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Review of metering in the Victorian lower Murray regulated surface water system

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GPO Box 1801, Canberra ACT 2601
engagement@mdba.gov.au



1800 230 067
mdba.gov.au

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The Murray–Darling Basin Authority pays respect to the Traditional Owners and their Nations of the Murray–Darling Basin. We acknowledge their deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

The guidance and support received from the Murray Lower Darling Rivers Indigenous Nations, the Northern Basin Aboriginal Nations and our many Traditional Owner friends and colleagues is very much valued and appreciated.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.

Executive Summary

Background

The part of the Murray River stretching from Nyah to the South Australian border in north-west Victoria contains a mix of water users, ranging from small users within irrigation areas through to large corporations taking water directly from the Murray River. This area includes the Red Cliffs, Merbein, First Mildura and Robinvale irrigation districts (colloquially referred to as the ‘Sunraysia irrigation district’).

In the 2018-19 Water Year approximately 608 GL of water was extracted for irrigation along this part of the Victorian Murray. Of this, around 143 GL was used within the Sunraysia pumped districts and Millewa Stock & Domestic supplies, with the remainder extracted directly from the Murray River by ‘private diverters’. Refer to Appendix B for a breakdown.

Water take for the area is managed by Lower Murray Water (LMW), a State-owned Water Corporation. LMW is responsible for managing water licencing for all water users in their area of responsibility and is also responsible for delivering water to users located within the Sunraysia and Robinvale irrigation districts.

This area was chosen for review as it represents an area of significant water use within Victoria. The area is a major producer of dried fruit, table grapes, wine grapes, almonds, pistachios, olives, avocados, citrus and vegetables. Further, the MDBA is aware that agriculture in the region is experiencing change, mainly through the expansion of large corporate enterprises and adjustments to the mixture of crop types grown in the area.

This review is one of a series being undertaken across the Basin States to help the MDBA assess the systems and procedures that states have in place to ensure the accuracy of water metering and measurement, and the integrity of data provided to the MDBA through annual water take reporting (in accordance with section 71 of the *Water Act 2007*). At the Basin-scale, these reviews will help improve the transparency of, and build confidence in, how water take information is collected and reported. For Victoria, this looks at whether there are appropriate systems in place to ensure metered surface water take is reported accurately within in that part of the Victorian Murray managed by LMW.

The MDBA is conducting this review under section 13.10¹ of the Basin Plan, and Section 173(1)² of the *Water Act 2007*, and in accordance with the MDBA’s 2019-20 Annual Audit Work Program.

Review Approach

Fieldwork for this review was undertaken in mid-October 2019. MDBA officers travelled to Mildura to observe LMW procedures for collection of water usage information. This consisted of an overview of

¹ Under s13.10 of the Basin Plan, the Authority has the power to undertake periodic audits to assess the extent of compliance with the Basin Plan.

² Section 173(1) of the *Water Act 2007* (Cwlth) provides the Authority with the power to do anything that is necessary or convenient to perform its functions (which are listed in s172). Those functions include measuring, monitoring and recording information about the Basin water resources, including water take (s172 (1) (v)).

the LMW telemetry system, followed by a field exercise where MDBA accompanied LMW meter readers to a number of ‘private diverter’ sites to observe the manual meter read collection process.

Following this, MDBA officers held discussions with both the Victorian Department of Environment, Land, Water and Planning (DELWP) and Goulburn-Murray Water (GMW) staff to gain an understanding of the procedures in place to collate and then report this water usage data back to the MDBA in accordance with Section 71 of the *Water Act 2007*.

The MDBA would like to thank the staff that participated in this review, in particular the staff from LMW who took the time to facilitate the fieldwork component of this review. The MDBA thanks these staff for their co-operation and professionalism.

Review Objective

The objective of this review was to assess the adequacy and effectiveness of the recording and reporting arrangements that Lower Murray Water (LMW) and the Victorian Department of Environment, Land, Water and Planning (DELWP) have in place to ensure that metered surface water take is accurately measured and reported; and that the MDBA can rely on this data to support the determination of annual actual take and inform our assessment of compliance with the Victorian Murray Sustainable Diversion Limit (SDL).

Conclusion

Overall this review found that LMW and DELWP have effective mechanisms in place to ensure that metered surface water usage in the lower Murray area of Victoria is accurately captured and reported, and can be relied on to support the determination of annual actual take in the region.

An investment in a sophisticated telemetry system which covers over 95% of water extracted in this area has enabled LMW to accurately track water extraction in near real-time, providing a high level of accuracy with regard to monitoring non-urban water usage, as well as a powerful tool to identify instances of possible non-compliance by licence holders.

In addition, LMW have put in place additional measures to further strengthen the integrity of its water measurement data collection and storage processes. As an example, an automated data analysis process has been implemented to review all telemetered data received by LMW and identify any possible ‘exceptions’ from those readings on a daily basis.

Further details on this and other observations are explored below.

The MDBA concludes that the overall rating for this review is **Satisfactory**. This report does not make any recommendations for improvement.

Overall Rating	Satisfactory
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Detailed Observations

1. Telemetry coverage

Telemetered meter readings within LMW's irrigation districts (Red Cliffs, Merbein, Mildura, Robinvale and Millewa Stock & Domestic supplies) are a two-tier system, with each of the irrigation districts having their bulk extraction flow meters report readings and consumption via telemetry daily. In addition to the first-tier telemetered meters at each of the irrigation district bulk extraction points, individual irrigation customers downstream of the bulk extraction points are also fitted with telemetered meters to capture individual consumptions. Therefore, 100% of water extracted for use in the LMW-managed irrigation districts is telemetered at the point it is taken from the river.

Information provided by LMW shows that for the 2018/19 Water Year, water use by private diversion customers in the area managed by Lower Murray Water (LMW) totaled approximately 465 GL. Of this total, 444.8 GL (96%) was recorded through, and reported via, a telemetered flow meter at the Murray River extraction point.

Water use data (from meters fitted with telemetry) is delivered to LMW via a supervisory control and data acquisition (SCADA) system, where it is stored in a 'data warehouse' before undergoing a validation process (further information on this process is detailed below). LMW was able to show the MDBA that when water is being extracted, measurement data is delivered to LMW in near real-time (with a 5 – 10 min delay). Importantly, this data includes the flow rate of extraction, which allows LMW to monitor when that rate changes. If the indicated flow rate is not consistent with the size of the pump, this can be an early indication of a faulty meter.

This broad coverage of telemetry means LMW is able to actively monitor most of its customers as they are extracting water, giving LMW the ability to quickly identify potential issues that may require immediate attention. Another benefit of telemetry to LMW is that it gives them the ability to better track water conveyancing losses within their irrigation districts, allowing them to potentially identify improvements that could be made in this area.

Irrigators also benefit from telemetry as it allows them to more accurately monitor their water usage, which can help them to identify efficiencies in their irrigation system and minimise any water lost due to seepage or evaporation.

2. Data integrity

MDBA reviewed the processes LMW have implemented to help ensure that water meter data collected – via either telemetry or in-field meter reads – is accurate before it is formally recorded in the Victorian Water Register.

LMW noted that water use data for their licence holders undergoes several validation checks before it is finalised and sent to their billing department and the Victorian Water Register (Water Register).

Firstly, all data that comes in from telemetered meters undergoes an automatic validation check by LMW software, based on parameters set by LMW to highlight any extraction data that falls outside of an expected range.

If this initial validation process identifies an issue with a particular reading – for example, a reading it deems as unusually high – that reading is quarantined and flagged for a manual check by a LMW officer. All readings that are identified as ‘exceptions’ are compiled in an ‘exception report’ which is created daily (at 3pm). This report is then sent to several LMW officers for manual review.

Information provided by LMW for the week 18 to 24 November 2019 shows that:

- 6,544 meter readings were received via telemetry; and
- 127 of these meter readings (less than 2%) were raised as ‘alerts’ and required human intervention to validate and process.

One example of an ‘exception’ quarantined by the daily exception report is:

- For private diverters, where they have recorded greater than 50 megalitres (ML) of take in a single day; and
- For in-district diverters, where they have recorded greater than 5 ML of take in a single day.

This exception report is manually reviewed each day by LMW staff and the readings in that report are either approved or flagged for further investigation. If a reading that was initially identified as an ‘exception’ had been subsequently approved manually, the LMW officer who approved that reading is required to enter a notation against that reading indicating why it was approved.

One example of a reading that was considered an exception that was demonstrated to MDBA during this review was where a private diverter had extracted 70 ML in a single day. After undergoing a manual check by a LMW officer, it was identified that this particular telemetered meter had not been in communication with LMW for 3 consecutive days, meaning that the 70 ML had actually been taken by the water user over a period of several days (and was subsequently determined to be within the typical usage rate for a private diverter of this size). Having performed the manual check and confirming the validity of the reading, the data was manually approved and uploaded into the LMW billing system (and sent on to the Water Register), and the meter itself was flagged for a manual inspection and maintenance check.

Those meter readings obtained via a physical reading of the meter (i.e. non-telemetered meters) by a LMW field officer also undergo a validation process before they are finalised. MDBA officers accompanied LMW staff to a number of in-field meter sites, where LMW staff conducted a walkthrough of their manual meter reading process as described below.

Each non-telemetered irrigation meter is manually read on a monthly cycle. To do this, a LMW officer will use a device called a Hand Held Meter Reader (HHMR). Each month the LMW billing system (P&R) will produce a list of all meters that are required to be read, and the details of these meters and their locations are loaded into the HHMRs for use by the field officers.

Meters to be read are loaded on to the HHMRs as 'routes' for the LMW staff to follow – once a reading for a particular meter is entered in to the HHMR, the details of the next meter to be read are then displayed on the device (including name of owner, location of meter and meter ID number).

If the figure that is entered falls outside the normal range expected (using parameters set by LMW), the HHMR will display a warning message and require the field officer to input that reading a second time. This requirement acts as a control to prevent incorrect readings from being recorded. When the LMW field officer returns to the office, alert readings are further reviewed by another LMW officer to validate or assess the alerts and determine if any corrective action is required prior to the readings being uploaded into the LMW database.

If a meter is unable to be read, (for example, it is not operating due to a malfunction), LMW staff use a range of alternative data inputs to estimate water usage during the time that the meter is offline. Chief among these is a reading obtained from the power meter linked to the pump which can be used to determine pump hours. This figure, multiplied by the size and flow rate of the pump, gives a volumetric figure. LMW will sometimes also use historical meter readings – eg. the same period in previous years - as a guide. The licence holder is kept informed about this process as it is being undertaken and can provide any other relevant information which they believe should be taken into account when estimating water usage.

3. Identifying and reporting faults and compliance issues

As was demonstrated to MDBA during the fieldwork for this review, LMW field officers will conduct a visual inspection of meters when they are performing a meter read (for non-telemetered meters). Primarily they are looking for any indication of a faulty meter, whether through malfunction or possible tampering.

If a fault is identified, the LMW field officer will make a note of this (including taking photos of the meter if it appears to have been tampered with), then on returning to the office, they will log a job (called a 'merit') in their customer relationship management (CRM) system, then send that merit to the appropriate officer for further review, whether that be a technical expert or someone in the compliance team.

LMW do carry out scheduled maintenance on each of their telemetered meters every 2 years (at a minimum) for battery replacements. LMW's current maintenance approach does not include any regular in-situ validation of telemetered meters. LMW noted that they are aiming for AS4747-consistent validation of all compliant meters (both electronic and mechanical) every 5 years, however there is no current validation schedule established by LMW to meet this timeframe, and there are resourcing implications that need to be considered before such an approach can be implemented. The MDBA notes that LMW are currently involved in the Metrological Assurance Framework (MAF) modernisation project, part of which includes developing a risk categorisation process that may be used to inform meter maintenance and validation requirements.

LMW did state that they believe that the sophistication of their telemetry system is such that any faults or meter maintenance issues for telemetered meters would be detected. For example, if a telemetered meter fails to submit a reading for 3 consecutive days, an 'alarm' is triggered which prompts a LMW officer to investigate and attempt to remedy the issue from the LMW office. If they are unable to fix the problem, then a merit is raised to have this meter investigated.

MDBA agrees that whilst a process to conduct regular in-situ validations of all telemetered meters in its fleet would represent 'better' or even 'best' practice, the risk of not doing so is largely mitigated by the sophistication of the telemetry system and the resources dedicated to monitoring that system by LMW staff. The MDBA suggests that LMW should revisit this approach once the MAF modernisation project is finalised.

LMW also demonstrated to MDBA how they use 'raw' telemetry data to detect any potential meter issues. LMW use a program called 'Metermade' to view meter flow rate data as well as the battery voltage of the meter. During the fieldwork for this review, LMW highlighted to MDBA a meter that was showing as taking a small volume of water (2L/s) consistently over an extended period, which was possibly an indication of a faulty meter.

LMW Response

LMW conduct an annual verification of all its bulk extraction meters that extract from the Murray River to its irrigation and treated water networks.

Private diverter meters are visited at a minimum once every 2 years, for a physical inspection in combination with routine battery replacement. Many meters will have a brief visual inspection on a monthly basis, as many meters are clustered together at *ideal pumping locations* and when meter

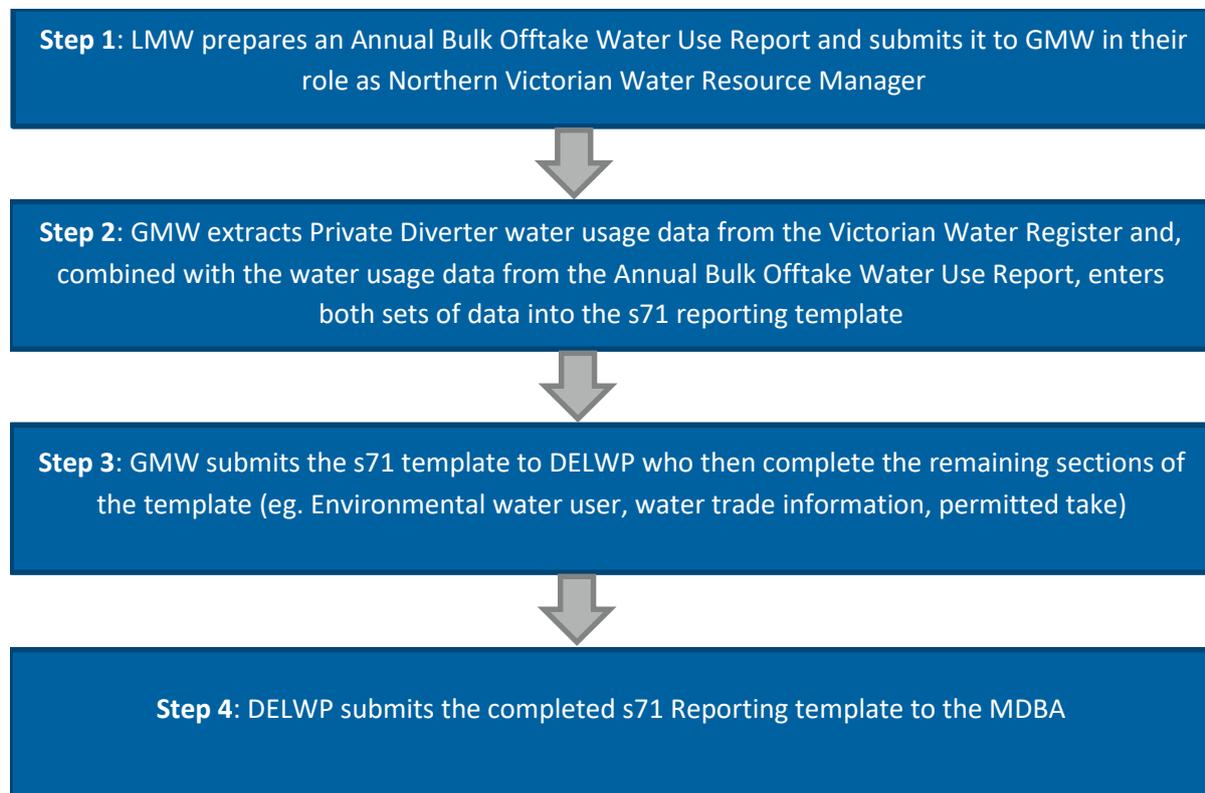
maintenance, reading, or inspections are carried out in that area others will be visually inspected at the same time. The issue is that the brief inspections are not recorded

Meters are validated on a as needs basis where LMW use this as a diagnostic to help with assessment of a meter if either LMW or the customer believe there is a meter fault.

As an initial measure LMW will aim to annually validate meters at diversion points that have a history to deliver above 5000ML, in the longer term LMW are working towards a program towards the routine validation of 20% of all metering fleet every year, but resources and funding will be a factor in the implementation of such a program.

4. Section 71 reporting data

A Section 71 (s71) Report on water usage is prepared by each Basin states annually and submitted to the MDBA. The reports are analysed by the MDBA to ensure annual water usage in each SDL resource unit complies with the SDL. Section 71 data is provided to the MDBA directly by DELWP, however both LMW and Goulburn Murray Water (GMW) have roles in preparing this annual water use information. The steps in the process are represented in the following diagram:



The data undergoes a quality assurance check at each step of the above process, as described below

For Step 1, the Annual Bulk Offtake Water Use Report is prepared using the validated water usage data that is collected via telemetry from the bulk offtake points (as described earlier in the report).

For Step 2, GMW undertakes a number of quality assurance processes to ensure the data received from the Victorian Water Register and LMW is correct:

- GMW checks to ensure that they have extracted all relevant and required Private Diverter water usage data from the Victorian Water Register – GMW assume that this information is correct (further detail on data validation undertaken by LMW before it is submitted to the Victorian Water Register is provided in Part 2 above).
- GMW compares the submitted Annual Bulk Offtake Water Use Report data with a summary of each Daily Bulk Offtake Water Use Report that LMW submits to them throughout the water year. These numbers are not expected to line up perfectly (as the Daily reports are point-in-time and used for operational purposes), but the comparison allows for identification of any discrepancies for further investigation.

For Step 3, DELWP undertakes a limited quality assurance check of the actual water usage data. Comparison of the DELWP-modelled permitted take and the GMW-provided actual take data is undertaken, and any discrepancies are identified for further investigation.

For Step 4, the MDBA undertakes a significant number of quality assurance checks of DELWP-submitted s71 Reporting data, mostly focusing on permitted take, water trade and environmental water use (all outside scope of this review). DELWP and GMW were both clear that where any discrepancies are identified by the MDBA and queried, both agencies are involved in investigating and solving the issues (where they are relevant to their areas of expertise).

Appendix A – Map of the Victorian lower Murray area



Figure 1

Appendix B – Extract from LMW Annual Report showing breakdown of extractions amounts

APPENDIX 4

Our Bulk Water Entitlement—Irrigation

Bulk Entitlement (River Murray—Lower Murray Urban and Rural Water—Irrigation)
Conversion Order 1999 as amended October 2015

Area supplied	Off-take point	Clause 22.1 (b)	Clause 22.1 (d)	Clause 22.1 (e)	Clause 22.1 (f)
		Annual Amount of Water Taken (ML)	Amount of Water Returned (ML)	Amount of Water Supplied to VEWH (ML)	Amount of Water Supplied to Primary Entitlement Holders (ML)
Robinvale irrigation district	Robinvale pumping station	21,579	0	0	21,579
Red Cliffs irrigation district, and remaining Carwarp area of Carwarp-Yelta waterworks district	Red Cliffs pumping station	35,047	0	0	30,994
Merbein irrigation district, and Yelta part of Carwarp-Yelta waterworks district	Merbein pumping station	22,638	0	546	19,743
Millewa waterworks district and diversion licences	Millewa river pump	21,520	0	0	18,093
This is counted as the point where water is diverted from the River Murray	Central Main Pump Station, at King's Billabong	42,949	0	1,015	38,939
Used to replenish King's Billabong where River Murray flows are at insufficient level to do this (see clause 18.10)	Psyche Bend pumps	N/A	N/A	N/A	N/A
Along River Murray between the Nyah pumps and the South Australian border, and around King's Billabong	Private diversion points	465,194	0	0	0

Notes

- Our irrigation customers transacted water shares and allocation trades reported by the Victorian Water Register annually
- Customers received a 100% water allocation on 17 December 2018
- Clause 22.1(a) & (b) The daily amount of water taken at each off-take point was recorded and included in the total annual amount of water reported in Clause 22.1 (b)
- Clause 22.1(c) No new irrigation district off-take points were agreed to, or used
- Clause 22.1(d) No water was returned at specified or agreed return points
- Clause 22.1(e) The annual amount supplied via our distribution system to the bulk entitlement held by the Victorian Environmental Water Holder (VEWH), to Lake Hawthorn and Koorlong Basin
- Clause 22.1 (f) The annual amount supplied to primary entitlement holders other than those referred to in Clause 22.1 (e)
- Clause 22.1(g) Our approved Bulk Entitlement Metering Program (2011) is being implemented in accordance with Clause 21.3. A record of all work undertaken is maintained via a central register. We are considering timing of a review of our Bulk Entitlement Metering Program.
- Clause 22.1 (h) No transfers occurred of any temporary or permanent water of our bulk entitlement or of primary entitlements
- Clause 22.1(i) We did not transfer any entitlement or assignment of water allocation under the Act
- Clause 22.1(j) No amendments were made to this bulk entitlement

Appendix C – Engagement Report Rating and Findings Rating

Engagement Report Rating

Report rating	Explanation
Satisfactory	Controls are adequate and effective in addressing key risks. No critical, high-rated or moderate-rated findings identified. Any findings identified have been assessed as low risk.
Satisfactory with room for improvement	Controls are largely adequate and effective in addressing key risks. No critical or high-rated findings identified. Any findings are moderate or low.
Requires improvement	Controls only partially addresses the key risks. Some high-rated and/or medium-rated findings were identified.
Unsatisfactory	Controls are ineffective in addressing the key risks. Most findings were rated as critical and/or high and urgent corrective actions are necessary.

Findings/Observations – Risk Ratings

Finding rating	Explanation
Low	The event is of low consequence. Remedial action (if noted) should be considered.
Moderate	The event may threaten an element of the organisation’s objectives. Remedial action should be implemented in the short to medium term.
High	The event may threaten the achievement of the organisation’s objectives. A high priority should be given to implementing remedial action.
Critical	The event represents a significant control weakness which could stop the achievement of the organisation’s objectives. Remedial action should be implemented as a matter of urgency.

Office locations

Adelaide
Albury–Wodonga
Canberra
Goondiwindi
Griffith
Mildura
Murray Bridge
Toowoomba

 mdba.gov.au

 1800 230 067

 engagement@mdba.gov.au