

# LOCATING "AWAY"

## Identifying Suitable Sites for an Anaerobic Digestion Facility on Cape Cod, Massachusetts

### Background

In 2014 Massachusetts established a Commercial Food Waste Ban, requiring businesses producing at least 1 ton of food waste each week to divert the waste from the traditional waste stream through food rescue, composting, anaerobic digestion, feeding animals, and industrial processing. Statewide there are over 1,700 food waste generating facilities that must comply with the ban. Across the state there are dozens of businesses that divert food waste, but they are not necessarily located across the state based on the location of food waste generators.

There is a significant gap between food waste generators and businesses that receive food waste in Barnstable County, otherwise known as Cape Cod. Currently, there is one diversion facility in the county, a composting business located on the eastern side of Cape Cod, while there are over 100 food waste generators in compliance with the ban in the region. The number of food waste generators may be an underestimate as generators must be in compliance with the ban even if they only produce 1 ton of food waste in one week of the year. Cape Cod is a highly seasonal destination, so it is likely that additional businesses must comply with the ban in the summer months.

This project aims to identify parcels in Barnstable County that would be suitable for an anaerobic digestion facility based on land use, flood zones, and parcel size, and then determine which parcels are located closest to the center of all of the food waste generators in the county.

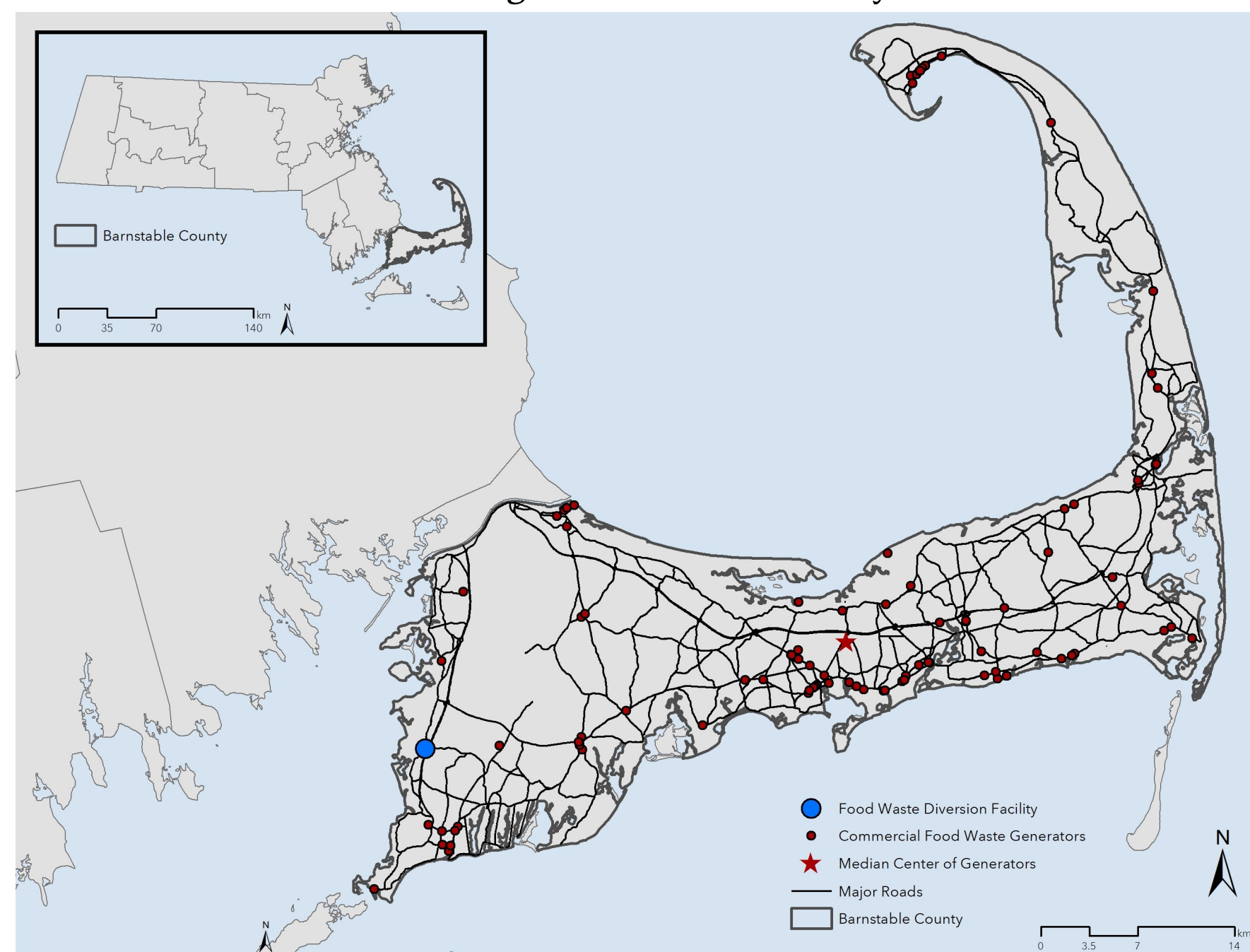


Figure 1: Generators and Receivers of Commercial Food Waste on Cape Cod, Massachusetts

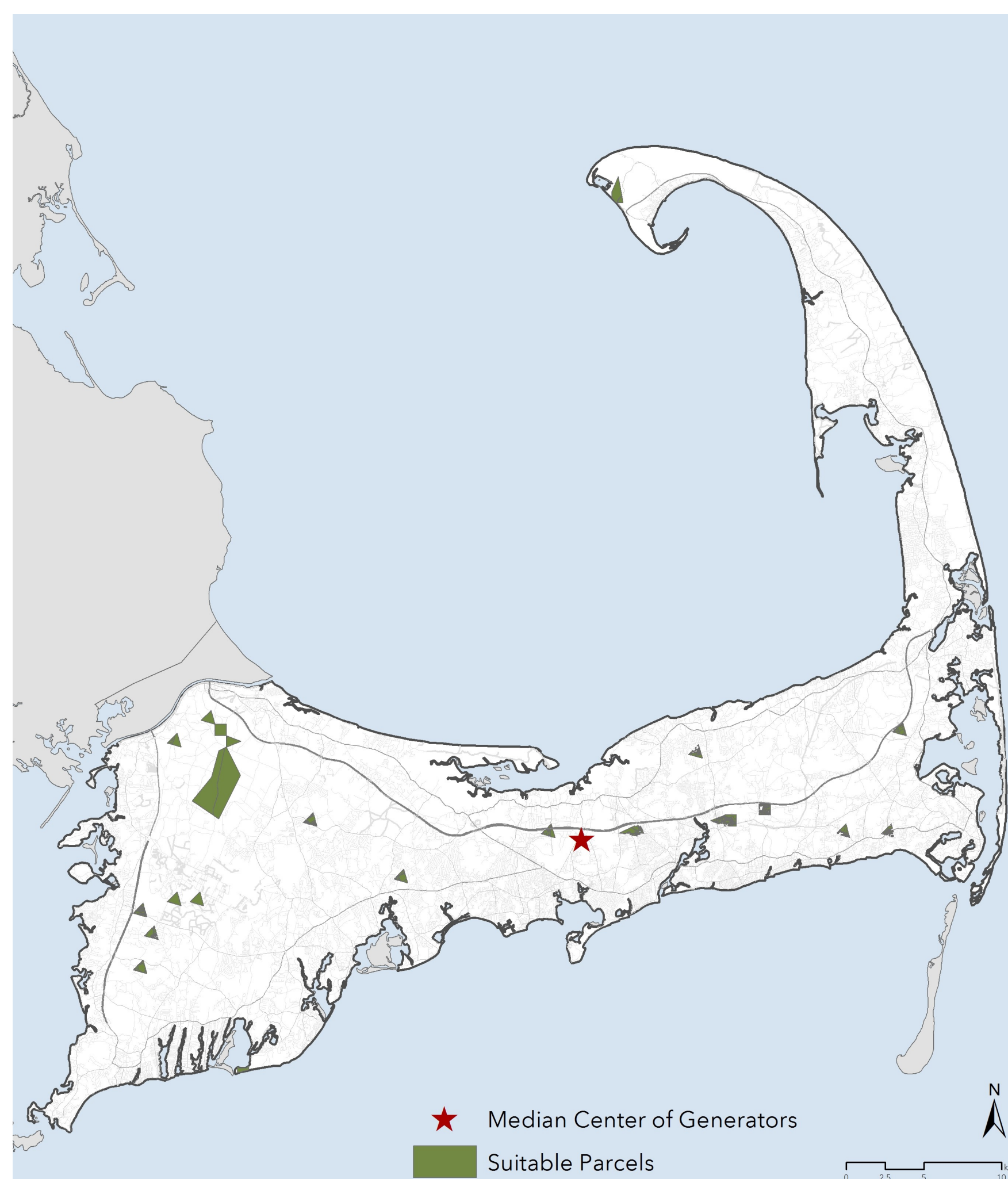


Figure 2: Suitable Parcels for Anaerobic Digestion Facility

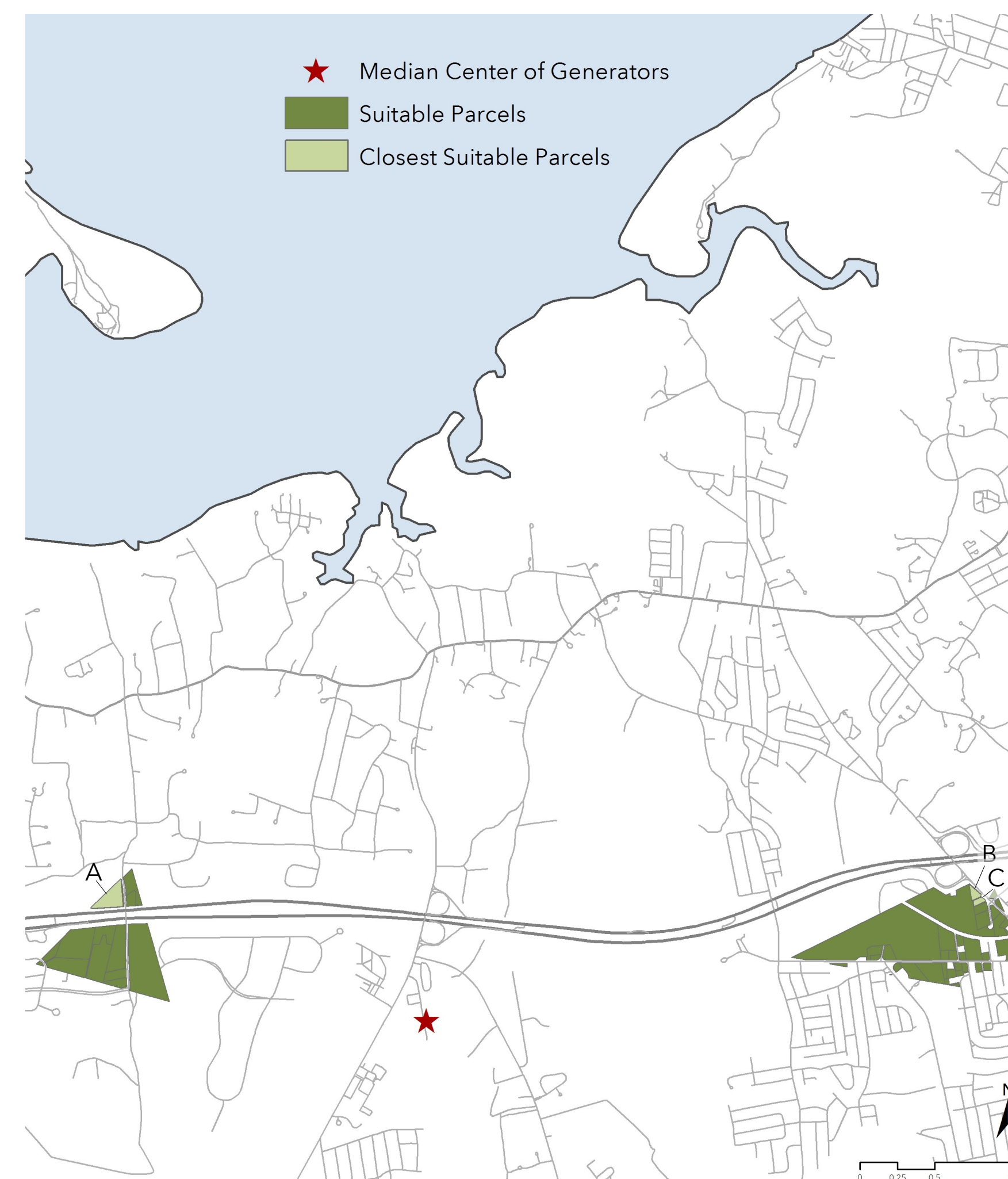


Figure 3: Nearest Suitable Parcels to the Median Center of Food Waste Generators

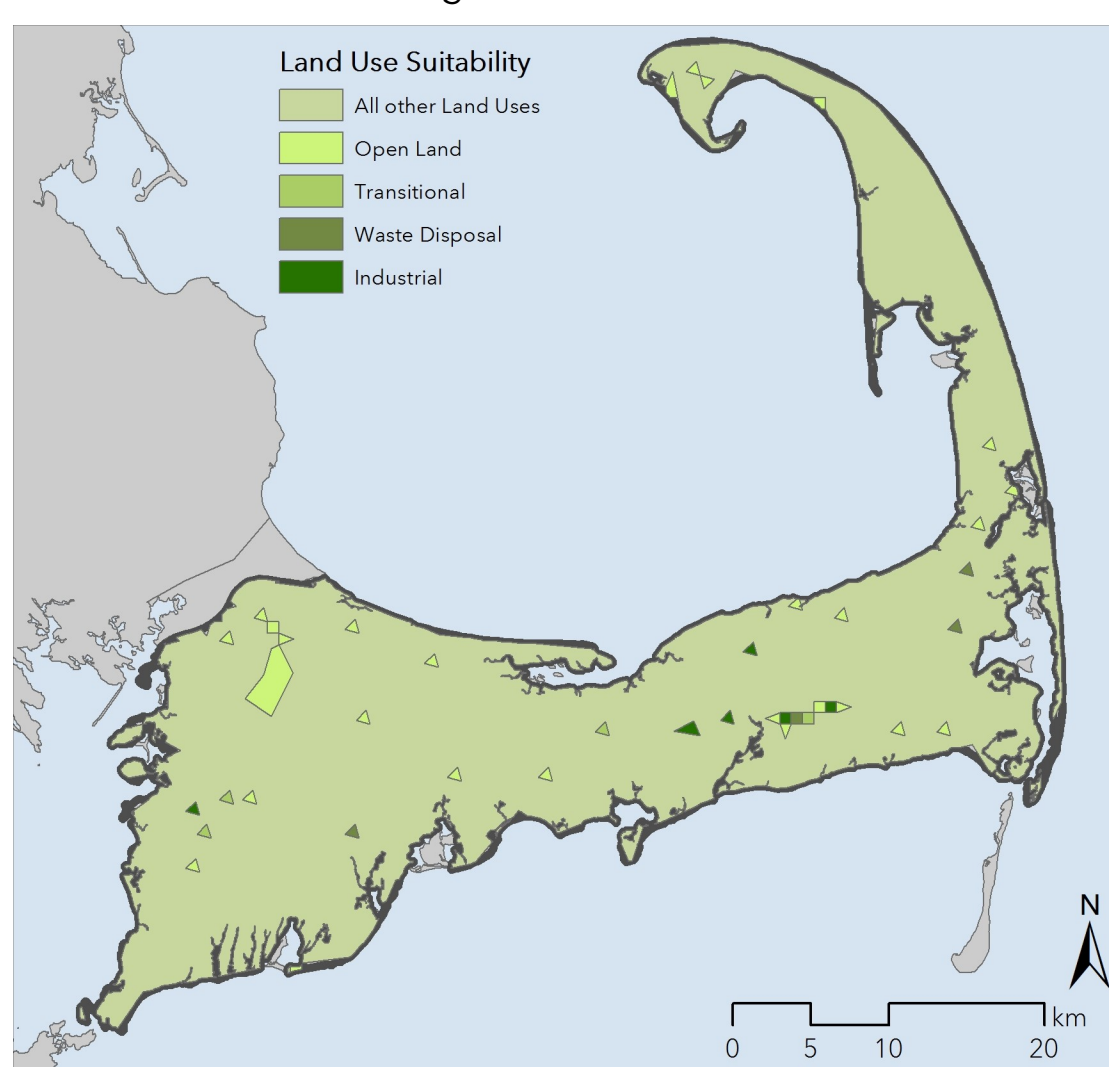


Figure 4: Suitable Land Uses

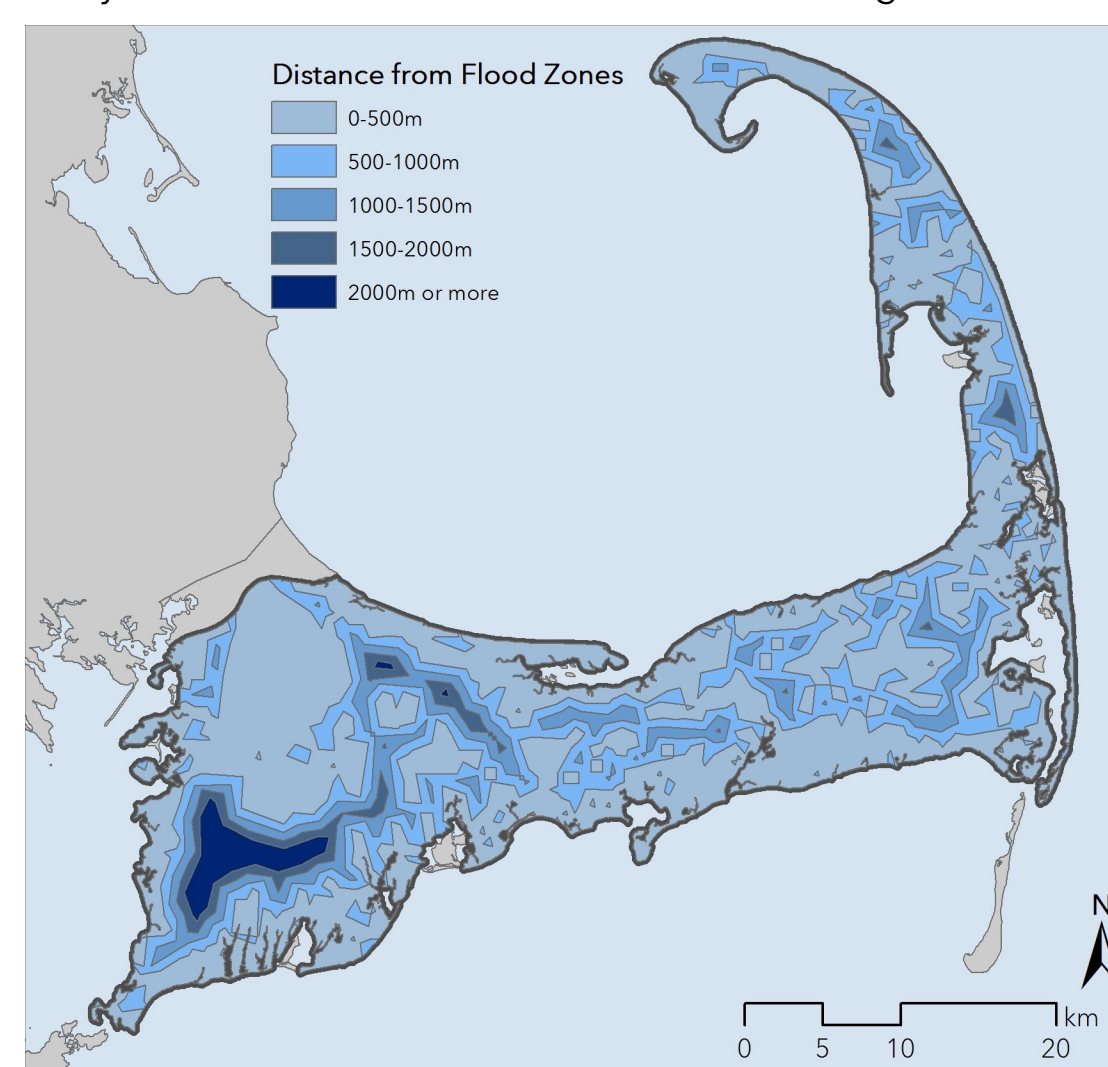


Figure 5: Distance From Flood Zones

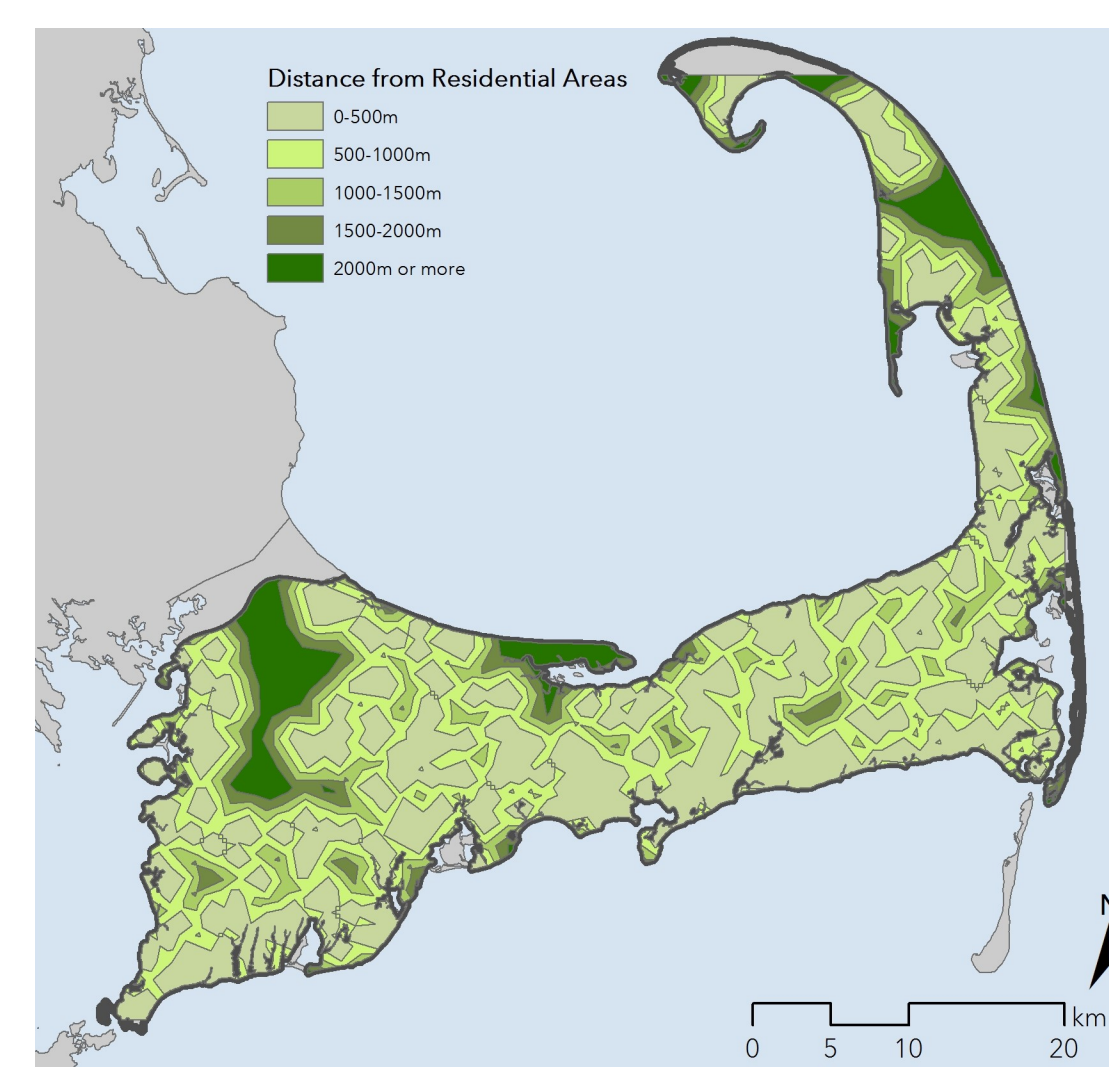


Figure 6: Distance From Residential Area

### Results & Conclusions

After considering traits that would make a parcel suitable for an anaerobic digester - land use, flood zones, parcel size, and surrounding land use - 806 parcels were identified as being suitable for an anaerobic digestion facility; the parcels are depicted in suitability clusters in Figure 2.

Network analysis identified the suitable sites located closest, considering driving time, to the median center of food waste generators. Three parcels were identified, indicated in Figure 3. Parcel A, the parcel to the East of the median center of food waste generators is 2 miles, or within a 3.25 minute drive of the median center and parcels B and C, the two parcels West of the median center are both 2.8 miles, or within a 5 minute drive of the median center.

Parcel	Distance to Median Center	Time to Median Center
A	2 miles	3.25 minutes
B	2.8 miles	5 minutes
C	2.8 miles	5 minutes

The closest facility analysis indicates that parcels that are located closest to the median center with regard to Euclidean distance are not necessarily the closest to the median center when considering drive time, illustrating the significance of network analysis in the siting of facilities. Had a Euclidean distance been used to determine the most suitable parcels none of the parcels indicated in Figure 3 would have been selected.

While the three identified parcels are the most suitable when considering proximity to the median center of food waste generators and because of limitations in the data other parcels in either of the two suitable clusters surrounding the median center may be deemed most suitable in reality. A deeper analysis and investigation, including ground-truthing would be necessary to choose a site for an anaerobic digestion facility.

### Limitations

One of the main limitations in this analysis is that land use data can incorrectly identify a parcel's land use if a small parcel of one land use is surrounded by a large parcel or many parcels of another land use. Some of the parcels identified as being suitable because of their land use may in reality be in land uses other than industrial, waste disposal, transitional, or open space, and thus may not be suitable for an anaerobic digestion facility.

There are some potential limitations with the MassDEP data as well. The food waste generator data dates back to 2011, which is before the ban went into effect. While this dataset is six years old, MassDEP estimates that the data is still relevant as levels of food waste do not change significantly over time, and if a business closes it is often replaced with a similar business. The food waste receiver dataset does not include businesses that receive food waste from specific businesses or institutions, creating the potential for an underestimate of food waste receivers throughout the state, including in Barnstable County.

The analysis does not address if parcels are currently in use or could be (re)developed, which is a variable important to siting a potential facility. A facility would likely not be constructed in an area currently in use, so ground-truthing would be necessary to identify if the identified parcels could feasibly be used for a new anaerobic digestion facility.

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Data Sources: Food Waste Generators, MassDEP 2011; Food Waste Receivers, MassDEP 2017; StreetMap North America, ESRI 2005; Level 3 Assessors' Parcels, MassGIS 2017; Land Use, MassGIS 2005; FEMA National Flood Hazard Layer, MassGIS 2017; Major Roads, MassDOT 2014

Project Coordinate System: NAD 1983 State Plane Massachusetts Mainland FIPS 2001

### Methodology

#### Determining Region of Interest

To determine the region of interest for locating an anaerobic digestion facility, the MassDEP data on food waste generators and receivers was mapped, and generators in compliance with the ban were selected and identified. The relationship between generators and receivers on Cape Cod is unbalanced with 1 food waste receiver and 100 food waste generators, as seen in Figure 1. In other parts of the state food waste receivers are located in greater proximity to food waste generators and there are more receiving facilities in a region than on Cape Cod. Once Cape Cod was chosen as the area of focus, the mean and median centers of food waste generators were calculated to indicate central area of food waste generators. The median center was chosen as a better representative of the center of food waste generators in the region and the analysis of suitable sites located parcels in proximity to the median center of food waste generators.

#### Identifying Suitable Parcels

The table that follows indicates criteria used in the assessment of suitable parcels for an anaerobic digestion facility. Land use, flood zones, surrounding land use, and parcel size were used to filter suitable parcels.

Criteria	GIS Filtration
Land Use	Excludes parcels that are not industrial, waste disposal, transitional, or open space
Surrounding Land Use	Excludes parcels near residential areas
Flood Zones	Excludes parcels near flood zones
Parcel Size	Excludes parcels < 1/2 Acre

Using land use data, parcels in industrial, waste disposal, transitional, and open space land uses were identified as suitable uses, with all other land uses deemed unsuitable, depicted in Figure 4. Euclidean distance from flood zones was calculated, and ranked with distance between 0 and 500m of a flood zone receiving a score of 0 and distances 2,000m or more from a flood zone receiving a score of 4, depicted in Figure 5. Euclidean distance from all types of residential uses were calculated, and ranked similarly to flood zones, with distance between 0 and 500m of a residential area receiving a score of 0 and distances 2,000m or more from a residential area receiving a score of 4, depicted in Figure 6. Parcel size was also considered, identifying all parcels

with an area of at least half an acre, a suitable size for anaerobic digestion facilities and a metric used in similar analyses.

The ranking of flood zones and surrounding land uses were weighted, with distance from flood zones accounting for 60 percent of the score and distance from residential area accounting for 40 percent of the score. The heavier weighting for flood zones was based on the long-term importance of building outside of a flood zone. Cumulative weights ranged between 0 and 2. Parcels of at least a half acre in size in the suitable land uses that intersected areas with a weight of 1 or 2 were identified as having suitable characteristics for an anaerobic digestion facility, depicted in Figure 2 and Figure 3.

#### Locating Closest Suitable Parcels

Network Analysis was used to determine the closest suitable parcels to the median center of food waste generators. To determine the closest parcels, the centroid of each suitable parcel was identified and the centroids were used in the analysis. The closest three sites were identified within the parameters of a 15-minute drive from the median center of food waste generators.