Department of Planning and Environment

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Prerequisite Policy Measures

NSW Annual Review and Evaluation 2021-22

September 2023

Acknowledgement of Country

The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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More information

water.dpie.nsw.gov.au/environmental-water-management-in-nsw/what-we-are-working-on-now/pre-requisite-policy-measures

Acknowledgements

We acknowledge the contribution of the NSW Prerequisite Policy Measures Working Group and its members' respective agencies, including WaterNSW, NSW Department of Planning and Environment – Environment and Heritage Group, Commonwealth Environmental Water Office and Murray–Darling Basin Authority.

TMP-MC-R-WC-V1.2

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Abbreviations

Abbreviation	Description
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
Environment and Heritage Group	Department of Planning and Environment – Environment and Heritage Group (previously Environment, Energy and Science)
Water Group	Department of Planning and Environment – Water
EWAG	Environmental Water Advisory Group
EWC	Environmental Water Committee (Tier 1)
EWHs	Environmental water holders (includes DPE EHG and CEWH)
EWIG	Environmental Water Improvement Group
HEW	Held environmental water
MAA	Murray Additional Allowance
MDBA	Murray–Darling Basin Authority
MIL	Murray Irrigation Limited
MLS	Menindee Lakes system
PEW	Planned Environmental water
PPM	Prerequisite policy measure
RMIF	River Murray Increased Flow
RMO	River Murray Operations
SCBEWC	Southern Connected Basin Environmental Watering Committee
TLM	The Living Murray

Preface

This report is the third annual review of prerequisite policy measures (PPMs) implementation in NSW. It examines the PPM environmental watering actions and implementation processes within NSW jurisdiction during the 2021-22 water year. Importantly, it has been prepared incorporating the recently developed NSW PPMs Evaluation Framework. The framework was a key recommendation from the first annual review for the 2019-20 water year.

Significant advancements were achieved in the ongoing implementation of PPMs in NSW during 2021-22, including:

- two environmental watering events in the Lower Darling and two in the Great Darling Anabranch that relied on PPMs, delivering a total of 55 GL of return flows to the South Australian border
- five events in the Murrumbidgee that relied on PPMs, during which environmental water was delivered on top of system flows to provide efficiencies in achieving environmental outcomes
- the Murray multi-site event that uses the PPM 'return flows' to water multiple sites during the one event as well as another watering event in the Kolety/Edward-Wakool system
- further development of loss accounting in the Lower Darling to consider higher flows
- ongoing collaboration and cooperation between agencies to implement PPMs arrangements to deliver and account for environmental water more efficiently and effectively.

There are also some areas that could be improved:

- streamlining processes to provide improved clarity and consistency around event planning and decision making, including risk assessments, consultation and timing
- improved timeliness of return flow accounting
- reviewing accounting arrangements that have been in place and used since the commencement of PPMs
- developing loss accounting arrangements for environmental water deliveries in the Murrumbidgee.

The Evaluation Framework criteria: consistency, efficiency and effectiveness were used to assess the implementation of PPMs during the 2021-22 water year. These three criteria all received an overall rating of average (evidence of minimal positive performance, below expectation). The ratings were based on mostly moderate and low performance indicator scores and neutral trends. The performance indicators displayed increasing trends for outcomes and implementation but a decreasing trend in information provision. The ratings reflect that, despite the increase in use of PPMs during watering events, there is further work required to improve the procedures.

Summary of recommendations

The recommendations arising from the 2021-22 annual review report are that:

R.1. The Water Group determine assumed uses for directed releases in the Murrumbidgee

R.2. The Water Group collaborate with other agencies to streamline the PPMs implementation process, including:

- fit-for-purpose water ordering
- documentation of risks and mitigation measures
- reporting requirements

R.3. The Water Group to convene a workshop to discuss accounting issues in the Murrumbidgee and develop a set of principles for PPM implementation

R.4. The Water Group develop a policy on PPMs from Menindee Lakes System when under NSW control

R.5. The Water Group review the Edward/Kolety river assumed use statement, work with River Murray Operations (RMO) to simplify and improve accuracy for varying conditions

R.6. The Water Group develop a policy on the use of MIL escapes for return flows

R.7. The Water Group collaborate with WaterNSW to develop a method for completing a post-event comparison of losses debited as per assumed use statement with 'actual' loss

R.8. PPM Working Group update the NSW PPM work plan to include recommendations from this annual review report and prioritise, taking into consideration other high priority PPM tasks and resource availability

R.9. The Water Group to progress a review of the procedures manuals and update as necessary to reflect new actions and the outcomes of recommendations

Recommendations from the annual review report will be included in the NSW PPMs annual work plan. The plan identifies and prioritises activities for PPMs implementation, including reporting and communication commitments, watering priorities and technical tasks for each system where PPMs apply. The PPMs work plan is maintained by the Water Group and regularly reviewed by the NSW PPMs Working Group to identify and prioritise tasks, particularly as resource conditions change.

1 Introduction

Prerequisite policy measures (PPMs) are legislative and operational rule changes introduced as part of the Basin Plan. The changes are designed to support the effective and efficient use of held environmental water (HEW) in the Murray–Darling Basin southern connected system.

The Murray–Darling Basin Authority (MDBA) assessed PPMs as being in effect in NSW from 1 July 2019. MDBA's PPM assessment reports for all Basin states are available on the MDBA website at mdba.gov.au > Publications and data > Publications > Prerequisite policy measure documents.

In NSW, PPMs are being implemented in the NSW Murray and Lower Darling and the Murrumbidgee regulated rivers. The NSW Government has adopted an adaptive management approach to support continuous improvement in PPMs implementation for held environmental water delivery in these river systems. More detailed information on the background and implementation of PPMs in NSW is available on the website of the Department of Planning and Environment – Water (Water Group) at water.dpie.nsw.gov.au > Environmental water management > What we are working on now > Pre-requisite policy measures.

This report presents the findings and recommendations from the annual review and evaluation (the annual review) of the implementation of PPMs in NSW during the 2021-22 water year, from 1 July 2021 to 30 June 2022. The annual review is a key component of the NSW Government's commitment to the ongoing implementation of PPMs under the adaptive management framework.

The review was conducted by the Water Group, with input from the Department of Planning and Environment – Environment and Heritage Group, WaterNSW, Commonwealth Environmental Water Office (CEWO) and MDBA.

The purpose of the annual review is to:

- support continuous improvement of PPMs processes to improve environmental water management, and
- provide transparency about the use of PPMs in 2021-22 water year.

This annual review report focuses on environmental watering actions that use PPMs (that is, piggybacking or return flow recognition) under NSW jurisdiction only. The assessment of any multi-jurisdictional PPMs environmental watering actions undertaken during the water year is beyond the scope of this review.

This annual review report will be provided to the MDBA as part of NSW's requirement under the Basin-wide Environmental Water Protection Strategy and Implementation Plan.

The annual review is not designed to assess environmental benefits resulting from the PPMs watering actions, nor to describe these benefits. Reporting on the use of water for the environment and its outcomes is a matter for separate consideration by the environmental water holders and their respective agencies (see environment.nsw.gov.au > Topics > Water > Water for the environment > Planning and reporting > Outcomes report 2021-22).

2 Requirements for the annual review

The purpose of the annual PPMs review is to support continuous improvement of the NSW PPMs processes and provide transparency about the use of PPMs in the 2021-22 water year.

The matters for consideration in the annual review are set out in Section 5.2 of the *Prerequisite Policy Measures: Procedures Manual for the NSW Murray and Lower Darling Regulated Rivers*[1] and the *Prerequisite Policy Measures: Procedures Manual for the Murrumbidgee Regulated River*[2] ('the procedures manuals').

This 2021-22 annual review was conducted in accordance with these requirements, including consideration of reports provided by the river operator (WaterNSW) and environmental water manager (Environment and Heritage Group) that document the environmental watering actions undertaken using PPMs. These reports are the:

- WaterNSW's 'Annual Environmental Release River Operations Report' (Appendix A) that documents the application of specific agreed actions, trial actions, and associated supporting measures, including the accounting of river flows, transmission losses, and water delivery that occurred, and
- Environment and Heritage Group's 'Annual Environmental Watering Statement' (Appendix B) that documents any issues that arose in the ordering or delivery and accounting of environmental water using the agreed and trial actions.

This annual review was conducted using the PPMs evaluation framework for PPMs implementation. Applying this framework provides annual performance indicator results and trends that form the basis of the criteria (consistency, efficiency and effectiveness) ratings, as well as narrative answers for key evaluation questions (KEQs) designed to be answered annually.

Table 1 outlines the matters from the procedures manuals that the annual review is required to consider and the relevant section of this report that addresses those requirements.

Table 1. Matters for consideration in the annual review and section of this report where these are addressed

Section of this report	Matters for consideration
Section 3: Results	• the results and recommendations of the reporting elements provided by the river operator and environmental water manager – Appendix A Annual Environmental Release River Operations Report – Appendix B Annual Environmental Watering statement

[1] https://www.industry.nsw.gov.au/__data/assets/pdf_file/0006/549519/NSW-PPM-Procedures-Manual-for-the-NSW-Murray-and-Lower-Darling-Dec-2022.pdf

[2] https://www.industry.nsw.gov.au/__data/assets/pdf_file/0007/549520/NSW-PPM-Procedures-Manual-for-the-Murrumbidgee-Regulated-River-Dec-2022.pdf

Section of this report	Matters for consideration
Section 4: KEQ1	• whether general operational procedures were followed for the delivery of HEW via PPMs. • any issues relating to PPMs raised through consultation with stakeholders in the valley
Section 4: KEQ2	• whether the current PPM actions and the associated supporting measures provide for the efficient use of held environmental water
Section 4: KEQ3	• whether the current PPM actions and the associated supporting measures provide for the effective use of held environmental water
Section 4: KEQ4	• whether there are sufficient mitigation measures in place and whether they have been effective • reporting on the implementation of improvements from previous review, including consideration of recommendations provided by the PPM Working Group
Section 4: KEQ5	• whether the actions and associated supporting measures should be expanded, modified, or remain unchanged • any proposals for variations or new actions and/or supporting measures that may be brought forward by the river operator or the environmental water holder

The PPM work plan for the 2021-22 water year is provided in Appendix C.

3 PPM actions undertaken in NSW in 2021-22

3.1 2021-22 Resource summary

There was a major improvement in water resources in NSW in the 2021-22 water year, with full recovery from the drought. Good rainfalls resulted in the maximum allocation to most licence types on the southern regulated rivers, together with opportunities for supplementary water.

The Murrumbidgee regulated system experienced very wet conditions in the 2021-22 water year. All high priority and high security licences received their maximum (100%) or full opening allocations respectively on 1 July; general security licences received a 30% opening allocation. Burrinjuck and Blowering Dams were at 84% and 94% respectively. By November 2021, allocations to general security licences reached full allocations (100%) following ongoing wet conditions.

Similarly, in the NSW Murray regulated river, all high priority and high security licences received their maximum (100%) or full opening allocations. General security licences received a 3% opening allocation and reach full allocation of 110% of entitlement in October 2021. All Lower Darling regulated river entitlements, including general security, received their full allocation (100%) on 1 July, 2021.

In May 2021, the Menindee Lakes system rose above the 640 GL threshold and became a shared Murray resource, in accordance with the Murray–Darling Basin Agreement. Airspace releases were made down the Great Darling Anabranch (the Anabranch) from November onwards, apart from a small window in March. Airspace releases commenced down the Lower Darling on 25 September. At the end of the 2021-22 water year, Menindee Lakes storage was at 110%.

PPMs were used to enable directed releases and return flows for environmental water actions in the Lower Darling, the Anabranch, the Murrumbidgee and the Edward/Kolety-Wakool systems during the 2021-22 water year (Figure 1). Table 2 provides a summary of events; further details are provided below.

Unlike previous years, there were no other measures, such as the use of Section 324 (temporary water restrictions) used in the southern Basin for environmental water protection.

Table 2. Summary of environmental watering events that used PPMs in 2021-22

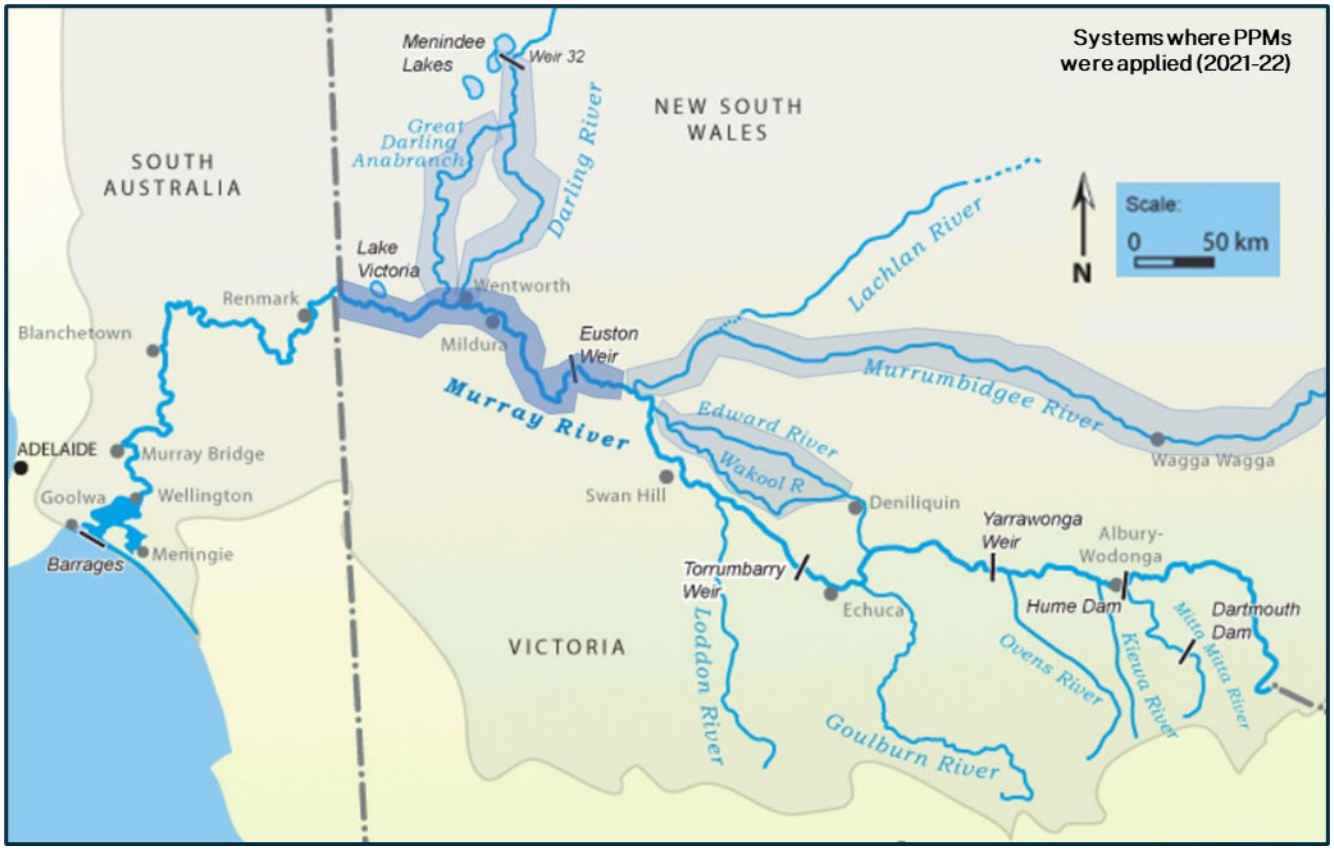
Details	Lower Darling/Baaka	Great Darling Anabranch	Murrumbidgee Native Fish Recruitment Flow	River Murray Channel Multi-Site 2021-22	Edward/Kolety-Wakool River system 2021-22
Environment and Heritage Group event number	LOD21/22-01	LOD21/22-02	MBG21/22-12	MUR21/22-01	MUR21/22-08
WaterNSW reference	PPM-LDR-Events #1&2	PPM-LDR-Events #3&4	PPM Event #1-5	MUR21/22-01	MUR21/22-08
Reference in this report	Section 3.2	Section 3.2	Section 3.3	N/A	Section 3.4
Overview of environmental watering action	Additional spring flows in the Lower Darling /Baaka to support native fish nesting and recruitment, and connectivity	Flows down the Great Darling Anabranch from Lake Cawndilla	Dilution flows during the recession of flood events, provided hypoxic blackwater refuge flows and managed rates of recession for native fish habitat and connectivity during and after flood events	Delivery of environmental water down the Murray from Hume to SA targeting flow rates D/S of Yarrawonga.	Delivery of environmental water targeting different in channel flow rates through each of the rivers throughout the season. A large portion of these targeted flow rates are met by the Murray Multi-site event.
Environmental site/s watered	Lower Darling River	Great Darling Anabranch	D/S of Maude Weir to the junction with the River Murray	Murray river channel, including Millewa Forest and anabranches including the Edward-Wakool system	Edward, Colligen/Niemur, Yallakool and Wakool River systems.

Details	Lower Darling/Baaka	Great Darling Anabranch	Murrumbidgee Native Fish Recruitment Flow	River Murray Channel Multi-Site 2021-22	Edward/Kolety-Wakool River system 2021-22
				(including Werai forest)	
Delivery period	July – November 2021	October 2021 – March 2022	January – June 2022	July 2021-June 2022	September 2021 -May 2022
PPMs action	Lower Darling in-channel delivery (via directed releases from Menindee Lakes when a shared resource) Return flow recognition to SA border	Great Darling Anabranch (via directed releases from Lake Cawndilla when a shared resource) Return flow recognition to SA border	Directed releases from storage/s to meet a target flow at downstream site/s	Directed release and assumed use (return flows)	Accounting for diversion of operational water to meet environmental flow targets (environmental water accounting)
Assumed use method/ accounting method	*Determination of debit*: additional releases from storage, calculated as the difference between actual releases and those estimated to have been made without the environmental water order (operational requirement) Minimum of:	*Determination of debit:* the volume released from the Lake Cawndilla outlet to meet the order. *Determination of return flow:* i. after adjusting for travel time, when the daily average flow passing Tara Downs (425054) is equal to or exceeds releases, no losses are to be applied and the full volume of the environmental debit flow is recognised at the South Australian border	*Determination of debit:* additional releases from storage, calculated as the difference between actual releases and those estimated to have been made without the environmental water order (operational requirement including intervalley trade). Minimum of:	As per the 'Specific objectives and outcomes for river operations in the River Murray system' (SO&O) 2.4 & 2.5	*Determination of debit:* A seasonal loss rate is applied to all environmental water inflows that exceed the seasonal loss threshold as per method detailed in Appendix C of the NSW PPM Procedures Manual for the NSW Murray & Lower Darling. The loss threshold can be considered as the identified inflow (to the

Details	Lower Darling/Baaka	Great Darling Anabranch	Murrumbidgee Native Fish Recruitment Flow	River Murray Channel Multi-Site 2021-22	Edward/Kolety-Wakool River system 2021-22
	• The target flow +10% minus required operational flow, or • The observed flow minus required operational flow. Determination of return flow (end of Lower Darling): Proportional loss lookup table. *Determination of return flow (SA border):* Incremental loss look up table (Boundary Bend to SA),(noting proportional losses when environmental water component < 500 ML/d. No losses applied when the system is unregulated conditions.	ii. after adjusting for travel time, when the daily average flow passing Tara Downs is less than releases, the flow at Tara Downs is reduced by a loss value and recognised at the South Australian border. The loss value applied is equivalent to the proportional daily loss that occurred between Bulpunga (425011) and Tara Downs iii. after adjusting for travel time, when flows at Tara Downs reach 0 ML/day, no return flows are to be recognised.	• The target flow +10% minus required operational flow, or • The observed flow minus required operational flow *Determination of return flow (end of Murrumbidgee):* As the environmental water target flow was referenced at the end of system (downstream Balranald Weir), in-channel losses were socialised *Determination of return flow (SA border):* Incremental loss rate (look up table). No losses applied when the system is in unregulated conditions.		system), below which there is a possibility of no outflows from the Wakool system EWHs also debited for the balance of any environmental flow required on top of operational requirements to meet the loss threshold. *Determination of return flow:* Not applicable for this accounting arrangement, noting that diversions are made using operational water only.

Details	Lower Darling/Baaka	Great Darling Anabranch	Murrumbidgee Native Fish Recruitment Flow	River Murray Channel Multi-Site 2021-22	Edward/Kolety-Wakool River system 2021-22
Total volume of environmental water ordered (ML) (EHG)	56,866 ML	39,668 ML	195,226 ML	225,713	11,283 (Water NSW)
Total volume of environmental water debited (ML) (WaterNSW)	58,716 ML (TLM 45,430; CEWH 13,286)	39,668 ML (CEWH 35,118; NSW 4,550)	181, 294 ML 100,950 ML (CEWH) 20,344 (NSW GS) 60,000 ML (TLM)	205,314 (BM-EWA 47,893, RMIF 25,000, TLM 20,250, CEW 112,171)	73,619 (CEW 65,463 via MIL not covered by PPM, NSW 8,156)
Return flow volume recognised (end of system)	55,139 ML	5,636 ML	152,053 ML	145,161 ML	N/A
Return flow volume recognised (SA border)	49,372 ML	5,636 ML	152,053 ML	145,161 ML	N/A

Figure 1. Locations of environmental watering actions that used PPMs in NSW during the 2021-22 water year



3.2 Lower Darling

The use of PPMs enabled directed releases to be made from Menindee Lakes to provide environmental flows down the Lower Darling and the Anabranch to be delivered on top of operational flows (Table 3 and Table 4). Over 55 GL of return flows were recognised at the South Australian border from environmental water releases made from Menindee Lakes over the 2021-22 water year.

Note there was interaction between directed releases and operational flows, including airspace releases for flows down both the Lower Darling and the Anabranch. Environmental orders were replaced with operational delivery from 24 September 2021 when there was a system surplus; environmental releases recommenced on 24 October and ended on 28 November when airspace releases down the Lower Darling commenced.

Environmental releases were made from Lake Cawndilla down the Anabranch from 24 October under airspace releases commenced on 28 November 2021. There was a small window of environmental flows during 2-18 March where e-water deliveries resumed in the Anabranch before airspace releases recommended on 19 March.

Table 3. Overview of environmental watering events that used PPMs in 2021-22 – Lower Darling/Baaka

LOD21/22-01	PPM-LDR-Event #1 (as reported by WaterNSW)	PPM-LDR-Event #2 (as reported by WaterNSW)
Delivery start date	1/07/2021	23/10/2021
Delivery end date	23/09/2021	27/11/2021
Total volume of water delivered to support environmental watering	Actual hydrograph: 58,783 ML Ops hydrograph (without eWater): 20,900 ML eWater hydrograph: 37,866 ML (target 43,524 ML) System surplus commenced on 25/9. eWater orders replaced by operational delivery from 24/9.Minimum release of 500 ML/d when MLS reach FSL on 11/9/21.	Actual hydrograph: 87,350 ML Ops hydrograph (without eWater): 66,500 ML eWater hydrograph: 20,850 ML (target 35,000 ML) Airspace releases commenced 28/22/21 to manage the storage to FSL by 1 Jan 2022 Minimum releases reverted to WSP 17/12/21 as MLS fell below FSL (1,730GL) on 16/12/21
Total volume of environmental water debited (ML) as reported by WaterNSW	37,866 ML 24,580 ML (TLM) 13,286 ML (CEWH)	20,850 ML (TLM)
Return flow volume recognised (end of system)	35,594 ML was delivered to Murray Valley (23,105 TLM, 12,489 CEWH). 2,272 ML was deemed as lost in the Lower Darling River US of Burtundy (6% loss rate).	19,599 ML was delivered to Murray Valley. 1,251 ML was deemed as lost in the Lower Darling River US of Burtundy (6% loss rate). *Note that the proportional loss lookup table is to be applied for future events (as determined at PPMs WG 29 October 2021).*
Return flow volume recognised (SA border)	30,521 ML recognised at SA Border (19,812 TLM, 10,708 CEWH). 5,073 ML is deemed to be lost in the Murray system (incremental loss lookup table).	18,851 ML will be recognised at SA Border. 748 ML is deemed to be lost in the Murray system (incremental loss lookup table).
Target daily flow rates and volumes.	Averaging 512 ML/d (vary from 297-1,000 ML/da for 85 days requiring 43,524 ML.	Averaging 2,500 ML/d for 35 days requiring 87,500 ML.
Actual daily flow rates and volumes	Averaging 445 ML/d (vary from 276-1,039 ML/d) for 85 days delivering 37,866 ML.	Observed flows at Weir 32 averaged 2,496 ML/d (vary 2,458 to 2,532 ML/d) for 35 days delivering 87,350 ML (of which 20,850 ML was environmental water).

Table 4. Overview of environmental watering events that used PPMs in 2021-22 – Great Darling Anabranch

LOD21/22-02	PPM-LDR-Event#3 (as reported by WaterNSW)	PPM-LDR-Event#4 (as reported by WaterNSW)
Delivery start date	*23/10/2021*	*1/03/2022*
Delivery end date	*26/11/2021*	*17/03/2022*
Total volume of water delivered to support environmental watering	Actual hydrograph: 35,118 ML Ops hydrograph (without eWater): 0 ML eWater hydrograph: 35,118 ML (target 35,000 ML)	Actual hydrograph: 5,611 ML Ops hydrograph (without eWater): 500 ML eWater hydrograph: 4,650 ML(target 4,650 ML) 17/3/22 end of eWater release and start of airspace releases
Total volume of environmental water debited (ML) as reported by WaterNSW	35,118 ML (CEWH)	4,550 ML (NSW)
Return flow volume recognised (end of system)	2,321 ML (CEWH) was recognised in River Murray. 32,797 ML was deemed as lost in the Great Darling Anabranch to Murray R confluence.	3,315 ML (NSW) recognised in River Murray. 1,725 ML was deemed as lost in the Great Darling Anabranch to Murray R confluence.
Return flow volume recognised (SA border)	2,321 ML recognised at SA Border (no additional losses applied in the River Murray).	3,315 ML recognised at SA Border (no additional losses applied in the River Murray).
Target daily flow rates and volumes.	Averaging 1,000 ML/day for 35 days requiring 35,000 ML.	Averaging 274 ML/d (varying from 150- 500 ML/d) for 17 days requiring 4,650 ML.
Actual daily flow rates and volumes	Averaging 1,003 ML/d (vary from 987-1,017 ML/d) for 35 days delivering 35,118 ML.	Averaging 296 ML/day (varying from 114-719 ML/d) for 17 days delivering 5,040 ML.

3.3 Murrumbidgee

Environmental watering actions using directed releases and return flows were undertaken in the Murrumbidgee system from January to June 2022. These events aimed to provide elevated base flows in the Murrumbidgee River and Yanco Creek to protect Murray and trout cod nests from fluctuating river levels. In particular, directed releases were used to manage water levels as flows returned from unregulated to regulated conditions (that is, recession management) (Table 5).

Table 5. Overview of environmental watering events that used PPMs in 2021-22 – Murrumbidgee

MBG21/22-12	PPM Event #1 DS Maude Jan 2022	PPM Event #2 DS Maude Feb 2022	PPM Event #3 Wagga Mar 2022	PPM Event #4 Wagga May 2022	PPM Event #5 Wagga Jun 2022
Delivery start date	6/01/2022	13/02/2022	15/03/2022	4/05/2022	1/06/2022
Delivery end date	14/01/2022	26/02/2022	28/03/2022	14/05/2022	18/06/2022
Total volume of water delivered to support environmental watering	Actual hydrograph: 109,412 ML Ops hydrograph (without eWater): 84,089 ML eWater hydrograph: 42,287 ML (target 45,000 ML)	Actual hydrograph: 39,954 ML Ops hydrograph (without eWater): 21,890 ML eWater hydrograph: 8,703 ML	Actual hydrograph (at Wagga): 194,755 ML Ops hydrograph (without eWater): 128,510 ML eWater hydrograph: 65,756 ML	Actual hydrograph (at Wagga): 156,714 ML Ops hydrograph (without eWater): 123,191 ML eWater hydrograph: 33,523 ML	Actual hydrograph (at Wagga): 476,180 ML Ops hydrograph (without eWater): 445,156 ML eWater hydrograph: 31,024 ML
Total volume of environmental water debited (ML) as reported by WaterNSW	42,287 ML (TLM)	8,703 ML (NSW GS)*	65,756 ML 48,043 ML (NSW GS) 17,713 ML (TLM)	33,523 ML (NSW GS)	31,025 ML (NSW GS)

MBG21/22-12	PPM Event #1 DS Maude Jan 2022	PPM Event #2 DS Maude Feb 2022	PPM Event #3 Wagga Mar 2022	PPM Event #4 Wagga May 2022	PPM Event #5 Wagga Jun 2022
Return flow volume recognised (end of system)	42,287 ML (no losses applied as it was a gaining river due to flood conditions).	8,703 ML (no losses applied as it was a gaining river due to flood conditions).	36,515 ML (no losses applied as it was a gaining river due to flood conditions). 18,802 ML (NSW GS) (NOTE: A volume of 29,241 ML was reused in Lowbidgee via Nimmie-Caira channels). 17,713 ML (TLM).	33,523 ML (no losses applied as it was a gaining river due to flood conditions).	31,025 ML (no losses applied as it was a gaining river due to flood conditions).
Return flow volume recognised (SA border)	42,287 ML (no further losses in Murray R as it was under unregulated conditions to SA Border).	8,703 ML (no further losses in Murray River as it was under unregulated conditions to SA Border).	36,515 ML (no further losses in Murray River as it was under unregulated conditions to SA Border). 18,802 ML (NSW GS). 17,713 ML (TLM).	33,523 ML (no further losses in Murray River as it was under unregulated conditions to SA Border).	31,025 ML (no further losses in Murray River as it was under unregulated conditions to SA Border).
Target daily flow rates and volumes.	5,000 ML/d for nine days delivering 45,000ML.	3,557 ML/d for 14 days; targeting 5,000 ML/d for eight days then gradually slowing to 500 ML/d; delivering 49,800 ML.	4,640 ML/d for 14 days; targeting 10% flow reduction per day at Wagga Wagga from the airspace releases of say 24 GL/d; total ordered volume 63,000 ML.	5,455 ML/d for 11 days; targeting 10% flow reduction per day at Wagga Wagga from the airspace releases of say 16 GL/d; total ordered volume 60,000 ML.	800 ML/d for 30 days; targeting 10% flow reduction per day at Wagga Wagga from the airspace releases of say 25 GL/d; total ordered volume 24,000 ML

MBG21/22-12	PPM Event #1 DS Maude Jan 2022	PPM Event #2 DS Maude Feb 2022	PPM Event #3 Wagga Mar 2022	PPM Event #4 Wagga May 2022	PPM Event #5 Wagga Jun 2022
Actual daily flow rates and volumes	Averaging 5,581 ML/d (4,687-7,701 ML/d) delivering 42,287ML.	2,854 ML/d delivering 8,703 ML (882-4,580 ML/d). The natural system flows were higher than initially forecast.	9,179 ML/d (5,624-19,389 ML/d).	17,413 ML/d (15,838-18,571 ML/d); The natural system flows were higher than initially forecast.	21,645 ML/d (16,273-28,908 ML/d); The natural system flows were higher than initially forecast.

3.4 Edward Kolety-Wakool and Murray multi-site

The environmental watering event (MUR21/22-08) for the Edward Kolety-Wakool river system (which includes the Edward Kolety River, Colligen Creek, Niemur River, Yallakool Creek, and Wakool River) delivered baseflows from September 2021 to May 2022. These flows were aimed at providing connectivity and opportunities for native fish spawning, recruitment, movement and refuge habitat during poor water quality events. This event largely re-used flows delivered as part of the multi-site River Murray Hume to South Australia event. Outside the multi-site period a separate PPM in-channel use loss rate was applied. Similar to previous years, some environmental water delivered for this event was delivered via the Murray Irrigation system and is not covered by a PPMs action (Table 6).

Under the interim accounting arrangement in place (being for diversion of operational water), no return flows from this event are available. Rather, environmental water holders pay for the additional losses (inefficiencies) of putting water through the Wakool system.

A multi-site Hume to South Australia watering event (MUR21/22-01) also used water from NSW held environmental water (HEW) licences in the Murray Regulated River system. A total of 205, 314 ML of environmental water was debited, including 47, 893 ML from the Barmah-Millewa Environmental Water Allowance. Note that the Barmah-Millewa Environmental Water Allowance is not subject to PPMs as it is planned environmental water. The River Murray multi-site accounting method used was the difference between releases without environmental water (the hypothetical operational requirements) and the delivery of the environmental water hydrograph, using the agreed loss rate for the calculation of return flow as per the SO&O (mdba.gov.au). This multi-jurisdictional Hume to South Australia event was undertaken as part of PPMs in the River Murray System overseen by the joint venture states and is not therefore considered further in this report.

Table 6. Overview of environmental watering events that used PPMs in 2021-22 – Edward/Kolety-Wakool

MUR21/22-08	Edward/Kolety-Wakool River system 2021-22
Delivery start date	14/08/2021
Delivery end date	31/05/2022
Total volume of water delivered to support environmental watering	Target e-water hydrograph: Actual hydrograph:
Total volume of environmental water ordered (ML) as provided by EHG	11,283 (Water NSW) 92,173 (CEWH)
Total volume of environmental water debited (ML) as reported by WaterNSW	73,619 (CEWH 65,463 via MIL not covered by PPMs, NSW 8,156)

MUR21/22-08	Edward/Kolety-Wakool River system 2021-22
Return flow volume recognised (end of system)	No return flow as all operational water.
Return flow volume recognised (SA border)	No return flow as all operational water
Target daily flow rates and volumes.	Average of 587 ML/d for 335 days delivering 194,719 ML (Total for Wakool, Colligen and Yallakool, no target flows for Little Merran and Waddy Cutting)
Actual daily flow rates and volumes	Actual flow average of 879 ML/d for 335 days delivering 318,180 ML Actual e-water delivery average of 129 ML/d for 63 days delivering 8156 ML.

3.5 NSW PPMs work plan

The NSW PPMs work plan is maintained by the Water Group. The PPMs Working Group are provided the opportunity to review the work plan at each working group meeting to identify and prioritise tasks. The tasks for PPMs implementation are distributed between members of the working group based on the roles and responsibilities of each agency, availability of resources and the priority identified in the work plan.

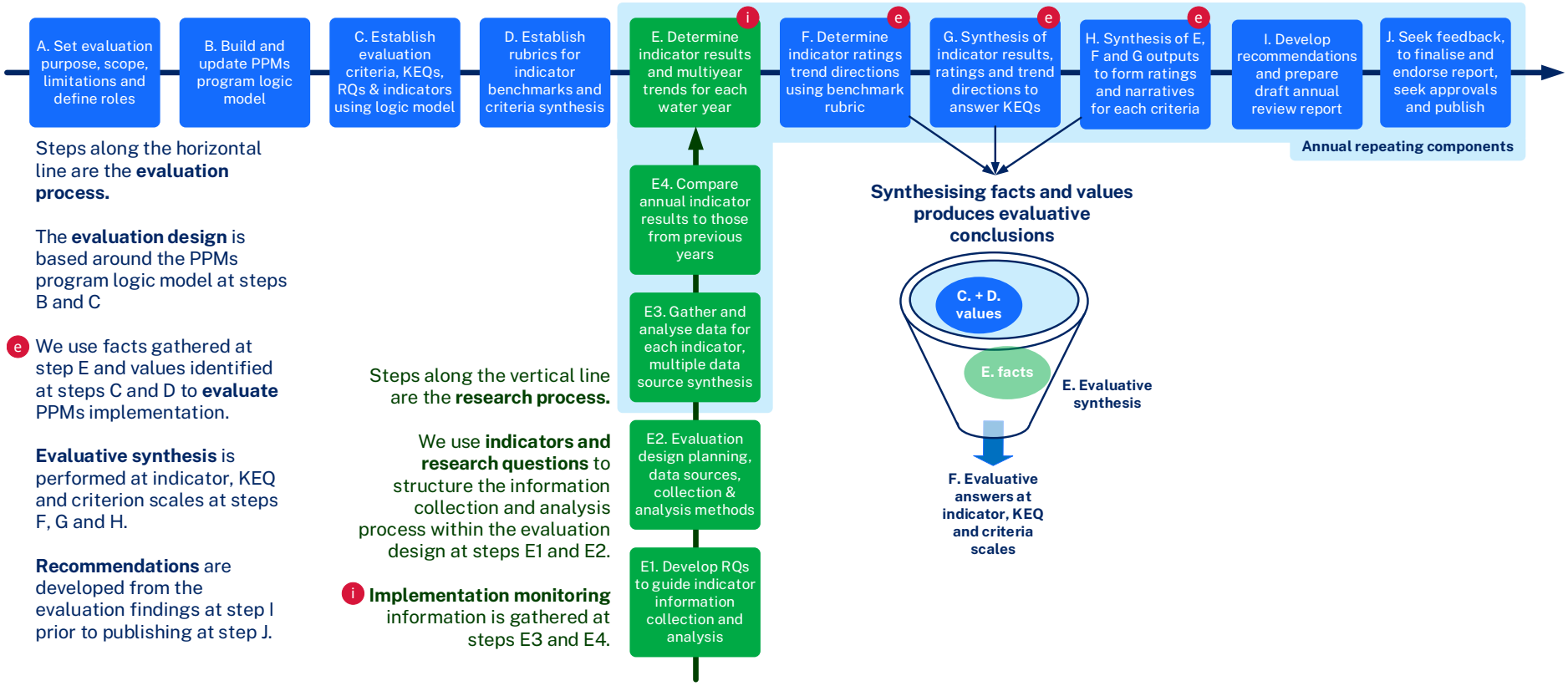
The PPMs work plan for the 2021-22 water year is provided in Appendix C.

4 Evaluation of PPMs implementation process

The 2019-20 and 2020-21 annual review reports recommended the development of an evaluation framework for PPMs implementation. The purpose of the framework, developed by the department, is to be objective, systematic and track the performance over time of the implementation of PPMs using the following key criteria: consistency, efficiency, and effectiveness. The framework expands on the annual review requirements outlined in the Procedures Manuals.

The framework structure shown in Figure 2 below is used to navigate the evaluation process. Evaluation steps E through to J were undertaken as part of this annual review. Initially, evaluative analysis is undertaken, from which findings are synthesised and consolidated which can be used to prepare the annual review report (that is, this report) and develop recommendations. The NSW PPMs Evaluation Framework should be referred to for further details.

Figure 2. Steps for PPMs process evaluation (extracted from the NSW PPMs Evaluation Framework)



This annual review report is the first report which encompasses findings from the PPMs evaluation process. Results from the evaluative analysis are provided in Appendix D. Evaluation findings are summarised below, and inform discussions and recommendations provided in this report.

The evaluation framework uses a program logic model of PPM implementation to provide the basis for the selection of evaluation criteria and the development of the key evaluation questions (KEQs). The evaluation sets five KEQs to be answered annually as shown in Table 7.

Table 7. Assigned performance indicators for KEQs

Key evaluation questions (KEQs)	Performance indicators	Reason for indicator inclusion, use of indicator
KEQ 1 How consistently were PPMs implemented during the last water year and how did that compare to previous years?	PI 1a Extent to which agencies fulfilled their roles as set out in the Procedures Manuals during each stage of the process	Demonstrate whether each agency fulfilled their key obligations through each phase of PPMs i.e., planning, ordering, accounting, reporting phases. Assessed for each event relying on the implementation of PPMs.
	PI 1b Level of agency understanding of their roles and responsibilities	Determine how well each key agency understands of their obligations (activate if PI 1a assessment falls below acceptable benchmark level)
	PI 2a Extent to which reports and supporting information were provided (including annual reports, event forecasts and post-event accounting)	This indicator assesses the quality and comprehensiveness of the information provided by implementing agencies. The provision of data and reporting elements is a key element of successful PPMs implementation. Good indicator performance demonstrates NSW compliance with the PPMs procedure; ongoing identification of issues and recommendations and areas for improvements; building of data sets; building basis for future reviews.
KEQ 2 Was the PPMs process implemented efficiently during the last water year and how did that compare to previous years?	PI 2b Extent to which reports, and supporting information were submitted on time (including annual reports, event forecasts and post-event accounting)	This indicator assesses timeliness of information provided by implementing agencies. The timely provision of data and reporting elements is a key element of PPMs implementation and an environmental watering plan commitment; delay may indicate onerous or inappropriate reporting requirements or lack of understanding. Delay in post-event accounting may also limit the efficient and effective use of HEW.

Key evaluation questions (KEQs)	Performance indicators	Reason for indicator inclusion, use of indicator
KEQ 3 How effective are PPMs in improving the use and accounting of environmental water?	PI 6 Extent to which accounting arrangements demonstrated improved efficiencies for environmental water use	Demonstrate from an accounting perspective where and how there have been ongoing improvements and efficiencies for how environmental water is accounted for and used.
KEQ 4 Are adaptive management processes effective in improving PPMs implementation?	PI 5 Extent to which recommendations from previous reviews were actioned	Determine if NSW making good on our commitment for review and continuous improvement.
	PI 7 Extent to which the level of conservatism in arrangements was commensurate with risk to other water users	Determine if the level of conservatism changes (i.e., decreases) as our knowledge, understanding and management of the real risk improves (e.g., ensure that the EWHs are not 'paying' for unnecessary conservatism to enable optimisation of e-water use).
KEQ 5 How can the implementation of PPMs be improved?	PI 3 Extent to which the process cannot be implemented as intended	Addresses consistency aspects. Identifies which elements of the process cannot be implemented by a particular agency (or agencies) and why not (impediments or barriers).
	PI 4 Extent to which risks were well managed	Addresses efficiency aspects. Management of risks, including risk to other water users, is important given that PPMs provide a new way of managing water requiring effective processes to be established and followed. New and emerging risks should be assessed, mitigated and documented as they arise. The mitigation of risks to other licence holders is also a key principle of PPMs implementation.

A response to each of the five KEQs is provided below, incorporating the performance indicators.

4.1 Key evaluation questions

KEQ 1 – How consistently were PPMs implemented during the last water year and how did that compare to previous years?

The PPMs process was mostly followed as intended during the 2021-22 water year throughout the planning, implementation and adaptive management stages to support return flows and piggybacking of environmental water. Key agencies generally met their nominated responsibilities,

noting that certain key elements such as risk identification and reporting were generally not adhered to as set out in the process described in the procedures manuals.

The mostly consistent implementation of PPMs shows agencies generally have a good understanding of their roles and requirements, demonstrated by key responsibilities generally being fulfilled and the number of watering events relying on PPMs taking place.

Gaps in implementation were around risk identification and reporting, which relates to both understanding of roles and also the quality of information provided by agencies. Risks to other water users are considered at a bulk level during the initial planning stage when assumed use arrangements are being determined. Ideally, this would be done at an event-by-event basis.

Assumed use methods as per the procedures manual (Table 6) were applied for e-water deliveries in the Lower Darling, Edward/Kolety-Wakool and Murrumbidgee flows entering the Murray River. Losses for the multi-site delivery in the Murray River were applied as per SO&O2.5. There were no losses applied for environmental water deliveries in the Murrumbidgee to Balranald due to the delivery point being the end of the system and therefore losses were socialised. Future events in the Murrumbidgee where the point of delivery is upstream of Balranald will require an assumed use statement during regulated conditions, this is a gap that needs to be addressed.

There are elements of the PPMs process that need altering to improve implementation consistency. Impediments or barriers to implementation are not well documented, except for WaterNSW as the river operator highlighting the issues of water orders not being fit-for-purpose and the number of amendments for any event.

Stakeholder consultation was completed as required by the procedures manual. No issues were raised by external stakeholders regarding the use of PPMs.

The findings from this water year were similar to previous years. Table 8 offers a summary of the operational procedures followed for actions in each of the systems (noting that multiple events in one system during the water year have been grouped together and any departure from procedure noted). Crosses or ticks represent whether the procedure was implemented and is marked against the responsible agency/agencies only.

Table 8. Fulfilment of roles and responsibilities

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
Planning							
Environmental water holders develop annual environmental watering priorities, strategies and plans and inform the department			✓				
EHG to work collaboratively with other environmental water holders (i.e. CEWO and through the Southern Connected Basin Environmental Watering Committee (SCBEWC) if appropriate) in the planning and coordinated use of environmental water			✓	✓	✓		
NSW PPMs workplan maintained, and incorporates annual environmental watering priorities as provided by EWHs	✓						Workplan reviewed at PPMs WG meeting, 31 March 2022
Assist in developing assumed use/in-stream loss rates/methods as per principles and rules in this manual	✓	✓	✓	✓	✓		• Lower Darling loss table updated to include flows > 9,000 ML/day • Interim agreement for Anabranch releases developed • Initial workshop on Werai Forest held 6 June 2022
Assess assumed use/in-stream loss rates/methods as per principles and rules in this manual	✓						Water Group were leads in developing and finalising any new accounting arrangements

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
Approve proposed interim arrangements or trials if suitable conditions and mitigation measures are demonstrated	✓						Interim arrangements approved for: • losses for high flows (> 9,000 ML/d in the Lower Darling • releases from Lake Cawndilla down the Anabranch
Consult with the PPM Working Group on any new or revised actions or supporting measures	✓					✓	• losses for high flows in the Lower Darling presented at WG #6, October 2021 • arranges for losses of releases down the Anabranch discussed at WG #7, March 2022, and endorsed
Classification of take/return measurement at recognised environmental watering sites	N/A	N/A					No additional sites used
Work collaboratively to develop orders for environmental water action and recommend appropriate mitigation strategies	✓ (some what)	✓ (some what)	✓ (some what)	✓ (some what)	✓ (some what)		General collaboration, however, further collaboration during the planning stage would assist in risk identification/contingency planning. Water Group to seek further detail on the Murrumbidgee dam airspace operations and integrated e-water management opportunities (July 2021) noting that their agency raised this event in their reports
Environmental water holders work with WaterNSW to develop a watering proposal, including a target flow and location		✓	✓	✓	✓		EHG did not identify any impediments to this process in their Annual Environmental Watering Statement

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
Review and approval of environmental watering proposal/plan using PPMs	✖						Events using PPMs are not always provided to the Water Group, for example, watering the Edward-Wakool and some of the Murrumbidgee events. This responsibility is listed in Table 2 of the procedures manual but not clearly articulated elsewhere in the procedures and all agencies appear uncertain as to whether these events should be referred to the department for approval.
Implementation (ordering & release)							
EHG submits water order to WaterNSW			✓				In their annual reports, WaterNSW raised the issue that the water order process needs to be improved, with water orders to include all the elements as outlined in the procedures manuals.
WaterNSW to consider operational risks and mitigation measures when considering water orders		✖					Risks documented in the Environmental Release River Operations reports largely consider under/over-estimates and accounting. Confirm if/how operational risks are considered.
WaterNSW to collaborate with EHG on risk and mitigation strategies as they relate to the use of PPMs prior to approval or rejection of water orders		✖	✖	✖	✖		Confirm if/how operational risks are considered during event planning and ordering. Some risks are identified as provided by EHG.
For approved water orders, WaterNSW is to operate the river accordingly		✓					

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
For water orders that are refused or rejected, WaterNSW is to document the supporting explanations in the Annual Environmental Release River Operations Report		✓					No reports indicated that any order was refused or rejected
Environmental water managers are required to undertake appropriate communication actions to ensure that potentially affected landholders and the general community are aware of the proposed watering event			✓				Annual Environmental Water Statement listed consultation with MLD EWAGs only
WaterNSW to provide operational reporting on release of environmental water, including regular environmental water use accounting during events		✖					Confirm frequency of reporting provided to EWHs during events
Accounting							
WaterNSW to provide monthly reporting to environmental water holders on water usage and return flows, split by licence holder		✖					Monthly reporting not consistently provided to EWHs
WaterNSW determines and debits volume of held environmental water as a result of environmental watering actions using PPMs via an assumed use statement (including supporting information such as loss rates, source of data and assumptions)		✓					Assumed use statements are not provided. WaterNSW provide volumes of debit and return flows by email with supporting spreadsheets that set out the calculations based on the assumed use method (and also included in their PPMs annual environmental release statement).

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
Adaptive management (reporting & evaluation)							
WaterNSW will provide an Annual Environmental River Operations Report and relevant supporting information		✓					Yes, provided 21-23 March 2023 Edward-Wakool report still outstanding at May 2023
EHG to provide an Annual Environmental Watering Statement and relevant supporting information			✓				Yes, provided on 7 December 2022, without accompanying documents
EHG to provide the CEWO and MDBA (TLM) with the Annual Environmental Watering Statement for their review			?	?	?		Confirm if this has taken place
Water Group to complete Annual Evaluation & Review Report	✓						Completed for 2020-21 This assessment forms part of the 2021-22 report
Consult with WaterNSW, EHG, MDBA and CEWO via the PPMs Working Group when conducting each annual review, including the annual evaluation and review report and its recommendations	✓					✓	Consultation and opportunity for review provided to the WG on the 2021-22 report Report discussed at a meeting and opportunity for written comment given. Most agencies provided feedback.
Developing and documenting accounting arrangements for new or interim actions	✓						• Lower Darling loss table updated to include flows > 9,000 ML/day • interim arrangement for Anabranch releases developed • initial workshop on Werai Forest held 6 June 2022

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
Building and expanding data sets	✖						Not formally undertaken as an action, however, data received from PPMs actions are collated and stored.
Hindcasting and review	✖						None undertaken to date. Review and refinement of existing arrangements are considered in light of broader workplan and priorities.
Refining/improving accounting arrangements	✖						None undertaken to date. Review and refinement of existing arrangements are considered in light of broader workplan and priorities.
Updates to procedures manuals published	✖						No updates to the procedures manuals were made during the 2021-22 water year, however, amendments were made post-July 2022 based on work completed during the 2021-22 water year.
Approved and documented accounting methods	✓						New arrangements are documented and shared with the PPMs Working Group. These arrangements were included in the subsequent updates to the PPMs procedures manuals.
Review and approve PPMs arrangements and any subsequent variations following the review phase of PPM operations	✓						
Consultation							
Water Group to consult with WaterNSW, EHG, MDBA via the NSW PPM WG on the annual review, developing new or existing actions and supporting measures	✓						Regular PPM Working Group meetings were not held, however were held on an as-needed basis to communicate new supporting measures, a PPM communication plan is recommended to be completed.

Requirement	Water Group	Water NSW	EHG	MDBA (TLM)	CEWO	PPMs WG	Further details (as needed)
WaterNSW will consult with water users or their representative groups via existing forums and provide a summary as part of the requirements of the Annual Environmental Releases River Operations Report	✓						
EHG will consult with the river operator regarding proposed watering actions using PPMs before placing the order	✓						

KEQ 2 – Was the PPMs process implemented efficiently during the last water year and how did that compare to previous years?

The efficiency of the PPMs process could be improved to meet both the broader objectives of efficient and effective use of water for the environment, and the NSW requirement that PPMs will use operational tools that are simple, practical to implement and cost effective.

The PPMs process is codified in the procedures manuals. This includes the requirement for monthly reporting on water usage and return flows, split by water holder/licence for each PPMs watering action. Currently, within-and post event reporting is generally not provided on a regular or timely basis.

The lack of post-event reporting, in particular the breakdown of return flows, has flow-on implications for EWHs for their own portfolio management and reporting commitments (including ability to meet annual reporting commitments for PPMs).

The delay in within-event reporting is also exacerbated by overly complex assumed use accounting arrangements that require significant resources to embed into WaterNSW operational spreadsheets and processes. This issue is being partially addressed by WaterNSW who are in the process of automating the accounting arrangements. Further work on reporting is required. This issue will also be addressed by the adaptive management process, that is, to review and improve accounting arrangements.

There have also been a number of 'grey' areas or delivery scenarios that are not explicitly covered in the procedures manual that have required complex negotiations between the Water Group, WaterNSW and the Environment and Heritage Group over multiple meetings. An example of this is the treatment of air-space releases and rainfall rejection in the Murrumbidgee. These issues have contributed to delays in accounting. Work done to resolve issues will reduce the resourcing requirements in implementing PPMs and improve efficiency.

KEQ 3 – How effective are PPMs in improving the use and accounting of environmental water?

PPMs are generally effective in improving the use of environmental water however further work needs to be done to improve the effectiveness of PPMs in the accounting of environmental water. The accounting arrangements that are in place and were used during the 2021-22 water year demonstrated the effectiveness with regards to the reduced volume required to undertake environmental watering activities using 'piggy-backing' and the volume of environmental that has been reused using 'return flows'.

Environmental water events using PPMs were undertaken in the Lower Darling, the Great Darling Anabranch, the Murrumbidgee and the Edward/Kolety-Wakool system, as well as multi-site events in the River Murray.

At a bulk level, 213 GL of return flows from NSW tributaries were recognised in the River Murray; of this, 207 GL was recognised at the South Australia border with an additional 29 GL reused in the Lowbidgee via Nimmie-Caira channels. A total of 225 GL was used in the River Murray Channel Multi-site event.

Individual event hydrographs provided in the Annual Environmental Release River Operations Report (Appendix A) show the volumes of event hydrographs compared with the volume of environmental water debited.

KEQ 4 – Are adaptive management processes effective in improving PPMs implementation?

Post-event reviews

The adaptive management process as described in the procedures manuals (section 5) comprises the annual reporting and evaluation process and the post-event review of accounting arrangements. The post-event review is also listed as one of the risk mitigation methods in the procedures manual (section 4.5) to mitigate the risk of the under/over estimation of the volume of environmental water used.

The post-event review is important to ensure that the level of conservatism in the accounting arrangements is commensurate with the risk to other water users. The current assumed use methods that use a proportional or incremental loss approach adopt either a 'maximum' or 90th percentile loss rate approach to ensure that losses incurred by the environmental water flows downstream of the delivery point are not socialised by other water users. Statistically, over time using the 90th percentile will result in the significant over-charging of e-water holders. Refinements of these methods, towards more accurate loss rates are required as well as investigation into alternative methods to mitigate the risks to third parties.

No post-event reviews have been conducted to date using a methodology to estimate the 'actual loss', for example using gauged or modelled data and a comparison with the assumed use. The capability to do this review using the MDBA Source model is currently being developed by River Murray Operations for the multi-site event.

Addressing previous annual review recommendations

Each annual review report makes a number of recommendations; of the ten recommendations made for the previous water year, half were fully completed. The status of the recommendations from the 2020-21 report is shown below in Table 9.

All recommendations are included on the PPMs workplan for consideration and prioritisation by the PPMs WG. Some recommendations from the first annual review report (2019-2020) remain outstanding, such as:

R.2 Review the Edward-Wakool seasonal loss accounting treatment

R.9 Provide Assumed Use Statements where accurate measurement is not possible.

Based on the assessment of which recommendations from previous annual reviews have been addressed, it can be concluded that the adaptive management process is partially effective in improving PPMs implementation. A number of items listed as recommended in the 2020-21 are yet to be completed. These issues have been raised again during the 2021-22 water year. Additional resourcing within the Water Group aims to address the delay in progress on key recommendations.

Table 9. Status of recommendations from the 2020-21 annual evaluation and review report

	2020-21 Recommendation	Status (June 2023)
R.1	That an evaluation framework be developed for PPMs that includes guidance on how to determine whether PPMs and supporting actions contribute to the efficient and effective use of environmental water	Draft completed (March 2023) and being applied to this annual report.
R.2	That NSW develop a policy on PPMs from Menindee Lakes System when under NSW control	In progress.
R.3	That the Edward/Kolety-Wakool seasonal loss accounting treatment be reviewed using data from the 2019-20 and 2020-21 watering events	Not progressed.
R.4	That NSW update the annual environmental release river operation report template to specifically include details on risk assessment and mitigation	Updates made to report template and provided for the 2021-22 water year.
R.5	That an assumed use template is agreed on and implemented, or progress an alternative process that documents the necessary data, methods and assumptions, as soon as possible	Not progressed.
R.6	That the PPM process be streamlined to include fit-for-purpose water ordering and documentation of risks and mitigation measures	Not progressed.
R.7	That the use of MIL escapes for return flows be retained on the work plan for further consideration.	Not progressed.
R.8	Review and update the consultation requirements outlined in the procedures manuals to clarify agency responsibilities and stakeholder expectations	Minor updates made to consultation requirements as part of the updates to the procedures manuals.
R.9	Update the NSW PPM work plan to include recommendations from this annual review report and tasks prioritised in light of other high-priority PPM tasks as determined by the PPM Working Group	Completed. Recommendations included in work plan.
R.10	Water Group to progress a review of the procedures manuals and update as necessary to reflect new actions and the outcomes of recommendations.	No reviews of the procedures manuals were undertaken in 2021/22.

KEQ 5 – How can the implementation of PPMs be improved?

While PPMs are adaptively evolving as the uptake increases and the supporting knowledge base improves, the PPMs process itself has not. Based on the above review, the ways in which PPMs implementation can be improved are:

- water ordering
- clear process with timing and responsibilities
- improved documentation of risks and mitigation measures during event planning
- use of assumed use statements
- post-event reporting.

The recommendations for the 2021-22 water year are listed in Table 10 and include outstanding items from the 2020-21 water year.

Table 10. Recommendations for the 2021-22 water year

Focus area	Recommendation	Arising from
Consistency	R.1. Water Group determine assumed uses for directed releases in the Murrumbidgee	KEQ1
Efficiency	R.2. Water Group collaborate with other agencies to streamline the PPMs implementation process, including: – fit-for-purpose water ordering, – documentation of risks and mitigation measures, – reporting requirements. R.3. Water Group to convene workshop to discuss accounting issues in the Murrumbidgee and develop a set of principles for PPM implementation R.4. Water Group to develop a policy on PPMs from Menindee Lakes System when under NSW control	KEQ2
Effectiveness	R.5. Water Group review the Edward/Kolety river assumed use statement and work with RMO to simplify and improve accuracy for varying conditions R.6. Water Group develop a policy on the use of MIL escapes for return flows. R.7. Water Group to collaborate with WaterNSW to develop method for completing a post-event comparison of losses debited as per assumed use statement with 'actual' loss R.8. PPM WG update the NSW PPM work plan to include recommendations from this annual review report and prioritise them taking into consideration other high-priority PPM tasks and resource availability	KEQ3 KEQ4

Focus area	Recommendation	Arising from
	R.9. Water Group to progress a review of the procedures manuals and update as necessary to reflect new actions and the outcomes of recommendations	

4.2 Evaluation criteria

Three interrelated criteria (consistency, efficiency, and effectiveness) set the evaluation focus (Table 11) and serve the evaluation purposes of implementation accountability and improvement. These criteria reflect the requirements for environmental water protections as described in the Basin-wide Environmental Water Protection Strategy (adopted at Basin Officials Committee meeting 81 in 2021). These criteria will be used to track the performance of the implementation of PPMs over time.

Table 11. Evaluation criteria

Criteria
Consistency Whether the PPMs process was followed as intended and activities were implemented consistently to support return flows and piggybacking of environmental water; whether consistency improves through time. To understand the degree and consistency of PPMs process implementation, identify constraints and barriers to implementation. **KEQ 1, KEQ 5**
Efficiency Whether the implementation of the PPMs process was timely, activities could be easily implemented, how the process (and supporting arrangements) has improved over time To understand whether the PPMs process is easy to follow and practical to implement across the agencies. To identify possible improvements within the PPMs process and document for action through the PPMs adaptive management process; to understand issue size and agency perspectives. **KEQ 2, KEQ 4, KEQ 5**
Effectiveness Whether the NSW PPMs implementation process is effective in providing a secure, operable, adaptive and transparent framework for the protection of held environmental water (PPMs do not currently apply to planned environmental water). To determine whether adaptive improvement processes are working; to inform recommendations for implementation design improvement; to identify opportunities to improve the PPMs process and refine related activities. **KEQ 3, KEQ 5**

4.3 Evaluation of findings

Individual indicator ratings are synthesised using the criteria rating rubric to determine an annual criteria rating for consistency, efficiency and effectiveness (column 1 of Table 7). All three evaluation criteria of consistency, efficiency and effectiveness scored an average rating, based on the mostly moderate and low ratings for performance indicators. An average rating means there is evidence of minimal positive performance and is likely to be below expectations for the program.

The roles and responsibility matrix (Table 8) was used to help assign a performance rating for performance indicators PI1a and PI2a and is also useful for identifying which obligations are not being met, across the key areas of planning, implementation and active management. Based on documentation provided during event planning and annual reporting, risk identification and mitigation (during both the planning and ordering phases) and operational reporting were regularly not completed. A number of requirements listed under adaptive management, such as hindcasting and review and refining/improving accounting arrangements were not undertaken during the 2021-22 water year.

A value-based rating of performance for each indicator was determined by reviewing the reports provided by the river operator and environmental water manager for the 2021-22 water year and other records and documents as necessary. The annual focus area performance, based on individual indicator ratings, and trend directions are summarised in Table 11. A more detailed summary is provided in Table D. 1 (Appendix D).

Performance for each focus area ranged between low to moderate. No focus areas achieved a high performance rating during the 2021-22 water year. Focus areas that performed at a low level are information quality, information provision, risk identification and PPMs implementation.

General trends were considered based on performance this year compared to that of previous two years. Trends for most focus areas were mostly neutral (retention of low to moderate performance). The performance focus area for effectiveness in outcomes and implementation were increasing. This reflects the higher uptake of PPMs for watering actions that increased from 5 actions in 20/21 to 11 actions in 21/22 as well as the increase in accounting arrangements for watering actions. The performance focus area of information provision decreased and was largely related to the late submission of reporting elements, both for annual events and post-event accounting numbers. This focus area is about the timeliness, transparency and relevance of planning, accounting and reporting.

Table 12. PPMs implementation performance rating summary 2021-22

Criteria ratings	Focus area	Low	Moderate	High	Trends since PPMs started
Consistency (KEQ 1 & %) Average	Roles and responsibilities PI 1a, PI 1b		✓		neutral

Criteria ratings	Focus area	Low	Moderate	High	Trends since PPMs started
	Information quality PI 2a	✓			neutral
	Impediments or barriers PI 3		✓		neutral
Efficiency (KEQ 2, 4 & 5) Average	Information provision PI 2b	✓			decreasing
	Risk identification PI 4	✓			neutral
	Adaptive response & improvement changes PI 5		✓		neutral
	Balance within risk management PI 7		✓		neutral
Effectiveness (KEQ 3 & 5) Average	PPMs outcomes P! 6		✓		increasing
	PPMs Implementation PI 8	✓			increasing

Appendix A – WaterNSW annual environmental release river operations reports

Prerequisite policy measures

Annual Environmental Release River Operations Report 2021-22

This report was prepared by WaterNSW in accordance with the reporting requirements described under Section 5.1 of the Prerequisite Policy Measures Procedures Manual for the Murrumbidgee Regulated River and the Prerequisite Policy Measures Procedures Manual for the NSW Murray and Lower Darling Regulated Rivers.

Action	Responsibility	Date
Report prepared	Nachi Nachiappan Water System Operations Supervisor – South WaterNSW	15/03/2023
Report reviewed	Mary Fielder Water System Planner WaterNSW	17/03/2023
Report reviewed	Shaun Gleeson Water System Operations Supervisor – South WaterNSW	17/02/2023
Report approved	Jonathan Belej Water System Operations Manager – South WaterNSW	20/03/2023

Environmental watering actions

In Table 13, provide an overview of the environmental water actions undertaken using PPMs in the 2021/22 water year.

Table 13. Summary of PPM watering actions in 2021/22

Name of environmental watering action	PPM Event #1 DS Maude Jan 2022	PPM Event #2 DS Maude Feb 2022	PPM Event #3 Wagga Mar 2022	PPM Event #4 Wagga May 2022	PPM Event #5 Wagga Jun 2022
River system	Murrumbidgee	Murrumbidgee	Murrumbidgee	Murrumbidgee	Murrumbidgee
Type of PPM event	Directed releases from storage/s to meet a target flow at downstream site/s	Directed releases from storage/s to meet a target flow at downstream site/s	Directed releases from storage/s to meet a target flow at downstream site/s	Directed releases from storage/s to meet a target flow at downstream site/s	Directed releases from storage/s to meet a target flow at downstream site/s
General description of watering action	Maintain minimum flow to address potential hypoxic flood water impact on native fish	Maintain minimum flow to address potential hypoxic flood water impact on native fish	Manage flow recession at Wagga at the end of airspace releases from Burrinjuck Dam	Manage flow recession at Wagga at the end of airspace releases from Burrinjuck Dam	Manage flow recession at Wagga at the end of airspace releases from Burrinjuck Dam
Release start date	06/01/2022	13/02/2022	15/03/2022	04/05/2022	01/06/2022
End date	14/02/2022	26/02/2022	28/03/2022	14/05/2022	18/06/2022
Was this an agreed or interim action?	Agreed	Agreed	Interim	Interim	Interim
Delivery pathway	Upper storage/s to nominated downstream site/s.	Upper storage/s to nominated downstream site/s.	Upper storage/s to River Murray. Estimated return flows are to be protected	Upper storage/s to nominated downstream site/s.	Upper storage/s to nominated downstream site/s.

Name of environmental watering action	PPM Event #1 DS Maude Jan 2022	PPM Event #2 DS Maude Feb 2022	PPM Event #3 Wagga Mar 2022	PPM Event #4 Wagga May 2022	PPM Event #5 Wagga Jun 2022
	Estimated return flows are to be protected downstream, including for delivery to the Murray River.	Estimated return flows are to be protected downstream, including for delivery to the Murray River.	downstream of target sites, including for reuse downstream and delivery to the Murray River.	Estimated return flows are to be protected downstream, including for delivery to the Murray River.	Estimated return flows are to be protected downstream, including for delivery to the Murray River.
Environmental site/s watered	Murrumbidgee River D/s Maude Weir	Murrumbidgee River D/s Maude Weir	Murrumbidgee main channel below Wagga Wagga	Murrumbidgee main channel below Wagga Wagga	Murrumbidgee main channel below Wagga Wagga
Total volume of environmental water delivered (ML)	42,284 ML	8,703 ML	65,756 ML	33,523 ML	31,025 ML
Accounting method used	Assumed use method: Debit additional releases from storage, calculated as the difference between the actual releases from storage and those that are estimated would have been made without the environmental water order.	Assumed use method: Debit additional releases from storage, calculated as the difference between the actual releases from storage and those that are estimated would have been made without the environmental water order.	Assumed use method: Debit additional releases from storage, calculated as the difference between the actual releases from storage and those that are estimated would have been made without the environmental water order.	Assumed use method: Debit additional releases from storage, calculated as the difference between the actual releases from storage and those that are estimated would have been made without the environmental water order.	Assumed use method: Debit additional releases from storage, calculated as the difference between the actual releases from storage and those that are estimated would have been made without the environmental water order.

Risk assessment and mitigation

In Table 14, detail any risks identified during the planning and release of the environmental water orders received which use Prerequisite Policy Measures, including deliverability risks, operational risks and other risks considered. The mitigation measures applied should also be included in Table 14. Table 14 should include any risk assessments undertaken in consultation with the Department of Planning and Environment – Environment and Heritage Group during the planning on a watering event.

Attach supporting information in Attachment A *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 14. Risks considered during event planning

#	Description of risk	Mitigation measure/s applied
1	Under/over-estimating the volume of environmental water used: Inaccurate measurement	Used appropriate estimates of unaccounted differences and operational decisions when estimating the 'without environmental order' when calculated additional release from storage
2	Under-use/overuse of environmental water allocated for individual events resulting in potential forfeit of HEW from licensed accounts.	Regular reporting of estimated water use to the eWater managers with uncertainties in the usage forecasts Educating the eWater managers on water ordering and use debit procedures by WaterNSW for all licensed users to effectively manage HEW portfolio under the NSW rules.

Water orders

In Table 15, provide an overview of the environmental water orders received for Prerequisite Policy Measures in the 2021/22 water year (including any order that was subsequently refused/rejected).

Provide further detail in Attachment B *(of the WaterNSW Annual Environmental Release River Operations Report)* as needed, including water orders and assumed use statements. If any water order using PPMs was refused, please provide documentation and rationale supporting this decision.

Table 15. Water orders received by WaterNSW in 2021/22

Order number	Event #1	Event #2	Event #3-1	Event #3-2	Event #4-1	Event #4-2	Event #5
Organisation submitting order	EHG on behalf of TLM	EHG on behalf of CEWO	EHG on behalf of TLM	EHG on behalf of CEWO	EHG on behalf of CEWO	EHG on behalf of TLM	EHG on behalf of CEWO
Date order was submitted	06/01/2022	19/03/2022	29/03/2022	25/03/2022	23/05/2022	10/05/2022	27/06/2022
Volume of order (ML)	45,000	8,703	18,000	45,000	44,000	16,000	24,000
Organisation delivering order	WaterNSW	WaterNSW	WaterNSW	WaterNSW	WaterNSW	WaterNSW	WaterNSW
Release date (days)	23/12/2021 — 31/12/2021 (9)	13/02/2022 — 26/02/2022 (11)	15/03/2022 — 17/03/2022 (3)	18/03/2022 — 29/03/2022 (12)	06/05/2022 — 16/05/2022 (11)	17/05/2022 — 20/05/2022 (4)	01/06/2022 — 30/06/2022 (30)
Form of water order submitted (e.g. Form A, email, verbal, other)	Email	Email	Email	Email	Email	Email	Email

Comparison of forecast and actual environmental water use

Provide an overview of:

- target daily flow rates and volumes
- actual daily flow rates and volumes
- forecast losses and actual losses (at an appropriate temporal scale for the event)
- volume of environmental water debited (with corresponding licence numbers)
- volume of water delivered to the Murray Valley that will be recognised as environmental water.

Attach supporting information in Attachment C *(of the WaterNSW Annual Environmental Release River Operations Report)*.

PPM event #1: Hypoxic Water Management Event January 2022 below Maude Weir

- Target daily flow rates and volumes
  - 5,000 ML/d for nine days delivering 45,000 ML.
- Actual daily flow rates and volumes
  - 4,699 ML/d delivering 42,287 ML.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - No losses were forecast as it was a gaining river due to flood waters.
- Volume of environmental water debited (with corresponding licence numbers)
  - 42,287 ML (TLM licence 40AL405811).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 42,287 ML (TLM licence 40AL405811)
  - No further losses in Murray R as it was under unregulated conditions to SA border.

Figure 3. Chart 1 – PPM event #1: Hypoxic Water Management Event January 2022 below Maude Weir

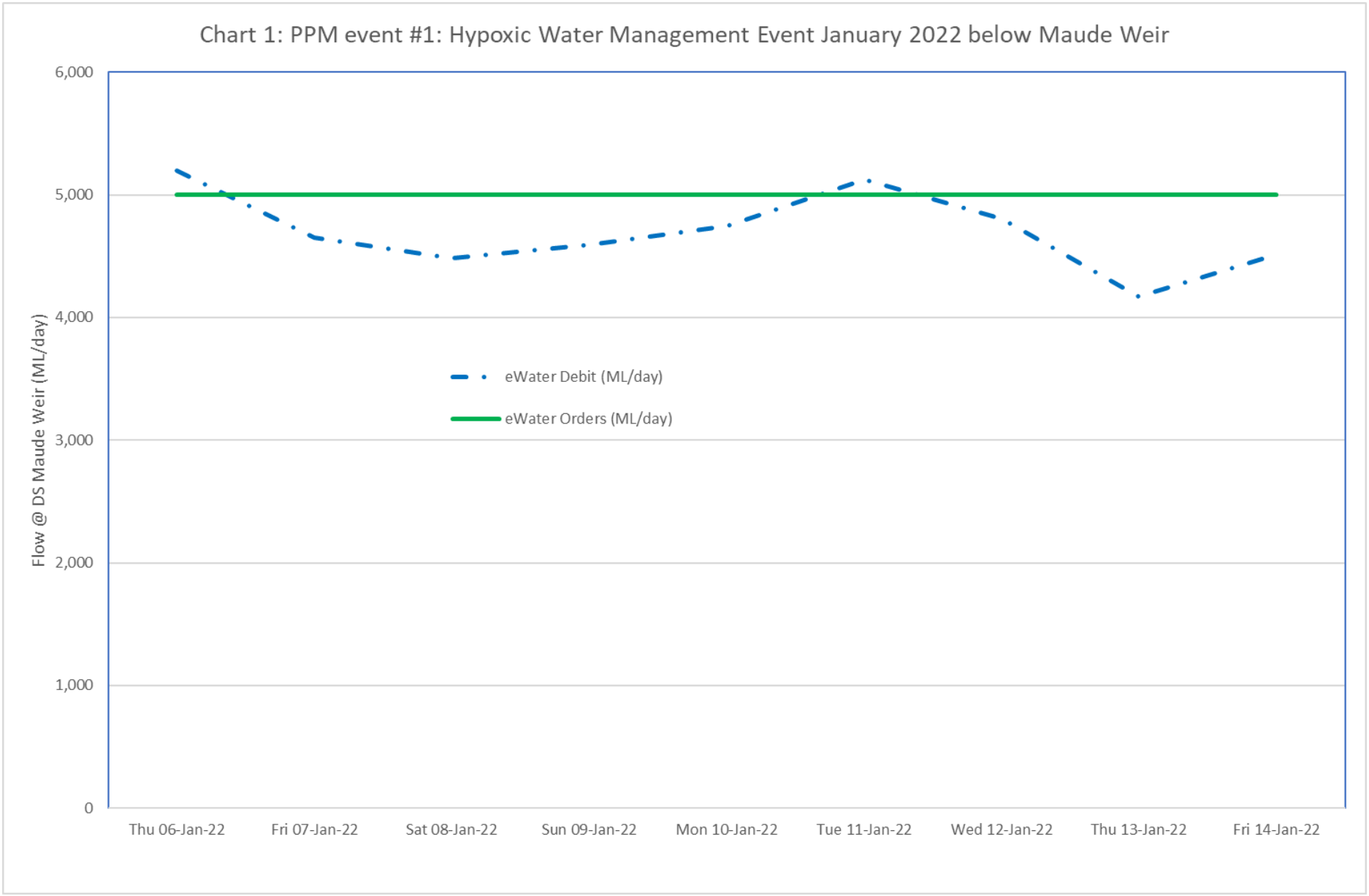
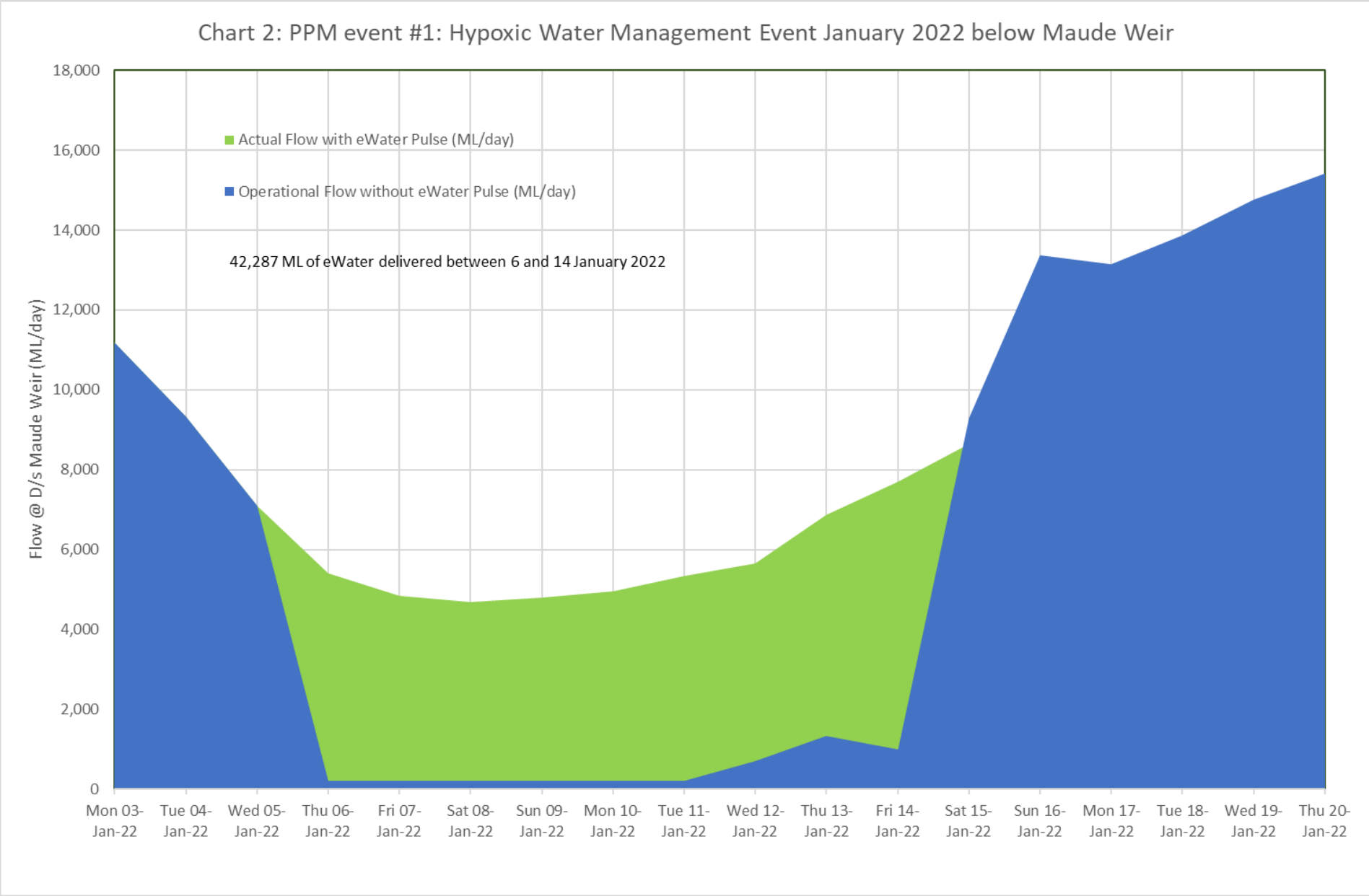


Figure 4. Chart 2 – PPM event #1: Hypoxic Water Management Event January 2022 below Maude Weir



PPM event #2: Hypoxic Water Management Event February 2022 below Maude Weir

- Target daily flow rates and volumes
  - 3,557 ML/d for 14 days delivering 5,000 ML/d for eight days and then gradually slowing up to 500 ML/d; delivering 49,800 ML
  - Water orders were revised by eWater managers post event to reflect actual assessed usage.
- Actual daily flow rates and volumes
  - 622 ML/d delivering 8,703 ML; the natural system flows were higher than initially forecast
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - No losses were forecast as it was a gaining river due to flood waters.
- Volume of environmental water debited (with corresponding licence numbers)
  - 8,703 ML (EHG/CEWO licence 40AL415740).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 8,703 ML (EHG/CEWO licence 40AL415740)
  - No further losses in Murray R as it was under unregulated conditions to SA border.

Figure 5. Chart 3 – PPM event #2: Hypoxic Water Management Event February 2022 below Maude Weir

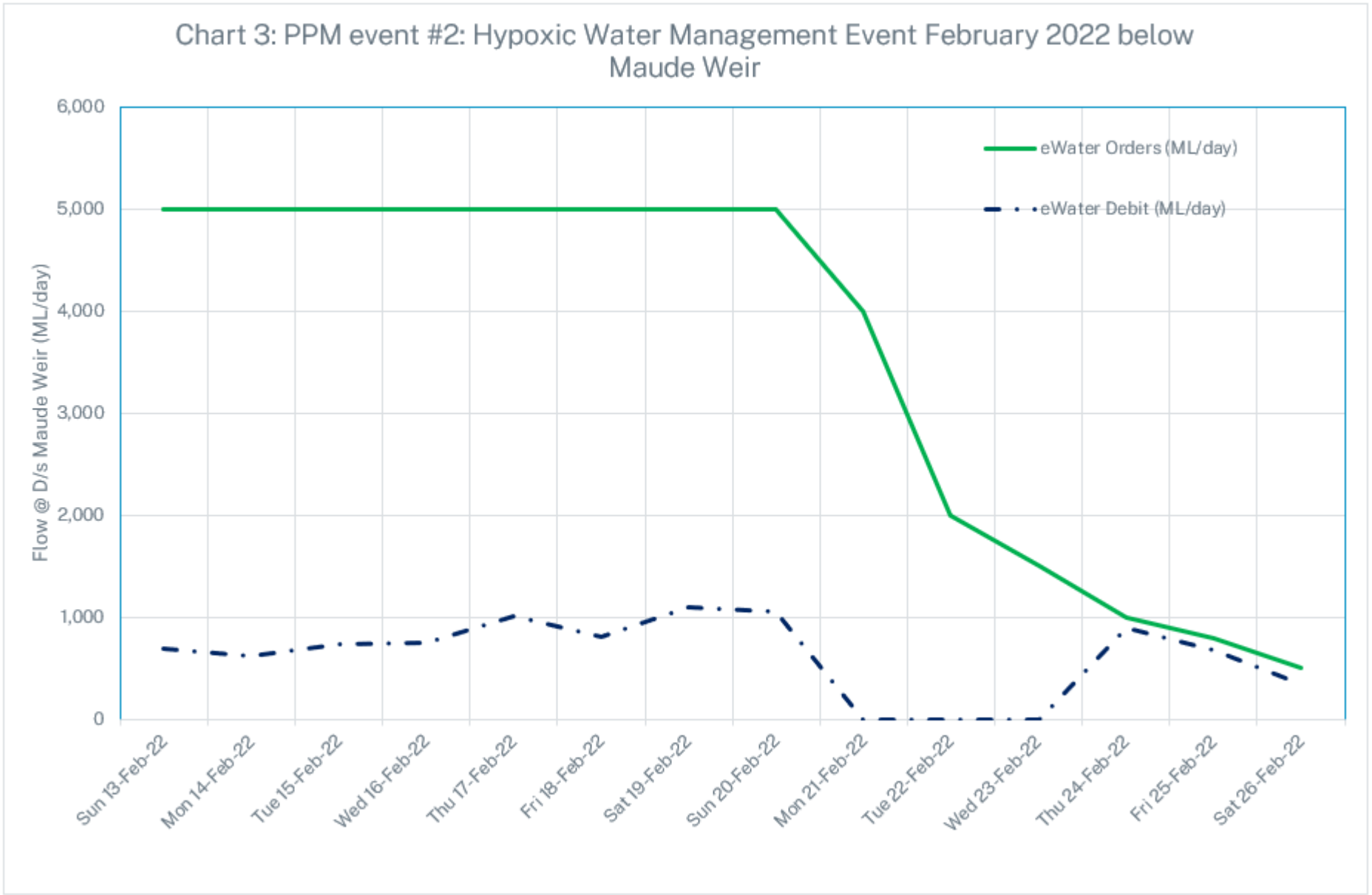
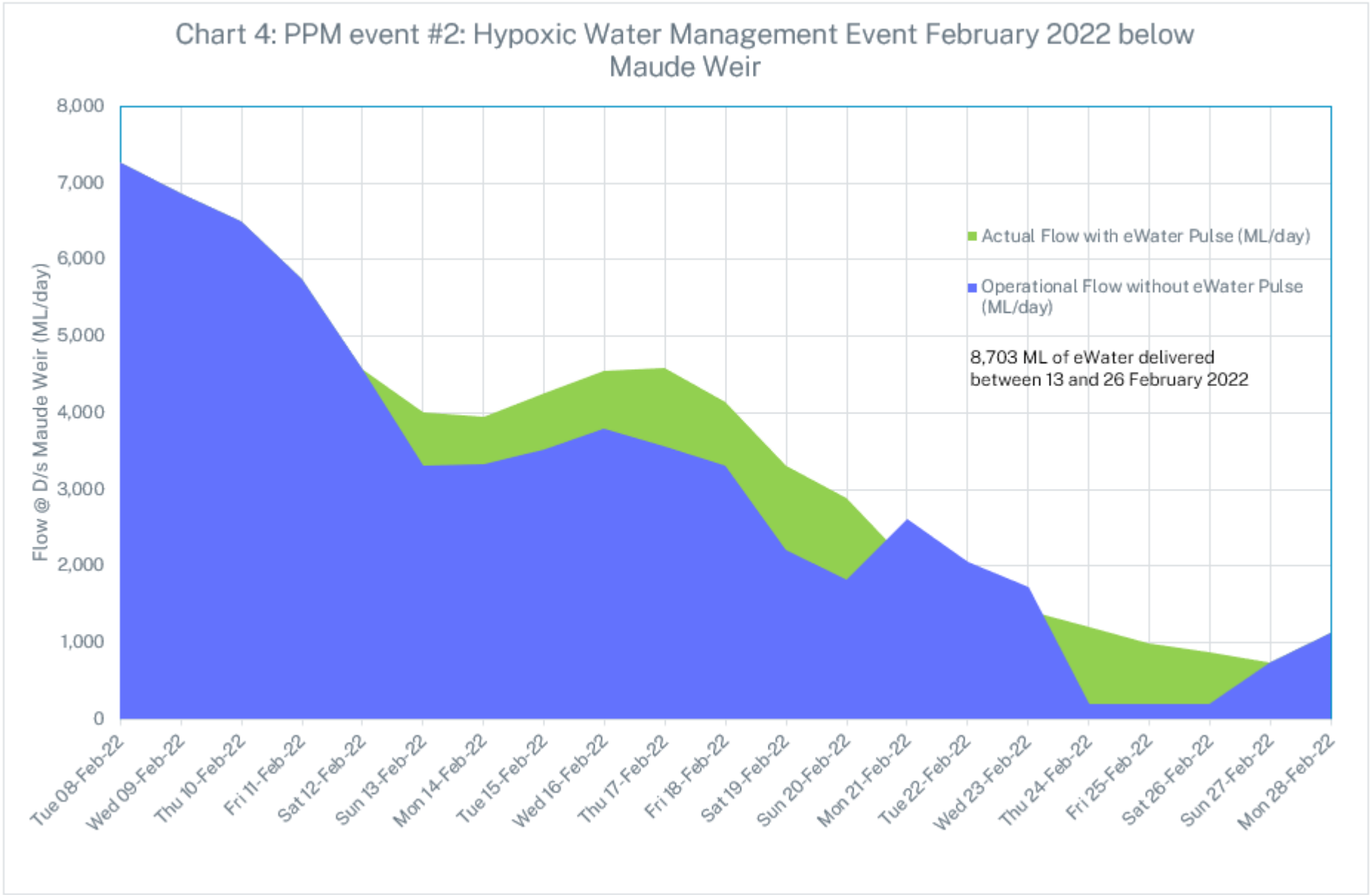


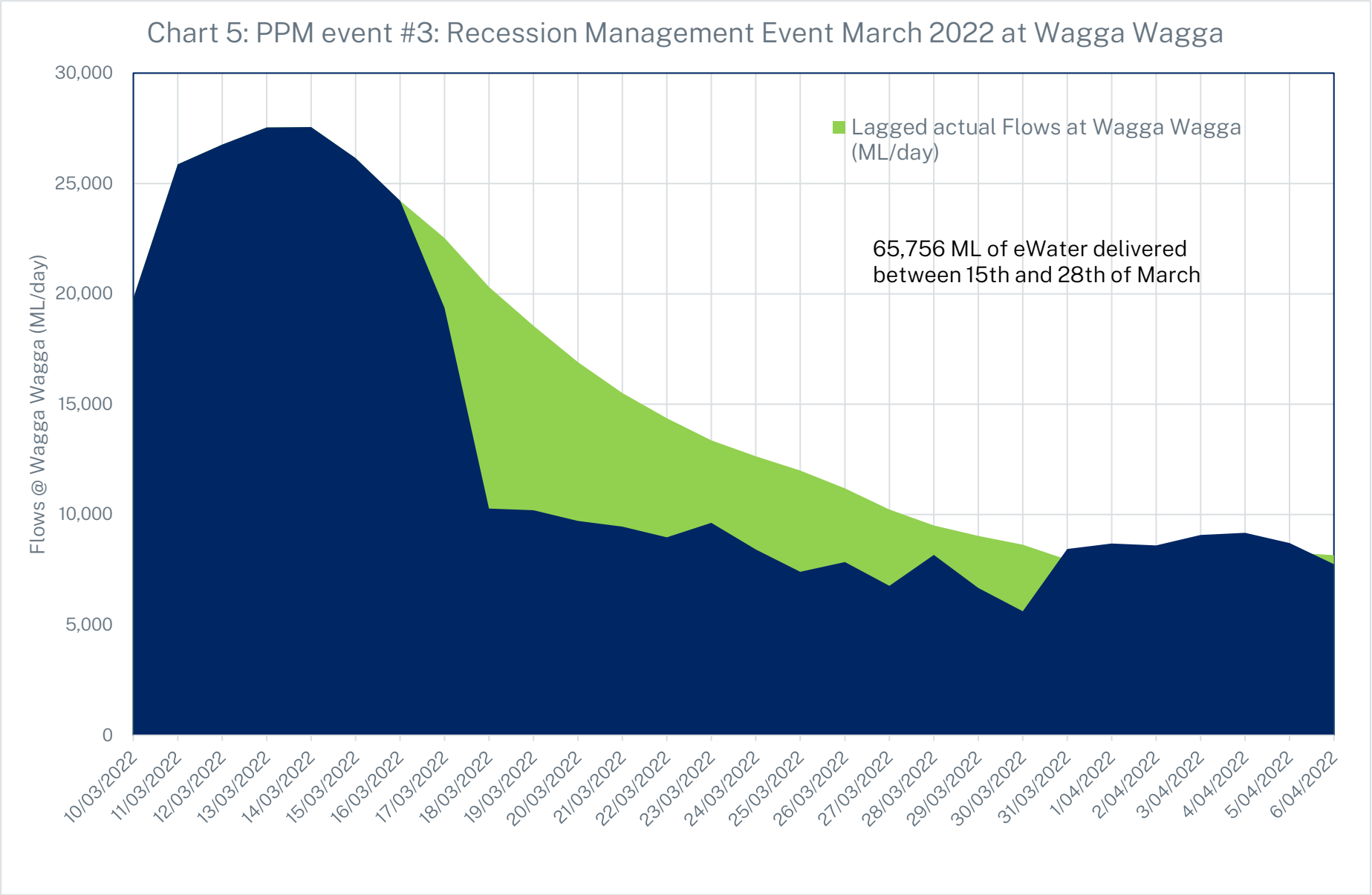
Figure 6. Chart 4 – PPM event #2: Hypoxic Water Management Event February 2022 below Maude Weir



PPM event #3: Recession Management Event March 2022 at Wagga Wagga

- Target daily flow rates and volumes
  - 4,640 ML/d for 14 days; targeting 10% flow reduction per day at Wagga Wagga from the airspace releases of say 24 GL/d; total ordered volume 63,000 ML.
- Actual daily flow rates and volumes
  - 4,697 ML/d delivering 65,756 ML.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - No losses were forecast as it was a gaining river due to flood waters.
- Volume of environmental water debited (with corresponding licence numbers)
  - 48, 403 ML (EHG/CEWO licence 40AL415740)
  - 17,713 ML (TLM licence 40AL405811).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 18,802 ML (EHG/CEWO licence 40AL415740); (NOTE: A volume of 29,241 ML was reused in Lowbidgee via Nimmie-Caira channels)
  - 17,713 ML (TLM licence 40AL405811)
  - No further losses in Murray R as it was under unregulated conditions to SA border.

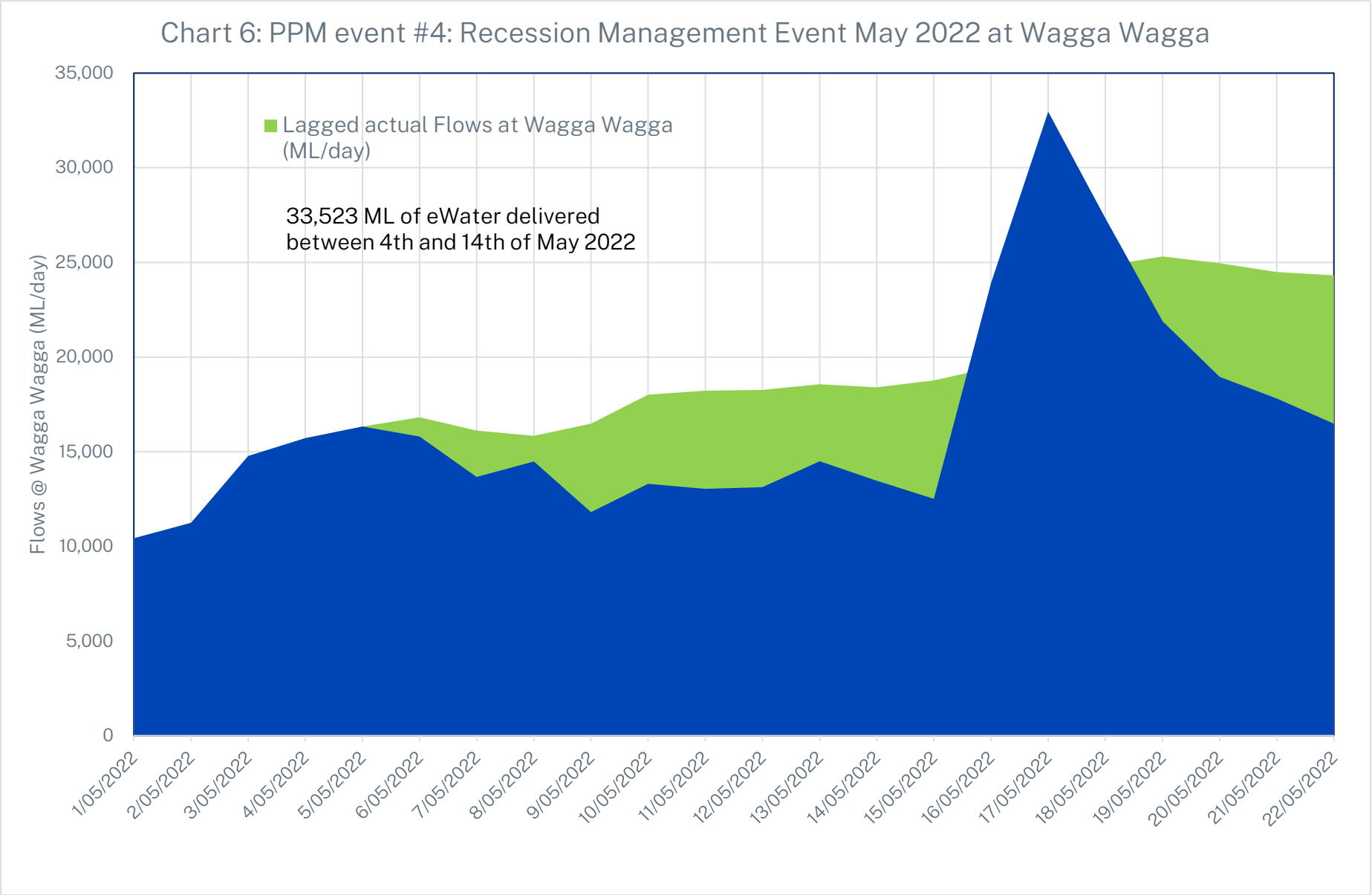
Figure 7. Chart 5 – PPM event #3: Recession Management Event March 2022 at Wagga Wagga



PPM event #4: Recession Management Event May 2022 at Wagga Wagga

- Target daily flow rates and volumes
  - 5,455 ML/d for 11 days; targeting 10% flow reduction per day at Wagga Wagga from the airspace releases of say 16 GL/d; total ordered volume 60,000 ML.
- Actual daily flow rates and volumes
  - 3,725 ML/d delivering 33,523 ML; the natural system flows were higher than initially forecast.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - No losses were forecast as it was a gaining river due to flood waters.
- Volume of environmental water debited (with corresponding licence numbers)
  - 33, 523 ML (EHG/CEWO licence 40AL415740).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 33,523 ML (EHG/CEWO licence 40AL415740)
  - No further losses in Murray R as it was under unregulated conditions to SA border.

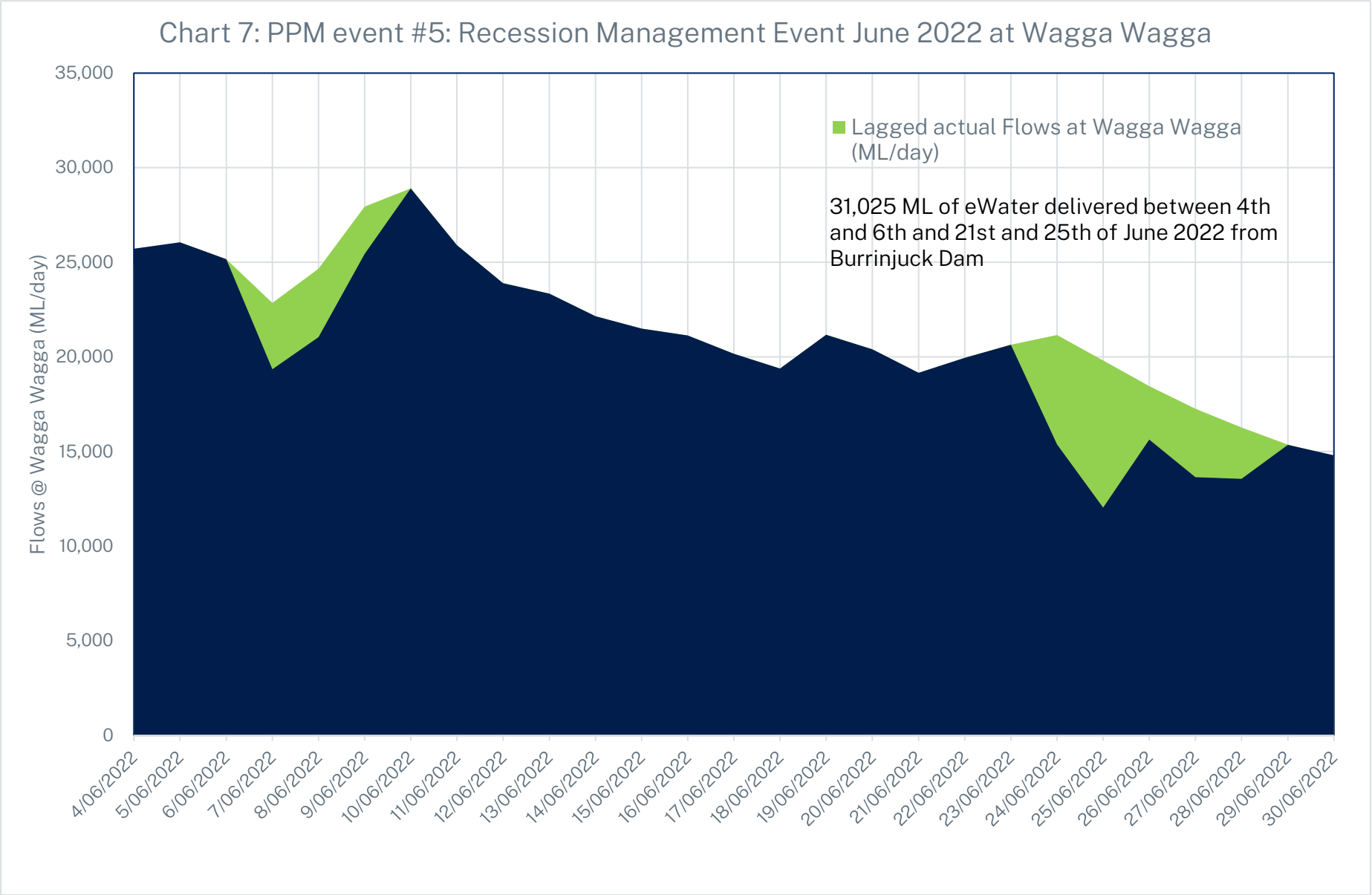
Figure 8. Chart 6 – PPM event #4: Recession Management Event May 2022 at Wagga Wagga



PPM event #5: Recession Management Event June 2022 at Wagga Wagga

- Target daily flow rates and volumes
  - 800 ML/d for 30 days; targeting 10% flow reduction per day at Wagga Wagga from the airspace releases of say 25 GL/d; total ordered volume 24,000 ML.
- Actual daily flow rates and volumes
  - 3,878 ML/d delivering 31,025 ML; the natural system flows were higher than initially forecast.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - No losses were forecast as it was a gaining river due to flood waters.
- Volume of environmental water debited (with corresponding licence numbers)
  - 31, 025 ML (EHG/CEWO licence 40AL415740).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 31,025 ML (EHG/CEWO licence 40AL415740)
  - No further losses in Murray R as it was under unregulated conditions to SA border.

Figure 9. Chart 7 – PPM event #5: Recession Management Event June 2022 at Wagga Wagga



Stakeholder consultation

In Table 16, provide a summary of stakeholder consultation. Attach supporting documents in Attachment D *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 16. Summary of stakeholder consultation

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
21/12/2021	MDBA-TLM, DPE, EHG, WaterNSW	Heads-up to maintain a baseflow below Maude Weir to address potential hypoxic concerns	Email discussions and phone calls	Approval to use TLM water under PPM arrangements	Instructions placed via emails followed by Water Orders to WaterNSW	
18/01/2022	DPIE and EHG	Maintain a baseflow below Maude Weir to address potential hypoxic conditions	Email	Approval to use PPM procedures	PPM Procedures to be applied	
08/03/2022	EHG, WaterNSW, CEWO	Flow recession management at Wagga	Email	Confirmation of TLM and CEWO water availability	Commence delivery from headwater storages	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
17/03/2022	EHG, WaterNSW, CEWO, MDBA	PPM flow delivery progress	Email	Update on daily environmental flow delivery at Balranald and losses to SA border	None	
30/03/2022	Murrumbidgee ROSSCo	PPM events delivery progress	Presentation	Members noted the progress	None	
20/04/2022	WaterNSW, DPE, MDBA	PPM flow delivery progress	Email	Update on daily environmental flow delivery at Balranald and losses to SA border	None	
27/04/2022	EHG, WaterNSW, CEWO	Heads-up for another Flow recession management at Wagga	Email	Plan for another PPM event	Commence delivery from headwater storages	
11/05/2022	MDBA, RMW, WaterNSW	PPM flow delivery progress	Email	Update on daily environmental flow delivery at Balranald and losses to SA Border	None	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
31/05/2022	EHG, WaterNSW	Heads-up for another Flow recession management at Wagga	Email	Plan for another PPM event	Commence delivery from headwater storages	
01/06/2022	Murrumbidgee eWAG	PPM events delivery progress	Presentation	Members noted the progress	None	
21/07/2022	Murrumbdigee CAG	PPM events delivery progress	Presentation	Members noted the progress, system operations	None	
21/07/2022	MDBA, WaterNSW	PPM flow delivery progress	Email	Update on daily environmental flow delivery at Balranald and losses to SA Border	None	

Recommendations to improve future environmental watering actions

In Table 17, provide a summary of key issues encountered in 2021/22 and recommendations for addressing these. Attach supporting documents in Attachment E *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 17. Summary of issues and recommendations

Environmental watering action	Issue	Agencies involved	Stakeholders involved	Recommendations	List of supporting documents
Event #1 to #5	Water order process continued to frustrate all parties with the availability of water for delivery, the timeliness of amendments and the necessary feedback of actual use to the customers so that orders can be managed in real time.	EHG and WaterNSW	EHG, CEWO, TLM, DPE	The water orders must have all the elements as outlined in the PPM Procedures manual. (Section 2.4.2 of NSW PPM Procedures Manual for the Murrumbidgee Regulated River (Nov 2022))	

Prerequisite policy measures

Annual Environmental Release River Operations Report 2021-22

This report was prepared by WaterNSW in accordance with the reporting requirements described under Section 5.1 of the Prerequisite Policy Measures Procedures Manual for the Murrumbidgee Regulated River and the Prerequisite Policy Measures Procedures Manual for the NSW Murray and Lower Darling Regulated Rivers.

Action	Responsibility	Date
Report prepared	Nachi Nachiappan Water System Operations Supervisor – South WaterNSW	21/03/2023
Report approved	Mary Fielder Water System Planner WaterNSW	23/03/2023
Report approved	Shaun Gleeson Water System Operations Supervisor – South WaterNSW	23/02/2023
Report approved	Jonathan Belej Water System Operations Manager – South WaterNSW	23/03/2023

Environmental watering actions

In Table 18, provide an overview of the environmental water actions undertaken using PPMs in the 2021/22 water year.

Table 18. Summary of PPM watering actions in 2021/22

Name of environmental watering action	PPM-LDR Event #1	PPM-LDR Event #2	PPM-LDR Event #3	PPM-LDR Event #4
River system	Lower Darling River	Lower Darling River	Great Darling Anabranch	Great Darling Anabranch
Type of PPM event	Directed releases from Menindee Lakes via the Lower Darling River	Directed releases from Menindee Lakes via the Lower Darling River	Directed releases from Cawndilla Lake via the Great Darling Anabranch	Directed releases from Cawndilla Lake via the Great Darling Anabranch
General description of watering action	Native fish management – breeding and dispersal	Native fish management – breeding and dispersal	Native fish management – breeding and dispersal	Native fish management – breeding and dispersal
Release start date	01/07/2021	23/10/2021	23/10/2021	01/03/2022
End date	23/09/2021	26/11/2021	26/11/2021	17/03/2022
Was this an agreed or interim action?	Agreed	Agreed	Interim	Interim
Delivery pathway	Residual held environmental water from the Lower Darling at Burtundy, recognised through to the South Australian border without regulation in Lake Victoria.	Residual held environmental water from the Lower Darling at Burtundy, recognised through to the South Australian border without regulation in Lake Victoria.	Menindee Lakes downstream to South Australian border, via the Great Darling Anabranch.	Menindee Lakes downstream to South Australian border, via the Great Darling Anabranch.

Name of environmental watering action	PPM-LDR Event #1	PPM-LDR Event #2	PPM-LDR Event #3	PPM-LDR Event #4
Environmental site/s watered	Lower Darling in-channel delivery (via directed releases from Menindee Lakes when a shared resource)	Lower Darling in-channel delivery (via directed releases from Menindee Lakes when a shared resource)	Great Darling Anabranch (via directed releases from Lake Cawndilla when a shared resources)	Great Darling Anabranch (via directed releases from Lake Cawndilla when a shared resources)
Total volume of environmental water delivered (ML)	37,866 ML	20,850 ML	35,116 ML	4,550 ML
Accounting method used	When the Murray River is in regulated conditions, an incremental loss method will be applied to residual HEW from the Lower Darling recognised at Burtundy. When the Murray River in unregulated conditions, no loss rate is to be applied to return flows recognised at Burtundy.	When the Murray River is in regulated conditions, an incremental loss method will be applied to residual HEW from the Lower Darling recognised at Burtundy. When the Murray River in unregulated conditions, no loss rate is to be applied to return flows recognised at Burtundy.	i. after adjusting for travel time, when the daily average flow passing the Tara Downs gauge (425054) is equal to or exceeds releases, no losses are to be applied and the full volume of the environmental debit is recognised at the South Australian border, ii. after adjusting for travel time, when the daily average flow passing Tara Downs is less than releases, the flow at Tara Downs is reduced by a loss value and recognised at the South Australian border. The loss value applied is equivalent to the proportional	i. after adjusting for travel time, when the daily average flow passing the Tara Downs gauge (425054) is equal to or exceeds releases, no losses are to be applied and the full volume of the environmental debit is recognised at the South Australian border, ii. after adjusting for travel time, when the daily average flow passing Tara Downs is less than releases, the flow at Tara Downs is reduced by a loss value and recognised at the South Australian border. The loss value applied is equivalent to the proportional

Name of environmental watering action	PPM-LDR Event #1	PPM-LDR Event #2	PPM-LDR Event #3	PPM-LDR Event #4
			daily loss that occurred between the Bulpunga gauge (425011) and Tara Downs iii. after adjusting for travel time, when flows at Tara Downs reach 0 ML/day, no return flows are to be recognised.	daily loss that occurred between the Bulpunga gauge (425011) and Tara Downs iii. after adjusting for travel time, when flows at Tara Downs reach 0 ML/day, no return flows are to be recognised.

Risk assessment and mitigation

In Table 19, detail any risks identified during the planning and release of the environmental water orders received which use Pre-requisite Policy Measures, including deliverability risks, operational risks and other risks considered. The mitigation measures applied should also be included in Table 19. Table 19 should include any risk assessments undertaken in consultation with the Department of Planning and Environment – Environment and Heritage Group during the planning on a watering event.

Attach supporting information in Attachment A *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 19. Risks considered during event planning

#	Description of risk	Mitigation measure/s applied
	For flows down the GDA, the Tara Downs gauge can be backwater affected. Periods of backwater are established onsite, and water level data is used to determine when the rating can be used (or not).	In the event the Tara Downs gauge is affected by backwater, a suitable loss value shall be applied to the daily average flow passing Bulpunga gauge (425011) to determine return flow volumes of environmental water
	The interim approach for delivery via GDA assumes that environmental water delivery in the Anabranch remains in-channel. Opportunistic cropping of the lakes along the Anabranch is known to occur. The opening or removal of any block banks will affect the losses and return flow volumes.	The environmental water holders with work the Anabranch Private Irrigation District and landholders (including National Parks and Wildlife Service) to notify them when environmental water is being released down the Anabranch

Water orders

In Table 20, provide an overview of the environmental water orders received for Prerequisite Policy Measures in the 2021/22 water year (including any order that was subsequently refused/rejected).

Provide further detail in Attachment B *(of the WaterNSW Annual Environmental Release River Operations Report)* as needed, including water orders and assumed use statements. If any water order using PPMs was refused, please provide documentation and rationale supporting this decision.

Table 20. Water orders received by WaterNSW in 2021/22

Order number	PPM-LDR Event#1 a	PPM-LDR Event#1 b	PPM-LDR Event#1 c	PPM-LDR Event#1 d	PPM-LDR Event#1 e	PPM-LDR Event#1 f
Organisation submitting order	DPI EES	DPI EES	DPI EES	DPI EES	DPI EES	DPI EES
Date order was submitted	06/07/2021	09/07/2021	30/08/2021	01/09/2021	13/09/2021	13/09/2021
Volume of order (ML)	11,328 ML	6,195 ML	6,650 ML	12,350 ML	21,450 ML	12,600 ML
Organisation delivering order	WaterNSW	WaterNSW	WaterNSW	WaterNSW	WaterNSW	WaterNSW
Release date (days)	01/07/2021 to 28/08/2021 (59 d)	01/07/2021 to 28/08/2021 (59 d)	29/08/2021 to 16/06/2021 (19 d)	29/08/2021 to 16/06/2021 (19 d)	17/09/2021 to 19/10/2021 (33 d)	17/09/2021 to 19/10/2021 (33 d)
Form of water order submitted (e.g. Form A, email, verbal, other)	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form

Order number	PPM-LDR Event#1 a	PPM-LDR Event#1 b	PPM-LDR Event#1 c	PPM-LDR Event#1 d	PPM-LDR Event#1 e	PPM-LDR Event#1 f
Supporting documents	60AL582512	60AL583376	60AL583376	60AL582512	60AL582512	60AL583376

Order number	PPM-LDR Event#2 a	PPM-LDR Event#2 b	PPM-GDA Event#1 a	PPM-GDA Event#2 a	PPM-GDA Event#2 b
Organisation submitting order	DPI EES	DPI EES	DPI EES	DPI EES	DPI EES
Date order was submitted	13/12/2021	18/01/2021	22/11/2021	01/03/2022	11/03/2022
Volume of order (ML)	3,500 ML	7,870 ML	30,000 ML	1,650 ML	4,200 ML
Organisation delivering order	WaterNSW	WaterNSW	WaterNSW	WaterNSW	WaterNSW
Release date (days)	23/10/2021 to 29/10/2021 (7 d)	30/10/2021 to 14/11/2021 (16 d)	23/10/2021 to 21/11/2021 (30 d)	02/03/2022 to 12/03/2022 (11 d)	13/03/2022 to 21/03/2022 (9 d)
Form of water order submitted (e.g. Form A, email, verbal, other)	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form	Email – WaterNSW Water Order Form
Supporting documents	60AL582512	60AL582512	60AL583376	60AL583376	60AL583376

Comparison of forecast and actual environmental water use

Provide an overview of:

- target daily flow rates and volumes
- actual daily flow rates and volumes
- forecast losses and actual losses (at an appropriate temporal scale for the event)
- volume of environmental water debited (with corresponding licence numbers)
- volume of water delivered to the Murray Valley that will be recognised as environmental water.

Attach supporting information in Attachment C *(of the WaterNSW Annual Environmental Release River Operations Report)*.

LDR-PPM Event #1: Native Fish Management July to September 2021 below Weir-32

- Target daily flow rates and volumes
  - Averaging 512 ML/d (vary from 297 to 1,000 ML/day) for 85 days requiring 43,524 ML.
- Actual daily flow rates and volumes
  - Averaging 445 ML/d (vary from 276 to 1,039 ML/day) for 85 days delivering 37,866 ML.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - About 2,272 ML was deemed as lost in the Lower Darling River US of Burtundy – 6% as per the PPM.
- Volume of environmental water debited (with corresponding licence numbers)
  - A total of 37,866 ML was debited from eWater licences
  - 24,580 ML (TLM licence 60AL582512
  - 13,286 ML (CEWO licence 60AL583376).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 35,594 ML was delivered to Murray Valley
  - Out of which about 5,073. ML is deemed to be lost in the Murray system and hence 30,521 ML will be recognised at SA border.

Figure 10. Chart 1 – LDR-PPM event #1: Native Fish Management July to September 2021 below Weir-32

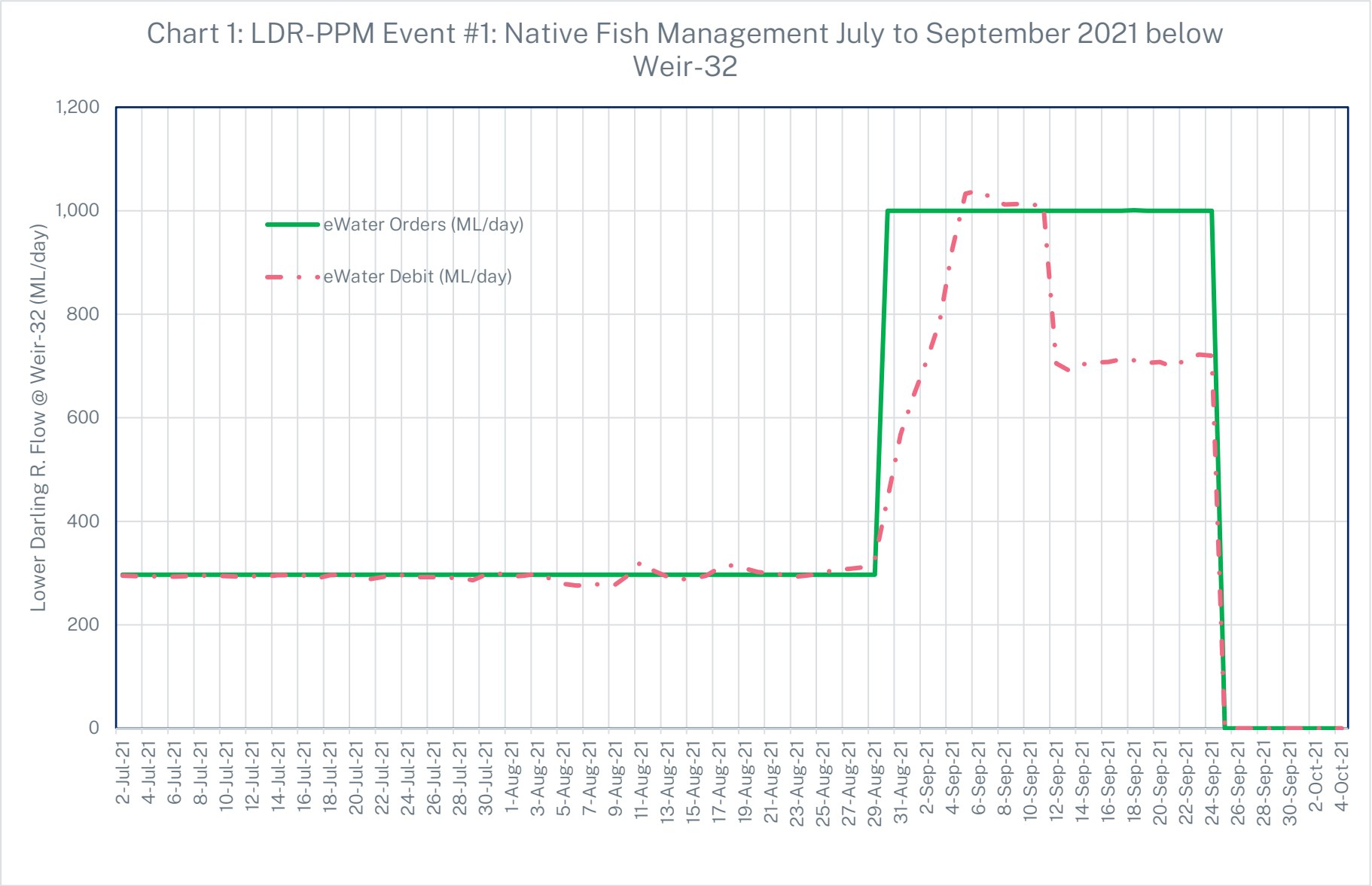
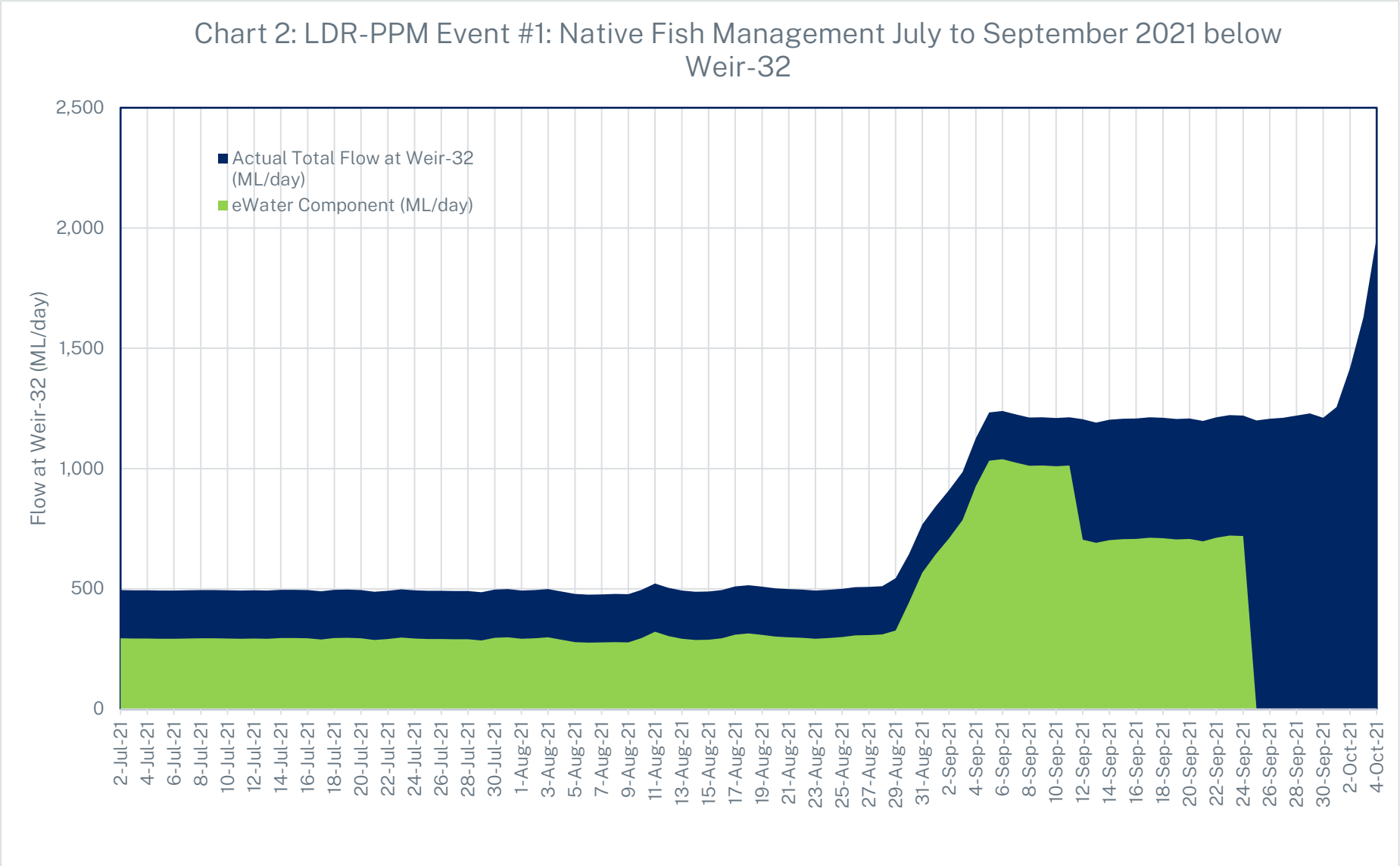


Figure 11. Chart 2 – LDR-PPM event #1: Native Fish Management July to September 2021 below Weir-32



LDR-PPM Event #2: Native Fish Management October to November 2021 below Weir-32

- Target daily flow rates and volumes
  - Averaging 1,000 ML/d for 35 days requiring 35,000 ML.
- Actual daily flow rates and volumes
  - Averaging 596 ML/d (vary from 558 to 632 ML/day) for 35 days delivering 20,850 ML.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - About 1,251 ML was deemed as lost in the Lower Darling River US of Burtundy – 6% as per the PPM.
- Volume of environmental water debited (with corresponding licence numbers)
  - A total of 20,850 ML was debited from eWater licences
  - 20,850 ML (TLM licence 60AL582512).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 19,599 ML was delivered to Murray Valley
  - Out of which about 748. ML is deemed to be lost in the Murray system and hence 18,851 ML will be recognised at SA border.

Figure 12. Chart 3 – LDR-PPM Event #2: Native Fish Management October-November 2021 below Weir-32

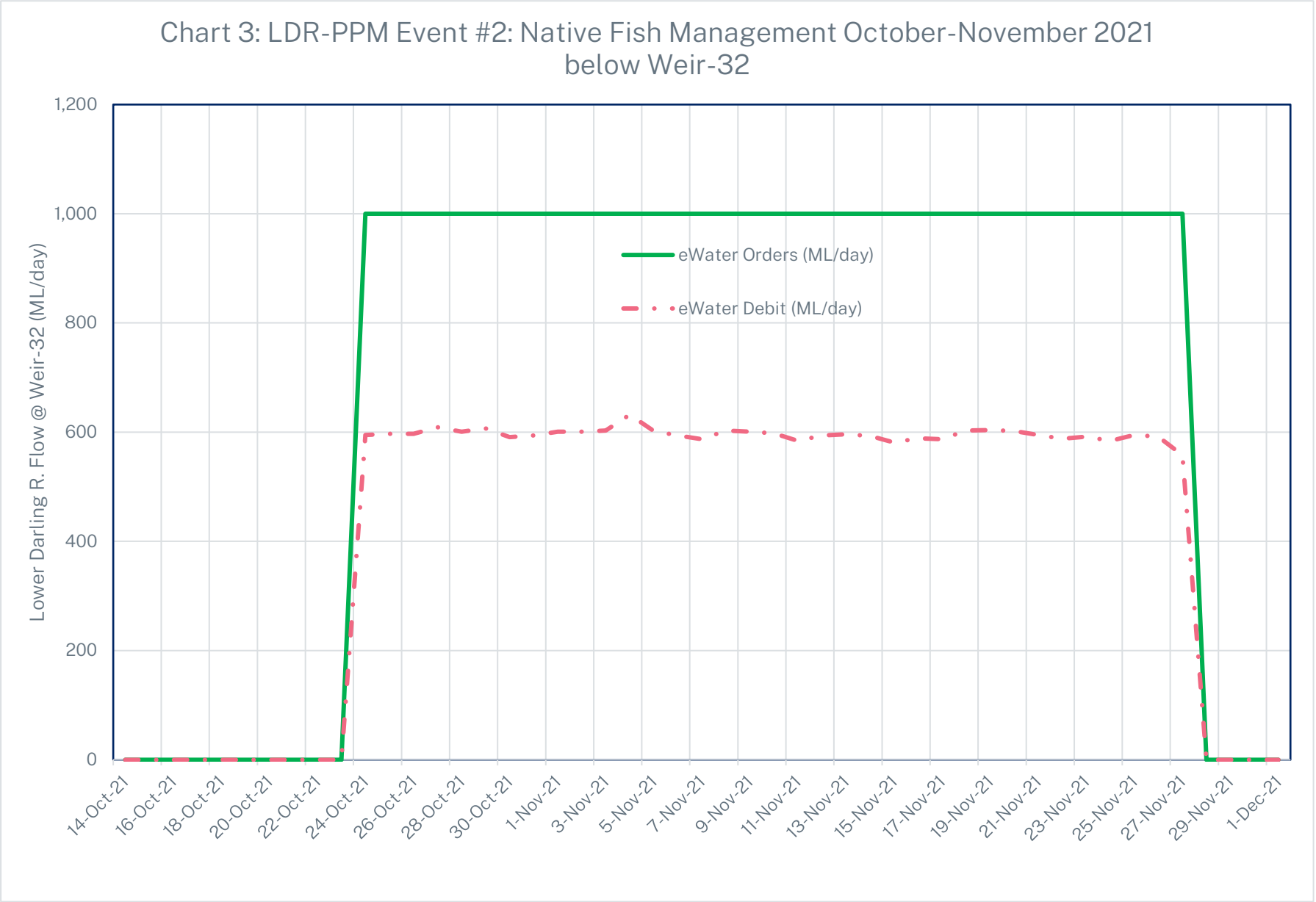
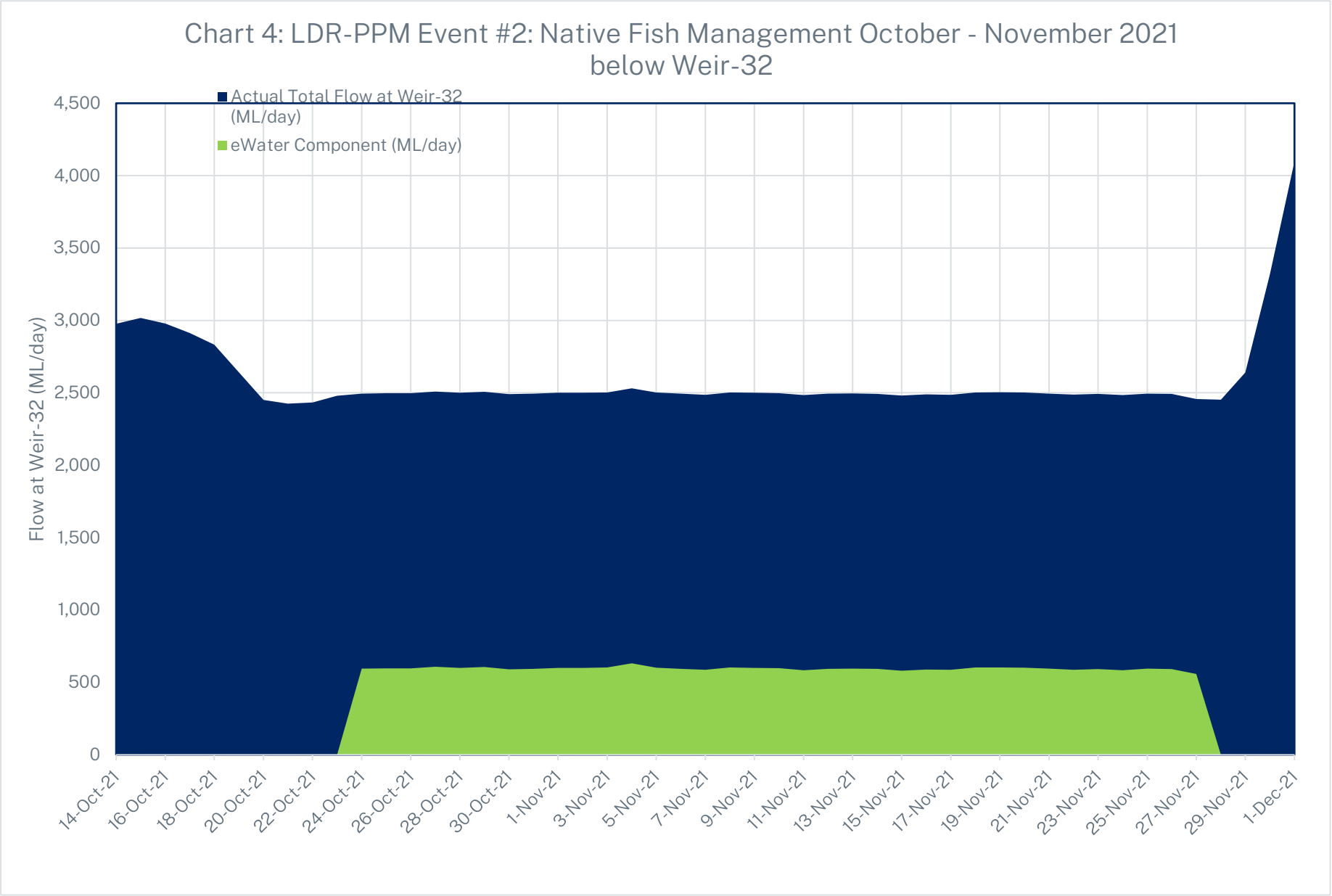


Figure 13. Chart 4 – LDR-PPM Event #2: Native Fish Management October-November 2021 below Weir-32



LDR-PPM Event #3: Native Fish Management October to November 2021 in Great Darling Anabranch

- Target daily flow rates and volumes
  - Averaging 1,000 ML/d for 35 days requiring 35,000 ML.
- Actual daily flow rates and volumes
  - Averaging 1,003 ML/d (vary from 987 to 1,017 ML/day) for 35 days delivering 35,118 ML.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - About 32,797 ML was deemed as lost in the Great Darling Anabranch to Murray R confluence.
- Volume of environmental water debited (with corresponding licence numbers)
  - A total of 35,118 ML was debited from eWater licences (CEWO licence 60AL583376).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 2,321 ML will be recognised at SA border.

Figure 14. Chart 5 - LDR-PPM Event #3: Native Fish Management October-November 2021 below Cawndilla Outlet

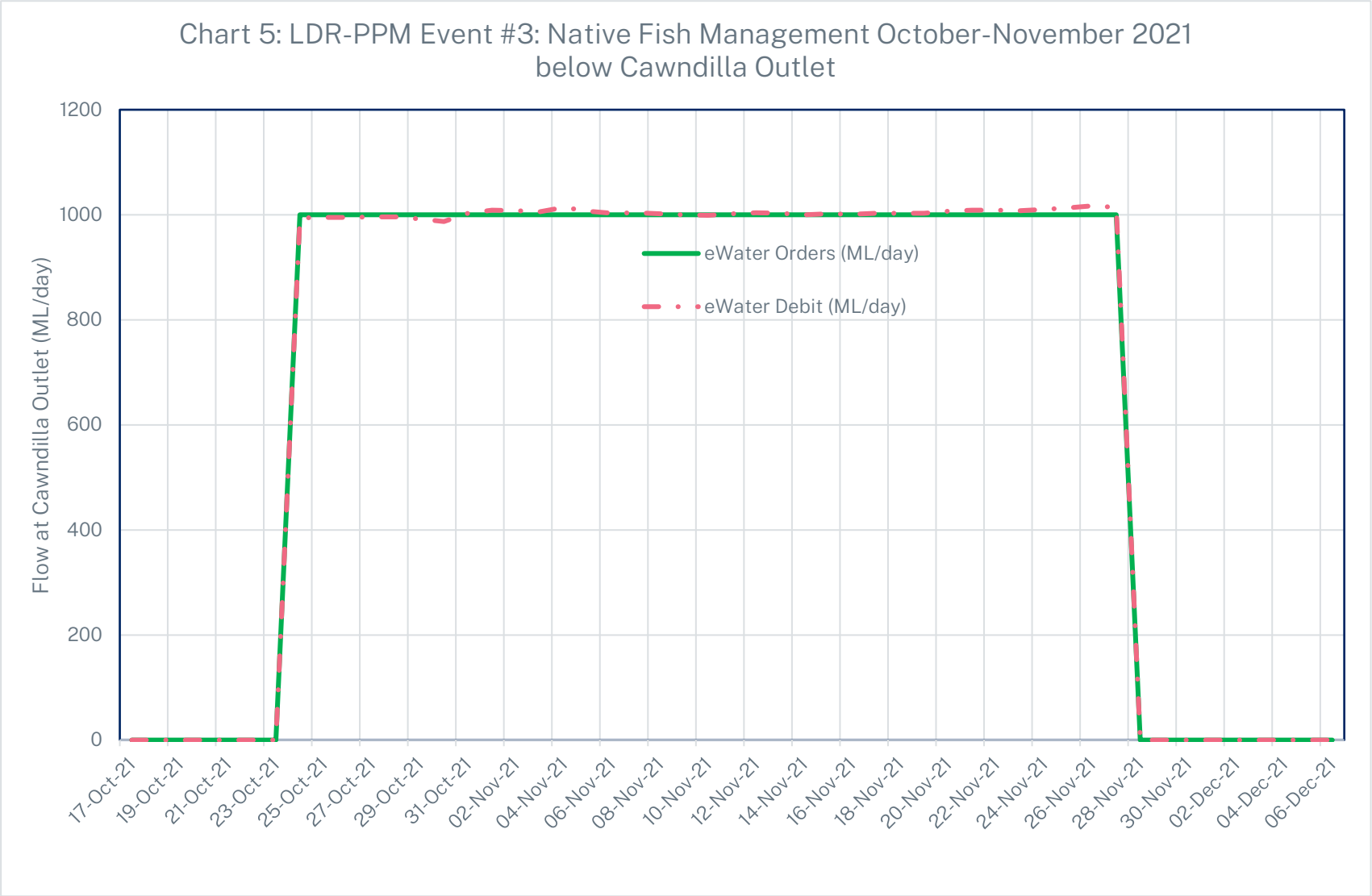
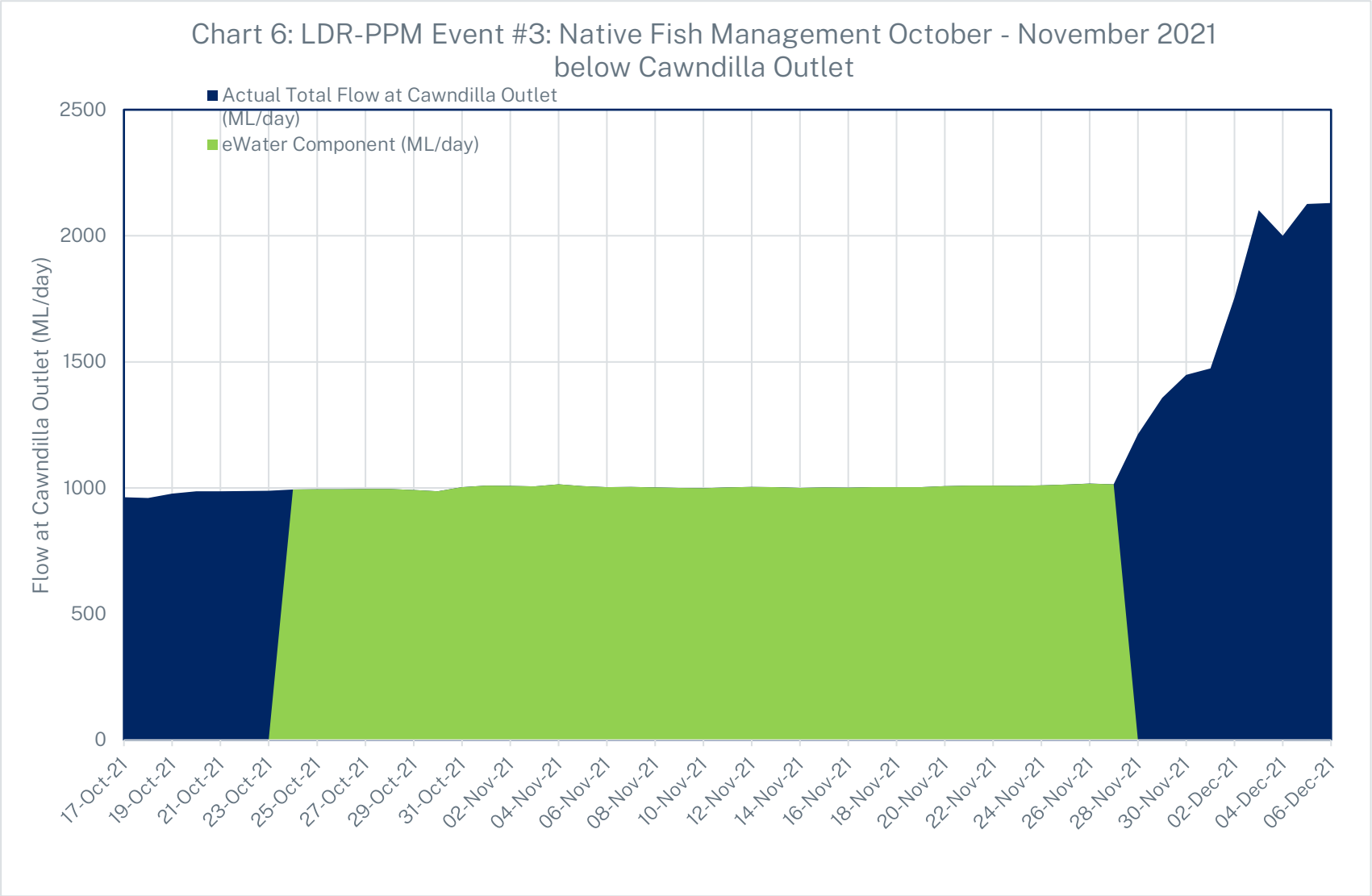


Figure 15. Chart 6 - LDR-PPM Event #3: Native Fish Management October-November 2021 below Cawndilla Outlet



LDR-PPM Event #4: Native Fish Management March 2022 in Great Darling Anabranch

- Target daily flow rates and volumes
  - Averaging 274 ML/d (varying from 150 ML/day to 500 ML/day) for 17 days requiring 4,650 ML.
- Actual daily flow rates and volumes
  - Averaging 296 ML/d (vary from 114 to 719 ML/day) for 17 days delivering 5,040 ML.
- Forecast losses and actual losses (at an appropriate temporal scale for the event)
  - About 1,725 ML was deemed as lost in the Great Darling Anabranch to Murray R confluence.
- Volume of environmental water debited (with corresponding licence numbers)
  - A total of 4,550 ML was debited from eWater licences (CEWO licence 60AL583376).
- Volume of water delivered to the Murray Valley that will be recognised as environmental water
  - 3,315 ML will be recognised at SA border.

Figure 16. Chart 7 - LDR-PPM Event #4: Native Fish Management March 2022 below Cawndilla Outlet

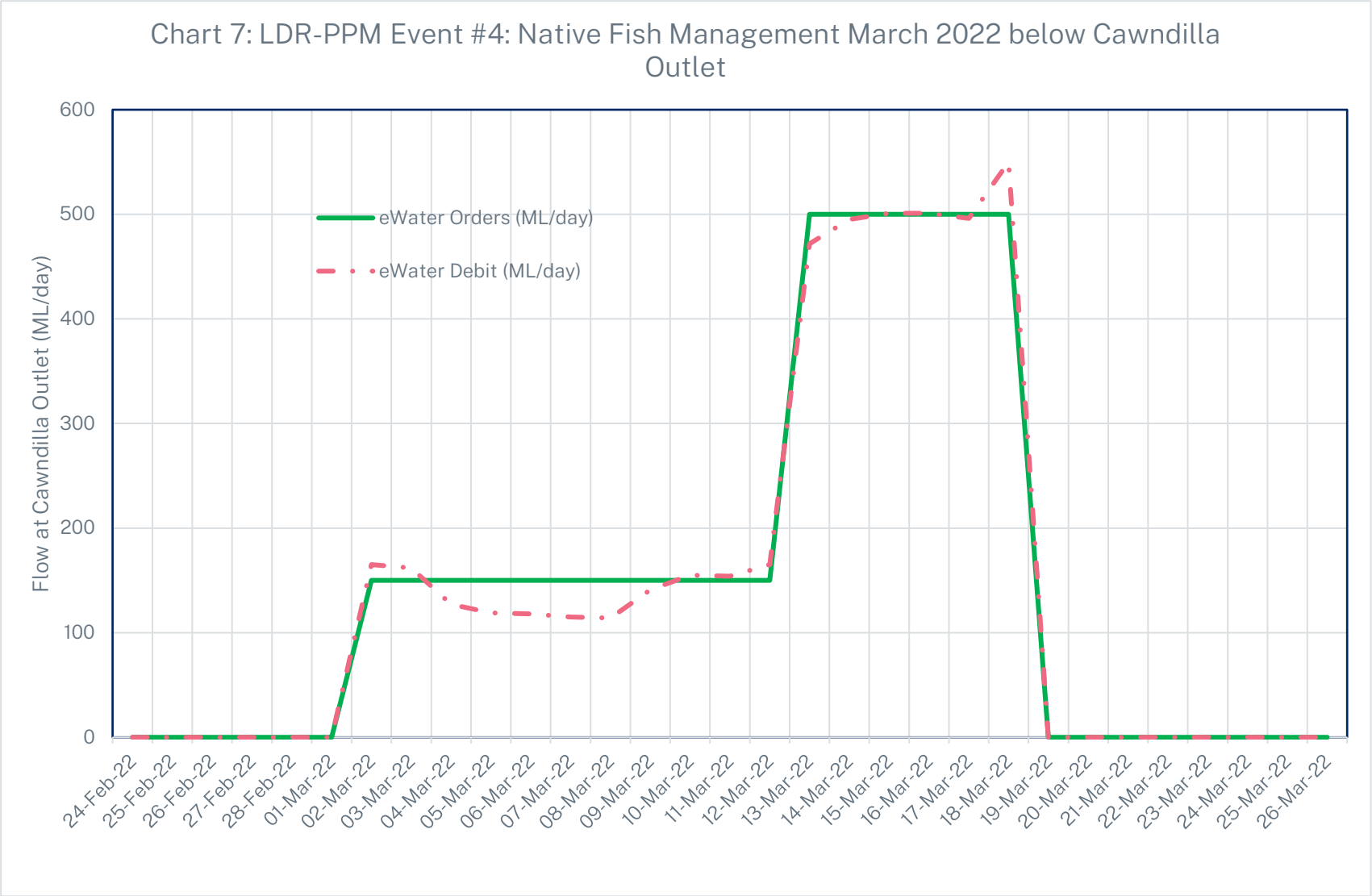
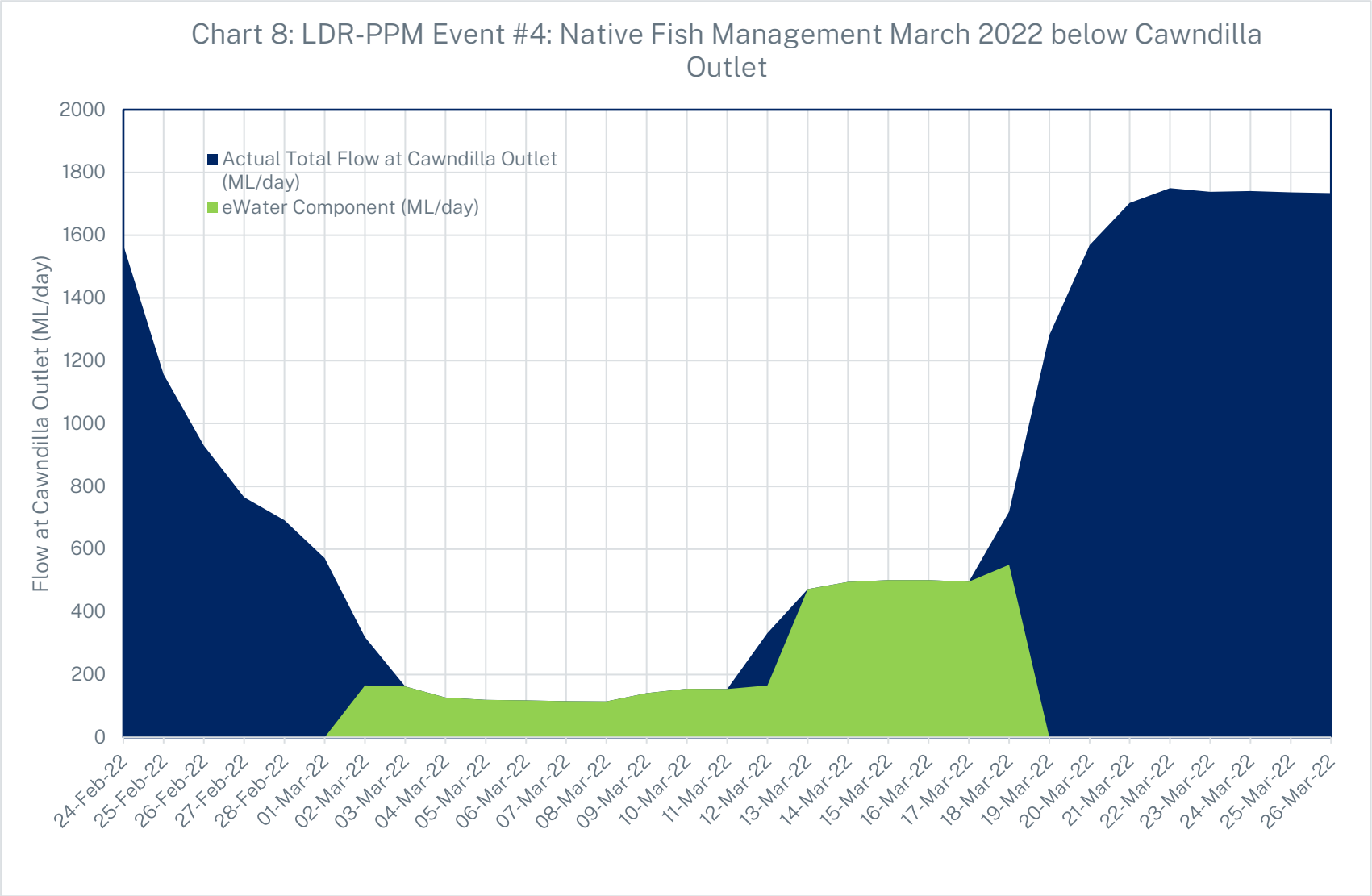


Figure 17. Chart 8 - LDR-PPM Event #4: Native Fish Management March 2022 below Cawndilla Outlet



Stakeholder consultation

In Table 21, provide a summary of stakeholder consultation. Attach supporting documents in Attachment D *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 21. Stakeholder consultation

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
03/08/2021	CEWO, DPI EES, Fisheries, MDBA, DPI, WaterNSW	2021/22 Lower Baaka environmental flow discussions to support Murray cod breeding in the spring	TAG – Teams Meeting	Discussed the objectives and watering requirements for 1) a stable flow rate through spring to support breeding by Murray cod. 2) Triggering breeding in the LDR below Menindee for Golden perch and Silver Perch and 3) Maximising dispersal by juvenile Golden perch in the Menindee Lakes into the Lower Darling	Potential operational releases from the lakes by WaterNSW/MDBA	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
23/08/2021	CEWO, DPI EES, MDBA, WaterNSW	Progress and updated daily accounts of LDR PPM delivery	Email + Spreadsheet	Update on daily environmental flow delivery at Weir-32, Burtundy and losses to SA Border	None	
20/09/2021	DPI EES, DPI, MDBA, CEWO, WaterNSW	Clarification on PPM arrangements in the LDR	Email	Continuation of existing PPM arrangement	None	
06/10/2021	DPI EES, DPI, WaterNSW	Progress and updated daily accounts of LDR PPM delivery	Email + Spreadsheet	Update on daily environmental flow delivery at Weir-32, Burtundy and losses to SA Border	None	
21/10/2021	DPI, RMO, DPI EES, MDBA, WaterNSW	Progress and updated daily accounts of LDR PPM delivery	Email + Spreadsheet	Update on daily environmental flow delivery at Weir-32, Burtundy and losses to SA Border	None	
22/10/2021	DPI, DPI EES, CEWO, WaterNSW	Lower Darling Operations update	Teams Meeting	Progress of PPM events, loss estimations, planned future events	None	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
08/11/2021	DPI EES, DPI Fisheries, CEWO, MDBA, WaterNSW, ARI	2021/22 Lower Baaka environmental flow discussions to support Murray cod breeding in the spring	TAG – Teams Meeting	River Operations update, eWater use options	None	
17/01/2022	DPI EES, DPI Fisheries, CEWO, MDBA, WaterNSW	Operations and eWater use update	TAG – Teams Meeting	Members noted the progress	None	
27/01/2022	DPI-EES, WaterNSW	Advise on licences to be used for the LDR eWater usage in spring	Email	TLM to be used as a priority and the remainder to be debited against CEWO licence	None	
14/02/2022	DPI EES, DPI Fisheries, CEWO, MDBA, WaterNSW	Operations and eWater use update	TAG – Teams Meeting	Members noted the progress	None	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
22/05/2022	MDBA, DPI, WaterNSW	Progress and updated daily accounts of LDR and GDA PPM delivery	Email + Spreadsheet	Update on daily environmental flow delivery at Weir-32, Cawndilla Outlet, Burtundy, Tara Downs and losses to SA Border	None	
22/05/2022	MDBA, DPI EES, WaterNSW	Progress and updated daily accounts of LDR and GDA PPM delivery	Email + Spreadsheet	Update on daily environmental flow delivery at Weir-32, Cawndilla Outlet, Burtundy, Tara Downs and losses to SA Border	None	

Recommendations to improve future environmental watering actions

In Table 22, provide a summary of key issues encountered in 2021/22 and recommendations for addressing these. Attach supporting documents in Attachment E *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 22. Summary of issues and recommendations

Environmental watering action	Issue	Agencies involved	Stakeholders involved	Recommendations	List of supporting documents
Event #1 to #4	Water order process to be improved	DPI EES, WaterNSW	DPI EES, CEWO, TLM, DPE	The water orders must have all the elements as outlined in the PPM Procedures manual.	

Prerequisite policy measures

Annual Environmental Release River Operations Report 2021-22

This report was prepared by WaterNSW in accordance with the reporting requirements described under Section 5.1 of the Prerequisite Policy Measures Procedures Manual for the Murrumbidgee Regulated River and the Prerequisite Policy Measures Procedures Manual for the NSW Murray and Lower Darling Regulated Rivers.

Action	Responsibility	Date
Report prepared	Mary Fielder Water System Planner WaterNSW	09/06/2023
Report approved	Jonathan Belej Water System Operations Manager – South WaterNSW	28/06/2023

Environmental watering actions

In Table 23, provide an overview of the environmental water actions undertaken using PPMs in the 2021/22 water year.

Table 23. Summary of PPM watering actions in 2021/22

Name of environmental watering action	PPM-LDR Event #1
River system	NSW Murray
Type of PPM event	Return flows
General description of watering action	Provide flow variability conducive to native fish breeding and recruitment
Release start date	4 April 2022
End date	27 May 2022
Was this an agreed or interim action?	Agreed
Delivery pathway	Colligen – Wakool-Yallakool Flow
Environmental site/s watered	Edward-Wakool River system
Total volume of environmental water delivered (ML)	Total e-water delivered to the site from multi-site and ordered system delivery - 34,321 ML Debit ordered system delivery – 8,156 ML Multi-site delivery – 26,165 ML
Accounting method used	Determination of use by agreed loss rate

Water orders

In Table 24, provide an overview of the environmental water orders received for Prerequisite Policy Measures in the 2021/22 water year (including any order that was subsequently refused/rejected).

Provide further detail in Attachment B *(of the WaterNSW Annual Environmental Release River Operations Report)* as needed, including water orders and assumed use statements. If any water order using PPMs was refused, please provide documentation and rationale supporting this decision.

Table 24. Water orders received by WaterNSW in 2021/22

Order number	1	2	3	4	5	6	7	8	9
Organisation submitting order	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES
Date order was submitted	2 March 2022	2 March 2022	2 March 2022	4 April 2022	8 April 2022	8 April 2022	12 May 2022		
Volume of order (ML)	865ML	2633ML	1058ML	900ML	3,473ML	2,354ML	1,600ML		
Organisation delivering order									
Release date (days)	2 March-9 March 2022	2 March -28 March 2022	2 March – 31 March 2022	1 April -30 April 2022	3 April -25 April 2022	4 April – 25 April 2022	12 May -27 May 2022		

Order number	1	2	3	4	5	6	7	8	9
Form of water order submitted (e.g. Form A, email, verbal, other)	Email	Email	Email	Email	Email	Email	Email	Email	Email
Supporting documents	Orders E-water Account spreadsheet Wakool system	Orders E-water Account spreadsheet Wakool system	Orders E-water Account spreadsheet Wakool system	Orders E-water Account spreadsheet Wakool system	Orders E-water Account spreadsheet-Wakool system	Orders E-water Account spreadsheet – Wakool system	Orders E-water Account spreadsheet -Wakool system		

Comparison of forecast and actual environmental water use

Provide an overview of:

- target daily flow rates and volumes
  - see charts 1 and 2
- actual daily flow rates and volumes
  - see charts 1 and 2
- forecast losses and actual losses (at an appropriate temporal scale for the event)
  - Analysis has not been completed
- volume of environmental water debited (with corresponding licence numbers)

Row Labels	Sum of Orders	Sum of Usage
50AL503537	11283	8156
Grand Total	**11283**	**8156**

- volume of water delivered to the Murray Valley that will be recognised as environmental water
  - All releases for this event were made from Murray storages – as such the debit volume of 8,156 ML is the recognised environmental water volume delivered to the Murray for this event.

Attach supporting information in Attachment B *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Figure 18. Total target e-water hydrograph V total actual stream discharge (Colligen Creek, Yallakool Creek and Wakool River offtakes)

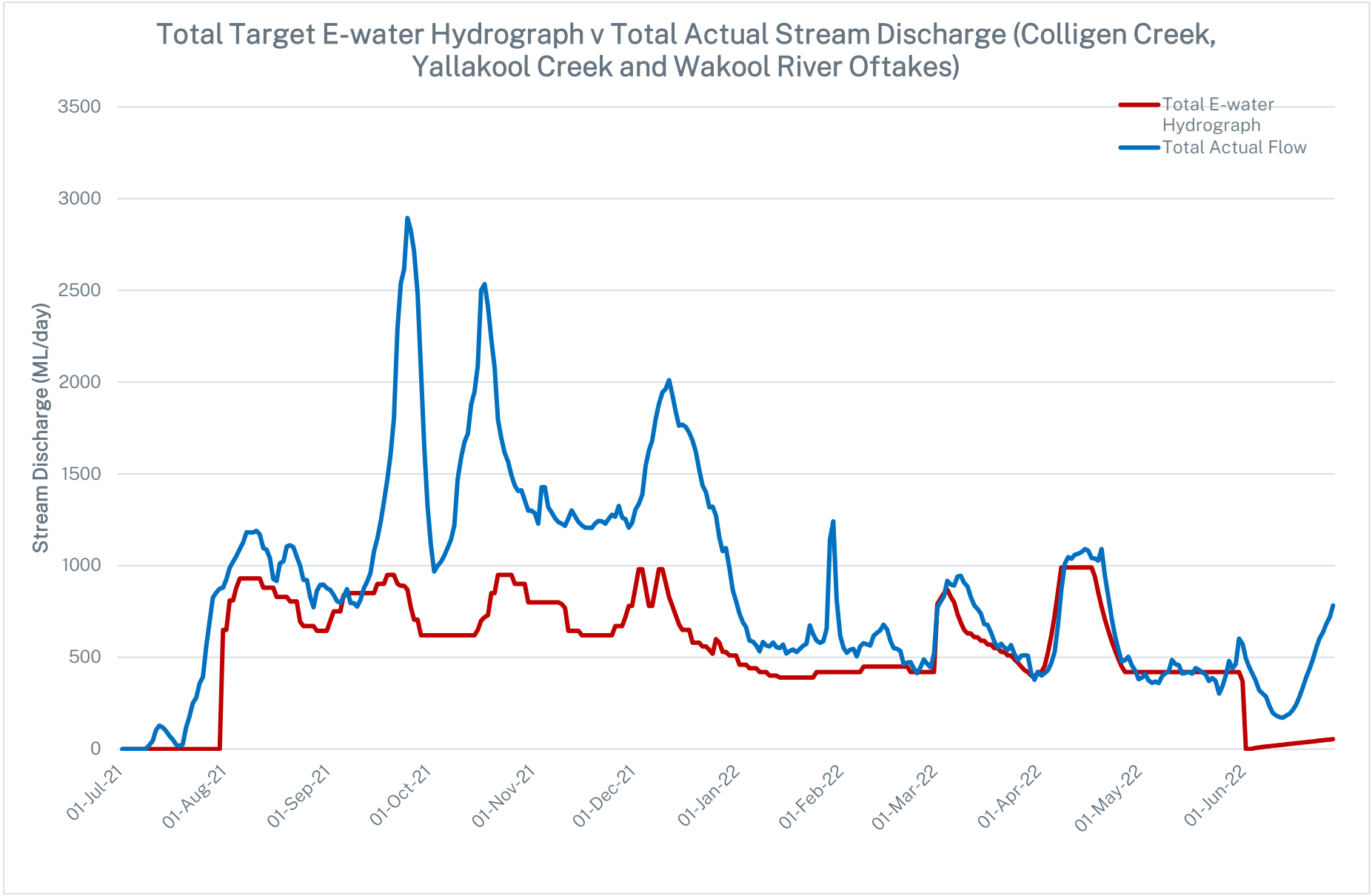


Figure 19. Actual daily flow rates and volumes

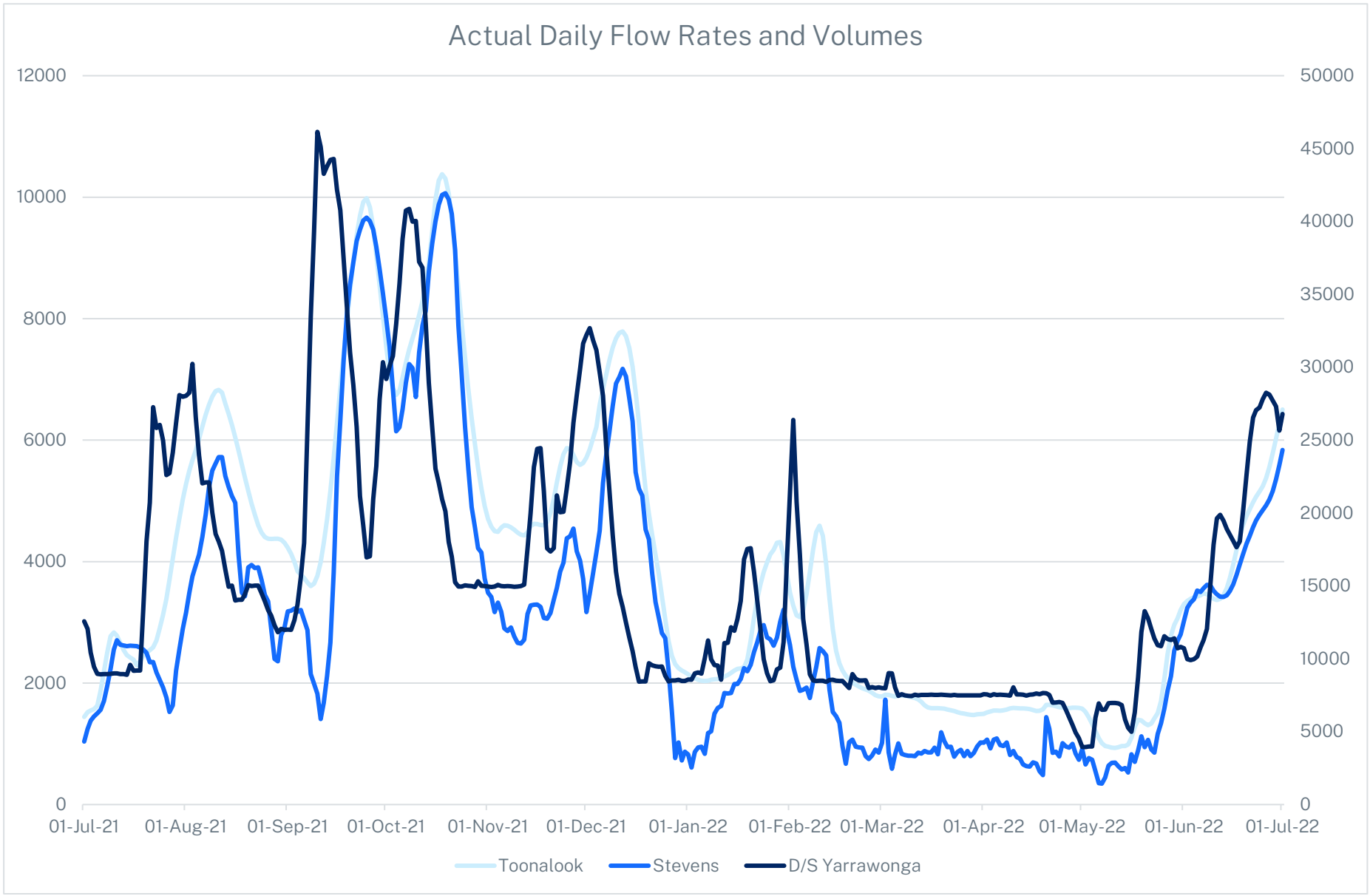
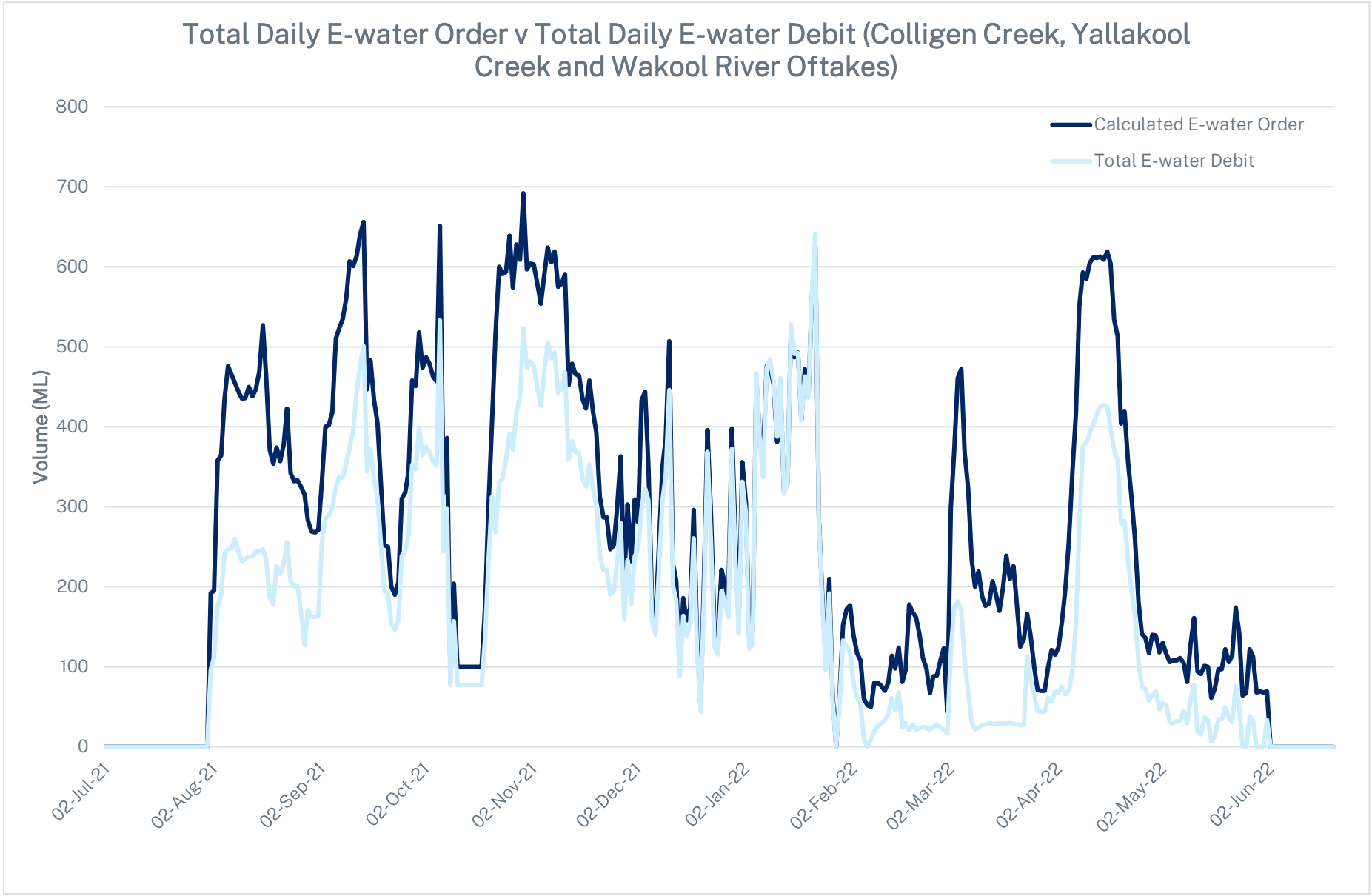


Figure 20. Total daily e-water order V total daily e-water debit (Colligen Creek, Yallakool Creek and Wakool River offtakes)



Stakeholder consultation

In Table 25, provide a summary of stakeholder consultation. Attach supporting documents in Attachment D *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 25. Stakeholder consultation

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
19/01/2021	Yallakool and Wakool Flows	Offtake regs fully open to pass unreg and Murray multisite flows through to the end of November -aim to help facilitate fish movement and maintain good levels for cod nesting. Multisite flows be used to deliver a perch pulse in the Colligen-Niemur and Edward d/s stevens with the help of Edward escape.	Email correspondence			
07/12/2021 11:49 am	Colligen flows	Divert Stevens Weir flow down Colligen Creek whilst keeping	Email correspondence	Biggest challenge is to maintain sufficient head at	Variation in flow at Colligen, Yallakool and Wakool	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
		Yallakool and Wakool offtakes fully open- less flow through Werai forest less blackwater ending up in the Niemur		Wakool Main canal offtake for MIL. The management of Yallakool and Wakool Offtake is unlikely to be an option. Push Colligen further is related to available head for MIL and not flow volume.		
01/03/2022 3:42 pm	Yallakool-Wakool orders	Autumn Pulses in the Yallakool-Wakool – target flows minus ops base flow and with 65% accounting arrangement for PPMs applied. Colligen pulse moved forward	Email correspondence			
22/04/2022 1:14 pm	Murray ewater A/c summary	Draft summary of ewater accounts in the NSW Murray/no orders placed for Gulpa/except for	Email correspondence	TLM water usage for Gulpa creek and Millewa events. Confirm CEWO use for	Ewater accounts	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
		some email communications		Wakool Yallakool and Colligen		
Weekly/ fortnightly online meetings	Edward-Wakool Operations Advisory Group	Operational updates	Online meetings	Ewater actions	River ops and forecast update	

Prerequisite policy measures

Annual Environmental Release River Operations Report 2021-22

This report was prepared by WaterNSW in accordance with the reporting requirements described under Section 5.1 of the Prerequisite Policy Measures Procedures Manual for the Murrumbidgee Regulated River and the Prerequisite Policy Measures Procedures Manual for the NSW Murray and Lower Darling Regulated Rivers.

Action	Responsibility	Date
Report prepared	Mary Fielder Water System Planner WaterNSW	27/06/2023
Report approved	Jonathan Belej Water System Operations Manager – South WaterNSW	27/06/2023

Environmental watering actions

In Table 26, provide an overview of the environmental water actions undertaken using PPMs in the 2021/22 water year.

Table 26. Summary of PPM watering actions in 2021/22

Name of environmental watering action	[Event #1] Multi Site Water event – Hume to SA	[Event #2] Multi Site Water event – Hume to SA
River system	NSW Murray	NSW Murray
Type of PPM event	Directed releases from Hume Dam; Assumed use for directed releases from Hume Dam	Directed releases from Hume Dam; Assumed use for directed releases from Hume Dam
General description of watering action	To deliver increased flows in the River Murray Channel downstream of Yarrawonga to provide the following ecological outcomes as described in the NSW Murray-Lower Darling Long-term Environmental Watering Plan for the Yarrawonga to Barmah reach (and Edward-Wakool): • Native fish – dispersal/condition (all species), pre-spawning, condition (flow pulse specialists) • Ecosystem functions through longitudinal connectivity along the Murray, and Edward-Wakool – connectivity with low lying wetlands, hydraulic diversity and productivity and transport of nutrients and carbon • Native Vegetation — in-channel woody and non-woody, wetland vegetation and low-level river red gum condition	To deliver increased flows in the River Murray Channel downstream of Yarrawonga to provide the following ecological outcomes as described in the NSW Murray-Lower Darling Long-term Environmental Watering Plan for the Yarrawonga to Barmah reach (and Edward-Wakool): • Native fish – dispersal/condition (all species), pre-spawning, condition (flow pulse specialists) • Ecosystem functions through longitudinal connectivity along the Murray, and Edward-Wakool – connectivity with low lying wetlands, hydraulic diversity and productivity and transport of nutrients and carbon
Release start date	12 August 2021	22 April 2022

Name of environmental watering action	[Event #1] Multi Site Water event – Hume to SA	[Event #2] Multi Site Water event – Hume to SA
End date	28 February 2022	30 June 2022
Was this an agreed or interim action?	Agreed	Agreed
Delivery pathway	Hume Dam downstream to South Australian border via Barmah-Millewa and potentially other wetlands.	Hume Dam downstream to South Australian border via Barmah-Millewa and potentially other wetlands.
Environmental site/s watered	Barmah-Millewa Forest; Edward-Wakool River system; River Murray channel	Barmah-Millewa Forest; Edward-Wakool River system; River Murray channel
Total volume of environmental water delivered (ML)	132,171 Total multi-site figure = 132,421ML	250 ML
Accounting method used	O&O document: SO&O 2.4 Directed releases from Hume Dam. SO&O 2.5 Assumed use for directed releases from Hume Dam. NSW environmental water licences will be debited the volume of environmental release calculated according to SO&O 2.4, as advised each month by the MDBA. The volume of return flows shall be calculated according to SO&O 2.5. Water orders will be managed under Bulk Entitlement Delivery arrangements. The volume of that order, and any amendments, will be placed in the WaterNSW accounting system at the time they are placed with the MDBA by WaterNSW.	O&O document: SO&O 2.4 Directed releases from Hume Dam. SO&O 2.5 Assumed use for directed releases from Hume Dam. NSW environmental water licences will be debited the volume of environmental release calculated according to SO&O 2.4, as advised each month by the MDBA. The volume of return flows shall be calculated according to SO&O 2.5. Water orders will be managed under Bulk Entitlement Delivery arrangements. The volume of that order, and any amendments, will be placed in the WaterNSW accounting system at the time they are placed with the MDBA by WaterNSW.

Water orders

In Table 27, provide an overview of the environmental water orders received for Prerequisite Policy Measures in the 2021/22 water year (including any order that was subsequently refused/rejected).

Provide further detail in Attachment A *(of the WaterNSW Annual Environmental Release River Operations Report)* as needed, including water orders and assumed use statements. If any water order using PPMs was refused, please provide documentation and rationale supporting this decision.

Table 27. Water orders received by WaterNSW in 2021/22 (excluding orders for RMIF, MAA and BM-EWA)

Order number	1	2	3	4	5	6	7
Organisation submitting order	DPIE – BCS	DPIE – BCS	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES	DPIE – EES
Date order was submitted	6 August 2021	19 August 2021	24 September 2021	20 October 2021	6 December 2021	25 January 2022	22 April 2022
Volume of order (ML)	30,000	163,000	100,000	170,000	170,000	170,000	30,000
Organisation delivering order	MDBA	MDBA	MDBA	MDBA	MDBA	MDBA	MDBA
Release date (days)	12 August-30 November 2021	12 August-30 November 2021	12 August-30 November 2021	12 August-30 November 2021	12 August 2021-31 January 2022	12 August 2021-28 February 2022	22 April-30 June 2022
Form of water order submitted (e.g. Form A, email, verbal, other)	Email	Email	Email	Email	Email	Email	Email

Order number	1	2	3	4	5	6	7
Supporting documents							

Comparison of forecast and actual environmental water use

Provide an overview of:

- target daily flow rates and volumes
  - see charts 1 and 2
- actual daily flow rates and volumes
  - see charts 1 and 2
- forecast losses and actual losses (at an appropriate temporal scale for the event)
  - Not available from WaterNSW – data is held by MDBVA and request will need to be made for this analysis
- volume of environmental water debited (with corresponding licence numbers)

Row Labels	Sum of Orders	Sum of Usage
50AL507293	66380	20250
50AL513824	169036	112171
Grand Total	**235416**	**132421**

- volume of water delivered to the Murray Valley that will be recognised as environmental water
  - All releases for this event were made from Murray storages – as such the debit volume of 149,997 ML is the recognised environmental water volume delivered to the Murray for this event.

Attach supporting information in Attachment B *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Figure 21. Release from Hume Dam

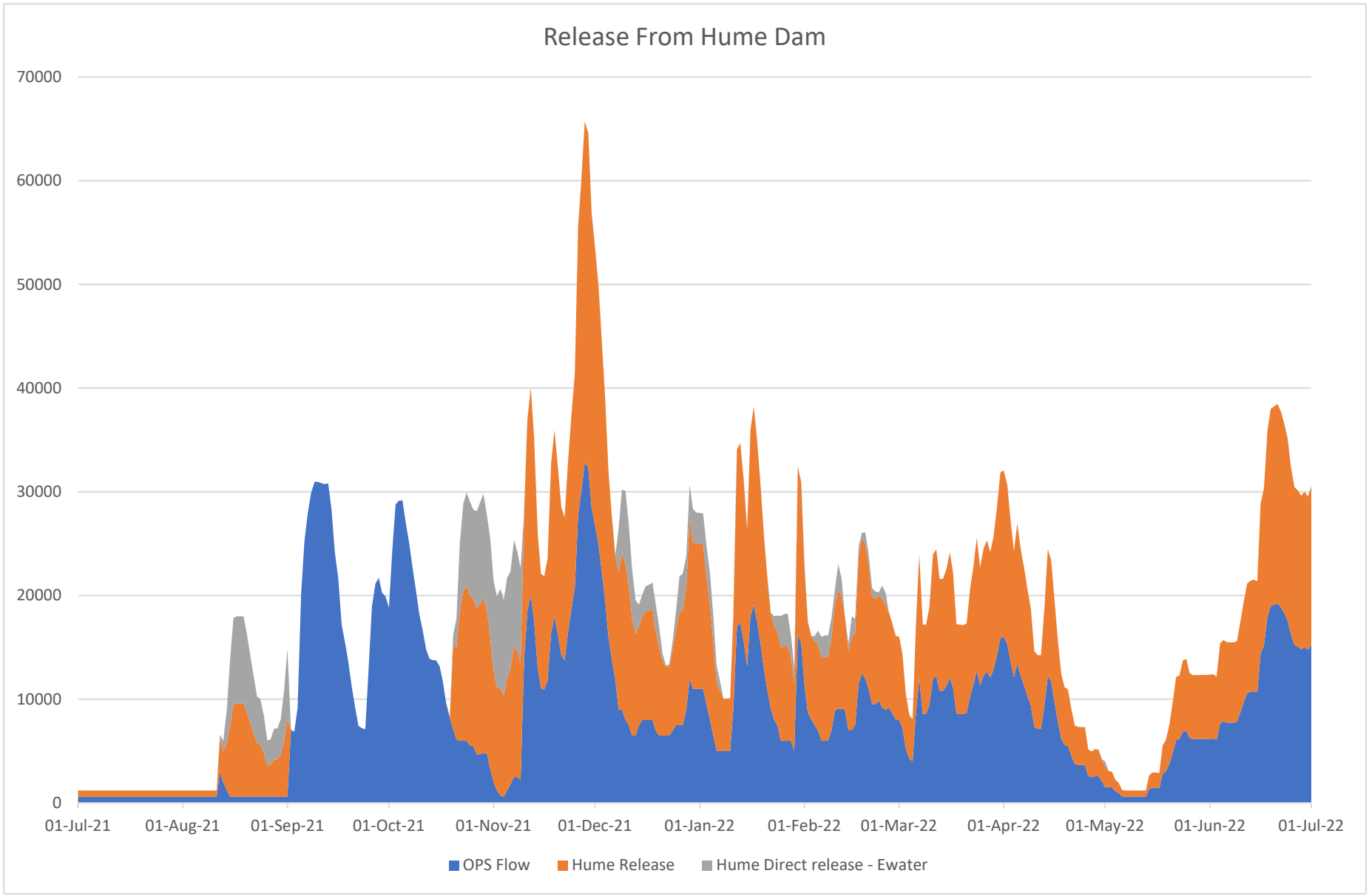
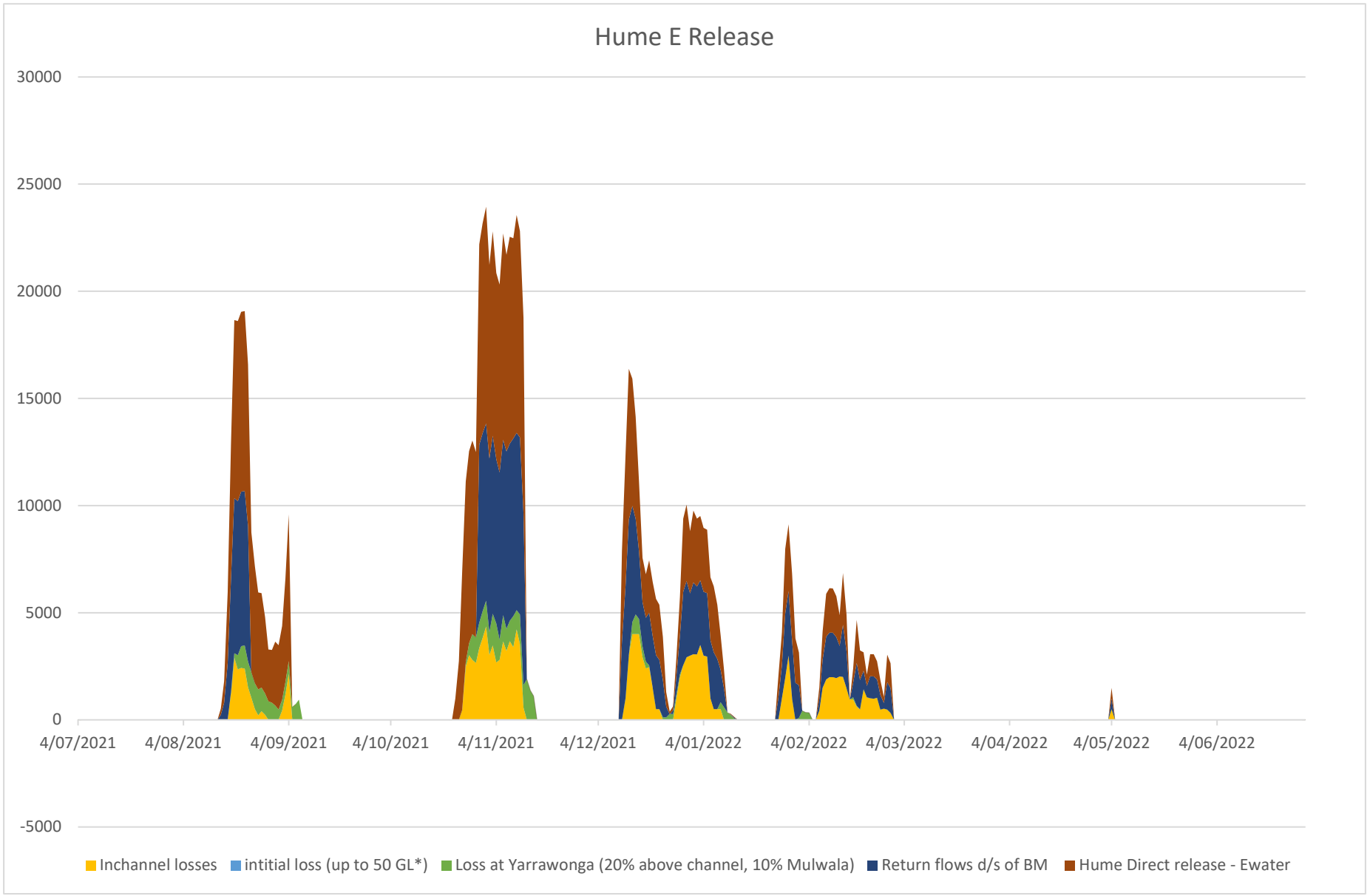


Figure 22. Hume e-Release



Stakeholder consultation

In Table 28, provide a summary of stakeholder consultation. Attach supporting documents in Attachment D *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 28. Summary of stakeholder consultation

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
28/01/2022	Barmah forest and Murray River	Enables water from the water holdings to be used to achieve environmental objectives and expected watering effects in the Barmah forest and Murray river, consistent with the Seasonal Watering Plan 2021-22	Emails – meetings	This watering Authorisation is valid from 19 August 2021 to 30 June 2022 unless superseded by another watering authorisation or revoked by the Victorian Environmental Water holder.		Barmah Murray email
Meetings monthly	Water Liaison Working Group	Operational updates	Online meetings		River ops and forecast update	
Weekly/ fortnightly online meetings	Barmah Millewa Ops Advisory Group- GMW, VEWH, GBCMA, WaterNSW, NSW OEH, NSW	Operational updates	Online meetings	Current river operations Accounting update Update on e-water use plans and critical ecological targets	River ops and forecast update	

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
	Parks, CEWO, EWC, YYNAC, DEW, PV			Confirmation/discussion of regulator settings and decision points, field report		

Appendix B – DPE EHG Annual Environmental Water statement

Annual Environmental Watering Statement 2021/22

This statement was prepared by DPE-Environment and Heritage in accordance with the reporting requirements described under Section 5.1 of the Prerequisite Policy Measures Procedures Manual for the Murrumbidgee Regulated River and the Prerequisite Policy Measures Procedures Manual for the NSW Murray and Lower Darling Regulated Rivers ('the PPMs Procedures Manuals').

Action	Responsibility	Date
Report prepared	James Dyer DPE E&HG	03/11/2022
Report approved	DPE E&HG	

List of environmental watering actions

In Table 1, provide a list of the environmental water actions undertaken using Prerequisite Policy Measures (PPMs) in the 2021/22 water year. In Attachment A, please provide any relevant supporting documentation for each event, including:

(a) Water Event Plan (Form A – Request to Deliver Environmental Water)
(b) Water Event Outcome (Form B – Environmental Water Delivery Report)
(c) Water Orders (including email orders)

Table 29. List of environmental watering actions using PPMs in 2021/22

Event number (From Form A)	LOD21/22-01	LOD21/22-02	MUR21/22-01	MUR21/22-08	MBG21/22-12
Name of environmental watering action	Lower Darling/Baaka 2021-22	Darling Anabranch	River Murray Channel Multi-Site 2021-22	Edward/Kolety-Wakool River system 2021-22	Murrumbidgee Native Fish Recruitment Flow2021-22
River system/target valley	Lower Darling	Lower Darling	Murray	Edward, Colligen, Yallakool and Wakool River systems.	Lower Murrumbidgee River
Overview of environmental watering action	This event provided additional flow in the Lower Darling /Baaka in the Spring	This event provided flows down the Great Darling Anabranch from Lake Cawndilla	River Murray Multisite is the delivery of environmental water down the Murray from Hume to SA targeting flow rates D/S of Yarrawonga.	Delivery of environmental water targeting different in channel flow rates through each of the rivers throughout the season. A large portion of these targeted flow rates are met by the Murray Multi-site event.	This event provided dilution flows during the recession of flood events, provided hypoxic blackwater refuge flows and managed rates of recession – all of which benefited native fish habitat and connectivity during and after flood events

Event number (From Form A)	LOD21/22-01	LOD21/22-02	MUR21/22-01	MUR21/22-08	MBG21/22-12
Environmental site/s targeted	Lower Darling River	Great Darling anabranch	Murray river channel, Edward-Wakool system (including Werai forest), Barmah-Millewa forest complex, Gulpa Creek (including reed beds and other associated wetlands.	Edward, Colligen/Niemur, Yallakool and Wakool River systems.	D/s of Maude Weir to the junction of the Murrumbidgee River
Type of PPM event	Return flows at SA	Return flows at SA	Return flows at SA	Operational in-efficiencies of delivery through this system accounted for as Ewater.	Return flow at Murray Junction
Delivery start date	01/07/2021	24/10/2021		14/09/2021	17/01/2022
End date	27/11/2021	18/03/2022		31/05/2022	30/06/2022
PPM action	Accounting for losses through the system.	Accounting for losses through the system.	Accounting for losses through the system.	Accounting for losses through the system.	Accounting for losses through the system.
Total volume of environmental water ordered (ML)	56,866	39,668	225,713	11,283 (Water NSW)	195,226ML

Event number (From Form A)	LOD21/22-01	LOD21/22-02	MUR21/22-01	MUR21/22-08	MBG21/22-12
Total volume of environmental water debited (ML) Include bread up of state and Commonwealth entitlement if available	58,716 (TLM 45,430) (CEW13,286)	39,668 (CEW 35,118) (NSW 4550)	205,314 (BM-EWA 47,893, RMIF 25,000, TLM 20,250, CEW 112,171)	73,619 (CEW 65,463 via MIL not covered by PPM, NSW 8,156)	Total 181, 294ML CEW -100,950 NSW GS – 20,344 TLM – 60,000
Volume of return floes recognised at end of system (if applicable)				N/A	181,294ML?
Volume of return flows recognised at South Australian border (if applicable					

Risk assessment and mitigation

In Table 30, detail any risks identified during the planning of environmental water events which relied on Prerequisite Policy Measures, including deliverability risks, operational risks and other risks considered. The mitigation measures applied should also be included in Table 30.

Table 30 should include any risks considered when planning for the event with Water NSW.

Attach supporting information in Attachment B *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 30. Risks considered during event planning

#	Description of risk	Mitigation measure/s applied
	Risks for each event as outlined in event plan	Mitigation for each event as outlined in event plan

Environmental outcomes

In Table 31, provide a summary of the objectives of the environmental watering event and the extent to which these objectives were met. Please also provide information on the environmental outcomes observed to date, any ongoing monitoring of these outcomes and any relevant comments. Attach supporting documents in Attachment C *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 31. Summary of environmental outcomes

Event number	Event name	Environmental objectives	Degree to which environmental objectives were satisfied	Environmental outcomes observed or being monitored	Comments
LOD21/22-01	Lower Darling/Baaka 2021-22		Target flow rates were successfully delivered	Monitoring has been delayed due to floods	
LOD21/22-02	Darling Anabranch		Target flow rates were successfully delivered	Limited monitoring so far has indicated that there are large numbers of Golden Perch in the GDA.	
MUR21/22-01	River Murray Channel Multi-Site 2021-22		Target flow rates were successfully delivered	Monitoring so far has shown that combined with large unregulated flows the 2021-22 season provided good outcomes across the whole system for native fish and floodplain vegetation.	

Event number	Event name	Environmental objectives	Degree to which environmental objectives were satisfied	Environmental outcomes observed or being monitored	Comments
MUR21/22-08	Edward/Kolety-Wakool River system 2021-22		Target flow rates were successfully delivered	Monitoring of native fish populations has so far indicated that the 2021/22 season saw successful recruitment and above average growth rates for Murray Cod juveniles.	
MBG21/22-12	Murrumbidgee Native Fish Recruitment Flow2021-22		Target flow rates were successfully delivered	CEWO MER program has revealed that a good assemblage of native fish exist in the mid-Billabong creek system, including juvenile catfish. Ongoing monitoring in the Lowbidgee lakes and adjacent river sites has been flood affected	

Stakeholder consultation

Section 5.1 of the PPMs Procedures Manuals states that the Annual Environmental Watering Statement must document "any feedback from consultation with stakeholders on the actions undertaken".

In Table 32, please provide a summary of stakeholder consultation. Attach supporting documents in Attachment D *(of the WaterNSW Annual Environmental Release River Operations Report)*.

Table 32. Summary of stakeholder consultation

Date	Stakeholder forum/name	Environmental watering action/s discussed	Type of consultation (e.g. workshop, webinar, phone call, letter, survey, public exhibition)	Summary of feedback	Stakeholder requests	List of supporting documents
May and June 2021	MLD EWAG meetings	All Murray/Lower Darling events	Teleconference	Group generally supportive of events and outcomes being achieved	none	

Appendix C – NSW PPMs workplan

Task ID	Action	Responsibilities	Due	Priority	Status
	Meetings and administration				
1.	PPM Working Group meetings	All agencies	Quarterly	Routine	N/A
2.	PPM technical working group meetings	All agencies	As required	Routine	N/A
3.	Update 2021-22 PPM working group workplan	DPIE Water	July 2021	High	Review each WG meeting
4.	Update E-watering priorities for 2022-23 - Lower Baaka and Darling Anabranch options - Use of MIL escapes - Bulk trade adjustment using return flows between Victoria and NSW - Respond/review arrangements from the previous year in the thinking for 22-23	DPIE EES, CEWO, MDBA	May-Jun 2022	High	Not commenced
5.	WSP gazettal; work approval conditions	DPIE Water		High	Ongoing
	Reporting and communication				
6.	Finalise annual PPM evaluation and review report 2019-20	DPIE Water	July 2021	High	Complete. Report on web.
7.	PPMs comms and consultation - Develop comms plan - Agency consultation requirements as per procedures manuals	DPIE Water All agencies	2021-22	Mod	Not commenced. JAH to progress OOS
8.	Assumed Use Statements	WaterNSW	Prior to each watering event	High	Linked to PPM process work
9.	Event reporting (within and/or post event)	DPIE EES and WaterNSW	Per event or monthly	High	Linked to PPM process work
10.	Annual Environmental Watering Statement 2020-21	DPIE EES	5 Nov 2021	High	Report has been received from EES (Nov 21).

Task ID	Action	Responsibilities	Due	Priority	Status
11.	Annual Environmental River Operations Report 2020-21	WaterNSW	5 Nov 2021	High	Report has been requested from WaterNSW
12.	Annual PPM evaluation and review report 2020-21	DPIE Water	Jan-Mar 2022 Draft early 2022 to share with WG	High	Commenced.
	Watering priorities and technical tasks (by valley) - Murrumbidgee				
13.	<u>Mid-Murrumbidgee wetlands reconnection event (multi-site)</u> - Timing: autumn 2022 - Stand-alone and/or piggy backing event(s) – propose up to 25 GL/d @ Wagga - Current (Jul 2021) wet seasonal conditions favourable for HEW releases. - EWHs propose dam wall debit accounting of releases from storage. - Accounting treatment of environmental flow reuse from Mid-Murrumbidgee wetlands to Balranald.	All agencies	Jul-Aug 2021	High	Agreement not yet reached on proposed directed release / piggybacking options method - discussion continuing. With and without loss accounting treatment to Balranald. Unlikely to proceed in 21/22 water year but progress assumed use method.
14.	<u>Lowbidgee weir pool filling</u> Dry conditions means not enough water in the system to fill weir poor at times when EWH want to deliver water. Previously EWHs have been charged (as WaterNSW would be delivering to only one or two customers). Consider if EWH have ownership of the water d/s of the weir/event (i.e. similar to a multi-site arrangement) - Consider accounting treatment of return flows to fill Lowbidgee weir pools to enable delivery of e-water into GNC, Yanga or Redbank. - Timing, flow target and resource condition - various	EES WaterNSW	2022-23 consideration	Low-Mod	Need confirmation whether it will proceed due to changes to WSP

Task ID	Action	Responsibilities	Due	Priority	Status
15.	<u>Yanco/Billabong/Forest Creek system</u> Maintaining stable water level to provide nesting habitat cod; historically would have variable water levels through this period of the year; target 600 ML/d @ Yanco offtake; a portion of this would have ended up at Darlot but not recognised, need to establish loss return and return flows, noting that this year there is water in Wanganella Swamp. - Accounting treatment for in-channel deliveries and possible return flows into the River Murray - Investigate possible incremental loss application - Proposed water actions	Technical working group	Due commence November	High	Current
16.	<u>Mid Murrumbidgee Fish pulse (Darlington Point)</u> EES coordinating (James Maguire); targeting Murray Cod flow at Darlington Point rather than Balranald; looking to mitigate the dropping river and risk to cod nesting in the mid-river; about 3,500-5,000 ML/day through to December totalling 50 GL TLM water; want return flow recognition with delivery of TLM water down to Murray Icon sites. WNSW will deliver the outcome, but we need to sort out how. Note that once supplementary flows finishes typically would be diversions into Lowbidgee which would use some of the volume delivered to Darlington Point.	DPIEW / WaterNSW Technical working group	Due commence November	Mod	Underway. In Dec 21, event changed to maintaining a base flow past Maude weir (5000 ML/day) using 50 GL TLM and 40 GL CEWO water. Return flows recognised in River Murray.
17.	<u>2017-18 BED trial review:</u> - Finalise Murrumbidgee BED trial write up as supporting document for Murrumbidgee - Publish review	DPIE Water	ASAP (Dec 2021)	Mod	In progress. EES have provided feedback and DPIEW is working through publishing
	Watering priorities and technical tasks (by valley) – LD & GDA				
18.	<u>Lower Darling</u> - Accounting for directed releases from MLS and return flows into the River Murray when MLS is under NSW control - 6% loss MLS to Burtundy, incremental loss Burtundy to SA border (based on Murrumbidgee look-up table)	DPIE Water	June 2021	Low	Ongoing. Return flows recognised by NSW in autumn 2020-21 flows. MLS now above 640 GL (July 2021) and under MDBA control

Task ID	Action	Responsibilities	Due	Priority	Status
					Loss paper shared with WG. Loss paper to be put on website.
19.	<u>Lower Darling - proposed watering actions (2021-22):</u> - Expected volumes of water ranges between 68 GL ('dry') to up to 138 GL ('wet'), actual volumes may be less if operational delivery is meeting the target flow. - August target flow rate (Weir 32) expected to remain at 500 ML/d - September to early summer, the target flow (Weir 32) is likely to increase to 700-800 ML/d - Between October and January (ideally November to December) a golden perch pulse will be delivered targeting a peak flow of around 2,500 ML/d to 7,000 ML/d (but ideally above 4,000 ML/d) with a slow recession over January to mid-Feb in line with the operational rules. The pulse would be timed to coincide with operational releases where possible to maximise the environmental outcomes. The perch pulse will be shaped to include a 'primer pulse' (up to 1,500 ML/d) to stimulate egg maturation, movement to spawning areas followed by the higher pulse to stimulate perch spawning. - Depending on water availability and native fish monitoring, delivery of elevated winter flows could re-commence in May targeting between 400-500 ML/d at Weir 32. Operational releases may meet this target flow and would reduce need for e-water delivery.	DPIE EES, CEWO, MDBA	Immediately	High	Ongoing. Adjusted loss lookup tables to be confirmed with Victoria and MDBA river operators (3 Nov). Tables (and report) shared with WG on 20 Dec 21). Note release scenarios are dependent on operational needs (MLS to be managed back to FSL by 31 Dec). WaterNSW to advise WG as conditions change.
20.	<u>Great Darling Anabranch:</u> - Up to 130 GL is planned to be delivered under all water availability scenarios. - The start would be informed by fish monitoring in Menindee Lakes to time the delivery for when juvenile golden perch in the lakes are big enough to disperse through the Anabranch and into the Murray. - Late spring/summer start targeting up to 1000 ML/d for minimum 90 days connection with the Murray (i.e. approximately 5 months at Packers Crossing to account for the ~ 40-50 days travel to Murray and then another month once Packers Crossing releases finish). - Two options for delivery were considered: i. Coordinated delivery with operational flows where EWHs cover the loss in the Anabranch and the water measured as entering the Murray is either operational flow or a combination of operational		Underway	High	EoS gauges are being recalibrated. Need to consider how return flows are treated.

Task ID	Action	Responsibilities	Due	Priority	Status
	and environmental flow – if e-water holders choose to release more water that is in addition to operational needs (will need states to agree to this alternate delivery pathway as not described in the MDB Agreement). ii. An EWH only event. EWHs cover the loss in the Anabranch and the water measured as entering the Murray is recognised as environmental water return flows to be delivered to SA. <u>Update (29/10):</u> E-water currently being delivered on back of spill into anabranch, water currently about halfway down system and expected to reach Murray by end of November. Approx 1,000 ML/day, total volume 100-120GL for connectivity, first 30-40 GL is operational water. ACTION: WaterNSW to confirm volume of operational water ACTION: DPIE to consider return flow arrangements (incremental loss tables from MBG)				
21.	<u>Lower Darling</u> - TLM licence review, noting that discussion of CEWH holdings is out of scope.	DPIE Water	ASAP	Mod	Review under way as part of the broader NSW Water Administration Ministerial Corporation (WAMC) licences review. Options paper has progressed, noting contentious nature. DPIEW discuss option/s before going to public.
	Watering priorities and technical tasks (by valley) - Murray				
22.	<u>Wakool River</u> - Investigate refinement of accounting treatment subject to evaluation of 2019/20 and 2020/21 events (hindcasting – consider if two years is sufficiently data to refine arrangements). - Need to consider in conjunction with use of MIL escapes (if progressed)	Technical working group		Low	Not commenced

Task ID	Action	Responsibilities	Due	Priority	Status
23.	Werai Forest - Consider possible accounting treatment. - return flows - Proposed watering actions: - TBC	Technical working group	Spring 2022	High	Commenced prelim discussions
24.	Return flows and loss accounting 2022-23 Spring/august flows	DPIE Water	1 July 2022	Mod	Commenced
25.	Millewa Forest - Determine assumed use when Victorian regulators are closed, noting current mismatch in accounting arrangements with Victoria - Proposed watering actions: - TBC	Technical working group		Low	
26.	Bulk trade adjustments with Victoria - Develop arrangements to enable the bulk trade adjustments trial to enable the use of NSW return flows in Victoria and Victorian return flows in NSW. - Aim to be event ready in 2021-22.	All agencies	June 2022	Low	
27.	MIL escapes - Use of Murray Irrigation Limited escapes in the Edward-Wakool - Intersects with Werai Forest watering (Niemur flows) - Consider loss accounting and return flow	DPIE Water and EES	June 2022	Mod	Not commenced.

Appendix D – Evaluation results

Table D. Annual indicator performance

Indicator	Annual performance	Evidence to support performance assessment	Trend since PPMs started
PI 1a Extent to which agencies **fulfilled** their roles as set out in the procedures manual during each stage of the process	**Moderate**: Agencies generally fulfilled nominated responsibilities. When not met, explanation of when, why and circumstances are identified and documented. Reports submitted in full. Activates assessment of PI 1b.	At a broader level, all agencies made a genuine attempt to make good on their PPMs responsibilities; this level of adhere to roles and processes is generally consistent with previous years. Obligations around the collaborative development of water orders, seeking departmental review of orders using PPMs and regular e-water reporting are areas which have not been fully subscribed to both in this water year and earlier; however, it is noted that the PPMs process possibly is not prescriptive enough around seeking the department's review of an PPMs proposal.	**Neutral:** Retention of low or moderate performance
PI 1b Level of agency **understanding** of their roles and responsibilities	**Moderate:** Agencies generally understand nominated responsibilities. Most areas of poor understanding are identified and there are plans to address them.	Consistent previous years, all agencies have a general understanding of their nominated responsibilities as set out under PPMs. The day-to-day busyness of staff across all agencies and the resource-intensive nature of the planning and reporting of events using PPMs (as opposed to say consumptive water orders) are the sticking point. However, this is generally fully articulated or captured in any reporting or meeting minutes.	**Neutral:** Retention of low or moderate performance
PI 2a Extent to which reports and supporting information were provided, including annual reports, event forecasts and post-event accounting	**Low:** Most reporting elements were not submitted or only provided at the request of the department.	The annual reports provided were generally complete in that all sections of the reports were generally filled in. Relevant supporting information was provided, such as accounting spreadsheets and Form As. In both reporting elements (i.e. the river operations report and the environmental watering statements), both the risk assessment and issues/recommendations sections of the respective report would benefit from more complete documentation to provide meaningful input into the PPMs review process, including agency perspectives on recommendations as to how these risks or issues could be overcome.	**Neutral:** Retention of low or moderate performance
PI 2b Extent to which reports, and supporting information was provided, including annual reports, event forecasts and post-event	**Low:** Less than 50% submitted within agreed timeframes or by submission dates.	The timely provision of reporting elements by partner agencies continues to be problematic; the delayed submission of these reports for the 2021-22 water year significantly compromises the ability of the department to meet its reporting obligations to have an annual review report completed before the end of the following water year.	**Negative:** Declining performance level

Indicator	Annual performance	Evidence to support performance assessment	Trend since PPMs started
accounting, were submitted on time			
PI 3 Extent to which the process cannot be implemented as intended	**Moderate:** Process in generally implemented; where there have been deviations or departures from process, there is a documented reason including identifying any possible risk or implications; barriers have been identified but not addressed.	While the overall PPMs process was generally implemented as intended; elements within the process fall over where shown to 'fall over' or be insufficient to support a proposed event.	**Neutral:** Retention of low or moderate performance
PI 4 Extent to which risks were managed	**Low:** No evidence of consideration of risks during PPMs implementation.	There is little documentation to support any assessment of how risks were identified and managed. Failure to capture these risks and how they were mitigated means that opportunities to learn from these planning discussions may be missed and they cannot be 'built' into subsequent events or any supporting measures (such as assumed use methods or accounting arrangements).	**Neutral:** Retention of low or moderate performance
PI 5 Extent to which recommendations from previous reviews have been actioned	**Moderate:** Prior review recommendations are included in this year's workplan; PPMs Working Group are generally satisfied with this year's progress on high priority actions.	At least half of the recommendations made in the previous year's annual review (2020-21) have been completed, including some larger pieces of work such as the PPMs evaluation framework and updating the procedures manuals; outstanding items remain on the workplan.The PPMs WG prioritise items on the workplan based on resources and their watering priorities. It is expected that the number of items on the workplan will reduce over time, as key tasks (such as those required under FAA and IPART) are completed.	**Neutral:** Retention of low or moderate performance
PI 6 Extent to which accounting arrangements demonstrated improved efficiencies	**Moderate:** Accounting arrangements have been implemented for 3+ years without review; post-event accounting can demonstrate efficiencies in the volumes of e-water used.	Environmental water accounting demonstrates the efficiencies provided by PPMs in the southern NSW Basin. Without PPMs in place, the 213,000 ML of residual flows reaching the river Murray would otherwise have been re-socialised/reallocated to NSW resources. Similarly, a large portion of these return flows were then able to be recognised at the SA border, providing opportunities for downstream environmental benefits.	**Positive:** Increasing performance or retention of high performance

Indicator	Annual performance	Evidence to support performance assessment	Trend since PPMs started
PI 7 Extent to which the level of conservatism in arrangements were commensurate with risk to other water users	**Moderate:** Level of conservatism in discretionary decision making is somewhat commensurate with risks to other water users; new knowledge, understanding and data partially incorporated; not all arrangements have been subject to review of actual versus estimated losses.	NSW PPMs implementation principles state that they will be implemented to the extent that impacts on other licence holders can be mitigated or offset; where there is uncertainty, NSW adopts a precautionary approach to minimise potential detrimental impacts. For example, in the Edward-Wakool system highly conservative seasonal loss rates are applied to a number of factors, including the limited confidence (agreed by all agencies) in the data that was available at the time.	**Neutral:** Retention of low or moderate performance
PI 8 Extent to which PPMs are being adaptively implemented	**Low:** Recommendations from previous years have not been adopted; barriers not identified; no evidence that the knowledge base is being continually improved.	PPMs are being adaptively implemented, as demonstrated by both the types of events using PPMs for more efficient environmental water delivery, and also through (gradual) improvement of arrangements that are in place.	**Positive:** Increasing performance or retention of high performance