

Lower Campaspe Valley Water Supply Protection Area Groundwater Management Plan

Annual Report

For year ending 30 June 2020

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Excellence



Honesty



Accountability



Courage



Caring

Document History and Distribution

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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 2019/20 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* on 17 October 2012.

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

This report provides an overview of the groundwater management activities administered under the Plan during the 2019/20 water year.

A copy of this report is available for inspection at the GMW Tatura office, or for download from the GMW website.



Charmaine Quick

MANAGING DIRECTOR

Date: 25/09/2020

Executive summary

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

The 2019/20 water year marks the eighth year of operation of the Plan.

Goulburn-Murray Water (GMW) announced an allocation of 100 per cent for the 3 northern management zones of the Lower Campaspe Valley Water Supply Protection Area (the WSPA) during the 2019/20 water year. The southern-most management zone, Barnadown Zone, was restricted to a 75 per cent allocation for the first time since the Plan was implemented.

Recorded use in the WSPA in 2019/20 was 41,730 ML, or 75 per cent of the total licence entitlement volume, which was the third highest since the Plan was implemented.

There was substantial trade activity in the WSPA during the 2019/20 water year; 34 temporary licence transfers totalling 4,753.8 ML and 2 permanent licence transfers totalling 9 ML/yr.

Licence holders in the WSPA are entitled to carryover up to a maximum of 25 per cent of their unused licence entitlement volume for use in the subsequent water year. A total of 12,590.6 ML was carried over for use in the 2020/21 water year.

A third consecutive year of below-average rainfall (i.e. 2019/20, following 2018/19 and 2017/18) was recorded at Rochester within the WSPA. The cumulative impacts of these drier conditions, combined with the larger volumes of groundwater abstraction, resulted in lower groundwater recovery levels across much of the WSPA.

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

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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 2019/20 water year (1 July 2019 to 30 June 2020).

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 4 management zones within the WSPA: Elmore-Rochester Zone –1031, Bamawm Zone – 1032, Echuca Zone – 1033 and Barnadown Zone – 1034, as shown in Figure 1.

The 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 (DBNS).

1.3 Groundwater Management Plan

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.gmwater.com.au.

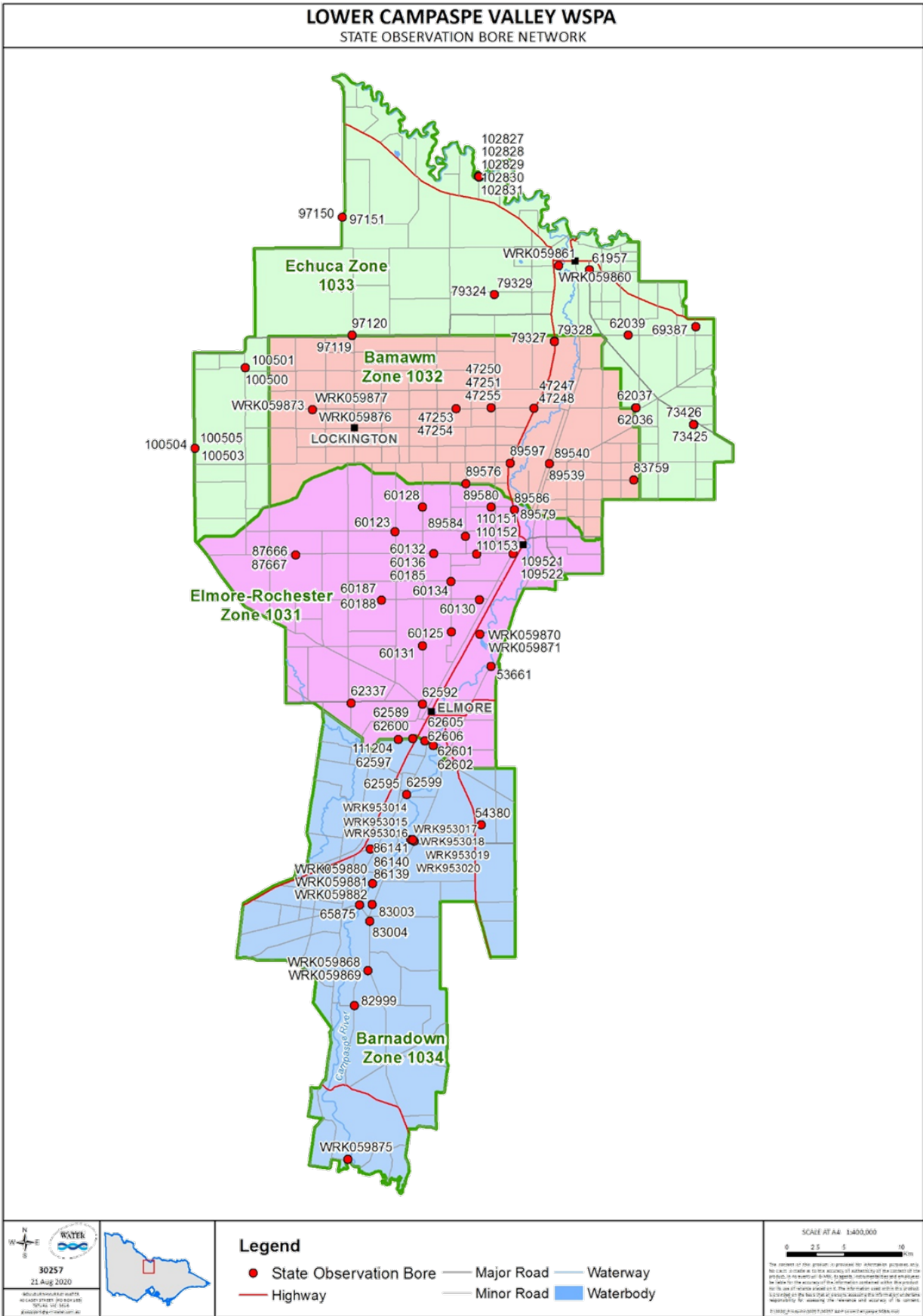


Figure 1 Lower Campaspe Valley Water Supply Protection Area

2 Groundwater Management

2.1 Licence entitlement volume

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

At 30 June 2020, licence entitlement volume in the WSPA was 55,860.4 ML/yr (Table 1), which remained unchanged from 30 June 2019. The number of licences in each management zone is summarised in Table 1, as well as the total number of licensed bores and the total licence entitlement volume.

Table 1 Groundwater licence entitlement volume in the Lower Campaspe Valley WSPA in 2019/20

Management zone	Licences	Licensed bores	Licence entitlement volume (ML/yr)
Elmore-Rochester Zone – 1031	53	65	17,152.6
Bamawm Zone – 1032	41	47	25,873.3
Echuca Zone – 1033	16	18	4,839.5
Barnadown Zone – 1034	20	59	7,995.0
Total	130	189	55,860.4

Note: Data extracted from the Victorian Water Register 1 July 2020.

2.2 Groundwater allocations

Annual groundwater allocations in the WSPA are determined by comparing the average of annual maximum groundwater recovery levels recorded in key state observation bores from the previous 3 water years (i.e. a 3 year rolling average) against trigger levels outlined in Prescription 1 of the Plan. These trigger levels are illustrated in Figure 2 for the northern management zones and Figure 3, for the Barnadown Zone only.

During the 2019/20 water year, the Department of Environment, Land, Water and Planning (DELWP) undertook a State Observation Bore Network (SOBN) refurbishment program. The program included treatment of bore 79324, which is used to determine annual allocations for the northern management zones (i.e. Elmore-Rochester, Bamawm and Echuca zones). The bore was decommissioned due to ageing materials and replaced by a new observation bore (WRK117046) constructed 20 March 2020, at the same location and to the same specifications.

2019/20 allocation

GMW determined allocations for the 2019/20 water year based on the average of maximum recovery levels recorded for the respective trigger bores over the previous 3 water years (i.e. 2016/17 to 2018/19). An allocation of 100 per cent was set for the northern management zones and a 75 per cent allocation was set for the Barnadown Zone. This marked the first time a restriction had been placed on groundwater extraction in the WSPA since the Plan was implemented.

2020/21 allocation

GMW announced allocations for the 2020/21 water year on 17 June 2020. An allocation of 75 per cent was set for all management zones, as the average of maximum recovery levels recorded for both trigger bores, individually, over the previous 3 water years (2017/18 to 2019/20), were below the 16-metre trigger level (Figure 2 and Figure 3).

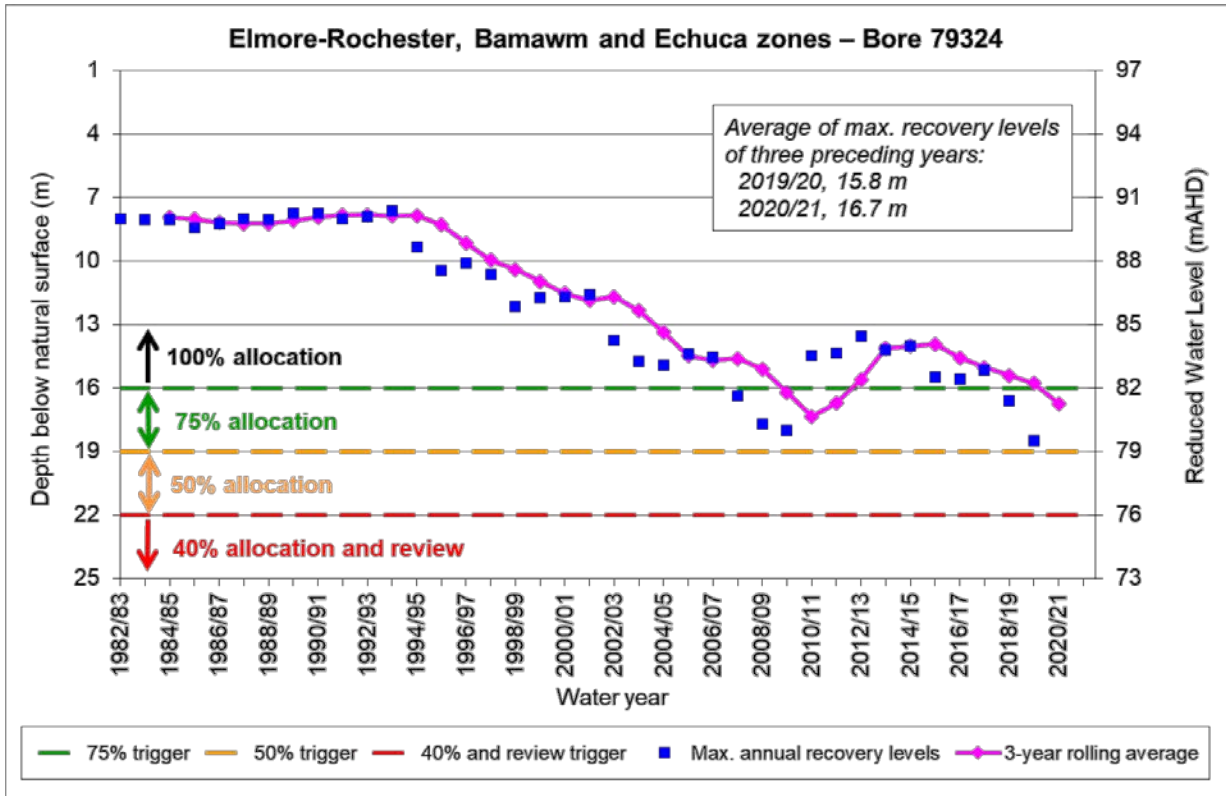


Figure 2 Trigger levels to determine allocations for the Elmore-Rochester, Bamawm and Echuca zones of the Lower Campaspe Valley WSPA

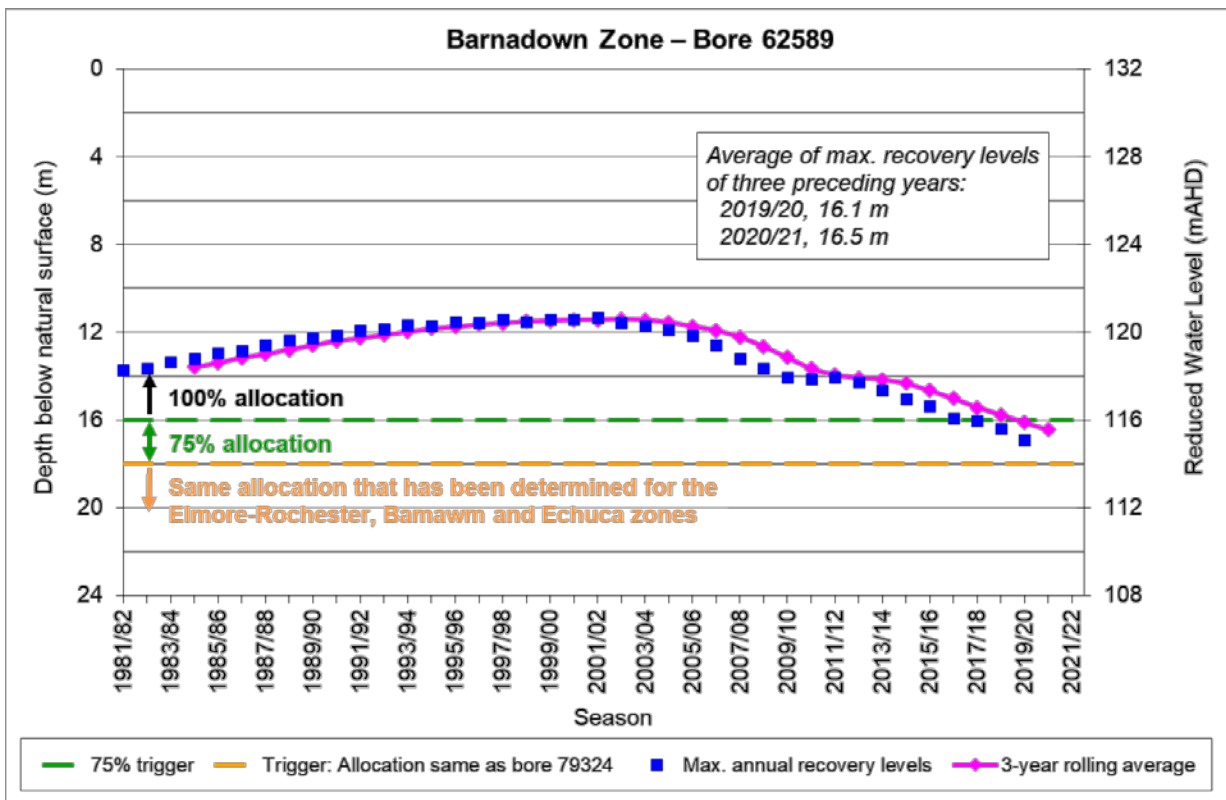


Figure 3 Trigger levels to determine allocations in the Barnadown Zone of the Lower Campaspe Valley WSPA

2.3 Groundwater use

Total recorded use in the WSPA in 2019/20 was 41,730 ML, or 75 per cent of total licence entitlement volume (Figure 4). This is a 15 per cent decrease on the volume used in 2018/19. Note: recorded use refers to metered and deemed use.

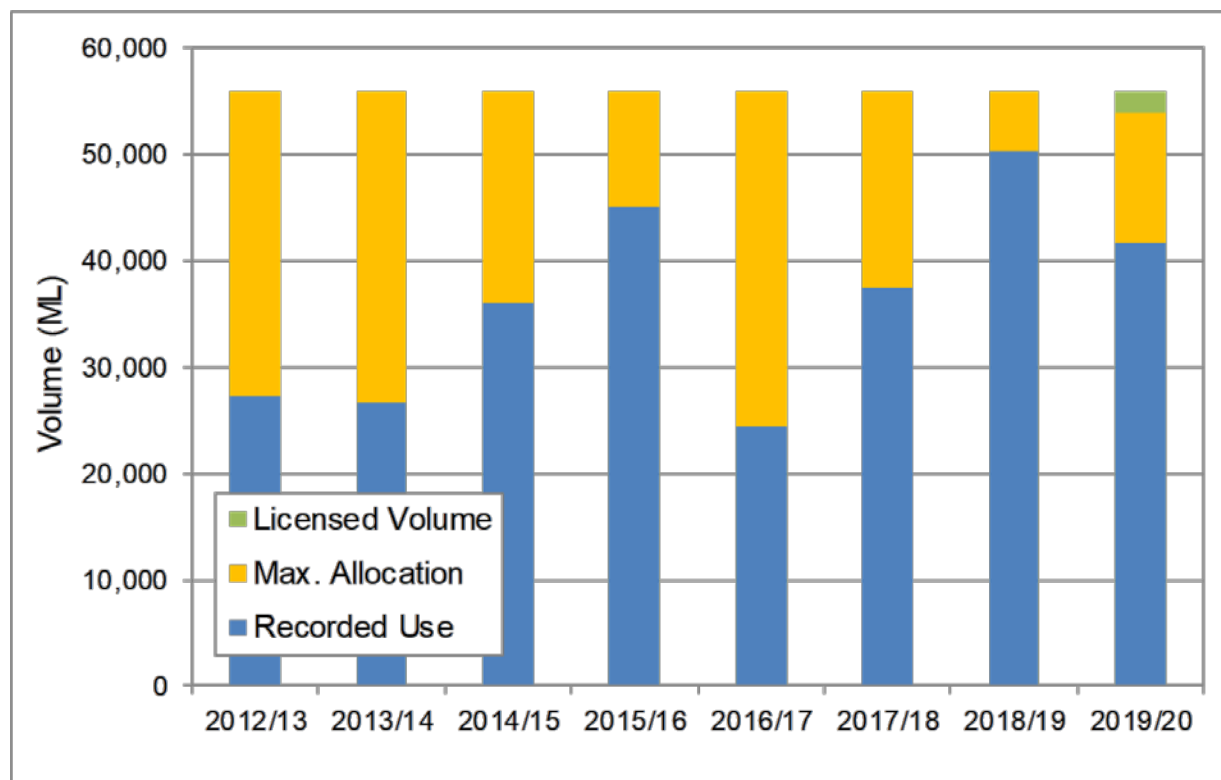


Figure 4 Total licence entitlement volume, allocation and recorded use in the Lower Campaspe Valley WSPA

Recorded use was greatest in the Bamawm Zone, where the highest proportion of licence entitlement volume is held (Table 2). Recorded use as a proportion of total licence entitlement was also highest in the Bamawm Zone, at 90 per cent.

Table 2 Recorded use in the Lower Campaspe Valley WSPA in 2019/20

Management zone	Licence entitlement volume (ML/yr)	Recorded use (ML)	Proportion of total licence entitlement volume used
Elmore-Rochester Zone – 1031	17,152.6	10,865.7	63%
Bamawm Zone – 1032	25,873.3	23,206.5	90%
Echuca Zone – 1033	4,839.5	4,040.4	83%
Barnadown Zone – 1034	7,995.0	3,617.4	45%
Total	55,860.4	41,730.0	75%

Note: Data extracted from Irrigation Planning Module on 30 July 2020.

2.4 Rainfall

Historical rainfall data, sourced from the Bureau of Meteorology weather station at Rochester (BOM, 2020), is presented in Figure 5 as an indicator of climate trends across the 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); and 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 implemented, resulting in reduced recharge to groundwater systems within the WSPA.

There was a total of 384 mm of rainfall recorded for Rochester during the 2019/20 water year. Higher than average rainfall occurred in March and April 2020, which resulted in a short-term increase in the mean monthly trend.

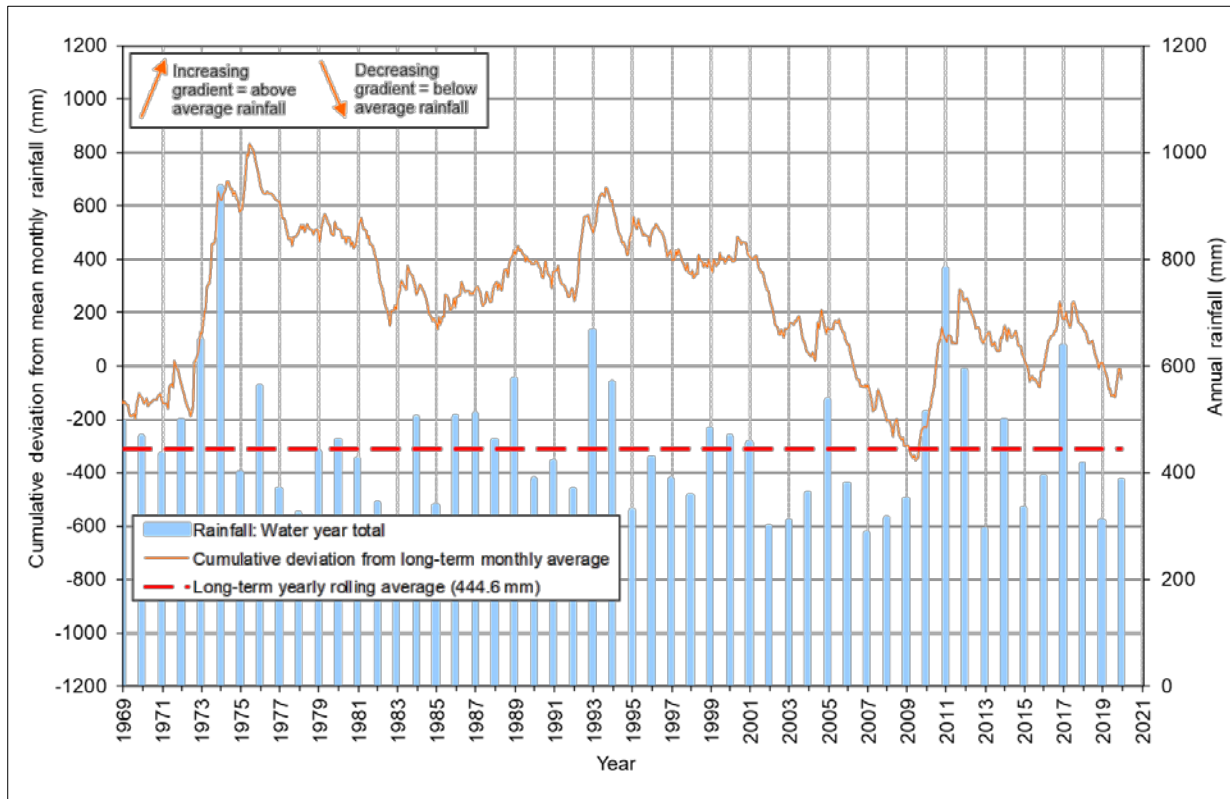


Figure 5 Rainfall recorded at Rochester in the Lower Campaspe Valley WSPA (BOM, 2020)

2.5 Licence transfers

The Plan allows groundwater licence holders to temporarily or permanently transfer licence entitlement volume. During the 2019/20 water year, there were 34 temporary licence transfer transactions for a total of 4,753.8 ML and 2 permanent transfers for a total of 9 ML/yr (Figure 6).

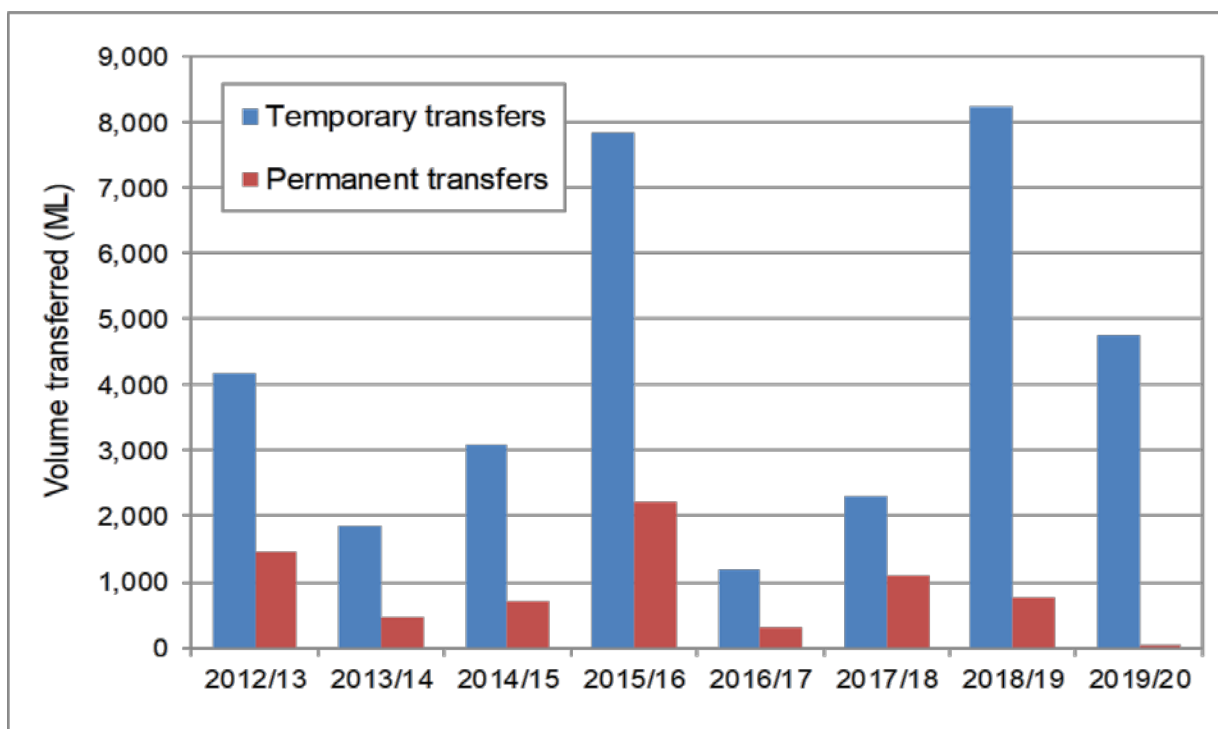


Figure 6 Total licence entitlement volumes transferred in the Lower Campaspe Valley WSPA

The majority of transfers occurred between licence holders within the same management zones (Table 3).

Of the 34 temporary transfers, 8 were between management zones resulting in a net increase of temporary licence volume in the Bamawm zones of 1,277.6 ML. Temporary licence transfers occurred in all 4 management zones of the WSPA; however, the permanent transfers occurred exclusively between licence holders within the Elmore-Rochester Zone only (Table 3).

Table 3 Licence transfers in the Lower Campaspe Valley WSPA in 2019/20

Management 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/yr)	No. of transfer	Volume (ML/yr)
Elmore-Rochester Zone – 1031	10	1,291.8	4	295.2	2	9.0	2	9.0
Bamawm Zone – 1032	16	2,240.0	24	3,517.6	0	0.0	0	0.0
Echuca Zone – 1033	4	601.0	2	320.0	0	0.0	0	0.0
Barnadown Zone – 1034	4	621.0	4	621.0	0	0.0	0	0.0
Total	34	4,753.8	34	4,753.8	2	9.0	2	9.0

2.6 Carryover

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

There was a total of 11,511.8 ML carried over by licence holders in the WSPA for use in the 2019/20 water year. At the conclusion of 2019/20, a total of 12,590.6 ML was carried over for use in the 2020/21 water year.

2.7 Metering

There were 150 metered service points and 39 deemed service points in the WSPA at 30 June 2020. There were 162 meter-related activities undertaken during the 2019/20 water year, including inspections, maintenance, battery replacements and 3 meters installed (Table 4).

All meters were read at least twice during the 2019/20 water year.

Table 4 Metering activities in the Lower Campaspe Valley WSPA in 2019/20

Metering activity	Year ending 30 June 2020
Total number of meters	150
Total number of meter reads	300
Meters installed or replaced	3
Meter inspection events	140
Meter maintenance events	19

2.8 Licence compliance

There were no prosecutions or convictions relating to groundwater matters in the WSPA during the 2019/20 water year.

There were 5 instances of alleged overuse (i.e. licence entitlement volume exceedance) in 2019/20. 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 water is used in accordance with the constraints imposed by the Act.

The installation of a bore for domestic and stock use requires a bore construction licence, in accordance with section 67 of the Act. Upon completion of a bore, a bore completion report is required to be submitted to GMW and details are recorded in the Victorian state groundwater database, referred to as the Water Measurement Information System.

During the 2019/20 water year in the WSPA there were 41 domestic and stock bore construction licences issued by GMW and the Victorian Water Register (combined) and 29 domestic and stock bore completion reports received and processed by GMW.

3 Monitoring Program

3.1 Groundwater levels

During the 2019/20 water year, a total of 100 state observation bores, located within the WSPA, were monitored by GMW and DELWP (Figure 1). This figure includes the 60 key bores listed in Schedule 1 of the Plan, where practicable (Appendix B). Of the 100 bores, 74 were monitored remotely using telemetry equipment, with measurements recorded hourly, and 26 were monitored manually, with measurements recorded on a monthly or quarterly basis.

Water level data for these bores are presented in Appendix B.

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 WSPA in 2019/20 continued to decline and were lower than the 2018/19 water year. However, seasonal drawdown levels were less for some locations than what was observed in the previous water year.

The maximum recovery level in a Deep Lead observation bore (60134), located near Rochester in the Elmore-Rochester Zone, was 0.28 m lower in 2019/20 than the maximum level in 2018/19; 16.13 m DBNS in July 2018, versus 15.85 m in August 2017 (Figure 7). The magnitude of seasonal drawdown was 14.98 m during 2018/19, recorded in the same Deep Lead bore.

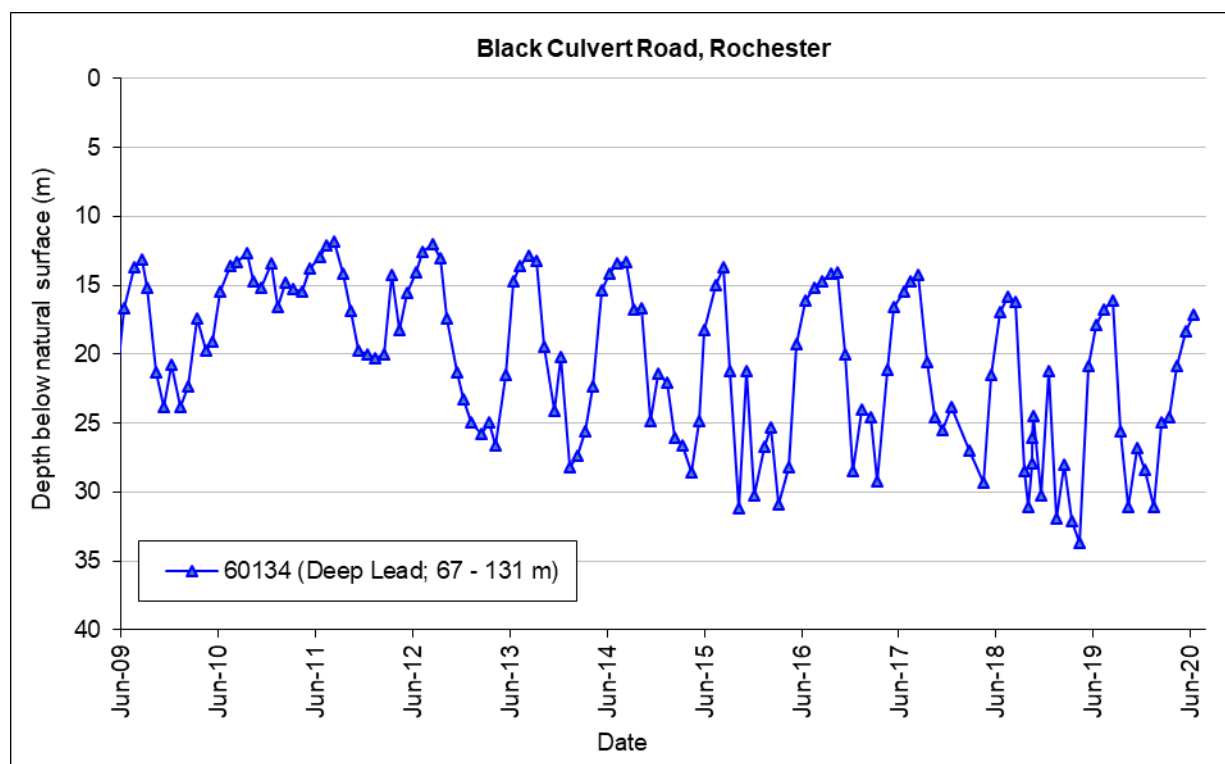


Figure 7 Groundwater monitoring in the Elmore-Rochester Zone at Rochester – June 2009 to June 2020 (DELWP, 2020)

In the Bamawm Zone, there was a larger decline in maximum recovery levels in 2019/20. In Deep Lead observation bore 47247 at Strathallan (the maximum recovery level was 22.79 m DBNS in August 2019 compared to 21.84 m in August 2018 (Figure 8). The magnitude of seasonal drawdown was approximately 15.55 m during 2019/20.

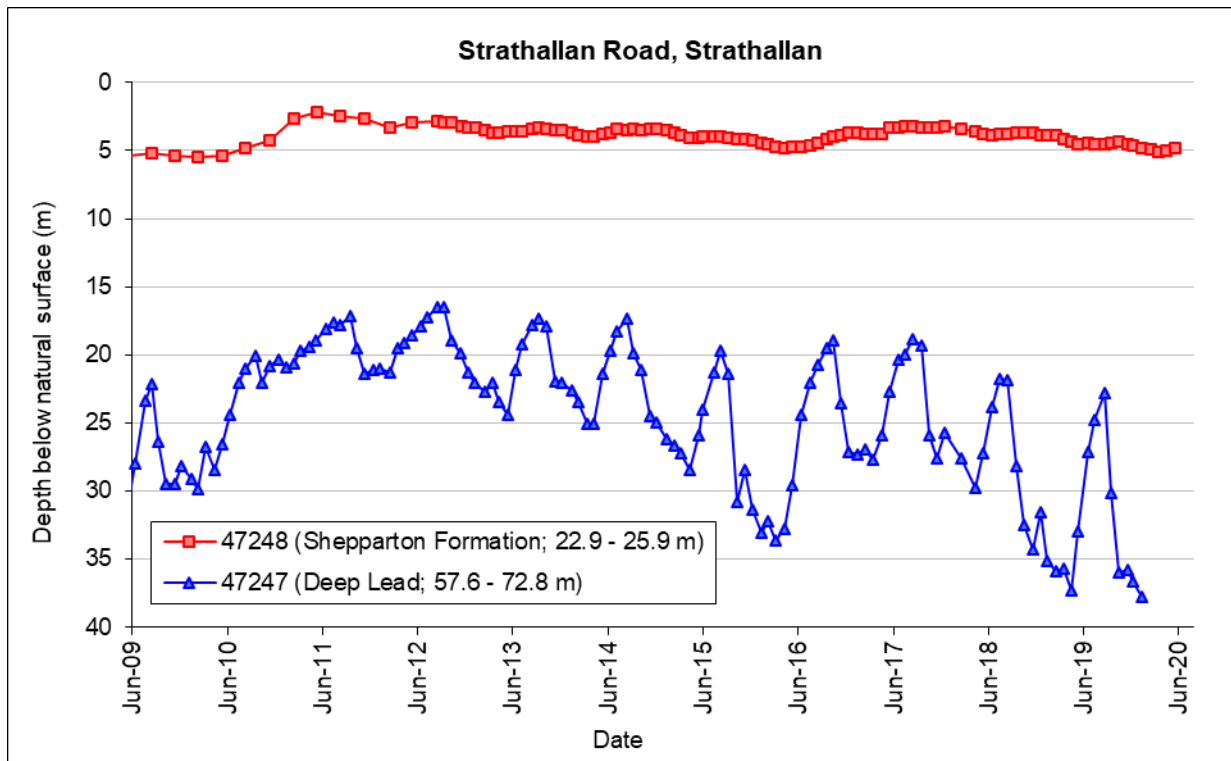


Figure 8 Groundwater monitoring in the Bamawn Zone at Strathallan – June 2009 to June 2020 (DELWP, 2020)

In the Echuca Zone, groundwater recovery levels remained relatively steady in 2019/20. In Deep Lead observation bore 79324 at Echuca West, the maximum recovery level was 19.4 m DBNS in August 2019. That is 2.8 m lower than the maximum recovery level in 2018/19; 16.6 m in August 2018 (Figure 9). In the same bore the magnitude of seasonal drawdown was 5.45 m during 2018/19.

In the Barnadown Zone, there is typically less seasonal variation in groundwater levels compared to the other 3 management zones. In a Deep Lead observation bore located adjacent to the Campaspe River at Runnymede (G8010638/07), the maximum recovery level in 2019/20 was 23.64 m DBNS compared to 23.74 m DBNS in the previous year (Figure 10). The magnitude of seasonal drawdown was approximately 1.35 m during 2019/20.

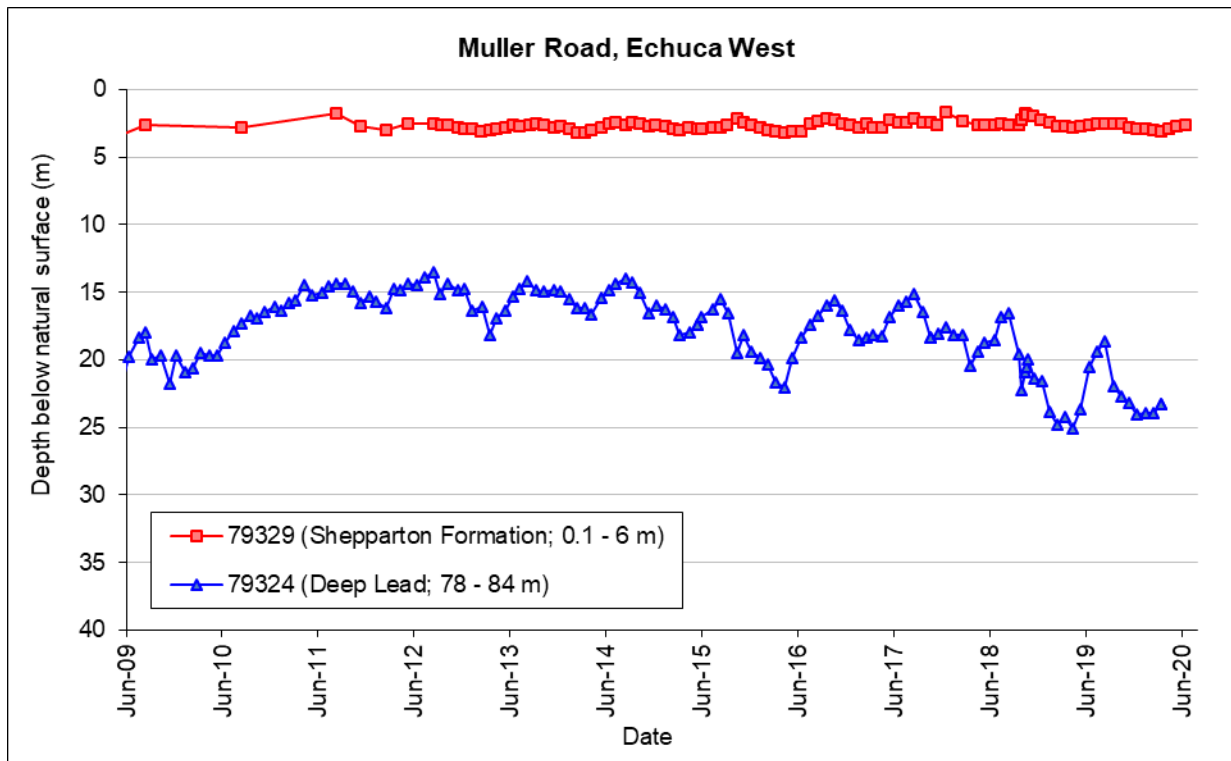


Figure 9 Groundwater monitoring in the Echuca Zone at Echuca West – June 2009 to June 2020 (DELWP, 2020)

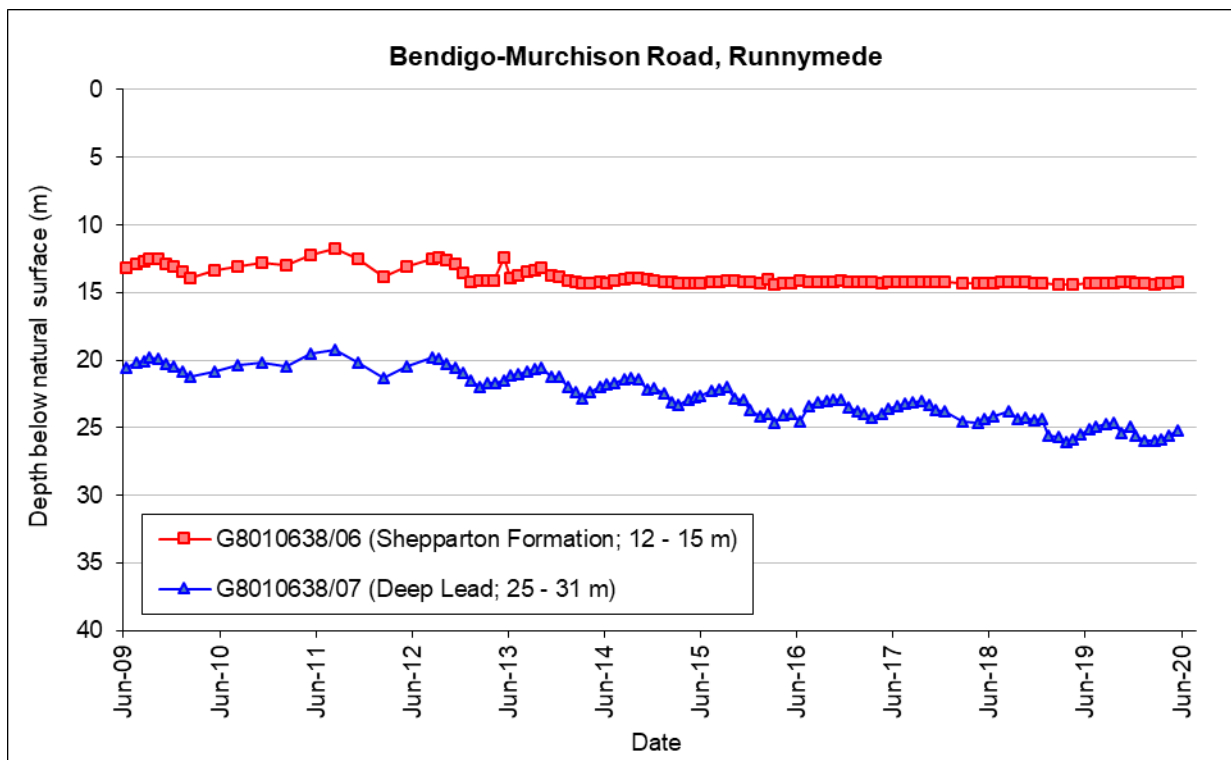


Figure 10 Groundwater monitoring in the Barnadown Zone at Runnymede – June 2009 to June 2020 (DELWP, 2020)

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 Water Management Information System. 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 private bores

GMW has enlisted 7 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 2019/20 are presented in Appendix C.

Groundwater salinity varies between water years, although there has been a rising salinity trend of groundwater in some bores, notably licensed bores WRK01877 in the Barnadown Zone and WRK015989 in the Bamawm Zone. Continued monitoring will enable trends to be better understood and to inform future resource management decisions.

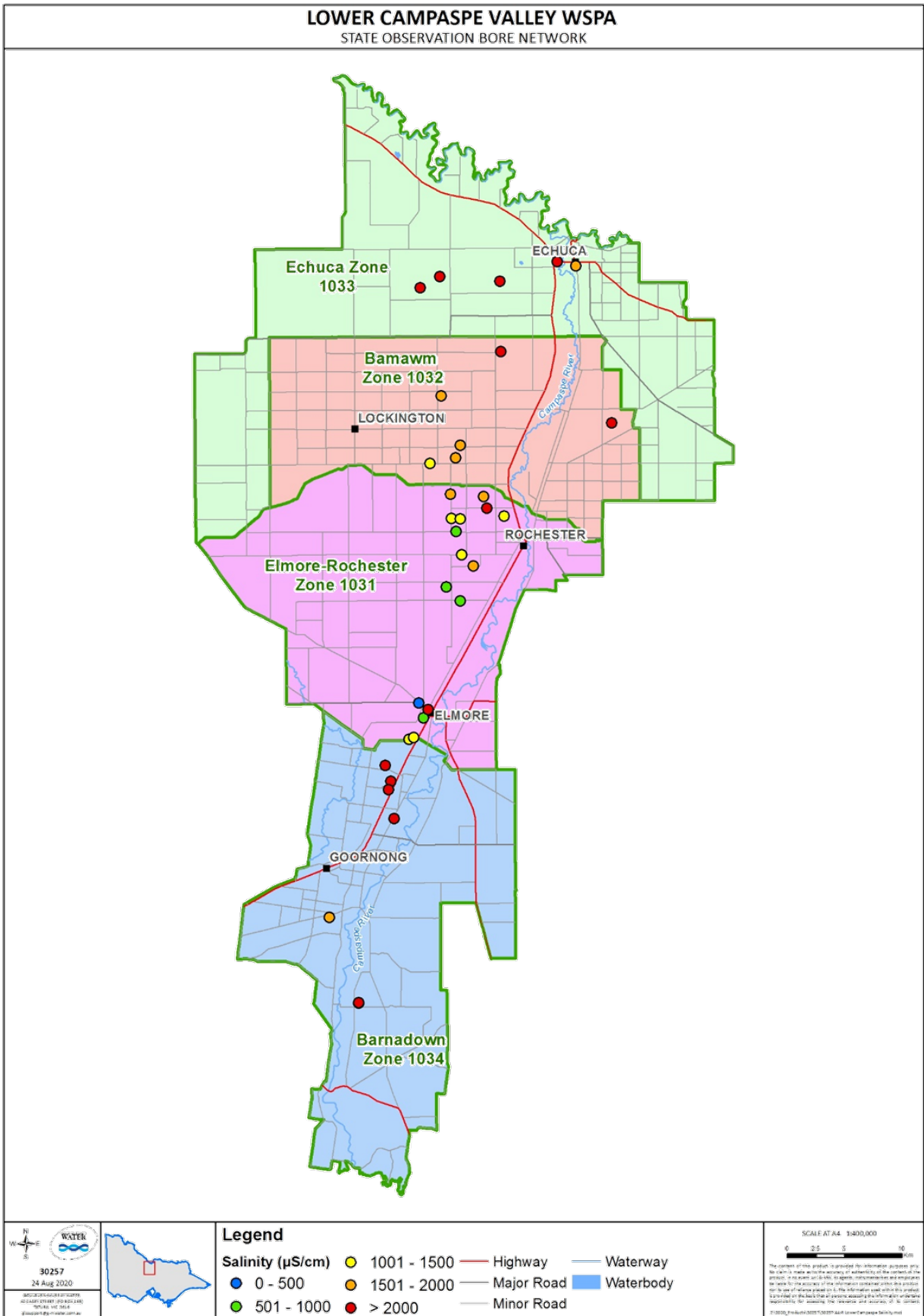


Figure 11 Samples submitted by groundwater users in the Lower Campaspe Valley WSPA

Sampling of state observation bores

Groundwater samples from nested state observation bores were sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. The full suite of results are presented in Appendix C.

Nested sites feature 2 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 WSPA.

Groundwater salinity results from samples collected during the 2019/20 water year are presented in Table 5, with the exception of bore 102828, which was being refurbished in October 2019 when the water quality sampling was being undertaken. These results are compared against historical data in Appendix C.

Groundwater salinity varies between water years, but Bore 89584 in the Elmore-Rochester Zone declined from a value of 3,330 $\mu\text{S}/\text{cm}$ in 2018/19 to 1,400 $\mu\text{S}/\text{cm}$ in 2019/20. All other sites remained similar to the previous water year. There were no strong trends in the data; however, salinity levels have been generally declining in some bores since 2015/16. Continued monitoring of groundwater quality will enable trends to be better understood and support future management decisions.

Table 5 Groundwater salinity results for bores sampled during 2019/20 in the Lower Campspe Valley WSPA

Management zone	Location	Bore ID	Depth of screened interval (m)	Aquifer screened	Salinity, as electrical conductivity ($\mu\text{S}/\text{cm}$)
Elmore-Rochester Zone – 1031	Lowe Road, Diggera	89584	100 – 140	Deep Lead	1,400
		89596	2 – 14	Shepparton Formation	<i>(Bore dry)</i>
Bamawm Zone – 1032	Strathallan Road, Lockington	WRK059873	82 – 87	Deep Lead	3,600
		WRK059876	92 – 97	Deep Lead	2,900
		WRK059877	34 – 37	Shepparton Formation	4,200
	Strathallan Road, Bamawm	47251	22 – 27	Shepparton Formation	4,000
		47250	73 – 85	Deep Lead	1,700
Echuca Zone – 1033	Casey Road, Wharparilla	102827	108 – 114	Deep Lead	4,100
		102828 ¹	160 – 167	Deep Lead	N/A
		102829	71 – 74	Shepparton Formation	4,000
	Craig Road, Koyuga	73425	87 – 89	Deep Lead	10,000
		73426	6 – 18	Shepparton Formation	8,600

4 Administration and Engagement

4.1 Groundwater Reference Committee

The Groundwater Reference Committee, appointed in accordance with Prescription 7(c) of the Plan, met on 4 December 2019.

Key points of discussion included:

- Actions from last meeting discussed and committee updated
- Local issues – current and emerging including:
 - relationship between the Barnadown Zone and the northern management zones
 - expressions of interest for Exploratory Licences North of Elmore
 - restrictions in the Northern Zones
 - how carryover should be managed in the future
- Resource update and administration activities.

4.2 Community engagement

GMW held a groundwater information session on 22 January 2020 at the GMW Rochester Office for all groundwater license holders in the WSPA. The session was held at the request of the Groundwater Reference Committee to inform licence holders of current resource conditions, the process for determining allocations and possible future allocations.

4.3 New observation bore installed

Prescription 4(b) of the Plan committed GMW to install at least one new shallow observation bore in the Coonambidgal Formation to better inform groundwater interaction with the Campaspe River.

GMW have undertaken the following works in 2020:

- Identified potential site based on requirements stated in Plan technical documents
- On-ground inspections for proposed site
- Project plan undertaken to install SOBN observation bore adjacent to the Campaspe River
- Ordered, paid and received bore construction materials
- Developed Environmental Management Plan for works
- Completed engagement and consent for use of land with the following:
 - Dja Dja Wurrung Clans Aboriginal Corporation
 - DELWP
 - Neighbouring property owners

An 8.5 m bore screening the Coonambidgal Formation was drilled and constructed on 3 September 2020 adjacent to the Campaspe River at Runnymede, just south of Elmore. Works were undertaken to the minimum construction standards for water bores in Australia by a licensed driller.

The bore will be monitored through the State Observation Bore Network to obtain groundwater level information for ongoing administration and reviews of the Plan.

5 References

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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 3 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 2019, GMW determined the allocations for the 2019/20 water year based on the rolling average of the maximum annual groundwater recovery levels from the preceding three water years. Allocations were set at 75 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> <p>DELWP undertook a State Observation Bore Network (SOBN) refurbishment program, which included the allocation bore for the Echuca, Bamawm and Elmore-Rochester Zones (79324) has been decommissioned, with WRK117046 constructed on the 20 March 2020 becoming its replacement. GMW use now use WRK117046 for ongoing allocation determinations in the WSPA.</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 34 temporary transfer transactions for a total of 4,753.8 ML/yr; and 2 permanent transfers for a total of 9 ML/yr in 2019/20.</p> <p>GMW processed all groundwater licence applications in accordance with Prescription 2(a) and (c).</p>	Yes

Prescription	Activity	Compliant
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>	<p>Yes</p>
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. During 2019/20 GMW purchased the construction materials for an observation bore in the Coonambidgal Formation and commenced engagement DELWP on how this should be completed to align with the existing SOBN monitoring in the WSPA.</p> <p>An 8.5 m bore screening the Coonambidgal Formation was drilled and constructed on 3 September 2020 adjacent to the Campaspe River at Runnymede, just south of Elmore.</p>	<p>Yes</p>

Prescription	Activity	Compliant
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 7 licence holders participating in the target sampling of licensed bores. A total of 10 bores were sampled in 2019/20.</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 2019 and the data were entered into the Water Register.</p>	Yes

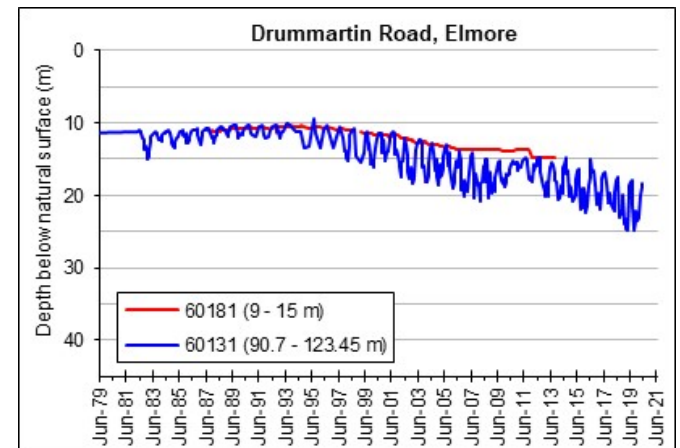
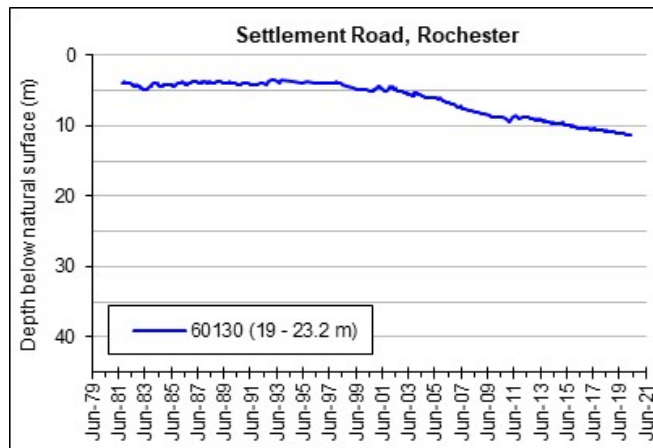
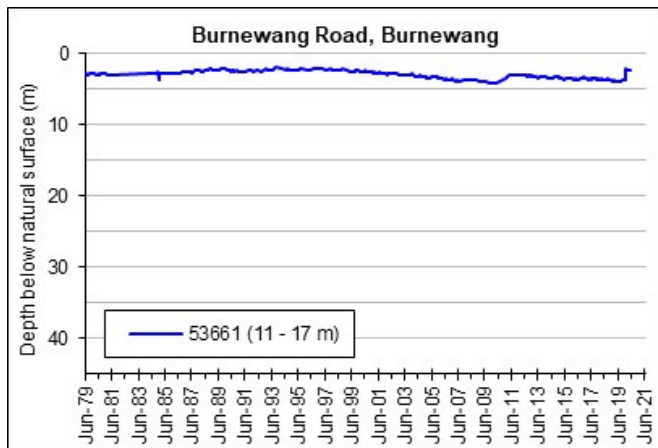
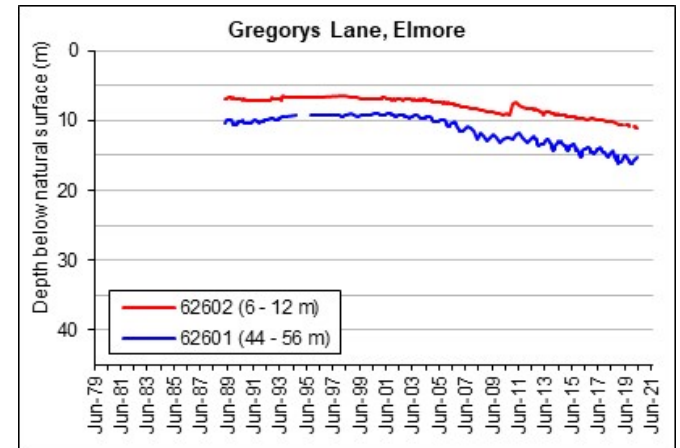
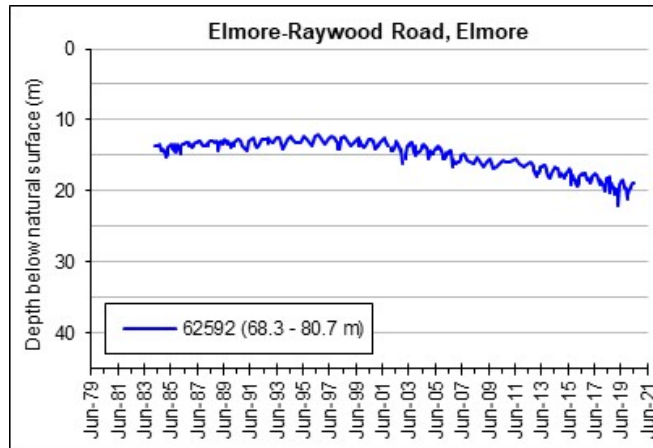
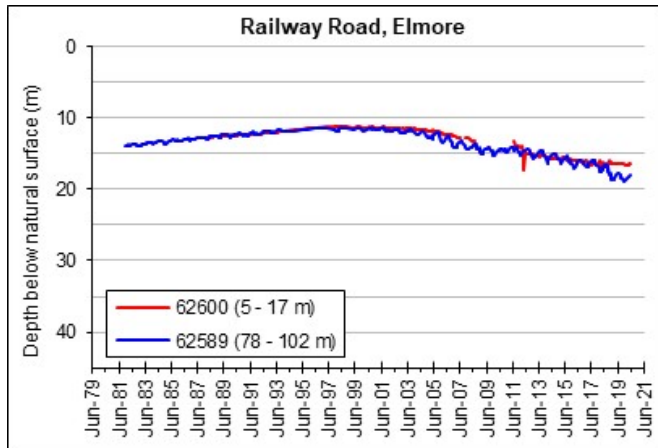
Prescription	Activity	Compliant
PRESCRIPTION 7 Plan implementation		
<p>The Corporation will:</p> <ul style="list-style-type: none"> (a) Post on its website the Plan; annual reports and newsletters; groundwater levels; and rolling average for trigger bores. (b) Mail a newsletter in October each year 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 5 years from approval, or sooner if warranted by any clause contained within the Plan. 	<p>GMW prepared an annual report on the administration and enforcement of the Plan during the 2018/19 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 2018/19 annual report and 2019 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 December 2019 to discuss Plan implementation, resource conditions and allocations as it was the first time Barnadown had an allocation of 75%.</p>	<p>Yes</p>

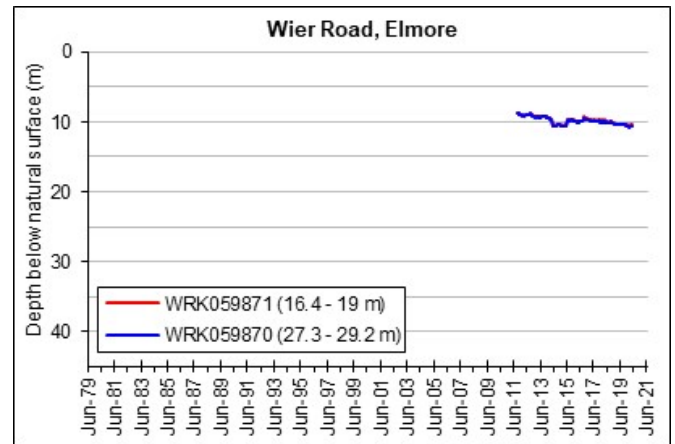
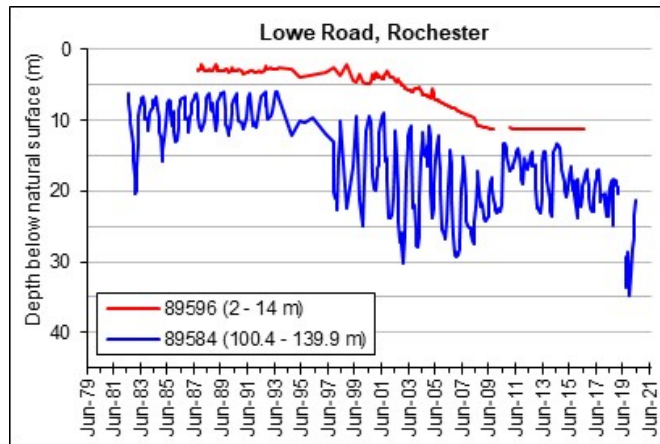
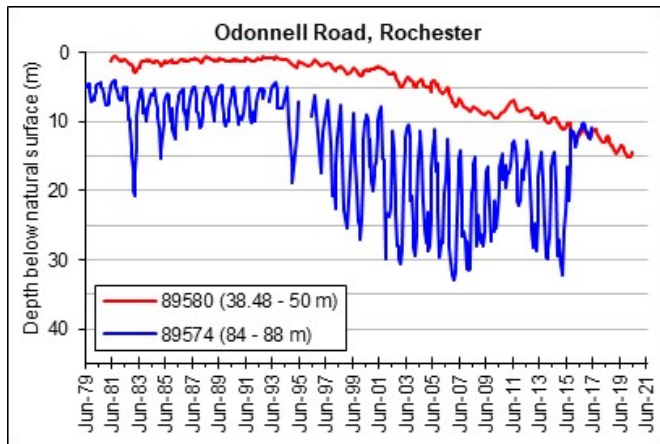
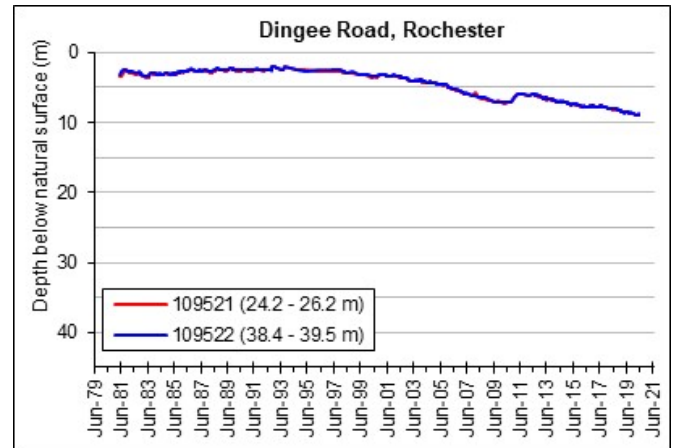
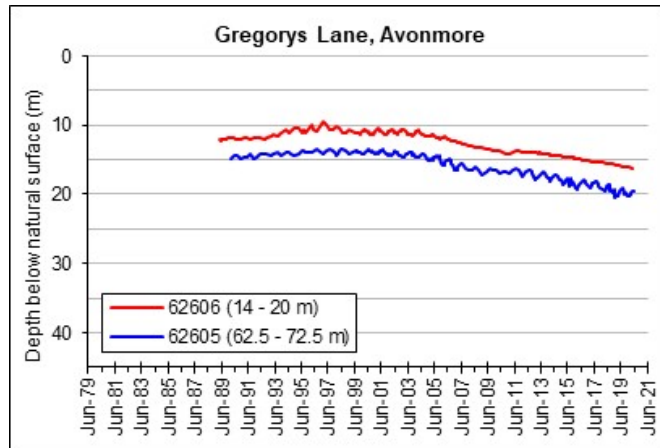
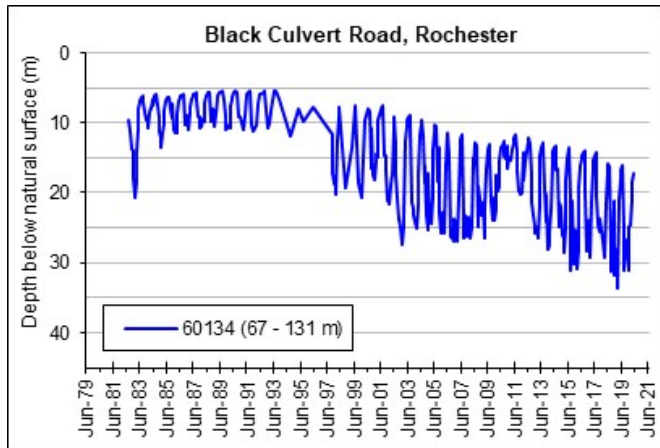
Appendix B – Groundwater level data

Hydrographs are provided for key monitoring bores listed in Schedule 1 of the Plan. All data is sourced from the Water Measurement Information System (DELWP, 2020).

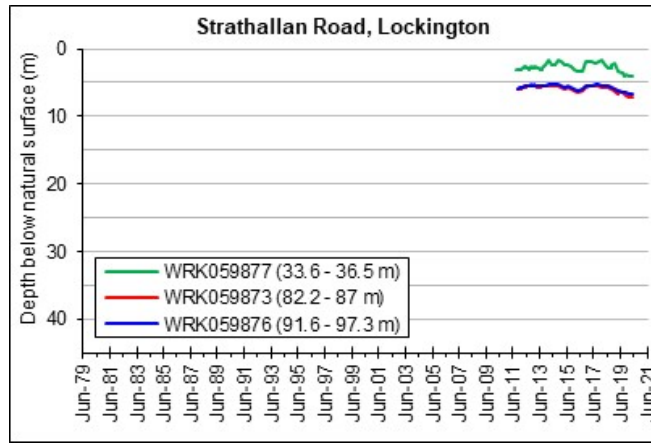
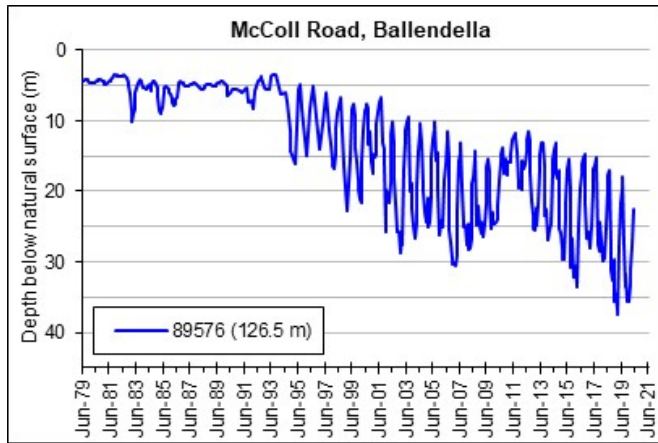
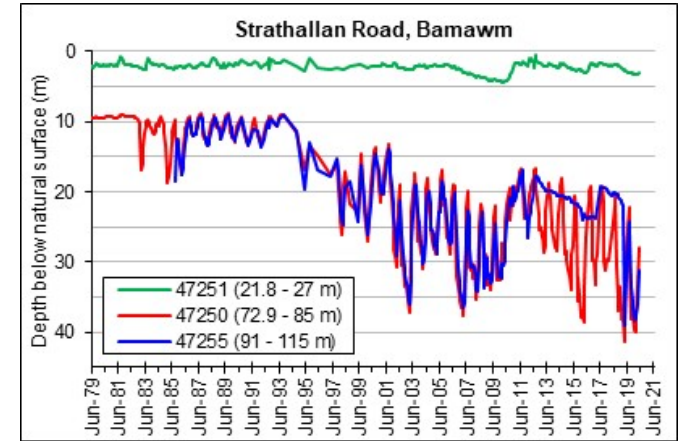
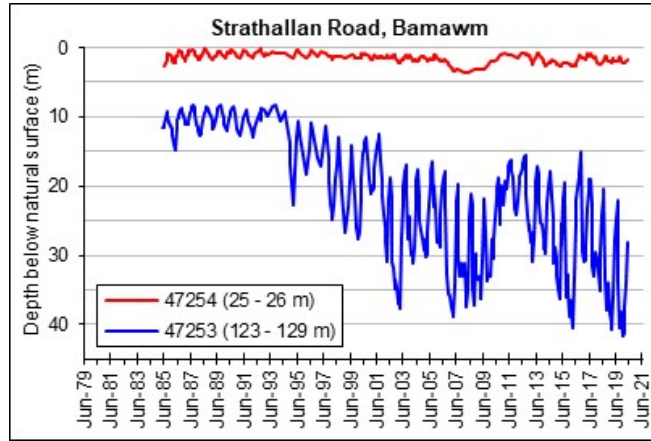
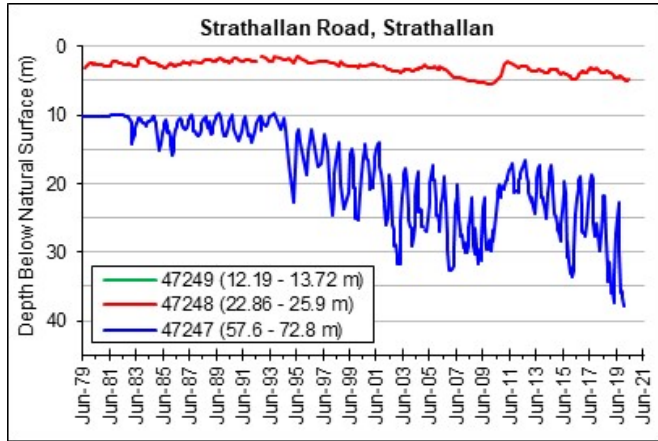
Further groundwater level information is available on the Water Measurement Information System at <https://data.water.vic.gov.au>

Elmore-Rochester Zone – 1031

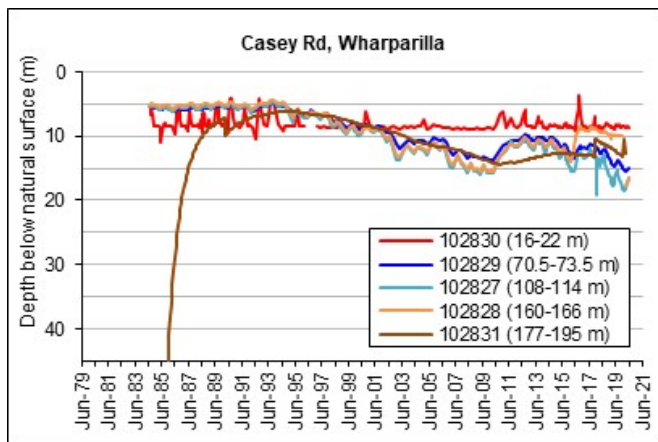
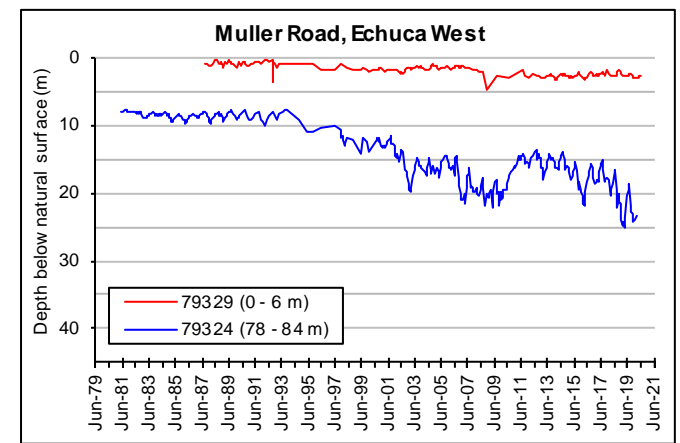
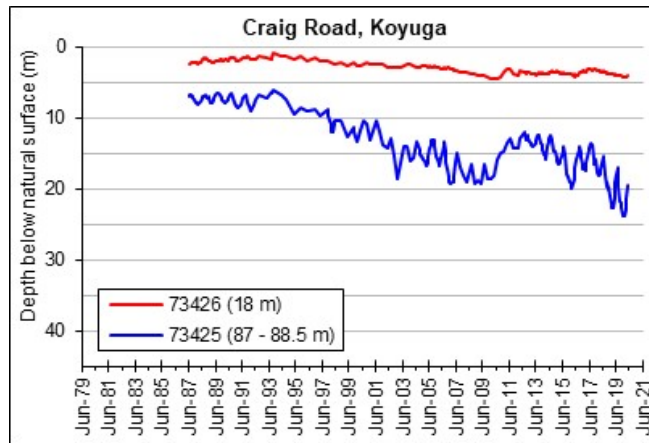
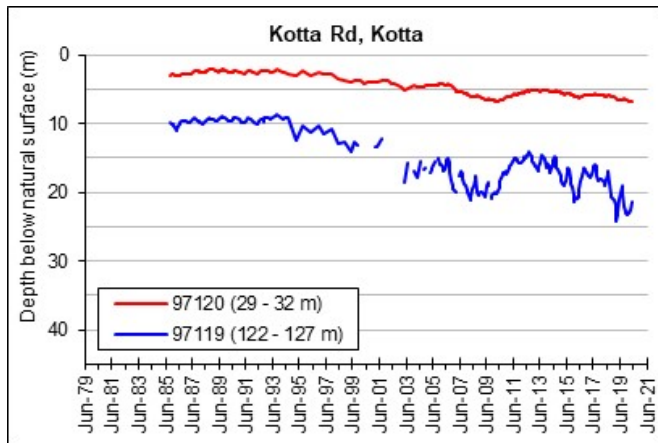




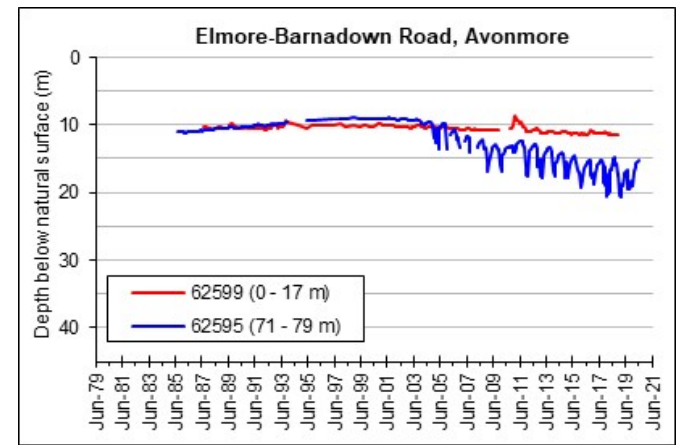
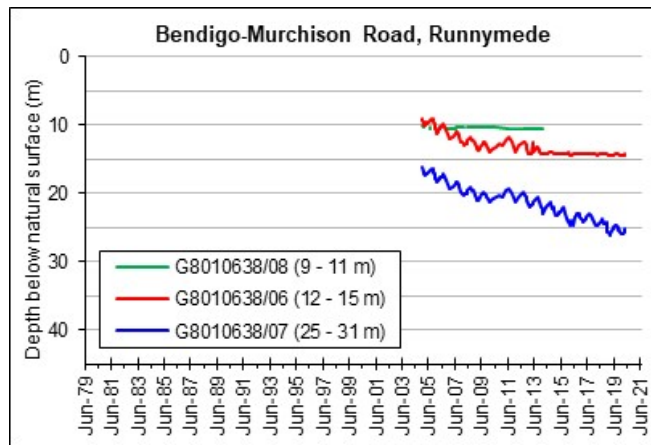
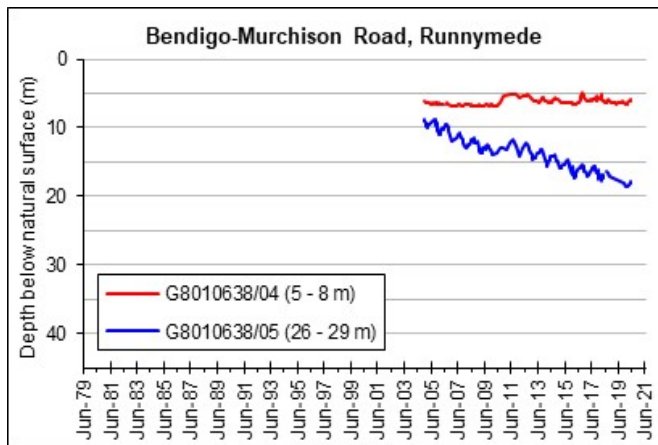
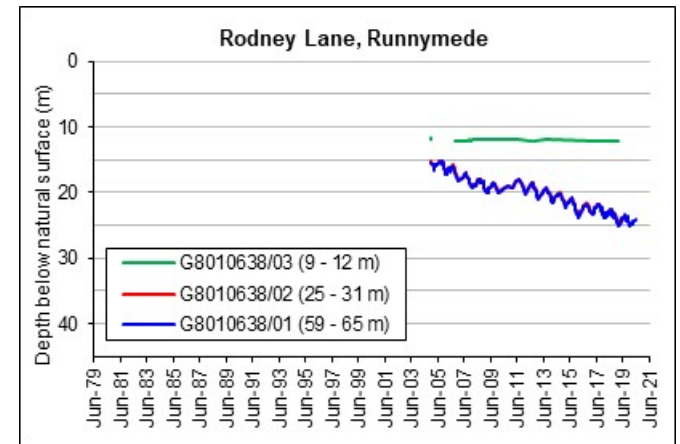
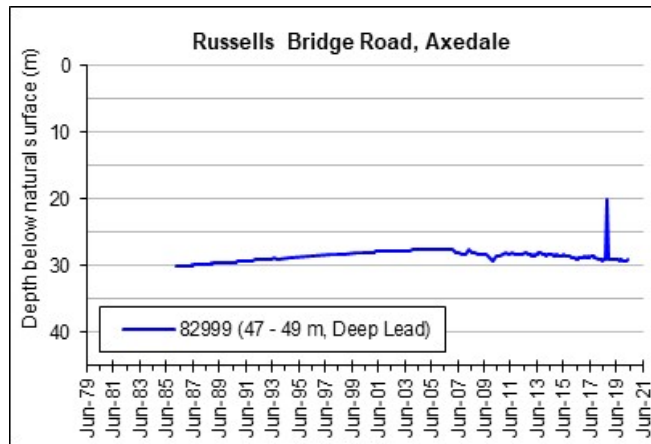
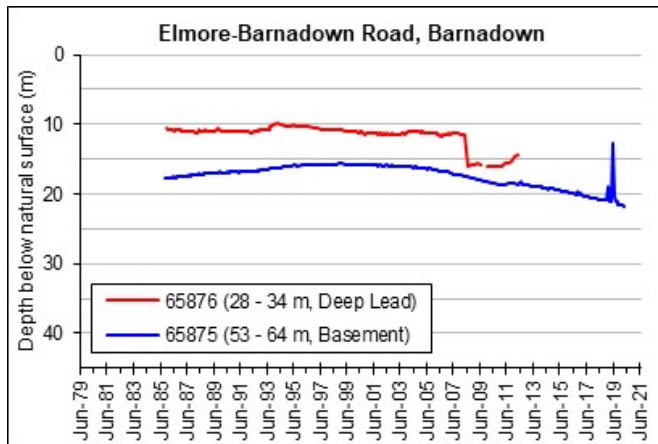
Bamawm Zone – 1032

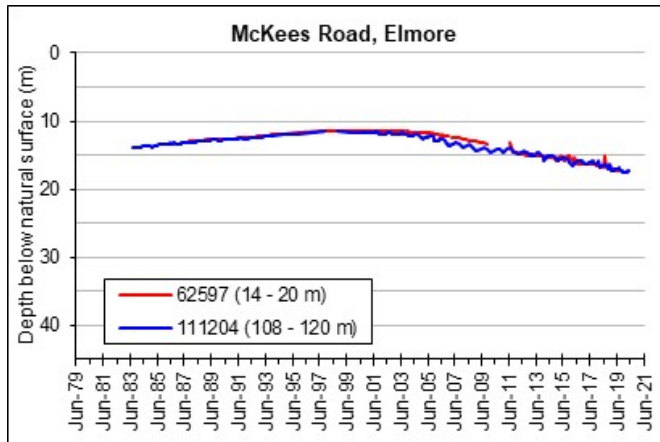


Echuca Zone – 1033



Barnadown Zone – 1034





Appendix C – Groundwater quality results

Analytical chemistry results for 2019/20

Analytical chemistry results are provided for key monitoring bores listed in Schedule 1 of the Plan, with the exception of bore 102828 which was being refurbished in October 2019 when the water quality sampling was being undertaken.

Further groundwater quality information is available on the Water Measurement Information System at <https://data.water.vic.gov.au>

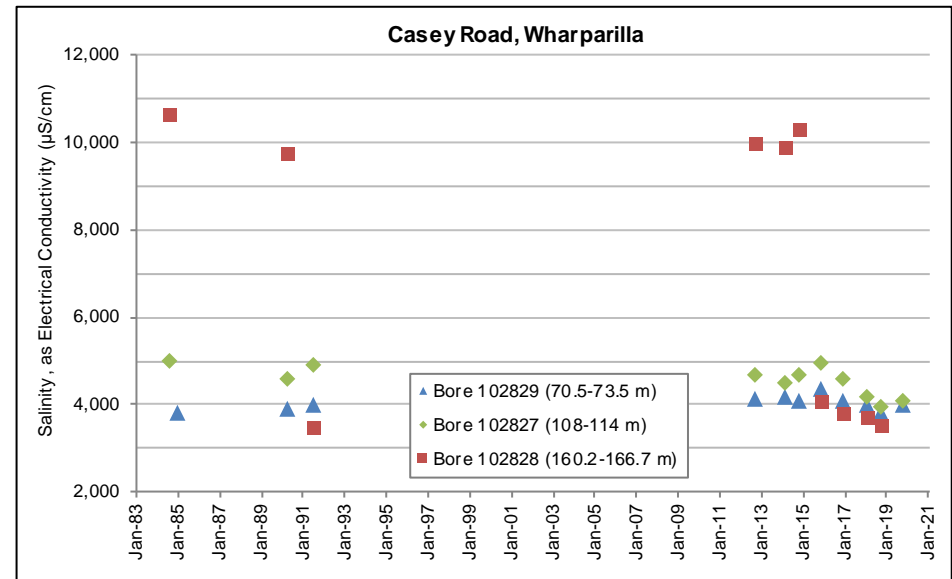
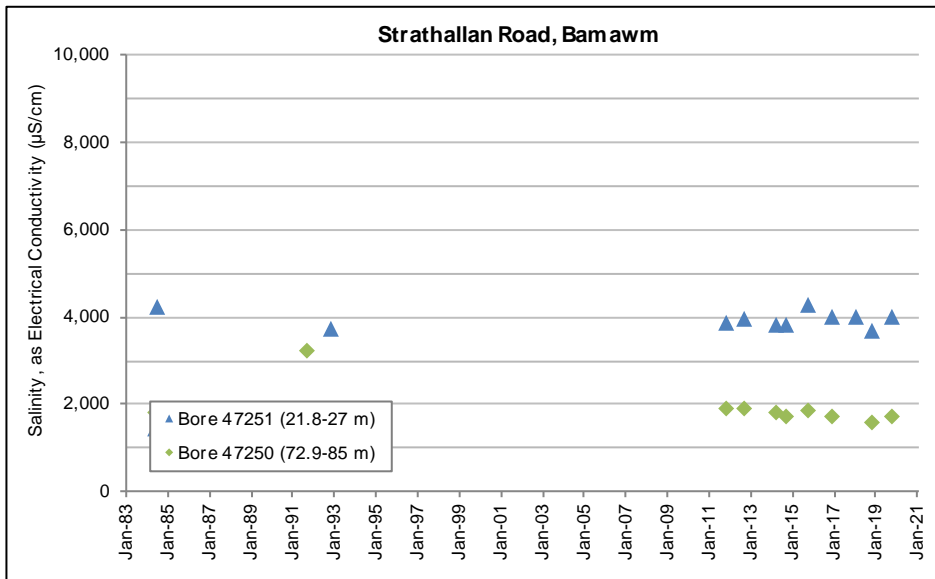
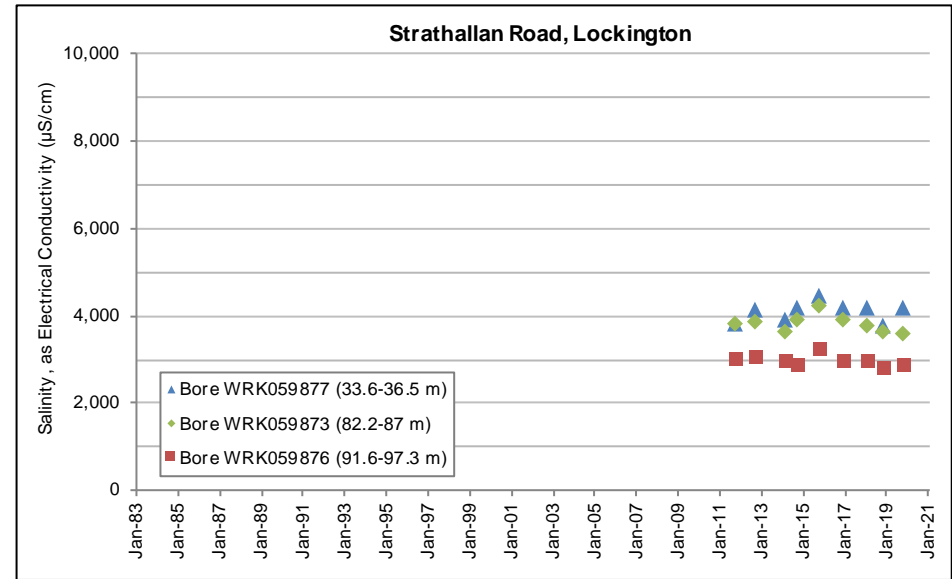
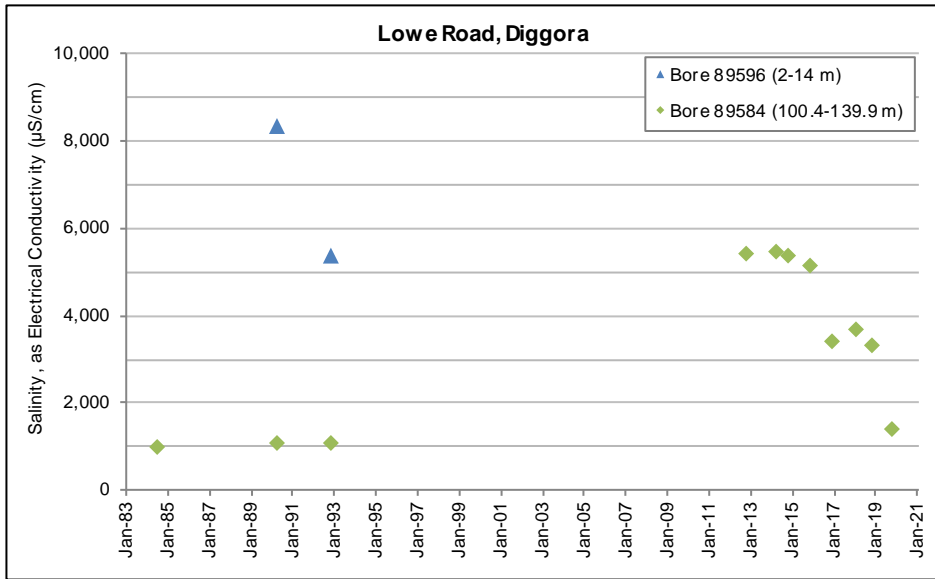
		Bore:	102827	102829	47250	47251	73425	73426	89584	WRK059873	WRK059877	WRK059876
		Aquifer:	Deep Lead	Deep Lead	Shepparton Formation	Deep Lead	Shepparton Formation	Deep Lead	Shepparton Formation	Deep Lead	Deep Lead	Deep Lead
		Date:	21/10/2019	21/10/2019	17/10/2019	17/10/2019	16/10/2019	16/10/2019	31/10/2019	22/10/2019	21/10/2019	22/10/2019
Analyte	Unit											
Conductivity @ 25°C	µS/cm		4100	4000	1700	4000	10000	8600	1400	3600	4200	2900
pH	pH units		9.4	7.3	9.6	8.9	6.9	6.7	8.6	7	7.1	7
Ionic balance	%		8.82	7.45	10	7.36	12.1	9.34	18.1	19.4	3.5	8.58
Total Anions	meq/L		42	40	17	44	125	100	14	41	43	31
Total Cations	meq/L		35	35	14	38	98	83	10	28	40	26
Ion Balance - TDS (EC) vs TDS	mg/l		2	1.9	2.2	1.9	1.8	2	1.8	1.8	1.8	1.8
Total Alkalinity, as CaCO ₃	mg/L		110	180	76	150	190	63	58	130	150	160
Bicarbonate Alkalinity, CaCO ₃	mg/L		62	180	45	130	190	63	56	130	150	160
Calcium, as Ca	mg/L		3	33	5.7	16	120	100	14	66	57	41
Carbonate Alkalinity, as CaCO ₃	mg/L		45	2	32	26	2	2	2	2	2	2
Chloride, as Cl	mg/L		1400	1100	530	1300	3800	2600	450	1200	1200	990
Hydroxide Alkalinity, as CaCO ₃	mg/L		2	2	2	2	2	2	2	2	2	2
Potassium, as K	mg/L		8	7	5.6	13	13	6	3.5	9	11	7
Sodium, as Na	mg/L		710	610	270	710	1600	1400	160	530	680	440

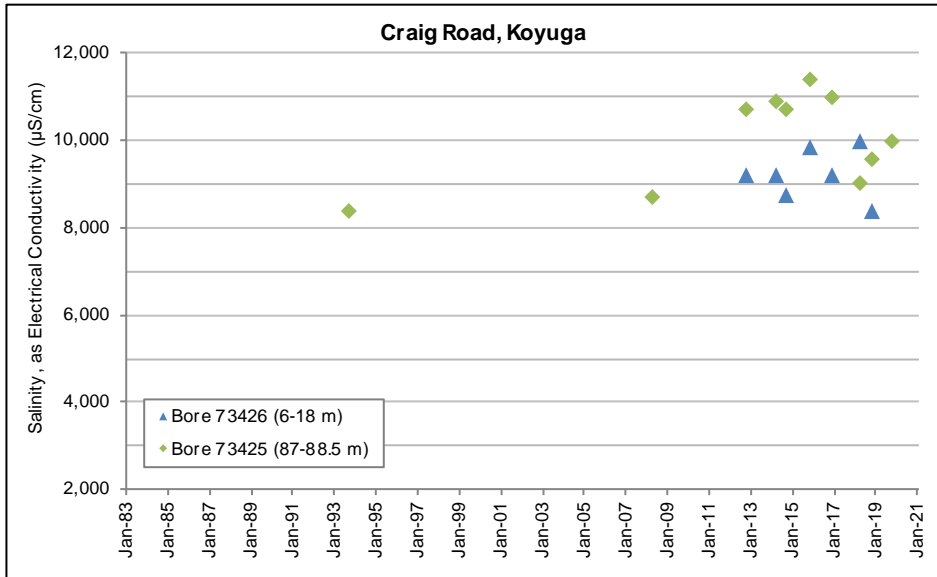
		Bore:	102827	102829	47250	47251	73425	73426	89584	WRK059873	WRK059877	WRK059876
		Aquifer:	Deep Lead	Deep Lead	Shepparton Formation	Deep Lead	Shepparton Formation	Deep Lead	Shepparton Formation	Deep Lead	Deep Lead	Deep Lead
		Date:	21/10/2019	21/10/2019	17/10/2019	17/10/2019	16/10/2019	16/10/2019	31/10/2019	22/10/2019	21/10/2019	22/10/2019
Analyte	Unit											
Ammonia, as N	mg/L	0.1	0.1	0.2	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1
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	0.02	0.01	0.01	3	0.01	0.01	0.01	1.1	0.05
Nitrate + Nitrite, as N(0.003d	mg/L	0.01	0.01	0.02	0.01	0.01	3	0.01	0.01	0.01	1.1	0.05
Sulphate, as SO4	mg/L	6	280	35	230	680	1200	8	210	310	6	6
Total Kjeldahl Nitrogen, as N	mg/L	0.1	0.1	0.3	0.6	0.2	0.2	0.1	0.3	0.1	0.3	0.3
Total Nitrogen, as N	mg/L	0.1	0.1	0.3	0.6	0.2	3.1	0.1	0.3	1.1	0.3	0.3
Arsenic, as As	mg/L	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Iron, dissolved as Fe	mg/L	0.01	1	0.01	0.02	0.45	0.05	0.37	4.7	0.02	0.26	0.26
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	0.0001
Magnesium, as Mg	mg/L	46	78	23	77	270	200	24	98	93	60	60
Manganese, dissolved as Mn	mg/L	N/A	0.72	0.03	0.083	0.12	0.002	0.063	0.11	0.002	0.081	0.081
Total Dissolved Solids, 180C	mg/L	2000	2100	780	2100	5400	4400	800	2000	2400	1600	1600
Total Organic Carbon	mg/L	0.5	0.5	0.5	0.8	1.2	0.5	2.6	0.5	0.5	2.7	2.7
Turbidity, NTU	NTU	3.1	12	26	11	8.3	180	4.3	21	0.3	8	8
Phosphorus, total as P	mg/L	0.05	0.05	0.05	0.05	0.05	0.14	0.05	0.11	0.05	0.15	0.15
Lead, dissolved (ICP-MS)	mg/L	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
Nickel, dissolved (ICP-MS)	mg/L	0.001	0.093	0.001	0.001	0.002	0.004	0.002	0.001	0.001	0.001	0.001
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	0.0002
Chromium, dissolved (ICP-MS)	mg/L	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.008	0.001	0.001

Bore:	102827	102829	47250	47251	73425	73426	89584	WRK059873	WRK059877	WRK059876	
Aquifer:	Deep Lead	Deep Lead	Shepparton Formation	Deep Lead	Shepparton Formation	Deep Lead	Shepparton Formation	Deep Lead	Deep Lead	Deep Lead	
Date:	21/10/2019	21/10/2019	17/10/2019	17/10/2019	16/10/2019	16/10/2019	31/10/2019	22/10/2019	21/10/2019	22/10/2019	
Analyte	Unit										
Copper, dissolved (ICP-MS)	mg/L	0.001	0.001	0.002	0.002	0.004	0.001	0.001	0.001	0.002	0.001
Zinc, dissolved (ICP-MS)	mg/L	0.002	0.014	0.002	0.003	0.11	0.008	0.002	0.006	0.006	0.001

Note: Some results may be below detection limits, but these limits are not available from data source.

Historic groundwater salinity data for key monitoring bores listed in Schedule 1 of the Plan





Historic groundwater salinity data for private bores sampled in the targeted sampling program

