# Report to the MDBA by the Review Panel of the Western Porous Rock Groundwater SDL Resource Unit in NSW

## Introduction

The Basin Plan has set Sustainable Diversion Limits (SDLs) for all groundwater and surface water resource units across the Murray-Darling Basin. The SDLs define the long-term average volume of water that can be taken from the resource unit and will take effect on 1 July 2019.

SDLs have been set with the objective of establishing environmentally sustainable limits on the volume of water that can be taken for consumptive use from Basin water resources, having regard to social and economic impacts. Determining the SDL volume requires careful consideration of water availability, environmental objectives and requirements, socio-economic requirements and system constraints within a balanced policy position.

Information and knowledge used to inform the setting of SDLs can improve over time; for this reason, the Basin Plan includes a review mechanism. Under Section 6.06 of the Basin Plan, the Murray-Darling Basin Authority (MDBA) may, in consultation with the Basin States and other interested persons, or at the request of the Murray-Darling Basin Ministerial Council, undertake reviews of the Basin Plan, including in relation to whether there should be changes to the SDLs. The reviews must have regard to the management of climate change risks and include an up-to-date assessment of those risks, and consider all relevant knowledge about the connectivity of surface and groundwater, the outcomes of environmental watering and the effectiveness of environmental works and measures.

In setting SDLs, there were three groundwater resource units where differing views existed between the MDBA and Basin States as to the magnitude of the appropriate SDL that could not be resolved prior to the Basin Plan being made. These are the:

- Western Porous Rock SDL resource unit (NSW);
- Eastern Porous Rock Water Resource Plan area (NSW); and
- Goulburn-Murray Sedimentary Plan SDL resource unit (Victoria).

Accordingly, a mechanism was included in the Basin Plan under Section 6.06 (Clauses 6 to 9) that requires a review of the long-term average SDL and the Baseline Diversion Limit (BDL) for each of these resource units to be undertaken within two years of the commencement of the Basin Plan. The review(s) must consider all relevant information about the SDL resource unit, including modelling, State planning and policy arrangements and an evaluation of the appropriateness of any precautionary factors associated with setting the SDL. The Basin Plan also provides general guidance on the experts who should be invited to participate in the reviews as the Review Panel - the available members of the Independent Expert Scientific Committee on Coal Seam Gas and Coal Mining (IESC) as well as two individuals with expertise in groundwater or groundwater management nominated by the relevant State.

This report is a review of the Western Porous Rock SDL resource unit (NSW).

# Report to the MDBA by the Review Panel of the Western Porous Rock Groundwater SDL Resource Unit in NSW

## Review Panel Membership

The Review Panel membership was:

Malcolm Forbes (Independent Chair as agreed between MDBA and NSW Office of Water)
Professor Craig Simmons (IESC member; National Centre for Groundwater Research & Training)
Ms Jane Coram (IESC member; Geosciences Australia)
Dr Glen Walker (CSIRO, nominated by MDBA)
Dr Peter Cook (CSIRO, nominated by NSW Government)
Michael Williams (NSW Office of Water)
Peter Hyde (MDBA)

The Panel was assisted by Ray Evans (Principal Hydrogeologist, SKM) as an independent expert, facilitator, and the prime author of the Synthesis Report (see below).

## Essential Background Information

The MDBA, in collaboration with the NSW Office of Water, commenced the review for the Western Porous Rock SDL resource unit by establishing the Review Panel and commissioning SKM to prepare a Synthesis Report. The Synthesis Report is a specially prepared report synthesising existing material to support the deliberations of the Review Panel. The *Western Porous Rock Groundwater SDL Review Synthesis Report* at Attachment A (the Synthesis Report) summarises currently available information on the Western Porous Rock SDL resource unit including:

- hydrogeological characteristics of the Western Porous Rock groundwater source;
- technical information relevant to the review (such as recharge, connectivity, groundwater quality); and
- technical information on how the SDL, BDL and State extraction limit have been determined, including information on methods, assumptions and precautionary/sustainability factors.

## Review Panel Objectives

The objective of the review is "to review all available information relevant to the determination of SDLs and BDLs of the Western Porous Rock SDL resource unit." This should include a review of the science, methods and policies utilised by MDBA and NSW to determine the limits on groundwater take.

To achieve this, the Review Panel is tasked to provide recommendations to the MDBA on the determination of the SDL and BDL for the Western Porous Rock SDL resource unit. These recommendations are to be based on the *Western Porous Rock Groundwater SDL Review Synthesis Report*, information presented during a review meeting and any other relevant information.

## Panel Deliberations

This report is a summary of the considerations and recommendations from the Review Panel. It should be read in conjunction with the detailed technical information contained within the Synthesis Report at Attachment A.

The Review Panel met on Wednesday 1st May, 2013 to discuss the various approaches and to formulate advice to the MDBA regarding the SDL volume currently proposed within the Basin Plan for the Western Porous Rock SDL resource unit. Whilst the Panel relied upon the results of the interim report from Geoscience Australia on investigations in the Menindee and Broken Hill area (Lawrie and

others, 2011)[1] at its first meeting, it met again on 14th June 2013 to review its findings following further information presented in a confidential briefing from Geoscience Australia on the recently completed *Broken Hill Managed Aquifer Recharge Study*. The briefing did not alter the Panel's findings from its first meeting.

The Panel considered the information contained in the Synthesis Report at Attachment A and the confidential briefing and discussed various matters related to the technical detail.

The Panel noted that there were two major issues that required consideration. Firstly, the manner in which direct rainfall recharge had been measured and estimated by various investigations/projects recently and over the past few decades and whether these recharge rate estimates were robust and applicable to the Western Porous Rock (WPR). It was also noted that there were issues for consideration related to how the recharge estimates had been extrapolated to the broader resource unit area to derive the total flux of recharge to the groundwater system. Both of these processes produced uncertainty and the Panel deliberated as to what level of uncertainty could be attributed in each case. There was also some discussion of the role of macro-pore flow and whether this process would invalidate the current estimates of recharge (generally derived under assumptions of piston flow). It was decided that though macro-pore flow was a valid component of the overall diffuse recharge process in the resource unit area, its contribution to recharge could be deemed small and inconsequential to a calculation of an SDL. The issues associated with consideration of the recharge rates related to technical decisions.

Secondly, the Panel reviewed the sustainability factors (also referred to as precautionary factors) used by both MDBA and NoW (NSW Office of Water) in their methods to derive a level of take. The issues associated with consideration of these factors related to policy decisions. Sustainability factors are used to reduce the volume available for extraction based on consideration of social, environmental and economic concerns. The Panel discussed at length how each agency had applied their specific factors, how they had been derived and the basis and intent of each application.

It is highly relevant to this discussion to understand in detail the MDBA approach to applying sustainability factors in its methodology for deriving SDL volumes for the WPR SDL resource unit.

An Environmentally Sustainable Level of Take is derived by factoring the total recharge volume by 70%, reflecting an effective allocation to the environment of 30%. A PEL was derived by factoring the ESLT based on a consideration of the uncertainty of the level of knowledge of the hydrogeology in the SDL resource unit area. In the case of the WPR area, the factor was effectively 100% as it was decided after consultation with NoW that the knowledge of the area was commensurate with its ranking. The PEL, specifically for the WPR, was further reduced based on a consideration of the volume of unassigned water (the so-called Unassigned Water Factor – UWF). A Basin-wide default value of 25% of the difference between the PEL and the BDL was adopted with in the Basin Plan as the amount of take that would be allowed above the current BDL.

The UWF value for the WPR SDL resource unit area was derived according to the process outlined in the *Addendum to the proposed groundwater baseline and sustainable diversion limits: methods report*, July 2012. This report detailed that MDBA had partitioned the Basin into a number of regions for consideration of how unassigned water should be treated; one of these regions was termed Western System and this included the Western Porous Rock SDL resource unit. The revisions to SDLs in the Western System in association with unassigned water were influenced by data quality and the risks of localised impacts. The review process gathered comments from experts that surface water/groundwater connectivity was not thought to be a major issue for the area overall and this was

[1] Lawrie, K.C., Brodie, R.S., Dillon, P., Tan, K.P., Halas, L., Christensen, N.B., Ley-Cooper, A.Y., Davis, A., Somerville, P., Smith, M.S., Apps, H.E., Magee, J., Gibson, D., Clarke, J.D.A., Page, D., Vanderzalm, J., Miotlinski, K., Barry, K., Levett, K., & Gow, L., (2011) Securing Broken Hill's Water Supply: Assessment of Groundwater Extraction and Conjunctive Water Supply Options at Menindee Lakes Professional Opinion No 2011/2

not a factor in considering the application of unassigned water factors to derive the SDL. The Plan instead focussed on the issue of low data quality and that this level of quality justified a more precautionary approach, and hence the UWF value of 25%.

On face value this attribution of the UWF to account for low data quality seemed to indicate that data quality had been factored into the method twice, once when considering the uncertainty in the hydrogeological system in moving from ESLT to PEL and once in assigning the UWF. However, the Panel discussed that the first use of the factor recognised the knowledge of the hydrogeological system (or more specifically the uncertainty in that knowledge) generally, whereas the UWF was seeking to quantify the uncertainty in the knowledge of the future impacts of groundwater extraction on key assets.

The Panel also discussed that the use of the UWF was also similar in intent to the use of local area management rules within the NSW Water Sharing Plans, including the NSW Murray-Darling Basin Porous Rock Groundwater in the Lower Murray Darling water management area.

### Local Area Management Rules

NSW has a number of avenues for managing local area impacts due to extraction. These are implemented either via the specific clauses of the relevant Water Sharing Plan or via State-wide Policy (such as the Aquifer Interference Policy). Together, these rules act to limit all impacts on agreed assets such as groundwater dependent wetlands, sites of cultural significance or other groundwater users to acceptable levels. The rules have the effect of further qualifying any extraction limit imposed by a WSP, but do so by managing the impacts of extraction as part of the outcome of the planning and management process. This approach is different from the Basin Plan in relation to groundwater, where the focus is on the volume of water to be taken and not necessarily on the impact.

The Basin Plan does not explicitly provide for these rules to be taken into consideration when deriving groundwater SDL volumes for resource units. This results in a situation where the Basin Plan may be proposing an approach that achieves a level of conservatism that is greater than that required if local area management rules were taken into consideration.

In the case of the Western Porous Rock SDL resource unit, the relevant local area management rules are contained within Part 9 of the Water Sharing Plan and in Table 1 of the Aquifer Interference Policy. The assets that these rules protect are defined in Schedule 3 of the WSP; however, to date Schedule 3 has not been populated with specific assets of significance for the WPR area. Effectively, though the policy exists and is theoretically protecting assets from unacceptable impacts, there are no assets to trigger the specific local area rules accept those related to existing basic rights groundwater licence holders.

The minimal impact considerations for aquifer interference (as detailed in the NSW Aquifer Interference Policy) for less productive groundwater sources for porous and fractured rock water sources are detailed as follows:

1) Water table
    a) Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan” variations, 40m from any:
        i) high priority groundwater dependent ecosystem; or
        ii) high priority culturally significant site;

        listed in the schedule of the relevant water sharing plan. A maximum of a 2 m decline cumulatively at any water supply work.

b) If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any:

i) high priority groundwater dependent ecosystem; or

ii) high priority culturally significant site;

listed in the schedule of the relevant water sharing plan if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site.

If more than a 2m decline cumulatively at any water supply work then make good provisions should apply.

2) Water pressure

a) A cumulative pressure head decline of not more than a 2m decline, at any water supply work.

b) If the predicted pressure head decline is greater than requirement (a) above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.

3) Water quality

a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.

b) If condition (a) is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

The Western Porous Rock Water Sharing Plan also sets out a series of sharing rules. These include:

- Managing extraction to the LTAAEL;
- Unassigned water;
- Aquifer interference;
- Protecting environmental values and groundwater dependent ecosystems;
- Managing connectivity and access rules;
- Available water determinations;
- Carryover and water accounts; and
- Trading of access entitlement.

There are also a number of mandatory conditions applicable to each licence.

The Plan also sets out a series of adaptive management mechanisms that are used to manage the water resources of the resource unit. These include:

- The monitoring of plan performance;
- Sets plan performance indicators; and
- A mandatory review;

# Report to the MDBA by the Review Panel of the Western Porous Rock Groundwater SDL Resource Unit in NSW

### Consideration of the level of knowledge in the WPR

The Panel considered the issue of the level of knowledge of the WPR SDL resource unit, as this was a key part that influenced the choice of sustainability factors as reported in the previous section. The Panel understood from MDBA that the UWF value of 25% was applied uniformly to all SDL resource units within the Western Sector. Further, the Panel concluded that the level of knowledge in the Western Porous Rocks unit was comparatively good, relative to other units in the Western Sector, and probably only marginally less than for the Mallee Prescribed Wells area in South Australia. On this basis the Panel considered whether the level of knowledge provided an opportunity to reconsider the option for a variation to the 25% UWF value to a less conservative value.

### SDL Resource Unit Area

The various reports detailing the characteristics of the resource unit area, and those dealing with the estimation of recharge, provide varying estimates of the area of the SDL unit. MDBA advised that they have now adopted an area of 75,333.8 $km^2$ for their calculations. This will cause a revision of the SDL under their method and a potential change in the SDL from 116.6 GL/y to 131.2 GL/y.

## Panel Conclusions

The Panel came to a number of conclusions as a result of its deliberations.

### Recharge

- The Panel noted that the NoW estimate of recharge volume as reported in the documents provided to the review was based on rainfall record to 1995 and acknowledged that if the rainfall was updated to the full record this would result in an increased recharge estimate under the NoW method.

- There is a degree of uncertainty associated with the choice of an average recharge rate (or rates) for the resource unit area. This is based on the limited field studies in the area, even though the data represents one of the better investigations of recharge rates in the Murray Darling Basin. The level of uncertainty is difficult to quantify, but is large enough that there is no obvious *correct* rate to choose.

- The extrapolation techniques employed by either agency in their methods introduce further uncertainty into the estimation of a volume of recharge to the resource unit. The technique, in the case of the MDBA approach, relies on estimating a recharge rate for each land use category. The uncertainty of how soils can be correlated with land use further confuses the situation.

- Whilst the level of uncertainty in recharge estimation was large, the Panel concluded that the NSW recharge rates were probably at the high end of possible recharge rates that could be applied to the area. NSW used its best judgement in choosing the 6% of rainfall value for recharge.

### Sustainability Factors

- The Panel concluded that the use of sustainability factors was subjective, though the intent of their use was understood and supported. The choice of the value for a specific factor also seemed arbitrary, though the relativity between values was logical. The Panel noted that there was little external work that could be used to justify specific factor values.

- The Panel noted that MDBA had applied sustainability factors for the Western Porous Rock SDL resource unit that appeared to be inconsistent. Specifically, their use of a value of 100% for the factor accounting for the level of uncertainty due to current knowledge and their use of a value of 25% for the UWF. However, the Panel concluded that this may reflect a difference between current knowledge of the system versus future knowledge of the impacts.

- The Panel concluded that the use of the UWF as a precautionary mechanism in the setting of SDLs was a valid approach and should not be changed, and the use of 25% as the UWF though subjective was not challenged.

- Further, the Panel concluded that the only instance where the UWF could be varied is if there were assurances as to how the groundwater system would be managed on an ongoing basis to ensure no stress is imposed on the system's key assets. The approach envisaged would be one of a statement of the high level outcomes that needed to be met, with a clear set of criteria that would need to be put in place to achieve those outcomes.

## Panel Findings

The Panel recommends that:

(1) the SDL is varied to take account of the agreed area for the WPR in line with the current MDBA calculation and applied sustainability factors;

(2) the MDBA could consider varying the UWF for a SDL resource unit to a value to be determined once assurances have been made by the relevant jurisdiction that they can demonstrate that the resource will be managed via State policies and plans in such a way that impacts are limited to acceptable levels. These assurances would need to be explicit and would include specification of the assets to be protected within Schedule 3 of the relevant NSW WSP, an agreement on the criteria that would be used to define acceptable impacts and monitoring, compliance and review processes.