

# Mid-Loddon Groundwater Management Area Local Management Rules

Annual Report

For year ending 30 June 2021

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Excellence



Honesty



Accountability



Courage



Caring

# Document History and Distribution

## Versions

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Draft v1	10 September 2021	Jock Richardson	Document creation and drafting
Draft v2	14 October 2021	Scott Ridges	Document review and edits
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## Distribution

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# Foreword

Goulburn-Murray Water (GMW) is pleased to present the annual report for the *Mid-Loddon Groundwater Management Area Local Management Rules* (the Rules) for the 2020/21 water year.

GMW is responsible for implementation and administration of the Rules which was endorsed by the Board of GMW in 2009.

This report provides an overview of the groundwater management activities administered under the Rules during the 2020/21 water year.

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



Matthew Pethybridge  
GROUNDWATER AND STREAMS MANAGER

Date: 22 October 2021

# Executive summary

The *Mid-Loddon Groundwater Management Area Local Management Rules* (the Rules) was endorsed by the Board of Goulburn-Murray Water in July 2009. The 2020/21 water year marks the twelfth year of operation under the Rules.

A groundwater allocation of 100 per cent of licence entitlement volume was set for the Mid-Loddon Groundwater Management Area (the GMA) for the 2020/21 water year. Recorded use was 17,514.6 ML, or 52 per cent of the total licence entitlement volume. This is seven per cent less than the volume used in 2019/20. A total of 9,914.2 ML has been carried over for use in the 2021/22 water year.

There was moderate licence transfer activity during the 2020/21 water year; nine temporary transfers, totalling 1,195.1 ML, and one permanent transfers (100 ML/yr), were completed.

After three consecutive years of annual-rainfall totals below the long-term average, the total rainfall recorded at Bridgewater, in 2020/21, was slightly above average. The combination of reduced groundwater extraction and increased rainfall during 2020/21 resulted in the maximum decline in groundwater levels (maximum drawdown) not being as low as the previous three years.

Groundwater monitoring and metering programs continue to support the objectives of the Rules.

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# 1 Introduction

## 1.1 Purpose

This annual report has been prepared to meet requirements of the *Mid-Loddon Groundwater Management Area Local Management Rules* (GMW, 2009) (the Rules).

This report provides an overview of groundwater resource status and summarises the groundwater management activities undertaken in accordance with the Rules during the 2020/21 water year (1 July 2020 to 30 June 2021).

## 1.2 Water Supply Protection Area

The Mid-Loddon Groundwater Management Area (the GMA) extends from Tullaroop Reservoir in the south to Mitiamo in the north and includes the townships of Carisbrook, Bridgewater and Serpentine.

The GMA incorporates groundwater resources to all depths and contains three management zones – Moolort Zone (1011), Laanecoorie-Serpentine Zone (1012) and Jarklin Zone (1013) – as shown in Figure 1.

## 1.3 Groundwater Management Plan

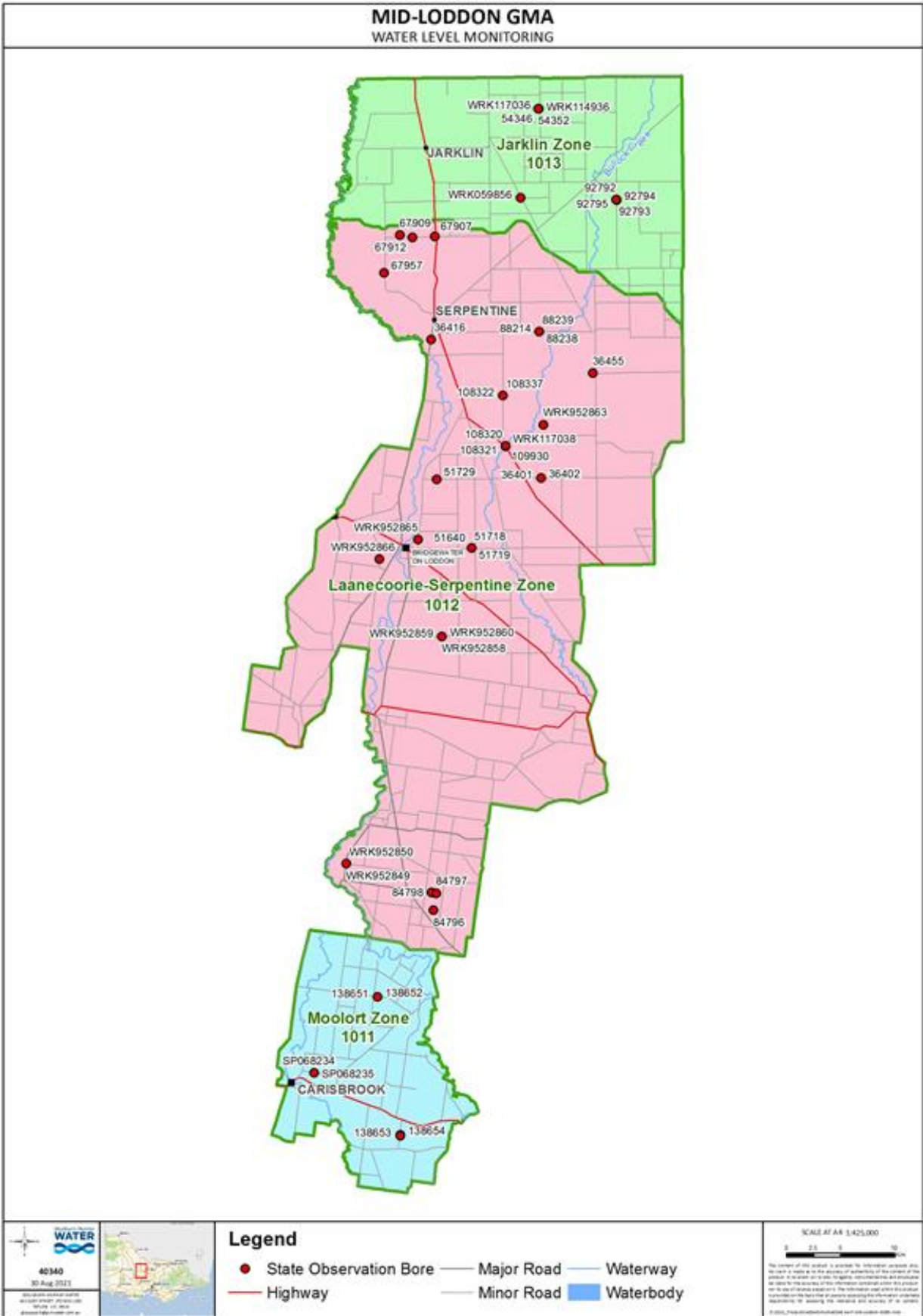
The Rules was endorsed for implementation by the Board of Goulburn-Murray Water (GMW) on 1 July 2009.

The Rules aims to ensure groundwater resources in the GMA are managed in an equitable and sustainable manner. More specifically, the Rules seeks to:

1. Provide all groundwater users with access to the resource, including domestic and stock users;
2. Enable development of the groundwater resources to realise the potential for its use in the region;
3. Provide environmental benefits through management of groundwater resources and maintain the integrity of the aquifer system, including its structure and groundwater quality;
4. Manage groundwater interference and intensively pumped areas to protect existing authorised users and the environment from unacceptable drawdown levels;
5. Establish transparent trigger levels and restrictions;
6. Provide mechanisms such as transfer of licence entitlement and carryover to allow flexible and adaptive management in response to changing demands, such as climatic conditions; and
7. Establish an effective monitoring program and provide periodic communications that will inform groundwater users of the status of the resource.

An assessment of GMW's activities against the Rules is presented in [Appendix A](#).

A copy of the Rules can be downloaded from the GMW website, at [www.gmwater.com.au/midloddongma](http://www.gmwater.com.au/midloddongma)



**Figure 1 Mid-Loddon Groundwater Management Area**

# 2 Groundwater Management

## 2.1 Licence entitlement volume

The Minister for Water declared a Permissible Consumptive Volume of 34,037 megalitres per year (ML/yr) for the GMA in March 2013 (Victorian Government, 2013).

At 30 June 2021, the total of licence entitlement volume in the GMA was 33,927.1 ML/yr. This has remained unchanged since 30 June 2020. 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 licences in the Mid-Loddon GMA in 2020/21**

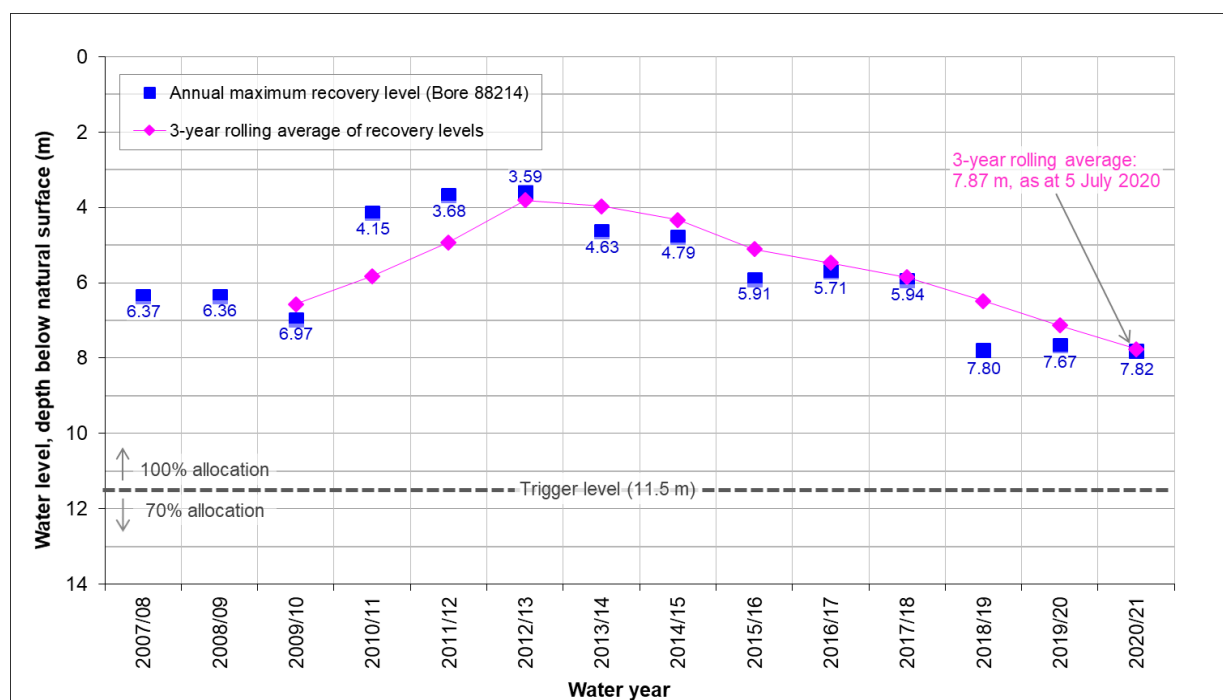
Management zone	Licences	Licensed bores	Licence entitlement volume (ML/yr)
Moolort Zone (1011)	23	27	3,875.4
Laanecoorie-Serpentine Zone (1012)	67	84	27,204.7
Jarklin Zone (1013)	14	19	2,847.0
<b>Total</b>	<b>104</b>	<b>130</b>	<b>33,927.1</b>

Note: Data extracted from the Victorian Water Register 30 June 2021.

## 2.2 Groundwater allocations

Annual groundwater allocations are determined by comparing the average of annual maximum groundwater recovery levels recorded in observation bore 88214 (referred to as the trigger bore) across three water years (the current and two preceding), against a trigger level outlined in the Rules (11.5 m).

On 31 July 2020, an allocation of 100 per cent was announced for all groundwater licence holders in the GMA for the 2020/21 water year (Figure 2).



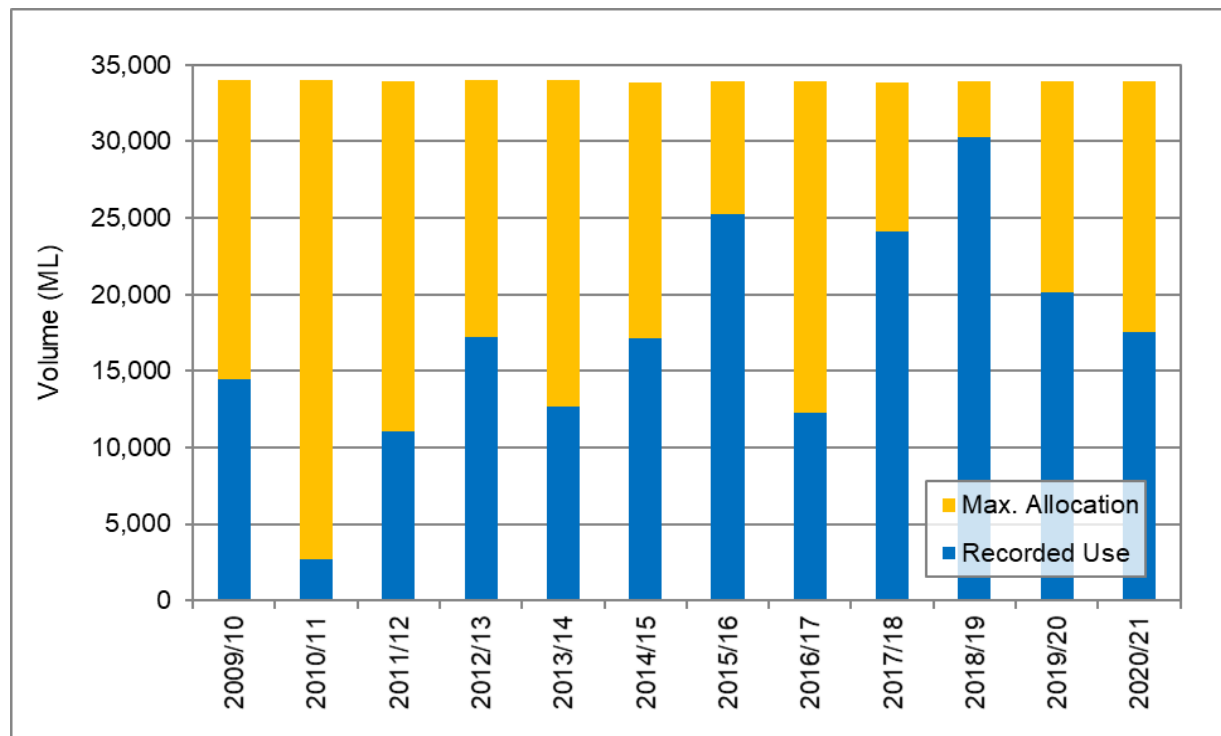
**Figure 2 Groundwater levels in bore 88214, compared to the trigger level**



## 2.3 Groundwater use

Total recorded use in the GMA in 2020/21 was 17,514.6 ML, or 52 per cent of the licence entitlement volume (Figure 3). This is a seven per cent decrease on the volume used in 2019/20.

Note: 'recorded use' refers to metered and deemed use.



**Figure 3 Total allocation and use in the Mid-Loddon GMA, since 2009/10**

In 2020/21, the volume of recorded use was greatest in the Laanecoorie-Serpentine Zone, where the majority of the licence entitlement volume was held. The highest recorded use, as a percentage of licence entitlement volume, occurred in Jarklin Zone; although this statistic was quite even in 2020/21 (Table 2).

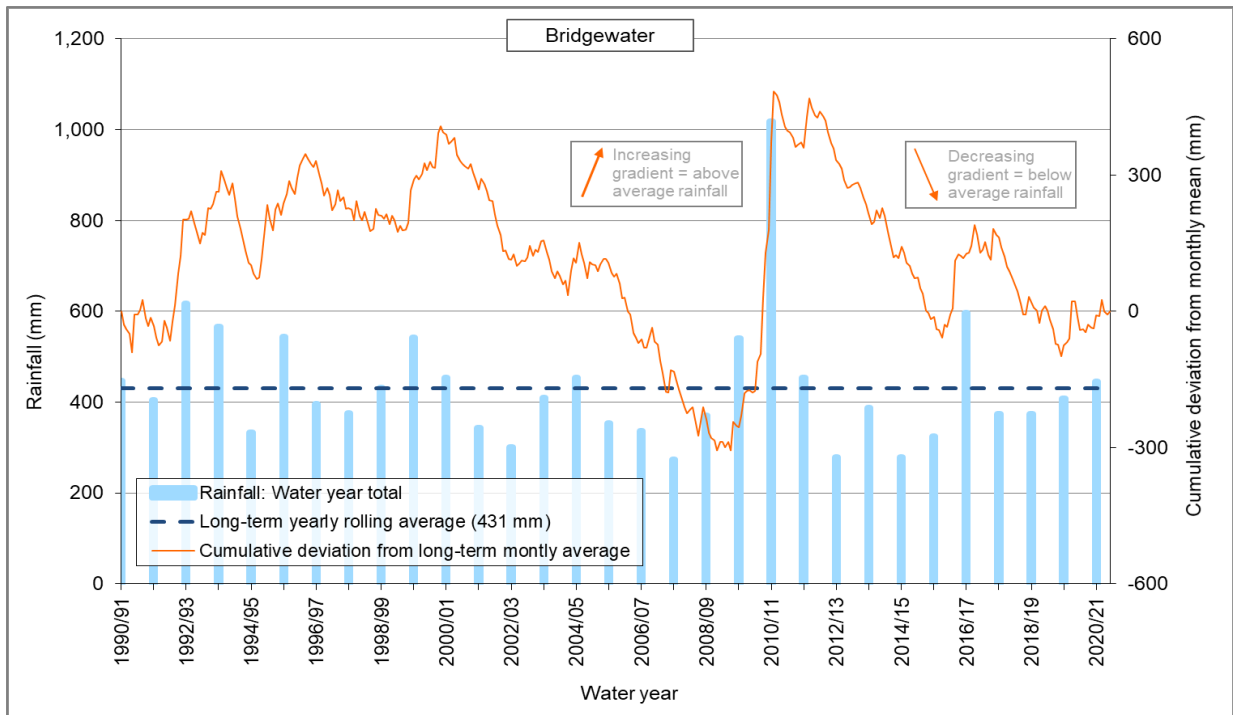
**Table 2 Recorded use in the Mid-Loddon GMA in 2020/21**

Management zone	Licence entitlement volume (ML/yr)	Recorded use (ML)	Proportion of licence entitlement volume used
Moolort Zone (1011)	3,875.4	2,112.4	55%
Laanecoorie-Serpentine Zone (1012)	27,204.7	13,798.4	51%
Jarklin Zone (1013)	2,847.0	1,603.8	56%
<b>Total</b>	<b>33,927.1</b>	<b>17,514.6</b>	<b>52%</b>

## 2.4 Rainfall

Historic rainfall data, sourced from the Bureau of Meteorology weather station at Bridgewater (BOM, 2021), is presented in Figure 4 as an indicator of climate trends across the GMA.

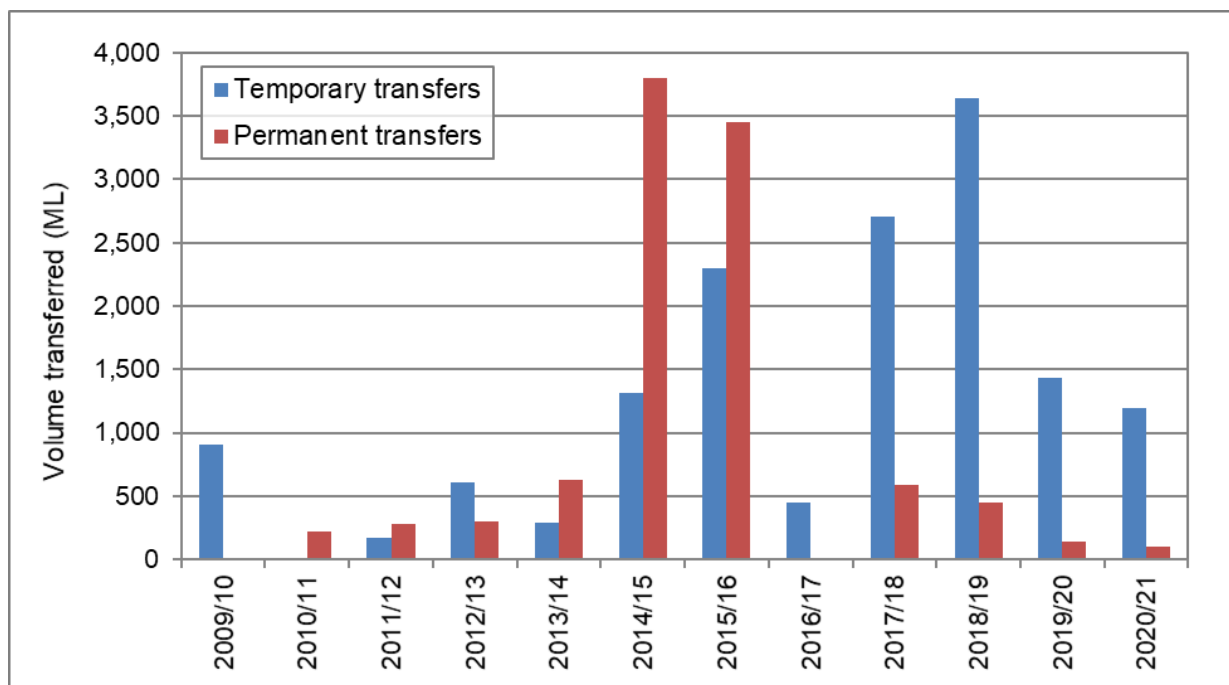
The data indicate that annual rainfall totals have mostly been below the long-term average (431 mm) since the Rules was implemented (Figure 4). Notable exceptions include the 2010/11 year, when widespread flooding occurred as a result of significant rain events, as well as 2016/17. The predominantly drier conditions have resulted in reduced recharge to the groundwater system.



**Figure 4 Rainfall recorded at Bridgewater in the Mid-Loddon GMA (BOM, 2021)**

## 2.5 Licence transfers

The Rules allows groundwater licence holders to temporarily or permanently transfer licensed volume. During the 2020/21 water year there were nine temporary transfer transactions for a total of 1,195.1 ML and one permanent transfer transaction for a total of 100 ML/yr (Figure 5).



**Figure 5 Licence entitlement volumes transferred in the Mid-Loddon GMA, since 2009/10**

Of the nine temporary transfers completed, eight were between licence holders within the same management zones. The permanent transfer was between zones; from the Laanecoorie-Serpentine Zone to the Moolort Zone (Table 3).

**Table 3 Licence transfers in the Mid-Loddon GMA the 2020/21**

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)
Moolort Zone (1011)	-	-	1	288.0	-	-	1	100
Laanecoorie-Serpentine Zone (1012)	8	1,091.1	7	803.1	1	100	-	-
Jarklin Zone (1013)	1	104.0	1	104.0	-	-	-	-
<b>Total</b>	<b>9</b>	<b>1,195.1</b>	<b>9</b>	<b>1,195.1</b>	<b>1</b>	<b>100</b>		<b>100</b>

## 2.6 Carryover

Under the Rules, licence holders in the GMA are permitted to carryover up to a maximum of 30 per cent of their unused licence entitlement from one water year to the next.

Licence holders in the GMA carried over a total of 9,763.9 ML for use in the 2020/21 water year; and at the conclusion of 2020/21 were able to carryover 9,914.2 ML for use in the 2021/21 water year.

## 2.7 Metering

There were 130 active meters in the GMA, as at 30 June 2021. All meters were read at least twice during the 2020/21 water year; and there was 92 preventative maintenance events.

## 2.8 Licence compliance

The Victorian Government and GMW have a zero-tolerance approach to unauthorised take of non-urban water. GMW is responsible for ensuring water users in northern Victoria comply with their licence conditions. All incidents of non-compliance are investigated by GMW and action is taken in accordance with GMW's Risk-Based Compliance and Enforcement Framework. More information can be found on GMW's website, at [www.gmwater.com.au/water-resources/water-use-compliance](http://www.gmwater.com.au/water-resources/water-use-compliance).

There were two instances of alleged unauthorised take of water (i.e. licence entitlement volume exceedance) in the GMA in 2020/21; there were zero prosecutions or convictions relating to groundwater matters.

## 2.9 Domestic and stock bore licences

The volume of groundwater taken for 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 and is not regulated by the Plan.

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 (WMIS).

According to the Victorian Water Register, there were 15 domestic and stock bore construction licences issued, and five domestic and stock bore completion reports received by GMW, for locations within the GMA, during the 2020/21 water year.

# 3 Monitoring Program

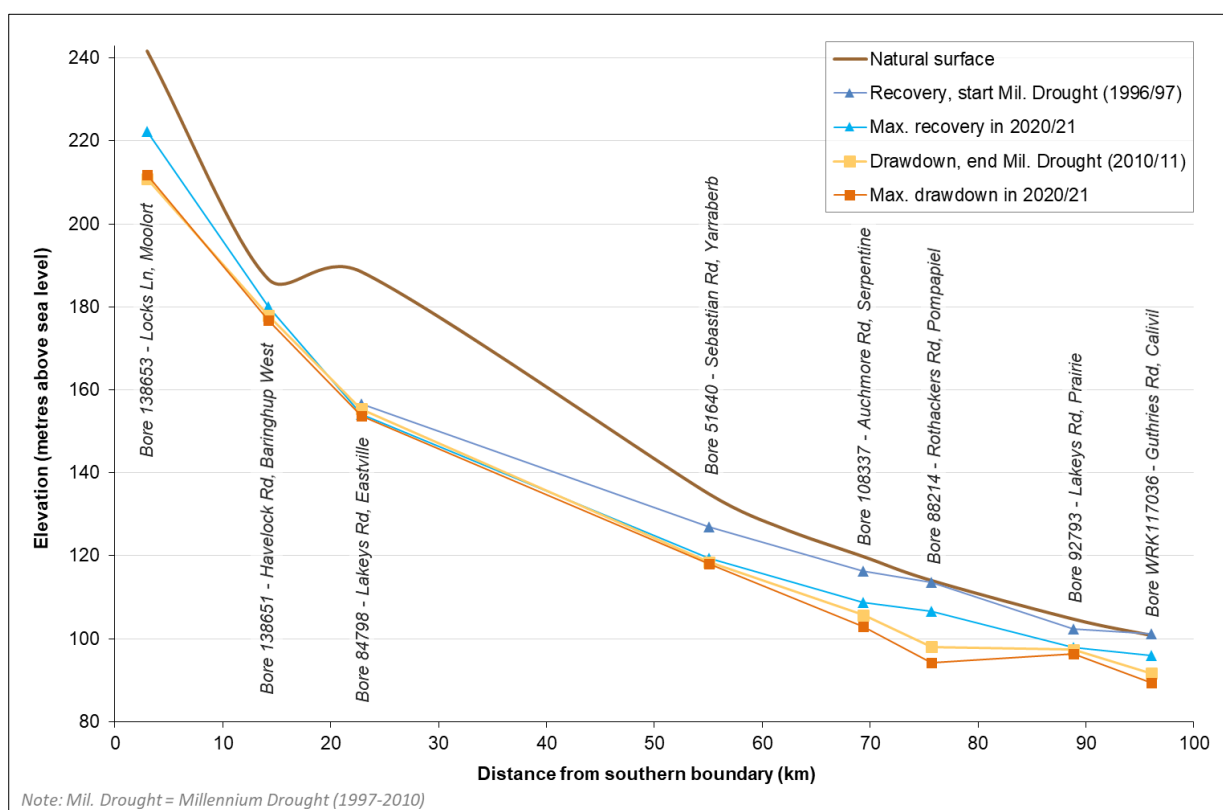
## 3.1 Groundwater levels

During the 2020/21 water year a total of 49 state observation bores, located within the GMA, were monitored by GMW and the Department of Environment, Land, Water and Planning (DELWP) – see Figure 1. Of these, 38 were monitored remotely using telemetry equipment, with measurements recorded hourly, and 11 were monitored manually, with measurements recorded on a monthly or quarterly basis.

This figure includes the 25 key bores listed in Schedule 1 of the Rules, where practicable. Water level data for these bores are presented in [Appendix B](#).

Monitoring data obtained from the State groundwater database, the Water Measurement Information System (WMIS), indicate that groundwater levels were within historic ranges during 2020/21, across the majority of the GMA. Recovery levels<sup>1</sup> in most bores were similar, or slightly lower (declined), in 2020/21 compared to the previous year. The combination of reduced groundwater extraction and increased rainfall, during 2020/21 (Figure 3, Figure 4), resulted in maximum drawdown levels that were notably higher, compared to the previous two to three years.

Seasonal drawdown of up to 10.4 m was observed in areas of intensive groundwater extraction, such as Moolort and Pompaple; and typically less than 2 m in areas with less intensive groundwater development, such Yarraberb and Prairie (Figure 6).



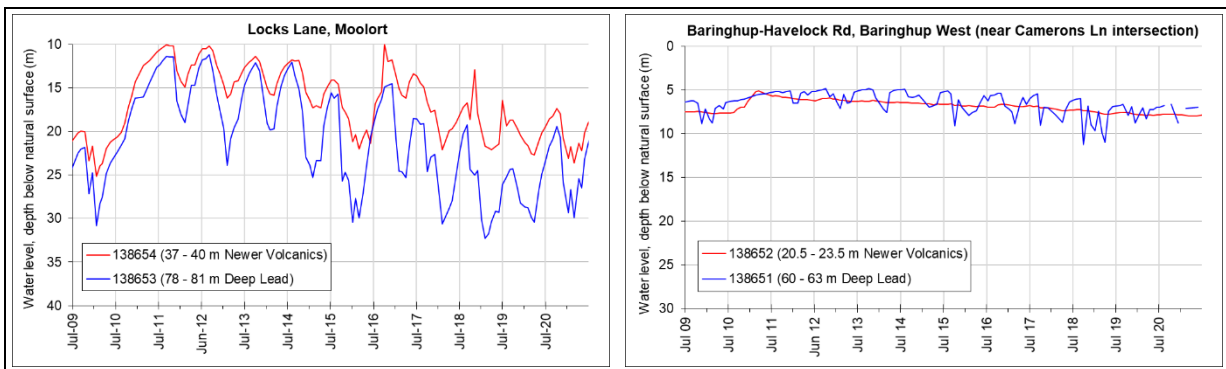
**Figure 6 Groundwater levels along a south-to-north section of the Mid-Loddon GMA**

<sup>1</sup> 'Recovery level' refers to the highest water level (i.e. closest to the ground surface) recorded during a water year – this typically occurs between August and November when rainfall is higher and groundwater extraction is lower.

## Moolort Zone

At Moolort, the groundwater level in deep lead observation bore 138653 recovered to 5 m higher (i.e. closer to the surface) in 2020/21, compared to 2019/20 (19.4 m, up from 24.4 m depth). The magnitude of drawdown<sup>2</sup> was 4 m greater in 2020/21, compared to 2019/20 (10 m, up from 6 m), however the maximum drawdown level (depth) did not reach that of 2019/20 (Figure 7).

At Baringhup West, groundwater in deep lead observation bore 138653 recovered to the same level in 2020/21 as it did in 2019/20 (6.74 m depth); and the magnitude of drawdown was also comparable (approx. 2 m) (Figure 7).

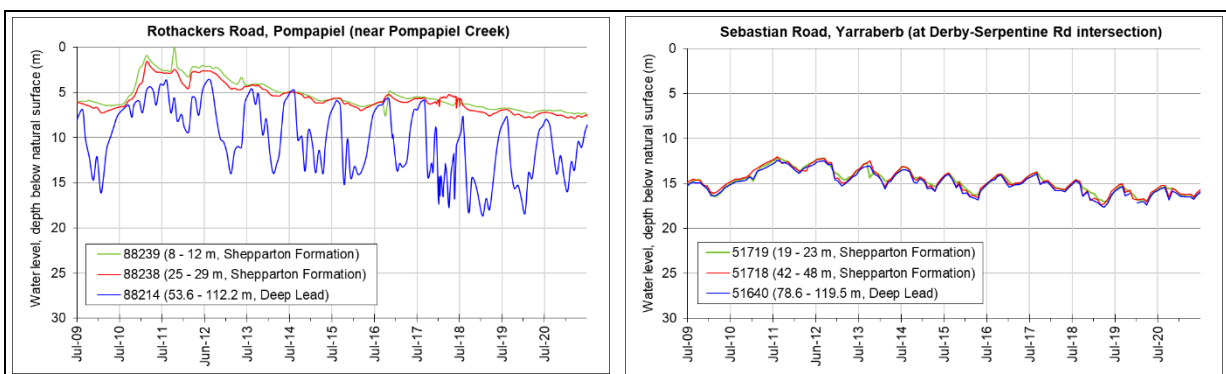


**Figure 7 Groundwater level monitoring in the Moolort Zone, July 2009 to June 2021 (DELWP, 2021)**

## Laanecoorie-Serpentine Zone

The maximum groundwater recovery level in the allocations trigger bore (ID 88214), located on Rothackers Road near Pompapiel Creek, was 0.22 m lower (i.e. deeper) than the maximum of 2019/20 (7.98 m, compared to 7.76 m depth); however the magnitude of drawdown was notably less (8.0 m, compared to 10.6 m in 2019/20) (Figure 8).

At Yarraberb, groundwater recovery levels in deep lead observation bore 138653 was 0.14 m lower in 2020/21; and the magnitude of drawdown was around 1.3 m.



**Figure 8 Groundwater level monitoring in the Laanecoorie-Serpentine Zone, July 2009 to June 2021 (DELWP, 2021)**

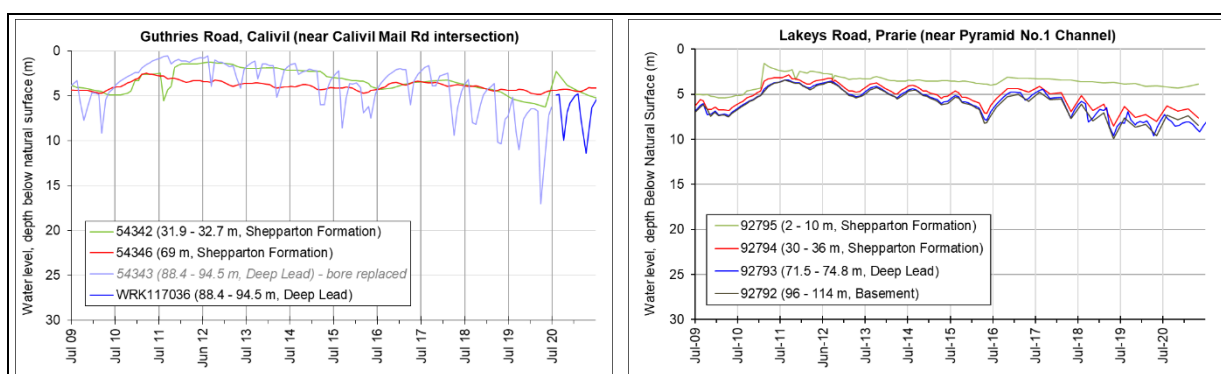
<sup>2</sup> The 'magnitude of drawdown' is the difference in depth between the maximum and minimum water levels recorded during the same water year.

## Jarklin Zone

At Calivil, the highest groundwater level recorded in deep lead observation bore WRK117036 (which replaced bore 54343 in August 2020) during 2020/21 was 4.81 m; 0.33 m higher than the highest level recorded in 2019/20 (Figure 9). The magnitude of drawdown was 6.53 m which was just over half that of 2019/20.

At Prairie, the highest groundwater level recorded in deep lead observation bore 92793 during 2020/21 was 7.25 m; 0.31 m lower than the highest level recorded in 2019/20, and the magnitude of drawdown was 1.94 m (Figure 9)

Lower groundwater levels can provide improved drainage and reduced waterlogging and land salinity problems in this area.



**Figure 9 Groundwater level monitoring in the Jarklin Zone, July 2009 to June 2021 (DELWP, 2021)**

## 3.2 Groundwater quality

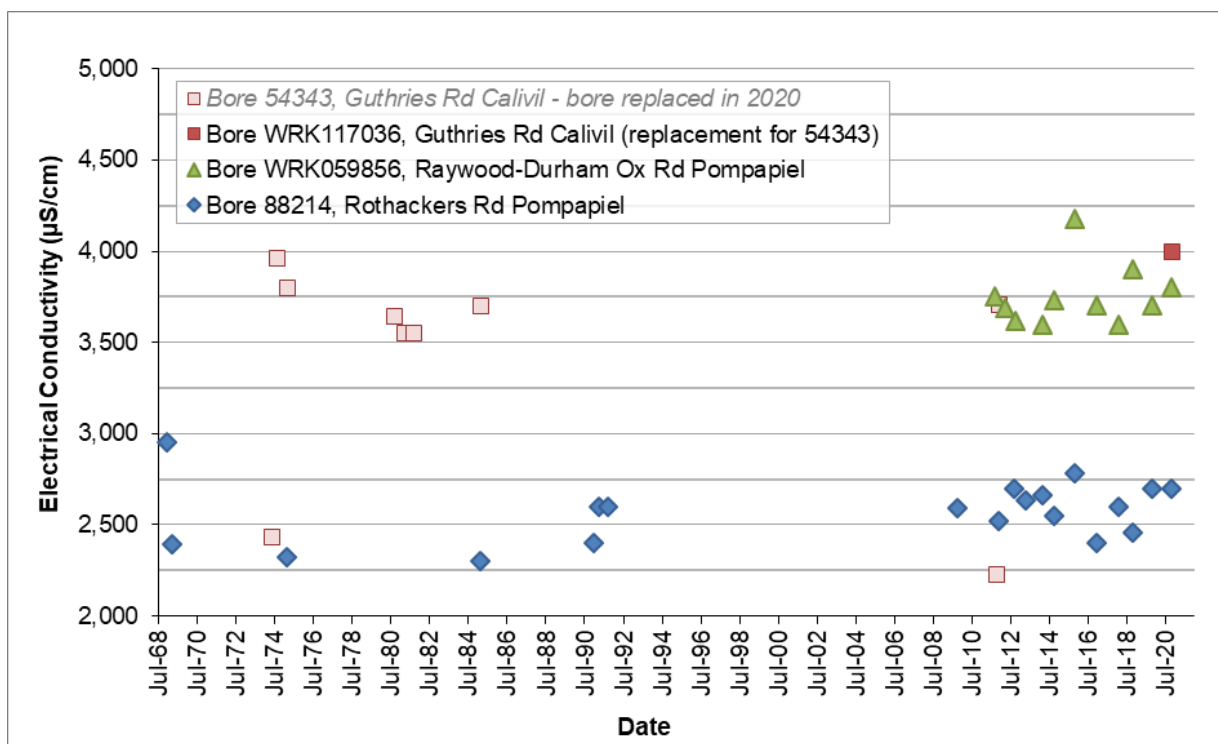
### Sampling of state observation bores

During the 2020/21 water year three state observation bores, located within the GMA, were sampled by GMW and DELWP. These comprise bore 88214 in the Laanecoorie-Serpentine Zone; and bores WRK117036 (replacement for bore 54343) and WRK059856 in the Jarklin Zone. All three bores are screened in the Deep Lead aquifer.

Groundwater samples collected from these bores were sent to a laboratory for analysis. The full suite of results are presented in [Appendix C](#).

Time-series groundwater salinity results, presented in Figure 10, indicate that groundwater salinity levels have been relatively stable since 2009; and were at similar levels in the 1970s.

Ongoing annual sampling of these key bores will enable trends in groundwater quality to be observed.



**Figure 10 Salinity of groundwater in key monitoring bores in the Mid-Loddon GMA (DELWP, 2021)**

### Sampling of private bores

GMW provides all groundwater licence holders in the GMA with a sample bottle and a reply-paid envelope to submit a groundwater sample for salinity analysis. In the 2020/21 water year, 129 sample bottles were sent out and 24 samples, or 19 per cent, were returned for analysis.

Generally, the salinity of groundwater samples collected in 2020/21 were slightly higher than previous results (Table 4).

Continued sampling of private bores, particularly those that have a sampling history, will assist with identifying trends in groundwater salinity. A greater return rate would further improve the spatial and temporal understanding of groundwater salinity in the GMA. Groundwater users are strongly encouraged to participate in this program so that they can identify any changes in groundwater salinity at their bore that might impact on their business.

**Table 4 Salinity of private bore water samples returned in 2020/21**

Management zone	Samples returned	Salinity range, as electrical conductivity (µS/cm)	Average of differential from previous salinity result
Moolort Zone (1011)	7	1,670 – 4,100	+ 1%
Laanecoorie-Serpentine Zone (1012)	16	774 – 12,080	+ 5%
Jarklin Zone (1013)	1	3,780	no change

# 4 Administration and Engagement

## 4.1 Groundwater Reference Committee

The Groundwater Reference Committee, appointed under the Rules, had its thirteenth meeting on 4 November 2020 via videoconference.

Key topics included:

- Changes to GMW team and committee membership
- Outstanding actions from previous meetings
- Plan implementation and administration, including a summary of the 2019/20 water year
- Resource condition and 2020/21 season outlook
- Groundwater management planning in the lower Loddon groundwater catchment, including stakeholder engagement challenges
- Recent interest to develop deep lead groundwater resources in unincorporated areas, north of the GMA



## 5 References

Bureau of Meteorology (BOM), 2021. *Climate Data Online – Bridgewater (Post Office) station number 81058*. Retrieved on 15 September 2021 from: [http://www.bom.gov.au/jsp/ncc/cdio/wData/wdata?p\\_nccObsCode=139&p\\_display\\_type=dataFile&p\\_stn\\_num=081058](http://www.bom.gov.au/jsp/ncc/cdio/wData/wdata?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=081058)

Victorian Department of Environment, Land, Water and Planning (DELWP), 2021. *Water Measurement Information System*. Data retrieved in September 2021 from: <https://data.water.vic.gov.au>

Goulburn-Murray Water (GMW), 2009. *Mid-Loddon Groundwater Management Area Local Management Rules*. Goulburn-Murray Water, Tatura, Victoria.

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

*Water Act 1989* (Vic), viewed 30 June 2021, [http://classic.austlii.edu.au/au/legis/vic/consol\\_act/wa198983/](http://classic.austlii.edu.au/au/legis/vic/consol_act/wa198983/)

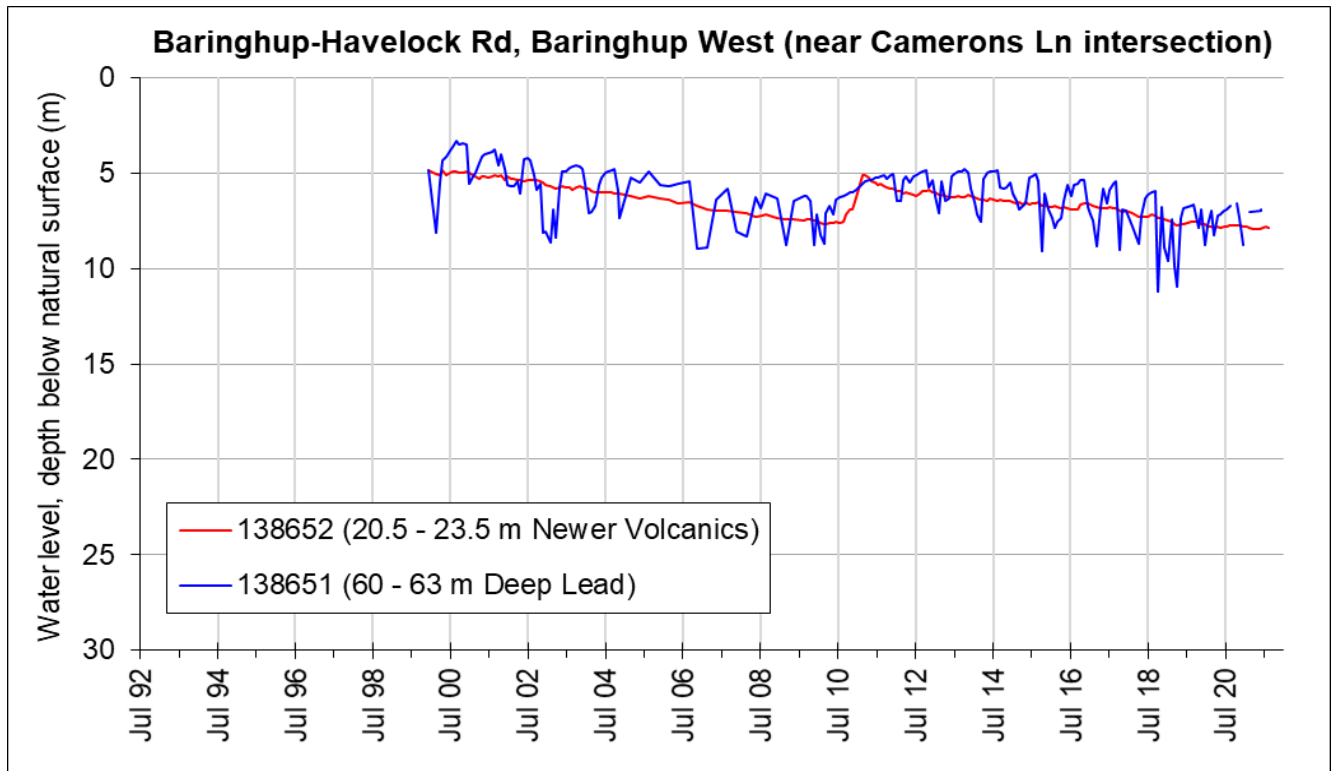
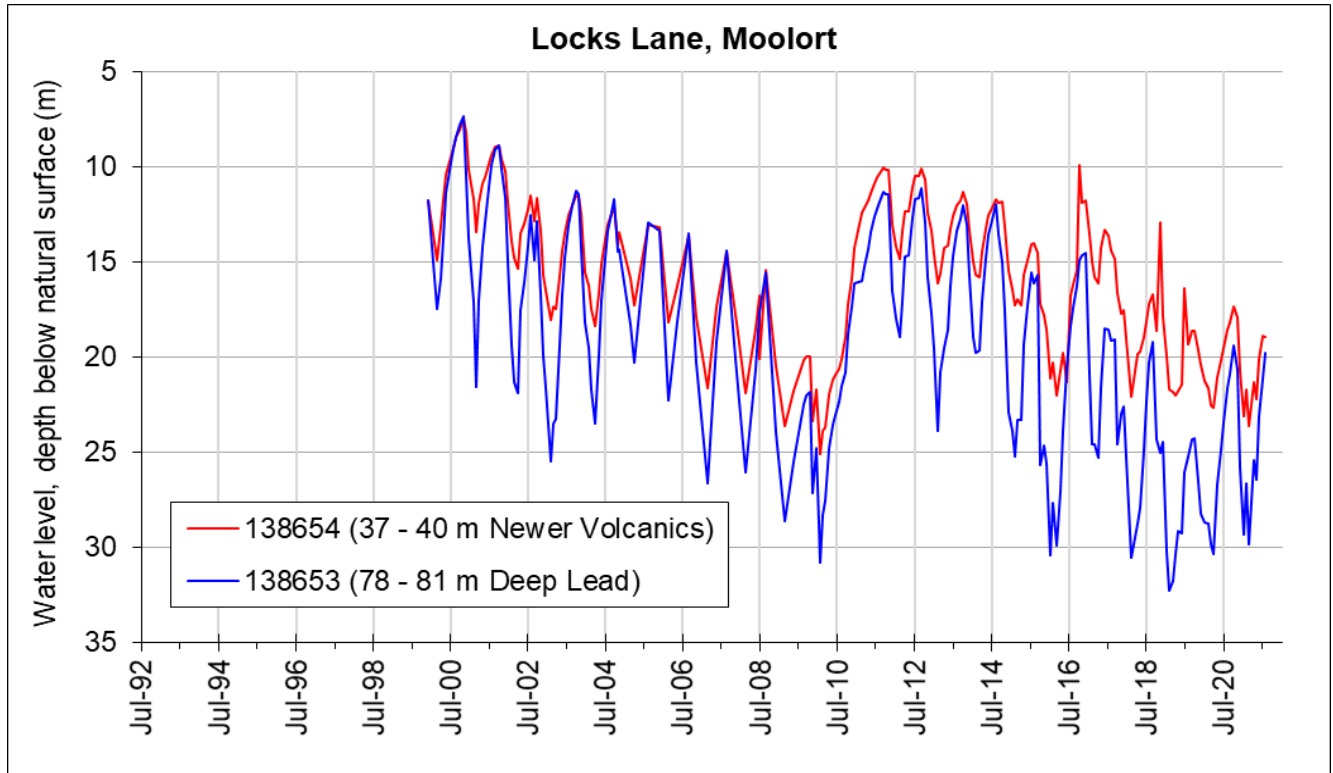
# Appendix A – Assessment of activities against the Rules

Rule	Activity	Compliant?
1. Cap on licence entitlement	The Minister for Water declared the Permissible Consumptive Volume for the Mid-Loddon GMA of 34,037 ML/year in March 2013.	Yes
2. Managing groundwater interference	GMW processed all groundwater licence applications in accordance with Rule 2 and section 40 of the Act.	Yes
3. Managing intensity of groundwater extraction	GMW processed all groundwater licence applications in accordance with Rule 3.	Yes
4. Managing groundwater levels	On 31 July 2020, GMW announced an allocation of 100% of licence entitlement volume for all management zones for the 2020/21 water year. GMW announced the allocation by listing it on their website, sending letters to all licence holders and placing public notices in local newspapers.	Yes
5. Transfer of groundwater licence entitlement	GMW processed nine temporary- and one permanent transfer transactions in 2020/21. All transfers were carried out in accordance with conditions in Rule 5.	Yes
6. Carryover	Carryover up to 30% of licence volume was available to licence holders.	Yes
7. Monitoring groundwater levels	GMW obtained readings from state observation bores listed in Schedule 1 of the Rules, where practicable. The frequency of readings was at least monthly, and in some cases hourly.	Yes
8. Monitor groundwater salinity	State observation bores 88214 and WRK059856 were sampled and analysed for salinity in October 2020. Bottles were sent to all licensed groundwater users and salinity measured in returned samples. Licence holders were advised of the results.	Yes
9. Record meter readings	Meters are fitted to all operational bores in the Mid-Loddon GMA. Meters were read in January/February and May/June during 2020/21.	Yes
10. Annual reporting	In September 2020, GMW prepared an annual report summarising the groundwater management activities under the Rules for the 2019/20 season. The report was published on the GMW website before 1 October 2020.	Yes
11. Provide effective communication	GMW's communication activities during 2020/21 included: <ul style="list-style-type: none"> <li>meeting with the Mid-Loddon Groundwater Reference Group on 4 November 2020;</li> <li>prepared an annual newsletter in September 2020, and mailed a copy to all licence holders in the GMA;</li> <li>published on its website: the 2019/20 annual report, the 2020 annual newsletter; updated hydrographs and trigger graphs on a monthly basis</li> </ul> The Rules and other supporting documents have been available on the GMW website since approval.	Yes
12. Review of local management rules	In 2018, GMW undertook a formal review of the Rules in consultation with DELWP and the Mid- Loddon Groundwater Reference Group.	Yes

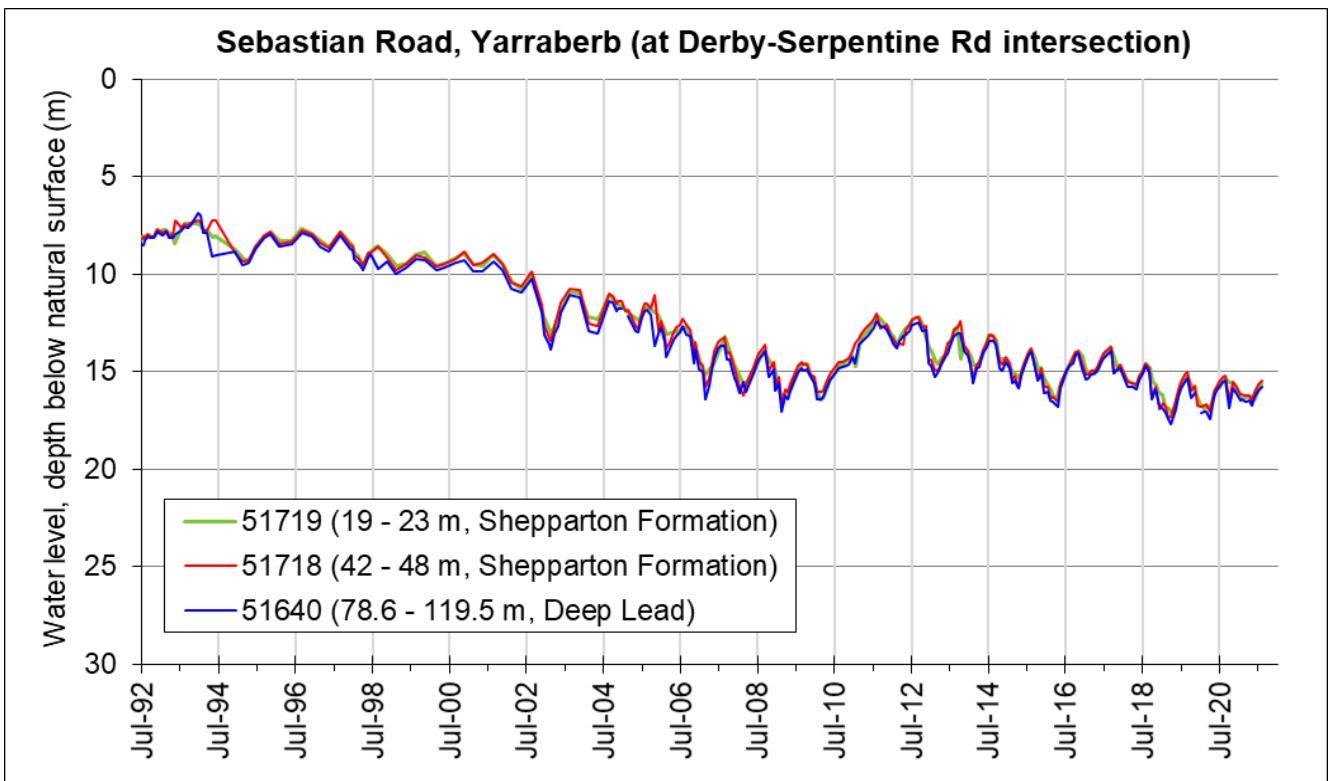
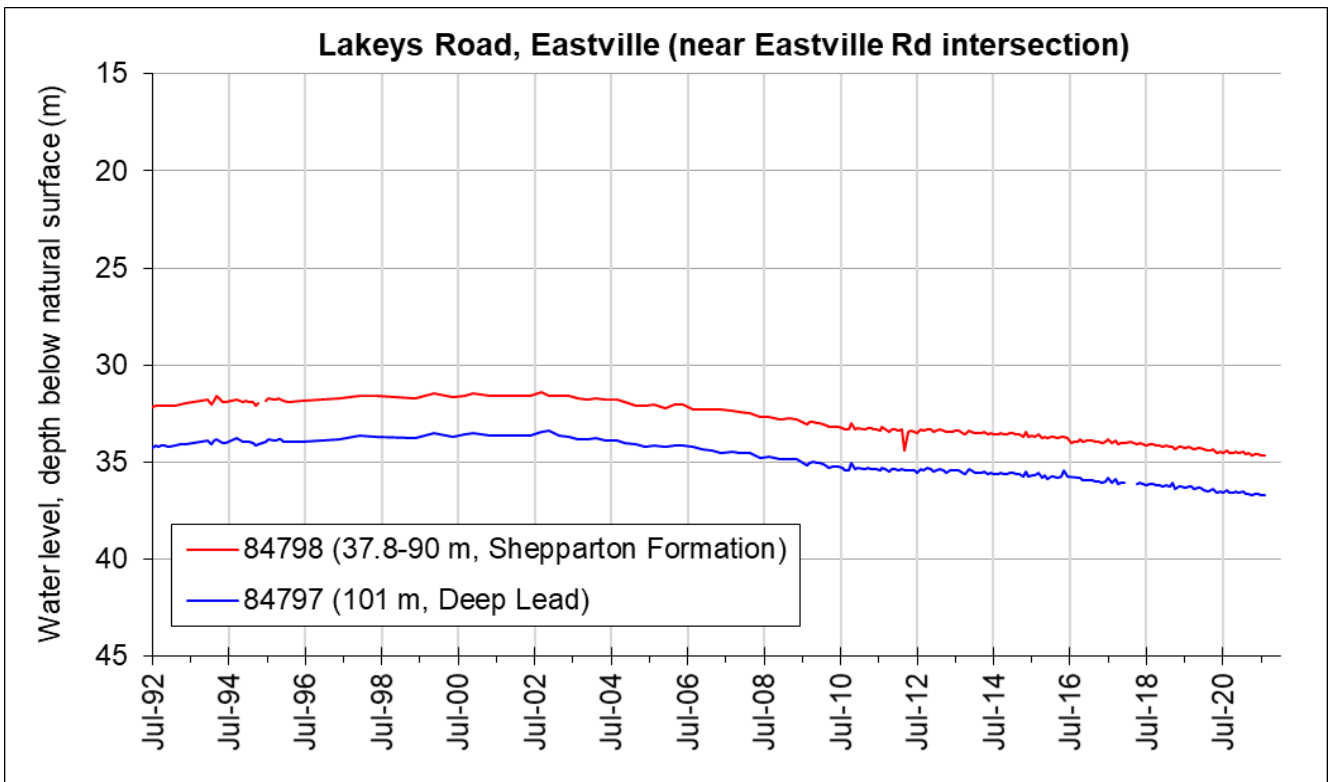
# Appendix B – Groundwater level data

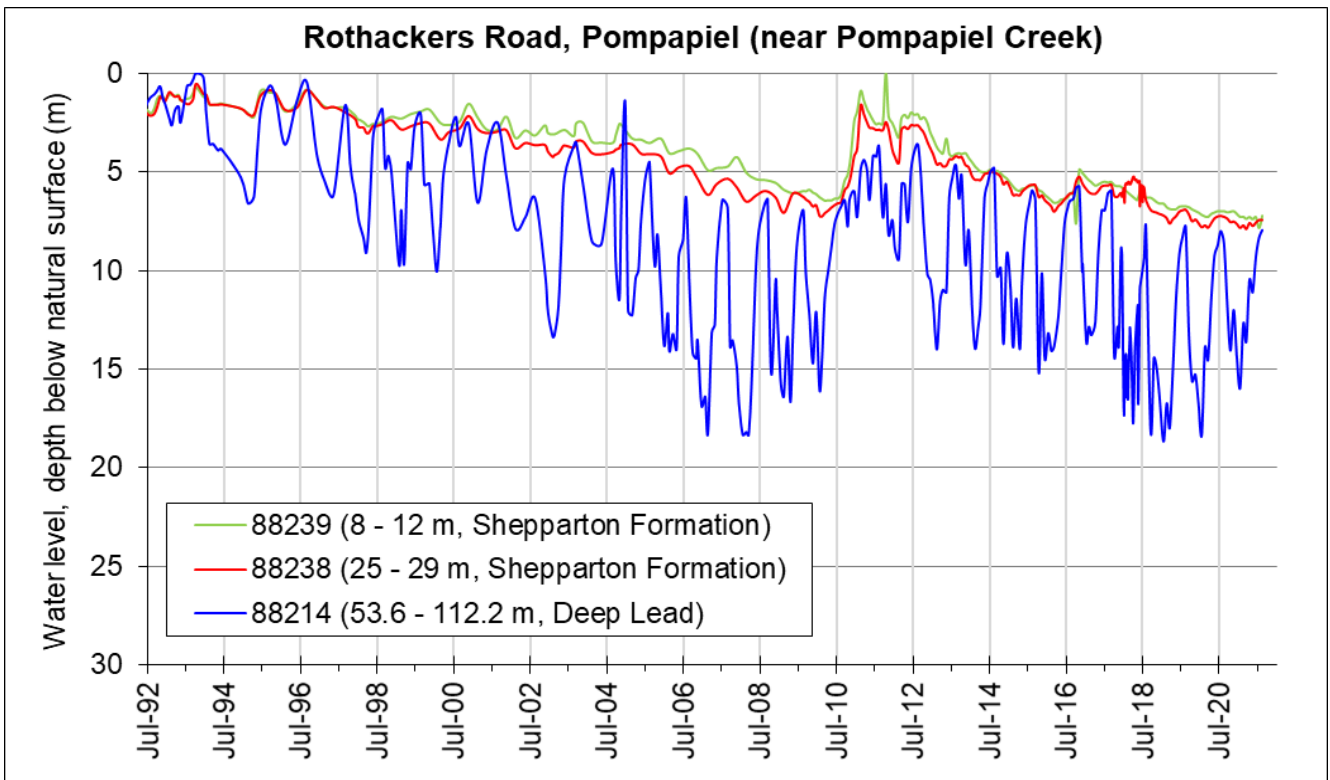
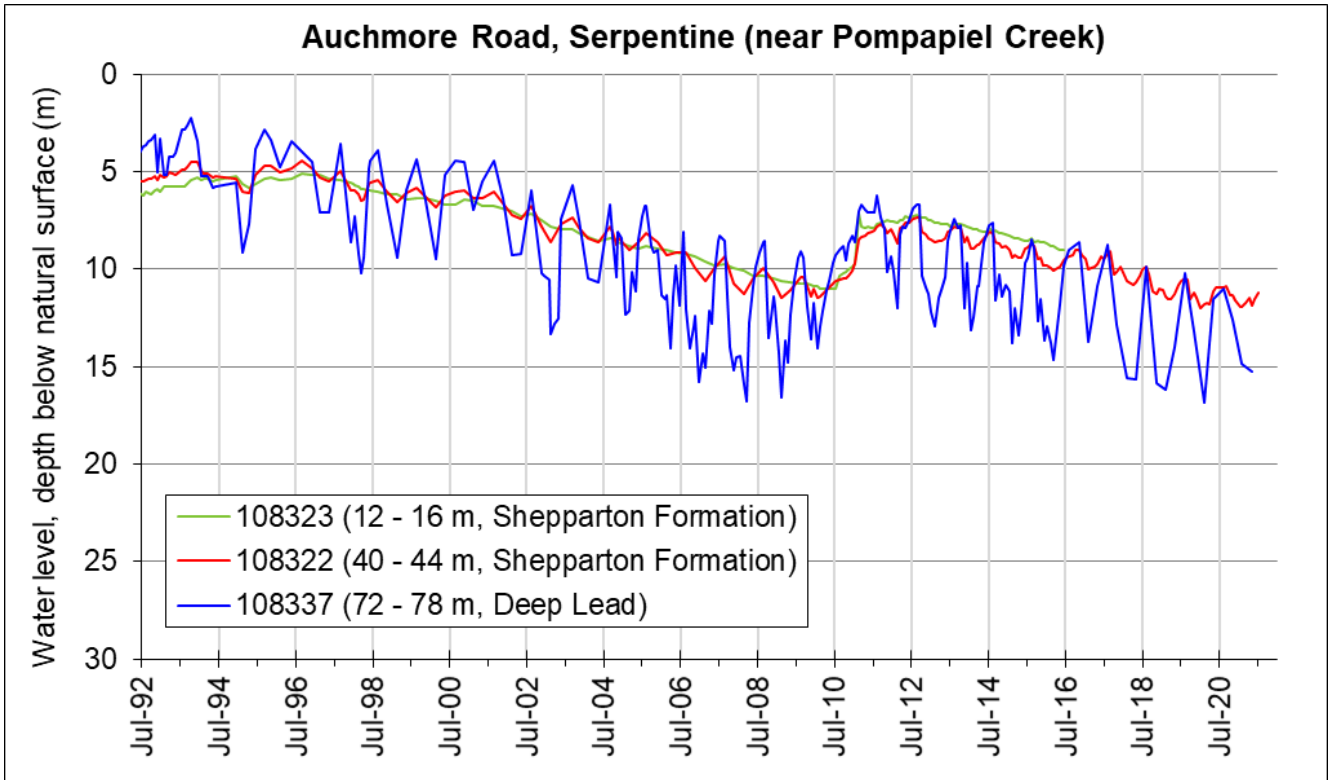
Hydrographs for key monitoring bores in the GMA. All data is sourced from the Water Measurement Information System (DELWP, 2020). Further groundwater level information is available on the Water Measurement Information System at <https://data.water.vic.gov.au>

## Moolort Zone (1011)

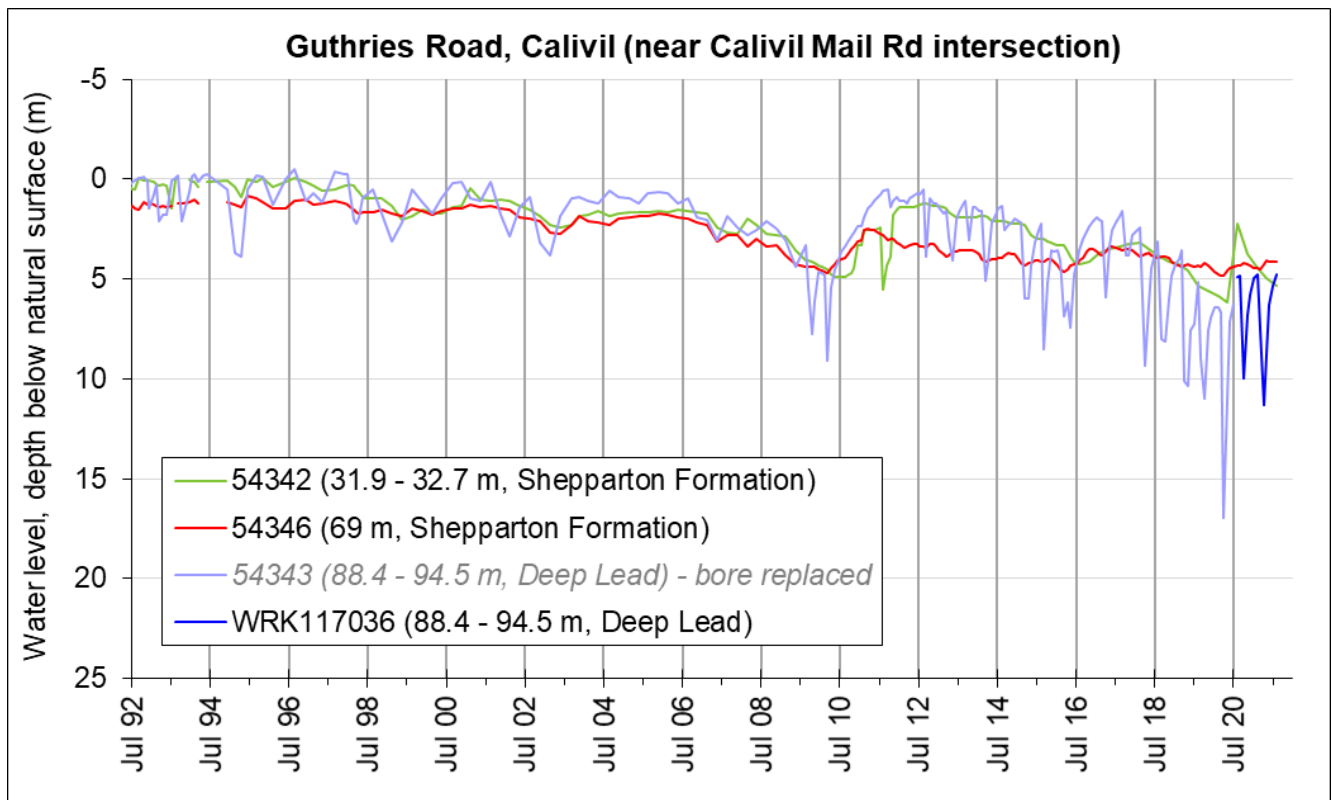
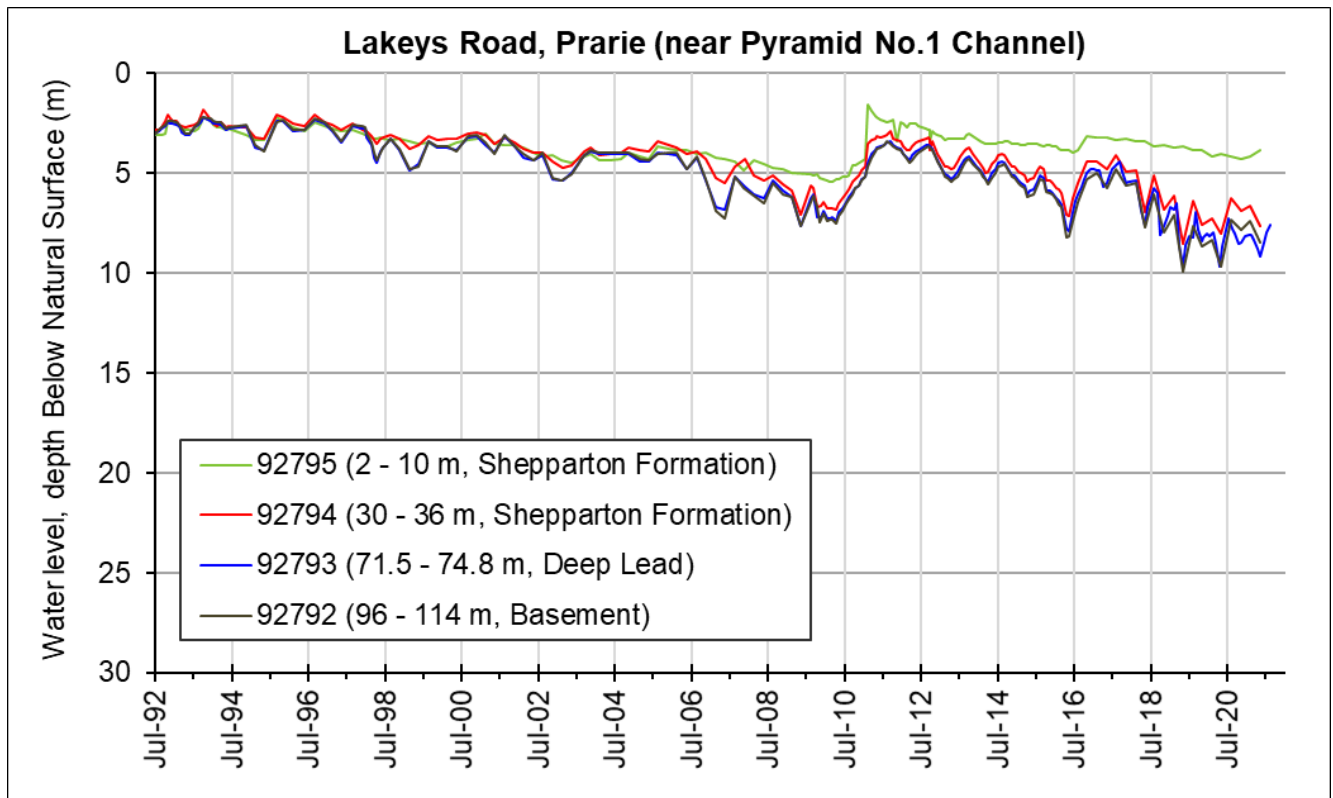


Laanecoorie-Serpentine Zone (1012)





## Jarklin Zone (1013)



# Appendix C – Groundwater quality results

Analytical chemistry results for selected monitoring bores. Further groundwater quality information is available on the Water Measurement Information System, at <https://data.water.vic.gov.au>

		<b>Bore:</b>	<b>88214</b>	<b>WRK059856</b>
		<b>Aquifer:</b>	<b>Deep Lead</b>	<b>Deep Lead</b>
		<b>Date:</b>	<b>27/10/2020</b>	<b>27/10/2020</b>
<b>Analyte</b>	<b>Unit</b>			
Conductivity @ 25°C	µS/cm		2700	3800
pH	pH units		8.8	7.2
Ionic balance	%		0.55	-2.12
Total Anions	meq/L		25	36
Total Cations	meq/L		24	38
Ion Balance - TDS (EC) vs TDS	mg/L		2.1	2
Total Alkalinity, as CaCO <sub>3</sub>	mg/L		180	210
Bicarbonate Alkalinity, CaCO <sub>3</sub>	mg/L		160	210
Calcium, as Ca	mg/L		16	60
Carbonate Alkalinity, as CaCO <sub>3</sub>	mg/L		19	<2
Chloride, as Cl	mg/L		700	980
Hydroxide Alkalinity, as CaCO <sub>3</sub>	mg/L		<2	<2
Potassium, as K	mg/L		9.8	10
Sodium, as Na	mg/L		400	610
Ammonia, as N	mg/L		0.1	<0.1
Nitrite, as N	mg/L		<0.01	<0.01
Nitrate, as N	mg/L		0.01	0.04
Sulphate, as SO <sub>4</sub>	mg/L		59	200
Total Kjeldahl Nitrogen, as N	mg/L		0.2	<0.1
Total Nitrogen, as N	mg/L		0.2	<0.1
Arsenic, as As	mg/L		<0.001	0.006
Iron, dissolved as Fe	mg/L		<0.01	0.59
Mercury, as Hg	mg/L		<0.0001	<0.0001
Magnesium, as Mg	mg/L		71	94
Manganese, dissolved as Mn	mg/L		0.051	0.13
Total Dissolved Solids, 180C	mg/L		1300	1900
Total Organic Carbon	mg/L		0.8	0.9
Turbidity, NTU	NTU		0.8	29
Phosphorus, total as P	mg/L		<0.05	0.12
Lead, dissolved (ICP-MS)	mg/L		<0.001	0.002
Nickel, dissolved (ICP-MS)	mg/L		<0.001	0.002
Cadmium, dissolved (ICP-MS)	mg/L		<0.0002	<0.0002
Chromium, dissolved (ICP-MS)	mg/L		<0.001	<0.001
Copper, dissolved (ICP-MS)	mg/L		<0.001	0.001
Zinc, dissolved (ICP-MS)	mg/L		<0.001	0.026

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