Tenterfield Shire Council

Integrated Water Cycle Management Evaluation Study and Strategy Plan

Final

October 2013

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PROJECT 12-045– TENTERFIELD IWCM

REV	DESCRIPTION	AUTHORS	REVIEW	APPROVAL	DATE
0	Issued for TSC review	R. Campbell, K. Pratt	M. Howland	M. Howland	27/5/13
1	Updated with IWCM Strategy	R. Campbell	M. Howland	M. Howland	17/6/13
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EXECUTIVE SUMMARY

Tenterfield Shire Council (TSC) is continually planning for the on-going provision of water, sewerage and stormwater services to the urban areas of Tenterfield LGA. In the process of planning for these services, TSC is implementing best-practice management in its water supply and sewerage businesses including the preparation of this Integrated Water Cycle Management (IWCM) Strategy.

The IWCM process is about addressing water cycle management problems. The issues are defined by non-achievement of water cycle management objectives and non-compliance with urban water service targets, including both legal obligations and agreed levels of service.

TSC continually develops and implements plans for water service provision through the LWU business planning process (e.g. Strategic Business Planning, Asset Management Planning) as well as solving issues as they arise. This IWCM Strategy identifies the actions which have been adopted by TSC in relation to each of the identified IWCM issues as well as any additional actions required. These issues will be addressed through minor additional capital works and strategic planning actions. The required response is detailed in the IWCM Strategy action plan (Table E1). The proposed budgets in this Action Plan as well as ongoing asset management planning will be used to develop Council's expenditure program as part of its Integrated Planning and Reporting requirements.

The next IWCM review in 8 years (2021) will confirm whether the actions in the IWCM Strategy have adequately addressed the identified issues. The progress of each action will be reviewed as part of TSC's Water Supply and Sewerage Strategic Business Plans which will be updated in 2014 and every three years after that.

Table E1: IWCM Action Plan

Item	Potential Funding	Proposed Delivery	Proposed Budget (2013 $k)												
			10 year total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 - 2033	2034 - 2043
Best-Practice Compliance															
Strategic Business Planning	Water and Sewer Funds	Manager Water and Waste	**75**	25				25			25			100	75
Financial Planning	Water and Sewer Funds	Manager Water and Waste	**45**	15		MB	MB	15	MB	MB	15	MB	MB	60	45
Pricing - Developer Charges	Water and Sewer Funds	External consultant	**40**				20						20	20	40
Pricing - Tariff Review	Water and Sewer Funds	Manager Water and Waste	**MB**			MB	MB		MB	MB		MB	MB		
Water Conservation Planning [1]	Water and Sewer Funds	External consultant	**60**		20				20				20	40	60
Drought Management Planning	Water and Sewer Funds	Manager Water and Waste	**MB**		MB										
Performance Monitoring	Water and Sewer Funds	Manager Water and Waste	**MB**		MB	MB	MB	MB	MB	MB	MB	MB	MB		
IWCM Strategy Review	Water and Sewer Funds	External consultant	**50**								50			50	50
Drinking Water Management															
Tenterfield improvement program	Water and Sewer Funds	External contractor	**130**	90		20	20								
Urbenville improvement program	Water and Sewer Funds	External contractor	**20**	10			10								
Develop water supply agreement with SDRC	Water and Sewer Funds	External consultant	**15**		15	MB									
Operation and maintenance plans	Water and Sewer Funds	Water operations	**OB**		OB	OB	OB								
WTP replacement - concept design	Water and Sewer Funds	External consultant	**100**		50	50									
WTP - potential modifications	Water and Sewer Funds	Construction contractor	**200**				200								
WTP replacement - construction	Water and Sewer Funds	Construction contractor	**4,500**							4,500					
Water Sharing Plans															
Liaison with Office of Water	Water and Sewer Funds	Manager Water and Waste	**MB**	MB											
Recycled Water Risk Management Plans															
Tenterfield Golf Course	Water and Sewer Funds	External consultant	**30**		30										
Farm	Water and Sewer Funds	External consultant	**20**			20									
Biosolids Management															
Biosolids Management Strategy [2]	Water and Sewer Funds	External consultant	**30**		10	20									
On-Site Sewerage Systems															
Risk assessment (as part of SBP) [2]	Water, Sewer and General Funds	External consultant	**20**		20										
Secure Yield Assessment															
Tenterfield Water Supply	Water and Sewer Funds	External consultant	**25**		25										
Urbenville Water Supply	Water and Sewer Funds	External consultant	**25**		25										
Climate Change/Flood Impacts															
Risk assessment	Water and Sewer Funds	External consultant	**30**		10	20									

Item	Potential Funding	Proposed Delivery	Proposed Budget (2013 $k)												
			10 year total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 - 2033	2034 - 2043
Human Resources															
External Project Management Services	Water and Sewer Funds	External consultant	**50**		15	15	5	10	5						
Asset Management (additional actions have been identified in the AMPs which will be adopted by TSC in June 2013)															
Mains replacement - Jennings	Water and Sewer Funds	Water operations	**100**	10	10	10	10	10	10	10	10	10	10		
Flood repairs - Shirley Park bore	Water and Sewer Funds	External contractor	**20**				20								
Water meter replacement program - Tenterfield	Water and Sewer Funds	Water operations	**200**	20	20	20	20	20	20	20	20	20	20		
Valve/hydrant replacement - Urbenville	Water and Sewer Funds	Water operations	**10**	10											
Dam Safety Upgrade - design, approvals, procurement	Water and Sewer Funds, 50% subsidy from NOW	External consultant	**460**	190	180	90									
Tenterfield Dam Safety Upgrade - integrated development approval	Water and Sewer Funds, 50% subsidy from NOW	External consultant	**50**	50											
Tenterfield Dam Safety Upgrade - construction	Water and Sewer Funds, 50% subsidy from NOW	Construction contractor	**4,500**			3,000	1,500								
Tenterfield Dam Safety Upgrade - construction management	Water and Sewer Funds, 50% subsidy from NOW	External consultant	**450**			300	150								
Sewer Mains - Maintenance and Rehabilitation - Tenterfield	Water and Sewer Funds	Sewer operations	**800**	80	80	80	80	80	80	80	80	80	80		
Sewer Mains - Maintenance and Rehabilitation - Urbenville	Water and Sewer Funds	Sewer operations	**150**	15	15	15	15	15	15	15	15	15	15		
Sewer Mains - Relining - Tenterfield	Water and Sewer Funds	External contractor	**1430**	80	150	150	150	150	150	150	150	150	150		
Sewer Manholes - level alterations - Tenterfield	Water and Sewer Funds	External contractor	**1340**	80	140	140	140	140	140	140	140	140	140		
Smoke Testing - Tenterfield	Water and Sewer Funds	External contractor	**50**	5	5	5	5	5	5	5	5	5	5		
CCTV Inspections - Tenterfield	Water and Sewer Funds	External contractor	**30**	30											
CCTV Inspections - Urbenville	Water and Sewer Funds	External contractor	**10**	1	1	1	1	1	1	1	1	1	1		
Drummond St Flood Proofing	Water and Sewer Funds	Sewer operations	**5**	5											
Totals			**15,070**	**716**	**821**	**3,956**	**2,346**	**471**	**446**	**4,921**	**511**	**421**	**461**	**4,480**	**4,480**
		Manager Water and Waste	***120***	*40*				*40*			*40*			*160*	*120*
		External consultant	***1,455***	*240*	*400*	*515*	*175*	*10*	*25*		*50*		*40*	*110*	*150*
		External contractor	***12,230***	*296*	*296*	*3,316*	*2,046*	*296*	*296*	*4,796*	*296*	*296*	*296*	*2,960*	*2,960*
		Water Operations	***310***	*40*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*300*	*300*
		Sewer operations	***955***	*100*	*95*	*95*	*95*	*95*	*95*	*95*	*95*	*95*	*95*	*950*	*950*

MB - included in Management budget, OB - included in Operations budget

1. Not including allowance for rebates etc.

2. Not including allowance for capital works recommended as part of the strategy

CONTENTS

1. INTRODUCTION

Tenterfield Shire Council (TSC) is the local water utility (LWU) providing urban water services to the towns and villages of the Tenterfield local government area (LGA).

TSC is continually planning for the on-going provision of water, sewerage and stormwater services to the urban areas of Tenterfield LGA. In the process of planning for these services, TSC is implementing best-practice management in its water supply and sewerage businesses in accordance with the *Best-Practice Management of Water Supply and Sewerage Guidelines August* (DWE, 2007). One of the criteria for achievement of best-practice is the preparation of an Integrated Water Cycle Management (IWCM) Strategy.

1.1 The IWCM Process

Water utilities need to consider all aspects of the water cycle and catchment in relation to their business activities – the provision of safe, reliable, environmentally sound and affordable urban water services. IWCM recognises the impact of increasing demands on river and groundwater resources, changing climatic conditions and resulting adjustments in statutory regimes. IWCM is also about the provision of essential urban water services (water supply, sewerage and stormwater management) to customers, both now and into the future.

IWCM enables utilities to manage their urban water services in a holistic manner within a catchment context. The Best-Practice Management guidelines and Generic Scope of Works (DWE, 2008) require a two-step process for developing an IWCM Strategy:

- Part 1: Evaluation Study, to identify the issues; and
- Part 2: Strategy Plan, if IWCM issues are not solved by existing actions and commitments.

The Evaluation Study (Part 1):

- Describes the urban water service/utility targets;
- Documents the urban water services provided by the water utility;
- Lists all information and data related to providing the urban water services;
- Defines any IWCM issues;
- Considers all existing activities and commitments in developing the Business as Usual (BAU) Scenario;
- Defines the remaining IWCM issues which the BAU Scenario does not solve; and
- Identifies feasible options for addressing the remaining issues and provides a recommendation for the strategy phase (Part 2).

The Strategy Plan (Part 2) is either:

- Simplified - if no additional (significant) capital works are required within 10 years; or
- Detailed - if additional capital works are required within 10 years to address the remaining issues and there are any opportunities for integration of water supply, sewerage and stormwater services.

Consultation with stakeholders is critical to ensure all issues are identified, all viable options are considered and the stakeholders are fully involved in determining the utility's IWCM Strategy and preferred scenario. This is achieved through the involvement of a Project Reference Group (see Section 2).

1.2 Previous Studies

TSC commissioned Parsons Brinkerhoff (PB) to commence the IWCM process through preparation of an IWCM Evaluation Report (PB, 2012). This report (attached in Appendix 1) summarises the relevant information from previous studies and provides background information on:

- The IWCM process;
- System boundaries;
- Catchment information;
- Water resources;
- Urban water supply;
- Urban sewerage systems; and
- Urban stormwater systems.

1.3 Structure of this Document

This IWCM Evaluation Study and Strategy Plan focuses on the following key areas:

- LWU targets;
- LWU issues;
- The BAU Scenario; and
- Recommendations regarding the need for and type of IWCM Strategy required.

This document draws on the data and information in the draft PB study (Appendix 1) supplemented with additional research to meet the requirements of the IWCM guidelines (Appendix 2).

The stakeholder consultation undertaken as part of the development of the IWCM Evaluation Study is documented Section 2.

2. CONSULTATION

Stakeholder consultation was undertaken to facilitate inclusion of stakeholder input and assist with development of the IWCM Strategy.

Stakeholders include people that are involved with the urban water service including representatives from the LWU, State government agencies and indigenous, customer, catchment management and industry groups. Stakeholders contacted as part of this IWCM during April/May 2013 were:

- Tenterfield Shire Council;
- NSW Office of Water;
- DPI Fisheries;
- Border Rivers Gwydir Catchment Management Authority;
- Northern Rivers Catchment Management Authority;
- NSW Health;
- Tenterfield Shire Ratepayers Association;
- Border Rivers Food and Fibre;
- Moombahlene LALC; and
- Muli Muli LALC.

The stakeholders were contacted by email to disseminate information on the IWCM process and identified issues. The stakeholders were invited to provide written feedback and/or participate in a Project Reference Group (PRG) workshop.

Table 1 presents a summary of issues raised by stakeholders and considered in the IWCM Strategy. Other stakeholders did not provide any input to the project.

A PRG workshop was held during May 2013 to confirm the preliminary findings of the IWCM Evaluation Study, provide input on existing and potential urban water management issues, together with options for managing these issues. The meeting was attended by representatives from TSC, Office of Water, DPI-Fisheries and Hydrosphere Consulting (facilitator). A summary of the meeting is attached in Appendix 3.

Table 1: Stakeholder feedback for consideration by the IWCM

Stakeholder	Feedback	Reference in this Report
DPI Fisheries	Threatened fish species occurring within the Tenterfield LGA include: • Purple Spotted Gudgeon; • Western population of Freshwater Catfish; and • Western population of Olive Perchlet. Development of the IWCM strategies should consider the following state government and Fisheries NSW policies including: • NSW Weirs Policy; • Fisheries NSW Policy and Guidelines; • Listed Key Threatened Processes; and • Threatened Fish Species Priority Action Statement.	Section A5 - Fisheries Policies and Guidelines and Section A13.7 – discussion of environmental flows and review of Water Sharing Plan in 2014.
Border Rivers Gwydir Catchment Management Authority [1]	• Hydrometric characteristics of flows and flooding	Section A17 - Flood Management
	• Run-on & run-off water quality	Section A16 - Urban Stormwater Management and Appendix 1 (Section 3.3, PB, 2012)
	• Water disposal structures and points	Section A10 - Environment Protection Licences, Section A13.3 - Sewerage System Overflows and Section A16 - Urban Stormwater Management
	• Industrial and domestic waste management and disposal	Section A13.4 - Biosolids Management and Section A13.5 - Liquid Trade Waste. Domestic waste management is not addressed in TSC's IWCM Strategy
	• Groundwater contamination, recharge & discharge	Appendix 1 (Section 3.3, PB, 2012)
	• Storm and flood protocols for inundation of sewage infrastructure, including identification of sites for mitigation works	Section A17 - Flood Management
	• Storm and flood modelling for the town & villages	Section A17 - Flood Management
	• Erosion and sediment control procedures for urban development and waste management	Section A16 - Urban Stormwater Management
	• Integrated surface and groundwater discharge monitoring from waste management and disposal sites	No data available
	• Storm water discharge points appropriately designed with GPTs fitted	Section A16 - Urban Stormwater Management

1. The BRGCMA primary role is to address issues in the broader catchment, however, many of these issues translate to issues within the IWCM.

3. IWCM TARGETS

The IWCM process is about addressing water cycle management problems. The issues are defined by non-achievement of water cycle management objectives and non-compliance with urban water service targets, including both legal obligations and agreed levels of service.

All LWUs have targets which relate to legislation, contracts, standards and agreed levels of service. Some targets relate to regulatory requirements (for example water extraction, water processing, water discharge and waste disposal) and cannot be varied. These targets are mandatory and non-compliances are therefore described as IWCM issues. The relevant policy frameworks and guideline documents also set objectives for performance of the LWU businesses. This is important for understanding how well the system is performing as well as identifying system issues.

One area that may be varied is the levels of service that TSC has agreed with its customers. For the purposes of this IWCM Strategy, targets also include formal guidelines and objectives which Council intends to meet.

The targets and objectives that are relevant to this IWCM Strategy are discussed in Appendix 2. Key IWCM targets are summarised in Table 2.

Table 2: Key IWCM Targets

Item	Target	Comments
NSW Legislation	100% compliance with legislative obligations	Legislation drives many other IWCM targets. Refer Section A1
Community Strategic Plan (CSP) 2013-2023	CSP Objectives guide and coordinate Council's activities	The CSP Identifies the long term aspirations of the community, key directions, outcomes and key result areas. Many key directions from the CSP are relevant to IWCM including (refer Section A3): • Drainage systems allow for effective management of stormwater; • Urban water supply networks are modern, efficient and meet industry best practice guidelines; • Urban wastewater supply networks are modern, efficient and meet industry best practice guidelines; • The natural environment will be protected, enhanced and promoted for future generations; • A total water cycle management approach including water conservation and reuse is adopted; • Environmental risks and impacts are strategically managed; and • Water is used carefully in Council's buildings, parks, sporting grounds and daily operations.
Water Sharing Plans	100% compliance with Water Access Licences for town water supplies	Town water supplies are governed by the Water Sharing Plans for NSW Murray-Darling Basin Fractured Rock Groundwater and Tenterfield Creek Water Source. Refer Section 0.

Item	Target	Comments
Australian Drinking Water Guidelines (AWDG)	100% compliance with ADWG	The ADWG defines safe, good quality water and how it can be achieved and assured. The *Public Health Act, 2010* and *Regulation 2012* require water utilities to prepare and implement a risk-based drinking water quality management plan in accordance with the ADWG. Refer Section A9.
Environment Protection Licences	100% compliance with Environment Protection Licences	TSC holds licences for operation of Tenterfield and Urbenville sewerage systems, discharge of backwash water from Tenterfield WTP and control of algae in Tenterfield Dam. Refer Section A10.
Best-Practice Management of Water Supply and Sewerage Guidelines	100% compliance with Best-Practice Management Guidelines	The Guidelines were prepared to encourage continuing improvement in performance and identify criteria for best-practice management of water supply and sewerage. Refer Section A11.
Asset Management Planning	Management actions and strategies guide and co-ordinate Council's activities	TSC has recently prepared Asset Management Plans which identify current and emerging issues and identify management actions. Refer Section A13.1.
Levels of Service – Water Supply, Sewerage and Stormwater	100% compliance with Levels of Service	The Levels of Service define the standards required and direct Council's detailed planning. Refer Sections A13.2 and A16.

4. ADEQUACY OF DATA

During the development of this IWCM Strategy, data from Council, stakeholders and publicly available information were reviewed. The information gained was generally adequate to identify current issues, however, addressing the data gaps listed below would improve the understanding of the issues facing TSC in urban water service delivery both now and into the future.

Table 3: Data Gaps

No.	Data Gap	Related Obligation/Target	Actions
D 1	The current secure yield of the water supply systems has not been assessed with consideration of demand hardening and the additional emergency supplies.	• Community Strategic Plan, Levels of Service	Undertake security of supply assessment for existing Tenterfield and Urbenville water supplies in accordance with current best-practice
D 2	The impact of climate change on the secure yield of the water supply systems into the future has not been assessed.	• Community Strategic Plan, Levels of Service	Determine the potential impact of climate change on the secure yield of Tenterfield and Urbenville water supplies in accordance with current best-practice.
D 3	The impact of climate change on the water supply, sewerage and stormwater assets and achievement of levels of service has not been assessed.	• Levels of Service	The risk of asset damage, isolation and impact on levels of service due to climate change should be assessed with reference to the potential increase in flood levels that may arise in future.

5. IWCM ISSUES

The available information on the water systems has been documented in PB (2012) included as Appendix 1 as well as the additional background information provided in Appendix 2.

The issues identified in this IWCM Evaluation Study are listed in Table 4.

Table 4: Urban Water Management Issues

No.	Issue	Reference in Appendix 2	IWCM Target	Responsibility
Urban Water Supply				
I 1	Unacceptable risks from bacteria and protozoa have been identified within the Tenterfield drinking water system due to major run-off events, incorrect dose of alum, filter break-through, failure of UV system and stagnation in reservoirs.	Section A9	• NSW Public Health Act 2010, Public Health Regulation 2012, ADWG	TSC Engineering Services Department (Water and Wastewater Services Group)
I 2	Unacceptable risks from bacteria and protozoa have been identified within the Urbenville drinking water system due to major run-off events, incorrect dose of alum and failure of the chlorination system.	Section A9	• NSW Public Health Act 2010, Public Health Regulation 2012, ADWG	TSC Engineering Services Department (Water and Wastewater Services Group)
I 3	An inherent risk from bacteria has been identified for the Jennings scheme due to receipt of out-of-specification treated bulk water from Southern Downs Regional Council.	Section A9	• NSW Public Health Act 2010, Public Health Regulation 2012, ADWG	TSC Engineering Services Department (Water and Wastewater Services Group)
I 6	The potential failure of the white PVC water reticulation system in Jennings has been identified as a risk.	Section A13.1	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group)
I 8	Shirley Park bore is currently not operational due to damage caused by flooding in 2011.	Section A13.1	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group)
I 12	The Water Supply Levels of Service need to be reviewed and updated to reflect current standards and requirements.	Section A13.2	• Water Supply Levels of Service, Best-Practice Requirements	TSC Engineering Services Department (Water and Wastewater Services Group)
I 14	Total losses in the Tenterfield water supply system are greater than 15% (on average).	Section A13.6	• Community Strategic Plan	TSC Engineering Services Department (Water and Wastewater Services Group)

No.	Issue	Reference in Appendix 2	IWCM Target	Responsibility
I 15	Tenterfield Creek is regarded as a stressed river with highly variable flow and is known to experience extended periods of low or no flow. The Review of the Tenterfield Creek Water Sharing Plan in 2014 may include changes to environmental flow requirements depending on results of aquatic fish and habitat monitoring in Tenterfield Creek.	Section A13.7	• Water Sharing Plan, Water Access Licence, Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group), NSW Office of Water
I 16	The current capacity of Tenterfield WTP is expected to be exceeded by 2016 as the original plant has been decommissioned.	Section A13.7	• Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group)
I 17	The town water supply dam on Tenterfield Creek does not satisfy the ANCOLD Guidelines for Stability of Gravity Dams and the situation is likely to deteriorate.	Section A13.8	• Community Strategic Plan, Levels of Service, ANCOLD guidelines	TSC Engineering Services Department (Water and Wastewater Services Group)
Urban Wastewater Management				
I 5	Ongoing non-compliance with Environment Protection Licence due to high TSS values at Urbenville STP. This is believed to be caused by high rainfall and algae growth in the maturation ponds.	Section A10	• Environment Protection Licence, POEO Act	TSC Engineering Services Department (Water and Wastewater Services Group)
I 7	The production of sulphides in some sewers is causing surface pitting and exposed aggregate which may lead to pipe failure.	Section A13.1	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group)
I 9	In the older sewers, there is a high level of stormwater infiltration into the collection system, resulting in over loading at the Tenterfield STP during storm events.	Section A13.1	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group)
I 10	The back-up generator and electrical control panel for the main sewerage pumping station in Drummond Street are vulnerable to flooding and need to be raised above flood level.	Section A13.1	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Water and Wastewater Services Group)
I 11	The levels of service documented in the Strategic Business Plan for Sewerage Services are not being achieved in terms of percentage effluent reuse, number of complaints and effluent quality from Urbenville STP.	Section A13.2	• Sewerage Levels of Service, Best-Practice Requirements	TSC Engineering Services Department (Water and Wastewater Services Group)
I 13	The Sewerage Levels of Service need to be reviewed and updated to reflect current standards and requirements.	Section A13.2	• Best-Practice Requirements	TSC Engineering Services Department (Water and Wastewater Services Group)

No.	Issue	Reference in Appendix 2	IWCM Target	Responsibility
I 18	Recycled water management plans have not been prepared for the recycled water systems.	Section A13.1	• Recycled Water Management Guidelines	TSC Engineering Services Department (Water and Wastewater Services Group)
I 19	All biosolids are disposed of to landfill with no beneficial reuse.	Section A13.4	• Environmental Guidelines: Use and Disposal of Biosolids Products	TSC Engineering Services Department (Water and Wastewater Services Group)
I 21	There is concern from the community and Council regarding public health risks and about contamination of local waterways from inadequate on-site sewerage systems in the villages of the Shire.	Section A15	• OSSM Policy	TSC Engineering Services (Water and Wastewater Services Group) and Environmental and Community Services Departments
Urban Stormwater Management				
I 22	Stormwater from urban areas of Tenterfield causes water quality impacts in waterways.	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 23	In some urban areas of Tenterfield, localised flooding is experienced due to site constraints and insufficient capacity of the stormwater systems.	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 24	Community health and safety risks have been identified due to stagnant stormwater and mosquitoes.	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 25	Community health and safety risks have been identified due to septic tank discharges to stormwater systems.	Section A16	• Community Strategic Plan, Levels of Service	TSC Environmental and Community Services Department
I 26	There is a lack of community awareness about stormwater issues.	Section A16	• Community Strategic Plan	TSC Engineering Services Department (Transportation Services Group)
I 27	Council's current funding levels are insufficient to continue to provide urban stormwater services at current levels in the medium term.[1]	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
Human Resources				
I 4	Staff resourcing issues have caused administrative non-compliances with Environment Protection Licences (late submission of annual returns).	Section A10	• Environment Protection Licence, POEO Act	TSC Engineering Services Department (Water and Wastewater Services Group)
I 21	Due to staff resourcing issues, some targets outlined in the On-site Sewerage Management Policy are not currently being fully achieved.	Section A15	• OSSM Policy, POEO Act	TSC Environmental and Community Services Department

No.	Issue	Reference in Appendix 2	IWCM Target	Responsibility
I 28	Human resource challenges such as ageing workforce, difficulty recruiting and retaining professional staff and increasing community expectations may affect delivery of urban water services.	Section A18	• Community Strategic Plan, Levels of Service	TSC's General Manager's Department
I 29	Local government reform may alter the governance and regulatory arrangements for the provision of urban water services.	Section A20	-	TSC's General Manager's Department

1. The adopted Stormwater AMP includes a funding strategy for the next 10 years.

6. ADDRESSING THE IWCM ISSUES

TSC continually develops and implements plans for water service provision. This is undertaken through the LWU business planning process (e.g. Strategic Business Planning, Asset Management Planning) as well as solving issues as they arise.

The Business as Usual (BAU) Scenario (refer Table 5) identifies the actions which have been adopted by TSC in relation to each of the identified IWCM issues. The Asset Management Plans to be adopted by Council in June 2013 also address many of these issues.

The non-IWCM issues (those that are not the responsibility of the TSC Water and Sewerage Services Group) listed in Table 6 will be referred to the relevant department of TSC.

Table 5: BAU Scenario

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
Urban Water Supply				
I 1	Unacceptable risks from bacteria and protozoa have been identified within the Tenterfield drinking water system due to major run-off events, incorrect dose of alum, filter break-through, failure of UV system and stagnation in reservoirs.	TSC Engineering Services Department (Water and Wastewater Services Group)	The Drinking Water Management System (DWMS, 2013) identifies improvement measures and the following actions are funded in the 2013/14 Council capital works budget: • Alternate coagulant and coagulant dosing equipment (Alchor); • Replacement of filter bed material; and • Relining of East Street reservoir.	The DWMS also recommends the following improvement measures which will be prioritised and funded in future years: • Online raw water and colour monitoring; • Online monitoring for settled water pH and turbidity; • Online turbidity meters on individual filters; • Investigation of UV system performance; • Improving turnover and mixing in reservoirs; and • Reservoir cleaning program. The DWMS also identified improvement actions common to all schemes as follows: • Prepare operation and maintenance manuals for each scheme; • Develop water asset management plans including targets for levels of service; • Commission new standby generator; • Develop and adopt a drinking water quality policy; • Develop standard operating procedures; • Develop water quality incident and emergency response plan; and • Investigate one-off project to test for disinfection by-products with local public health unit. Ongoing implementation and review of the improvement measures identified in the DWMS is considered to assist in addressing this issue. Upgrade of the Tenterfield WTP is addressed in Issue 17.

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
I 2	Unacceptable risks from bacteria and protozoa have been identified within the Urbenville drinking water system due to major run-off events, incorrect dose of alum and failure of the chlorination system.	TSC Engineering Services Department (Water and Wastewater Services Group)	The chlorination system was repaired in early 2013. The Drinking Water Management System (DWMS, 2013) identifies improvement measures and the following actions are funded in the 2013/14 Council capital works budget: • Alternate coagulant and coagulant dosing equipment (Alchor).	The DWMS also recommends the following improvement measures which will be prioritised and funded in future years: • Alarms for water turbidity; • Raw water testing for manganese; • Enable auto plant shutdown if high raw water turbidity occurs to enable jar testing and correction of chemical dosing; • Establish communication protocol with Kyogle Council to optimise storage during rain events; and • Improvement actions common to all schemes listed in Issue 1. Ongoing implementation and review of the improvement measures identified in the DWMS is considered to assist in addressing this issue.
I 3	An inherent risk from bacteria has been identified for the Jennings scheme due to receipt of out-of-specification treated bulk water from Southern Downs Regional Council (SDRC).	TSC Engineering Services Department (Water and Wastewater Services Group)	Not currently addressed.	The Drinking Water Management System (DWMS, 2013) identifies the need to formalise the water supply agreement between TSC and SDRC, including communication protocols and water quality criteria. Ongoing implementation and review of the improvement measures identified in the DWMS is considered to assist in addressing this issue.
I 6	The potential failure of the white PVC water reticulation system in Jennings has been identified as a risk.	TSC Engineering Services Department (Water and Wastewater Services Group)	TSC progressively replaces the reticulation system with blue brute PVC. An allowance of $10,000 p.a. is included in the adopted capital works budget.	The ongoing mains replacement program is considered to address this issue.
I 8	Shirley Park bore is currently not operational due to damage caused by flooding in 2011.	TSC Engineering Services Department (Water and Wastewater Services Group)	In accordance with the Drought Management Plan, Council will monitor water levels in the dam and when the level reaches 70% and level 1 restrictions are imposed, TSC will repair the bore and ensure it is operational.	The adopted approach is considered to adequately address this issue.
I 12	The Water Supply Levels of Service need to be reviewed and updated to reflect current standards and requirements.	TSC Engineering Services Department (Water and Wastewater Services Group)	Not currently addressed.	It is recommended that the Water Supply Services Strategic Business Plans are reviewed and updated including a review of Levels of Service.

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
I 14	Total losses in the Tenterfield water supply system are greater than 15% (on average).	TSC Engineering Services Department (Water and Wastewater Services Group)	TSC participated in the Water Loss Management Program between 2006 and 2011 (Water Directorate, 2012). No major leaks were found but some leaking hydrants were repaired. Estimated water savings was 34.7 ML/a with funding of $33,000 through the program. A meter replacement program for Tenterfield ($20,000 p.a.) and hydrant replacement in Urbenville ($10,000 in 2013/14) is also included in the adopted capital works budget.	TSC should continue to monitor water losses to determine the effectiveness of the current actions.
I 15	Tenterfield Creek is regarded as a stressed river with highly variable flow and is known to experience extended periods of low or no flow. The Review of the Tenterfield Creek Water Sharing Plan in 2014 may include changes to environmental flow requirements depending on results of aquatic fish and habitat monitoring in Tenterfield Creek.	TSC Engineering Services Department (Water and Wastewater Services Group), NSW Office of Water	The Office of Water has advised that it is likely that the Plan will be incorporated into the Water Sharing Plan for the NSW Border Rivers Regulated River and the review is unlikely to alter the town water supply licence conditions.	TSC should liaise with Office of Water regarding licence conditions and provide input into the review of the Tenterfield Creek Water Sharing Plan as well as the development of the Clarence Unregulated and Alluvial Water Sources Water Sharing Plan which is likely to incorporate the Urbenville water supply. Ongoing liaison with Office of Water is considered to adequately address this issue.
I 16	The current capacity of Tenterfield WTP is expected to be exceeded by 2016 as the original plant has been decommissioned.	TSC Engineering Services Department (Water and Wastewater Services Group)	TSC does not have sufficient funds to upgrade the WTP and the Office of Water has advised that the WTP upgrade is not eligible for subsidy under the Country Towns Program. As discussed in Issue 1, operational modifications are being undertaken to improve the performance of the existing WTP.	It is recommended that TSC investigate whether interim works to repair the old WTP and increase the capacity of the plant (e.g. replacement of air scour system) are cost-effective. TSC should continue to monitor peak day demand and growth in Tenterfield and compare with available plant capacity. It is also recommended that the restriction policy is reviewed to include consideration of WTP capacity and the potential need to restrict peak demand.

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
I 17	The town water supply dam on Tenterfield Creek does not satisfy the ANCOLD Guidelines for Stability of Gravity Dams and the situation is likely to deteriorate.	TSC Engineering Services Department (Water and Wastewater Services Group)	The adopted capital works budget includes an allowance of $1m in 2013/14 to develop the design of the dam stability works with 50% subsidy from Office of Water. Construction works are expected to be completed by 2016/17. The budget includes an allowance of $4.5m to construct the works and this estimate will be updated with the construction cost once the design and costing is completed. Design of the works will consider the approval requirements including addressing fish passage within the Tenterfield Creek system.	The adopted approach is considered to adequately address this issue. The budget estimate for design, approvals and procurement phases should be updated with information provided by NSW Public Works. Design of the works will also need to consider the integrated development approval requirements including addressing fish passage within the Tenterfield Creek system.
Urban Wastewater Management				
I 5	Ongoing non-compliance with Environment Protection Licence due to high TSS values at Urbenville STP. This is believed to be caused by high rainfall and algae growth in the maturation ponds.	TSC Engineering Services Department (Water and Wastewater Services Group)	The licence annual returns identified potential measures to control algae growth in the maturation ponds including introduction of silver perch and filtration at the pond outlet but these have not been successful. The EPA has confirmed to TSC that compliance is currently acceptable	Similar issues have been experienced by many other regional councils. The non-compliances at Urbenville STP are not considered significant with only occasional occurrence of high pH or suspended solids. Effluent is irrigated during dry periods and the remainder is released to Tenterfield Creek. Continued monitoring and review of licence compliance (through the annual returns) and liaison with EPA is recommended.
I 7	The production of sulphides in some sewers is causing surface pitting and exposed aggregate which may lead to pipe failure.	TSC Engineering Services Department (Water and Wastewater Services Group)	The adopted operations budget includes allowance for maintenance and rehabilitation of sewer mains.	The adopted approach is considered to adequately address this issue.

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
I 9	In the older sewers, there is a high level of stormwater infiltration into the collection system, resulting in over loading at the Tenterfield STP during storm events.	TSC Engineering Services Department (Water and Wastewater Services Group)	The current capital works plan includes allowance for relining of 1 km of mains per year ($80,000 p.a.) as well as $80,000 p.a. for alteration of manholes. Smoke testing and CCTV inspections are also included in the budget.	The adopted approach is considered to adequately address this issue.
I 10	The back-up generator and electrical control panel for the main sewerage pumping station in Drummond Street are vulnerable to flooding and need to be raised above flood level.	TSC Engineering Services Department (Water and Wastewater Services Group)	TSC is currently preparing a flood study which will identify design flood levels. An allowance of $5,000 has been included in the adopted capital works budget to address the issue. The existing generator is below ground level and raising the generator is causing concerns for neighbours regarding visual impacts of any flood proofing. This will be addressed during the design of flood-proofing works.	The adopted approach is considered to adequately address this issue.
I 11	The levels of service documented in the Strategic Business Plan for Sewerage Services are not being achieved in terms of percentage effluent reuse, number of complaints and effluent quality from Urbenville STP.	TSC Engineering Services Department (Water and Wastewater Services Group)	Irrigation of treated effluent from Tenterfield STP is dependent on rainfall and reuse can range from 0% in wet periods to 100% in dry periods. Effluent quality from Urbenville STP is addressed in Issue 4. Ongoing implementation of improved asset management procedures is likely to reduce the number of complaints over time.	It is recommended that the Sewerage Services Strategic Business Plans are reviewed and updated including a review of Levels of Service.
I 13	The Sewerage Levels of Service need to be reviewed and updated to reflect current standards and requirements.	TSC Engineering Services Department (Water and Wastewater Services Group)	Not currently addressed.	It is recommended that the Sewerage Services Strategic Business Plans are reviewed and updated including a review of Levels of Service.

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
I 18	Recycled water management plans have not been prepared for the recycled water systems.	TSC Engineering Services Department (Water and Wastewater Services Group)	Not currently addressed.	It is recommended that recycled water management plans are prepared for the effluent reuse applications.
I 19	All biosolids are disposed of to landfill with no beneficial reuse.	TSC Engineering Services Department (Water and Wastewater Services Group)	Full cost recovery of landfill disposal is likely to be applied to the wastewater business from 2013/14. To reduce costs associated with disposal and increase the beneficial reuse of biosolids, TSC is investigating the potential reuse of the biosolids as organic fertiliser.	It is recommended that TSC prepare a Biosolids Management Study to identify potential reuse options.
I 21	There is concern from the community and Council regarding public health risks and about contamination of local waterways from inadequate on-site sewerage systems in the villages of the Shire.	TSC Engineering Services (Water and Wastewater Services Group) and Environmental and Community Services Departments	Council's On-site Sewage Management Policy (2002) provides a framework for implementation of ecologically and socially sustainable on-site sewage management practices and implementation of the policy is the responsibility of the TSC Environmental and Community Services Department. TSC does not have sufficient funds to provide reticulated sewerage services to these villages. The Wastewater Services Group aims to develop plans for a centralised, post-treatment storage tank with greywater reuse within the village of Jennings from 2014/15.	As discussed in Issue 21 (Table 6), management and regulation of on-site systems is the responsibility of the TSC Environmental and Community Services Department but limited resources is affecting the implementation of TSC's On-Site Sewage Management Policy. It is recommended that the TSC Engineering Services and Environmental and Community Services Departments work together to identify and implement an appropriate response to the potential public health and environmental risks.

No.	Issue	Responsibility	BAU Scenario	Recommendations/Additional Actions
Human Resources				
I 4	Staff resourcing issues have caused administrative non-compliances with Environment Protection Licences (late submission of annual returns).	TSC Engineering Services Department (Water and Wastewater Services Group)	Council has recently filled the position of Manager Water and Waste and annual returns are being submitted in accordance with licence requirements.	Ongoing implementation of the TSC Workforce Plan is required to address the resourcing challenges facing Council.

Table 6: Non-IWCM Issues identified in the Evaluation Study

No.	Issue	Reference in Appendix 2	IWCM Target	Responsibility
I 20	Due to staff resourcing issues, some targets outlined in the On-site Sewerage Management Policy are not currently being achieved.	Section A15	• OSSM Policy, POEO Act	TSC Environmental and Community Services Department
I 22	Stormwater from urban areas of Tenterfield causes water quality impacts in waterways.	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 23	In some urban areas of Tenterfield, localised flooding is experienced due to site constraints and insufficient capacity of the stormwater systems.	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 24	Community health and safety risks have been identified due to stagnant stormwater and mosquitos.	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 25	Community health and safety risks have been identified due to septic tank discharges to stormwater systems.	Section A16	• Community Strategic Plan, Levels of Service	TSC Environmental and Community Services Department
I 26	There is a lack of community awareness about stormwater issues.	Section A16	• Community Strategic Plan	TSC Engineering Services Department (Transportation Services Group)
I 27	Council's current funding levels are insufficient to continue to provide urban stormwater services at current levels in the medium term. [1]	Section A16	• Community Strategic Plan, Levels of Service	TSC Engineering Services Department (Transportation Services Group)
I 28	Human resource challenges such as ageing workforce, difficulty recruiting and retaining professional staff and increasing community expectations may affect delivery of urban water services.	Section A18	• Community Strategic Plan, Levels of Service	TSC's General Manager's Department
I 29	Local government reform may alter the governance and regulatory arrangements for the provision of urban water services.	Section A20	-	TSC's General Manager's Department

1. The adopted Stormwater AMP includes a funding strategy for the next 10 years.

7. IWCM IMPLEMENTATION

TSC will implement the BAU actions as described in Table 5. The BAU Scenario is considered to be the appropriate strategy to address many of the identified IWCM issues. The remaining IWCM issues, which require additional action, relate to:

- Drinking water quality improvements (Issues 1, 2, 3);
- Strategic planning (Issues 11, 12, 13);
- The development and review of Water Sharing Plans (Issue 15);
- Management of peak water demands in Tenterfield (Issue 16);
- Management of effluent reuse (Issue 18);
- Biosolids management (Issue 19);
- Adequacy of village on-site sewerage systems (Issue 21); and
- Adequacy of financial and human resources (Issues 4, 16, 21).

These issues will be addressed by minor additional capital works and strategic planning actions. The required response is detailed in the IWCM Strategy action plan (Section 8). Additional data collection is also required (particularly relating to secure yield and climate change impacts) to provide improved understanding of potential emerging and future IWCM issues.

The non-IWCM issues will be referred to the relevant body or division of TSC (refer Table 6). TSC will review the status of each issue and the solutions proposed on a regular basis and formally at the next IWCM review.

The next IWCM review in 8 years (2021) will confirm whether the actions in the IWCM Strategy have adequately addressed the identified issues. The progress of each action will be reviewed as part of TSC's Water Supply and Sewerage Strategic Business Plans which will be reviewed in 2014 and every three years after that.

8. IWCM STRATEGY PLAN

8.1 Best Practice Requirements

Issues 11, 12, 13

A key component of the IWCM Strategy Plan is the ongoing achievement of the water utility best-practice requirements.

As discussed in Section A11 (Appendix 1), TSC is required to update some management plans to continue to achieve compliance with the State Government's best-practice requirements. A summary of the actions required to maintain compliance is listed below.

Table 7: Compliance with Best-Practice Requirements

Criteria	Actions to achieve compliance
Strategic Business Planning	Update the SBPs incorporating the recommendations of this IWCM Strategy Plan in accordance with the current guidelines and every 3 years. Review target levels of service and actual achievements. The financial plans should be reviewed and updated each year with revised capital works programs to determine appropriate funding scenarios.
Pricing (including Developer Charges, Liquid Trade Waste Policy and Approvals)	The water supply tariff should be adjusted to provide the required level of income from user charges (50% of residential revenue). Pricing should be reviewed each year as part of the financial planning. Development Servicing Plans should be reviewed by 2017 in accordance with the guidelines current at that time.
Water Conservation	The Water Conservation and Demand Management Plan (2010) included a 3 year implementation program (2010 – 2012). The success of these initiatives and the future demand management requirements should be reviewed. Initiatives to reduce peak demand should be considered to assist with delaying the need for augmentation of the Tenterfield WTP (refer Section 8.3). A water loss monitoring program will be also be developed.
Drought Management	The Drought Management Plan should be reviewed with any new information on secure yield (refer Section 8.8) and WTP capacity (refer Section 8.3).
Performance Monitoring	Submit completed reporting forms to NSW Office of Water each year. Prepare an annual Action Plan to address areas of concern (initially as part of the SBP review).
Integrated Water Cycle Management (IWCM)	Review in 8 years (prior to 2021).

8.2 Drinking Water Quality Improvements

Issues 1, 2, 3

TSC will commence the DWMS improvement measures for Tenterfield water supply in 2013/14 with the installation of Alchor coagulant dosing equipment and replacement of filter bed material at the WTP. Works at East Street reservoir include relining and inlet modifications to improve mixing. The Hospital Hill reservoir will also be taken off line to reduce detention times. These modifications will increase reservoir turnover and mixing and reduce the likelihood of bacteria growth due to stagnation in the reservoirs. Reservoir cleaning will be undertaken as part of the scheduled maintenance program.

TSC will also install Alchor coagulant dosing equipment at Urbenville WTP and a high-turbidity alarm which allows the operator to shut down the plant and adjust the dosing regime in the event of poor raw water quality.

The remaining improvement measures recommended in the DWMS for Tenterfield and Urbenville water supplies will be prioritised for implementation over the medium term.

The arrangements between TSC and the bulk water supplier for Jennings (SDRC) have historically been relatively informal. This can lead to issues relating to the lack of clear responsibility for customer water quality and the security of supply. The DWMS identified the need for a water supply agreement with SDRC to define responsibilities, communication protocols and levels of service. Following initial consultation with SDRC, the agreement is likely to be developed as follows:

- A suitable independent facilitator will assist with development of the agreement;
- A workshop with TSC and SDRC representatives will be held to discuss water supply to Jennings and identify bulk supply issues;
- A plain English water supply agreement will be developed covering:
    - Supply protocols – data collection (water quality, consumption, complaints), information sharing, community education, operations (communication lines, responsibilities, incident response);
    - Quantity/Security – levels of service (drought security, annual and peak demand), demand management, drought management, future development, reliability (frequency and duration of interruptions), long term water supply planning;
    - Accountability – responsibilities (e.g. water quality testing and flow metering);
    - Compliance - legislative/regulatory requirements, best-practice, licences, efficiency targets, leakage targets;
    - Dispute resolution; and
- The agreement will be adopted by TSC and SDRC.

As part of the ongoing review and update of the Water Supply Asset Management Plan and Strategic Business Plan, TSC will also develop operation and maintenance plans for the water supply schemes addressing the DWMS improvement actions common to all schemes (refer Table 5). TSC's Manager Water and Waste will review and record the progress of the DWMS Improvement Actions every 6 months in accordance with the DWMS.

8.3 Treated Water Capacity

Issues 16

The Tenterfield WTP was augmented in 1985 with additional filtration capacity. The design capacity of Tenterfield WTP is 5.0 ML/d however the original 1930s plant is currently not in service and plant capacity has been reduced to 3.5 ML/day. Current peak day demand is approaching this capacity. Complete replacement of the plant is estimated to cost approximately $4.5 million (based on the NSW Reference Rates Manual and including survey, investigation and design). TSC does not have sufficient funds to upgrade the WTP at this time and no government subsidies are expected to be available.

The operational modifications recommended in the DWMS and discussed in Section 8.2 are expected to improve the performance of the existing WTP. To address the peak demand and capacity limitations at Tenterfield, the following actions will be implemented:

- Ongoing monitoring of connection growth and peak day demands (particular during hot and dry periods) and comparison with WTP capacity;

- Review of the water conservation and demand management plan will consider initiatives that can reduce peak demand such as:
    - Community awareness and education programs;
    - Residential rebates for rainwater tanks and grey water reuse systems; and
    - Compulsory covers for all pools within the Shire.
- Review of the drought management plan and restriction policy will consider WTP capacity, the potential need to restrict peak demand and the success of the restriction policy in reducing peak demands; and
- Development of a concept and design for the upgrade of the WTP in the short-term. This is in order to confirm budget estimates and enable financial planning and development of a funding strategy for the WTP upgrade. The design will also consider short-term measures to prolong the life of the existing facility such as repairs (e.g. air scour system) to the old plant. Construction of the new WTP would then be undertaken as a funding source is identified.

8.4 Water Sharing Plans

Issue 15

The Tenterfield Creek Water Sharing Plan (2004) is currently being reviewed by NSW Office of Water and is likely to be incorporated into the macro Water Sharing Plan for the NSW Border Rivers Regulated River Water Source (2009). TSC has a water licence for town water supply from Tenterfield Dam (under the Tenterfield Creek Plan) and NSW Office of Water has advised that town water supply licence conditions are unlikely to be modified in the review.

A new macro water sharing plan is being developed for the Clarence Unregulated and Alluvial Water Sources. Council's existing *Water Act 1912* licence for the Urbenville water supply from Tooloom Creek will be converted to a water access licence under the *Water Management Act, 2000* once this new plan is commenced.

TSC will consult with NSW Office of Water during the preparation of the Water Sharing Plans in relation to town water entitlements and extraction conditions. As discussed in Section 8.8, there is a need to update the secure yield estimates to confirm the adequacy of the existing water access arrangements. Council will reinforce the need for continuation of the current town water access requirements as well as obtain information regarding the longer-term implications for town water supply resulting from the commencement of the water sharing plans.

8.5 Recycled Water Management

Issue 18

Treated effluent is currently reused during dry periods for irrigation of Tenterfield Golf Course and a private farm adjacent to the STP. In accordance with the current national water recycling guidelines (Section A2), any scheme that recycles water must ensure that public health and the environment are protected. The guidelines require that every scheme should have a risk management plan based on a 12 element framework similar to the ADWG (assessment of risks, management of risks and monitoring/reviewing risks).

TSC will adopt a risk management approach including identification and assessment of hazards, and development of preventative measures to control the hazards. The approach will include monitoring to ensure that the preventive measures operate effectively, and verification to ensure that the management system consistently provides recycled water of a quality that is fit for its intended use.

The risk management plans need to be developed in consultation with the golf course and farm operators. Key considerations include:

- Microbial and chemical quality and log reduction requirements for the end uses;
- Hazards to human and environmental health;
- Preventative measures – treatment process, effluent storage, irrigation methods, cross-connection prevention, education, buffer zones, access control; and
- Data collection for monitoring and validation.

8.6 Biosolids Management

Issue 19

All biosolids from the WTP and STP are dewatered and stored on-site prior to disposal at the Tenterfield landfill. Full cost recovery of landfill disposal is likely to be applied to the wastewater business from 2013/14. The *Environmental Guidelines: Use and Disposal of Biosolids Products (EPA, 2000)* provide guidance related to the beneficial use and disposal of biosolids.

A biosolids management strategy will be prepared including:

- Legislative requirements;
- Analysis of biosolids load and stabilisation and contaminant grade of the biosolids product for each plant;
- Potential future changes to biosolids loads or quality;
- On-site biosolids treatment and handling processes and the need for additional processes;
- Comparison of potential reuse and disposal options (capital, operating and maintenance costs, management requirements and operational flexibility, environmental and social impacts); and
- Flexibility to adapt to future legislative changes or altered market conditions.

8.7 On-Site Sewerage Management

Issue 21

There is anecdotal evidence of potential health and environmental risks due to poor performance of on-site sewerage systems in the villages of Jennings, Liston, Drake and Torrington. As part of the development of the Strategic Business Plans (SBP, refer Section 8.1), Council will develop a servicing strategy based on the identified risks in each village. The SBP will document:

- Existing population and type of wastewater management facilities in each village;
- Results of on-site sewerage facility inspections and performance data and any requirements of Council's On-site Sewerage Management Policy (2013);
- Assessment of risks based on topography and ground conditions, sensitive receiving environments, rainfall and water quality and soil testing;
- Community feedback on adequacy of existing systems;
- Assessment of potential servicing strategies including upgrade of on-site systems, post-treatment effluent storage and reuse, "low-cost" reticulated sewerage systems and connection to existing SDRC effluent management systems (Jennings); and
- Potential costs and funding strategies.

8.8 Secure Yield

Data Gaps 1, 2

Secure yield is defined as the highest annual water demand that can be supplied from a water supply headworks system whilst meeting the 5/10/10 rule (restrictions no more than 5% of the time with a frequency of no more than 1 in 10 years and on average a 10% reduction in consumption).

Secure yield estimates for Tenterfield and Urbenville water supplies were calculated in 1996 and 2002 respectively. Since that time, there have been changes in the NSW security of supply planning methodology, water supplies and storage capacity and potential for demand reductions during restrictions. The current secure yield estimates will be updated with these considerations.

Draft guidelines are being prepared by the NSW Office of Water to assist NSW local water utilities assess and adapt to the impact of global warming and climate variability on the secure yield of their urban water supplies (NSW Office of Water, 2013d). The draft guidelines include a list of water utilities which need to assess the secure yield in accordance with the guidelines as soon as possible. TSC is included on the list as a utility which experienced significant stress in the recent (2007) severe drought and has not undertaken major augmentation works.

The assessment of future secure yield described in the draft guidelines adopts the methodology used in a pilot study (Samra and Cloke, 2010) which incorporated the scientific logic of the CSIRO's Murray Darling Basin Sustainable Yields Project. That Project used daily historical data from 1895 to 2006 and applied the relevant global climate models (GCMs) to provide projected (~2030) climate changed data for each GCM. The Murray Darling Basin data has been extended to cover all of NSW based on the Year 2030 A1B warming scenario.

The secure yield assessment process involves (for Tenterfield and Urbenville water supplies):

- Development (or update) of a system simulation model considering the surface water (dam/weir) storage, current environmental flow provisions, additional groundwater supplies and restriction policy to determine the current secure yield;
- Calculation of the climate-changed daily streamflows for each GCM using the existing rainfall-runoff model; and
- Using the system simulation models and climate-changed daily streamflows to determine the secure yield for each of the 15 GCMs under the 5/10/10 rule and a more severe restriction regime (10/15/25).

The assessment of water supply security used for the IWCM Strategy development is based on the current knowledge of secure yield. TSC will review the need for water supply augmentation based on the updated secure yield data as soon as it is available.

8.9 Climate Change and Flood Impacts

Data Gap 3

There are key implications of flooding for water cycle management in the Tenterfield Shire including:

- Inundation of low lying water, wastewater and stormwater assets causing asset failure and reduced access for maintenance during flooding events; and
- Increased groundwater infiltration and surface water inflow into water, wastewater and stormwater systems affecting system performance (e.g. overflows, etc.).

The major flood in 2011 resulted in inundation and damage to TSC's water supply (Shirley Park bore) and sewerage assets (pump stations). As well as current flood events, there is a risk that increased flooding due to climate change will affect Council's ability to achieve its levels of service over the long-term. A flood study

has recently been undertaken for Tenterfield Creek (DHI, 2013) providing design flood levels, discharge and velocity information for 10, 20, 50 and 100 year Average Recurrence Interval and Probable Maximum Flood events using current climate data. This study will be extended to include consideration of climate change impacts and the sensitivity of flooding to higher intensity rainfall which may occur in future.

It is recommended that a risk assessment is undertaken to assess flood risks and climate change impacts on water cycle management and particularly asset management in areas vulnerable to flooding. The existing flood study provides a sound basis for the risk assessment. The priority areas are critical water supply and sewerage assets.

8.10 Financial Resources

Issues 16, 21

Part of the best-practice requirements (Section 8.1) is annual financial planning to enable TSC to meet its target levels of service over the long-term. TSC will update its financial plans using the NSW Financial Planning Model (FINMOD) as part of the preparation of the SBPs. Key inputs to this process will incorporate the outcomes of other actions in this IWCM Strategy and will include:

- 30 year capital works programs (4 years with detailed estimates, 5-30 years with preliminary estimates) including the costs identified in the AMPs;
- 30 estimates of recurrent costs (4 years with detailed estimates, 5-30 years with preliminary estimates) including the costs identified in the AMPs;
- Potential funding sources (grants, developer contributions, annual charges, usage charges, interest and loans); and
- Financial strategies and actions to achieve planning objectives considering the low customer base, potential funding sources, community affordability and willingness to pay.

The financial planning process is inter-related with the asset management plans and workforce management plans.

8.11 Human Resources

Issue 4, 29

As a small regional council, TSC has historically relied on limited human resources (staff numbers and small skill base). While the TSC water supply and sewerage management and operations staff are best-placed to undertake day-to-day tasks, many of the components of this IWCM Strategy will require additional human resources to undertake each action. The Action Plan included in Section 8.12 identifies the tasks that could be undertaken by existing TSC staff as part of their current roles as well as those actions that are considered to be more-effectively delivered by external resources. The ability of the existing workforce (Council labour) to deliver the operations and maintenance activities (approximately $140k p.a.) will be confirmed.

Project management is a key component of the delivery of major projects and requires expertise in brief/specification/contract development, tendering and procurement, data supply, review and ongoing contractor management. The cost of external project management services has been included the action plan where appropriate.

The TSC Workforce Plan provides strategies to ensure effective and efficient delivery of Council services and facilities. TSC will continue to implement and monitor the plan outcomes as part of the corporate reporting system.

8.12 Action Plan

The required IWCM actions have been compiled into a 30 year implementation program including timing and potential funding sources (Table 8). The proposed budgets in this Action Plan as well as ongoing asset management planning will be used to develop Council's expenditure program as part of its IPR requirements.

The IWCM action plan includes all existing (BAU) actions as well as additional actions identified in this Strategy. The actions have been prioritised as follows:

- The best-practice management initiatives (particularly SBPs and financial planning) will be undertaken as soon as possible as these provide strategic direction and funding for other components. In addition, continuing best-practice compliance is a key aim of the IWCM Strategy;
- Risk-management actions (particularly assessment of secure yield, recycled water management, climate change adaptation and on-site sewerage management) should be undertaken as a priority to inform future decision-making; and
- A biosolids management strategy is also required as soon as possible to identify potential cost savings and increased beneficial applications of biosolids.

Other actions rely on the completion of these priority actions. The timing of each action has been optimised to even out the expenditure and account for the logical work flow.

Table 8: IWCM Action Plan

Item	Issues Addressed	Potential Funding	Proposed Delivery	Proposed Budget (2013 $k)												
				10 year total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 - 2033	2034 - 2043
Best-Practice Compliance																
Strategic Business Planning	11, 12, 13, 16	Water and Sewer Funds	Manager Water and Waste	**75**	25				25			25			100	75
Financial Planning	11, 12, 13, 16, 21	Water and Sewer Funds	Manager Water and Waste	**45**	15		MB	MB	15	MB	MB	15	MB	MB	60	45
Pricing - Developer Charges	Ongoing compliance	Water and Sewer Funds	External consultant	**40**				20						20	20	40
Pricing - Tariff Review	Ongoing compliance	Water and Sewer Funds	Manager Water and Waste	**MB**			MB	MB		MB	MB		MB	MB		
Water Conservation Planning [1]	Ongoing compliance	Water and Sewer Funds	External consultant	**60**		20				20				20	40	60
Drought Management Planning	Ongoing compliance	Water and Sewer Funds	Manager Water and Waste	**MB**		MB										
Performance Monitoring	Ongoing compliance	Water and Sewer Funds	Manager Water and Waste	**MB**		MB	MB	MB	MB	MB	MB	MB	MB	MB		
IWCM Strategy Review	Ongoing compliance	Water and Sewer Funds	External consultant	**50**								50			50	50
Drinking Water Management																
Tenterfield improvement program	1	Water and Sewer Funds	External contractor	**130**	90		20	20								
Urbenville improvement program	2	Water and Sewer Funds	External contractor	**20**	10			10								
Develop water supply agreement with SDRC	3	Water and Sewer Funds	External consultant	**15**		15	MB									
Operation and maintenance plans	1, 2, 3	Water and Sewer Funds	Water operations	**OB**		OB	OB	OB								
WTP replacement - concept design	16	Water and Sewer Funds	External consultant	**100**		50	50									
WTP - potential modifications	16	Water and Sewer Funds	Construction contractor	**200**				200								
WTP replacement - construction	16	Water and Sewer Funds	Construction contractor	**4,500**							4,500					
Water Sharing Plans																
Liaison with Office of Water	15	Water and Sewer Funds	Manager Water and Waste	**MB**	MB											
Recycled Water Risk Management Plans																
Tenterfield Golf Course	18	Water and Sewer Funds	External consultant	**30**		30										
Farm	18	Water and Sewer Funds	External consultant	**20**			20									
Biosolids Management																
Biosolids Management Strategy [2]	19	Water and Sewer Funds	External consultant	**30**		10	20									
On-Site Sewerage Systems																
Risk assessment (as part of SBP) [2]	21	Water, Sewer and General Funds	External consultant	**20**		20										
Secure Yield Assessment																
Tenterfield Water Supply	21	Water and Sewer Funds	External consultant	**25**		25										
Urbenville Water Supply	21	Water and Sewer Funds	External consultant	**25**		25										
Climate Change/Flood Impacts																
Risk assessment	21	Water and Sewer Funds	External consultant	**30**		10	20									

Item	Issues Addressed	Potential Funding	Proposed Delivery	Proposed Budget (2013 $k)												
				10 year total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 - 2033	2034 - 2043
Human Resources																
External Project Management Services	All	Water and Sewer Funds	External consultant	**50**		15	15	5	10	5						
Asset Management (additional actions have been identified in the AMPs which will be adopted by TSC in June 2013)																
Mains replacement - Jennings	6	Water and Sewer Funds	Water operations	**100**	10	10	10	10	10	10	10	10	10	10		
Flood repairs - Shirley Park bore	8	Water and Sewer Funds	External contractor	**20**				20								
Water meter replacement program - Tenterfield	14	Water and Sewer Funds	Water operations	**200**	20	20	20	20	20	20	20	20	20	20		
Valve/hydrant replacement - Urbenville	14	Water and Sewer Funds	Water operations	**10**	10											
Dam Safety Upgrade - design, approvals, procurement	17	Water and Sewer Funds, 50% subsidy from NOW	External consultant	**460**	190	180	90									
Tenterfield Dam Safety Upgrade - integrated development approval	17	Water and Sewer Funds, 50% subsidy from NOW	External consultant	**50**	50											
Tenterfield Dam Safety Upgrade - construction	17	Water and Sewer Funds, 50% subsidy from NOW	Construction contractor	**4,500**			3,000	1,500								
Tenterfield Dam Safety Upgrade - construction management	17	Water and Sewer Funds, 50% subsidy from NOW	External consultant	**450**			300	150								
Sewer Mains - Maintenance and Rehabilitation - Tenterfield	7	Water and Sewer Funds	Sewer operations	**800**	80	80	80	80	80	80	80	80	80	80		
Sewer Mains - Maintenance and Rehabilitation - Urbenville	7	Water and Sewer Funds	Sewer operations	**150**	15	15	15	15	15	15	15	15	15	15		
Sewer Mains - Relining - Tenterfield	9	Water and Sewer Funds	External contractor	**1430**	80	150	150	150	150	150	150	150	150	150		
Sewer Manholes - level alterations - Tenterfield	9	Water and Sewer Funds	External contractor	**1340**	80	140	140	140	140	140	140	140	140	140		
Smoke Testing - Tenterfield	9	Water and Sewer Funds	External contractor	**50**	5	5	5	5	5	5	5	5	5	5		
CCTV Inspections - Tenterfield	9	Water and Sewer Funds	External contractor	**30**	30											
CCTV Inspections - Urbenville	9	Water and Sewer Funds	External contractor	**10**	1	1	1	1	1	1	1	1	1	1		
Drummond St Flood Proofing	10	Water and Sewer Funds	Sewer operations	**5**	5											
Totals				**15,070**	**716**	**821**	**3,956**	**2,346**	**471**	**446**	**4,921**	**511**	**421**	**461**	**4,480**	**4,480**
			Manager Water and Waste	***120***	*40*				*40*			*40*			*160*	*120*
			External consultant	***1,455***	*240*	*400*	*515*	*175*	*10*	*25*		*50*		*40*	*110*	*150*
			External contractor	***12,230***	*296*	*296*	*3,316*	*2,046*	*296*	*296*	*4,796*	*296*	*296*	*296*	*2,960*	*2,960*
			Water Operations	***310***	*40*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*300*	*300*
			Sewer operations	***955***	*100*	*95*	*95*	*95*	*95*	*95*	*95*	*95*	*95*	*95*	*950*	*950*

MB - included in Management budget, OB - included in Operations budget

1. Not including allowance for rebates etc.

2. Not including allowance for capital works recommended as part of the strategy

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APPENDIX 1: TENTERFIELD INTEGRATED WATER CYCLE MANAGEMENT PLAN – DRAFT EVALUATION REPORT, MARCH 2012

TSC commissioned Parsons Brinkerhoff (PB) to commence the IWCM process through preparation of an IWCM Evaluation Report (PB, 2012). This report provides background information on the IWCM process, system boundaries, catchment information, water resources, urban water supply, urban sewerage systems, and urban stormwater systems.

Tenterfield Integrated Water Cycle Management Plan Draft Evaluation Report

March, 2012

Tenterfield Shire Council

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Revision	Details	Date	Amended By
A	Preliminary draft to identify Data Gaps	24 Jan 2012	AWT
B	Issues added for council comment	21 Mar 2012	AWT
C	Council input on issues assessment	4 Dec 2012	AWT

Author: Ryan Hawken, Andrew Tipene .....

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Reviewer: Emma Makey .....

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Approved by: .....

Signed: .....

Date: .....

Distribution: .....

Contents

Contents (continued)

Page Number

List of tables

Contents (continued)

Page Number

List of figures

List of appendices

1. Introduction

In recognition of the impacts of increasing demand on river and groundwater resources, attention has turned towards looking at ways to maximise water use efficiencies in the urban environment.

In 2004, the NSW Department of Water and Energy (then the NSW Department of Energy, Utilities and Sustainability) introduced a new best-practice management criterion for local water utilities: Integrated Water Cycle Management (IWCM). IWCM enables water utilities to manage their urban water services in a holistic manner within a catchment context in accordance with the *Best-Practice Management of Water Supply and Sewerage Guidelines, August 2007*.

Water utilities are responsible for providing an appropriate, affordable, cost-effective and sustainable urban water service that meets community needs, protects public health and the environment and makes best use of regional resources (DWE 2008). IWCM involves the integration of urban water services, including water supply, sewerage and stormwater, to enable best practice solutions to be applied to existing issues and to optimise use of water resources.

1.1 What is Integrated Water Cycle Management?

IWCM is a process that provides local water utilities with the means to manage their regional water systems in a way that maximises benefits to the community and the environment, both now and into the future.

IWCM involves the integration of the planning and management of water supply, sewerage and stormwater systems within the broader context of the region to ensure the provision of secure and sustainable water services and focuses on:

- The catchment, including issues relating to land use within the catchment area that may impact or be impacted by the water cycle, such as pollution of rivers through agricultural run-off and the potential for algal blooms or dryland salinity associated with irrigation practices.
- Water resources, including issues related directly to water resources (e.g. rivers and groundwater) such as water yields, water quality and water sharing and access rights.
- Urban water systems including the three principal urban water systems — water supply, stormwater and sewerage — and other decentralised systems that are used for water supply, wastewater reuse or disposal within urban areas.

Exploring all of these systems in a holistic manner provides a deeper understanding of underlying problems and highlights opportunities for integrated management of all water systems.

It is therefore increasingly important that water utilities consider all aspects of the water cycle and catchment in relation to their business activities to ensure the continued provision of safe, reliable, environmentally sound and affordable urban water services.

1.2 The Integrated Water Cycle Management Process

A schematic of the IWCM process (DWE 2008) is shown on *Figure 1-1*. The IWCM process consists of two main phases as follows:

- IWCM Evaluation: Lists all utility and urban water service targets and identifies all the issues relating to planning and service delivery for urban water supply, sewerage and stormwater over the next 30 years. It examines what issues can be addressed by existing or formally adopted actions and capital works, whether any issues remain to be addressed and if a Simplified or Detailed IWCM Strategy is required.
- IWCM Strategy: If there are remaining issues, an IWCM Strategy is developed to address the water and sewerage issues, and where cost effective for the utility, the stormwater issues. A Simplified Strategy can be undertaken where significant capital works are not required within 10 years. A Detailed Strategy should be undertaken where significant capital works are required within 10 years. Both strategies will identify the actions and capital works required to address all the remaining issues from the IWCM Evaluation. The Simplified Strategy only requires the development of one scenario. The Detailed Strategy develops several possible scenarios then evaluates and ranks them using a triple bottom line assessment of their social, environmental and economic impacts.

This report covers the first phase of the IWCM process - the IWCM Evaluation and includes the following:

- The circumstances of the area within which the utility operates (Section 2)
- All information and data related to running the utility and providing the urban water service (Section 2)
- Urban water supply, sewerage or stormwater issues (Section 4)
- Whether the IWCM issues can be addressed through normal Council actions and capital works, which is referred to as the ‘business as usual’ scenario
- The remaining issues not addressed by the ‘business as usual’ scenario
- The list of all technically feasible options to address the remaining IWCM issues
- How the remaining IWCM issues could be addressed, based on the need for significant capital works within 10 years.

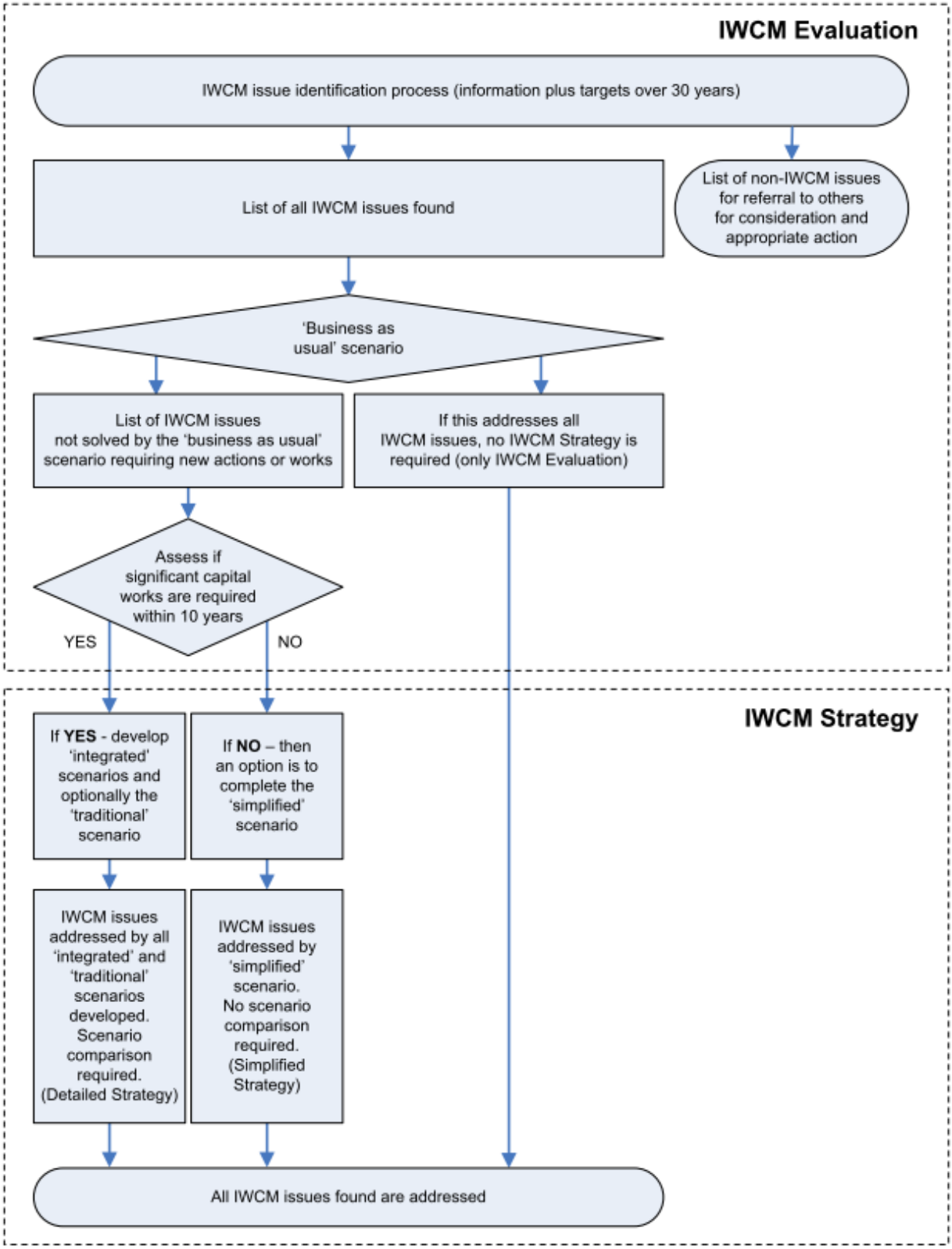

Figure 1-1: IWCM Process Schematic (DWE 2008)

2. IWCM targets

With the implementation of their IWCMP the Tenterfield Council has set the following targets. These targets have been set to meet legal obligations and agreed levels of service as a water service provider.

Table 2-1: IWCM targets

Goals	Targets
Catchment Management	Provide information and education for landholders in the catchment areas of Tooloom Creek and Tenterfield Creek to improve land use practices by June 2013
	Encourage revegetation of riparian areas and fencing off creeks for stock access through education programs in partnership with Landcare by June 2013
Water Resources Management	Reduce water demand through education programs by October 2013
	Change the current rainwater tank policy for dwellings connected to reticulated water supply, such that tank water is able to be used for showering and drinking, encourage tank owners to re-plumb for showering and drinking by March 2013.
	Employ a permanent water conservation policy by enforcing level one restrictions permanently by March 2013
	Review the pricing of water to increase water usage rates on excessive water users by March 2014
Urban Water Targets	Continue with yearly sewer main and sewer manhole relining to reduce infiltration of stormwater into the sewerage reticulation system – every year
	Investigate replacement of very old water treatment plant - scope of supply by Sep 2013
	Have all Council parks & Gardens watered by recycled or bore water – by Dec 2014

3. State of the water system

The IWCM process relies on accurate and relevant data and information that relates directly or indirectly, at a catchment, water resource or urban level, to the provision and management of the urban water service. This data and information may often be missing, incomplete or not quality assured. The purpose of this part of the Evaluation is to collate and review all available data to ensure it is relevant and accurate and to identify any data gaps.

The following section describes the boundaries of the water system and information of the wider catchment, water resources and on the urban water systems.

3.1 System Boundaries

3.1.1 Administrative Boundaries

Tenterfield Shire Council (TSC) is responsible for the provision of water, sewerage and stormwater services within the LGA (Local Government Area). With the exception of Jennings, whose water is supplied from the Wallangarra system in the adjoining Southern Downs Regional Council Area, TSC is the sole provider of water services within the LGA. TSC has a water supply agreement with Kyogle Council to supply treated bulk water for use by Muli Muli and Woodenbong, administered by Kyogle Council.

Figure 3-1 shows the Tenterfield Local Government Area (LGA) boundary in relation to the surrounding region while Figure 3-2 shows the main features and towns of the LGA.

The provision of water supply and sewerage services is regulated by a number of NSW government departments, primarily the NSW Department of Water and Energy (DWE), NSW Health, and the NSW Department of Environment and Climate Change (DECC). Armidale and Alstonville are the main administrative centres for the local representation of each of these department whilst DECC has an office in Tenterfield.

In so far as its discharge may constitute pollution, the NSW Department of Environment and Climate Change (DECC) is the primary regulator of stormwater in the study area.

The Northern Rivers Catchment Management Authority (NRCMA) and the Border Rivers – Gwydir Catchment Management Authority (BR-GCMA) are also administrative bodies relevant to the management of the Tenterfield LGA urban water cycle. Each CMA has produced a Catchment Action Plan (NRCMA 2007; BR-GCMA 2007) which set targets to protect and enhance the natural resources of the region.

3.1.2 Operational Boundaries

The operational area covers all localities where the utility has customers, from which it draws its water or to which it discharges water or waste. This area may extend beyond the LGA, especially if there is a regional bulk water provider or significant other water users.

TSC operates three water systems and two sewerage systems as follows:

- Water Systems
  - Tenterfield including Tenterfield Dam, Shirley Park Bore, Tenterfield Water Treatment Plant (WTP), two service reservoirs and 56 km of water mains.
  - Urbenville including Urbenville WTP, Tooloom Creek Pump Station, one service reservoir and 9.9 km of water mains. The Urbenville WTP also supplies potable water to Woodenbong and Muli Muli in the adjoining Kyogle Council Area.
  - Jennings including one service reservoir and 2.7 km of water mains. Water is supplied from the Wallangarra system in the adjoining Southern Downs Regional Council Area in Queensland (formerly Stanthorpe Shire Council).
- Sewerage Systems
  - Tenterfield including Tenterfield Sewage Treatment Plant (STP), 4 sewage pump stations and 65 km of sewerage mains.
  - Urbenville including Urbenville STP, 2 sewage pump stations and 9 km of sewerage mains.

Figure 3-1: Tenterfield LGA in the Regional Context

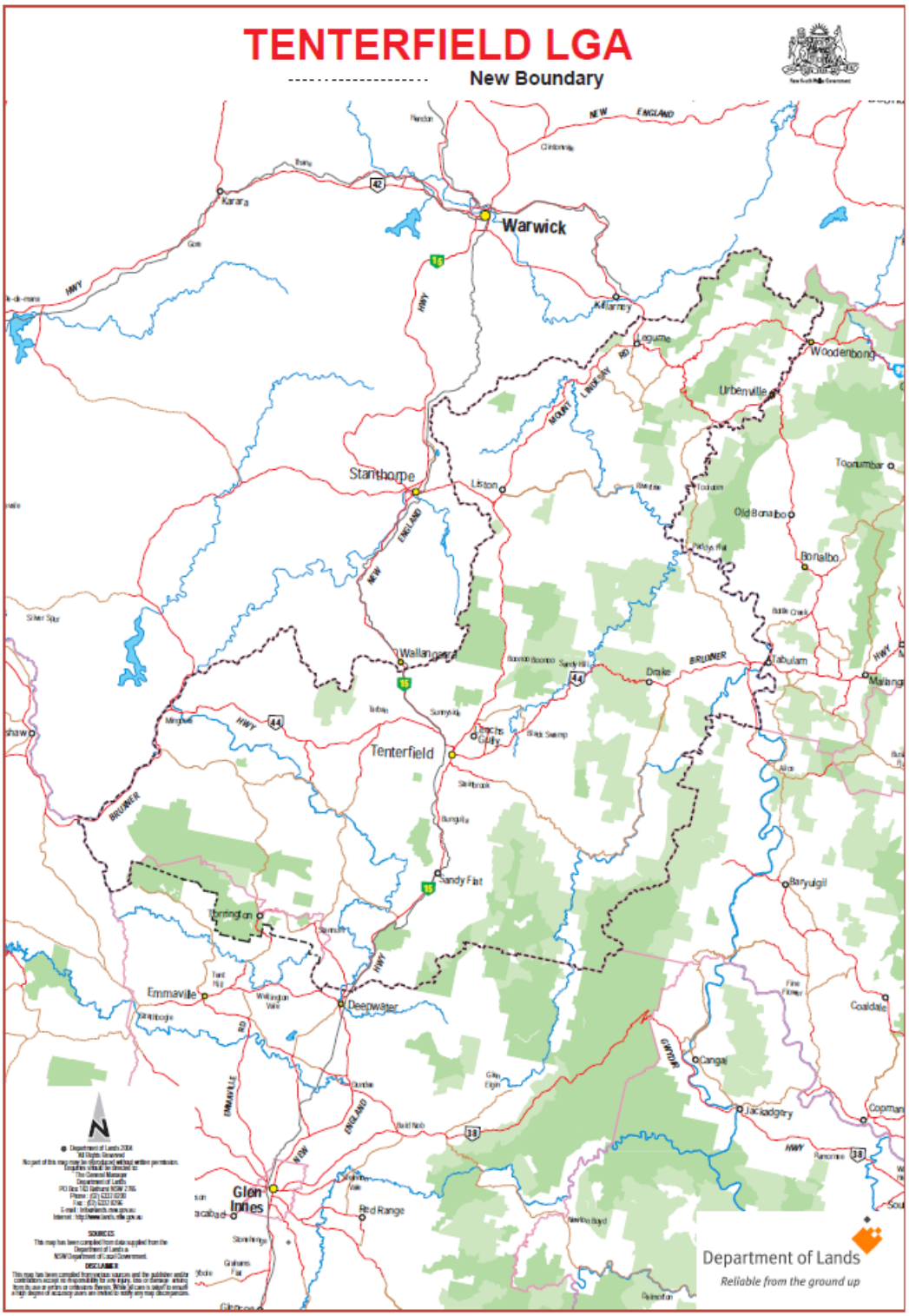

Figure 3-2: Tenterfield LGA (Source: NSW Department of Lands, 2004)

3.2 Catchment Information

The information outlined in Section 3.2 provides a context for the broader opportunities and limitations being faced by TSC. It highlights catchment industries which may not be part of the urban environment, but may still compete for the same water resources, may provide significant employment or economic viability to the local community and/or may allow the opportunity for replacement of industrial water extraction with use of recycled water. These industries may include mines, abattoirs, power generation and tourism.

It provides a brief description and analysis of information relevant to the urban water service provided by the utility including location, climate population and land use.

The main source of information for this section is the *Tenterfield Urban and Rural Land Use Strategy* (PB 2007) and is supplemented from other sources including the *Tenterfield Shire State of the Environment Report* (Aspect North 2005), Tenterfield Creek Flood Study (DHI 2006) and data from the Australian Bureau of Statistics website.

3.2.1 Location

Tenterfield Shire is located in northern New South Wales approximately 770km north of Sydney and 270km southwest of Brisbane, straddling the Great Dividing Range at the northern end of the New England Highlands. The Shire covers a total area of 7177 km^2.

The major population and administrative centre in the Shire is the town of Tenterfield which is situated at the intersection of the North-South running New England Highway and East-West Bruxner Highway some 6 km west of the Great Dividing Range and 15 km south of the New South Wales/Queensland border.

Other population centres in the Shire include the villages of Drake, Jennings, Legume, Liston, Torrington and Urbenville.

Figure 3-1 shows the Tenterfield LGA boundary in relation to the surrounding region while Figure 3-2 shows the main features and towns of the LGA.

The northern areas of the Shire which are close to the Queensland border (including the villages of Liston, Legume and Jennings), while being within the administration and governance of NSW and Tenterfield Shire, have Queensland based utility and postal services (e.g. telephone numbers, postal address). The residents in the northern area access most of their retail, business, health and other community services from the Queensland town of Stanthorpe. Jennings water is also supplied from the Wallangarra system in the adjoining Southern Downs Regional Council Area in Queensland.

The villages of Urbenville and Drake are located on the eastern foothills of the Great Dividing Range and close to the Shire's boundary with Kyogle Council. Woodenbong and the aboriginal township of Muli Muli in the Kyogle LGA are located north east of Urbenville.

3.2.2 Climate

The Tenterfield LGA is in the transitional zone between the summer high rainfall areas of northern Australia and the winter high rainfall areas of southern Australia. Rainfall patterns vary depending on geographic location within the LGA. Maximum and minimum temperature varies mainly in relation to elevation. Generally, the Shire experiences warm summers with cool to cold winters with frequent frosts from June to August.

The average annual rainfall in the area ranges between 717 millimetres and 1,380 millimetres with higher rainfall in the east associated with the NSW North Coast bioregion and lower rainfall occurring in the west. The North West bioregion experiences the highest variation of rainfall, with the Nandewar bioregion in the west having, on average, a lower variation of rainfall.

Other important climatic factors include rainfall variability, mean, maximum and minimum temperatures and number of frost days. Topography has an impact on climate, with areas of higher altitude generally being colder than other areas. In general, the average annual frost risk days decrease from east to west. Historical climate information for Tenterfield and Urbenville is shown in *Table 3-1*. The data represents long term historical averages at Tenterfield in the central south and Urbenville in the north east.

Table 3-1: Historical Climate information for Tenterfield, Urbenville and Jennings

	Tenterfield BOM Station#56032	**Urbenville BOM Station#057020**	**Jennings BOM Station#041116 (Wallangarra)**
Mean annual rainfall (mm)	851.4	1034.8	776.6
Mean number of rain days per year	97.1	94.1	68.8
Mean daily maximum temp (°C)	21.4	23.6	20.8
Mean daily minimum temp (°C)	8.1	10.2	8.6

Source: www.bom.gov.au

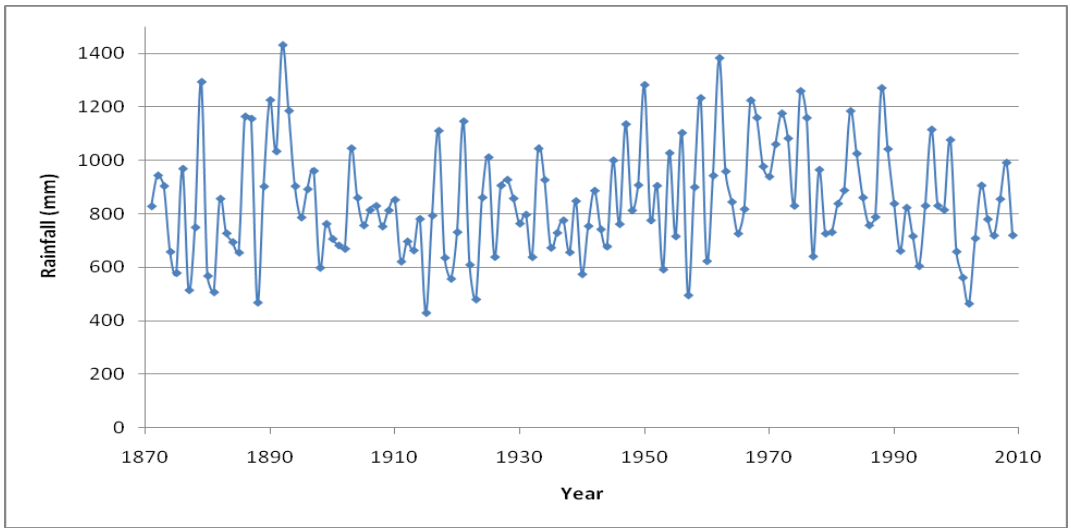

Figure 3-3: Tenterfield annual rainfall (source: Australian Bureau of Meteorology)

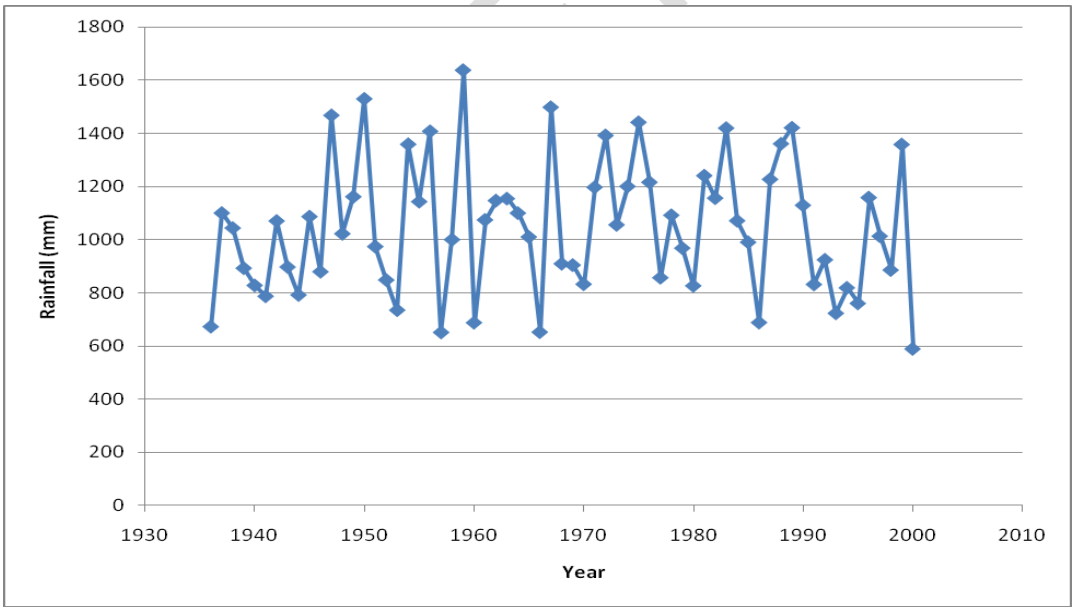

Figure 3-4: Urbenville annual rainfall (source: Australian Bureau of Meteorology)

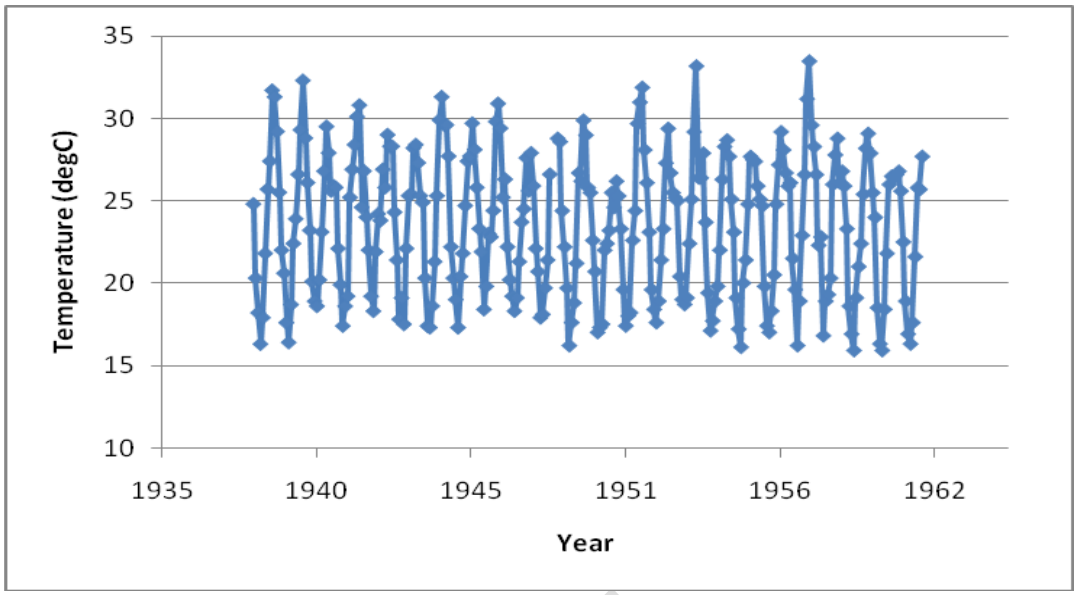

Figure 3-5: Urbenville monthly temperature (source: Australian Bureau of Meteorology)

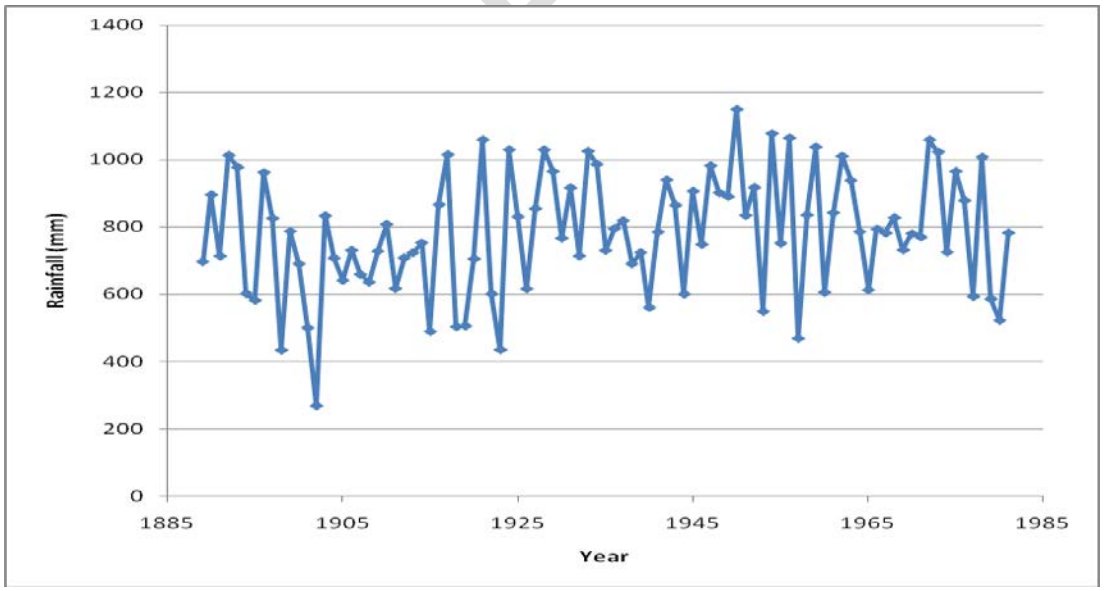

Figure 3-6: Jennings annual rainfall (source: Australian Bureau of Meteorology)

Climate change is likely to have significant impacts on Australia. In the context of this study it is likely to affect the availability of water resources for both urban and rural uses as well as other competing demands. It is also likely to impact water infrastructure which will have to deal with more frequent and more severe storms (CSIRO 2006).

By 2030, relative to 1990, NSW is likely to become warmer, with more hot days and fewer cold nights. Droughts are also likely to become more frequent and more severe, with greater fire risk (CSIRO 2006). Increases in extreme weather events are likely to lead to

increased flash flooding, strains on sewerage and drainage systems, greater insurance losses, possible black-outs and challenges for emergency services.

Table 3-2: Possible Climate Change Impacts for NSW (for 2030 relative to 1990)

	Low Global Warming Scenario	High Global Warming Scenario
Annual average temperature	+0.6˚C	+1.3˚C
Annual average rainfall	0%	0%
Seasonal average rainfall		
Summer	1.5%	3.5%
Autumn	1.5%	3.5%
Winter	-3%	-7.5%
Spring	-3%	-7.5%
Annual average potential evaporation	2.40%	5.60%
Annual average number of hot days (>35˚C)	+1 days	+25 days
Annual average number of cold nights (<0˚C)	-5 days	-30 days

Source: CSIRO 2006

Further information on climate and the effects of climate change are discussed in relation to water resources in Section 3.4

3.2.3 Flooding

Modelled and documented information on flooding within the LGA is only available for Tenterfield and Tenterfield Creek. Anecdotal evidence indicates that Urbenville is also prone to flooding.

Tenterfield

The Tenterfield Creek Flood Study (DHI 2006) forms the first part of the Floodplain Risk Management process for the Tenterfield Creek floodplain. The DHI flood study built on the Tenterfield Dam Dambreak Study (DPWS 1996) which developed a MIKE11 model of the Tenterfield Creek catchment.

The following information is extracted from the DHI Flood Study report.

Tenterfield lies on the banks of Tenterfield Creek which is an upper tributary of the Darling River. High on the western side of the Great Dividing Range and at an elevation exceeding 830 mAHD, Tenterfield experiences occasional flooding on the Tenterfield Creek floodplain. The main creek channel bisects the town in a north-south direction.

Tenterfield Creek's total catchment area to town is 83 km^2 of which 33 km^2 drains into the upstream water supply dam. The other tributary catchments draining into the town catchment are Groombridge's Creek (19 km^2), Currys Gap Creek (17 km^2) and two other unnamed creeks east of the town (14 km^2).

A moderate flood occurred in 1976 and smaller floods occurred in October 1999 and February of 2001. The Annual Exceedance Probability (AEP), i.e. the relative size, of these floods is not known.

During floods lower lying areas in the town along Tenterfield Creek channel become inundated and in larger events the problem can be compounded by floodwaters backing up behind some of the bridges that cross the creek in town. Flooding of the Tenterfield Creek floodplain has historically resulted in inundation of private property and has restricted road and property access.

The DHI study found that some roads and bridges will be overtopped in flood events larger than the 20% Annual Exceedance Probability (AEP) flood event. On Tenterfield Creek these bridges include Douglas St, Manners St, High St and Naas St West. No flood extent or hazard mapping has been undertaken.

A flood warning system was installed in 2000 as part of the NSW Government Dam Safety program. The system included rainfall gauges and stream level gauges at several locations within the catchment of Tenterfield Dam, at several locations within other creek systems upstream of Tenterfield and in Tenterfield Creek. The system provides an automated warning (SEWS) siren based on a computer modelling program (TSC 2008).

The first stage of the upgrading of the Flood Warning System was completed with the replacement of batteries, solar panels and other infrastructure by TSC. The initial supplier of the system has been contracted to upgrade computer processing and telemetry. It was expected that the system upgrade would be completed by the end of October 2008 (TSC 2008).

In January 2011 Tenterfield Shire suffered major flooding closing major roads and causing damage to property. Tenterfield was declared a natural disaster zone during this flood event considered to be the worst flooding in 60 years.

Urbenville

The other village within the Tenterfield shire that is known to experience flooding is Urbenville. Urbenville is located within the Tooloom Creek floodplain. There is little information available on the flooding of Urbenville but it is understood that the township itself is only flood affected in large flood events.

Flooding has not thus far been considered a major issue for the village of Urbenville; however future development of the town could encroach further into the floodplain. To ensure future development occurs in a sustainable manner a flood study should be completed such that the extent of inundation for a range of design flood events can be established. The flood study should be completed in accordance with the NSW Government's Floodplain Development Manual (April 2005).

3.2.4 Population

Tenterfield LGA forms part of the New England North West region which is located in northern NSW. The region's population has been steadily declining. It was projected that 13 of the 19 local government areas located in the region will experience continuing

population declines in the future. The population of the region in the past decades is representative of many non-metropolitan areas in NSW with a large ageing population and a large proportion of young people migrating from the region. However in the past few years this trend seems to have reversed possibly due to housing affordability in the major centres and 'tree changers' wishing to escape urban living.

The estimated population of Tenterfield LGA in recent years is shown in *Table 3-3*. This information contains estimates of the resident population of the LGA for June 30 of each year from 2001 to 2008. Estimates for 2001 to 2006 are final, estimates for 2007 are revised to align with new 2007 state and territory totals and estimates for 2008 are preliminary.

It should be noted that the *local government area* population estimates information does not correlate with the *statistical local area* population shown below; LGA data is typically 400 to 500 people greater than the statistical local area data. Both data sets are from the Australian Bureau of Statistics. The local government area population estimates correlate most closely with Council's own data.

From 2001 to 2004 there was a decline in population in Tenterfield Shire LGA but this has been offset by growth from 2005 to 2008.

Table 3-3: Tenterfield Shire LGA Recent Population Growth

Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
LGA Population	6,897	6,867	6,774	6,723	6,726	6,793	6,857	6,907
Change	-	-0.43%	-1.35%	-0.75%	0.04%	1.00%	0.94%	0.73%

Source: ABS 2009

The historical population growth by *local statistical area* is shown in *Table 3-4*. This shows a historical decline in population which has been more than offset by recent strong growth. In the 2006 census, of the 6534 people in the local statistical area, the population of the Tenterfield Township was 3130. Historically the Tenterfield township population has been between 3100 and 3400 people since the year 1960.

Urbenville's population has been declining and the number of dwellings has remained relatively stable. The changes in the forestry industry, and the closing down of several saw mills have had implications on the growth of Urbenville.

Table 3-4: Tenterfield Local Statistical Area Historical Population

Year	**1981**	**1988**	**1991**	**1996**	**2001**	**2006**
Population	6,750	6,650	6,577	6,529	6,394	6534
Change	-	-1.5%	-1.1%	-0.7%	-2.1%	2.2%

Source: PB 2007; ABS 2009

Table 3-5: Tenterfield Township Historical Population

Year	1981	1986	1991	1996	2001	2006
Population	-	3,370	3,310	3,205	3,191	3,130
Change	-	-	-1.8%	-3.3%	-0.4%	-1.9%

Source: PB 2007; ABS 2009

Table 3-6: Urbenville Township Historical Population

Year	1981	1986	1991	1996	2001	2006
Population	282	291	250	251	221	245
Change	-	0.6%	-3.0%	0.1%	-12.0%	10.9%

Source: Cardno 2002a; ABS 2009

Table 3-7: Jennings Township Historical Population

Year	1981	1986	1991	1996	2001	2006
Population	n/a	n/a	142	n/a	n/a	130
Change	-	-	-	-	-	-

Source: Cardno 2002a; ABS 2009

The Department of Planning, New South Wales State and regional Population Projections 2001 – 2051 (Mackintosh and Parr, 2004) report predicts that the population of the Northern region of NSW will remain virtually static between 2001 and 2031. The population forecasts from the Australian Bureau of Statistics (ABS) for the LGA are shown in Table 3-8. A low growth rate was assumed in the ABS prediction due to a limited economic growth and job opportunities. The ABS applied a population growth rate of 0.9% to the Tenterfield community and the a 1% growth rate for the LGA was used,

Table 3-8: ABS Population forecasts

Community	2010	2015	2020	2040
LGA	6534	6860	7200	8640
Tenterfield	3130	3270	3420	4035
Urbenville	245	245	250	260
Jennings	130	130	130	135

Source: ABS 2010

3.2.5 Land Use and Employment

The Tenterfield LGA covers a total area of 713,439 ha. The Shire retains a predominantly rural character with a large percentage of the land use being for pasture, horticulture, and viticulture as well as conservation and other vegetated areas.

A breakdown of land use within the LGA is shown in *Table 3-9*. It should be noted that the data in the table is incomplete as it excludes the area in the south west of the Shire that was added to Tenterfield from Severn Shire.

The dominant land uses in Tenterfield local government area are grazing (41.9%) and tree and shrub cover (29.4%), as well as conservation areas (24.9%). A large proportion of the grazing area of Tenterfield local government area is used for cattle grazing.

Although mining currently has a relatively small percentage of land use (0.1%), this may alter in the future due to the buoyant price of minerals. There are numerous current exploration licences and licences under application in the Tenterfield area.

Table 3-9: Land use data within Tenterfield LGA

Land use	Area (ha)	% of area
Conservation Area	129,959	24.9
Cropping	3,051	0.6
Grazing	218,428	41.9
Horticulture	687	0.1
Intensive Animal Production	36	0.0
Mining & Quarrying	494	0.1
Power Generation	120	0.0
River & Drainage System	6,188	1.2
Special Categories	1,486	0.3
Transport & Other Corridors	978	0.2
Tree & Shrub Cover	153,111	29.4
Urban	3,664	0.7
Wetland	527	0.1
Unknown	2,773	0.5
Total	**521,503**	

Note: Data is not complete as it excludes the area in the south west of the Shire that was added to Tenterfield from Severn Shire

Source: PB 2007

Within the Tenterfield local government area, the most dominant industries in 2001 were agriculture; forestry and fishing employing 28.6 per cent of the workforce.

Retail trade was the next largest industry (12.4 per cent) followed by health and community services (8.5 per cent). These industries have increased in recent times and other industries have declined. Industries which have declined within the Tenterfield local government area include the tobacco industry as well as the closure of abattoirs and saw mills.

Although traditionally rural communities have relied on the agricultural sector for their economic well-being, this sector has changed dramatically, with important consequences for rural communities. The extent to which the Tenterfield community relies on the primary production sector for employment will need to be investigated given changing economic conditions for agriculture and forestry in NSW and Australia.

3.2.6 Topography, Soils and Vegetation

Topography

The Tenterfield local government area is located on either side of the Great Dividing Range in northern NSW. The eastern half of the Shire is located in the Clarence catchment and the western half is located in the Upper Murray-Darling Basin (ASPECT north 2005). The Great Dividing Range divides the Shire into an eastern and western half as both areas have significantly different natural features.

The Tenterfield local government area consists of hilly landscapes and ranges in elevation from 150 metres above sea level to 1,500 metres above sea level (ASPECT north 2005). The plains (generally with lower elevation) located within the local government area have similar geological and topographical features to the neighbouring local government areas including Kyogle and Richmond Valley Councils (ASPECT north 2005).

The eastern part of the local government area is predominantly steeper with areas north and south of Drake having slopes over 18 degrees. Most of these areas are heavily vegetated and are either State forests or nature reserves. However, east of Drake the area is moderately flat heading east towards the plains at Tabulam with slopes less than 3 degrees. Areas south west of Tenterfield near Clive also have steep slopes over 18 degrees similar to the slopes surrounding Drake.

Generally, areas in the western half of the Shire are much flatter than those in the eastern half. The area stretching from Tenterfield north to Wylie Creek and villages such as Mingoola, Maryland and Urbenville are also predominantly flat with slopes ranging from 0 to 3 degrees. These flatter areas are not as heavily vegetated as the areas in the eastern half of the Shire particularly the areas directly surrounding Tenterfield, Mingoola and Maryland. These areas are identified as being sparse or heavily grazed grasslands and as are commonly used for agricultural purposes.

Soils

The soil type in the Tenterfield local government area varies across the region. In particular basalts are found in the eastern areas and granitic soils in the west (ASPECT north 2005). The diversity of soil types has also been found to support a variety of different ecosystems (ASPECT north 2005).

Vegetation

Due to the variations in topography as well as variations in soil types across the Local Government Area, and because it occurs at an overlap between tropical and temperate climates, the LGA supports high ecosystem and species diversity (ASPECT north 2005; NSW National Parks and Wildlife Service 1999). A total of 1,340 floral species and 440 faunal species has been recorded within the Shire (ASPECT north 2005). The north-east region of New South Wales, in which the Tenterfield Shire is located, has been identified by the World Heritage panel as one of the two major centres of eucalypt species richness in Australia. It contains the largest number of tall eucalypt species of any bioregion in Australia and a unique diversity of eucalypt subgenera (NSW National Parks and Wildlife Service 1999).

A full description of the ecology of the LGA is available in the *Tenterfield Urban and Rural Land Use Strategy* (PB 2007).

3.2.7 Adequacy of Data

Location

The physical and service boundaries are well defined.

Climate

The historical climate of the LGA is well defined; however this may not provide adequate information for planning due to the impacts of climate change. The impacts of climate change are explored further in relation to water resources in *Section 3.4*.

Flooding

No flood extent or hazard mapping has been prepared at this stage. To ensure future development occurs in a sustainable manner it is recommended that to a Floodplain Risk Management Study and Plan be prepared for Tenterfield Creek

Flooding has not been considered a major issue for the village of Urbenville; however future development of the town could encroach further into the floodplain. To ensure future development occurs in a sustainable manner a flood study should be completed such that the extent of inundation for a range of design flood events can be established.

The studies should be completed in accordance with the NSW Government's Floodplain Development Manual (April 2005).

Population

Historical population data is well defined. Population growth estimates have been taken from the Department of Planning and Australian Bureau of Statistics estimates. Specific population growth estimates from Council should be investigated to validate the population forecasts presented in this report.

Land Use and Employment

Land use and employment within the LGA is well defined.

Topography, Soils and Vegetation

Topography, Soils and Vegetation within the LGA is well defined.

3.3 Water Resources

This section relates to water resources within the LGA and provides a context for urban water use within the wider LGA and the possible effects of climate change.

Adequate water resources are critical to ensuring the continued productivity of agricultural enterprises in the Tenterfield local government area. The extensive agricultural industries in the Shire such as cattle, sheep and wool production are based on rain fed systems where influences of seasonality, including drought, impact on yields. A combination of farm dams, bores and streams supply water for stock and domestic purposes. Water requirement for towns is further discussed below.

Information in this section has primarily been obtained from the *Tenterfield Urban and Rural Land Use Strategy* (PB 2007) and is supplemented with information from other sources.

3.3.1 Surface Water

As discussed in *Section 3.1*, the Tenterfield local government is located within two catchment management authority areas. Tenterfield and areas to the West are within the Border Rivers – Gwydir Catchment Management Authority (CMA) while the remainder of the catchment is situated within the Northern Rivers CMA.

The Western area drains via a number of waterways, including Tenterfield Creek, the Mole River, Reedy Creek, Gulf Creek, Black Creek and Beardy River, to the Dumaresq River which is a tributary of the MacIntyre River within the Murray Darling Basin. The eastern area drains via a number of waterways, including Tooloom Creek, Koreelah Creek, the Maryland River, the Boonoo Boonoo River, the Cataract River and the Rocky River, to the Clarence River which discharges to the ocean at Yamba. Stream flow data at gauging stations for major waterways within the Tenterfield Shire Council are shown in *Table 3-10* below. Figure **3-7** shows the major waterways within the Tenterfield LGA.

Table 3-10: Tenterfield major waterways stream flow data

Waterway Name	Gauging Station Site name	Site No	Catchment Area (sq km)	Mean Annual Flow volume (ML)	Mean Peak Annual discharge (ML/day)
Dumaresq River	Dumaresq at Roseneath	416011	5,550.00	344,143	29,898
Tenterfield Creek	Tenterfield Creek at Clifton	416003	541.02	51,771	7,734
Mole River	Mole River at Donaldson	416032	1,610.00	106,197	11,349
Beardy River	Beardy River at Haystack	416008	866.00	50,175	9,624

Cataract Creek	Cataract Creek at Sandy Hill	204036	236.00	51,849	5.392
Maryland River	Maryland River D/S Wyile Creek	204039	373.00	34,699	4,587

Source: NSWG 2010

A Water Sharing Plan, the *Tenterfield Creek Water Sharing Plan* (DWE 2004), has been developed for the Tenterfield Creek Water Source. Tenterfield Creek is one of the major river catchments in the Tenterfield Shire and forms part of the Border Rivers Water Management Area. In July 2004, when the Plan commenced, there were 56 licences for irrigation, one (1) licence for industrial purposes, one (1) licence for the local water utility, one (1) licence for recreation and six (6) licences for domestic and/or stock purposes.

Water Sharing Plans for other water sources in the Tenterfield LGA, have not yet been developed, and as such, the Water Act 1912 remains in force in those areas.

The DWE is currently preparing a macro water-sharing plan for other water sources in the Border Rivers Region not covered by existing plans, but this macro plan does not apply to any of the rivers in the Tenterfield LGA.

3.3.2 Groundwater

The availability of groundwater is restricted by the distribution of geological units (i.e. alluvium), their aquifer properties (i.e. sands) and the water end use requirements (water quality and yield requirements), providing a constraint to the development and use of groundwater in the local government area. Groundwater has the potential to provide water for stock and residential uses.

Information in this section is derived from the *Tenterfield Urban and Rural Land Use Strategy* (PB 2007).

The catchment is located in an area dominated by fractured rocks of the New England area. The geology within the whole study area is complex. The primary features are:

- Fractured sedimentary, volcanic and intrusive rocks.
- Very limited extents of Tertiary Main Range Basalts in the north of the local government area.
- Minor Quaternary alluvium associated with the Mole River, Tooloom Creek, and Beardy River.

The different types of aquifer systems that naturally occur in the area are predominantly fractured rock aquifers. Deposits of unconsolidated sediments are limited to the areas in the immediate vicinity of the river systems, with the exception of isolated areas of alluvium away from active rivers.

Based on the available information, groundwater available for high volume uses such as irrigation and industrial use is expected to be limited. Groundwater yield depends on the intensity of fracturing in the rock and the recharge by rain or surface water infiltration.

Groundwater is unlikely to provide water supply volumes comparable to that currently provided by surface water resources.

There are registered bores within the Shire in all the major rock types. Limited information is available on groundwater use within the local government area, however stock, domestic, garden and minor irrigation would be expected as the dominant uses. Council have also installed a bore to supplement water supply from Tenterfield Dam. This is discussed in Section 3.5.1. Figure 3-8 shows the locations of the resisted bores within the Tenterfield LGA.

Groundwater vulnerability mapping techniques have been used to map specific regions across NSW where human activities may pose a risk to important aquifer systems. The tools used for vulnerability mapping are designed to allow planners, developers, and agencies to make more informed judgements about the potential for groundwater contamination from surface activities and are considered here to assess the potential for groundwater contamination.

A groundwater vulnerability map has been produced for the Macintyre River, which forms the boundary of NSW and Queensland in the north of the Tenterfield LGA. However, vulnerability mapping is only available for the western section of the Shire, extending west from Tenterfield.

Overall the vulnerability rating for the western area of the Shire is low to moderate, with moderately high vulnerability around the Mole River and tributaries, which is believed to reflect the shallower depth to groundwater and greater aquifer permeability (alluvium) in and around the rivers. It is expected that vulnerability ratings will be similar in the east of the Tenterfield local government area, although it is noted that this area is topographically lower and rainfall recharge characteristics may include greater rainfall in this area.

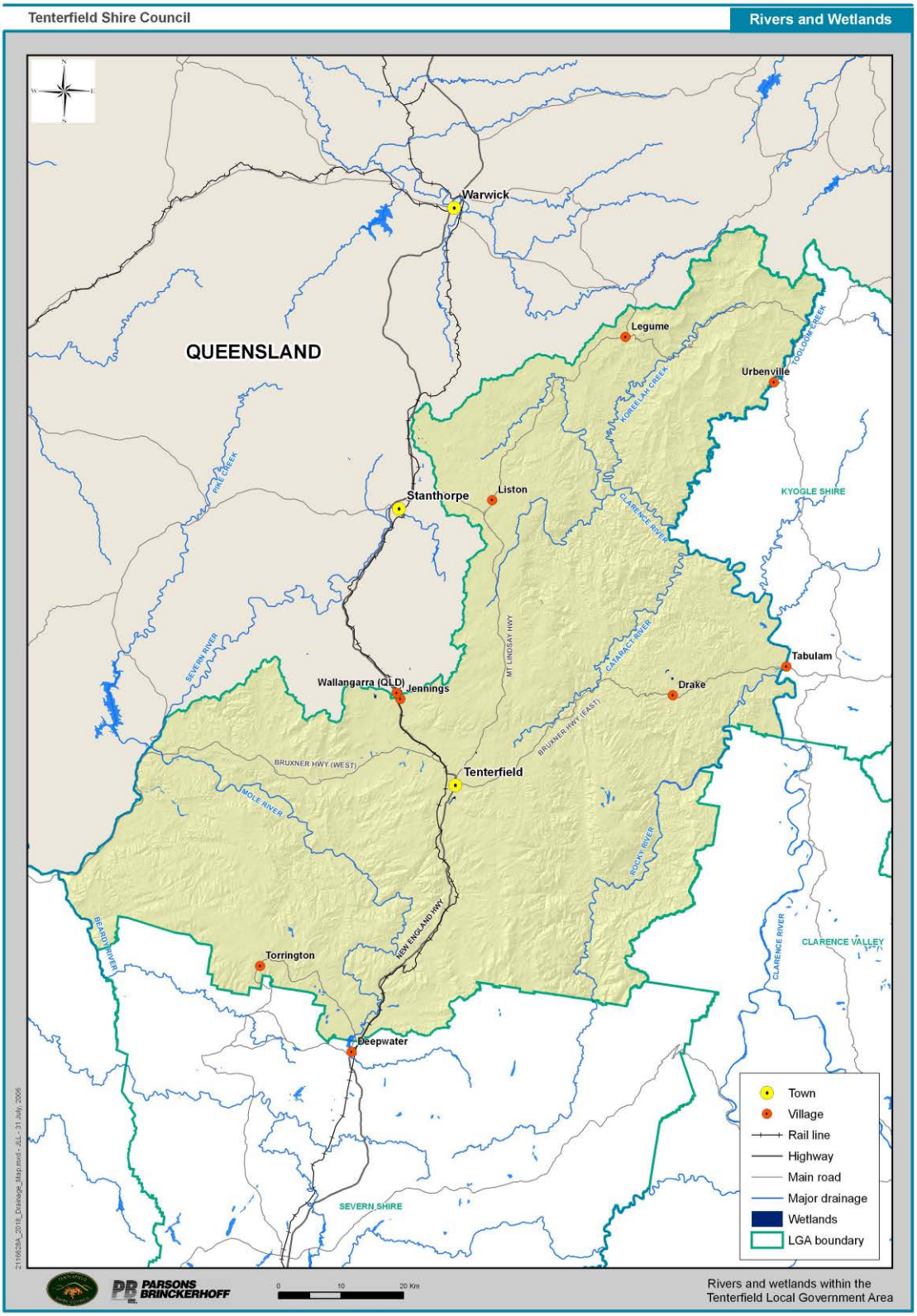

Figure 3-7: Tenterfield LGA Surface Water

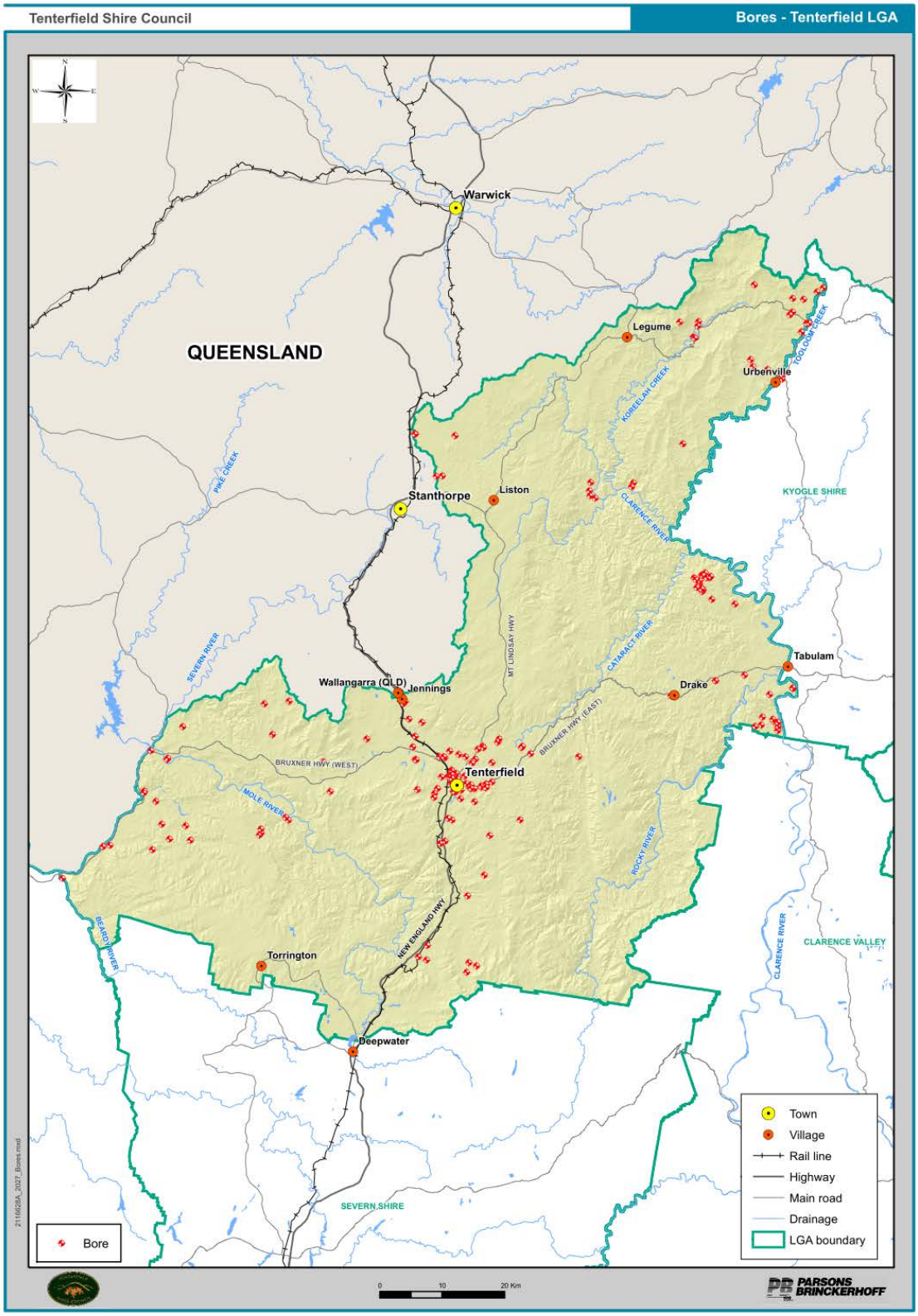

Figure 3-8: Tenterfield LGA Bore Locations

3.4 Impacts of climate change on Water Resources

As discussed in *Section 3.2.2*, NSW is likely to become warmer, with more hot days and fewer cold nights. Droughts are also likely to become more frequent and more severe, with greater fire risk.

Increases in extreme weather events are likely to lead to increased flash flooding, strains on sewerage and drainage systems, greater insurance losses, possible black-outs, and challenges for emergency services.

Water resources are likely to be further stressed due to projected growth in demand and climate-driven changes in supply for irrigation, cities, industry and environmental flows. Little change in annual rainfall with higher evaporative demand would lead to a tendency for less run-off into rivers in the order of 0% to -25% (CSIRO 2006).

This will likely impact both the rural and urban communities of Tenterfield LGA. Agricultural demands are likely to increase while diminishing run-off may result in increased frequencies of water shortages in urban catchments.

The future viability of Tenterfield Creek Dam and Tooloom Creek as water supplies for the main urban centres, as well as rainwater tanks for rural villages, must therefore be assessed. It may be necessary to meet demands by augmenting supply using additional schemes including rainwater tanks, grey water harvesting, additional weirs or dams, stormwater harvesting, effluent reuse or recycled water.

3.4.1 Adequacy of Data

Surface water

Surface water catchments and waterways within the LGA are well defined. Current water usage licence information, surface water extraction limits and water quality information however was not available from Council at the time that this report was written. These items should be investigated further to provide an accurate assessment of the current condition of the surface water assets and to estimate their ability to provide adequate quantity and quality of water into the future.

Ground water

The location of registered groundwater bores within the LGA is well defined. However, limited information is available from Council on the use of the groundwater bores and bore licence information. Groundwater bore water quality information was also not available from Council at the time at which this report was written. Groundwater vulnerability mapping has not been completed for the western section to the shire, extending west from Tenterfield. Given the importance of groundwater to the water supply system and the potential impact improper management of this resource can cause to the environment, further investigations should be conducted to enable the long term management of this resource.

Climate Change

There is no data available on the potential impact of climate change specifically in relation to Tenterfield LGA. The information which is available is for the New South Wales region.

The effect of climate change on Tenterfield Dam and Tooloom Creek should be investigated to determine the sustainable long term yield to aid in future planning. Given the prevalence of water supply from tanks, the impacts of climate change should also be determined on individual users of water supply tanks within the LGA, which make up over 45% of the population.

3.5 Urban Water Systems

Tenterfield Shire Council is the local water utility and operates two water supply systems in Tenterfield and Urbenville. Jennings also has a reticulated water system but does not have a water treatment plant as water is provided to the system from Stanthorpe in Queensland. The remaining villages in the Shire do not have a water treatment plant or reticulated water supply.

Tenterfield also operates sewerage systems in Tenterfield and Urbenville. The remaining villages in the Shire do not have a sewerage network or a centralised treatment plant.

3.5.1 Water Headworks

This information outlined below is based on numerous sources including the *Tenterfield Water Supply Strategy Study* (GHD 1996), which estimated future water demands and the capacity of the existing system to supply these demands in the future, the *Urbenville, Woodenbong and Muli Muli Water Supply Augmentation Delivery Main Assessment Report* (Cardno 2002), which details the Urbenville scheme, the *Jennings Water Supply Strategy* (SKM 1998), which details the Jennings Scheme, and information from past Annual Reports produced by Council.

Tenterfield

The major water supply for Tenterfield is Tenterfield Dam which is located two kilometres south of Tenterfield on Tenterfield Creek. The Tenterfield Dam catchment has an area of 3,786 hectares which is predominantly undulating cleared grazing land. The reservoir itself covers an area of 40 hectares when full.

The dam was built in 1930 and had an initial capacity of 872ML. In 1973 the dam was raised by 1.83m increasing the storage capacity to approximately 1263ML. It is a 13 metre high concrete gravity structure with a total crest length of 360 metres including a 202 metre spillway at the centre (DHI 2006). The dam spillway has not been officially rated for flow capacity although it is reported to be 800m^3 per second (DHI 2006; GHD 2005). Water levels in the dam are measured using a continuous water level recorder which was installed in 1996.

Excavation of the southern storage banks in 2003 under a drought mitigation program, incorporating the removal of 110,000m^3 of soil, restored the storage capacity to approximately 1,300 ML at full storage level (TSC 2006).

Table 3-11: Recent minimal storage levels in Tenterfield dam

Date	Storage
30 June 2006	65%
5 November 2006	60%
14 November 2006	96%
30 June 2007	78%
30 July 2007	76%
31 October 2007	94%
5 February 2008	100%
27 April 2008	91%
30 July 2008	88%
31 October 2008	85%
5 February 2009	97%
27 April 2009	99%

Source: Tenterfield Shire Council, Annual Reports 2006 – 2009

The Dam stability has been the subject of multiple studies (DPWS 1996a; DPWS 1996b; DPWS 1997; DPWS 1998). The final study found that the most probable failure mode was sliding of one or more blocks of the dam wall. Failure due to earthquakes and sunny day operational failure were considered negligible.

As a result of the studies, which found that the societal risk did not meet regulatory requirements, a flood warning system was installed in 2000 and was upgraded in 2008 to decrease the risks to life in the event of a dam break. Additional structural recommendations to reduce the risk of sliding failure have not been implemented to date.

The ability of the dam and Shirley Park bore (discussed below) to meet future demands is discussed further in *Section* ***Error! Reference source not found.***.

The average yearly Tenterfield Dam water quality information is presented below in *Table 3-12*.

Table 3-12: Recent Tenterfield Dam Water Quality – Yearly Averages

Date	Temp (°C)	Colour	Turbidity	Alkalinity	pH
2001	17.7	182.7	7.1	36.4	7.5
2002	17.8	72.3	3.8	45.1	7.8
2003	18.0	145.5**	15.6	43.4	7.6
2004	19.0	87.5	5.1	37.4	7.8
2005	19.3	42.7	2.6	53.7	8.7
2006	18.5	64.9	3.1	70.1	8.7

2007	20.0	61.6	2.7	63.0	8.1
2008	16.5	114.8	4.1	50.6	7.5
2009	17.6	105.0	6.0	48.7	7.7
2010	17.0	98.9	4.6	57.7	7.8
2011*	21.0	191.5***	16.2	54.7	7.7
AVERAGE	**18.4**	**106.1**	**6.5**	**51.0**	**7.9**

* 2011 Data includes results up to the 1st May 2011

** One (1) sample recorded as ">500", assumed to equal 500 in average calculation

*** Six (6) samples recorded as ">500", assumed to equal 500 in average calculation

Figure 3-9: Tenterfield Dam

A secondary source of water supply for emergency purposes is from Council's production bore installed in the early to mid 1990's at Shirley Park. The bore was drilled to a total depth of 96 metres and the bore is equipped with a pump at 62 metres. The bore is configured for use during drought periods, and can pump directly to Tenterfield's primary storage dam or the water treatment plant.

Discussions with Council have indicated the bore can pump approximately 1ML over a 24 hour period, corresponding to a total flow of 12 L/s, which is a high yielding bore for the Shire's aquifer units. It is likely the bore taps an area of significant fracturing. The reported sustainable yield of the bore is 6L/s (GHD 1996). The longest period the bore has been operated by Council is for 70 days, with the longest period of continuous use

being 20 days. Council is understood to have a volumetric allocation of 160 ML/year for this bore.

The extraction from Shirley Park Bore in recent years is shown in *Table 3-13* below. The supply tank at Shirley Park also supplies stock water and a small amount of bulk water for road works when other supplies have been exhausted.

Table 3-13: Recent Extraction from Shirley Park Bore

Date	Volume
2004	55.68 ML
2005	46.46 ML
2006	65.21 ML
2007	20.74 ML
2008	0.09 ML
2009	2.8 ML

The quality of the Shirley Park Bore water was the subject of a DPWS study undertaken as part of the GHD study (Appendix D in GHD 1996). The water quality was found to be generally good but contained slightly elevated hardness, fluoride, manganese, lead, arsenic and radioactivity. All these contaminant parameters can be adequately addressed through shandying with the dam water or dilution in the dam and treatment at the WTP. The report recommended that the Shirley Park Bore be used only as an emergency supply. Appendix D shows an indicative water quality analysis of the Shirley Park bore.

In January 2011 the Shirley Park Bore was damaged during the floods and is presently out of service. Council is taking steps to bring the bore back on line but no indication of when this may happen has been provided.

Urbenville

The water supply system serving Urbenville, Woodenbong and Muli Muli was installed in 1967 (Cardno 2002a). Muli Muli and Woodenbong are approximately 9km and 13km north east of Urbenville respectively.

The water supply pumps supply water to Urbenville from Tooloom Creek, at the so named Urbenville Weir pool. This is a natural pool formed by a basalt flow across the creek, which forms the top of Tooloom Creek Falls. The pool has a natural capacity of 240ML, however because of constraints on the suction level the effective storage capacity of the pool is approximately 160 ML (Cardno 2002a).

In August 2007, works were undertaken to improve access to lower levels of water in Tooloom Creek (TSC 2008). This work was funded from a $66,000 grant received for emergency capital works under the NSW Drought Relief for Country Towns program. The work consisted of:

- the extension of pipe work to lengthen the foot valve;
- the excavation of the creek bed;

- the installation of a protective cage to stop the ingress of material that may block the suction; and
- the placement of select rock around the cage to filter and secure the protective cage.

The total annual extraction from Tooloom Creek in recent years is shown in *Table 3-14*.

Table 3-14: Recent Extraction from Tooloom Creek

Date	Annual Extraction Volume (ML)
2001-02	110.14
2002-03	109.27
2003-04	88.52
2004-05	104.03
2005-06	101.39
2006-07	95.19
2007-08	98.90
2008-09	121.97
2009-10	98.64

Source: Tenterfield Shire Council

A hydrological analysis has been undertaken of the creek which indicated that the pool is able to provide a secure yield of 175ML per year making no provisions for environmental flows (Cardno 2002a). Other scenarios considered in the hydrological analysis which provide for environmental flows, require the provision of an off stream storage with a capacity of 50ML to 160 ML depending on the environmental requirements imposed.

Historical pool storage levels in the Urbenville Weir pool since records were kept in 2007 are shown in *Table 3-15*.

Table 3-15: Historical Urbenville Weir Pool Storage Levels

Date	Average Pool Depth (%)	Lowest Pool Depth (%)	Highest Pool Depth (%)
2007-08	71	38	100
2008-09	100	100	100
2009-10	100	100	100

Source: Tenterfield Shire Council

Historical water quality in Tooloom Creek at the Urbenville Pool for the period 1987 to 1997 is shown in *Table 3-16.* The Tooloom Creek raw water contains a number of microbiological and chemical impurities and the physical characteristics (colour, clarity, taste and smell) make it undesirable for drinking purposes. In addition, there are seasonal and other local factors that contribute to quality issues that cannot be controlled with the current treatment process.

Table 3-16: Tooloom Creek Historical Raw Water Quality

Parameter	Results	Guidelines Value	Failures
pH	6.6 - 8.0	6.5-8.5	0 from 14
Turbidity	0.9 - 28	5	12 from 14
Hardness	46 - 96	200	0 from 5
Iron	0.23 - 1.6	0.3	7 from 14
Manganese	0.05 - 0.18	0.1	2 from 4
Alpha Radiation	0.02 ± 0.03	0.1	-
Beta Radiation	0.14 ± 0.07	0.5	-

Source: DPWS 2003

Figure 3-10: Tooloom Creek extraction structure

Bulk water is also supplied to both Woodenbong and Muli Muli by pipeline under a water supply arrangement with Kyogle Council. Water supplied from this system is potable following completion of Urbenville WTP in August 2010..

Jennings

The village of Jennings is supplied from the Wallangarra system in the adjoining Southern Downs Regional Council in Queensland. The Jennings/Wallangarra water supply headworks are largely owned and operated by Southern Downs Regional Council. One of the water sources, Cusacks Dam, is privately owned.

Water for the Jennings/Wallangarra system is sourced from four sources (SKM 1998):

- The Soak which is a 22ML earthen dam on an unnamed creek which pump through a 150mm asbestos cement (AC) main to the WTP.
- The Wells which are a series of shallow wells in an alluvial deposit upstream from The Soak which pump through a 80mm uPVC main to The Soak or an 150mm AC main to the WTP.
- Beehive Dam which is a 98ML concrete gravity dam on an unnamed creek which pumps through a 150mm AC main to the WTP
- Cusacks Dam which is a privately owned 628ML earthen dam which pumps to an intermediate tank before gravitating to The Soak. Southern Downs Regional Council has an informal agreement for the supply of 25ML per year.

The water quality from all sources is reported to be good (SKM 1998).

Other Villages

In conjunction with the potable water sources mentioned above, dwellings may also be connected to a rainwater tank.

Other villages within the TSC that are not connected to a potable water network will most likely completely rely on rainwater tanks for all portable water needs. The Tenterfield Shire Councils rainwater tank policy only applies to dwellings which are connected to the reticulated water supply (TSC 2007b) .The key requirements of this policy are:

- An approved “intelligent controller” system must be installed to any tank connected to plumbing fixtures
- A first flush and full overflow connection to the stormwater system must be made
- No direct connection between the mains water supply and the tank is permitted
- Tanks can only be used for the following purposes:
    - Toilet flushing
    - Garden irrigation
    - Washing cars
    - Washing machines and;
    - Filling ornamental ponds/swimming pools

3.5.2 Water Treatment

This information included in this section is based on several sources including the *Tenterfield Water Supply Strategy Study* (GHD 1996), which estimated future water demands and the capacity of the existing system to supply these demands in the future, the *Urbenville, Woodenbong and Muli Muli Water Supply* reports (Cardno 2002a; Cardno 2002b; DPWS 2003), which details the Urbenville scheme, the *Jennings Water Supply Strategy* (SKM 1998), which details the Jennings Scheme, and information from past Annual Reports produced by Council.

Tenterfield

Tenterfield WTP is located adjacent to the dam with a capacity of 5ML per day. The water treatment process includes using chemical coagulation and sedimentation and deep bed filtration, combined with UV disinfection and chlorination using chlorine gas.

The plant was built in 1930 and was extended in 1958 and 1985 with the provision of additional filtration capacity. The plant is coming to the end of its serviceable life and the current operator of the plant has found concrete cancer appearing in a number of locations, serious structural rust in parts of the walkway supports and numerous leaks over recent years around cast iron fittings.

The Tenterfield water supply has also been subject to much debate regarding fluoridation of the water supply. Fluoride is advocated by NSW Health due to improvements in dental hygiene delivered from its inclusion in drinking water supplies.

A packaged fluoride dosing unit fully funded by the NSW Government was delivered in March 2008 to dose in-line at the outlet of the WTP. This system was commissioned in in August 2012.

Daily and monthly water sampling and testing is undertaken at the plant to ensure compliance with Australian Drinking Water Guidelines. The sampling includes microbiological testing which have consistently shown a zero pathogen plate count.

Figure 3-11: Tenterfield Water Treatment Plant

Urbenville

Due to the poor raw water quality from Tooloom Creek studies were undertaken to develop options to improve the product water quality. The studies recommended the installation of a new treatment plant for the system under a Design and Construct contract (DPWS 2003). This new treatment plant was completed and commenced operation in August 2010..

The new water treatment plant for Urbenville is a DAFF treatment system, (dissolved air floatation and flocculation). This system will see the specific conditions of the Tooloom Creek water supply treated to appropriate standards greatly improving the quality of life for residents in the Urbenville area. The WTP has a hydraulic capacity of 1.5 Megalitres per day and has been designed to operate at a minimum and maximum flow rate of 0.3 and 0.75 Megalitres per day respectively (TSC 2010c). The process elements in the water treatment system include; coagulation, pH correction, dissolved air floatation and filtration and a hypochlorite dosing system. The WTP is connected to a Supervisory Control And Data Acquisition (SCADA) system which allows remote access to the operation of the plant. The WTP has been deigned to start and stop automatically depending on the treated water level in the clear water tank. The WTP will automatically stop in the event of a failure in the treatment or flow within the system

Sampling and analysis of the Urbenville WTP product water quality has been conducted by Richmond Water Laboratories. The results of analysis of nine (9) recent water

samples between 2010 and 2011 have be summarised in *Table 3-17* below. The water quality targets from Table 4 of the Urbenville WTP OM Manual (TSC 2010c) have also been included where applicable.

Table 3-17: Urbenville WTP Historical Product Water Quality

Parameter	Range	Average	Quality Target	Failures
Calcium (mg/L)	10.8-19.4	13.9	NA	NA
Magnesium (mg/L)	4-8	6	NA	NA
Hardness (as CaCO3) (mg/L)	45-80	58	NA	NA
pH	7.5-8.6	8.2	7.2 ≥ pH < 8.0	5 from 9
Electrical Conductivity (µS/cm)	314-402	389	NA	NA
Total Dissolved Solids	200-255	248	NA	NA
Turbidly (NTU)	0.22-0.34	0.56	NA	NA
True Colour (Pt-Co)	<2-9	4	< 25	0 from 9
Total Iron (mg/L)	0.007-0.03	0.029	NA	NA
Total Manganese (mg/L)	0.006-0.03	0.037	NA	NA

Source: TSC 2010c and RWL (2010)

3.5.3 Water Network

This section is based on numerous sources including the *Tenterfield Water Supply Strategy Study* (GHD 1996), which estimated future water demands and the capacity of the existing system to supply these demands in the future, the *Urbenville, Woodenbong and Muli Muli Water Supply* reports (Cardno 2002a; Cardno 2002b; DPWS 2003), which details the Urbenville scheme, the *Jennings Water Supply Strategy* (SKM 1998), which details the Jennings Scheme, and information from past Annual Reports produced by Council.

Tenterfield

The main water supply infrastructure in Tenterfield was laid during the 1960s and 1970s, although it has existed since the 1930s. Replacement and augmentation of the existing infrastructure has occurred over the past twenty years. The older pipes are primarily cement lined cast iron and asbestos cement with newer pipes of PVC construction. The pipes are mainly 100 millimetres in diameter with some sections up to 250 millimetres.

Water is pumped from the Tenterfield water treatment plant via a 250mm diameter pipe to the main concrete reservoir in East Street (2.1 ML capacity, TWL 914.5 mAHD) and by a series of mains to an auxiliary concrete reservoir on Hospital Hill (2.3 ML capacity, TWL 900.5mAHD) on the western side of Tenterfield. A second and smaller reservoir is located at Hospital Hill, although it is not currently used.

A supplementary supply for other users, including rural domestic consumers, is available on a fee for service basis via a stand-pipe located adjacent to the Works Depot in Riley Street, Tenterfield.

Extensions to the water supply infrastructure have occurred, particularly to the north of Tenterfield, to service the residential expansion of the town. Pipes have been laid to the north of Cowper Street (west of Tenterfield Creek) in response to new development.

Conversely almost one kilometre of pipe was also laid in the 1980's along Rouse Street, from Drummond Street to the northern boundary of the village zone. This water infrastructure currently services only a farm and a handful of other dwellings, suggesting underutilised capacity to service development in this location.

In the west, another extension to the south of Douglas Street, near the railway station, provided town water supply to dwellings west of the railway line for the first time in 1996. An existing 'paper subdivision' of almost 40 lots to the south of Douglas Street, between the railway and the creek, is not serviced by town water which may have contributed to this area remaining undeveloped.

In the eastern part of the town, the water infrastructure generally extends as far as Wood Street, with extensions to East Street occurring during the 1990's in the vicinity of Miles and Douglas Streets, Cowper Street, and Molesworth and Petrie Streets. Pipes laid in the 1970's also provide reticulated water approximately 500 metres to the east of East Street along both Aldershot Road and Casino Road (Bruxner Highway).

The Saddlers Estate located to south of Tenterfield has utilised an existing water pipe that previously serviced the saw mill on the southern outskirts of the town. A water booster is to be provided within the estate to bring water pressure up to required fire fighting standards.

Council experienced higher than normal dirty water complaints between January and May 2008. The dirty water was not related to the quality of water being produced by the Water Treatment Plant nor to the condition of the two storage reservoirs in Tenterfield (TSC 2008).

The presence of dirty water was attributed principally to the age and condition of the public water reticulation system of Tenterfield. Seasonal temperature changes, ongoing development needs, peak usage and mains breaks all contributed to the release of accumulated scale or other deposits on the walls of the water mains and sending it through the system. It may have also loosened scale and other deposits found in the household water lines, particularly the older galvanised iron lines, through expansion and contraction

To overcome this problem, Council flushed water mains in the general area of reports of dirty water. This process removes scale and other deposits. Mains flushing itself however, can result in dirty water events for consumers in areas adjacent to the initial complaint. A program of air scouring of mains was commenced in 2008/09 to minimise the risk or recurrence. The initial results of this program are unknown.

The Tenterfield water reticulation network is viewed as being in reasonable condition, with major capital and maintenance works of the Tenterfield water network during the past five (5) years as reported in the Tenterfield Shire Council Annual Report – Services (TSC 2006, TSC 2007, TSC 2008, TSC 2009, and TSC 2010) are shown in *Table 3-18* below:

Table 3-18: Major capital and maintenance works on the Tenterfield Water Network

Location	Description of Works
2005-06	
Stage 1 of Rouse Street North	Replacement of 350 m of 100 mm water main
All fire hydrants	Hydrants inspected, marked, cleaned and distances measured
2006-07	
Clifton Street	Construction of 100 mm water connection
New England Highway	Replacement of 55 metres of 100 mm water main
Riley Street	Construction of 270 m of 200 mm Water main
East Street	Construction of 200 metres of 150 mm water main
Millrace Retirement Home	Construction of 100 mm fire service
Riley Street	Construction of 180 metres of 100 mm water main
Wood Street	Construction of 220 m extension of 100 mm water main
Saddlers Estate	Mains testing and the construction of pipework to High Zone Water Pump Station (HZPS)
2007-08	
All	"Fair Valuation" of water supply assets completed
East and High Streets.	Construction of water main, 492.1 m long
Simpson Street	Construction of 150 mm water main to connect Logan Street to New England Highway
RSL building at the Memorial Hall.	Replacement of 45 metre water service
All	Stage 1 - Water Loss Reduction Program. Identifying locations of water losses and leaks in the water reticulation system and reservoirs
2008-09	
All fire hydrants and valves	Fire hydrants and valves cleaned and painted in conjunction with blue indicator markers on road centreline.
All fire hydrants not within the pavement	Yellow triangles has been marked on the pavement
Hospital Hill reservoir	Control valving upgraded including the installation of telemetry to report level indication back to the Water Treatment plant.
2009-10	
Hospital Hill reservoir to Riley Street	Construction of 220 metres of 200 mm water main to replace existing AC main in new Tenterfield Industrial Park
Tenterfield Industrial Park	Construction of 650 metres of 150 mm water mains and associated hydrants
Riley St and Shirley Park bore	Purchase of card reader for standpipes
Two locations	Extension of mains as part of private works

Source: Tenterfield Shire Council Annual Report – Services 05/06, 06/07, 07/08, 08/09 and 09/10

Urbenville

As part of the submission by the Tenterfield Shire Council on the 23rd April 2008 to the NSW Minister for Water Utilities recommending stage three (3) funding for the revised tender for new Urbenville Water Treatment Plant, tender submissions were included for upgrading of roofing and access at the Urbenville reservoir. (TSC 2008). Construction works for the new Urbenville Water Treatment Plant and Urbenville reservoir roof and access are now completed.

Tenterfield Shire Council has commented that the current condition of the Urbenville water supply network is considered as good, with few breaks and good pressure being provided and that there are no capital works planned for the foreseeable future (Graeme

Schreiber. g.schreiber@tenterfield.nsw.gov.au. RE: IWCM Study for Tenterfield SC. 15 December 2011.).

The major capital and maintenance works of the Tenterfield water network during the past five (5) years as reported in the Tenterfield Shire Council Annual Report – Services (TSC 2006, TSC 2007, TSC 2008, TSC 2009, and TSC 2010) are shown in Table 3-19 below:

Table 3-19: Major capital and maintenance works on the Urbenville Water Network

Location	Description of Works
2005-06	
Public Toilets	A new service was installed to enable the watering of the new gardens in the park
All fire hydrants	Inspection program conducted
Water pump station intake	Foot valve was replaced
2006-07	
Forestry Depot	Construction of 200 metres of new service line and repairs on the overhead fill unit
All fire hydrants	Inspection program conducted
2007-08	
All	"Fair Valuation" of water supply assets completed
2008-09	
NA	NA
2009-10	
NA	NA

Source: Tenterfield Shire Council Annual Report – Services 05/06, 06/07, 07/08, 08/09 and 09/10

Jennings

. A new 1000m section of 100mm dia main is planned for Ballandean St, Jennings in the later part of 2011-12. The major capital and maintenance works of the Tenterfield water network during the past five (5) years as reported in the Tenterfield Shire Council Annual Report – Services (TSC 2006, TSC 2007, TSC 2008, TSC 2009, and TSC 2010) are shown in *Table 3-20* below:

Table 3-20: Major capital and maintenance works on the Jennings Water Network

Location	Description of Works
2005-06	
Gladstone Street	130 m mains replacement
NA	100 mm valve was installed
2006-07	
two new dwellings	Installation of 75 metres of 100 mm water main
NA	100 mm valve was installed
2007-08	
High Street	Replacement of 180 metres of 100 mm water main
Aspley and Gladstone Streets	Installation of 200 metres of new 100 mm main
All	"Fair Valuation" of water supply assets completed
2008-09	
Aspley to Gladstone Streets	Construction of the water main link

Location	Description of Works
All fire hydrants	Hydrant marking and cleaning completed
2009-10	
NA	routine maintenance works, including an increasing number of repairs to mains breaks, were completed.

Source: Tenterfield Shire Council Annual Report – Services 05/06, 06/07, 07/08, 08/09 and 09/10

3.5.4 Sewerage Network

This information included below is based on a number of sources including the *Tenterfield Sewerage Strategy Study* (GHD 1995), the *Tenterfield Sewerage Augmentation: Final Report on proposed Sewerage* (MWH 2004), which estimated future water demands and the capacity assessment of the existing system, two sewer overflow investigation reports for Tenterfield and Urbenville (Eschelon 2007a; Eschelon 2007b), and information from past Annual Reports produced by Council.

Tenterfield

The Tenterfield sewerage system was largely constructed in the 1950s to coincide with construction of the sewage treatment plant. The system consists of a network of gravity pipes and two operational pumping stations, which together with the gravity system deliver flows to the sewerage treatment plant.

The system covers the main central areas of the town and was extended in the 1960s and in 1981. There is approximately 33 kilometres of gravity mains and a 375mm diameter trunk main from the Drummond Street pumping station to the STP, which is located approximately 3.5 kilometres from the town centre to the north.

The existing system consists of small diameter mains predominately 150 and 225mm diameter mains. The sewerage catchment is effectively spilt in two by Tenterfield Creek creating two separate sewer reticulation systems.

The Drummond Street SPS and Saddlers Estate SPS meet the DECC requirements for both dry and wet weather flows. Both pump stations have an emergency generator (Echelon 2007). The Drummond Street Road pumping station contains duty/standby pumps with a capacity of 127 L/s per pump. The Drummond Street SPS accepts approximately three quarters of the Tenterfield sewerage catchment from the southern half and north-east corner. The Saddlers Estate SPS was only recently commissioned in 2007 to service a new development to the south of the town. The Saddlers Estate SPS has a standby and a duty pump, however, at the time at which this report was written pump capacities and duties were not able to be supplied by Council. Additionally, a smaller SPS is located at Federation Park which has a separate discharge line to the STP. The Federation Park SPS serves a low area containing approximately 30 residences, bounded by Pelham St, Martin St, Nass St and George St. The duty of the Federation Park SPS is approximately 8 L/s at 4m of head. At the time at which this report was written, information pertaining to the pump arrangement and capacity of the Federation Park SPS was not available in addition to the pump stations ability to meet DECC requirements.

Infiltration has previously been identified as a problem in the sewerage system, with the sewerage system having a rapid response to rainfall which indicates that there is a high level of infiltration, presumably due to the age and condition of the system (GHD 1995; Eschelon 2007).

It has been reported in the Tenterfield Shire Council Annual Report – Services (TSC 2010) that peak discharges through the sewerage treatment plant regularly coincide with rainfall events. This may indicate that currently there still exists a high level of stormwater infiltration into the sewerage network.

Council has initiated an inspection and testing program of the existing sewerage system though CCTV inspection and smoke testing to identify the condition of the sewer mains and illegal stormwater connections. This along with an ongoing relining programme, will aid in reducing infiltration to the sewerage system.

Council also has a relatively high amount of chokes, again presumably due to the age and condition of the system. The number of chokes over the past seven years is shown in *Table* 3-21.

Table 3-21: Tenterfield Sewerage Chokes

Year	Chokes (qty)	Sewerage Mains (km)	Chokes (qty/100km.year)
2001-02	65	59.9	109
2002-03	84	59.9	140
2003-04	69	59.9	115
2004-05	60	59.9	100
2005-06	73	65	112
2006-07	89	65	137
2007-08	92	65	141

Source: TSC mandatory reporting data 2002-2008

Tree roots have historically been responsible for over 50% of all sewer chokes and blockages (Eschelon 2007). Again, this is presumably due to the age and condition of the system and can only be permanently prevented through refurbishment or replacement of the mains.

Fats and grease also result in approximately 10% of all sewer chokes and blockages (Eschelon 2007). As a result Council have recently adopted a Liquid Trade Waste Policy. The policy has been developed in accordance with the NSW Government Best Practice Management for Water Supply and Sewerage Guidelines and requires the approval of the NSW Department of Water and Energy. The implementation of this Policy is a requirement for the funding by the NSW Government of the new Tenterfield Wastewater Treatment Plant. The Policy came into effect in July 2011. Property owners and occupiers affected by the Liquid Trade Waste Policy have been formally notified of the classification (A, B or C) of their discharge. As on-site treatment measures are implemented this should progressively result in a reduction in chokes arising from fats and grease.

As of 5th December 2011, information supplied by Council showed that 73 properties have been inspected for trade waste in Tenterfield and Urbenville. Of these, 4 were non-dischargers, 11 were exempt, 17 were A1 compliant, 35 were A2 compliant and 3 had B2 Concurrence. Two properties were not inspected as the businesses had closed. Non-compliant properties were given until October 2012 to comply to allow business owners time to budget for any required works

Non-compliant properties for Tenterfield are listed in the *Table 3-22* below.

Table 3-22: Tenterfield Trade Waste Non-Compliant Properties

Assessment	Business	Property Address
7708	Ambulance Station	Manners Street,
14860	Tenterfield Bakery	226 Rouse Street,
14902	Coachman Coffee Shop	234 Rouse Street,
14951	Cumquats	250 Rouse Street,
15040	Willowtree Coffee Shop	274 Rouse Street,
15172	Masons Store	340 Rouse Street,
15198	Burgers on Rouse	348 Rouse Street,
12591	Federation Park	Duncan Street

Several developed areas remain unsewered in the catchment and it is estimated that 8-12 per cent of the residents in Tenterfield are not connected to the sewerage system (GHD 1995).

At the time at which this report was written, information was not available from Council in regards to the current condition of the Tenterfield sewage network.

Capital works carried out in 2011-12 include 400m of relining works and 380m of 150mm dia gravity main as part of Stage 2 of the Tenterfield Industrial Park project. CCTV filming and cleaning was carried out in approximately 1500m of trunk main.

The major capital and maintenance works of the Tenterfield sewage network in the previous five (5) years as reported in the Tenterfield Shire Council Annual Report – Services (TSC 2006, TSC 2007, TSC 2008, TSC 2009, and TSC 2010) below are shown in *Table* 3-23 below

Table 3-23: Major capital & maintenance works on the Tenterfield Sewage Network

Location	Description of Works
2005-06	
All	Completion of the Manhole raising program
Riley Street	Connection of a subdivision to the sewer main
2006-07	
Mount Lindesay Road to Cowper Street	Construction of sewer main extension
Wood Street	Construction of extension of 50 metres of sewer main
Riley Street	Construction of 180 metres of sewer main
Pelham Street	Realignment of 50 metres of main
Pelham Street	Construction of 26 metres of main
Saddlers Estate SPS	Mains testing and the construction of pipework to the SPS
Drummond Street	Extension of main
2007-08	
Clifton and Simpson Streets	Construction of gravity sewer main
NA	Cleaning and foam treatment of 1.6 km of main.
NA	CCTV investigation of mains.
Rouse Street	Lining of 180 metres of 150 mm main
Petre Street	Lining of 80 metres of 225 mm main
NA	Extension of 150 mm UPVC sewer main
NA	Fair Valuation" of sewer assets completed
NA	Smoke testing of sewer mains.
2008-09	
Drummond Street SPS	Removed and repaired faulty pump
Petrie Street SPS	Refurbished faulty pump
NA	CCTV inspection & cleaning program of 14 km of sewer main
Petre Street	Lining of 120 metres of 225 mm main
Pelham & Manners Street.	Lining of 215 metres of 150 mm main
2009-10	
Simpson Street	Completion of gravity and rising mains and installation of pump well
NA	CCTV inspection & cleaning program of 9 km of sewer main
Duncan & Manners Streets.	Lining of 300 metres of 150 mm main
Tenterfield Industrial Park	Installation of 1,040 m of gravity mains and 23 access pits

Source: Tenterfield Shire Council Annual Report – Services 05/06, 06/07, 07/08, 08/09 and 09/10

Options for the staged connection of four identified unserviced areas in Tenterfield were examined in the *Tenterfield Sewerage Augmentation: Final Report on proposed Sewerage* (MWH 2004). The study concluded that a hybrid gravity/low pressure sewerage system and pumping stations be pursued for detailed design and construction. Gravity mains are to be adopted where possible with low pressure sewerage adopted where hard rock exists at shallow levels.

These areas include:

- Stage 1 (south) – located south of Clive Street and extending south to Tenterfield Creek. The Stage 1 works will also require a new 27.5L/s lift SPS located at the bottom of Clive Street

- Stage 2 (northwest) – located west of Pelham Street and extending from Drummond to Riley Streets. The Stage 2 works will also require a new 13L/s lift SPS located on the Western Boundary Road.
- Stage 3 (northeast) – located north of Petre Street, and extending along the eastern town edge and north along Mount Lindesay Road.
- Stage 4 (east) – located south of Petre Street and extending south along the eastern town edge to High Street.

Urbenville

The Urbenville sewerage system is a newer system than Tenterfield system and was built approximately 20 years ago. It consists of a treatment works, two pumping stations and approximately 7 kilometres of sewerage mains.

The major capital and maintenance works of the Urbenville sewerage network during the past five (5) years as reported in the Tenterfield Shire Council Annual Report – Services (TSC 2006, TSC 2007, TSC 2008, TSC 2009, and TSC 2010) are shown in *Table 3-24* below:

Table 3-24: Major capital & maintenance works on the Urbenville Sewage Network

Location	Description of Works
2005-06	
No major activities undertaken	
2006-07	
No major activities undertaken	
2007-08	
NA	"Fair Valuation" of sewer assets completed
2008-09	
Sewage pumping station	Replaced all float switches at the No1 sewage pumping station.
Sewage pumping station	Serviced pumps at the No1 sewage pumping station.
Sewage pumping station	Refurbished faulty pump at No1 sewage pumping station.
2009-10	
No major activities undertaken	

Source: Tenterfield Shire Council Annual Report – Services 05/06, 06/07, 07/08, 08/09 and 09/10

Over the longer term, continuation of these capital works programs will be required in order to maintain the current infrastructure, and provide for new infrastructure when urban demand is reached. New development and subdivisions should contribute through developer contribution charges towards these capital works.

Other Villages

Septic tanks provide small scale sewage treatment and generally service areas with no connection to the main sewerage pipes. Septic tanks are a key component of the Tenterfield Shire Councils septic system and service a number of smaller villages. The use of septic tanks within the TSC is governed by the septic tank policy. The Tenterfield Shire Councils septic tank effluent connections policy applies to urban sewerage systems where the subject land is not rateable (TSC 2000). These urban effluent connections will be permitted on the following basis:

- that a capital contribution equal to the minimum sewerage rate for the time being be paid as a contribution towards the capital cost of the sewerage treatment plant and reticulation system generally
- that the owner be required to meet all costs attributable to such connection and including the maintenance of any pipeline from Council's main to the properly, and;
- that such premises be subject to an annual charge equal to the minimum rate.

The Tenterfield Shire Council as at the 19th of May 2011 had a total of 1474 recorded septic tank connections. 83 of these septic tank connections have been recorded as "High Risk" and the remaining 1391 connections are considered to be a "Low Risk".

There is currently no sewerage infrastructure in Jennings. All properties use septic tank and no studies have been undertaken.

Unsewered villages like Jennings pose a threat to groundwater quality as the potential contamination sources are often distributed over a broad area. Groundwater bores in proximity to on-site effluent disposal systems (domestic or Council) pose a significant threat to aquifers, potentially providing a preferential pathway for contamination to enter the aquifer.

Areas of primary concern where the groundwater is vulnerable to potential contamination are recharge areas with shallow water tables. Within the Tenterfield local government area the alluvium of the Mole River and tributaries has been identified as having a moderately high vulnerability. The Tertiary basalts in the north or the area are potentially vulnerable to groundwater contamination if they are significantly fractured and porous (PB 2007).

Provision of a reticulated sewerage service or an effluent collection system in Jennings should also be investigated by Council. Provision of such new infrastructure within the life of this strategy is recommended to address the current public health issues.

If a regional factor does emerge, which leads to significant growth, there are likely to be implications for the sewer capacity of Tenterfield and Urbenville and for the on-site effluent disposal within the villages.

3.5.5 Sewage Treatment

This section is based on numerous sources including the *Tenterfield Sewerage Strategy Study* (GHD 1995), which estimated future water demands and the capacity of the existing system to supply these demands in the future, the *Tenterfield Sewerage Augmentation Options Review* (MWH 2002), which reviewed the strategy developed in the previous report and information from past Annual Reports produced by Council.

Tenterfield

The Tenterfield Sewage Treatment Plant, completed in October 2009 is licensed under EPL 4305. The effluent concentration requirements of the licence are shown in *Table 3-25.* There are also additional load based requirements.

Table 3-25: Tenterfield STP Effluent Requirements

Pollutant	90% Percentile Limit
pH	6.5-8.5
Biochemical Oxygen Demand	40
Total Suspended Solids	45

The new STP is a 3,700 EP capacity Intermittent Decant Aerated Lagoon (IDAL) treatment plant. The process includes fine mechanical screening with step screens, vortex grit removal, magflow meter flow measurement, IDAL secondary treatment with diffused aeration, chemical phosphorus removal with alum and supplementary caustic dosing, chlorination with chlorine gas and dechlorination with sodium bisulphate and effluent storage. Approximately half the effluent is spray irrigated to land and the remainder discharging to Tenterfield Creek. Sludge will be periodically dewatered using a dehydrator recently purchased by Council.

The results of the water testing analysis as performed by Richmond Water Laboratories for the Tenterfield STP since October 2009 for the raw water and final effluent are shown in the *Table 3-26* below.

Table 3-26: Tenterfield STP Historical Product Water Quality

Parameter	Raw Effluent Test Results		Final Effluent Test Results	
	Range	Average	Range	Average
Alkalinity (as CaCO3) mg/L	195-391	250	28-220	118
pH	7.4-8.3	7.7	7.1-9.6	8.4
Electrical Conductivity	589-1203	831	541-1181	771
Turbidity (NTU)	7.4-81.7	33.5	0.88-25	10.64
BOD (mg/L)	20-176	65	<2.0-20	7
COD (mg/L)	52-466	221	26-113	56
Soluble Phosphorous (mg/L)	2.7-8.6	4.7	<0.010-7.3	0.87
Total Phosphorous (mg/L)	3.2-10.5	6.1	<0.050-4.7	1.01
Ammonia-N (mg/L)	5-66	30.3	0.04-26	3.19
Nitrite-N (mg/L)	0.01-0.54	0.15	0.04-0.1	0.07
Total Nitrogen (mg/L)	14.9-93	37.8	1.9-32	7.2
TKN (mg/L)	14.7-93	39.8	1-26.7	6.1
Suspended Solids (mg/L)	24-264	95	4-43	19

For the 12 months up to Sept 2011 the new Tenterfield STP treated effluent had the following average pollutant levels in Table 3-27. Overall, the effluent produced by the new STP is of excellent quality.

Table 3-27: New Tenterfield STP Final Effluent Quality

Pollutant	Measure Unit	Mean Reading
Ammonia	Mg/L	0.2
BOD	Mg/L	3.3
Conductivity	Microsiemens/cm	672
Faecal Coliforms	Units/100ML	36
Total Nitrogen	Mg/L	2.8
Oil & Grease	Mg/L	<2
pH	pH	8.2
Total Phosphorus	Mg/L	0.24
Total Suspended Solids	Mg/L	17

Urbenville

The Urbenville Sewage Treatment Works is located approx 1 km west of Urbenville on Urbenville Road. It consists of a 500 EP Passveer Channel treatment plant, two settlement ponds and two sludge lagoons. The STP currently serves 107 tenements or approximately 250 EP. Council is currently not expecting a capacity increase in the foreseeable future.

The treated effluent from the treatment plant is pumped 1.5 kilometres to an unnamed ephemeral watercourse approximately 1 km from Beaury Creek.

The plant is licensed under EPL 4306. The requirements of the licence are shown in *Table* 3-28*.* The plant regularly exceeds the suspended solids effluent requirement presumably due to lack of settlement or natural processes within the settlement pond.

Table 3-28: Urbenville STP Effluent Requirements

Pollutant	**90% Percentile Limit**
Oil and Grease	10
Biochemical Oxygen Demand	20
Total Suspended Solids	30

Jennings

Jennings has no reticulated sewerage system. The majority of properties are serviced by septic tanks. There are a limited number of private on site treatment systems.

3.5.6 Stormwater Network

Stormwater management refers to the management of surface water run-off from land that is not within a watercourse. Stormwater drainage systems are designed to convey surface water run-off away from affected areas, so it does not impede the normal workings of those areas.

The townships of Tenterfield and Urbenville have formalised stormwater drainage networks. This includes kerb, guttering and pits for collection and pipes for conveyance. Also within these townships there are open swale drains. Council has recently undertaken some upgrading works on sections through Tenterfield.

However there is no formal documentation of the stormwater system and at the time at which this report was written, information was not available from Council in regards to the Councils stormwater infrastructure.

3.5.7 Adequacy of Data

Water Headworks

Tenterfield

A secure yield assessment was undertaken in 1996 which estimated the secure yield to be 510 and 600 ML per annum depending on environmental release requirements (Appendix A in GHD 1996). This did not take into account the possible effects of climate change.

It is recommended that the secure yield analysis completed in 1996 should be updated to incorporate the effects of climate change in the region to enable long term analysis of water yield.

Water Treatment

The assessment of the Urbenville WTP product water quality is based on nine (9) recent water samples since the WTP began production in mid-2010. It is recommended that a larger number of water samples over a longer time frame are reviewed in order to achieve a higher certainly from the statistical analysis of the product water quality.

Sewerage Network

The age of the network, in combination with high levels of infiltration and the high choke frequency all suggest that the Tenterfield sewer network is in relatively poor shape

However, existing information regarding the Tenterfield and Urbenville sewerage networks is fragmented and unverified and as such it is difficult to provide an accurate assessment of the capacity and condition of the system.

As recommended in the *Tenterfield Sewerage Augmentation Report* (MWH 2004) it is recommended that a full asset survey be undertaken of the existing sewerage system to establish a level of confidence in the existing information and at the same time transfer the records to GIS format, such as Infoworks, for ease of use.

Subsequent to the completion of the asset survey, prioritisation of main refurbishment or replacement can be undertaken.

It is also recommended that modelling of the network to determine capacity be undertaken at the same time enable better decision making with respect to whether to replace, upsize, duplicate or refurbish mains.

Another potential contamination hazard are the private on-site sewerage locations which are currently not all known by Council. There is concern that surface and ground water systems may be contaminated if not properly monitored and managed by owners. During the community visioning workshops held at Liston and Drake residents raised concern about the contamination of their local waterways from on-site sewerage systems. Council is also concerned with on-site effluent in the villages of Jennings and Torrington due to the poorer quality soils.

Sewage Treatment

The new Tenterfield STP is considered to be performing well as shown in Tables 2-26 and 2-27

Stormwater

There is no formal documentation of the stormwater system. The preparation of catchment and town based stormwater management plans will provide the Tenterfield Council with an opportunity to develop an appropriate approach to managing stormwater issues in each catchment. These plans would highlight the need to focus on issues that affect the health and amenity of waterways in the local government area, and to broaden the traditional focus on flood mitigation and drainage.

a) It is recommended that a stormwater asset survey and stormwater management plan be undertaken for Tenterfield and Urbenville. Again records should be implemented in a GIS format which will aide ease of use.

3.6 Water Use and Costs

3.6.1 Water Demands and Demand Management

Water Consumption & Demands

Data from the TSC shows a decline in water demands for the Tenterfield Water Utility since 1990 (Tenterfield Shire Council, 2010). Over the past 10 years TSC data shows a slight decline in water consumption for Jennings, a decline by almost half for Urbenville and relatively static for Tenterfield (refer to Table 3-29 below). Water usage in the Tenterfield area is however expected to increase at a rate of 0.9%/a over the next 20 years with the increase in development (Tenterfield Shire Council, 2010)

Table 3-29: Annual water demand for Tenterfield, Urbenville and Jennings 2000-2009

Year	Annual Demand (ML)		
	Tenterfield	Urbenville	Jennings
2000	332.9	27.2	12.2
2001	375.2	31.2	14.2
2002	394.8	28.4	12.8

2003	338.8	26.3	12.2
2004	317.7	24.9	10.7
2005	366.3	25.0	15.7
2006	346.4	23.1	11.6
2007	353.4	24.8	10.7
2008	297.8	15.1	8.9
2009	303.1	15.6	10.5

Source: data supplied by Tenterfield Shire Council

More recent data gives a breakdown of the water consumption by different user categories, with the predominant water user being residential in Tenterfield, Urbenville and Jennings. *Tables Table* 3-30*Table 3-31* and *Table* 3-32 show the metered water consumption for different water user categories for Tenterfield, Urbenville and Jennings respectively.

Table 3-30 Tenterfield Water Supply System – Metered Consumption by Category for 2008 to 2009

Demand Category	Consumption (ML/a)	% of Total Consumption	Connections	Average Consumption Per Connection (KL/a/property)
Residential	220.1	61.8%	1438	**153**
Commercial	46.4	13%	201	**230.8**
Rural	14.3	4%	45	**317.8**
Institutional	24.2	6.8%	73	**331.5**
Public Parks, Gardens & Amenities	45.1	12.7%	10	**4512**
Water Losses	6	1.7%	N/A	**N/A**

Table 3-31: Urbenville Water Supply System – Metered Consumption by Category for 2008 to 2009

Demand Category	Consumption (ML/a)	% of Total Consumption	Connections	Average Consumption Per Connection (KL/a/property)
Residential	15.2	67.8%	129	**118.1**
Commercial	1.4	6.25%	15	**373.4**

Rural	N/A	N/A	N/A	**N/A**
Institutional	4.6	20.5%	22	**209.1**
Public Parks, Gardens & Amenities	1.2	5.3%	2	**600**
Water Losses	N/A	N/A	N/A	**N/A**
Totals	**22.4**	**100%**	**166**	**325.2**

Source: Tenterfield Shire Council, 2010

Table 3-32: Jennings Water Supply System – Metered Consumption by Category for 2008 to 2009

Demand Category	Consumption (ML/a)	% of Total Consumption	Connections	Average Consumption Per Connection (KL/a/property)
Residential	8.9	80.2%	94	**94.7**
Commercial	1.2	10.8%	2	**600**
Rural	N/A	N/A	N/A	**N/A**
Institutional	N/A	N/A	N/A	**N/A**
Public Parks, Gardens & Amenities	1	9%	1	**1000**
Water Losses	N/A	N/A	N/A	**N/A**
Totals	**11.1**	**100%**	**96**	**564.9**

Source: Tenterfield Shire Council, 2010

Water consumption data for the major water users for Tenterfield, Urbenville and Jennings is shown in *Table 3-33* below (data based on metered data and supplied by the Tenterfield Shire Council). Note the data shown excludes the abattoirs from Jennings and saw mills in Urbenville.

Table 3-33: Water consumption for large water users in Tenterfield, Urbenville and Jennings during 2007, 2008 and 2009

Large Water User	Annual Water Consumption (kL)		
	2007	**2008**	**2009**
Tenterfield			
Royal Hotel	1644	1675	1121

Caravan Park	1932	1694	1858
Telegraph Hotel	1493	1487	1386
Bowling Club	2436	2367	2301
Golfers Inn	1456	1449	1637
Golf Club	2193	2159	2355
Peter Allen Motor Inn	983	831	351
Jumbuck Motel	999	1254	1463
Craig's Caravan Park	1006	936	1022
BP Seven Nights	1803	1687	1567
Tenterfield Motor Inn	74	1029	1502
Settlers Motor Inn	1022	842	814
Henry Parks Motor Inn	63466	3862	2665
Tavern	611	356	174
Tally Ho Motor Inn	973	995	1044
Urbenville			
Crown Hotel	276	250	284
Jennings			
Service Station	863	837	683
Jennings Hotel	448	336	334

Source: Tenterfield Shire Council

The annual water demands for Tenterfield are predicted to increase in the next 20 years. *Table 3-34* shows the predicted future water demands by user category (Tenterfield Shire Council, 2010).

Table 3-34: Annual water demand forecast for Tenterfield

Demand Category	2010 (ML/a)	2015 (ML/a)	2020 (ML/a)	2025 (ML/a)	2030 (ML/a)
Residential	220.1	230.0	240.4	251.2	262.5
Commercial	46.4	48.5	50.7	53.0	55.3
Rural	14.3	14.9	15.6	16.3	17.1
Institutional	24.2	25.3	26.4	27.6	28.9

Public Parks, Gardens & Amenities	45.1	47.1	49.3	51.5	53.8
Water Losses	6	6.3	6.6	6.8	7.2
Totals	**356.1**	**372.1**	**388.9**	**406.4**	**424.7**

(Source: Tenterfield Shire Council, 2010)

Demand Management Measures

The TSC has implemented a number of water conservation measures to manage water demand, reduce water consumption and promote water wise development. A significant part of TSC's demand management measures was the introduction of the user pays system for water usage in 1995, which lead to a decrease in water consumption by almost one third (Tenterfield Shire Council, 2010). More recently the TSC has also developed a Water Conservation & Demand Management Plan (May 2010) and Best Practice Management initiatives to further address water efficiency and demand issues. The following list outlines some of the demand management measures implemented by Council (information from Tenterfield Shire Council, 2010):

- *Integration of user pays system for water supply (introduced in 1995)*
- *Mandatory dual flush toilet installation in new homes or work places under development*
- *Rebates for efficient appliances in homes constructed before December 2007*
- *BASIX water and energy wise analysis for any proposed development*
- *Bulk water production metered and recorded on a daily basis*
- *All new free standing and multi-unit residential developments (both strata and non-strata) approved after 1 July 2004 must be separately metered*
- *All free standing residential premises must be separately metered by 1 July 2007*
- *Separate metering of existing multi-unit residential developments, where it is deemed cost effective*
- *Customers classified in accordance with the categories defined in the latest NSW water supply and sewerage performance monitoring report and consumptions and reported annually*
- *In the event of high water demand periods, monitoring and recording of daily water levels*
- *Development of leak detection and repair system*
- *Residential audits and retrofit program – effective from 1 July 2010*
- *Non-residential large users audit program (focusing on the Tenterfield LGA's 50 largest water users) – effective from 1 July 2010*

- *Residential rebates (of varying amounts) for rainwater tanks, 4 star WELS rating washing machines, 3 star/AAA rating dual flush toilets and 3 star/AAA rating water efficient shower heads*
- *Community awareness program*

The TSC intends on implementing other water demand management measure in the future including having water consumption metered and billed quarterly (to be implemented in 2011/2012). Water recycling is currently not seen as a commercially viable option for water supply, however this will be re-assessed by Council in the future.

Water Restrictions

Historically water levels in the Tenterfield Dam have varied quite significantly, hence the need for water restrictions have also varied. In May 2010 the dam reached full capacity (data recorded by the Tenterfield Shire Council, 2010), however in recent years there have also been periods with low levels of water available and therefore water restrictions in place. In 2003 the dam levels reached a low of 32%, which was also the last time stage 4 water restrictions were in place (Tenterfield Shire Council, 2010).

Total rainfall recorded at the Tooloom Creek off-take in 2007/08 was 1326 mm. This is more than double the rainfall received in 2006/07 and included 441 mm in January 2008. Water restrictions, initially at Level 3, were further tightened to Level 6 on 12 August 2007 when the water level dropped to 920 mm below spillway at Tooloom Falls or approx 40 % of capacity. Storage levels increased in September 2007 following significant rain which allowed the easing of restrictions to Level 1 as of the 24 September 2007. Level 1 restrictions have been maintained since this time despite the storage remaining at 100% since that time.

Total rainfall recorded at the Tooloom Creek off-take in 2006/07 was 595 mm. Water restrictions were maintained throughout 2006/07 with Level 3 restrictions imposed on 30 June 2007 when the storage level fell to 52% capacity. More stringent levels of restriction are expected if there no significant rainfall to increase the storage levels.

The TSC have developed a Drought Management Plan (June 2010) which details levels of water restrictions, restriction triggers and other drought management measures. *Table 3-35* below, from the Drought Management Plan (Tenterfield Shire Council, June 2010, p.19), outlines the levels of water restrictions for Tenterfield and Urbenville.

Table 3-35: Summary of water restrictions for Tenterfield and Urbenville

Level of Restriction	**1**	**2**	**3**	**4**	**5**
Level Below Spillway	1.0m	1.5m	1.7m	2.2m	4.4m
Dam Storage Condition	70%	60%	50%	40%	15%
Domestic					
Consumer Type	**Restriction Actions**				
Fixed hoses/Sprinklers	2 hrs/day *	BANNED	BANNED	BANNED	BANNED
Approved Micro sprays/Garden Watering Systems	2 hrs/day *	1 hr/day #	1 hr/day #	1 hr/day #	BANNED
Hand held hoses	No Restrictions	No Restrictions	2 hrs/day *	1 hr/day #	BANNED

Swimming Pools and Spas	Filling Permitted	Filling BANNED Topping up permitted	Filling BANNED Topping up permitted	Filling and topping up Banned	Filling and topping up Banned
Washing Hard Surfaces	No Restrictions	Buckets Only	Buckets Only	BANNED	BANNED
Public/Commercial					
Public Gardens	Sprinklers 2 hrs/day *	Sprinklers 1 hrs/day #	Hand held hose 2 hr/day *	Hand held hose 1 hr/day #	BANNED
Sports Grounds	Sprinklers 2 hrs/day *	Sprinklers 1 hrs/day #	Hand held hose 2 hr/day *	Hand held hose 1 hr/day #	BANNED
Show Ground	Sprinklers 2 hrs/day *	Sprinklers 1 hrs/day #	Hand held hose 2 hr/day *	Hand held hose 1 hr/day #	BANNED
Market Gardens	Sprinklers 6 hrs/day	Sprinklers 6 hrs/day ##	Sprinklers 4 hrs/day ##	Sprinklers 2 hrs/day ##	BANNED
Nurseries	Sprinklers 2 hrs/day *	Sprinklers 1 hrs/day #	Hand held hose 4r/day *	Hand held hose 2 hr/day #	BANNED
Washing of Motor Vehicles	No Restrictions	Buckets Only On Grassed Areas	BANNED	BANNED	BANNED
Fountains	No Restrictions	Topping up BANNED	BANNED	BANNED	BANNED
Auto Flush Toilets/Urinals	No Restrictions	No Restrictions	BANNED	BANNED	BANNED
Ready mix concrete	No Restrictions	No Restrictions	No Restrictions	8 hrs/day operation	BANNED
Stock troughs	No Restrictions	No Restrictions	No Restrictions	Automatic filling only **	BANNED
Water cartage	No Restrictions	No Restrictions	Council Approved	Council Approved	BANNED
Others	No Restrictions	No Restrictions	Council Approved	Council Approved	BANNED

Legend:

No Restrictions Apply
Restrictions Imposed
Council Approval Needed to proceed
BANNED

Notes on Restrictions:

* Between 5:30 pm and 7:30 am daily Daylight Saving Time
* Between 4:30 pm and 6:30 am daily Eastern Standard Time
\# Between 6:30 pm and 7:30 pm daily Daylight Saving Time
\# Between 4:30 pm and 5:30 pm Eastern Standard Time
\## Between 6:30 pm and 6:30 am daily Daylight Saving Time and Eastern Standard Time
** Between 9:00 am and 5:00 pm Daily Daylight Saving Time and Eastern Standard Time

Source: Tenterfield Shire Council, June 2010, Drought Management Plan, p.19

The TSC Drought Management Actions Plan applies to all towns in the Tenterfield Shire that are supplied by a reticulated water supply system. The action plan outlines five (5) levels of water restrictions and seven (7) stages of restriction strategies. Each stage has set triggers by which the stage begins and ends with both volume percentages and depth values from below the spillway of either the Tenterfield or Urbenville Dam. Each stage also has remediation actions to help reduce the severity if the drought with daily usage targets that aim to reduce daily consumption by a nominated percentage. *Table 3-36* below, from the Drought Management Plan (Tenterfield Shire Council, June 2010),

outlines the storage condition in the dam which triggers each restriction strategy for Tenterfield and Urbenville.

Table 3-36: Summary of Drought Management Action Plan for Tenterfield and Urbenville

Stage	Storage Condition	Restriction Strategy
Pre-Activation	**> 70%**	• Public Education and consultation • Communication strategies active • Permanent Water Conservation measures implemented – refer Water Conservation and Demand Management Plan
1 (Low)	**70%**	• Permanent Water Conservation Measures enforced • Level 1 restrictions activated • Drought Management Team activated. • Reduce normal average daily household consumption by 10% • Target consumption levels of 220-320 litres/person/day • Review alternate water source availability • Review Emergency Procedures • Step up public awareness campaign • Consider community, commercial and industrial needs
2 (Low to Moderate)	**60%**	• Level 2 restrictions activated • Reduce normal average daily household consumption by 15% • Target consumption levels of 200-320 litres/person/day • Step up public awareness campaign including advertisement of penalties • Consider community, commercial and industrial needs
3 (Moderate)	**50%**	• Level 3 restrictions activated • Reduce normal average daily household consumption by 20% • Target consumption levels of 200-300 litres/person/day • Expand publicity of restrictions and penalties • Public notices on roads and in motels etc • Commence policing of restriction • Consideration of community, commercial and industrial needs
4 (Moderate to High)	**40%**	• Level 4 restrictions activated • Reduce normal average daily household consumption by 30% Target consumption levels of 180-260 litres/person/day • Continue to expand publicity of water conservation, restrictions and penalties • Enforce restrictions and impose penalties • Implement alternative water supply options • Implement emergency procedures • Consider community, commercial and industrial needs
5 (High)	**15%**	• Level 5 restrictions activated • Reduce normal average daily household consumption by 50% • Target consumption levels of 160-220 litres/person/day • Continued public awareness campaign • Finalise alternate water supply options • Consider community, commercial and industrial needs
6 (Very High)	**10%**	• Level 5 restriction maintained and enforced • Target consumption levels of 100-150 litres/person/day • Extensive water conservation maintained and expanded • Consider community commercial and industrial needs
7 (Extreme)	**< 10%**	• Level 5 restrictions maintained and enforced • Target consumptions levels of 100 litres/person/day • Alternate supply commissioned • Water cartage commenced when supply fails

		• Intermittent reticulation supply • Consider community, commercial and industrial needs
Source: Tenterfield Shire Council, June 2010, Drought Management Plan		

During the recent drought periods (2002-05 and 2006-08) water restrictions where implemented by the TSC. The Tenterfield water network experienced Level 3 restrictions in 2003 and level 2 restrictions in during the 2006-08 drought. (TSC 2010). In comparison, the Urbenville water network was impacted more significantly by the recent drought periods. The 2002-05 drought saw the implementation of level 2 restrictions, whilst in 2007 the dam supply level fell below 10% and hence triggered Stage 6 water restrictions. Historical water restrictions for Urbenville are shown below in *Table 3-37*

Table 3-37: Historical Water Restrictions for Urbenville

Date	Water Restriction Stage
23/10/2002	Stage 1
24/02/2003	Stage 2
22/12/2003	Stage 1
06/05/2007	Stage 2
15/07/2007	Stage 3
12/08/2007	Stage 6
23/09/2007	Stage 1

Source: TSC 2010

4. Urban water issues

The purpose of this section is to identify issues within the catchment and urban water cycles. This involves:

- Identify local water utility "targets"
- Auditing the available data to identify current and potential future water cycle management issues;
- Discussing the audit results with stakeholders to further clarify issues; and
- Prioritising the identified issues.

Although some issues have been highlighted by collating background data (see Section 2), auditing the available information on the water system against relevant policy frameworks and guideline documents is important for understanding how well the system is performing and identifying system issues. Issues can then be verified through consultation with stakeholders.

Confirmed issues can then be prioritised by stakeholders so that they can be systematically addressed. A broad list of issues for discussion with Council and stakeholders is provided below in Table 4-1.

Table 4-1: Broad urban water issues

	Issue	Details	Recommendation
Surface Water	Lack of information	Current water usage licence information, surface water extraction limits and water quality information is currently unavailable from Council	Information research and acquisition should be undertaken. An accurate assessment of the current condition of the surface water assets and to estimate their ability to provide adequate quantity and quality of water into the future is required.
Ten'field Dam	Dam does't meet current ANCOLD safety standards	Risk of sliding failure under flood conditions	Structural upgrade of Tent'field Dam is required to meet current dam safety standards.

	Issue	Details	Recommendation
Groundwater	Lack of information	Limited information is available on the use of the groundwater bores and bore licence information. Groundwater vulnerability mapping has not been completed for the western section to the shire, extending west from Tenterfield.	Given the importance of groundwater to the water supply system and the potential impact improper management of this resource can cause to the environment, further investigations should be conducted to enable the long term management of this resource
Bulk water quantity	Tenterfield supply	Shirley Park Bore was damaged during the floods and is presently out of service. This Bore acts a as backup to the Tenterfield Dam water supply	Reinstate bore
	Urbenville supply	Lack of yield analysis information for Tooloom Creek	Undertake yield analysis and determine supply capability of Tooloom Creek Assess ability of Tooloom creek to supply Urbenville water demands.
WS to Kyogle Council	Agreement for water supply to KC	Water supply agreement with Kyogle Council has not been finalised	Finalise WS Agreement
Raw water quality	Urbenville supply	The Tooloom Creek raw water contains a number of microbiological and chemical impurities.	Investigate possible catchment improvements. Ensure fail safes are in place at Urbenville treatment plant to prevent poor water quality impacting treated water quality]
Raw water quantity	Tenterfield & Urbenville supplies	Lack of secure yield study including impact of climate change.	Undertake secure yield studies on Tenterfield & Urbenville water supplies, incl impact of Climate change.

	Issue	Details	Recommendation
Water network	Tenterfield deteriorated water reticulation pipe work	Dirty water has been noted by residence on occasion. No condition assessment of water reticulation network has been completed	Complete water reticulation condition assessment. Remove and replace old or deteriorated pipe work.
Stormwater network	Lack of information	No drainage, catchment, runoff or capacity details are available for assessment of the suitability of the Tenterfield Shires stormwater network.	Detailed stormwater network investigations are required before an assessment of the suitability of the existing stormwater network can be made.
Sewer network	Tenterfield infiltration	Increased flows coinciding with rainfall events suggest significant infiltration into he sewer network occurs. This adds additional and unnecessary strain on the sewage treatment plant.	Further sewer network condition assessments are required Prepare renewal/replacement program to address infiltration/inflow.
Sewer network Sewerage treatment	Lack of asset information	No information on the condition of the TSC sewer network is available.	As recommended in the Tenterfield Sewerage Augmentation Report (MWH 2004) it is recommended that a full asset survey be undertaken of the existing sewerage system
	Lack of capacity information	No information on the capacity of the TSC sewer network is available.	Modelling of the sewer network should be undertaken to provide better decision making with respect to whether to replace, upsize, duplicate or refurbish sewer mains.

	Issue	Details	Recommendation
	Private sewerage	A potential contamination hazard is through private on-site sewerage systems (septic tanks) which are currently not all known by Council. There is concern that surface and ground water systems may be contaminated if not properly monitored and managed by owners.	Develop register of private properties and undertake condition and risk assessments
	Septic tanks	Unsewered villages like Jennings pose a threat to groundwater quality as the potential contamination sources are often distributed over a broad area The likelihood of contamination is increased during rainfall when sewage infiltration areas associated with septic tanks can become inundated.	Provision of a reticulated sewerage service or an effluent collection system in Jennings should also be investigated by Council Condition of septic tanks in Tenterfield and Urbenville should be assessed. Connection to Council sewerage system should be provided if feasible
Water Treatment	Age of Tenterfield Water Treatment Plant	The plant was built in 1930 and is beginning to show signs of significant structural deterioration	Further condition assessments should be completed and possible replacement of treatment plant.

5. Urban water issues assessment

An assessment of the urban water issues was undertaken by Tenterfield Council and the following assessment of actions put forward to address these issues. It is intended that through future consultation with stakeholders and community, further actions will be put in place and the below actions table updated in the near future.

Table 5-1: Issues assessment

Business as Usual Assessment	The sewer reticulation system experiences high volumes during periods of high rainfall leading to the conclusion there is significant stormwater infiltration into the reticulation system. TSC currently has a program in place to identify and reline damaged manholes and mains. This will continue on a yearly basis.
	Maintain current water restriction triggers.
Outstanding Issues	The Tenterfield Water Treatment Plant was built in the 1930's with minimal upgrades since. A thorough investigation is required to determine feasibility of constructing a new water treatment plant
	Investigate provision of a sewer reticulation system in Jennings .
Recommended Strategy	Education and information packages to be established to provide information and guidelines to: • Water users from mains • Water users from tanks.
	Revision to the Rainwater Tank Policy for Dwellings connected to reticulated water supply to allow tank water to be used more appropriately.

References

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Appendix A

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Appendix B

Shirley Bore Water Quality

Appendix C

Referenced document summaries

APPENDIX 2: BACKGROUND DATA – IWCM TARGETS AND ISSUES

This Appendix summarises all catchment, water, urban and legislative obligations, targets and requirements which relate to the provision of urban water services. An assessment of compliance with the obligations which relate to the provision of water supply and sewerage services is also provided.

A1. LEGISLATIVE REQUIREMENTS

The key legislation which drives many of the IWCM targets is discussed in Table A 1.

Table A 1: Key Legislation

Target	Summary of Requirements
Local Government Act, 1993, and *Local Government (General) Regulation 2005*	This Act provides the legal framework for the system of local government in NSW. The Act addresses: • Requirement to comply with DWE best-practice management criteria before making a payment of a dividend from the surplus of Council's water supply or sewerage businesses; • General pricing and headwork charges as well as developer charges for water supply and sewerage services and stormwater contributions; • Approval for private greywater and sewage treatment systems; • Inspection, assessment and licensing of on-site sewage systems; • Approval from the Minister of Land and Water Conservation (i.e. Office of Water) to undertake water supply or sewerage works (Section 60); • Accountable, effective end economical management; • Self-funding of water utility operations, and no cross subsidy with other Council activities; • Stormwater management service charge up to $25 per household; • Ministerial approval for undertaking water supply and sewerage new works and augmentation; and • Agenda 21 and ecological sustainability.
Local Government (Water Services) Regulation,1999	The Regulation supplements the provisions of the Local Government Act 1993 relating to the carrying out of water supply, sewerage and stormwater drainage works by councils and regulates the use of such works including: • The imposing of water restrictions, • The discharge of prohibited matter into sewers and drains, • The functions of councils in relation to water supply, sewerage and stormwater drainage (includes provisions for joint council works, installation of fire hydrants, inspection of pipes and drains, cutting off of water supply and connections to sewerage systems), • General requirements for the carrying out of water supply, sewerage and stormwater drainage work, • The installation, use and testing of water meters, • The use and misuse of water, and • The prohibition of joint sewerage services. The Regulation refers to the Plumbing and Drainage Code of Practice in relation to the laying of house service pipes.
Environmental Planning and Assessment (EP&A) Act, 1979	The Act requires that all proposals, activities and functions which are investigated, designed, planned, constructed and operated should be studied during all stages of their environmental impact on the basis of scale, location and performance. Environmental impact assessments may also be required to satisfy Commonwealth legislation processes. The Act provides the basis for the preparation of environmental planning instruments (refer Table A 2);
Water Management Act, 2000	This Act provides for the sustainable and integrated management of the water sources of NSW. The Act provides a framework for water sharing plans and environmental flows, sets out bulk water supply regimes, defines local water utility access licences and requires TSC to levy developer charges.
Water Act, 1912	In those water sources (rivers, lakes and groundwater aquifers) in NSW where water sharing plans have not commenced, the Water Act 1912 governs the issue of new water licences and the trade of water licences and allocations.

Target	Summary of Requirements
Protection of the Environment Operations (POEO) Act, 1997	Councils and private businesses are required to exercise due diligence to avoid environmental impact. The Act addresses: • Penalties to individuals and corporations who cause pollution; • Council needs to develop operations emergency plans and due diligence plans to ensure that procedures are in place to prevent / minimise pollution; • A system is required to monitor operations, improve controls and reduce risks; • Council's officers, as well as the Council, may be liable for breaches of requirements; • Council has a duty to notify Office of Environment and Heritage of pollution incidents; • System licensing for sewerage systems (Scheduled Activity) including Pollution Reduction Program (PRP) requirements; and • Pollution from private systems - Local councils are the regulatory authorities for non-scheduled activities, except activities undertaken by a public authority which the EPA will regulate.
Public Health Act, 2010	This Act commenced in 2012, replacing the Public Health Act, 1991. The Act requires drinking water suppliers to establish and adhere to a quality assurance program that complies with the Regulation. The Act gives NSW Health powers with respect to the provision of safe drinking water. These include powers to: • Require the issuing of advice to the public on the safety of a drinking water supply; • Require the correction of any misleading information issued to the public; • Enter and inspect premises of a supplier of drinking water; • Require testing of drinking water; • Require production of information including the results of testing; and • Order the rectification or closure of a water supply. The Act was amended to mandate compliance with the "health critical" elements of the Australian Drinking Water Guidelines in regional NSW. Division 1 of the Act deals with safety measures for drinking water and requires that: • Drinking water must be fit for human consumption; and • A supplier of drinking water must establish, and adhere to, a quality assurance program that complies with the requirements prescribed by the regulations. The regulations may make provision for water testing, maintenance of records.
Fisheries Management Act, 1994	The objects of this Act are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Often works associated with water supply structures including dams, weirs, pipelines and extraction points involve works that trigger certain approval requirements under the *Act*, in particular (refer Section A5): • S198-202 provisions relating to dredging and reclamation activities on and within water; • S218-220 provision relating to fish passage; and • Part 7A relating to threatened fish species.
Occupational Health and Safety Act 2000 and Rehabilitation Act 1987	The Acts places emphasis on risk management and consultation with staff to minimise work related accidents and health impacts. Council needs to train staff in safety issues and provide a safe working environment and supply equipment to ensure safety. Council and Council's officers may be liable for breaches of these requirements.
Competition Policy including Competition Policy Reform Act, 1995	Council is subject to prohibition on anti-competitive behaviour, according to the Trade Practices Act. The provision of services by a monopoly is subject to compliance with the National Water Commission (previously the National Competition Council).

Target	Summary of Requirements
Water Industry Competition Act, 2006	The objectives of the Act and supporting Regulations are to encourage competition in the water industry and to foster innovative recycling projects and dynamic efficiency in the provision of water and wastewater services. The core reforms introduced by the Act are the establishment of a new licensing regime for private sector providers of reticulated drinking water, recycled water and sewerage services, provisions to authorise IPART to arbitrate certain sewer mining disputes and the establishment of a third-party access regime for water and sewerage infrastructure.
Dam Safety Act, 1978	The Dams Safety Committee (DSC) operates under the Act. The DSC's statutory role is to ensure the safety of dams and their storage reservoirs in order to adequately protect the interests of the community. Dam owners are required to comply with the Australian National Committee on Large Dams (ANCOLD) *Guidelines on the Consequence Categories for Dams* (September 2012).

Table A 2: Environmental Planning Instruments

Instrument	Summary of Requirements
SEPP Building Sustainability Index (BASIX), 2004	BASIX was mandatory for new residential dwellings in regional NSW from 2005/06. It has now been extended to all residential developments valued in excess of $50,000. BASIX sets energy and water reduction targets for new homes and apartments. Rainwater tanks are now required for all new developments in NSW including new developments for swimming pools or spas that require a BASIX certificate. Water targets range from 40% to 0% across NSW, taking into account the significant variances in climate.
State and Regional Development SEPP, 2011	The system establishes two separate assessment frameworks for State significant development (SSD) and State significant infrastructure (SSI). Projects that fall within these categories will be assessed by the Department of Planning and Infrastructure and determined by the Minister, the Planning Assessment Commission or senior departmental staff. The SSD assessment system has been established to guide planning decisions on: • Large-scale industrial, resource and other proposals in 24 different development classes; or • Development in precincts identified as important for the State by the NSW Government. The SSI assessment system has been established to allow planning decisions on major infrastructure proposals, in particular linear infrastructure (such as roads, railway lines or pipes which often cross a number of council boundaries) or development which doesn't require consent but which could have a significant environmental impact (such as a port facility).
SEPP Infrastructure, 2007	Provides a consistent planning regime for infrastructure and the provision of services across NSW, along with providing for consultation with relevant public authorities during the assessment process.
Tenterfield LEP 1996	The LEP zones a range of areas for various urban land uses. It provides the main statutory basis for future development in the shire. The NSW State Government requires all councils to prepare new LEPs that comply with the Standard LEP Template prepared by the NSW Department of Planning and Infrastructure (DP&I). Council prepared a comprehensive draft LEP based on the Standard LEP and this was placed on public exhibition from 24 September 2012 to 2 November 2012. The Draft LEP 2012 will be forwarded to the DP&I with a request that the Plan be approved by the Minister.
Tenterfield DCP	DCPs indicate to developers what level of detail is required with certain types of applications and what standards are sought with the design of certain developments.

A2. GUIDELINES, STANDARDS AND CODES

Guidelines relevant to IWCM are shown in Table A 3.

Table A 3: Relevant Urban Water Management Guidelines

Target	Summary of Objectives Related to IWCM
Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (2006)	Adopt a risk management approach to managing risks to human health and the environment from recycling of water from greywater and treated sewage.
NSW Interim Guidelines for Management of Private Recycle Schemes (2008)	Provides advice, for obtaining approval to install and operate a private recycled water scheme
NSW Guidelines for Greywater Reuse in Sewered, Single Household Residential Premises (2008)	Guidelines for approval of greywater treatment systems in accordance with Item C6, Section 68, *Local Government Act, 1993*
Environmental Guidelines: Use of Effluent by Irrigation (DECC, 2004)	Guidelines for use of treated effluent in landscape watering, irrigation of pasture, crops, orchards, vineyards, plantation forests or rehabilitated sites and irrigation of golf courses, racecourses and other recreation grounds
Environmental Guidelines: Use and Disposal of Biosolids Products (EPA, 2000)	Guidelines related to the beneficial use and disposal of biosolids
Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households (known as the 'Silver Book'), 1998	Guidelines to assist with the assessment, regulation and management of single household on-site sewage management systems
Managing Urban Stormwater: Soils and Construction Guidelines	Guidelines for managing erosion and sediment control during construction works.

A3. INTEGRATED PLANNING AND REPORTING FRAMEWORK

The NSW Government has established Integrated Planning and Reporting legislation, requiring all councils to establish a long term strategic, infrastructure and financial framework. The "objectives" identified in the Tenterfield Shire Council (TSC) Community Strategic Plan (2013-2023) translate into "strategies" which feed into the Delivery Program. Actions are identified, funded and delivered through the annual Operational Plan. The corporate objectives that are relevant to IWCM are given in Table A 4.

Table A 4: IWCM Objectives from IPR Framework

IPR Component		Summary of Objectives Related to IWCM
Community Strategic Plan (CSP) 2013-2023		Identifies the long term aspirations of the community, key directions, outcomes and key result areas.
Key Directions relevant to IWCM:		
2.2	*Drainage systems allow for effective management of stormwater*	
2.2a	Stormwater drainage systems will be well designed, constructed and efficiently maintained	
2.2b	Effectively manage stormwater quality and protect Tenterfield Creek and other urban water courses.	
2.3	*Urban water supply networks are modern, efficient and meet industry best practice guidelines*	
2.3a	Urban water supply networks will be well designed, constructed and efficiently maintained	
2.3b	Ensure compliance with the Best-Practice Management of Water Supply and Sewerage Guidelines 2007 and the NSW Reference Rates Manual for Valuation of Water Supply, Sewerage and Stormwater Assets	
2.3c	Ensure long-term security of Tenterfield's urban water supply	

IPR Component	Summary of Objectives Related to IWCM
2.4	*Urban wastewater supply networks are modern, efficient and meet industry best practice guidelines*
2.4a	Urban wastewater supply networks will be well designed, constructed and efficiently maintained
2.4b	Ensure compliance with the Best-Practice Management of Water Supply and Sewerage Guidelines 2007 and the NSW Reference Rates Manual for Valuation of Water Supply, Sewerage and Stormwater Assets
3.1	*The natural environment will be protected, enhanced and promoted for future generations*
3.1a	Manage, protect, enhance and conserve the natural environment in a sustainable manner
3.1b	Provide compliance and regulatory services to protect the amenity of the environment
3.3	*A total water cycle management approach including water conservation and reuse is adopted*
3.3a	Implement projects to conserve potable water and contribute to improved water quality outcomes
3.5	*Environmental risks and impacts are strategically managed*
3.5a	Review and prioritise recommendations contained in the NSW Government's Floodplain Development Manual
3.5b	Ensure management of water quality in the catchments
3.6	*Water is used carefully in Council's buildings, parks, sporting grounds and daily operations*
3.6a	Minimise water use in Council operations and facilities

A4. STATE OF THE ENVIRONMENT REPORT

The Tenterfield State of the Environment Report 2009-2012 (Tenterfield SOE, TSC, 2012b) has been prepared in accordance with section 482A of the *Local Government Act, 1993*. The SOE reports on environmental issues identified in the previous Tenterfield Community Strategic Plan (2011-2021), indicators, trends and impacts in Tenterfield Shire during the period 1st July 2009 to 30th June 2012. This report uses long term data collected through State of the Environment Reports produced since 1997 and data provided by Council, relevant NSW and Federal Government Departments, Catchment Management Authorities and local environment groups. Relevant indicators, measures and current results for the period 2009-2012 are shown in Table A 5.

The key highlights of the 2009-2012 SOE Report related to IWCM were a trend towards decreased water use in the Shire and a significant increase in kilometres of stream reach protected. Challenges include some minor non-compliance with STP licence requirements and an increase in community calls regarding water, which may reflect increasing concern or greater awareness about water related issues.

Table A 5: Performance Indicators and Measures from SOE Report

Environmental Direction	Indicator	Measure	Result 2009-2012
The natural environment will be protected, enhanced and promoted for future generations	Water quality	Compliance/non-compliance with Sewage Treatment Plant licence requirements	Non-compliant (refer Section A10) - Minor non-compliance, overall quality of treated effluent a significant improvement on previous periods due to the new STP at Tenterfield.
	Waterways protected	Kilometres of stream reach protected	Total Border Rivers Gwydir Catchment 53.731 km, mean = 17.910 km p.a. Northern Rivers Catchment = 5 river protection projects funded (length unknown) This was a significant increase of approximately 21 km of stream reach protection compared to the previous SOE reporting period.

Environmental Direction	Indicator	Measure	Result 2009-2012
A total water cycle management approach including water conservation and reuse is adopted	Water use	Domestic water consumed per year	Mean of 318,068 kL/yr. This was a significant decrease in consumption compared to previous years (26% less than the previous SOE reporting period)
	Level of community concern regarding water	Number of call received by Environment Line regarding water	Mean of 6 calls/yr. This was an increase of 3 calls (50%) compared to the previous SOE reporting period.
	Water quality	Compliance/non-compliance with Sewage Treatment Plant licence requirements	Refer above.
Environmental risks and impacts are strategically managed	Level of community concern regarding water	Number of call received by Environment Line regarding water	Refer above.
	Water quality	Compliance/non-compliance with Sewage Treatment Plant licence requirements	Refer above.
Water is used carefully in Council's buildings, parks, sporting grounds and daily operations	None (resourcing is required in order for Council to undertake a review and inspection of Council facilities where a reduction in water use may be possible)		

Source: TSC (2012b)

A5. FISHERIES POLICIES AND GUIDELINES

The development of IWCM strategies is required to consider the state government policies on fisheries management.

The objectives of the *Fisheries Management Act 1994* are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Part 7 of the Act deals with the protection of aquatic habitats and Part 7A deals with threatened species conservation.

Under the 'integrated development' provisions of the *NSW Environmental Planning and Assessment Act 1979*, the NSW Department of Primary Industries (DPI) is an 'approval body' for local development that requires permits under the *Fisheries Management Act*. Activities that may not require development consent under the EP&A Act may still require a permit under Part 7 or 7A of the *Fisheries Management Act*. Relevant activities include:

- Section 198 – 202: permit to carry out works of dredging or reclamation, i.e. any excavation within or filling of water land. Dredging works may be required to construct the footings or foundations for waterway crossings. Reclamation works could include the construction and replacement of pylons and abutments for bridges, creation of in-stream construction pads to access the works or the placement of material in a waterway to construct temporary or permanent waterway crossings;
- Section 218 - 220 - permit to obstruct the free passage of fish; and
- Part 7A relating to threatened fish species. Works that could impact on threatened fish species would require assessment (test of significance and possibly a threatened species impact statement).

Threatened fish species occurring within the Tenterfield LGA include:

- Purple Spotted Gudgeon;
- Western population of Freshwater Catfish; and
- Western population of Olive Perchlet.

Records of the occurrence of these species are known from Tenterfield Creek (below the dam), the Mole River, Deepwater River and many of their tributaries. Within the eastern flowing waters, Purple Spotted Gudgeons have been recorded in Oakey Creek and are expected in the Clarence River and many of its tributaries. Eastern Freshwater Cod are known to occur in the Timbarra and Clarence Rivers and are expected to occur in several major tributaries (P. Dwyer, 2013).

A Priority Action Statement (PAS) is a statutory, non-regulatory document addressing each threatened species, population and ecological community and key threatening process listed on the schedules of the *Fisheries Management Act*. The PAS:

- Sets out the strategies to be adopted for promoting the recovery of each threatened species, population or ecological community to a position of viability in nature and for managing each key threatening process;
- Establishes relative priorities for the implementation of recovery and threat abatement strategies;
- Establishes performance indicators to facilitate reporting on the implementation of recovery and threat abatement strategies and their effectiveness;
- Contains a status report on each threatened species, where information is available; and
- Sets out clear timetables for recovery and threat abatement planning and achievement.

Currently listed key threatening processes under the *Threatened Species Conservation Act 1995* for NSW include the “alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands”.

A6. WEIRS POLICY

In September 1995, the Minister for Land and Water Conservation announced that a State-wide review of weirs would take place as part of the water industry reforms. The State Weirs Policy provides the framework for that review and establishes the goals and principles for the ongoing approval and management of weirs. The goal of the State Weirs Policy is to halt and, where possible, reduce and remediate the environmental impact of weirs. The goal is to be supported by the adoption of the following management principles:

- The construction of new weirs, or enlargement of existing weirs, shall be discouraged.
- Weirs that are no longer providing significant benefits to the owner or user shall be removed, taking into consideration the environmental impact of removal.
- Where retained, owners shall be encouraged to undertake structural changes to weirs to reduce their impact on the environment.

In 1999, NSW Fisheries and the (then) Department of Land and Water Conservation undertook the NSW Initial Weir Review (2002) to identify priority sites for further investigation. The review did not identify any priority weir sites managed by Tenterfield Shire Council.

A7. WATER SHARING PLANS AND LICENCES

The *Water Management Act, 2000* requires the implementation of ten-year plans defining water sharing arrangements between the environment and water users. Water Sharing Plans set rules for sharing water between the water users and environmental needs of the river or aquifer, and also between the different types of water use such as town water supply, stock watering, rural domestic supply, irrigation and industry.

The aims of the water sharing plans are:

- To protect the fundamental environmental health of the water source;
- To ensure that the water source is sustainable in the long-term; and
- To provide water users with a clear picture of when and how water will be available for extraction.

There are two commenced Water Sharing Plans governing water supplies within the Tenterfield LGA. They are:

- NSW Murray-Darling Basin Fractured Rock Groundwater, commenced 16 January 2012; and
- Tenterfield Creek Water Source, commenced 1 July 2004.

The *Water Management Act* governs the issue of new water licences and the trade of water licences and allocations for those water sources (rivers, lakes and groundwater) in NSW where water sharing plans have commenced. The *Water Act 1912* governs the issue of water licences in other areas. Once a water sharing plan commences, all existing *Water Act 1912* licences are converted to water access licences (WAL) and approvals under the *Water Management Act*. Specific purpose category licences (such as local water utility, domestic and stock access licences and Aboriginal cultural licences) provide higher priority access to water than licences for most 'commercial' categories' such as 'high security', 'general security', 'unregulated' and 'aquifer'.

From the date of commencement of the plan, WALs have a share component and an extraction component. Licence holders must comply with both the share and extraction components. TSC has WALs for Tenterfield Dam and Shirley Park bore (Table A 6).

Table A 6: Water Sharing Plans, Town Water Sources and Water Access Licences

Water Sharing Plan	Water Sharing Plan Area/ Source	Town Water Source/ Storage	Water Access Licence	Share Component (ML/yr)	Extraction Component
NSW Murray-Darling Basin Fractured Rock Groundwater	New England Fold Belt groundwater source	Shirley Park bore	WAL31091	160	Subject to conditions (monitoring, reporting and maximum allocations) water may be taken at any time or rate.
Tenterfield Creek Water Source	Tenterfield Creek (zone 1)	Tenterfield Dam	WAL6491	824	Water may be taken at any time or rate from river, lake or surface water runoff. During periods of very low flow or low flow water may be taken (subject to announcements by the Minister) when the outflow equals or exceeds the inflow to the dam, or when there are no inflows to the dam.

The Urbenville water supply is not currently subject to a Water Sharing Plan but is likely to be incorporated in the Clarence Unregulated and Alluvial Water Sources Water Sharing Plan (due for release in 2013/14).

Water Sharing Plans are reviewed after ten years and the plan for the Tenterfield Creek Water Source will be reviewed by NSW Office of Water by June 2014. The Office of Water has advised that it is likely that the Plan will be incorporated into the Water Sharing Plan for the NSW Border Rivers Regulated River Water Source (commenced 2009) and that the review is unlikely to alter the town water supply licence conditions (pers. comm, T. Rabbidge, May 2013).

A8. NSW FLOODPLAIN HARVESTING POLICY

Floodplain harvesting is the capture and use of water flowing across a floodplain that is not covered by another extraction category such as an access licence, harvestable right or capture of irrigation runoff in tailwater return systems according to licence conditions or best management practices. The NSW Government issued the NSW Floodplain Harvesting Policy in 2013 to bring floodplain harvesting activities into a statutory licensing and approvals framework under the *Water Management Act 2000*.

The Policy provides a framework for the management of water extraction from floodplains for the benefit of existing water users and the environment. The Policy ensures that eligible floodplain water users have the security of a water licence that is compensable under the *Water Management Act,* which is the case for most other water categories. Under the Policy, the amount of floodwater available for extraction in NSW will be capped and shared among existing water users. All works undertaking floodplain harvesting extractions will require an approval from the NSW Office of Water before being used to capture floodplain harvesting water.

A9. AUSTRALIAN DRINKING WATER GUIDELINES

The Australian Drinking Water Guidelines (ADWG) were developed by the National Health and Medical Research Council (NHMRC) and the Natural Resource Management Ministerial Council (NRMMC). The ADWG defines safe, good quality water and how it can be achieved and assured. The ADWG provides a framework for management of drinking water supplies, which will assure safety at point of use when correctly implemented.

The *Public Health Act, 2010* and *Regulation 2012* require water utilities to prepare and implement a risk-based drinking water quality management plan in accordance with the ADWG. The Framework for Management of Drinking Water Quality is a preventive management approach that encompasses all steps in water production from catchment to consumer. The Framework incorporates a preventive risk management approach including elements of the Hazard Analysis and Critical Control Point (HACCP) system, Australian and International Standards (ISO 9001 and AS/NZS 4360), but applies them in a drinking water supply context to support consistent and comprehensive implementation by suppliers.

The coverage of the framework includes all aspects of supply from catchment to consumer and all water products, systems and organisational responsibilities.

TSC has prepared its Drinking Water Management System (DWMS). Development of the DWMS included analysis of water quality data and risk assessments. The DWMS (Viridis Consultants, 2013b) identifies the preventive measures and residual risk and improvement measures (risk treatment) for each water supply system as follows:

- Tenterfield water supply: The unacceptable residual risks, after considering the barriers and preventive measures were from bacteria and protozoa. The hazardous events that can result in bacteria and protozoa being unacceptable residual risks are major run-off events, incorrect dose of alum, filter break-through, failure of UV system and stagnation in reservoirs.

  Improvement actions have been assigned to the unacceptable risks as follows:

  - Investigate online raw water and colour monitoring;
  - Investigate alternate coagulant and coagulant dosing equipment;
  - Investigate online monitoring for settled water pH and turbidity;
  - Investigate online turbidity meters on individual filters;
  - Conduct condition assessment of media and replace/replenish as necessary;
  - Investigate UV system performance;
  - Investigate improving turnover and mixing in reservoirs;

- Formalise reservoir cleaning program; and
- Rectify tree root issues and repair/line reservoir walls.

The areas where further investigations are required to inform the risk for the Tenterfield scheme are stagnation of water at the reservoirs (as no chlorine is tested in the reservoirs) and potential for disinfection by-product formation in reticulation (no data).

- Urbenville water supply: The unacceptable residual risks after considering the barriers and preventive measures were from bacteria and protozoa. The hazardous events that can result in bacteria and protozoa having unacceptable residual risks are major run-off events, incorrect dose of alum and failure of the chlorination system.

  Improvement actions were identified to manage the unacceptable residual risks as well as to optimise the treatment processes as follows:

  - Set up alarms for water turbidity;
  - Raw water testing for manganese;
  - Investigate improving electrical circuitry for alum dosing;
  - Set up auto plant shutdown if high raw water turbidity occurs to enable jar testing and correction of chemical dosing; and
  - Establish communication protocol with Kyogle Council to optimise storage during rain events.

  The areas where further investigations are required to inform the risk for the Urbenville scheme (uncertainty level being 'estimate') are the stagnation of treated water in the reservoir and the formation of disinfection by-products.

- Jennings water supply: The unacceptable residual risk for the Jennings scheme was from bacteria. The hazardous event relating to bacteria was receipt of out of specification water from SDRC.

  An improvement action to formalise the water supply agreement between TSC and SDRC, including communication protocols and water quality criteria has been identified.

- Whole scheme: Improvement actions have been identified as:
  - Prepare operation and maintenance manuals for each scheme;
  - Develop water asset management plans including targets for levels of service;
  - Commission new standby generator;
  - Develop and adopt a drinking water quality policy;
  - Develop standard operating procedures;
  - Develop water quality incident and emergency response plan; and
  - Investigate one-off project to test for disinfection by-products with local public health unit (PHU)

The DWMS also specifies investigative studies and research monitoring including strategic programs designed to increase understanding of the water supply systems, to identify and characterise potential hazards, to fill gaps in knowledge and decrease level of uncertainty during the risk assessment process.

A10. ENVIRONMENT PROTECTION LICENCES

Sewage systems with capacity greater than 2,500 persons or 750 kL/d are scheduled activities which are required to be licensed under the *POEO Act*. Council holds Environment Protection Licences for Urbenville and Tenterfield STPs as well as water supply operations. The licences specify load, concentration and volume limits for the discharge monitoring points. The STP licences also require TSC to monitor and record:

- Pollution complaints;
- STP bypasses;
- Biosolids; and
- Sewer overflows to the environment.

Under the licences, TSC is required to produce annual return documents, notify of any harm to the environment as a result of the sewerage system operation, provide written reports as requested by the authority, notify of bypass or overflow incidents and supply annual performance reports. The licences include pollution reduction programs (PRPs) and Special Conditions if improvements to operation of the sewerage systems are required.

Table A 7 provides a summary of the *POEO Act* licences held by TSC.

Table A 7: Environment Protection Licences

Licence No.	Premises
4306	Urbenville STW (discharge to Beaury Creek)
4305	Tenterfield STW (discharge to Tenterfield Creek)
7661	Tenterfield Water Supply Dam (chemical control of algae, non-scheduled activity)
4304	Tenterfield WTP (discharge of backwash water)

Details of the non-compliances with the licence requirements over the last 3 years are given in Table A 8.

Table A 8: Details of Non-Compliances from 2009/10, 2010/11 and 2011/12 Annual Returns

Item	Year	Result	Licence Requirement	Explanation provided in Annual Return
Tenterfield sewage treatment works				
pH	09/10	Number of samples meeting concentration limits in licence was less than 90%ile. Results for pH exceeded the maximum pH limit on 4 occasions during 2009/10 (max 9.5).	6.5 – 8.5 (90%ile of results must be within range)	Algae bloom in detention pond. Adjustment for pH not possible. Naturally occurring condition over warmer months.
Flow	09/10	Not recorded for 16 days during 2009/10	Daily	Delayed installation of flow meter
Phosphorous	09/10	No result on 2 occasions during 2009/10	Monthly	Laboratory results not returned
Late completion of Annual Return	09/10	Submitted after 23 Nov 2010	Submit by 23 Nov 2010	Resignation of Services Manager and other staff unavailable.
Nitrogen	10/11	No result on 1 occasion in 10/11	Monthly	Laboratory results not returned
Flow	10/11	Not recorded for 3 days during 2010/11	Daily	Flow meter malfunction. Meter repaired after 3 days.
Flow	11/12	High result not correct	Daily	Flow meter malfunction.

Item	Year	Result	Licence Requirement	Explanation provided in Annual Return
Urbenville sewage treatment works				
Late completion of Annual Return	09/10	Submitted after 23 Nov 2010	Submit by 23 Nov 2010	Resignation of Services Manager and other staff unavailable.
Total Suspended Solids	09/10	Number of samples meeting concentration limits in licence was less than 90%ile. Results for TSS exceeded the maximum limit on 2 occasions during 2009/10.	30mg/L (90%ile of results must be below this limit)	Build-up of algae in tertiary pond over summer. Silver perch were added to pond and outcomes being monitored.
Total Suspended Solids	10/11	Number of samples meeting concentration limits in licence was less than 90%ile. Results for TSS exceeded the maximum limit on 2 occasions during 2010/11.	30mg/L (90%ile of results must be below this limit)	Very high rainfall and/or presence of algae in maturation ponds. Operator will investigate placing filter on maturation pond outlet.
Total Suspended Solids	11/12	Number of samples meeting concentration limits in licence was less than 90%ile. Results for TSS exceeded the maximum limit on several occasions during 2012.	30mg/L (90%ile of results must be below this limit)	High levels coincided with high rainfall. Future investigation into stormwater ingress and infiltration reduction proposed.
Tenterfield water treatment plant				
Late completion of Annual Return	09/10	Submitted after 23 Nov 2010	Submit by 23 Nov 2010	Resignation of Services Manager and other staff unavailable.

There were a number of non-compliances reported at the Tenterfield STW over the last three years. Water quality limits for pH were exceeded on four occasions in 2009/10, with high pH attributed to algal blooms in the detention pond. The annual return described this as a naturally occurring condition over warmer months with adjustment for pH not possible. There were no non-compliances for pH in the following year (2010/11). The other non-compliances were related to missing results due to either laboratory errors (2 results for phosphorus and 1 result for nitrogen not returned) or delays in equipment installation or equipment malfunction (flow meter). There was also a late completion of the 2009/10 annual return due to staff resourcing issues.

There were no water quality or data non-compliances at the Tenterfield WTP. The only non-compliance arose from late completion of the 2009/2010 annual return due to staff resourcing issues.

The 2009/10 and 2010/11 annual returns for Urbenville STW recorded two occasions when TSS exceeded the 90 percentile concentration limit. Very high rainfall and/or presence of algae in maturation ponds were identified as the main causative factor for the non-compliance and TSC reported that staff would investigate mitigation strategies.

The NSW Environmental Protection Authority (EPA) issued a notice under the *Protection of the Environment Administration Act 1991* to all NSW councils early in 2012, requiring each council to develop a Pollution Incident Response Management Plan (PIRMP) for each licence held. TSC has prepared PIRMPs for the licensed treatment works in accordance with the Environmental Guidelines: *Preparation of Pollution Incident Response Management Plans*. The purpose of the PIRMP is to provide a vehicle for identifying potential pollution incidents, understanding and evaluating the likelihood of occurrence, identification of mitigation techniques and a clear “who to advise” register.

A11. NATIONAL WATER INITIATIVE AND BEST-PRACTICE MANAGEMENT

The National Water Initiative (NWI) agreement is Australia's blueprint for national water reform. The agreement has been signed by all State governments. It provides objectives, outcomes and agreed actions to be undertaken by state and local governments across all aspects of water management.

TSC is required to demonstrate compliance with the NWI by encouraging best-practice through effective, efficient and sustainable water supply and sewerage businesses. The *Best Practice Management of Water Supply and Sewerage Guidelines* (DWE, 2007) were prepared to encourage continuing improvement in performance and identify criteria for best practice management of water supply and sewerage. Substantial compliance with the Best-Practice Guidelines is a pre-requisite for State Government financial assistance towards the capital cost of backlog water supply and sewerage infrastructure and for payment of a dividend from the surplus of the water supply or sewerage business to the council's general revenue. Compliance with the Best-Practice Management Guidelines is also a requirement of the Division of Local Government's Planning and Reporting Manual. To facilitate council reporting under the NSW Local Government Integrated Planning and Reporting Framework, the strategic business plan are now required to provide input to the 10-year Community Strategic Plan, the 4-year Delivery Program and the Annual Operational Plan.

The TSC Community Strategic Plan (2013-2023) identified compliance with the best-practice guidelines as a key priority for the community (refer Section A3).

There are six criteria TSC needs to complete to demonstrate best-practice management of water and sewerage businesses (Table A 9). In 2011/12, Council complied with all Best Practice Requirements for water supply and sewerage (NSW Office of Water, 2013a).

Table A 9: Best-Practice Management Requirements

Criteria	Summary of Requirements	Comments on Compliance
Strategic Business Planning	A current, sound Strategic Business Plan (SBP). A robust 20-year financial plan which includes a capital works plan and identifies the lowest possible typical residential bill (TRB).	Council adopted the Water and Sewerage SBPs in 2002 and 2005 respectively. These should be updated in accordance with the current guidelines and incorporating the recommendations of this IWCM Strategy Plan. Financial plans were prepared in 2005. The financial plans should be updated each year with revised capital works programs to determine appropriate funding scenarios.

Criteria	Summary of Requirements	Comments on Compliance
Pricing (including Developer Charges, Liquid Trade Waste Policy and Approvals)	Full cost recovery for water supply and sewerage businesses. Appropriate tariffs without significant cross-subsidies. Total annual income and projected TRB should be consistent with the financial plan, generally resulting in a positive economic real rate of return (ERRR). Water supply tariff with appropriate water usage charge/kL based on long-run marginal cost, access charge relative to a customer's capacity requirements, step price increase for high water consuming residential customers. At least 50% of residential revenue generated through usage charges by June 2008. Appropriate sewerage tariff with uniform residential bill and a two-part tariff to non-residential customers. Complying liquid trade waste fees and charges for all liquid trade waste dischargers. Liquid trade waste approval issued to each trade waste discharger. Development Servicing Plan with commercial developer charges. For dual supply systems with non-potable component, LWUs are encouraged to install water meters and apply an appropriate non-potable water usage charge per kL based on long run marginal cost and access charge relative to customer's capacity requirements.	TSC adopted the Development Servicing Plans in 2012. TSC adopted the Liquid Trade Waste Policy in 2011. In 2010/11, 42% of residential water supply revenue was derived from usage charges. Council is required to increase this to 50% to comply with the best-practice guidelines. The water supply tariff should be adjusted to provide the required level of income from user charges. The sewerage tariff complies with the guidelines.
Water Conservation	Sound water conservation and demand management in place, involving appropriate demand forecasting, monitoring and management and subsidy of at least 2 of the identified demand management initiatives.	The Demand Management Plan was completed and adopted in June 2010.
Drought Management	Sound drought management implemented in accordance with the adopted schedule of trigger points for implementation of water restrictions.	The Drought Management Plan was completed and adopted in July 2010.
Performance Monitoring	Completed performance reporting forms to DWE by 15 September each year. Performance reported data audited in an independent, rigorous and comparable manner. Review 2-page LWU Performance Report and prepare Action Plan.	Performance Reports are completed each year.
Integrated Water Cycle Management (IWCM)	Completion of IWCM Evaluation by June 2007. Completion of IWCM Strategy by June 2008. Implementation of IWCM in accordance with the Strategy by June 2008.	This IWCM Evaluation Strategy complies with the best-practice requirements.

A12. CLIMATE CHANGE

Natural variations in temperature and rainfall in NSW are influenced by the naturally variable climate systems. Although there is natural variability in the climate, there is consensus among climate scientists that the rate and magnitude of climate change is outside the expected range of this natural variability. Climate change is an important consideration for strategic planning. It is generally anticipated that rainfall events will become more intense, even if average rainfall reduces, in response to climate change (refer Section 3.4, Appendix 1, PB, 2012). This may result in effects such as more floods as well as greater erosion of unconsolidated sediments within the catchment.

There will be impacts from climate change that are unavoidable such as changes to rainfall patterns and therefore long-term management planning needs to consider the likely changes and the factors constraining adaptation to such change. Council needs to ensure that water cycle management planning accounts for climate change adaptation requirements to ensure appropriate function of the water supply, wastewater and stormwater systems under climate change conditions.

Changes in customer demand and usage patterns should also be considered in future water service planning. Adaptation to climate change impacts and public awareness is important for effective partnership. Water security planning needs to accommodate drought and flood impacts and maintain sufficient flexibility to adapt as climate change science improves.

A13. WATER SUPPLY AND SEWERAGE ASSET MANAGEMENT

The TSC Community Strategic Plan (2013-2023) identified design, construction and efficient maintenance of the water supply and sewerage systems as a key priority for the community (refer Section A3).

A13.1 Asset Management Plans

Asset Management Plans for water and sewerage services have been developed by Council to define levels of service, how the services will be provided and how much it will cost. The Plans also detail information about infrastructure assets (condition, age, life cycle etc.) and actions required to provide the agreed level of service in the most cost effective manner.

The *TSC Water Supply Asset Management Plan* (TSC, 2013d) identifies the following issues:

- Ageing Tenterfield WTP (initially built in 1930) needs to be considered for replacement in the short to medium term. This is discussed further in Section A13.7. The ageing back-up generator needs replacement;
- Tenterfield Dam wall needs upgrading to reduce risk to town and continuity of supply;
- High electricity usage at the treatment plants (Council is planning to install solar panels); and
- Ageing reticulation network.

In January 2011, Tenterfield Creek overflowed and flooded the Shirley Park bore site. The perimeter fence was severely damaged and subsequently removed. The onsite storage tank was undermined and two of the bore header pressure gauges were severely damaged (TSC, 2011b). The bore and associated infrastructure has not yet been reinstated. Council plans to commence work when the dam levels indicate the bore may be needed.

The *TSC Sewerage Asset Management Plan* (TSC, 2013e) identifies the following issues:

- In the older sewers, there is a high degree of stormwater infiltration into the collection system, resulting in severe over-loading at the Tenterfield STP during storm events. However STP bypasses have not occurred;
- The STP at Tenterfield is a new 3,700 EP facility completed in 2009. However, it has limited capacity to handle future growth in Tenterfield; and

- The back-up generator and electrical control panel for the main pumping station in Drummond Street is vulnerable to flooding and needs to be raised above flood level.

Water supply and sewerage assets were re-valued in 2012 using "fair valuation" principles. The asset valuation undertaken in 2012 included asset management recommendations as follows (CPE Associates, 2012):

- The asset registers are in reasonably good condition. It is important that as Council acquires, disposes and replaces assets within its network that sufficient engineering data is captured to allow these assets to be re-valued according to a replacement cost approach;
- Council should continue to maintain the main water supply dam to optimise its service life. A modern replacement structure might be beyond the economic resources of the shire to fund;
- Council should conduct a strategic assessment of its water treatment plant to determine whether the original operating elements of the plant should be rehabilitated or replaced. The Tenterfield WTP is partially unserviceable with the original 1930s plant currently not in service. Plant capacity has been reduced from 5 to 3.5 ML/day. This is discussed further in Section A13.7;
- Council should monitor the state of the white PVC pipe system in Jennings for early signs of brittle failure and deterioration, as this pipe media is failing in many places in Australia where pressure variation and the margin between the working head and the rated maximum head is minimal. Failure can be systemic and occur over a limited period; and
- Sewer mains constructed of concrete are showing severe signs of surface pitting and exposed aggregate, which is typical where sulphide slimes colonise the upper inner pipeline walls, and corrode the pipe wall by removing calcium from it. This will eventually lead to exposure of the steel reinforcing where it is present and ultimately the collapse of the pipe. A significant number of these pipes are assumed to be in a critical condition. Financial resources should be allocated to undertake further inspections to confirm the current condition of these mains and planning for their near-term replacement. Where sulphide slimes have been found, these need to be treated using a light application of pressure jet cleaning on a quarterly basis. It is further recommended that Council seek expert advice on how to control the production of sulphides in the sewers.

Asset management recommendations were also provided in the Sewerage System Overflow reports (Echelon 2007a; Echelon, 2007b) including CCTV surveys, additional chemical treatment and smoke testing to further assess the long-term condition of sewer infrastructure as well as development of a GIS system based on work-as-executed plans for easier location of system elements (refer Section A13.3).

A13.2 Strategic Business Plans

TSC's Strategic Business Plans (SBPs) for Sewerage and Water Supply Services were prepared in 2005 and 2002 respectively. These identified the performance of the water supply and sewerage services, levels of service and issues to be addressed.

Table A 10: Strategic Business Plan Objectives, Targets, Strategies and Performance Indicators – Water Supply and Sewerage

Objective	Performance Target	Strategy	Performance Indicator
Customer Service			
Provide water supply/sewerage services to all small urban communities where there are identified significant environmental and health risks, community desires and economic feasibility.	Complete by 2017.	Examine the feasibility of providing services to all towns	The percentage of urban residents unserved.

Objective	Performance Target	Strategy	Performance Indicator
Community consultation to be undertaken with interested parties when major capital works are proposed.	100% of affected stakeholders contacted.	Undertake consultation with the community	Percentage of stakeholders/interested parties contacted
To encourage responsible use of water through consumer education, pricing policy and restriction levels	10% reduction on normal per capita annual demand	Reduce system leakage and improve water accounting. Develop consumer education program. Pricing Policy	Per capita annual demand
Eliminate all illegal stormwater and other connections to the sewerage system.	No illegal connections.	Carry out a thorough drainage inspection of all sewered premises. Reduce stormwater entering the system. Control trade waste entering the system	Number of illegal connections found per year Progressive reduction in peak wet weather flows
Environment			
Responsibly manage the water supply/sewerage systems to meet regulatory requirements and to minimise adverse environmental impacts.	Water supply/sewerage systems to have no significant impact on the environment.	Develop measures to reduce existing environmental impacts	No failures to meet EPA licence
Public Health			
To maintain the present high quality of the water resource	Meet the water quality parameters outlined in the NHMRC guidelines	Control activities in the catchment area to maintain water quality. Disinfect water supply and roof reservoirs.	Water quality complies with requirements such as NHMRC guidelines
Asset Management			
Operate and maintain and enhance the systems to deliver reliable water supply/sewerage services to customers.	No operational failures above the Levels of Service.	Improve management and operation of the systems. Improve reliability of system. Minimise environmental impacts	Compliance to EPA and Level of Service requirements
Provide appropriate infrastructure to meet current and projected demands to agreed Levels of Service, with the ability to economically accommodate additional unexpected demand.	No Levels of Service failure due to inadequate infrastructure. Upgrade as noted within strategy studies	Develop long term major infrastructure to supply the Shire's needs. Implement short term measures to improve the existing system.	Capacity/Demand
Human Resources			
Provide skilled staff to effectively operate and reliably maintain the systems to deliver agreed Levels of Service.	No Levels of Service failure due to inadequate human resources.	Review current needs. Adjust resources to suit needs.	Adequate staffing levels

Objective	Performance Target	Strategy	Performance Indicator
Finance			
Finance the establishment and operation of the systems, with appropriate borrowings, to achieve equitable cost burdens between present and future customers and between communities within the Shire.	Equitable cost burdens are achieved.	Develop a long term funding strategy. Maintain adequate charges	Equitable cost structures are developed
Proposals for capital works to improve Levels of Service will be subject to scrutiny by Council and community, on the impact on affordability and Council's financial position.	Capital works undertaken should be within both the Council's and the community's financial capacity.	Balance Levels of Service with consumer acceptance and financial risk	Council has financial capacity and community expectations are met

The Levels of Service define the standards required from TSC's water supply and sewerage systems and direct Council's detailed planning (refer Table A 11 and Table A 12). The standard of service desired must be balanced against the cost of providing the service.

Table A 11: Sewerage Levels of Service

Description	Unit	Level of service	
		Tenterfield	Urbenville
Effluent reuse			
Amount of effluent to be re-used	% of effluent	75	0
Service interruptions			
Planned	number/year	0	0
Unplanned	number/year	60	5
Max length of interruptions	hours	2	2
Other complaints	number/year	2	2
System failures			
System overflows	number /year	0	0
Response time			
Chokes (blockages)	Hours	1	1
Verbal complaints	Hours	1	1
Written complaints	Days	14	14
Effluent management			
Maximum quantity	kL/day	650	N/A
Quality – current (EPA licence) - BOD - Suspended solids/NFR - Grease and Oil - pH	 mg/L mg/L 10 -	 40 45 Not specified 6.5 – 8.5	 20 30 10 not specified
Future	As determined by EPA (probably more stringent)		

Note: the Levels of Service are the current targets which Council aims to meet. They are not intended as a formal customer contract.

The Levels of Service have been compared to the available data on Council's current performance (refer Section A13.5). Non-compliances are:

- Between 14 and 19% of effluent is recycled (target is 75% in Tenterfield);
- There were between 17 and 20 sewerage service complaints per year between 2009/10 and 2011/12 (target is 4 per year);
- Effluent quality at Urbenville STP does not always comply with the licence requirements (refer Section A10).

Data on service interruptions and response times are not available.

Table A 12: Water Supply Levels of Service

Description	Unit	Level of service		
		Tenterfield	Urbenville	Jennings
Availability of supply				
Normal Quantity Available:				
Domestic Peak Day	kL/dwelling/day	3.0	2.10	2.50
Domestic Annual	kL/dwelling/year	415	395	350
Total Peak Daily Capacity	ML/day	4.9	0.25	0.20
Total Annual Secure Capacity	ML/year	550 (1), 615 (2)	175	65-130
(1) If environmental flows are required to be maintained, capacity is 510 ML/a (2) Estimated current unrestricted demand				
Fire Fighting:	L/s			7.5
Compliance with Building Code of Australia and NSW Fire Brigade requirements	% area	75	100	100
Pressure				
Minimum pressure when conveying maximum instantaneous demand (0.15 L/s/ET)	m head	< 12 (3)	Not Known	Not Known
(3) Affects 25% town				
Maximum static pressure	m head	70	60	50
Service Interruptions				
No. of interruptions				
Planned	No./year	35	2	3
Unplanned	No./year	15	3	5
Maximum length of interruptions	Hours	6	6	6
Customer Complaints				
Quality	No./year	91	20	5
Pressure	No./year	5	0	2
Other	No./year	5	5	2
Response Times				

Description	Unit	Level of service		
		Tenterfield	Urbenville	Jennings
Pipeline Breaks	Hours	<1	<1	<1
Other oral complaints	Hours	<1	<1	<1
Written complaints	Days	14	14	14
Quality				
Compliance with 1987 NHMRC Guidelines	% tests passing	99	<10	99

Note: the Levels of Service are the current targets which Council aims to meet. They are not intended as a formal customer contract.

The Water Supply and Sewerage Levels of Service need to be reviewed and updated to reflect current standards and requirements (e.g. water quality compliance).

A13.3 Risk Management

TSC undertook an Emergency Risk Management project between 2005 and 2009 (Echelon, 2008). The project considered natural and technology hazards. The hazards and responses relevant to urban water services are:

- Dam Failure (Flood) - assessed as 'high risk' and requiring a multi-agency response;
- Infrastructure failure (Water) - Council, as water service provider has adequate back-up strategies; and
- Infrastructure failure (Sewerage) - Occurrence of the hazard could be managed by Council.

Of the above identified hazards, failure of Tenterfield dam was considered to be the only hazard requiring a significant and coordinated emergency response. A risk statement was developed to define the nature and extent of the impact on the community. The risk statement identified that there is a risk that if Tenterfield Dam failed suddenly there could be human fatalities and injuries, up to 400 persons could require evacuation, including residents from aged care facilities, damage to properties (residences and businesses) due to inundation, medium term damage to riverbanks, damage to road crossings and other infrastructure in the flow path, possible injuries and fatalities to animals / livestock, with major financial losses. The existing control measures to address the risk include the TSC Dam Safety Plan, Tenterfield Local Flood Plan, and the Local Disaster Plan (DISPLAN). Dam safety is discussed further in Section A13.8.

A13.4 Business Continuity Planning

The TSC Business Continuity Plan (Echelon, 2013) identifies the required facilities, technical infrastructure, key responsibilities and processes that will be required to position Council to be able to respond and recover from a business interruption event. In the BCP, water and sewerage services are identified as critical business within Council. The Plan determines the maximum acceptable outage of a particular business process for water and sewerage. Exceeding the maximum outage period will generally result in the establishment of the Continuity Management Team to direct, oversee and support the emergency, continuity and recovery response phases. The Plan provides Business Continuity Sub Plans for water and sewerage businesses which detail Council's intended response to these events.

A13.5 Drought Management

TSC imposed drought restrictions during recent drought periods (2002-2005 and 2006-2008) as follows:

- Level 3 restrictions were imposed in Tenterfield between 2002 and 2005 followed by level 2 restrictions until 2008. The Shirley Park bore was developed in 2003 with a licence for 160 ML/a.

The perimeter of Tenterfield Dam was excavated in 2003 providing an additional 80 ML storage capacity;

- Level 2 restrictions were imposed in Urbenville between 2002 and 2005 followed by a brief period of level 6 restrictions in 2007 with supply dangerously close to depletion. Emergency works were completed in 2007 to allow an additional 80 ML of low level storage to be accessed; and
- Permanent conservation measures were introduced in 2005. These measures are enforced as part of the Level 1 restrictions.

TSC adopted its Drought Management Plan in 2010. Restriction levels for Tenterfield and Urbenville water supplies relate to the water level in Tenterfield Dam and Urbenville weir respectively. Restrictions on the use of water from SDRC water supply systems (including Jennings) are documented in the SDRC Drought Management Plan (2009).

The storage level in Tenterfield Dam since 2008 is shown in Figure A 1 with the current restriction levels.

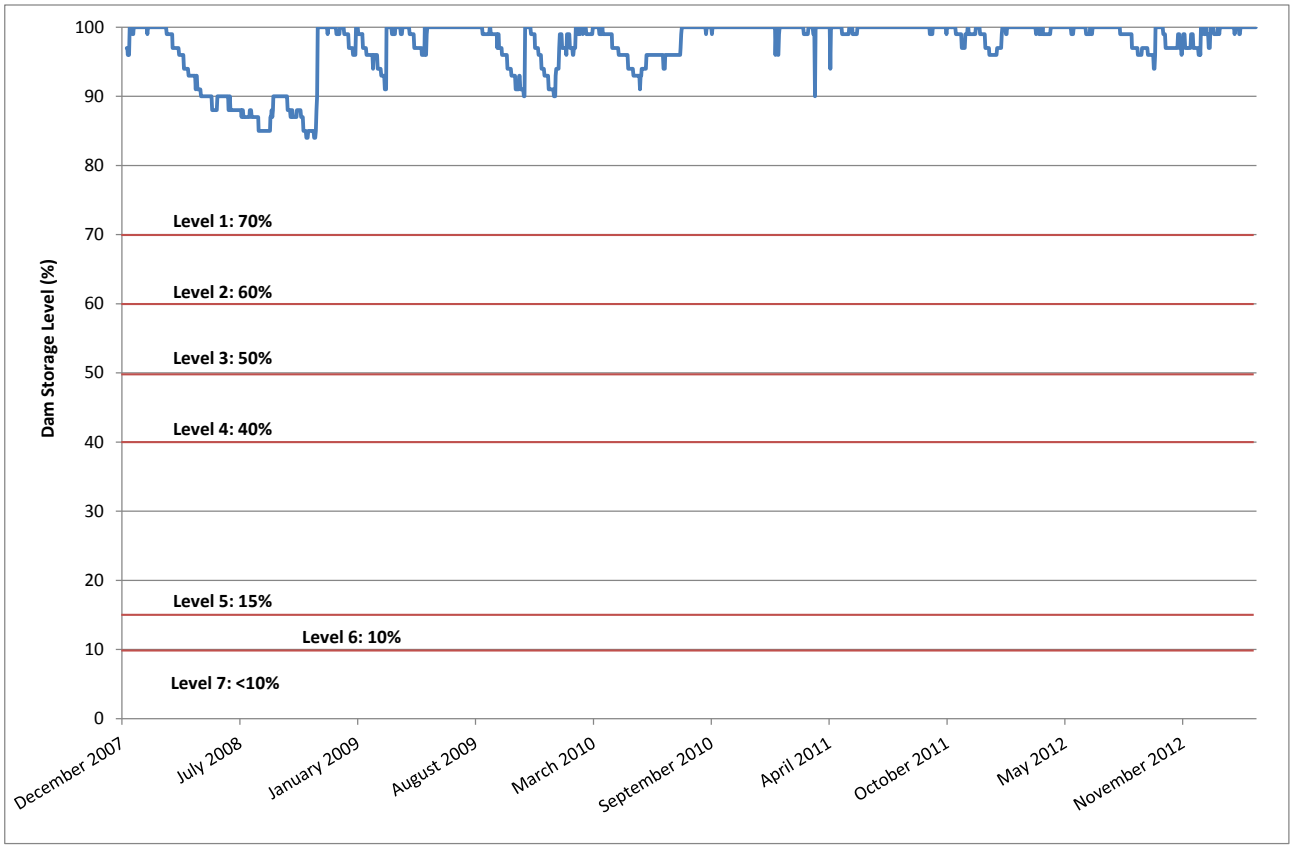


Figure A 1: Tenterfield dam levels 2008 - 2013 and restriction levels

The level in Urbenville weir during the drought in 2007 is shown on Figure A 2. The restriction levels imposed at the time are more severe than the current restriction policy due to the increase in storage provided by emergency works in 2007. Other data on weir levels are not available.

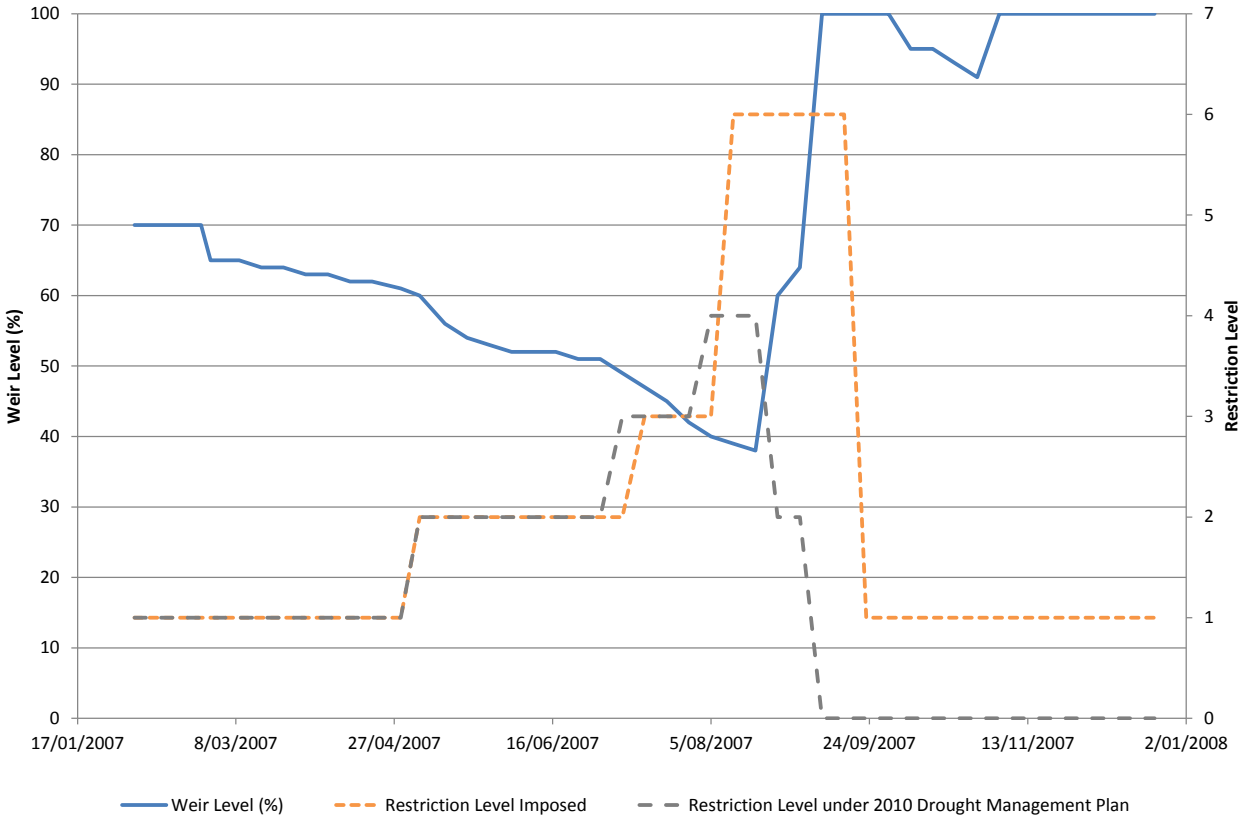


Figure A 2: Urbenville Weir level during drought of 2007 and restriction levels

A13.6 Demand Management

The TSC Community Strategic Plan (2013-2023) identified the conservation of potable water as a key priority for the community (refer Section A3).

Data from Council's billing system (consumption and total connections where available) is shown in the following figures. The data indicate decreasing demand despite a slight increase in number of connections, particularly in Tenterfield.

Major water users (refer PB, 2012 in Appendix 1) are hotels and motels, caravan parks, bowling clubs, golf clubs, service stations and the Urbenville timber mills. The top 10 users in Tenterfield, Urbenville and Jennings consume approximately 12%, 8% and 12% of the total demand respectively.

The benchmarking data (refer Section A13.5) suggest the current residential demand in Tenterfield shire is between 138 and 186 kL/connected property compared to the state-wide median for LWUs with 1,500 – 3,001 properties of 238 kL/connected property.

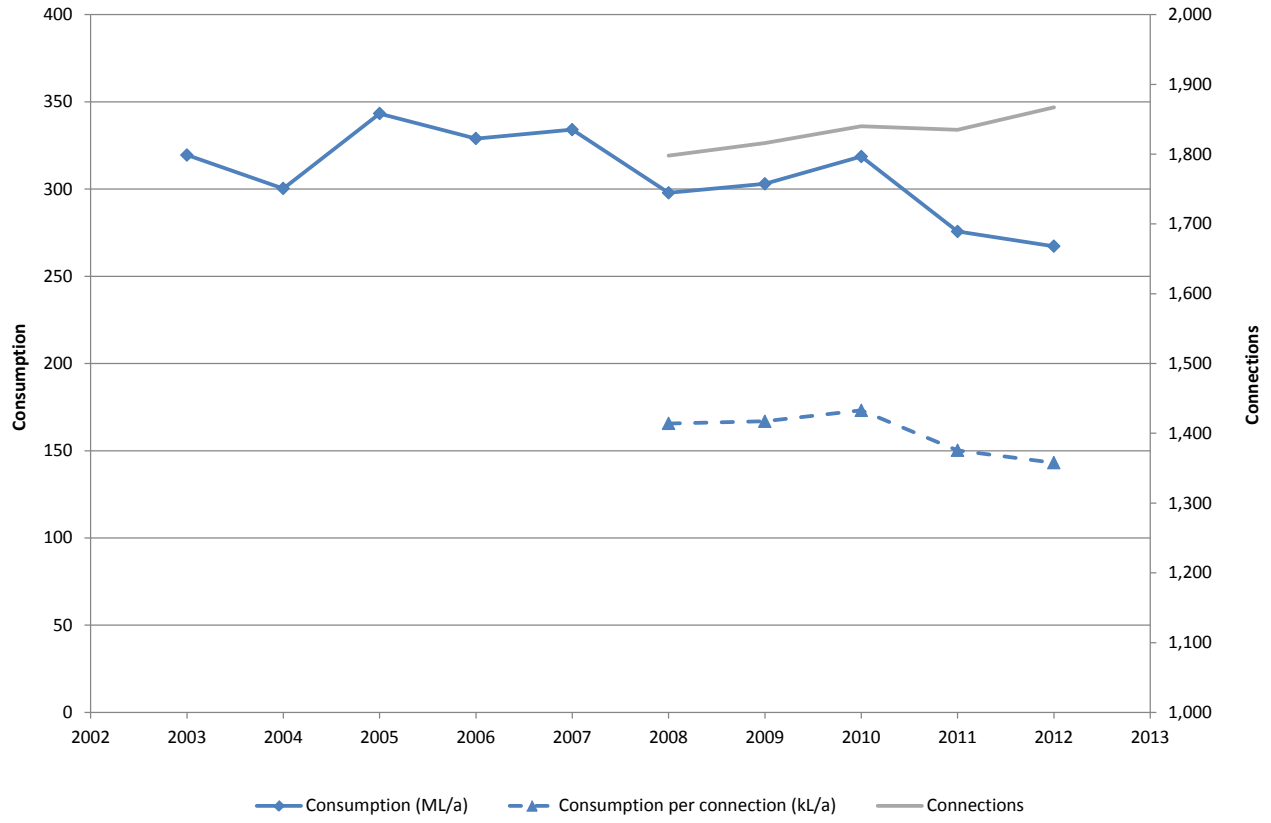


Figure A 3: Tenterfield water supply consumption and connections

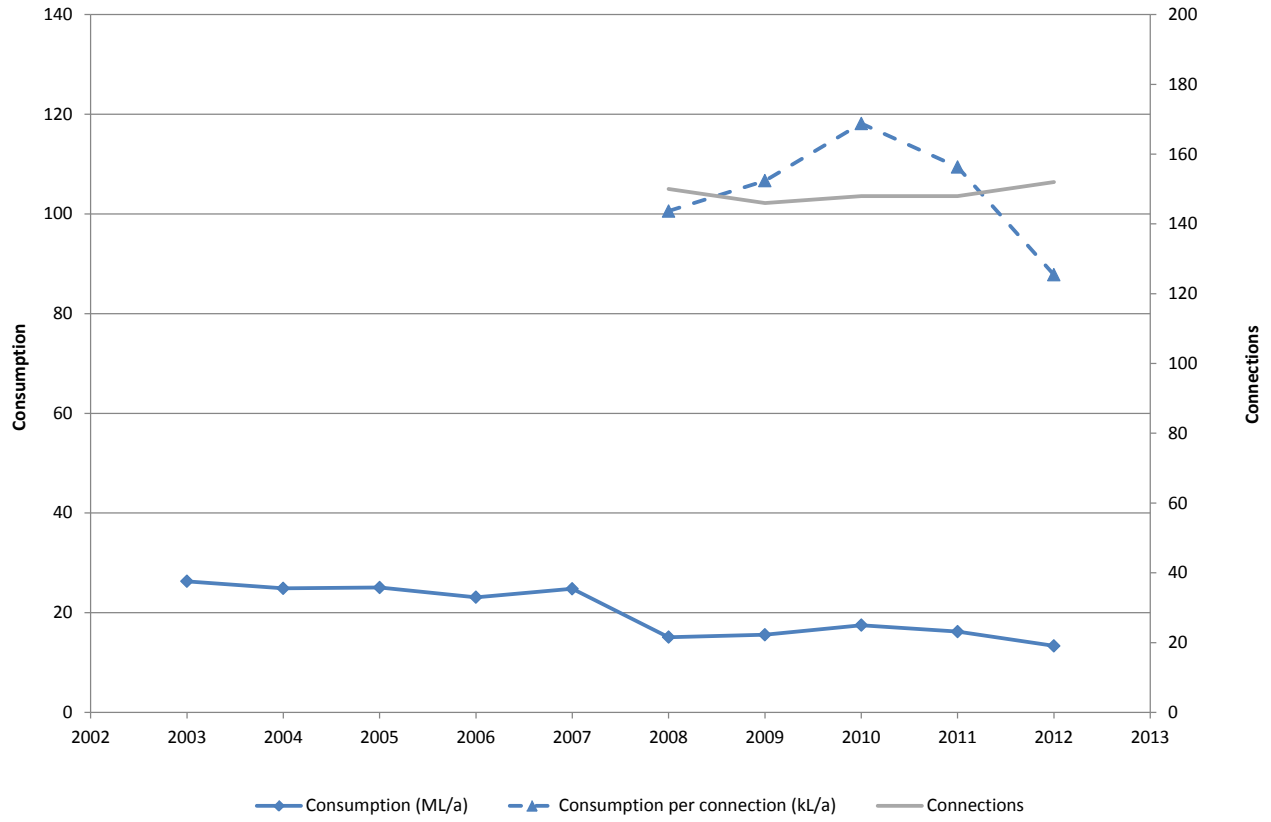


Figure A 4: Urbenville water supply consumption and connections

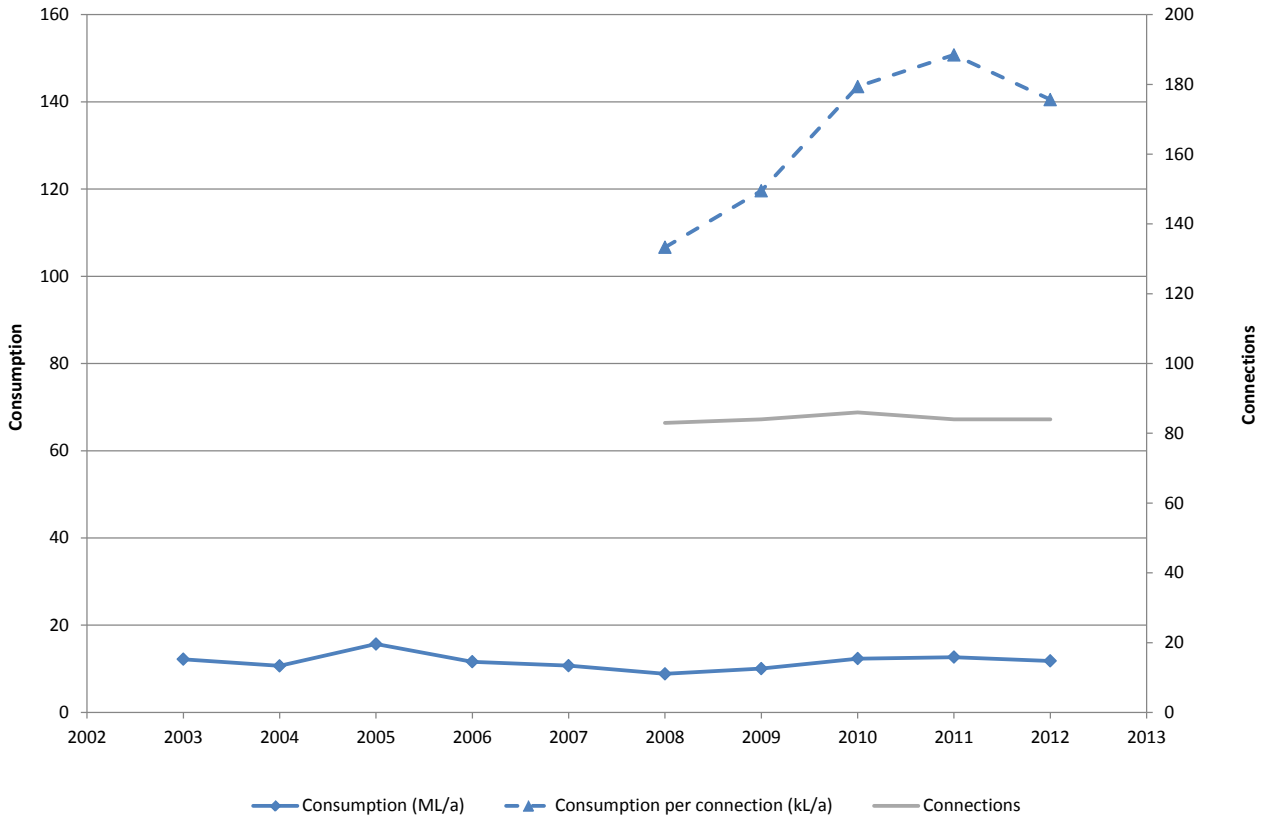


Figure A 5: Jennings water supply consumption and connections

The National Performance Reporting Framework classifies water losses in the distribution system as either apparent losses (unauthorised consumption, retail metering errors) or real losses (leakage and overflows from mains, service reservoirs and service connections prior to customer meters). Non-revenue water (NRW) includes the water lost through unknown leakage, meter inaccuracies, theft, water provided for fire-fighting, known and unavoidable leakage, use of unmetered standpipes plus water lost during emergency and planned maintenance of water mains. This is equivalent to the total sourced potable water less the water sold to customers. The “real losses” represent a wasted resource, reduce the effective capacity of a water supply system and may result in unnecessary operating costs.

Data on water treatment plant flows and customer consumption for Tenterfield water supply are given in Table A 13. Total losses in the Tenterfield water supply system are on average greater than 15%. Annual data for the other water supply systems are not available.

Table A 13: Tenterfield Water Supply – WTP flows and customer consumption

Year	WTP Inflow (ML/a)	WTP Outflow (ML/a)	WTP losses – backwash (ML/a)	WTP losses – backwash (% of inflow)	Customer Consumption (ML/a)	NRW (ML/a)	NRW (%)
2008	351	345	6.3	1.8%	298	47	14%
2009	375	367	7.9	2.1%	303	64	17%
2010	332	328	4.3	1.3%	319	9	3%
2011	341	337	4.2	1.2%	276	61	18%
2012	328	325	3.0	0.9%	267	58	18%
Average	345	340	5.1	1.5%	292	48	14%

TSC has implemented a number of initiatives aimed at reducing water consumption in the LGA. These include:

- A user pays pricing structure introduced in 1995 which resulted in a decrease of over 30% in average annual consumption levels;
- Permanent conservation measures were introduced in 2005;
- Rainwater Tanks Policy – Installation requirements where reticulated water is connected (TSC, 2012). This Policy was adopted to encourage water conservation by the installation of water tanks, connected to household fixtures, through a safe and reliable method, to supplement the mains supply. The policy does not offer rebates for rainwater tank installation;
- Mandatory dual flush toilet installation into any new homes or businesses and rebates for rated appliances installed in homes constructed before 2007;
- Residential rebates for water wise or AAA rating water saving shower heads and dual flush toilets;
- Management initiatives to allow for more effective means for tracking and reducing water consumption rates in the community have included:
    - Bulk water production metered and recorded on a daily basis;
    - All new free standing and multi-unit residential developments (both strata and non-strata) approved after 1 July 2004 must be separately metered;
    - All free standing residential premises were separately metered by 1 July 2007;
    - Separate metering of existing multi-unit residential developments, where it is deemed cost effective;
    - Customers classified in accordance with the categories defined in the latest NSW water supply and sewerage performance monitoring report and consumptions and reported annually;
    - In the event of high water demand periods, monitoring and recording of daily water levels; and
    - Water consumption metered and billed quarterly.

Council adopted a Water Conservation and Demand Management (WCDM) Plan in June 2010. The WCDM Plan (TSC, 2010a) has been prepared to supplement the Drought Management Plan with measures that aim to reduce the community's total water usage levels during both drought and non-drought periods and increase the security of the water supply systems. The WCDM Plan will be reviewed every 3 years. Additional demand management measures may include:

- Funding for the upgrade of a community awareness and education program;
- Residential rebates for water wise or AAA rating water saving devices that may include, washing machines, rainwater tanks and grey water reuse systems;
- Compulsory covers for all pools within the shire;
- Residential audits and retrofits for both indoors and outdoors;
- Non-residential water audits for the top 50 water users, including Council; and
- Water loss management for any system losses and leaks.

A13.7 Water Supply Security

The TSC Community Strategic Plan (2013-2023) identified the long-term security of Tenterfield's water supply as a key priority for the community (refer Section A3).

Existing Secure Yield

Given that climate and rainfall are highly variable from year to year, it is necessary to establish the amount of water that can be reliably obtained from the water sources during any year, regardless of climatic conditions. Secure yield is calculated using historic climate and stream flow data and a set of rules that describe water demand and the long-term effect of water restrictions. Secure yield was historically determined using the NSW Security of Supply Methodology (the highest annual water demand that can be supplied from a water supply headworks system whilst meeting the 5/10/20 rule - restrictions no more than 5% of the time with a frequency of no more than 1 in 10 years and on average a 20% reduction in consumption). The current estimates of secure yield for the TSC water sources use the 5/10/20 rule and are provided in Table A 14. These do not consider the additional storage provided in the dam and the additional groundwater supply provided as a response to the drought in 2003 (refer Section A13.5).

Table A 14: Secure yield estimates

Water Supply	Current Estimate of Secure Yield (ML/a) [1]	Source	Adequacy of data
Tenterfield	510 - 600 (550 with current licence conditions)	GHD (1996)	This estimate is 17 years old and does not consider the effects of demand hardening, increased dam capacity and groundwater bore supply implemented in 2003, potential environmental flow provisions or climate change.
Urbenville	175	Cardno (2002)	This estimate is 11 years old and does not consider the effects of increased weir storage provided in 2007, demand hardening, potential environmental flow provisions or climate change.

1. Secure yield determined using the 5/10/20 rule.

Over the last 4 years there has been an overall reduction in average water use per connection due to increased water awareness within the community, user pays pricing structure and increased use of water efficient fixtures and appliances, as promoted through demand management programs and the BASIX efficient building requirements. Increased water efficiency and demand management strategies have reduced or eliminated many of the non-essential uses of water from everyday life, meaning that it is now harder for water restrictions to achieve sustainable long-term reductions in demand (demand hardening). Future water supply planning in NSW is now based on achieving a 10% reduction in consumption i.e. a "5/10/10 rule", which supersedes the previous "5/10/20 rule". This dictates that a water supply should be designed to be able to supply a minimum of 90% (instead of 80%) of normal water demand during the worst drought. TSC has not yet assessed the impact of demand hardening on its water supplies.

Future Secure Yield

The potential effects of climate change including alterations to local temperature, rainfall, evaporation, runoff and stream-flows were discussed in the PB Study (Appendix 1) and Section A12. The secure yield of a water supply system is expected to be impacted by the effects of climate change which are considered likely to reduce water supply availability.

The impacts of climate change on the secure yield of NSW water resources has been investigated as part of a NSW Office of Water pilot study in 2010. The pilot study is based on the IPCC Emission Scenarios A1B which describes a future world of very rapid economic growth, global population that peaks in the mid-21st century and declines thereafter, and the rapid introduction of new and more efficient technologies with a balance across all energy sources (IPCC, 2007). The A1B scenario is considered to represent the ongoing global response to increasing awareness of climate change. The A1B scenario indicates the most likely climate change impacts will be an increase in average global maximum daily temperatures of 0.9°C above 1990 conditions by 2030 and an increase of 2°C by 2060. The Office of Water pilot study (Samra and Cloke, 2010) predicted a reduction in secure yield for the 0.9°C warming scenario of 9% for Rous Water's supplies and larger reductions for inland water sources (12% in northern NSW) .

There are no data available on the impact of climate change on the secure yield of the TSC water sources.

In the absence of local data for the water supply systems, it is considered appropriate that water supply planning considers the impact of a 12% reduction in secure yield of surface water sources due to climate change by 2030 as this is consistent with the pilot study undertaken by NSW Office of Water.

A comparison of the secure yield and forecast annual demand for Tenterfield water supply is given in Figure A 6. This assumes:

- The current secure yield is 550 ML/a. It is acknowledged that this does not consider the impact of demand hardening, additional dam capacity and bore supply on the secure yield;
- The secure yield will decrease by 12% p.a. by 2030 and the rate of reduction in secure yield will continue beyond 2030; and
- The number of connections will grow by 0.9% p.a. for the next 20 years (refer PB Study in Appendix 1). The ABS Census data suggests the number of dwellings in Tenterfield (Urban Centre/Locality) has decreased by 0.5% p.a. over the last 5 years with the number of occupied dwellings decreasing by 1.0 % p.a. This suggests the growth predicted by PB may be overestimated.

Environmental flow provisions that may result from the current review of the Water Sharing Plan (refer below) has not been factored into the prediction of future yield.

Despite the lack of data on current and future secure yield, the recent performance of the water supplies since the addition of additional emergency supplies suggests that the water supplies are secure for the near future. This is supported by the forecast shown in Figure A 6.

Recent data on extraction from Urbenville weir are not available. The average annual customer consumption in Urbenville is approximately 15.5 ML/a. TSC also supplies Kyogle Council with approximately 52 ML/a for Woodenbong and Muli Muli. Assuming losses are 15% p.a., the total water supplied by the weir is on average 80 ML/a which is significantly lower than the current estimate of secure yield (175 ML/a from Table A 14). Census data suggests the number of occupied dwellings has decreased by 0.9% p.a. over the last 5 years and therefore demand in the near future is not expected to increase significantly. However, the comments relating to data adequacy for Tenterfield water supply also apply to Urbenville weir.

Guidelines on assessing the impact of climate change on secure yield are being developed as part of the Best-Practice Management program. For LWUs with a storage dam or shallow bores, analysis similar to that carried out in the pilot study is likely to be recommended. The potential reduction in surface water availability and long-term suitability should then be addressed as part of the consideration of water supply planning.

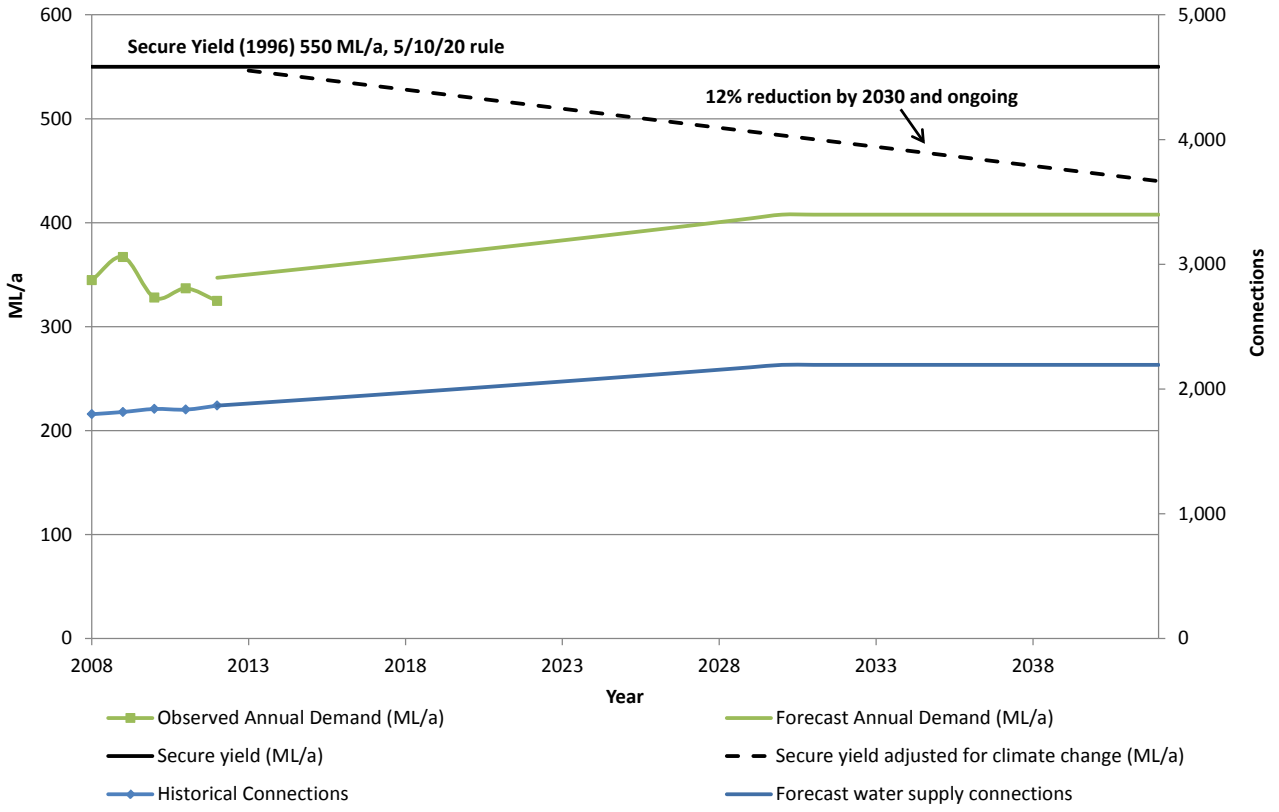


Figure A 6: Tenterfield Water Supply Future Supply and Demand Forecasts

Environmental Flows

The requirement for environmental flows is also a key consideration when estimating future secure yield. The *Water Management Act, 2000* requires water to be allocated for the fundamental health of a river and its dependent ecosystems, such as wetlands and floodplains, as a first priority. The Water Sharing Plan does this by setting aside a proportion of each flow class for environmental needs.

Of particular relevance to Tenterfield Creek is the maintenance of water in the water source during the very low flow periods which is essential to provide refuge areas for fish and other aquatic species. The Creek is regarded as a stressed river with highly variable flow and is known to experience extended periods of low or no flow (DIPNR, 2005). NSW Office of Water and NSW Fisheries are conducting monitoring of the water source and the impact of the water sharing plan rules and the ability to address the habitat requirements of biota, with particular reference to Purple-Spotted Gudgeon, a threatened fish species known to inhabit Tenterfield Creek (refer Section A5). Further work on the fish habitat availability and suitability in Tenterfield Creek is also being conducted in a collaborative project between the NSW Office of Water and the University of New England. It is envisaged that these projects will provide the information necessary for the review of the Tenterfield Creek Water Sharing Plan in 2014 (Lewis and Growns, 2012). Changes to environmental flow requirements for Tenterfield Creek have the potential to impact on the secure yield of the water supply and the ongoing management of the water source. Any future secure yield estimates should consider changes to environmental flows. At this stage, the Office of Water has advised that the review will not increase the requirement for environmental flow releases from Tenterfield Dam (refer Section 0).

Water Treatment Capacity

A comparison of current and predicted future peak day demand and the capacity of Tenterfield WTP is given in the following figure. This assumes the same population growth as for Figure A 6. The design capacity of Tenterfield WTP is 5.0 ML/d however the original 1930s plant is currently not in service and plant capacity

has been reduced to 3.5 ML/day (refer Section A13.1). The current capacity of the WTP is predicted to be exceeded by 2016. Issues related to the treatment performance of the WTP are discussed in Section A9.

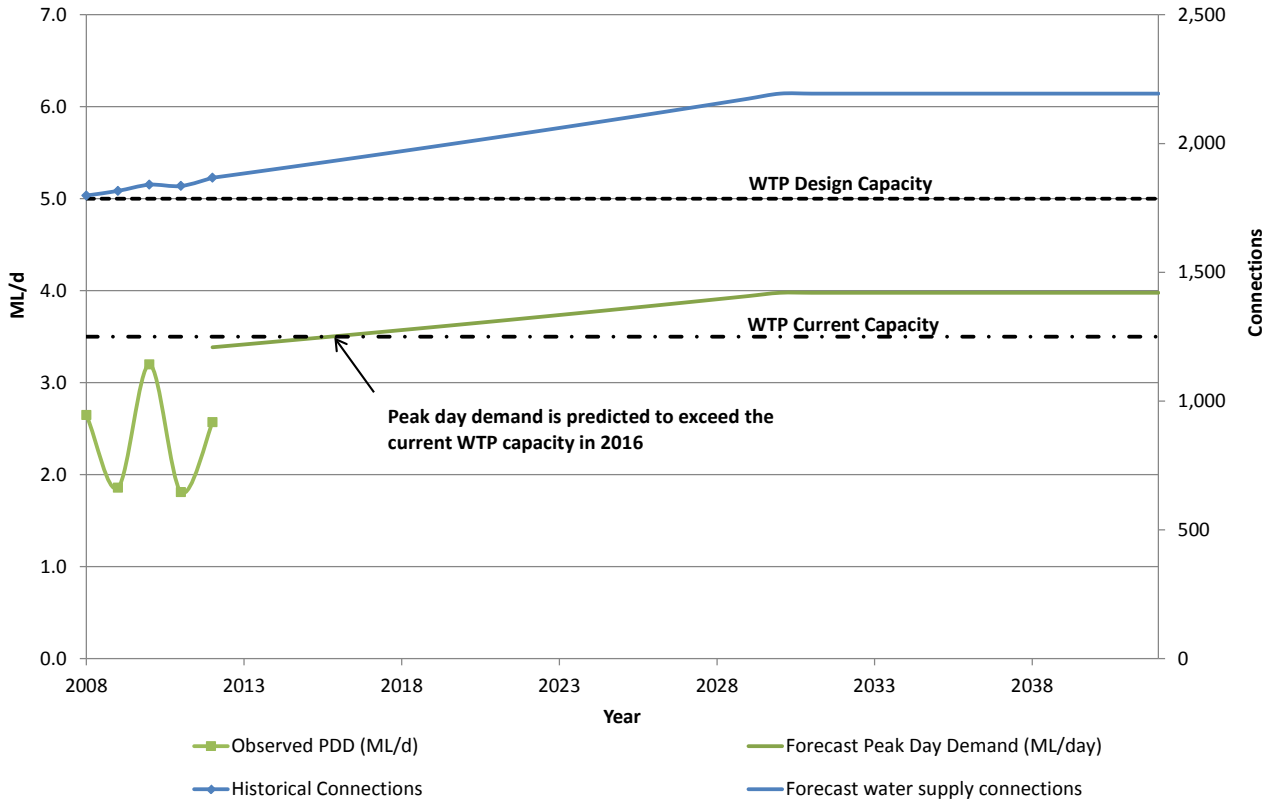


Figure A 7: Tenterfield Water Treatment Plant Capacity and Peak Demand Forecasts

A13.8 Dam Safety

In 2009, the NSW Dams Safety Committee required that TSC prepare a stability analysis of the Tenterfield Dam (Black and Veatch, 2012). For some of the load scenarios considered during the traditional deterministic stability analysis, some of the blocks/sections were found to have insufficient safety margin against horizontal shear failure or overturning. A subsequent peer review (Rodd, 2013) identified the need for consideration of additional flood load cases, potential issues with the condition of the post-tensioned anchors and also recommended an updated flood study and seismic study are undertaken prior to remedial works. The studies concluded that the dam does not satisfy the ANCOLD Guidelines for Stability of Gravity Dams and that the situation is likely to deteriorate given that the performance of the post-tensioning cables is questionable and due to the continuing corrosion and demonstrated loss of load (Rodd, 2013).

A13.1 Water Supply Agreement with Kyogle Council

A joint water supply agreement between Kyogle and Tenterfield Councils has been adopted and updated in July 2012. The agreement relates to the funding, construction and operation of the UWMM water supply system.

A13.2 Effluent Management

Tenterfield STP provides treated effluent for land-based irrigation of Tenterfield Golf Course and paddocks around the STP. In 2011/12, 52 ML of treated effluent (19% of sewage produced) was reused at the golf course. The remainder is discharged to Tenterfield Creek.

Treated effluent from Urbenville STP is pumped to an unnamed ephemeral watercourse approximately 1 km from Beaury Creek.

Compliance with the Environment Protection Licences (effluent volume and quality) is discussed in Section A10.

The *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks* (2006) adopt a risk management approach to managing risks to human health and the environment from recycling of water from greywater and treated sewage. Recycled Water Use Agreements should be prepared for any recycled water systems including identification and assessment of hazards, and development of preventative measures to control the hazards. The approach also includes monitoring to ensure that the preventive measures operate effectively, and verification to ensure that the management system consistently provides recycled water of a quality that is fit for its intended use.

Recycled water management plans have not been prepared the recycled water systems.

A13.3 Sewerage System Overflows

In response to the Pollution Reduction Program (PRP100) included on the sewerage system Environment Protection Licences (Section A10), Sewer Overflow Investigation Reports were prepared for the Tenterfield and Urbenville sewerage systems (Echelon, 2007a; Echelon, 2007b). The reports assess the location and likelihood of overflows and the evaluation of environmental and public health impacts. Management priorities and action plans are also presented.

The assessment of overflows within the Tenterfield and Urbenville systems indicates a low risk for both impct on sensitive urban waterways and potential for human contact (and hence public health issues). Council has a response protocol in place that minimises the impact of overflows, however the report recommended asset management strategies including CCTV surveys, additional chemical treatment and smoke testing to further assess the long-term condition of sewer infrastructure and development of a GIS system based on work-as-executed plans for easier location of system elements. The development and implementation of a trade waste policy to regulate the discharge from commercial and industrial discharges was also recommended and a policy has since been adopted.

A13.4 Biosolids Management

All biosolids from the WTP and STP are dewatered and stored on-site prior to disposal at the Tenterfield landfill. To reduce costs associated with disposal and increase the beneficial reuse of biosolids, TSC is investigating the potential reuse of the biosolids as organic fertiliser. The *Environmental Guidelines: Use and Disposal of Biosolids Products (EPA, 2000)* provide guidance related to the beneficial use and disposal of biosolids.

A13.5 Liquid Trade Waste

TSC reviewed and adopted its Liquid Trade Waste Policy in 2011. The policy sets out how Council will regulate sewerage and trade waste discharges to its sewerage system in accordance with the NSW Framework for Regulation of Sewerage and Trade Waste. The policy is concerned with the approval process for liquid trade wastes discharged into the sewerage systems and the levying of appropriate sewerage and liquid trade waste fees and charges. It was developed to ensure the proper control of liquid trade waste discharged to the sewerage system and hence protection of public health, worker safety, the environment, and Council's sewerage system. The policy also promotes waste minimisation and water conservation (TSC, 2011a).

A14. WATER SUPPLY AND SEWERAGE BENCHMARKING

The NSW Office of Water compiles LWU performance data each year. Key indicators for TSC are summarised in the following table (from the Water Supply and Sewerage Performance Reports and Benchmarking Reports).

Table A 15: Water Supply and Sewerage Performance Data

Performance Criteria	2009/10	2010/11	2011/12	Median [1] (2011/12)	Comments
Connected properties – residential, water (number)	1,960	1,960	2,010	-	-
Connected properties – residential, sewerage (number)	1,630	1,736	1,700	-	-
Average annual residential water consumption (kL/connected property)	138	186	161	238	Consumption is low compared to the median
Real losses (leakage) (L/service connection/day)	30	40	30	70	Water losses are discussed in Section A13.6.
Total recycled water (% of effluent)	N/A	14	19	12	-
Typical residential water bill ($/assessment)	524	658	677	581	Bills are high compared to the median which reflects the low customer base.
Typical residential sewerage bill ($/assessment)	669	738	760	414	
Total OMA cost ($/connected property)	927	901	984	772	Costs are high which reflects the low customer base, large geographic area and topography.
Water supply OMA cost (c/kL)	170	192	260	116	
Sewerage OMA cost (c/kL)	258	235	271	159	
Residential revenue from water usage charges (%)	42	49	46	58	This should be increased to 50% to comply with best-practice.
Water quality compliance – physical (%)	99	100	92	N/A	Water quality is discussed further in Section A9.
Water quality compliance – chemical (%)	100	100	100	N/A	
Water quality compliance – microbiological (%)	100	99	99	N/A	
Water quality complaints (per 1,000 properties)	6	15	10	2	Complaints are high compared to the median.
Water service complaints (per 1,000 properties)	3	3	3	N/A	
Water main breaks (per 100 km of main)	10	6	9	9	-
Sewage odour complaints (per 1,000 properties)	1	0	0	0	-

Performance Criteria	2009/10	2010/11	2011/12	Median [1] (2011/12)	Comments
Sewerage service complaints (per 1,000 properties)	34	28	29	16	Complaints are high compared to the median.
Sewer overflows to the environment (per 100 km of main)	0	0	0	-	-
Sewerage licence compliance BOD (%)	100	100	100	93	Compliance is discussed further in Section A10.
Sewerage licence compliance SS (%)	100	100	100	75	-
Water supply employees (per 1,000 properties)	N/A	3.1	3.5	1.9	The number of employees is high compared to the median which reflects the low customer base.
Sewerage employees (per 1,000 properties)	N/A	3.5	4.1	2.0	

1. % of LWUs basis for 1,500 to 3,001 properties.

Sources: NSW Office of Water, 2011a, 2011b, 2012a, 2012b, 2013a, 2013b.

A15. ON-SITE SEWAGE MANAGEMENT

On-site sewage management systems (OSSMs) such as traditional septic tanks present a potential contamination hazard to surface and groundwater systems if not properly maintained and monitored. There are approximately 1,550 properties in the LGA not connected to a reticulated sewerage system. These properties generally rely on on-site sewage treatment usually in the form of septic tanks and absorption trenches.

Section 68 and Section 124 of The *Local Government Act 1993* require landowners to obtain Council approval to operate their on-site sewage management systems and to maintain and operate their systems to standards protecting public health, the environment and community living. The Act gives Councils the responsibility to issue approvals to operate and to monitor all systems to ensure they meet the standards.

The TSC Community Strategic Plan (2013-2023) identified compliance and regulatory services to protect the amenity of the environment as a key priority for the community (refer Section A3).

Council's *On-site Sewage Management Policy* (adopted 2013) provides a framework for implementation of ecologically and socially sustainable on-site sewage management practices. The objectives of the policy are:

- Prevention of public health risk;
- Protection of surface water;
- Protection of groundwater;
- Protection of land;
- Protection of community amenity;
- Conservation and reuse of resources; and
- Ecologically sustainable development.

The policy refers to a number of related documents for implementation of the policy including the *Environment and Health Protection Guidelines: On-Site Management for Single Households* (Department of Local Government, 1998).

The policy includes a number of goals and targets to be achieved by Council including:

- To maintain and update a database of all existing systems;
- To develop and implement a cost effective supervision program for on-site sewage management systems;
- To adopt a partnership approach with householders and service agents to support continual improvement of on-site systems;
- To provide education and information for operators of on-site sewage management systems;
- To ensure that all onsite systems are inspected at regular intervals and are desludged and maintained as required;
- To ensure that all residents with Aerated Wastèwater Treatment Systems consult with service agents and submit quarterly maintenance reports;
- To ensure that all land application areas comply with environment and health protection standards as well as Council operating requirements; and
- To review council development standards and approval criteria for subdivision, development and building to ensure that appropriate provision is made for onsite sewage management when residential development occurs in non-sewered areas.

Council maintains risk registers of all OSSMs according to the OSSM Policy and inspections are undertaken on a priority basis. As at May 2011, 83 septic tank connections were recorded as “High Risk” and 1391 connections are considered to be a “Low Risk” (PB, 2012). During the period from 2009-2012 a total of 12 notices were issued for inadequate OSSMs. During this period there were several systems that needed upgrading in which Council’s Building Surveyor undertook inspections with the owners. Rectification advice was given and systems were re-inspected for compliance (TSC, 2012b).

During development of this study, TSC staff indicated that OSSMs are only inspected after installation and on an as needs basis and no performance information is currently available. Due to limited resources within Council, the targets outlined in the OSSMs Policy with regard to inspections and monitoring are not currently being achieved.

In 2012 Council adopted an *Aerated Wastewater Treatment System Policy* to regulate installation, maintenance and monitoring procedures for the use of Aerated Wastewater Treatment Systems, to provide a more flexible approach to water conservation, re-use and to ensure the protection of public health and the environment in the Shire.

The following villages are not provided with a reticulated sewerage service (TSC, 2005):

- Legume, population 100;
- Liston, population 50;
- Drake, population 150;
- Mingoola, population 20;
- Torrington, population 200;
- Jennings, population 70;

The Sewerage Services SBP (TSC, 2005) identified issues with septic tank runoff, sullage water ponding and odours due to the poor absorption of the soils, particularly in Jennings. In 1988, Council offered the residents of Jennings an effluent collection drainage scheme, but it was rejected by the residents due to the

cost (TSC, 2005). The SBP includes an objective to provide water supply/sewerage services to all small urban communities where there are identified significant environmental and health risks, community desires and economic feasibility (to be completed by 2017).

During the community visioning workshops held at Liston and Drake in 2006, residents raised concern about the contamination of local waterways from on-site sewerage systems. Council is also concerned with on-site effluent in the villages of Jennings and Torrington due to the poorer quality soils (PB, 2012).

Council is currently reconsidering the need for action in Jennings and aims to develop plans for a centralised, post-treatment storage tank with greywater reuse within the village.

A16. URBAN STORMWATER MANAGEMENT

The TSC Community Strategic Plan (2013-2023) identified effective management of stormwater as a key priority for the community (refer Section A3).

Stormwater assets were re-valued in 2013. The *TSC Stormwater Asset Management Plan* (TSC, 2013b) defines the stormwater services to be provided, levels of service, how the services will be provided and how much it will cost. The Plan also details information about infrastructure assets and actions required to provide an agreed level of service in the most cost effective manner. Urban stormwater assets include network stormwater drainage systems, intersection cross-drainage of table drains and kerb and gutter systems which connect to trunk drainage culverts located at road crossings of natural watercourses within the town of Tenterfield. Over the last 60 years, new stormwater infrastructure has been added with little consideration to consistent design of pits, pipes and end structures. As a result, the stormwater infrastructure of Tenterfield is widely varying ranging from stone / brick structures (including kerb, headwalls and arch culverts) through to concrete pits of varying dimensions, many of them buried and inaccessible (TSC, 2013b).

The Plan sets out required services including operations, maintenance, renewal and upgrade of existing stormwater assets. Table A 16 presents Council's target and current levels of service for stormwater assets.

Table A 16: Urban stormwater management levels of service

Key Performance Measure	Level of Service Objective	Performance Measure Process	Desired Level of Service	Current Level of Service
Quality	All surface water carried by system	Flooding of dwellings and businesses	1 in 10 year flood carried	Most dwellings and businesses are flood free but some localised water retention occurs
Function	Flood free access	Flood Frequency	1 in 10 year flood	Mostly 1 in 10 year flood free
Safety	Safe environment	Number of accidents or complaints	No trip hazards; No child access hazards or pollution to waterways	Some hazards are present, but do not present a high level of risk
Operations	Stormwater network is kept clear of obstructions as far as possible	System carries flows	1 in 10 year flood	Practical stormwater drainage requirements are largely satisfied, although some overtopping at choke points can occur. Properties on Logan and Railway Streets have significant drainage issues

Key Performance Measure	Level of Service Objective	Performance Measure Process	Desired Level of Service	Current Level of Service
Maintenance	Effective drainage	Number of blockages	No blockages or flooding	Maintenance program in progress, issues fixed as identified
Renewal	Defective assets renewed	Renewal program	Assets renewed when programmed	Assets not renewed
Upgrade/New	All properties flood free with no standing water	Community complaints	2% of network upgraded annually	Significant stormwater projects are budgeted, but insufficient resources are available for significant upgrades

Source: TSC (2013b)

Generally TSC is achieving the levels of service stipulated in the asset management plan. Exceptions include some localised flooding during 1 in 10 year floods, drainage issues at a small number of specific sites. In addition assets have not been renewed and planned upgrades to the stormwater network have not been carried out due to insufficient resources (TSC, 2013b).

Council has estimated the cost of carrying out the required services over the 10 year planning period and has determined that Council's current funding levels are insufficient to continue to provide services at current levels in the medium term (shortfall estimated as approximately $13,650 per year). It is likely that council will have to reduce service levels in some areas, unless new sources of revenue are found. For stormwater, the service level reduction may include increased localised flooding.

The Asset Management Plan identifies a number of steps to address the funding shortfall as follows:

- Improving asset knowledge;
- Improving efficiency in operations, maintenance, replacement and construction of new assets to optimise life cycle costs;
- Identifying and managing risks associated with providing services or not meeting levels of service;
- Making trade-offs between service levels and costs;
- Community consultation to ensure drainage services and costs meet the need of the community; and
- Developing partnerships with other bodies and seeking additional funding from government sand other bodies.

The NSW Environmental Protection Authority (EPA) issued a notice under Section 12 of the *Protection of the Environment Administration Act 1991* to all NSW councils early in 1998, requiring each council to develop an Urban Stormwater Quality Management Plan. TSC commenced its urban stormwater quality management plan preparation in November 1999 in accordance with the *Stormwater Quality Management Plan (SWQMP) Guidelines* (Managing Urban Stormwater Council Handbook, 1997) prepared by the EPA. The updated *Urban Stormwater Quality Management Plan* (TSC, 2013a) aims to address stormwater quality management problems within the catchment, particularly environmental issues. The Plan identifies stormwater issues and seeks to achieve an overall improvement in the management of the stormwater system by recommending an action plan to the Council for implementing a stormwater improvement strategy. The Plan is focused on the urban area adjacent to Tenterfield Creek.

The key stormwater issues identified in the Stormwater Quality Management Plan (TSC, 2013a) are:

- Insufficient community awareness of impacts of litter, dog droppings, fertiliser use and grass clippings in the stormwater system;

- Decreased water quality (e.g. litter in waterways, odour problems, increased nutrient levels in waterways, grease and oil pollution, infiltration of stormwater into the sewerage system causing overflows);
- Erosion (e.g. erosion of road verges causing siltation in stormwater system and increased turbidity, erosion of riverbanks during major floods);
- Planning and infrastructure issues (e.g. poor drainage due to geographic constraints, and lack of information on the drainage system);
- Localised flooding and stormwater (e.g. many hotspot areas have been identified due to insufficient drainage, insufficient stormwater capacity and location of properties next to water courses);
- Impact on aquatic and terrestrial habitats (e.g. introduction of weeds, siltation, water quality issues); and
- Impact on community health and safety (e.g. septic tank surcharges into stormwater channels, infiltration of stormwater into sewerage system and surcharges, stagnant stormwater at the showground and mosquito breeding).

Implementation strategies to address these issues were developed as part of the Plan, including community education, monitoring and on ground remediation works. This process involved the identification of a number of options to address issues which were then assessed using a cost-benefit analysis to shortlist options for implementation. A number of options identified were already commenced or on-going.

The following prioritised actions were proposed by the Stormwater Quality Management Plan with a focus on source control, practicality and cost-effectiveness:

- Water quality monitoring in Tenterfield Creek;
- Continue to support Streamwatch programs;
- Community education including general stormwater education programs, using local media to report on stormwater issues, collection and disposal of dog droppings and litter, correct use of fertilisers, correct car washing procedures and disposal of garden waste, negative effects of introduced Willow, discourage housing cattle next to waterways, health and safety issues associated with stormwater, benefits of community groups such as Landcare;
- Install more rubbish bins and signage in appropriate locations such as the park by Tenterfield Creek and the main street;
- Investigate and address sewage overflows and surcharges;
- Investigate areas of septic tank/sewage discharges into stormwater channels;
- Implement cost-effective strategy to clean stormwater structures;
- Investigate upgrading stormwater channels;
- Map existing stormwater structure;
- Increase maintenance; and
- Revegetate bare areas of soil and seal unsealed road verges.

A17. FLOOD MANAGEMENT

Tenterfield Creek is subject to flooding, including flash flooding. Council has identified risks associated with floods such as those experienced in 2011 and 2012. In response to these events, a Tenterfield Creek flood study has been prepared (DHI, 2013). The results of this study will be used to identify the actions required to address the risks of flooding. A 2D model has been prepared and calibrated using newly acquired LiDAR data. This will allow Council and the community (through the Section 355 Floodplain Management

Committee) to establish flood heights for design floods and understand flood behaviour in detail. The flood study and subsequent floodplain risk management plan will identify issues regarding damage to buildings and assets and emergency management as well as long-term town planning issues that council intends to address. Council has received grant funding from the state government to undertake these studies. A key consideration will be the impact of climate change and expected changes to stream flows as discussed in Section A12.

A18. CATCHMENT ACTION PLANS

The Tenterfield local government is located within two catchment management authority areas. Tenterfield and areas to the West of the Great Dividing Range are within the Border Rivers – Gwydir Catchment Management Authority (CMA) while the remainder of the catchment is situated within the Northern Rivers CMA.

The Catchment Action Plan (CAP) is a statutory, non-regulatory plan to guide the region to take action in natural resource management. The CAP outlines targets that are aimed at improving and protecting natural assets, such as water, soil, native vegetation, cultural heritage and biodiversity. The CAP also has a variety of targets relating to water management, some of which include water supply and waste water management, water conservation management, water quality management and water sharing. The CAP also promotes the value of people and communities in the catchment and addresses issues such as salinity. The health of catchment and waterways are directly relevant to TSC's water supply, specifically in the Shire's key water sources.

The Border Rivers Gwydir CAP catchment goals relevant to this IWCM are:

- G3 - Water quality in priority river, wetland and groundwater systems supports the requirements for environmental, domestic, stock and irrigation uses; and
- G4 - Hydrological regimes of river, wetland and groundwater systems are managed to ensure flow characteristics are appropriate for balanced environment, production and human use.

The Northern Rivers CAP is being reviewed during 2012/13 as directed by the NSW Natural Resources Commission. The 2006 CAP targets relevant to this IWCM are:

- Management Target W2 - Urban Water Cycle Management: By 2016, 100% of local water utilities to have undertaken planning for managing their water systems using an integrated approach, with 33% of priorities from this planning implemented (50% of planning and 10% of implementation to be completed by 2009);
- Management Target W3 – Water Information & Education: By 2016, 100% of Local Government authorities actively participating in water monitoring/environmental education networks (key networks established by 2009);
- Management Target W4 - Aquifer Health and River Flow: By 2016, extractions from 95% of aquifers are within identified sustainable yields and extractions from unregulated surface waters in 95% of sub-catchments will provide for environmental water (80% of aquifers and 80% of sub-catchments meeting requirements by 2009); and
- Resource Condition Target (Catchment Target) - By 2016, river and aquifer condition is improved;

A19. HUMAN RESOURCES

The TSC Engineering Services department delivers services including roads, bridges, stormwater drainage, water, sewerage construction and maintenance. The Department also manages fleet and workshop services and supports emergency services management through the State Emergency Service and Rural Fire Service. Council functions relevant to urban water services are shown below (TSC, 2013g). On-site sewerage management services are undertaken by the Environmental and Community Services department.

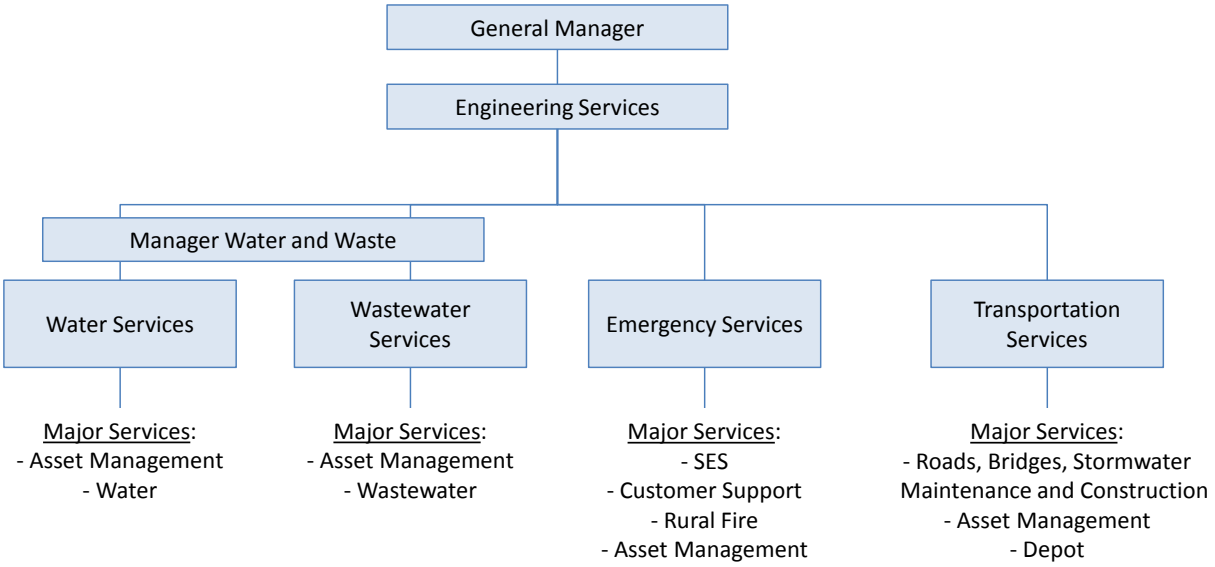


Figure A 8: Council organisation structure and functions related to urban water management

The Water Supply and Sewerage SBPs (refer Section A13.2) include an objective to provide skilled staff to effectively operate and reliably maintain the systems to deliver agreed Levels of Service with no Levels of Service failure due to inadequate human resources.

TSC's Workforce Plan (2013-2017) identifies some challenges that may affect delivery of urban water services:

- Council has an ageing workforce (50% of the workforce is over 50 years of age and 15% is over 60 years of age);
- Like many other regional local government authorities, it is difficult for Council to recruit and retain core professionals such as engineers, town planners and other technical specialists; and
- Community expectations of service delivery are increasing.

The Workforce Plan identifies a number of strategies to address these challenges relating to staff recruitment and retention, staff reward and recognition, reviewing staff performance, training and development, workplace safety and organisation development.

A20. URBAN WATER REFORM

Urban water reform is being investigated by State and Federal Governments. The outcomes of the recent and current inquiries may affect the delivery of water and wastewater services in Tenterfield Shire:

- Review of Water Supply and Sewerage Services in Regional NSW (Armstrong and Gellatly, 2008) - Review to identify the most appropriate structural and regulatory arrangements;
- Regional Towns Water Quality and Security Review - Infrastructure Australia commissioned a report (Aecom, 2011) to help identify opportunities to improve Australia's regional towns' water quality and security and to form practical recommendations for change at the federal, state and local government levels;
- Productivity Commission Inquiry into examining the case for microeconomic reform in Australia's urban water sector (2011) - Examines the case for microeconomic reform in the urban water sector and to identify pathways to achieving improved resource allocation and efficiency; and
- Independent Local Government Review (2013) - The NSW Government has appointed an Independent Local Government Review Panel to develop options to improve the strength and

effectiveness of local government in NSW. The Panel is to investigate and identify options for governance models, structural arrangements and boundary changes for local government in NSW.

The current Local Government Review (Independent Local Government Review Panel, 2013) draws on the findings of the NSW Treasury Corporation review of the financial sustainability of the NSW Local Government Sector which allocated all Councils a Financial Sustainability Rating (FSR). TSC was given a FSR of "weak" with a negative FSR outlook.

The preliminary recommendations of the Local Government review include:

- Establishment of County Councils under existing Local Government Act provisions with the following core functions:
    - Strategic regional and sub-regional planning;
    - Regional advocacy, inter-government relations and promoting collaboration with State and federal agencies in infrastructure and service provision;
    - Management of, or technical support for, water utilities;
    - Road network planning and major projects;
    - Waste and environmental management (including weeds and floodplain management);
    - Regional economic development;
    - Library services; and
    - 'High level' corporate services.
- Sustainability benchmarking and financial management;
- Increased investment in infrastructure;
- Measurement of productivity and improvement; and
- Governance modifications.

The Review recommended that TSC becomes part of a New England – North County Council and merges with Glen Innes Severn Council.

APPENDIX 3: PROJECT REFERENCE GROUP MEETING MINUTES

A summary of the PRG workshop held in May 2013 is attached.

Hydrosphere Consulting

MEETING RECORD

Project No: 12-045

SUBJECT:	Tenterfield IWCM Evaluation Study		
PURPOSE:	Project Reference Group (PRG Workshop 1)		
DATE:	Thursday 16 May 2013	**TIME:**	10.00 am – 1.00 pm
LOCATION:	DPI - Wollongbar		
ATTENDEES:	Tenterfield Shire Council – Deanne Eaton (DE), John Edmonds (JE) Office of Water – Chris Hennessy (CH), Terry Call (TC) DPI-Fisheries – Pat Dwyer (PD) Hydrosphere Consulting - Robyn Campbell (RC)		

ITEM	ITEM DETAILS	ACTION
1	*PRG*	
1.1	RC discussed the PRG involvement to date. Correspondence received from Fisheries (PD) and Border Rivers Gwydir CMA. BRGCMA was invited to meeting and clarification on the correspondence has been requested.	RC
2	*Targets*	
2.1	List of targets was discussed and agreed. Potential additional target (Floodplain harvesting/farm dams policy) to be reviewed/considered.	RC
3	*Issues*	
3.1	PD provided a summary of relevant Fisheries policy, guidelines and approval role. Main consideration is presence of Threatened Species (Purple Spotted Gudgeon) in Tenterfield Creek. Impact on habitat and water quality to be considered as part of water utility activities. Approvals required for work near watercourses or modification of in-stream structures (e.g. dam modifications). Fish passage within creek system is a key consideration. Fisheries approval for dam safety upgrade will need to consider fish passage requirements. Thermal pollution also discussed but not considered to be significant for Tenterfield Dam. PD left following this discussion (approx. 10.45 am)	Note
3.2	Tenterfield Creek Water Sharing Plan being reviewed. TSC to provide input into review.	DE
3.3	Urbenville water supply to be incorporated in Clarence Unregulated and Alluvial Water Sources Water Sharing Plan (due 2013/14). TSC to provide input into WSP development.	DE
3.4	Tenterfield WTP issues (Issue 1) – Council will not replace the WTP unless funding becomes available. CH advised that State Government would not be funding the project. PRG agreed interim measures (operational modifications, rectification of old plant, demand management e.g. through restrictions) would be appropriate.	Note

ITEM	ITEM DETAILS	ACTION
3.5	2013/14 budget includes allowance for WTP operational modifications (coagulant, filter media, reservoir lining etc.). Chlorination has been fixed. Adopted budget to be provided.	DE
3.6	Issue 6 – white PVC pipe. Progressive replacement with blue brute PVC included in budget.	Note
3.7	Issue 16 – TSC participated in WLMP (Water Directorate), no major leaks found, some leaking hydrants repaired. Meter replacement program in budget.	Note
3.8	Issue 30 – flooding of water assets is not a significant issue.	Note
3.9	TSS/pH non-compliance considered to be due to algae in ponds (not duckweed as reported in annual return). Non-compliance is considered to be low level (up to 2 high readings per year). Effluent is irrigated during dry periods and remainder released to creek. EPA has confirmed to TSC that compliance is currently acceptable. Continued liaison with EPA required.	Note
3.10	Issue 10 – Sewer infiltration – relining and manhole sealing in budget.	Note
3.11	Issue 11 – Tenterfield industrial estate – sewer completed March 2013.	Note
3.12	Issue 12 – Flooding in 2011 considered to be exacerbated by riparian weeds, since removed by land care groups. 2012 floods not as high. Tenterfield SPS generator and control panel may need raising but TSC has experienced opposition from neighbours due to aesthetic concerns. Flood study currently being completed.	Note
3.13	Issue 21 – biosolids. Landfill disposal costs to be considered. Suggest grading/classification required to determine potential beneficial use. Current data on biosolids classification to be provided.	DE
3.14	Issue 23 – unsewered villages. Council funds not available for backlog sewer. Currently considering greywater disposal system at Jennings (similar to Wallangarra).	Note
3.15	Issue 32 – Water supply/sewer structural review planned for 2013/14. IWCM Strategy to discuss resourcing requirements for implementation of IWCM actions.	RC

Attachment: Presentation Slides

END OF RECORD

Integrated Water Cycle Management Evaluation Study

Project Reference Group Workshop

Thursday 16 May 2013

Agenda

- IWCM Process
- Role of PRG
- IWCM Targets
- IWCM Issues and Business-As-Usual Scenario
- Next Steps

IWCM Process

- Framework to identify and scope issues relating to urban water management
- Optimise Water Supply, Sewerage and Stormwater services
- Consider all aspects of the water cycle and catchment in relation to water supply and sewerage business activities
- Recognises the impact of increasing demands on water resources, changing climatic conditions and resulting adjustments in statutory regimes

IWCM Process

- Part 1: Evaluation Study, to identify the issues; and
- Part 2: Strategy Plan, if IWCM issues are not solved by existing actions and commitments. Either:
  - Simplified - if no significant capital works are required within 10 years; or
  - Detailed - if significant capital works are required within 10 years to address the remaining issues and there are any opportunities for integration of water supply, sewerage and stormwater services.
- Community, regulator and water utility input for each step

Project Reference Group

- Facilitates stakeholder involvement in IWCM planning
- Confirm obligations to be met by Tenterfield Shire Council water supply and sewerage businesses
- Verify issues to be considered in IWCM process
- Assist in developing solutions to these issues

Project Reference Group

- Tenterfield Shire Council
- NSW Office of Water
- DPI Fisheries
- Border Rivers Gwydir Catchment Management Authority
- Northern Rivers Catchment Management Authority
- NSW Health
- Ratepayers Association
- Border Rivers Food and Fibre
- Moombahlene LALC
- Muli Muli LALC

IWCM Targets

- IWCM issues are defined by non-compliance with urban water service targets, both legal obligations and agreed levels of service or non-achievement of water cycle management objectives
- Targets relate to legislation, contracts, standards and agreed levels of service
- Some targets are mandatory and some relate to customer preferences and levels of service that the TSC has agreed with its customers

IWCM Targets

Item	Target	Comments
NSW Legislation	100% compliance with legislative obligations	Legislation drives many other IWCM targets.
Community Strategic Plan 2011-2021	CSP Objectives guide and co-ordinate Council's activities	The CSP Identifies the long term aspirations of the community, key directions, outcomes and key result areas
Water Sharing Plans	100% compliance with Water Access Licences	Town water supplies are governed by the Water Sharing Plans for NSW Murray-Darling Basin Fractured Rock Groundwater and Tenterfield Creek Water Source
Australian Drinking Water Guidelines	100% compliance with ADWG	The ADWG defines safe, good quality water and how it can be achieved and assured. The Public Health Act, 2010 and Regulation 2012 require water utilities to prepare and implement a risk-based drinking water quality management plan in accordance with the ADWG.

IWCM Targets

Item	Target	Comments
Environment Protection Licences	100% compliance with Environment Protection Licences	TSC holds licences for operation of Tenterfield and Urbenville sewerage systems, discharge of backwash water from Tenterfield WTP and control of algae in Tenterfield Dam.
Best-Practice Management of Water Supply and Sewerage Guidelines	100% compliance with Best-Practice Management Guidelines	The Guidelines were prepared to encourage continuing improvement in performance and identify criteria for best-practice management of water supply and sewerage.
Asset Management Planning	Management actions and strategies identified guide and co-ordinate Council's activities	TSC has recently prepared Asset Management Plans which identify current and emerging issues and identify management actions. Refer Section A11.1

IWCM Targets

Item	Target	Comments
Levels of Service – Water Supply, Sewerage and Stormwater	100% compliance with Levels of Service	The Levels of Service define the standards required and direct Council's detailed planning.

IWCM Targets

- Related Guidelines/Policies/Strategic Plans also inform direction for IWCM e.g.
  - Water recycling guidelines
  - Biosolids management guidelines
  - Urban stormwater management guidelines/plans
  - Fisheries policies/guidelines
  - Catchment Action Plans
  - Demand Management Plan
  - Dam Safety requirements
  - Water Supply Agreement
  - On-site sewerage management policy

Urban Water Supply Issues

No.	Issue	Target	Responsibility
I 1	Unacceptable risks from bacteria and protozoa have been identified within the Tenterfield drinking water system due to major run-off events, incorrect dose of alum, filter break-through, failure of UV system and stagnation in reservoirs	NSW Public Health Act 2010, Public Health Regulation 2012, ADWG	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 2	Unacceptable risks from bacteria and protozoa have been identified within the Urbenville drinking water system due to major run-off events, incorrect dose of alum and failure of the chlorination system.	NSW Public Health Act 2010, Public Health Regulation 2012, ADWG	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 3	An inherent risk from bacteria has been identified for the Jennings scheme due to receipt of out-of-specification treated bulk water from Southern Downs Regional Council.	NSW Public Health Act 2010, Public Health Regulation 2012, ADWG	TSC Eng. Services Dept (Water and Wastewater Services Group)

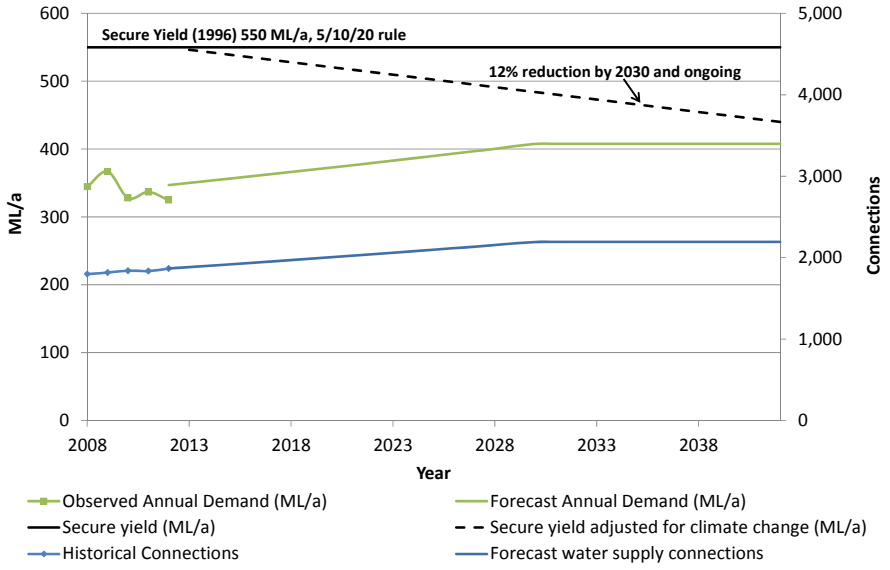
Urban Water Supply Issues

No.	Issue	Target	Responsibility
I 6	The potential failure of the white PVC water reticulation system in Jennings has been identified as a risk.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 8	Shirley Park bore is currently not operational due to damage caused by flooding in 2011	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 14	The Water Supply Levels of Service need to be reviewed and updated to reflect current standards and requirements.	Water Supply Levels of Service, Best-Practice Requirements	TSC Eng. Services Dept (Water and Wastewater Services Group)

Urban Water Supply Issues

No.	Issue	Target	Responsibility
I 16	Total losses in the Tenterfield water supply system are greater than 15% (on average).	Community Strategic Plan	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 17	Tenterfield Creek is regarded as a stressed river with highly variable flow and is known to experience extended periods of low or no flow. The Review of the Tenterfield Creek Water Sharing Plan in 2014 may include changes to environmental flow requirements depending on results of aquatic fish and habitat monitoring in Tenterfield Creek. This may have implications for secure yield of the water supply.	Water Sharing Plan, Water Access Licence, Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group), NSW Office of Water

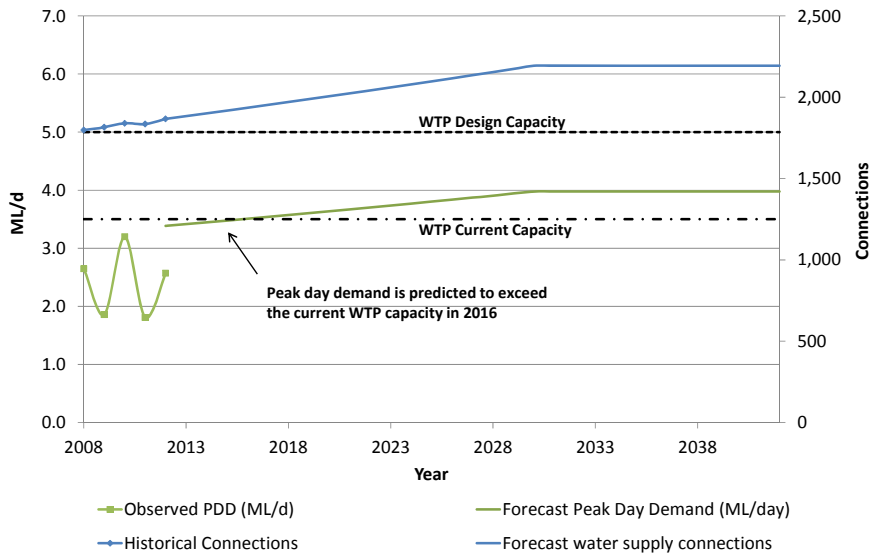
Demand and Secure Yield



Urban Water Supply Issues

No.	Issue	Target	Responsibility
I 18	The current capacity of Tenterfield WTP is expected to be exceeded by 2016 as the original plant is not in service.	Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)

WTP Capacity and PDD



Urban Water Supply Issues

No.	Issue	Target	Responsibility
I 19	The town water supply dam on Tenterfield Creek does not satisfy the ANCOLD Guidelines for Stability of Gravity Dams and the situation is likely to deteriorate.	Community Strategic Plan, Levels of Service, ANCOLD guidelines	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 30	Flooding and subsequent failure of water infrastructure remains a significant issue for Council with potential for significant impacts or loss of services, damage to infrastructure and harmful discharges to the environment	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)

Urban Wastewater Issues

No.	Issue	Target	Responsibility
I 4	Ongoing non-compliance with Environment Protection Licence due to high TSS values at Urbenville STW. This is believed to be caused by high rainfall and duck weed growth in the maturation ponds	Environment Protection Licence, POEO Act	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 7	The production of sulphides in some sewers is causing surface pitting and exposed aggregate which may lead to pipe failure.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 10	In the older sewers, there is a high degree of stormwater infiltration into the collection system, resulting in over loading at the Tenterfield STP during storm events.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)

Urban Wastewater Issues

No.	Issue	Target	Responsibility
I 11	The asset Management Plan identified the need for connection of the Tenterfield Industrial Estate to the Tenterfield sewerage system	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 12	The back-up generator for the main sewerage pumping station in Drummond Street is vulnerable to flooding and needs to be raised above flood level.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 13	The levels of service documented in the Strategic Business Plan for Sewerage Services are not being achieved in terms of percentage effluent reuse, number of complaints and effluent quality from Urbenville STP.	Sewerage Levels of Service, Best-Practice Requirements	TSC Eng. Services Dept (Water and Wastewater Services Group)

Urban Wastewater Issues

No.	Issue	Target	Responsibility
I 15	The Sewerage Levels of Service need to be reviewed and updated to reflect current standards and requirements	Best-Practice Requirements	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 20	Recycled water management plans have not been prepared for the recycled water systems.	Recycled Water Management Guidelines	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 21	All biosolids are disposed of to landfill with no beneficial reuse.	Environmental Guidelines: Use and Disposal of Biosolids Products	TSC Eng. Services Dept (Water and Wastewater Services Group)

Urban Wastewater Issues

No.	Issue	Target	Responsibility
I 23	There is concern from the community and Council regarding public health risks and about contamination of local waterways from inadequate on-site sewerage systems in the villages of the Shire.	OSSM Policy	TSC Eng. Services Dept (Water and Wastewater Services Group) and Environmental and Community Services Departments
I 31	Flooding and subsequent failure of sewerage infrastructure remains a significant issue for Council with potential for significant impacts on loss of services, damage to infrastructure and harmful discharges to the environment.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)

Urban Stormwater Issues

No.	Issue	Target	Responsibility
I 24	Stormwater from urban areas of Tenterfield causes water quality impacts in waterways	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Transportation Services Group)
I 25	In some urban areas of Tenterfield, localised flooding is experienced due to site constraints and insufficient capacity of the stormwater systems..	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Transportation Services Group)
I 26	Community health and safety risks have been identified due to stagnant stormwater and mosquitos.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Transportation Services Group)

Urban Stormwater Issues

No.	Issue	Target	Responsibility
I 27	Community health and safety risks have been identified due to septic tank discharges to stormwater systems.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Transportation Services Group)
I 28	There is a lack of community awareness about stormwater issues.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Transportation Services Group)
I 29	Council's current funding levels are insufficient to continue to provide urban stormwater services at current levels in the medium term.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Transportation Services Group)

Human Resources Issues

No.	Issue	Target	Responsibility
I 3	Staff resourcing issues have caused administrative non-compliances with Environment Protection Licences (late submission of annual returns).	Environment Protection Licence, POEO Act	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 9	Staff resourcing difficulties have prevented a complete Water Supply and Sewerage asset inventory from being compiled.	Community Strategic Plan, Levels of Service	TSC Eng. Services Dept (Water and Wastewater Services Group)
I 22	Due to staff resourcing issues, some targets outlined in the On-site Sewerage Management Policy are not currently being fully achieved.	OSSM Policy, POEO Act	TSC Environmental and Community Services Department

Human Resources Issues

No.	Issue	Target	Responsibility
I 32	Human resource challenges such as ageing workforce, difficulty recruiting and retaining professional staff and increasing community expectations may affect delivery of urban water services.	Community Strategic Plan, Levels of Service	TSC's General Manager's Department
I 33	Local government reform may alter the governance and regulatory arrangements for the provision of urban water services.		TSC's General Manager's Department

IWCM Issues

- Are there any other issues?

Data Gaps

No.	Issue	Target
D1	The current secure yield of the water supply systems has not been assessed with consideration of demand hardening and the additional emergency supplies.	Community Strategic Plan, Levels of Service
D2	The impact of climate change on the secure yield of the water supply systems has not been assessed.	Community Strategic Plan, Levels of Service
D3	The impact of climate change on the water supply, sewerage and stormwater assets and achievement of levels of service has not been assessed.	Levels of Service

Next Steps

- Draft IWCM Evaluation Study
- PRG Feedback
- Likely to be Simplified Strategy (can be prepared as additional section in document)