NSW GOVERNMENT

NAMOI WATER RESOURCE PLAN

Sustainable diversion limit scenario method for Namoi

September 2019

Version History

Version	Author(s)	Comments	Date
0.1	Andrew Brown	Initial template draft	05/09/2018
0.2	Michael Sugiyanto	Initial draft	23/03/2019
0.3	Michael Sugiyanto	Updated model run to reflect updated Peel BDL as per MDBA comments	02/05/2019
0.4	Michael Sugiyanto	Added assumption that shortfall recovery will be fully recovered by Commonwealth	06/05/2019
1.0	Michael Sugiyanto	Addressed references and checked numerical values	13/05/2019
1.1	Michael Sugiyanto	Updated unmodelled component based on MDBA 's Aug 2019 estimate	20/09/2019
1.2	Michael Sugiyanto	Updated APT section Added comments about SDLAM	26/09/2019

Approval

Action	Staff member	Role	Signature	Date
Submitted	Michael Sugiyanto	Senior Modeller		23/03/2019
Approved	Richard Beecham	Manager Water Modelling		17/05/2019

Published by the Department of Planning, Industry and Environment

Namoi River System – Sustainable Diversion Limit Scenario Method

First published September 2019

INT19/47928

More information

Michael Sugiyanto, Department of Planning, Industry and Environment—Water, Parramatta

www.industry.nsw.gov.au/water

Acknowledgments

[http://www.environment.nsw.gov.au/ieo/Namoi/maplg.htm]

Contents

Figures

Tables

Glossary

Term	Definition
BDL	Baseline Diversion Limit under the Basin Plan
Cap	The Murray Darling Basin Ministerial Council Cap on Diversions
DOS	Disk Operating System
EFRG	Environmental Flows Reference Group
EWA	Environmental Water Allowance
ECA	Environmental Contingency Allowance
FPH	Floodplain Harvesting
GUI	Graphical User Interface
IQQM	Integrated Quantity and Quality Model
LTAAEL	Long term Average Annual Extraction Limit
LTDLE	Long Term Diversion Limit Equivalence
MDB	Murray Darling Basin
MDBA	Murray Darling Basin Authority
MDBSY Project	Murray Darling Basin Sustainable Yields Project
OLFH	Over Land Flow Harvesting
PBPR	Pre-Basin Plan Recovery
SDL	Sustainable Diversion Limit
WMA	Water Management Act
WRP	Water Resource Plan
WSP	Water Sharing Plan

1 Introduction

The 2012 Basin Plan, established under the WA 2007, defines the maximum limit of consumptive diversions at valley as well as basin scale. Water Resource Plans (WRPs) are being developed for each valley to meet Basin Plan requirements. A significant element of the WRP is that the allowable long term average annual diversions have been set as the Sustainable Diversion Limit (SDL). This SDL depends on an estimate of the Baseline Diversion Limit (BDL), which is the long term average annual diversion calculated over the period 1895-2009 that was allowable under state water planning law prior to when the Basin Plan was formulated. The SDL is the BDL minus a fixed recovery target.

These long term average annual diversions are estimated using IQQM software models of the river system. These models estimate a range of water balance components such as streamflow and diversions based on climatically derived water availability, levels of water resource development, and water sharing policies.

An estimate of BDL by MDBA published in Schedule 3 of the 2012 Basin Plan has since been revised by NSW, with the changes principally based on improved flow calibration and revisions of components of the WSP, which are based on actual rather than assumed operation. These improvements are reported in a related technical note.

This revised BDL estimate has resulted in a commensurate revised SDL that the Namoi WRP needs to comply with. The Namoi WRP has been developed with the water sharing arrangements and rules informed by the results of a range of modelled scenarios. Although the Namoi is managed as one resource unit in WRP under the Basin Plan, New South Wales manages the Namoi under two WSPs:

- Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources (hereafter the Namoi WSP)
- Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources (hereafter the Peel WSP)

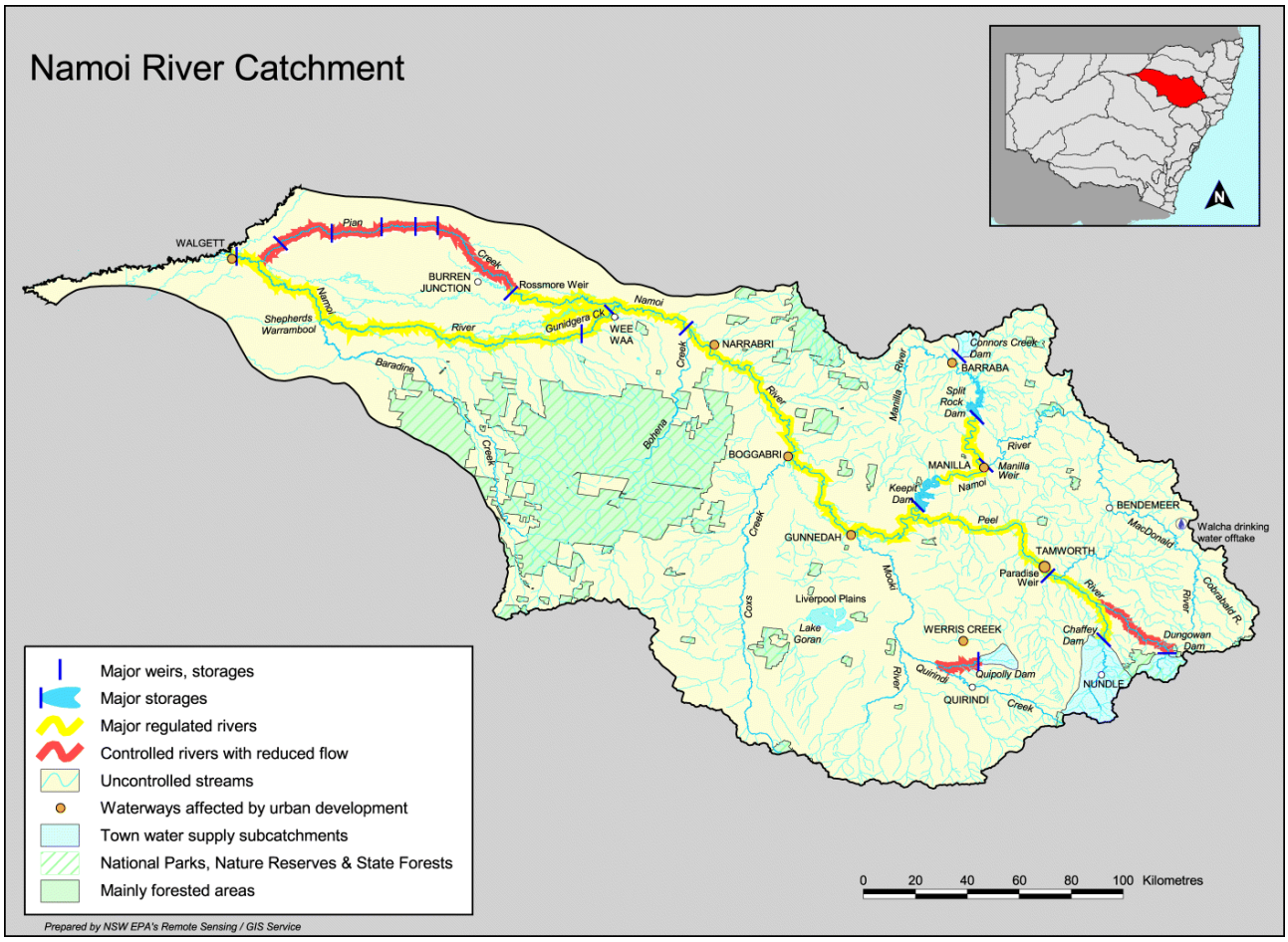

Figure 1-1. Namoi and Peel River Catchment

1.1 The Sustainable Diversion Limit Scenario

The SDL scenario is the model configured with the development conditions that currently exist and management arrangements that will be in place for the WRP period to 2029. This includes development conditions such as: public infrastructure, areas developed for irrigation, and the capacity of water users to extract and store water on farm, as well as management arrangements such as the distribution and usage patterns of entitlement holders, the crop area planting decisions of irrigation enterprises, and operation of storages to supply consumptive and environmental water.

The SDL scenario demonstrates that the WRP would be SDL compliant over the historical reference period 1895 to 2009 in response to clause 10.10 of the Basin Plan. The SDL scenario is also a component of the method for determining the permitted take.

This report describes the development of the SDL scenario, and should be read in conjunction with other reports including the PBP and BDL scenario reports (DoI, 2018a; DoI, 2018b; DoI, 2018c; DoI, 2018d), MDBA Technical report 2010/20 (MDBA, 2011) and the IQQM CAP implementation summary report (DIPNR, 2005).

1.2 Purpose of Report

This report is intended primarily for MDBA to fulfil the requirements of two Basin Plan clauses on SDL compliance and permitted take method. The report also informs the Stakeholders Advisory Panel (SAP) on both of these items. The purpose of the report is to describe how the SDL Scenario was developed, and document the key features of the scenario.

The technical content of this report is kept to only that necessary to meet the intent. The general development and calibration of the model is described in the IQQM Cap Implementation Summary Report (DIPNR, 2005).

2 Model Development

As mentioned in section 1, there are two WSPs that cover the Namoi Water Resource unit. Subsequently, there are two separate river system models that have been developed and used for planning purpose. The Namoi model covers both the Upper and Lower Namoi; starting from headwater inflows of Split Rock Dam (Manilla catchments), down to the Keepit Dam then the Namoi lower floodplains where it joins Barwon River confluence at Walgett. The Peel model covers the Peel River system, from upstream Chaffey Dam through to Tamworth and Peel River at Carroll Gap.

2.1 WSP to 2009

The initial Namoi (Upper Namoi and Lower Namoi) and Peel IQQM were developed in the mid and late-1990s using an early version of the IQQM software for the purpose of MDBMC Cap compliance and for developing the 2004 Namoi WSP and 2010 Peel WSP.

Subsequent to the WSP, the capability of the Namoi and Peel IQQM to estimate annual and long term average diversions was established by an independent review under MDBC Cap governance arrangements. The review assesses the following aspects:

- accuracy of the model to predict annual diversions and end of system flows;
- the method used to establish levels of development, and their representation in the models;
- the method used to adjust water use for climatic variation;
- capability of the model to simulate long-term average diversions; and
- robustness of the model to simulate outside the calibration period.

The conceptualisation, data, calibration and scenario configurations are reported in the Namoi (DIPNR, 2005) and Peel (DNR, 2006). These models were independently audited under the MDBMC Cap (Bewsher, 2005 and Bewsher, 2007).

The reviewer concluded the model to be sufficiently robust and unbiased, and recommended it could be used to estimate annual and long-term average diversions. The model was Cap approved by the Commission as fit for purpose.

A further review of the model was undertaken as part of the MDB Sustainable Yields Project, and to establish its fitness-for-purpose for use in MDBA modelling for the Basin Plan (Podger et al, 2010).

2.2 Revisions to model

2.2.1 Post 2009

The department continually improves its models. The Namoi model key updates are listed below with details reported in model update document (DPI, 2017).

- More consistent climate data source
- Improved ungauged flow and loss estimates due to longer calibration period.
- Higher resolution of flow path configuration
- Better representation of Split Rock to Keepit transfer behaviour

The most significant update to the Peel model is the responsive capability to estimate planted area depending on water availability. This makes the model more appropriate when evaluating potential rule changes during the WRP process.

2.2.2 Difference of SDL from PBP

The SDL scenario is intended to estimate diversions based on conditions that currently exist and management arrangements that will be in place for the WRP period to 2029. This means that the difference between the PBP and the SDL scenarios is confined to difference in the management rules between the current WSP and the WSP that will be enacted under the Basin Plan.

In the current Namoi WSP, Upper Namoi General Security entitlement can have a maximum account balance of 100%. The WSP proposes to change this to 150%, which provides flexibility to Upper Namoi water users during dry years (the ability to carry over their unused water). The maximum annual usage limit is kept the same at 100%.

Apart from the trade rule modification, there is no change to the Peel WSP so the management rules are largely the same as WSP at the start of the WSP. So the Peel SDL model is the same as Peel PBP model.

All other input parameters of the PBP scenarios are presented in Namoi and Peel PBP reports (DoI, 2018a and DoI, 2018b).

3 Valley SDL number

The surface water SDL for the Namoi water resource plan area is defined by the Basin Plan as the BDL minus 20 GL/year of local reduction and Namoi's component of the shared reduction amount in the northern Basin shared zone in Schedule 2 of the Basin Plan. The shared reduction for the Namoi SDL unit is zero GL/year, making total reduction required equal to 20.0 GL (MDBA, 2018).

There are no notified supply or efficiency measures for the Namoi under the SDL adjustment mechanism on the Register of measures dated 30 June 2019[1].

The BDL is based on the sum of the modelled diversions, unmodelled watercourse diversions and interceptions. Schedule 3 of the Basin Plan states Namoi BDL to be 508 GL/year, and consists of the following components:

- Regulated river diversions - 265 GL/year
- Flood-plain harvesting – 13.8 GL/year (MDBA, 2011)
- Unregulated rivers take (excluding take under basic rights) –78 GL/year
- Take by runoff dams - 160 GL/year
- Take by commercial plantations - 5 GL/year

The revised model provides an updated estimate of BDL (DoI, 2018). The required Valley SDL is calculated as UPDATED BDL minus REQUIRED RECOVERY. Assuming no further changes in the shared reduction target, the Namoi SDL is 490.3 GL/year, calculated as 510.3 GL/year minus 20.0 GL/year.

[1] Table B from Register of Measures as published by MDBA. Retrieved from https://www.mdba.gov.au/sites/default/files/Register-of-measures-30-June-2019.pdf

4 Results and Demonstration of SDL Compliance

4.1 Long-Term simulation results

Table 1 shows the average annual diversions for different components of the models discussed. The modelled component has been estimated using the latest models, including the updated BDL estimates from the new BDL models for the Upper and Lower Namoi as well as Peel model. The FPH estimate in the table is the same as the MDBA estimate[2]. Modelling work is being carried out to better estimate FPH take as part of the Healthy Floodplains Project. At the date of this report the work is not yet completed and the previous estimate of FPH take prepared by MDBA will continue to be used until the Healthy Floodplains Project is complete.

Table 1 - Comparison of modelled results from updated BDL and SDL scenarios (1985 - 2009)

Component	Scenario	
	Updated BDL	SDL
	Long term average diversion (GL/year)	
General Security	198.5	159.3
Supplementary access	44.3	59.7
High Security, Utilities, Domestic and Stock	10.5	12.3
Modelled total	**253.2**	**231.2**
MDBA estimates for other components:		
- *Floodplain Harvesting*[1]	14.0	14.0
- *Unregulated (excluding Basic Rights)*	78.1	78.1
- *Runoff Dams (excluding Basic Rights)*	139.0	139.0
- *Runoff Dams (under Basic Rights)*	21.0	21.0
- *Commercial plantations*	5.0	5.0
Unmodelled total	**257.1**	**257.1**
TOTAL	**510.3**	**488.3**

[2] Murray-Darling Basin Baseline Diversion Limits - estimate for 2019 / 2020 water year. Retrieved from https://www.mdba.gov.au/sites/default/files/pubs/Baseline%20Diversion%20Limit%20%28BDL%29s%20for%202019_2020%20water%20year%20-%20surface%20water....pdf

4.2 Description of representation of HEW

As of March 2019 the Held Environmental Water (HEW) portfolio in the Namoi consists of only General Security entitlements[3], which are detailed in Table 2:

Table 2 – Namoi HEW portoflio

Catchment	Shares (ML)		
	Purchased	Efficiency Programs	Total
Upper Namoi	105	0	105
Lower Namoi	6,594	6,954	13,548
Peel	0	1,257	1,257
Total HEW	**6,699**	**8,211**	**14,910**

Because very little is known regarding how exactly HEW is going to be used, the use of assumed demand behaviours for the HEW portfolio would introduce material risk that the resulting scenario could show 3rd party impacts or benefits that are unrealistic. To avoid distortion of the scenario outcomes that may alter decisions made around other rules and options being considered, the HEW portfolio has been modelled as a consumptive use that assumes an irrigation demand pattern.

Based on this modelled representation of HEW, a deemed use can be estimated through application of the latest Long Term Diversion Limit Equivalence (LTDLE) factors (MDBA, 2016A). Results and calculation process are shown in Table 3. Estimate on current water recovery in the Namoi is also presented in this table.

[3] Data source: Environmental Water Portal (EWP), 2018

Table 3 - Estimates of NSW and Commonwealth HEW via LTDLE Factors

Usage category	LTDE factor*	NSW and Commonwealth HEW	
		Entitlement (shares)	SDL deemed use (GL/year)
Calculation →	*[1]*	*[2]*	*[3]=[2] x [1] / 1000*
Upper Namoi + Lower Namoi			
Domestic and Stock	0.435	0	0
Local Water Utility	0.349	0	0
High Security	0.723	0	0
General Security	0.753	13,653	10.3
Supplementary Water Access	0.279	0	0
Peel			
Domestic and Stock	0.282	0	0
Local Water Utility	0.525	0	0
High Security	0.393	0	0
General Security	0.209	1,257	0.3
TOTAL			**10.5**

4.3 SDL Compliance and current water recovery

Based on figures in Table 1 and Table 3, the expected long term average annual diversion over the period 1895 to 2009 calculated SDL[4] is 477.8 GL/year (i.e. 488.3 GL/year minus 10.5 GL/year), which is 12.5 GL/year lower than required SDL of 490.3 GL/year.

The latest estimate of 10.5 GL/year current recovery in the Namoi indicates 9.5 GL/year of shortfall in total required recovery.

We assume that the Commonwealth will fully recover the shortfall. The majority of the water recovery has come from the Upper and Lower Namoi, where the LTDLE factor is higher. We could then assume that the additional recovery would come from General Security entitlements in Upper and Lower Namoi with the same LTDLE factor in Table 3. Approximately 12.6 GL of General Security purchased would equal to 9.5 GL/year of equivalent recovery.

[4] FPH component is based on previous MDBA estimate

If we assume that full recovery is met, the expected long term average annual diversion over the period 1895 to 2009 calculated SDL becomes 468.3 GL/year (i.e. 488.3 GL/year minus 20.0 GL/year), which is 22.0 GL/year lower than required SDL of 490.3 GL/year.

4.4 Permitted Take Method for the Namoi

Section 10.10 of the Basin Plan requires the WRP for each SDL resource unit to set out the method for determining the maximum quantity of water that the plan permits to be taken for consumptive use in each water year after 30/06/2019. For the Namoi this method consists of running SDL scenario model over the year of SDL compliance audit, and assessing simulated take against actual take.

Details on how the model is to be used to estimate permitted annual take are presented in Table 4 below.

The SDL scenario is intended to estimate diversions based on conditions that currently exist and management arrangements that will be in place for the WRP period to 2029. This means that the difference between the PBP and the SDL scenarios is confined to difference in the management rules between the current WSP and the WSP that will be enacted under the Basin Plan. This also means that the SDL scenario is regarded as the most up to date current conditions model at the start of the Water Resource Plan in 2019.

The IQQM model scenario system files to be used are NamoS002.sqq (INT19/47926) and PeelS001.sqq (INT19/47917) dated 02/05/2019.The version of the IQQM executable is 7.91.6 [Rev2999].

Consumptive trade is allowed between the Peel and the Lower Namoi WSP unit, subject to conversion factor (system loss) and other conditions specified in both the Namoi WSP and the Peel WSP. However, there is no trade from and to the Namoi SDL unit (SS21). Therefore adjustment for consumptive trade is not required for the Namoi permitted take method because both Peel and Namoi are part of the same SDL unit.

Table 4 - Calculation of annual permitted take using SDL model

Water take	Nodes/Value	No of Nodes	IQQM Output variable	Post- processing	Comment
Modelled					
Upper and Lower Namoi					
General Security	All node type 8.1	29	1	Sum all values	N/A
Supplementary	All node type 8.1	29	2	Sum all values	N/A
High Security, Utilities, Stock and Domestic	All node type 3.0	51	2	Sum all values	N/A
Peel					
General Security	All node type 8.0 except node 0091	5	1 + 2	Add variable 1 (General Security) and variable 2 (uncontrolled flow portion)	Uncontrolled flow is debited against General Security accounts. Node 0091 is a redundant node in the model with zero water use.
Town Water Supply	Node type 3.7	1	2	N/A	Tamworth water use.
High Security, Stock and Domestic	All node type 3.0	7	2	Sum all values	N/A
Unmodelled (as estimated by MDBA)					
Floodplain Harvesting	13.8	n/a	n/a	Adopt estimate	MDBA (2010)
Unregulated[5]	78.1	n/a	n/a	Adopt estimate	MDBA (2010)
Basic Rights	n/a	n/a	n/a	Adopt estimate	Yet to be estimated
Runoff dams	160.0	n/a	n/a	Adopt estimate	Schedule 3 of BP 2012
Commercial plantations	5.0	n/a	n/a	Adopt estimate	Schedule 3 of BP 2012
Total				**Sum all values**	

4.4.1 Calculating the scaling factor

If water use in the valley was the same as at 30 June 2009 and water recovery had removed the intended amount of potential consumptive take, then the long-term mean take from the current conditions model would be equal to the SDL. As the behaviour of water users has not remained stationary then it is unlikely that the current conditions model will return a level of take that is at the SDL. In the event that the model did reproduce the required SDL, there is still a requirement under section 10.10(5) to produce a permitted take method that can be adjusted for amendments to the SDL. To achieve this flexibility, it is proposed to scale the consumptive take simulated by the

[5] Excludes extraction under Basic Rights

current conditions scenario in such a way that the long-term mean annual permitted take is equal to the required SDL.

To calculate the scaling factor, the BDL model is run over the standard period to get the mean annual consumptive take, $\overline{BDL}$. The current conditions model is run over the same period to obtain mean annual consumptive take, $\overline{CURR}$. A scaling factor is then calculated as follows:

$$k_{div} = \frac{\overline{BDL} - Required\_SDL\_Reduction}{\overline{CURR}}$$

A scaling factor ensures that the long-term mean annual permitted take will always be equal to the SDL, when calculated over the standard period. This meets the requirement in section 10.10(4) of the *Basin Plan* and, because the required SDL reduction is a parameter of the method, the requirement at 10.10(5) is also met.

Scaling makes the annual permitted take independent of the current level of utilisation and ensures that the method meets the requirements of 10.12(1)(g) as far as the permitted take method is part of the growth-in-use strategy. A permitted take method will only work as a growth-in-use strategy when used in conjunction with a SDL compliance mechanism and the necessary water sharing plan rules to give effect to the compliance outcomes.

The most current condition model (SDL scenario described in previous section) indicates modelled long term total consumptive take of 231.2 GL/year. If we assume that recovered recovery occurs only at the modelled forms of take, the modelled component of the unadjusted SDL estimate is then 2 GL/year lower than the required SDL of 233.2 GL/year (253.2 GL/year minus 20.0 GL/year).

The required scaling factor is then the ratio of 233.2 GL/year divided by 231.2 GL/year. **This ratio is 1.0087.**

4.4.2 Calculating an annual value for a particular water year

After the end of a water year, the input data for the current conditions model will be updated. The model will then be run over the period 1 July 2019 to the end of the current water year. The model will provide consumptive take for the last water year (t), $CURR_t$. The annual permitted take (APT_t) is then calculated by multiplying with scaling factor (k_{div}):

$$APT_t = k_{div} \times CURR_t$$

After the water year has finished, the inputs to the current condition model are updated to the end of the last water year. This includes updating the required inputs for both the Namoi and Peel models.

The current condition models are then run with initial conditions that will replicate historically recorded storage volumes as at 30 June 2019. The model then run continuously to the last water year.

After running the PBP model, the consumptive take is calculated for the last water year by following the same methodology as described in Table 1. The annual total is multiplied by the scaling factor, thereby producing the annual permitted take.

4.4.4 Unmodelled forms of take

For the forms of take currently unmodelled, the long-term mean annual values in Table 1 have been adopted. Unless otherwise noted, these values have been taken from MDBA (2018b) and are the best available information.

4.4.5 Demonstration that the annual permitted take meets the SDL

The Basin Plan requires a demonstration where the application of the annual permitted take method over the reference period of 1895 to 2009 meets the SDL.

For the modelled forms of take, this is achieved by applying the proposed annual permitted take method to the period 1895-2009 (see Figure 2). The mean annual value for the period July 1895 to June 2009 is 233.2 GL/year, which is equal to the modelled regulated river component of the SDL.

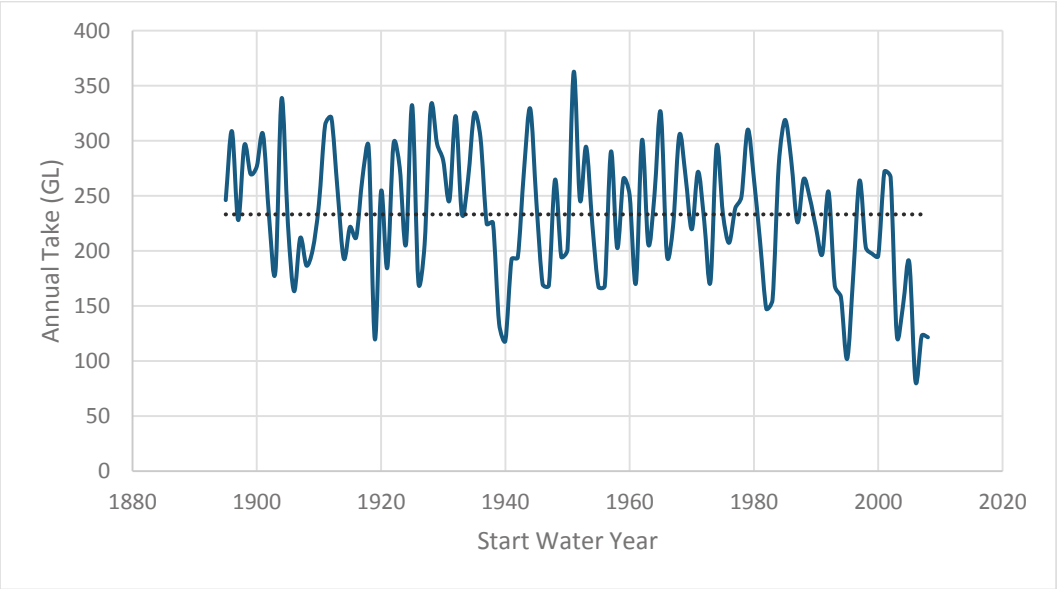

Figure 2 Annual Permitted Take Regulated River

For unmodelled forms of take, the latest MDBA estimate will be used as discussed above.

5 SDL key Model Parameters

Table 5 and Table 6 contain key configuration information for the SDL scenario.

Table 5 – Namoi Model - SDL Infrastructure & Development Parameters

Items	Description
General	
System File Name	NamoS002.SQQ
IQQM Version developed in	7.91.6
Available Simulation Period	30/09/1892-30/06/2016
Water Year	July to June
Valley Development Levels	
Maximum Crop area	2012
Crop Mix	Average of 2008 to 2016
Licence Volume	2012
Catchment Information	
Headwater storages modelled	
Split Rock	
Inactive storage (GL)	3.2
Full supply volume (GL)	397.4
Keepit	
Inactive storage (GL)	6.6
Full supply volume (GL)	425.5
Entitlements	
General Security (shares)	
d/s Split Rock Dam	9,352[6]
d/s Keepit Dam	
Consumptive	228,467
HEW NSW	0
HEW Commonwealth	14,910
d/s Keepit Dam Total	243,377
TOTAL VALLEY	252,729
High Security (shares)	
d/s Split Rock Dam	80
d/s Keepit Dam	3,904
TOTAL	3,984
Town Water Supply (shares)	2,421
Stock and domestic (shares)	2,160
Supplementary Access Cap (ML/y)	113,900
Irrigation development	

[6] The model has an additional 50% of General Security entitlements in the Upper Namoi. This is done to reflect 150% account limit as proposed. This is the best available method at the time of writing due to IQQM limitation.

Items	Description
Maximum farm area (ha)	88,882
Maximum summer area (ha)	38,541
Maximum winter area (ha)	10,326
On-farm storage capacity (ML)	219,025
Installed pump capacity (ML/d)	14,065
On-farm storage operation	
Rainfall runoff harvesting	Yes
Airspace allowed	Yes
Accounting System Lower Namoi	
Type	Continuous
Debiting type	Water order
Maximum balance	200%
Maximum use of entitlement	125% subjected to a max of 300% in 3 consecutive years
Accounting System Upper Namoi (not modelled explicitly)	
Type	Annual, first priority
Debiting type	Water use
Uncontrolled flow	Use without debit when AWD < 60 %
Storage Operation	
Split Rock to Keepit transfers	Water can be transferred from Split Rock to Keepit when volume stored in Keepit is insufficient to meet projected downstream demands and when volume stored in Split Rock Dam above 38 GL. Releases made to a pattern.
In-stream requirements	
Average annual replenishment flow usages and maximum caps in brackets(ML/y)	
Pian Creek	2,000 (14,000)
Minimum flow requirements at various locations (ML/d)	
Manilla R d/s Split Rock	5 (Apr – Sep) and 6 (Oct – Mar)
Namoi R d/s Keepit	10
Namoi R @ Walgett	21 (Jun), 24 (Jul) and 17 (Aug)
Environmental Water	
Planned Environmental Water	
Surplus flow sharing	90:10 July to October (Environment: Irrigation) 50:50 the rest
Surplus flow threshold	Various, as of WSP c49(9) to (12), function (allocation, month)

Table 6 – Peel Model - SDL Infrastructure & Development Parameters

Items	Description
General	
System File Name	PeelS001.SQQ
IQQM Version developed in	7.91.6
Available Simulation Period	01/01/1892 - 30/06/2016
Water Year	July to June
Valley Development Levels	
Maximum Crop area	2013
Crop Mix	2000
Licence Volume	2005
Catchment Information	
Headwater storages modelled	
Chaffey	
Inactive storage (GL)	2.4
Full supply volume (GL)	100.0
Average annual inflow (GL)	52.2
Dungowan	
Inactive storage (GL)	0.4
Full supply volume (GL)	6.3
Average annual inflow (GL)	11.2
Entitlements	
General Security Entitlements (shares)	
d/s Chaffey Dam	
Consumptive	30,878
High Security (shares)	
d/s Chaffey Dam	601
Town Water Supply (shares)	
d/s Chaffey	16,400
Stock and domestic (shares)	381
Irrigation development	
Maximum planted area (ha)	1,746
Installed reg pump capacity (ML/d)	415
Accounting System Lower Peel	
Type	Annual
Debiting type	Water use
Maximum balance	100%
Maximum use of entitlement	100%
Storage Operation	
Dungowan Dam	Water is released from Dungowan dam to meet Tamworth demand, based on maximum daily limit of 22 ML/d. The Tamworth Regional Council Drought Management Plan in 2015 aims to increase water held in Dungowan Dam.
Chaffey Dam	Demand from Tamworth is restricted during dry years as per

Items	Description
	advice given by Tamworth Regional Council. Reduction of demand applies according to 2015 TRC Drought management Plan triggers. **Dam Level** — **Usage Target** 40% — 95% 35% — 90% 30% — 85% 25% — 75% < 25% — 65%
In-stream requirements	
Average annual replenishment flow usages and maximum caps in brackets(ML/y)	
Translucency	5,000 ML/y of ECA account is set aside in Chaffey Dam. The WSP does not specify triggers; however the model releases 700 ML/d in Mar-June (advised to be most likely use period).
Minimum flow requirements at various locations (ML/d)	
Chaffey Dam release	3
Dungowan Creek R d/s Dungowan	10
Carrol Gap	10 (Oct to Feb)
Environmental Water	
Planned Environmental Water	
Surplus flow sharing	50% as per Water Act 1912
Surplus flow threshold	As per WSP c62: If AWD < 35% and Carroll Gap Flow > 40 ML/d If AWD >= 35% and Carroll Gap Flow > 50 ML/d

References

Government of Commonwealth of Australia 2007, *Water Act (WA) 2007*, Canberra, 2010. https://www.legislation.gov.au/Details/C2007A00137

Bewsher Consulting Pty Ltd (2005), Namoi Valley Independent Audit of Cap Model

Bewsher Consulting Pty Ltd (2007), Peel Valley Independent Audit of Cap Model

Department of Infrastructure, Planning and Natural Resources (DIPNR) 2005, *IQQM Cap Implementation summary report for the Namoi River Valley.* NSW DIPNR 2005

Department of Infrastructure, Planning and Natural Resources (DIPNR) (2004), *Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016.* https://legislation.nsw.gov.au/#/view/regulation/2015/631/whole

Department of Infrastructure, Planning and Natural Resources (DIPNR) (2009), *Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010.*
https://www.legislation.nsw.gov.au/#/view/regulation/2010/134/whole

Department of Industry Water (DoI) 2013, Namoi 2013 Flow Recalibration – Technical Note (unpublished)

Department of Industry Water (DoI) 2018a, Namoi Regulated River System Baseline Diversion Limit Scenario Model

Department of Industry Water (DoI) 2018b, Namoi Regulated River System Pre Basin Plan Scenario Model

Department of Industry Water (DoI) 2018c, Peel Regulated River System Baseline Diversion Limit Scenario Model

Department of Industry Water (DoI) 2018d, Peel Regulated River System Pre Basin Plan Scenario Model

Department of Primary Industries Water (DPI, 2017), Namoi Regulated River: 2017 Updating BDL Notes. DPI Water. (unpublished)

Department of Natural Resources (DNR) 2006, *IQQM Cap Implementation summary report for the Peel River Valley.* NSW DNR 2006

Murray-Darling Basin Authority (MDBA) 2010, *Water Resource Assessments for Without Development and Baseline Conditions Report*, MDBA, 2011

Murray-Darling Basin Authority (MDBA) 2011, *Water Resource Assessments for Without Development and Baseline Conditions Report: Murray–Darling Basin Authority technical report 2010/20 Version 2*, MDBA, 2011

Murray-Darling Basin Authority (MDBA) 2016a, *NSW BDL based LTDLE factors v20A – 25 May 2018.xlsx*, MDBA, 2018

Murray-Darling Basin Authority (MDBA) 2016b, *The Northern Basin Review*, MDBA, 2016.

Murray-Darling Basin Authority (MDBA) 2019, Murray-Darling Basin Baseline Diversion Limits - estimate for 2019 / 2020 water year, 2019

Podger, G.M., Barma, D., Neal, B., Austin, K. and Murrihy, E. (2010). *River System Modelling for the Basin Plan Assessment of fitness for purpose*. CSIRO: Water for a Healthy Country National Research Flagship, Canberra, December 2010, pp 64