

Katunga Water Supply Protection Area Groundwater Management Plan

Annual Report

For year ending 30 June 2022

Document Number: A4427677
Version: Final



Excellence



Honesty



Accountability

OFFICIAL



Courage



Caring

Foreword

Goulburn-Murray Water (GMW) is pleased to present the annual report for the *Groundwater Management Plan for the Katunga Water Supply Protection Area* (the Plan) for the 2021/2022 water year.

GMW is responsible for implementation and administration of the Plan, which was approved by the Minister administering the *Water Act 1989* on 24 July 2006.

This report has been prepared in accordance with section 32C of the *Water Act 1989*. It provides an overview of the groundwater management activities administered under the Plan between 1 July 2021 and 30 June 2022.

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



Charmaine Quick

MANAGING DIRECTOR

Date: 27/09/2022

Executive summary

The *Groundwater Management Plan for the Katunga Water Supply Protection Area* (the Plan) was approved on 24 July 2006 by the Minister for Water.

In 2017, a consultative committee appointed by the Minister for Water, in accordance with section 32G of the *Water Act 1989*, recommended amendments to the Plan. The Minister approved the amendments on 22 August 2017, including: a new method for determining restrictions, simplification of trading rules, salinity monitoring requirements and the establishment of a groundwater reference group.

During the 2021/22 water year, and for the third time since the Plan was amended in 2017, licence holders had their access restricted to 70 per cent of their licence entitlement volume. Restrictions were implemented in accordance with the Plan.

Recorded use in the 2021/22 water year was 14,922.6 ML, or 25 per cent of the total licence entitlement volume. This is just over half of the total recorded in the 2020/21 water year.

Permanent licence transfer activity during the 2021/22 water year was subdued (three transfers, totalling 205 megalitres per year). However, the sustained, high level of temporary licence transfer activity, which commenced in 2018/19, continued in 2021/22 (29 transfers for a total of 4,975.6 ML/yr).

Groundwater monitoring and metering programmes continue to support the implementation of the Plan. The five year rolling average of maximum recovery levels, which is calculated to determine licence restrictions under the amended Plan, has started to stabilise, after five years of continuous decline.

Goulburn-Murray Water met with the Katunga Groundwater Reference Group for the fourth time since its foundation, via video-conference, on 16 November 2021. There are currently no plans to undertake a review of the Plan.

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1 Introduction

1.1 Purpose

This report has been prepared to meet the requirements of Prescription 7 of the *Groundwater Management Plan for the Katunga Water Supply Protection Area* (DSE, 2006) (the Plan) and section 32C of the *Water Act 1989* (the Act). It provides an overview of groundwater resource status within the Katunga Water Supply Protection Area (the WSPA) and summarises the groundwater management activities carried out under the Plan during the 2021/22 water year (1 July 2021 to 30 June 2022).

1.2 Water Supply Protection Area

The WSPA is located in the valleys of the Murray and Goulburn rivers, extending from Yarrawonga in the east to Barmah East in the west and from the River Murray in the north to Kaarimba and Youanmite in the south. Larger townships located within the WSPA include Numurkah, Cobram, Nathalia, Katunga and Katamatite – refer Figure 1.

The WSPA has an upper-vertical extent (boundary) of 25 metres below the ground surface. Above this boundary, groundwater resources are considered to be part of a separate management unit – the Shepparton Irrigation Region Groundwater Management Area.

Groundwater resources in the WSPA are managed and reported under three management zones – North Western Dryland Zone (1061), Numurkah-Nathalia Zone (1062) and Cobram Zone (1063) – shown in Figure 1.

1.3 Groundwater Management Plan

The Plan, which applies to the management of groundwater resources within the areal and depth extents of the WSPA, was approved on 24 July 2006 by The Hon. John Thwaites MP, Minister for Water, in accordance with section 32A(6) of the Act.

In 2017, a consultative committee appointed by then Minister for Water, The Hon. Lisa Neville MP, in accordance with section 32G of the Act recommended amendments to the Plan. Minister Neville approved the amendments on 22 August 2017, including a new method for determining restrictions, simplification of trading rules, salinity monitoring requirements and the establishment of a groundwater reference group.

The objective of the Plan is to make sure that groundwater resources within the WSPA are managed in an equitable and sustainable manner. When allocations are made under the Plan, all groundwater licence holders in the WSPA are treated in the same manner.

The Plan enables annual allocations to be set to manage groundwater extraction. The intent of the annual allocation process is to maintain groundwater access for groundwater users. Goulburn-Murray Water (GMW) is responsible for the implementation, administration and enforcement of the Plan. An assessment summary of GMW's activities in accordance with prescriptions in the Plan is presented in [Appendix A](#).

A copy of the Plan can be downloaded from the GMW website: www.gmwater.com.au

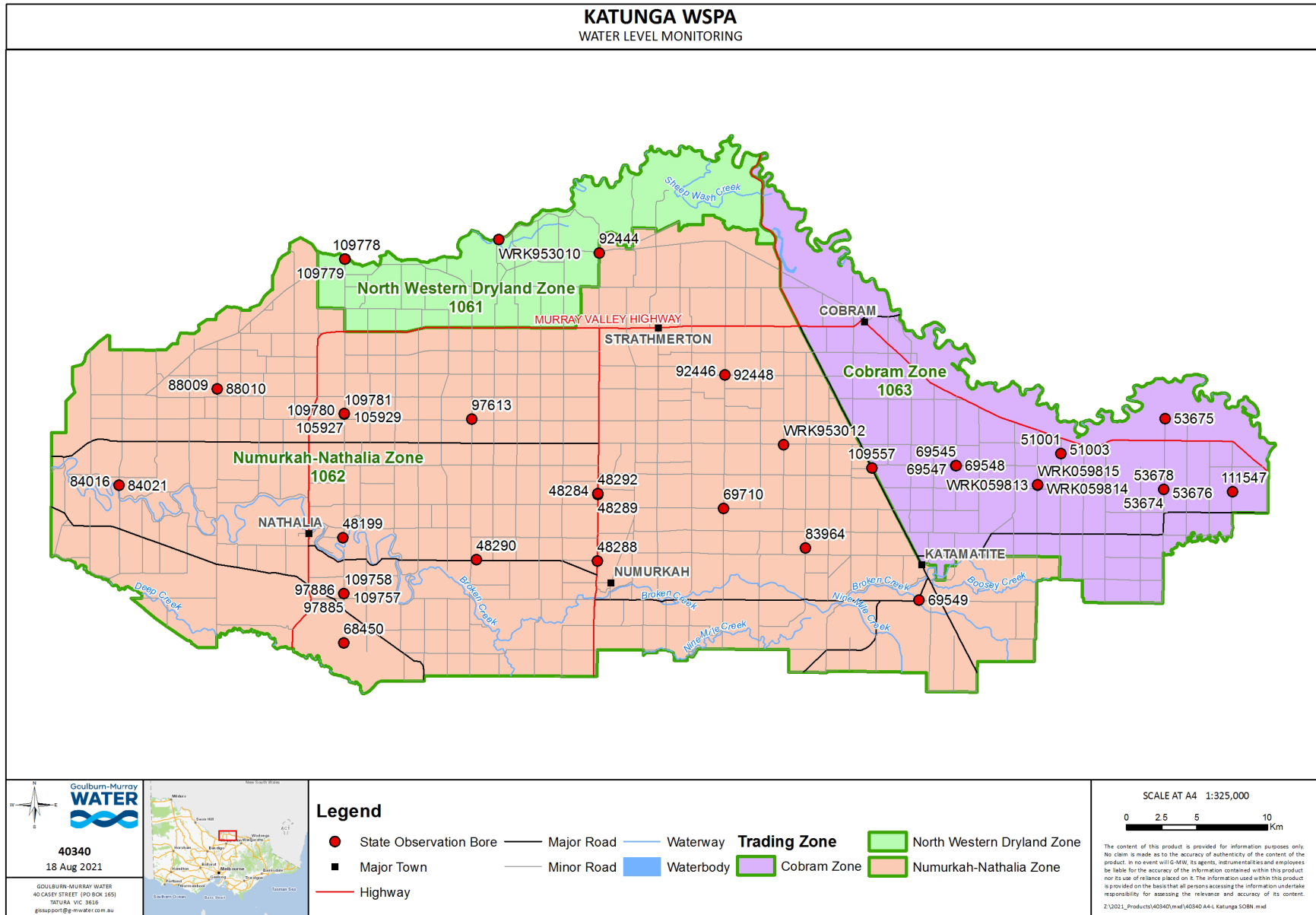


Figure 1 Katunga Water Supply Protection Area

2 Groundwater Management

2.1 Licence entitlement volume

A permissible consumptive volume of 60,577 megalitres per year (ML/yr) for the WSPA was declared by the Minister for Water in March 2013 (Victorian Government, 2013).

At 30 June 2022, the total licence entitlement volume in the WSPA was 60,200.9 ML/yr. The number of licences in each management zone is summarised in Table 1, as well as the total number of licensed bores and the sum of licence entitlement volume.

Table 1 Groundwater licences by management zone in the Katunga WSPA

Management zone	Licences	Licensed bores	Sum of licence entitlement volume (ML/yr)
North Western Dryland Zone (1061)	21	23	5,000.2
Numurkah-Nathalia Zone (1062)	177	200	34,358.7
Cobram Zone (1063)	67	79	20,842.0
Total	265	302	60,200.9

Note: Data extracted from the Victorian Water Register on 1 July 2022.

2.2 Groundwater allocations

Following amendments to the Plan in 2017, the method for determining annual groundwater allocations was revised – *refer Prescription 2 of the Plan*. Annual allocations are now determined by calculating the average of the annual maximum recovery levels of seven key monitoring bores (listed in Schedule 1 of the Plan), from the preceding five water years (known as the 'five year rolling average'). The allocation is determined by comparing the five year rolling average to trigger levels specified in the Plan – *refer Table 2 and Figure 2 below*.

Table 2 Trigger levels for the determination of annual allocations in the Katunga WSPA

Trigger level, depth below natural surface (m)	Allocation
21.0 and above	100%
21.1 to 24.0	70%
Below 24.1	70%, and review undertaken by GMW in consultation with Katunga Groundwater Reference Group

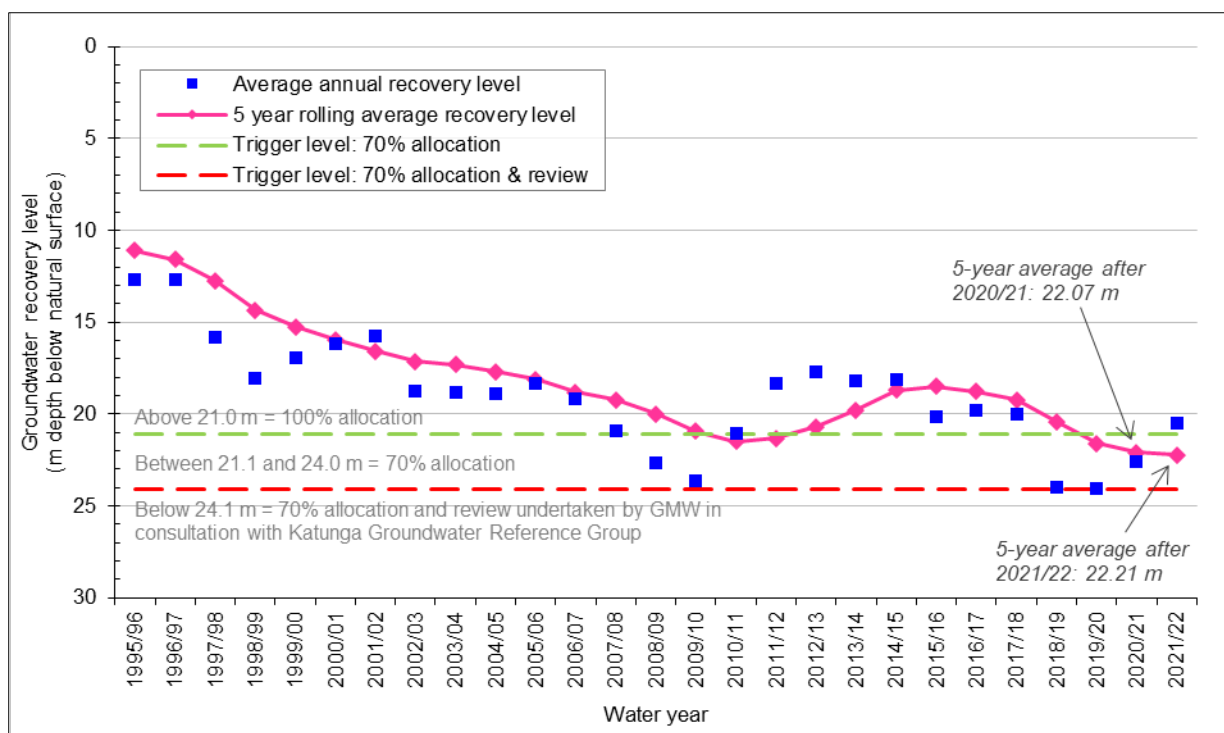


Figure 2 Trigger graph for determination of annual allocations for the Katunga WSPA

Table 3 presents the maximum groundwater recovery level measured in each of the seven key monitoring bores in 2021/22, and the preceding water years, back to 2016/17; the annual averages of those maximum levels; and the five year rolling averages calculated in June 2020 (2020/21) and June 2021 (2021/22) which were used to determine the annual allocations for the 2021/22 and 2022/23 water years, respectively.

Level monitoring records for these seven bores are provided as hydrographs in [Appendix B](#).

Table 3 Calculation of five year rolling averages for determination of annual allocations for the 2021/22 and 2022/23 water years

Bore details		Maximum groundwater recovery level recorded in each water year					
Site ID	Screen depth	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
48282	118-133	21.34	20.47	20.55	22.74	22.32	20.59
51001	110-118	20.17	20.41	28.53	27.18	22.62	20.79
69545	109-111	18.36	19.50	24.26	23.34	21.13	18.48
69710	122-124	19.43	19.64	23.96	24.05	22.77	21.18
83964	112-114	21.21	21.38	25.24	24.57	24.52	22.17
92446	134-135	19.50	19.92	23.83	24.09	22.91	20.58
97613	137-139	18.50	18.60	21.39	22.30	21.63	19.68
Annual average:		19.79	19.99	23.97	24.04	22.56	20.50
Five year rolling averages:						22.07	22.21

Note: all levels in this table are given in metres (m) depth below the natural ground surface at each site

2021/22 allocation

In June 2021, GMW determined an annual allocation of 70 per cent of licence entitlement volume for the 2021/22 water year. The allocation was announced on 25 June 2021 by publication on the GMW website,

advertisement in local newspapers (*Shepparton News* and *Country News*) and a letter posted to licence holders in the WSPA.

The five year rolling average of maximum recovery levels recorded in the seven key monitoring bores was 22.07 m (depth below natural surface) which was between the 21.0 m trigger level and the 24.0 m trigger level (Table 3).

2022/23 allocation

In June 2022, GMW determined an allocation of 70 per cent of licence entitlement volume for the 2022/23 water year. The allocation was announced in June 2022 by publication on the GMW website, advertisement in local newspapers (*Shepparton News*, *Cobram Courier* and *Numurkah Leader*) and a letter posted to licence holders in the WSPA.

In this instance, the five year rolling average was 22.21 m (depth below natural surface) which was again between the 21.0 m and 24.0 m trigger levels (Table 3).

2.3 Rainfall

Long-term rainfall data, sourced from the Bureau of Meteorology weather station at Cobram (BOM, 2022), are presented in Figure 3, as an indicator of trends across the WSPA.

A total of 650.4 mm was recorded in Cobram during the 2021/22 water year, which is 186.4 mm more than the long-term average (464 mm). The cumulative residual-mass rainfall curve shows that the wetter-than-average rainfall trend, which commenced in January 2020 following three years of drier-than-average conditions, continued to strengthen during 2021/22.

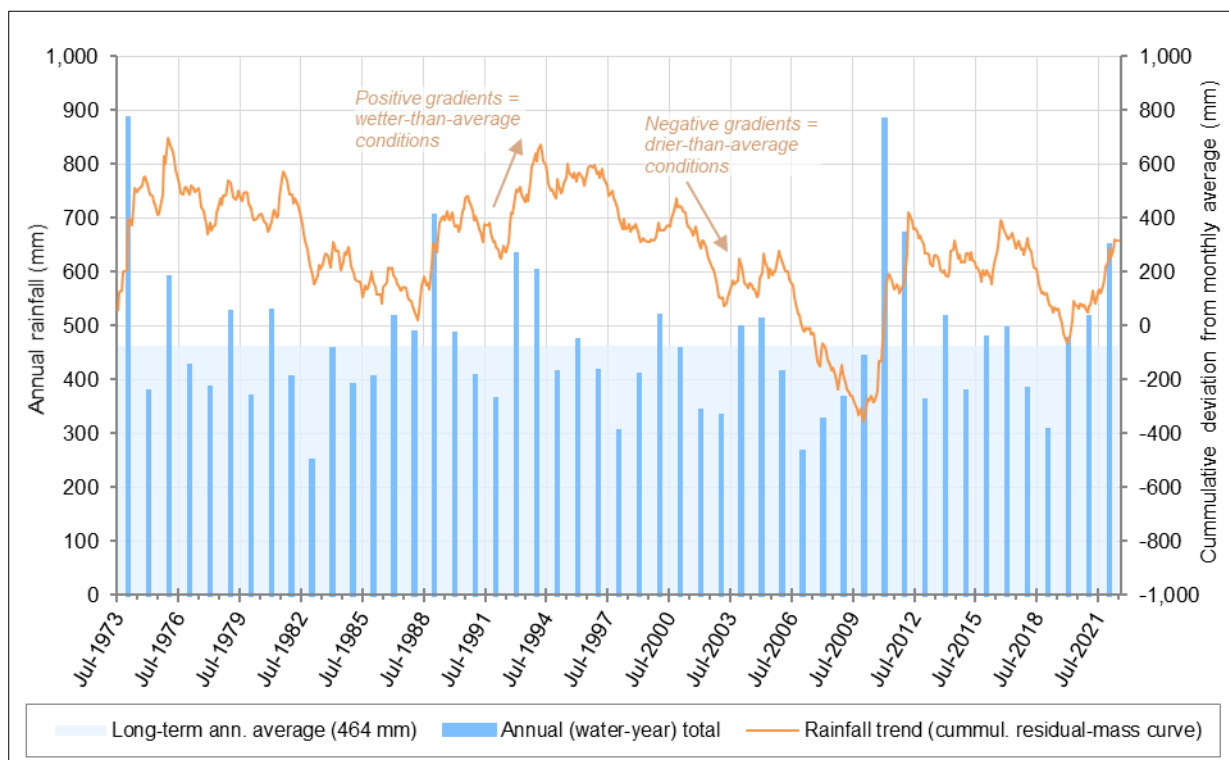


Figure 3 Rainfall recorded at Cobram, July 1973 to June 2022

2.4 Surface water availability

Regulated surface water resources are physically accessible across approximately 75 per cent of the land within the WSPA. This access includes delivery (via a network of channels and pipelines) and

diversion (private pumps on rivers or other waterways). The availability of surface water within the WSPA has an influence on the demand for groundwater for irrigation purposes.

There are three regulated water systems which supply different parts of the local area – the Murray, Goulburn and Broken water systems. The annual maximum allocation (percentage) of high-reliability water shares (HRWS) in each system since 2006/07 is presented in Figure 4 (NVRM, 2022).

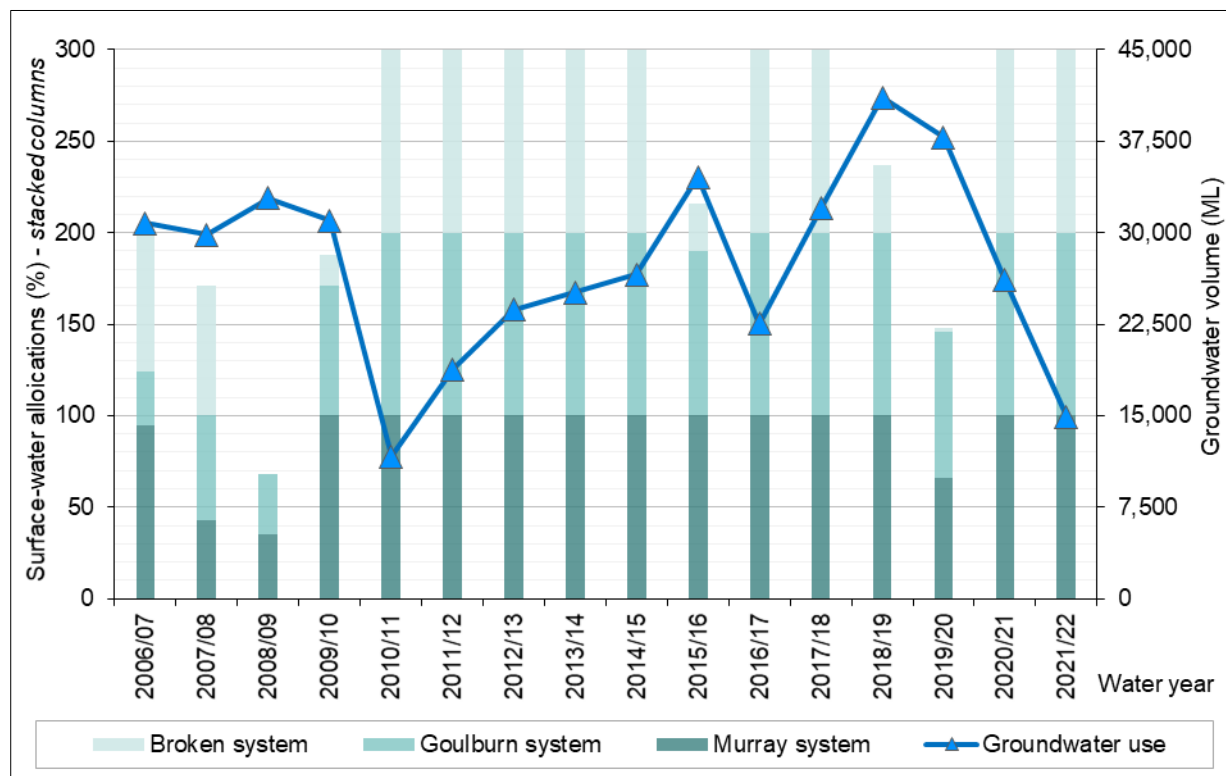


Figure 4 Annual-maximum allocation of high reliability water shares of the regulated surface water systems accessible within the Katunga WSPA since 2006/07

2.5 Groundwater use

Historically, groundwater use in the WSPA has been largely influenced by climate and the availability (and price) of regulated surface water. Groundwater users have typically increased their use during extended periods of drier climate and when surface water allocations have been low.

This relationship is demonstrated in Figure 4, which shows the total of HRWS allocations in the three regulated water systems (stacked columns) and the total recorded use of groundwater in the WSPA for each water year since 2006/07. In periods when surface water allocations have been low – such as 2018/19 to 2019/20 – groundwater use in the WSPA has been high. Conversely, when surface water allocations have been at their peak (i.e., 100 per cent in all three systems) – such as 2020/21 to 2021/22 – groundwater use has been subdued.

Total recorded use in the WSPA in 2021/22 was 14,922.6 ML, or 25 per cent of the total licence entitlement volume (Figure 5). This is just over half (57 per cent) of the volume used in 2020/21 and the second lowest volume since the Plan was implemented. Increased rainfall and surface water availability in 2021/22 were likely significant contributors to reduced deep lead groundwater use relative to previous years.

Note: recorded use refers to metered and deemed use.

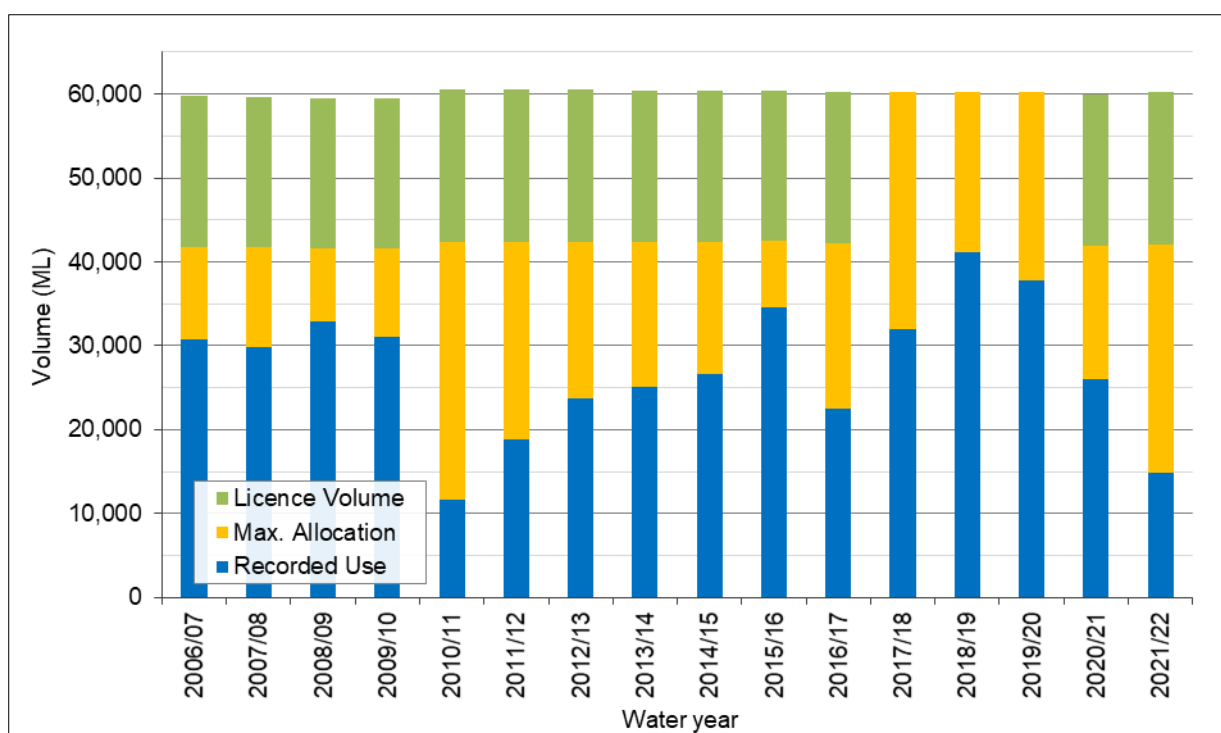


Figure 5 Annual recorded use volumes compared to licence entitlement and allocation volumes in the Katunga WSPA since 2006/07

Recorded use by management zone is provided in Table 4. Recorded use as a proportion of the sum of licence entitlement volume was greatest in the North Western Dryland Zone (36 per cent) and lowest in the Cobram Zone (14 per cent).

Table 4 Recorded use and licence entitlement volume by management zone for 2021/22

Management zone	Sum of licence entitlement volume (ML/yr)	Recorded use (ML)	Proportion of sum of licence entitlement volume used
North Western Dryland Zone (1061)	5,000.2	1,798.3	36%
Numurkah-Nathalia Zone (1062)	34,358.7	10,117.3	29%
Cobram Zone (1063)	20,842.0	3,007.0	14%
Total	60,200.9	14,922.6	25%

Note: Data extracted from Irrigation Planning Module on 25 July 2022.

2.6 Licence transfers

The Plan allows groundwater licence holders to temporarily or permanently transfer licence entitlement volume. A summary of transfers completed during the 2021/22 water year is provided in Table 5. Figure 6 compares the total volume of completed transfers for each water year since the Plan was implemented, in the 2006/07 water year.

During the 2021/22 water year there were three permanent transfers totalling 205.0 ML/yr and 29 temporary transfers totalling 4,975.6 ML/yr. These totals equate to 67 per cent and 18 per cent less than the 2020/21 totals, respectively. One of the permanent transfers (2.0 ML/yr) was to a licence in the Broken Groundwater Management Area which adjoins the WSPA to the south-east.

Table 5 Licence entitlement transfers completed during 2021/22

Management zone	Permanent transfers				Temporary transfers			
	Transfer from		Transfer to		Transfer from		Transfer to	
	No. of transfers	Volume (ML/yr)	No. of transfers	Volume (ML/yr)	No. of transfers	Volume (ML/yr)	No. of transfers	Volume (ML/yr)
North Western Dryland Zone (1061)	1	200.0	1	200.0	2	29.0	-	-
Numurkah-Nathalia Zone (1062)	2	5.0	1	3.0	20	3,434.6	28	4,832.6
Cobram Zone (1063)	-	-	-	-	7	1,512.0	1	143.0
Total	3	205.0	2	203.0	29	4,975.6	29	4,975.6

Note: Data extracted from the Victorian Water Register on 28 July 2022.

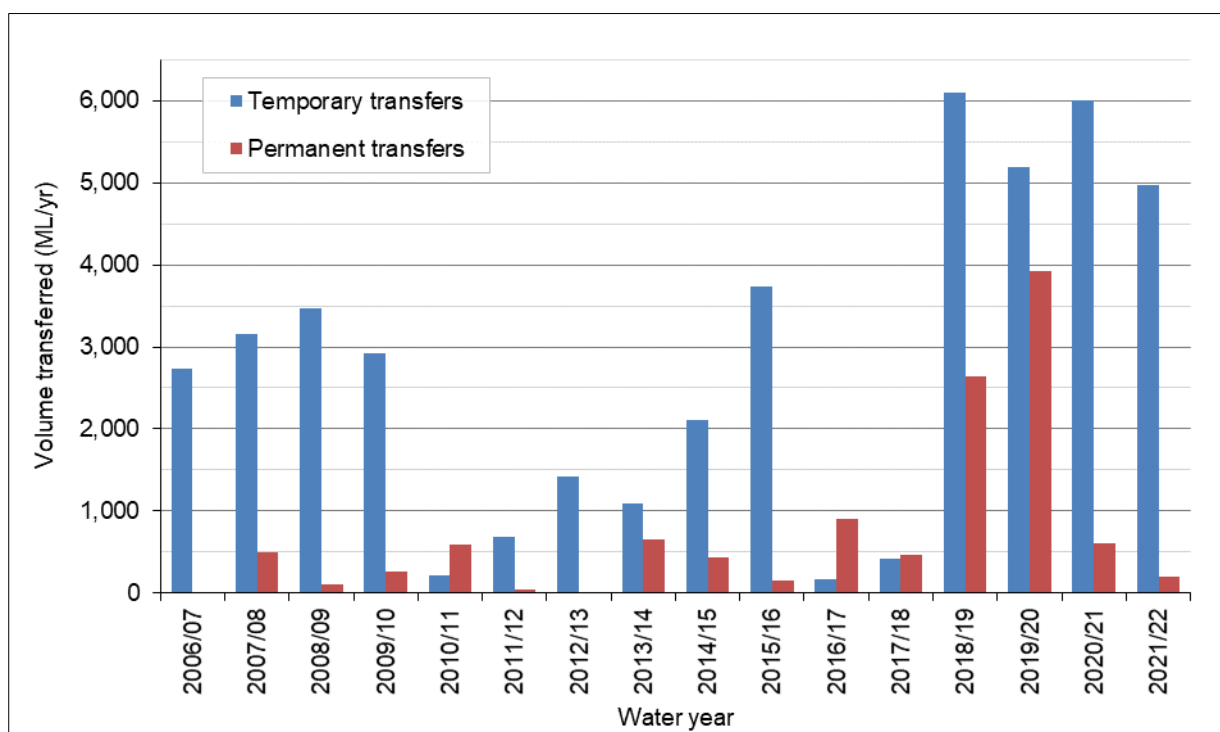


Figure 6 Annual totals of licence transfers in the Katunga WSPA, since 2006/07

2.7 Metering

At 30 June 2022 there were 298 active service points in the WSPA comprising 191 metered, 104 deemed and three unmetered service points. All meters were read at least twice during the 2021/22 water year. Other meter-related activities undertaken in 2021/22 included 90 inspections, 14 installations (for new service points or replacement of existing meters) and two maintenance events.

2.8 Licence compliance

The Victorian Government and GMW have a zero-tolerance approach to unauthorised take of non-urban water. GMW is responsible for ensuring water users in northern Victoria comply with their licence conditions. Relevant actions, if required, are taken in accordance with GMW's Risk-Based Compliance and Enforcement Framework.

More information can be found on the GMW website, at www.gmwater.com.au/water-resources/water-use-compliance.

In 2021/22 there were 14 instances of alleged, unauthorised take of water (i.e. allocation volume exceedance), totalling 835.3 ML. These incidents are being investigated and GMW will take action in accordance with GMW's Risk-Based Compliance and Enforcement Framework. No prosecutions or convictions relating to groundwater matters in the WSPA occurred during the 2021/22 water year.

2.9 Domestic and stock bore licences

Domestic and stock (D&S) use is not required to be licensed as it is a private right under section 8 of the Act, provided that water is used in accordance with the constraints imposed by the Act.

The installation of a bore for D&S use requires a bore construction licence, in accordance with section 67 of the Act. Upon completion of a bore, a 'bore completion report' is required to be submitted to GMW and details are recorded in the Victorian state groundwater database (currently known as the *Water Measurement Information System*).

During the 2021/22 water year, 37 licences to construct a D&S bore were issued by GMW and the Victorian Water Register (combined) within the WSPA.

3 Monitoring Program

3.1 Groundwater levels

Prescription 5 of the Plan requires that groundwater levels are monitored in seven State Observation Bores Network (SOBN) bores, specified in Schedule 1 of the Plan. Level monitoring records for these bores are presented as hydrographs in [Appendix B](#). Locations of all SOBN bores in the WSPA that were routinely monitored during the 2021/22 water year, are shown in Figure 1.

3.2 Groundwater salinity

State observation bores

Prescription 6 of the Plan requires GMW to collect water samples from nine SOBN bores, once per year; and have the samples analysed for salinity (salt concentration) by an accredited laboratory. The locations of the bores are shown in Figure 1.

In December 2021 samples were collected from the nine specified bores, as well as one additional SOBN bore (ID 97613) screened in the Calivil Formation at Yalca. The samples were analysed by ALS Limited for salinity as well as a suite of general water quality analytes. All results are publicly available on the *Water Measurement Information System* website, <https://data.water.vic.gov.au>.

The salinity results of the 2021/22 samples, as well as details about the 10 bores, are presented in Table 6. These data indicate that groundwater encountered within the WSPA can range from 300 to more than 8,000 microSiemens per centimetre ($\mu\text{S}/\text{cm}$)¹ and groundwater in the upper extent of the Shepparton Formation can be as high as 35,352 $\mu\text{S}/\text{cm}$ (*note, this is outside the bounds of the WSPA, as described in section 1.2 of this report*).

¹ Microsiemens per centimetre ($\mu\text{S}/\text{cm}$) is a common unit for *electrical conductivity*, a measurement of salt concentration in solution, at 25°C.

Table 6 Groundwater salinity results for bores sampled in 2021/22 in the Katunga WSPA

Management zone	Location	Bore ID	Depth of bore screen (m)	Aquifer screened	Salinity, as electrical conductivity ($\mu\text{S/cm}$)
North Western Dryland Zone (1061)	Barmah National Park	WRK953007	84 - 90	Calivil Formation	615
		WRK953008	36 - 39	Shepparton Formation	640
Numurkah-Nathalia Zone (1062)	Numurkah	48281	109 - 116	Calivil Formation	3,019
		48288	10 - 16	Shepparton Formation	3,700
	Yalca	97613	137 - 139	Calivil Formation	2,019
	Picola	84016	129 - 146	Calivil Formation	8,400
		84021	4.5 - 14.5	Shepparton Formation	35,352
Cobram Zone (1063)	Katamatite	69545	109 - 110.5	Calivil Formation	1,000
		69547	73.5 - 75.5	Shepparton Formation	300
		69548	4 - 22	Shepparton Formation	420

Annual salinity results from a subset of the bores (those screened in the Calivil Formation aquifer) are presented in Figure 8. These data suggest that, despite the large range of salinities across different parts of the WSPA, the salinity of groundwater in the Calivil Formation has remained relatively stable since 2014/15 (when sampling of these bores began).

Annual salinity results for all of the 10 bores are presented in [Appendix C](#).

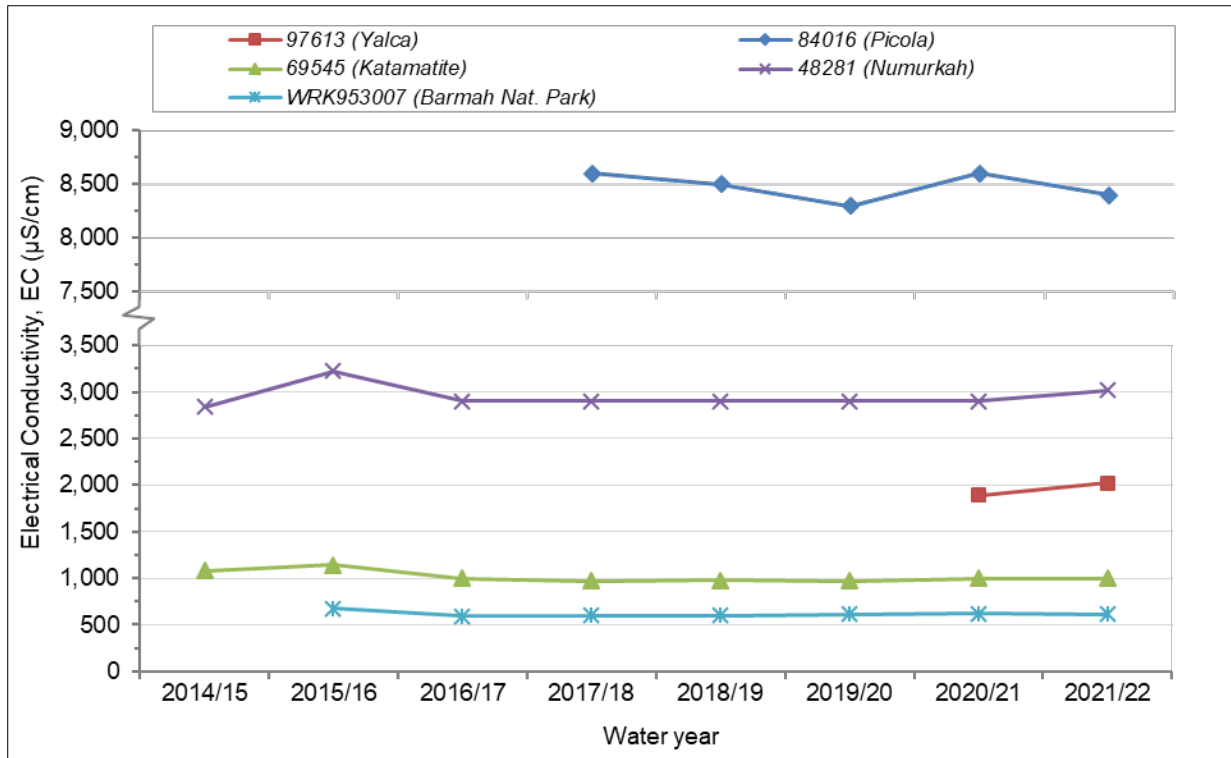


Figure 7 Annual groundwater-salinity results of Calivil Formation monitoring bores in the Katunga WSPA (ALS, 2022)

Continued sampling of the same set of bores going forward will allow for improved evaluation of water-quality trends over time.

Private bores

Prescription 6 of the Plan also requires GMW to provide a sample bottle to any groundwater user (licensed or for domestic and stock) in the WSPA who requests one and to test the salinity of returned samples. In 2021/22, no requests for sample bottles were received.

4 Administration and Engagement

4.1 Groundwater Reference Group

After the amendments to the Plan were approved, a groundwater reference group comprising local landowners and representatives of key stakeholder agencies (Goulburn Valley Water and Goulburn Broken Catchment Management Authority), was formed.

GMW met with the Katunga Groundwater Reference Group via video-conference on 16 November 2021. This was the fourth meeting of the group, which has met annually since inception. Key items of discussion included:

- Actions from the previous meeting
- Summary of 2020/21 water year
- Resource condition update
- Outlook for the 2021/22 water year
- Whether a review of the Plan is required
- Compliance and zero-tolerance on water theft
- Different intensity approaches

4.2 Plan review

GMW will meet with the Groundwater Reference Group in November 2022 to present a summary of the 2021/22 water year and discuss any need to review the Plan.

5 References

ALS, 2022. *Certificate of Analysis – Batch No. 21-51512 – Final Report 937766*. Laboratory report completed for Department of Environment, Land, Water and Planning. ALS Limited, Scoresby – 18 January 2022.

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Appendix A – Assessment of activities against Plan prescriptions

Prescription	Activity	Compliant								
PRESCRIPTION 1 – Limit on groundwater licences										
<p>GMW must not approve an application for a groundwater licence if the approval of the application would cause:</p> <p>a) the total licensed volume within a 2 km radius of the proposed extraction site exceeding 3,700 ML/year; or</p> <p>b) the following zone limits to be exceeded.</p> <table border="1"> <thead> <tr> <th>Management zone</th> <th>Zone limit (ML/yr)</th> </tr> </thead> <tbody> <tr> <td>North Western Dryland Zone (1061)</td> <td>6,500</td> </tr> <tr> <td>Numurkah-Nathalia Zone (1062)</td> <td>No limit</td> </tr> <tr> <td>Cobram Zone (1063)</td> <td>25,000</td> </tr> </tbody> </table>	Management zone	Zone limit (ML/yr)	North Western Dryland Zone (1061)	6,500	Numurkah-Nathalia Zone (1062)	No limit	Cobram Zone (1063)	25,000	<p><i>No applications were approved that contravened this prescription.</i></p>	<p>Yes</p>
Management zone	Zone limit (ML/yr)									
North Western Dryland Zone (1061)	6,500									
Numurkah-Nathalia Zone (1062)	No limit									
Cobram Zone (1063)	25,000									
PRESCRIPTION 2 – Restrictions on taking groundwater										
<p>By 15 September 2017, and by 1 July each year thereafter GMW will:</p> <p>a) determine the rolling average of the maximum annual groundwater recovery levels from the preceding 5 irrigation years for bores listed in Schedule 1 and announce a corresponding allocation for the subsequent irrigation season as detailed below:</p> <table border="1"> <thead> <tr> <th>Trigger level, depth below natural surface (m)</th> <th>Allocation</th> </tr> </thead> <tbody> <tr> <td>21.0 and above</td> <td>100%</td> </tr> <tr> <td>21.1 to 24.0</td> <td>70%</td> </tr> <tr> <td>Below 24.1</td> <td>70% and review undertaken by GMW in consultation with Katunga Groundwater Reference Group</td> </tr> </tbody> </table> <p>b) Announce allocations by listing them on its website, sending letters to all licence holders and placing public notices in local newspapers.</p>	Trigger level, depth below natural surface (m)	Allocation	21.0 and above	100%	21.1 to 24.0	70%	Below 24.1	70% and review undertaken by GMW in consultation with Katunga Groundwater Reference Group	<p><i>The annual allocation for the 2021/22 water years was determined in accordance with the Plan methodology and a 70 per cent allocation was announced on 25 June 2021.</i></p> <p><i>All licence holders were informed by mail posted. Allocation information was also published on the GMW website and advertised in local newspapers, Shepparton News and Country News.</i></p>	<p>Yes</p>
Trigger level, depth below natural surface (m)	Allocation									
21.0 and above	100%									
21.1 to 24.0	70%									
Below 24.1	70% and review undertaken by GMW in consultation with Katunga Groundwater Reference Group									

Prescription	Activity	Compliant
PRESCRIPTION 3 – Transfer of a groundwater licence		
<p>3.1 GMW may approve a permanent transfer of a groundwater licence provided relevant matters have been considered and:</p> <ul style="list-style-type: none"> a) zone limits in Prescription 1 will not be exceeded; and b) the total licensed volume within 2 km of an applicant's bore will be less than 3,700 ML/year; or c) where the total licensed volume within 2 km of an applicant's bore is equal to or greater than 3,700 ML/year, the permanent transfer is from other licence holders within a 2 km radius of the applicant's bore. 	<p><i>All applications were assessed with regard to this prescription.</i></p>	<p>Yes</p>
<p>3.2 GMW may approve a temporary transfer of a groundwater licence provided relevant matters have been considered and:</p> <ul style="list-style-type: none"> a) zone limits in Prescription 1 will not be exceeded; and b) the total licensed volume within 2 km of an applicant's bore will be less than 3,700 ML/year; or c) where the total licensed volume within 2 km of an applicant's bore is equal to or greater than 3,700 ML/year – <ul style="list-style-type: none"> i. the applicant's licensed volume in one water season will not exceed 125% of their permanent licensed volume prior to any temporary trade occurring; or ii. the temporary transfer is from other licence holders within a 2 km radius of the applicant's bore 	<p><i>All applications were assessed with regard to this prescription.</i></p>	<p>Yes</p>
PRESCRIPTION 4 – Metering of licensed take		
<p>GMW will:</p> <ul style="list-style-type: none"> a) ensure that a meter is fitted to new licensed bores; b) read each meter at least once a year and record take in appropriate database(s); and c) if GMW is unable to measure the volume of water taken through a meter it may: <ul style="list-style-type: none"> i. make an estimate of take; or ii. request the licence holder to provide a meter reading 	<p><i>All new bores have meters installed.</i></p> <p><i>Meter readings were recorded at least once in 2021/22.</i></p>	<p>Yes</p>

Prescription	Activity	Compliant
PRESCRIPTION 5 – Groundwater level monitoring		
<p>5.1 GMW will:</p> <ul style="list-style-type: none"> a) obtain groundwater levels from bores used for allocation assessments (listed in Schedule 1) on a monthly basis. If a bore used for allocation assessments becomes defective an alternative bore may be monitored and the defective bore should be decommissioned. The alternative bore will be selected by consensus between DELWP and GMW. b) undertake water level monitoring at appropriate locations throughout the Katunga WSPA to: <ul style="list-style-type: none"> i. assess annual and long-term impact on water levels from groundwater pumping; ii. monitor regional and local seasonal drawdown; and iii. monitor the impacts of groundwater pumping generally across the Katunga WSPA and in areas of high intensity groundwater pumping. 	<p><i>Groundwater levels for allocation assessments were obtained monthly.</i></p> <p><i>Water-level monitoring is undertaken at appropriate locations in the WSPA.</i></p>	Yes
<p>5.2 DELWP will manage the State observation bore network so that:</p> <ul style="list-style-type: none"> a) continuous regional baseline monitoring is maintained to provide sufficient information to identify changes in groundwater resource availability and condition; b) State observation bores are properly maintained; and c) data collected from the bores is entered into the groundwater database, within 30 days after it has been collected. 	<p><i>Baseline monitoring is being supported by DELWP.</i></p> <p><i>State observation bores are maintained by DELWP.</i></p> <p><i>Data collected from the bores were entered into the groundwater database by DELWP.</i></p>	Yes
PRESCRIPTION 6 – Groundwater salinity monitoring		
<p>GMW must:</p> <ul style="list-style-type: none"> a) sample bores specified in Schedule 1 and have the samples analysed at an accredited laboratory for salinity once a year; b) enter salinity measured in bores referred to in Schedule 1 to the State groundwater database; and c) provide a sample bottle to any groundwater user in the Katunga WSPA who requests 1, test the salinity level of returned samples and provide the results to the groundwater user. 	<p><i>Bores specified in Schedule 1 were sampled and analysed for salinity in December 2021.</i></p> <p><i>Salinity results were entered into the State groundwater database.</i></p> <p><i>No groundwater users in the WSPA requested a sample bottle in 2021/22.</i></p>	Yes
PRESCRIPTION 7 – Annual reporting		
<p>By 30 September each year GMW will prepare an annual report on the enforcement and administration of the Plan. The report will be provided to the Minister and the Goulburn Broken Catchment Management Authority and made publicly available on GMW's website.</p>	<p><i>An annual report was prepared by GMW and provided to the Minister for Water and the Goulburn Broken Catchment Management Authority on 29 September 2021.</i></p> <p><i>The annual report was also published on GMW's website.</i></p>	Yes

Appendix B – Groundwater level data

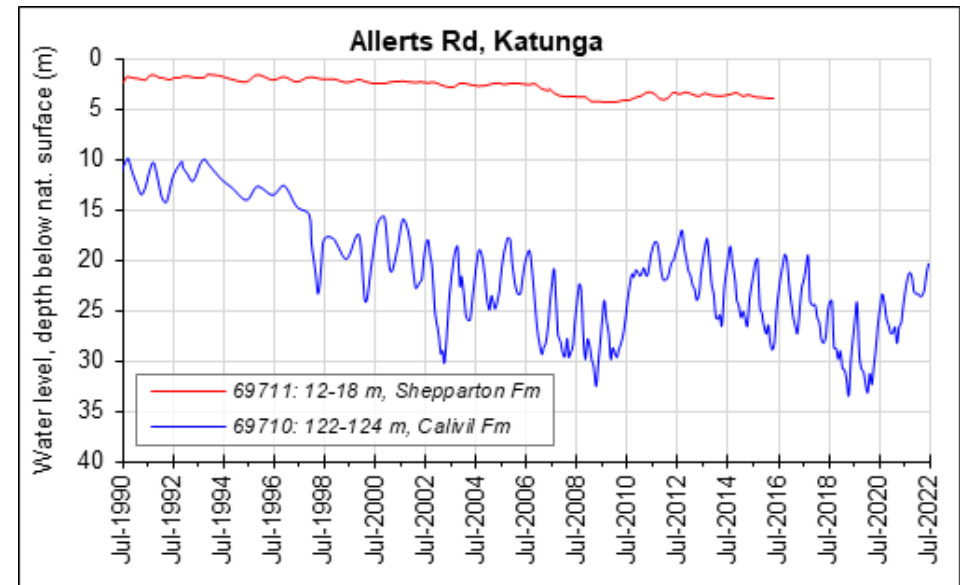
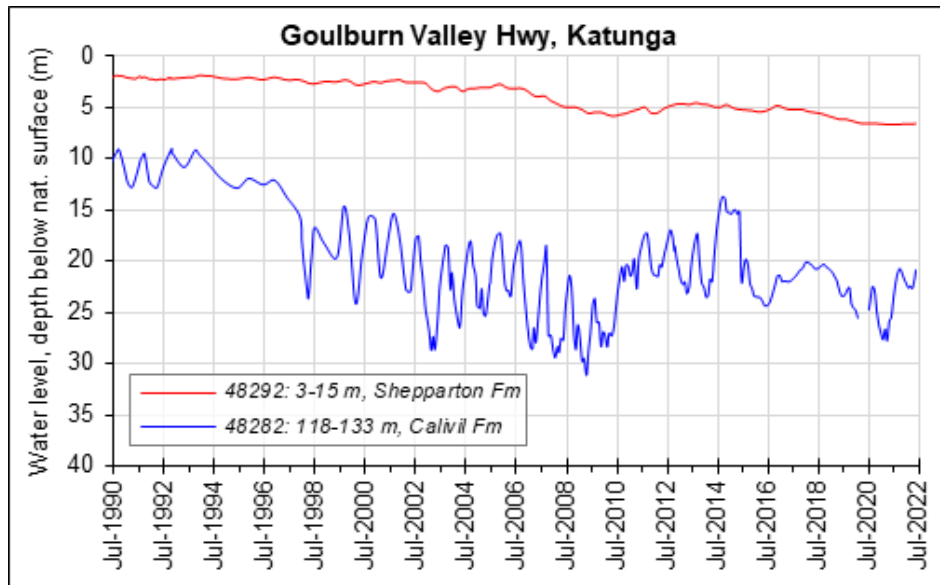
Schedule 1 bores

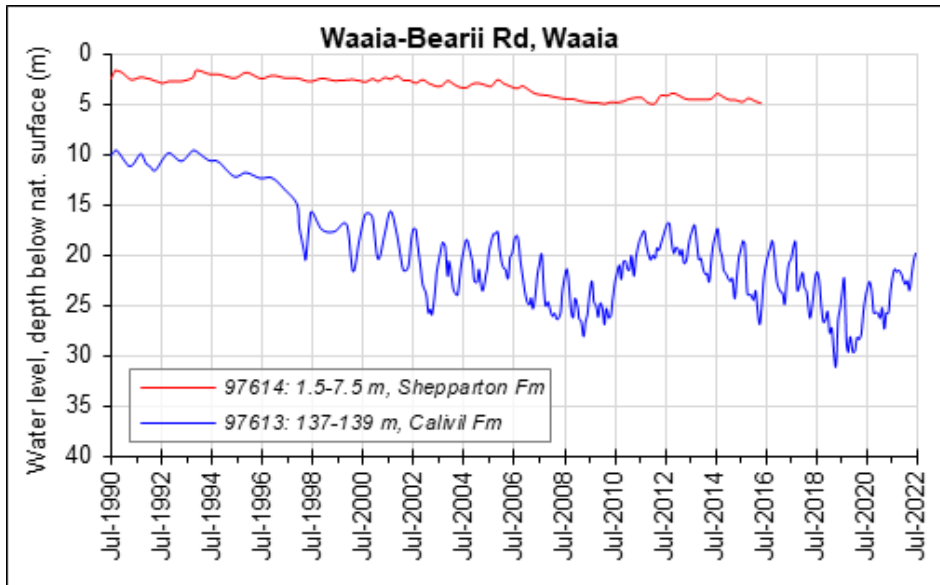
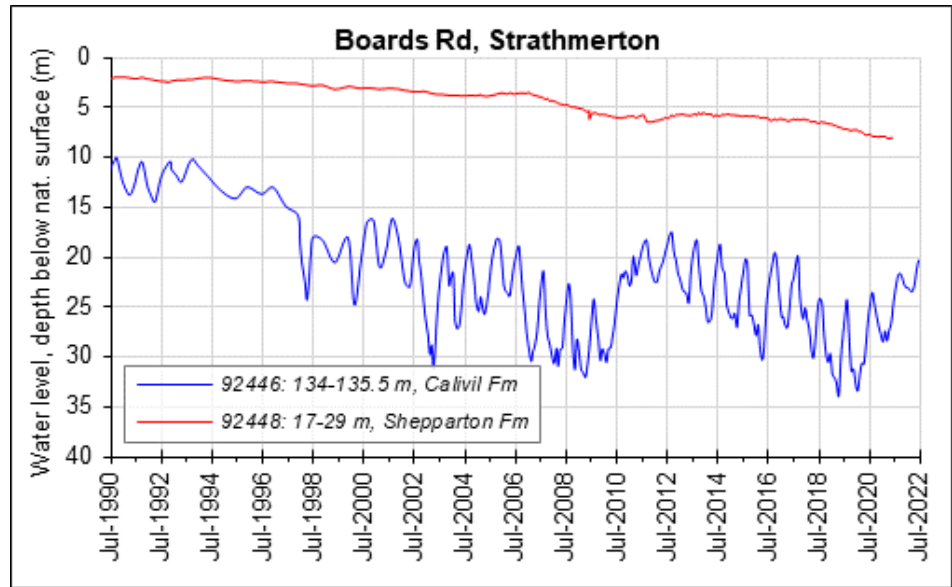
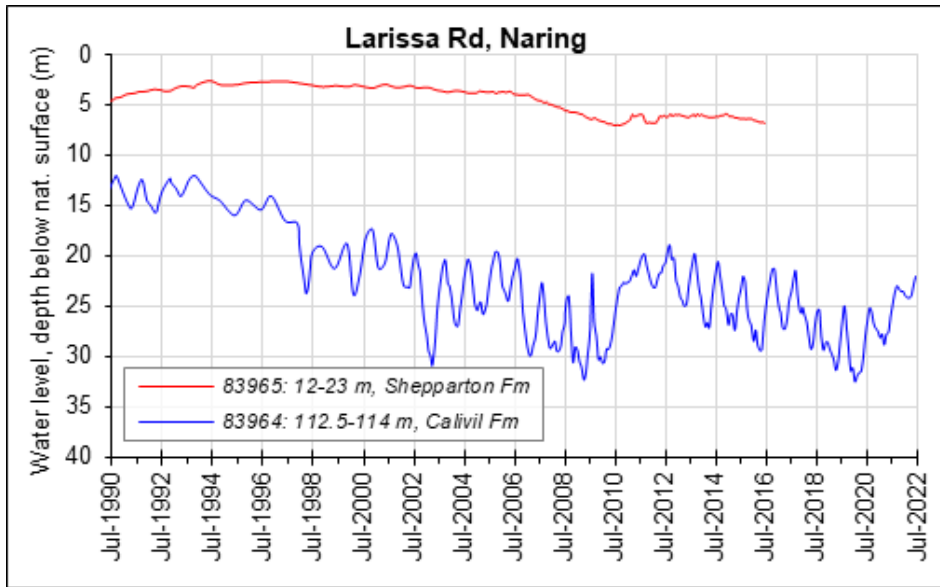
Groundwater level data for key monitoring bores listed in Schedule 1 of the Plan. Note: monitoring of some of the shallow bores has ceased.

All data have been sourced from the *Water Measurement Information System (WMIS)* (DELWP, 2022). Further information is available on the WMIS website, at <https://data.water.vic.gov.au>.

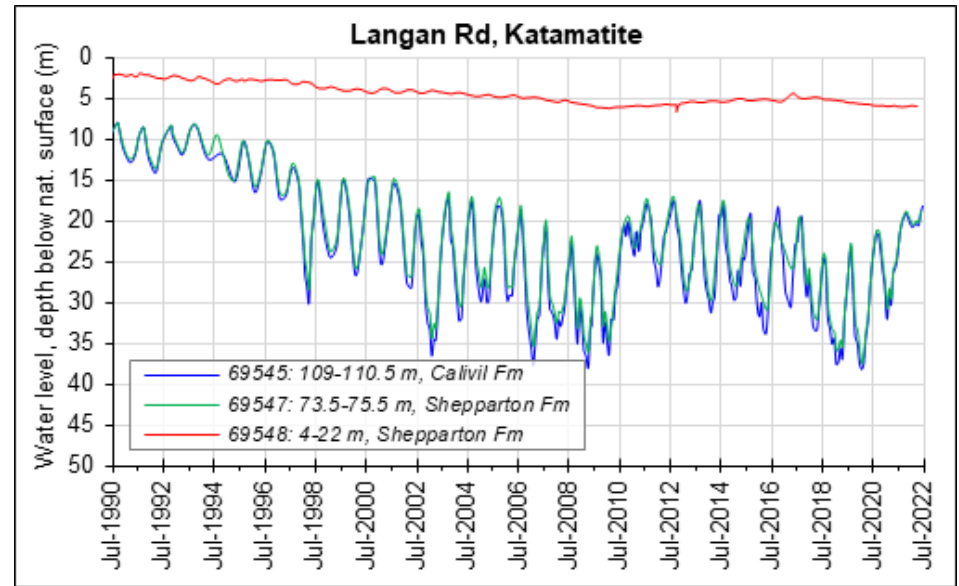
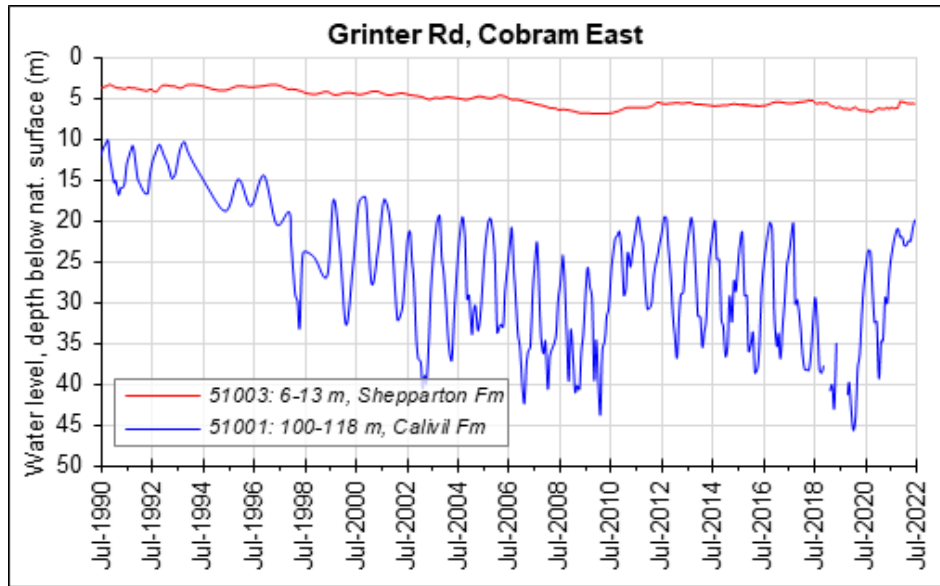
Please note that the data presented here are not continuous. Data points which make up these curves are at either monthly or quarterly intervals. Since November 2017, some sites have been converted to remote-read which has allowed for hourly levels to be recorded. For those sites, only one level per month is presented in the hydrographs – 12:00 PM on the 15th day (or closest available).

Numurkah-Nathalia Zone (1062)





Cobram Zone (1063)

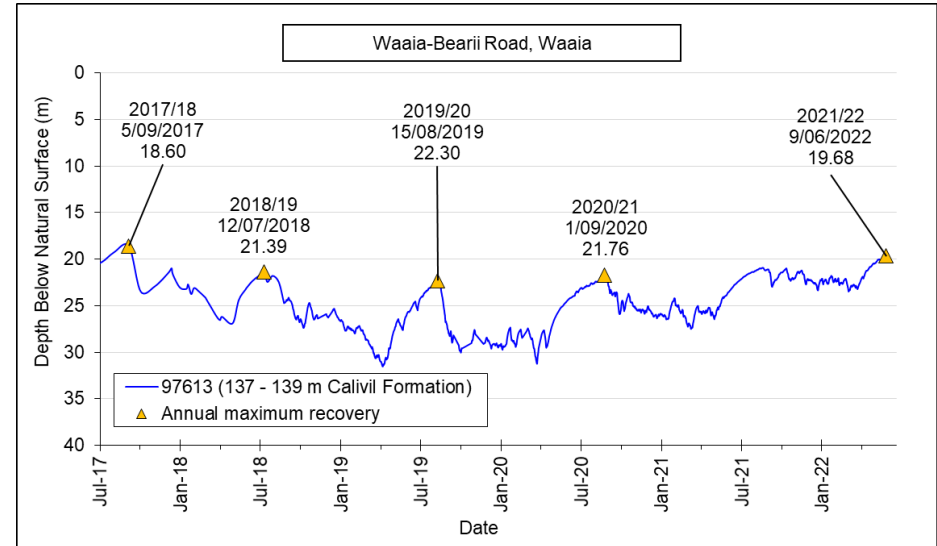
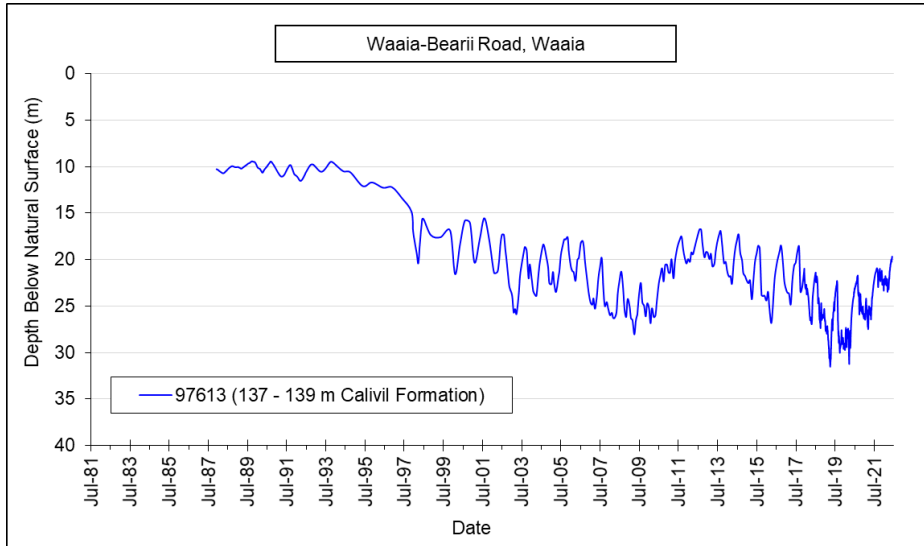


Note: Fm = Formation

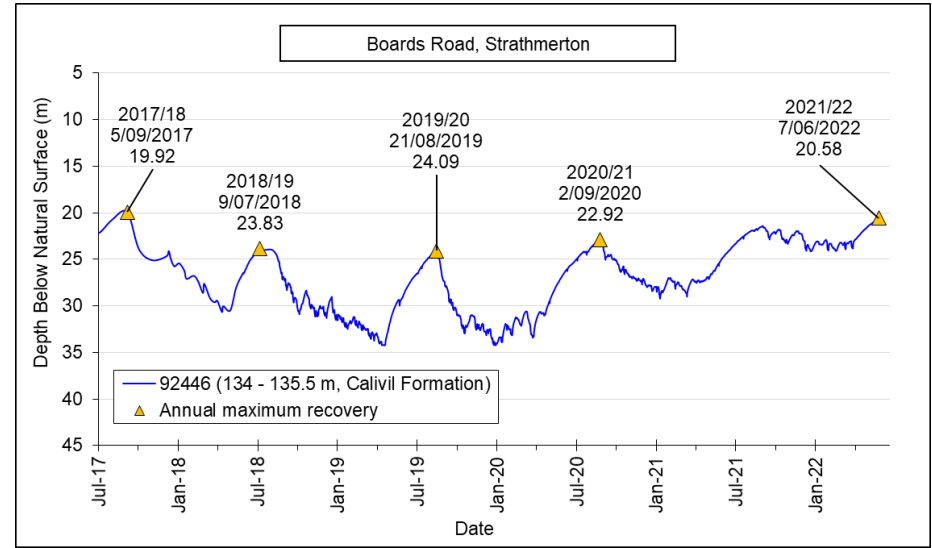
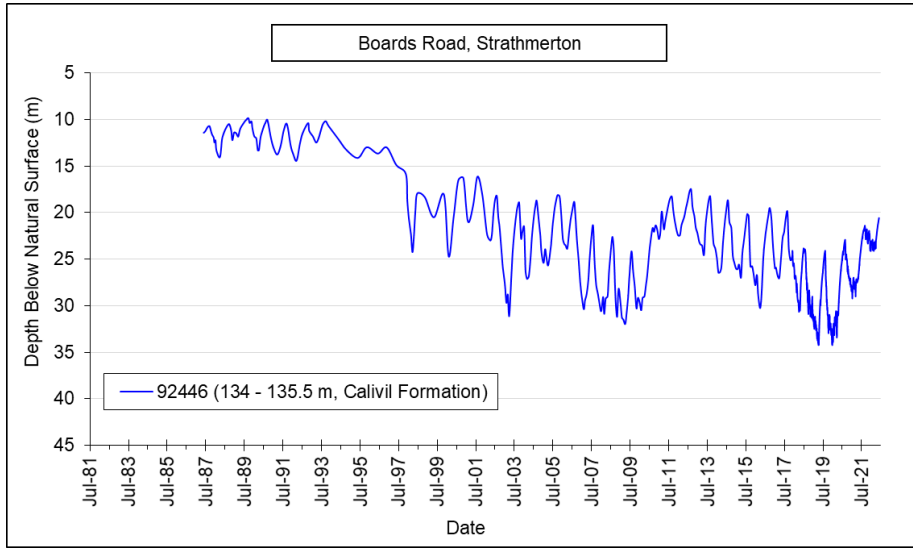
Allocation assessment bores

The 2021/22 and 2022/23 allocations were determined using the seven State observation bores listed Schedule 1 of the Plan. The data used for these determinations are shown in the hydrographs below. Each bore is represented by a set of two hydrographs – full monitoring record (left) and last five water years, only (right).

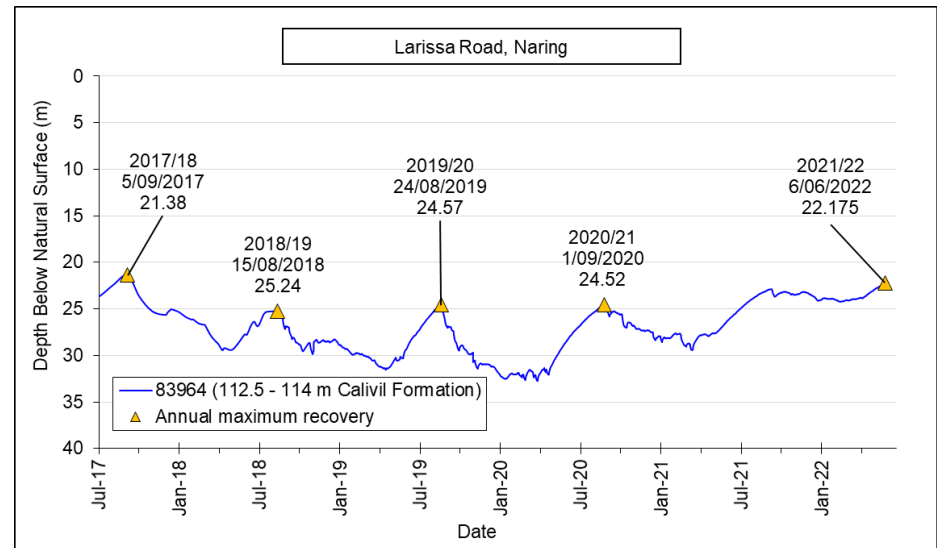
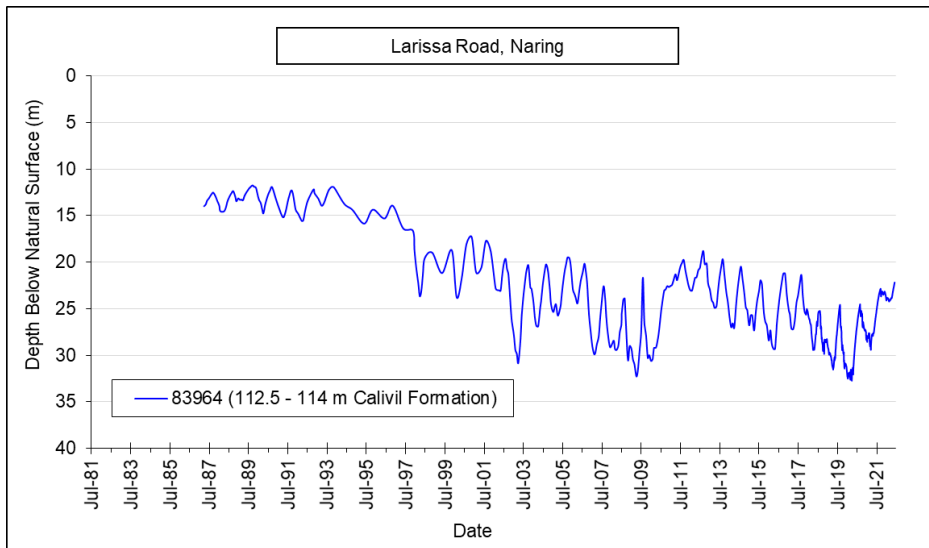
Bore 97613



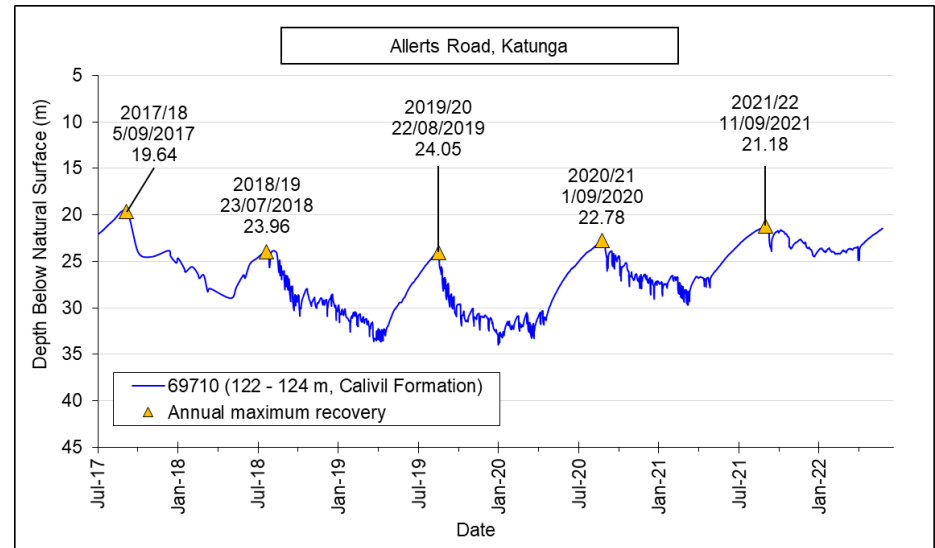
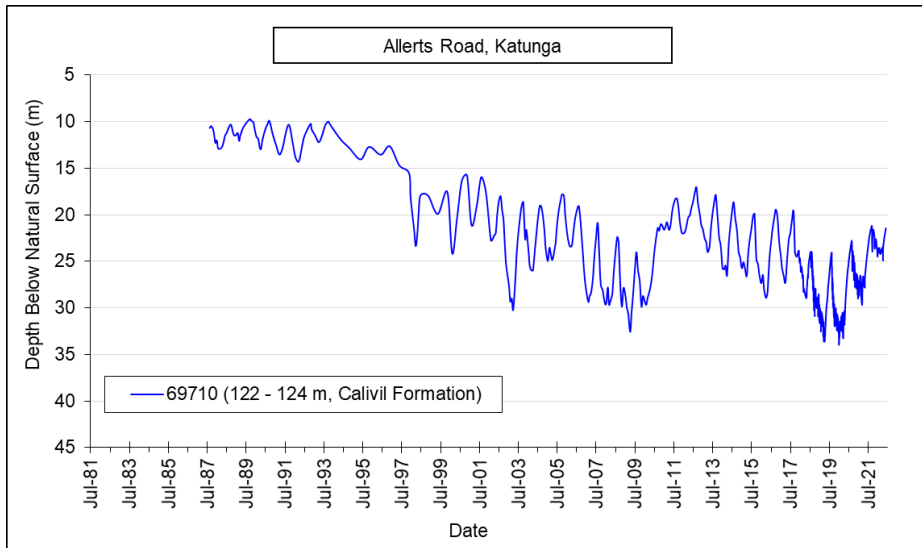
Bore 92446



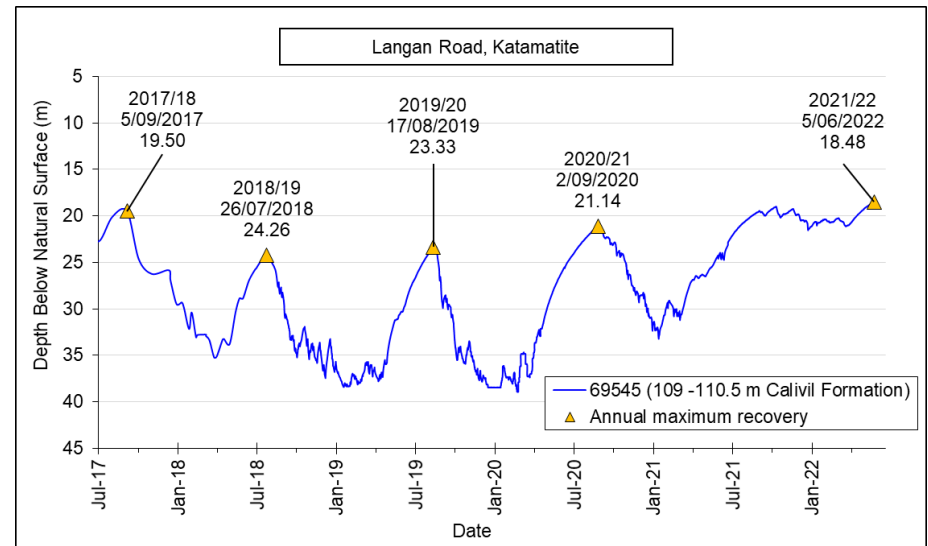
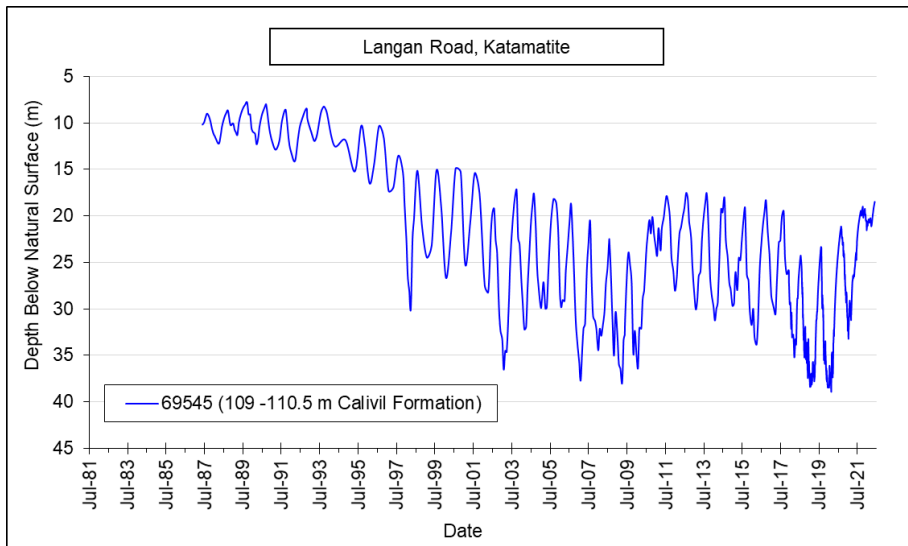
Bore 83964



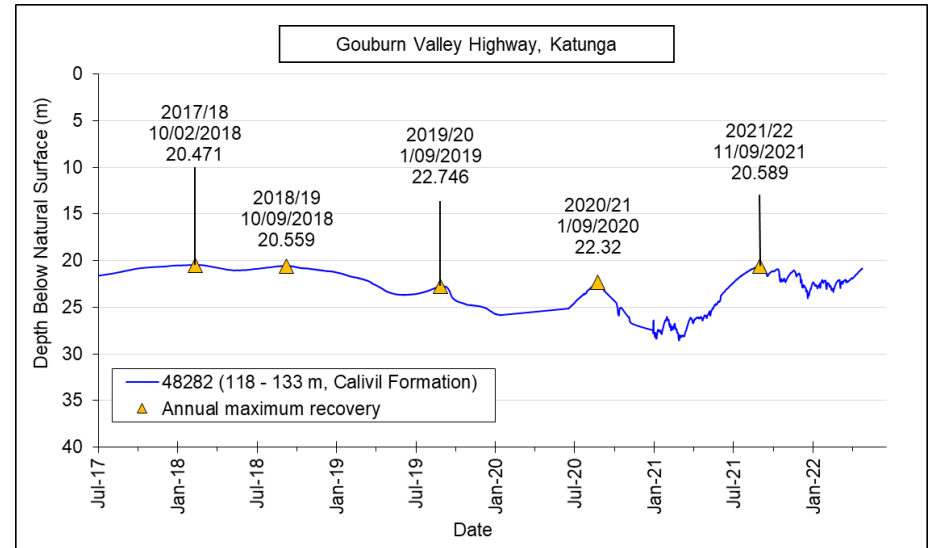
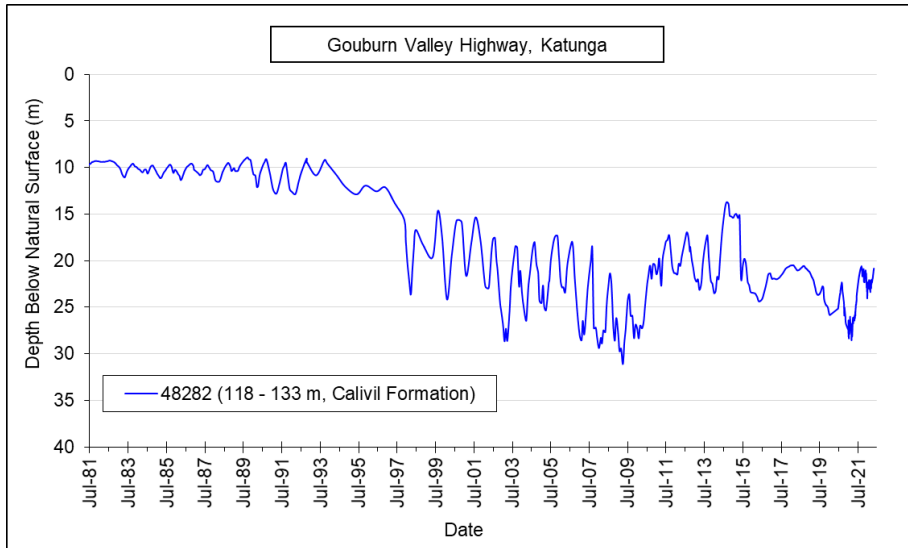
Bore 69710



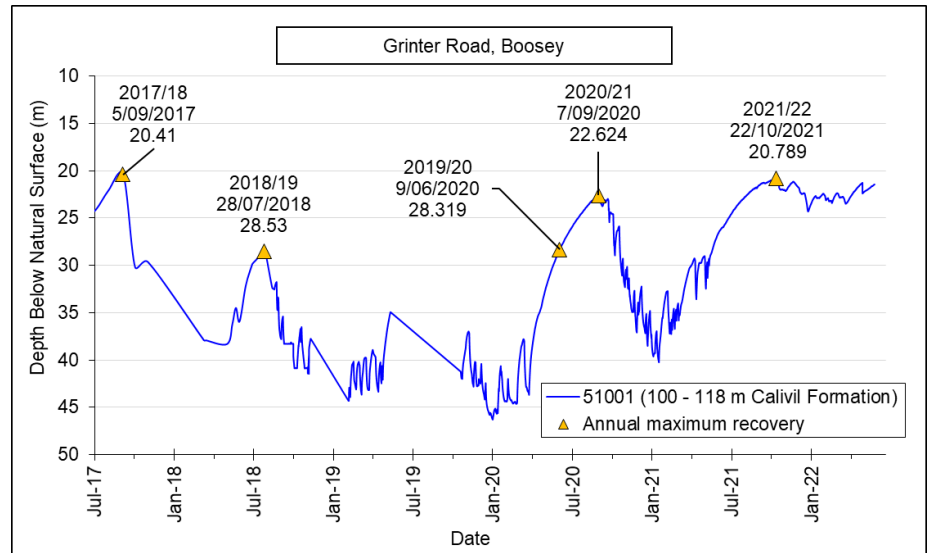
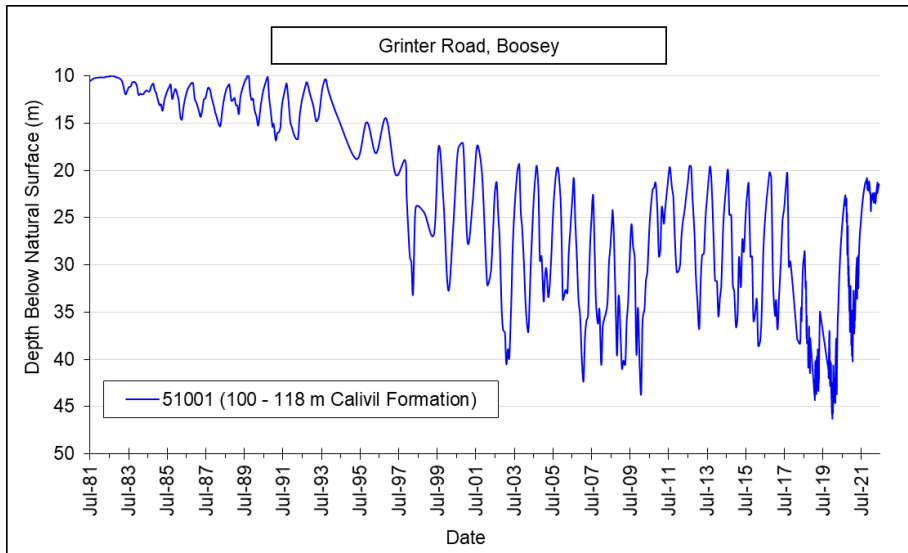
Bore 69545



Bore 48282



Bore 51001



Appendix C – Groundwater quality results

Analytical chemistry results for 2021/22

Analytical chemistry results for key State observation bores sampled during the 2021/22 water year. All data sourced directly from laboratory reports completed by ALS Limited (ALS, 2022). Further information is available on the *Water Measurement Information System* website, at <https://data.water.vic.gov.au>.

		Bore:	WRK953007	WRK953008	48281	48288	84016	84021	69545	69547	69548
		Aquifer:	Calivil Formation	Shepparton Formation (lower)	Shepparton Formation	Shepparton Formation (upper)	Calivil Formation	Shepparton Formation (upper)	Calivil Formation	Shepparton Formation (lower)	Shepparton Formation (upper)
		Date:	15/12/2021	15/12/2021	16/12/2021	14/12/2021	9/12/2021	14/12/2021	15/12/2021	15/12/2021	27/10/2021
Analyte	Unit										
pH	pH units		7	7.2	7.4	7.2	8.6	7.7	7.4	7.4	7.5
Total Kjeldahl Nitrogen, as N	mg/L		<0.1	0.2	1.8	0.3	2	<1	0.4	0.1	0.7
Phosphorus, total as P	mg/L		<0.05	0.07	0.21	<0.05	0.07	<0.5	1.1	0.15	0.08
Total Organic Carbon	mg/L		<0.5	<0.5	4	2.3	2.2	3.7	<0.5	<0.5	7.9
Total Dissolved Solids, at 180°C	mg/L		360	400	1700	2200	4500	22000	500	180	250
Electrical Conductivity, at 25°C	µS/cm		610	640	3100	3700	8400	35000	1000	300	420
Turbidity, NTU	NTU		7.3	15	28	0.8	8.5	49	490	110	7.6
Chloride, as Cl	mg/L		58	35	810	960	2900	15000	200	21	33
Sulphate, as SO ₄	mg/L		51	51	180	180	<1	3000	34	17	11
Bicarbonate Alkalinity, as CaCO ₃	mg/L		170	220	120	340	62	620	150	97	140
Carbonate Alkalinity, as CaCO ₃	mg/L		<2	<2	<2	<2	7	<2	<2	<2	<2
Hydroxide Alkalinity, as CaCO ₃	mg/L		<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Alkalinity, as CaCO ₃	mg/L		170	220	120	340	69	620	150	97	140
Anionic Strength	meq/L		6	6	29	38	83	498	9	3	4
Cationic Strength	meq/L		6	6	23	29	82	331	9	3	4
Ion Balance - relative difference	%		1.33	4.2	10.5	12.3	0.83	20.1	3.41	6.18	4.33
Ion Balance - TDS (EC) vs TDS	unitless		0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.6
Total Nitrogen, as N	mg/L		<0.1	0.2	1.9	1.4	2.1	<1	0.4	0.1	4.4
Ammonia, as N	mg/L		<0.1	<0.1	0.4	<0.1	2	0.6	<0.1	<0.1	<0.1

		Bore:	WRK953007	WRK953008	48281	48288	84016	84021	69545	69547	69548
		Aquifer:	Calivil Formation	Shepparton Formation (lower)	Shepparton Formation	Shepparton Formation (upper)	Calivil Formation	Shepparton Formation (upper)	Calivil Formation	Shepparton Formation (lower)	Shepparton Formation (upper)
		Date:	15/12/2021	15/12/2021	16/12/2021	14/12/2021	9/12/2021	14/12/2021	15/12/2021	15/12/2021	27/10/2021
Analyte	Unit										
Nitrate + Nitrite, as N	mg/L		0.09	0.06	<0.1	1	0.03	0.02	0.01	0.03	3.7
Nitrate, as N	mg/L		0.09	0.06	<0.1	0.99	0.03	0.01	0.01	0.03	3.7
Nitrite, as N	mg/L		<0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	mg/L		<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	<0.001
Cadmium	mg/L		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chromium	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
Copper	mg/L		<0.001	<0.001	<0.001	0.009	<0.001	0.013	<0.001	<0.001	0.01
Iron	mg/L		<0.01	0.02	<0.01	<0.01	0.02	0.06	0.61	0.09	<0.01
Lead	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L		0.001	0.011	<0.001	0.14	0.074	12	0.11	0.031	0.006
Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L		<0.001	<0.001	<0.001	0.002	<0.001	0.051	0.008	0.076	<0.001
Zinc	mg/L		<0.001	<0.001	0.018	0.016	<0.001	0.033	<0.001	<0.001	0.009
Calcium	mg/L		5.8	6.3	27	53	54	540	8.7	1.1	6.8
Magnesium	mg/L		10	9.6	51	64	54	1100	15	2.3	13
Potassium	mg/L		1.5	1.5	4	7	22	19	2.7	1.7	7.5
Sodium	mg/L		110	110	410	490	1700	4900	160	52	52

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

Historic groundwater salinity data for key monitoring bores

