Strategic Planning Framework for Recycled Water

Prepared by

RMCG

Consultants for Business, Communities & Environment

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ABN: 35 154 629 943

RMCG
Consultants for Business, Communities & Environment

Bendigo Office:
135 Mollison Street, Bendigo
PO Box 2410 Mail Centre, Bendigo, Victoria 3554
T (03) 5441 4821 F (03) 5441 2788

E rm@rmcg.com.au W www.rmcg.com.au

Contact Details:
Name: Anna Kelliher
Title: Principal Consultant
Address: PO Box 2410, Mail Centre, Bendigo 3554
P: 03 54414821
F: 03 54412788
M: 0427 859129
E: annak@rmcg.com.au

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1 Introduction

1.1 Background

The efficient use of water to meet the social, economic and environmental needs of our community is becoming a high priority throughout Australia, especially given the extremely dry climatic conditions experienced in recent years.

One important water resource is recycled water (treated wastewater). This resource has been gradually tapped for community and regional benefits, including:

- Agricultural irrigation.
- Municipal uses such as irrigation of public open spaces and sports grounds.
- Dual reticulation systems for residential areas, with recycled water used for gardens and toilet flushing.
- Provision of environmental flows.
- Industrial uses.

Whilst a significant amount of reuse has been successfully undertaken throughout Australia, it is still possible to improve the way recycled water is used.

This document provides a strategic planning framework that integrates the technical, environmental, economic and social aspects of beneficially using recycled water.

The framework was originally developed in 2004, for Grampians Water and the Wimmera Water for Growth Committee, with funding from the Victorian state government. This resulted in the report *Grampians Water - Strategic Planning Framework for Reclaimed Water* (RMCG, 2004). This document provides a summary of the key elements of the strategy in a form that is suitable for wider, more generic use.

1.2 Project outcomes

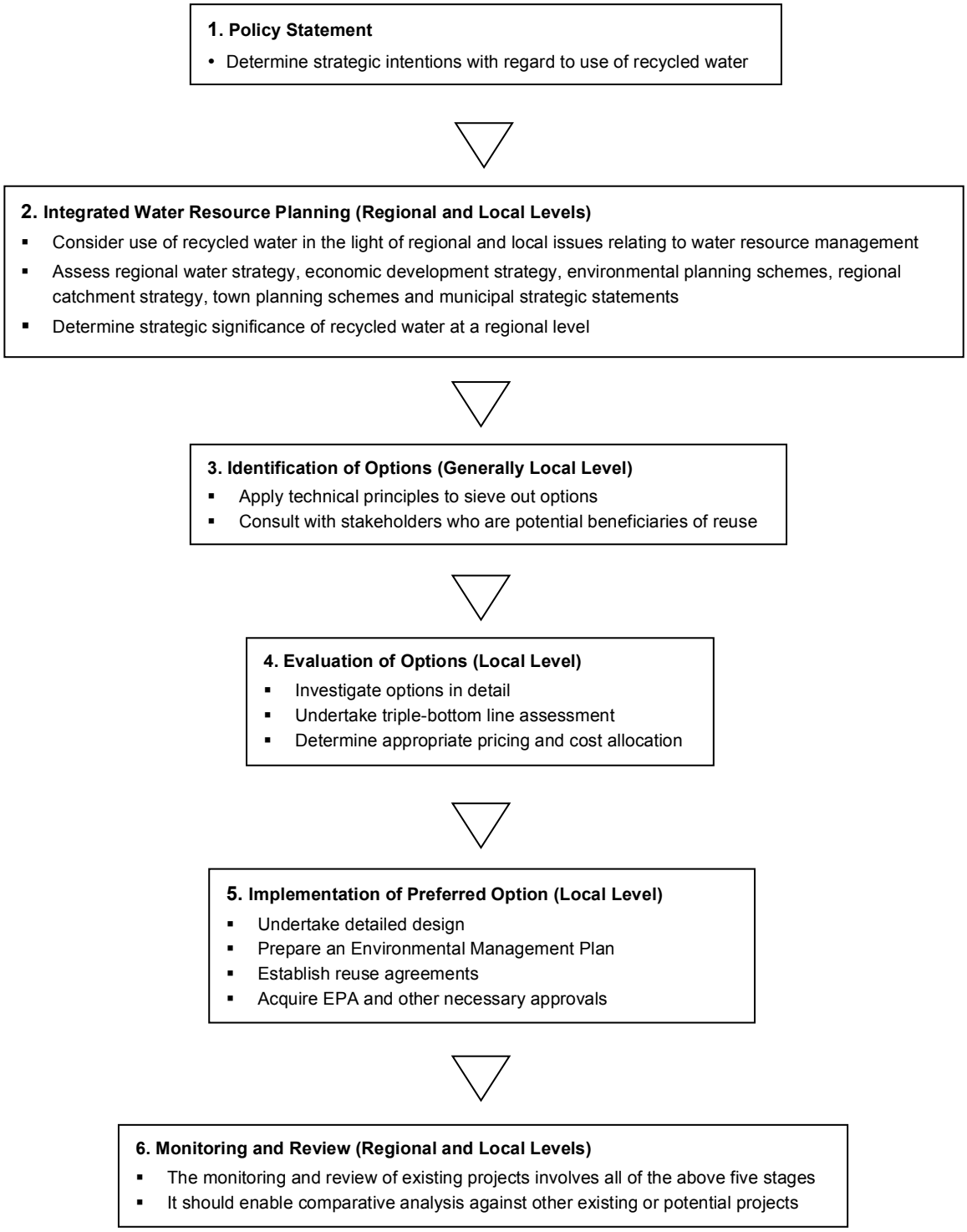
Key conclusions arising from the development of this Strategic Planning Framework for Recycled Water are as follows:

- Integrated water resource planning is a vital step both locally and regionally. Solutions to recycled water use need to be developed in conjunction with solutions to potable or other water supplies.
- Identification of specific options for recycled water use requires consultation with key stakeholders to determine interest in and feasibility of potential end uses. Consultation involves both informing the stakeholder about the recycled water (including its potential benefits), and listening to the stakeholder's needs and concerns.
- In most situations there is some history and certain givens relating to recycled water, and it is necessary to build on the existing situation. The process described in this document can be used to enhance recycled water use, whether there is a "clean slate" or an existing situation.

- Reuse schemes that are driven by a regional economic imperative are generally the most successful. The economic benefits encourage both commitment to a high level of management and maintenance, and support from the local community and/or local government.
- Use of a strategic planning framework provides a transparent process, which can be replicated. It is a practical method for showing others, including government agencies and neighbouring farmers, that strategic planning has been undertaken. A checklist of issues/topics that are to be considered in assessment of recycled water schemes is included in the framework.

2 Strategic Planning Framework Overview

The following diagram summarises the six steps of the Strategic Planning Framework for Recycled Water. Note that an iterative approach is recommended.



3 Step 1: Policy Statement

3.1 Purpose

The body responsible for recycled water management (eg. local government, water authority, source industry) needs to develop a policy statement to ensure that the strategic intentions with regard to the use of recycled water are determined and documented. This will guide the approach to reuse.

3.2 Process

To create a policy statement the following steps should be undertaken:

- Investigate key drivers for recycled water use through consideration of the agencies vision, the regulatory framework, environmental imperatives, state government direction and stakeholder feedback
- Consult with internal stakeholders to determine their intentions with regard to the use of recycled water
- Draft a statement of intentions
- Submit statement of intentions to the relevant board (or equivalent) for review and approval.

4 Step 2: Integrated Water Resource Planning

4.1 Purpose

The aim of integrated water resource planning is to ensure that the use of recycled water is considered in light of current and emerging issues relating to water resource management at both a regional and local level.

The outcome of this assessment will be a focus on the key areas for recycled water use.

4.2 Process

To achieve integrated water resource planning, an assessment of water resources, regional development, environmental and social issues is required. This is undertaken through consideration of:

- Regional water strategy
- Economic development strategy
- Environmental planning and regional catchment strategy
- Town planning schemes, municipal strategic statements and local planning policies.

Each of these segments is discussed below.

4.3 Regional water strategy

Recycled water is one of several sources of water for urban, agricultural, industrial, recreational and environmental use.

All sources of water and all consumptive uses in a region need to be identified and an assessment made of the trends and pressures on water, including long-term climate change. This will enable opportunities for recycled water to be identified in a broad sense.

It is likely that there will be existing documented plans or strategies of relevance. For example, in Victoria, a Sustainable Water Strategy has been developed for each of four regions: Western, Northern, Gippsland and Central regions. Access to existing documents and consultation with local authorities will allow determination of the trends and pressures on water in the region.

Key questions to consider include:

- What sources of water are available?
- What is the quality of the water available?
- What infrastructure exists for the supply of water and what are the maintenance/upgrade plans for this into the future?
- What is the water being used for?
- What are the current trends in water use?
- Is development being limited by availability of water?

- How is water supply affected by climatic conditions (i.e. what happens in drought/flood years)?
- How is water use impacting on the surface water and groundwater environments?
- Do the surface and/or groundwater systems need additional environmental flows?
- How does water use impact on neighbouring, particularly downstream, regions?
- How is stormwater managed in urban areas? (Note this could be a water resource and/or an environmental issue)
- How does/could recycled water fit into the water strategy?
- Is there a recognised value for recycled water?
- Can recycled water be used to substitute for existing use of freshwater (potable or raw supplies)?
- Can use of recycled water reduce the need for future water supply or treatment infrastructure?
- Is recycled water accepted as an alternative source of water?
- Are other alternative supplies likely to become viable in future through technology advancement?

4.4 Economic Development Strategy

Reuse schemes that are driven by a regional economic imperative are generally the most successful. The economic benefits encourage both commitment to a high level of management and maintenance, and support from the local community and/or local government.

The economic benefits can be both direct and indirect. Recycled water may:

- Facilitate the growth of a particular industry such as viticulture
- Improve community facilities such as golf courses, to enhance lifestyle opportunities
- Increase environmental flows and thus encourage additional tourism due to improved river amenity.

Access to the economic development strategy for a region is through local government. In some regions there may also be a body that considers economic development at a larger scale.

Key questions relating to economic development are:

- What forms of agriculture/horticulture exist in the area?
- How much water is used in agriculture/horticulture and for what purpose?
- What types of industry are located in the area?
- How much water is used in industry and for what purpose?
- Where are the majority of the population employed?
- What are the development trends in the area?

- Does the area have a distinct competitive advantage in a particular industry due to location, environment, existing infrastructure?
- Is availability of water limiting development?
- Would access to recycled water enhance existing developments or create new development opportunities?

4.5 Environmental Planning and Regional NRM Strategy

Recycled water has the potential to impact on the environment in both positive and negative ways. For example it can:

- Enhance environmental flows through substitution for freshwater supplies
- Add nutrients and salt to rivers or wetlands via direct discharge or through inappropriate management of reuse

The regional Natural Resource Management (NRM) strategy (e.g. Victoria: Catchment management strategies, NSW: Catchment action plans) and supporting river health plans or equivalent, need to be assessed to determine where recycled water can contribute to achieving environmental outcomes.

Environmental related questions to consider include:

- What are the major environmental issues in the region?
- What is causing (or has caused) these issues?
- What programs are in place, or planned, for addressing environmental issues?
- Are there site specific issues in proximity to the source of recycled water (e.g. sensitive wetlands, remnant native vegetation, salinized areas)?
- Is recycled water use currently causing adverse environmental impacts?
- Can recycled water help negate existing environmental issues?

4.6 Town Planning Schemes, Municipal Strategic Statements and Local Planning Policies

As with the environment, recycled water can have positive or negative impacts on social factors such as amenity, recreation and community confidence. Assessment of town planning schemes, municipal strategic statements and local planning policies will enable integration of recycled water into the social development strategy.

Urban and rural planning is vital for the orderly development of housing, industry and community services into areas best suited for them. Protection of scarce resources, preservation of coastal and rural areas, conservation of historic urban precincts, public access to State and regional facilities, distribution of business centres and general social equity are important considerations in the planning process.

The provision of water is a key requirement of any planning scheme.

Implications for recycled water can be identified through consideration of:

- Urban area growth (resulting from population growth), which may provide potential for third pipe reuse systems.
- Location of open space and recreation facilities, the management/use of these facilities and their need for water.
- Planning for growth issues. Urban encroachment could impact on siting of treatment plants, protective buffer areas, or location of irrigated agriculture.

5 Step 3: Identification of Options

5.1 Purpose

This step aims to identify specific options for recycled water use by:

- Applying a range of technical principles to assess the potential for implementing reuse
- Considering the potential beneficiaries of reuse and undertaking consultation with these key stakeholders.

5.2 Technical sieve

5.2.1 General

Use of recycled water is constrained by a number of technical factors relating to the recycled water itself, the physical features of the local area and existing/potential land use. Through consideration of these at an early stage in the process, potential options can be narrowed down to those that are feasible.

5.2.2 Recycled water quality and quantity

Health Risk due to Microbial Hazards

The treatment process used and the resulting water quality, combined with on-site controls, determine the range of acceptable end uses available for recycled water.

The *Guidelines for Environmental Management: Use of Reclaimed Water* (EPA Victoria, 2003, Publication 464.2) outline four classes of recycled water. The class relates to the level of treatment undertaken, the resulting water quality objectives achieved and the risk there is to human health. For each class the acceptable categories of end use are defined. A brief summary is provided in the table below.

Class	Treatment Process	Range of Irrigation Uses
A	Tertiary and pathogen reduction.	Urban (non-potable): with uncontrolled public access Agricultural: eg. human food crops consumed raw Industrial: open systems with worker exposure potential
B	Secondary and pathogen reduction (including helminth reduction for cattle grazing)	Agricultural: eg dairy cattle grazing Industrial: eg. washdown water
C	Secondary and pathogen reduction (including helminth reduction for cattle grazing)	Urban (non-potable): with controlled public access Agricultural: eg. human food crops cooked/processed, grazing/fodder for livestock Industrial: systems with no potential worker exposure
D	Secondary	Agricultural: non-food crops including instant turf, woodlots, flowers

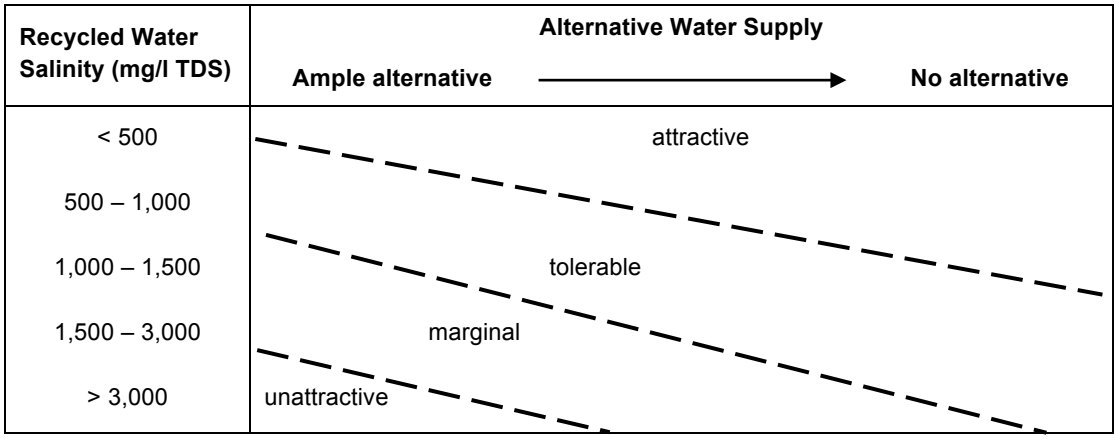
The approach used in the *National Guidelines for Water Recycling: Managing Health and Environmental Risks* (NRMMC, EPHC & AHMC, 2006) is based on performance targets expressed as log reductions required to meet compliance with the tolerable risk of 10^{-6} DALYs per person per year[1]. Viruses, protozoa and bacteria have separate log reduction targets. Log reductions achieved are based on a combination of treatment processes, on-site controls and use restrictions. An example is provided in the following table.

Municipal Uses (open space, sports grounds, golf courses)		**Viruses**	**Protozoa**	**Bacteria**
Log reduction targets		*5.0*	*3.5*	*4.0*
Use	**Preventive Measures**			
Unrestricted use and application	Advanced treatment – eg. secondary plus membrane filtration and UV disinfection	5.0	3.5	4.0
	No specific on-site measures	-	-	-
	Total	*5.0*	*3.5*	*4.0*
Restricted access and application	Secondary treatment with disinfection	2.0 – 3.0	1.0	>6.0
	Restrict public access during irrigation	2.0	2.0	2.0
	Spray drift control – eg. low throw sprinklers, vegetation screening	1.0	1.0	1.0
	Total	*5.0 – 6.0*	*4.0*	*> 9.0*

Salinity

Salts in recycled water can limit the type of land use and/or the volume of water that can be applied in irrigation.

Note that the availability of alternative water supplies impacts on the attractiveness of the recycled water.



[1] DALYs = Disability adjusted life years. 10^{-6} = 1 illness per 1,000,000 people. This risk level is consistent with WHO Guidelines for Drinking Water Quality.

Nutrients

Nutrients are utilised in plant growth and can therefore be beneficial in terms of production. However, if nutrients are applied in excess they can be transported offsite and cause adverse impacts to surface waters and groundwater.

The nutrient content of secondary treated sewage is normally between 10 and 30 mg/l nitrogen, and between 6 and 10 mg/l phosphorus. Tertiary treatment plants configured for nutrient removal typically reduce these levels to < 5 mg/l nitrogen and < 1 mg/l phosphorus.

The following table outlines relative nutrient risk for various climates. Climate impacts on risk level as it determines the annual plant demand for water and thus the nutrient loading (in kg/ha).

Average Annual Rainfall	**Phosphorus**		**Nitrogen**	
	Low Risk	High Risk	Low Risk	High Risk
< 400 mm	< 3 mg/l	> 6 mg/l	< 10 mg/l	> 20 mg/l
400 – 700 mm	< 5 mg/l	> 8 mg/l	< 20 mg/l	> 30 mg/l
> 700 mm	< 8 mg/l	> 12 mg/l	< 30 mg/l	> 40 mg/l

Toxicants

Toxicants such as organic chemicals and heavy metals, may adversely affect soils and the safety levels of produce.

Toxicants in recycled water are generally sourced from industrial waste inputs. Therefore the critical question to consider is:

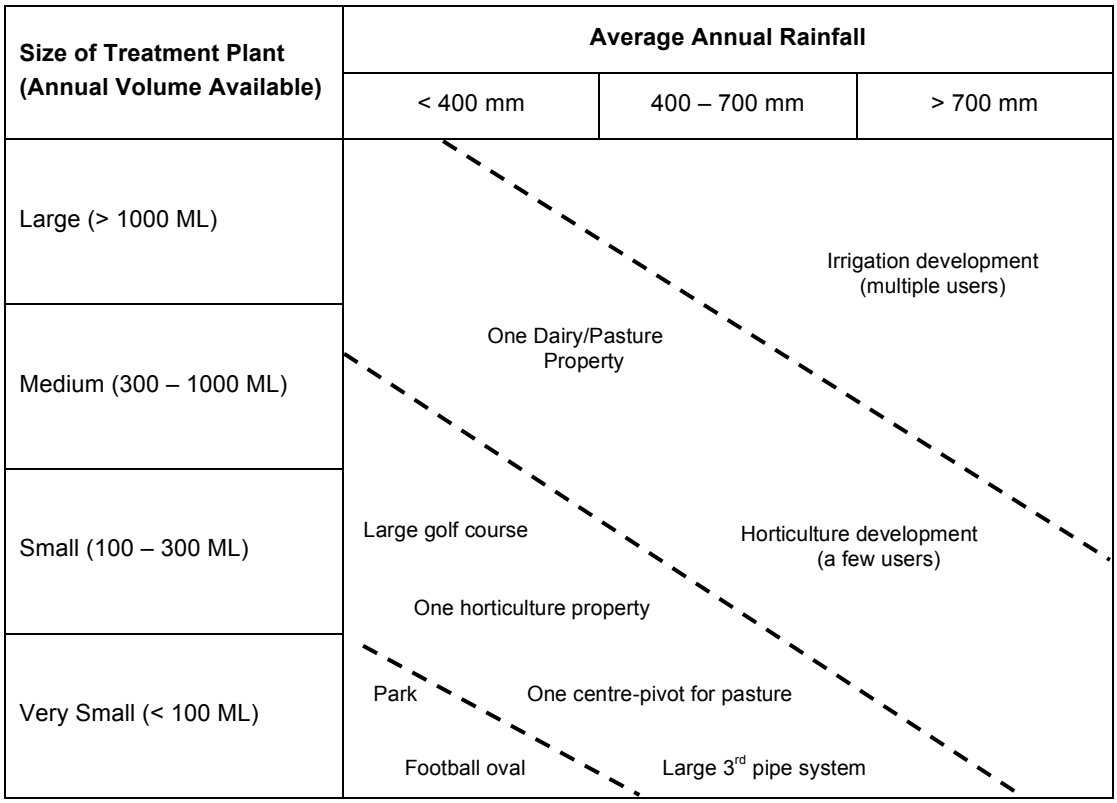
- Are there any industrial waste inputs to the sewer system?

If the answer is NO, toxicants are not expected to limit reuse. If the answer is YES, the type of industry will determine the toxicant risk. For example waste from food processing industries is unlikely to contain toxicants, while waste from the petro-chemical industry is very likely to contain toxicants.

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) provide guidance for individual toxicants.

Volume

The volume of recycled water, in combination with the local climate, determines the area of land required for reuse. This in turn can determine the potential types of reuse available.



Note the significance of a volume as environmental flows will be dependent on the receiving water.

5.2.3 Natural features of the area

Soils

The inherent properties of a soil determine its suitability for irrigation, the types of crops that can be grown successfully and the potential crop yields that can be achieved. The following table obtained from *A Soil Survey Method for Productivity in Irrigated Agriculture* (Cockcroft & Dillon, 2004) outlines this relationship.

Soil Class	Depth of Topsoil	Texture of Topsoil	Texture of Subsoil	Crops that can be irrigated
1	> 25 cm	Sand, Sandy loam	Clay loam and lighter	Excellent for horticulture
2	17 – 25 cm	Sandy loam, Loam	Sandy loam, Clay loam, Sandy clay, Light clay	Good for horticulture
3	11 – 16 cm	Loam	Light – medium clay	Marginal for horticulture. Excellent for pastures.
4	7 – 10 cm	Loam, Clay loam, Sandy clay	Light – medium clay	Good for pastures.
5	5 – 6 cm	Clay loam, Clay	Medium – heavy clay	Marginal for any irrigation.
6	< 5 cm	Clay	Heavy clay	Unsuitable for irrigation

Topography

Steep slopes are unsuited to irrigation due to the risks of erosion and surface runoff.

For moderate to flat grades, topography determines the most suitable type of irrigation and consequently the cost of development.

Slope	Irrigation Method
Steeper than 1:10	Not suited to irrigation
1:10 to 1:1000	Drip, fixed sprinkler or “big gun” irrigation
1:20 to 1:1000	Centre pivot or linear move irrigation
1:50 to 1:1000 (uniform slope)	Flood (border check) irrigation

Vegetation

Conserving native vegetation plays a key role in achieving environmental, economic and social objectives by, for instance, maintaining biological diversity, preventing land degradation and providing habitat for flora and fauna.

In Victoria native vegetation removal is controlled by legislation such that planning permits are required for removal, lopping or destroying native vegetation on land holdings greater than 0.4 ha in size.

Areas of significant native vegetation should be avoided in development of reuse.

Surface Waters and Groundwater

Development of reuse should ensure protection of beneficial uses of surface waters and groundwater.

Initially an assessment of the location and sensitivity of surface waters, the depth to the watertable and the quality of groundwater is required to determine if there are sensitive areas that it is preferable to avoid.

Later in the evaluation and implementation phases appropriate processes for managing risk to surface water or groundwater can be determined.

5.2.4 Existing/Potential Land Use

Existing Infrastructure

Existing irrigation, distribution or storage infrastructure, provided it is in good condition and meets the required standards, has the potential to result in capital cost savings.

Management Experience

Where experienced operators are present, risk of poor management is reduced.

Experience in both the irrigation system and the land use is preferred. Examples include an existing tomato irrigator substituting recycled water into an existing subsurface drip system, or an experienced green keeper utilising water in an existing golf course irrigation system.

Experience in one or the other, i.e. the irrigation system or the land use, is also of benefit. An example is an existing olive grower who has not irrigated in the past and wants the recycled water to help increase production.

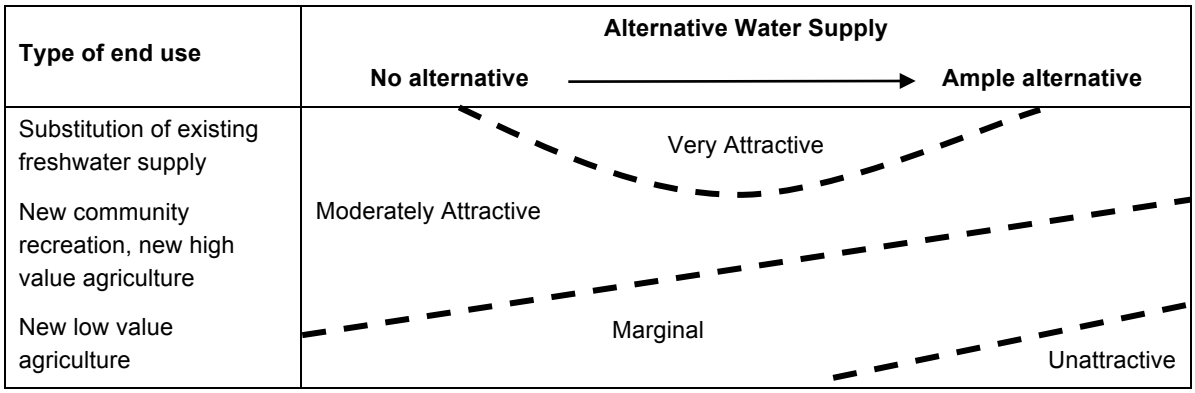
Viability

Viability relates to the economic performance of a system. Strong economic viability encourages a high management level and commitment to ongoing maintenance or improvement of the system.

Viability is dependent on:

- The potential for substitution for existing freshwater use. Generally the existing user can afford to pay up to the current price of freshwater. There are also potential savings in treatment and distribution costs for the water supplier, and if water supplies are under pressure the need for augmentation may be delayed. However, if there is a plentiful supply of freshwater, it may be difficult to encourage people to use what is most likely a poorer quality recycled water.
- The benefit to the community. Where the local community can see benefit from say irrigation of their golf course (that was previously unirrigated) there will be commitment to ongoing management and improvement of the scheme, and most likely increased member numbers.
- The value of the product produced with the recycled water. For instance horticulture and winegrapes are of significantly higher value than pasture.

The attractiveness of various types of end use are compared in the following diagram.



5.3 Stakeholder consultation

5.3.1 General

Consultation with local stakeholders is required to determine the potential interest in reuse and thereby the options that may be available.

The consultation process involves two main parts:

- Informing the stakeholder about the recycled water, its potential uses and the potential benefits
- Listening to the stakeholders ideas and concerns

Prior to consultation, the potential benefits should be considered from each stakeholder's point of view. This will help to ascertain what will drive the stakeholder to get involved in implementing or promoting reuse. Often the stakeholders will not realise the benefits themselves due to a lack of knowledge or experience regarding recycled water.

5.3.2 Potential stakeholders

A list of relevant stakeholders and the benefits they could receive from reuse is provided in the table below.

Stakeholder	**Benefits**
Environmental Protection Authority	compliance, continuous improvement, environmental sustainability
Local Government	social amenity, economic development, planning, recreation management
Regional Water Authority	reduced demand results in "saved water" for regional development and the environment reduced water supply or sewerage costs, reduced management inputs
Catchment Management Authority / State Government / environmental groups	environmental flows; reduced impact of wastewater discharges
Local communities	recreation; open space; amenity
Community groups	golf course; race course; sporting ovals
Private users	industrial use; agricultural use; improved security of supply

5.3.3 Consultation process

The document *Working Together: A Guide to Consultation for Victorian Water Businesses* (Victorian Water Industry Association Inc, 2002) is an excellent reference in determining how to go about the consultation process.

In general the consultation process should include:

- Identification of the local stakeholders
- Assessment of the potential benefits for each of these stakeholders
- Preparation of an information sheet for each stakeholder, individualised according to the benefits to the stakeholder
- Individual/group meetings with local authority/agency representatives and with identified potential end users
- An open meeting within the local community
- Feedback to keep stakeholders informed as the process evolves

Note that consultation should be ongoing and may involve a number of meetings/conversations with a particular stakeholder (or several of the stakeholders). At the beginning, in particular, the stakeholders may need to do a significant amount of learning (taking in and processing of information) before they can properly respond/participate.

6 Step 4: Evaluation of Options

6.1 Purpose

The options identified in the previous step, need to be evaluated to determine which is the preferred option.

6.2 Process

Evaluation of options involves:

- Detailed investigation of technical issues, costs, benefits, environmental/social impacts, risk and so on
- Triple-bottom line (TBL) assessment
- Determination of pricing/cost-sharing arrangements.

This evaluation process is in line with the *Draft Guidelines for Planning and Reporting Recycled Water Programs* (DSE, Oct 2003).

6.3 Detailed Investigation

6.3.1 Overview

A detailed investigation of each option is required to allow a full TBL assessment to be completed.

The elements to be investigated are:

- Technical factors
- Costs and benefits
- Environmental impacts
- Water resource impacts
- Social impacts
- Regional development
- Risk factors

The issues to be considered for each are detailed below.

6.3.2 Technical Factors

Investigation of technical factors will enable the concept design for each option to be developed and its feasibility determined.

A list of relevant factors is as follows:

- Volume available, its variability throughout the year and its location
- End user demand for water and the location of this demand
- Distribution and storage systems required to supply water to the end user

- Quality required by end user (microbiology, salinity, nutrients, toxicants)
- Quality of recycled water and whether any additional treatment, or shandying with freshwater, is required to achieve quality objectives
- End user infrastructure needs
- Regulatory and institutional framework and constraints, for example government environmental policy such as the *State Environment Protection Policy (Waters of Victoria)*, 2003.

6.3.3 Costs and Benefits

Costs to be considered for each option include:

- Capital costs of infrastructure required for treatment, distribution, storage, irrigation, etc.
- Operating costs including maintenance, labour, monitoring, pumping, etc.
- Revenue reduction due to, for example, reduced potable demand and hence lost revenue.

Benefits to be considered are:

- Capital savings due to, for example, deferred potable system augmentation
- Operating cost reductions on water supply systems
- Potential income from sale of recycled water
- Potential cost sharing with end user or other beneficiaries
- Potential business growth associated with use of recycled water.

6.3.4 Environmental impacts

For each option the impact on the following environmental elements will need to be considered:

- Soils
- Surface waters
- Groundwater
- Native vegetation.

Impacts can be positive or negative and may include:

- Salinisation of soils
- Loss of soil structure
- Environmental flows for surface waters
- Reduced discharge of poor quality water to surface waters
- Nutrient/salt runoff to surface waters
- Leaching of salt/nutrients to groundwater
- Leaching to groundwater causing increased watertables
- Removal of native vegetation for development.

6.3.5 Water resource impacts

The benefits for water resource management in the area need to be assessed for each reuse option. They may include:

- Increased availability of freshwater due to substitution with recycled water
- Increased security of supply for freshwater sources
- Reduced pumping of groundwater aquifers
- Enabling joint approaches with other alternative water resources such as stormwater.

6.3.6 Social impacts

Social parameters that may be affected by recycled water are as follows:

- Public health
- Amenity
- Opportunities for recreation
- Cultural heritage
- Community confidence
- Customer/community satisfaction

6.3.7 Regional development

Regional development benefits that may arise from use of recycled water include:

- Increased value of production
- Growth of businesses and promotion of jobs
- Population growth and therefore residential growth

6.3.8 Risk factors

The commercial, compliance and/or technical risks involved in each reuse option need to be assessed. Examples include:

- Risk of supply not being delivered (quantity or quality)
- Risk of option not proceeding
- Environmental risks
- Risk to on-going viability
- Public health risks
- Risk of reduced demand in future due to water saving or water use efficiency initiatives
- Increased liability risks, or insurance requirements, due to increased third party involvement.

6.4 TBL assessment

6.4.1 General

The following TBL framework is based around a simple form of multi-criteria assessment. It involves a committee of stakeholders giving scores to the various options against a set of standard factors covering all three major TBL criteria (environmental, social and economic outcomes).

6.4.2 Advisory committee

The process of selecting the preferred reuse option needs to involve a range of stakeholders from across the community. This will ensure that conflicting concerns are taken into account. It will also give the outcome credibility across the range of interests and help to promote the end result.

It is recommended that this process is undertaken through an Advisory Committee selected on the basis of involvement in issues relevant to recycled water. Appropriate people could be identified from the consultation undertaken at Step 3 – Identification of Options.

6.4.3 TBL assessment overview

The TBL assessment involves the Advisory Committee reviewing each option in turn and judging the extent to which they will generate economic, environmental and social benefits. The process involves four key steps:

- Confirm the TBL criteria
- Score each option against those criteria
- Agree the weights for each criteria
- Assess the final outcome.

The information gathered in the detailed investigation feeds into this process, enabling the committee to make an informed assessment.

6.4.4 The criteria and its weighting

It is important that the assessment is made against a consistent set of criteria. This allows for comparison between options.

A standard set of seven key criteria is proposed. These cover the three major criteria of environmental, economic and social outcomes.

Each criterion is weighted to give it a relative importance against the other factors. The weighting is subject to discussion and agreement of the advisory committee. It allows the relative importance of, say, economic development as against environmental factors to be assessed on a local basis.

The following table outlines the seven criteria and provides an example of how they may be weighted against each other. Further explanation of each criterion is provided in the *Draft Guidelines for Planning and Reporting Recycled Water Programs* (DSE, Oct 2003).

Criteria	Weight
1. Impact on the environment (water/land/air)	30%
2. Impact on water resources	25%
3. Impact on regional development	15%
4. Impact on social factors (amenity/recreation/confidence)	5%
5. Direct project costs	10%
6. Impact on other costs of the water business (water supply or sewerage)	5%
7. Risk outcome	10%
Total	**100%**

6.4.5 Scoring the options

The score for each option will be relative to the base case. The base case is the existing recycled water use situation, or the minimum that has to be undertaken to ensure the recycled water scheme achieves EPA compliance. This may represent either continued disposal to a waterway or a low financial return use, such as pasture irrigation.

The Advisory Committee will be asked to consider whether each option is better or worse than the base case, when judged in terms of its outcome against each of the criteria, and if so by how much it differs from that base case. The following table outlines the scoring system.

Impact	Score
Very much better	+4
Much better	+3
Moderately better	+2
Little better	+1
No change	0
Little worse	-1
Moderately worse	-2
Much worse	-3
Very much worse	-4

6.4.6 Outcome assessment

To determine the overall outcome for each option the scores and the weights for each criterion are combined (for an option, multiply score by weight for each criterion, then add to determine overall value). This provides an indication as to which option generates the greatest overall TBL outcomes in comparison to the base case (note the base case has a value of zero).

The final outcome of the assessment will then be subject to challenge by the Advisory Committee through a series of steps including:

- A sensitivity analysis which will identify the relative importance of the weighting for the final index and ranking of projects
- A sanity check, which will involve the Committee in deciding on whether the final outcome reflects their considered judgment on the issues and options.

The outcome of this stage will be determination of the preferred option on a TBL justified basis. In some cases retention of the base case may prove to be the optimal outcome.

6.5 Recycled water - Pricing and Cost Sharing

6.5.1 Context

One of the critical issues in any strategy for the future use of recycled water relates to the prices that can be charged and/or realised.

There are a number of factors that need to be acknowledged at the outset:

- recycled water is not a standard product in the market place. It is a hybrid article combining attributes both of a utility commodity and a waste by-product;
- some aspects of its sale therefore can be considered within a standard pricing framework, whilst other aspects fit more comfortably within a waste disposal context;
- within the waste-disposal context, the regulated entity faces obligations to dispose of the product:
  - sale of the product may be a cheap form of disposal – particularly if on a long-term contract;
  - sale of the product will often generate benefits not only for the end-user but also for the regulated entity and its customers within a disposal context;
  - sale of the product may also generate wider triple bottom line benefits from the environmental, social and economic outcomes achieved;
- recycled water is located within a market place where:
  - value is determined by the relative availability and price of other products. In simple terms, the market value of recycled water varies inversely with rainfall. The drought sequence enhanced its value and the recent rainfall has depressed its price
  - other, competing products are commonly subsidised with prices covering neither the full costs of production nor negative externalities;
  - the wider TBL benefits from use of recycled water are often unpriced and sale of the product is generally unable to realise a commercial return given the current pricing of alternative market competitors; and
  - a purchaser of recycled water is faced with greater controls on product use, including controls on usage and customer acceptance that do not arise with competing products. These factors argue for a discount in price relative to competing market products.

Given this context, it would be unrealistic in most cases, to expect that the recycled water will be able to command a premium price or recover all the costs involved beyond the sewage treatment works from the end user. The end user is unlikely to be the sole beneficiary and it would therefore be unfair in most cases for them to be the only contributor to cost.

6.5.2 Pricing Tests

In Victoria, pricing of water is regulated by the Essential Services Commission. The Water Industry Regulatory Order 2003 (WIRO) includes provision of retail and bulk recycled water as:

> *prescribed services in respect of which the Commission has the power to regulate price … and declared services in respect of which the Commission has the power to regulate standards and conditions of service and supply.*[2]

This means that the provision of recycled water services must be included in a Water Authority's Water Plan and comply with 'Regulatory Principles' under Clause 14 of the WIRO. This clause sets the criteria for prices, ie that they should (amongst others):

- not reflect monopoly rents or inefficient expenditure;
- provide incentives for sustainable use of Victoria's water resources; and
- provide the regulated entity with incentives to promote the sustainable use of Victoria's water resources.

The ESC has set out some key principles to be followed in setting prices for recycled water:[3]

> *The Commission endorses the pricing principles adopted at the 2008 price review. Prices should:*
>
> - *consider the price of any substitutes, and customers' willingness to pay. This includes the possibility of the substitutability, in some cases (such as sewage disposal), of potable and non-potable water*
> - *cover the full cost of providing the service (except for services related to specified obligations or for maintaining the balance of supply and demand)*
> - *include a variable component.*

Within this context there are a number of tests, which are helpful in establishing prices in a number of practical situations.

- **Transparency:** first the regulated entity must be able to account for the costs which it incurs and the revenue which it recovers in delivering the recycled water services as a standalone activity, separate from the delivery of sewerage services;
- **Maximum Price:** the maximum price which the regulatory agency can charge will be set as the upper bound for cost recovery as determined by the building block approach, ie. renewals expenditure, tax, depreciation and a return on capital based on the weighted average cost of capital. This level determines "monopoly rents" in Clause 14 of the WIRO;
- **Market Forces:** in practice, the price which recycled water can command will ultimately be determined by the market place – subject to intervention by the Water Trust or Government to place a dollar value on TBL outcomes or provide a CSO (Community Service Obligation, see section 6.5.3) payment;

[2] Water Industry Regulatory Order 2003, clause 6, gazetted 18 December 2003.

[3] ESC (2011), *Guidance Paper - 2013 Water Price Review*, page 96

- **Competition:** the maximum price which can be realised will always be constrained by an upper limit set by the price of the nearest alternative means of supply. This alternative competing price may not meet full cost recovery principles. However, in the absence of any change in Government policy that price will provide a cap on the level which can be charged for recycled water;
- **Discount for Overheads:** recycled water will generally need to provide a discount below the price for the nearest competing source of supply to reflect the increased overheads involved in handling recycled water;
- **Premium Price:** on the other hand, there may be situations where recycled water can command a premium if it has significantly greater security or locational benefits;
- **Lower Level:** in other situations, the effective market price may be close to zero if this is the value which a commercial enterprise places on the benefits which it will be able to realise from access to the resource:
  - for example, farmers may offer very low terms for the right to lease a parcel of irrigated land owned by an regulated entity if all they can do is agist fat lambs;
  - in this situation the regulated entity may achieve a low return from the sale of the recycled water but at the same time win benefits from ensuring compliant disposal of the waste-stream and save the additional costs which it may otherwise incur in order to implement alternative disposal or reuse technologies;
- **Other Levels:** other levels of cost recovery may also be achieved between the upper bound, set by the price of competing products in the market, and a lower bound at zero which treats the reuse as a form of waste disposal. These alternative arrangements reflect the range of beneficiaries from the supply of the product as discussed further below;
- **Tariff Structures:** charges and revenues can be expressed in a number of different forms, which represent different time-frames or approaches to risk sharing. Each of these is valid as a means of recovering some of the costs of providing recycled water services:
  - annual charges to meet on-going operational costs are only one of a suite of approaches;
  - up-front capital contributions to capital costs can help fund new developments and off-set business development and financing risks. In these circumstances, particularly where the end-user retains ownership of the infrastructure, it may be appropriate to supply recycled water at low or zero marginal charge. Sewerage customers could be expected to carry any annual expenditure involved in the supply as the cost of compliance with discharge requirements;
  - longer-term contracts to guarantee continuity of supply/purchase over time may merit a discount to reflect the savings to the regulated entity in having to seek alternative market options;
  - customers may share risks with the regulated entity over issues such as the seasonal variation in demand, through the construction of storages on site to provide for a flow which better meets production demand requirements. Once again this would merit a discount in price to reflect the cost savings to the supply entity.

6.5.3 Sharing Benefits & Costs

Beneficiaries from the sale of the recycled water product may, therefore, include:

- the purchaser of the recycled water who wins access to a resource for a productive commercial enterprise or other useful function (such as a social recreational activity). This benefit can be recognised through charges;
- the regulated entity and its customers who achieve compliance with a disposal obligation. This benefit can be represented through the sewerage charges to customers;
- the regulated entity and its customers may also save money:
  - in not having to implement other, alternative, more expensive disposal routes;
  - in displacing current potable supply thus deferring the need for system augmentation;
- the environment from the removal of a waste-stream from a waterway, or from reduced pressure on consumptive extractions; and
- social outcomes such as enhanced recreational facilities, employment or wider business confidence.

These last two benefits are generally unpriced and not realised as an explicit return to the regulated entity. It is possible in future that these benefits could be accounted for either as a CSO (Community Service Obligation) or through a grant from Government to help promote investments that are otherwise uncommercial.

Note that CSO is a term that comes from Clause 3 (a)(ii) of the COAG Strategic Water Reform Framework, which requires water companies to recover the full costs of service delivery. Where water businesses are required to provide services at less than the full cost, then Government is supposed to make up the difference in the form of an explicit payment or CSO.

The ESC recognises that prices will not always be able to "*cover the full cost of providing the service"*. In these situations there is a need to share costs and prices between the sewerage customer (as the polluter) and the end-user of the recycled water (as the beneficiary). The ESC distinguishes between three scenarios:[4]

- *Where water is recycled as a least cost alternative to treating and disposing of effluent or to complying with discharge licence standards, the treatment costs should be recovered on a 'polluter pays' basis through sewerage and trade waste charges. Any revenue derived from the beneficial reuse of treated effluent must be used to offset sewerage and trade waste fixed charges.*
- *Revenue shortfalls from recycled water initiatives undertaken to meet specified obligations (including Government recycling obligations or supply and demand balancing) may be recovered from the general customer base through variable water charges, where such recycling confers benefits on all water customers (through improved availability or security of potable water supplies).*

[4] ESC (2011) op cit, page 97

- *The costs of discretionary projects (undertaken for environmental, social or other reasons not directly related to specified Government targets) should generally be recovered from recycled water users. However, where the broader customer base benefits (for example, from managing supply and demand or from improved environmental values), there may be a case for spreading an appropriate share of treatment costs across the broader customer base.*

6.5.4 Recycled Water: Pricing Checklist

This checklist provides a simple series of tests to support decisions on the pricing of recycled water products:

1. **Confirm Costs:** identify full costs of the recycled water product. These will be the costs incurred after the discharge point of the treatment plant and include:
   - initial and renewals capital expenditure
   - operating expenditure, (fixed and variable)
   - overheads of wider business
   - off-setting savings (ie in potable water displacement or asset augmentation deferral)
2. **Set Upper Bound Price:** defined in Clause 14 of WIRO as efficient costs and no monopoly rent. Need to demonstrate robust basis for cost allocation. WIRO also requires simplicity and transparency in price setting.
3. **Obligation:** Does the EPA Licence require reuse or is it a market development initiative?
   - if EPA requirement then presume cost sharing with sewerage customers
   - if solely a marketing initiative then full cost recovery required from product sales
4. **Market Test:** test to see what the market will bear as a price/service mix for the product. Key issues will include:
   - **competitor products:** an upper limit on price will be set by the availability of competing products in the marketplace. Political/agency pressure could be employed to promote a level playing field;
   - **service attributes:** price will also be a function of other service attributes, such as security of supply, locational availability and compliance costs;
   - **product value:** ultimately the value of any input to a business is determined by the NPV of the additional economic value which a commercial enterprise can generate as a result. Consider using a tender process to see what local businesses can afford. Use of recycled water for growing pasture on small plots will tend to drive a low $/ML price.
5. **Risk and Cost Sharing:** price is also a function of risk and cost sharing between the end-user and the regulated entity. The entity may seek to reduce its risks and costs by sharing these with the end-user:
   - **infrastructure owned:** if the end-user provides all the infrastructure and retains ownership then annual charges from the regulatory agency will be very low;

- **capital contribution:** if the end-user contributes to the capital costs up-front then a discount will be appropriate in annual charges;
- **variability in supply:** recycled water is generally a steady supply over the year, while the end-user often has a variable, seasonal demand. Either party can carry the costs of meeting this imbalance between supply and demand, eg. by providing storage.
- **contract length:** where the sewage treatment works is subject to an EPA disposal requirement then a longer-term contract with an end-user provides compliance certainty for the regulated entity and merits a discount. However, there are then potential risks from limiting the ability of the regulated entity to test the market in later years.

7 Step 5: Implementation of Preferred Option

7.1 Purpose

The purpose of this step is to ensure the preferred option is implemented in an appropriate manner that meets regulatory requirements and best practice standards.

7.2 Process

Implementation of the preferred option involves:

- Detailed design of infrastructure required
- Preparation of an Environmental Management Plan/s
- Establishment of reuse agreements
- Acquisition of approvals
- Training of system operators.

7.3 Detailed design

Infrastructure such as pipelines, storages and treatment systems may be required to enable implementation of the preferred reuse option.

Detailed design of this infrastructure should be undertaken by a competent engineer and involves:

- Defining and reviewing the input criteria
- Undertaking design activities
- Verification and validation of resultant designs

Design and installation is to be undertaken in accordance with appropriate Australian Standards, Codes of Practice and/or Guidelines.

7.4 Preparation of Environmental Management Plan

7.4.1 Objective

The development of an environmental management plan (EMP) is essential for sustainable recycled water irrigation and generally necessary to ensure compliance with EPA requirements. In Victoria, the management plan is referred to as an Environment Improvement Plan.

The EMP should combine important business planning and everyday management practices to ensure a safe, sustainable and compliant reuse scheme. The level of detail should reflect the scale of operation, potential human and livestock exposure and environmental risk involved.

The objectives of the EMP should be to:

- Demonstrate that the performance outcomes of relevant EPA Guidelines can and will be complied with by detailing procedures and practices implemented to manage risk
- Address all elements of the scheme which could pose a risk to the environment, human and stock health, and food safety
- Provide a monitoring, reporting and review framework to assess the long-term performance of the reuse scheme and thereby ensure sustainability.

7.4.2 Framework

It is recommended that the EMP includes the following:

A. System Description

Recycled Water

- treatment provided
- recycled water quality and resulting end use restrictions
- recycled water quantity and end use allocations

Reuse Site Description

- site/s location, climate, soils, topography, groundwater, surface waters, public access, vegetation, etc. – as relevant to the type of end use
- surrounding area (sensitive features like houses, schools, watercourses, public amenity issues)

End Use

- type of end use (eg. dairy, vineyard, golf course, environmental flows)
- plant (vegetation) type to be grown (if relevant)

Infrastructure

- storage and distribution system
- irrigation type, location, scale and drainage available (if relevant)
- key operating details (flow rates, scheduling, hydraulic loading etc)
- control measures in place (wind/rain cut-off, buffer zones, shandying, etc)

Management

- staff/equipment resources
- roles and responsibilities
- monitoring, record keeping
- inspection and maintenance programs
- attach reuse agreement (if appropriate).

B. Layout Plan

- attach a map/plan showing layout of key infrastructure and other relevant site features (eg. drainage, warning signs, groundwater bores, native vegetation, etc)
- for irrigation systems this is generally a summary of the detailed irrigation design plan
- note some local government councils require a planning permit or certified farm plan prior to implementing an irrigation system.

C. Elements		
Address range of environmental/social/economic elements ie		
Recycled Water	Environmental factors	Social and Economic factors
1. recycled water quality	6. soil	10. cultural heritage
2. recycled water volume	7. surface water	11. human and stock health
3. nutrients	8. groundwater	12. public amenity
4. salinity/sodicity	9. native vegetation	13. viability
5. toxicants		
▪ consider performance outcomes for each element ▪ assess the risks involved ▪ describe the practices (operation, monitoring and recording) implemented to manage risk ▪ include trigger points and response actions in the event that changes take place ▪ describe emergency responses to potential accidents or extreme situations		

D. Reporting and Review Process
▪ describe what will be reported, to whom and how often ▪ document audit frequency and who will be involved ▪ outline process for review/update of EMP

7.5 Establishment of reuse agreements

A formal agreement should be developed between the supplier and user of the recycled water if they are not within the one organisation.

Suggested issues that may be addressed in the agreement include:

- Definition of roles and responsibilities
- Responsibility for conveyance works
- Cost of recycled water
- Contract duration (term, conditions for termination)
- Recycled water characteristics (source, quality, quantity, pressure, flow variations)
- Reliability of supply
- Commencement of use
- Ownership of the facilities
- Intended uses
- Responsibility for the operation, maintenance, monitoring and auditing processes
- Liabilities — including risk allocation and insurance
- Restrictions on use and sale of irrigated produce or products
- Responsibility for the development and implementation of the EMP
- Other issues determined relevant by the parties involved.

7.6 Acquiring approvals

7.6.1 EPA approval

The approval process varies by State. The Victorian situation is outlined below as an example.

In Victoria, waste discharges into the environment are typically subject to works approval and licensing by the EPA. However, an exemption from these processes is provided for recycled water schemes that meet the following guidelines (where relevant):

i. Publication 464.2, June 2003 – *Guidelines for Environmental Management: Use of Reclaimed Water*

ii. Publication 168, 1991 – *Guidelines for Wastewater Irrigation*

The exemption reflects that, in contrast to being a waste, recycled water can be sustained as a resource.

The process for achieving an exemption includes:

- Consultation with the EPA during the planning and design phase
- Preparation of an Environment Improvement Plan/s
- EPA sign-off of EIP/s for schemes involving greater than 1 ML/d. The EPA refer the EIP/s to other government departments for endorsement as deemed necessary.

7.6.2 Planning approval

Elements of any reuse scheme are likely to require planning approval from local government. For example pipelines along roadsides will require planning permits.

7.6.3 Other agencies

Approvals may also be required for particular items from the relevant electricity distributor, government authority or road authority.

7.7 Training of system operators

All personnel involved in the operation of a recycled water system need to have the appropriate skills and training to perform their tasks efficiently and competently, as well as knowledge and understanding of the impact their activities can have on the environment and human health.

Commonly used training techniques and methods include formal training courses accredited by a national training body, in-house training, on-the-job experience, mentor programs, workshops, demonstrations, seminars, courses and conferences.

Training is an ongoing process, and requirements should be reviewed regularly to ensure that operators, contractors and end users maintain appropriate experience and qualifications.

8 Step 6: Monitoring and Review

8.1 Purpose

Ongoing monitoring and review of existing reuse systems is critical in ensuring the system continues to be the best available option.

Changes in the availability or cost of technology, the recycled water quality or quantity, the needs of the community, potential customers (e.g. industry), environmental priorities and so on, may present new opportunities for reuse.

8.2 Process

The monitoring and review of existing projects involves all of the five steps described in the previous chapters.

How well does the reuse system address the factors of?

1. Strategic intentions for reuse of recycled water
2. Integration into regional water resource planning
3. General technical criteria and stakeholder needs
4. Triple-bottom line outcomes
5. Best practice design and management criteria, the EMP and reuse agreement, and EPA or other government authority requirements.

The monitoring and review process should enable a comparative analysis against other potential reuse options.

Note that there will also be an auditing or reporting process in place for EMPs. This focuses on the issues considered under Step 5 above. The monitoring and review process outlined here is at a more strategic level and is additional to the auditing/reporting process for EMPs.

A checklist of issues/topics that are to be considered is provided in the following section.

8.3 Checklist

Step	Measure	Response
1. Policy Statement	Policy statement approved by current board	
	Policy statement in line with state government direction	
	Reuse scheme (new/existing) in line with policy statement	
2. Integrated Water Resource Planning[1]	Reuse is in line with the regional water strategy	
	Trends and pressures on water in the region have been identified and their connection to recycled water addressed	
	The reuse system contributes to the local economy	
	Other reuse options that enable regional development have been identified	
	Reuse meets environmental planning requirements and the regional catchment strategy	
	Environmental issues that could be addressed via a change in the reuse system have been identified	
	The reuse system meets a current social development need	
	Other social development needs that could be addressed through reuse have been identified	
	The current key areas for recycled water use in the region have been identified	

[1] Note that for integrated water resource planning, a positive response is not always possible for all measures. A reuse scheme cannot necessarily meet water resource, regional development, environmental and social development needs simultaneously.

Step	Measure	Response
3. Identification of Options	Technical issues have been considered, including recycled water volume and quality, salinity, nutrients, soils, surface and groundwater, viability of reuse and so on	
	Key technical constraints include …	
	Consultation has been undertaken with stakeholders	
	Key stakeholders can identify the benefits of reuse	
	All local options have been identified	
4. Evaluation of Options	A detailed investigation has been undertaken, including costs, benefits, environmental and social impacts, risk and so on.	
	The options identified have been evaluated on a triple-bottom line basis	
	The preferred reuse system has been identified	
	Cost-sharing and pricing options have been evaluated	
5. Implementation of Options	The design and management of the reuse system meets current best practice standards	
	An up to date EMP is in place	
	Management of the system complies with the EMP	
	An up to date reuse agreement is in place	
	Feedback from the end users and the public has been recorded and responded to appropriately	
	The reuse system meets current EPA and other government authority requirements, and where necessary has been approved by these authorities	