Managing Water. Serving Communities.

ANNUAL REPORT 2011/12

Regional Environmental Improvement Plan
Werribee Irrigation District
Recycled Water Scheme

1 October 2012

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1. Introduction

The Werribee Irrigation District (WID) is an important vegetable growing area on the western fringe of metropolitan Melbourne. Historically the district has relied on water from the Werribee River and the Deutgam Aquifer to support up to 200 growers producing predominantly lettuce, broccoli and cauliflower for local consumption and export.

The WID Recycled Water Scheme was announced on 8 January 2004 to overcome a severe water shortage due to drought and offer a secure water supply for future production. The project involved a $20 million investment comprising: an upgrade to Melbourne Water's Western Treatment Plant, building a connecting pipeline into the WID, completing an environmental investigation and developing an operational framework. The first deliveries of Class A recycled water were made in January 2005.

Recycled water is produced by Melbourne Water (MWC) at the Western Treatment Plant and supplied to participating customers by SRW through its existing irrigation channels and pipelines. The Department of Health (DHS) requires an extensive verification process to ensure that Class A quality can be guaranteed and has endorsed MWC recycled water as Class A.

During the 2011/2012 season the surface water allocation was as follows:

Date	High Reliability Water Share	Low Reliability Water Share	Stored for 2012/13 season
7-Jul-2011	100%	5%	30%
15-Jul-2011	100%	15%	30%
9-Aug-2011	100%	15%	35%
6-Sep-2011	100%	20%	35%
4-Oct-2011	100%	20%	40%
18-Oct-2011	100%	25%	40%
15-Nov-2011	100%	25%	45%
1-Dec-2011	100%	30%	45%
10-Jan-2012	100%	35%	50%
6-Mar-2012	100%	45%	50%
30-May-2012	100%	50%	50%
12-Jun-2012	100%	75%	60%

Table 1-1 Allocation 2011-12 season

The seasonal allocation started at 100% of entitlement with low reliability water share also available for the entire year. Conditions remained good for harvesting in the latter half of 2011 and early 2012 leaving the storages full at the end of the season. Groundwater has remained at 2010-11 levels although extraction rates have not been high due to the abundant supply of river water and with frequent rainfall throughout the season.

There was no recycled water delivered to customers in 2011-12. Recycled water supply contracts lapsed on 30th June 2011 and the decision to renew them was delayed whilst Melbourne Water investigated dicamba and MCPA, herbicides contained in many consumer lawn treatments, which were detected in very low concentrations in the in-flows to the Western Treatment Plant.

Monitoring programs outlined in the REIP have continued to be conducted where required and the results indicate that levels of nutrients and salinity passing to the environment do not vary significantly when only river water is being used for irrigation. This hopefully will provide us with insight as to the real effects of irrigating with recycled water versus the concerns expressed when the scheme was commenced in 2005.

SRW continues to examine options for modernising the infrastructure supporting the WID and is continuing to communicate with the Minister for Water in this regard. New recycled water supply contracts have been drafted, with customer consultation, for the recommencement of deliveries in the 2012-13 irrigation season. The total volume of recycled water usage forecast for 2013 (1,850 – 3,700ML) onwards is much less than in the peak usage years of 2009 & 2010 (>13,000ML)

The demand for recycled water from industry and residential developments has continued to increase and City West Water have started development on a salt reduction facility at the WTP where they will treat a small volume of A-Class water and shandy it back into the supply. Options are also being explored to store the treated A-Class water in the aquifer below the WTP to cope with demand fluctuation. Melbourne Water, City West Water and SRW continue to collaborate on ways to optimise and improve the production and delivery of recycled water in a cost effective manner.

2. WID Inflows

The following table details the inflows of all water sources into the WID during 2011-2012, and includes the average weekly salinity monitored in the Main Channel as well as the system efficiency.

Week Commencing	River Into District (HR/LR)	Recycled into District	Total into District	High Reliability	Low Reliability	Recycled delivery	Outfalls	Total Deliveries	Rainfall	Efficiency	Mean EC Level (Main Channel)
4/07/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	0.00	700
11/07/2011	216.2	0.00	216.2	123	0.00	0.00	.41	123.41	10	57.08%	700
18/07/2011	69	0.00	69	30.9	0.00	0.00	0.00	30.9	6	44.78%	800
25/07/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%	700
1/08/2011	165.3	0.00	165.3	105.8	0.00	0.00	4.32	110.12	.4	66.62%	600
08/08/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%	800
15/08/2011	128.2	0.00	128.2	61.6	0.00	0.00	.23	61.83	13	48.23%	900
22/08/2011	184.6	0.00	184.6	107.45	0.00	0.00	1.3	108.75	0.00	58.91%	600
29/08/2011	177.5	0.00	177.5	117.45	0.00	0.00	.48	117.93	0.00	66.44%	700
05/09/2011	260	0.00	260	154.45	0.00	0.00	.27	154.72	0.00	59.51%	700
12/09/2011	191.03	0.00	191.03	89.2	0.00	0.00	1	90.2	0.00	47.22%	900
19/09/2011	239.37	0.00	239.37	142.35	0.00	0.00	1.11	143.46	2.4	59.93%	900
26/09/2011	342.36	0.00	342.36	198.5	0.00	0.00	1.05	199.55	32.2	58.29%	1000
3/10/2011	71.05	0.00	71.05	34.34	0.00	0.00	.09	34.43	0.00	48.46%	900
10/10/2011	214.56	0.00	214.56	116.56	0.00	0.00	.54	117.1	0.00	54.58%	950
17/10/2011	387.8	0.00	387.8	228.35	0.00	0.00	1.52	229.87	2	59.28%	700
24/10/2011	132.94	0.00	132.94	71.28	0.00	0.00	.46	71.74	0.00	53.96%	700
31/10/2011	195.6	0.00	195.6	101.19	0.00	0.00	.83	102.02	0.00	52.16%	1000
7/11/2011	156.46	0.00	156.46	94.24	0.00	0.00	2.35	96.59	0.00	61.73%	700
14/11/2011	164.15	0.00	164.15	83.6	0.00	0.00	.48	84.08	0.00	51.22%	1000
21/11/2011	215.47	0.00	215.47	138.34	0.00	0.00	.66	139.00	0.00	64.51%	1000
28/11/2011	72.6	0.00	72.6	32.96	0.00	0.00	1.88	34.84	74.5	47.98%	700
5/12/2011	388.7	0.00	388.7	232.74	0.00	0.00	2.54	235.28	0.00	60.53%	700
12/12/2011	249.76	0.00	249.76	150.22	0.00	0.00	5.65	155.87	0.00	62.41%	1000

Week Commencing	River Into District (HR/LR)	Recycled into District	Total into District	High Reliability	Low Reliability	Recycled delivery	Outfalls	Total Deliveries	Rainfall	Efficiency	Mean EC Level (Main Channel)
19/12/2011	398.81	0.00	398.81	252.05	0.00	0.00	6.65	258.7	0	64.87%	800
26/12/2011	421.65	0.00	421.65	312.95	0.00	0.00	3.33	316.28	0.00	75.01%	900
2/01/2012	552.95	0.00	552.95	362.39	0.00	0.00	10.3	372.69	4.6	67.4%	800
09/01/2012	411.69	0.00	411.69	291.59	0.00	0.00	3.61	295.2	9.0	71.7%	900
16/01/2012	605.58	0.00	605.58	410.23	0.00	0.00	1.47	411.7	0.00	67.98%	900
23/01/2012	579.58	0.00	579.58	418.92	0.00	0.00	5.24	424.16	0.00	73.18%	900
30/01/2012	567.83	0.00	567.83	391.23	0.00	0.00	13.8	405.03	0.00	71.33%	900
06/02/2012	525.06	0.00	525.06	325.92	0.00	0.00	.82	326.74	0.00	62.23%	800
13/02/2012	485.58	0.00	485.58	352.42	0.00	0.00	4.44	356.86	0.00	73.49%	900
20/02/2012	505.85	0.00	505.85	342.29	0.00	0.00	5.34	347.63	0.00	68.72%	900
27/02/2012	195.63	0.00	195.63	111.35	0.00	0.00	3.52	114.87	0.00	58.72%	900
5/03/2012	159.65	0.00	159.65	71.33	0.00	0.00	.13	71.46	0.00	44.76%	890
12/03/2012	437.62	0.00	437.62	257.22	0.00	0.00	4.52	261.74	0.00	59.81%	1000
19/03/2012	382.31	0.00	382.31	193.03	0.00	0.00	1.15	194.18	0.00	59.15%	1100
26/03/2012	382.97	0.00	382.97	243.97	0.00	0.00	3.23	247.2	0.00	64.55%	1100
02/04/2012	443.42	0.00	443.42	281.6	0.00	0.00	.28	281.88	0.00	63.57%	1100
09/04/2012	246.05	0.00	246.05	137.96	0.00	0.00	3.67	141.63	0.00	57.56%	1000
16/04/2012	380.33	0.00	380.33	292.95	0.00	0.00	5.25	298.2	0.00	78.41%	1000
23/04/2012	81.25	0.00	81.25	23.04	0.00	0.00	0.17	23.22	0.00	28.58%	1000
30/04/2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.6	0.00%	1000
07/05/2012	93.95	0.00	93.95	47.7	0.00	0.00	.04	47.74	0.00	50.81%	1000
14/05/2012	128.05	0.00	128.05	94.01	0.00	0.00	.31	94.32	11	73.66%	1000
21/05/2012	233.74	0.00	233.74	124.44	0.00	0.00	2.12	126.56	33	54.15%	1000
28/05/2012	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	29	0.00%	1000
04/06/2012	19.49	0.00	19.49	15.16	0.00	0.00	.07	15.23	0.00	78.14	1000
11/06/2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8	0.00%	1000
18/06/2012	57.1	0.00	57.1	24.69	0.00	0.00	1.31	26	13.4	45.53%	1000
25/06/2012	58.17	0.00	58.17	53.4	0.00	0.00		53.4	5	91.8%	900
Total	**12522.97**	**0.00**	**12522.97**	**7846.37**	**0.00**	**0.00**	**108.39**	**7954.76**	**275.10**	**63.52%**	

Table 2-1 WID Inflows

3. Drain Monitoring

3.1 Drain flow and water quality monitoring

SRW's drain monitoring program for 2011/12 includes data capture from drains 1, 5, 6, and 11 where continuous stream-flow monitoring sites are in place. In accordance with the Regional Environment Improvement Plan 2009, this monitoring program surveys water quality and flow quantity in drains D1, D5, D6 and D11. The report uses flow data from each of these drains to estimate total flow from the district. As over 70 % of the district area is being monitored for flow, total district discharge is estimated by multiplying area monitored by the non-monitored area on a drain wetness assessment basis.

The channel supply system has thirteen outfall structures that allow for unused irrigation supply to be discharged safely to the drainage system. The outfalls comprise both continuously monitored and unmonitored discharge points that vary significantly in flow discharge. Four of the outfalls are considered to be major outfalls representing over 60% of the supply system, these are also located where discharge is more likely to occur due to the configuration of the supply system. The remaining outfalls are considered minor and represent a smaller proportion of the WID and generally at the end of tightly regulated spur channels where outfalls are uncommon. These discharges are not captured by the drain monitoring sites, as they enter either downstream of drain monitoring sites or are on unmonitored drains. Total volumes discharged are added to drain discharge for overall combined discharge.

Grab sampling for nutrient analysis is undertaken monthly at drain D5 and analysed for TP, TKN and Total N. Samples were taken on 8 of the 12 dates scheduled, on 4 occasions the drain had insufficient flow for sampling. Other grab sampling was undertaken at drains D1, D6 and D11 in line with REIP requirements. Occasionally samples were not able to be taken as drains have been dry at scheduled collection times. However opportunistic sampling was undertaken at other times when sampling could be arranged at short notice.

The D5 catchment covers 21% of the total district drain catchment, D6 17%, D11 about 11%, and D1 captures 22%. Overall the drain monitoring program captures 71% of the district's drainage catchment. These drains have differing characteristics and we have classified them accordingly.

- Drain 1 is known to be a wet drain with flows occurring on average more than 100 days per annum
- Drain 5 is also considered a wet drain
- Drain 6 is considered a semi dry drain in that it flows on average less than 30 days per annum and
- Drain 11 is considered a dry drain with an average of less than 15 days recorded flows per annum.

These characteristics come about by both the types of soil and their proximity to the supply systems. Generally the wetter drains having heavier soils and being in close proximity to the supply channels.

In addition to drain monitoring, monitoring also occurs at the Werribee Diversion Weir, prior to river water entering the irrigation system. Although results of the river water monitoring are discussed elsewhere, salinity readings at the weir are discussed here, as they give some background information to interpret the readings obtained in the drainage system.

The plan below indicates the location of the current monitoring stations and drain catchments.

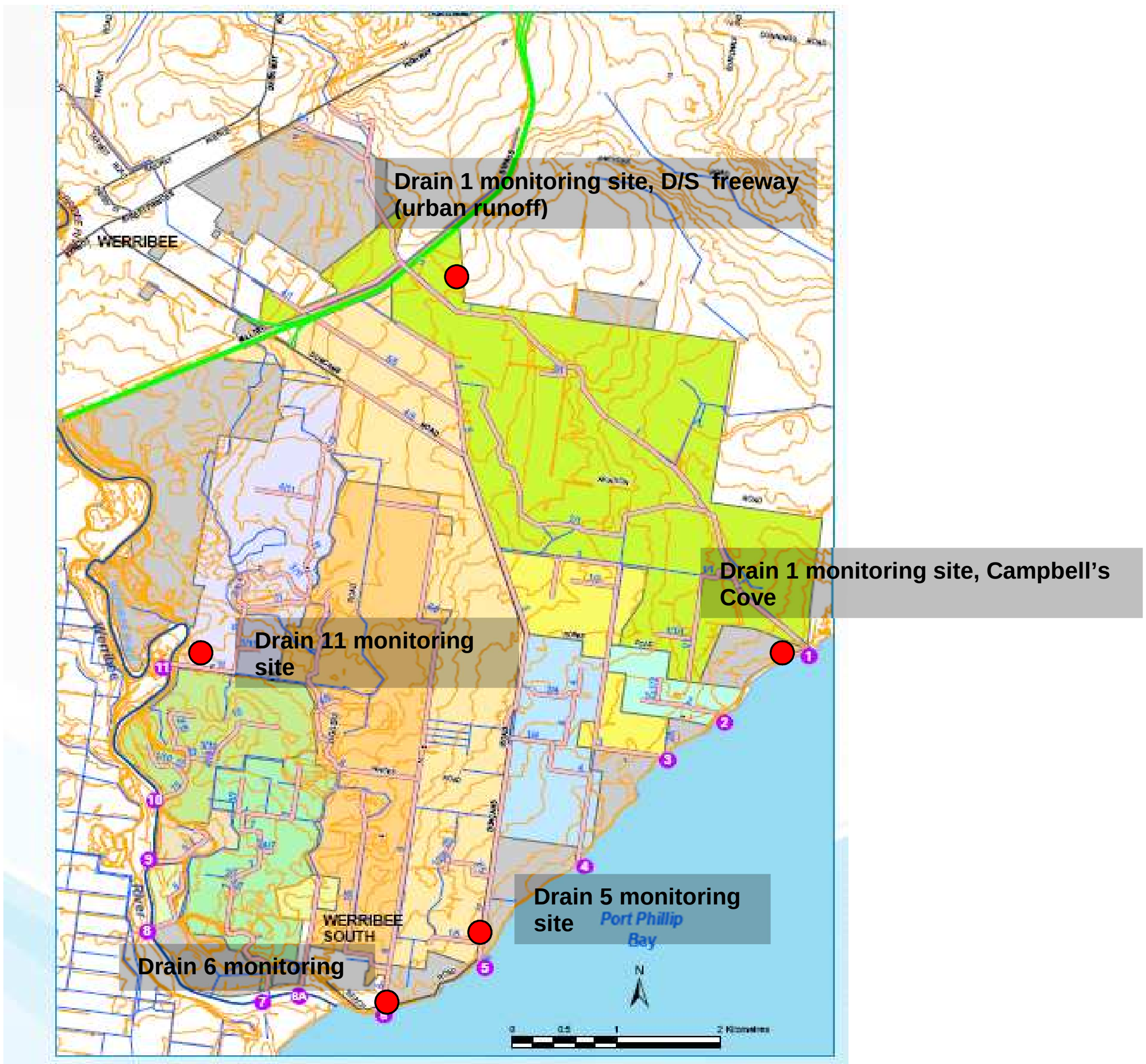

Figure 3-1 WID drainage catchments & monitoring sites

3.1.1 Drain Discharge:

Drain discharge volumes for 2011-2012 were captured at four drain sites as well as the channel outfall discharges that enter receiving waters at points not monitored by the drain discharge points. The four monitored drain catchments represent 71% of the WID drainage catchments; by multiplying the monitored volume by the drainage area of the type of drain we can estimate the total discharge for the total of that type of drain e.g. drain 6 = semi dry drain classification (monitored volume) ML x semi dry drains total area 31.9/100 (total semi dry drain % of district). This is done for each of the monitored drains providing a total estimated drain discharge. The annual monitored discharge of 4,634 ML from the 4 drains includes 3,331 ML of urban discharge (this is picked up at the Drain 1 Hoppers Lane site). The extrapolated district discharge is estimated to be 6,888ML (including urban monitored flow).

The following tables list the monitored monthly drainage and outfall discharge for 2011/2012

Month	**Drain 5**	**Drain 6**	**Drain 11**	**Drain 1 @ freeway**	**Drain 1 @ Bay**	**Drain 1 WID Discharge (Drain 1 @ Bay - Drain 1 @ Freeway)**	**Drain Total**
July	19.05	4.98	0.04	76.65	92.7	16.1	**116.8**
August	14.25	5.25	1.76	37.47	46.8	9.3	**68.1**
September	32.84	18.76	2.82	120.82	110.5	-10.3	**164.9**
October	27.04	18.92	4.51	271.36	234.54	-36.8	**285.0**
November	178.66	105.75	14.71	1189.1	1146.4	-42.7	**1445.5**
December	48.10	44.91	8.12	372.26	478.06	105.8	**579.2**
January	45.6	14.4	1.1	66.1	65.7	-0.4	**126.8**
February	31.1	33.1	0.0	159.8	141.3	-18.6	**205.5**
March	38.4	10.0	0.0	151.7	157.8	6.2	**206.2**
April	24.7	15.2	0.0	112.3	133.1	20.8	**173.0**
May	74.3	31.9	13.1	352.5	393.6	41.2	**513.0**
June	65.4	29.9	13.5	420.7	641.7	221.0	**750.5**
Total	***599.32***	***333.08***	***59.78***	***3330.73***	***3642.25***	***311.52***	***4634.4***

Table 3-1 WID Drain discharge 2011-12

*Negative values are result of drainage diversion between monitoring points

Month	Main outfall	Spur 4/5 outfall	Spur 5 outfall	Spur 6 outfall	All others	Outfall totals
July	0.23	0.040	0.15	0.00	0.00	**0.4**
August	2.30	0.14	3.18	0.27	0.00	**5.9**
September	1.75	0.74	0.80	0.70	0.00	**4.0**
October	1.31	0.53	0.50	0.43	0.00	**2.8**
November	6.10	2.33	7.62	1.55	0.00	**17.6**
December	5.59	9.74	0.54	3.95	0.00	**19.8**
January	5.51	6.32	4.04	4.42	0.00	**20.3**
February	10.54	4.17	4.00	6.93	0.00	**25.6**
March	2.89	2.47	4.00	1.86	0.00	**11.2**
April	2.81	5.85	0.24	0.46	0.00	**9.4**
May	0.27	2.56	0.04	0.32	0.00	**3.2**
June	0.12	0.48	0.78	0.00	0.00	**1.4**
Total	***39.42***	***35.37***	***25.89***	***20.89***	***0.00***	***121.6***

Table 3-2 WID outfalls 2011-12

Charts 1- 5 below show the monthly discharge of outfalls, drains, combined total and extrapolated with cumulative totals.

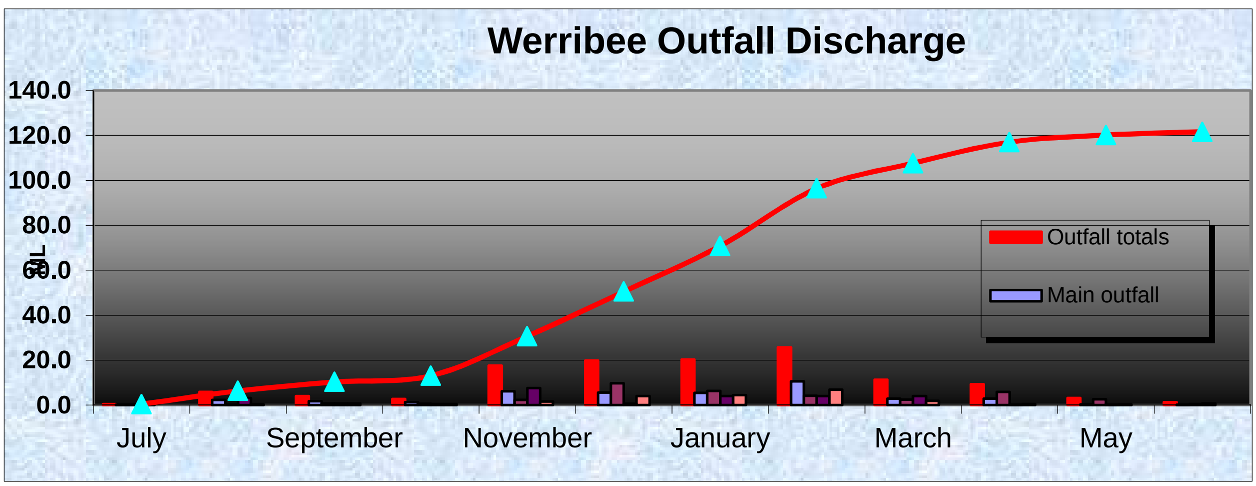

Figure 3-2 WID outfall discharges, all sites

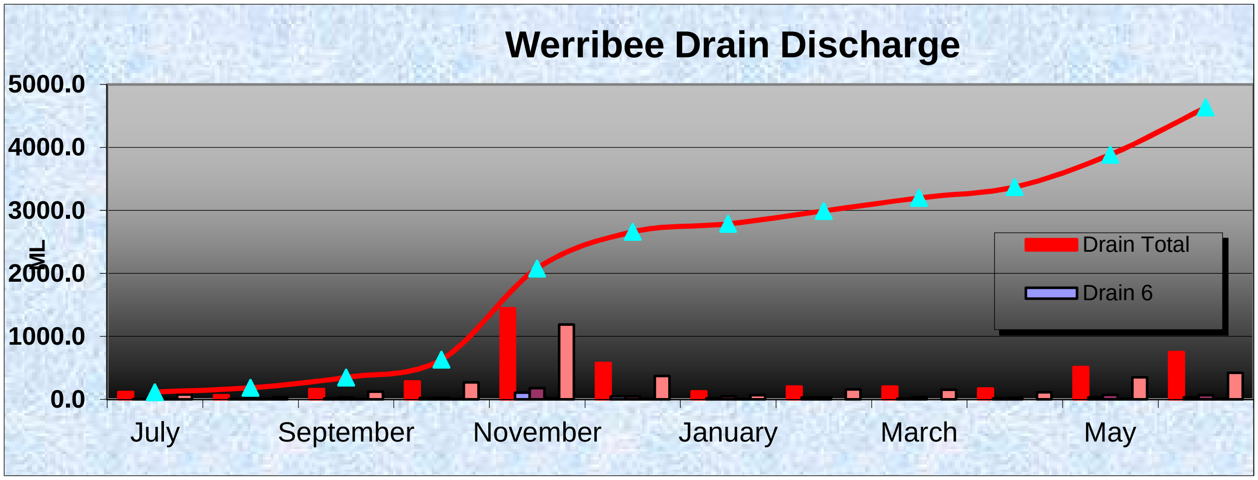

Figure 3-3 WID drain discharge, monitored sites

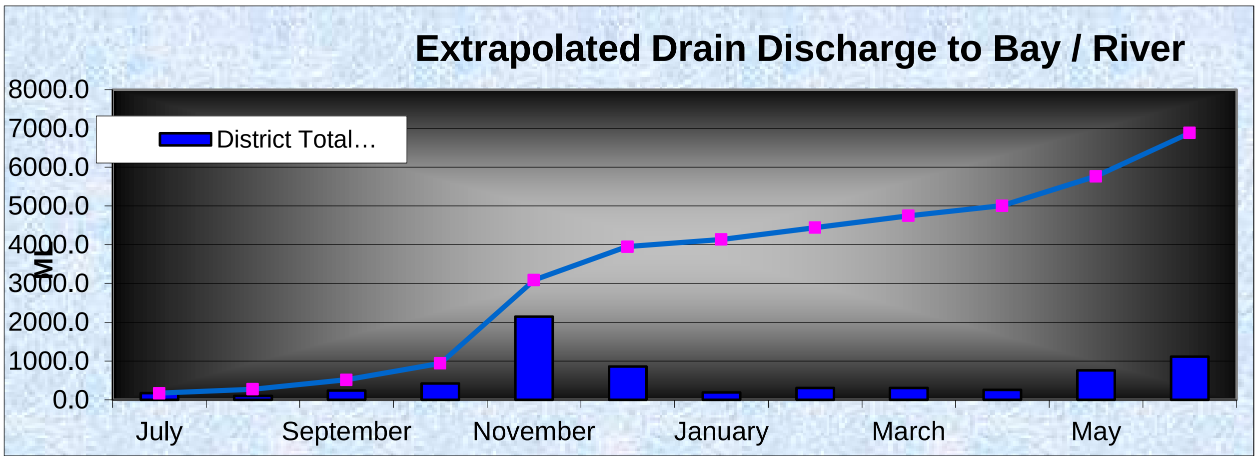

Figure 3-4 WID extrapolated drain discharge 2010-11

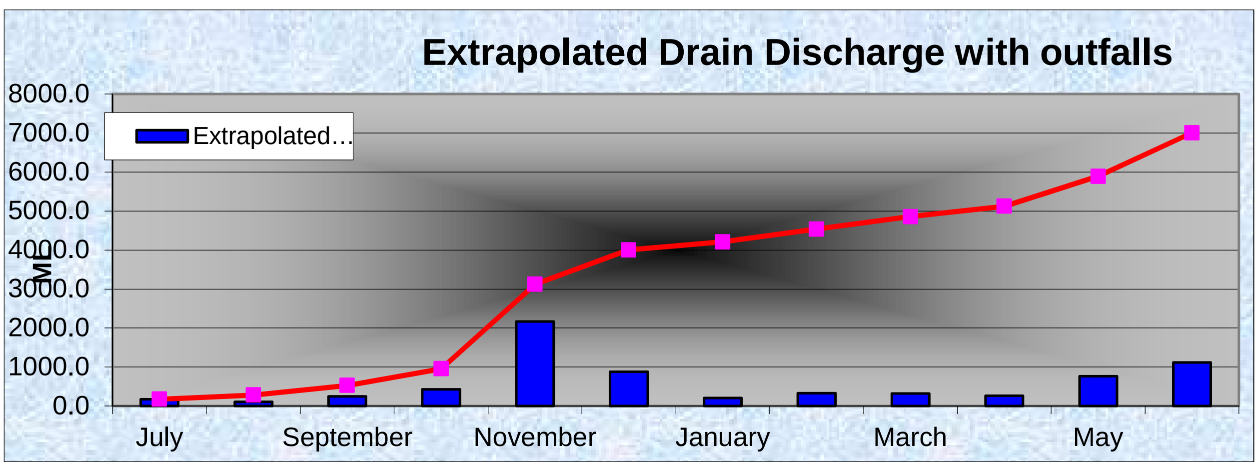

Figure 3-5 WID extrapolated drain discharge with outfalls 2010-11

Channel outfall discharge for the 12 months totalled 122ML, down slightly on the previous year's discharge of 151ML. The outfall volume is additional to the extrapolated drain discharge of 6,888ML. Overall discharge attributable to the district to the receiving waters is estimated to be 3,679ML for the year (7,010ML – 3331ML urban runoff =3,679ML).

3.1.2 Water Quality:

Salinity

Electrical Conductivity (EC) of drain discharge at Drain 5 for 2011/12 averaged 1,280 µS/cm which is slightly lower than the 2010/11 average of 1,400 µS/cm recorded. The Werribee River recorded an average 850 µS/cm in 2011/12, much lower than the preceding year which averaged 1,550 µS/cm. The reduction in drain salinity may in part be due to the lower salinity in water supplied to the district. The reduction in salinity in the river is due to much greater flows in the river resulting in lower concentrations.

Figure 3-6 Salinity trends for drain D5 & Werribee River @ diversion weirbelow, shows salinity trends for both Drain 5 and the Werribee River at the diversion weir.

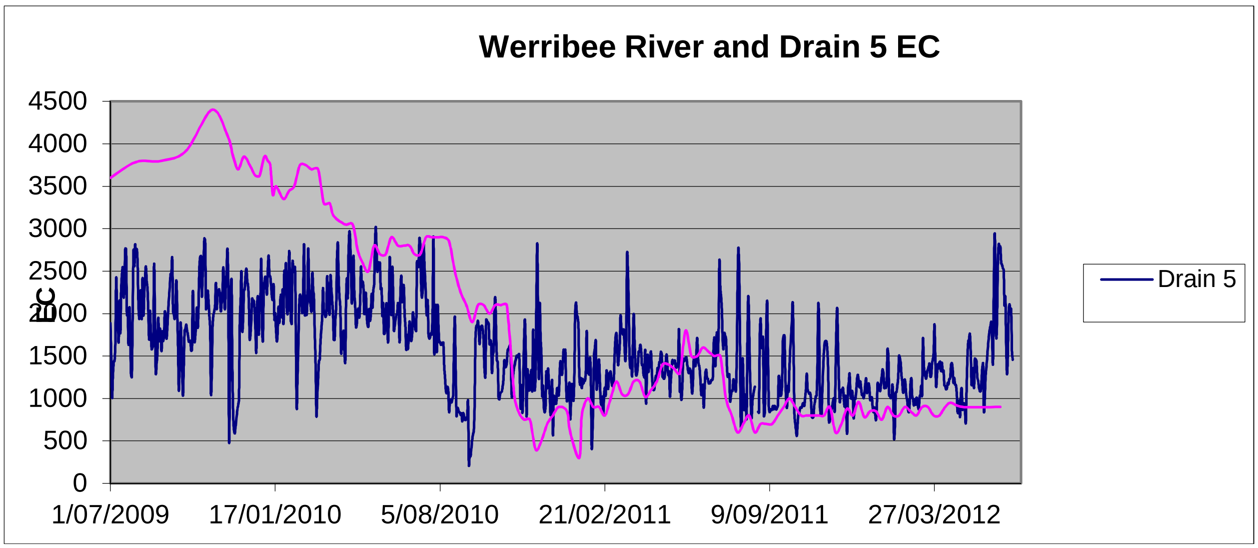

Figure 3-6 Salinity trends for drain D5 & Werribee River @ diversion weir

Nutrients

Monthly water quality data from drain samples has been used to determine overall drainage load volumes. Channel discharge loads have not been calculated as recycled water was not supplied to the district for the reporting year. Where drain samples were not collected due to low or no flow events at the drain monitoring sites average values for the year have been applied. Figure **3-7** presents the results for Total Phosphorus (TP) and Total Nitrogen (TKN+TON) in Drain 5 from the start of 2005.

As no recycled water was delivered to the district it was expected that nutrient levels would be lower, with an average Total P concentration of 0.9 mg/L compared to 2.3mg/L in 2010/11, and an average Total N concentration of 4.2 mg/L compared to 5.4mg/L for 2010/11.

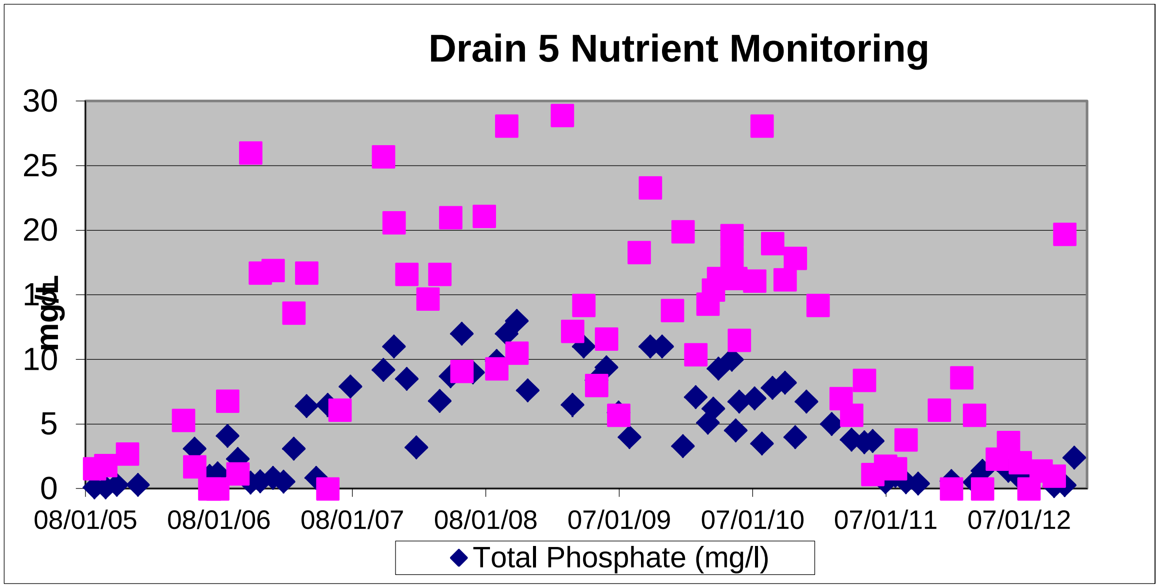

Figure 3-7 Nutrient monitoring in drain D5 2010-11

Date	Total Phosphate (mg/L)	Total Nitrogen (mg/l)
05/07/11	0.60	6.10
02/08/11	No sample taken	No sample taken
06/09/11	0.50	8.60
28/09/11	1.40	5.70
07/11/11	No sample taken	No sample taken
8/12/2011	1.40	2.30
9/01/2012	0.80	3.60
2/02/2012	0.50	2.03
6/03/2012	No sample taken	No sample taken
11/04/2012	**0.20**	1.38
10/05/2012	0.27	**0.98**
5/06/2012	**2.40**	**19.70**

Table 3-3 Monthly sampling @ drain D5 (min / max values bolded)

Loads

The method used for calculating drain discharge loads is the monthly concentration discharge method where concentrations measured during a period are averaged and multiplied by the discharge over this period. Successive monthly loads are summed to produce a sum estimate for the twelve months applying the extrapolation method below. Results from drains D1, D5, D6 and D11 have been used in estimating total nutrient loads. As testing was not undertaken at channel outfalls it is not possible to provide an accurate estimate of nutrient loads discharged from channel outfalls. Previously nutrient levels from the MWC treatment plant were used in estimating outfall discharge load, this reporting was possible because recycled water made up a large percentage of total water supplied and subsequent outfalls.

L=Av Cc * (drains 1,5 Vol * 50.4/100) + (drain 6 Vol * 31.9/100) + (drain 11 Vol * 17.8/100)

An estimated TP load of 2.4 Tonnes (well down on the 2010/11 total of 4.6 tonnes) and an estimated TN load of 75 tonnes were discharged from the drainage system. Total TN loads were up significantly on 2010/11 due mainly to high concentrations on Drain one, and high flow discharges.

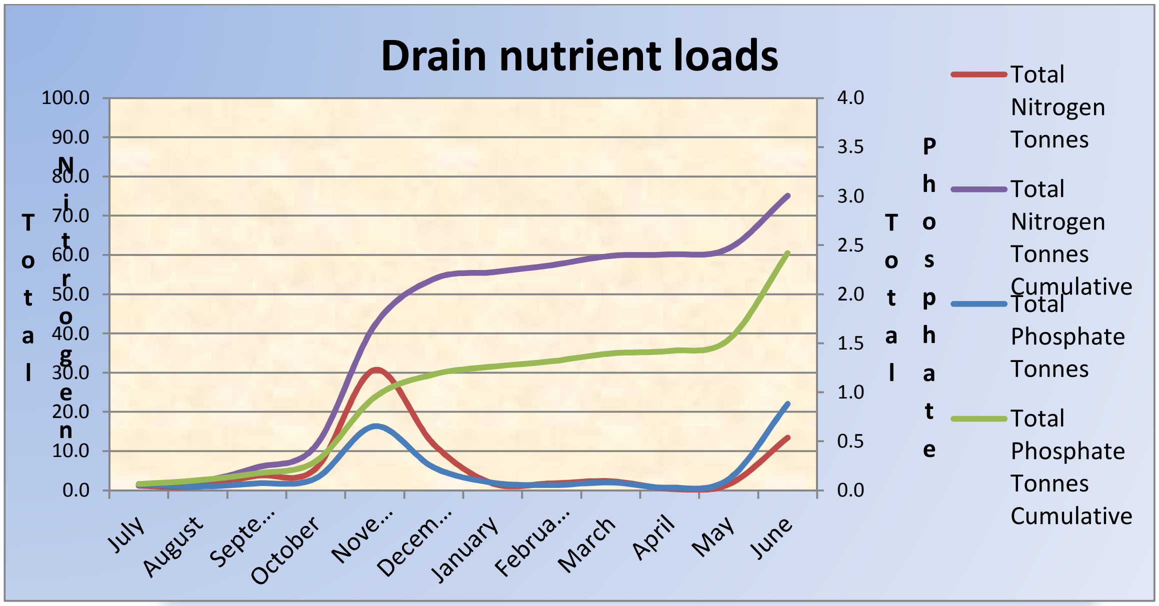

Figure 3-8 WID drain nutrient loads 2010-11

Nutrient Monitoring at other sites

Samples were also collected at Drain1(two sites) on a monthly basis also at D6 and D11 when opportunities to sample arose. Twelve samples were collected from the D1 site at Campbell's Cove immediately upstream of where the drain enters Port Philip Bay. Routine samples recorded values averaging 0.16mg/L of total P and 10.5mg/L of total N, nearly identical to the 0.26mg/L TP and 10.6mg/L TNin 2010/11. Routine samples taken from D6 provided average values of 0.87mg/L for total P and 12.8mg/L for total N.
Routine samples for drain D11 averaged 1.9mg/L total P and 13.7mg/L total N noting only two samples were obtained for the year.

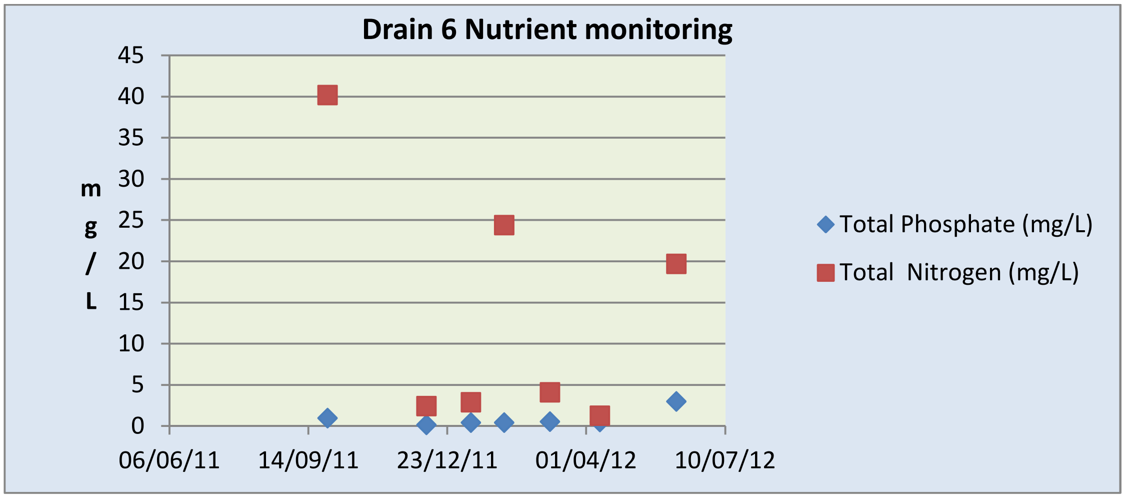

Figure 3-9 WID drain D6 nutrient monitoring

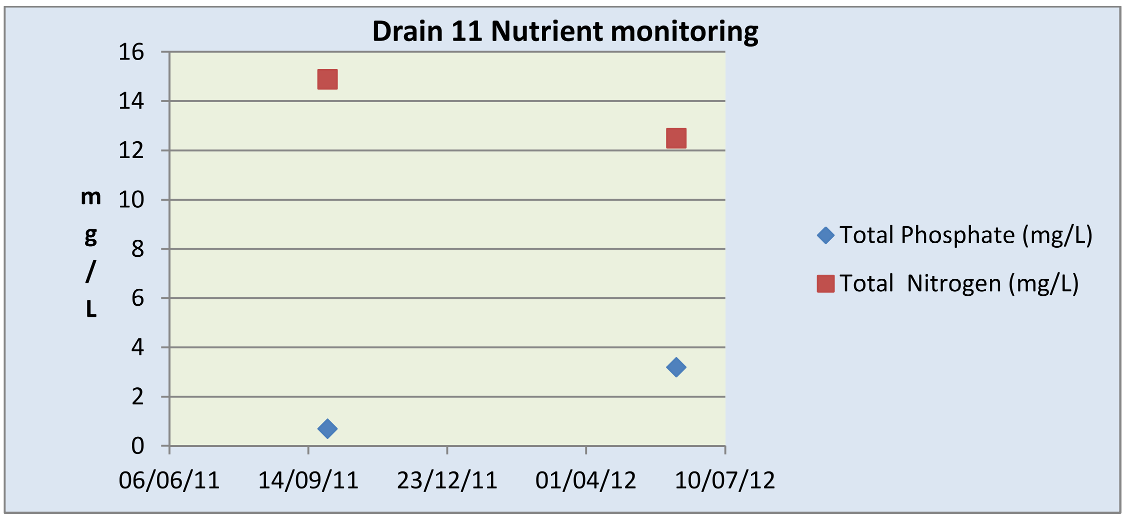

Figure 3-10 WID drain D11 nutrient monitoring

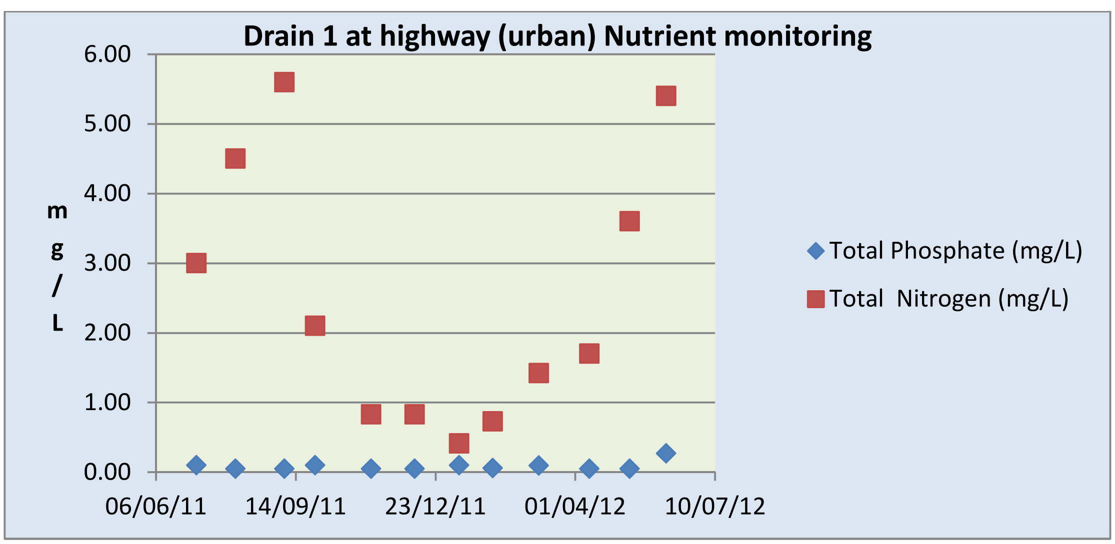

Figure 3-11 WID drain D1 monitoring @ Hoppers Lane

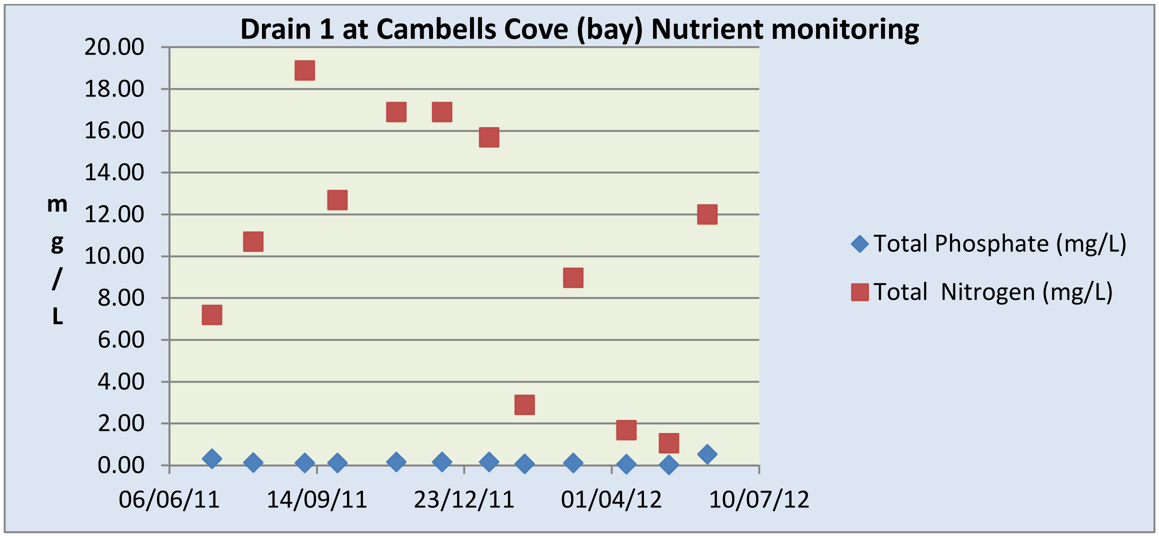

Figure 3-12 WID drain D1 monitoring @ Campbell's Cove

Grab samples at the D5 drain monitoring site were collected as per the table below:

Date	Flow at time of sample ML/d	Total P mg/L	Total N mg/L	EC@25
28/9/2011	23.7	1.4	6.1	850
25/5/2012	131	5.0	16.7	804
Average		3.2	11.4	827
Average routine sampling		0.9	4.2	1,280

Table 3-4 Event based sampling @ drain D5

Sampling results from the grab samples show higher average nutrient levels compared to the average for routine sampling at drain D5.

Assessment of compliance against SEPP requirements.

SEPP environmental objectives for marine and estuarine waters (estuaries and inlets) specify values of 0.3mg/L for total nitrogen (75th percentile) and 0.03mg/L for total phosphorous (75th percentile). Total nitrogen values for drain D5 were: Avg 5.4mg/L, Max 14.2mg/L, Min 1.1mg/L. Total Phosphorous values were: Avg 2.3mg/L, Max 5.0mg/L and the minimum value for the period was 0.4mg/L. The 2010/11reporting year has seen improvement in nutrient levels from the previous year although levels are still well above the SEPP objectives for marine and estuarine waters requirements.

Heavy Metals

Sampling for heavy metals was undertaken at drain 5 and drain 6 in October 2010 and again at all 5 drain monitoring sites in February 2011, with two samples taken from drain 5.

4. Receiving Surface Waters Monitoring

With the publication of the REIP in 2009 there was a requirement to introduce a program to monitor the water quality of the receiving surface waters adjacent to the WID. This program was designed to detect whether the outfalls and drains from the WID were discharging levels of nutrients that were potentially detrimental to the environment.

4.1.1 Werribee River & Estuary Sampling Locations

- 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 a 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 (Cuttriss Road)
- 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 PPB. Samples are taken at depths up to 0.5m below the surface.

4.1.2 Port Phillip Bay – Inshore Segment Sampling Points

- PPB1 – Adjacent to Drain 1 outfall
- PPB2 – Adjacent to Drain 5 outfall
- PPB3 – Adjacent to Drain 6 outfall

4.1.3 Results

Sampling was undertaken by Ecowise in January 2012 & July 2012. The full results are shown in Attachment 15.3.
The concentration of nutrients at the sampling locations is as follows:

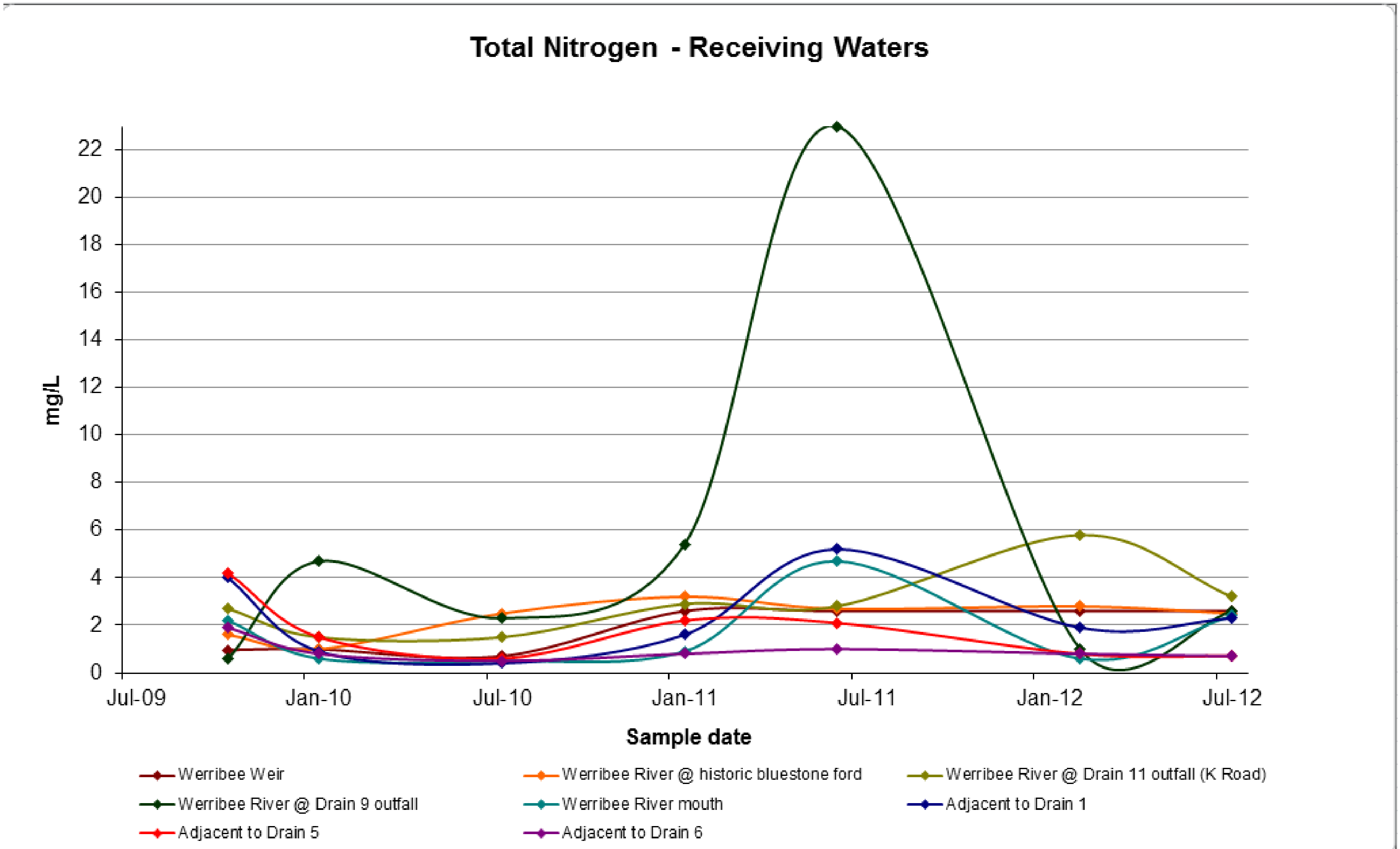

Figure 4-1 WID receiving waters nitrogen levels 2011-12

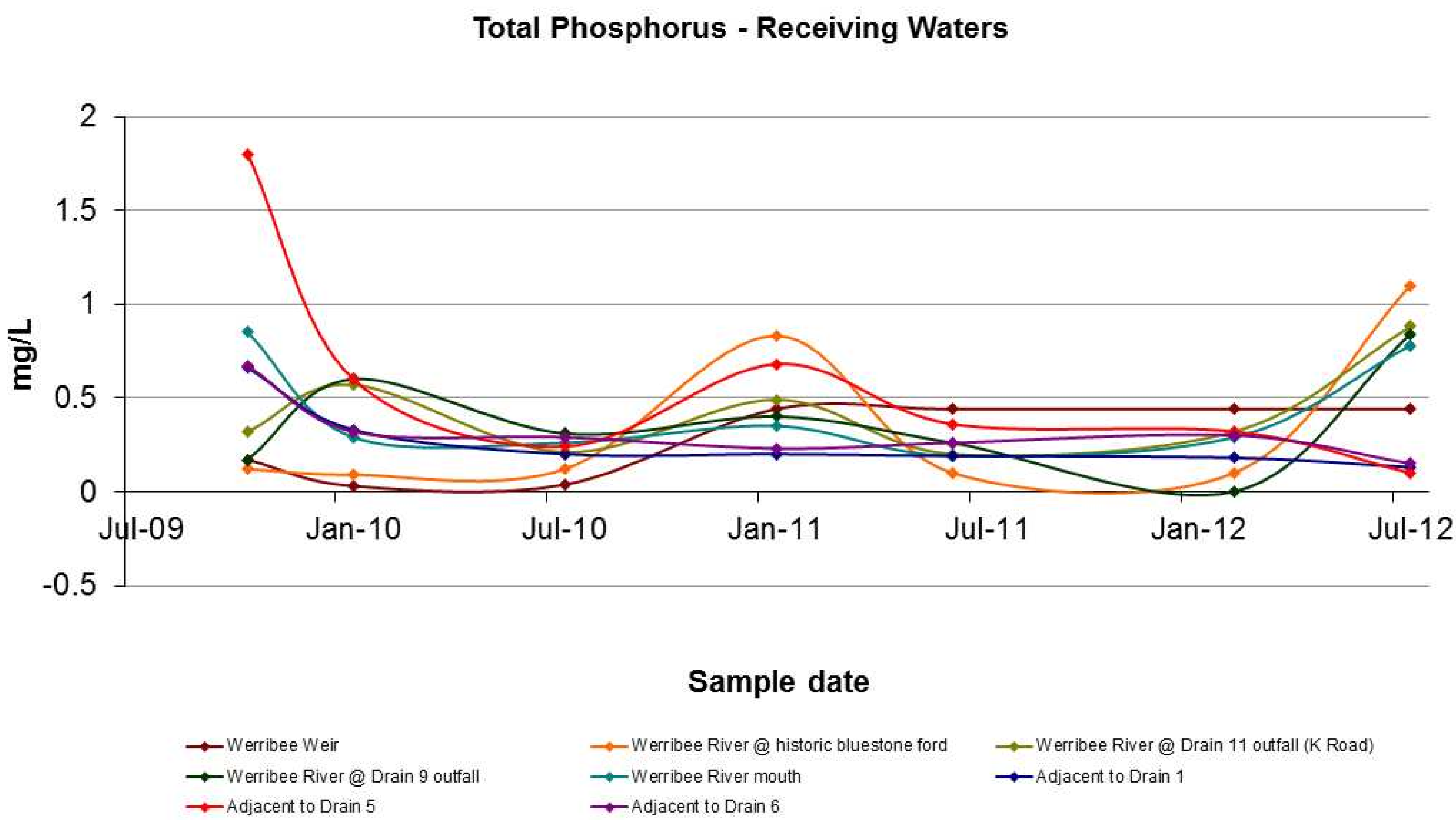

Figure 4-2 WID receiving waters phosphorus levels 2011-12

4.1.4 Assessment versus SEPP objectives

The 2011-12 irrigation season was characterised by continued higher than average rainfall and no recycled water deliveries. High flows along the Werribee River into Port Phillip Bay contained higher nutrient loads typical of storm events. As documented in the drainage section of this report the run-off from the WID was very high as compared to previous seasons. The samples that were collected this year showed that nitrogen levels remained consistent with the results from previous sampling. Phosphorus levels have increased since 2010-11 despite no recycled water being delivered during the season

4.1.4.1 Nitrogen

In January 2012 nitrogen levels in the river were at or below SEPP objectives (300 mg/l @ 75th percentile) for estuaries and inlets, except for D11. Results from the coastal waters were at similar levels but the lower objectives (120 mg/l @ 75th percentile) meant that all samples remained above SEPP objective levels.

In July 2012, at which point recycled water had not been delivered to the WID in 18 months, nitrogen levels had not moved from long term averages. These levels are consistent with the higher nutrient loads (albeit at lower concentrations) observed in the drains and outfalls.

4.1.4.2 Phosphorus

The January 2012 samples were consistent with the previous sampling results and below the SEPP thresholds.

In July 2012 phosphorus levels in the river climbed back over SEPP levels but the outlets located on Port Philip Bay remained at the same level.

5. Groundwater

5.1 Groundwater overview

The Werribee Irrigation District (WID) overlies a groundwater management area known as the Deutgam Water Supply Protection Area (WSPA). The WSPA covers an alluvial gravel aquifer to a depth of 40 meters, known as the Werribee Delta. A groundwater extraction ban to mitigate the threat of saline intrusion resulting from over-extraction of the resource was lifted during 2011 following significant rainfall and aquifer recovery.

Currently, groundwater monitoring is undertaken in accordance with the REIP requirements, as well as additional monitoring undertaken to assess the threat of saline intrusion to the aquifer from the Werribee River estuary, Port Phillip Bay and underlying, saltier aquifers. Saline intrusion monitoring is conducted on a monthly basis but only information relevant to the operation of the recycled water scheme has been reported here. Monitoring infrastructure comprises 25 State Observation Bores (SOB) and a number of private groundwater bores (**Figure 5-1 WID groundwater monitoring locations**).

In general, groundwater flows from north to south across the WSPA and is recharged via a combination of rainfall, river flows, delivery channel leakage and irrigation leaching.

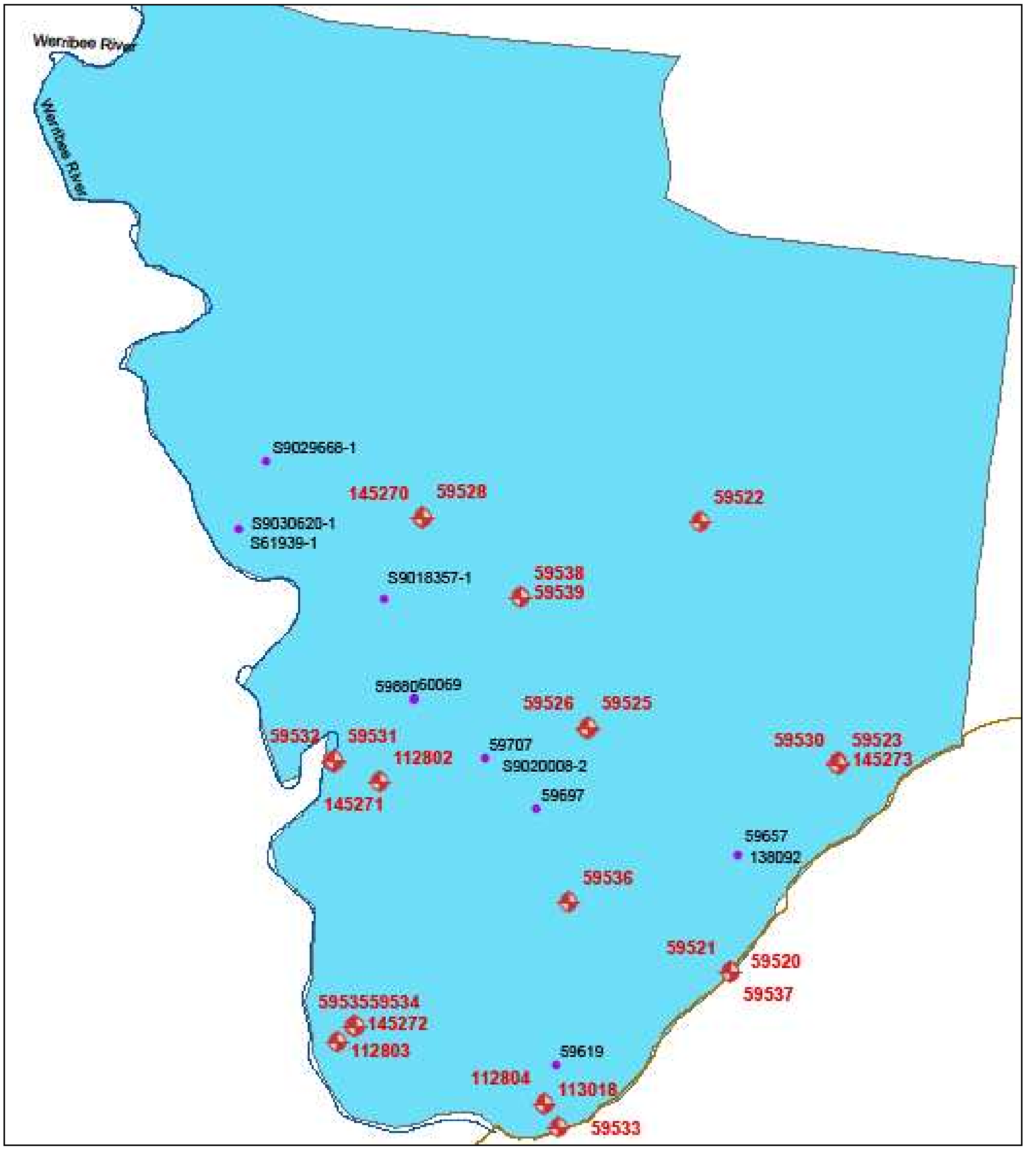

Figure 5-1 WID groundwater monitoring locations

SOB network shown in red, private bores are indicated in purple.

5.2 Groundwater Level Monitoring

Groundwater level is monitored across all 25 SOB on a monthly basis as part of SRW's saline intrusion monitoring program. The graph below illustrates the average drawdown across the entire alluvial aquifer over time. In general, groundwater levels declined during the low rainfall period commencing in 1997. There was a significant period of decline between 2005 and 2007, with some recovery observed over the following 3 years, attributed to increased compliance with the groundwater extraction ban. Significant recovery has since occurred in the 12 months from Jan 2010 – 2011 due to replenishment from rainfall, resulting in groundwater levels that are at a lower risk of saline intrusion from both the estuary and the Bay. The most recent year has shown relatively stable levels, with drawdown remaining close to 0 m. Groundwater level contour maps are not regularly updated and have not been provided.

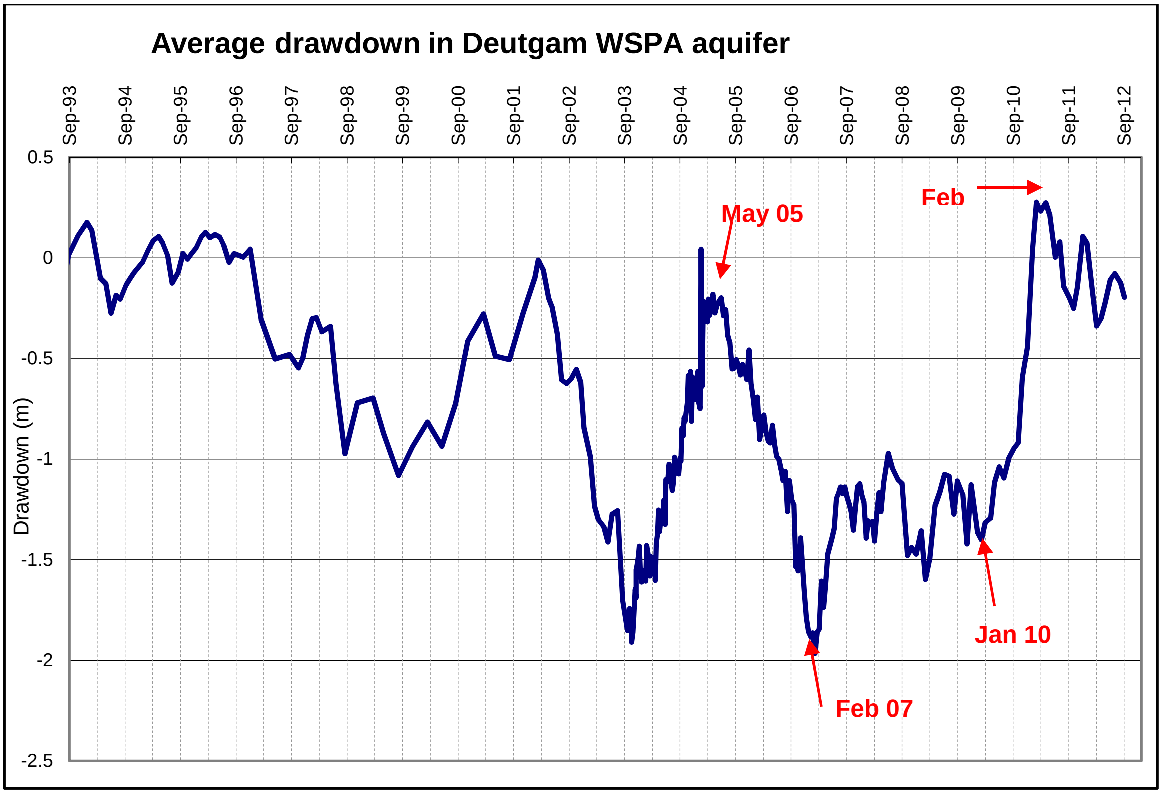

Figure 5-2 Average drawdown in Deutgam WSPA aquifer

5.3 Groundwater Salinity Monitoring

Groundwater salinity monitoring is conducted in 9 out of the total 25 State observation bores on a rotating monthly basis as part of SRW's saline intrusion monitoring program. Data is also collected from several private bores. Only information relevant to the recycled water scheme operation is presented in this report.

Private bore monitoring data collected to date indicates that salinity may be increasing in two of the private bores, in the central and northern WID. The reason behind the apparent increases is not clear.

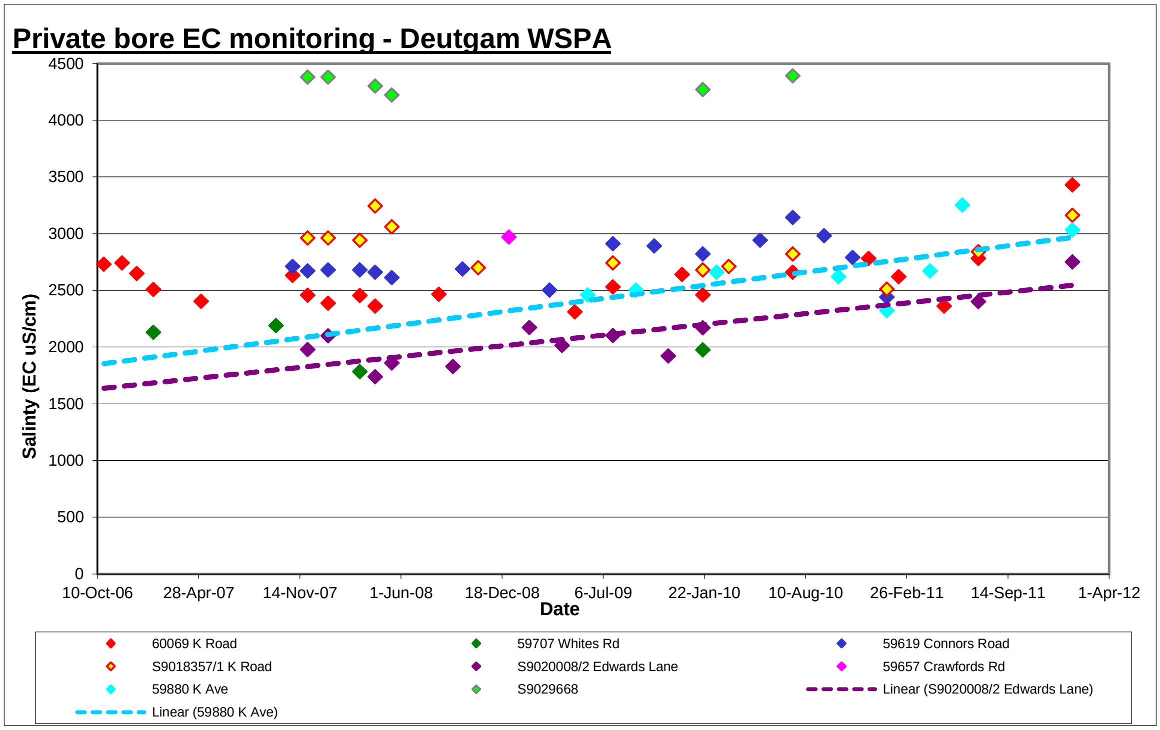

Figure 5-3 Private bore monitoring - Deutgam WSPA

Salinity data collected from alluvial aquifer bores in the northern and mid portions of the WID (see graphs below), adjacent to delivery channels, indicates no significant overall increase in groundwater salinity in the majority of bores, since recycled water delivery commenced in December 2004. Some increase was experienced in low rainfall years, attributed primarily to reduced freshwater recharge, however with increased rainfall in the past 2 years, salinity has generally remained stable or decreased. This indicates that there is little contribution to salinity from recycled water infiltration.

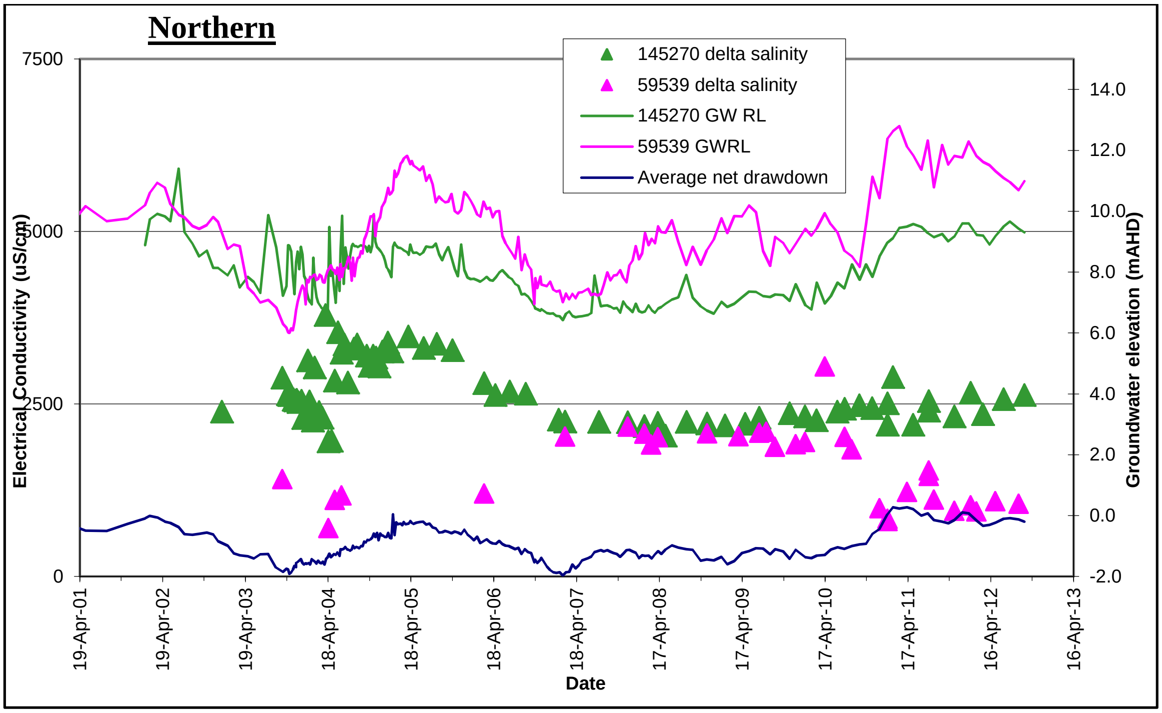

Figure 5-4 Salinity data from bores in northern section of WID

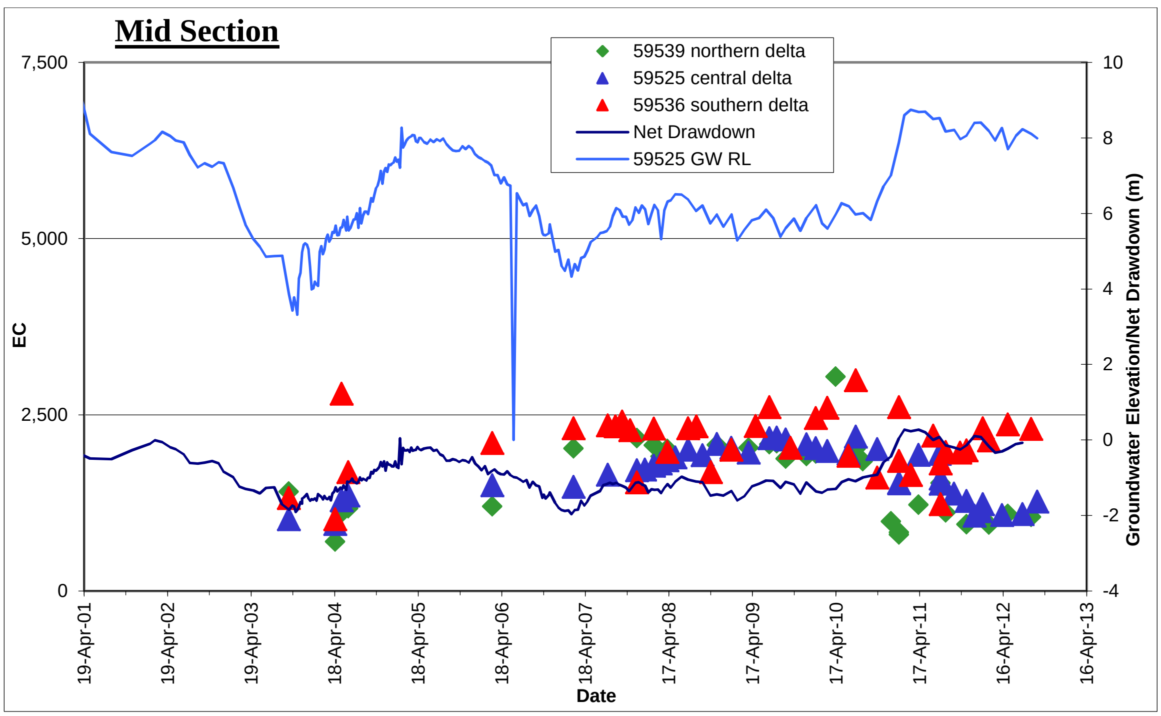

Figure 5-5 Salinity data from bores in central section of WID

In contrast, salinity data collected from coastal and riverside monitoring bores clearly indicates some significant increases in salinity at depth, although this has decreased over the past 24 months in correlation with freshwater replenishment of the aquifer from higher rainfall. There is little change in the salinity of shallow bores. Increases in salinity in deeper bores are attributed to saline intrusion from the estuary and the Bay and not to recycled water. If recycled water was the primary cause of salinity changes in the alluvial aquifer, we would expect to see more uniform changes to salinity with depth and across the WID, with a slightly higher rate of change in bores adjacent to delivery channels, such as 59539, however this is not the case.

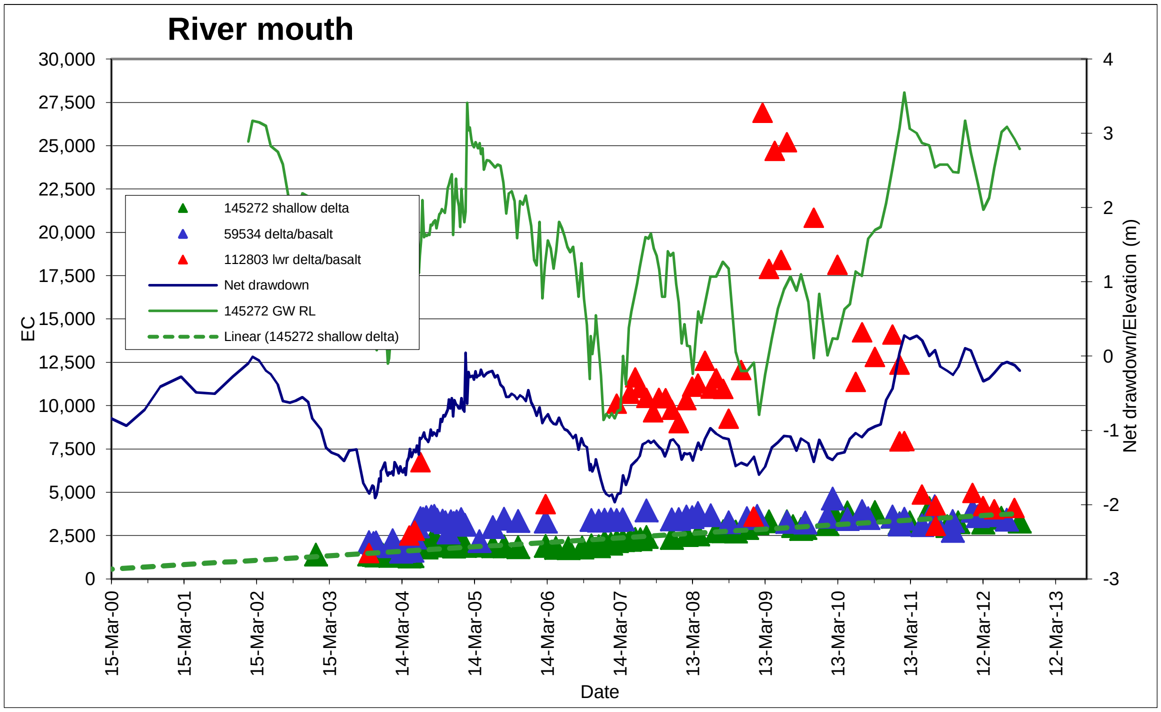

Figure 5-6 Salinity data from bores adjacent to Werribee River mouth

5.4 Groundwater Contaminant Monitoring

REIP groundwater sampling event was conducted twice during the reporting period (July 2011 and January 2012) in accordance with REIP requirements. A complete REIP sampling round was also completed in July 2012 and summary results are included, but this data will be further documented in the next reporting period. Groundwater analytical results from the REIP sampling program are summarised in Attachment 15.1 and compared to relevant ANZECC criteria for irrigation and marine ecosystem protection (for slightly to heavily modified systems). The application of these guideline figures was reviewed, and it was decided to continue comparison with guidelines for T90 – 95% levels of ecosystem protection. As the area is highly modified, the T99% level of protection was considered inappropriate. Additional SEPP criteria for estuaries and inlets were also compared to sampling results. Laboratory analytical certificates are available on request.

Relevant contaminant concentration guidelines for some metals have been exceeded in several bores on one or more occasions. While in some cases lab detection limits were similar to or higher than some guideline values, these were as low as reasonably practical with consideration to cost. Additionally, exceedances of ecosystem protection guidelines by metals are common even in systems which have not been heavily modified and these results are considered unlikely to be directly related to operation of the recycled water scheme. There are no indications of increasing concentrations or spatial trends to the results.

Total nitrogen results are summarised in the graphs below. Nutrient concentrations exceeded the guidelines for protection of slightly modified marine ecosystems in most bores and across the majority of sampling events conducted to date. Many bores also exceed the recommended ANZECC long term trigger value for the application of irrigation water.

Total nitrogen concentrations from the majority of SOB in the delta aquifer showed no overall increasing trends. Some sites experienced increases in samples taken in July 2012, particularly 59537 (central eastern coast), 112803, 59534 (both SW river on coast) and 59533 (lower south coast). These increases followed significant decreases shown in the 2011 monitoring. SOBs drawing from multiple aquifers also showed no overall increases in TN concentrations. Most SOBs in the deeper aquifers experienced no upward trend, with the exceptions of 112804 (Brighton Formation, central coast) and 59535 (Volcanics/Brighton formation at the river mouth). These sites showed increasing total nitrogen concentration over the past 6 - 12 months. Similar results have been recorded at 59535 in the past so the most recent results are within the historical range for this bore. Total nitrogen concentration in private bores showed no overall increase except 9018357/1 (northern central). Not all private bores could be sampled for all events due to localised flooding.

There is no evidence to suggest that recycled water use is leading to decreases in groundwater quality. The few sites that show increases in total nitrogen concentrations are located near the coast rather than near irrigation channels. It would be expected that if upward trends were due to the application of recycled water, sites closer to irrigation channels and irrigation areas would experience the highest rises in concentrations. As peaks in nutrient concentration are not reflected in boron concentrations (see **Figure 5-11 Boron in groundwater - Delta aquifer** and **Figure 5-12 Boron in groundwater - Multiple aquifers**), it is likely that these trends are due to fertiliser use, rather than recycled water impacts.

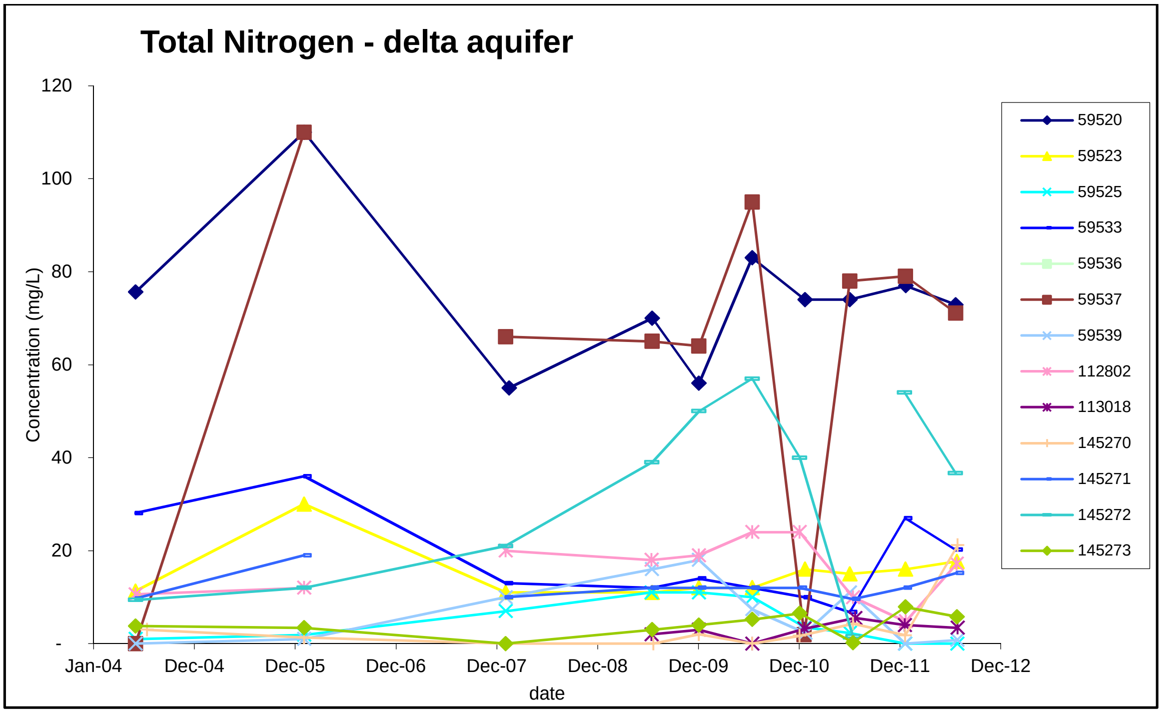

Figure 5-7 Total nitrogen in groundwater - Delta aquifer

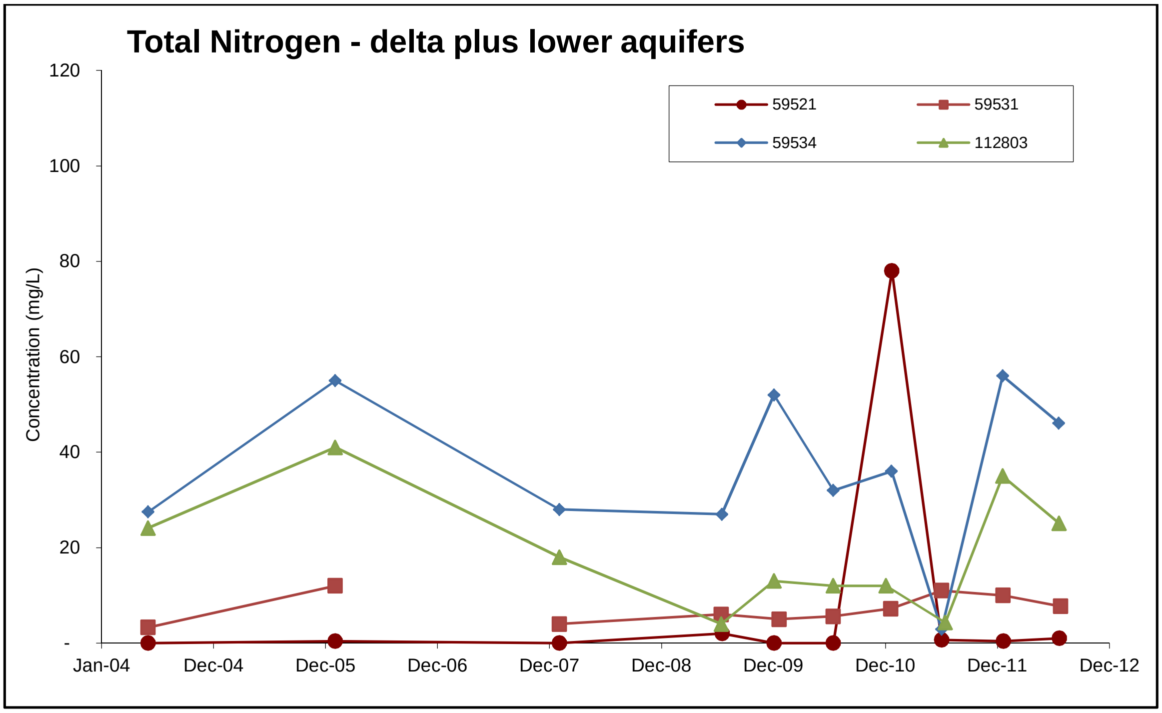

Figure 5-8 Total nitrogen in groundwater - Multiple aquifers

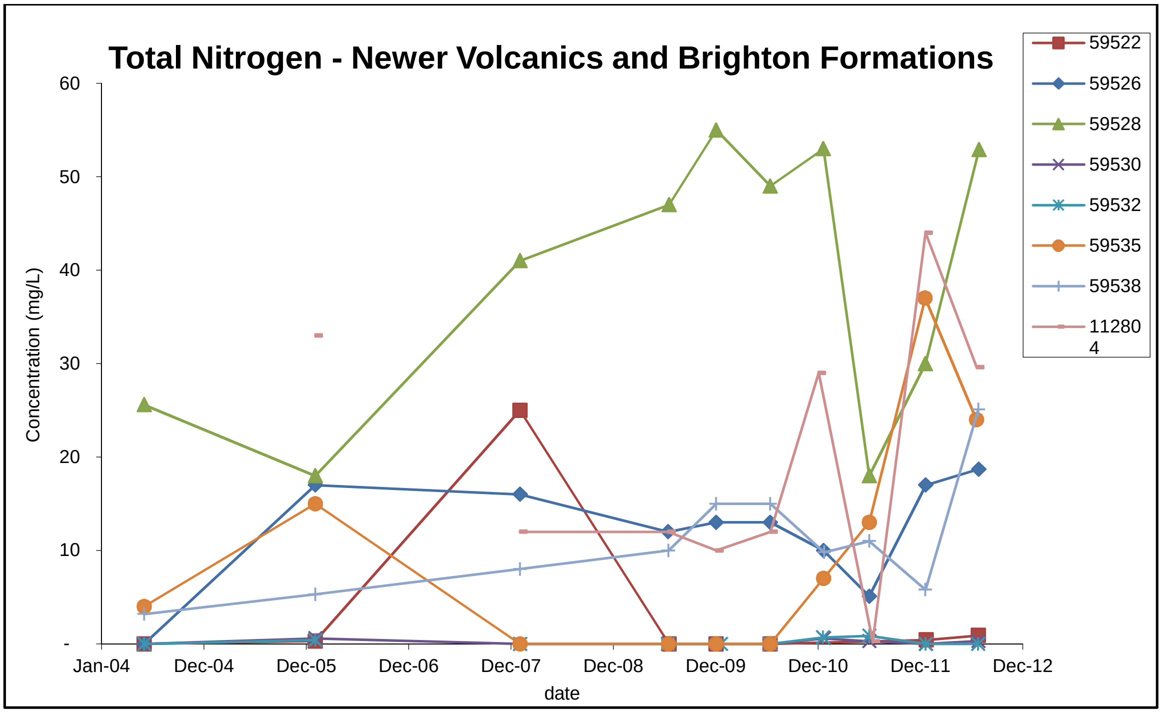

Figure 5-9 Total nitrogen in groundwater - Lower aquifers

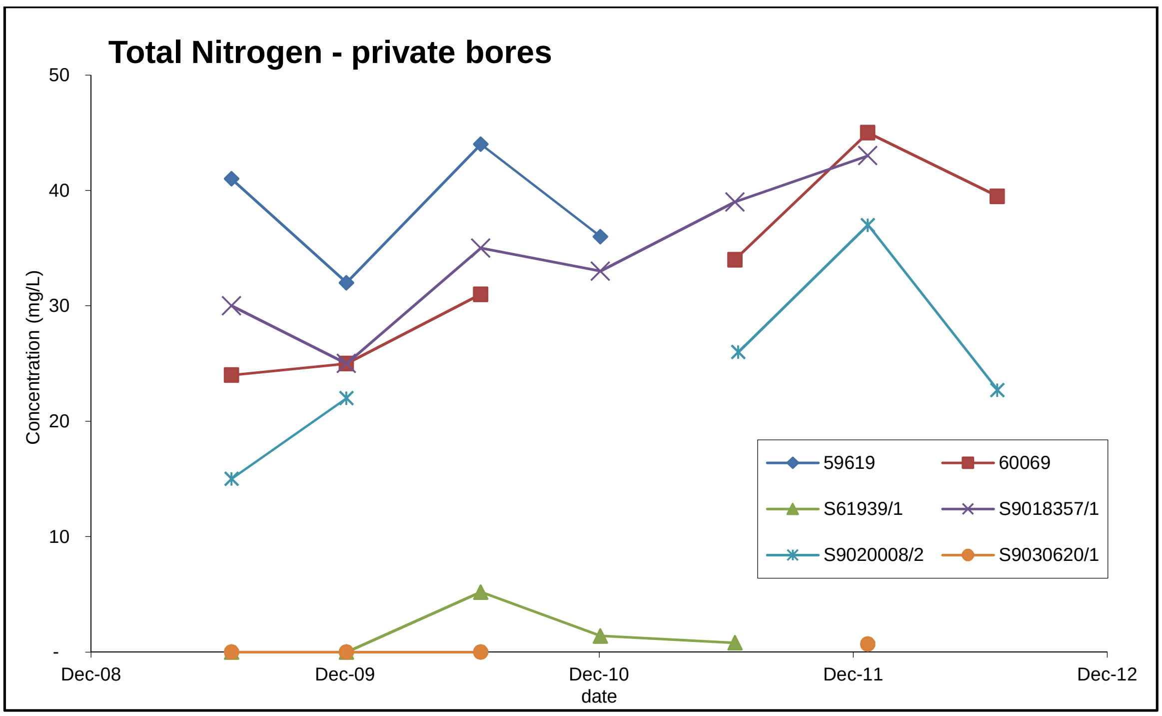

Figure 5-10 Total nitrogen in groundwater - Private bores

Boron concentrations also exceeded SEPP guidelines for rivers and streams at most bore sites for the many sampling events. The graphs below show a summary of recorded boron concentrations. High boron levels are typically associated with the use of recycled water however there is no indication of overall increasing concentrations since the beginning of the recycled water scheme. The majority of boron concentrations recorded from SOBs in both the delta aquifers and multiple aquifers showed no overall increasing trend.

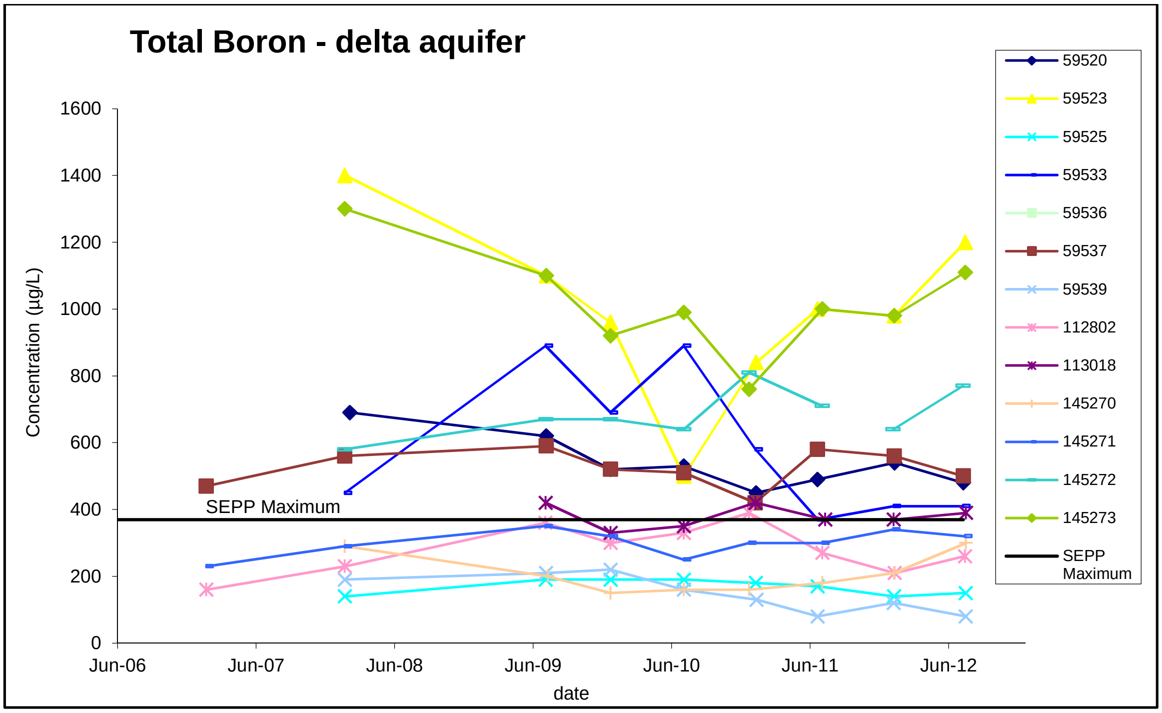

Figure 5-11 Boron in groundwater - Delta aquifer

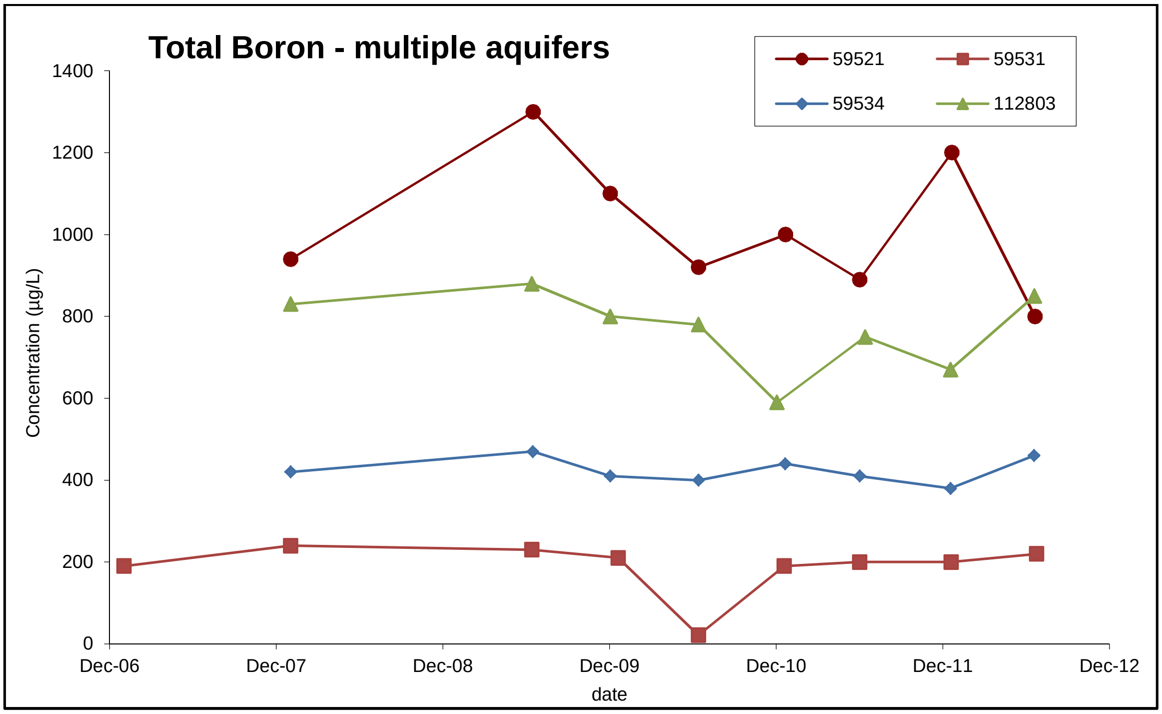

Figure 5-12 Boron in groundwater - Multiple aquifers

6. Soil Monitoring

6.1 Introduction

Due to no recycled water being delivered during the 2011-12 season there was no requirement to undertake soil sampling as per the Annual Soil Sampling Program in the REIP 2009.

7. Reporting Triggers

<table>
<tr><th colspan="2">Trigger Value</th><th>Outcome</th></tr>
<tr><td colspan="3">Recycled Water</td></tr>
<tr><td colspan="2">Concentrations exceed recycled water defined in MW RWQMP and “Guidelines for Environmental Management: Dual Pipe Water Recycling Schemes” (EPA Pub. No. 1015, Oct 2005)</td><td>Refer 2011-2012 Melbourne Water Annual Report</td></tr>
<tr><td colspan="2">Conditions are such that undesirable levels of chloramines maybe produced</td><td>No chloramine was produced during the 2011-2012 season</td></tr>
<tr><td colspan="2">If known extreme levels of toxicants are identified in recycled water that exceed relevant guideline levels in ANZECC / ARMCANZ 2000.</td><td>Refer 2011-2012 Melbourne Water Annual Report</td></tr>
<tr><td colspan="3">WID Water Distribution System Inflows and Outflows</td></tr>
<tr><td colspan="2">Water management system identifies less than 60% efficiency on an annual flow basis.</td><td>This trigger was not exceeded; refer Section 2 for summary data.</td></tr>
<tr><td colspan="3">Customer Site Soil Triggers</td></tr>
<tr><td>Salinity > 6.0 ECe</td><td>Sodicity > 15% ESP</td><td rowspan="9">Due to zero deliveries of recycled water in 2012-2012 there were no properties required to deliver a soil sample..</td></tr>
<tr><td>pH <5.0 or >8.8</td><td>Chloride > 600mg/kg</td></tr>
<tr><td>Phosphorus (Cowell):</td><td>Increase above baseline levels</td></tr>
<tr><td>Depth</td><td>85-100cm</td></tr>
<tr><td>Trigger</td><td>> 50mg/kg</td></tr>
<tr><td>Nitrate:</td><td>Increase above baseline levels</td></tr>
<tr><td>Depth</td><td>85-100cm</td></tr>
<tr><td>Trigger</td><td>> 100 mg/kg</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="3">Groundwater</td></tr>
<tr><td colspan="2">Concentrations of parameters monitored as per Table 6-4 of the REIP increase significantly (> 20%) from pre-recycled water (January 2005) baseline levels</td><td rowspan="2">Some triggers have been exceeded, refer to Section 5.4</td></tr>
<tr><td colspan="2">Concentrations of parameters monitored as per Table 6-4 of the REIP exceed SEPP or ANZECC / ARMCANZ 2000 water quality objectives for defined Beneficial Use Criteria</td></tr>
<tr><td colspan="3">Surface Drains</td></tr>
<tr><td colspan="2">Concentrations of parameters monitored as per Table 6-5 of the REIP exceed SEPP or ANZECC / ARMCANZ 2000 water quality objectives for defined Beneficial Use Criteria</td><td>These triggers have been exceeded, refer to Section 3.1.2</td></tr>
<tr><td colspan="3">Receiving Waters: Werribee River Estuary & Port Phillip Bay</td></tr>
<tr><td colspan="2">Concentrations of monitored parameters as per Table 6-6 in the REIP exceed SEPP or ANZECC / ARMCANZ 2000 water quality objectives for defined Beneficial Use Criteria</td><td>These triggers have been exceeded, refer to Section 4.1.4</td></tr>
</table>

Table 7-1 REIP 2009 reporting triggers

8. Asset Inspection & Maintenance

8.1 Melbourne Water asset handover for WID

Negotiations between SRW and Melbourne Water are continuing about the take over the maintenance responsibilities for the valves, meters, automatic actuation and infrastructure at both these supply points.

The negotiations had stalled due to the fact that there was no Recycled water supplied through these valves during the 2011/2012 season. The outstanding SCADA issues and automatic shut-off for the main valve and the 4/1 sensor still need to be rectified, and can only be fixed whilst we are supplying. We are confident these issues will be fixed during the 2012/2013 season.

Melbourne Water will continue to be responsible for all scheduled and unscheduled maintenance from the Western Treatment Plant to downstream of the supply valves on the main and the 4/1 channels.

8.2 SRW Assets

SRW continues to carry out life and asset condition inspections in the WID. A further 681 assets were inspected during the 2011/2012 season. The reviews consist of rating the condition of the asset and scheduling any urgent maintenance.

Asset	SRW (or Contractor)	2011 Performance
Asset Life Inspection		
	Ongoing - 5 year cycle	72.7%
Channels		
Maintenance and Repairs	Ongoing	Completed
Inspection	Ongoing	Completed
De-silting	June – Sept	Completed
Weed Control	Quarterly	Completed
Drains - WID		
Maintenance and Repairs	Ongoing	Completed
Weed Control	Quarterly	Completed
Inspection	Ongoing	Completed
Flow Monitoring	Ongoing(now data log capable)	Completed
Monitoring Equipment	Monthly	Completed
Drain 1 - WID		
Maintenance and Repairs	When required	Completed
Inspection	Quarterly	Completed

Weed Control	Quarterly	Completed
Pipeline		
Maintenance and Repairs	Ongoing	Completed
Equipment – Valves / Meters / Wheels		
Maintenance and Repairs	When required	Completed
Inspection	Ongoing	Completed
Interface Point - Downstream		
Maintenance and Repairs	Quarterly and as Required	Completed
SCADA System	When required	Completed
Interface Point - Upstream		
Maintenance and Repairs	Will be carried out by MW as required for 2012/2013 Season	Scheduled for 2012/2013 Season
SCADA System	Will be carried out by both SRW & MW as required	2012/2013 Season
Outfalls		
Maintenance and Repairs	Ongoing	Completed
Monitoring	Ongoing(now data log capable)	Completed

Table 8-1 SRW asset maintenance overview

9. Incident & Non-conformance Reporting

As no recycled water was delivered during this period, this section is not applicable.

10. Complaints & Enquiries

There were no complaints as no recycled water was delivered during this period.

11. Audits & Verification of Information

As all recycled water contracted in the WID expired on the 30th June 2011 and no recycled water was supplied during the 2011/2012 season, there was no requirement to do Customer Site Management Plans (CSMP) audits.

As the new recycled water contracts commenced in the WID on 1st of July 2012 we will be completing new CSMP's for all customers.

12. Improvement Programs

As no recycled water was delivered during this period, this section is not applicable.

13. Data Quality Statement

Data Source:	Annual Soil Sampling Program Receiving Waters Monitoring Program WID Groundwater Monitoring Program WID Drainage Monitoring Program
Institutional Environment:	SRW collects this data gathered by private contractors, including Ag-Challenge Pty Ltd, Ecowise Australia Pty Ltd, Theiss & SKM The data was collected under the guidelines set forth by the 2009 Regional Environmental Improvement Plan for the Werribee Irrigation District Recycled Water Scheme. The data was compiled by the organisation responsible for collection.
Relevance:	Werribee Irrigation District during the 2011-2012 financial year. WID Water Supply data includes volumes of water from all sources, into and out of the district. WID Groundwater data includes levels and sample analysis for major cations, heavy metals and nutrients. WID Drainage data includes volumes, major event logging and water quality. WID Receiving Waters data includes water quality. WID Annual Soil Sampling Program data includes standard agronomic tests, cation balances and soil texture. The data has been collected to ensure that SRW are able to comply with the monitoring requirements of the WID Recycled Water Scheme REIP 2009.
Timeliness:	All data was collected in accordance with the guidelines set forth in Section 6 of the WID Recycled Water Scheme REIP, any exceptions have been clearly identified. The reference period for this data is the 2011-2012 financial year.
Accuracy:	All samples were taken in accordance with the requirements in Section 6 of the WID Recycled Water Scheme REIP, each of the organisations collecting the samples have provided relevant QA statements. Privacy legislation requires that soil samples taken from landholders cannot be individually identified from any published use of the data. All data has been compiled by fully accredited organisations with the relevant QA checks in place to minimise processing errors. The data has also been verified by SRW staff to ensure that the reporting requirements have been met. When data collection has not occurred according to the schedules set out in the WID Recycled Water Scheme REIP, this has been recorded and noted in the Annual Report.
Coherence:	The data from 2011-2012 is directly comparable to the previous year and more detailed than samples taken in earlier years. However, valid comparisons can still be made between results from different years. There is a consistent time series for this data.

	In 2011-2012 the impact of recycled water in the WID would have been mitigated by the increase in rainfall over previous monitoring years. This is reflected in the subsequent results. The data is collected and recorded in a way that enables direct comparison with SEPP water quality objectives for Victoria.
Interpretability:	Other Supporting information: For additional information please refer to the WID Recycled Water Scheme REIP, available for download from the SRW website.
Accessibility:	The data is available in the 2011-2012 REIP Annual Report, which provides summary information for each reporting category as well as copies of the raw data in the appendices.

For further information please contact:

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Telephone Number:	(03) 9259 5051
Email Address:	Craig.smith@srw.com.au

14. Other Information

MWC Liaison Meetings

Liaison meetings with Melbourne Water were held quarterly to discuss ongoing operations and maintenance of the recycled water supply. Separate meetings were also held to discuss,

- The transfer of Melbourne Water assets located in the Werribee Tourist Precinct to SRW,

15. WID register of recycled water customers & 2011-12 usage

No recycled water usage in 2011-2012