



Ballina-Lennox Head Recycled Water Master Plan



Mayor's Foreword

On behalf of Ballina Shire Council, I am very pleased to present our Recycled Water Master Plan for the Ballina-Lennox Head area.

Endorsed by Council in 2007, the Ballina-Lennox Head Recycled Water Master Plan (Master Plan) provides a clear direction for achieving our Urban Water Management Strategy objectives. The Master Plan demonstrates Council's direction for the sustainable management of its water resources over the next 20 years.

Community input and acceptance of these initiatives has been strong throughout the development of both the Urban Water Management Strategy and Master Plan. There is a strong emphasis from the community to save drinking water resources and deliver long term sustainable outcomes. I would like to congratulate and sincerely thank the community for their involvement throughout the development of the Master Plan.

The delivery of the Master Plan will see the implementation of a major capital works program, the value of which has not been seen previously by Council. The \$140 Million program will deliver recycled water to some 7,200 new residential allotments over the next 20 years and provide improved sporting facilities through the irrigation of playing fields and open spaces. In addition, the creation of vegetation regeneration lots will provide environmental benefits and the possibility for linking up areas of remnant vegetation and the creation of wildlife corridors.

The Master Plan will deliver real water savings and provide for a cleaner environment and a more sustainable community.

I encourage the community to support this Master Plan as Council endeavours to deliver environmental and economic outcomes that the community can embrace.



Phil Silver
Mayor

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Introduction

The Ballina-Lennox Head Recycled Water Master Plan (Master Plan) is the next important step following the development of the Ballina Shire Urban Water Management Strategy (UWMS), adopted in September 2003. The UWMS was developed in consultation with the Community Reference Group, made up of residents, community interest group representatives and government agencies. It provided a blueprint for the sustainable management of urban water resources across the Ballina Shire. Recycled water schemes are already operating for the villages of Wardell and Alstonville.

This document describes the objectives of the Master Plan, the evaluation and selection process for reuse options and the details of the proposed recycled water scheme for the Ballina-Lennox Head area. The Master Plan delivers elements of the UWMS and has been further developed following a process that included a number of technical studies, analysis and research into what the community wants. A technical report titled the "Supplementary Report" which supports the Master Plan, provides a more detailed description of these studies and research, and describes the other recycled water reuse options that were considered prior to determining the preferred scheme to service the Ballina-Lennox Head area.

For more information regarding this Master Plan:

Phone: 02 6686 4444
Email: council@ballina.nsw.gov.au
Write: PO Box 450, Ballina NSW 2478
Web: www.ballina.nsw.gov.au

The Master Plan at a glance

Background

In 2000, Ballina Shire Council commenced a process to develop the Ballina Shire Urban Water Management Strategy (UWMS). The UWMS outlined the long-term direction for the policies, planning and program of capital works to support an integrated urban water cycle for Ballina Shire. It was adopted by Council in September 2003.

The UWMS identified potential reuse types and nominated initial targets for dry weather recycled water reuse. These initial dry weather reuse targets were 40% reuse by 2008 and 80% reuse by 2013, however these targets have been revised following further investigation into delivering the program (Please see 'Background Study' on page 4 for reasoning behind this).

The UWMS embraced a number of statutory and contemporary planning principles such as the need for integrated planning and management of natural resources, including:

- demand management;
- long term strategic management;
- whole of system management;
- life cycle management;
- whole of sustainable water cycle management;
- affordability;
- protection of Public Health; and
- the need for resource recovery and the capacity to take up new technologies.

A major component of the UWMS is currently being implemented through the Ballina-Lennox Head Recycled Water Master Plan (Master Plan). The Master Plan includes initiatives for long-term management of wastewater from existing and projected future urban developments in the Ballina-Lennox Head area.

Why Develop a Master Plan?

Water is a natural resource and as the demand for water increases, people are starting to realise that there is not an endless supply. Whilst in the Ballina Shire we are surrounded by water and typically have plentiful rainfall in most areas to supply our needs (urban water use is approximately, 4000 ML/yr), the region's supply is still vulnerable due to factors such as climate change, drought, wasteful practices and population growth. Adequate planning and conservation are ways to ensure that there will be sufficient supplies available for future generations. The Ballina-Lennox Head area has a population of 26,500 and this is expected to grow to 41,400 by the year 2026.

Finding new ways to manage the water and wastewater services for the region not only makes good sense, it is essential to ensure a more sustainable community. New freshwater supplies are becoming more difficult and increasingly more costly to develop. Smarter and more reliable solutions are required that are consistent with the community's aspirations and values.

In 2008, Ballina Shire was releasing 90% of the highly treated wastewater from the Ballina-Lennox Head area into the Richmond waterway or the ocean. Council has investigated and has already implemented a number of recycled water reuse schemes at villages such as Wardell and Alstonville. In the Ballina-Lennox Head area, recycled water is being used on public playing fields and the golf course. The areas of greatest future potential relate to how the community (residents, business owners, industry etc) can use recycled water and contribute to reducing the regional demand on drinking water supplies.

This Master Plan outlines the proposed recycled water scheme to provide the community with long-term sustainable solutions for water resource management in the Ballina-Lennox Head area.

What are the objectives of the Master Plan?

The use of recycled water has ranged from 7-10% of the total recycled water production from 2002 to 2004 inclusive. Considering the corresponding seasonal dry periods (September to January inclusive) during the same years, recycled water use ranged from 10-21% of the total recycled water production. Council is already achieving approximately 15% recycled water reuse in dry weather.

The UWMS nominated higher reuse targets for the Ballina Shire for use of recycled water in dry months, as follows:

- Wardell Wastewater Treatment Plant (WWTP) – 100% by 2008.
- Alstonville WWTP – 80% by 2008 and 100% by 2013.
- Ballina and Lennox Head WWTP – 40% by 2008 and 80% by 2013.

The achievement of targets for Wardell and Alstonville are considered feasible and are on schedule. However, investigations into the feasibility of achieving the recycled water reuse targets for the Ballina-Lennox Head area as set out in the UWMS, identified some challenges. These investigations are documented in the 'Background Study' on page 4 of this document.



These early studies identified that the initial reuse targets and mix of reuse types might need to be re-considered, if the long-term sustainability and affordability objectives of the plan were to be achieved. This particularly related to a lack of integration between reuse types required to achieve the early targets (land irrigation), compared with more sustainable reuse types (residential reuse) capable of achieving the higher levels of substitution for fresh water resources. As a result, it was determined that for the Master Plan only one longer term recycled water reuse target should be set - 80% of dry weather reuse by 2026.

The objectives of the Master Plan process were to:

- Identify possible localities in the Shire where recycled water could be used and the type of use;
- Explore arrangements for infrastructure to support recycled water reuse;
- Identify areas for further investigation within the planning program;
- Outline a plan for optimisation of the preferred scheme showing key actions and responsibilities; and
- Outline additional requirements for the scheme including water reuse statutory requirements, approvals, agreements and system management requirements.

How was this Master Plan developed?

Council established a project team in July 2005 to prepare the Master Plan. The Master Plan process undertaken by the team aimed to explore in greater detail the direction for recycled water reuse that was originally identified as part of the UWMS.

This planning process involved a number of technical studies and analysis, including community and other stakeholder consultation and a comprehensive Social Research Study. These are described in greater detail below.

Background Study

In 2005/2006, a Background Study was prepared to develop a range of recycled water reuse options for the Ballina-Lennox Head region to meet the original reuse targets, which were consistent with the reuse types established by Council as part of the UWMS. The following technical investigations were undertaken:

- A review of previous studies and the recycled water reuse initiatives established in the Shire;
- More detailed investigation of the available supply and potential demand for recycled water in the Ballina-Lennox Head area between 2005-2026 based on the current land release strategy;
- Assessment of the existing and required recycled water qualities to match the potential uses identified;
- Preliminary options development, analysis and assessment to compare recycled water reuse options, including the definition of infrastructure needs and associated costs; and
- A comparison of risks and responsibilities associated with each option and key issues relating to the feasibility and practicalities of recycled water reuse were identified.

At the conclusion of the Background Study it was recommended that the original dry weather reuse target be reviewed and a new target be adopted; that the affordability of the scheme be investigated further; that a new short-list of options reflecting the new target and the range of feasible solutions be investigated; and that community input into the Master Plan process continue. This led to the development of the Supplementary Report.

Supplementary Report

The purpose of the Supplementary Report was to undertake further analysis and evaluation of the short list of recycled water reuse options identified in the Background Study and to determine the preferred reuse scheme. The options or scenarios that were looked at included:

Option A - 53% dry weather reuse target with end uses of recycled water reuse of urban open space irrigation and urban dual reticulation (urban uses);

Option B - 80% dry weather reuse target with end uses of recycled water reuse of urban open space irrigation (parks and gardens) and urban dual reticulation, plus agricultural reuse (AG) from the recycled water treatment plant;

Option C - 80% dry weather reuse target with end uses of recycled water reuse of urban open space irrigation and urban dual reticulation, plus vegetation regeneration (VR) from the recycled water treatment plant; and

Option D - 80% dry weather reuse target, end uses of recycled water for agriculture, vegetation regeneration and existing urban open space irrigation.

The following tasks were undertaken during the development of the Supplementary Report:

- Development and evaluation of various reuse options based on the work previously conducted in the Background Study;
- Multi-criteria Analysis;
- Community and other stakeholder communications and a Social Research Study, to determine amongst other things the community's willingness to pay for an expanded recycled water reuse scheme;

- Investigations to determine infrastructure needs and associated costs; and
- Identification of the preferred recycled water reuse scheme and recommendations for its implementation.

Due to the substantial costs of some options, a **Social Research Study** was undertaken to seek information from the community on their 'willingness to pay' for the possible reclaimed water reuse schemes (now referred to as recycled water reuse schemes). Specialist independent consultants undertook this study which involved both quantitative surveys in the form of completed telephone interviews (601 in total) and qualitative surveys in the form of four focus groups (9 people in each). The study was conducted with those residents owning or renting property with town sewerage connected, across Ballina Shire.

The results of the study indicated that:

- the majority of residents (76%) rated the importance of a new treated wastewater scheme between 8 to 10, on a 1 to 10 scale, where 10 means very important;
- open space irrigation and dual reticulation were valued more than reuse for either agricultural irrigation or vegetation regeneration;
- the overriding community driver, irrespective of the end uses, was a preference for a high percentage of water reuse, with 67% indicating that a high proportion of water reuse was extremely important; and
- community support increased as the re-use target and subsequent annual sewer rates increased, although one quarter (23%) of participants were against all three options that were proposed. The options being 23% reuse involving a \$184 pa increase in rates, 55% reuse involving a \$210 pa increase in rates and 80% reuse involving a \$270 pa increase in rates.

The four focus groups provided insights into other issues. The expanded reclaimed water reuse scheme was considered as very important to those that attended the focus groups, with the most common reason being that it would reduce the demand for drinking water. Participants also confirmed their preparedness to pay for reuse, in line with the quantitative results for the telephone survey. The results of the Social Research study were a key consideration in determining the preferred scheme.

A **Multi-criteria Analysis** was undertaken, taking into account benefits and impacts based on a range of environmental, social and economic factors. Each of the options was assessed and compared against the criteria and the results of this assessment were considered in determining the preferred scheme.

The analysis indicated that:

Option A - (expanded urban uses only) could only achieve 53% dry weather recycled water reuse and hence was limited in its opportunities in terms of all three factors, and failed to achieve the majority community aspiration for a high level of reuse;

Option B - (expanded urban uses + AG) could achieve 80% dry weather recycled water reuse, had a strong urban recycled water reuse component with associated conservation of current freshwater supplies, and would thus have strong community willingness to pay, but had a significant component of AG end use which is least preferred by the community;

Option C - (expanded urban uses + VR) could achieve 80% dry weather recycled water reuse, had a strong urban recycled water reuse component, strong support from the community and a significant component of VR end use (which is supported ahead of AG due to its environmental benefits and for the possibility of linking up areas of existing vegetation or creating wildlife corridors);

Option D - (existing urban uses + AG/VR) could achieve 80% dry weather recycled water reuse and thus would be supported by the community, but is strongly reliant on the non-urban uses with minimal conservation of current freshwater supplies (an important community aspiration, including AG which is the least preferred reuse type). The option also requires acquisition of large areas of land for irrigation, and there were doubts that this land could be acquired.

Supporting communication and consultation activities

In keeping with the ongoing communications and consultation over the years in developing the UWMS, a number of activities have been in place as a means of ensuring that the Ballina Shire community can access up to date information and provide their views on the Master Plan process, as well as other projects being undertaken as part of the UWMS. The activities include:

Water Talk – A number of Water Talk Newsletters have been produced, communicating updates on the Master Plan and UWMS initiatives. These Newsletters have been distributed to the entire Ballina Shire community and are available for download from Ballina Shire Council’s website.

Community Input Line - A community input telephone line was set up for the duration of the program’s community consultation periods. The community and other interested parties could call this toll free number to ask any questions that they may have had about the process or the wider program.

Website - Information on the UWMS and Master Plan is available at www.ballina.nsw.gov.au

Fact Sheets – A series of fact sheets on the UWMS and Master Plan can be viewed on Ballina Council’s website at www.ballina.nsw.gov.au.

Master Plan Exhibition – The Master Plan was exhibited for 4 weeks. The community had an opportunity during the exhibition period to make comments on the Master Plan by lodging a submission.

Adaptable - Innovation

By being adaptable the Masterplan will be able to respond to future changes in water supply requirements, technological advancements or changed community expectations.

Diverse - Reducing demand + Resource Efficiency

By introducing diverse water supply sources we will improve the security of our water supply and won’t be totally relying on rainfall for our water.

Community Input - Community Engagement

By exploring and taking account of community aspirations and values we will create a plan that everyone understands and supports.

Balanced - Social + Environmental + Economic

By considering environmental, social and economic factors in assessing available options we will create a more balanced outcome.

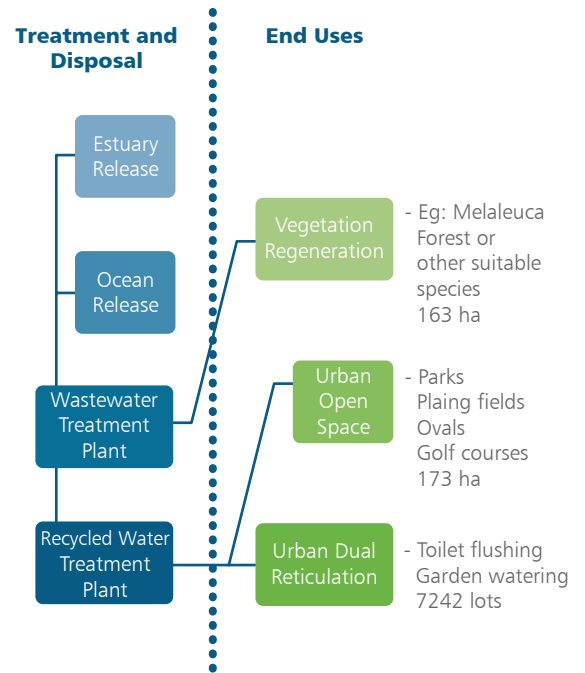
Proposed Recycled Water Reuse Scheme

The Master Plan was exhibited for community comment, and subsequently adopted by Council, in 2007. The Master Plan aims to achieve a dry weather reuse target of 80% by the year 2026 based on maximising urban residential reuse opportunities (open space irrigation and dual reticulation) and vegetation regeneration (VR).

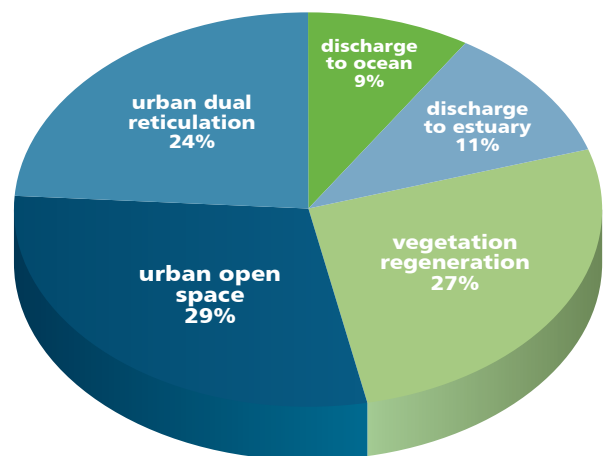
The Master Plan includes the following elements:

- Recycled Water Treatment Plants (RWTP) to further treat the water coming from the upgraded Ballina and Lennox Head Wastewater Treatment Plants to a very high standard suitable for residential and open public space reuse.
- Urban dual reticulation for most greenfield developments to service toilet flushing, cold water machine washing, car washing and garden watering demands. Servicing of an estimated 7200 lots from 2007-2026, is expected. Greenfield sites will be targeted, as they are new developments, making it more feasible to install a second incoming pipe to distribute highly treated recycled water to the lots. This is an additional pipe to the drinking water system that will be used for toilet and cold washing machine tap as well as garden and car washing.
- Expansion of Council’s existing urban open space irrigation from 36 hectares to an estimated 170 hectares by the year 2026.
- Vegetation regeneration, approximately 160 hectares by the year 2026. This is supported for its environmental benefits and for the possibility of linking up areas of remnant vegetation or creating wildlife corridors. An example would be the creation of native Melaleuca forest or other suitable species on previously degraded or agricultural land.
- Ongoing waterway and ocean release from the existing Wastewater Treatment Plants, with a substantial reduction in volume during dry weather conditions.

Vision for recycled water in the year 2026



Master Plan Proposed Ballina - Lennox Head WWTP dry period water balance in 2026





Aerial photo showing key elements of the Master Plan

LEGEND

- Existing or Imminent Dual Reticulation
- Proposed Dual Reticulation
- Existing Open Space Irrigation
- Proposed Open Space Irrigation
- Proposed Irrigation of Regenerated Vegetation
- Potential Constructed Wetland or Irrigation of Regenerated Vegetation
- Existing Wastewater Treatment Plant (WWTP)
- Potential Recycled Water Treatment Plant (RWTP) Location
- Potential Recycled Water Reservoir (RWR) Location
- Existing Recycled Water Pipeline
- Proposed Recycled Water Pipeline

- ① Proposed Recycled Water Reservoir near Ross Lane / Pacific Highway Junction
- ② Proposed Recycled Water Reservoir at Cumbalum / Ballina Heights
- ③ Existing Ballina Wastewater Treatment Plant (WWTP)
- ④ Potential Recycled Water Treatment Plant adjacent to Ballina WWTP
- ⑤ Potential Recycled Water Treatment Plant at Southern Cross Industrial Estate
- ⑥ Existing Lennox Head Wastewater Treatment Plant (WWTP)
- ⑦ Potential Recycled Water Treatment Plant within the Lennox Head WWTP site
- ⑧ Alternate Locations for Proposed Recycled Water Reservoir at Lennox Head

What is dual reticulation?

A dual water supply system will allow residents in new greenfield sites to have access to two water sources, through separate pipe networks. One water supply is drinking water (also known as potable water), that is safe for human consumption, the other source of water is recycled water that has been treated to standards that are safe for uses such as:

- watering the garden
- toilet flushing
- cold washing machine tap
- washing your car
- washing your pathway or house walls
- backyard ponds

Recycled water treated to this level cannot be used for drinking, cooking or use in the kitchen, bathing, personal washing, or swimming pools.

NSW Health supports the use of recycled water reuse and has established standards and guidelines for its usage.

What is open space irrigation?

Recycled water can be treated to the appropriate standards and used to irrigate open space areas such as parks and golf courses, which may otherwise use valuable drinking water to irrigate the land.

What is vegetation regeneration?

Recycled water can be used for irrigation of newly planted native vegetation. This supports the regeneration of native vegetation such as Melaleuca or other suitable species.

What is waterway and ocean release?

This refers to the proportion of recycled water that is not reused and is released into a waterway or ocean. Currently a large amount of water is being released, which could otherwise be used to substitute for some uses of drinking water.

Following the implementation of the scheme, waterway and ocean release will be significantly reduced, especially during dry weather. This will benefit the waterway, as it is more vulnerable to the effects of recycled water during dry weather.

Benefits of using Recycled Water

In 2008, Ballina Shire, reused on average less than 10% of treated wastewater, with about 90% being discharged to the Richmond waterways or ocean. The proposed recycled water reuse scheme intends to achieve an 80% dry weather reuse target in the Ballina Shire by the year 2026. This is equivalent to re-using 56% of all the wastewater produced in the Ballina Lennox Head area throughout the year.

This will be achieved through a focus on dual reticulation, urban open space irrigation and vegetation regeneration.

The advantages of using recycled water include:

- Reducing demand on existing water supplies, conserving freshwater supplies for drinking and personal use;
- Being a more reliable source that is less climate sensitive and can greatly reduce the likelihood of water restrictions as it can be supplied all year round;
- Delaying capital works programs such as upgrades and construction of new freshwater storage, treatment and distribution facilities, potentially saving millions of dollars;
- Providing water and some nutrients for lawn and plant growth;
- Decreased nutrient loads on waterways such as estuaries and streams; and
- Benefiting the environment through regeneration of native vegetation and associated wildlife corridors.



Lennox Head Wastewater Treatment Plant

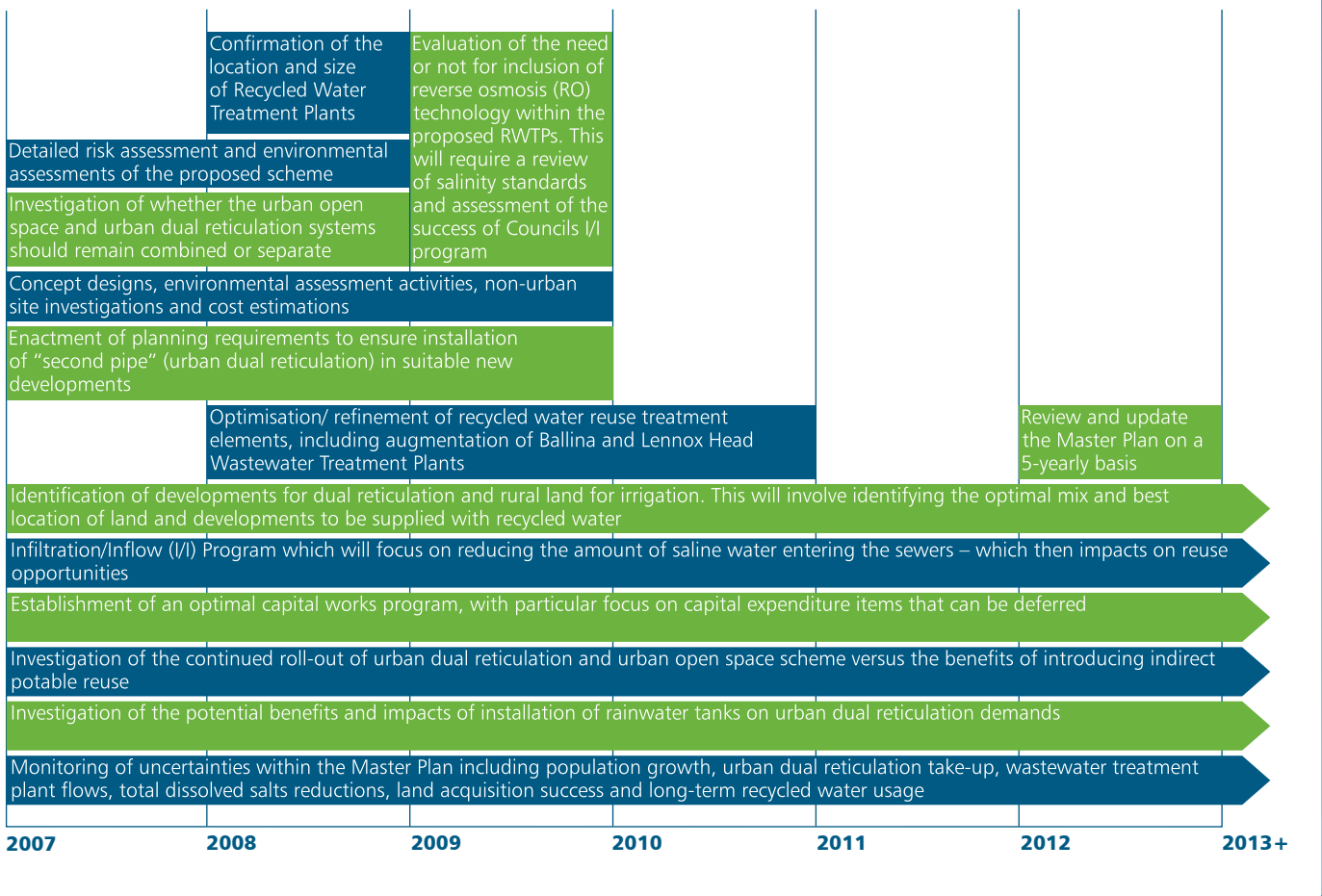
Implementation of the Master Plan

It is essential that the implementation the Master Plan is planned, staged and reviewed on an ongoing basis, to ensure that the maximum benefits from this program are achieved. Council’s Master Plan project team will oversee the implementation phase which will include forums and ongoing liaison with the community and other stakeholders.

The Master Plan involves progressive implementation with some elements able to proceed immediately, and others requiring further investigation and development. Two implementation programs will run concurrently, a planning program as well as an infrastructure delivery program.

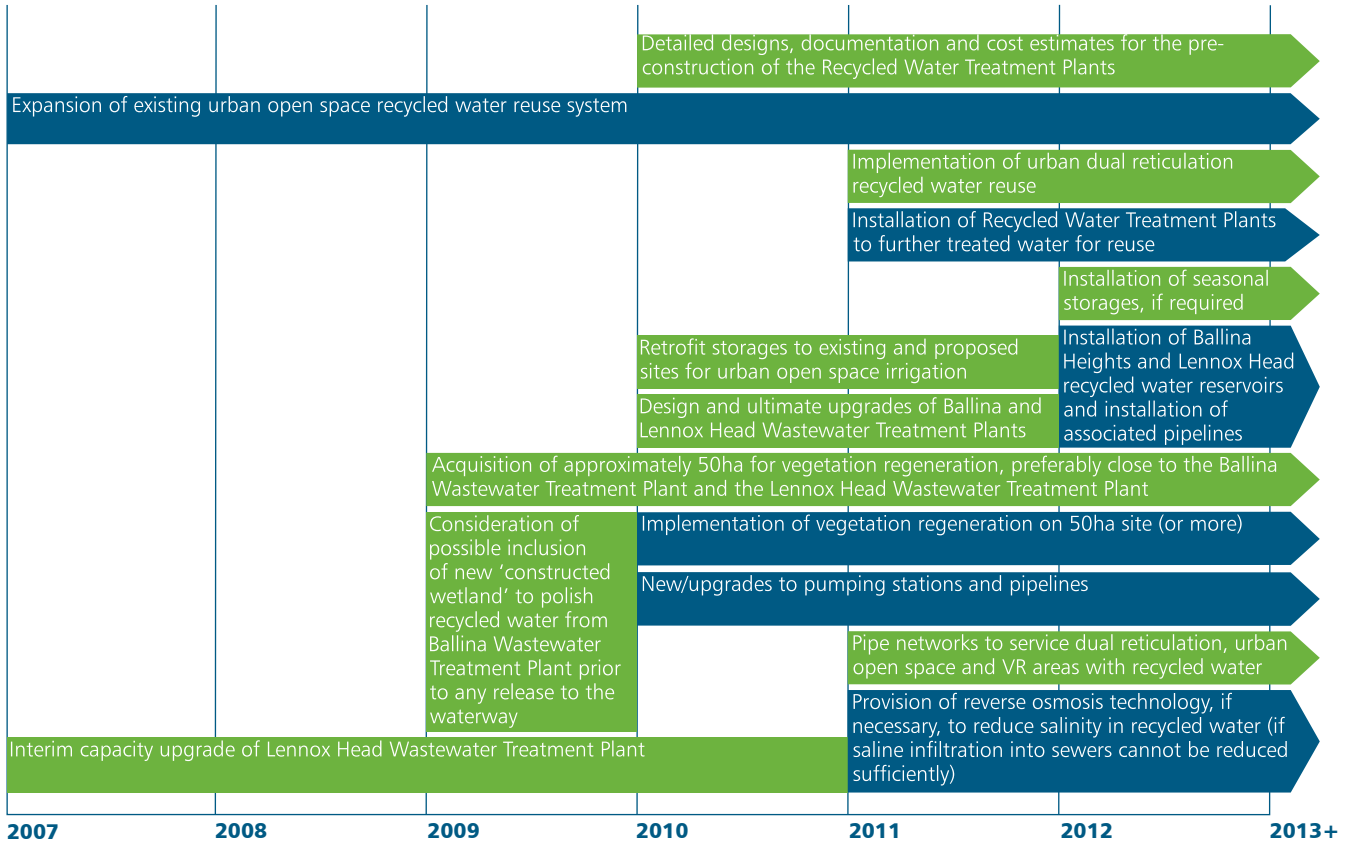
This involves activities that are already underway or can start immediately (2007-2012), as well as activities that will commence once some of the issues in the planning stage are resolved (2007-2012 and beyond). An extensive infrastructure system is required and will be provided in a timely and logical manner to ensure each use can be supplied with appropriately treated recycled water.

Planning Program Activities



Implementation of the Master Plan Cont.

Infrastructure Delivery Activities



Review and Monitoring

The Master Plan will be formally reviewed every five years. This will ensure the plan continues to be adaptable and responsive to the changing water requirements. These reviews will allow outcomes from ongoing research into localised and emerging initiatives and new technologies to be considered and incorporated where possible into the Master Plan. These reviews will also ensure that the community continues to have input into the sustainability of its integrated water cycle systems.

Cost of the Recycled Water Scheme

The total predicted scheme costs for the implementation of the Master Plan, and other elements of the UWMS, is \$140 million over 30 years (in 2008's \$dollars). These costs include:

1. Renewal of existing reticulation assets - \$29 million (plus \$3,500,000 anticipated for Sewer Rehabilitation/Salinity Abatement Program)
2. Renewal and upgrading of existing treatment facilities, pumping stations and rising mains - \$50 million
3. Master Plan works total - \$61 million which involves the building of:
 - Ballina and Lennox Head Recycled Water Treatment Plants (RWTPs) - \$16 million
 - Distribution Network - \$18 million
 - Open Space infrastructure - \$7 million and
 - Vegetation Regeneration infrastructure - \$20 million.

The \$61 million allocated to implementing the Master Plan will be allocated across a number of stages. Stage 1 includes works up until 2013 which have an associated cost of \$52 million.

In addition to the \$61 million required for the implementation of the scheme, developers will be required to install onsite infrastructure for the Urban Dual Reticulation. These works are estimated to cost \$15 million.

The operation of the new scheme will also involve significant additional operational costs and resources.

Activity	Total Estimated Cost	Estimated dates of Construction
Urban Open Space	\$7 Million	2007-2020
Vegetation Regeneration	\$20 Million	2008-2020
Urban Dual Reticulation	\$15 Million	2008-2020
Distribution Network	\$18 Million	2008-2020
Recycled Water Treatment Plant	\$16 Million	2010-2023

How will this affect Council rates?

The impact of the Master Plan on Council's sewerage rates has been assessed. Modelling of the rated impact indicates that works would increase the total residential bill (TRB) from \$480 per annum to between \$700 and \$800, depending on the level of contingency and treatment technology required. If salinity issues cannot be addressed through the current remedial programs and reverse osmosis is required, the cost may be increased.

Council is, however, attempting to remove the need for reverse osmosis through the implementation of an Inflow/Infiltration Abatement Program. The modelling of the rates are based on 2007 dollars and have been modelled for a staged increase of typically \$40 per year with the ultimate total increase being achieved by 2013 at the earliest depending on the loan strategy adopted.

As the designs are further developed, more accurate cost estimates will be available and the rate impacts will be reviewed. The benefits to the Ballina and Lennox Head communities of implementing the Master Plan is only possible with a rise in residential rates and private developer charges.

Glossary

Catchment – The land area drained by a river and its tributaries.

Capital works – Infrastructural developments which satisfy service delivery requirements.

Drinking (potable) water – Water treated to a standard suitable for drinking.

Dual reticulation – Two separate pipe networks: one supplies drinking (potable) water and the other supplies recycled water.

Highly treated recycled water – Recycled water that has undergone extensive filtration and disinfection processes and treated to a level suitable for toilet flushing, cold tap machine washing and external uses such as garden watering and car washing.

Master Plan - The overall vision and guidelines for sustainable urban water management practices that meet community needs.

Multi-criteria analysis – Evaluation of options against Triple Bottom Line criteria ie, Environmental, Social and Economic.

Nutrients – Substances, including nitrogen and phosphorus, which are necessary for life and act as fertilisers to promote biological activity.

Ocean release – Release from the recycled water treatment plant to the ocean.

Open space irrigation – Irrigation of urban open space such as playing fields and golf courses.

Project team – The team of Council personnel, project managers and consultants responsible for delivery of the project.

Recycled water – Wastewater that has undergone a rigorous series of advanced treatment processes that remove organic matter, nutrients and micro-organisms to deliver water that is cleaner, clearer, odourless and disinfected.

Recycled Water Treatment Plant (RWTP) – A facility that processes treated water from the wastewater treatment plant to a higher quality for use within the community, in particular for residential re-use for gardens, toilet flushing and car washing.

Reuse – The beneficial use of recycled water. Reused water is recycled water that is utilised as a resource, rather than a waste.

Reverse osmosis (RO) - A water treatment method used to remove dissolved inorganic chemicals and suspended particulate matter from a water supply, especially the removal of salts. Water, under pressure, is forced through a semi-permeable membrane that removes molecules larger than the pores of the membrane.

Sewerage – The system of pipes and pump stations and treatment plants used to transport and treat wastewater.

Social research project – Independent assessment of the communities 'willingness to pay' and issues identification through focus groups and telephone surveys.

Stormwater – The portion of rainfall that does not infiltrate into the soil combined with rainfall that runs off non-permeable surfaces such as roads and roofs.

Sustainable – Activities that can be maintained over the long-term, while achieving a balance between the environment, the economy and the society.

Urban Water Management Strategy (UWMS) – Long term integrated water cycle management strategy adopted by Council in 2003.

Urban Water Reference Group - A group made up of Council and community members to facilitate community feedback on 'water' issues within Ballina Shire.

Vegetation regeneration – The use of recycled water to regenerate local vegetation such as Melaleuca forest or similar native species.

Wastewater – Wastewater is generated from commercial, industrial and residential properties including waste from the toilet, kitchen, bathroom and laundry.

Wastewater Treatment Plant (WWTP) – A facility that processes wastewater to a standard suitable for discharge to the natural environment including some reuse applications.

Water cycle – The continuous cycle of water movement through the environment, including the oceans, the atmosphere surface water systems and groundwater.

Water demand – Total water use requirements of an area.

Water supply – System of water sources (eg Dams), treatment plants, pump stations, reservoirs and distribution pipes to supply drinking water on demand to customers.

Waterway (estuary) – A waterway is a semi-enclosed body of water which has a free connection with the open sea and within which sea water mixes with freshwater. Waterways include streams, creeks, rivers, estuaries inlets and harbours.



For more information regarding this Master Plan:

Phone: 02 6686 4444

Email: council@ballina.nsw.gov.au

Write: PO Box 450, Ballina NSW 2478

Web: www.ballina.nsw.gov.au