

Supplemental Materials for Mapping Environmental Injustice in Chelsea, Massachusetts

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Project Advisors: Professor Jason Davis and Professor Sarah Stanlick

Sponsor names: Ben Cares and Alexander Trains from the Department of Housing and Community
Development (H+CD)

Supplemental Material for an interactive qualifying project submitted to the faculty of Worcester Polytechnic
Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science

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Authorship

Seth Coellner contributed to data retrieval for ArcGIS Pro and final analysis of the completed data. He worked on finding sources during the preliminary research phase. He also worked on writing, editing, and proofreading the final booklet. Seth also developed many of the final images used in the presentation and booklet.

Lena Dias was responsible for GIS data gathering, data display, organization of materials, and writing. Lena contributed to the process of finding usable data and organizing said data so it could be easily displayed within ArcGIS. A majority of the writing in this booklet, and its formatting, was also handled by her. Lena also contributed to clerical work, presentation preparation and delivery, and communication with third parties.

Marcel Paolillo was the project manager for the group and was largely responsible for the management of deadlines, meetings, interview preparations, and organization of assignments during the project. Marcel also helped in secondary and preliminary research for the project. He also contributed to the organization of information that would be included in the final booklet, the structuring of presentations, and writing for side assignments.

Zachary Taylor was the primary contributor to data collection and formatting. He was responsible for the conversion of data from unusable raw files into displayable, ArcGIS-compatible formats. Zach also developed analysis methods and the “impact score” theoretical ranking tables. Additionally, Zach contributed to preliminary research, secondary research, presentations, and writing.

About the Sponsor

The Department of Housing and Community Development in Chelsea, Massachusetts, through its community and business partners, provides affordable housing options, financial assistance, and other support to communities in Chelsea. They oversee different types of assistance and funding for consumers, businesses, and non-profit partners. Ben Cares, our main contact with the department, is the senior planner and project manager of this department.

Interview with the MAPC

Interview with Sharon Ron

Email: SRon@mapc.org

Phone: 617-933-0788

General Agenda Plan:

1. General introduction
2. Our team will introduce our project to you so you can get some background about our project and the reason we wanted to meet with members of the MAPC
3. Our questions for you
4. Any questions you might have for us

Planned Questions (some questions might be changed slightly during our meeting based on what we learn from you but these are the 10 main questions we plan to ask)

1. Question: What does a typical day in your position at the MAPC look like?
 - Regional planning agency for boston and the 101 communities around boston
 - Provide technical assistance, regional policy making and collaboration
 - i. Some communities are well-resourced and able to do work on their own, but when this is not the case municipalities can make use of the MAPC resources
 - Come together as regions and subregions to work on projects and programs
 - Public health team - kind of rare to have this in a regional planning office
 - i. Focus on social determinants of health (neighborhoods, interactions, personal access, transportation)
 - ii. Specifically takes on public health aspects in these municipalities, and contributes to larger documentation and planning
 - MAPC is regional planning agency for boston
 - i. Provides technical instance
 1. Lots of urban, land use, technical planners, etc. good for communities that cant keep expertise on staff
 - ii. Organize regional policymaking
 - iii. Coordinate regional collaboration
 1. “Municipal boundaries have no meaning”
 - Rare to have a public health team in the area
 - i. Focus on social determinants of health
 - ii. Places you live in, people you interact with, transportation, access, etc
 - iii. Make master plans for next 10 years
 - iv. Specifically take on specific social determinants

- Work with specific interest groups within communities, brings in high level governmental policy stance to these community discussions
 -
 - Jeanette (climate), Heidi, Wane (food), Sharon (environmental health exposure, transport)
 -
2. Question: Are there any health conditions that you or the MAPC tend to take into account when planning projects or policies unrelated to public health (such as asthma, cardiovascular diseases, etc)?
- Air pollution
 - i. Highways end up bisecting residential neighborhoods, exposing people to pollutants
 - ii. Logan is in the heart of Boston - air quality
 - iii. Boston port is huge source of admissions
 - iv. Mobile sources often fall through the cracks of the EPA's regulations, unlike factories who have enforced emissions
 - v. People fly over, drive through Chelsea
 - Heat exposure
 - i. Not prepared for it - big extreme heat waves becoming more common in the summer
 - ii. Air quality and extreme heat mitigation measures have big overlap
 - iii. Wildfires from out west impact here
 - iv. Climate change?
 - 1. Sharon says she isn't that well positioned to determine a cause
 - 2. But she does say old housing/schools don't have modern central air, making them uniquely vulnerable
 - 3. Residents don't know how to react due to not having historical hot summers
 - Chicago heat wave - people were keeping their windows shut and locked during heat wave because they were too afraid to open their windows due to crime, leading to many heat related deaths
 - Impacts of air quality and heat affected by COVID
3. Follow-up: Of these health conditions mentioned, are you aware of any that are exacerbated by the presence of environmental hazards such as air pollution, extreme heat, or toxic emissions?
- Air pollution
 - i. Buildings themselves are causing air pollution with the fossil fuels that are heating them

- ii. Revere neighborhood is concerned about trash disposal place
 - iii. Most chelsea concerns are due to airports and highways
 - Heat
 - i. Impervious dark surfaces
 - ii. Little green space
 - Non-MBTA trains actually rely on diesel, diesel trains are used for the majority of trains
 - MBTA trains are electric, but contribute to poor air quality due to brake and wheel deterioration, etc
 - Chelsea got grant for air conditions and their electricity cost, got 700 applicants for 70 air conditioners
 - There is an acute need but more can be done about chronic problem; address both causes and results
 - i. Policy solutions are far away, have both
 - ii. More sustainable transportation
 - iii. Traffic isn't going anywhere near highways, but we can at least support the homes near them
4. ~~Question: Do you know of a source from which we may obtain quantifiable public health data, such as hospitalization rates for various conditions?~~
5. Question: Are there ongoing/upcoming projects or policies that are focused on alleviating the effects of hazards on public health?
- Bylaws from city of chelsea about trees/climate policy?
 - Environmental Law Institute/env law groups
 - Does chelsea have environmental considerations when planning and in bylaws?
 - Look at Cambridge Climate Change Vulnerability Analysis
 - i. Describes what makes a resident more or less vulnerable/resistant to climate change using publicly available data, where those neighborhoods are
6. Follow-up: Are any of these projects intended to focus on Environmental Justice communities? If so, is there anything that sets these projects or policies apart from those not focusing on EJ communities?
- Finished up heat pool sommerville project
 - i. Understanding and assessing the issue of climate change and exposure in somerville
 - Photovoice - what about this community at a ground level (heat climate, air) being affected by
 - Pilot project to mitigate heat impact

- i. Pop up event in a park with water features and similar
 - ii. Visiting nurses program for isolated adults, etc
 - Heat and health grants for impacted communities, chelsea is a recipient that used for ac
 - Congress in summerville and chinatown air pollution project on their website
 - i. <https://www.mapc.org/resource-library/air-quality/>
 - ii. Halfway down page
 - iii. Hvac and hepa chelsea part of
 - iv. Impact working groups chelsea part of
 - v. Chelsea is concerned about way to monitor finer particles than 2.5
7. Question: Our project involves presenting a list of recommendations to our sponsor including action items and possible policy changes. However, our team has little to no experience in policymaking and as such will likely compile a list of successful policies from similar municipalities, and select from these when making our final recommendations. Do you have any recommendations for policies that have proven successful in other areas that may apply to Chelsea?
- Think small scale and main scale policies that changes
 - Take into consideration getting the communities who are affected involved
 - Make sure you are clear about the sheer amount of work needed
 - Policies are not just law
 -
8. When soliciting community feedback on proposals, what information do you find helpful for the planning and revision processes? Do you have any suggestions for how our team could create, format, or justify useful recommendations to our sponsor and similar organizations?
- Connect with sponsor on communication output
 - Most people will not want to read the planning report
 - We will need to summarise and create suammarisable material
 - Do we need to create separate works like fliers and small pallets to easy to bring out general
 - Chelsea is greatly connected with Capic, GreenRoots and other close community organizations.
 - People care about what the problem is and the call to action as clearly and simplistically as possible. Focus on call to action

9. Question: Do you know of any other individuals that we should reach out to who may be able to elaborate on any points from our discussion, or who are involved in projects or research of interest to our team?
 - Alex tran
 - What policy is ben and alex working on currently in chelsea
 - How can they put air conditioning into capital investment fund
 - Where do our sponsors see policy opportunity?
 - Talk to ben about upcoming grants, funding
 - Would be useful to ben to get him any studies from paid databases and literature that has been used in other communities
 - i. Finding similar case studies from around the US would be huge in supporting our recommendations

10. Our team is making several different deliverables for our IQP project and the Department of Housing and Community Development of Chelsea, including a website, booklet, and several files containing GIS maps with multiple demographic layers. Are there any specific views, analyses, or additional resources that we could provide at the end of our project that would be useful for your work or the MAPC?
 - Make sure to avoid gentrification, esp green gentrification
 - Highlight importance of working with the community and consider unintended consequences, like pricing and future situation changes
 - Be explicit about who we are calling “the community”
 - Near highway, low income, residents of color
 - What policies can go in place that would be both immediately effective for these groups, but take them and their wants into account
 - See what exists in Chelsea bylaws for existing environmental policy
 - Policy can be like what order our sponsor chooses their projects in
 - Policy can recommend, for example, working on acute threats over long term projects
 - Keep in mind the necessary effort, work behind, requirements, costs, etc of each recommendation
 - Students are useful for doing things that our sponsor really isn’t able or willing to do
 - Traffic flow, traffic safety, green space, some interesting examples of citywide programs tracking people who consistently end up in emergency room and do related interventions (boston used to have program)
 - Zoning codes often set parking space minimums, but rarely maximums.
 - MAPC has study noting how everyone is building too much parking (“Perfect Parking study”)
 - [raised] community gardens on old parking lots

- Cluster buildings in one part of parcel
- Focus on ZONING
- Revere did a parklet study where they offered long term leases to organizations to build parklets on city-owned open space

<https://www.mapc.org/resource-library/air-quality/> Link sent by Sharon for air quality projects

Material for references made in the booklet

Layers for analysis

| <i>Urban Heat Islands</i> | <i>Flooding</i> | <i>Air Quality</i> |
|---------------------------|------------------------------------|----------------------|
| Air Temperature | 1% FEMA | PM 2.5 |
| Impervious Surfaces | NOAA Overlay | Buffer Roads |
| Sensitivity | Hurricane Surge & Inundation Zones | Buffer Bus Routes |
| Vulnerability | Sea Level Rise | Buffer Subway & Rail |
| Adaptability | Sensitivity | |
| | Vulnerability | |
| | Adaptability | |

| Demographics | | |
|---------------------|--------------------|-------------------------------|
| Minority % | 3 Person Household | Doctorate Degree |
| Hispanic/Latino % | 4 Person Household | Adult English Proficient % |
| Vacant % | 5 Person Household | Underage English Proficient % |
| Total Population | 6 Person Household | In Poverty % |

| | | |
|----------------------------|--|-----------------------------------|
| Male/Female Ratio | 7+ Person Household | Unemployed % |
| Youth % | Did not complete primary school | Unemployed or Institutionalized % |
| Adult % | Completed primary school (K-5) | Did not work Past 12 Months % |
| Senior % | Did not complete secondary school (6-12) | Without Insurance % |
| Householder Living Alone % | Received HS Diploma/GED/Equivalent | Out of Poverty Insured % |
| Family Household % | Completed some college, no degree | In Poverty Insured % |
| 1 Person Household | Bachelor's/Associate's Degree | Redlining |
| 2 Person Household | Master's Degree/Professional School Degree | EJ Communities |

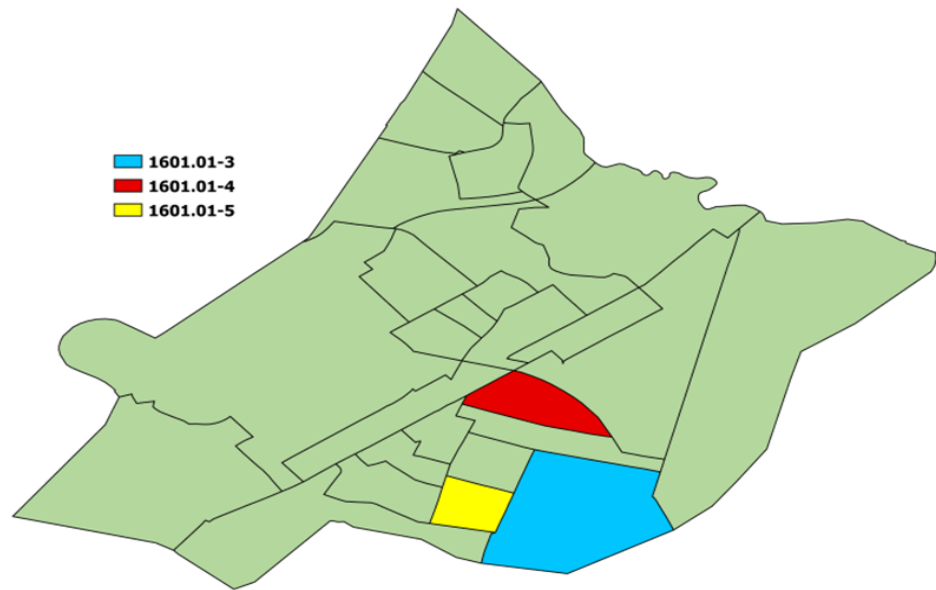
| Health |
|--------------------------|
| Cardiovascular Disease |
| Kidney Chronic Disease |
| Diabetes |
| Lung cancer |
| Asthma |
| COPD |
| Stroke |
| High blood pressure |
| Smoking status |
| Mental health not good |
| Physical health not good |
| Sleep not good |
| Obesity |

2-Pager Public Material:

Executive Summary of Project: Working with the Department of Housing and Community Development in Chelsea, MA, our team developed a more comprehensive understanding of environmental hazards within the municipality. Environmental hazards can be damaging to the health of residents and often disproportionately affect minority and disadvantaged communities. Using data primarily from the City of Chelsea, the United States Census Bureau, and the United States Environmental Protection Agency, we geospatially charted the locations of environmental hazards alongside the locations of selected demographics in order to determine whether any patterns emerged. The primary concerns of our research were determining which demographics and locations within Chelsea were most affected by certain categories of hazards, and additionally how environmental hazards impacted the health of these at-risk demographic groups. We developed a theoretical ranking method in order to highlight for our sponsor which areas need the most assistance in mitigating the effects of environmental hazards via environmental policy. Our team also developed easily-translatable community outreach materials in order to garner interest in our findings, such as social media materials, a two page summary of our project and findings, and a project website. Our method of developing recommendations to combat environmental hazards in Chelsea consisted of researching short term, immediately effective reactive policy to address the symptoms of environmental hazards, along with long term preventative policies which would work to mitigate the environmental and health effects of hazards. Specific recommendations were made for the most affected locations in Chelsea, and more general city or state level recommendations were made to address the state of certain hazards in the city. These recommendations were also sorted loosely by feasibility (cost, time to implement, side effects of the policy on the city, etc), as well as priority (whether the solution addresses multiple populations or locations, is an immediate solution versus a long term one, etc). Additionally, we interviewed the senior public health and regional planner for the Metropolitan Area Planning Council to gain insight on the intricacies of community planning, solutions to environmental issues that have been used in similar municipalities, and advice on our recommendations from the perspective of a policymaker.

Highest priority Block Groups:

Image 1 (Left): A map of Chelsea broken up into its census block groups with the three areas of greatest risk based on our analysis highlighted in different colors.



City-wide recommendations:

Many of the major environmental hazards contributing to the problems of flood risks, poor air quality, and extreme heat are present across multiple block groups in Chelsea. Therefore, we have come up with a series of city-wide recommendations which, if applied correctly, would reduce the effects of certain environmental hazards or could potentially remove one or more environmental hazard sites. These recommendations are not ranked.

Recommendations:

1. **Enhance the reliability of the current transportation system and reevaluate traffic laws.**
2. **Creation of green roofs and white roofs**
3. **Repurposing of unused spaces to create green spaces**
4. **City-wide plans in the event of an emergency due flooding, extreme heat, and/or poor air quality.**
5. **Programs to assist in the purchase and installation of HEPA filters and AC units.**
6. **Work with companies in the region which produce or house toxic materials which could be washed up in the event of a major flood.**

Twitter + Facebook description (280 characters or less):

Live in Chelsea, MA and interested in the environment and how it affects you? A recent research project by WPI students may let you know which environmental hazards are hurting your neighborhoods—and who's at risk.

Data Collection References:

Source link: [CDC/ATSDR's Social Vulnerability Index \(SVI\)](#)

Description: Source for data regarding regulations for social vulnerabilities

Centers for Disease Control and Prevention. (2021, April 28). *CDC/ATSDR's social vulnerability index (SVI)*. Centers for Disease Control and Prevention. Retrieved October 12, 2021, from <https://www.atsdr.cdc.gov/placeandhealth/svi/index.html>.

Source link: [MassGIS Data Layers | Mass.gov](#)

Description: MASSGIS data information for demographics and other collection of data sets

Mass.gov. (n.d.). *MassGIS data layers*. Mass.gov. Retrieved from <https://www.mass.gov/info-details/massgis-data-layers#survey/demographic-data->.

Source link: [American Community Survey \(ACS\) \(census.gov\)](#)

Description: ACS census for data collection for GIS mapping

Bureau, U. S. C. (2021, October 8). *American Community Survey (ACS)*. Census.gov. Retrieved from <https://www.census.gov/programs-surveys/acs>.

Source link: [Massachusetts 2020 Environmental Justice Populations \(arcgis.com\)](#)

Description: Site of a map showing all of Massachusetts EJ populations

Mass.gov. (n.d.). *Environmental Justice Populations in Massachusetts*. ArcGIS web application. Retrieved from <https://mass-eoea.maps.arcgis.com/apps/webappviewer/index.html?id=1d6f63e7762a48e5930de84ed4849212>.

Source link: [Improved Race and Ethnicity Measures Reveal U.S. Population Is Much More Multiracial \(census.gov\)](#)

Description: part of the ACS census, this part of the ACS website goes more into how the 2020 Census Illuminates Racial and Ethnic Composition of the Country

Jones, N., Marks, R., Ramirez, R., & Rios-Vargas, M. (2021, August 12). *2020 census illuminates racial and ethnic composition of the country*. Census.gov. Retrieved from <https://www.census.gov/library/stories/2021/08/improved-race-ethnicity-measures-reveal-united-states-population-much-more-multiracial.html>.

Source link: [National Environmental Public Health Tracking Network Query Tool \(cdc.gov\)](#)

Description: CDC tracking tool for general health data information in the USA. Does only national level data in health issues

Centers for Disease Control and Prevention. (n.d.). *National Environmental Public Health Tracking Network Query Tool*. Centers for Disease Control and Prevention. Retrieved from <https://ephtracking.cdc.gov/DataExplorer/>.

Source link: [2019 Data Profiles | American Community Survey | US Census Bureau](#)

Description: Another part of the ACS data information for a 5 year summary from 2015-2019

Bureau, U. S. C. (n.d.). *Data Profiles*. 2019 Data Profiles | American Community Survey | US Census Bureau. Retrieved from <https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/>.

Source link: <https://www.census.gov/programs-surveys/acs/data/summary-file.html>

Description: ACS summary file location and information

Bureau, U. S. C. (2021, October 8). *American Community Survey Summary File*. Census.gov. Retrieved from <https://www.census.gov/programs-surveys/acs/data/summary-file.html>.

Source link: [OpenAQ](#)

Description: Air Quality Info

OpenAQ. (n.d.). *Chelsea HP in SUFFOLK, US*. OpenAQ. Retrieved from <https://openaq.org/#/location/224972>.

Source link: [Real-time air quality map | PurpleAir](#)

Description: PurpleAir showing real time air quality information in Chelsea along with the spreadsheets for this information

PurpleAir. (n.d.). *Real-time air quality map*. PurpleAir. Retrieved from <https://map.purpleair.com/1/mAQI/a10/p604800/cC0?select=103788#15.14/42.397863/-71.023971>.

Source link: [Boston, MA Weather History | Weather Underground \(wunderground.com\)](#)

Description: Use to learn about the weather history in Chelsea for temperatures (compare it to purple air data)

TWC Product and Technology LLC. (n.d.). *Boston, Ma Weather history* star_ratehome. Weather Underground. Retrieved from <https://www.wunderground.com/history/daily/us/ma/boston/KBOS/date/2020-8-27>.

Source link: [OLIVER \(state.ma.us\)](#)

Description: GIS Map of flooding in boston (and chelsea)

OLIVER. (n.d.). *OLIVER: MassGIS's Online Mapping Tool* . OLIVER. Retrieved from http://maps.massgis.state.ma.us/map_ol/oliver.php?lyrs=Hurricane%20Surge%20Inundation%20Zones~FEMA_Hurricane_Surge_Inundation_Zones2~%7CFEMA%20National%20Flood%20Hazard%20Layer~FEMA_FEMA_National_Flood_Hazard_Layer~%7CDetailed

%20Features~Basemaps_MassGISBasemapWithLabels2~&bbox=-71.08422299859768,42.37898509462885,-70.97856542108288,42.419423404343384&coordUnit=m&measureUnit=m&base=MassGIS%20Statewide%20Basemap¢er=-7907178.6337757,5220967.6456005&zoom=14&opacity=1,1,1&baseO=1&filt=undefined%7Cundefined%7Cundefined.

Source link: [FEMA's National Flood Hazard Layer \(NFHL\) Viewer \(arcgis.com\)](#)

Description: FEMA layer maps for the USA and to help us find flood zones in chelsea

FEMA. (n.d.). *Header ControllerFEMA's National Flood Hazard Layer (NFHL) Viewer.*

ArcGIS web application. Retrieved from

<https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd&extent=-71.0495306339075%2C42.38506835258673%2C-71.00798858068374%2C42.400915654643896>.

Source link: [MapsOnline - Chelsea - SimpliCITY Mapping by PeopleGIS](#)

Description: Map showing all the green spaces in Chelsea MA

PeopleGIS. (n.d.). *Chelsea Maps Online.* Home. Retrieved from

<https://www.mapsonline.net/chelseama/#x=-7915440.189712,5216939.040133,-7900764.280283,5224143.230048>.

Source link: [Chelsea and East Boston Heat Study \(arcgis.com\)](#)

Description: Map showing Chelsea and East Boston Heat Study is a collaborative research project between Boston University School of Public Health and GreenRoots. Covers several topics with a variety of information.

GreenRoots. (n.d.). *The Chelsea and East Boston Heat Study.* bucas.maps.arcgis.com.

Retrieved from

<https://bucas.maps.arcgis.com/apps/MapSeries/index.html?appid=afedd36cf86b4903ad7a3c35c55d7bd1&embed#>.

Source link: [21inch Sea Level Rise 10pct Annual Flood - GeoJSON - Analyze Boston](#)

Description: Another map showing Flood Maps in Boston (and chelsea)

OpenGov. (n.d.). *Geojson*. Analyze Boston. Retrieved from <https://data.boston.gov/dataset/21inch-sea-level-rise-10pct-annual-flood/resource/4c65aa6b-c0e1-4566-b7a4-5912de53dba4>.

Source link:

<https://massdocs-digital-mass-gov.s3.amazonaws.com/s3fs-public/2017/chrepor.pdf?SH118uukzZ2RoCiHzb7OIaR.cRCkEUiR>

Description: 2005 hazard locations

Bureau of Waste Sites Cleanup Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection.
(July 2005). An Investigation to Determine Whether Waste Sites Are Affecting Schools
in Chelsea, Massachusetts.

<https://massdocs-digital-mass-gov.s3.amazonaws.com/s3fs-public/2017/chrepor.pdf?SH118uukzZ2RoCiHzb7OIaR.cRCkEUiR>

Source link: <https://www.mass.gov/info-details/massgis-data-layers>

Description: MAPC data

MassGIS (Bureau of Geographic Information). (n.d.). *MassGIS data layers*. Mass.gov.
Retrieved from <https://www.mass.gov/info-details/massgis-data-layers>.

Source: Green Infrastructure Map <https://green-infrastructure.esri.com/AssetFinder/index.html>

Description: notes some “farmland of local importance” within chelsea in the agriculture tab

Green infrastructure. Green infrastructure - asset finder. (n.d.). Retrieved from
<https://green-infrastructure.esri.com/AssetFinder/index.html>.

Source: MEPHT Health Data <https://matracking.ehs.state.ma.us/Health-Data/index.html>

Description: Lung Cancer and Bronchus Rates

Mass.gov. (2021, July 14). *Massachusetts Environmental Public Health Tracking*. Health
Data | MEPHT. Retrieved from <https://matracking.ehs.state.ma.us/Health-Data/index.html>.

Source: PLACES: Census Tract Data

<https://chronicdata.cdc.gov/500-Cities-Places/PLACES-Census-Tract-Data-GIS-Friendly-Format-2020-/yjkw-uj5s>

Description: Various health data at the census tract level, from the CDC

Centers for Disease Control and Prevention. (2021, January 4). *Places: Census tract data (GIS friendly format), 2020 release*. Centers for Disease Control and Prevention. Retrieved from

<https://chronicdata.cdc.gov/500-Cities-Places/PLACES-Census-Tract-Data-GIS-Friendly-Format-2020-/yjkw-uj5s>.