GOULBURN-MURRAY WATER

Mid-Loddon

Groundwater Management Area

Local Management Rules

Annual Report

2012

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1 Introduction

The Mid-Loddon Groundwater Management Area (GMA) Local Management Rules (the Rules) were implemented from 1 July 2009 to ensure groundwater resources are managed in an equitable and sustainable manner.

This report has been prepared to provide groundwater users with an overview of implementation of the Rules to 30 June 2012. It reports on items specified in Rule 10 including:

- groundwater extractions, including trading and carryover (Chapter 2);
- groundwater level response (Chapter 3);
- groundwater quality description (Chapter 4); and
- the need to amend any of the Rules based on policy developments, improved technical understanding of the aquifer system or validity of the Rules (Chapter 5)

1.1 Local Management Rules

The Rules were developed by a Goulburn-Murray Water appointed Groundwater Reference Committee which comprised groundwater users in the area, and extensively consulted with the wider community, Department of Sustainability and Environment and the North Central Catchment Management Authority. The Rules are designed to be transparent, consultative and adaptive. A copy of the Rules can be downloaded from the Goulburn-Murray Water website http://www.g-mwater.com.au/ .

The Rules provide groundwater licence holders with greater flexibility to manage their entitlement and scope for future development through provisions for carryover and the permanent transfer of entitlement. The establishment of a cap on licence entitlement, trigger levels and restrictions on annual extractions if required; offer security of access to existing groundwater users, including domestic and stock users. Further, the Rules consider environmental water requirements, risks to the aquifer and provide land salinity benefits.

The Rules ensure that there is effective reporting and communication of the resource status, determined through appropriate monitoring. Importantly, a methodology for reviewing the Rules is prescribed to ensure that they remain current and appropriate.

1.2 Groundwater management area

The Mid-Loddon GMA lies within the Loddon River Catchment of the Murray-Darling Basin. It covers an area of around 3,000 km^2, extending from Tullaroop Reservoir in the south to Mitiamo in the north, including the towns of Carisbrook, Bridgewater and Serpentine (Figure 1).

The GMA includes all major aquifers in this region, including the Newer Volcanic Basalts, Calivil Formation and Shepparton Formation. No depth limit has been specified for the GMA to ensure that all of these aquifers are included.

Three management zones have been established within the GMA:

- Moolort Zone 1011
- Laanecoorie-Serpentine Zone 1012
- Jarklin Zone 1013

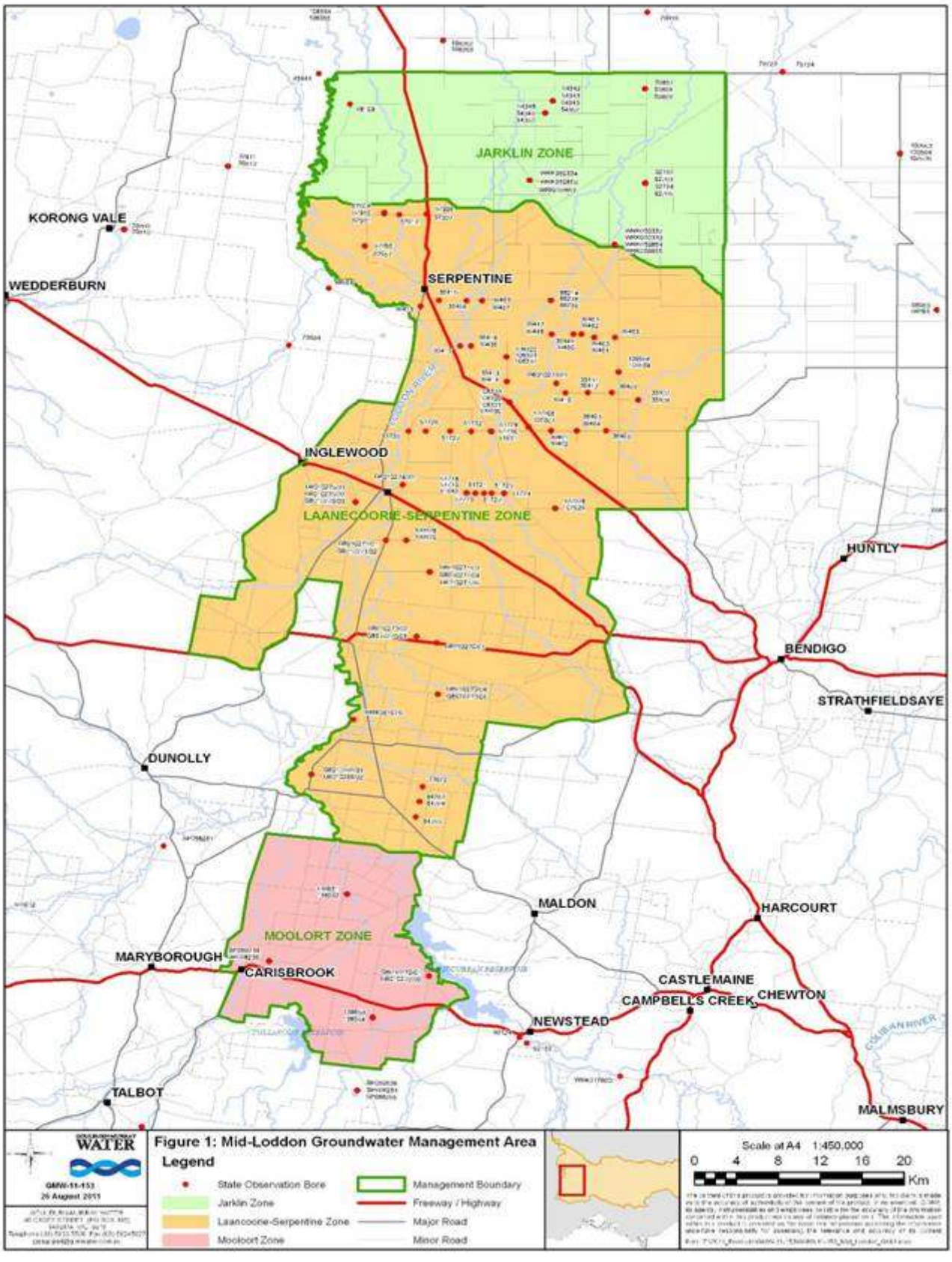


Figure 1 Mid-Loddon management zones and monitoring bores

2 Managing groundwater extractions

2.1 Licence volume

Licence volume in the Mid-Loddon Groundwater Management Area (GMA) is 34,036 ML/year. It has increased from 33,905 ML/yr when the Rules were written to account for an oversight in licence renewal (110 ML/yr) and licensing of dairy wash bores under the Department of Sustainability and Environment's Dairy Shed Water Licence Transition Program (22 ML/yr).

Licence entitlement has been capped to protect existing groundwater users and the environment. The distribution of entitlement is shown in Table 1.

No additional licence volume is to be issued in the area, however new development may occur through the transfer of existing groundwater licence entitlement.

Table 1 Licensed volume and metered extraction to 30 June 2012

Zone	Licensed volume (ML)	Metered use (ML)	% of licensed volume extracted
Jarklin	2,957	987	33%
Laanecoorie-Serpentine	27,922	8,982	32%
Moolort	3,157	1,159	37%
TOTAL	34,036	11,128	33%

2.2 Allocations

Allocations are a percentage of licence entitlement volume that may be extracted in a given season.

Allocations are assessed by comparing the average maximum groundwater recovery level three year rolling average to the trigger level.

An allocation of 100% was announced in the Mid-Loddon GMA for the 2011/12 season in September 2011.

The average maximum groundwater recovery level three year rolling average in 2011/2012 was 4.93 m, which was above the trigger level (11.5 m depth below the natural surface) (Figure 2).

Figure 2 Maximum recovery level three year rolling average

2.3 Groundwater use

Metered groundwater extraction in the Mid-Loddon GMA in 2011/12 was 11,128 ML (Table 1). This is below the average use in recent years, which may be attributed to rainfall events during the irrigation season and availability of surface water.

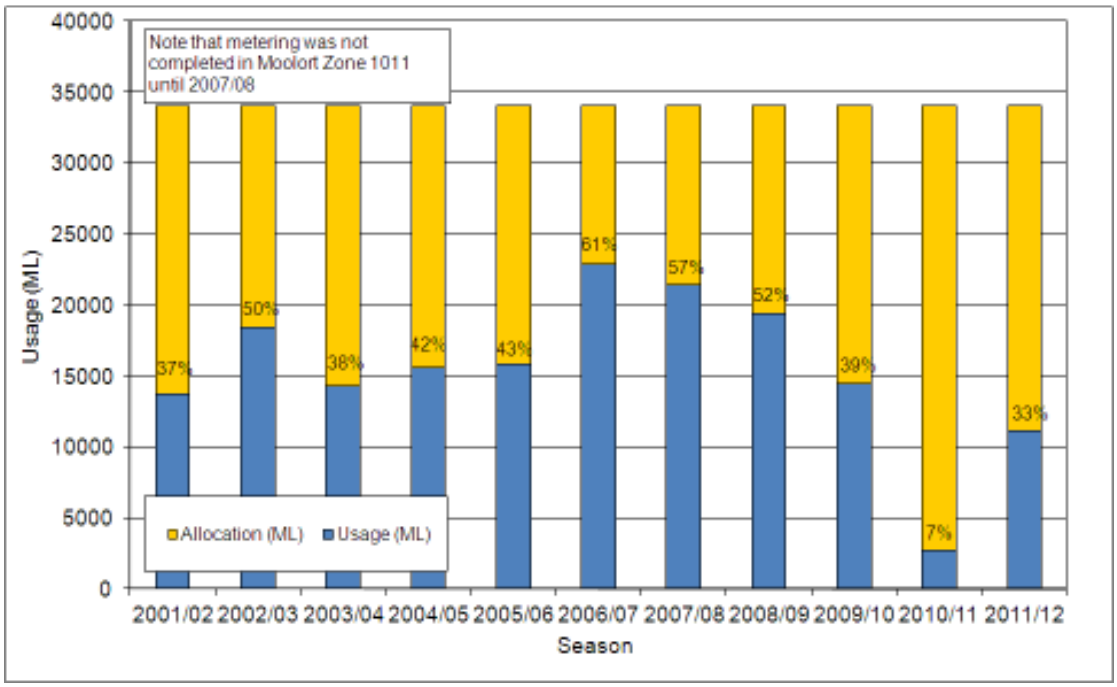


Figure 3 Metered groundwater extraction

The greatest volume was extracted from the Laanecoorie-Serpentine Zone, which has the largest proportion of licence entitlement. The percentage of licence volume extracted from each zone was fairly consistent, ranging from 32% to 39% (Figure 4).

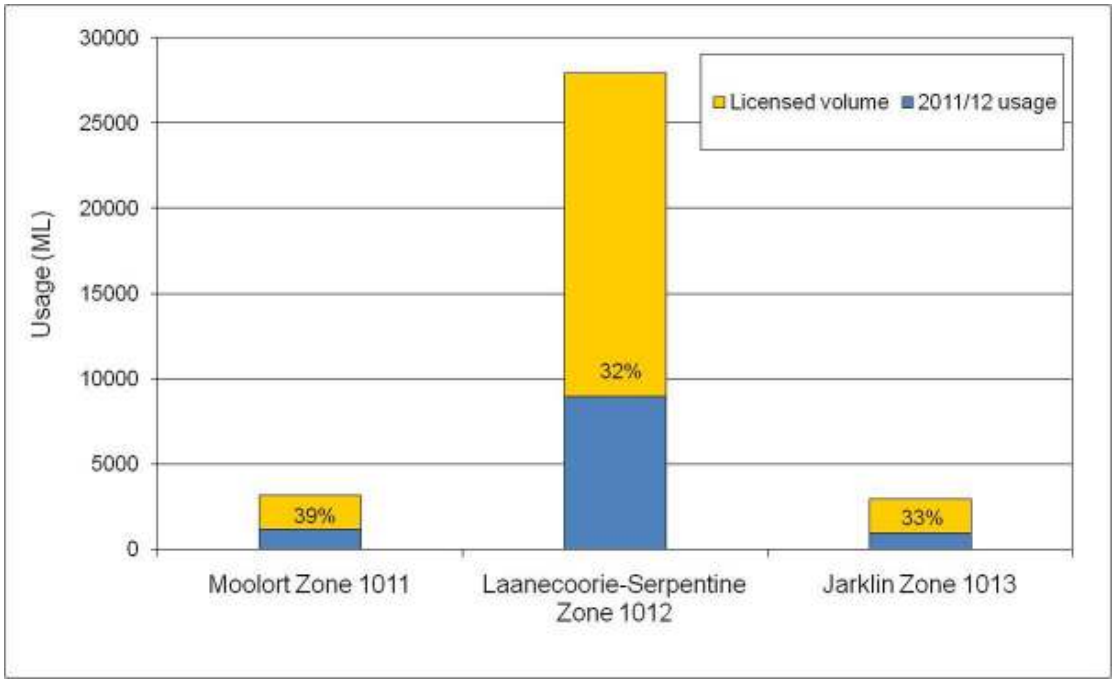


Figure 4 Licence volume and use per zone

All licensed bores are metered. Meters were read by Goulburn-Murray Water in March and May in the 2011/12 season.

Licence holders are required to report any faulty meter issues to Goulburn Murray Water immediately.

Groundwater users are reminded that if groundwater is to be extracted for any other purpose than domestic and stock use the bore must be licensed and metered.

2.4 Transfer of groundwater entitlement

The temporary and permanent transfer of groundwater entitlement is available to licence holders in the Mid-Loddon GMA subject to the conditions prescribed in Rule 5 of the management rules.

There was 175 ML of groundwater licence entitlement temporarily transferred in the 2011/12 season (Figure 5). The relatively small number and volume of temporary trades may be attributed to less demand due to timely rainfall events, particularly when compared to the dry seasons in 2007/08 and 2008/09.

There was also 280 ML of groundwater licence entitlement permanently transferred in the 2011/12 season (Figure 5).

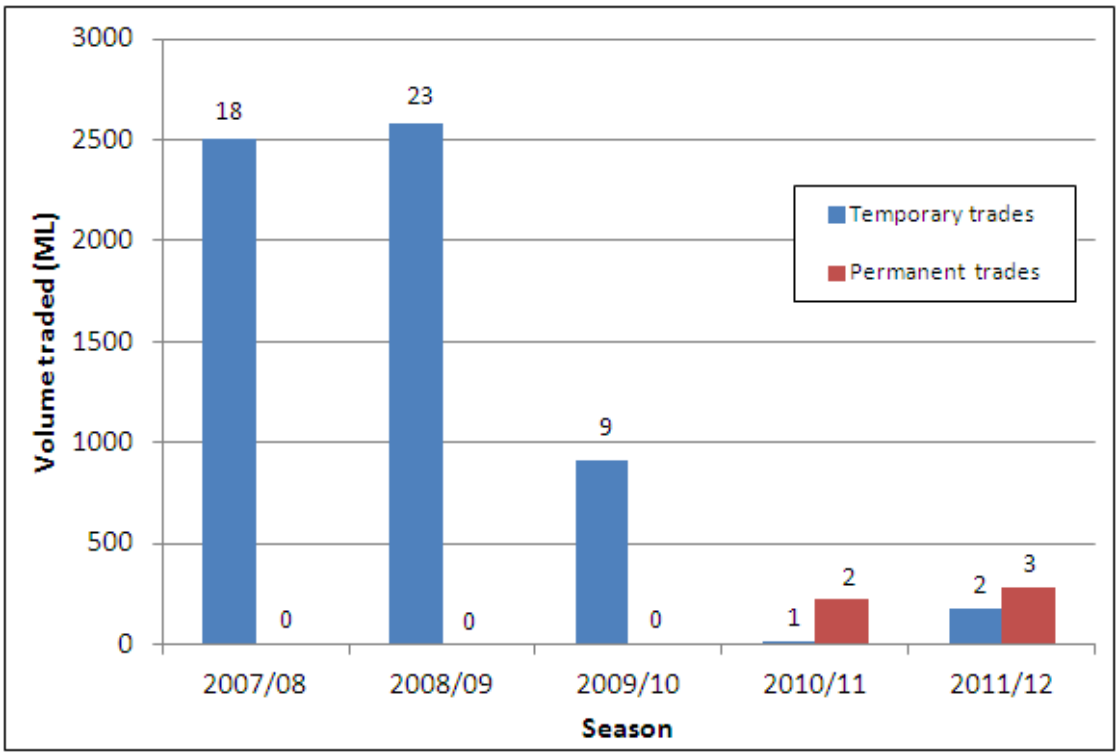


Figure 5 Transfer of entitlement

The temporary and permanent transfer of entitlement is permitted between zones provided that the entitlement in the Laanecoorie-Serpentine zone does not exceed 28,000 ML and the entitlement in the Jarklin Zone is not less than 3,000 ML.

There was no temporary transfer of groundwater entitlement between zones with the majority of entitlement temporarily transferred within the Laanecoorie-Serpentine Zone.

Of the 280 ML permanently transferred in the 2011/12 season, 200 ML was transferred from the Laanecoorie-Serpentine Zone to the Moolort Zone, while 80 ML was permanently transferred within the Laanecoorie-Serpentine Zone.

Licence holders are reminded to ensure that they have written approval from Goulburn-Murray Water before extracting any groundwater in excess of their licence entitlement.

2.5 Carryover

Carryover provides licence holders with greater flexibility to manage their licence entitlement and is available to licence holders in the Mid-Loddon GMA under Rule 6 of the management rules.

Licence holders that do not use all their allocation may carryover up to a maximum of 30% of their licence entitlement for use in the next season.

In 2011/12 there was 11,128 ML of groundwater extracted from 43,365 ML available which includes licensed entitlement and available carryover. Therefore there was 32,067 ML of unused allocation.

The sum of individual licence holder carryover volumes for 2011/12 was 10,071 ML, which is 29.5% of the total licence volume available for carryover into the 2012/13 season (Figure 6).

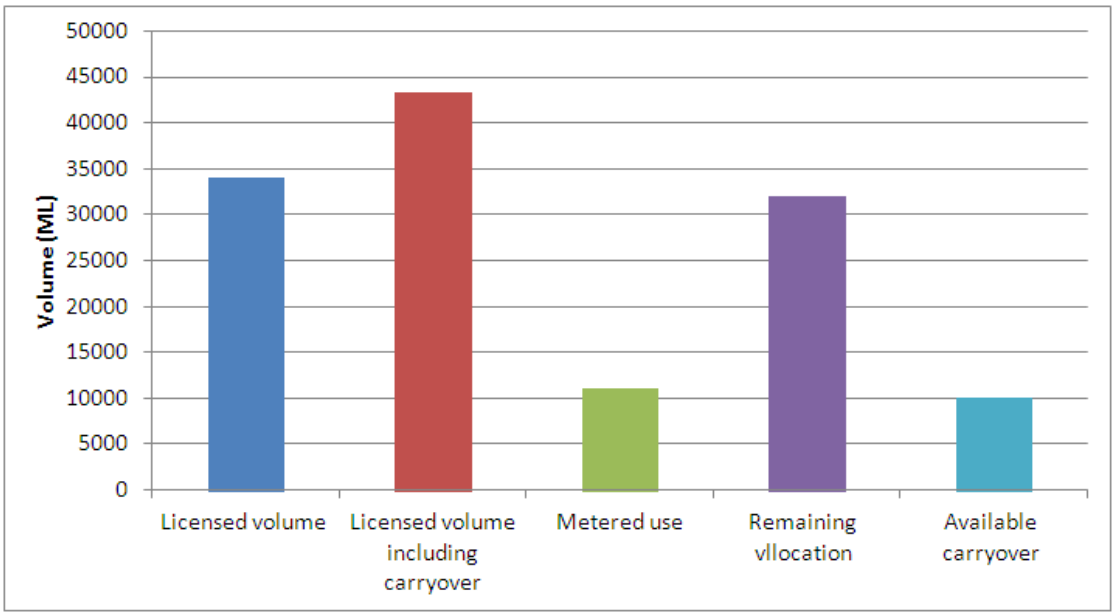


Figure 6 Available carryover at the end of season 2011/12

In March 2012, the Minister for Water signed a declaration to authorise carryover usage in the Mid-Loddon GMA. This means that Rule 6(c) under the Local Management Rules no longer applies and there is no requirement for licence holders to obtain approval from Goulburn-Murray Water before using carryover volumes.

Licence holders can apply to Goulburn-Murray Water to increase their extraction rate to enable them to use their carryover volume if their licence conditions are limiting.

3 Monitoring groundwater levels

The Mid-Loddon GMA has an extensive network of groundwater monitoring bores that are monitored and maintained by the Department of Sustainability and Environment.

Groundwater levels are measured quarterly in February, May, August and November in over 100 State observation bores by the Department of Sustainability and Environment (DSE) (Figure 1**Error! Reference source not found.**). Goulburn-Murray Water undertakes additional monitoring in key State observation bores identified in the Rules to capture monthly measurements.

Plots of the change in groundwater levels over time from these key bores are presented in Appendix A. Goulburn-Murray Water also plots the change in groundwater levels over time and posts it on its website (http://www.g-mwater.com.au/) for the benefit of its customers.

Groundwater levels remained relatively steady across the Mid-Loddon GMA during 2011/12 with reduced seasonal drawdown observed in response to timely rainfall.

In the Moolort Zone, groundwater pumping around Locks Lane has a greater impact on groundwater levels, with seasonal drawdown of up to around 10 m, compared to around Baringhup-Havelock Road. Goulburn-Murray Water continues to closely monitor the development of groundwater resources in this area.

Groundwater recovery levels in the Laanecoorie-Serpentine Zone 1012 were generally consistent to those observed in 2010/11. Around 6 m of seasonal drawdown was observed in trigger bore 88214 in the north of the zone in 2011/12. This is significantly less than the seasonal drawdown of up to around 12 m seen during the dry years in the 2000s.

In the Jarklin Zone 1013 groundwater levels remain high following the 2010/11 floods and could cause water logging and land salinity problems.

3.1 Aquifer margin

Additional monitoring has been undertaken along an east-west section of Rothackers Road to assess groundwater level response at the margins of the Mid-Loddon GMA.

In this area, domestic and stock users have been concerned about reduced access and yield.

Groundwater levels from bores 36415, 36416 and 36458 show little seasonal variation suggesting that they are not well connected to the deep lead (Appendix A). Groundwater levels in these bores have remained relatively steady since the 2010/11 floods.

This is supported the interpretation that shallow domestic and stock bores (ranging from 12 to 40 m depth) in this region are poorly connected to the deep lead.

In February 2012 the East Loddon Pipeline was officially opened providing year-round water supply to more than 107 town and rural water users across a 37,000 hectare region and the small townships of Jarklin and Serpentine. This includes supply to domestic and stock users on the margin of the Mid-Loddon WSPA.

The pipeline ensures a more reliable and better quality domestic and stock supply than the old East Loddon channel scheme, where customers did not receive a supply for five years due to the drought, and reduces reliance on groundwater for domestic and stock use on the margin of the Mid-Loddon GMA around Serpentine.

3.2 North-south section

Groundwater levels from key observation bores along a north-south section are monitored monthly to assess aquifer response against historical observations. Figure 7 illustrates that the system response has been consistent over time.

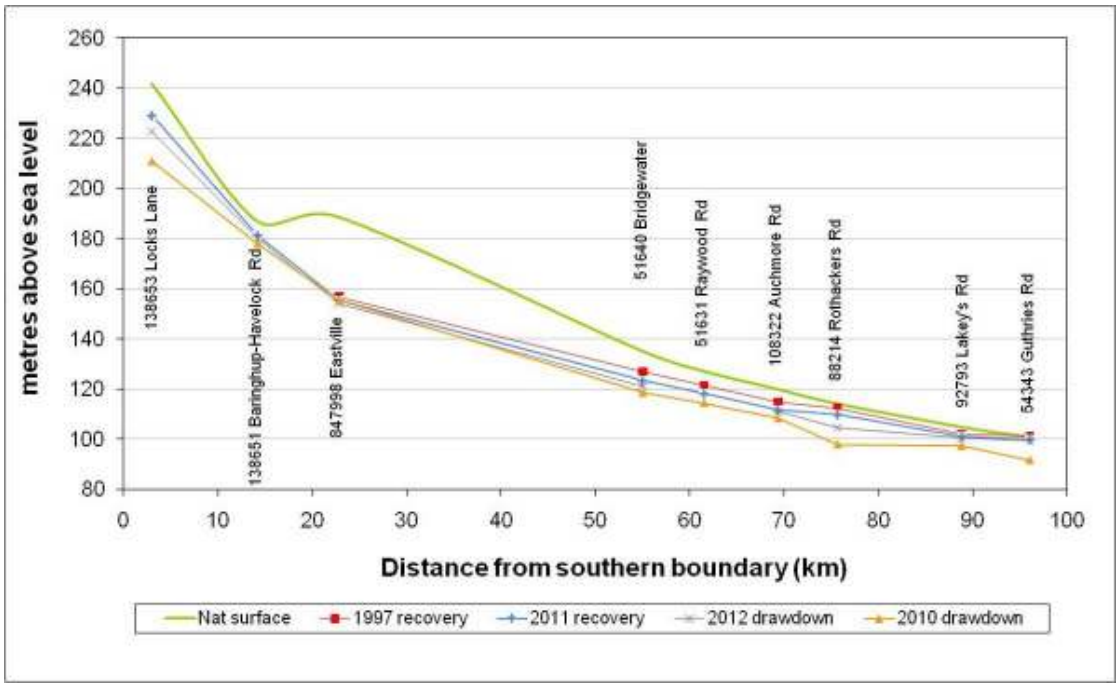


Figure 7 Groundwater level down valley from Moolort

4 Monitoring groundwater quality

4.1 State observation bores

Goulburn-Murray Water undertook a sampling program on all recently installed State observation bores as part of the Department of Sustainability and Environment funded State Observation Bore Network (SOBN) Refurbishment Program.

The sampling program included analysis of ten bores in the Mid-Loddon GMA.

Sampling was also undertaken from bore 88214 as required under the Rules, along with nested shallow bores 88238 and 88239 screened in the Shepparton Formation. Bore 54343 was not sampled as it is reported that it is not functioning correctly. It is considered that bore WRK059856 is a suitable replacement.

Groundwater salinity (EC) ranged between 2,730 and 21,400 EC (Table 2).

Table 2 Groundwater quality in Mid-Loddon GMA

Bore	Zone	Formation	Groundwater EC
WRK059854	Jarklin	Shepparton	3430
WRK059855	Jarklin	Shepparton	4080
WRK060332	Jarklin	Calivil	3310
WRK060333	Jarklin	Shepparton	3300
WRK059856	Jarklin	Calivil	3750
WRK059857	Jarklin	Calivil	3650
WRK060334	Jarklin	Shepparton	21,400
WRK061075	Laanecoorie –Serpentine	Shepparton	4300
SP068234	Moolort	Newer Volcanics	5290
SP068235	Moolort	Calivil	2750
88214	Laanecoorie –Serpentine	Calivil	2730
88238	Laanecoorie –Serpentine	Shepparton	6280
88239	Laanecoorie –Serpentine	Shepparton	2850

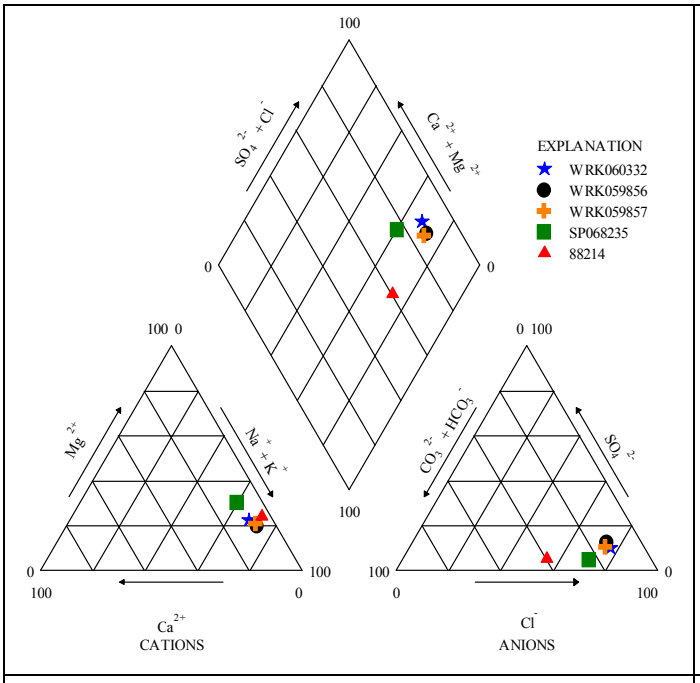
Source: Department of Sustainability and Environment, 2011 sampling results ref DM3296469.

A chemical analysis was undertaken on all samples for salinity, major ions and metals by a National Association of Testing Laboratories accredited laboratory to ensure confidence in the results.

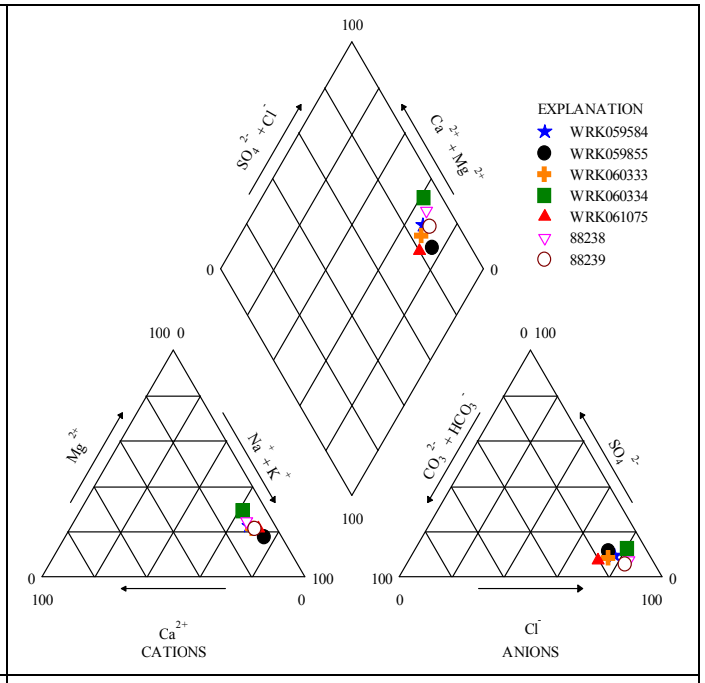
Figure 8 shows the results of the chemical analysis on piper plots for the bores screened in the Calivil Formation, Shepparton Formation and the Newer Volcanics respectively.

Piper plots display the relative chemical concentrations of the major ions (cations, anions and combined properties) found in the groundwater as a percentage of milliequivalents per litre.

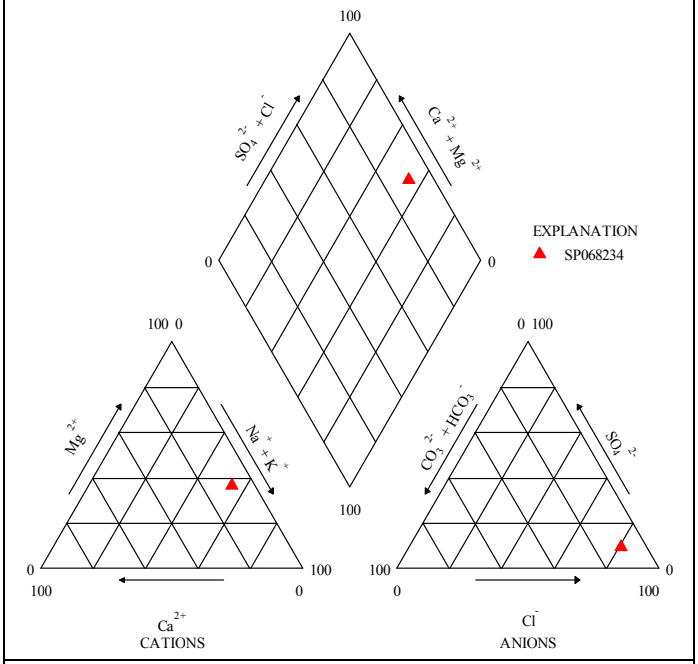
The analysis found that the groundwater in all three aquifers is of Sodium Chloride (NaCl) type across the Mid-Loddon GMA with no distinct trend in the change of concentration along the dominant groundwater flow path.



(a) Calivil Formation



(b) Shepparton Formation



(c) Newer Volcanics

Figure 8 Piper plots of groundwater chemistry

Ongoing analysis of bore 88214 for major ions indicates there is no significant shift in groundwater quality in the Calivil Formation; however intermittent results suggest chloride concentrations have increased in recent years (Figure 9).

The increase in chloride concentration of bore 88214 correlates with an observed increase in the groundwater electrical conductivity, an indication of salinity levels, over the same period (Figure 10).

The high recharge events experienced during this period may have resulted in an increase in the salt mobilisation from the upper Shepparton Formation to the Calivil

Formation; however continued monitoring of groundwater chemistry over time will enable trends to be better identified and understood.

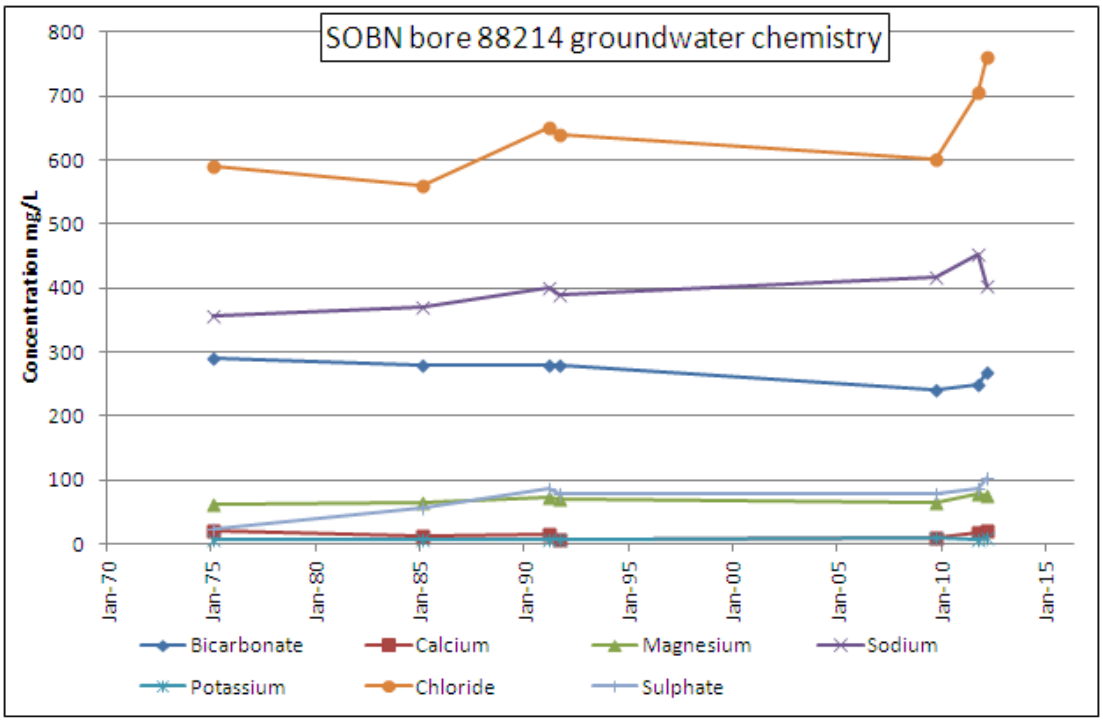


Figure 9 Major ions analysis over time of SOBN bore 88214

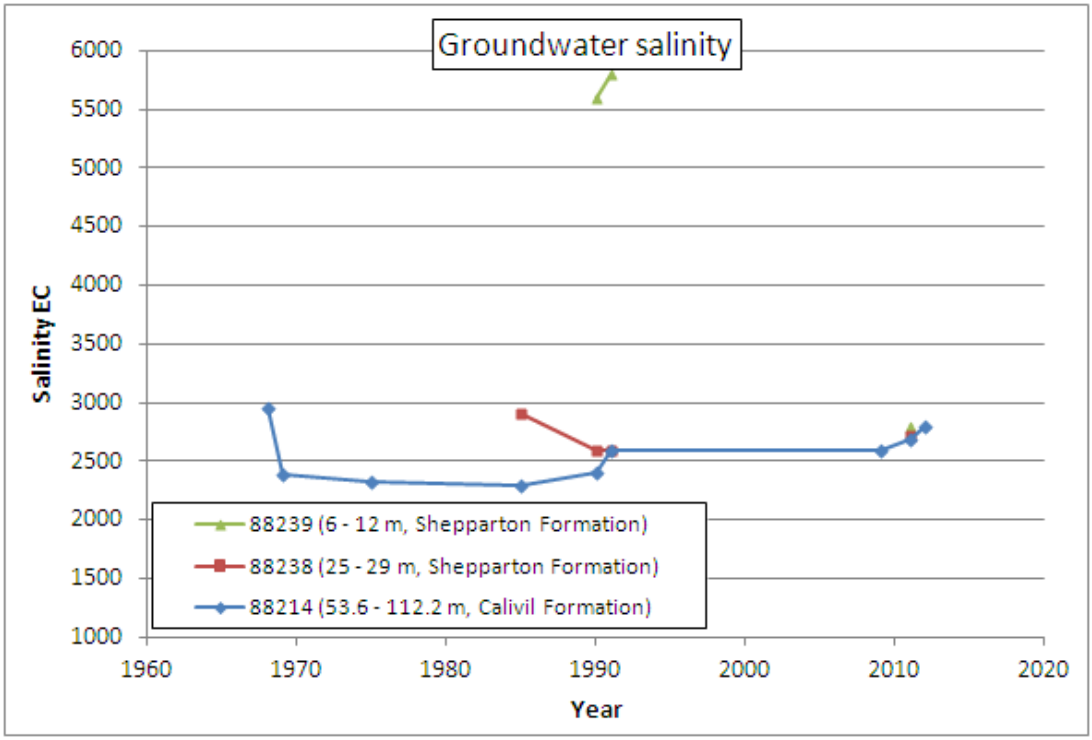


Figure 10 Groundwater salinity of bores 88214, 88238 and 88239

The Department of Sustainability and Environment has also undertaken Flood Recovery Works on the State Observation Bore Network, which included sampling from some bores in the Mid-Loddon GMA. Bartley Consulting Pty Ltd (2012)

identified that there is a trend of increasing groundwater salinity in the Calivil Formation in the northern Mid-Loddon GMA. It was noted that there are a range of possible causes for the apparent salinity trends that warrant further evaluation.

The results highlight the importance of continued monitoring under the Rules to assist with interpretation of changes groundwater quality.

4.2 Private bores

Goulburn-Murray Water provided sample bottles to all groundwater licence holders, and any stock and domestic users upon request, measured the salinity of returned samples and provided the results back to the individuals that supplied samples.

Only fourteen groundwater samples were returned for analysis during the 2011/12 irrigation season, which is a decline in the number provided in previous seasons (Table 3).

Groundwater salinity was found to range between around 1,400 and 9,390 EC with a median of 2,190 EC (Figure 11). This is within expected ranges as demonstrated by the comparison to the salinity of the Calivil Formation as mapped by the Murray Darling Basin Commission (MDBC, 2000).

Table 3 Salinity results for the returned samples

Zone	Number of samples provided	Salinity range EC µS/cm
1011 Moolort	4	1,621 – 3,020
1012 Laanecoorie-Serpentine	8	1,400 – 2,970
1013 Jarklin	2	3,390 – 9,390

Despite insufficient information to accurately assess groundwater salinity trends, the data provided suggests that groundwater is more saline in the north.

A greater return rate would further improve the spatial understanding of groundwater salinity in the Mid-Loddon GMA. Continued return of samples will enable trends in groundwater quality to be observed.

Groundwater users are strongly encouraged to return samples so that they can monitor any change in groundwater salinity from their bore.

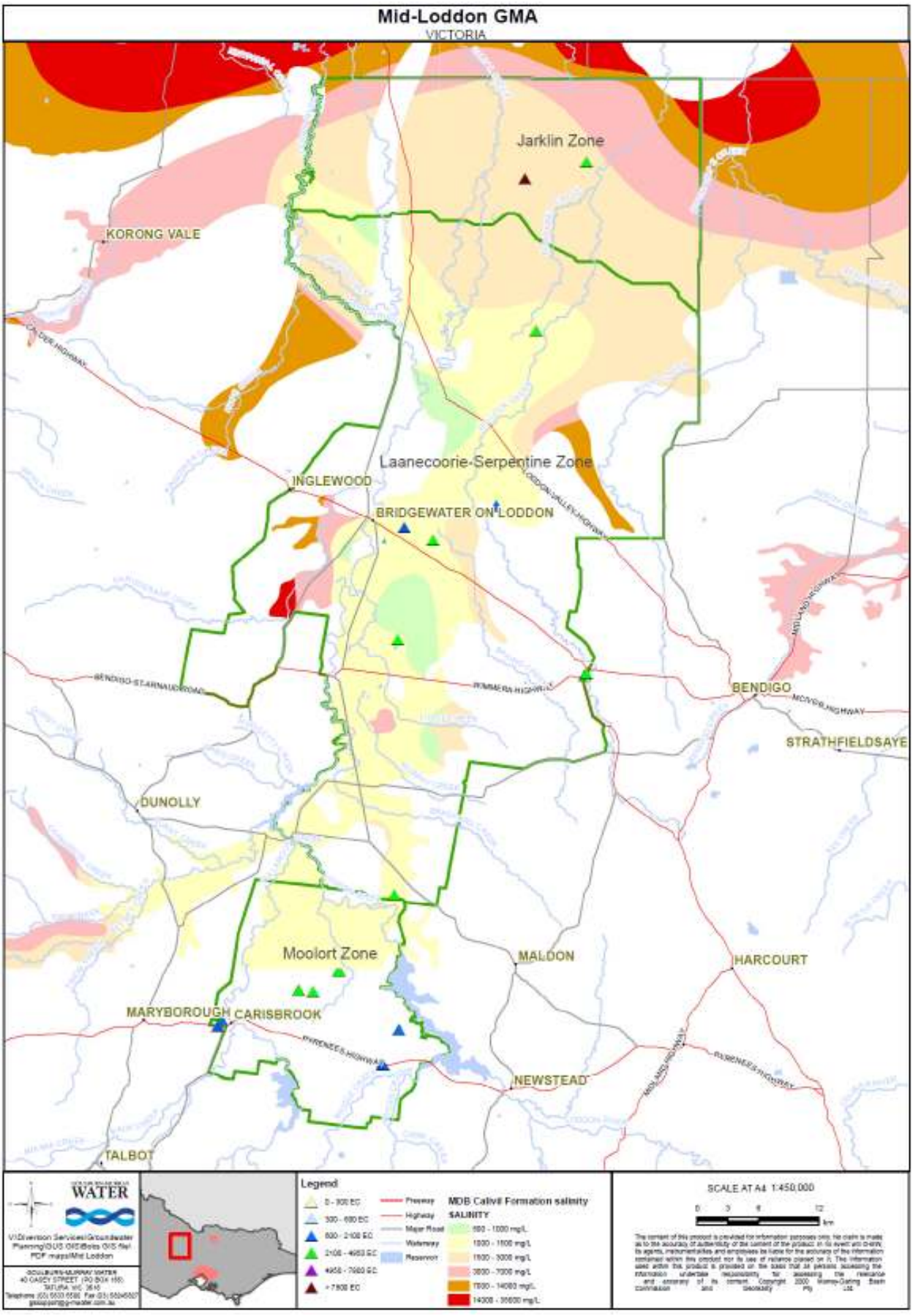


Figure 11 Groundwater salinity of samples returned from private bores

5 Review of local management rules

Goulburn-Murray Water met with the Mid-Loddon GMA Groundwater Reference Committee on 30 August 2012 to review the Rules and consider the need for any amendments.

The ability to amend the Rules to reflect changes in policy or an improved technical understanding of the groundwater systems is one of the key strengths of the Rules. At the Groundwater Reference Committee meeting the following items were discussed:

- Resource status
- Policy development
- Technical investigations
- Any need to amend the Rules

Some of the key points are discussed below.

5.1 Policy development

5.1.1 Carryover

An amendment to the Victorian Water Act in 2010 allows for the Minister for Water to make a declaration for licence holders in a particular management area to use carryover volumes subject to the conditions outlined in the declaration. Under section 62(A), the Minister for Water signed a declaration to authorise carryover usage in the Mid-Loddon GMA in March 2012.

As outlined in chapter 2.5 of this report, licence holders in the Mid-Loddon GMA are no longer required obtain approval from Goulburn-Murray Water before using carryover volumes so long as the water is extracted in accordance with licence conditions. In some cases the licensed extraction rate may limit the ability of a licence holder to extract carryover volumes. In this case a licence holder may apply to Goulburn-Murray Water to increase the licence extraction rate if required.

5.1.2 Murray Darling Basin Plan

The impacts of the impending Murray Darling Basin Plan are not yet well known.

5.1.3 Sustainable Water Strategies

The Western and Gippsland Region Sustainable Water Strategies were released in November 2011 and provide greater detail on the development of local management plans and consideration of groundwater dependent ecosystems that can be incorporated into a review of the Rules (DSE, 2011a, 2011b).

5.1.4 Improving management of Victoria's groundwater resources

The Department of Sustainability and Environment released a policy paper which provides State-wide approach for managing groundwater resources (DSE, 2011c). The paper describes State policy changes to the establishment of management boundaries with emphasis placed on better aligning boundaries with the extent of groundwater systems. These policy changes should be considered when reviewing the Rules.

5.1.5 Review of Water Act

A review of the Victorian Water Act 1989 is currently being undertaken. It is not yet certain if this will have any impacts on the Rules.

5.1.6 Loddon Highlands Water Supply Protection Area

A draft groundwater management plan has been prepared for the Loddon Highlands Water Supply Protection Area (WSPA). This plan is currently being considered by the Minister for Water.

The Loddon Highlands WSPA groundwater management plan provides opportunity for the transfer of groundwater entitlement between the Mid-Loddon GMA and Loddon Highlands WSPA.

It has also been recognised that there may be opportunity for improvement to the Rules based on learning from more recently developed groundwater management plans. In particular, there may be opportunity to further refine Rule 3 (managing the intensity of groundwater extraction) to manage drawdown in the Moolort Zone and provide greater flexibility in the north. These matters will be considered as part of a review of the Rules.

5.2 Technical investigations

5.2.1 Aquifer mapping

Building on work undertaken by G-MW to map aquifers in the Loddon and Campaspe catchments, DSE has now mapped aquifers across the State.

Some of the outcomes from this work, as well as other useful groundwater data, can be viewed at the following website:

http://www.vvg.org.au/cb_pages/disclaimer.php

This information is an effective tool for communicating groundwater information with users and could be useful in the review of the Rules.

5.2.2 Groundwater dependent ecosystem mapping

Goulburn-Murray Water commissioned a project to identify potential riparian groundwater dependent ecosystems (GDEs) in the Loddon and Campaspe catchments. The project, which involved consultation with the Department of Sustainability and Environment and the North Central Catchment Management Authority is now complete.

Potential riparian GDEs where identified at several locations across the Mid-Loddon GMA including along the Loddon River and Tullaroop Creek in the south and along Bullock and Pompapiel Creeks in the north (Figure 12).

Further detailed field investigations to confirm the presence and value of potential GDEs are required to better understand how GDEs may be considered in future groundwater management. The outcomes from this investigation are to be considered as part of a review of the Rules.

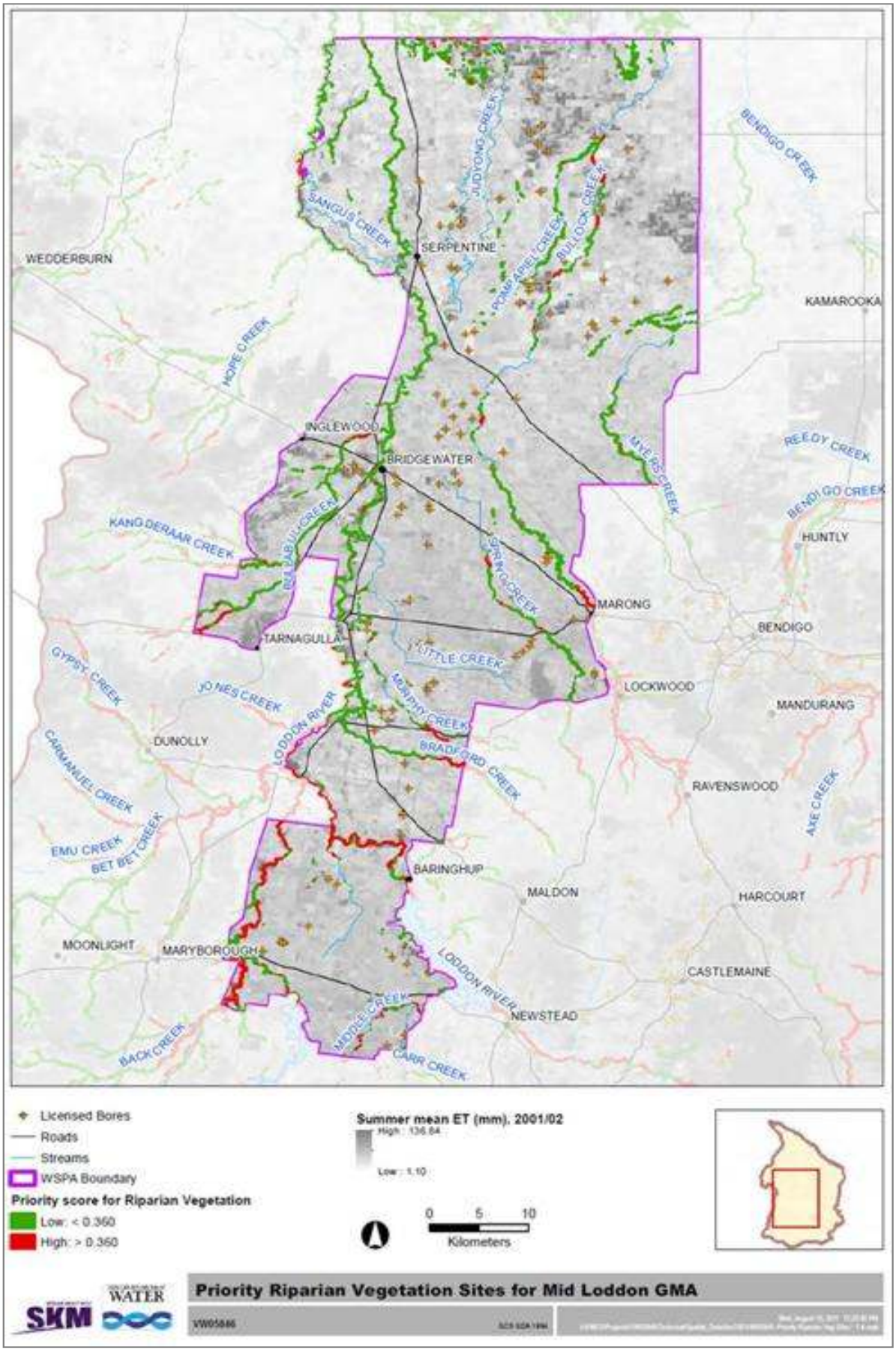


Figure 12 Potential Groundwater Dependent Ecosytems in Mid-Loddon GMA

5.2.3 Improved licensed bore location information

G-MW has undertaken a project to improve the accuracy of licensed bore location. This information will enhance G-MW's ability to manage groundwater resources and will be used in all future licensing and resource planning work.

5.3 Any need to amend Rules

The Groundwater Reference Committee noted that there may be some opportunity for improvement in the Rules, but there was a consensus that there is no need to adjust the Rules at present. Rather, these opportunities should be investigated as part of a comprehensive and programmed review of the Rules in 2014.

6 References

Bartley Consulting Pty Ltd 2012 State Groundwater Monitoring Network Flood Works Program 2011-12, Overview Report for the Department of Sustainability and Environment.

Department of Sustainability and Environment, 2011a. Western Region Sustainable Water Strategy. Victorian State Government, Melbourne.

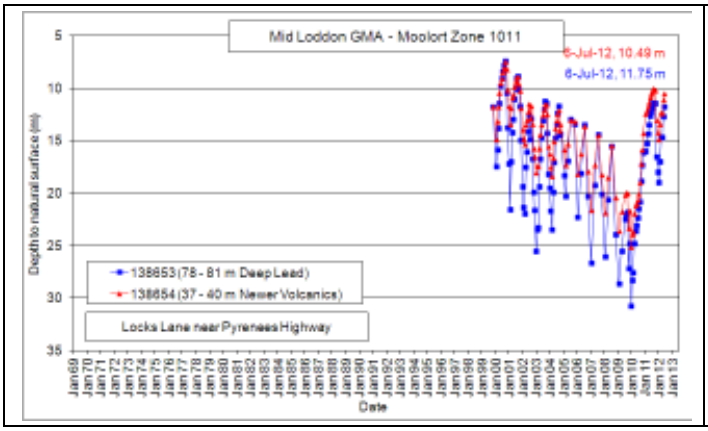
Department of Sustainability and Environment, 2011b. Gippsland Region Sustainable Water Strategy. Victorian State Government, Melbourne.

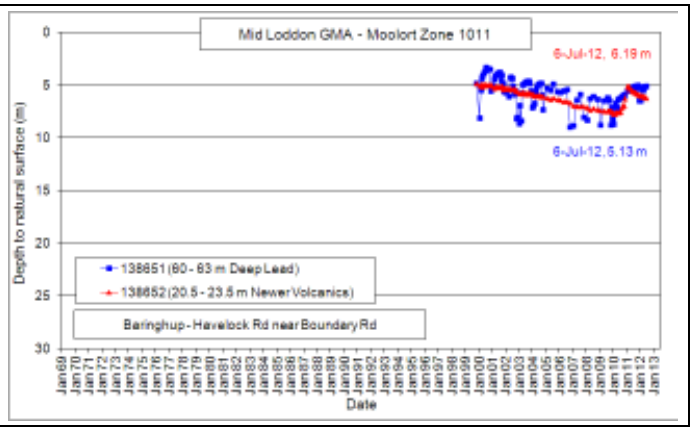
Department of Sustainability and Environment, 2011c. Policy Paper. Improving management of Victoria's groundwater resources. Victorian State Government, Melbourne.

Murray-Darling Basin Commission 2000 Murray-Darling Basin Mapping: Basin-in-a-box. Set A- Small regional dataset. Australia.

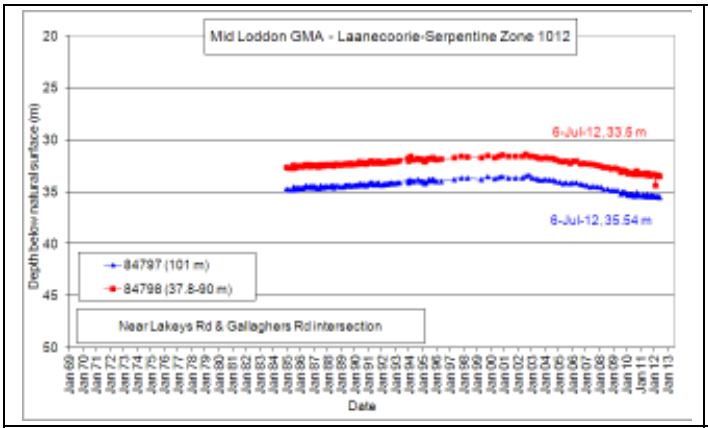
Appendix A

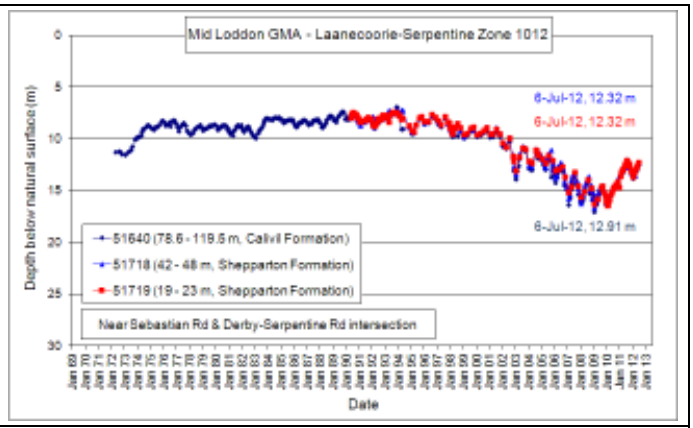
Moolort Zone 1011

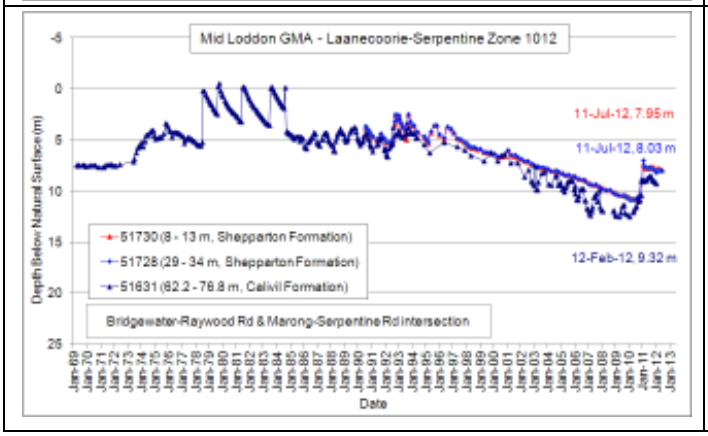


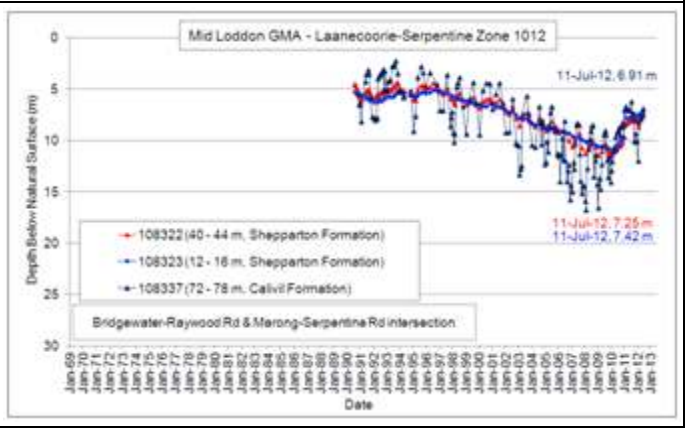


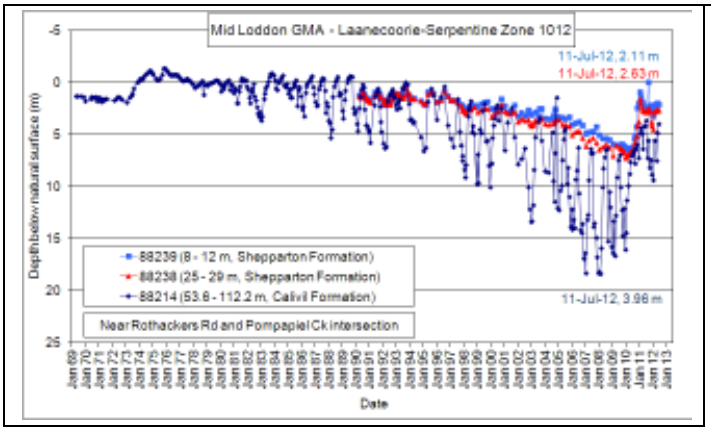
Laanecoorie-Serpentine Zone 1012



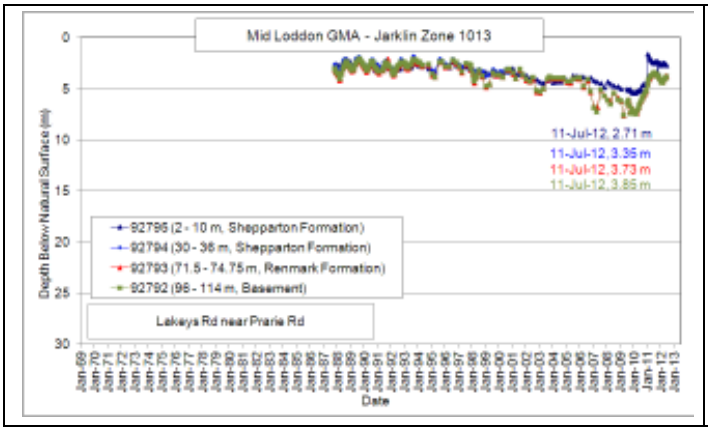


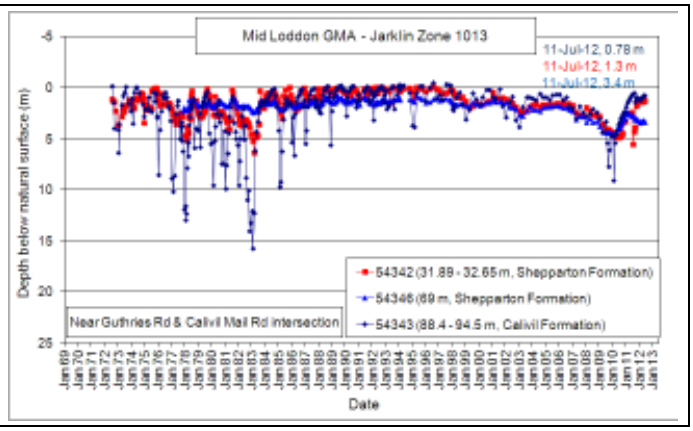






Jarklin Zone 1013





Shallow monitoring bores along Rothackers Road