



# Desalination: Brackish Groundwater

Brackish groundwater is an important water supply source in Texas. The state has more than 2.5 billion acre-feet of brackish groundwater in 26 of the 31 major and minor aquifers. Brackish groundwater is defined as groundwater with a total dissolved solids content between 1,000 and 10,000 parts per million. Desalination is a widely used process that makes brackish water drinkable. Factors that affect the implementation of desalination include local conditions, permitting, treatment, and concentrate disposal.

## How does it work?

Desalination is the process of removing dissolved solids and other minerals from brackish groundwater. Membranes are used to physically separate the dissolved solids from water. The widely used commercial membrane technology is reverse osmosis, which uses high pressure to push water through the membranes. Reverse osmosis is used by 52 of the 53 desalination facilities in Texas.

The treatment process in a desalination plant typically consists of pretreatment, reverse osmosis, and post treatment. After pretreatment, the feed water is pumped to the reverse osmosis trains, which results in two streams: (1) the permeate (the desalted water) and (2) the concentrate (the salted water). In post treatment, the permeate is dosed with chemicals or blended with raw water to add minerals and make it less corrosive. The concentrate may be discharged to a saline water body, sanitary sewer, injection well, or evaporation pond.

## Brackish Desalination in Texas

The Texas Water Development Board (TWDB) maintains an online desalination plant database (<https://www3.twdb.texas.gov/apps/desal/default.aspx>) to track the growth of desalination. Presently, 53 municipal water facilities with a capacity of more than 25,000 gallons per day desalinate brackish water in Texas. Of these facilities, 36 desalinate brackish groundwater, 16 desalinate brackish surface water, and 1 desalinate reclaimed water. More specifically, the state has a design capacity of 90 million gallons per day (100,769 acre-feet per year) for *brackish groundwater* desalination, 65 million gallons per day (72,443 acre-feet per year) for *brackish surface water* desalination, and 2.5 million gallons per day (2,800 acre-feet per year) for *advanced treated reclaimed water*. In total, Texas has a desalination design capacity of approximately 157 million gallons per day (176,013 acre-feet per year) for municipal use.

El Paso Water Utilities operates the Kay Bailey Hutchison Desalination Plant, which is the largest inland municipal

desalination facility in the nation. The plant has a design capacity of 27.5 million gallons per day (30,800 acre-feet per year).

## Demonstration Projects

The TWDB established the Brackish Groundwater Desalination Initiative in 2004 to demonstrate the use of innovative, cost-effective desalination technologies. Between 2004 and 2009, the TWDB funded 17 projects related to brackish groundwater desalination totaling \$2.7 million, including the implementation of demonstration projects and preparation of guidance manuals.

In 2013, the TWDB funded a study that determined computer models could effectively predict membrane performance of reverse osmosis systems operated at normal conditions. In support, rules were later adopted that provided an alternative to pilot testing.

## State Regulations

The Texas Commission on Environmental Quality adopted rules in 2015 to improve their approval of desalination technology by allowing the use of nanofiltration and reverse osmosis systems to remove chemical contaminants. The past rules considered these membranes an innovative/alternate treatment technology and required an exception request adding time to the permitting process. The adopted rules also allowed the use of membrane manufacture models to design brackish groundwater treatment systems, instead of conducting pilot testing. Before the plant goes online, the engineer must conduct performance validation testing and submit data.

## Desalination in the State Water Plan

In the 2022 State Water Plan, nine regional water planning groups (regions E, F, G, H, J, K, L, M, and N) recommended brackish groundwater desalination as a water management strategy. If these strategies are implemented, groundwater desalination will produce about 157,000 acre-feet per year of additional water supply by decade 2070. This constitutes about 2.1 percent of all recommended water management strategies in the state water plan. Regional water planning groups propose implementing 33 brackish groundwater desalination projects, which can lead to 26 new desalination plants.

## More Information and Contact

[www.twdb.texas.gov/innovativewater/desal](http://www.twdb.texas.gov/innovativewater/desal).

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