NSW GOVERNMENT | Public Works Advisory

Wingecarribee Shire Council

Integrated Water Cycle Management Strategy

Report Number: PWASR - 18002

September 2018

WINGECARRIBEE SHIRE COUNCIL

A division of the Department of Finance, Services and Innovation

Wingecarribee Shire Council

Integrated Water Cycle Management Strategy

Report Number: PWAISR - 18002

Document Control

Version	Author	Reviewer	Approved for Issue	
			Name	Date
Draft 1	G. Fernandes, G. Clemens	M Sundar	G. Fernandes	29/03/18
Final Draft	G. Fernandes	M Sundar	G. Fernandes	24/04/18
Final	G Fernandes	M Sundar	G Fernandes	21/09/18

Glenn Fernandes

Principal Engineer – Planning (Water Utilities)

Level 3 Foreshore House

66 Harrington Street

Sydney NSW 2000

T: 02 9240 8751

E: glenn.fernandes@finance.nsw.gov.au

W: www.publicworks.nsw.gov.au

Cover Photo: Robertson (australiaforeveryone.com.au/nsw/southern-highlands)

© Crown in right of NSW through the Department of Finance, Services and Innovation 2017

This publication is copyright and may incorporate moral rights of an individual. Other than for the purposes of and subject to the conditions prescribed under the Copyright Act, no part of it may, in any form or by any means, be reproduced, altered, manipulated, stored in a retrieval system or transmitted without prior written consent of the copyright owner or owner of moral rights. Any inquiries relating to consents and use of this publication, including by NSW Government agencies must be addressed to Public Works Advisory.

While this publication has been formulated with all due care, the State of New South Wales does not warrant or represent that the report is free from errors or omissions, or that it is exhaustive. The State of NSW disclaims, to the extent permitted by law, all warranties, representations or endorsements, express or implied, with regard to this publication including but not limited to, all implied warranties of merchantability, fitness for a particular purpose, or non-infringement. The State of NSW further does not warrant or accept any liability in relation to the quality or accuracy of this publication and no responsibility is accepted by the State of NSW for the accuracy, currency, reliability and correctness of any information in this publication provided by the client or third parties.

A division of the Department of Finance, Services and Innovation

Executive Summary

Introduction

The Integrated Water Cycle Management (IWCM) Strategy addresses two elements of the Best-Practice Management of the Water Supply and Sewerage Framework. It is a local water utility's (LWU's) 30-year strategy for the provision of appropriate, affordable, cost-effective and sustainable urban water services that meet community needs and protect public health and the environment. Preparation of an IWCM Strategy will also enable Council to comply with the NSW Government's Best-Practice Management of the Water Supply and Sewerage Framework.

The development of Council's IWCM has followed the DI Water methodology outlined in the IWCM Strategy Check List (July 2014). The following studies have been completed to date.

- **IWCM Issues Paper** – identifying the IWCM Issues
- **IWCM Options Review Paper** – assessing the options to address the issues
- **IWCM Scenarios** – evaluating the IWCM scenarios

This IWCM Strategy report contains a summary of all the outcomes. It outlines the adopted IWCM Scenario and includes a Total Asset Management Plan (TAMP) and a Financial Plan (FP).

The IWCM Issues

The key issues impacting on Wingecarribee Shire Council's water supply schemes are:

- Capacity – By 2031 the Peak Day Demand is predicted to be very close to the combined production capacities of the WTPs thus compromising the Levels of Service during peak demand periods.
- A number of reservoirs operate with relatively high differential head which presents a risk in meeting the supply pressure.
- The water supply scheme may not be able to supply the bush firefighting requirements and should be reflected in the adopted Levels of Service.

The key issues impacting on Wingecarribee Shire Council's sewerage schemes are:

Berrima STP

- Algal bloom is an issue in the tertiary pond which leads to an exceedance of the effluent pH limit.
- There have been a few exceedances of daily effluent volume limit due to high rainfall resulting in higher inflows to the plant.

Bowral STP

- There have been repeated exceedances of effluent concentration limits for total nitrogen and some for total phosphorous due to high loadings at the treatment plant.
- There has also been an exceedance of the load limit for Total Suspended Solids.
- The hydraulic capacity of the STP is expected to be exceeded by 2025.

Mittagong STP

- There has been an exceedance of the 50th percentile concentration limit for total Nitrogen due to potentially high concentration loadings being received at the plant.
- The hydraulic capacity of the plant is expected to be exceeded by 2035.

Moss Vale STP

- The load limit of total Nitrogen was exceeded due to high rainfall.
- There have been repeated exceedances of the daily volume limit due to high rainfall.

- The hydraulic capacity of the plant is expected to be exceeded by 2020 depending on the growth in the Moss Vale Enterprise Corridor (MVEC).

Shire-Wide IWCM Scenarios

Feasible options to address the IWCM issues were evaluated and assessed. The shortlisted options were combinedin to five Shire-wide IWCM Scenarios. The scenarios address all the identified issues. All scenarios have common management system measures which relate to data and information management. The scenarios may be modified to reflect the priorities and preferences of individual communities and as a result of additional information and knowledge becoming available from ongoing investigations. Figure S1 presents the combined typical residential bills for water supply and sewerage services for the five Shire-wide IWCM scenarios.

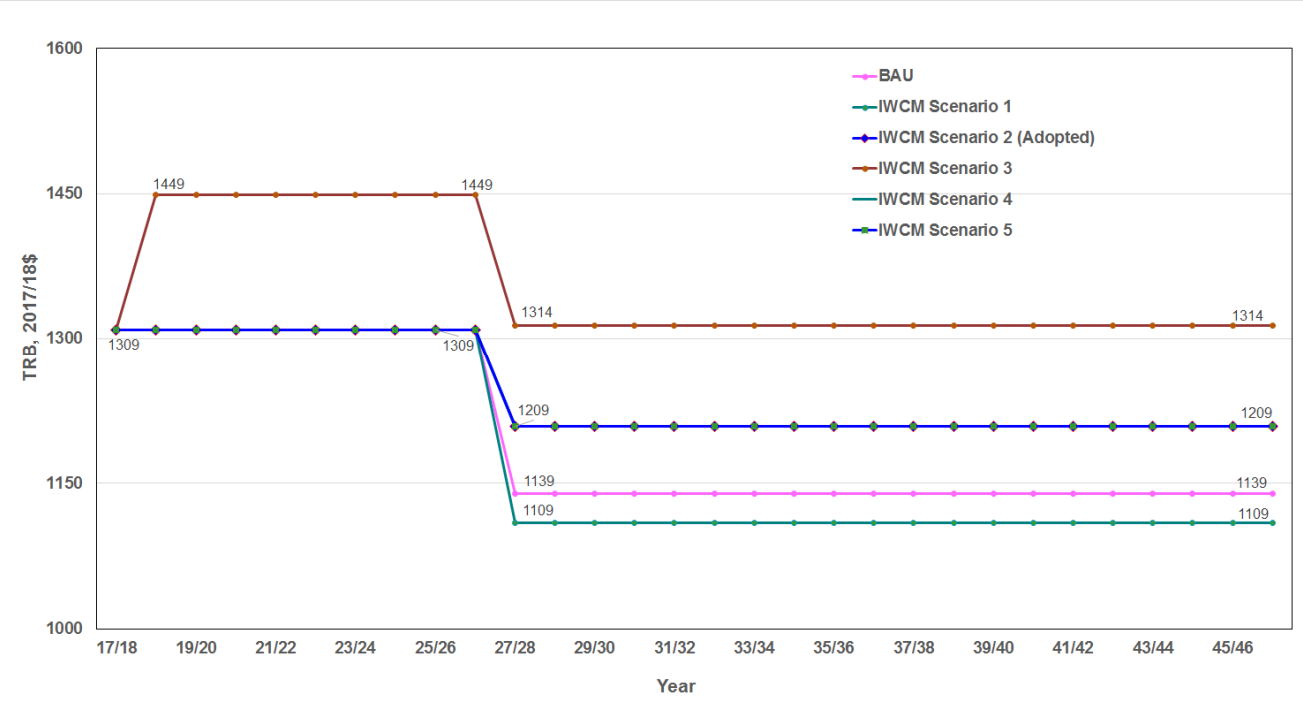

Figure S1: Combined Water + Sewerage TRBs for IWCM Scenarios

Table S1 shows the outcome of the Triple Bottom Line analysis for each IWCM Scenario

Table S1: IWCM Scoring Ranking

Scenario	30-year Total Present Value ($M)	ESS	ESS/NPV	Rank
Scenario 1	80.55	4.85	0.060	4
Scenario 2	96.82	7.10	0.073	1
Scenario 3	132.97	7.55	0.057	5
Scenario 4	100.31	6.35	0.063	3
Scenario 5	97.38	6.95	0.071	2

According to the assessment and ranking criteria used above, the preferred Shire Wide IWCM Scenario is Integrated Scenario 2. Table S2 provides a summary of the measures included in each scenario.

Table S2: Shire Wide IWCM Scenarios – Headworks augmentation

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
Water Supply Systems							
System Capacity	By 2031 the PDD for the Shire is predicted to be very close to the combined production capacities of Bundanoon and Wingecarribee WTPs.	Upgrade and retain Medway WTP Augment Wingecarribee WTP in 2041				✓	
		Decommission Medway WTP Augment Wingecarribee WTP in 2031	✓	✓	✓		
		Decommission Medway WTP Supply part of Moss Vale demand from Bundanoon WTP. Augment Bundanoon WTP in 2023 (2020 – 2030)					✓
Bowral Sewage Treatment Plant							
Regulatory	Exceedances of EPA license limits for total nitrogen and total phosphorous	Operate the plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. Decommission the Pasveer channels and build a new 9,000 EP capacity reactor. No NorBE compliance considered.	✓	-	-		

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
Capacity – biological and nutrient loading	The plant is currently operating close to its capacity for biological and past its capacity for nutrient loading	Operate plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. This will reduce the capacity of the IDEA reactor to approximately 10,000 EP. Decommission the Pasveer channels and build a new 9,000 EP capacity reactor. <u>NorBE Compliance</u>: Upgrade tertiary filtration system for TP compliance. Provide chlorination/ dechlorination system for enhanced TN removal.	-	✓	-	✓	✓
Capacity - hydraulic	The plant is currently operating close to its hydraulic capacity.	Construct a new common STP to treat sewage from Berrima, Moss Vale and Bowral with NorBE compliance. Stage 1: 34,000 EP Stage 2: 51,000 EP (between 2020 and 2030 depending on MVEC development)	-	-	✓		
Mittagong Sewage Treatment Plant							
Capacity – biological and nutrient loading.	The plant is currently operating at its design capacity for biological and nutrient loading	Operate the plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility.	✓	✓	✓	✓	✓
		Build a new 5,000 EP capacity reactor in 2022. No NorBE compliance considered.	✓	-	-		

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
		Build a new 5,000 EP capacity reactor in 2022. <u>NorBE Compliance:</u> Upgrade tertiary filtration system for TP compliance. Provide chlorination/ dechlorination system for enhanced TN removal.	- -	✓ ✓	✓ ✓	✓ ✓	✓ ✓
Moss Vale Sewage Treatment plant							
Capacity – biological and nutrient loading. Capacity - hydraulic	The plant is currently operating close to its design capacity for biological and nutrient loading The plant is operating close to its hydraulic capacity	Operate the plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. Stage 1: Build a new 12,500 EP capacity reactor. Stage 2: Build another 12,500 EP reactor (this could be in 2025 or 2030 depending on the development of the MVEC) No NorBE compliance considered.	✓	-	-		

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
		Operate plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. Stage 1: Build a new 12,500 EP capacity reactor. Stage 2: Build another 12,500 EP reactor (this could be in 2025 or 2030 depending on the development of the MVEC) <u>NorBE Compliance:</u> Upgrade tertiary filtration system for TP compliance. Provide chlorination/ dechlorination system for enhanced TN removal.	-	✓	-	✓	✓
		Construct a new common STP to treat sewage from Berrima, Moss Vale and Bowral with NorBE compliance. Stage 1: 34,000 EP Stage 2: 51,000 EP (between 2020 and 2030 depending on MVEC development)	-	-	✓		

Long-term Financial Plans

Council's current Total Asset Management Plan for Water and Wastewater has been updated to include the growth and ILOS capital works identified to address the IWCM issues by the adopted strategy. Financial models for water and sewer funds of the Wingecarribee Shire Council for the adopted IWCM strategy have been developed to forecast the lowest, sustainable price path for the water supply and sewerage services on which to base Council's tariff structure. The adopted IWCM scenario does not consider government grant or subsidy for any of the planned capital works for the financial modelling purposes. The financial projections need to be reviewed annually with respect to material changes to the proposed capital works program and/or changes to any of the underlying assumptions.

The water fund financial model has demonstrated that the current (2017/18) water supply TRB of $489 p.a. can be maintained at the current level for all the remaining forecast years with ongoing annual adjustments for CPI / inflation. The levels of TRB, cash and borrowing outstanding during the forecast period for the water fund are depicted in the figure below.

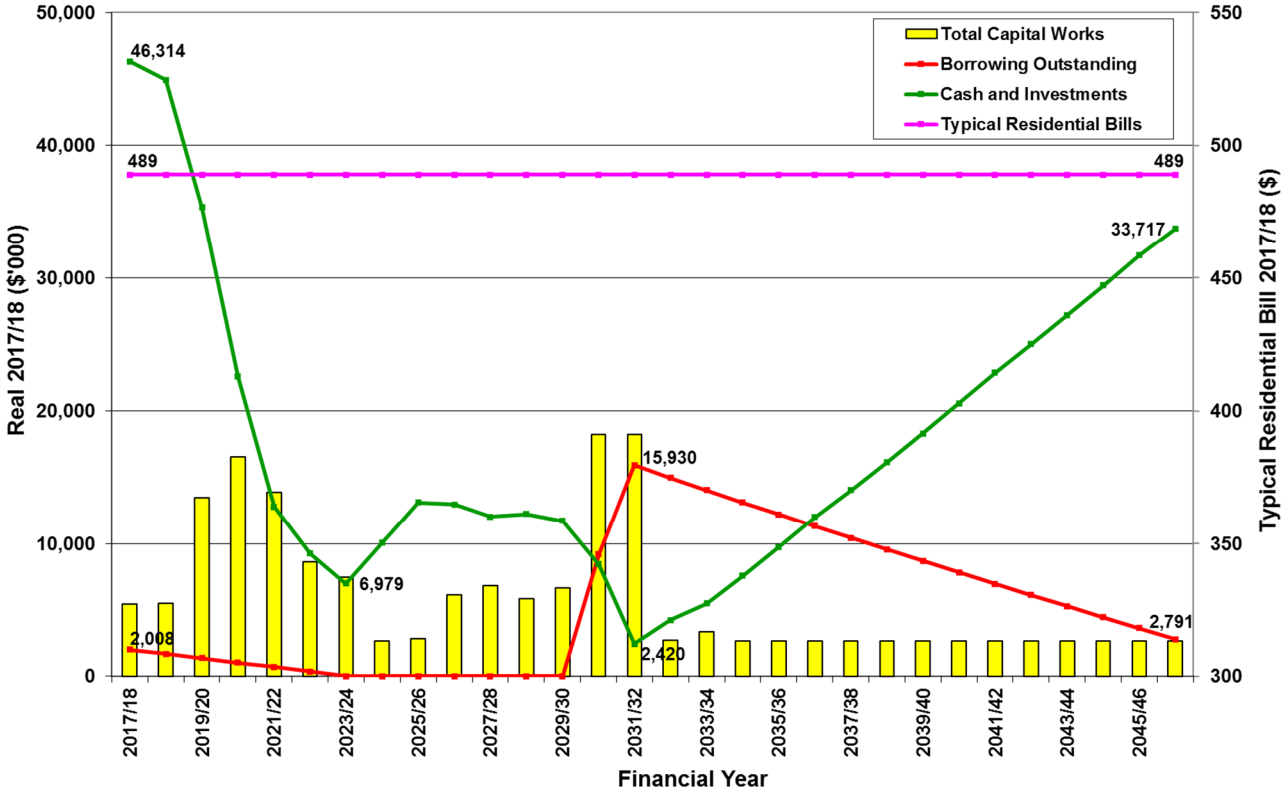

Figure S2: Water Fund Financial Model Forecasts for the adopted IWCM Scenario

The sewer fund financial model for the adopted IWCM scenario shows that the sewerage TRB can be maintained at the current level of $820 p.a. for the next nine years (till 2026/27) and can be decreases by $100 to $720 p.a. in 2027/28. Sewerage TRB can be maintained at the reduced level for the remainder of the forecast period. The levels of TRB, cash and borrowing outstanding during the forecast period for the sewer fund are depicted in the figure next page.

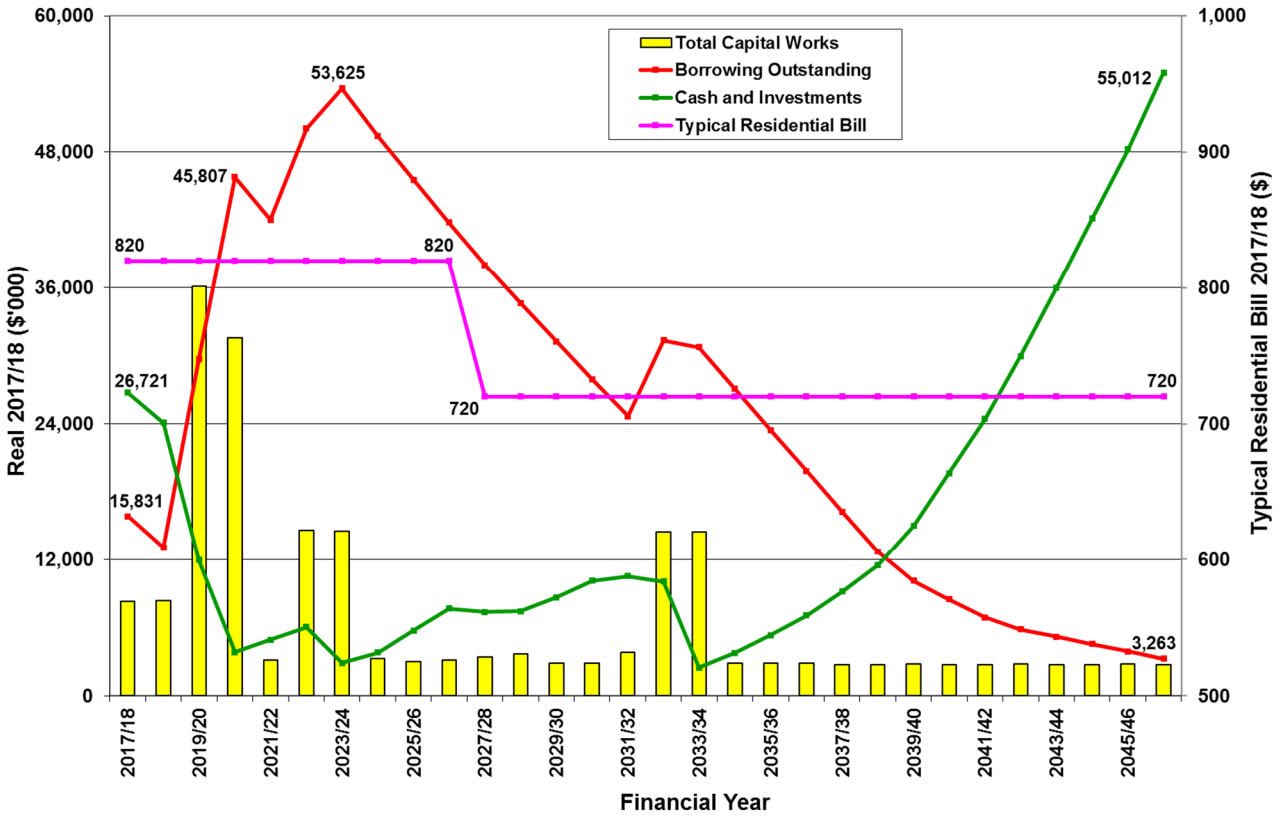

Figure S3: Sewer Fund Financial Model Forecasts for the adopted IWCM Scenario

The projected level of charges is sufficient to maintain liquidity with a minimum of $2,000 K of cash in hand in each of the water and sewer funds over the forecast period.

Strategy Review Cycle

Although this IWCM Strategy has been developed for a planning period of 30 years, the strategy should be reviewed in 8 years.

Contents

Executive Summary i
Introduction i
The IWCM Issues i
Shire-Wide IWCM Scenarios ii
Long-term Financial Plans 1
Strategy Review Cycle 2
Contents 3
1 Context 8
2 Introduction 9
2.1 Overview 9
2.2 Background to Wingecarribee Shire Council's IWCM Strategy 9
2.3 Progress 9
3 Description of Wingecarribee Shire 10
3.1 Overview 10
3.2 Water Catchments 10
3.2.1 Wingecarribee Reservoir catchment 11
3.2.1 Bundanoon Creek Dam catchment 11
3.2.2 Medway Dam catchment 11
4 Description of Urban Water Services 12
4.1 Overview 12
4.2 Water Supply System 12
4.2.1 Wingecarribee Water Supply Scheme 14
4.2.2 Bundanoon Water Supply Scheme 14
4.2.3 Medway Water Supply Scheme 14
4.2.4 Water distribution systems 14
4.3 Sewerage Schemes 16
4.3.1 Berrima Sewerage Scheme 16
4.3.2 Bowral Sewerage Scheme 16
4.3.3 Bundanoon Sewerage Scheme 17
4.3.4 Mittagong Sewerage Scheme 18
4.3.5 Moss Vale Sewerage Scheme 19
4.3.6 Robertson Sewerage Scheme 20
4.3.7 Sewer reticulation network 21
4.4 Unserviced Areas 22
5 Population and Demographic Projection 23
5.1 Overview 23
5.2 Moss Vale Enterprise Corridor 23

5.3 Population projections 23
6 Water Demand Projection and Capacity Issues 25
6.1 Historical analysis 25
6.2 Firefighting 26
6.3 Moss Vale Enterprise Corridor 26
6.4 Water supply projections 26
6.5 Headworks Capacity assessment 27
6.6 Secure Yield and drought reliability 27
6.6.1 Wingecarribee Reservoir 28
6.7 Water distribution issues 28
7 Sewage Load Projection and Capacity Issues 30
7.1 Historical data 30
7.2 Sewer Flows and Projections 32
7.3 Sewage Treatment Plant Capacity Assessments 32
7.3.1 Berrima Sewage Treatment Plant 33
7.3.2 Bowral Sewage Treatment Plant 33
7.3.3 Bundanoon Sewage Treatment Plant 33
7.3.4 Mittagong sewage treatment plant 34
7.3.5 Moss Vale Sewage treatment plant 34
8 Business and Infrastructure Performance Issues 35
8.1 Water supply scheme issues 35
8.1.1 Legislative compliance issues 35
8.1.2 Levels of Service (LOS) issues 35
8.2 Sewerage scheme issues 35
8.2.1 Legislative compliance issues 35
8.2.2 Levels of Service issues 36
8.2.3 Unserviced communities 36
9 Work being done by Council 37
10 Feasible Regional and Local options 40
10.1 Water supply capacity options 40
10.2 Sewerage Schemes 41
10.2.1 NorBE compliance 41
10.2.2 Sewerage options 42
11 Shire Wide IWCM Scenarios 44
11.1 Measures and works common to all IWCM Scenarios 44
11.2 Description of the IWCM Scenarios 45
11.3 Present Value Analysis of IWCM Scenarios 50
11.3.1 Water supply Service 50

11.3.2 Sewerage Service 50
11.3.3 Avoided costs for IWCM Scenarios 50
11.4 IWCM Scenario Costs 51
11.5 Triple Bottom Line Assessment of Scenarios 51
11.6 Adopted Scenario 53
12 Total Asset Management Plan 55
12.1 Capital Works 55
12.2 Recurrent Costs 56
13 Financial Plan 64
13.1 Overview 64
13.2 Financial Modelling Methodology 64
13.3 Financial Model Inputs 65
13.3.1 Charges 66
13.3.2 Revenues and Expenditures 67
13.3.3 Service Provision 67
13.3.4 Funding Capital Works 67
13.4 Assumptions and Limitations of the Model 68
13.5 Financial Model Outcomes – Water Supply 69
13.5.1 Projected Financial Position 69
13.5.1 Sensitivity of Financial Projections 71
13.6 Financial Model Outcomes – Sewerage 73
13.6.1 Projected Financial Position 73
13.6.2 Sensitivity of Financial Projections Results 75
Appendices 79
Appendix A IWCM Issues Paper A-1
Appendix B Options Review Paper B-1
Appendix C Secure Yield Analysis Report for Bundanoon Dam C-1
Appendix D Adopted Levels of Service D-1
Appendix E Present Value Cost Estimates for Water and Sewer Options E-1
Appendix F Water Supply and Sewerage Asset Management Plans F-1
Appendix G Financial Model Input and Output Data - Water G-1
Appendix H Financial Model Input and Output Data - Sewer H-1

Figures

Figure 1-1: Interaction of IWCM Strategy with IP&R Framework 8
Figure 3-1: Wingecarribee Shire LGA map 10
Figure 4-1: Wingecarribee Shire water supply service area 12
Figure 4-2: Wingecarribee Water Supply Scheme – Service areas for each WTP 13

Figure 4-3: Berrima Sewerage Scheme 16
Figure 4-4: Bowral Sewerage Scheme 17
Figure 4-5: Bundanoon Sewerage Scheme 18
Figure 4-6: Mittagong Sewerage Scheme 19
Figure 4-7: Moss Vale Sewerage Scheme 20
Figure 4-8: Robertson Sewerage Scheme 21
Figure 6-1: Annual metered demand by customer category 25
Figure 6-2: System Capacity and Projected Peak Day Demand – Existing Zoning 27
Figure 7-1: Daily STP Inflow and rainfall for Berrima STP 30
Figure 7-2: Daily STP Inflow and rainfall for Bowral STP 30
Figure 7-3: Daily STP Inflow and rainfall for Bundanoon STP 31
Figure 7-4: Daily STP Inflow and rainfall for Mittagong STP 31
Figure 7-5: Daily STP Inflow and rainfall for Moss Vale STP 31
Figure 7-6: Berrima STP - projected EP growth, biological loading and STP capacity 33
Figure 7-7: Bowral STP projected EP growth, biological loading and STP capacity 33
Figure 7-8: Bundanoon STP projected EP growth, biological loading and STP capacity 33
Figure 7-9: Mittagong STP projected EP growth, biological loading and STP capacity 34
Figure 7-10: Moss Vale STP projected EP growth and STP hydraulic capacity with and without MVEC 34
Figure 7-11 – Moss Vale STP projected EP growth and STP biological and nutrient capacity with and without MVEC 34
Figure 12-1: 30-year Capital Works Program - Water Supply 61
Figure 12-2: 30-year Capital Works Program - Sewerage 61
Figure 13-1 – Elements of Financial Modelling 64
Figure 13-2: Typical Residential Bill for Water Supply 69
Figure 13-3: Cash & Borrowing Projections for Water Supply 70
Figure 13-4: Sensitivity of Typical Residential Bill for Water Supply 72
Figure 13-5: Sensitivity of Cash and Investment Levels for Water Supply 72
Figure 13-6: Typical Residential Bill for Sewerage 73
Figure 13-7: Cash & Borrowing Projections for Sewerage 74
Figure 13-8: Sensitivity of Typical Residential Bill for Sewerage 76
Figure 13-9: Sensitivity of Borrowing Levels for Sewerage 77
Figure 13-10: Sensitivity of Cash and Investment Levels for Sewerage 77

Tables

Table 4-1: Water supply scheme capacities 14
Table 4-2: Wingecarribee and Bundanoon water supply scheme reservoir capacities 15
Table 4-3: Results of inflow/infiltration analysis results 21

Table 4-4: Unserviced Communities 22
Table 5-1: Serviced permanent population projection – water supply zones 24
Table 5-2: Serviced Equivalent Population projection – sewerage schemes 24
Table 6-1: Average daily water demands in 2012 25
Table 6-2: Moss Vale Enterprise Corridor Demands 26
Table 6-3: Water demand, production and extraction 26
Table 6-4: Bundanoon dam secure yield estimates 27
Table 7-1: Estimated ADWF, Hydraulic, Biological and Nutrient Loadings 32
Table 7-2: Projected ADWF and PDWF 32
Table 10-1: Water supply feasible options 40
Table 10-2: Pros and cons of water supply and treatment options 40
Table 10-3: Local and regional sewerage options 42
Table 10-4: Pros and cons of sewerage options 43
Table 11-1: Common Management System Measures for Shire Wide IWCM Scenarios 44
Table 11-2: Shire Wide IWCM Scenarios – Headworks augmentation 46
Table 11-3: Summary of Capital and Present Value Costs for the IWCM Scenarios – Water Supply Service Component 50
Table 11-4: Summary of Capital and Present Value Costs for the IWCM Scenarios – Sewerage Service Component 50
Table 11-5: Summary of 30-year Present Value Avoided Costs for IWCM Scenarios 51
Table 11-6: Summary of 30-year present value IWCM Scenario cost 51
Table 11-7: Social and Environmental Performance Targets and Objectives 52
Table 11-8: Summary of TBL Score for IWCM Scenarios 53
Table 11-9: IWCM Scoring Ranking 53
Table 12-1: Renewal Priority Criteria 55
Table 12-2: 30-Year Capital Works Schedule for Water Supply – Adopted IWCM Scenario 57
Table 12-3: 30-Year Capital Works Schedule for Sewerage – Adopted IWCM Scenario 58
Table 12-4: Capital Works Summary for Water Supply ($'000) 59
Table 12-5: Capital Works Summary for Sewerage ($'000) 60
Table 12-6: Recurrent O&M Expenditure Summary - Water Supply ($'000) 62
Table 12-7: Recurrent O&M Expenditure Summary - Sewerage ($'000) 63
Table 13-1: Key Input Parameters for the Financial Models 66
Table 13-2: Projected Financial Results – Water Fund 71
Table 13-3: Sensitivity Analysis – Water Fund 71
Table 13-4: Projected Financial Results for Sewer Fund 75
Table 13-5: Sensitivity Analysis – Sewer Fund 76

1 Context

The Office of Local Government's Integrated Planning and Reporting (IP&R) framework allows NSW councils to draw their various plans together, understand how they interact and get the maximum leverage from their efforts by planning holistically and sustainably for the future. The IP&R Framework requires Councils to have a long-term Resourcing Strategy for the provision of resources required to implement the strategies established by the Community Strategic Plan. The strategy must include provisions for:

- Long term financial planning
- Workforce management planning and
- Asset management planning

Councils that have responsibility for water supply and sewerage infrastructure need to comply with the requirements and timeframes of the NSW Government's Best Practice Management of Water Supply and Sewerage framework set by the Department of Industry (DoI) Water. Accordingly, a Local Water Utility's (LWU's) peak planning documents for its water supply and sewerage businesses are its current Integrated Water Cycle Management (IWCM) Strategy and its current Strategic Business Plan (SBP). The IWCM Strategy and SBP need to be prepared every 8 years on a rotation of every 4 years. The outputs of an IWCM Strategy are the Total Asset Management Plan (TAMP) and the 30-year Financial Plan (FP). Council's IWCM Strategy therefore becomes its Resourcing Strategy for Water Supply and Sewerage. The interaction between the IP&R Framework and the IWCM process is shown in Figure 1-1. The IWCM Strategy is an input to Council's resourcing strategy for water and sewerage.

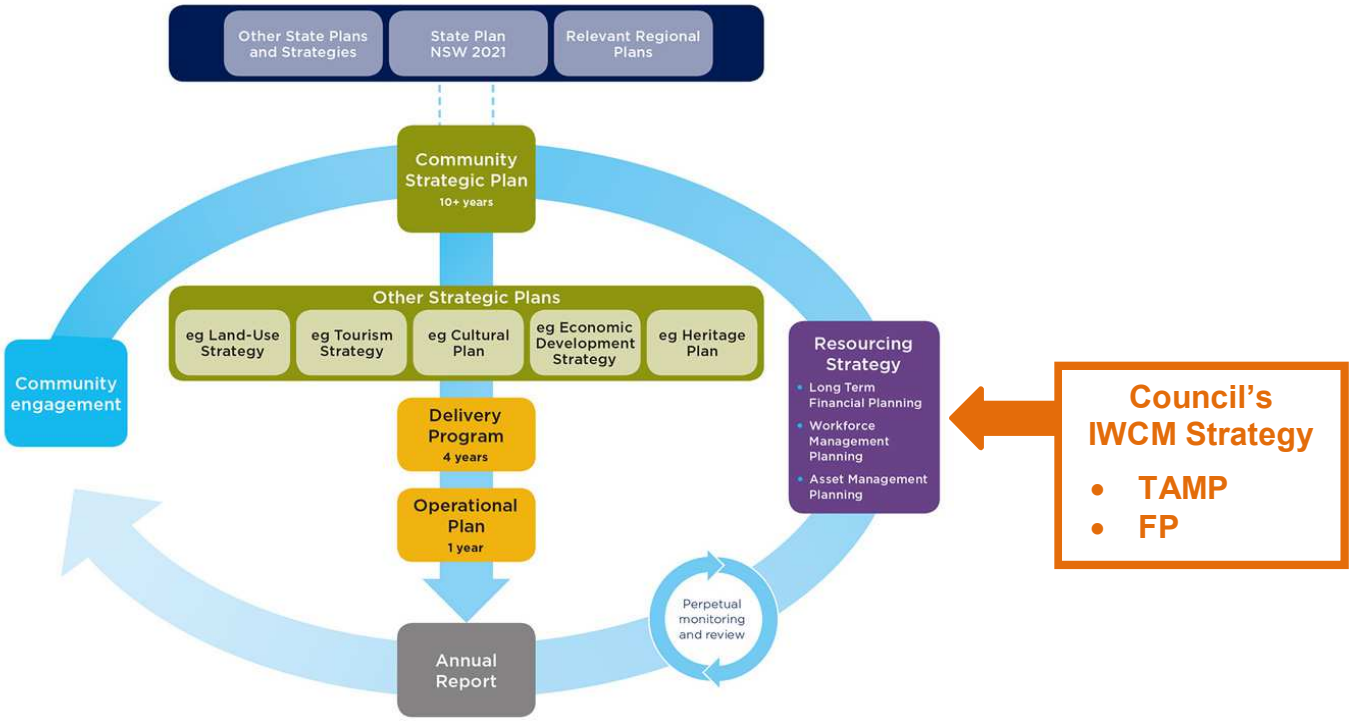

Figure 1-1: Interaction of IWCM Strategy with IP&R Framework

2 Introduction

2.1 Overview

The Integrated Water Cycle Management (IWCM) Strategy addresses two elements of the Best-Practice Management of Water Supply and Sewerage Framework and is a local water utility's (LWU's) 30-year strategy for the provision of appropriate, affordable, cost-effective and sustainable urban water services that meet community needs and protect public health and the environment.

The IWCM Strategy:

- Right sizes' any projects and identifies the best-value 30-year IWCM scenario and Strategy on a triple bottom line basis.
- It includes a 30-year Total Asset Management Plan and Financial Plan
- Identifies the lowest uniform level of stable typical residential bills (TRBs) to meet the levels of service negotiated with the community
- Includes an update of the existing 30-year renewals plan.

2.2 Background to Wingecarribee Shire Council's IWCM Strategy

Wingecarribee Shire Council's water supply and sewerage infrastructure requires upgrading to meet population growth, regulatory requirements, and best practice standards. The other important consideration that impacts Council's operations is that being located in the Greater Sydney drinking water catchment, all proposed development in the Council to have a neutral or beneficial effect on water quality (NorBE).

2.3 Progress

The development of Council's IWCM has followed the DoI Water methodology outlined in the IWCM Strategy Check List (July 2014). The following studies have been completed to date.

- **IWCM Issues Paper**

  This report identified and outlined the current and 30-year projected issues relating to Council's regulatory requirements, levels of service (LOS), and performance of Council's water supply and sewerage services. The Issues paper addresses Tasks 1 to 8 of the IWCM Check List and is provided in Appendix A.

- **IWCM Options Review Paper**

  This report assessed a number of options to address the issues identified in the Issues Paper, and used Triple Bottoms Line (TBL) criteria to evaluate and shortlist the individual options for subsequent bundling into scenarios. The Options Review Paper addresses Tasks 9 and 10 of the IWCM Check List and is provided in Appendix B.

- **IWCM Scenarios**

  Following the evaluation and shortlisting of options IWCM Scenarios were created using a mix of options that together, address the urban water service issues. The Scenarios were evaluated to identify the scenario which provides the best value for money taking full account of the social, environmental and economic considerations. This addressed Tasks 11 and 12 of the IWCM Check List.

This IWCM Strategy report contains a summary of all the outcomes. It outlines the adopted IWCM Scenario and includes a Total Asset Management Plan (TAMP) and a Financial Plan (FP).

3 Description of Wingecarribee Shire

3.1 Overview

Wingecarribee Shire Council is the local government authority for the Wingecarribee Shire of New South Wales, a region typically referred to as the Southern Highlands. It is located midway between Sydney and Canberra off the Hume Highway and covers an area of about 2,700 km^2 with a population of 47,584 people (as at 2014). The Shire is largely rural, with several urban areas; the main ones being Bowral, Moss Vale, Mittagong and Bundanoon.

Rural land is used largely for sheep and cattle grazing, with some timber production, fruit and vegetable growing, mining and viticulture. The Shire is an important water catchment area for Sydney Water and within the declared catchment of Sydney Water.

The pattern of development is one of small towns and villages, separated by a semi-rural landscape and from a planning perspective, Council intends to retain this character of the Shire.

Figure 3-1: Wingecarribee Shire LGA map

3.2 Water Catchments

Wingecarribee Shire sits on a major catchment divide, with the south east of the Shire in the Kangaroo River catchment, the north-east of the Shire in the Upper Nepean River catchment and the more populated middle and western areas of the Shire in the Warragamba catchment.

Within these major catchments lie the sub-catchments for three of the Shire's main water supplies; the Wingecarribee Reservoir, the Bundanoon Creek Dam and the Medway Dam.

3.2.1 Wingecarribee Reservoir catchment

Wingecarribee Reservoir is about 10 kilometres south-east of Bowral on the Wingecarribee River (direct catchment 41 km^2). The reservoir supplies the majority of the water used by Wingecarribee Shire, and is part of the Shoalhaven Scheme which during drought also tops up water supplies for Sydney and Goulburn. Most of the water in Wingecarribee Reservoir is transferred in from Lake Yarrunga and transferred via Bendeela Pondage and Fitzroy Falls Reservoir. Wingecarribee Reservoir has an operating capacity of 24.13GL, is operated by WaterNSW and supplied to Wingecarribee Shire Council under a Bulk Water Supply Agreement.

3.2.1 Bundanoon Creek Dam catchment

Bundanoon Creek Dam is sited in a steep valley with the fringes of the lake mostly covered by thick vegetation, both in the Meryla State Forest and privately held land. Bundanoon Creek Dam is located 7km east of Exeter and has a catchment of 54 km^2. It drains into the Kangaroo River catchment, feeding Lake Yarrunga (catchment 5750 km^2 and impounded by Tallowa Dam), the primary water source utilised by Shoalhaven Water. The dam has a volume of approximately 2,000 ML.

3.2.2 Medway Dam catchment

The majority of the Medway Dam catchment has been cleared with a narrow strip of uncleared land around the edges of the lake. The catchment includes Sutton Forest, Werai and most of Moss Vale along with a stretch of the Hume Highway and the Berrima cement works. The dam has a volume of approximately 1,300 ML.

4 Description of Urban Water Services

4.1 Overview

The majority of residents as well as commercial and industrial premises within the urban centres are provided with water supply, sewerage and stormwater services. WSC owns, operates and manages these services and the associated assets on behalf of the local community and the community pays a rate for this service. The majority of the rural population have their own on-site water supply and sewerage systems and hence do not pay urban water service rates to WSC. These rural communities, however, depend on WSC's water supply system during dry/drought periods. Council has installed dedicated water filling stations for water carters to extract water from the network.

4.2 Water Supply System

The Wingecarribee Shire Water Supply System currently provides drinking water to Bowral, Mittagong, Moss Vale and Bundanoon towns and Exeter, Sutton Forest, Aylmerton, Berrima, Robertson, Braemar, Willow Vale, Colo Vale, Hill Top, Yerrinbool, Burrawang, Balaclava and New Berrima villages. The current system consists of three water treatment plants (WTPs); Wingecarribee WTP, Bundanoon WTP and Medway WTP. The Shire-wide water distribution system comprises 31 treated water storages, ten booster pump stations and over 650 km of trunk, distribution and reticulation mains.

The water supply service area is mapped in Figure 4-1.

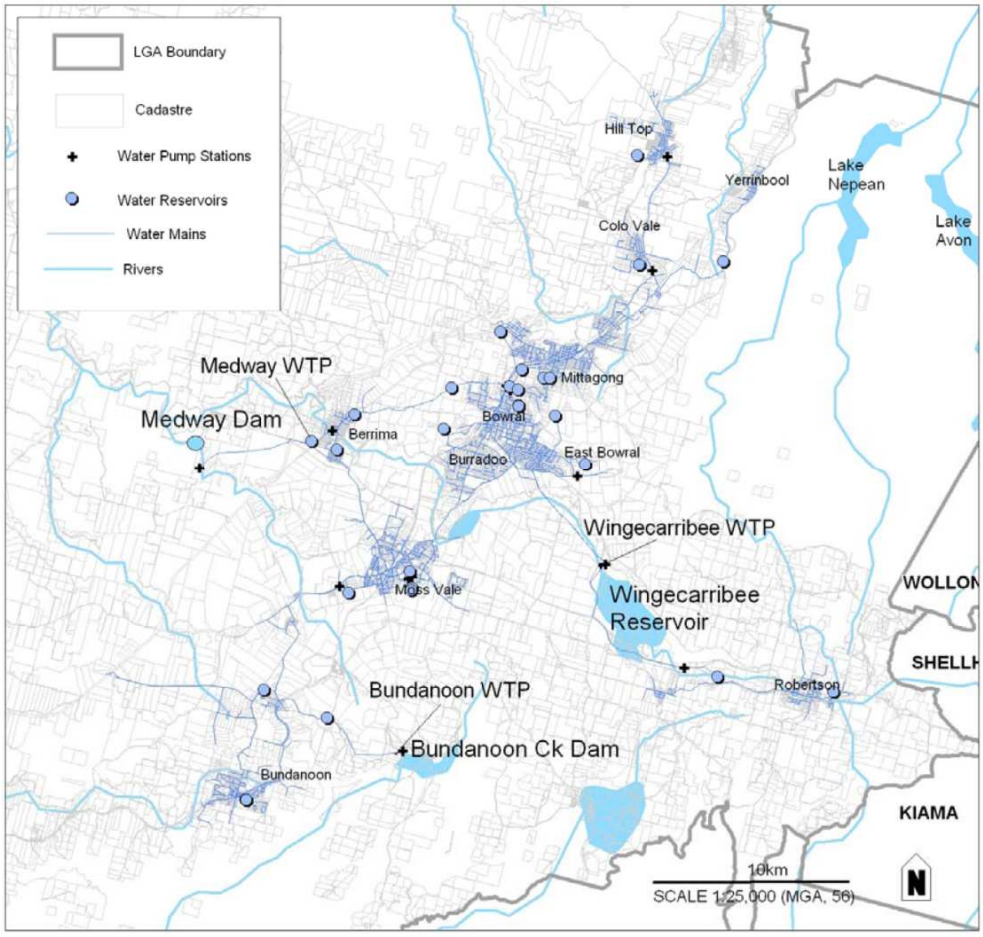

Figure 4-1: Wingecarribee Shire water supply service area

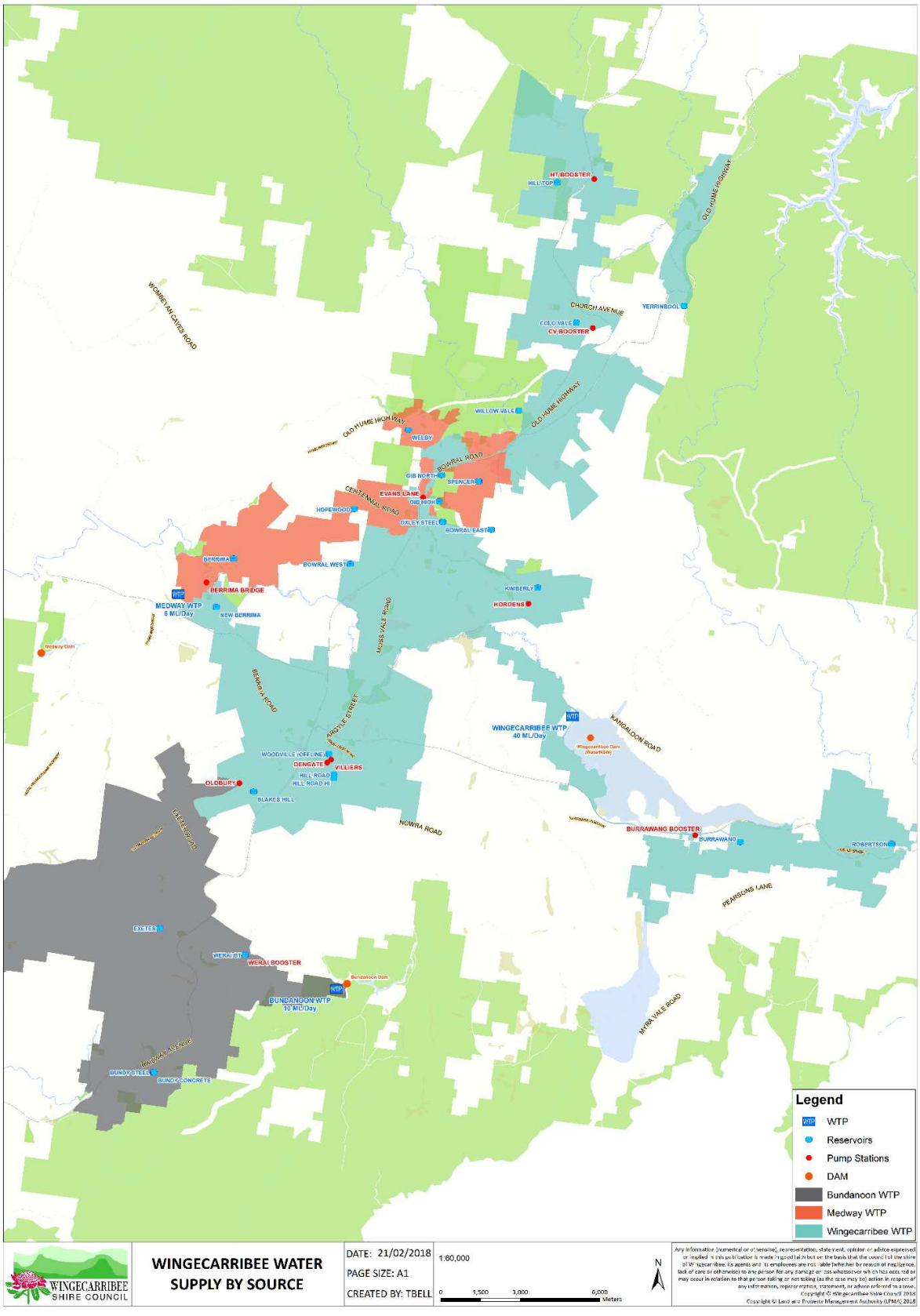

Figure 4-2: Wingecarribee Water Supply Scheme – Service areas for each WTP

The three systems are interconnected; however, isolation valves are used for zoning purposes. Zone boundaries have been changed from time to time as the demand increased and Council has recently embarked on a program of rezoning in order to effect pressure management within the reticulation system. There are provisions to supply water to different zones from different sources in case of emergency or for source water management.

4.2.1 Wingecarribee Water Supply Scheme

The Wingecarribee water supply scheme draws water from the Wingecarribee Reservoir and comprises of:

- A raw water intake at Wingecarribee dam with a provision for PAC dosing when required.
- A dissolved air flotation filtration (DAFF) WTP with a clear water tank and chemical dosing facilities consisting of lime, carbon dioxide, alum, polymer and fluoride dosing.
- Chlorination for disinfection.
- Clear water pumping station that pumps water to the distribution system.

4.2.2 Bundanoon Water Supply Scheme

The Bundanoon Water supply scheme draws water from Bundanoon Creek dam and comprises of:

- A raw water intake on Bundanoon creek dam with a provision for PAC dosing when required.
- A dissolved air flotation (DAF) and media filtration WTP with a clear water tank and chemical dosing facilities consisting of lime, carbon dioxide, alum, polymer and fluoride dosing.
- Chlorination for disinfection.
- A clear water pumping station that pumps the water to Werai balance tank, from where it is pumped to Exeter reservoir and gravitates to the distribution system.

4.2.3 Medway Water Supply Scheme

The Medway Water Supply Scheme consists of an intake on Medway Dam and a WTP which has currently been mothballed due to a number of performance, operation, safety, water quality and operating cost issues. When in use it supplied water to Berrima and parts of Bowral and Mittagong, however these are now supplied by the Wingecarribee Water Supply Scheme.

Design capacities for Wingecarribee and Bundanoon water supply schemes are given in Table 4-1.

Table 4-1: Water supply scheme capacities

Unit	Wingecarribee Water Supply		Bundanoon Water Supply	
	Design Flow (L/s)	Design Capacity (ML/d)	Design Flow (L/s)	Design Capacity (ML/d)
Raw Water Intake	500		130	
Raw Water Pumping Station	500		130	
Water Treatment Plant	500	42.00 ML/d	126.00	10.00 ML/d
Clear Water Pump	475		110 – 130	
Clear Water Tank	-	3.00 ML	-	0.156 ML

4.2.4 Water distribution systems

The Wingecarribee Shire water distribution system comprises thirty one treated water storages, ten booster pump stations and over 650 km of trunk, distribution and reticulation mains. Council has been considering supplying some of the areas around Moss Value and New Berrima from the

Bundanoon WTP to better utilise the capacity of the Bundanoon WTP. In order to aid understanding, the areas that may be switched will be referred to as the Wingecarribee South water supply area. The reservoir sizes are given in Table 4-2.

Table 4-2: Wingecarribee and Bundanoon water supply scheme reservoir capacities

Wingecarribee		Wingecarribee South		Bundanoon	
Reservoir	**Size**	**Reservoir**	**Size**	**Reservoir**	**Size**
Berrima	0.46 ML	Blakes Hill	2.27 ML	Bundanoon (small)	1.36 ML
Burrawang	3.30 ML	Hill Rd	10 ML	Bundanoon (large)	2.5 ML
Colo Vale	0.68 ML	Hill Rd (high level)	0.68 ML	Exeter	4.55 ML
East Bowral	5.00 ML	New Berrima	0.59 ML	Werai Balance Tank	0.23 ML
Gib North	6.00 ML	Woodville Rd	2.29 ML		
Gib High	0.50 ML				
Hill Top	1.60 ML				
Hopewood	2.28 ML				
Kimberly	0.14 ML				
Murchison St	0.23 ML				
Oxley Dr (Concrete)	10 ML				
Oxley Dr (Steel)	2.28 ML				
Robertson	0.68 ML				
Soma Ave	1.24 ML				
Spencer	2.30 ML				
West Bowral	2.50 ML				
Welby	1.43 ML				
Willow Vale	10 ML				
Yerrinbool	1.20 ML				

Council undertook a review to examine the performance of the water supply system under existing and future demands. The objectives of the study were to:

- Examine the performance of the WSC water supply network under existing design loads and identify system deficiencies
- Develop a capital works improvement plan to address system deficiencies under current design loads
- Examine the performance of the WSC water supply system under future demand conditions for a range of future planning horizons that correspond with the planning horizons nominated in the Council commissioned study 'Wingecarribee demographic and housing study, May 2012' completed by SGS Economics and Planning
- Develop a capital works improvement plan to address system deficiencies under future design loads out to 2031
- Review an ad hoc list of operational and network management issues

4.3 Sewerage Schemes

Wingecarribee Shire Council operates six sewage collection and treatment schemes: Berrima, Bowral, Bundanoon, Mittagong, Moss Vale and Robertson.

4.3.1 Berrima Sewerage Scheme

Berrima sewerage scheme receives sewage from residential lots in the areas of Berrima and New Berrima. The collection system is a conventional gravity sewerage system comprising seven pumping stations. The STP receives sewage flows via a single pump station.

Berrima STP is a 2,000 EP capacity STP that utilizes a Pasveer channel for secondary treatment and chemical phosphorous removal to treat sewage. Effluent is discharged to Oldbury Creek. The Berrima sewerage scheme is shown in Figure 4-3.

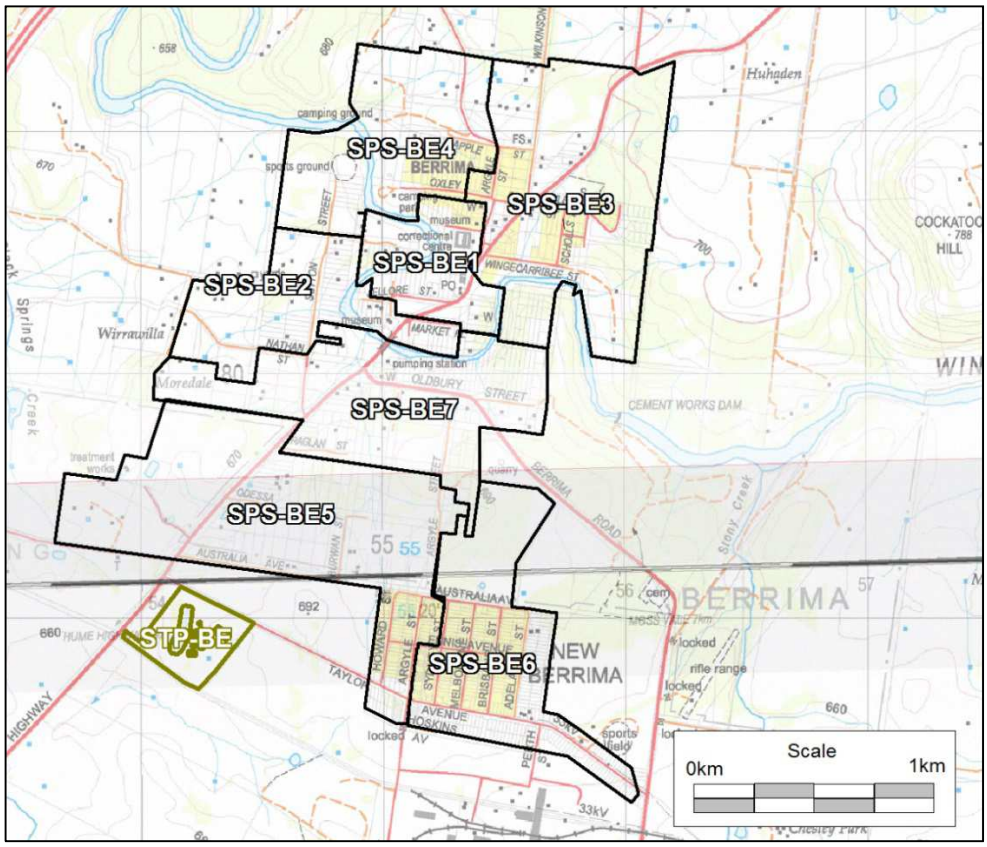

Figure 4-3: Berrima Sewerage Scheme

4.3.2 Bowral Sewerage Scheme

Bowral sewerage scheme services the areas of Bowral, East Bowral and Burradoo. The collection system is a conventional gravity sewerage system comprising 15 pumping stations. The STP receives sewage flows through two trunk gravity mains from Bowral and a trunk rising main from Burradoo.

The plant inflows are directed to a lift pump station prior to the inlet works. Sewage flows greater than lift pump station capacity, or in the event of power failure, are diverted from the lift pump station into the storm detention pond.

Bowral STP is a 14,600 EP capacity STP that utilizes one IDEA reactor and two Pasveer channels for secondary treatment and chemical phosphorus removal to treat sewage. The effluent is filtered and disinfected via a UV unit prior to discharge to Wingecarribee River. Some treated effluent from the STP is currently reused at the STP. The Bowral sewerage scheme is shown in Figure 4-4.

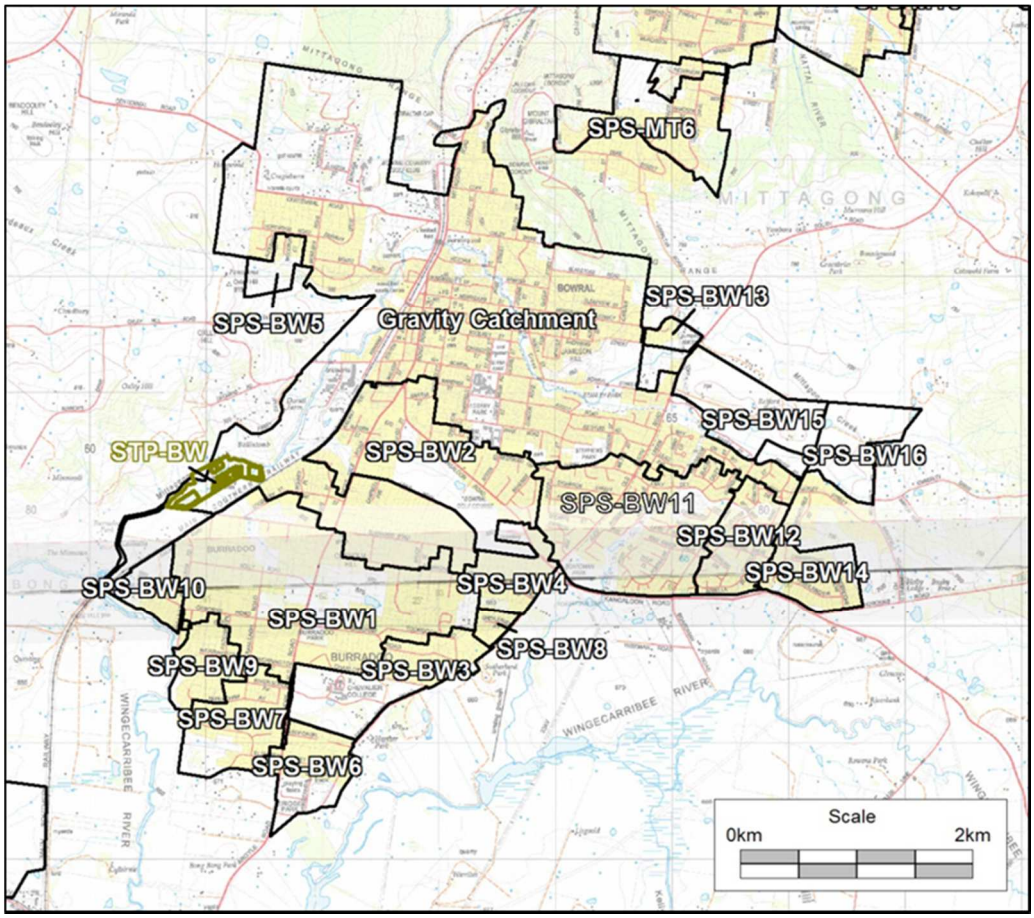

Figure 4-4: Bowral Sewerage Scheme

4.3.3 Bundanoon Sewerage Scheme

Bundanoon sewerage scheme services the community of Bundanoon. The collection system is a conventional gravity sewerage system comprising 12 pumping stations. The STP receives sewage flows through a trunk gravity main.

All sewage gravitates into the reception chamber of the inlet works via the trunk main. Flow greater than the inlet works capacity overflows to the storm detention pond.

Bundanoon STP has a design capacity of 5,400 EP and is comprised of an IDEA reactor and Pasveer channel for secondary treatment, cloth media filters, UV disinfection, and chemical phosphorous removal. Treated effluent is discharged to Reedy Creek, and some is recycled for use in irrigating a sports fields and agricultural land. The Bundanoon sewerage scheme is shown in Figure 4-5.

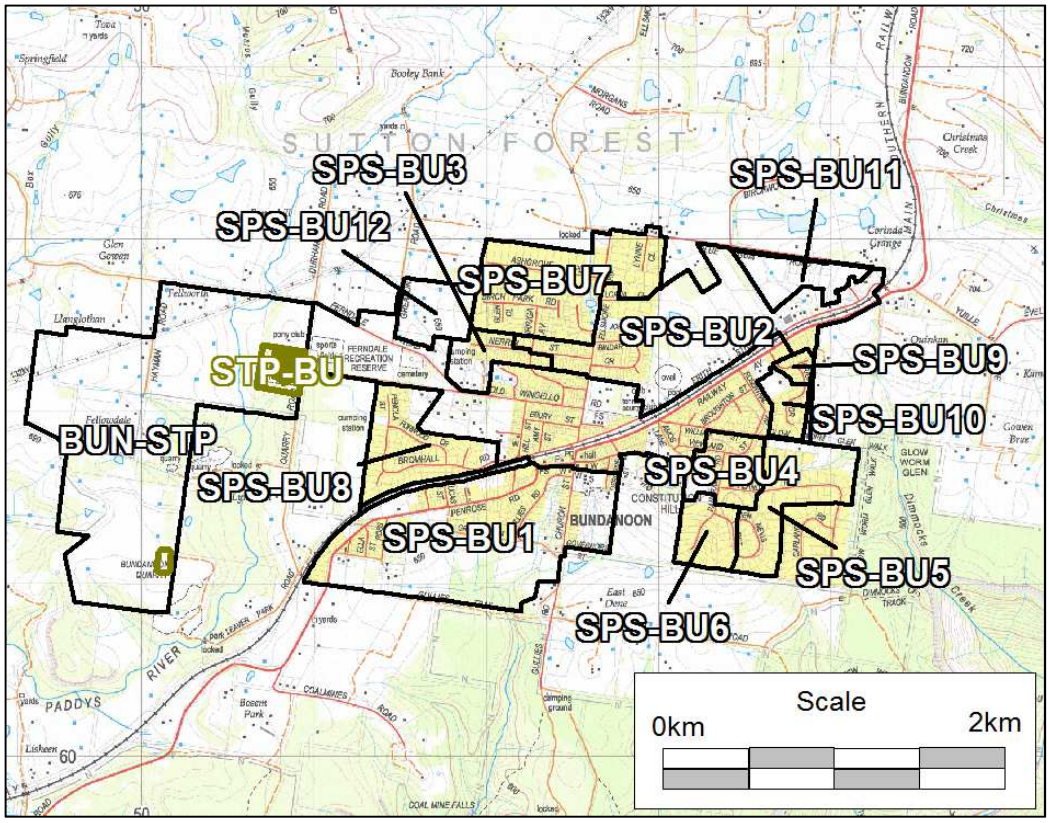

Figure 4-5: Bundanoon Sewerage Scheme

4.3.4 Mittagong Sewerage Scheme

Mittagong sewerage scheme services the areas of Mittagong, Willow Vale, Braemar, Hill Top, Colo Vale and Aylmerton. The collection system is a conventional gravity sewerage system comprising 21 pumping stations. The STP receives sewage flows via a single pump station (Willow Vale 1 SPS).

Mittagong STP has a design capacity of 14,000 EP and utilizes two IDAL reactors for secondary treatment, chemical phosphorus removal and UV disinfection to treat sewage. Treated effluent is discharged into Mittagong Creek, with some effluent reused at the Highlands Golf Course.

There is no storm diversion before the main reactors (diversion occurs post IDALs) and the process has been designed to hydraulically cater for a peak flow of 7 x ADWF. The Mittagong sewerage scheme is shown in Figure 4-6.

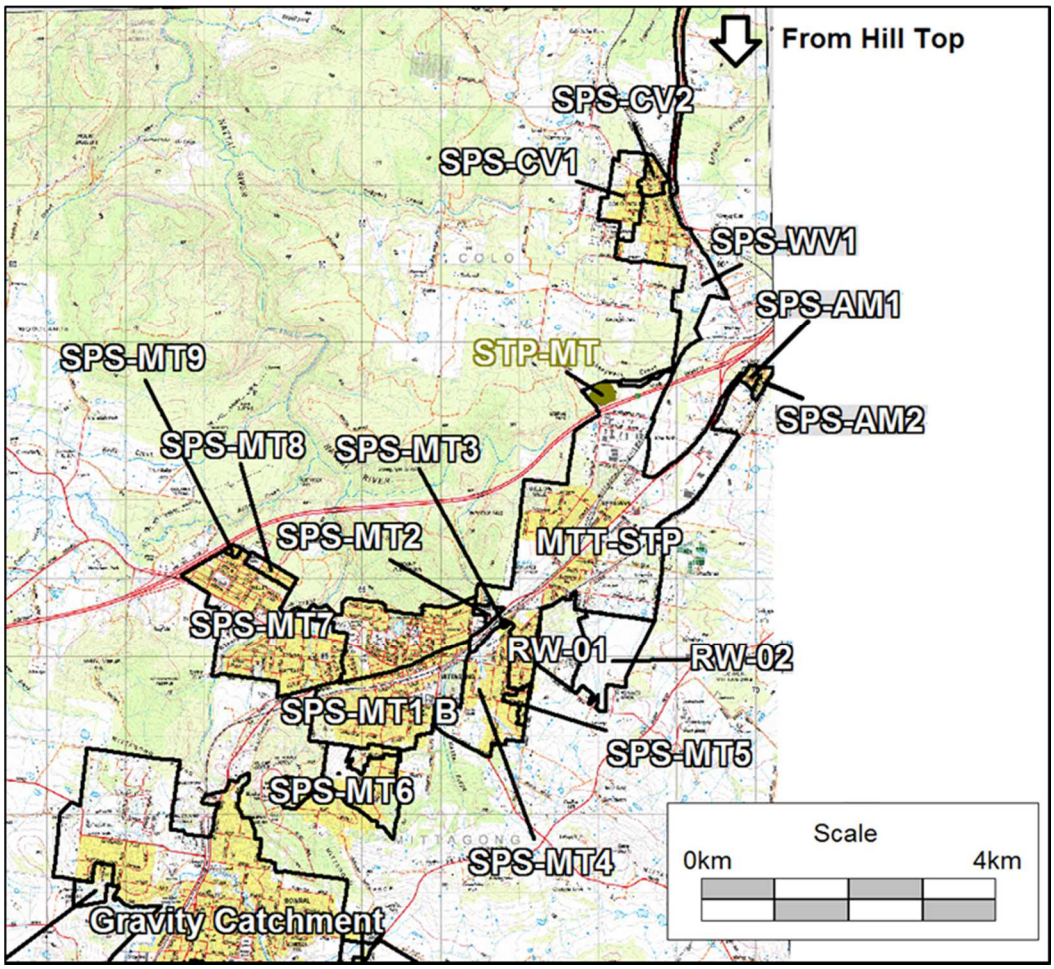

Figure 4-6: Mittagong Sewerage Scheme

4.3.5 Moss Vale Sewerage Scheme

Moss Vale sewerage scheme services the community of Moss Vale. The collection system is a conventional gravity sewerage system comprising 13 pump stations. The STP receives sewage flows through a trunk gravity main.

Moss Vale STP has a design capacity of 9,000 EP and utilizes two IDEA reactors for secondary treatment, chemical phosphorus removal and UV disinfection to treat sewage. Treated effluent is discharged to Whites Creek.

During storms, sewage is diverted from the inlet works to two wet weather storage ponds in series, which is then returned to the plant when inflow subsides. The Moss Vale sewerage scheme is shown in Figure 4-7.

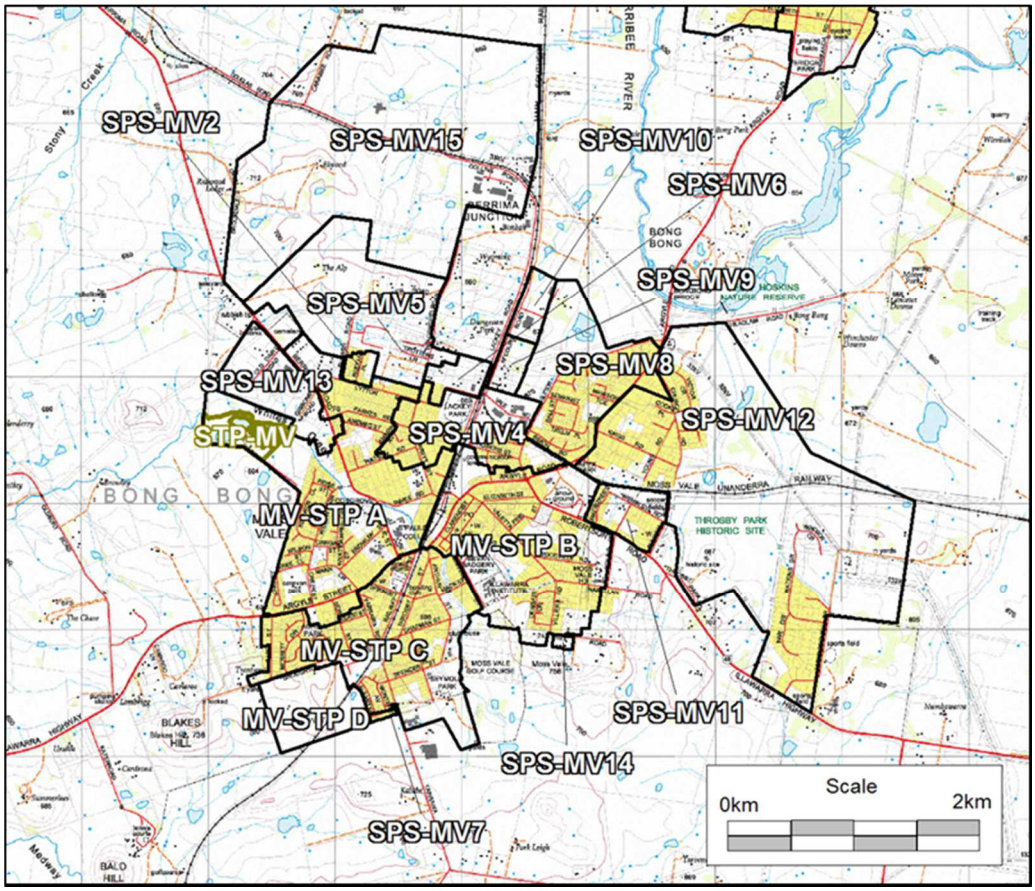

Figure 4-7: Moss Vale Sewerage Scheme

4.3.6 Robertson Sewerage Scheme

Robertson lies in the immediate catchment of Wingecarribee Reservoir. Due to the importance of the Wingecarribee Reservoir as a water source for the Wingecarribee Shire and the downstream Warragamba Dam, WSC found it necessary to sewer Robertson in 2012 to reduce the risk of contamination from on-site sewage management systems.

The collection system is a conventional gravity sewerage system comprising a single pump station which pumps sewage to Robertson STP. Note, there is a low-pressure catchment which includes design capacity of 122 pods.

Robertson STP has a design capacity of 2000 EP. It utilizes Siemens BioNutre activated sludge process for secondary treatment followed by filtration in a membrane operating system. Treated effluent then undergoes UV disinfection before being transferred to the agricultural reuse scheme via a 15 Km effluent transfer main to a purpose-built 47 ML storage dam in Glenquarry where it is used for pasture irrigation on 42 hectares of agricultural land. The Robertson sewerage scheme is shown in Figure 4-8.

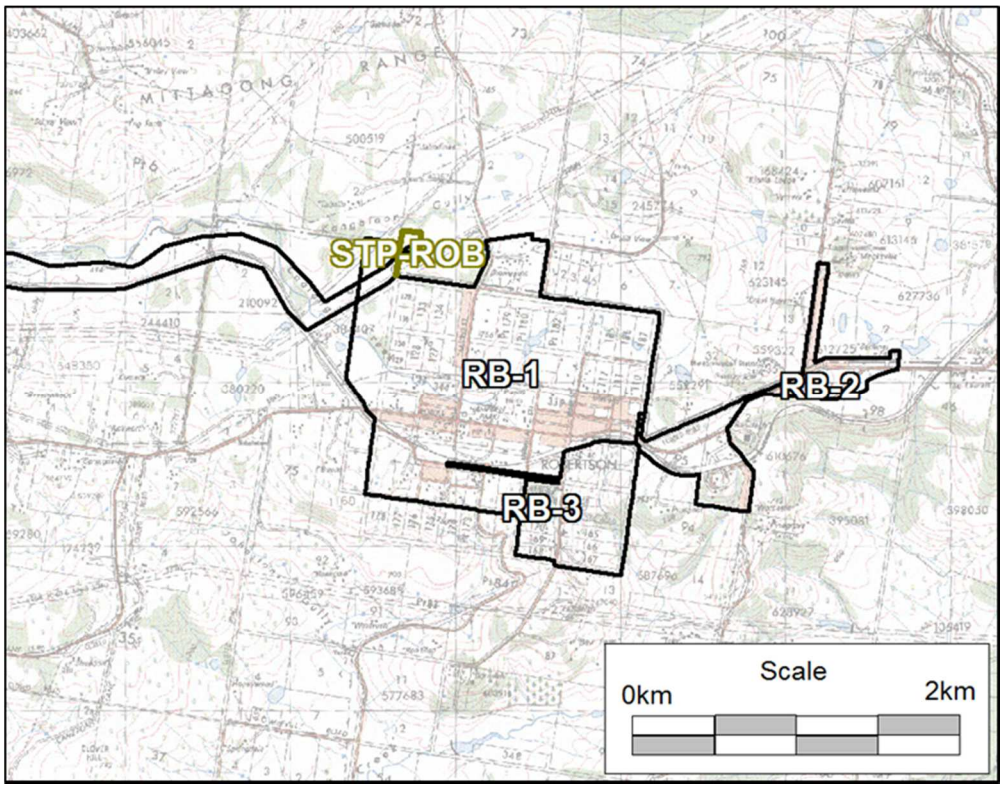

Figure 4-8: Robertson Sewerage Scheme

4.3.7 Sewer reticulation network

Council assessed the overflow performance of the sewerage systems within the Shire for both the existing loads and also for the forecast loads. The systems were assessed for a 1 year, 2 year and 5 year return period storm events for a range of durations to establish the current system performance and extent of issues including areas of infiltration and overflows. Council adopted a 1 in 2 year containment level of service across all catchments.

In July 2018 Council completed a study (Environmental Improvement Program (EIP)) to identify areas where groundwater and stormwater flows, or infiltrates into 5 sewerage catchments across Wingecarribee Shire Council. The information obtained from this EIP will be used to contribute to Council's Annual Capital Renewal program which is also linked to the 'Sewer Main and Manhole Renewal EIP'. A summary of the inflow/infiltration analysis for each scheme is presented in Table 4-3.

Table 4-3: Results of inflow/infiltration analysis results

Sewerage Scheme	Inflow/infiltration(I/I) % identified	Year reviewed
Berrima	2 catchments with 1% and 1.1%	2017
Bowral	5 catchments greater than 8% Average 5% across remaining Bowral catchments	2012
Bundanoon	4 catchments greater than 8% Average 6% across remaining Bundanoon catchments	2018
Moss Vale	Catchment MV09 recorded the highest I/I rate of 3.5% Average 1.16% across Moss Vale catchments	2017
Mittagong	Catchments MITT08 and MITT09 recorded the highest	2017

Sewerage Scheme	Inflow/infiltration(I/I) % identified	Year reviewed
	I/I rate of 1.8% Average 0.8% across the Mittagong catchments	

The analyses showed that all flow monitor catchments (except Bowral and Bundanoon) had calculated I/I rates of less than 5% indicating that those schemes are reasonably "tight" systems. Significant works have been undertaken in the Bowral scheme to help reduce the I/I including CCTV inspections, main renewals and house to house inspection. Bundanoon will be targeted for further investigation.

4.4 Unserviced Areas

A summary of the unserviced villages within the Wingecarribee Shire is provided in Table 4-4.

Table 4-4: Unserviced Communities

Town	Current Services	2001 EP*	2011 Census			
			Community		Surrounding Rural area	
			Dwellings	People	Dwellings	People
Balmoral	None	165	140	314	4	20
Burrawang	Water	235	159	245	111	174
Exeter	Water	369	277	527	129	229
Fitzroy Falls	None	<200	32	52	85	167
Kangaloon	None	<200				
Penrose	None	169			124	234
Sutton Forest	Water	218	44	92		
Wingello	None	264	172	383		
Yerrinbool	Water	927	366	1024	25	77

*CH2MHILL. 2001. Sydney Catchment Authority: Review of Catchment Sewerage Needs

Penrose and Wingello were surveyed in 2014 and 73% of responses received were not in favour of new water or waste water services. A similar survey in Balmoral Village in 2015 found that 51% of responses were not in favour. Following each survey, Council voted unanimously to defer the matter for five years and re-analyse the community needs in 2019 and 2020 respectively.

There are at least 5,000 On-site Sewage Management Systems (OSMS) across the Shire consisting of septic tanks or aerated systems. Council has an 'On-site Sewage Management Strategy' adopted in 2000 and last reviewed in 2014. Council maintains a register of all OSMS'. Council have indicated that they do experience shortage of resources to undertake the number of inspections required.

Due to the high cost of backlog schemes, such as Robertson Sewer Scheme which was constructed in 2013 at a cost of approximately $33M, construction of new sewer schemes have not been considered by council.

5 Population and Demographic Projection

5.1 Overview

To develop coherent IWCM strategy it is necessary to consider the rate at which the population is expected to grow, areas of potential growth, and the timing and rate of uptake of future developments. Several different sources of historical and projected population data were assessed to analyse population growth rate. These include:

- Historical ABS Census data
- Forward projections from NSW Department of Planning
- *Wingecarribee Demographic and Housing Study* by SGS Economics and Planning
- Council's *Water Supply System Master Plan (WSSMP)*
- Council's historical and expected land releases / sub-divisions

ABS census data shows that the Wingecarribee LGA has been experiencing a growth of around 1 percent over the last ten years. The "New South Wales State and Local Government Area Population, Household and Dwelling Projections: 2014 Final" for the period 2011 to 2031 nominated a population growth starting at 0.68 percent and decreasing to 0.34 percent. A demographic and housing study prepared by SGS Economics and Planning (SGS) showed a population growth starting at 0.86% per year, increasing to 0.94% per year and then decreasing to 0.83% per year. The SGS study noted that the major policy guiding the Wingecarribee LGA is the Sydney-Canberra Corridor Regional Strategy 2006-2031. Bowral is the preferred location for infill development, with Moss Vale and Mittagong expected to contain the majority of greenfield development.

This information was discussed with Council's Strategic Planners and Council has nominated the Water Master Plan growth strategies and statistics as the basis for the Shire wide growth projection. The Master Plan projected growth up to 2031, with the growth rate beyond 2031 extrapolated at the 2026 to 2031 rate, to cover the 30-year IWCM Scenario. Under this projection, the percentage of the population served by the reticulated water supply schemes remains at about 91% and sewerage schemes goes from 77% to 79%.

The peak tourist season is during the months of September and October with the summer period being the off-peak season. The population generally increases by about 20 percent during the peak season.

5.2 Moss Vale Enterprise Corridor

The Moss Valve Enterprise Corridor (MVEC) development is a proposed large-scale industrial/ non-residential development in the North Western corner of the Moss Vale area. The development is proposed to contain approximately 640 ha of industrial properties. The 'Water Master Plan' stated that the primary growth in non-residential demand is expected to derive from the MVEC. It further states that the land use planners were unable to provide a firm indication of the type of development that is expected to occur in the MVEC and therefore forecasting demand for the site is somewhat difficult. Previous experience with proposals for large non-residential sites and analysis of existing large development sites has indicated that existing design standards for non-residential developments tend to be very conservative for this reason.

5.3 Population projections

The serviced population for each water supply and sewerage scheme is provided in Table 5-1.

Table 5-1: Serviced permanent population projection – water supply zones

Water Scheme	2011 Census	2011 Census + WSSMP Growth					Forecast extension		
		2011	2016	2021	2026	2031	2036	2041	2046
Wingecarribee	28,197	28,197	30,955	32,640	33,697	34,719	36,027	37,383	38,791
Wingecarribee South	8,475	8,475	9,045	10,309	11,214	12,092	12,547	13,020	13,510
Bundanoon	3,685	3,685	3,900	4,115	4,224	4,251	4,411	4,577	4,750
Total Serviced	**40,357**	**40,357**	**43,900**	**47,064**	**49,135**	**51,062**	**52,985**	**54,980**	**57,050**
Unserviced	4,103	4,103	4,410	4,857	4,962	5,072	5,263	5,461	5,667
Total	**44,460**	**44,460**	**48,310**	**51,920**	**54,097**	**56,134**	**58,248**	**60,441**	**62,717**

The summary of the residential population, non-residential EP and total EP for each sewerage scheme are provided in Table 5-2. Non-residential EP for the Moss Vale Enterprise Corridor (MVEC) was calculated on the assumption that the MVEC comes on-line from 2016

Table 5-2: Serviced Equivalent Population projection – sewerage schemes

Sewer Scheme	EP	2011 Census + WSSMP Growth				Forecast extension		
		2016	2021	2026	2031	2036	2041	2046
Berrima	Residential	826	879	1,011	1,011	1,050	1,091	1,133
	Non-residential	387	392	397	402	407	412	417
	Sub total	1,212	1,270	1,407	1,412	1,456	1,502	1,549
Bowral	Residential	12,480	13,425	14,003	14,462	15,003	15,564	16,146
	Non-residential	2,362	2,392	2,422	2,452	2,483	2,514	2,546
	Sub total	14,842	15,817	16,425	16,914	17,486	18,078	18,692
Bundanoon	Residential	2,527	2,559	2,589	2,616	2,712	2,813	2,917
	Non-residential	96	97	99	100	101	102	104
	Sub total	2,623	2,656	2,687	2,716	2,813	2,915	3,020
Mittagong	Residential	11,727	12,454	12,902	13,539	14,099	14,679	15,281
	Non-residential	2,320	2,349	2,379	2,409	2,439	2,470	2,501
	Sub total	14,047	14,804	15,281	15,948	16,538	17,149	17,782
Moss Vale	Residential	7,711	8,888	9,662	10,427	10,799	11,186	11,586
	Non-residential	593	600	608	615	623	631	639
	Sub total	8,303	9,488	10,269	11,042	11,422	11,816	12,224
Moss Vale + MVEC	Residential	7,711	8,888	9,662	10,427	10,799	11,186	11,586
	Non-residential	5,218	9,808	14,441	19,073	19,081	19,089	19,097
	Sub total	12,928	18,696	24,103	29,500	29,880	30,275	30,683
Grand Total		**53958**	**62731**	**70175**	**77533**	**79596**	**81737**	**83953**

6 Water Demand Projection and Capacity Issues

6.1 Historical analysis

The annual total metered water consumption for each customer category is presented in Figure 6-1.

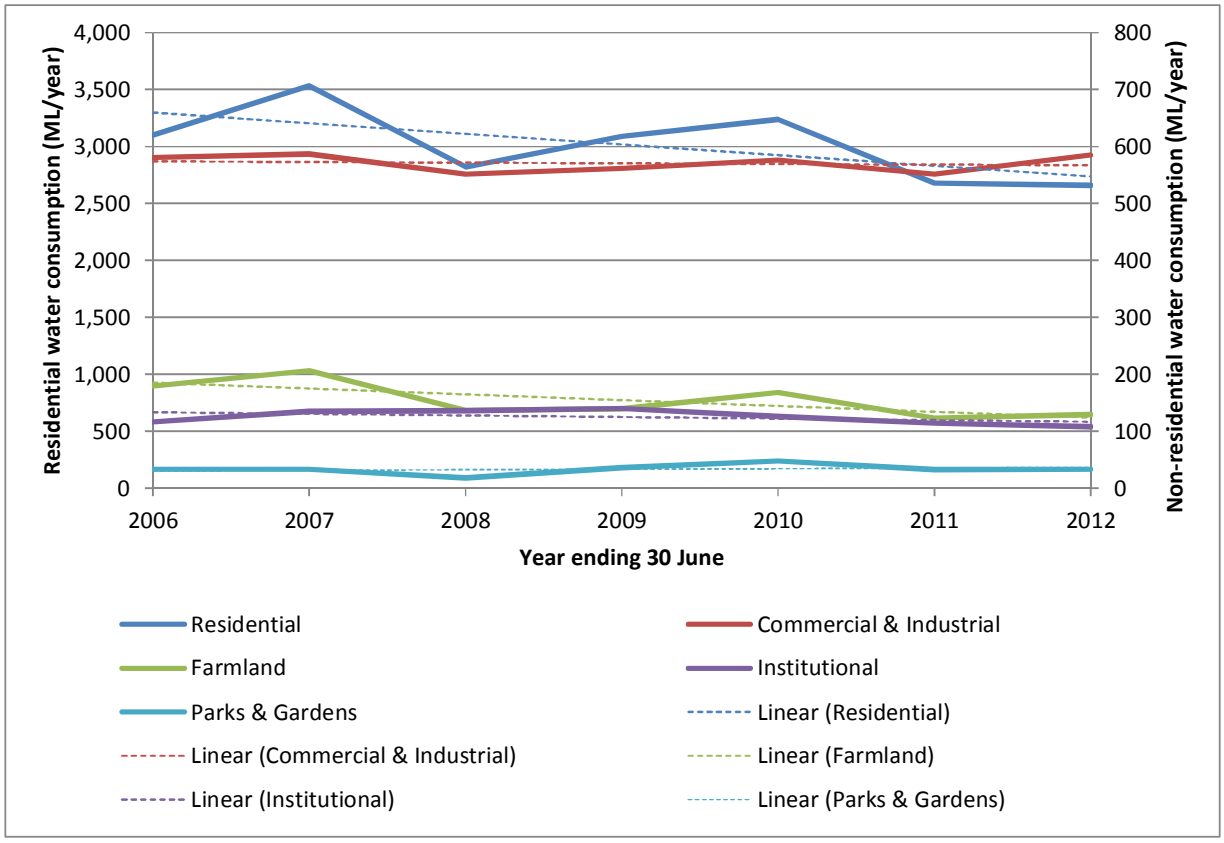

Figure 6-1: Annual metered demand by customer category

The Figure shows that residential demands have been falling while the population has been increasing, with the 2012 demand 86% of the 2006 demand. Farmland demands have been decreasing, with the 2012 demand at 72% of the 2005 demand. Commercial and industrial demands have been relatively consistent, with a variance of less than ±3.3%. Parks and gardens demands are relatively low and highly variable, with demands between 55% and 143% of the average with no significant overall trend.

The WSSMP used records from the 2012 calendar year to estimate the average daily water demand for this period are summarised in **Table 6-1**.

Table 6-1: Average daily water demands in 2012

Category	ADD (ML/day)
Non-residential	2.11
Residential	8.16
Total revenue water	**10.27**
Non-revenue water	2.09
Total production	**12.37**
Non-revenue water %	16.9%

6.2 Firefighting

It was noticeable that the water demand in 2013/2014 was much higher than could be accounted for by the climate at the time. This additional demand could potentially be attributed to firefighting requirements due to the severe bush fires in that year.

6.3 Moss Vale Enterprise Corridor

With the limited available information regarding the likely time frame for development of the site, a simple assumption of 25% increase in development at each future site was applied in the Water Master Plan. On this basis, the MVEC demands modelled in the Master Plan are:

Table 6-2: Moss Vale Enterprise Corridor Demands

Horizon	2011	2016	2021	2026	2031
MVEC ADD (L/s)	0.00	12.81	25.61	38.42	51.22
MVEC ADD (ML/d)	0.00	1.11	2.21	3.32	4.43
PDD / ADD Ratio	1.60	1.60	1.60	1.60	1.60
MVEC PDD (ML/d)	0.00	1.77	3.54	5.31	7.08

6.4 Water supply projections

The peak day demand and average day demand forecasts for 2013 to 2031 have been sourced from the WSSMP and extended using the expected population growth in each water supply area. The un-restricted dry year demand projection has been undertaken by scaling the average day demand by the 2014 dry year to average year ratio (1.074).

The Peak Day and Annual water production has been estimated by accounting for the non revenue water which is currently estimated to be 2.1 ML/d. The water supply projections are shown in Table 6-3.

Table 6-3: Water demand, production and extraction

		2012	2016	2021	2026	2031	2036	2041	2046
Metered Demand	Average year (ML/year)	3,756	4,544	5,289	5,906	6,508	6,784	7,070	7,366
	Dry year ML/year)	4,034	4,881	5,680	6,343	6,990	7,286	7,593	7,911
Filtered Production	Peak day (ML/day)	30.54	35.25	39.62	43.00	46.27	48.37	50.54	52.80
	Average year (ML/year)	4,522	5,311	6,055	6,672	7,274	7,550	7,836	8,133
Raw Extraction	Peak day (ML/day)	32.98	38.07	42.79	46.44	49.97	52.24	54.59	57.03
	Dry year ML/year)	5,246	6,160	7,024	7,739	8,438	8,757	9,089	9,433

The above projections do not include the bush firefighting demands that were placed on the system in 2013/2014. This means that the system will not cater for 'bush firefighting' and this needs to be appropriately communicated in the Levels of Service. It should be noted that 'bush firefighting' requirements are different to 'town firefighting' requirements which all systems are designed to cater for.

6.5 Headworks Capacity assessment

A time series graph showing the historical and projected peak day demand super-imposed with the design capacity of the existing treatment works for the Wingecarribee and Bundanoon schemes is provided in Figure 6-2.

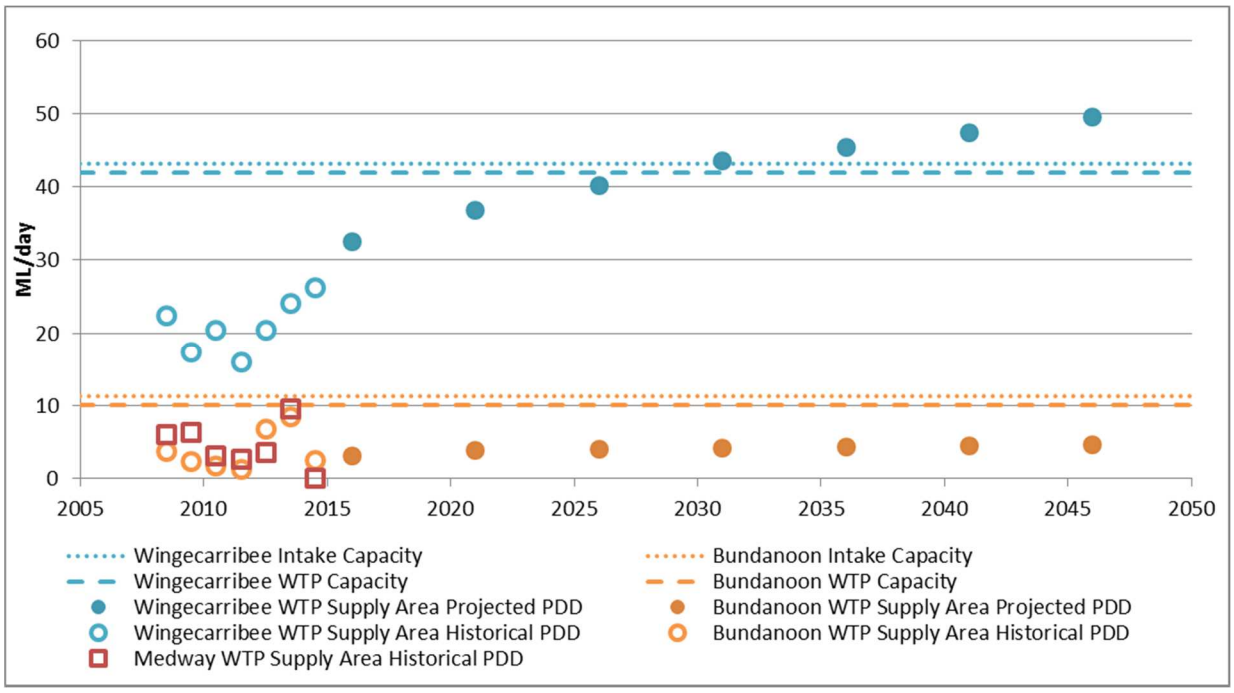

Figure 6-2: System Capacity and Projected Peak Day Demand – Existing Zoning

Under the existing WTP supply area zoning, the Wingecarribee supply area PDD is predicted to exceed the WTP capacity by around 2031.

6.6 Secure Yield and drought reliability

With the mothballing of the Medway WTP, the two main water sources for WSC are the Wingecarribee Dam and Bundanoon Dam. As the owner and operator of Wingecarribee Dam, WaterNSW is the bulk supplier to WSC. A secure yield analysis, in accordance with draft NSW Guidelines on Assuring Future Urban Water Security – Assessment and Adaption Guidelines for NSW Local Water Utilities, was therefore required only for the Bundanoon system. One of the considerations in the secure yield modelling was Council's wish to increase the volume of water sourced from its Bundanoon dam and reduce the volume of water purchased from NSW Water for the following reasons:

- The increase in the cost of water purchased from WaterNSW
- To better utilise the spare capacity available in the Bundanoon WTP
- To extend the service area of the Bundanoon water supply scheme.

The secure yield estimates for Bundanoon Dam only (ie without supply from the Wingecarribee Reservoir) for the main cases examined for the climate experienced over the last 120 years or so and with projected 1°C climate warming is provided in Table 6-4. The secure yield analysis report is provided in 13.6.2Appendix C.

Table 6-4: Bundanoon dam secure yield estimates

Bundanoon Gross dam Storage Size (ML)	EFR releases (ML/d)	Secure Yield (ML/a)	
		Historic climate	1°C Climate Warming
2046	Up to 1	1,967	1,965

6.6.1 Wingecarribee Reservoir

Modelling was also undertaken to estimate transfers required from the Wingecarribee Reservoir to meet a nominated future demand of 9,433 ML/a with the aim to maximise the use of Bundanoon Dam and thus minimise the use of transfers from the Wingecarribee Reservoir. The results are summarised below:

- On occasions, all the daily demand can be met from Bundanoon Dam, however there are times when all the daily demand needs to be met from the Wingecarribee Reservoir.
- For the modelled historic climate, 64 to 62% of demand on average could be supplied from the Bundanoon Dam storage while 36 to 38% of demand on average would need to be supplied from the Wingecarribee Reservoir.
- For the modelled 1^{o}C warming scenarios, 55 to 48% of demand on average could be supplied from the Bundanoon Dam storage while 45 to 52% of demand on average would need to be supplied from the Wingecarribee Reservoir.

The potential option to maximise the use of Bundanoon dam and minimise the transfers from the Wingecarribee reservoir will be constrained by the water extraction license limits and the capacity of Bundanoon WTP.

6.7 Water distribution issues

A range of hydraulic issues identified by Council were investigated through the water system Master Plan. These are:

6.7.1 Reservoir fill rates

A number of reservoirs operate with relatively high head differentials between the upstream system and the operating level in the reservoir. This can lead to a high head loss across the inlet valve or a high flow rate within the feeder main and a corresponding high head loss in this main. Both situations present undesirable risks to meeting levels of service targets. To manage these risks, it was suggested that Council consider installing solenoid controlled diaphragm type (or similar construction and operation) regulating valves at the inlets to these reservoirs. This works has been included in Council's capital works program.

6.7.2 Reservoir storage

The performance of the upgraded 2031 system was analysed with regards to the available reservoir storage versus system demand. It was found that all systems maintain at least 12 hours PDD storage at their lowest operating level.

6.7.3 Storage issues Mt Gib

It was noted that Mt Gib zone has only marginally more than 12 hours PDD storage at 2031 and the zone has relatively little future growth located in it suggesting that PDD storage is currently an issue. Council is investigating options to manage this potential future storage issue.

6.7.4 Storage issues New Berrima

New Berrima zone has only 17 hours storage however it is one of the most remote reservoirs. This will be an issue until the alternate supply from the Berrima zone is provided. This provides an alternate feed and makes the reservoir supply much more reliable. Council has installed infrastructure to supply from Berrima WPS / Medway zone to overcome this issue.

6.7.5 Micro Water Modelling

Developers are required to undertake micro water modelling, using their proposed point of connection and water demand projections expected from their development, to ensure current levels of service are not negatively impacted by their development.

Shire wide water quality modelling is planned to be undertaken in the near future. Modelling outputs will be used to determine any works or maintenance strategies aimed to ensure optimal water quality is sustained within in the water network.

7 Sewage Load Projection and Capacity Issues

7.1 Historical data

The historical daily inflows for all STPs in conjunction with site rainfall records are presented in the Figures below.

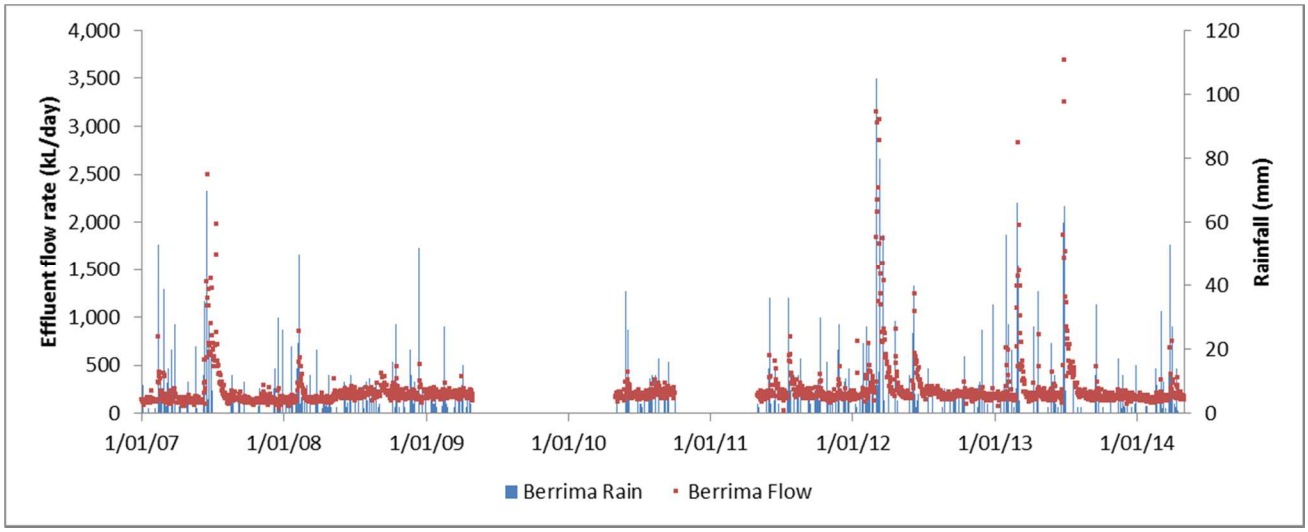

Figure 7-1: Daily STP Inflow and rainfall for Berrima STP

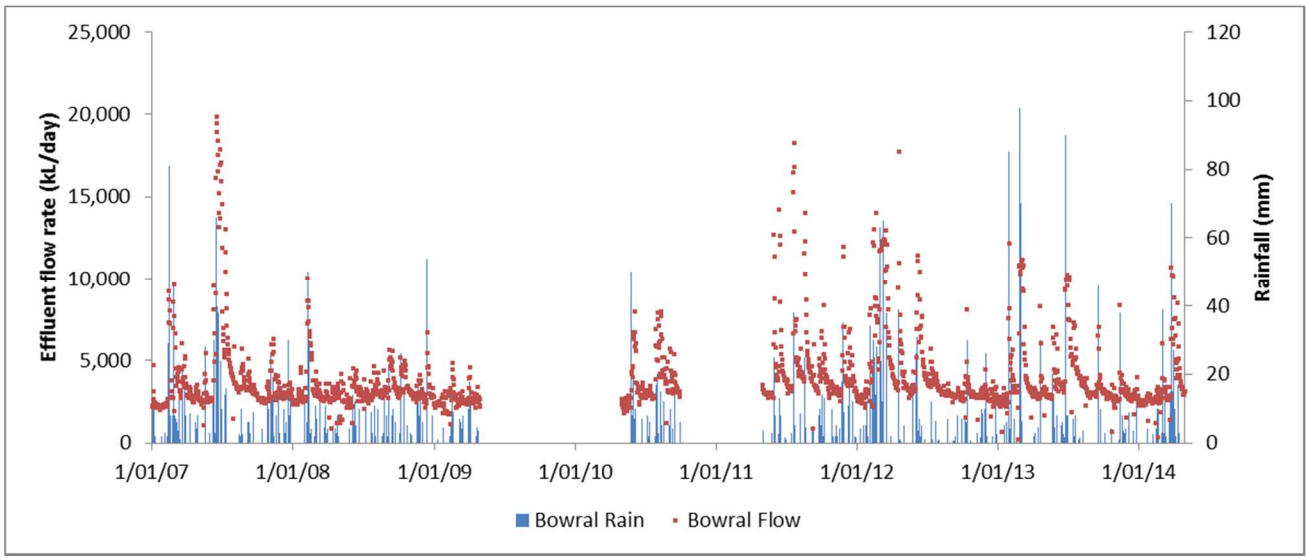

Figure 7-2: Daily STP Inflow and rainfall for Bowral STP

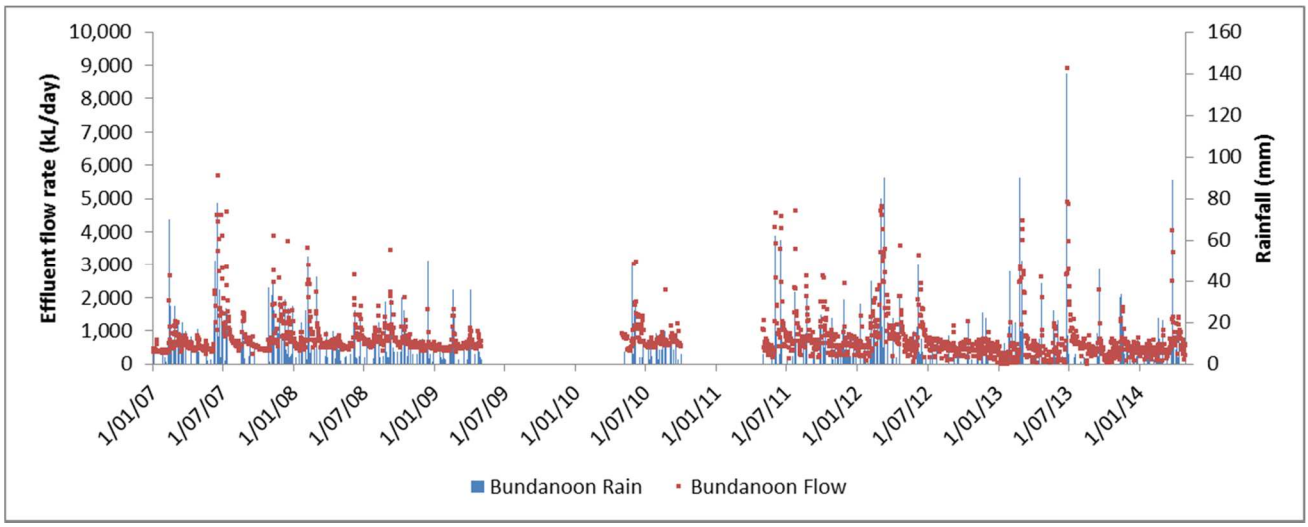

Figure 7-3: Daily STP Inflow and rainfall for Bundanoon STP

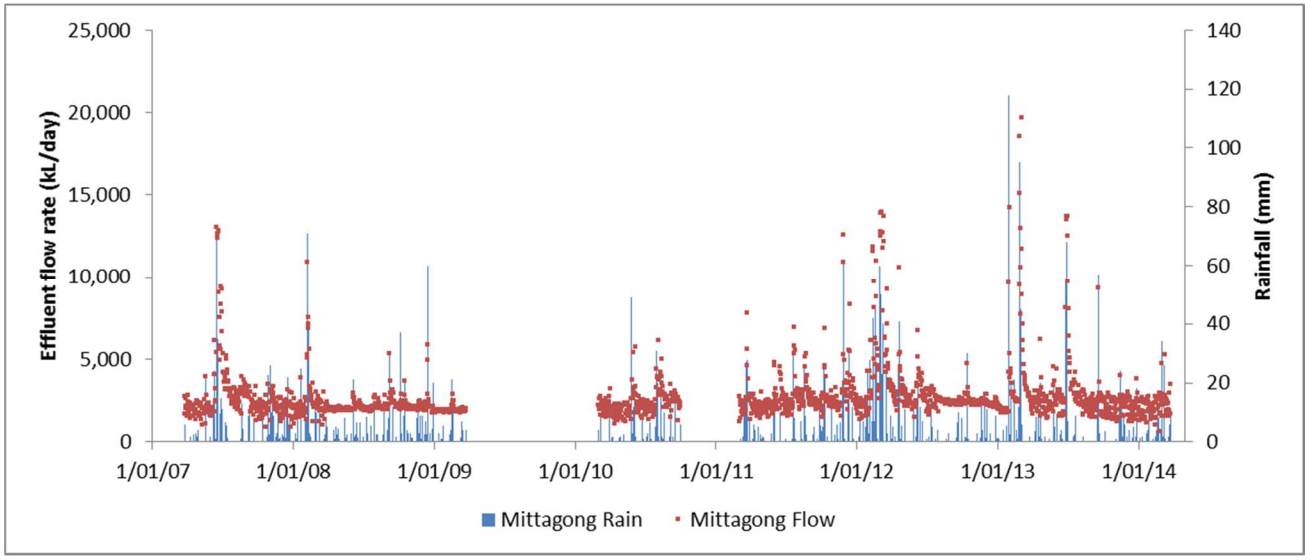

Figure 7-4: Daily STP Inflow and rainfall for Mittagong STP

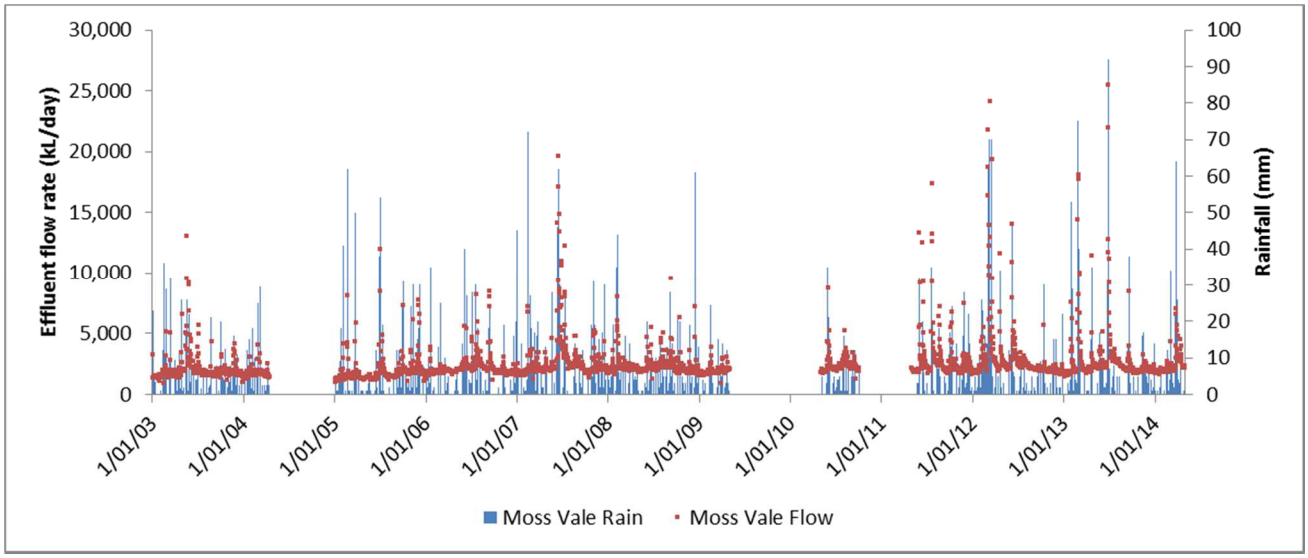

Figure 7-5: Daily STP Inflow and rainfall for Moss Vale STP

7.2 Sewer Flows and Projections

The historical data was analysed to determine Average Dry Weather Flow (ADWF). The estimated 2014 ADWF is shown in Table 7-1 which is used in EP calculations. The estimated hydraulic loading rate for all the STPs is also shown.

Table 7-1: Estimated ADWF, Hydraulic, Biological and Nutrient Loadings

	Berrima	Bowral	Bundanoon	Mittagong	Moss Vale
Estimated 2014 ADWF (kL/day)	220	3,200	500	2,400	2,100
Hydraulic Loading (L/EP/day)	215	221	191	177	269
Adopted Hydraulic Loading (L/EP/day)	220	220	200	200	240
PWWF/ADWF	5.1	7.4	6.1	5.5	8.4
Biological loading (BOD) g/EP/d	60	60	58	55	55
Total Kjeldahl Nitrogen (TKN) g/EP/d	12.5	12.5	14.8	16.9	11.9
Total Phosphorus (TP) g/EP/d	3.0	3.0	2.9	2.5	2.0

It is possible that the PWWF could be higher based on higher rainfall scenarios. Council embarked on a programme to assess the performance of the sewerage systems within the Shire. Overflow performance of the systems was assessed for both the existing loads and also for the forecast loads in the year 2030. A review of the PWWF/ADWF ratio is suggested following this modelling.

Future ADWF, PDWF were estimated by using the adopted unit loadings given in Table 7-1. The future STP sewage loading projections are shown in Table 7-2.

Table 7-2: Projected ADWF and PDWF

Scheme		2016	2021	2026	2031	2036	2041	2046
Berrima STP	ADWF (kL/d)	267	279	310	311	320	331	341
	PDWF (L/s)	8	8	9	9	9	9	9
Bowral STP	ADWF (kL/d)	3,265	3,480	3,614	3,721	3,847	3,977	4,112
	PDWF (L/s)	70	74	77	79	81	83	86
Bundanoon STP	ADWF (kL/d)	525	531	537	543	563	583	604
	PDWF (L/s)	14	14	14	14	14	15	15
Mittagong STP	ADWF (kL/d)	2,809	2,961	3,056	3,190	3,308	3,430	3,556
	PDWF (L/s)	60	63	65	68	70	72	75
Moss Vale STP	ADWF (kL/d)	1,993	2,277	2,465	2,650	2,741	2,836	2,934
	PDWF (L/s)	45	51	55	59	60	62	64
Moss Vale STP + Moss Vale Enterprise Corridor (MVEC)	ADWF (kL/d)	3,103	4,487	5,785	7,080	7,171	7,266	7,364
	PDWF (L/s)	68	94	119	143	144	146	148

7.3 Sewage Treatment Plant Capacity Assessments

Time series graphs showing the projected EP growth and biological loadings, with the STP design capacity are provided for each STP. All STPs were designed using typical design hydraulic loadings of 240 L/EP/day.

7.3.1 Berrima Sewage Treatment Plant

Figure 7-6 below provides an assessment of the STP capacity against the projected EP growth for the Berrima sewage treatment plant.

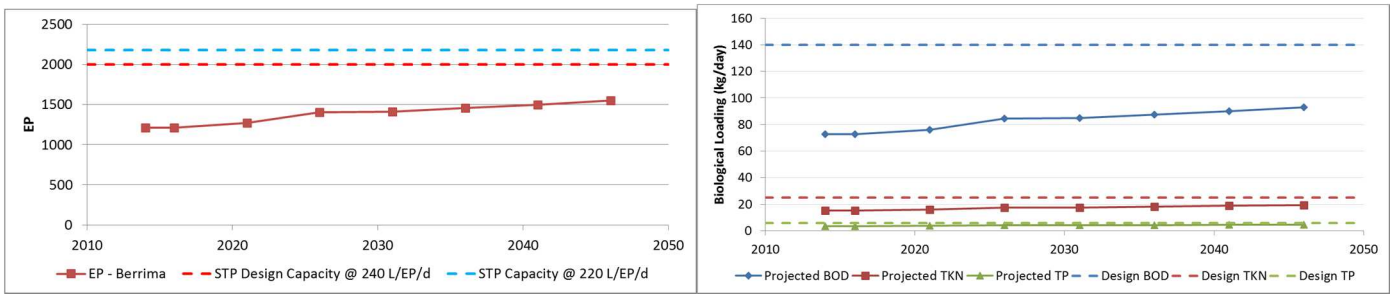

Figure 7-6: Berrima STP - projected EP growth, biological loading and STP capacity

The current estimated load of 1,212 EP is below the 2,000 EP design capacity of the STP. For the assessed hydraulic loading of 220 L/EP/day in this study, the functional hydraulic capacity of the STP is increased to 2,180 EP. At this hydraulic load, the STP capacity will not be exceeded in the 30-year planning period. The Berrima STP is also expected to remain within its biological/ nutrient design capacity up to and beyond 2046. Berrima STP does have a septic receival point and this could impact on the biological/ nutrient capacity.

7.3.2 Bowral Sewage Treatment Plant

Figure 7-7 below provides an assessment of the STP capacity against the projected EP growth for the Bowral sewage treatment plant.

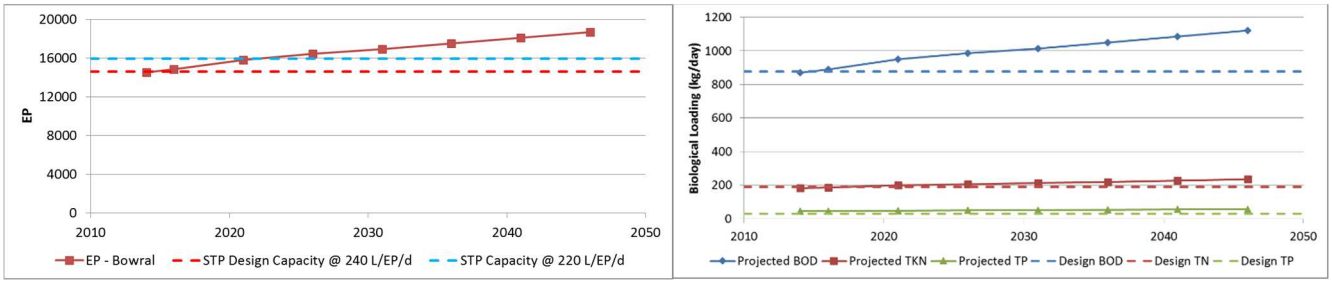

Figure 7-7: Bowral STP projected EP growth, biological loading and STP capacity

The current estimated EP of 14,842 exceeds the plant's design capacity of 14,600 EP. For the assessed hydraulic loading of 220 L/EP/day in this study, the functional hydraulic capacity of the STP is increased to 15,930 EP. At this capacity, it is estimated that the STP hydraulic capacity will not be exceeded until around 2021. The Bowral STP is also currently operating close to or past its biological/ nutrient design capacity.

7.3.3 Bundanoon Sewage Treatment Plant

Figure 7-8 below provides an assessment of the STP capacity against the projected EP growth for the Bundanoon sewage treatment plant.

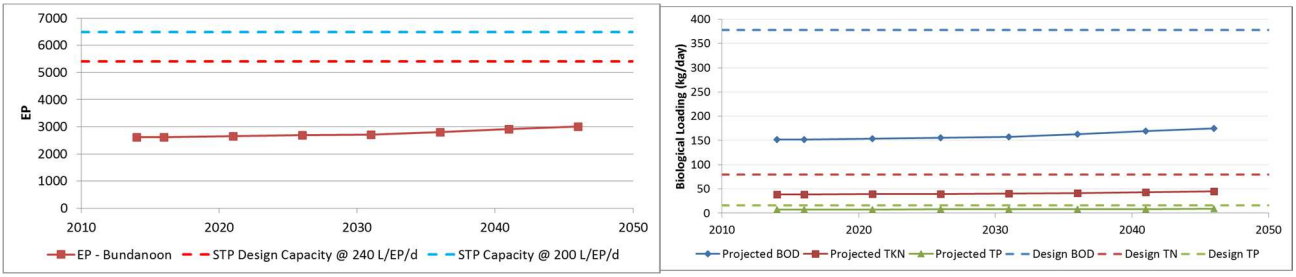

Figure 7-8: Bundanoon STP projected EP growth, biological loading and STP capacity

The current estimated EP of 2623 is below the plant's design capacity of 5400 EP. The Bundanoon STP is also expected to remain within its biological/nutrient design capacity up to and beyond 2046.

7.3.4 Mittagong sewage treatment plant

Figure 7-9 below provides an assessment of the STP capacity against the projected EP growth for the Mittagong sewage treatment plant.

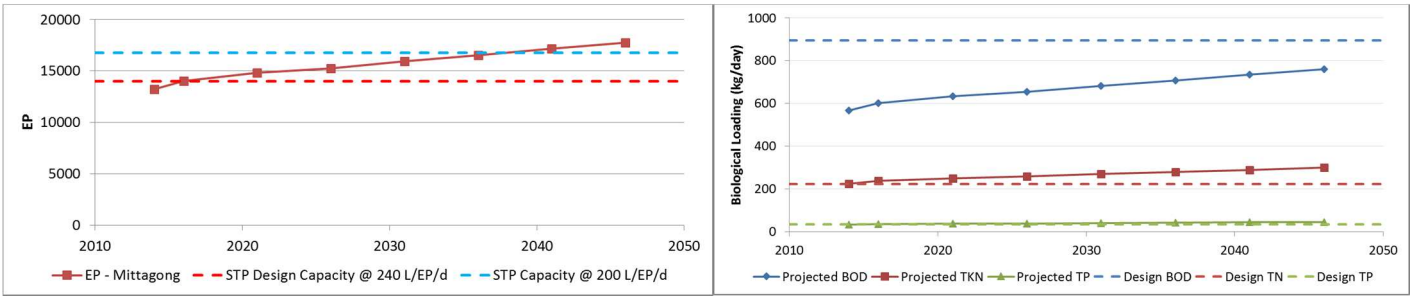

Figure 7-9: Mittagong STP projected EP growth, biological loading and STP capacity

The current estimated EP of 14,047 exceeds the plant's design capacity of 14,000 EP. For the assessed hydraulic loading of 200 L/EP/day in this study the functional hydraulic capacity of the STP is increased to 16,800 EP. At this capacity, it is estimated that the STP hydraulic capacity will not be exceeded until around 2039. The STP is currently operating within the capacity for BOD loading but exceeds the current total Nitrogen loading capacity of the plant.

7.3.5 Moss Vale Sewage treatment plant

Figure 7-10 and Figure 7-11 below provides an assessment of the STP capacity against the projected EP growth for the Moss Vale sewage treatment plant.

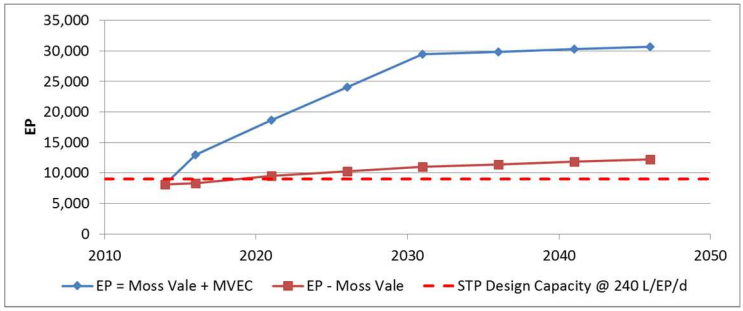

Figure 7-10: Moss Vale STP projected EP growth and STP hydraulic capacity with and without MVEC

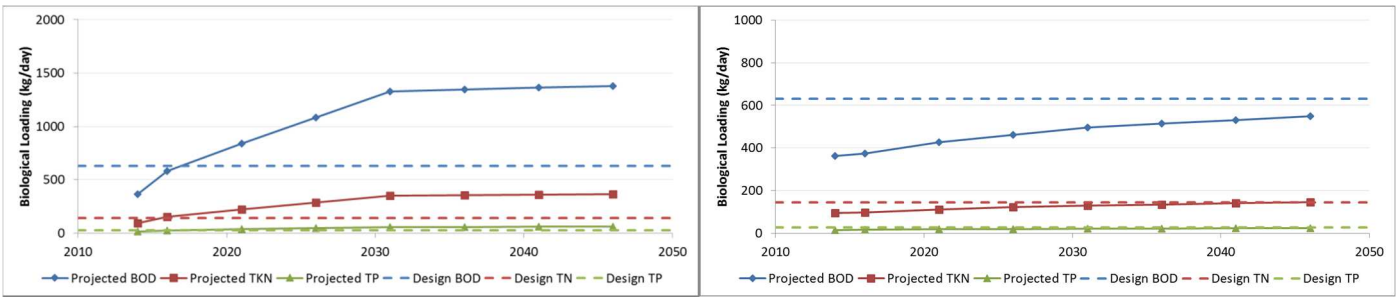

Figure 7-11 – Moss Vale STP projected EP growth and STP biological and nutrient capacity with and without MVEC

The Figures show that the current estimated EP treated by the plant is 12,298 with the MVEC or 8,303 EP without the MVEC. Including the load from the MVEC the 9,000 EP capacity of the plant is already exceeded. Without the load from the MVEC, the STP capacity is estimated to not be exceeded until around 2020. The rate of development of the Moss Vale Enterprise Corridor (MVEC) will determine the timing and extent of the augmentation for the Moss Vale STP.

8 Business and Infrastructure Performance Issues

The infrastructure performance issues were classified under the following categories:

- Legislative compliance issues
- Levels of Service issues

The Levels of Service were reviewed and updated and community consultation was completed through the NSW Council reform – Fit for the Future process and adopted through the IP&R framework. The adopted levels of service are provided in Appendix D.

8.1 Water supply scheme issues

8.1.1 Legislative compliance issues

The legislative compliance issues are summarised below:

- The Drinking Water Management Plan risk assessment identified the need to confirm the chlorine contact time available at both water treatment plants.
- Some of the Critical Control Points (CCPs) nominated in the Drinking Water Management plan, for example dam water extraction and reticulation free chlorine, are considered to be operational control points.

8.1.2 Levels of Service (LOS) issues

The LOS issues are summarised below:

- By 2031, the PDD is predicted to be very close to the combined production capacities of the WTPs thus compromising the Levels of Service during peak demand periods.
- Several reservoirs that operate with relatively high differential head which presents a risk in meeting the supply pressure.
- The water demand in 2013/2014 was much higher than could be accounted for by the climate at the time and was attributed to firefighting requirements due to the severe bush fires in that year. This indicates that the system is not designed to provide supply for bush fire fighting while meeting the level of service for the community and therefore during a bush fire levels of service to the community may be hindered.

8.2 Sewerage scheme issues

8.2.1 Legislative compliance issues

The legislative compliance issues are summarised below:

- The SEPP SDWC requires that all proposed development in the Greater Sydney drinking water catchment have a neutral or beneficial effect on water quality (NorBE). This requirement will impose more stringent effluent quality requirements for any STP upgrades or augmentations that may be required.

Berrima STP

- The 100 percentile limit of pH was not met in 2014 due to algal bloom. Algal bloom is occasional occurrence in the tertiary pond. This can also result in a exceedance of the pH limit.
- There have been a few exceedances of daily volume limit due to high rainfall resulting in higher inflows to the plant

Bowral STP

- There have been repeated exceedances of the 50th percentile concentration limit for total nitrogen due to high loadings at the treatment plant.

- There have been some exceedances of the 90th percentile limit for total phosphorus concentration limit for various reasons. There were 6 such exceedances in 2011.
- There has also been an exceedance of the load limit for Total Suspended Solids (Enclosed Waters) due to high flows being received at the plant, system failure and solids build up.

Mittagong STP

- There has been an exceedance of the 50th percentile concentration limit for total Nitrogen due to potentially high concentration loadings being received at the plant.
- There has one exceedance of the pH limit.

Moss Vale STP

- The load limit of total Nitrogen was exceeded due to high rainfall experienced in the catchment throughout the year.
- There have been repeated exceedances of the daily volume limit due to periods of high rainfall that increased the water table & reduced capacity within the reticulation system.

8.2.2 Levels of Service issues

The LOS issues are summarised below:

- Pump stations BE1 in Berrima, BW3, BW6 and BW11 in Bowral, BU1 in Bundanoon, and MV4, MV8 and MV12 in Moss Vale are considered to have a high risk of odour/septicity potential due to high sewage detention times which are a result of having longer than average rising main lengths.
- For certain pump stations including BW11 and the Lift PS at Bowral, Hill Top and Frankland St PS at Mittagong, and MV8 at Moss Vale, the emergency storage volume available is not sufficient to allow for the failure response times adopted in the LOS.

8.2.3 Unserviced communities

There are several communities in Wingecarribee Shire that are not sewered. These communities rely on On-site Sewage Management Systems (OSMS), such as septic tanks.

There are at least 5,000 On-site Sewage Management Systems (OSMS) across the Shire consisting of septic tanks or aerated systems. The process of installing an OSMS requires approval to install and approval to operate from Council. An 'Approval to Operate' license is granted for a period of two, three or five years.

Council have indicated that they do experience shortage of resources to undertake the number of inspections required.

9 Work being done by Council

There are several initiatives and projects that Council is either currently undertaking or have been included in the 'Business as Usual' capital works program. These are:

Water Loss Reduction

In 2011 Wingecarribee Shire Council had relatively high levels of water losses and excessive water pressures for households and businesses in some areas. To address these matters, Council implemented an innovative sustainable water management project involving:

- Establishment of District Metered Areas with remote monitoring for water losses
- Establishment of a hydraulic water model for the Shire to enable engineers to optimise network performance, reduce water losses and extend asset life
- Pressure management program using the flow modulated pressure control systems or manually set pressure at the Pressure Reducing Valve to minimise water losses, save money on infrastructure renewals and enhance customer service.

Water savings of approximately 243ML/annum was achieved through leakage reduction and pressure management. Council are currently reviewing the system and identifying new technology to further improve and automate this process.

Inflow Infiltration Reduction

Stormwater ingress into the sewer network is an ongoing issue for the shire with some catchments experiencing high levels of inflow infiltration. This occurs from poor quality assets, illegal connections and infrastructure located within flood zones.

Council has undertaken a multipronged approach to reduce the impact of storm events on the sewer network. This includes; targeted sewer main and manhole condition inspections, catchment smoke testing and house to house inspections to identify illegal connections (e.g. roof downpipes directed into gully traps), increased sewer main and manhole renewals, completed sewer modelling and sewer flow gaging to identify specific poor performing areas within the sewer catchments.

This multipronged approach is seen as an effective method to reduce the impact of storm events on the sewer system. In 2016 council undertook flow gauging of a specific catchment within Bowral, before and after, renewing 4.9km of sewer main and 174 sewer connections. There was an observed reduction of 184.5ML/Y of inflow infiltration as a result of renewing these poor condition assets.

Controlled Water Extraction Points

Approved water extraction points have been established within the water network to allow water carters to extract water while minimising the impact on existing customers. Water filling stations have been installed at six locations throughout the shire including, Exeter, Robertson, Moss Vale, East Bowral, Werai and Aylmerton. Council is currently reviewing the operating system and plans to expand the number of extraction points including new locations in Berrima and Hill Top.

Water Security

Council has upgraded Oldbury Road water pump station to strengthen water security within the shire. The upgrade allows water to be transferred from the Wingecarribee scheme to the Bundanoon scheme. In the event of a major issue at the Bundanoon Water Treatment Plant, water can now be provided from the Wingecarribee scheme via Oldbury Road Water Pump Station. Further to this council is currently designing permanent and mobile emergency generators at Wingecarribee Water Treatment Plant and various water pump stations. This will ensure operations are not impacted in the event of power outage.

Raw Water Quality Management

Bundanoon Dam provides approximately 10% of the shires water supply. Historically there has been evidence of poor raw water quality within the dam which required additional treatment processes at the Bundanoon Water Treatment Plant, such as Powdered Activated Carbon, to remove algae. Council has recently completed a Bundanoon Raw Water stabilisation project to help improve the raw water quality, this included upgrading the air compressors and installing new air diffusers within the dam. This project included digitally mapping the dam catchment floor, designing the new compressor and pipework, construction and commissioning.

Asset Management

Council currently has Core Asset Management Plans for Water and Sewerage and is in the process of developing these plans to advanced levels. Advanced asset management plans are built on good asset information and community consultation. Over the past few years council has increased its asset knowledge and developed a robust asset register. Data collection projects, such as field surveys collecting asset type and location information, revaluation projects informed asset values, condition assessments, criticality and risk assessments have all been completed. Council utilises Geographical Mapping Systems and Asset Management Systems to support effective engineering decisions and these are the basis for moving our asset management plans to advanced levels.

Councils current Asset Management Plans are provided in Appendix D, these plans will be updated to reflect the adopted strategies within the IWCM.

Council maintains an Asset Management Improvement Plan, which aims to improve asset management practices within the organisation across all asset classes. The improvement plan forms part of the Strategic Asset Management Plan, a key document in the Integrated Planning and Reporting framework.

Compliance with Department of Industry "Best Practice Management Guidelines"

Council complies with all elements of the Department of Industry Water, Best Practice Management Guidelines. Best Practice Management enables council to achieve sustainable water supply and sewerage business and complies with the Australian Government's National Competition Policy and National Water Initiative. There are six main elements of Best Practice Management including, Strategic Business Plan, Water Pricing, Water Conservation and Demand Management, Drought Management, Performance Reporting and Integrated Water Cycle Management.

Water Treatment Plant Process improvements

Council have planned process improvement projects at Wingecarribee and Bundanoon water treatment plants to achieve:

- Manganese removal
- Removal of algae and algal toxins
- Backwash wastewater management
- Water quality risk management for backwash water return to the plant inlet

Water Quality Improvements

- Reduced age of water through seasonal storage management.
    - Removal from service where reservoirs have poor turnover (reducing unnecessary storage)
    - Lowering of reservoir operating levels where winter turnover reduces in essential storage (reducing dead water)
- Capital investment projects programmed for the installation of reservoir mixing nozzles
    - Ensuring the stored water body has fresh inflow mixing to maintain good chlorine residual
    - Mixing also eliminates thermal stratification, removing the issue of warm old water not turning over

- Reinforced chlorination dosing (network re-dosing) using temporary dosing units which has step changed our commitment to meeting ADWG at network periphery in the last 18 months.
- Capital investment projects programmed for the installation of permanent gas chlorinators (replacing temporary units) within the network for long term re-chlorination.

10 Feasible Regional and Local options

This section provides a summary of the local and regional options that were considered to address the IWCM issues that were identified. The present value cost estimates for the options are provided in Appendix E.

10.1 Water supply capacity options

The main water supply issue to be addressed is that, with the Medway WTP currently mothballed, by 2031 the Shire-wide Peak Day Demand (PDD) is predicted to be very close to the combined production capacities of the Wingecarribee and Bundanoon WTPs and the Wingecarribee supply area PDD is predicted to exceed the WTP capacity by around 2031.

The three water supply zones within the Shire are interconnected and their boundaries can be adjusted. Currently the Medway water supply zone is being supplied from the Wingecarribee WTP. The Bundanoon water supply zone can be extended to include the Moss Vale and Berrima area of the Wingecarribee zone. Doing this would better utilise the capacity of the Bundanoon WTP as the Bundanoon supply area demands have not grown as expected.

Based on these considerations the regional options that were assessed, and the outcomes of the assessment, are provided in Table 10-1.

Table 10-1: Water supply feasible options

Option	Moss Vale and New Berrima Supply from Bundanoon	Medway Supply from Wingecarribee	Wingecarribee WTP augmentation	Bundanoon WTP augmentation	Present value capital cost ($M)	30-year total present value cost ($M)
1	0	No	2041	No	6.8	6.9
2	0	Yes	2031	No	4.8	3.4[1]
3	2 to 3 ML/d	Yes	No[2]	2020 – 2030	8.8	4.0[1]

Note 1: The reduced total present vale cost is due to the avoided cost.

For the option of keeping the Medway WTP operational, the Wingecarribee augmentation (2041) could be pushed further back if the Bundanoon supply area is expanded in to Wingecarribee.

The augmentation of the Bundanoon WTP (2020-2030) would depend on the growth and development within the Bundanoon supply area.

Table 10-2 presents the comparison between the options.

Table 10-2: Pros and cons of water supply and treatment options

Option	Pros	Cons
Option 1: Keep Medway WTP operational. No expansion of Bundanoon supply area.	• Provides flexibility for operating the three supply areas independently. • Provides greater redundancy in the system and hence improves reliability. • Provides an alternate supply option when the Wingecarribee WTP is out of service due to power failure or mains break. • Reduced reliance on Wingecarribee dam as Medway	• Has the highest up-front capital cost. • Has the highest 30-year total present value cost due to the need to operate three plants.

Option	Pros	Cons
	WTP sources water from Medway Dam.	
Option 2: Decommission Medway WTP and connect Medway WTP supply area to Wingecarribee WTP.	• Has the lowest 30-year total present value cost. • Major capital works expenditure is deferred which can then be adjusted based on further information on growth in the MVEC.	• Reduces flexibility and redundancy in the system. • Limited alternate supply is available when Wingecarribee WTP is out of service. • Increased reliance on Wingecarribee dam and greater exposure to increase in bulk water supply cost.
Option 3: Decommission Medway WTP and connect Medway WTP supply area to Wingecarribee WTP. Supply Moss Vale and New Berrima from Bundanoon WTP.	• The 30-year present value cost is low and similar to that of Option 2. • Major capital works expenditure is deferred which can then be adjusted based on further information on growth in the MVEC.	• Reduces flexibility and redundancy in the system, and may reduce reliability. • Limited alternate supply is available when Wingecarribee WTP is out of service. • Limited alternate supply is available when Wingecarribee WTP is out of service. • Increased reliance on Wingecarribee dam and greater exposure to increase in bulk water supply cost. • The following issues would need to be considered: ➢ Capacity of transfer system from Werai Balance Tank to Exeter Reservoir. ➢ Turnover of Moss Vale reservoirs. ➢ Low residual chlorine at Berrima and New Berrima.

All of the above options were taken forward in to the creation of Scenarios.

10.2 Sewerage Schemes

10.2.1 NorBE compliance

The Bowral, Mittagong and Moss Vale STPs are located within the Sydney drinking water catchment and are subject to the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011. The Policy States that

Any development or activity proposed to be carried out on land to which this Policy applies should incorporate Water NSW's current recommended practices and standards

A consent authority must not grant consent to the carrying out of development under Part 4 of the Act on land in the Sydney drinking water catchment unless it is satisfied that the carrying out of the proposed development would have a neutral or beneficial (NorBE) effect on water quality.

It is likely that the NorBE requirements would be considered by the EPA when reviewing the EPL license for these STPs. It is expected that NorBE impact will be assessed against the average performance over the whole of the asset life.

Two strategies could be considered to progress towards achieving NorBE for the STP augmentations. These are:

- Effluent reuse for irrigation thereby reducing the discharge volume and consequently the contaminant load
- Achieving the required higher quality effluent through process optimisation, and/or including additional treatment units.

The capacity to utilise effluent for irrigation is limited by the relatively cool and wet climate in the Shire. A preliminary analysis showed that a large irrigation area is required to achieve 50 percent and 100 percent effluent reuse during very wet and also relatively dry years. In addition to the availability of land, for the Southern Highlands region an indicative storage of about 325 ML would be required as a seasonal storage. The analysis confirmed that effluent reuse is unlikely to be a feasible strategy for achieving NorBE.

Process optimisation and/or additional treatment would be required to produce a higher quality effluent to achieve NorBE. When assessing further treatment the following needs have been considered:

- The cost and complexity of the additional treatment.
- The possible need to achieve further improvements in effluent quality to meet NorBE requirements arising out of other potential future upgrades.

The extent that the upgrade will meet the NorBE requirements will be finalised during the concept design.

10.2.2 Sewerage options

The main sewerage system issues to be addressed are the regulatory issue due to non-compliance with the EPA license requirements, and the capacity issue due to growth.

Shire Wide option

A common STP replacing the plants at Berrima, Bowral, and Moss Vale was considered as a shire wide option.

Local Options

Individual upgrades/augmentation to each of Bowral, Mittagong and Moss Vale STPs were assessed to address the regulatory and capacity issues at the plants. The augmentations were also assessed with and without consideration of the NorBE requirements, to provide an indication of what financial burden this would impose on the community. Details of the assessment are provided in the Options Review Paper in Appendix B.

The local and regional sewerage options that were assessed are listed in **Table 10-3**

Table 10-3: Local and regional sewerage options

Criteria	Option 1	Option 2	Option 3
Bowral STP	Upgrade to 19,000 EP (upfront)		Construct new common STP for Berrima, Bowral and Moss Vale Stage 1: 34,000 EP Stage 2: 51,000 EP in 2031
Moss Vale STP	Stage 1: Upgrade to 19,600 EP Stage 2: Upgrade to 32,000 EP in 2031.		
Mittagong STP	Process optimisation upfront with capacity upgrade to 18,500 EP in		Process optimisation upfront with capacity upgrade to 18,500 EP in

Criteria	Option 1	Option 2	Option 3
	2022		2022
NorBE consideration	Yes	No	Yes
Present value capital cost ($M)	86.4	71.3	123.2
30-year total present value cost ($M)	93.4	77.1	129.5

Table 10-4 presents the comparison between the options.

Table 10-4: Pros and cons of sewerage options

Option	Pros	Cons
Option 1: Upgrade individual STPs with NorBE consideration.	• Minimises the impact on the environment. • Minimises pollutants being discharged to the aquatic environment. • Meets the requirement of the SEPP Sydney Drinking Water Catchment.	• High initial capital outlay and high 30-year total present value cost. • Increased financial burden on the community.
Option 2: Upgrade individual STPs with no NorBE consideration.	• Lowest initial capital and 30-year total present value cost.	• Increased impact on the environment. • Increased level of pollutants being discharged to the aquatic environment. • Does not meet the requirement of the SEPP Sydney Drinking Water Catchment.
Option 3: Construct new common STP for Berrima, Bowral and Moss Vale with NorBE consideration.	• Appeal of the Shire is improved. • Minimises the impact on the environment. • Minimises pollutants being discharged to the aquatic environment. • Meets the requirement of the SEPP Sydney Drinking Water Catchment. • Improves waste management and handling. • Regulatory and statutory requirements for three plants are consolidated in to one.	• Highest initial capital outlay and highest 30-year total present value cost. • Increased financial burden on the community.

All of the above options were taken forward in to the creation of Scenarios.

11 Shire Wide IWCM Scenarios

After evaluating and shortlisting all the available options both at the regional and local individual town level, the shortlisted options have been combined in to IWCM Scenarios.

11.1 Measures and works common to all IWCM Scenarios

The issues associated with data, information and asset management needs which could be done using common management systems across the Shire for all the scenarios, along with a comment on the current status are provided in Table 11-1.

Table 11-1: Common Management System Measures for Shire Wide IWCM Scenarios

Target for Compliance	Issue	Action	Comment
Performance	The Drinking Water Management Plan risk assessment identified the need to confirm the chlorine contact time available at both WTPs	Computational fluid dynamic modelling has been undertaken to confirm the contact time available.	Recommendation to install baffles in the clear water tank to ensure contact time is achieved with no short circuiting. The installation of baffles will be completed in the 2018/19 financial year.
Best Practice Management	There are some areas in the reticulation where a chlorine residual of 0.2 mg/L is not achieved.	Council has identified a programme of work to improve the chlorine residual in the system.	• Flushing program • Small capital works projects like reducing dead ends. • Increased satellite chlorination with mobile units. • Directional nozzles to be installed in reservoirs. • Water age/chlorine residual modelling to inform future operational / capital works programs.
Best Practice Management	There is a discrepancy between the on-line and bench top test results for water quality	Indicates that one or the other has not been calibrated correctly or the true reading is not within the range of the instrumentation	
Drinking Water Management Plan	The dam water extraction and reticulation free chlorine have been identified as Critical Control Points (CCP). Based on the definition and role of a CCP these parameters are not considered as CCPs.	A review of the CCPs should be undertaken during the annual DWMS audit.	
Levels of Service	Maintaining supply when fighting a fire.	Assess through hydraulic modelling, the system pressures with firefighting demands. If the pressure cannot be sustained	System is not designed to provide supply for bush fire fighting while meeting the level of service for the

Target for Compliance	Issue	Action	Comment
		when fighting a fire, the Level of Service should be modified to reflect what can be achieved.	community. The cost of upsizing infrastructure to meet demand, and the water quality issues, hinder the ability to meet this requirement.
Levels of Service	The WSSMP found that under the 2031 system demand Mt Gib and New Berrima have only marginally more than the 12 hours PDD storage required.	The WSSMP suggests that Council progress the secondary supply from Berrima WPS/ Medway zone as a priority.	Council is investigating the upgrade of Soma Av WPS to act as booster during peak periods. New Berrima can be supplemented by Blakes Hill
	The WSSMP review identified a number of reservoirs that operate with relatively high differential head which presents a risk in meeting the supply pressure	WSSMP suggests installing regulating valves at these reservoir inlets	Included in the current capital works program
Levels of Service	Pumping station BE5 at Berrima, BW11 and Lift PS at Bowral, Hill Top at Mittagong and MV8 at Moss Vale all have an emergency storage less than the adopted response time.	Review the Service Level criteria and Emergency Response Plan.	
Unserviced Areas	Council has an on-site sewage management strategy but experience shortage of resources to undertake number of inspections required.	Prepare a resource plan to undertake assessments of on-site sewage management systems	Any systems that are identified as high risk will have to be further reviewed to consider servicing.

11.2 Description of the IWCM Scenarios

Table 11-2 shows the bundled scenarios segregated for convenience into water supply and sewerage schemes. The issues that are being addressed by each option are also listed.

Table 11-2: Shire Wide IWCM Scenarios – Headworks augmentation

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
Water Supply Systems							
System Capacity	By 2031 the PDD for the Shire is predicted to be very close to the combined production capacities of Bundanoon and Wingecarribee WTPs.	Upgrade and retain Medway WTP Augment Wingecarribee WTP in 2041				✓	
		Decommission Medway WTP Augment Wingecarribee WTP in 2031	✓	✓	✓		
		Decommission Medway WTP Supply part of Moss Vale demand from Bundanoon WTP. Augment Bundanoon WTP in 2023 (2020 – 2030)					✓
Bowral Sewage Treatment Plant							
Regulatory	Exceedances of EPA license limits for total nitrogen and total phosphorous	Operate the plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. Decommission the Pasveer channels and build a new 9,000 EP capacity reactor. No NorBE compliance considered.	✓	-	-		

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
Capacity – biological and nutrient loading	The plant is currently operating close to its capacity for biological and past its capacity for nutrient loading	Operate plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. This will reduce the capacity of the IDEA reactor to approximately 10,000 EP. Decommission the Pasveer channels and build a new 9,000 EP capacity reactor. <u>NorBE Compliance</u>: Upgrade tertiary filtration system for TP compliance. Provide chlorination/ dechlorination system for enhanced TN removal.	-	✓	-	✓	✓
Capacity - hydraulic	The plant is currently operating close to its hydraulic capacity.	Construct a new common STP to treat sewage from Berrima, Moss Vale and Bowral with NorBE compliance. Stage 1: 34,000 EP Stage 2: 51,000 EP (between 2020 and 2030 depending on MVEC development)	-	-	✓		
Mittagong Sewage Treatment Plant							
Capacity – biological and nutrient loading.	The plant is currently operating at its design capacity for biological and nutrient loading	Operate the plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility.	✓	✓	✓	✓	✓
		Build a new 5,000 EP capacity reactor in 2022. No NorBE compliance considered.	✓	-	-		

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
		Build a new 5,000 EP capacity reactor in 2022. NorBE Compliance: Upgrade tertiary filtration system for TP compliance. Provide chlorination/ dechlorination system for enhanced TN removal.	-	✓	✓	✓	✓
Moss Vale Sewage Treatment plant							
Capacity – biological and nutrient loading. Capacity - hydraulic	The plant is currently operating close to its design capacity for biological and nutrient loading The plant is operating close to its hydraulic capacity	Operate the plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. Stage 1: Build a new 12,500 EP capacity reactor. Stage 2: Build another 12,500 EP reactor (this could be in 2025 or 2030 depending on the development of the MVEC) No NorBE compliance considered.	✓	-	-		

Target for Compliance	Issue	Option	Scenarios				
			1	2	3	4	5
		Operate plant with a 25-day sludge age to allow for improved nitrification capability and provide more operational flexibility. Stage 1: Build a new 12,500 EP capacity reactor. Stage 2: Build another 12,500 EP reactor (this could be in 2025 or 2030 depending on the development of the MVEC) <u>NorBE Compliance:</u> Upgrade tertiary filtration system for TP compliance. Provide chlorination/ dechlorination system for enhanced TN removal.	-	✓	-	✓	✓
		Construct a new common STP to treat sewage from Berrima, Moss Vale and Bowral with NorBE compliance. Stage 1: 34,000 EP Stage 2: 51,000 EP (between 2020 and 2030 depending on MVEC development)	-	-	✓		

11.3 Present Value Analysis of IWCM Scenarios

The detail net present value cost estimate for the four scenarios is provided in Appendix D

11.3.1 Water supply Service

Table 11-3 presents the summary of the estimated total cost of capital outlay and the present value of the capital, and the operating and maintenance (O&M) cost estimates over the 30 years of the water supply service in each IWCM Scenario based on 2017/18 dollars.

Table 11-3: Summary of Capital and Present Value Costs for the IWCM Scenarios – Water Supply Service Component

Water Scenario	Total Capital Cost $K (over 30 years)	Present Value of Capital Cost $K @7%	Total Present Value $K @ 7%
Scenario 1	31,980	13,252	18,091
Scenario 2	31,980	13,252	18,091
Scenario 3	31,980	13,252	18,091
Scenario 4	32,090	6,775	6,938
Scenario 5	12,480	8,813	23,168

Scenario 4 has the lowest present value costs as the cost to upgrade and retain Medway WTP are already included in Council's capital works program, and the cost to augment the Wingecarribee WTP is deferred to 2041.

11.3.2 Sewerage Service

Table 11-4 presents the summary of the estimated total cost of capital outlay and the present value of the capital, and the operating and maintenance (O&M) cost estimates over the 30 years of the sewerage service in each IWCM Scenario based on 2017/18 dollars.

Table 11-4: Summary of Capital and Present Value Costs for the IWCM Scenarios – Sewerage Service Component

Sewer Scenario	Total Capital Cost $K (over 30 years)	Present Value of Capital Cost $K @7%	Total Present Value $K @ 7%
Scenario 1	92,305	71,318	77,106
Scenario 2	113,065	86,444	93,371
Scenario 3	153,058	123,223	155,835
Scenario 4	113,065	86,444	93,371
Scenario 5	113,065	86,444	93,371

The capital cost analysis shows that the additional cost to comply with NorBE requirements is about $20 M. It also shows that the construction of a common STP (Scenario 3) is not an economical option when compared to augmenting the STPs individually.

11.3.3 Avoided costs for IWCM Scenarios

The IWCM Scenarios will result in avoided operating and maintenance costs due to the following:

- Berrima, Bowral, and Moss Vale sewage treatment plants (STPs) being replaced by one common STP.
- Transfer of Medway WTP operating cost to Wingecarribee WTP
- Transfer of some operating cost from Wingecarribee WTP to Bundanoon WTP

The avoided operating and maintenance costs for each Scenario are presented in Table 11-5.

Table 11-5: Summary of 30-year Present Value Avoided Costs for IWCM Scenarios

IWCM Scenario	Water Supply Schemes avoided cost ($K)	Sewerage Schemes avoided cost ($K)	Total avoided cost ($K)
Scenario 1	14,647	-	14,647
Scenario 2	14,647	-	14,647
Scenario 3	14,647	26,306	40,953
Scenario 4	-	-	-
Scenario 5	19,158	-	19,158

11.4 IWCM Scenario Costs

The 30-year present value IWCM Scenario costs are presented in present value

Table 11-6: Summary of 30-year present value IWCM Scenario cost

Scenario	Present value capita cost ($K)	Present Value Operating Cost ($K)	Present value avoided cost ($K)	Total Present Value ($K)
Scenario 1	84,570	10,625	14,647	80,548
Scenario 2	99,696	11,765	14,647	96,814
Scenario 3	136,475	37,450	40,953	132,972
Scenario 4	93,219	7,089	-	100,308
Scenario 5	95,257	21,281	19,158	97,380

Scenarios 2, 4 and 5 could be considered similar in terms of total present value. The present value estimates are used in the triple bottom line assessment of scenarios.

11.5 Triple Bottom Line Assessment of Scenarios

A total of 8 environmental and social criteria have been used to score the IWCM Scenarios as to how they address the IWCM Issues. The criteria were based on selected social and environmental objectives. Suitable weightings were assigned to the criteria. The criteria and their scores for each Scenario, are shown in **Error! Reference source not found.**.

Table 11-7: Social and Environmental Performance Targets and Objectives

		Criteria	Weighting	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Comments
				No Medway, No NorBe	No Medway, NorBe	No Medway, NorBe Central STP	Retain Medway, NorBE	No Medway, increase Bundy, NorBE	
TBL CATEGORY	ENVIRONMENTAL	Minimise the impact on the environment	0.35	2	4	4	3	4	Achieving NorBE would produce an effluent with lower pollutant concentrations. Retaining Medway would have associated sludge disposal requirements.
		Reduce energy consumption during operation	0.15	4	3	2	3	2	Achieving NorBE is more energy intensive. A common STP is more energy intensive due to the need to redirect the sewage. Supply Medway from Bundanoon would be more energy intensive.
		Minimises pollutants being discharged to the aquatic environment	0.35	2	3	4	3	3	Not achieving NorBE would result in increased pollutants in the STP effluent.
		Impact on waste management	0.15	4	3	3	2	3	Not achieving NorBE results in reduced waste generation from the STPs. Retaining the Medway WTP requires handling sludge generated from an additional treatment plant.
			1.00	**2.60**	**3.35**	**3.55**	**2.85**	**3.20**	
	SOCIAL	Maintains or improves the reliability of the services	0.25	3	3	4	4	3	Retaining Medway WTP increases redundancy. Providing a common STP consolidates operation and maintenance at one plant.
		Minimises non-compliance to statutory requirements	0.35	2	4	4	3	4	Keeping an additional plant in operation increases the risk of non-compliance.
		Improves the levels of service	0.25	2	4	4	4	4	The NorBE option scores higher than the no NorBE option
		Appeal of the Shire is maintained or improved.	0.15	2	4	4	3	4	Higher score for NorBE option and no Medway WTP due to the increased reliability of the water supply
			1.00	**2.25**	**3.75**	**4.00**	**3.50**	**3.75**	

The outcome of the environmental and social scoring for each IWCM Scenario across the 8 targets is shown in **Table 11-8**.

Table 11-8: Summary of TBL Score for IWCM Scenarios

Scenario	Environmental Score	Social Score	Environmental and Social Score(ESS)
Scenario 1	2.60	2.25	4.85
Scenario 2	3.35	3.75	7.10
Scenario 3	3.55	4.00	7.55
Scenario 4	2.85	3.50	6.35
Scenario 5	3.20	3.75	6.95

Table 11-9 presents the ranking of the IWCM Scenarios following the DoI Water ranking methodology.

Table 11-9: IWCM Scoring Ranking

Scenario	30-year Total Present Value ($M)	ESS	ESS/NPV	Rank
Scenario 1	80.55	4.85	0.060	4
Scenario 2	96.82	7.10	0.073	1
Scenario 3	132.97	7.55	0.057	5
Scenario 4	100.31	6.35	0.063	3
Scenario 5	97.38	6.95	0.071	2

According to the assessment and ranking criteria used above, the preferred Shire Wide IWCM Scenario is Integrated Scenario 2.

11.6 Adopted Scenario

In addition to the common measures and works listed in Table 11-1 the adopted IWCM consists of the following major water supply and sewerage works.

- Decommission Medway WTP and supply the Medway service area from Wingecarribee WTP.
- Retain the Medway raw water source for use during emergencies by installing a package water treatment plant (subject to feasibility assessment).
- Augment Wingecarribee WTP in 2031/32.
- Upgrade raw water pumping station at Medway dam

Bowral STP

- Derate the plant capacity to allow for operation with a 25-day sludge age for improved nitrification capability and provide more operational flexibility.
- Decommission the Pasveer channels.
- Build a new 9,000 EP capacity reactor (2019/20).
- Upgrade the tertiary filtration system for better total phosphorus removal to address NorBE requirements for augmentations.
- Provide chlorination/ dechlorination system for enhanced TN removal to address NorBE requirements for augmentations.

Mittagong STP

- Derate the plant capacity to allow for operation with a 25-day sludge age for improved nitrification capability and provide more operational flexibility.
- Review the plant process with a view to optimising the operation of the plant.
- Build a new 5,000 EP capacity reactor (2023).
- Upgrade the tertiary filtration system for better total phosphorus removal to address NorBE requirements for augmentations.
- Provide chlorination/ dechlorination system for enhanced TN removal to address NorBE requirements for augmentations.

Moss Vale STP

- Derate the plant capacity to allow for operation with a 25-day sludge age for improved nitrification capability and provide more operational flexibility.
- Stage 1 augmentation: Build a new 12,500 EP capacity reactor (based on high MVEC growth).
- Stage 2 augmentation: Build a new 12,500 EP capacity reactor. This could be anywhere between 2025 and 2030 depending on the development rate of the MVEC.
- Upgrade the tertiary filtration system for better total phosphorus removal to address NorBE requirements for augmentations.
- Provide chlorination/ dechlorination system for enhanced TN removal to address NorBE requirements for augmentations.

Emergency Response Plan

Council has a current Drought Management Plan which outlines triggers for the implementation of water restrictions in the event of prolonged drought. The plan will be reviewed and updated as an emergency response plan following the adoption of the IWCM Strategy.

12 Total Asset Management Plan

This total asset management plan presents the details of the projected capital works and recurrent (operation, maintenance and management – OMA) expenditure schedules for the next 30 years, which are significant parameters for financial planning.

The capital works and the OMA details used in the financial models ensure forecasting funds required to implement the scheduled capital works as planned, and help develop effective funding strategies to moderate any financial impact on customers and the Council.

12.1 Capital Works

The adopted IWCM strategy enables Council to develop a schedule of expected capital works into the future to satisfy the forecast service demands in terms of growth, improved levels of service and replacement of existing assets.

Growth works	Works required to increase the capacity of facilities, to service new release areas/ subdivisions.
Improved level of service works - ILOS (including backlog works)	Works to provide better public health and environmental standards, better service, higher reliability, or an extension of services to unserviced existing development. Works in this category may be eligible for Government grants.
Asset renewal	Renewal/ replacement of existing assets, which have aged and reached the end of their economic service life

The adopted IWCM strategy develops the growth and ILOS capital works over the planning horizon based on the adopted options to address the identified IWCM issues. Additionally, anticipating the need and timing for asset renewal/ replacement is vital given the significant capital investment requirements and the need to ensure availability of funds.

Council regularly undertakes CCTV inspection of sewer mains, inspection of sewer pump stations and manholes for condition assessment. For the underground water supply assets, non-destructive testing of critical water mains and analysis of burst history data are carried out for assessing the conditions. Council maintains a current infrastructure risk register for reporting critical assets based on the asset condition data with “very high’ and ‘high’ levels of service risks. The ranking criteria used to determine priority is presented in the Table 12-1.

Table 12-1: Renewal Priority Criteria

Criteria	Weighting
Service capacity	Varies between asset classes
Number of customers the asset is servicing	
Operational importance as defined by operators	
Environmental consequences of the asset failing	
Fire risk	
Replacement cost/total value of the asset	
Total	**100%**

The asset condition data is then used to inform the asset renewal requirements and incorporated in the Asset Management Plans. Prioritising and planning for renewal and replacement capital works is then undertaken in consideration of meeting service level objectives and minimising infrastructure service risks based on the current hierarchy of critical assets so identified. Council typically undertakes asset renewal to either:

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

The Water Supply and Wastewater Asset Management Plans of the Council (Appendix F) develop and document assets requiring renewal based on the above considerations. The levels of renewal capital expenditure are based on current data and is continually reviewed and refined as more data is collected. The 30-year water supply and sewerage capital works programs for the adopted IWCM strategy are presented in Table 12-2 and Table 12-3.

12.2 Recurrent Costs

Administration/ Management costs	Reflects true overheads associated with providing this service. Any cross subsidies with General Fund should be eliminated or explicitly disclosed in the Annual Accounts.
Operations and Maintenance (O&M) costs	It is assumed that the current level of costs shown in the Financial Statements reflects a realistic level of expenditure for the current schemes. The projections assume costs increased in proportion to the growth
Model cost overrides	Additional costs are included where specific activities have been identified for future years. This includes new initiatives plus additional costs associated with new capital works identified as part of the adopted IWCM scenario. For details of overrides used in the model, refer to the next section (Financial model variables).

Details of overrides for recurrent expenditure are as follows:

- Administration – as estimated and adopted by the Council
- Engineering & Supervision – includes estimates for additional resources
- Operation and Maintenance expenses – includes additional cost estimates for IWCM identified measures
- Energy costs – includes additional cost estimates for IWCM identified measures
- Chemical costs – includes additional cost estimates for IWCM identified measures
- Other expenses – as estimated by the Council
- Other revenue, grants and contributions – as estimated based on adopted assessment growth rate

The recurrent O&M costs for the adopted water supply and sewerage IWCM scenario are presented in Table 12-6 and Table 12-7.

Table 12-2: 30-Year Capital Works Schedule for Water Supply – Adopted IWCM Scenario

WINGECARRIBEE SHIRE COUNCIL
WATER: 30-Year Capital Works Program — Current Year 2017/18
Capital Works in 2017 ($'000)

PROJECT	ILOS	GROWTH	Works (Improved LOS+	RENEW	Total	1 2017/18	2 2018/19	3 2019/20	4 2020/21	5 2021/22	6 2022/23	7 2023/24	8 2024/25	9 2025/26	10 2026/27	11 2027/28	12 2028/29	13 2029/30	14 2030/31	15 2031/32	16 2032/33	17 2033/34	18 2034/35	19 2035/36	20 2036/37	21 2037/38	22 2038/39	23 2039/40	24 2040/41	25 2041/42	26 2042/43	27 2043/44	28 2044/45	29 2045/46	30 2046/47
A: NEW WORKS - BACKLOG																																		
Balmoral Water Supply	100%		100%		**4,600**				400	600	3,600																								
Penrose / Wingello Water Supply	100%		100%		**5,400**			400	500	4,500																									
B: NEW WORKS - GROWTH																																		
Mittagong / Willow Vale Development		100%	100%		**0**																													
Master Plan (Distribution Model Output)		100%	100%		**14,400**	1,215	1,650	5,335	1,600	1,485	1,395	790	-	-	290	-	-	-	-	-	-	640	-	-	-	-	-	-	-	-	-	-	-	-
2030 Capacity Upgrade Wingecarribee WTP		100%	100%		**31,200**														15,600	15,600														
Private works, connections, extensions		100%	100%		**4,500**	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
New Meters and Connections		100%	100%		**4,350**	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145
Gib North to Willow Vale Water Main Construction		100%	100%			1,000																												
C: NEW WORKS - SERVICE IMPROVEMENT / OTHER																																		
Dams (Component) upgrade	75%		75%	25%	**1,115**	270	5	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Wingecarribee WTP Improvements	75%		75%	25%	**9,730**	-	555	1,300	3,000	3,000	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Bundanoon WTP Improvements	75%		75%	25%	**4,650**	-	-	-	4,000	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Medway Dam Raw Water PS Improvements	75%		75%	25%	**780**	-	-	780																											
Pump Station (Component) upgrade	75%		75%	25%	**4,180**	-	20	250	3,000	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Reservoirs (Component) upgrade	75%		75%	25%	**1,170**	100	230	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Telemetry System upgrade	75%		75%	25%	**560**	-	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Total control system and starters at BWTP and control system for chemical dosing at WWTP	75%		75%	25%	**0**	-	-																												
BWTP and WWTP clearwater tank baffles	75%		75%	25%	**0**																													
Oldbury Road Booster Pump Station	75%		75%	25%	**0**																													
UFS	75%		75%	25%	**230**	125	105																												
Advanced Designs	75%		75%	25%	**1,200**	300		100	100	100				150	150	150	150																		
Critical Mains Upgrade		50%	50%	50%				2,300	1,400	1,600	1,000	4,000			3,000	4,000	3,000	4,000																	
Depot Upgrade	50%		50%	50%			250																												
D: ASSET / COMPONENT RENEWAL																																		
Dams			0%	100%	**1,160**	-	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Water Treatment Plants		50%	50%	50%	**6,490**	100	290	700	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Pump Stations		50%	50%	50%	**2,450**	350	-	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Reservoirs			0%	100%	**2,160**	60	-	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Water Mains		50%	50%	50%	**36,200**	1,000	1,600	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Service Connections			0%	100%	**1,450**	50	50	-	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Hydrants, Valves & PRVs			0%	100%	**3,560**	100	100	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Bulk Meters			0%	100%	**810**	30		30		30		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Water Meters			0%	100%	**3,050**	200	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Backflow Prevention Devices				100%	**200**			50	50												50	50														
Plant Replacement			0%	100%	**6,000**	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Lease Vehicle Replacement				100%	**1,800**	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Telemetry System				100%	**0**																														
TOTAL					**178,945**	**5,455**	**5,500**	**13,490**	**16,545**	**13,870**	**8,625**	**7,450**	**2,660**	**2,810**	**6,100**	**6,810**	**5,810**	**6,660**	**18,260**	**18,260**	**2,710**	**3,350**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**	**2,660**
Expected Subsidy / Contribution on Projects					**0**	**0**	**0**	**0**	**0**	**0**																										

Table 12-3: 30-Year Capital Works Schedule for Sewerage – Adopted IWCM Scenario

WINGECARRIBEE SHIRE COUNCIL
SEWER: 30-Year Capital Works Program Current Year 2017 /18
Capital Works in 2017 ($'000)

PROJECT	ILOS	GROWTH	New Works (Improved LOS+ Growth)	RENEW	Total	1 2017/18	2 2018/19	3 2019/20	4 2020/21	5 2021/22	6 2022/23	7 2023/24	8 2024/25	9 2025/26	10 2026/27	11 2027/28	12 2028/29	13 2029/30	14 2030/31	15 2031/32	16 2032/33	17 2033/34	18 2034/35	19 2035/36	20 2036/37	21 2037/38	22 2038/39	23 2039/40	24 2040/41	25 2041/42	26 2042/43	27 2043/44	28 2044/45	29 2045/46	30 2046/47
A: NEW WORKS - BACKLOG																																		
Robertson Sewer Scheme	100%		100%		**0**																													
Yerrinbool Sewer Scheme	100%		100%		**0**																													
Exeter Sewer Scheme	100%		100%		**0**																													
Burrawang Sewer Scheme	100%		100%		**0**																													
Penrose & Wingello Sewer Scheme	100%		100%		**0**																													
Balmoral Sewer Scheme	100%		100%		**0**																													
					0																													
B: NEW WORKS - GROWTH					**0**																													
Bowral STP Upgrade by 9,000 EP		100%	100%		**34,000**	1,000	2,000	16,500	14,500																									
Moss Vale STP Stage 1 Upgrade by 12,500 EP		100%	100%		**28,600**	1,000		13,800	13,800																									
Mittagong STP Upgrade to 20,000 EP		100%	100%		**24,900**		1,000	1,500			11,200	11,200																						
Moss Vale STP Stage 2 Upgrade by 12,500 EP		100%	100%		**24,200**														1,000	11,600	11,600													
Robertson STP Upgrade to 3,000 EP		100%	100%		**0**																													
Main Capacity Upgrade for Growth & PRP		100%	100%		**2,900**	100	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Pump Station Capacity Upgrade for Growth & PRP		100%	100%		**2,183**	75	8	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Private Works - Extension & Connection		100%	100%		**2,250**	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
C: NEW WORKS - OTHER (Performance Improvement)																																		
STP Upgrades / Improvements	100%		100%		**6,417**	600	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	201	202	203	204	203	204
Pump Station Upgrades / Improvements	100%		100%		**1,700**	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85										
Telemetry System Upgrade 66734	100%		100%		**2,270**		1000	1000		30			30			30			30			30			30			30				30		
Depot Works	50%		50%	50%	**250**		250																											
Sewer Containment	100%		100%		**4,310**			290	450	240	560	490	420	170	300	540	850																	
D: RENEWALS																																		
STP Asset Renewal				100%	**6,135**	200	335	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Pump Station Asset Renewal				100%	**5,400**	750	450	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Pump Replacements				100%	**3,000**	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Reticulation - Mains / Service Lines		50%	50%	50%	**50,000**	2,600	2,400	1,800	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Vent Pipe Replacement				100%	**890**	20	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Plant Replacement				100%	**5,250**	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
Lease Vehicle Replacement				100%	**1,500**	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Telemetry Component Renewal 66734				100%	**2,400**	1,500	200	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Sewer Manhole Renewals				100%	**6,000**	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
TOTAL					**214,555**	**8,530**	**8,558**	**36,355**	**31,815**	**3,335**	**14,825**	**14,755**	**3,515**	**3,235**	**3,365**	**3635**	**3,915**	**3,065**	**3,095**	**4,065**	**14,665**	**14,695**	**3,065**	**3,065**	**3,095**	**2980**	**2,980**	**3,010**	**2,980**	**2,981**	**3,012**	**2,983**	**2,984**	**3,013**	**2,984**
Expected Subsidy / Contribution on Projects					**0**	**0**	**0**	**0**	**0**	**0**	**0**																								

Table 12-4: Capital Works Summary for Water Supply ($'000)

2017/18 ($'000)	Growth and Minor Works	Improved Levels of Service	Asset Renewals	Total Capital Works	Expected Subsidy	Cost to Council
2017/18	3,235	596	1,624	5,455	0	5,455
2018/19	2,890	811	1,799	5,500	0	5,500
2019/20	7,768	2,283	3,440	13,491	0	13,491
2020/21	3,333	8,535	4,678	16,546	0	16,546
2021/22	3,318	7,530	3,023	13,871	0	13,871
2022/23	2,928	3,761	1,936	8,625	0	8,625
2023/24	3,823	161	3,466	7,450	0	7,450
2024/25	1,033	161	1,466	2,660	0	2,660
2025/26	1,033	274	1,504	2,811	0	2,811
2026/27	2,823	274	3,004	6,101	0	6,101
2027/28	3,033	274	3,504	6,811	0	6,811
2028/29	2,533	274	3,004	5,811	0	5,811
2029/30	3,033	161	3,466	6,660	0	6,660
2030/31	16,633	161	1,466	18,260	0	18,260
2031/32	16,633	161	1,466	18,260	0	18,260
2032/33	1,033	161	1,516	2,710	0	2,710
2033/34	1,673	161	1,516	3,350	0	3,350
2034/35	1,033	161	1,466	2,660	0	2,660
2035/36	1,033	161	1,466	2,660	0	2,660
2036/37	1,033	161	1,466	2,660	0	2,660
2037/38	1,033	161	1,466	2,660	0	2,660
2038/39	1,033	161	1,466	2,660	0	2,660
2039/40	1,033	161	1,466	2,660	0	2,660
2040/41	1,033	161	1,466	2,660	0	2,660
2041/42	1,033	161	1,466	2,660	0	2,660
2042/43	1,033	161	1,466	2,660	0	2,660
2043/44	1,033	161	1,466	2,660	0	2,660
2044/45	1,033	161	1,466	2,660	0	2,660
2045/46	1,033	161	1,466	2,660	0	2,660
2046/47	1,033	161	1,466	2,660	0	2,660
Total	**90,184**	**27,832**	**60,936**	**178,952**	**0**	**178,952**

Table 12-5: Capital Works Summary for Sewerage ($'000)

2017/18 ($'000)	Growth and Minor Works	Improved Levels of Service	Asset Renewals	Total Capital Works	Expected Subsidy	Cost to Council
2017/18	3,550	685	4,070	8,305	0	8,305
2018/19	4,283	1,410	2,640	8,333	0	8,333
2019/20	32,950	1,575	1,605	36,130	0	36,130
2020/21	29,350	735	1,505	31,590	0	31,590
2021/22	1,050	555	1,505	3,110	0	3,110
2022/23	12,250	845	1,505	14,600	0	14,600
2023/24	12,250	775	1,505	14,530	0	14,530
2024/25	1,050	735	1,505	3,290	0	3,290
2025/26	1,050	455	1,505	3,010	0	3,010
2026/27	1,050	585	1,505	3,140	0	3,140
2027/28	1,050	855	1,505	3,410	0	3,410
2028/29	1,050	1,135	1,505	3,690	0	3,690
2029/30	1,050	285	1,505	2,840	0	2,840
2030/31	1,050	315	1,505	2,870	0	2,870
2031/32	2,050	285	1,505	3,840	0	3,840
2032/33	12,650	285	1,505	14,440	0	14,440
2033/34	12,650	315	1,505	14,470	0	14,470
2034/35	1,050	285	1,505	2,840	0	2,840
2035/36	1,050	285	1,505	2,840	0	2,840
2036/37	1,050	315	1,505	2,870	0	2,870
2037/38	1,050	200	1,505	2,755	0	2,755
2038/39	1,050	200	1,505	2,755	0	2,755
2039/40	1,050	230	1,505	2,785	0	2,785
2040/41	1,050	200	1,505	2,755	0	2,755
2041/42	1,050	201	1,505	2,756	0	2,756
2042/43	1,050	232	1,505	2,787	0	2,787
2043/44	1,050	203	1,505	2,758	0	2,758
2044/45	1,050	204	1,505	2,759	0	2,759
2045/46	1,050	233	1,505	2,788	0	2,788
2046/47	1,050	204	1,505	2,759	0	2,759
Total	**144,033**	**14,822**	**48,950**	**207,805**	**0**	**207,805**

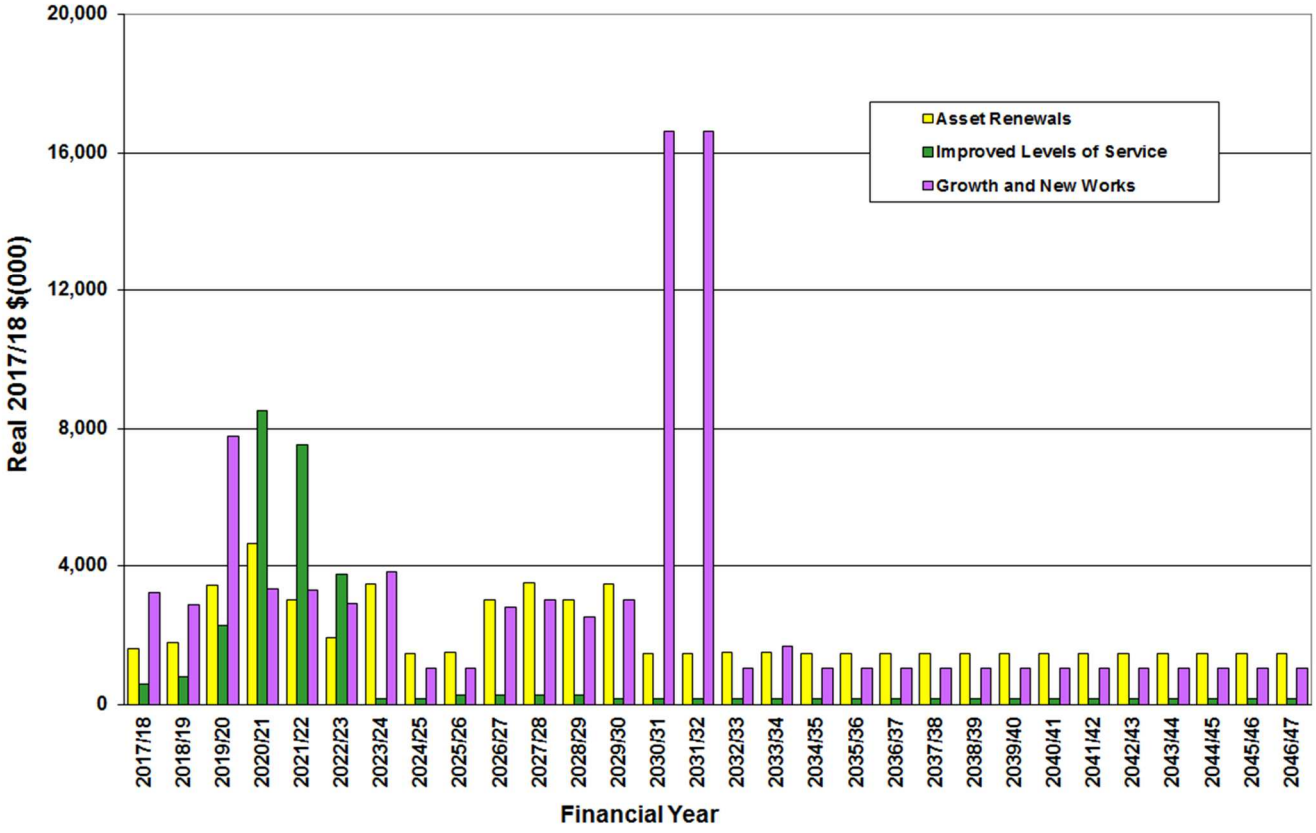

Figure 12-1: 30-year Capital Works Program - Water Supply

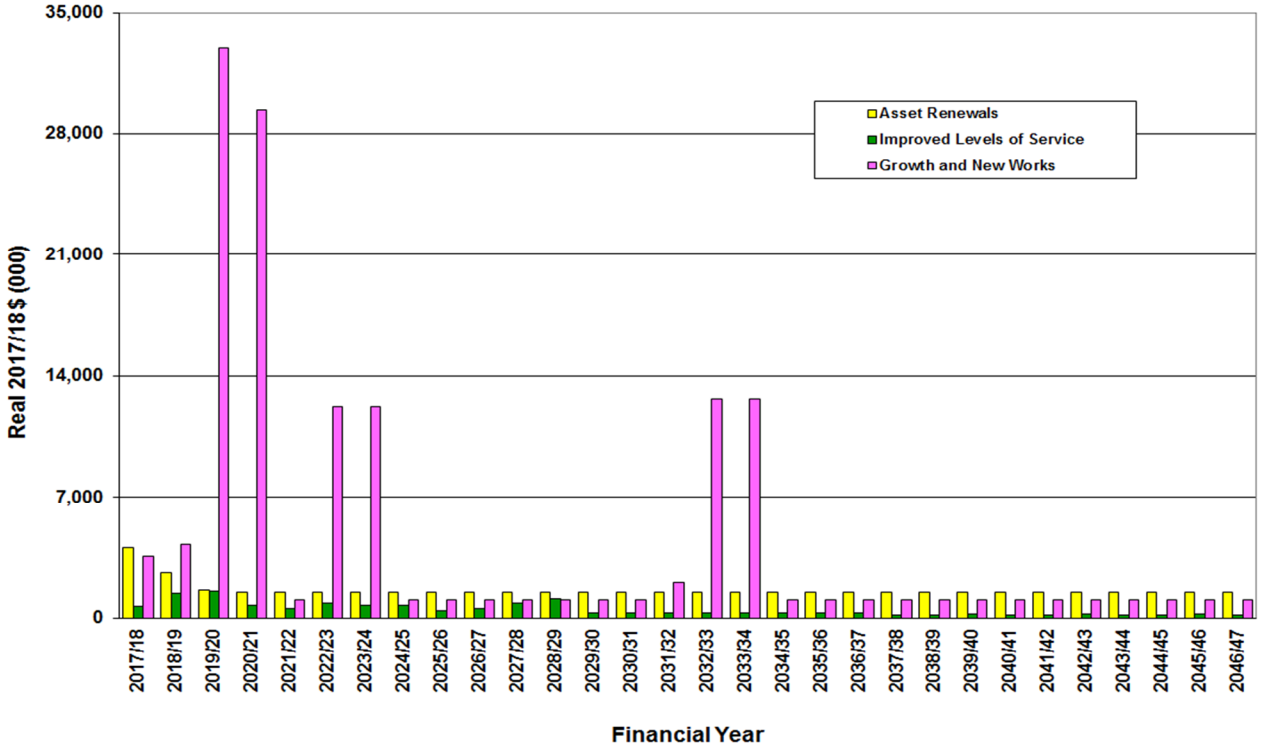

Figure 12-2: 30-year Capital Works Program - Sewerage

Table 12-6: Recurrent O&M Expenditure Summary - Water Supply ($'000)

2017/18 ($'000)	Management	Operation & Maintenance	Depreciation (Non-Cash)
2017/18	2,007	6,042	4,302
2018/19	1,980	6,322	4,341
2019/20	1,982	6,496	4,455
2020/21	1,984	6,533	4,590
2021/22	1,987	6,567	4,714
2022/23	1,991	6,604	4,789
2023/24	1,994	6,641	4,817
2024/25	1,999	6,678	4,700
2025/26	2,003	6,716	4,715
2026/27	2,007	6,755	4,752
2027/28	2,011	6,794	4,792
2028/29	2,015	6,835	4,825
2029/30	2,019	6,875	4,863
2030/31	2,022	6,918	5,060
2031/32	2,027	7,219	5,257
2032/33	2,031	7,262	5,270
2033/34	2,035	7,305	5,292
2034/35	2,039	7,350	5,306
2035/36	2,043	7,395	5,320
2036/37	2,047	7,440	5,334
2037/38	2,050	7,487	5,348
2038/39	2,053	7,534	5,362
2039/40	2,056	7,583	5,376
2040/41	2,059	7,632	5,390
2041/42	2,062	7,682	5,404
2042/43	2,065	7,733	5,418
2043/44	2,068	7,785	5,432
2044/45	2,071	7,837	5,446
2045/46	2,074	7,891	5,460
2046/47	2,077	7,945	5,474

Table 12-7: Recurrent O&M Expenditure Summary - Sewerage ($'000)

2017/18 ($'000)	Management	Operations & Maintenance	Depreciation
2017/18	1,414	6,328	5,461
2018/19	1,505	7,131	5,546
2019/20	1,505	7,610	5,970
2020/21	1,505	7,509	6,340
2021/22	1,505	7,492	6,377
2022/23	1,505	7,641	6,583
2023/24	1,505	7,641	6,571
2024/25	1,505	7,645	6,610
2025/26	1,505	7,645	6,646
2026/27	1,505	7,645	6,684
2027/28	1,505	7,645	6,706
2028/29	1,505	7,644	6,732
2029/30	1,505	7,645	6,747
2030/31	1,505	7,645	6,763
2031/32	1,505	7,610	6,791
2032/33	1,505	7,610	6,942
2033/34	1,505	7,610	7,095
2034/35	1,505	7,761	7,110
2035/36	1,505	7,761	7,127
2036/37	1,505	7,762	7,143
2037/38	1,505	7,762	7,158
2038/39	1,505	7,762	7,173
2039/40	1,505	7,762	7,188
2040/41	1,505	7,762	7,203
2041/42	1,505	7,762	7,218
2042/43	1,505	7,762	7,233
2043/44	1,505	7,762	7,248
2044/45	1,505	7,762	7,263
2045/46	1,505	7,762	7,278
2046/47	1,505	7,762	7,293

13 Financial Plan

13.1 Overview

This section presents the details of the long-term financial plans for the shire-wide water supply and sewerage services of the Wingecarribee Shire Council for the adopted IWCM strategy. The water and sewer funds for this purpose are consolidated shire-wide funds and are not based on individual schemes or catchments. The overall goal of financial planning is to determine the lowest, sustainable price path for the water supply and sewerage services on which to base Council's tariff structure. The details of assumptions, input data and output financial projections for the adopted IWCM capital works and growth are presented in this plan. The plan also presents the sensitivity of financial projections to possible changes in key model variables.

13.2 Financial Modelling Methodology

FINMOD 4.0, the software developed by the DI Water was used to develop the financial models. For a particular Level of Service (LOS), FINMOD enables an examination of a range of funding options to determine the best mix of borrowing and internal funding.

A stable level of annual residential charges for water supply and sewerage services has been achieved using Finmod by optimising the long-term funding strategy in meeting the demands of the capital works program and day-to-day operations, while ensuring a minimum level of cash liquidity. The financial models have been developed for a 30-year planning horizon.

The financial model balances the forecast income and expenditure for each service delivery option over the projected modelling period. (Figure 13-1) illustrates the main elements, which affect the financial modelling.

The goals of the financial modelling task are to:

- optimise long term funding strategy
- meet the demands of the capital works programme and other life cycle costs of the system assets
- ensure a minimum level of cash liquidity
- provide a forecast of the average residential annual charges over the long term.

The long-term financial plans demonstrate the sustainability of future actions and also to show the sensitivity of model outcomes to some of the key assumptions made.

Funding is usually from a mix of borrowing and direct revenue and can also be offset by receiving Government subsidies where applicable. Renewal campaigns would usually be funded from revenue, and some cash would be accumulated in anticipation of major projects, to reduce the need for borrowing.

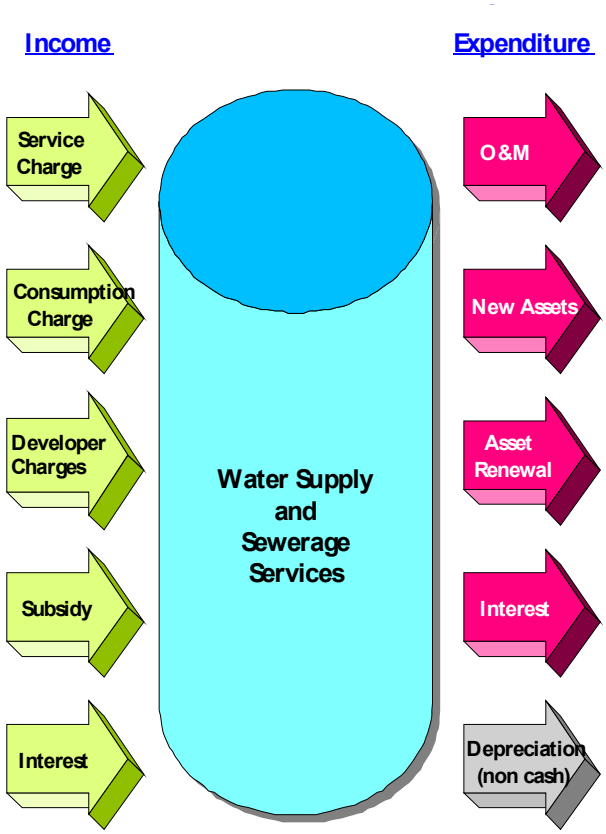

Figure 13-1 – Elements of Financial Modelling

The DI Water encourages the use of long-term loans because they support the idea of intergenerational equity and this will reduce the demand for funds in the short term

Funding is usually from a mix of borrowing and direct revenue and can also be offset by receiving Government subsidies where applicable. Renewal campaigns would usually be funded from revenue, and some cash would be accumulated in anticipation of major projects, to reduce the need for borrowing. The DI Water encourages the use of long-term loans because they support the idea of intergenerational equity and this will reduce the demand for funds in the short term.

If the resulting annual charges are considered unacceptable or unaffordable, some input variables (levels of service) can be adjusted to arrive at a satisfactory projection of annual charges. For example, to reduce the level of annual charges, Council may delay some of the capital works, may increase developer charges, or may take long-term or structured loans. Council's charging (pricing) policies will also take into account corporate policies, approach to risk and the acceptability of charges to the community. Some of these risks are evident from the sensitivities presented in this plan.

While the preferred model reflects the expected performance of the systems, it does not give any indication of the sensitivity of the proposed solution should the basic assumptions used prove significantly different in practice.

For this reason, a sensitivity analysis is carried out if it is perceived that a variable may change significantly in the future. The value of a sensitivity analysis is that it shows:

- The sensitivity of the results to assumptions (uncontrollable variables); and
- The impact of changing controllable variables.

The DI Water Guidelines suggest that a number of sensitivities should be carried out to test the robustness of the plan. In regard to controllable variables such as type of loan structure, level of developer charges the model enables Council to make decisions to establish the right management policies.

With uncontrollable variables, Council is at the mercy of change. The down side risk of an increase in interest rates, or lower than expected growth rates, or rise in energy costs, may be significant.

Council's charging (pricing) policies will also take into account corporate policies, approach to risk and the acceptability of charges to the community. Some of these risks are evident from the sensitivities presented in this Plan.

On-going Review

Over time, changes in model variables can have a significant impact on the model's accuracy and this has implications for Wingecarribee Shire Council's forward planning. It is recommended that the models be reviewed annually and the financial planning be revisited regularly preferably on a 3-yearly basis. If Council has an active capital works program that requires subsidy then annual updates are recommended by DPI Water.

13.3 Financial Model Inputs

Several variables and assumptions have been used in the development of the base cases of the water and sewer fund financial models (Appendix G and Appendix H) and are summarised in Table 13-1. The model assumptions have been first agreed to by the Council based on a representative view on the impact of a number of factors. They have been grouped into five main policy areas and are discussed below:

- Charges
- Revenues and Expenditures
- Service Provision

- Funding/ Financing Capital Works
- Performance Measures

Table 13-1: Key Input Parameters for the Financial Models

	Input Data/ Assumption/ Source	
	Water Supply	**Sewerage**
Historical Data	Wingecarribee Shire Council special schedules 3,4,5 and 6 for years 2015/16 and 2016/17 and the Revenue Policy 2017/18	
Financial Data	Average annual long-term inflation rate: 2.5% p.a. Annual Borrowing Interest Rate: 4.5% p.a. Annual Investment Interest Rate: 3.0% p.a.	
Demographic Base Data (2016/17)	No. of Resi. Assessments: 18,628 (Vacant - 601) No. of Non-Resi. Assessments: 1,937 (Vacant - 399) Pensioner Assessments: 4005 Assessment growth rate: 0.9% p.a.	No. of Resi. Assessments: 16,190 (Vacant - 452) No. of Non-Resi. Assessments: 1,148 (Vacant - 134) Pensioner Assessments: 3576 Assessment growth rate: 1.0% p.a.
Current Charges (from Revenue Policy 2017/18)	All customers: Access Charge*: $158 p.a. (20 mm) Usage Charge: $1.78/ Kl (up to 225 KL) $2.67/ KL (above 225 KL) Typical Residential Bill: $489 p.a. Residential Revenue: 76.4% Non-residential Revenue: 23.6% Sec.64 Developer Charges: $10,676	Residential Charges: $820 p.a. Non-Residential: Access Charge* (20mm): $675 p.a. Usage Charge: $1.44/ Kl Residential Revenue: 81.9% Non-residential Revenue: 18.1% Sec.64 Developer Charges: $10,350
Opening Balances	Outstanding Loan: $2,282 K Cash and Investments: $ 43,920 K Minimum operating cash: $2,000 K	Outstanding Loan: $ 18,120 K Cash and Investments: $ 28,027 K Minimum operating cash: $2,000 K

* - For larger than 20 mm meter size connections, the annual access charges increase by the square of the proportion of larger meter sizes to 20 mm. Refer to the Revenue Policy 2017/18

13.3.1 Charges

Charging Structure

The projection of typical residential bills (TRBs) for water supply and sewerage is made in real (2017/18) dollars and demonstrates the lowest long-term practical price path that can be achieved based on assumptions made. Where feasible the price path is maintained level in real terms and it is assumed that on an annual basis these charges are increased in line with the CPI (consumer price index).

Typical residential bills calculated by the model are higher than the average bills because the model considers account revenue losses due to vacant and/or unoccupied tenements and pensioner rebates. Council can use this information in fixing its service pricing tariffs. These are to be reviewed at least every 5 years and indexed in the interim.

Developer Charges

Current (2017/18) Sec.64 developer charges for the new developments are $ 10,676/ET and $10,350/ET for water supply and sewerage services, respectively, based on the Development Servicing Plans (DSPs) adopted by the Council in 2017. These charges have been adopted for the financial modelling. Developer charges are due for review in 4 – 8 years unless significant new

capital works that had not been previously included in the DSP, in which case Council can seek DI Water approval to review the same in less than four years.

Cash and Investments

Minimum cash levels of $ 2,000,000 each for water fund and the sewerage fund have been considered.

13.3.2 Revenues and Expenditures

Inflation

Average long-term inflation rate of 2.5% p.a. for general and capital works financial activities has been adopted for both water supply and sewerage models.

Interest Rates

The interest rates adopted in this analysis are 4.5% p.a. for all new borrowing from 2018/19 onwards and 3.0% p.a. for all investments.

Capital Works

The capital work expenses form a significant component of the inputs. The capital works program adopted for financial modelling includes all the capital works identified for IWCM Scenario 2 and in the Council's current 30-year Total Asset Management Plan (refer to Section 12).

Recurrent Costs

The financial models for water supply and sewerage consider a number of ongoing recurrent costs from historic input details. By default, the modelling increases historical operation and maintenance expenses on a pro-rata basis with respect to growth. This has been overridden where Council has provided revised estimates, i.e. where the IWCM action plan requires new initiatives or where new works require additional operating resources as described in Section 12.

13.3.3 Service Provision

Growth Projections

An average assessment growth rate of 0.9% p.a. for water supply and 1.0% p.a. for sewerage has been adopted for residential assessments. In line with Council's adopted development policy, the growth has been assumed to occur in all the serviced towns. Same growth rates have been adopted for water supply and sewerage models.

Expected life of assets

The default average life of the system assets is based on the weighted average of long-lived structures and shorter-lived mechanical plant. These average lives are currently estimated by Council to be 85 years for water assets and 70 years for sewerage assets.

Depreciation is a non-cash expense, which is dependent upon asset lives. The age of assets directly affects the level of future asset renewal works, which are part of the capital works program.

13.3.4 Funding Capital Works

Some, or all, capital works can be funded directly from accumulated cash reserves. To overcome intergenerational equity issues, it is general practice to fully fund renewals programs out of internally generated cash (where practical) and to borrow against capital acquisitions.

Funds, which are surplus to requirements, can be used to further reduce or eliminate borrowing requirements and reduce interest payments.

Loans - taken out as required to maintain the adopted minimum cash level of $2,000,000 in each of water and sewer funds.

Revenue – Typical Residential Bills maintained at constant level in real terms, unless where an increase is required for the long term financial viability.

Subsidies/Grants for Capital Works

Financial assistance in the form of grants for capital works may be received under various funding programs by the State and Federal Governments such as the Restart NSW or the National Stronger Regions Fund (NSRF). The Program's guidelines, published by the Department of Industries and Infrastructure NSW at the State level and Commonwealth Department of Infrastructure and Regional Development, define the extent of the available grants/ subsidies.

The financial models for both the water and sewer fund assume that no government grant/ subsidy for any of the planned capital works.

13.4 Assumptions and Limitations of the Model

The projections of the financial models are mainly based on the previous two years (historical) financial records. Allowance is made for new initiatives, future rate forecasts, and maintenance of sustainable Levels of Service (LOS) as identified and adopted by Council through the IWCM process.

The net operating results and other financial performance indicators such as the economic real rate of return (ERRR) etc., in the financial projections should be seen in light of the fact that the depreciation of existing assets shown in the operating statement is not a cash item. FINMOD specifically models Council's asset renewal program as a component of the capital works program. A modest negative operating result is often sustainable as conventional depreciation of assets is conservative in comparison with an asset renewal program that has been rigorously evaluated and adopted for the financial projections.

The financial model manages the cash flow and keeps a running tally of the cumulative depreciation so that Council can appreciate the potential future liability for maintaining the value in the system and the LOS. By planning ahead and making optimum use of existing assets, a more cost effective and efficient service should result.

Typical Residential Bills are used as the performance indicators representing overall revenue requirements from residential customers. This should not be confused with pricing structure. Pricing, i.e. distribution of the charges according to consumption or special customer groups, is the subject of a separate revenue planning exercise. Tariff structure for the services will need to take into account corporate policies, approach to risks such as lower than adopted growth rates, increase in interest rates and the acceptability of charges to the community.

The financial model is not a substitute for normal budgeting, (i.e. short-term financial planning). The model assumes that all expenses and income occur at the beginning of the year and is therefore not appropriate to track cash flow throughout the year. It is important, however, that the budgeting process is carried out within the framework of the long-term financial plan.

The TAM Plan (refer to Section 12) shows the expenditure based on the current estimates for the long-term capital, operational and maintenance and are used in the models for projecting the financial position over the next 30 years. Models will require updating as more accurate expenditure schedules become available. Annual update and 3 to 4 yearly review of the model projections with the up to date level of expenditure is recommended.

13.5 Financial Model Outcomes – Water Supply

13.5.1 Projected Financial Position

All costs and revenues in the input data and the model outcomes are in 2017/18 dollars unless stated otherwise. The first year of model projections is 2017/18 and CPI should be applied for all future year projections accordingly. The financial projections need to be reviewed annually with respect to material changes to the proposed capital works program and/or changes to any of the underlying assumptions.

The adopted IWCM scenario of the water fund financial model has demonstrated that the current (2017/18) water supply TRB of $489 p.a. can be maintained at that level for the remaining forecast years with ongoing annual adjustments for CPI / inflation.

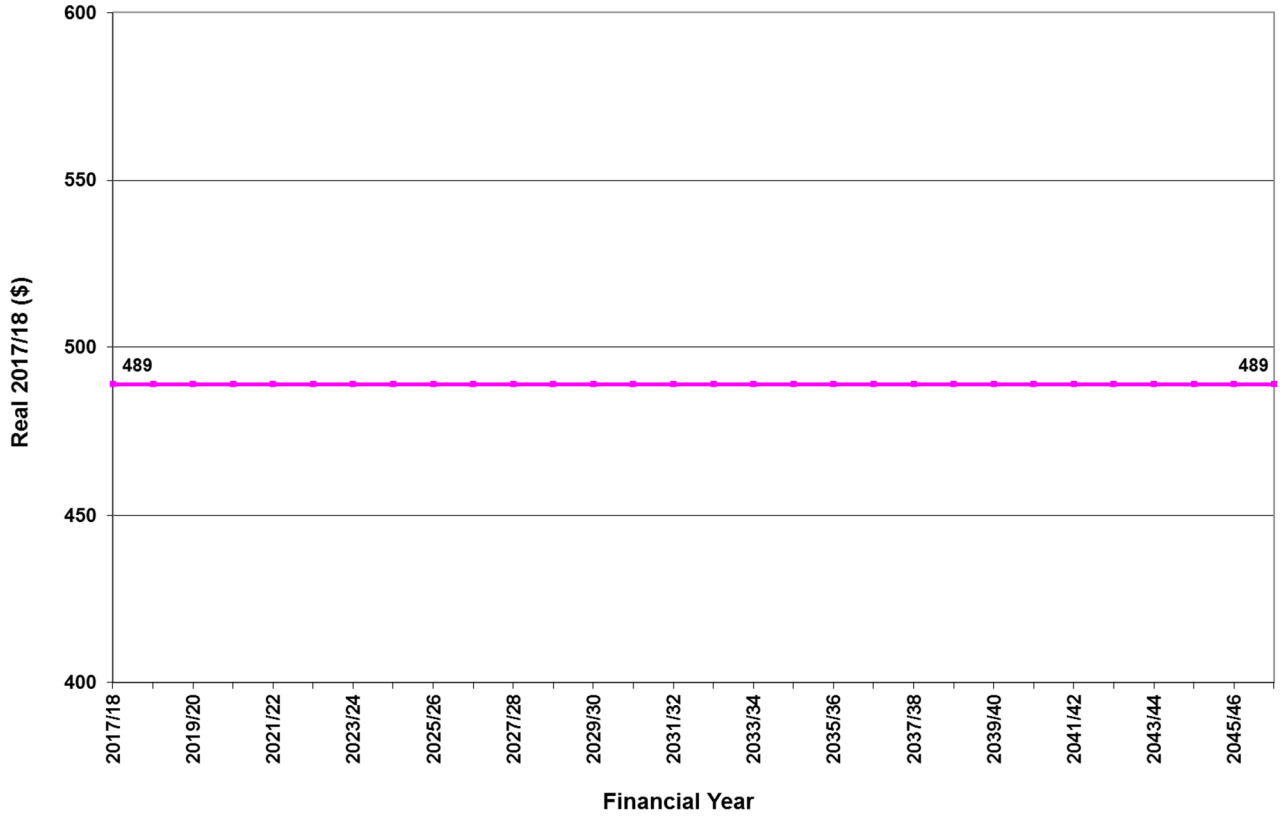

Figure 13-2: Typical Residential Bill for Water Supply

The projected level of charges is sufficient to maintain liquidity with a minimum of $2,000 K of cash in hand over the period.

The model forecasts demonstrate that with the 'preferred' price path, all the planned capital works till 2029/30 can be fully funded internally. The current water fund loan of $2,282 K as at 30 June 2017 will be fully retired by 2023/24 in accordance with the Council's current loan repayment schedule.

External borrowing will be required to part fund the Wingecarribee WTP upgrade capital work planned during 2030/31 and 2031/32. The outstanding borrowing is expected to reach a peak of $15,930 K in 2031/32 and will be gradually paid-off. The levels of cash and borrowing outstanding during the forecast period are depicted in Figure 13-3.

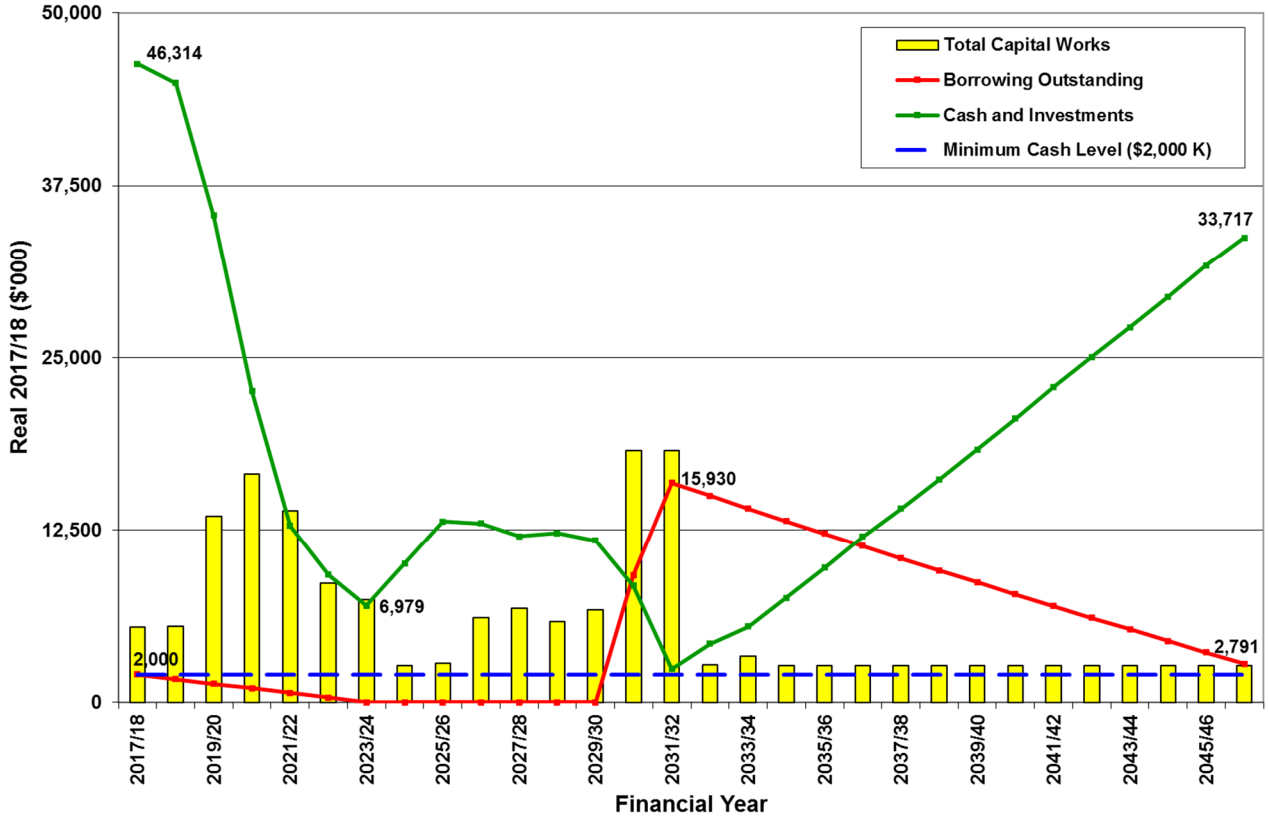

Figure 13-3: Cash & Borrowing Projections for Water Supply

Projected financial results for the water fund are presented in Table 13-2. Note that all the projected financial figures are in current (2017/18) dollars and need indexing for CPI/Inflation for future years. More detailed financial output statements are as presented in Appendix G.

Table 13-2: Projected Financial Results – Water Fund

2017/18 ($'000)	Revenue and Expenses			Capital Transactions		Financial Position					System Assets			Typical Residential Bills
Financial Year	Total Revenue	Total Expenses	Operating Result (Before Grants)	Acquisition of Assets	Principal Loan Payments	Cash and Investments	Borrowings	Total Assets	Total Liabilities	Net Assets Committed	Current Replacement Cost	Less: Accumulated Depreciation	Written Down Current Cost	
2017/18	17,306	13,382	3,924	5,455	274	46,314	2,008	266,062	3,430	262,632	372,649	157,800	214,849	489
2018/19	14,938	13,669	1,268	5,500	282	44,937	1,677	264,748	3,109	261,639	376,349	160,177	216,173	489
2019/20	14,836	13,943	893	13,491	289	35,330	1,347	263,576	2,788	260,788	386,400	161,031	225,370	489
2020/21	14,532	14,100	432	16,546	298	22,570	1,016	262,873	2,466	260,407	398,268	160,785	237,483	489
2021/22	14,573	14,243	330	13,871	306	12,805	685	262,690	2,146	260,544	409,116	162,322	246,794	489
2022/23	15,322	14,342	980	8,625	315	9,233	354	263,123	1,831	261,292	415,805	165,024	250,780	489
2023/24	15,433	14,393	1,040	7,450	345	6,979	0	263,655	1,494	262,161	419,789	166,245	253,545	489
2024/25	15,609	14,307	1,302	2,660	0	10,058	0	264,104	1,511	262,593	420,983	169,479	251,505	489
2025/26	15,857	14,364	1,493	2,811	0	13,116	0	264,550	1,527	263,023	422,291	172,690	249,601	489
2026/27	16,069	14,444	1,625	6,102	0	12,978	0	265,572	1,545	264,027	425,388	174,438	250,950	489
2027/28	16,022	14,526	1,496	6,810	0	12,045	0	266,652	1,560	265,092	428,694	175,726	252,968	489
2028/29	16,193	14,605	1,588	5,812	0	12,258	1	267,616	1,577	266,039	431,502	177,547	253,955	489
2029/30	16,344	14,687	1,657	6,660	0	11,724	1	268,832	1,593	267,239	434,696	178,944	255,752	489
2030/31	16,442	15,354	1,088	18,260	301	8,429	9,200	279,473	10,808	268,665	451,490	182,538	268,952	489
2031/32	16,508	16,167	340	18,259	545	2,420	15,930	288,119	17,555	270,564	468,284	186,330	281,954	489
2032/33	16,136	16,187	-50	2,710	556	4,222	14,986	286,799	16,625	270,174	469,478	190,084	279,394	489
2033/34	16,298	16,213	84	3,351	568	5,483	14,052	285,675	15,706	269,969	471,312	193,859	277,453	489
2034/35	16,469	16,236	233	2,660	578	7,556	13,131	284,339	14,799	269,540	472,507	197,699	274,807	489
2035/36	16,646	16,258	388	2,660	590	9,736	12,221	282,993	13,903	269,090	473,700	201,554	272,146	489
2036/37	16,825	16,281	545	2,660	602	12,021	11,321	281,634	13,018	268,616	474,894	205,422	269,472	489
2037/38	16,644	16,305	339	2,660	614	14,047	10,431	280,033	12,140	267,893	476,088	209,304	266,784	489
2038/39	16,793	16,331	462	2,660	626	16,149	9,551	278,406	11,271	267,135	477,282	213,200	264,082	489
2039/40	16,949	16,358	591	2,660	638	18,330	8,679	276,755	10,412	266,343	478,476	217,110	261,365	489
2040/41	17,097	16,385	711	2,660	652	20,579	7,816	275,073	9,561	265,512	479,670	221,035	258,635	489
2041/42	17,235	16,412	823	2,660	665	22,885	6,961	273,354	8,719	264,635	480,863	224,972	255,891	489
2042/43	17,156	16,444	712	2,660	677	25,026	6,113	271,472	7,883	263,589	482,057	228,924	253,133	489
2043/44	17,274	16,476	797	2,660	691	27,199	5,273	269,545	7,054	262,491	483,251	232,890	250,361	489
2044/45	17,400	16,507	892	2,660	705	29,415	4,440	267,578	6,231	261,347	484,446	236,871	247,575	489
2045/46	17,531	16,542	989	2,660	719	31,672	3,612	265,571	5,415	260,156	485,639	240,865	244,774	489
2046/47	17,407	16,577	830	2,660	733	33,717	2,791	263,395	4,603	258,792	486,833	244,873	241,960	489

13.5.1 Sensitivity of Financial Projections

The water fund financial model does not involve any grant/ subsidy, hence, does not warrant sensitivity analysis for a 'no subsidy scenario'. Sensitivity of the model forecasts were analysed for lower growth rates and higher than estimated capital costs of planned works and the impact of these variables on the water supply TRB forecasts are summarised in following Table and the Figures.

Table 13-3: Sensitivity Analysis – Water Fund

Sensitivity	Values of Variables for Analysis	Effect on TRB compared to the Preferred Scenario
Lower than expected assessment growth rate	0.5% p.a. instead of the adopted 0.9% p.a.	TRB to increase by $25 p.a. for first three years compared to the 'nil' increase for the adopted scenario.
Higher New Works Capital expenditure	Capex estimates for New works increase by 20%	TRB to increase by $20 p.a. for first three years compared to the 'nil' increase for the adopted scenario.

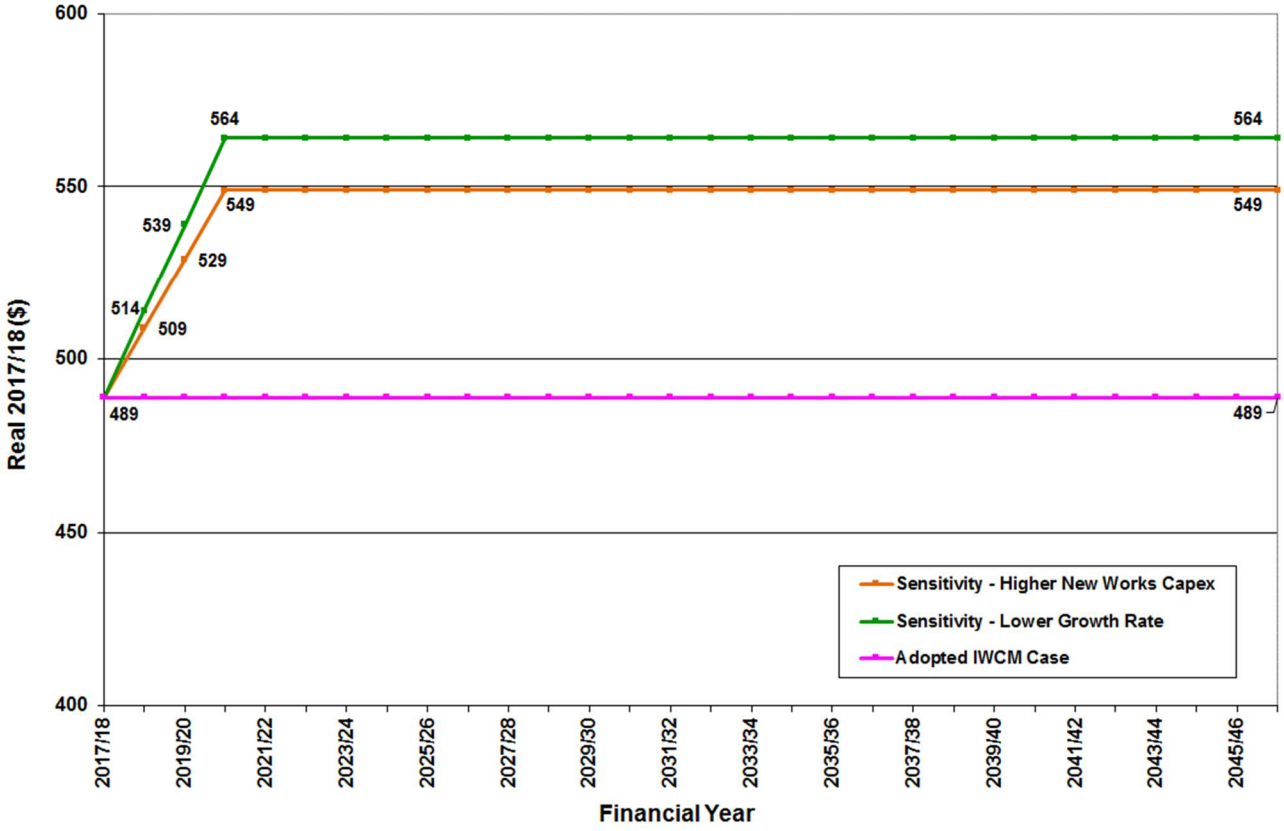

Figure 13-4: Sensitivity of Typical Residential Bill for Water Supply

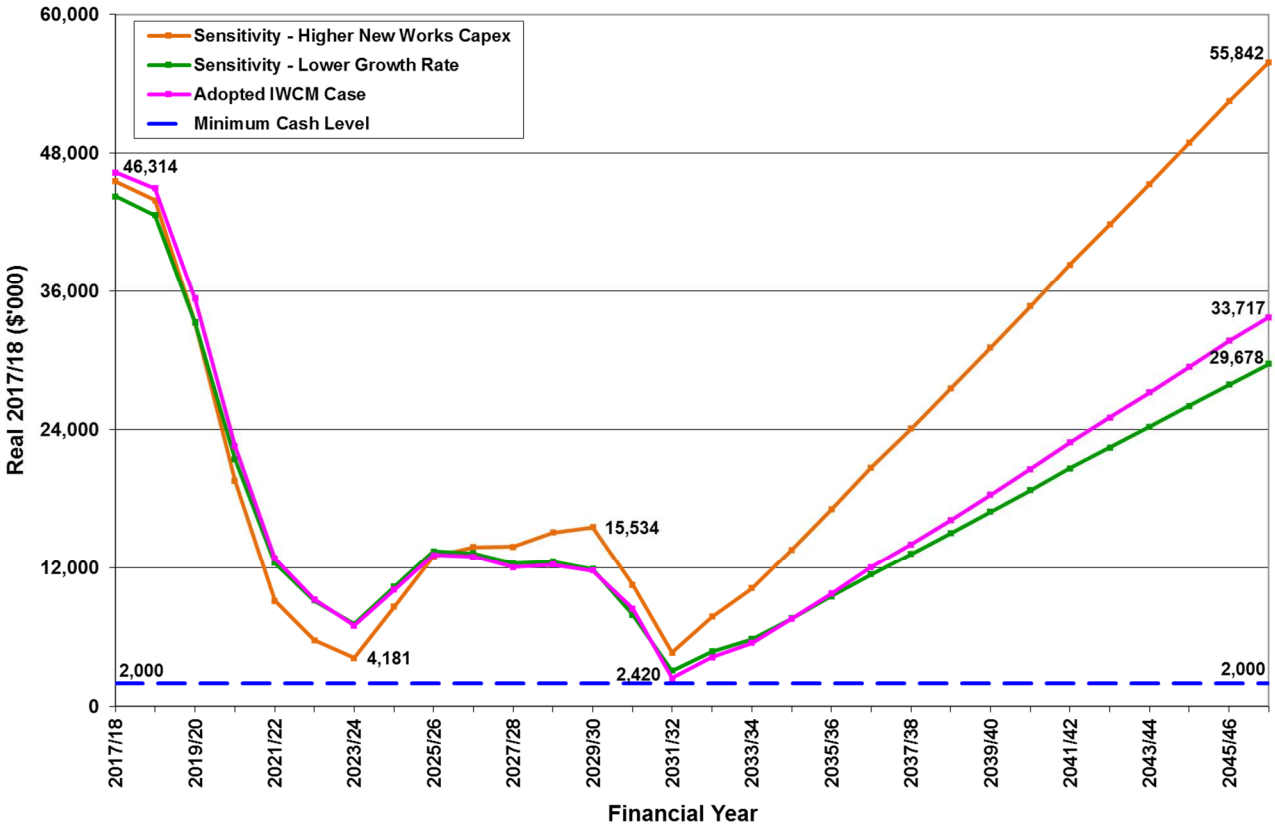

Figure 13-5: Sensitivity of Cash and Investment Levels for Water Supply

13.6 Financial Model Outcomes – Sewerage

13.6.1 Projected Financial Position

The first year of model projections is 2017/18 and CPI should be applied accordingly. All costs and revenues in the input data and the model outcomes also are in 2017/18 dollars unless stated otherwise. The financial projections need to be reviewed annually with respect to material changes to the proposed capital works program and/or changes to any of the underlying assumptions.

The adopted IWCM scenario of the sewer fund financial model does not consider any government grant or subsidy for any of the planned capital works. Accordingly, the TRB forecasts determined by the model for the next 30-years is presented in Figure 13-6.

The model forecasts demonstrate that the sewerage TRB can be maintained at the current level of $820 p.a. for the next nine years (till 2026/27) and can be decreases by $100 to $720 p.a. in 2027/28. The sewerage TRB can be maintained at the reduced level for the remainder of the forecast period.

The projected level of charges is sufficient to maintain liquidity with a minimum of $2,000 K of cash and investments in the sewer fund over the forecast period.

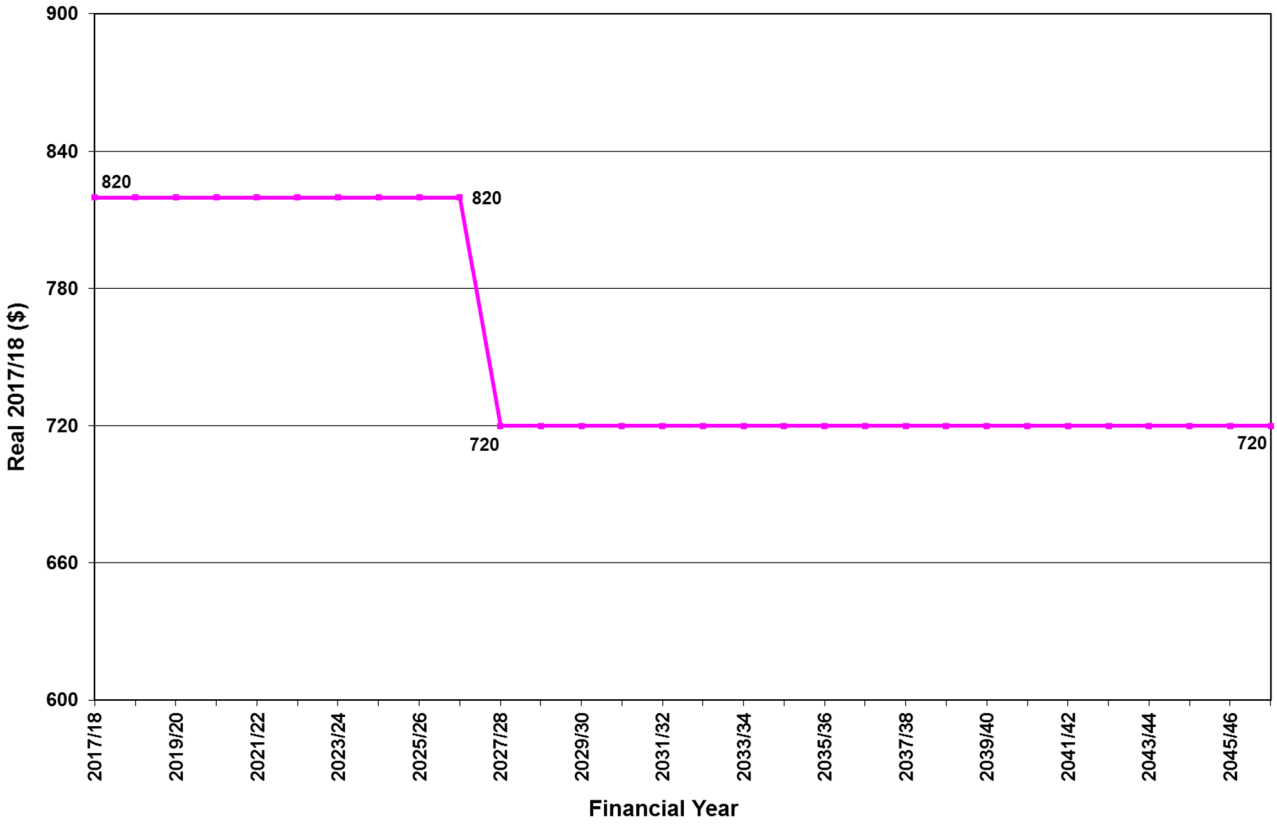

Figure 13-6: Typical Residential Bill for Sewerage

The model forecast demonstrates that with the adopted price path, all the planned capital works can be funded through a mix of internal cash reserves and external borrowings as and when required. The current outstanding loan for sewer fund is $18,120 K as at 30 June 2017. There will be a need for new external borrowing every year till 2023/24. Within the 30-year projection period, the outstanding borrowing is expected to reach a peak of $53,625 K in 2023/24 and will be gradually paid-off. The levels of cash and borrowing outstanding during the forecast period are depicted in the Figure 13-7.

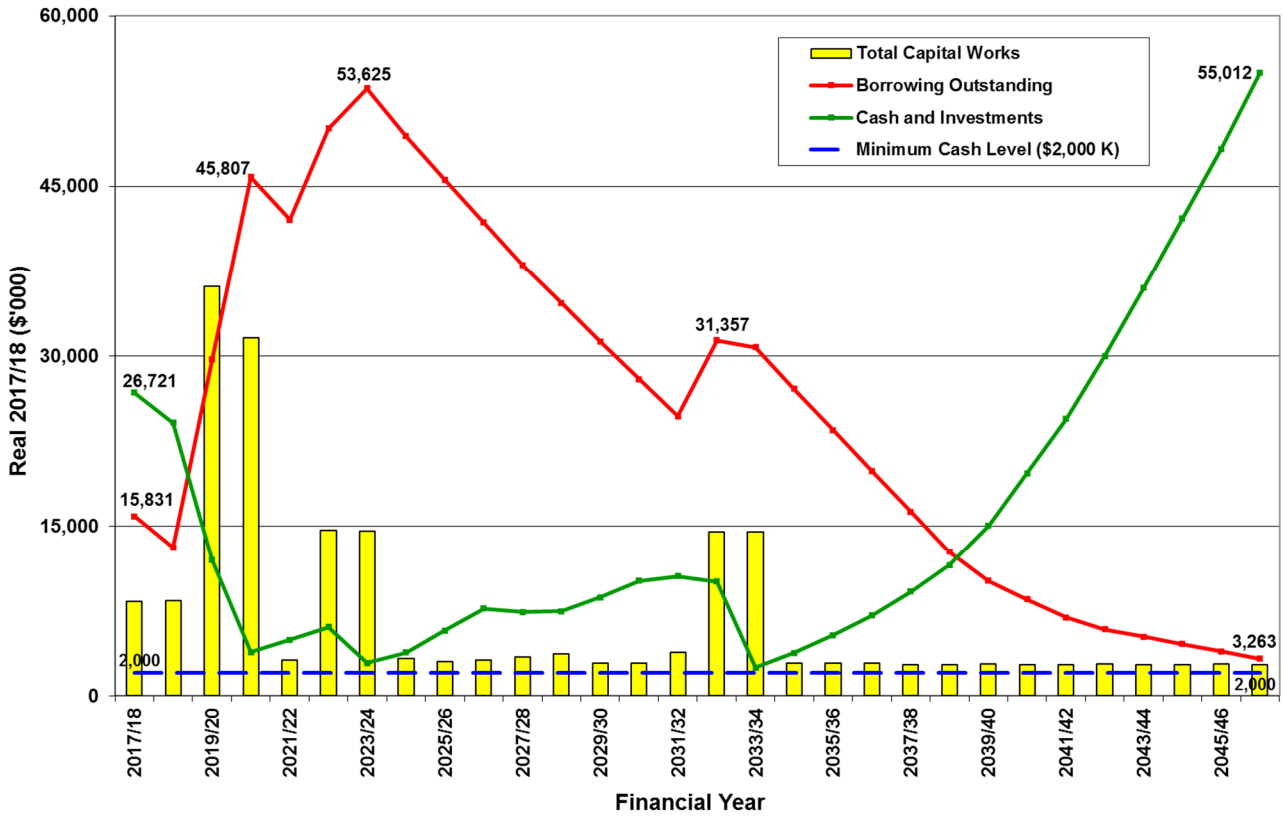

Figure 13-7: Cash & Borrowing Projections for Sewerage

Projected financial results for the sewer fund are presented in Table 13-4 next page. Note that all the projected financial figures are in current (2017/18) dollars and need indexing for CPI/Inflation for future years. More detailed financial output statements are as presented in Appendix H.

Table 13-4: Projected Financial Results for Sewer Fund

2017/18 ($'000)	Revenue and Expenses			Capital Transactions		Financial Position					System Assets			
Financial Year	Total Revenue	Total Expenses	Operating Result (Before Grants)	Acquisition of Assets	Principal Loan Payments	Cash and Investments	Borrowings	Total Assets	Total Liabilities	Net Assets Committed	Current Replacement Cost	Less: Accumulated Depreciation	Written Down Current Cost	Typical Residential Bills
2017/18	19,557	15,386	4,171	8,530	2,289	26,721	15,831	294,795	17,215	277,580	369,556	107,243	262,313	820
2018/19	19,740	16,193	3,546	8,558	2,387	24,096	13,058	295,214	14,460	280,754	375,249	109,939	265,310	820
2019/20	19,765	17,807	1,958	36,355	3,033	11,925	29,706	313,462	31,126	282,336	409,774	114,076	295,698	820
2020/21	19,704	18,744	960	31,816	3,176	3,820	45,807	330,867	47,245	283,622	439,860	118,667	321,193	820
2021/22	19,486	18,551	935	3,335	2,664	4,919	42,025	328,952	43,479	285,473	441,465	123,278	318,187	820
2022/23	19,738	19,243	495	14,826	2,909	6,022	50,092	338,327	51,561	286,766	454,560	128,043	326,517	820
2023/24	19,919	19,375	544	14,755	3,245	2,867	53,625	343,390	55,111	288,279	467,585	132,963	334,622	820
2024/25	20,137	19,193	943	3,515	2,919	3,792	49,398	341,252	50,900	290,352	469,370	137,903	331,467	820
2025/26	20,405	19,033	1,371	3,235	2,613	5,744	45,580	339,824	47,099	292,725	470,874	142,860	328,014	820
2026/27	20,422	18,888	1,533	3,365	2,675	7,657	41,793	338,446	43,327	295,119	472,509	147,837	324,672	820
2027/28	18,426	18,731	-305	3,635	2,740	7,370	38,033	335,118	39,583	295,535	474,413	152,836	321,577	720
2028/29	18,602	18,576	26	3,915	2,473	7,432	34,633	332,393	36,197	296,196	476,598	157,861	318,737	720
2029/30	18,802	18,440	361	3,065	2,524	8,643	31,264	329,952	32,845	297,107	477,932	162,901	315,031	720
2030/31	19,027	18,307	720	3,095	2,576	10,116	27,926	327,787	29,522	298,265	479,297	167,957	311,340	720
2031/32	18,766	18,143	624	4,066	2,576	10,518	24,669	325,485	26,278	299,207	481,632	173,041	308,592	720
2032/33	18,933	18,587	346	14,665	2,709	10,049	31,357	332,761	32,979	299,782	494,567	178,276	316,291	720
2033/34	18,956	18,715	242	14,695	2,858	2,462	30,735	332,796	32,370	300,426	507,533	183,664	323,869	720
2034/35	19,087	18,720	367	3,065	2,916	3,772	27,069	330,083	28,718	301,365	508,868	189,067	319,801	720
2035/36	19,256	18,575	682	3,065	2,973	5,324	23,437	327,596	25,099	302,497	510,204	194,487	315,717	720
2036/37	19,413	18,431	983	3,096	3,033	7,063	19,832	325,311	21,508	303,803	511,570	199,922	311,647	720
2037/38	19,610	18,287	1,323	2,981	3,093	9,169	16,256	323,262	17,945	305,317	512,820	205,373	307,447	720
2038/39	19,792	18,145	1,647	2,981	3,156	11,500	12,704	321,423	14,407	307,016	514,071	210,839	303,232	720
2039/40	20,007	18,014	1,993	3,010	2,276	14,982	10,118	320,752	11,835	308,917	515,351	216,320	299,031	720
2040/41	20,231	17,924	2,306	2,980	1,379	19,635	8,492	321,205	10,223	310,982	516,601	221,815	294,786	720
2041/42	20,458	17,867	2,591	2,981	1,407	24,443	6,878	321,801	8,623	313,178	517,852	227,326	290,526	720
2042/43	20,710	17,818	2,893	3,012	869	29,957	5,841	323,118	7,599	315,519	519,134	232,852	286,282	720
2043/44	20,946	17,791	3,154	2,983	510	36,000	5,188	324,922	6,962	317,960	520,387	238,393	281,994	720
2044/45	21,183	17,777	3,406	2,983	520	42,151	4,542	326,819	6,330	320,489	521,641	243,949	277,692	720
2045/46	21,300	17,764	3,536	3,013	531	48,258	3,900	328,683	5,701	322,982	522,923	249,519	273,404	720
2046/47	22,060	17,752	4,309	2,984	541	55,012	3,263	331,163	5,082	326,081	524,177	255,105	269,072	720

13.6.2 Sensitivity of Financial Projections Results

Sensitivity of the sewer fund model forecasts were analysed for lower growth rates, higher capital cost estimates and higher interest rates. The impact of these variables on the sewerage TRB forecasts are summarised in the following Table and the Figures.

Table 13-5: Sensitivity Analysis – Sewer Fund

Sensitivity	Values of Variables for Analysis	Effect on TRB compared to the Preferred Scenario
Lower than expected assessment growth rate	0.5% p.a. instead of the adopted 1.0% p.a.	TRB will need to be increased by $60 from 2018/19 onwards and maintained at that level for the following eight years (till 2026/27). From 2027/28 onwards, the TRB can reduced by $60 to $820 p.a. and maintained at the level for the remaining forecast period.
Higher New Works Capital Cost Estimates	Capex estimates for New works increase by 20%	TRB will need to be increased by $110 from 2018/19 onwards and maintained at that level for the following eight years (till 2026/27). From 2027/28 onwards, the TRB can reduced by $50 to $880 p.a. and maintained at the level for the remaining forecast period.
Higher than adopted interest rates	7.5% p.a. borrowing interest rate and 6% p.a. investment interest rate	TRB will need to be increased by $10 from 2018/19 onwards and maintained at that level for the following eight years (till 2026/27). From 2027/28 onwards, the TRB can reduced by $60 to $730 p.a. and maintained at the level for the remaining forecast period.

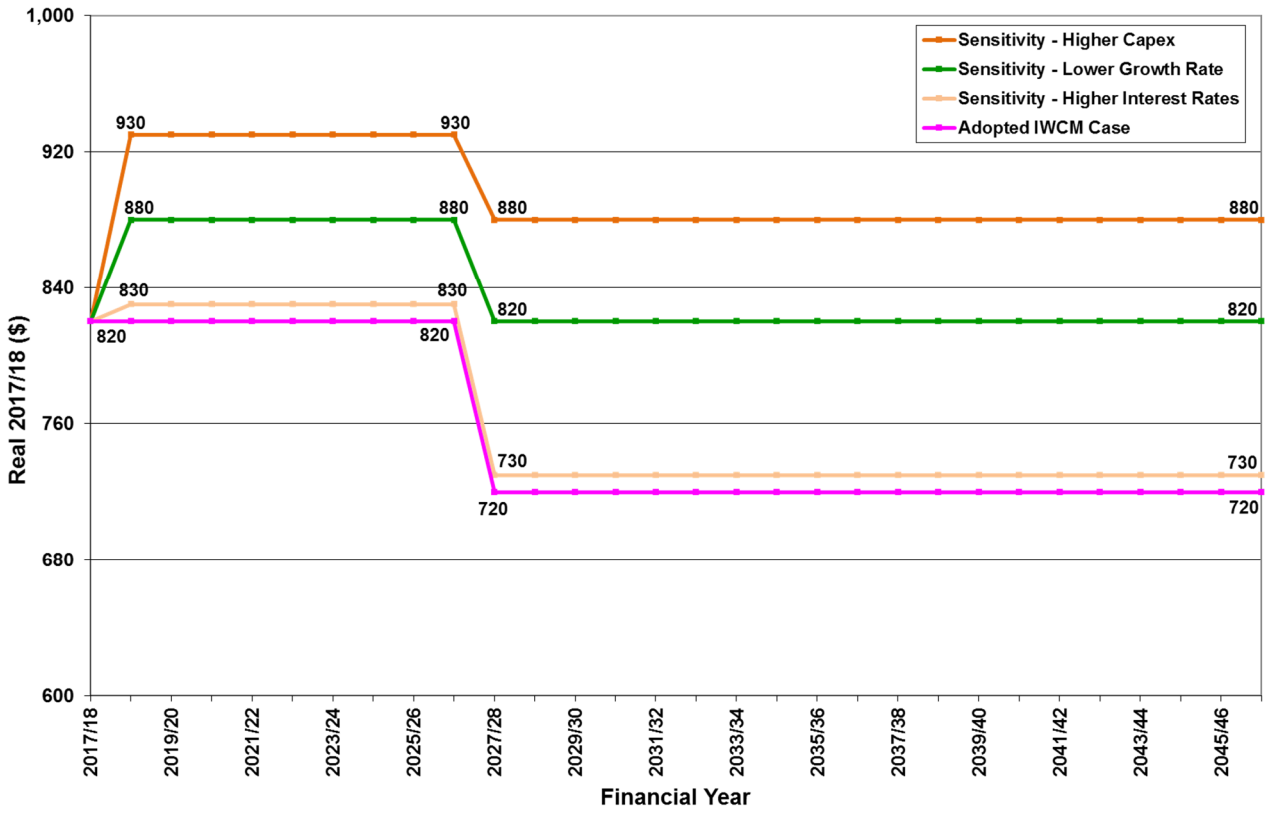

Figure 13-8: Sensitivity of Typical Residential Bill for Sewerage

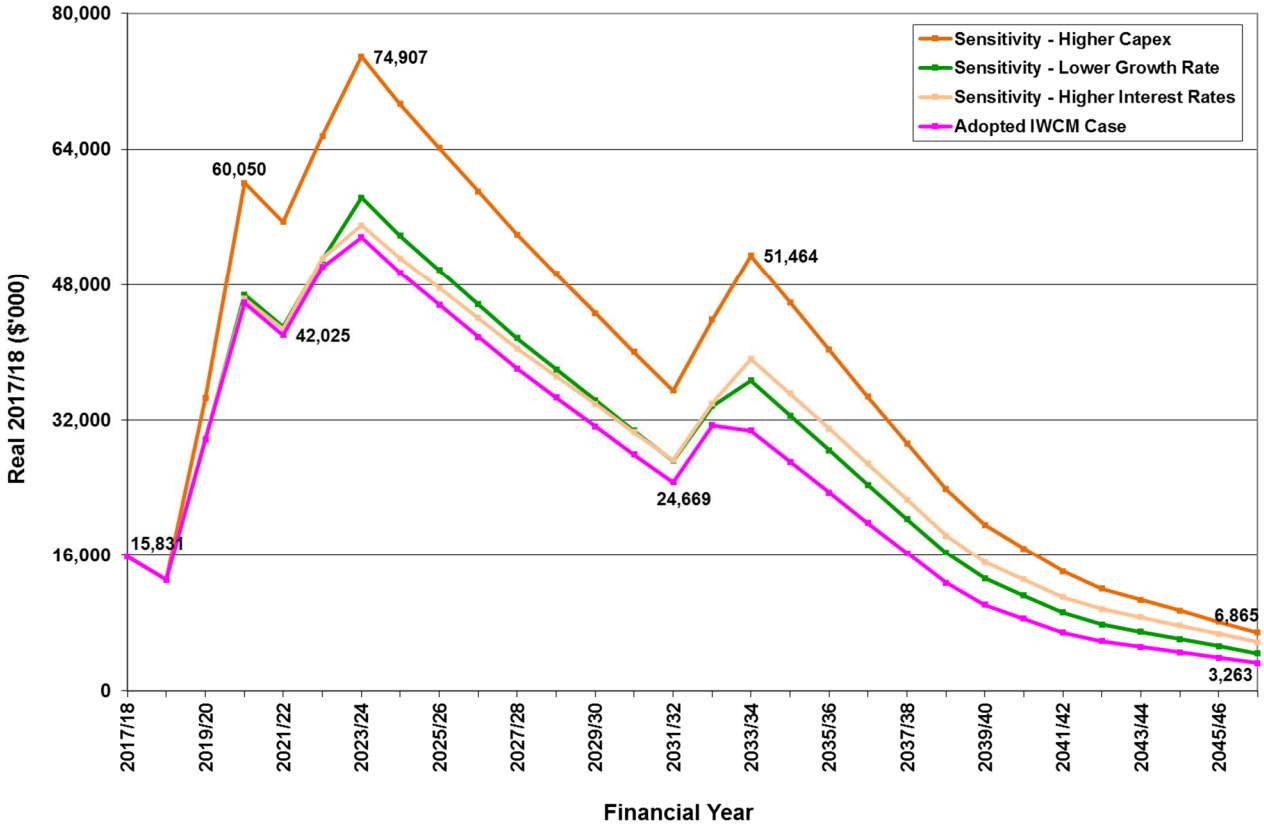

Figure 13-9: Sensitivity of Borrowing Levels for Sewerage

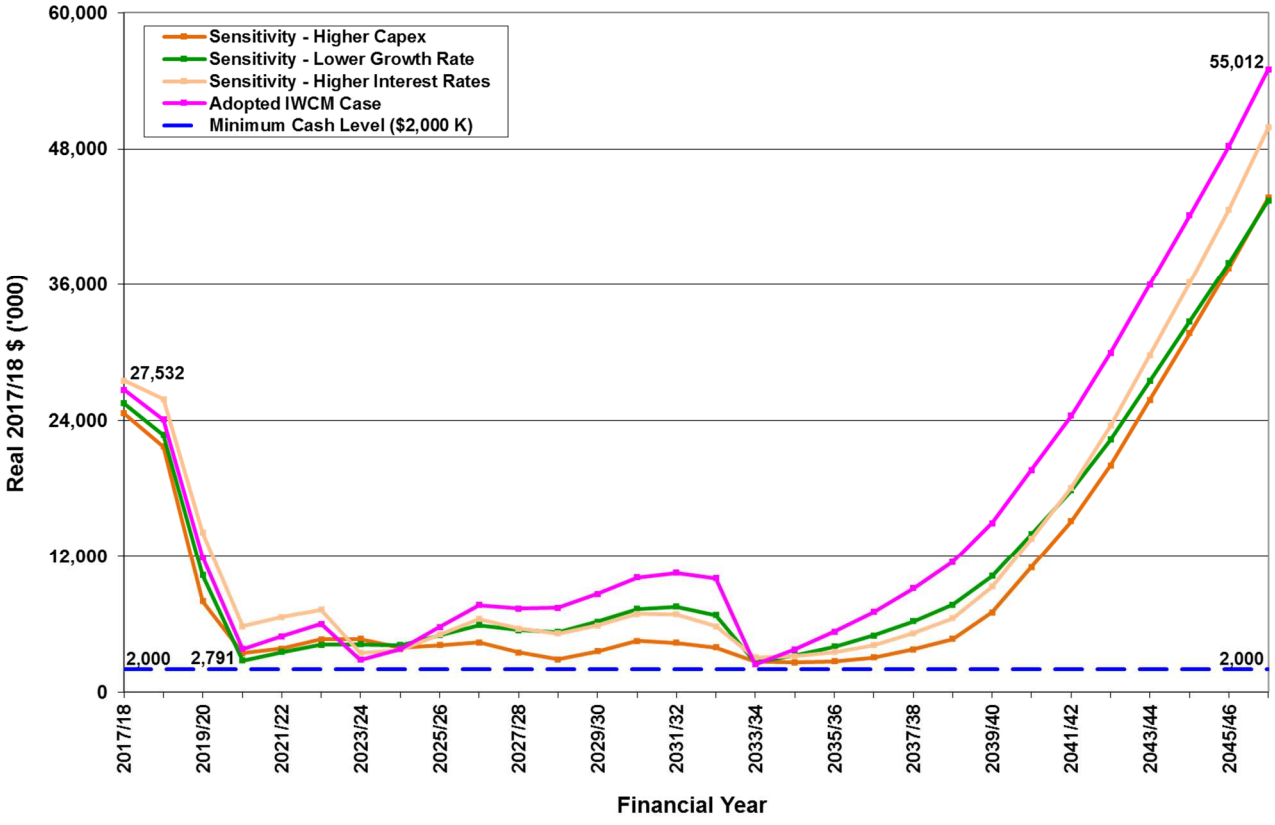

Figure 13-10: Sensitivity of Cash and Investment Levels for Sewerage

Appendices

List of Appendices

Appendix A: IWCM Issues Paper

Appendix B: Options Review Paper

Appendix C: Secure Yield Analysis Report for Bundanoon Dam

Appendix D: Adopted Levels of Service

Appendix E: Present Value Cost Estimates for IWCM Scenarios

Appendix F: Water Supply and Sewerage Asset Management Plans

Appendix G: Financial Model Input and Output Data – Water

Appendix H: Financial Model Input and Output Data - Sewer

Appendix A IWCM Issues Paper

Appendix B Options Review Paper

Appendix C Secure Yield Analysis Report for Bundanoon Dam

Appendix D Adopted Levels of Service

Appendix E Present Value Cost Estimates for Water and Sewer Options

Appendix F Water Supply and Sewerage Asset Management Plans

Appendix G Financial Model Input and Output Data - Water

Appendix H Financial Model Input and Output Data - Sewer

Public Works Advisory

Level 3, 66 Harrington Street
Sydney NSW 2000

www.publicworks.nsw.gov.au