

# **National Groundwater Strategic Framework**

2016–2026



**Australian Government**

**This document was developed by the Australian and state and territory governments**

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# 1 Summary

Groundwater is the only reliable, cost-effective water source for large parts of Australia, which also sustains many environmentally significant dependent ecosystems, terrestrial vegetation systems, wetlands and stream base flows and coastal systems.

Groundwater is a crucial resource for Australia's future economic development. In addition to providing a water source it can be significantly affected by developments in terms of quantity depletion or quality degradation, impacts that must be effectively managed.

Increasing demands and impacts on groundwater for economic development and from climate variability call for a nationally coordinated approach to better understand, manage and secure Australia's groundwater systems.

The National Groundwater Strategic Framework provides a strategic vision for the next 10 years, focusing on three priority objectives where action is required to sustain our groundwater resources and enable ongoing access to this increasingly valuable water resource.

Jurisdictions have been instrumental in supporting and implementing national initiatives to respond to escalating demands on groundwater resources and will play a key role in implementing the actions detailed in the Strategic Framework. Appropriate consultation with stakeholders such as water users, existing entitlement holders, researchers and the broader community will also be required. Implementation pathways will be aligned with existing resources and jurisdictional priorities.

Successful implementation of the strategic framework would optimise the contribution that groundwater makes to Australia's economic, environmental and social wellbeing through more efficient, effective and innovative groundwater management.

The three priority objectives are:

- Sustainable extraction and optimal use—supporting the value of groundwater and improving understanding of groundwater resources to support optimal use
- Providing investment confidence—providing confidence for investment through risk based, consistent and efficient regulation of groundwater resources
- Planning and managing now for the future—developing integrated water supply planning to enhance future water security.

These strategic objectives will be achieved by:

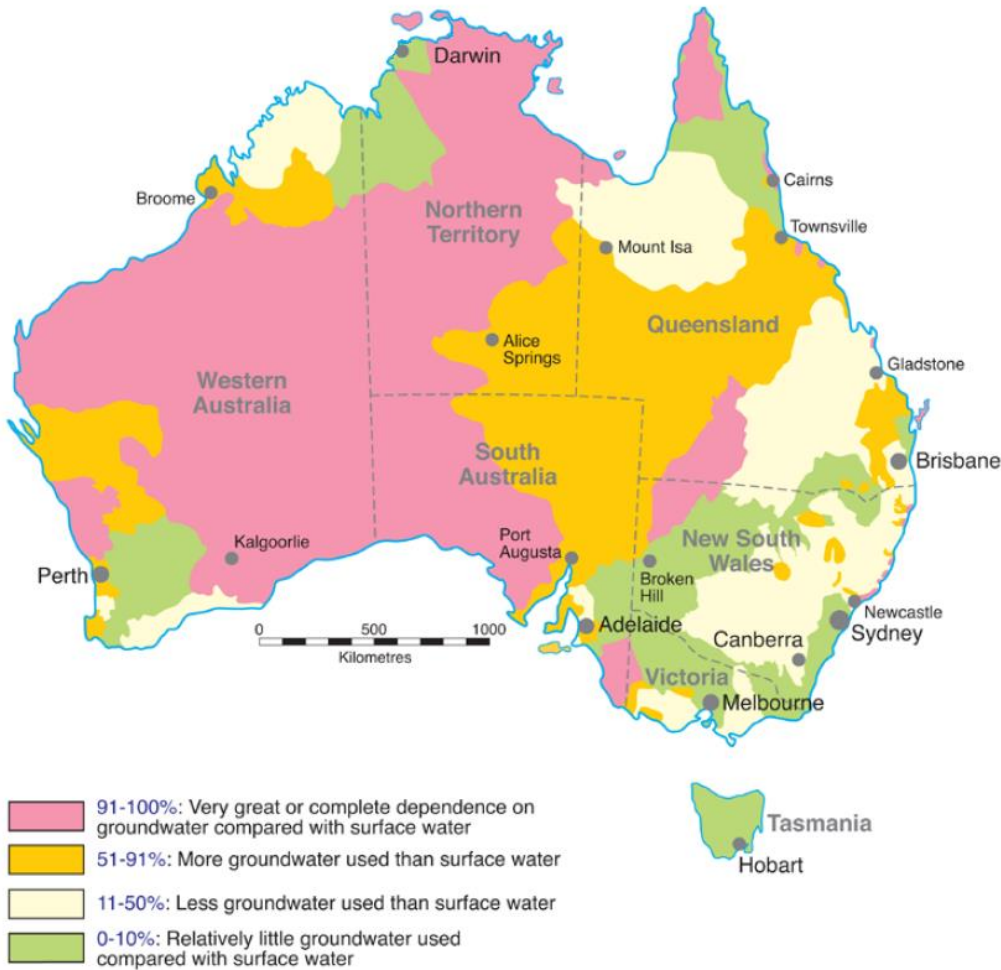
- recognising and supporting groundwater values
- understanding the resource and developing new knowledge
- implementing risk based approaches to groundwater management and use
- adopting more efficient and effective regulatory processes
- improving access to information for decision-making
- identifying innovative opportunities to use groundwater as part of the integrated water cycle.

Groundwater resources function within broad, diverse landscapes, sustaining and interacting with complex ecological and hydrological systems. Decisions regarding groundwater management need to be informed by a strong understanding of the interconnections and feedback mechanisms associated with these broader systems.

To manage groundwater effectively it is essential to recognise the connection between groundwater and surface water, its interaction with other natural resources and land use, groundwater quality, and groundwater functions in supporting important ecosystems including wetlands, rivers and groundwater-dependent vegetation. The connection groundwater has with built water systems (for example, water supply) must also be recognised to optimise water management outcomes.

Australia has witnessed a rapid development of groundwater resources use over the past 40 years. Demand for groundwater resources is expected to continue to increase with the growth of Australia’s population and ongoing economic development. It is vital for water security and sustainability of urban areas, rural communities, industry and our environment that we manage groundwater innovatively and effectively.

**Map 1 Groundwater use in Australia as a percentage of total water consumption**



Source: Deloitte Access Economics 2013

Groundwater use in Australia, as a percentage of total water use is identified in Map 1. This map provides a broad indication of groundwater resources and dependency throughout Australia. An estimate widely accepted by scientists and policymakers is that groundwater now directly supplies close to 30 per cent of Australia's total water needs, and more than 60 per cent in south-west Western Australia (CSIRO 2009).

The *Economic Value of Groundwater in Australia* report (Deloitte Access Economics 2013), estimates groundwater's contribution to GDP. The direct value of consumptive uses to groundwater users is estimated to be between \$3.0 to \$11.1 billion annually. The economic value of production to the Australian Economy supported by groundwater is estimated to be \$33.8 billion. This is comprised of metal ore mining \$24.8 billion (73 per cent), agricultural production dependant on groundwater \$3.7 billion (11 per cent) and agricultural livestock in groundwater dependant areas \$1.0 billion. Groundwater represents significant water security at times of limited alternative water supply for various types of agricultural, mining and industrial production throughout Australia, underpinning investment in these sectors. Further, it is important to note that groundwater resource development and use typically involves costs associated with treating water.

The non-consumptive values of groundwater such as supporting environmental values can also represent a co-contribution toward other economic activities, such as tourism through maintaining and/or improving environmental biodiversity.

It is important to identify that these associated economic values do not include the intrinsic value of the non-consumptive use of groundwater for environmental water requirements, cultural values and the maintenance of water quality.

In the absence of improved knowledge and governance, economic development may be unnecessarily constrained and opportunities for growth foregone. This is the focus of the actions described within the National Groundwater Strategic Framework.

## 2 Introduction

### 2.1 Working towards groundwater sustainability

The Council of Australian Governments (COAG) initiated wide-ranging water reform in 1994, which was followed by the National Water Initiative (NWI) in 2004 to provide greater certainty for future investment. The NWI explicitly recognised the need to better manage groundwater resources and conjunctive use of water resources. Implementation of these NWI commitments remains paramount.

The most recent programme to improve our understanding and stewardship of groundwater has been led by the National Water Commission's (NWC) \$82 million National Groundwater Action Plan (GAP), which recognised that investment in groundwater management and knowledge had not reflected its economic or social significance.

GAP investment from 2008 to 2012 provided support to the policy, resource assessment, management, monitoring and compliance responsibilities of the state and territory governments and the Commonwealth. The programme included a \$50 million commitment to hydrogeological investigations of groundwater systems, and a \$30 million joint venture between the NWC and the Australian Research Council to establish the National Centre for Groundwater Research and Training (NCGRT) to build groundwater capacity and expertise.

Additionally, the Commonwealth *Water Act 2007* gave responsibility to the Bureau of Meteorology to make a national database of water information available through the internet. The Bureau of Meteorology has developed a National Groundwater Information System (NGIS) providing standards for reporting on hydrogeological and bore construction details at boreholes in conjunction with jurisdictional groundwater managers that will facilitate access to reliable groundwater data.

These initiatives placed a necessary focus on the importance of groundwater in the water reform process and heightened awareness of the value of Australia's groundwater resources. Jointly they have made significant gains in addressing a substantial deficiency in groundwater knowledge and capacity, but there remains an ongoing need to address historical under investment and increasing, and changing, future demands.

The National Groundwater Strategic Framework aims to capitalise on the significant technical advances from the GAP to secure Australia's groundwater future. Work is now required to ensure that the practical contributions of the GAP investment to water planning and management are fully utilised and that any limitations inhibiting the implementation of improved management are addressed. In times of significant fiscal constraint, the focus of this framework is the strategic prioritisation of effort to achieve cost-effective improvements in regulation and management.

A synopsis of key groundwater issues are documented in a supporting National Groundwater Sub-Group document (WTOG 2013) to this National Groundwater Strategic Framework, providing supporting context to the three strategic priorities.

# 3 Strategic objectives

## 3.1 Sustainable extraction and optimal use

*The optimal use of groundwater will be achieved by increasing our understanding of how aquifers function, how they respond over time to extraction, climate variability and management settings, and the diverse social, economic and environmental values they support.*

### 3.1.1 Supporting groundwater values

Groundwater is an unseen resource for most users, and raising awareness of the contribution of groundwater to society, the economy and the environment is important for public acceptance of policies and regulation for better management and sustainable use.

Groundwater is strongly connected to surface water and is part of the total water cycle. It is often present in multiple aquifer systems with varying degrees of connection between the aquifers either vertically or laterally. It supports a range of values including:

- often supplies a significant proportion of annual catchment yields and is linked to the landscape, supporting aquatic ecological systems and terrestrial vegetation
- the only reliable water source in the semi-arid to arid areas of Australia
- of cultural significance for Indigenous Australians
- a significant resource and management priority for municipal water supplies, industry, agriculture, mineral resources and energy generation
- important in sustaining dependent ecosystems
- the only viable water source in times of restricted surface water availability.

Groundwater has important economic and social values for many regional cities and towns and city water supplies, such as Perth, and for irrigation water supplies and mine water supplies as exemplified by the *Assessing the value of groundwater* report (Marsden Jacobs Associates 2012).

There is a need for sound and robust information relating to key national issues, such as the long-term impact of coal seam and tight gas and other extractive industries. Human induced impacts on groundwater can be significant well before becoming apparent, and may be irreversible in terms of aquifer depletion, water quality degradation or pollution. There is a need for detailed understanding, analysis and management of groundwater systems to minimise the risk of irreversible damage. Where relevant national water planning or management frameworks are in place these should be actively applied to all groundwater management processes.

#### **Actions**

1. Apply the NWI Policy Guidelines for Water Planning and Management (COAG 2010) in groundwater planning processes.
2. Build on the National Atlas of Groundwater Dependent Ecosystems (BOM 2016) as a primary current source to identify potential Groundwater Dependent

Ecosystems when preparing management plans and assessing development proposals.

3. Implement communication strategies that are informed by social research, through mechanisms such as the water planning process to engage the broader community about the importance of groundwater and provide timely advice in response to community concerns about groundwater issues.

### **3.1.2 Understanding the resource**

Water plans should be underpinned by best available scientific knowledge and socio-economic analyses (COAG 2010). Coordinated strategic resource assessments are needed across Australia for effective decision-making and action.

Being underground, groundwater systems are complex to understand and manage and sustainable extraction regimes are challenging to define. Australia is still a long way from answering important questions such as the scale of groundwater use, the depletion of its groundwater resources, quantifying recharge rates, and the effects on connected surface water resources.

Increased groundwater salinity in response to groundwater extraction is a potential risk in many groundwater systems due to inter-aquifer leakage or accessions of saline irrigation drainage to groundwater or due to vulnerability to seawater intrusion. Management of salinity can be a limiting factor for determining sustainable extraction regimes for environmental values, or fit for purpose uses (human drinking water, irrigation, industrial, mining). In many water supply systems groundwater quality is highly variable, and often more variable than surface water. In some cases groundwater quality degradation due to point source pollution, diffuse land use impacts or chemical reactions such as acidification can limit groundwater availability.

Groundwater systems are complex and targeted investigations with sustained, often comprehensive monitoring are often required to adequately understand the hydrologic processes and changes over time, which characterise the resources and their connectivity with other water resources and the environment.

In many areas, fundamental research regarding the physical nature of groundwater systems, their natural recharge and discharge regimes, groundwater resource characteristics (such as the size, location, dynamics and sustainability of extraction) and vulnerability to hydrological perturbations are needed to inform management. Research into surface water and groundwater connectivity shows planned conjunctive use is vital for sustainability and to create opportunities to optimise water extraction and use options, particularly in high extraction areas.

Progress is being made, however the overall need to support knowledge development and basic data collection has been largely underestimated and under-resourced. As an example, the analysis of the Groundwater Action Plan programme identified an urgent need to maintain or replace existing, ageing monitoring networks to be able to effectively monitor the trends in groundwater status. This need has been partially addressed by the Bureau of Meteorology through administration of the Modernisation and Extension of Hydrologic Monitoring Systems programme (2007–2012); however, more work is required.



There is a need for greater information on groundwater resources to support allocation and management decisions. Sustainable extraction and optimisation requires a commitment to funding ongoing investigation and monitoring. This is particularly important in the context of conjunctive management and use of water systems, which requires robust knowledge of the complex dynamics of surface water and groundwater resources across temporal and spatial scales.

### **Actions**

1. Maintain or implement assessment programmes of high priority groundwater resources, based on a risk based categorisation, or resources at high likelihood of major development.
2. Embed water quality into planning, management and regulation frameworks utilising the National Water Quality Management Strategy: Guidelines for Groundwater Quality Protection in Australia (ANZECC and ARMCANZ 2013) to support national water management processes.
3. Provide adequate investment in meters, monitoring, (including emerging monitoring technologies such as remote sensing) and compliance commensurate with the risks to the resource, including investment for analysis of data and communication of monitoring and compliance. Produce investment guidelines for monitoring networks, which take into account the system's characteristics, the level of extraction, and potential demand and associated levels of risk.

### **3.1.3 New knowledge**

Knowledge is captured and applied by the states and territories to best manage groundwater resources. However, a strategically focused research and development programme is essential to support planning and decision-making across all priorities identified in this framework.

Increased knowledge from future research will be instrumental in helping to shape innovative and effective policy and governance for the sustainable management of Australia's groundwater. Demonstrating the benefits of new scientific advances, while quantifying and communicating areas of uncertainty, is important to reduce the gap between research and practice and to improve the effectiveness of evidence-based policy.

The National Water Knowledge and Research Platform identifies groundwater research priorities for forming national research programmes. Coordinated engagement by jurisdictions with researchers would enhance opportunities for investment to progress these research priorities. A collaborative approach between researchers and jurisdictional agencies would also provide opportunities to build capacity and enhance adaption of research through strategies such as staff exchanges on projects.

The NCGRT, established in 2009 as a university based node centre, provides a national profile for groundwater research and training to address key national groundwater management issues. It complements research undertaken by the CSIRO, other Australian universities, Commonwealth and state government organisations.

## **Actions**

1. Support the implementation of the National Water Knowledge and Research Platform by reviewing and liaising with researchers on research priorities and adaptation.
2. Support the continuation of coordinated groundwater research and training in Australia.
3. Promote strategies to improve communication by implementing approaches that integrate science, government (policy/legislation), industry (managers who make decisions about water use) and community to develop new knowledge, tools and processes to improve management of groundwater systems.
4. Support social research to enhance the understanding of society's and decision-makers' diverse needs, values and practices that surround groundwater.

## **3.2 Providing investment confidence**

*Risk-based, consistent and efficient regulation of groundwater resources will provide confidence for investors and ensure long-term sustainability.*

### **3.2.1 Risk based approaches to groundwater management and use**

Good governance is essential for the long-term sustainability of Australia's groundwater and confidence in investment. Cost-effective water planning takes a risk-based approach and also involves a balance between competing economic, social and environmental interests.

One aspect of this is to ensure that those who use the resource have clarity in respect to the legal nature of water entitlements. The processes by which access to groundwater is enabled, the legal status of that access, and the rules and costs which apply to its extraction need to be transparent and accountable.

COAG and NWI water reforms (COAG 2010) have resulted in jurisdictions moving towards agreed principles for water management, including processes and practices to achieve sustainability through legally enforceable water management plans.

However, inconsistencies in practices still persist. Further work is needed to better understand the nature of the differences in state and territories approaches to groundwater management, and to gain agreement on harmonised approaches to groundwater policy and practices where appropriate.

Key areas where harmonisation and the use of risk based approaches would deliver the greatest benefit to investment confidence include:

- understanding the environmental, public benefits, social and economic values and comparisons of these in decision-making
- the role of off-sets in resolving resource management decisions
- trade-off of short term and long term values (eg. mining versus agriculture)

- the approach to using groundwater that is not currently replenished (non-renewable resources), considering the needs of future generations.

The NWI Policy Guidelines for Water Planning and Management (COAG 2010) stated that stakeholders should be able to identify and understand how environmental and other public benefits and social and economic objectives are identified. This should involve actively and transparently considering and settling the trade-offs between competing outcomes for water systems, using best available science, social and economic analysis and community input, and addressing impacts on affected water entitlement holders and communities.

### **Actions**

1. Develop a risk-based categorisation process for groundwater resources to plan for innovative management, and to inform broader national and state water management processes where relevant.
2. Develop risk-based approaches to specifying water entitlement for groundwater, and the associated conditions (quantity, quality and surrounding users), which recognise seasonal variability, lag effects and uncertainty.
3. Develop risk-based approaches to assess and manage impacts of groundwater extraction on connected surface water resources, surface water and groundwater quality and dependent ecosystems.
4. Develop risk-based approaches to assess and manage cumulative effects associated with multiple stressors and water extractions.

### **3.2.2 Efficient, effective and transparent regulatory processes**

Industry and the community expect government to regulate access and protection of groundwater in a fair, transparent and efficient manner. Regulatory frameworks should ensure that the benefits of regulation justify the associated costs and that regulation is clear, consistent, comprehensible and accessible to users.

The NWI Policy Guidelines for Water Planning and Management (COAG 2010) stated that ‘all water use by mining and other extractive industries, including energy generation, should be authorised and accounted for in water budgets and managed under regulatory arrangements that are part of, or consistent with, water plans’.

Greater levels of industry and community confidence in state and territory development approval process will be gained by the adoption of integrated assessment approaches to ensure that issues are addressed holistically between state and territory regulatory agencies. This is particularly relevant where groundwater is connected to other water resources or dependent environments or will be affected by cumulative impacts from multiple developments.

Some regulatory processes for groundwater are often considered too bureaucratic. For example, groundwater trading approval processes can be considerably slower than the trading processes available on surface water systems. However, groundwater systems can be complex and often require more time and resources to undertake technical assessment of transfer applications against criteria or trading rules specified in management plans.

Clear criteria and rules for the access and trading of groundwater, recognising this complexity, are required for industry to invest confidently in its use, and for the community to have confidence in its protection. In addition, full accounting and reporting for all groundwater extraction and uses, including irrigation, mining and other extractive industries and interception activities will improve certainty for investment.

### **Actions**

1. Assess groundwater trading rules, including their effectiveness and opportunities for improvement and appropriate application of trade between surface water and groundwater.
2. Address regulatory frameworks and legal uncertainty which inhibits the update of innovative groundwater solutions (such as Managed Aquifer Recharge, groundwater trading and use of recycled water), with appropriate safeguards and where these solutions provide additional options to complement traditional water infrastructure approaches.
3. Introduce appropriate outcomes based regulation and full accounting for all groundwater extractions and uses, including mining and energy, and interception activities.

### **3.2.3 Information for decisions**

Access to information and data is essential for understanding groundwater systems, which is critical for effective groundwater management and use.

Ready access to temporal and spatial data to monitor trends in groundwater conditions, groundwater quality and to evaluate the effectiveness of management plans, strategies and actions is particularly important. The Commonwealth *Water Act 2007* charged the Bureau of Meteorology with the task of collating, standardising and disseminating national water information data.

This includes key groundwater data described in the Water Regulations 2008 under the *Water Act 2007*. A mechanism for developing uniformity in data sets between jurisdictions—which is a foundation for developing consistent approaches to groundwater management—is provided by the legislation.

The Bureau of Meteorology has developed the Australian Water Resources Information System (AWRIS) to collate, standardise and house groundwater and related data, and is collating essential contextual data for groundwater bore construction and hydrogeological stratigraphy through the National Groundwater Information System (NGIS).

States and territories update and maintain their ‘point-of-truth’ data to ensure consistent, accurate, state and territory wide information. The information is to be available through a common national platform, like the NGIS, and also on state and territory information portals. Where possible and appropriate, the data-set should include as much information on groundwater as possible, including information from private industry datasets (eg. mining). In such cases data provision requirements should be efficient, non-duplicative and proportional to the water resource management risk.

To underpin confidence in groundwater resources management there is a need for ongoing advances in data acquisition, storage and aggregation, particularly for complex systems such as geological basins containing unconventional gas resources. The level of uncertainty, and hence accuracy in assessing risks with groundwater resource development and management, will depend on data type, availability and quality. Quantifying and reducing sources of uncertainty in groundwater models will continue to be an important key research area to derive meaningful uncertainty estimates and improve accuracy for decision-making.

#### **Actions**

1. Populate and use the public information platform provided by the Bureau of Meteorology for groundwater data.
2. States and territories to update and maintain their 'point-of-truth' groundwater data sets.
3. Reach cross-jurisdictional agreement on minimum data sets in formats consistent with a national framework to provide comparative information.
4. Improve access to groundwater data and information either through a national portal (currently at Bureau of Meteorology) or web-based access to jurisdictional information systems.

### **3.3 Planning and managing now for the future**

*Integrated and sustainable water supply planning will enhance future water security.*

#### **3.3.1 Groundwater opportunities in an integrated water cycle**

Australia has large groundwater resources of varying quality, which are the only reliable, cost-effective water sources in large parts of Australia. While supporting existing industries, agriculture, domestic and town water supplies, groundwater is increasingly recognised as a viable water source in meeting future water demands.

In considering future groundwater developments it is important to assess risks to the use of groundwater resources in light of the scientific uncertainties about the resource.

A key challenge is the conjunctive management of different water systems which have traditionally been managed separately.

Groundwater is increasingly being used:

- in conjunction with surface water for agricultural purposes
- in conjunction with surface water and other water sources, such as treated stormwater and recycled wastewater
- as a water bank or storage medium for injected or infiltrated water through Managed Aquifer Recharge (MAR) schemes to offset groundwater extraction and increase the available water and/or for environmental benefit
- by mining and energy sectors using desalination technology on saline groundwater for potable and non-potable water uses as a more cost-effective option.

Conjunctive management of groundwater in integrated water supply systems can provide opportunities with other sources to expand water supply options for development demands rather than relying solely on one source. These approaches also provide increased water supply flexibility and security in managing for climate variability and change and fluctuating water availability, and potentially provide opportunities to better respond to extreme event such as drought.

#### **Actions**

1. Support the integration of water supply options for urban and rural water systems through the conjunctive management of surface water, groundwater and other water sources. This should include the proactive application of innovative options such as treated stormwater, recycled wastewater, managed aquifer recharge, water banking and treated brackish or saline groundwater resources.
2. Develop regionally appropriate protocols to assess conjunctive groundwater-surface water extraction limits, given future climate scenarios.
3. Create stronger links between quantity and quality information in modelling of water systems to improve calibration and prediction.

### **3.3.2. Capacity building and training**

Strong collaborative links need to be forged and maintained with industry networks and government sectors to achieve the right balance for research, education and training. Training capacity is required at both the professional and the field technician level. While the GAP and NCGRT made significant progress in this area, the effort needs to expand and continue beyond their funding horizons.

University graduate courses are now available for groundwater professionals. Through the National Groundwater Action Plan programme, groundwater teaching has been integrated into the National Curriculum, increasing the likelihood of students entering university with some knowledge of groundwater.

A key strategy of the NCGRT is training the next generation of groundwater researchers and experts and to transfer new research knowledge to industry practitioners, resource managers, policymakers and groundwater users.

Industry training and skill development is provided by other water centres and private providers, and in-house training is delivered within jurisdictions tailored to their legislative and operational context.

A principal focus of capacity building therefore is the embedding of a groundwater perspective in water management.

#### **Actions**

1. Integrate groundwater into water management training, and align training with the knowledge needed to support groundwater management, monitoring and assessment practices.

2. Undertake further labour force analysis to assess future need for groundwater professionals and work towards ensuring there is enough capacity to manage changing and pressing groundwater issues over the next 10 years.
3. Support training and development opportunities to ensure new scientific knowledge and research are transferred to groundwater practitioners.
4. Build effective collaborative relationships between government agencies, research institutions and the private sector with groundwater expertise.

## 4. Future directions

This National Groundwater Strategic Framework 2016–2026 is a strategic vision for the next 10 years specifically aimed at policy and decision-makers. It is framed in the knowledge that groundwater is a resource that currently underpins a significant percentage of Australia’s basic human water needs and economic development requirements. In large parts of Australia it is the only reliable water source to support economic development.

The framework outlines the challenges we face and identifies the strategic goals to effectively manage Australia’s groundwater resources for current and future needs, focusing on three priority objectives for action:

- sustainable extraction and optimal use
- providing investment confidence
- planning and managing now for the future.

The framework identifies key strategies and actions over the next 10 years to realise the value of groundwater within well-managed systems that support a diversity of uses and environmental, social and cultural values. Innovative approaches are needed to address the capacity and financial constraints on jurisdictions to make new investments in groundwater knowledge and reform.

The three priority objectives outlined in the framework are essential for the long-term management and sustainability of our groundwater resources. There is recognised overlap between these priorities, with research and development providing fundamental data to support decision-making and innovation in all areas, supported by good governance. These pathways are highlighted in Figure 1.

All jurisdictions will respond to the actions in accordance with their jurisdictional policy and management requirements, priorities and available resources.

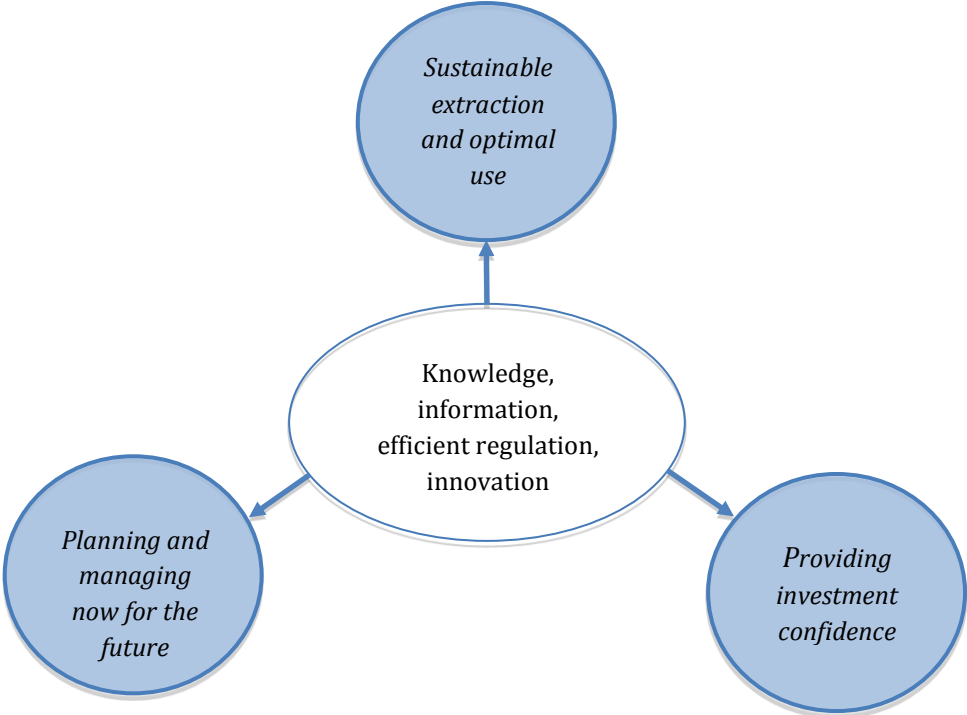
There is also broad scope for initiatives outlined in this strategy to sit alongside and complement other national priorities, such as the Independent Expert Scientific Committee established by the Federal Government to advise on coal seam gas and large coal mining, the setting of sustainable diversion limits for groundwater under the Murray-Darling Basin Plan, and the next steps in water reform prepared by the former Standing Council on Environment and Water.

The plan is also integral to helping meet the goals outlined in the Challenges at Energy-Water-Carbon Intersections report (PMSEIC 2010) developed by the Prime Minister’s Science, Engineering and Innovation Council (PMSEIC).

Better groundwater management is part of the answer.



**Figure 1 The interrelated pathway for implementation of the three strategic objectives**



Note: This diagram highlights the interrelationships between the cross-cutting themes (Knowledge, Information, Efficient Regulation and Innovation) required for the implementation of the three strategic priorities.

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