Desalination: Brackish Groundwater

Brackish groundwater is a critical water supply source in Texas. There is more than 3.2 billion acre-feet of brackish groundwater in 12 of the state's 31 major and minor aquifers. Brackish groundwater is defined as groundwater with a total dissolved solids content between 1,000 and 10,000 milligrams per liter, and desalination is a 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 typically used to physically separate the dissolved solids from water, and the most widely used commercial membrane technology in Texas is reverse osmosis, which uses high pressure to push water through the membranes. Reverse osmosis is used by 57 of the 60 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 desalinated water) and (2) the concentrate (the high salinity 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 into 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 (www3.twdb.texas.gov/apps/ desal/default.aspx) to track the growth of brackish water desalination. Presently, 60 municipal water facilities with a design capacity of more than 25,000 gallons per day desalinate brackish water in Texas. Of these facilities, 43 desalinate brackish groundwater, 16 desalinate brackish surface water, and 1 desalinates reclaimed water.

More specifically, the state has a design capacity of 98 million gallons per day (109,774 acre-feet per year) for brackish groundwater desalination, 71 million gallons per day (79,530acre-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' desalination capacity is approximately 172 million gallons per day (192,665 acre-feet per year) for municipal use.

El Paso Water 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.

State Regulations

In 2013, the TWDB funded a study that determined that computer models could effectively predict membrane performance of reverse osmosis systems operated under normal conditions.

Using the findings of that study, in 2015 the Texas Commission on Environmental Quality adopted new rules that allowed the use of nanofiltration and reverse osmosis systems to remove chemical contaminants and the use of membrane manufacture models to design brackish groundwater treatment systems instead of conducting pilot testing. The rules also require engineers to conduct performance validation testing and submit data before a nanofiltration or reverse osmosis plant goes online.

Prior rules considered these membranes to be an innovative/ alternate treatment technology and required an exception request, which lengthened the permitting process.

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 by 2070. This constitutes about 2.1 percent of all recommended water management strategies in the state water plan. Regional water planning groups propose implementing 37 brackish groundwater desalination projects, which can lead to 27 new desalination plants — and the Texas Water Fund, created in 2023, is now available to fund desalination projects.

More Information

For more information about desalination, visit www.twdb.texas.gov/innovativewater/desal or contact:

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