



BETTER MANAGEMENT OF ENVIRONMENTAL WATER

Active Management in Unregulated Rivers Policy

Protecting environmental water from extraction in New South Wales

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Contents

Introduction	3
Purpose of this document.....	3
The need for active management.....	3
Benefits of active management	4
Consultation.....	4
Objectives and principles.....	5
Process	5
Adjusting commence-to-pump/cease-to-pump thresholds	6
Distributing the available volume	7
Access announcements	7
Regulatory framework	7
Active Management in Unregulated Rivers Policy.....	7
Water sharing plans.....	7
Active management procedures manuals	8
Defining active environmental water.....	8
Held environmental water.....	9
HEW arising from water access licences in Queensland.....	9
HEW arising from water access licences in upstream NSW unregulated river water sources	9
Planned environmental water	9
Areas where active management applies	10
Priority areas for implementation	10
Other areas considered	11
Limits to the recognition of active environmental water	11
Managing active environmental water	11
Protecting an equivalent volume of active environmental water from extraction	11
Accounting for non-extractive use of unregulated licences	12
Determining the volume of water otherwise permitted to be taken	12
Seepage, evaporation and evapotranspiration	13
Other loss attribution options considered.....	13
Adjusting access for unregulated river access licences	14
Adjusting CtP thresholds and flow classes	14
Licences subject to only visible flow conditions at the pump site.....	15
Sharing the available volume among licences.....	15
No distribution	15
Distributing by shares or individual daily extraction components where they apply.....	16

Distributing by expression of interest	16
Access announcements	16
Default access arrangements	17
Access under basic landholder rights and other licence categories.....	18
Forecasting flows and managing uncertainty	18
Managing forecasting uncertainty	18
Estimating losses during flow events	19
Assigning tributary gains	19
Managing differences between forecast and actual flows	20
Operational responses to reconcile mismatches during an event.....	20
Operational responses to reconcile mismatches between events	21
Continuous improvement.....	21
Adaptive management.....	21
Annual review of the implementation of active management	22
Reporting	22
Policy evaluation and review	22
Appendix 1 – Summary of water sharing plan rules and procedures manuals	24
Appendix 2 – Sources of uncertainty in flow forecasting	26
Water use	26
Tributary inflows	26
River transmission losses	26
Determining river transmission losses	27

Introduction

The New South Wales (NSW) Government is committed to improving the health of NSW water sources by maximising environmental outcomes without affecting the reliability of the water supply and access for users.

NSW is implementing 'active management' to protect active environmental water (AEW) from extraction in unregulated rivers so that it remains in the water source for environmental purposes.

It is using this approach for priority water sources in the NSW northern Murray-Darling Basin. Active management will protect environmental water through the unregulated system so they can reach the Barwon-Darling. This approach can also be applied more generally to other unregulated rivers across NSW and may be implemented more widely in future.

Purpose of this document

This document outlines the NSW Government's policy positions for active management of environmental water. These positions were used to develop the water sharing plan rules for active management and the Active Management Procedures Manual (procedures manual) for each water sharing plan area where active management applies.

This document aims to outline the NSW Government's policy positions on how to better manage active environmental water (AEW) in unregulated river systems for better outcomes for the environment. AEW is defined as water that the NSW Minister for Water identifies as requiring protection from extraction on a given day. AEW includes:

- held environmental water (HEW) flowing from an upstream water source
- planned environment water (PEW) from upstream water sources protected from extraction under the existing water sharing plan rules, and
- licensed unregulated river water where the licence holder has notified the Minister that they want the water left in the unregulated river water source and protected from extraction.

Further detail on active management and active environmental water is contained in the procedures manuals and water sharing plans for the affected water sources. The procedures manuals contain the operational details for implementing active management to protect AEW and share the available water. The relevant water sharing plans contain definitions and rules which help establish how active management will be carried out.

Breakout boxes occur throughout the document. These boxes summarise the NSW policy position for the relevant section.

The need for active management

The NSW and federal governments have made significant investments to recover water for the environment across the Murray–Darling Basin. We refer to water held under recovered licences as held environmental water, as it is 'held' for the environment. The public expects that water recovered for the environment will remain in the water source to achieve intended environmental purposes.

Water sharing plan rules previously did not protect HEW and some types of planned environmental water (PEW) from extraction in unregulated rivers when it remained in the water source for environmental purposes. Once licensed access conditions (including commence-to-pump/cease-to-

pump (CtP) thresholds) were met, take by unregulated access licence holders could only be regulated by using temporary water restrictions.

In addition, the *Intergovernmental Agreement on Implementing Water Reform in the Murray-Darling Basin* includes a commitment to establish a mechanism to protect environmental flows in water resource plans submitted for accreditation. This mechanism is to be in place and operating by the end of 2020.

Benefits of active management

Active management reduces the need to use temporary water restrictions to protect AEW from extraction. It helps improve water sharing, compliance and transparency by:

- protecting AEW for environmental purposes
- making it clear to licence holders when and how much water they can take
- increasing public understanding of when water can and cannot be taken, and
- sharing access between licence holders during an unregulated flow event when flows are above CtP thresholds and demand exceeds the volume of available water.

Active management will also help maximise the environmental outcomes from AEW by ensuring it remains in the water source to reach its intended purpose. It will help support environmental outcomes coming from:

- HEW from licence holder accounts for regulated river water sources that flow into a downstream unregulated river water source where active management applies
- PEW releases from an upstream regulated river water source already protected from extraction by the water sharing rules for an actively managed downstream unregulated river water source. For example, it protects releases of Macquarie Environmental Water Allowance – Sub Account 2 (active) from Burrendong Dam from extraction in the Lower Macquarie River and Marthaguy Creek water sources, and
- HEW originating from accounts held within an actively managed unregulated river water source.

Consultation

In September to October 2019, the Department of Planning, Industry and Environment – Water (the Department) sought public feedback on the *Active Management in Unregulated Rivers – draft policy for public consultation* and proposed amendments to the following water sharing plans to support active management:

- *Water Sharing Plan for the Barwon-Darling Unregulated and Alluvial Water Sources 2012*
- *Water Sharing Plan for Macquarie Bogan Unregulated and Alluvial Water Sources 2012*, and
- *Water Sharing Plan for the Gwydir Unregulated and Alluvial Water Sources 2012*.

The feedback was considered in finalising this policy and water sharing plan rules.

Objectives and principles

The primary objective of active management is to:

manage access to water in unregulated systems to allow held environmental water to remain in the water source for environmental purposes.

The secondary objectives are to:

- support compliance activities to protect PEW and ensure transparency and equity of access
- provide certainty through enduring arrangements
- avoid relying on temporary arrangements to protect HEW from extraction.

The key principles to implementing active management are to:

- avoid, mitigate or offset any material change to reliability and access, including unintended gains
- be evidence-based and outcomes-focused
- be simple, practical and cost-effective
- support cultural and social outcomes, and
- be continuously improved through an adaptive management process.

These objectives and principles seek to ensure that active management achieves the intended outcomes without undue effects.

Process

AEW is the water in a water source identified by the Minister on any given day as requiring protection from extraction. Water sharing plans and procedures manuals define AEW in more detail.

To actively manage AEW in an unregulated river, the relevant authorities:

- forecast the inflows expected to enter the unregulated river and identify the volume of AEW entering the unregulated river
- forecast the flows along the river including estimating expected losses to evaporation, seepage and evapotranspiration
- determine if flows are above CtP thresholds
- determine the volume of AEW in the water source
- adjust CtP thresholds by the amount necessary to protect the AEW
- determine the volume available for unregulated river access licences
- announce flow classes, adjusted CtP thresholds, pumping restrictions and volumetric limits for unregulated river access licences, and
- derive the volume of AEW that reaches the next management zone or water source that is protected from extraction, based on transmission losses in the current zone.

The process is simpler when only AEW is present. If only AEW is present, there is no water to contribute to meeting flow thresholds, and access will be prohibited.

Further advice on how the relevant authorities will adjust CtP thresholds, distribute an available volume and announce access is provided in the following sections.

Adjusting commence-to-pump/cease-to-pump thresholds

Commence-to-pump/cease-to-pump thresholds defined in the water sharing plans and on licence conditions will be adjusted by an amount necessary to protect the AEW present.

The adjusted CtP thresholds are the sum of the base CtP threshold defined in the water sharing plan and on the licence conditions, plus the volume of protected AEW in the water source.

Figure 1 illustrates the concept based on 150 ML/day of AEW occurring in scenarios 2–5, and the base CtP threshold in the water sharing plan is 200 ML/day.

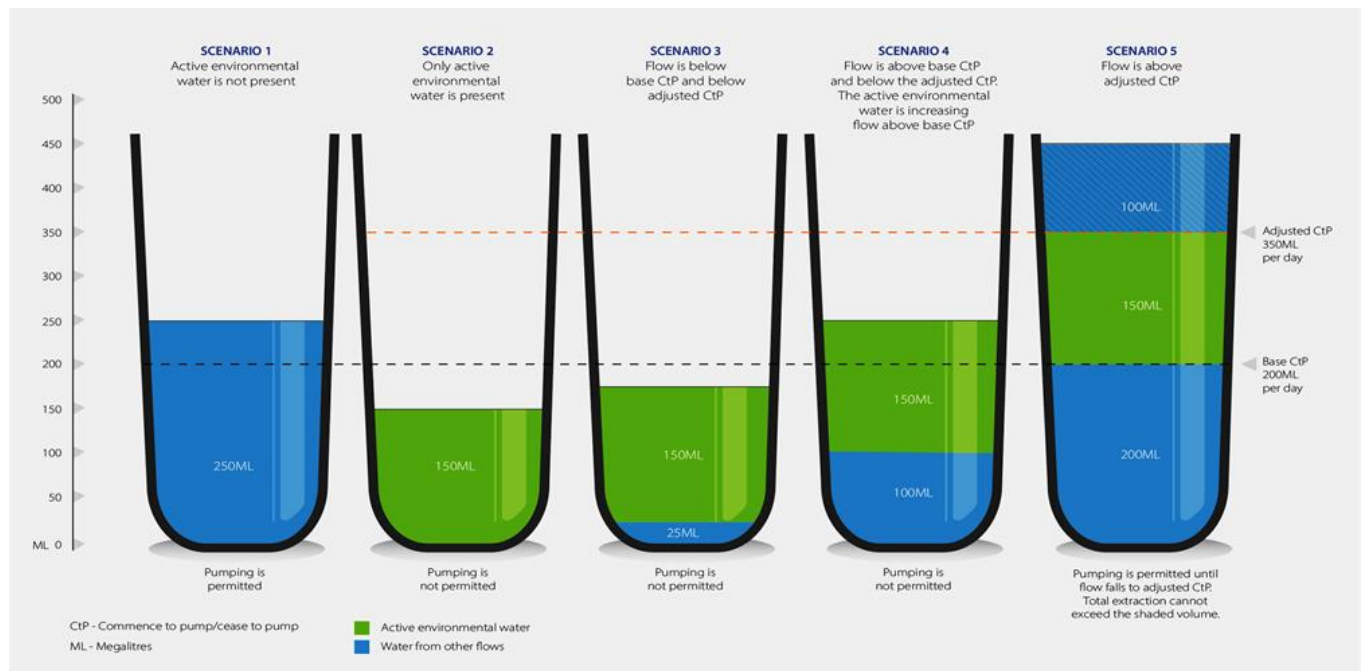


Figure 1: The active management concept.

The scenarios in Figure 1 show that, if all other access conditions and account management requirements are met, access will be permitted when flows are above the:

- base CtP threshold when there is no AEW present (Scenario 1), or
- adjusted CtP threshold when there is AEW present (Scenario 5).

Access will be prohibited if:

- only AEW is present (Scenario 2)
- flow is below the base CtP threshold (Scenario 3), or
- flow is above the base CtP threshold (due to the presence of AEW) but below the adjusted CtP thresholds (Scenario 4).

The procedures manuals outline how WaterNSW will calculate the volume of AEW to be protected and the adjusted CTPs.

Distributing the available volume

Once the volume of water available for extraction (see lined blue portion in Scenario 5 in Figure 1) has been calculated, it may be distributed among unregulated river access licences.

For example, in the Barwon-Darling, the CtP thresholds for each flow class are adjusted by the amount necessary to protect AEW and the adjusted flow classes announced (either permitting or prohibiting access). If access is permitted and the available volume is less than the sum of the individual daily extraction limits in the management zone, the volume will be distributed among licence holders by announcing the volume they can take per daily flow share.

The available volume needs to be distributed this way to ensure that any water nominated to be left in the water source remains there. For example, holders of HEW may choose to leave their volume in the water source during a given event. The distribution process will also equitably share water when demand for water exceeds the volume available to licence holders, even if AEW is not present.

Announcing a daily volumetric limit for each licence simplifies compliance requirements for licence holders where access rules are complex. This reduces the risk of licence holders interpreting information incorrectly.

Access announcements

The Minister may announce the flow class, adjusted CtP thresholds and daily volumetric limits each day, if required. WaterNSW will publish access announcements on its website for flow class announcements, and through the water access licence portal for volumetric limits or daily flow shares for individual licences.

Regulatory framework

The regulatory framework for implementing active management in unregulated rivers consists water sharing plans, this policy and the active management procedures manuals. The relevant contents of these documents are discussed in the following sections.

Active Management in Unregulated Rivers Policy

The Active Management in Unregulated Rivers Policy (this document) outlines the NSW Government's policy positions for active management of environmental water.

These positions were used to develop the water sharing plan rules for active management and the Active Management Procedures Manual (procedures manual) for each water sharing plan area where active management applies.

Water sharing plans

Water sharing plans with active management have provisions to:

- define AEW to be protected from extraction
- adjust access by the amount necessary to protect AEW that is present
- allow access licence holders to leave in the water source some or all the water they are permitted to take, and
- prepare and publish procedures manuals.

Active management procedures manuals

The procedures manual for each water sharing plan area (where active management applies) provides the operational details WaterNSW uses to implement active management. It also outlines:

- the water sources or management zones the procedures manual covers
- the water that is defined as AEW that is protected from extraction in each water source or management zone
- how flows are forecast
- how losses are calculated and shared
- how operational uncertainty is managed (for example, adjustments to flow forecasts)
- how the volume of AEW is determined
- how the adjusted flow class, CtP threshold and volumetric limit is determined
- the form an access announcement will take and the information it must contain
- what access licence holders will need to do if they want to leave their water within the water source and how their water allocation account will be debited for water remaining in the water source
- reporting requirements
- timeframes, circumstances, procedures and responsibilities relating to reviews of the procedures manual, and
- who approved the procedures manual and when it was approved.

The procedures manuals outline management methods for responding to the circumstances of each flow event while showing how active management is implemented. The procedures manuals will be regularly reviewed and refined to respond to new information or insights (adaptive management) and manage risks.

The Department consulted with stakeholders to develop the procedures manuals. WaterNSW is responsible for implementing active management and communicating with licence holders in each water source. Appendix 1 further describes the water sharing plan rules and procedures manuals.

Defining active environmental water

Active environmental water is the water in the water source identified on any given day as requiring protection from extraction.

The primary objective of active management is to manage access to water in unregulated systems to allow held environmental water to remain in the water source for environmental purposes.

Active environmental water is defined in a way that minimises any effects on downstream water sharing arrangements, including unregulated river access licence reliability. The definition of AEW is limited to the water in an actively managed river that arises from:

1. HEW flowing from an upstream water source including:
 - a. water released from an upstream regulated storage and debited from a water allocation account, where that water remains in the water source and flows into the actively managed unregulated river water source
 - b. water from a regulated river supplementary water licence that is debited from the water allocation account and recognised as AEW, which flows to the downstream actively

managed unregulated river water source. This water will only be available during supplementary access events.

2. an unregulated river water access licence where the licence holder has notified the Minister that they want the water protected from extraction in the unregulated river water source, and
3. PEW from upstream water sources protected from extraction under the existing rules in a downstream unregulated water sharing plan where active management is applied.

Held environmental water

HEW is water available under a water access licence to achieve environmental outcomes. Both the NSW and federal governments have acquired water licences for environmental purposes for regulated, unregulated and groundwater sources. The following HEW will be managed as AEW:

1. HEW from licences in northern NSW regulated storages and Queensland storages in the Border Rivers that flow into an unregulated actively managed river, and
2. HEW from an actively managed area that is otherwise permitted to be taken under an unregulated river access licence where the licence holder has notified the Minister, in accordance with the relevant procedures manual, that they want to protect the water from extraction.

HEW arising from water access licences in Queensland

NSW and Queensland are working on a method for determining the volume of HEW arriving at the NSW-Queensland border. Once this work is complete, flows from HEW licences originating in Queensland (other than releases from the regulated Border Rivers system) will be recognised as AEW and managed through NSW systems. This work is due to be complete in July 2021.

HEW arising from water access licences in upstream NSW unregulated river water sources

HEW arising from water access licences in upstream NSW unregulated river water sources that flow into an actively managed unregulated river water source (either directly or through a regulated river water source) will be recognised as AEW. A method to determine the additional volume of water arising from the HEW licence that arrives in the actively managed river is being prepared.

Planned environmental water

PEW is water committed for ecosystem health or other environmental purposes and managed through rules in water sharing plans established under the *Water Management Act 2000* (NSW). This water is also known as 'rules-based' environmental water. It can be 'discretionary' (meaning it can be ordered for use by environmental water managers) or 'non-discretionary' (meaning it is automatically scheduled for release from water storage or protected from extraction when the water sharing plan rules are met).

Water sharing plans were developed on the basis that all inflows to a water source are shared as set out in the rules in the plan, without regard to where the water originated. Water sharing plans for unregulated water sources typically do not recognise that flows from an upstream water source are for specific purposes.

These arrangements have informed the understanding of the long-term reliability of water sources. Reliability for unregulated river access licences may be affected if water that was previously available from upstream PEW were to be set aside for the environment.

Water identified as upstream PEW that flows into an unregulated river water source will not generally be protected from extraction under active management, to minimise the effect on historical reliability for downstream users.

PEW is not protected using the mechanisms of active management, except PEW from an upstream water source that is already protected by a water sharing plan for a downstream unregulated river water source.

Active management is an operational mechanism to protect PEW from an upstream water source that is protected by a water sharing plan for an unregulated river water source.

For example, clause 53 (27) of the *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012* requires that flows from a release of water from the Environmental Water Allowance (active) Sub-allowance 2 from Burrendong Dam in the Macquarie regulated system are protected from extraction in several downstream unregulated river water sources.

If it is in the public interest, temporary water restrictions may continue to be used to protect PEW that enters an unregulated river water source when flows exceed CtP thresholds.

Areas where active management applies

There are many unregulated river water sources in NSW where active management could be used to protect environmental water from extraction. However, the implementation of active management is limited to priority areas in the northern Basin that provide the greatest opportunity to maximise benefits and which align with the objectives and principles of this policy.

Other areas may be considered in future, based on the objectives and principles of this active management policy. The relevant water sharing plans would need to be amended and stakeholders consulted before active management could be implemented in any additional areas.

Active management will be considered in the future for unregulated surface water sources where:

1. HEW from upstream regulated rivers has been delivered or is intended to be delivered within the next five years
2. the water source includes unregulated river HEW access licences
3. HEW that remains in-stream in the water source is not protected from extraction by a downstream unregulated river access licence in a current water sharing plan and licence conditions, or
4. implementation will meet the objectives and principles set out in this policy.

Priority areas for implementation

Priority areas identified in the northern Basin for the implementation of active management are the:

1. Barwon-Darling Unregulated River Water Source to the last flow gauge in the Barwon-Darling Unregulated River Water Source or to the point where AEW attenuates (whichever is upstream)
2. Lower Macquarie Bogan at the:
 - a. Lower Macquarie River Water Source including Gum Cowal, Lower Macquarie River Downstream and the Lower Macquarie River Upstream Management Zones, and
 - b. Lower Marthaguy Creek Management Zone (within the Marthaguy Creek Water Source)

3. Gwydir at the:
 - a. Gingham Watercourse Water Source including the Upper Gingham Watercourse and the Lower Gingham Watercourse Management Zones, and
 - b. Mallowa Creek Management Zone (within the Mehi Creek Water Source).

These are unregulated rivers downstream from a regulated river water source where:

- environmental water originating from a regulated river has been delivered previously
- the environmental water holders intend to deliver environmental water in the future
- HEW could be extracted by unregulated access licence holders under their current licence conditions, and
- it is operationally feasible to implement active management.

These areas were prioritised in part because of the unique characteristics of the Barwon-Darling as the key conduit for the northern Basin. This made protecting HEW in this area a priority, so that it can be used to achieve northern Basin connectivity outcomes.

Other areas considered

Implementation of active management in the Lower Gwydir unregulated river and the Marra Creek, Bogan River and Marthaguy Creek above the confluence with Terrigal Creek in the Lower Macquarie valley was also considered because environmental water is not protected from extraction as it passes through these water sources. Active management is not being implemented in these areas at this time because there are no plans to deliver environmental water to them. Should this change, implementing active management in these areas will be considered.

Limits to the recognition of active environmental water

The Lower Darling water source is a regulated system. As such, protection of environmental water in the Lower Darling is outside the current scope of active management.

Recognising AEW volumes that flow into the Lower Darling water source will depend on future management decisions for Menindee Lakes and amendments to the Murray-Darling Basin Agreement. A method for determining the volume of AEW that flows into Lake Wetherell will need to be developed and agreed by NSW.

Managing active environmental water

This section describes how active environmental water will be protected from extraction, including the process for determining the volumes protected and how seepage and other losses will be accounted for.

Protecting an equivalent volume of active environmental water from extraction

Active management limits the take of water so that volume equivalent to that defined as AEW is protected from extraction. The volume of AEW to be protected is determined by WaterNSW, using the methods in the relevant procedures manual.

Instead of tracking specific parcels or litres of AEW, active management limits the take of water so that an equivalent volume to that defined as AEW is protected from extraction.

The more closely limits on take align with the volume AEW flowing past a given licence holder, the more effectively active management can protect the intended environmental flow event. Monitoring flows and the proportion of AEW at gauges throughout the system will improve the effectiveness of active management.

The volume of AEW protected from extraction is determined in accordance with the relevant procedures manual.

Accounting for non-extractive use of unregulated licences

The volume of water available to an unregulated HEW licence holder is determined in the same manner as it is for other unregulated river access licences, so that the characteristics of the licence are maintained.

Environmental water holders purchase unregulated river access licences and seek to leave the water otherwise permitted to be taken from the water source for environmental purposes. Active management allows environmental water holders and any other unregulated river access licence holders to leave this water in the water source and prevent it from being extracted downstream.

Any unregulated river access licence holder in an actively managed water source may notify the Minister that they want the water otherwise permitted to be taken to remain in the water source and protected from extraction.

Water otherwise permitted to be taken by an unregulated river access licence holder that is to remain in the water source must be identified as AEW. It will be debited from the water allocation account. The volume identified as AEW will be the lesser of the volume the licence holder requested be protected, and the volumetric limit announced for the licence.

To manage AEW originating from an unregulated river access licence in the water source where active management is applied, WaterNSW will:

- determine the volume otherwise permitted to be taken by the holder of the unregulated river access licence
- confirm the volume the licence holder wants to remain in the water source and protected from extraction
- debit the water allocation account by the volume to remain in the water source (rather than the volume extracted), and
- adjust access in downstream management zones by the amount necessary to protect the water debited from the water allocation account.

Determining the volume of water otherwise permitted to be taken

Water allocation accounts are debited when water is extracted based on metered water use, estimated water use or a recognised dealing. For non-extractive use, water allocation accounts are debited once the volume otherwise permitted to be taken is determined, and the licence holder has notified the Minister that they want to protect some or all of the available water so that it remains in the water source.

Water sharing plans covering water sources where active management applies include account rules that allow:

- unregulated river access licence holders to notify the Minister that they want to leave some, or all, of the water otherwise permitted to be taken under their licence in the water source, and
- water allocation accounts to be debited in accordance with the relevant procedures manual to enable any water to be protected from extraction.

The volume debited will then be recognised as AEW and protected from extraction in downstream management zones.

The procedures manual for the relevant water source describes the process for determining the volumes available to each access licence holder and notifying the Department of the proportion to be protected from extraction. In the Barwon-Darling and Macquarie Bogan regions, water users submit an expression of interest.

The same approach will be applied to all unregulated river access licences in each management zone.

Seepage, evaporation and evapotranspiration

The volume of water recognised as AEW that moves into the next management zone will be reduced by the equivalent share of river transmission losses, and in proportion to the total flows in the management zone or river reach when in-stream.

In some cases, environmental water may be delivered outside the channel to achieve an environmental benefit, which may mean a greater proportion of water does not return to the downstream flow. The procedures manuals allow WaterNSW to consider alternative options to sharing losses if AEW is deliberately delivered outside the channel and the standard proportional sharing of losses has a demonstrated effect on the volume available to other access licence holders.

WaterNSW operators will identify these occurrences and document their process for predicting losses or gains from delivering water outside the channel and forecasting these flows. These processes can be reviewed in the adaptive management process.

Some AEW protected from extraction will evaporate, be used by plants or seep into the ground. These natural processes contribute to the health of the river system and associated ecosystems. They are referred to by river operators as river transmission losses. As AEW flows downstream, the volume recognised as AEW must be reduced by its share of these losses.

The preferred approach is to assign losses proportionally based on the ratio of AEW at the start of the management zone relative to the total flows. This is a simple and reasonable approach to sharing losses and is appropriate within a channel. If AEW is flowing outside channels, WaterNSW may select an alternative approach to assigning losses. This will be reported through the active management review process.

The volume of AEW is not reduced in its own management zone or as it passes into the management zone immediately downstream from where it was debited. This is because losses were factored in when the available volume was determined. The volume is adjusted at the border between management zones, based on the proportion of the unaccounted difference (whether losses or gains) that occurs as it moves through the management zone, and at each transition between management zones thereafter.

Other loss attribution options considered

If AEW were not reduced by its share of losses as it flows downstream, these losses would have to come from the volume available to unregulated river access licence holders. If the losses associated with the AEW were 'socialised' (shared) and counted as system losses, they would in effect be borne

by the unregulated river access licence holders. This would conflict with the principle to mitigate the impact on other licence holders.

Assigning incremental losses is the most neutral approach because it considers the losses arising from the use of AEW. This requires a comparison of losses with and without AEW to determine the relative losses attributed to the presence of the environmental water. It is a more complex process and not practical within the timeframe of a flow event, and for these reasons is not supported.

Adjusting access for unregulated river access licences

The CtP threshold or flow classes in water sharing plans and licence conditions that regulate access under unregulated river access licences is increased by the volume of AEW to be protected. Individual volumetric limits are also determined where the total volume available in a management zone may be less than the daily extraction capacity in that zone.

WaterNSW will issue the access announcements, adjusted flow class or CtP threshold, and/or individual volumetric limits.

Access arrangements to implement active management must:

1. protect an equivalent volume of AEW from extraction so that it remains in the water source while providing for access permitted under the water sharing plans
2. be flexible to accommodate varying river conditions, flow volumes and timing of AEW delivery and unique circumstances in each active management area
3. be clear so that licence holders and the public can understand when water can and cannot be taken
4. provide for unregulated HEW licences to protect water from extraction for environmental purposes, and
5. support the sharing of water among licence holders when there is a limited supply.

Adjusting CtP thresholds and flow classes

Water sharing plans for unregulated rivers establish CtP thresholds for unregulated river access licences. These may be expressed as CtP conditions on licences or as flow classes. Flow classes are in place in the Barwon-Darling and Gwydir unregulated river water sources and simple CtP conditions are in place in the Macquarie unregulated river water sources.

Typically, water access licence conditions detail the flow class or the CtP thresholds that apply for that licence. An unregulated river access licence holder can take water when flows at flow reference points (often a river gauge) are above either the CtP condition or the CtP threshold of the flow class nominated on their licence, if all other licence access conditions and account management requirements are met. Active management changes this arrangement. Licence holders must now wait for WaterNSW to determine if these conditions are met and to announce access.

In some cases water sharing plans may also require a visible flow at the pump site. Some licences may have additional or more stringent CtP thresholds than those detailed in the water sharing plan. Where this is the case, these conditions must be met before licence holders take water, even if WaterNSW has announced access.

The relevant procedures manual outlines how the river operator will forecast inflows and losses to determine the adjustment to protect AEW present in the water source from extraction.

Licences subject to only visible flow conditions at the pump site

Some licences don't have CtP thresholds linked to a river flow gauge. Instead, access is permitted when there is visible flow at the pump site, and all other licence and account management conditions are met.

Under active management, access under these licences is prohibited if only the following is present:

1. PEW arising from the daily access rules in Division 2 of Part 8 and AEW, or
2. AEW.

If flow in the water source is from AEW and other sources, access may be linked to a CtP at an appropriate river flow gauge, or a volumetric limit of take per day may be announced. The method used will depend on the circumstances in each water source, including the feasibility of determining the AEW within the water source and the available infrastructure.

The relevant procedures manual outlines how access for these licences will be changed to protect AEW from extraction.

Sharing the available volume among licences

The volume of water available under unregulated river access licences will be determined by WaterNSW and then distributed among individual unregulated river access licences within a water source, management zone or flow class, to protect AEW or protect water below the flow class threshold.

Where the available volume is distributed among unregulated river access licence holders in a management zone, the distribution may be based on individual daily extraction components (IDECs) where they exist or share components on water access licences. Distribution may be managed through an expression of interest process.

Distribution of the available volume is particularly important in management zones with unregulated HEW licences to identify the maximum volume that can be protected from extraction.

Under previous unregulated river water sharing plans, access was on a first-come, first-served basis. A similar arrangement can continue under active management, or the volume available above the adjusted CtP threshold can be determined and distributed among licences. Different approaches may suit different water sources, depending on the complexity of the licence conditions.

Water sharing plans covering water sources with active management outline the circumstances under which a volumetric limit can be imposed. The procedures manuals outline if and how the volume available is distributed. The available options are set out below.

No distribution

The management arrangements for unregulated rivers currently don't provide for the distribution of available water. The simplest option is to continue this approach. This option is also most appropriate where distribution is unnecessary because the total possible volume of daily access in the management zone is lower than the minimum available volume once conditions have been met.

However, not distributing the water available among licences will mean an unregulated HEW holder's share in the daily flows is not established. This would likely result in AEW being extracted by other

licence holders. This approach therefore can't be used in water sources and management zones where HEW licences are located and there is limited available volume.

Distributing by shares or individual daily extraction components where they apply

Distributing the volume available based on a proportion of shares or IDECs:

- makes it clear what volumes can be pumped under each licence
- equitably shares the volume available when it is less than the sum of IDECs or less than the total pump capacity in a management zone or water source, and
- identifies the volume that a licence holder, such as a HEW licence holder, can choose to leave in the water source and have protected from extraction.

This approach shares the volume available among licences, whether or not a licence holder intends to take water. From time to time and for various reasons, a licence holder may not want to take their share of available water. If water is not taken, it is made available in the next management zone.

Distributing by expression of interest

In management zones where available volumes may be less than the sum of the possible volume a licence holder may extract in a day, licence holders are required to submit an expression of interest before accessing water. This is now a licence condition.

An expression of interest process gives WaterNSW the information it needs to distribute the volume of available water to the licence holders wishing to access it. After WaterNSW distributes the available volume, the Minister announces the volumes accessible by each licence holder who submitted an expression of interest. In the Barwon-Darling, the amount each licence holder can take is expressed as a proportionate share of the daily flow. For example, a daily flow share of 0.7 would indicate a licence holder may pump 70 per cent of their full IDEC volume. In the Macquarie Bogan, the amount is expressed as a total volumetric limit.

Only licence holders who express an interest are given a share and are permitted to take water on a given day. This approach maximises economic opportunity while still meeting the primary objective of protecting environmental water, in line with the policy principles.

In the Barwon-Darling, the maximum volume of water permitted to be taken on any day under an access licence will be the lesser of the volume permitted by the access announcement and the IDEC. For other water sources, maximum limits can be linked to pump capacity.

Water allocation accounts will be debited by the volume taken or the volume the licence holder nominates to remain in the water source and protected from extraction. The relevant procedures manual outlines the process for a licence holder to express an interest and a process for the Minister to confirm the volume each licence holder can take.

When the sum of the potential daily access volumes for all licences in a management zone cannot exceed the available volume once adjusted CtP thresholds and other conditions are met, expressions of interest and distribution of available volumes are not required.

Access announcements

Under previous arrangements, unregulated river water access licence holders were required to check that the flows at the relevant river flow gauge/s, or at the pump site for visible flow conditions, were

above the CtP thresholds for their licence or licence class, and meet all other licence and account conditions, before pumping.

Under active management, to protect AEW in a particular management zone or water source, the Minister announces, where appropriate:

- the flow class that applies to that management zone or water source for any particular day
- the adjusted CtP threshold or flow class thresholds for any particular day or period
- volumetric limits that apply for individual licences, or
- that take is prohibited.

The approach taken may always apply or apply only when AEW is present. The approach for a particular water source will be established in the relevant water sharing plan rules or through discretionary conditions. On days where there is no access announcement, normal access conditions will apply.

Before making an access announcement, WaterNSW adjusts the CtP thresholds in the water sharing plan and licence conditions by the amount necessary to protect AEW from extraction from the water source. A volumetric limit per licence holder is determined if the available water is less than the sum of the possible access volume.

Announcements are made daily during an event or at less frequent intervals (that is, announcements could apply for longer than one day) if flow forecasts are reliable. Frequent announcements allow river operators to respond and update thresholds and licence conditions to achieve the appropriate balance between consumptive access and environmental water protection. This is particularly relevant during times of forecasting uncertainty.

This approach clarifies when pumping is permitted. Licence holders will need to know their licence conditions relating to announcements, flow classes and access thresholds.

The relevant procedures manuals outline how announcements are made and the details that each announcement must include for each water source and management zone.

Default access arrangements

Default access arrangements need to be in place for circumstances when the volume of AEW present can't be determined, or it isn't otherwise possible to make an announcement (for example, if a gauging station or IT system fails).

The default arrangements take into account the circumstances in each water source or management zone, including, but not limited to:

- infrastructure available to determine AEW, and
- risks to AEW and unregulated river access licences.

These circumstances and required actions are outlined in water sharing plans and described in more detail in the procedures manuals and licence holder information material.

Access under basic landholder rights and other licence categories

Access under domestic and stock, local water utility, supplementary water (Aboriginal environmental) access licences and unregulated river access licences will not change under active management except where licence conditions are subject to A class announcements.

Existing exemptions from access rules in water sharing plans will continue to apply.

Forecasting flows and managing uncertainty

A key part of implementing active management is flow forecasting. Forecasting involves estimating:

- inflows to each river reach/management zone from upstream water sources and tributaries, including the volume of inflows, the makeup of those inflows, and when inflows are expected
- river transmission losses expected along the zone, and
- the take permitted under basic landholder rights and water access licences.

Forecasting is inexact given the inherent variability in natural river systems and environmental watering activities. Actual flows may fall short or exceed forecast flows. As such, forecasting is the primary operational risk in implementing active management.

As part of active management, the river operator will forecast flows to determine the volume of:

- water expected to reach a certain point in the river
- AEW within the water source
- water available to unregulated river access licence holders, and
- AEW that will pass into the next management zone.

This section discusses how uncertainty in forecasting is managed, how forecasting is used and reconciled with actual outcomes, and how it will be improved over time.

Managing forecasting uncertainty

Uncertainty in forecasting flows arise from uncertainty in estimating water use, river transmission losses, tributary inflows or flow routing effects (as detailed in Appendix 2).

A flow forecast is useful, even if there is a margin of error in the estimation. Uncertainty affects water management decisions and subsequent outcomes. There is a trade-off between achieving the ideal sharing outcomes in each event versus introducing additional complexity that may interfere with making timely decisions. The more complex the process and calculation methods, the greater the cost of running the system, and the lower the transparency for licence holders and the public.

When forecasts are uncertain, WaterNSW manages water to minimise any potential effects of overestimating or underestimating the volume of protected AEW or the water available to unregulated river access licence holders, within the limits of operational feasibility and cost-effectiveness.

The procedures manuals describe operational arrangements to estimate initial and ongoing losses and manage mismatches during an event. The effectiveness of these approaches is reviewed annually as part of the adaptive management approach.

Estimating losses during flow events

Initial and subsequent loss estimates during a flow event are based on an assessment of the average losses for comparable past historical events. The subsequent losses are adjusted based on observed losses during that event.

When a given volume of water enters an actively managed system, river operators will forecast the amount of water expected to reach each gauge based on comparable historic events. The operator will forecast river transmission losses between gauges and the flows expected at each gauge, and assign losses arising from seepage, evaporation and evapotranspiration between gauges.

Losses are then assigned proportionally to the AEW and other flows. This approach distributes the risk of under- or over-estimating losses.

Initial losses depend on antecedent conditions. Estimating the effect of antecedent conditions on flows and losses is one of the greatest sources of uncertainty in forecasting. For example, initial losses from flows restarting after long periods of very low or no flow can vary considerably, because of the filling of depleted pools and saturating of the dry bed and banks of the river. Analysing past river transmission losses shows that a range of initial losses is possible, even for similar past events and further categorisation into wet, average and dry antecedent conditions.

When events are short in duration, the initial loss estimates are particularly important because there are limited opportunities for river operators to adjust available volumes to compensate for under- or over-estimates of available volumes.

If flows continue to the extent that they saturate the bed and banks of the river, ongoing losses from further flows can be relatively small.

Basing initial and ongoing loss estimates on average losses for previous similar events will minimise any bias in the difference between forecast and actual losses over the longer term. The procedures manuals define the best approach to forecasting losses in each management zone based on the current data and methods available. WaterNSW adaptively manages loss forecasts by using the best available information to ensure losses are forecast as accurately as possible for each event. WaterNSW will also recommend improvements to procedures as understanding of the systems improve.

Assigning tributary gains

Tributary inflows (not attributed to HEW) are not protected from extraction unless they contribute to the water below the flow class or access thresholds.

Major tributary rivers, including the major regulated rivers, have flow gauging stations that are used to calculate and forecast inflows. Where these tributary inflows are attributed to HEW, they will be assessed as AEW. Where these tributary inflows are not attributable to HEW, they are considered in determining the water available to water users, subject to access conditions being met. They are not assessed as AEW.

Significant local rainfall can produce inflows from smaller streams with no gauges and from the residual catchment along the actively managed river. Ungauged inflows can also occur when higher flows in tributaries break out of the channel and bypass flow gauges before entering the actively managed river. The river operator assesses ungauged tributary inflows, based on the difference in flow at gauges on the actively managed river, after allowing for water use and gauged inflows and

outflows. These ungauged inflows are considered when assessing the water available to water users, subject to access conditions being met. They are not assessed as AEW.

Managing differences between forecast and actual flows

Flows are forecast based on upstream flows and predicted river losses. This is done by taking observed flows upstream and calculating the volume at a gauge downstream if anticipated losses and gains occur.

WaterNSW uses operational responses to minimise the mismatch between forecast and actual losses during an event. It will:

- adaptively adjust ongoing loss forecasts based on the observed unaccounted difference. This is the difference between flows at upstream and downstream gauges that are not otherwise explained by known extraction or tributary inflows, and
- adjust access during a flow event based on the cumulative mismatch between forecast and actual unaccounted differences.

This is called reconciliation, and seeks to ensure that licence holders, including environmental water licence holders, receive the anticipated amount of water during an event. Mismatches between forecast and actual losses are reconciled within, but not across, events.

This is because typically the same set of licence holders would participate in the whole event, but different licence holders may wish to access the next event and may be either disadvantaged or advantaged by adjustments, rather than participating equally in both.

Operational responses to reconcile mismatches during an event

Operational responses during an event can minimise the mismatch between forecast and actual flows. These 'within-event' adjustments:

- reduce the likelihood that mismatches accumulate downstream and over time to unacceptable levels, and
- improve the likelihood that the volume protected is equivalent to the volume of water defined as AEW and effects on unregulated river access licence reliability are mitigated.

Operational responses to manage mismatches during an event are outlined below.

Vary the frequency of access announcements

WaterNSW can make access announcements as necessary, up to daily during an event. Frequent access announcements mean WaterNSW can implement further operational responses to updated forecasting. This helps reach an appropriate balance between consumptive access and environmental water protection.

Adaptively adjust ongoing loss forecasts

Operational responses are adaptively adjusted to react to the differences between forecast and observed losses and the resulting actual flows. These adjustments ensure mismatches arising from uncertainty in ongoing loss forecasts do not compound as the event proceeds. This minimises risks to the AEW and licence holders.

This approach increases decision-making requirements and related resources compared to not attempting to correct mismatches that occur because of inaccurate loss forecasts. The decision-making process is outlined in the procedures manuals.

Loss forecasts and loss estimates are updated daily during an event, even if announcements or management actions regarding water availability occur less frequently.

Adjust access based on the cumulative mismatch

Access to water may be adjusted based on an observed mismatch on the previous day(s). This minimises imbalances between AEW and water available for unregulated river access licences. This approach also increases decision-making and resourcing requirements, and the frequency of announcements.

The procedures manuals define when adjustments occur. That is, they determine when the level of mismatch is so significant that an adjustment is required during an event to mitigate possible impacts. The procedures manuals also provide details about how the adjustment will be made.

Initial conservative access announcements

An initial conservative access announcement that provides a higher CtP threshold or lower volume of water available to licence holders until river losses are better understood will not be used because it has potential to affect the reliability of access for unregulated river access licence holders.

Announcements are made based on the best available information at the time.

Operational responses to reconcile mismatches between events

As unregulated systems are highly variable, mismatches between events will not be reconciled or managed. Doing so could create further uncertainty for licence holders around timing and reliability of access during future events.

Continuous improvement

Active management processes use the best available information, including from hydrometric and rainfall monitoring networks.

Improved metering and telemetry will reduce some forms of uncertainty in flow forecasting. A new metering framework, which improved the standard and coverage of non-urban water meters across NSW, was released on 1 December 2018. Under the framework, affected licensed water users must install compliant metering equipment by the relevant roll-out date (which is determined by the size of their pump and works).

As new metering data becomes available, the department will integrate it into active management procedures. The department will also consider opportunities to further reduce flow forecast uncertainty by installing additional flow and rainfall measurement points or revising hydrometric operations.

Adaptive management

An adaptive management approach will be used to ensure active management continuously improves and responds to information, insights, infrastructure, tools and systems.

Managing AEW through unregulated rivers is a significant change from the previous management arrangements. These had many challenges, particularly in relation to forecasting river flows and understanding the implications of uncertainty when forecasting flows.

Management has evolved through 'learning by doing' and due to improved information, insights, infrastructure, tools and systems. Active management will continue to evolve over time for the same reasons, and in response to the findings of an annual review.

Each procedures manual includes an adaptive management procedure for regularly assessing the implementation of active management. Annual reports and evaluations inform the review of active management procedures and assess compliance with the procedures manual.

Annual review of the implementation of active management

The Department will conduct an annual evaluation and review of the operation of active management after considering information provided by WaterNSW, the Department of Planning, Industry and Environment – Environment, Energy and Science, and the Natural Resources Access Regulator. The principles and objectives for active management in this document will guide the review.

The annual evaluation will inform the ongoing development and improvement of active management, including the review of this policy and the procedures manuals.

The review should consider whether the primary objective of active management has been fulfilled. However, it will not include monitoring of environmental outcomes arising from the use of environmental water. This is the responsibility of the environmental water holders.

The Department will prepare and publish a report on the review each year, including any findings on the review and recommendations.

The procedures manuals include details of reporting requirements for the annual review. At a minimum, the annual review report will include:

- any proposed variations or new procedures
- any issues relating to active management raised through consultation with stakeholders
- whether active management procedures should be expanded, modified or remain unchanged, and
- reporting on the implementation of improvements from previous reviews.

Reporting

The active management procedures will be regularly assessed to determine how well they are achieving the policy outcomes defined in this document. This includes how effective they are in protecting environmental water, and whether they are achieving secondary objectives. This process will help ensure that active management is conducted transparently.

The procedures manuals include details of reporting requirements for the annual review. At a minimum, the reports will:

- document relevant data such as forecast and actual river flows, forecast and actual transmission losses, AEW protected, environmental water used in-stream, volume of water available to unregulated river access licence holders in each management zone, and volume available to each licence if distributed
- include the results of an audit of implementation against procedures manuals
- document issues arising during implementation of active management and any recommendations that address those issues or improve operations, and
- include feedback from consultation with stakeholders.

Policy evaluation and review

The Department's policy evaluation framework will be used to assess the effectiveness of this policy and to inform policy reviews. The evaluation framework aligns with NSW Government Program

Evaluation Guidelines, as shown in Figure 2. This policy will be evaluated and reviewed at least every five years to:

- assess the ongoing appropriateness of policies
- evaluate whether implementation was efficient and as intended, and
- assess effectiveness in providing a mechanism for allowing HEW to remain in the water source for environmental purposes.

The policy evaluation will identify any issues arising or opportunities for improvement that occur during the review period. Evaluation findings will be considered in policy reviews.

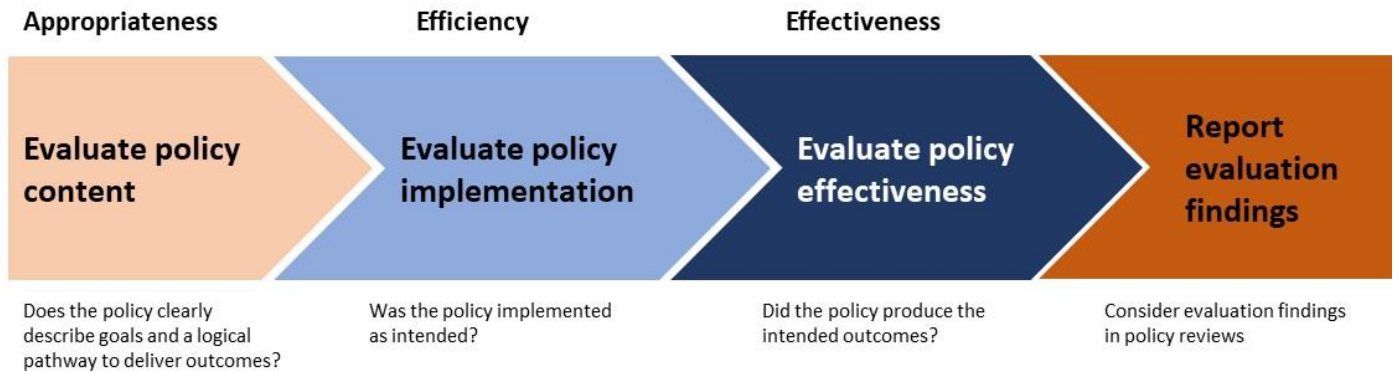


Figure 2: Policy evaluation framework

Appendix 1 – Summary of water sharing plan rules and procedures manuals

What water sharing plans will do	What the procedures manual will document
Define active environmental water	
<ul style="list-style-type: none"> Define the term AEW, including the broad categories of environmental water that will be actively managed 	<ul style="list-style-type: none"> Criteria and process for determining what is AEW Environmental water that will be classified as AEW in each active management river
Manage active environmental water	
<ul style="list-style-type: none"> Require licence holders to notify the Minister if they want to leave water permitted to be taken under their licence in the water source, in accordance with the procedures manual Provide for the water allocation account of an access licence to be debited if water permitted to be taken under the licence is to remain in the water source for environmental purposes, in accordance with the procedures manual 	<ul style="list-style-type: none"> How the volume of AEW entering an unregulated river is determined The water sources or management zones where water can remain in the water source and protected from extraction The process a licence holder must follow to notify the Minister that they want to leave water permitted to be taken in the water source and protected from extraction How the volume of unregulated HEW to be actively managed is determined That the volume debited from an unregulated HEW licence account will be actively managed water through the downstream zones or water sources where it will be classified as AEW That the volume of AEW is to be reduced as it flows through each management zone or water source, based on a proportional share of river transmission losses Account management processes to debit water from an unregulated water allocation account that is to remain in the water source and protected from extraction
Areas where active management may apply	
<ul style="list-style-type: none"> Access rules for water sources under active management will be amended Management zones may be established for active management areas where required 	<ul style="list-style-type: none"> The area to which the procedures manual applies
Adjust access for unregulated river access licences	
<ul style="list-style-type: none"> Provide for an increase in flow class or CtP thresholds by an amount determined by the Minister, to protect AEW from 	<ul style="list-style-type: none"> How the amount of AEW to be protected is determined (including flow forecasting approaches) and how access is adjusted to protect the AEW present – including how CtP thresholds will be

What water sharing plans will do	What the procedures manual will document
<p>extraction and determine a volumetric limit</p> <ul style="list-style-type: none"> • Provide for announcements for flow classes, CtPs and volumetric limits that will apply for a 24-hour period • Provide for establishing procedures manuals • Provide for the Minister to announce a share of the available volume that an individual licence holder can take on a given day • Provide rules that ensure the maximum volume that can be extracted or protected from extraction will be the lesser of the licence holder's individual daily extraction limit (where it exists) or share of the available flow 	<p>adjusted or the volume available to unregulated river access licences will be distributed</p> <ul style="list-style-type: none"> • How announcements are made • What an announcement must contain • Steps required to make an announcement • How any delays in announcements will be managed • How the maximum volume that can be protected from extraction will be the lesser of the licence holder's individual daily extraction limit (where it exists) or how the share of the available flow is determined
Forecast flows and manage uncertainty	
<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • How initial and ongoing losses are estimated • How mismatches in the forecast and actual losses are managed
Adaptive management	
<ul style="list-style-type: none"> • Allow for the amendment of access rules to facilitate active management to share flows, including requiring water be taken in accordance with Ministerial notices or announcements or requiring licence holders to express an interest in accessing their entitlement during an event 	<ul style="list-style-type: none"> • Monitoring and reporting requirements • Reporting and review responsibilities and timeframes • Matters to be considered in the review • Opportunities for improvement • Requirements and processes for the river operator, environmental water manager, licence holder or other stakeholder representatives to present for consideration proposals for changes or improvements to the procedures manuals

Appendix 2 – Sources of uncertainty in flow forecasting

Water use

Expected water use is a significant component of calculating forecast flows. An initial assumption that all licence holders will take all water available to them would result in a conservative estimate of the available volume for downstream reaches. Overestimating extraction would result in a lower volume of water being available to downstream management zones and may even result in a lost opportunity for all extractive users to access the volume in the system.

Unmetered use (where metering is not required), such as access for basic landholder rights, is generally captured in the estimates for river transmission losses.

Expressions of interest and the implementation of greater telemetry requirements will provide river operators with more insight into water use and allow them to run the river more efficiently and accurately.

Tributary inflows

For regulated tributaries, there are well-established processes for forecasting flows, and there is scope to update forecasts as flows travel down these systems.

However, for unregulated tributaries, there is currently no process for forecasting flows that might reach the actively managed rivers. For example, understanding the timing and volume of outflows from the Macquarie Marshes and the Gwydir Wetlands is likely to be less certain than flows from other sources.

While some tributaries of the Barwon-Darling have a flow gauging station near the confluence with the Barwon-Darling, other tributaries' flow gauging stations may be upstream of the confluence, meaning it is necessary to forecast some losses and travel times to estimate the inflows to an actively managed stream.

Further consideration is required to understand the scope for undertaking forecasts and whether any additional flow gauging stations might be needed.

At times, smaller local creeks can have significant flows following heavy local rainfall. These local inflows within an actively managed river may happen quickly and be more difficult to forecast. It is unlikely that these inflows could be measured in many cases, and active management would mean relying on the river operator to assess the unaccounted differences against expected losses, to estimate these inflows.

River transmission losses

River transmission losses include evaporation from the water surface of the river, seepage and evapotranspiration from surrounding vegetation. River transmission losses can vary due to several factors, including antecedent conditions, prevailing climatic conditions and the rate of flow in the river.

Generally, there is less variation in the seepage loss after the flow has been established. But there may be a considerable variation in the initial seepage loss as a result of depleted weir pools and natural river pools filling up following prolonged drought and saturation of the dry bed and banks of the river.

Once flows have been established, and as the bed and banks become saturated, seepage losses are relatively small. These types of losses, which depend on antecedent conditions, may alter from a loss to a gain.

Once water starts to flow out of river banks and across a floodplain, there is a transition period with a relatively small increase in height but a large change in the area inundated. This makes the change in flow difficult to determine. It can also be difficult to estimate losses when flows break out into anabranches in the system.

Determining river transmission losses

River transmission losses cannot be directly measured. For the operational management of rivers, the river transmission losses are estimated as the unaccounted differences between flow recorded at gauges at the top and bottom of the management zone. These unaccounted differences can be unpredictable and vary from day to day.

Forecasts of river transmission losses are normally based on the trends in the unaccounted differences in the preceding days and weeks. When a significant change in river flows occurs, forecast losses might also be based on similar past events.

The unaccounted differences can also be attributed to errors in flow and extraction measurements (for example, a river flow gauge not accurately measuring flow) or routing effects (for example, where losses vary due to a change in the flow path and travel times).