The Role Produced Water Can Play in Agriculture

January 24, 2024

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Texas Produced Water Consortium

Created by SB 601 during 87th Texas Legislative Session (2021)

- *"The consortium is created to bring together information resources to study the economics of and technology related to, and the environmental and public health considerations for, beneficial uses of fluid oil and gas waste."*

SB 601 additionally set a requirement to develop a report to the Texas Legislature

- *"Not later than September 1, 2022, the consortium shall produce a report that includes:*

  (1) suggested changes to law and administrative rules to better enable beneficial uses of fluid oil and gas waste, including specific changes designed to find and define beneficial uses for fluid oil and gas waste outside of the oil and gas industry;

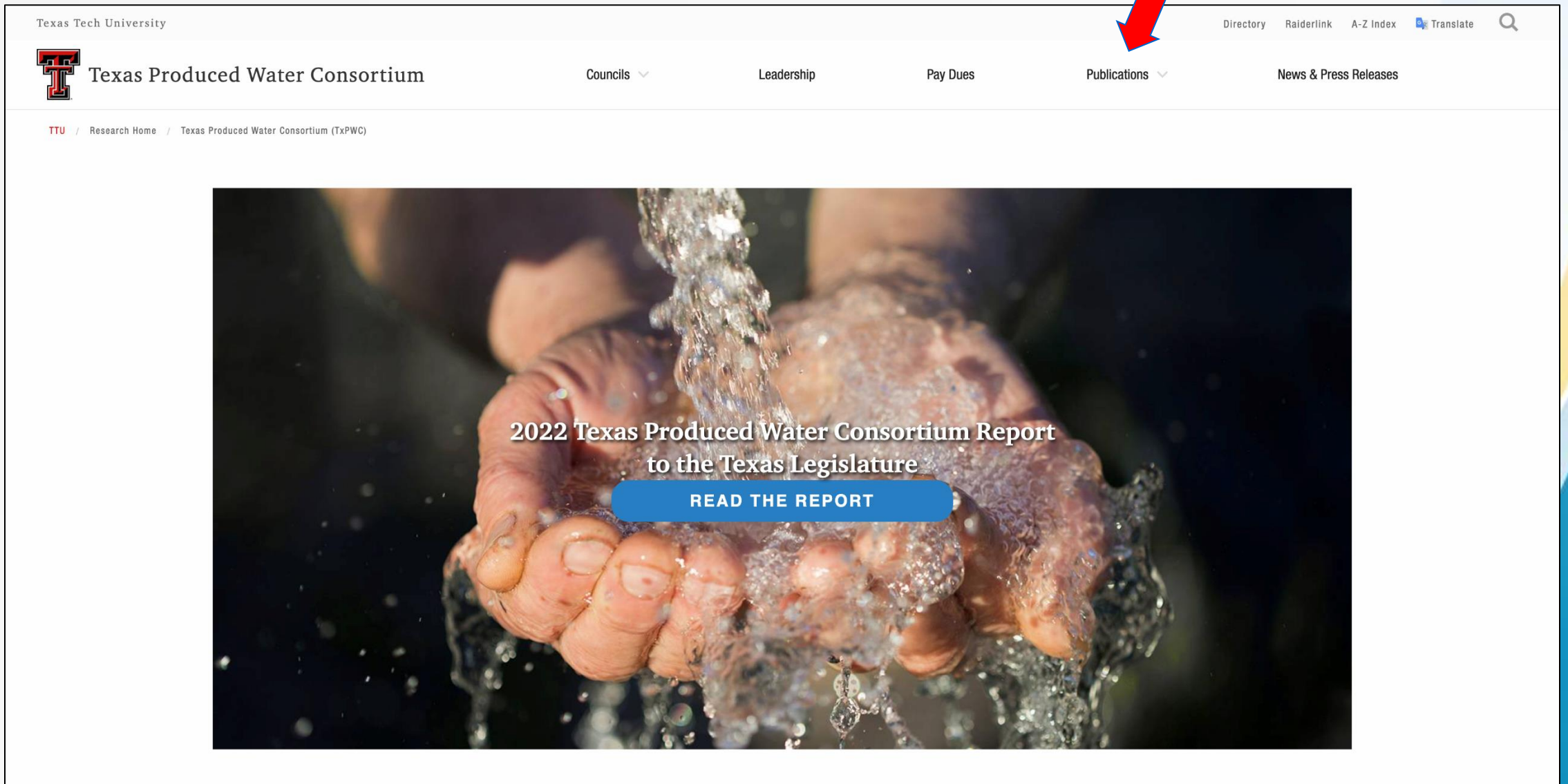
  (2) suggested guidance for establishing fluid oil and gas waste permitting and testing standards;

  (3) A technologically and economically feasible pilot project for state participation in a facility designed and operated to recycle fluid oil and gas waste; and

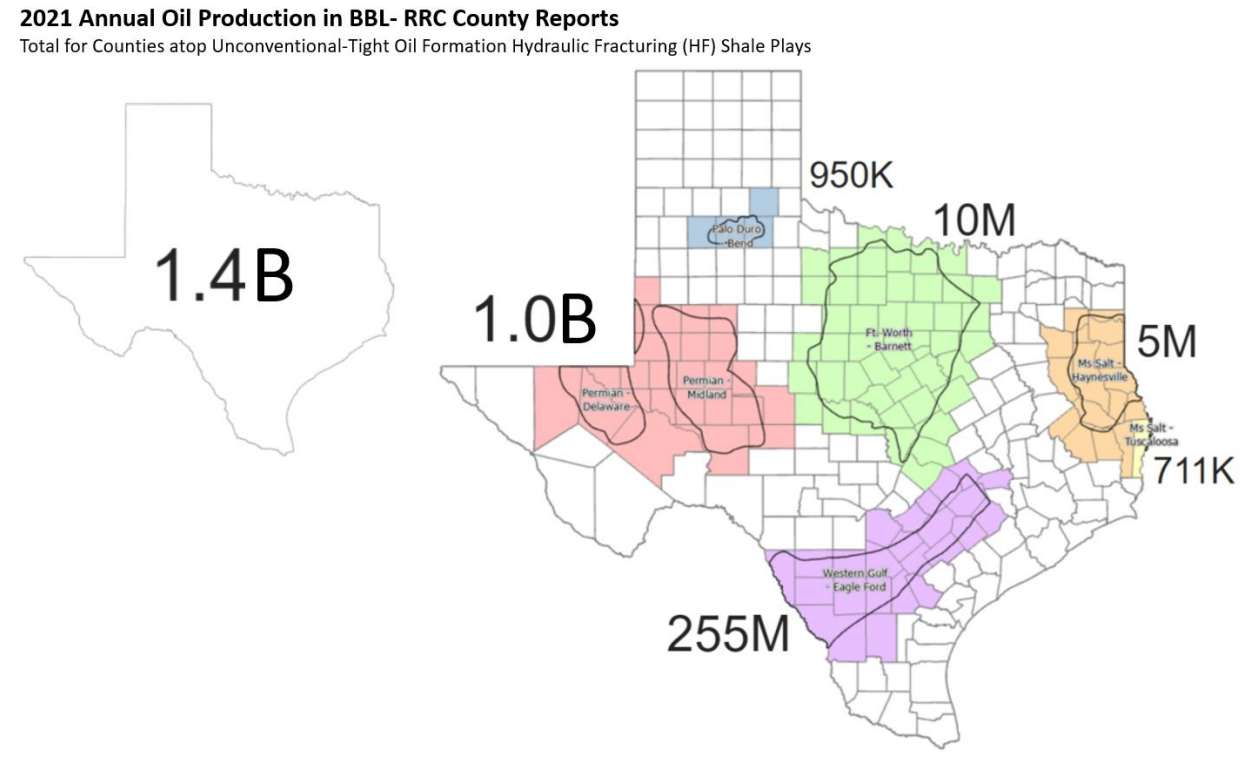
  (4) an economic model for using fluid oil and gas waste in a way that is economical and efficient and that protects public health and the environment."

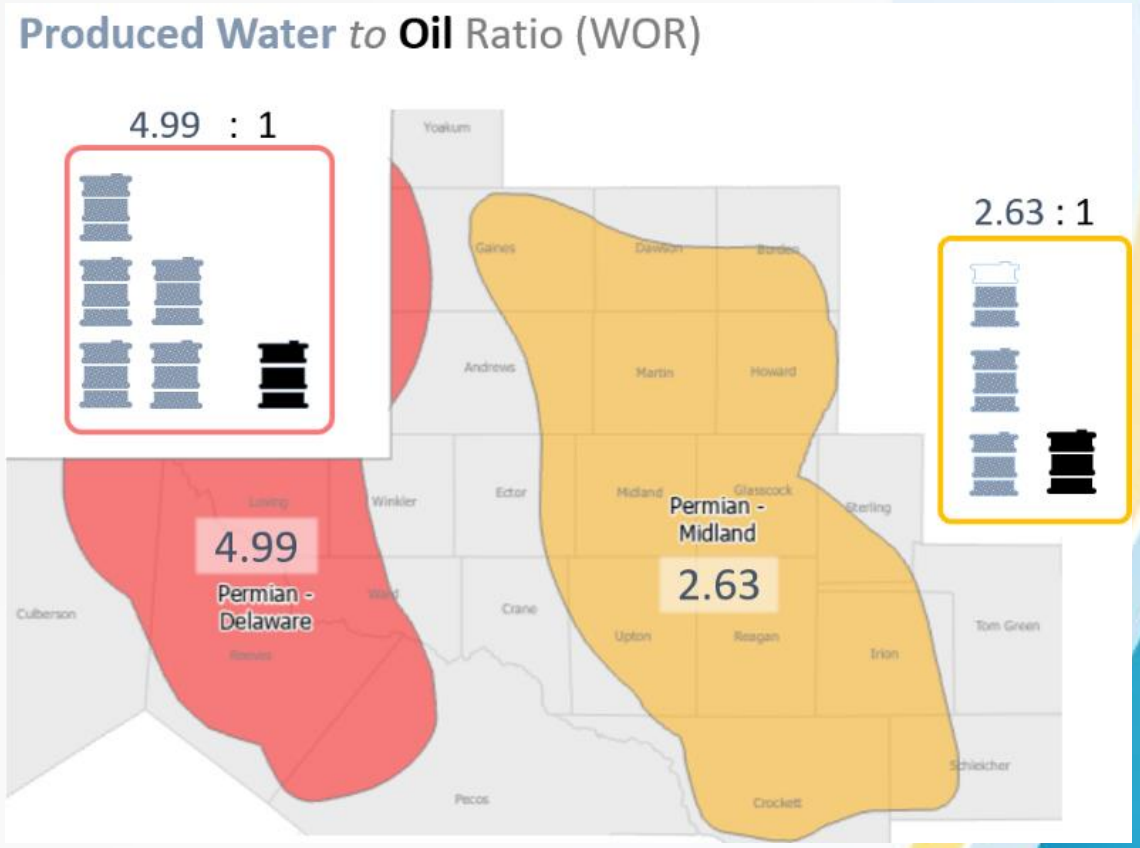
Accessing the Report

Http://www.txpwc.org



Substantial Produced Water Available





TXPWC Projected 38-year Average PW Volume: **~14MM bbl/day**

Volume projection less industry reuse: **~11MM bbl/day, or 500,000-515,000 acre-feet/year**

Current Technically Recoverable Estimate @ 50% Recovery: **~250,000-260,000 acre-feet/year**

Initial Technologies Evaluated

Report Focus

- Reverse osmosis (RO)
- Multi-effect distillation (MED)
- Membrane distillation (MD)
- Multi-stage flash evaporation (MSF)
- Mechanical vapor compression (MVC)

Other Identified Technologies

- Membrane based processes
  - Electrodialysis metathesis (EDM)
  - Nanofiltration (NF)
  - High pressure reverse osmosis (HPRO)
  - Forward osmosis (FO)
  - Electrodialysis (ED) and electrodialysis reversal (EDR)
  - Osmotically assisted reverse osmosis (OARO)
  - Membrane crystallization
- Thermal processes
  - Brine concentrator (BC)
  - Spray dryer (SD)
  - Eutectic freeze crystallization (EFC)
  - Brine crystallizer (BCr)

Treatment Trade-Off

- Membrane processes (such as RO) are cost-effective and efficient water treatment options, but may not be able to handle high initial salinity such as that of Permian Basin produced water.
- Thermal processes (such as MSF) yield high quality treated water free of many constituents, but are energy-intensive and less economical.

Pilot Projects

Phase 1: Immediate Focus, Minimum 2 Projects Selected

- Co-location of treatment technology in the Midland Basin at an existing produced water collection site, capable of treating a minimum inflow of 500 BBL/day, necessary to provide treated produced water samples for testing and analysis of constituent characterization and risk and toxicology assessment, and operational costs. Estimated operation: 3-6 months per technology, continuing thereafter as necessary.

- Co-location in the Delaware Basin at an existing produced water collection site, capable of treating a minimum inflow of 500 BBL/day, necessary to provide treated produced water samples for testing and analysis of constituent characterization and risk and toxicology assessment, and operational costs. Estimated operation: 3-6 months per technology, continuing thereafter as necessary.

Phase 2: Operated as Funding and Consortium Member Interest Allows

- Establish bench scale “plug-and-play” testing facility to focus on innovative technologies and treatment-train efficacy research.

- Site analysis of existing non-Texas based produced water treatment facilities.

- Contained and monitored application testing of treated produced water on native rangeland, cotton, and/or regional edible crops to further aid in overall system knowledge regarding human and environmental hazard and risk assessment.

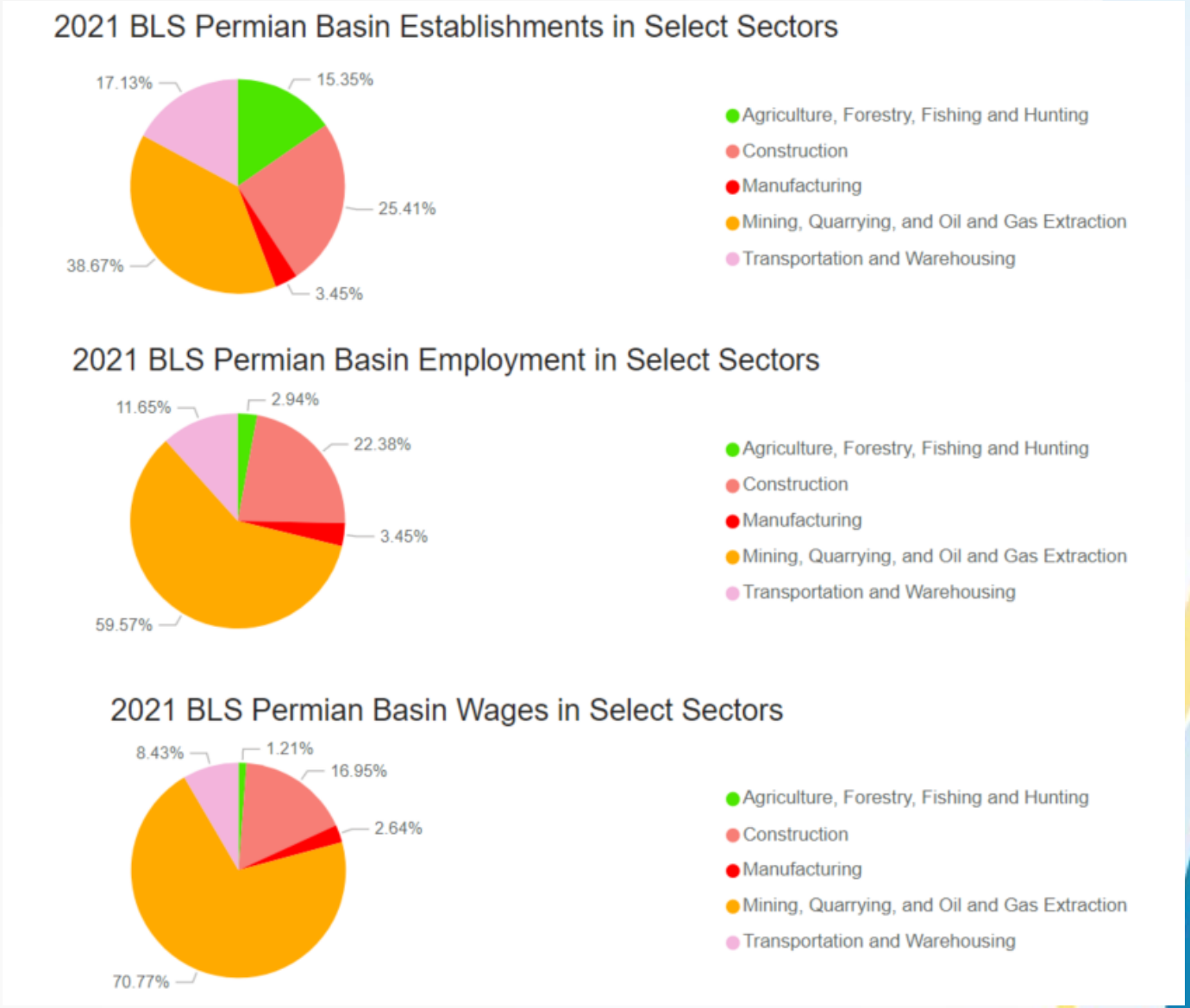
2021 BLS Establishments, Employment, Wages

Permian Delaware & Midland Basin Counties (24)

12K
Establishments

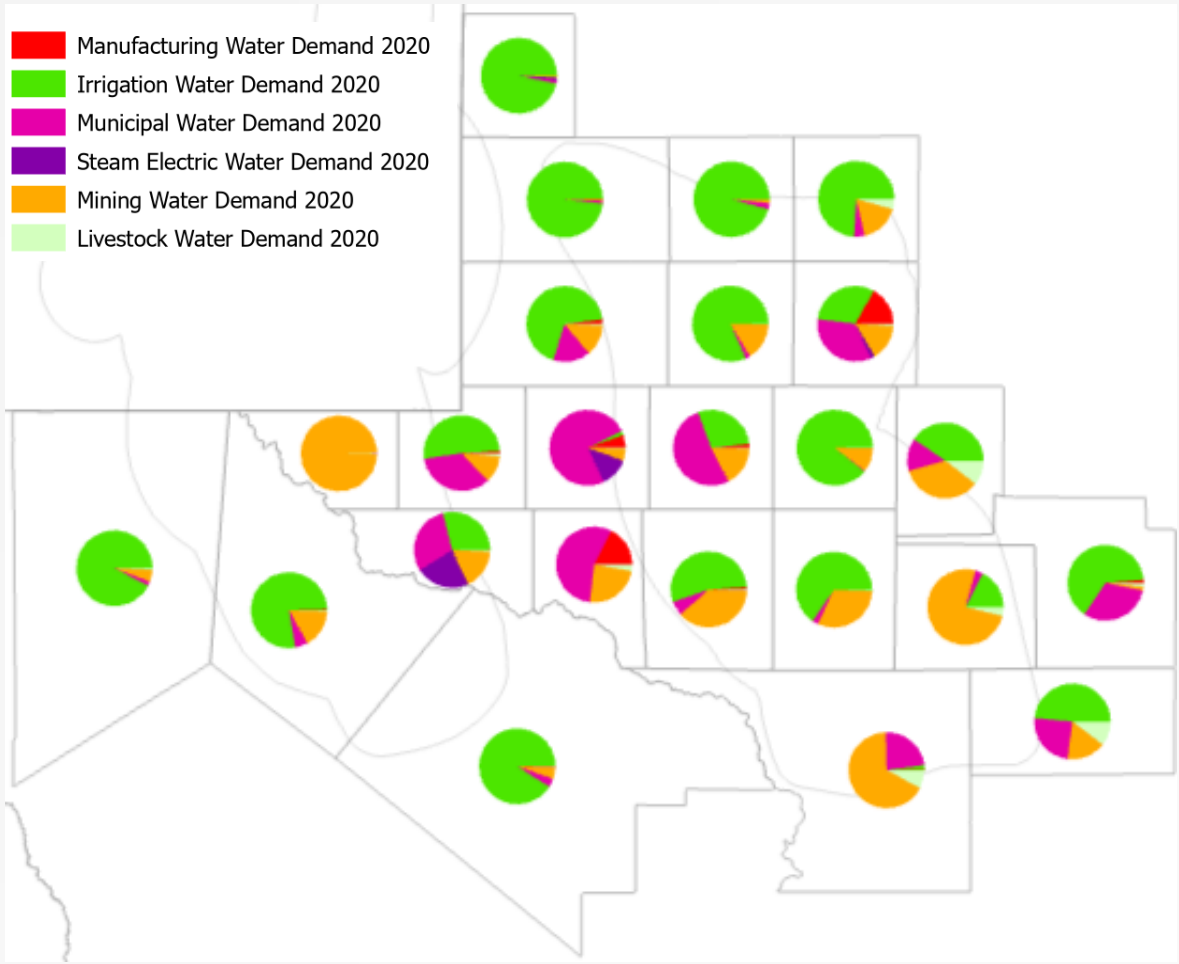
152K
Employment

$11B
Wages



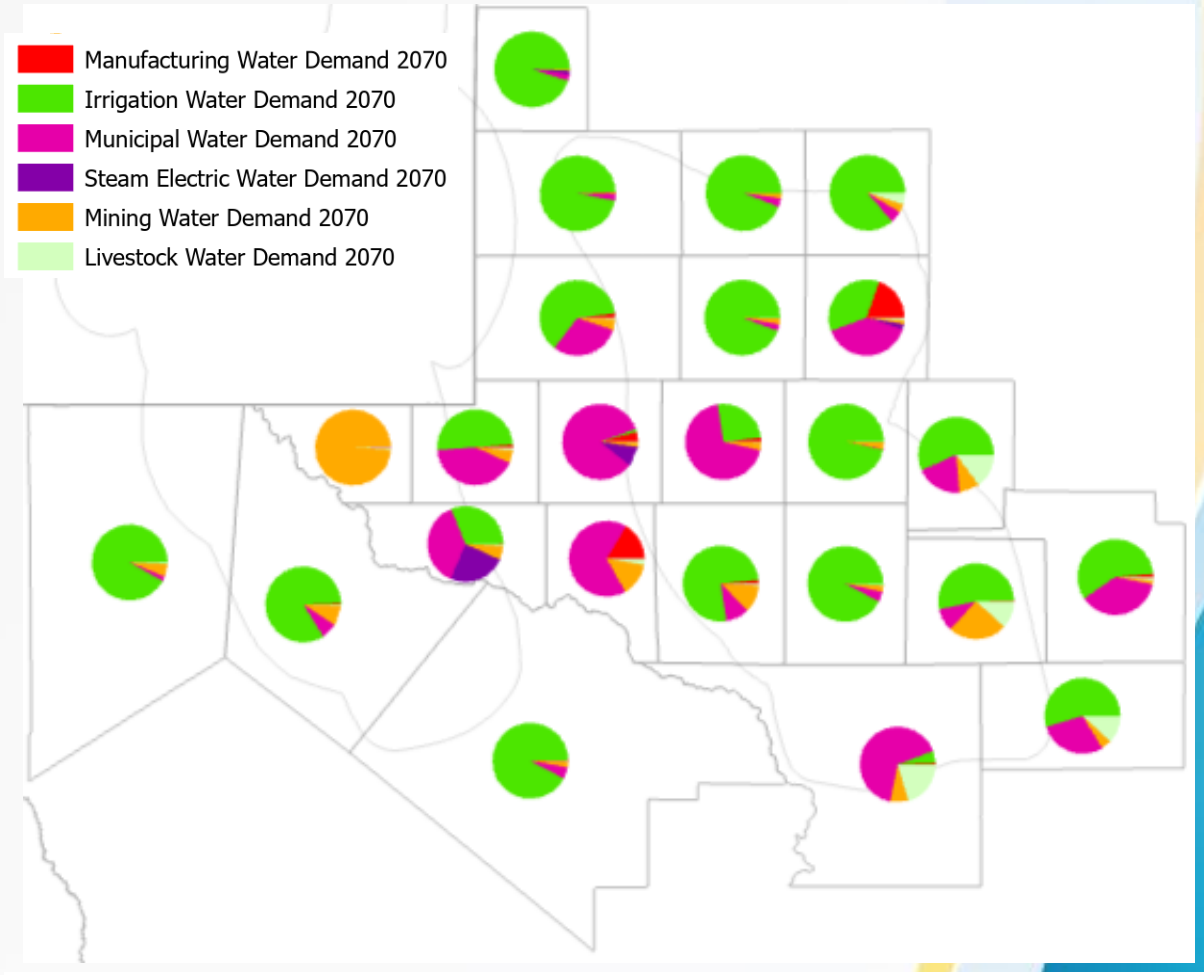
2020 Total Water Demand

Permian Delaware & Midland Basin Counties (24)

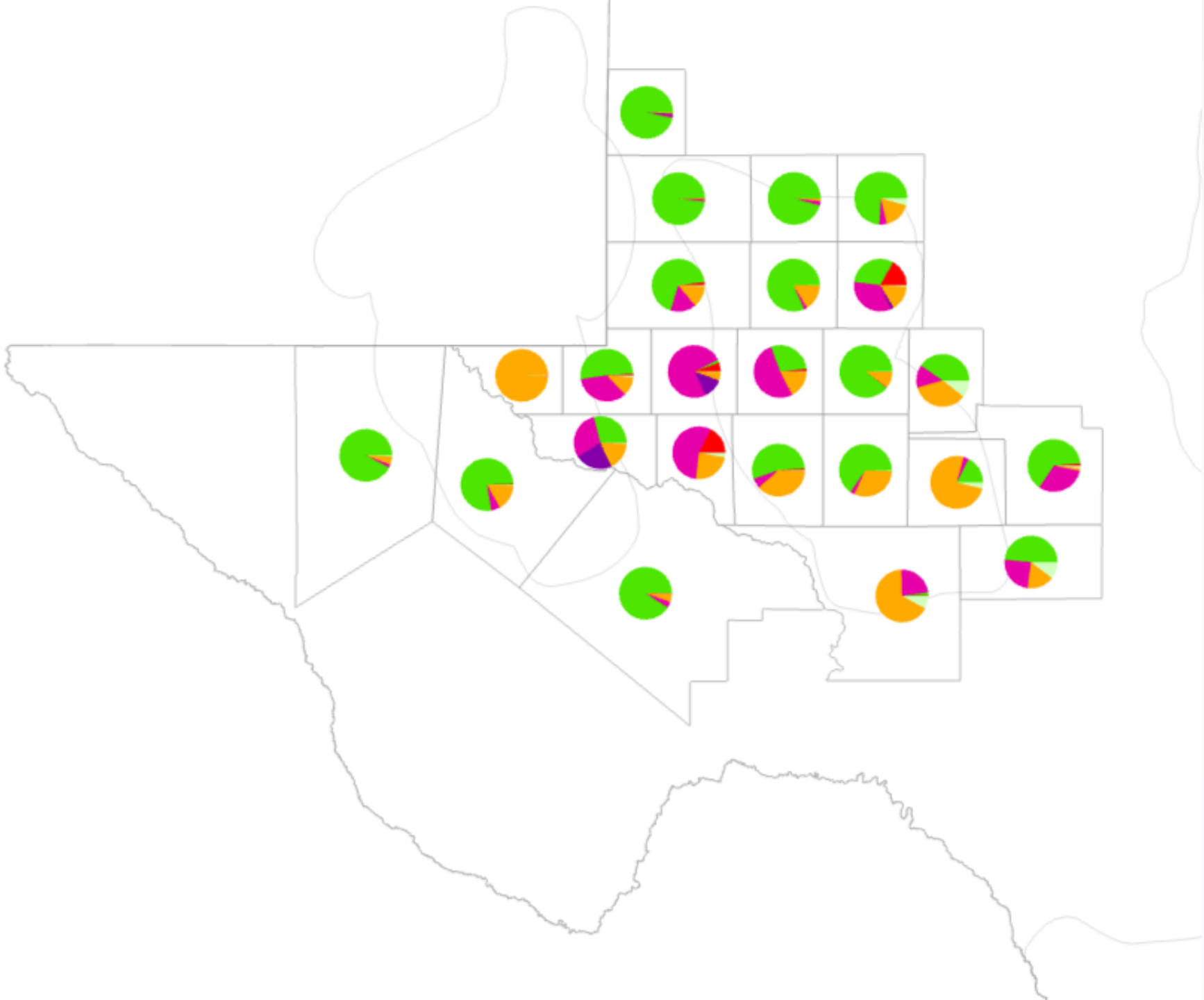


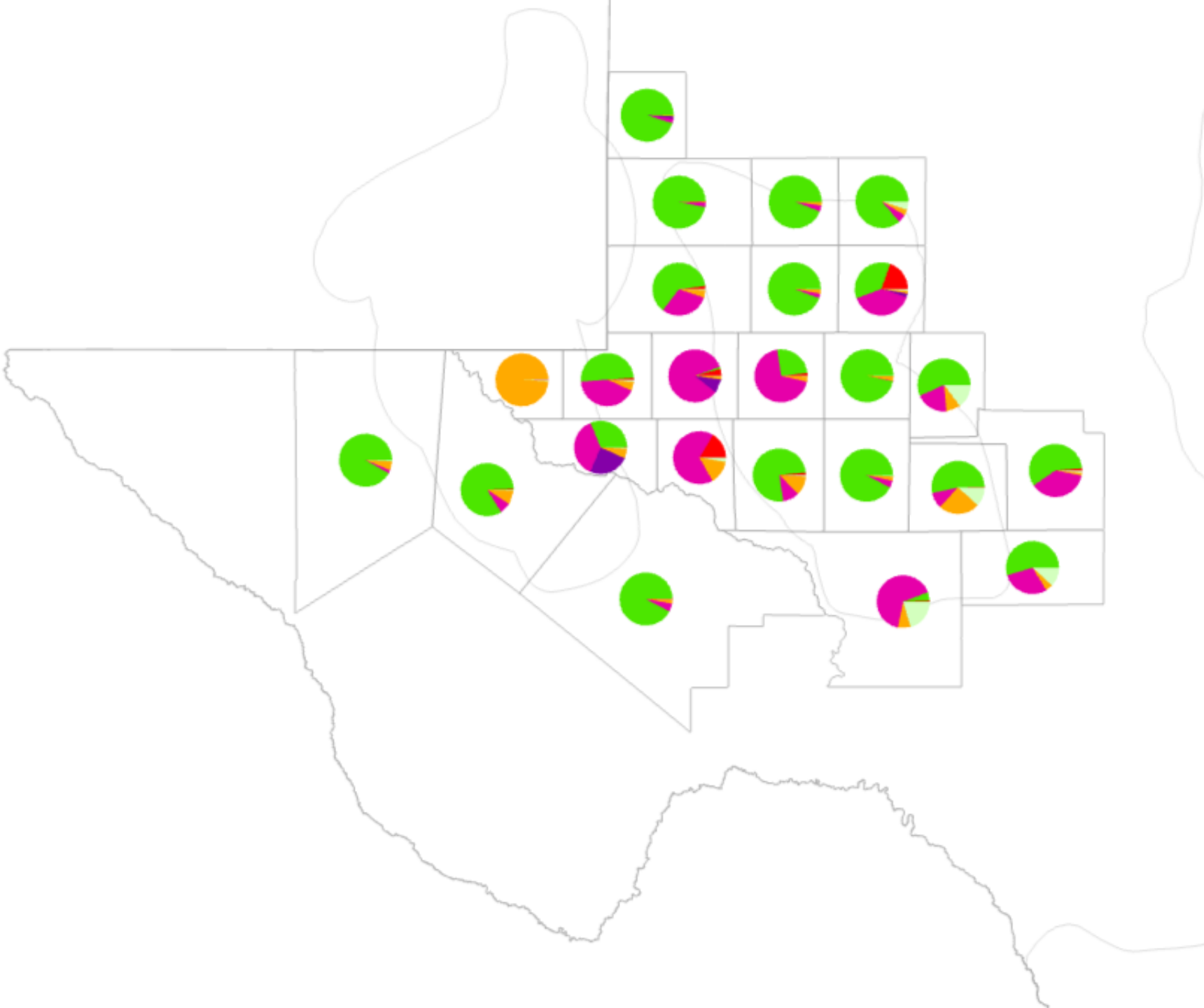
2070 Total Water Demand

Permian Delaware & Midland Basin Counties (24)



Note the decline in the Orange Mining Demand and increases in Green Irrigation and Magenta Municipal Demands.


Texas Water Plan 2022
Water Demand Categories2020
Manufacturing Water Demand 2020
Irrigation Water Demand 2020
Municipal Water Demand 2020
Steam Electric Water Demand 2020
Mining Water Demand 2020
Livestock Water Demand 2020

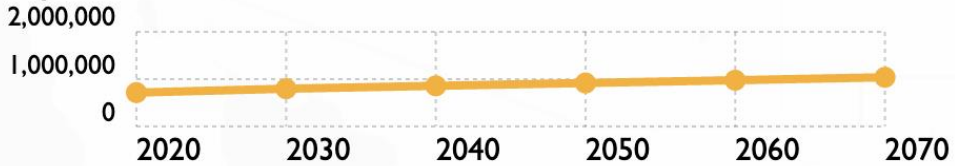

Texas Water Plan 2022
Water Demand Categories2070
Manufacturing Water Demand 2070
Irrigation Water Demand 2070
Municipal Water Demand 2070
Steam Electric Water Demand 2070
Mining Water Demand 2070
Livestock Water Demand 2070

View data for Planning Region Select Region GO

Planning Region F

Regional Water Planning Area in Texas

Population



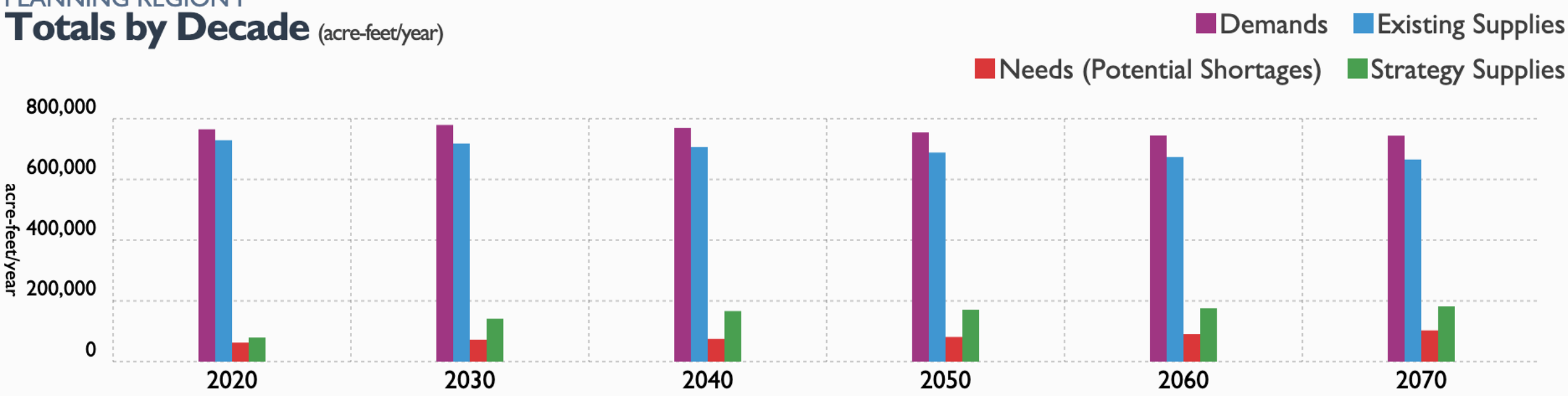
SHOW DATA TABLE

The Region F Regional Water Planning Area is located in the Edwards Plateau encompassing 32 counties. Intersected by the Pecos River to the south and the Colorado River to the north, most of the region is located in the upper portion of the Colorado River Basin and Pecos portion of the Rio Grande Basin; a small portion is in the Brazos Basin. The major cities in the region include Midland, Odessa, and San Angelo. The 2021 Regional Water Plans can be found on the TWDB website at: http://www.twdb.texas.gov/waterplanning/rwp/plans/2021/index.asp.

Region F

PLANNING REGION F

Totals by Decade (acre-feet/year)

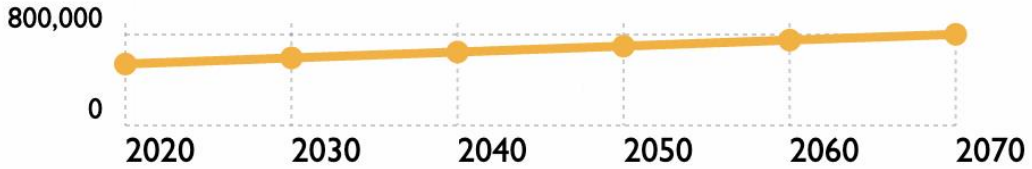


	2020	2030	2040	2050	2060	2070
Demands	765,150	779,505	769,525	755,112	744,947	744,366
Existing Supplies	729,263	718,312	706,607	688,587	673,716	665,624
Needs (Potential Shortages)	62,592	71,866	75,088	81,200	90,974	102,788
Strategy Supplies	79,345	141,281	166,483	171,034	175,868	181,964

Planning Region O

Regional Water Planning Area in Texas

Population



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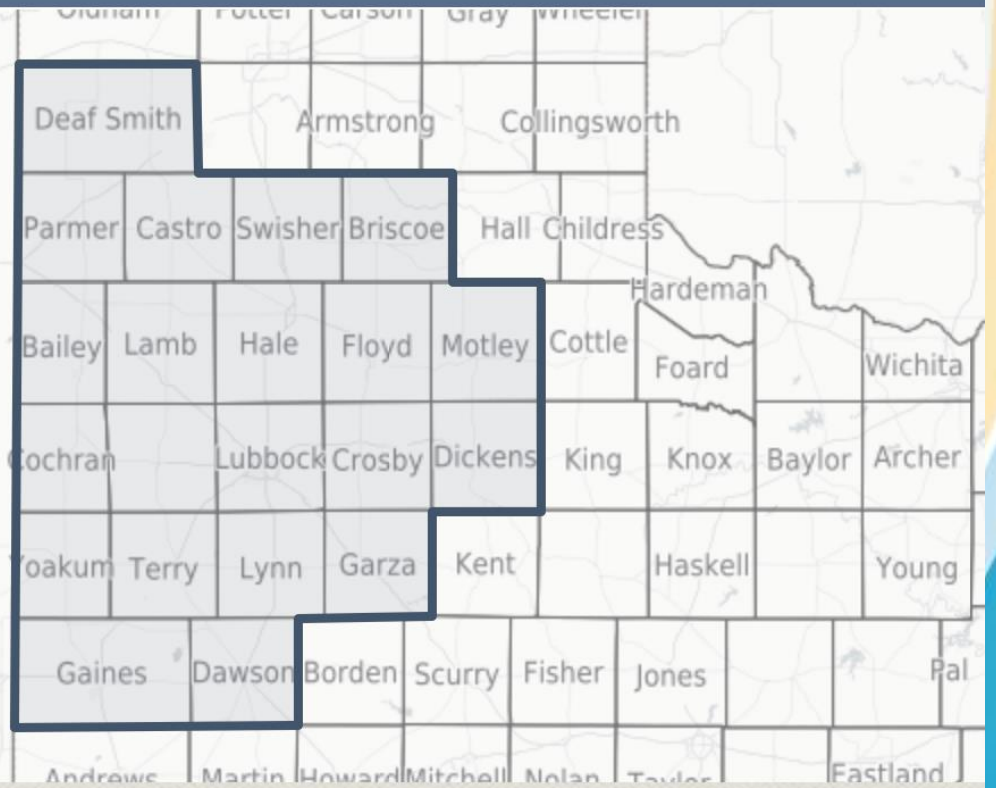
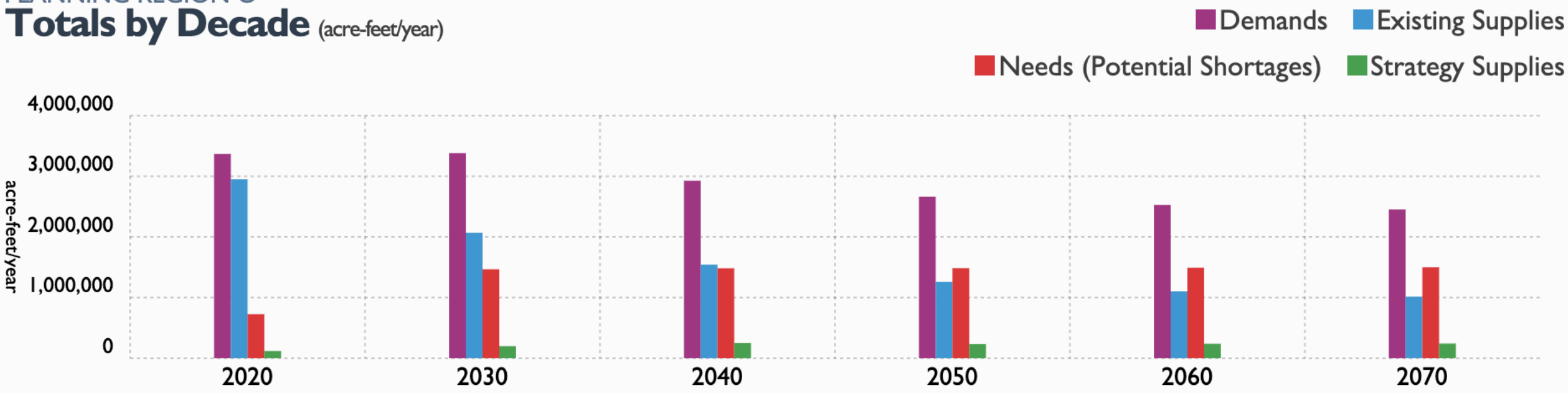


The Llano Estacado (Region O) Regional Water Planning Area encompasses 21 counties in the southern High Plains of Texas. The region lies within the upstream parts of four major river basins (Canadian, Red, Brazos, and Colorado). Major cities in the region include Lubbock, Plainview, Levelland, Lamesa, Hereford, and Brownfield. The 2021 Regional Water Plans can be found on the TWDB website at: http://www.twdb.texas.gov/waterplanning/rwp/plans/2021/index.asp.

REGION O

PLANNING REGION O

Totals by Decade (acre-feet/year)



	2020	2030	2040	2050	2060	2070
Demands	3,367,953	3,381,960	2,927,996	2,663,087	2,526,590	2,452,931
Existing Supplies	2,951,798	2,067,674	1,543,044	1,257,514	1,103,438	1,014,486
Needs (Potential Shortages)	726,021	1,466,543	1,483,178	1,484,990	1,492,860	1,499,897
Strategy Supplies	119,393	199,247	249,021	235,684	239,437	241,763

So what is produced water's real challenge related to ag use?

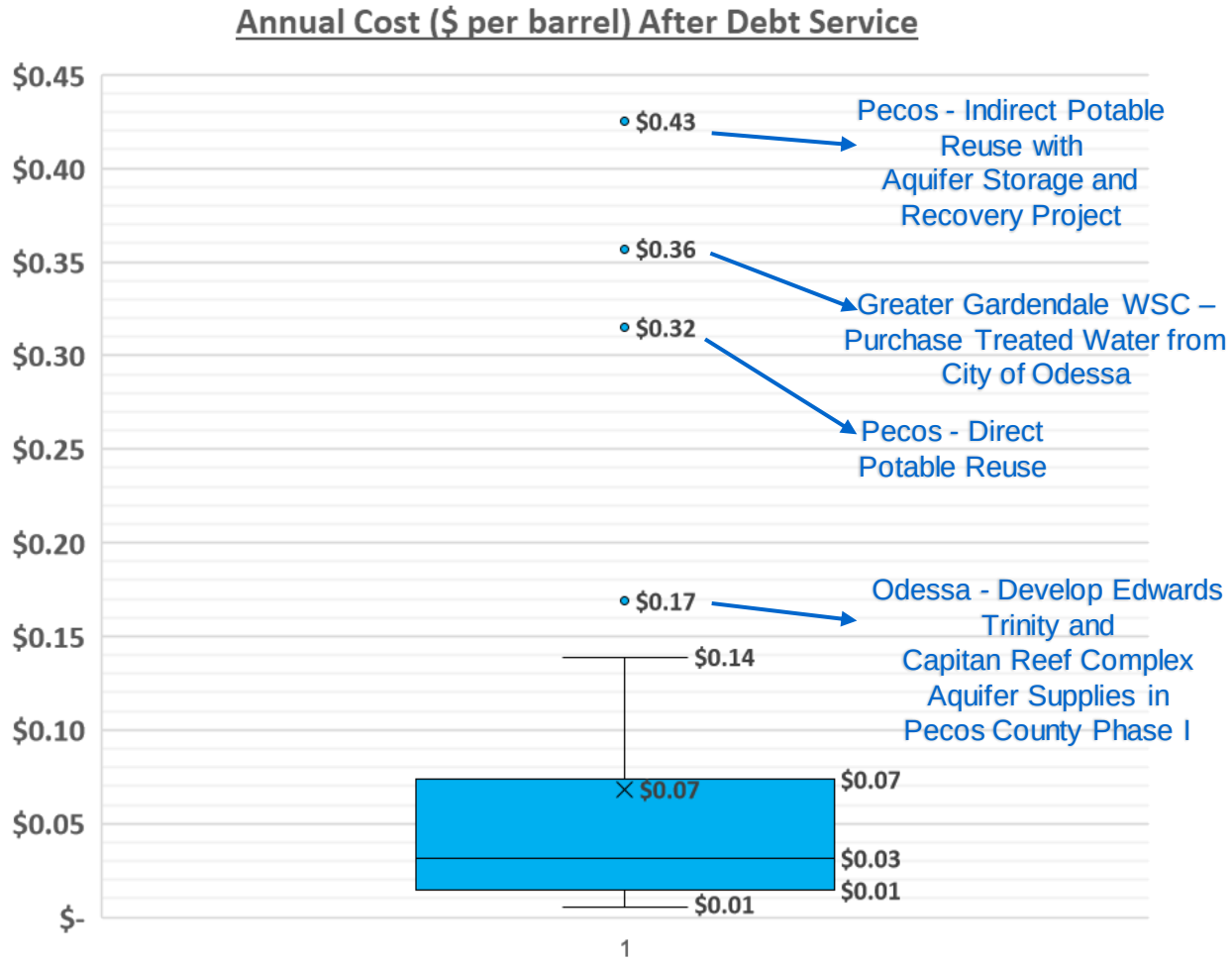
Economics of Beneficial Use

Treatment Economics

- Disposal Costs: Average range of **$0.60-0.70/bbl**
- Targeted competitive marginal treatment cost: **$1.00/bbl**
- Current estimated average treatment cost: ~**$2.55/bbl**

Water Economics

- Average cost of irrigation: **$0.03/bbl**
- Average cost of water supply projects during debt service, Region F: **$0.20/bbl**
- Average cost of water supply projects after debt service, Region F **$0.05-0.07/bbl**
- Survey of municipal water cost (treatment, distribution, administration) Region F: **$0.22/bbl**
- Survey of municipal water rates (all rate classes), Region F: **$0.40/bbl**



Looking Ahead

- RFP released January 2024 for a target 1Q 2024 start
- TTU setting up plant test beds on campus for treated produced water application
- Developing standards for pilot project testing as well as general industry standards for review by membership and state agencies
- Utilizing an external firm for current and projected water market evaluation in the Permian Basin
- Two new faculty joining the Consortium: Dr. Shane Walker (technical lead) and Dr. Ryan Williams (economics lead)
- Coordinating with Dr. Krishna Jagadish in plant and soil science to develop land application protocol and future pilot project preparations

Contact

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