TEXAS BIOFUEL SUPPLY NETWORK OPTIMIZATION

BY

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SUPPLY NETWORK

254
County
Suppliers

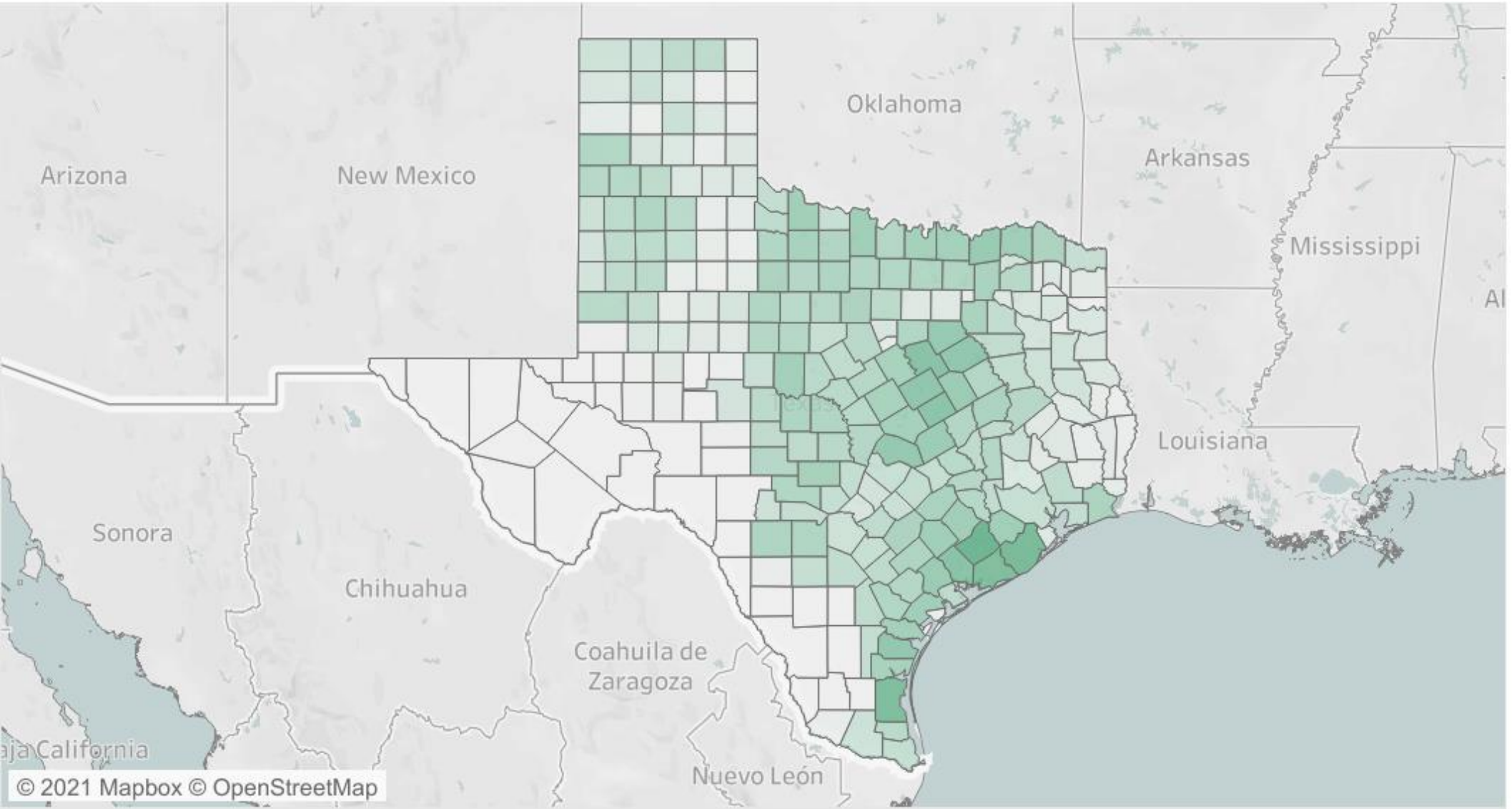
1303
Potential
Hubs

167
Potential
Biorefineries

ASSUMPTIONS

- The centroid of the county is considered as the county supplier
- Road and Rail distances are not accounted for since they correlate with the costs
- 2nd Law of Thermodynamics is ignored since there is no energy loss from Biomass conversion to liters
- Cleaned data errors and redundancies are considered as bonuses and policy issues

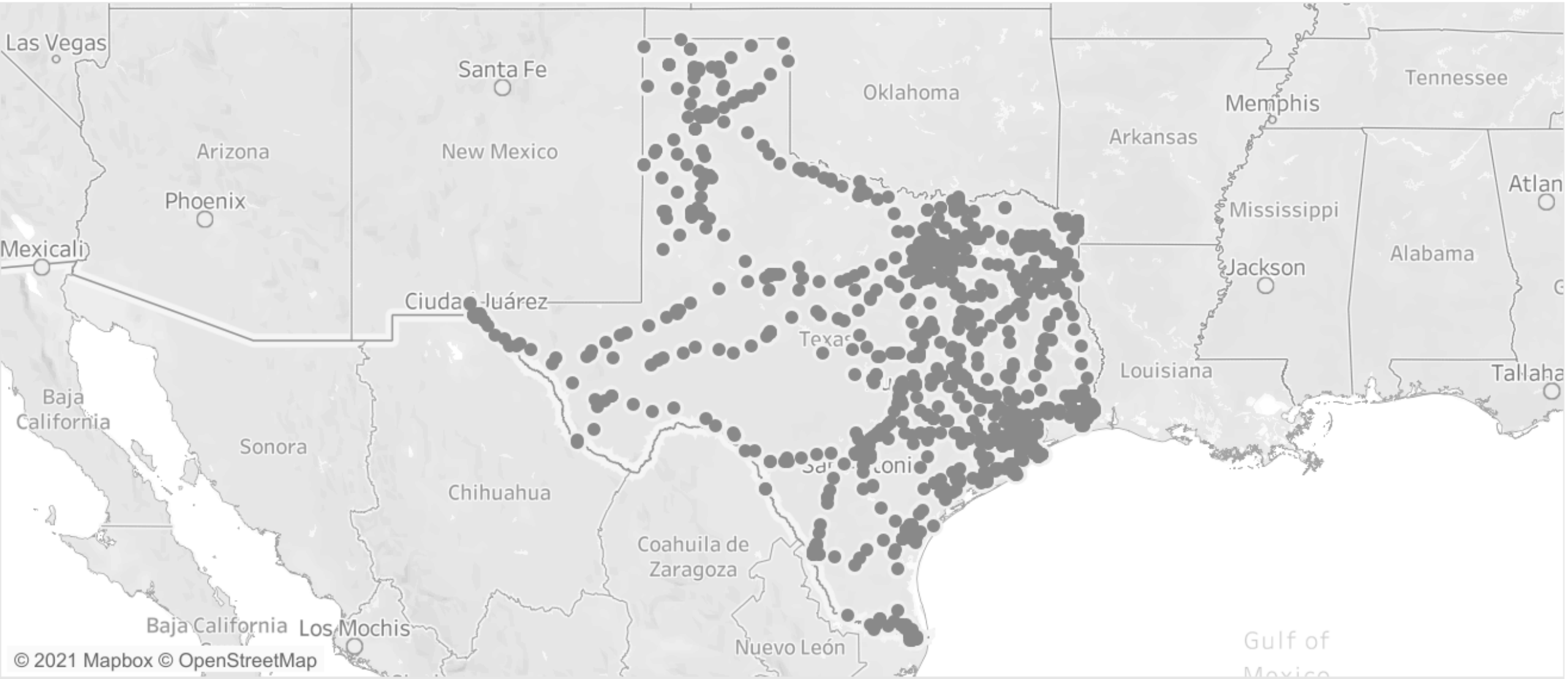
Supply by County



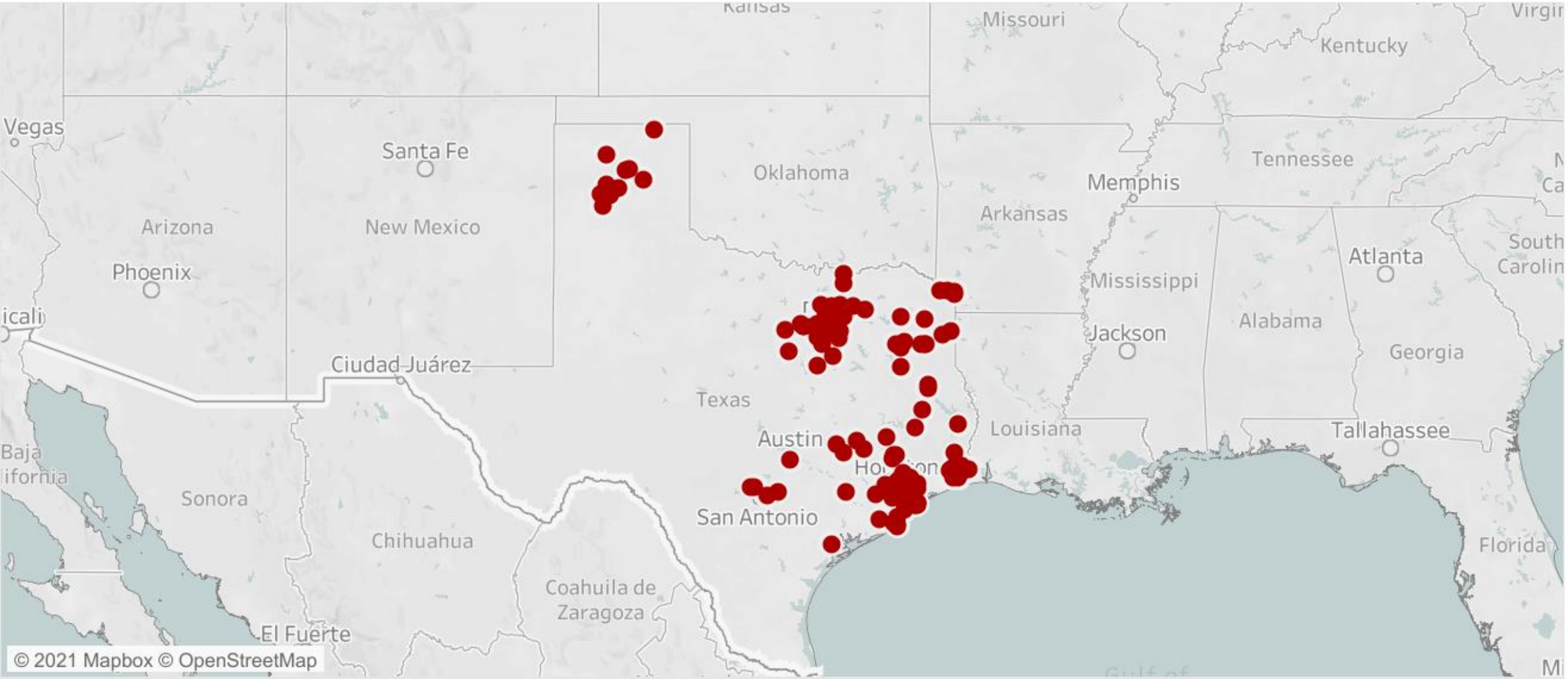
Supply

0 45,431

Potential Hubs



Potential Plants



PARAMATERS

HUB PARAMETERS	
Investment cost	$ 3,476,219
Preprocessing capacity	300,000 Mg
PLANT PARAMETERS	
Investment cost	$ 130,956,797
Annual conversion capacity	152,063,705 liters
Conversion yield	232 liters/Mg
DEMAND	
Network demand	1,476,310,602 liters

Note: All the parameters are considered for a period of time of one year.

CALCULATIONS

From the datasets and parameters:

Total Supply = 3,053,377.71 Mg

Demand in Mg = Network demand in liters / Conversion yield

= 1,476,310,602 liters / 232 liters/Mg

= 6,363,407.77 Mg

Since the demand supersedes the total supply, a third-party supplier is to be introduced:

3rd party Supply = Demand – Total Supply = 3,310,030.06 Mg

CALCULATIONS

- The Average Road Cost is used as the estimated 3rd party cost per unit

  = $ 30,488,893.10 / 330,962 = $92.122 ≈ $92

- Number of plants to meet demand

  = Demand / Annual Conversion Capacity = 9.7085 ≈ 10 plants
- Total Plant Investment Cost = 10 x $ 130,956,797 = $ 1,309,567,970
- Number of hubs to meet plant requirement

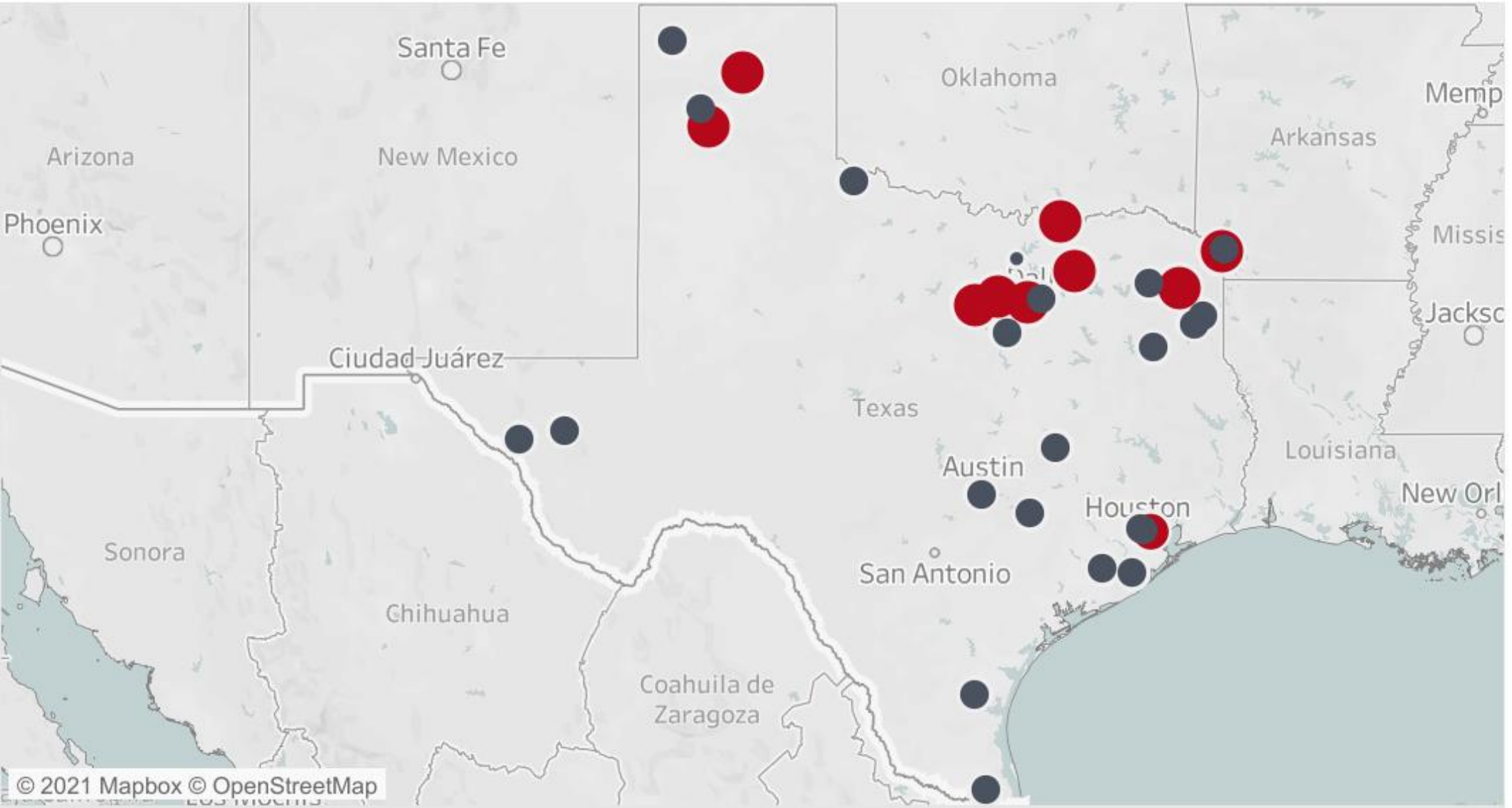
  = Demand / Hub Capacity = 21.21 ≈ 22 hubs
- Total Hub Investment Cost = 22 x $ 3,476,219 = $ 76,476,818

RESULTS

	hub_status	road_supply
hubs		
512	1.0	300000.000
17246	1.0	300000.000
17318	1.0	300000.000
17387	1.0	300000.000
17399	1.0	300000.000
17482	1.0	300000.000
17517	1.0	300000.000
17623	1.0	300000.000
17695	1.0	63407.767
17850	1.0	300000.000
17886	1.0	300000.000
17909	1.0	300000.000
17969	1.0	300000.000
18006	1.0	300000.000
18012	1.0	300000.000
18097	1.0	300000.000
18103	1.0	300000.000
18119	1.0	300000.000
18255	1.0	300000.000
18264	1.0	300000.000
18307	1.0	300000.000
18483	1.0	300000.000

	plt_status	rail_supply
plants		
543	1.0	655447.00
9088	1.0	655447.00
9091	1.0	655447.00
9104	1.0	655447.00
9142	1.0	655447.00
9167	1.0	464384.73
9188	1.0	655447.00
9203	1.0	655447.00
10060	1.0	655447.00
10061	1.0	655447.00

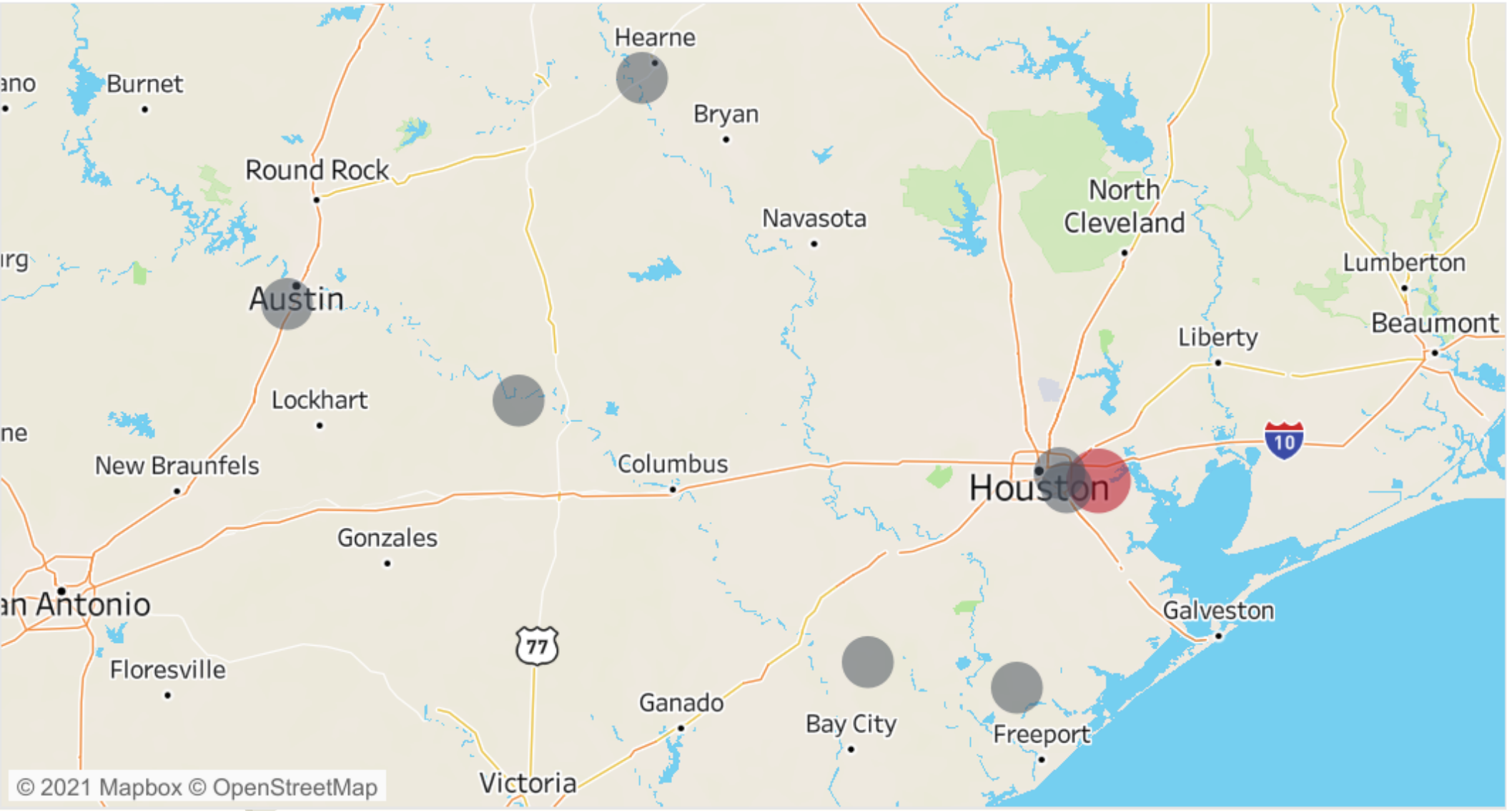
Optimal Hubs and Plants



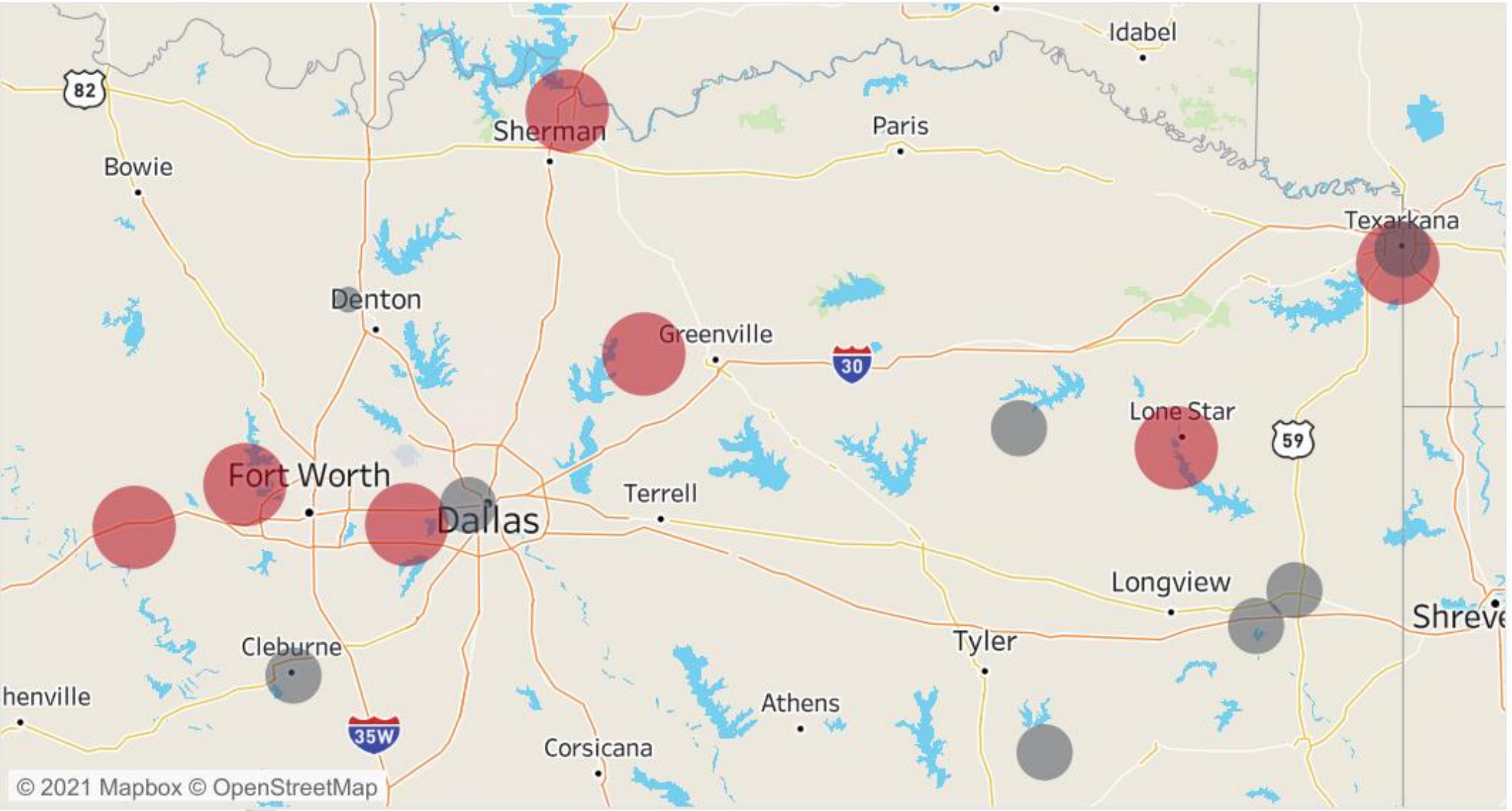
Supply
63,408
200,000
400,000
655,447

facility
hubs
plants

South East Map



East Map



Supply
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200,000
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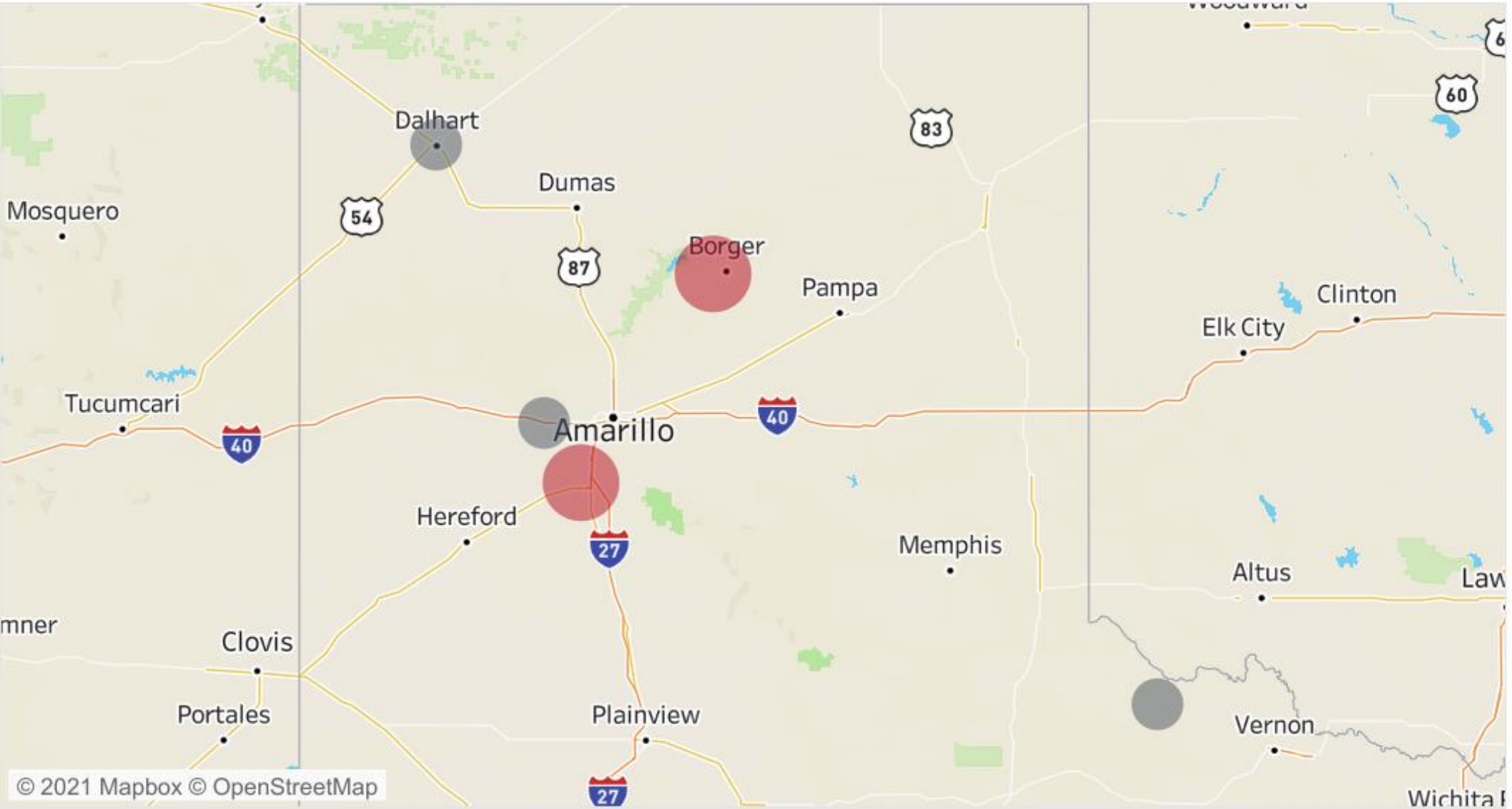
655,447

facility
hubs
plants

North Map



Supply
63,408
200,000
400,000
655,447

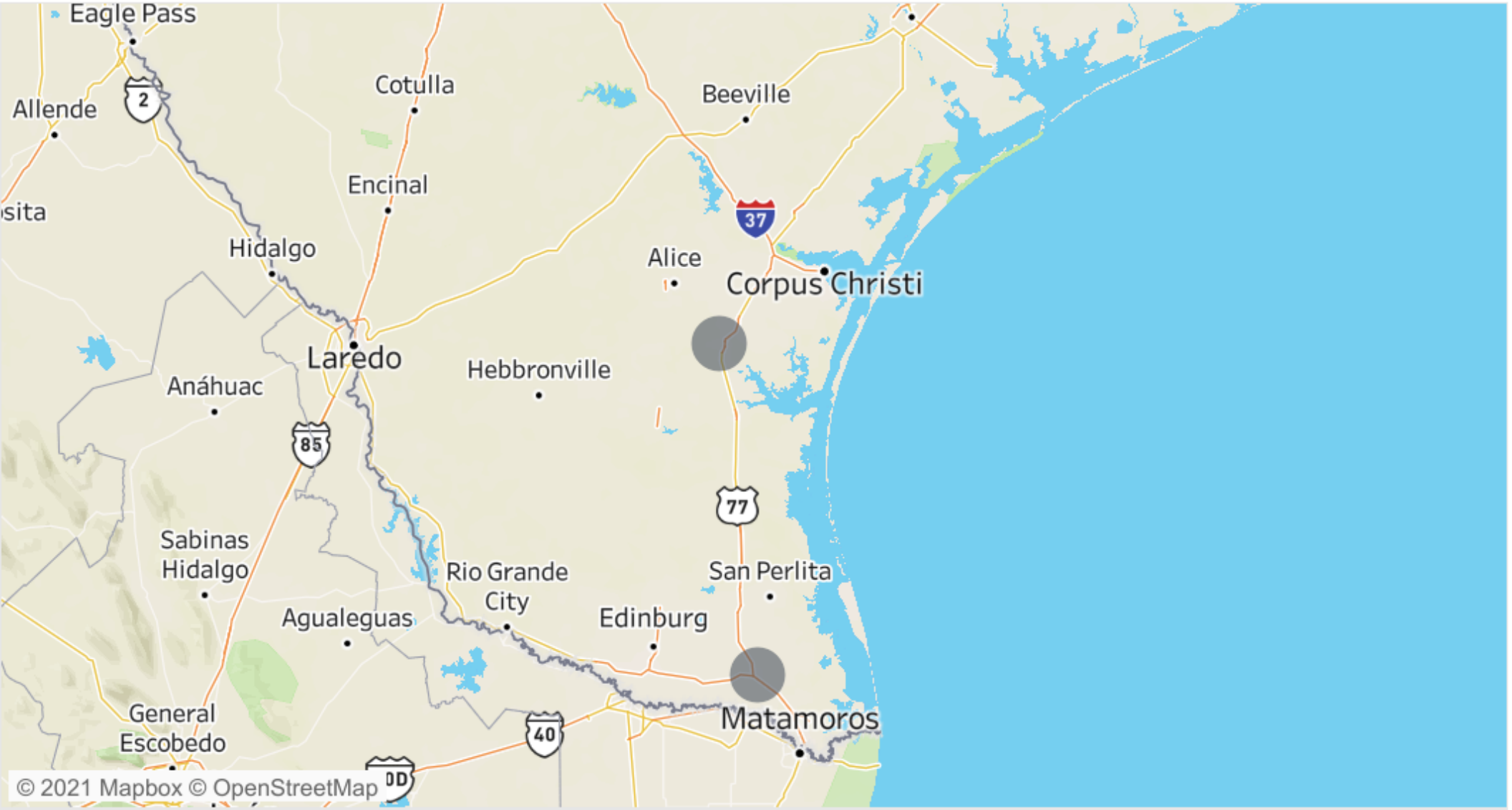
facility
hubs
plants

West Map

Supply
63,408
200,000
400,000
655,447

facility
hubs
plants

South Map



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facility
hubs
plants

CONCLUSION & RECOMMENDATIONS

- The optimal number of **22 hubs** and **10 plants** were obtained for an overall network (investment and transportation) cost of **$1,725,868,653,500**

- With **0.025%** and **0.215%** error rate from the TX_roads and TX_railroad datasets these results were retrieved, but with more accurate data better results would have been reached.