Reasonable Excuse Report – Barwon-Darling 2020/21 Sustainable Diversion Limit Compliance

A report to the Murray Darling Basin Authority setting out reasons for actual take exceeding permitted take by more than 20% for the 2020/21 compliance period.

Executive Summary

NSW has completed the 2020/21 annual assessment of compliance with the Sustainable Diversion Limit (SDL) in the Barwon-Darling as required in chapter 6 of the Basin Plan. The cumulative Annual Actual Take (AAT) exceeds the Annual Permitted Take (APT). This exceedance, prior to any adjustments for incomplete recovery, is 39% of the long-term average SDL. This is higher than the 20% exceedance trigger specified by the Basin Plan. The majority of the take during this reporting period is from B class and C class licences, which access medium to higher flows. The SDL is required to be calculated annually on the basis of full recovery and will differ to SDL volumes in the cumulative register which are adjusted for incomplete recovery and to reflect updated information over time.

NSW claims reasonable excuses RE1.2 (Discover) and RE4 (incomplete recovery) under the *Sustainable Diversion Limit Reporting and Compliance Framework* published by the Murray Darling Basin Authority (MDBA) in November 2018[1].

NSW has identified the main cause for the exceedance as:

- New meters have been fitted to nearly all major Barwon-Darling works and preliminary results from investigations of the relationships between new and old meters indicate that the new meters generally read higher than previous meters over equivalent pumping events. The model used in the APT method was calibrated to match the figures returned by the previous meters so there is an inconsistency between modelled and actual take. If this were corrected, there would be a substantial increase in the APT, reducing the exceedance.

In addition to this major issue, the Commonwealth has not completed 1.6 GL of the planned 32 GL recovery target in the Barwon-Darling.

NSW identified this metering issue along with other issues during the 2019/20 SDL Compliance assessment and was directed by MDBA to undertake several “make good” actions in response to the breach. This included a number of short and longer-term tasks. The actions planned for the 2020/2021 water year have been delivered, including a major change to the APT method to correctly represent temporary water restrictions. This required the removal of past modelled embargo behaviour that is no longer used following the construction of the Broken Hill pipeline.

A suite of make good actions were identified relating to meter error. For the 2020/21 assessment, the actions required an analysis of how a metering adjustment would change compliance outcomes. This reasonable excuse report demonstrates that by applying the best available information on the relationship between the old and new meters, the Barwon-Darling would be SDL

[1] https://www.mdba.gov.au/publications/policies-guidelines/sustainable-diversion-limit-reporting-compliance-documents

compliant for the 2019/2020 and 2020/2021 assessment period. This analysis also shows that in the most recent year, the AAT is lower than the APT by a small amount.

NSW will continue to progress the "make good" actions to recalibrate the APT model and update the metering data prior to our 2021/22 SDL compliance assessment which is expected to reduce the cumulative balance to zero. This report describes the steps being undertaken to reduce the cumulative balance to zero. If the steps described in the report are insufficient to reduce the cumulative balance to zero NSW is able to curtail the Available Water Determination (AWD) to reduce diversion in future years through clause 36 of the Barwon-Darling water sharing plan. If necessary, NSW may also undertake discretionary measures in advance, or in addition to, the required actions to bring take in the Barwon-Darling within the relevant limits.

Summary of Compliance Accounting Outcomes

The cumulative Barwon-Darling AAT for 2019/21 is higher than the SDL 20% trigger. NSW has identified the causes for the exceedance as:

1. New meters were rolled out across the Barwon-Darling system in the last 10 years. The new meters are reported to read higher on average across the whole metering fleet than previous meters over equivalent pumping events. The model used in the APT method was calibrated to match the figures returned by the previous meters. This results in inconsistencies between the current recorded diversion volumes and what is reflected in the model.
2. The Commonwealth has not completed 1.6 GL of the planned 32 GL recovery target in the Barwon-Darling. NSW has placed no restrictions or limitations on Commonwealth water purchases in this system and hence the incomplete recovery is beyond NSW control.

The SDL exceedance is summarised as follows:

- The long-term SDL is currently calculated as 176,228 ML for the Basin Plan assessment period of 1895 to 2009, and the 20% exceedance trigger is 35,246 ML.
- The cumulative difference between the AAT and APT is 68,728 ML or 39% of the long term sustainable diversion limit (SDL) prior to accounting adjustments for any incomplete recovery.

Table 1 compares the actual measured and estimated take with the modelled permitted take.

Table 1 - Comparison of AAT and APT volumes for the 2020/21 water year

Type	Annual Actual Take (ML)	Available account at end of year (ML)	Annual Permitted Take (ML)
A class	11,047[1]	17,475	10,191
B class	162,800[1]	175,788	131,867
C class	18,037[1]	98,311	33,426
(Total Watercourse)	(191,884)	(291,574)	(175,824)
"Geera"	4,804	N/A	(3,037[3])
Local Water Utility	1,916	3,444	2,333

Domestic & Stock	53	916	2,660
Floodplain Harvesting	7,775[2]	N/A	6,446
Basic Rights	826	N/A	826
Total	**207,258**		**187,749**

Table note 1 As supplied in the spreadsheet *Account_balance_summaries_202021_4modelling.xlsx* by the Water Accounting team for s71 compliance. These figures are consumptive use only.

Table note 2 Floodplain harvesting usage is estimated as the unscaled modelled floodplain harvesting produced by the APT model component. This method differs from the 2019/2020 assessment and was directed to be applied by MDBA for the 2020/2021 assessment year. It is expected that the metering of actual take will occur as the Healthy Floodplains program is completed in the Barwon-Darling.

Table note 3 The Barwon-Darling model includes a representation of take in the Lower Macquarie unregulated water source by the property "Geera". This take has been considered in the past as a Barwon-Darling diversion right through Cap, BDL & Basin Plan development, but is now identified as incorrectly included. As directed by MDBA, the metered take at the "Geera" Macquarie pumps has been added to Barwon-Darling compliance assessment for the first time in 2020/2021 as an interim step that improves the robustness of the compliance by ensuring that "Geera" take is reflected in both AAT and APT. The number is included in the B class total.

The assessed AAT exceeds the APT in 2020/2021 by 19,509 ML. The balance carried forward from 2019/2020 is -49,219 ML for a total balance of -68,728 ML. The 2020-21 cumulative balance has been further adjusted for incomplete recovery in 2019-20. This brings the balance to -66,789ML. The balance is not adjusted for incomplete recovery in 2020-21 and hence this forms part of the reasonable excuse. After reviewing this claim, MDBA can add an adjustment to the following water year's assessment.

The take from the river by A, B and C entitlement class water users was under the *Water Sharing Plan for the Barwon Darling Unregulated Water Source 2012*. The water sharing plan allows water users to take a maximum volume of three times the share volumes of entitlements of each class that they hold in a water year, provided that they have a sufficient account balance.

Summary of the 2019/2020 Reasonable Excuse Report

In the first year of operation the SDL compliance assessment undertaken by NSW found that AAT exceeded APT by more than 20%.

The outcome was not consistent with NSW's understanding that a previous management action to reissue entitlement shares as an individual's share of the valley long term Cap volume would prevent any future breaches of similar annualised valley scale diversion limits.

The performance of the APT method and model was closely assessed, and it was found that the model included a representation of diversion embargoes that were applied in the past to support supplies in Menindee Lakes to service the Broken Hill town water supply. The past practice of embargoing diversions by B & C class Barwon-Darling entitlement holders was no longer relevant since a new pipeline was constructed from the Murray to Broken Hill.

At the same time, the NSW government imposed restrictions on diversions during the 2019/2020 water year using orders made under s324 of the NSW *Water Management Act* for the purpose of

restarting the river through to the Murray and relieving critical supply conditions along the Barwon-Darling and Lower Darling systems for smaller town water supplies and basic rights water users.

Although the two types of restriction were similar in style, the newer s324 orders were lifted a few weeks earlier than was expected by the modelled Broken Hill embargo representation and the two weeks of extra pumping could not be caught up later in the water year since the flow event finished before all irrigation farms could fully utilise their available allocations and on farm storage capacity.

NSW proposed in the subsequent reasonable excuse report that Broken Hill embargoes should be removed and a new method for s324 orders be added instead. The net effect would be to increase the APT by 17 GL in 2019/2020.

Separately to this modelling review, it was realised that 2019/2020 was the first year that newly installed meters had reported diversions that materially contributed to AAT figures. Although many of the meters had been installed in the previous year, the long period of no flow conditions had prevented any irrigation pumping and hence no data had been collected from the new meters.

Anecdotal reports from some irrigators had indicated that the new meters gave much higher readings compared to the previous meters. Irrigators claimed that they had exhausted their allocation balances or annual account limits with fewer days of pumping than historically, despite not changing their pumping infrastructure.

The installation of new more accurate meters improves water management generally. However, the model included in the existing APT method is calibrated to reproduce the level of diversions recorded by the previous meters. The entitlements issued in the Barwon-Darling are also set to the volumes shown on the previous meters. This meant that whilst the previous meters had systemic under reading problems, the water management framework was constructed to be consistent with those meters and hence growth in use could be monitored and managed.

If the new meters reported significantly different volumes in comparison to the old meters, that consistency would be broken and comparisons of APT, AAT and entitlements to water would no longer be useful. Despite no data being available on meter performance due to the drought, NSW was aware that this outcome was likely to happen and had already commenced a metering recalibration program using the data from meters as it became available during 2019/2020. Preliminary results suggested the differences in meters may be around +20% and the issue with new meters was then included in the 2019/2020 reasonable excuse report.

NSW submitted a reasonable excuse report based largely on correcting these two issues in future years which was expected to remove the substantial difference between AAT and APT. MDBA accepted the technical veracity of the two issues but rejected the request for a reasonable excuse. This was on the basis that NSW had not undertaken an annual compliance assessment for the long-term average annual extraction limit (LTAAEL) as specified in the water sharing plan (WSP). Thus, the Barwon-Darling Water Sharing Plan was assessed as not being fully operational in the 2019/2020 water year.

NSW undertook the plan limit compliance check shortly after the MDBA finding and demonstrated that the valley was easily compliant with LTAAEL in the Water Sharing Plan. This test was not affected by the change in metering.

MDBA published a formal list of “make good” actions for the purpose of returning the Barwon-Darling to SDL compliant status across multiple years. These “make good” actions are based on the substantive measures proposed by NSW in its reasonable excuse request. These were to address embargo modelling and metering recalibration. MDBA also added a range of other matters that will not alter the compliance outcome but may be considered to contribute to good overall water management processes.

The "make good" actions were accepted by NSW and this report includes a summary of progress against each action. This reasonable excuse report should be read as a continuation and update of the 2019/2020 reasonable excuse report.

Background for the 2020/2021 Compliance Year

The 2020/21 water year continued the generally wet conditions that broke a severe drought event in 2019/2020.

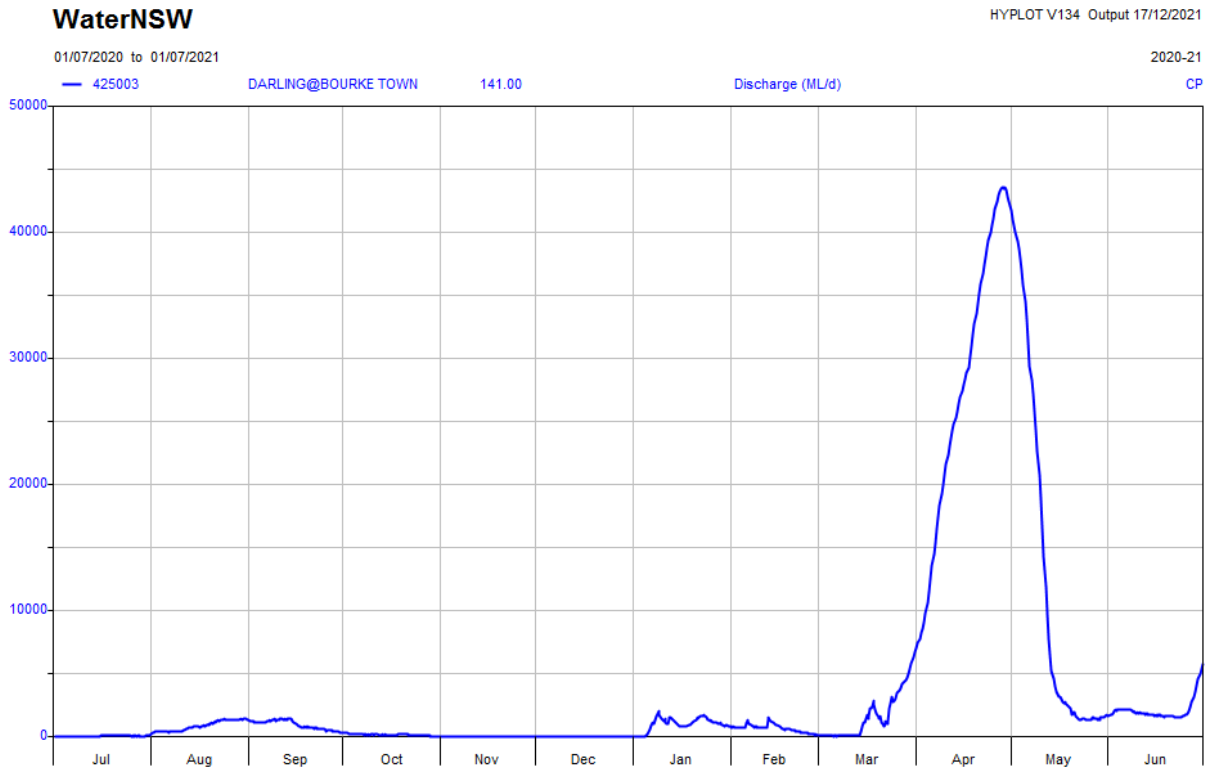

Figure 1 - Flows at Bourke for the 2020/21 water year

There were extended pumping opportunities in spring and summer for all A class water uses and most B class water users. In Autumn a large flow event occurred that provided extended access to all entitlement holders (Figure 1). It is expected that most irrigators planted with full on-farm storages and ran a maximum cropping program over summer, then were able to refill their on-farm storages before the end of the water year.

For the first time in 2020/2021, held environmental water entitlements were activated and environmental water managers used up to the 300% annual use limit on many of their entitlements, averaging 173% usage of the shares for their entitlements.

Changes to the APT method for 2020/2021

The Barwon-Darling does not have an accredited APT method in the absence of an accredited Water Resource Plan. By agreement with NSW, MDBA instead directs the APT method that will be applied in 2020/2021 through a bi-lateral agreement with NSW government.

The APT method is based largely on the method submitted to MDBA in the now withdrawn water resource plan (WRP).However, the following changes have been applied for 2020/2021 at the direction of MDBA after assessment of proposals for improvements to the method made by NSW.

This direction was via a bi-lateral agreement as also described in the 2020/21 narrative report submitted to MDBA as part of the annual assessment of compliance.

Table 2 – Summary of Changes to the APT method for 2020/2021

Change Description	Comment
Removed prior modelled Broken Hill embargoes that are no longer relevant following the construction of the Broken Hill pipeline	NSW has in the past restricted pumping on the Barwon-Darling at times when the town water supply for Broken Hill was under threat. A pipeline has been constructed from the Murray to Broken Hill and it is not expected that a Broken Hill pumping embargo will be applied in the future. Broken Hill embargoes will continue to be applied in the Cap and BDL models for the Barwon-Darling. Water for Broken Hill was supplied from the Lower Darling water source with entitlements in that same water source. Water is now supplied instead from the Murray water source from Murray entitlements. Embargoes in the Barwon-Darling water source increased the volumes of water available in the downstream Lower Darling water source at key times when the Broken Hill supply was under imminent threat. The historical embargoes were never part of WRP/WSP rules but were agreed by NSW to be included in the Cap model for Barwon-Darling to reflect circumstances when access to flows could be expected to be restricted under special circumstances provisions under the water Act. The new Murray pipeline precludes the possibility that a special circumstances restriction would be imposed for this purpose in the future. The long-term water available for extraction in the Barwon-Darling is not altered by this change. The BDL/SDL is derived from the Cap model which retains Broken Hill embargoes as these are deemed to be in effect as at 1993/1994. The update to the APT model just means that the year-to-year pattern of water use better reflects the expected SDL compliant water use. There is no change to the long-term water available for extraction as the results are scaled to ensure an SDL compliant outcome as further described below (see *Separated scaling factors for FPH & watercourse take*).
Added actual s324 pumping restriction orders	NSW has used orders made under s324 of the NSW Water Management Act 2000 to restrict pumping from the Barwon-Darling during critical periods. A time series of actual restrictions is applied in the model to ensure that the APT method does not overstate what could be taken. No restrictions were made in 2020/2021, however these restrictions were important in 2019/2020. These were represented in the revised 2019/20 assessment, which forms part of the 2020/2021 assessment.

Changed the AAT method for floodplain harvesting (FPH)	The previous AAT method was that in any year that FPH was deemed to have taken place, the AAT would be the modelled long-term average FPH. MDBA directed a change of method where the FPH AAT is the unscaled FPH figure produced by the APT model for that year. This gives a better yearly estimate, rather than using a long-term average value.
Separated scaling factors for FPH & watercourse take.	The APT method relies on a scaling factor that ensures that the take estimate provided by the APT model over the 1895 to 2009 SDL demonstration period exactly matches the required long-term average SDL. MDBA requested that NSW calculate separate scaling factors for FPH and watercourse diversions. The change is not required for Basin Plan compliance and does not alter the final SDL figure, but has been supported and applied by NSW to enhance MDBA's capacity to review compliance outcomes.
Corrected five result post-processing errors	The APT method includes a post-processing software tool for model results called LISTQUAN that is used to extract and combine model outputs from binary files into human readable text summaries. Reviews by internal NSW staff and MDBA had previously flagged that the configuration of the tool may be incorrect in a number of places. A full cross check of all parameters was conducted, and 5 errors were found and corrected. These errors are technical and do not alter the long-term modelled SDL due to the application of scaling factors, but does alter modelled take by particular licence classes in some years. Full documentation of proposed changes was provided to MDBA to support the integrity and transparency of the SDL assessment, and MDBA directed that the changes be applied after conducting its own review.

Clarified treatment of historical climate and flow data sets.	In some places within the APT model, NSW had previously followed a practice to extend the existing input data for the new compliance year. NSW proposed to MDBA that it would be more consistent with the Basin Plan requirement to use the "best available information" if the full model period was regenerated or reextracted from database systems each year to provide an opportunity for the APT method to incorporate the routine ongoing corrections and improvements that occur within those data systems. MDBA agreed and directed that the modified practice be implemented and documented. This change is a detailed technical matter that is not substantive to the SDL compliance assessment. The change is listed in this report to support the integrity and transparency of the SDL assessment process. The change has no effect on AAT, but may alter the estimated tributary inflows that reach the Barwon-Darling in the model and hence alter the APT. The three affected sites are all minor flow contributors to the valley overall and no material changes are expected. The matter has more relevance to inform the adoption of best practice modelling techniques more broadly across the basin and is expected to lead eventually to MDBA stipulations that an equivalent method is applied universally by all affected states.
Added "Geera" AAT	During their review of the withdrawn WRP, MDBA sought further information on how diversions on properties that are able to take water from both the Barwon-Darling and the adjacent tributary water source are accounted for in each water source. A detailed investigation of each site showed that in all but one case take was correctly attributed to applicable water sources. The property "Geera" is able to divert water from both the Barwon-Darling and the Lower Macquarie unregulated water sources. The Lower Macquarie access point has been historically assessed as Barwon-Darling because much of the accessed water is backed up from the Barwon-Darling, however the pump site was administratively moved to the Lower Macquarie unregulated water source as part of activities to implement the Barwon-Darling WSP. MDBA reviewed the available information with NSW and directed NSW to apply an interim SDL compliance approach to include metered take net of trades at the "Geera" pump within the Barwon-Darling SDL compliance methodology. This approach ensures that growth in use can be identified at this site while a longer-term solution based on a new model that covers the Lower Macquarie unregulated water source can be built. This change has been applied for both the 2019/2020 and 2020/2021 assessment periods.

Reasonable Excuses Claimed

The *Sustainable Diversion Limit Reporting and Compliance Framework* published by MDBA in November 2018 requires a specific claim of reasonable excuse to be made.

NSW claims a reasonable excuse classification RE1.2 on the basis that the WRP was in operation during the 2020/21 water year, and this is the second year of the SDL register of take exceeding the 20% trigger.

The Barwon-Darling was managed for the entire 2020/21 water year in accordance with the Bi-lateral Agreement between NSW and the MDBA and the proposed Water Resource Plan (WRP) submitted to MDBA for accreditation and published at: https://www.mdba.gov.au/publications/mdba-reports/barwon-darling-watercourse-water-resource-plan. This WRP has been withdrawn and is currently being reworked to address technical issues raised by MDBA. However, no material changes are expected with either the BDL or APT methods that would alter s71 compliance outcomes. This makes the Barwon-Darling eligible to access the reasonable excuse provisions established through the compliance framework published by MDBA.

Investigations of the underlying technical issues identified in 2019/2020 are ongoing. The proposed correction of embargo representation has been implemented as directed by MDBA for the 2020/2021 water year. A first assessment has been completed for the effects of the metering recalibration project, as described in this document.

NSW claims a reasonable excuse classification RE4 on the basis that Commonwealth led water recovery was incomplete during the 2019/20 water year as advised by MDBA. NSW continues to support Commonwealth water recovery in this system and has processed all relevant trade applications.

The *Sustainable Diversion Limit Reporting and Compliance Framework* also sets out the information required to support a claim. The key steps are:

Step 1 – Investigate the issue and review permitted take method.

Step 2 – Review other forms of take

Step 3 – Test growth-in-use response.

For step 1, the RE1.1 claim made for 2019/20 identified a number of tasks that are required to update the permitted take method in order to return the cumulative balance to zero. These are revisited in the following section and a status update provided.

Similarly step 2 and 3 are revisited in the following sections. Note however that step 3 is not immediately required to support a reasonable excuse claim but is required by the time RE3 (respond) is expected to be granted. This outcome is not anticipated at this stage, hence we have only provided some preliminary information rather than detailed analysis for this section.

Steps NSW will take to reduce the cumulative balance to zero

The *Sustainable Diversion Limit Reporting and Compliance Framework* requires that a claim for reasonable excuse outlines the steps that will be taken to reduce the cumulative balance to zero.

The Barwon-Darling was found to be non-compliant with the SDL in the 2019/2020 assessment. MDBA published a list of 'make good' requirements and NSW is on track for implementing the

"make good" actions following the 2019/2020 finding of non-compliance. These steps are expected to reduce the cumulative balance to zero.

Progress on 2019/2020 Make Good tasks

Progress against the required 'make good' tasks is summarised in Table 7.

Table 7 Update on Barwon-Darling Make Good Tasks

Task	Status update	Relevance to achieving SDL compliance zero cumulative balance
Remove historic embargo behaviour and inclusion of current restrictions in Barwon-Darling model	**Complete** Barwon-Darling Watercourse (BDW) APT has been updated to represent current temporary restrictions. This revised model has been used to revise the 19-20 assessment as well as for 20-21 APT.	**High** Correct representation of water sharing plan rules is essential for estimating APT
Metering Recalibration project adjustment of Barwon-Darling models project	**In progress** A metering recalibration project is underway to upgrade the accuracy of metered diversion records that were captured prior to the new pattern approved metering rollout program and subsequently revise models. A report has been prepared comparing old and new meters and been independently reviewed. Some follow up work is still required to complete some site inspections before this work can be finalised There have been some delays to this as COVID restrictions have prevented field work to be completed by NRAR. A project plan has been developed for updating models and a working group will be formed to guide this work. The outcome of the project may be an adjustment to the baseline diversion limit and entitlement volumes to reflect this limit. In the interim, one of the requirements of the make good actions is to estimate what the APT values would have been in 19/20 and 20/21 if meter error corrections were applied. This analysis has been completed and described in this 2020-21 reasonable excuse report. Attachment 1 lists all of the associated tasks and progress.	**High** Accurate representation of extractions that occurred under Cap conditions is essential for estimating APT
Implement systems enabling reporting of SDL compliance data by due date	**In progress** There was some delay to the surface water submission due to our reliance on other jurisdictions to provide model inputs – MDBA granted an extension for the SW submission to 17th Dec 2021. We continue to work with MDBA on creating a more efficient s71 framework however the serial modelling method is likely to continue to create delays until a more automated approach can be implemented. In the past, valleys with inflows from upstream valleys subject to annual diversion limit compliance used recorded inflows to extended model inflow sequences as these records were available within a timeframe that was compatible with the 31st October target date. The MDBA has subsequently changed to a requirement that modelled inflows from the relevant	**None** Relevant to the Basin Plan objective to submit assessments by 31st October annually but no relevance to correct SDL compliance assessment

	upstream compliance run be used instead, and at the same time hardened the 31st October date from a draft outcomes date to a final submissions date through the Basin Plan. This approach has introduced inherent timeframe challenges and timeframes have been missed every year since it was introduced because each state needs until mid-October in practice to collect and collate all the data required for the model updates, run those models, then report on results. The Barwon-Darling requires modelled outflows from four NSW valleys and three QLD valleys. Similarly, MDBA then has to wait for modelled outflows from the Barwon-Darling and Murrumbidgee in NSW as well as the Victorian systems Additional procedure documentation has been written for Barwon-Darling that will provide incremental efficiency gains. This type of improvement improves resilience of the process to unplanned delays or staff unavailability but will never lead to a full resolution of the timing issue. NSW has also engaged with the MDBA led modelling uplift program which is expected to contribute to achieving material gains in capacity to meet Basin Plan target dates through the use of automated processes to ingest input data sets, run the required models sequentially, and output results in the required form automatically. This level of automation is a major investment that must be applied across the entire basin to be effective	
Assessing compliance with long-term average annual extraction limit (LTAAEL)	**Complete** The assessment of compliance with the Barwon-Darling Unregulated River Long-term Average Annual Extraction Limit (LTAAEL) was completed and a report provided to MDBA. This assessment used model results over the period 1/7/1895 to 30/06/2020 to compare long term average diversions under current conditions with the limit, which in the Barwon Darling is defined by the Murray Darling Basin Cap. This showed compliance with the limit. An assessment for the 1895 to 2021 period has recently been completed and also shows compliance with the limit.	**None** This is relevant to demonstrate that the water source was managed for the entire 2020/21 water year in accordance with the Bi-lateral Agreement between NSW and the MDBA and the proposed Water Resource Plan (WRP), providing additional confidence in the SDL assessments, but has no impact on the SDL cumulative balance.
Accreditation of Barwon-Darling WRP	**In progress** Will be submitted for accreditation before June 2022	**Limited** The accreditation of a WRP includes a formal APT method. No substantive changes to the method are planned beyond those described in the 2019/2020 and 2020/2021 reasonable excuse reports.

Upgrade of Barwon-Darling watercourse model to the Source platform	**In progress** The Barwon-Darling Source model is at an advanced stage of development and targeted for completion by end of 2021/22 water year. This development is happening in parallel with finalising floodplain harvesting in the existing IQQM model, which when completed will be transferred directly into Source as we did for existing irrigation farms. The floodplain harvesting work is further valuable as it materially improves the provenance and accuracy of farm-based data, important for stakeholder acceptance. The development of replacement hydrological planning models is complex, and unforeseen issues arise that may take time to resolve, leading to high uncertainty estimating completion dates. NSW remains committed to a Source build for the Barwon-Darling that will address key capability issues with the existing IQQM based model and include the latest available information. NSW has committed to a process that includes peer reviews and stakeholder consultation that we take seriously, even where this may lead to delays in estimated timelines.	**None** The Source model is in development and cannot be considered as a replacement APT method until it has been completed, documented, reviewed and accepted by MDBA through a new WRP accreditation process. As this model plays no part in the current APT method, it is not relevant to current compliance assessment and there are no known reasons why the change of model platform will contribute to the cumulative balance returning to zero.
Regulation of floodplain harvesting Measurement of floodplain harvesting take	The NSW Government is committed to regulating floodplain harvesting through implementation of the NSW Floodplain Harvesting Policy. Following the completion of the NSW Legislative Council's inquiry into floodplain harvesting, the NSW Government is considering the report's recommendations. It will provide a formal response to those recommendations prior to 15 June 2022. Noting that the relevant regulations have been disallowed by the NSW Legislative Council, the Government, progress is uncertain. Licence entitlements have been determined in the Gwydir and Border Rivers valleys, and licensing is intended to be complete prior to 1 July 2022. The department and the MDBA regularly meet to discuss WRP development, including floodplain harvesting provisions. Until recorded FPH take data is available as a result of the Healthy Floodplains project, NSW will continue to account for FPH for annual SDL compliance in accordance with the Bilateral Agreement and/or the Barwon-Darling WRP.	**Limited** The latest modelling for floodplain harvesting indicates growth in the Barwon-Darling is relatively small compared to the influence of meter recalibration.
<u>Other broader ongoing programs:</u> Implementation of Barwon-Darling WRP Monitor compliance by individual entitlement holders Mandate and enforce the take up of AS4747 meters Compliance response according to clause 36 of	DPE continue to work toward all these regulation changes and together with NRAR, deliver implementation and enforcement. Metering compliance is published on NRAR's state of play website (https://www.nrar.nsw.gov.au/how-to-comply/metering/compliance-state-of-play).	**None** While the listed actions are all positive ongoing water management development and enhancement efforts being undertaken by NSW, they will not affect the SDL compliance outcomes.

the water sharing plan, if required		

Metering Recalibration Project

A metering recalibration project is underway to upgrade the accuracy of metered diversion records that were captured prior to the new pattern approved metering rollout program.

A first comparison of daily pumping records between the different meters on the same installed pumping equipment has been undertaken and reported in *Barwon-Darling Pump Recalibration Project REPORT- August 2021* by Alluvium. Over the longer term, this work is expected to improve our understanding of diversions that have occurred historically and lead to model improvements that will ultimately result in better estimates of the Cap, Baseline Diversion Limits (BDL), and SDL.

NSW has previously engaged technical independent advice on the most robust and practical method to undertake this recalibration. The final report *Existing Analysis and Reports on Historical Water Extraction Data in the Barwon-Darling Water Source* identifies a procedure that uses "agreed rates" to be compared with current pumping records to determine conversion factors.

The metering recalibration project has recently engaged an independent peer review. This recommended that further work was required to document and confirm installed pumping equipment at some sites to ensure that we understand any changes that have occurred over time. This site survey work has been delayed by COVID restrictions and NSW is exploring other approaches to collecting installed pump information at the moment.

MDBA staff continue to be involved in the project and have provided ongoing feedback.

First estimates of the effect of metering adjustments

The support work for the Alluvium report included a spreadsheet of the ratio between new and old meters on a per meter basis for 19 major farms and 52 metering points on the Barwon-Darling. These ratios cannot be directly applied within the APT model as the model aggregates the total pumping capacity at a farm to a single daily pumping rate.

Recorded diversions per pump were manually extracted from the water accounting system and used to pro-rata individual pump ratios to an aggregate farm scale factor. These calculations are contained in the spreadsheet *B-D_Pump Information v3.0 + cumulative metered usage per pump.xlsx* that is supplied as supporting material to this report.

The per-farm factor is then applied as factors within the listquan parameter file *Darl-APT-v03_21.run* which builds on the parameter file *Darl-APT-v02_21.run*. Both files will be supplied as supporting material to this report.

A detailed breakdown of AAT & APT components has been supplied separately to MDBA from the SDL compliance process in the spreadsheet *Barwon-Darling APT components 2020-2021 v4.xlsx*. The compliance process does not require this detailed breakdown, but NSW has agreed to supply it to assist MDBA's review of compliance submissions. A matching spreadsheet *Barwon-Darling APT components 2020-2021 v5.xlsx* is also supplied that replicates the directed APT method, but incorporates modelled diversions factored by the pro-rata pumping factors.

This version 5 spreadsheet indicates that if the first estimate of pumping factors were adopted, the SDL compliance status on the Barwon-Darling would be -21,905 ML in 2019/2020 (13%) and +2,748 ML (-2%) in 2020/2021 for a cumulative balance of -19,157 ML (11%) and the Barwon-Darling would be SDL compliant over the period 2019 to 2021.

Progress on the Metering Rollout

NSW has published ongoing reports on the rollout of new meters in the Barwon-Darling

1. NRAR's field works are 59 active pumps 500mm or greater in the Barwon Darling and West region
2. The results of NRAR's published compliance assessment of these pumps, indicate that as of 17 September 2021, 71% (41) of these pumps have compliant metering AND telemetry equipment. This is the highest rate of compliance of all northern valleys.
3. However, the actual number of these pumps with either a pattern approved meter or an accurate non-pattern approved meter is likely to higher. NRAR's compliance assessment indicates that as of 17 September, across the state, 91% of pumps 500mm or greater have accurate meters.
4. In the Barwon Darling there are 57 active surface pumps 500 mm and above – with 49 (86%) accurate meters. These are not just pattern approved meters, they also include accurate meters that satisfy AS4747 (e.g. manufacturer certificate 2.5% and in situ testing with 5 % accuracy).

Future work

The metering recalibration project is ongoing, but the progress on installing accurate meters appears to be well advanced. It is noted that the large farms are more likely to have factors closer to 1.0, while smaller farms often had larger discrepancies, which is consistent with the general understanding that the large farms had more attention from metering inspectors during the period when the old metering fleet was operational.

While the results will almost certainly change in response to ongoing work to improve our understanding of the differences between meters, it is very likely that the final results will be relatively close to the draft estimates in this report. These draft results have identified most of the remaining technical causes for the large differences between AAT and APT seen in this system for the SDL compliance years of 2019 to 2021.

For the 2020/2021 water year, after applying all the proposed adjustments for metering, embargoes and incomplete water recovery, the AAT is slightly lower than the APT. For the 2019/2020 water year reassessment the AAT is higher than the APT by 13%. These calculations are shown on the spreadsheet *Barwon-Darling APT components 2020-2021 v5.xlsx* supplied as supporting material to this report

A single year of higher than modelled diversion is not an SDL compliance issue, however it remains as a technically interesting outcome that merits more investigation. We have postulated that the additional diversions seen during the 2019/2020 year are caused by unusually large winter crop plantings that occurred in the 2020 winter season. The revised results indicate no additional diversions in 2020/21, despite similar levels of (high) water availability across the two years. The Barwon-Darling model does include some small amounts of winter cropping, but generally the irrigators prioritise summer cotton programs as these have a higher level of profitability per ML diverted and this is reflected in the model configuration.

In the 2019/2020 year we think that many farms had been financially stressed by the extended drought and when the drought broke after the summer cropping season was nearly finished, they planted winter cereals at a much larger scale than normal in an effort to bring forward some level of income rather than waiting for the following summer cropping season.

More data will be collected to describe the 2020 winter cropping period and MDBA will be consulted on whether this apparent unusual event should be incorporated in future models as the expected farmer behaviour in response to large flow events after long drought periods. Any changes to models in response to one-off or rare circumstances carry the risk of introducing errors or other unexpected model behaviours that result in overall reduced model performance and NSW may choose to not address this modelled representation of planting decision behaviour if the long-term effects on results are minor.

Incomplete recovery

Estimates of relevant Basin Plan recovery for Barwon-Darling in 2019/20 supplied by the MDBA show that the Commonwealth is 1.6 GL short of the 32 GL target. Applying the latest scaling factor methodology, as agreed in the 2020-21 bi-lateral, results in an adjustment of 1,939 ML being applicable for the 2019/20 SDL compliance period applied in the 2020/2021 assessment.

NSW calculates an adjustment to the APT for incomplete recovery by adding the long-term value of incomplete recovery to the long-term sustainable diversion limit figure, then calculating a new scaling factor for modelled diversions that produces the required (as adjusted for incomplete recovery) SDL over the demonstration period 1895 to 2009.

The entire calculation process is provided to MDBA on a spreadsheet for demonstration purposes and to support review by MDBA.

Incomplete recovery adjustments are applied by MDBA in the following year's SDL compliance cumulative balance.

Planned Actions and Timelines

NSW has no ability to influence Commonwealth recovery programs and hence cannot provide any guidance on when recovery may be completed.

NSW will continue to facilitate purchases as we have done many times to date.

Review Other Forms of Take

The *Sustainable Diversion Limit Reporting and Compliance Framework* requires a review of other forms of take (see part 5.4.1 of the framework).

Table 1 in this report contains the best available information at the time of writing to describe the components of take.

The major differences are related to watercourse take by A, B and C class entitlements, and floodplain harvesting, where take through A class and C class is less than was expected by the APT method, and B class and floodplain harvesting are greater than was expected by the APT method. Differences in other components are not material to the outcome.

It is noted that floodplain harvesting estimates will be upgraded through the Healthy Floodplains Program, and upgrades to the estimates for local water utilities and domestic & stock usage are expected to be delivered through a Barwon-Darling source model build. Improved representation of these smaller water use types is not expected to alter SDL compliance outcomes.

Test Growth-in-use Response

The *Sustainable Diversion Limit Reporting and Compliance Framework* requires a test of the growth-in-use response (see part 5.4.1 of the framework).

As part of the 2012 Water Sharing Plan, NSW reissued all entitlements in the Barwon-Darling as individual shares of the long-term Cap limit which forms the basis of subsequent BDL and SDL set through the Basin Plan. Previously the sum of entitlements on the Barwon-Darling was approximately 540 GL which allowed for the potential that irrigation businesses could develop more infrastructure over time and use greater portions of their entitlements during years with sufficient access to flows. This may have resulted in growth in the long-term average consumption in a similar fashion to growth in use in other valleys across the Murray Darling Basin seen prior to the introduction of measures such as the Cap.

Instead, NSW issued entitlements that sum to the long-term Cap of ~189 GL/year with full carryover of account balances permitted. This means that growth in use is curtailed by the licencing framework, because although irrigators can catchup on foregone opportunities, they cannot take more than the expected long-term average over time.

In addition to this limitation, NSW has observed that accumulated account balances at a valley scale have trended up since 2012 which indicates systemic underuse of allocations that are designed to be at the limit for Cap. At the commencement of the WSP on 4/10/2012 the total account balances for the system were 798,555 ML and at 30/6/2021 the total account balances available to be carried forward into the 2021/2022 water year for the system was 1,074,600 ML, meaning a reduction in use of 276,045 ML against the expected level of take.

It should be noted that 246,933 ML of the carried forward balance is in the accounts of held environmental water entitlements.

The current Water Sharing Plan for the Barwon-Darling Unregulated River Water Source published at https://legislation.nsw.gov.au/view/html/inforce/current/sl-2012-0488 includes growth in use provisions at clause 36 which have the effect of reducing announcements for Available Water Determinations (AWDs) made to entitlement classes A, B and C.

For the 2021/2022 compliance assessment NSW will propose to MDBA or the Inspector General that the latest metering recalibration information will be applied within the APT method. If still in exceedance of the 20% trigger and no acceptable reasonable excuse is available, NSW will curtail the AWD to bring Barwon-Darling take within the relevant limits in accordance with the rules of the water sharing plan.

For example:

- The current unit shares of these entitlements are 190,159 shares
- The cumulative difference, that is the current exceedance of SDL on the register of take is 68,728 ML
- An AWD of 70% could be made in a future water year and beyond should the exceedance remain beyond the trigger without a reasonable excuse
- This should return the system to a zero balance within 5 years of normal or average conditions.

If necessary, NSW may undertake other discretionary actions in support of the mandated growth in use action. NSW plans to licence floodplain harvesting take within the Barwon-Darling water source during 2022. The licencing arrangements are designed to limit long term total diversions to remove any net growth within the valley and return total diversions to Cap levels.

Conclusions

The SDL compliance assessment for the 2020/21 water year on the Barwon-Darling has identified a 39% cumulative balance on the compliance register in the second year of operation.

This exceedance results from a combination of technical deficits in the APT method and incomplete recovery by the Commonwealth. NSW is applying for reasonable excuse to provide sufficient time to continue the implementation of the MDBA directed “make good” actions which are expected to correct the issues that have been identified in the first and second assessment by the APT method.

NSW takes seriously the exceedance of the Barwon-Darling SDL and has implemented the planned actions to address the problems identified. The major changes for the 2020/2021 compliance year are:

- Implemented update of the embargo behaviour in the APT model as directed by MDBA
- Provided a demonstration that applying the current best available information of metering factors would result in the Barwon-Darling being assessed as SDL compliant over the period 2019 to 2021.

NSW will continue to work closely with the MDBA and the Inspector General to ensure that the agreed compliance framework continues to be closely adhered to in a transparent manner and that a zero cumulative balance is returned.

References

Murray–Darling Basin Sustainable Diversion Limit Compliance outcomes 2019–20 (MDBA)

This reasonable excuse report builds on the 2019/2020 SDL compliance assessment. MDBA has published extensive documentation of the process at the following address.

https://www.mdba.gov.au/publications/mdba-reports/murray-darling-basin-sustainable-diversion-limit-compliance-outcomes-2019

Bi-lateral agreement 2020-2021 (MDBA & NSW)

An accredited water resource plan is not in place for the Barwon-Darling for the 2020/2021 water year. A bi-lateral agreement is used instead to operate a compliance process for sustainable diversion limits including new or improved information, methods or models. MDBA has published the bilateral agreements at the following address:

https://www.mdba.gov.au/publications/governance/bilateral-agreements-basin-state-territory-governments

Barwon-Darling Water Resource Plan (Withdrawn)

NSW presented a WRP to MDBA in 2020 which was later withdrawn from the accreditation process to address a range of issues. The accreditation of WRPs has transpired to be a highly technical and legalistic process that is taking time to work through in detail. MDBA published a copy of what they received on their website but took that down when the WRP was withdrawn. NSW still has a copy of the draft published at the link below. Although the WRP is withdrawn, it should be expected that the material content will be very similar in a final WRP and NSW is operating to the WRP in effect via bi-lateral agreements.

https://www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/barwon-darling

B-D_Pump Information v3.0 + cumulative metered usage per pump.xlsx

This is a spreadsheet tool that combines data from individual meters and historical usage information to calculate factors that can be applied to modelled diversion figures that scale the model outputs that were developed to match the old meters to figures that should be meaningful against diversions recorded by new meters. This spreadsheet has been provided to MDBA to inform their assessment, but will not be more generally published as it contains private details of entitlement holders.

Darl-APT-v03_21.run and Darl-APT-v02_21.run

These are configuration files for a model results post-processing tool. The tool collates model results in a form suitable for assessment reporting, and also has been used to apply metering factors to estimate the contribution of metering changes on the SDL assessment outcomes. The files are human readable plain text and freely available on request, but in practice they are only

meaningful to specialised modellers and were provided to MDBA to allow their modelling staff to review the changes that had been made.

Barwon-Darling APT components 2020-2021 v4.xlsx & APT components 2020-2021 v5.xlsx

NSW uses a spreadsheet to combine modelled APT components with unmodelled estimates for other forms of take, then apply scaling factors for watercourse take and floodplain harvesting components. The spreadsheets also calculate an adjustment for incomplete recovery.

Version 4 contains the number for the SDL assessment in 2020/2021 and Version 5 demonstrates how the outcomes would be altered if a metering correction was applied. Versions 1 to 3 contain the results of assessments with single scaling factors and as the assessment process was altered at the direction of MDBA during preparation. A similar spreadsheet exists for the 2019/2020 assessment year.

These sheets are most useful to assist detailed review by MDBA staff to check for errors and to confirm that the agreed process was followed.

Sustainable Diversion Limit Reporting and Compliance Framework

This report is prepared against the requirements of the Basin Plan more generally, but also against detailed requirements in a compliance framework drawn up by MDBA and published at the address below. The compliance framework lays out the steps to be followed once an SDL assessment indicates a cumulative exceedance of greater than 20%. The 20% test defined in the Basin Plan is recognised as having a limited ability to detect genuine growth in use, and is deliberately set to favour false positives to avoid failure to detect genuine growth that may be occurring. The compliance framework allows states an opportunity to investigate the operation of the APT method and identify and correct any faults that could be producing a false positive result.

https://www.mdba.gov.au/basin-plan/compliance-enforcement/action-compliance-review/sustainable-diversion-limit-reporting

Barwon-Darling Pump Recalibration Project REPORT August 2021

This is the most recent major report from the NSW metering recalibration project. The report has been provided to MDBA and the Inspector General for Water Compliance as supporting materials.

Independent Review of: Existing Analysis and Reports on Historical Water Extraction Data in the Barwon-Darling Water Source by Bewsher consulting. (Bewsher 2020)

This report was commissioned by DPIE as a stocktake type product that would improve understanding where the previous time & event to Mace2 metering project had finished, and what suitable options existed in the current circumstances where the old metering fleet had been swapped out for new meters without an opportunity for parallel metering to occur.

New and old meters operating concurrently was the previous practice when we wanted to understand differences in metered take on the same pumping equipment.

Drew Bewsher was uniquely placed for this work through his extensive previous Barwon-Darling work and he also engaged closely with Mick Allen (retired) who was the long term metering inspector for the valley and Richard Cooke (retired) who built the original Barwon-Darling model and was key contributor to the first WSP for the Barwon-Darling.

The report lays out the technical strategy that the Dept is following for metering recalibration.

The report has been provided to MDBA and the Inspector General for Water Compliance as supporting materials.

Attachment 1. Detailed status update for metering recalibration project

	Task Description	Indicative completion Date	Status update
1.	Collate data sets from the NSW Metering Recalibration Program for the old (time and event meters) and the newer flow meters (mostly MACE meters, also some AS4747-compliant meters). Calculate ratio between recorded flow volume in the old and the newer meters and use to improve estimates of diversions (as recommended by reviewer)	30/06/2021	In progress, delayed due to COVID restrictions A report has been prepared comparing old and new meters and been independently reviewed. Some follow up work is still required to complete some site inspections before this work can be finalised There have been some delays to this as COVID restrictions have prevented field work to be completed by NRAR. Draft data has been updated for the following tasks.
2.	*Post process APT model results* with site-by-site ratios between new and old meters applied to model diversions. NSW will provide the adjustment spreadsheet to MDBA to inform a 20/21 reasonable excuse application if required.	Ahead of date agreed in BA amendment	Complete An analysis was completed on basis of available data as outlined in this report
3.	Provide MDBA a report based on the metering adjustment data that estimates the difference in metering outcomes for 19/20 and 20/21	31/10/2021	Complete As per this report and the associated data files
4.	Barwon Darling watercourse cap model development: • Use the recalibrated pumping rates of all the irrigators in the Cap model and run it for the cap period to determine the	Before March 2022*	In Progress - delayed This target date is unlikely to be met due to delays in confirming installed pumping equipment as recommended by an independent review (item 1). NSW will prepare estimates of changes to Cap based on the

	Task Description	Indicative completion Date	Status update
	individual irrigators cap share and the total valley cap value		pumping factors as they become available or are updated. It is expected that final formal changes to valley Cap and individual Cap shares will be controversial and require extended consultative processes.
5.	BDW Cap/BDL/APT model development (metering): Step 2: reprocess historical observed data stored in the NSW databases then recalibrate all the relevant models with adjusted diversion rates for submission to MDBA for accreditation through both Schedule E of the MDB Agreement (Cap conditions)	June 2022*	In progress A project plan has been developed for updating models and a working group will be formed to guide this work. The outcome of the project may be an adjustment to the baseline diversion limit and entitlement volumes to reflect this limit.
6.	Amend Barwon Darling water sharing and water resource plans • Present Cap, BDL and APT models to MDBA for review • Re-issue entitlements and amend WSP and WRP	Before Oct 2022*	In Progress - delayed This target date is unlikely to be met as it follows on from item 4. It is still intended to undertake the action once the preceding steps are completed.
7	MACE meters replaced with AS4747-compliant meters. Update models and update WSP and WRP	June 2028^	In progress – on track In the Barwon Darling there are 57 active surface pumps 500 mm and above – with 49 (86%) accurate meters. These are not just pattern approved meters, they also include accurate meters that satisfy AS4747 (e.g. manufacturer certificate 2.5% and in situ testing with 5 % accuracy). It is noted that Time & Event meters are also being replaced under this program. The requirement to update models, then WSP and WRP duplicates actions above.