrade of Dam to occur. Stage 1 complete (1 in 100 year outfall). Stage 2 raising of dam crest and construction of 1 in 1000 year spillway. Overland flow issue resolved through construction of interceptor swale drains and connection to the reticulation.	Review and operation of Dam safety Emergency Management Plan. Upgrade of Romaine dam to provide flood protection for South Burnie and meet dam safety obligations. Communicate proposed benefits of works to the community.

Emu Bay 2	Catchment 0.4km ² . Localised South Burnie catchment – mix of commercial and residential.	No flood study conducted to date. No identified need at present.	No identified flooding issues in this small catchment to date.	Multiple points of discharge to Emu Bay. No know infrastructure issues.	Monitor system performance issues as they arise and assess.
Whale Bone Creek	Catchment 1.8km ² . Urban residential catchment with abutting development along the length of Whalebone Creek. Piped stream from Aileen Crescent to Burnie Port.	Detailed flood study prepared by Hydro Tasmania Consulting in 2010.	Localised flooding immediately south of Aileen crescent. Impacting on adjacent units. Localised flooding south of Linton street (single dwelling).	Cross road culvert at Linton street, Sutton Street and Aileen Crescent do not provide for 1 in 100 year flow. Upgrade of culverts found to be uneconomical and current configuration allows for slowing down flows and mitigating other potential flood risks.	Affected property owners have been communicated with, hot spot locations noted and inspected to ensure maximum capacity is available.
West Beach	Catchment 1.2km ² . Encompasses the CBD and general surrounds.	No flood study conducted to date. No identified need for a flood study.	Localised flooding has occurred in Marine Terrace (near Spring Street). North Terrace in the vicinity of Alexander street. Flooding has not significantly impacted the local properties.	Flooding has been related to localised blockages. Issue on North Terrace has been resolved. Marine Terrace related to pit blockages.	Monitoring issues in the CBD.

Catchment	Description	Flood Study	Flood Issues	Infrastructure and Infrastructure Limitations	Potential Improvements
Shorewell Creek	Catchment 3.7km ² . Extending through the City from Bass Strait to the southern extent of the urban area. Abutting residential development.	Flood study prepared by Entura in 2011.	<p>The creek reach between View Road and Eastwood Drive was identified as the most susceptible to flooding. Note impact extended to out buildings and not dwellings.</p> <p>Reports of flooding south of View Road, adjacent to 119 View Road (out building affected).</p>	<p>Sections of the creek are piped.</p> <p>The channel has been modified in various locations with some rock lined sections. Adjacent to the Burnie Tennis Centre a settlement pond was constructed many years ago. There is a current management challenge in respect to the pond being at capacity and requiring desilting.</p> <p>In the reach Eastwood drive to View Road, the streamline has been modified and embankments constructed to manage the 1 in 10 flood flows (reducing nuisance flooding).</p> <p>Through Burnie Park there is a series of ponds that aid in settling sediments prior to discharge to Bass Strait.</p> <p>Management of inlet structure (hot spots) aids in lessening the potential for localised flooding.</p> <p>Continuing sub divisional development in the catchment has the potential to increase storm flows. The flood study incorporated provision for such growth in the flood analysis work.</p>	<p>Ongoing maintenance of sedimentation ponds to retain effectiveness.</p> <p>Review effectiveness of stream modification works View Road to Eastwood Drive.</p> <p>Monitor flooding in vicinity of 119 View Road.</p>

Catchment	Description	Flood Study	Flood Issues	Infrastructure and Infrastructure Limitations	Potential Improvements
Bass Strait 2	Catchment areas 0.4km ² . Urban escapement of Parkland	No flood study conducted to date. No identified need for a flood study	No reports of significant flooding in this catchment. Significant spring activity and saturated ground conditions occur, with low depth overland flows. Nuisance value to residents.	Drainage work has occurred in a number of locations focused on installing new stormwater lines to allow for property connections (removing connections to soakage lines). Subsurface drainage installed as part of street upgrades aids in reducing the impact of sub surface flows.	Progressively implement infrastructure gap projects.
Cooee Creek	Catchment 5.1km ² . Mainly rural catchment with limited residential development at present.	Flood study prepared by Entura in 2011.	In early 2011 significant flood occurred in Cooee, when the Cooee Creek broke its banks at Cambria Street. Ongoing flooding of properties north of Thirkell Street (note back yards mainly impacted).	A levee was constructed to prevent over topping of the Cooee Creek in at Cambria street. The levee has performed well in storm events post construction. Down steam of Thirkell Street the properties are in the flood plain and dwellings to date have been outside the zone of inundation. No identified options to address resident concerns. Significant development potential in this catchment, with appropriate zoning to allow for said development.	Seek clarity on management responsibility for waterway north of Thirkell Street. Understand and document instances of dwelling inundation. Map flood levels in respect to floor levels. Monitor and inspect Cooee levee. Development proposals need to be assessed against the flood study to understand potential impacts.

Catchment	Description	Flood Study	Flood Issues	Infrastructure and Infrastructure Limitations	Potential Improvements
Bass Strait 3	Catchment area 1.3km ² Follows the escarpment from Cooee to Camdale	Flood study by PDA 2013	Overland flows have been a concern for various sections of the catchment where open lands abut the developed areas. Flood study identified opportunities to better manage outfalls. Localised capacity issues noted to address minor flooding. Priority areas for treatment noted as Alma Street Reserve and Caravan Park.	Localised overland flow issues managed post event. Generally related to changes or alterations in the catchment above the properties. Outfall performance affected by debris etc Flood study noted capacity issues in existing systems.	Program and fund Alma Place works. Caravan Park Project noted in 16/17 capital works project. Audit of Outfalls and development of improvement program to address periodic blockages. Overland flow (address issues as they arise).
Messenger Creek	Catchment Area 0.2km ² . Small catchment, rural headwaters and through an industrial area.	No flood study has been carried out. No current need for a flood study.	Limited history of flooding. Lower reaches were upgraded with the Bass highway upgrade in early 2000's.	No known capacity issues. Section of main drain between Bass Highway and Besser Crescent vegetated with willows. Vegetation management required.	Vegetation management program required in lower reaches.
Cam River	Catchment area 0.1km ² Rural catchment	No flood study by Council. System managed by State Government.	Flooding of private lands abutting the river occurs. No public infrastructure affected based on current understanding.	No capacity issues noted at present.	Liaise with State Government to understand what hydraulic modeling has occurred in the catchment , risk implications for the community and potential measures to manage risk or inform the community

Catchment	Description	Flood Study	Flood Issues	Infrastructure and Infrastructure Limitations	Potential Improvements
Ridgley Township	Catchment area 1.1km ² . Small township bordered by rural lands.	No flood study has been carried out.	The Ridgley Highway at the Circular Road intersection has been closed a number of times in recent years due to flooding of the highway. Overland flows on to residential properties (from the abutting rural lands) has been a cause of concern for residents.	Ridgley Highway cross road culvert capacity appears to be limited and may require upgrading. Network capacity not known nor its potential to assist in managing overland flows.	Flood study of the community required, including hydraulic assessment of the existing stormwater system in its entirety.

Risk Assessment

The preceding sections have provided an understanding of what we know about the Burnie and Ridgely stormwater systems, identified potential actions and undertakings to address community risk, improve system performance and support improved environmental outcomes.

Broadly actions identified can be grouped under the following headings:

- Operational management and management improvements.
- Environmental management.
- Development impacts.
- Flooding including hotspot management.

A focus of the SSMP is risk management and understanding the relative risk of the issues and impact of the implementation of the proposed action/s will aid in prioritising actions and projects.

A basic risk assessment applying Council's risk management framework was undertaken.

The framework notes ten risk categories. For the purpose of this exercise there is a focus on the assets and infrastructure, and public safety categories but this is not to suggest that the other risk categories are less important or relevant. Generally there will be alignment across many of the risk categories in respect to risk scoring. The risk assessment has been applied to the matters raised above, which would have apparent risk implications if not managed.

The output from the risk assessment will be included in the corporate risk register, and the risk rating used to assign a priority to projects listed in the action plan.

1. Risk Assessment											
Risk Category	Responsible Officer	Risk Issue	Consequence	Inherent Assessment			Treatment	Residual Risk after Treatment			Notes
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk	
Public Safety / Assets and infrastructure	Director Works and Services	Management and design processes do not reflect current practice.	Service level expectations not met. Required infrastructure capacity for new and upgrade work not to an appropriate standard.	Possible	Minor	Medium	Staff training , periodic review of design process and policies	Unlikely	Minor	Low	
Public Safety / Assets and infrastructure	Director Works and Services	Development impacts on existing system performance	System capacity issues. New incidences of local flooding. Damage to infrastructure.	Possible	Minor	Medium	Develop a policy to guide system management for new subdivisions eg detention / retention , upgraded etc	Unlikely	Minor	Low	
Public Safety / Assets and infrastructure	Director Works and Services	Development within areas of inundation.	Flood impact on new properties. Insurance claims and claims against council.	Possible	Moderate	High	Development controls and associated flood hazard maps in scheme	Rare	Moderate	Medium	Finalise internal consolidated flood map for BCC
Public Safety / Assets and infrastructure	Director Works and Services	Waterway / flora and fauna health impacts due to use as drainage systems	Eco system is damaged. Poor water quality. Community complaint about the aesthetic of the waterways. Potential impact on use of recreational waters.	Likely	Minor	Medium	Develop waterway management plans	Possible	Minor	Medium	Lower priority project at this point in time . Acknowledgement of the need to develop over time.
Public Safety / Assets and infrastructure	Director Works and Services	Cross connections between sewer and stormwater create public health issues	Stormwater impacts on operation of the sewerage. Sewage enters waterways and impact on water quality	Likely	Minor	Medium	Work with TasWater on I and I programs. Provide details of past investigations to support TasWater. Infill drainage works as per gap analysis.	Possible	Minor	Medium	Forward work program to address in part over time
Public Safety / Assets and infrastructure	Director Works and Services	Service area maps don't reflect infrastructure provision.	Impacts on charging regimes .	Possible	Insignificant	Low	Review network maps and align.				Focus is on political and financial risk

1. Risk Assessment											
Public Safety / Assets and infrastructure	Director Works and Services	Hot spot management and identification	Inattention to hotspots will result in localised flooding and potential damage to infrastructure	Possible	Minor	Medium	Identify hot spot flooding. Maintenance regimes	Unlikely	Minor	Low	Existing system in operation.
Public Safety / Assets and infrastructure	Director Works and Services	Emu River flooding	Properties and businesses in River road and surrounds are inundated. Consequential loss and damage.	Possible	Major	High	Seek advice from State Government on flood studies for the Emu River .Further modelling required.	Possible	Major	High	Review need for stream gauging, setting of flood levels and warning system. Significant impact / cost on business due to past flood. Communications strategy to potentially affected properties.
Public Safety / Assets and infrastructure	Director Works and Services	Romaine / Alexander creeks	Flooding of South Burnie. Risk of Dam failure.	Possible	Major	High	Romaine dam raising : flood mitigation and dam safety improvements	Rare	Major	Medium	Communications strategy to potentially affected resident.
Public Safety / Assets and infrastructure	Director Works and Services	Bass Strait 3 catchment flooding	Flooding of properties due to capacity issues in pipe network.	Possible	Minor	Medium	Improvement actions noted . Complete Alma place and Caravan park drainage.	Unlikely	Minor	Low	Caravan park drainage in 16/17 capital works program.
Public Safety / Assets and infrastructure	Director Works and Services	Cam river flooding	Potential impacts on abutting properties	Unlikely	Moderate	Medium	Seek advice from State Government on flood studies for the Cam River	Unlikely	Moderate	Medium	Develop a better understanding of flood risk and plan future actions
Public Safety / Assets and infrastructure	Director Works and Services	Ridgley township flooding	Known instances of flooding due to overland flow and major culvert capacity issues on Bass highway.	Possible	Moderate	High	Implement a flood study for Ridgley	Possible	Moderate	High	Develop an understanding of the actual level and extent of risk exposure. Provide for forward planning.

8. IDENTIFICATION OF STRATEGIES AND OUTCOMES

Within Council there is a mature understanding of stormwater asset management, design, construction and operational management. This is supported by appropriate operational resources and funding.

Council in recent years have been relatively focused on understanding the source of a number of flood incidents that have occurred and identifying opportunities to mitigate the extent and impact of flooding.

This is evidenced in the flood mitigation works identified for implementation and those already completed.

As noted in the preceding sections, further work is required in this space.

Through the discussion and risk assessments in section Seven (7) various specific actions were identified related to works implementation, flood studies and the like, with a more strategic focus.

Matters related to improvements to internal processes, information capture and communication were also noted, and in most instances existing administrative arrangements will allow these matters to be addressed over time, as noted in the discussion section.

An Action plan has been prepared to capture those specific tasks that will require focus and resource.

It is suggested that overall priorities for management of the urban stormwater systems are (in order of importance).

1. Quantifying flood risk in all urban catchments.
2. Identifying and implementing flood mitigations strategies.
3. Communicating / educating the community.
4. Systems and process improvements and knowledge capture management regimes.
5. Waterway environment and water quality.

It is acknowledged that others may consider that waterway environment and water quality are important matters for Council to focus its efforts. However from a broad community perspective protection of people and property from flood risk, which has the potential to be managed or mitigated, is the priority focus area for Council at this point in time.

Future iterations of this plan will focus on waterway environment and water quality improvements.

The action plan noted below documents the key matters which Council wishes to address within the life of this plan.

ACTION PLAN

Action / Strategy	Scope	Benefit	Priority High 2 to 5 years Medium 10 Years Low 10 to 20 years	Cost	Funding source	Timeline	Responsibility
Emu River Flooding	Work with the State Government to understand the extent/impact of flooding on Emu River. Assess mitigation and flood warning options including stream gauging	Community knowledge. Warning of potential flooding. Minimization of flood impacts and consequential disruption to business and industry- previous flood impact totaled in excess of \$10 M on the business community.	High	TBD	State Government	17/18	State Government – partnership with stakeholders.
Ridgley Township flood study.	Comprehensive flood study of the Ridgley township to identify extent of flooding, properties at risk and mitigation strategies	Improved understanding of flood risk in Ridgley Township.	High	\$37,000 (est).	BCC and external grant funding.	17/18	BCC- seeking grant funding NDRP

Action / Strategy	Scope	Benefit	Priority High 2 to 5 years Medium 10 Years Low 10 to 20 years	Cost	Funding source	Timeline	Responsibility
Implementation of Ridgley Flood Study	Outcome of study to be determined. Prioritise recommended projects. Ridgley Highway works to involve DSG.	Progressively address flood risk to properties and broader community	High	TBD	BCC and DSG	18/19 onwards	BCC – primary role
Cam River Flood Study	Work with the State Government to understand the extent/impact of flooding on Cam river	Community preparedness Develop consolidated flood mapping for City	High	TBD	State Government	19/20	State Government (partnership with BCC and WWC).
Romaine Dam raising: flood mitigation and dam safety.	Alterations to dam crest and spill way	Flood mitigation for South Burnie community. Up to 180 properties affected by flooding or dam burst	High	\$500,000	BCC	Funded in 2016/17 Cap ex year	BCC
Bass Strait 3: infrastructure works	System improvements, new infrastructure to drain areas currently affected by localised flooding.	Flooding risk removed for the locations addressed	High	\$250,000(est)	BCC	Fund over 16/17, 17/18 and 18/19 financial years	BCC
Bass Strait 3: overland flows	Mitigation works to capture / redirect overland flows.	Localised impacts to properties addressed.	Medium	\$50,000 (est0	BCC and land owners.	Fund over 16/17, 17/18 and 18/19 financial years	BCC and Landowners

Action / Strategy	Scope	Benefit	Priority High 2 to 5 years Medium 10 Years Low 10 to 20 years	Cost	Funding source	Timeline	Responsibility
Illegal and cross connections	Knowledge transfer to TasWater as to outcomes of Stormwater infrastructure improvement program.	Facilitate on going improvement programs. Address health risk. Reduced cost to the community.	High	No cost	N/A	16/17	BCC and Taswater
Development controls in flood inundated area	Develop flood hazard mapping to support application of planning provisions.	Address inundation risks prior to development. Reduced cost to the community.	Medium	TBD	State Government	Post adoption of new statewide planning scheme	State Government and BCC
Communications strategy for flooding and flood risk	Communicate council's current knowledge of flood risk to assist community to manage risk individually	Informed community.	High	\$10,000	BCC	17/18	BCC

Specific system and process improvements noted for action are:

Systems and Process	Benefits	Responsibility	Timeline
Review ARI set for storm events against the catchment responses and climate change impacts . Determine if new design criteria are required and if so adopt.	Design of new systems and existing system upgrades cater for expected storm flows. Mitigate over time instances of localised flooding associated with higher intensity storm events.	Works and Services	17/18
Consolidate flood information in one location/map.	Knowledge is available across Council. Support the development of planning scheme hazard maps.	Works and Services (GIS)	16/17
Develop a Stormwater detention / retention policy.	Clear guidance on the use of such infrastructure, maintenance responsibilities and the like.	Works and Services	17/18
Serviced area maps: review area serviced and align with current / future ability to service.	Clear linkage between network maps and expansions plans and areas where the stormwater charge is applied.	Works and Services	17/18
Maintain a register of flooding hot spots, capture new issues as they arise.	Manage localised flooding risk. Identify issue which may require assessment and intervention in forward works programs. GIS map: incorporated in to flood layer. Ready reference for staff.	Works and Services	Ongoing
Appropriate management arrangements are in place to guide work in waterways, so as to limit impact. Education and training of staff and contractors.	Preserve the integrity of existing waterway values	Works and Services	Ongoing
Reticulation “gaps” are noted and captured in forward works program.	Identified and costed improvement program to guide future works. Progressively address locations within the urban area where there is no ability to connect.	Works and Services	Ongoing

9. COSTS, BENEFITS AND FUNDING ARRANGEMENTS

The action plan has broadly identified cost, benefit and funding opportunities to address those projects and strategies. Such an approach assists in broadly identify priorities.

For the majority of projects and strategies there is a need to source funding, either via the Council's capital works program or externally through grants or other agencies.

In seeking such funding there is generally a need for a more detailed assessment of "Cost and Benefit" to enable a projects viability to be proved up.

The more detailed assessment may include

- Preliminary design and project costing.
- Cost benefit analysis.
- Risk assessment.

And the like.

10. PRIORITIES AND TIMEFRAMES

Project priorities are noted on the action plan. The priority has been assigned generally through consideration of Risk exposure either to Council or more directly to the community, at a local or broader level.

Timeframes will adjust over time depending upon budget allocations and review of project priorities and in respond to unforeseen circumstances.

11. RESPONSIBILITIES

Council has primary responsibility for managing stormwater in the urban area.

The river environments and coastal beach strip are managed by the State Government. Works in those environments, related to stormwater assets, requires approval from the respective Government Agencies.

Understanding the impacts of riverine flooding is a joint responsibility of the State Government and Council, however the role for Council is understanding the extent of risk and working with stakeholders to mitigate the risk or ensuring persons at risk are aware of the potential for inundation.

Communication and Consultation

The purpose of this plan is to provide the community and Council staff with an understanding of the Urban stormwater system, how it is managed, current issues and risks which may need to be addressed and a plan of action to address such issues and risks, on a priority basis.

The plan informs decisions in regard to the allocation of resources within Council and supports potential applications for external funding to address identified issues.

Planned communication and consultation actions include:

Action	Responsibility	Timeline
Communicate with residents / property owners where land is situated in a known flood plain or is subject to inundation. Provide information on the extent of flood impacts, advice on flood preparedness and plan mitigation actions.	Manager Engineering Services	17/18
Develop a page on the Council web site to provide information on stormwater management, flooding and flood preparedness and water quality issues. Include a linkage to planning scheme hazard mapping and consolidated flood map.	Director Works and Services	Adoption of SSMP
Publish the Stormwater System management plan on Council' website.	Director Works and Services	Adoption of SSMP

These actions will be captured as part of the development of a broader communications strategy , associated with this storm water system management plan.

12. REVIEW OF THE STORMWATER SYSTEM MANAGEMENT PLANS

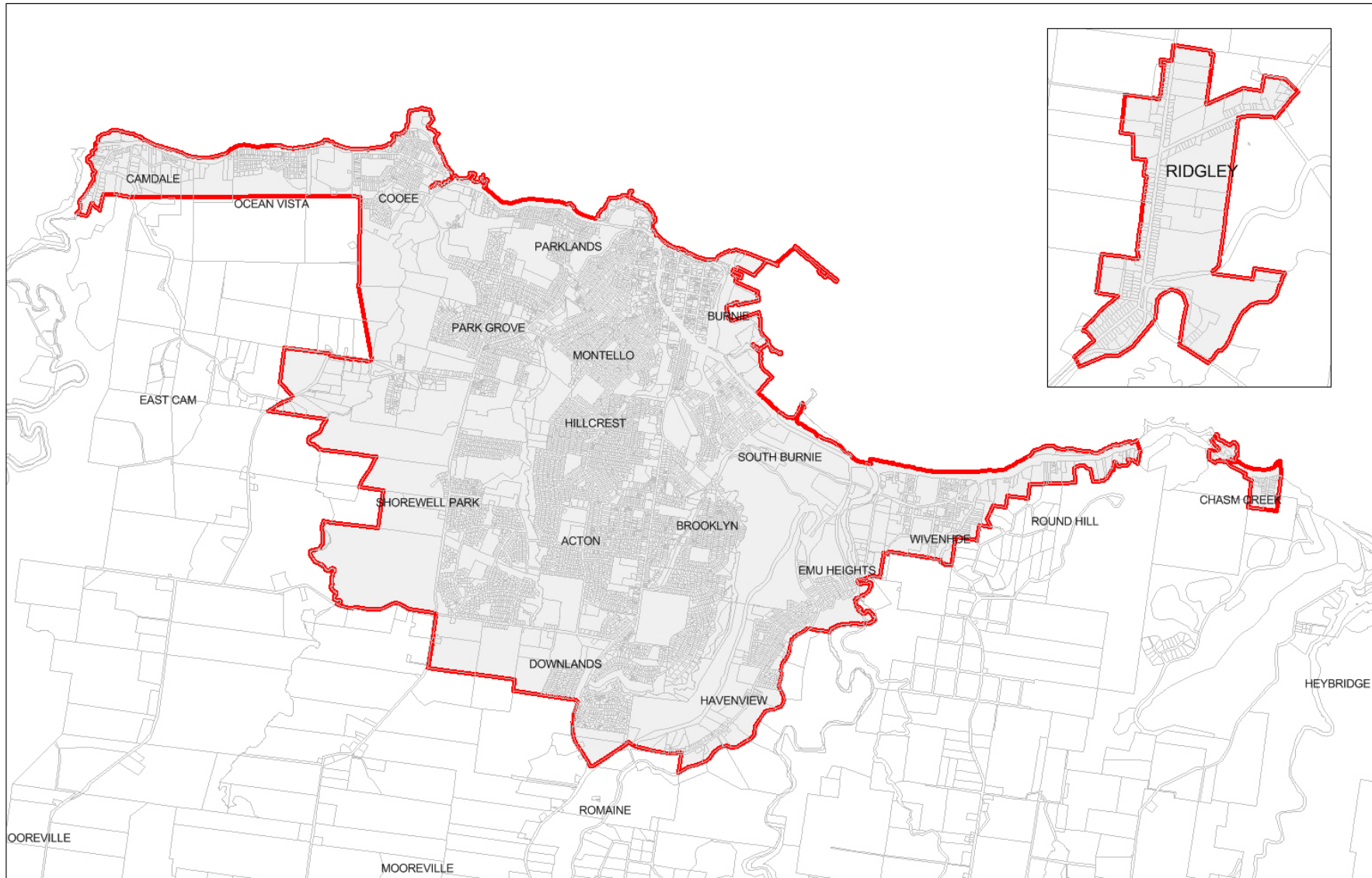
This initial Stormwater System Management plan is the first iteration of such a document.

The plan is underpinned by a range of other documents as noted throughout this document.

To implement the actions noted within the plan will require a number of budget cycles.

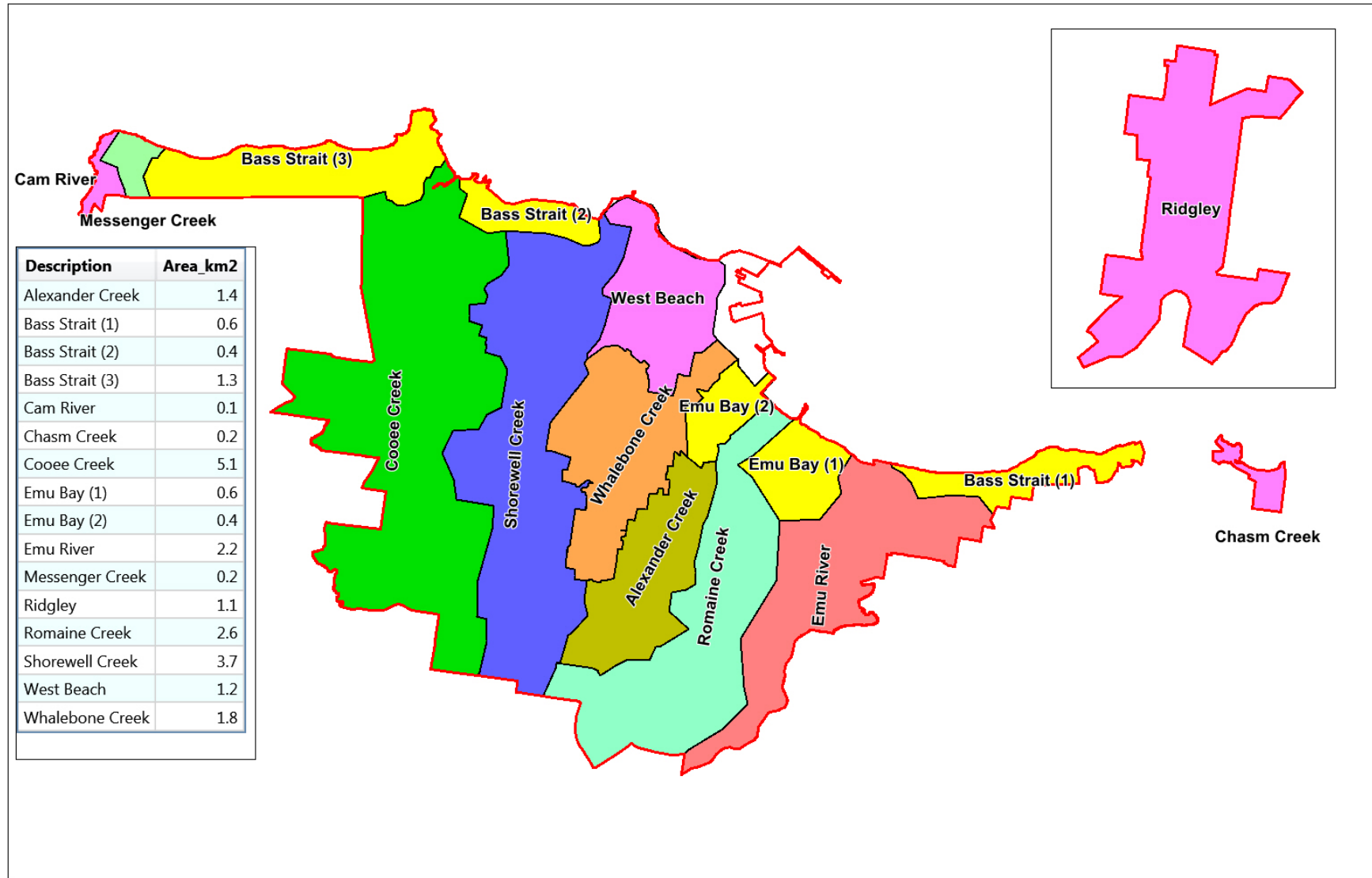
The planed review cycle for this plan is 4 years.

APPENDIX A: URBAN AREAS



Burnie and Ridgley Stormwater District

APPENDIX B: CATCHMENTS



Burnie and Ridgley Stormwater Catchments