

NSW Groundwater Strategy - Stakeholder survey

Thank you for taking the time to provide your feedback on the draft NSW Groundwater Strategy.

Groundwater is water found underground in rock formations called aquifers and is an important resource for NSW. For more information about groundwater, [visit the department's website](#).

The draft strategy sets a long-term vision and direction for groundwater management in NSW.

This survey aims to gather your opinion about the draft strategy. Your comments will help us identify community views and key areas of interest and help us to develop the final strategy.

This survey will close on **Sunday 14 August 2022 at 11.59pm (AEST)**.

The survey is structured according to the draft strategy's main chapters:

- Introduction and general overview of groundwater resources and management in NSW.
- Strategic Priority 1 – Protect groundwater resources and the ecosystems that depend on them in the strategy.
- Strategic Priority 2 – Build community and industry resilience through sustainable groundwater use (this part of the survey also includes an opportunity for Aboriginal people to provide cultural-specific feedback).
- Strategic Priority 3 – Improve groundwater management decisions with better information.

Confidentiality preferences - Publishing your submission

Please indicate if you give permission for your submission to be published on the department's website, and whether you give permission to be identified as the author of the submission or wish to remain anonymous.

I give permission for the department to publish my name with my submission on the department's website.

I do not give permission for the department to publish my name with my submission on the department's website. In selecting this option, I understand that my submission will be published anonymously.

I do not give permission to publish my submission at all.

Sharing your submission within the department

Please indicate if you give permission for your name and email to be included when sharing survey response data internally within the department.

- I give permission for my name and email to be shared within the department.
- I do not give permission for my name and email to be shared within the department. In selecting this option, I understand that my submission will be shared anonymously.

Your submission

If you would like to provide additional feedback in an attached document, please add it to this submission when you return the survey.

Please note, if you wish to remain anonymous, please do not include personal information in your attachment.

If you would prefer to email your feedback or if you have any enquiries, please email the department at nsw.groundwaterstrategy@dpie.nsw.gov.au.

Data privacy

The Department of Planning and Environment is subject to the *Privacy and Personal Information Protection Act 1998* in managing your personal information. In the interests of transparency, the department's website intends to publish all feedback received on its website. You can choose to have your feedback published anonymously or not published at all. Please review our [privacy statement](#) for further information.

Introduction and overview of groundwater resources and management in NSW

Groundwater is water found below the ground in rock formations called aquifers. Groundwater is also used for a multitude of purposes in NSW such as agriculture, town water supply, and also to sustain important ecosystems.

Thinking about your relationship to groundwater, which of the following user groups or parts of the community best describes you? (please select only one)

- General public
- Local Council / Local water utility
- NSW Government department
- Australian Government department
- Domestic and stock
- Agriculture
- Industry
- Manufacturing
- Research / academia
- Environmental group
- Other (please specify) _____

In NSW, there are almost 80 groundwater sources west of the Great Dividing Range and over 450 sources on the coast.

Based on the 13 NSW regions outlined in the map below, in which region are you located?



Choose your region

- Border Rivers
- Far North Coast
- Greater Hunter
- Greater Sydney
- Gwydir
- Lachlan
- Macquarie-Castlereagh
- Murray
- Murrumbidgee
- Namoi
- North Coast
- South Coast
- Western

Groundwater is an important resource for NSW. It is used for town water supply, agriculture in the Namoi for example, or industry in the Hunter Valley.

How important is it for you to access groundwater as a resource?

- Not at all important
- Of minor importance
- Neutral
- Important
- Very important

To what extent do you agree with the following statements? (please select one response per row)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Groundwater is important for basic human needs (drinking, cooking)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Groundwater is important for stock watering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Groundwater is important for Aboriginal communities and Country	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Groundwater is important for agriculture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Groundwater is important for the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Groundwater is important for industrial businesses (including mining)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Groundwater is important for manufacturing (water bottling, food processing and others)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Groundwater in NSW currently provides close to 10% of water used for town supply, and over 70% for agriculture, as well as supporting a range of ecosystems. In the context of a growing population and climate change, please answer the following questions.

Please indicate what you think NSW's groundwater needs will look like over the next 20-40 years.

- The same
- Less than current needs
- More than current needs
- Not sure

Which part/s of the community do you think will have the greatest change in their groundwater needs in the future?

Select all that apply.

- Households
- Agriculture
- Industry
- Manufacturing
- Towns and cities
- Aboriginal communities and Country
- Ecosystems dependent on groundwater
- Not sure
- I don't believe there will be any change

Do you think you should change the way you will use groundwater in the future?

- Yes, I've already begun to change my groundwater usage habits
- Yes, I've started doing research and am in the process of making changes
- I've thought about it, but have done nothing more
- No, it hasn't even crossed my mind
- I don't use groundwater

How well do you know the NSW groundwater management framework, rules and legislation?

- Not at all
- Not well at all
- Unsure
- Well
- Very well

The Draft NSW Groundwater Strategy identifies 4 key issues affecting change in groundwater management in NSW.

Please rank these issues from most important to least important, where 1 = Most important and 4 = Least important.

- 2 _____ Our climate is changing, and groundwater recharge and demands will be affected by this
- 1 _____ The risks to groundwater from development and land use change are increasing
- 3 _____ Community notions of sustainability and fair access to groundwater have evolved over time
- 4 _____ Our understanding of groundwater, its behaviour and use is improving

Please tell us of any other challenges that are affecting groundwater management in NSW.

In the following sections of this survey, you will be asked questions based on each of the draft NSW Groundwater Strategy priorities. [You can read the draft strategy on our website.](#)

Strategic Priority 1 – Protect groundwater resources and the ecosystems that depend on them

Strategic Priority 1 aims to sustain our groundwater resources for current and future uses and protect our important ecosystems that depend on groundwater.

In priority 1 of the draft strategy, 4 key challenges affecting groundwater resources and the ecosystems that depend on them are identified.

Please rank these challenges in order of importance, where 1 = Most important and 4 = Least important.

- 2 _____ Our policy framework for sustainable groundwater management needs to be updated to be more responsive to emerging challenges such as climate change
- 3 _____ Ecosystems that depend on groundwater face increased threats such as intensive groundwater extraction and pollution
- 1 _____ There is a lack of integration between groundwater, surface water and land management
- 4 _____ Threats to groundwater quality are growing and need to be addressed

Please tell us any other challenges you think will affect the protection of groundwater resources and the ecosystems that depend on them.

Each of these issues is important

How important for you is the protection of groundwater resources and the ecosystems that depend on them?

- Not at all important
- Of minor importance
- Neutral
- Important
- Very important

The department has put forward a range of draft actions to increase the protection of groundwater resources and the ecosystems that depend on them. The following questions will review each of the draft actions and their sub-actions.

Action 1.1 - Refresh and expand our approach to sustainable groundwater management by reviewing and updating our groundwater policy and planning framework.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Action 1.2 - Better integrate groundwater management with other land and water management processes.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 1.2?

	Not at all important	Of minor importance	Neutral	Important	Very important
Refresh and expand our approach to sustainable groundwater management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Manage groundwater and surface water together	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Integrate groundwater considerations into land use planning decisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Improve management of large developments impacting groundwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Strengthen cross-border groundwater management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Action 1.3 - Improve management and protection of groundwater dependent ecosystems and baseflows to streams.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 1.3?

	Not at all important	Of minor importance	Neutral	Important	Very important
Review and update our approach to protecting groundwater dependent ecosystems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Deliver a program to improve our understanding of groundwater dependent ecosystems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Action 1.4 - Review and update approaches to sustainable groundwater extraction.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 1.4?

	Not at all important	Of minor importance	Neutral	Important	Very important
Review groundwater source extraction limits using new knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Better manage impacts of extraction at a local level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Improve clarity around management of groundwater sources with a low long-term entitlement share value	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Action 1.5 - Protect groundwater quality within natural limits.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 1.5?

	Not at all important	Of minor importance	Neutral	Important	Very important
Review and update our approach to managing groundwater quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Deliver a program to better understand groundwater quality and risks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Please tell us any other suggested actions you think we should consider in Strategic Priority 1.

Water storage should be explicitly included as a key component in the strategy to ensure social and environmental resilience and socio-economic development. There is a growing need to establish strategies for integrated water storage in response to increasing demand and falling availability, exacerbated by climate change. Implementation of integrated water storage would require a transition in land and water policy. This transition is feasible if implemented in stages and would establish NSW as a national leader in integrated water storage solutions. Further details are in the briefing note attached to this submission "Integrated water storage for a resilient water system".

Strategic Priority 2 – Build community and industry resilience through sustainable groundwater use

Strategic Priority 2 aims to improve water security through the sustainable use of groundwater by urban populations, water dependent cultural, spiritual and economic aspirations of Aboriginal people, and support opportunities for other groundwater dependent development.

The strategy identifies 3 key challenges affecting the resilience of communities and industries using groundwater.

Please rank these challenges in order of importance, where 1 = Most important and 3 = Least important.

- 1_____ Increasing demand for groundwater undermines town water supply
- 3_____ New and expanding industries need to consider groundwater opportunities and constraints
- 2_____ Aboriginal rights to and uses of groundwater are not adequately recognised

Please tell us any other challenge you think will affect community and industry resilience in using groundwater.

How important is it for you that communities and industries using groundwater resources have a reliable and secure supply?

- Not at all important
- Of minor importance
- Neutral
- Important
- Very important

The department has put forward a range of draft actions to increase the resilience of communities and industries using groundwater. The following questions will review each of the draft actions and their sub-actions.

Action 2.1 - Support towns and cities using groundwater to improve their urban planning.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Action 2.2 - Support economic growth using groundwater.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 2.2?

	Not at all important	Of minor importance	Neutral	Important	Very important
Provide better information on groundwater opportunities and constraints to communities and industries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Enable the increase of sustainable groundwater use in targeted areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Foster innovative groundwater solutions, including Managed Aquifer Recharge (also called 'water banking', to support communities and industries)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Action 2.3 - Support Aboriginal rights, values and uses of groundwater.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 2.3?

	Not at all important	Of minor importance	Neutral	Important	Very important
Increase access to groundwater for Aboriginal people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Protect groundwater-dependent places of significance to Aboriginal communities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Better integrate Aboriginal knowledge into groundwater management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

The following questions focus on groundwater challenges and opportunities for Aboriginal people in NSW.

Please only answer questions 43 to 51 if you identify as Aboriginal or Torres Strait Islander. If you do not identify as Aboriginal or Torres Strait Islander, please go to question 52.

A key objective of the NSW Government is to improve groundwater management outcomes for Aboriginal people across the state. We want to ensure that Aboriginal people and their wisdom and knowledge have a greater influence in groundwater planning and management.

You have indicated that you are of Aboriginal or Torres Strait Islander descent. To help us to better plan for and manage groundwater to support Aboriginal rights, interests and access, please answer these additional questions.

Do you identify as Aboriginal and/or Torres Strait Islander?

- Aboriginal
- Torres Strait Islander
- Both Aboriginal and Torres Strait Islander
- Neither
- Prefer not to say

Please tell us what groundwater health and secure groundwater supply means for you, your family, your clan, your Nation.

Please tell us about the changes you have seen in groundwater management in your cultural landscape.

Please indicate which of these cultural opportunities you have seen in action in the way groundwater is managed in NSW.

Select all that apply.

- Cultural wellbeing and healing
- Cultural significance of higher flows to waterways
- Protection and restoration of cultural sites of significance
- Restoring healthy Country
- Cultural ecotourism
- Other (please specify) _____

Please provide any other comments about cultural opportunities or challenges in groundwater management in NSW.

The strategy strives to provide more cultural and economic opportunities for Aboriginal people in relation to groundwater.

What are the most important opportunities for you?

Select all that apply.

- Fairer access to traditional land and resources
- Better contemporary economic opportunities in culture and recreation
- Increased access to employment and commercial opportunities on projects
- Improving awareness of Aboriginal people’s knowledge and contribution to how groundwater is managed in NSW in the next 20-40 years
- Other (please specify) _____

Please provide any other comments about benefits of cultural and economic opportunities and how we realise those benefits in groundwater management and planning in NSW.

This concludes the questions specific to your cultural heritage. If you would like to provide additional material to support your position, please email them along with this document.

Please tell us any other suggested actions you think we should consider in Strategic Priority 2.

Strategic Priority 3 – Improve groundwater management decisions with better information

Strategic Priority 3 aims to support better groundwater management and investment decisions with improved innovation and knowledge.

The strategy identifies 3 key challenges affecting the use of information to manage groundwater resources sustainably.

Please rank these challenges in order of importance, where 1 = Most important and 3 = Least important.

- 3_____ Being underground and difficult to investigate, information about groundwater is lacking
- 1_____ There are gaps in our scientific knowledge and research capabilities
- 2_____ Our groundwater monitoring network is ageing and has limited coverage

Please tell us any other challenge you think is affecting the use of information and data to manage groundwater resources.

How important is it for you to have access to more information and data about groundwater management and use?

- Not at all important
- Of minor importance
- Neutral
- Important
- Very important

How interested are you in finding out more about how groundwater is managed and used?

- Not at all interested
- Of minor interest
- Neutral
- Interested
- Very interested

What ways could the department use to communicate with you and others in your community about groundwater management?

Please tell us what type of information and data about groundwater resources you would like available on our departmental website?

The department has put forward a range of draft actions to improve the use of data and information to make groundwater management decisions. The following questions will review each of the draft actions and their sub-actions.

Action 3.1 - Develop a groundwater knowledge plan to improve how we use groundwater information to make decisions.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Action 3.2 - Better share and integrate groundwater information.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 3.2?

	Not at all important	Of minor importance	Neutral	Important	Very important
Expand the range of knowledge and insights products including information systems, platforms and interfaces for storing, managing, accessing and interrogating groundwater data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Improve and diversify how we communicate information on groundwater resources and their management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Support strategic planning and decision-making by councils and groundwater users with improved access to information on groundwater and its management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Develop a unified framework to consolidate and analyse all groundwater data across all relevant agencies and groundwater users and impacting activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Support data and database integration across agencies to address data gaps and improve customer service delivery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Action 3.3 - Improve our understanding of groundwater resources.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 3.3?

	Not at all important	Of minor importance	Neutral	Important	Very important
Expand our multi-disciplinary understanding of groundwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Improve our groundwater models where required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Increase our capacity and capability to apply leading groundwater science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Action 3.4 - Expand our groundwater data collection.

To what extent do you agree with this draft action?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

How important to you are each of the following sub-actions required under Action 3.4?

	Not at all important	Of minor importance	Neutral	Important	Very important
Improve our groundwater monitoring infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Improve our groundwater monitoring programs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Please tell us any other suggested actions you think we should consider in Strategic Priority 3.

If you have any further feedback, please provide any final comments or upload additional material here.

I am submitting a separate document entitled: Attachment to Submission by Andrew Ross "Integrated water storage for a resilient water system".

About you

We appreciate your time in responding to this survey. Before you submit your survey response, we would appreciate your feedback to help us more broadly understand our audience. This enables us to communicate more clearly and to customise messages to the community. Please choose 'Prefer not to say', if you would rather not answer a question.

The information you provide will only be used for the purposes of this survey, to assist us in preparing the final NSW Groundwater Strategy and in the development of new groundwater policies and plans for NSW.

Personal information

Please note, your personal information will only be shared if you granted permission for this to occur.

- Name _____
- Email _____
- Your business name (if you are responding on behalf of an organisation)

How did you hear about this survey? Select all that apply.

- Community group
- Department's website
- Email or e-newsletter from the department
- Newspaper
- NSW Government announcement
- Radio
- Social media - Facebook
- Social media - Instagram
- Social media - LinkedIn
- Television
- Word of mouth
- Work in the Water industry
- Other (please specify) _____
- Prefer not to say

What age bracket do you fit into?

- Under 18 years
- 18 - 24 years
- 25 - 34 years
- 35 - 44 years
- 45 - 54 years
- 55 - 64 years
- 65 - 74 years
- 75 + years
- Prefer not to say

How do you describe your gender?

- Female
- Male
- Non-binary
- Other
- Prefer not to say

Do you speak a language other than English at home?

- Yes (please specify) _____
- No
- Prefer not to say

Do you identify as a person with a disability?

- Yes
- No
- Prefer not to say

Enter your postcode:

Thank you for completing this survey. Please email to nsw.groundwaterstrategy@dpie.nsw.gov.au

Attachment to submission by Andrew Ross: Integrated water storage for a resilient water system

Water storage is a critical component of social and environmental resilience and socio-economic development. In many countries rainfall is naturally variable, with wet years followed by dry years. The ability to manage annual and seasonal variability is crucial in maintaining water security for cities and agriculture, together with healthy rivers and other water based ecosystems. Water storage provides a buffer for managing uncertainty and variability in water supply, and adds adaptive capacity. Water storage services also include water purification, regulation of water flow and habitat.

Water is stored in natural and built systems above and below the ground. About 30% of the freshwater on earth is stored in aquifers and only 1.2% in surface water, the rest is found in glaciers and ice caps. Water stored in human built systems, such as dams, retention ponds and tanks is small yet vital for people's livelihoods and economic development. Vast amounts of water are stored in natural systems including glaciers (68.7 %), aquifers (30%) wetlands, lakes and rivers (1.2%) and soils.

The risks and opportunities related to water storage are growing. Water supply is becoming more uncertain with increasing variability in rainfall and more intense floods and droughts owing to climate change. The demand for water is growing owing to population and economic growth. These trends are leading to increased demand for water storage, but it has been estimated that global terrestrial freshwater storage has reduced by 15,700 billion m³ between 1970-2019 (Yu et al 2020). The rate of new dam construction peaked in the 1970s and has declined since then. In many regions the most promising locations for dams have been used and demand for other land uses is growing. While much groundwater is inaccessible or too saline to be used, the usable component is massive. There are substantial opportunities for exploiting the wide range of services provided by groundwater including water storage, retention and regulation; water quality control and purification; environmental flows and habitat (GRIPP 2018). Natural wetlands and soil moisture provide additional water storage.

Surface water reservoirs, ponds and tanks, aquifers, natural wetlands and soil moisture have different characteristics in terms of volume, feasibility, adaptability, controllability, reliability, vulnerability, sphere of control, cost and sustainability and risks associated with climate change. Water storage is not identified as a key element in the National Water Initiative or the Murray Darling Basin Plan and integrated water storage is not included in state water resource plans. There is a growing need to establish strategies for integrated water storage in response increasing demand and falling availability, exacerbated by climate change. This would include assessment of storage requirements, evaluation of benefits and costs of different options and development of an integrated water storage portfolio.

The draft New South Wales groundwater strategy highlights the role that groundwater plays in ensuring water security and providing ecological services in NSW, especially in dry times. The strategy identifies future risks to groundwater because of increasing demand and reductions in recharge owing to climate change. The strategy includes better integration of groundwater management with surface water and land management recognising surface water and groundwater connectivity and the cross impact of surface water and groundwater and land uses on other resources. Water storage should be explicitly included as a key component in the strategy.

Implementation of integrated water storage would require a transition in land and water policy. This transition is feasible if it is implemented in stages. The first stage would be more rapid implementation of existing approaches for integrated water storage such as conjunctive water management and storage, and managed aquifer recharge. The second stage would be the development of a national strategy for water storage, as outlined below. Further stages would follow the development of the strategy.

The opportunities for conjunctive water management and storage and MAR are well understood in Australia (Dillon 2009, Ross 2018) and globally (Dillon et al. 2019). MAR is already being used in a number of locations in Australia including Adelaide and Perth (Zheng et al. 2021). Aquifers that provide sufficient

storage for commercial scale water banking have been identified in New South Wales (Gonzales et al 2020). The New South Wales government is developing a policy framework for MAR.

There is sufficient information about MAR and community support for the concept to proceed with one or more pilot studies. A study of MAR in the Colleambally irrigation area found that there are opportunities to increase water storage capability of irrigation companies and regions that may include capture and banking of unallocated water during wet periods, use of existing entitlements to store water to ensure water security in dry years, and or conjunctive management of groundwater and surface water to maximise more consistent annual water availability and quality. The study recommended proceeding with a MAR pilot study involving irrigation companies, researchers and the New South Wales government that would also support MAR policy development (Merritt et al. 2020).

MAR is only one of multiple integrated water storage solutions. Further work is required to develop the concept of integrated water storage and to compile the information required to support an integrated water storage strategy in NSW:

- development of a framework for considering water storage as an integrated service or set of services, taking account of the different attributes and applications of different storage services and their co-dependence;
- compilation of an inventory of water storage types, attributes and uses over time;
- assessing and accounting for the socio-economic costs and benefits of integrated water storage systems as a whole, and of different types of storage in specific uses.

Although these points represent a substantial information gathering and research agenda, much of the information is likely to be already available. One approach to motivate and channel this effort would be to adopt integrated water storage as an additional component of the NSW groundwater strategy to promote water security and resilience to climate change. This would position NSW as a national leader in the development of integrated water storage solutions.

References

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