



Mid-Loddon

Groundwater Management Area

Local Management Rules

Annual Report

For year ending 30 June 2018

# Document History and Distribution

## Versions

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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 2017/18 water year.

This report provides an overview of the groundwater management activities in the Mid-Loddon Groundwater Management Area and documents the successful operation under the Rules in the 2017/18 season.

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



Matthew Pethybridge

MANAGER GROUNDWATER AND STREAMS

Date: 30/08/2018

# Executive summary

The Mid-Loddon Groundwater Management Area (GMA) Local Management Rules (the Rules) were endorsed by Goulburn-Murray Water in July 2009. The 2017/18 season marks the ninth year of operation under the Rules.

Allocations were 100% in all zones of the Mid-Loddon GMA in 2017/18. Recorded use was 24,152.4 ML, which is 71% of licence entitlement.

There were 16 temporary transfers for a total of 2705.3 ML and 3 permanent transfers for a total of 594.0 ML/yr in 2017/18. The temporary transfers were associated with all management zones and the permanent transfers were between or into the Laanecoorie-Serpentine Zone.

Licence holders in the Mid-Loddon GMA are entitled to carryover a maximum of 30% of their licence entitlement. A total of 8,713.8 ML has been carried over into 2018/19.

Groundwater recovery levels have fallen since the wet conditions experienced in 2010/11, but are within historical ranges.

Groundwater monitoring and metering programs continue to be successfully implemented 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 (GMA) Local Management Rules (the Rules) (GMW, 2009).

This report provides an overview of groundwater management activities undertaken in accordance with the Rules from 1 July 2017 to 30 June 2018.

## 1.2 Groundwater Management Area

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

The Mid-Loddon GMA incorporates groundwater resources to all depths.

There are three management zones in the Mid-Loddon GMA; namely, are the Moolort, Laanecoorie-Serpentine and Jarklin Zones (Figure 1).

## 1.3 Local Management Rules

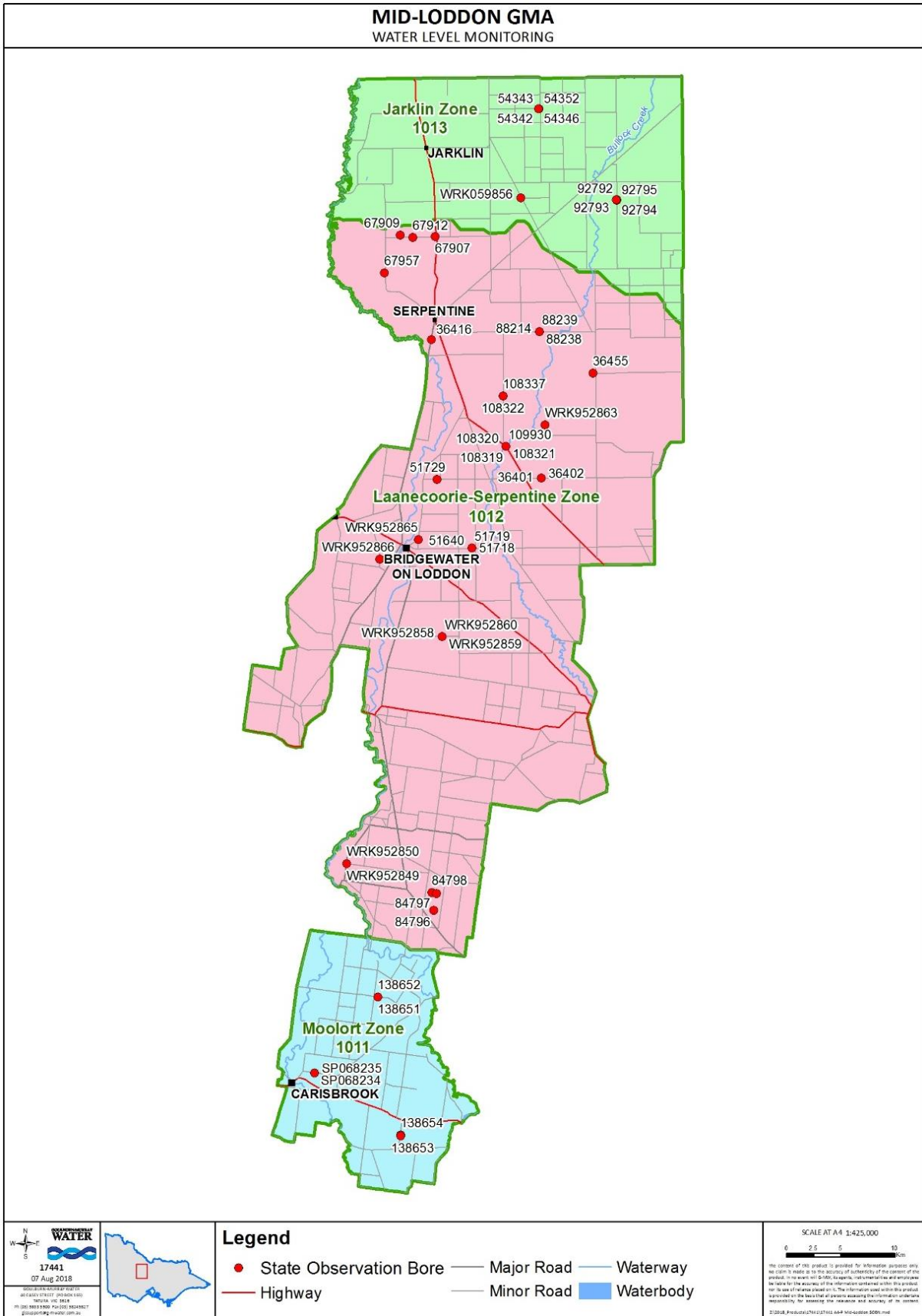
The Local Management Rules were approved for implementation on 1 July 2009.

The Rules aim to ensure groundwater resources in the Mid-Loddon GMA are managed in an equitable and sustainable manner. More specifically, the Rules seek 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 [www.g-mwater.com.au](http://www.g-mwater.com.au).



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

## 2 Groundwater management

### 2.1 Licence volume

The Minister for Water declared the Permissible Consumptive Volume in the Mid-Loddon GMA to be 34,037 megalitres per year (ML/yr) in March 2013 (Vic Gov't, 2013).

At 30 June 2018 the licence volume in the Mid-Loddon GMA was 33,927.1 ML/yr (Table 1).

**Table 1 Licence entitlement in the Mid-Loddon GMA**

| Management zone        | Licences   | Licensed bores | Licence volume (ML/year) |
|------------------------|------------|----------------|--------------------------|
| Moolort                | 22         | 30             | 3,750.4                  |
| Laanecoorie-Serpentine | 64         | 79             | 27,329.7                 |
| Jarklin                | 15         | 18             | 2,847.0                  |
| <b>Total</b>           | <b>101</b> | <b>127</b>     | <b>33,927.1</b>          |

NOTE: Data extracted from the Victorian Water Register 30 June 2018. A 50 ML/yr discrepancy was identified in the data which was due to a licensing administration error. The discrepancy has been investigated and rectified for this report.

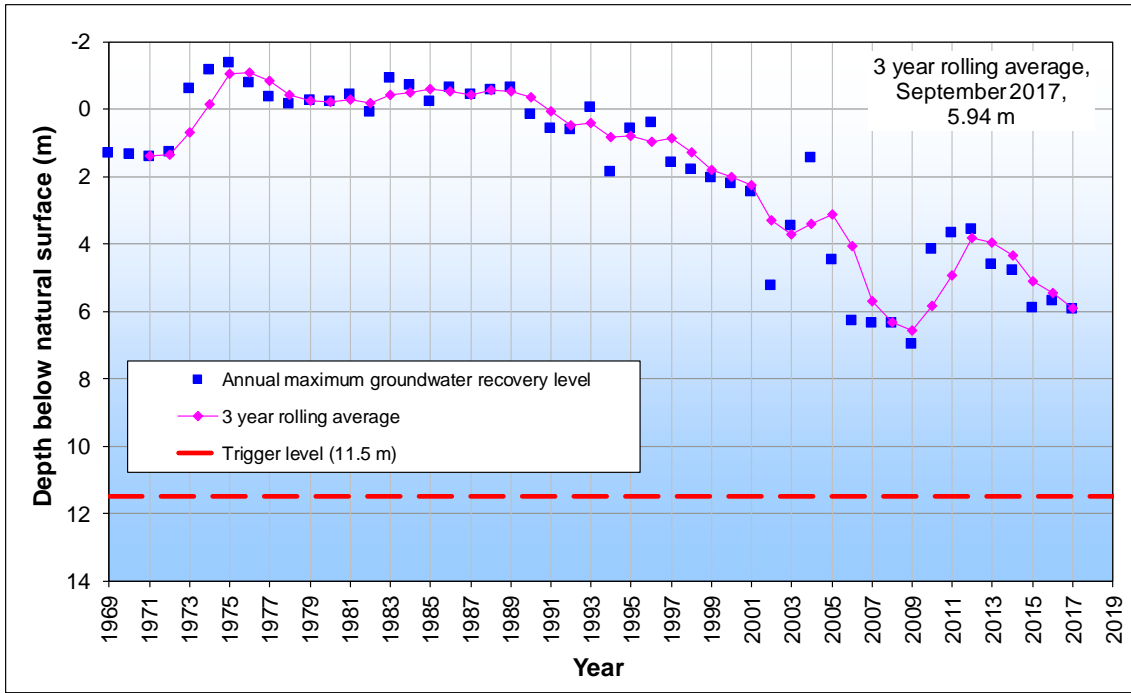
License volume as at 30 June 2017 was 33,927.1 ML/yr, so there was no change in the 2017/18 water year.

### 2.2 Groundwater allocations

Allocations are a percentage of licence entitlement that may be extracted in a given season. They are determined by comparing the three year rolling average of the annual maximum groundwater recovery levels from State observation bore 88214 against the trigger level (Figure 2).

In September 2017 an allocation of 100% was announced for all groundwater licence holders in the Mid-Loddon GMA for 2017/18.

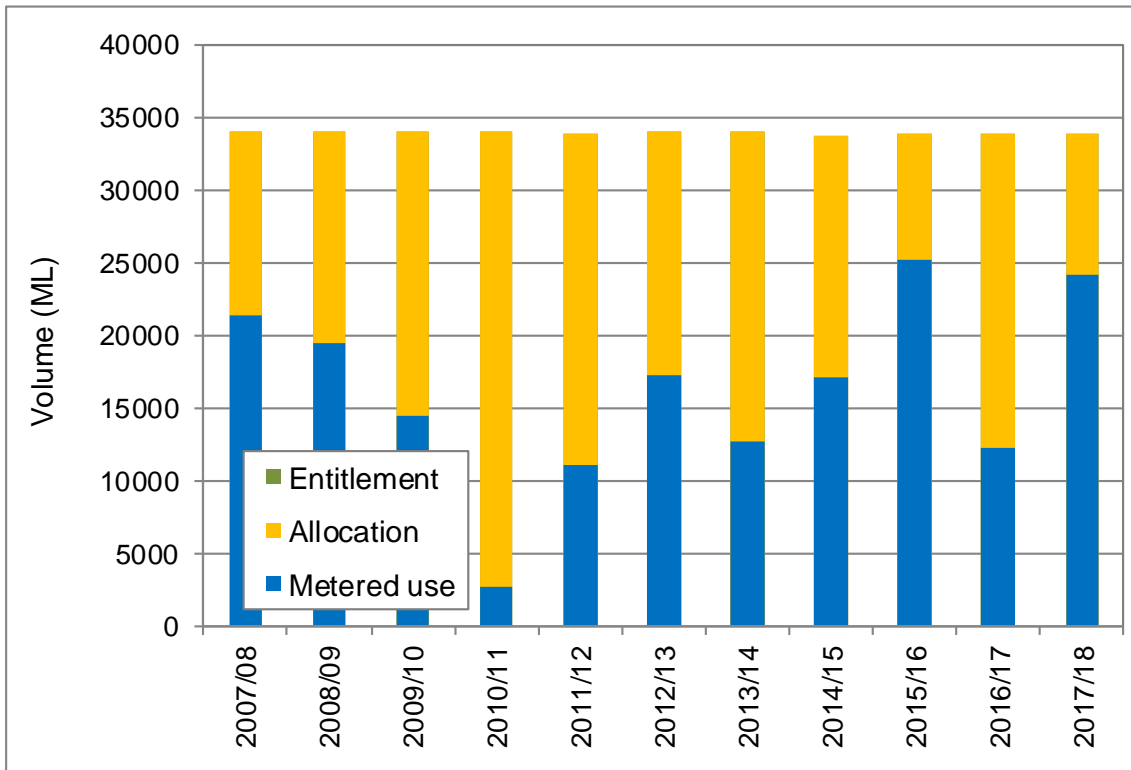




**Figure 2 Groundwater levels in bore 88214 compared to the trigger level**

### 2.3 Groundwater use

Recorded use in the Mid-Loddon GMA in 2017/18 was 24,152.4 ML, or 71% of licence entitlement. This is well above average and close to the highest use ever recorded in 2015/16 (Figure 3).



**Figure 3 Metered use in the Mid-Loddon GMA**

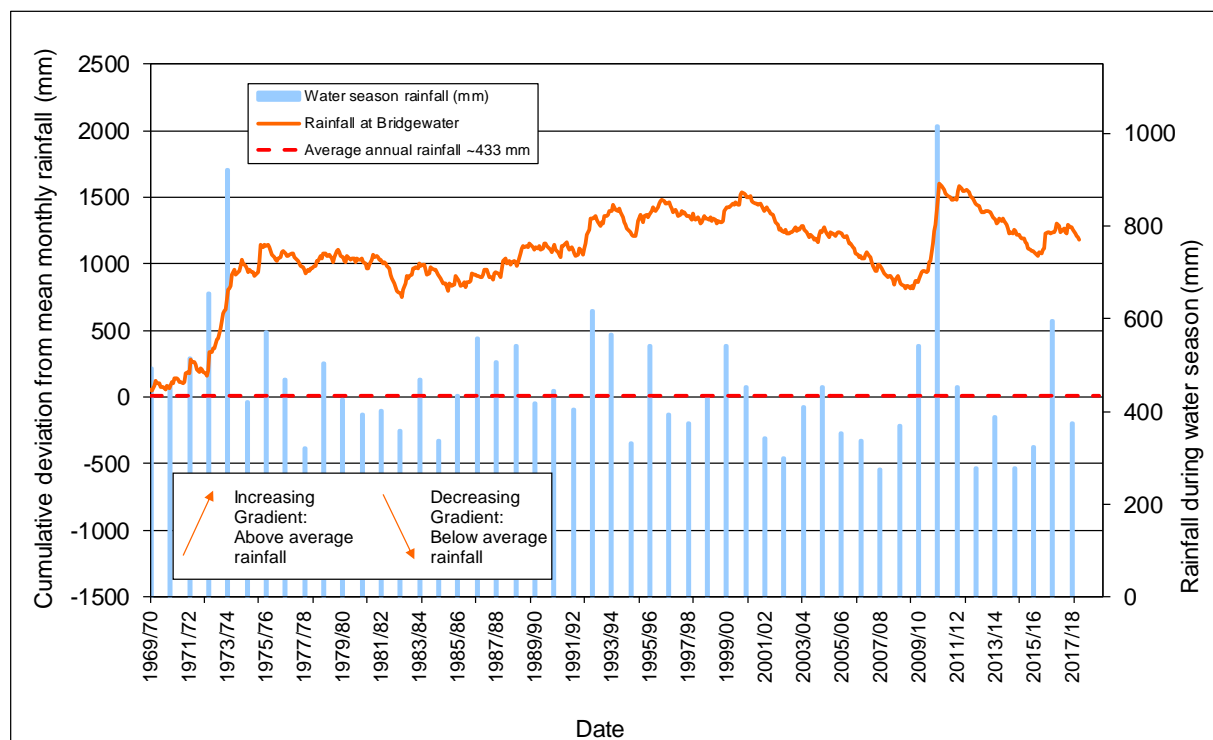
Recorded use was highest in the Laanecoorie-Serpentine Zone, where most of the entitlement is held. Licence holders in the Moolort Zone used the greatest percentage of licence entitlement (Table 2).

**Table 2 Metered use in the Mid-Loddon GMA in 2017/18**

| Management zone             | Licence volume (ML/yr) | Metered use (ML) | % Licensed volume used |
|-----------------------------|------------------------|------------------|------------------------|
| 1011 Moolort                | 3,750.4                | 3,3314.8         | 88%                    |
| 1012 Laanecoorie-Serpentine | 27,329.7               | 18,905.7         | 69%                    |
| 1013 Jarklin                | 2,847.0                | 1,931.9          | 68%                    |
| <b>Total</b>                | <b>33,927.1</b>        | <b>24,152.4</b>  | <b>71%</b>             |

## 2.4 Rainfall

Rainfall data from the Bureau of Meteorology (BoM) weather station at Bridgewater indicates that rainfall has generally been below average since the Rules have been implemented (Figure 4). Notable exceptions include the high rainfall events in 2010/11 which resulted in widespread flooding. Above average rainfall was also recorded in 2016/17. The drier conditions have resulted in reduced recharge to the groundwater system.

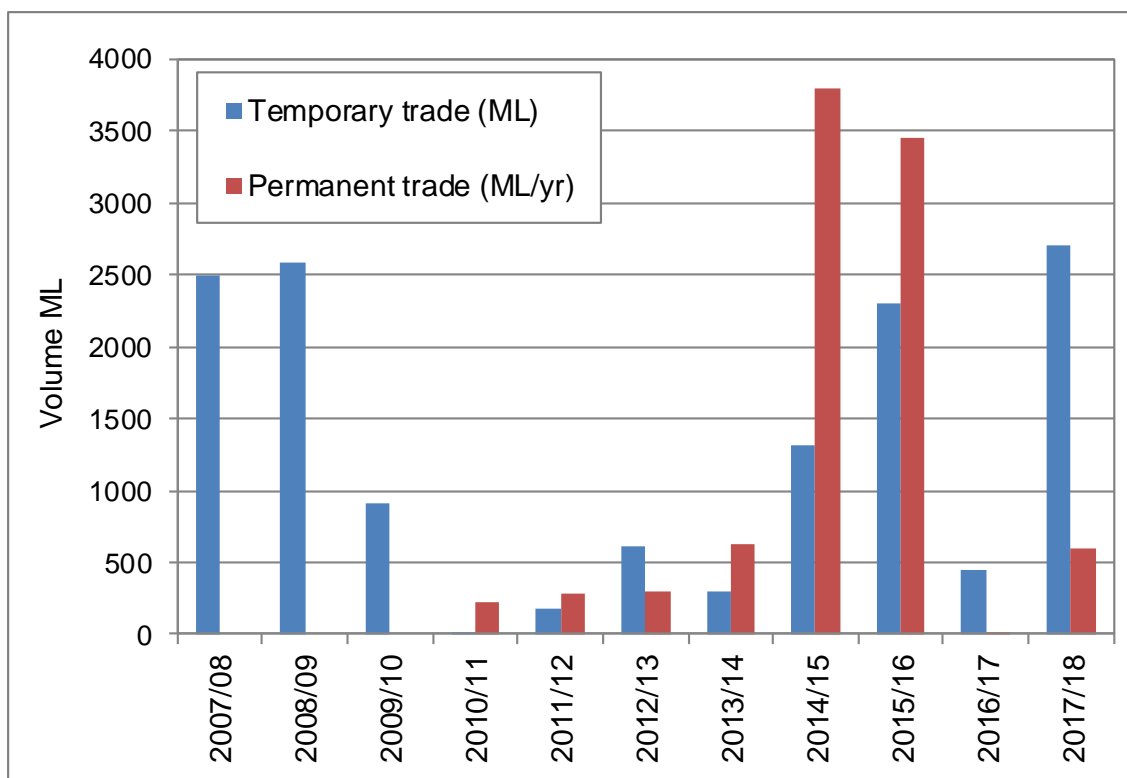


**Figure 4 Monthly rainfall data for Bridgewater Post Office (BoM station 081058)**

## 2.5 Transfer of entitlement

The Rules allow groundwater licence holders to temporarily or permanently transfer licence entitlement.

There were 16 temporary licence transfers for a total of 2,705.3 ML; and three permanent licence transfers for a total of 594 ML/yr in 2017/18 (Figure 5).



**Figure 5 Licence transfer activity in the Mid-Loddon GMA**

A total of 838 ML was temporarily transferred from the Laanecoorie Zone to the Moolort Zone (Table 3). There was 95 ML/yr permanently transferred from the Moolort Zone to the Laanecoorie-Serpentine Zone.

**Table 3 Licence transfers in the Mid-Loddon GMA 2017/18**

| 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)  | No. of transfer | Volume (ML)  |
| 1011 Moolort                | 0               | 0.0            | 4               | 838.0          | 1               | 95.0         | 0               | 0.0          |
| 1012 Laanecoorie-Serpentine | 12              | 2,291.3        | 8               | 1,453.3        | 2               | 499.0        | 3               | 594.0        |
| 1013 Jarklin                | 4               | 414.0          | 4               | 414.0          | 0               | 0            | 0               | 0.0          |
| <b>Total</b>                | <b>16</b>       | <b>2,705.3</b> | <b>16</b>       | <b>2,705.3</b> | <b>3</b>        | <b>594.0</b> | <b>3</b>        | <b>594.0</b> |

## 2.6 Carryover

Licence holders in the Mid-Loddon GMA are permitted to carryover up to a maximum of 30% of their licence entitlement for use in the next season.

There was 9,913.1 ML of carryover available to licence holders in the Mid-Loddon GMA in the 2017/18 season.

At the conclusion of the 2017/18 season, groundwater licence holders in the Mid-Loddon GMA were able to carryover 8,713.8 ML into the 2018/19 season.

## 2.7 Domestic and stock bores installed

There were 13 applications made for a licence to construct a bore for domestic and stock purposes in the 2017/18 season in the Mid-Loddon GMA.

# 3 Monitoring program

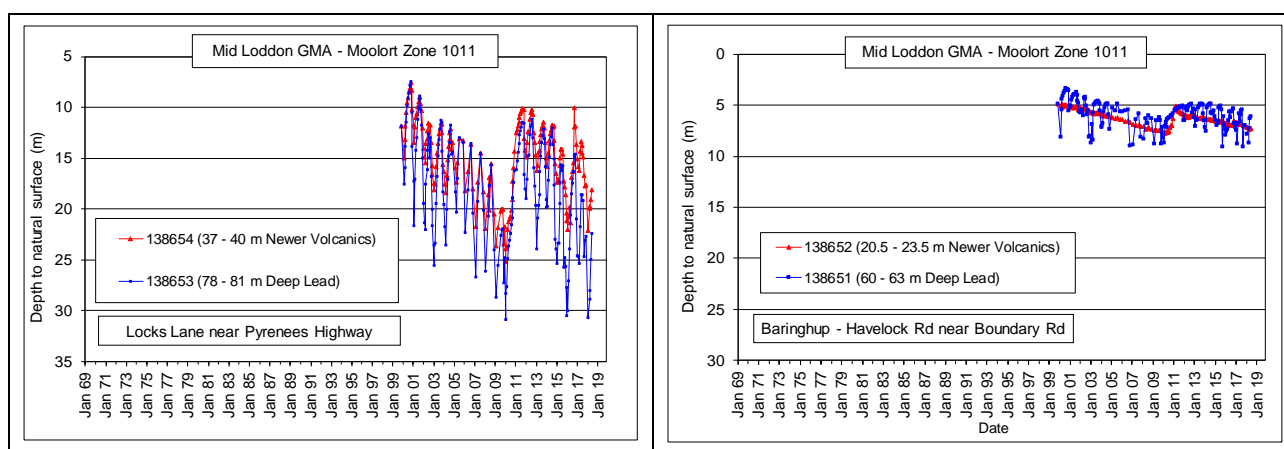
## 3.1 Groundwater levels

The Department of Environment, Land, Water and Planning (DELWP) monitored 47 bores in the Mid-Loddon GMA on a quarterly basis in February, May, August and November as part of the State Observation Bore Network (Figure 1). GMW conducted monthly monitoring of 25 key State observation bores identified in Schedule 1 of the Rules (Appendix B).

Groundwater level monitoring generally indicates that groundwater levels rose during the wet period in the early-1970s and remained high until the mid-1990s. The increase in the seasonal fluctuations represents an increase in groundwater extraction over time. From the mid-1990s to 2009 groundwater recovery levels (i.e. highest groundwater level each year) fell, largely in response to reduced rainfall recharge. Groundwater levels recovered strongly in response to the wet conditions experienced in 2010/11. Since 2011 groundwater recovery levels have declined in response to reduced rainfall recharge and increased extraction, particularly in 2015/16 and 2017/18.

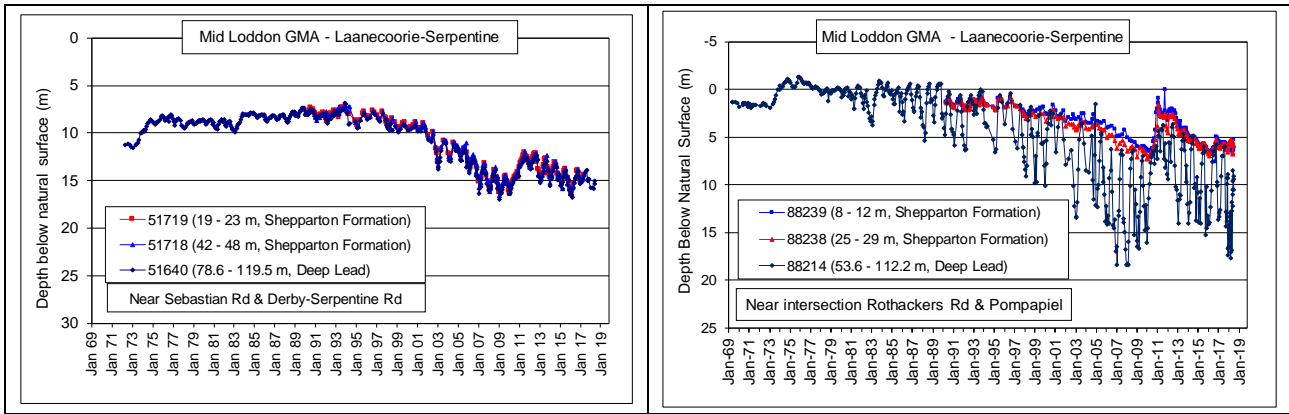
Groundwater levels in the Mid-Loddon GMA remain within historical ranges. There was a general decline in groundwater recovery levels in 2017/18, typically less than 0.3 m, which may be attributed to reduced rainfall recharge and high groundwater extraction. Seasonal drawdown of up to 12 m was observed in areas of intensive groundwater extraction, but was typically less than 2 m.

In the Moolort Zone, groundwater recovery levels declined by around 3.9 m in 2017/18 to 18.6 m depth at bore 138653, with seasonal drawdown of 12 m (Figure 6). In comparison, groundwater recovery levels at bore 138651 declined by around 0.1 m to 5.4 m depth with seasonal drawdown of 3.8 m.



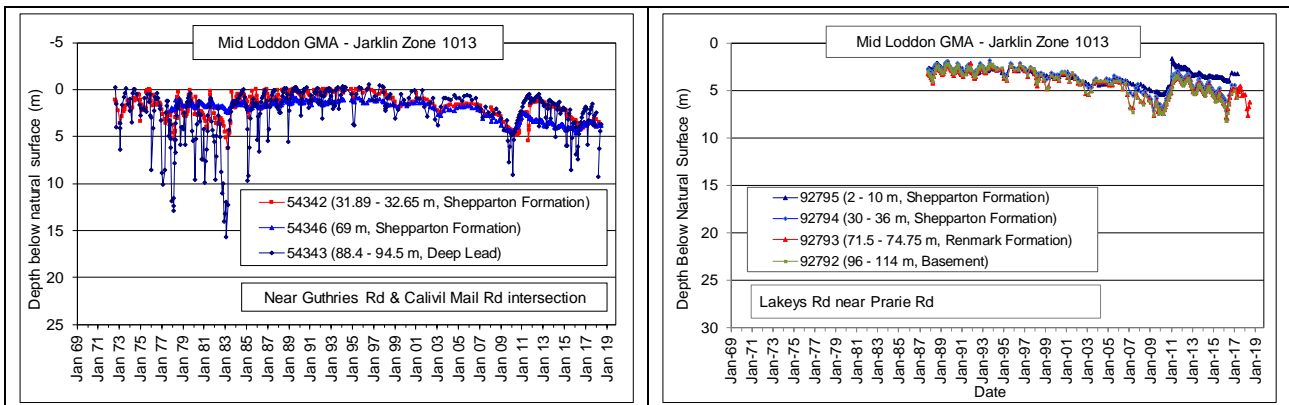
**Figure 6 Groundwater levels in the Moolort Zone**

In the Laanecoorie-Serpentine Zone, groundwater recovery levels declined by 0.3 m in 2017/18 to 6.1 m below the natural surface in trigger bore 88214 on Rothackers Road, with seasonal fluctuation of around 11.6 m (Figure 7). At bore 51640, the groundwater recovery level declined by 0.1 m in 2017/18 to 14.1 m below the natural surface, with seasonal fluctuation of around 1.8 m.



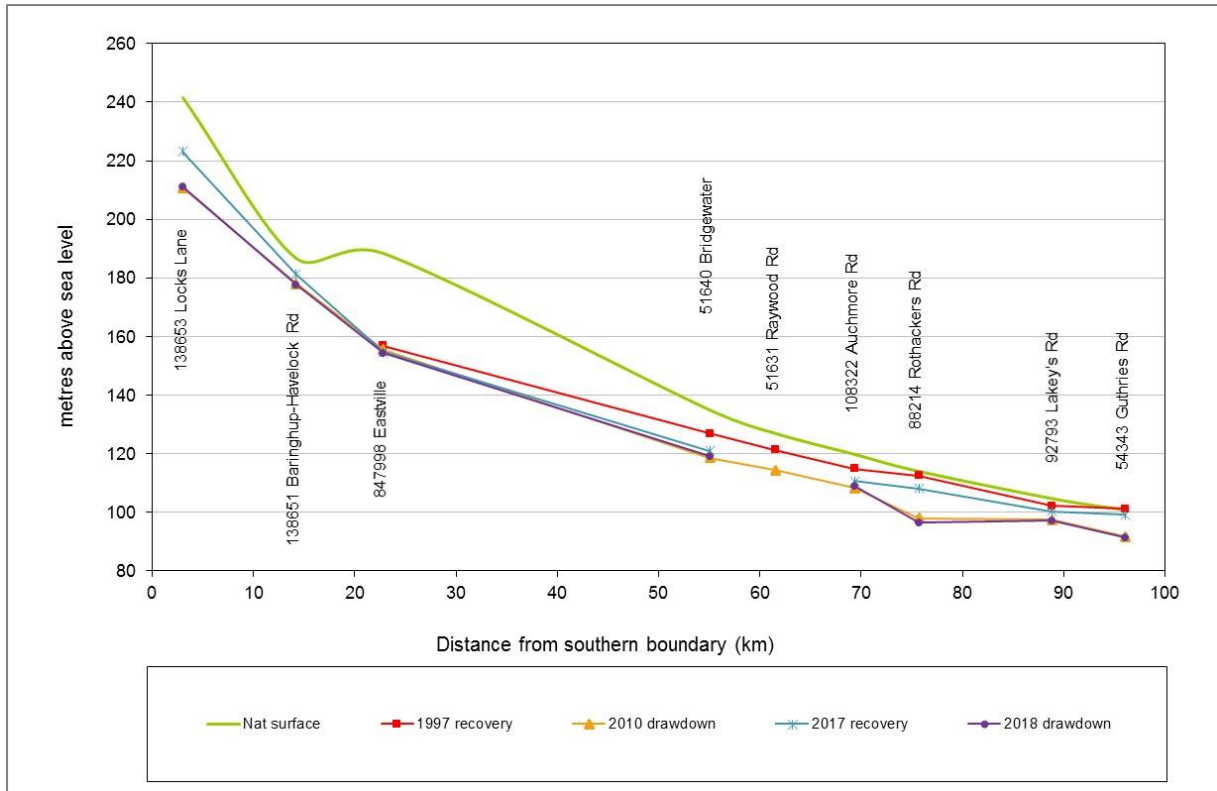
**Figure 7 Groundwater levels in the Laanecoorie-Serpentine Zone**

In the Jarklin Zone, groundwater recovery levels rose by 0.2 m in 2017/18 to 1.8 m below the natural surface in bore 54343, with seasonal fluctuation of around 7.52 m (Figure 8). At bore 92793, the groundwater recovery level declined by 0.2 m in 2017/18 to 4.6 m below the natural surface, with seasonal fluctuation of around 3.0 m. Lower groundwater levels can provide improved drainage and reduced waterlogging and land salinity problems in this area.



**Figure 8 Groundwater levels in the Jarklin Zone**

Groundwater levels from key State observation bores along a north-south section show that the aquifer response is consistent with historical observations (Figure 9).



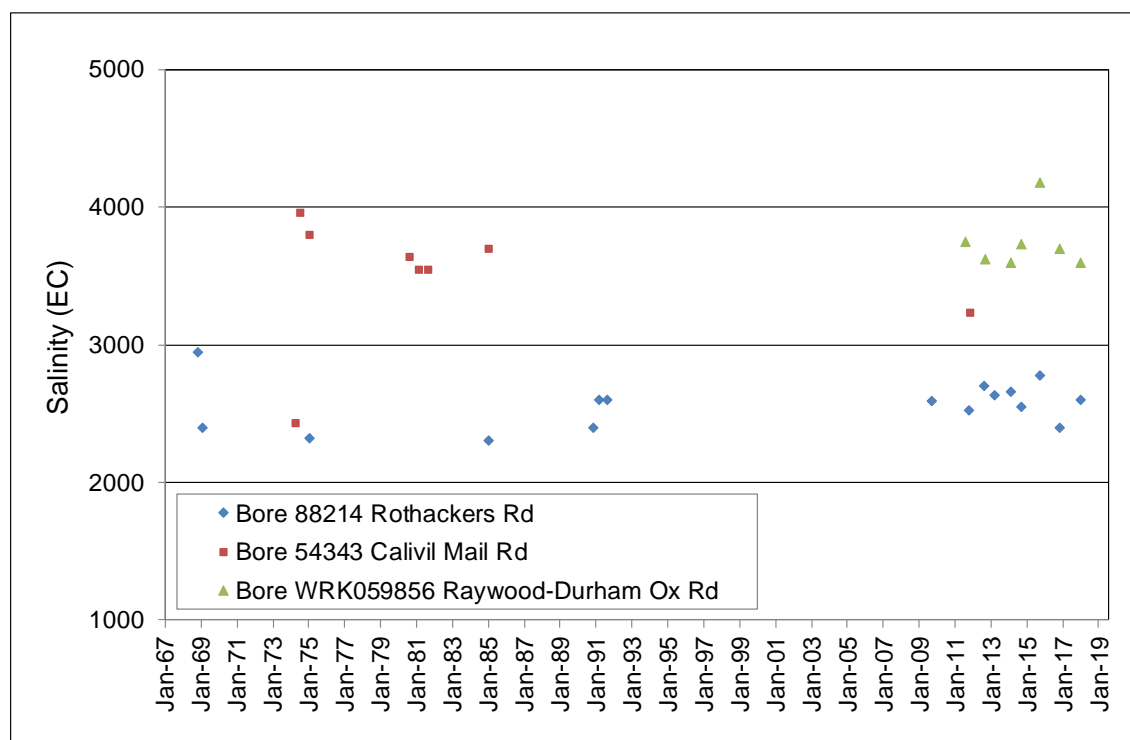
**Figure 9 Groundwater level along a north–south section of the Mid Loddon GMA**

### 3.2 Groundwater quality

#### Sampling from State observation bores

Groundwater quality has been recorded from State observation bores 88214 in the Laanecoorie-Serpentine Zone and WRK059856 (replacement for bore 53434) in the Jarklin Zone. Both bores are screened in the Deep Lead aquifer. The data indicates that groundwater salinity levels are relatively stable (Figure 10). Results for the other parameters are provided in

Appendix C – Groundwater chemistry. Ongoing annual sampling of these key bores will enable any trends in groundwater quality to be observed.



**Figure 10 Groundwater salinity in key monitoring bores in the Mid-Loddon GMA**

### Sampling from private bores

GMW provides all groundwater licence holders in the Mid-Loddon GMA with a sample bottle and a reply paid envelope to submit a groundwater sample for salinity analysis. In the 2017/18 season, 125 sample bottles were sent out and 27 samples (22%) were returned for analysis.

Groundwater salinity in each zone is within expected ranges (Table 4). The data suggests that groundwater is more saline in the north. Continued return of samples assists with identifying any trends in groundwater salinity. A greater return rate would further improve the spatial and temporal understanding of groundwater salinity in the Mid-Loddon 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 results from private bores**

| Management zone             | Samples returned | Salinity range, EC (µS/cm) |
|-----------------------------|------------------|----------------------------|
| 1011 Moolort                | 6                | 1,120 – 3,990              |
| 1012 Laanecoorie-Serpentine | 19               | 450 – 3,510                |
| 1013 Jarklin                | 2                | 2,750 – 3,390              |

### 3.3 Metering

There were 128 active meters in the Mid-Loddon GMA as of 30 June 2018. There were 123 meters that required preventative maintenance across the WSPA in 2017/18 (Table 6). All meters were read at least twice during the 2017/18 water year.



**Table 5 Metering activities in the Mid-Loddon GMA in 2017/18**

| <b>Metering activity</b>      | <b>Year ending 30 June 2018</b> |
|-------------------------------|---------------------------------|
| Number of meters installed    | 1                               |
| Number of meters replaced     | 0                               |
| Meter maintenance events      | 130                             |
| Total number of meters in GMA | 128                             |
| Total number of meter reads   | 256                             |

### **3.4 Licence compliance**

There were no prosecutions or convictions relating to groundwater matters in the Mid-Loddon GMA in 2017/18.

There was one incident of unauthorised take and use of groundwater. This incident has been investigated and GMW has taken action in accordance with the National Framework for Compliance and Enforcement of Systems for Water Resource Management (DSEWPC, 2012).

# 4 Future management considerations

## 4.1 Groundwater Reference Committee

GMW met with the Mid-Loddon Groundwater Reference Group on 19 September 2017 to report on the resource status, discuss groundwater trading in area of intensive groundwater pumping and progress on the review of the Rules.

## 4.2 Review of Local Management Rules

Rule 12(d) of the Mid-Loddon GMA Local Management Rules states that the Corporation will undertake a review of the Plan after five years from approval (June 2009). GMW has commenced a review and engaged the Mid-Loddon community at public meetings in Serpentine and Baringhup on 12 October 2017 to explore opportunities for improvement.

## 5 References

Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2012. *National Framework for Compliance and Enforcement of Systems for Water Resource Management*. [WWW document]

<http://webarchive.nla.gov.au/gov/20160106180441/http://www.environment.gov.au/resource/national-framework-compliance-and-enforcement-systems-water-resource-management>

BoM, 2017, Climate Statistics for Australian Sites – Bridgwater (Post Office) station number 081058.

Bureau of Meteorology. Retrieved 13 August 2018,

[http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p\\_nccObsCode=139&p\\_display\\_type=dataFile&p\\_startYear=&p\\_c=&p\\_stn\\_num=081058](http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=081058)

Goulburn-Murray Water, 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.

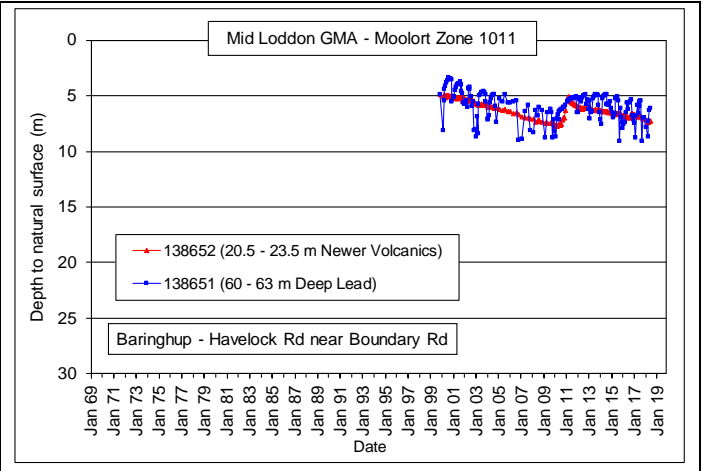
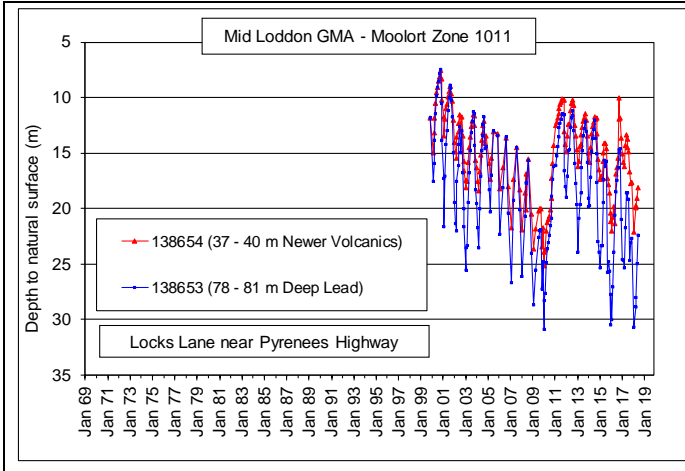
# Appendix A – Assessment of activities against Rules

| Rule  | Activity   | Compliant? |
|---|--|------------|
| 1. Cap on licence entitlement                   | The Minister for Water declared the Permissible Consumptive Volume in the Mid-Loddon GMA to be 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                  | GMW announced allocations of 100% for all groundwater licence holders in September 2017.<br>GMW announced allocations by listing them 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 16 transactions for temporary transfer and 3 transactions for permanent transfer in 2017/18. All transfers were compliant 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 monthly readings from State observation bores listed in Schedule 1 of the Rules where practicable.  | Yes        |
| 8. Monitor groundwater salinity                 | Groundwater salinity was analysed from State observation bores 88214 and WRK059856.<br>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 2017/18.  | Yes        |
| 10. Annual reporting                            | GMW has prepared this annual report for the 2017/18 season and posted it on its website.   | Yes        |
| 11. Provide effective communication             | GMW met with the Mid-Loddon Groundwater Reference Group on 19 September 2017 to report on the resource status, discuss groundwater trading in area of intensive groundwater pumping and progress on the review of the Rules.                   | Yes        |
| 12. Review of local management rules            | A review of the Mid-Loddon GMA Local Management Rules is currently being undertaken. GMW consulted the community on 12 October 2017.   | Yes        |

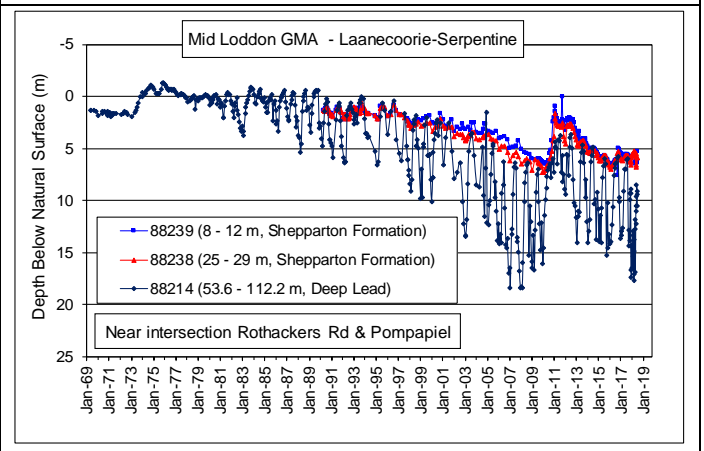
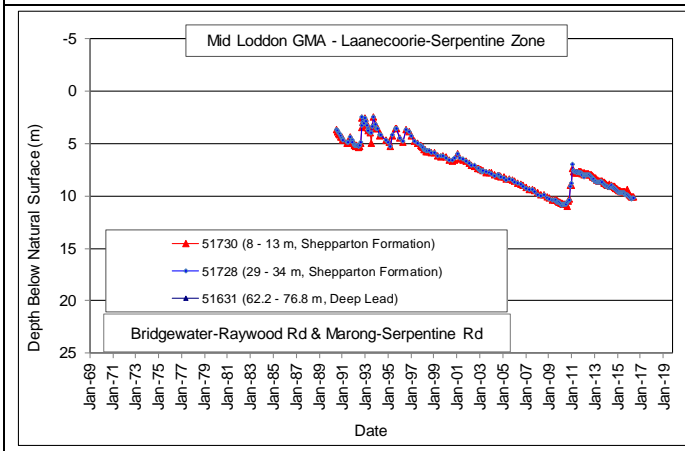
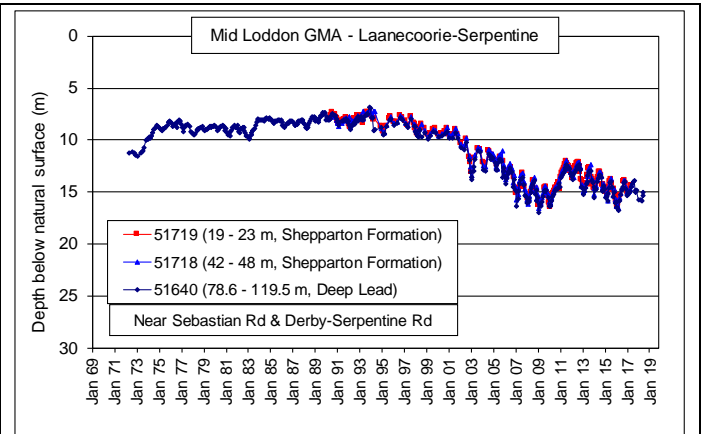
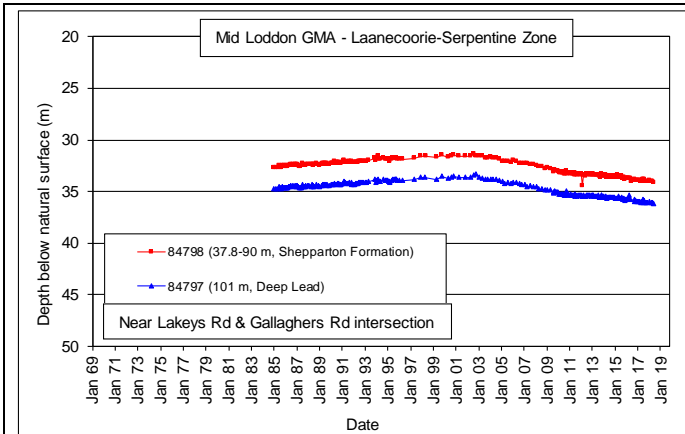
# Appendix B – Hydrographs

Hydrographs for key monitoring bores. Groundwater level information on other State observation bores can be obtained from the Water Measurement Information System website at <http://data.water.vic.gov.au/monitoring.htm>

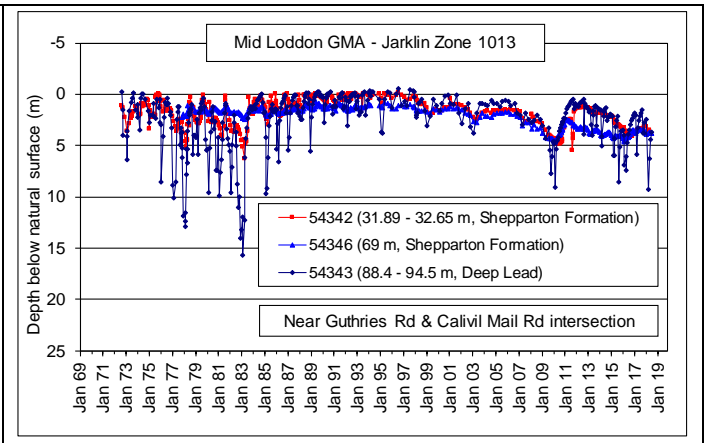
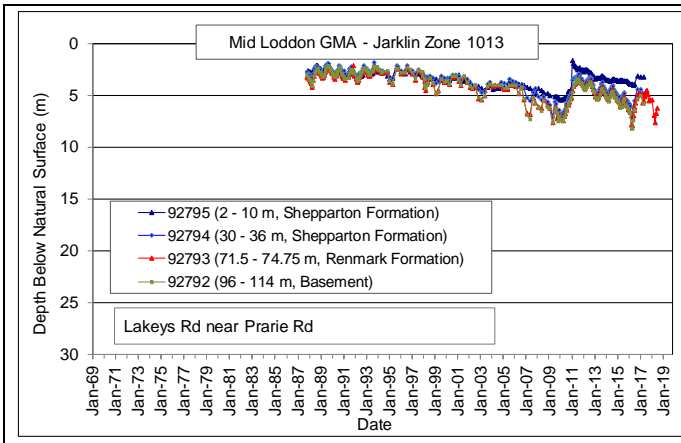
## Moolort Zone 1011



## Laanecoorie-Serpentine Zone 1012



# Jarklin Zone 1013



# Appendix C – Groundwater chemistry

Groundwater chemistry from nested State observation bores

| Analyte  | Unit         | Bore        | 88214      | WRK059856 |
|--|--------------|-------------|------------|-----------|
|  |              | Sample date | 31/01/2018 | 1/02/2018 |
| Conductivity (µS/cm)                               | µS/cm @ 25°C |             | 2,545      | 3,598     |
| pH Colour  | Units        |             | 8.7        | 6.82      |
| Total Alkalinity as CaCO <sub>3</sub> (mg/l)       | mg/l         |             | 200        | 200       |
| Alkalinity (Carbonate as CaCO <sub>3</sub> , mg/l) | mg/l         |             | 20         | <2        |
| Dissolved Oxygen (ppm)                             | ppm          |             | 270        | 280       |
| Sulphate as SO <sub>4</sub> (mg/l)                 | mg/l         |             | 75         | 190       |
| Total Alkalinity, as CaCO <sub>3</sub>             | mg/L         |             | 200        | 200       |
| Calcium, as Ca                                     | mg/L         |             | 14         | 60        |
| Chloride, as Cl                                    | mg/L         |             | 680        | 980       |
| Hydroxide Alkalinity, as CaCO <sub>3</sub>         | mg/L         |             | <2         | <2        |
| Potassium, as K                                    | mg/L         |             | 7          | 10        |
| Sodium, as Na                                      | mg/L         |             | 350        | 530       |
| Ammonia, as N                                      | mg/L         |             | 0.2        | <0.1      |
| Nitrate, as N                                      | mg/L         |             | 0.02       | 0.03      |
| 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     | <0.001    |
| Iron, dissolved as Fe                              | mg/L         |             | 0.02       | 0.35      |
| Mercury, as Hg                                     | mg/L         |             | <0.0001    | <0.0001   |
| Magnesium, as Mg                                   | mg/L         |             | 57         | 96        |
| Manganese, dissolved as Mn                         | mg/L         |             | 0.05       | 0.08      |
| Total Dissolved Solids, 180C                       | mg/L         |             | 1400       | 2100      |
| Turbidity, NTU                                     | NTU          |             | 3.1        | 5.2       |
| Phosphorus, total as P                             | mg/L         |             | <0.05      | <0.05     |
| total organic carbon (TOC)                         | mg/L         |             | <0.5       | <0.5      |
| Lead, dissolved (ICP-MS)                           | mg/L         |             | <0.001     | <0.001    |
| Nickel, dissolved (ICP-MS)                         | mg/L         |             | <0.001     | <0.001    |
| 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     | 0.013     |