



Potential Windfarm Locations in South Texas

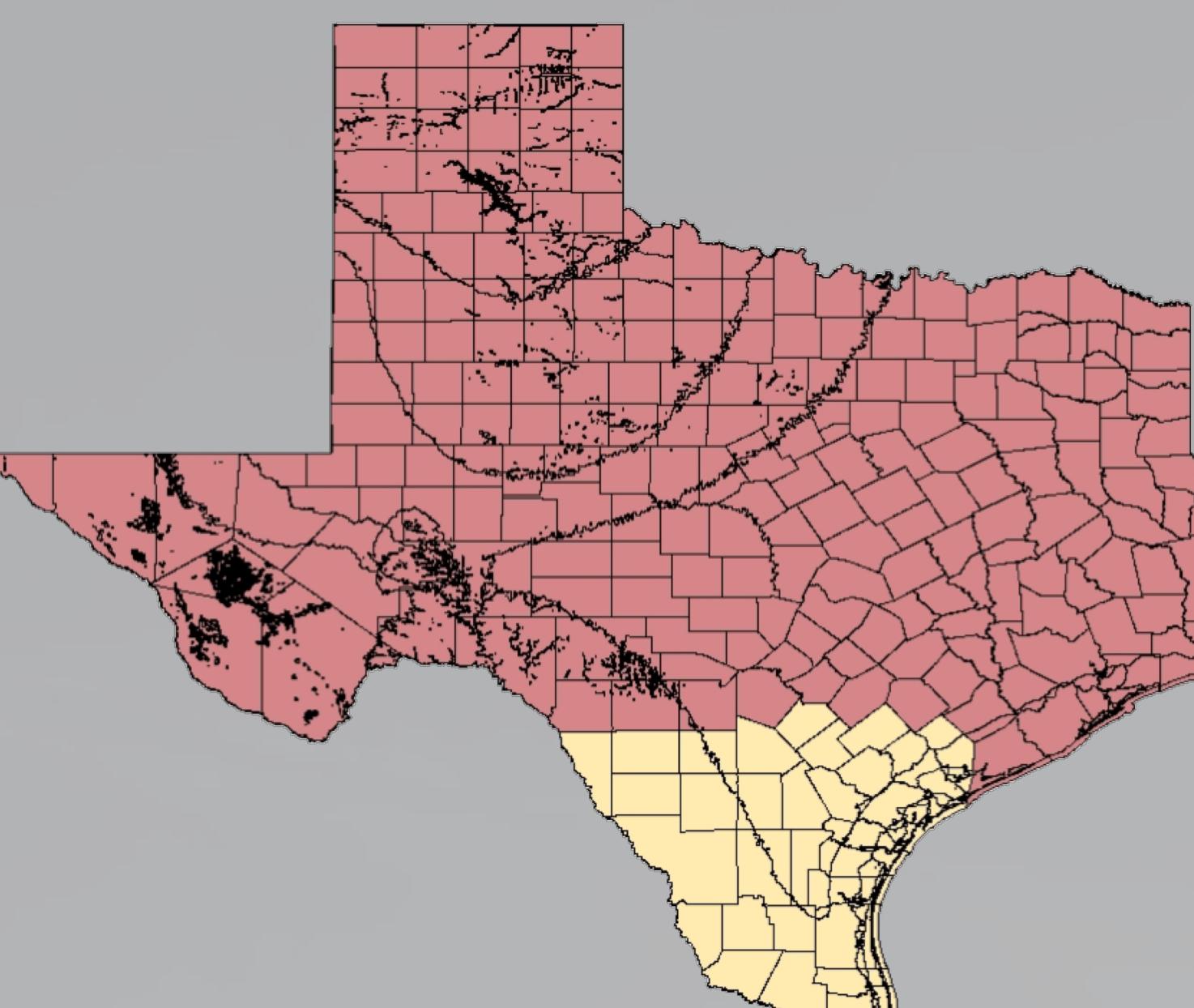


Background: The U.S. is highly dependent on fossil fuels and coal for its energy sources. The Texas electrical grid is about 75% dependent on coal and natural gas, both of which are nonrenewable resources that emit CO₂, NO_x, and SO_x, compounds when burned. Energy maps show that Texas has the highest potential wind capacity than any other state, and there is potential for far more wind farm installations. There have been great movements toward using wind and solar power energy in the U.S. over the last decade. One of the quickest growing areas is the South Texas region which is known for its flat land and perpetual wind. Some windfarms already exist in this area, but some energy companies may be looking to expand into this area and provide more options for consumers.

Purpose: To find suitable land in the South Texas region for an industrial windfarm.

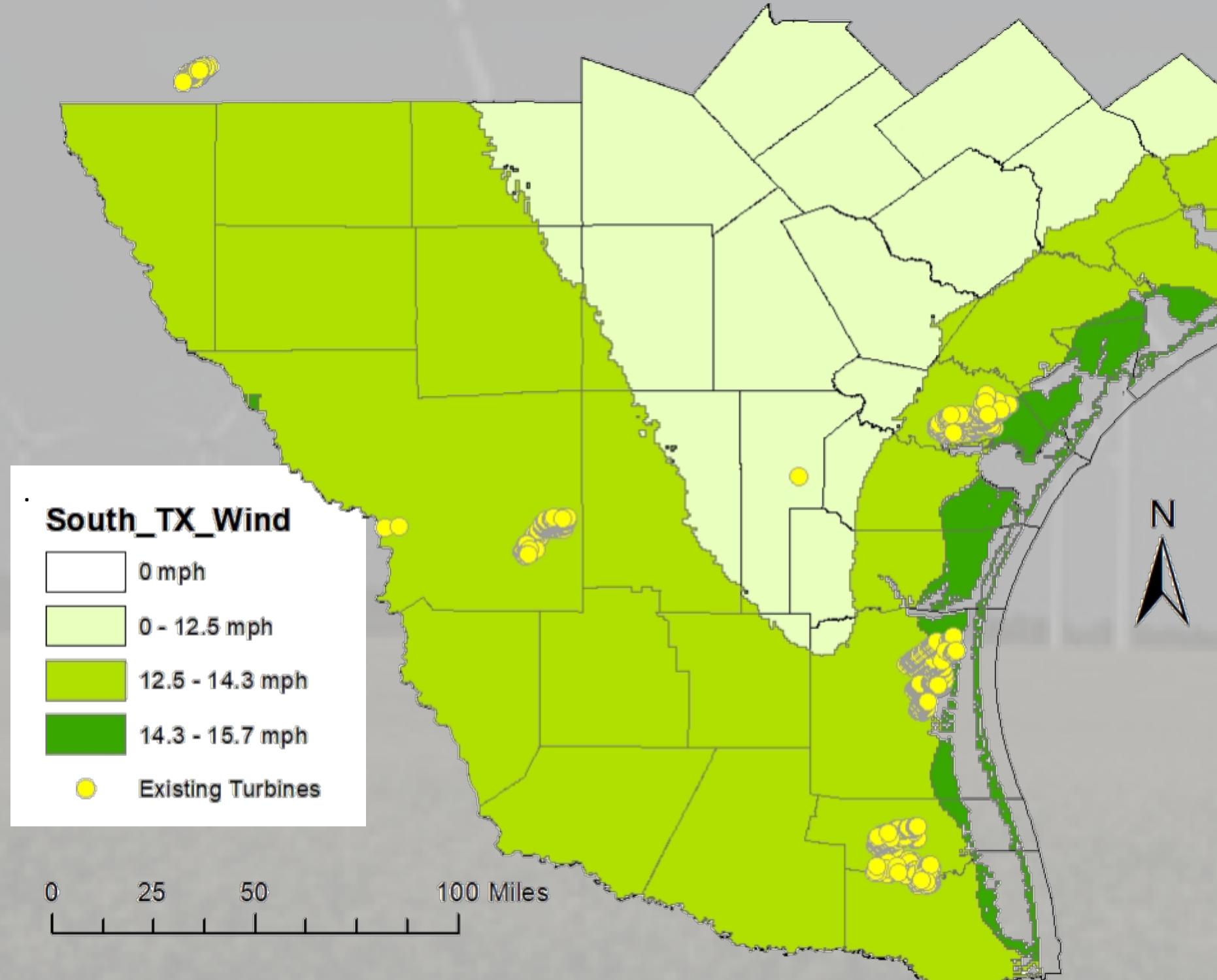
Criteria: Turbines must be at least 7 rotor diameters away from each other and 1000 feet away from urban areas. Profitability requires a minimum average windspeed of 13 mph. Ideal locations should service a maximum number of people and contain a minimum of 50 turbines in the relative area.

Turbine Specs: GE 1.5 megawatt models. Blade rotor diameter is 232 feet.

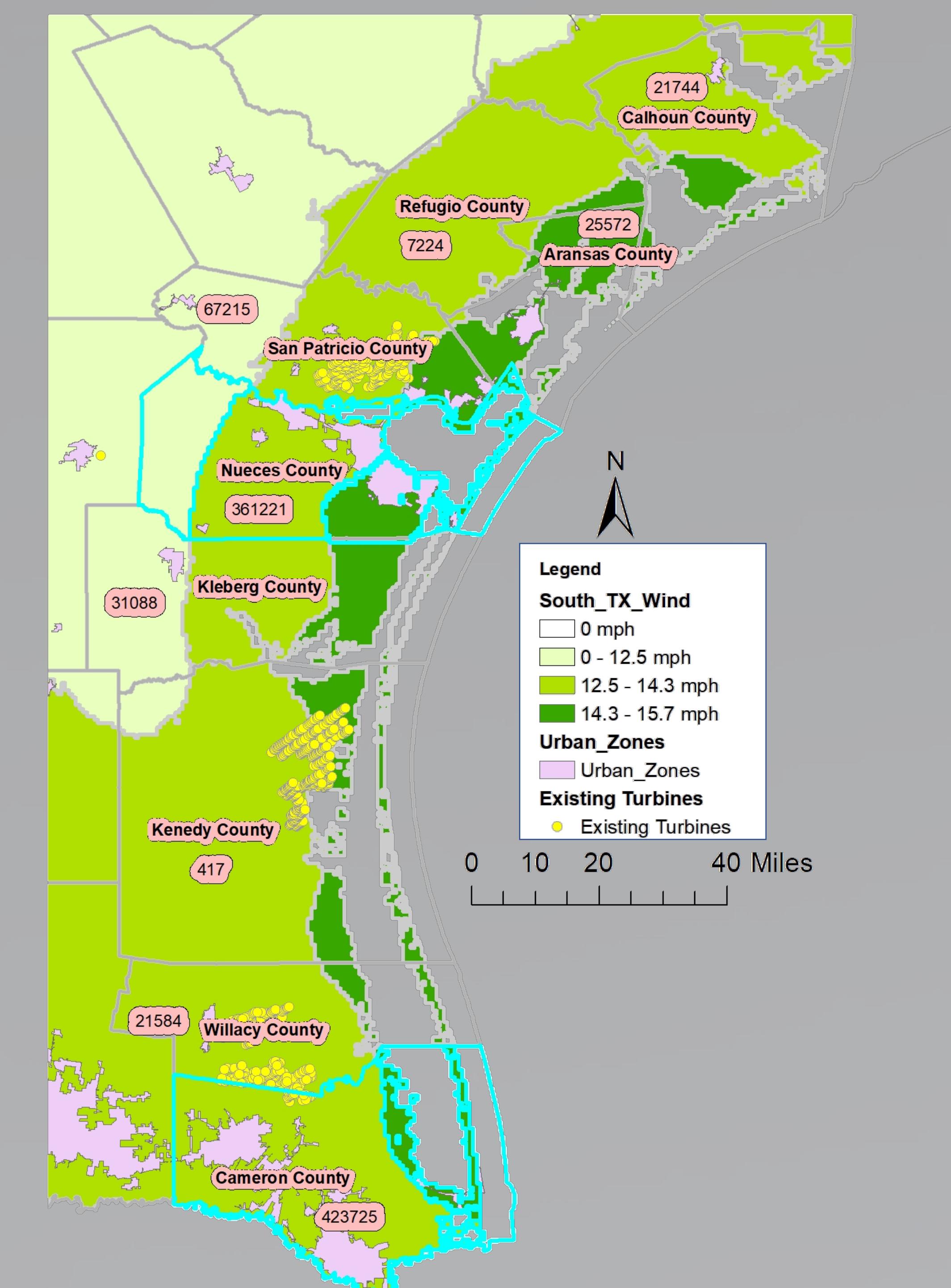


1: South Texas is divided into its wind power regions based upon average wind speed. Light colored zones are low power regions while darker areas have more available power. Existing turbine placement is also considered as competition zones that should be avoided as it could result in lower profitability.

South Texas Wind Regions

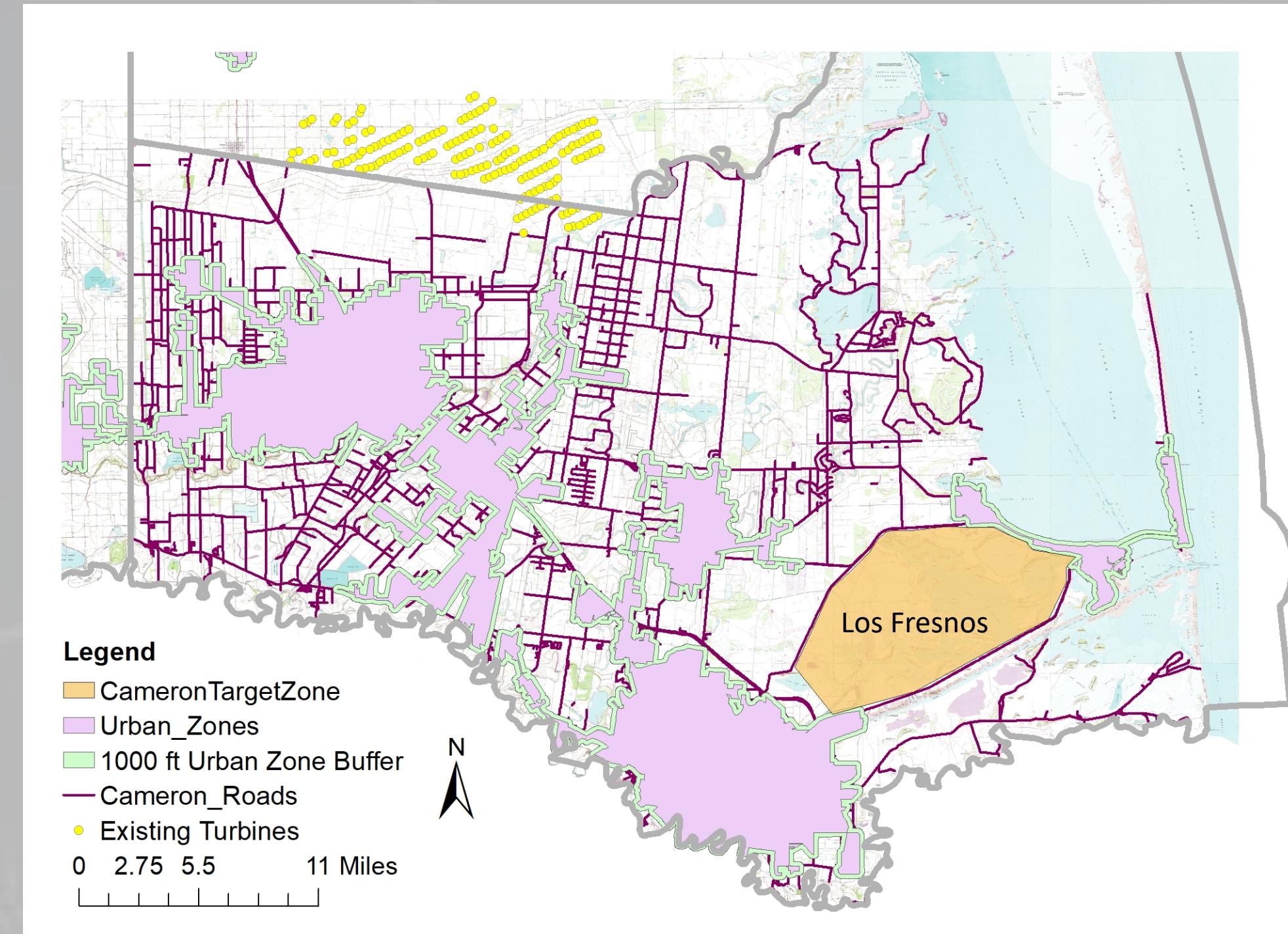


2017 County Populations



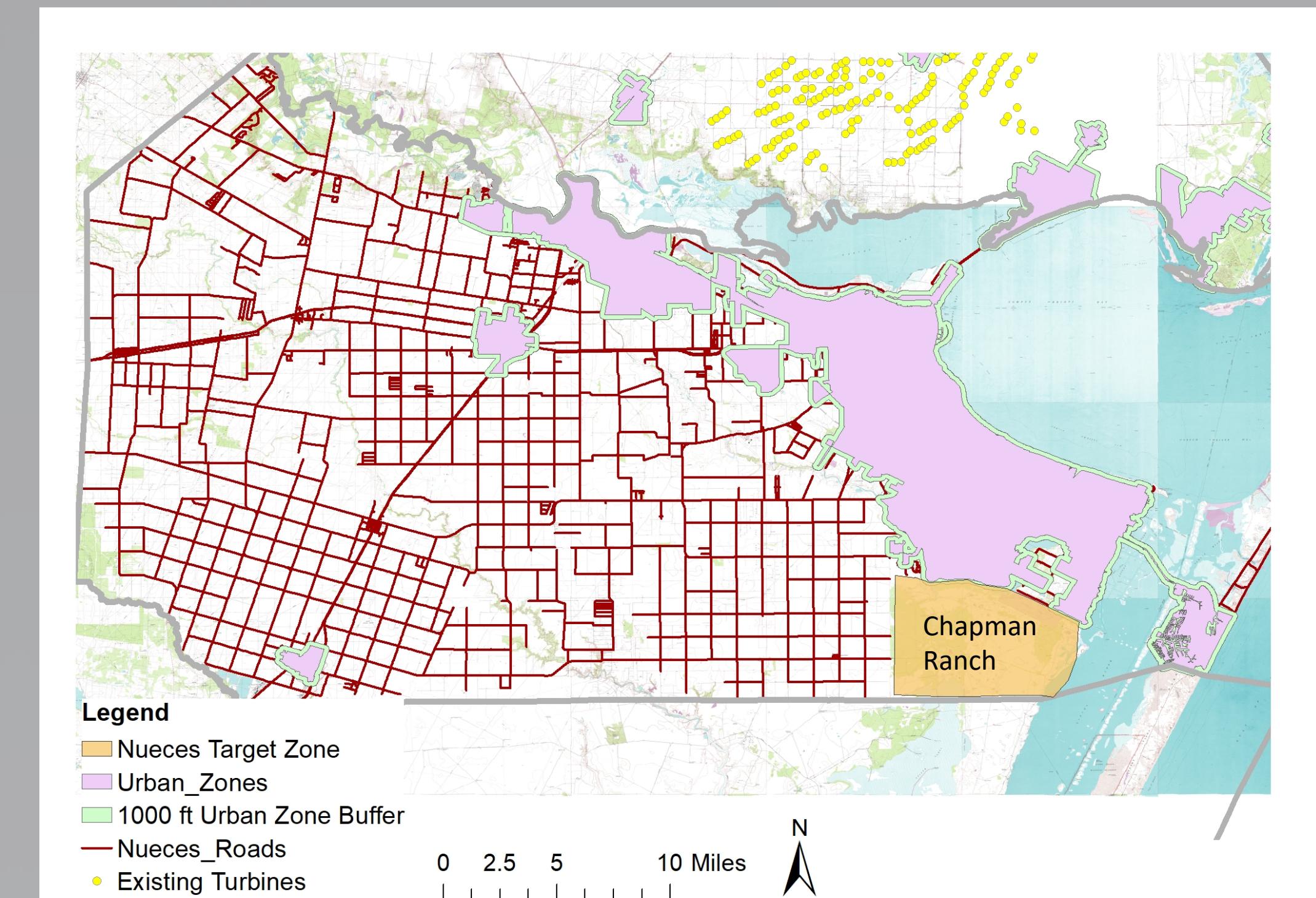
2: The projected 2017 population from the 2010 census was calculated for the target regions near areas of highest wind speed in South Texas. The selected counties indicate the two highest population areas. These two counties also do not have any existing windfarms making them ideal for a competitive company.

Cameron County Urban Zones



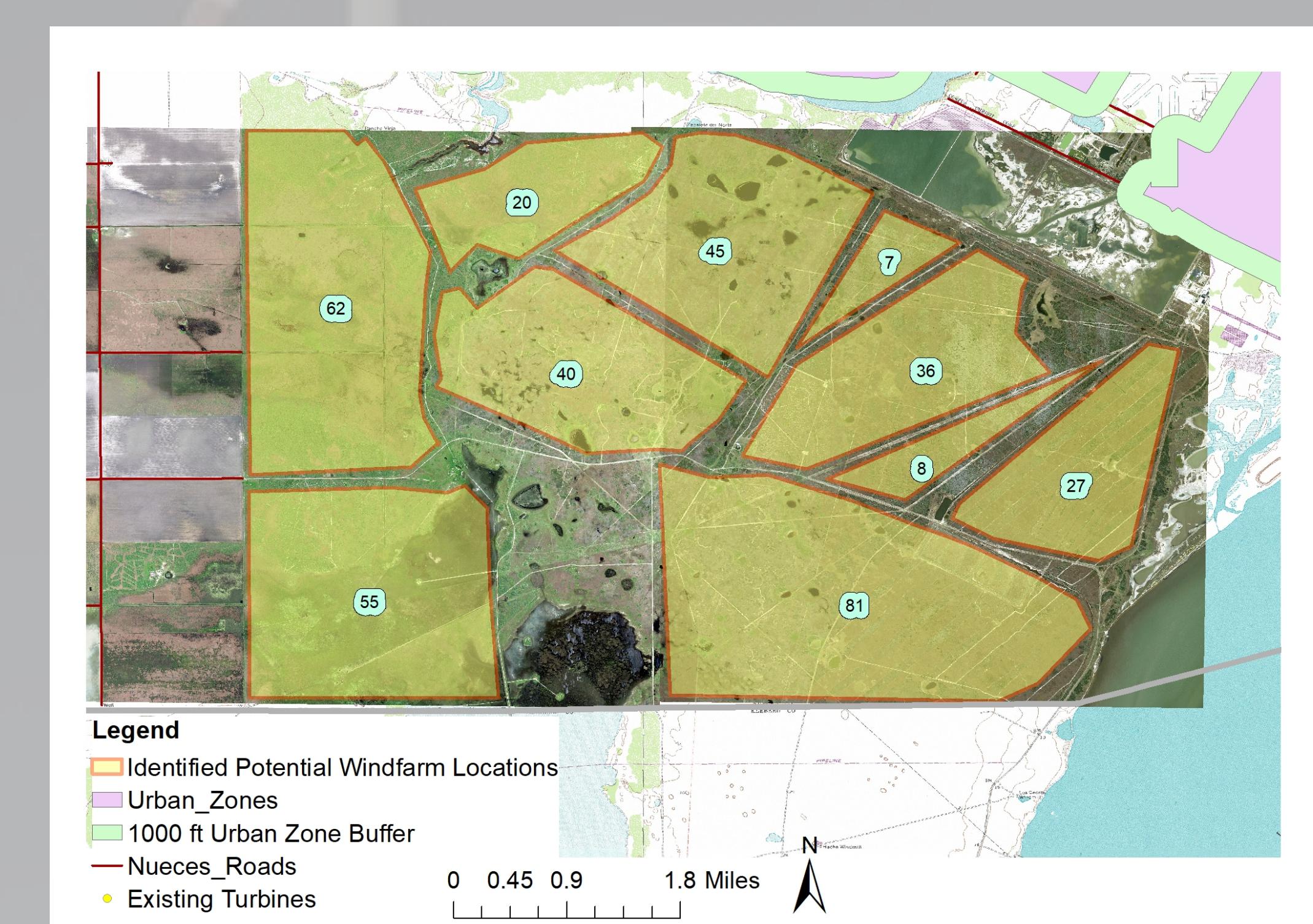
3: Cameron county has the highest population. This map shows urban areas within Cameron County and the 1000ft buffer from the urban areas. This county is densely populated and does not have many suitable regions for windfarms. The Los Fresnos area in the Southeast corner of the county has suitable land area, but has too many water ponds as shown by the topographic map overlay.

Nueces County Urban Zones



4: The area of second highest estimated population is Nueces County. This region has fewer urban zones, the primary city is Corpus Christi. The Southeast corner of the county has a large area known as Chapman Ranch / Pita Island which mainly have farm access roads. Overlays include a road map which indicate populated areas.

Potential Windfarm Locations



5: Nueces County's Chapman Ranch area has the fewest obstacles and the most infrastructure. The area is also very close to the Corpus Christi urban area creating fewer energy losses due to distance. The highlighted areas conform around the various access roads and water bodies. This area is also in the area of high wind power above the minimum 13 mph. The aerial overlay map shows the topography including seasonal waterbodies due to rain and farms. The chosen areas avoid those water bodies and are away from major roads passing through farming areas. This area is owned by a single family as it was once a parcel from King Ranch. The city of Corpus Christi has tried to implement a windfarm project previously, allowing for city ordinances in favor of wind turbines.

$$\text{Number of Turbines} = \frac{\text{Area Available}}{\frac{1856^2 \sqrt{3}}{4}}$$

Turbine Configuration
1 Turbine

Discussion: The chosen area is only one of many options within the state of Texas. The coastline regions clearly have the highest wind power potential, but also come with drawbacks. Coastal regions are prone to salt-water weathering, flooding, and hurricanes. Notice that the wind map indicates the dark green color has a higher average windspeed than the minimum 13 mph deemed acceptable. The mid-tone areas of 12.5 – 14.3 mph can also contain windfarms and may have larger available areas. The South Texas Region is known for its “flat as a pancake” slopes and elevation close to or at sea level. Populated urban areas were avoided due to common city ordinances. Road map overlays were used to indicate areas where people might complain about windmills disturbing the peace or being too close to homes. Areas not marked with major roads are usually farms and ranches which are easily used for wind turbine farms.

As such, my final recommendation is the Chapman Ranch area of Nueces County due to its proximity to urban areas, the high wind potential, and the size of available area. These areas can contain a total of 381 turbines jointly using the formula and configuration illustrated.

References and Data Sources:

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- Hoen, B.D., Diffendorfer, J.E., Rand, J.T., Kramer, L.A., Garrity, C.P., Hunt, H.E. (2018) United States Wind Turbine Database. U.S. Geological Survey, American Wind Energy Association, and Lawrence Berkeley National Laboratory data release: USWTDB V1.2 (October 1, 2018). <https://eerscmap.usgs.gov/uswtdb>.
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Projected Coordinate System: NAD 1983 (2011)

Texas South FIPS 4205 U.S. Ft

Projection: Lambers Conformal Conic

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