ASSET MANAGEMENT PLAN

CWMS

(Community Wastewater Management Systems)

Version V2.0 - 2022

QUALITY ASSURANCE

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1.2	August 2022	Alignment with NAMS+ template Updated figures, tables and text	L.B	
2.0	August 2022	Final	L.B	05/09/2022

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EXECUTIVE SUMMARY

1 Executive Summary

1.1 The Purpose of the Plan

This asset management (AM) plan documents the management of Community Wastewater Management Systems (CWMS) assets to achieve the required levels of service to the community. This plan defines the provision and maintenance of the CWMS and outlines Wattle Range Council's (Council) asset management practices and lifecycle strategy for the next ten years.

1.2 Asset Description

Council owns and operates four CWMS in the townships of Penola, Kalangadoo, Southend and Beachport. Kalangadoo, Penola and Southend are Septic Tank Effluent Disposal (STED) schemes whilst Beachport is a full sewer scheme. Table 1 gives an overview of the systems.

Table 1 CWMS Infrastructure Summary

CWMS Element	Element Component	Location			
		Penola	Kalangadoo	Southend	Beachport
Collection Network	Service Connections	783	250	224	536
	Gravity Mains (m)	17,813	5,383	6,332	11,629
	Pump Stations	17	2	2	8
	Pumps	34	4	4	16
	Rising Mains (m)	15,749	3,856	903	8,426
Treatment Infrastructure	Primary Lagoons	1	1	0	1
	Primary Treatment Capacity (ML)	12.7	2.3	N/A	10.6
	Secondary Lagoons	4	In Primary Lagoon	0	2
	Secondary Treatment Capacity (ML)	11.2	N/A	N/A	5.6
	Storage Lagoons	1	1	1	1
	Storage Capacity (ML)	75.6	12.9	7.73	3.8
	Average Detention Time (days)	66	101	25	Unknown at time of this AM plan
	Lagoon/Irrigation Pumps	1	7	4	4
Irrigation Infrastructure	Sprinklers	24	70	145	33
	Irrigation Area (Ha)	11	2	3	15
	End Use	Irrigated pasture hay	Evaporation in storage lagoon	Irrigated pasture hay	Irrigated pasture hay
	Groundwater Monitoring Bores	4	3	3	0

The total replacement cost of the infrastructure is over $41,300,000 as at 1 July 2021.

1.3 Levels of Service

Council has developed both customer and technical levels of service to ensure the safe and reliable processing of wastewater collected by the CWMS.

Customer levels of service monitor the quality, reliability and safety of the systems, whilst the technical levels of service consider the operations, maintenance and renewal of the assets.

1.4 Future Demand

The factors influencing future demand and the impacts they have on service delivery are created by:

- Static population growth
- Ageing population
- Seasonal Population
- Climate change

These demands will be approached using a combination of managing existing assets, upgrading existing assets and providing new assets to meet demand. Demand management practices may also include a combination of non-asset solutions, insuring against risks and managing failures.

- Optimise the utilisation / performance of existing assets.
- Reduce or defer the need for new assets.
- Meet the organisation's strategic objectives.
- Deliver a more sustainable service.
- Respond to customer needs.

1.5 Lifecycle Management Plan

1.5.1 What does it Cost?

The forecast lifecycle costs necessary to provide the services covered by this AM plan includes operation, maintenance, renewal, acquisition, and disposal of assets. Although the AM plan may be prepared for a range of time periods, it typically informs a Long-Term Financial Planning period of 10 years. Therefore, a summary output from the AM plan is the forecast of 10 year total outlays, which for the CWMS Infrastructure is estimated as $405,000 on average per year.

1.6 Financial Summary

1.6.1 What we will do

Estimated available funding for the 10 year period is expected to be 100% of the cost to sustain the current level of service at the lowest lifecycle cost.

The infrastructure reality is that only what is funded in the long-term financial plan can be provided. The Informed decision making depends on the AM plan emphasising the consequences of Planned Budgets on the service levels provided and risks.

1.6.2 What we cannot do

We currently do **not** allocate enough budget to sustain these services at the proposed standard or to provide all new services being sought. Works and services that cannot be provided under present funding levels are:

- Penola irrigation system has been identified for full change to wetland, however this is dependent on third party approvals through Department of Health and community support.
- Financial constraints and the revenue source may limit renewals following condition assessments.

1.6.3 Managing the Risks

Our present budget levels are sufficient to continue to manage risks in the medium term.

The main risk consequences are:

- Environmental in relation to possible spills or overflows to the environment
- Economic in relation to
    - The unknown condition and location of underground assets
    - The poor data or details available for the infrastructure
    - The uncertainty around system capacity and demand
    - Hidden failures in the systems
- Work Health Safety (WHS) in relation to undertaking maintenance on a system where pump stations cannot be inhibited leading to sewerage still being pumped to and is 'live' at work site

We will endeavour to manage these risks within available funding by:

- Routine site visits and inspections
- Online monitoring of systems, where available
- Timely response to alarms generated from the systems
- Timely response to customer reports
- Optimised management and operation of systems

1.7 Asset Management Planning Practices

Assets requiring renewal are identified from either the asset register or an alternative method.

The timing of capital renewals based on the asset register is applied by adding the useful life to the year of acquisition or year of last renewal; alternatively, an estimate of renewal lifecycle costs is projected from external condition modelling systems and may be supplemented with, or based on, expert knowledge.

The Asset Register was used to forecast the renewal lifecycle costs for this AM plan.

This AM plan is based on a low level of confidence information.

This plan aligns with key organisational documents including the current Council Strategic Plan, Annual Business Plan and Asset Policy.

1.8 Monitoring and Improvement Program

This plan is a living document that is owned by the Manager Assets and Environment and will be internally reviewed annually. A full review will be undertaken to coincide with asset revaluation and condition assessments and to meet the requirements of the *Local Government Act 1999*.

Key areas of improvement include:

- Collection of asset condition data to inform operations, renewal and valuation
- Collection of asset details to enable accurate asset register to be developed
- Capacity and demand assessment of the CWMS systems to understand future capacity and upgrade /renewal timeframes
- Development and implementation of scheduled maintenance programs including gravity mains flushing, maintenance shaft inspections and pump station pump outs
- Clear documented processes around trade waste management
- Clear documented processes for building over or adjacent to underground infrastructure

INTRODUCTION

2 Introduction

2.1 Background

Local Government exists to provide core services to meet the needs of its community. Typically, in South Australia, sewerage services are provided by SA Water. Within Council's boundary the townships of Millicent, Mount Burr and Nangwarry are serviced by SA Water, however Beachport, Penola, Southend and Kalangadoo are not within SA Water's portfolio. To ensure the needs of the community are met, Council owns and operates Community Wastewater Management Schemes (CWMS) in these towns.

For the townships of Penola, Kalangadoo and Southend, Council operates STED (Septic Tank Effluent Disposal) schemes, where the runoff from septic tanks is collected and processed by Council. In Beachport, there is a full sewer system that processes solids and wastewater without septic tanks on each property.

2.1.1 Purpose

This asset management plan documents the management of CWMS assets to achieve the required levels of service to the community. This plan defines the provision and maintenance of the CWMS and outlines Council's asset management practices and lifecycle strategy for the next ten years.

This asset management plan communicates the requirements for the financially sustainable delivery of services through management of assets, compliance with regulatory requirements, and required funding to provide the appropriate levels of service.

2.1.2 Related Documents

Council's Strategic Asset Management Framework (Figure 1) illustrates the relationship of this asset management plan with relevant documentation. The following Wattle Range Council documents are directly related to this plan.

- Strategic Plan 2018-2021
- Annual Business Plan
- Asset Management Strategy
- Long Term Financial Plan 2020-2029
- Asset Policy
- Records Management Policy
- Procurement Policy
- Safety Reliability Maintenance and Technical Management Plan (SRMTMP)

This asset management plan has been developed in line with the principles laid out in ISO 55000:2014, ISO 55001:2014 and ISO 55002:2018 that prescribe the international standards for asset management. This plan has been documented following the NAMS+ Asset Management Plan Template which provides guidance on how to meet the ISO principles.

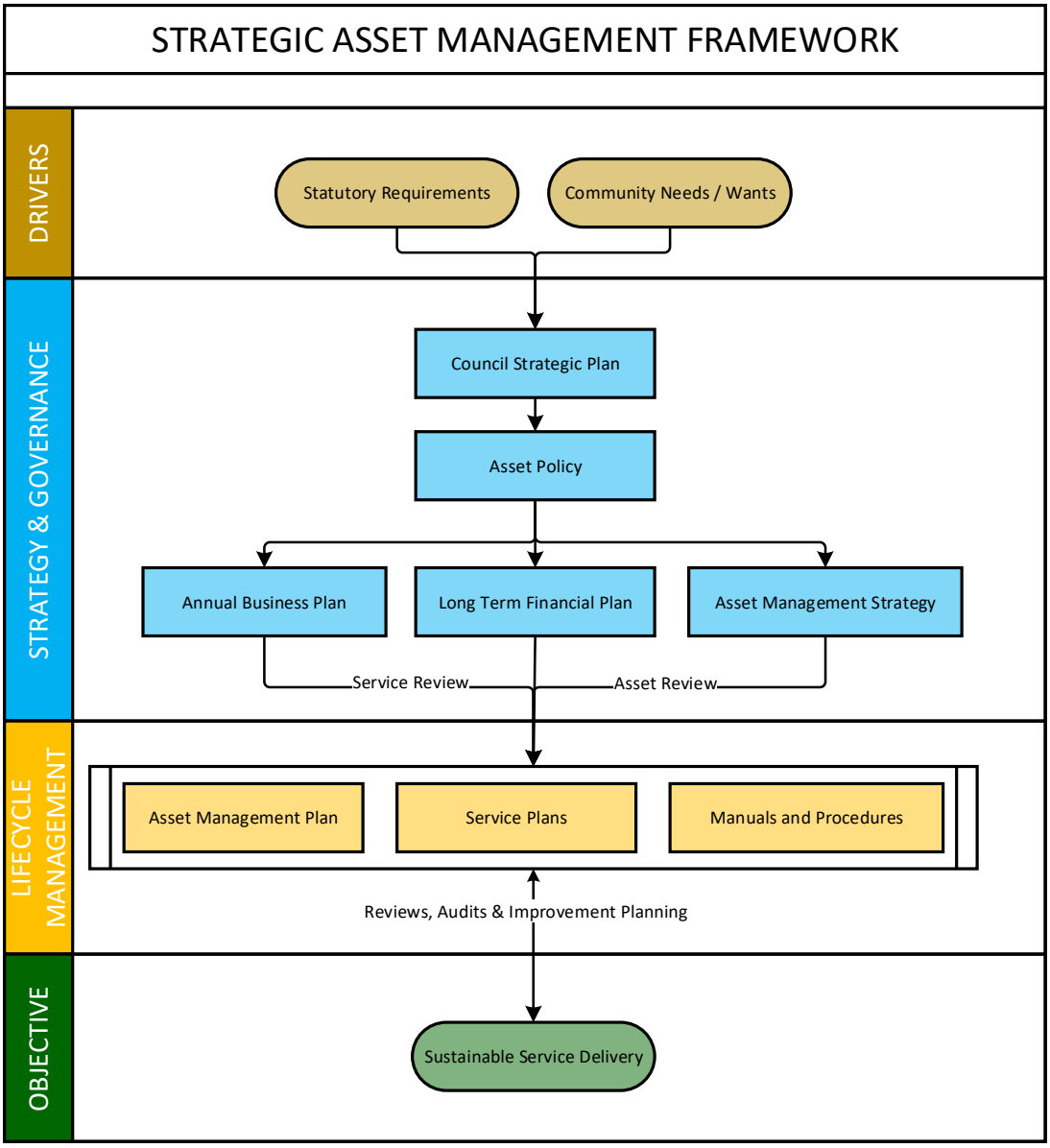

Figure 1: Strategic Asset Management Framework

2.1.3 Infrastructure Assets

This plan covers the asset management of the wastewater infrastructure summarised in Table 1 and further detailed in Section 5.1.1. It includes the collection network of gravity and rising mains, pump stations and service connections, treatment facilities comprising mainly of HDPE lined lagoons and irrigation infrastructure

Table 2 shows the accepted audited values of these assets as at 1 July 2021.

Table 2 Adopted CWMS Infrastructure Values as at 1 July 2021

Location	Replacement Cost ('$000)	Depreciated Replacement Cost ($'000)	Accumulated Depreciation ($'000)	Depreciation Expense ($'000)
Beachport	15,677	13,590	2,087	263
Kalangadoo	5,690	3,634	2,056	98
Penola	15,970	11,063	4,907	303
Southend	3,993	2,646	1,347	66
Total	**41,330**	**30,933**	**10,397**	**730**

2.1.4 Key Stakeholders

Best practice asset management is seen as a whole of organisation activity, that is, it impacts on or involves staff from across the organisation who are involved with the lifecycle management of the Council's assets or delivering services supported by those assets.

The Council, Executive Leadership Team and key asset management staff have defined roles, responsibilities and commitments within the Council's Asset Policy.

Table 3: Stakeholders

Stakeholder	Responsibilities
Council	To act as stewards for infrastructure assets. To set corporate asset management policy and vision with linkage to the Strategic Plan (available on Council's public website). To set levels of service, risk and cost standards. Ensure the development of asset management plans and improvement strategies and monitor the outcomes. To ensure appropriate resources and funding for asset management activities are made available to integrate asset management policies and asset management plans into the corporate governance framework.
Maintenance Contractor	Preventative maintenance and emergency repairs as directed by Council staff
State Government (Including but not limited to: Environment Protection Authority, Essential Services Commission of South Australia, Office of the Technical Regulator, Department for Health and Wellbeing, Department of Primary Industries and Regions South Australia, Department of Environment and Water)	Legislators / Regulators / Licensing
Residents and visitors to the localised communities serviced by the systems.	Discharge of wastewater into network
Local businesses serviced by the systems	Discharge of wastewater into network
Local businesses that discharge trade waste to the systems	Discharge of trade waste into network in line with Trade Waste Authorisation issued under *South Australian Water Industry Act 2012* and associated regulations
Ratepayers	Customers who contribute to the funding of the services

2.1.5 Organisation Structure

Figure 2 illustrates the organisational structure within Council that has the responsibility for the service delivery from the CWMS infrastructure. The adopted team structure, outlined in Figure 2, reflects the roles of Council and senior management, including designated staff from a variety of service areas.

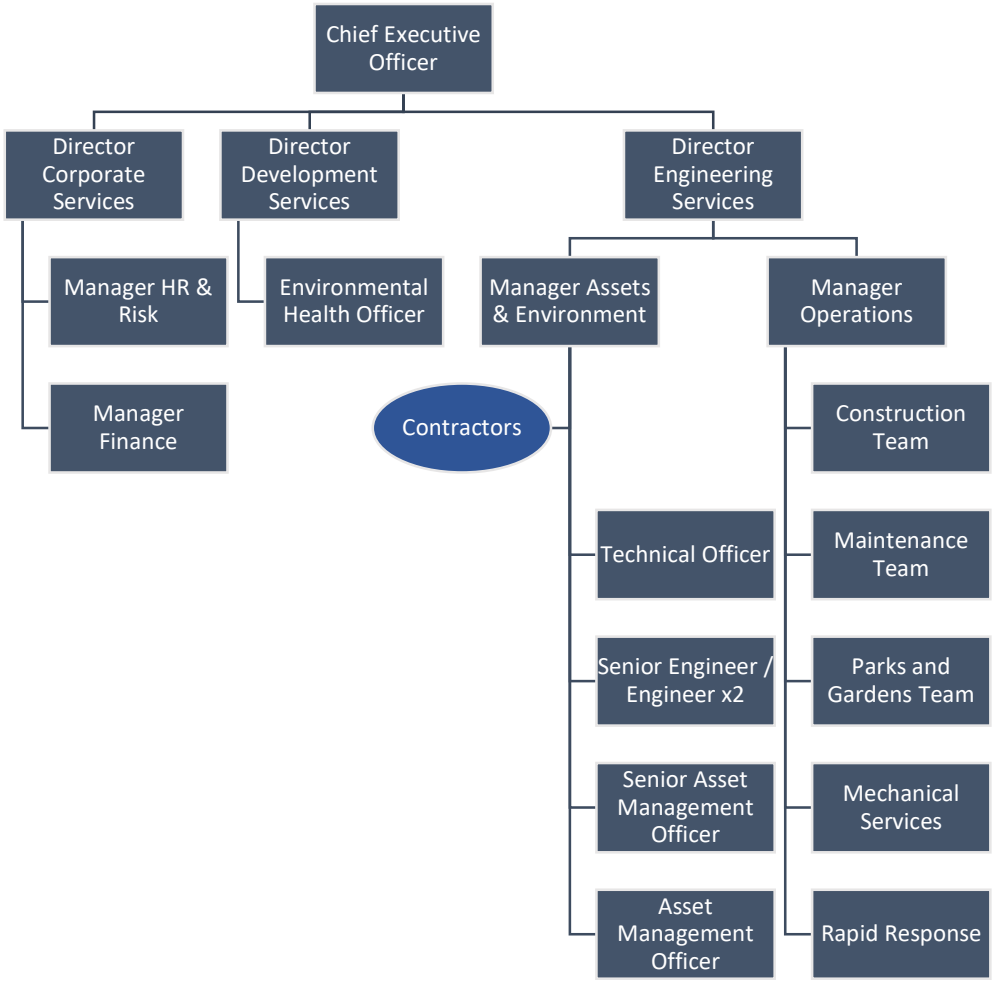

Figure 2: Organisation Chart specific to management and operation of CWMS

2.2 Goals and Objectives of Asset Ownership

Council operates and maintains the CWMS infrastructure to ensure safe and responsible management of wastewater generated by the connected households and businesses in the four townships.

Council's key goals and objectives for operating and maintaining CWMS infrastructure include:

- Providing a defined level of service and monitoring performance
- Monitoring capacity to meet demand, including during peak holiday periods
- Identifying, assessing and appropriately controlling risks
- Having a long-term financial plan to meet appropriate maintenance, renewal and upgrade requirements

LEVELS OF SERVICE

3 Levels of Service

3.1 Customer Research and Expectations

As wastewater is an essential service, connected households and businesses expect that wastewater services will be provided at all times, with minimal interruptions due to planned maintenance or emergency responses. It is also expected that Council manages the wastewater collected in accordance with legislative requirements to minimise the risks to public health and the environment.

The Customer Charter – Sewerage Services (WRC 2015) defines the service standards for customers. Council monitors the number and nature of customer service requests recorded each financial year to determine the standard of customer expectations. Furthermore, Council addresses complaints as per the Customer Experience Policy and Compliments and Complaints Handling Procedure and maintains a complaints register in accordance with legislative requirements.

3.2 Strategic and Corporate Goals

This plan has been prepared with consideration to Council's vision, mission, values, themes and objectives. Table 4 identifies how this plan links to Council's themes and objectives as set in the Strategic Plan 2018-2021.

Table 4: Strategic Plan Alignment

Theme		Objective	Strategy	Action	Alignment
1	Community Vibrancy & Presentation	Generate and support community vibrancy through advocacy and maintenance of community services and enhanced public facilities	1.3 Provide sustainable, vibrant community facilities.	No specific action listed	This asset management plan ensures that wastewater from public spaces is appropriately and sustainably managed.
2	Economic Prosperity	A sustainable and prosperous economy that supports local businesses and industry and creates employment and prosperity for the region	2.2 Through appropriate planning, develop opportunities to expand economic and business opportunities throughout Wattle Range.	No specific action listed	This asset management plan provides the framework for future development and will inform the expansion of the wastewater infrastructure needed for economic prosperity.
3	Environmental Sustainability	Protect the natural assets and infrastructure of the region by leveraging additional environmental programs that will protect the environment for future generations	3.3 Minimize the financial impact of Waste Management on the community and provide a service that meets the current and future needs of the community	No specific action listed	This asset management plan ensures the management of wastewater and biological waste products are disposed of within legislated parameters, with limited impact to the surrounding environment, using the most cost-effective approach.

Theme		Objective	Strategy	Action	Alignment
4	Infrastructure and Asset Sustainability	Provide functional, safe, fit for purpose assets that meet the changing needs of the community	4.1 Create a sustainable stock of assets, with appropriate long-term asset planning and optimal use	Review and implement operation, irrigation and monitoring plans for all CWMS	This asset management plan prioritises work based on consumption, condition and best practice across the asset class in a single document for easy reference and transparency. It also defines the strategic objectives to be reflected in the operational plans.
5	Organizational Excellence	A great place to work where innovation and efficiency is expected and customers are our focus.	5.4 Optimise Council operation of businesses and assets, to ensure value for money is returned to the community.	Investigate options to transfer ownership of non-essential assets to an alternative organisation (public or private) and reinvest capital into other key infrastructure projects	This asset management plan provides one of the supporting requirements for the investigation into the opportunity to transfer ownership of the CWMS infrastructure

3.3 Legislative Requirements

Wattle Range Council complies with the South Australian legislation relating to wastewater wherever practical. This includes:

- *Water Industry Act 2012* and *Regulations 2012*
- *Essential Services Commission Act 2002* and *Regulations 2019*
- *South Australian Public Health Act 2011* and *Regulations (Wastewater) 2013*
- *Environment Protection Act 1993*
- *Landscape South Australia Act 2019* and associated regulations
- *Work Health and Safety Act 2012* and *Regulations 2012*
- *Local Government Act 1999* and associated regulations

There are a wide range of codes, standards, policies and guidelines relating to the management of wastewater in South Australia. Where practical, Council seeks to operate within these guidelines, including:

- *AS ISO 19600:2015 – Compliance Programs*
- *Water Retail Code – Minor & Intermediate Retailers*
- *Water Industry Guideline No 1 – Compliance System and Reporting*
- *Water Industry Guideline No 3 – Regulatory Information for Minor & Intermediate Retailers*
- *Environment Protection (Water Quality) Policy 2003*
- Guidelines, Design Criteria and Standards for Community Wastewater Management Schemes (LGA SA)
- Community Wastewater Management System Codes 2013 (DHA)
- Sewage Pumping Station Code of Australia (WSA 04)
- Vacuum Sewerage Code of Australia (WSA 07)
- Pressure Sewerage Code of Australia (WSA 07)
- AS/NZS 3500: Plumbing and drainage
- AS/NZS 5667: Water quality – Sampling – Guidance on the design of sampling programs, sampling techniques and the handling of samples.
- AS/NZS 2031: Water quality – Sampling for microbiological analysis (ISO 19458:2006, MOD)
- AS/NZS ISO 3100: Risk management – Principles and Guidelines
- The National Construction Code (NCC) Volume 3 Plumbing Code of Australia (PCA) including South Australian Variations and/or Additional Provisions as listed in Appendix A.
- Standard Form: Technical Specification – Construction of Septic Tank Effluent Drainage Schemes (DH, LGA)
- Septic Tank Effluent Drainage Scheme Design Criteria (DH, LGA)
- South Australian Biosolids Guidelines for the Safe Handling, Reuse or Disposal of Biosolids (EPA)
- South Australian Recycled Water Guidelines (DHA)
- Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) (NRMMC, EPHC)

3.4 Customer Values

Customer values indicate:

- what aspects of the service is important to the customer
- whether they see value in what is currently provided; and
- the likely trend over time based on the current budget provision

Table 5 captures customer values and Table 6 builds on these further detailing the customer levels of service.

Table 5 Customer Values

Service Objective	Customer Values	Customer Satisfaction Measure
Wastewater is collected from residents and suitable businesses, and treated in accordance with legislative requirements	No public health or environmental risks	Number of complaints registering releases to the environment or private property
Wastewater treatment systems have capacity to meet existing flows	No loss of service	Number of complaints registering unable to connect to the system
Ensure safety around high risk system assets including exclusion zones for members of the public	No public health or environmental risks	Number of internal incident reports
Respond to spills and breakdowns in a reasonable timeframe	No public health or environmental risks No loss of service	Number of complaints registering reported issue not being addressed
Septic tank pump outs completed on four-year cycle	Notification of works provided and works undertaken within stated timeframes	Number of complaints registering septic tank not being pumped out Frequency of pump outs

3.5 Customer Levels of Service

Council is committed to the safe and reliable management of our CWMS assets to meet and exceed community expectations within financial and other practical constraints. Table 6 identifies the existing and target customer levels of service. Current performance is based on the last full reporting year prior to preparation of the AM Plan.

Table 6: Customer Levels of Service

Activity	Service Objective	Performance Measure	Current Performance	Target Performance
Quality	Wastewater is collected from residents and suitable businesses, and treated in accordance with legislative requirements	Number of customer complaints Speed of reporting of quality incidents	1 complaint in 20/21	Less than 10 complaints per system per year All relevant incidents reported to appropriate agencies within legislated timeframes
Capability	Wastewater treatment systems have capacity to meet existing and projected flows	Number of new connections	100% of residential properties within existing service areas able to connect in 20/21 100% of extensions to existing collection network for residential development can be accommodated by the wastewater treatment systems in 20/21	100% of residential properties within existing service areas able to connect 100% of extensions to existing collection network for residential development can be accommodated by the wastewater treatment systems
Responsiveness	Customer complaints and reported issues are dealt with in line with Council's customer service standards	Number of days to action customer requests or resolve issues	Not previously recorded, however the introduction of Datascape as the new corporate software provides for this to be captured in the future.	To be developed along with the capability of recording the measurable data in Datascape

Activity	Service Objective	Performance Measure	Current Performance	Target Performance
Safety	Ensure safety around high risk system assets including exclusion zones for members of the public	Number of internal incident reports relating to the CWMS	No major incidents at any scheme in 20/21 1 minor incident in 20/21 1 near miss in 20/21	No major incidents occurring per year No more than 1 minor incident per scheme per year
	Respond to overflow events in a reasonable timeframe (eg wastewater not contained within the collection or treatment networks)	Time taken for initial attendance at overflow events Time taken to resolve overflow event	Not previously recorded, however the introduction of Datascape as the new corporate software provides for this to be captured in the future.	Initial attendance within 4 hours Resolution of overflow event within 7 days (eg. address cause)
	Respond to all other incidents in a reasonable timeframe	Time taken for initial attendance at incident Time taken to resolve incident	Not previously recorded, however the introduction of Datascape as the new corporate software provides for this to be captured in the future.	Initial attendance within 48 hours Resolution of incident within 7 days (e.g. address cause)
Reliability	Septic tank pump outs completed on four-year cycle	Pump out frequency	Four year cycle	Four year cycle

3.6 Technical Levels of Service

These technical measures relate to the activities and allocation of resources needed to achieve the desired customer outcomes and demonstrate effective performance. Table 7 identifies the existing and target technical levels of service. Current performance is based on the last full reporting year prior to preparation of the AM Plan.

Table 7: Technical Levels of Service

Activity	Service Objective	Performance Measure	Current Performance	Target Performance
Operations	Meet EPA Requirements	Number of Mandatory incident reports to EPA	1 incident in 20/21	<5 incident reports per financial (reporting) year
	Meet Department of Health Requirements	Quarterly Effluent Monitoring Report results	Compliant in 20/21	Quality parameters monitored meet license requirements per financial (reporting) year
	Meet ESCOSA Requirements	Annual ESCOSA Reports	Compliant in 20/21	Annual report submitted on time
	Meet Office of Technical Regulator Requirements	Annual review of Safety, Reliability, Maintenance and Technical Management Plan	Recent review completed in May 2022	Review of SRMTMP once per financial year
	Review and update operation and maintenance manuals	Manuals are relevant for current systems	Once every 6 years	Every 2 years
Reliability	Septic tanks are pumped out on regular basis to minimise blockages and overflow on private property and reduce solids in the pipe network	Pump out frequency	Four year cycle	Four year cycle

Activity	Service Objective	Performance Measure	Current Performance	Target Performance
Capability	Availability of system to absorb flow without blockages or seepage outside the systems	Number of system errors detected	0 system errors in 20/21	<2 system errors for all schemes
	Wastewater treatment systems have capacity to meet existing and projected flows	Number of overflows	0 overflows in 20/21	Overflow target of 0 (zero) per financial (reporting) year for lagoons Overflow target of ≤1 per financial (reporting) year per system for collection networks
Maintenance	Existing infrastructure is maintained in a suitable condition that is fit for purpose	Number of reactive service requests	20 public reactive service requests	<25 public reactive service requests across all schemes
		Visual assessment undertaken to determine condition of CWMS components	Quarterly inhouse inspections completed	Quarterly inhouse inspections undertaken
		Assessment of asset condition	Desktop assessment completed in 20/21	Full valuation and condition assessments undertaken every 4 years
		Operating and Maintenance budget	Predominant work is undertaken as reactive	90% of maintenance is planned for in the annual budget process

Activity	Service Objective	Performance Measure	Current Performance	Target Performance
Renewal	CWMS infrastructure is fit for purpose and is upgraded or replaced as needed	Age and performance of network Outcomes of condition assessment	Planned renewals on pump stations Reactive repair of breaks and blockages	Major replacement work is planned for in the annual budget process Future work program is informed by condition assessment
Safety	Preventable hazards are identified and managed in accordance with Council's risk management policy	Risk register maintained	Initial review of systems for hazards completed in 2022	Annual review systems for new hazards and update existing hazards

FUTURE DEMAND

4 Future Demand

4.1 Demand Drivers

The key factors that directly impact the demand for services and related infrastructure include:

- Static population growth
- Ageing population
- Seasonal Population
- Climate change

4.2 Demand Forecast

4.2.1 Population

The most recent data available in relation to population is from the Australian Bureau of Statistics (ABS) 2016 census. Data from the 2021 census has not yet been made available. As the data is over 5 years old and important changes may have occurred since that time; particularly in relation to changes brought about from the reaction to the coronavirus (COVID-19) pandemic, no data has been presented in this AM plan due to low confidence in the population data providing an accurate and reliable summary that can be used for the management of the CWMS. Projections available were also produced prior to COVID-19 which has influenced the dynamics of the population due to the increasing trends towards remote working and a desire to move away from major urban centres. Included below for each location is a summary of the potential development, sourced from the draft Wattle Range Strategic Land Use Plan 2022, and known characteristics that will affect population and therefore potentially have an effect the CWMS.

4.2.1.1 Penola

Penola is the second largest town within the Council's district and being a major town in the Coonawarra wine region is a much-visited tourist destination. This results in peaks in population over holiday periods and weekends, as well as during festivals and events. Penola is a hub for agricultural services with population increases from seasonal workers.

There is a substantial amount of infill land and land for residential development available in Penola, as well as a high demand for industrial land and rural living with larger allotments. This means that Penola has the highest potential to increase in permanent population.

4.2.1.2 Southend

Southend is a tourist destination. Whilst the township's permanent population is relatively low, there is a major influx of visitors during peak holiday periods including Christmas/New Year, Easter, School Holidays and long weekends; the population and therefore system capacity demand increases at these times.

Being situated on the coast, Southend has significant environmental challenges for development including coastal erosion, inundation and bushfire risks. At the time of writing the AM plan, there is potential for development of some light industry, minor commercial and residential within the CWMS service area. There is development identified for rural living with larger allotments outside of the service area of the CWMS.

4.2.1.3 Beachport

Similar to Southend, Beachport is a tourist destination with a slightly higher permanent population and significant increase peaking during the holiday periods. System capacity demand increases at these times as the town has a relatively low permanent population with many homes being holiday homes and short-term rentals.

The town of Beachport is located on a peninsula and surrounded by a Conservation Park limiting the potential to expand within the township boundary. As a result, Beachport's development potential is mainly infill land or increased densities including smaller allotments or increased heights. The environmental pressures, that Beachport being on the coast, is experiencing such as rising sea levels and coastal erosion further limits the development options for the town.

There are existing rural living developments and further development proposed in nearby Muggleton which are not proposed to be included in the CWMS collection or treatment systems due to the allotment sizes being suitable for safe on-site wastewater disposal.

4.2.1.4 Kalangadoo

Kalangadoo has a small timber mill and is surrounded by farmland and forestry. It is a small town and currently has little potential for growth. There is the potential for rural living with larger allotments that would not be serviced by the CWMS.

4.2.2 Climate Change

With the increased volatility of Australia's weather patterns, there is an increased likelihood of infrastructure damage by natural disasters. Following any natural disaster event any damaged CWMS infrastructure will need to be assessed and replaced/renewed accordingly. Due to the reactive nature of these works, Council will often be required to divert resources away from the routine cycle of renewal and maintenance works for CWMS infrastructure, which can create infrastructure renewal backlogs.

In addition to any natural disaster events that may occur, CWMS infrastructure within the Council area may be impacted by changes in rainfall intensity. Inevitably, the CWMS schemes collect stormwater, in some instances as there is no alternative and in other cases, through illegal connections or inflow and infiltration. The volume of stormwater flowing into the system is likely to peak during storm events and it is necessary to analyse the capacity of each system to accept and process the additional flows.

4.3 Demand Impact and Demand Management Plan

The objective of demand management is to actively seek to modify customer demands for services in order to:

- Optimise the utilisation / performance of existing assets.
- Reduce or defer the need for new assets.
- Meet the organisation's strategic objectives.
- Deliver a more sustainable service.
- Respond to customer needs.

It is vital to the success of the plan that demand factors be analysed comprehensively, and their impact quantified in terms of the following:

- The effect of the growth of the asset network.
- Any possible future need to increase or decrease infrastructure.
- The implementation of non-asset solutions, such as managing demand.
- Insuring against risks and managing failures.

Currently the infrastructure in use can meet the demands and provide the expected level of service to the communities supported. The built-in redundancy and structure of the systems makes the likelihood that end users experience problems very unlikely unless there is a catastrophic failure of a CWMS.

The impact of the demand drivers on service has been captured in Table 8.

Table 8 Demand Impact

Demand Driver	Impact on Service
Population Growth	Residential growth is expected to be minimal in Kalangadoo and development at Beachport should be able to be managed within existing CWMS capacity.
Connectivity to the system	The potential growth in Penola and Southend may exceed existing capacity however until Council's land use planning has been adopted this is not confirmed. Significant industrial or commercial development may require infrastructure upgrades that would be considered as part of the development process.
Ageing Population	Little impact on service requirements May impact on availability of technicians, operators or service managers
Seasonal Population	Existing CWMS infrastructure was designed to meet peak demand expectations. Will need to be monitored, but existing infrastructure has built in redundancy for expected seasonal usage. Emergency response times for CWMS are considerably shorter during peak holiday season.
Operational and Maintenance Costs	There are significant regulatory requirements for owning and operating CWMS infrastructure. Monitoring of impacts of reporting and maintaining ageing infrastructure that could be run in the private sector should be considered.

4.4 Asset Programs to Meet Demand

The new assets required to meet demand may be acquired, donated or constructed. Council will capture expected investment to maintain, renew and upgrade as appropriate all CWMS systems in the reviewed Long Term Financial Plan. It is acknowledged that historically, proactive maintenance has been minimal.

4.5 Climate Change Adaptation

The impacts of climate change may have a significant impact on the CWMS assets and the services they provide. In the context of the Asset Management Planning process climate change can be considered as both a future demand and a risk.

How climate change impacts on assets will vary depending on the location and the type of services provided, as will the way in which we respond and manage those impacts. As a minimum consideration is given how to manage existing assets given potential climate change impacts for the region. Risk and opportunities identified to date are shown in the risk register (Appendix 2).

Additionally, the way in which new assets are constructed should recognise that there is opportunity to build in resilience to climate change impacts. Building resilience can have the following benefits:

- Assets will withstand the impacts of climate change;
- Services can be sustained; and
- Assets that can endure may potentially lower the lifecycle cost and reduce their carbon footprint

Table 9 summarises some asset climate change resilience opportunities.

Table 9 Building Asset Resilience to Climate Change

New Asset Description	Climate Change impact These assets?	Build Resilience in New Works
All new assets in Beachport	Coastal erosion, rainfall intensity	Locate new infrastructure out of the identified coastal erosion zone Consider capacity of collection network and treatment facilities to accept increased stormwater
All new assets in Southend	Coastal erosion, rainfall intensity	Locate new infrastructure out of the identified coastal erosion zone Consider capacity of collection network and treatment facilities to accept increased stormwater
All new assets in Penola	Rainfall intensity, stormwater inundation	Build new infrastructure out of flood zone or above flood levels as per flood modelling and lidar Consider capacity of collection network and treatment facilities to accept increased stormwater
All new assets in Kalangadoo	Rainfall intensity, stormwater inundation and groundwater infiltration	Build new infrastructure out of flood zone or above flood levels as per flood modelling and lidar Consider capacity of collection network and treatment facilities to accept increased stormwater

The impact of climate change on assets is a new and complex discussion and further opportunities will be developed in future revisions of this AM plan.

LIFECYCLE MANAGEMENT PLAN

5 Lifecycle Management

The lifecycle management plan details how the organisation plans to manage and operate the assets at the agreed levels of service defined above while optimising life cycle costs.

5.1 Background Data

The CWMS at Penola, Southend and Kalangadoo involve the collection of septic tank effluent flows from the boundary connection point of each property via a network of gravity drains. These gravity drains flow to a series of pumping stations at lower points that pump effluent through a system of rising mains to the treatment lagoons.

The plumbing system and septic tank on each private property is the responsibility of the individual landholder. Council is responsible for the drains and infrastructure beyond the effluent connection point at each property boundary. Generally, Council owned infrastructure is located on roadways, footpaths or rear lanes, however in some cases, these assets are located on or traverse private property and may or may not be the subject of a formal easement.

The full sewer system at Beachport required landholders to remove their septic tanks in order to connect to the scheme. This is part of the application process for connection to the sewer scheme.

Occasionally, there is insufficient depth to connection for gravity feed from a property to the connection point and it may be necessary for effluent to be pumped from the property into the system. In some cases, the pump is the responsibility of the landholder, however in limited circumstances, Council may have supplied a private pump station (PPS). There are private pump stations in Penola and Beachport.

5.1.1 Physical Parameters

The assets covered by this AM plan are summarised in Table 1. Further detail of the assets on each of the four schemes has been captured in sections 5.1.1.1 to 5.1.1.4 and schematics of each scheme have been provided in Appendix 6 to Appendix 9.

5.1.1.1 Penola CWMS

The Penola CWMS was constructed in the 1970s, with minor expansions in 2002 and 2005. In 2012, Council completed a significant upgrade to the collection network to provide connections to all properties within the Penola township area and increased the storage capacity and detention time at the treatment lagoons.

Penola CWMS has a unique shelter design covering dual aboveground pumps at 14 of the 17 pump stations (Figure 3). The remaining pump stations are dual submersible pumps. Pump stations are fitted with modems to alert operators of the pump station alarms via text message. Effluent is pumped to the treatment plant via a 150mm rising main for detention and storage in a series of lagoons.

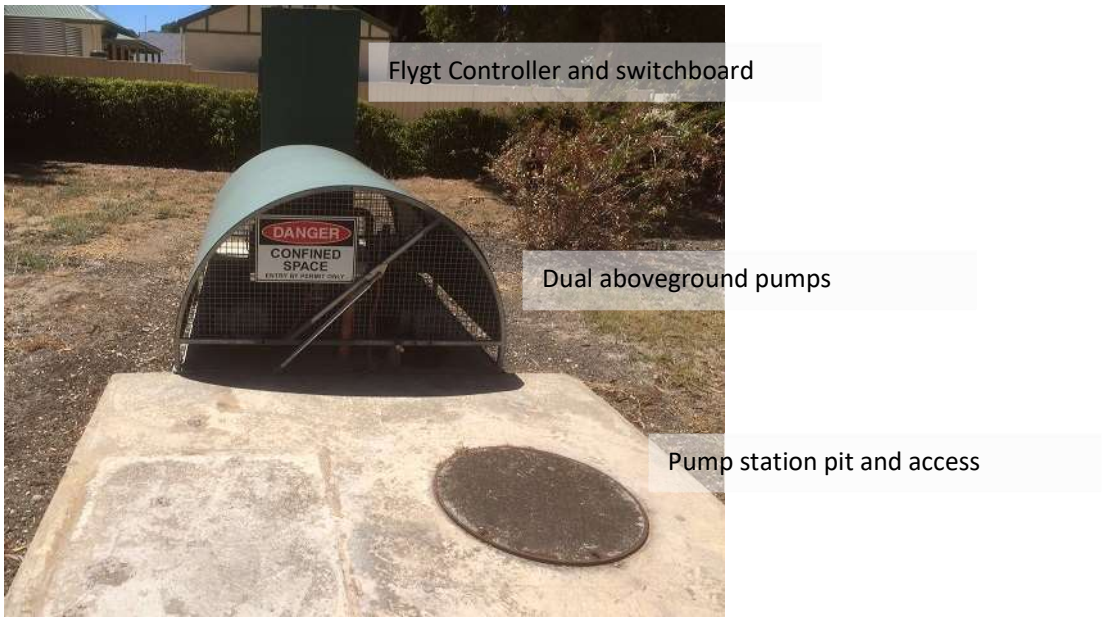

Figure 3 Penola aboveground pump station

The treatment process at Penola consists of one 12.7 ML primary treatment lagoon, four 2.8 ML facultative secondary treatment lagoons and one 75.6 ML storage lagoon. The facultative lagoons are designed to provide a total wastewater detention time of 66 days for an ultimate equivalent population of 1,962.

The storage lagoon design was based on rainfall for a 1:10 wet year event. All treatment lagoons are 1.2m deep and the storage lagoon is 3.2m deep, all with an additional 600mm freeboard. All lagoons are high density poly ethylene (HDPE) lined to reduce the likelihood of leakage. In addition, there are four groundwater monitoring bores placed around the treatment lagoons.

Treated wastewater is pumped from the winter storage lagoon, approximately 1.5km south to Council owned land known as the “Airstrip Paddock”. The irrigation system consists of 24 overhead Rainbird sprinklers (Figure 4) with low aerosol producing nozzles suitable for wastewater irrigation. The sprinklers are controlled individually and are at 60m spacing in a triangular pattern with overlapping coverage.

Figure 4 Rainbird sprinkler at Penola Irrigation Area

5.1.1.2 Kalangadoo CWMS

The pumping systems and 4.6 ML lagoon were built around 1985 and wastewater was drained to a clay-lined evaporation basin. In 2012, Council completed works to install a 12.9 ML winter storage lagoon, as well as a chlorination and filtration system. An upgrade to the irrigation system and drainage at the adjoining football oval was also completed with the intention of treated wastewater supplying the irrigation needs of the oval.

There are two pump stations in Kalangadoo, with dual aboveground pumps, an electronic controller and auto dialler to alert operators of alarms via a call system. The Crowe Street Pump Station discharges water to the Adelaide Street Pump Station, which in turn pumps to the treatment lagoons. There is consistency in the design and fit out of pump stations in Kalangadoo.

Figure 5 Pump Station 1 at Kalangadoo

The treatment and storage lagoons are situated approximately one kilometre north of the town. The original lagoons measure approximately 84m x 46m (0.4 ha) and are 1.2 m deep, giving a volume of 4.6ML. They are partitioned with Fibrolite (asbestos containing) fencing resulting in about half the

area being the primary lagoon and the other half secondary lagoon. The secondary lagoon is further divided into four sections by fencing.

Figure 6 Treatment Lagoon at Kalangadoo

In 2012, Council completed works to install a new storage lagoon with 12.9ML capacity. The storage lagoon is HDPE lined to reduce the likelihood of leakage and there are three groundwater monitoring bores placed around the storage lagoon.

The 2012 upgrade project also included construction of a wastewater treatment plant and irrigation system on the football / cricket oval. As there is no electricity at the lagoon site, a solar farm was installed to provide power to pump water back to the treatment plant.

The treatment plant includes filtration and chlorination with sodium hypochlorite (liquid chlorine) and the treated water is then pumped onto the football oval. Due to the low population of the township and high evaporation rates in the treatment and storage lagoons, the volumes of treated wastewater are insufficient to meet the irrigation requirements of the oval and a backup bore supplies groundwater for irrigation for the majority of the year.

5.1.1.3 Southend CWMS

The Southend system was built in 1996-97, consisting of two pump stations and a wastewater treatment plant. In the initial treatment plant, water was treated using ultraviolet light, alum dosing and sand filters. Upgrades in 2010 included works to improve the standard and capacity of the storage lagoon, expansion of the irrigation area and alternative treatment processes.

The system is designed for an estimated population of 500, or 85,000L per day and has capacity for peak periods

The treatment plant and irrigation area are surrounded by Canunda National Park and crown land used for drainage infrastructure. This provides a good buffer as there are no residences or businesses within 500m of the plant.

There are two pump stations in Southend, with dual aboveground pumps, an electronic controller and auto dialler to alert operators of alarms via a call system. The Bridges Drive Pump Station discharges

water to the George Street Pump Station, which in turn pumps to the treatment plant. There is consistency in the design and fit out of pump stations in Southend.

The treatment plant is a modified sequence batch reactor, utilising activated sludge to treat wastewater. Septic tank runoff is pumped to a mechanical intermittent aerator where a timer automatically operates the 40 minute aeration and 80 minute settling periods. Following settling, water flows to a decant tank and is pumped to the storage lagoon. The quality of the activated sludge is maintained with excess sludge syphoned into a sludge thickening tank.

As a result of the 2010 upgrade, the storage lagoon now has a capacity of 7.73ML and is HDPE lined to reduce the likelihood of leakage. There are three groundwater monitoring bores located around the storage lagoon, with one at the eastern end of the lagoon, closest to the irrigation area and two bores at the western end of the lagoon to reflect the direction of flow for groundwater. Treated wastewater is retained for a minimum 25 days until it is irrigated onto natural grasslands, however the detention time is generally in excess of 6 months, or 180 days.

Figure 7 Intermittent aerator at Southend Wastewater Treatment Plant (WWTP)

Figure 8 Sludge thickening tank at Southend WWTP

Figure 9 Decant tank at Southend WWTP

Figure 10 Storage lagoon at Southend WWTP and irrigation area in background

5.1.1.4 Beachport CWMS

The township of Beachport is serviced by a full sewer collection, treatment and disposal / reuse system. Beachport has an estimated peak occupancy of approximately 4,000 during the summer period. The summer period includes South Australian and Victorian school holidays, long weekends and Easter, with visitor numbers peaking between Christmas and New Year's Day.

As a full sewer system, as properties are connected to the Beachport CWMS, the septic tank at each property is removed as part of the connection process and all wastewater including solids flows through gravity mains to a pump station. The Beachport system has eight pump stations with all flows directed to Pump Station 4 before being pumped via rising main to the treatment lagoons. Each sump contains two macerating pumps with alternate start on a duty and standby arrangement.

Figure 11 Pump Station 4 adjacent Beachport Visitor Information Centre

Each pump station also has a controller with access to a Telstra-hosted Supervisory Control and Data Acquisition (SCADA) program. The SCADA allows the operator to monitor pump station levels, respond to alarms, control pumps remotely and automatically inhibits flow from upstream pump stations when an alarm is present.

Wastewater from Beachport is pumped by rising main to a multi-stage lagoon approximately 6km east of the township. The first stage lagoon is a 5.2ML settling lagoon, with a depth of 2.4m, followed by a 10.6ML primary facultative lagoon with a depth of 1.7m. Wastewater then flows to two 2.8ML secondary lagoons with a depth of 1.9m and a final 38ML storage lagoon with a depth of 3.6m. The lagoons are lined with a 1.5mm HDPE welded liner and a secondary 1.0mm HDPE liner. There is a leakage collection and detection system between the two layers. Wastewater passing through the series of lagoons is treated by a combination of facultative bacteria action and UV radiation.

A 15 hectare irrigation area has been established adjacent to the lagoon with the intent of growing pasture hay.

5.1.2 Asset Capacity and Performance

The Beachport CWMS was designed for greater than predicted population growth, including infill of existing allotments and is considered to have enough capacity for population over the next 50 years.

In 2010 and 2012, Council undertook works at Southend, Penola and Kalangadoo to increase storage capacity and added some infrastructure. Largely since this time, maintenance has been undertaken reactively, and minimal planned work has been undertaken to assess or improve on capacity or performance at these locations.

Assets are generally provided to meet design standards where these are available. However, there is insufficient resources to address all known deficiencies. Locations where deficiencies in service performance are known are detailed in Table 10. These service deficiencies were identified from system knowledge by asset operator and captured as assessed risks in the risk register (Appendix 2).

Table 10 Known Service Performance Deficiencies

Location	Service Deficiency
Kalangadoo	Pump Station No.1 is impacted by high rainfall events, causing excessive pump run times and backing up in the gravity mains.
Penola	Pump Station No.14 has small sized sump to contain high volume flows and it services the hospital
Penola	Pump Station No.16 is not fit for purpose

5.1.3 Asset Condition

Council will be undertaking revaluation and condition assessments of asset classes in accordance with the Asset Policy on a four-yearly cycle. This data will be kept in Council's asset register, currently maintained in the Brightly software system (formerly Assetic). The data will be used to assist in prioritising future capital works and maintenance programs.

At the time of the development of this AM plan, the actual condition of the CWMS assets was not known. The asset conditions could be calculated from useful life and age, however this was deemed to not be a reliable method to determine the asset condition therefore the risk of this uncertainty has been captured in the asset register (Appendix 2) and an action item has been proposed to work towards obtaining reliable and accurate asset condition data.

Condition ratings will be based on a six-point scale as detailed in Table 11.

Table 11 Asset Condition Rating Description

Condition	Description	Remaining Useful Life
0 Brand New	Asset is brand new or in brand new condition	100%
1 Excellent	Asset has no defects, asset is new, within defect liability period. Subject to preventative maintenance only.	99% - 92%
2 Good	Asset exhibits normal wear and tear, minor defects, minor signs of deteriorated surfaces finishes. Minor maintenance required (about 5% of asset).	91% - 80%
3 Fair	Asset is in an average condition, building services are functional. Building fabric displays sign of defects, signs of deterioration to surface finishes requiring attention with intervention levels for building fabric triggered. Repairs are required to prevent faster degradation of asset life. Significant maintenance required (about 5-20% of asset).	79% - 60%
4 Poor	Asset has deteriorated badly, serious problems with building services, general appearance of building fabric is poor and can be associated with cracks. The asset is still functional but shows signs of major wear and tear and defects, backlog maintenance work exists. Significant renewal work required (about 20-50% of asset).	59% - 26%
5 Very Poor	Asset has reduced functionality. Asset has significant defects affecting many components, deteriorated surfaces require significant attention, services are functional but failing spasmodically, major backlog maintenance work exists. Over about 50% of asset requires replacement.	25% - 10%
6 End of Life	Asset has reached the end of its useful life. Asset requires replacement.	0%

5.2 Operations and Maintenance Plan

Council employs a dedicated staff member to oversee the operational and maintenance aspects of managing the CWMS infrastructure, with support from the Operations Team. Majority of the preventative and reactive maintenance is undertaken by a third party contractor.

5.2.1 Operations and Maintenance Strategies

General maintenance strategies include:

- Ensuring the infrastructure is maintained in accordance with agreed levels of service
- Deferring maintenance work and grouping in the capital improvement program annually unless urgent or safety related.

Currently maintenance has been undertaken reactively, only when alarms are activated, issues are observed during inspections, or customer complaints are received. This plan outlines the work required to transition the asset class into a data driven renewal and maintenance program to assist Council in meeting its obligations to regulators and users. Implementing a proactive maintenance program should also allow Council to reduce maintenance costs and strategically tender for services and goods.

Table 12 identifies the standard maintenance activities including frequency and responsible agent.

Table 12: Routine Maintenance Inspections and Actions

Activity	Frequency	Responsibility
Lagoon inspection	Monthly	Council / Contractor
Pump station maintenance checks	Monthly	Council / Contractor
Treatment plant inspection	Quarterly	Council
	Monthly	Contractor
Wastewater quality sampling and analysis	Quarterly	Council / Australian Water Quality Centre
Groundwater quality sampling and analysis	Annually	Council / Australian Water Quality Centre
Regular maintenance i.e. Weed removal; fence repairs	As required	Contractor to inform Council
Septic tank desludging	4-year cycle	Council / Contractor
Pump station pump out and visual condition check of wells and sumps	As required	Council / Contractor

5.2.2 Maintenance Budget

It is difficult to be precise in determining true maintenance needs. Even if a process of zero-based budgeting was undertaken, maintenance is subject to many variables including extremes of weather, ground disturbance and unpredictable loadings.

Historical data from previous financial years maintenance and capital works funding to maintain, renew and upgrade the CWMS is presented in Figure 12.

In 2012 Council completed significant upgrades in Penola and Kalangadoo, with Southend having capital works undertaken in 2010. The Beachport scheme was constructed in 2012-14 and commenced operation in the 2014. This expenditure trend is clearly visible in Figure 12 along with the visualisation that since those major projects, maintenance expenditure has been mainly operational funding and highly reactive. Assessment and priority of reactive maintenance is undertaken by staff using experience and judgement.

All figure values are shown in current day dollars.

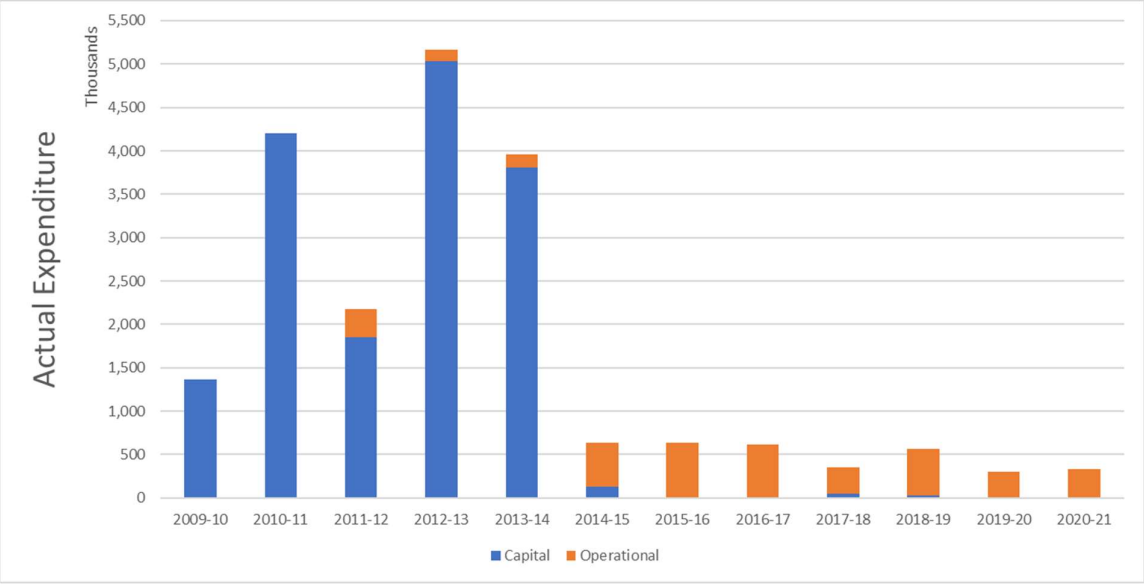

Figure 12 Historic Capital and Operational Expenditure

Maintenance budget levels are considered to be adequate to meet projected service levels, which may be less than or equal to current service levels. Where maintenance budget allocations are such that they will result in a lesser level of service, the service consequences and service risks have been identified and are highlighted in this AM plan and service risks considered in the Risk Register (Appendix 2). With the implementation of Datascape it is expected that greater granularity of maintenance budget expenditure will be captured in the future.

5.3 Renewal Plan

As per Council's Asset Policy, the objective of asset management is to ensure the assets deliver the required level of service in the most effective and efficient manner now and into the future. Minor renewal works will be undertaken annually with larger or longer-term projects identified as part of the 10-year Long Term Financial Plan. The table below identifies the considerations when setting the renewal programs.

Table 13: Renewal Program Identification Process

Step	Description
1	Potential renewal projects identified from the: • Condition rating and remaining useful life • Monthly maintenance inspections
2	Projects are prioritized into the ten-year program
3	The ten-year program is referred to the Long-Term Financial Plan for inclusion
4	At the start of the budget process, the next years projects are inspected to verify the current condition to ensure both appropriate calculation of expected costs and the programed project still requires renewal above other components

Asset renewal is typically undertaken to either:

- Ensure the reliability of the existing infrastructure to deliver the service it was constructed to facilitate, or
- To ensure the infrastructure is of sufficient quality to meet the service requirements.

It is possible to prioritise renewals by identifying assets or asset groups that:

- Have a high consequence of failure,
- Have high use and subsequent impact on users would be significant,
- Have higher than expected operational or maintenance costs, and
- Have potential to reduce life cycle costs by replacement with a modern equivalent asset that would provide the equivalent service.

The pumps and electrical infrastructure of the CWMS would be expected to follow the bathtub failure curve model. This model accounts for early failure which would be consistent with faulty mechanical parts followed by low failure rates until an increased wear out of components at the end of their expected useful lives.

Figure 13 Bathtub failure curve model

All other infrastructure such as sheds, pipes and tanks would be expected to have a fatigue failure curve and be expected to fail with age or general wear and tear.

Figure 14 Fatigue Failure Curve

As assets begin to reach the end of their lifecycle it would be expected that condition assessments would generally be undertaken more regularly to ensure increased maintenance, renewal work or replacements could be scheduled before failure occurred.

Pipe infrastructure would be the exception to this, as condition assessment of underground assets is both expensive and time consuming. Council will undertake initial condition assessments of the drainage network via internal CCTV gradually from 2022-23. The results of these assessments will determine the long-term strategy for the pipe infrastructure.

The renewal strategy at the time of this AM plan identified for specific CWMS assets has been described in Table 14. CWMS renewals will be assessed to determine the appropriate scope of works. This means that both the infrastructure being replaced and the replacement approach will be assessed to establish whether replacement should be like-for-like, a renewal, an upgrade, replacement with significantly different infrastructure, or a redundancy. This will ensure that the outcome is fit-for-purpose and cost effective.

Table 14 Renewal Strategy

Asset Description	Strategy	Justification
Pumps	Run to fail	The quantity, size and cost of the assets enables for readily available replacement from suppliers without significant lead time or loss of service.
Pump ancillaries	Run to fail	The quantity, size and cost of the assets enables for readily available replacement from suppliers without significant lead time or loss of service.
Rising and gravity mains	Condition based	Condition will be used to plan renewals as these assets are underground and cannot be easily accessed.
Underground valves	Run to fail or replace when mains are being renewed	Assets are underground and cannot be easily accessed.
Treatment Infrastructure	Condition and capacity	Asset condition will be used to plan renewals however capacity will also be monitored as a renewal trigger
Irrigation infrastructure	Run to fail	The quantity, size and cost of the assets enables for readily available replacement from suppliers without significant lead time or loss of service.
Buildings and structures	Condition based	Condition will be used to plan renewals as these assets are used to house and contain other assets
Service connections	Run to fail	Assets are underground and cannot be easily accessed
Power and control systems	Risk based	Due to the rapid innovations that occur in technology these assets may become obsolete leading to the inability to perform maintenance or repairs with the only option then being replacement

Assets identified as not going to be renewed once useful life has been attained and will be retained and maintained until condition dictates disposal have been presented in Table 15.

Table 15 Assets that will not be renewed when useful life is attained

Location	Asset Description	
Penola	P.LAG.10	Old Pump Station Shed
Penola	P.LAG.35	Dog Kennel Shed

5.4 Summary of Future Renewal Costs

Forecast renewal costs are projected to increase over time if the asset stock increases.

Annual capital expenses predicted for the CWMS for the next 20 years were investigated from the perspective of remaining accounting useful life and current replacement costs of the assets. The data demonstrated that the sole use of accounting useful life to predict future capital expenses leads to an uneven spread of expenses over the years and could not be solely relied upon for future capital planning. Council's budget would be a constraint to these predictions as well as the capacity to undertake the works within the timeframes. Moving forward detailed asset condition assessments will be completed and this data will be utilised to update asset useful life and plan renewals.

The forecast capital expenditure for the next 10 years has been presented in Figure 15, based on system knowledge and known deficiencies. This forecast of expenditure will be adjusted as the Council budget is reviewed annually and as condition assessments are undertaken to inform the

renewals. The list of the projects that make up the forecast capital expenditure is supplied in Appendix 4.

All figure values are shown in current day dollars.

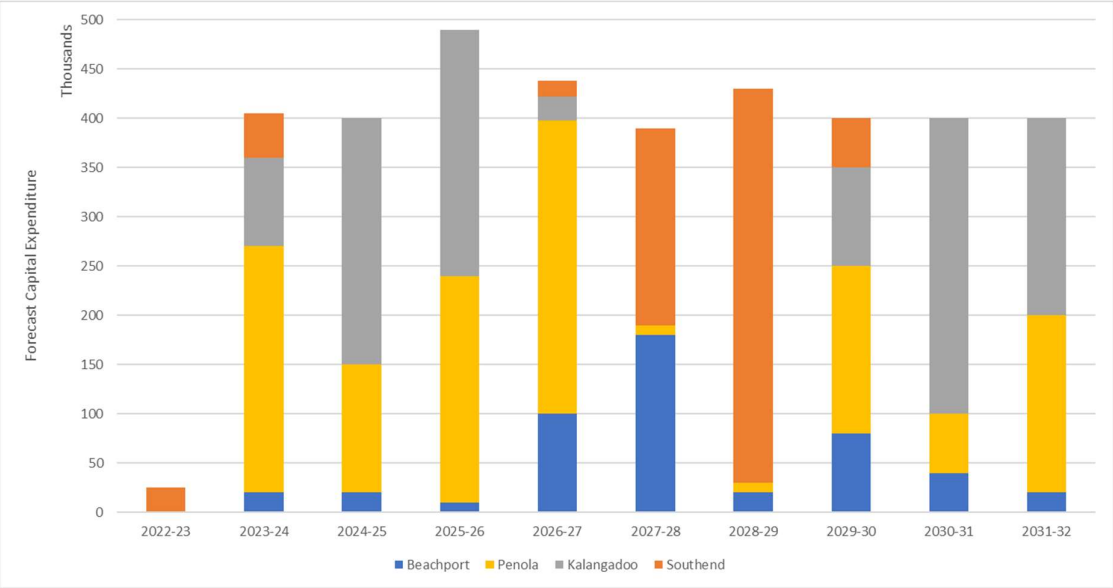

Figure 15 Forecast Capital Expenditure for the next 10 years

5.5 Acquisition Plan

Council's Asset Policy outlines the need to make decisions for service delivery focused on asset renewal, rationalising underutilised assets and non-asset solutions as far as practicable, to achieve a cost-effective asset base and deliver financial sustainability. Upgrades and new expenditure will be undertaken as required to accommodate growth only where full lifecycle costs can be accommodated.

The current CWMS have sufficient capacity for expected residential growth during the life of this plan. Where additional pump stations and mains are required for residential development or upgrades are required for commercial or industrial development, it will be the responsibility of the developer to invest in the capital.

5.6 Disposal Plan

Council's Contracts and Tenders – Sale of Assets Policy outlines the procedure to be undertaken when disposing of Council's assets including all CWMS infrastructure. Disposal includes any activity associated with the disposal of a decommissioned asset including sale, demolition or relocation.

Council's Strategic Plan 2018-2021 identifies the action to investigate options to transfer ownership and/or management of the CWMS to a water industry provider. Consideration of any outcomes from the investigation would be presented to Council for a resolution.

5.7 Summary of asset forecast costs

The financial projections from this asset plan are discussed in the sections 5.7.1 to 5.7.4. These projections include forecast costs for acquisition, operation and maintenance, renewal, and disposal.

5.7.1 Forecast Acquisition Costs

The acquisitions forecast at the time of this plan have been captured in Table 16. No acquisitions are expected for Kalangadoo during the life of this plan.

Table 16 Forecast Acquisitions

Location	Asset Description	Timing
Penola	A new pump station in Penola that is being constructed by the developer of a new subdivision	2022-23
Penola	Estimated 5 new service connections	Per year for next 10 years
Beachport	Estimated 3 new service connections	Per year for next 10 years
Southend	Estimated 2 new service connections	Per year for next 10 years

5.7.2 Forecast Operation and Maintenance Costs

The forecast operational expenditure for the next 10 years has been presented in Figure 16, based on system knowledge. This forecast of expenditure will be adjusted annually as Council budget is reviewed. The list of the projects that were identified for incorporation in the forecast operational expenditure is supplied in Appendix 5.

All figure values are shown in current day dollars.

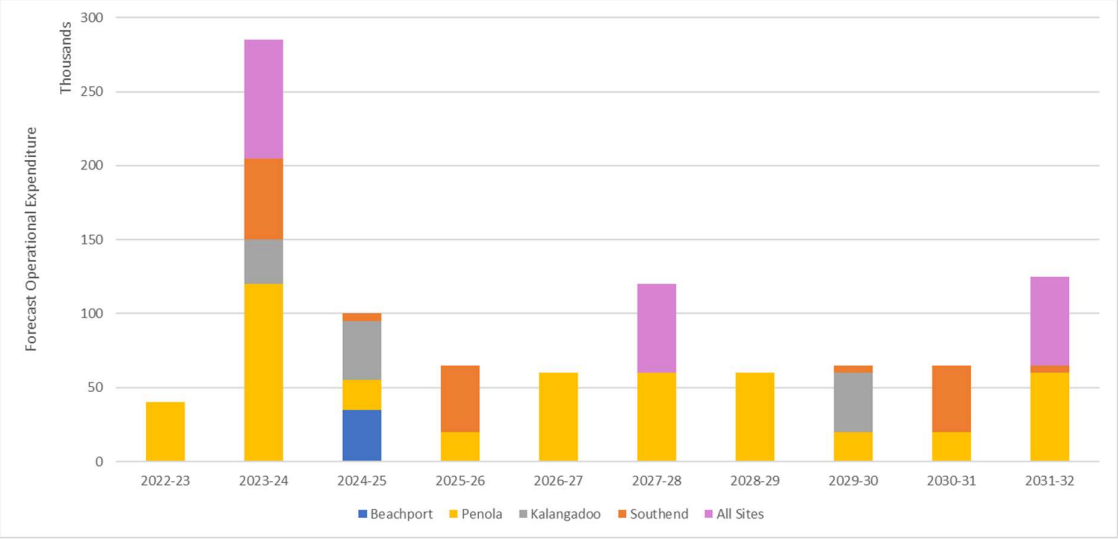

Figure 16 Forecast Operational Expenditure for the next 10 years

5.7.3 Forecast Renewal Costs

The forecast renewal cost have been captured and described in section 5.4.

5.7.4 Forecast Disposal Costs

Disposal costs will be incurred through renewals and upgrades and through removal of redundant assets. The costs of disposal through renewals and upgrades have been included in section 5.4.

Assets identified as not in use and not providing a service function but are still physically in situ awaiting removal and disposal are described as redundant. The assets which have been identified as redundant at the time of this AM plan are listed in Table 17.

Table 17 Redundant Assets

Location	Asset Description	
Beachport	B.LAG.79	Gas Leak Detector
Beachport	B.LAG.73	Chlorine Dosing Control Panel
Beachport	B.LAG.83	Chlorine Analyser
Beachport	B.LAG.75	Chlorine Booster Pump
Beachport	B.LAG.76	Chlorine Booster Pump
Beachport	B.LAG.78	Emergency Shut Down Control

RISK MANAGEMENT PLANNING

6 Risk Management Planning

This document utilises principles established in the ISO 31000:2018. The overall objectives of a formal risk management approach are to:

- Outline the process by which Council manages risk associated with its assets, so that all risks can be identified and evaluated in a consistent manner.
- Identify operational and organisational risks at a broad level.
- Allocate responsibility for managing risks to specific staff to improve accountability.
- Prioritise the risks to identify the highest risks that should be addressed in the short to medium term.

6.1 Critical Assets

Critical assets are defined as those which have a high consequence of failure causing significant loss or reduction of service. Critical assets have been identified and along with their typical failure mode, and the impact on service delivery, are summarised in Table 18. Failure modes may include physical failure, collapse or essential service interruption.

Table 18: Critical CWMS Assets

Critical Asset(s)	Impact
Beachport Pump Station No. 4	Last pump station in network collecting all wastewater and single pump station pumping to lagoons
Penola Pump Station No.14	Services hospital

6.2 Risk Assessment

Risk assessments are undertaken in accordance with Council's Risk Management Policy and utilising Council's Risk Matrix. Council maintains an online Corporate Risk Register, which is regularly reviewed by staff, ELT and the Audit and Risk Committee. The Audit and Risk Committee is comprised of elected members, Council staff and suitably qualified independent community members.

The only practical means of readily identifying risk is by regular monitoring and inspections of our assets. This process should enable significant risks to be discovered and remedied in advance of possible injury or incident. Implementing the maintenance inspections and completing the actions as captured in Table 12 enables the identification of risks related to the CWMS assets.

The CWMS Asset Risk Register has been provided in Appendix 2. The hazards that are assessed to have a residual risk of High (H15 – H20) or Extreme (E21 – E25) will be carried up and incorporated into Council's Corporate Risk Register.

6.3 Infrastructure Resilience Approach

The resilience of the CWMS infrastructure is vital to the ongoing provision of services to customers. To adapt to changing conditions the need to understand our capacity to 'withstand a given level of stress or demand', and to respond to possible disruptions to ensure continuity of service.

Section 4.5 details the adaptations that are being implemented to build resilience to climate change. Resilience will be built into new developments with each development application being assessed individually on a case by case basis.

Further resilience will be investigated for implementation after the growth forecasts and land use planning are adopted for each location. Adoption of the land use planning will allow for capacity assessments and options studies to be performed.

The plan to commence asset condition assessments of the CWMS infrastructure will further benefit the approach to resilience.

6.4 Service and Risk Trade-Offs

The decisions made in adopting this AM plan are based on the objective to achieve the optimum benefits from the available resources.

6.4.1 What we cannot do

There are some operations and maintenance activities and capital projects that are unable to be undertaken within the next 10 years. These include:

- Penola irrigation system has been identified for full change to wetland, however this is dependent on third party approvals through Department of Health and community support.
- Financial constraints and the revenue source may limit renewals following condition assessments.

6.4.2 Service trade-off

If there is forecast work (operations, maintenance, renewal, acquisition or disposal) that cannot be undertaken due to available resources, then this will result in service consequences for users. These service consequences include:

- Engagement of contractors though Council procurement policy has not achieved the desired outcome
- Availability of local contractors with specialist skills is major impediment to undertaking works the consequence of this is the engagement of plumbing services contractors who in some instances don't have the knowledge of the regulatory and standards requirements

6.4.3 Risk trade-off

The operations and maintenance activities and capital projects that cannot be undertaken may sustain or create risk consequences. These risk consequences include:

- The Council's financial capacity to achieve the identified maintenance and renewal program over the 10 year period in line with established fees and charges
- The move from reactive maintenance to programmed maintenance due to various issues particularly sustainable resources

These actions and expenditures are considered and included in the forecast costs, and in the risk register (Appendix 2).

FINANCIAL SUMMARY

7 Financial Summary

7.1 Financial Sustainability and Projections

7.1.1 Sustainability of service delivery

There are two key indicators of sustainable service delivery:

- Asset renewal funding ratio (proposed renewal budget for the next 10 years / forecast renewal costs for next 10 years), and
- Medium term forecast costs/proposed budget (over 10 years of the planning period).

7.1.1.1 Asset Renewal Funding Ratio

Asset Renewal Funding Ratio[1] 100%

The Asset Renewal Funding Ratio is an important indicator and illustrates that over the next 10 years we expect to have 100% of the funds required for the optimal renewal of assets.

7.1.1.2 Medium term – 10 year financial planning period

This AM plan identifies the forecast operations, maintenance and renewal costs required to provide an agreed level of service to the community over a 10 year period. This provides input into 10 year financial and funding plans aimed at providing the required services in a sustainable manner.

This forecast work can be compared to the proposed budget over the first 10 years of the planning period to identify any funding shortfall.

The forecast operations, maintenance and renewal costs over the 10 year planning period is $405,000 on average per year.

Providing sustainable services from infrastructure requires the management of service levels, risks, forecast outlays and financing to achieve a financial indicator of approximately 1.0 for the first years of the AM plan and ideally over the 10 year life of the Long-Term Financial Plan.

7.1.2 Forecast Costs (outlays) for the long-term financial plan

Table 19 shows the forecast costs (outlays) required for consideration in the 10 year long-term financial plan.

Providing services in a financially sustainable manner requires a balance between the forecast outlays required to deliver the agreed service levels and the planned budget allocations in the long-term financial plan.

A gap between the forecast outlays and the amounts allocated in the financial plan would indicate that further work is required to review service levels in the AM plan (including possibly revising the long-term financial plan).

The 'gap' will be managed by developing this AM plan to provide guidance on future service levels and resources required to provide these services in consultation with the community.

Forecast costs are shown in current day dollars.

[1] AIFMM, 2015, Version 1.0, Financial Sustainability Indicator 3, Sec 2.6, p 9.

Table 19 Forecast Costs (Outlays) for the Long-Term Financial Plan

Year	Acquisition ($)	Operation and Maintenance ($)	Renewal and Disposal ($)
2022-23	15,000	40,000	25,000
2023-24	65,000	205,000	405,000
2024-25	15,000	100,000	400,000
2025-26	15,000	65,000	490,000
2026-27	15,000	60,000	438,000
2027-28	15,000	60,000	390,000
2028-29	15,000	60,000	430,000
2029-30	15,000	65,000	400,000
2030-31	15,000	65,000	400,000
2031-32	15,000	65,000	400,000

The forecast depreciation expense taking into account renewals, disposals and acquisitions has been provided in Figure 17.

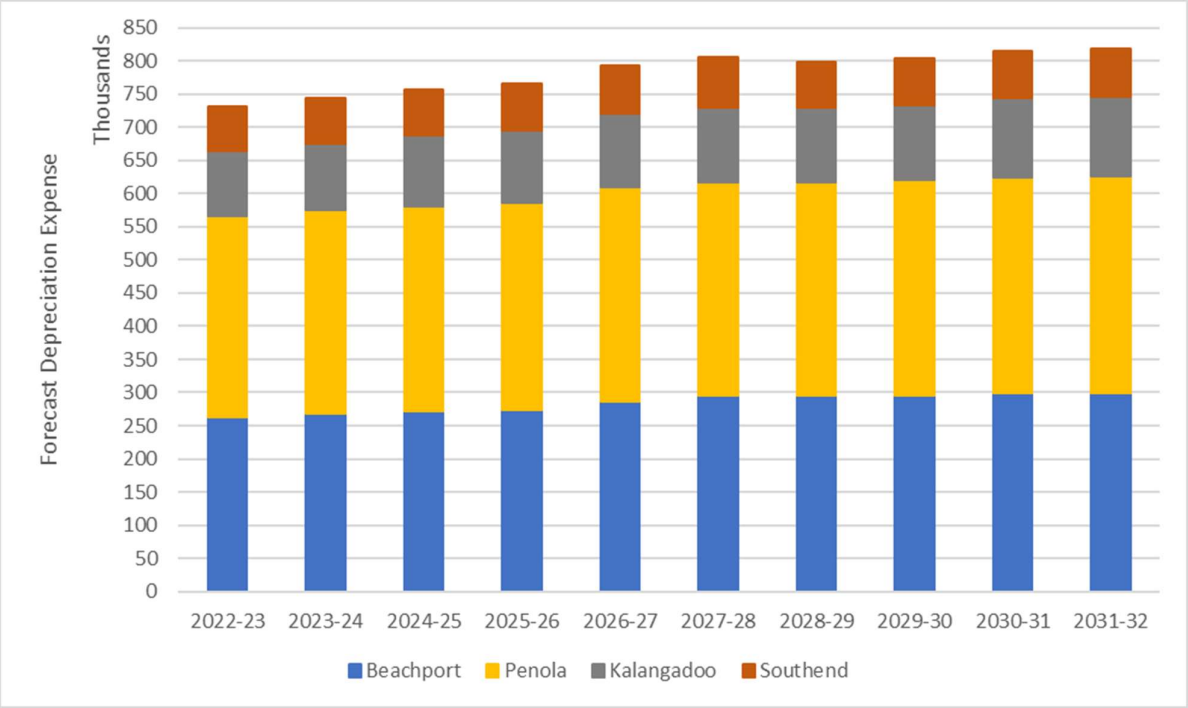

Figure 17 Forecast Depreciation Expense for the next 10 years

7.2 Funding Strategy

Funding for assets is outlined in the Council's annual budget and long-term financial plan.

Council's financial strategy determines how funding will be provided, whereas the AM plan communicates how and when this will be spent, along with the service and risk consequences of various service alternatives.

There are three main sources of funding for the CWMS infrastructure renewals and maintenance;

- Increase in service charges,
- Loan borrowings, and
- External grants from State Government and/or the LGA.

Expenses from operational and capital works are taken from a reserve account that holds excess funds collected through service charges and the cost of loans and loan interest payments are also drawn off the reserve account.

7.3 Valuation Forecasts

7.3.1 Asset valuations

The best available estimate of the value of assets included in this AM plan are shown below and in Table 2. The assets are valued using the application of unit rates as detailed in Sections 7.3.1.1 to 7.3.1.3.

Current (Gross) Replacement Cost	$41,330,000
Depreciable Amount	$41,330,000
Depreciated Replacement Cost[2]	$30,933,000
Depreciation	$730,000

7.3.1.1 Useful Life

The recent CWMS asset valuation as of 1 July 2021 applied the useful life to the assets as per Table 20. The useful lives were generated based on those recommended by the Australian Taxation Office in their publication TR 2021/3 - Income tax: effective life of depreciating assets.

[2] Also reported as Written Down Value, Carrying or Net Book Value.

Table 20 Asset Useful Life

Asset Type	Network Measure	Network Unit	Useful Life (years)
Mains	Length	m	80
Valves	Length	m	25
Lagoons	Area	m^2	50
Baffles	Length	m	20
Electrical – air conditioners, control panels, alarm systems	Quantity	Each	25
Pumps – wastewater, dosing, irrigation	Quantity	Each	25
Chemical dosing systems	Quantity	Each	15
Monitors - Sensors, meters, probes	Quantity	Each	10
Telemetry – Alarms, modems RTU	Quantity	Each	10
Flow Meters	Quantity	Each	20
Water Tanks – Concrete	Area	m^2	30
Water Tanks – Other	Area	m^2	80
Sprinklers – Irrigation system	Quantity	Each	5
Concrete – bund, sump, pit, slab	Quantity	Each	100
Colorbond – sheds and covers	Quantity	Each	40
Fencing	Length	m	30
Lagoon Ladders	Quantity	Each	20
Bores	Quantity	Each	30

7.3.1.2 Unit Rates

Unit rates for the systems as of 1 July 2021 were largely generated from Rawlinsons Australian Construction Handbook 2021 (Rawlinsons). Where a suitable rate was not available within Rawlinsons, a site-specific quote was obtained with the exception of Council's lagoons which use SA Water's unit rate plus a lining component based on installation costs. All items not valued using Rawlinsons, and the source of the alternative unit rate, are identified in Table 21.

Table 21 Asset Unit Rate Source

Item	Unit Rate Source	Network Unit
Lagoon	SA Water	Area
Charcoal Air Filters	Quote	Each
Lagoon Baffles	Quote	Each
Scrubber Valves	Actual replacement	Each
Pontoon	Actual replacement	Each
Solenoid Valves	Actual replacement	Each
Oval Drainage Pump	Actual replacement	Each
Flow Meter	Actual replacement	Each

7.3.1.3 Revaluation Methodology

Asset Group	Replacement Cost =	Accumulated Depreciation =
Area based assets i.e. lagoons, water tanks	Area of asset * applicable unit rate	Replacement Cost * consumed useful life
Length based assets i.e. pipes, fences (depth for Bore etc)	Length of asset * applicable unit rate	Replacement Cost * consumed useful life
Quantity based assets i.e. manholes, valves, safety showers	Applicable unit rate	Replacement Cost * consumed useful life
Complex Assets i.e. rising mains, vent stacks, sheds	Complex assets, where a recent direct quote for supply and install was not available, have been calculated by combining the elements of the assets to find a reflective replacement cost.	
	Example Pump Station Shed; ((Shed unit rate + slab floor unit rate) *area) + electrical connectivity unit rate = Replacement Cost	Example Rising Main; (Length * Pipe diameter unit rate) + ((length*depth*width) * excavation rate) + (Plant hire rate) + (Labour rate) = Replacement Cost.

7.3.2 Valuation forecast

A minor increase to asset values is forecast as additional assets are added through small scale development.

Although not expected to be significant in the life of this plan, additional assets will generally add to the operations and maintenance, future renewals and depreciation forecasts.

7.4 Key Assumptions Made in Financial Forecasts

Key assumptions made in this AM plan for financial forecasts are:

- The Long-term Financial Plan will contain sufficient budget allocations to meet 100% of the planned capital and operational works. This is dependent on the approval of the Long-term Financial Plan prior to the end of the financial year 2022-23.
- Current asset age and useful life are accurate.
- Where acquisitions were predicted, average depreciation expense was utilised for depreciation expense forecasting.
- Where acquisitions and renewals were forecast, a best estimate useful life has been utilised for depreciation expense forecasting as the actual infrastructure to be installed is not known at the time of this plan.
- As condition of underground infrastructure is not available to accurately predict the quantity of renewals an assumption has been made that 5km of pipe per year will be renewed. This assumption has been used to forecast depreciation expense.

7.5 Forecast Reliability and Confidence

The forecast costs, proposed budgets, and valuation projections in this AM plan are based on the best available data at this point in time. For effective asset and financial management, it is critical that the

information is current and accurate. Data confidence is classified on a A - E level scale[3] in accordance with Table 22.

Table 22 Data Confidence Grading System

Confidence Grade	Description
A. Very High	Data based on sound records, procedures, investigations and analysis, documented properly and agreed as the best method of assessment. Dataset is complete and estimated to be accurate ± 2%
B. High	Data based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example some of the data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Dataset is complete and estimated to be accurate ± 10%
C. Medium	Data based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade A or B data are available. Dataset is substantially complete but up to 50% is extrapolated data and accuracy estimated ± 25%
D. Low	Data is based on unconfirmed verbal reports and/or cursory inspections and analysis. Dataset may not be fully complete, and most data is estimated or extrapolated. Accuracy ± 40%
E. Very Low	None or very little data held.

The estimated confidence level for and reliability of data used in this AM plan is shown in Table 23.

Table 23 Data Confidence Assessment for Data

Data	Confidence Assessment	Comment
Demand drivers	C. Medium	Operator knowledge of the systems is reliable and accurate, but not documented.
Growth projections	D. Low	Requirement for the land use planning to be adopted and up to date census data.
Acquisition forecast	D. Low	These are predicted based on local knowledge at the time of this plan as Council's land use planning has not been adopted resulting in uncertainty
Operation and Maintenance forecast	D. Low	Currently most work is undertaken as reactive maintenance this does not allow any level of confidence in the future needs
Renewal forecast - Asset values	D. Low	No condition data or on site verification of assets has been completed.
- Asset useful lives	E. Very Low	No condition data or on site verification of assets has been completed.
- Condition modelling	E. Very Low	No condition modelling has been undertaken at the time of this plan
Disposal forecast	D. Low	It has been assumed that where renewals have been forecast that all the in situ infrastructure will be disposed.

The estimated confidence level for and reliability of data used in this AM plan is considered to be Very Low.

[3] IPWEA, 2015, IIMM, Table 2.4.6, p 2|71.

PLAN IMPROVEMENT AND MONITORING

8 Plan Improvement and Monitoring

8.1 Status of Asset Management Practices

8.1.1 Accounting and financial data sources

This AM plan utilises accounting and financial data. The source of the data is Council's financial and records software system, Synergy and Brightly (formerly Assetic). Synergy contains accounting and financial data up to financial year 2020/21 whilst Brightly contains the asset specific financial data. In 2021/22 Council transitioned to Datascape software for finance.

8.1.2 Asset management data sources

This AM plan also utilises asset management data. The source of the data is Brightly. Brightly is the asset management system that holds the asset register and the asset relevant financial data.

8.2 Improvement Plan

The improvement plan generated from the risk register is provided in Appendix 3.

8.3 Monitoring and Review Procedures

This AM plan will be reviewed during the annual budget planning process to consider any material changes in service levels, risks, forecast costs and proposed budgets as a result of budget decisions.

The AM plan will be reviewed annually and updated if there is a significant change to the current service level, asset values, forecast operations, maintenance, renewals, acquisition and asset disposal costs and planned budgets. These forecast costs and proposed budget will be incorporated into the Long-Term Financial Plan.

The AM plan has a maximum life of 4 years and will be reviewed within 2 years of a Local Government election or a complete revision within 12 months of an asset financial revaluation.

8.4 Performance Measures

The effectiveness of this AM plan can be measured in the following ways:

- The degree to which the required forecast costs identified in this AM plan are incorporated into the Long-Term Financial Plan,
- The degree to which the 1-5 year detailed works programs, budgets, business plans and corporate structures consider the 'global' works program trends provided by the AM plan,
- The degree to which the existing and projected service levels and service consequences, risks and residual risks are incorporated into the strategic planning documents and associated plans,
- The Asset Renewal Funding Ratio achieving the Organisational target (this target is often 90 – 100%).

9 References

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10 Appendices

Appendix 1 List of Definitions

Term	Definition
ABCB	Australian Building Codes Board
ABS	Australian Bureau of Statistics
AIFMM	Australian Infrastructure Financial Management Manual
AM	Asset Management
ATO	Australian Taxation Office
Council	Wattle Range Council
CWMS	Community Wastewater Management Systems
DHA	former Department of Health and Ageing, now Department for Health and Wellbeing
DHW	Department for Health and Wellbeing formerly Department of Health and Ageing (DHA)
ELT	Wattle Range Council Executive Leadership Team Made up of Chief Executive Officer, Director Corporate Services, Director Development Services and Director Engineering Services
EPA	Environment Protection Authority
EPHC	Environment Protection and Heritage Council
ESCOSA	Essential Services Commission of South Australia
HDPE	High Density Poly Ethylene
IM	Injury Management
IOT	Internet of Things
IPWEA	Institute of Public Works Engineering Australasia
ISO	International Organisation for Standardization
KPI	Key Performance Indicator
L	Litres
LGA	Local Government Association
LTFP	Long Term Financial Plan
ML	Megalitre
NAMS+	A subscription-based product designed to provide high value/low cost infrastructure planning and decision support for any asset intensive organisation irrespective of size
NCC	National Construction Code
NPV	Net Present Value
NRMMC	National Resource Management Ministerial Council
OTR	Office of the Technical Regulator
PCA	Plumbing Code of Australia
PIRSA	Department of Primary Industries and Regions South Australia
PPS	Private Pump Station
PS	Pump Station
Rawlinsons	Rawlinsons Australian Construction Handbook 2021
Redundant	The asset is not providing a service function but is physically still in situ. The asset is not intended to return to use but will have to be maintained for WHS concerns until it is physically removed.
SA	South Australia

Term	Definition
SCADA	Supervisory Control and Data Acquisition
SRMTMP	Safety Reliability Maintenance and Technical Management Plan
SS	Suspended Solids
STED	Septic Tank Effluent Disposal
Trade waste	Any wastewater that arises from any commercial, industrial, business, trade or manufacturing activity that is discharged into the sewerage system
WHS	Work Health Safety
WSAA	Water Services Association of Australia
WWTP	Wastewater Treatment Plant

Appendix 2 CWMS Asset Risk Register

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A1	All	**All**	**Aboveground infrastructure**	Asset Operator	No unauthorised access of Council property	Vandalism to CWMS infrastructure	Public gain access to aboveground CWMS infrastructure e.g. pump station or treatment plant Public or stock gain access to irrigation field	No	Economic	Possible	Moderate	**Medium (M11)**	Monthly visual inspection Security fencing with locked gate surrounding treatment plants and lagoons Pump stations and switchboards locked Stock fencing surrounding irrigation field	Rare	Moderate	**Low (L3)**		
A2	CWMS	**All**	**Water quality**	Regulator	Compliance with legislation, regulation and license	Non-compliance	Failure to meet water quality targets / limits	Yes	Economic	Possible	Major	**High (H17)**	Monthly visual inspections 4 yearly condition assessment Quarterly water monitoring program Annual reporting	Possible	Moderate	**Medium (M11)**	With mostly lagoon based systems there is little action that can be taken to change water quality. However this water is rarely released from the system, rather it is held in the lagoons until it is of suitable quality for release by irrigation	A1 - Consider whether the risk is in the quality measures being exceeded or if the risk is really in releasing to the environment or public, which we definitely mitigate
A3	CWMS	**All**	**Staff retention**	Asset Owner	Retain staff and/or have sufficient handover to new staff	Loss of knowledge	Staff with knowledge of the systems leave the organisation due to retirement or other opportunities	No	WHS	Possible	Moderate	**Medium (M11)**	Maintain up-to-date operations manuals of each system Maintain accurate records AMP	Possible	Minor	**Medium (M10)**		T01 - Develop/update CWMS Operations Manuals T02 - Train additional staff. Formal qualifications in WW Operations. T03 - Initiate and maintain good records

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A4	CWMS	**All**	**All**	Asset Owner	Condition of assets understood to enable future planning for maintenance and renewals	Condition of assets not understood or known	Poor renewal planning and budget not being spent in correct area due to lack of knowledge of assets. Could lead to widespread failure of the systems or significant financial impact as all constructed at the same time.	Yes	Economic	Possible	Catastrophic	**Extreme (E21)**	Development of AMP and 4 yearly review	Possible	Major	**High (H17)**		T04 - Implement project to CCTV wastewater pipes for all CWMS (capture pipe length, pipe diameter, pipe material, pipe condition, defects (location and description, jump ups (location and status)) and provide CCTV footage for records) T05 - Implement project to undertake maintenance shaft / manhole inspections (capture depth, diameter, type/material, condition, defects (description)) T06 - Implement project to condition audit aboveground infrastructure

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A5	CWMS	**All**	**Property connections**	Asset Owner	All live property connections are being billed accordingly	Number and location of live property connections not fully understood	Possible loss of revenue impacting long term sustainability of the schemes	Yes	Economic	Almost certain	Minor	**High (H19)**	Small schemes therefore dwellings unknowingly connected is not easy to conceal	Unlikely	Minor	**Low (L5)**	Penola is the greatest unknown.	T04 - High priority to fund location and condition assessment for underground services. T07 - Undertake desktop study of property connections to ascertain location and billing and develop corrected asset register
A6	CWMS	**All**	**All**	Asset Owner	Long term sustainability of systems	System is not sustainable	Applicable fees and charges are not able to sustain and fund the systems	No	Economic	Possible	Major	**High (H17)**	Currently larger systems are funding smaller systems that are not making a profit	Possible	Moderate	**Medium (M11)**		T04 - Implement project to CCTV wastewater pipes for all CWMS (capture pipe length, pipe diameter, pipe material, pipe condition, defects (location and description, jump ups (location and status)) and provide CCTV footage for records) T08 - Review fees and charges along with live property connections to understand revenue cost ratios and sustainability of the systems

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A7	CWMS	**All**	**All**	Asset Owner	Safe work practices are followed when working on CWMS infrastructure	Contractor is injured whilst working on CWMS infrastructure	Contractor working on CWMS infrastructure is injured due to not following safe work procedures	No	WHS	Possible	Catastrophic	**Extreme (E21)**	All contractors must be sourced from the prequalified list. All contractors complete on site inductions. The register for these is maintained in Skytrust Where contractors are undertaking large scale works a Council representative supervises the works.	Rare	Major	**Medium (M7)**		
A8	CWMS	**All**	**All**	Asset Operator	The CWMS has sufficient capacity to meet peak demands and future development	Development of the towns increases demand on the CWMS	CWMS does not have capacity to meet demands of development leading to poor treatment and/or spills to the environment and/or greater frequency of breakdowns as infrastructure is operating under constant heavy load outside design parameters	No	Economic	Possible	Major	**High (H17)**		Possible	Major	**High (H17)**		T09 - Undertake a capacity and demand assessment of the CWMS systems once the Strategic Land Use Plan has been officially adopted
A9	CWMS	**All**	**All**	Asset Operator	All staff involved in the operation of the CWMS are appropriately trained	No or insufficient training of staff	Potential for increase in incidents both work place safety and operational due to poorly trained staff	No	WHS	Likely	Moderate	**High (H18)**	Operational Manuals for each CWMS New staff training	Unlikely	Moderate	**Medium (M8)**	Beachport is 'new' system with as cons and more knowledge of this system in house	T01 - Develop/update CWMS Operations Manuals

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A10	CWMS	**All**	**Property connections**	Asset Owner	Capacity of CWMS is not exceeded	New development connecting into CWMS exceeds system capacity	CWMS system capacity exceeded through new connections from development	No	Environmental	Unlikely	Moderate	**Medium (M8)**		Unlikely	Moderate	**Medium (M8)**	Beachport as a 'new' system was designed to be a full sewer system and moved away from STED to provide more scope for future developmentSignificant development within Kalangadoo is unlikely to occurSouthend is of most concern with an increase in connections	T09 - Investigate system capacity and when capacity will be exceeded based on connections.T10 - Kalangadoo - Document decision and have it passed through Council that future development will accommodate on site waste management systems
A11	Lagoons	**All**	**Lagoons**	Asset Operator	No spills or releases to the environment	Overflow of lagoon due to high influent volume as a result of stormwater inundation of the network and/or stormwater inundation of the lagoon	System capacity exceeded due to inflow and infiltration resulting in spills and environmental releases	No	Environmental	Possible	Major	**High (H17)**	Monthly visual inspection by Technical Officer or Contractor. Reactive Maintenance Increased lagoon level monitoring during storm events. Irrigation / wastewater disposal to lower lagoon level if available. Lagoon operating levels managed to ensure freeboard is available.	Rare	Major	**Medium (M7)**		A2 - Consider remote monitoring of inflows to monitor trends

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A12	Lagoons	**All**	**Lagoons**	Regulator	No spills or releases to the environment	Seepage of untreated wastewater or biological substances from lagoons	Wastewater seeps from the lagoon base and walls and enters groundwater	Yes	Environmental	Unlikely	Major	**Medium (M9)**	Monthly visual inspection of lagoon liner Annual groundwater bore sampling. Preventative Maintenance. Contractor undertakes sampling and testing. High density polyethylene lined lagoons at Penola, Kalangadoo (storage only) and Southend, Beachport (has a secondary layer with leakage detection)	Unlikely	Moderate	**Medium (M8)**		A3 - Investigate useful life of HDPE liners and technology available for condition assessment. T11 - Investigate options for renewal of HDPE liners (all likely to require replacement around the same time) A4 - Move groundwater quality data from spreadsheets on server to AM system
A13	Lagoons	**All**	**Lagoons**	Asset Operator	No spills or releases to the environment	Lagoon failure	Lagoon wall fails due to over exposure or groundwater inundation or animals burrowing/digging compromising the wall integrity	No	Environmental	Unlikely	Moderate	**Medium (M8)**	Monthly visual inspection by Technical Officer or Contractor	Unlikely	Moderate	**Medium (M8)**		
A14	Lagoons	**All**	**Ladders**	Asset Owner	No drownings in the lagoons	Drowning in the lagoon	A person is not able to climb out a lagoon if they happen to fall in	No	WHS	Possible	Catastrophic	**Extreme (E21)**	Lone Work Procedure in place and is to be used when accessing the lagoons. Ladders for people in the lagoons to enable someone to climb out. Security fencing	Rare	Major	**Medium (M7)**		T42 - Budget for ladder renewal as these all will be end of life at the same time

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
A15	Lagoons	**All**	**Lagoons**	Asset Operator	Ability to undertake maintenance in timely and cost effective manner	Sludge accumulation in lagoon	Sludge level in lagoon rises resulting in reduced capacity for treatment in lagoon and increased risk of overflowing or pump blockages	No	Environmental	Unlikely	Major	**Medium (M9)**	Sludge level monitoring in lagoon. Preventative maintenance Sludge removal from lagoons when sludge high level triggers requirement	Rare	Major	**Medium (M7)**	Beachport has sonar sludge level monitoring in lagoon	T12 - Budget for sludge monitoring in lagoons
A16	Lagoons	**All**	**Ladders**	Asset Operator	No loss of service or spills or releases to the environment	Wildlife accessing the lagoons	Wildlife damaging lagoon walls and or pump draw offs leading to environmental release	No	Environmental	Possible	Major	**High (H17)**	Monthly visual inspection by Technical Officer or Contractor Security fencing with locked gate surrounding lagoons Wide net wildlife ladders in lagoons	Unlikely	Major	**Medium (M9)**	No wide net wildlife ladders in Beachport lagoons Turtles in Kalangadoo block pipe in lagoon	T13 - Install cap on lagoon outlet pipe in Kalangadoo to prevent turtles accessing T42 - Budget for ladder renewal as these all will be end of life at the same time
A17	Lagoons	**All**	**Lagoons**	Asset Operator	No odour complaints	Odour released from lagoons	Long retention time in the network, high temperatures and turbulent flow can result in the wastewater releasing odorous gases and also going septic which increases the odours released	No	Public Health	Possible	Minor	**Medium (M10)**	Odour complaints are responded to by the Technical Officer individuallyLagoons are located a large distance from residents or public venues and town	Unlikely	Minor	**Low (L5)**		

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A18	Network	**All**	**Gravity Main**	Asset Operator	No loss of service	Blockage	Pipe blockage causing backup of flow and potential for overflow on private property Build up of sludge or rag in pipes results in blockage Gum tree roots infiltrate pipes and cause blockages	Yes	Environmental	Possible	Major	**High (H17)**	Preventative Maintenance, Pump out sludge as needed Responding to customer reports of backed up pipes. Working with local plumbers to respond as needed Beachport - Live SCADA with real time monitoring and alarms.	Possible	Moderate	**Medium (M11)**		T14 - Establish a scheduled maintenance task for pipe flushing. Ensure this occurs post septic tank pump out and prior to pump station pump out. T04 - Implement project to CCTV wastewater pipes for all CWMS (capture pipe length, pipe diameter, pipe material, pipe condition, defects (location and description, jump ups (location and status)) and provide CCTV footage for records)
A19	Network	**All**	**Gravity Main**	Regulator	No spills or releases to the environment	Breakage	Pipe breakage resulting in release to the environment or private property	Yes	Public Health	Possible	Moderate	**Medium (M11)**	Reactive maintenance Responding to customer reports of water pooling. Working with local plumbers to respond as needed	Possible	Moderate	**Medium (M11)**		T14 - Establish a scheduled maintenance task for pipe flushing. Ensure this occurs post septic tank pump out and prior to pump station pump out.

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A20	Network	**All**	**Trade Waste Discharge**	Asset Operator	No loss of service	Grease or fat blockage or release of contaminants that adversely affects the system	Pipe blockage causing backup of flow and potential for overflow Release that causes odour, pumping or treatment issues	Yes	Environmental	Possible	Moderate	**Medium (M11)**	Monthly visual inspections of visible infrastructure including pump sumps for signs of grease. Preventative maintenance. Grease trap cleaning. Commercial clients to install grease arrestors	Unlikely	Minor	**Low (L5)**	Beachport - Pump Station No.7 has previously had a fat burg that had to be removed	T15 - Develop and document clear roles and responsibilities for management and oversight of trade waste discharging commercial clients
A21	Network	**All**	**Gravity and Rising Main**	Asset Operator	Access to infrastructure for maintenance	No easement over underground infrastructure	Difficult to access underground infrastructure due to refusal by land owners or buildings / structures over infrastructure Easement alignment may not cover infrastructure	No	Stakeholder Service Levels	Likely	Moderate	**High (H18)**		Likely	Moderate	**High (H18)**		T04 - Location of underground services to be determined as high priority as we are unsure of the location particularly in Penola. A5 - Notification to residents that there is infrastructure on their property. T16 - Training for staff on Water Industry Act powers. T17 - Develop policy for no construction over infrastructure to assist planning team

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A22	Network	**All**	**Rising Main**	Asset Operator	No loss of service	Blockage	Pipe blockage causing backup of flow and potential for overflow on private property Build up of sludge at pump station results in sludge being pumped into rising main causing a blockage Build up of sludge or rag in pipes results in blockage	No	Environmental	Possible	Major	**High (H17)**	Monthly check of sludge level at pump station. Reactive maintenance. Pump out sludge as needed Pump station monitoring and alarms Incident response procedures	Possible	Major	**High (H17)**	Kalangadoo - Pipe to the lagoons is of significant length which puts it at higher risk from blockage Penola - no ability to isolate primary rising mains to undertake repair works	T18 - Establish a scheduled maintenance task for pump station pump out. Also look at ensuring pump station pump occurs post septic tank pump out and mains flushing program.
A23	Network	**All**	**Rising Main**	Asset Operator	No spills or releases to the environment	Breakage	Pipe breakage resulting in release to the environment or private property	No	Environmental	Possible	Major	**High (H17)**	Reactive maintenance Pump station monitoring and alarms Incident response procedures	Possible	Major	**High (H17)**	Kalangadoo - Pipe to the lagoons is of significant length which puts it at higher risk from blockage Penola - no ability to isolate primary rising mains to undertake repair works	T35 - Investigate options and/or operational philosophy that can be applied at Penola to enable maintenance to be performed safely on the wastewater network
A24	Network	**All**	**Pump**	Asset Operator	Documented details of assets to enable renewal projects to be planned and purchasing of correct items	Pump details unknown	Accurate and cost effective renewals unable to be delivered	No	Economic	Possible	Minor	**Medium (M10)**	Run time hours monitored manually in hardcopy	Possible	Minor	**Medium (M10)**	No knowledge of which pump is in which pump station and pump details. All submersible pumps are not standard size. Currently pump size is fit for purpose.	T19 - Implement project to collect data on pumps at each pump station

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A25	Network	**All**	**Gravity Main**	Asset Operator	No spills or releases to the environment	Overflow of wastewater from network	Pump stations or treatment plant are not operational resulting in the network filling up with wastewater and overflowing onto private propertyHigh groundwater levels and defects in pipe result in groundwater intrusion into the system causing exceedence of system capacity and potential for spills or environmental releasesStorm water inundation in network from illegal connections or defective infrastructure	No	Environmental	Possible	Major	**High (H17)**	Reactive maintenancePump station monitoring and alarmsIncident response proceduresImprovement to stormwater management infrastructure in Penola and Kalangadoo	Unlikely	Major	**Medium (M9)**	Kalangadoo Pump Station No.1 overflows onto private property at least once a year sometimes morePenola Pump Station No.14 has small sump that experiences groundwater infiltration and it also services the hospital	T04 - Implement project to CCTV wastewater pipes for all CWMS (capture pipe length, pipe diameter, pipe material, pipe condition, defects (location and description, jump ups (location and status)) and provide CCTV footage for records)T05 - Implement project to undertake maintenance shaft / manhole inspections (capture depth, diameter, type/material, condition, defects (description))T 20 - Investigate option for smoke testing to be undertaken in Penola network to identify illegal connections

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A26	Network	**All**	**Gravity and Rising Main**	Asset Operator	Ability to undertake maintenance in timely and cost effective manner	Unable to locate infrastructure	Location and details of underground infrastructure is unknown	No	Stakeholder Service Levels	Possible	Major	**High (H17)**		Possible	Major	**High (H17)**	Beachport is 'new' system with as cons and more knowledge of this system in house	T04 - Implement project to CCTV wastewater pipes for all CWMS (capture pipe length, pipe diameter, pipe material, pipe condition, defects (location and description, jump ups (location and status)) and provide CCTV footage for records) T05 - Implement project to undertake maintenance shaft / manhole inspections (capture depth, diameter, type/material, condition, defects (description))

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A27	Pump Station	**All**	**Motors**	Asset Operator	No loss of service	Electrical failure	Failure of electrical component such as motors leading to inability to pump wastewater	No	Environmental	Possible	Moderate	**Medium (M11)**	Monthly visual inspections 4 yearly condition assessment. Reactive maintenance. Contractors available for emergency pump out Alarms installed with immediate notification to operators for power faults as well as level alarms. Back up batteries in controllers dual pumps in every pump station as back up. Generator plugs at all sites and generator on standby. Renewal of electrical componentry every 10 years in rolling program for each scheme.	Unlikely	Minor	**Low (L5)**		T21 - Check every site has generator plug for easy use (can always be hardwired in by an electrician). T04 - Budget for 4 yearly condition assessment T22 - Budget for monthly inspections

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A28	Pump Station	**All**	**Pumps**	Asset Operator	No loss of service	Mechanical failure	Failure of mechanical component such as impellor leading to inability to pump wastewater	No	Environmental	Possible	Moderate	**Medium (M11)**	Monthly visual inspections 4 yearly condition assessment. Reactive maintenance. Spares are readily accessible for some of the pumps, some pumps held in stock for immediate replacement. Contractors available for emergency pump out. Alarms installed with immediate notification to operators for mechanical faults as well as level alarms. Southend - Red light on building that flashes when pump station is in alarm state Freeboard in lagoon available to provide storage of wastewater and therefore time to undertake repair Beachport - Live SCADA with real time monitoring and alarms Redundancy through duty/standby installation Southend - No redundancy for single irrigation pump	Unlikely	Minor	**Low (L5)**		T23 - Check list of replacement parts available Replace as used for critical pumps/parts with long lead time T04 - Budget for 4 yearly condition assessment T22 - Budget for monthly inspections
A29	Pump Station	**All**	**Pump Station**	Asset Operator	No odour complaints	Odour released from pump station	Long retention time in the network, high temperatures and turbulent flow can result in the wastewater releasing odorous gases and also going septic which increases the odours released	No	Public Health	Possible	Minor	**Medium (M10)**	Odour complaints are responded to by the Technical Officer individuallyAll pump stations have a passive vent stack installed or carbon filter	Unlikely	Minor	**Low (L5)**		T24 - Develop and implement carbon filter assessment and renewal program

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A30	Network	**All (Except Beachport)**	**Private Septic Tanks**	Asset Operator	No loss of service	Private septic tanks do not provide primary treatment and/or allow sludge to overflow into network pipes	Private septic tanks accumulate sludge which then overflows into network pipes	Yes	Economic	Likely	Moderate	**High (H18)**	Preventative maintenance. Private septic tanks are pumped out on a regular schedule	Unlikely	Minor	**Low (L5)**		T14 - Establish a scheduled maintenance task for pipe flushing. Ensure this occurs post septic tank pump out and prior to pump station pump out.
B1	CWMS	**Beachport**	**Network**	Asset Owner	Infrastructure is resilient to climate change	Climate change	Coastal erosion and inundation	No	Economic	Rare	Major	**Medium (M7)**	Monitoring erosion and identifying assets that may be impacted so they can be relocated early rather than in emergency works. Preventative maintenance Monitoring erosion and identifying assets that may be impacted so they can be relocated early rather than in emergency works	Rare	Moderate	**Low (L3)**		T25 - Coastal adaptation plan for Beachport to consider wastewater infrastructure
B2	CWMS	**Beachport**	**All**	Asset Operator	No loss of service or spills or releases to the environment	Influx of visitors to town during holidays	Peak flows during holidays exceeding capacity of CWMS	No	Environmental	Possible	Moderate	**Medium (M11)**	Reactive maintenance Live SCADA with real time monitoring and alarms. Lagoon operating levels managed to ensure freeboard is available.	Possible	Minor	**Medium (M10)**		

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B3	CWMS	**Beachport**	**All**	Asset Operator	No loss of service	Power outage	Power turned off by supplier due to bushfire risk	No	Environmental	Possible	Moderate	**Medium (M11)**	Local contractor has 2 generators set aside for Council who have priority access for hire Access to generators available when need is identified Alarms installed with immediate notification to operators for power faults Pump stations have generator plug in points built in to allow generator connection	Possible	Minor	**Medium (M10)**		T26 - Investigate generator hire and costs agreement to ensure that it is current
B4	CWMS	**Beachport**	**All**	Asset Operator	No loss of service	Communication outage	Poor phone reception causes outages of the communication system	No	Stakeholder Service Levels	Possible	Moderate	**Medium (M11)**	Monthly visual inspections. Reactive maintenance. Contractors available for emergency pump out Alarms that notify of comms failure	Possible	Minor	**Medium (M10)**		T43 - Budget funds to renew electronics within the CWMS network and treatment sites
B5	Network	**Beachport**	**Pump Station**	Asset Operator	No loss of service	Pump Station No.4 is only pump station to pump to lagoons	Single pump station collects all wastewater from network and pumps to lagoons	No	Environmental	Unlikely	Moderate	**Medium (M8)**	Monthly inspections. Preventative maintenance Live SCADA with real time monitoring and alarms. Both automatic and manual inhibitors for pump stations.	Unlikely	Minor	**Low (L5)**		
B6	Network	**Beachport**	**Rising Main**	Asset Operator	No loss of service	Pipe blockage/breakage	Single pipe of about 6km from pump station No.4 to lagoons therefore no redundancy	Yes	Environmental	Possible	Major	**High (H17)**	Monthly check of lagoon. Reactive maintenance Live SCADA with real time monitoring and alarms.	Unlikely	Major	**Medium (M9)**		T27 - Consider installation of flowmeter at lagoon inlet to reconcile flow totals from Pump Station No.4

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B7	Pump Station	**Beachport**	**All**	Asset Operator	Safe work practices are followed when working on CWMS infrastructure	Performing maintenance on full sewer system i.e. raw sewerage	Exposure to raw sewage due to undertaking maintenance on live full sewer system	No	WHS	Possible	Major	**High (H17)**	Reactive maintenanceLive SCADA with real time monitoring and alarms.Both automatic and manual inhibitors for pump stations.WH&S procedures in placeStaff vaccination prerequisites	Possible	Minor	**Medium (M10)**		
B8	Pump Station	**Beachport**	**Pump**	Asset Operator	No loss of service	Pump blockage	Public disposing of incorrect items into the sewer resulting rag build up in the pump station	No	Environmental	Possible	Moderate	**Medium (M11)**	Reactive maintenance Live SCADA with real time monitoring and alarms. Redundancy through duty/standby installation	Possible	Minor	**Medium (M10)**		T18 - Establish a scheduled maintenance task for pump station pump out. Also look at ensuring pump station pump occurs post mains flushing program.
B9	Pump Station	**Beachport**	**Pump Station**	Asset Operator	No loss of service or spills or releases to the environment	Overflow or pump blockage at private pump station	Private pump station located on private property and any issues result in public exposure to raw sewage and difficulties in access to undertake maintenance	No	Public Health	Likely	Moderate	**High (H18)**	Reactive maintenance	Likely	Moderate	**High (H18)**		T29 - Investigate options for handover of private pump stations to land owner and implement handover
K1	CWMS	**Kalangadoo**	**All**	Asset Owner	No loss of service	Climate change	Bushfire causes major loss of infrastructure (network or WWTP)	No	Economic	Unlikely	Catastrophic	**High (H16)**	Preventative maintenance. Regular slashing of irrigation area and vegetation surrounding the WWTP and pump stations	Unlikely	Major	**Medium (M9)**		

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K2	Lagoons	**Kalangadoo**	**Baffles**	Asset Operator	Safe work practices are followed when working on CWMS infrastructure	Asbestos baffles	Health and safety risk of undertaking any maintenance on or replacements of infrastructure containing asbestos - Exposure to asbestos due to poor condition friable material	No	WHS	Possible	Catastrophic	**Extreme (E21)**	Not operational or in use Asbestos register Signage Located within lagoon	Rare	Moderate	**Low (L3)**		T30 - Risk to be eliminated by removing asbestos baffles
K3	Network	**Kalangadoo**	**Network**	Asset Operator	No loss of service or spills or releases to the environment	Connection to sporting oval stormwater runoff	Stormwater runoff from sporting oval connects into CWMS and if not manually turned off has preference in flow resulting in backup of wastewater	No	Environmental	Possible	Moderate	**Medium (M11)**	Reactive maintenance. Manually turn off connection to sporting oval. Monitoring by Technical Officer	Possible	Minor	**Medium (M10)**		
K4	Pump Station	**Kalangadoo**	**Pump Station No. 1**	Asset Operator	No loss of service	Stormwater flooding	Pump station and gravity mains cannot handle the amount of stormwater and wastewater, causing overflow on private property	No	Environmental	Possible	Moderate	**Medium (M11)**	Reactive maintenance Alarms installed with immediate notification to operators for pump run time and sump level. Ability to manually switch off drainage pumps at Kalangadoo Oval, which contribute to the stormwater being pumped to the WWTP.	Possible	Minor	**Medium (M10)**		T31 - Investigate options for diversion of stormwater from oval to an alternate location than WWTP through rising main. T32 - Kalangadoo pump station upgrade needed to ensure alarms can be received as auto-dialler units are at end of life.

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K5	Treatment Plant	**Kalangadoo**	**Treatment Plant**	Asset Operator	Infrastructure is fit for purpose	Infrastructure is not in use but is still insitu	Treatment plant does not receive sufficient flow to operate	No	Economic	Almost certain	Major	**Extreme (E24)**	Reactive maintenance	Almost certain	Major	**Extreme (E24)**	Financial commitment is >500k and over multiple years. System is old with new pumps.	T33 - Investigate and implement a decommissioning plan for the treatment plant and other infrastructure not in use
P1	CWMS	**Penola**	**All**	Asset Owner	No loss of service	Climate change	Increased frequency of rainfall events leading to increased inflow and infiltration that exceeds system capacity resulting in overflow	No	Environmental	Possible	Moderate	**Medium (M11)**	Reactive maintenance Increased lagoon level monitoring during storm events. Irrigation / wastewater disposal to lower lagoon level if required	Unlikely	Moderate	**Medium (M8)**		
P2	Irrigation	**Penola**	**Irrigation Field**	Asset Operator	Compliance with legislation, regulation and license	Irrigation on only one location	Potential to increase nutrient levels and adversely effect soil if effluent is irrigated on only one location	No	Environmental	Likely	Major	**Extreme (E22)**	Monthly visual inspectionWater quality testing and limit irrigation when quality is poor. Restricted access for public to irrigation areaIrrigation management plan	Possible	Moderate	**Medium (M11)**		T34 - Investigate option to send treated wastewater to wetland in place of irrigation system
P3	Lagoons	**Penola**	**Lagoons**	Asset Operator	Full treatment of wastewater	Insufficient retention time in lagoons	Poor treatment in lagoon due to low capacity resulting in insufficient retention time	No	Environmental	Unlikely	Moderate	**Medium (M8)**	Monthly visual inspection by Technical Officer or Contractor Lagoon operating levels managed by Technical Officer	Unlikely	Minor	**Low (L5)**		T09 - Undertake a capacity and demand assessment of the CWMS systems once the Strategic Land Use Plan has been officially adopted

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P4	Pump Station	**Penola**	**Pump Station**	Asset Operator	Ability to inhibit pump station	Unable to inhibit pump stations to enable maintenance to be performed	Maintenance, if required, must be performed on live network. Includes staff and contractors working in confined space with inflows of effluent and pumps operating in close proximity with risk of carbon monoxide poisoning	No	WHS	Possible	Catastrophic	**Extreme (E21)**	Reactive maintenance. Pre-qualified contractors with safety systems in place, only licensed contractors for confined space entry, SWMS and supervision Where contractors are undertaking large scale works a Council representative supervises the works.	Unlikely	Major	**Medium (M9)**	Southend, Beachport and Kalangadoo systems enable inhibition of pump stations Penola has a common main that multiple rising mains from multiple pump stations discharge into as well as gravity lines Penola treatment plant is long distance from town	T35 - Investigate options and/or operational philosophy that can be applied at Penola to enable maintenance to be performed safely on the wastewater network
P5	Pump Station	**Penola**	**Pump Station**	Asset Operator	Consistency in assets to enable cost effective maintenance and renewals	Standardisation in pump stations	No standardisation and inconsistency in pumps and pump controls	No	Economic	Possible	Minor	**Medium (M10)**		Possible	Minor	**Medium (M10)**	Penola has 14 mono pump stations and 4 submersible pump stations all with different pumps and controls. High number of pump stations due to flat topography.	T36 - Develop and implement pump station design standards and specifications for future pump station construction
P6	Pump Station	**Penola**	**Pump Station**	Asset Owner	Infrastructure is fit for purpose	Pump station is not fit for purpose	Pump station not fit for purpose increasing maintenance costs and risk of incidents	No	Stakeholder Service Levels	Almost certain	Moderate	**High (H20)**	Reactive maintenance Monitoring of pump station	Likely	Moderate	**High (H18)**	Penola pump station No. 18 is not fit for purpose	T09 - Undertake a capacity and demand assessment of the CWMS systems once the Strategic Land Use Plan has been officially adopted
S1	CWMS	**Southend**	**Network**	Asset Owner	No loss of service	Climate change	Coastal erosion and inundation	No	Economic	Possible	Major	**High (H17)**	Monitoring erosion and identifying assets that may be impacted so they can be relocated early rather than in emergency works. Coastal adaptation plan for Southend.	Possible	Moderate	**Medium (M11)**		

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S2	CWMS	**Southend**	**All**	Asset Operator	No loss of service	Power outage	During winter months and high rainfall power outage occurs leading to overflow Power turned off by supplier due to bushfire risk leading to overflow	No	Environmental	Possible	Major	**High (H17)**	Local contractor has 2 generators set aside for Council who have priority access for hire Access to generators available when need is identified The 2 pump stations and treatment plant have generator plug in points built in to allow generator connection	Possible	Minor	**Medium (M10)**	Southend is end of line for power grid therefore any incidents on the grid prior to Southend result in loss of power at Southend	T26 - Investigate generator hire and costs agreement to ensure that it is current
S3	CWMS	**Southend**	**All**	Asset Operator	No loss of service or spills or releases to the environment	Influx of visitors to town during holidays	Peak flows during holidays exceeding capacity of CWMS	No	Environmental	Possible	Moderate	**Medium (M11)**	Reactive maintenance Monitoring and alarms Lagoon operating levels managed to ensure freeboard is available	Possible	Minor	**Medium (M10)**		

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
S4	Lagoons	**Southend**	**Treatment**	Asset Operator	Treatment of wastewater to meet legislative and license requirements	Release of live crayfish storage tank water into system	Occurs roughly twice a year and the salt water release modifies the wastewater quality which in turn affects the biological treatment of the wastewater	No	Economic	Likely	Minor	**Medium (M13)**		Likely	Minor	**Medium (M13)**	Southend is a biological treatment process that relies on microbes to treat the wastewater as a result the microbes are sensitive to changes in wastewater quality resulting in poor or ineffective treatment if their balance is affected	T37 - Investigate the license requirements particularly in relation to discharges from the commercial enterprise with the live crayfish to ensure that their discharges are meeting their license. Then investigate options to have an agreement with the business regarding their discharges. Perhaps notifications prior to or slow release could be investigated to avoid shock to the treatment process.T41 - Investigate alternate treatment options and/or treatment plant upgrade options

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
S5	Lagoons	**Southend**	**Treatment and Irrigation**	Asset Owner	Infrastructure is safeguarded	Climate change	Bushfire destroys WWTP due to proximity to National Park	No	Economic	Possible	Catastrophic	**Extreme (E21)**	Preventative maintenance. Regular slashing of irrigation area and vegetation surrounding the WWTP and pump stations Business Continuity Plan for bushfire event in Southend impacting WWTP	Unlikely	Catastrophic	**High (H16)**		
S6	Network	**Southend**	**Maintenance Shaft**	Asset Operator	Available maintenance shafts in the network to enable inspections and maintenance to be performed as required	No access to network through maintenance shafts	Access to pipes for inspections and/or maintenance is not available through maintenance shafts and only through excavations	Yes	Economic	Possible	Minor	**Medium (M10)**	Septic tank pump out every 4 years	Possible	Minor	**Medium (M10)**	There are only 2 maintenance shafts in Southend located at each of the pump stations. There are no maintenance shafts in the wider network.	T38 - Investigate and plan a capital project to install maintenance shafts in the Southend network to enable inspections and maintenance to be performed without excavations
S7	Network	**Southend**	**Property connections**	Asset Operator	Capacity of CWMS is not exceeded	Inflow of stormwater from properties during rain season	Properties have illegal connections of stormwater to the wastewater network resulting in excess flow during rain season	Yes	Environmental	Possible	Minor	**Medium (M10)**		Possible	Minor	**Medium (M10)**		T39 - Investigate stormwater connections to the CWMS

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
S8	Pump Station	**Southend**	**Level Sensor**	Asset Operator	Capacity of CWMS is not exceeded	Peak use and/or inflow of stormwater	High flow of water into the system leading to high levels and potential to exceed capacity leading to overflow	No	Environmental	Possible	Minor	**Medium (M10)**	Level sensors in pump station wet wells for LL, HL and HHL which alarm to Technical Officer. Level sensors on treatment plant tanks which alarm to Technical Officer. Float sensor on lagoon. 1 day storage pump stations and network. More than 2 days storage at treatment plant.	Rare	Minor	**Low (L2)**		
S9	Treatment Plant	**Southend**	**Pump**	Asset Operator	No loss of service	Mechanical failure	Mechanical failure of pump resulting in the inability to run treatment plant	No	Economic	Possible	Moderate	**Medium (M11)**	Reactive maintenance. Contractors available for emergency pump out. Capacity in network to hold wastewater to provide time to undertake repairs 1 day storage pump stations and network. More than 2 days storage at treatment plant.	Possible	Minor	**Medium (M10)**	No back up or spare submersible pumps/parts for Southend treatment plant	T23 - Review critical spares and spares lists for in stock / on shelf requirements to ensure maintenance requirements can be met in timely manner

ID				STAKEHOLDER DRIVERS		HAZARD				MAXIMUM RISK - NO INTERVENTION			PREVENTATIVE MEASURES	RESIDUAL RISK - AFTER INTERVENTION			RISK TREATMENT	
Risk ID	CWMS Element	Location	Component	Stakeholder	Stakeholder Desired Outcome	Hazardous Event & Source of Hazardous Event	Description of Risk	Hidden ?	Risk Category / Driver	Likelihood	Conseq.	Risk	INTERVENTION	Likelihood	Conseq.	Residual Risk	Comments	Action/Task
S10	Treatment Plant	**Southend**	**SBR**	Asset Operator	No loss of service	Winter season adversely effects the microbes that are used for treatment of wastewater	Poor effluent quality as microbes are not performing optimally	No	Economic	Likely	Moderate	**High (H18)**	Preventative maintenance. At the end of each winter season the treatment microbes are pumped out and the SBR is reseeded with a new culture of microbes water quality testing and limit irrigation when quality is poor. Restricted access for public to irrigation area	Unlikely	Minor	**Low (L5)**		T40 - Ensure this process is documented in the Operational Manual for Southend CWMS

Appendix 3 Improvement Program

Task	Task Description	Responsibility	Resources Required	Proposed Commencement Date	Status
A1	Consider whether the risk is in the quality measures being exceeded or if the risk is really in releasing to the environment or public, which we definitely mitigate	Manager Assets & Environment	Manager Assets & Environment	N/A	Proposed
A2	Consider remote monitoring of inflows to monitor trends	Manager Assets & Environment	Technical Officer	N/A	Proposed
A3	Investigate useful life of HDPE liners and technology available for condition assessment.	Manager Assets & Environment	Senior Engineer	N/A	Proposed
A4	Move groundwater quality data from spreadsheets on server to AM system	Manager Assets & Environment	Senior Asset Management Officer	N/A	Proposed
A5	Notification to residents that there is infrastructure on their property.	Manager Assets & Environment	Senior Engineer & Communications Officer	N/A	Proposed
T01	Develop/update CWMS Operations Manuals	Manager Assets & Environment	Senior Asset Management Officer	Jan-23	Proposed
T02	Train additional staff. Formal qualifications in wastewater Operations.	Manager Assets & Environment	Registered Training Organisation	Jan-23	Proposed
T03	Initiate and maintain good records	Manager Assets & Environment	Technical Officer & Senior Asset Management Officer	Aug-22	Proposed
T04	Implement project to locate and CCTV wastewater pipes for all CWMS (capture pipe length, pipe diameter, pipe material, pipe condition, defects (location and description, jump ups (location and status)) and provide CCTV footage for records)	Manager Assets & Environment	Technical Officer & Senior Asset Management Officer	Jul-22	Proposed
T05	Implement project to undertake maintenance shaft / manhole inspections (capture depth, diameter, type/material, condition, defects (description))	Manager Assets & Environment	Technical Officer & Senior Asset Management Officer	Jul-23	Proposed
T06	Implement project to condition audit aboveground infrastructure	Manager Assets & Environment	Technical Officer & Senior Asset Management Officer	Aug-22	Proposed
T07	Undertake desktop study of property connections to ascertain location and billing and develop corrected asset register	Manager Assets & Environment	Technical Officer & Senior Asset Management Officer & Senior Engineer	Jan-23	Proposed

Task	Task Description	Responsibility	Resources Required	Proposed Commencement Date	Status
T08	Review fees and charges along with live property connections to understand revenue cost ratios and sustainability of the systems	Manager Financial Services	Manager Assets & Environment, Technical Officer & Senior Asset Management Officer	Jul-23	Proposed
T09	Undertake a capacity and demand assessment of the CWMS systems once the Strategic Land Use Plan has been officially adopted	Manager Assets & Environment	Senior Engineer	TBA	Proposed
T10	Kalangadoo - Document decision and have it passed through Council that future large scale or industrial development will accommodate on site waste management systems	Manager Assets & Environment	Senior Engineer	Jan-23	Proposed
T11	Investigate options for renewal of HDPE liners (all likely to require replacement around the same time)	Manager Assets & Environment	Senior Engineer & Technical Officer	Jul-23	Proposed
T12	Budget for sludge monitoring in lagoons	Manager Assets & Environment	Senior Engineer	TBA	Proposed
T13	Install cap on lagoon outlet pipe in Kalangadoo to prevent turtles accessing	Manager Assets & Environment	Technical Officer	TBA	Proposed
T14	Establish a scheduled maintenance task for pipe flushing. Ensure this occurs post septic tank pump out and prior to pump station pump out.	Manager Assets & Environment	Senior Engineer & Technical Officer	TBA	Proposed
T15	Develop and document clear roles and responsibilities for management and oversight of trade waste discharging commercial clients	Manager Development Services	Environmental Health Officer	Aug-22	Proposed
T16	Training for staff on Water Industry Act powers.	Manager Assets & Environment	TBA	Aug-22	Proposed
T17	Develop policy for no construction over infrastructure to assist planning team	Manager Assets & Environment	Senior Asset Management Officer & Manager Development Services	Aug-22	Proposed
T18	Establish a scheduled maintenance task for pump station pump out. Also look at ensuring pump station pump occurs post septic tank pump out and mains flushing program.	Manager Assets & Environment	Technical Officer	TBA	Proposed

Task	Task Description	Responsibility	Resources Required	Proposed Commencement Date	Status
T19	Implement project to collect data on pumps at each pump station	Manager Assets & Environment	Technical Officer & Senior Asset Management Officer	Aug-22	Proposed
T20	Investigate option for smoke testing to be undertaken in Penola network to identify illegal connections	Manager Assets & Environment	Technical Officer	TBA	Proposed
T21	Check every site has generator plug for easy use (can always be hardwired in by an electrician).	Manager Assets & Environment	Technical Officer	TBA	Proposed
T22	Budget for monthly inspections	Manager Assets & Environment	Manager Assets & Environment	TBA	Proposed
T23	Review critical spares and spares lists for in stock / on shelf requirements to ensure maintenance requirements can be met in timely manner, Check list of replacement parts available. Replace as used for critical pumps/parts with long lead time	Manager Assets & Environment	Technical Officer	TBA	Proposed
T24	Develop and implement carbon filter assessment and renewal program	Manager Assets & Environment	Senior Engineer & Technical Officer	TBA	Proposed
T25	Coastal adaptation plan for Beachport to consider wastewater infrastructure	Manager Assets & Environment	Senior Engineer	TBA	Proposed
T26	Investigate generator hire and costs agreement to ensure that it is current	Manager Assets & Environment	Technical Officer	TBA	Proposed
T27	Consider installation of flowmeter at lagoon inlet to reconcile flow totals from Pump Station No.4 in Beachport	Manager Assets & Environment	Technical Officer	TBA	Proposed
T29	Investigate options for handover of private pump stations to land owner and implement handover in Beachport	Director Engineering Services	Manager Assets & Environment & Senior Engineer	Jul-24	Proposed
T30	Risk to be eliminated by removing asbestos baffles in Kalangadoo	Manager Assets & Environment	Senior Engineer	Jul-23	Proposed
T31	Investigate options for diversion of stormwater from oval to an alternate location than WWTP through rising main at Kalangadoo.	Manager Assets & Environment	Senior Engineer	Jul-23	Proposed
T32	Kalangadoo pump station upgrade needed to ensure alarms can be received as auto-dialler units are at end of life.	Manager Assets & Environment	Senior Engineer	Jul-23	Proposed

Task	Task Description	Responsibility	Resources Required	Proposed Commencement Date	Status
T33	Investigate and implement a decommissioning plan for the treatment plant and other infrastructure not in use at Kalangadoo	Manager Assets & Environment	Senior Engineer	Jul-29	Proposed
T34	Investigate option to send treated wastewater to wetland in place of irrigation system in Penola	Director Engineering Services	Manager Assets & Environment & Senior Engineer	Jul-23	Proposed
T35	Investigate options and/or operational philosophy that can be applied at Penola to enable maintenance to be performed safely on the wastewater network	Manager Assets & Environment	Senior Engineer & Technical Officer	TBA	Proposed
T36	Develop and implement pump station design standards and specifications for future pump station construction	Manager Assets & Environment	Senior Engineer & Technical Officer	TBA	Proposed
T37	Investigate the license requirements particularly in relation to discharges from the commercial enterprise with the live crayfish in Southend to ensure that their discharges are meeting their license. Then investigate options to have an agreement with the business regarding their discharges. Perhaps notifications prior to or slow release could be investigated to avoid shock to the treatment process.	Manager Assets & Environment	Senior Engineer & Technical Officer	TBA	Proposed
T38	Investigate and plan a capital project to install maintenance shafts in the Southend network to enable inspections and maintenance to be performed without excavations	Manager Assets & Environment	Senior Engineer, Engineer & Project Manager	Jul-29	Proposed
T39	Investigate stormwater connections to the CWMS	Manager Assets & Environment	Senior Engineer, Engineer & Project Manager	TBA	Proposed
T40	Ensure the reseeding process is documented in the Operational Manual for Southend CWMS	Manager Assets & Environment	Senior Asset Management Officer	Jan-23	Proposed
T41	Investigate alternate treatment options and/or treatment plant upgrade options	Manager Assets & Environment	Senior Engineer, Engineer & Project Manager	Jul-27	Proposed

Task	Task Description	Responsibility	Resources Required	Proposed Commencement Date	Status
T42	Budget for ladder renewal at all sites as these all will be end of life at the same time	Manager Assets & Environment	Senior Engineer, Engineer & Project Manager	Jul-26	Proposed
T43	Budget funds to renew electronics within the CWMS network and treatment sites	Manager Assets & Environment	Senior Engineer, Engineer & Project Manager	Jul-22	Proposed

Appendix 4 Forecast Capital Projects

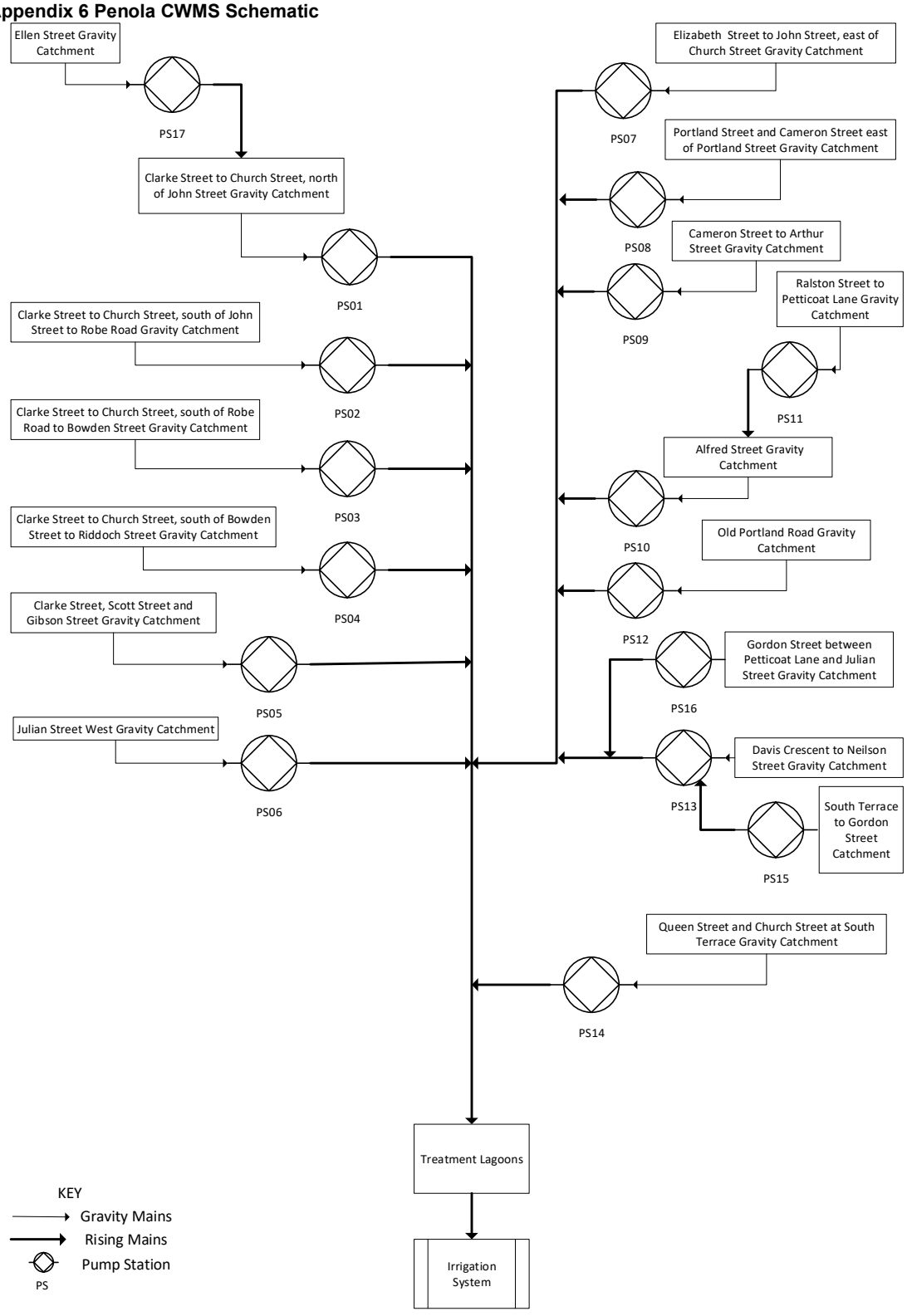
Location	Description	Forecast Financial Year of commencement	Driver
Beachport	Replacement of irrigation sprinklers as needed (end of remaining useful life but run-to-fail approach being applied) Estimate replacement of 5 sprinklers and solenoids per year ~ $5k each with a 5 year useful life	2023-24	At end of useful life
Beachport	Replacement of both submersible pumps in PS4	2029-30	At end of useful life
Beachport	Replacement of irrigation pump (coastal environment, run intermittently, sewerage, reduce useful life to 14 years based on experience at Penola)	2030-31	At end of useful life
Beachport	Replacement of pump station controllers - 8@ ~$20k each	2027-28	Improvement Program T43
Beachport	Replacement of 20 ladders in the lagoons ~ $4k each (Useful life estimated 20 years but high UV, sewerage, wet & dry reduce to 10 years)	2026-27	Improvement Program T42
Penola	Replacement of all irrigation sprinklers (potentially with alternate approach)	2023-24	At end of useful life
Penola	Upgrade all pump station controllers over 10 year period 18@ ~$20k each	2023-24	Improvement Program T43
Penola	Replacement of pump station pumps as needed base on failure estimated 2 per year @ $5k each	2023-24	Failure mode
Penola	Replacement of ladders in the lagoons (replace plastic welded with rope @ same time as Beachport estimated 22 ladders @ $4k each)	2026-27	Improvement Program T42
Penola	Manhole replacement program $4k each (3 in first year, 5 per year for future years to enable CCTV)	2023-24	Improvement Program T05
Penola	Renewal of underground infrastructure including pipes and valves over 15 years	2031-32	Improvement Program T04
Kalangadoo	Replacement of sheds ($20k each), controllers ($20k each), switchboards ($5k each) and SCADA for both pump stations in the same year	2023-24	Improvement Program T32
Kalangadoo	Replacement of Asbestos Separation Fences in oxidation lagoon	2024-25	Improvement Program T30
Kalangadoo	Replacement of irrigation system (likely to be alternate approach to current set up)	2024-25	Improvement Program T31

Location	Description	Forecast Financial Year of commencement	Driver
Kalangadoo	Renewal of WWTP (if alternate approach not adopted prior)	2029-30	Improvement Program T31 & T33
Kalangadoo	Replace ladders in storage lagoon @ same time as Penola & Beachport ~$4k each x 6	2026-27	Improvement Program T42
Southend	Treatment plant upgrade and replacement of all irrigation sprinklers and pipework	2027-28	Improvement Program T41
Southend	Replacement of 1 large pump ($10k) in PS1 and 2 smaller pumps in PS2 ($10k)	2023-24	At end of useful life
Southend	Replacement of pump station controller ($20k), switchboards ($5k) at both pump stations	2022-23	Improvement Program T43
Southend	Installation of additional maintenance shafts	2029-30	Improvement Program T38
Southend	Replacement of ladders in the lagoon $4k x 4	2026-27	Improvement Program T42

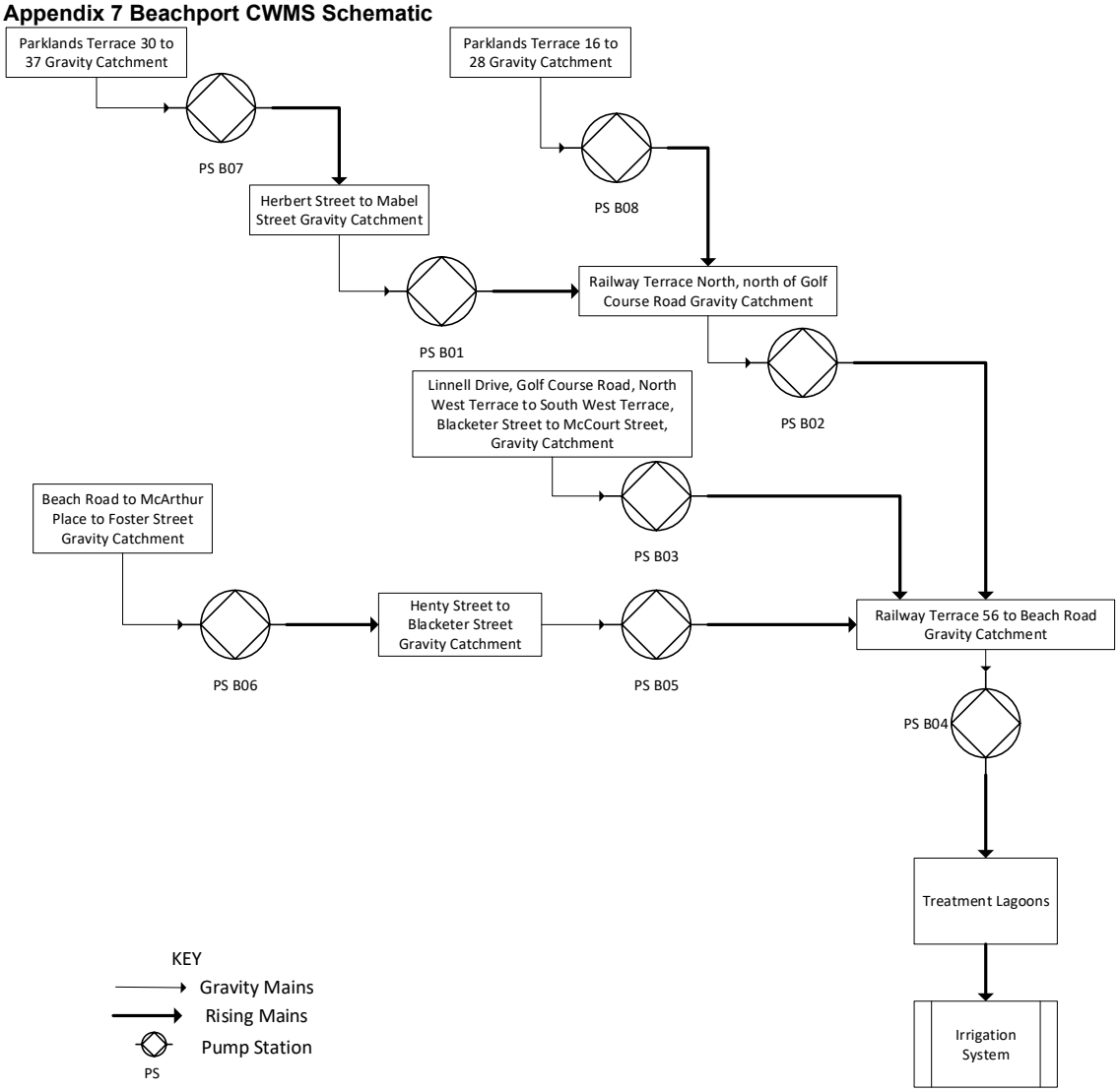
Appendix 5 Forecast Operational Projects

Location	Description	Forecast Financial Year of commencement	Driver
Beachport	Negotiate transfer of ownership for 5 private pump stations (may include one off payment to landholder ~$5k each + legal costs)	2024-25	Improvement Program T29
Penola	Location and condition assessment of underground infrastructure (CCTV Project)	2022-23	Improvement Program T04
Penola	Investigation and options study into irrigation infrastructure and wetland opportunities	2023-24	Improvement Program T34
Kalangadoo	Location and condition assessment of underground infrastructure (CCTV Project)	2024-25	Improvement Program T04
Kalangadoo	Investigation and options study into irrigation infrastructure regarding ownership opportunities and options for replacement of asbestos separation fences	2023-24	Improvement Program T30 & T31
Southend	Location and condition assessment of underground infrastructure (CCTV Project)	2025-26	Improvement Program T04
Southend	Review of WWTP and design for renewal	2023-24	Improvement Program T41
Southend	Regular replacement of sprinklers as maintenance (lower value set up than other schemes)	2023-24	At end of useful life
All Sites	Condition assessment and revaluation	2023-24	Improvement Program T04, T05 and T06
All Sites	Investigation of HDPE liner life, techniques for condition assessment and renewal options	2023-24	Improvement Program T11

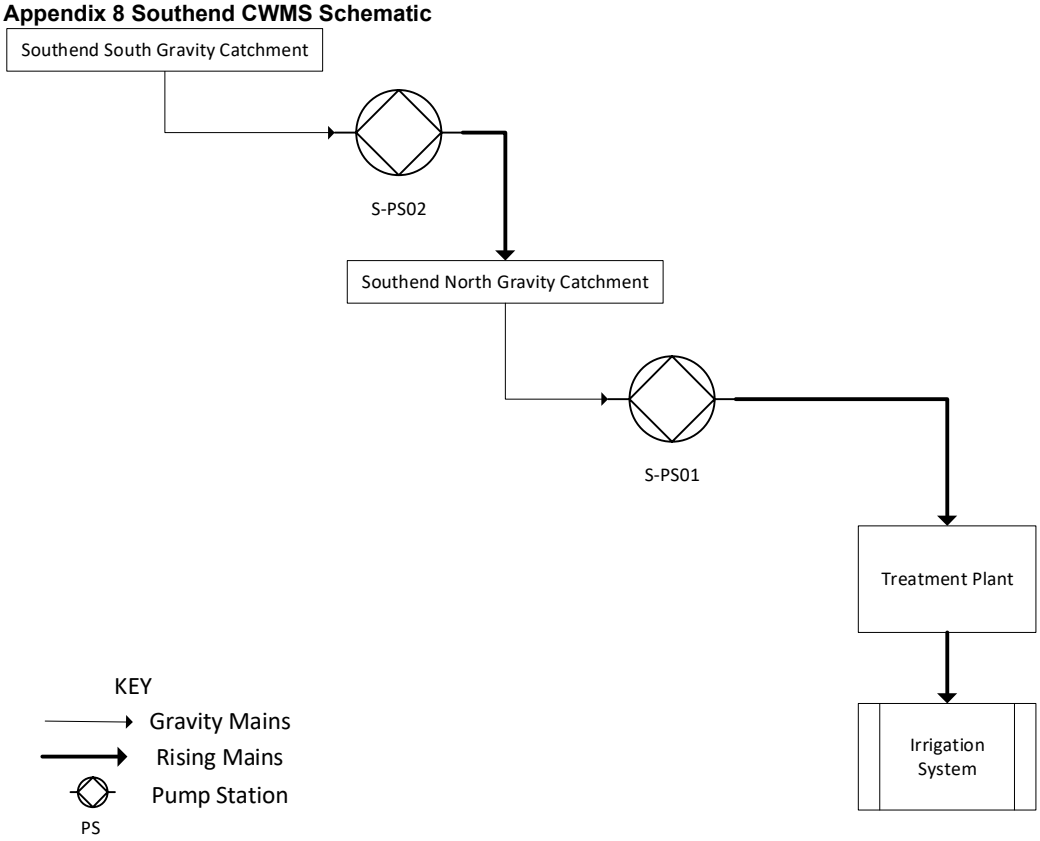
Appendix 6 Penola CWMS Schematic



Appendix 7 Beachport CWMS Schematic



Appendix 8 Southend CWMS Schematic



Appendix 9 Kalangadoo CWMS Schematic