CRC for
Water Sensitive Cities

WA Groundwater Replenishment Trial

A case study of creating the enabling environment for regulatory change

Yvette Bettini and Brian W. Head

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

WA Groundwater Replenishment Trial
A case study of creating the enabling environment for regulatory change
Better governance for complex decision-making (Project A3.1)
A3.1 – 1 - 2016

Authors
Yvette Bettini[1,2] and Brian W. Head[1,2]

[1] The University of Queensland
[2] CRC for Water Sensitive Cities

ISBN: 978-1-921912-34-4

Publisher

Cooperative Research Centre for Water Sensitive Cities
Level 1, 8 Scenic Blvd, Clayton Campus
Monash University
Clayton, VIC 3800

p. +61 3 9902 4985
e. info@crcwsc.org.au
w. www.watersensitivecities.org.au

Date of publication: May 2016

An appropriate citation for this document is:

Bettini, Y., and Head, B.W. (2015) WA Groundwater Replenishment Trial: A case study of creating the enabling environment for regulatory change. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities, November 2015.

Table of contents

Executive summary

The Groundwater Replenishment Trial (GWRT), conducted by the Water Corporation in Western Australia, was the first of its kind in Australia. It set out not only to test advanced water treatment and recharge systems, but also to develop the supporting regulatory frameworks, monitoring regimes, and community support needed to ensure a technological innovation could be progressed into a mainstream water supply source.

This case study explores how the idea to recycle and recharge water gained traction, how the processes of testing and development were managed, and how eventual acceptance of groundwater replenishment as a new source of water was achieved within water licencing and regulatory arrangements and community perceptions. The case provides some important lessons in how to take an innovative idea and technological solution, and translate it into professional practice.

The case study explored the success factors that facilitate the adoption of a contentious concept that challenged the practice norms and existing regulatory frameworks. This success depended on the carefully managed development of groundwater replenishment, from initial idea to new proven supply source. Features of this managed process included:

- Being cognisant of how the concept was perceived from professional practice, community and regulatory points of view, and implementing strategies to inform and manage the impacts of these perspectives
- Learning from related experiences in other locations
- Informing communities of a range of options, and earnestly seeking their input to prioritise options
- Engaging regulators early in a co-learning process, to develop shared understanding and ownership
- Systematically building a knowledge base through targeted research, addressing questions critical to the viability of the concept
- Significant investment, of time and financial resources, in communication and engagement, to ensure transparency and opportunity for input, and to build acceptance
- Designing the scope of the project to include design/testing crucial institutional aspects that would be necessary for broader uptake or formal adoption of the solution
- Fostering a 'safe' testing ground in the form of small-scale pilots, strategic funding, and supportive project partners to help minimise and manage the risks
- Anticipate potential developments and distracting influences in the broader operating environment, and prepare mitigation or management strategies
- Establish clear project governance arrangements that clarify roles and responsibilities of partners, with an interagency working group to progress the project, monitor and address issues as they emerge.

This organised and strategic approach to developing the option required a wide range of capacities, not only to conduct the trial, but also to manage the processes and potential disruptions around the project. These included:

- Dedicated positions to project manage and examine specific aspects of the project, filled by individuals with a solution-focused outlook, ability to engage internal areas of the organisation, and stamina
- Senior management involvement, particularly those with well-respected reputations in the industry/sector
- Scientific expertise, and the ability to translate this information to satisfy regulators and communicate transparently with communities
- Community engagement expertise, and particularly to manage a process that had to be as transparent as possible
- Communications expertise to engage with the media and track community attitudes
- Ability to appreciate project partner's positions, constraints, obligations and internal organisational processes
- Ability for project partner representatives to take issues back to their organisations for resolution or to gain senior management/executive agreement

- Ministerial access to maintain both Government and opposition support, and build project ownership in both political camps
- Commitment to an open transparent process, and ability to design project processes capable of identifying and addressing community and stakeholder concerns.

Overall, this project demonstrates the importance of the long timeframe and significant organisational investment required to develop understanding, knowledge and acceptance of novel water supply options. Given that novel solutions will increasingly emerge as future options for urban water supply systems, these results suggest water supply planning efforts will need to be organised in a more substantial manner, in order to foster the community, stakeholder, political, and regulatory acceptance required for successful adoption.

Introduction

The Groundwater Replenishment Trial (GWRT), conducted by the Water Corporation in Western Australia, set out not only to test advanced water treatment and recharge systems, but also to develop the supporting regulatory frameworks, monitoring regimes, and community support needed to ensure that a technological innovation could be progressed into becoming a mainstream water supply source.

This project is of interest from a governance perspective, as it represented a substantially new source of water that did not readily fit within existing water quality regulatory frameworks (human health and environmental), or existing water licensing and allocation arrangements. Thus while the trialling of advanced water recycling technology was important for determining water treatment quality and receiving waterway (aquifer) health, the process of negotiating how this new water source would be approved, managed and regulated is of key interest.

This case study explores how the idea to recycle and recharge water gained traction, how the processes of testing and development were managed, and how eventual acceptance of groundwater replenishment as a new source of water was achieved within water licensing and regulatory arrangements and community perceptions. The case provides some important lessons in how to take an innovative idea and technological solution, and translate it into common practice. This is a critical gap in current understanding of innovation and transition processes, yet provides an important pathway to finding new water management solutions to deliver the expanded range of water services and benefits needed in a Water Sensitive City (WSC). Thus, the GWRT has been chosen as a case study primarily because of its interface between technological innovation and policy/regulation adjustments, providing an opportunity to identify and explore the factors that transfer learning and innovation from specific practice changes and projects, into institutional structures.

This report documents this case study to inform the CRC for Water Sensitive Cities (CRCWSC) project *Better governance for complex decision-making* (Project A3.1). This research project seeks to better understand the governance arrangements needed to support water sensitive cities, by:

- Describing the mechanisms and strategies known to help overcome governance challenges
- Identifying adaptive elements of governance arrangements that enable the flexibility to find solutions to complex policy problems
- Exploring the policy integration and innovation pathways needed to start the transition toward more water sensitive governance systems.

This report describes the GWRT and background context in Section 2, and presents the results of the case study research in Section 3, distilling some lessons on the mechanisms, tools and strategies useful for addressing issues of regulatory change and bridging the demonstration project-to-policy gap. Direct quotes from interview participants are presented in italics throughout the document to highlight ideas and support claims. The research methods used to collect and analyse case study materials are outlined in Appendix A.

Case study description

The case study follows the emergence and eventual adoption of groundwater replenishment, which in the WA context involved recycling wastewater through an advanced water treatment plant (AWTP), and injecting the resulting drinking quality water into a confined aquifer, to be extracted for the Integrated Water Supply Scheme (IWSS) at a location suitably distant from the injection point (Water Corporation, 2013b). This proposed configuration of a groundwater replenishment scheme, suitable for WA conditions, took some 6 years to establish following the visit from an international managed aquifer recharge expert from Orange Country (USA), which initiated the concept in 2003. The idea prompted preliminary scientific studies and collaboration across agencies, culminating in a three year Groundwater Replenishment Trial (GWRT) from 2009-2012.

Organisational context

The West Australian Water Corporation was created in 1996 as a government-owned business enterprise accountable to a sole shareholder, the Minister for Water. The Corporation is the principal bulk water supplier, wastewater and drainage services provider in Western Australia, and manages water supply, wastewater, and drainage infrastructure assets worth over $15 billion(Water Corporation, 2015b). The Water Corporation was the lead agency in the GWRT, however preliminary studies were led by the Department of Health and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), though with the close involvement of the Water Corporation and other key agencies.

Water planning, allocation, and groundwater protection in WA are the responsibility of the Department of Water (DoW). Thus, the Department's involvement in the GWRT was in relation to protecting groundwater sources and clarifying the allocation rights to the recycled water. The Department of Health (DoH) is the responsible agency for human health, including drinking water and wastewater treatment, and the Department of Environment and Conservation (DEC) for the environmental impacts of the discharged water and activities associated with the treatment facility (Water Corporation, 2011). In addition to their regulatory responsibilities, these participating agencies also recognised the need to clarify policy and regulatory frameworks for innovations like groundwater replenishment; in the interests of securing new water sources for WA's diminishing supplies (see Section 3.2).

An internal team had been set up in the Water Corporation during 2003 to explore water recycling options. At the time options to reuse treated water for potable use were considered on the periphery, due to their health risks and prevalent community perceptions, and the availability of 'safer' options such as industrial reuse and irrigation of open space and horticulture. Similarly, though a few years later, the DoW established a recycling and efficiency branch to develop various pieces of clarifying policy around water recycling and other emerging water issues and options.

Political and governance context

In 2003, when the idea that groundwater replenishment could be a viable water source was being internally considered at Water Corporation, the WA Premier was also the Minister for Water (Hon. Geoff Gallop). With water availability declining, the Premier called a 3-day summit to discuss the issues. According to one interviewee, water recycling was flagged as a potential new source, and as the concept of managed aquifer recharge had been raised through the visit from the Orange County expert and a subsequent discussion paper, it was put onto the agenda of the summit for discussion.

> *The Premier was very focused on water. So he was actually Minister for Water himself. So that was a real - it was an opportunity crisis thing because we were in deep trouble at that point. [Water Utility Officer]*

> *A paper that we started off…it was going to be just something to publish, an interesting thing on water recycling. Then the Premier actually called a summit at Parliament House, a three-day conference thing on water. People were looking around for what to do on recycling and there it was. [Water Utility Officer]*

Despite the changes in Governments and Ministers over the gestation and implementation of the GWRT, the concept maintained support within the key organisations involved. This was in part due to urgency for a new water source, but also through the efforts of the project team to embed the initiative in organisational documents and the attentions of key decision-makers (sees Section 3.2).

As the idea gained traction and the work of the Water Corporation's recycling team had established internal and external support for a trial, developments at the Federal level put water innovation on the agenda, in the *Water for the Future* initiative. Funding became available through the *Water Smart Australia* program, and the GWRT was granted a $19.4 million contribution from this Australian Government scheme (Department of the Environment, 2015).

While wastewater treatment and recycling was to be approved and regulated through an established process between DoH and DEC, the WA legislation defined water produced through advanced water recycling plant as wastewater. This prevented the injection of this water into the protected groundwater sources under existing regulations (Water Corporation, 2013b). As such, one of the explicit aims of the GWRT was to design and test a regulatory framework for groundwater replenishment as part of the trial.

> *So we actually got an inter-agency agreement with departments of health, water and environment, that an outcome of this trial would be the regulation to be able to do this for the state. [Water Utility Officer]*

> *It wasn't about just trying to get the trial approved but setting up the framework for a full-scale scheme. [Regulatory Officer]*

This aspect of the trial was overseen by an Inter-agency Working Group (IAWG), with membership from DoH, DoW and DEC, and input from various expert panels. The IAWG developed a regulatory framework that defined the requirements for the approval and ongoing regulation of a groundwater recharge scheme, using existing statutory processes where possible, and following national guidelines (Water Corporation, 2013b). The specific regulatory issues that needed to be worked through by the IAWG included:

- Identification of the approvals required for recharge
- Identification of the environmental values of the Leederville aquifer that should be protected
- Definition of the treatment standard and recycled water quality standards required for recharge to protect the environmental values; and
- Identification of the ongoing requirements for operating the trial (Water Corporation, 2011)

In relation to the first point, a major issue was the definition of the water produced following advanced treatment; as described above existing regulation classified this water as wastewater. It was agreed through negotiations within the working group that throughout the treatment train the water would be classified as wastewater. This enabled the DoH to have control over the operation of the plant, as it was processing wastewater as defined under the *Health Act 1911*[a]. In reality the water entering the AWTP was secondary treated water from the Beenyup Wastewater Treatment Plant, but defining the water as wastewater until the point of injection gave the

[a] A *Public Health Bill 2014* was introduced into the Western Australian Parliament in November 2014, to repeal and update the *Health Act 1911*.

regulators control over the process, and hence the confidence that the aquifer and public health would be protected. As the interviewees explained:

> *It came down to the definition of the final product water, the recycled water at the end. Particularly, the environmental protection Acts with the DEC, as our regulator and the health department - both acts defined once wastewater as sewerage, always wastewater as sewerage. So we had to work around that. So what they did was come up with a policy position that said, at this point in the process, it's now become drinking water. [Water Utility Officer]*

> *As soon as we declared it to be drinking water, it immediately meant that if it didn't comply it wasn't drinking water. As soon as it wasn't drinking water, it was sewerage. If you injected sewerage into your aquifer you would breach and in fact, not only that, but you'd contaminated your aquifer. That sat really well with the DEC because they wanted to know at what stage this water was or was not a contaminated substance. [Regulatory Officer]*

In relation to the second task of protecting the Leederville aquifer, the DoW defined the process for identifying environmental values, and the DEC provided a licence to discharge into the aquifer, along with works approval for the construction of the treatment plant (Water Corporation, 2011). As it had been agreed that the water recharged to the aquifer was to be drinking water quality, the treated water was regulated to the same quality standards, satisfying both public health and environmental health requirements. This arrangement also simplified regulatory arrangements, as drinking water regulation was the responsibility of the DoH, and as the DEC were satisfied that the recharged water was no longer a contaminated substance, they were comfortable with the operational and management standards the DoH would enforce.

A number of other issues emerged during the course of the Trial that also required coordination from the IAWG to resolve. One area was the clarification of property rights in relation to the recharged water. Property rights under existing legislation did not recognise the recycled, recharged water as a separate resource from existing natural groundwater, and thus it could be considered as the Crown-vested groundwater resource and be subject to licencing and allocation under the *Rights in Irrigation and Water Act 1914* (Vincent and Gardner, 2014). This interpretation did not recognise the Water Corporation's investment in producing the additional recharge water (e.g. treatment costs), and the lack of security for the subsequent use of the resource acted as a disincentive for the Corporation to invest in the recycling scheme. These issues were subsequently resolved by the agreement to a one-for-one allocation of recharged to abstracted water for the GWRT by the DoW (see Section 3.2 for discussion). This agreement continued for the subsequent full scale groundwater replenishment scheme constructed post-trial, with an annual short-term licencing arrangement granted for the recharged water, in addition to the Corporation's baseline abstraction licence, which is granted for a five year period (Water Corporation, 2013a).

A second issue which required resolution was the safe distance between recharge and abstraction points, referred to as the Recharge Management Zone (RMZ). The implementation of a RMZ was to ensure the groundwater quality would continue to meet the guidelines identified to protect the Environmental Values. The RMZ was determined by the Groundwater Technical Reference Group[b] which established the distance through groundwater monitoring and modelling of the recharged plume in the aquifer. The requirement to implement a RMZ was incorporated into the regulatory framework, and DoW developed broader policy on recycled water and updated existing managed aquifer recharge guidelines based on the outcomes of the trial.

b The Groundwater Technical Reference Group was a panel of research scientists, consultants and practitioners with groundwater expertise established for the Groundwater Replenishment Trial.

Key drivers

The drying conditions experienced in SE Western Australia have strained the State's existing Integrated Water Supply Scheme (IWSS) (Water Corporation, 2015c). The surface water sources that contribute to the water supplies distributed in this scheme decreased markedly from the mid-1970s, with average inflow to dams from 2001 – 2008 representing only 30% (113 GL) of the long-term average inflow prior to 1979 (378GL) (Water Corporation, 2009). Coupled with increased demand for water from other factors such as population growth, this drastic reduction in the region's water availability prompted a review of the long-term feasibility of traditional surface and groundwater supplies from the early 2000s.

The Water Corporation embarked on a long term planning exercise to identify new sources of water that would meet growing demand, engaging with communities and stakeholders on options, and resulting in their 2009 *Water Forever* plan. The strategy for achieving greater water security put forward in the plan was to adopt a portfolio approach; increasing water efficiency and water recycling and developing new 'climate independent' water sources (Water Corporation, 2009). At the time, seawater desalination was considered to be the most viable new water source, and large-scale plants were commissioned in 2006 and 2011 (the second upgraded in 2013). These plants now supply up to 50% of the water to the IWSS in the Perth metropolitan region (Water Corporation, 2015a). However, with desalinated water coming at a high cost, other water sources, including options for direct and indirect potable sources, were also being investigated prior to the *Water Forever* plan.

Given the severity of the water availability outlook, the drivers for investigating a wide range of water supply options were strong and significant incentives in the form of financial and human resources were made available to pursue innovative ideas.

The Groundwater replenishment system

Groundwater replenishment in the context of the Water Corporation trial involved advanced treatment of secondary treated wastewater from the Corporation's Beenyup wastewater treatment plant. This advanced water treatment produced water which meets Australian guidelines for drinking water. This water is then recharged to a confined aquifer to be stored for later use in drinking water supplies, making the scheme an example of indirect potable reuse. The treated water mixes with groundwater and undergoes natural filtering before the groundwater is extracted after a residence time of a number of years, and treated once again before being added into the existing water distribution system(Water Corporation, 2013b).

The advanced treatment used for the trial employed ultrafiltration, reverse osmosis and ultra-violet disinfection. The trial showed this treatment train consistently met the water quality guidelines, protecting peoples' health as well as the Environmental Values[c] of the deep Leederville aquifer. The water was recharged at depths between 120 to 220 metres at a location remote from existing drinking water abstraction bores. Water quality was monitored throughout the treatment process and post-injection via an extensive network of 22 groundwater monitoring bores located at the Beenyup site.

The success of the trial suggests a potential to supply up to 20 per cent of Perth's drinking water needs by 2060(Water Corporation, 2013b), through the recycling of wastewater sources.

[c] The Environmental Values are defined by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality as '*the particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and that require protection from the effects of pollution, waste discharges and deposits*.'

The Groundwater replenishment trial

In 2003 the ex-General Manager of Orange County Water District (William R. Mills) attended a Water Corporation workshop on water recycling, presenting on the District's experiences with managed aquifer recharge[d] and the groundwater replenishment scheme then under construction in Orange county to purify wastewater for recharge into aquifers. Staff at the Water Corporation saw potential for a similar scheme in WA, and authored a paper on the subject along with groundwater experts at CSIRO (pers. comm. interviewee, 2015).

Following this informal production of a scoping piece on the potential for groundwater recharge in the Perth, the idea was somewhat fortuitously picked up for discussion in a water summit organised by the Premier/Water Minister in 2003. This in turn led Water Corporation, through the Minister for Water, to approach the EPA to produce some strategic advice[e] on the options and issues for managed aquifer recharge using recycled wastewater on the Swan coastal plain. This initiated the public exhibition of a discussion paper and six public consultation forums around Perth in May 2005, followed by the release of a draft report for further comment before the final advice was provided to the Minister (Environmental Protection Authority, 2005).

The EPA's strategic advice on groundwater replenishment recommended that a trial be undertaken in an area of low risk to human health and the environment (Environmental Protection Authority, 2005). Based on this advice, Water Corporation identified the Beenyup Wastewater Treatment Plant (WWTP) site at Craigie in Perth's northern suburbs as a suitable site and commenced planning a trial in 2006.

Funding through the State Government's *Premier's Collaborative Research Program* (Department of Health, 2015) was granted in 2005, and a project to characterise the wastewater from existing treatment plants, and test the proposed treatment technologies to see if they could consistently produce water to appropriate human health and environmental standards, commenced (Department of Health, 2009). The DoH led the three-year research project, which identified 254 water quality guidelines that the recycled water must meet to protect human health (Department of Health, 2009). This research subsequently informed the design of the AWTP and the water quality monitoring regime to be tested throughout the GWRT.

Following this scoping work and feasibility research, the proposal for a groundwater replenishment trial was put forward, and the Water Corporation committed significant funding ($31.5 million), as well as gaining supporting funds from the Australian Government ($19.4 million) (Water Corporation, 2011).

The Trial set out with three objectives, to:

- provide a context for the States' regulatory agencies to develop health and environmental regulation and water allocation policy for groundwater replenishment;
- demonstrate the technical feasibility of the treatment process and aquifer response to reliably meet health and environmental water quality guidelines; and
- raise awareness and encourage community discussion about groundwater replenishment and its potential as a future water source(Water Corporation, 2013b).

[d] Managed aquifer recharge schemes have been operating in California's Orange County since the early 19th Century Orange County Water District (2013) *Groundwater Recharge Operations*: Orange County Water District. Available at: http://www.ocwd.com/ProgramsProjects/GroundwaterRecharge.aspx (Accessed: 20 Aug 2015)..

[e] Under Section 16(3) of the *Environmental Protection Act 1986* the Minister for Water can request advice from the EPA on the environmental aspects of any proposal or scheme.

As previously discussed, an inter-agency working group was established to oversee the regulatory and technical feasibility objectives. A range of other groups were also convened, including technical reference groups for the water treatment process and groundwater impacts, and a community advisory panel (Water Corporation, 2013b).

An extensive community and stakeholder engagement strategy surrounded the GWRT, to build acceptance and support for the future water supply option throughout the course of the trial. The strategy sought to engage with both the general community and key experts and opinion leaders, such as peak bodies, industry associations, and prominent scientists. Face-to-face engagement was employed as much as possible, and an educational facility was built as part of the AWTP for tours and open days to be held. More traditional communication methods such as a website, newsletters and community forums, as well as a social media campaign, were also used.

> *Water Corporation did a really good job in having heaps and heaps of information sessions… plus they also built a purpose-built information centre where school groups could come through and see the process and have tours. So it was very open and transparent…also a dedicated website with all the information on there as to what they were doing and pictures of the aquifer and the treatment and the quality. [Regulatory Officer]*

The focus of these engagement techniques was to provide open and transparent access to information about the trial, but to also provide opportunities for the community to discuss issues, raise concerns, and to have input into the process, so as to build trust and acceptance of the water supply option. This also enabled community concerns to inform subsequent communications materials, and potential issues were identified and addressed in a timely way. An extensive monitoring and evaluation program around the engagement activities was also conducted to track community understanding, perceptions and attitudes, and included review of communication materials, media monitoring and market research.

Stakeholder engagement had begun prior to the trial, through the EPA's strategic advice process and early discussion and collaboration between Water Corporation and regulators. During the trial, advisory panels and reference groups provided one avenue for stakeholder input. Regular briefings to 120 stakeholders were also conducted throughout the trial to ensure questions and concerns could be addressed (Water Corporation, 2013b). This also proved a useful strategy for media engagement, as the support of a number of these independent spokespeople were quoted in the media during the trial. An important component of the communications strategy was the briefing of Members of Parliament. Regular briefings were held with relevant Ministers and Shadow Ministers, and other parliamentary members, both during the development of the trial and throughout its implementation. This built support and importantly ownership of the project on both sides of politics. Another key component of the stakeholder engagement strategy was to connect with public health officials, including national peak bodies and associations, and known critics of potable reuse technologies. This strategy was conducted in partnership with DoH, whose reputation in the industry, and particularly the individual person involved, greatly assisted in gaining acceptance within the public health sector. Finally, the project team sought to engage proactively with the media to ensure accurate information was reported, and sensationalist coverage limited. This proved a successful strategy as when, following the trial, a sensationalist report was published in the local tabloid press, other journalists were already aware of the trial, and did not see it as a 'newsworthy' story. This limited the amount of sensationalist coverage, and subsequent market research showed that public support for the Water Corporation and groundwater replenishment water supply had not diminished as a result of the story (Water Corporation, 2013b).

At the conclusion of the trial, the Water Corporation also sought independent auditing of the trial's results, and invited a response/endorsement from regulators. This further enhanced the transparency and trustworthiness of the groundwater replenishment water supply option.

Groundwater replenishment innovation timeline

2003 Water recycling team established within Water Corporation

Visit from expert in managed aquifer recharge from Orange County, USA.

Premier's Water Summit

2005 EPA conducts public seminars and compiles strategic advice on groundwater recharge

Premier's Collaborative Research Project to characterise treated wastewater for drinking purposes begins (2005-2008)

2006 Water Corporation identifies Beenyup Wastewater Treatment Plant as a suitable location for a trial replenishment scheme, and commences planning a trial

2007 Inter-Agency Agreement signed between Water Corporation and the DoW, DoH and DEC to develop policy and regulation for groundwater replenishment

Australian Government commits $19 million to the GWRT through the *Water Smart Australia* program

2008 Advanced Water Treatment Plant, recharge and monitoring bores constructed (completed December 2009)

2009 Baseline groundwater monitoring conducted from January 2009 until November 2010

2010 Advanced Water Treatment Plant commissioning completed in November 2010. Recharge to Leederville aquifer commences (concludes December 2012)

2013 State Government announce that groundwater replenishment will provide the next major source of water to the Perth supply system.

2014 Construction on the full-scale groundwater replenishment scheme commences

Results and discussion

The Groundwater Replenishment Trial is an interesting case study from a regulatory perspective for transitioning towards a water sensitive city, as this technological innovation to pursue indirect potable reuse of wastewater has now been identified as the next major water source for Perth(Redman, 2013), despite an initial absence of a State or National Regulatory Framework. Thus, the GWRT process offers lessons on how to successfully navigate regulatory regimes to find 'fit' for the technology and go beyond 'demonstration' status to be adopted as a mainstream water supply solution. In addition, the GWRT experience in Perth offers insights into how to build acceptance for a contentious option such as recycling for potable use. The key to success of the GWRT was the management of the innovation process, from the emergence of the idea for groundwater recharge, building industry support, investing in research, running a trial, and perhaps most importantly, ensuring the social and institutional conditions were in place to enable broader adoption post-trial. Key success factors in the management of this process are discussed, followed by an analysis of the key governance mechanisms evident in the case study. The commentary is illustrated with direct quotes from interview participants in italics.

Innovation process management

The success of the project was ensured largely by a strategic, project management-style approach from the inception of the idea, through to the GWRT project. This success factor is well supported by studies of innovation in the public sector, which note managing innovation as a process ensures a novel invention can actually become innovation through implementation and the creation of value (Kastelle and Steen, 2011). As one interviewee reflected:

> *We never had a crisis. We were always doing this diligently, slowly, as part of an overall strategy. [Water Utility Officer]*

The idea of groundwater replenishment was initially developed internally at Water Corporation, because it was recognised as a significant challenge to established norms within the local water sector. Groundwater resources in WA are afforded significant legislative protection, due to the high reliance on these sources of supply in both metropolitan and remote communities. The idea of recharging treated wastewater into these sources confronted this protection regime. In addition, community perceptions of using recycled water, particularly for potable use, were a contentious issue in the broader Australian community at the time. Prolonged drought conditions had driven the option of recycling onto the table in many capital cities, and sensationalist media reporting on the drought and water supply issues did not help to generate informed debate to counter the stigma associated with drinking recycled wastewater. The politicisation and community polarisation over the issue in Toowoomba (QLD) and subsequent failed referendum was the pinnacle illustration of how controversial the topic had become. Indeed Water Corporation staff noted how they followed the Toowoomba story, and took lessons on how not to approach engagement on the issue from the experience.

> *Obviously there was a great degree of public concern about other failed attempts to use treated wastewater for potable purposes interstate. The Corporation was really cognisant of that as we moved forward as well. [Policy Officer]*

> *I watched her [Toowoomba practitioner] do a presentation and I sat there and I thought… there is no way - the way she was putting it [the option of indirect potable recycling] out, it was like literally ramming it down people's throats. That went south. [Water Utility Officer]*

From the outset, the idea of groundwater recharge was carefully communicated and developed as a water source option tentatively and diligently. First, a discussion paper analysing the applicability of the technology in the Perth context was drafted by a water practitioner and groundwater scientist. When the idea gained traction, the EPA was requested to provide some considered advice on the issue. This served to start community and stakeholder engagement, and helped to manage public concerns by placing a protective organisation (EPA) in the lead role to

consult and provide recommendations to Government on the options. The EPA's consultation workshops were designed to provide a forum for informed discussion on the options. Also, as a broad range of reuse options were within the scope of the consultation, communities were afforded a genuine say in the development of wastewater reuse as a supply option.

> *Our entire engagement strategy had been around all use, engaging with all people. [Water Utility Officer]*

The idea of a replenishment trial was included in the EPA's final recommendations, and subsequently a series of targeted research projects were conducted: these were aimed at characterising the wastewater from Perth's major treatment plants, identifying the water quality parameters and indicators critical to environment and human health, looking at the benefits of recharge, and piloting the proposed treatment train and examining the water quality against drinking standards. These background studies provided the baseline understanding needed to design the full trial. However, more significantly, these feasibility research projects had been conducted with involvement from environmental, water, and health regulators. As a result, these key stakeholders had a similar understanding of the issues that needed to be tested during the trial, a shared appreciation of the importance of groundwater recharge as a viable water source, and hence joint motivation and commitment to develop the water source through a comprehensive trial.

> *We're all there for the same purpose of basically having a new drinking water source and understanding the whole process better [Technical Officer]*

Finally, the trial was designed, not only to prove the treatment technology and monitor the impact of the flume of recharged water in the aquifer, but to build community acceptance of the approach, and to use the trial as a test case for establishing approval processes and designing and implementing a monitoring regime and reporting protocol which would inform the basis of the regulatory framework for groundwater replenishment projects in the future.

> *…this was like there was a real project and there was a real driver to sort these issues out. [Regulatory Officer]*
>
> *We get a bit absorbed in the technology here. So when we got the direction from EPA to do the trial, what are we trying to achieve? There was a technical objective - does it work? Can we get the behaviours and the business systems in place to get it to work – that was the bit that I actually didn't fully appreciate. [Water Utility Officer]*
>
> *Basically we considered we needed to have regulation in place for the trial and actually test it during the trial. [Water Utility Officer]*

The comprehensive scope of the trial ensured that the water treatment and injection plant did not become a demonstration of technology, but showcased a viable water source with a satisfactory regulatory regime and community support. These results lead to the endorsement of the supply option by the State Government following the trial, and funding commitments to build a full-scale plant (Redman, 2013, Davies, 2015).

Another aspect of the trial that assisted in its success was the careful approach to risk management, which had been outlined in the EPA's suggested framework for investigating groundwater replenishment feasibility. This included selecting a location remote from abstraction bores for water supply and other uses, and following discussion in the IAWG, also included choosing to inject into the confined aquifer to minimise damage to aquatic ecosystems. In addition, communications material emphasised that the water to be injected was drinking water quality, and had a residence time of a number of years, over which natural filtration and dilution processes would occur. Unexpectedly, one common response to this fact from community members through the engagement activities surrounding trial was '*Why don't we drink it directly, rather than recharge to the aquifer?' (Water Corporation, 2013b).* Strategic funding for the trial from the Australian Government's *Water Smart Australia* also

helped to financially 'de-risk' the initiative for the Water Corporation. The partnership that had been built between the key agencies through the development of the concept and early research phases also helped to share and manage the risks of to the project, while the investment in research helped to manage both technical and regulatory risks by identifying some of the issues and enabling them to be built into the design of the trial for further testing. The major features of the innovation process around groundwater replenishment, leading up to and during the GWRT, are summarised in Table 1.

Table 1. Key features and their influences in the Ground Water Replenishment innovation process

Feature	Influence
International expert visit	Highlights a novel option and demonstrates feasibility through successful experience in another location
Informal discussion paper authored	'Think piece' explores applicability for local context and generates information discussions within organisations/industry
Public Water Summit	'Think tank' tests response to novel option in wider community. Provides traction for the concept
Request for strategic advice from EPA	Initiates community and stakeholder engagement on concept of groundwater replenishment to canvass issues and preferred reuse options Provides forums for informed discussion and opportunity for genuine community input Protective role and perceived neutrality of lead agency (EPA) builds community trust Sets out framework for further investigation Includes the idea of a trial Authorises further development of the concept
Feasibility studies	Builds knowledge base to inform design of full trial Pilots components to be incorporated into trial (e.g. water treatment methods) Provides opportunity to engage regulators at feasibility stage, creating co-learning and building joint ownership Choice of lead agency (DoH) helps to build trust in water source
Australian Government funding	Adds 'industry leadership' status to project Helps to financially 'de-risk' project for water utility
Comprehensive design of GWRT	Ensures transparent communication of technical performance of AWTP Designs and tests regulatory framework needed for future groundwater replenishment projects, including approvals, operating standards, and reporting protocols Builds community and stakeholder acceptance of water source option
Interagency agreements and working group	Ensures agreement to project objectives and ongoing commitment to project, including allocation of agency resources (staff time) Clarifies roles and responsibilities, by designating regulatory responsibilities/lead agencies Ensures regulatory interpretations or decisions do not become barriers to project progress Ensures endorsement of supply option from regulators and process for broader adoption
Comprehensive communication and engagement strategy	Choice of partnership approach to engage with public health industry helps to build acceptance within critical stakeholder group Extensive briefings to key stakeholders and opinion leaders limits misinformation and assists with positive media coverage, as well as builds acceptance/support Ongoing briefings of Government and Opposition ensure political ownership from both major parties Proactive media engagement helps limit uninformed debate and negative media coverage Ongoing monitoring and evaluation of engagement and communication activities enables public concerns to addressed early, and public support to be demonstrated

The summary above does not do justice to the hard graft, stamina and strategic opportunism needed to successfully progress the initial idea of groundwater replenishment to an adopted source of indirect potable water. This journey took ten years and the concerted effort of a dedicated group of individuals within Water Corporation, along with other champions within the key regulatory agencies. The effort involved navigating a dynamic operating context that included a succession of Ministers and Directors-General, departmental amalgamations and separations, and sensationalist media attention. Work to manage the project within this background context was required on top of the job of negotiating regulatory definitions, approvals and monitoring and reporting requirements for the trial.

> *We needed to identify what components of the legislation we had to work around. Then we had to work out what could we operate within - what guidelines and processes could we operate within, that the department, all three departments, would be comfortable with. [Water Utility Officer]*

The skills and strategies required for this work are discussed in Section 3.3. However one of the key abilities of the team was to keep a watching brief on their operating context to anticipate and mitigate any distracting influences, maintain support for the project with key decision-makers, and of course deliver the trial project.

Sustaining the inter-organisational support for the project was assisted greatly by the clear governance arrangement that had been established for the project. This was formalised in an inter-agency agreement that established the roles and responsibilities of the various departments in the trial, and perhaps most importantly, established clearly the areas each department would regulate where there was duplication within existing regulatory frameworks.

> *So we actually got an inter-agency agreement with Departments of Health, Water and [then] Environment [and Conservation], that an outcome of this trial would be the regulation to be able to do this for the state…and that was some trick, I tell you. There was a few months work in that. [Water Utility Officer]*

> *We wrote up this inter-agency agreement that was signed off - all the lawyers looked at it and signed off at DG level. It set out what all of our roles were. What the proposal was. The objectives and what each agency would do with working out - to be clear upfront on what the trial needed to do and show in order to support a full-scale scheme being able to get up. [Regulatory Officer]*

This agreement ensured the continued involvement of these key agencies, not only in terms of staff members in the inter-agency working group, but also executive level support when issues from the trial arose and needed to be taken ‘in-house’ to the relevant agency to resolve. This clarity in responsibilities also smoothed the process of dealing with these issues, avoiding lengthy deliberation of who was the responsible agency.

In summary, the carefully managed development of groundwater replenishment from idea to new supply source was a key to the successful adoption of a contentious concept that challenged practice norms and existing regulatory frameworks. Features of this managed process included:

- Being cognisant of how the concept was perceived from professional practice, community and regulatory points of view, and implementing strategies to inform and manage the impacts of these perspectives
- Learning from commensurate experiences in other locations
- Informing communities of a range of options, and earnestly seeking their input to prioritise options
- Systematically building a knowledge base through targeted research, addressing questions critical to the viability of the concept
- Engaging regulators early in a co-learning process, to develop shared understanding and ownership
- Designing the scope of the project to encompass design/testing critical institutional aspects to broader uptake or formal adoption of the solution

- Fostering a ‘safe’ testing ground in the form of small-scale pilots, strategic funding, and project partners to help minimise and manage the risks
- Anticipate potential developments and distracting influences in the broader operating environment, and prepare mitigation or management strategies
- Establish clear project governance arrangements that clarify roles and responsibilities of partners, with an interagency working group to progress the project, monitor and address issues as they emerge
- Regulators had the capacity to access scientists and specialists to inform on technical aspects throughout the Trial.

Specific mechanisms, tools and strategies

This section explores some of the specific governance features that enabled those involved in the GWRT to develop a viable and accepted new water supply, and ensure the policy and regulatory setting was adjusted to support this innovation. These case study insights are grouped as i) structural features within governance arrangements that incentivised innovation, ii) the skills and capabilities that were critical for utilising opportunities and successful implementation of the trial, and iii) the collaborative processes and arrangements that help to ensure success.

Incentives

The severity of the drought and data on the declining surface and groundwater resources led to in-principle and bipartisan support from the State Government that new sources of water were needed for Perth’s water supplies.

> *Political imperative is always good, it was clearly a political imperative of the incumbent government but it also had bipartisan support. [Policy Officer]*
>
> *I think that it didn’t take a lot of convincing because we just had such a clear cut story here in South West WA, that we're likely not to have any surface water to use within 100 years, 50 years, who knows? [Water Utility Officer]*

The urgency of the water availability problem made more financial resources available for research and development, helping to ‘de-risk’ the project by reducing the amount of upfront investment required from the Water Corporation. This funding and political support was also noted as an important way to get regulators involved from the outset.

> *I think those sort of research funds, they just kind of de-risk it a bit from a utility perspective, and they also allow others to collaborate and to kind of start engaging with the science...They're a useful mechanism for getting the regulators into the room. [Water Utility Officer]*

Support for exploring managed aquifer recharge had also emerged at the national level, adding access to further funding. Again, this reduced the perceived risks of the initiative, not only through the additional funds but the shared commitment from State and Federal partners. The interest from the national level also acted as an incentive by elevating the project to a nationally important initiative, thereby attracting a status of industry leadership for those involved.

Interviewees also noted that having staff with input into internal strategy development or business planning processes assisted by including these ideas in these documents, thus helping to justify staff activity and expenditure on developing the new ideas. For example, one interviewee recounted:

> *That then got folded into the state water strategy, which was quite opportune and basically the recommendations that me and one other guy in Water Corporation had written became the state strategy, which is quite handy. [Water Utility Officer]*

Testing the acceptance for aquifer recharge using recycled water with communities and other stakeholders, and introducing the idea of a trial project through the EPA's public forums, generated the perception with regulators and other stakeholders that the idea had 'authorisation' to continue to the 'proof-of-concept' stage.

> *We thought about this idea of doing a trial and we discussed that. Essentially, that got embedded in the outcomes of that document. That's bulletin 1199, from the EPA. [Water Utility Officer]*

> *Having, particularly for the Department of Health, having the community engagement and the stakeholder engagements showing all of these peak health bodies are okay, the community are in this space. That gave them the comfort to keep going. And they needed that. It was a tough gig for them. [Water Utility Officer]*

Thus, the magnitude and knowledge of the drought problem prompted political support at multiple levels of government, which in turn made significant funding resources available. These resources and the attention from governments (particularly national) assisted in motivating other key stakeholders to join the initiative. The additional resources and shared commitment also helped to reduce the perceived risks to the utility in taking on such an innovative project, and provided the added incentive of being seen as an industry leader.

> *It [funding] helps to de-risk it from the utility perspective and I guess we were keen to be participating in this, in a national level. [Water Utility Officer]*

Through the course of the actual trial itself, there were also some key agreements reached in negotiations between regulators to further incentivise the Water Corporation to continue pursuing recycled water for aquifer recharge. In order to make certain that the investment into advanced water treatment was attractive for the Corporation, the DoW agreed to a one-for-one allocation; i.e. every unit of water treated and recharged would be included in the Corporation's allowable extractions from the same groundwater area. While the internal preference at DoW was to allocate slightly less water for extraction to provide some additional benefit in terms of helping to recharge aquifers (pers. comm., interviewee, 2015), the Department recognised that for the Corporation to invest in the option, they would require a guaranteed and equal return on their investment (i.e. equal water allocation). As such, the Department agreed to a one-for-one arrangement for the project.

Similarly, while the DEC would have gained additional benefits for the Swan Coastal Plain's drying wetlands had recharge been into the superficial aquifer that interacts with these surface waters, they recognised this would compromise the security of the Water Corporation's supply. If recharged was to the superficial aquifer, the water would be accessible to other users, and therefore at greater risk of being misused/unavailable to meet the Corporation's supply responsibilities.

> *Although we were thinking a superficial aquifer to have more benefit to the wetlands and the groundwater dependent ecosystems on the surface, because obviously drying climate is also affecting all of that, but we would end up with less benefit for drinking water use. We would also be much more potentially impacting or lose water to other users of that superficial aquifer. [Water Utility Officer]*

The Department of Health took a similar position, seeing a risk that a return on investment of less than 100% could act as a disincentive to investment in maintenance or upgrades, thus, increasing risks to human health through potential technological failure. As a result, the Department of Health supported the one-for-one allocation, and advocated for this arrangement with their fellow regulatory agencies (pers. comm. interviewee, 2015):

> *I was concerned that we were going to get into a situation where we could have our water industry saying, look we're not going to repair something or we're going to delay replacement…because we know we're not going to get our full buck back. [Regulatory Officer]*

Thus, the three regulators recognised the need for flexibility to ensure the Water Corporation would be incentivised to invest in developing this new water supply option. As such, they were willing to negotiate a reinterpretation of regulatory requirements in the interest of the greater public benefits that could result in the trial project moving forward.

> *There are not very many options. So it certainly needed investigating as an option… So it's really in the public interest to investigate it… it would seem silly not to - well silly for a closed mind regulator to block out what could be a much more effective and therefore cost efficient, basically in the public's interests to pursue, water supply. [Water Utility Officer]*

> *Rather than us being the regulators and them being the proponents, it was - yeah it felt more like we were a team and all working together for the one benefit. [Regulatory Officer]*

In summary, a range of incentives drove first the initiation of the project, and then helped to maintain momentum as the full trial was conducted. These summarised in Table 2.

Table 2. Initiation and momentum incentives identified in the GWRT

Initiation incentives	Momentum incentives
Drought	Political and financial support attracts other partners
Political support	Status as a national initiative
Access to additional funding	The ability to embed justification for activities in internal business planning and strategy documents
Community and stakeholder engagement by a neutral or trusted agency, to generate authorisation to proceed	Flexible interpretations of regulations to ensure any disincentives are weighed against potential benefits

Capacity

The GWRT case study revealed a wide range of capacities that were required not only to conduct the trial, but also to manage the processes and potential disruptions around the project.

In terms of the individual skills and capabilities that were recognised as success factors, the ability of Water Corporation staff and other project participants to look beyond the current constraints to develop solutions was highlighted by a number of interviewees. The following quote illustrates this mindset:

> *So we need to be a bit smarter about the water we've already got, of which this [recycled wastewater] is a huge volume. Albeit, yes it's contaminated and it's got constraints but how can we be smart? How can we show some innovation? What have other people done in the space? How do we make it happen? [Policy Officer]*

Interviewees also noted it was critical to have people with the scientific expertise to understand the problem and design robust research around the trial, as well as those able to translate this complex information into simpler forms that could be understood by laypeople. Good communication was crucial no only to communicate results to

communities and maintain transparency, but also to increase the regulators' trust in the technology by increasing their own understanding of the system and its performance.

> *Depending on what level you knew… So for me being a scientist I could dig deeper to get more information but if you just wanted the basics of what was happening then there was the basics. [Regulatory Officer]*

There was also a need for some engagement and collaboration internally at Water Corporation, as the idea of utilising treated wastewater significantly challenged the long held rationale of protecting groundwater drinking water resources from contamination. As interviewees reflected:

> *That sort of mindset has simply been deeply embedded in the culture…It's through the entire industry. [Regulatory Officer]*

> *Certainly within this organisation and there was a lot of trust to build within this organisation.. [Water Utility Officer]*

In addition, efforts to engage with peak bodies and industry associations was also made early in the process, to canvass the perceptions and issues of industry experts and opinion leaders, ensure they were well informed, and to address or mitigate the issues which could derail the concept as it progressed.

> *They brought researchers in, the scientific community came on board, policy community came on board and the other government regulators were all on board. [Policy Officer]*

For a project with significant potential to raise concerns in the community, interviewees noted the importance of community consultation expertise. This included in-house expertise to design the engagement program around the trial, contracting in further resources to conduct media monitoring and market research on community attitudes, or deliver specific engagement events, and also building the capacity of staff members to interact with community members through open days and other public events. These interactions were cited as being particularly important for the community to see that the Water Corporation had their interests and safety at the forefront of the project, and to also build trust in the technology itself.

> *So we've always had a dedicated communications officer, who had links to the education officers. Together, they developed the content for the incursions and for the school kids' tour groups. [Water Utility Officer]*

> *On open days, you'd have - I would go and I'd basically be standing around, waiting for the difficult people…you get difficult questions. We never really got anything that was impossible. [Water Utility Officer]*

The departmental interactions throughout the trial also generated 'joined-up' government capacity, in that inter-agency participants and other departmental staff drawn into the project built their own knowledge of the processes and operations of other agencies.

> *…because we were seeing each other so often and we all were immersed into all of the approvals that we required. Because we would all sit and have a meeting together. We would learn all the processes and so if somebody rings up [Department of Health] now they can pretty much say, well no you don't need a licence for that, oh yes you do for us… [Regulatory Officer]*

> *…because this was so complex and so big and so long in getting the approval because there was so much information that was required, you just got a better appreciation of everybody, understanding and working with them [Regulatory Officer]*

The project also built on-going connections across departments and agencies. All those interviewed found the experience of working on the project, and in the inter-agency group particularly, as a rewarding professional experience.

> *All of those relationships have all stayed. They might have moved into different jobs but it's good knowing that you can - and having that background of knowledge as well has been really helpful. [Regulatory Officer]*
>
> *Not that we always agreed on everything but we sort of - agreed on a process and could work through it together. [Regulatory Officer]*

In addition to making connections across the departments involved, project staff also worked to embed backing for the project in the succession of water related policy setting documents of the two main political parties. As one interviewee described:

> *So over the years, we kind of did something so that this government would - that embedded in the state water recycling strategy and then this one would do it in the state water. So it was kind of linked in through success of governments, changes of colour. So by the time the trial ended, they both felt that they had some ownership of it. [Water Utility Officer]*
>
> *There was a marvellous moment when the current minister went and presented, when we were announcing the trial and the previous minister was in the audience and he sort of said, thank you for having this great idea. [Water Utility Officer]*

As the above quote indicates, this strategy helped to build bipartisan support for the project, and required staff to have good connections with policy staff within the relevant Minister and Shadow Minister's offices, which interviews noted took up significant time and effort.

These project participants also took a very strategic approach to many aspects of the project, such as:

- Selecting a trial site where the aquifer could be quarantined if contamination occurred
- Utilising the reputations of other partnering agencies (and senior managers) to help avoid negative stakeholder and community perceptions (see commentary in Collaboration section below)
- Engaging with the regulators from the outset to ensure the GWRT would continue past a trial, and to also show the public that the water would be well-regulated
- Communicating that the trial produced drinking-quality water to inject into the aquifer, highlighting that this represented indirect potable reuse, but leaving the way open to direct potable reuse for the future
- Observing developments in other States (such as the Toowoomba water recycling proposal) and learning from these events.

These strategies highlight the complex and dynamic nature of innovation processes, and demonstrate the need for strategic policy, engagement, communication and other skills in order to anticipate and/or overcome barriers to adoption. In particular, the ability to strategically plan the process and adapt the approach as circumstances or events changed the operating context, as the following quotes illustrate:

> *We came up with a whole list of success criteria. What the things that we needed to address were and at what time. What the measures of success would be. [Regulatory Officer]*
>
> *You just used to go home and just sit and think, "What now?" What haven't they thought of yet? Where do we need to be thinking? The key thing was, what will they be thinking about in six months and what <u>should</u> they be thinking about in six months? So we - I think we never got caught out…we*

> *always had thought it through, which was - that was a key element of the project. [Water Utility Officer]*

A key element of capacity cited by a number of interviewees was the availability of dedicated staff to work on aspects of the project. For example, prior to the beginning of the trial there were some questions raised about the chemicals of concern that would need to be monitored in the regulatory regime. Money was found within one of the agencies to fund a PhD project on the issue, and inform the trial as it progressed. Interviewees also highlighted that having a full-time staff member to project manage the trial was one of the critical factors in ensuring the project progressed in a well-coordinated way, by ensuring stakeholders remained engaged and their concerns were addressed, communications and meetings were organised effectively, and to follow up on any emerging issues. However, they also noted this project manager was well supported by other internal staff available to work on the project, and the IAWG when issues needed to be dealt with within other agencies.

> *I think the right personalities and all in the Interagency Working Group that everyone got along and were trying to work together. [Regulatory Officer]*

> *If this came along now it would be given to someone in a branch who had other work and I wouldn't imagine they would be pulled offline. [Regulatory Officer]*

The interviewees also highlighted that having project participants from senior management roles within key departments, but also with highly regarded reputations within their industry, helped to generate internal and external support for the project.

> *To some extent we were lucky. At the time we had a regulator who was new to WA…at a reasonably high level, as in at the important position as far as we were concerned, who was very proactive and very intelligent and very articulate. So he was a good lead person. [Water Utility Officer]*

> *So those two people - if they stood up and told you something, you believed it. The integrity of that was daunting. It was amazing. [Water Utility Officer]*

> *So everywhere you go, everybody knows him. He's amazing. Basically, the feedback - you could summarise it - is, if [he is] okay with it, we're okay with it. [Water Utility Officer]*

Another critical aspect to the success of the GWRT was the communications strategy around the project. Alongside the community engagement activities, communications expertise also helped the project team to engage proactively with the media, continuing their open approach to information provision. This investment paid off when a journalist tried to sensationalise the GWRT project. Due to previous engagement with other journalists, the story was not picked up by other outlets. In addition, community advisory panel members were willing to offer support in the form of a public response, and a Freedom of Information request was answered by pointing to the fact that all information was already publicly available on the project website. Thus, due to past efforts to engage the media and community, and the open approach taken, the negative media coverage did not have a significant impact on the project. As one project member reflected:

> *It faded away because of years and years of open - solid technical work, open engagement. [Water Utility Officer]*

Finally, the success of the project could be attributed to the long-term dedication of various staff involved, who initiated and drove the idea to completion.

> *I mean, seriously, we invested a significant part of our lives in getting this to happen. [Water Utility Officer]*

It is also worth remembering that the in-kind support required by the project had been greatly underestimated, as one interviewee reflected:

> *There was a huge in-kind into that, way beyond what we originally would have quoted. [Water Utility Officer]*

This case study illustrates the significant breadth of individual and organisational capacity needed to develop innovative ideas through to realisation in practice. Often, the benefits in investing in capacity and collaboration can be undervalued, and are difficult to value from the outset. However, the GWRT demonstrates how personal and organisational attributes can be critical to the delivery of a successful innovation process. The capacity identified as being important to the successful adoption of groundwater recharge with recycled wastewater in Perth, in summary, included:

- Dedicated positions to project manage and examine specific aspects of the project
- Significant in-kind support
- Senior management involvement, particularly those with well-respected reputations in the industry/sector
- Staff with a solution focused outlook, and stamina
- Ability to engage with other areas of the organisation
- Scientific expertise, and the ability to translate this information to satisfy regulators and communicate transparently with communities
- Community engagement expertise, and particularly to manage a process that had to be as transparent as possible
- Ability to appreciate project partner's positions, constraints, obligations and internal organisational processes
- Ability for participants to take issues back to their respective organisations for resolution or to gain senior management/executive agreement
- Ministerial access to maintain both Government and opposition support, and build project ownership
- Commitment to an open transparent process, and ability to design project processes capable of identifying and addressing community and stakeholder concerns
- Communications expertise to engage with the media and track community attitudes.

Collaboration

The GWRT was a highly collaborative process, as a succession of joint activities initiated and then managed the trial. The collaborative aspects of the project included cooperation between individuals, and also partnerships between organisations that drew upon the various functions and reputations of these organisational partners to deliver on the objectives of the trial.

Following the exchange with the groundwater recharge expert from Orange County, two Water Corporation staff members thought the idea was worth pursuing.

> *…me and the principal hydro-geologist went for a beer afterwards and said, we could do that here. That started a 10 year journey. [Water Utility Officer]*

Following the uptake of the idea, there was collaboration with the EPA to raise the issue on the public agenda. This strategy was seen to have a number of benefits by interviewees, including:

- Utilising the EPA's function to develop strategic advice provided a third party 'facilitator' role to canvass issues, and engage with relevant stakeholders from a more neutral position
- Utilising the EPA's reputation as a 'protection' agency to bring the issue to the broader public's attention was perceived to maintain more neutrality on the issue (i.e. generate less objection), than perhaps would have occurred if the Water Corporation had pursued the issue themselves (i.e. a Corporation who is in the business of making a profit from supplying water may have prompted the perception that the environment's or community's best interests were not being considered).

Following the acceptance for a groundwater recharge trial in the EPA's strategic advice, the staff involved at Water Corporation continued to pursue a collaborative approach to the project, recognising the importance of continuing to engage with stakeholders and communities would be critical to the success of the process.

> *We were very open from the beginning and to some extent our group…probably had a slightly different approach to the rest of the business generally in putting everything on the table, just being completely open, because we couldn't afford not to. [Water Utility Officer]*
>
> *So the reporting process…would then actually include quite a lot of actual detail…I think this was important for the Department of Health to gain confidence in the process. [Water Utility Officer]*

Similarly to the EPA's earlier involvement, having the DoH lead the background scoping research to characterise the wastewater and test the treatment technologies helped to gain trust in the idea, from stakeholders and communities, in a way the Water Corporation would perhaps have been unable to generate itself.

> *Essentially, you'd get to the point where people would kind of say, oh, I'm uncomfortable about it but providing the health department is making them do the right thing… [Water Utility Officer]*
>
> *I think it was certainly good from a perceptions point of view, as in the health regulator is leading this research. [Water Utility Officer]*

Interviewees reflected that having regulators involved from the outset was really important to the project, not only because it developed co-learning and joint ownership of the objectives of the project, but also so that the regulatory arrangements could be developed and tested during the trial itself.

> *But the Corporation basically early on established an Interagency Working Group to get all the parties together conceptually as much as operationally…very early in the project history. [Policy Officer]*
>
> *So that was really useful because we weren't developing the guidelines and we weren't relying on trying to get the regulator to develop the guidelines but we were as part of this collaborative project. [Water Utility Officer]*

One highly cited issue with long-term projects such as the GWRT is the loss of key contact staff or critical decision-makers within partner organisations from the project, usually due to their movement out of the organisation. Interviewees noted that some Departments suffered from this problem more so than others. Also, having a key contact within partner organisations, who could help to engage successive decision-makers on the project, was cited as one strategy for potentially overcoming this problem.

> *A lot of that is about relationships with individuals who change. People come and go. The great thing about the [Department of Health] is that you have great knowledge and maturity and largely stable relationships. [Water Utility Officer]*
>
> *So we have been through a few individuals. There has been one person below them who has been there right from the beginning effectively. She still sits within that group and is key to the liaison between the Water Corp and the Department of Health. [Water Utility Officer]*

Despite these continuity issues, the political support, innovative status, and most importantly formal agreement between the organisations, help to maintain focus on the project, and in-kind commitment from all the partners.

Conclusions

The WA experience of developing groundwater replenishment as a water supply offers many strategies and techniques for finding regulatory and community acceptance of a novel and controversial water source option. Fostering this 'enabling environment' for innovations to emerge, be developed and be adopted, will be critical for further developing the water services and water uses that shift a city from 'supplied, sewered, and drained,' to 'water sensitive.' Some of the key elements of the WA journey were:

- A long time frame for developing understanding, knowledge and acceptance
- An organised and strategic approach to developing the option
- Extensive collaboration and partnership, which included engaging with regulators from the outset to ensure co-learning and concept ownership
- Significant investment, of time and financial resources, in communication and engagement, to ensure transparency and opportunity for input, and to build acceptance
- Designing and testing regulatory and policy frameworks, as well as technologies
- Clear governance arrangements for cross-agency initiatives; and
- Dedicated and collaborative project teams and working groups

Overall, this project demonstrates the importance of the long timeframe and significant organisational investment required to develop understanding, knowledge and acceptance of novel water supply options. Given that novel solutions will increasingly emerge as future options for urban water supply systems, these results suggest water supply planning efforts will need to be organised in a more substantial manner, in order to foster the community, stakeholder, political, and regulatory acceptance required for successful adoption.

Appendix A: Case study methods

Interviews were conducted in early 2015 with practitioners directly involved in the GWRT (n=9). Secondary sources included agency reports, policy documents, legislation, Hansard, media releases and articles, consultancy reports, industry newsletters and published academic research.

The NVivo software package was used to code interview transcripts and to identify and explore key concepts and themes in the data.

The data analysis approach drew on a coding framework derived from an initial literature review(Bettini and Head, 2013) that identified incentive mechanisms, capacity requirements and collaborative efforts as critical elements behind the resolution of governance challenges in the urban water sector. The coded results were then used to explore the themes of interest in the case study (regulatory change, process of innovation) and comment on the envisaged pathways for transitioning governance arrangements to better support WSC (policy innovation), which were derived in the development of a conceptual framework for governance change(Bettini and Head, 2014).

The text of this case study report was provided to key interview participants for cross-checking of facts and comment on analysis results. The researchers would like to acknowledge the time and effort of these study participants.

References

Bettini, Y. and Head, B. W. (2013) *Specifying the Urban Water Governance Challenge.*, Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Bettini, Y. and Head, B. W. (2014) *'Next' practice governance for Water Sensitive Cities*, Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Davies, M. 2015. Investing in infrastructure to grow the State: Groundwater replenishment surges ahead. Perth, Australia: Government of Western Australia.

Department of Health (2009) *Characterising Treated Wastewater for Drinking Purposes Following Reverse Osmosis Treatment: Technical Report* Perth, Australia: Department of Health (WA).

Department of Health (2015) *Premiers Collaborative Research Program: Characterising treated wastewater for drinking purposes following reverse osmosis treatment*: Department of Health (WA). Available at: http://www.public.health.wa.gov.au/3/1657/2/groundwater_replenishment_trial_research_and_publi.pm (Accessed: 24 August 2015.

Department of the Environment (2015) *Craigie Groundwater Replenishment Trial Project (previously Beenyup)*: Australian Government. Available at: https://www.environment.gov.au/water/cities-towns/water-smart/craigie-groundwater (Accessed: 23 September 2015 2015).

Environmental Protection Authority (2005) *Bulletin 1199: Strategic advice on Managed Aquifer Recharge using treated wastewater on the Swan Coastal Plain*, Perth, Australia: Environmental Protection Authority (WA).

Kastelle, T. and Steen, J. (2011) 'Ideas are not innovations', *Prometheus,* 29(2), pp. 199-205.

Orange County Water District (2013) *Groundwater Recharge Operations*: Orange County Water District. Available at: http://www.ocwd.com/ProgramsProjects/GroundwaterRecharge.aspx (Accessed: 20 Aug 2015).

Redman, T. 2013. Advanced recycling to help secure water supply. Perth, Australia: Government of Western Australia.

Vincent, K. and Gardner, A. (2014) 'Managed aquifer recharge using alternative water sources in Western Australia: A new property rights approach', *Australian Property Law Journal,* 23, pp. 36-55.

Water Corporation (2009) *Water Forever: Towards climate resilience*, Perth, Australia: Water Corporation.

Water Corporation (2011) *Progress Report No. 10: Groundwater Replenishment Trial Project*, Perth, Australia: Water Corporation.

Water Corporation (2013a) 'Appendix 3: Letter from DoW to Water Corporation providing GWR entitlement', *Groundwater Replenishment Trial: Final Report.* . Perth, Australia: Water Corporation.

Water Corporation (2013b) *Groundwater Replenishment Trial: Final Report*, Perth, Australia: Water Corporation.

Water Corporation (2015a) *Desalination (Webpage)*: Water Corporation. Available at: http://www.watercorporation.com.au/water-supply-and-services/solutions-to-perths-water-supply/desalination (Accessed: 19 August 2015).

Water Corporation (2015b) *The Way We Work (Webpage)*: Water Corporation. Available at: https://www.watercorporation.com.au/about-us/the-way-we-work?pid=res-au-np-www (Accessed: 20 August 2015).

Water Corporation (2015c) *What is the Integrated Water Supply Scheme (Webpage)*: Water Corporation. Available at: http://www.watercorporation.com.au/home/faqs/water-supply-and-services/what-is-the-integrated-water-supply-scheme (Accessed: 23 September 2015).

Cooperative Research Centre for Water Sensitive Cities

Lvl 1, 8 Scenic Blvd
Monash University, Clayton,
Victoria 3800, Australia

info@crcwsc.org.au

www.watersensitivecities.org.au