

Recycled water for drinking: Direct potable reuse a temporary solution for Wichita Falls, Texas

In July 2014, the city of Wichita Falls, Texas, became one of the first in the United States to use treated wastewater directly in its drinking water supply. The scheme is a temporary solution to the city's drought-induced water crisis.

The drivers

Two lakes (Lake Kickapoo and Lake Arrowhead) have traditionally provided the water supply for Wichita Falls. No groundwater or other water sources are available within about 130 kilometres.

In the late 1990s, the city experienced a severe multi-year drought, driving the decision to add a reverse osmosis plant to the existing Cypress Water Treatment Facility to treat the brackish water from a third lake — Lake Kemp. The plant was completed and brought online in 2008.

Again in 2011, the area experienced a severe drought which, coupled with extreme temperatures of over 38 °C (100 °F) for more than 100 days at a time, caused reservoir water levels to drop. In November of 2013, the water shortage escalated to a state of emergency and the city entered a stage-4 drought disaster (on a scale of 1-lowest to 5-highest), lowering production to about 47 million litres per day. By May 2014, stage-5 was triggered and production averaged 42 million litres per day.

During the emerging crisis, the city recognised that it was conveying 28 million litres of wastewater a day from its wastewater treatment plant to other cities downstream and that this treated wastewater could instead be further treated locally at the existing Cypress Water Treatment Plant and used to augment the public drinking water supply.

The scheme at a glance

- Treated wastewater is disinfected and pumped to the Cypress Water Treatment Plant where it goes through clarification, microfiltration, reverse osmosis, and ultraviolet light disinfection before being released into a holding lagoon where it is blended with lake water (50:50). The blended water goes through a seven-step conventional surface water treatment process. The treated water is stored and then pumped to the distribution system.
- The scheme provides 19 million litres a day, satisfying up to half of the city's daily demand. Wichita Falls and the surrounding community has a population of about 150,000.
- The scheme is considered a temporary drought response and will be replaced by a \$US35 million permanent indirect potable reuse scheme whereby high quality effluent will be stored in Lake Arrowhead. The permanent scheme will recycle 45 to 60 million litres a day and will take three years to complete.



The path taken

Investigation

Wichita Falls responded to the drought in 1999 by building a microfiltration/reverse osmosis plant. The plant, completed in 2008, enabled them to bring a third lake online as a water source, providing an additional 38 million litres of water per day.

During the most recent drought, which started in October 2010, the city re-evaluated previous strategies, looking at quality, reliability and cost, before deciding in April 2012 to pursue both direct and indirect potable reuse schemes.

The existing advanced wastewater treatment facility and water quality monitoring regime helped speed up the regulatory approval process for direct potable reuse, and kept construction costs down.

The only construction required was a 21-kilometre pipeline connecting the wastewater plant to the existing Cypress Water Treatment Plant where the water is purified for drinking.

Trial

In lieu of a pilot for the direct potable reuse scheme, the Texas Commission on Environmental Quality (TCEQ) allowed the city to conduct a 45-day verification trial, discharging the treated water to the river. The city already had a discharge permit for their reverse osmosis treatment plant for Lake Kemp, which speeded up the process. Installation of a pipeline to connect the wastewater treatment plant to the water treatment plant was completed in late December 2013. This was followed by the 45 days of extensive quality testing by the city and the TCEQ. The TCEQ then requested an additional 30 days of tests, analysing the results and meeting with city staff to discuss the findings.

Approval for full-scale implementation

The TCEQ approved a permit to release recycled water into the public distribution system in June 2014.

Commissioning

The US\$9.5 million scheme was launched on 9 July 2014.

Engaging the community

Engaging decision-makers, regulators and politicians

Leaders at the city's Public Works Department said that having the support of the City Manager and the City Council from the beginning of the scheme proposal was crucial to moving the project forward quickly.

Engaging customers

A public information team created an aggressive public education campaign to inform customers about their water supply situation. Their work included developing city water reports and educating residents on water-related issues through a frequent newsletter.

An extensive speaking campaign targeted at civic organisations was run, including appearances by the mayor and city manager. The public information team worked closely with media (TV and newspaper) and also had their own television channel. The city produced videos of local physicians and university professors for the channel and these were also published on YouTube and on the city website.

Many residents could visually see the water levels in their reservoirs fall and this helped them to understand the urgency for considering alternative water supplies.

The city published weekly lake levels so by the time direct potable reuse was proposed in April 2012 the community were very aware of declining lake levels.

Success factors

City and state government support

Policymakers at city and state levels were very supportive during the process, particularly as it became clear there was no supply alternative and no groundwater reserves to draw upon as lake levels were visibly falling.

High levels of trust in wastewater utility

For 40 years, the city had operated a state-of-the-art wastewater system with a pre-treatment program. This track record, and the wastewater utility's excellent regulatory history, helped make the scheme possible. At the beginning of the proposal the utility staff strongly advocated for a high level of treatment to ensure the public could be very confident in the safety of the scheme.

Extensive testing

Because this scheme was one of the first of its type in the US, permitting and regulating the new facilities presented challenges. The state government required extensive testing, some of which required new analytical methods to be developed.

Water quality not compromised

The wastewater is treated to a level that meets 97 percent of drinking water standards. It is then piped to the Cypress Water Treatment Plant, where it is purified using microfiltration, reverse osmosis, ultraviolet light and conventional treatment, to a quality that exceeds the current Federal EPA and TCEQ drinking water standards.

The city created an extensive system of checks and balances to ensure quality, coupled with a state-of-the-art control room where state operators monitor quality daily.

Sustained community support

City rate-payers approved an 8.5 percent rate increase for the initial funding of the scheme. They have shown continued support by approving an additional 30 percent rate increase to fund the proposed indirect potable reuse scheme.

Lessons learnt

- Involving a public information team to execute the speaking campaign helped gather concerns and get project information out to residents.
- The public needed to see the water levels drop in the city's reservoirs and know that all alternative water sources had been exhausted before they accepted the concept of drinking purified wastewater.
- Demonstrating to the community that the quality of advanced treated water was safe for drinking water purposes.
- Educating the public and policymakers on the cost difference of other options that may not produce water to the same high quality as potable reuse, or may produce less water, was difficult.
- Getting academics and medical professionals on-board at the start, and working with the media from the outset, helped develop credibility among the public and water users.
- Demonstrating the need for the scheme and starting early with regulatory agencies reduced the approval timeline.