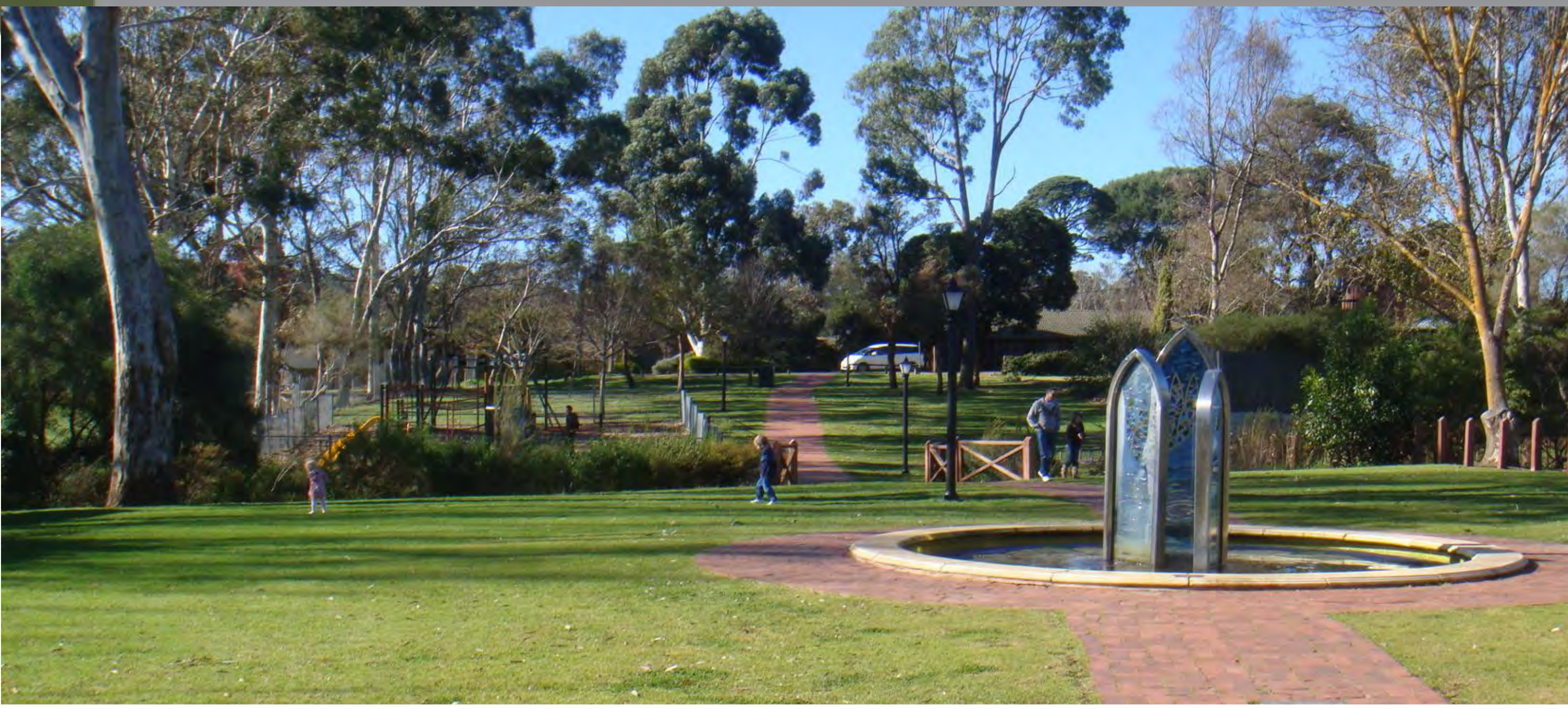
Government of South Australia
Adelaide and Mount Lofty Ranges Natural Resources Management Board

INTEGRATED WATER MANAGEMENT PLAN for the RURAL COMMUNITY OF HAHNDORF

December 2012

District Council of Mount Barker

FINAL REPORT



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SKM

Integrated Water Management Plan for the District Council of Mount Barker – Hahndorf

- Integrated Water Management Plan - Hahndorf
- District Council of Mount Barker

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Executive Summary

The District Council of Mount Barker (the Council) is committed to the responsible stewardship of natural resources, ensuring that water resources are protected and use of alternative (sustainable) water resources is maximised. This Integrated Water Management (IWM) Plan for the Township of Hahndorf has been prepared to identify the most sustainable mix of water supply solutions for the community through the consideration and incorporation of all water sources including reticulated mains water, rainwater, stormwater, groundwater and treated wastewater.

Climate change forecasts suggest that the region will trend toward warmer and drier average conditions over the next 20-60 years (Hayman et al, 2011). Surface water availability across the entire Murray-Darling Basin is expected to decline due to climate change and inflows to the state from the River Murray will be reduced (CSIRO, 2008). In addition to climate variability and climate change, land use activities and other pressures act to increase demand for available water resources. Whilst Hahndorf is not located within the Murray-Darling Basin, mains water supply to Hahndorf is sourced from the River Murray and hence the town is affected by water availability within the Basin. While drought conditions may ease, water availability in the region is likely to remain constrained.

The 30 Year Plan for Greater Adelaide does not propose any development for Hahndorf and hence the population is predicted to increase only as a result of urban in-fill. For the purposes of Integrated Water Management Planning, a growth rate in line with the State average of approximately 1% has been assumed which corresponds to around 300 new households over the next 30 years.

Responsibilities for water management in Hahndorf are divided between the agencies responsible for the various aspects of water supply, treatment and management including SA Water, the District Council of Mount Barker, the Adelaide and Mount Lofty Ranges NRM Board (the NRM Board); and the community who uses the water. Successful IWM requires good communication and cooperation between all stakeholders and an agreed vision for the future. Whilst this project has focused on actions the Council can directly influence, other actions such as wastewater reuse will require coordination between Council and SA Water.

Objectives and Action Plan

The objective of this Integrated Water Management Plan (IWMP) is to provide for sustainable, resilient water management of Hahndorf through the identification of 'fit for purpose' water supplies for the Council, residential, commercial, and industrial uses, considering the pressures of reduced water availability. While Hahndorf has not been identified as a community for significant growth, implementation of sustainable water solutions in Hahndorf is a priority for future water security and environmental benefits. Increasing the diversification of water sources is a key objective, to be achieved through increasing the use of recycled stormwater, wastewater and rainwater.

A range of water management options were investigated throughout development of the Plan, and their feasibility was assessed by a triple bottom line (TBL) assessment process. The water management options

that were investigated for Hahndorf are summarised in Table ES-1 and mapped in Figure ES-1. A detailed Action Plan for Hahndorf has been developed which breaks the actions down into smaller components and identifies priorities, responsibilities, and links to relevant goals, benefits and outputs. All options included in the action plan are feasible, and their implementation should be guided by subsequent development and water management decisions made in the area.

Table ES-1: Summary of potential integrated water management actions for Hahndorf

Potential Infrastructure Actions – Hahndorf
▪ Local wastewater reuse of up to 410ML/year, which will be generated from the future township in 2040. Wastewater from the Hahndorf WWTP is currently discharged into Hahndorf Creek, with some reused for irrigation of local horticulture. A range of potential demands for treated wastewater for irrigation of open space and industrial and horticultural users exist around Hahndorf. However, as the management of wastewater in Hahndorf is the responsibility of SA Water, Council may have limited control over the management and reuse of this water.
▪ Stormwater reuse of around 265 ML/ annum by 2040 could be achieved through harvesting from a storm water wetland downstream of the township. Similar to the wastewater reuse, appropriate demands would be required for this to be considered a feasible option.
▪ Water Sensitive Urban Design (WSUD) treatments through the township. This is expected to result in average annual infiltration of 90ML.
▪ Rainwater harvesting, an average of an additional 25ML/year as a result of mandating 5000L rainwater tanks to all new households, plumbed to outdoor, toilet and hot water uses as well as retrofitting 5000L rainwater tanks to existing houses that do not have tanks, or have smaller tanks.
Planning Actions – Hahndorf
▪ Mandate rainwater tanks in Development Plan
▪ Update Residential Development Code and Development Plan
Capacity Building and Governance – Hahndorf
▪ Community education and awareness
▪ Training for Council staff and decision-makers
Water Conservation – Hahndorf
Monitoring and Review – Hahndorf

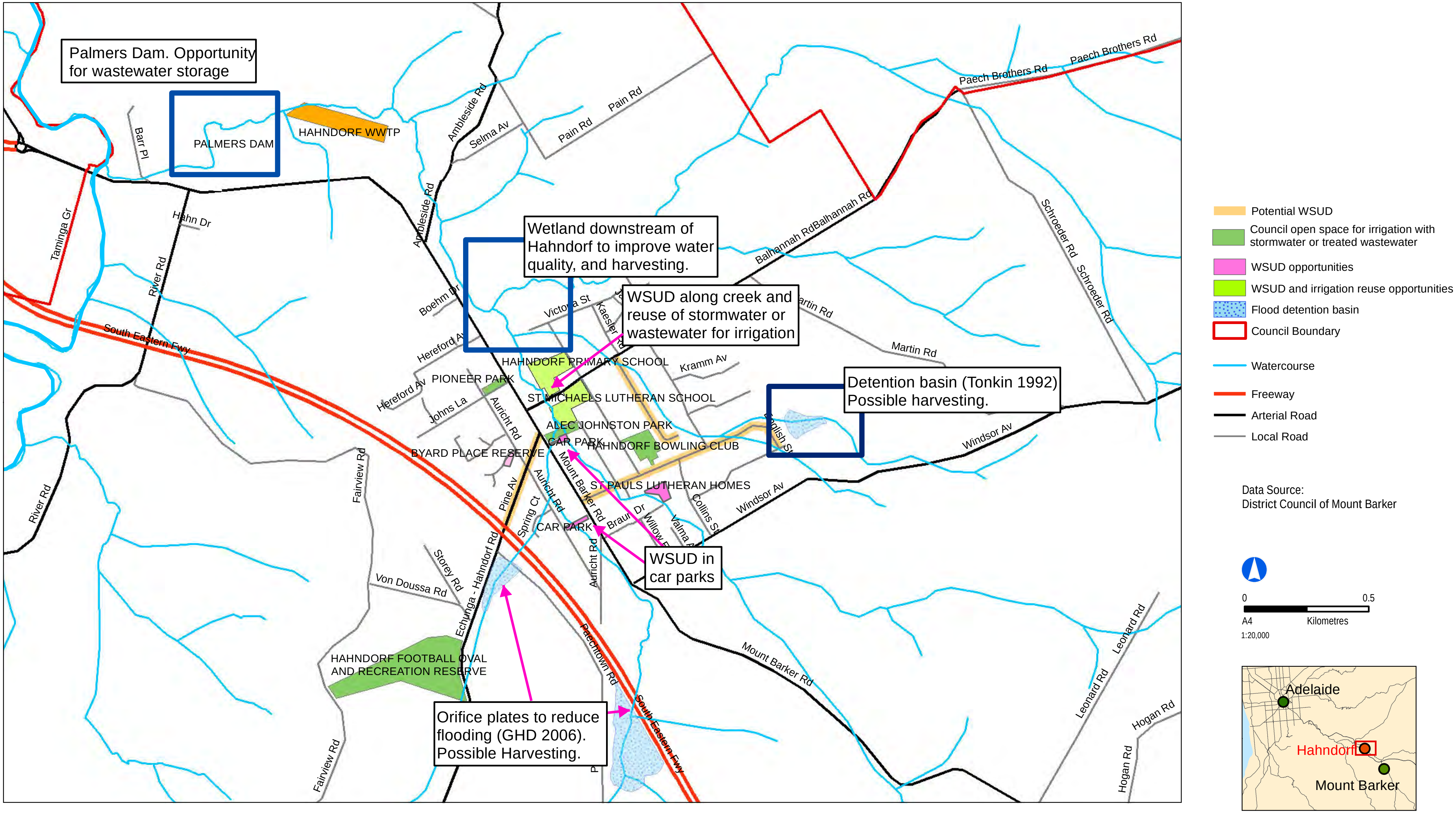

Figure ES-1 Opportunities for Integrated Water Management - Hahndorf

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Integrated Water Management Plan - Hahndorf

v1

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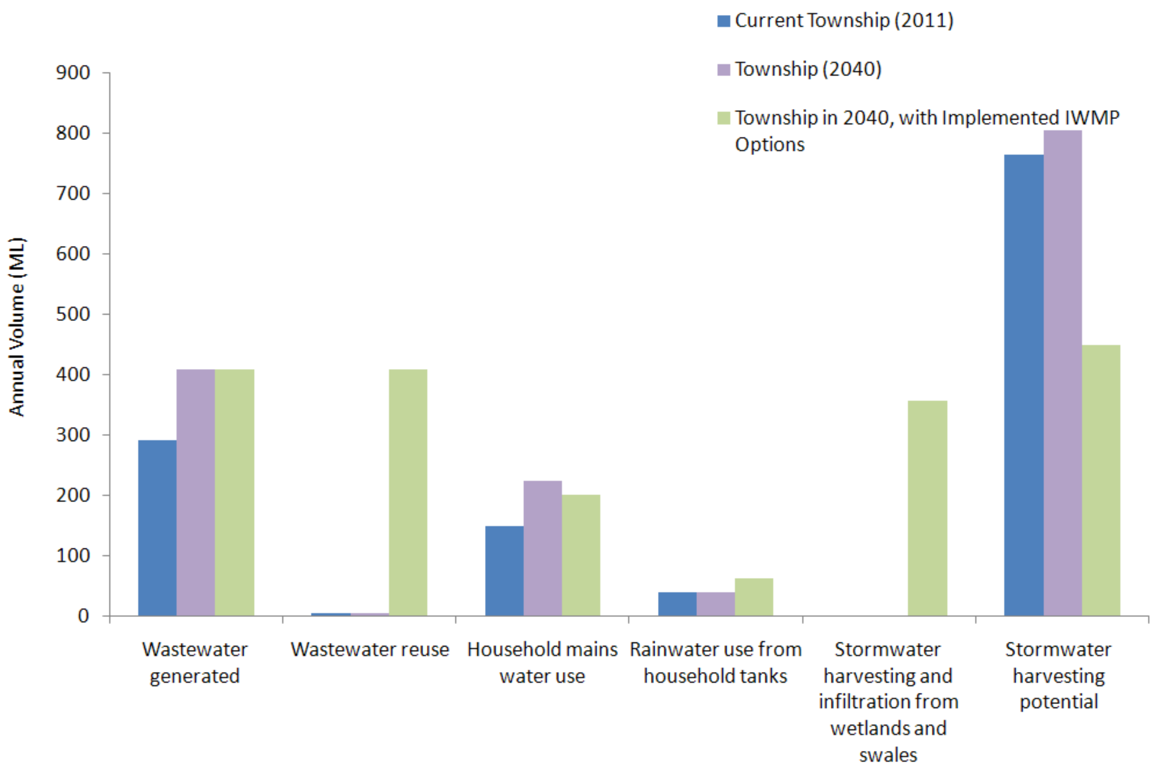
Predicted Impacts of Climate Change

For Hahndorf, the volumes of runoff are predicted to decrease by a small amount as a result of the climate change projections. There will also be a small increase in runoff due to additional impervious areas which result from urban infill (growth rate of 1% assumed). These influences are likely to approximately balance, hence the expected impacts of recommended infrastructure action were calculated used historic climate data and the current population.

Major Elements of Urban Water System

Modelling of the major elements of the urban water system was completed for Hahndorf. Figure ES-2 compares estimates of the volumes of the major elements of the water system now, in 2040 for a situation where no water management actions are implemented, and in 2040 if the recommended water management actions are implemented. The estimated volumes for the mitigated scenario show that greater diversity of water supply would result from the infrastructure and planning initiatives proposed in the Action Plan. Increasing the volumes of fit for purpose water will reduce the volumes of excess wastewater and stormwater and result in a range of environmental and community benefits for the region, including irrigated open space, establishment of wetland areas with biodiversity and amenity values and watercourse protection. The stormwater harvesting potential does not include an allowance for predevelopment flows, as discussed in Section 3.3.1. The Draft Water Allocation Plan for the Western Mount Loft Ranges defines pre development flows as the flows from the catchment prior to 2004. As most of the current Hahndorf Township was developed in 2004, the current stormwater flows would not significantly exceed the flows from the township in 2004. As agreed with Council and the NRM Board, maintenance of predevelopment flows has not been considered so as not to limit the opportunities for IWMP actions.



▪ **Figure ES-2: Comparison of current and future water volumes for Hahndorf**

Table ES-2 and Table ES-3 provide the numbers used within the water balance for the current township, and future township in 2040 with implementation of the recommended actions. The stormwater discharge and reuse volumes will vary, depending on climate conditions, however the estimates for the 50th percentile (average year) has been included in the table.

- **Table ES-2: Water supply and use figures for major elements of the urban water system for the current township**

Wastewater	Wastewater generated (ML/year)	Wastewater reuse (ML/year)	Wastewater excess (ML/year)		
Hahndorf	291	4	287		
Stormwater	**Stormwater generated (ML/year)**	**Stormwater infiltration & evaporation (ML/year)**	**Stormwater reused for irrigation (ML/year)**	**Rainwater use from household tanks (ML/year)**	**Stormwater available for additional alternative uses (ML/year)**
Hahndorf	763	Unknown	0	39	724
Mains	**Household mains water use (ML/year)**	**Irrigation mains water use (Council) (ML/year)**			
Hahndorf	148	>1			
Groundwater	**Groundwater use (ML/year)**				
Hahndorf	23				

- **Table ES-3: Water supply and use figures for major elements of the urban water system for the future township (2040), with implementation of all IWMP options**

Wastewater	Wastewater generated (ML/year)	Wastewater reuse (ML/year)	Wastewater excess (ML/year)		
Hahndorf	409	409	0		
Stormwater	**Stormwater generated (ML/year)**	**Stormwater infiltration & evaporation (ML/year)**	**Stormwater reuse from wetlands (ML/year)**	**Rainwater use from household tanks (ML/year)**	**Stormwater available for additional alternative uses (ML/year)**
Hahndorf	800	90	266	62	382
Mains	**Household mains water use (ML/year)**	**Irrigation mains water use (Council) (ML/year)**			
Hahndorf	200	0			
Groundwater	**Groundwater use ML/year)**				
Hahndorf	23				

Key outcomes would include:

- Approximately 90ML of stormwater to be infiltrated/evaporated through implementation of WSUD features (including swales and wetlands) throughout the existing township. The recommended WSUD actions include vegetated swales, to promote infiltration and treatment of the stormwater. More details of the specific locations available for WSUD features are included in Appendix I.
- Around 266 ML of stormwater could be available for reuse from a wetland downstream of the Hanhdorf township. This could be used for irrigation of public open spaces or local horticulture. The volume of stormwater available from this wetland has not been limited by the requirement to retain predevelopment flow rates to Hahndorf creek, so that the full potential of the IWM action can be considered. This is discussed further in Section 3.3.1.
- An additional 23ML of rainwater harvested from household rainwater tanks and reused within gardens, toilet and hot water systems, as a result of installing 5000L rainwater tanks to all new residences, and retrofitting a minimum 5000L rainwater tanks to all existing houses which do not have them.
- All treated wastewater to be sold to local and/or regional industries and horticulture resulting in a potential 409ML/year of wastewater reuse; however this will depend upon the future demand from local industry, and arrangements with SA Water.

More details of each of the recommended actions, and their impacts are included in Section 7, Section 8 and Section 9

Technical details including a planning policy review, options identification report, water quality (MUSIC) modelling data, Triple Bottom Line analysis and details of Net Present Value cost estimates are included in the Appendices of this report.

Water Security

Implementation of the recommended actions will assist future water supply security for the Township of Hahndorf. In particular, this includes:

- Maintaining the amenity of public open space and recreational areas. The volume of stormwater available for reuse for irrigation of public open space would increase from 0ML/year to around 266ML/year. This would enable Council to expand the number of reserves that are irrigated, without requiring additional mains water use, and also replace current mains water use for irrigation of public open spaces with stormwater.
- Decreasing mains water use per household. The requirement for all new residences to have a minimum of 5000L rainwater tanks plumbed to garden, toilet and hot water and existing residences to have 5000L tanks retrofitted will reduce the annual water consumption per person and result in a total reduction in main water use of 23ML/year.
- Potential to provide up to 409ML treated wastewater per annum for sale to private industry.

- Diversity of water sources, acknowledging that some sources show seasonal variability.

The variability of water sources can be illustrated by the variation in stormwater runoff to the Hahndorf Creek for dry, medium and wet years. Figure ES-3 shows an estimate of the volume of urban stormwater that is discharged to the Hahndorf Creek for the current township. The 20th percentile, 50th percentile and 80th percentile rainfall years from the historical rainfall record (1887 – 2010) were used and show that runoff for a dry year (600ML) is around two thirds of the volume of runoff in a wet year (860ML).

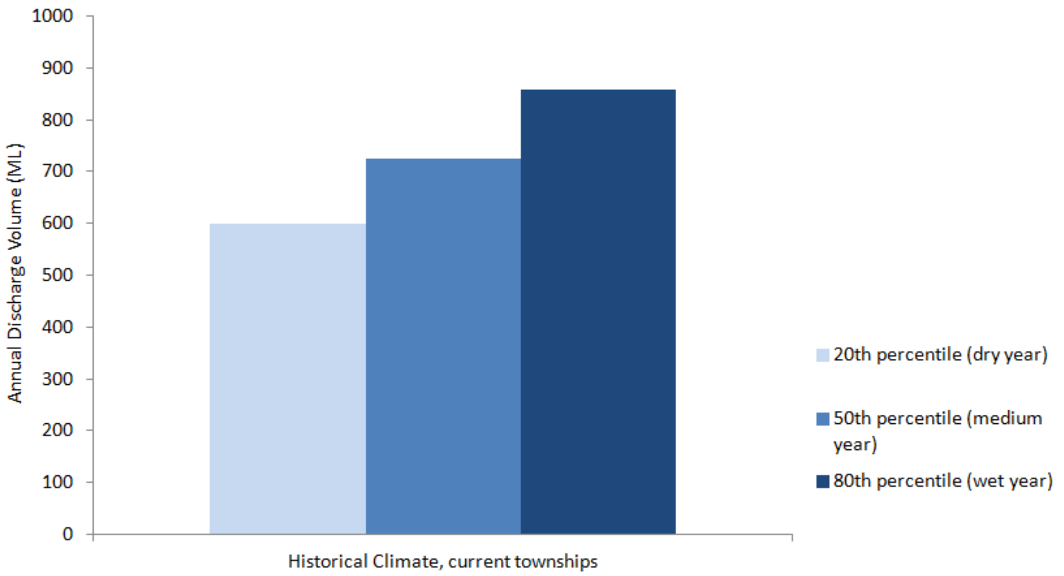


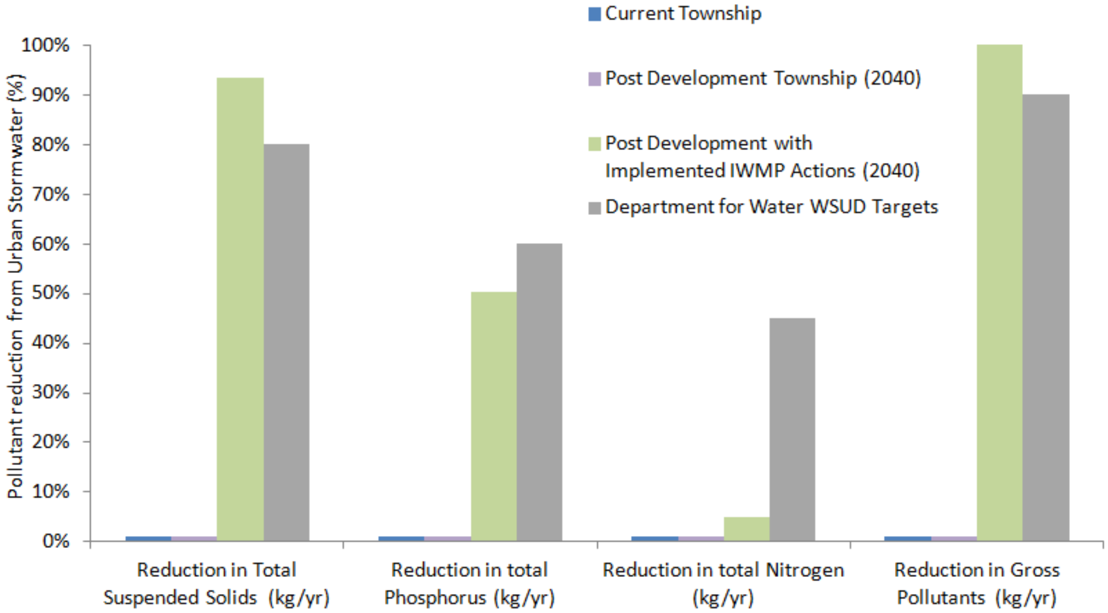
Figure ES-3: Estimate of the volume of stormwater discharged to Hahndorf Creek from the current Hahndorf Township (2011)

Water Quality Benefits

Stormwater runoff from urban areas is subject to pollution as it passes over impervious (paved) areas, including oils, sediments and excess nutrients (DPLG, 2009). The amount of impervious area compared to pervious (open space/landscaped) areas affects the total volume of runoff because it affects the total volume of infiltration.

The Department for Water (DfW) has developed a set of targets related to WSUD, as part of their *Water Sensitive Urban Design Consultation Statement* (2012). The target is for the WSUD features to reduce average annual loads of suspended solids, phosphorus, nitrogen and gross pollutants by 80%, 60%, 45% and 90% respectively. The stormwater management actions that are recommended in this Plan have been developed in consideration of the WSUD targets. By implementing the recommended initiatives to maximise stormwater infiltration, treatment, storage and re-use, the proportion of stormwater that is ultimately discharged to the Hahndorf Creek will be of the quality described in Figure ES-4.

The Figure compares the total pollutant removal estimated from stormwater runoff from the urban catchments of Hahndorf for the current and future (2040) township without implementation of IWM actions, and future township (2040) with implementation of the IWM actions. The DfW WSUD targets for water quality are also shown on the graph for comparison. For the post development township with implementation of the IWM actions, the removal of suspended solids and gross pollutants both exceed the targets, however the removal of phosphorus is around 10% below the target, and the removal of nitrogen is around 50% below the target.



- **Figure ES-4: Comparison of current and future water quality parameters for Hahndorf**

Liveability/ Amenity/ Microclimate benefits

The recommended actions will also impact positively on the quality of life of the Hahndorf community. The specific benefits will include:

- Community benefit from new combined wetland and parkland/public open spaces. These features should be designed as high value public open space, with community access and facilities.
- WSUD features are likely to be accepted and appreciated as a visual and obvious water savings and water treatment approach.
- Rainwater tanks to all new residences, and retrofit of tanks to existing houses that do not have them will provide opportunity for community education and awareness of water conservation.
- Public open space that is irrigated throughout summer to provide green areas with shade.

1. Introduction

The District Council of Mount Barker ("the Council") and the Adelaide and Mount Ranges Natural Resources Management Board (AMLR NRMB) are working together to improve the condition of natural resources (including water and biodiversity) across the Mount Lofty Ranges. Water quality, sustainable water resource management and reuse of stormwater and wastewater are priorities for the AMLR NRMB which are identified in the Board's long term Regional Targets. The Council's Strategic Plan identifies their commitment to the protection and restoration of water resources.

This Integrated Water Management Plan (IWMP) identifies options to ensure a sustainable, resilient water future for the Township of Hahndorf through the identification of 'fit for purpose' water supplies for the Council, residential and agricultural uses. It aims to maintain and enhance the valued amenity and open space features of the town and protect and restore the local environment.

The District Council of Mount Barker is focussed on considering appropriate responses to climate change, and incorporating the impacts and risks to natural resource management. This IWMP will assess the risks and implications associated with providing water for growing communities in an uncertain climate future. It will allow the Council to plan for future investment in water savings initiatives throughout the Township of Hahndorf, and provide input to development plan policy.

The 2006 census reported the population in Hahndorf to be 1,804 people, with an occupancy rate of 2.4 persons per dwelling (ABS, 2006). The 30 Year Plan for Greater Adelaide does not propose any development for Hahndorf and hence the population is predicted to increase only as a result of urban in-fill. For the purposes of Integrated Water Management Planning, a growth rate in line with the State average of approximately 1% has been assumed which corresponds to around 300 new households over the next 30 years.

1.1. Project Overview

Sinclair Knight Merz (SKM) and collaborating consultants URPS, were engaged by the Council to prepare this IWMP. This project has been undertaken concurrent to the preparation of an IWMP for Mount Barker, Littlehampton, Nairne and Callington.

The objectives of the IWMP are to provide management actions:

- for the sustainable management of all water resources within, impacted or drawn upon by the townships and their planned growth areas;
- for the preservation, or enhancement where possible, of the ecological function of the region's watercourses;
- for productive, sustainable, liveable, socially inclusive towns that are well placed to meet future challenges and growth;

- for sufficient water supplies to maintain public open space for amenity and recreational values, while protecting the health and wellbeing of the community in a warming climate;
- for water use that is “fit for purpose”, i.e. water treated to an appropriate standard in keeping with its intended use;
- for clearly articulated connections and directions to the different sections of the Council’s business, e.g. Planning and Engineering, Operations, and Strategy;
- for resilient townships capable of responding to an uncertain climate future;
- for water infrastructure that addresses the water-energy nexus and has a minimised carbon footprint across its life-cycle; and
- for leadership to the community and clear direction as to how water will be managed within growth areas and existing townships subject to the plan

1.2. Methodology and Key Tasks

Table 1-1 summarises the key tasks that were completed during the development of this IWMP. The outputs from each task are described in the Appendices of this Report.

Table 1-1: Summary of Methodology and Tasks

KEY TASKS	METHOD		OUTPUTS
Consult stakeholders (Council, community, agencies and developers)	A Council and government agency stakeholder workshop was held to identify and articulate the goals, issues and opportunities for integrated water management in the District Council of Mount Barker. Interviews were conducted with known land owners and developers of future growth areas. Additional consultation with Council and stakeholders was ongoing through the project.	→	Goals for IWM Summary in Section 2 Consultation notes in Appendix A
↓			
Undertake Policy and Planning Review	A Policy Review was prepared summarising the key strategic planning directions and statutory planning policy context for integrated water management relating to the District Council of Mount Barker	→	Policy and Planning Review Summary in Section 3 Full report in Appendix B
↓			
Gather information regarding water supply and use, population and predicted growth	An analysis of the current population, future population growth and the baseline demand forecast for Hahndorf was conducted to ensure that the water management options and recommendations of actions for the next 30 years could be based on robust assumptions.	→	Summary in Section 4
↓			
Calculate impacts of development on water balance		→	This report Section 5
↓			

KEY TASKS	METHOD	OUTPUTS
Calculate impacts of predicted climate change on water balance		This report Section 6
Identify options for IWM	A range of options were developed for Integrated Water Management in Hahndorf. These options were developed following a review of the relevant background documents, discussions with Council staff and a site visit. Scenarios were developed by increasing action implementation.	This report Section 7
Compare options through Triple Bottom Line Assessment to identify preferred options	The water management options were assessed through a Triple Bottom Line (TBL) approach, to compare the relevant economic, environmental and social impacts of each option. A workshop with relevant stakeholders was conducted to complete the assessment. A range of technical information was gathered to assist in decision making during the workshop.	This report Section 8
Reporting final recommendations	The final recommendations contained within this report have been developed in consultation with the District Council of Mount Barker and the Adelaide and Mount Lofty Ranges NRM Board.	This report

1.3. Integrated Water Management Plan

This report outlines the Integrated Water Management Plan for the Township of Hahndorf. The plan is structured as follows:

- **Section 1**: An introduction to the project.
- **Section 2:** Summarises the goals that were identified for Integrated Water Management within Hahndorf
- **Section 3:** Provides a description of the population, growth and planning and policy context of the Township of Hahndorf.
- **Section 4:** Provides a description of the water resources for Hahndorf, including natural watercourses, stormwater, groundwater, mains water supply and wastewater.
- **Section 5:** Compares estimates of the volumes of the major elements of the water system for the current townships and in 2040 after urban infill has occurred (based on an assumed increase of 1%)
- **Section 6:** Describes the impacts to water resources due to climate change projections
- **Section 7:** Describes a range of IWM actions for Hahndorf
- **Section 8:** Describes the process undertaken to develop and prioritise IWM infrastructure development scenarios for Hahndorf, and summarises the impacts that the priority IWM actions would have on the major elements of the urban water system.
- **Section 10:** Presents an action plan and final recommendations for IWM for Hahndorf over the 30 year lifespan of the Plan to the year 2040.

1.4. Integrated Water Management

Integrated Water Management (IWM) is defined as providing the most sustainable mix of water solutions for the community through the consideration and incorporation of all water sources including reticulated mains, rain, stormwater, groundwater and wastewater.

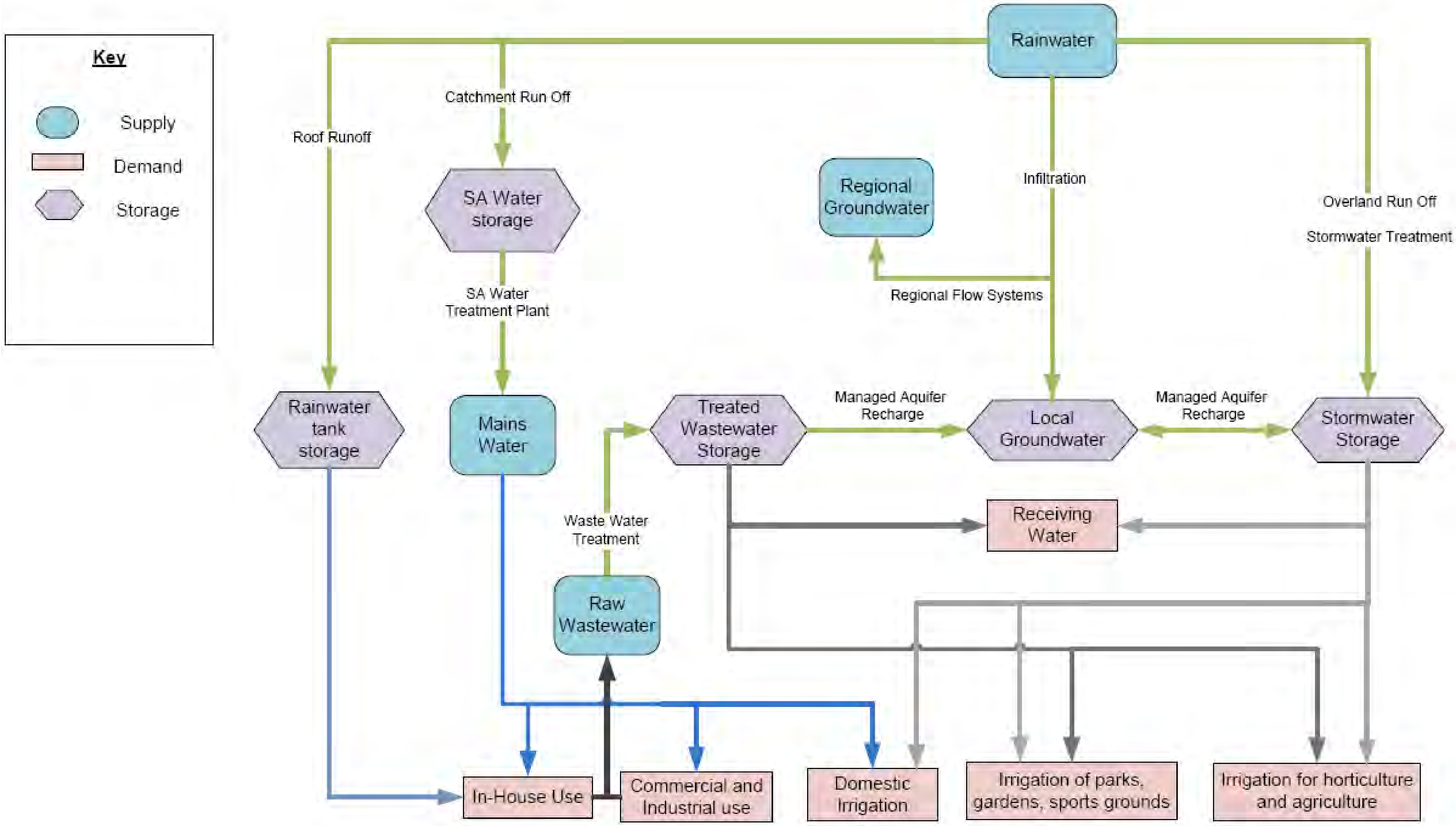
Figure 1-1 shows the interactions between these water sources and the cycle of supply, demand, treatment and storage.

IWM integrates social, economic, environmental and technical considerations in managing water. It links areas that in the past have often been treated as distinct, such as:

- Land use and water use;
- Water quantity and quality;
- Water movement in rivers and aquifers;
- Wastewater and water suitable for treatment and reuse;
- Upstream and downstream interests; and
- The relative use of other resources when managing water such as energy and materials.

As well as technical issues IWM addresses social issues such as:

- Coordination of different levels of government and governance, from local to national and global, in water policy making and management;
- Involvement of all stakeholders in the decision-making process;
- Accounting for the impact on water resources of policies and planning in other areas, such as food, transport, energy and population;
- The provision of adequate information to support decision making; and
- Influencing water users to recognise the need for long-term viability of water resources and to use water accordingly.

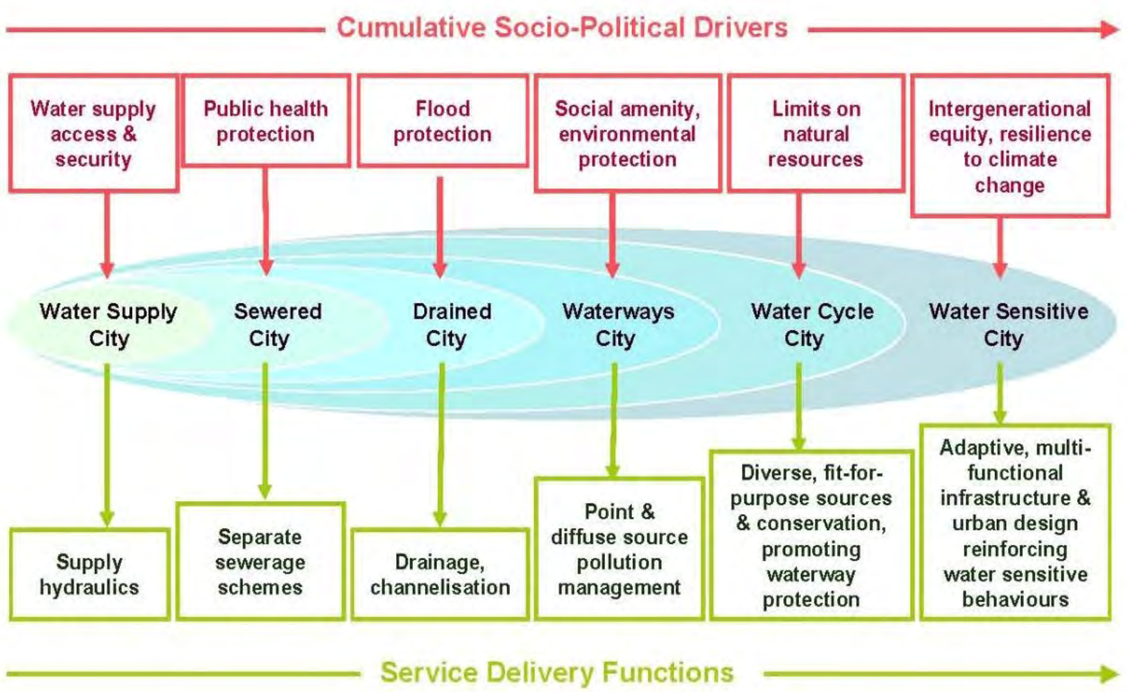


■ **Figure 1-1: Integrated Water Management: Interactions between a range of Water Sources for Hahndorf**

1.5. Transitioning to a water sensitive town

The recommended actions from this plan aim to promote the Township of Hahndorf as a 'Water Sensitive City'. Brown et. al (2009) propose a framework for benchmarking the development of urban water management in cities. It presents six categories or states which urban cities transition through when moving toward sustainable urban water management. The purpose of the spectrum is to assist urban water managers with transitioning to the ultimate goal of water sensitive cities. Figure 1-2 describes each of the states.

At the low extreme of the spectrum is a 'water supply' city, which solely provides access to water. In contrast, at the high extreme of the spectrum, a 'water sensitive city' provides sustainable water management, with resilience to climate change and water sensitive behaviours. Hahndorf is currently in between a "Waterways City" and a "Water Cycle City". A suite of infrastructure, policy, governance and capacity building initiatives will be required to assist the District Council of Mount Barker to transition toward a "Water Sensitive City".



- **Figure 1-2: Urban Water Management Transitions Framework (Brown et al., 2009)**

1.6. Responsibilities for IWM in the Township of Hahndorf

Responsibilities for IWM are divided between the agencies and community responsible for the various aspects of water supply, treatment, use and management; SA Water (mains water supply, wastewater), the District Council of Mount Barker (stormwater, flooding and natural watercourses on Council land), the Adelaide Mount Lofty Ranges NRM Board (catchment management and water allocations), land developers and the community who as landholders may have and use rainwater tanks, and use mains water and groundwater for domestic use and irrigation.

Successful IWM requires good communication and cooperation between all stakeholders and an agreed vision for the future. Whilst this project has focused on actions the Council can directly influence, other actions such as wastewater reuse will require coordination between Council and SA Water. In addition, Council has a role in the education and support of their community to better manage their water resources.

1.7. Context for Future Water Resources Management

Over the 30 year lifespan of this plan, there are a number of factors that may affect how water is managed throughout Hahndorf and which may require review and consideration of previously more expensive water management options. These factors will influence the development of IWM options and priorities for IWM actions, and they are described below.

- **Increased volumes of stormwater and risks of flooding**

Urban infill will result in greater volumes of stormwater from Hahndorf. There are already flooding risks along the creek lines throughout Hahndorf, and it is likely that these will also increase in the future as urban in-fill and development on the creek banks continues. This risk can be managed through design of flood mitigation infrastructure, development of Council policies for creek line management, and water sensitive urban design.

- **Decreasing water quality and subsequent impacts on biodiversity**

Increasing population and visitor numbers may increase the stormwater pollutant load, resulting in decreasing water quality in Hahndorf Creek to a level that is no longer acceptable to the Council or AMLR NRMB, with adverse impacts on aquatic biodiversity locally and downstream. Private ownership of watercourses throughout the urban areas of Hahndorf increases this risk and reduces Council's ability to manage riparian zones.

- **Increased cost of mains water**

Securing a mains water supply that is resilient to climate change effects (eg. desalinised water) has already resulted in increases in the cost of mains water supply across South Australia. Further cost increases may place additional demand on alternate supplies and make it more important to diversify water sources and utilise fit for purpose sources.

- **EPA requirement to cease discharge of treated wastewater to water bodies**

Currently, excess wastewater from the Hahndorf WWWTP is discharged to the Hahndorf Creek. In the future, further restrictions may be placed on the disposal of wastewater from the Hahndorf WWWTP. Hence finding an economic, long term and environmentally suitable use for the treated wastewater is required.

- **Decreasing groundwater availability or increasing groundwater salinity**

There are a range of current users of groundwater for irrigation throughout Hahndorf, such as St Michaels Primary School, the Hahndorf Oval and Recreation Reserve and the Hahndorf Bowling Club. Current groundwater quality and availability means there is no particular need for these irrigators to change to a different source of water. However if groundwater salinity were to increase, or groundwater availability were to decrease (due to policy or other reason) it could become necessary to replace groundwater use with alternative water sources such as treated wastewater or stormwater. Due to the location of Hahndorf at the upstream end of the catchment in a recharge zone of fractured rock aquifer, salinisation is expected to be a low risk, but changes in recharge or government policy could restrict availability.

2. Stakeholder Consultation and Goals for Integrated Water Management

In the early stages of development of this IWMP, workshops and interviews were conducted with the Council, government agencies, land owners, developers and the community in order to identify and articulate the goals, issues and opportunities for IWM in Hahndorf. This Section describes the outcomes of the workshops, with more details provided in Appendix B.

2.1. Consultation and Goals from Council and Government Agencies

A Council and government agency stakeholder workshop was held on August 9, 2010 to identify and articulate the goals, issues and opportunities for integrated water management in the District Council of Mount Barker. The goals were further refined following the workshop for specific applicability to the Township of Hahndorf during a meeting with project stakeholders on the 21st of March 2011.

The goals that were identified for Integrated Water Management within the Township of Hahndorf are summarised in this section. Some of these goals relate directly to the action that should be undertaken, and others relate to the decision making process (Goal 7). The recommended actions from this IWMP were developed to work toward achievement of these goals.

Goal 1: Opportunistic application of Water Sensitive Urban Design (WSUD) where meaningful and practical

It is expected that climate change/global warming will induce severe weather events with increasing frequency. Water Sensitive Urban Design aims to combat the increased risk of flooding by increasing the permeability of the urban landscape to allow infiltration, and temporary storage of water in the catchment, thus reducing runoff volumes and peak flows during storms. Opportunities to retrofit WSUD throughout the Hahndorf Community should be sought as infrastructure is replaced or upgraded. A range of WSUD options should be implemented to ensure 'fit for purpose' solutions.

Goal 2: Capture, storage and reuse of stormwater and wastewater

Integral to the IWMP is the need to capture, store and reuse stormwater and wastewater and a range of opportunities should be identified to achieve this. The IWMP should address a range of options suitable for Hahndorf including onsite harvesting and use of rainwater, community based collection and treatment, integrating landscape design with capture, storage and reuse techniques and Managed Aquifer Recharge (MAR). Identifying appropriate uses for water supplies should also be an important component of the IWMP, including ensuring that water is matched with its best use.

Within Hahndorf, the Western Mount Lofty Ranges Water Allocation Plan may limit the volume of stormwater harvesting, however the IWMP should identify opportunities.

Goal 3: Explore opportunities for water trading

Opportunities for water trading should be identified, including trading water between different areas and utilising the restrictions that result from the Western Mount Lofty Ranges Water Allocation Plan to stimulate the trade of water between water management areas.

Goal 4: Appropriate provision of water for the environment through sound development / catchment planning

Genuine acknowledgement and consideration should be made for water for the environment, including the need to ensure that increased stormwater volumes do not prevent or limit opportunities for watercourse rehabilitation, that water dependent ecosystems at the local and regional level are protected and enhanced and that environmental issues are considered "up front" in the concept planning process.

Goal 5: District Council of Mount Barker is recognised as a leader in Integrated Water Management

The District Council of Mount Barker aims to become a leader in policy and action relating to integrated water management. This will include building the capacity of local government, planners, developers, related industries and consultants to better understand integrated water management planning and implementing it in development.

Goal 6: Support an aware and active community

There is a need for the community to be an engaged and active player in IWM and work with Council and developers to achieve IWM outcomes. Awareness raising could include celebrating water in a positive way such as via a Water Festival and promoting the costs and savings of techniques to capture, recycle and reuse water/wastewater.

Goal 7: Account for whole of lifecycle economic and energy costs

Any direction proposed by the IWMP should not result in unacceptable increases in other costs (economic and environmental) for example through requiring additional energy to meet a new water supply option. Consideration of embodied energy versus operational energy, that is, lifecycle energy should also be considered by the IWMP.

3. Policy and Planning Review

3.1. Introduction

A Policy Review was prepared summarising the key strategic planning directions and statutory planning policy context for integrated water management relating to the Township of Hahndorf. This Section describes population factors for Hahndorf and describes the policy review that was conducted. The complete Policy Review can be found in Appendix A.

The planning and policy information was used as a basis for developing infrastructure and policy opportunities and actions for IWM.

3.2. Population and Growth

The Township of Hahndorf consists of a township area, surrounded by rural residential properties. The township was settled in 1836 by German immigrants, and tourism has become a major source of income to the town, which has retained its German heritage. Surrounding land uses include vineyards, livestock and fruit farming, and community features include two schools, several wineries and a resort. Figure 3-1 provides a map of the Township of Hahndorf.

The 2006 census reported the population in Hahndorf to be 1,804 people, with an occupancy rate of 2.4 persons per dwelling (ABS, 2006). The 30 Year Plan for Greater Adelaide does not propose any development for Hahndorf and hence the population is predicted to increase only as a result of urban in-fill. For the purposes of Integrated Water Management Planning, a growth rate in line with the State average of approximately 1% has been assumed which corresponds to around 300 new households over the next 30 years.

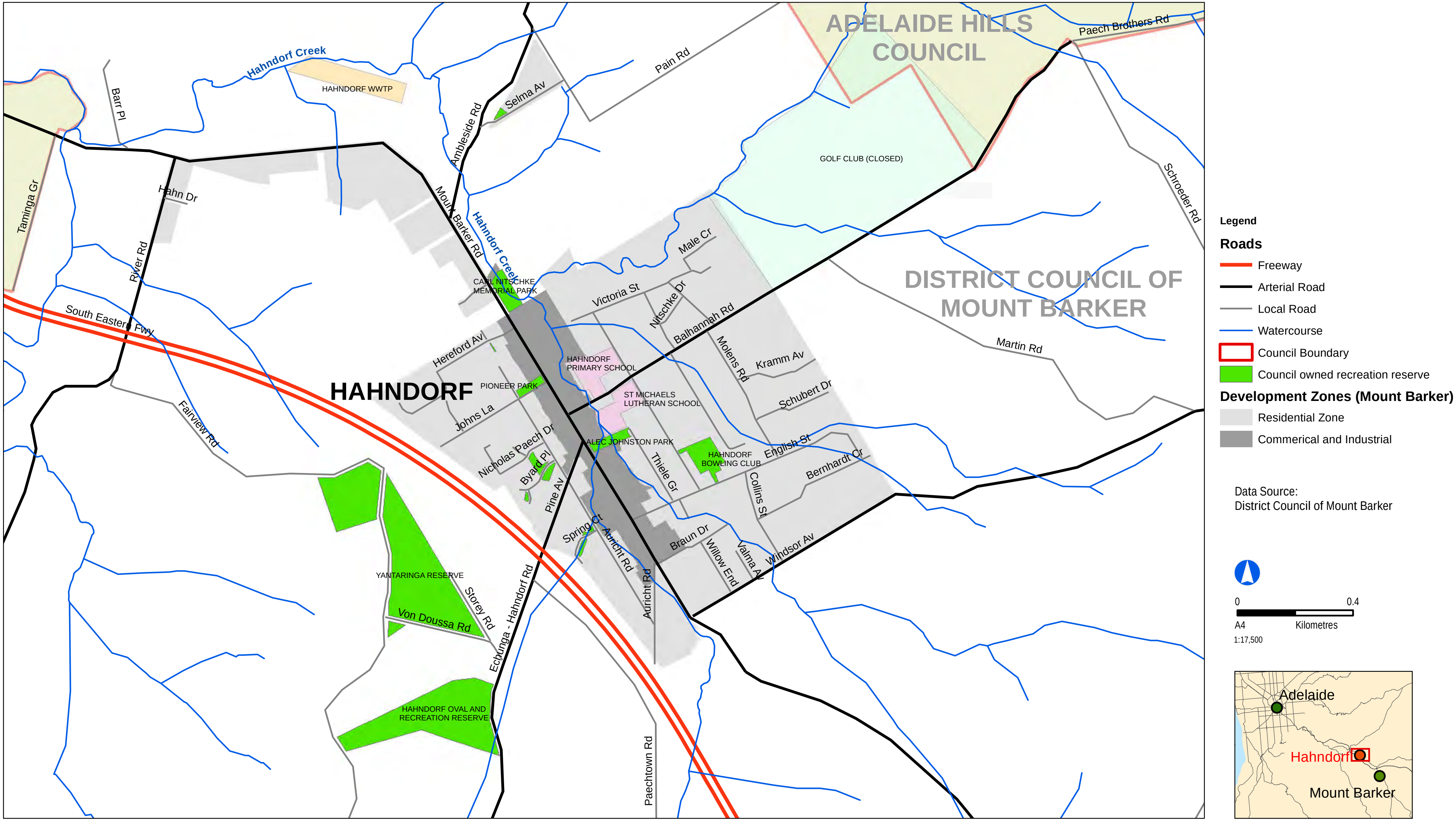


Figure 3-1 Location and Current Extent - Hahndorf

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3.3. Policy and Planning Review

There are a range of State, regional and local planning processes and documents which drive planning policy and provide the strategic and statutory policy context for integrated water management. These range from high level strategic planning documents such as the 30 Year Plan for Greater Adelaide, to regional plans such as the Adelaide and Mount Lofty Ranges Natural Resources Management Plan, to local plans such as Council's Development Plan.

Understanding this context is important, as it is this strategic and statutory policy context which will assist in delivering the directions proposed by this IWMP "on the ground" via new and possibly (in some cases) retrofitted development. The Policy Review (Part 2, Section 1) provides more detail about this policy context.

3.3.1. Draft Water Allocation Plan for the Western Mount Lofty Ranges Prescribed Water Resources Area

The township of Hahndorf is within the Western Mount Lofty Ranges Prescribed Water Resources Area (PWRA). The water resources of the Western Mount Lofty Ranges PWRA were prescribed in September 2005 under the *Natural Resources Management Act 2004,* and the prescription covers all surface water, watercourse water and groundwater resources. The Draft Water Allocation Plan (WAP) for the Western Mount Lofty Ranges (PWRA) guides water licensing, allocations, and permits for water affecting activities within the area (AMLR NRMB, 2010).

The opportunities for IWM that are included in this Plan have been developed in consideration of the WAP requirements, however have not been limited by the limits on water interception and allocation that are outlined in the WAP. The limits on water interception and allocation outlined in the WAP that are relevant for IWM planning are summarised below:

Stormwater (Refer Section 6.7 of AMLR NRMB, 2010)

- Stormwater from a new urban land use development may only be allocated where the allocation would not exceed the difference between the urban runoff and the predevelopment runoff, where the urban runoff is the current volume of runoff from the urban area, and the predevelopment runoff is the runoff from the area that would have occurred prior to October 2004.

The Draft Water Allocation Plan for the Western Mount Loft Ranges defines pre development flows as the flows from the catchment prior to 2004. As most of the current Hahndorf Township was developed in 2004, the current stormwater flows would not significantly exceed the flows from the township in 2004.

The AMLR NRM Board has indicated that for the preparation of this IWMP, the restrictions of the WAP should not limit the options that are considered. As such, stormwater harvesting and reuse options have been investigated and the stormwater harvesting volumes have not been limited to account for pre development flows.

3.3.2. 30 Year Plan for Greater Adelaide

The *30-Year Plan for Greater Adelaide*, adopted in February 2010, provides land use and development direction for the Greater Adelaide region for the next 30 years. The Plan is predicated on achieving an additional 560, 000 people and 258,000 new homes in the Adelaide region over the next 30 years. This high rate of growth will be increasingly concentrated in the existing urban area, with 70% of new housing growth to be accommodated in transit oriented development, along transit corridors and in higher density developments in strategic locations. However, the expected high rates of growth means that outward urban growth expansion will continue, with new greenfields development to occur in a range of townships. The Plan does not indicate significant development in Hahndorf over the next 30 years, however the water management actions outlined in the plan are still relevant.

In terms of water, the Plan identifies 'water efficiency' as a challenge for the Plan to respond to, noting that 'securing water supplies for a growing population and economy is fundamental to economic, social and environmental wellbeing'. It is in this context that the Plan notes that the actions of the Water for Good are being implemented and will ensure that Greater Adelaide has sufficient water supplies in coming years. The Plan also notes that urban form presents an opportunity to reduce water consumption, insomuch as increasing housing densities and improved water efficiency of buildings will result in more efficient use of water across the urban area overall. The Plan's direction in terms of water can be summarised as:

- Raising the standards for water efficiency in new residential, commercial and industrial buildings through a wider roll-out of WSUD techniques (including incorporating WSUD techniques in areas undergoing structure planning)
- Mandating WSUD for all new developments by 2013
- Reducing reliance on mains water supply
- Protecting water supply catchments, key watershed areas and potential locations for stormwater harvesting
- Reducing domestic water consumption through the shift to smaller accommodation, in line with demographic trends, at higher densities
- Ensuring new public open space is independent of mains water supplies
- Developing infrastructure to maximise the re-use of wastewater

Key WSUD policies and targets identified by the Plan are described below.

Policies

- Incorporate water-sensitive urban design (WSUD) techniques in new developments to achieve water quality and water efficiency benefits.

- Require WSUD techniques to be incorporated in Structure Plans and Precinct Requirements for State Significant Areas.

- Mandate WSUD for new developments (including residential, retail, commercial, institutional, industrial and transport developments) by 2013 (consistent with Water for Good).
  The Climate Change, Housing Affordability and Sustainable Neighbourhoods Task Force will advise the State Government on the most effective way to implement this policy without compromising housing affordability.

- Require new greenfield developments that are subject to Structure Plans from 2011 to source water for outdoor use from non-mains water supplies.
  This recognises the need to plan alternative water sources at the commencement of new large greenfield developments, rather than retrofit these sources for latter stages of the development.

- Identify and protect locations for potential stormwater harvesting schemes, including those areas identified in Map D22.

- Ensure appropriate policy links and consistency between Stormwater Management Plans, Structure Plans and Development Plans to address stormwater and flood management matters.

Targets

- Reduce demand on mains water supply from new development through the introduction of water-sensitive urban design. (This target will be quantified once the WSUD mandating scheme is determined.)

- Require all new dwellings to be connected to alternative water sources, which must supply at least 15 per cent of the internal water needs of these households.

- Achieve independence from mains water supplies for new public open spaces in transit corridors through WSUD techniques.

- Achieve alternatives to mains water for outdoor use through WSUD techniques in all new greenfield developments that are subject to Structure Plans and Precinct Requirements after 2011.

3.3.3. Water For Good

Water for Good is the State Government's integrated water management plan that provides strategic directions and over 90 actions to ensure the State's long term water supply needed to support economic, cultural and social development. At the heart of the document is new policy which aims to diversify water supplies to reduce reliance on the River Murray and other rain-dependent sources, and transition to a variety of water sources, including desalination, harvested stormwater and treated wastewater.

Stormwater Strategy-The Future of Stormwater Management

The Department for Water has also released the Stormwater Strategy, a high-level 'road map' for the future of stormwater management in South Australia.

The Stormwater Strategy includes nine actions to improve stormwater management in Adelaide in a way that integrates it with other urban water resources. Under the Strategy, the South Australian Government will develop a 'blueprint for urban water' to bring together stormwater and wastewater alongside other water resources in the Adelaide region, guide future infrastructure investment and policy requirements across Adelaide, and assist transition to a water sensitive city.

Part of this Strategy includes introducing interim targets for water sensitive urban design, completing further studies to improve the knowledge and management of public health risks relating to the recycling of stormwater, and ensuring a strong scientific basis for our future approach to urban water management.

A key action identified by this Strategy includes:

> *Before the end of 2011, introduce interim targets for water sensitive urban design, ahead of developing and implementing the best regulatory approach to mandate water sensitive urban design.*

3.3.4. Regional NRM Plan

The Adelaide and Mount Lofty Ranges NRM Plan identifies long term (20 year) regional targets relating to the reuse of stormwater, protection of water resources to meet water quality guidelines, and the sustainable use of water resources. Integrated water management planning can assist to deliver on these targets as it is underpinned by the concept of considering the sustainable management of all aspects of the water cycle, considering water quantity and quality, and identifying ways to capture, treat and reuse water.

3.3.5. Department for Water WSUD Consultation Statement

The Department for Water (DfW) has developed a set of targets related to WSUD, as part of their *Water Sensitive Urban Design Consultation Statement* (2012). The target is for the WSUD features to reduce average annual loads of suspended solids, phosphorus, nitrogen and gross pollutants by 80%, 60%, 45% and 90% respectively.

The State-wide objectives, as provided in DfW, (2012) are:

- *To support the sustainable use of natural water resources that provide our water supplies and to help ensure that our water supplies are resilient to climate variation, by conserving water*

- *To help to protect the health of water bodies and associated ecosystems in or downstream of urban areas, by managing runoff and maintaining or improving water quality.*
- *To complement other measures (including at catchment scale) that aim to manage the potential flood-related risk associated with urbanisation, by managing runoff.*
- *To promote the potential for WSUD to support other relevant State, regional, and local objectives, by encouraging integrated planning, design and management of WSUD measures that maximise the potential to achieve multiple outcomes*

3.3.6. Council Plans

Council's Strategic Plan makes multiple references to different aspects of IWM. It is apparent that, in particular, an integrated approach to managing stormwater and the roll-out of water sensitive urban design are strategic level commitments of Council. Council's commitment to IWM is also evident in actions and targets of the Plan to, for example, develop a water management strategy and completely water-proof one township. Council could strengthen its commitment to integrated water management in its Strategic Plan by giving greater attention to wastewater re-use and developing localised fit-for-purpose water supplies.

The District Council of Mount Barker Development Plan provides a good level of coverage on many aspects of IWM. A particular strength is its coverage of water sensitive design and integrated stormwater management, which translates to multiple policies that encourage IWM. The Development Plan also addresses catchment water management and recognises the localised dimensions of the water cycle and the need to manage water quality and quantity, water-based ecosystems and functions, and water infrastructure at the catchment scale. Provisions around waste-water re-use are less well developed or detailed in the Development Plan, and may require revision in encouraging integrated water management. There are no provisions which speak to fit for purpose water supplies.

4. Current Water Resources

4.1. Introduction

The major elements of urban water management system include wastewater, stormwater, mains water and groundwater. Each of the elements has different availability and water quality, which has implications for the purposes for which it can be used. Historically, urban water supply in Hahndorf has relied largely on mains water for a range of uses including household use, irrigation of open spaces, industrial and commercial uses while excess volumes of stormwater and treated wastewater were discharged to the Hahndorf Creek.

'Fit for purpose' water use refers to matching a demand for water with a source that has appropriate availability and water quality. An example is the use of passively treated stormwater for irrigation of open spaces; the quality of treated stormwater is suitable for irrigation and its use results in energy and resource savings through reduction of mains water demands and reduction in stormwater discharge to the environment.

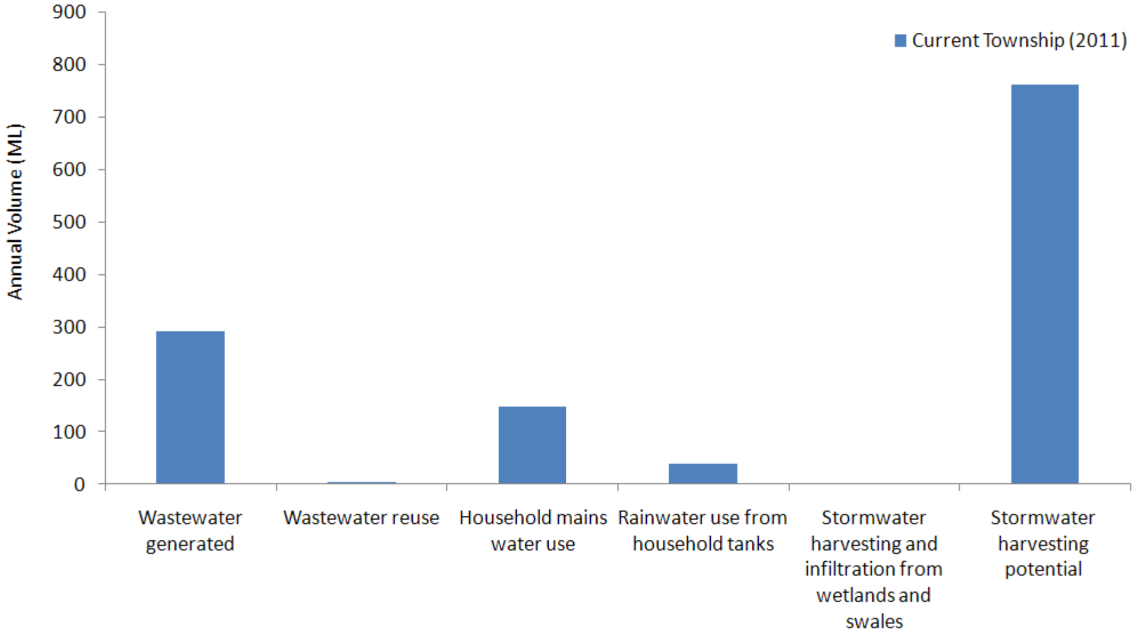
Each of the major elements of the urban water management system has been described for the township of Hahndorf. Where possible, the water volumes for a dry, medium and wet year have been quantified. This information was used as a basis for development of IWM opportunities and the infrastructure and policy actions from this IWMP.

4.2. Current Water Resources

4.2.1. Summary of major urban water elements

Figure 4-1 and Table 4-1 summarise the volumes estimates of the main components of the water system for the current township of Hahndorf. Further information on each component can be found in the following sections.

The plot shows that there is a significant volume of stormwater and wastewater that is not currently reused. There is the potential to utilise this source in order to decrease the current household mains water use volumes through fit for purpose reuse.



- **Figure 4-1: Major urban water elements for the current Hahndorf township**

- **Table 4-1: Water supply and use volumes for major elements of the urban water system for Hahndorf (2011)**

Wastewater	**Wastewater generated (ML/year)**	**Wastewater reuse (estimated) (ML/year)**	**Wastewater excess (ML/year)**		
Hahndorf	291	4	287		
Stormwater	**Stormwater generated (ML/year)**	**Stormwater infiltration & evaporation (ML/year)**	**Stormwater reused for irrigation (ML/year)**	**Rainwater use from household tanks (ML/year)**	**Stormwater available for additional alternative uses (ML/year)**
Hahndorf	763	Unknown	0	39	724
Mains	**Household mains water use (ML/year)**	**Irrigation mains water use (Council) (ML/year)**			
Hahndorf	148	>1			
Groundwater	**Groundwater use (ML/year)**				
Hahndorf	23				

4.2.2. Natural Watercourses

Hahndorf Creek runs through the Township of Hahndorf and meets the Onkaparinga River downstream of the town. Data from flow gauging station A5030537 (Hahndorf Creek DS Sewage Treatment Works) from June 2002 to January 2012 indicates that the median flow in Hahndorf Creek is approximately 5ML/day, with flow in winter months being much higher than in summer months. Approximately 0.8ML/day of treated wastewater is discharged into Hahndorf Creek downstream of the Hahndorf Wastewater Treatment Plant (see section 4.2.8). Water from the Hahndorf Creek flows to the Onkaparinga River and then into Mt Bold Reservoir.

The majority of the Hahndorf Creek catchment area consists of rural land uses; however it also passes through the urban areas of the town. The creek lines throughout the urban areas have been modified due to extensive development, and have been identified as a risk for localised flooding. This is of particular concern in the tributaries flowing north-west through the Hahndorf Township (on the north eastern side of Mount Barker Road). In response, studies have been conducted investigating flood mitigation options for the township (Tonkin, 1992; GHD, 2006). A map of the catchment, showing the main tributaries is provided in Figure 4-2.

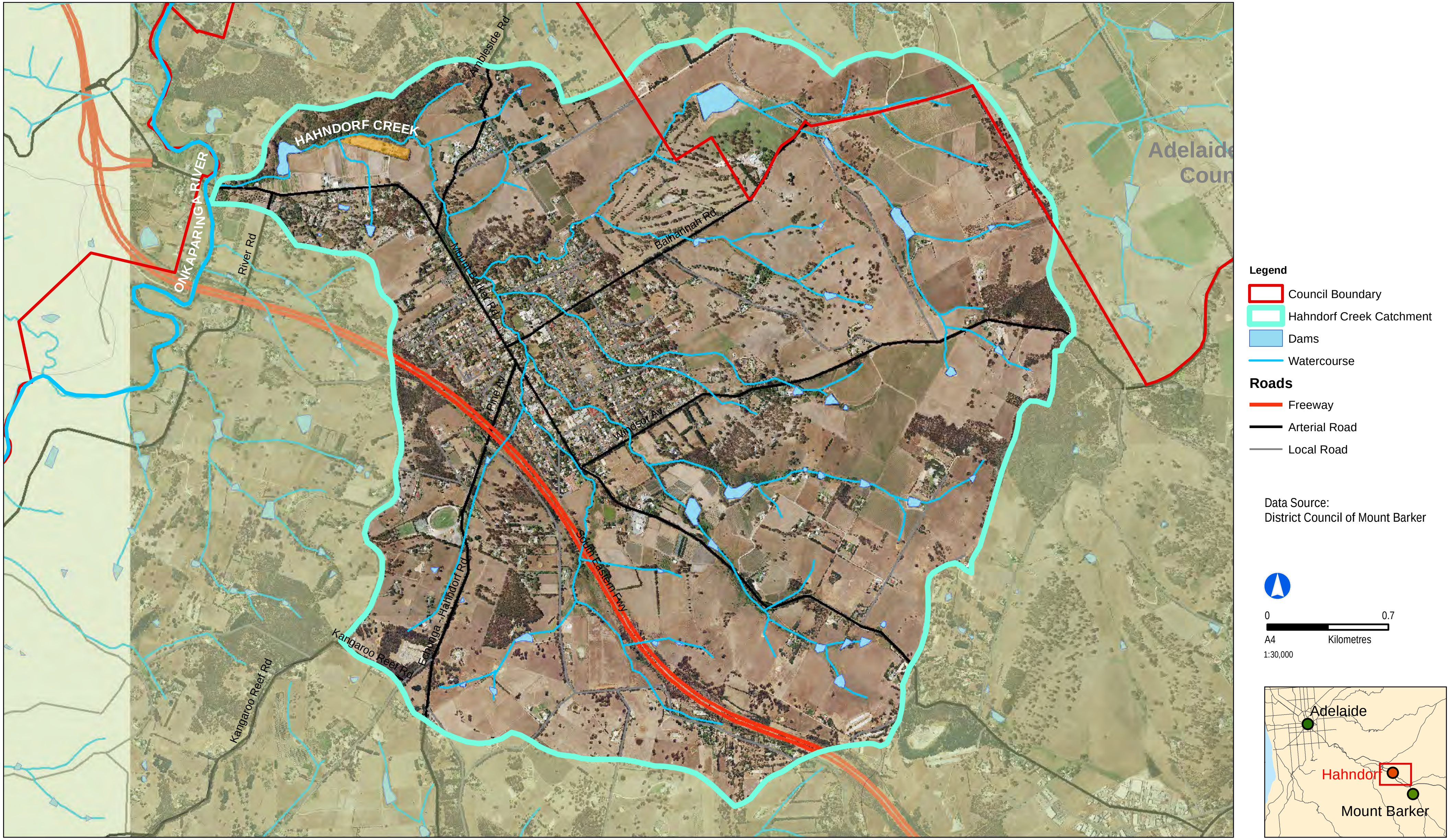


Figure 4-1 Hahndorf Creek Surface Water Catchment

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4.2.3. Stormwater

Stormwater runoff from the rural and urban catchments of Hahndorf is routed to roadside kerbs and an underground drainage network before being discharged to Hahndorf Creek. There are currently no treatment or re-use schemes in place. Farm dams capture runoff throughout the rural areas, and surface water is extracted from them for irrigation of surrounding farmland and use as stock water.

Estimate of Stormwater Volumes for Current Township: MUSIC Modelling

An estimate of the volume of stormwater runoff from the current Hahndorf Township was completed using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC was developed by the Co-Operative research Centre for Catchment Hydrology (CRCCH), and it includes the following key components:

- Simulation of the hydrologic behaviour of catchments
- Generation of pollutant loads for suspended solids, total phosphorus and total nitrogen
- Pollutant removal achieved by the individual stormwater treatment components

MUSIC was considered the most suitable model for this investigation as it is able to model both the inflows to the catchment and the water quality improvements resulting from the Water Sensitive Urban Design (WSUD) infrastructure.

The following data were used to set up the MUSIC model:

- Daily rainfall for Mount Barker for the period from 1887 to 2010, supplied from the BOM (Station 23733). The data was analysed and the 20th percentile (1980), 50th percentile (1987) and 80th percentile (1947) rainfall years were selected from the series to investigate stormwater variability for dry, average and wet climate conditions.
- Monthly evaporation data for Lenswood Research Centre (Station 023801)(BOM) (12km north of Hahndorf in the Mount Lofty Ranges).
- Current urban catchment areas from analysis of contour map of the township
- Percentage impervious for urban catchments from analysis of aerial photography of current town.
- Gauged water quality data from Aldgate Creek (Station A5030509) from 1996 – 2011 were input to the MUSIC model to approximate the stormwater runoff quality into Hahndorf Creek. An analysis of the water quality data is provided below.

A range of assumptions were made as part of the MUSIC modelling. These include:

- Rainwater tanks were not explicitly included in the MUSIC Model.
- The MUSIC model only includes runoff from urban areas, and there would be additional runoff from the agricultural areas surrounding Hahndorf. The urban runoff has been quantified separately, as it forms the focus of IWMP opportunities and actions.

Water Quality Analysis: MUSIC Modelling

Gauged water quality data from Aldgate Creek (Station A5030509) from the period 1996 – 2011 were input to the MUSIC model to approximate the stormwater runoff quality into Hahndorf Creek. MUSIC includes default water quality parameters, which can be used to approximate the stormwater runoff quality from a general urban area. The Aldgate Creek water quality data compared to the MUSIC model default stormwater parameters in Table 4-2. The MUSIC default parameters include different water quality for baseflow and stormflow, however only the average of all flows from the Aldgate water quality data were input to the model.

Comparison of the two sets of parameters show that the mean load of suspended solids from the Aldgate Creek data is within a similar range to the default MUSIC model parameters, however has a much higher standard deviation. Both the average phosphorus and nitrogen concentrations from the Aldgate Creek data are lower than both the baseflow and stormflow default MUISC parameters, and have much narrower standard deviations. The lower concentrations are likely to be due to the difference in the quality of stormwater runoff assumed for an average urban community and for rural communities such as Aldgate and Hahndorf. Higher amounts of green space and vegetation throughout these towns and in the upper catchments are likely to result in a better water quality result than for a highly urbanised city, such as Adelaide.

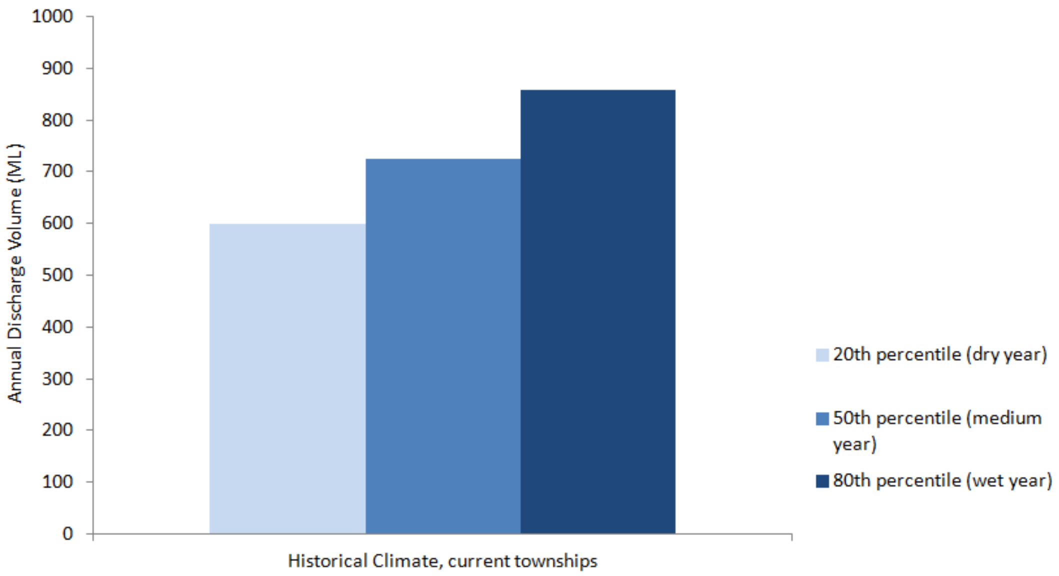
- **Table 4-2: Stormwater Quality Parameters from Aldgate Creek gauge compared with MUSIC model default parameters**

	Aldgate Creek Data		MUSIC Model default parameters	
	Mean	Standard Deviation	Mean	Standard Deviation
Suspended solids (mg/L)	36.7	47.1	12.5 (Baseflow), 158.4 (Stormflow)	1.5 (Baseflow), 2.1 (Stormflow)
Phosphorus (mg/L)	0.11	0.18	0.15 (Baseflow), 0.35 (Stormflow)	1.55 (Baseflow), 1.78 (Stormflow)
Nitrogen (mg/L)	0.98	0.61	2.1 (Baseflow), 2.6 (Stormflow)	1.3 (Baseflow), 1.6 (Stormflow)

Figure 4-3 shows a schematic of the MUSIC model for the current township. The Hahndorf Township has been represented by a single urban node of area 200 Ha, and percentage impervious of 30% to account for the mix of urban and rural properties throughout the community. The runoff from the township is discharged to the Hahndorf Creek. The location of the nodes on the schematic is indicative only. The flow and water quality outputs from each node of the model are included in Appendix G.

■ **Figure 4-3: Schematic of the MUSIC model catchments for the current Hahndorf township**

Figure 4-4 shows the volume of urban stormwater that is discharged to the Hahndorf Creek for the current township, as estimated through the MUSIC Modelling. The 20th percentile, 50th percentile and 80th percentile rainfall years from the historical rainfall record (1887 – 2010), were used to show that runoff for a dry year (600ML) is around two thirds of the volume of runoff in a wet year (860ML).



- **Figure 4-4: Estimate of the volume of stormwater discharged from the current Hahndorf Township**

Estimate of Stormwater Quality for Current Township: MUSIC Modelling

The quality of stormwater runoff from urban areas can deteriorate as it passes over impervious (paved) areas, including oils, sediments and excess nutrients (DPLG, 2009). The amount of impervious area compared to pervious (open space/landscaped) areas affects the total volume of runoff because it affects the total volume of infiltration.

The Department for Water (DfW) has developed a set of targets related to WSUD, as part of their *Water Sensitive Urban Design Consultation Statement* (2012). The target is for the WSUD features to reduce average annual loads of suspended solids, phosphorus, nitrogen and gross pollutants by 80%, 60%, 45% and 90% respectively. It has been assumed that the current stormwater infrastructure in Hahndorf has a negligible effect on pollutant removal; hence the percentage reductions for the current and future towns (without IWM) are close to zero. Table 4-3 provides the Department's WSUD targets.

- **Table 4-3: Water Quality Pollutant Load - Current Hahndorf Township**

	Pollutant Load Reduction Target WSUD Targets (DfW, 2012)	Average annual pollutant load reduction % - 2011	Average annual pollutant removal (Kg) – 2011
Total suspended solids	80%	<5%	N/A
Nitrogen	45%	<5%	N/A
Phosphorus	60%	<5%	N/A
Gross Pollutants	90%	<5%	N/A

4.2.4. Groundwater

A desktop study was conducted to investigate the current groundwater resources of the Hahndorf township area. Information on the general aquifer properties, current rates of extraction, current uses and water quality was used for developing the IWM opportunities and actions that are described later in the plan. The complete groundwater report is included in Appendix H.

Hahndorf is located at the top of the Mount Lofty Ranges in the Onkaparinga Catchment where Adelaidean sediments are the predominant rock type. These rock units comprise mainly siltstone, shale and slate with minor beds of sandstone and quartzite. The fractures and joints that make up the Fractured Rock Aquifers of the Adelaidean sediments tend to be open and permeable to water and wells generally exhibit yields of (3 – 10 L/s) and low salinities (< 1500 mg/L), however they are variable in distribution.

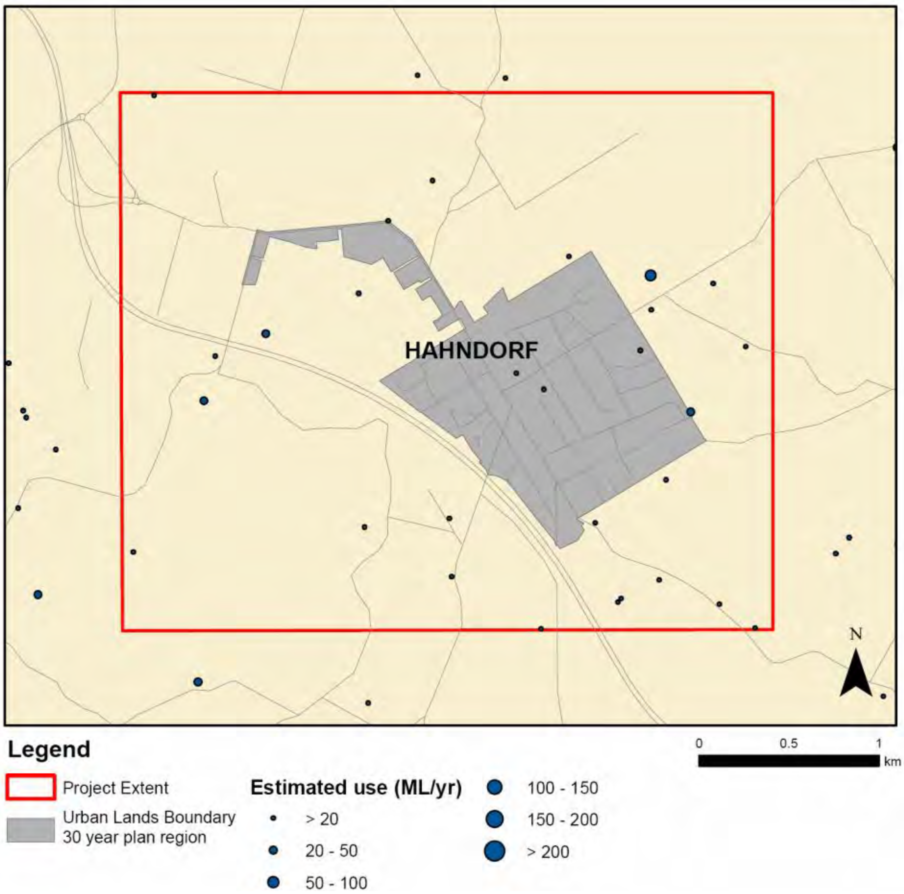
Hahndorf is part of the Western Mount Lofty Ranges Prescribed Water Resources Area, which was declared in 2005. The PIRSA Drillhole Enquiry System shows that the majority of bores in the area are classified as stock and domestic or for irrigation and many also correspond with the locations of prescribed wells. Current groundwater users in the town include St Michaels Primary School, the Hahndorf Recreation Ground and the Hahndorf Bowling Club.

Current Extraction

The Western Mount Lofty Ranges (WMLR) Prescribed Water Resources Area (PWRA) was declared in 2005 and estimated use from prescribed wells has been provided by the Department for Water (Figure 4.5). Extraction appears to be low, with most prescribed wells having estimated extractions of less than 50 ML/yr. Demand for stock and domestic purposes in the WMLR PWRA has been estimated at 500 kilolitres per well recorded as being used for stock and domestic purposes (AMLR NRMB, 2010).

Groundwater salinity around Hahndorf is variable but generally of good quality, with most wells having recorded total dissolved salts (TDS) below 1500 mg/L.

According to the WMLR WAP groundwater extraction records, within the Hahndorf groundwater management zone there are 43 licensed allocations totalling 702ML/yr, and within the Hahndorf Township (including the oval) there are a total of 5 allocations totalling 23ML/yr.



■ **Figure 4.5: Estimated use from prescribed wells**

4.2.5. Council groundwater use

According to the WMLR WAP groundwater extraction records, there is one licensed bore at the Hahndorf Football Oval and Recreation Reserve, with an allocation of just over 9ML/year.

4.2.6. Mains water supply

SA Water is responsible for supply of mains water to Hahndorf. River Murray water from the Murray Bridge to Onkaparinga Pipeline is delivered to the Summit Raw Water Storage and is treated before being pumped to Hahndorf. Potable water is supplied to just over 1000 properties (commercial and residential) with an average annual consumption of 234,000kL between 2003/4 and 2008/9. Average residential household consumption has decreased in recent years from 238kL per year in 2004/5 to 194kL per year in 2008/9. Currently, many houses throughout Hahndorf use rainwater to supplement mains water for garden and in-house uses. This is particularly common on the outskirts of the town where lot sizes are typically larger.

Estimate of current household mains water consumption and current rainwater consumption

The water use per person was estimated and SA Water data consumption data was analysed in order to estimate the current household mains water consumption and rainwater consumption for Hahndorf. Total water demand is made up of in-house uses, as well as outdoor uses such as garden watering.

The expected in-house demand per person is presented in Coombes (2003) *Analysis of Performance of Rainwater Tanks in Australian Capital Cities*. Coombes (2003) presents the data in Table 4-4, showing that water use will range depending on numbers of occupants. However, assuming an average occupancy of around 2.4 people per house, an in-house use of around 400 L/household/day is obtained, or around 170 L/person/day.

Table 4-4: In house demands based on number of persons (L/household/Day)

In-house demand (number of occupants)				
1	2	3	4	5+
180	325	470	615	760

SA Water have estimated that typically 40% of residential water use in urban areas is for outdoor use, as shown in Figure 4-6. Assuming 170 L/person/day for in-house use, the total use per person would therefore be around 280 L/person/day, giving a household use of 680 L/household/day. This total value is consistent with analysis of SA Water data for the years 2001 – 2009 by the Australian Bureau of Statistics (ABS, 2011).

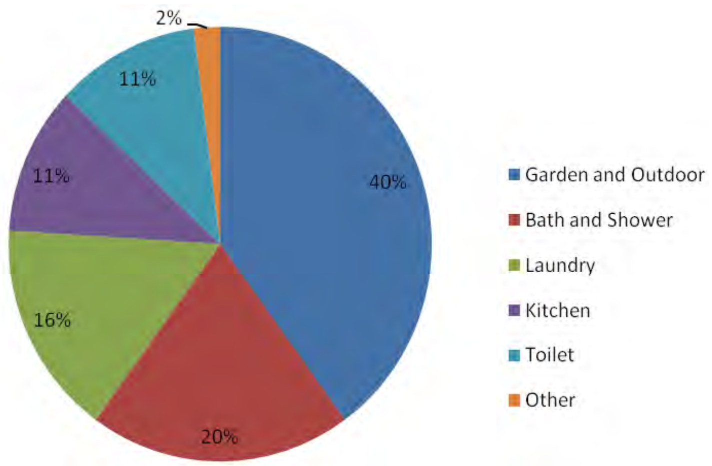


Figure 4-6: Residential water use locations (source SA Water)

Appendix C contains an analysis of SA Water consumption data, which reports a total residential consumption volume of 139ML for Hahndorf in 2010/11. For a population of 1,804 with average household size of 2.4 people this results in consumption per household of around 540L/household/day.

The estimate of average household consumption by the ABS (2011) is around 140ML/year higher than the consumption per household from SA Water mains data. It has been assumed that this difference is provided by household rainwater tanks in the current township, as summarised in the table below. Council have indicated that the volume of rainwater tank use in the current Hahndorf township is high.

Consumption	Estimated volume
ABS estimate of average daily household use, assuming 2.4 people per household	680L/household/day
SA Water consumption data for Mount Barker	540L/household/day
Rainwater tank use = difference between average consumption and mains water use in Mount Barker	140L/household/day

For the current township of Hahndorf, with population of around 1,804, a volume of 150ML/year was estimated as the total yearly household mains water consumption, with an additional 39ML/year supplied by rainwater tanks.

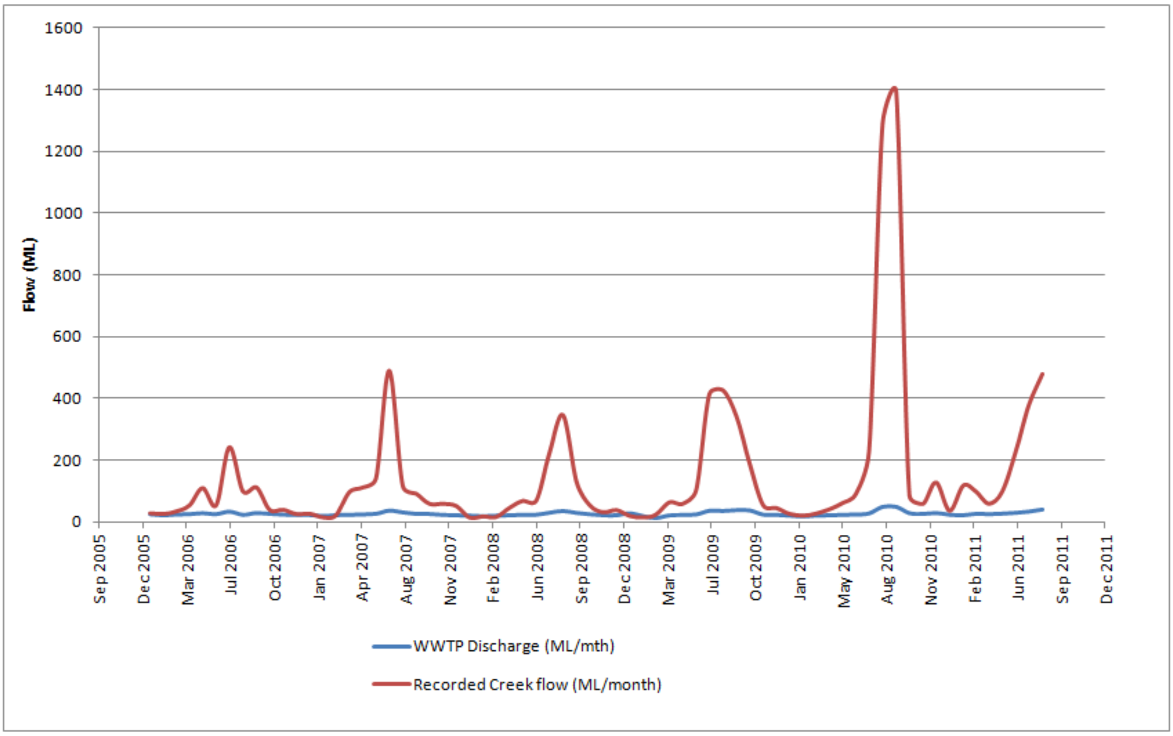
4.2.7. Council mains water irrigation use

According to Council records, a small volume (less than 1ML) of water is used by Council for irrigation of public open space, at Pioneer Park and Alec Johnson Park.

4.2.8. Wastewater

Wastewater from Hahndorf is currently treated at an SA Water wastewater treatment plant located on the north-east side of Hahndorf (see Figure 4-2) and discharged to Hahndorf Creek. This water ultimately flows to the Mt Bold Reservoir from where it is reused for human consumption throughout Adelaide after further treatment. An average of 290 ML/yr is discharged, approximately 0.8 ML/day.

Analysis of the streamflow data from a gauging station located just downstream of the Hahndorf wastewater treatment plant (A5030537) was undertaken to investigate the likely historic reuse volumes. Monthly discharge data from the WWTP was compared with the creek streamflow data to estimate the likely volume of stormwater reuse, for the period January 2006 – August 2011. It was assumed that the volume of reuse for each month was equal to any volume of discharge from the WWTP that was greater than the measured streamflow in the creek. Figure 4.7 compares the two data sources. It shows that the baseflow in the creek during the summer months is similar to the volume discharged from the WWTP, and in some months the volume of discharge is greater than the measured volume in the creek.



- **Figure 4.7: Comparison of WWTP discharge data and creek flow recorded downstream of the WWTP**

Table 4-5 shows the likely volume of reuse for each of the years of data. Each of the volumes comes from the summer months, where discharge from the WWTP exceeds the measured streamflow in the creek. From comparison of the data, around 4ML/year was estimated to be reused. Using this method, it is not possible to determine the exact volume of wastewater reuse. As the creek flow directly upstream of the WWTP is ungauged, it is not possible to directly assess the impact of the WWTP discharge on the creek flow.

- **Table 4-5: Potential wastewater reuse from comparison of WWTP discharge data and creek flow recorded downstream of the WWTP.**

Year	Potential Wastewater reuse (ML/year)
2006	0.00
2007	3.19
2008	7.68
2009	9.17
2010	0.00
AVERAGE	4.01

Analysis of Wastewater Quality

Table 4-6 shows a comparison between water quality data for the discharge of wastewater from the Hahndorf WWTP and guidelines for the discharge and reuse of wastewater. The comparison was undertaken to investigate whether there are potential issues with discharge of the wastewater from Hahndorf WWTP to the Hahndorf Creek or reuse of the wastewater for irrigation of public open spaces.

For potential reuse of the discharge from the Hahndorf WWTP, the SA Water data were compared with the EPA National Guidelines for Water Recycling (2006) – for municipal use with restricted access and application or landscaping use. The comparison shows that for E. Coli, BOD and Suspended Solids, all of the average discharge concentrations were below the guideline values.

For continued discharge of the treated wastewater to the Hahndorf Creek, the Environment Protection (Water Quality) Policy 2003 for discharge to aquatic environments was used. The comparison shows that for Total Phosphorus, BOD and suspended solids the average discharge from the WWTP is below the guideline levels, however for Ammonia (as Nitrogen) the average concentration of the WWTP discharge is more than double the guideline concentration.

- **Table 4-6: Comparison of quality of WWTP discharge from Hahndorf Creek with wastewater discharge and reuse guidelines**

	SA Water Data Average Concentration of Hahndorf WWTP discharge (2005-2011) (mg/L)	EPA National Guidelines for water recycling - for municipal use with restricted access and application or landscaping use (2006)	Environment Protection (Water Quality) Policy 2003 for discharge to aquatic environments
E. Coli	29.53 CFU/100ml	<100 CFU/100ml	-
TDS (by EC)	751.04	-	-
Total P	0.43mg/L	-	0.5 mg/L
FRP	0.09mg/L	-	-
BOD	3.48mg/L	<20mg/L	<10 mg/L
Total N	4.93mg/L	-	-
Ammonia as N	1.18mg/L	-	0.5mg/L
SS	5.61mg/L	<30mg/L	<20mg/L

5. Impacts to Water Resources due to Urban Infill by 2040

5.1. Introduction

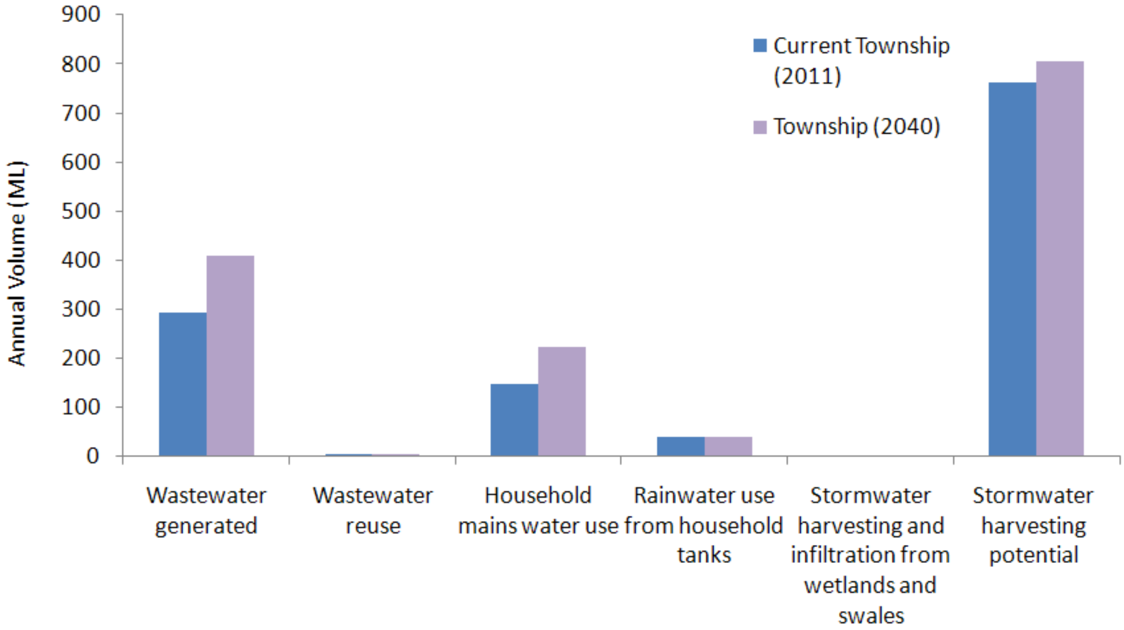
The 2006 census reported the population in Hahndorf to be 1,804 people, with an occupancy rate of 2.4 persons per dwelling (ABS, 2006). The 30 Year Plan for Greater Adelaide does not propose any development for Hahndorf and hence the population is predicted to increase only as a result of urban in-fill. For the purposes of Integrated Water Management Planning, an annual growth rate in line with the State average of approximately 1% has been assumed which corresponds to around 300 new households over the next 30 years.

This section describes the possible impacts of the urban infill to the main elements of the urban water supply system. Where possible, the water volumes for a dry, medium and wet year have been quantified. This information was used as a basis for development of IWM opportunities and the determination of infrastructure and policy actions from this IWMP.

5.2. Summary of major urban water elements

Figure 4-1 summarises the volume estimates of the main components of the water system for Hahndorf, following urban infill to the year 2040. Further information on each component can be found in the following sections.

Figure 4-1 shows that the volume of wastewater generated and stormwater that could be harvested are both predicted to increase due to the urban infill. There is the potential to utilise these sources in order to decrease the future household mains water demand and for other fit for purpose uses, such as irrigation of open spaces and for local industries.



- **Figure 5-1: Major urban water elements for the 2040 Hahndorf Township, without implementation of IWM actions**

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Table 5-1: Annual water supply and use figures for major elements of the Urban Water system for current (2011) and future (2040) Hahndorf township

Wastewater	**Wastewater generated (ML/year)**	**Wastewater reuse (ML/year)**	**Wastewater excess (ML/year)**		
Current Township (2011)	291	4	287		
Future Township (2040)	409	4	405		
Stormwater	**Stormwater generated (ML/year)**	**Stormwater infiltration & evaporation (ML/year)**	**Stormwater available for reuse from wetlands (ML/year)**	**Rainwater use from household tanks (ML/year)**	**Stormwater available for additional alternative uses (ML/year)**
Current Township (2011)	763	0	0	39	724
Future Township (2040)	805	0	0	39	766
Mains	**Household mains water use (ML/year)**	**Irrigation mains water use (Council) (ML/year)**			
Current Township (2011)	148	>1			
Future Township (2040)	223	>1			
Groundwater	**Groundwater use (ML/year)**				
Current Township (2011)	23				
Future Township (2040)	23				

5.2.1. Stormwater volumes for future township (2040)

An estimate of the volume of stormwater runoff from the Hahndorf township in 2040 was completed, using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), based on the assumption of 1% infill to the township over the next 30 years. The same methodology and assumptions were used as described in Section 0 for the current township.

The following data were used to set up the MUSIC model:

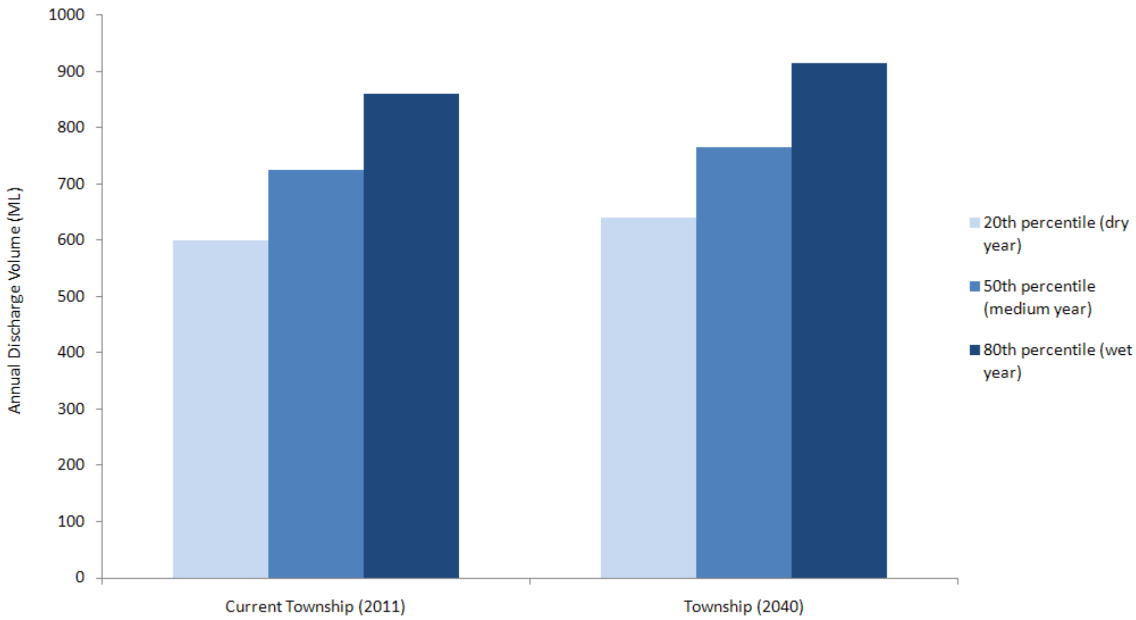
- Daily rainfall for Mount Barker for the period from 1887 to 2010, supplied from the BOM (Station 23733). The data was analysed and the 20th percentile (1980), 50th percentile (1987) and 80th percentile (1947) rainfall years were selected from the series to investigate stormwater variability for dry, average and wet climate conditions.
- Monthly evaporation data for Lenswood Research Centre (Station 023801)(BOM) (12km north of Hahndorf in the Mount Lofty Ranges).
- Percentage impervious for urban catchments from analysis of aerial photography of current town, and predictions of urban infill of 1% per annum over the next 30 years.

Figure 5-2 shows a schematic of the MUSIC model for the Hahndorf township. Similar to the model for the current year, the Hahndorf Township has been represented by a single urban node of area 200 Ha, and percentage impervious of 36% to account for the urban infill which will increase the volume of stormwater runoff from the town. The runoff from the township is discharged to the Hahndorf Creek. The location of the nodes on the schematic is indicative only. The flow and water quality outputs from each node of the model are included in Appendix G.

■ **Figure 5-2: Schematic of the MUSIC Model for the Hahndorf Township at 2040, without stormwater management actions**

Figure 5-3 shows the volume of urban stormwater that would be discharged to the Hahndorf Creek for the future (2040) township of Hahndorf following urban infill, as estimated by the MUSIC Model. The 20th percentile, 50th percentile and 80th percentile rainfall years from the historical rainfall record (1871 – 2010), were used to show the difference in the volume of urban runoff for a dry, medium and wet year.

Figure 5-3 shows that the volume of runoff is predicted to increase by 40-60ML/year as a result of the urban infill. While this is not a dramatic increase, there is still a need for implementation of IWM actions, to manage the current volumes of runoff, implement water quality improvements, and increase the volume of fit for purpose uses.



- **Figure 5-3: Estimate of the volume of stormwater discharged from future (2040) Hahndorf Township**

Table 5-2 provides an estimate of the water quality parameters for the future (2040) Hahndorf township with implementation of the IWM actions along with the Department for Water's WSUD targets *(Water Sensitive Urban Design Consultation Statement* (2012)). It has been assumed that the current stormwater infrastructure in Hahndorf has a negligible effect on pollutant removal; hence the percentage reductions for the current and future town (without IWM) are close to zero if no additional stormwater infrastructure is installed.

■ **Table 5-2: Water Quality Pollutant Load – Future (2040) Hahndorf Township**

	Pollutant Load Reduction Target WSUD Targets (DfW, 2012)	Average annual pollutant load reduction % - 2040	Average annual pollutant removal (Kg) – 2040
Total suspended solids	80%	<5%	N/A
Nitrogen	45%	<5%	N/A
Phosphorus	60%	<5%	N/A
Gross Pollutants	90%	<5%	N/A

5.3. Groundwater

The urban infill in Hahndorf is not predicted to significantly change the volumes of groundwater used as the majority of groundwater is used for irrigation.

5.4. Household mains water consumption

It has been assumed that household mains water for the new 300 new households in Hahndorf would be supplied by SA Water, and that they would not utilise rainwater without implementation of a rainwater tank mandate.

The same methodology and assumptions as described in 4.2.6 for the current Hahndorf township were used to estimate the household mains water consumption for the township in 2040. For the future population of around 2,500, the total household annual mains water consumption was estimated to be around 223ML.

5.5. Wastewater

For the future population of around 2,500, the total wastewater production was estimated to increase to around 409ML, which is an increase of around 117ML compared with the current township. It has been assumed that without implementation of IWM actions, this additional demand would be supplied by SA Water, and would continue to be discharged to the Hahndorf Creek.

6. Impacts to Water Resources due to Climate Change Projections

6.1. Introduction

Climate change projections indicate reductions in rainfall and increases in temperature and evaporation across most of South Australia.

To inform this project, the South Australian Research and Development Institute (SARDI) completed climate change modelling for the District Council of Mount Barker area to provide an estimate of the changes to temperature, rainfall and evaporation expected over the 30 year lifespan of the IWMP (Hayman et al, 2011). The modelling included two scenarios, a 'mild drying' scenario, and a 'more severe drying' scenario. For the Hahndorf region in 2030, the SARDI modelling predicts around a 0.7 – 0.9°C increase to average annual temperature, 2.4– 11.4% decrease to annual rainfall and a 36.2 – 49.9mm increase to annual evaporation. Refer to Appendix E for plots showing the monthly modelling results for Hahndorf.

The Climate Change Scenarios Report (Hayman et al, 2011) highlights the uncertainty in climate predictions which results from the use of different climate models and different emission scenarios. Of particular note to this IWM project is the change in uncertainty over time. For predictions to 2030, there is a lower level of uncertainty and the main source of uncertainty is due to differences in comparisons of different climate models. There is increased uncertainty for the 2100 predictions due to the uncertainties associated with the magnitude of future emissions, and how sensitive climate will be to the emissions.

The combined effects of higher temperature, lower rainfall and higher evaporation will pose serious challenges to management of South Australia's water resources, and water shortages are likely to result (SA Government, 2010). The threat to South Australia's water security will impact on urban and rural water supplies, primary industries and regional economies. Adverse impacts are also expected to river and wetland ecosystems and groundwater systems throughout South Australia.

In order for South Australia to adapt to climate change, sustainable water management measures must be incorporated into planning and infrastructure decisions now (SA Government, 2010). Integrated water management will be imperative for diversifying water sources, reducing reliance on a single source of water (rainfall) and maximising reuse.

The following issues were amongst those identified in the South Australian government report '*Prospering in a Changing Climate (2010)*' to be taken into consideration when developing adaptation responses for water resources:

- The need for environmental water;
- The ability for surface water and groundwater storages to cope with flood, low flow and recharge events;

- The sustainability of water supply sources;
- The impact of reduced rainfall on runoff volumes and groundwater recharge; and
- The impact of increased temperature on water demand.

This Section describes the impacts of projected climate change impacts to the volumes of stormwater runoff from the Hahndorf township. This information was used as a basis for development of IWM opportunities and the determination of infrastructure and policy actions.

This report has focused on the impacts of climate change on stormwater runoff. Recent dry years have seen reduced household consumption of mains water and subsequent reductions in wastewater generation across South Australia, which may also occur in a drier climate. These impacts have not been modelled for this project.

6.2. Estimate of Climate Change Impacts to Stormwater Volumes for Hahndorf

An estimate of the impact of climate change projections (Hayman et al, 2011) to the volume of stormwater runoff from the current and future (2040) Hahndorf Township was undertaken using MUSIC modelling. The same methodology and assumptions were used as described in Section 0 for the current Hahndorf Township, and in Section 5.2.1 for the future (2040) townships.

The results provided by the Climate Change Scenarios Report (Hayman et al, 2011) suggested the use of a "mild drying" climate scenario. This was adopted by concurrent projects undertaken in the South Australian Murray-Darling Basin area considering future climate change.

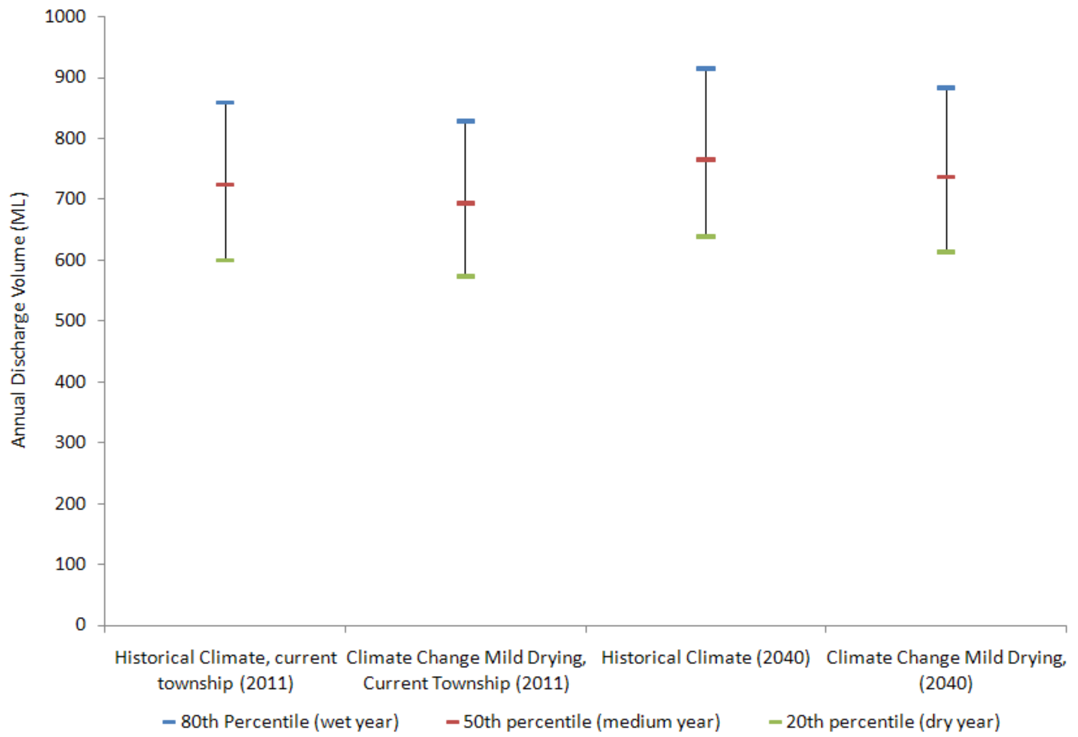
The following data were used to set up the MUSIC model:

- Daily rainfall for Mount Barker for the period from 1887 to 2010, supplied from the BOM (Station 23733). The data was analysed and the 20th percentile (1980), 50th percentile (1987) and 80th percentile (1947) rainfall years were selected from the series to investigate stormwater variability for dry, average and wet climate conditions. The rainfall series were adjusted by the projected changes to rainfall from the SARDI Mild Drying climate change scenario.
- Monthly evaporation data for Lenswood Research Centre (Station 023801)(BOM) (17km north of Mount Barker in the Mount lofty Ranges), adjusted by the projected changes to evaporation from the SARDI Mild Drying climate change scenario..
- Percentage impervious for urban catchments from analysis of aerial photography of current town, and predictions of infill growth to the town.

Figure 6-1 shows a comparison between the volume of urban stormwater that is discharged to the Hahndorf Creek for the historical climate and the Mild Drying climate change projection, for the current Hahndorf township, and the future (2040) township, following urban infill. The 20th percentile, 50th

percentile and 80th percentile rainfall years for both the historical and climate change scenario were used to show the difference in the volume of urban runoff for a dry, medium and wet year.

The Figure shows that the volumes of discharge are predicted to decrease by a small amount as a result of the climate change projections. Subsequently the expected impacts to the main water elements as a result of recommended infrastructure action were calculated using historic climate data.



- **Figure 6-1: Impacts of climate change projections to the volume of stormwater discharge from the current (2011) and future (2040) Hahndorf township**

7. Water Management Actions in Hahndorf

7.1. Introduction

This section outlines the range water management actions that were identified for Hahndorf. The major benefits of each action are discussed, and the impacts that each action would have to the major elements of the urban water system are included.

The actions were developed in alignment with the IWM goals, in consideration of the priorities for the Hahndorf township and future considerations that may affect water resources management. The actions were developed following a review of the relevant background documents, a site visit to the Hahndorf area and in consultation with the AMLR NRM Board and District Council of Mount Barker.

Rainwater tanks have been included in the section on Planning Actions as their implementation would require the Development Plan to be amended to mandate their installation.

Appendix B contains the Options Report and contains a description of all IWM actions that were considered.

The key actions are:

- Stormwater detention and treatment,
- Stormwater reuse
- Wastewater reuse (both local and regional)
- WSUD treatments.
- MAR investigations
- Planning actions (including mandating rainwater tanks, as well as retrofitting them to current houses)
- Capacity building and governance
- Advocacy
- Water conservation – demand management

7.2. Use of Recycled Water

The South Australian Department of Health encourages the use of reclaimed water (treated wastewater), however highlights the need to consider the distribution and reuse purpose to prevent public health risks and adverse environmental impacts. Reuse is only allowed for non-potable (not for human consumption) purposes (Department of Heath, 2011).

The Environment Protection and Heritage Council, the Natural Resource Management Ministerial Council and the National Health and Medical Research Council have developed guidelines for the safe use of recycled water (NWQMS, 2009). The guidelines should be reviewed when planning any recycled water initiative:

Australian Guidelines for Water Recycling: Managing Health and Environmental Risks

Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2): Stormwater Harvesting and Reuse

Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2): Managed Aquifer Recharge

7.3. Wastewater Reuse

The water balance analysis for Hahndorf has identified that there will be around 410ML/year of wastewater generated from the Hahndorf township in 2040. A range of demands for treated wastewater for irrigation of open space and industrial and horticultural users may be identified surrounding Hahndorf, as well as opportunities for regional reuse of the water in the future. However, the management of wastewater in Hahndorf is the responsibility of SA Water, hence Council may have limited control over the management and reuse of this water. There are opportunities for both local wastewater reuse, and regional wastewater reuse, and both are discussed in the following subsections.

7.3.1. Local Wastewater Reuse

Opportunities to increase the volume of local wastewater reuse have been identified by Council. Currently, the wastewater from the SA Water Treatment plant is discharged to Palmers Dam and to the Hahndorf Creek. It has been estimated that an average of around 4ML/year is reused from Palmers Dam. The site has the potential to be converted to a wetland to provide a greater level of treatment to the wastewater prior to discharge to the Hahndorf Creek (refer **Error! Reference source not found.** for location), similar to aratinga Wetland in Mt Barker. It could also be used for storage of the wastewater prior to reuse. A pump and pipeline system would be required to distribute the wastewater for local reuse.

There is potential to increase the volume of wastewater reuse for irrigation of public open spaces within Hahndorf or for irrigated horticulture. Opportunities for reuse of stormwater within the local Hahndorf area include:

- Irrigation of local open spaces, such as the two school ovals, football oval, lawn bowls club and the Alec Johnston Park.
- Sale to local agricultural or horticultural industries, such as the Beerenberg Farm, surrounding vineyards and other local farms for irrigation use.
- Irrigation of areas which currently use groundwater, especially if the viability of groundwater extraction is reduced in the future due to increased salinity.

The key benefits of local wastewater reuse are:

- Encourage growth of industry to the area by providing up to 410ML additional treated wastewater (assumes all wastewater from 2040 township is available for reuse).
- Increased diversity of water sources improving security of supply.
- Reduced risk of discharge of treated effluent to the Hahndorf Creek and subsequent reduced risk of water quality compromise to the Hahndorf Creek.
- Economic returns to Council and/or SA Water.

Future demand for wastewater will need to be confirmed as a first step in implementing any form of reuse scheme, so that additional wastewater infrastructure that would be required and estimating the volume and quality of water that will be reused.

The ability for Council to implement this action will depend on decisions made by SA Water regarding the future wastewater management arrangements for Hahndorf.

A preliminary estimate of the Net Present Value of a local wastewater reuse system was developed for the purpose of comparison with other water management options. For local wastewater reuse, the cost estimate is for the construction of around 3km of pipe work and pumping system for a distribution network between the Hahndorf WWTP and local demands. It has been assumed that the Palmer Dam would be adequate for wastewater storage.

The present value of the major components of the costs and revenue are included in Table 7-1. It has been assumed that all of the available wastewater (410ML/year) could be reused. All assumptions included in the cost estimate and a breakdown of the inclusions and unit rates used is included in Appendix F.

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■ **Table 7-1 Estimated costs for local wastewater reuse**

Cost Component	Preliminary Cost Estimate (present value)
Total capital costs (for increase in diameter of pipeline from 150mm to 200mm to allow for additional volumes)	$1.9 M
Annual maintenance and operational costs	$80,000
Average yearly revenue from sale of water (based on assumed 1700ML/annum of reuse, and a price of 50c/kL)	$200,000
Total net present value (over 30 year timeframe)	$425,000
Total net present value per ML of reuse (over 30 year timeframe)	$35/ML (revenue)

7.3.2. Regional Wastewater Reuse

There are a large number of water reuse opportunities around Mount Barker, and hence there is an opportunity to transfer the recycled water from the Hahndorf wastewater treatment plant to Mount Barker via a pipeline. The recycled water could be added to Mount Barker wastewater storages at Brown Dam and reused.

The key benefits that this option would provide are:

- Ceased discharge of treated effluent to Hahndorf Creek;
- Reduced risk of water quality compromise to Hahndorf Creek; and
- Reliable demand for treated water at Mount Barker. This may enable a greater reuse of recycled water than if local reuse opportunities are sought.

Council investigations have identified a range of unspecified demands from irrigators surrounding Mount Barker, Littlehampton and Nairne. A pipeline from Hahndorf could assist in the delivery of wastewater to these demands.

Council's role in implementing wastewater reuse will depend on decisions made by SA Water regarding the future wastewater management arrangements for Hahndorf and Mount Barker. There is uncertainty regarding Council's role in wastewater management, and how much wastewater will be available to Council for reuse in the future. Before this action could be implemented, arrangements between the Council and SA Water will need to be made to eliminate this uncertainty.

This option has not been included in the range of feasible options for Hahndorf, since the additional costs of infrastructure for delivery of the water to Mount Barker would be significant. Hence local wastewater reuse is considered to be a more feasible option.

7.4. Stormwater Harvesting and Reuse

Additional stormwater management infrastructure could improve runoff water quality and reduce the volume of water discharged to the Hahndorf Creek. Urban infill will increase volumes of stormwater runoff, and there is potential to provide wetlands for storage, treatment and reuse of this water. The harvested stormwater could be used locally for fit for purpose reuse.

To improve stormwater management and treatment in the Hahndorf township, it is recommended that a stormwater detention wetland be constructed downstream of the Hahndorf township to reduce the volume and improve the quality of stormwater discharge to the Hahndorf Creek. It would be preferable for the wetland area to be designed to provide high-value amenity and recreation space. A preliminary recommended location of the stormwater wetland is shown in Figure 7-7.

Opportunities for reuse of stormwater within the local Hahndorf area are predominantly irrigation of open space, similar to the opportunities for wastewater reuse, listed in Section 7.3.1.

The key benefits of these opportunities for stormwater reuse are:

- Reduced volume of runoff to Hahndorf Creek by an average of around 310 ML of stormwater per annum by 2040 (through infiltration and reuse). The volume of stormwater available from this wetland has not been limited to maintenance of predevelopment flow rates to Hahndorf creek, as discussed in Section 3.3.1.
- Improved quality of water discharged to Hahndorf Creek through reduction in total annual load of P 25(kg), N (125kg) and total suspended solids (241,000kg) by 2040, improving the protection of aquatic ecosystems in Hahndorf Creek and downstream catchments.
- Replacement of up to 23ML of groundwater or mains water with fit for purpose water source, for irrigation of public open space or other suitable uses.
- Increased diversity of water sources improving security of supply.

A preliminary estimate of the Net Present Value was developed for this initiative, for the purpose of comparison with other water management options. The costing included for the design and construction of a 1.6Ha wetland, including a 2km pipeline and pump station for distribution to local demands. The present value of the major components of the costs and revenue are included in **Error! Reference source not ound.**. All assumptions included in the cost estimate and a breakdown of the inclusions and unit rates used is included in Appendix F.

▪ **Table 7-2 Estimated Costs for Stormwater Harvesting and Reuse**

Cost Component	Preliminary Cost Estimate (present value)
Total capital costs (includes construction of 1.6Ha wetland, 2km pipeline and pump station)	$4.0M
Annual Maintenance and operational costs	$85,00
Average yearly revenue from use of water (based on assumed 100ML/annum of reuse, and a price of 50c/kL) – this would be an opportunity cost for water to be reused by Council	$130,000
Total net present value (over 30 year timeframe)	-$2.9M (cost)
Total net present value per kL of reuse (over 30 year timeframe)	-$370/ML (cost)

7.5. WSUD Treatments

Water Sensitive Urban Design (WSUD) treatments should be implemented opportunistically throughout the Township of Hahndorf over the next 30 years. As there is limited urban development predicted for Hahndorf, most of the WSUD features will involve retrofitting drainage networks. To minimise costs, WSUD should be considered for all roadside locations that are the subject of infrastructure upgrades. A range of treatments such as swales, buffer strips, pervious pavements and bio retention basins should be considered and implemented where most appropriate. A range of WSUD features are briefly described in the following section.

MUSIC modelling of the WSUD features in Hahndorf has included a single swale node, which represents the retrofit of a range of WSUD features throughout the township, for treatment and infiltration of water as it runs off. A total of 650m of swales, of top width 10m were included in the modelling. The dimensions were determined from inspection of aerial photography of the town, based on areas of available space where WSUD features could be retrofitted.

The key benefits that WSUD will provide are:

- Minor flood attenuation. While the treatments will have little effect for major flood events, they will contribute to attenuation of minor flooding through slowing down runoff throughout the catchment, and enabling infiltration.
- Reduction to the volume of stormwater runoff, through infiltration. The estimated average yearly volume of infiltration through the swales that were modelled for the project is estimated to be 40ML. Reducing stormwater quantity will assist in the prevention of excess discharge (above pre-development flows) to Hahndorf Creek, reducing erosion potential.
- Improved quality of water discharged to Hahndorf Creek through reduction in total annual load of P (132), and total suspended solids (2,488,000kg) by 2040.The reduction in nitrogen from the

swales is estimated to be negligible, due to the already low loading of nitrogen in the water (water quality data sourced from Aldgate Creek).

The locations of WSUD treatments should be chosen to best integrate stormwater management throughout all new developments. A summary of locations within Hahndorf which have been identified for high potential for retrofit of WSUD features is included in Table 7-5. This table was developed through desktop and site assessment of the Hahndorf township area to identify areas where there is potential (including acceptable land slope and availability of space) for implementing WSUD treatments. Three photographic examples from the table are provided in Figure 7-1, Figure 7-2 and Figure 7-3. Full details of the assessment are provided in Appendix I.

A preliminary estimate of the Net Present Value was developed for this initiative, for the purpose of comparison with other water management options. The present value of the major components of the costs and revenue are included in Table 7-3 below. Costing information was sourced from the WSUD Design Technical Manual for Greater Adelaide, with application of a BPI to escalate rates for 2010. All assumptions included in the cost estimate and a breakdown of the inclusions and unit rates used is included in Appendix F.

- **Table 7-3 Estimated Costs for WSUD Treatments to be retrofitted to the Hahndorf Township**

Cost Component	Preliminary Cost Estimate (present value)
Total Capital Costs (includes a total of 650m of swales, of top width 10m).	$180,000
Annual Maintenance and Operational costs	$30,000
Average yearly revenue from use of water	No sale of water
Total Net Present Value (over 30 year timeframe)	-$420,000 (cost)
Total Net present Value per kL of reuse (over 30 year timeframe)	No water reuse

Table 7-4: Description of WSUD Treatments (Department of Planning and Local Government, 2009)

WSUD Feature	Description	Example Visualisation
Swales	Swales are linear depressions which are used to convey runoff, capture sediments and pollutants and reduce runoff through infiltration. They can be densely vegetated and can be incorporated along streets and within parklands.	
Buffer strips	Buffer strips are broad, sloped areas of dense vegetation which remove pollutants from runoff and reduce the volume of runoff through infiltration.	
Pervious pavements	Pervious pavements allow infiltration of runoff through the paving substrate and into the underlying soil. Hence they reduce the total volume of runoff and reduce transport of pollutants.	
Bio retention basins	Bio retention basins are vegetated filtration systems that can temporarily detain runoff, allowing it to infiltrate and improve the water quality. They are densely vegetated and contain a filter media for filtration of the runoff.	

- **Table 7-5: Summary of locations with high potential for WSUD treatments throughout Hahndorf**

Location	Comments and potential WSUD treatments
(a) Roads	
Pine Ave	Space constrained in some areas as properties face directly onto road however some sections have relatively wide verges enabling potential for roadside WSUD treatments such as swales, permeable pavement, infiltration trench, buffer strips.
Strempel Ave	Relatively wide verges throughout, enabling potential for roadside WSUD treatments such as swales, permeable pavement, infiltration trench, buffer strips. Potential for bioretention system and restoration of creek at corner of Strempel and Balhannah Road.
English St	Space constrained in some areas as properties face directly onto road however some sections have relatively wide verges enabling potential for roadside WSUD. Space available upstream of the creek crossing for a swale, infiltration trench or bioretention system.
(b) Car Parks	
West of Mount Barker Road, between Braun Dr and English St	Each of these car parks has available space for retrofit of an infiltration system such as permeable pavement, bioretention system, infiltration trench or a rain garden.
East of Mount Barker Road, next to Alec Johnston Park	
(c) Ovals and Open Spaces	
Oval near Thiele Grove (St Michael's Lutheran School)	Creek passes alongside oval, and there is potential to utilise open space to retrofit WSUD features. Creek line alongside the oval has already been revegetated as part of the 'Million Trees' program, and there is more potential for creek restoration works.
Oval North of Balhannah Road Hahndorf Primary School	Creek passes alongside oval, and there is potential to utilise open space to retrofit WSUD features such as bioretention system, swales or buffer strips.
Alec Johnston Park	Space available for WSUD features such as bioretention systems, swales or buffer strips, and potential for restoration of creek through the park.
Open Space at Eastern end of Braun Drive (St Pauls Lutheran Homes)	Open space available for WSUD treatments alongside creek at empty lot at the eastern end of Braun Drive.
Open space along creek line along Southern side of Byard Place (Byard Place Reserve)	Open space available for WSUD treatments alongside creek in reserve along Southern side of Byard Place

*Refer to Section 5.4 of Part 2 for WSUD potential in other locations throughout Hahndorf

- **Figure 7-1: Potential for Roadside WSUD Treatments along Pine Ave**

- **Figure 7-2: Potential for retrofit of WSUD treatments at car-park West of Mount Barker Road, between Braun Dr and English St**

- **Figure 7-3: Open space available for WSUD treatments alongside creek in reserve along Southern side of Byard Place**

7.5.1. Flood Protection Infrastructure

Stormwater detention systems at locations previously recommended by Tonkin (1992) and GHD (2006) should be provided upstream of the township to reduce the risk of flooding throughout Hahndorf (as shown on Figure 7-7). The recommendations from the previous reports should be used as a starting point and refined to form final infrastructure solutions.

Flood protection infrastructure should be prioritised as an essential action from the Plan due to the economic, health and safety concerns associated with flooding of the township.

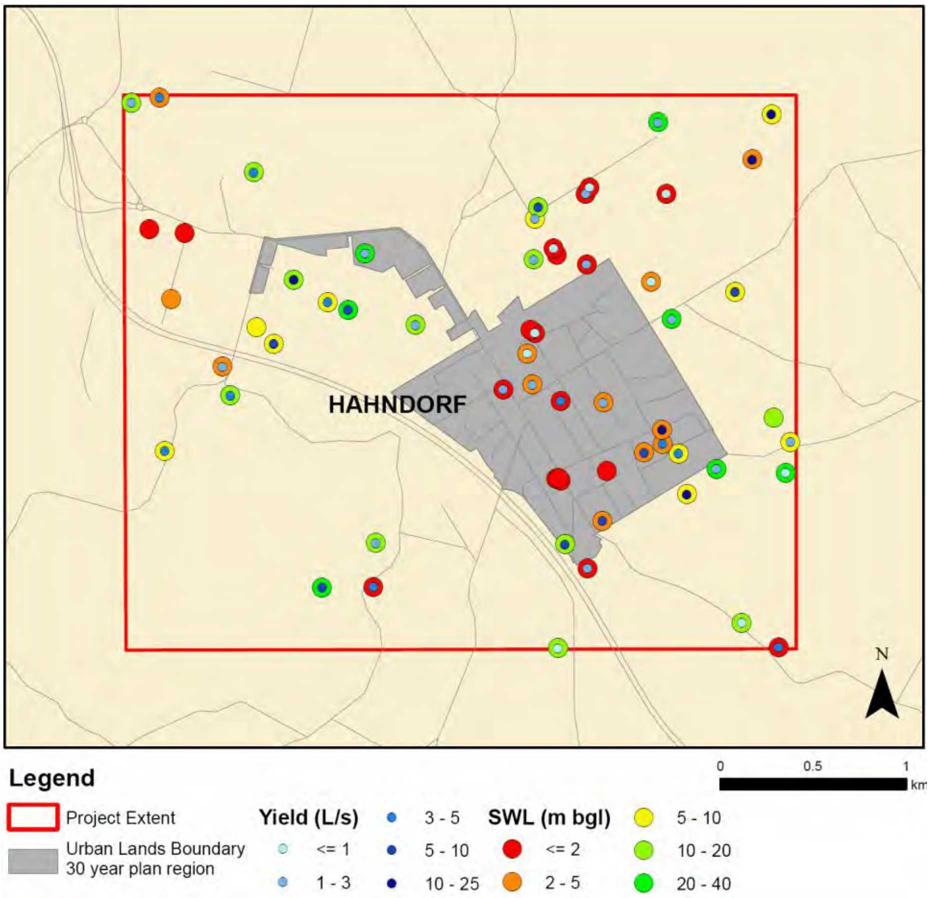
A preliminary estimate of the Net Present Value was developed for this initiative, for the purpose of comparison with other water management options. The present value of the major components of the costs and revenue are included in Table 7-3 below. Costing information was sourced from Tonkin (1992), and GHD (2006), with application of a BPI to escalate rates for 2010. All assumptions included in the cost estimate and a breakdown of the inclusions and unit rates used is included in Appendix F.

- **Table 7-6 Estimated Costs for two stormwater detention systems upstream of Hahndorf Township**

Cost Component	Preliminary Cost Estimate (present value)
Total Capital Costs (two stormwater detention systems upstream of the township).	$430,000
Annual Maintenance and Operational costs	$10,000
Average yearly revenue from use of water	No sale of water
Total Net Present Value (over 30 year timeframe)	-$560,000 (cost)
Total Net present Value per kL of reuse (over 30 year timeframe)	No water reuse

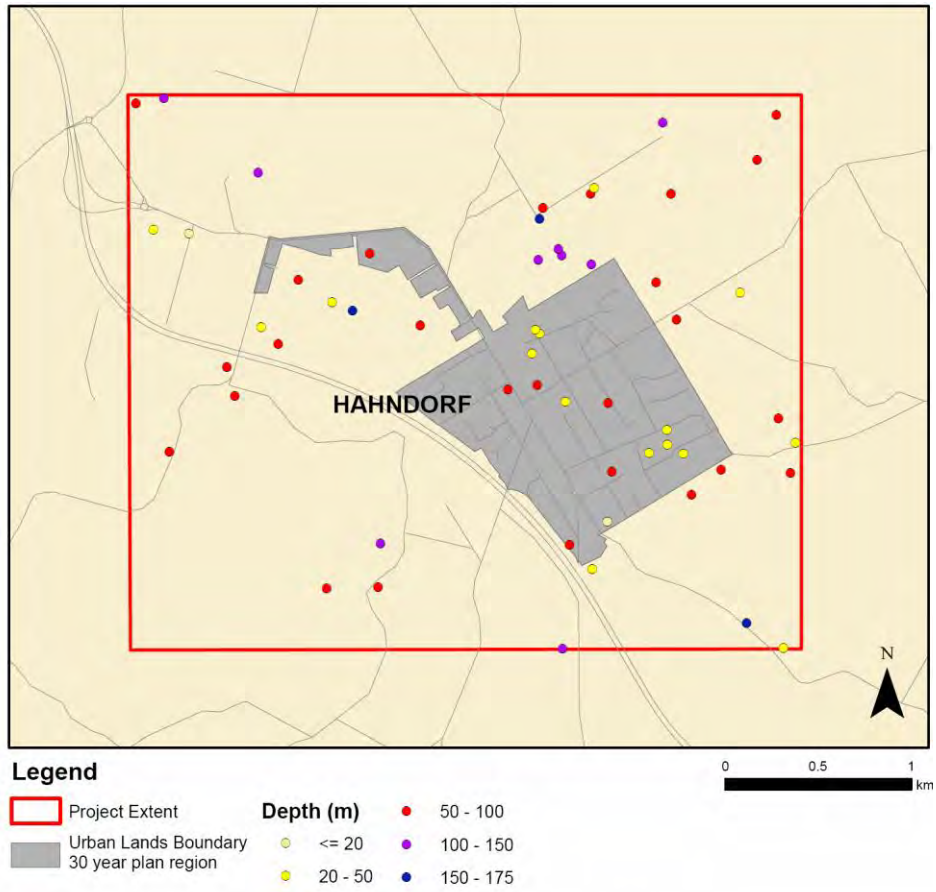
7.6. Opportunities for MAR

The potential for managed aquifer recharge (MAR) in the Hahndorf vicinity is limited due to the underlying hydrogeology. In general the Fractured Rock Aquifers are low yielding with variable salinities across all rock types. Whilst salinity is generally low, indicating that MAR well efficiencies could be relatively high, the combination of shallow depths to water and low yields recorded in wells are not favourable for MAR. There are some wells that record deeper standing water levels coincident with relatively higher well yields as shown on Figure 7-4.



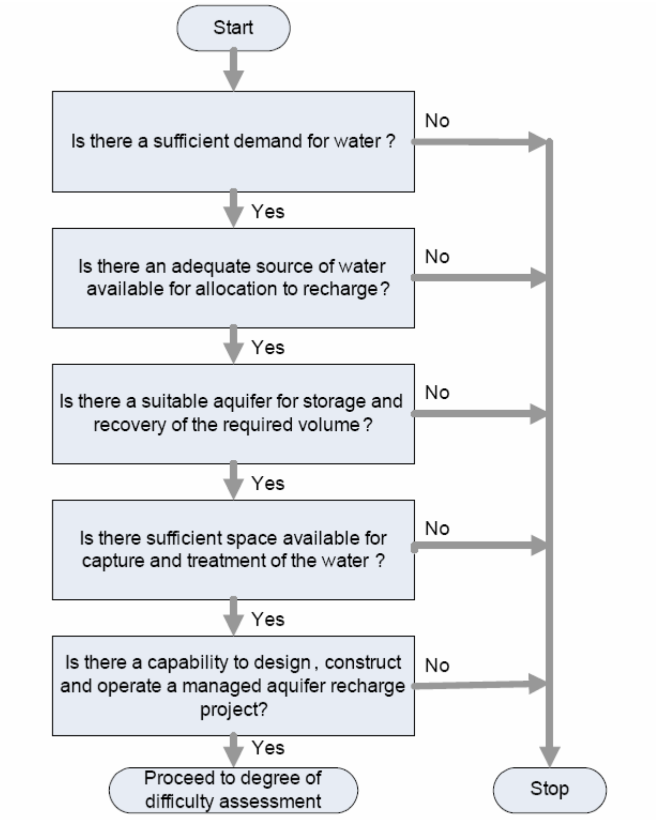
- **Figure 7-4: Standing water level and well yields recorded since 1980**

The undertaking of MAR in fractured rock aquifers requires site specific investigation as large variability in hydrogeological conditions can occur within short distances. This is indicated by the variety in the depth of wells constructed in the area since 1980 shown in Figure 7-5. Targeting fractures and joints can be challenging and drilling, fracture orientation and aquifer testing investigations are required to ensure successful MAR wells can be constructed. Topography is another consideration with higher gradients naturally occurring in the landscape encouraging greater groundwater movement along interconnected fractures and joints.



- **Figure 7-5: Depth of wells constructed since 1980**

Entry level viability assessment, as schematically represented in Figure 2.9, is required for any MAR operation considered for Hahndorf and the main uncertainty, as in any location underlain by Fractured Rock Aquifers, is the location of suitable aquifer without which a scheme cannot succeed. More detailed hydrogeological assessment and investigation to build understanding in the area can be undertaken using existing wells prior to investing in drilling investigations. Investigation with data collection for assessment can comprise aquifer testing and investigation of fracture orientation in existing wells in addition to an assessment of well logs to build a conceptual understanding of the local area.



- **Figure 7-6: Schematic for entry-level viability assessment for managed aquifer recharge (source: NRMMC, 2009)**

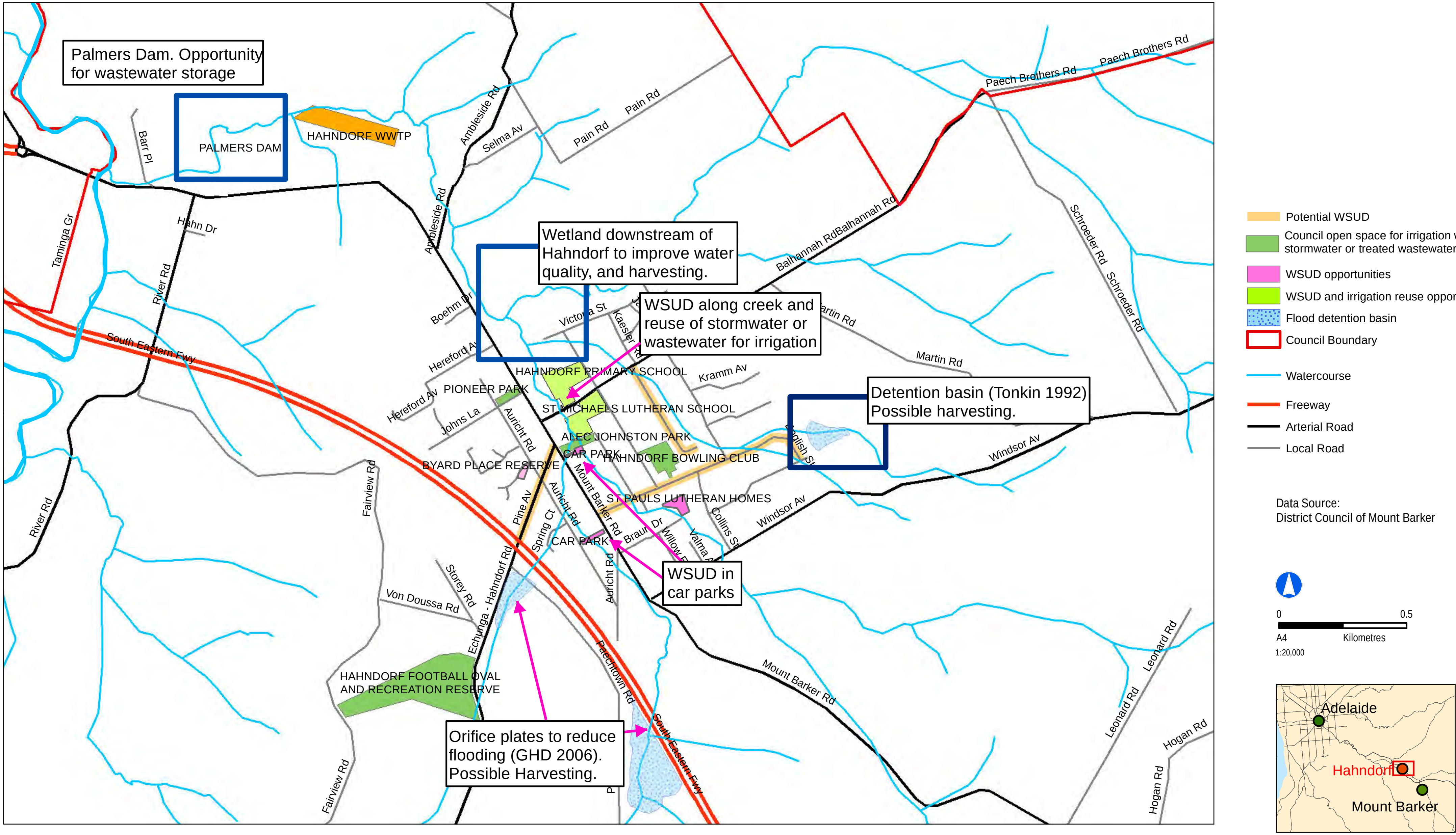


Figure 7-7 Opportunities for Integrated Water Management - Hahndorf

Integrated Water Management Plan - Hahndorf v1

GDA 94 MGA z54

June 2012

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7.7. Water Conservation – Demand Management

Urban water demand can be managed through a mix of restrictions, pricing and water efficiency (NWC, 2011). Whilst restrictions and pricing are outside the direct control of the Council, water efficiency measures can be encouraged and supported by the Council. Greater water use efficiency means less water will be required. The national Water Efficiency Labelling Scheme (WELS) requires mandatory labelling and minimum standards for agreed appliances, allowing consumers to make informed purchases.

Residential water demand has been modelled at 650 litres/**household** per day based upon the discussion included in Section 4.2.6. Modelling for the impacts that may be caused by implementation of water efficiency measures has not been included in the analysis.

Rebates from SA Water are available towards the purchase of water efficient garden goods, stand-alone rainwater tanks and retrofitting water efficient fixtures and fittings. SA Water rebates for showerheads, dual flush toilets, hot water re-circulators, pool covers and cover rollers and home water audits are no longer available.

Establishment of a target for a reduction in water use per capita would underpin any future demand management strategies. A community education and awareness program should include demand management as a key element.

7.8. Planning Actions for Hahndorf

There are a range of opportunities for the planning context to be improved in order to deliver better integrated water management outcomes. These opportunities are not restricted to the township of Hahndorf and many, if implemented, would deliver benefits at the Council-wide and/or regional level.

7.8.1. Mandate particular rainwater tank sizes and in-house use for all new developments

Maximising the capture and reuse of rainwater within all new (and existing) homes would reduce the volumes of stormwater that need to be managed on a larger scale and reduce reliance on potable mains water supply. It is recommended that:

- 5000L household rainwater tanks to be plumbed to laundry, toilets and hot water supply will maximise the volume that can be reused within each home. This should apply to both existing and new residences within the Hahndorf area, hence should include retrofit of rainwater tanks to existing houses that do not have the 5000L capacity.
- This would increase the estimated volume of residential rainwater from 39ML/year to 62ML/year.

The District Council of Mount Barker Development Plan should be amended to provide policy guidance regarding:

- Minimum size and connection (use) requirements of rain water tanks for all new development (5000L)
- The design and siting of rain water tanks. For example, this guidance should address how to accommodate a tank on a smaller allotment (eg under the eaves of a house) and opportunities to combine the use of tanks in residential flat buildings.

Another opportunity is to seek amendments to legislation to mandate minimum rainwater tank sizes. Relevant legislation that could be amended in this way includes:

- Building Code of Australia
- Residential Development Code (Schedule 4 of the Development Regulations)

It should be noted that currently, the Residential Development Code does not apply to new dwellings constructed in the District Council of Mount Barker, although this is anticipated to change in the future.

7.8.2. Update the Residential Development Code to addresses WSUD

The Residential Development Code does not currently include any Water Sensitive Urban Design (WSUD) criteria against which new residential development is assessed. There is opportunity therefore to amend the Code to include WSUD. This would result in new residential development needing to address WSUD criteria in order to be assessed under the Code.

It is noted that amendments to the Residential Code will require a change to the Development Regulations. Making an amendment to the Development Regulations is governed by the Subordinate Legislation Act 1978. The power to make regulations and amendments is vested in the Governor pursuant to Section 108 of the Development Act 1993.

7.8.3. Amend Schedule 5 of the Development Regulations

Schedule 5 of the Development Regulations describes the required information that must be submitted with development applications. There is opportunity to require applicants to provide WSUD and/or stormwater management plans with their development applications via amendment to Schedule 5 of the Development Regulations.

7.8.4. Wastewater reuse and water harvesting

To further promote the use of wastewater reuse and water harvesting techniques, Council could update its Development Plan provisions to favour such an approach. Wastewater reuse and water harvesting policy would be particularly useful if it can be triggered at the land division stage of a development.

The Mount Barker Development Plan already provides a good level of coverage on many aspects of integrated water management. A particular strength is its coverage of water sensitive design and integrated stormwater management, which translates to multiple policies that encourage integrated water management. The plan also speaks heavily to catchment water management which recognises the localised dimensions of the water cycle and the need to manage water quality and quantity, water-based ecosystems and functions, and water infrastructure at the catchment scale. Provisions around waste-water re-use however are less well developed or detailed in the Plan, and require revision to better encourage integrated water management.

7.8.5. Protection of relevant riparian areas

The 30 Year Plan for Greater Adelaide identifies a number of water related policies including the need to "*Incorporate the protection of relevant coastal and riparian areas and Ramsar wetlands in Structure Plans and Development Plans*". (Water Policy 6, The 30-Year Plan for Greater Adelaide (pg 142).

It is therefore recommended that in any future structure planning or Development Plan Amendment process, relevant riparian areas are identified in Council's Development Plan or relevant Structure Plan/s.

There is also opportunity to better describe and identify watercourses and biodiversity areas in Council's Development Plan. The current Structure Plan that relates to Hahndorf could be updated to reflect the watercourses that traverse the township as well as any key biodiversity areas.

7.9. Capacity Building and Governance

The capacity of the community and the Council has been identified as a key impediment to the achievement of integrated water management outcomes.

Key issues identified include the lack of awareness by the wider community of the benefits that simple water conservation measures can deliver, and the changes they can make at a household level to reduce their water use and reliance on mains water sources.

One example of a relatively straight forward initiative that can deliver benefits to households and the wider community is the installation and proper use of a rainwater tank. Rainwater tanks can deliver alternative water supply to households for indoor and outdoor use in times of water restrictions and are an asset to home purchasers. These aspects can be emphasised to the wider community in order to encourage their uptake.

Khastagir (2008) calculated the payback period for 5000L rainwater tanks in 3 locations in Victoria of medium annual rainfall of 450mm (Werribee), 710mm (Berwick) and 1050mm (Kinglake), at various discount rates. Assuming a fixed water price of $0.9/kL, he calculated the payback period at 10% discount rate of 19, 15 and 14 years for Werribee, Berwick and Kinglake respectively. With annual rainfall just higher than Berwick, and mains water more expensive, a similar payback period of around 15 years would be expected for Hahndorf. Expected increases in mains water prices would decrease this payback period.

Challenges to delivering better uptake of rainwater tanks include overcoming the perception that a large tank, and therefore space, is required for the tank to be of any benefit and providing guidance around the design and siting of tanks, particularly on small allotments.

At the same time, there is also a lack of knowledge about how to appropriately use a rain water tank as a household water source, and therefore the wider community needs to be better educated about its use and management so that their contribution to integrated water management can be maximised. Historically many South Australians with rainwater tanks have used them sparingly, but frequent use via plumbed systems is required to reduce mains water consumption and stormwater generation.

7.9.1. Community Education and Awareness

Opportunities for raising awareness and educating the community about water management include:

- Preparing information materials that are easy to read and detail changes people can make at the household level to contribute to better water management. Messages that should be emphasised include the benefits of such changes (e.g. cost savings, environmental benefits).
- Providing links to information sources, such as websites, that provide information that relates to integrated water management.
- Establishing an interactive web page which calculates a household's current water use and shows how by making changes (e.g. installation and use of a rain water tank, low flow shower head, half flush toilets etc) can reduce their water use.
- Promoting good news stories about water in the local media.
- Holding a water festival or similar event that celebrates water and recognises the positive action that is being taken in the community (including industry, Council, business, householders etc) to manage water.
- Considering ways to support action by providing community grants for projects that are contributing to integrated water management.

By increasing the awareness, knowledge, skills and capacity of the community it is hoped that individuals will take action to change their behaviours to better manage their water demand and recognise the integrated nature of water resource management.

7.9.2. Training of Decision-Makers

Opportunities (e.g. training and workshops) should be facilitated that increase the capacity of local government Elected Members, Development Assessment Panel members, staff and applicants to better understand water management (e.g. water recycling and WSUD), natural resources management outcomes and the value these bring.

Capacity building of Council staff is a critical element to be addressed, particularly in relation to the application of WSUD. The Council engineers and planners need access to information and guidelines to assist them with the application of WSUD. It is recommended that

1) Council staff are trained in

    a. The interpretation of the DPLG WSUD Technical Manual

    b. The use of WSUD performance analysis tools such as MUSIC modelling, which can be used for estimating stormwater volumes and quality for IWM infrastructure, and

2) An implementation guide be prepared which identifies different WSUD treatments for different scales of development (e.g. 1 allotment versus 30 allotments).

The development industry also has a key role to play, and the Council needs to educate developers about expectations around integrated water management and hold them to account via the development assessment process. This will require clear and consistent application of the Council policy direction to all new developments which in turn will require that the Council as a whole organisation is committed to achieving integrated water management.

Up-skilling of engineers and planners will be required to ensure they are knowledgeable about the content of IWMPs that have been prepared for their Council areas, understand how to apply recommendations and are committed to their implementation. In this way, Councils can ensure that relevant messages will be communicated to applicants regarding their development proposals and that the relevant information will be taken into account during the assessment process.

7.9.3. Identify Champions within the Council for Integrated Water Management

It is recommended that at least one Champion for IWM be identified within the Council staff who has the ability to influence the practices of engineering design, development assessment, infrastructure maintenance to maximise the implementation of the Integrated Water Management Plans and adoption of WSUD principles in new development and Council infrastructure projects. Training should be provided to fill any knowledge gaps of the Champion.

An additional staff or elected member who has the technical understanding and communication skills to advocate in the public domain for the implementation of the Integrated Water Management Plans and Water Sensitive Urban Design could also be identified. If this person has any knowledge gaps, the necessary training would need to be provided.

7.9.4. Explanatory Guidelines

It is recommended that the Council prepare guidelines which provide further local specific details to the generally broad WSUD/NRM policies currently outlined within Development Plans. Guidelines could valueadd to the existing DPLG WSUD documentation by providing "on the ground" examples of WSUD treatments already being utilised in the Council area, their costs and performance. Such guidelines, while not recognised by Courts, will provide additional guidance to planning authorities, designers and applicants in achieving the intent of policies. The District Council of Mount Barker's Sustainable Development Fact Sheets that were partly funded by the SA MDB NRM Board are a good example of this additional guidance.

7.9.5. Government Agencies Schedule 8 (Development Regulations) Responses

Schedule 8 of the Development Regulations articulates the instances where a planning authority such as a Council, is required to refer a development application to a referral body. It has been identified that when these referral bodies provide advice and planning conditions to the Council, at times, their advice may not be based on Development Plan policy but rather policy derived at a State or regional level, yet to be legislated.

Similar to the requirement of a planning authority to assess a development application against the existing Development Plan policies, there is a similar requirement that the advice (including planning conditions) provided by State Government agencies be based on existing Development Plan policy and not necessarily their own codes and/or Departmental policy. This implies that when agencies provide comments to planning authorities, they would need to refer to the relevant Council Development Plan.

It is therefore recommended that referral agencies have access to appropriate information that supports their review of development applications in relation to a Council's Development Plan, as well as guidelines which assist with drafting valid planning conditions.

7.9.6. Branding

One of the goals of the IWM is to promote the District Council of Mount Barker as a water sensitive city/community via use of appropriate branding to signal to future developers and members of the community expectations with respect to the nature and quality of future growth within the Council area. Council's success in winning the 2011 United Nations Association of Australia Local Government Award for Best Specific Environmental Initiative for Laratinga Wetland provides a base from which additional branding action could be made. This could include:

- Appropriate site specific signage showing residents and visitors where The Council is investing in water management actions.
- A regular 'water' spot in the local newspaper (The Courier).
- Increased visibility of water related information on the Council website.
- On-going communication with residents through existing newsletters.

This action could be undertaken concurrent with community education and awareness however it is important to distinguish that the primary objective of this action is to benefit the Council, rather than the community.

7.10. Advocacy

7.10.1. State and Federal Government Funding

Lobby State and Federal Government for funding to support (i) detailed structure planning process for identified growth areas, (ii) preparation of Stormwater Management Plans as required by the Local Government Act, (iii) construct public WSUD features and other associated water related infrastructure, to support the growth areas identified in The 30-Year Plan for Greater Adelaide.

7.10.2. NRM and WSUD Overlays

Initiate discussions with the Department of Planning and Local Government and NRM Boards to strengthen Water Sensitive Urban Design policies and other related Natural Resources Management overlays to be incorporated within the State's Planning Policy library. The role of these overlays will be to provide a broader perspective on NRM/WSUD objectives and will be used to guide appropriate development at a multi-zone level.

7.11. Opportunities for WSUD

Investigate opportunities to incorporate WSUD targets into Development Plan policy. The City of Port Adelaide Enfield has drafted such policy for inclusion in its Better Development Plan Conversion Development Plan Amendment. There may be merit in pursuing this approach further with the Department of Planning and Local Government to investigate how this may be done appropriately. It is important that in setting targets and embedding them in Development Plan policy that they are identified and applied consistently across regions.

These targets should be considered as guidelines similar to setback requirements currently included in Development Plans. That is, they are not considered to be mandatory.

Investigate opportunities to review the Better Development Plan NRM module which includes WSUD, to include better guidance relating to maintaining pre-development discharge conditions from sites. Currently no guidance is provided as to whether these conditions relate to 1 in 5 year events or 1 in 10 years etc.

This will be strengthened via the Strengthening Basin Communities Regional Councils' Integrated Water Management DPA project that is being implemented concurrently to the development of this IWMP. The project is being led by the Rural City of Murray Bridge on behalf of the eleven partner Councils in the SA Murray-Darling Basin.

8. Assessment of Integrated Water Management Infrastructure Options for Hahndorf

8.1. Introduction

A range of actions for water management in Hahndorf were developed following consideration of the major elements of the urban water supply system. This section describes the process that was undertaken to prioritise the options. It is acknowledged that the availability of funding will influence which scenarios are implemented, as well as the timing of implementation.

Following the assessment process, it was agreed by Council that the actions would not be prioritised but rather all appropriate actions be identified as opportunities for the future. Their implementation will depend on availability of funding and negotiations with other groups, in particular SA Water and the EPA regarding the reuse of wastewater from the Hahndorf WWTP.

8.2. Triple Bottom Line Assessment Process

A Triple Bottom Line (TBL) assessment process was undertaken to prioritise and optimise the IWM options available for Hahndorf. The assessment was conducted using a tool developed by SKM and based on the Melbourne Water Triple Bottom Line (TBL) Guidelines, Department of Treasury and Finance Gateway Lifecycle Guidance material. The criteria used included relevant financial, environmental and social factors and were developed using Council's Procurement Policy and Tender Evaluation Procedure.

8.2.1. Criteria and Weightings

The TBL evaluation used a multi-criteria assessment (MCA) process. MCA is a management tool that enables monetary and non-monetary data of various options to be considered. A range of criteria were developed to compare and assess each of the IWM scenarios by each of the financial, environmental and social themes. Weights were assigned to each criteria or theme. The SA Water recommended approach to the preliminary scoring and weighting was used as a start point, which assigns equal weighting to all themes.

▪ **Table 8-1: Criteria used in the Triple Bottom Line Assessment process**

Theme	Criteria	Description
Financial	Net Present Value	An estimate of the Net present value of each scenario, calculated over 30 years. It includes capital costs, annual maintenance costs, annual operating costs and revenue from sale of recycled water.
Environmental	Volume of yearly stormwater reused/discharged.	This considers the environmental benefits associated with increased stormwater reuse and decreased stormwater discharge associated with each scenario.
	Volume of yearly wastewater reused/discharged.	This considers the environmental benefits associated with increased wastewater reuse and decreased wastewater discharge associated with each scenario.
	Reduction to household mains water demand.	This considers how much of the household water demand is supplied from fit for purpose sources.
	Operational energy usage.	This considers the relative energy consumption (hence greenhouse gas emissions) associated with each of the scenarios.
	Adaptability to climate change.	This considers how well the scenario would be able to adapt to decreased total rainfall, increased evaporation and higher intensity storms.
	Quality of water discharged to receiving waters.	This considers any impacts that the scenario will have on the quality of stormwater discharged to receiving waters.
Social	Maintenance required by Community.	This considers any household maintenance of the infrastructure
	Community ownership and acceptance.	This considers whether the initiatives raise community awareness of water conservation, and whether the community is likely to accept the initiatives.
	Creation of high quality green space.	This considers the amount and value of open space that the initiative provides
	Flooding attenuation.	This considers the social benefits associated with a reduction to minor flooding from improved stormwater management.

8.3. Description of technical work to enable prioritisation of options

The following sub sections describe a range of technical calculations that were used to help prioritise the IWMP options for Hahndorf, and investigate the impact that they would have on the major components of the Hahndorf urban water balance.

8.3.1. Stormwater reuse volumes and water quality

The impacts of each of the stormwater IWMP options on stormwater runoff and the quality of water discharged to the Hahndorf Creek were estimated using MUSIC modelling, modified from the approach described in Section 5.2.1.

A range of additional assumptions were made as part of the MUSIC modelling of the IWM options. These are:

- Rainwater tanks were not explicitly included in the MUSIC Model. The 5,000 litre rainwater tanks which are recommended as an action of the plan were simulated by adjusting the impervious area for each of the housing allotments in the new development areas. The volume of water reuse from implementation of the rainwater tanks was estimated separately using the University of South Australia's tank size estimation tool.

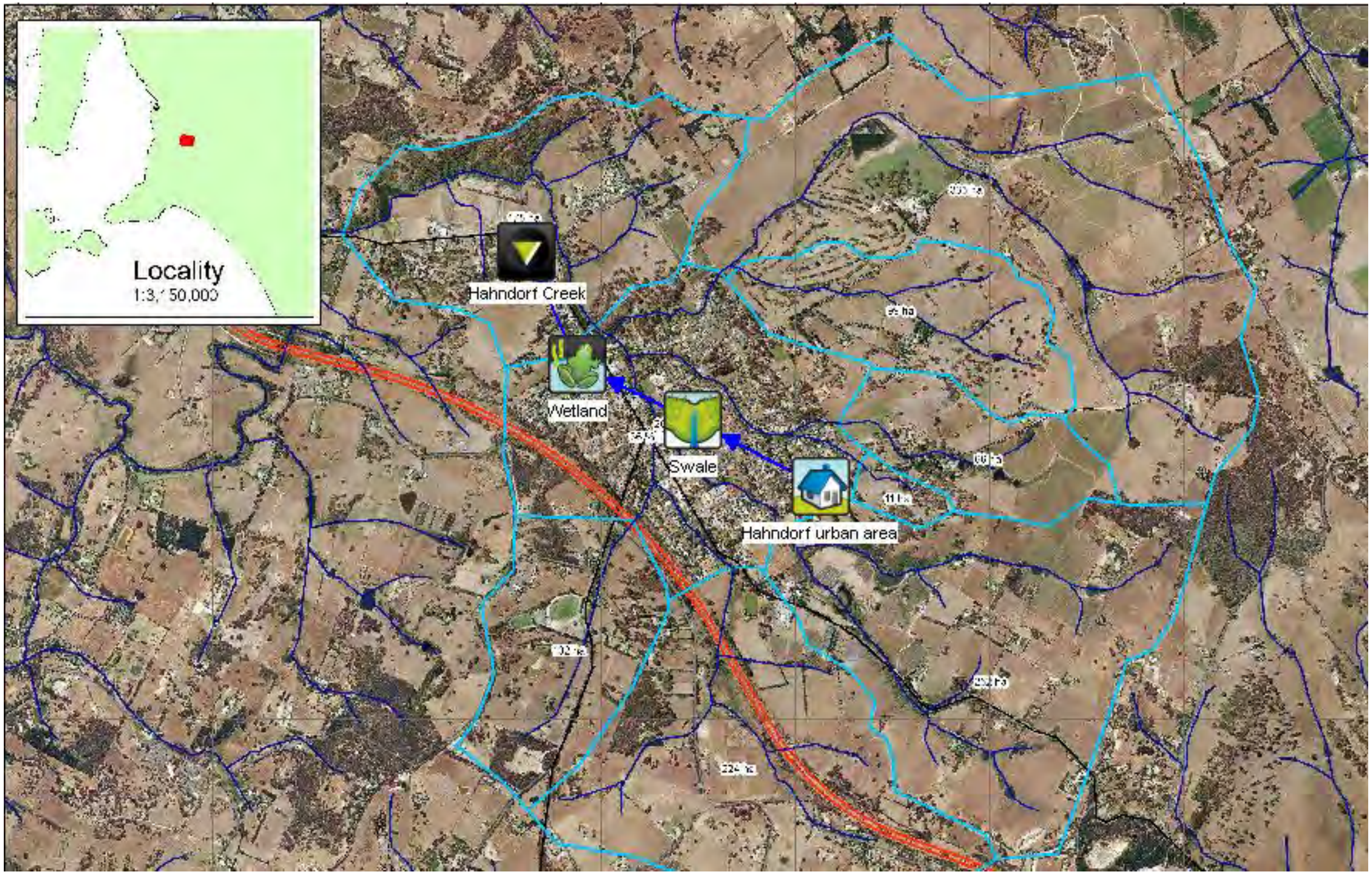
- The swales throughout the Hahndorf catchment are modelled in one large swale node, where runoff is discharged from the urban area into the swale at its highest point. From there, the water runs through the length of the swale, and the infiltration and treatment is modelled in this way.

- Gauged water quality data from Aldgate Creek (Station A5030509) from 1996 – 2011 were input to the MUSIC model to approximate the stormwater runoff quality into Hahndorf Creek.

- The model includes an urban node for the urban catchment of Hahndorf, and directs stormwater from the catchment to the wetland or swales. Within the wetland node, the volume of water that undergoes treatment in the wetland is calculated, and this is the volume that is taken to be available for reuse. During high flow events, some of the water bypasses the wetland and this excess runoff is directed to the Hahndorf Creek, as it assumed that it would be discharged. The water quality results are the average quality of both treated and excess stormwater as it is discharged, prior to dilution within the Hahndorf Creek.

Figure 8-1 shows a schematic of the MUSIC model for the future (2040) Hahndorf township, with the stormwater IWM actions included. A wetland and swale node has been added to the Hahndorf catchment for stormwater infiltration, harvesting and reuse. Water would be reused locally from each of the stormwater wetlands, and water that is not reused would be discharged to the Hahndorf Creek. The flow and water quality outputs from each node of the model are included in Appendix F: Cost Estimates

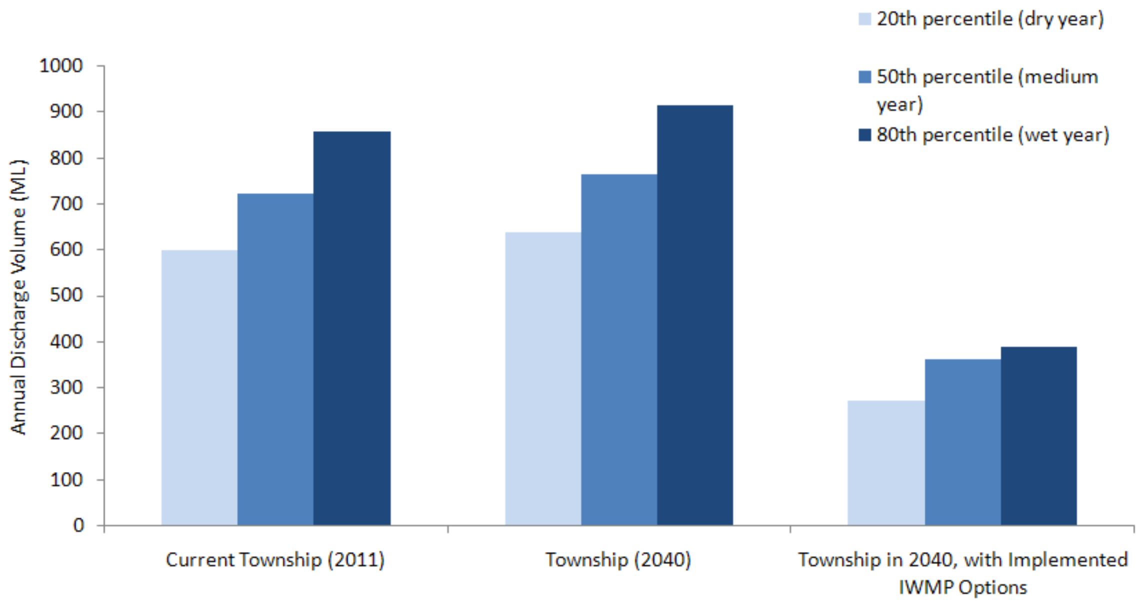
Appendix G.



▪ **Figure 8-1 Schematic of the MUSIC Model for the Hahndorf township in 2040, with implementation of all IWMP options**

Figure 8-2 shows the volume of urban stormwater that would be discharged to the Hahndorf Creek as estimated by the MUSIC Model for the current township, future (2040) township without implementation of the stormwater IWMP options, and the future (2040) township with implementation of all of the stormwater IWMP options. The 20th percentile, 50th percentile and 80th percentile rainfall years from the historical rainfall record (1871 – 2010), were used to show the difference in the volume of urban runoff for a dry, medium and wet year. This assumes that stormwater reuse greater than pre development flows can be implemented (refer Section 3.3.1).

The Figure shows that the volumes of discharge for the future (2040) township are predicted to approximately halve as a result of implementation of **all** of the IWM stormwater options (combined result).



- **Figure 8-2: Estimate of the volume of stormwater discharged from the Hahndorf townships (for implementation of all IWM Options)**

Table 8-2 provides an estimate of the water quality parameters for the future (2040) Hahndorf Township with implementation of the IWMP actions, derived using the MUSIC model. The water quality was modelled using gauged water quality data from Aldgate Creek (Station A5030509) from 1996 – 2011 to approximate the stormwater runoff quality into Hahndorf Creek.

The Table also demonstrates how the water quality for the future (2040) township with implemented IWMP actions is estimated to perform relative to the Department for Water WSUD Targets. The IWM actions provide an increase to the percentage of pollutant removal when compared to the future (2040) township without IWM actions (Table 5-2). For suspended solids and gross pollutants, the IWMP actions exceed the Department for Water targets. For phosphorus removal, the actions are within 10% of meeting the target, however for nitrogen removal the modelled removal is far below the target. The low removal result for nitrogen may be due to the low initial loading of nitrogen in the Aldgate water quality data (which was input to the model), hence further removal is difficult to achieve.

- **Table 8-2: Water quality pollutant load – Future Hahndorf townships (2040), with implementation of all of the IWMP options**

	Pollutant Load Reduction Target (SA MDBNRMB, 2011)	Average annual pollutant load reduction % (2040 township with IWM actions)	Average annual pollutant removal (Kg) (2040 township with IWM actions)
Total suspended solids	80%	93%	25,121,000
Nitrogen	45%	5%	83
Phosphorus	60%	50%	157
Gross Pollutants	90%	100%	22,300

8.3.2. Rainwater Harvesting Volumes – UniSA Rainwater Tank Optimisation Tool

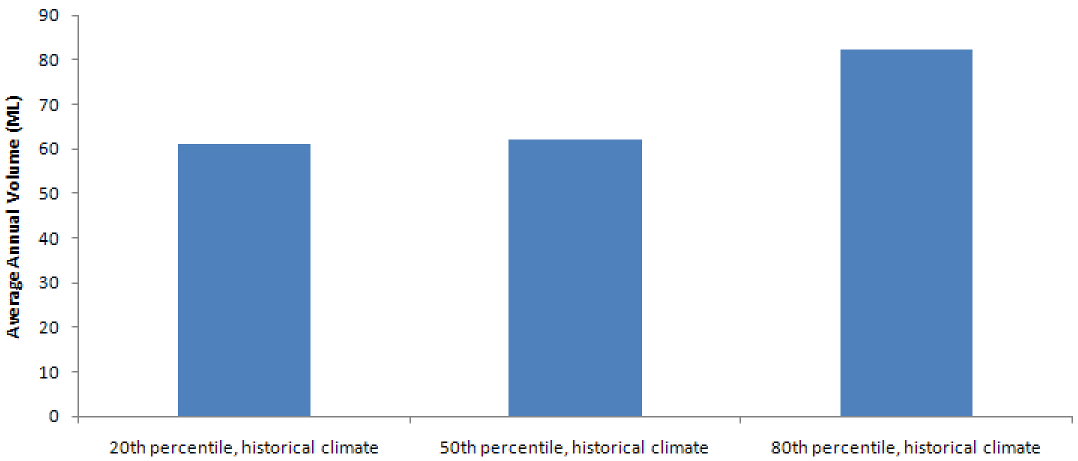
The University of South Australia's Tank Size Estimation Tool was used to estimate the optimal size of rainwater tanks for the Hahndorf township, and to estimate the volume of reuse that would result if rainwater tanks were mandated for all new residences, and retrofitted to all existing residences that do not have rainwater tanks. The model was also used to investigate the variability in the volume harvested for dry, medium and wet years using the 20th percentile, 50th percentile and 80th percentile rainfall year's within the modelling.

The following inputs were used within the model:

- Daily rainfall for Mount Barker for the period from 1887 to 2010, supplied from the BOM (Station 23733). The data was analysed and the 20th percentile (1980), 50th percentile (1987) and 80th percentile (1947) rainfall years were selected from the series to investigate stormwater variability for dry, medium and wet climate conditions.
- 100m^2 assumed average garden area for watering
- 150 m^2 assumed average roof area connected to tanks
- 130 L/day: assumed laundry demand supplied by rainwater
- 70 L/day assumed toilet demand supplied by rainwater

(for in house use rates, refer to Section 8.3 of "WSUD (Argue, 2004): basic procedures for 'source control' of stormwater " (Argue 2004))

From the Tank Size Estimation Tool, the optimal size of 5000L was selected Figure 8-3 shows the estimated volume of rainwater harvested and reused within households if 5000L rainwater tanks were implemented for all new residences, and retrofitted to all existing residences that do not have rainwater tanks in Hahndorf. The volume harvested varies depending on the rainfall each year, so the 20th, 50th and 80th rainfall percentiles were modelled to show the variation in the estimated harvest volume for a dry, medium and wet year. For an average year, the volume harvested is around 62ML.



- **Figure 8-3: Estimate of rainwater harvest volume for 5000L rainwater tanks for all new residences, and retrofitted to all existing residences that do not have rainwater tanks in Hahndorf for the 20th, 50th and 80th percentile rainfall**

8.3.3. Net Present Value Calculations

An estimate of the Net Present Value (NPV) was made for each IWM option. The NPV was calculated for duration of 30 years and included the following costs:

- Capital costs
- Annual maintenance costs
- Annual operating costs
- Revenue from sale of recycled water

A discount rate of 6% and an escalation rate of 3.5% were applied, which are both consistent with the rates used by SA Water for infrastructure projects.

Due to the high level nature of this study, a range of assumptions were made as part of the estimation of costs and revenue for each scenario. The intent of the NPV calculations is to enable comparison of the economic value of each of the scenarios, and should not be used for any other purpose.

Section 7 contains a summary of the NPV for each IWM option, and Appendix F contains a detailed breakdown of costs and assumptions.

8.3.4. Consideration of climate change impacts during Triple Bottom Line Assessment process

The climate change impacts for the various IWMP options were evaluated as part of the Triple Bottom Line (TBL) assessment. Within the environmental theme the assessment criteria titled 'adaptability to climate change' was used to consider how well the scenario would allow adaptation to decreased total rainfall and increased evaporation.

Climate change adaptability was assessed qualitatively using the principles contained in Table 8-3.

Table 8-3 Climate Change Impacts Considered in the TBL Assessment

IWMP Infrastructure Option	Climate Change Impacts Considered for TBL Assessment
Water Sensitive Urban Design features	▪ Vegetated WSUD features such as swales or bioretention systems are likely to dry out more frequently due to decreased rainfall, increased temperature and increased evaporation. Hence they may require more maintenance.
Stormwater harvesting and reuse	▪ If stormwater is available to water public open spaces this would reduce reliance on other sources. Additional water sources increases reliability and resilience. ▪ Design of stormwater storages should take into account reduced average rainfall and increased evaporation.
Wastewater reuse	▪ Wastewater reuse will provide an additional climate independent water source for local farms and public open spaces. Additional water sources increases reliability and resilience.
Rainwater Tanks	▪ Household use of rainwater will reduce mains water demand. Additional water sources increases reliability and resilience.

8.4. TBL Assessment Outcomes

The discussions during the TBL assessment workshop, and subsequent information provided by the Mount Barker Council and AMLRNRM Board led to the agreement that the actions would not be prioritised but rather all appropriate actions be identified as opportunities for the future.

There are a range of factors which create uncertainty in the future water management for Hahndorf, and will impact on which options are able to be implemented, and the timing of implementation. These include:

- Uncertainty associated with the future management of wastewater, due to management by SA Water
- Limited opportunities for the cost effective retrofit of WSUD options due to small streets and uncertainty as to when particular roads will be re-surfaced,
- Lack of new development expected within the township limiting the potential for implementing options in Greenfield sites.

The following sections describe the preferred actions t.

8.4.1. Wastewater Reuse

Wastewater reuse of around 410ML/year could be achieved through supply to local demands. However, the management of wastewater in Hahndorf is the responsibility of SA Water, hence Council may have limited control over the management and reuse of this water.

Local wastewater reuse should be a low priority if the EPA requirements remain as they are due to the additional treatment and infrastructure costs associated with the scheme. However this option may become a higher priority if the EPA requires discharge to the Hahndorf Creek to be reduced or cease in the future.

Total net present value (over 30 year timeframe)	$ 425,000M
Total net present value per ML of reuse (over 30 year timeframe)	$35/ML

8.4.2. Stormwater Harvesting and Reuse

Stormwater Harvesting in new development areas

Stormwater reuse of around 265 ML/ annum by 2040 could be achieved through harvesting from a wetland downstream of Hahndorf for irrigation of public open spaces.

The TBL assessment indicated that local stormwater detention, treatment and reuse should be moderate priority action from this plan, the water quality benefits that it could provide and the need for stormwater management, balanced against the costs associated with the scheme and current availability of groundwater for irrigation.

Total net present value (over 30 year timeframe)	-$2.9M (cost)
Total net present value per kL of reuse (over 30 year timeframe)	-$370/ML (cost)

8.4.3. WSUD Treatments

In particular this will include construction of vegetated swales which will promote infiltration and treatment of the stormwater, retrofitted to the current Hahndorf Township. This is expected to result in average annual infiltration of 50ML/year.

The TBL assessment process identified that WSUD treatments should be a high priority action from this plan due to the benefits that they would provide, and efficiencies associated with retrofitting them opportunistically throughout the existing township, and these opportunities should be sought as infrastructure is upgraded. Additional details are provided in Appendix D.

Total Net Present Value (over 30 year timeframe)	-$420,000 (cost)
Total Net present Value per kL of reuse (over 30 year timeframe)	No water reuse

8.4.4. Flood Protection Infrastructure

Stormwater detention systems at locations previously recommended by Tonkin (1992) and GHD (2006) should be provided upstream of the township to reduce the risk of flooding throughout Hahndorf. The recommendations from the previous reports should be used as a starting point and refined to form final infrastructure solutions.

Flood protection infrastructure should be prioritised as an essential action from the Plan due to the economic, health and safety concerns associated with flooding of the township.

Total Net Present Value (over 30 year timeframe)	-$560,000 (cost)
Total Net present Value per kL of reuse (over 30 year timeframe)	No water reuse

8.4.5. Mandate rainwater tanks for new developments and retrofit to existing residences

Maximising the capture and reuse of rainwater within all new (and existing) homes would reduce the volumes of stormwater that need to be managed on a larger scale and reduce reliance on mains water supply. It is recommended that:

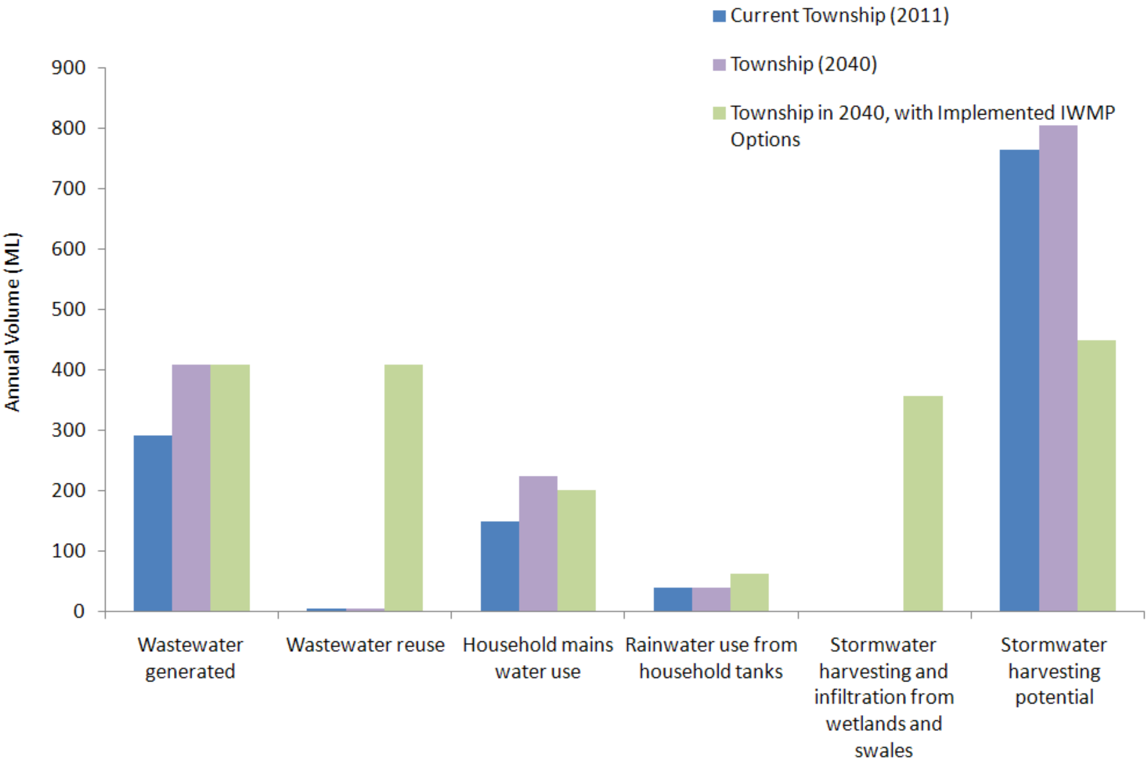
- 5,000 litre (L) household rainwater tanks to be plumbed to laundry, toilets and hot water supply will maximise the volume that can be reused within each home. This shall apply to both new residences and current residences, with less than 5000L rainwater tanks.

It is estimated that by 2040, around 62ML/year of rainwater would be captured and used through this scheme.

8.5. Impacts of IWMP Options on Water Resources

As discussed in Section 6, for Hahndorf, the volumes of runoff are predicted to decrease by a small amount by 2040 as a result of the climate change projections, and increase by a small amount due to urban infill increasing the runoff throughout the township. The expected impacts to the main urban water elements as a result of recommended infrastructure action were calculated used historic climate data.

Figure 8-4 and **Error! Not a valid bookmark self-reference.** compare the major urban water elements for Hahndorf for the current township, Future Township (2040) without implementation of IWM actions, and Future Township (2040) with implementation of the IWMP actions (assuming all are implemented).



- **Figure 8-4: Comparison of the major urban water elements for Hahndorf for the current township (2011), future township (2040) without implementation of IWM actions, and future township (2040) with implementation of the IWM actions (assuming all are implemented)**

- **Table 8-4: Water Supply and Use figures for major elements of the urban water system for Hahndorf for the current township (2011), future township (2040) without implementation of IWM actions, and future township (2040) with implementation of the IWMP actions (assuming all are implemented)**

Wastewater	Wastewater generated (ML/year)	Wastewater reuse (ML/year)	Wastewater excess (ML/year)
Current Township (2011)	291	4	287
Future Township (2040)	409	4	405
Future Township (2040) with IWMP Actions	409	409	0

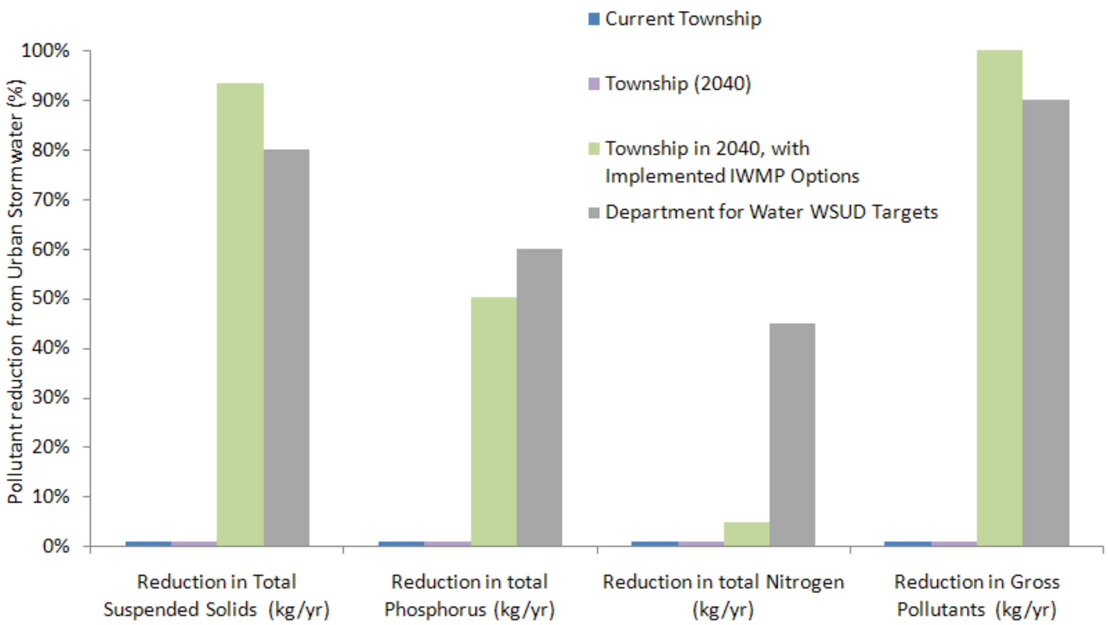
Stormwater	Stormwater generated (ML/year)	Stormwater infiltration & evaporation (ML/year)	Stormwater available for reuse from wetlands (ML/year)	Rainwater use from household tanks (ML/year)	Stormwater available for additional alternative uses (ML/year)
Current Township (2011)	763	0	0	39	724
Future Township (2040)	805	0	0	39	766
Future Township (2040) with IWMP Actions	800	90	266	62	382

Mains	Household mains water use (ML/year)	Irrigation mains water use (Council) (ML/year)
Current Township (2011)	148	>1
Future Township (2040)	223	>1
Future Township (2040) with IWMP Actions	200	0

Groundwater	Groundwater use (ML/year)
Current Township (2011)	23
Future Township (2040)	23
Future Township (2040) with IWMP Actions	0

8.6. Impact of Preferred Infrastructure on Stormwater Quality

Figure 8-5 compares the total pollutant removal estimated from stormwater runoff from the urban catchments of Hahndorf for the current township, future township (2040) without implementation of IWM actions, and future township (2040) with implementation of the IWM actions. The DFW WSUD targets for water quality are also shown on the graph for comparison. For the post development township with implementation of the IWM actions, the removal of suspended solids and gross pollutants both exceed the targets, however the removal of phosphorus is around 10% below the target, and the removal of nitrogen is around 50% below the target.



- **Figure 8-5: Comparison of the percentage removal of pollutants for Hahndorf for the current township (2011), future township (2040) without implementation of IWM actions, and future township (2040) with implementation of the IWMP actions (assuming all are implemented)**

9. Action Plan

The actions recommended for Integrated Water Management for Hahndorf have been summarised in Table 9-1. The table includes explanation of the priority of each action, key benefits, the outputs that will result, cost estimate information, and the timing for implementation. For actions that are to be implemented opportunistically, cost estimate information has not been presented as it will depend highly on funding opportunities and timing of implementation. The actions have been prioritised based on the outcomes of the TBL assessment process, which compared IWM scenarios based on a range of economic, environmental and social criteria.

As described in Section 1.5, responsibilities for IWM are divided between the community and agencies responsible for the various aspects of water supply, treatment, use and management including SA Water, the District Council of Mount Barker and the AMLR NRM Board. This Action Plan has prioritised those actions the Council can directly control, along with other actions where the Council can influence the water management decisions of others.

Many of the actions relating to planning, capacity building and governance are highlighted to occur in the next 1-5 years. Most of these actions are required to provide the foundations for IWM action, in particular implementation of WSUD and assessment of new development applications.

Table 9-1: Summary Integrated Water Management Action Plan for Hahndorf

Action	Priority	Responsibility	Relevant Goals (Section 2)	Key benefits and risks addressed	Output	Estimated Cost	Timing (year)		
							2012-2015	2015-2025	2025-2040
Infrastructure Actions									
WSUD Treatments	High	Council (may look to funding from others)	Goals 1, 2 and 4	▪ Improved water quality of stormwater discharge to Hahndorf Creek ▪ Reduced volumes of stormwater discharged to Hahndorf Creek ▪ Minor flooding mitigation benefits	Implementation of WSUD treatments as opportunities for retrofit become available	NPC of $420,000 estimated for comparison with other options (Indicative only)	Implement opportunistically throughout lifetime of plan		
Flood Protection Infrastructure	High	Council	Goal 5	▪ Reduced risk of flooding to township	Design of flood protection infrastructure, using Tonkin (1992) and GHD (2006) as starting points.	NPC of $560,000 based on implementation of Tonkin (1992) and GHD (2006) concepts. Indicative only.			
		Council	Goal 5		Construction of flood protection infrastructure				
Local Stormwater Reuse	High	Council	Goal 2	▪ Reduced volumes of stormwater discharged to Hahndorf Creek ▪ Diversification of water resources, replacement of groundwater extraction with stormwater reuse ▪ Increased security of supply	▪ Design of stormwater storage and reuse network ▪ Construction of stormwater storage and reuse network	NPC of $2.9M estimated for comparison with other options (Indicative only)			
Wastewater Reuse (Local)	Medium (may become High if EPA requirements change)	SA Water	Goal 2	▪ Reduce or eliminate discharge of treated wastewater to Hahndorf Creek ▪ Diversification of water resources ▪ Increased security of supply	▪ Design of wastewater storage and reuse network ▪ Construction of wastewater storage and reuse network	NPV of $425,000 estimated for comparison with other options (Indicative only)	Look for opportunities throughout lifetime of plan, implement as required by EPA.		
Investigate MAR Opportunities	Low (Since groundwater	Council /AMLR NRMB	Goals 2, 3 and 5	▪ Underground storage of wastewater or stormwater would reduce evaporative losses and	Detailed analysis of potential MAR locations, including drilling	Preliminary investigation $50k-$100k	Implement opportunistically throughout lifetime of		

Action	Priority	Responsibility	Relevant Goals (Section 2)	Key benefits and risks addressed	Output	Estimated Cost	Timing (year)		
							2012-2015	2015-2025	2025-2040
	investigation indicated little potential)			eliminate land availability constraints.	investigations		plan		
Planning									
Mandate rainwater tanks for all new developments	High	Council	Goal 5	▪ Reduced volumes of stormwater discharged to Hahndorf Creek ▪ Diversification of water resources ▪ Increased security of supply	Development plan policy requiring all new developments to include a 5kL rainwater tank	Not costed – internal costs to Council			
Update the Residential Code	High	Council	Goals 1 and 5	▪ Ensure all new development addresses WSUD	Update to Residential Code	Not costed – internal costs to Council			
Amend Schedule 5 of Development Regulations	High	Council	Goal 5	▪ Ensure all development applications include information that show how they address WSUD	Update to Development Regulations	Not costed – internal costs to Council			
Protection of riparian areas	High	Council	Goals 4 and 5	▪ Watercourses will be better protected through Structure and Development Plans	Updates to Structure Plans and Development Plans	Not costed – internal costs to Council			
Capacity Building and Governance									
Community Education and Awareness	High	Council and AMLR NRM Board	Goal 6	▪ Improve community awareness and knowledge, key steps on the way to enabling behaviour change	Various, including Information materials, updating Council website, media stories, community grants	Not costed – will depend on available budget and support			
Training of decision-makers	High	Council	All	▪ Provide Council staff with improved basis for decision making on development and water management	Better skilled decision makers	Not costed – internal costs to Council			

Action	Priority	Responsibility	Relevant Goals (Section 2)	Key benefits and risks addressed	Output	Estimated Cost	Timing (year)		
							2012-2015	2015-2025	2025-2040
Identify IWM Champions	High	Council	All	▪ Integrate IWM into all areas of Council and provide advocacy and support	Responsibility for IWM identified	No cost			
Develop explanatory Guidelines	Medium	Council	Goals 4 and 5	▪ Guidance to Council staff on intent and implementation of water-related policies within the Development Plan	Explanatory guidelines	Not costed – internal costs to Council			
Review Government Agencies Schedule 8 Responses	Medium	Council	Goals 4 and 5	▪ Obtain timely and relevant responses to water management development issues	Updated response schedule	Not costed – internal costs to Council			
Branding	Medium	Council	Goal 5	▪ Promote the Council as a water sensitive city	Various, including demonstration sites, media stories, website development	Not costed			
Water Conservation									
Demand management measures	Medium	Council	Goals 5 and 6	▪ Encourage and support community water use efficiency	Community education, grants or rebates for water efficient fixtures	Not costed – will depend on measures adopted			
Monitoring and Review									
Finalise and implement Monitoring and Reporting Plan	High	Council	All	▪ Monitor progress and maximise opportunities for implementation ▪ Reporting to inform community	Regular report cards of progress and updates to IWM Action plan	Not costed – internal costs to Council	Annual monitoring and reporting required		

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9.1. Monitoring and Review

The actions and recommendations included in this plan should be reviewed periodically over the next 30 years to monitor progress and maximise opportunities for implementation.

A team should be set up to continually track achievement of the actions outlined in the plan, and to have overall accountability for implementation of the actions. This team should be comprised of members of the District Council of Mount Barker, the AMLR NRM Board, and other relevant stakeholders. An important function of this team will be to update the actions outlined in the plan as situations change, and water management risks emerge. Many of the actions included in the plan are to be implemented 'opportunistically', and this team will be responsible for seeking and identifying these opportunities to ensure that the actions are completed.

A proposed monitoring framework is suggested in the table below. For each of the goals, potential monitoring indicators, suggested targets and timeframes for the achievement of targets have been identified.

A reporting framework should be developed that describes how the information collected will be reported back to stakeholders and the community. A regular report card could form part of the Council's community education and awareness program.

- **Table 9-2: IWMP Monitoring Framework**

IWM Goals	Potential Indicators	Suggested Targets and Timeframes	Comments
Goal 1: Opportunistic application of Water Sensitive Urban Design (WSUD) where meaningful and practical	Proportion of infrastructure upgrades that consider WSUD options during planning	100% over the life of the IWMP	Not every infrastructure upgrade will include WSUD, but every infrastructure upgrade should consider what WSUD options may be appropriate
	Proportion of infrastructure upgrades that install WSUD features	50% (*to be confirmed)*	Not all sites are appropriate for WSUD so an achievable target is suggested
Goal 2: Capture, storage and reuse of stormwater and wastewater	Volume of urban stormwater captured and reused	50% by 2040	Success may only occur if circumstances change. Also contributes to AMLR NRMB Regional Targets.
	Volume of wastewater captured and reused for irrigation	100% by 2040	Outside Council's direct control – requires SA Water intervention. Also contributes to AMLR NRMB Regional Targets.

IWM Goals	Potential Indicators	Suggested Targets and Timeframes	Comments
Goal 3: Explore opportunities for water trading	Review WAP for implications to stormwater harvesting and reuse	Complete review by 2012 Update as required during IWM implementation	A brief review of the WAP may be beneficial to see where this may be applicable to Hahndorf
Goal 4: Appropriate provision for water for the environment by development / catchment planning	Water quality in Hahndorf Creek downstream of township meets guideline criteria (EPA) for nutrients and suspended solids	Guideline values met 100% of the time by 2040	May require additional monitoring downstream of Hahndorf (but upstream of WWTP). Water quality can be an indicator that development and catchment planning are considering environmental requirements. Also contributes to AMLR NRMB Regional Targets.
Goal 5: District Council of Mount Barker is a leader in Integrated Water Management	Number of WSUD, watercourse restoration or other demonstration sites in Hahndorf	2 sites by 2020	Demonstration sites are those which can be used to illustrate IWM to the community.
	Council 'water sensitive' branding activities undertaken	1 activity per year	These activities are those which primarily benefit Council (rather than the community – see below)
Goal 6: An aware and active community	Number of community awareness raising events or activities run by Council	1 per year targeting Hahndorf	Only include those targeting Hahndorf towards this measure
	Number of people volunteering for water management activities (eg Waterwatch, Our Patch sites, Clean Up Australia Day)	Target 10% of the Hahndorf population each year	Cooperate with AMLR NRMB for projects/actions and monitoring
Goal 7: Account for whole of lifecycle economic and energy costs	Proportion of water management projects considering life cycle costs	100% of projects over the life of the plan	Every project should consider the life cycle costs (refer to the TBL results for assessments undertaken for this project)
IWMP Implementation Review	Annual review of implementation	1 per year	Undertake an annual review of opportunities to ensure new opportunities are identified and necessary changes to the action plan are made.

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