



Coliban
WATER

Epsom Spring Gully Recycled Water Project

Regional Environment Improvement Plan

Prepared for
Coliban Water

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Revision History

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1	Kirsty Johns	Following EPA and DHS final comments	08 August 2007
2	Johanna Schortinghuis	Milestone 2 Updates	2 June 08

Document Acceptance

Action	Name	Signed	Date
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Table of Contents

1	Introduction	1
....1.1	Management Commitment.....	1
....1.2	Purpose of the Regional Environment Improvement Plan.....	1
....1.3	Description of the Scheme.....	1
....1.4	Scope of the REIP.....	4
....1.5	Approval of the REIP.....	5
2	Roles and Responsibilities	6
2.1	Coliban Water.....	6
2.2	Customers.....	6
2.3	EPA Victoria.....	6
2.4	Department of Human Services.....	7
2.5	Department of Sustainability and Environment.....	7
2.6	REIP Representative.....	7
3	Description of the Plant	8
3.1	Introduction.....	8
3.2	Overview.....	8
3.3	Milestone 1.....	8
3.4	Milestone 2.....	9
4	Security of Supply	11
4.1	Inflow.....	11
4.2	Treatment.....	11
4.3	Pipeline and Pumping.....	11
4.4	Maintenance of the System.....	12
5	Water Quality Objectives	13
5.1	Legislation and Guidelines.....	13
5.2	Water Quality Requirements - Class A Water.....	13
5.3	Other Key Water Quality Parameters.....	13
5.4	Approved Uses.....	14
5.5	Alternative Supply.....	16
6	Risk Management	17
6.1	Risk Assessment Methodology.....	17
6.2	Treatment Process.....	18
6.3	Pipeline and Pumping.....	18
6.4	Distribution.....	19
6.5	Customer Use.....	19
7	Emergency Procedures	22
7.1	Incidents and Impacts.....	22
8	Monitoring, Reporting and Review	23
8.1	Monitoring.....	23
8.2	Incident Reporting.....	23
8.3	Audits.....	24
8.4	Future Work.....	24

9	REIP Review	25
10	Community Liaison	26
10.1	Ongoing Liaison	26
10.2	Complaints	26
10.3	Detailed Community Engagement Strategy.....	26

Appendices

Appendix A – Process Flow Diagrams
Appendix B – Community Engagement Strategy
Appendix C – Pipeline Route Plans
Appendix D – Risk Assessments
Salinity
Nutrients
Spring Gully Reservoir
On-Site Storage of Recycled Water
Fit for Purpose Tables
Appendix E – Blue Green Algae Management and Response Plan
Appendix F – Emergency Management and Response Plan
Appendix G – Examples of Signage

Glossary

CoGB	City of Greater Bendigo
CSMP	Customer Site Management Plans
DHS	Department of Human Services
DSE	Department of Sustainability and the Environment
EDR	Electro Dialysis Reversal
EIP	Environment Improvement Plan
EPA	Environment Protection Authority
ESGRWP	Epsom Spring Gully Recycled Water Project (“the project”)
HACCP	Hazard Analysis Critical Control Point
HAZOP	Hazard and Operability Analysis
HEMP	Health and Environment Management Plan
HLPS	High Lift Pump Station
LLPS	Low Lift Pump Station
NTU	Nephelometric Turbidity Units
REIP	Regional Environment Improvement Plan
RMCG	RM Consulting Group
RO	Reverse Osmosis
RWF	Recycled Water Factory
RWQMP	Recycled Water Quality Management Plan
SAR	Sodium Absorption Ratio
SOP	Standard Operating Procedure
TDS	Total Dissolved Solids
UF	Ultra Filtration
UV	Ultra Violet
WRP	Water Reclamation Plant
WSAA	Water Services Association Australia

1 Introduction

1.1 Management Commitment

The management of Coliban Water is committed to providing a recycled water delivery system which manages both environmental and health risks. Coliban Water will ensure that adequate resources are provided for recycled water programs, including adherence to the REIP, RWQMP, HACCP plans and the HEMPs, and that the public is educated about the risks and correct use of recycled water. Coliban Water will ensure that these programs are adhered to, by conducting audits of recycled water management systems and by investigating health and environment incidents. The cycle of continuous improvement will be used to improve recycled water management systems, where deficiencies are found.

1.2 Purpose of the Regional Environment Improvement Plan

The Regional Environment Improvement Plan (REIP) for the Epsom Spring Gully Recycled Water Project (ESGRWP) aims to identify and explain the management of the environmental and health risks associated with the operation of the recycled water project. It also seeks to inform the recycled water customers, the users of public open space areas and the wider Bendigo community.

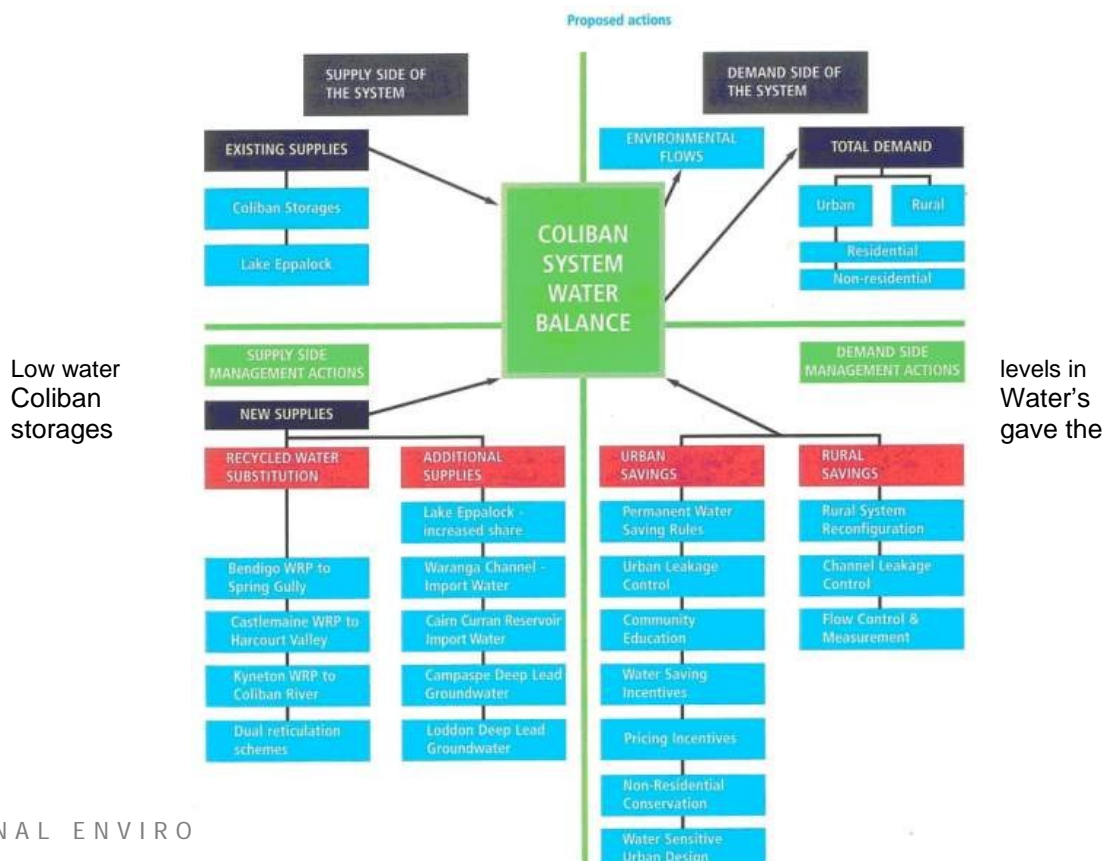
This Regional Environment Improvement Plan supersedes all previous versions.

1.3 Description of the Scheme

1.3.1 Background

Waterplan 2055 outlines Coliban Water's approach to securing sufficient water for the region for the next 50 years. Four key areas have been identified, as shown in Figure 1, and the Epsom Spring Gully Recycled Water Project is part of the supply side management actions to arise from this.

Figure 1 – Coliban Water Balance Diagram



implementation of the project urgency, with Milestone 1 completed and the completion of Milestone 2 due for mid 2008. Milestone 1 provides treatment to Class A standard, pumping and a transfer pipeline for the Class A water. Milestone 2 is the addition of membrane treatment to further improve the quality of the water and reduce salinity.

The existing Bendigo Water Reclamation Plant (WRP) has an average inflow of approximately 5,500 ML/year and produces, on average, approximately 15 ML/d of treated effluent (Class B¹ recycled water). The first priority is to provide class B recycled water to Perseverance Mining, secondly to feed the ESGWRP (milestone 1 and 2), thirdly to supply some onsite and offsite irrigators. The remainder is discharged to Bendigo Creek under EPA licence. Treatment at the Bendigo WRP consists of nutrient removal, filtration and ultraviolet (UV) disinfection.

1.3.2 Overview

The project takes water from the Bendigo WRP. Milestone 1 further disinfects this water using increased UV capacity and chlorination. Milestone 2 involves a parallel train to Milestone 1 consisting of membrane treatment of a portion of the flow (output flow of 3ML/d membrane treated water), by ultra filtration (UF) and reverse osmosis (RO), to reduce salinity and nutrients. Electro-Dialysis Reversal (EDR) will reduce the waste stream flow (RO concentrate). Brine lagoons will be used for treatment of the RO concentrate by evaporation.

Treated water is pumped along a 14 km pipeline to Spring Gully Reservoir. An overview diagram is shown below, with detailed diagrams attached in Appendix A.

Figure 2, project schematic giving an overview of the project, is on the next page.

¹ Classified as Class B effluent under the Victorian EPA Guidelines for Environmental Management – Use of Reclaimed Water, Publication 464.2, June 2003.

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1.3.3 Customers

Coliban Water can supply recycled water to four classes of consumers. Examples of the uses to which the water can be put are listed in Table 1. These are further detailed in the HEMPs and discussed in the Community Engagement Strategy, attached as Appendix B to this document. Water supplied to these customers is classed as fit for purpose for all proposed uses, as discussed in Section 5 below.

City of Greater Bendigo, Coliban Water and the EPA are in discussion regarding Lake Weeroona. A risk assessment will be carried out for this following a period of sampling of the Class A water, and further details will be provided when they are available. Class A water will not be used for this purpose prior to approval of the HEMP.

**Table 1
Uses of Recycled Water**

Category of Use	Consumers	Use
Rural customers	<ul style="list-style-type: none"> ■ Individual customers ■ Public open space areas (as per category below) 	<ul style="list-style-type: none"> ■ Garden watering ■ Toilet flushing ■ Stock drinking ■ Irrigation of pasture and crops ■ Washing machine ■ General outdoor
Public open spaces (eg. public parks, botanic gardens, recreation reserves, sports ovals, schools, racecourse, golf course)	<ul style="list-style-type: none"> ■ City of Greater Bendigo ■ Schools ■ Community-managed facilities ■ Privately-managed facilities 	<ul style="list-style-type: none"> ■ Irrigation of parks, gardens and sports fields. ■ Toilet flushing ■ General outdoor ■ Filling water features and ponds
Standpipe	<ul style="list-style-type: none"> ■ Commercial/Industrial users ■ City of Greater Bendigo 	<ul style="list-style-type: none"> ■ Dust suppression ■ Road construction ■ Watering of parks and gardens
Commercial/Industrial	<ul style="list-style-type: none"> ■ Hospital Laundry ■ Others (future) 	<ul style="list-style-type: none"> ■ Washing machine use (pre-wash) ■ Dust suppression ■ Wash-down of vehicles ■ Appropriate commercial uses

1.4 Scope of the REIP

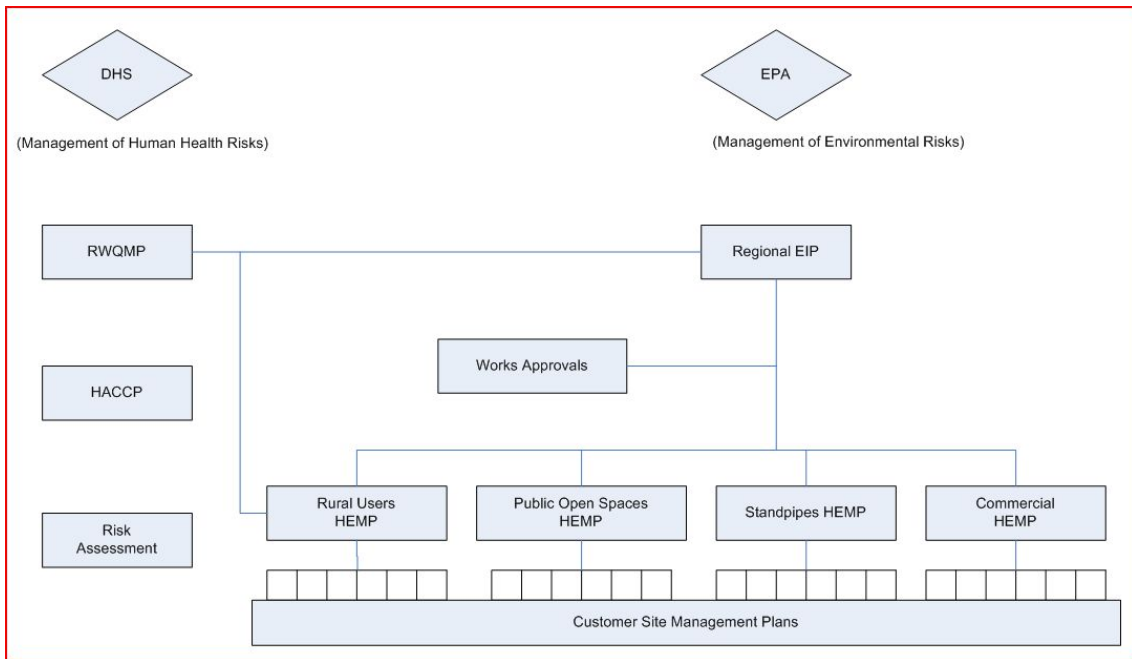
The REIP addresses environmental and health issues associated with the operation of the system as a whole from treatment to use by the customers.

It is supported by the following:

- Customer's site-specific details relating to end use of the recycled water will be addressed in the Health and Environment Management Plans (HEMPs) and Customer Site Management Plans (CSMPs).
- A Recycled Water Quality Management Plan details the treatment process used to achieve Class A recycled water, including an ongoing management and monitoring program.
- Works approval applications to EPA Victoria for the treatment upgrades (Milestone 1 works approval application submitted in December 2006 and Milestone 2 in November 2007).
- Risk assessment for Spring Gully Reservoir, attached to this document in Appendix D.

Figure 3, below, shows the relationship between this REIP and the documents listed above.

Figure 3 – REIP Relationships



1.5 Approval of the REIP

This document will be submitted to the Environment Protection Authority (EPA) Victoria.

2 Roles and Responsibilities

2.1 Coliban Water

Coliban Water is the bulk supplier and retailer of recycled water. It is responsible for complying with the EPA guidelines and the requirements of the REIP. It is also responsible for:

- Obtaining endorsement of the REIP, and the ongoing annual maintenance of the REIP, including reviewing and continually improving the system, as necessary, through the REIP.
- Ensuring each customer has agreed to a HEMP and CSMP, which meets the requirements of the EPA guidelines, before recycled water is supplied
- Operating and maintaining the Recycled Water Factory (RWF), pump station and pipeline to achieve the quality standard
- Supplying recycled water in accordance with agreements with customers, and ensure these agreements are kept up to date with changes of property ownership
- Keeping a register of information about customers, including addresses, quality and quantity of supply, and end use of the water. This information will be reported each year to the EPA and DHS.
- Communications policy, including informing customers of the potential risks and assisting in the management of those risks
- Providing an annual report on findings and compliance to the EPA
- Providing a reliable system for recording and responding to customer complaints
- Informing customers of restrictions of use for reclaimed water

2.2 Customers

The customers are responsible for using the recycled water provided for approved end uses as defined by the HEMPs and site management plans. They are also responsible for implementing appropriate management and monitoring practices (also outlined in the HEMPs) to ensure protection of public health and the environment.

2.3 EPA Victoria

The EPA is responsible for ensuring the effective implementation of the relevant guidelines (including Use of Reclaimed Water² and Wastewater Irrigation³). The EPA ensures that the project is sustainable. Specifically, the EPA is responsible for the approval of the following documentation:

- Works Approval
- Community Engagement Strategy
- Regional EIP
- Health and Environmental risk assessment
- HEMPs
- Site Management Plans

They provide formal agreement that the project is environmentally sustainable provided all documentation is complied with.

² Guidelines for Environmental Management: Use of Reclaimed Water; EPA Victoria (publication 464.2), June 2003.

³ Guidelines for Wastewater Irrigation; EPA Victoria (publication 168), April 1991

2.4 Department of Human Services

The Department of Human Services (DHS) is responsible for ensuring Class A water quality criteria are protective of public health. DHS is also responsible for endorsing the Recycled Water Quality Management Plan for the scheme, to verify that systems are in place to control the reliable production and use of Class A water.

The DHS is further responsible for endorsing the Regional EIP (through the EPA) and Health and Environmental Management Plans for dual pipe schemes. DHS have commented around the health and environmental risk assessments for Class A water, again through the EPA.

2.5 Department of Sustainability and Environment

The Department of Sustainability and Environment (DSE) is responsible for establishing strategic water policies, such as resource management, pricing and communications, within the state of Victoria. DSE has no role or responsibilities associated with the REIP.

2.6 REIP Representative

The REIP representative listed below is responsible for reporting, and the annual review and maintenance of the REIP and related documentation. They shall be the primary point of contact for issues relating to the REIP.

Name and/or position: Executive Manager, Planning
 Organisation: Coliban Water
 Phone: 1300 363 200
 Postal Address: PO Box 2770, Bendigo DC, Victoria 3554

Table 2
Summary of Responsibilities

Item	Responsible
Provision of recycled water to the quality standards set out in the RWQMP and HEMPS	Coliban Water
Annual review of Regional EIP	Coliban Water
Annual review of HEMPs	Coliban Water
Annual review of Customer Site Management Plans	Coliban Water
Annual review of RWQMP and HACCP	Coliban Water
Annual report to EPA, including all monitoring results as required by RWQMP, HACCP and HEMPS	Coliban Water
Maintenance and update of operational management programmes	Coliban Water
Monitoring of water quality at plant and at Spring Gully Reservoir	Coliban Water
Provision of alternative supply where necessary	Coliban Water
Maintain record of recycled water users	Coliban Water
Provide EPA with annual list of recycled water users	Coliban Water
Communication with customers during an incident	Coliban Water
Notification of EPA of an incident or exception within 14 days	Coliban Water
Notification of EPA of an emergency immediately	Coliban Water
Compliance with customer site management plan and HEMP	Customer
Assessment and review of customer compliance	Coliban Water
Statutory audit, in compliance with AS/NZS 19011:2003 Guidelines for Quality and/or Environmental Management Systems Auditing	External party, arranged by Coliban Water
Action against users who do not comply with HEMP and site management plan	Coliban Water

3 Description of the Plant

3.1 Introduction

The following section summarises the works. The existing Bendigo WRP has been upgraded and infrastructure and Class A treatment plant have been installed at the new site. This includes the pumping and treatment facility installed at milestone 1 and the membranes installed at Milestone 2. This treatment plant will be referred to as the Recycled Water Factory (RWF). A process diagram is included in Appendix A.

3.2 Overview

Effluent is taken from the WRP, where it has been treated by biological nutrient removal (BNR), lagoon settlement, rapid gravity filtration and UV disinfection. Improvements have been made to the turbidity monitoring to allow more accurate monitoring of the existing works, and therefore ongoing security of the water quality supplied to the Class A works.

Following a storm, the quality of the water passing through the existing works for treatment was reduced due to the sudden influx of dirty water into Lagoon 1. The storm flow bypass was diverted from WRP Lagoon 1 to WRP Lagoon 4, which is not connected to the treatment process, to eliminate this problem. From here, the water will evaporate or be used for on-site irrigation.

Water is pumped to the RWF after the existing take-off for Perseverance Mine.

3.3 Milestone 1

3.3.1 Treatment

Milestone 1 treatment consists of sodium hypochlorite dosing for disinfection, followed by the water passing through a chlorine contact tank to provide at least the minimum required disinfection. This is followed by secondary UV unit, which in turn is followed by dosing with sodium metabisulphite to neutralise the chlorine residual.

The final water tank is a concrete structure external to the building, which buffers the flow through the treatment prior to pumping. Water from both Milestone 1 and 2 treatment streams is collected there.

A high lift pump station pumps Class A water to Spring Gully Reservoir. This pump station is housed in a new building, which also contains the office space and amenities for the RWF.

3.3.2 Pipeline and Distribution

A diagram of the recycled water pipeline route is provided in Appendix C.

The pipe route starts at the RWF site within the existing Bendigo WRP, near the intersection of Howard Street and Bowles Street, and runs south through Bendigo, along creeks, cycle paths and roads, until it reaches Spring Gully Road. It runs along Spring Gully Road and turns west up Shakespeare Street to the Spring Gully Reservoir.

Off-takes at various points along the pipeline been provided for public open spaces, standpipes and commercial use. These off-takes are shown on a diagram in Appendix C and listed below in Table 3. Rural channel customers will continue to receive their allocation through the existing channel system from Spring Gully Reservoir. Coliban Water is considering replacing the existing open channel system with a piped system to reduce losses in an ongoing programme over the next 2-5 years. If it proceeds, it will take place under a separate programme of works, and will not reduce the water quality provided by this project.

Table 3
Current Off-takes on ESGRW Pipeline

Location	Status	Required Flow (L/s)
Athletics Complex	Designed	
Bendigo Bowls Club	Designed	4
Bendigo Cemetery	Proposed	
Bendigo East Primary School	Proposed	
Bendigo Tennis Club	Designed	4
Epsom Primary School	Proposed	
Ewing Park	Designed	9
Jackass Flat	Designed	32.0
Kennington Oval	Designed	6
Loddon Linen Laundry	Designed	
Nolan St Tennis Complex	Proposed	
Peppergreen Farm Nursery	Proposed	
Ridley Agri Products	Proposed	
Robbins United Nurseries	Proposed	
Rodney Street Reserve	Proposed	
Rosiland Park	Designed	20
Spring Gully Primary School	Proposed	
Spring Gully Recreation Reserve	Designed	6
Spring Gully Soccer Club	Designed	6
Stanley Ave Standpipe	Designed	17.5
St Therese's Primary School	Proposed	
Weeroona Oval	Designed	6
Weeroona Park	Designed	1.0
Weeroona College	Designed	
White Hills Cemetery	Proposed	
White Hills Primary School	Designed	6
White Hills Botanical Gardens	Designed	10
White Hills Oval	Designed	6

3.4 Milestone 2

3.4.1 Treatment

The Milestone 2 treatment involves membrane treatment of a split stream (giving a flow of 3ML/d membrane treated water), by ultra filtration (UF) and reverse osmosis (RO), to reduce salinity and nutrients. Electro-dialysis Reversal (EDR) is used to reduce the waste stream flow (RO concentrate). Brine lagoons are used for disposal of the EDR concentrate by evaporation. Milestone 2 works will improve the quality of water provided for irrigation by reducing salinity.

UF is required as pre-treatment to RO in order to minimise fouling of the RO membranes. These membranes will reject suspended solids, colloidal particles, bacteria, and viruses. The system incorporates automatic backwashing, including chemical dosing where necessary, effectively removing solids and microorganisms that collect on the membrane surface during the filtration process. Backwash water is returned to the inlet works of the Bendigo WRP.

A two stage RO plant follows the UF membranes. The RO plant includes a complete anti-scalant system including chemical tanks, bunding, dosing pumps and pipework. An automatic clean-in-place type membrane cleaning system has also been provided, with waste from this being evaporated in the brine lagoons.

3.4.2 Brine Lagoons

A series of four lagoons plus a deep store, bitterns and crystalliser will be constructed on site. The deep store has already been constructed.

At Epsom, evaporation does not significantly exceed rainfall in wet years, reducing the efficiency of evaporation of the EDR concentrate stream. To reduce the effect of rainfall, brine will be pumped back to the deep store during winter. Any rainfall in the dry remaining lagoons will be piped to WRP lagoons 4 and 5 during this period, and will not return to the treatment process. The rainwater in the brine lagoons will be tested for suitable salinity prior to transfer to the wastewater lagoons. Based on review of EPA Publication 168, if the salinity is under 500mg/L TDS (i.e. special practices for salinity control not usually required) the transfer will be conducted without further review. If the salinity is over 500mg/L TDS, the volume and salinity of water in the WRP lagoons and the nature of the plants to be irrigated will be considered. If the transfer cannot be made then the saline rainwater will be retained in the brine lagoons and evaporated with the RO waste.

It is estimated that 70 ML of waste brine per year is generated. There are only likely to be limited opportunities for reuse of the dried salt, both because it has been produced from wastewater and because of the limited quantities produced. Commercial sales of the bitterns may be possible. Disposal of some of the dried product to landfill will be required. Although the waste will not require disposal for approximately 20 years, it is noted that locally, currently only the Tullamarine landfill site is licensed to accept this waste.

Groundwater monitoring wells have been installed on site around the lagoons to monitor any impact on groundwater.

Transfer Pipeline

A brine waste discharge pipe, which runs parallel to Eaglehawk Creek, will transfer brine waste from the RWF to the brine lagoons. This existing pipe has been extended to carry the brine solution from the RWF to the deep store.

As the transfer pipe runs adjacent to Eaglehawk Creek, a monitoring system has been installed to detect leaks in the pipe. An electromagnetic flowmeter is installed at both ends of the transfer pipe to enable leak detection in the pipe during operation.

4 Security of Supply

4.1 Inflow

The inflow to the plant is a stable flow from the existing Bendigo WRP. Works have been carried out to improve the reliability of the quality of this water. Should the quality fall below the level able to be treated by the new facility, the flow will be disposed of on-site or to Bendigo creek under the existing licence. In these circumstances, when planned maintenance or other shutdown occurs, there will be no inflow to the plant and therefore the only outflow will be that stored in the LLPS and final water tanks, giving around 15 minutes of flow. Once pumping stops, water will backflow from Spring Gully Reservoir.

4.2 Treatment

The Recycled Water Quality Management Plan (RWQMP) has been developed to allow Coliban Water to undertake its activities in a manner that supports its commitment to the supply of recycled water to its customers. It references the standards and procedures that ensure the potential risks are managed appropriately. A Hazard Analysis Critical Control Point (HACCP) assessment (a quality management tool used widely in the water industry to ensure water quality) has been carried out, as discussed in Section 5, and the outcomes documented in the RWQMP.

A monitoring programme has been designed for the ongoing operation of the RWF. Monitoring will be carried out at the inlet to the new plant, throughout the process and at the outlet.

An operation and maintenance manual for the plant is kept at the RWF. It includes:

- SOPs
- Equipment schedule
- Control methods and fault diagnosis
- Software configuration and set points
- Planned maintenance schedule

4.3 Pipeline and Pumping

The key design elements incorporated to maximise reliability of transport and distribution are:

- Operations and maintenance manual for pumps
- Design and construction of the pumps and pipelines in accordance with the Water Services Association Australia (WSAA) and Australian standards;
- Standby pumps have been incorporated into the design to cover breakdowns and planned maintenance;
- Coliban Water has a planned maintenance programme;
- Management and contingency plans are in place to cover pump or pipeline failure.

The public open space and standpipe users rely on a constantly pressurised system. Their supply, and the supply to customers on the Ascot Channel, is extremely reliable, due to backflow from Spring Gully Reservoir. Customers on Axe Creek Channel do not receive backflow, due to the configuration of the pipes and channels. However, they can also be supplied from the Eppalock – Sandhurst Pipeline and the Coliban Main Channel if necessary. The uses that this water will be put to are not high-risk uses, and in the event of no-flow, there will be minimum impact. All customers who require it will be supplied with alternative water in an emergency (e.g. through water tankers).

Isolation valves have been installed in the pipeline to facilitate maintenance and emergency operation. The locations of these are shown in the key plan in Appendix C.

4.4 Maintenance of the System

Coliban Water has numerous procedures in place to ensure that plant, pumps and pipelines are correctly maintained. The equipment installed under this project is also subject to these procedures. In particular, QD 10.1.4 – Networks, references the disinfection of tools, burst repairs, and the introduction of contaminants. A section has been added to cover recycled water. For the purposes of maintenance the water will be treated as potable to prevent cross-contamination with sewage. For the purposes of leakage and bursts the water will be treated as sewage, to protect the environment.

Further documentation is discussed in the HACCP document.

5 Water Quality Objectives

5.1 Legislation and Guidelines

The EPA Discharge Licence governs water quality at Bendigo WRP and this existing license will continue to apply to discharges to Bendigo Creek.

The EPA Reclaimed Water⁴ and Dual Pipe Guidelines⁵ set the level of treatment and water quality objectives needed to address the environmental, public health and quality issues associated with Class A recycled water systems. Specifically, the dual pipe guidelines define the microbial criteria for Class A systems.

The ANZECC Guidelines for Fresh and Marine Water⁶ cover water quality in the context of irrigation for agricultural use. In particular they cover salinity, chlorine and heavy metals. These have been considered in developing the treated water quality envelope applied to the works.

The Australian Guidelines for Water Recycling provide further guidance on assessment of potential impacts from key recycled water quality parameters.

5.2 Water Quality Requirements - Class A Water

The treated sewage effluent from the ESGRWP meets Class A requirements as defined by EPA guidelines. In order to demonstrate that treatment is operating effectively and continues to meet Class A standard, the recycled water must meet the following key parameters for pathogens:

- <10 *E coli*/100mL (as indicator of bacterial pathogens)
- Helminth removal by filtration, or by appropriate lagoon detention, approved by the Chief Veterinary Officer
- Protozoan parasites - 6 log₁₀ reduction from raw sewage to recycled water.
- Viruses - 7 log₁₀ reduction from raw sewage to recycled water.

An assessment of the pathogen log reductions required for the various end uses has been undertaken to determine the on-site preventive measures required for protection of human health. This assessment is summarised in Appendix D. For Class A treatment, a reduction of 7 log for viruses and 6 log for protozoa is required, and the assessment and presentation of removal methods is presented in the RWQMP. A long term monitoring programme, to ensure these criteria are met, is also detailed in the RWQMP.

The Chief Veterinary Officer has provided provisional approval of the treatment process for helminth removal. This approval is subject to 6 months testing following commissioning, in order to demonstrate that the log removal of helminths is 4 log or greater. The results of this testing will be available late 2008 and then provided to EPA, DHS and DPI for review.

Testing has been carried out to establish the chlorination requirements in conjunction with the pathogen removal requirements. This assessment and discussion is also presented in the RWQMP.

5.3 Other Key Water Quality Parameters

⁴ Guidelines for Environmental Management: Use of Reclaimed Water; EPA Victoria (publication 464.2), June 2003.

⁵ Guidelines for Environmental Management: Dual Pipe water Recycling Schemes – Health and Environmental Risk Management; EPA Victoria (publication 1015), October 2005

⁶ Australian New Zealand Guidelines for Fresh and Marine Water; ANZECC; 2000

5.3.1 Introduction

The following sections consider aspects of the water quality that are not covered by the Class A quality limits, but can potentially impact on the environment and human/animal health. These include salinity, nutrients and contaminants (e.g. heavy metals).

5.3.2 Salinity

The membrane treatment plant constructed as part of the Milestone 2 works reduces the salinity of the recycled water. Nevertheless the salinity of the recycled water will be slightly higher than the current water supply for all customers. However, the salinity level of the recycled water is still relatively low. The salinity levels are summarised in Table 4.

A detailed assessment has been undertaken of the risks associated with the expected salinity of the recycled water, and this is presented in Appendix D. The key hazards and mitigation measures are summarised in Table 8, and detailed in the HEMPs.

5.3.3 Nutrients

Treatment at the Bendigo WRP includes biological nutrient removal. The membrane treatment plant also enhances the nutrient reduction in the recycled water. Nutrient levels in the recycled water are very low. The nutrient levels are summarized in Table 4.

A detailed assessment of the risks associated with nutrients (including blue-green algae growth in storages) is presented in Appendix D. The key hazards and mitigation measures are summarised in Table 7, and detailed in the HEMPs.

5.3.4 Contaminants

a. Trade Waste

Chemicals entering the sewerage system are managed through trade waste control, substantially diluted with other waste and generally removed or degraded by the treatment processes. Coliban Water has developed a Trade Waste program to provide for the minimisation, treatment and disposal of waste. The program is based on Coliban Water's Trade Waste Policy and By-Law No. 5, which includes a Schedule of Standards. The Schedule defines acceptable chemical concentrations for discharges into the sewerage system. Trade waste contaminants are controlled by the following measures:

- Trade Waste By-Law No. 5
- Trade waste agreements and auditing
- Education and Awareness Program
- Fines for illegal dumping
- 24-hour fault line and duty roster to report incidents
- Septic tank acceptance procedures
- Effluent and biosolids monitoring.

These control measures ensure that contaminants either do not reach the WRP or are effectively treated within the WRP and have no impact on end users. This is further discussed in the HACCP.

5.4 Approved Uses

The expected quality of the recycled water to be supplied, in relation to environmental and human health risk factors, is summarised in the following table, and covered in further detail in Appendix D.

**Table 4
Water Quality Parameters**

Parameter	Treated effluent from Bendigo Water Reclamation Plant – Expected Limit (95%ile)*	UF/RO - Maximum	Combined Stream - Expected Range	Suitable for the end uses listed in this document
Salinity	850 mg/L TDS	25 mg/L TDS	< 350 mg/L TDS	Yes
Sodium	212 mg/L		< 200 mg/L	Yes
Chloride	314 mg/L		< 250 mg/L	Yes
Boron	0.080 mg/L		< 0.1 mg/L	Yes
Total Nitrogen	8 mg/L	<0.5 mg/L	< 5 mg/L	Yes
Phosphorus	0.5 mg/L	<0.005 mg/L	< 0.5 mg/L	Yes
pH	6-9		6-9	Yes
Heavy Metals	Refer to Recycled Water Quality Management Plan		Within irrigation water standards and stock drinking water standards	Yes
Microbiological quality	Class A		< 10 E.coli/100mL	Yes
Chlorine disinfection residual	< 0.01 mg/L at point of use		< 0.01 mg/L at point of use	Yes

* Note; TDS, sodium, chloride and boron values are based on data from 2003 to 2007, during which time both Eppalock and Malmsbury source waters were used for Bendigo's water supply. Since September 2007, when primarily water from Colbinabbin (ex Waranga Channel) has been used, TDS values have dropped to less than 550 mg/L. It is expected that therefore sodium, chloride and boron concentrations would have dropped accordingly during this period.

Recycled water of the quality outlined in the table above is suitable for the following purposes, subject to site management requirements:

- Irrigation of public open spaces, such as parks and sports fields, where public access is unrestricted.
- Domestic garden watering, including vegetable gardens.
- Toilet flushing.
- Washing machine use.
- General outdoor uses such as car washing, dust suppression, construction and wash down.
- Filling water features and ponds that are not used for swimming.
- Fire fighting and fire protection systems, including hydrants and sprinkler systems.
- Irrigation of human food crops, including those consumed raw.
- Irrigation of non-food crops (eg. flowers, turf).
- Irrigation of pasture/fodder for dairy and beef cattle, sheep, horses and goats.
- Livestock and pet drinking water.
- Industrial uses, including open systems with worker exposure potential.

The recycled water is NOT considered acceptable for the following uses:

- **Drinking.**
- **Cooking or other kitchen purposes**
- **Bathing and showering.**
- **Filling swimming pools and spas.**

- **Children's water toys.**
- **Any and all uses involving contact with pigs.**

5.5 Alternative Supply

There is a small number of piggeries that have historically utilised water from the rural channels. These piggeries are not utilising water from channels receiving recycled water, but instead are now accessing alternative water supplies including potable water and groundwater. Recycled water will not be supplied to any piggeries.

Some rural channel customers do not have access to the potable drinking water supply. Generally these customers use rainwater tanks to supply water for drinking and household purposes. However, consultation with rural customers has identified that there are a small number of customers who in the past used channel water for household purposes. Coliban Water has worked with these customers to ensure they have an appropriate drinking water supply and that channel water is not connected to the house for anything other than toilet flushing. All customers have been educated about plumbing requirements through the Stakeholder Engagement Strategy and the appropriate HEMP.

6 Risk Management

6.1 Risk Assessment Methodology

6.1.1 Assessment of Risks During Design and Construction

In order to manage the risks inherent in a project of this size, a risk matrix was created. During an initial workshop (between Coliban Water and Beca) the risks were identified under four categories: environmental, technical, delivery and stakeholder. These risks were then qualified in terms of likelihood and consequence and were prioritised in the following terms:

- Extreme Threat
- Very High Threat
- High Threat
- Moderate Threat
- Low Threat

A second workshop was then held in order to establish mitigation measures for each risk. The extreme, very high and high threats were discussed, and a responsible person was assigned to each. The risks were then taken from the matrix and an individual sheet prepared for each, detailing the risk, the mitigation measures, the responsible person, and any interested parties.

The person responsible then took each risk they were allocated and checked that the mitigation measures were satisfactory. Should there be any change in circumstances relating to the risk, they will notify the interested parties listed, and any further mitigations required will be established. A central risk matrix is held which will log any changes of circumstance or personnel.

The allocation of responsibility to an individual ensures that no risk will be ignored or missed during design and construction.

6.1.2 Assessment of Risks to End Users

The risk assessment discussed above focussed on the design and construction of the treatment upgrade works and Epsom Spring Gully pipeline. An additional risk assessment was therefore undertaken to assess the specific risk for end users.

The methodology used to assess this risk was based on the framework for management of recycled water quality and use given in the National Guidelines for Water Recycling⁷.

In applying this approach the first step was to look systematically at all the hazards in the recycled water that could potentially affect human or environmental health (e.g. pathogens, salinity). Once the hazards were identified the risk from each was assessed by estimating the likelihood that the event would happen and the consequences if it did. The outcomes of the preliminary screening risk assessment are summarised in Appendix D. Detailed risk assessments were then carried out for hazards posing an appreciable risk, and these are also presented in Appendix D.

For those hazards for which preventative measures were found to be necessary to reduce the risk to acceptable levels, appropriate preventative measures (mitigation actions) were identified. Hazards and mitigation measures are summarised in Table 9 (refer section C5). Monitoring programs have been designed to ensure the preventative measures operate effectively

While the risk assessment did not involve end users specifically, all relevant comments and questions received during consultation with end users have been considered.

⁷ National Guidelines for Water Recycling: Managing Health and Environmental Risks; NRMCC, EPHC & AHMC; 2006

6.1.3 HACCP Assessment of Treatment Process

The purpose of the HACCP is to identify all hazards in the treatment process that could cause the final product to be out of specification, such that it could cause illness or injury and to establish system controls to ensure the quality of the recycled water. This is further discussed in the RWQMP and within the HACCP document.

6.2 Treatment Process

The following environmental risks were identified in relation to the treatment process.

**Table 5
Treatment Process Risks**

Risk	Mitigation Measure	Mitigated Risk Level
Chemical leaks- impact on staff and local wildlife	Maintenance, detection, alarms and emergency plans to comply with dangerous goods act and OH&S requirements	Low
System failure and Class A water is not achieved, or overflowing , leading to dumping/overflow from tanks, UV channel, LLPS or membrane plant	Monitoring throughout the plant to stop flow as soon as possible. Non-specification and other overflow water will be disposed of on-site.	Low
Leakage from brine lagoons	Groundwater quality monitoring. Approved liner design	Low
Failure of brine transfer pipe	Flow measurement at each end. Notify EPA	Low

For health-related treatment process risks refer to refer to the HACCP.

**Table 6
Water Quality Deviation Risks**

Location	Action Upon Deviation from Critical Limits
Inlet to new plant	Low lift pumping station will be shut down and no flow will be treated by the RWF. Flow will either pass to Bendigo Creek, if it is within the EPA discharge license limits, or be recycled to the head of the works, or used on site.
Throughout new plant	Adjustments will be made to the process to bring the water quality back on line. If these measures fail the plant will be immediately shut down, and procedures will continue as described for the actions upon outlet deviations.
Outlet from new plant	Plant will be immediately shut down. No water will be pumped. The water that is out of spec will be recycled or used on site. Plant will be investigated and re-started. The re-start will follow original commissioning procedures regarding disposal of out-of-spec water

6.3 Pipeline and Pumping

The following risks were identified in relation to the transport of recycled water.

**Table 7
Pipeline and Pumping Risks**

Risk	Mitigation Measure	Mitigated Risk Level
Leakage	Careful contractor selection, independent inspection services, QA in construction, and planned maintenance	Low
Check valve failing. Reverse flow from Spring Gully reservoir to site	Provide alarm on reverse flow via flow transmitter and onsite drainage designed for this	Low

Risk	Mitigation Measure	Mitigated Risk Level
Scouring of pipes leads to discharge of recycled water to the environment	Scour pits located near manholes to pump to sewer, or have pump out pits	Low
Burst pipe will drain Spring Gully Reservoir	Notify EPA. Coliban Water sewer spill response plan.	Low

6.4 Distribution

The following risks were identified in relation to the distribution network.

**Table 8
Distribution Risks**

Risk	Mitigation Measure	Mitigated Risk Level
Blue-green algae outbreak due to increase in nutrients in water in Spring Gully Reservoir	Coliban have a Blue Green Algae Management and Response Plan that will continue to apply to Spring Gully Reservoir. It includes threshold blue green algal cell numbers that trigger various mitigation responses	Low - Moderate
Re-growth of opportunistic pathogens in Spring Gully Reservoir storage	Careful control of water quality leaving plant. Ongoing monitoring of Spring Gully Reservoir, with trigger points to various mitigation responses.	Low - Moderate
Leakage from open channels wastes water and impacts on groundwater and/or nearby waterways.	The recycled water is of high quality, with only minor increases in salinity and nutrients compared to the current channel supply. Leakage from the channels will continue to occur but the recycled water will not increase the impact on the surrounding environment. Coliban is considering upgrading the channel system to piped system to prevent leakage over the next 2-5 years.	Low
Risk to public health from misuse of channels (e.g. swimming)	Community consultation and information days have been held, and a communication strategy will continue. Use of recycled water in the channels will not alter the existing risks associated with open channels in built up areas.	Low

6.5 Customer Use

The following risks have been identified in relation to the use of recycled water, and the mitigation measures are discussed further in the individual HEMPs.

**Table 9
Usage Risks**

Hazard or Hazardous Event	Mitigation Measure	Mitigated Risk Level
Lack of public acceptance due to community fears about health risks associated with recycled water.	Coliban Water's community consultation program has not shown any objections. Strategy for ongoing communication will track this and keep the public informed at all times.	Low.
Health risks for workers exposed to recycled water.	The health risk from the recycled water is minimal. Customers to communicate to visitors, etc, requirements relating to recycled water. Details will be included in HEMPs. Coliban Water's customer centre number to be provided in all literature in case of questions.	Low.
Contamination of the drinking water supply with recycled water due to cross connection between the two supplies within customer properties.	All plumbing works will be undertaken in accordance with AS/NZS 3500:2003 – <i>National Plumbing and Drainage Code</i> , which is consistent with the Plumbing Industry Commission <i>Recycled Water Plumbing Guide</i> and the EPA <i>Dual Pipe Guidelines</i> . Above-ground recycled water and drinking water infrastructure will be separated by at least 100 mm and below-ground infrastructure by at least 300 mm.	Low.
Human exposure due to drinking from recycled water outlet.	Customers will be advised that the recycled water is not suitable for drinking. Warning signs will be located on all recycled water outlets in public areas – no further than 150 mm from the tap handle. These signs should read 'Do Not Drink'. Warning signs will also be located at site entrances to public areas. Signs should read 'Recycled Water in Use. Do Not Drink.' Examples of these can be found in Appendix G.	Low.
Inappropriate use of recycled water (e.g. filling swimming pools).	Advice will be provided to customers regarding acceptable use of the recycled water. Drinking water will be supplied from an alternative source (either town potable supply or rainwater tanks).	Low.
Offsite water movement or spray drift from irrigation systems.	No buffer distances are prescribed for Class A recycled water. However, spray drift should be prevented to avoid nuisance aspects of the water. Customers will be provided with advice regarding management of spray drift. Customers will also be provided with advice regarding prevention of surface runoff.	Low.
Excess build up of nutrients in soil resulting in adverse impact on surface waters or groundwater.	Nutrient balance indicates nutrients applied in recycled water will be well below plant requirements. Build up is unlikely to occur as a result of irrigation with recycled water. Customers will be advised about the nutrient levels in the recycled water through the HEMPs. This will enable them to adjust their fertiliser use appropriately.	Low.

Hazard or Hazardous Event	Mitigation Measure	Mitigated Risk Level
Salinity of recycled water impacts on plant health, soil structure, surface waters or groundwater.	<p>Generally the risks related to the salinity of the recycled water are low. This is particularly the case in relation to stock health and the off-site environment. There are potentially some issues for customers growing sensitive plants, particularly via sprinkler irrigation, and for those irrigating impermeable soils. Customers will be advised to:</p> <ul style="list-style-type: none"> ■ Avoid sprinkler irrigation direct to plant leaves in the heat of the day – relevant to salt sensitive plants only; ■ Where impermeable soils (eg. heavy clays) exist to improve soil drainage (eg. via addition of organic matter or imported soil) or avoid irrigation of salt sensitive plants. <p>These recommended management practices will be detailed in the HEMPs.</p>	Low.
Contaminants (heavy metals, chlorine residuals) impact on plant health, surface water or groundwater.	Contaminant levels post-treatment are within guideline limits for the approved end uses. The monitoring programme is shown in the RWQMP and critical control points have been developed through a HACCP.	Low.

7 Emergency Procedures

7.1 Incidents and Impacts

Incidents may affect the environment or animal or human health through surface or groundwater pollution or soil contamination, for example. These incidents may include:

- Deviation from specification of water quality;
- Leakage or spillage of recycled water;
- Toxic algal bloom;
- Unauthorised use of recycled water;
- Accidental cross connection of recycled water and potable supplies;
- Failure of brine transfer pipe; and
- Spill of hazardous material

Coliban Water will include in their operating procedures, emergency responses to out of specification water, leakage, and other incidents. These are defined through the HACCP.

Following the establishment of critical control points at the HACCP a corrective action plan has been developed, based on the potable water Risk Management Plan. The objective of the corrective action plan is to:

- Bring the process back under control as soon as possible;
- Where possible dispose of any unsafe water before it can reach the customer; and
- Generate improvement plans to avoid recurrence of exceedance of critical limits.

Coliban Water maintains an Emergency Management and Response Plan (Appendix F), which covers the actions, roles and responsibilities of Coliban Water Staff and others in the case of a real or potential incident which could threaten the health and safety of persons, damage to property or the environment and service to customers. This plan is for use in conjunction with other plans, including:

- Dam Safety Emergency Plans;
- Coliban Water/CAMS Quality Management System Part 3 Emergency Response Standard Operation Procedures - Management Manual;
- Coliban Water/CAMS Quality Management System Parts 9 – 14 Operations Standard Operation Procedures - Operational Manual;
- Blue Green Algae Management & Response Plan; and
- Spill response plan as part of Coliban Water/CAMS QMS 9.3 Chemical Storage & Handling.

The Blue Green Algae response plan currently has three alert levels, with actions ranging from an increase in monitoring to treatment at source or the use of an alternative supply. This plan is presented in Appendix E.

The HEMPs will outline procedures for incidents relevant to end use of the recycled water.

8 Monitoring, Reporting and Review

8.1 Monitoring

8.1.1 Summary

In addition to monitoring the critical limits, Coliban Water measures the quality of the water at the inlet to the plant, throughout the treatment process and at the outlet. A long term monitoring programme is in place, with the objectives of:

- Monitoring the concentrations of parameters that indicate pathogens and chemicals of potential concern to human health and the environment;
- Providing baseline data and trends for these parameters to allow early detection of potential problems.

Included in the long-term monitoring program are bacteria, viruses, nitrogen and phosphorus, pesticides and heavy metals. Details of this programme can be found in the RWQMP and critical control points are detailed in the HACCP. Coliban Water will collate annually all monitoring as required in the REIP, HEMP and RQWMP, as well as results of compliance regarding site management plans.

8.1.2 Treatment Monitoring

The monitoring programme in place to check the quality of the Class A recycled water is detailed in the Recycled Water Quality Management Plan provided to the DHS as part of the approval procedure for Class A water.

Control of the process requires monitoring of chlorine levels and UV dose, membrane integrity, and online monitoring of all parameters defined as Critical Control Points by the HACCP. Various parameters are measured in the final water from the project over and above this, including pH, turbidity and electrical conductivity.

8.1.3 Spring Gully Reservoir

Coliban Water currently monitors blue green algae levels at Spring Gully Reservoir, and an ongoing monitoring programme has been put in place. This monitoring programme is attached to the RWQMP as Appendix D. Trigger limits, and actions on exceedence of these, are defined in the Spring Gully Reservoir Risk Assessment attached in Appendix D of this document.

8.1.4 Customer Use

Requirements for ongoing management and monitoring relating to end use will be detailed in the HEMPs and/or Customer Site Management Plans. The main monitoring requirement will be measurement of volumes of recycled water supplied.

For each public open space and commercial site a monitoring checklist will be included as part of the customer site management plan (CSMP). The monitoring checklist will be completed by the customer at the end of each financial year and submitted to Coliban Water. Coliban Water will follow up with a review of the checklist submitted for each site. This review will include a site inspection.

For rural customers, Coliban Water will conduct site inspections on a random basis.

8.2 Incident Reporting

In the event of an incident Coliban Water will inform the EPA and other relevant agencies and stakeholders. Where public health could be impacted, or an incident such as illness that could be related to the use of recycled water occurs, Coliban Water will inform DHS immediately. Coliban will assess whether customers need to be informed, and carry out liaison as necessary. The process for reporting of incidents that occur on a customer's property will be included in each customer site management plan.

Coliban Water will produce an annual report to the EPA and DHS detailing monitoring, compliance with RWQMP, and any incidents. Included in this will be records of Critical Control Points, as defined by the HACCP, and any system failures. Any changes to the RWQMP or treatment process will also be included. This report will be available to the public.

8.3 Audits

Coliban Water will undertake an annual internal review of the recycled water scheme. This will include analysis of all monitoring data to ensure any potential risk exposures are being adequately managed. Coliban Water will keep records of all monitoring results and internal reviews. They will notify EPA of any significant non-compliance, particularly breaches of Critical Control Points (see HACCP for details).

Coliban Water will also engage an auditor appointed pursuant to Part IXD of the *Environment Protection Act 1970* to undertake a statutory audit of the scheme and submit an audit report pursuant to section 53V of the *Environment Protection Act 1970* to EPA. EPA will provide a copy of the report to DHS for review and comment.

A statutory audit will be conducted within the first 12 months of commissioning of the recycled water scheme. The frequency for ongoing audits will be determined in consultation with EPA and depend on the outcomes of the initial audit. It is anticipated, however, that audits will occur at least every three years following the initial audit.

The audit will be developed in accordance with AS/NZS 19011:2003 Guidelines for Quality and/or Environmental Management Systems Auditing.

The scope of the audit will ensure:

- that the provisions within the REIP and the HEMPs are implemented;
- that any issues identified in system monitoring or system review as potentially impacting on compliance with the guideline performance objectives are being appropriately addressed;
- that any changes in the system management that could impact on compliance with the guideline performance objectives are identified and are being appropriately addressed;
- that a preventive risk management system is in place and that it appropriately addresses risk identification, assessment and management.

8.4 Future Work

As the population of Bendigo increases Coliban Water intends to increase the capacity of the plant to eventually treat all inflows for beneficial reuse in and around Bendigo. Therefore, the management practices for the ESGRWP may change in the future. Further investigation would be required for example, for:

- Appropriate salinity and nutrient levels for environmental flows
- Effect on the groundwater of recycled water

These investigations will be instigated by Coliban Water but will require the support of government agencies for their implementation.

9 REIP Review

The REIP will be reviewed annually. The review will take into consideration changes to:

- Customer base
- Water quality
- Treatment processes
- EPA guidelines
- Regulatory requirements
- Coliban Water policies

The REIP will be reviewed and endorsed by the EPA and DHS.

The review process will take place concurrently for all documentation. Any changes required to the Regional EIP will flow down to the Recycled Water Quality Management Plan, the HEMPS and finally the site agreements. A 360-degree review cycle will take place, with necessary changes from site agreements and HEMPS flowing back up through the RWQMP and REIP. All documents will be resubmitted to the EPA and DHS as a package, to enable cross-checking in the review.

10 Community Liaison

10.1 Ongoing Liaison

A communications plan has been in place since the start of the project. The communications facilitated by press releases, information days and targeted letters will continue through the implementation and usage of the project. Coliban Water will continue to communicate with all its customers about ongoing usage and needs.

10.2 Complaints

Coliban Water has an existing call centre, which handles all incoming queries and complaints. When a complaint is received regarding the project it will be logged and issued to the Coliban manager for the scheme. For each complaint the Coliban Water standard operating procedure for call logging is followed.

Some complaints are received via mail, fax and email, and these are also logged with as much information as possible from the communication. The complaint is then actioned and, following resolution of the complaint, communication takes place with the customer to ensure their satisfaction.

A summary of the complaints received will be included in the annual report from Coliban Water.

10.3 Detailed Community Engagement Strategy

Coliban Water has provided the EPA details of the consultation carried out to date, and indicated the further work intended. The Stakeholder Engagement Strategy provided in Appendix B was developed to guide communication and consultation with stakeholders during all phases of the project. It considered all stakeholders likely to have an interest in the project, including end users, directly affected parties including landowners along the pipeline route, general community, regulatory authorities and Coliban Water staff.

The key messages identified in the report include:

- Use of water recycling is part of a larger package of measures to protect the future supply of water to Coliban customers. This includes:
 - Actions to reduce demand and losses.
 - Actions to increase supply
 - Actions to source additional water.
- Water used for irrigation purposes will be of high quality water standard, and will undergo a high level of treatment and testing/monitoring;
- Clear management procedures will be in place to ensure operation of the system meets the highest standards possible;
- Recycled water will be used for uses such as irrigating local Bendigo parks, rural irrigation, etc which currently do not require potable water;
- Construction of the project will be managed to minimise the impacts on the local community;
- Implementation of the project is required as soon as possible, given Bendigo's current water supply situation. This is one of a whole range of measures proposed to resolve our future water supply;
- Recycled water will meet legislative requirements for its intended use;
- This project is one measure Coliban Water can implement that does not rely on rainfall.

Appendix A
Process Flow Diagrams

Appendix B
**Community Engagement
Strategy**

Appendix C
Pipeline Route Plans

Appendix D
Risk Assessments

Appendix E
**Blue Green Algae
Management and
Response Plan**

Appendix F
**Emergency Management
and Response Plan**

Appendix G
Examples of Signage