

Introduction

This is a summary guide to the water allocation method for the Belubula regulated river. This concise document aims to provide public information on how water is allocated according to entitlement priority. The rules and processes described in this guide implement the legislative requirements of the *Water Sharing Plan for the Belubula Regulated River Water Source 2012* (hereafter, WSP).

Department of Planning and Environment (hereafter, the department) periodically allocates water to water access licence (WAL) holders after assessing available water resources. The resource assessment identifies the volume of water available to the different categories of water access licence holders. The process is known as an Available Water Determination (AWD)¹. The results of the resource assessment and allocation process are advised through water allocation statements published on the department's website.

The water allocation statement explains the percentage of entitlement each category of WAL has been allocated and therefore the volume of water credited to respective accounts. The water allocation statements in this water source are published periodically until a full allocation is made to all WAL categories.

This summary guide presents the key components behind the water allocation, followed by an example of a past water allocation (29 March 2022) at page 7.

Water users

There are different categories of water use including environment, basic rights as well as WAL holders. The principles and hierarchy of allocating available water to the different categories of licences are prescribed in the *Water Management Act 2000* (hereafter, the Act) and the WSP. The Act states² that sharing of water from a water source must protect the water source, its dependent ecosystems, and basic landholder rights.

The volumes equivalent to 100% allocation to rights, allowance, and licence categories in megalitres (ML) per water year are listed below³:

- | | |
|---------------------------|---------------------|
| • Basic landholder rights | 201 ML ⁴ |
| • Domestic and stock WAL | 233 ML |
| • Local water utility WAL | 0 ML |
| • High security WAL | 1,095 ML |
| • General security WAL | 22,766 ML |

There is also a supplementary WAL with full entitlement of 3,125 ML. Supplementary water users can only use their entitlement to access water in periods of announced supplementary flow, typically from surplus tributary inflow and/or spillage from dams. Supplementary water is surplus to all other needs and cannot be ordered from Carcoar Dam (regulated water), therefore does not compete for allocations with regulated licence categories.

¹ *Water Management Act (2000)*, section 59

² *WMA 2000*, section 5(3)

³ WSP, clauses 17-24

⁴ WSP, clause 17, 0.55 ML/day x 365 days

Planned environmental water

The Belubula WSP specifies⁵ an end of system flow, which requires a minimum flow of 10 ML/day at the Helensholme gauge (412033) for environmental purposes. This also serves the purpose of achieving connectivity with the Lachlan River and any surplus flow from the Belubula River becomes resource for the Lachlan River. The resource assessment sets aside 3,650 ML each year to meet this end of system target (see Table 2).

Opening allocations

Allocations open anew at the beginning of each water year on 1 July as the unused account balance of the previous year is forfeited⁶ for all except for general security (GS) WAL holders. The following AWDs are directed by the WSP for higher priority users at the beginning of each water year whenever possible:

- Full (100%) allocation for domestic and stock, local water utilities, and high security licences⁷.

If a year starts with insufficient water to make these higher priority allocations, then they are met with the next available resource improvements. Only when these opening allocations have been made, can allocations then be made to GS WAL holders⁸.

Supplementary WAL usually receives full 100% allocation⁹ at the beginning of each year unless a reduction is necessary to address exceedance of long-term average annual extraction limits.

Major steps in water allocation

The major steps in the resource assessment process to enable water allocation include:

- 1) Identifying the accessible water in storages.
- 2) Add minimum (design) future inflows into storage and from tributaries.
- 3) Deduct all existing commitments, including water for future higher priority needs.
- 4) Set aside water for system overheads to deliver allocated water.
- 5) Distribute unassigned water for allocation as directed by the WSP.

This can be further illustrated using Equation (1) below.

$$\text{Water for Allocation} = \text{Current Resource} + \text{Future Inflow} - \text{Commitments} - \text{System Overheads} \quad (1)$$

Water available for allocation first goes to meet any unmet opening allocations listed earlier. Then available water is allocated to lower priority general security accounts until full.

Every river system has its own way of arranging the line items of its balance sheet (see Table 3). In broad terms, the balance sheet conforms with Equation (1), as explained next:

⁵ WSP, clause 26

⁶ WSP, clause 45.6

⁷ WSP, clauses 39 – 41

⁸ WSP, clause 42.2

⁹ WSP, clause 43

Current resource

The Belubula Regulated River Water Source has one main storage (Figure 1). Carcoar Dam is the headwater storage, with a capacity of 35,800 ML. The active volume behind Carcoar Dam at the assessment date constitutes current resource. The volume of water that stays below the outlet and cannot be released by gravity is known as dead storage. A dead storage of 300 ML is deducted from the total resource volume of Carcoar Dam.

Figure 1: Belubula Regulated River system.

Small volumes of water associated with other weirs and pondages normally have little bearing on overall resource availability and are not considered during the resource assessment.

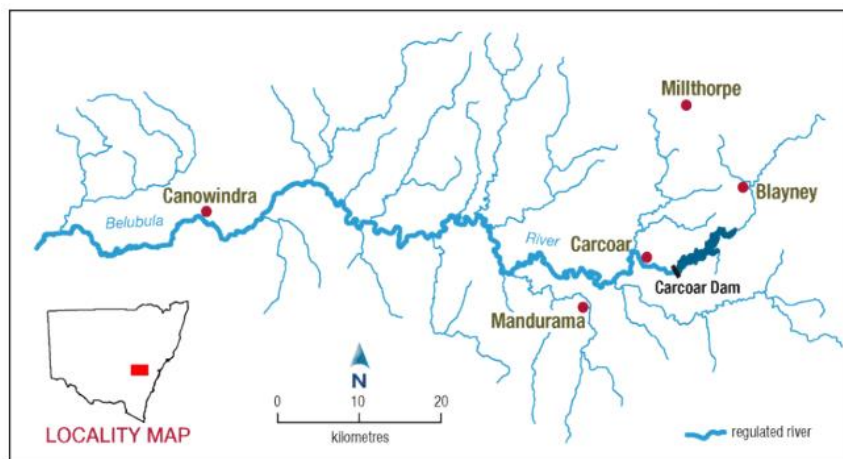
Future inflow

The resource assessment budgets for a future inflow which has yet to accrue in storage. The key principle in the resource assessment is that enough water must be available to meet higher priority needs through a repeat of the driest observed inflow period to the water source known at the commencement of the plan in 2012. This is a statutory obligation that has been outlined in the WSP¹⁰, and balances the risk between allocating water for productive use and water security in the event of a drought. The driest observed inflow (often known as drought of record) is based on the inflow series from 1895 to 2008. The series was derived as part of Belubula IQQM used for developing the water sharing plan and was current as of 26/7/2010. Note that the time series is ending in 2008 instead of 2012 as the plan stipulates. The guide assumes that the absence of last 4 years has no material difference in computational outcome.

There are two sources of future inflow: inflow stored behind Carcoar Dam and tributaries flowing into the regulated Belubula River. These are explained next.

Carcoar inflow

Minimum inflows within 1895 to 2008 into Carcoar Dam are budgeted to arrive over the resource assessment horizon. During opening allocation on 1st July, the horizon spans over three water years. As the water year progresses the assessment horizon shortens to the remainder of the water year plus another two water years. The budgeted inflows to Carcoar Dam at different assessment months are listed in Table 1. The opening allocation includes a budget of 0.1 gigalitre (GL) of inflow into Carcoar Dam for the next 12 months. This inflow volume reduces as the year progresses with fewer months remaining, as does the corresponding demand. Depending on the assessment month, there is 5.2 – 7.9 GL of inflow expected in the next two water years of the assessment horizon.



¹⁰ WSP, Clause 31.1

Table 1: Minimum inflow volume for Carcoar Dam– period assessed 1895 to 2008

From	to rest of Year 1	to end of Year 2	to end of Year 3		
Assessment month	Inflow (GL)	Inflow (GL)	Inflow (GL)	months	Historical period
July	0.1	5.1	8.0	36	July 1895 - June 1898
August	0.1	4.7	7.7	35	August 1895 – June 1898
September	0.1	3.3	7.2	34	Sept 1896 – June 1899
October	0.1	2.5	6.1	33	October 1896 – June 1899
November	0.1	1.5	5.9	32	November 1896 – June 1998
December	0.1	0.7	5.6	31	December 1896 – June 1899
January	0.1	0.2	5.4	30	January 1897 – June 1899
February	0.1	0.2	5.3	29	February 1897 – June 1899
March	0.0	0.1	5.3	28	March 1897 – June 1899
April	0.0	0.1	5.2	27	April 2006 – June 2008
May	0.0	0.1	5.2	26	May 2006 – June 2008
June	0.0	0.1	5.2	25	June 2006 – June 2008

Usable Tributary flows

Tributary flows are significant in the lower catchment due to a strong interaction between groundwater and surface water. However, they cannot be stored or used in full. Tributary inflows that are considered usable are those that may be assumed to meet either orders from downstream users or those that may contribute directly to meeting the end of system flow target. Tributary inflows during the growing season (Oct-Mar period) are particularly useful in offsetting/reducing releases from Carcoar Dam required to meet downstream orders. The usable portion of tributary flow is considered as a resource in the assessment.

An analysis of usable tributary flows over 2012 to 2022 returned a range of volumes from 3.7 GL to 8.7 GL per year. The analysis separately measured tributary utilisation to meet orders, transmission losses and end of system targets. A different analysis of 1895 to 2008 simulation, limiting maximum useful volume to 300 ML/month, returned 3.5 GL useful volume from the driest water year (2002/03). These findings guide the budgeted amount.

The resource assessment published on 29 March 2022 considered 4.4 GL of usable tributary inflow for each of the following two water years (2022/23, 2023/24) and a pro rata volume for the remainder of the current year, 2021/22. This is reflective of utilisation during recent dry years¹¹.

¹¹ The dry water years starting 2012, 2014, 2015, 2017 and 2018 utilised 4.4 GL per year on average.

Commitments

Each assessment accounts for commitments for the remainder of the current water year plus an extra two water years in storage reserve for higher priority users. The period corresponds to the budgeted inflow horizon. Current water year commitments include water for basic landholder rights and the account balances of the water that has been already allocated, including to general security users in addition to a 6,100 ML of storage reserve for the future. The storage reserve contains future water year commitments including the required annual opening allocations discussed earlier, overheads and the Helensholme gauge target.

Higher priority reserve: 6100 ML

A storage reserve is kept meeting system overheads, flow targets and higher priority needs for the second and third water year, see Table 2. The reserve provides security that opening allocations of 100% to all higher priority users will be met for the next 1 July and for the one after. The reserve is offset by the minimum inflows expected over the future two years. A reserve covering two consecutive water years ensures security against the longest dry spell after which the drought breaking inflow is expected.

Table 2: Higher priority reserve for the 2nd and 3rd water years

Assessment Items	Budget ¹² (ML)
Domestic and stock (233 ML/year x 2)	440
High security (1095 ML/year x 2)	2,200
Minimum releases for rights (2 ML/day) ¹³	260
End of system flow target (3650 ML/year x 2)	7,300
Transmission and operational losses	9,200
Evaporation ¹⁴	700
<i>less</i>	
Minimum storage inflows, 24 months from July	(5,100)
Minimum usable tributary flows, 24 months from July	(8,900)
Total reserve for 24 months	6100

System overheads

System overheads are volumes that are required to operate the river, the unavoidable loss. The system overheads are explained below under two key components: (i) evaporation loss and (ii) transmission and operation losses.

Storage evaporation loss

Evaporation loss is the estimated volume of water that is lost from the storage due to evaporation and seepage. The amount of loss varies by season, water temperature and surface area of the storage. Evaporation loss is a direct function of storage level, the time of the year and the

¹² Indicative consideration within overall reserve, rounded by the operators.

¹³ WSP, clause 26A; 2 ML/day x 65 day/year.

¹⁴ Evaporation from simulated low opening 6.4 GL and closing 0.6 GL Carcoar volumes in 2nd year during drought. The depleted storage is returning low evaporation.

drawdown pattern over the planning horizon. The assessment assumes that the maximum annual evaporation is 6 GL if Carcoar Dam remains full for the entire year. The evaporation volume corresponds to 1,500 mm evaporation depth. For context, Blayney Post Office (63010)¹⁵ returned a 1,377 mm evaporation in 1957/58, the maximum annual evaporation when analysed over 1888 to 2021.

A simple pro-rated reduction from 6 GL is made to reflect the storage volume and the fraction of the remaining water year as shown in equation below:

$$E = 6 \times \left[\left(\frac{S_0 + S_1}{2} \right) \times \left(\frac{1}{36} \right) \right] \times \frac{N}{12} \quad (2)$$

Where:

E = Evaporation volume for remainder of the year in GL

S_0 = Current Carcoar volume in GL.

S_1 = Predicted Carcoar volume in GL at the end of the current water year.

N = Number of months remaining in the current water year.

The same equation is used to estimate evaporation loss for next 2 water years as well. Where, projected storage volume at the start of year 2 is S_0 and that of at the end of year 2 is S_1 . Using Equation (2), this returned the 700 ML in the example cited in Table 2.

Transmission and operational loss

Transmission loss is water lost through seepage and evaporation in the river systems below the major storages. This volume must be released from the storages in addition to orders and other requirements. It is often described as ‘water to run the river system’.

Operational loss is the unavoidable surplus release. In a hypothetical water delivery scenario with perfect control, the end of the river should exactly discharge the minimum flow rate or simply stop flowing if there were no end-of-system flow target. In practice, water delivery efficiency is subject to variable weather patterns, losses and customer behaviour, and the timely ability of operators to respond to these changes. As a result, a volume greater than the minimum flow may be discharged from the bottom of the system.

The demands from water users and climatic conditions vary from year to year. Losses can be particularly high during the growing season (Oct-Mar) when deliveries are being made during dry conditions. A conservative approach in resource assessment would be to reserve sufficient volume in Carcoar Dam to match the highest observed historical loss in any given water year, or the highest observed 2-year loss total for a 2-year assessment or third year. At present, losses are budgeted based on the average loss during dry years between 2012-2020 and revised throughout the water year depending on conditions. Annual transmission and operational loss budgets are 3.2 GL and 1.4 GL respectively or 4.6 GL in total.

The assessment of 29/3/2022 budgeted 1 GL of transmission loss and 0.3 GL of operational loss for the remainder of the water year and 9.2 GL (4.6 GL x 2) for the 2nd and 3rd water years (see Table 3).

¹⁵ About 12 km arial upstream of the damsite.

Water Allocation Example of 29 March 2022

The table below shows the water allocation computation behind the statement that was published on 29 March 2022. The resource assessment returned a 7% increase in allocation to general security entitlement holders.

Table 3: Belubula resource assessment of 29/03/2022

Assessment Items (4/22 to 6/24)	ML	ML
Resources		35,900
Carcoar Dam (31/3/2022)	35,600	
<i>less</i> Dead storage	(300)	
Minimum inflows (4/22 to 6/22)	00	
Usable tributary flows (4/22 to 6/22)	600	
<i>less</i> Commitments (4/22 to 6/22)		(28,152)
Domestic and stock balance	220	
Local water utility balance	N/A	
High security balance	150	
General security balance	21,982	
Minimum release and end of system target	1,000	
Transmission and operational losses	1,300	
Evaporation (Equation 2)	3,500	
<i>less</i> Storage reserve (2022/23 and 2023/24):		(6,100)
Domestic and stock	440	
High security	2,200	
Minimum operational storage releases	260	
End of system flow target	7,300	
Transmission and operational losses	9,200	
Evaporation	700	
<i>less</i> Minimum inflows (2022/23 and 2023/24)	(5,100)	
<i>less</i> Usable tributary flows (2022/23 and 2023/24)	(8,900)	
Surplus for allocation (or shortfall)		1,648

General security allocation = Surplus / Eligible GS shares = 1,648 ML ÷ 22,766 ML = 7%

Disclaimer

Allocations are based on a very conservative future inflow budget. However, during extended dry period, inflow may be less than the budget with higher delivery losses creating shortfalls in allocated resources. The management of a system deficit during extreme drought is beyond the scope of this summary guide. Readers are referred to the NSW Extreme Events Policy for details.

The routine water allocation computation, while follows this guideline, is subject to wider hydrological considerations not covered in this summary document. This is a guide only and subject to improvements and changes over time. Water users should use this information with caution and are encouraged to seek their own expert advice as needed.

Version History

First edition	February 2022	C Barclay, S Chowdhury
Second edition	June 2023	S Chowdhury, C Barclay and P Inamdar
This edition	December 2023	S Chowdhury

© State of New South Wales through Department of Planning and Environment 2023. The information contained in this publication is based on knowledge and understanding at the time of writing (December 2023). However, because of advances in knowledge, users should ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate departmental officer or the user's independent adviser.

ANNEX
WATER ALLOCATION STATEMENT EXAMPLE
29 March 2022

29 March 2022

Belubula Regulated River Water Source

Water availability and allocation update

There is a **7% allocation to general security (GS) entitlements** in the Belubula regulated river water source bringing the total cumulative allocation to 83% of entitlement for this water year. Including carryover, total water availability is at 110% of entitlement. All higher priority licences as well as supplementary entitlements received a full allocation at the start of the 2021/22 water year.

Wet conditions during January and low demand have resulted in Carcoar Dam remaining near full capacity. Dam spills along with relatively high tributary flows have enabled ongoing access to supplementary flows and have allowed all demands in the system, including end of system flow targets, to be met. Access to supplementary take has now ceased as entitlements have been fully utilised.

It is expected that tributary flows will be sufficient to meet any water orders as well as the end of system flow target at Helensholme, and that dam releases will not be required to deliver water orders in near future. Currently, the budget for essential requirements is based on dry years following wet periods.

The previous allocation increment in December 2021 caused some GS licences to reach their 130% limit. Water in excess of the 130% entitlement account limit was forfeited and has become available for allocation. Any GS account water forfeited as a result of this allocation will be allocated in the next assessment.

With effective available GS water above 50% (as of 10 December 2021), uncontrolled flow take is not permitted, as specified in the water sharing plan. Uncontrolled flow taken 'without debit' earlier this year has been converted to debit take in individual accounts, which effectively increases the usage and has resulted in more water becoming available for allocation in this assessment. It is likely that access to uncontrolled flows will not be available in the 2022-23 water year as GS carryover may exceed 50% of share component.

2021/22	High Security	General Security
Belubula Regulated River Water Source	100%	83%

Storage levels (as at 29 March 2022)

Carcoar Dam – 98% full – falling – 35,500 ML.

Seasonal climate and streamflow outlooks

The Bureau of Meteorology's seasonal outlook for April to June indicates that rainfall is likely to be about average across the catchment. Daytime temperatures are likely to be about average and overnight temperatures are likely to be warmer than average.

For further details: <http://www.bom.gov.au/climate/outlooks/#/overview/summary>

Belubula Resource Assessment Data Sheet

Resource Distribution (April 2022 to June 2024)	Volume (ML)
Current and Future Resources ⁽¹⁾	35,900
<i>less</i>	
High Security ⁽²⁾	150
General Security balance ⁽³⁾	21,982
Domestic and Stock ⁽²⁾	220
Evaporation from storage	3,500
Essential Requirements and Losses ⁽⁴⁾	2,300
Storage reserve for 2022/23, 2023/24 ⁽⁵⁾	6,100
<i>equals</i>	
Surplus (or deficit) ⁽⁶⁾	1,648

Notes:

- (1) Predicted volume of Carcoar Dam volume at 31 March 2022, minus 300 ML dead storage, plus minimum historical dam inflows and usable tributary flows budgeted from April 2022 to June 2022.
- (2) Domestic, Stock and High Security: volume required to meet these high priority entitlements to 30 June 2022 in full.
- (3) The balance includes the current available balance, adjust for any trade, minus 1,005 ML of account forfeits, minus 724 ML of uncontrolled flow usage (as of 23 March 2022), as per cl 48(7) of the WSP. This does not include the allocation announced in this statement.
- (4) Essential Requirements and Losses: best estimate of the volume required to run the river under dry conditions through to June 2022 to meet all demands. This mostly comprises of natural transmission losses as water soaks into the riverbed, end of system flows and operational surpluses.
- (5) A minimum storage volume of 6,100 ML in Carcoar Dam on 30 June 2022 is required to ensure critical needs can be met through the 2022/23 and 2023/24 water years.
- (6) The volume of the current surplus enabling the 7% allocation with 76 ML remaining unallocated.

Next announcements

The next water allocation statement will be issued in May 2022, or earlier if conditions change significantly.

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