Delivering a Sustainable Water Supply

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Abstract

The Western Corridor Recycled Water (WCRW) Project is the largest recycled water project in Australia and the third largest advanced water treatment project in the world.

When finished in late 2008, the project will have the capacity to supply up to 232 megalitres of purified recycled water a day to power stations, industry, agriculture and the Wivenhoe Dam system.

More than 200 kilometres of pipeline, three advanced water treatment plants, six storage tanks and nine pumping stations combine to make up the project, which is being delivered in three stages by five Alliances.

"First Water" began flowing to Swanbank Power Station in August 2007 and to Tarong Power Station in June 2008.

A number of innovations have already been achieved as part of the $2.5 billion project, which is being constructed in world record time in response to South East Queensland's sustained drought conditions. These innovations relate to design, pipeline and plant construction and the application of water treatment processes. The advanced water treatment processes used on this project are world's best practice.

The project is designed to help meet the needs of the region's growing population and economy in a time of drought and climate change, and will improve water quality in Brisbane River and Moreton Bay.

Introduction

One of the most significant issues facing South East Queensland today is ensuring we have adequate, secure and sustainable water supplies for the future.

South East Queensland has one of the fastest growing populations in Australia. Over the next 20 years, the population is expected to double to more than four million people. This rapid growth, combined with the impact of climate change, has resulted in a need to rethink the way we manage and use our available water supplies, particularly in urban areas.

The Western Corridor Recycled Water Project is a $2.5 billion Government initiative designed to diversify South East Queensland's water sources. Established in 2006, the two-year project involves treating urban wastewater to the highest standard—resulting in purified recycled water—and transporting it through a supply network of more than 200 kilometres of large-

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diameter underground pipeline to the region's two main power stations, other potential industrial and agricultural customers, and to the region's main water storage, where it will supplement drinking water supplies.

This advanced water supply system has been constructed in three phases. Stage 1A of the project was completed in August 2007 and included an advanced water treatment plant at Bundamba, a pipeline linking the Goodna and Bundamba Wastewater Treatment Plants to the Bundamba Advanced Water Treatment Plant, and a pipeline to transport purified recycled water to Swanbank Power Station for use in its cooling processes. Stage 1B of the project included connecting two more wastewater treatment plants at Oxley and Wacol to Bundamba, expanding Bundamba's capacity to up to 66 megalitres of purified recycled water a day, laying 80 kilometres of large-diameter pipeline from Bundamba to Caboonbah and building associated pump stations and balance tanks. With completion of Stage 1B in June this year, purified recycled water is now flowing to a storage lake at Tarong, where it is available for use by Tarong and Tarong North Power Stations.

Combined with Stage 1A, the Western Corridor Recycled Water Project is now freeing up more than 41 megalitres of drinking water a day, equivalent to enough water for about 240,000 people meeting Target 170 water use levels.

Stage 2 of the project involves constructing the Gibson Island and Luggage Point advanced water treatment plants, a 58 kilometre pipeline connecting to the current system at Bundamba and an offtake to Wivenhoe Dam to supplement drinking supplies.

Once completed by the end of 2008, the Western Corridor Recycled Water Project will have the capacity to supply up to 232 megalitres a day of purified recycled water, equivalent to about half the daily water needs of the regions population, helping to secure a long-term sustainable water supply for the region.

Project History

The Wivenhoe, Somerset and North Pine dams are the main storages that serve the South East Queensland (SEQ) region. Between 2001 and 2007 rainfall over dam catchments was extremely low and the region suffered from the worst drought on record.

In 2004, local and state government commissioned the SEQ Regional Water Supply Study. Stage 1 of the study concluded that the existing major sources were probably adequate to around 2020, however the region was heavily dependent on a single source (Wivenhoe Dam) and that diversification of supply sources should be given further serious consideration.

By 2005, concerns about supply availability grew as the region's water supplies dwindled. The Regional Drought Strategy was initiated in May 2005 by SEQWater, the Queensland Government and 13 regional councils to increase and diversify water supplies and alleviate the unprecedented pressures on SEQ's water resources.

In March 2006, the government provided funding for the development of concept designs and procurement strategies for a dual pipe system to supply recycled water for industrial purposes. The concept in this business case was to develop only Stage 1A and 1B.

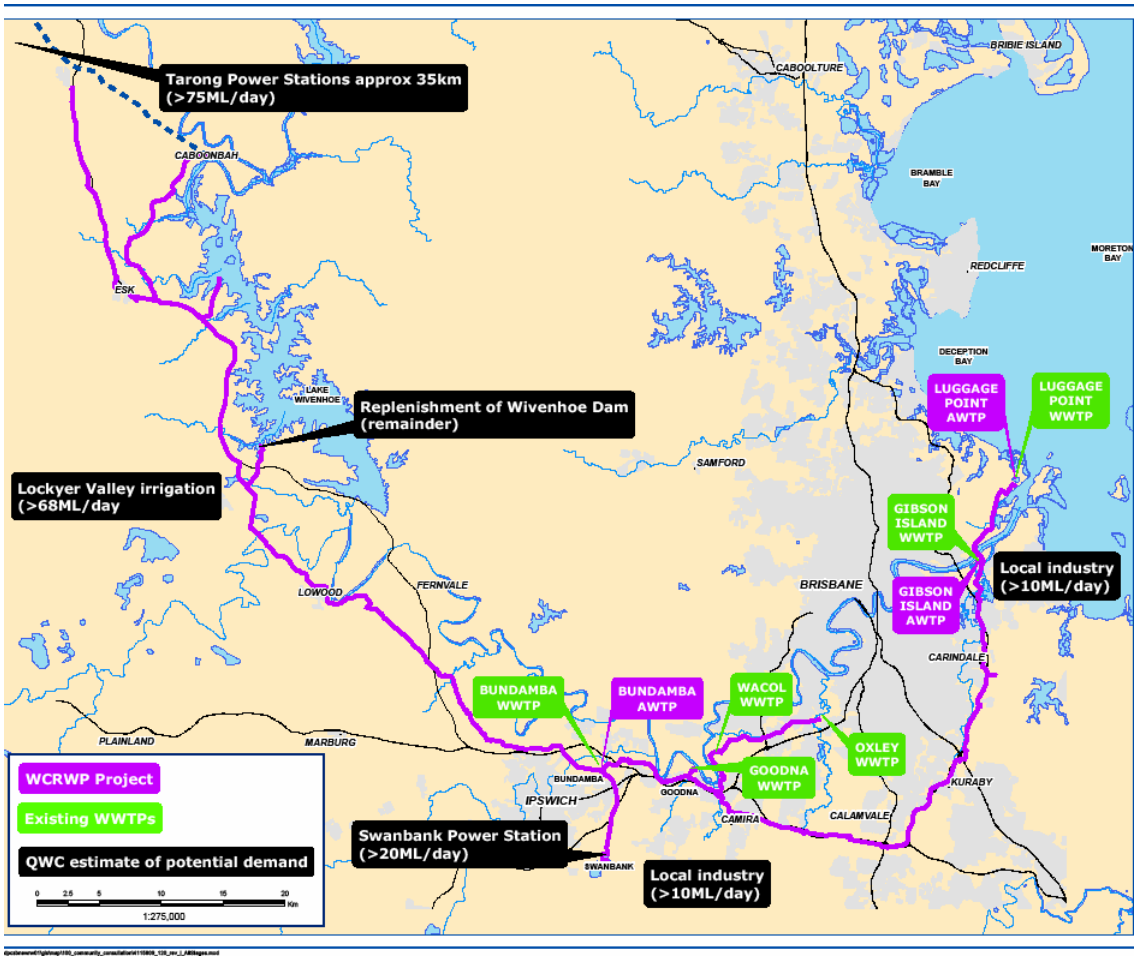
By April 2006, dam levels were at a record low and community concerns were even more prevalent. The government began looking at a new concept design which included Stage 2 and formed the basis of the current Western Corridor Recycled Water Project.

The Queensland Government is contributing $2.1 billion to the project through the $9 billion SEQ Water Grid, and the Australian Government is contributing $408 million through the Water Smart Australia Program.

The total project cost includes an additional $100 million for drought contingency works the Queensland Government announced in early 2008 that would fund measures including doubling the capacity of the Gibson Island Advanced Water Treatment Plant. This increased investment makes the Western Corridor Recycled Water Project the largest urban drought response in Australia, helping to secure a water supply for today and tomorrow.

The project is shown conceptually in Figure 1.

Figure 1 Project Overview



Water Quality and Safety

Around the world, experience and studies[4] have shown purified recycled water is safe for indirect potable reuse[5]. To further safeguard public health, Western Corridor Recycled Water's

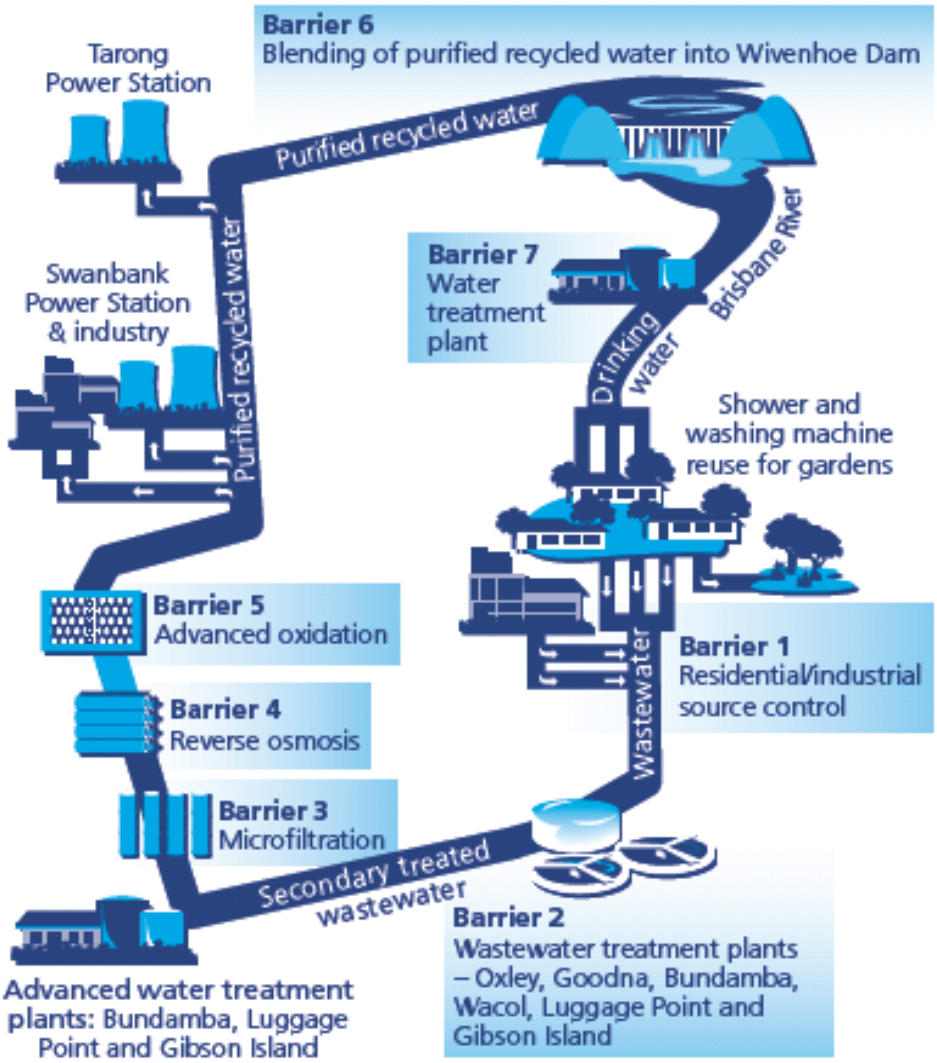
[4] http://www.qwc.qld.gov.au/Studies+on+health+effects

[5] A process involving adding purified recycled water treated to a higher standard than potable (drinking) water to a river, aquifer, dam or other body of water

purified recycled water is undergoing a rigorous testing program supervised by Queensland Health. Purified recycled water will not be used to supplement the region's drinking water supplies before this testing program is completed in February 2009 and Queensland Health and the Department of Natural Resources and Water have authorised its release into Wivenhoe Dam.

To meet the Queensland Health quality standards, water passes through a seven barrier treatment system as shown in figure 2.

Figure 2: Seven Barrier Treatment System



The Western Corridor Recycled Water Project provides three barriers in this process, microfiltration, reverse osmosis and advanced oxidation, through its advanced water treatment plants.

In the microfiltration barrier process, water passes through very fine hollow-fibre membranes to eliminate tiny particles, viruses and microbial materials. At the reverse osmosis barrier, dissolved salts, undissolved organic materials and bacteria are removed. The advanced oxidation barrier uses hydrogen peroxide (a powerful oxidant) and ultraviolet light to destroy trace level of organic and microbiological organisms that have not already been rejected.

Particles removed through microfiltration and reverse osmosis are processed seperately through a clarrifier and denitrification system. Sludge containing phosphates, nitrates and other matter is disposed of as land fill, while the reverse osmosis concentrate (ROC) is discharged in the Brisbane River through diffusers.

These technologies have been used to replenish water supplies in many parts of the world for up to 40 years, including the United States, the United Kingdom, Germany and Singapore. However, periodic monitoring and testing of the process at each barrier, combined with a range of primary research activities examining the water quality released into Wivenhoe Dam, provides quality assurance that the indirect potable reuse of Western Corridor's purified recycled water is a safe and sustainable solution for the community and environment.

Wiser Waterways

The Western Corridor Recycled Water Project recognises the benefits of sustainable environmental management and the project is committed to protecting environmental resources in the short and long term.

South East Queensland includes 14 major river catchments including the Caboolture, Pine, Brisbane, Bremer and Logan Rivers. Many of these rivers and creeks flow directly into Moreton Bay, a marine park listed as a wetland of international significance under the Ramsar Convention, and home to a vast array of marine habitats, plants and animals.

One of the less publicised, yet significant, benefits of the Western Corridor Recycled Water Project is a reduction in nutrient release to the Brisbane River and Moreton Bay. Phosphorus is primarily removed through coagulation at the start of the treatment process. It is anticipated that around 60 per cent (and potentially up to 90 per cent) of the total phosphorus load that would otherwise be released from six wastewater treatment plants in Brisbane and Ipswich will be removed in this way.

There will also be a significant reduction in the mass load of nitrogen. Indicatively, half of the nitrogen will be removed. At Bundamba, for example, the ROC is passed through nitrifying and denitrifying filters to manage ammonia (primarily arising from chloramine dosing ahead of the membranes) and nitrates, respectively. The concentrate has been subject to eco-toxicity testing and near-field hydrodynamic modelling to ensure that there are no localised acute impacts. Far-field modelling has demonstrated the broader performance of the system.

Procurement and Delivery

The Western Corridor Recycled Water Project is being delivered in just 30 months from concept to completion. However short timeframes and a tight construction market quickly identified that this could not be achieved through conventional delivery strategies.

Project alliancing is a form of procurement where the State or another government entity collaborates with one or more service providers to share the risks and responsibilities in delivering the capital phase of a project. Through commissioning five independent alliances, split into three treatment plant alliances and two transfer system alliances, the project was able to have a collaborative, incentive-driven method of contracting where all participants work cooperatively, sharing the risks and rewards of bringing the project in within time and cost.

In addition, alliancing allowed the Western Corridor Recycled Water Project to bring together 16 world leaders in construction, pipe laying, engineering and water services and has provided a flexible delivery strategy enabling the owner to actively participate in project delivery and costing decision making.

To ensure the work between the alliances is properly coordinated, the Project is guided by Western Corridor Recycled Water's Project Management Group which has taken responsibility for land acquisition, environmental approvals, high-level community consultation and corporate communications.

Another interesting feature of project delivery has been the parallel construction of three other major pipeline projects in the region – all of which are being delivered through the State Government. It was identified early in the project that these projects would start to compete in the pipe supply market, and the State Government established a centralised pipe procurement unit within the Department of Infrastructure and Planning to address this.

This has allowed the prioritisation of resources on a regional basis, and has also provided the scale of purchasing necessary to encourage the involvement of new vendors. This has included some 60 kilometres of large-diameter (1000mm and 1200mm) GRP pipe installed in the western part of the WCRW Project. This is the first major application of this particular GRP technology for an Australian pipeline project.

International Recognition

The Western Corridor Recycled Water Project is the largest water project in Australia since the Snowy Mountains Hydro Electric Scheme in the 1950s, and is the third-largest advanced water treatment project in the world.

This complex project has drawn attention and praise from all over the world. Stage 1A of the project has received numerous major international industry awards including the 2007 and 2008 Global Water Project of the Year, at the Global Water Awards and the Global Level Honour Award at the International Water Association (IWA) Project Innovation Awards. The project also won global recognition in April for its organisation and management of the "First Water" event which celebrated the successful completion of Stage 1A in August 2007, winning the 2008 International Public Relations Association Event Management Award and a merit (silver) award in the International Association of Business Communicators: Special Events category, Communication Management division.

On a national level, Bundamba Advanced Water Treatment Plant Stage 1A was one of six finalists recognised at the 2008 Australian Construction Achievement Awards in May. Judges described the project as "an innovative and sustainable water solution to growing water scarcity in South East Queensland."

Such national and international endorsement is testament to the significance of the project and its importance in providing sustainable water security for the South East Queensland region for the future.

Conclusion

In 2006 South-East Queensland, Australia's fastest growing region, faced the very real possibility of running out of water. By the end of 2008 the immplementation of the Western Corridor Recycled Water Project will help to ensure the region is never in that position again.

The purified recycled water produced by the Western Corridor Recycled Water Project will provide SEQ's power stations, industry and agriculture with an alternative water source so that they don't have to use the region's drinking water. It will also provide a safe, pure supplement to our valuable drinking water supplies.

Importantly, this recycling process will also deliver significant benefits to South East Queensland's waterways, enhanced supply reliability and environmental benefits through reductions in nutrient release to the region's sensitive rivers, creeks and Moreton Bay.

The award-winning Western Corridor Recycled Water Project is a project of which all Australians can be proud, and something that places Australia at the forefront of water recycling worldwide.