

# Application and assumptions used for deriving the BDL-based 2024 LTDLE factors for the Murrumbidgee

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## Introduction

Long-Term Diversion Limit Equivalence (LTDLE) factors when a water resource plan (WRP) is accredited in a river valley or the BDL model is revised with agreed corrections and refinements. The Murrumbidgee WRP was accredited in February 2024. A revised NSW BDL model was used in the WRP that merged appropriate model updates and increased model resolution features. This report details how NSW has updated 2024 LTDLE factors for the Murrumbidgee Valley.

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## Data Sources

### Entitlements

The entitlements under BDL conditions, (generally 30 June 2009), were reviewed considering sources from the Water Information Reporting & Extraction (WIRE) system, General Purpose Water Accounting Report (GPWAR), and BDL scenario report of 'Murrumbidgee Surface WRP' (Attachment A to Schedule F). Decisions have been made that the WIRE system has the longest historical records from 2004/05 to current, and already have corrected known errors found in previous reports, therefore, entitlements recorded in WIRE have been adopted for the calculation of updated LTDLE factors in the Murrumbidgee, as shown in Table 1. Only consumptive use entitlements contributing to BDL are included in the analysis. Adjustments have been made to exclude the effects of entitlements owned by The Living Murray (TLM) program and the Water for Rivers (WfR) program, as listed in Table 2.

Lowbidgee entitlements were issued in 2012 following the Commonwealth's purchase of Nimmie-Caira. However, the right to take water existed in 2009. For the purpose of this analysis, the initial Lowbidgee consumptive entitlements are used. These represent back-calculated volumes, applied retrospectively to reflect the entitlements as they would have existed as at 30 June 2009. It is important to note that the Redbank South consumptive entitlements have been corrected by excluding Yanga National Park entitlements (148,087 shares). Yanga was purchased by the NSW Office of Environment and Heritage in July 2005. It is pre-existing held environmental water as at 30 June 2009 and not contributing to Bridging The Gap (BTG). This is consistent with the NSW BDL

report in Attachment A to Schedule F (Murrumbidgee Surface WRP – Baseline Diversion Limit Scenario Report (update December 2021)).

Table 1. Murrumbidgee entitlements (BDL conditions as at 30 June 2009)

Entitlement type	Shares <sup>1</sup>	Comment
Domestic and stock	35,922	N/A
Local water utility	23,586	N/A
High Security	357,431	359,316 from WIRE, minus 1,885 shares for WfR (as per Table 2)
High Security (TWS)	19,769	N/A
Conveyance	351,468	375,968 from WIRE, minus 24,500 shares for WfR shares (as per Table 2)
General Security	1,734,662	1,892,022 from WIRE, minus 75,489 shares for WfR (as per Table 2) and 81,871 shares for TLM (the same TLM shares used for the 2018 factors)
Supplementary water access	198,780	N/A
Lowbidgee entitlement - Nimmie-Caira net diversions	381,000	Issued in 2012, retrospectively applied as at 30 June 2009 for baseline assessment purposes
Lowbidgee entitlement - Redbank North diversions	211,000	As above
Lowbidgee entitlement - Redbank South diversions	6,913	Represent consumptive shares only, 155,000 initial shares minus 148,087 Yanga National Park environmental shares
<b>Total</b>	<b>3,320,531</b>	N/A

*Murrumbidgee\_2004-2024\_extWMAWaterAccounts-413.xlsx from WIRE*

<sup>1</sup> Shares for certain entitlement types used in the calculation of the 2018 factors could not be reconciled with any available entitlement registers. Accordingly, entitlement shares sourced from WIRE as at 30 June 2009 have been adopted for the current analysis.

Table 2. Environmental shares for WfR program (issued)

Category	Access Licence	Environmental Start Date	Share Component
Regulated River (High Security)	40AL403340	17/03/2006	1,885
Regulated River (General Security)	40AL403341	17/03/2006	75,489
Murrumbidgee Irrigation (Conveyance)	40AL403381	19/07/2006	20,000
Coleambally Irrigation (Conveyance)	40AL403396	04/09/2006	3,500
Regulated River (Conveyance)	40AL405431	17/03/2009	1,000

Snowy\_WFR\_holdings.xlsx

## BDL Diversions

The revised NSW BDL model (rev 243<sup>1</sup>) was used in the Murrumbidgee WRP. The revised model represents the WfR program at a virtual irrigator immediately downstream of Blowering Dam and all the demand is to be directly met from the dam. The WfR entitlements were used outside the Murrumbidgee Valley, so recorded usages from the WIRE did not include WfR usages.

The BDL model (rev 243) was adopted as the primary source of data to describe long-term (1895–2009) diversions in the Murrumbidgee Valley. The average of recorded historical diversions was used instead if the model does not represent usage by a class of entitlement or a portion of a class of entitlement.

<sup>1</sup> <https://svn.waterinfo.nsw.gov.au/svn/MurrumbidgeelqgmSystemFiles/systemfiles/wrp/bdl/BIDGBDLA.iqq> (rev 243, update November 2022)

Table 3. Murrumbidgee BDL diversions 1895–2009

Entitlement type	Diversions 1895–2009 (ML/y)	Source of water usage data used for LTDLE calculation
Domestic and stock	27,334	Used average historical diversion from WIRE (2004-2023) as per Table 4.
Local water utility	12,918	Modelled estimate from BDL rev 243. 10 specific town nodes.
High Security	255,832	The total for the valley uses the average historical value 268,216 ML/a from WIRE (2004-2023) as per Table 4. 12,384 ML is deducted for returns at CIA and MIA (NSW BDL estimate based on pro-rata split (12,271/94,579 this ratio from MDBA estimate) between high and general security and for all volumes returned: 95,453 ML).
High Security (TWS)	19,661	Used average historical diversion from WIRE (2004-2023) as per Table 4.
Conveyance	231,536	Used average historical diversion from WIRE (2004-2023) as per Table 4.
General Security	1,180,834	NSW BDL regulated component of the Murrumbidgee (2,044,220 ML/y) minus all other categories.
Supplementary water access	84,088	Modelled estimate from BDL rev 243 of 'off allocation' (112,719 ML/a) minus the historical without debit take (25.4%) which is counted instead as general security diversion
Lowbidgee entitlement – Nimmie–Caira net diversions	173,900	Fully contributes to BTG, deemed to be 173,900 ML/y.

Entitlement type	Diversions 1895–2009 (ML/y)	Source of water usage data used for LTDLE calculation
Lowbidgee entitlement – Redbank North diversions	56,205	<p>Modelled estimate from BDL Rev 243 for total Redbank is 99,721 ML/a in which 58.28% is used as consumptive in WRP.</p> <p>'Long-term diversion limit equivalence factors for Redbank' 2018 document calculated the historic diversion ratios between North (56.73%) and South (43.27% in which 41.34% for Yanga National Park and 1.93% for consumptive use) based on data in 1982/83-2005/06. In this case, Redbank total consumptive use is 56.73% + 1.93% = 58.66%.</p> <p>To match the NSW BDL, a scaling factor (<math>58.28/58.66=0.9935</math>) is used.</p> <p><math>99,721 * 56.73% * 0.9935 = 56,205</math> ML/a</p>
Lowbidgee entitlement – Redbank South diversions	1,912	<p>As above.</p> <p><math>99,721 * 1.93% * 0.9935 = 1,912</math> ML/a</p>
<b>Total</b>	<b>2,044,220</b>	NSW BDL regulated component of the Murrumbidgee

Modelled take: *BDLA\_bdl\_take.xlsx*

### Historical utilisation rates

The historical utilisation rate is calculated by summing the average available determination and the net temporary trade for each class of entitlement to give the total allocation account volumes available by class. The recorded usage by entitlement class is divided by the total allocation account volume available to that class to give the level of activation by that class. The historical allocation account balance summary was from the WIRE. Table 4 shows the details of average historical account usage and the activation factors. The historical period was extended to 2004–05 to 2022–23 for better demonstration of the diversions over a wider range of climate conditions.

Table 4. Murrumbidgee allocation account balance summary (average 2004–05 to 2022–23)

Entitlement type	Share <sup>1</sup>	AWD	Trade in	Trade out	Net trade	AWD + Net	Account usage	Use / (AWD + Net)
Domestic and stock	34,322	34,446	61	5	56	34,502	27,334	0.792
Local water utility	23,731	23,656	64	619	-555	23,102	10,834	0.469
High Security <sup>2</sup>	368,810	352,884	36,062	96,899	-60,838	292,046	287,877	0.986
Conveyance	375,968	302,319	4,704	49,282	-44,578	257,741	231,536	0.898
General Security <sup>3</sup>	1,915,494	924,885	443,184	439,177	4,007	928,891	779,507	0.839
Supplementary	197,854	197,547	29,151	29,204	-53 <sup>4</sup>	197,495	82,084	0.416
Supplementary (Lowbidgee)	747,000	747,000	295,963	295,963	0	747,000	63,123	0.085

*Murrumbidgee\_2004-2024\_extWMAWaterAccounts-413.xlsx from WIRE*

<sup>1</sup> Calculated as the average of total shares for each entitlement type over the period from 2004–05 to 2022–23. The total shares include all environmental entitlements to ensure an accurate estimate of overall utilisation rates.

<sup>2</sup> Include High Security (Town Water Supply)

<sup>3</sup> General Security usage includes volumes taken without debit under General Security licences during supplementary flow periods, also referred to as uncontrolled flow. The total account usage of 779,507 ML/y already incorporates 27,961 ML/y attributed to this without debit use.

<sup>4</sup> All data are from the WIRE water balance summary. In 2012–13, there was a -1,000 ML difference between In Assignment (40,874.1 ML) and Out Assignment (41,874.1 ML) in the supplementary balance. Averaged over 2005 to 2023, this equals -53 ML/y.

## Allocation reliability

The MDBA has agreed that the allocation reliability indicated by the BDL model in the WRP represents the best available information to describe the reliability of allocations made to entitlements under the BDL conditions, as shown in Table 5. It should be noted that High Security (Town Water Supply) has been treated the same as High Security (HS) in the model. This assumes that both entitlement types are subject to the same operational rules and therefore have equivalent reliability.

Table 5. Murrumbidgee average allocation reliability

Entitlement type	Average reliability from BDL model run	Method description
Domestic and stock	1.000	All NSW water sharing plans require that these entitlements are fully available each year. Defined as 100%.
Local water utility	1.000	All NSW water sharing plans require that these entitlements are fully available each year. Defined as 100%.
High Security	0.978	The long-term average allocation at the end of the water year is used. Note no direct output variable in the model. HS allocations were calculated using modelled General Security (GS) allocations based on rules in the WSP 2003 as at 21/11/2008.  HS Alloc = min(100, max(95, GS Alloc +1))  BDLA_alloc_30Jun.xlsx
Conveyance	0.953	The long-term average allocation at the end of the water year is used. Note no direct output variable in the model. Conveyance allocations were calculated using modelled GS allocations based on rules in the WSP 2003 as at 21/11/2008. Share component and allocation lookup tables are shown in Table 6 and Table 7.
General Security	0.784	The modelled long-term average allocation at the end of the water year is used. Note this figure is not directly used by the LTDLE factor calculation. Modelled GS allocations were used to calculate the HS allocations. BDLA_alloc_30Jun.xlsx
Supplementary	-	Note that this is not used by the LTDLE factor calculation.

Table 6. Murrumbidgee Irrigation (Conveyance) access licence share component look up table

Allocation (%)	MI Conveyance Consumptive Share	MI Conveyance Total Share	Snowy Water Savings Share
0	117,844	128,413	10,569
60	212,066	231,085	19,019
60.0001	223,000	243000	20,000
94	223,000	243000	20,000

Allocation (%)	MI Conveyance Consumptive Share	MI Conveyance Total Share	Snowy Water Savings Share
99	223,000	243000	20,000
100	223,000	243000	20,000

Table 7. Coleambally Irrigation (CI) (Conveyance) access licence share component look up table

Allocation (%)	CI Conveyance Consumptive Share	CI Conveyance Total Share	Snowy Water Savings Share
0	108,595	111600	3,005
35	108,595	111600	3,005
40	112,293	115400	3,107
94	125,318	128,785	3,467
99	126,264	129,757	3,493
100	126,500	130,000	3,500

## Results

### 2018 factors

In the 2018 factors calculation, the Basin Plan BDL regulated component for the Murrumbidgee was 2,116,997 ML. This is 72,777 ML (or 3.6%) higher than the revised Basin Plan BDL estimate of 2,044,220 ML adopted in the Murrumbidgee WRP for the 2024 factors. For comparison with the newly derived factors, Table 8 presents the entitlements, BDL shares and LTDLE factors used in the 2018 analysis. Except for Lowbidgee Redbank diversions, these values were sourced from Table 18 of the [Water reform technical report: Derivation of LTDLE factors in NSW \(May 2018\)](#). The factors were calculated as the BDL share divided by the entitlement and rounded to three decimal places. The LTDLE factors for Redbank North and South were revised in 2019 report [Long-term diversion limit equivalence factors for Redbank](#), following an investigation prompted by recommendations to allocate the north–south split based on historical diversions.

### 2024 factors

Table 8 outlines the basis for determining the updated LTDLE factors in 2024. The revised Basin Plan BDL for the regulated component of the Murrumbidgee is 2,044,220 ML.

The LTDLE factors for entitlement types — Domestic and Stock, Local Water Utility, High Security and High Security (TWS), and Conveyance — were calculated by multiplying the average reliability by the utilisation factor.

For supplementary and Lowbidgee entitlement types (Nimmie–Caira, Redbank North and South), the LTDLE factors were calculated by dividing BDL shares, derived from the long term average BDL diversions in Table 3 (see section ‘BDL diversions’), by the respective entitlement shares. As Nimmie–Caira net diversions fully contribute to Bridging The Gap, the BDL share is deemed to be 173,900 ML/y. Accordingly, the LTDLE factor for Nimmie–Caira remains unchanged from the 2018 value of 0.456. For Redbank, the updated BDL diversions in Table 3 were divided by the updated consumptive entitlement shares, resulting in updated LTDLE factors of 0.266 for Redbank North and 0.277 for Redbank South.

A different approach was used to calculate the LTDLE factor for General Security. To maintain consistency with the total BDL regulated component of 2,044,220 ML/y, the BDL share for General Security was derived as the residual — calculated by subtracting the BDL shares of all other entitlement categories from the revised BDL regulated total — resulting in a value of 1,024,125 ML/y. The LTDLE factor for General Security was then calculated by dividing this BDL share by the entitlement share, yielding a factor of 0.590.

## Updated water recovery estimates

For a relative comparison, the environmental entitlements were from Water reform technical report: Derivation of LTDLE factors in NSW (May 2018). As shown in Table 9 the new factors result in a decrease in the LTDLE volume of high security, conveyance, general security and Redbank North Lowbidgee entitlement types. This is offset by increases in the LTDLE value of recovery from supplementary water. This represents a net increase of 224 ML/y in the LTDLE volume of recovery in the Murrumbidgee.

Table 8. Murrumbidgee entitlements, 2018 factors, 2024 factors derivation and BDL shares by entitlement class

Entitlement type	2018			2024				
	BDL Entitlements	Factors	BDL share (ML/y)	BDL Entitlements	Average reliability	Utilisation factor	Factors <sup>e</sup>	BDL share (ML/y)
Domestic and stock	35,922	0.805	28,923	35,922	1.000	0.792	0.792	28,450
Local water utility	21,586	0.488	10,531	23,586	1.000	0.469	0.469	11,062
High Security	357,651	0.977	349,592	357,431	0.978	0.986	0.964	344,563
High Security (TWS)	19,769	0.977	19,324	19,769	0.978	0.986	0.964	19,057
Conveyance	371,468	0.870	323,276	351,468	0.953	0.898	0.856	300,857
General Security	1,744,030	0.591	1,031,429	1,734,662	0.784	-	0.590	1,024,125
Supplementary water access	198,780	0.377	75,000	198,780	-	-	0.423	84,088 <sup>f</sup>

Application and assumptions used for deriving the BDL-based 2024 LTDLE factors for the Murrumbidgee

Entitlement type	2018			2024				
Lowbidgee entitlement- Nimmie-Caira net diversions	381,000	0.456	173,900	381,000	-	-	0.456	173,900
Lowbidgee entitlement- Redbank North diversions	213,499	0.279 <sup>a</sup>	59,579 <sup>b</sup>	211,000 <sup>c</sup>	-	-	0.266	56,205
Lowbidgee entitlement- Redbank South diversions	152,501	0.298 <sup>a</sup>	45,443 <sup>b</sup>	6,913 <sup>d</sup>	-	-	0.277	1,912
<b>Total</b>	<b>3,496,206</b>	<b>-</b>	<b>2,116,997</b>	<b>3,320,531</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2,044,220</b>

NSW BDL based LTDLE factors - updated Murrumbidgee 2024.xlsx (sheet '2 BDL Factors', row 87-101 & col O-T for 2024 factors related)

<sup>a</sup> updated factors of 0.2791 for Redbank North and 0.2980 for Redbank South diversions from Long-term diversion limit equivalence factors for Redbank (2019)

<sup>b</sup> updated BDL share for Redbank South of 59,579 (105,022 \* 56.73%) and Redbank North (105,022 \* 43.27%) from Long-term diversion limit equivalence factors for Redbank (2019)

<sup>c</sup> Redbank North entitlement as at 30 June 2009 was assumed as the initial share entitlement of 211,000.

<sup>d</sup> Redbank South entitlement as at 30 June 2009 was calculated as: initial share entitlement of 155,000 minus Yanga National Park share entitlement of 148,087 = 6,913 shares

<sup>e</sup> factors are rounded to three decimal places, as directed by MDBA.

Application and assumptions used for deriving the BDL-based 2024 LTDLE factors for the Murrumbidgee

<sup>f</sup> Use attributable to supplementary access entitlements has increased, despite the modelled ‘off-allocation’ being largely unchanged. The difference derived from the subdivision of the modelled ‘off-allocation’ into without debit take which is reconcile to general security licences and supplementary entitlement access. This subdivision is based on historical diversion records since been updated from 2016.

Table 9. Summary of Murrumbidgee environmental entitlements, the LTDLE volumes under the 2024 and 2018 factors and the difference between the 2024 and 2018 factor volumes by entitlement class

Entitlement type	NSW environmental entitlements register–May 2018 (ML)	Other entitlements nominated by MDBA & DAWR (ML)	Total environmental entitlements (ML) <sup>a</sup>	2018 factor	Recovery under 2018 factors (ML/y) <sup>d</sup>	2024 factor	Recovery under 2024 factors (ML/y) <sup>d</sup>	Change in recovery amount (ML/y)
Domestic and stock	–	–	–	0.805	–	0.792	–	–
Local water utility	–	–	–	0.488	–	0.469	–	–
High Security	10,866	5,124	15,990	0.977	15,622	0.964	15,414	-208
High Security (TWS)	–	–	–	0.977	–	0.964	–	–
Conveyance	29,545	16,317	45,862	0.870	39,900	0.856	39,258	-642
General Security	301,888	9,799	311,687	0.591	184,207	0.590	183,895	-312
Supplementary water access	27,666	5,888	33,554	0.377	12,650	0.423	14,193	1,543
Lowbidgee entitlement–Nimmie–Caira net diversions	381,000	–	381,000	0.456	173,736	0.456	173,736	0

Application and assumptions used for deriving the BDL-based 2024 LTDLE factors for the Murrumbidgee

Entitlement type	NSW environmental entitlements register–May 2018 (ML)	Other entitlements nominated by MDBA & DAWR (ML)	Total environmental entitlements (ML) <sup>a</sup>	2018 factor	Recovery under 2018 factors (ML/y) <sup>d</sup>	2024 factor	Recovery under 2024 factors (ML/y) <sup>d</sup>	Change in recovery amount (ML/y)
Lowbidgee entitlement–Redbank North diversions	12,117	–	12,117	0.279 <sup>b</sup>	3,381	0.266	3,223	-158
Lowbidgee entitlement–Redbank South diversions	–	–	–	0.298 <sup>b</sup>	–	0.277	–	–
Unregulated	164	–	164	0.517 <sup>c</sup>	85	0.517 <sup>c</sup>	85	0
<b>Total</b>	<b>763,246</b>	<b>37,128</b>	<b>800,374</b>	<b>–</b>	<b>429,580</b>	<b>–</b>	<b>429,805</b>	<b>224</b>

NSW BDL based LTDLE factors - updated Murrumbidgee 2024.xlsx (sheet 'BIDG\_WaterRecovery\_Table9)

<sup>a</sup> General security entitlement volume of 7,656 ML purchased for the ACT shared reduction amount is not accounted for in this table

<sup>b</sup> The factors for Lowbidgee Redbank North and South diversions from 'Long-term diversion limit equivalence factors for Redbank'

<sup>c</sup> The factor 0.517 for unregulated river is from 'Use of Long-term Diversion Limit Equivalence (LTDLE) factors for unregulated river systems'

<sup>d</sup> The recovery volumes presented here are for relative comparison only, calculated by applying the 2018 and 2024 three-digit factors to the total environmental entitlements shown in the table.

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## Reference material

### LTDLE factors reference:

- Consultation paper: [NSW updated factors for water recovery](#) (June 2018)
- Water reform technical report: [Derivation of LTDLE factors in NSW](#) (May 2018) (refer to this document for all inputs related to calculate the LTDLE factors including the reference files)
- Updated Redbank LTDLE factors: [Long-term diversion limit equivalence factors for Redbank](#) (2019)
- Unregulated LTDLE factors: [Use of Long-term Diversion Limit Equivalence \(LTDLE\) factors for unregulated river systems](#)

### Supporting files for the updates

- Confluence page: [Murrumbidgee 2024 LTDLE](#) (All referenced files are available on this page)
- NSW BDL based LTDLE factors - updated Murrumbidgee 2024.xlsx (sheet '2 BDL Factors')
- Murrumbidgee\_2004-2024\_extWMAWaterAccounts-413.xlsx
- Snowy\_WFR\_holdings.xlsx
- BDLA\_bdl\_take.xlsx
- BDLA\_alloc\_30Jun.xlsx
- Convey\_reliability\_bdl.xlsx

### Other reference

- Murrumbidgee Surface WRP – Modelling – Baseline Diversion Limit Scenario Report (update December 2021), Attachment A to Schedule F of the Murrumbidgee Surface Water Resource Plan.