Department of Climate Change, Energy, the Environment and Water

Intersecting Streams held environmental water extraction risk assessment

March 2025



Acknowledgement of Country



Department of Climate Change, Energy, the Environment and Water acknowledges the traditional custodians of the land and pays respect to Elders past, present and future.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

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1 Summary

1.1 NSW committed to better management of held environmental water through the Intersecting Streams

As part of the Intergovernmental Agreement on Implementing Water Reform in the Murray–Darling Basin 2019 (IGA 2019), the NSW Department of Climate Change, Energy, the Environment and Water (the department) committed to better management of held environmental water (HEW) crossing the Queensland–NSW border into the Intersecting Streams water sharing plan area. At the time of the commitment, it was uncertain whether active management rules were required in the Intersecting Streams, due to assumed low extraction rates and a lack of flow gauging. Given the uncertainty, the department committed to assessing whether active management rules were required to protect HEW instream for environmental purposes.

1.2 The risk of HEW extraction is low, with 0–5% of HEW at risk of extraction in historic events

The department has assessed the current risk of HEW, arriving from Queensland, extraction by unregulated licence holders in NSW based on current extraction rates and historical HEW flows from the period 23 Nov 2021 – 9 May 2024. The assessment used two scenarios – (1) 'HEW historic' representing historic HEW events in a total flow scenario and (2) a HEW-only, conservative scenario where non-HEW flows were removed from the total daily flow. NSW HEW was not considered in the assessment as NSW HEW entitlements only exist at the lower end of the Warrego, where there are no extraction risks.

The results in Figure 1 show the risk is 'low' (that is, 0–5% of annual Queensland HEW flows at risk of extraction) in the Moonie, Narran and Culgoa water sources for both the historic HEW and HEW only scenarios, 'low' in the Warrego for the historic HEW scenario but 'medium' (5–10% of annual Queensland HEW flows at risk of extraction) in the Warrego for the conservative HEW only scenario. Only one water access licence (WAL) in the Narran and 2 WALs in the Warrego were identified as 'active' across the NSW Intersecting Streams. The assessment was not required for the Paroo or Yanda water sources as they do not transmit HEW flows.

1.3 A HEW loss accounting arrangement, with ongoing extraction risk monitoring, will enable HEW to be recognised and protected into the Barwon–Darling

Given the low extraction risk, HEW protection under active management rules is currently not recommended. It is recommended that:

• volumes of Queensland and NSW HEW that arrive in the Barwon–Darling (minus transmission losses) be recognised and protected under active management rules already implemented there, and

the department monitors for any change in extraction risk in the Intersecting Streams using
remote sensing and telemetered extraction data. If the risk changes, temporary water
restrictions are available and active management can be reconsidered, noting that
implementation barriers for active management due to data limitations are likely to persist due
to high costs to resolve the issue.

The department is currently developing a HEW loss accounting arrangement to estimate Queensland and NSW HEW arriving from the Intersecting Streams to the Barwon–Darling and will be consulting with key stakeholders on this accounting arrangement in the 2024–25 water year.



Figure 1. Extraction risk to HEW at the water source level in the NSW Intersecting Streams

2 Introduction

2.1 NSW's commitment to better management of northern Basin HEW

As part of the Intergovernmental agreement on water reform in the Murray–Darling Basin 2019 (IGA 2019), the department committed to several 'Toolkit' measures to allow HEW recovered for the environment to remain instream for environmental purposes. Measure 2 to protect environmental water included better management of Queensland and NSW HEW in the Intersecting Streams, requiring a method to account for HEW arriving at the Queensland-NSW border, so that it 'could be incorporated in arrangements to actively manage held environmental water instream through the Barwon–Darling'.

In December 2020, NSW implemented active management rules to protect 'active environmental water' (AEW)¹ from extraction in the unregulated Barwon–Darling, Macquarie–Bogan and Gwydir (DPE 2020). Initially, the NSW Intersecting Streams were considered, but without a method to account for environmental water crossing the Queensland-NSW border, no further action was taken at that time.

In 2021, NSW and Queensland implemented an accounting method to recognise HEW arriving at the Queensland–NSW border via the Border Rivers, Moonie, Culgoa and Warrego water sources, with data available from 1 July 2021. The method identifies gifted and non-gifted² Queensland HEW. Since the cross-border accounting method was implemented, NSW has been gathering information and developing a solution to manage Queensland HEW through the Intersecting Streams and into the Barwon–Darling, minus transmission losses. As part of this process, NSW has considered whether active management rules should be implemented in the Intersecting Streams water sources (Figure 2). NSW began protecting non-gifted Queensland HEW from the Border Rivers into the Barwon–Darling in September 2023, since the 2021 cross border accounting method already reported HEW to the Mungindi gauge in the Barwon–Darling water source.

2.2 Risk-based approach to active management expansion in NSW

The department is taking a risk-based approach when determining new areas where active management rules should be implemented. The risk-based approach aligns with the objectives and principles in the *Active Management in Unregulated Rivers Policy 2021* (DPE 2021), specifically that implementation should be 'evidence based and outcomes focused' as well as 'simple, practical and cost effective'.

The department has developed an extraction risk assessment method and has applied it to determine the proportion of Queensland HEW (including gifted and non-gifted HEW) at risk of extraction by unregulated licence holders, given the policy does not protect HEW from extraction under basic landholder rights or domestic and stock licences. The risk assessment method uses evidence of unregulated licence extraction and historic HEW events. The results of the risk assessment are then used to decide whether active management implementation is required, given active management's resource intensive implementation.

2.3 Data limitations in the NSW Intersecting Streams

Significant data limitations exist in the NSW Intersecting Streams. Currently water use is self-reported and not automatically compiled. There is also limited gauging. The ephemeral streams can also impact the quality of gauging data and geomorphology limits suitable flow reference points for additional gauges.

¹ 'Active environmental water' (AEW) – water in the water source identified or determined by the Minister on any given day as requiring protection from extraction, in accordance with the active management procedures manuals. AEW includes held environmental water from upstream water sources and some planned environmental water.

² Non-gifted HEW refers to Queensland HEW recognised by the NSW Government and gifted HEW refers to Queensland HEW not currently recognised by the NSW Government.

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Figure 2. Intersecting Streams water sources showing the gap in arrangements to manage HEW between Queensland and the Barwon–Darling. Reporting location refers to the Queensland HEW reporting location, where the NSW HEW arrangement would begin.



2.4 Background

2.4.1 Hydrology and climate

The NSW Intersecting Streams water sharing plan area comprises 6 surface water catchments or water sources (Figure 1). The Paroo River, Warrego River, Culgoa River, Narran River and Moonie River originate in Queensland and flow across the border into NSW, while Yanda Creek occurs entirely within NSW. Each water source is ephemeral, providing intermittent connecting flows to the Barwon–Darling system during wetter periods. The fluvial processes of these water sources and the shifting nature of the streams mean that river channels are more dynamic and not well defined, which makes accurate flow gauging a challenge.

The climate of the area is characterised by hot summers and mild winters. The average annual rainfall across the Intersecting Streams ranges from 280 mm in the west to 425 mm to the east. Rainfall is variable, resulting in intermittent river flows. Significant flow events are generally a result of heavy rainfall in the elevated headwater areas rather than runoff from lowland areas.

2.4.2 Land use and irrigation

Irrigated cropping in the Intersecting Streams area occurs mostly in Queensland, and in NSW primarily along the Barwon–Darling River although under Barwon–Darling unregulated entitlements. A preliminary water source level review of satellite imaging and land use mapping showed minimal irrigation development and on-farm storages in the NSW Intersecting Streams. Water use and entitlement utilisation is low across the NSW Intersecting Streams. Water use is self-reported in the Intersecting Streams and there is currently no metering data available.

2.4.3 Entitlements

Table 1 summarises HEW and non-HEW unregulated entitlements by water source in the NSW Intersecting Streams plan area, unregulated WALs with approved pumps and HEW recovered in upstream Queensland water sources. Across the Intersecting Streams there is a total of 36 unregulated WALs, 19 with entitlements less than 100 ML, 7 with entitlements between 100–500 ML and 9 with entitlements between 500–1,000 ML.

Table 1. NSW Intersecting Streams unregulated annual HEW and non-HEW entitlements data by water source and upstream Queensland HEW. All HEW entitlements are held by the Commonwealth.

QLD Water Plan area	NSW Intersecting Streams WSP Water Source	Avg. Annual Discharge ³ (ML)	NSW Unregulated Non-HEW entitlement⁴ (ML)	NSW Number of Unreg. WALs with pump	Upstream QLD HEW ⁵ recovered (ML)	HEW entitlement in NSW
Border Rivers and Moonie	Moonie River	71,000	1,047	2	5,671	0
Condamine and Balonne	Narran River and Culgoa River	242,000	8,834 (Narran) 2,979 (Culgoa)	18 (Narran) 12 (Culgoa)	75,299 ⁶	0
Warrego, Paroo, Bulloo and Nebine ⁷	Warrego River	58,000	3,755	6	39,455	17,826 ⁸
Warrego, Paroo, Bulloo and Nebine ⁹	Paroo River	0- ¹⁰	791	4	0	0

³ MDBA 2011

⁴ Entitlement is based on active WALs as defined in the WaterNSW (2011) Water Licensing System.

⁵ Supplemented entitlement as of 30 September 2023, Source (DCCEEW, 2023a). This includes both gifted and non-gifted HEW.

⁶ Includes HEW from Condamine-Balonne and Nebine and excludes overland flow entitlement in Condamine-Balonne.

⁷ The Nebine river in Queensland flows to the NSW Culgoa water source

⁸ Includes 8,106 ML of unregulated river entitlement and 9,720 ML special additional high flow entitlement. The HEW WAL is linked to a works approval at the end of the Warrego River, so there is no risk of extraction to NSW HEW.

⁹ The Nebine river in Queensland flows to the NSW Culgoa water source

¹⁰ The Paroo River rarely flows to the Barwon–Darling system so, in absence of sufficient data, inflows from Paroo are assumed to be zero.

The Commonwealth Environmental Water Holder (CEWH) holds entitlements upstream of the NSW Intersecting Streams WSP area in the Condamine–Balonne, Moonie, and Warrego River systems. Most of this entitlement is unsupplemented (known as 'unregulated' in NSW) and overland flow entitlement, particularly in the Condamine–Balonne. The CEWH is the only environmental water holder in the Queensland Murray–Darling Basin. The 3 primary water sources where CEWH HEW will be transmitted through the Intersecting Streams to the Barwon–Darling are the Warrego, Culgoa and the Moonie water sources. The Narran water source only connects to the Barwon–Darling in extremely wet events, and the Paroo water source neither transmits Queensland HEW or has NSW HEW entitlements.

CEWH entitlements within the NSW Intersecting Streams are held in the Warrego River water source only, primarily at Toorale Station, close to the junction of the Warrego River and the Darling River. CEWH HEW in the Warrego equates to 8,106 ML under unregulated river access licences and 9,720 ML under unregulated river (special additional high flow) access licences.

3 HEW extraction risk assessment

3.1 Method

A 3-step method¹¹ was used to assess the current Queensland HEW (gifted and non-gifted) extraction risk in the NSW Intersecting Streams. The 3 steps were:

- 1. Identify active unregulated WALs that could extract a significant volume of any instream Queensland HEW in the Intersecting Streams using a decision tree
- 2. Quantify the proportion of Queensland HEW that could have been extracted by the active unregulated licences during historic HEW events in a total flow (actual) scenario and HEW-only (conservative) flow scenarios
- 3. Rate the risk to Queensland HEW using the proportion from step 2 and the overall risk rating matrix (Table 2).

3.1.1 Method – step 1: identify active WALs

A decision tree was used to identify current extraction in each water source by eliminating inactive WALs and WALs with insignificant impact on HEW (see Appendix A: Step 1 – identify active WALs). Any WALs determined to be 'active', or to have 'significant impact on HEW' were included in step 2. If the outcome of the decision tree suggested the WAL was either inactive, or would have insignificant impact, then no further assessment was undertaken for that WAL. If no WALs were identified as active or significant for a water source, that water source did not undergo step 2. Water use surveys undertaken in this step were also used to confirm extraction behaviour and confirm pump capacity, where possible.

¹¹ This risk assessment differs from the risk assessments used in the <u>surface water risk assessments</u> due to the scale (current risk compared to future risk) and the specific nature of assessing HEW extraction risk only.

3.1.2 Method – step 2: quantify the proportion of HEW at risk of extraction

For step 2, modelling was required to determine the HEW component of flows along each water source. A simple hydrologic model was used to model 2 scenarios at a daily timestep — (1) historic HEW events in a total flow scenario and (2) a HEW-only, conservative scenario where non-HEW flows were removed from the total daily flow. The model used gauged flow data and all reported volumes of Queensland HEW (gifted and non-gifted) arriving at the Queensland border, both at a daily time-step, over the period 23 Nov 2021–9 May 2024. Routing and proportional losses were applied to the HEW based on flow relationships between gauges.

Once the modelling was completed, the proportion of HEW at risk of extraction was determined at relevant gauges using the following method:

- 1. **Estimate non-HEW component of flow**: subtract the modelled HEW component from total daily flow to estimate the non-HEW proportion of daily flow from the relevant gauge. This step is not required for the HEW only scenario.
- 2. Assess if extraction is permitted: apply the water sharing plan rules and/or associated works approval conditions to the total daily flow rate to assess if extraction is permitted.
- 3. Estimate possible daily extraction: if extraction is permitted, first subtract the possible daily extraction volume¹² from the non-HEW component of flow, then subtract any remaining possible daily extraction volume from the HEW component.
- 4. In the case that the HEW component triggers increased pumping days: compare take with and without HEW in the system. Extraction only available due to HEW presence is considered HEW extraction.
- 5. Estimate HEW volumes and possible extracted HEW volumes across the period: sum both the HEW daily volumes and the possible HEW extracted volumes for all days across the period at the relevant gauges.
- 6. Estimate the proportion of HEW at risk of extraction: divide the possible extracted HEW volume by the total HEW volume for the entire HEW delivery period to estimate proportion of HEW at risk from extraction.

3.1.3 Method – step 3: apply water source risk rating

Using the proportion of HEW at risk of extraction from step 2, risk ratings were applied to each water source using the matrix in Table 2. The risk ratings are consistent with internal departmental methods to assess HEW extraction risks in unregulated rivers. The water sources with no WALs identified as active or significant are assigned a low-risk rating.

¹² As described from user surveys (descried in the Identification of extraction section of this report) or if the user survey is non-descript — the maximum pumping capacity specified in the work approval. The latter is known to overestimate actual extraction and is considered a worst-case scenario. See Appendix B for extraction assumptions.

Table 2. Overall risk rating matrix based on current proportion of HEW at risk from extraction

Proportion of HEW at risk of extraction	Risk rating
0-5%	Low
5-10%	Medium
>10%	High

3.2 Results

3.2.1 Results – step 1: identify active WALs

Only 1 WAL in the Narran and 2 WALs in the Warrego were identified as 'active' across the NSW Intersecting Streams. No active licences were identified in the Moonie or the Culgoa and therefore Step 2 was not required for these water sources (Table 3). The step-by-step identification of these WALs is described in Appendix A: Step 1 – identify active WALs.

Table 3. Results from Step 1 – identify active WALs

Water source	Proceed to Step 2 (Yes/No)
Moonie River	No
Culgoa River	No
Narran River	Yes
Warrego River	Yes
Paroo River	No

3.2.2 Results – step 2: quantify the proportion of HEW at risk of extraction

Table 4 shows that less than 1% of Queensland HEW in the Narran (0.6%) and Warrego (2.9%) was at risk of extraction in the HEW historic scenario, while higher proportions were at risk in the conservative HEW only scenario (2.7% Narran and 9.3% Warrego). A summary of historic Queensland HEW events used in the risk assessment, along with the relevant extraction assumptions and conditions of take are described in Appendix B: Step 2 – quantify proportion of HEW at risk of extraction.

For context, preliminary hydrological modelling for the HEW accounting method estimated total transmission losses during flow periods in the Warrego and the Narran are 64% and 45% respectively.

Table 4. Proportion of HEW at risk of extraction in the Narran and Warrego water sources based on historic HEW events and a hypothetical HEW only scenario

Water source	Scenario	HEW at QLD border (avg. ML/yr)	Potential unregulated extraction (avg. ML/yr)	Potential unregulated HEW extraction (avg. ML/yr)	Proportion of HEW at risk of extraction (avg. ML/yr)
Narran River	HEW historic	14,754	740	77	0.6%
Narran River	HEW only	14,754	607	607	2.7%
Warrego River	HEW historic	8,882	3,125	252	2.9%
Warrego River	HEW only	8,882	829	829	9.3%

3.2.2.1 Narran

For the HEW historic scenario, results for the period 23 Nov 2021–9 May 2024 indicate 0.6% of the HEW could have been extracted due to unregulated licence extraction (Figure 3) since nearly all extraction could be met from the non-HEW flow. There were only 8 days where the extraction may have impacted on HEW. Daily extraction would have to increase to 240 ML/day before the HEW impact would reach 5%. For historic delivery, the high risk was for an event in February 2024, where the risk reached 4.7%. No other delivery had a risk exceeding 1%.

In the conservative HEW only scenario, the proportion of HEW at risk of extraction increased to 2.7%. The small increase from 0.6% to 2.7% was due to low extraction rates in the Narran.

HEW events generally represented a small proportion of total flow (Figure 3). At a daily timestep, the proportion of HEW at risk of extraction increased where HEW formed all or most of the flow, particularly at lower total flow rates (for example, 18 April 2024¹³ in Figure 3), however, the HEW only scenario results explain the risk is less significant at an annual timestep. The historic event-by-event HEW results can be seen in Appendix C.

¹³ Note that 18 April 2024 in Figure 3 demonstrates a limitation in the HEW modelling, since HEW flows cannot be greater than total flows

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Figure 3. Estimated HEW component of flows and total flows at the Narran Park gauge 25 Nov 2021-9 May 2024. (Note that the HEW volume on 18 April 2024 demonstrates a limitation in the HEW modelling, since HEW flows cannot be greater than total flows)



3.2.2.2 Warrego

The HEW historic results indicate that for 25 Nov 2021-3 Mar 2024, less than 2.9% of the HEW could have been extracted from unregulated licence take (Table 4). Most extraction demand could be met from non-HEW flow.

There was one event over the assessment period where extraction may have impacted HEW above 5% (the historic event-by-event HEW results can be seen in Appendix C). It is unlikely that extraction would increase to a level where HEW risk would reach 5% more frequently, as the remaining consumptive licences have relatively small entitlements and there is only one special additional high flow licence.

The historic HEW events varied in size, however, HEW was generally only a small proportion of total flow (Figure 4). At a daily timestep, the proportion of HEW at risk of extraction increased where HEW formed all or most of the flow, particularly at lower total flow rates (for example, November 2022 in Figure 4).

For the HEW only scenario, the risk of take increased to 9.3% of HEW. The current cease to pump in place for the special additional high flow unregulated river licence in the Warrego prevented some extraction of HEW, limiting the impact to below 10% of HEW. Based on current extraction, if HEW is delivered with at least an additional 200 ML/d of non-HEW in the system (after losses) the unregulated licence demand (based on the pumping capacity of the active user) can be satisfied.

Figure 4. Estimated HEW component of flows and total flows at the Barringun No2 gauge 25 Nov 2021 – 3 Mar 2024



3.2.3 Results – step 3: water source risk rating

Applying the risk matrix, the risk of unregulated take of HEW (Table 5) is:

- low risk in the Culgoa and Moonie as no significant extraction was identified in Step 1
- low risk in the Narran for both historic HEW deliveries and HEW only events
- low risk in the Warrego for historic HEW deliveries and medium for HEW only events.

Table 5. Overall risk ratings of unregulated take on HEW for Intersecting Streams water sources

Water source	Risk rating			
	HEW historic scenario	HEW only scenario		
Moonie River	Low*	Low*		
Culgoa River	Low*	Low*		
Narran River	Low	Low		
Warrego River	Low	Medium		
Paroo River	N/A	N/A		

* Step 2 not undertaken as no active WALs identified in Step 1.

4 Recommendations

4.1 Recommendation 1 – active management in the Intersecting Streams is not required

There is currently no requirement for development and implementation of active management in the Intersecting Streams water sources to protect flows as:

• the risk of unregulated extraction of HEW is 'low' in all water sources, except for the Warrego under a HEW only hypothetical scenario where the risk is 'medium'

- it is unlikely that total annual unregulated licence extraction would occur during future HEW only events, as modelled in the HEW only hypothetical scenario
- where the risk is 'medium' for HEW only events, other measures can be taken, specifically a temporary water restriction under section 324 of the *Water Management Act 2000*. Section 324 orders can be applied to restrict unregulated licence extraction for events where the Minister for Water determines they are in the public interest, noting the order will not prevent HEW flow from being captured by fixed crest block banks.

In addition to the risk assessment findings above, there are other limitations and requirements that would need to be addressed even if the extraction risk increased in any water source. These have significant lead times and include:

- additional gauging and improved data quality at existing gauges (note that significant investment is required to improve gauging)
- increased metering and reporting coverage to enable compliance with any active management rules
- changes to the Intersecting Stream WSP would be required to enable active management implementation
- changes to licence conditions to include cease to pump thresholds and active management provisions
- development of Intersecting Streams active management procedures to guide WaterNSW's implementation of active management.

4.2 Recommendation 2 – implement a HEW loss accounting arrangement and monitor for changes in risk

Implementing a HEW (Queensland and NSW HEW in the Warrego) loss accounting arrangement can ensure the estimated volume of HEW transmitting through the Intersecting Streams is protected on arrival to the Barwon–Darling water source where active management rules are already implemented.

The benefits of implementing a HEW loss accounting arrangement are that it:

- is relatively simple and quick to implement by the river operator (WaterNSW)
- can be developed from an existing simplistic hydrologic routing model
- extraction risks can be managed through adaptive management.

The HEW loss accounting arrangement can manage increased extraction risk in the future by including a risk monitoring plan. The risk monitoring plan can include regular review of the extraction risk across the Intersecting Streams. The review can utilise additional data as it becomes available from the:

- non-urban metering program to improve monitoring and compliance of extraction,
- the remote sensing portal to estimate irrigation area and water storages, and
- the Long Term Average Annual Extraction Limit project which uses modelling and remote sensing to better understand compliance with the extraction limit.

If the review finds that the risk has significantly increased, active management implementation can be reconsidered.

5 Appendices

5.1 Appendix A: Method Step 1 – identify active WALs

5.1.1 Decision tree and detailed method

Figure 5 shows the decision tree used to identify active WALs, with the corresponding steps detailed below.

Figure 5. Decision tree to identify active entitlement with potential to impact HEW



- 1. Entitlement: Water sources where Queensland HEW transmits through were excluded from step 2.
- 2. Entitlement associated with relevant work approval: WALs significant enough to materially impact HEW (>1% of HEW entitlement in that water source) that were attached to a pump approval were investigated further. All other entitlements were classified as inactive or to have an insignificant impact on HEW, and were excluded from step 2.
- 3. Water user surveys: In-order to confirm active licences, an online survey was conducted, followed by targeted water user surveys for larger WAL holders (where possible those identified in step 2). Licences that were confirmed as active were included in step 2, licences that were confirmed as insignificant and no further assessment was required. Where no further information was obtained on a licence from interviews, it progressed to the next round of assessment.
- 4. Land use mapping: The land use classification layer (DCCEEW 2023b) was used to exclude any properties with a WAL and pump where there was no grazing, cropping or irrigation. Where there was grazing, cropping or irrigation present, remote sensing analysis was undertaken.
- 5. Remote sensing analysis: Remote sensing analysis was undertaken on licences where land use classified properties attached to the WAL were classified as irrigation, cropping or grazing. The monthly average evapotranspiration (WaPOR 2024) for each land use class in a property attached to the WAL was compared to the monthly regional precipitation sourced (Commonwealth Bureau of Meteorology 2024a). Where the evapotranspiration exceeded the precipitation, it was considered that irrigation is possible, and these licences could not be excluded. The analysis was undertaken from 2021-2024.
- 6. Overbanking: Where the evapotranspiration exceeded the precipitation, evidence of overbanking was investigated. The period in which evapotranspiration was occurring at a higher rate than precipitation was checked for upstream flood warnings (Commonwealth Bureau of Meteorology 2024b), as it is assumed that the moisture from overbank flows explains the higher evapotranspiration. The flood warning level was also compared to the gauged flow level. If the flow level was higher than the flood level upstream, these WALs were excluded from step 2.

5.1.2 Detailed results from step 1

Table 6 shows results of the decision tree steps to identify active WALs, with descriptions below.

Decision tree #	Decision tree # summary	Moonie River	Narran River	Culgoa River	Warrego River	Paroo River
-	Total WALs	2	18	12	6	4
1	HEW present/ transmitted	0	0	0	0	4 (No HEW present or transmitted)
2	Entitlement associated	0	10	9	4	-

Table 6. Results from the decision tree to identify active WALs

	with work approval					
3	User survey*	0	5	1	0	-
4	Land use	0	0	0	0	-
5	Remote sensing	0	2	2	2	-

*Take was confirmed for 1 entitlement in the Narran and 2 entitlements in the Warrego and no further analysis was required

1. Entitlement

The Paroo transmits no Queensland HEW and holds no NSW HEW, and therefore was excluded from further analysis. All other water sources were progressed.

2. Entitlement associated with relevant work approval

Table 7 shows the WALs associated with a pump approval that are greater than 1% of total HEW entitlement for that water source, which will therefore be included in the next stage of assessment. All other licences were excluded from further assessment. The sum of entitlement excluded from further assessment totalled less than 1% of HEW entitlement in the Culgoa and the Warrego, and 1.3% of the HEW entitlement in the Narran.

All entitlement types were unregulated river shares, except for one special additional high flow unregulated river licence in the Warrego.

Water source	Significant entitlement - Unit shares with potential to impact HEW (associated with a relevant work approval and pump)	Combined shares of all other unregulated WALs
Moonie River	2 unregulated river WALs with total shares of 1,063 ML	None
Culgoa River	3 unregulated river WALs with shares of 2,545 ML	1,490 ML (less than <1% of HEW entitlement)
Narran River	7 unregulated river WALs with shares of 6,022 ML	0
Warrego River	2 unregulated river WALs of 3,402 ML (one special high flow class)	353 ML (<1% of HEW entitlement)

Table 7. WALs with an associated pump approval identified in the Intersecting Streams water sources

3. Water use surveys

Online survey

The department surveyed WAL holders about their water use behaviour, water supply works and storage capacity. Only 2 users responded to the online survey indicating some past extraction, no current extraction, and some possible future extraction.

Targeted water user interviews

In response to low survey uptake, targeted interviews were held with 6 water users with larger unregulated entitlements in the Narran, Culgoa and Warrego systems. The interviews confirmed the following extraction that will be included in step 2:

- In the Narran, 1 licence holder described their water extraction behaviour.
- In the Warrego, 1 licence holder described their water extraction behaviour for their 2 WALs.
- Other licence holders indicated no recent extraction under unregulated licences, except under small stock and domestic licences or extraction under basic landholder rights. These licences were then classified as low risk.

Some surveyed water users mentioning that the lack of reliable water limits their opportunity to irrigate crops. All other licences where extraction was not determined were progressed for further assessment.

4. Land use mapping

All WALs in this round of assessment contained either grazing or cropping (non-irrigated) and therefore progressed to remote sensing analysis.

5. Remote sensing analysis

The assessment indicated that no WALs were attached to a property where the evapotranspiration exceeded precipitation (see example in Figure 6). One licence in the Moonie indicated potential irrigation in neighbouring properties, but not on the property attached to the WAL. These 2 WALs progressed to an overbanking assessment. All other properties attached to WALs had evapotranspiration that followed precipitation trends, meaning they are unlikely to be irrigating recently, so those WALs were classed as low risk.





6. Overbanking

The overbanking analysis was used to investigate 2 properties — one property attached to the licence in the Narran where irrigation could not be ruled out, and one property adjacent to a WAL in the Moonie. The Moonie property appeared to be subject to an overbanking event. The Narran property had no evidence of overbanking and was included in step 2.

5.2 Appendix B: Method Step 2 – quantify proportion of HEW at risk of extraction

Table 8 summarises the annual HEW (gifted and non-gifted) volume accounted at the Queensland and NSW border. Table 9 describes relevant cease to pump rules that were taken from the water sharing plan and applied in Step 2 of the risk assessment. Daily extraction capacity and entitlement was taken from confidential surveys with water users.

Table 8. Historic annual HEW (gifted and non-gifted) volume accounted at the Queensland and NSW borders for the risk assessment analysis period

Queensland Catchment	NSW WSP water source	Transmission river	Volume accounted (ML) 2021–22	Volume accounted (ML) 2022–23	Volume accounted (ML) 2023–24
Moonie	Moonie	Moonie River	4,439	3,655	3,865
Condamine and Balonne*	Narran	Narran River	45,630	18,325	14,488
Condamine and Balonne	Culgoa	Culgoa River	121,031	36,699	33,110
Condamine and Balonne	Culgoa	Briarie Creek	23,145	11,614	11,196
Condamine and Balonne	Culgoa	Ballandool River	22,947	10,144	4,712
Condamine and Balonne	Culgoa	Bokhara River	7,253	2,652	2,184
Nebine	Culgoa	Nebine River	5,920	5,920	5,920
Warrego	Warrego	Warrego River	13,203	10,083	10,043
Total			243,568	99,092	85,518

*Total volume accounted for Condamine and Balonne catchment was 220,006 ML, 79,434 ML and 65,690 ML for the 2021–22, 2022–23 and 2023–24 water years respectively—corresponding to the sum of volumes for the Condamine and Balonne transmission rivers. Note that non-gifted QLD HEW from the Border River is already protected into the Barwon–Darling.

Table 9. Conditions of take stipulated in the water sharing plan or water access licence

Water source	Management zone	Cease to pump as per WSP or licence conditions
Narran River	Narran River Tributaries	None
Narran River	Zone 1	170 ML/d at the Angledool No2 gauge

Water source	Management zone	Cease to pump as per WSP or licence conditions
Narran River	Zone 2	115 ML/d at the Wilby Wilby gauge
Narran River	Zone 3	10 ML/day at the Narran Park gauge
Warrego River	n/a	None for unregulated licences
Warrego River	n/a	750 ML/day at the Barringun No. 2 gauge for special additional high flow licence
Warrego River	n/a	Cease to pump as per WSP or licence conditions

5.3 Appendix C: Results Step 2 – quantify proportion of HEW at risk of extraction

Table 10. Extraction risk for historic HEW (gifted and non-gifted) deliveries by delivery event in the Narran water source

HEW delivery event	HEW delivered (ML/event)	Potential unregulated HEW extraction (ML/event)	Proportion of HEW at risk of extraction (%)
Nov-21	42,823	70	0.16%
Feb-22	580	-	0.00%
Mar-22	2,227	-	0.00%
Jul-22	15,904	40	0.25%
Oct-22	2,421	-	0.00%
Feb-24	2,542	120	4.72%
Apr-24	11,946	-	0.00%

Table 11. Extraction risk for historic HEW (gifted and non-gifted) deliveries by delivery event in the Warrego water source

HEW delivery event	HEW delivered (ML/event)	Potential unregulated HEW extraction (ML/event)	Proportion of HEW at risk of extraction (ML/event)
Nov-21	10,311	877	8.51%
Feb-22	1,300	-	0.00%
May-22	1,592	-	0.00%
Sep-22	7,393	29	0.39%

HEW delivery event	HEW delivered (ML/event)	Potential unregulated HEW extraction (ML/event)	Proportion of HEW at risk of extraction (ML/event)
Feb-23	2,690	51	1.91%
Jan-24	610	-	0.00%
Feb-24	2,750	-	0.00%

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