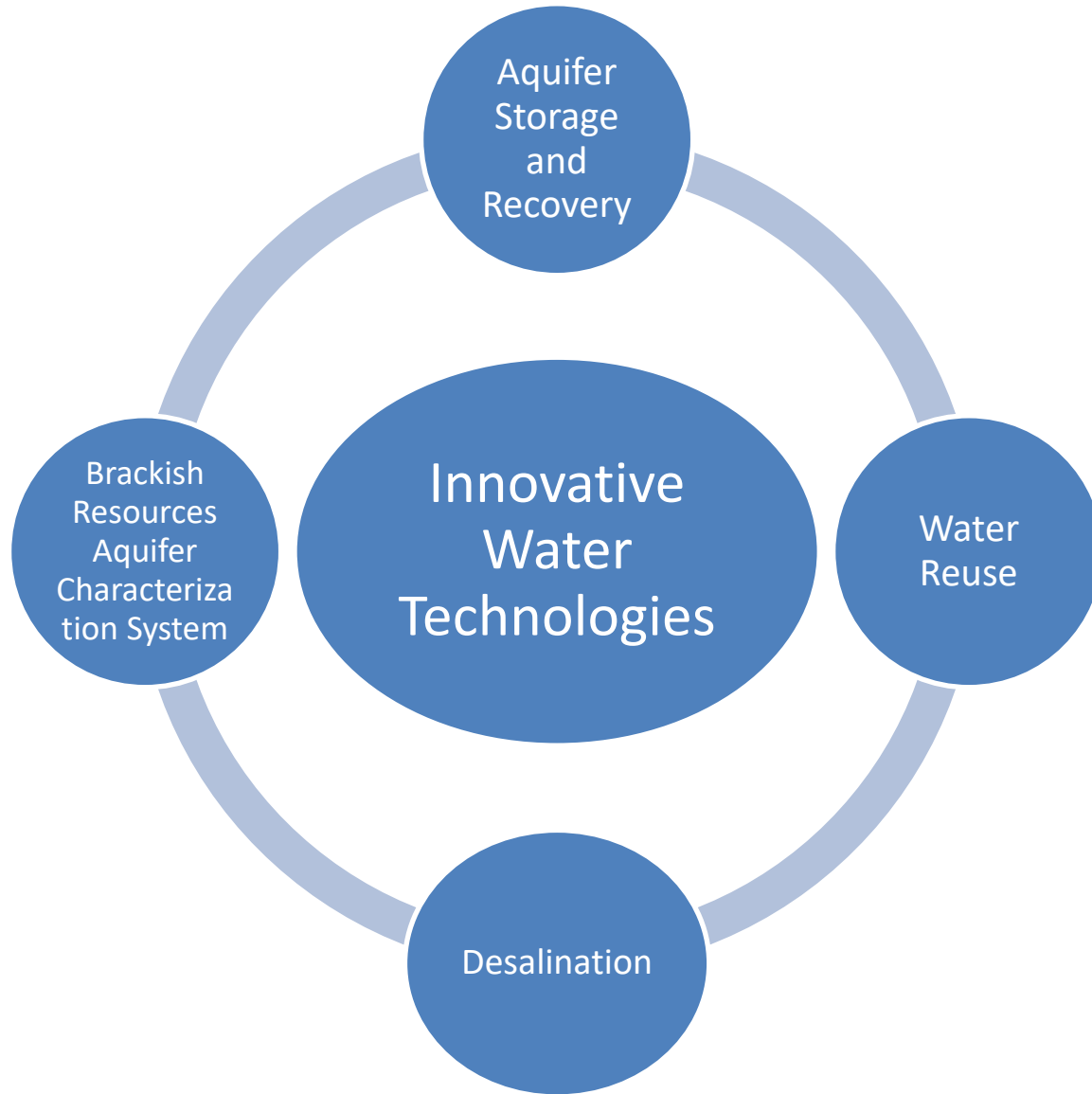


Water Desalination in Texas

James A. Golab, Ph.D.

Western States Water Council Virtual Spring Meeting
March 24, 2021

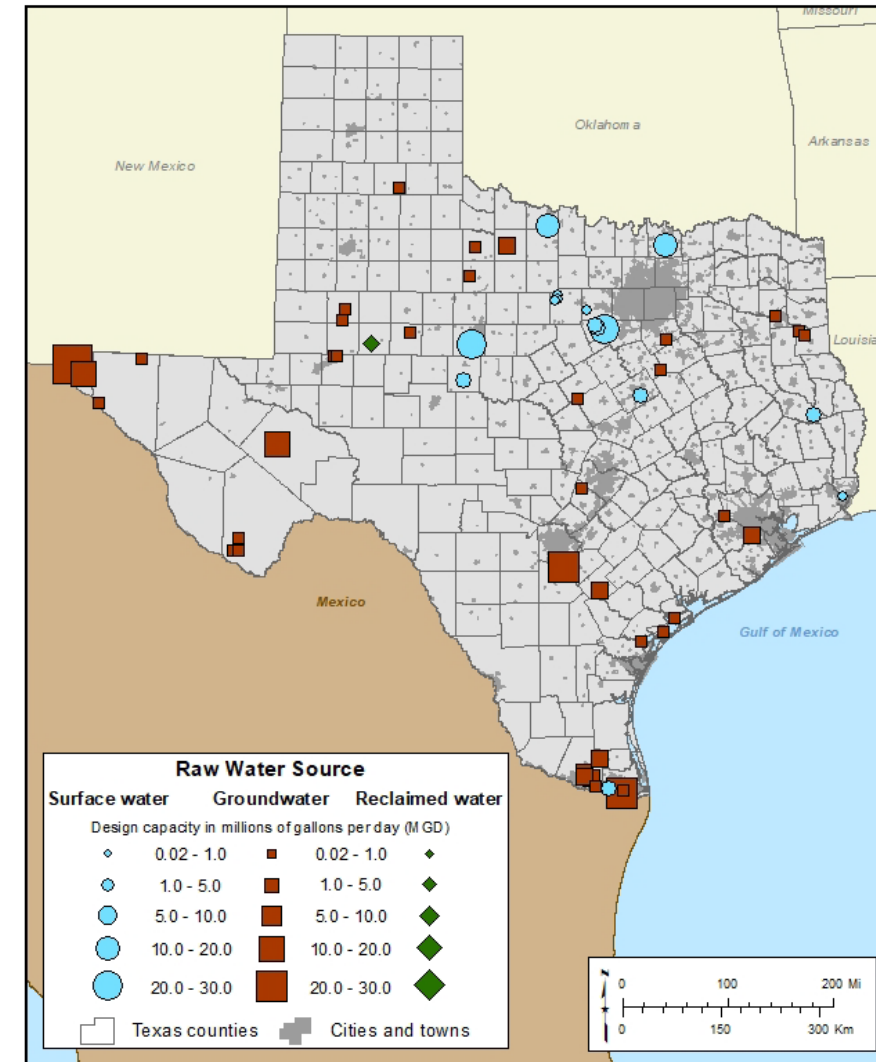


Innovative Water Technologies

- Mission is to advance the development of alternative water supplies in Texas.
- Participate in research and demonstration projects needed to advance technology
- Develop publications and educational materials
- Disseminate information to the public through presentations, active participation in organizations, and other outreach activities.

Desalination Program

- Created in 2002 with legislation directing TWDB to pursue seawater desalination and to report progress in a biennial report.
- In 2004, added brackish groundwater desalination
- Funded \$3.2 million for 5+ seawater desalination studies
- Funded \$2.1 million for 11 brackish groundwater desalination studies



Desalination process

- Process of removing dissolved salts from brackish water (surface water, groundwater, and seawater)

Groundwater Salinity Classification	Salinity Zone Code	Total Dissolved Solids Concentration (milligrams per liter)
Fresh	FR	0 to 1,000
Slightly Saline	SS	1,000 to 3,000
Moderately Saline	MS	3,000 to 10,000
Very Saline	VS	10,000 to 35,000
Brine	BR	Greater than 35,000

BRACKISH (highlighted in yellow box, spanning Slightly Saline, Moderately Saline, and Very Saline)

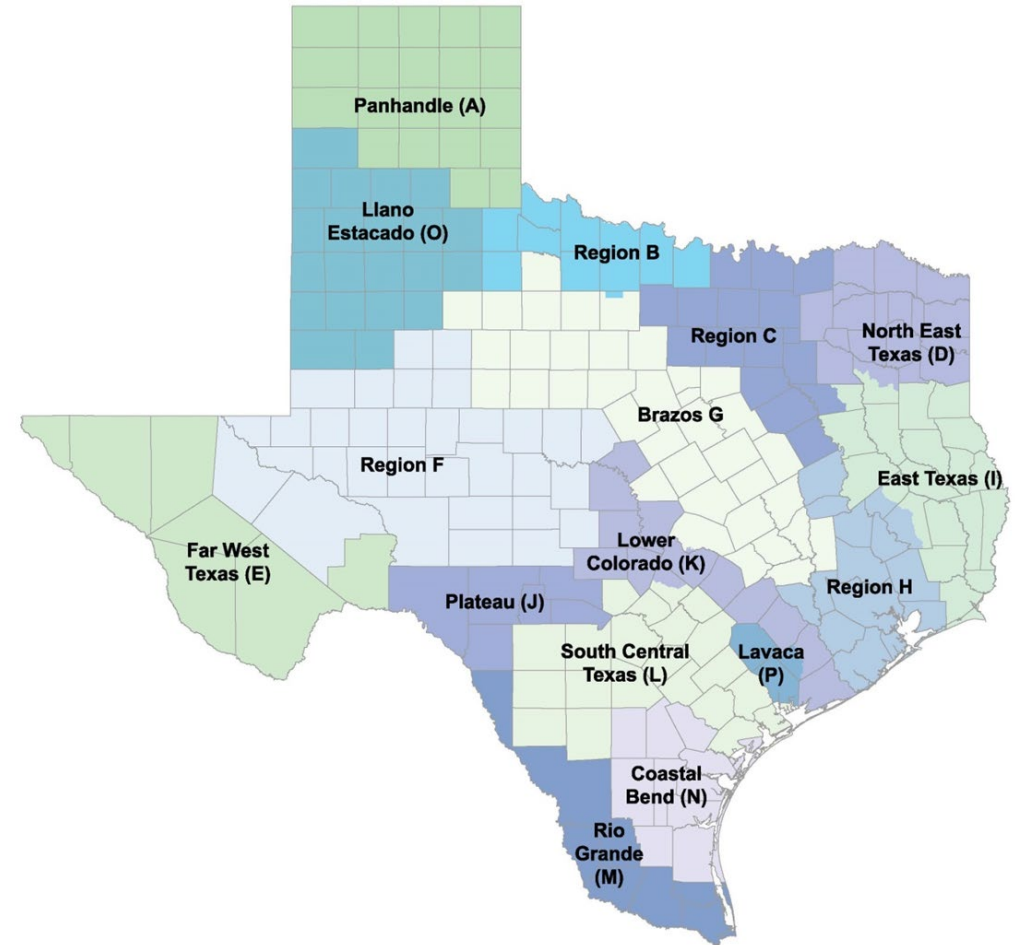
← Most Major/Minor Aquifer Mapped Limit (points to the boundary between Moderately Saline and Very Saline)

← Seawater (points to the boundary between Very Saline and Brine)

modified from Winslow and Kister (1956) USGS WSP 1365

Early Desalination in Texas

- Investigation of desalination began in the early 1960s
 - First state water plan (1961) noted the potential of desalination for the state
 - TWDB participated in a study by SWR in 1966 that identified 11 Texas cities for potential desalination projects



Early Desalination in Texas

- First seawater desalination plant in Texas was the **Freeport Demonstration plant**
 - Online June 21, 1961
 - 1 MGD capacity
 - TDS 35,000 mg/l (seawater), 140,000 mg/l (brine)
 - Cost ~\$1.5 million
 - Decommissioned in 1969
- First groundwater desalination plants
 - Port Mansfield (1969)
 - Corpus Christi (1965)



Seawater Desalination

- Currently there are no operational seawater desalination plants in Texas
- Several proposed projects in the Gulf Coast area
- The Corpus Christi area is the most active with 5 potential projects
- Two of these projects (The City of Corpus Christi and Port of Corpus Christi Authority) have submitted permits for their proposed projects

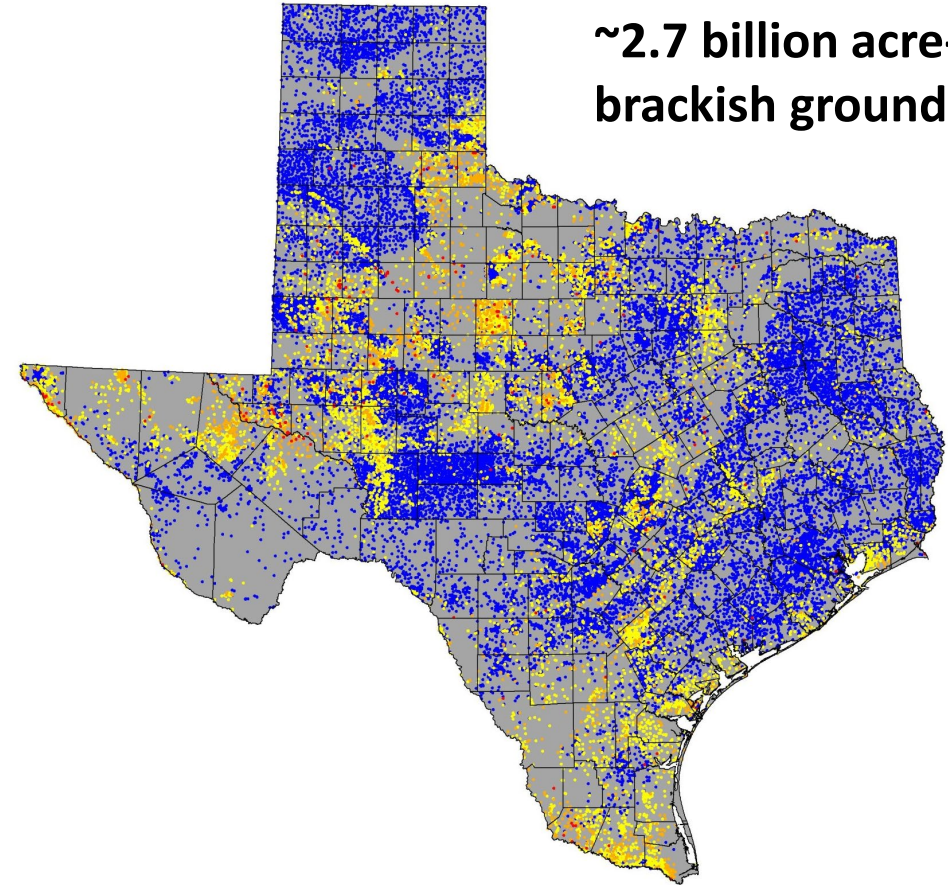


Groundwater Desalination

Brackish Resources Aquifer
Characterization System (BRACS)
established in 2009:

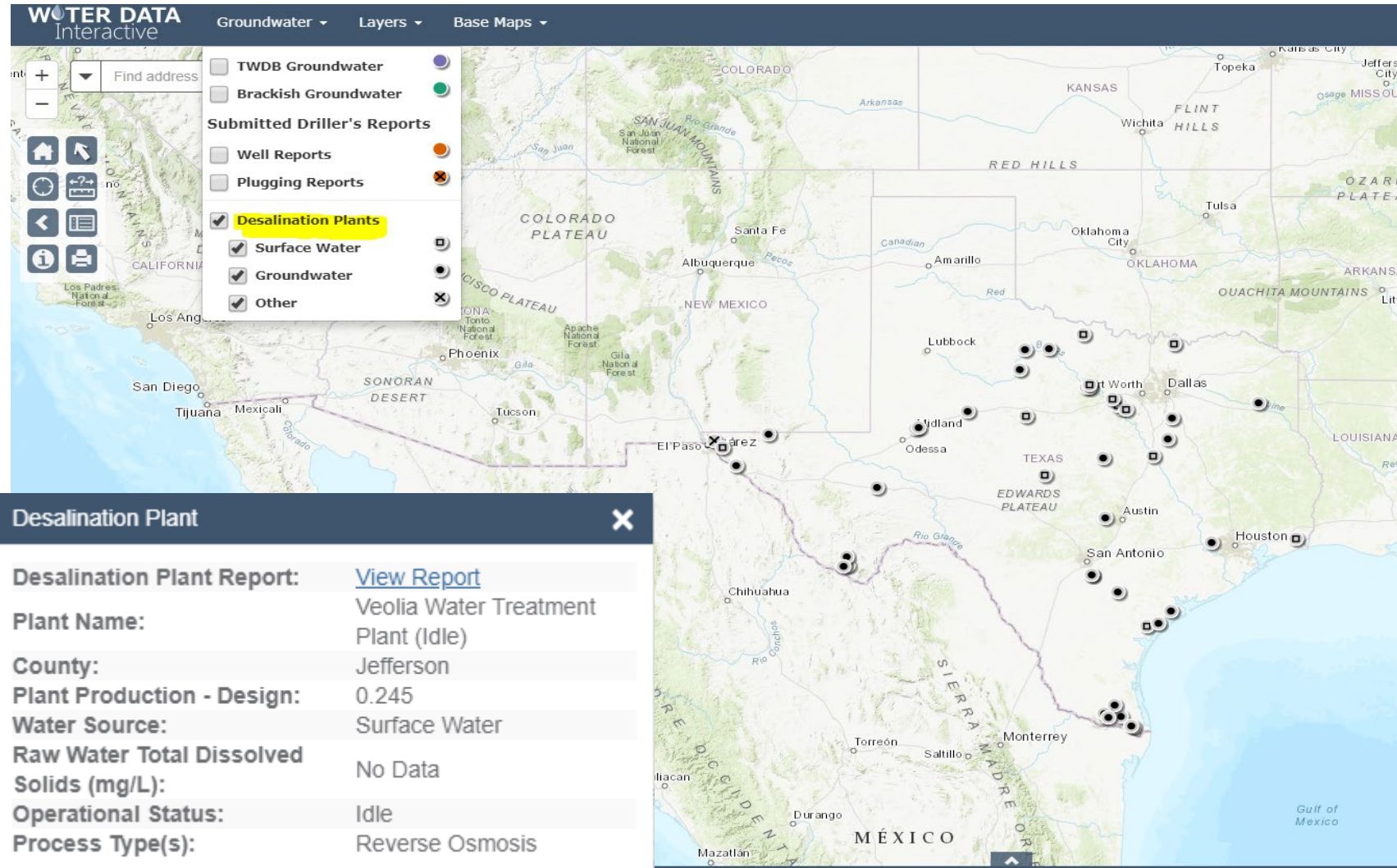
- map aquifers to 10,000 mg/L TDS
- map key desalination parameters
- estimate aquifer properties
- estimate brackish water volumes
- prepare data for numerical groundwater-flow models
- collect well logs (water, oil/gas) for interpretation
- build datasets (database, GIS)

~2.7 billion acre-feet of
brackish groundwater

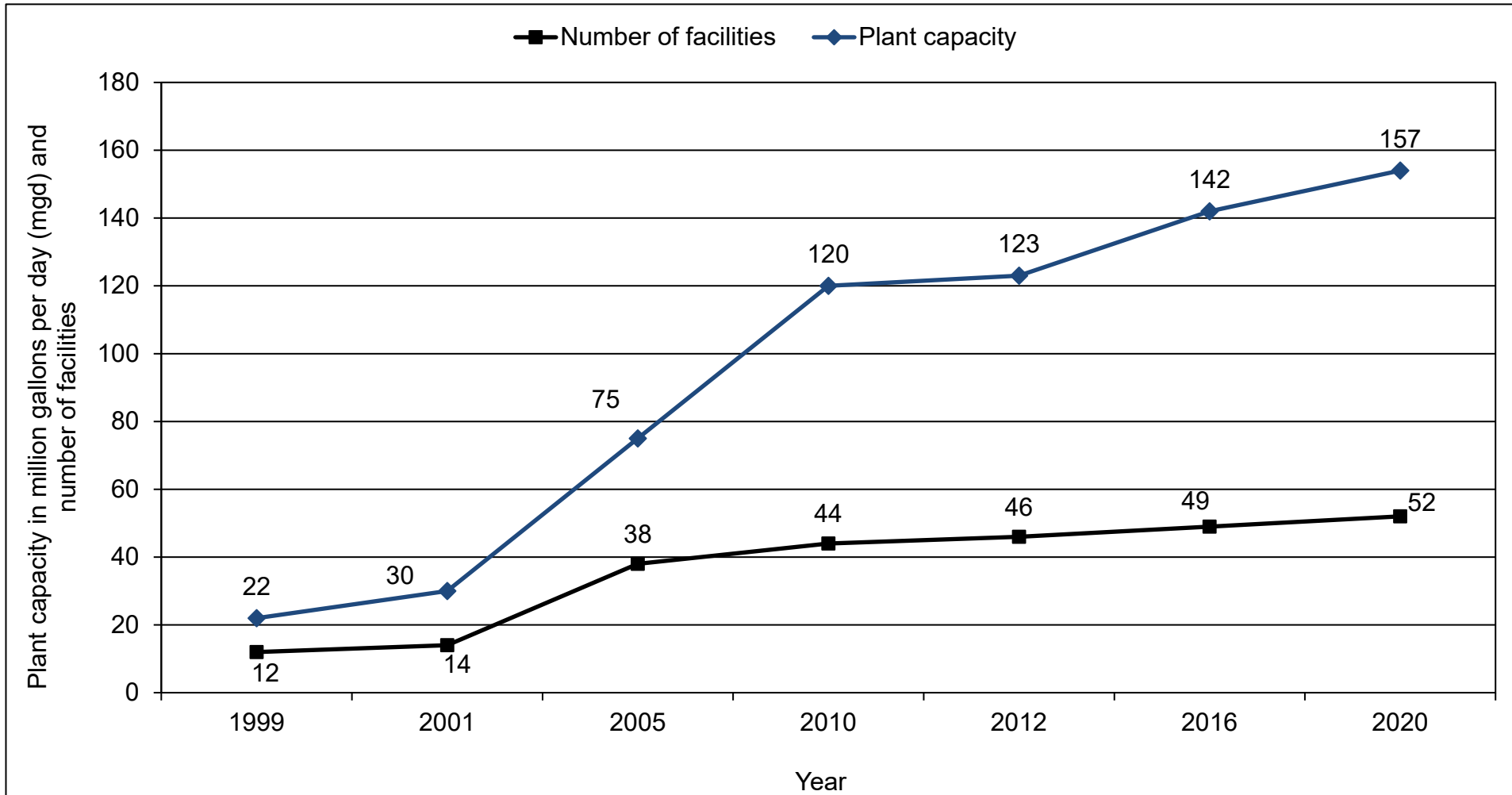


	1,000 mg/L	3,000 mg/L	10,000 mg/L
Fresh	Brackish		Saline
Fresh	Slightly-saline	Moderately-saline	Very-saline

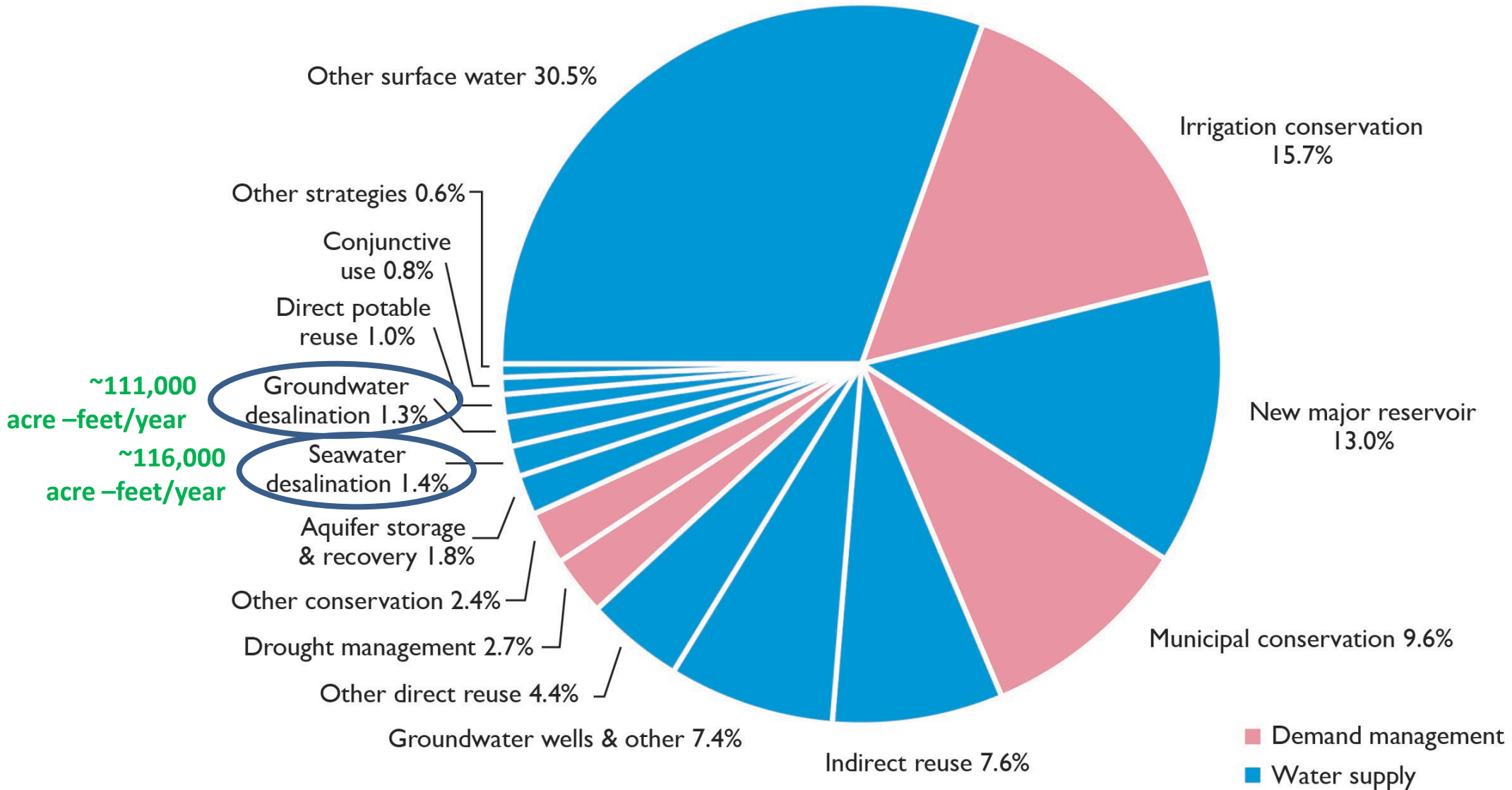
Desalination Plant Database



Desalination growth in Texas



2017 State Water Plan



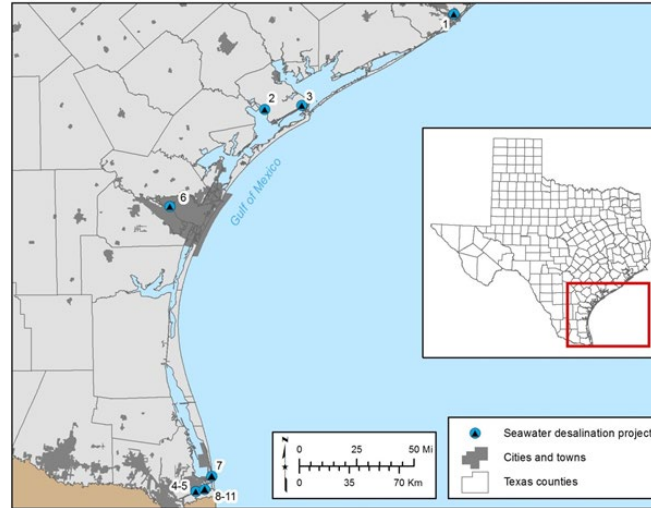
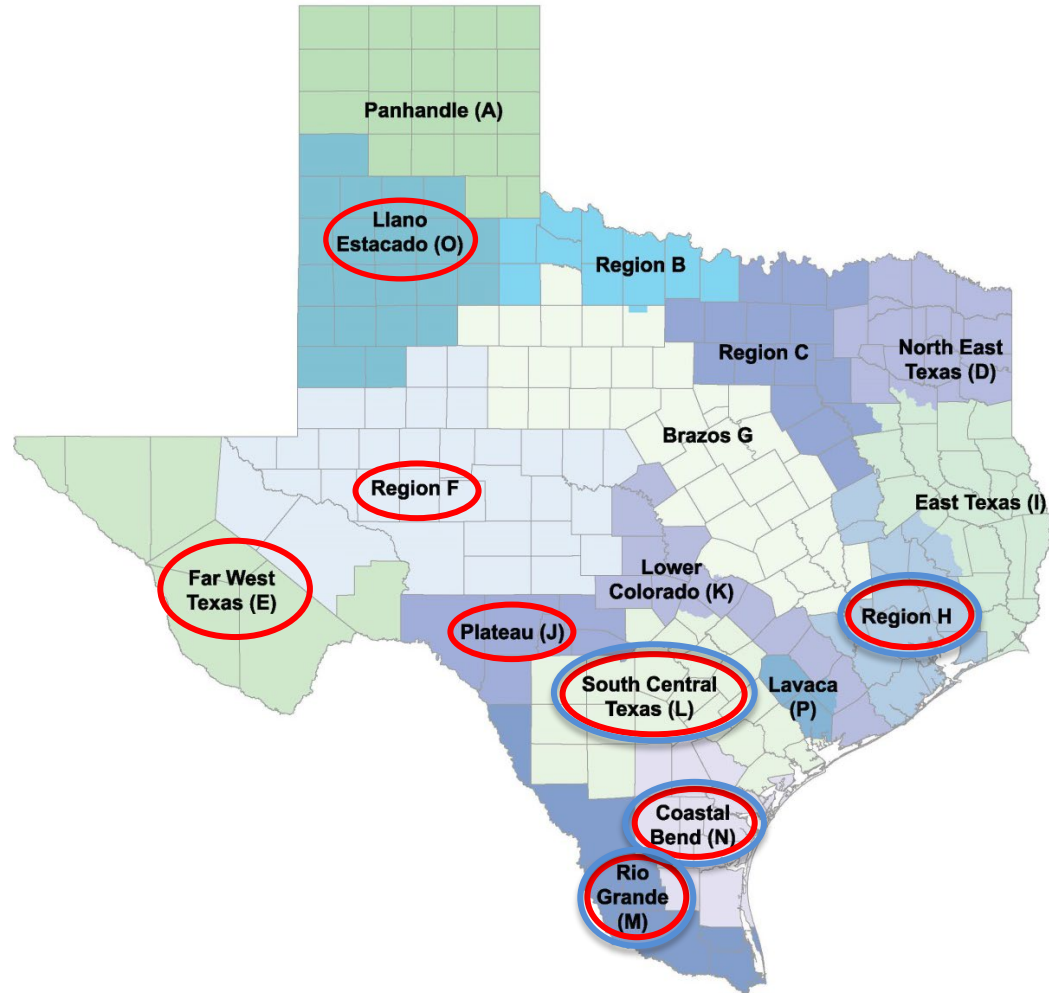
2017 State Water Plan

Water management strategy type	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Texas
Aquifer storage and recovery	na	na	na	na	\$296	\$480	\$252	na	na	\$205	\$645	\$209	na	na	\$243	na	\$419
Conjunctive use	\$106	na	na	na	\$361	na	\$1,031	\$928	na	na	na	\$615	na	na	\$106	na	\$699
Direct potable reuse	na	\$950	na	na	\$1,212	\$1,041	\$740	na	na	na	na	\$743	\$1,137	na	\$2,065	na	\$1,134
Groundwater desalination	na	na	na	na	\$415	\$718	na	\$850	na	na	na	\$698	\$1,146	\$646	\$1,713	na	\$713
Groundwater wells and other	\$314	\$635	\$350	\$522	\$756	\$226	\$357	\$582	\$303	\$236	\$774	\$588	\$66	\$120	\$256	na	\$476
Indirect reuse	na	\$360	\$111	\$288	\$563	na	\$125	\$398	na	na	\$46	na	na	na	na	na	\$283
Irrigation conservation	\$17	\$53	\$310	na	\$55	na	\$230	\$112	na	na	\$163	na	\$531	\$230	\$42	\$134	\$147
Municipal conservation	\$446	\$254	\$154	\$591	\$226	\$437	\$460	\$257	\$182	\$381	\$319	\$652	\$464	\$483	\$599	\$345	\$374
New major research	na	\$482	\$563	\$95	\$267	\$710	\$450	\$72	\$270	na	\$585	\$596	na	\$595	\$179	\$33	\$470
Other conservation	na	\$573	\$310	na	na	\$794	na	na	na	na	na	na	\$1,899	na	na	na	\$190
Other direct reuse	na	na	\$285	na	na	\$267	\$290	\$210	na	\$58	\$1,157	\$356	\$505	\$341	na	na	\$423
Other strategies	\$8	\$280	na	na	na	\$308	na	na	na	na	\$2,978	na	\$10	na	na	na	\$1,249
Other surface water	na	\$361	\$571	\$49	\$356	\$83	\$324	\$245	\$437	\$99	\$176	\$606	\$222	\$508	\$427	na	\$381
Seawater desalination	na	na	na	na	na	na	na	\$1,461	na	na	na	\$611	\$3,708	\$550	na	na	\$1,431

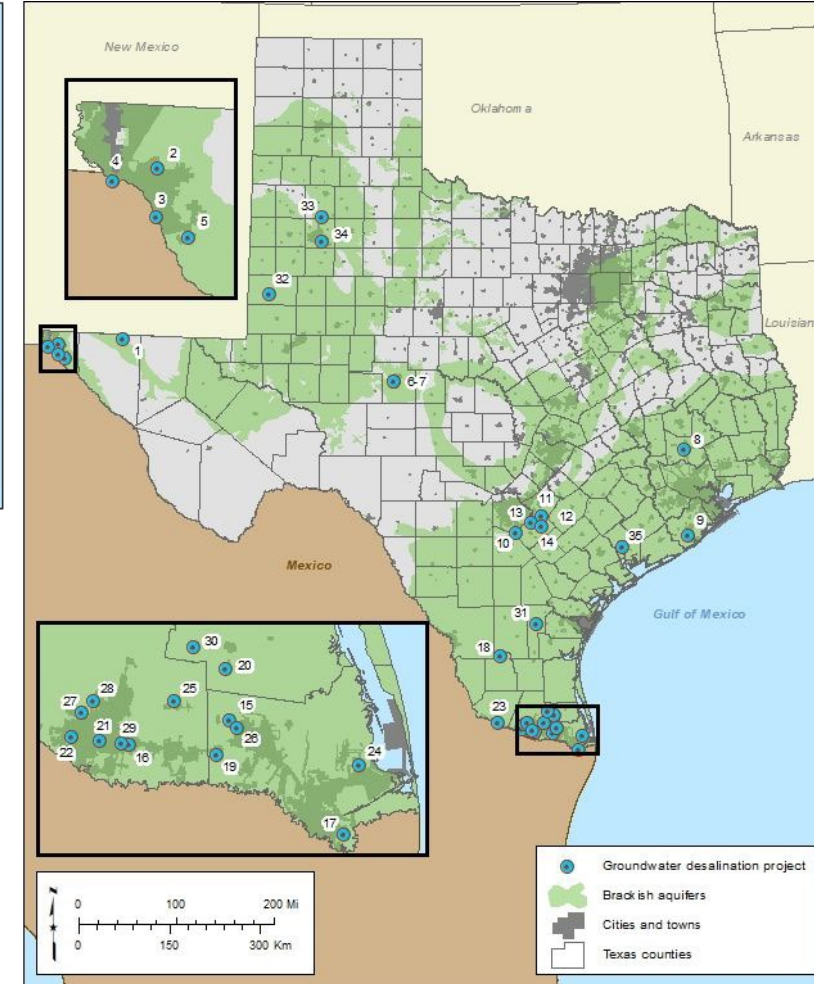
*Unit costs include a mixture of projects, some of which will be beyond their debt service period by 2070

na = not applicable or not available.

Groundwater desalination recommended water management strategies and projects



Groundwater Desalination WMS
 Seawater Desalination WMS



Biennial Report on Desalination

The Future of Desalination in Texas

2020 Biennial Report on Seawater and
Brackish Groundwater Desalination in Texas



87th Texas Legislative Session



- Ninth report in series
- 18 years of activities toward advancing seawater desalination
- Third report to include brackish groundwater desalination and designating brackish groundwater production zones in aquifers



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Innovative Water Technologies

www.twdb.texas.gov/innovativewater/index.asp