

SOUTH AUSTRALIAN PRODUCTIVITY COMMISSION INQUIRY INTO RESEARCH AND DEVELOPMENT

SUBMISSION FROM THE GOYDER INSTITUTE FOR WATER RESEARCH AND PARTNERS

1. Introduction

The South Australian water sector is a critical foundation of the economy and is essential for the ongoing competitiveness of all of the State's growth industries. Water also underpins many important social and environmental assets that are important for the health and wellbeing of the community.

Under the Government's economic development framework, *Growth State - Our Plan for Future Prosperity*, an ambitious target of 3% annual growth in gross state product has been set. As new sector plans have been prepared for initial priority industries in support of accelerated growth, it is apparent that water will be a key factor that needs active and ongoing attention by Government and the private sector. For example, for *Food, Wine and Agribusiness*, water access, price, regulation and irrigation improvement will be necessary areas of focus, while for *Energy and Mining*, the availability and cost of water were identified as key constraints, with the lack of available water resources a major barrier to mine expansion and investment.

New water technologies and solutions, underpinned by a strong water research and development ecosystem, will provide a cost effective way to overcome water constraints to growth, not just in *Food, Wine and Agribusiness* and *Energy and Mining*, but across all aspects of the South Australian economy. In the near future, it is possible to see the State driving innovations in:

- Low or zero energy 'water manufacturing', storage and transport systems;
- Fully automatic, active learning and zero water loss irrigation systems, which respond to biological cues from crops for water;
- Integrated water resource monitoring and management systems, enabled by a combination of in-ground IOT sensors, earth observation by satellite and big data analytics.

Being the 'driest state in the driest inhabited continent' means that South Australia's economy, environment and society are all highly vulnerable to what will be an uncertain water future under a changing climate, despite water supplies being secure for the Adelaide Metropolitan areas as a whole for the foreseeable future, due in large part to the Adelaide Desalination Plant. Importantly, however, this uncertainty also presents an opportunity for the State to establish itself as a world leader in new water innovations, with direct economic benefits resulting from improved water use productivity across critical sectors and increased international trade from and inward investment in the local water industry.

Globally we know that:

- Over 2 billion people are already living in regions experiencing high water stress, with over 700 million people worldwide likely to be displaced by intense water scarcity by 2030¹;
- 80% of future climate change adaptation responses will be in water related areas, particularly in regard to reduced water availability, changing water quality delivered to our water treatment plants and flooding²;
- 3 out of 4 jobs globally are reliant on water availability and future security³.

In response, many countries are actively investing in the capacity of their water sectors, particularly in priority R&D areas and commercialisation programs. This is primarily to ensure the continued development of technology and solutions for emerging and future water challenges, particularly unanticipated shocks from climate change, but also to drive efficiencies in assessing and rapidly responding to emerging issues. Such investments are also acting as a catalyst for the growth of the water industry in those regions, delivering new investment, exports and jobs.

Accordingly, the water industry is now one of the fastest growing sectors around the world, with the market currently valued around US\$600 billion, forecast to grow to US\$1 trillion by 2025⁴. Similarly, private investment in water stocks is growing substantially, with many private water utilities and infrastructure companies expanding between 10-25% above average market rates each year⁵. Further, in the United States, it is estimated that investments in traditional water infrastructure generate 10 to 26 jobs per US\$1 million⁶.

Alarming, in contrast to international trends, Australia and South Australia continue to see a reduction in public and private investment in water research and a contraction of the water sector more generally. For urban water research alone, investment has decreased from \$100-130 million in 2013 to \$40-50 million in 2015⁷.

In the context of the State economy this is:

- Seeing a rapid decline in capacity and capability to develop local solutions to water threats across critical sectors of the economy;
- Missing out on the opportunity to develop not only flexible technological solutions to proactively address such threats, but also create a capable workforce and community which is well equipped to respond as needed.

¹ https://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/ and https://img1.wsimg.com/blobby/go/27b53d18-6069-45f7-a1bd-d5a48bc80322/downloads/1c2meuvon_105010.pdf

² Henk Ovink, Water Ambassador of the Netherlands, 2019

³ <http://commit.cleaneas.org/pt-br/node/7922>

⁴ <https://www.globalwaterintel.com>

⁵ <https://thewaternetwork.com/ /water-and-financing/article-FfV/why-every-investor-should-invest-in-water-1n9ZHpl6NytXrx8EYDP3aA>

⁶ UNESCO, Water and Jobs, 2016

⁷ http://www.awa.asn.au/AWA_MBRR/Publications/Latest_News/What_s_behind_the_alarming_drop_in_water_research_investment.aspx

- Resulting in un-realised opportunities for new growth, through declining exports from and inward private investment in the water sector.

This submission has been prepared by the Goyder Institute for Water Research and its partners to present a consolidated South Australian water sector perspective on future R&D directions and priorities, as well as associated capability needs and opportunities. It also includes valuable contributions from a number of local water industry leaders.

The South Australian Productivity Commission should note that there is significant scope for South Australia to reposition water as a core element of the Government's industry development agenda, particularly through the ongoing evolution of Growth State and as part of the COVID-19 economic recovery process.

Improving the State's water innovation ecosystem and enabling the more effective translation of current and future research to local, national and international applications will need to be a key centrepiece of any renewed focus on water in South Australia.

This submission recommends the following areas for action:

- Development of a comprehensive South Australian water vision, with innovation and technology development at its core;
- Preparation of a long-term strategic water research plan, covering immediate and over the horizon threats and opportunities across the economy and society, to stimulate additional private and public investment;
- Establishment of focussed water innovation and commercialisation hub(s) to provide for the rapid development and deployment of new water solutions for local and global application;
- Further leveraging Government funding of water research, state owned infrastructure, policy and procurement to provide new pathways for innovation and technology development;
- Formation of a program of targeted international engagement and inward R&D investment through global research programs.

2. The Goyder Institute for Water Research

The Goyder Institute for Water Research is a partnership between the South Australian Government (through the Department for Environment and Water), CSIRO, Flinders University, the University of Adelaide and the University of South Australia. Additional collaboration with other key State research and government agencies has also featured throughout the life of the Institute, including the National Centre for Groundwater Research and Training, Environmental Protection Authority, SA Water, Primary Industries and Regions SA and Water Research Australia.

The Institute was established in 2010 to enable targeted research to underpin Government policy making during the Millennium Drought.

The initial term of the Goyder Institute included a cash investment by the South Australian Government of \$25 million, with matching in-kind contributions provided by the partners. Following a successful initial period, the Institute's term was extended for a further four years with a cash investment by the Government of \$8 million, with matching in-kind contributions again provided by partners.

The Australian Productivity Commission recognised the Institute as one of South Australia's key achievements under the *National Water Initiative*⁸ in its 2018 review of national water reform, going on to recommend that such collaborative research and knowledge adoption models should continue in order to support future national economic prosperity.

The key achievements of the Goyder Institute during its first two terms have included:

- Improved health of the Murray-Darling Basin through the Murray-Darling Basin Plan, with research underpinning the targets for the recovery of water for the environment;
- The identification of new outback groundwater resources to support mining developments;
- Increased food production through the broader adoption of the use of recycled water;
- Improved water security for Adelaide, by maximising the use and further development of all available water resources for the city.

An independent review of the first half of the first-term of the Institute estimated that it would deliver more than \$500 million of economic benefit from the initial Government investment of \$25 million.

Central to the success of the Institute to date is the collaboration fostered between researchers and end-users. This is actively facilitated through a deliberate governance model, which includes a Management Board, a Research Advisory Committee, Project Advisory Committees and project teams.

Collectively, this governance has achieved a highly cooperative approach to identifying water knowledge gaps, targeted research projects and direct adoption pathways. Importantly, the model has required the sponsored research to directly focus on specific water issues, as identified by Government and industry, by:

- Establishing up-front priority knowledge requirements from end-users;
- Establishing multi-disciplinary and multi-organisational research teams that have the necessary skills to comprehensively cover the relevant research question;
- Enabling the ongoing involvement of end-users in the research project process.

⁸ Source: <https://www.pc.gov.au/inquiries/completed/water-reform/report>

For the third-term of the Goyder Institute (2020-2023), the Government will not be providing an annual funding contribution. Institute partners still see significant value in continuing to collaborate to develop the water solutions of the future and to position South Australia as a national and regional leader innovative water research, committing to the Goyder model for a further three years. The partners all have complementary strengths in different aspects of water that can be combined to form highly competitive, multidisciplinary teams.

The funding model now for the Institute is to use this competitive advantage to leverage investment from State, national and international research programs and to deliver targeted research for industry. Since July 2018, a number of new research opportunities have been facilitated by the Institute, with a total value of \$10 million.

While this approach to the funding of projects provides an opportunity to leverage greater investment in water R&D into South Australia from other sources, there is also a risk that emerging water threats to strategic industries and the economy more generally will not receive adequate local research attention. There is also an associated risk that, without an ongoing program of water research, the State will lose much of its core capacity and, over time, be exposed to importing required water technology and solutions from interstate and overseas, as well as missing new opportunities for industry growth.

3. The Importance of Water and Associated R&D to the Future of South Australia's Economy, Environment and Society

Water is essential to all economic sectors in South Australia, from irrigated agriculture to mining, broad scale agriculture, processing, manufacturing and tourism. It is also critical for the future of the economy and new areas of development for the State, including intensive under cover crops, defence, manufacturing, mining and new agriculture that directly addresses the constraints of a drying climate.

Water and its availability, cost, treatment, use and disposal are important influences on the trajectory of the international economy. In 2015, the World Economic Forum highlighted water as the greatest threat to global prosperity, noting:

'Global water crises – from drought in the world's most productive farmlands to the hundreds of millions of people without access to safe drinking water – are the biggest threat facing the planet over the next decade⁹.'

Water continues to be rated as one of the top five challenges by the forum each year.

This is not surprising when it is recognised that water use has been growing globally at more than twice the rate of population over the last century, with water scarcity

⁹ <https://www.weforum.org/agenda/2015/01/why-world-water-crises-are-a-top-global-risk/>

already having a significant impact on economies, communities and the environment, for example:

- Over 2 billion people live in countries experiencing high water stress¹⁰;
- 700 million people worldwide could be displaced by intense water scarcity by 2030¹¹;
- About 4 billion people, representing nearly two-thirds of the world's population, experience severe water scarcity during at least one month of the year¹²;
- Due to the impacts of climate change, by 2030, water scarcity in some arid and semi-arid places will displace between 240 million and 700 million people¹³;
- A third of the world's biggest groundwater systems are already in distress¹⁴.

Similar to global trends, Australia continues to face significant challenges in regard to water security, with most of the nation already facing water shortages of one kind or another at least one month out of every year. This has most recently been demonstrated through the predominant drought conditions experienced across much of South Eastern Australia over the last five years.

Climate change is forecast to significantly change rainfall and evaporation patterns over coming decades, with this likely to be realised in the form of less overall precipitation, but an increase in the number of large rain events.

The World Bank has noted that *'the impacts of climate change will be channelled primarily through the water cycle'*¹⁵.

South Australia will face a number of unique water tests under future forecast climate change scenarios. The extent and spatial distribution of many impacts will not be able to be forecast accurately. However, overall the State is likely to see a reduction in yields from existing natural catchments and increased frequency and severity of flooding in both urban and rural locations.

As an example, using downscaled climate projections, the Goyder Institute for Water Research has predicted the potential for a 20 percent decline in annual flows in the Onkaparinga Catchment by 2045, with further significant declines beyond this time¹⁶. Such trends are anticipated to occur in other catchments across South Australia, leading to either a resultant need for 'rationing' across economic and environmental

¹⁰ https://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/

¹¹ https://img1.wsimg.com/blobby/go/27b53d18-6069-45f7-a1bd-d5a48bc80322/downloads/1c2meuvon_105010.pdf

¹² <https://advances.sciencemag.org/content/2/2/e1500323/tab-figures-data>

¹³ <https://www.unwater.org/publications/water-changing-world/>

¹⁴ <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015WR017349>

¹⁵ <https://www.worldbank.org/en/topic/water/publication/high-and-dry-climate-change-water-and-the-economy>

¹⁶ <http://www.goyderinstitute.org/news/2017/new-research-to-empower-decision-makers-with-climate-change-data/>

uses, or at a minimum, a commensurate increase in water use productivity within industry.

Despite these somewhat dire forecasts, by positioning water at the centre of the Government's economic development agenda, with a renewed focus on R&D and water sector expansion, it will be possible to mitigate impacts, adapt to the changes and accelerate industry growth in a constrained water future, whilst also capturing new export and investment by tapping into national and global markets for water technologies and services.

It is important for the South Australian Productivity Commission's inquiry into research and development to note that many of the visions for the future of the State require a step-change in our local capacity to deliver targeted R&D and to innovate across all aspects of the water cycle. Specific examples include:

- The Green Adelaide program and the establishment of more liveable cities and towns will require new cost effective water supplies and use technologies to deliver the associated health, tourism, workforce productivity and immigration benefits;
- The further expansion of the food, wine and agricultural sectors, in line with the National Farmer's Federation's \$100 billion growth strategy, will require a new wave of productivity enhancement that will draw heavily from innovation in water, given that existing resources are already heavily allocated;
- Nature based tourism expansion will require the protection of key environmental assets through water stewardship and more active water management approaches that can also unlock water for other potentially competing economic uses;
- The expansion of the space industry into environmental and water monitoring technologies will require improved connections with the water sector and clear pathways for beneficial adoption and commercialisation, which can also act as a foundation for the State to play a lead role in international efforts to find water sources on the Moon and Mars;
- Australia's forward defence strategy and South Australia's role within it will require greater recognition of the impact of water insecurity across the Indo-Pacific in the form of jurisdictional conflict over water supplies and the possible mobilisation of 'water refugees'.

Targeted water research and clear pathways for adoption, both through new policy directions and technology and service commercialisation, will be essential as an ongoing foundation from which the State can adapt to future water risks to the economy, environment and society and leverage the associated economic development benefits.

4. South Australia's Current Water Research Capabilities and Strengths

South Australia is well recognised internationally for its historical approach to water management. The State's water sector is diverse and includes a broad number of organisations that provide:

- Research, research brokerage on the national and international scale and education/professional capability development;
- Water and wastewater services;
- Water technologies and services;
- Policy and regulation.

Much of our existing water capabilities have been developed over many decades, primarily in response to specific water events such as prolonged drought, flooding and the ecological impact of water take or wastewater disposal. International benchmarking of South Australia’s water expertise by the Water Industry Alliance in 2016 identified particular globally competitive strengths in:

- Small scale water and wastewater treatment;
- Water quality testing and management;
- Alternative water source development (stormwater and wastewater);
- Irrigation systems and business decision tools;
- Big data water analytics and remote monitoring;
- Groundwater, including access, treatment, reuse and managed aquifer recharge;
- Basin and integrated water management and water security policy.

South Australia has a robust innovation ecosystem, with a number of strong research areas, as outlined in Table 1.

Table 1: Internationally Recognised Water Research Capabilities in partners and associate partners of the Goyder Institute in South Australia

Institution	Research Strengths
CSIRO	<ul style="list-style-type: none"> • Groundwater, including managed aquifer recharge • Water monitoring and assessment • Water and mining/energy interface • Drought resilience • Flood management • Indigenous water values • Freshwater and estuarine ecosystems • Salinity management • Basin scale hydrologic modelling • Hydro-geophysics • Climate change modelling • Remote sensing and monitoring • Machine learning and artificial intelligence • Water and society
University of Adelaide	<ul style="list-style-type: none"> • Remote sensing and landscape scale monitoring • Microbial ecology • Biogeochemistry • Water engineering, hydrology and climate impacts • Climate change adaptation

Institution	Research Strengths
	<ul style="list-style-type: none"> • Integrated urban water resource management and urban water supplies • Water treatment and distribution • Water resources law, property rights, markets and pricing • Hydrodynamic modelling • Irrigation and farm systems • Aquatic ecosystems • Water quality, including • Water and culture and Indigenous water interests • Optimisation • The energy and water nexus • Advanced sensing systems and applications of artificial intelligence/machine learning
Flinders University	<ul style="list-style-type: none"> • Groundwater • Hydrological modelling • Eco-hydrology • Hydrometeorology • Water and health • Wastewater treatment
University of South Australia	<ul style="list-style-type: none"> • Water quality processes and analysis • Water sensitive urban design and stormwater harvesting • Water storage and source management • Potable water treatment, recycling of treatment waste and distribution management • Water sanitation and remediation • Water flow measurement and testing • Wastewater treatment technology development and water reclamation • Resource management and circular economy • Remote sensing of natural assets • Soil water science and modelling • Antibiotic resistance and wastewater epidemiology • Legal institutions and water governance analysis • Water resource economics
Department for Environment and Water	<ul style="list-style-type: none"> • Groundwater • Water ecology • Environmental water • Policy and regulation
South Australian Research and Development Institute	<ul style="list-style-type: none"> • Irrigation • Water ecology • Drought resilience • Monitoring
SA Water	<ul style="list-style-type: none"> • Water and wastewater treatment • Optimisation and smart water networks • Energy recovery

Institution	Research Strengths
	<ul style="list-style-type: none"> • Water and wastewater monitoring and public health risk assessment • Catchment management • Hydrodynamic modelling • Water quality • Urban greening and cooling • Water sensitive urban design • Wastewater recycling and stormwater capture • Groundwater science • Asset management • Pilot plants • Data and analytics • Energy management (and recovery) • Molecular microbiology (Cryptosporidium, bacteria and viruses) • Emerging chemical contaminants

This technical capability of the Goyder Institute and its partners is also complemented by Water Research Australia, based in Adelaide, which has extensive expertise in coordinating research collaborations in the areas of alternative water, COVID-19, catchment management, antimicrobial resistance, data management, PFAS treatment and integrated water management.

The State’s research capability is extremely strong in an international context. For instance, the 2019 Academic Ranking of World Universities rated Flinders University and Adelaide University as 14th and 34th respectively out of the strongest 200 universities in water resources globally, with the University of South Australia also ranking between 150 and 200.

It has been estimated that, by housing the water expertise that exists across the three South Australian universities in one place, it would rank in the top ten internationally and even the top five, if the focus was purely on water scarcity.

Despite this capability, there are limitations to the extent to which this can be systemically applied to the water challenges and opportunities of the future.

5. How has Water Research in South Australia been historically leveraged for Industry Development, Environmental and Social Outcomes?

By necessity, South Australia has always been a national (and in some cases international) leader in water. The State’s dry and variable climate has given rise to a number of technological and regulatory advances, which have all been underpinned by robust research.

Much of the State’s success to date in water has been based around a highly collaborative environment that brings together industry, government, research and education to focus on priority water threats. This has enabled an acceleration of

reform in a number of key areas, particularly water usage in the Murray-Darling Basin, irrigation efficiency, water property rights, trading and markets, stormwater and wastewater re-use for high value agricultural production, groundwater resource mapping and managed aquifer recharge, among others.

Water research in South Australia has historically been translated into tangible economic, social and environmental outcomes in a number of ways, through both the public and private sectors. Examples include:

- Cooperative Research Centre for Water Quality and Treatment – an internationally recognised industry and research network established in Adelaide in 1995 focussed on methods and technology for public health risk assessment, catchment management, water treatment and maintaining water quality through distribution systems. Over the period that the CRC operated, it was responsible for leveraging \$97.8 million in industry focussed research and enabled the development of many of the capabilities in water quality that the State is now globally renowned for. It has since successfully evolved into the member-based not for profit organisation, Water Research Australia;
- Optimatics – a spin-off company from the University of Adelaide founded in 1996, Optimatics utilises its commercialised OPTIMIZER™ digital technology product to improve water system planning and deliver significant cost savings in water and stormwater infrastructure project delivery. The company has headquarters in both Adelaide and Chicago and provides advice and analysis worldwide. In 2017, the global water business SUEZ took a stake in the company to further leverage Optimatics' intellectual property in international markets;
- Expert Panel Assessment of the Likely Ecological Consequences in South Australia of the Proposed Murray-Darling Basin Plan (Goyder Institute for Water Research) – an independent review of the South Australian Government's assessment of the potential impact of the draft Murray-Darling Basin Plan in 2012 and associated water recovery scenarios validated State concerns on lower levels of water recovery and provided supporting evidence for debate in relevant forums. The availability of independent and peer reviewed science was a significant reason for the adoption of the current recovery targets in the Basin Plan, these being 2,750 Gigalitres a year, plus an additional 450 Gigalitres a year of efficiency measures, by 2024;
- South Australian Research and Development Institute (SARDI) Water Resources, Viticulture and Irrigated Crops Science Program – the current iteration of SARDI's irrigation R&D program continues to deliver targeted research for improving irrigation efficiency and water productivity of crops and reducing the impact of agricultural land-use on the quality of water resources. This program (it is various interactions) has supported the development of the irrigated agriculture sector over many decades and is importantly a key factor as to why South Australia's water use efficiency in the irrigation sector is approximately 85%, one of the highest in the world;

- Hydro-dis – a unique water disinfection technology developed in South Australia, Hydro-dis is a start-up company that is now exporting its product to the world as a chemical free and low energy solution for providing clean drinking water to remote villages. Starting in 2002, the technology has been developed by the company with the support of the University of South Australia, resulting in the commercialisation of an electro-catalytic process to destroy waterborne micro-organisms and simultaneously convert chloride ions into chlorine, which has extensive application worldwide;
- GFLOWS – the Finding Long-term Outback Water Solutions project of the Goyder Institute for Water Research brought together a team of over 20 staff with expertise in hydrogeology, hydrology, geophysics, groundwater modelling, spatial analysis and programming from CSIRO, Flinders University, the Geological Survey of South Australia and the Department for Environment and Water to map groundwater resources in the remote areas of the State. The information has been used to identify new water supplies for mining and energy developments and remote communities, thereby decreasing the cost of water supplies in these regions and removing barriers to industry investment.

From these and other case studies of the effective application of research into practical water problem solutions, it is apparent that a number of themes are consistently at play:

- A clear focus on an existing or emerging well defined challenge or opportunity;
- Clearly articulated pathways for research adoption, commercialisation and market application;
- The use of multi-disciplinary teams that unlock new ways of thinking;
- Ongoing collaboration between research institutions, government and industry throughout the R&D process;
- Co-investment by the Government to enable collaboration and to address constraints of low critical mass.

6. What are the Emerging Constraints and Opportunities in Water R&D in South Australia?

There is a significant opportunity for South Australia to further develop its water capabilities over the coming five years and beyond to more strongly position the State as a globally recognised leader in water innovation, research and education, targeting local, national and global water threats, particularly across the Asia Pacific.

This would deliver a number of direct economic and other benefits, such as:

- Good quality, secure and affordable water supplies for all South Australian's under a changing climate – supporting a competitive business environment and reduced cost of living;
- Increasing availability of water for growth – alleviating future 'rationing' between industries and the environment;

- Increased water business relocations and start-ups – using an unparalleled focus on water in the Southern Hemisphere as a catalyst for inward foreign direct investment;
- A robust ecosystem driving innovation and the water technology of the future – exponential improvements in water use productivity across all aspects of the economy;
- The establishment of a regional hub(s) for Australian water solutions to address global water issues – improved direct and indirect export penetration, growth in high wage jobs, inward research investment attraction;
- An internationally trusted provider of advice and training – expansion and diversification of international education offerings in a post COVID-19 environment.

Despite South Australia’s rich history in water research and innovation over many decades and our global standing, we have been seeing a retraction in the water sector over recent years, primarily due to the following drivers:

- Declining government and private sector investments in water projects and R&D, particularly since the end of the Millennium Drought;
- Limited contemporary national and state policy directions on water reform and priority given to future water related challenges to the economy, environment and society;
- A fragmented water research, innovation and industry ecosystem, with many organisations operating below critical mass and with expertise distributed across various institutions;
- No current strategic framework for a sustainable and value-adding water sector, at both the national and state levels;
- Insufficient larger scale water R&D programs at the national level (such as cooperative research centres) in which South Australia can participate, limiting the ability to develop the water skills and leaders of the future;
- Increased competition for water experts worldwide;
- Limited strategic connections between water research and water dependent industries;
- Declining success at the State level in leveraging national research programs, particularly those through the Australian Research Council.

As noted in 2018 by Professor Rob Vertessy, internationally recognised water professional from the University of Melbourne and further supported by data presented in Figure 1:

“Unfortunately, we are at a low ebb in terms of water research in Australia. I believe we are doing much less than we should be in terms of developing the people, technologies, systems and research institutions that are needed to confront the challenges of the future.

We have no national water research strategy, nor any appropriately scaled and governed water research commissioning agency. Research funding from

central and state governments is as low as I can recall in my time. More worryingly, it appears that the water industry at large (including government) has become less skilled and interested in engaging with the water research community and directing it to strategic problem-solving tasks.

With the industry pull for water research decreasing, I fear we are entering a negative spiral that will give rise to far less evidence-based policy and management responses in the future. Personally, I think this is an urgent matter that requires the attention of government.”

Figure 1: Water R&D Investment in Australia is at its Lowest Levels since the 1980s¹⁷

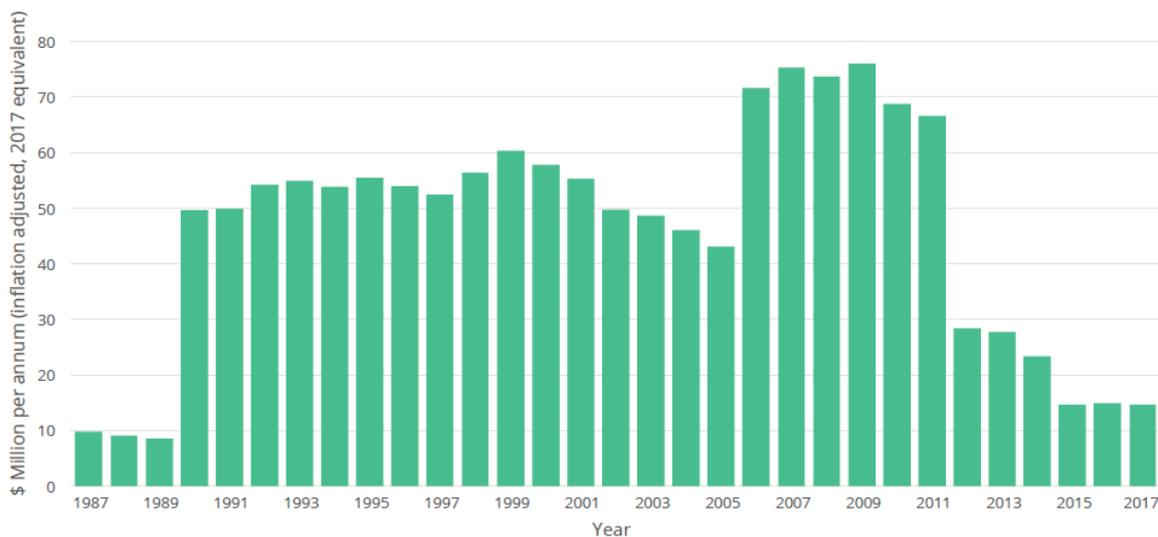


Figure1: Annual spend on non-core contestable and programmatic funding for water research in Australia, 1987–2017. Annual rate shown has been smoothed over duration of funding period. Spending shown is expressed in inflation adjusted terms using 2017 dollar values.

Similarly, the Australian Productivity Commission, in its 2018 review of national water reform¹⁸, observed recent decreases in the level of investment into water research. The Commission concluded that ongoing research and capacity building is central to Australia’s ability to deliver sustainable water resources in the face of challenges from climate change, population growth and increasing community expectations.

The Commission concluded that governments, industry and research institutions should work collaboratively to advance knowledge, build capacity and develop technological and innovative solutions. They identified collaborative models, such as

¹⁷ Source:

https://static1.squarespace.com/static/5dcb6771a39a5c466f667690/t/5ec4b3a46e811d193c3132aa/1589949389529/ONE+Basin+CRC+-+Prospectus_v16+May+2020.pdf

¹⁸ Source: <https://www.pc.gov.au/inquiries/completed/water-reform/report>

the Goyder Institute, Water Research Australia and cooperative research centres, were required to achieve this.

Importantly, all of the current drivers of the trend of decline in the water sector are solvable and there is scope for South Australia to establish itself as the national leader in a renewed approach to water and associated R&D.

Through this, South Australia would position itself at the centre of a next wave of water innovation, being an active player in reimagining the water cycle through advances such as:

- Increased use of alternative water sources, coupled with new energy technologies - producing affordable water supplies and increasing water availability;
- Localised water harvesting and water grids – reducing need for capital intensive infrastructure in cities;
- Full biological treatment systems with limited energy consumption – lower cost water treatment for business and industry;
- Greater use of aquifer storage for water ‘banks’ in regional areas – increased water security and reduced costs through greater use of local water supplies;
- Full energy capture across all water grids – zero energy use and emissions from water supply systems and irrigation networks;
- Irrigation systems that respond to natural plant signals for watering – full automation;
- Joined up technologies to optimise water-energy-food systems so as to reduce local and global anthropogenic impacts on climate and reduce costs to industry – increased sustainability of food production for export markets;
- Satellite based monitoring of wastewater quality and automatic treatment systems – reduced costs, reduced environmental impacts.

7. Recommendations for Action

South Australia has a unique opportunity now to set a new direction and vision for water as a priority foundation for the future development of the State – economic, environmental and social. While Adelaide’s immediate water security is assured, due to policy settings and investments made in response to the Millennium Drought, water challenges will continue to emerge for different industries and regions over the coming 10 years, many of which will be unanticipated.

The State can translate such threats to future prosperity to positive action, providing new avenues to drive increased water use productivity across the economy, positioning South Australia as a provider of new water innovations to global markets and leveraging ongoing investment in the local water ecosystem.

To achieve this, a new partnership is required between the Government, industry and the research sector, targeted at practical initiatives to build a sustainable water sector, one that is closely linked to the State’s growth industries and international

water organisations. Research and development and innovation will be an essential element of such a partnership, which also needs to cover matters such as exports, investment, education and training.

A number of recommendations for action are proposed below. Each of these has arisen from various consultations across the water sector over recent years to define a practical pathway for growth. These are presented for consideration by the Productivity Commission, noting that each still requires further assessment and industry consultation.

Recommendation 1: A Comprehensive South Australian Water Vision

The Government should work in collaboration across the water sector to develop a contemporary vision and overarching plan for growth, establishing a clear direction for how water can support economic, social and environmental directions across the State.

Such a vision must have R&D and innovation aspects at its core, but also address other fundamental matters such as governance, branding, exports and investment.

Recommendation 2: Long-term Strategic Water Research Plan

The Government should initiate the preparation of a long-term water research plan for South Australia that explicitly aligns with State water challenges, future opportunities and policy directions and priorities. This should be prepared in consultation with research organisations, industry and other sectors.

The plan would identify both over the horizon and more immediate areas for attention, providing a platform to direct future and leverage more targeted R&D investment from both government and the private sector, in areas of practical application. It would also provide a platform for considering future skill needs for water across all aspects of the economy.

Complementary to this, the Government should assess the merits of establishing a Water Dependent Industries' Solution Program to leverage private investment into targeted research on agreed medium-term challenges to growth in critical industries, such as agriculture, food, wine, mining, energy, space, tourism and defence.

Recommendation 3: Water Innovation and Commercialisation Hub(s)

The Government, the water sector and strategic State industries should collaborate to form a water innovation and commercialisation hub or hubs to provide for the rapid development and deployment of new water technologies

and services for local and global markets. The Tonsley and Waite precincts could be initial physical locations for such centres.

These hub(s) could also provide landing pads for overseas water companies to further develop their technologies and services for the Australian and South-East Asian markets, facilitating inward business investment. Parallel to this, consideration should be given the establishment of a joint Government and industry seed fund to support new technology application and demonstration projects.

Recommendation 4: Leveraging Government Water Research Funding, State Infrastructure, Policy and Water Related Procurement for New Innovations and Technology

The Government should review the current alignment of funding for water related research across all State agencies against key economic and environmental policy directions. This should include funds invested through SA Water¹⁹, Department for Environment and Water, the Environment Protection Authority and Primary Industries and Regions SA to ensure that this resourcing is leveraging the greatest return and encouraging parallel private investment.

Opportunities to align funding with Commonwealth Government program directions, such as the National Water Grid Authority, the Future Drought Fund and the Water and Development Research Program to improve State leverage should be a component of any review.

In addition, the Government should also review and develop a targeted program to provide:

- Access to state owned infrastructure, including that of SA Water²⁰, for water technology testing and demonstration;
- Policy incentives in water regulation and water allocation plans that encourage the application of innovative water practices and new technologies;
- Pathways for new water technology application through Government procurement.

¹⁹ SA Water note that there are certain constraints and risks associated with the redirection of any agreed funding, such as impacts on customers and compliance with economic regulation, that would require detailed consideration in any review.

²⁰ SA Water note that there are a range of risks associated with increasing access to the agency's infrastructure, such as impacts on customers, operational risks and constraints, cyber security risks, work, health and safety management with external people on operational site and costs, that require detailed assessment.

Recommendation 5: International Engagement and Inward R&D Investment

The Government should consider the formation of a new program to develop stronger international R&D partnerships with targeted countries on significant global water challenges. Part of this program should provide for seed funding to enable targeted international research partnerships that can then leverage new inward R&D investment from international programs and business into the State.

There is a significant opportunity to build on existing CSIRO, university, South Australian Government and other (eg the former International Centre of Excellence in Water Resources Management) global water partnerships in India, China, Hong Kong, Malaysia and Israel.