Water Allocation Methodology

Hunter Regulated River

Introduction

This is a summary guide to the water allocation method for the Hunter regulated river water source. It is a concise document that aims to provide public information on the priorities for water sharing and how water is allocated to competing interests.

The Department of Planning, Industry and Environment periodically allocates water to water access licence (WAL) holders after assessing available water resources. This resource assessment identifies the volumes of water available to the different categories of WALs.

The process is formally 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 sets out the percentage of entitlement that each category of WAL has been allocated and therefore; the volume of water credited to respective accounts. The water allocation statements are normally published monthly until full allocation is made to all WAL categories. This summary guide presents key components behind the water allocation followed by an example of an earlier allocation.

Water users

There are various types of water users including the 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* and the Water Sharing Plan for the Hunter Regulated River Water Source 2016.

The Act states[2] that sharing of water from a water source must protect the water source, its dependent ecosystems, and basic landholder rights.

The maximum annual volumes that can be assigned to rights and licence categories in megalitres (ML) per year are listed below[3]:

- Basic landholder rights[4] 5,515 ML
- Domestic and stock[5] WAL 1,836 ML
- Major utility[6] WAL 36,000 ML
- Local water utility[7] WAL 10,832 ML
- High security[8] WAL 21,740 ML
- General security[9] WAL 128,544 ML
- Environmental water allowance (EWA)[10] 20,000 ML

[1] *Water Management Act (2000)*, Clause 59.
[2] Section 5(3).
[3] Water sharing plan, Clause 21-27.
[4] Exempt use, Act, Clause 52.
[5] Water sharing plan, Clause 21.
[6] Water sharing plan, Cause 23.
[7] Water sharing plan, Clause 24.
[8] Water sharing plan, Clause 25.
[9] Water sharing plan, Clause 26.
[10] Water sharing plan, Clause 29.

There are also supplementary WALs with full entitlement of 48,518 shares, meaning a volume of 48,518 ML is assigned at 100% allocation. Allocation to this licence category does not adversely affect the above entitlements because the water stems from a different source; unregulated flows.

The allocation to this licence category in this system is generally 100%, with a potential to rise to 200%[11] of entitlement. Supplementary water users can only access water in periods of announced supplementary flow events.

Opening allocation

Allocation must be provided at the beginning of each water year (1 July) for the following water users: domestic and stock, local water utility and EWA, as they forfeit any unused account balance at the end of each year.

The following AWDs are directed by the water sharing plan[12] for these and other higher priority users at the beginning of each water year whenever possible:

- Full 20,000 ML for EWA.
- Full (100%) for utilities, domestic and stock.
- 75% for high security users.

If additional water is available, further allocation shall be made following a distribution hierarchy[13] as follows:

- General security water users receive their allocation increment only after the above higher priority commitments have been met, including at least 75% allocation to high security users.
- Once allocation to high security reaches 75%, then every 1% increment to high security users is accompanied by a 2% increment to general security users. This continues as more resource is identified available for allocation until high security reaches its maximum allocation of 100% with corresponding general security cumulative allocation reaching 50% of entitlement.
- Any further available resource will then be allocated to general security users to the maximum 100% of entitlement in a water year.

Major steps in water allocation process

The major steps in the resource assessment resulting water allocation include:

1) Identifying the available water in storages.

2) Considering future minimum inflow.

3) Deducting all existing commitments, inclusive of reserves for the following year's higher priority commitments.

4) Setting aside water for system operation.

[11] Water sharing plan, Clause 50.
[12] Water sharing plan, Clauses 29.2, 44.2, 46.2, 47.2, 48.3.
[13] Water sharing plan, Clauses 48, 49.

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

$$Available\ Water = Current\ Resource + Future\ Inflow - Commitments - System\ Overheads \quad (1)$$

General security water users receive their allocation increment only if additional water is identified through the resource assessment and high security has received at least 75% allocation.

The four items shown in Equation (1) are explained next.

Current resource

This river system has two headwater reservoirs, namely; Glenbawn Dam with a capacity of 750,000 ML and Glennies Creek Dam with a capacity of 283,000 ML. Glenbawn Dam is on the Hunter River, whereas Glennies Creek Dam releases flows down the creek meeting the Hunter River near Camberwell.

Physically, Hunter water users upstream of the Glennies Creek confluence can therefore only access Glenbawn water. However, the assessment considers the total volume in two storages against total demand irrespective of delivery location.

While this poses a shortfall risk, mainly for users on Glennies Creek, the risk is considered low and manageable and has been supported by water users.

Future inflow

The department allocates water very conservatively, basically assuming that the next drought is now commencing. The resource assessment secures water for higher priority needs through a repeat of the driest observed inflow period prior to 1 July 2004 (the commencement[14] of the inaugural water sharing plan).

This is the agreed level of risk, specified in the water sharing plan, balancing water allocation for productive use, versus water needed for security against drought. The two objectives are mutually exclusive.

The department uses the available 120 years of hydrological record to plan for the 24 to 36 months ahead, after which the system is statistically expected to recover. The future inflow planning period from the current monthly assessment includes the remainder of the current water year, plus the next two full water years.

[14] Water sharing plan, Clause 30.

The assessment considers the following two inflow sources:

1) Inflows into the two headwater storages.

2) A portion of tributary flows entering the river below the dams[15].

While inflow into the storages is considered in full, only the useable fraction of unregulated tributary inflow downstream of the storages is included in the assessment.

Usable tributary inflow considers the flow that can be effectively used to deliver water orders and system requirements that would otherwise be supplied from the dams. The usable tributary inflow includes flows up to 150 ML/day (maximum 4.5 gigalitres (GL)/month) during April to September and 300 ML/day (maximum 9 GL/month) during October to March.

The minimum inflow statistics applicable to period prior to 2004 are included in **Table 1**, returning 1939 to 1941 as the driest period on record. Note: the driest period did not change when analysed over the available 1893 to 2013 period, inclusive of the Millennium drought, meaning that the Millennium drought was not the worst drought on record for this water source.

Table 1. Minimum inflow volume within 1892 to 2004 period

Number of consecutive water years	Historical period	Storage inflow	Historical period	Usable tributary inflow	Total
One	July 1939 to June 1940	26.9 GL	July 1939 to June 1940	25.8 GL	52.7 GL
Two	July 1939 to June 1941	68.2 GL	July 1938 to June 1940	67.1 GL	135.3 GL

The resource assessment commences a water year by budgeting for a 52.7 GL inflow for next 12 months. This inflow volume reduces as the year progresses with fewer months remaining. The additional inflow expected to arrive during the second year is 82.6 GL (135.3 – 52.7 = 82.6).

Commitments

Every monthly assessment sets aside all commitments for the current water year, plus a storage reserve for higher priority requirement of 186.5 GL (**Table 2** below) for the next two water years.

Commitments for the current water year include basic landholder rights, EWA and the balance of already allocated water. At the beginning of the water year, the balance may include water carried over from the previous water year and the minimum allocation stipulated in the water sharing plan for higher priority users.

The next section explains the computation of the higher priority requirement for the second and third years.

Higher priority requirements

The resource assessment first secures the higher priority requirements for the second and third water years. The details behind the estimated 108.9 + 77.6 = 186.5 GL requirement of next 2 water years is shown in **Table 2**.

[15] Rouchel Br (210014), Pages R (210052), Dart Br (210088), Wybong Cr (210040), Goulburn R (210031), Doyles Cr (210087), Foy Br (210042), Wollombi Br (210028), West Br (210080), Black Cr (210089).

Table 2. Higher priority requirement for second and third water years

Items	Second water year (GL)	Third water year (GL)
Basic landholder rights	5.5	5.5
Domestic and stock licence	1.8	1.8
EWA	20.0	20.0
Major water utility	36.0	36.0
Local water utility	10.8	10.8
High security x 75%	16.3	16.3
Minimum flow target at Greta	19.5	19.5
System overhead	51.7	50.3
Less, Minimum future inflow	(52.7)	(82.6)
Subtotal per water year	**108.9**	**77.6**

System overheads

System overheads are volumes that are required to operate the river. In the resource assessment, the following four overheads items are explicitly considered:

- Evaporation loss
- Transmission loss
- Operational surplus
- Minimum flow targets

Evaporation loss

Evaporation loss is a direct function of storage volume and the drawdown pattern. The assessment considers median annual evaporation, net of rainfall, over 2008 to 2019 period which was 600 mm[16].

This consideration returned a maximum of 25 GL evaporation loss per year from a maximum possible combined storage volume of 1,033 GL throughout the year. Accordingly, a simple pro-rated reduction is made to reflect the actual volume and the fraction of the remaining water year as shown in equation below:

$$E = 25 \times \left[\left(\frac{S_0+S_1}{2}\right) \times \left(\frac{1}{1033}\right)\right] \times \frac{N}{12} \qquad (2)$$

Where:

E = Combined annual evaporation volume from the two headwater storages in GL.
S_0 = Current combined storage volume of the two storages in GL.
S_1 = Predicted combined storage volume in GL at the end of the current water year.
N = Number of months remaining in the current water year.

[16] The assumed evaporation of 600 mm closely matches 2008-09 and 2018-19 climate.

Delivery loss

Delivery of water through natural river channels typically results in water loss through seepage into the riverbed and banks. This is accounted as transmission loss.

Operators analysed 2004 to 2018 data on water delivery and loss. The simple analysis chose water years starting 2005, 2009, 2012, 2016 as representative high loss years. The analysis returned a 42 GL annual transmission loss, while delivering around 135 GL of water demand.

Actual transmission losses are difficult to measure and can be highly variable in time and space. The resource assessment considers a fixed 42 GL loss per year irrespective of delivery demand (which is often lower than 135 GL). A pro-rated reduction is made to budget losses for the remaining water year and the loss budget is constantly checked, particularly as conditions turn dry.

Operational surplus

In a hypothetical water delivery scenario with perfect control, the end of the river should exactly discharge the minimum flow rate or just stop flowing if no minimum rate exists. In practice, the water delivery efficiency is subject to uncertainty.

The uncertainty includes forecast tributary inflows, volumes of flow routing, positive bias in favour of ensuring demands can be safely met, rejection of orders due to rain events and the flow rate required to maintain river health and continuity. As a result, a volume more than the minimum flow requirement discharges from the bottom of the system that cannot be controlled for re-use. This is classed as operational surplus or loss.

The annual budget for operational surplus in the assessment has been 8 GL, which is based on 2018-19 data. Every effort is made to minimise this ‘cost’, while also maintaining a reliable river flow. In dry years the river has been run with just 6 to 7 GL of operational loss.

Minimum flow target

The plan requires the operators to meet a set of flow targets at Liddell and Greta that vary with time (months), as well as with catchment conditions (wet/dry). Hunter River flow at Belltrees gauge (210039) over a fortnight determines the catchment condition.

The water sharing plan target[17] ranges from 21 to 73 ML/day at Greta and a lower range at Liddell. A dry year budget of 19.5 GL and a normal year budget of 32 GL are the volumes estimated by the river operators to meet these targets.

The example in this guide is based on a dry year budget. The budget is based on two components:

1) Base flow of 33 ML/day x 365 days needing 12 GL.
2) Top up of 27 ML/day x 280 days needing another 7.5 GL.

These flow rates referred to are at Greta, which is at the downstream end of the regulated river operation. Flow released for Greta from Glenbawn Dam should meet the Liddell target without needing additional water. The annual budget of 19.5 GL is discounted on a pro-rata basis throughout the water year.

[17] Water sharing plan, Clause 28.

Water allocation example of 14 August 2020

The table below demonstrates the water allocation computation behind the statement published on 14 August 2020. The assessment returned a 10% allocation to high security users and 23% allocation to general security users. The summary is shown in **Table 3**.

Table 3. Major items of resource assessment of Hunter allocation of 14/8/20

Assessment items	Item volume (GL)	Balance (GL)
Glenbawn and Glennis Creek (31/7/20)		434.67
Minimum inflow for the remainder of the water year (8/20 to 6/21)	49.60	484.27
Basic landholder rights	5.06	
Domestic and stock account balance	1.83	
Local water utility account balance	10.45	
Major utility account balance	68.40	
Environmental water allowance	20.00	
Minimum flow target at Greta (8/20 to 6/21)	17.84	
High security (HS) account balance	20.94	
Evaporation, transmission & Operational losses (8/20 to 6/21)	53.12	
Storage reserve for 2021/22 (see, Table 2)	108.92	
Storage reserve for 2022/23 (see, Table 2)	77.56	
General security (GS) account balance	68.06	
Surplus for allocation (or shortfall)		32.09

Allocation hierarchy

As of 13/8/20, high security allocation = 90%, general security allocation = 30%	
Maximum high security increment possible 10%, volume required: 21.7 GL x 10%	2.17 GL
Commensurate general security increment 20%, volume used: 128.5 GL x 20%	25.70 GL
Further general security increment available is 3%, volume used: 128.5 GL x 3%	4.22 GL
Total volume allocated on 14/8/20	32.09 GL

Disclaimer

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

For example, in the unlikely event of a shortfall where there is insufficient physical water to match all water in accounts, and if it is in the public interest to do so, a temporary water restriction can be imposed to prevent access to account water. This is one drought management tool, akin to a negative water allocation, used to protect supplies for critical needs.

The routine water allocation computation, while broadly following 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	August 2020	V Gupta
This edition	August 2021	S Chowdhury, V Gupta

Annexure

Example: Water Allocation Statement – 14 August 2020

Water Allocation Statement

Water availability and allocation update

14 August 2020

Hunter Regulated River Water Source

Allocation update

There is an **allocation increase** to **high security, general security and aquifer access** licence holders announced in this statement.

Rainfall in July 2020 was mostly above average in the Hunter catchment. Glenbawn Dam and Glennies Creek Dam received about 111 mm and 137 mm of rainfall respectively in July 2020 with net inflow in July into Glenbawn Dam about 38 gigalitres (GL) and 7 GL for Glennies Creek Dam.

The resource improvement enables allocation to high security and aquifer access licences to increase by 10 per cent to 100 per cent of entitlement in accordance with the water sharing plan. There is also enough water to increase allocation to general security licences by 23 per cent to a total of 53 per cent of entitlement.

All high priority water access licence holders in the Hunter Regulated River Water Source have now received their full (100%) allocation for this 2020/21 water year.

Current allocations

2020-21	High Security	General Security	Drought Stage
Hunter Regulated River Water Source	100%	53%	Stage 1

Drought stage

The NSW Extreme Events Policy introduced a staged approach from one to four to manage extreme circumstances such as severe droughts or poor water quality events. Currently, the Hunter regulated river water source is classed at Stage 1 - meaning normal regulated river operations.

Dam levels (as at 14 August 2020)

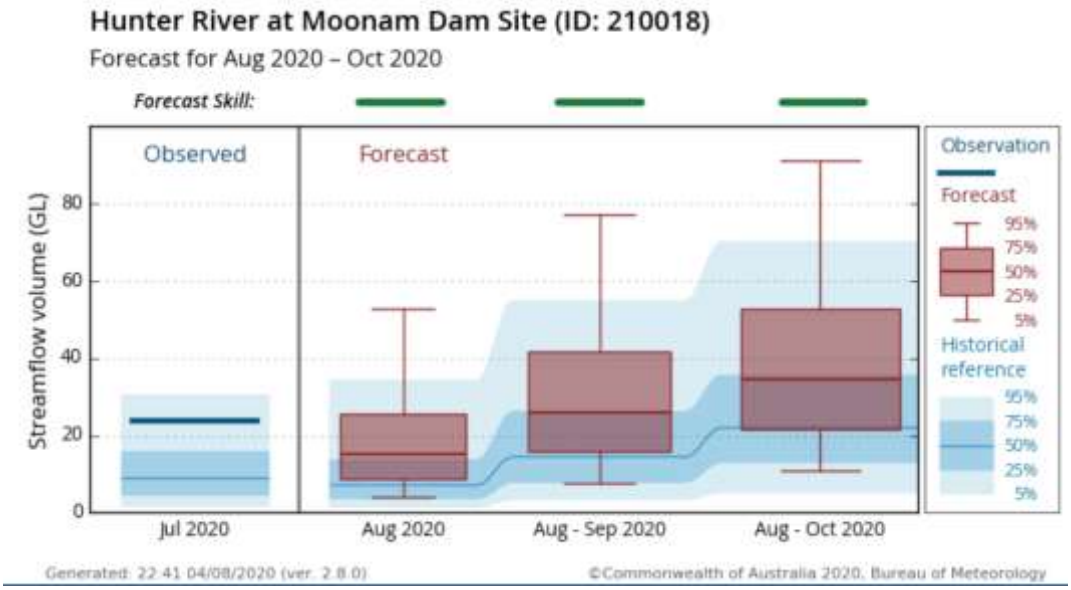
Glenbawn Dam is about 45 per cent full – rising – holding about 338 gigalitre (GL). It was about 50 per cent full at this time last year.

Glennies Creek Dam is about 39 per cent full – rising – holding about 112 GL. It was about 51 per cent full at this time last year.

Seasonal inflow and rainfall forecast

The Bureau of Meteorology climate outlook for September to November shows a good chance of exceeding median rainfall conditions.

The Bureau of Meteorology issues a seasonal flow forecast for the Hunter River upstream of Glenbawn Dam to provide an indication of potential inflows. The forecast total median flow from August to October is of similar volume to the historical 75th percentile flow. This indicates a welcoming shift to wetter than normal inflow conditions for the next two months. The forecast dry quartile volume has climbed to the historical median volume, which is also encouraging.



For further details: www.bom.gov.au/climate/outlooks/#/rainfall/summary & http://www.bom.gov.au/water/ssf/#id=210018&product_type=FC_9

Further information

Water Allocation Statements for the Hunter regulated river water source are usually only published annually on 1 July when full allocations have been granted. However, while general security allocations remain less than full, the Hunter resource assessments and allocation statements will continue to be updated monthly.

The next Hunter water allocation statement will be released on Friday 18 September 2020.

Information on available water determinations and water sharing plans is available on the Department of Planning, Industry and Environment website - www.industry.nsw.gov.au/water

Subscribe here to receive the Department of Planning, Industry and Environment's monthly email update on water planning, management and reform in New South Wales.

Resource Assessment Data Sheet

Resource Distribution (1 August 2020 to 30 June 2023)	(GL)	(GL)
Glenbawn plus Glennies Ck active storage volume[1]		
		434.7
Minimum storage & tributary inflows (8/20 to 6/21)[2]		49.6
less		
Basic Land Holder Rights	5.1	
Domestic and Stock 100%	1.8	
Local Water Utility balance	10.5	
Major Utility account balance	68.4	
Environmental Water Allowance (100%)	20.0	
Minimum Flow Target at Greta	17.8	
High Security account balance	20.9	
Losses (evaporation, transmission, operation) (8/20 to 6/21)	53.1	
Storage Reserve for 2021-22[3]	108.9	
Storage Reserve for 2022-23[4]	77.6	
General Security account balance	68.1	
Equals		
Surplus (or deficit)[5]		32.1

Notes:

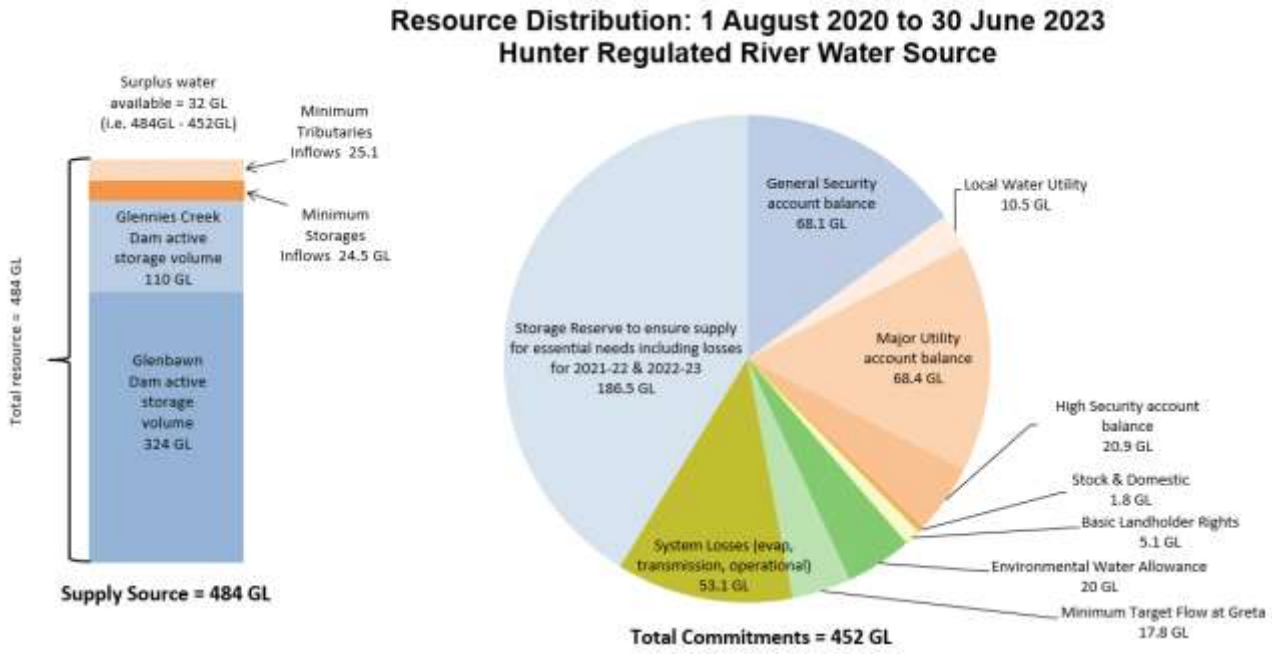
(1) Available Resource in the dams – is the total active storage volume in Glenbawn Dam and Glennies Creek Dam combined as at 1 August 2020.

(2) Minimum historical dam inflows (24.5GL) and minimum historical usable tributary inflows (25.1GL) from 1 August 2020 to 30 June 2021.

(3) Water required to be set aside in storages as reserve to meet essential supply requirements and system losses of 108.9GL in 2021-22. Calculated as: system losses of 51.7GL plus Essential Requirements of 109.9GL minus 52.7GL of minimum storage & tributary inflows for the first 12 months of 24-month minimum inflows starting 1 July 2021. Essential Requirement includes minimum 75% HS opening allocation and all other high priorities.

(4) Water required to be set aside in storages as reserve to meet essential supply requirements and system losses of 77.6GL in 2022-23. Calculated as: system losses of 50.2GL plus Essential Requirements of 109.9GL minus 82.6GL of minimum storage & tributary inflows for the second 12 months of 24-month minimum inflows starting 1 July 2021.

(5) Surplus or deficit of water after accounting for all commitments. The surplus of 32.1 GL signifies the additional water available for allocation.


Resource Distribution: 1 August 2020 to 30 June 2023
Hunter Regulated River Water Source
Surplus water available = 32 GL (i.e. 484GL - 452GL)
Minimum Tributaries Inflows 25.1
Minimum Storages Inflows 24.5 GL
Glennies Creek Dam active storage volume 110 GL
Glenbawn Dam active storage volume 324 GL
Total resource = 484 GL
Supply Source = 484 GL
General Security account balance 68.1 GL
Local Water Utility 10.5 GL
Storage Reserve to ensure supply for essential needs including losses for 2021-22 & 2022-23 186.5 GL
Major Utility account balance 68.4 GL
High Security account balance 20.9 GL
Stock & Domestic 1.8 GL
Basic Landholder Rights 5.1 GL
System Losses (evap, transmission, operational) 53.1 GL
Environmental Water Allowance 20 GL
Minimum Target Flow at Greta 17.8 GL
Total Commitments = 452 GL