

# Submission to the Productivity Commission's Inquiry into the Reform of Australia's Water Resources Sector

October 2017

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## Background

1. This submission is directed towards the portions of the PC's National Water Reform Draft Report (September 2017) ('PC draft report') that deal with groundwater, in particular addressing the following terms of reference in relation to groundwater:
  - 'progress in jurisdictional adoption of NWI principles';
  - 'progress against the recommendations in the National Water Commission's National Reform Assessment 2014'; and
  - 'the scope for improving the NWI, addressing current and future challenges'.
2. This submission is based on my current groundwater law research at the Melbourne Law School; my experience leading the 4-year Comparative Groundwater Law and Policy Program (2010-2014) a joint initiative of the Stanford Woods Institute for the Environment and the Bill Lane Center for the American West at Stanford University, and the United States Studies Centre at the University of Sydney; and my previous and ongoing experience as a practising water lawyer.

## Groundwater and the NWI

3. At the time that the signatories committed to the NWI, groundwater management did not rank particularly highly in the minds of the public and many regulators. Indeed, Australia's era of water reform, extending over the past three decades, has been driven largely by concerns about surface water. Where groundwater was considered, its extraction tended to be seen as a risk to the integrity of the surface water entitlement system (PC draft report p 63) rather than the subject of strong independent concerns about sustainability and ecological value. However, the jurisdictions have made very significant progress in groundwater management since, as outlined in the PC draft report.
4. Despite significant progress, key areas for improvement remain. Some of these are highlighted by the PC draft report, for example, developing regulatory frameworks to facilitate managed aquifer recharge (MAR), bringing groundwater withdrawals by extractive industries within entitlement frameworks, and balancing environmental and consumptive values in the context of climate change. I support the need to focus on these areas in the context of groundwater.
5. This submission sets out additional areas that warrant the PC's attention in the context of groundwater, which are already within the scope of the NWI commitments. In addition, it seeks to

highlight ways in which a renewed NWI could deal explicitly with some of the challenges that are unique to, or particularly affect, groundwater, and which are not well dealt with under the NWI as it stands.

### **‘Environmental outcomes’ for groundwater**

6. One of the NWI’s most important contributions to water reform has been to encourage attention to environmental outcomes. The NWI frequently uses the phrase ‘environmental and other public benefit outcomes’, which refers to, among other things ‘maintaining ecosystem function (eg. through periodic inundation of floodplain wetlands); biodiversity, water quality; river health targets’. This definition relates to both surface water and groundwater.
7. Australian federal agencies, for example, the former Environment Australia and, more recently, the National Water Commission, have funded significant work related to groundwater-dependent ecosystems (GDEs) as part of the now concluded Groundwater Action Plan. Key works, and the investments required to develop them, included:<sup>1</sup>
  - An Australian Groundwater-Dependent Ecosystems Toolbox, which is directed towards identifying GDEs and determining the impact of changes in groundwater on GDEs (\$499,121);
  - A new approach to accounting for groundwater-dependent ecosystems and surface water systems (\$300,000);
  - Atlas of groundwater-dependent ecosystems (\$5,545,000);
  - NSW groundwater quality and coastal groundwater dependent ecosystems (\$960,000); and
  - Groundwater-dependent ecosystem vulnerability in the Mid West of Western Australia (\$2,460,000).
8. This work, and other publications, make clear that GDEs comprise an enormous range of ecosystems, including some that are rarely, if ever, considered in the jurisdictions’ water plans. GDEs represent a key component of biodiversity. Scientific work suggests that aquifer ecosystems—only one type of GDE—represent “the most extended array of freshwater ecosystems across the entire planet ... [with] high levels of endemism and high proportions of relictual species compared with surface environments”.<sup>2</sup> Terrestrial ecosystems stand out as a broad-scale example of GDEs that are entirely ignored by the vast majority of water plans. In its GDE Atlas, the Bureau of Meteorology shows three kinds of GDEs:

*Aquatic ecosystems that rely on the surface expression of groundwater—this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs. Marine and estuarine ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.*

*Terrestrial ecosystems that rely on the subsurface presence of groundwater—this includes all vegetation ecosystems.*

*Subterranean ecosystems—this includes cave and aquifer ecosystems.<sup>3</sup>*

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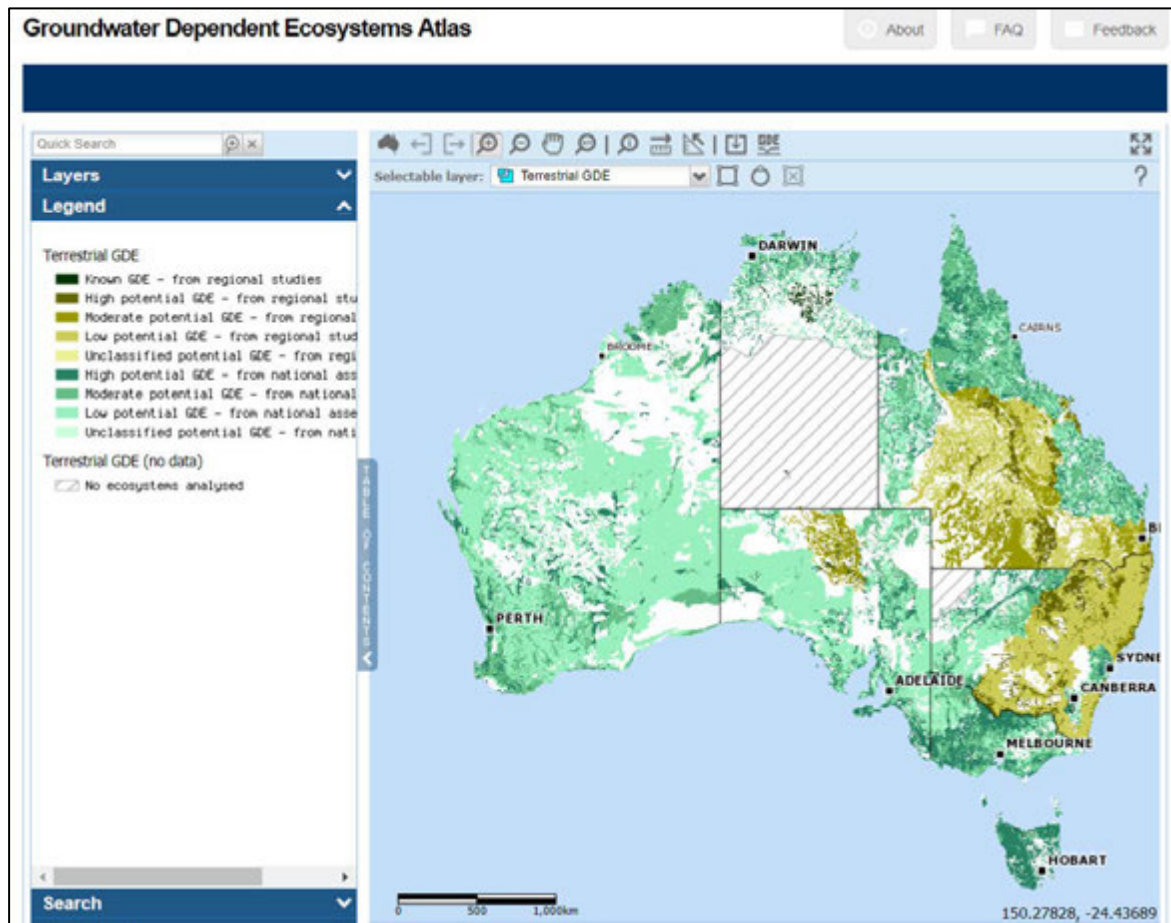
<sup>1</sup> See NWC National Groundwater Action Plan projects - Vulnerability of Groundwater Dependent Ecosystems, archived at

<http://webarchive.nla.gov.au/gov/20160615063314/http://archive.nwc.gov.au/rnws/ngap/groundwater-projects>.

<sup>2</sup> Sinclair Knight Merz Pty Ltd, *Environmental Water Requirements to Maintain Groundwater Dependent Ecosystems*, National River Health Program Environmental Flows Initiative Technical Report Number 2 (Environment Australia, 2001).

<sup>3</sup> Bureau of Meteorology, GDE Atlas, <http://www.bom.gov.au/water/groundwater/gde/>.

9. The GDE Atlas shows that a vast area of the Australian landmass is covered by terrestrial ecosystems that have a moderate or high potential to be groundwater-dependent (as shown by the darker colours in the map below). However, in practice, it is usually only ‘aquatic ecosystems that rely on the surface expression of groundwater’ that receive any attention in statutory water plans or that are the beneficiaries of policy attention to ‘environmental flows’, which are primarily conceived of in surface water terms.



10. The NWI contains no indication that only the subset of GDEs that involve the surface expression of groundwater are to be considered by jurisdictions in pursuing ‘environmental outcomes’. A plain reading of the NWI would suggest that it was intended that statutory plans protect, or at least transparently consider protecting, all GDEs. Heavy national investment in investigating the full range of GDEs supports this. Our current national groundwater policy statement, the *National Groundwater Strategic Framework 2016–2026*, which the PC draft report cites, also refers to recognising ‘groundwater functions in supporting important ecosystems including wetlands, rivers and **groundwater-dependent vegetation** [emphasis added]’ as ‘critical’.<sup>4</sup> It is also worth noting that the high-level water policy and law of other jurisdictions (notably the EU Water Framework Directive) apply to groundwater-dependent terrestrial vegetation.<sup>5</sup> **Pursuing protections for terrestrial GDEs is required by the NWI, consistent with contemporary Australian policy, and required by global best practice.**

<sup>4</sup> *National Groundwater Strategic Framework 2016–2026* (2017) 3.

<sup>5</sup> Rebecca Nelson and Philippe Quevauviller, “Groundwater Law” in Tony Jakeman, Olivier Barreteau, Randall Hunt, Jean-Daniel Rinaudo and Andrew Ross (eds), *Integrated Groundwater Management: Concepts, Approaches and Challenges* (Springer Publishing, 2016) 173, 181.

11. My research has found that an important prerequisite to implementing protections for GDEs (that is, environmental flows for groundwater) is the availability of a system for prioritising GDEs to be protected. This is particularly important given the wide range of ecosystems that are likely to be groundwater-dependent.
12. My research interviewing state water planning staff suggests that multiple, sometimes quite informal or non-transparent systems for prioritising GDEs protections are in use around Australia, in practice:

*GDEs may be prioritized based on community input; consultation with regional environmental or natural resources agencies or specially convened technical panels; a basic risk assessment of likely impacts (such as the surrounding level of consumptive demand for groundwater), which forms the foundation for requesting more detailed information of applicants; a sophisticated multi-criteria risk assessment; or, more simply, GDEs that are likely to be particularly at risk due to special, very large groundwater uses (such as coalbed methane extraction); or GDEs within protected areas or with threatened species status [citations omitted]<sup>6</sup>*

13. Protecting GDEs also relies on attitudinal and cultural pre-conditions: people need to know what GDEs are and realise that many ecosystems that they care about are GDEs. The PC has a key role to play in this regard by increasing the profile of GDEs (which are only referred to once in the 487-page report) and calling out the insufficient attention given to them in the jurisdictions' water plans.

14. **Implications:** The PC draft report should note that in implementing their NWI obligations, the jurisdictions have taken a narrow perspective on 'environmental outcomes' in relation to groundwater, relative to the full extent of ecosystems that depend on groundwater. The PC draft report's description of progress in environmental management must acknowledge that the jurisdictions' progress in relation to environmental management for groundwater has lagged markedly behind that for surface water, and that this should be another key 'focus for the next phase of reform'. In better addressing groundwater, a future iteration of the NWI should include express language in relation to environmental outcomes that refers to the full extent of GDEs, including terrestrial and subterranean GDEs, consistent with contemporary scientific knowledge and policy as expressed in the *National Groundwater Strategic Framework 2016–2026*. It should also encourage the development of a transparent system for prioritising protection within this broad range of GDEs.

### **Groundwater-surface water interaction**

15. The PC draft report finds that recognising surface water-groundwater interactions has been 'largely achieved' (p 67). This is based on a simple assessment that the 'number of water plans that recognise connectivity between groundwater and surface water (including through linked groundwater and surface water plans) has increased substantially since 2004' (p 67).
16. The PC draft report should note that there is no consistent approach used across Australia to determining what 'counts' as a connected resource, and that this can present problems. The NWC and others have long argued in favour of the assumption that groundwater and surface water are

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<sup>6</sup> Rebecca Nelson, *Groundwater Wells Versus Surface Water and Ecosystems: An Empirical Approach to Law and Policy Challenges and Solutions* (Stanford University, JSD dissertation, 2014), available in the Stanford University digital repository, at <https://searchworks.stanford.edu/view/10531752> at 57.

connected until proven otherwise.<sup>7</sup> However, even this does not provide any guidance as to what would be required to ‘prove otherwise’, that is, to determine a degree of connection that is too insignificant to worry about. Determining a consistent threshold at which connectivity becomes significant, and therefore must be considered in water planning and licensing, is important. Only if this approach to connectivity is somewhat consistent can the security of water entitlements (including those bought back for environmental flows using public money) be guaranteed to the same degree—at least in relation to the effects of groundwater take—between water planning areas.

17. In practice, not only is there no consistent approach to the treatment of connectivity across Australia, but approaches vary very widely. In general, thresholds for determining ‘significant’ connectivity between surface water and groundwater used in Australia are very high compared to those used in comparative jurisdictions, for example in certain western US states. This means that we accept a relatively high degree of unaccounted-for impact on our surface water systems, caused by groundwater take, before our regulatory system ‘kicks in’ to moderate this impact:

*...thresholds in Australia tend to allow comparatively large adverse pumping impacts. NSW has banned new groundwater licences in certain areas where 70% of the water pumped from bores is drawn from connected surface waters within a single irrigation season (a “70% in 9 months policy”). In formulating sustainable diversion limits for the MDB, the MDB Authority used a “50% in 50 years policy” as a key threshold of risk related to setting groundwater extraction caps.*

*By contrast, numerical thresholds in western US states are much stricter in areas with fully-allocated surface water, even in areas that would be considered to have low connectivity between surface water and groundwater in Australia. Colorado adopts a 0.1% in 100 years policy... [citations omitted]<sup>8</sup>*

18. In support of the points made here in relation to groundwater-surface water connectivity, I **attach** a published article that describes different potential approaches to groundwater-surface water connectivity thresholds.<sup>9</sup> This is a brief summary of my doctoral work on this subject, which also extended to reviewing the legal mechanisms available to protect GDEs more generally.<sup>10</sup>
19. In addition to clarifying the degree of connection required, jurisdictions should adopt a more nuanced approach to groundwater-surface water interaction than is presently the case. This approach should mirror scientific knowledge, and consider connectivity in terms of “the timing, direction and volume of interaction, its spatial and temporal scale, and an understanding of its ecological relevance”.<sup>11</sup>

20. **Implications:** the PC draft report should note that although connectivity is increasingly recognised in water plans, the way in which it is recognised is not consistent between jurisdictions, and

<sup>7</sup> Peter Cullen, 'Flying Blind: The Disconnect between Groundwater and Policy' (2006) (19 September 2006) 10th Murray-Darling Basin Groundwater Workshop 4; National Water Commission, *The National Water Initiative - Securing Australia's Water Future: 2011 Assessment* (National Water Commission (Australia), 2011) 100; I Fullagar, *Rivers & Aquifers: Towards Conjunctive Water Management (Workshop proceedings)* (Bureau of Rural Sciences, 2004) 2.

<sup>8</sup> Rebecca Nelson, “Groundwater, Rivers and Ecosystems: Comparative Insights into Law and Policy for Making the Links” (June 2013) *Australian Environment Review* 558, 559.

<sup>9</sup> See generally *ibid.*

<sup>10</sup> See generally Nelson, above n 6.

<sup>11</sup> Moya Tomlinson, *Ecological Water Requirements of Groundwater Systems: A Knowledge and Policy Review*, Waterlines Report Series No 68, National Water Commission (National Water Commission, 2011) 38.

allows for differing levels of impact on resource security. In some cases, these impacts may be significant. In making assessments about when connectivity is significant and the management actions that should ensue, jurisdictions should ensure they consider the timing, direction and volume of interaction, its spatial and temporal scale, and its ecological relevance.

### **Triggers for water planning and ‘risk-based management’**

21. There is an increasing trend towards ‘risk-based management’ of water resources. This plays out in relation to water plans in jurisdictions that undertake water planning only for resources that are deemed to be subject to relatively high levels of extraction. The PC draft report reflects this in reporting on the extent of water planning in the ‘main areas of intensive water use’ (p 65). The NWC also made this assumption in its 2014 assessment (‘In intensively used systems, where all water must be accounted for and its use maximised, accurate information is essential to optimise management by running systems precisely and efficiently... Conversely, in less intensively used systems, development opportunities may be stifled by conservative management settings based on poor system understanding’ p 110).
22. However, risk-based management that is premised (implicitly or explicitly) primarily on quantities of water extracted (including quantities of extraction relative to storage) may cause regulators to overlook protections for GDEs, which may experience significant impacts even at low levels of extraction.<sup>12</sup> The *National Groundwater Strategic Framework* recognises the need to take a more sophisticated approach to the concept of ‘risk’, calling for the development of ‘risk-based approaches to assess and manage impacts of groundwater extraction on connected surface water resources, surface water and groundwater quality and dependent ecosystems’.<sup>13</sup>

23. Implications: the PC draft report should avoid implying that if water plans cover most intensive areas of extraction, that is sufficient. Rather, it should acknowledge that jurisdictions should develop, and be guided by, a more sophisticated risk-based framework for triggering water planning for groundwater that responds to the sensitivity and value of connected surface water and GDEs, consistent with NWI cl 25(x). Such an assessment of risk would be a more accurate indicator of the sufficiency of jurisdictions’ coverage of water plans.

## **Part II: Scope for improving the NWI, addressing current and future challenges**

### **Water planning versus water licensing outside of plan areas**

24. Statutory water plans are a central feature of the NWI. While the NWI also discusses the nature of entitlements (eg cl 31), it does not say anything about processes to issue entitlements, and it appears to assume that subjecting the issue of entitlements or allocations to consistency with water plans (cl 29) can assure the achievement of environmental and other public benefit outcomes.
25. Water plans are not a sufficient basis for the pursuit of environmental and other public benefit outcomes in relation to groundwater—neither in theory nor in practice. An individual bore can have very localised pumping impacts on river reaches (particularly pools in unregulated river systems) and other GDEs. Accordingly, it is important to consider decision-making tools at the local level in light of specific local conditions (which may not appear distinctly at the water plan level) and a specific predicted impact. These types of considerations should arise through licensing processes.

<sup>12</sup> See generally *ibid*.

<sup>13</sup> *National Groundwater Strategic Framework 2016–2026* (2017) 10.

26. In practice, water plans typically only take effect ‘on the ground’ through constraints or considerations that they apply to licensing processes, alongside other statutory provisions. To put it another way, the PC can only truly consider ‘the outcomes to date of the NWI’ (as per the terms of reference for this inquiry) in relation to water plans by considering the licensing processes that work alongside, and implement, water plans. In addition, significant areas of Australia, particularly those in which groundwater use is less intensive, lack water plans (or water plans that cover groundwater), although extraction there can have significant localised adverse impacts managed through licences or other arrangements.<sup>14</sup>

27. Implications: A future incarnation of the NWI, and future assessments against the NWI or its successor, should consider water licensing processes and other non-water plan ways of achieving NWI objectives in relation to groundwater diversions.

**Cumulative impacts in relation to groundwater withdrawals and indirect impacts on groundwater (for example, through land use change and other forms of interception activities)**

28. The NWI deals with cumulative impacts in various ways. Water plans are inherently a tool to manage cumulative impacts through aggregate water withdrawal caps. Indeed, early in the development of academic thought about water plans, they were conceived as a key vehicle for precautionary ‘caps’ to control cumulative effects,<sup>15</sup> rather than relying on licence-by-licence determinations. The NWI also recognises that the cumulative effects of legally uncontrolled withdrawals threaten the security of water entitlements and also environmental and other public benefit outcomes. Its provisions in relation to interception activities seek to address this.
29. The 2014 NWC assessment specifically mentioned cumulative impacts as deserving of particular concern (p 138). In its assessment, ‘no state or territory has fully implemented interception arrangements that meet the requirements of ... the NWI’.<sup>16</sup> The PC draft report includes some discussion of cumulative impacts, noting the significant federal investment in bioregional assessments intended to assess the potential cumulative impacts of coal seam gas and large coal mining developments (p 256). In relation to interception specifically, the PC draft report notes that ‘more could be done to meet objectives and outcomes of the NWI with respect to managing interception and water use that occurs outside of entitlements and planning arrangements’ (p 317).
30. In the regulatory context, there is often little formal guidance about how to go about assessing and dealing with cumulative impacts in Australia.<sup>17</sup> The contribution of the NWI to guidance about cumulative impacts can be summarised as encouraging jurisdictions to expand their water governance frameworks to a wider range of stressors that may be individually minor, but which may be collectively significant (ie interception activities). This responds to an important branch of the scientific literature in relation to cumulative impacts, which focuses on ensuring that a comprehensive range of stressors is considered. However, it does not give any guidance about the other elements of assessing and managing cumulative impacts that the scientific literature has established.

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<sup>14</sup> Eg declared underground water areas in Queensland, in which regulations govern the taking of underground water in the absence of a water plan: *Water Act 2000* (Qld) s 1046, *Water Regulation 2016* (Qld) Pt 15 Div 2.

<sup>15</sup> Maher M, Nevill J and Nichols P, *Improving the Legislative Basis for River Management in Australia (Stage 2 Report: Final Report)* (2001) 26, 59; Nevill J, "Managing the Cumulative Effects of Incremental Development in Freshwater Resources" (2003) 20(2) *Environmental and Planning Law Journal* 85 at 88-89.

<sup>16</sup> National Water Commission, Australia, *Australia's Water Blueprint: National Reform Assessment 2014* (2014) 33.

<sup>17</sup> Howe P, *Framework for Assessing Potential Local and Cumulative Effects of Mining on Groundwater Resources – Project Summary Report* (National Water Commission, Canberra, 2011) 7.

31. Water policy discussions about cumulative impacts have focused on the cumulative impacts of individual minor, unregulated water extractions, and multiple regulated water extractions that tend to be considered in isolation,<sup>18</sup> but have not yet analysed the underlying concepts at play in the notion of cumulative impacts. These concepts go beyond interception activities, and a renewed NWI should reflect this. Analysing groundwater characteristics and problems against a scientific understanding of cumulative impact suggests that a much broader set of issues and concepts are relevant to addressing them. These include recognising the potential for non-accumulative responses or systemic or structural changes to natural systems, and exploring the potential for water-related offsets to manage cumulative impacts. I note that the *National Groundwater Strategic Framework 2016–2026* calls for harmonised approaches to the use of ‘off-sets in resolving resource management decisions’ to ensure investor confidence.<sup>19</sup> A renewed NWI would be the most appropriate place to develop policy for such harmonisation.
32. I **attach** a recent published paper dealing with groundwater and cumulative impacts,<sup>20</sup> and a recent public paper dealing with water-related offsets (which are well-established in the western US, but largely unknown in a formal policy sense in Australia),<sup>21</sup> to support and further explain these points.

33. Implications: a future revision of the NWI should expand its consideration of cumulative impacts beyond the important challenge of interception activities and more comprehensive consideration of stressors. It should include guidance in relation to the broader scope of challenges that science recognises as relevant to managing cumulative impacts, and the potential tools for managing these challenges, particularly offsets.

### **Water plans, temporal scope and non-renewable groundwater**

34. Water plans typically have a 10-year life before they are reviewed. However, water plans and their parent legislation are often unclear about the time horizon to be applied to decisions about water entitlements or allocations that are affected by the plans. In other words, to what extent should a 10-year water plan be concerned about impacts of management decisions that are likely to manifest in 50 or 100 years’ time? This is not likely to be problematic in the case of surface water, where a diversion will have relatively immediate impacts in the vicinity of the extraction, or at worst short-term impacts further downstream.
35. However, groundwater withdrawals can involve time-lagged impacts on valued receptors (ecological receptors as well as other extraction points) that may extend well beyond the life of a water plan. The NWI does not provide any guidance on how to deal with this, and this is not surprising, given the emphasis on surface water at the time that it was signed.
36. In the case of a water plan that deals with groundwater, it would not be appropriate to consider only the impacts of activities that would manifest during the life of the plan. The slow movement

<sup>18</sup> Eg National Water Commission, *The National Water Initiative - Securing Australia's Water Future: 2011 Assessment* (National Water Commission, Canberra, 2011) 44; Nevill J, "Managing the Cumulative Effects of Incremental Development in Freshwater Resources" (2003) 20(2) *Environmental and Planning Law Journal* 85; Bubna-Litic K, "Fracking in Australia: The Future in South Australia?" 32 *Environmental and Planning Law Journal* 437, 448. Cf Randall A, "Coal Seam Gas – Toward a Risk Management Framework for a Novel Intervention" (2012) 29 *Environmental and Planning Law Journal* 152.

<sup>19</sup> *National Groundwater Strategic Framework 2016–2026* (2017) 9.

<sup>20</sup> Rebecca Nelson, "Broadening Regulatory Concepts and Responses to Cumulative Impacts: Considering the Trajectory and Future of Groundwater Law and Policy" (2016) 33(4) *Environmental and Planning Law Journal* 356-371.

<sup>21</sup> Rebecca Nelson, "Paying Back the River: A First Analysis of Western Groundwater Offset Rules and Lessons for Other Natural Resources" (2015) 34 *Stanford Environmental Law Journal* 129-194.



of groundwater means that pumping permitted over a decade, for example, could “lock in” undesirable outcomes long into the future. These outcomes would be irreversible for non-renewable resources (that is, aquifers that receive little or no modern-day recharge). This cannot be ignored.

37. There is wide recognition that the non-renewable nature of some groundwater resources requires special consideration. In better addressing groundwater, a future iteration of the NWI should expressly address non-renewable groundwater resources. I note that the *National Groundwater Strategic Framework 2016–2026* expressly calls for harmonised approaches to ‘using groundwater that is not currently replenished (non-renewable resources), considering the needs of future generations’.<sup>22</sup> A renewed NWI would be the most appropriate place to develop such harmonised policy.
38. Even outside the context of non-renewable resources, the issue of time lags in groundwater management is a critical element of considering our goals for groundwater sustainability and for making sense of the concept of adaptive management, which the PC draft report highlights as only ‘partially achieved’ thus far (p 66). Time lags raise questions like ‘sustainable for how long?’ and ‘adaptation over what period of time?’ that are fundamental to these NWI concepts.

39. Implications: a future revision of the NWI should explicitly consider principles for determining the time-frame that a water plan should consider in relation to impacts of management actions covered by the plan, and should explicitly consider policy approaches to using non-renewable groundwater.

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<sup>22</sup> *National Groundwater Strategic Framework 2016–2026* (2017) 10.