

FEMA LIFELINE CATEGORIZATION

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FEMA



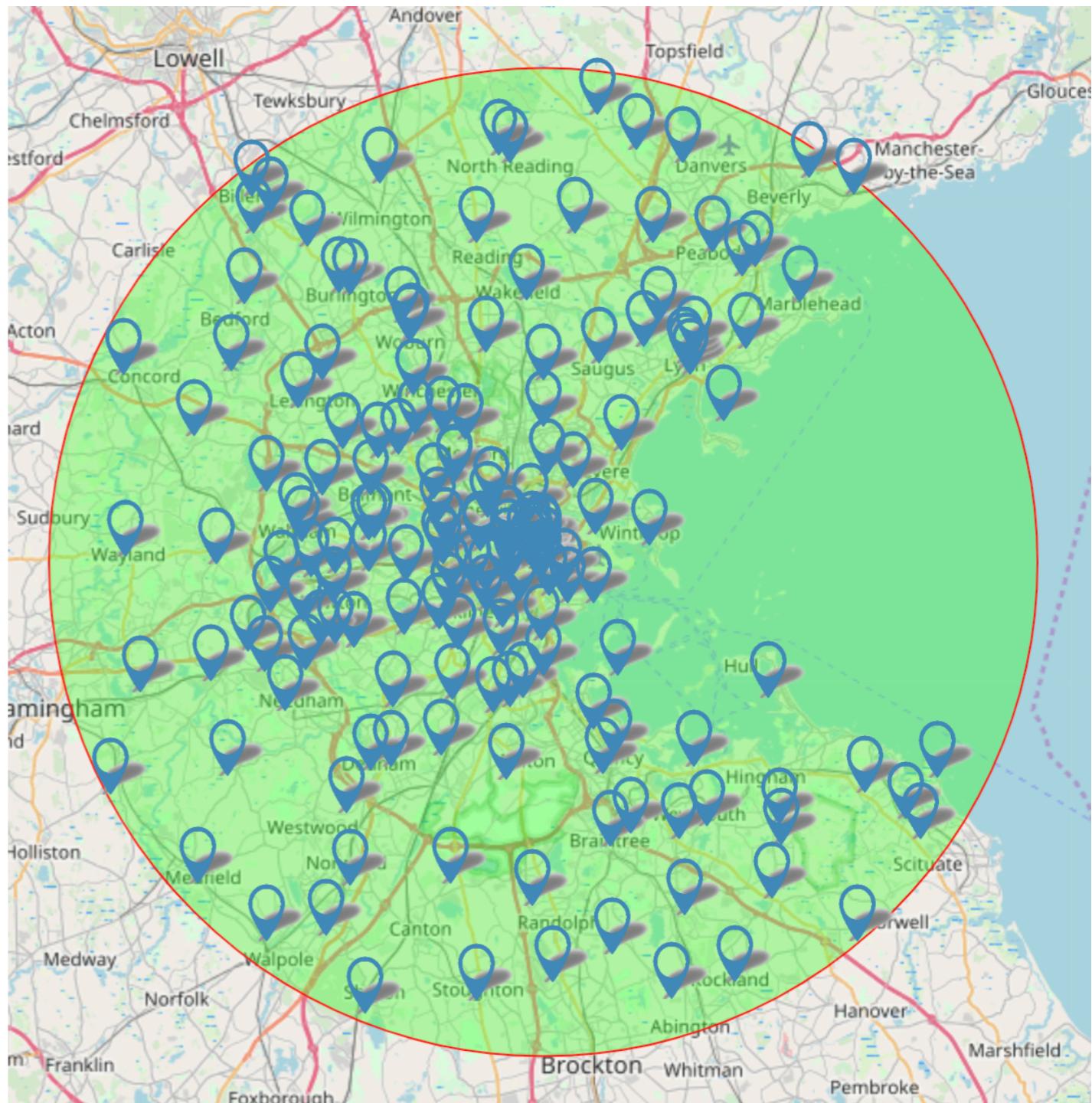
PROJECT BACKGROUND

- FEMA defines a community lifeline a business or service that enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security.
- When emergencies occur in an area stabilization of lifelines is a priority, therefore identification of lifelines is necessary to understand how many were operational before a disaster vs how many are still functioning after the disaster
- Scraping Yelp! allows us to do a partial categorization of certain lifeline categories on their website and group them by zip code as well as do lifelines per capita
- Zillow data is incorporated for future exploration on lifeline count and average home price per zip code



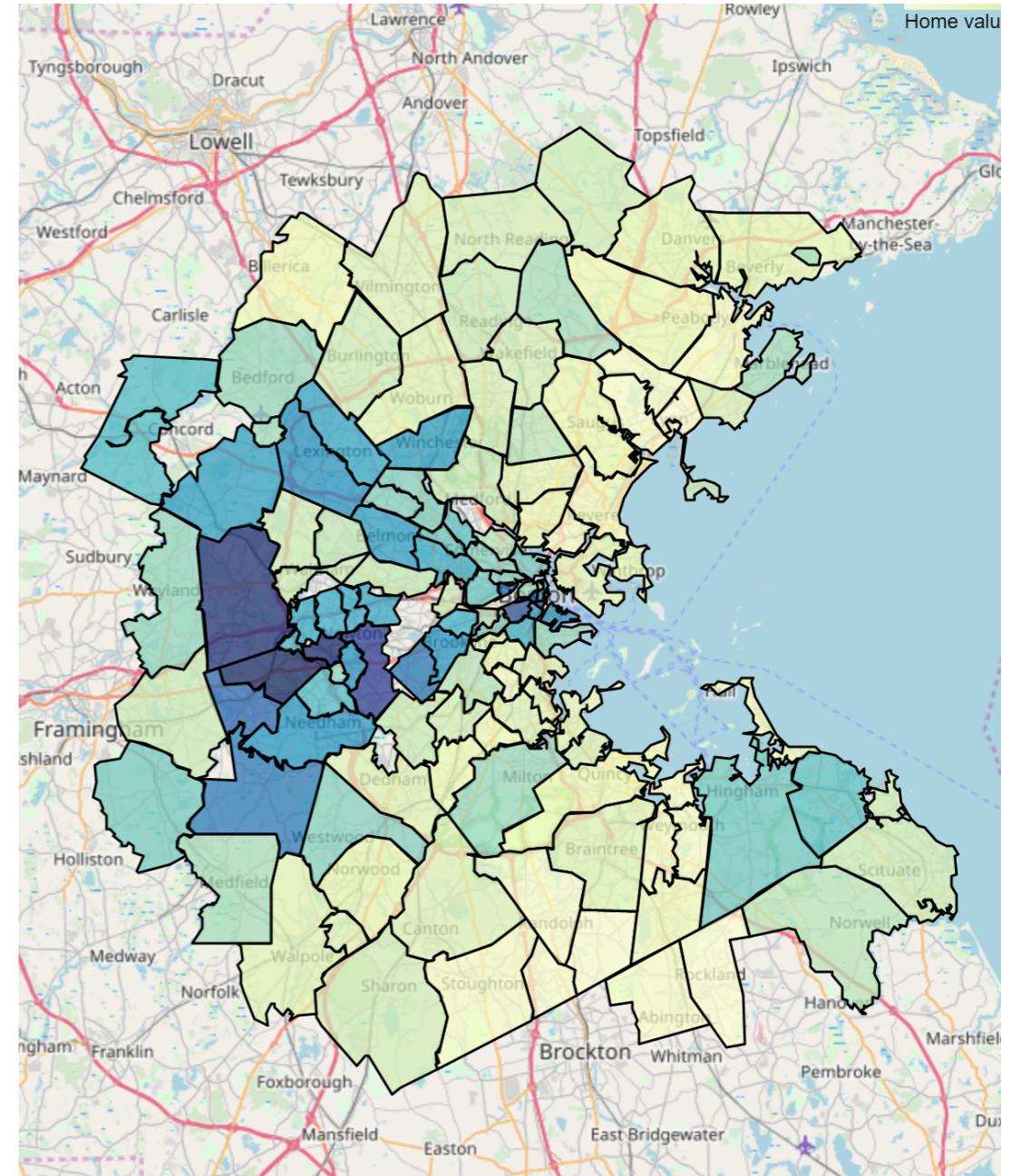
WHERE TO MAP

- Disasters and emergencies that hit Boston will also affect outlying towns and communities
- All zip codes with significant territory that falls within a 30 km (18.64 miles) radius of downtown Boston (zip 02110) are included to form a “Boston Metro Area” zone
- 186 zip codes total of varying demographics and geography



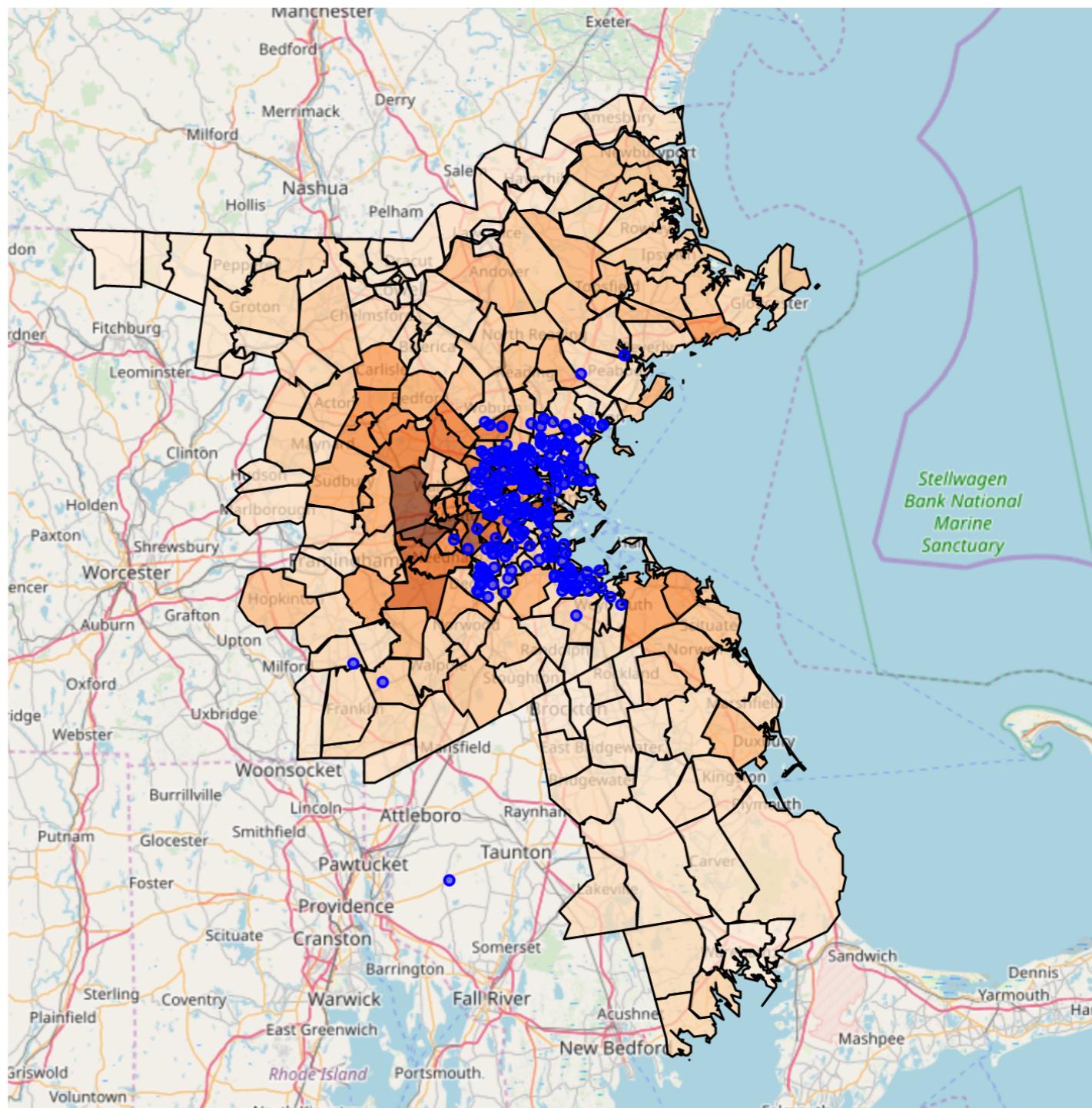
COMMUNITIES CONNECTED TO BOSTON

- All of the beltway included, significant disparity in population, area, average home price
 - All communities rely on Boston proper in some manner, transportation, administration, development and planning
 - Any natural events of consequence almost always affect this region as a whole



GREATER BOSTON AREA

- Boston-Cambridge-Newton Metro area, 231 zip codes and 92 towns
- Unacceptable for Boston-centric emergency categorization, includes areas significantly far away from Boston
- Several areas that fall into other large metro areas such as Lowell, Framingham, Providence
- Natural events that can affect just northern/southern/coastal areas of these towns but not others



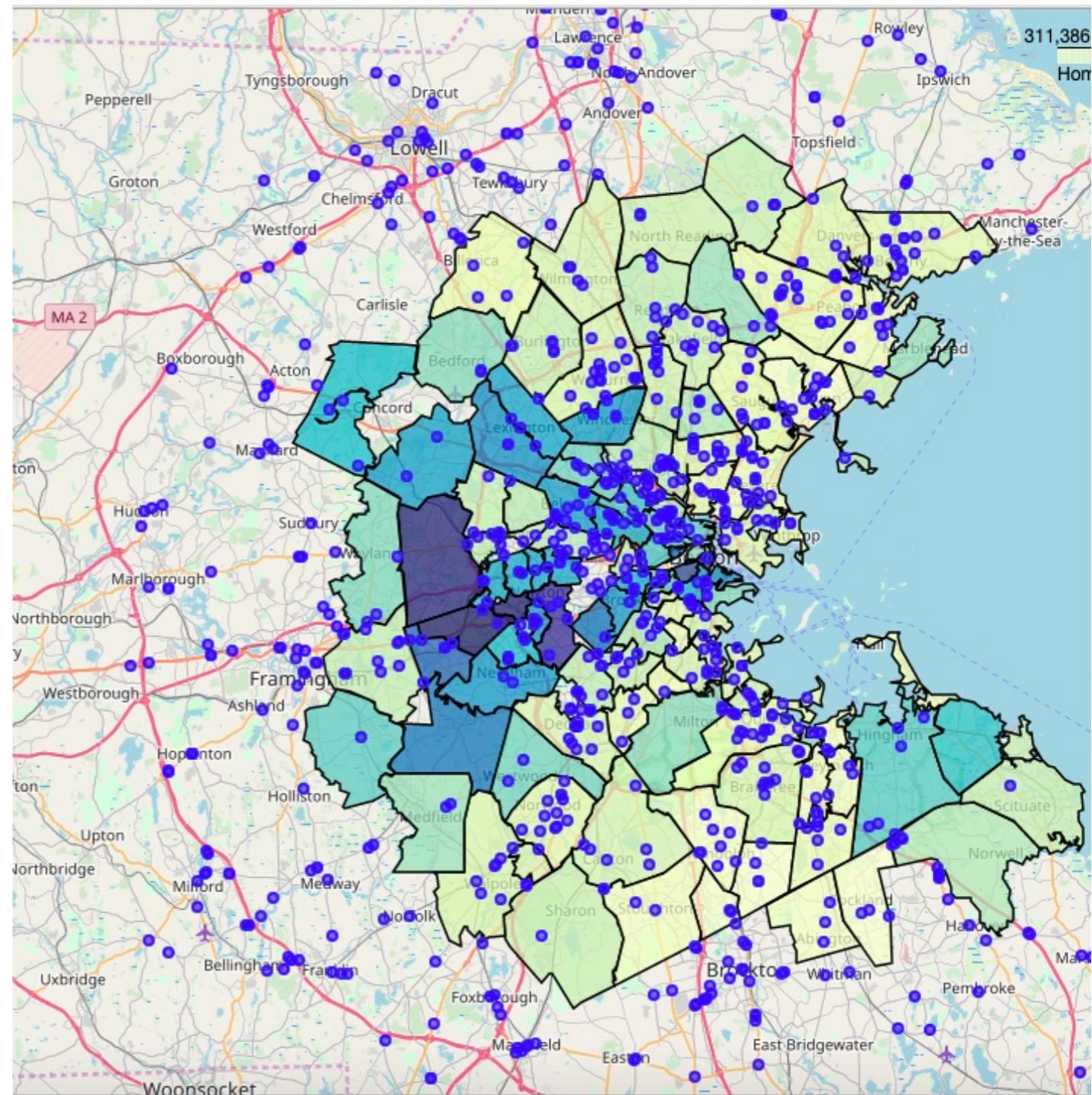
YELP! LIMITATIONS

- Yelp! only tracks businesses and the API only returns those that have received at least one customer rating
- Lifelines such as power transmission stations, powerplants, fuel pipelines, oil platforms, data transmission towers, canals, flood control not listed
- However, almost all utilities and infrastructure locations are already tracked by their managing agencies and are known to FEMA
- 5,000 requests per day per API key required splitting the 186 zip codes into separate batches to be scraped by different project members
- API returns results outside of requested zip code causing significant overlap, over ~306,000 results given but only ~16,000 unique business IDs
- Primary purpose of Yelp! is to add businesses that do not register with emergency agencies to existing lifeline lists such as food distribution, health clinics, transportation



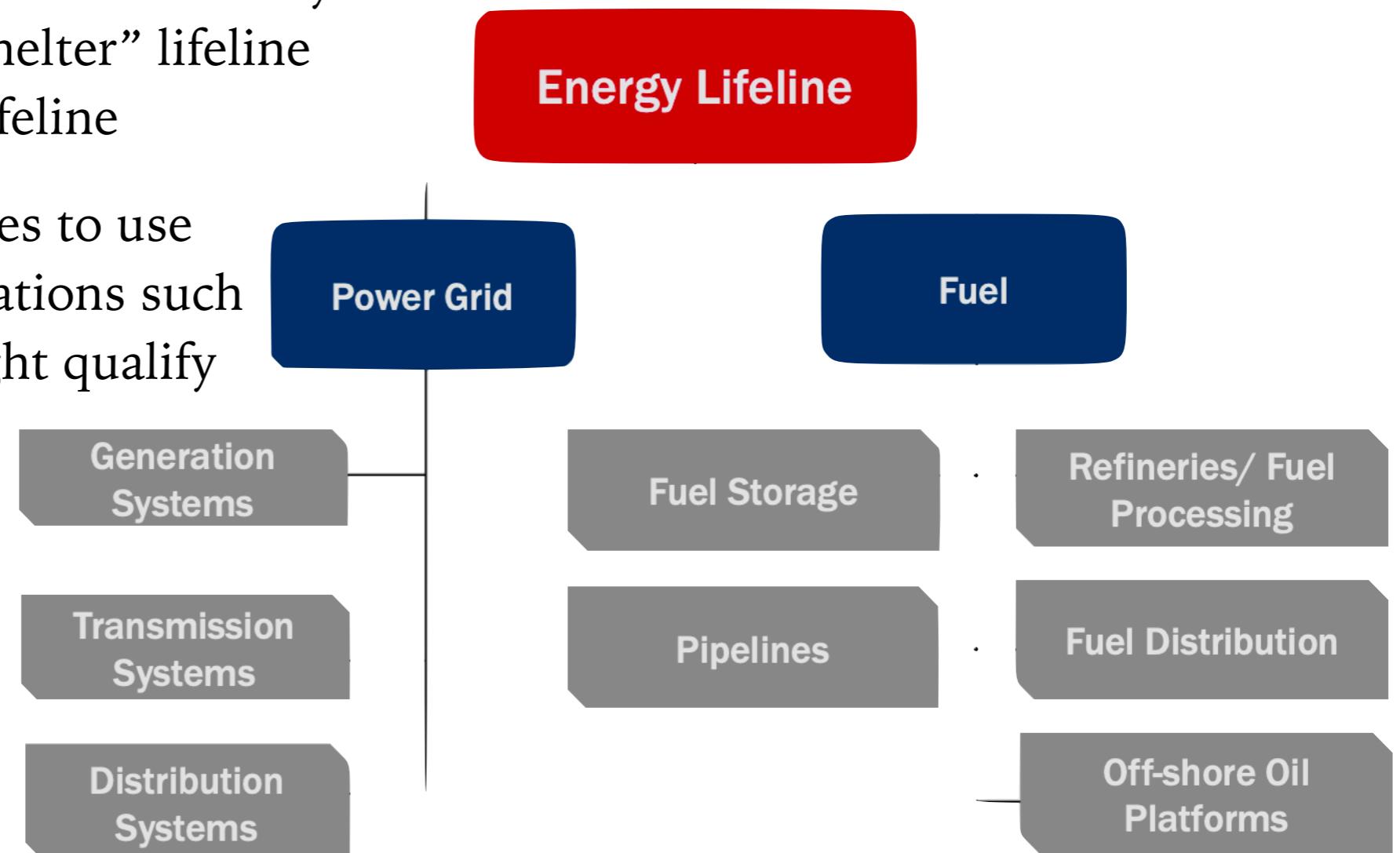
YELP! ERRORS

- Of ~16,000 unique IDs, ~3000 were not even in the 186 requested zip codes
- Several businesses not in Massachusetts, 5 not in United States
- Searching within a category only returns the first 1000 results, downtown Boston required a separate 4th scrape due to density to make sure all business data captured



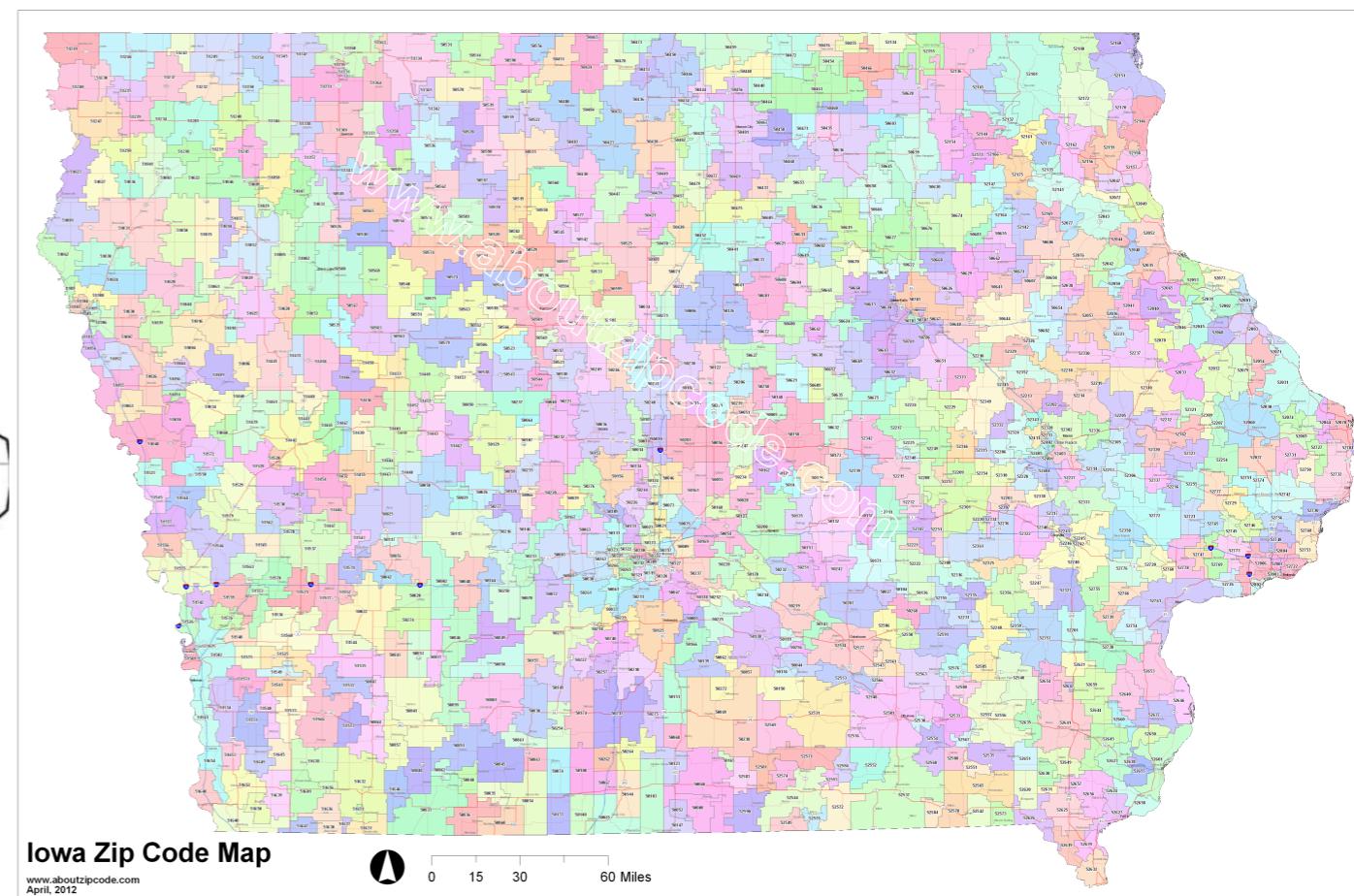
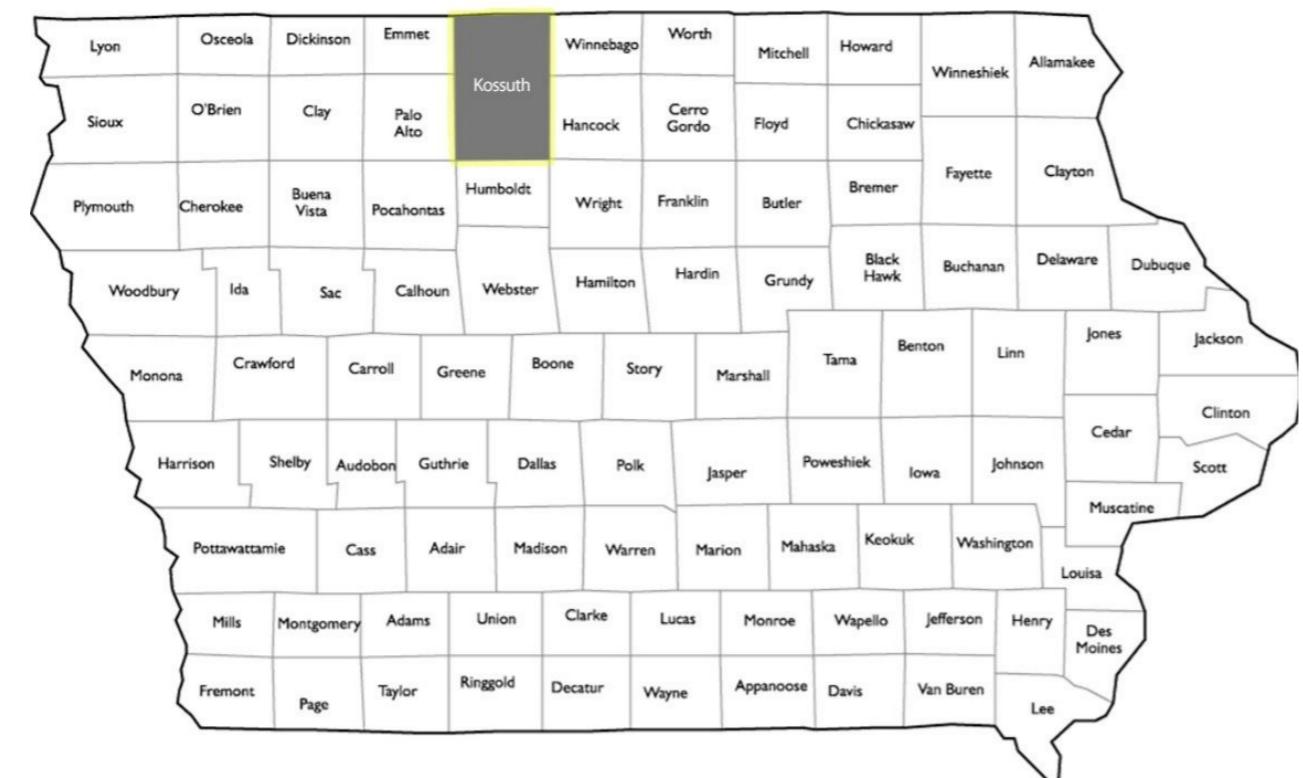
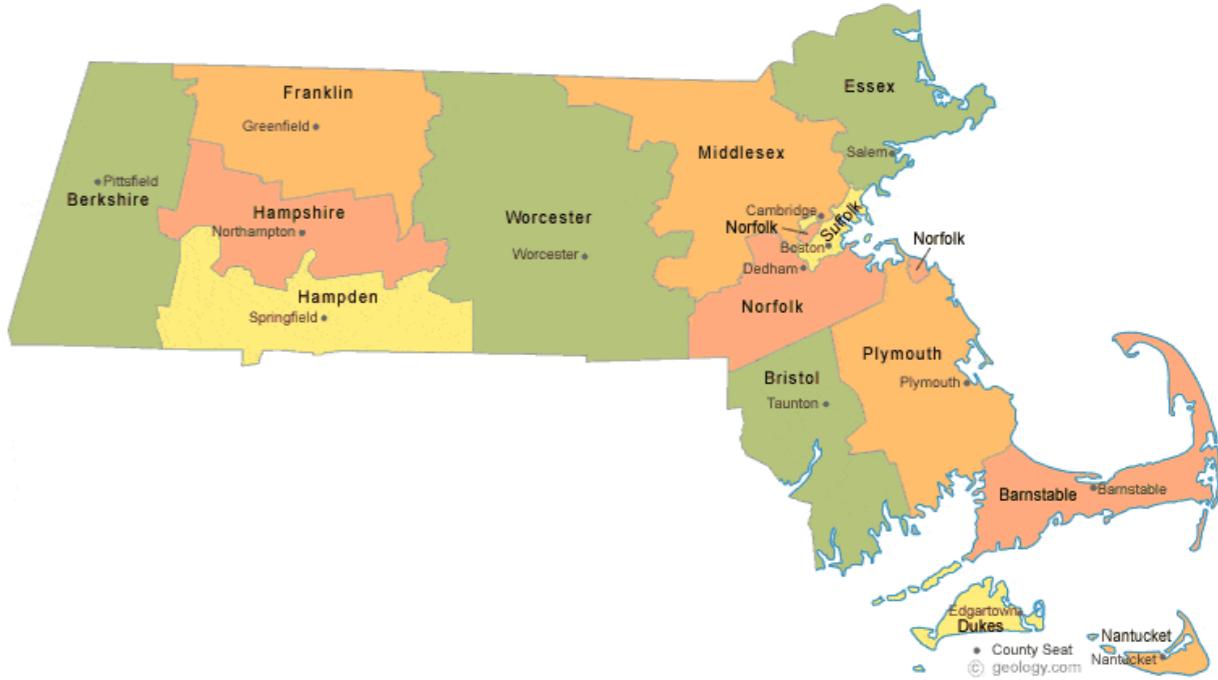
LIFELINE CATEGORIZATION

- Yelp! has its own categories that require manual sorting into FEMA lifeline types
- Certain parent categories are completely inclusive of what you'd want such as "food" parent category including only what we would want for commercial food
- Hotels & Travel breaks down mostly into either "food, water, shelter" lifeline or "transportation" lifeline
- Yelp! allows businesses to use only 3 categories, locations such as a hospital that might qualify for multiple lifelines will only be assigned as 1 unless clinics within the hospital have their own Yelp! listing



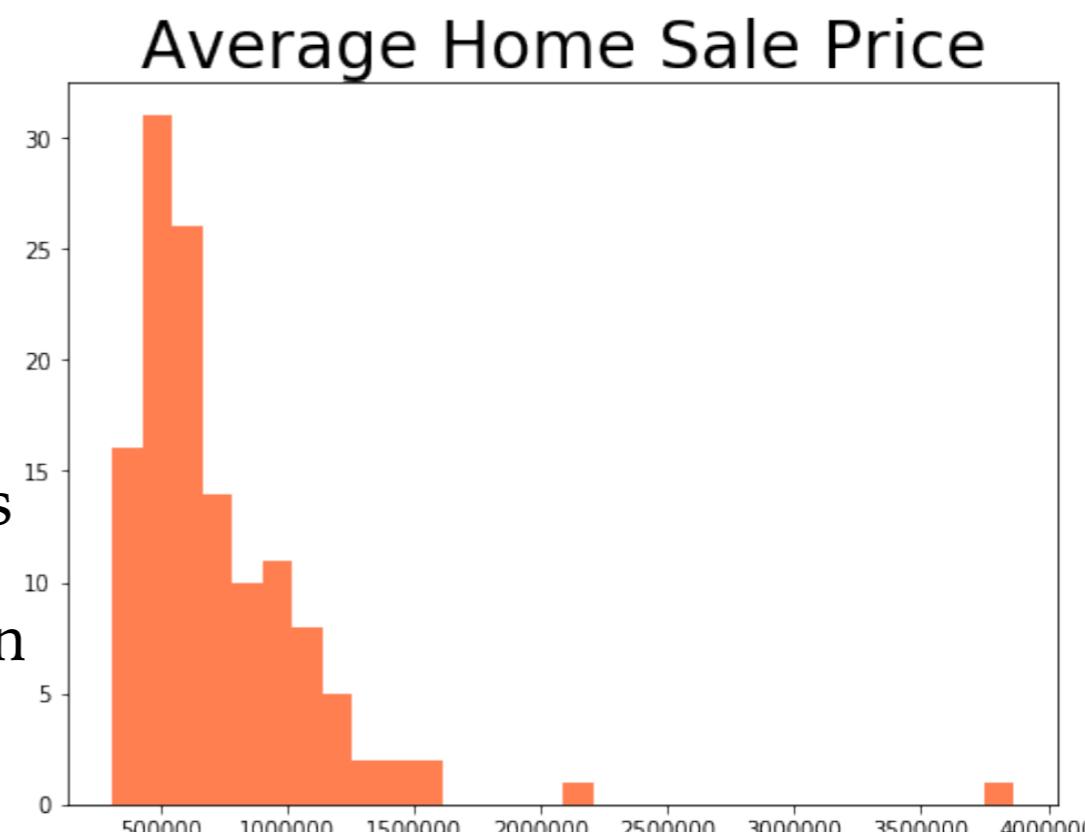
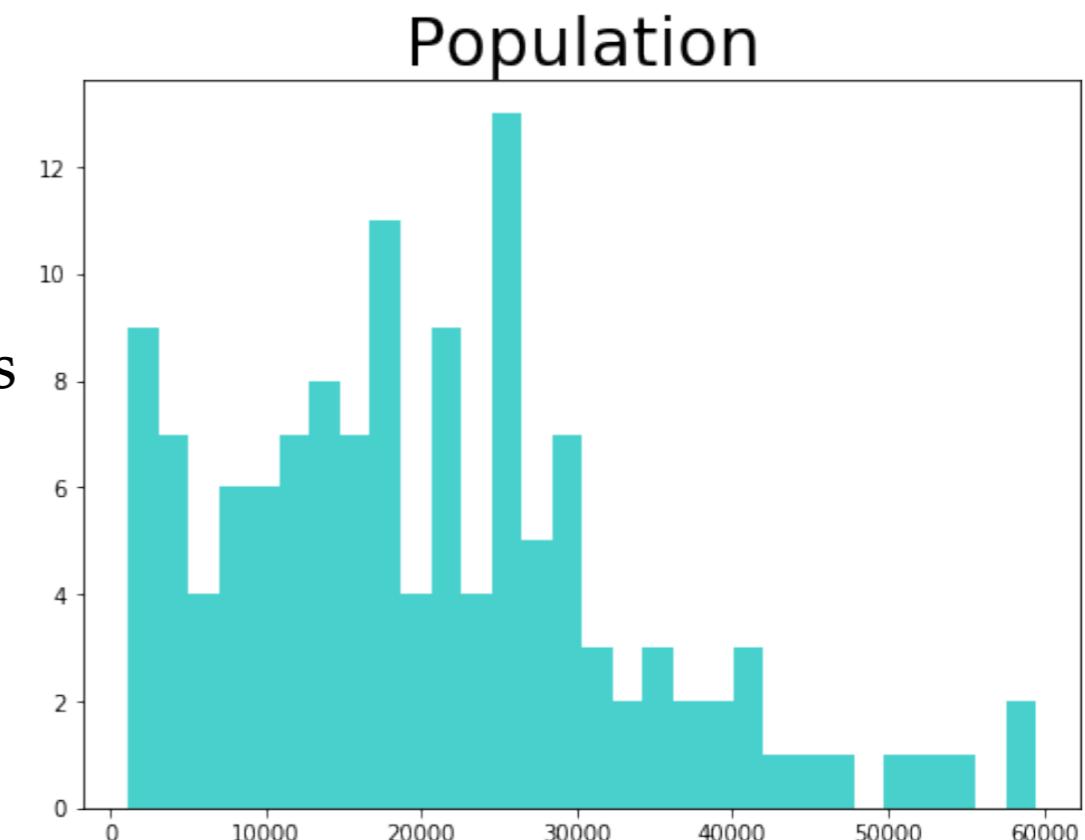
FLASK DEMONSTRATION

- Tick placement for lifelines in zip codes or counties with disparate shapes
- Zip codes cross county lines but are more granular categorizations for distance in Massachusetts due to non-uniform borders
- Could work for other states



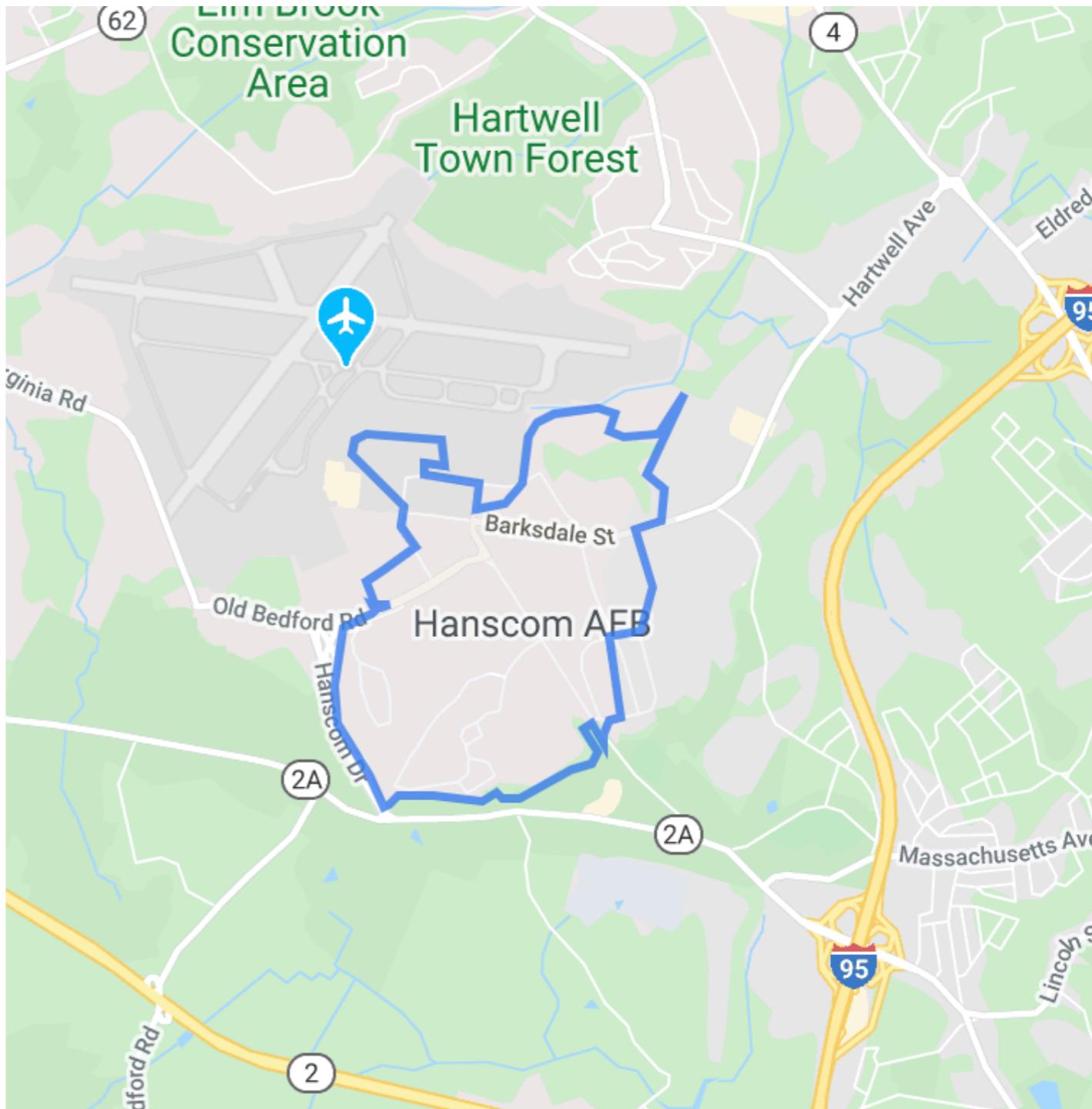
ZILLOW AND POPULATION INFORMATION

- Zillow API used for gathering mean home price
Only 129 of 186 zip codes had available data
- 96% of square mileage covered by 129 zip codes
- 132 of 186 zip codes had available population data, overlapping entirely with Zillow data
- 2.7 million total population accounted for, zip codes capture partial town populations on border of 30km zone
- Decided against imputation at the end because of disparity of county/city/town zipcode demographics within area, from downtown Boston to more rural parts of MA, vastly different geographical sizes of missing zip codes
- Possible future step for lifeline/price/population integration



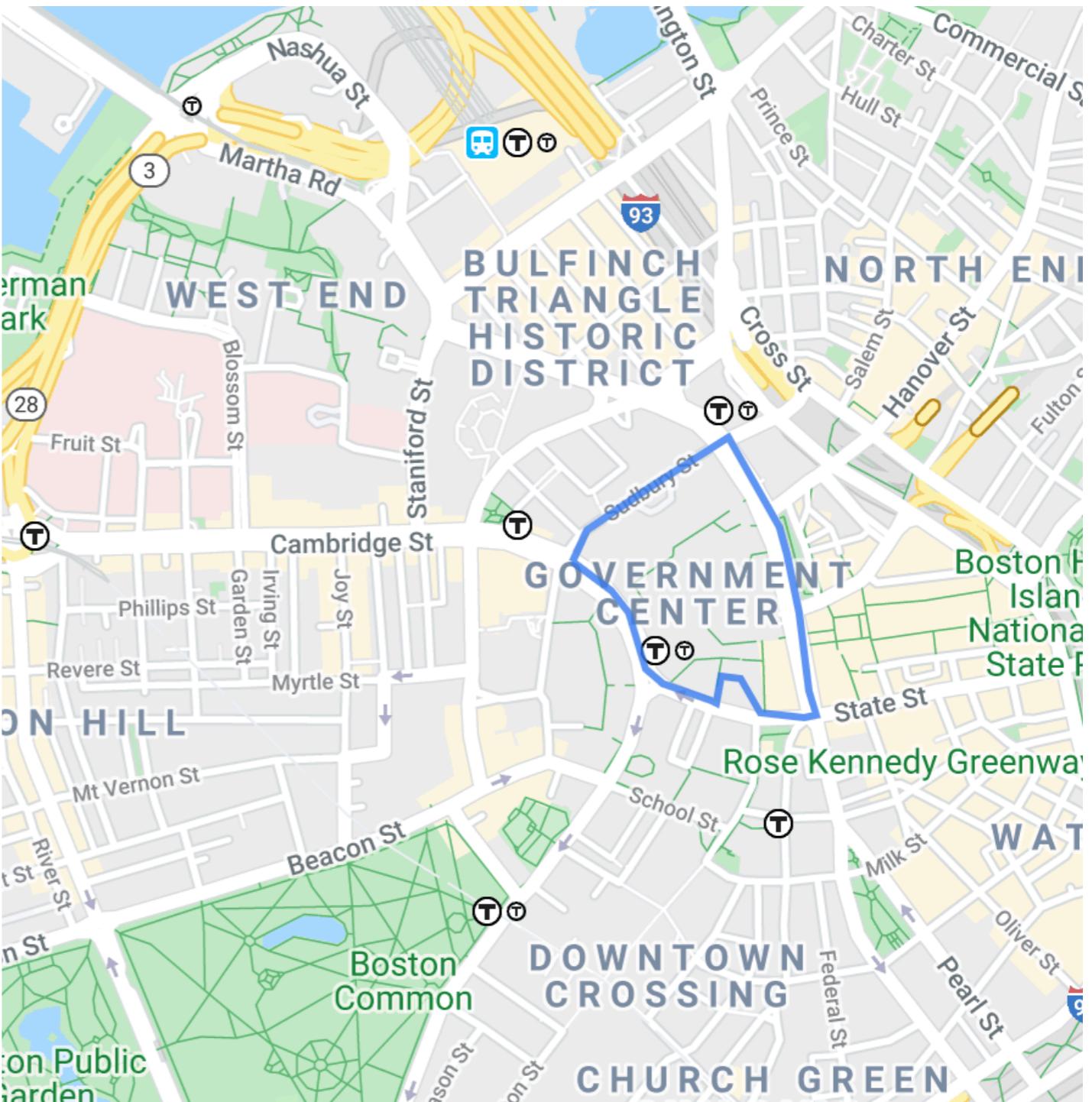
ZIP CODE ANOMALIES

- Hanscom Air Force Base, zip code 01731, permanent population not registered on Census data, no real estate sales for mean home price
- Does it make sense to impute this data? Does Hanscom Air Force Base rely on the same type of lifelines a residential town would?
- Significant resources within the base in the event of natural disaster or emergency that make external lifelines unnecessary



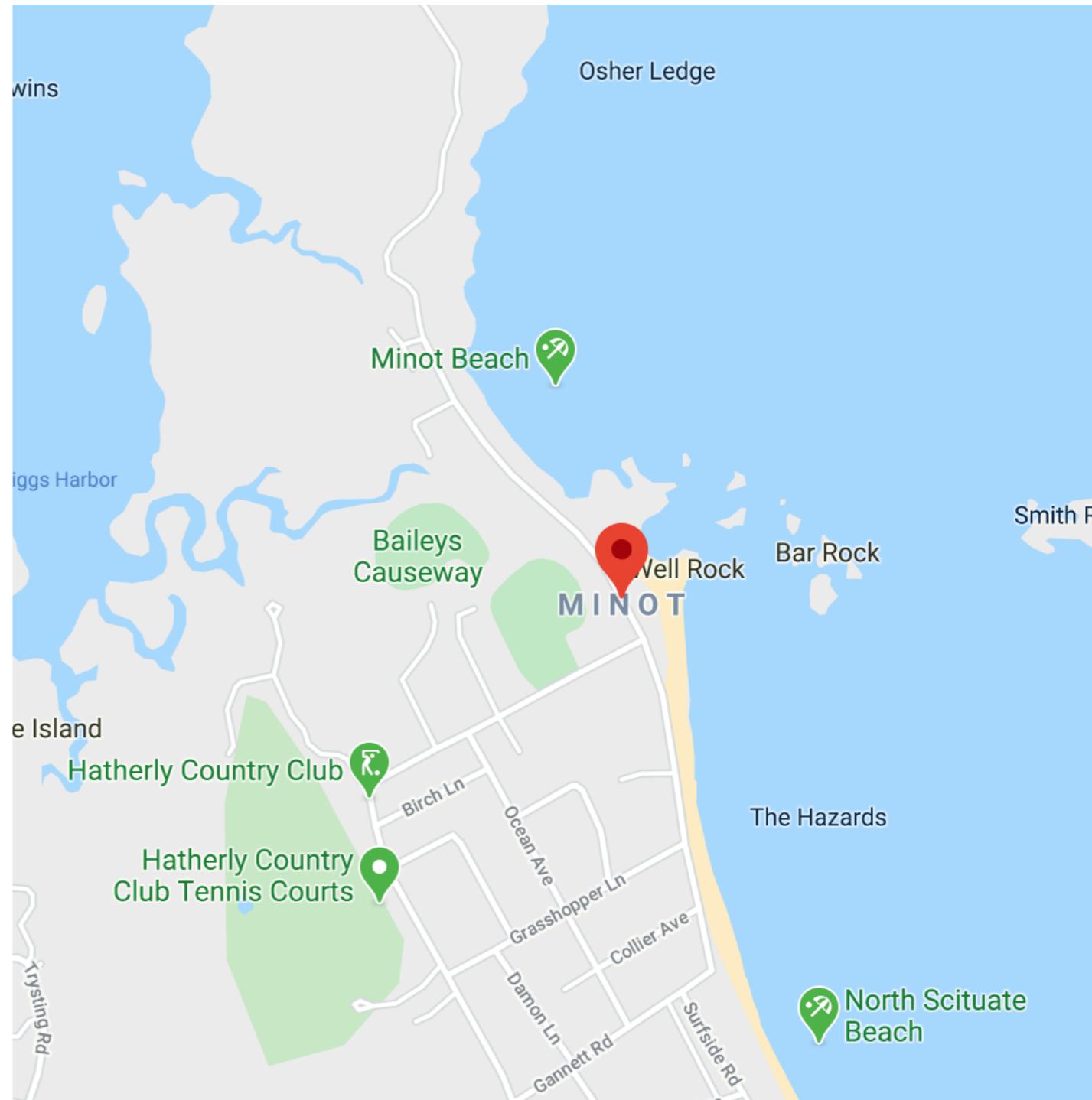
ZIP CODE ANOMALIES

- Boston City Hall, zip code 02201
- Does it make sense to impute this data? Does Boston City Hall Plaza have a residential population or home sales?
- In the event of a natural emergency this zip code is small enough that neighboring zip code lifelines can provide for city employees
- Contains its own lifelines as relating to security, records, essential government services



ZIP CODE ANOMALIES

- Minot, Scituate, MA zip code 02055
- Beach community within Scituate, no businesses except a country club and postal office
- Part of Scituate, no separate demographic data yet its own zip code
- Similar to Boston City Hall, must rely on neighboring lifelines



BOSTON WATER EMERGENCY

- 2010 May 1-4 non-weather related emergency affecting 32 communities
 - Water pipe break in Weston causes drinking water to flood into Charles River, forcing emergency use of surface reservoirs downstream of the break
 - Surface reservoir water is untreated
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- Bacterial level tests for untreated water takes several days to complete, in the meantime a boil water order was issued to affected cities and towns
 - Cambridge unaffected due to separate, unaffected water supply system



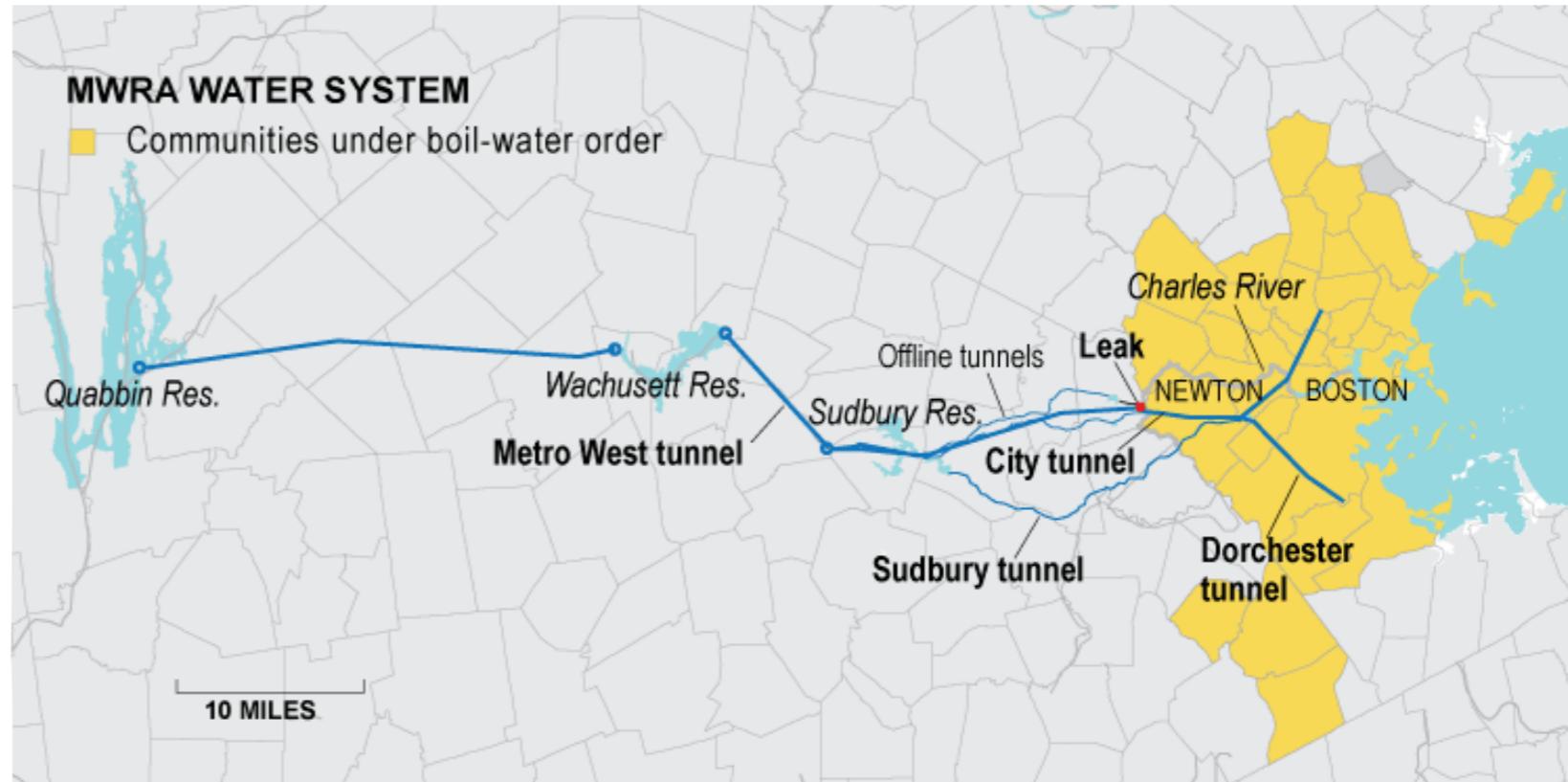
IMMEDIATE EFFECTS, COMMUNITY AND GOV'T RESPONSE



- Local shops quickly sell out of bottled water, businesses that use municipal water such as coffee shops and some restaurants forced to temporarily close
- Suppliers asked by state government to increase delivery of bottled water, Massachusetts National Guard deployed to aid in water delivery to affected areas
- DHS and FEMA coordinate relief efforts within state, other lifelines unaffected

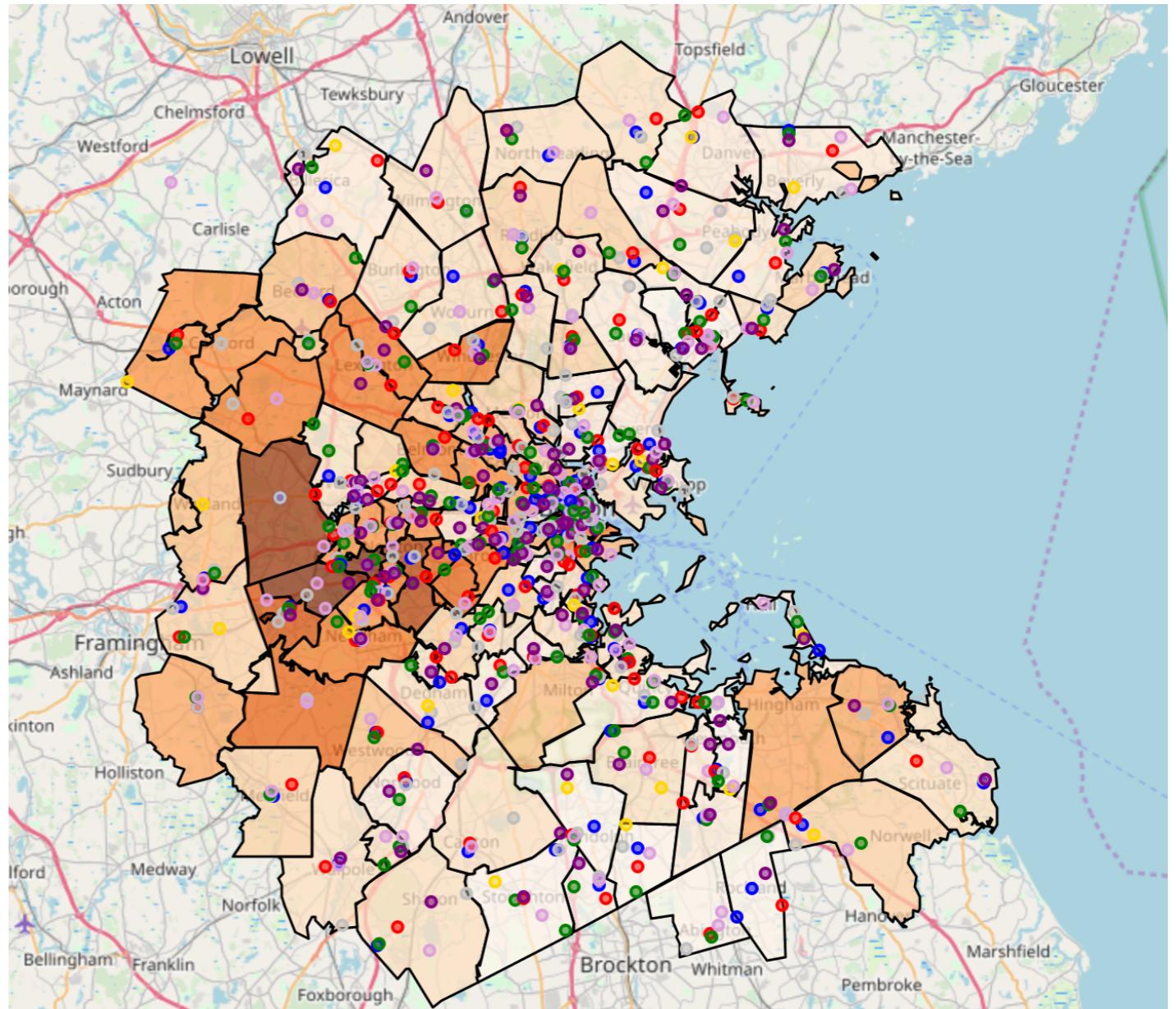
AFTERMATH, LIFELINE ANALYSIS

- Bacterial analysis reveals acceptable levels, boil water order unnecessary
- Significant amount of 30km radius around Boston affected by water emergency
- Local water purification lifelines unaffected
- Energy, transportation lifelines intact, people can boil water with their stoves or percolators, additional deliveries can be made to stores
- Health lifelines intact, if anyone had gotten sick from untreated water then medical treatment would have remained available at full capacity
- Identification of affected lifelines, plans to repair lifeline to fully operational status, use of other lifelines to supply substitute water all critical to relief efforts



NEXT STEPS

- Integration of FEMA and other federal databases of lifeline location, category, count
 - Analysis of community-driven lifelines: is there a correlation between population, affluence, and lifelines? Do wealthy communities have more health and medical options? Do high population areas have sufficient security lifelines?
 - Lifeline qualification: a dental office does not provide the same emergency relief as a hospital or health clinic, can communities have a lifeline score for emergency preparedness



- Do coastal cities have different lifeline distributions than inland cities due to the different nature of emergencies they might face? What about those in different climates?