



Lower Campaspe Valley Water Supply Protection Area Groundwater Management Plan

Annual Report

For year ending 30 June 2019

Document History and Distribution

Versions

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Foreword

Goulburn-Murray Water (GMW) is pleased to present the annual report for the Lower Campaspe Valley Water Supply Protection Area Groundwater Management Plan (the Plan) for the 2018/19 water year.

GMW is responsible for the implementation, administration and enforcement of the Plan which was approved by the Minister administering the *Water Act 1989* (the Minister) on 17 October 2012.

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

This report provides an overview of the groundwater management activities administered under the Plan during the 2018/19 water year.

A copy of this report is available for inspection at the GMW Tatura office, or it can be downloaded from the GMW website.



Charmaine Quick

MANAGING DIRECTOR

23/9/19

Date

Executive summary

The Lower Campaspe Valley Water Supply Protection Area (WSPA) Groundwater Management Plan (the Plan) was approved by the Minister for Water on 17 October 2012.

The 2018/19 water year marks the seventh year of operation of the Plan.

Allocations in 2018/19 were 100 per cent of licensed volume in all management zones of the Lower Campaspe Valley WSPA.

Recorded use in 2018/19 was 90 per cent of licensed volume (50,258.9 ML), which was the highest in more than 14 years.

There was a lot of trade activity during the 2018/19 water year; 55 temporary licence transfers totalling 8,240.1 ML/year and four permanent licence transfers totalling 770 ML/year.

Licence holders in the Lower Campaspe Valley WSPA are entitled to carryover a maximum of 25 per cent of their unused licensed volume for use in the subsequent water year. A total of 11,511.8 ML has been carried over for use in the 2019/20.

A second consecutive year of below-average rainfall (i.e. 2018/19 following 2017/18) was recorded at Rochester within the Lower Campaspe Valley WSPA. The cumulative impacts of these drier conditions, combined with the larger volumes of groundwater abstraction, resulted in lower groundwater recovery levels than those recorded in 2016/17 and 2017/18, across much of the Lower Campaspe Valley WSPA.

Groundwater monitoring and metering programs continue to be successfully undertaken to support the objectives of the Plan.

GMW undertook a detailed review of the Plan in 2018 and has sought feedback from the Groundwater Reference Committee and other stakeholders.

Contents

Document History and Distribution	2
Foreword	3
Executive summary	4
1 Introduction.....	6
1.1 Purpose	6
1.2 Water Supply Protection Area	6
1.3 Groundwater Management Plan.....	6
2 Groundwater Management	8
2.1 Licensed volume.....	8
2.2 Groundwater allocations	8
2.3 Groundwater use	10
2.4 Rainfall.....	10
2.5 Licence transfers	11
2.6 Carryover	13
2.7 Metering.....	13
2.8 Licence compliance	13
2.9 Domestic and stock bore licences	13
3 Monitoring Program.....	14
3.1 Groundwater levels.....	14
3.2 Groundwater quality.....	16
Groundwater user salinity sampling	16
Targeted sampling of licensed bores	16
Sampling from State observation bores.....	19
4 Future Management Considerations.....	20
4.1 Groundwater Reference Committee.....	20
4.2 Management Plan review	20
5 References	22
Appendix A – Assessment of activities against Plan prescriptions.....	23
Appendix B – Hydrographs for key monitoring bores	26
Appendix C – Groundwater quality results.....	32
Groundwater salinity from key monitoring bores listed in Schedule 1 of the Plan.....	32
Groundwater chemistry results from key monitoring bores listed in Schedule 1 of the Plan.....	34
Groundwater salinity results from targeted sampling program and available historical data	36

1 Introduction

1.1 Purpose

This report has been prepared to meet the requirements of Prescription 7 of the Lower Campaspe Water Supply Protection Area Groundwater Management Plan (the Plan) and section 32C of the *Water Act 1989* (the Act).

The report provides an overview of groundwater resource status and summarises the groundwater management activities undertaken in accordance with the Plan during the 2018/19 water year (1 July 2018 to 30 June 2019).

1.2 Water Supply Protection Area

The Lower Campaspe Valley Water Supply Protection Area (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: Barnadown Zone (1034), Elmore-Rochester Zone (1031), Bamawm Zone (1032) and Echuca Zone (1033), as shown in Figure 1.

The Lower Campaspe Valley WSPA includes groundwater resources to all depths, except where it is overlain by the Shepparton Irrigation Region Groundwater Management Area. In these areas, the Plan only applies to the management of groundwater resources greater than 25 metres (m) depth below the surface.

1.3 Groundwater Management Plan

The Groundwater Management Plan for the Lower Campaspe Valley WSPA (the Plan) was approved on 17 October 2012 by the Minister for Water, in accordance with section 32A(6) of the *Water Act 1989*.

The objective of the Plan is to make sure that groundwater resources within the WSPA are managed in an equitable and sustainable manner. More specifically, the Plan seeks to:

- Protect existing groundwater users and the environment by managing groundwater levels and the potential for change in groundwater salinity.
- Enable equitable development of groundwater resources to realise the potential for its use in the region.
- 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. A summary of GMW's activities in accordance with Plan prescriptions is presented in Appendix A.

A copy of the Plan can be downloaded from GMW's website: www.g-mwater.com.au

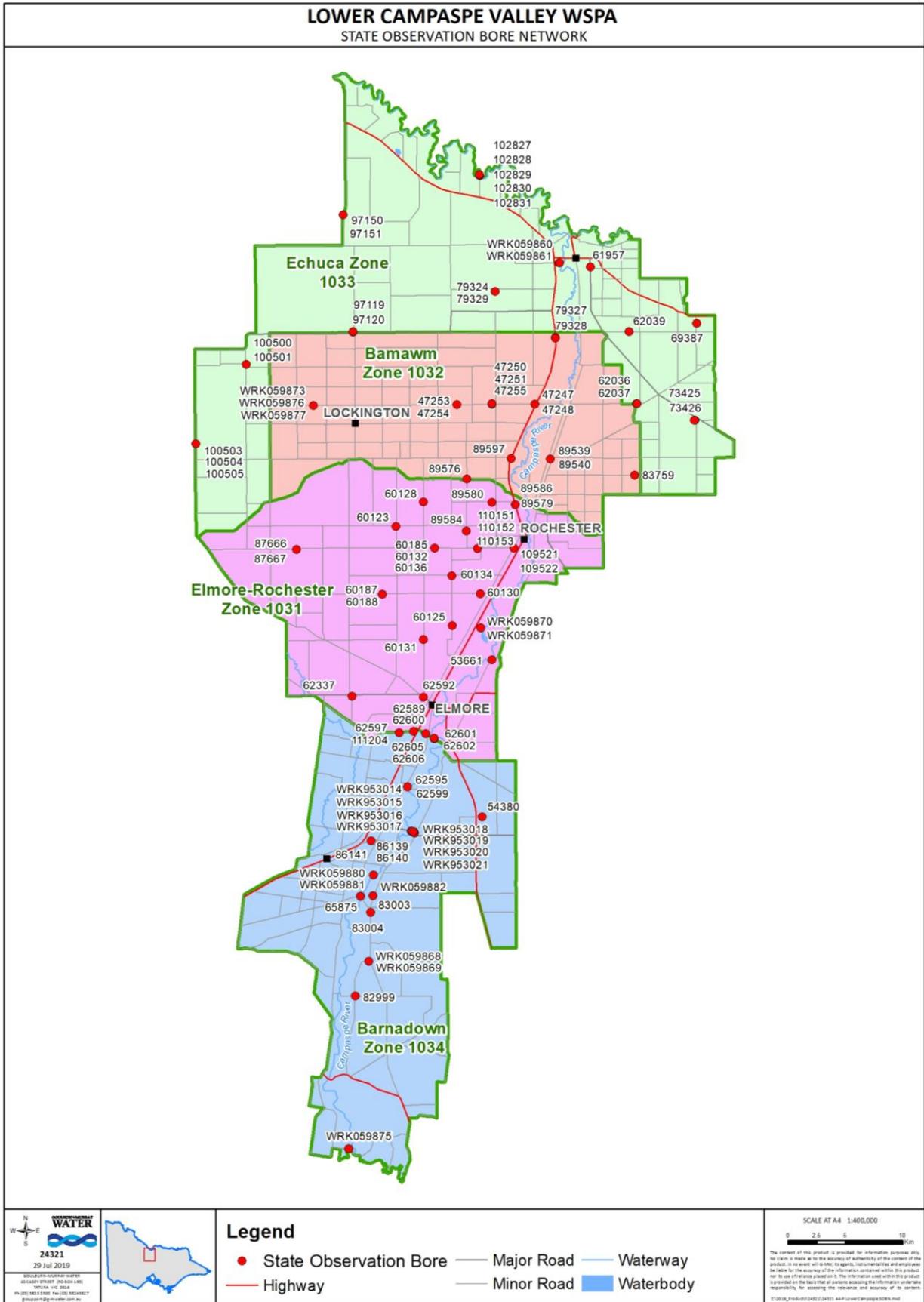


Figure 1 Lower Campaspe Valley Water Supply Protection Area

2 Groundwater Management

2.1 Licensed volume

The Minister declared the Permissible Consumptive Volume of 55,875 megalitres per year (ML/year) for the Lower Campaspe Valley WSPA in March 2013 (Victorian Government, 2013).

At 30 June 2019 licensed entitlement volume in the Lower Campaspe Valley WSPA was 55,860.4 ML/year (Table 1) which remained unchanged from 30 June 2018.

Table 1 Groundwater licensed entitlement volume in the Lower Campaspe Valley WSPA in 2018/19

Management zone	Licences	Licensed bores	Licensed entitlement volume (ML/year)
Elmore-Rochester Zone – 1031	52	68	17,152.6
Bamawm Zone – 1032	41	50	25,873.3
Echuca Zone – 1033	16	19	4,839.5
Barnadown Zone – 1034	20	62	7,995.0
Total	129	199	55,860.4

Note: Data extracted from the Victorian Water Register 1 July 2019.

2.2 Groundwater allocations

An allocation is the percentage of licensed entitlement volume that may be abstracted within a water year. Annual allocations in the Lower Campaspe Valley WSPA are determined by comparing the average of the maximum annual groundwater recovery levels recorded in key State observation bores (79324 and 62589) from the three preceding years (i.e. a three-year rolling average), against trigger levels outlined in Prescription 1 of the Plan (Figure 2 and Figure 3).

On 5 July 2018, GMW announced the annual allocations to be 100 per cent across all management zones for the 2018/19 water year.

In November 2018, GMW was able to provide an early indication of groundwater allocations for the 2019/20 water year. It was identified that the Barnadown Zone would be subject to an annual allocation of 75 per cent during the 2019/20 water year; and the allocation in the other three management zones would remain at 100 per cent of licence volume. GMW communicated this early indication by sending letters to all licence holders and holding a public meeting in Rochester on 22 November 2018.

Monitoring data for these key bores indicate that groundwater recovery levels are on a declining trend. If this trend continues further restrictions may be imposed in future water years.

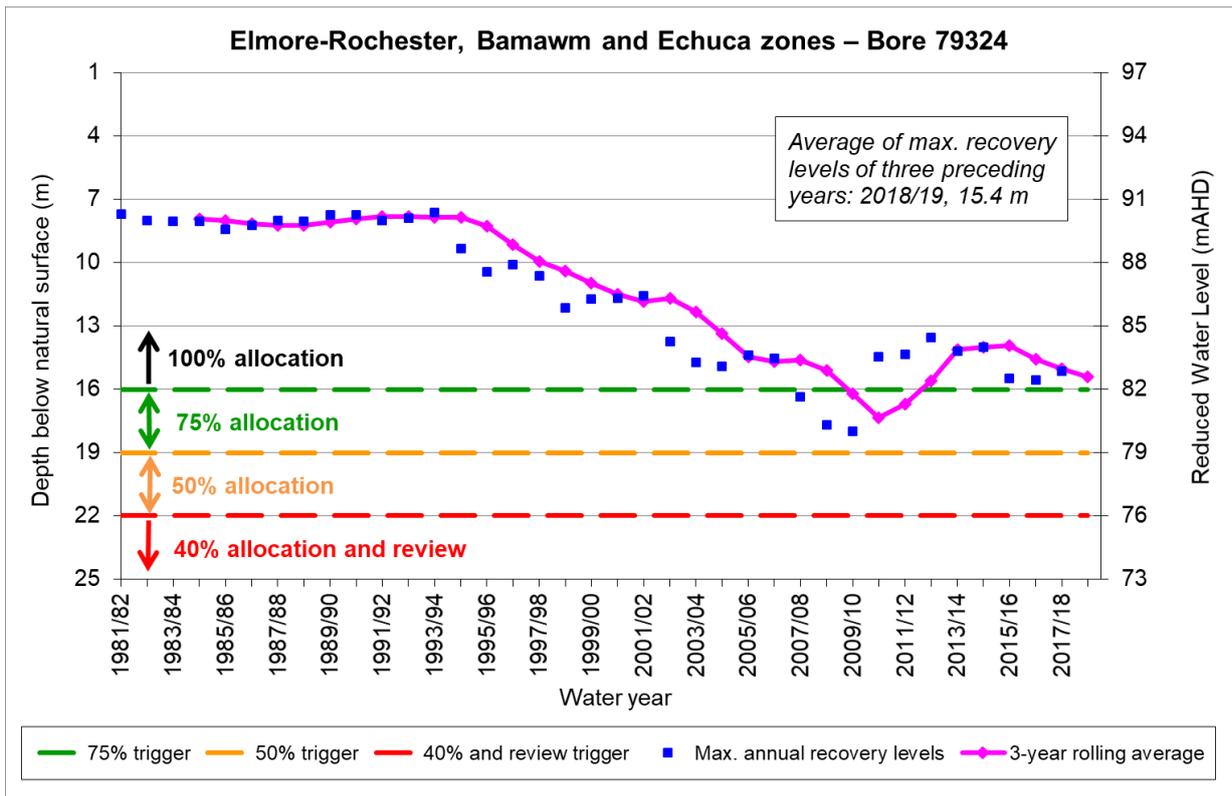


Figure 2 Trigger levels and allocations for the Elmore-Rochester, Bamawm and Echuca zones

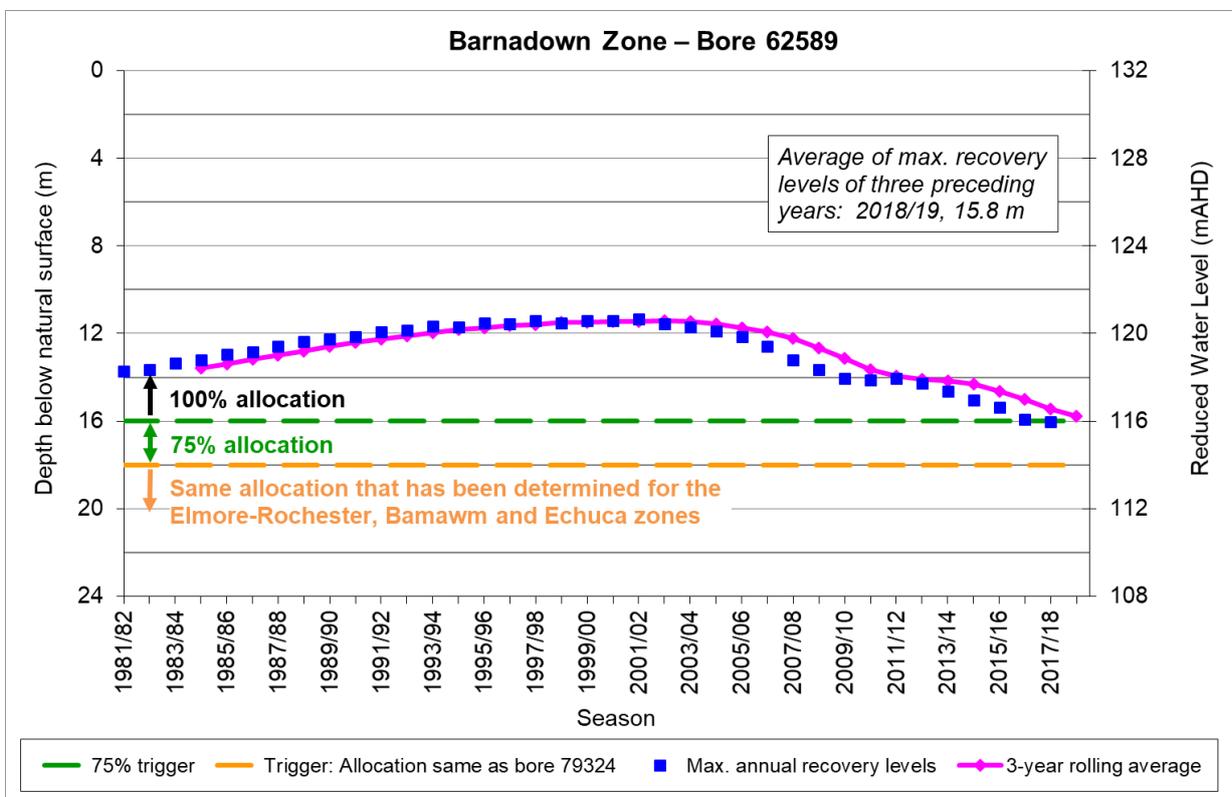


Figure 3 Trigger levels and allocations for the Barnadown Zone

2.3 Groundwater use

Recorded use in the Lower Campaspe Valley WSPA in 2018/19 was 50,258.9 ML, or 90 per cent of total licensed volume, which was the highest on record (Figure 4).

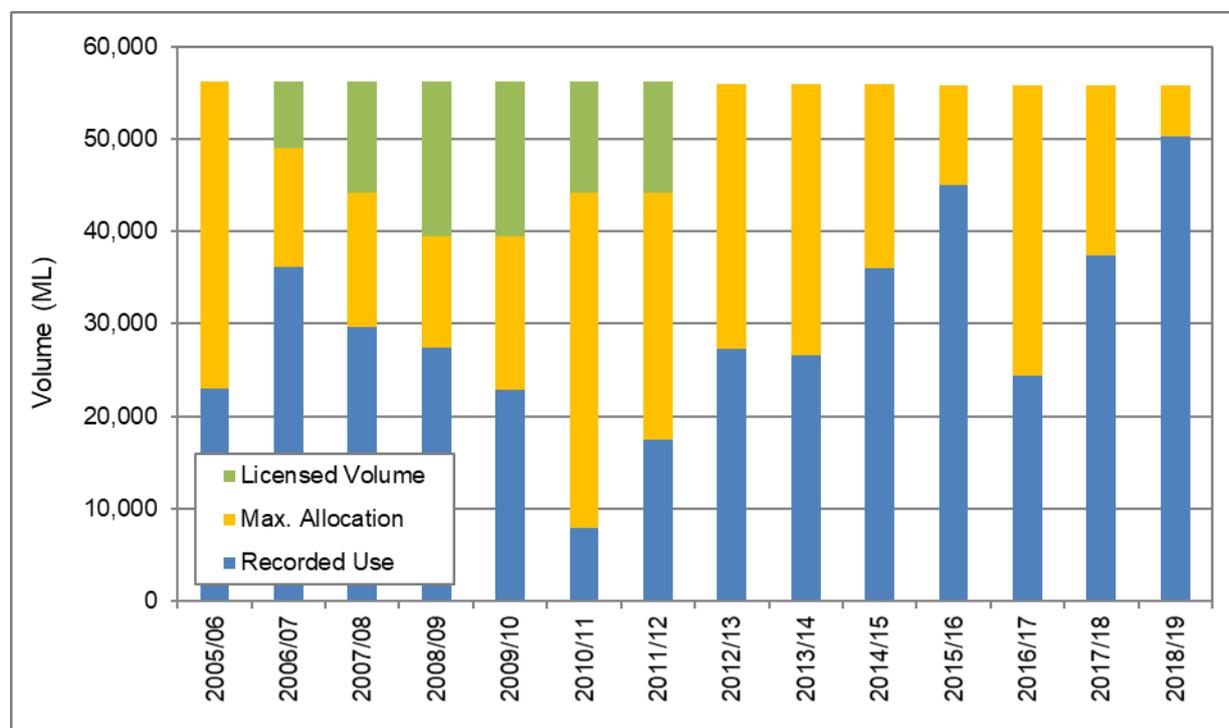


Figure 4 Total licensed volume, allocation and recorded use in the Lower Campaspe Valley WSPA

Recorded use was greatest in the Elmore-Rochester and Bamawm zones, where the majority of the licensed volume is held (Table 2).

Table 2 Recorded use in the Lower Campaspe Valley WSPA in 2018/19

Management zone	Licensed volume (ML/year)	Recorded use (ML)	Proportion of total licensed volume used
Elmore-Rochester Zone – 1031	17,152.6	14,584.0	85%
Bamawm Zone – 1032	25,873.3	26,050.7	101%
Echuca Zone – 1033	4,839.5	4,438.3	92%
Barnadown Zone – 1034	7,995.0	5,185.9	65%
Total	55,860.4	50,258.9	90%

Note: Data extracted from Irrigation Planning Module on 4 July 2019.

2.4 Rainfall

Historic rainfall data sourced from the Bureau of Meteorology (BoM) weather station at Rochester is presented in Figure 5 as an indicator of climate trends across the Lower Campaspe Valley WSPA.

The data show that annual rainfall was generally above average in the early 1970s and remained relatively steady through the 1980s and 1990s. Between 2001/02 and 2008/09 annual totals were below-average (Millennium Drought) until conditions improved in 2010.

With the exception of the 2013/14 and 2016/17 water years, annual rainfall totals have been below average since the Plan was approved, resulting in reduced recharge to groundwater systems within the Lower Campaspe Valley WSPA.

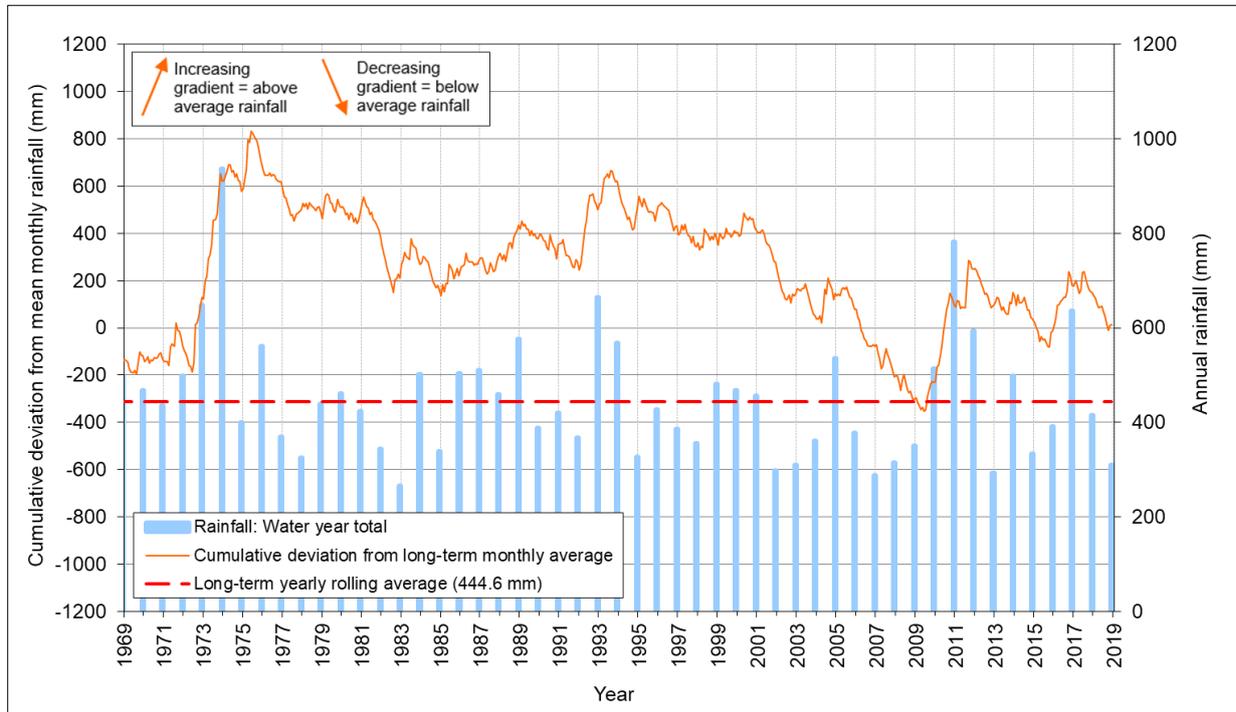


Figure 5 Rainfall recorded at Rochester (BoM station 080049) in the Lower Campaspe Valley WSPA

2.5 Licence transfers

The Plan allows groundwater licence holders to temporarily or permanently transfer licensed entitlement volume. During the 2018/19 water year there were 55 temporary licence transfers for a total of 8,240.1 ML/year and four permanent transfers for a total of 770 ML/year (Figure 6).

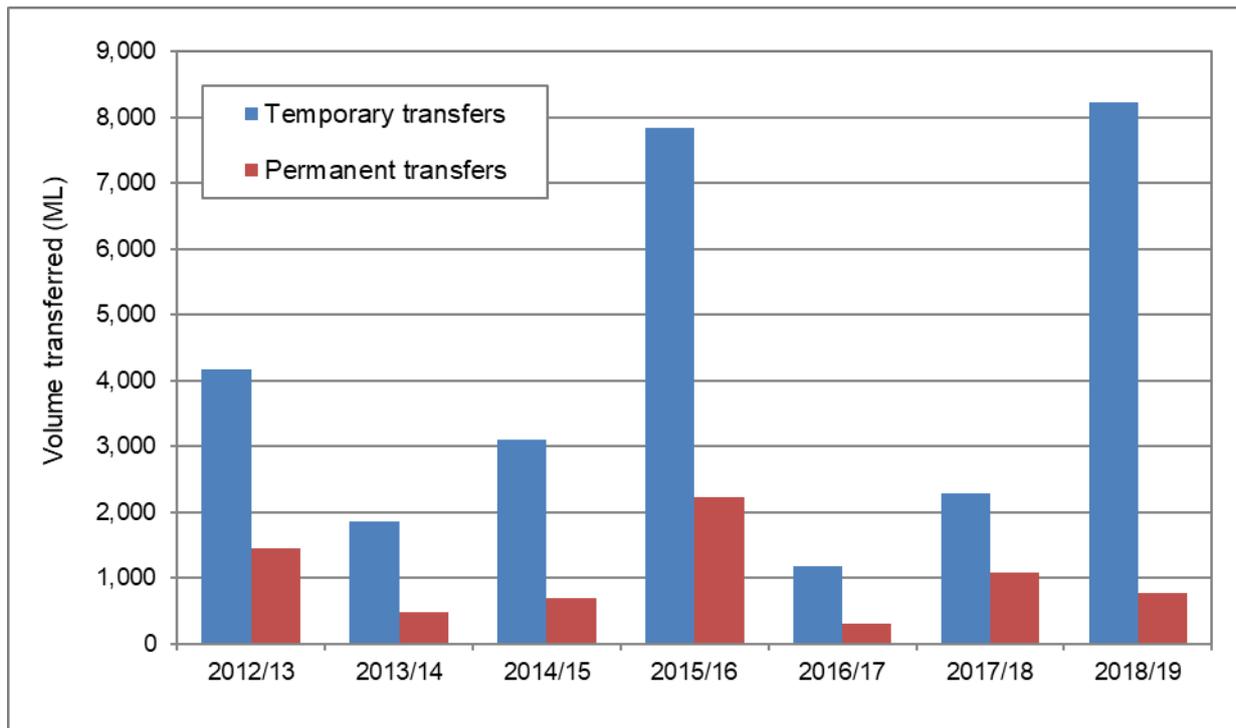


Figure 6 Total licensed volumes transferred in the Lower Campaspe Valley WSPA

During the 2018/19 water year 80 per cent of licence transfers occurred within the same management zone (Table 3). There were 12 transfers between management zone which resulted in net increases of temporary licence volume in the Bamawm and Echuca zones by 728.5 ML/year and 89 ML/year, respectively; and a net increase of permanent licence volume in the Elmore-Rochester Zone of 250 ML/year.

There was one transaction which resulted in 100 ML/year of licence volume being temporarily transferred out of the WSPA from the Barnadown Zone to a licence holder in the Puckapunyal Zone of the West Goulburn Groundwater Management Area.

Table 3 Licence transfers in the Lower Campaspe Valley WSPA in 2018/19

Management zone	Temporary				Permanent			
	Transfer from		Transfer to		Transfer from		Transfer to	
	No. of transfer	Volume (ML/yr)						
Elmore-Rochester Zone – 1031	14	2,525.5	13	1,708.0	2	400.0	3	650.0
Bamawm Zone – 1032	33	4,624.6	33	5,353.1	1	250.0	1	120.0
Echuca Zone – 1033	3	617.0	4	706.0	1	120.0	0	0.0
Barnadown Zone – 1034	5	473.0	4	373.0	0	0.0	0	0.0
Total	55	8,240.1	*54	8,140.1	4	770.0	4	770.0

*Note, there was one temporary transfer (100 ML/yr) to a licence holder outside of the Lower Campaspe Valley WSPA

2.6 Carryover

In November 2012, the Minister declared that groundwater licence holders in the Lower Campaspe Valley WSPA were authorised to carry over up to a maximum of 25 per cent of their unused licensed volume for use in the subsequent water year (Victorian Government, 2012).

A total of 12,839.7 ML was carried over by licence holders in the Lower Campaspe Valley WSPA for use in the 2018/19 water year. At the conclusion of the 2018/19, groundwater licence holders in the Lower Campaspe Valley WSPA carried over 11,511.8 ML into the 2019/20 water year.

2.7 Metering

There were 148 metered service points and 35 deemed service points in the Lower Campaspe Valley WSPA as at 30 June 2019. There were 159 meter-related activities undertaken during the 2018/19 water year, including inspections, maintenance, battery replacements and one full meter replacement (Table 4).

All meters were read at least twice during the 2018/19 water year.

Table 4 Metering activities in the Lower Campaspe Valley WSPA in 2018/19

Metering activity	Year ending 30 June 2019
Total number of meters	148
Total number of meter reads	296
Meters installed or replaced	1
Meter inspection events	145
Meter maintenance events	13

2.8 Licence compliance

There were no prosecutions or convictions relating to groundwater matters in the Lower Campaspe Valley WSPA during the 2018/19 water year. There were three instances of alleged overuse (i.e., licensed volume exceedance). These incidents are being investigated and GMW will take action in accordance with GMW's Risk-Based Compliance and Enforcement Framework.

2.9 Domestic and stock bore licences

Domestic and stock use is not required to be licensed, as it is a private right under section 8 of the Act provided that use occurs in accordance with the definition of domestic and stock use in the Act.

The installation of a bore for domestic and stock use requires a bore construction licence. Upon completion of a bore, a bore completion report is required to be submitted to GMW and details are recorded in the Water Measurement Information System at <http://data.water.vic.gov.au/monitoring.htm>.

During the 2018/19 water year in the Lower Campaspe Valley WSPA there were: 27 domestic and stock bore construction licences issued by GMW and the Victorian Water Register (combined); and nine domestic and stock bore completion reports received and processed by GMW.

3 Monitoring Program

3.1 Groundwater levels

During the 2018/19 water year a total of 101 State Observation Bores, located within the Lower Campaspe Valley WSPA, were monitored by GMW and the Department of Environment, Land, Water and Planning (DELWP) (Figure 1). This figure includes the 60 key bores listed in Schedule 1 of the Plan, where practicable (Appendix B).

Of the 101 bores, 24 were monitored remotely using telemetry equipment, with measurements recorded hourly; and 77 were monitored manually, with measurements recorded on a monthly or quarterly basis.

Monitoring indicates that seasonal groundwater recovery levels have been generally declining since the Plan was implemented in 2012. Groundwater recovery levels in the Deep Lead aquifer, across much of the Lower Campaspe Valley WSPA, were at their lowest on record during the 2018/19 water year. Seasonal drawdown levels also reached their lowest on record.

The maximum recovery level in a Deep Lead observation bore (60134), located near Rochester in the Elmore-Rochester Zone, was 1.56 m lower in 2018/19 than the maximum level in 2017/18; 15.85 m below natural surface in July 2018, versus 14.29 m in August 2017 (Figure 7). The magnitude of seasonal drawdown was 17.85 m during 2018/19, recorded in the same Deep Lead bore.

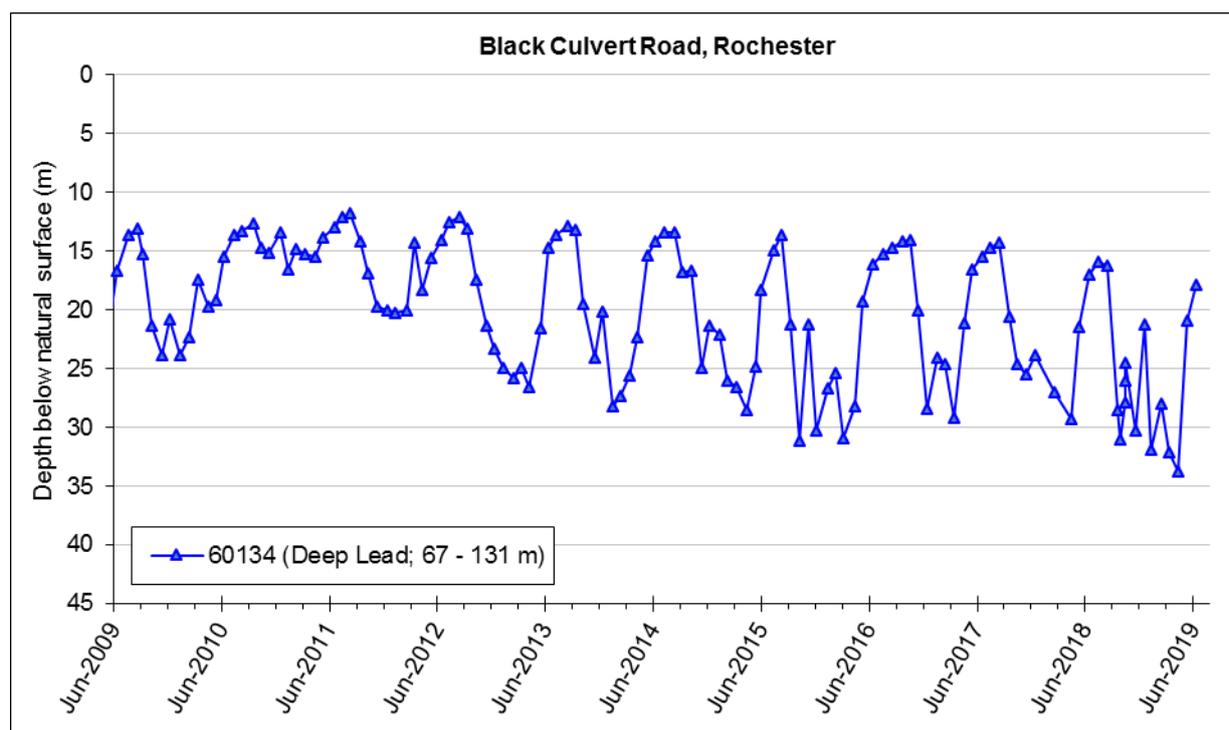


Figure 7 Groundwater monitoring in the Elmore-Rochester Zone at Rochester – June 2009 to June 2019

In the Bamawm Zone, there was a typically a larger decline in maximum recovery in 2018/19. In a Deep Lead observation bore at Strathallan (47247), the maximum recovery level was 21.84 m below natural surface in August 2018 compared to 18.84 m in August 2017 (Figure 8). The magnitude of seasonal drawdown was approximately 15.49 m during 2018/19.

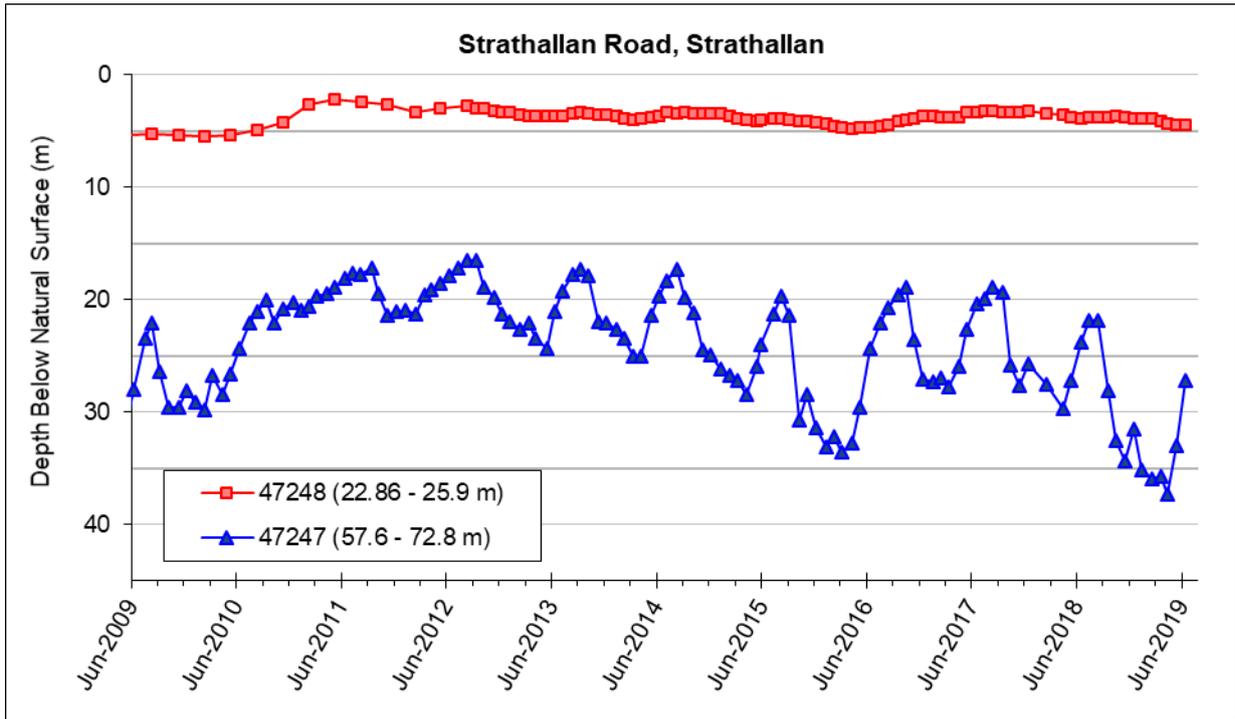


Figure 8 Groundwater monitoring in the Bamawn Zone at Strathallan – June 2009 to June 2019

In the Echuca Zone, groundwater recovery levels remained relatively steady in 2018/19. In a Deep Lead observation bore at Echuca West (79324), the maximum recovery level was 16.6 m below natural surface in August 2018. That is 1.1 m lower than the maximum recovery level in 2017/18; 15.5 m in August 2017 (Figure 9). In the same bore the magnitude of seasonal drawdown was 8.52 m during 2018/19.

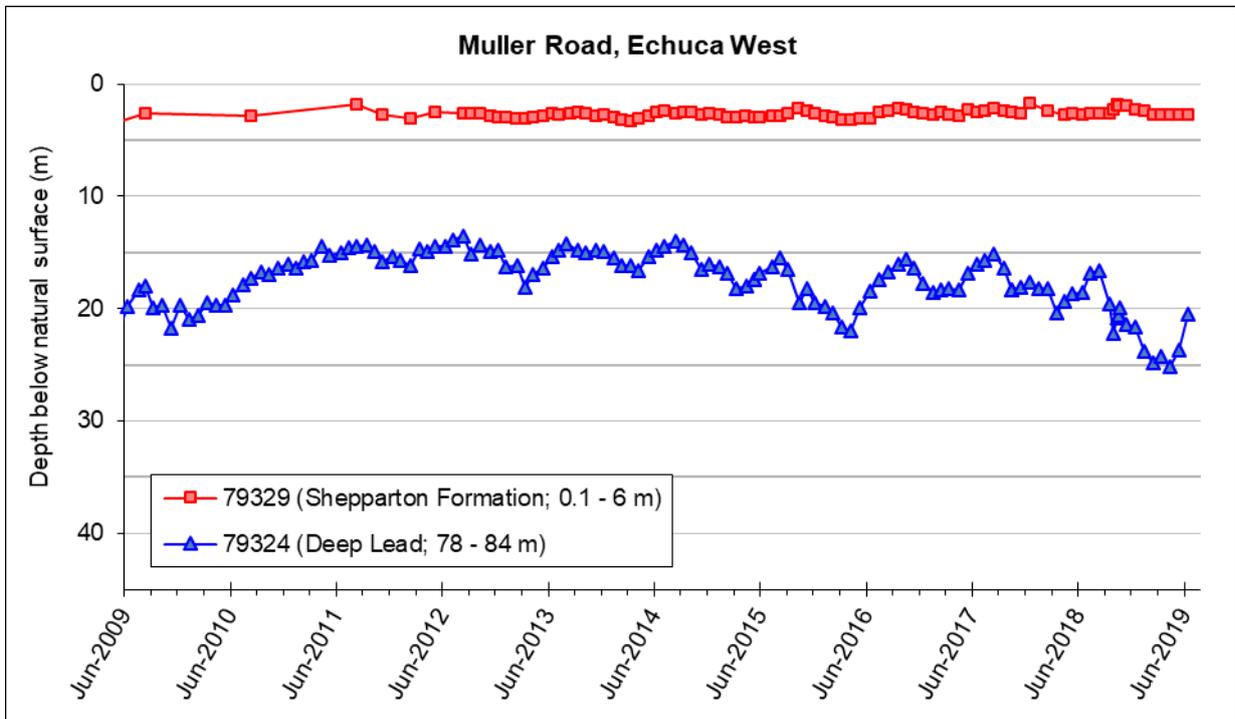


Figure 9 Groundwater monitoring in the Echuca Zone at Echuca West – June 2009 to June 2019

In the Barnadown Zone, there is typically less seasonal variation in groundwater levels compared to the other three management zones. In a Deep Lead observation bore, located adjacent to the Campaspe River at Runnymede (G8010638/07), the maximum recovery level in 2018/19 was 23.74 m below natural surface compared to 23.08 m in the previous year (Figure 10). The magnitude of seasonal drawdown was approximately 2.32 m during 2018/19.

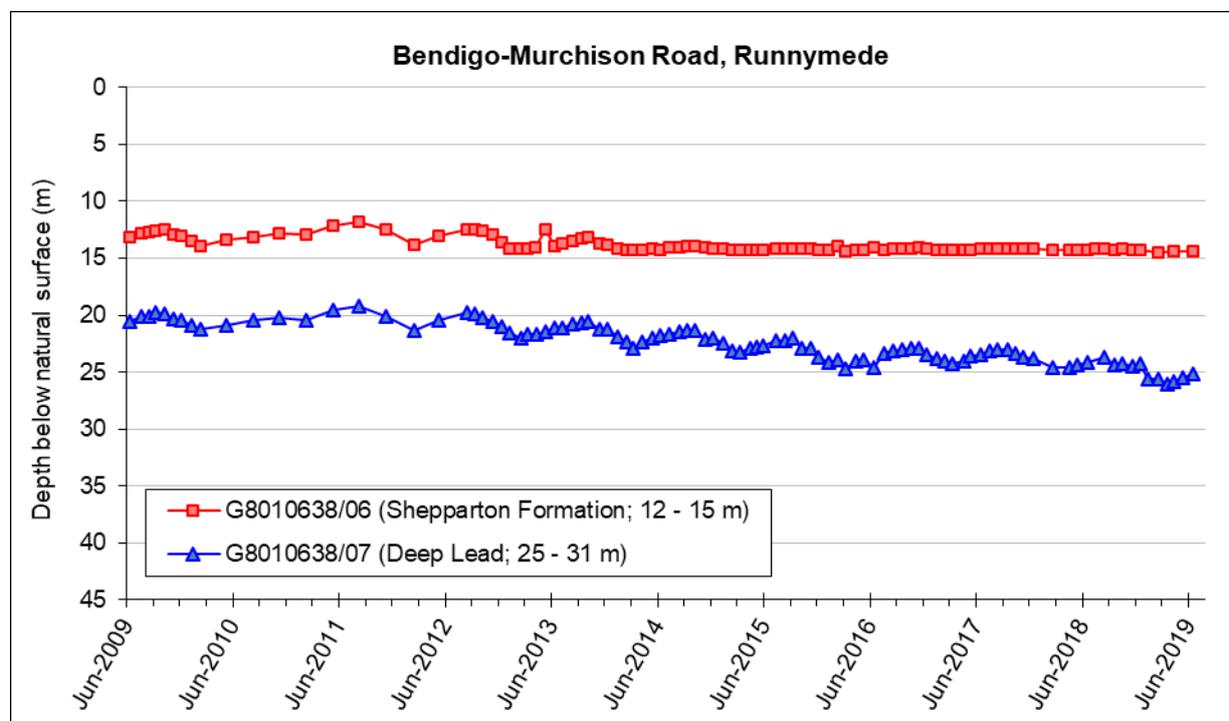


Figure 10 Groundwater monitoring in the Barnadown Zone at Runnymede – June 2009 to June 2019

3.2 Groundwater quality

Groundwater user salinity sampling

GMW sent 188 sample bottles and reply-paid envelopes to licence holders, and domestic and stock users upon request, to collect a groundwater sample from their bore for analysis. There were 28 samples returned for analysis; a return rate of 15 per cent.

GMW measured the groundwater salinity of each sample; advised each bore owner of their result; and recorded the data in the State Groundwater Database. The results are presented spatially in Figure 11 and show that less saline groundwater occurs within the Elmore-Rochester Zone. Groundwater samples collected from bores within the Barnadown Zone, west of the Campaspe River, were more saline (1,501 to >2,000 $\mu\text{S}/\text{cm}$); likely influenced by groundwater through-flow from the Huntly Deep Lead.

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.

Targeted sampling of licensed bores

GMW has enlisted seven licence holders to participate in a targeted groundwater salinity monitoring program. Samples are collected on an annual basis from the same set of 11 private bores which have been strategically selected based on location and bore construction details. The aim of the program is

to build a reliable and consistent dataset of groundwater salinity over time to support licensing and resource management decisions.

Results from the groundwater samples collected in 2018/19 are presented in Appendix C. Groundwater salinity varies between water years, although there appears to be a rising trend in groundwater from particular bores. Continued monitoring will enable trends to be better understood and future resource management decisions.

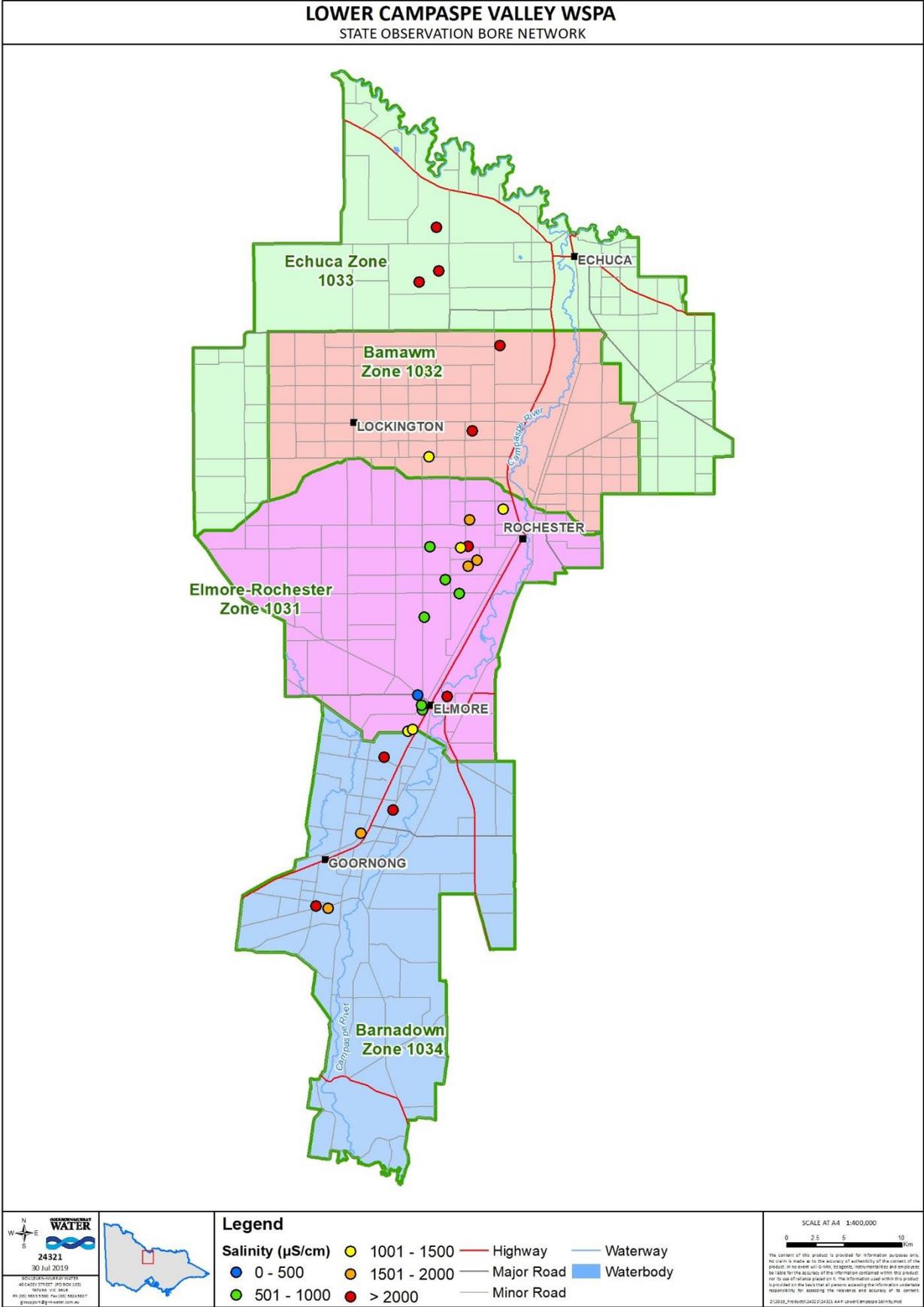


Figure 11 Location of returned samples analysed for groundwater salinity in the Lower Campaspe Valley WSPA

Sampling from State observation bores

Groundwater samples from nested State observation bores were sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. 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 areas of intensive groundwater pumping west of Rochester; and at the northern margins of the Lower Campaspe Valley WSPA.

Groundwater salinity results from samples collected during the 2018/19 water year are presented in Table 5. The results are compared to historical measurements in Appendix C. Groundwater salinity varies between water years. There are no strong trends in the data, however salinity levels have been generally declining since 2015/16. Continued monitoring of groundwater quality will enable trends to be better understood and support future management decisions.

Table 5 Results from groundwater quality sampling between January and April 2019 in the Lower Campaspe Valley WSPA

Management zone	Location	Bore ID	Bore screened interval (metres below natural surface)	Aquifer screened	Salinity, as Electrical Conductivity (µS/cm)
Elmore-Rochester Zone – 1031	Lowe Road, Diggora	89584	100 – 140	Deep Lead	3,330
		89596	2 – 14	Shepparton Formation	<i>(Bore dry)</i>
Bamawm Zone – 1032	Strathallan Road, Lockington	WRK059873	82 – 87	Deep Lead	3,630
		WRK059876	92 – 97	Deep Lead	2,840
		WRK059877	34 – 37	Shepparton Formation	3,800
	Strathallan Road, Bamawm	47251	22 – 27	Shepparton Formation	3,700
		47250	73 – 85	Deep Lead	1,600
Echuca Zone – 1033	Casey Road, Wharparilla	102827	108 – 114	Deep Lead	3,940
		102828	160 – 167	Deep Lead	3,520
		102829	71 – 74	Shepparton Formation	3,790
	Craig Road, Koyuga	73425	87 – 89	Deep Lead	9,580
		73426	6 – 18	Shepparton Formation	8,380

4 Future Management Considerations

4.1 Groundwater Reference Committee

The Groundwater Reference Committee, appointed in accordance with Prescription 7(c) of the Plan, met on 10 October 2018.

Key points of discussion included:

- Local issues – current and emerging
- Resource condition
- Plan implementation
- Review of the Plan

4.2 Management Plan review

GMW undertook a detailed review of the Plan in 2018, in accordance with Prescription 7(d) of the Plan.

Key recommendations of the Plan review included:

1. Develop a local management plan to manage groundwater resources at a catchment scale; and, once endorsed, seek to abolish the Plan.

The development of a local management plan should build on the successful components of the Plan by adopting opportunities for improvement, including:

- Explore opportunities for smaller incremental changes in restrictions (allocations) to allow licence holders to adapt to reduced water availability.
 - Investigate potential to reduce costs for reoccurring temporary transfers and explore possibility of allowing licence volume to be on-traded.
 - Simplify the rules that manage the density of licence volume
 - Terminate the annual groundwater user salinity sampling program and expand the targeted salinity monitoring program of licensed bores.
 - Install an observation bore in the Coonambidgal Formation to improve understanding of groundwater interaction with the Campaspe River.
 - Investigate opportunities to reduce operating costs; e.g. reduce the frequency of meter reads or use telemetry to monitor metered use.
 - Investigate opportunities to streamline administrative tasks to create efficiencies
2. Develop a numerical groundwater model for the Campaspe catchment to inform future management arrangements. Specifically, the model should:
 - inform a catchment scale PCV and review management zone caps;
 - advance knowledge of the interactions between groundwater and surface water;
 - inform the potential for change in groundwater salinity; and
 - Improve estimates of through-flow and impacts of groundwater management in New South Wales.

3. Revisit the relationship between the Barnadown Zone and the northern management zones, and the hydraulic gradient to New South Wales, and revise the trigger levels if necessary.

GMW presented the findings of the Plan review to the Groundwater Reference Committee, at its meeting on 10 October 2018; and sought feedback on the review document from the committee and the Department of Environment, Land, Water and Planning (DELWP).

GMW will continue to consult with DELWP and licence holders regarding the status of the Plan and regulatory approaches to the potential amendment of the Plan.

5 References

Bureau of Meteorology (BoM), 2019. *Climate Data Online – Rochester station number 080049*. Retrieved in August 2019, from: <http://www.bom.gov.au/climate/data/index>

Department of Sustainability and Environment, 2012. *Lower Campaspe Valley Water Supply Protection Area Groundwater Management Plan*. Department of Environment and Primary Industries, Melbourne

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.

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
PRESCRIPTION 1 Triggers and Restrictions		
<p>By 1 July each year the Corporation will:</p> <ul style="list-style-type: none"> (a) Determine the rolling average of the maximum annual groundwater recovery levels from the preceding three seasons for the relevant bore, or its replacement, and announce a corresponding allocation for the subsequent season for zones as detailed in the Plan. (b) Announce seasonal allocations by listing them on its website; sending letters to all licence holders and placing public notices in local newspapers. (c) Not apply restrictions to any water authorised to be taken in a subsequent water season (carryover). 	<p>In June 2018, GMW determined the allocations for the 2018/19 water year based on the rolling average of the maximum annual groundwater recovery levels from the preceding three water years. Allocations were set at 100 per cent for all management zones.</p> <p>GMW announced allocations by placing public notices in local newspapers, listing them on their website and sending letters to all licence holders.</p>	Yes
PRESCRIPTION 2 Trading rules		
<p>The Corporation may approve a transfer of a groundwater licence under section 62 of the <i>Water Act 1989</i> provided section 53 matters have been considered and it accords with the following:</p> <ul style="list-style-type: none"> (a) Transfer of licence entitlement can occur between zones as specified in the Plan (b) Despite (a) above, if the groundwater level falls to a depth of 18 metres below the natural surface in bore 62589 a licence may be transferred between the Barnadown Zone and other zones (c) Limits on the maximum licence volume in each zone as specified in the Plan are not exceeded. 	<p>GMW processed 55 temporary transfer transactions for a total of 8,240.1 ML/yr; and four permanent transfer transactions for a total of 770 ML/yr in 2018/19.</p> <p>GMW processed all groundwater licence applications in accordance with Prescription 2(a) and (c).</p>	Yes
PRESCRIPTION 3 Intensive groundwater pumping		
<p>The Corporation may approve an application to take and use groundwater under section 51 or a transfer under section 62 of the <i>Water Act 1989</i> provided that section 53 matters have been considered and the following conditions are satisfied:</p> <ul style="list-style-type: none"> (a) For a permanent transfer, the total licence entitlement of bores within a 4 km radius of an applicant's bore is less than 7.5 GL/yr. (b) Where summed licence entitlement exceed the limits specified in (a) above, then a licence holder's usage is to be limited to 125% of entitlement in one water season whether it occurs through either temporary transfer of entitlement or carryover. (c) Usage may exceed 125% of entitlement as specified in (b) above through temporary or permanent transfer of entitlement from others within the 4 km radius. 	<p>GMW processed all groundwater licence applications in accordance with Prescription 3.</p>	Yes

Prescription	Activity	Compliant
PRESCRIPTION 4 Monitoring groundwater levels		
<p>The Corporation will:</p> <ul style="list-style-type: none"> (a) Obtain monthly groundwater level readings (up to 480 readings per season) from key State observation bores from the list in Schedule 1, or their replacement, where practicable. (b) Install at least one new observation bore in the Coonambidgal Formation to better inform groundwater interaction with the Campaspe River. 	<p>GMW obtained monthly groundwater level readings from bores listed in Schedule 1 of the Plan, where practicable.</p> <p>A new observation bore is yet to be installed in the Coonambidgal Formation. Consideration will be given to the installation of this bore now that DELWP have completed the review of the State observation bore network.</p>	No
PRESCRIPTION 5 Monitoring groundwater salinity		
<p>The Corporation will:</p> <ul style="list-style-type: none"> (a) Support annual groundwater user salinity sampling by: <ul style="list-style-type: none"> (i) Providing a sample bottle and a reply paid envelope to each groundwater licence holder and request that they collect a groundwater sample from all their licensed bores and return the samples to the Corporation for salinity analysis. (ii) Providing a sample bottle and a reply paid envelope to any domestic and stock groundwater user upon their request for them to provide a sample for salinity analysis. (iii) Measuring groundwater salinity in all returned sample bottles and providing the bore owner with the results. (iv) Entering the groundwater salinity results into the State groundwater database. (b) Establish a targeted groundwater salinity monitoring program to collect and analyse groundwater samples from selected licensed bores each year. (c) Collect groundwater samples from selected State observation bores identified in Schedule 1 where practicable, or their replacement. 	<p>GMW provided sample bottles 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.</p> <p>GMW engaged with the seven licence holders participating in the target sampling of licensed bores. A total of 10 bores were sampled in 2018/19.</p> <p>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.</p>	Yes
PRESCRIPTION 6 Metered licensed use		
<p>The Corporation will:</p> <ul style="list-style-type: none"> (a) Ensure that a meter is fitted to all operational licensed bores. (b) Read each meter at least once a year and enter readings into the Water Register. 	<p>GMW ensured that use was accounted for each operational licensed bore.</p> <p>Meters were read in February/March and May/June 2018 and the data were entered into the Water Register.</p>	Yes

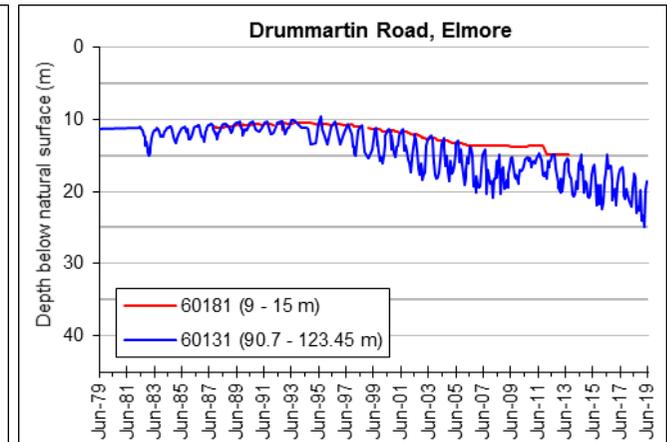
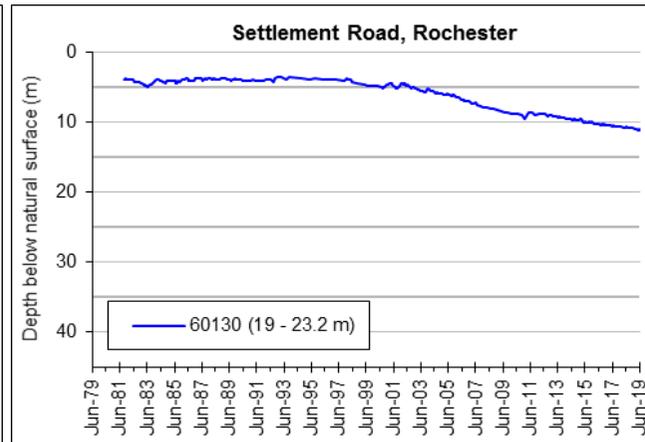
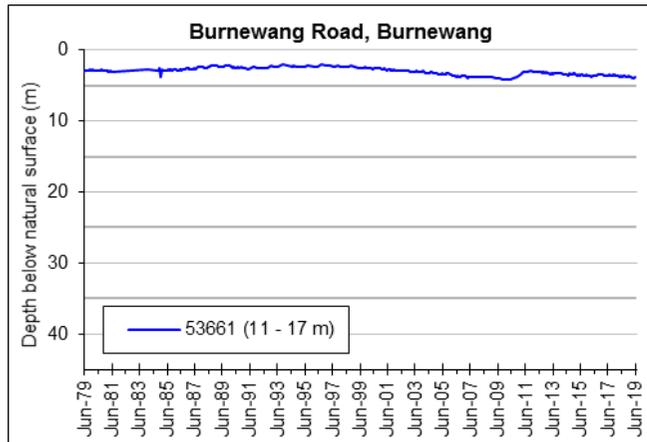
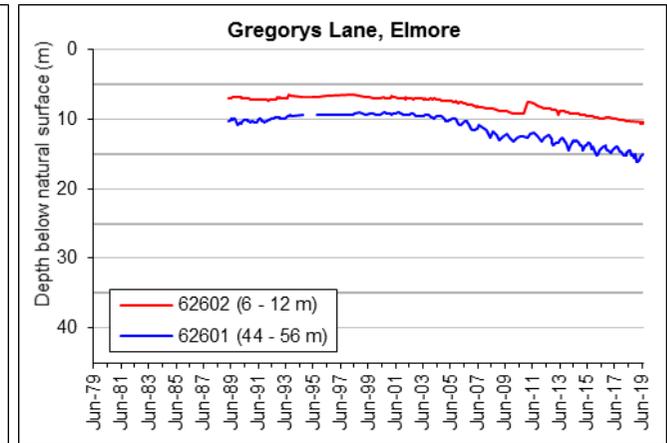
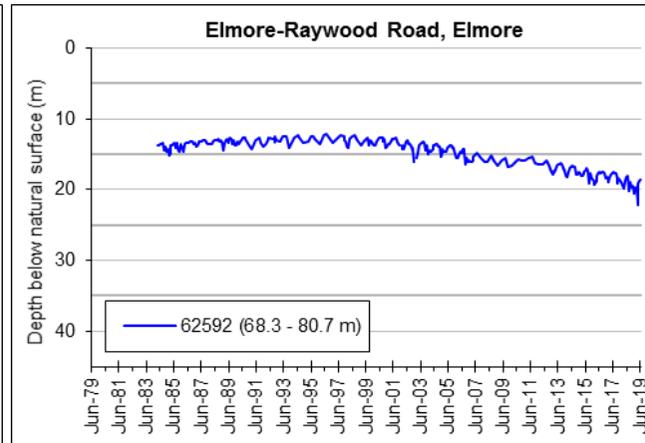
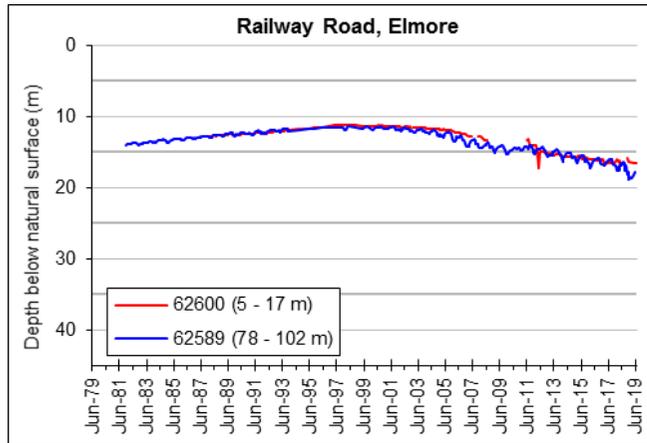
Prescription	Activity	Compliant
PRESCRIPTION 7 Plan implementation		
<p>The Corporation will:</p> <ul style="list-style-type: none"> (a) Post on its website the Plan; annual reports and newsletters; groundwater levels; and rolling average for trigger bores. (b) Mail a newsletter in October each year to groundwater licence holders, and domestic and stock users upon request, in the Lower Campaspe Valley WSPA and relevant agencies stating the resource position and summarising outcomes in the annual report. (c) Meet with the Groundwater Reference Committee at least once each year to report on the groundwater resource status and implementation of the Plan and consider the need to review the Plan. (d) Undertake a comprehensive review of the Plan after five years from 	<p>GMW prepared an annual report on the administration and enforcement of the Plan during the 2017/18 water year; for the Minister and relevant agencies. GMW also sent a newsletter to licence holders summarising the information in this report.</p> <p>GMW has posted on its website: the Plan; and the 2017/18 annual report and 2018 newsletter (and previous versions).</p> <p>GMW updates a selection of hydrographs of groundwater levels on its website every quarter.</p> <p>GMW undertook a comprehensive review of the Plan in 2018.</p> <p>GMW met with the Groundwater Reference Committee in October 2018 to discuss Plan implementation, resource conditions, and the 2018 Plan review.</p>	<p>Yes</p>

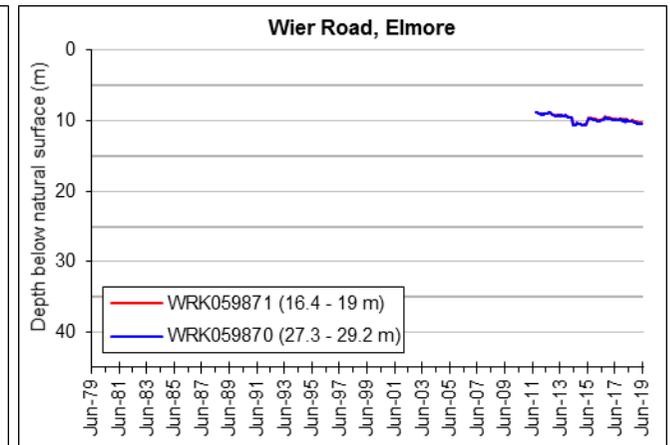
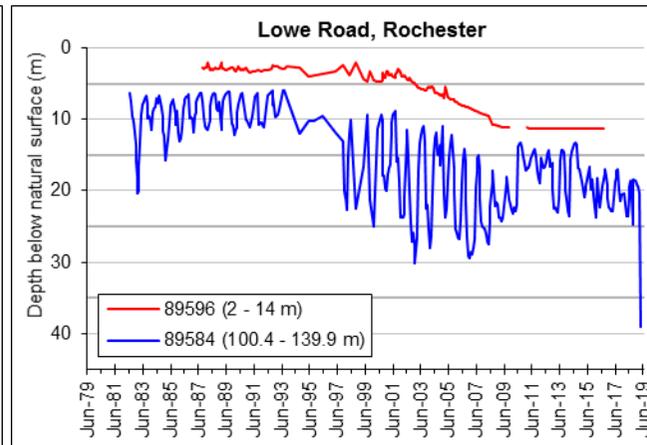
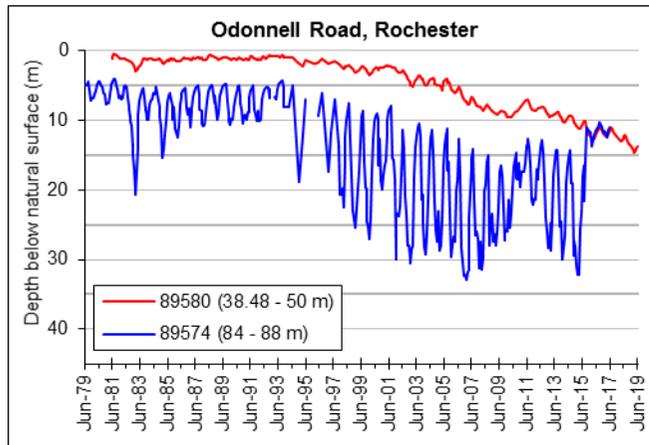
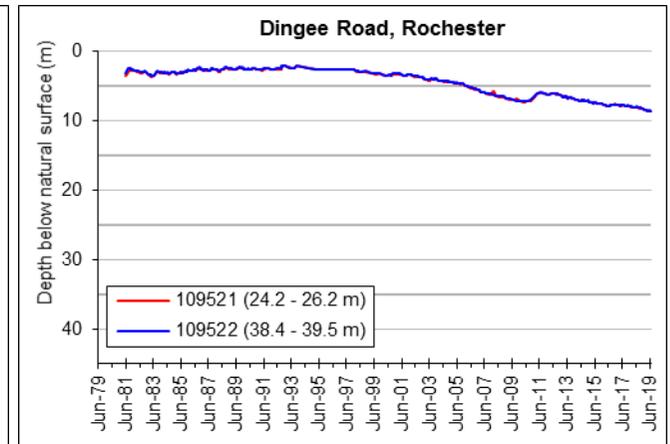
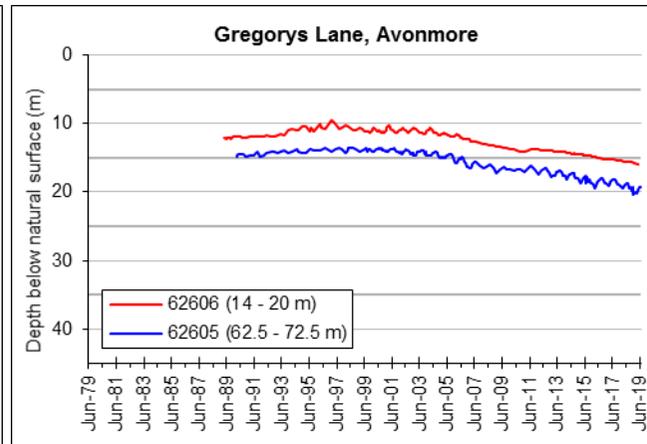
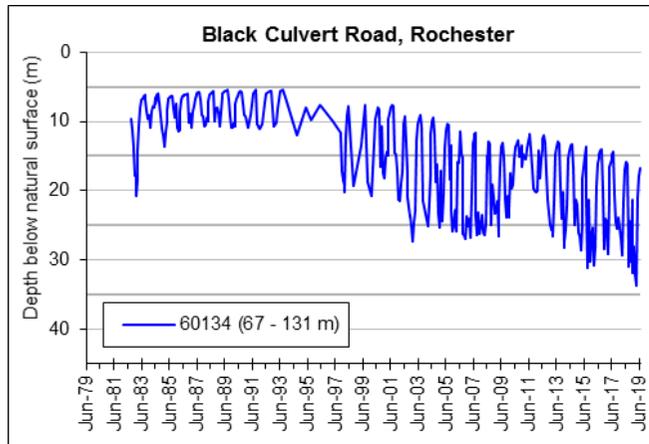
Appendix B – Hydrographs for key monitoring bores

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

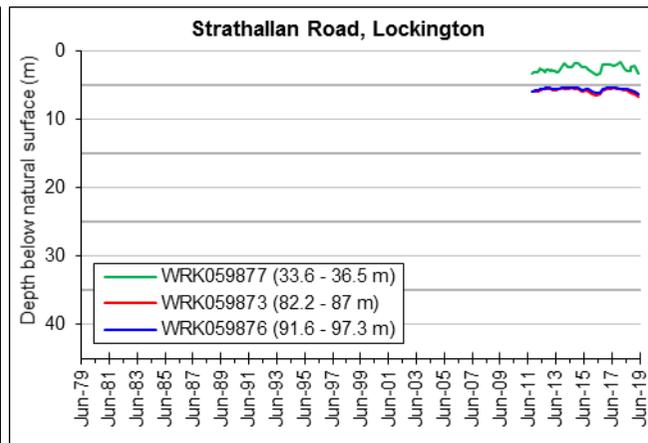
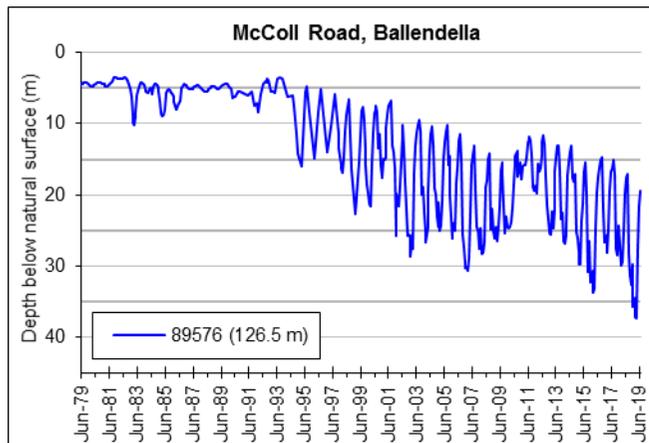
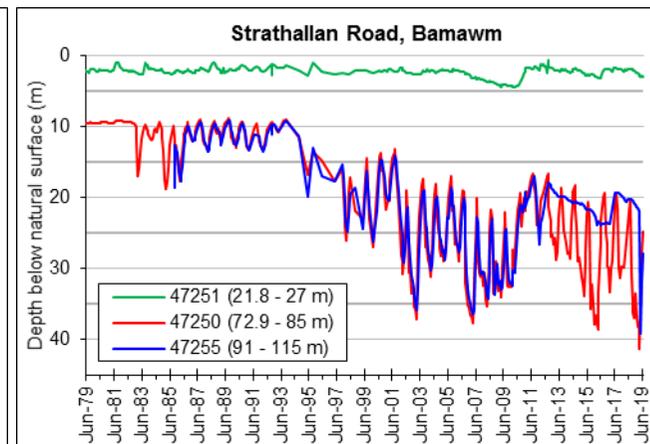
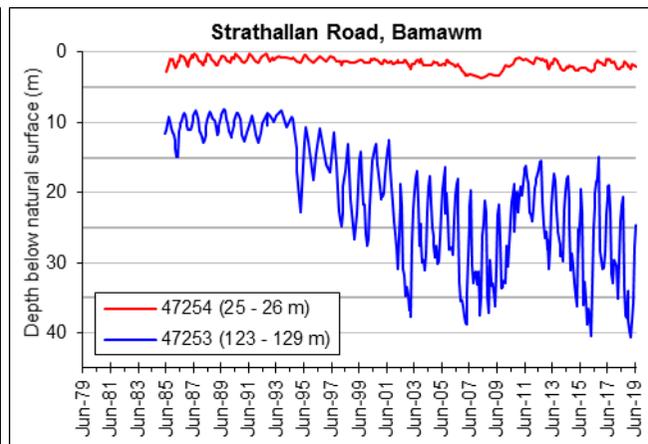
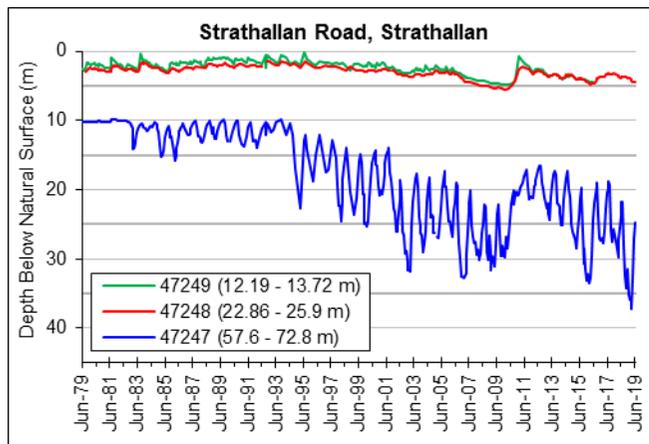
Further groundwater level information is available on the Water Measurement Information System website: <http://data.water.vic.gov.au/monitoring.htm>

Elmore-Rochester Zone – 1031

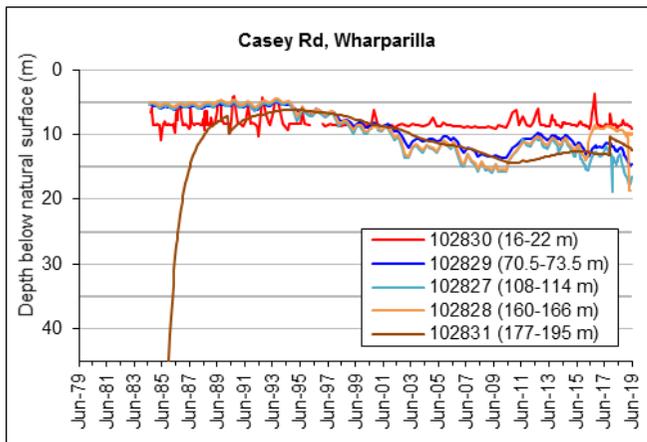
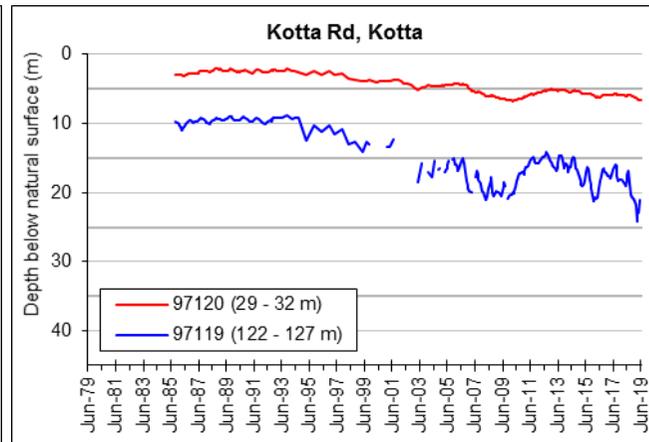
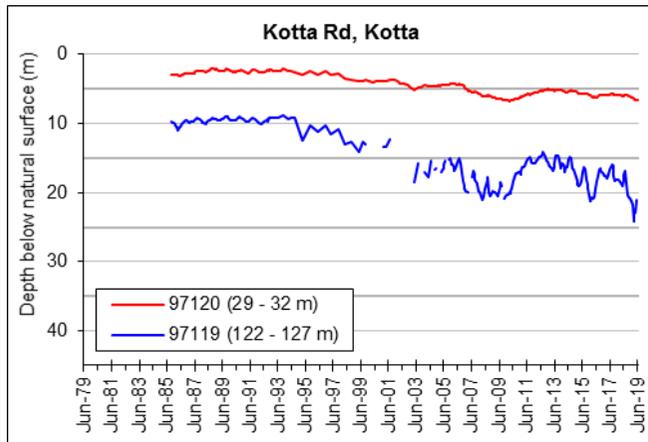
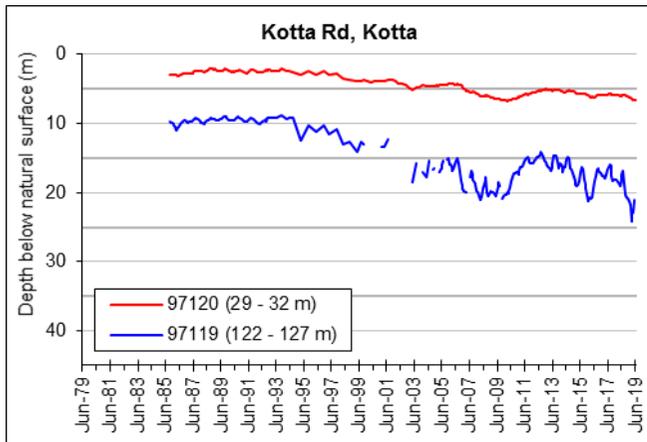




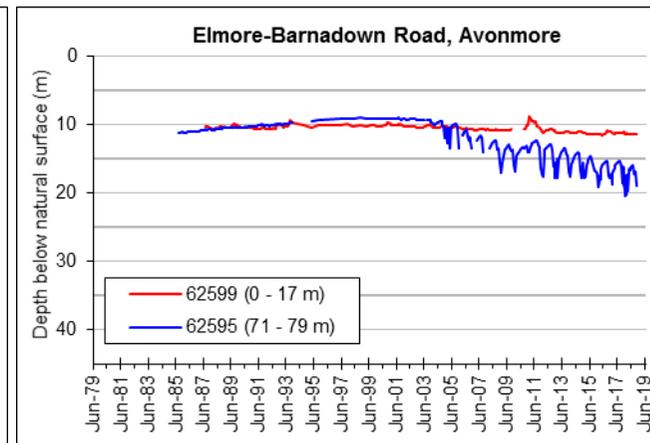
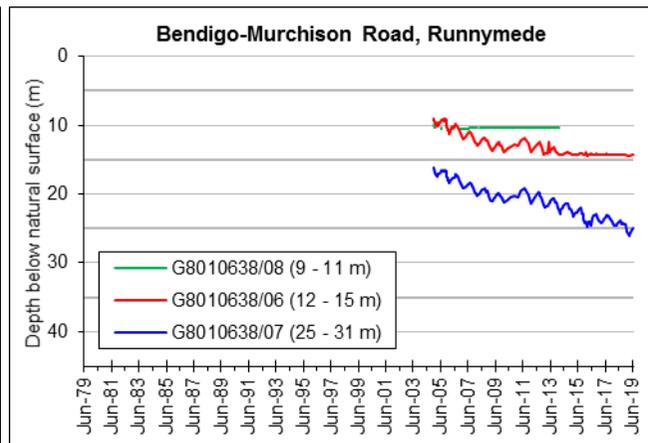
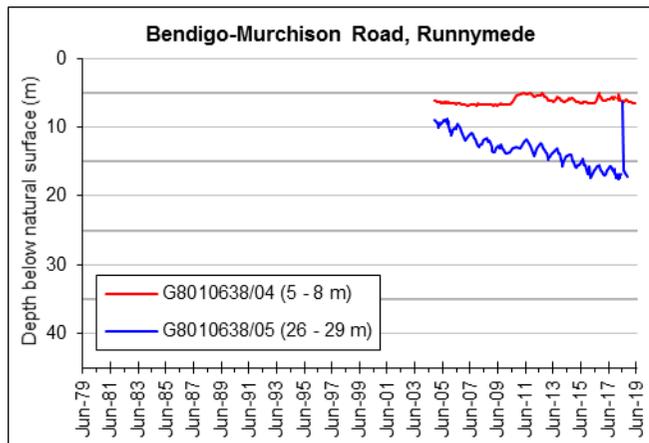
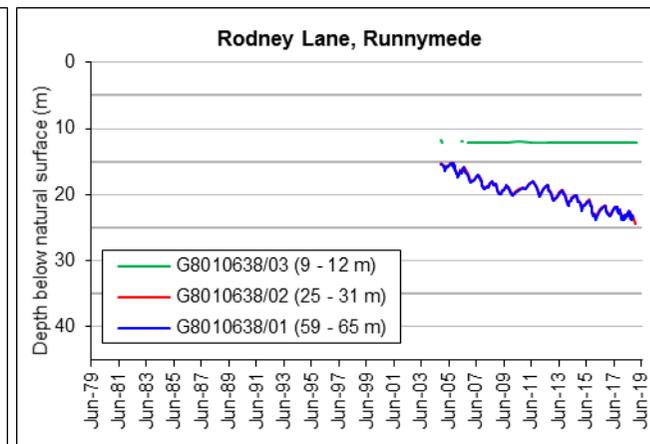
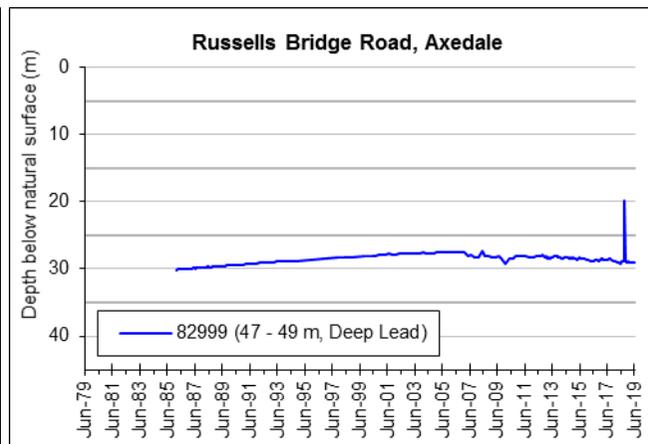
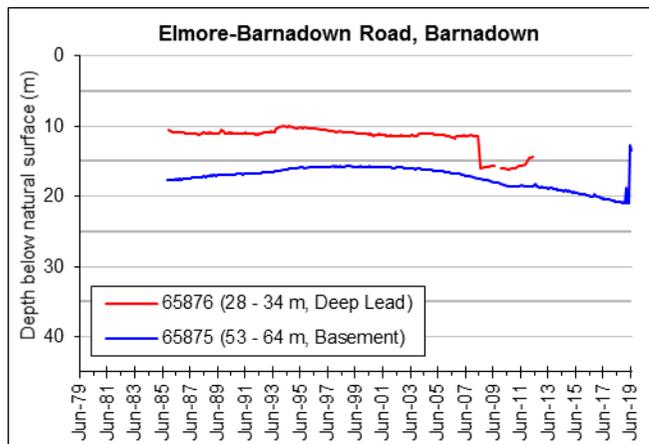
Bamawm Zone – 1032

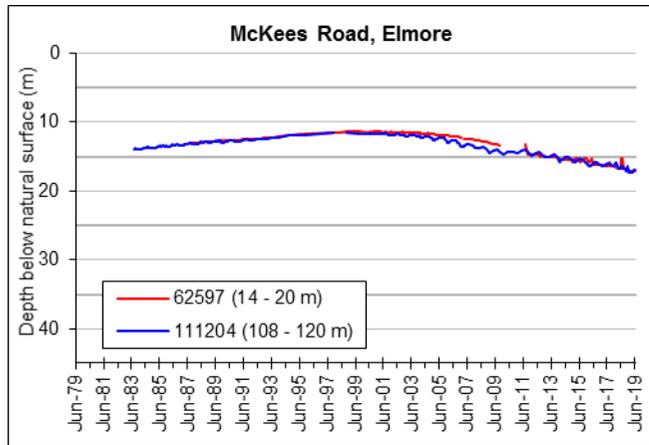


Echuca Zone – 1033



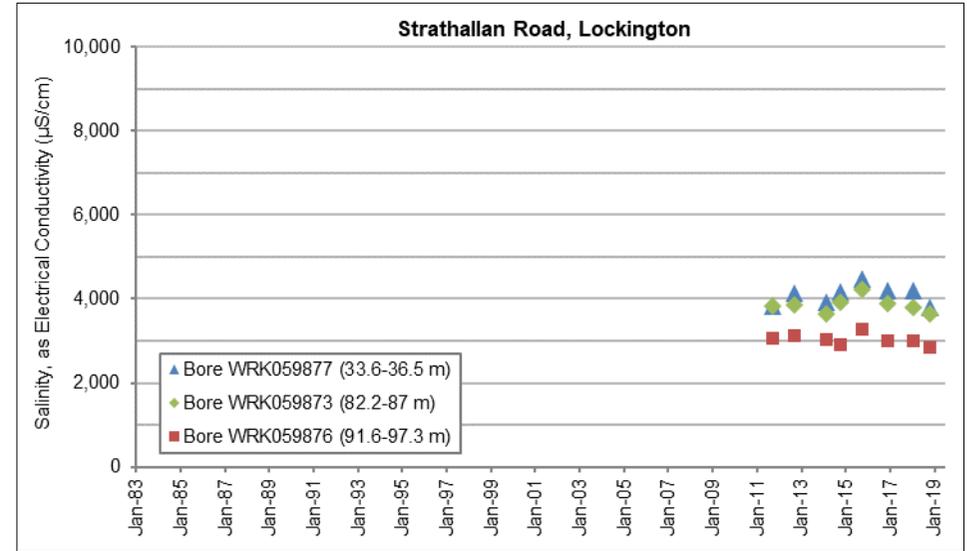
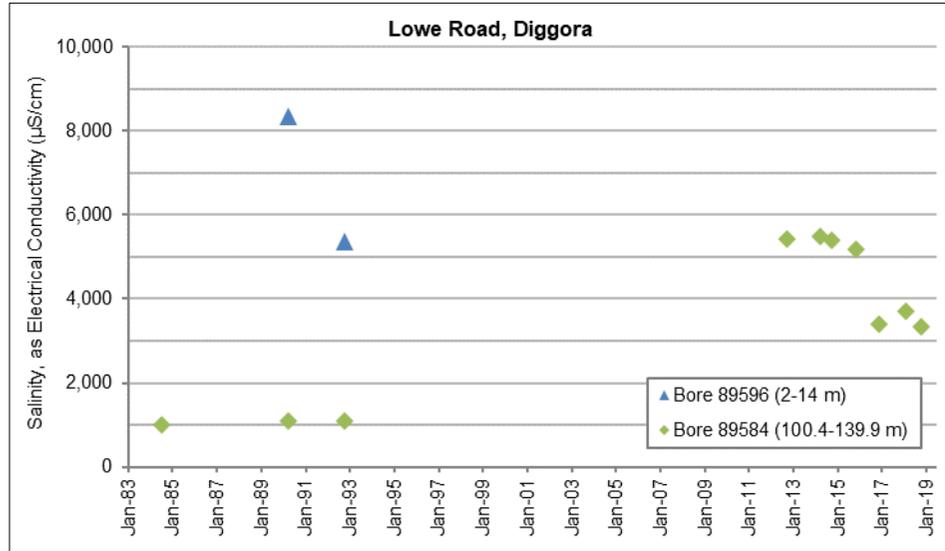
Barnadown Zone – 1034

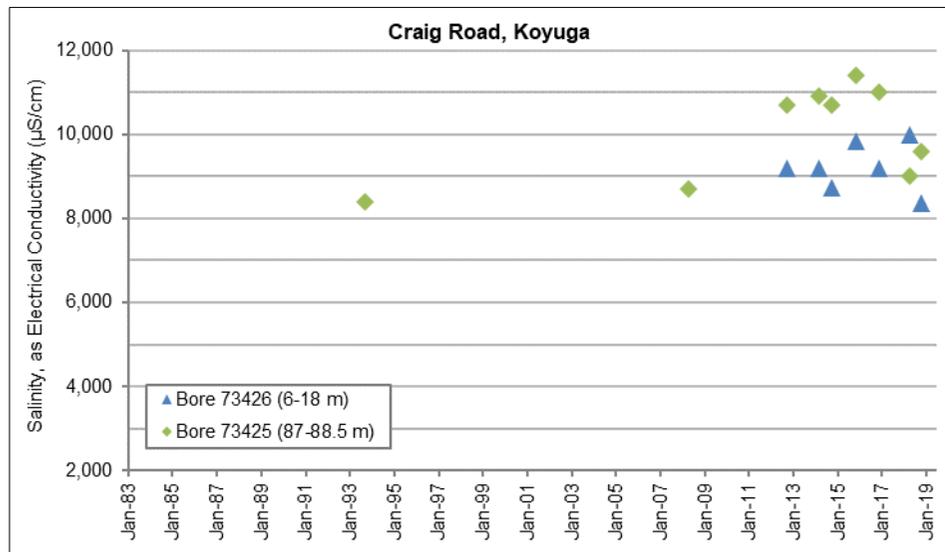
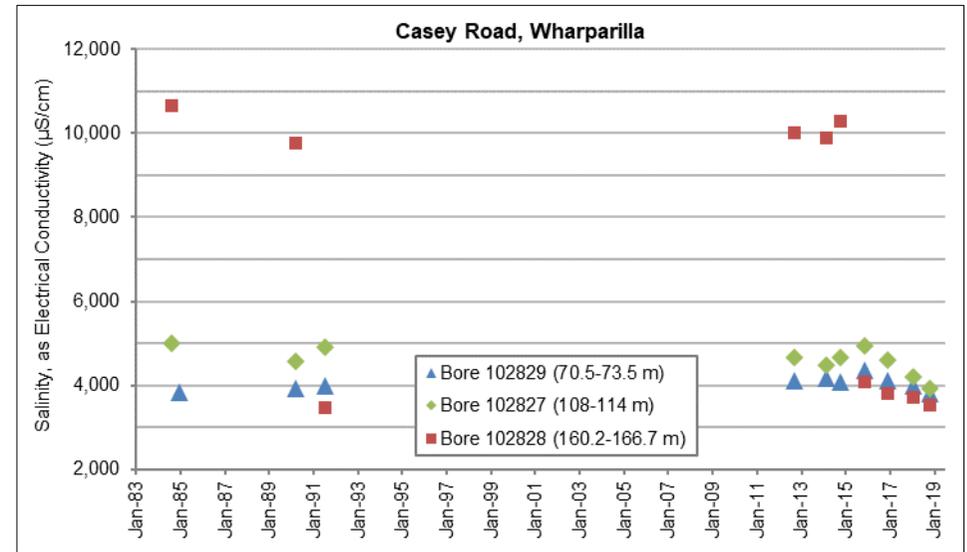
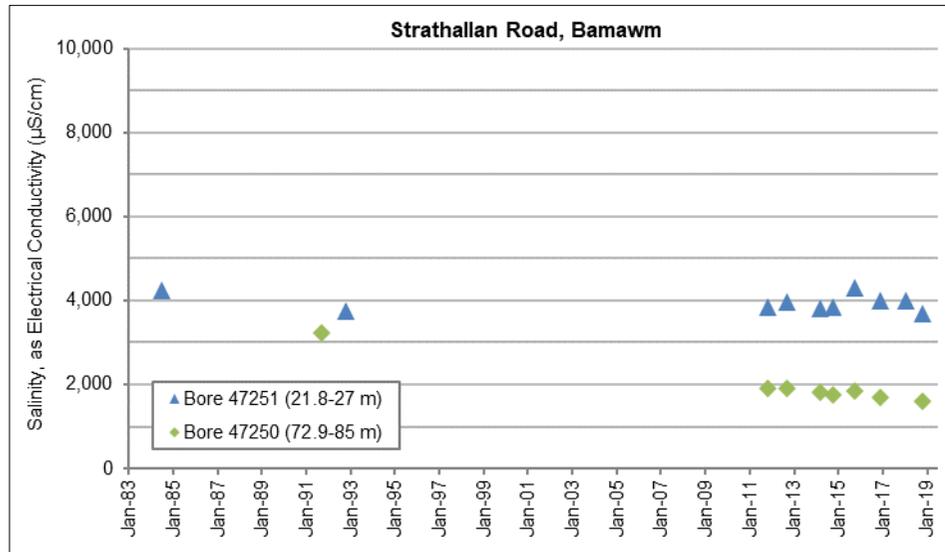




Appendix C – Groundwater quality results

Groundwater salinity from key monitoring bores listed in Schedule 1 of the Plan





Groundwater chemistry results from key monitoring bores listed in Schedule 1 of the Plan

		Bore:	102827	102828	102829	47250	47251	73425	73426	89584	WRK059873	WRK059877
		Aquifer:	Deep Lead	Deep Lead	Shepp Fm	Deep Lead	Shepp Fm	Deep Lead	Shepp Fm	Deep Lead	Deep Lead	Deep Lead
		Date:	22/10/2018	22/10/2018	22/10/2018	25/10/2018	25/10/2018	25/10/2018	25/10/2018	24/10/2018	23/10/2018	23/10/2018
Analyte	Unit											
Electrical conductivity @ 25°C	µS/cm		4300	3800	4100	1700	4000	11000	9200	3700	3800	3000
pH sediment	–		9.6	7.9	7.4	9.5	9	6.9	6.6	5	6.7	6.7
Turbidity	NTU		9.5	68	35	3.7	10	7.4	9.2	19	15	8.2
Total Dissolved Solids	mg/L		2300	1900	2300	770	2000	5400	4700	1800	2000	1500
Alkalinity (Bicarbonate), as CaCO ₃	mg/L		34	230	180	47	120	190	39	<2	130	160
Alkalinity (Carbonate), as CaCO ₃	mg/L		90	<2	<2	34	34	<2	<2	<2	<2	<2
Alkalinity (Hydroxide), as CaCO ₃	mg/L		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Alkalinity, as CaCO ₃	mg/L		120	230	180	81	150	190	39	<2	130	160
Calcium, as Ca	mg/L		4	31	39	5.9	12	130	120	32	62	44
Chloride, as Cl	mg/L		1600	1100	1200	530	1300	3600	2900	1300	1100	960
Magnesium, as Mg	mg/L		57	74	91	23	67	260	220	120	100	65
Potassium, as K	mg/L		9	7	7.8	5.8	13	13	7	6.2	9.6	7.7
Sodium, as Na	mg/L		800	680	710	280	730	1700	1500	300	490	430
Ammonia, as N	mg/L		<0.1	<0.1	<0.1	0.3	0.2	0.3	<0.1	0.5	<0.1	<0.1
Nitrate, as N	mg/L		<0.01	<0.01	<0.01	1.4	<0.01	<0.01	2.8	0.05	<0.01	<0.01
Nitrite, as N	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	0.24	0.17	0.05	<0.01	<0.01
Total Kjeldahl Nitrogen, as N	mg/L		<0.1	<0.1	<0.1	0.2	0.3	1	<0.1	<0.1	<0.1	<0.1

		Bore:	102827	102828	102829	47250	47251	73425	73426	89584	WRK059873	WRK059877
		Aquifer:	Deep Lead	Deep Lead	Shepp Fm	Deep Lead	Shepp Fm	Deep Lead	Shepp Fm	Deep Lead	Deep Lead	Deep Lead
		Date:	22/10/2018	22/10/2018	22/10/2018	25/10/2018	25/10/2018	25/10/2018	25/10/2018	24/10/2018	23/10/2018	23/10/2018
Analyte	Unit											
Total Combustible Nitrogen, as N	mg/L	<0.1	<0.1	<0.1	1.7	0.3	0.2	3.1	<0.1	<0.1	<0.1	
Sulphate, as SO4	mg/l	10	330	310	19	190	580	950	1	180	5	
Total organic carbon	mg/L	0.5	0.8	0.6	0.5	0.5	0.7	0.5	0.5	0.8	2.6	
Arsenic, as As	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.002	
Cadmium, dissolved (ICP-MS)	mg/L	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	
Chromium, dissolved (ICP-MS)	mg/L	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper, dissolved (ICP-MS)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	
Iron, dissolved as Fe	mg/L	<0.01	0.02	<0.01	<0.01	<0.01	0.75	<0.01	200	<0.01	0.23	
Lead, dissolved (ICP-MS)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Manganese, dissolved as Mn	mg/L	0.018	0.39	0.021	0.023	0.052	0.12	0.002	9.1	0.11	0.079	
Mercury, as Hg	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Nickel, dissolved (ICP-MS)	mg/L	<0.001	<0.001	0.045	<0.001	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	
Phosphorus, total as P	mg/L	0.05	0.05	0.05	0.05	0.05	0.5	0.05	0.08	0.05	0.15	
Zinc, dissolved (ICP-MS)	mg/L	<0.001	0.006	0.008	<0.001	0.002	0.04	0.065	0.039	0.009	0.003	

Groundwater salinity results from targeted sampling program and available historical data

