GOULBURN-MURRAY WATER

# Lower Campaspe Valley Water Supply Protection Area Groundwater Management Plan

# Annual Report

June 2013

## Document History and Distribution

### Version(s)

| Version | Date | Author(s) | Notes |
|---|---|---|---|
| Draft v1 | Aug 2013 | B Knowles | Document Creation |
| Draft v2 | 11Sep 2013 | B Cossens | Comments incorporated |
| Final | 11Sep 2013 | S Cowan | Comments incorporated |

### Distribution

| Version | Recipient(s) | Date | Notes |
|---|---|---|---|
| Draft | | | |
| | | | |

## Foreword

Goulburn-Murray Water (GMW) is pleased to present the annual report for the Lower Campaspe Valley Water Supply Protection Area (WSPA) Groundwater Management Plan (the Plan) for the 2012/13 season.

GMW is responsible for implementation and administration of the Plan, which was approved by the Minister for Water in October 2012.

This report has been prepared in accordance with section 32C of the *Water Act 1989*.

This report provides an overview of groundwater management activities in the Lower Campaspe Valley WSPA and documents the successful implementation of the Plan during the 2012/13 season.

A copy of this report is available for inspection at the Tatura office, or it can be downloaded from the GMW website http://www.g-mwater.com.au.

Gavin Hanlon
MANAGING DIRECTOR

Date: 26/9/2013

## Executive summary

The 2012/13 irrigation season saw the successful implementation of the Lower Campaspe Valley Water Supply Protection Area (WSPA) Groundwater Management Plan (the Plan), which was approved by the Minister for Water in October 2012.

Groundwater recovery levels across the WSPA remained relatively steady in 2012/13 and seasonal drawdown was within expected ranges.

Allocations in all zones of the Lower Campaspe Valley WSPA were announced at 100% in 2012/13.

Metered usage in the Lower Campaspe Valley WSPA was 49% (27,260 ML) of licence entitlement. This is closer to the historic average use than the previous two seasons, which were notably wetter than average.

There was significant licence transfer activity during 2012/13. There were 25 temporary transfers for a total of 4,171 ML. this included one temporary transfer 70 ML to a licence holder outside of the WSPA. There were permanent transfers for a total of 1,457 ML 2012/13. This included a 200 ML permanently transferred from the Bamawm Zone to the Elmore–Rochester Zone.

In November 2012, the Minister for Water declared that groundwater licence holders in the Lower Campaspe Valley WSPA were authorised to take carryover up to a maximum of 25% of their licence entitlement. Licence holders have carried over 12,297 ML into the 2013/14 season.

Groundwater monitoring and metering programmes are in place to support the implementation of the Plan.

## Table of Contents

# 1 Introduction

## 1.1 Purpose

This report has been prepared to meet requirements of the Lower Campaspe Valley Water Supply Protection Area (WSPA) Groundwater Management Plan (the Plan) and section 32C of the *Water Act 1989* (the Act).

It discusses the implementation of the Plan and provides an overview of groundwater resource management activities undertaken in accordance with the Plan during the 2012/13 season.

## 1.2 Water Supply Protection Area

The Lower Campaspe Valley WSPA was declared in June 2010. It extends from Lake Eppalock in the south to Echuca in the north and includes the towns of Axedale, Goornong, Elmore, Lockington and Rochester.

There are four management zones within the Lower Campaspe Valley WSPA comprising the Barnadown, Elmore-Rochester, Bamawm and Echuca zones (Figure 1).

The WSPA includes groundwater resources at all depths except where it is overlain by the Campaspe West Salinity Management Plan Area and the region to the north north of the Waranga Western Channel. In these areas, the Plan only applies to the management of groundwater resources from 25 m to all depths.

## 1.3 Groundwater Management Plan

The Plan was approved by the Minister for Water in accordance with section 32A(6) of the Act on 17 October 2012.

The objective of the Plan, as defined in section 32A(1) of the Act, is to make sure that groundwater resources of the WSPA are managed in an equitable manner so as to ensure the long term sustainability of those resources. More specifically, the Plan seeks to:

1. Protect existing groundwater users and the environment by managing groundwater levels and the potential for change in groundwater salinity;
2. Enable equitable development of groundwater resources to realise the potential for its use in the region; and
3. Communicate the Plan's objectives, management rules and resource status with stakeholders and the wider community.

Goulburn-Murray Water (GMW) is responsible for the implementation, administration and enforcement of the Plan. An assessment summary of GMW's activities in accordance with Plan prescriptions is presented in Appendix A.

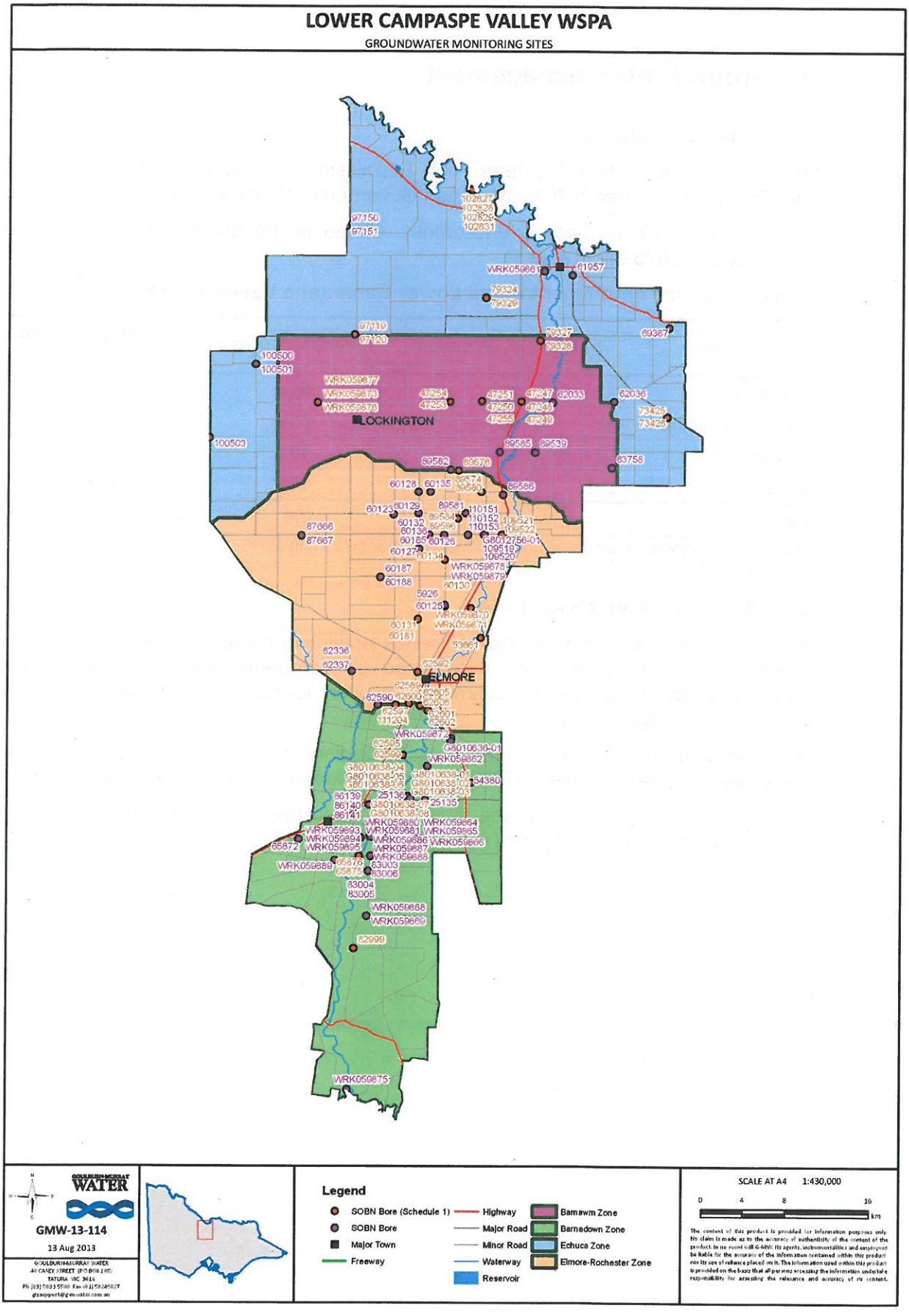



**Figure 1 Lower Campaspe Valley Water Supply Protection Area with State observation bores indicated**

# 2 Groundwater management

## 2.1 Licence volume

The Minister for Water declared the Permissible Consumptive Volume to be 55,875 ML/year in March 2013 (Victorian Government Gazette, 2013).

At 30 June 2013 the licence entitlement volume in the Lower Campaspe Valley WSPA was 55,875 ML (Table 1).

**Table 1 Licence entitlement in the Lower Campaspe Valley WSPA**

| Zone | Number of Licences | Licensed bores | Licence volume (ML) |
|---|---|---|---|
| Barnadown | 20 | 55 | 7,999 |
| Elmore-Rochester | 60 | 68 | 16,036 |
| Bamawm | 45 | 49 | 26,929 |
| Echuca | 18 | 18 | 4,911 |
| **Total** | 143 | 190 | 55,875 |

NOTE: Data extracted from the Victorian Water Register on 29 July 2013

## 2.2 Groundwater allocations

Allocations refer to a percentage of licence entitlement that may be extracted in a given season. Allocations are determined by comparing the three year rolling average of maximum annual groundwater recovery levels in bores 62589 and 79324 with the Plan trigger levels.

Allocations of 100% were announced at the beginning of the 2012/13 season under the Lower Campaspe Valley WSPA Interim Management Rules (GMW, 2010).

After the Plan was approved, the allocations were reviewed and determined to be 100% of licence entitlement in all management zones (Figure 2 and Figure 3).

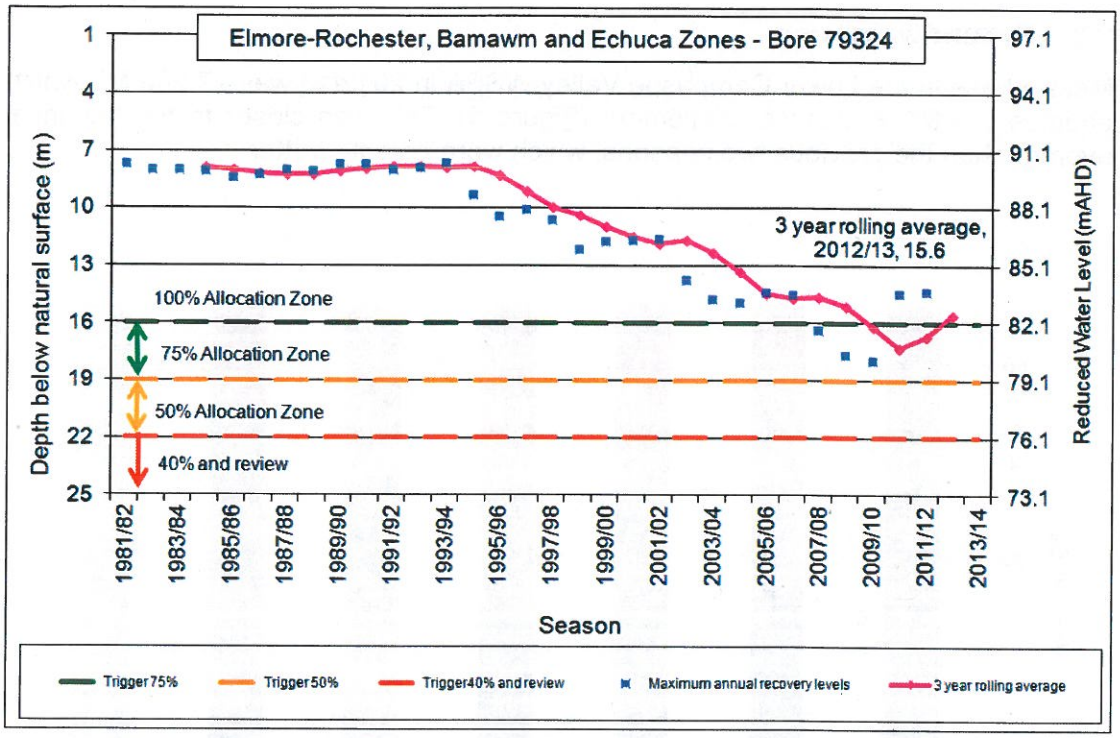



**Figure 2 Trigger levels to determine allocations in the Elmore-Rochester, Bamawm and Echuca Zones**

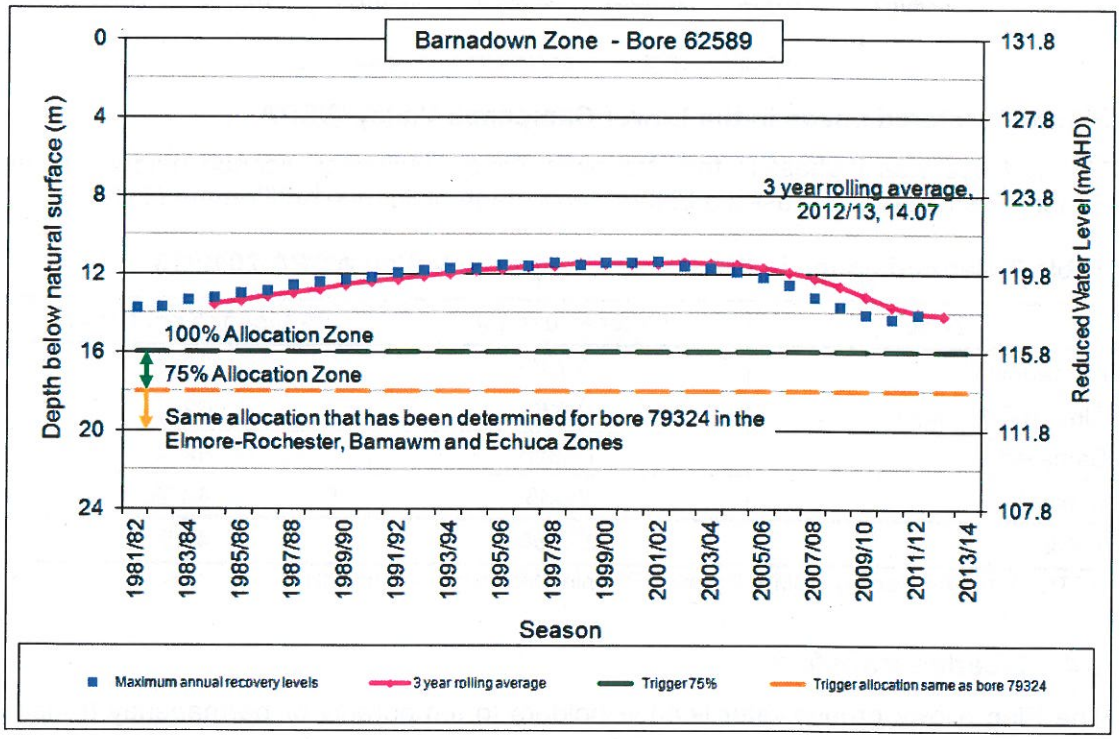



**Figure 3 Trigger levels to determine allocations in the Barnadown Zone**

## 2.3 Groundwater use

Metered use in the Lower Campaspe Valley WSPA in 2012/13 was 27,260 ML which equates to 49% of licence entitlement (Figure 4). This was closer to the historical average than the previous two seasons, which were notably wetter.

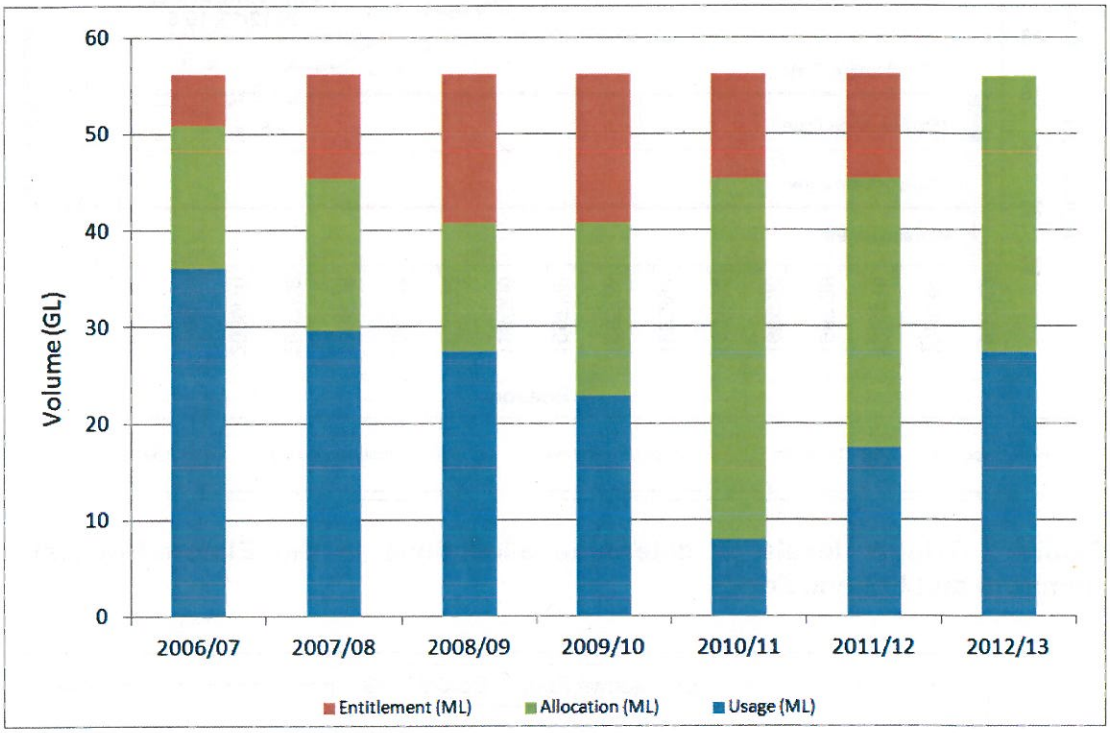



**Figure 4 Metered usage in the Lower Campaspe Valley WSPA**

Metered use was highest in the Bamawm Zone. However, licence holders in the Elmore-Rochester Zone used a higher percentage of licence entitlement (Table 2).

**Table 2 Metered usage in the Lower Campaspe Valley WSPA 2012/13**

| Zone | Metered use (ML) | % Licence entitlement |
|---|---|---|
| Barnadown | 3,735 | 47 % |
| Elmore-Rochester | 9,932 | 62 % |
| Bamawm | 11,255 | 42 % |
| Echuca | 2,338 | 48 % |
| **Total** | **27,260** | **49 %** |

NOTE: Data extracted from GMW Irrigation Planning Module 19 August 2013

## 2.4 Licence transfers

The Plan allows groundwater licence holders to temporarily or permanently transfer licence entitlement.

In 2012/13 there were 25 temporary transfers for a total of 4,171 ML (Table 3). One trade for 70 ML was to a licence holder outside of the WSPA. There was 1,257 ML transferred out of the Bamawn Zone, most of which was transferred into the Echuca Zone.

There were four permanent transfers in the Lower Campaspe Valley WSPA for a total of 1,457 ML. This included a 200 ML permanent transfer from the Bamawm Zone to the Elmore–Rochester Zone.

**Table 3 Transfers in the Lower Campaspe Valley WSPA in 2012/13**

| Zone | Temporary | | | | Permanent | | | |
|---|---|---|---|---|---|---|---|---|
| | Transfer from | | Transfer to | | Transfer from | | Transfer to | |
| | No. of transfer | Volume (ML) | No. of transfer | Volume (ML) | No. of transfer | Volume (ML) | No. of transfer | Volume (ML) |
| Barnadown | 2 | 400 | 2 | 400 | 1 | 280 | 1 | 280 |
| Elmore-Rochester | 12 | 1,563 | 13 | 1,670 | 1 | 197 | 2 | 397 |
| Bamawm | 11 | 2,208 | 6 | 951 | 2 | 980 | 1 | 780 |
| Echuca | 0 | 0 | 3 | 1,080 | 0 | 0 | 0 | 0 |
| **Total** | **25** | **4,171** | **24** | **4,101** | **4** | **1,457** | **4** | **1,457** |

## 2.5 Carryover

Following an application from GMW, the Minister for Water declared that groundwater licence holders in the Lower Campaspe Valley WSPA are authorised to carry over unused entitlement, up to 25% of licence entitlement volume, from October 2012 (Victorian Government Gazette, 2012).

At the conclusion of the 2012/13 season, groundwater licence holders in the WSPA had a total of 12,297 ML of entitlement available to carry over and use in the 2013/14 season.

# 3 Monitoring program

## 3.1 Groundwater levels

The Department of Environment and Primary Industries (DEPI) monitored groundwater levels in more than 100 State observation bores across the Lower Campaspe Valley WSPA on a quarterly basis (Figure 1). GMW conducted monthly infill monitoring of 60 State observation bores in accordance with Schedule 1 of the Plan (Appendix B).

Groundwater recovery levels across the WSPA remained relatively steady in 2012/13 following significant recovery in 2010/11 and 2011/12. Groundwater drawdown levels in 2012/13 were consistent with those observed in drier seasons, with up to 17 m of drawdown observed in the more intensively pumped areas in the Elmore-Rochester and Bamawm Zones (Figure 5).

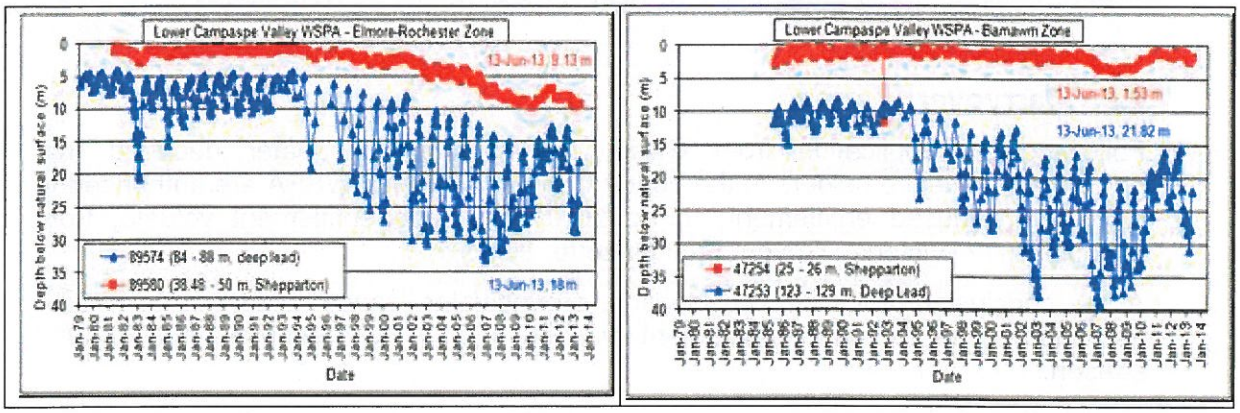



**Figure 5 Groundwater levels in the Elmore-Rochester and Bamawn Zones**

Groundwater levels remained relatively stable across the Barnadown and Echuca zones in 2012/13, with seasonal drawdown of up to 5 m observed in some areas (Figure 6).

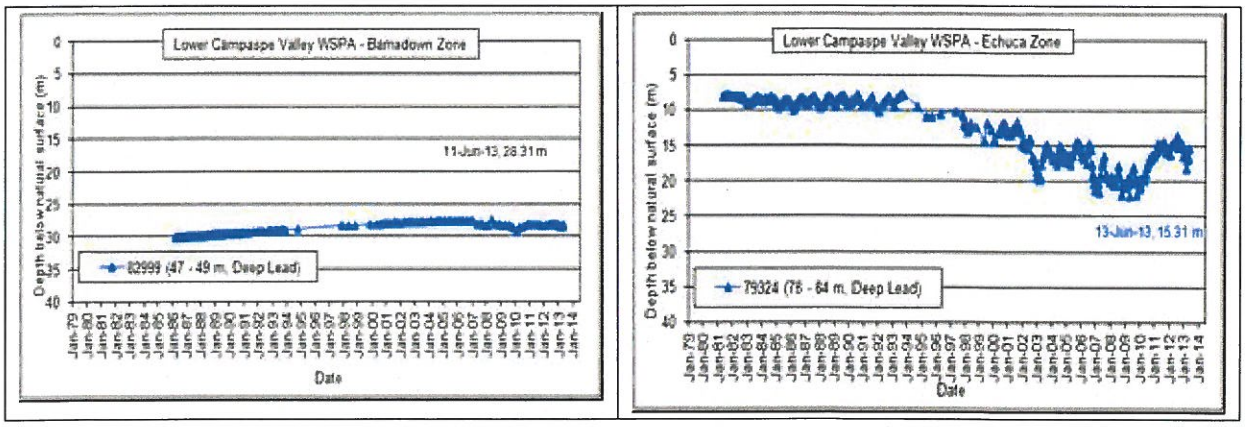



**Figure 6 Groundwater levels in Barnadown and Echuca Zones**

## 3.2 Groundwater salinity

Groundwater quality testing was undertaken by taking samples from nested State observation bore sites in the Lower Campaspe Valley WSPA. Nested sites feature two or more monitoring bores in close proximity, each monitoring a different aquifer. The State observation bores used for water quality testing are located in the areas of intensive groundwater pumping west of Rochester and at the northern margins of the WSPA.

Groundwater salinity results are presented in Table 4. The results have been compared to earlier measurements of groundwater salinity (Appendix C). While in most bores it appears that the groundwater salinity has remained relatively steady, in bores 102828, 73426 and 89584 there appears to be some anomalous data. Regular periodic analysis of groundwater quality will enable any trends to be identified with greater confidence.

**Table 4 Groundwater salinity levels in key monitoring bores in the Lower Campaspe Valley WSPA**

| Bore number | Zone | Screen depth below natural surface (m) | Salinity (EC µS/cm) |
|---|---|---|---|
| 102827 | Echuca | 108 - 114 | 4,680 |
| 102828 | Echuca | 160 -167 | 10,000 |
| 102829 | Echuca | 70 - 74 | 4,110 |
| 73425 | Echuca | 87 - 89 | 10,700 |
| 73426 | Echuca (SIR) | 6 - 18 | 9,190 |
| WRK059873 | Bamawm | 82 - 87 | 3,850 |
| WRK059876 | Bamawm | 91 - 97 | 3,110 |
| WRK059877 | Bamawm | 34 - 37 | 4,140 |
| 47250 | Bamawm | 73 - 85 | 1,900 |
| 47251 | Bamawm | 22 - 27 | 3,970 |
| 89584 | Elmore-Rochester | 84 - 88 | 5,430 |
| 89596 | Elmore-Rochester | 2 - 14 | Bore dry |

GMW sent 193 sample bottles and a reply paid envelope to licence holders, and domestic and stock users upon request, to collect a groundwater sample from their bore for analysis. There were 36 (18%) samples returned for analysis.

GMW measured the groundwater salinity, advised the bore owner of the result and recorded the result in the State groundwater database. The results are shown spatially in Figure 7 and illustrate that groundwater salinity level is higher in the northern parts of the WSPA. A higher and more consistent sample return rate would assist with spatially assessing any changes in groundwater salinity over time. Groundwater users are strongly encouraged to participate in this program so that they can identify any changes in groundwater salinity at their bore that might impact on their business.

GMW (2013) has developed an approach for the targeted sampling of licensed bores and will invite licence holders to participate during the 2013/14 season. This program will ensure that samples are consistently collected each year from licensed bores located in strategic locations that will provide a reliable data set to aid in understanding any changes in groundwater salinity.

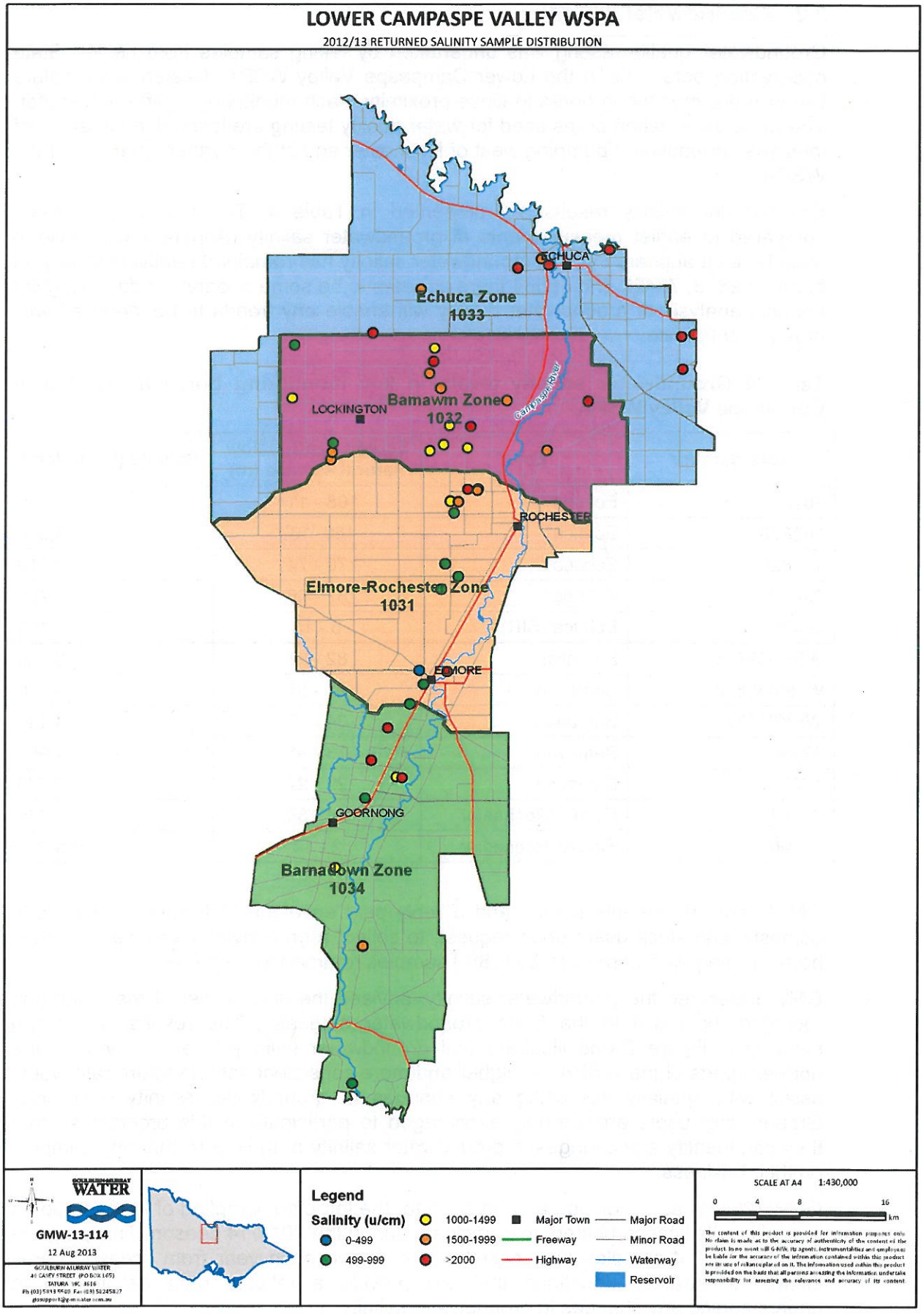



**Figure 7 Location of returned samples analysed for groundwater salinity**

# 4 Future management considerations

## 4.1 Policy changes

DEPI provided policy advice during the 2012/13 season that GMW may consider issuing temporary licence transfers for a period of up to five years.

The policy change means that temporary transfers can be considered for a term up to five years in the Lower Campaspe Valley WSPA providing that, when assessing groundwater resource conditions, GMW is confident there would be a low risk of any unacceptable impact on third parties or the environment for the duration of the licence transfer period.

# 5 References

Goulburn-Murray Water, 2013. Lower Campaspe Valley Water Supply Protection Area Groundwater Targeted licensed bore sampling. Unpublished report by Goulburn-Murray Water, Tatura. Document reference number 3503975.

Lower Campaspe Valley Water Supply Protection Area Groundwater Management Plan October 2013. Department of Environment and Primary Industries, Melbourne

Victorian Government, 2012. Victorian Government Gazette No. G43 25 October 2012. Victoria Government, Melbourne

Victorian Government, 2013. Victorian Government Gazette No. G10 7 March 2013. Victoria Government, Melbourne

# Appendix A

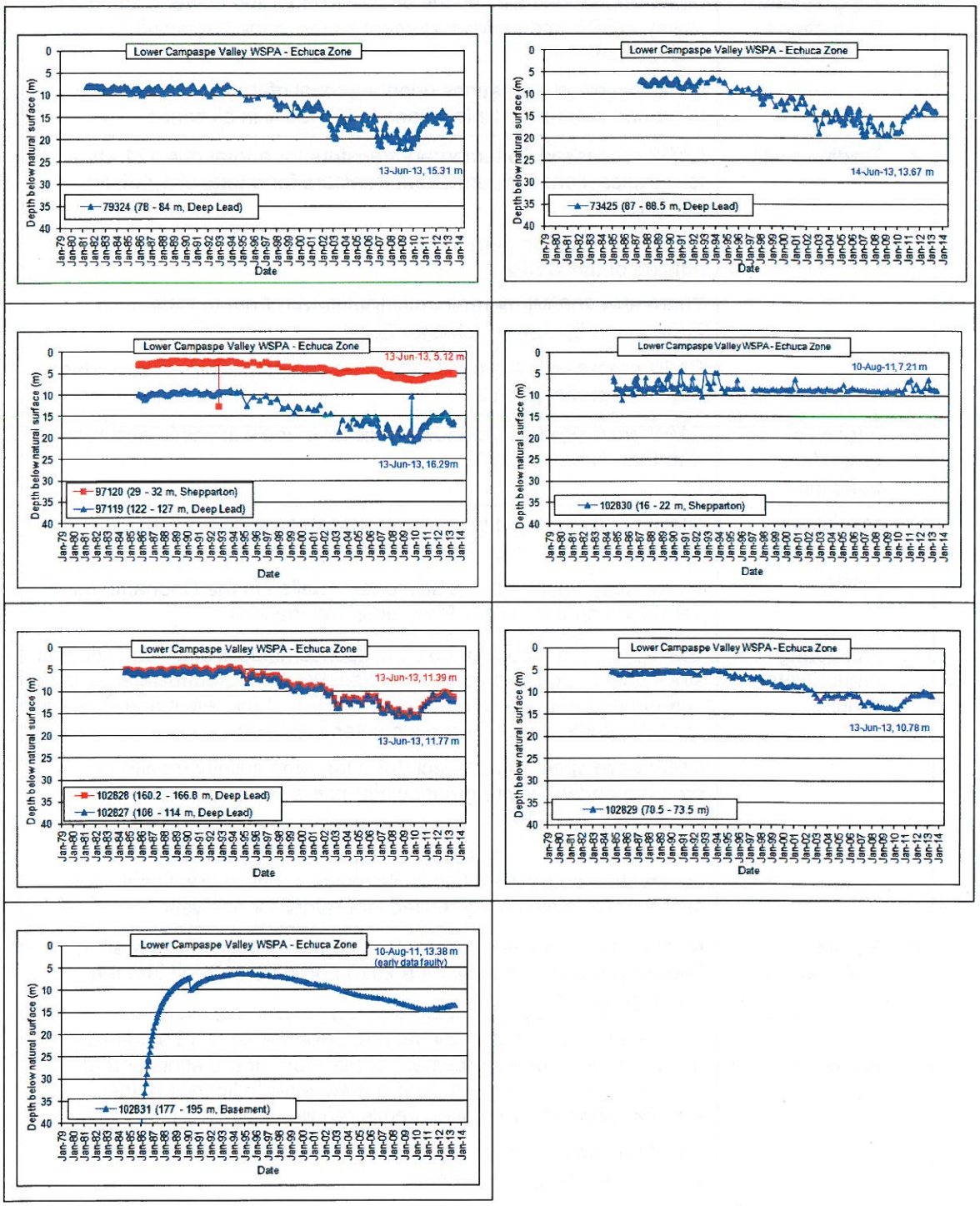
Assessment of activities against Plan prescriptions

| Prescription | Activity | Compliant? (Yes/No) |
|---|---|---|
| 1. Triggers and Restrictions | GMW announced allocations of 100% under the Lower Campaspe Valley WSPA Interim Management Rules at the beginning of the 2012/13 season.<br>GMW reviewed allocations upon approval of the Plan in October 2012 and determined allocations to be 100% in all zones. | Yes |
| 2. Trading rules | GMW processed 25 temporary transfers for a total of 4,171 ML and four transactions for permanent transfers for a total of 1,457 ML 2012/13.<br>There was one temporary transfer for 70 ML to a licence holder outside of the WSPA.<br>There was 200 ML permanently transferred from the Bamawm Zone to the Elmore–Rochester Zone.<br>GMW processed all groundwater licence applications in accordance with Plan prescription 2. | Yes |
| 3. Intensive groundwater pumping | GMW processed all groundwater licence applications in accordance with Plan prescription 3. | Yes |
| 4. Monitoring groundwater levels | GMW obtained monthly groundwater level readings from bores listed in Schedule 1 of the Plan where practicable.<br>A new observation bore is still to be installed in the Coonambidgal Formation aquifer as per Plan recommendations. | Yes |
| 5. Monitoring groundwater salinity | GMW provided a sample bottle to licence holders and domestic and stock users upon request. GMW measured the groundwater salinity in returned samples, advised bore owners of the result and entered the results into the State groundwater database.<br>GMW developed an approach for a targeted salinity monitoring program and will invite groundwater users to participate in the program in 2013/14.<br>GMW collected groundwater samples from nested State observation bores identified in Schedule 1 where practicable and sent them to a NATA accredited laboratory for analysis. | Yes |
| 6. Metered licensed use | All operational licensed bores are metered. Meters were read in February/March and May/June 2013 and data entered into the Water Register. | Yes |
| 7. Plan implementation | GMW has prepared this annual report for the 2012/13 season on administration and enforcement of the Plan for the Minister and relevant agencies and will send a newsletter to licence holders summarising the information in this report.<br>GMW has posted on its website the Plan, this annual report and a season summary newsletter.<br>GMW updates hydrographs of groundwater levels every three months on their website in accordance with the Plan.<br>GMW met with the Loddon and Campaspe Regional Water Services Committee on the 28 June 2013 to discuss the composition of a Groundwater Reference Committee. | Yes |

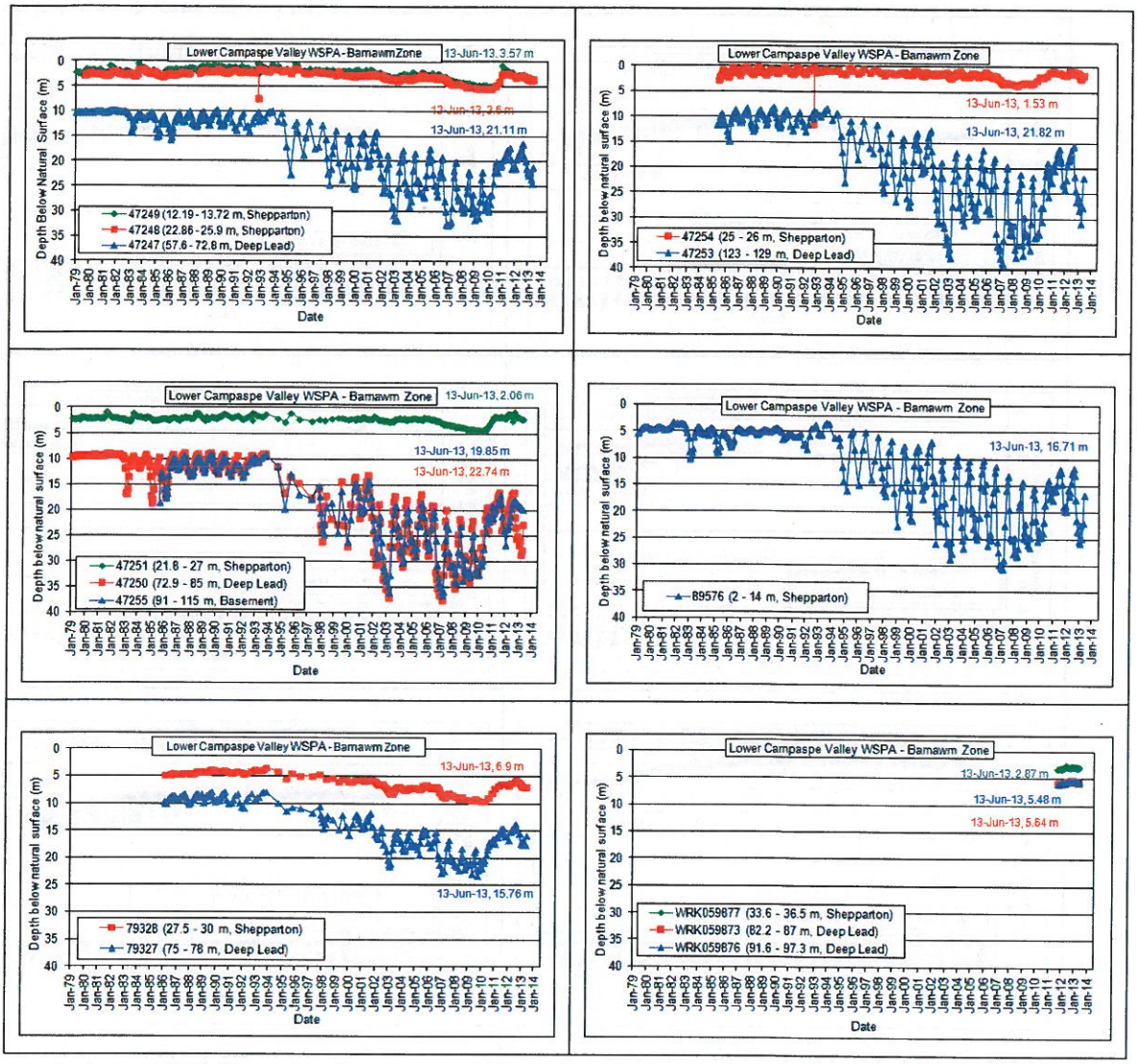
# Appendix B

Hydrographs for key monitoring bores listed in Schedule 1 of the Plan

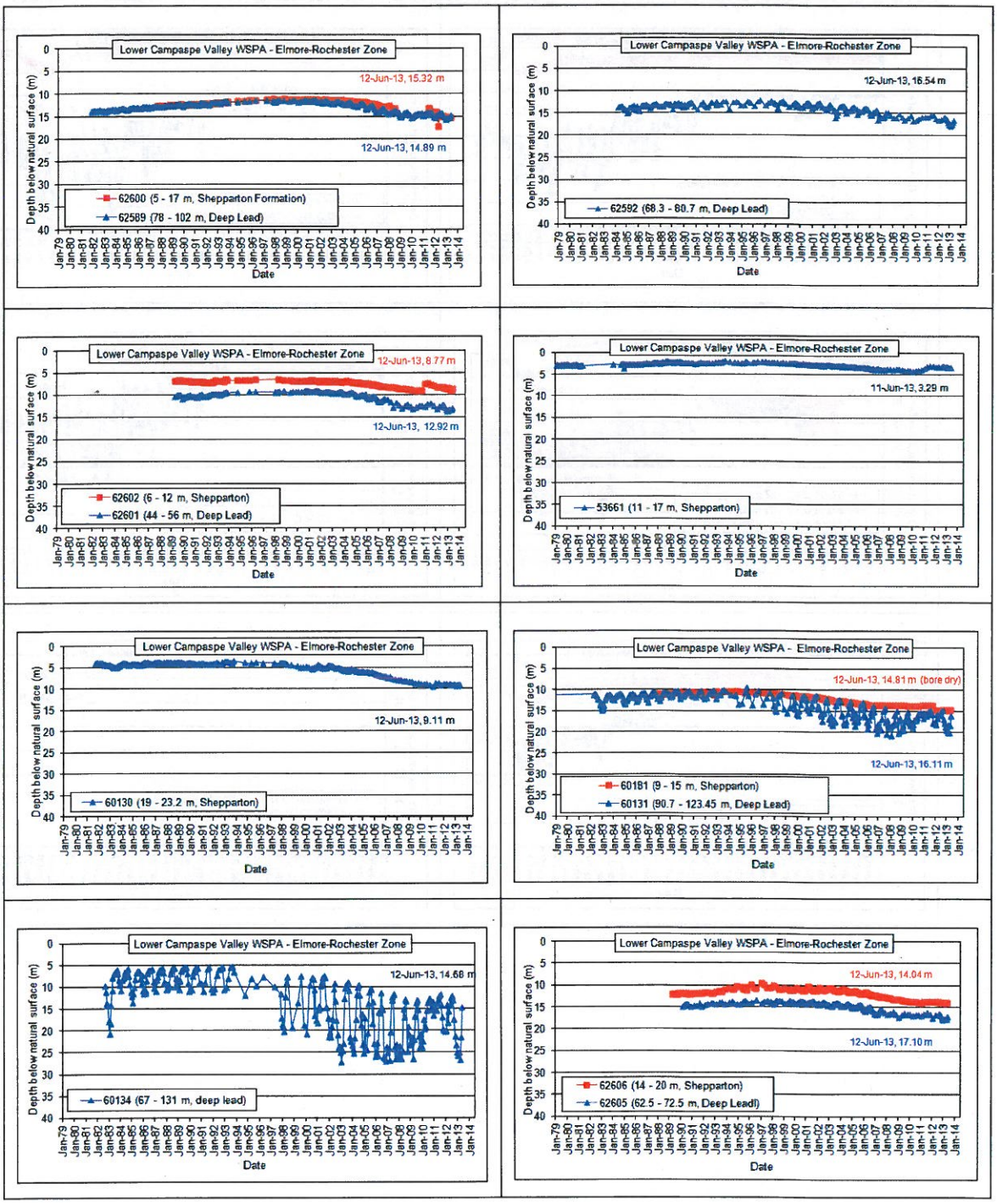
## Echuca Zone

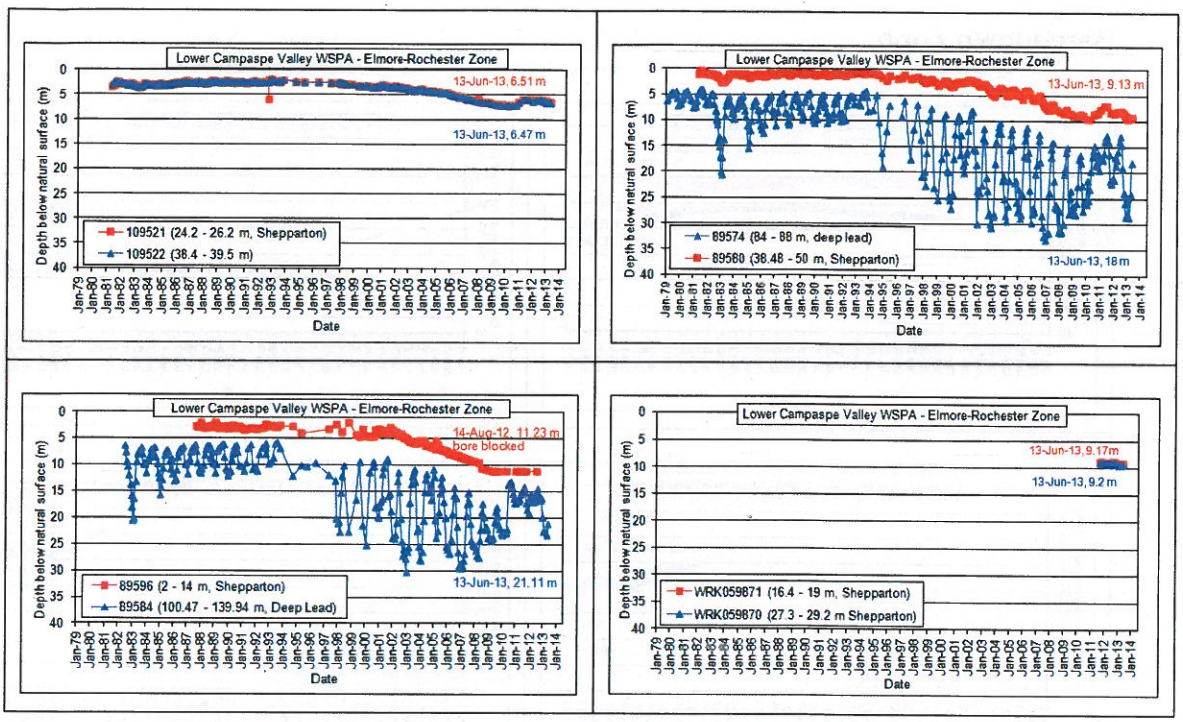


## Bamawm Zone

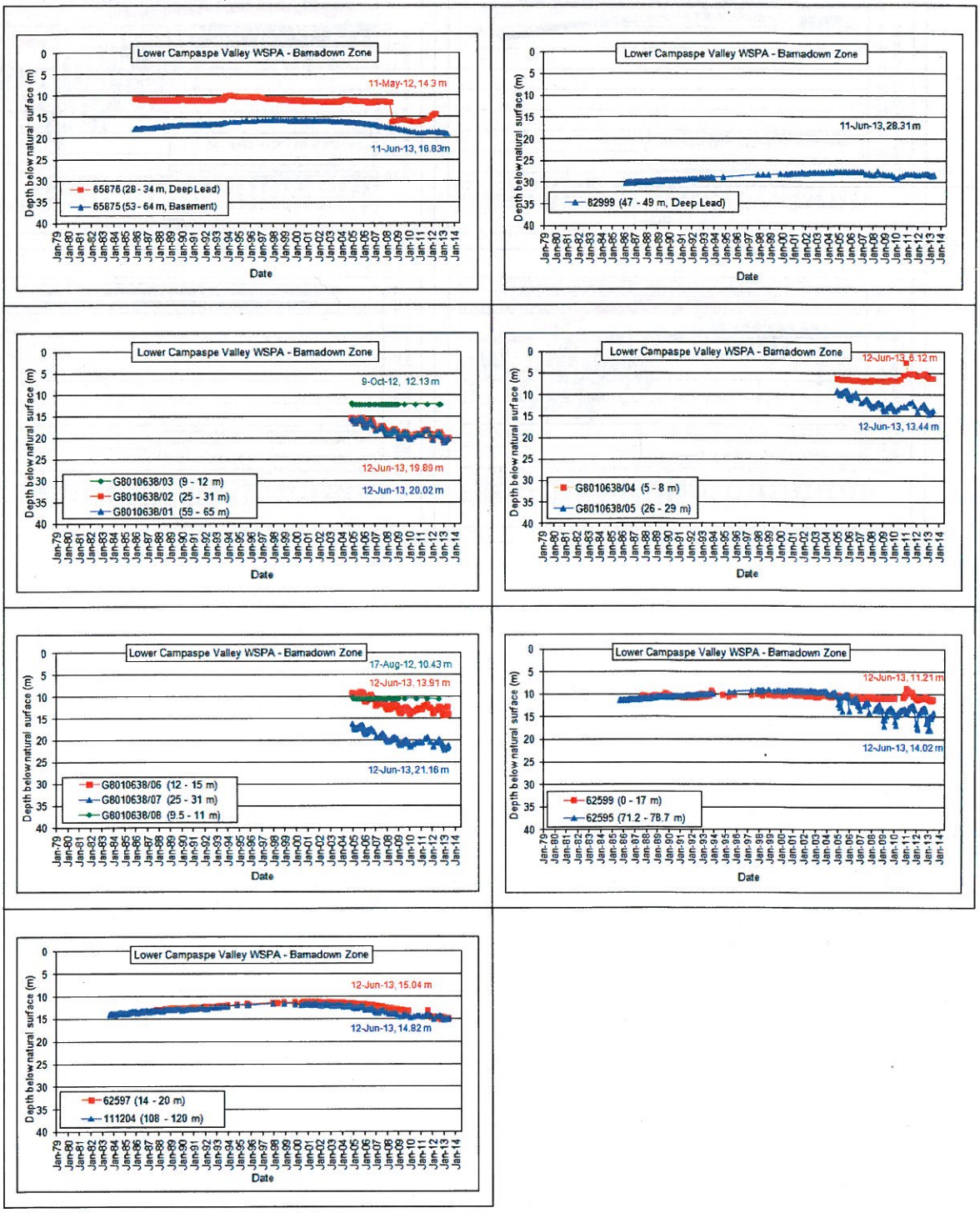

Lower Campaspe Valley WSPA - Bamawm Zone
13-Jun-13, 3.57 m
13-Jun-13, 21.11 m
47249 (12.19 - 13.72 m, Shepparton)
47248 (22.86 - 25.9 m, Shepparton)
47247 (57.6 - 72.8 m, Deep Lead)
Depth Below Natural Surface (m)
Date
Lower Campaspe Valley WSPA - Bamawm Zone
13-Jun-13, 1.53 m
13-Jun-13, 21.82 m
47254 (25 - 26 m, Shepparton)
47253 (123 - 129 m, Deep Lead)
Depth below natural surface (m)
Date
Lower Campaspe Valley WSPA - Bamawm Zone
13-Jun-13, 2.06 m
13-Jun-13, 19.85 m
13-Jun-13, 22.74 m
47251 (21.8 - 27 m, Shepparton)
47250 (72.9 - 85 m, Deep Lead)
47255 (91 - 115 m, Basement)
Depth below natural surface (m)
Date
Lower Campaspe Valley WSPA - Bamawm Zone
13-Jun-13, 16.71 m
89576 (2 - 14 m, Shepparton)
Depth below natural surface (m)
Date
Lower Campaspe Valley WSPA - Bamawm Zone
13-Jun-13, 6.9 m
13-Jun-13, 15.76 m
79328 (27.5 - 30 m, Shepparton)
79327 (75 - 78 m, Deep Lead)
Depth below natural surface (m)
Date
Lower Campaspe Valley WSPA - Bamawm Zone
13-Jun-13, 2.87 m
13-Jun-13, 5.48 m
13-Jun-13, 5.64 m
WRK059877 (33.6 - 36.5 m, Shepparton)
WRK059873 (82.2 - 87 m, Deep Lead)
WRK059876 (91.6 - 97.3 m, Deep Lead)
Depth below natural surface (m)
Date

## Elmore-Rochester Zone



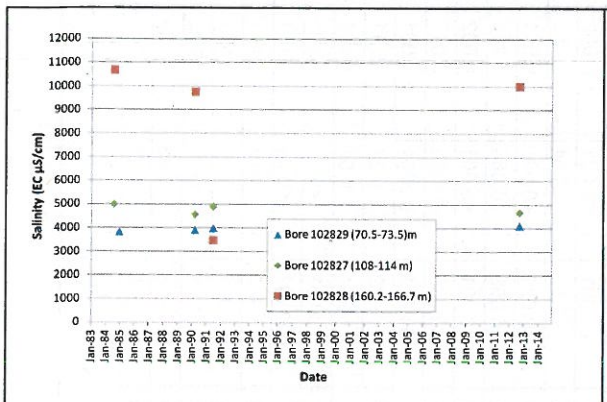

Lower Campaspe Valley WSPA - Elmore-Rochester Zone
Depth below natural surface (m)
Date
13-Jun-13, 6.51 m
13-Jun-13, 6.47 m
109521 (24.2 - 26.2 m, Shepparton)
109522 (38.4 - 39.5 m)
Lower Campaspe Valley WSPA - Elmore-Rochester Zone
Depth below natural surface (m)
Date
13-Jun-13, 9.13 m
89574 (84 - 88 m, deep lead)
89560 (38.48 - 50 m, Shepparton)
13-Jun-13, 18 m
Lower Campaspe Valley WSPA - Elmore-Rochester Zone
Depth below natural surface (m)
Date
14-Aug-12, 11.23 m
bore blocked
89596 (2 - 14 m, Shepparton)
89584 (100.47 - 139.94 m, Deep Lead)
13-Jun-13, 21.11 m
Lower Campaspe Valley WSPA - Elmore-Rochester Zone
Depth below natural surface (m)
Date
13-Jun-13, 9.17m
13-Jun-13, 9.2 m
WRK059871 (16.4 - 19 m, Shepparton)
WRK059870 (27.3 - 29.2 m Shepparton)

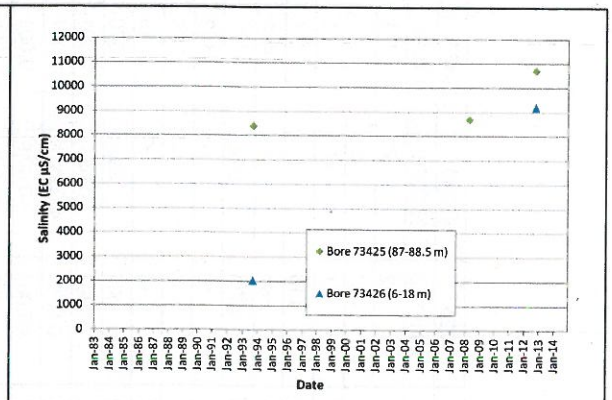
## Barnadown Zone

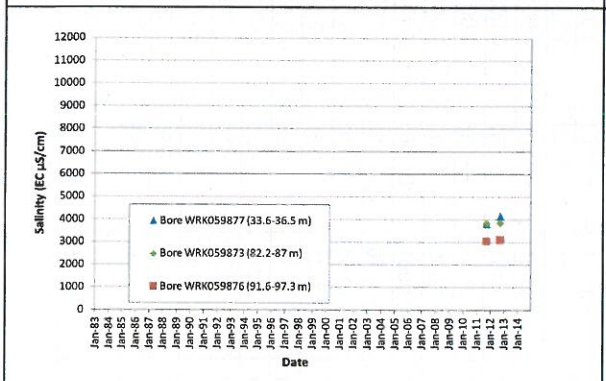


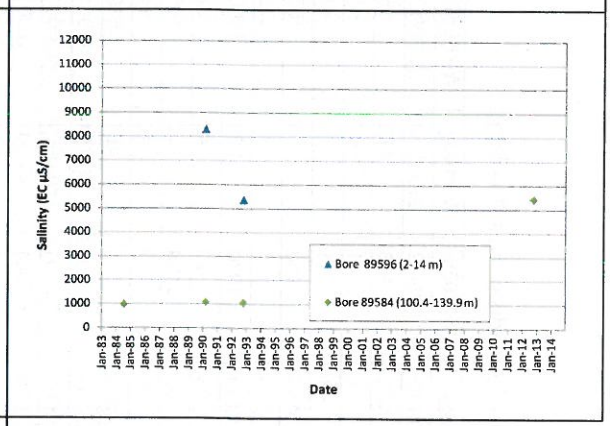
# Appendix C

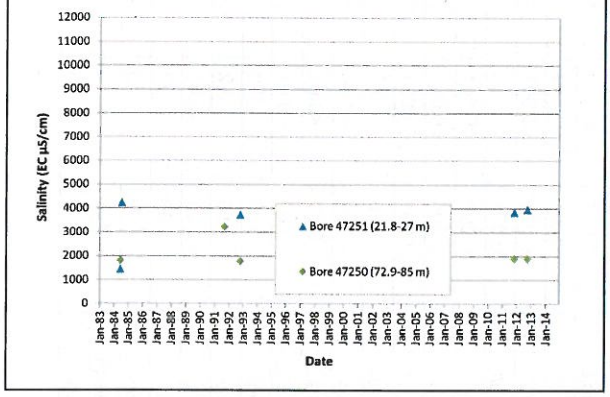
Historical groundwater salinity from State observation bores listed in Schedule 1 of the Plan



Groundwater quality results from State observation bores listed in Schedule 1 of the Plan

| | Bore | 102828 | 102827 | 102829 | WRK059 | WRK059 | WRK059 | 47251 | 47250 | 73425 | 73426 | 89584 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | Date | 24/09/12 | 24/09/12 | 24/09/12 | 25/09/12 | 25/09/12 | 25/09/12 | 26/09/12 | 26/09/12 | 8/10/12 | 8/10/12 | 8/10/12 |
| Bicarbonate Alkalinity as CaCO3 | mg/L | 135 | 80 | 184 | 158 | 176 | 156 | 82 | 56 | 211 | 49 | 3 |
| Carbonate Alkalinity as CaCO3 | mg/L | 38 | 85 | <1 | <1 | <1 | <1 | 33 | 28 | <1 | <1 | <1 |
| Hydroxide Alkalinity as CaCO3 | mg/L | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Total Alkalinity as CaCO3 | mg/L | 173 | 165 | 184 | 158 | 176 | 156 | 116 | 84 | 211 | 49 | 3 |
| Sulfate as SO4 - Turbidimetric | mg/L | 191 | 164 | 285 | 153 | <1 | 276 | 141 | 36 | 490 | 770 | 4 |
| Chloride | mg/L | 3640 | 1520 | 1180 | 1070 | 899 | 1100 | 1030 | 542 | 3410 | 2770 | 1770 |
| Calcium | mg/L | 28 | 6 | 33 | 70 | 42 | 52 | 10 | 6 | 123 | 108 | 90 |
| Magnesium | mg/L | 250 | 87 | 80 | 114 | 72 | 100 | 55 | 34 | 275 | 225 | 127 |
| Potassium | mg/L | 20 | 12 | 8 | 12 | 10 | 14 | 14 | 6 | 15 | 10 | 6 |
| Sodium | mg/L | 1750 | 801 | 616 | 514 | 461 | 619 | 601 | 295 | 1570 | 1540 | 336 |
| Arsenic | mg/L | <0.001 | <0.001 | <0.001 | 0.005 | <0.001 | <0.001 | 0.001 | <0.001 | 0.001 | <0.001 | <0.001 |
| Cadmium | mg/L | <0.0001 | <0.0001 | 0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.0001 | <0.0001 |
| Chromium | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.007 | <0.001 | <0.001 | 0.001 | 0.002 | <0.001 |
| Copper | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 | <0.001 | 0.002 | 0.004 | 0.007 |
| Iron | mg/L | <0.05 | 1.42 | <0.05 | 5.71 | 0.27 | <0.05 | <0.05 | 0.84 | 0.2 | <0.05 | 496 |
| Lead | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 | <0.001 |
| Manganese | mg/L | 0.091 | 0.115 | 0.011 | 0.481 | 0.152 | 0.002 | 0.056 | 0.064 | 0.114 | 0.008 | 20.1 |
| Nickel | mg/L | <0.001 | <0.001 | 0.086 | 0.003 | 0.038 | 0.001 | <0.001 | <0.001 | 0.002 | 0.004 | 0.002 |
| Zinc | mg/L | <0.005 | <0.005 | 0.013 | 0.019 | 0.012 | <0.005 | <0.005 | <0.005 | 0.017 | 0.008 | 0.13 |
| Mercury | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Ammonia as N | mg/L | 0.5 | 0.1 | 0.02 | 0.16 | 0.2 | 0.03 | 0.29 | 0.24 | 0.11 | 0.06 | 1.02 |
| Nitrite as N | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrate as N | mg/L | 0.01 | <0.01 | <0.01 | 0.01 | 0.01 | 0.64 | <0.01 | <0.01 | 0.01 | 2.21 | <0.01 |
| Nitrite + Nitrate as N | mg/L | 0.01 | <0.01 | <0.01 | 0.01 | 0.01 | 0.64 | <0.01 | <0.01 | 0.01 | 2.21 | <0.01 |
| Total Kjeldahl Nitrogen as N | mg/L | 0.5 | 0.2 | 0.1 | <0.1 | <0.1 | <0.1 | 0.3 | 0.3 | <0.1 | <0.1 | 1 |
| Total Nitrogen as N | mg/L | 0.5 | 0.2 | 0.1 | <0.1 | <0.1 | 0.6 | 0.3 | 0.3 | <0.1 | 2.2 | 1 |
| Total Phosphorus as P | mg/L | <0.01 | <0.01 | <0.01 | 0.06 | 0.17 | <0.04 | <0.01 | 0.03 | 0.02 | 0.06 | 0.03 |
| Ionic Balance | % | 5.53 | 7.59 | 9.83 | 1.38 | 0.97 | 2.3 | 4.25 | 4.85 | 6.34 | 2.16 | - |
| Total Anions | meq/L | 110 | 49.6 | 42.9 | 36.5 | 28.9 | 39.9 | 34.3 | 17.7 | 111 | 95.2 | 50.1 |
| Total Cations | meq/L | 98.6 | 42.6 | 35.2 | 35.5 | 28.3 | 38.1 | 31.5 | 16.1 | 97.4 | 91.2 | 29.7 |
| Total Organic Carbon | mg/L | 8 | 3 | 3 | 5 | 8 | 1 | <1 | 4 | 4 | 1 | 12 |