R E I P

Regional Environment Improvement Plan
Werribee Irrigation District
Class A Recycled Water Scheme






Prepared for:

Southern Rural Water

1 Tower Road

Werribee VIC 3030

in conjunction with:

Melbourne Water

July 2009

43283439

SRW Contract No. SRW108108

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Managing Water. Serving Communities.

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Date: July 2009 Reference: Rev 2 Status: Final

Auditor Statement

I have reviewed this REIP and find that it is consistent with the requirements of the Guidelines for Environmental Management Use of Reclaimed Water EPA publication 464.2 as amended subject to the following:

Guideline requirement	Auditor Comment
Annual EPA auditor review (section 8.6 of EPA Guidelines 464.2)	The REIP refers to a range of audits scheduled to be undetaken by an EPA appointed auditor including: • Bi-Annual verification audits of SRW annual reports commencing for the 2009-2010 FY report, then every two years thereafter. • Bi-Annual verification audits of MW's Class A Recycled Water Plant performance including recycled water monitoring results commencing for the 2008-2009 FY report, then every two years thereafter. • Section 53V Risk to the Environmental Audits for the 2010-11 SRW Annual Report. I am satisfied that this meets the intent of the guidelines and is a satisfactory program.

Dr Harry Grynberg

Environmental Auditor Appointed pursuant to the Environment Protection Act 1970

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Foreword

Southern Rural Water (SRW) and Melbourne Water (MW) have reviewed the Regional Environmental Improvement Plan (REIP) for the Use of Recycled Water in the Werribee Irrigation District, originally approved by EPA and DHS in 2004. This new updated REIP provides the environmental management framework to ensure the WID recycled water scheme can continue for another 3 years in accordance with EPA guidelines.

The WID Recycled Water Scheme was established to provide greater water security for the WID in the face of prolonged drought. In 2004 the Victorian Government made the decision to supply Class A recycled water to the WID from Western Treatment Plant (WTP). The first recycled water was supplied to WID in January 2005.

The WID Recycled Water Scheme was originally expected to operate as a supplementary supply to river water entitlements. The WID was supposed to receive a "shandy" of lower salinity river water diluted with recycled water in accordance with "Shandy Rules" described in the original 2004 REIP. The scheme operated in this manner for the 2004/05 and 2005/06 seasons. However, from 2006/07 river water allocations had reduced to less than 10% and recycled water has contributed over 80% of the water supply to WID. At the same time use of groundwater in the WID has also been heavily restricted or banned.

In 2007-08 and 2008-09, more than 13,000 ML/Yr of recycled water was supplied into the WID for use by 190 recycled water customers (includes the 4 Werribee Tourist Precinct Customers). This diverted over 230 tonnes of nitrogen and 140 tonnes of phosphorus that if not used for other recycling purposes would have discharged directly from WTP into Port Philip Bay (PPB). Not only has recycled water supply to WID contributed significantly towards meeting the 20% recycling target for Melbourne's treated effluent by 2010, it has also helped to achieve the aim of 1000 tonne/year reduction in nitrogen loads from all Bay sources by 2006 in accordance with SEPP (Waters of Victoria, Schedule F6 Waters of PPB) and the "PPB Environmental Management Plan".

SRW has been active in working with growers over the past three years to help manage both the beneficial uses and environmental impacts of recycled water. A land and on farm management committee has worked to assist farmers identify and apply best practices in salinity management. SRW has worked at the Bulk Supply level to provide water from the Macalister Drought reserve to provide low salinity water for shandying over the past two summers. MW has also worked hard to improve the flow rate and reliability of the recycled water supply, and together with City West Water has continued its efforts on reduction in the salt sources entering Melbourne's sewerage system.

Importantly, the introduction of recycled water to the WID in early 2005 has ensured that growers can continue farming productively and maintain supply of fresh vegetables to local and interstate supermarkets and wholesale markets, thereby preserving local farm businesses and jobs. Availability of Class A recycled water to WID is therefore critical to the future water security and viability of farms given the scarcity of river water entitlements in recent times.

This "second edition" REIP describes the environmental management practices and improvement programs for the Class A recycled water supply and subsequent beneficial use by SRW's customers across the WID. This REIP follows the major review by SRW and MW arising from an extensive environment audit of the WID recycled water scheme during 2008.

This REIP is integrated into both the SRW and MW environmental management systems (EMS), and demonstrates each organisation's commitment for further environmental improvements to ensure productive agriculture can be sustained in the WID, and ensuring compliance with EPA Guidelines and State Environment Protection Policy (SEPP).

Executive Summary

The Werribee Irrigation District Recycled Water Scheme commenced in 2005 as a supplementary supply, shandied with river water allocations, used by irrigators in the district for growing vegetables. In November 2004 Southern Rural Water and Melbourne Water jointly released the initial Regional Environment Improvement Plan (REIP), which provided the environmental framework under which the Scheme was planned to operate.

The original recycled water scheme and 2004 REIP were developed under the planning assumption that most of the water used for irrigation in the WID would come from Werribee River allocations via Werribee Weir. It was expected that at least 75% of the water would come from the Werribee River, and 25% from recycled water under a 100% river water allocation scenario.

Unfortunately, a severe shortage of rainfall in the catchment has reduced Werribee River allocations to historic lows. Subsequent concerns about over extraction of groundwater and saltwater intrusion to the Werribee Delta or Deutgam Aquifer has led to a total groundwater use ban from this shallow aquifer. The only reliable supply of water currently available to irrigators in sufficient volume able to sustain farming is recycled water supplied from Werribee Treatment Plant's Class A Recycled Water Facility.

The 2004 REIP covered the initial 5 years of the recycled water scheme up until mid-2009. SRW and MW have issued this "second edition" REIP to cover the next three years. This 2009-2012 REIP has been developed following completion of the 2008 statutory environmental audit of the 2004 REIP, and builds on the 5 years of experience of running the WID recycled water scheme under on-going drought and water scarcity conditions that were not able to be forecast at the outset of the scheme.

The underlying planning assumptions which shape the 2009-12 REIP are as follows:

- The current climatic conditions will continue and allocations of river water and groundwater (in the absence of any other water supply) will continue to be below the levels normally required for sustainable farming.
- The monitoring and reporting requirements outlined in the 2004 were not designed for the current scenario. A more robust and extensive program for monitoring, data management and reporting is necessary to fully understand the impacts of the recycled water scheme as it currently operates.
- The salinity of recycled water is higher than published triggers for long-term use on vegetables such as broccoli and lettuce as the only supply of irrigation water.
- The 2009-2012 REIP has been developed on the assumption that improvements in recycled water quality and customer irrigation practices will be required if the scheme is to continue in the long term.
- Options for the long term outlook of the scheme are being outlined for the Victorian government by the Western Irrigation Futures project.

The principle objectives set during the 3 year tenure of the 2009-12 REIP are as follows:

- Develop the REIP as a document that can be referenced by Southern Rural Water, Melbourne Water and other agencies for relevant roles and responsibilities, information and practical advice on key aspects of the Werribee Irrigation District Recycled Water Scheme including day-to-day management and monitoring of supply infrastructure and customer activities, and clear requirements for incident and annual reporting.
- Ensure that recycled water quality and reliability are maintained at optimum levels to minimise risks to customers and their crops (eg. from chloramines or interruption of supply).

Executive Summary

- Improve the level of monitoring and reporting within key systems within the WID including:
  - Drain monitoring expansion to include Drain 1 flow and quality monitoring
  - Groundwater sampling to increase understanding of migration of nutrients from recycled water in channel seepage
  - Soil sampling results verified against trigger levels appropriate to the WID soil types
  - Receiving waters monitoring to be introduced for both Port Phillip Bay and Werribee River Estuary
  - Monitoring programs for groundwater, drains and receiving waters to be better co-ordinated to improve the consistency of the results (ie. sampling runs to be taken at the same time as far a practicable to ensure rainfall and other external events do not skew results)
- Introduce a Soil Improvement Plan to address potentially adverse impacts of recycled water use and also assist farmers in developing management practices to maintain viable yields of vegetables and other crops.

At the end of the 3 year term the 2009-12 REIP SRW and MWC are striving to achieve the following key environmental improvements:

- No incidents of crop stunting or failure occur where recycled water is considered as the soil contributing factor.
- No increase in the number of recycled water customers where soil sample results indicate trigger levels specified in the Soil Improvement Plan have been exceeded.
- Active soil improvement measures are in place for all customers who have recorded soil sampling results in excess of one or more triggers.
- Annual loads of nitrogen and phosphorus discharging from WID drains to receiving waters do not increase.
- The monitoring program for drainage, groundwater, soils and receiving waters has produced a comprehensive data repository and reporting tools and triggers to help understand the long-term impacts of recycled water use in the WID, and also to better understand the status of compliance with SEPP objectives for groundwater and receiving waters.
- Environmental Audits of the WID scheme demonstrate compliance with EPA *Guidelines for Environmental Management Use of Reclaimed Water* (EPA Vic Pub. No. 464.2, June 2003).

The review of this 2nd edition REIP will commence in July 2011, with the supply of recycled water continuing throughout the 2011-2012 year during the period of review, the outcome of which will determine the future of the WID recycled water scheme beyond the end of June 2012.

Introduction Section 1

1.1 Purpose and Objectives

Southern Rural Water (SRW) and Melbourne Water (MW) have reviewed the November 2004 Regional Environmental Improvement Plan (REIP) for the Werribee Irrigation District Class A Recycled Water Scheme. The original REIP was approved by EPA Victoria and Department of Human Services (DHS) to enable commencement of the WID recycled water scheme in January 2005.

This updated REIP replaces the original REIP and describes the environmental framework, improvement programs and management practices for the supply and beneficial use of Class A recycled water in the WID for the next three years. The REIP also demonstrates how SRW and MW will meet the following key objectives:

- reliable supply of Class A recycled water to WID customers to meet crop and soil leaching demands;
- demonstrate productive agriculture can be sustained in the WID when irrigating with recycled water;
- ensure customers meet their environmental obligations under CSMPs by working closely with them;
- comply with EPA's *Guidelines for Environmental Management Use of Reclaimed Water* (EPA Vic Pub. No. 464.2, June 2003) and other relevant EPA guidelines; and
- comply with SEPP environmental objectives through monitoring and environmental improvement programs.

This REIP has been developed in accord with EPA's reclaimed water guidelines, and describes how SRW and MW will achieve environmental improvements, accomplish the above objectives and facilitate the ongoing beneficial use of recycled water in the WID that can sustain productive agriculture in the WID.

1.2 Scope

The REIP addresses the environmental management issues associated with the following aspects of the WID recycled water scheme:

- Bulk Supply of recycled water from WTP via MW pipeline to the WID distribution system;
- Distribution of recycled water to customer supply off-takes via the WID channel and pipeline system;
- Beneficial use of recycled water at customer sites in accordance with individual CSMPs;
- Maintenance and inspection programs for both MW and SRW assets;
- Incident management plans for MW, SRW and customer works and activities;
- Environmental monitoring programs for recycled water, customer site soils, groundwater, drains, Port Phillip Bay (inshore segment waters), and Werribee River estuary (upstream and downstream of WID); and
- Internal and external auditing programs for both MW (bulk supply of recycled water to WID) and SRW (distribution system and customer site management).

This REIP broadly covers Class A recycled water production and monitoring at WTP, and provides links to where the detail can be found in Melbourne Water's Recycled Water Quality Management System (RWQMS), WTP Accredited Licence, EIP and environmental management system (EMS). This REIP addresses recycled water supply quality issues that could directly impact on SRW's customer farm productivity including soil salinity and nutrients, as well as impacts on groundwater and receiving waters from SRW's drainage system.

Section 1 Introduction

1.3 REIP Timeframe

The timeframe for this REIP covers the next three years, commencing 1 July 2009 and incorporating the next three irrigation seasons. Review for the next REIP will commence in January 2012, after submission of the 53V environmental audit and 2010-2011 SRW and MW Annual Reports in December 2011.

1.4 Development of this REIP

The original November 2004 REIP issued in was developed after a series of extensive land capability studies in the WID, including risk assessments for recycled water quality and potential impacts of irrigation use, and consultation with customers and other key stakeholders.

SRW and Melbourne Water (MW) submitted to EPA a "Statutory" environmental audit report pursuant to section 53V of the Environment Protection Act 1970, conducted in accordance with the auditing requirements of the 2004 REIP. This "Statutory Audit" was prepared by an EPA appointed environmental auditor and included assessment of the risk or possible harm or detriment to the air, water, groundwater and land environments caused by supply and use of Class A recycled water in the WID. The audit commenced in May 2008 and was completed at the end of 2008. The audit methodology involved the review of the system and monitoring data, compliance assessment with the REIP and relevant regulatory requirements, review of the risks identified in the REIP, risk assessment relating to compliance issues and development of recommendations addressing the identified significant risks.

Following the audit, SRW and MW agreed to implement environmental improvement actions as part of this new REIP to address the recommendations of the audit. Whilst this REIP does not incorporate the identified risks and mitigating measures explicitly, the improvement actions have been integrated into this REIP including the Action Plan in Section 5.

This REIP provides the environmental framework to enable extension of the WID Recycled Water Scheme in its current mode of operation for a further three years. This new REIP assumes that the recycled water supplied to the WID will continue to have salinity at levels above which is normally considered sustainable for long term irrigation of salt sensitive crops including lettuce.

SRW are developing a strategic plan through the Western Irrigation Futures project, and it is intended that the WID Recycled Water Scheme and REIP beyond 2012 will tie in closely to the outcomes of that project.

In parallel with this, MW are continuing to work with Melbourne's Retail Water Companies on practicable options under the salinity strategy for Melbourne's sewerage system, recognising that current water restrictions are impacting on the salinity of flows in the sewerage system and in turn the salinity of recycled water supplied to the WID.

Overview of WID Recycled Water Scheme

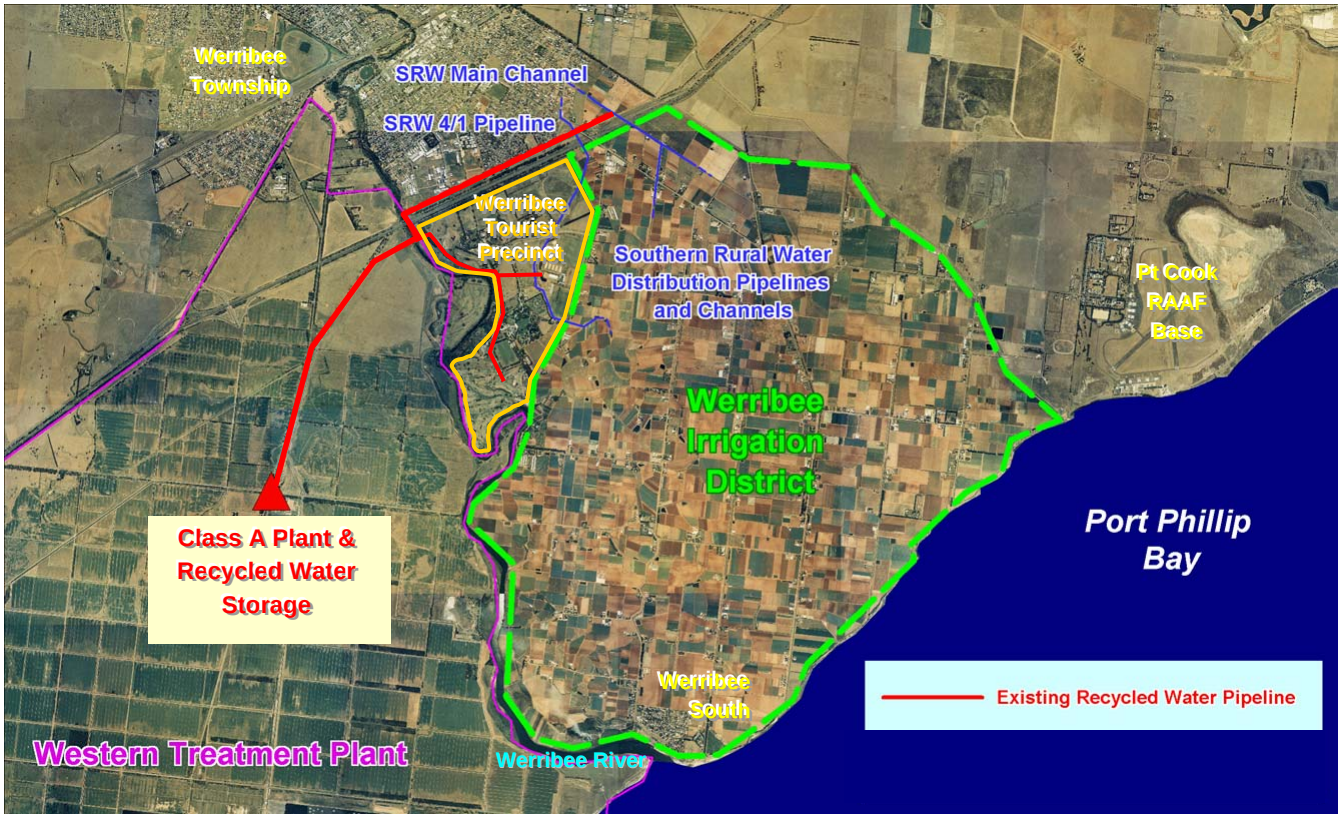
Section 2

2.1 General Description of the WID Scheme

The WID recycled water scheme is supplied by MW's Class A recycled water plant located at Western Treatment Plant (WTP), which is EPA and DHS approved. Recycled water is pumped via MW's 6.5km pipeline to SRW's WID irrigation supply distribution system connecting at SRW's Main Channel and Pipeline 4/1.

MW is responsible for operation and maintenance of its assets up to these two connection points. SRW is responsible for its assets downstream of the connection points with Main Channel and pipeline 4/1, including the network of open channels and underground pipelines which go onto to supply the 190 recycled water customers in the WID including the four Werribee Tourist Precinct customers (see Figure 2-1).

Figure 2-1 WID Recycled Water Scheme – General Locality and Features



In the WID agricultural areas, recycled water is only used by those customers that have a signed Customer Supply Agreement (CSA) and Customer Site Management Plan (CSMP) approved by SRW. Recycled water is used for irrigation of market gardens (over 80% of land in the WID) and some pasture in accordance with individual CSA's and CSMP's, as well as this REIP.

Werribee Tourist Precinct customers can be supplied via SRW's pipeline 4/1. Note that as an alternative point of recycled water supply the National Equestrian Centre and Werribee Park Golf Course can also be supplied from MW's 250mm diameter pipeline branching off the main recycled water pipeline on the east side of the Werribee River (see Figure 2-1 and Figure A-1 in Appendix A). The "Werribee Tourist Precinct Recycled Water Scheme Overall EIP" (December 2006) and individual Tourist Precinct Customer site EIPs provide the EPA approved environmental framework for the Tourist Precinct. The WID REIP is separate from these Tourist Precinct EIPs, and only deals with market garden customers and other agricultural customers irrigating with recycled water.

Section 2 Overview of WID Recycled Water Scheme

2.2 MW Class A Recycled Water Treatment Plant

2.2.1 Class A Quality Objectives

In Victoria the following guidance applies for determination of water quality objectives for Class A schemes:

- "Guidelines for Environmental Management: Dual Pipe Water Recycling Schemes" (EPA Pub. No. 1015, October 2005).
- "Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)" (NRMMC, EPHC and AHMC 2006, www.ephc.gov.au).

Note that the above guidelines supersede the original Class A criteria in Table 1 of "Guidelines for Environmental Management – Use of Reclaimed Water" (EPA Pub. No. 464.2, June 2003).

MW has adopted the following microbial and pathogen reduction criteria from the Pipe Water Recycling guidelines, because they represent the most stringent recycled water quality objectives available to water managers in Victoria.

- E.coli: median < 10 orgs/100mL
- protozoa: median 6-log reduction from raw sewage to recycled water, lower (critical) limit of 5-log reduction
- viruses: median 7-log reduction from raw sewage to recycled water, lower (critical) limit of 6-log reduction.

The above criteria were fundamental in the development of MW's Recycled Water Quality Management System (RWQMS) and Recycled Water Quality Management Plan (RWQMP).

2.2.2 Treatment Processes at Western Treatment Plant (WTP)

Raw sewage received at WTP is distributed between four parallel treatment systems (lagoons). The lagoons operate as constant replenishment systems, with inflow and outflow generally continuous throughout the day. While the lagoons hold very large volumes, limited capability exists to draw down water levels in the ponds and in this sense there is essentially no recycled water storage on site.

Treated effluent produced by the lagoons satisfies the quality objectives set out in the EPA Licence for WTP and is suitable for discharge to Port Phillip Bay. Typically the effluent from these systems also achieves Class C standard (as defined by EPA's Guidelines for Environmental Management – Use of Reclaimed Water).

All sewage is subject to anaerobic and aeration treatment, as well as natural biological processes in maturation ponds.

Two of the four lagoons – "25W" and "55E" – produce the highest quality of effluent of the four lagoons through a more advanced level of treatment, with activated sludge plants (ASPs) incorporated into these treatment systems. Construction of the ASPs was driven by discharge/compliance pressures, in particular the need to reduce nitrogen levels discharged to Port Phillip Bay. While the ASPs are very effective at nitrogen removal, they also play an important role in reducing pathogen levels. In this way the ASPs are critical to satisfying Class A water quality criteria.

Treated effluent can be captured for recycling from the 25W and 55E systems using existing infrastructure. However, no infrastructure is currently in place to enable the capture of effluent for recycling from the other two treatment lagoons.

The 55E and 25W lagoons provide a minimum 30-day detention time for helminth controls as required by the Chief Veterinary Officer.

Treated effluent (recycled water) can be drawn from the final pond of the 25W lagoon (via gravity) and the final pond of the 55E lagoon (via a pump station) into the southern end of the Recycled Water Channel. From this point, the recycled water flows to the northern end of the 1.4km channel via gravity, from where it is pumped via the ERW1 pumping station and the 3.9km Recycled Water Pipeline to the Head of Road Storage (HoRS). The capacity of this transfer system is limited by the integrity of the Recycled Water Pipeline to 340 ML/d.

MW's Class A recycled water treatment plant at WTP consists of the following key processes in series:

1) Pumping from the HoRS to the UV plant

2) Transfer via gravity to the chlorine detention basin, with in-line dosing on-route (using chlorination or chloramination depending on background ammonia levels);

3) Detention in the basin; and

4) Transfer to the WID (and other off-site customers) via the recycled water pumping station and pipeline.

The location of the Class A treatment process works at WTP and the route of the recycled water supply pipeline to the WID is shown in Figure A-1 in Appendix A (Source: MW RWQMP April 2008).

2.2.3 Class A Validation

Comprehensive validation of the WTP processes was initially undertaken in 2004/05 as part of the Class A production and supply approval process in consultation with EPA and DHS. Subsequent to this, additional validation work was undertaken associated with process enhancements and further EPA/DHS approvals.

Following the validation trials, critical limits were adopted for Critical Control Points identified during the development of WTP's (HACCP-based) Recycled Water Quality Management System (RWQMS) for Class A recycled water production and supply.

The Class A treatment process at WTP is fully endorsed by DHS and EPA, including all process enhancements made since the commencement of the recycled water scheme in January 2005. MW will maintain EPA and DHS endorsements for any process changes that may be undertaken during the 3 year timeframe of this REIP.

A detailed description of the Class A recycled water plant at WTP including treatment processes, validation and continuous monitoring (SCADA) can be found in MW's Recycled Water Quality Management Plan (RWQMP). This REIP does not go into the detail of the Class A recycled water treatment and quality assurance processes at WTP, but does provide the necessary links and cross references to the RWQMP and other MW operational procedures that specifically address possible recycled water quality issues or incidents directly impacting on SRW WID operations or customers such as elevated levels of salinity, chloramines, or blue-green algae.

2.2.4 Other Recycled Water Quality Parameters

A summary of the key parameters in recycled water supplied to the WID that are important to agricultural productivity are summarised in Table 2-1, based on 2008-09 monitoring results. Since the commencement of the recycled water scheme in 2005 salinity, SAR and Phosphorus have increased slightly each year associated with lower flows and less dilution within the sewerage system. Nitrogen levels vary each year, but recent trends show some reductions, whilst toxicants and other parameters generally remain at steady (compliant) levels.

Section 2 Overview of WID Recycled Water Scheme

Table 2-1 WTP Class A Recycled Water Quality (Source: MWC 2008)

Parameter	Baseline Medians (REIP 2004)	SRWMAIN Pipeline (Medians 2008-09)
BOD_5 (mg/L)	3	2
Suspended Solids (mg/L)	5	4
TDS (mg/L)	985	1100
EC (µS/cm)	1700	2100
SAR	8.1	9.1
pH	7.8	7.6
Total Nitrogen (mg/L)	10-20	17
Total Phosphorus (mg/L)	10	9.8

2.3 MW Recycled Water Supply Pipeline

MW transfers Class A recycled water in bulk from the pump station at WTP via the 6.5 km concrete-lined steel pipeline to SRW's supply system on the north side of the Princes Freeway (Maltby By-Pass) as shown in Figure 2-1 (also see Figure A-1 in Appendix A). The recycled water pipeline is 750mm in diameter over most of its length, with a 600mm diameter section in place where it crosses the Werribee River, plus part of the portion on MW property. Recycled water enters the SRW supply system at three interface points as follows:

1) WID SRW Main Channel 2) WID 4/1 Pipeline 3) Tourist Precinct (direct supply point)

All Tourist Precinct customers can be supplied with recycled water from SRW's WID 4/1 Pipeline. However, two Tourist Precinct customers are also supplied via an offtake on the eastern side of the Werribee River crossing, into smaller diameter pipelines discharging into these customers' on-site storages.

Sufficient treatment and transfer capacity exists to satisfy a minimum supply rate of 60 ML/d to WID as per the bulk recycled water supply agreement (as varied July 2009). Subject to prior agreement between MW and SRW, and MW is able to supply recycled water at higher flow rates on a "best endeavours basis". MW is considering opportunities to increase the Class A treatment capacity via upgrade of the UV disinfection plant.

2.4 SRW WID Distribution System

The SRW distribution system in the WID consists of about 50km of concrete lined channels, and about 12km of underground gravity flow pipelines as shown in Figure B-1 in Appendix B.

The channel system was originally constructed between 1926 and 1934, and upgraded and relined with sprayed concrete (gunite) between 1953 and 1960. SRW (and its predecessors) has progressively replaced certain sections of channel that deteriorated beyond repair, such that the system now has about 12km of pipelines. The concrete lining of the channel system is in poor condition at several locations but remains serviceable.

SRW has a channel maintenance program to manage its supply infrastructure. This involves the identification of issues and repair or replacement of assets. This includes actions such as channel lining, sealing of cracks and joints, repair of channel erosion and underscoring of concrete lining, removal of silt and weeds within and adjacent to channels and outlets (refer to Section 8.2).

2.4.1 Distribution System Flow Capacity and Efficiency

The maximum capacity of the supply system is 240 ML/d at the Werribee Weir off-take. The main channel has a 185 ML/d capacity at the freeway crossing and the 4/1 pipeline has a 50 ML/d capacity at the freeway crossing.

The system flows are regulated by manually operated drop-bar regulators and under-shot door regulators. Deliveries to customer outlets are measured by Dethridge wheels for channels or meters for pipelines.

Channel system losses by leakage and evaporation are mostly constant, therefore running the system below capacity decreases system efficiency considerably. As recycled water can only be delivered from MW assets at 60-70 ML/d the system efficiency is about 65 -70% compared with about 80% efficiency for the system running at full capacity, which would normally be the case under the full river water allocation scenario.

2.4.2 Shandy Rules

When the Class A recycled water supply commenced in early January 2005, it was anticipated that the recycled water scheme would provide a supplement to the river water supply in order to meet a salinity (EC) objective of 1000µS/cm for a mix (or "shandy") of river water and recycled water. The original 2004 REIP described the "Shandy Rules" including EC targets for mixed water under river water allocation models as shown in Table 2-1.

Table 2-1 WID Recycled Water Scheme Shandy Limits (REIP 2004)

	River Water Salinity			
Seasonal Allocation	**Shandy Target EC (µS/cm)**	**Less than Shandy Target**	**Between Shandy Target & 1,800EC**	**Greater than 1,800EC**
Up to 50%	1,800	Shandy Target	River Water Salinity	Salinity with maximum practical Recycled Water
51% - 75%	1,600			
76% -100%	1,400			
Above 100%	1,000			

Should higher river water allocations become available in the future, recycled water supply will revert to the "Shandy Rules" consistent with the original 2004 REIP (see summary in Appendix C).

2.4.3 Split Running Rules

During seasons of low river water allocations, recycled water supply runs for up to six days a week, with the seventh day reserved for river water deliveries subject to availability and quality (salinity) suitability.

The limited flow of recycled water means that the channel system is normally operated on a rotational basis. For two days the recycled water is directed through the 5/1 and 4/1 channels and deliver to outlets in the north-east and north-west of the district. On the subsequent two days recycled water is redirected through the central and south-west sections via the main channel.

Should higher river water allocations become available in the future, the operation of the channel system will revert to "Split Running Rules" consistent with the original 2004 REIP (see summary in Appendix C).

Section 2 Overview of WID Recycled Water Scheme

2.5 SRW WID Drainage System

The drainage system consists of 62 km of earthen drains that transport runoff from 12 sub-catchments located throughout the WID. The WID drainage system is shown in Figure B-2 in Appendix B.

Drain numbers 1, 2, 3, 4, 5, 6 and 6a all discharge into Port Phillip Bay, the remaining drains outfall to the Werribee River estuary. The north part of Drain 1 catchment north of Princes Freeway (Maltby Bypass) also services some urban areas of Werribee Township. The small Werribee South urban area drains to Drain 6.

Over 90% of the irrigation area has access to the earthen drain system. The service level of the drains is very high, with the ability to remove the runoff from a 75 mm, 6-hour rain event in one day. Rainfall runoff is the dominant source of major flows and contributes most of the annual drain flow volumes. By comparison, the base flows in the drains derive from a mix of channel outfalls, channel seepage/leakage and some sub-surface or localised water table discharge. The channel seepage/leakage enters the drain system mostly where a supply channel and drainage channel are adjacent eg. parts of Drains 5 and 6.

Drainage assets and drain monitoring station equipment are managed and maintained (including desilting, weed and rubbish removal) by SRW to ensure effective performance (refer to Section 8.2).

Section 6.3.3 and Appendix B of this REIP provides a general description and technical summary of the WID drainage system, sub-catchment hydrology, drain flow gauging and water quality monitoring programs, and nutrient load export calculation methods for wet and dry sub-catchments for annual reporting purposes.

2.6 Recycled Water Use

2.6.1 WID Agriculture and Horticulture

Vegetable growing occupies over 80% of the agricultural land in WID. The three main crops grown in the WID are broccoli, cauliflower and lettuce. Broccoli is the main crop grown all year round, whilst cauliflower is mostly grown through winter and spring, and lettuce is grown through the main irrigation season (September to May). Other vegetable crops grown in the WID can include cabbages, artichokes, onions, celery and fennel. Permanent pasture, lucerne and other fodder crops are also grown on roughly 15% of the area in the WID.

Recycled water is conveyed from the SRW distribution system to about 190 existing recycled water customers in the WID (including the 4 Werribee Tourist Precinct Customers). Locations of properties accessing recycled water are shaded green in Figure B-1 in Appendix B.

Customers place water orders with SRW progressively throughout the irrigation season up to 3 days before planned irrigation to meet crop water demands. Customers then receive their recycled water order via individual metered outlets, which discharge into on-farm dams for later pumping to spray and sprinkler irrigation systems.

There are about seven customers in the WID that have river water allocation licences for previous farm irrigation activities, but have not signed up to recycled water. There are several other properties in the district that are no longer farmed, do not irrigate at all or are owned by hobby farmers who choose not to sign-up for recycled water. Locations of properties that do not access recycled water are shaded yellow in Figure B-1 in Appendix B.

2.6.2 WID Irrigation Demand

Long Term Rainfall and Evaporation

Long term average rainfall and evaporation for the Werribee area up until late 2004 is given in Table 2-2 (source: 2004 REIP, data compiled from Werribee racecourse and WTP weather stations).

Table 2-2 Werribee Climate Data (REIP 2004)

Climate Data	10th percentile	Average	90th percentile
Rainfall (mm/year)	382	493	626
Evaporation (mm/year)	1122	1261	1354

Rainfall since 1996-97

The rainfall since late 1996 has been significantly lower than long term averages. Since the commencement of the WID Recycled Water Scheme in early January 2005, annual rainfall has averaged about 420mm/Yr (about 70mm/Yr lower than long term averages), whilst the 2005-06 financial year rainfall was only about 240mm, which was close to the lowest ever recorded. Evaporation over this period has remained about the same as long term averages.

Annual Irrigation Demand

Based on the above average climatic data, and using EPA Water Budget Calculations the long term average irrigation demand for vegetable or pasture cropping would be of the order 400-600mm/yr (4-6 ML/Ha/yr) depending on the type of crop grown, number of cropping rotations during the year, etc. The Irrigation Management Plan (RMCG, URS 2004) predicted the following average irrigation water use scenarios taking into account estimated water use from WID growers and agricultural professionals, including both channel and groundwater use, and accounting for typically 10-20% leaching fractions in the WID:

- Low Water Use: 5.5ML/Ha/Yr
- High Water Use: 7.0ML/Ha/Yr.

The low irrigation demand scenario assumed most water is sourced taken from channel supplies, whilst the high demand scenario (dry years) assumed higher groundwater use to supplement limited river water allocations.

Since commencement of the WID scheme, the recycled water use demands have been generally within the High Water Use Scenario range believed to be due to combination of continuing drought conditions, multiple crop rotations (3-4 rotations per year) occurring on many properties in the WID, and higher leaching requirements (10-20% is typical in the WID) due to increasing river water and recycled water salinity.

The 2008 AgChallenge soils report indicated that nine farms received more than 7 ML/Ha/Yr of recycled water in 2008. It is assumed for the timeframe of this REIP, recycled water demands for most customers will be more consistent with the High Water Use Irrigation scenario, particularly if drought conditions persist.

2.7 Other Recycled Water Customers (outside WID)

2.7.1 Werribee Tourist Precinct

SRW also manages the supply of recycled water to four Werribee Tourist Precinct Customers. The Tourist Precinct Customers are managed by SRW in conjunction with MW in accordance with the separate overall EIP and the individual customer site EIPs as listed below:

- “Werribee Tourist Precinct Recycled Water Scheme Overall EIP” (RMCG, December 2006)
- “Environment Improvement Plan Werribee Open Range Zoo” (RMCG March 2006)
- “Environment Improvement Plan National Equestrian Centre” (RMCG June 2007)

Section 2 Overview of WID Recycled Water Scheme

- "Environment Improvement Plan Parks Victoria – Werribee Park and Mansion" (RMCG March 2006)
- "Environment Improvement Plan Werribee Park Golf Club" (RMCG March 2006).

Recycled water is utilised on these sites for irrigation of public open spaces, sports fields, recreation turf, lawns and gardens, as well as animal yard wash down at the Open Range Zoo.

This REIP does not cover the Tourist Precinct customers. It only deals with agricultural/horticultural customers in the WID. However the WID agricultural and Tourist Precinct schemes are integrated and aligned in terms of incident management, monitoring, reporting and auditing programs and key milestones listed in section 11.5.4.

2.7.2 Other Customers

The following schemes are also supplied recycled water from WTP for customer uses that are outside the WID. These schemes are managed according to separate EIPs, or equivalent EPA approved management plans and are not discussed further in the WID REIP.

- Werribee Technology Precinct (CWW customers)
- MacKillop College (CWW customer)
- Standpipe facility (CWW customers)
- Barro-Richmond (future SRW customer).

Key Environmental Issues in the WID

Section 3

The following key environmental issues provide context regarding baseline and current conditions in the WID. These issues also provide the key focus and drivers for this new REIP including the environmental improvement actions and monitoring programs implemented by SRW and MW over the next three years.

3.1 Western Irrigation Futures

Due to limited availability and elevated salinity of water in the Werribee River due to drought, as well as bans on extracting groundwater from bores, the WID has been increasingly more reliant on recycled water. The WID Recycled Water Scheme was developed under the assumption that recycled water would supplement Werribee River water allocations by providing about 25% of the WID water supply in average years. The originally desired shandy of 25% recycled water and 75% river water was only achieved in the first two years of the scheme. In the three irrigation seasons from 2006-07 to 2008-09, river water allocations were severely limited and as a consequence above 80% of the total water delivered to WID customers was recycled water.

SRW is examining the long term options for water supply to the WID though its "Western Irrigation Futures" project. The objective of this project includes development of a long term strategic investment plan for the WID, to address key issues including:

- Secure suitable quality and reliable water supply;
- Establish water requirements for future agricultural production;
- Identify options for water supply infrastructure;
- Establish environmental requirements for sustainable production; and
- Ensure options provide for customer and SRW financial viability.

Until the Western Irrigation Futures project and subsequent long term future water supply strategy is completed by mid-2010, the continued sustainable supply of recycled water to the WID is critical in the medium term to ensure irrigation viability and agricultural productivity in the WID.

3.2 Recycled Water Salinity Reduction Strategy

The original 2004 REIP described a short term shandy objective of 1800 μS/cm, which corresponded to the <50% river water allocation model. The WID Recycled Water Scheme and original 2004 REIP were established with the expectation that a salinity reduction strategy would be implemented by MW in conjunction with the Retail Water Companies, to reduce recycled water salinity to 1000μS/cm electrical conductivity (EC) by 2009. This was to be achieved by means of a recycled water salt reduction plant at WTP in combination with salinity reduction programs across Melbourne's sewerage catchments. The 2004 REIP was to be reviewed after 2009 coinciding with this salinity reduction.

In 2007, MW chose not to proceed with the construction of a salt reduction plant as high capital and operating costs made it beyond the customers' capacity to pay. MW in conjunction with CWW, Yarra Valley Water (YVW) and South East Water (SEW) continue to pursue salinity reduction strategies across Melbourne's sewerage catchment, focusing on reducing trade waste salt loads and saline groundwater infiltration.

Recycled water salinity supplied to WID exceeds the original 1800 μS/cm shandy objective. Since the commencement of the WID Recycled Water Scheme in early 2005, water conservation measures across Melbourne have contributed to progressive increase in the salinity of sewage inflows to WTP, which have directly carried over to the salinity of recycled water supply. This is despite the salinity reduction (Cleaner Production) programs implemented by MW and the Retailers in the WTP sewerage catchment.

Section 3 Key Environmental Issues in the WID

In recent years, recycled water supplied to the WID has regularly exceeded EC of 2000 μS/cm during the irrigation season, and in early 2009 peaked at 2300 μS/cm. The annual median recycled water EC is now over 2000 μS/cm, almost 20% higher than the annual median of around 1700 μS/cm in 2004-05. These higher salinities occur late in the irrigation season and can cause farm productivity issues due to accumulation of soil salts including lower crop yields and in worst cases potential crop foliar damage.

As a drought relief measure, SRW has in some years been able to secure low salinity water allocations from the Thomson Dam for contingency supply via the potable supply system into the WID channel system. During the timeframe of this REIP, SRW has assumed that very low Werribee River allocations will continue and there is no guarantee of further "Thomson allocations". Heavy reliance on Class A recycled water supply to the WID is therefore likely to continue for the next three years of this REIP.

At the time of preparing this REIP, MW forecast that recycled water salinity may still increase in the short term by about 5-10% per year if sewage flows to WTP continue to reduce, particularly if current drought conditions result in ongoing or even more stringent water restrictions.

This REIP has been developed assuming that the salinity of recycled water supplied to the WID will not reduce significantly from its current levels, and may still increase slightly during the next three years. The customer site soil monitoring program described in section 6.4 of this REIP, and the customer site management and soil improvement plan measures as described in section 7 are specifically designed to evaluate and improve customer site and soil conditions to ensure good farm productivity can be sustained when using recycled water.

3.3 Soils

SRW has an extensive soil monitoring program across all recycled water customer farms in the WID. Baseline and annual soil testing since the commencement of the WID scheme has been undertaken by agricultural consultants (AgChallenge) under contract to SRW. Baseline soil conditions were established on all recycled water customer farms prior to supply of recycled water to each farm. These baseline soil tests were undertaken progressively between 2004 and 2008 as farmers signed up to the recycled water scheme. SRW will continue with annual soil monitoring under this REIP. From this work, SRW has extensively mapped the soil types across the WID (refer to map in Appendix E).

Most soils in the WID prior to commencement of the recycled water scheme already exhibited slightly elevated salinity, sodium, pH and nutrient levels. These "baseline" soil conditions are considered to be the result of over 80 years of irrigation (including use of river water and groundwater with increasing salinity) together with extensive fertiliser use over this time as part of normal horticultural practice aimed at ensuring good crop yields and economic viability for growers.

Since the recycled water scheme began in 2005, soil salinity, sodicity and nutrient levels have all increased above reporting trigger levels as defined in the original 2004 REIP. The 2008 soil monitoring report by AgChallenge concluded that soil salinity and sodicity in topsoils were similar on average to 2007 results. Whilst the 2008 soil salinity and sodicity levels were higher than baseline soil conditions, it was considered that soil conditions might be reaching an equilibrium point relative to recycled water salinity. However, given that MW considers that recycled water salinity may still increase by 5-10% per year in the short term, soil salinity and sodicity could increase by the same magnitude in the future. The soil conditions on customer sites will depend on the success of improved customer site irrigation and leaching practices outlined in section 7 of this REIP.

Soil nitrogen levels also appear to have stabilised, having already leached down the soil profile from 80 years of irrigation and fertiliser practices in the WID. Phosphorus not used by plants is being absorbed by the soils and is gradually increasing and is moving vertically down the soil profile. Improved management of nutrient levels in

customer site soils will be addressed through continuation of the soil monitoring program and assisting customers to recognise the nutrient value in both soils and recycled water, and making adjustments to traditional fertiliser rates as part of improved customer site practices to be outlined in section 7 of this REIP.

3.4 Groundwater

SRW has access to an extensive network of 25 State Observation Bores (SOB) across the WID as part of managing and monitoring the Deutgam (Werribee Delta) groundwater resource. SRW has monitored watertable and salinity levels for over 20 years in the WID and has an extensive database. Since 2005, nutrients and heavy metals have also been tested across the SOB network to monitor the potential impacts of recycled water supply and customer practices in the WID.

Heavy groundwater extractions from licensed bores for irrigation in combination with the drought has caused depletion of watertable levels and a gradual rise in salinity across the Deutgam groundwater system. This occurred even before the WID Recycled Water Scheme starting in 2005. Some areas bordering Port Phillip Bay (PPB) and the Werribee River estuary were already showing signs of seawater intrusion before 2005, indicated by sharp rises in salinity levels in certain SOBs drilled into the Werribee Delta aquifer.

As a resource protection measure SRW began to heavily restricting groundwater pumping and in 2005 introduced a WID-wide groundwater extraction ban (with some minor exceptions).

At the writing of this new REIP, groundwater in some areas bordering PPB and the Werribee River estuary were at moderately elevated salinities of 3000-3500 μS/cm, which are generally too high for irrigation of salt sensitive crops. In central areas of the WID groundwater salinity is generally lower at 900-2000 μS/cm, but is gradually increasing. It is for these reasons that SRW will continue with groundwater extraction bans across the WID, to enable the Deutgam system to recover, allow recharge to reduce salinity and prevent further seawater intrusion.

Gradual increases in groundwater salinity across the WID are still occurring despite watertable rebound in the period since the SRW groundwater extraction bans were imposed. SRW considers the continuing salinity increase to be a combination of seawater intrusion and up-coning from the underlying brackish/saline (Newer Volcanics) aquifer, as well as lack of low salinity recharge from rainfall. During the drought, channel seepage and irrigation area leaching have become the primary means of recharging the Werribee Delta aquifer and helping reduce increases in groundwater salinity in the WID.

If channels were fully lined or pipelined, it is expected that the effect of removing this significant source of artificial recharge (of the order 4GL/Yr) would be to produce rise in groundwater salinity levels across the WID at a faster rate than that currently occurring under present channel construction and low rainfall conditions.

SRW will continue to closely monitor groundwater conditions across the WID including both SOBs and private bores, and continue to implement its Seawater Intrusion Mitigation Strategy Deutgam WSPA (September 2003). SRW has increased the frequency of SOB monitoring for the next 2-3 years improve its understanding of recycled water migration from channels, drains and customer sites and potential water quality impacts on groundwater. Monitoring will now be undertaken every 6 months before and during the irrigation season, co-ordinated and integrated with other drain and receiving waters sampling programs (refer to Section 6.3.2).

3.5 WID Drainage

A general summary of the SRW drainage system across the WID was provided in Section 2.5. Rainfall runoff is the dominant source of major flows and contributes most of the annual drain flow volumes from the WID drainage system to Port Phillip Bay (via seven drain outfalls) or to Werribee River estuary (five outfalls).

Section 3 Key Environmental Issues in the WID

WID drainage system flows have reduced substantially due to the low rainfall derived flows, improved on-farm irrigation water use efficiency, and channel efficiency gains by SRW to reduce channel outfalls direct to drains. Annual drain flows have been generally lower since the commencement of the recycled water scheme (ie. since the 1-in-100 rainfall event in February 2005).

SRW have reported to EPA that there is a trend of increasing nutrient concentrations in the WID drainage system. However, the limited data collected since 2005 indicates significant variability and lower drain flows can have a concentrating effect. The water quality of the WID drains is influenced by channel seepage (ie. for those drains parallel to channels), recycled water usage and supplementary fertiliser usage on customer sites.

Since 2006, the nitrogen loads from the WID drainage system appear to be stabilising, whilst phosphorus loads may still be increasing. However, these loads are still small in comparison to other Port Phillip Bay and Werribee River catchment-wide sources – refer to Section 3.6.

SRW have implemented an improved drain flow gauging and water quality monitoring program to improve its understanding of the potential impacts of recycled water on flows and water quality of WID drains and outfalls to Port Phillip Bay and Werribee River estuary. The improved monitoring and reporting programs are to be undertaken in accordance with this REIP as outlined in Section 6.3.3.

The drain monitoring programs are to be integrated with the receiving waters monitoring program and water quality investigations – refer to Section 3.6 below as well as Section 6.3.4.

3.6 Receiving Waters - Port Phillip Bay and Werribee Estuary

The direct impacts of recycled water supply and use in the WID on Port Phillip Bay (PPB) and the Werribee Estuary are not well understood. The limited literature and water quality data indicates that the estuary was nutrient enriched well before commencement of the recycled water scheme, due to very low flows passing the Werribee Weir. High algal populations and algal blooms (including blue-green species) have been reported from time to time.

In 2008 the total annual nutrient loads to PPB (including via the Werribee estuary) from WID drain flows were estimated to be of the order 16 tonnes of nitrogen and 8 tonnes of phosphorus. These nutrient loads are considered minor in comparison to longer term nutrient loads to the Bay from other land uses in the PPB catchment including treated effluent discharges from WTP.

WID drainage nutrient loads are significantly offset by the diversion of around 12.5GL/Yr of recycled water to WID (2008-09 period) representing about 225 tonnes of nitrogen and 140 tonnes of phosphorus per year, which otherwise would have discharged directly into PPB from WTP.

However, if Werribee Weir passing flows to the estuary continue to be very low, WID drain discharges have potential to contribute relatively significant nutrient loads to the estuary, with localised effects particularly from nutrients exported in the first flush after rainfall.

SRW and MW propose to commence monitoring of receiving waters as part of this updated REIP and the improved monitoring programs as described in Section 6. The details of the receiving waters monitoring program are provided in section 6.3.4 of this REIP.

Roles and Responsibilities

Section 4

4.1 Governance of the WID Recycled Water Scheme

The WID Recycled Water Scheme is jointly managed by MW as the bulk supplier of Class A recycled water and SRW as the retailer of recycled water supply to the WID, in accordance with this REIP and the Customer Supply Agreements between SRW and each customer. The following documents describe further roles and responsibilities and project partnerships relationships for the efficient governance and implementation of the scheme beyond the scope of the REIP:

- Bulk Recycled Water Agreement Variation between MW and SRW ("BRWA Variation", 1 July, 2009), and original Bulk Recycled Water Agreement between MW and SRW ("BRWA", 15 December 2004).
- Werribee Irrigation District Recycled Water Scheme Project Partnership Principles as agreed between Department of Sustainability and Environment, Melbourne Water Corporation and Gippsland and Southern Rural Water Authority (Memorandum of Understanding, "MOU", 30 May 2005).

In addition to its key role as recycled water retailer for the WID, SRW is the rural water corporation responsible for supply of Werribee river water allocations to the WID as well as licensing of bore extractions and groundwater monitoring across the WID.

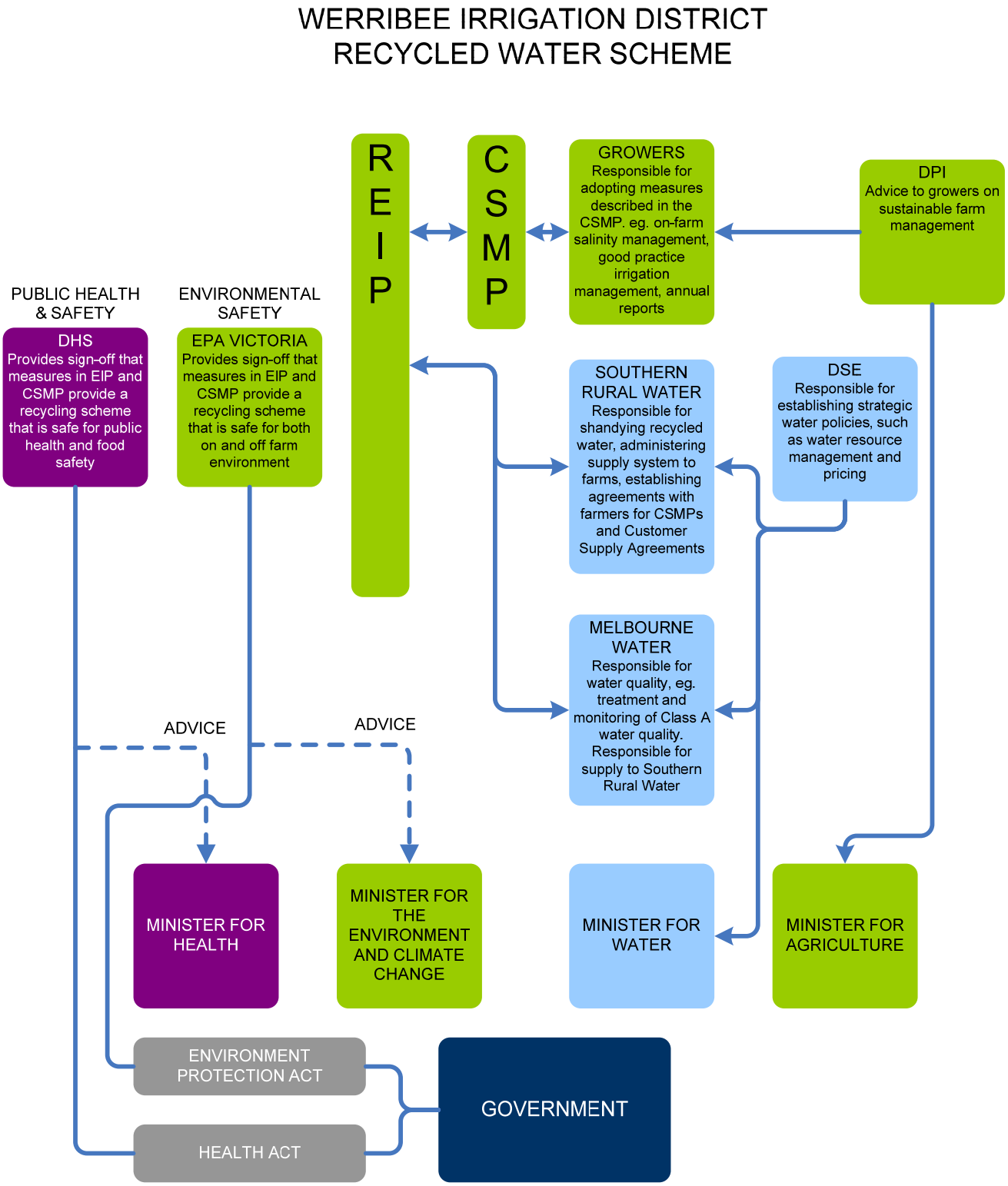
The institutional arrangements under the BRWA (and Variation) and the MOU are not expected to change during the next three years of this REIP.

Figure 4-1 illustrates the governance arrangements and relationships between the various parties involved in the WID recycled water scheme.

The key roles and responsibilities for SRW, MW, Customers and other key agencies involved in the WID Recycled Water Scheme are further outlined in sections 4.2 and 4.8.

Section 4 Roles and Responsibilities

Figure 4-1 Governance & Relationships for the WID Recycled Water Scheme (2009-2012)



4.2 Melbourne Water

Melbourne Water, as the bulk supplier of the recycled water for the scheme will:

a) Maintain EPA and DHS approvals and HACCP certification for the WTP Class A recycled water production and transfer systems

b) Supply Class A recycled water in accordance with the Bulk Recycled Water Agreement.

c) Operate and maintain the Class A treatment plant process, to achieve the required Class A water quality.

d) Operate and maintain other MW recycled water scheme assets including the recycled water pump station and pipeline to off-site customers (including WID) to ensure reliability of supply and avoid spills and leaks of recycled water to the environment.

e) Provide adequate inductions and refresher training to all MW staff involved in working with Recycled Water

f) Provide an annual report on findings and compliance to EPA Victoria in conjunction with SRW

g) Arrange for periodic independent audits of sections of the REIP for which Melbourne Water is responsible (as defined in Section 11.5.1)

h) Monitor and investigate incidents that might occur due to recycled water quality or use (ie. crop failures)

i) Provide communications for Melbourne Water in relation to recycled water.

j) Obtain and maintain EPA approval for the REIP in conjunction with SRW.

k) Comply with the REIP and EPA's *Guidelines for Environmental Management Use of Reclaimed Water*.

4.3 Southern Rural Water

Southern Rural Water, as the retailer of recycled water and river water allocations to the WID will:

a) Ensure the operation of the distribution system is undertaken in accordance with the REIP. Specifically, making sure that the water supplied to the customers is of a quality as outlined in the Customer Service Agreements.

b) Operate and maintain supply control valves and the distribution system up to the customer supply points

c) Provide adequate inductions and refresher training to all staff involved in working with recycled water

d) Provide adequate inductions and training to all new recycled water customers, and offer refresher training to existing customers

e) Monitor groundwater and surface water to ensure that there are no adverse environmental impacts related to recycled water use.

f) Ensure that a Customer Site Management Plan is completed for each customer, which meet the requirements of the REIP and EPA's reclaimed water use guidelines.

g) Undertake soil monitoring of recycled water customer sites in accordance with Soil Monitoring Program as defined in the REIP.

Section 4 Roles and Responsibilities

h) Monitor and audit customers in accordance with EPA's reclaimed water guidelines and verify that customers are meeting the requirements of the Customer Site Management Plans.

i) Keep a register of information about recycled water customers, including site addresses, supply volumes and end uses of the recycled water. Report this information annually to EPA.

j) Inform customers of the potential risks associated with the use of recycled water and assist in the management of those risks.

k) Ensure ongoing liaison with key stakeholders, including the community.

l) Provide public on-line access to water salinity and nutrient information from recycled water, river water and shandied water.

m) Provide a reliable system for recording and responding to complaints.

n) Implement the sections of the REIP covering the activities and responsibilities of SRW.

o) Provide annual reporting to EPA in accordance with the scope of reporting in this REIP

p) Provide communication for SRW in relation to recycled water.

q) Obtain and maintain EPA approval for the REIP in conjunction with MW.

r) Organise periodic independent audits of sections of the REIP for which SRW is responsible.

4.4 Recycled Water Customers

Recycled water customers will:

a) Beneficially use recycled water in accordance with the CSA and CSMP.

b) Maintain the recycled water dam and irrigation water distribution system on their site.

c) Allow site access to SRW for the purpose of meter reading, soil sampling and site auditing.

d) Participate in site audits by SRW's staff and external auditors as required.

e) Participate from time to time in SRW's customer recycled water inductions and refresher training sessions

f) Comply with CSMPs and report annually to SRW on performance against the guidance given in CSMPs.

g) Work towards keeping within the defined trigger levels for soils.

4.5 EPA Victoria

EPA is responsible for approval of the REIP and CSMP, and providing formal endorsement that the scheme complies with EPA guidelines and is exempt from works approval and licensing. EPA may audit the scheme from time to time for compliance with EPA guidelines and SEPP.

4.6 Department of Human Services (DHS)

DHS is responsible for the endorsement of the recycled water as Class A standard based on the Recycled Water Quality Management Plan (RWQMP) and detailed disinfection plant validation results provided by Melbourne Water. DHS provides formal endorsement that the recycled water is safe for public health and food safety if the REIP, CSMP and QMP are complied with.

4.7 Department of Primary Industries (DPI)

DPI has primary responsibility for administering legislation governing agriculture and has a range of extension and regulatory services to drive practice change in the farm sector. DPI works with the horticulture industry and farmers to develop and implement sustainable production systems for the long term viability of agricultural and food industries. DPI also plays a role in protecting the quality and safety of primary products including testing for contaminant residues (including cadmium) through the Victorian Produce Monitoring Program (VPMP) and other research and development programs.

In the WID DPI provides some extension services and guidance to irrigators that are using recycled water to help improve on-farm management practices and sustain crop productivity to facilitate economically viable farm businesses.

4.8 Department of Sustainability and Environment (DSE)

DSE is responsible for establishing strategic water policies such as water resource management, pricing and communications at a state level, and providing associated direction and advice to SRW and MW as required.

DSE is also responsible for bore management, maintenance, periodic condition assessments and replacements as necessary of State Observation Bores (SOB) and associated groundwater monitoring assets in the WID through contractual arrangements with groundwater monitoring service providers and equipment suppliers.

Section 5 REIP Action Plan

The REIP Action Plan to follow as Table 5-1 in this section summarises the management measures, environmental improvement programs and respective roles of responsibilities of SRW, MW, customers and other agencies for the next three years of operation of the WID recycled water scheme.

The REIP action plan provides links and cross references to where more detailed information can be found in other sections and Appendices of this REIP, and in other relevant operational and management systems, and management plans documentation held by SRW or MW including the incorporated documents as listed in Appendix H.

Table 5-1 WID Class A Recycled Water Scheme REIP Action Plan 2009-2012

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
1	**Recycled Water Treatment & Quality**								
1(a)	Compliance with Class A recycled water microbial quality objectives of relevant EPA guidelines. [MW has adopted the criteria in "*Guidelines for Environmental Management: Dual Pipe Water Recycling Schemes*" (EPA Pub. No. 1015, Oct 2005)]	WTP Class A treatment process: • fully validated and endorsed by EPA and DHS • HACCP certified Recycled Water Quality Management System (RWQMS) and Recycled Water Quality Management Plan (RWQMP). • Continuous process monitoring by SCADA control system at Critical Control Points (CCP)	• Annual review of performance improvement opportunities • Implementation of various asset and operational improvement initiatives aimed at improving system reliability, on-line monitoring capability, etc.	• Recycled water quality monitoring for microbial indicators – weekly for most parameters. • Continuous process monitoring data (securely retained on SCADA computer databases). • Bi-annual verification audits, and six monthly HACCP surveillance audits. • Annual reporting of monitoring results, including any breaches to EPA. Monthly summaries to SRW.		✓		2.2 6.2 9.2 11.1 11.5.1	RWQMP
1(b)	Recycled Water Salinity Reduction Strategy: work with retail water companies (City West Water, Yarra Valley Water & South East Water) in pursuit of feasible salinity reduction initiatives	Work with retail water companies to: • Monitor and enforce Trade Waste Agreements (TWA) for compliance with TDS limits and loads • Assess Industry Site applications for any variations to TWAs for higher TDS loads, and if appropriate require Waste Management Plans to reduce TDS loads to sewer.	Salinity reduction options under consideration: • reduced salt discharges from industrial customers via the retail water company cleaner production programs • reduction in salt components in domestic products (eg. Smart Water Fund Projects) • investigations into minimisation of inflow & infiltration of groundwater to the sewerage system	• Recycled water salinity monitored on-line and for weekly monitoring program. • Annual reports to EPA and monthly recycled water quality summaries to SRW. • Annual reporting of progress on Recycled Water Salinity Reduction Strategy including retail water company cleaner production programs and other salinity reduction initiatives		✓		3.2 11.1	MW & retail water company cleaner production programs

Section 5 REIP Action Plan

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
1(c)	Minimise the likelihood of chloramine impacts on customers	Implement preventative chloramine management plan to ensure: • operating envelop that is safe in terms of acceptable chloramine levels • on-line monitoring to enable early warning of potential conditions (eg. high ammonia) that could lead to elevated chloramines, and allow MW to make timely process adjustments to prevent undesirable chloramine levels.	• Implementation of chloramine contingency plan (includes installation of ammonia analysers throughout the WTP treatment system). • MW and SRW are jointly undertaking a detailed research experiment aimed at increasing knowledge of the impact of chloramines on lettuces	• Continuous SCADA process monitoring of key operating parameters (ie. ammonia, chlorine contact time & dose, TRC, temp., pH, etc). • Report on any chloramine incidents & outcomes of process and procedure reviews. • Report on chloramine research experiment on lettuces by mid 2010	✓	✓		9.4	MW Chloramine Management & Contingency Plan
1(d)	Minimise the likelihood of Blue-Green ("B-G") impacts on customers	• MW and SRW B-G Algal Management Plans (see 11(c) of this Action Plan) • Response plans in CSMPs, grower's information packs and information sessions.	• MW is implementing a suite of preventative, validation and monitoring/notifications initiatives aimed at improving B-G algal management	• Report on B-G algal bloom incidents impacting on recycled water supply as & outcomes of process and procedure reviews.	✓	✓		9.2 9.3	MW & SRW B-G Algal Management Plans (see 11(c) of this Action Plan)
2	**Recycled Water Quantity**								
2(a)	Satisfy the volume/supply rate requirements set out in the bulk recycled water supply agreement between MW and SRW	• Sufficient treatment and transfer capacity exists to satisfy a minimum 60 ML/d as per the bulk recycled water supply agreement (variation) effective July 2009. • Subject to agreement between MW and SRW, MW supplies recycled water at flow rates higher than the daily volumetric obligation (as per the agreement) on a "best endeavours basis".	• MW is considering opportunities to increase it's Class A treatment capacity via an upgrade of the ultraviolet disinfection plant	• On-line monitoring of instantaneous recycled water flow rates to WID (SRW Main) and totalised volumes. • Recycled water flows to the WID reported annually in both MW and SRW annual reports. • Volumes reported by MW monthly to SRW	✓	✓		2.3, 2.4, 6.2.1, 6.3.1, 11.1, 11.2	Bulk Recycled Water Agreement (including variation July 2009)

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
3	**Shandy Rules**								
3(a)	SRW to adhere to original REIP "Shandy Rules" subject to river water salinity and availability of allocations	• SRW to supply river water allocations (subject to availability) for mixing with recycled water or as "river only" supply as relevant to manage salinity loads to customer sites	• Western Irrigation Futures project is examining the long term options for water supply to the WID (outcomes expected to be known by mid-2010)	• Water inflows to WID from all sources reported in SRW Annual Report • 2009/10 Annual Report to document WIF project outcomes	✓			2.4.2, 6.3.1, 11.2, App. C	2004 REIP
4	**Split Running Rules**								
4(a)	SRW to adhere to "Split Running Rules" as per original REIP for supply of recycled water and river water	• SRW to operate according to Split Running Rules if river water availability and salinity allows. • SRW WID District rosters	• Western Irrigation Futures project as for 3(a) above	• Same as for 3(a) above	✓			2.4.3, 6.3.1, 11.2, App. C	2004 REIP
5	**SRW Channel System Distribution Reliability**								
5(a)	Reliable supply of recycled water (straight or shandied with river water) to meet the demands of WID customers as agreed in CSAs & CSMPs in accord with plant water demands	• SRW Customer order system: customer orders 3 days before scheduled irrigation to meet plant water demands • Channel (& pipeline) & Channel outfall condition & leakage inspection programs. • Critical Asset Inspection Process & Corrective Maintenance prioritised and scheduled as appropriate	• SRW ongoing modernisation investigations into improved flow measurement accuracy into WID and through customer outlets	• Monthly Meter reading of customer outlets • Continuous Monitoring and Reporting of flows into WID • Continuous monitoring of 4 major channel outfall points to drains • Asset Life Database Recording • Flows into WID reported in Annual Report to EPA • Individual customer usage recorded in secure Customer database.	✓			2.4.1, 2.6, 6.3.1, 7.1, 7.2, 7.4, 8.2, 11.2, 11.3	CSMPs & CSAs

Section 5 REIP Action Plan

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
6	**SRW WID Drainage System Management**								
6(a)	Minimise flows and nutrient loads to Werribee Estuary and PPB by: (i) Minimising recycled water channel outfalls & seepage to drains; and (ii) Minimising recycled water irrigation run-off from customer farms to drains	• Effective supply/demand management to minimise outfalls. • Adherence to EPA approved channel draining procedure. • Drain and Channel inspection programs. • Critical Asset Inspection Process & Corrective Maintenance prioritised/scheduled as approp. • Drainage diversion management (12 diversion licenses in WID) • Customer liaison program to advise on & promote water use efficiency & minimising runoff – refer to 10(a) & 10(b) • CSMP compliance and Customer site audit programs	• Outfall system monitoring Improvement Plan • Drainage system monitoring Improvement plan • Establish drain 1 continuous flow monitoring by early 2010 • Targeted channel maintenance program to reduce channel seepage to drains • Demonstration sites project • Fertiliser provider engagement program • Review & enhance CSMP audit program scope to include further soil, fertiliser and drainage assessments	• Asset Life Database Recording • Continuous monitoring of 4 major channel outfall points • Drain flow and quality monitoring program (Drains 1, 5, 6 & 11) • WID Maintenance system • Werribee Drains and Outfall Discharge recording • Drain monitoring program (flows and quality) results & outcomes of customer auditing programs included in Annual Report to EPA	✓			2.5, 3.5, 6.3.1, 6.3.3, 7.1, 7.4, 7.5, 7.7, 8.2, 11.2, 11.5.2, 11.5.3	
6(b)	Compliance with SEPP Waters of Victoria environmental and water quality objectives and relevant beneficial uses								
7	**Werribee River (Estuary)**								
7(a)	Compliance with SEPP (Waters of Victoria) water quality objectives and relevant beneficial uses	• Drain outfall management controls as for 6(a) and (b) above • Monitoring of Werribee Weir Quality (continue existing program & integrate with new receiving waters monitoring program – see next column)	• Drain outfall monitoring improvement program as for 6(a) and (b) above • Establish receiving waters monitoring program for the estuary (integrate with drain monitoring and Werribee Weir programs as for 6(a) and (b) above) • Work proactively with MW with a view to supporting the receiving waters quality monitoring program	• Same as 6(a) and (b) above plus the following: • Receiving waters monitoring database • Results of receiving waters monitoring program reported in SRW Annual Reports	✓	✓ (Water-ways Branch)		3.6, 6.3.4, 11.2, App. B	

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
8	**Port Phillip Bay (In-Shore Segment)**								
8(a)	Compliance with SEPP (Waters of Victoria) Schedule F6 (Waters of Port Phillip Bay) water quality objectives and relevant beneficial uses	• Drain outfall management controls as for 6(a), 6(b) and 7(a) above	• Drain outfall monitoring improvement program as for 6(a), 6(b) and 7(a) above • Establish receiving waters monitoring program for PPB inshore segment (integrate with drain, Werribee Weir and estuary monitoring programs as for 6(a), 6(b) and 7(a) above) • Work proactively with MW with a view to supporting the receiving waters quality monitoring program	• Same as 6(a), 6(b) and 7(a) above plus the following: • Receiving waters monitoring database • Results of receiving waters monitoring program reported in SRW Annual Reports	✓	✓ (Water-ways Branch)		3.6, 6.3.4, 11.2, App. B	
9	**Groundwater**								
9(a)	Compliance with SEPP (Groundwater of Victoria) water quality objectives and relevant beneficial uses of the groundwater systems in the WID with particular focus on protection of the Werribee Delta (Deutgam) Aquifer	• SOBN Groundwater Quality and Watertable Monitoring Program • Monitoring of selected (voluntary customers) private bores • Seawater Intrusion Mitigation Strategy (SRW 2003): monitor and review effectiveness of groundwater extraction bans on saline intrusion.	• Groundwater quality monitoring frequency increased to every 6 months • Recycled water migration assessment project (ongoing)	• Groundwater monitoring database • groundwater monitoring results assessed for trends and SEPP compliance and reported in SRW annual reports	✓			3.4, 6.3.2, 11.2, App. D	Seawater Intrusion Mitigation Strategy (SRW 2003)

Section 5 REIP Action Plan

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
10	**Customer Sites - Management and Compliance**								
10(a) 10(b)	Compliance with Customer Site Management Plans (CSMP) Assist Customers achieve optimal farm productivity within recycled water quality and quantity constraints	• Customer liaison program: # consultative committees # communications, newsletters # field days & demonstrations # Recycled Water Information Sessions on commencement # SRW advisory programs on Water Use efficiency • Annual Customer Site Soil Monitoring program, includes: # individual customer site interpretation reports # one-on-one interviews if requested by customer • CSMP compliance and SRW Customer site audit programs	• Soil Improvement Program • Improved WID soils database with data QA/QC checks. • Demonstration sites project • Fertiliser supplier/provider engagement program • Refresher Recycled Water Training for Customers • SRW to inform Customers of nutrient value in Recycled Water. Develop "Recycled Water Nutrients Calculator". • Review scope of CSMP audit program to integrate/align with Annual Soil Monitoring & Improvement Programs	• Soil monitoring results maintained in secure WID soils database with independent data quality (QA/QC) checks • Individual Customer Site Annual Soil Monitoring reports • Overall WID soils monitoring report attached to SRW Annual Report to EPA • Outcomes of Customer site auditing program and soil improvement program documented in SRW Annual Report to EPA	✓		✓	3.3, 6.4, 7, 10.3, 11.2, 11.3, 11.5, App. E, App. F	CSMP
11	**SRW & MW General Management & Compliance, Reporting & Auditing Activities**								
11(a)	Compliance with REIP Audit program	• Bi-Annual Verification Audits of SRW and MW Annual Report as required by REIP • SRW Customer site audit program including SRW annual customer site checks • 53V Audit for 2010-2011 year	• SRW Customer site audit program improvements including independent Customer Site audit if soil triggers exceeded (soil improvement program) • Review audit program outcomes at SRW/MW Liaison meetings	• Outcomes of REIP and Customer Audits documented in SRW and MW Annual Reports to EPA	✓	✓		11.5	

No.	Performance Objective	Management Controls	Improvement Programs (2009 - 2012)	Monitoring & Reporting	Responsibility (✓)			REIP Ref	Other Ref
					SRW	MW	Customer		
11(b)	Annual Reporting to EPA	• Prepare annual reports subject to verification audits as relevant • Include reporting against adopted water quality guidelines and reporting triggers • Submit annual reports to EPA by agreed due dates	• Implement improved scope of annual reporting in accordance with this REIP • SRW & MW to review scope of annual reporting through EPA feedback on annual reports	• SRW and MW Annual Reports submitted separately by November each year except for 2010-2011 SRW annual report which is to be submitted in December 2011 to enable 53V audit to be completed	✓	✓		11.1, 11.2	
11(c)	Timely and appropriate response to address non-compliances and incidents	Incidents are managed under a range of incident management systems, plans and procedures including: • Australian Interagency Incident Management System (AIIMS) • SRW Corporate Incident Management Plan (SRW CIMP) • MW General Emergency Management System • SRW Risk Management Plan for management of Blue-Green Algae Incidents in the WID • MW Blue-Green Algal Response Protocol • Chloramine Contingency Plan	• All incidents are subject to debriefings and reviews of outcomes to identify potential improvement opportunities for WID scheme activities and operations	• SRW & MW Incident Management Databases • Incident Reported at the time to affected agencies, customers and stakeholders as relevant in accordance with agreed incident reporting timelines • Incident outcomes and reviews are documented in MW and SRW Annual Reports.	✓	✓	✓	9, 11.1, 11.2	See list of documents referred to in 3rd column

Section 6 Monitoring and Data Management

6.1 Summary of Environmental Monitoring Programs

Table 6-1 below provides a summary of the various environmental monitoring programs carried out by MW, SRW and the Customer as relevant to each party's responsibilities.

Table 6-1 WID Recycled Water Scheme Summary of Monitoring Programs

Monitoring Program Element	REIP Section	Frequency	Month Due	Responsibility		
				MW	SRW	Customer
MW Recycled Water Monitoring Program:	6.2					
• Continuous Process Monitoring	6.2.1	Continuous	ongoing	✓		
• Recycled Water Quality Sampling and NATA Laboratory Analyses	6.2.2	Weekly	ongoing	✓		
SRW Monitoring Programs:	6.3					
• WID Water Supply Inflows & Outflows	6.3.1	Continuous	ongoing		✓	
• Groundwater	6.3.2	Bi-Annual	January & July		✓	
• WID Drainage	6.3.3				✓	
– 2009-2010 FY		Dr. 5 Mthly, Dr. 1, 6 & 11 Quarterly	ongoing, Jan., Apr., July, Oct.			
– 2010-2011 & 2011-2012 FY (pending review of 2009-2010 results)						
• Receiving Surface Waters	6.3.4			✓	✓	
– 2009-2010 FY		Quarterly	Jan., Apr., July, Oct.			
– 2010-2011 & 2011-2012 FY (pending review of 2009-2010 results)						
Customer Site Soil Monitoring	6.3.5	Annual	Between May & July		✓	✓

6.2 MW Recycled Water Monitoring Program

MW has an extensive monitoring program covering various process streams, including Class A recycled water. Continuous process monitoring is in place to provide real-time verification that Class A treatment processes and pathogen removal requirements are met for recycled water supplied to WID. Regular sampling and analyses is also undertaken by a NATA accredited laboratory for a wide range of physical, chemical and microbiological water quality parameters to verify Class A recycled water quality objectives are met and as part of ongoing irrigation sustainability and agricultural productivity assessments in the WID. This monitoring program is undertaken in accord with MW's RWQMP as endorsed by EPA and DHS.

6.2.1 Continuous Process Monitoring

The Class A treatment process is monitored at critical process steps by a SCADA system for key operating parameters and the continuous monitoring points as listed in Table 6-2.

Table 6-2 Class A Treatment Plant Continuous Monitoring Points

Location	Continuous Process Monitoring
Lagoon L55E and 25W activated sludge plant bypass structures	Pond level
Lagoon L55E and 25W activated sludge plant outlets (clarifiers)	Sludge blanket levels
Lagoon L55E and 25W outlets (outlets into the reuse channel)	Turbidity, ammonia
Head of Road Storage (HoRS) (pumped to UV Plant)	Flow, turbidity, transmissivity (UVT), ammonia
UV plant (including transfer to Chlorine Plant)	Flow (per UV channel), UV dose
Chlorination plant and detention storage	Chlorine dose residual, chlorine contact time residual, temperature, EC
Recycled water pump station to recycled water supply pipeline	Flow, Total chlorine residual (at point of supply), delivery pressure
SRW Main interface point (end of MW recycled water pipeline and start of SRW asset)	Flow, EC

Any breaches of a critical limit described in the RWQMP for the above continuous monitoring points activate alarms in the SCADA system and shut down recycled water supply to prevent supply to the WID until any breach is rectified. Refer to the RWQMP for details of the critical limits.

6.2.2 Recycled Water Quality Sampling and NATA Laboratory Analyses

Sampling and analyses of recycled water is undertaken on a weekly basis for the suite of physical, chemical and microbiological water quality parameters as listed below:

- BOD_5
- Total Suspended Solids
- pH
- TDS (total and inorganic)
- EC
- Colour
- Nitrogen (N) forms: NH_3, TKN, NO_3, NO_2, Organic N
- Total Phosphorus
- Cations: sodium, calcium, magnesium and potassium
- SAR (by calculation)
- chloride
- boron
- aluminium
- antimony
- arsenic
- barium
- beryllium
- cadmium
- chromium
- cobalt
- copper
- iron
- lithium
- lead
- manganese
- mercury
- molybdenum
- nickel
- selenium
- silver
- thorium
- tin
- vanadium
- Zinc
- E-Coli
- FRNA Colifage
- Helminths
- Viruses
- Cryptosporidium
- Giardia
- Algal scans and counts (including Blue-Green species if identified)

6.2.3 MW Data Management

Continuous Data

All data from continuous monitoring of process operating parameters and water quality is stored in the SCADA system database. This data is readily retrievable and can be displayed in spreadsheets and charts for purposes of process capacity reviews, trend analyses, monthly and annual reporting, incident response, etc.

Sampling and Analyses Data

Results of laboratory tests are sent to MW by the laboratory services provider in both electronic format and as corresponding hard copies of scanned signed NATA certificates of analyses (“COA”). Each weekly batch of electronic data is emailed to MW in spreadsheet format. This electronic data is accompanied by a quality assurance statement from the laboratory that the data is true and representative of samples taken and subsequent analyses, and that the data is identical to that contained on the signed COAs. These quality procedures are in accordance with the laboratory’s internal NATA accredited QA/QC procedures.

After MW receives the electronic and hard copy data, it carries out its own quality checks of the data in accordance with MW’s quality procedures under the RWQMP, to satisfy itself that the data is correct and ready for entering into MW’s "WTP Outlets" Access database. This database can be queried using spreadsheet tools to readily retrieve and display data for the purpose of process capacity reviews, trend analyses, monthly and annual reporting, incident response, etc.

Data Retrieval, Review and Reporting

MW reviews all Class A recycled water data against the microbial quality objectives set out in "Guidelines for Environmental Management: Dual Pipe Water Recycling Schemes" (EPA publication 1015, October 2005).

MW submits a "SRW Customer Report" on a monthly basis containing a summary of recycled water quality monitoring for that month. By November each year MW will submit to SRW and EPA an annual recycled water report for the previous financial year reporting period. Refer to Section 9 for more information on the scope of these annual reports.

In the event of any Class A water quality issue or incident SRW and EPA are notified as necessary in accordance the MW Incident Management procedures - see Section 9.

6.3 SRW Monitoring Programs

SRW has an extensive water resource and environmental monitoring programs in place across the WID to manage recycled water supply, river water supply, licensed groundwater bore use, groundwater quality and water tables, channel flows and outfalls, drain flows and receiving water quality (PPB and Werribee estuary). These are outlined below.

6.3.1 WID Water Supply Inflows & Outflows

SRW's has a number of water supply monitoring stations throughout the WID supply system to measure, record and report the various key water inputs and outputs to the WID. These are summarised in Table 6-3.

Table 6-3 WID Water Supply Inflows and Outflow Monitoring

Inflows to WID:	**Measurement Method**
Werribee Weir diversion into SRW Main	Continuous Gauging at Weir
Potable water bulk main into SRW Main (eg. Thomson Allocation)	Meter in Bulk Supply Main (read as required). Continuous Gauging in SRW Main downstream
Recycled water into SRW Main & Pipeline 4/1	Continuous Gauging and Meter for each
Outflow - System Losses & Customer Use:	**Measurement Method**
Supply to Individual Customer Outlets	Dethridge Wheel or Pipe Meters (read by SRW monthly or more frequently near end of customer annual entitlement)
Channel Outfalls to Drains	Continuous gauging on 2 key channel outfalls. Other gauged outfalls are spot read or estimated when planned to occur
Channel Efficiency (Unaccounted Losses from Channel Leakage, Evaporation & Meter Error)	Estimated from difference between total water delivered into WID (from all sources) and passed into Customer Outlets
Drain Flows (refer also to section 6.3.3)	Continuous gauging on Drains 5, 6 and 11. Estimations for other drains based on catchment ratio calculations for gauged drains with similar hydrology.

Note that licensed groundwater bores are also metered and read every 6-8 weeks by SRW (see section 6.3.2).

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Rainfall (mm) is also recorded monthly by SRW based on the weather station at Werribee racecourse (supplemented by the WTP weather station).

Data from the above information is stored in SRW's Water Management and Irrigation Reporting System (IRS) database and other software systems. These systems provide the date for analyses and annual reporting. A summary of annual water supply inputs and outputs is included in SRW's REIP Annual Report.

6.3.2 Groundwater

State Observation Bore Monitoring network

There are 25 State Observation Bores (SOBs) across the WID, which are closely monitored by SRW as part of its obligations to carefully manage the Deutgam Water Supply Protection Area (WSPA). SRW also regularly monitors six private groundwater bores.

Groundwater sampling and analyses program

SRW conducts monthly groundwater monitoring for saline intrusion checks and trends. This includes watertable measurements at all 25 SOBs and salinity (EC) monitoring (using a calibrated field meter) at 9 SOBs and one private bore (on a rotating basis). All 25 SOBs and 6 private bores will also be sampled twice each year (January and July) and analysed by a NATA accredited laboratory for the parameters as listed in Table 6-4.

Table 6-4 Groundwater Analyses Program and Frequency

Parameter	Month	
	January	July
pH	✓	✓
Salinity (Electrical Conductivity) and Total Dissolved Solids	✓	✓
Major Cations (Sodium, Calcium, Magnesium) & Major Anions	✓	✓
Nitrate & Nitrite nitrogen (NOx), Total Kjeldahl Nitrogen (TKN), Total Nitrogen (TN)	✓	✓
Total Phosphorus	✓	✓
Heavy Metals Analyses (Total: As, Cd, Cr, Cu, Ni, Pb, Zn) & Boron		✓

Bore samples will be carefully labelled according to specific bore number, location and depth of sampling within the bore to enable proper identification of bore and aquifer sampled. SRW will maintain all bores in the field are properly and clearly marked with the correct SOB or private bore number. A map and list of all SOB and private bore locations is given in Appendix D.

Groundwater Usage

Groundwater use from private licensed bores is metered and read every 6-8 weeks by SRW or its contractors. At the time of preparing this REIP, Groundwater use was banned by SRW due to saline intrusion risks.

Evaluation of recycled water migration to groundwater

The key objective of the groundwater monitoring program is to assess potential impacts of recycled water migration to groundwater via leakage from channels and through the soil profile as a result of irrigation. SRW will conduct additional monitoring and investigations to evaluate the extent of recycled water migration into groundwater and to improve its understanding of water quality impacts. This will include:

- Coordination of groundwater sampling events when channels are fully charged (in January during irrigation season) and also when empty (July during non-irrigation season),
- Coordination of groundwater sampling events with sampling events for drains, Werribee River and Port Phillip Bay, wherever possible;
- Investigations into feasibility of tracing movement of recycled water into groundwater, including Piper Plot analyses of groundwater and river water (Werribee Weir and estuary) for comparison with recycled water;
- Integrated data storage, quality assurance checking and validation for all monitoring data.

Progress made with the above investigations will be reported in the SRW annual report (refer section 11.2).

Groundwater Monitoring Database Integration & Improvements

Given the significant amount of data collected for groundwater and other recycled water monitoring programs within the WID, it is becoming increasing necessary to establish a new improved robust data repository for collecting and accessing information. However, during the time that it will take to assess, customise and implement an effective solution, SRW will increase protection measures for the data in it's current format.

SRW currently maintains two main groundwater databases as follows:

1) Deutgam Water Supply Protection Area (WSPA) SOB and private bore monitoring data (mostly EC and watertable data only); and

2) "Recycled Water" Groundwater Monitoring Program data (wider range of parameters as per Table 6-4), specifically for the purposes of the WID REIP, which in addition to the WSPA program.

A dedicated server directory will be established for these two databases with restricted update access to prevent accidental loss of data. SRW will nominate a resource accountable for the management of the WID recycled water monitoring data. The staff involved in the monitoring and analysis of recycled water monitoring data will have "read and write" access as required. The same staff would also be responsible for quality assurance checking of laboratory and field data with suspect data being identified and checked against primary sources (eg. field notes and certificates of analyses from laboratories) during data input.

Information is readily retrieved from these groundwater databases for the purposes of data sorting, filtering, assessment against SEPP objectives, statistical, temporal and spatial interpretations, GIS mapping, preparation of annual and individual customer site reporting, as well as investigations into potential illegal groundwater extractions and saline intrusion events.

6.3.3 WID Drainage

The WID drainage system has twelve discharge points, including seven draining directly to PPB and five draining directly to the Werribee River estuary as shown in Figure B-2 in Appendix B.

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The drainage system serves a total irrigated catchment area of around 2,880 ha. Of this Drain numbers 1, 5, 6 and 11 account for 2060 ha or 71% of the area served by the WID drainage system. Discharges to the Bay and estuary occur generally after rainfall events, though small base flows occur due to lateral leakage from supply channels that run parallel to drains, as well as smaller volumes of irrigation runoff and dam leakage from customer areas that are adjacent to drains.

Measurement and recording of drain flows

Drains 5, 6 and 11 all have continuous flow gauging stations near their outlets to PPB and the estuary respectively. These three sites account for almost 50% of the WID drainage system and are considered most representative of WID drainage flow and quality. Note that Drain 1 will be provided with a flow monitoring station in early 2010, increasing monitored drainage catchment area to around 71% of the WID

Drain 5 has been recording flows since 2001 when the site was established. This site had formerly been used as "representative" of the WID drainage system in assessing total drainage outflow for the purposes of original REIP and annual reporting. In late 2007 two new gauging sites were established on drain 6 and drain 11 to improve water measurement and reporting over the whole of the district. However, drain 6 and drain 11 sites tend to provide more sporadic data due to low or no flow conditions compared with Drain 5.

Verified flow data from these sites is provided by SRW's hydrographical contractors. The monitoring sites for both drain 5 and drain 6 are enabled with web based access for real time data access for operators.

Drain Water Quality Monitoring

Auto-sampler and manual grab samples are submitted to a NATA laboratory for testing of the parameters and at the frequencies as listed in Table 6-5.

Table 6-5 Drain Analyses Program and Frequency

Parameter	Frequency	
	Drain 5	Drains 1, 6 & 11
pH	• 2009-2010 FY: Rainfall Event Auto-Sampling, & Monthly Grab Sampling • 2010-2011 & 2011-2012 FY: Frequency is subject to findings of 2009-2010 monitoring program results	Quarterly Grab Sampling (January, April, July, October) including at least one significant rainfall event (trigger. >20mm)
Salinity (Electrical Conductivity)		
Total Nitrogen (TN), NOx, TKN		
Total Phosphorus (TP)		
Blue-Green (B-G) Algal species identification	• If significant B-G bloom identified during sampling	
Heavy metals (As, Cd, Cr, Cu, Pb, Ni, Zn) & Boron	• 2009-2010 FY: Bi-annual Grab Sampling January and July • 2010-2011 & 2011-2012 FY: Frequency is subject to findings of 2009-2010 monitoring program results	

The drain 5 hydrographic monitoring site comprises an automatic refrigerated water sampler that captures up to 24 samples in a flow event, triggered by the first flush of flows after rain. The auto-sampler has preset trigger levels for both upward and downward trends in a flow event or hydrograph.

The collected samples are stored in a refrigerated carousal until the samples are picked up by the contractor for submission to the NATA laboratory for analysis. SRW operators and hydrographic contractors will now be notified by SMS message when trigger levels are activated, to verify that the auto-sampler is working and samples are being collected.

Grab samples are manually collected for analysis on a monthly basis near the end of Drain 5 by SRW's hydrographic contractors. The frequency of grab sampling in drain 5 will be reviewed after the 2009-2010 reporting period for this REIP. Manual sampling will also be carried out on a quarterly basis at Drain 6 and Drain 11, provided flows are detected such that a representative sample can be collected.

Data Evaluation

The data will be primarily used for annual reporting to EPA as required by this REIP of drain quality, nutrient loads, trend analyses and comparisons with SEPP water quality objectives, and also for investigation of incidents (eg. large recycled water spills).

SRW will also use the flow and water quality data to gain a better understanding of drain flows in both wet and dry weather conditions, and to determine if any clear relationships or correlations between flows and surface water quality can be established.

SRW will conduct monitoring of the drains at the same time as monitoring receiving surface wastes at drain outfalls of the Werribee River estuary and Port Phillip Bay – refer to section 6.3.4.

Drain Classification & Estimation of drain discharge

Previous assessments of total drainage discharge to Port Philip Bay and the Werribee River estuary were based on extrapolating flow data received from the drain 5 monitoring site using catchment ratios (ie. drain 5 gauged flows x total WID drainage area).

It is considered that these estimations were unrepresentative of the area as a whole given drain 5 is known to be a "wet" drain during the irrigation season with base flows caused by leakage from channel (no. 5) that runs parallel to it.

Drains 6 and 11 which are also monitored for flow discharge are located on "semi dry" and "dry" drains, ie. they flow only after rainfall event or after a rare occurrence of farm drainage or accidental runoff. SRW has classified drains into three categories to better establish overall total drain discharge as follows:

- Drain 1 represents a wet drain — Recorded flow > 100 days year
- Drain 5 represents a wet drain. — Recorded flow >100 days year
- Drain 6 represents a semi dry drain — Recorded flow <30 days year
- Drain 11 represents a dry drain — Recorded flow <15 days year, flows only in heavy rainfall

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Estimations of total drainage discharge to Port Philip Bay and the Estuary are now based on extrapolating the combined volume of Drains 5, 6 and 11. These continuously monitored sites represent nearly 50% of irrigated drainage catchment – refer to breakdown in Appendix B. This will provide much closer estimation of total volumes, more consistent with rainfall and runoff principles.

Nutrient Load Estimations

Drain 5, 6 and 11 nutrient loads are estimated by the monthly laboratory test results multiplied by each drain flows for the month since the previous test result. Flows and loads from drains that are not gauged or sampled are estimated by extrapolation from monitored drains having similar hydrology.

Note that Drain 1 will be provided with a flow monitoring station in early 2010. The inclusion of Drain 1 will further increase flow monitored discharge area to 71% of the WID, and assist with more accurate flow and nutrient load estimations.

6.3.4 Receiving Surface Waters

SRW will consult with MW and EPA for the development of the WID receiving waters monitoring program for the Werribee River estuary and PPB inshore segment at Werribee South.

Werribee River and Estuary Sampling Points

The initial round of monitoring sites for the Werribee River will include the following approximate locations in 0.5-1m deep of water:

- “WW” - Werribee Weir pool (existing SRW sampling location),
- “WF” - Werribee River freshwater flowing into estuary at Historic Bluestone Ford (north west of Golf Course),
- “W11” - Werribee River estuary at K Road close to Drain 11 outfall (near Golf Course car park),
- “W9” - Werribee River estuary near drain 9 outfall midway between Drain 11 and river mouth (Cuttress Rd),
- “WM” - Werribee River Mouth from end of Jetty east of boat ramp (Werribee South).

The Werribee River estuary will be sampled at the turn of the outgoing tide, as water is leaving the estuary to ensure the sample is flowing past and outwards from the WID drain outlets to the Bay. Samples are taken at up to 0.5m below the surface.

Port Philip Bay – Inshore Segment Sampling Points

PPB inshore sampling will be in 0.5-1m deep water at approximately the following locations:

- “PPB1” - Adjacent to Drain 1 outfall
- “PPB5” - Adjacent to Drain 5 outfall
- “PPB6” - Adjacent to Drain 6 outfall

SRW will consult with MW and EPA for the development of the WID receiving waters monitoring program for the Werribee River estuary and PPB inshore segment at Werribee South.

Locations of the Werribee River and PPB sampling points are shown on the receiving water monitoring map in Appendix B (Figure B-2).

Parameters Tested & Frequency of Monitoring

The receiving waters will be tested for the parameters listed in Table 6-6. Quarterly monitoring of the estuary and PPB is proposed in the 2009-2010 reporting year. Dates of this monitoring will coincide as close a practicable with drain monitoring dates. Two samples would be taken either side of the irrigation season (June and September), with another two samples to be taken during the irrigation season (December and March), from all designated sampling points.

Data Evaluation

The receiving waters monitoring program will enable annual reporting to EPA as required by this REIP including flow and nutrient load estimates, assessment against SEPP water quality objectives and trend analyses using the *new baseline* established for the 2009-2010 reporting period. The same Levels of Reporting (LOR) will be used as for the groundwater and drain sampling. The data will be also be used for investigation of potential incidents (eg. significant large recycled water spills, blue-green algal blooms, fish kills, etc).

After the first year of monitoring in 2009/10, the frequencies and lists of parameters for both drains and receiving waters monitoring programs will be reviewed, with outcomes and recommendations to be used to develop the next phase of the monitoring programs for the 2010-2011 and 2011-2012 reporting periods.

Table 6-6 Receiving Waters Sampling and Analyses Program and Frequency

Parameter	Frequency	
	Werribee Estuary	PPB Inshore
pH	• 2009-2010 FY: Quarterly (January, April, July, October), including at least one significant rainfall event (trigger. >20mm) • 2010-2011 & 2011-2012 FY: Frequency is subject to findings of 2009-2010 monitoring program results	
Salinity (Electrical Conductivity)		
Total Nitrogen (TN), NOx, TKN		
Total Phosphorus (TP)		
Blue-Green (B-G) Algal species identification	• If significant B-G bloom identified during sampling	
Heavy metals (As, Cd, Cr, Cu, Pb, Ni, Zn) & Boron	• 2009-2010 FY: Bi-annual Sampling (January & July) • 2010-2011 & 2011-2012 FY: Frequency is subject to findings of 2009-2010 monitoring program results	

Storage of Water Samples from Monitoring Program

SRW will arrange for the storage of duplicate water samples identical to those samples collected and sent to the laboratories as part of the monitoring program described in this section including, river water and channel water (during shandy periods) samples. MW will also store duplicate recycled water samples at WTP. Samples will be refrigerated to minimise changes in water chemistry and held for a minimum period of six months. This will enable re-analysis of samples in the event of crop incidents or other incidents requiring investigation.

Sample re-analysis would be conducted where NATA laboratory holding times for particular analytes have not been exceeded, to ensure results are reliable and can be properly interpreted. Long preservation times do not affect salinity, exchangeable cations, total phosphorus or heavy metal levels, but will impact on nitrogen forms.

Section 6 Monitoring and Data Management

6.3.5 SRW Data Management

SRW has an extensive recycled water scheme data management system and standard procedures for receival, checking, processing and data storage for the significant amount of data from its groundwater, drains and receiving waters monitoring programs within the WID. Data quality assurance checks are undertaken for all stages in the monitoring program from sampling through to laboratory analyses, recording and reporting as outlined below. Note the procedures for soil sampling and laboratory results data management are given in Section 6.4.

"Water" Sampling and Chain of Custody Procedures

All groundwater, drains and receiving surface waters sampling will be conducted by SRW or its contractors in accordance with the following EPA guidelines (as relevant):

- "Groundwater Sampling Guidelines" (Pub. No. 669, April 2000).
- "A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes" (EPA Publication 441, March 2000).

Use of appropriate sample containers, preservation techniques, labelling, "chain of custody", duplicate sampling, QA/QC procedures and use of NATA laboratories are also in accordance with EPA Publication 441.

Data management and quality assurance

Laboratory test results for groundwater, drains and receiving water sampling programs are initially sent to the relevant sampling contractor by the laboratory services provider in both electronic format and as corresponding hard copies of scanned signed NATA certificates of analyses ("COA").

Each batch of electronic data is accompanied by a quality assurance statement from the laboratory that the data is true and representative of samples taken and subsequent analyses, and that the data is identical to that contained on the signed COAs. These quality procedures are in accordance with the laboratory's internal NATA accredited QA/QC procedures.

Results of testing will then be validated by the sampling contractor (including checks that test results correspond to the correct sample point number or bore number as relevant) prior to sending to SRW. The sampling contractor will retain an identical copy of the annual monitoring dataset as sent to SRW.

After SRW receives the validated electronic and hard copy dataset, it carries out its own quality checks of the data in accordance with SRW quality procedures, to satisfy itself that the data and sample numbers are correct and ready for entering into SRW's recycled water scheme database. After verification by SRW, the annual dataset will be added to SRW's master database, containing all monitoring data since commencement of the scheme in 2005 including all baseline testing. This master database is password protected and securely stored in SRW's WID recycled water scheme data management system.

Levels of Reporting (LOR)

Levels of Reporting (LORs) for laboratory analysis of water samples (ie. groundwater, drains and receiving waters) will be at levels that enable comparison with SEPP water quality objectives (ie. maintenance of ecosystems, irrigation and recreational use, etc) and NRMMC 2006 Australia Guidelines for Water Recycling as relevant. The following LORs will be met by the NATA laboratory:

- Total N 0.1 mg/L
- NO_x 0.01 mg/L
- TKN 0.1 mg/L
- Total P 0.01 mg/L
- Cations 1 mg/L
- Arsenic 0.001 mg/L
- Boron 0.05 mg/L
- Cadmium 0.0001 mg/L
- Mercury 0.0001 mg/L
- Copper, Chromium, Lead, Nickel 0.001 mg/L
- Zinc 0.005 mg/L

Recycled Water Scheme Monitoring Database Integration & Improvements

Given the significant amount of data collected for groundwater, drains and receiving waters monitoring programs within the WID, it is becoming increasing necessary to establish a new improved robust data repository for collecting and accessing information. During the time that it will take to assess, customise and implement an effective solution (expected to be achieved over the next 2 years), SRW will increase quality control and access protection measures for the data in its current format.

6.4 Customer Site Soil Monitoring

The following Annual Soil Sampling Plan (ASSP) and field sampling methodology have been adopted by SRW and the agricultural contractor for the next 3 years of this REIP. To ensure the required sampling is undertaken in accordance with the REIP, this soil monitoring methodology is attached as a schedule to the contractor's service and consulting agreement with SRW.

6.4.1 Annual Soil Sampling Plan (ASSP)

The ASSP determines which farm properties in the WID are to be visited for soil sampling collection, and from what depths the soils are to be collected. The document is to be prepared by the agricultural contractor in consultation with SRW as a field version at the commencement of field work each soil sampling season, and as a final version at the completion of all field sampling. The ASSP process is generally as follows.

1) The contractor appointed for the purpose of soil sample collection, analyses, interpretation and reporting shall have the responsibility of preparing the ASSP

2) In May each year the contractor shall work with SRW to compile a list of the recycled water use for the past 12 months for each property in the recycled water scheme. Using known data of the irrigation area for each property, the hydraulic load of recycled water for each property is calculated.

3) Properties are categorised by hydraulic load. Those properties with hydraulic loads of 1.5 ML/ha/Yr or greater comprise the list of *significant recycled water use* and this list is the first draft of the ASSP. Those properties with hydraulic loads of less than 1.5 ML/ha/Yr comprise the list of *minor recycled water use*.

4) The list of *minor recycled water use* properties will be compared with the list of *minor recycled water use* for the previous season. Any properties where the combined recycled water use is 2 ML/ha or more over the 2 irrigation seasons will be added into the ASSP.

5) Based on the previous soil monitoring data, those properties where the critical parameters of salinity (ECe) and exchangeable sodium percentage (ESP) are low and below both "Target Levels" of 3.5 dS/m and 10% will be removed from the ASSP.

6) From the list of *minor recycled water use* properties for any properties where the owner or operator is known to have specifically requested a soil test for the season, it will be added into the ASSP.

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7) If customer site has not been sampled in 2 years, these properties will be included in the ASSP.

8) The sampling regime for each property in the sampling plan will be prepared using Table 6-7. It will be necessary to consult records of the date of baseline sampling and *significant recycled water use* in each subsequent year to determine in which year of the program each property belongs. Prepare the ASSP field version, by allocating the required sampling regime to each property.

Table 6-7 Annual Customer Site Soil Sampling Depth and Frequency (if in ASSP)

Soil Sampling Schedule (a)	**Soil Sampling Depth**		
	0 - 30cm	**30 - 45cm**	**85 - 100cm**
Baseline Testing - prior to 1st use of recycled water (b)	✓	✓	✓
Spring 2005 or after 1st irrigation season (c)	✓		
Autumn/Winter 2006 or after 2nd irrigation season (d)	✓		
Autumn/Winter 2007 or after 3rd irrigation season (e)	✓		
Autumn/Winter 2008 or after 4th irrigation season (f)	✓	✓	✓
Autumn/Winter 2009 or after 5th irrigation season (g), (h)	✓		
Autumn/Winter 2010 or after 6th irrigation season	✓	✓	
Autumn/Winter 2011 or after 7th irrigation season	✓		
Autumn/Winter 2012 or after 8th irrigation season	✓	✓	✓

Notes and explanations to Table 6-7:

(a) The scheduling of annual soil sampling including required sampling depths on individual customer sites depends on the year that the customer first received recycled water.

(b) As at writing of this REIP, all WID recycled water customers have had baseline testing across all 3 sampling depths. Baseline tests occurred progressively as each customer signed up to the scheme, and before each farm received recycled water for the first time.

(c) A total of about 92 sites (63 farms) were sampled in spring 2005 after the 1st irrigation season of the scheme (nb: only very low volumes supplied in second half of irrigation season). Only surface soil sampling (0-30cm) occurred during this period.

(d) A total of about 80 sites (63 farms) were sampled in autumn/winter 2006 after the 2nd full irrigation season of the scheme. Again only surface soil sampling (0-30cm) occurred during this period.

(e) A total of about 154 sites (149 farms) were sampled in autumn/winter 2007. Again only surface soil sampling (0-30cm) occurred during this period.

(f) A total of 171 sites (165 farms) were sampled in autumn/winter 2008. Of these, 142 sites were sampled to 0-30cm depth, and 29 sites were sampled across all 3 sampling depths being the first group of farms that received recycled water in 2005 and have had four seasons of recycled water irrigation.

(g) A total of 191 sites (183 farms) were sampled in autumn/winter 2009. Of these, 45 sites were sampled to 0-30cm depth, 116 were sampled at 0-30cm and 30-45cm, and 30 sites were sampled across all 3 sampling depths.

(h) The 2009-2012 REIP timeframe covers the annual soil monitoring and reporting programs from autumn/winter 2009 (after the 5th irrigation season) until autumn/winter 2012 (after 8th irrigation season). All customer sites will have had all 3 sampling depths (0-30cm, 30-45cm and 85-100cm) tested by the autumn/winter 2012 sampling run.

9) Having undertaken the above steps the ASSP field version will be ready for field use. Each field operator undertaking field collection must have a copy and a master copy is to be held by SRW and the contractor.

10) Where a property to be sampled has multiple soil monitoring sites, the farm operator is to be consulted prior to sample collection to determine whether just one site should be sampled, or whether multiple sites should be sampled. A record shall be made by the field operator as to whether single or multiple sites at a property are sampled.

11) Where multiple properties are combined under a single water allocation licence, one or more of the properties may have been fallowed for the past season. The field operator will need to confirm whether this applies and make any necessary records. Properties that have not been irrigated due to fallow can be deleted from the ASSP.

12) At the completion of all field work, a final version of the ASSP is to be prepared by the contractor and one master copy is to be lodged with SRW while another master copy is to be held on record by the contractor.

Pre-Sampling Consultation & Scheduling of Individual Customer Site Sampling Work

The contractor will contact the customer at least 3 days before scheduled sampling onsite. Procedures for entering properties and collecting soil samples, together with farm safety and crop hygiene precautions to be observed when entering and accessing properties and cropped areas will be first developed in consultation with customers and if required SRW prior to sampling. The agreed site access procedures will subsequently be followed by the contractor's field staff responsible for the sampling.

Soils samples shall be collected to coincide as far as possible with the end of one irrigation season and before the start of the new season, and before significant autumn/winter rainfall. The aim is to complete soil sampling across all customer sites in the ASSP over an 8 week period between the mid-May and mid-July each year.

Wet weather could interrupt field sampling beyond mid-July on customer sites in the latter part of the ASSP sampling schedule. If heavy/extended wet weather occurs, sampling could be delayed for several weeks. Some customer sites might be excluded from sampling in the final ASSP if it is considered that a high degree of rainfall leaching would significantly impact on soil (eg. salinity, nitrogen) results.

Soil Sample Collection Methods

For each property that has signed up to the recycled water scheme, a "Reference Site" of approximately 6 metres in diameter was created at baseline testing for the annual sampling and analysis of soils. Where the farmer or farm owner has indicated significant soil variation on the property, more than one Reference Site has been created with each site being representative of a particular soil type.

Baseline soil samples were collected as bulked samples from four separate hand drilled auger holes from within the soil reference site. Annual soil samples are collected the same way from the following standard depths:

- Surface soil: 0 to 30 cm: (regular cultivation zone for these soils) referred to as surface soils;
- Subsoil: 30 to 45 cm: the B horizon of most soils (immediately below the cultivation zone); and
- Deep soil: 85 to 100 cm: the C horizon (below the root zone).

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At all monitoring sites, soil samples are to be collected and bulked together from at least 4 separate hand augured sampling holes at each reference site. Where more than 1 reference site has been created on a property due to soil type or other variation, the farm operator is consulted as to whether to sample just one site or multiple sites, and if the former, to nominate which site is to be monitored.

Each reference site is identified with latitude and longitude coordinates taken from a hand held GPS receiver using the ADG 66 datum. The GPS coordinates are used to locate each reference site, and each location is normally cross checked against written notes and sketch maps of each property.

Field notes are to be made for each property, including the date of sampling, current crop/fallow, any evidence of recent fertilizer application and any other relevant observations to farm productivity.

Sampling QA/QC and Chain of Custody

Sampling procedures will be consistent with "A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes" (EPA Publication 441, March 2000). This guide will be used as general reference for procedures to be followed for sample preservation, quality control, "chain of custody" to the laboratory. Where any instructions within this guideline differ from the specific procedures outlined in this REIP, the procedures in this REIP (eg. compositing of soil samples) shall take precedence.

The soil samples are to be thoroughly mixed and sub-sampled to derive a 100g sample for heavy metal analysis (if required) and a 500g sample for all other relevant tests (see below). All samples are to be clearly labelled with the customer site number, sample number and ADG 66 co-ordinates corresponding to each sampling point on the property.

Prior to forwarding to the respective NATA and ACPAC accredited laboratories, soil samples are to be transported and stored in cool boxes or in a cool room at no less than 3^0C and no more than 14^0C, with the aim of keeping samples as close to 3^0C as practical.

6.4.2 Soil Analyses

Samples are to be forwarded to an NATA accredited laboratory for heavy metal testing, and an ASPAC registered analytical laboratory for standard agronomic tests commonly carried out for agricultural soils:

- Soil pH (in water)
- Soil pH (in Calcium chloride)
- Chloride
- Electrical conductivity ($EC_{1:5}$)
- Exchangeable cations
- Soil texture
- Available phosphorus (Colwell)
- Phosphorus Buffer Index
- Nitrate
- Slaking
- Dispersion index
- Cadmium (Total) – in 2009 only, and subject to review of 2009 results repeated every 2 years thereafter
  NB: Required Level of Reporting (LOR) for Total Cadmium is <0.1 mg/kg

In addition to these tests, the following parameters will be calculated from the laboratory results based on cation balances and soil texture identified by the laboratory analyst:

- Exchangeable Sodium Percentage (ESP)
- Electrical Conductivity of Saturated Soil Extract (EC_e)
- Calcium : Magnesium Ratio
- Potassium : Magnesium Ratio

6.4.3 Soil Data Management and QA/QC

Results of soil testing will be initially received and managed by the agricultural contractor for verification and validation. The contractor will enter all data into a spreadsheet compatible with Access, GIS and similar type databases with a QA/QC step at time of data entry. The 3 key drivers for the soils database will be to maintain controlled access, data quality and compatibility with existing SRW databases and GIS systems.

After verification by the contractor, the annual soils dataset will be added to the WID master soils database, containing all soils data since commencement of the scheme in 2005 including all baseline testing. The finalised updated master soils database will be password secured and emailed to SRW for its own QA checks and secure storage in SRW's data management system. The contractor will retain identical copies of the annual soils dataset and WID master soils database as sent to SRW.

Soil monitoring data will then be retrieved for purposes of data sorting, filtering, interpretation and site ranking against soil targets and triggers, statistical, temporal and spatial interpretations, GIS mapping, customer site auditing, preparation of annual and individual customer site reporting, as well as potential crop incident investigations.

6.4.4 Individual Customer Soil Reports & One-on-One interviews

Soil monitoring reports will be sent to each farmer when all laboratory reports for the annual monitoring have been received from the analytical laboratory and validated by the contractor. Each farm operator will be given the option to either receive a tabular report of the soil analytical results together with an annual interpretation guide, or whether to have a customized report prepared which would identify any key issues and suggest possible remedial measures that could implemented. These reports will be sent to customers within one month of receiving laboratory results.

Farmers will also be given the option of a one-on-one interview with the contractor to discuss the results, at a convenient time for the customer. The farm operator shall receive a written version in note form of the main outcomes of the one-on-one farm discussion within one week of the interview.

The interpretation guides (updated each year), customised reports and one-on-one interviews will specifically focus on the parameters of salinity, sodicity, nutrient migration, cation balance, and soil pH. There may be other issues that the contractor wishes to also include in the annual reporting to farmers.

Farm owners who are not actively farming there property but are leasing to a farm operator will be given copies of these reports and SRW will make arrange to ensure that they receive these copies.

The contractor will submit to SRW controlled copies of all individual customer soil reports, one-on-one customer interview notes, and interpretation guides for that year.

6.4.5 Overall WID Annual Soils Report to SRW

The contractor shall prepare an annual report for SRW at the completion of sampling, all laboratory analyses and reporting to the farm community. The annual report will include the following as a minimum:

a) An executive summary of the report;

b) Overview of seasonal conditions;

c) Recycled water and river water quality and quantity, including some mass balance (eg. weighted salinity and nutrients) analyses;

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d) Description of sampling procedure, the Annual Soil Sampling Plan (ASSP), and general soil conditions;

e) Summary statistics of soil test results covers all customer sites and soil sampling depths, and confirmation of data validation;

f) Detailed interpretation of detected levels and trends in salinity, sodicity, chloride, soil pH, nutrients, cadmium (if tested in that year) including assessment and ranking with reference to REIP target and trigger levels, recycled water use and soil type;

g) Detailed assessment of soil structure and dispersion conditions, nutrient and salinity migration status, and any other issues that the contractor considers should be brought to the attention of SRW;

h) Make a list of any recommendations together with the responsible party (MW, SRW or the customer) that should act on the recommendation; and

i) Attach final ASSP, illustrative samples of grower reports, one-one interview notes, interpretation guides and all sampling and analytical procedures as appendices.

A flow chart showing the key steps and processes of the WID Annual Soil Monitoring Program from the ASSP through to overall annual soils reporting is provided in Appendix E.

Actions arising out of the annual soils monitoring program including any soil targets and triggers being approached or exceeded on customer sites, are to be managed according to the Soil Improvement Plan outlined in Section 7.3 of this REIP (also refer to Appendix E).

The overall Annual Soils Report is to be finalised and submitted to SRW by the agricultural contractor by end of September each year. This will enable the outcomes to be summarised and incorporated into the overall SRW REIP Annual Report to EPA, which is to be submitted by end of November each year.

6.5 SRW & MW Monitoring Records

SRW and MW will each retain electronic and hard copy records (as relevant) of all monitoring undertaken by each organisation as described throughout this section for a period of at least 10 years to enable analyses of trends and provide for audits and other historical data queries and investigations.

7.1 Customer Site Management Plan (CSMP)

All WID recycled water customers have a CSMP, which was developed based on SRW's standard CSMP template (see Appendix F) at the time of signing up to the scheme. The original CSMPs issued to each customer are not proposed to be reviewed or updated. The guidance provided to the customer on site management practices will remained unchanged unless there are major site modifications or environmental problems at a particular customer's site that require specific attention.

The content of a CSMP includes the following parts and detailed guidance for customers:

- Part A. Background:
  - Purpose of the CSMP, Roles and Responsibilities, Allowed uses and quality of Class A recycled water.
- Part B. Customer Site Management Report:
  - Compliance checklists (initial and annual), and Non-compliance response
- Part C. Customer Site Management Plan
  - Property maps
  - Storage of recycled water
  - Irrigation Management
  - Overhead spray and spray drift
  - Drainage and runoff controls
  - Algal management
  - Signage and pipe identification
  - Good practice, health and safety
  - Incidents
  - Monitoring and reporting.

A CSMP is a requirement of this REIP and EPA's guidelines. The structure of the CSMP is designed to comply with the EPA guidelines and the EIP checklist for irrigation of reclaimed water.

The role of the CSMP is to ensure that customers receiving recycled water are using recycled water in a manner that ensures productive agriculture and complies with EPA guidelines and does not cause nuisance to neighbouring properties and adverse impacts on the environment. All customers must comply with the guidance provided in their individual CSMP in order to receive ongoing supply of recycled water.

7.2 Customer Supply Agreement

SRW also has signed individual CSA's with all recycled water customers, which were signed by both SRW and the Customer prior to commencement of recycled water supply to the customer's site. The CSA details the legally enforceable contractual arrangements for the supply of recycled (shandied) water to the customer. It is a requirement of the CSA that customers must comply with the CSMP and REIP as well as EPA guidelines.

Customers are required to comply with the terms and conditions of the CSA in order to receive ongoing recycled water supply. The CSMP was developed by SRW as a method for recycled water customers to manage their obligations under the CSA.

Section 7 Customer Site Management

7.3 Soil Improvement Plan

As outlined in Section 3.3, one of the key environmental issues in the WID is the condition of irrigated soils and the impact of recycled water on soils and farm productivity. The soils across WID are still highly productive despite some increases in salinity, sodicity and nutrient in the soils since the commencement of the WID Recycled Water Scheme.

SRW has implemented a Soil Improvement Plan to address soil salinity, sodicity and nutrient issues, with the objective of stabilising soil conditions to ensure farms continue to be highly productive when using recycled water. The Soil Improvement Plan (attached in Appendix E) describes the major soil impacts associated with recycled water use and offers practical methods of progressively mitigating those impacts.

Additionally, the Soil Management Plan includes a long term target and short term trigger table outlining specific soil parameters. If these triggers are exceeded the Soil Improvement Plan includes a structured action plan for working closely with customers to address any deterioration in soil health with the aim of reversing these problems as soon as practicable.

As part of the required annual soil monitoring program (section 6.4) and Soil Improvement Plan customers have the opportunity to have a one-one review of soil testing results with an agronomist to advise them of issues related to their soil and farm productivity. Alternatively, they can receive a written interpretation of the soils results annually.

The key steps and processes in the Soil Improvement Plan are summarised in the flow chart in Appendix E.

7.4 Water Use Efficiency

The growers in the WID have a long history of continued improvement with irrigation methods, the main driver being the increased scarcity of traditional river water allocations. Today irrigation in the WID is by fixed spray irrigation, growers having moved over from flood irrigation many decades ago.

The extensive working of the soils and forming of raised beds/rows for vegetable cropping, has resulted in good topsoil permeability, ensuring runoff is minimized. Most irrigation or stormwater runoff tends to seep into the areas between rows, at the end of the rows, into the on-farm drains and other low points. Only after heavy rainfall or after extended wet periods does farm runoff tend to occur into the WID drainage system.

In recent times, many WID irrigators have made spray irrigation distribution uniformity improvements aimed at better crop growth across the farm and minimizing underwatering and overwatering impacts as follows:

- underwatering can result in inadequate leaching fraction, and potential salinity and chloride effects from recycled water use (particularly during hot and/or windy periods);
- overwatering can mean unnecessarily high leaching and potentially some localized runoff of recycled water (ie. Wastage not utilized by the crops).

SRW and its Agricultural Consultants provide advice to its customers on recycled water irrigation efficiency as part of the soil improvement plan and though information exchange, demonstration trials, field days, and consultative committees, customer liaison and communications (see next section).

The cost of the recycled water is also a significant incentive to customers to be efficient and not wasteful with recycled water.

7.5 Customer Liaison

7.5.1 Consultative Committees

SRW hosts several forums for discussion with customers about recycled water including:

- The Werribee and Bacchus Marsh Customer Consultative Committee (WBMCCC), which has a permanent Agenda item for recycled water matters
- The Land and On-Farm Management Committee (LoFMC), which is a customer group formed by SRW and attended by DPI and agricultural consultants (Ag-Challenge) for the purpose of discussing and improving customer site practices as part of adapting to higher than anticipated recycled water use due to severely limited river water allocations and groundwater bans.

One of the outcomes from the LoFMC has been the establishment of the On-Farm Demonstration Site Project, funded by Vision for Werribee Plains, the Smart Water Fund and SRW. This project seeks to demonstrate various practices to customers that will assist them in using recycled water sustainably, maintaining yields without degrading the quality of their soils. Results and outcomes of the On-Farm Demonstration Project will be published at the end of 2009.

In addition, AgChallenge and DPI extension officers for the WID are working directly with several customers who have identified plots of land with varying soil issues. Once the On-Farm Demonstration Site project is complete, the findings will be shared with other growers in the region via newsletters and an open day.

The LoFMC also publishes periodic newsletters related to the use of recycled water in the WID.

7.5.2 Communication

The SRW website includes regular updates for water quality parameters of recycled water. Several newsletters are published for customers in the WID each year keeping them informed of the issues related to recycled water.

SRW will provide further guidance to customers through the WBMCCC and LoFMC, and regular newsletters on a range of new developments in improved land uses, including guidance for making allowance for nutrients in recycled water as part of fertiliser planning.

Regular communication is undertaken with fertiliser manufactures and suppliers to inform and discuss key issues such as the salt and nutrient content of recycled water and the current situation with soils. The focus has been to explore opportunities to reduce the salt load in fertilisers supplied and optimise the nutrient balance. SRW will continue through the period of this REIP to have discussions with the large fertiliser manufacturers and suppliers and their agronomists who are influential in the WID.

SRW will develop a “Recycled Water Nutrients Calculator” to inform customers of recycled water nutrient concentrations and loads, and how to calculate recycled water nutrient loads, compare with equivalent loads of inorganic N and P fertilisers, and the indicative cost savings from avoided purchase of fertilisers. This Recycled Water Nutrients Calculator will be mailed to customers with newsletters and also provided on SRW’s website.

7.6 Werribee Tourist Precinct Customers

As stated in Section 2.7, there are several customers in the Werribee Tourist Precinct to the north-west of the irrigation district that have individual Environmental Improvement Plans (EIP) for recycled water use, under the framework of a separate overall EIP for the precinct.

Section 7 Customer Site Management

As these sites are not involved in agriculture and are also open to members of the general public. Their operating principles for recycled water are slightly different and therefore are covered by the separate EIPs. These EIPs will continue to exist in relation to the individual site management by the tourist precinct customers. However, they will be linked back to this REIP for the WID Recycled Water Scheme, given the need to align the roles and responsibilities of Melbourne Water, SRW and other government agencies, and to integrate/combine the WID and the Tourist Precinct monitoring, auditing and annual reporting programs.

7.7 Customer Site Auditing and Reporting

SRW will develop a new internal auditing process for Customer sites, which is more closely integrated and aligned to coincide with the annual soil monitoring program and individual customer site soil reporting as described in Section 6.4.

Further details of the customer auditing and reporting program are provided in sections 11.3 and 11.5.3 of this REIP.

8.1 Melbourne Water Assets

MW utilises the Hansen asset management system for the coordination of all programmed and unscheduled maintenance activities for civil, mechanical and electrical assets.

All instrumentation and equipment used for continuous process monitoring are regularly inspected, calibrated and serviced as required in accordance with maintenance activities scheduled by the Hansen asset management system.

The concrete-lined recycled water supply pipeline is a buried asset. This asset, and other civil assets used for recycled water supply, are routinely inspected and maintained.

Failure of any asset associated with Class A recycled water treatment or supply will trigger priority maintenance activities.

8.2 SRW Assets

A summary of key inspection and maintenance activities in the WID, relevant to water supply and drainage systems which are part of the recycled water scheme is given in Table 8-1.

SRW assets are subject to continual monitoring while water is being delivered by SRW operations staff. Any channel or pipeline break is immediately identified and isolated prior to urgent repairs being undertaken. Minor leaks are evaluated and reported and prioritised for repair primarily during the winter period where demand is reduced.

SRW have targeted a specific inspection and repair project on the assets which run parallel to the drains. SRW will implement a specific asset inspection program to identify and address channel leakage which may be feeding base flows in the drainage systems. When significant leaks are detected, the location and other relevant data is recorded in SRW's asset management system (Asset Life) and prioritised for future replacement.

The Western Irrigation Futures project is examining infrastructure options for the district with a view to improving the efficiency of the current delivery system, which is approaching the end of its life.

Section 8 Maintenance and Inspection

Table 8-1 SRW WID Maintenance and Inspection Programs

Asset	SRW (or contractor)
Channels	
Maintenance/Repairs	Ongoing
Inspection	Ongoing
De-silting	June – September
Weed Control	Ongoing
Drains – WID	
Maintenance/Repair	Ongoing
Weed Control	Quarterly
Inspection	Ongoing
Flow Monitoring	Ongoing
Monitoring Equipment	Monthly
Drain One – WID	
Maintenance/Repair	When Required
Weed Control	Quarterly
Inspection	Quarterly
Pipeline	
Maintenance/Repairs	Ongoing
Equipment-Valves/Meters/Wheels	
Maintenance/Repairs	When Required
Inspection	Ongoing
Interface Point - Downstream	
Maintenance	Quarterly
Repairs	When Required
SCADA System	When Required
Interface Point - Upstream	
Maintenance/Repairs	When Required
SCADA System	When Required
Outfalls	
Maintenance/Repairs	Ongoing
Monitoring	Ongoing

9.1 Incident Management - Introduction

Incidents which occur during the production and distribution of recycled water have the potential to cause an environmental, human health or social impact. SRW and MW have robust incident and contingency management processes in place to cope with such unplanned events.

9.2 Recycled water production and bulk transfer

MW manages incidents under the *Australian Interagency Incident management System (AIIMS)* consistent with major emergency management authorities across the country. The *AIIMS* approach underpins MW's *"General Emergency Management System"* which provides the framework for the management of incidents including those associated with MW's recycled water assets and operations.

In the context of MW's recycled water production and bulk transfer activities, occurrence of the following event types would constitute an environmental, public health or social incident:

- Supply of water affected by a Critical Control Point (CCP) breach and therefore a potential compromise of Class A recycled water quality objectives
- Supply of water containing blue-green algae toxins beyond the allowable thresholds outlined in SRW's *"Risk Management Plan for the management of Blue Green Algae incidents in the Werribee Irrigation District"*
- Contamination of a potable water supply system
- A discharge/spill of recycled water to the environment
- Severe unexpected impacts linked to the use of recycled water produced at WTP (eg. crop growth issues)
- An unscheduled supply outage of more than eight (8) hours.

All declared incidents are to be communicated immediately to SRW and managed through MW's corporate *Incident Management Database*. In addition, the declared incidents are to be reported in monthly and annual reports to SRW and EPA and in compliance with EPA licence requirements.

9.3 Recycled Water Distribution

SRW manages incidents under the *Australian Interagency Incident management System (AIIMS)* consistent with major emergency management authorities across the country. The *AIIMS* approach underpins SRW's *"Corporate Incident Management Plan"* which provides the framework for the management of all incidents including those associated with SRW's recycled water assets and operations.

Any incident is assessed and categorised according to its significance and potential impact as one of 3 levels:

- Level 1 – Moderate Incident
- Level 2 – Moderate Incident
- Level 3 – Major Incident

Once categorised, the level of staffing and resources can be determined and the appropriate notification and escalation protocol's followed, consistent with guidance provided in the plan.

Examples of incidents that may trigger a declaration of an incident include:

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- Unplanned significant recycled water discharge into drainage systems, customer property or other assets caused by channel breaks, channel overtopping or other unplanned discharges
- Crop problems or failure reported by customers that may involve recycled water supply
- An area of the WID which is identified as having soil salinity levels well above what is considered appropriate for agricultural crop production
- Blue Green Algae blooms within the drainage system or receiving waters at drain outlets to Werribee River estuary or Port Phillip Bay
- Accidental diversion of high salinity river water into the channel system subsequently supplied to customers
- Recycled water supplied by MW outside agreed parameters and subsequently supplied to customers, where a negative impact on crops or soils could reasonably expect to occur from such supply.
- Any reported human health incident reported as being associated with the supply of recycled water
- Any complaint reported to EPA relating to WID
- Other incidents assessed as significant at the time.

SRW also has a *Blue Green Algae Emergency Management Plan* which provides the formal notification and management requirements for any defined Blue Green Algae incident. In addition, SRW has developed a specific *"Risk Management Plan for the management of Blue Green Algae incidents in the Werribee Irrigation District".* This risk management plan specifies triggers for notification to customers and trigger levels for the cessation of supply of water should the Blue Green Algae pose an unacceptable risk.

All declared incidents will be reported to EPA and MW as soon as practicable.

All declared incidents will be reported and discussed in the Annual Report to the EPA.

9.4 Contingency Plans

There are a number of management plans and contingency plans that can be used by SRW and MW to address the range of incidents mentioned in Sections 9.2 and 9.3 above. The key contingency plan developed for the WID Recycled Water Scheme relates to management of chloramines in recycled water suppplied to the WID.

Recycled water produced during 'chloramine mode' and subsequently used by customers may have the capacity to cause impacts to sensitive crops. For example, a crop incident occurred in January 2008 when some lettuce plants demonstrated stunting and some yellowing, which prevented much of that crop from reaching harvest quality. An independent investigation concluded that the likely cause was a combination of unique factors which occurred at the time, including the combination of chloramine treated recycled water, very high salinity river water and very high air temperatures.

In view of this incident, MW and SRW developed management procedures to prevent these three factors combining again. This included the installation of a number of ammonia analysers by MW throughout the WTP treatment system to give early warning of potential conditions that could give rise to chloramines. These analysers have allowed MW to make more timely process adjustments and prevent ammonia concentrations rising to undesirable levels. In addition, MW and SRW are jointly undertaking a detailed research experiment aimed at increasing knowledge of the impact of chloramines on lettuces. At the time of developing this REIP, this scientific research was progressive but not finalised.

10.1 Melbourne Water Operators

MW has an extensive programme of staff induction, training and awareness as part of its environmental management and OH&S systems.

In addition, training is an element included in MW's RWQMS and RWQMP.

10.2 SRW Operators

SRW has an extensive induction and training program for its staff and customers. SRW's induction and training programs include issues that relate to the operation of the recycled water distribution system and health and safety aspects of the use of recycled water systems. All SRW Operators have to work within the regulations specified in "The SRW Bailiff's Manual" which describes all operating guidelines for field staff including explanation of the guidelines for working with recycled water. Each operator is familiarised with The SRW Bailiff's Manual when they join SRW and needs to sign-off that they have read and understood all the regulations contained in the document.

Existing SRW operators are required to reread and sign-off each time The SRW Bailiff's Manual is updated. The section in the manual dealing with recycled water outlines the health considerations on recycled water and specific operating procedures related to recycled water customers.

Copies of the most recent version of The Bailiff's Manual are located at the SRW Werribee office.

10.3 Customer Training

Aspects of the relevant training programs are as follows:

- Part A of the Customer Site Management Plan explains to customers about the dos & don'ts of Class A Recycled Water.
- Part C / C3 in the CSMP highlights compulsory information sessions held annually which go into more detail on recycled water usage. The information session is designed to help maximise the benefits from recycled water and minimise its incorrect use and may include topics such as best practice for irrigation scheduling and uniformity and managing soil nutrient, salinity and sodicity.

As a minimum requirement, the Customer who signs the CSMP (or their nominee) must attend the compulsory information sessions within one year from signing the Customer Supply Agreement.

The one-on-one interviews offered to customers following annual soil testing, is also an important ongoing training and awareness opportunity for farmers.

SRW run open days and demonstrations, and issues discussed in the Land and On Farm management committee are distributed to farmers through regular newsletters.

As a result of the existing CSAs being updated in 2009 most customers will be re-signing and SRW will make it a requirement to attend another session if it is deemed necessary for any particular customer.

The option of refresher courses to other existing customers can be provided if requested by farmers.

Section 11 Reporting and Auditing

11.1 Melbourne Water Annual Reporting

MW will submit an annual report to EPA addressing recycled water supply aspects for the WID scheme as outlined in this REIP and indicated below. MW's report will be sent to EPA by the end of November each year.

The MW Annual report will include the following with appropriate cross references to the SRW Annual report:

1) Introduction/Brief description of the Class A recycled water treatment plant and transfer systems to WID.

   This section will also contain a brief description of any significant changes over the past 12 months, and any proposed new works and improvements relating to the WID recycled water scheme in the next 12 months.

2) Recycled water volumes supplied to the WID

   This will include a summary table of supplied volumes by month, average daily supply (over each month) and number of days per month should be provided. Where there were periods of non supply, the duration and cause will be reported.

3) Recycled water quality monitoring data and assessment

   This section will contain a summary table of all Class A supplied water data with an assessment of compliance against the Class A water quality objectives, identification of any Reporting Triggers exceeded (see Table 11-1) including the following information (only provide if not reported as an incident):

   - Summary of relevant data, dates when and for how long Reporting Triggers were exceeded.
   - Explanation of why exceedances occurred.
   - SRW, MW, customer and/or other agencies notified and responses as relevant.

4) Data Quality Statement demonstrating that all the above monitoring data has been subject to appropriate QA/QC checks, data verification, internal checks, quality statements, etc by the laboratory, sampling contractors and SRW as relevant.

5) Asset Inspection and Maintenance

   An overview of operational or maintenance issues that had, or potential to have an impact on Class A recycled water quality in the last 12 months.

6) Incidents and Non-Conformances with REIP

   All incidents or non-conformances for the Class A plant and supply system or the REIP will be listed and the cause, impacts and rectification measures described. The date of the incident will be provided and the date of close out. Incidents that have not been closed out will also be reported. Incidents at WTP which impacted on the Class A plant or recycled water supply will be included

7) Complaints and Enquires

   A brief description of the complaints and enquires procedure will be provided, including date, type of complaint/enquiry, and the MW response.

8) Improvement Programs

   A description of any improvement programs (e.g. lessons from incidents etc), will be provided including opportunities for improvement arising from audits, operations response to issues that have been identified

9) Audits and Verification of Data and Information

The audit program undertaken will be summarised including a list of all internal or external audits relevant to the Class A plant and recycled water supply. Outcomes relevant to the Class A plant and recycled water supply will be presented including actions arising for MW. This will include the actions arising from the 2008 Statutory Environmental Audit of the WID recycled water scheme including close out of actions.

10) Other information as required

The annual report may also include any additional information arising from RWQMP requirements or the EPA licence or EIP for WTP that MW may consider relevant eg. changes to these documents impacting on the WID Recycled Water Scheme.

The scope of the MW annual reporting may change from year. EPA will be advised of this at the time.

11.2 SRW Annual Reporting

SRW's Annual reports will be submitted to EPA by the end of November each year to enable the annual verification audit in September to be completed. In the 2010-2012 year the SRW annual report will be submitted one month later in December to enable the 53V environmental audit to be completed.

The SRW Annual Report will include the following with appropriate cross references to MW Annual reports:

1) Brief Introduction, describing the WID scheme, and cross references to the MW annual report

This section will contain a brief description of SRW's assets and recycled water channel and pipeline distribution systems and any significant changes over the past 12 months, and any proposed new works and improvements in the coming 12 months.

2) Drain Monitoring Results including trend data from previous years and assessment of compliance with REIP, SEPP requirements and reporting triggers as relevant. This will contain a summary table of:

- Drain Monitoring data, as mean and maximum values, with as assessment of compliance against the SEPP requirements.
- Report on estimated loads to the Werribee River and PPB, including load calculation methodology.
- Trend data should be provided to demonstrate any trends that have been identified eg. increasing or reducing concentrations and/or loads.

3) Receiving Surface Waters Monitoring Results including trend data from previous years and assessment of compliance with REIP, SEPP requirements and reporting triggers as relevant. This will contain a summary table of the following

- Water quality data, mean and maximum values, with as assessment of compliance against the SEPP requirements.
- Trend data should be provided to demonstrate any trends that have been identified e.g. increasing reducing concentrations

4) Groundwater Monitoring Results including trend data from previous years and assessment of compliance with REIP, SEPP requirements and reporting triggers as relevant. This will contain summary tables, graphs, charts and mapping of the following:

Section 11 Reporting and Auditing

- Groundwater quality monitoring data, as mean and maximum values, with as assessment of compliance against the relevant SEPP environmental/water quality objectives.
- Trend data should be provided to demonstrate any trends that have been identified eg. increasing or reducing concentrations including with changes in watertable levels (eg. seawater intrusion, recharge from channels, etc).
- Groundwater watertable data and contour mapping with an assessment of level variations over time. Trend data should be provided to demonstrate any trends that have been identified eg. increasing or reducing levels, average drawdown and identification of critical areas such as areas under channels and fringing coastal and estuary areas.
- Progress made with investigations to evaluate recycled water migration to groundwater including predicted losses from channel and drain leakage and irrigation leaching, and potential groundwater quality changes considered related to recycled water (see section 6.3.2).

5) Soil Monitoring Results including trend data from previous years and assessment of compliance with REIP, SEPP requirements and reporting triggers and targets as relevant. This should contain a summary table of:
   - Soil monitoring data, as mean and maximum values, with assessment of compliance against trigger levels.
   - Trend data should be provided where trends have been identified.
   - Actions taken by SRW and customers under the Soil Improvement Program.

6) Reporting Triggers (see Table 11-1): summary of performance of all monitoring data against reporting triggers and identification of any triggers exceeded including the following:
   - Summary table(s) of relevant data, dates when and for how long exceedances occurred.
   - Explanation of why exceedances occurred.
   - SRW, MW, customer and/or other agency responses as relevant.

7) Data Quality Statement to demonstrate that all the above monitoring data has been subject to appropriate QA/QC checks, data verification, internal checks, quality statements, etc by the laboratory, sampling contractors and SRW as relevant.

8) Assets Inspection and Maintenance activities
   - An overview of operational, maintenance and inspection programs and significant activities carried out in the last 12 months that had potential to have an impact on recycled water supply (quantity or quality), channel outfalls, drainage flows or quality, or receiving surface water quality (at drain outfalls).

9) Incidents and non conformances with REIP
   - All incidents or non-conformances for the operation of the WID using recycled water or the REIP should be listed and the cause, impacts and rectification measures described. The date of the incident should be provided and the date of close out. Incidents that have not been closed out should also be reported. Incidents at WTP that impacted on operation of the WID scheme should be included.

10) Complaints and Enquires
   - A brief description of the complaints and significant enquires procedure should be provided. The date, type of complaint/enquires, and the SRW response should be presented. Complaints/ significant enquires at WTP that impacted on operation of the WID scheme should be included.

11) Improvement Programs

- A description of any improvement programs (e.g. lessons from incidents etc), should be provided. Opportunities for Improvement arising from audits, operations response to issues that were identified

12) Audits and Verification of Information

- The audit program undertaken should be presented. All internal or external audits relevant to the WID operations should be listed. These should include audits of CSMPs (number conducted against target, general findings). Outcomes from these audits relevant to the WID operations including actions arising for SRW should be presented. This should include actions arising from the 2008 Statutory Environmental Audit, including close out of recommended actions adopted by SRW and MW.

13) Other Information as required or relevant to the REIP such as:

- Liaison meetings with MW and other stakeholders and outcomes relevant to the WID
- Land and Farm Management committee meetings and outcomes relevant to the WID
- Summary details of new customer training and ongoing refresher training for existing customers.
- Details of progress and any outcomes of demonstration sites and research activities, field days, etc.
- Input from other government agencies eg. DPI and DSE.
- Up-to-date register of recycled water customers and uses in the WID.

11.3 Customer Annual Reporting

SRW operations staff will co-ordinate and assist customers with their annual Customer Site Management Reports to ensure completion of all parts of the report as required in Part B of the CSMP by end of October each year. Individual annual Customer Site Management Reports normally include the following information:

- volume of recycled water used and other water used (river water and groundwater if allocated)
- area under irrigation that recycled water was used on the customer's site in the last 12 months
- nutrient loads on the customer's site from recycled water
- types and indicative loads of supplementary fertilisers used on customer sites based on data collected by SRW from Customers as part of Soil Improvement Program
- completed Compliance Checklist to assess if customer has met the requirements of the CSMP
- listing of any non-compliances (based on checklist), and corrective actions undertaken with SRW or their representatives to overcome the non-compliance issue.

Annual soil monitoring and reports will be co-ordinated by SRW and their agricultural contractor as discussed in Section 6.4 on Customer Site Soil Monitoring. Refer to the CSMP template attached as Appendix F for more detail of scope of customer reporting.

11.4 Reporting Triggers

The reporting triggers to be assessed for MW and SRW Annual Reports for this REIP are given in Table 11-1. SRW and MW will review and in consultation with EPA may modify certain triggers each year to reflect baseline and changing conditions in recycled water and within the WID environment.

Section 11 Reporting and Auditing

Table 11-1 Reporting Triggers and Responses for Annual Reporting

Trigger Value				Response
Recycled Water				
Concentrations exceed recycled water criteria defined in MW RWQMP and "Guidelines for Environmental Management: Dual Pipe Water Recycling Schemes" (EPA Pub. No. 1015, Oct 2005)				Identify source or cause and rectify. If exceedances repeated on consecutive tests consider ceasing supply and implement incident response. Recommence supply after incident closed-out, and return to safe levels verified.
Conditions are such that undesirable levels of chloramines may be produced.				Advise SRW and Customers and prepare to implement Chloramines contingency plan.
If known extreme levels of toxicants are identified in recycled water that exceed relevant guideline levels in ANZECC/ARMCANZ 2000.				Cease supply & implement incident response. Recommence supply after incident closed-out, and return to safe levels verified.
WID Water Distribution System Inflows and Outflows				
Water management system identifies less than 60% efficiency on an annual flow basis				Implement an investigation to determine cause of losses (eg. channel seepage, meter error, etc) and implement appropriate control strategy.
Customer Site Soil Triggers				
Salinity >6.0 ECe		Sodicity> 15% ESP		Implement Soils Improvement Plan including One-on-one interview with Customer, and possible independent audit of customer site if levels continue to exceed triggers or rise significantly in two consecutive years.
pH <5.0 or pH >8.8		Chloride >600 mg/kg		
Phosphorus (Cowell):	value in surface soil	increase above baseline levels in subsoils		
Depth	0-30cm	30-45cm	85-100cm	
Trigger	>800mg/kg	>200mg/kg	>50mg/kg	
Nitrate:		increase above baseline levels in subsoils		
Depth		30-45cm	85-100cm	
Trigger		>100mg/kg	>100mg/kg	
Groundwater				
Concentrations of parameters monitored as per Table 6-4 increase significantly (>20%) from pre-recycled water (January 2005) baseline levels				Identify whether WID recycled water activities are the cause, through groundwater monitoring and recycled water tracing investigations. If unacceptable implement appropriate control strategy.
Concentrations of parameters monitored as per Table 6-4 exceed SEPP or ANZECC/ARMCANZ 2000 water quality objectives for defined Beneficial Use Criteria				
Surface Drains				
Concentrations of parameters monitored as per Table 6-5 exceed SEPP or ANZECC/ARMCANZ 2000 water quality objectives for defined Beneficial Use Criteria				Review receiving water quality data to determine impacts, if unacceptable develop and implement appropriate control strategy.
Receiving Waters: Werribee River Estuary & Port Philip Bay				
Concentrations of monitored parameters as per Table 6-6 exceed SEPP or ANZECC/ARMCANZ 2000 water quality objectives for defined Beneficial Use Criteria				Assess whether WID recycled water activities are the cause. If demonstrated, develop and implement appropriate control strategy.

11.5 Auditing Programs

11.5.1 Melbourne Water

Melbourne Water coordinates various audits relating to the production and supply of Class A recycled water. These include:

- Verification audits of the Recycled Water Scheme sections of Annual Reports to EPA;
- Surveillance audits (typically every 6 months) to maintain HACCP Certification of the RWQMS; and
- Environmental (regulatory) audits of the obligations of Melbourne Water under the WID REIP.

MW will commission an independent verification audit of the Class A recycled water component of the WTP Annual Report for the 2008-09 FY, then every two years thereafter. Elements of MW's annual reports relevant to the WID Recycled Water Scheme including performance of the Class A Recycled Water Plant and review of recycled water quality monitoring results will be included in the scope of these bi-annual verification audits. The audit scope will be discussed and agreed with EPA prior to commencement of the audit program.

11.5.2 Southern Rural Water

SRW's auditing program for the REIP will comprise:

- Annual verification audit by an EPA Appointed Auditor for 2009-2010 FY SRW Annual report, then every two years thereafter. Auditor's report due by end of October each year.
- Customer Site Auditing Program. SRW has developed new internal and external auditing process for Customer site checks –as referred to in section 7.7.
- Statutory Environmental Audit of Compliance with the REIP and risk to the environment (land, surface water and groundwater) in 2011. The audit scope will need to be agreed with EPA prior to commencement of the audit program.

11.5.3 Customers

SRW will implement an internal auditing process for customer sites, closely integrated and timed to coincide with the annual soil monitoring program and individual customer site soil reporting as described in Section 6.4 and annual reporting as mentioned in section 11.3. The key steps in SRW's customer site auditing process are as follows:

1) Selection of customer sites to be audited in the current reporting year based on priority sites identified from the soil monitoring and improvement program, plus a cross section of 10% of all customer sites in the WID.
2) One-on-one interview with the customer by the agricultural consultant within one month of individual test results being sent to the customer. This is a separate "consultative" visit from the one carried out by SRW internal auditor visit (due to need to maintain customer relationship and assist customer with co-operative solutions).
3) Site inspections by SRW internal auditors to be undertaken within 2 months of soil sampling and individual test results being sent to the customer.
4) External audits of customer sites that are identified in the soil monitoring and soil improvement program as exceeding salinity and sodicity soil triggers and with upward trend for more than 2 years.

Section 11 Reporting and Auditing

The aim of this auditing process is to identify customer site management issues, address any potential non-compliance with the CSMP, CSA, REIP and EPA guidelines, and recommend corrective actions and improvement opportunities for the customer. Refer also to Section 6.4 on Customer Site Soil Monitoring and Section 7 on Customer Site Management.

11.5.4 Key Milestones for Auditing, Reporting and REIP Review

The expected sequence of annual reporting, auditing and REIP review milestones is as follows:

1) REIP covering financial years: 2009-2010 to 2011-2012, commencing July 2009

2) 2008-09 SRW and MW Annual Reports submitted separately to EPA by November 2009, subject to the following:

   - Verification audit of the Class A Recycled Water component of the WTP Annual Report;
   - No verification audit proposed for the SRW Annual Report. SRW will rely on the URS December 2008 Statutory Audit report agreed outcomes and recommendations.

3) 2009-10 SRW and MW Annual Reports submitted separately to EPA by November 2010, subject to the following:

   - SRW Annual Report Verification Audit;
   - No verification audit proposed for the MWC Annual Report. MWC will rely on the 2009 verification audit report agreed outcomes and recommendations.

4) 2010-11 SRW and MW Annual Reports Annual Report submitted separately to EPA by December 2011, subject to the following:

   - 53V Statutory Audit including Verification Audits of Annual SRW and MW Annual Reports by December 2011 (one month later than previous years to allow for larger audit scope)

5) Commence REIP Review January 2012. Complete and issue new REIP by 30 June 2012 subject to the outcomes of the 53V Environmental Audit and Western Irrigation Futures project.

List of Appendices

MW Assets - Class A Recycled Water Plant and Recycled Water Pipeline Route to WID

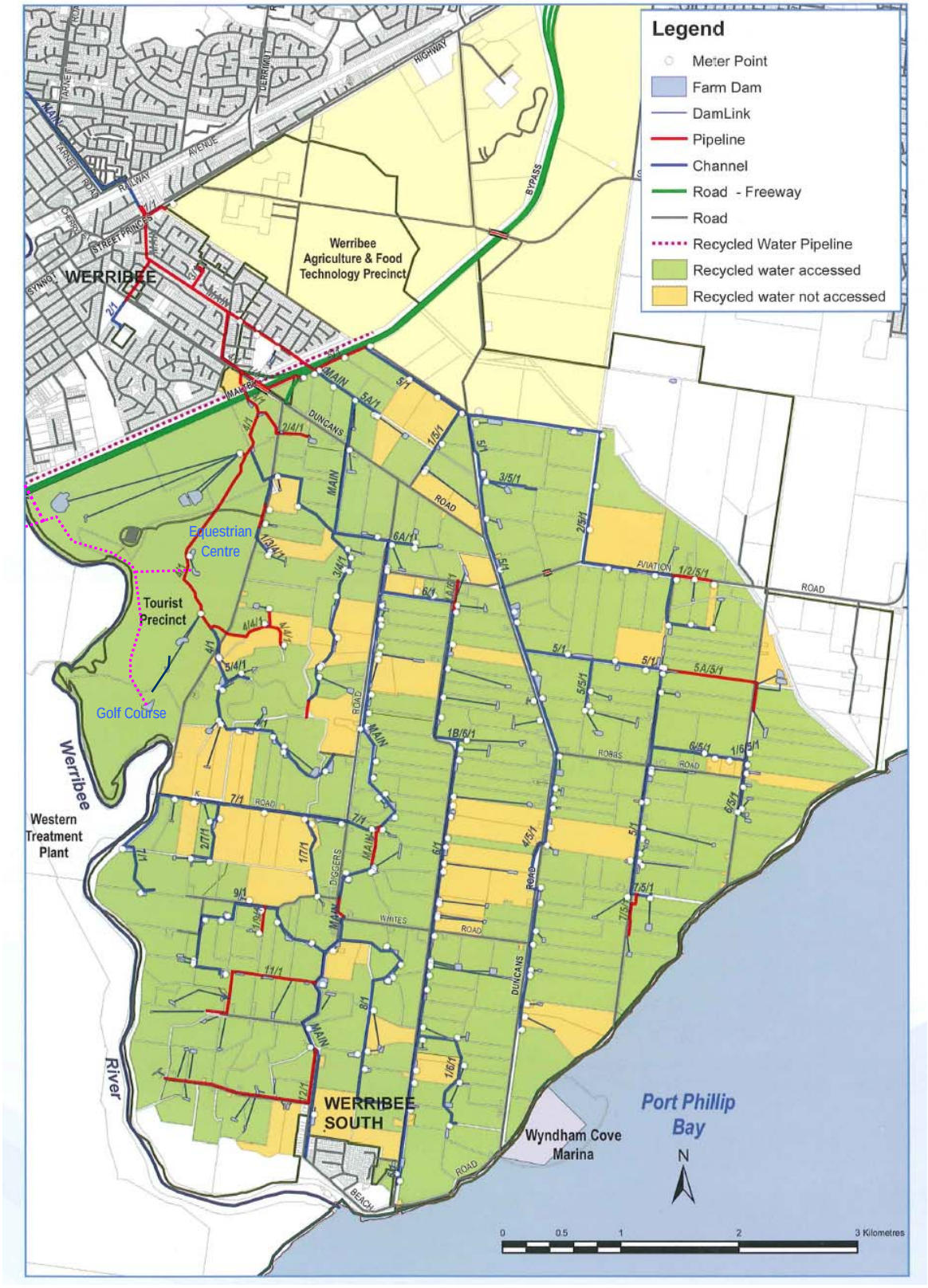
Appendix A

Figure A-1 WTP Class A Recycled Water Plant & Pipeline to WID

WID Supply Channel and Drainage Systems

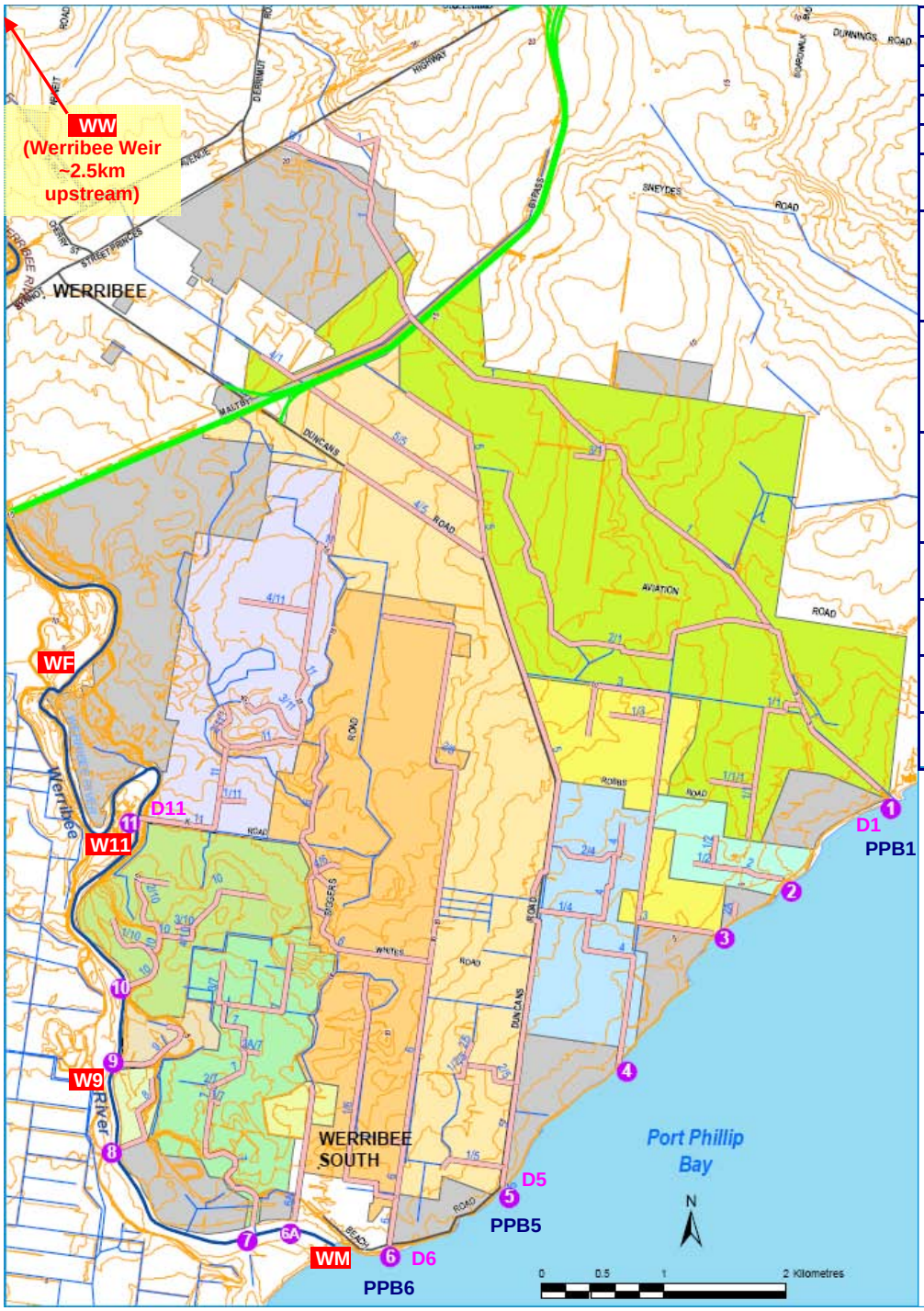
Appendix B

Figure B-1 WID Supply System and Customer Sites Using and Not Using Recycled Water



Appendix B WID Supply Channel and Drainage Systems

Figure B-2 WID Drainage Catchments, Drain Outfalls & Receiving Water Sampling Points



No.	Location
D1	Drain 1 Outfall
D5	Drain 5 outfall
D6	Drain 6 outfall
D11	Drain 11 outfall
WW	Werribee Weir (not shown on map)
WF	Werribee River freshwater at Bluestone Ford upstream of estuary
W11	Werribee estuary at K Road at Drain 11 outfall (near Golf Course car park)
W9	Werribee estuary at drain 9 outfall mid-way between Drain 11 & river mouth
WM	Werribee River Mouth from end of Jetty
PPB1	PPB Inshore at Drain 1 outfall
PPB5	PPB Inshore at Drain 5 outfall
PPB6	PPB Inshore at Drain 6 outfall

Legend

- Drainage Discharge Point
- Drain
- Road - Freeway
- Drainage Pattern
- contour (5 metre interval)

Drain Catchments

- Werribee Sub-catchment 1
- Werribee Sub-catchment 2
- Werribee Sub-catchment 3
- Werribee Sub-catchment 4
- Werribee Sub-catchment 5
- Werribee Sub-catchment 6
- Werribee Sub-catchment 6A
- Werribee Sub-catchment 7
- Werribee Sub-catchment 8
- Werribee Sub-catchment 9
- Werribee Sub-catchment 10
- Werribee Sub-catchment 11
- No Drainage

Figure B-3 WID Drainage System - Breakdown of Catchment Areas

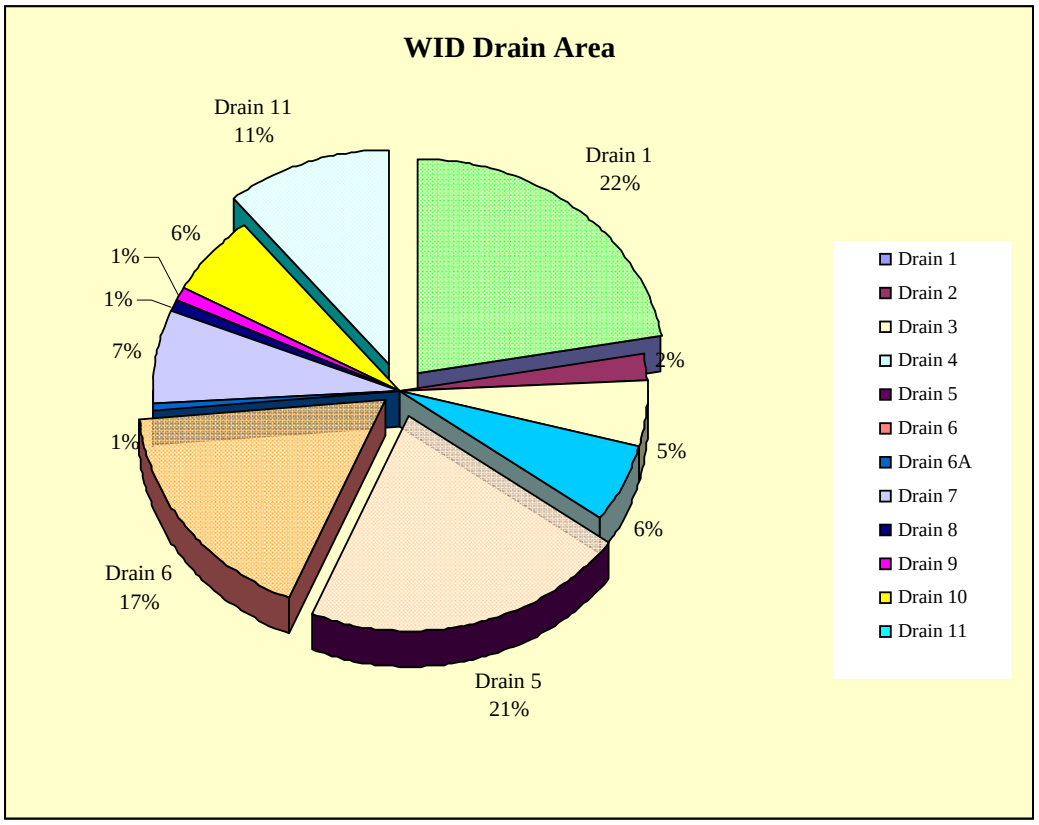


Table B-1 Hydrological Conditions of WID Drains

WID Individual drain catchments area and type			
Drain No	Area Ha	Percentage of district	Drain Type
Drain 1	638	22%	Wet
Drain 2	58.9	2%	Wet
Drain 3	142.9	5%	Wet
Drain 4	173.2	6%	Semidry
Drain 5	612.8	21%	Wet
Drain 6	494	17%	Semidry (small urban area included)
Drain 6A	20.7	1%	Dry
Drain 7	199.4	7%	Semidry
Drain 8	19.6	1%	Semidry
Drain 9	32.6	1%	Semidry
Drain 10	179.8	6%	Dry
Drain 11	311.4	11%	Dry
Total	**2883.3**	**100%**	

C.1 Extract of Shandy Rules and Split Running Rules from REIP 2004

13.2 Shandy Rules

13.2.1 Definitions

Terms have the meaning described in the Customer Supply Agreement, including:

***'Distribution system'** means the open channels, pipelines, drop bar checks, offtake regulators and meter outlets used to supply customers with irrigation water*

***'Recycled water salinity'** means the salinity, in µS/cm (EC) units, measured immediately upstream of the connection points to Southern Rural Water's delivery system on Spur 4/1 and the Main Pipeline.*

***'River water salinity'** means the salinity, in µS/cm (EC) units, measured at McMurray's Weir located on the Main channel upstream of the recycled water connection points, or if the distribution system is not in operation, measured at SRW's Werribee Diversion Weir pool.*

***'Shandied water salinity'** means the salinity, in µS/cm (EC) units, measured downstream of the connection point to SRW's delivery system on Spur 4/1, and measured downstream of the connection point to SRW's delivery system on the Main Pipeline.*

13.2.2 Operating Rules

a) On any day that Recycled Water is being supplied the Shandy Limit shall be as specified in Table 1.

b) In determining the Shandy Limit for a day from Table 13-1 of the Customer Supply Agreement, Southern Rural Water may use the Werribee River Water Salinity and the Recycled Water Salinity measured at any time not more than 48 hours prior to the day.

c) Subject to any tolerances allowed pursuant to Section 13.2.3 of the Customer Supply Agreement, the volume of Recycled Water taken into the Werribee Irrigation District must not cause the Shandied Water Salinity to exceed the Shandy Limit.

13.2.3 Tolerances

On any day that Recycled Water is brought into the distribution system the Shandied Water Salinity may exceed the Shandy Limit by not more than 100 µS/cm for short durations whilst water regulations is underway or adjustment to flow is occurring. The period of variance will not exceed six hours.

13.2.4 Reporting

Southern Rural Water shall maintain a record of daily salinity levels at each of the salinity monitoring sites and make them available for viewing on SRW's web site and/or at SRW's Werribee office.

Table 13-1 Salinity of shandied water that can be supplied given a range of water allocations relative to

Appendix C Shandy Rules & Split Running Rules - Summary

river water salinity

		Seasonal Water allocation	***Expected frequency in 30 years***	***Salinity target***	
				ECw (µS/cm)	***TDS (ppm or mg/L)***
Water allocation model	*1*	*100% +*	*27 years*	*Less than 1000*	
	2	***75%-100%***	***1 year***	***1400+***	***850***
	3	***50%-75%***	***1 year***	***1600+***	***970***
	4	***Up to 50%***	***1 year***	***1800+***	***1100***

Notes: - ***ECw = electrical conductivity of water***

- ***in winter when the Werribee River water salinity increases, dilution may not be possible to meet the target ECw. Waterline will advise all recycled water customers if water salinity changes from the target ECw.***

13.3 Split Running Rules

13.3.1 Definitions

Terms have the meaning described in the Customer Supply Agreement, including the following:

'Distribution system' *means the open channels, pipelines, drop bar checks, offtake regulators and meter outlets used to supply customers with irrigation water.*

'Efficiency of supply' *means the volume of water received in comparison to the volume of water delivered expressed as a percentage.*

'Irrigation season' *means the period of supply that irrigation water is made available for use commencing on 1 July and finishing on 30 June in any year.*

13.3.2 Operating Rules

The following rules will apply to the supply of water in the Werribee Irrigation District under Split-running, please refer to Appendix J Channel Management Report for a detailed outline of how the operating rules were established:

a) Shandied Water and River Water will be made available on the days specified in a Table selected by Southern Rural Water from Table 1, 2, 3, 4 or 5, or any other Table that may be determined in accordance with clause 4.

b) The phasing in or out of Recycled Water will start when daily flow changes are made (early morning and late afternoon) when the system is operating. Recycled Water will be shut off on the day before the start of a River Water period; however, no guarantee can be given that the system will be free of shandy residues in River Water periods.

c) As total weekly demand changes, Southern Rural Water will determine whether to operate according to Table 1, 2, 3, 4 or 5, or to any other Table that may be determined in accordance with clause 4.

d) On days shown on the Table selected in accordance with clause 2.1(c) to be Shandy Days the water available will be Shandied Water, and only Customers that have satisfied the requirements for the use of Recycled Water may order water for those days.

e) Recycled Water customers may order water on River Water days but preference may be given to other customers on those days.

f) To maintain reasonable efficiency of supply and minimise system losses a minimum flow rate of 50 ML/d is required before the system is operated.

g) Notwithstanding anything to the contrary in this clause, SRW may deliver water on a Shandy Day to Customers that have not satisfied the requirements for the use of Recycled Water:

i. When the previous day on which the Distribution System was operated as a River Water Day; and
ii. Such deliveries conclude prior to Recycled Water being brought into the Distribution System.

13.3.3 Reporting

Southern Rural Water will periodically report on usage for Recycled Water customers to allow Customers to monitor their usage of both River Water and Recycled Water.

13.3.4 Alterations to Split-running days

Prior to the commencement of each irrigation season, or at other times with at least 21 days notice, Southern Rural Water may:

a) Increase or decrease the number of days that Shandied Water and/or River Water is specified in Tables 1, 2, 3, 4 and/or 5;

b) Replace or delete Table 1, 2, 3, 4 or 5;

c) Add additional Tables.

13.3.5 Constraints of supply

Operating under Split-running will require frequent changes between Shandied Water and Recycled Water and may reduce the volume of Recycled Water that can be supplied.

Table 1: Typical 7-day operation

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Shandy	River Only	Shandy	Shandy	River Only	River Only	Shandy

Table 2: Typical 6-day operation

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Shandy	River Only	Shandy	Shandy	River Only	River Only	

Table 3: Typical 5-day operation

Appendix C

Shandy Rules & Split Running Rules - Summary

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	River Only	Shandy	Shandy	River Only	River Only	

Table 4: Typical 4-day operation

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		Shandy	Shandy	River Only	River Only	

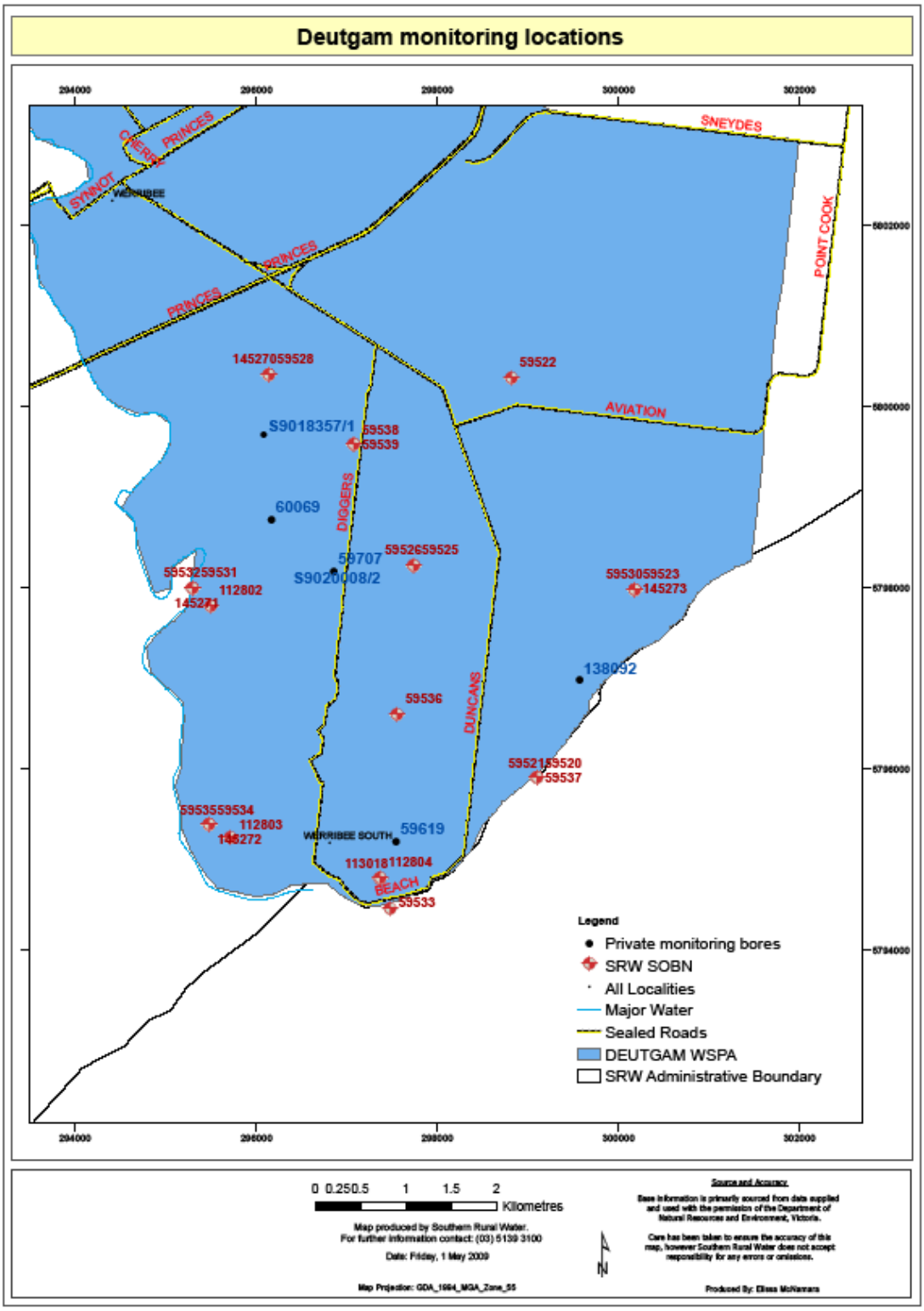
Table 5: Typical 3-day operation

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			Shandy	River Only	River Only	

WID Groundwater Bore Monitoring Locations

Appendix D

Figure D-1 Groundwater Monitoring Locations in the WID



Appendix D WID Groundwater Bore Monitoring Locations

Table D-1 List of SOB and Private Monitoring Bores in the WID

BHID	Location	Screen interval	Formation monitored
State Observation Bores			
59520	Central eastern coast	7-12.8m	Werribee Delta
59521	Central eastern coast	26-28m	Newer Volcanics
59522	Northern east	11.75-23m	Newer Volcanics
59523	Eastern coast	11-30m	Werribee Delta
59525	Upper mid central	8.5-14m	Werribee Delta
59526	Upper mid central	18-22m	Newer Volcanics
59528	Northern west	9-20m	Newer Volcanics
59530	Eastern coast	31-55m	Lower Werribee Delta- Thin Newer Volcanics - Upper Brighton Formation
59531	Western - river tidal extent	20-26m	Werribee Delta
59532	Western - river tidal extent	29-40.2m	Werribee Delta
59533	Central coast	14.2-20.2m	Werribee Delta
59534	SW coast on river	18.1-23.5m	Lower Werribee Delta- Newer Volcanics
59535	SW coast on river	23.7-31m (open hole)	Newer Volcanics Upper Brighton?
59536	Lower mid central	17-23m	Werribee Delta
59537	Central eastern coast	12-18m	Werribee Delta
59538	Northern central	13-27m	Newer Volcanics?
59539	Northern central	2.7-8.5m	Werribee Delta
112802	Western - river tidal extent	11.9-16.3m	Werribee Delta
112803	SW coast on river	19.5-25.5m	Werribee Delta
112804	Central coast	19-25m	Brighton Formation?
113018	Central coast	5-8m	Werribee Delta
145270	Northern west	7.6-10.6m	Werribee Delta
145271	Western - river tidal extent	17-20m	Werribee Delta
145272	SW coast on river	11-14m	Werribee Delta
145273	Eastern coast	7.5-10.5m	Werribee Delta
Private bores			
59707		17m	Werribee Delta
S9018357/1		18-27m	Werribee Delta
60069		15-17m	Werribee Delta
59619		unknown	Werribee Delta
S9020008/2		12-16m	Werribee Delta
138092		6-15m	Werribee Delta

E.1 Soils of the WID

SRW commissioned agricultural consultants (Ag Challenge) to prepare a WID soils map based on its extensive field experience and working knowledge of the WID as part of the soil sampling program. The resulting map of WID soils is shown in Figure E-1. Table E-1 summarises the main soil types in WID as reported by AgChallenge (table row shading approximates the shading in Figure E-1).

Table E-1 Soils of the WID (source: Tony Pitt Ag Challenge)

Map Unit	Description	Location	Approx. % of WID
Al	Alluvial Soils Topsoils – dull grey-brown sandy clay loams Subsoils – dark grey-brown sandy clays	Lower Werribee Floodplain on the western side of WID	5%
Rbe	Red Brown earths Topsoils – red brown fine sandy clay loam, over red/brown light clay Subsoils – red/grey-brown light clay, over grey/brown light/medium clays	Main soil type throughout the centre of WID	74%
Ug	Brown and Red Clays (Seasonally Cracking) Topsoils – yellow/brown light clay Subsoils – dark yellow/brown light/medium clay over grey/brown medium/heavy clay	Along the north and east side of WID. Transitional soils between Rbe and Dy mapping units	12%
Dy	Solodic Soils (Yellow/ Yellow Grey Duplex) Topsoils – yellow grey-brown clay loam over yellow-brown heavy clay Subsoils – yellow-brown and grey-brown heavy clay	Small areas on the north-east fringe of WID.	9%

The main soil types within WID are the Red Brown Earths, which in their natural form are red brown duplex soils. However after many years of cultivation in WID, the topsoil has been extensively mixed to the point where the productive soil depth is typically around 35-50cm, and the depth to subsoil is determined by the depth of working by machinery. A clay hardpan often exists immediately below this depth of cultivation on customer sites in WID, providing potential for perched groundwater and resultant lateral subsurface movement of irrigation excess (ie. leaching fraction). The drainage system constructed throughout WID is designed to collect this sideways subsurface drainage.

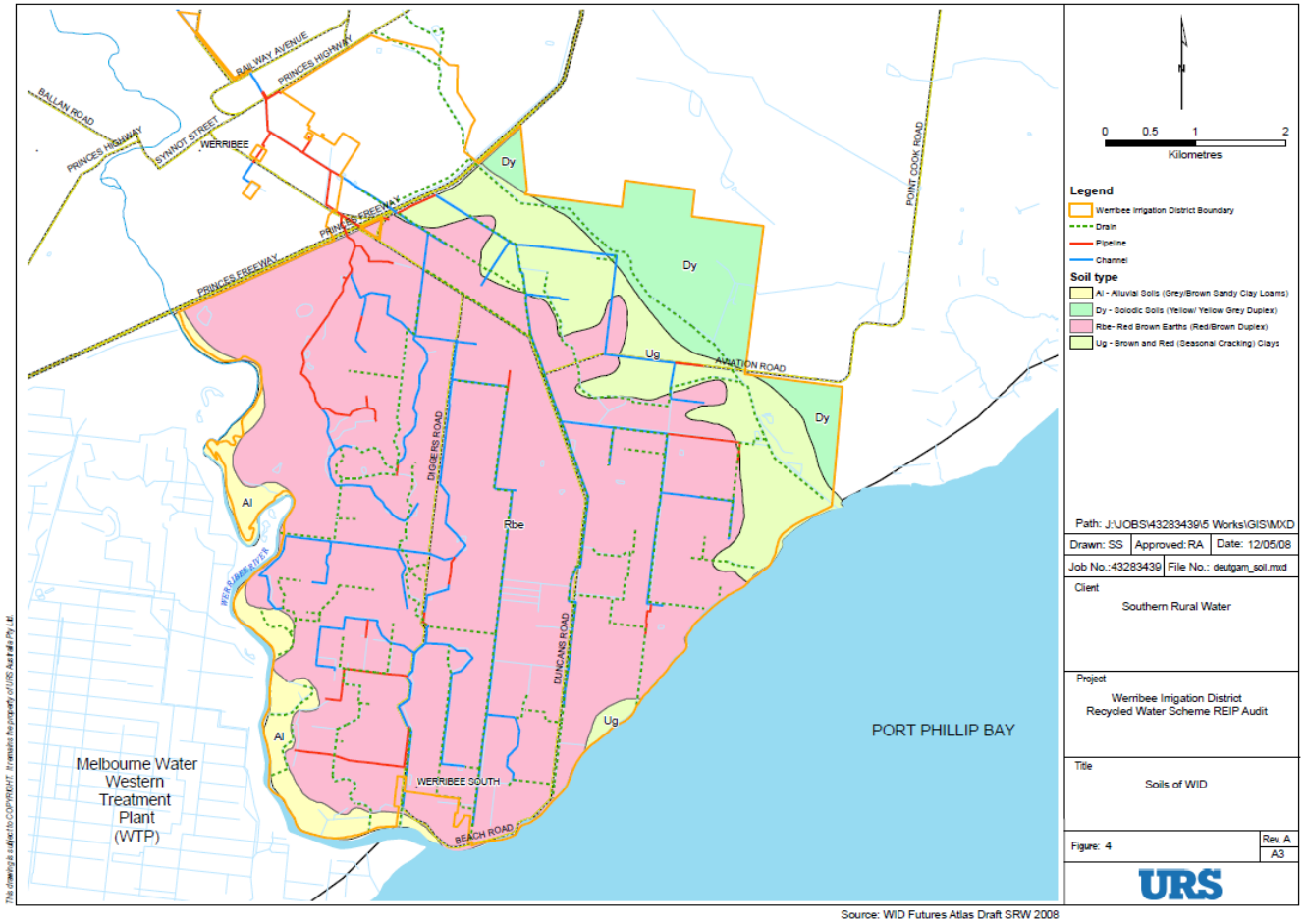
The alluvial soils on the lower Werribee floodplain (below the terraces) are only a few metres above sea level – refer to contours. These soils are recently deposited, more variable and generally more permeable (more sandy). They have potential to be the most productive soils.

The soils along the north-east side of WID are transitional soils between the red-brown earths (influenced by alluvial deposition in the Werribee Delta) and the soils of the basalt plains (volcanics). The Brown and Red Clays (Ug mapping unit) are also influenced by the original drainage line through this area. These soils therefore tend to be heavier, sodic, and subject to waterlogging and seasonal (shrink-swell) cracking. These soils tend to be of lower productivity and are more difficult to manage under irrigation, and are the underlying reason for the original designation of the eastern boundary of WID.

Appendix E

Annual Soil Sampling Plan (ASSP) & Soil Improvement Plan (SIP)

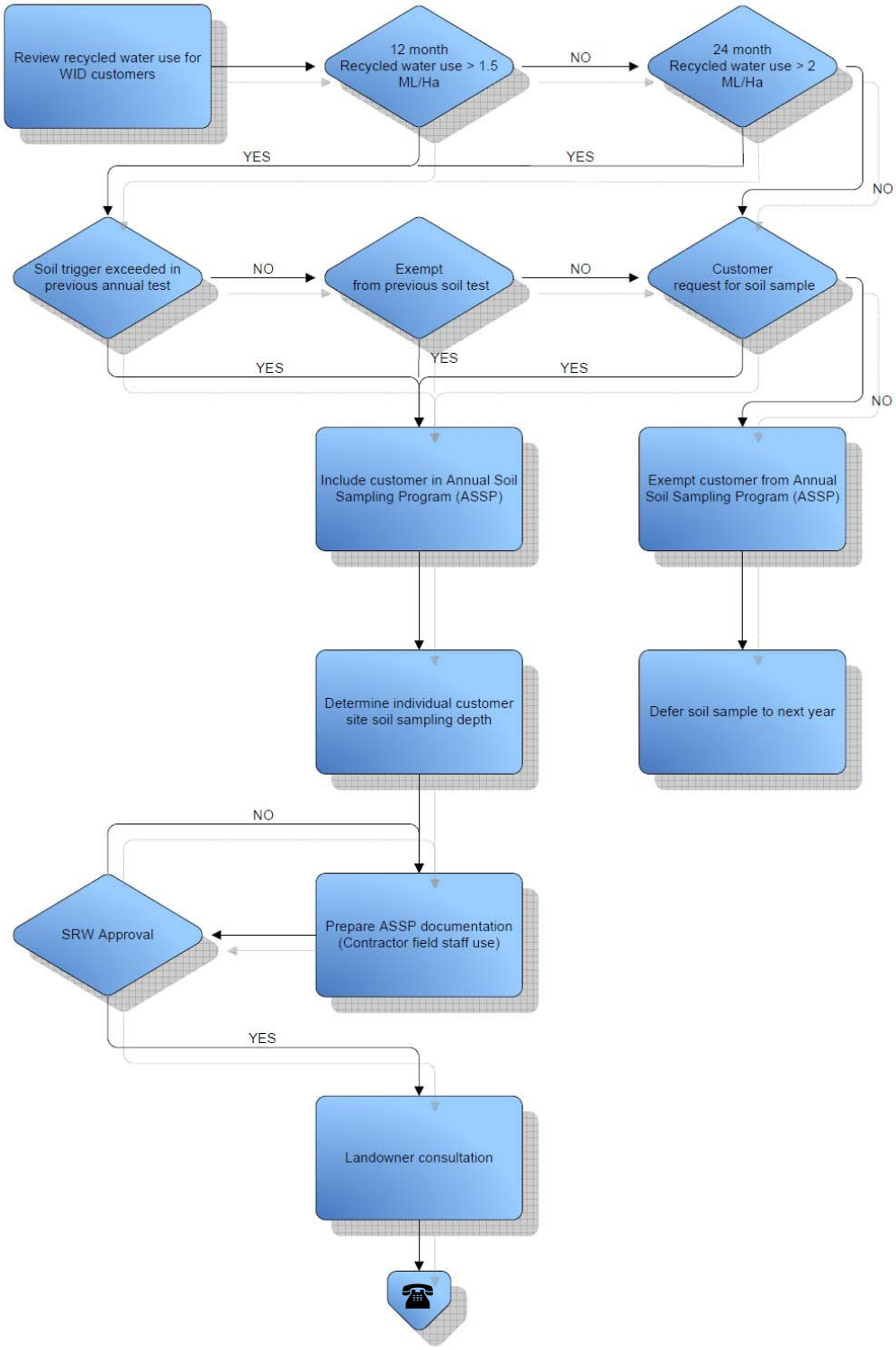
Figure E-1 Soils of the WID



Source: WID Futures Atlas Draft SRW 2008

E.2 Annual Soil Sampling Plan

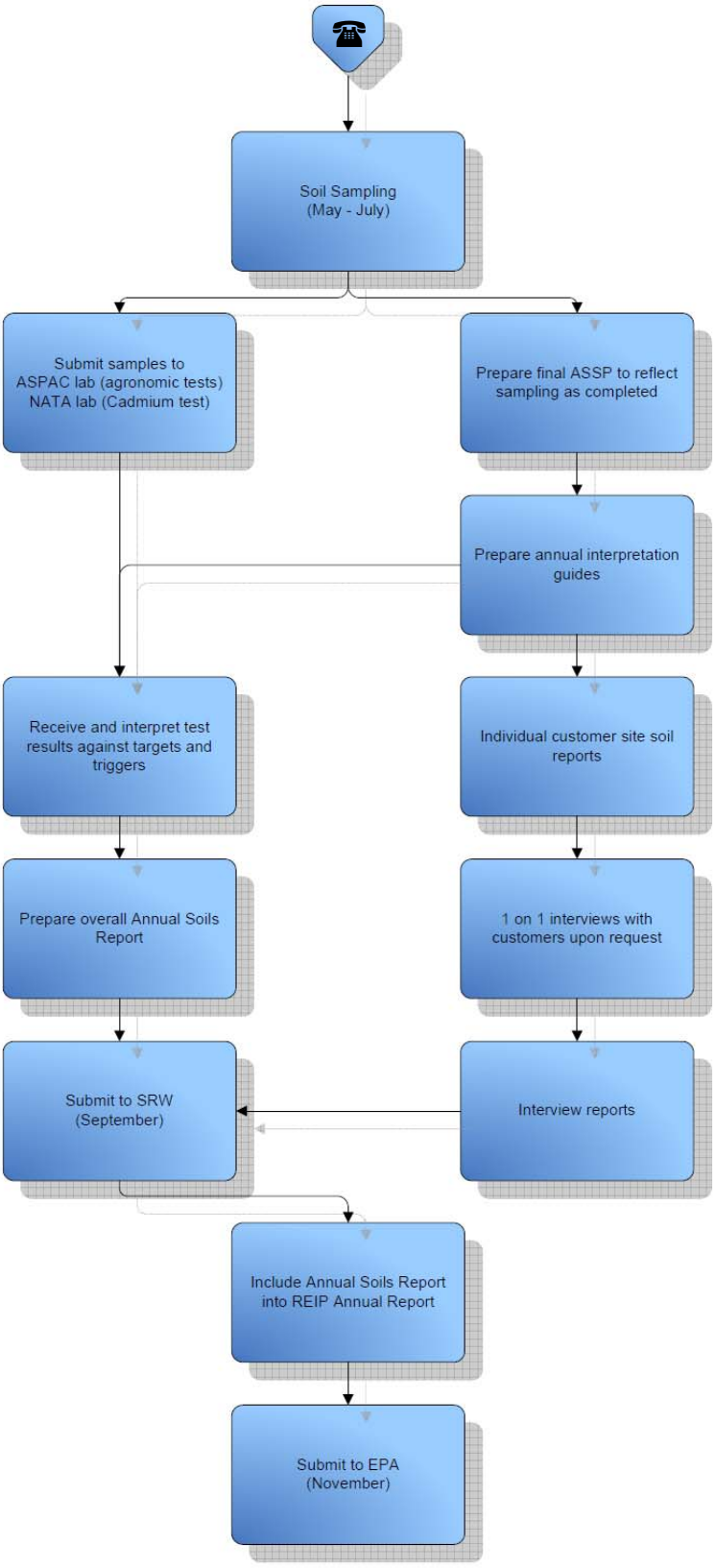
Figure E-2 Annual Soil Sampling Plan Flowchart



Appendix E

Annual Soil Sampling Plan (ASSP) & Soil Improvement Plan (SIP)

[Figure E-2 Continued]



E.3 WID Soil Improvement Plan

E.3.1 Background

Irrigation with recycled water in the Werribee Irrigation District ("WID") commenced in January 2005. Because of exceptionally low rainfall and catchment yield for the past four years, the district has been highly reliant on recycled water for most of the irrigation needs. Recycled water has a moderate level of salinity and sodicity and the long term use of this water for irrigation can potentially alter soil chemistry in undesirable ways. A potential ultimate impact is that the soils may become unproductive for agricultural use.

Since the commencement of the WID recycled irrigation scheme, all customer properties that have used recycled water have been monitored for a range of soil agronomic properties, to identify if undesirable trends in soil chemistry are occurring. Baseline testing of all recycled water customer sites also occurred prior to commencement of recycled water supply to each customer's property.

From the soil monitoring since 2005, district-wide average levels indicate an upward trend in salinity and sodicity that warrants continued scrutiny and ongoing monitoring, but did not threaten district productivity at the writing of the 2009-2012 REIP. At an individual farm level the results are mixed, with some properties showing no detrimental impact from the recycled water, but with some individual properties showing rapid rises in salinity and/or sodicity, as well as nutrients (particularly Colwell phosphorus).

The original 2004 REIP for the WID Recycled Water Scheme was for a period of five years, expiring in mid-2009. This new REIP outlines the environmental management framework until 2012 including the Soil Improvement Plan ("SIP") for WID customer soils. In accordance with this new REIP for the next 3 years, and using the soil monitoring results, information and experience gained with the WID soils over the past 5 years, the SIP sets out a soil reclamation process for those individual properties in the WID that continue to experience soil deterioration in terms of salinity, sodicity and nutrients.

The processes within the SIP involve a number of steps (see Figure E-3 at the end of this Appendix), and the key will assessment of soil monitoring results against the agreed trigger levels (see Table E-2 in this Appendix) that determine whether remedial action is warranted. The beneficiaries of this process will be the individual recycled water customers and landowners, the WID as whole and the environment. The overall goal is to prevent damage to WID soils which can potentially become irreversible and cause farms to be unproductive.

E.3.2 Determination of Trigger Levels for Key Soil Parameters

SALINITY

Salinity thresholds for yield decline in crops are usually specified as the electrical conductivity of a soil saturated extract (EC_e). This can be thought of as the salinity of a soil paste saturated with water. Because the laboratory measurement is a little more complex than more standard tests on soils, the EC_e value is commonly estimated by calculation using the measured electrical conductivity in 1:5 soil water slurry (EC) and multiplying by a conversion factor depending on soil texture. Published critical EC_e value for some loss of marketable yield in lettuce is 3.2 dS/m and the critical value for loss of marketable yield in cauliflower and broccoli is 5.5 dS/m.

These values indicate that the crop will have progressively greater difficulty in removing water from the soil and undergoing normal growth processes as the soil salinity approaches these EC_e values. However they are not tipping points at which normal crop yields can be expected below the critical value and poor yields above.

Appendix E Annual Soil Sampling Plan (ASSP) & Soil Improvement Plan (SIP)

The loss of crop productivity is progressive and there is strong interaction with management. Crop observation plays a major role in determining whether crops will still perform satisfactorily at an EC_e value above these thresholds, and WID farmers have developed keen observation skills in producing sensitive crops like lettuce.

The main impact of growing a crop like lettuce in soils with an EC_e value above 3.2 dS/m is that the crop will be seen to wilt and go into a mild moisture stress more quickly on a day of high respiratory demand. WID farmers respond by applying more water. High quality and high yielding lettuce crops are produced on WID soils with EC_e values of 4.5 dS/m, provided that the soils are kept very moist throughout the growth cycle. In extreme situations, lettuce crops have been grown successfully on soils with an EC_e value of 5.5 dS/m where the soil was maintained close to saturation for the duration of the cropping cycle. In practice, however, most growers seem to recognize that a particular block is becoming too salty for lettuce at an EC_e value of 4.5 dS/m, and will chose to grow another crop such as Broccoli or Cauliflower, until the salinity levels reduce to an acceptable level for lettuce. By watering heavily during one cropping cycle and temporarily increasing the leaching fraction, the salinity can often reduce to an acceptable value for lettuces with one cropping cycle.

Because of the strong experience and observational skills of the WID growers, and because their farm management incorporates the flexibility to grow crops under wetter regimes when high soil salinity prevails, an appropriate salinity trigger for remedial action for WID soils is an EC_e value of 6.0 dS/m in the top 30 cm of the soil profile. Beyond this EC_e value and productivity could be compromised, even when maintaining higher soil moisture levels (which is standard practice by WID growers).

SODICITY

High sodium is an undesirable property of soil. Soils with more than 6% exchangeable sodium (known as exchangeable sodium percentage or “ESP”) are referred to as sodic soils. Soils with ESP greater than 15% are regarded as being strongly sodic. The sodium cation has potential to cause detrimental impacts on a number of soil properties, including the stability of the soil structure, air movement in and out of the soil matrix, and water movement (ie. permeability) through the soil. Soils which are sodic often have a tendency to set hard as they dry out and form a surface crust which inhibits germination after partial drying. Sodic soils are more difficult to cultivate with a narrower margin between being too wet or too dry for good tilth and good seedbeds. High exchangeable sodium can also be toxic to certain crops. Surface crusting sodic soils can also cause greater localised runoff during intense irrigation and rainfall events.

All irrigated soils in the WID are sodic, and were already sodic prior to commencement of the WID recycled water scheme. The ESP levels are all greater than 6% in the surface soils, and ESP typically increases with depth. The undesirable properties of sodicity increase progressively with increasing ESP. Observation of the performance of WID soils has been that satisfactory cultivation leading to good seedbeds is certainly achievable with ESP values of 10% or less. The Richards Equation predicts an equilibrium value for ESP of 10.4% in soils irrigated with an SAR value of 8.8 (which was the 2007/08 median value for SAR in the recycled water supplied to WID). With the use of gypsum or other soil ameliorants which contain highly soluble forms of calcium it should be possible to maintain soil ESP in the surface soil below 10%.

An appropriate trigger level for further action to reduce ESP has been developed for this new REIP. A value of 10.4% is the theoretical equilibrium from the recycled water (based on 2007/08 SAR levels), but river water and groundwater and future recycled water quality could have higher SAR values than 8.8.

The WID average soil ESP value in 2008 was around 12%, which implies that there are other sources of sodium besides that coming from the recycled water. The 90th percentile value for ESP was 16% in 2008. Thus a trigger value of greater than 15% would have the following ramifications:

- It should be easily achievable given the use of gypsum and the current SAR value in recycled water
- It is a recognized value for highly sodic soils
- There are significant soil physical properties that progressively deteriorate when sodicity reaches and exceeds this threshold
- There is some data to indicate yield decline in certain crops at ESP values greater than 15%.

An ESP value of greater than 15% has been adopted as the trigger for remedial action for this new REIP.

CHLORIDE

Chloride is the key anion and is strongly correlated with salinity indicators (EC_e). Chloride can be toxic to crops and warrants additional consideration when determining if site specific action is required. Chloride levels of 600 mg/kg in the surface soil are of typical concern to toxicity for crops that are chloride sensitive. The chloride trigger adopted for this REIP is 600 mg/kg, and is used to determine appropriate remedial action required to address chloride as part of salinity impacts in WID soils.

SOIL pH

WID soils are all mildly to strongly alkaline, as were so even before commencement of the recycled water scheme. The problems that are likely to be experienced with soil reaction are excessive alkalinity. Very high values of soil pH (above 8.5) can have detrimental impacts on the solubility of calcium, potentially through free carbonate ions stripping calcium from solution and making gypsum ineffective in reducing sodicity. There are also other affects on plant nutrition related to the solubility of zinc and manganese. Soil pH levels above 8.5 would indicate an excessive use of lime and the potential for this to disrupt normal soil fertility and fertility management.

High soil pH can also have detrimental affects on crop growth through aluminium toxicity. With pH values above 8.5 the concentration of monovalent aluminium hydroxide in solution increases up to a maximum concentration at around pH 9.2. The value is close to a maximum at anywhere above pH 8.8

A soil pH of 8.8 (1:5 soil water ratio) or above in the surface soil has been adopted for this new REIP as the trigger point for remedial action to lower soil alkalinity.

NUTRIENT MIGRATION (PHOSPHORUS & NITRATE)

There is significant evidence of nutrient migration occurring in WID soils. This nutrient migration to deeper soils had already occurred before commencement of the recycled water scheme, due the extensive use of inorganic fertilisers for many decades in the WID. The movement of nitrate into the deeper parts of the soil profile has been occurring for some time, as high nitrate was detected in soil samples collected during baseline soil sampling in 2004 and early 2005. The movement of phosphate into the subsoil has been confirmed through soil sampling which has shown higher levels of available phosphorus in subsoil horizons than was present before the commencement of irrigation with recycled water.

Of the 29 irrigation blocks that were monitored for soil chemical changes at multiple depths in 2008 annual soils monitoring, 18 blocks recorded an increase in soil available phosphorus (Colwell method) of more 100 mg/kg at the 30 to 45 cm sampling depth. The other 11 blocks showed no appreciable change or a decrease in available phosphorus. For the 85 to 100 cm sampling depth there was just 1 block where the soil available phosphorus had increased by a value of 50 mg/kg or more and 4 blocks where the increase was 35 mg/kg or greater.

A number of nutrient triggers for different soil depths have been adopted for this new REIP as follows:

- If the surface soil available phosphorus is greater than 800 mg/kg (Colwell method).
- If the soil available phosphorus value in the soil sampling depth of 30 to 45 cm has increased by more than 200 mg/kg (Colwell method) above soil baseline values.
- If the soil available phosphorus value in the soil sampling depth of 85 to 100 cm has increased by more than 50 mg/kg (Colwell method) above baseline values.
- If soil available nitrate value in the soil sampling depth of 30 to 45 cm has increased by more than 100 mg/kg above baseline values.
- If soil available nitrate value in the soil sampling depth of 85 to 100 cm has increased by more than 100 mg/kg above baseline values.

E.3.3 Summary of Targets and Triggers

The short term "Triggers" adopted for this REIP for the next 3 years together with longer term "Targets" are given in Table E-1 below.

Table E-1 Soil Targets and Triggers

Soil Parameter	Sampling depth	Target Value	Trigger Value
Soil salinity	0 - 30 cm	EC_e < 3.5 dS/m	EC_e > 6.0 dS/m
Soil chloride	0 - 30 cm	Chloride < 200 mg/kg	Chloride > 600 mg/kg
Soil sodicity	0 - 30 cm	ESP < 10%	ESP > 15%
Soil pH (1:5 soil:water)	0 - 30 cm	pH < 8.0	pH < 5.0 or pH > 8.8
Phosphorus (Colwell method)	0 - 30 cm		> 800 mg/kg
Phosphorus (Colwell method)	30 - 45 cm		> 200 mg/kg Increase above baseline levels
Phosphorus (Colwell method)	85 - 100 cm		> 50 mg/kg Increase above baseline levels
Nitrate	30 - 45 cm		> 100 mg/kg Increase above baseline levels
Nitrate	85 - 100 cm		> 100 mg/kg Increase above baseline levels

E.3.4 Remedial Action for Restoration of Soil Quality

Table E-2 provides a list of some of the management initiatives that can be implemented at Werribee to improve one or more of these soil parameters. The list is not exclusive but it has been provided to indicate the sort of steps that farmers might take should one of the trigger points be exceeded.

Table E-2 WID Soil Remedial Actions

Remediation Action	Salinity Reduction	Chloride Reduction	Lower Sodicity	Lower soil pH	Reduce nutrient migration
Increase the irrigation to include more leaching	√√√	√√√	√		
Deep ripping to open pathways for vertical water movement.	√√√	√√√			
Application of gypsum	√	√	√√√		
Use of Calcium fertilizers (Calcium nitrate, Calcium thiosulphate)	√	√	√√√		√
Laser Grading to improve bed drainage	√√√	√√√			
Install underground drains	√√√	√√√	√		
Deepen and improve farm drainage	√√√	√√√	√		
Check and improve water distribution uniformity to achieve a DU approaching 90%	√√√	√√√			√
Examine fertilizer strategy and modify to balance with the nutrient in recycled water				√	√
Review lime use				√	

E.3.5 Implementation

The soil salinity parameters as discussed above are all controllable by various good farm management strategies that can be put in place to reduce the values back to a more acceptable level. In the first instance the grower needs to be alerted that a specific parameter of parameters have exceeded the adopted trigger, and then given the opportunity to alter the management with minimal intervention by SRW. In such cases where a trigger is exceeded, a follw-up round of soil testing is then brought forward and undertaken in 6 months rather than the normal 12 months. The results of these follow-up soil tests should hopefully confirm that the problem has been rectified.

Should the follow-up soil tests show that the salinity or nutrient trigger are still being exceeded, the grower is again advised of this and that follow-up soil tests will again be repeated in 6 months time. Thus the grower has a further 6 months to fix the problem. At this stage the grower will be provided with more information and assistance from SRW on how to manage soils with the particular problem (printed material or a one-on-one customer discussion and site visit).

Appendix E Annual Soil Sampling Plan (ASSP) & Soil Improvement Plan (SIP)

If these soil tests undertaken at six month intervals show that the triggers are still being exceeded after the second follow-up test, the grower will now be required to formally document how he/she intends to improve the soil and reverse the trends. The grower is required to prepare and lodge a site specific soil improvement plan for their property. The plan will need to be reviewed and found to be acceptable by SRW. The plan will include further provision for follow-up soil tests and inspections in another 6 months, and will specify various soil management initiatives to be implemented in the interim aimed at improving soil conditions.

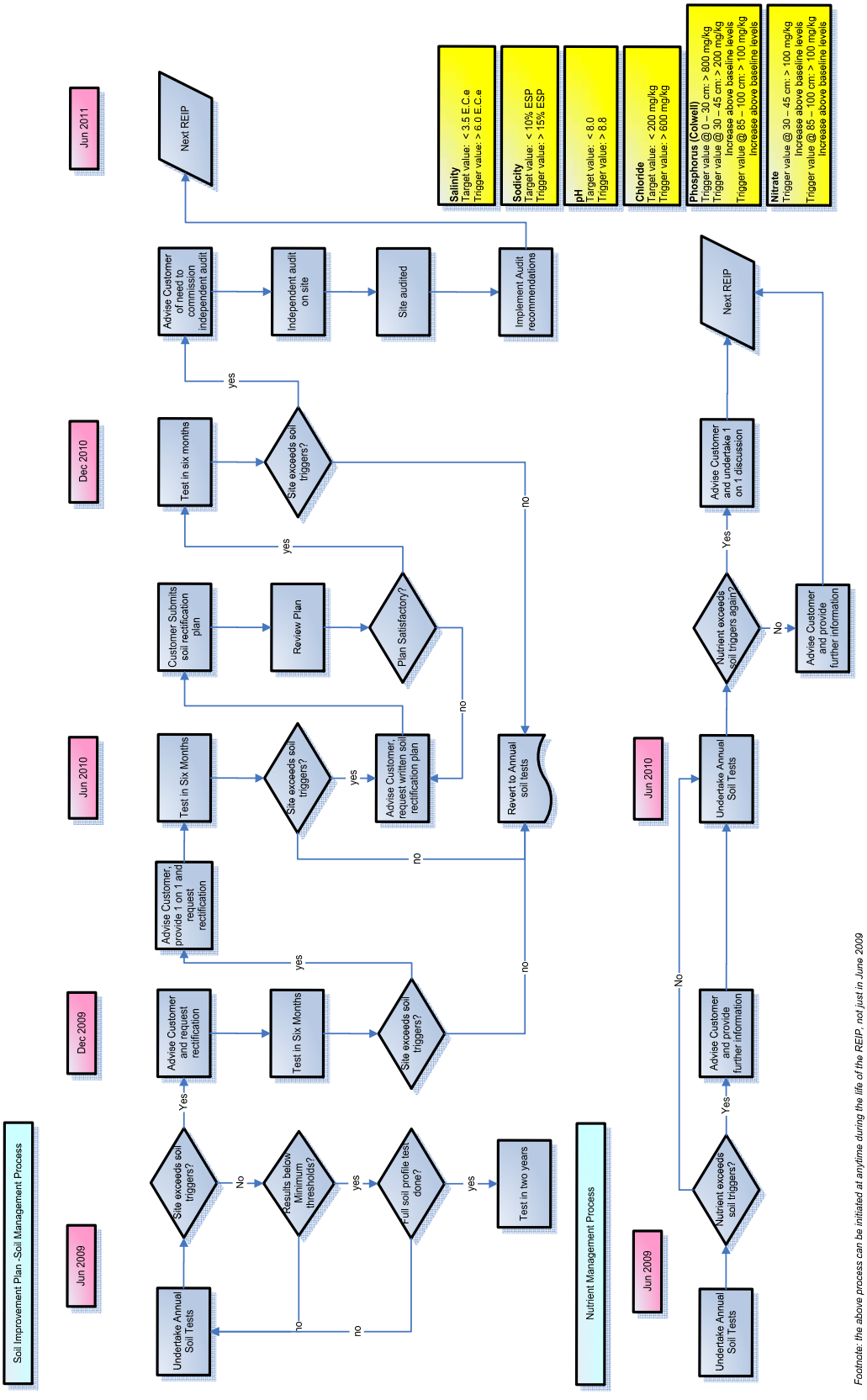
A further follow-up soil test is then implemented after 18 months after the first trigger level is exceeded. If the triggers are still being exceeded at this stage, the site specific soil improvement plan and the outcomes will be provide to an EPA endorsed auditor for review and for recommendations for action. At this time DPI extension officers may also be asked to review the site specific soil improvement plan, monitoring results and assist the customer with determining appropriate remedial actions.

The processes to be implemented as part of the Soil Improvement Plan for the period 2009 to 2011 are illustrated in the flow chart shown in Figure E-3 on the next page.

Annual Soil Sampling Plan (ASSP) & Soil Improvement Plan (SIP)

Appendix E

Figure E-3 WID Soils Improvement Plan Flowchart



Customer Site Management Plan Template

Appendix F

CUSTOMER SITE MANAGEMENT PLAN (CSMP)

GIPPSLAND AND SOUTHERN RURAL WATER AUTHORITY

WERRIBEE IRRIGATION DISTRICT
RECYCLED WATER SCHEME

October 2004

Table of Contents

Glossary of terms

Term	Definition
Class A Recycled Water	The most stringent of four classes of recycled water, based on microbiological parameters, used in the broadest range of situations including recreational watering and direct irrigation of food crops that may be consumed raw.
CSA	The Customer Supply Agreement (CSA) is the legal document outlining the contract between the entitlement holder and Southern Rural Water.
CSMP	The Customer Site Management Plan (CSMP) is a plan to ensure the safe and sustainable use of recycled water at the farm level.
CSMR	A Customer Site Management Report (CSMR) must be submitted annually to confirm for the EPA that the necessary controls and good practice measures are in place at the **farm level**.
Customer	Is the person who has entered into the Customer Supply Agreement with SRW to participate in the Werribee Irrigation District Recycled Water Scheme. They are responsible for ensuring that the Customer Site Management Plan (CSMP) requirements are met.
DHS	Department of Human Services Victoria.
EPA	Environment Protection Authority Victoria.
IMP	The **Irrigation Management Plan** (IMP) has been commissioned by SRW and externally reviewed before approval by the EPA. The IMP was commissioned to determine sustainable methods for delivering and irrigating with shandied water, maximising the benefits of recycled water for growers.
Land Owner	Is the person who's name appears on the property title.
Operator	The person who farms the land.
Recycled Water	Class A recycled water from the Western Treatment Plant and delivered by Melbourne Water to SRW.
EIP	The **Regional Environment Improvement Plan** (EIP) for the Werribee Irrigation District Recycled Water Scheme as approved by the Environment Protection Authority. This document describes the safe and sustainable use of recycled water at a regional level in the Werribee Irrigation District.
Shandied Water	Water in the WID that includes some or all Recycled Water.
SRW	Gippsland and Southern Rural Water.
WID	Werribee Irrigation District.

Units for irrigation water and soil

Term	Units	Definition
ECse	μS/cm or dS/m	Electrical Conductivity of a Soil saturation Extract. A measure to define salinity of water. 1000 μS/cm = 1.000 dS/m
ECw	μS/cm or dS/m	Electrical Conductivity of Water. A measure to define salinity of water. 1000 μS/cm = 1.000 dS/m
TDS	mg/L or ppm	Total Dissolved Solids is a measure to define salinity of water. For shandied water a TDS of 610 (ppm or mg/L) ≈ 1000 ECw (μS/cm). Note this is variable depending on your water source.
SAR	$(mmol_c/L)^{0.5}$	Sodium Adsorption Ratio of water or a soil extract
ESP	%	Exchangeable Sodium Percentage of the soil

Part A. Background

A1. Purpose of the Customer Site Management Plan

The aim of the Customer Site Management Plan (CSMP) is for the customer to consider and implement the controls necessary to ensure the correct and sustainable use of recycled water on their land for the benefit of crops and soils, staff, neighbours and the environment. A CSMP (or equivalent) is a requirement of Environment Protection Authority Victoria (EPA) for any agricultural use of recycled water. Wastewater Treatment Plants require an EPA licence to discharge treated wastewater to land, or waterways such as Port Phillip. The licence specifies certain water quality parameters (including nutrients) that the treated wastewater must meet to protect the environment. Agricultural use of reclaimed wastewater (recycled water) is exempt from requiring an EPA licence if it can be shown that the agricultural use of recycled (reclaimed) water is carried out sustainably, with no off-site impacts (eg. Nutrients leaching from agricultural irrigation to sensitive waterways).

This plan has been developed by Southern Rural Water (SRW) to assist with addressing compliance with the relevant EPA Guidelines (Guidelines for Environmental Management: Use of Reclaimed Water) (EPA Victoria 2003). Please contact SRW for further advice on these guidelines or for a copy. SRW and Melbourne Water are also responsible for the Werribee Irrigation District Regional Environment Improvement Plan (EIP), which can be obtained from SRW (Melbourne Water and SRW 2004). The EIP describes all the necessary procedures and assessments required for the region to ensure a sustainable recycling scheme is developed in the Werribee Irrigation District (WID). The EIP and the CSMP have been developed in consultation with the EPA and information from range of sources; one of the main sources was the Irrigation Management Plan (IMP). It assessed the potential impact of recycled water relative to the water sources already used in the WID (RMCG and URS 2004).

The Customer Site Management Report (CSMR; Part B, Page 7) must be completed and approved by SRW before Shandied Water (includes recycled water) can be received.

A2. Werribee Irrigation District Recycled Water Scheme

Melbourne Water is able to provide up to 55 ML/day of Class A recycled water from its Western Treatment Plant to SRW for delivery to the WID. Melbourne Water delivers recycled water via a pipeline to two points of SRW infrastructure immediately upstream of the Geelong Rd Freeway at Spur 4 and the Main Channel of the WID reticulation system. The recycled water mixes with river water at these points and flows through SRW's open channel system. To manage the salinity in the recycled water from 2004 to 2009, customers of recycled water, will be supplied a mix of river water and Class A recycled water (i.e. Shandied water) as per the seasonal allocation and the shandying rules of the Recycled Water Scheme as specified in the Irrigation Management Plan (RMCG and URS 2004). The shandy rules are discussed further in Part C (Page 13).

SRW customers that have not contracted for recycled water will receive the seasonal allocation from the river water for irrigation.

A3. Roles and responsibilities

Regardless of the land owner/operator situation, there are particular people who are responsible for specific aspects of using recycled water:

1. If the signatory to the Customer Supply Agreement (CSA) is both owner and operator of the property:
    - He/she is responsible for both preparing the CSMP and then complying with it
2. If the signatory to the CSA is the owner of the property, but not the operator:
    - The operator is responsible for complying with the CSMP
    - The owner and the operator can agree which of them will prepare the CSMP
    - BUT SRW will need to approve the assignment of the agreement to the operator, and such approval will reflect the decision of the owner and operator as to who will prepare the CSMP
3. If the signatory to the CSA is the operator of the property but not the owner:
    - He/she is responsible for both preparing the CSMP and then complying with it
    - The owner will need to give written approval for the use of recycled water on the land

A4. Purpose and quality of Class A recycled water

Class A classification is based on microbiological parameters. From a microbiological perspective, Class A recycled water is appropriate for use on all horticultural crops. As with river water, Class A recycled water is <u>not</u> suitable to be supplied as drinking water (DHS Victoria 2004).

Recycled water is acceptable for on-farm produce washing. However, individual growers must ensure that this practice is permitted under any Quality Assurance or HACCP programs that they must comply with. Under the Victorian Food Act, Class A recycled water or any non-potable water (eg river water) cannot be used during processing and food preparation. Food processing includes any slicing, peeling and cooking of the product (DHS Victoria, 2004).

EPA guidelines specify that recycled water has no restrictions from a health aspect with respect to irrigation method. EPA guidelines also specify that the use of recycled water must be sustainable from an agricultural perspective and must not result in negative environmental impacts. The Irrigation Management Plan (IMP) and the WID Regional Environmental Improvement Plan (EIP) have been developed for the Werribee Irrigation District to ensure these requirements are met. These documents provide a rigorous scientific review to ensure a sustainable system will be developed and a plan for the District to follow best management practices for the use of recycled water. From an agricultural aspect, these documents assessed that the recycled water quality is suitable for the soil types and crops grown in the region, if best management practices are adopted.

There is no issue with consuming fish taken from Class A recycled water. However, chlorine from the disinfection process, similar to many drinking water treatment processes, may cause the death of fish, as the chlorine affects the functionality of their gills. Any fish found dead in any water source should be considered as unfit for human consumption.

The Chief Veterinary Officer for Victoria has specified that pigs must not be fed or exposed to pastures, fodder or produce irrigated with recycled water, and should not be allowed to drink recycled water. This reflects a risk management approach that has been taken in Australia to ensure there is no risk of a tapeworm cycle between humans and pigs being established, as has occurred in other countries.

Part B. Customer Site Management Report

To be completed initially and then annually by users of recycled/shandied water as part of the Werribee Irrigation District Recycled Water Scheme and stored confidentially by SRW.

(A separate form is required for each designated property)

Land Ownership Details *(Full name of the person specified on the land title)*	
Contact details of Land Owner	*Phone*
	Fax
	Mobile
	Email
Address *(Postal and home address of Land Owner)*	
Property Details *(Crown allotment(s) where recycled water used)*	
Recycled Water Entitlement Owner *(Full name of the person that has signed the Customer Supply Agreement)*	
Contact details of Customer *(Name of person who's signature appears on the Customer Supply Agreement)*	*Phone*
	Fax
	Mobile
	Email
Contact Details of Operator *(Person who farms the land)*	*Name*
	Phone
	Fax
	Mobile
	Email

Compliance checklist – Initial and annual *The following is to be completed as part of the initial CSMR and annually thereafter*	**Yes**	**No**
The areas of the property where recycled water will be used have been specified on the site map provided by SRW (Section C1, Page 12).	☐	☐
The customer or their nominee will attend (or has attended) the compulsory Information Session as outlined in Section C3 (Page 13).	☐	☐
All sprinklers on the boundary of the property are direction adjustable or shielded so they are directed within the property boundaries (Section C4, Page 18).	☐	☐
All recycled water pipes within 10 m of potable water pipes of comparable size and material type have been painted lilac or wrapped in lilac tape (Section C7, Page 19).	☐	☐
I will allow baseline soil samples to be sampled by SRW or their representative before irrigation with any recycled water commences (Section C10, Page 20).	☐	☐
I have read this document in full (i.e. Parts A, B and C) and understand my obligations.	☐	☐
Compliance checklist – Annual *The following are to be completed as part of the annual CSMR (not for the initial CSMR).*	**Yes**	**No**
Recycled water was only applied to the areas specified on the site map in the Customer Site Management Plan (Section C1, Page 12).	☐	☐
Annual soil samples have been sampled by SRW.	☐	☐
Storage and Distribution of recycled water was carried out in accordance with this Customer Site Management Plan such that overflows or offsite discharges from storage or distribution systems were minimised.	☐	☐
Water volume used and nutrient loadings were recorded and reported (Table B.1, Page 9), and were consistent with the crop/plant water and nutrient balances discussed in the information session and outlined in Section C3 (Page 12).	☐	☐
There has been no evidence of onsite or offsite land degradation (eg. waterlogging, high water tables, soil salinity, plant growth damage) associated with the Customer's recycled water use activities.	☐	☐
Recycled water was only used for approved uses as defined in Section A4 (Page 5).	☐	☐
All staff and visitors entering the property were informed not to drink any irrigation water (Section C8, Page 20).	☐	☐
All incidences have been reported to SRW (Section C9, Page 20).	☐	☐

Table B.1 Crop grown, yields and water usage

Crops grown during CSMP reporting year	Total area of crop grown (ha or acres)	Water used for crop (ML)	Fertilisers used and quantity used (define units eg t/ha or kg/ha)					
1.								
2.								
3.								
4								
5								
For example Broccoli	37.5 ha	35 ML	Ammonia Nitrate 1.0 t/ha	Fowl Manure 2.0 t/ha	CaNO3 1.2 t/ha	If required	If required	If required

Note: A crop is considered to be one particular plant grown over a specified area.

The data collected in the above table will be collated into “District Averages” by SRW in conjunction with DPI, and will contribute to the annual report that SRW is required to submit to the EPA.

The completion of this table serves two main purposes.

- It provides a high level of assurance to the EPA that the Customer is aware of their management practises, and therefore balancing fertiliser and water use.
- It also provides a record of this good management practise, which will help protect the customer from litigation.

The Customer, to the best of their ability, is required to estimate the annual crop water use, fertiliser use, and number of crops, for the reporting period in the above table.

Land Owners and/or Customers who sign this Customer Site Management Plan will be accepting the responsibility to review the Customer Site Management Plan annually, to help ensure the sustainability of recycled water use and submit the CSMR annually.
Owner/operators must also allow Southern Rural Water or their representative to conduct at least one site visit per annum to audit performance against the CSMP (i.e. To confirm for the EPA that the compliance checklist is accurate).

Non-compliance

In the event of a reported non-compliance (see checklist above), any or all of the following actions may apply:

Non - compliance will be discussed with the customer, corrective actions determined and customers will work with SRW or their representatives to overcome the non-compliance issue.

- These actions must be implemented by the customer.
- If non - compliance is repeated and corrective actions are not implemented, the customer may lose access to shandied water.

I, the Land Owner, have read this document in full and understand my obligations and agree to comply with them, and I approve of the use of recycled water on my property		**Yes**	**No**
Print full name of Land Owner			
Signature of Land Owner	Date	/ /	
Witness (*required if Landowner is not the Operator*)	Date	/ /	
(Print witness name)			

I, the Customer, have read this document in full and understand my obligations and agree to comply with them.		**Yes**	**No**
Print full name of Customer			
Signature of Customer	Date	/ /	

I, the Operator, have read this document in full and understand my obligations and agree to comply with them. *(If the Customer is the Operator circle as above)*	As above	**Yes**	**No**
Print full name of Operator			
Signature of Operator	Date	/ /	

For SRW use only

SRW has inspected this property and it adequately complies with the requirements of the CSMP	**Yes**	**No**	Date	/ /
SRW representative (Print full name) Position (Print full description)				
Signature (SRW representative)			Date	/ /

Part C. Customer Site Management Plan

This section highlights specific items that must be read, understood and implemented before recycled water can be received.

C1. Property maps

Southern Rural Water will provide to the Land Owner a schematic layout of each property referred to in Part B (Page 7). For each property, to help satisfy EPA requirements, the Land Owner is required to mark the following items (where applicable) on this map:

1. Irrigated area boundaries and property boundary
2. Water pipelines – irrigation and potable
3. Buildings and water storage facilities
4. Major soil types. For example, sandy loam (light), loam (medium), or clay loam (heavy). See Table C.5, Page 17 for major soils types in the WID.

C2. Storage of recycled water

This CSMP does not place any additional controls on how water is stored in your dam, however growers should note that leaking farm dams can contribute to significant water (i.e. greater than 30 cm or 12 inches in 24 hours) and nutrient losses to groundwater. On-site dams that leak and lose significant quantities of water should be lined with a well-compacted low permeability clay liner to improve storage efficiency and minimise contribution to groundwater. If the monitoring undertaken by SRW detects detrimental impacts on groundwater from leaky dams, any dams that leak more the 30 cm in one 24 hour period will need to be modified to prevent leakage.

There are no restrictions on the time shandied water can remain in your dam, but one method of controlling algae growth is to minimise the stagnate water that remains in your dam between irrigation periods (See information sheet on “Managing Algae”).

Overflow from dams should be avoided to prevent nutrients or chloramine releases to Werribee River and Port Phillip.

C3. Irrigation Management

In order for the WID to be sustainable, the operator is required to irrigate in a way that:

- Maintains or improves water, salinity and nutrient balances
- Minimises pooling of water and decreases the risk of run-off
- Prevents the excessive accumulation of nutrients in soils and leaching of nutrients to groundwater
- Avoids long term degradation of soil health, such as erosion, salinity and sodicity.

To assist customers to demonstrate good practice when using recycled water, a **compulsory information session** will be held for all Customers (farmers/growers) as a requirement for the use of recycled water.

The information session will be designed to help maximise the benefits from recycled water and minimise its incorrect use and may include topics such as best practice for irrigation scheduling and uniformity, and managing soil nutrient, salinity and sodicity. The cost of these sessions will be fully funded by Government.

As a minimum requirement, the Customer who signs this CSMP (or their nominee) must attend the compulsory information sessions within one year from signing the Customer Supply Agreement (CSA).

Irrigation rates and scheduling

Good irrigation management includes understanding crop and soil requirements and watering within acceptable limits of these crop and soil factors. Too much watering will result in poor water efficiencies and excessive leaching of nutrients off-site, whilst too little watering will result in build up of salts in the soil and/or smaller crop yields. Good practise is to use systems that automatically turn off your irrigation cycle.

Shandying rules

From 2004 – 2009 the recycled water from Melbourne Water will be diluted with river water where possible to meet the desired water salinity target.

Table C.1 Salinity of shandied water that can be supplied given a range of water allocations relative to river water salinity

		Seasonal Water allocation	Expected frequency in 30 years	Salinity target	
				ECw (µS/cm)	TDS (ppm or mg/L)
Water allocation model	**1**	**100% +**	**27 years**	**Less than 1000**	
	2	*75%-99%*	*1 year*	*1400+*	*850*
	3	*51%-74%*	*1 year*	*1600+*	*970*
	4	*Up to 50%*	*1 year*	*1800+*	*1100*

ECw = electrical conductivity of water

Note: in winter when the river water salinity increases, dilution may not be possible to meet the target ECw. Waterline will advise all recycled water customers if water salinity changes from the target ECw.

Table C.2 Typical water source and salinity experienced in the WID

Water Source	**ECw (µS/cm)**	**TDS (ppm)**
River Water	650 - 1700	400 - 1050
Groundwater	2000+	1260+
Shandied Water to 2009	Up to 1800	Up to 1100
Shandied Water post 2009	≤ 1000	≤ 610

Note: The pre 2004 average flow-weighted salinity for the Werribee Irrigation District was an ECw of about 1000 (µS/cm)(RMCG and URS 2004).

ECw = Electrical Conductivity of water from various sources. TDS = Total Dissolved Salts. ppm = parts per million = mg/L

Nutrients

To manage the nutrients that can be received with recycled water the aim is to have them utilised in plant growth and removed from the site in plant product. The desired outcomes are:

- The applied nutrients (recycled water, shandied water and fertiliser applied) are utilised for plant growth and/or remain in the soil for future uptake by plants
- Excess nutrients are not applied late in the growth cycle where growers may wish to limit nutrient supply to some crops
- The applied nutrients do not build up in the soil to a level where they cause an adverse impact on beneficial use on-site or off-site (via surface runoff or leaching to groundwater).

Significant shandying of recycled water with river water from 2004 to 2009 means that nutrients applied during this period are minimal (Table C.3). When the salinity level of recycled water supplied by Melbourne Water is reduced to 1000 μS/cm in 2009, the amount of nutrient applied will change (increase). This is due to the amount of shandying with river water being decreased to still meet the ECw salinity target of 1000 μS/cm. Nutrient management will be reviewed again in 2009 when this change takes place.

Table C.3 summaries nutrient balances calculated from the IMP (RMCG and URS 2004) and the literature:

- Shandied water will provide significantly less than the total amount of nitrogen (N) and phosphorus (P) removed by crops grown in the WID
- The amount of fertiliser commonly applied during planting in the WID results in application of more nutrients than are removed by the crop. This could be required to maximise seedling establishment and crop yields. However, it could also lead to excess nutrient in the soil, which could lead to detrimental effect on plant growth and detrimental off-site environmental impacts. These impacts can be minimised by soil and/or plant sap testing combined with nutrient budgeting that avoids applying more nutrients than required, potentially reducing fertiliser requirements and their associated costs.

Table C.3 Estimates of average nutrient balance of crops grown in the Werribee Irrigation District

	Applied in shandied water[A]			Applied in fertiliser planting[B]			Harvest[C]	Removed in harvest[C]		
	N	P	K	N	P	K	Yield	N	P	K
Crop	kg/ha/crop			kg/ha/crop			t/ha/crop	kg/ha/crop		
Broccoli	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	45	7	90
Cauliflower	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	24	5	45
Lettuce	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	20	4	36
Onions	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	18	4	30
Cabbages	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	29	5	29
Celery	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	16	4	37
Lucerne	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	10	40	40	62
Artichokes	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	na	na	na	na
Fennel	9 (36)	5 (23)	12 (52)	115-259	25-55	70-109	na	na	na	na

Assumes: [A] 2.5 ML/ha/crop, shandied water nutrient load calculated assuming 1 part recycled water: 4 parts river water (Short term shandied water; RMCG and URS 2004). Values in brackets are average nutrient concentrations for shandied water after 2009 when the salinity of recycled water is decreases (assumes 1 part recycled water:0.2 parts river water)
[B] Estimates of fertiliser applied nutrients and removal are from ANZECC and ARMCANZ (2000), RMCG and URS (2004) and Sceswell and Huett (1998)
[C] Harvest yields for most crops are approximately 20 t/ha/crop (i.e. If your yield is 25 t/ha then multiply NPK removed in harvest by 2.5)
N = nitrogen, P = phosphorus, K = potassium
na – not available

Salinity and sodicity

Investigations show that soils in many parts of the WID are saline and sodic due to elevated groundwater salinity and SAR, and elevated river water salinity during some parts of the year. Currently, many growers manage this through leaching and application of calcium nitrates and gypsum. Soil salinity should also be managed through applying appropriate leaching fractions during irrigation to maintain soil salinity at appropriate levels for the crop to be grown (Table C.4). The maximum leaching fractions that can be managed by the soil of the Werribee Irrigation District are listed in Table C.5.

The ideal leaching fraction for using the shandied water of ECw 1000 µS/cm ranges from 4 to 10% and shandied water of ECw 1800 µS/cm ranges from 7 to 20%, depending on the crops grown and their tolerance to salinity (Table C.4). Most soils in the WID can receive these leaching fractions (Table C.5), but site-specific tests should be undertaken if you have not irrigated with water of this salinity before.

Irrigation water salinity can also cause damage directly through sprinkler application of water making direct contact with plant leaves. In this case, plants are generally more sensitive to the salinity and if irrigation methods are used where irrigation water comes in direct contact with the plant, the salinity of the irrigation water may need to be lower (eg lettuce in Table C.4). Direct plant damage from salinity can also be managed with calcium nitrate application, more frequent watering, and by watering at night. If not managed correctly, higher salinities may lead to slightly smaller yields (eg 90% of maximum yield; Table C.4) or effect crop quality (eg leaf tip burn). For example, in Table C.4 the soil salinity threshold for lettuce in 1300 ECse (µS/m) yet the plant sensitivity to irrigation water with overhead application is 900 ECw (µS/m). If the higher salinity is not managed well this may impact lettuce yield or quality.

Table C.4 Leaching requirements for irrigation water salinity to maintain soil salinity at levels where yields are not compromised (i.e. below 100% yield threshold) and prevent damage from overhead application of irrigation water

				Ideal leaching fraction of two Irrigation water qualities[A]		Irrigation water salinity threshold for direct toxicity to plant leaves from overhead application			
	Soil salinity threshold (ECse, µS/m)			1000 uS/cm ECw	1800 uS/cm ECw .	100% yield			90% yield
Crop	100% yield	90% yield	75% yield	Leaching fraction[A] (%)	Leaching fraction[A] (%)	ECw (dS/m)	ECw (µS/cm)	TDS (ppm)	ECw (µS/cm)
Broccoli	2800	3900	5500	4	7	1.9	1900	1150	2600
Cauliflowers	2500	na	na	5	8	0.9-2.7	900-2700	600-1850	
Lettuce	1300	2100	3200	9	17	0.9	900	600	1400
Onions	1200	1800	2800	10	19	0.8	800	550	1200
Cabbages	1800	2800	4400	7	12	1.2	1200	800	1900
Celery	1800	3400	5800	7	12	1.2	1200	800	2300
Lucerne	2000	3700	5200	7	12	1.3	1300	900	2200
Fennel	1100	na	na	11	21	na	na	na	na

na – not available, ECse = electrical conductivity of soil saturation extract ECw = electrical conductivity of irrigation water.
A To maintain soil salinity at 100% yield target. 1000 µS/cm = 1 dS/m = 610 TDS ppm or mg/L (may vary slightly depending on water source). Data extracted from the WID Irrigation Management Plan, ANZECC and ARMCANZ (2000) and Grattan (2002).
[A]Leaching fractions are the fraction of water that passes through the root zone when irrigating, they are commonly use to manage salinity. If you are unsure what a leaching fraction is they will be discussed at the information sessions or contact SRW.

Table C.5 Major soil types of the Werribee Irrigation District and their agricultural capacity

Soil type	Soil Class	Crop suitability	Potential leaching fraction
Werribee Fine sandy Loam (light)	Class I	Suitable for most vegetables except asparagus and some specialty vegetables	>20%
	Class II		12-20%
Werribee Loam (medium)	Class II	Suitable for most vegetables except asparagus and some specialty vegetables	12-20%
Duetgam fine sandy loam (light)	Class I	Suitable for most vegetables except asparagus and some specialty vegetables	>20%
	Class II		12-20%
Hopper clay loam (heavy)	Class II	Suitable for most vegetables except asparagus and some specialty vegetables	12-20%
	Class III		8-12%

Note:

- Werribee soil type - The topsoil of the Werribee Series consists of 10-30 cm of brown fine sandy loam to sandy loam. Subsoils are red-brown clays passing into fine sandy clays below 50 cms.
- Deutgam soil type - This soil is similar to the Werribee loam, although slightly heavier in texture in the upper profile. Below 50cm depth light clay with lime occurs.
- Hopper soil type - The topsoil is brownish grey clay loam that passes gradationally to a weakly mottled yellow/brown, red and brownish grey light clay between 40-65 cm depth. Below this, plastic yellow/grey clay occurs.
- From McGuckian (2003)

Soil sodicity (measured by SAR or ESP) should be managed by addition of calcium amendments, as recommend by your agronomist. Sodium Adsorption Ratio (SAR) of shandied water will be approximately 8, with salinity (ECw) of 1000 μS/cm usually. The SAR will not change significantly if the ECw ranges up to 1800 μS/cm in very dry years (See Shandying rules, Page 13). If the shandied water is greater than an ECw of 1000 μS/cm SRW will notify growers via *Waterline*. This represents a slight to moderate risk of problems with infiltration of water into soils. However, as this is no different to current practices on the soils of the WID with river water and better than some groundwater, changes with infiltration problems should not occur. If the SAR of the irrigation water exceeded 12, there would be severe restrictions on the use of irrigation water. This is not the case with shandied water which has an SAR of approximately 5 to10 (RMCG and URS 2004).

General good agricultural practice for use of shandied water in the WID would be:

- Annual soil sampling to monitor and manage soils salinity, sodicity and nutrient levels so as to prevent degradation of soils on-farm and minimising negative off-site impacts
- Maintain soil salinity below an ECse of 1200 to 2800 μS/cm (1.2 to 2.8 dS/m) depending on crops grown (see Table C.4)

- If soil salinity rises, management practises such as irrigating during the night and maintaining a moist growing environment (particularly on hot days) may help minimise salinity effects
- Maintain soil Exchangeable Sodium Percentage (ESP) below 6. Lettuce and onion are assumed to not suffer from toxic impacts unless the ESP is between 15 and 40, however, soil structural problems may occur at soil ESP's greater than 6
- If soils ESP increases above 6, this could be managed by applying gypsum or calcium nitrate to the soil and leaching before planting
- Scheduling irrigation to achieve maximum yield, including approximately a 10% leaching fraction (Table C.4), and stopping irrigation automatically.

Because of the farm specific nature of agronomic recommendations please consult your agronomic advisor for detailed, site-specific assessments.

C4. Overhead spray and spray drift

Best Management Irrigation Practice currently recommends spray onto roads and neighbouring properties under normal irrigation conditions to be minimised. This is to ensure water efficiency is maximised and to keep nutrients on-site (i.e. Best Practice).

As a minimum requirement, no overhead spray should be directed onto a neighbouring property, public land or public roadway. Sprinklers at the boundary of the property must have direction adjustable spray heads or shields so irrigation is directed within the farm boundaries.

Spray drift is the finer atomised particles of a spray stream that can move easily in air currents. Spray drift can and will move away from the target area where irrigation is being applied, and the stronger the wind, the greater the movement. Spray drift can be minimised by careful nozzle and operating pressure selection.

Good irrigation practice includes:

- If possible, avoid watering under strong wind conditions
- Using spray heads and pressures that prevent fine mist generation.

If it can be demonstrated that the irrigator has undertaken appropriate management techniques, described above, to minimise spray drift, any other spray drift will be considered acceptable for crop production.

When using Class A recycled water the use of buffers between irrigation areas and property boundaries is not required (Melbourne Water and SRW 2004).

C5. Drainage and runoff controls

It is a requirement of this Customer Site Management Plan that you minimise irrigation runoff from your property (i.e. Preferably there is no runoff). Runoff caused by irrigation presents a risk to neighbouring land and environmentally sensitive waterways. Many irrigators are already minimising runoff (0 - 5%). To help minimise runoff, to the extent that is practical, good practise options are to:

- Minimise irrigation prior to a storm event
- Stop irrigation if heavy rainfall is experienced
- Avoid excessive irrigation, which leads to pooling of water on the soil surface.

This can be managed through irrigation scheduling:

- Inspection of soil moisture and plant condition
- Monitoring of climatic conditions (rainfall and evaporation), which can be converted into plant demand using crop factors
- Use of soil moisture monitoring equipment.

It can also be managed by improving drainage characteristics of soils by maintaining good soil structure through addition of organic matter or calcium based amendments to keep soil ESP low (See Section C3 Salinity and sodicity, Page 12). Good fertiliser management also reduces the potential nutrient loads that may be lost from the farm via leaching or drainage off-site. If it can be demonstrated that the irrigator has undertaken appropriate management techniques, described above, to minimise runoff and some runoff is still required to manage their particular soils or crops, this runoff will be considered acceptable.

C6. Algal management

The recycled water and river water mix will have an increased nutrient load compared to existing irrigation water supplies. The storage of relatively nutrient rich irrigation water in farm dams presents a moderate risk of increased blue green algae outbreaks in these dams. However, the presence of chloramines from the disinfection process may in fact reduce this frequency.

The Customer is responsible for managing any algal blooms that occur in private dams. Recycled water is nutrient enriched, which may increase the frequency of algal blooms. Information on preventative and corrective actions for managing algae can be found in the Managing Algae Information Sheet provided by SRW.

C7. Signage and pipe identification

The strategic and prominent positioning of signs throughout the WID in compliance with AS 1319 Safety Signs for the Occupational Environment, will state "*Irrigation District – Do not drink irrigation water"*. Irrigators will need to ensure all staff and other people entering their property are made aware of this, as per Occupational Health and Safety requirements.

In order to prevent cross contamination, if recycled and potable (drinking) water pipelines are within 10 metres of each other and are of comparable size and material type:

- **Any above ground plumbing carrying recycle water must be coloured lilac or wrapped in lilac tape.**
- **Recycled water taps that may be confused with drinking or final wash water must also be coloured lilac.**

The official 'lilac' colour (Table C.6) for pipes carrying recycled water (including shandied water) is P23 from the Australian Standards 2700S 1996 or equivalent. Paint meeting this criteria can be obtained from SRW.

Table C.6 Colour similar to P23 from the Australian Standards 2700S 1996 for pipes carrying recycled or shandied water

C8. Good practice, health and safety

As with river water, workers must be informed that the water used for irrigation is unsuitable for drinking. If you have any lilac coloured taps you must also ensure staff are aware that this water is not suitable for drinking.

Workers who have handled Class A recycled water do not specifically need to wash their hands before eating or smoking. However it is always wise to wash hands after undertaking farming activities, as pathogens can be present in soils, fertilisers (for example compost or manure) and other irrigation water sources.

Workers should not be concerned about working with Class A water. In evaluating the use of Class A water for the irrigation of crops, the Department of Human Services Victoria have considered the risks of breathing in or swallowing small amounts of Class A water and determined that it was safe. Clothes that have become wet with Class A water are safe to wear.

Please note that toxin producing blue-green algae blooms in irrigation systems such as the WID are extremely rare. However, if there is a suspected blue-green algae bloom in any water source, it is unsafe to come in contact with this water sources (see the Managing Algae Information sheet provided by SRW).

C9. Incidents

The following items are deemed to be incidents with respect to dealing with shandied water and must be reported immediately to SRW (contact SRW on (03) 9974 4710):

- Significant leaks or overflows from the shandied water storage dams
- Discharges of shandied water to rivers or creeks
- Contamination of potable water supply by shandied water
- Soil salinity, sodicity or acidity problems by use of shandied water.

If an incidence leads to non-compliance by a Customer the action taken by SRW is outlined in Part C (Non-compliance, Page 10). The general response protocol is outlined below in the Customer Site Management Report - Non-compliance (Page 10). A detailed response strategy to be followed by SRW is documented in the EIP.

C10. Monitoring and reporting

Using the template (Part B, Page 7) you will be required to submit an initial and annual confidential report on your property as part of the Customer Site Management Plan. This form will be supplied to all Land Owners who have contracted for supply of shandied water annually. This can either be downloaded from SRW's web site at www.srw.com.au or it will be posted to you. The CSMR **must be completed** and submitted to SRW by 31st October each year.

Soil Monitoring

The Irrigation Management Plan and EIP requires that **soil samples must be taken** before irrigation with recycled water commences and annually thereafter. The number of samples required will depend on the size of your farm and the range of soils type in the areas were recycled water will be used. Usually one bulked sample per soil type, per farm, per year will be required and the soil sample must be taken at a similar time each year from the same area using 5 cm cores and sampling to 100 cm deep. Baseline soil samples will be archived

by SRW for future reference. SRW will implement and manage the annual sampling and analysis.

These results will be available to growers for their records and will include analysis summaries in Table C.7. SRW will ensure that these tests are undertaken and it will be necessary for the appointed contractor to access your farm/s. Initial soil sampling and analysis will be funded by the Government. Future tests will be managed by SRW and cost recovered through annual water pricing.

Table C.7 Summary of soil sample analysis to be undertaken

No.	Soil test
1.	pH (1:5 soil:water)
2.	Salinity (Electrical Conductivity, 1:5 soil:water) and ECse calculated.
3.	Olsen P (Plant available P)
4.	Nitrate N (Plant available N)
5.	Total cation concentration and exchangeable Ca, Mg, Na, K and ESP.
6.	Clay dispersion (Emerson)
7.	Total cadmium (mg Cd/kg soil on a dry weight basis)

Groundwater monitoring

Southern Rural Water will continue to conduct ongoing groundwater monitoring in the area to manage this water resource. From time to time SRW may request access to your property to take a water quality sample from your bore.

References

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Glossary & Abbreviations

Appendix G

ASSP	Annual Soil Sampling Plan (for Customer Sites)
BOD	Biological Oxygen Demand
BRWA	Bulk Recycled Water Agreement
BSA	Bulk Sewerage Agreement
CCP	Critical Control Point
CEC	Cation Exchange Capacity
COA	Certificate of Analyses
CSC	Customer Supply Contract
CSMP	Customer Site Management Plan
CVO	Chief Veterinary Officer (DPI)
CWW	City West Water
DHS	Department of Human Services
DPI	Department of Primary Industries Victoria
DSE	Department of Sustainability and Environment Victoria
EC	Electrical Conductivity
EPA or EPA Victoria	Environment Protection Authority Victoria
ESP	Exchangeable Sodium Percentage
HORS	Head of Road storage
IMP	Irrigation Management Plan
MOU	Memorandum of Understanding
MW or MW	Melbourne Water Corporation
NATA	National Association of Testing Authorities
NV	Newer Volcanics
PPB	Port Phillip Bay
REIP	Regional Environment Improvement Plan
RWP	Recycled Water Plant
RWQMP	Recycled Water Quality Management Plan
RWQMS	Recycled Water Quality Management System
SAR	Sodium Adsorption Ratio
SEPP	State Environment Protection Policy

Appendix G Glossary & Abbreviations

SEW	South East Water
SIP	Soil Improvement Plan (for WID Customer Soils)
SOB	State Observations Bores
SRW	Southern Rural Water (trading name of the Gippsland and Southern Rural Water Corporation, which is a statutory rural water corporation established under the provisions of the Water Act 2007)
SS	Suspended Solids
TRC	Total Residual Chlorine
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids (same meaning as “SS”)
UV	Ultra Violet
WAG	Werribee Agriculture Group
WCC	Wyndham City Council
WD	Werribee Delta
WID	Werribee Irrigation District
WSPA	Water Supply Protection Area
WTP	Western Treatment Plant
YVW	Yarra Valley Water

Incorporated Documents & References

Appendix H

A list of important incorporated documents referred to in this REIP is given below:

Melbourne Water 2008	Recycled Water Quality Management Plan. Production and Supply of Class A Recycled Water – Western Treatment Plant. 18th April 2008 Version 3.1
SRW December 2006	Werribee Tourist Precinct Recycled Water Scheme Overall EIP (RMCG, December 2006)
SRW March 2006	Environment Improvement Plan Werribee Open Range Zoo (RMCG March 2006)
SRW March 2006	Environment Improvement Plan Parks Victoria – Werribee Park and Mansion (RMCG March 2006)
SRW March 2006	Environment Improvement Plan Werribee Park Golf Club (RMCG March 2006).
SRW June 2007	Environment Improvement Plan National Equestrian Centre (RMCG June 2007)
SRW and MW 2004	Use of Recycled Water in the Werribee Irrigation District. Regional Environmental Improvement Plan (Revision J – Endorsed, 1 November 2004)