Loddon Highlands
Water Supply Protection Area
Groundwater Management Plan

Annual Report

For year ending 30 June 2018

Document Number: A3330398
Version: Final

Document History and Distribution

Versions

Version	Date	Author(s)	Notes
Draft	10 August 2018	Jock Richardson	Document creation and drafting
Draft	17 August 2018	Brendan Cossens	Document edits and review
Draft	20 August 2018	Jock Richardson	Document edits post review
Draft	22 August 2018	Karina Joy	Peer review
Final	23 August 2018	Jock Richardson	Document edits post review
Final	30 August 2018	Matthew Pethybridge	Document review and edits to incorporate feedback from DELWP
Final	12 September 2018	Karina Joy	Document review and edits to incorporate feedback from Scott Barber

Distribution

Version	Recipient(s)	Date	Notes
Draft	Brendan Cossens	16 August 2018	Peer review
Final	Karina Joy	22 August 2018	Peer review
Final	Matthew Pethybridge	27 August 2018	Review and endorsement
Final	Patrick O'Halloran (DELWP)	27 August 2018	Review and comment
Final	Mark Bailey	3 September 2018	Review and endorsement
Final	Scott Barber	11 September 2018	Review and endorsement
Final	Pat Lennon	13 September 2018	Review and approval
Final	The Hon. Lisa Neville MP Minister for Water	21 September 2018	
Final	Mr Brad Drust Chief Executive Officer, North Central Catchment Management Authority	21 September 2018	

Foreword

Goulburn-Murray Water (GMW) is pleased to present the annual report for the Loddon Highlands Water Supply Protection Area Groundwater Management Plan (the Plan) for the 2017/18 water year.

GMW is responsible for the implementation, administration and enforcement of the Plan which was approved by the Minister administering the *Water Act 1989* (the Minister) on 21 November 2012.

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

This report provides an overview of the groundwater management activities administered under the Plan during the 2017/18 water year.

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

Pat Lennon

MANAGING DIRECTOR

Date 18/09/2018

Executive summary

The Loddon Highlands Water Supply Protection Area Groundwater Management Plan was approved on 21 November 2012 by the Minister for Water.

The 2017/18 water year marks the sixth year of operation of the Plan.

Annual allocations for the 2017/18 water year were 100 per cent in all management zones of the Loddon Highlands Water Supply Protection Area (WSPA), with the exception of the Newlyn Zone where an annual allocation of 75 per cent was declared.

Recorded use in the Loddon Highlands WSPA in 2017/18 was 7,214.9 ML, or 35 per cent of the total licensed volume, which is slightly above the average since Plan approval.

There was moderate trade activity during the 2017/18 water year; eight temporary licence transfers totalling 302 ML and five permanent transfers totalling 24 ML/year.

Licence holders in the Loddon Highlands WSPA are entitled to carryover up to a maximum of 15 per cent of their unused licensed volume for use in the subsequent water year. A total of 2,930.1 ML has been carried over for use in the 2018/19 water year.

Although the Loddon Highlands WSPA received below-average rainfall during the 2017/18 water year, groundwater recovery levels were generally similar to 2016/17. Groundwater levels were buoyed by strong spring recovery during the 2016/17 water year, resulting from above-average rainfall and low groundwater use.

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

GMW is currently undertaking a review of the Plan to assess the success of the Plan and the need for any amendments.

Contents

1 Introduction

1.1 Purpose

This annual report provides an overview of groundwater resource status and use in the Loddon Highlands Water Supply Protection Area (WSPA) throughout the 2017/18 water year (1 July 2017 to 30 June 2018).

1.2 Water Supply Protection Area

The Loddon Highlands WSPA, declared in June 2010, extends from Newlyn and Learmonth in the south to Dunolly in the north, and includes the townships of Creswick, Waubra, Clunes, Talbot and Maryborough.

The Loddon Highlands WSPA incorporates groundwater resources to all depths.

There are seven management zones in the Loddon Highlands WSPA: Ullina Zone (1000), Talbot Zone (1101), Ascot Zone (1102), Mollongghip Zone (1103), Blampied Zone (1104), Waubra Zone (1106) and Newlyn Zone (1107), as shown in Figure 1.

1.3 Groundwater Management Plan

The Groundwater Management Plan for the Loddon Highlands WSPA (the Plan) was approved on 21 November 2012 by the Minister for Water, in accordance with section 32A(6) of the *Water Act 1989* (the Act).

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:

- Manage groundwater resources to protect groundwater users and the environment.
- Enable equitable access of groundwater resources to realise the potential for its use.
- Provide effective and transparent communication of Plan objectives, management rules and resource status.

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

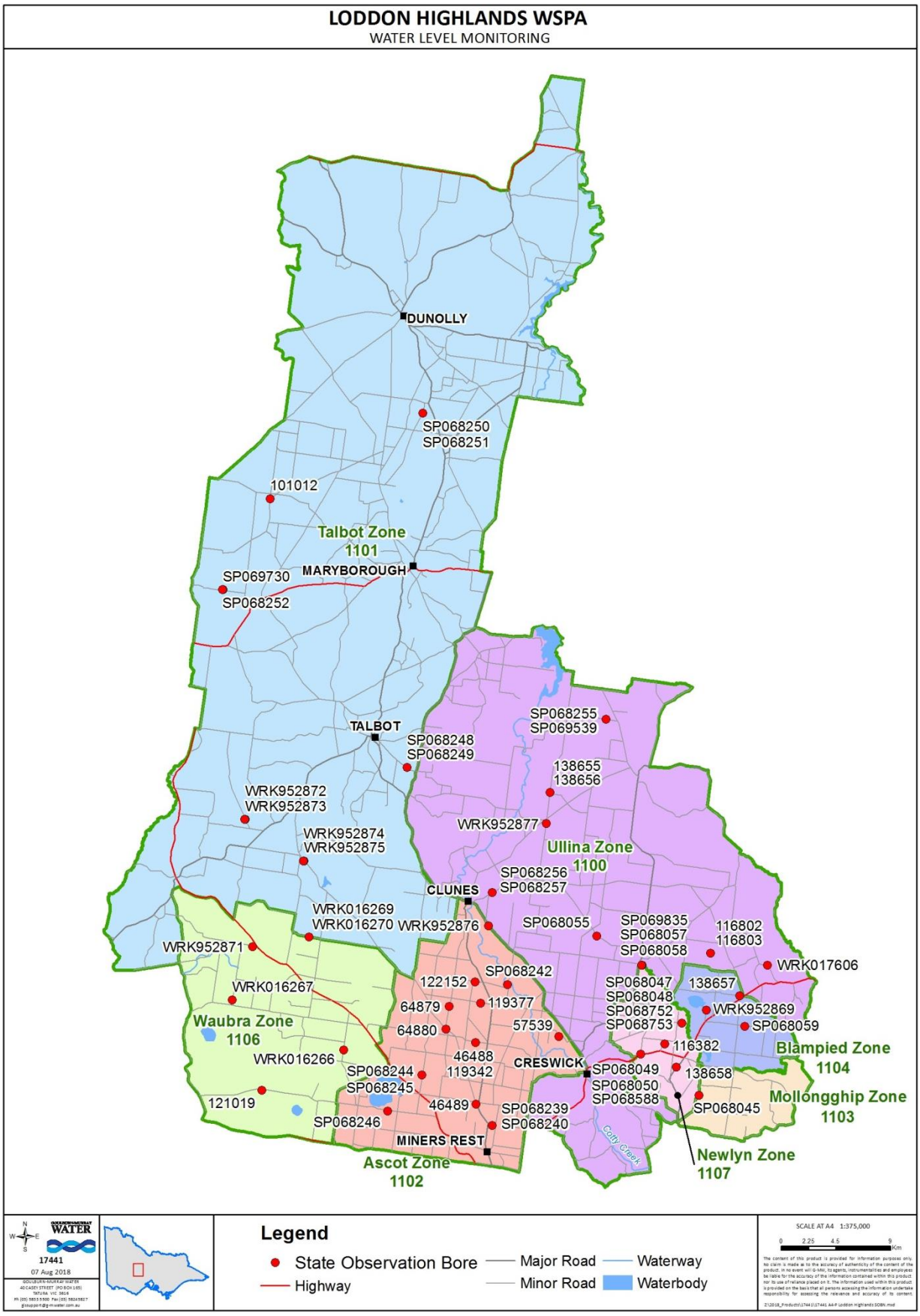


Figure 1 Loddon Highlands Water Supply Protection Area

2 Groundwater Management

2.1 Licensed volume

The Minister declared the Permissible Consumptive Volume of 20,697 megalitres per year (ML/year) for the Loddon Highlands WSPA in March 2013 (Victorian Government Gazette, 2013).

At 30 June 2018 licensed volume in the Loddon Highlands WSPA was 20,501.6 ML/year (Table 1). This is a reduction of 5 ML/year since 30 June 2017 which is due to the cancellation of one licence in the Talbot Zone during the 2017/18 water year.

Table 1 Groundwater licensed volume in the Loddon Highlands WSPA in 2017/18

Management zone	Licences	Licensed bores	Licensed volume (ML/year)
Ullina Zone – 1000	20	26	2,982.2
Talbot Zone – 1101	11	13	1,195.7
Ascot Zone – 1102	66	101	7,067.2
Mollongghip Zone – 1103	3	7	328.0
Blampied Zone – 1104	22	27	1,252.5
Waubra Zone – 1106	31	63	4,702.8
Newlyn Zone – 1107	26	46	2,973.2
Total	**179**	**283**	**20,501.6**

Note: Data extracted from the Victorian Water Register 2 July 2018.

2.2 Groundwater allocations

Annual groundwater allocations in the Loddon Highlands WSPA are determined by comparing average maximum groundwater recovery levels from key State observation bores against trigger levels outlined in Prescription 3 of the Plan.

Annual allocations are to be announced by 15 September of each year based on groundwater level readings measured in August of the same year. Allocations may be reviewed based on groundwater levels to November and allocations may be increased if there is sufficient recovery.

The State observation bores used to determine seasonal allocations in each management zone are listed in Table 2 and shown in Figure 1.

Table 2 State observation bores used to determine annual allocations in the Loddon Highlands WSPA

Management zone	Bore number
Ascot Zone – 1102	64879, 64880, 122152, 119377, 119342
Blampied Zone – 1104	138657
Waubra Zone – 1106	WRK016266, WRK016267, WRK016269
Newlyn Zone – 1107	138658, 116382

Trigger levels have been established in the Ascot, Blampied, Newlyn and Waubra management zones under the Plan because of:

- high density of licenses
- historical seasonal drawdown
- greater rates of groundwater level decline during dry periods.

Allocations for the 2017/18 water year were first announced on 12 September 2017. Six of the seven management zones started the water year with 100 per cent allocations. Only the Newlyn Zone was subject to restrictions on the take and use of groundwater, with an allocation of 75 per cent. This remained unchanged for the year as there was not sufficient recovery to trigger a higher allocation (Figure 2 to Figure 5).

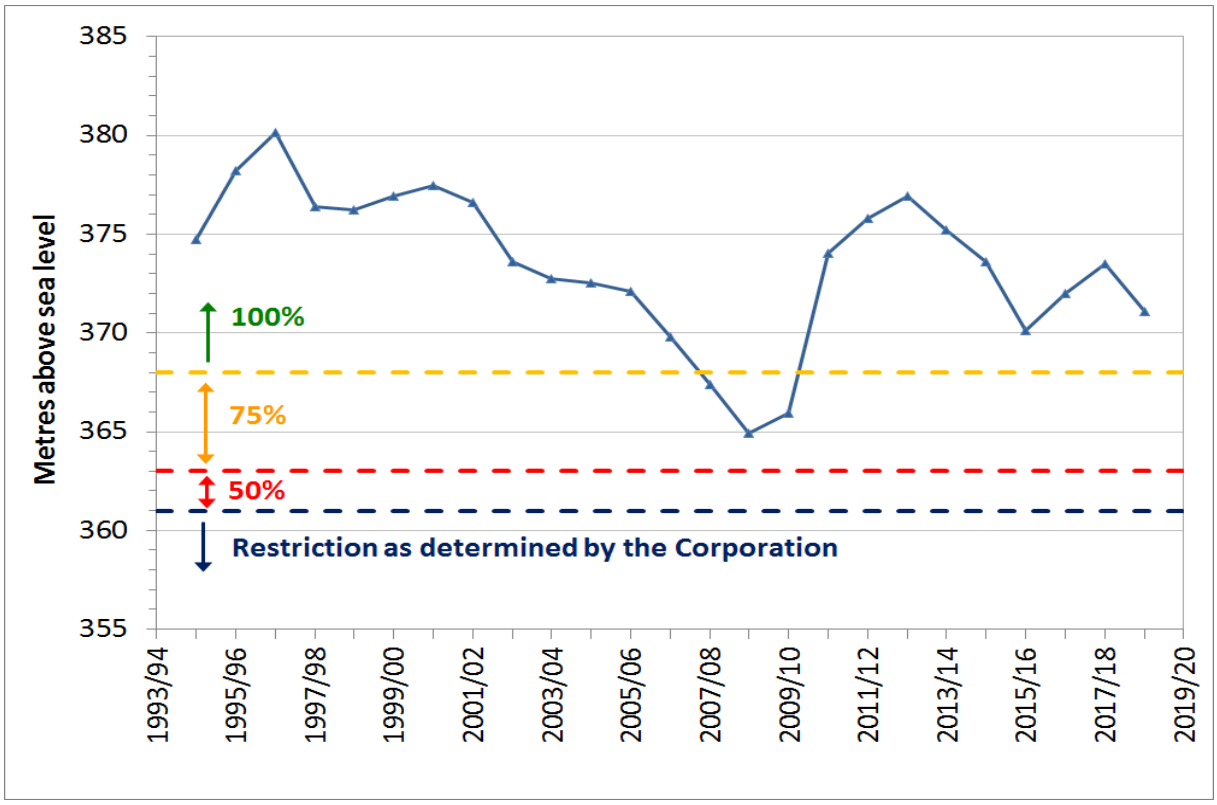


Figure 2 Trigger levels to determine allocations in the Ascot zone of the Loddon Highlands WSPA

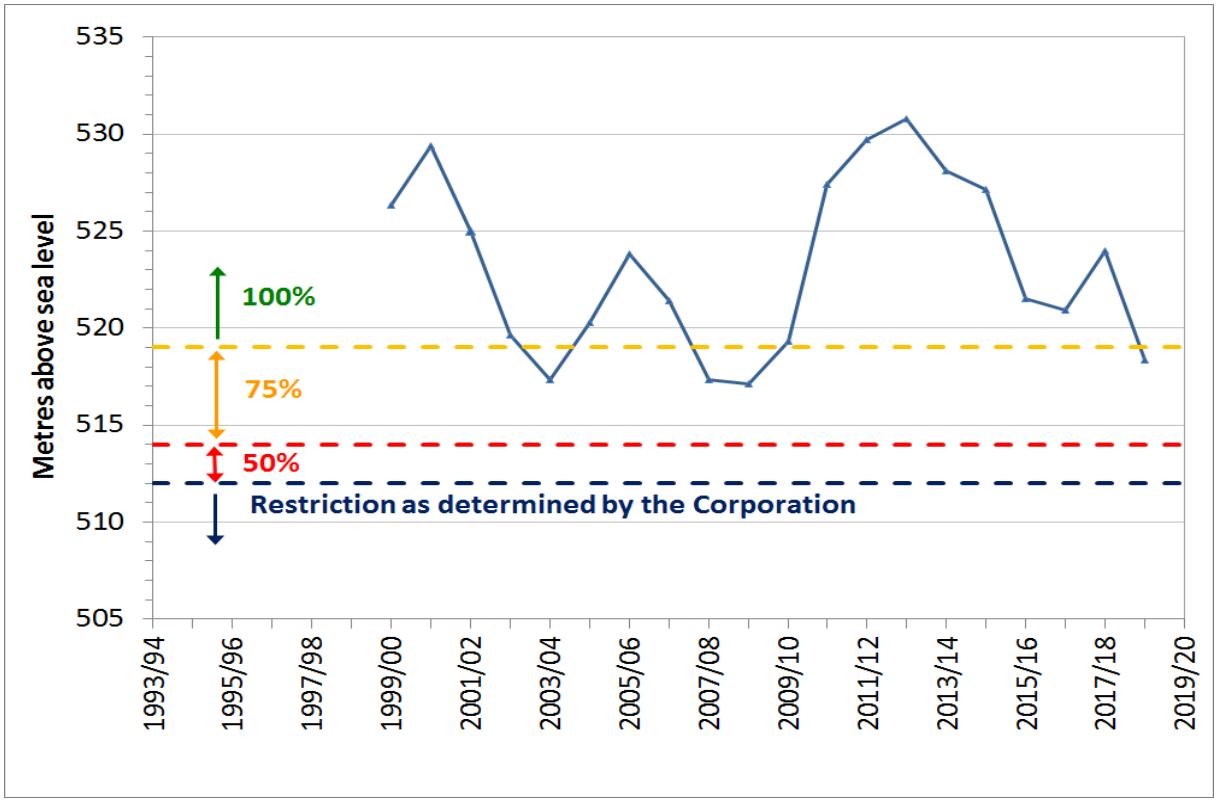


Figure 3 Trigger levels to determine allocations in the Blampied zone of the Loddon Highlands WSPA

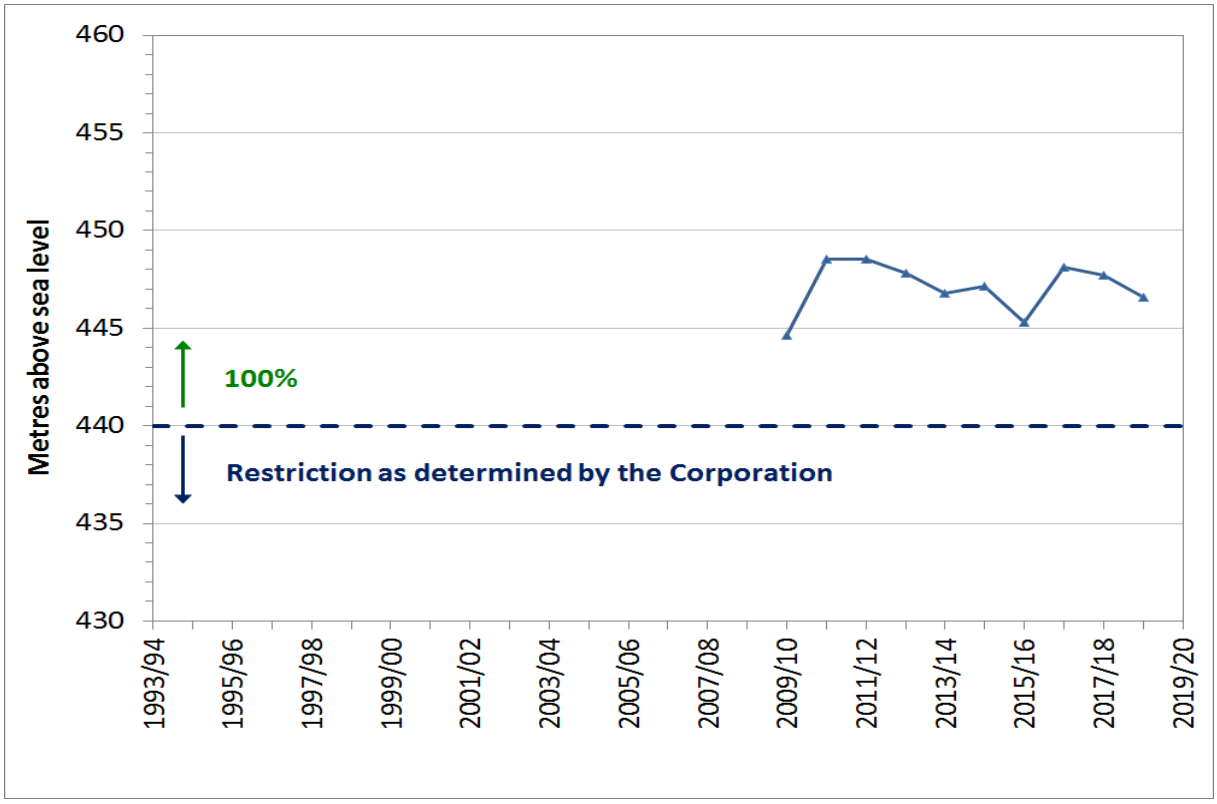


Figure 4 Trigger levels to determine allocations in the Waubra zone of the Loddon Highlands WSPA

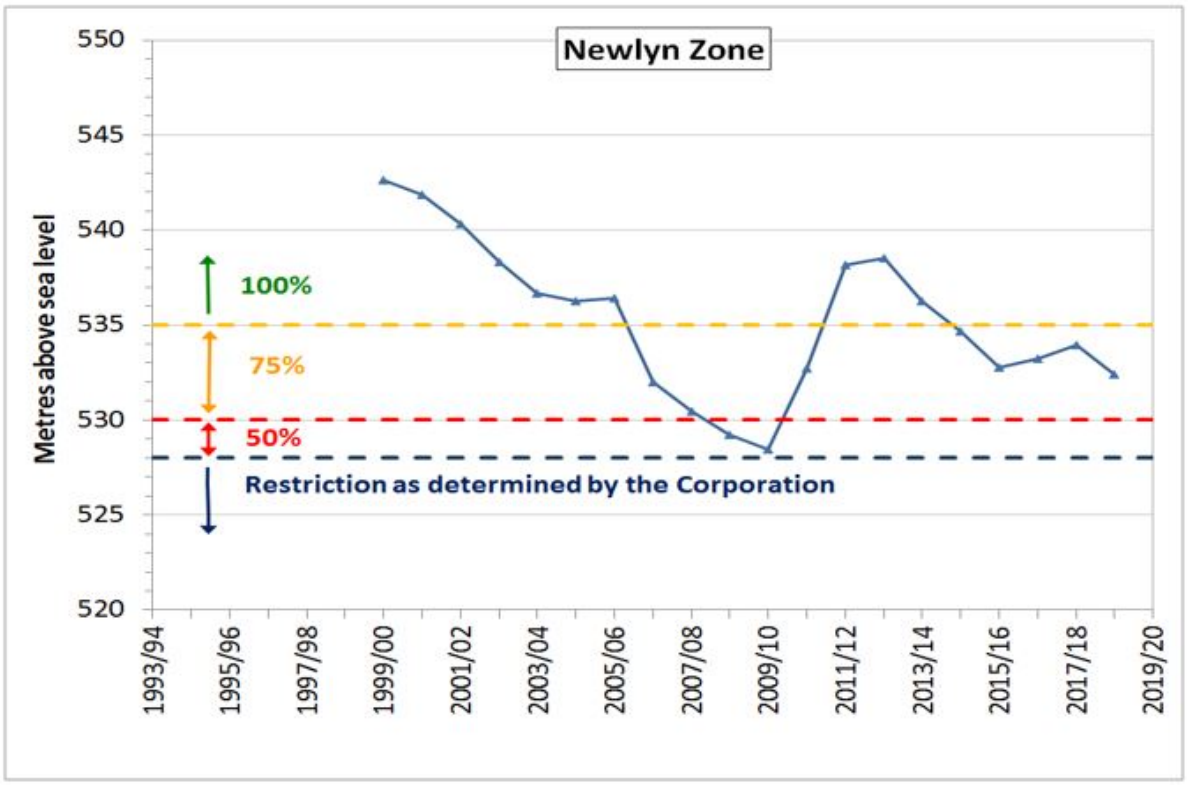


Figure 5 Trigger levels to determine allocations in the Newlyn zone of the Loddon Highlands WSPA

2.3 Groundwater use

Recorded use in the Loddon Highlands WSPA in 2017/18 was 7,214.9 ML, or 35 per cent of the total licensed volume, which is slightly above the average use since the Plan was implemented in 2012/13 (Figure 6). Note that recorded use refers to metered and deemed use.

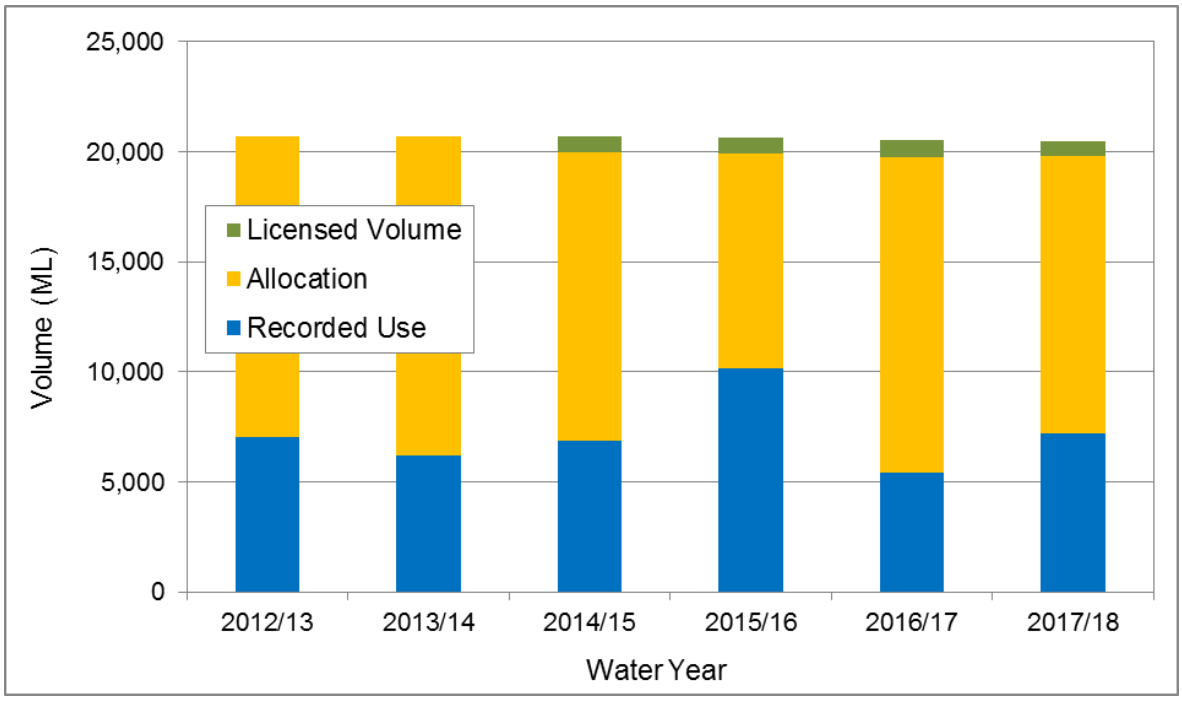


Figure 6 Total licensed volume, allocation and recorded use in the Loddon Highlands WSPA

Recorded use was highest in the Ascot Zone, where most licensed volume is held. Licence holders in the Blampied Zone used the greatest percentage of licensed volume (Table 3).

Table 3 Recorded use by Loddon Highlands WSPA management zone in 2017/18

Management zone	Licensed volume (ML/year)	Recorded use (ML)	Proportion of total licensed volume used
Ullina Zone – 1000	2,982.2	507.6	17%
Talbot Zone – 1101	1,195.7	378.7	32%
Ascot Zone – 1102	7,067.2	3,166.0	45%
Mollongghip Zone – 1103	328.0	104.6	32%
Blampied Zone – 1104	1,252.5	817.0	65%
Waubra Zone – 1106	4,702.8	1,263.9	27%
Newlyn Zone – 1107	2,973.2	977.1	33%
Total	**20,501.6**	**7,214.9**	**35%**

Note: Data extracted from Irrigation Planning Module on 13 July 2018.

2.4 Rainfall

Historical rainfall data sourced from the Bureau of Meteorology (BoM) weather station at Clunes is presented in Figure 7 as an indicator of trends across the Loddon Highlands 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 1999/2000 and 2008/09 annual totals were below-average (Millennium Drought) until significant rainfall events in 2009/10 and 2010/11.

With the exception of the 2016/17 water year, annual rainfall totals have been below average since the Plan was approved, resulting in reduced recharge to groundwater systems within the Loddon Highlands WSPA.

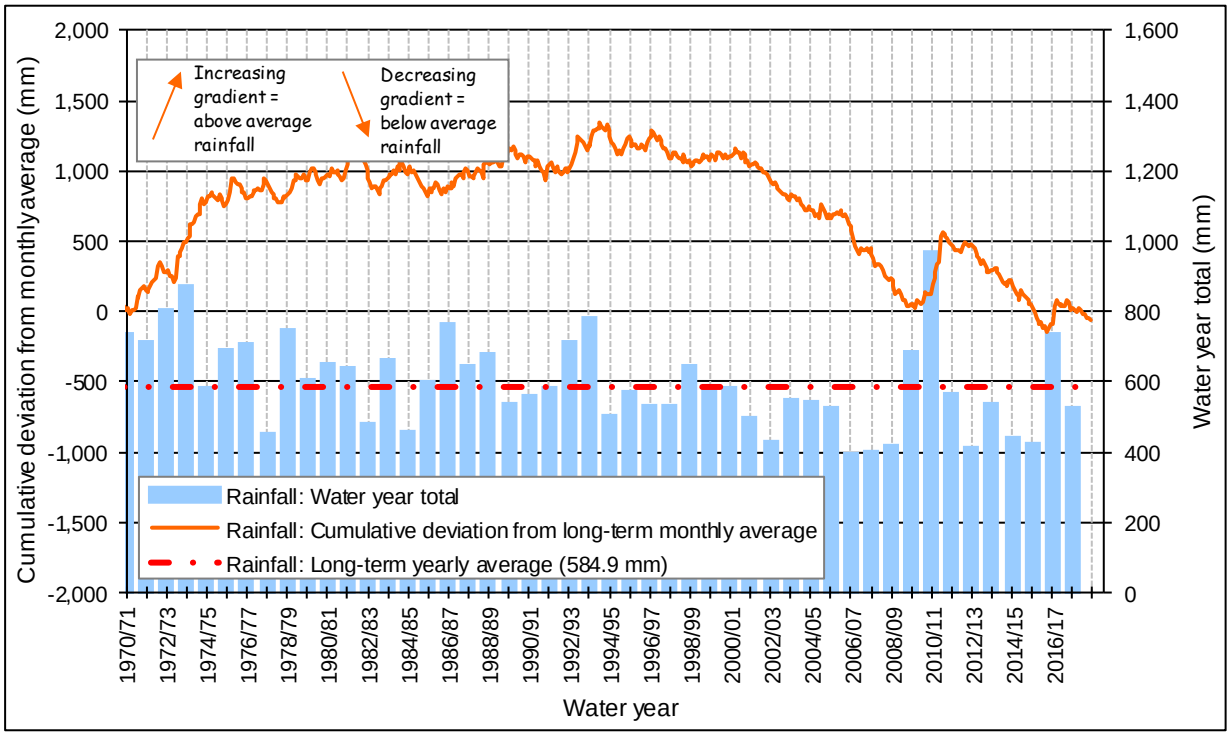


Figure 7 Rainfall recorded at Clunes (BoM weather station 088015) in the Loddon Highlands WSPA

2.5 Licence transfers

The Plan allows groundwater licence holders to temporarily or permanently transfer licensed volume. During the 2017/18 water year there were eight temporary transfer transactions for a total of 302 ML and five permanent transfer transactions for a total of 24 ML/year (Figure 8)

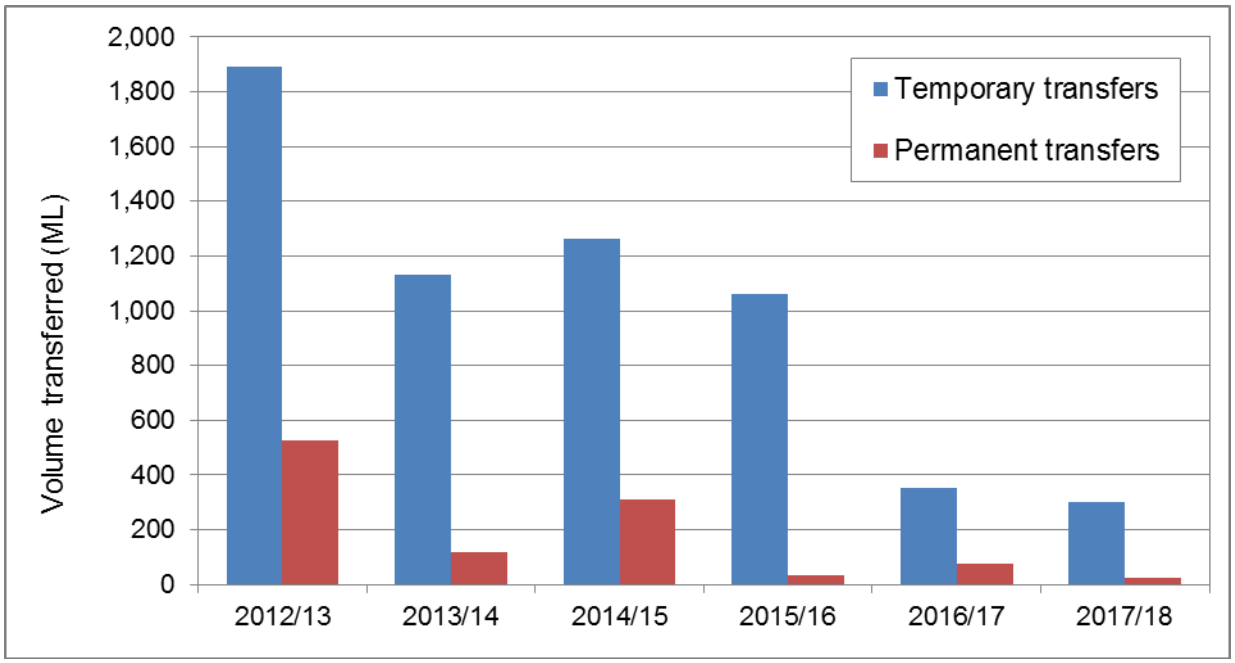


Figure 8 Total licensed volumes transferred in the Loddon Highlands WSPA

The majority of temporary transfers occurred within the same management zones (Table 4). There was one temporary transfer between management zones: 10 ML was transferred from the Newlyn Zone into the Ullina Zone.

There were three permanent transfers within the same management zone (Ascot Zone) and two permanent transfers between management zones: 5 ML/year was transferred from the Waubra Zone to the Talbot Zone, and 1 ML/year was transferred from the Ascot Zone to the Ullina Zone.

Table 4 Licence transfers in the Loddon Highlands WSPA in 2017/18

Management zone	Temporary transfers				Permanent transfers			
	Transfer from		Transfer to		Transfer from		Transfer to	
	No. of transfer	Volume (ML/yr)	No. of transfer	Volume (ML/yr)	No. of transfer	Volume (ML/yr)	No. of transfer	Volume (ML/yr)
Ullina Zone – 1000	0	0.0	1	10.0	0	0.0	1	1.0
Talbot Zone – 1101	0	0.0	0	0.0	0	0.0	1	5.0
Ascot Zone – 1102	2	94.0	2	94.0	4	19.0	3	18.0
Mollongghip Zone – 1103	0	0.0	0	0.0	0	0.0	0	0.0
Blampied Zone – 1104	2	106.0	2	106.0	0	0.0	0	0.0
Waubra Zone – 1106	2	62.0	2	62.0	1	5.0	0	0.0
Newlyn Zone – 1107	2	40.0	1	30.0	0	0.0	0	0.0
Total	**8**	**302.0**	**8**	**302.0**	**5**	**24.0**	**5**	**24.0**

2.6 Carryover

The Minister declared that groundwater licence holders in the Loddon Highlands WSPA were authorised to carryover up to a maximum of 15 per cent of licence volume in November 2012 (Victorian Government Gazette, 2012).

In 2017/18 there was a total of 2,936 ML carried over by licence holders in the Loddon Highlands WSPA.

At the conclusion of the 2017/18 water year, groundwater licence holders in the Loddon Highlands WSPA carried over 2,930.1 ML into the 2018/19 water year.

2.7 Metering

There were 238 metered service points, as well as four unmetered and 39 deemed service points, in the Loddon Highlands WSPA as at 30 June 2018. There were 210 meter-related activities undertaken during the 2017/18 water year, including inspections, maintenance and battery replacements (Table 5).

All meters were read at least twice during the 2017/18 water year.

Table 5 Metering activities in the Loddon Highlands WSPA in 2017/18

Metering activity	Year ending 30 June 2018
Total number of meters	238
Total number of meter reads	476
Meters installed or replaced	0
Meters inspection events	203
Meter maintenance events	7

2.8 Licence compliance

There were no prosecutions or convictions relating to groundwater matters in the Loddon Highlands WSPA during the 2017/18 water year.

There were 13 instances of overuse (i.e., licensed volume exceedance), two instances of unauthorised take of groundwater and one instance of unlicensed take and use of groundwater without consent identified in 2017/18. These incidents have 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).

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.

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

During the 2017/18 water year in the Loddon Highlands WSPA, 33 domestic and stock bore construction licences were issued by GMW and the Victorian Water Register (combined).

3 Monitoring Program

3.1 Groundwater levels

The Department of Environment, Land, Water and Planning (DELWP) monitored 59 bores from the State observation bore network on a quarterly basis in the Loddon Highlands WSPA during the 2017/18 water year (Figure 1).

GMW conducted monthly monitoring of the 34 key State observation bores identified in Schedule 1 of the Plan, where practicable (Appendix B).

Groundwater recovery levels were relatively steady during the late 1980s and early 1990s. From the mid-1990s to 2009 groundwater recovery levels declined, largely in response to below-average rainfall during the Millennium Drought. Groundwater levels responded strongly to above-average rainfall in 2010/11.

Groundwater levels have generally declined since approval of the Plan in 2012, largely in response to reduced rainfall recharge due to drier than average conditions, with the exception of 2016/17. Groundwater levels remain within historical ranges.

Seasonal drawdown during the 2017/18 water year was typically less than 10 m across the Loddon Highlands WSPA. In the Ascot Zone, where the greatest volume of groundwater was abstracted, drawdown up to 12.5 m was recorded in bore 64880 (Figure 9).

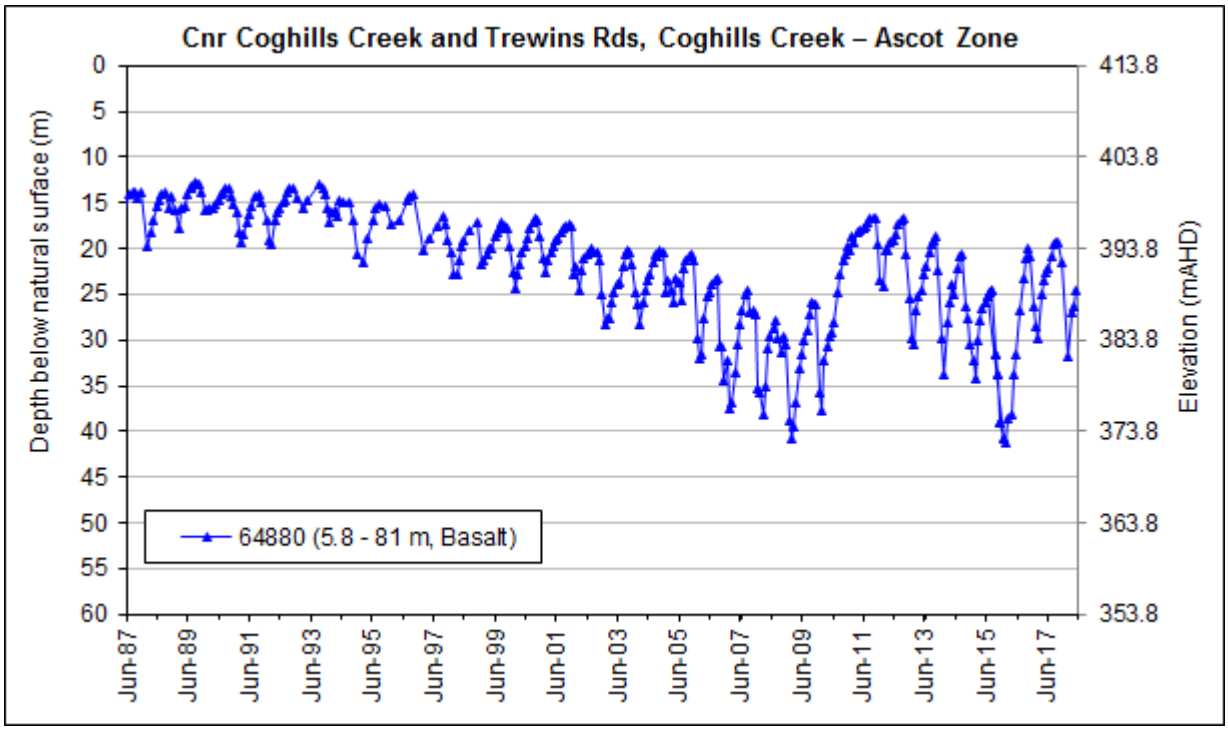


Figure 9 Groundwater mointoring in the Ascot zone in the Loddon Highlands WSPA

3.2 Groundwater quality

Groundwater quality monitoring was undertaken by collecting samples from two nested State observation bore sites in the Loddon Highlands WSPA. Nested sites feature two or more bores in close proximity, each monitoring a different aquifer. The State observation bore sites used for water quality

testing are located in the Talbot and Ullina management zones and monitor groundwater in both the Deep Lead and basalt aquifers.

Analytical chemistry results for these bores are presented in Appendix C. Time series groundwater salinity results, presented in Figure 10, indicate that groundwater salinity levels continue to be higher in the basalt aquifers than the underlying Deep Lead aquifers at both sites. Ongoing annual monitoring of these bores will enable natural variance to be established and any trends in groundwater quality to be observed.

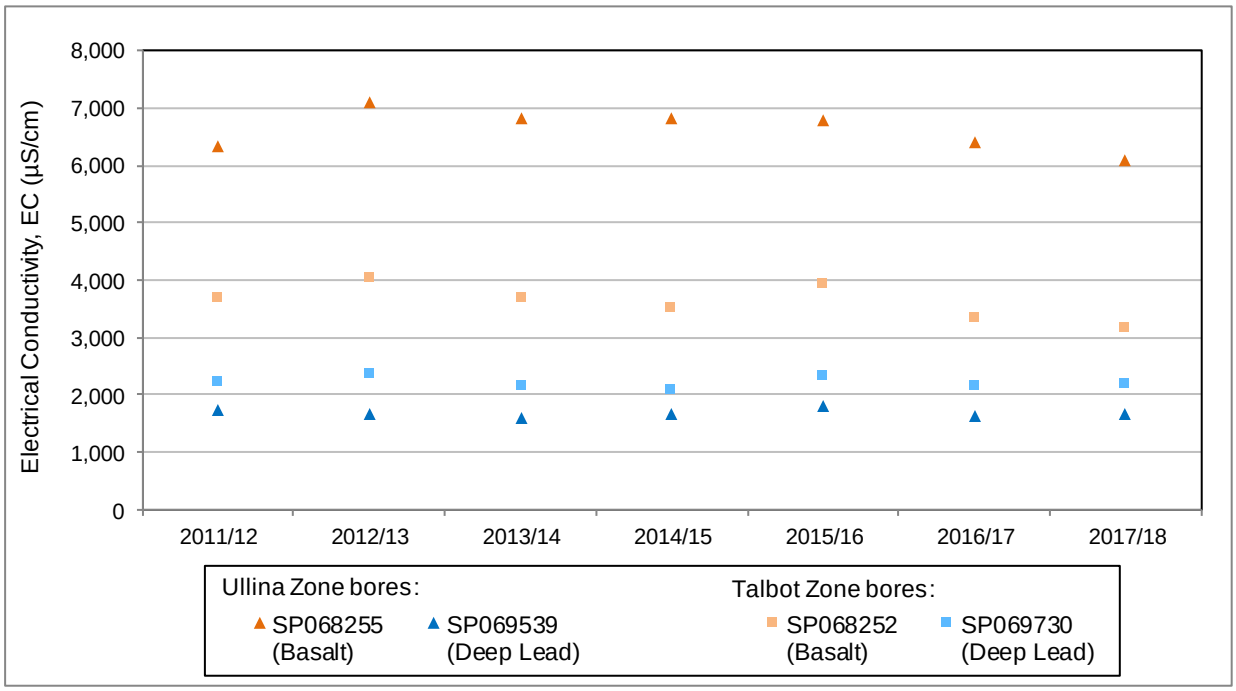


Figure 10 Salinity of groundwater in key monitoring bores in the Loddon Highlands WSPA

Groundwater salinity data from Central Highlands Water (CHW) licensed and monitoring bores has also been used to assess any changes in groundwater quality in the Loddon Highlands WSPA. Data was obtained from CHW bore fields at Forest Hill in the Newlyn Zone, Learmonth (Ascot Zone), Clunes (Ullina Zone), Waubra (Waubra Zone) and Bung Bong (Talbot Zone) (Figure 11). The data indicates that groundwater salinity levels are relatively stable and within historical ranges.

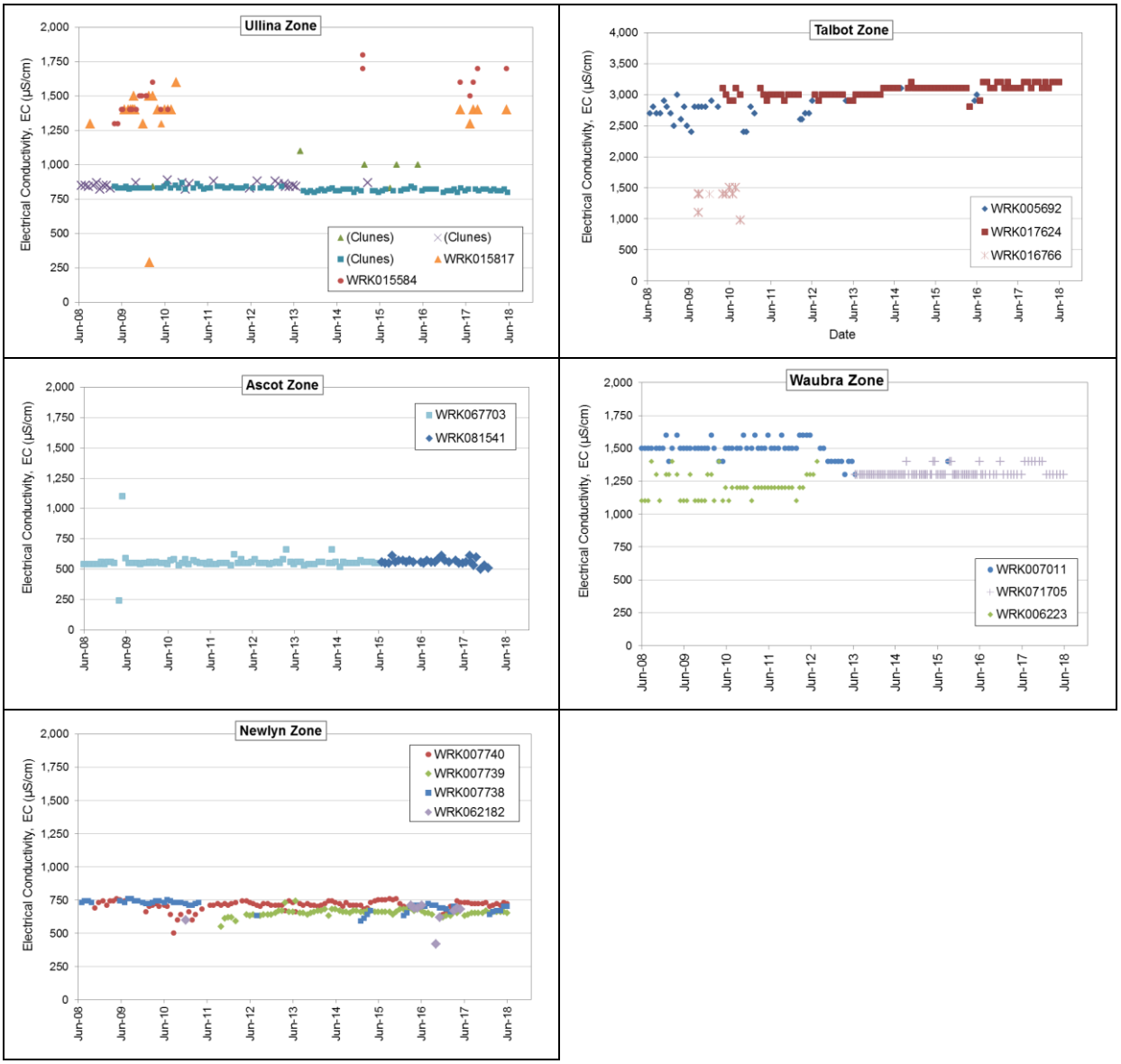


Figure 11 Groundwater salinity monitoring results from Central Highlands Water bores located in the Loddon Highlands WSPA

4 Future Management Considerations

4.1 Groundwater Reference Committee

The Groundwater Reference Committee, appointed in accordance with Prescription 7(c) of the Plan, met on 19 September 2017.

Key points of discussion included:

- Resource condition
- Plan implementation
- Initial findings from the North Central Catchment Management Authority on groundwater-surface water connectivity in Birch Creek
- Review of the Plan

4.2 Management Plan review

GMW has commenced a review of the Plan in accordance with Prescription 7(d) of the Plan. The review will be finalised in the last quarter of 2018.

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://www.environment.gov.au/system/files/resources/d4367a3b-28a9-430d-a869-2effbda8a447/files/ris-water-compliance-enforcement.pdf

Bureau of Meteorology (BoM), 2018. *Climate Statistics for Australian Sites – Clunes station number 088015*. Retrieved on 14 August 2018 from: http://www.bom.gov.au/jsp/ncc/cdio/wData/wdata?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=088015

Department of Sustainability and Environment, 2012. *Loddon Highlands Water Supply Protection Area Groundwater Management Plan.* Department of Sustainability and Environment, Melbourne

Victorian Government, 2012. *Victorian Government Gazette No. S389 Wednesday 21 November 2012*. Victoria State Government, Melbourne

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

Appendix A – Assessment of activities against Plan prescriptions

Prescription	Activity	Compliant
PRESCRIPTION 1 Carryover		
The Corporation shall: a) Apply to the Minister for Water to declare the availability of carryover in the Loddon Highlands WSPA up to a maximum of 15% of licence entitlement that will not be subject to restriction in the form of allocations. b) Consult with the Groundwater Reference Committee about the need to alter the percentage of carryover.	The Minister declared that licence holders in the Loddon Highlands WSPA may carryover up to 15 per cent licensed volume from November 2012.	Yes
PRESCRIPTION 2 Triggers and restrictions		
The Corporation shall: a) By 15 September each year determine the maximum seasonal groundwater recovery level in the relevant bore/s, or its replacement, and corresponding seasonal allocation as detailed in the Plan. b) Determine a seasonal allocation for the relevant zone based on the outcomes of a review of available data. The review will be undertaken when the 50% allocation is triggered in the Blampied, Newlyn or Ascot Zone. The Corporation shall consult with the Groundwater Reference Committee during the review. c) Determine a seasonal allocation for the Waubra Zone and consult with Groundwater Reference Committee. d) Announce seasonal allocations by listing them on its website; sending letters to all licence holders and placing public notices in local newspapers. e) Review allocations based on groundwater level readings to November each year and announce an increase if triggered.	GMW announced allocations for the 2017/18 water year on 12 September 2017. Allocations were 75 per cent in the Newlyn Zone and 100 per cent in all other management zones. These remained unchanged as there was not sufficient recovery in the Newlyn Zone bores to trigger a higher allocation. GMW announced allocations by listing them on its website, sending letters to all licence holders and placing public notices in local newspapers.	Yes
PRESCRIPTION 3 Trading between zones		
The Corporation may approve a temporary or permanent transfer of groundwater licence entitlement under section 62 of the Water Act 1989 provided section 53 matters have been considered and the following conditions are satisfied: a) The permanent transfer of licence entitlement is between zones as specified in the Plan. b) The temporary transfer of licence entitlement is between zones as specified in the Plan. c) Despite (b) above, a temporary transfer of licence entitlement may be considered where bores are located within 2.5 km of each other across an internal zone boundary. d) Licence entitlement may be temporarily traded into, or out of, the Loddon Highlands WSPA provided that the PCV is not exceeded.	In 2017/18, GMW processed eight transactions for temporary transfer of licensed volume, totalling 302 ML and five transactions for permanent transfer of licensed volume, totalling 24 ML/year. All transfers were compliant with Prescription 3.	Yes

<table>
<tr><th>Prescription</th><th>Activity</th><th>Compliant</th></tr>
<tr><td colspan="3">PRESCRIPTION 4 Groundwater level interference</td></tr>
<tr><td>The Corporation may approve an application to take and use groundwater under section 51 or a transfer under section 62 of the Water Act 1989 provided that section 53 matters have been considered and the following conditions are satisfied:
a) Licence entitlement may be temporarily or permanently transferred up to 1,000 ML/yr within 2.5 km radius of a licensed bore.
b) Where the licence entitlement within a 2.5 km radius of a licensed bore exceeds 1,000 ML/yr then:
<table><tr><td>(i). For temporary transfer of licence entitlement</td><td>1. Trade with usage in any one season limited to 115% of entitlement, whether it occurs through trade or carryover (this could include transferring from outside the 2.5 km radius); or
2. Trade from others within 2.5 km radius of the applicant’s bore for usage to exceed 115% of entitlement; or
3. Assess the application to consider other relevant information such as historical use and, if required undertake detailed investigations, when seeking to use more than 115% of your licence entitlement to demonstrate no unacceptable impacts are likely to occur. This could include transferring from outside the 2.5 km radius.</td></tr><tr><td>(ii). For permanent transfer of licence entitlement</td><td>1. Trade from others within 2.5 km radius of the applicant’s bore; or
2. Undertake detailed investigations to demonstrate no unacceptable impacts are likely to occur. This could include transferring from outside the 2.5 km radius.</td></tr></table></td><td>GMW processed all groundwater licence applications in accordance with Prescription 4.</td><td>Yes</td></tr>
<tr><td colspan="3">PRESCRIPTION 5 Groundwater monitoring</td></tr>
<tr><td>The Corporation shall:
(a) Obtain monthly groundwater level readings, where practicable, from State observation bores listed in Schedule 1 or their replacement (up to 288 readings per season).
(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, and send them to a NATA accredited laboratory for analysis.</td><td>GMW obtained monthly groundwater level readings from bores listed in Schedule 1 of the Plan, where practicable.
GMW used groundwater salinity monitoring data provided by Central Highlands Water from their urban supply bores to fulfil the requirements of a targeted salinity monitoring program.
GMW collected groundwater samples from nested State observation bores identified in Schedule 1 and sent them to a NATA accredited laboratory for analysis.</td><td>Yes</td></tr>
</table>

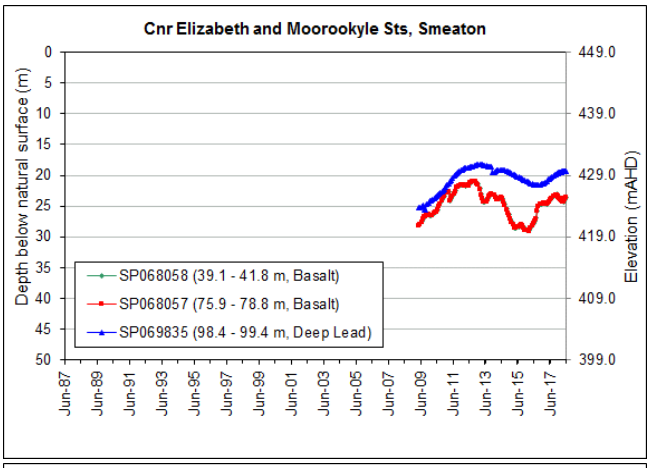
Prescription	Activity	Compliant
PRESCRIPTION 6 Metered licensed use		
The Corporation shall: (a) Ensure that a meter is fitted to all operational licensed bores. (b) Read each meter at least twice each season.	GMW ensured that use was accounted for each operational licensed bore and read each meter in January/February and May/June during 2017/18.	Yes
PRESCRIPTION 7 Plan implementation		
The Corporation shall: (a) By 30 September each year: (i). prepare an annual report on the administration and enforcement of the Plan for the Minister for Water and relevant agencies. (ii). mail a newsletter to groundwater licence holders, and domestic and stock users upon request, summarising the outcomes in the annual report. (b) Post on its website the Plan; annual report, newsletters and groundwater level monitoring results. (c) Meet with a Groundwater Reference Committee at least once each year to report on the implementation of the Plan and consider the need to review the Plan. (d) Undertake a review of the Plan after five years from its approval, or sooner if warranted by any prescription contained within the Plan.	GMW prepared this annual report on the administration and enforcement of the Plan during the 2017/18 water year; for the Minister and relevant agencies. GMW also sent a newsletter to licence holders summarising the information in this report. GMW has posted on its website: the Plan, this annual report and a water year summary newsletter. GMW updates hydrographs of groundwater levels every three months on its website. GMW met with the Groundwater Reference Committee on 19 September 2017 to discuss the implementation of the Plan.	Yes

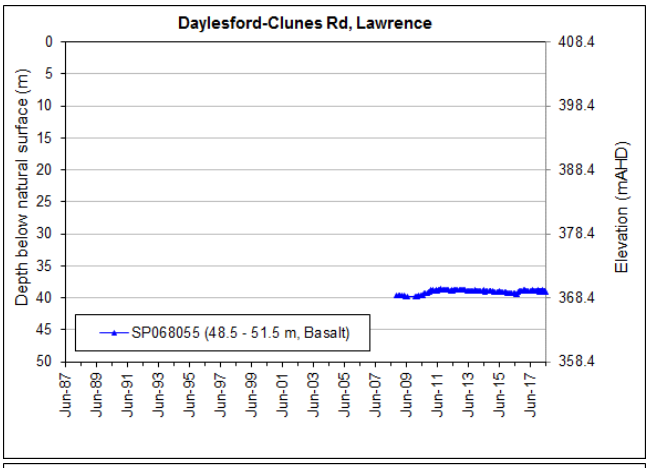
Appendix B – Hydrographs for key monitoring bores

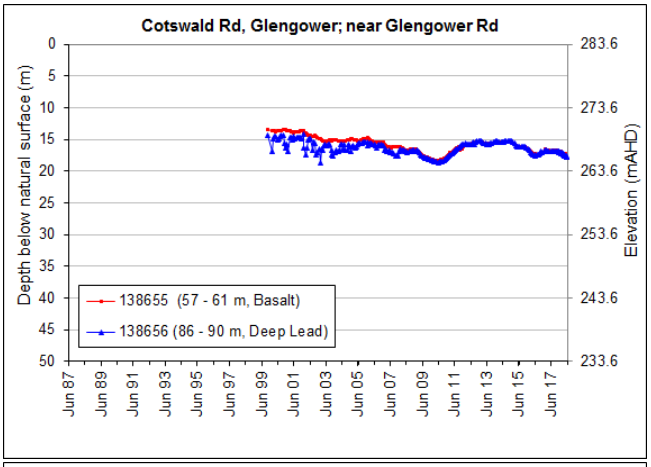
Hydrographs are provided for key monitoring bores listed in Schedule 1 of the Plan.

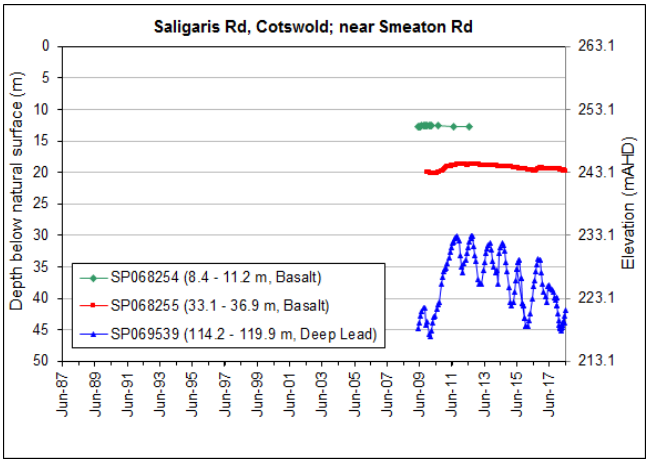
Further groundwater level information from other State observation bores is available on the Water Measurement Information System at http://data.water.vic.gov.au/monitoring.htm

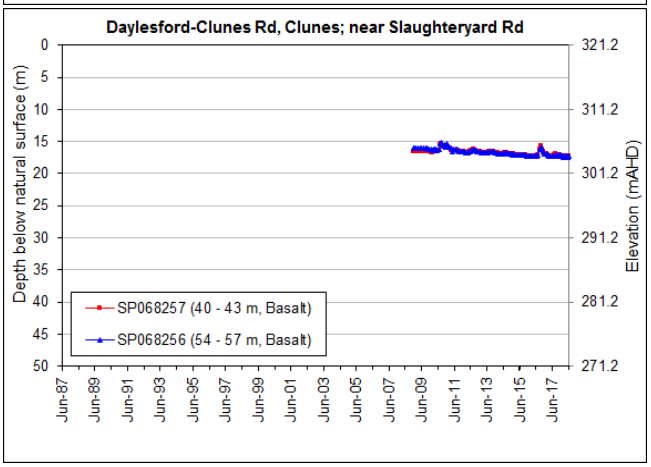
Ullina Zone – 1100



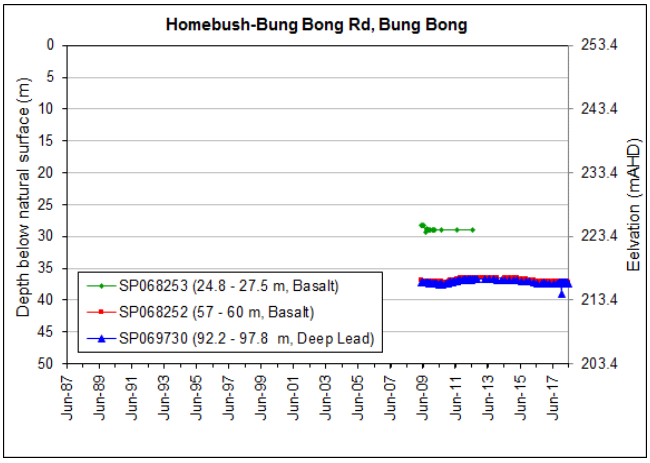




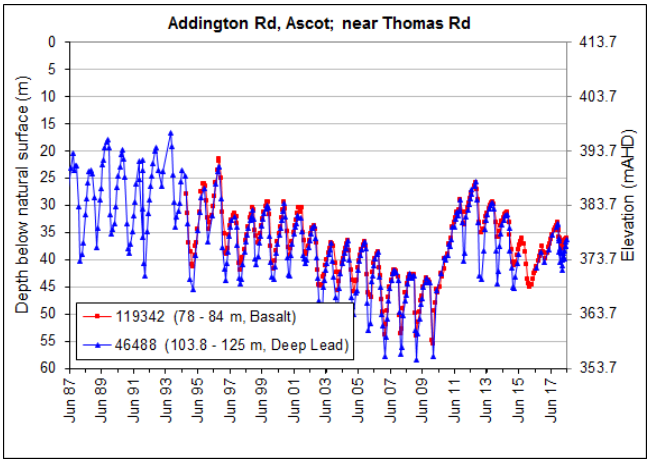


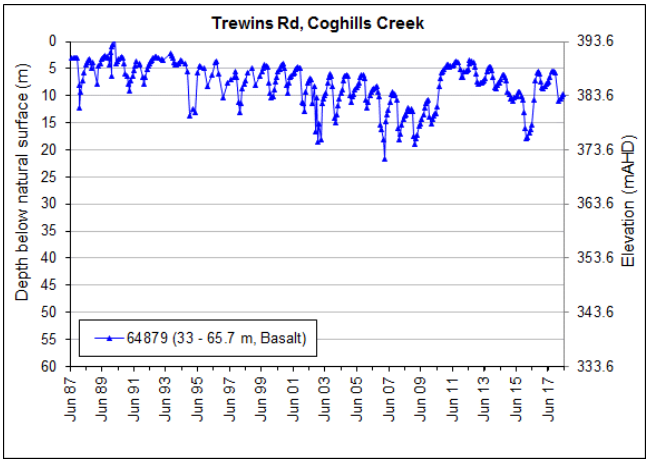


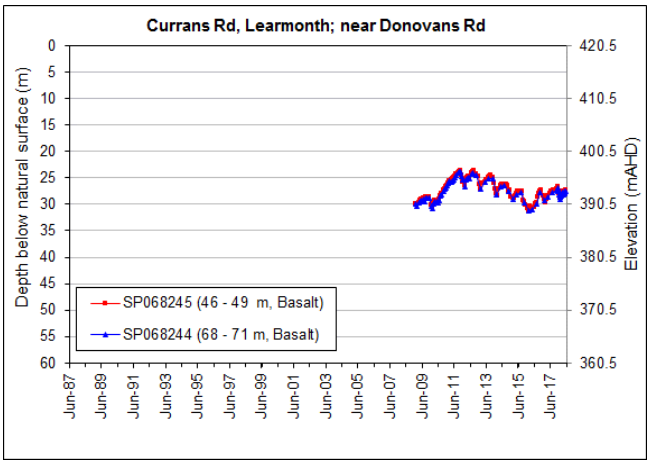
Talbot Zone – 1101

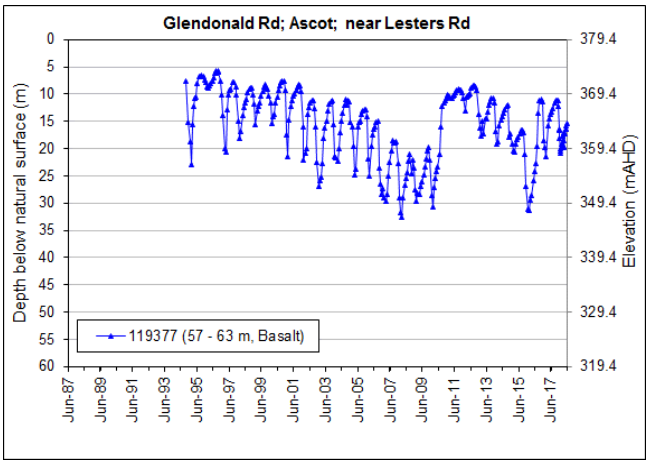


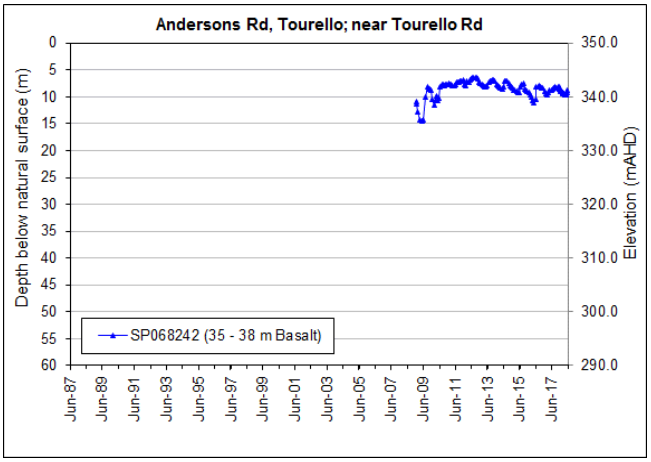
Ascot Zone – 1102

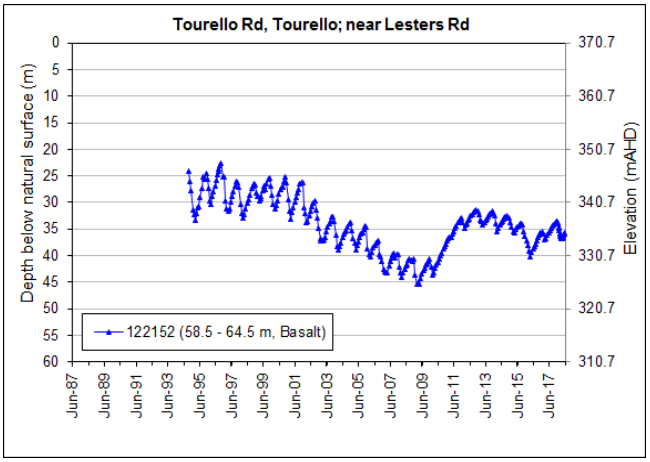


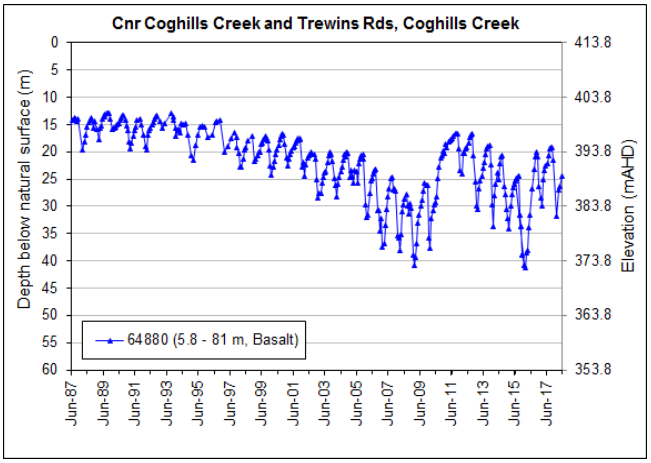




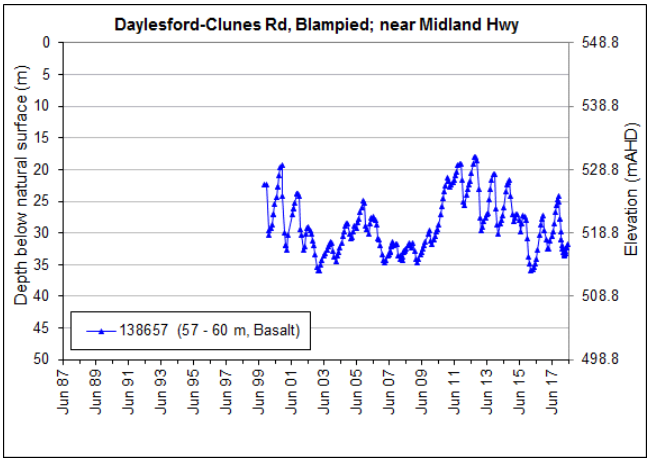


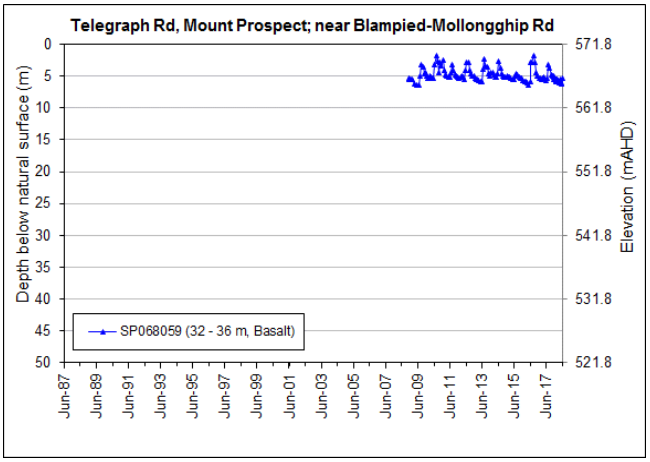




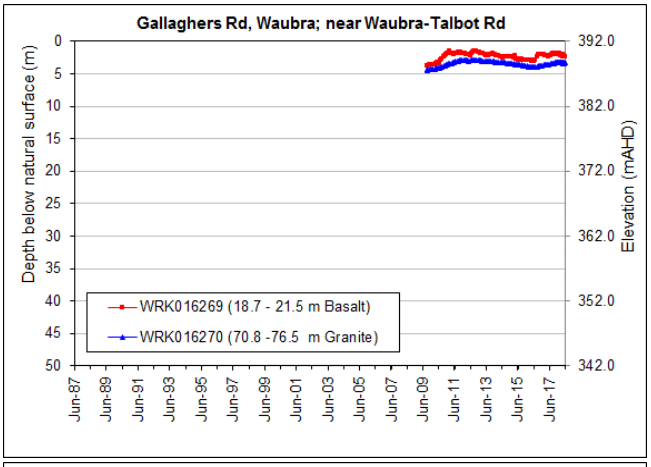


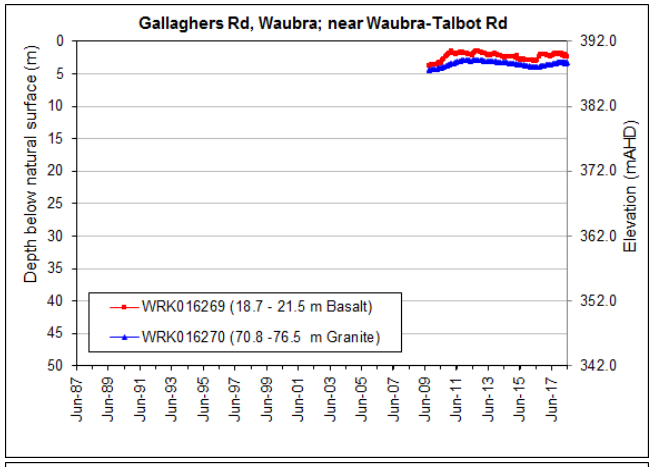
Blampied Zone – 1104

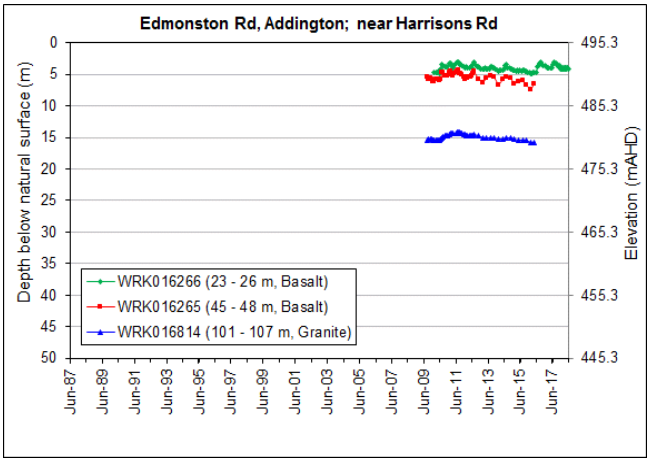


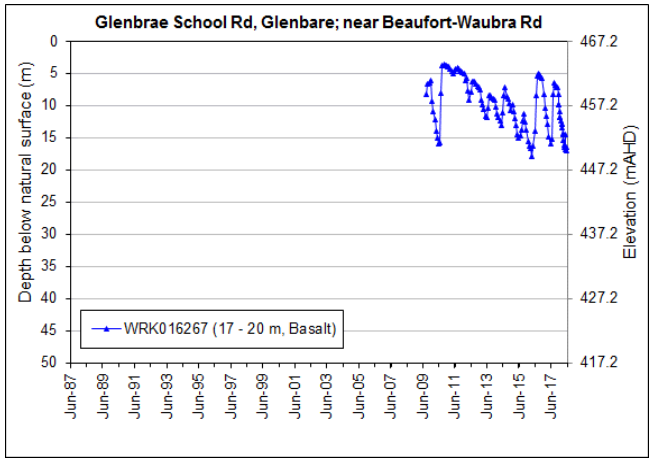


Waubra Zone – 1106

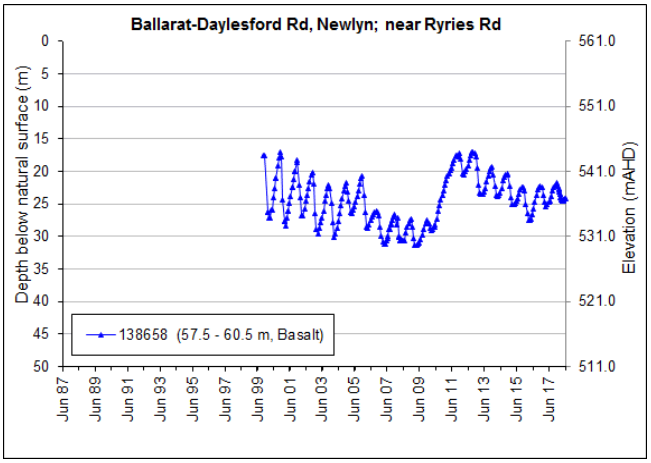


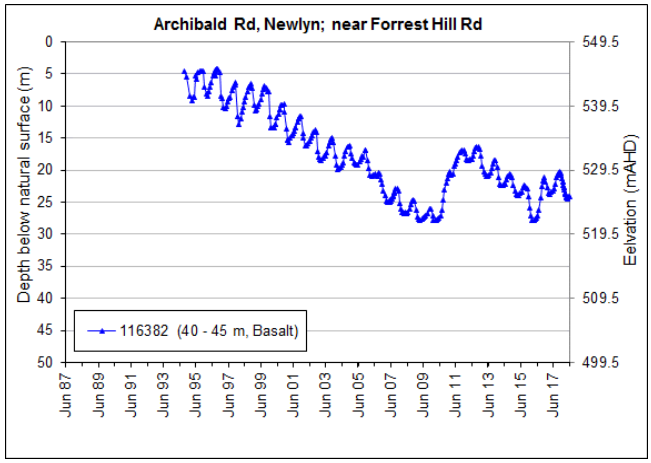


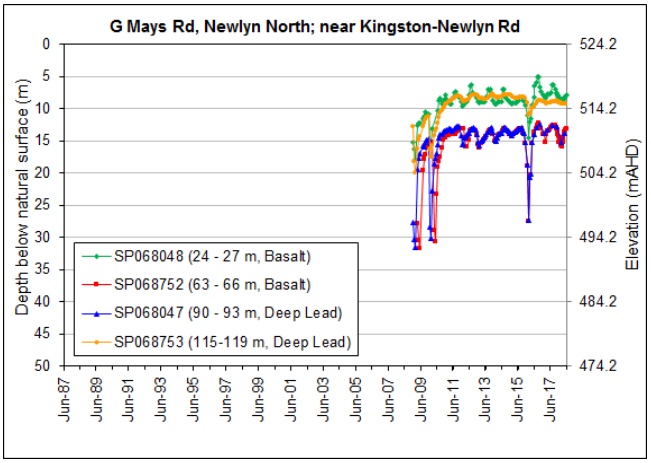


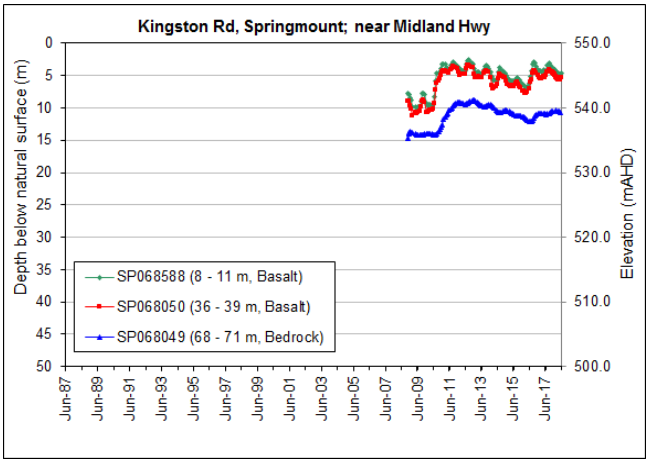


Newlyn Zone – 1107






G Mays Rd, Newlyn North; near Kingston-Newlyn Rd
Depth below natural surface (m)
Elevation (mAHD)
0
5
10
15
20
25
30
35
40
45
50
524.2
514.2
504.2
494.2
484.2
474.2
Jun-87
Jun-89
Jun-91
Jun-93
Jun-95
Jun-97
Jun-99
Jun-01
Jun-03
Jun-05
Jun-07
Jun-09
Jun-11
Jun-13
Jun-15
Jun-17
SP068048 (24 - 27 m, Basalt)
SP068752 (63 - 66 m, Basalt)
SP068047 (90 - 93 m, Deep Lead)
SP068753 (115-119 m, Deep Lead)


Kingston Rd, Springmount; near Midland Hwy
Depth below natural surface (m)
Elevation (mAHD)
0
5
10
15
20
25
30
35
40
45
50
550.0
540.0
530.0
520.0
510.0
500.0
Jun-87
Jun-89
Jun-91
Jun-93
Jun-95
Jun-97
Jun-99
Jun-01
Jun-03
Jun-05
Jun-07
Jun-09
Jun-11
Jun-13
Jun-15
Jun-17
SP068588 (8 - 11 m, Basalt)
SP068050 (36 - 39 m, Basalt)
SP068049 (68 - 71 m, Bedrock)

Appendix C – Groundwater chemistry results

	Bore:	SP068255	SP069539	SP068252	SP069730
	Aquifer:	Basalt	Deep Lead	Basalt	Deep Lead
	Date:	24/01/2018	24/01/2018	24/01/2018	24/01/2018
Analyte	**Unit**				
Electrical conductivity @ 25°C	µS/cm	6,100	1,700	3,200	2,200
pH sediment	–	7.66	6.36	7.26	7.17
Dissolved Oxygen	ppm	6550	560	6630	6110
Turbidity	NTU	0.4	0.9	0.3	5.3
Total Dissolved Solids	mg/L	4200	830	2100	1100
Alkalinity (Carbonate), as CaCO3	mg/L	<2	<2	<2	<2
Alkalinity (Hydroxide), as CaCO3	mg/L	<2	<2	<2	<2
Total Alkalinity, as CaCO3	mg/L	230	370	290	270
Calcium, as Ca	mg/L	110	43	84	59
Chloride, as Cl	mg/L	1800	300	820	510
Magnesium, as Mg	mg/L	330	69	150	96
Potassium, as K	mg/L	13	9	7	5
Sodium, as Na	mg/L	660	190	340	230
Ammonia, as N	mg/L	0.2	<0.1	<0.1	<0.1
Nitrate, as N	mg/L	4.1	<0.01	4.6	1.9
Nitrite, as N	mg/L	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen, as N	mg/L	0.2	<0.1	0.3	0.3
Total Nitrogen, as N	mg/L	4.3	<0.1	4.9	2.1
Sulphate, as SO4	mg/l	300	30	130	69
Total organic carbon (TOC)	mg/L	1.2	0.9	0.9	<0.5
Arsenic, as As	mg/L	0.003	0.002	0.004	0.004
Cadmium, dissolved (ICP-MS)	mg/L	<0.0002	<0.0002	<0.0002	<0.0002
Chromium, dissolved (ICP-MS)	mg/L	0.001	<0.001	0.001	0.001
Copper, dissolved (ICP-MS)	mg/L	<0.001	<0.001	<0.001	0.003
Iron, dissolved as Fe	mg/L	<0.01	0.27	<0.01	<0.01
Lead, dissolved (ICP-MS)	mg/L	<0.001	<0.001	<0.001	<0.001
Manganese, dissolved as Mn	mg/L	<0.001	0.083	<0.001	<0.001
Mercury, as Hg	mg/L	0.0001	<0.0001	0.0002	<0.0001
Nickel, dissolved (ICP-MS)	mg/L	<0.001	0.001	<0.001	<0.001
Phosphorus, total as P	mg/L	0.07	0.08	0.1	0.12
Zinc, dissolved (ICP-MS)	mg/L	0.002	0.045	0.054	0.021