JERSEY CITY
ENVIRONMENTAL RESOURCE INVENTORY

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Jersey City Environmental Commission

Jersey City Division of Planning

RUTGERS
CUES — Center for Urban Environmental Sustainability

Acknowledgments

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Photo Credits:
Zenon Tech-Czarny, Johnny Quispe, the students of the 2014 Regional Design Studio, or the Hartman Lab, unless noted otherwise.
Note: Many of the photos are snapshots generated during this study and are included as a simple record of what we saw as we explored Jersey City.

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Executive Summary

The Jersey City Environmental Commission, as part of its mission, commissioned this Environmental Resource Inventory. The 2017 Jersey City Environmental Resource Inventory provides a summary of information that is intended to support the environmental work of the Commission as well as various City of Jersey City Departments and Divisions. Much of the data are stable – for example, bedrock geology and geographic context do not change. Other categories of data are more ephemeral – for example, the current land use has already changed from the 2012 data used to create maps, and there are scientifically supported predictions that flooding will increase and storm surge patterns will change in the future.

The following is a list of recommendations to enable the Jersey City Environmental Commission to take full advantage of this resource and ensure that the most up-to-date and relevant environmental information is available to the City.

Recommendation 1. Work with the Jersey City Division of Planning to continuously annotate and update this document as changes occur.

Recommendation 2. Use this document in conjunction with other plans, studies, and reports, including – but not limited to - the current and updated Jersey City Stormwater Management Plan, the Jersey City Tree Canopy Study, the Jersey City Bikeway System, Jersey City Re-development Plans, Hudson County Soil Survey, etc.

Recommendation 3. Encourage citizen scientists to monitor local biodiversity, beginning with birds and vascular plants, through the use of tools such as the Global Biodiversity Information Facility (http://www.gbif.org),. Accept annual variability while watching for consistent trends.

Recommendation 4. Use this document in conjunction with others to evaluate and make recommendations on development and re-development proposals.

Recommendation 5. Post this document on the City website and create a mechanism for updates.

Jersey City has taken a number of promising actions towards growth and resilience. This document is generated with the hope of helping the City to set a high standard of environmental decision making over the next decade as it grows in population size. There are several related initiatives and documents that support this goal such as the Jersey City Environmental Commission Stormwater Initiatives. The Environmental Commission can work with the Department of Public Safety and the Division of Engineering and Traffic to address fire hazards in highway right-of-ways. The Environmental Commission can develop support and funding for independent monitoring of remediated super-fund sites that are re-developed or closed, and collaborate with the Jersey City Division of Parks and Forestry to integrate and demonstrate green infrastructure practices within these public spaces. Most importantly, the Environmental Commission can review the infrastructure in recent and proposed development and re-development projects as a basis for making specific recommendations for application of green infrastructure best practices. An active Environmental Commission can support the future health and growth of Jersey City.

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CHAPTER 1. Introduction

Introduction

As the name implies, a municipal Environmental Resource Inventory (ERI) is an inventory of a municipality's environmental resources. An ERI includes written narrative, photos, diagrams, maps and tables, which explain some of the key environmental elements that make up the city. Historically, this type of report focused only on the natural resources. In this document, we investigate what elements constitute an "Urban" Environmental Resource Inventory in Jersey City. We examine the physical and biological resources, as well as selected cultural characteristics that are part of the city's environment.

The Jersey City ERI represents a snapshot in time, that is, it is meant to be a "Working" document that will be used and updated regularly by the Environmental Commission, City Staff and the public in making decisions affecting environmental resources. It is intended to be user-friendly and clear for technical experts and lay people alike. It is also meant to be a "Living" document that provides references to resources that are frequently updated. Much of the data for this document comes from the New Jersey Department of Environmental Protection (NJDEP) and the City of Jersey City, but it also includes other state and federal data sources, which can be accessed through the data dictionary (Appendix B) or the Appendices that follow the main report. Because this document is intended to be a living document, the data layer and file information for each map is listed on the adjacent page. This will facilitate updates and allow anyone with access to GIS to re-create and update maps.

It should be noted that a previous Jersey City ERI was completed by David A. Vaccari, Ph.D., and includes two parts, one about the Physical Systems (1988) and a second about the Biological Systems (1993). These documents are available through the Rutgers University Library:

City of Jersey City, New Jersey, Environmental Resource Inventory: Part I - Physical Systems. 1988
https://rucore.libraries.rutgers.edu/rutgers-lib/28768/

City of Jersey City, New Jersey, Environmental Resource Inventory: Part II – Biological Systems. 1993
https://rucore.libraries.rutgers.edu/rutgers-lib/18213/PDF/1/

There are also several other relevant documents that help explain Jersey City's environment. These documents include:

The Jersey City Tree Canopy Assessment (2015, http://www.gicinc.org/PDFs/Jersey_City_Report.pdf),

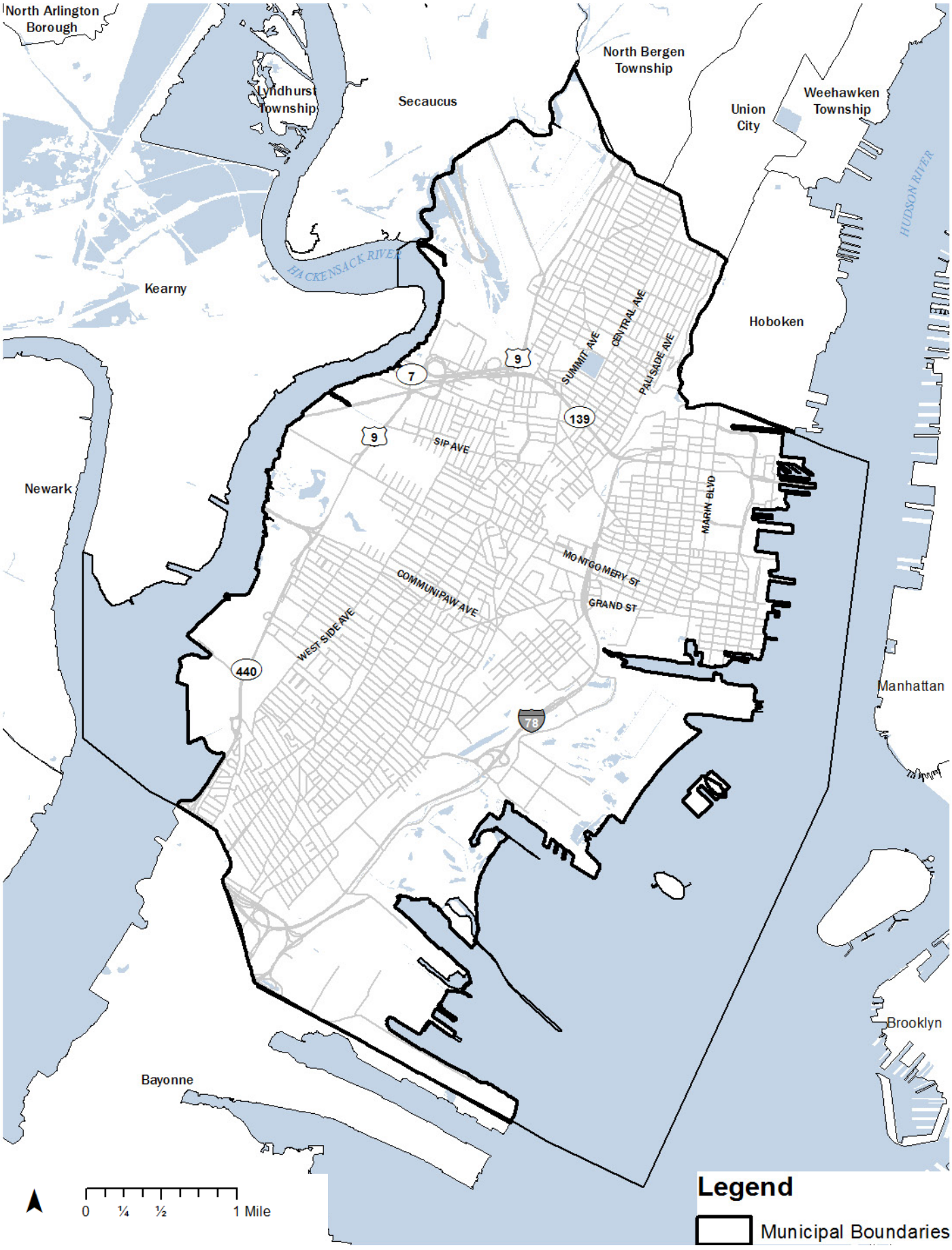
Jersey City Stormwater Management Plan (2008, http://www.jcmua.com/PDF's/Stormwater%20Management%20Plan%20August%202008.pdf),

Jersey City Recreation and Open Space Master Plan (2008, http://www.jerseycitynj.gov/uploadedFiles/City_Government/Department_of_Business_Administration/Jersey%20City%20Recreation%20Master%20Plan%20(Web)%20_4-2008%20REDUCED.pdf), and

The Jersey City Comprehensive Master Plan (2000 plus updates, http://www.jerseycitynj.gov/masterplan/).

The Hudson County Hazard Mitigation Plan (2014, section 9.7, http://hudsoncountynj.org/all-hazard-mitigation-plan/

Map 1. Context Map



Primary Sources: NJDEP, NJDOT

Context

Jersey City is situated in northeastern New Jersey in the southern portion of Hudson County; it is the County seat. The city is on a peninsula called Paulus Hook that sits between the Hackensack River and Newark Bay to the west and the Hudson River and Upper New York Harbor to the east (Map 1). Jersey City is opposite Kearny and Newark, New Jersey to the west and Lower Manhattan, Governors Island and Brooklyn to the east. Secaucus, Union City and Hoboken, New Jersey border the city to the north and Bayonne, New Jersey to the south.

Jersey City is at the nexus of several major regional transportation arteries, including Routes 78, 139, 440, and 1 & 9, as well as transit lines of the Port Authority Trans Hudson (PATH) rapid transit system, and the NJ Transit Hudson Bergen Light rail. The Newark Bay Bridge, the Pulaski Skyway and the US 9 Truck Bridge connect the city to the west. Route 78-Turnpike Extension goes into the Holland tunnel, which connects Jersey City to New York City. The PATH train connects Jersey City to Newark and New York City by rail.

A northwestern portion of Jersey City is within the Meadowlands District, a special environmental protection area established in 1969, which was formerly governed by the New Jersey Meadowlands Commission. The commission controlled certain powers such as land use and development. In December, 2014 the Meadowlands Commission was dissolved and merged into the NJ Sports and Exposition Authority (NJSEA), which now has responsibility for the District. Municipalities have the option of taking over land use controls or leaving zoning authority with NJSEA. Jersey City allows NJSEA to manage the land use of property in the Jersey City portion of the Meadowlands District.

Layer name	Attribute Column Name	Source
Meadowlands District Boundary	SHAPE	
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
New Jersey Municipality Boundaries	NAME	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
New York Boundary	SHAPE	
Highway Labels	ROUTE	http://www.state.nj.us/transportation/gis/data.shtm
Highways	SHAPE	http://www.state.nj.us/transportation/gis/data.shtm

CHAPTER 2. The Physical Characteristics of Jersey City

The Physical Characteristics of Jersey City

The basis of an environmental analysis is the description of the municipality's physical environmental resources. These resources influence how the municipality develops over time and defines some of the ongoing environmental constraints to development. Contrary to custom, this report presents information from the surface down to the bedrock geology, rather than vice versa. Based on conversations with reviewers, we chose this approach so that the most familiar physical characteristics are presented first.

Exchange Place, Jersey City.

Healing Garden at Senior Housing in Jersey City.

Map 2. Aerial

Primary Source: ESRI

The City

Jersey City is 21.08 square miles. The city is made up of 14.79 square miles of land and 6.29 square miles of water within its boundary. The city is highly urbanized, although there is a substantial amount of less developed land and open space, notably Lincoln Park and Liberty State Park, as well as many small parks and open spaces. The city is made up of several distinct neighborhoods/districts, such as Downtown, Journal Square, The Heights, West Side and Greenville.

According to the 2010 US Census, Jersey City is the second most populated city in New Jersey with approximately 262,146 residents. Since 2005, there has been an upward trend in population, and demographic projections indicate that Jersey City could eventually be the most populated city in the state.

The aerial map (Map 2) shows the complexity of the city. If the reader is familiar with Jersey City they will be able to make out familiar places, such as Lincoln Park, Downtown, Liberty State Park, etc. Of course, not everything is visible from an aerial. This ERI document aims to make additional information clear through thematic maps, diagrams and tables. Throughout this report, we will uncover what may be hidden to the naked eye, and reveal a Jersey City that people may not know.

Loew's Theater at Journal Square in Jersey City.


Farmers Market at Grove Street PATH Plaza.

Layer name	Attribute Column Name	
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
AERIAL	N/A	N/A

Climate

Typically, Jersey City experiences air temperatures between 30 and 80 degrees Fahrenheit. However, Jersey City has an extreme range of temperature that can fall below zero Fahrenheit during the winter or above a hundred degrees Fahrenheit during the summer.

The climate data shown below (Table 1) was measured at a National Oceanic and Atmospheric Administration (NOAA) weather station at Newark Airport, which was the closest station to Jersey City. For more specific weather and climate data from Jersey City, visit The Office of the New Jersey State Climatologist's Jersey City webpage: http://www.njweather.org/station/3411

There are consistent predictions of climate change for New Jersey (e.g. http://www.nj.gov/dep/dsr/trends/pdfs/climate-change.pdf). Based on these scenarios, it is likely that maximum temperatures will be higher and that drought conditions will occur more frequently. One reason that drought conditions are expected to become more common is that moisture in soils and vegetation evaporates to the atmosphere more quickly when temperatures are higher. As you can see (Figure 1), there has been an increase in the number of years with annual precipitation events over 54 inches. During the past 40 years, there has been a concurrent change in global average temperature of nearly 1 degree Celsius (Figure 2). The concurrence of these trends adds weight to the predictions of increasing climate changes in the future.

Patterns of wind direction and speed (Figure 3) show that the majority of the winds come from the west. Also, there are less frequent but strong winds from the northeast from September through February.

Table 1. Monthly Temperature, 2005-2015. Source NOAA http://www.ncdc.noaa.gov/cdo-web/

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Maximum	39.55	42.28	51.55	63.77	73.29	82.23	87.43	84.66	78.15	66.25	54.98	44.71
Mean	32.36	34.55	43.08	54.33	63.96	73.25	78.67	76.40	69.61	57.99	47.14	37.85
Mean Minimum	25.15	26.76	34.57	44.80	54.61	64.21	69.89	68.06	61.00	49.70	39.22	30.99

Figure 1. New Jersey Annual Precipitation for 120 years. Source: Office of the New Jersey State Climatologist http://climate.rutgers.edu/stateclim_v1/images/nj_pcp.jpg

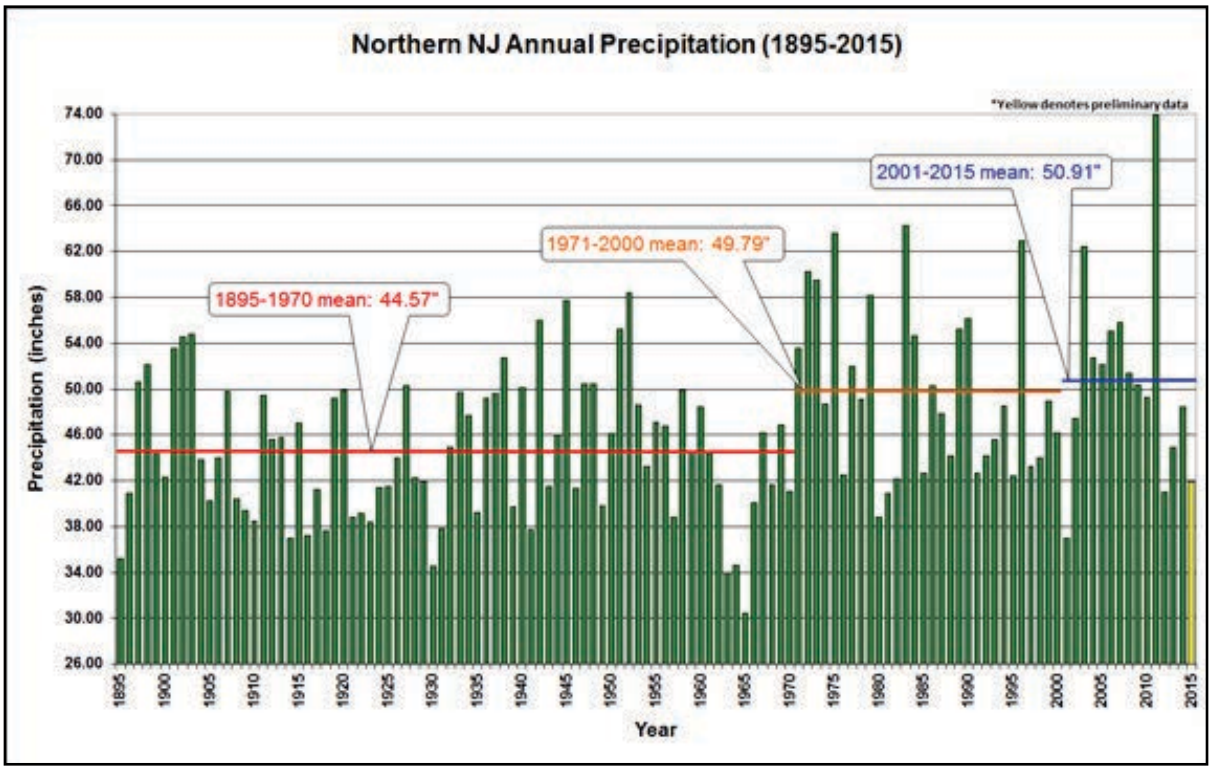


Figure 2. Temperature pattern over time. Source: NASA GISS http://data.giss.nasa.gov/gistemp/graphs/

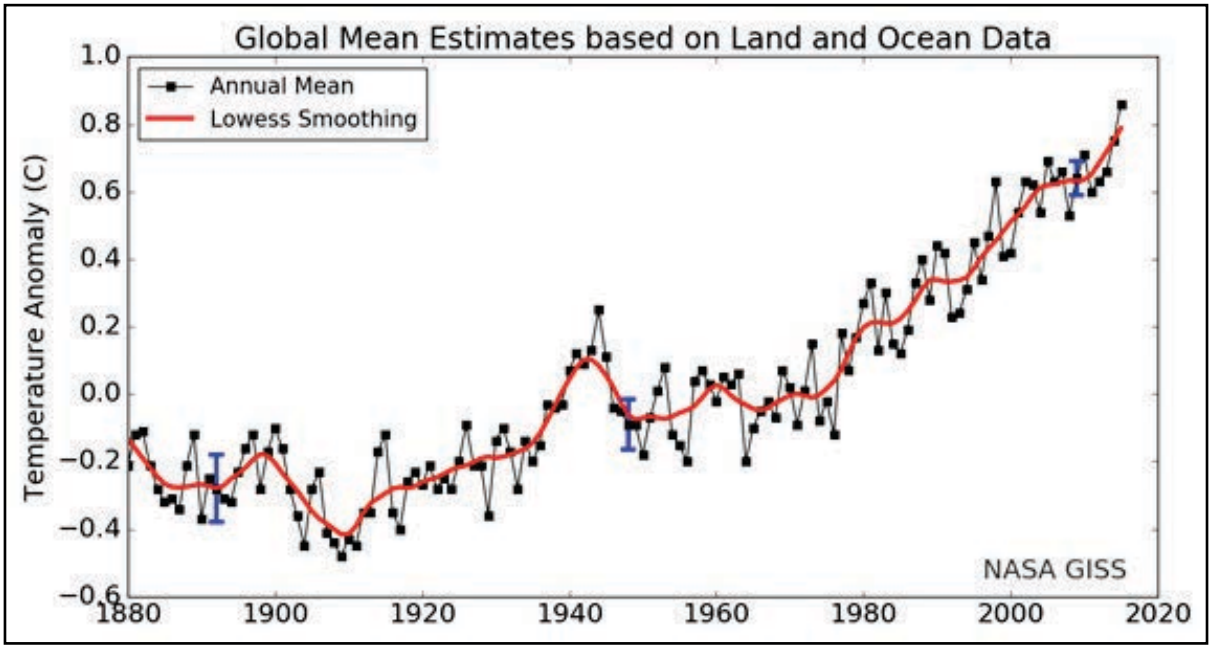
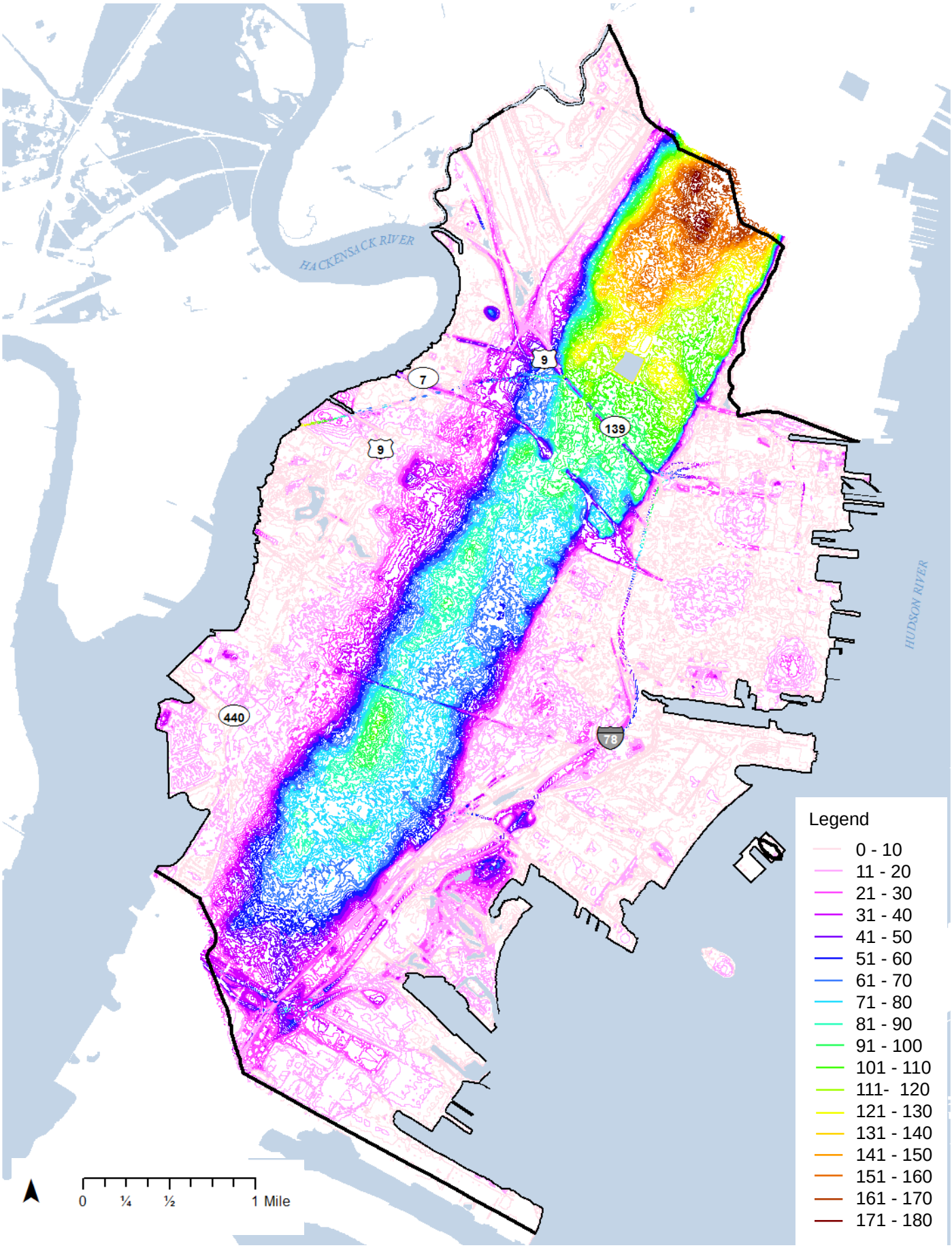


Figure 3. Patterns of Wind Direction and Speed by Month near Jersey City. A wind rose gives a succinct view of how wind speed and direction are typically distributed at a particular location. Presented in a circular format, the wind rose shows the frequency of winds blowing from particular directions. The length of each "spoke" around the circle is related to the frequency of time that the wind blows from a particular direction. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles. (Quoted from: https://www.wcc.nrcs.usda.gov/climate/windrose.html)

Tidal Creek near Hackensack River in Jersey City.

Map 3. Surface Topography Map (In feet)



Primary Source: Jersey City

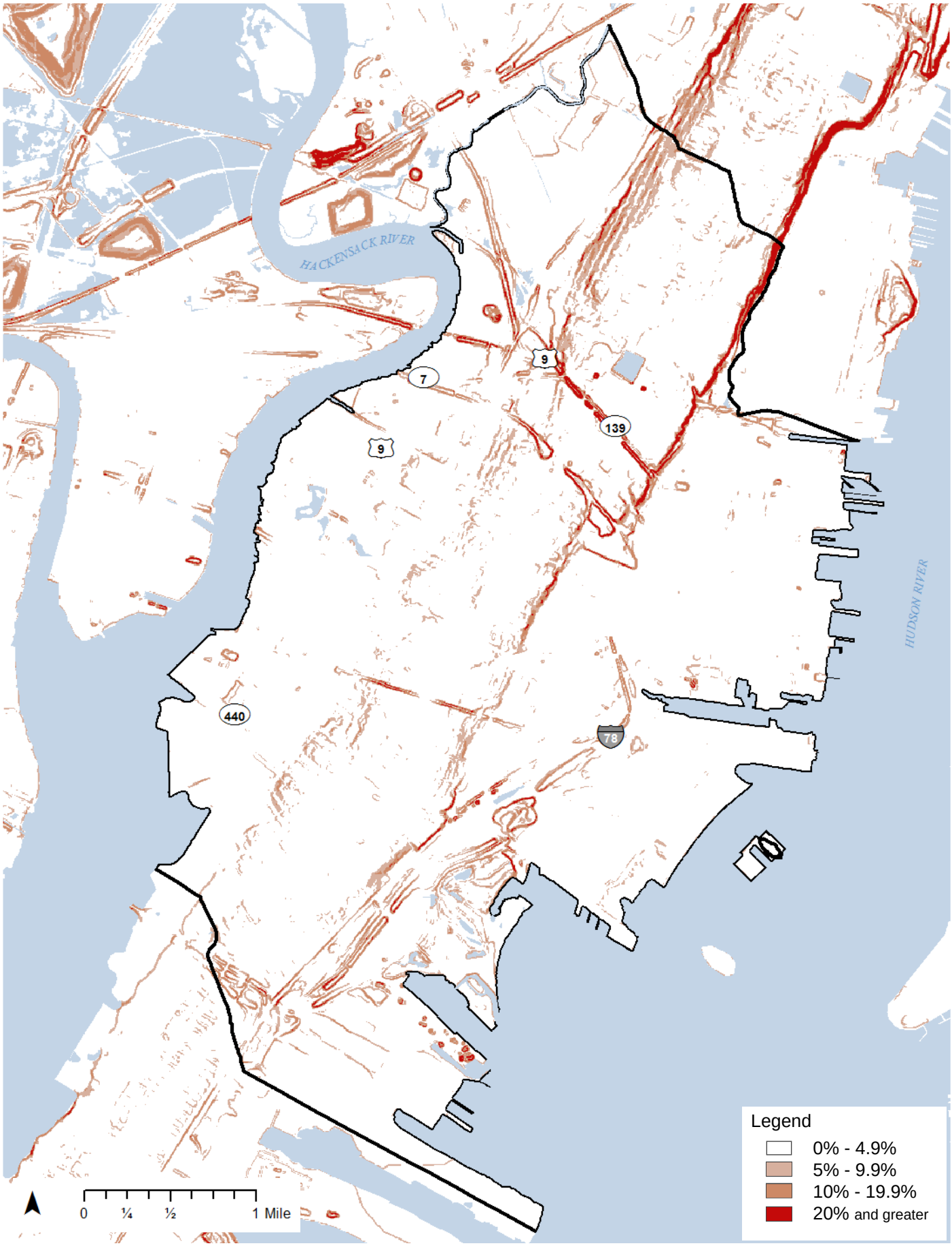
Topography

The land surface elevation of Jersey City ranges from sea level (0') to over 170' above sea level (Map 3). The highest area is in the Heights, near Washington Park. as shown by the contour lines on Map 3. Surface Topography is shown in 10' contours. The colors of the contour lines change from pale pinks for low elevations, to purple, blue, green, yellow and brown as the elevation increases. The white areas between contour lines are relatively flat.

In reading this map, notice the way the purple and dark blue contour lines outline a shape from the northeast to the southwest. This shape is the end of the diabase ridge, which is a geologic formation of extremely hard rock, formed by volcanic activity, long ago. This geologic formation creates the distinct elevation of the Heights in Jersey City and, further north, the Palisades.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
City Water	Type	
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Topography	Elevation	N/A

Map 4. Slope Map



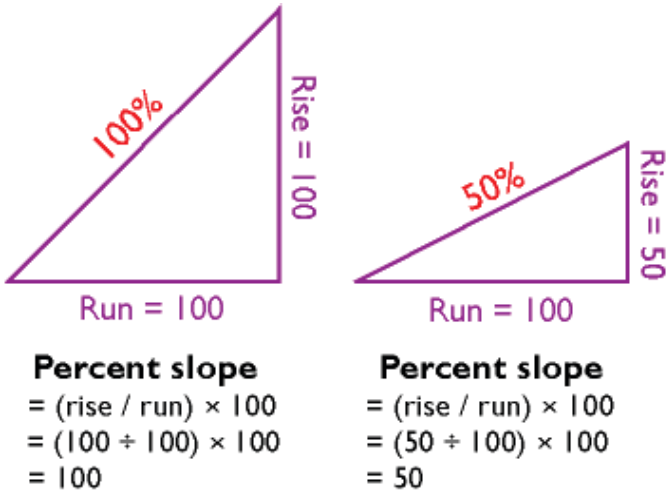
Primary Source: USGS

Slope

Landforms are defined by slopes – that is, places where the elevation is changing. The greater the change in elevation over a given distance, the greater the slope. Slope is typically measured in either degrees or percent. A 450 slope is equal to a 100% slope. Four categories of slope are defined: 0%-4.9% is relatively flat; 5%-9.9% is a noticeable, but usually walkable, slope; 10%- 19.9% is a difficult slope for walking or building; 20% and greater is very difficult and can be found on the walls of the Embankment, the Bergen Arches, and the edges of the Heights.

This map uses the percent scale (Map 4). The steepest slopes (in red) show the rock face that defines the eastern edge of the Heights, as well as the steep walls along the Embankment.

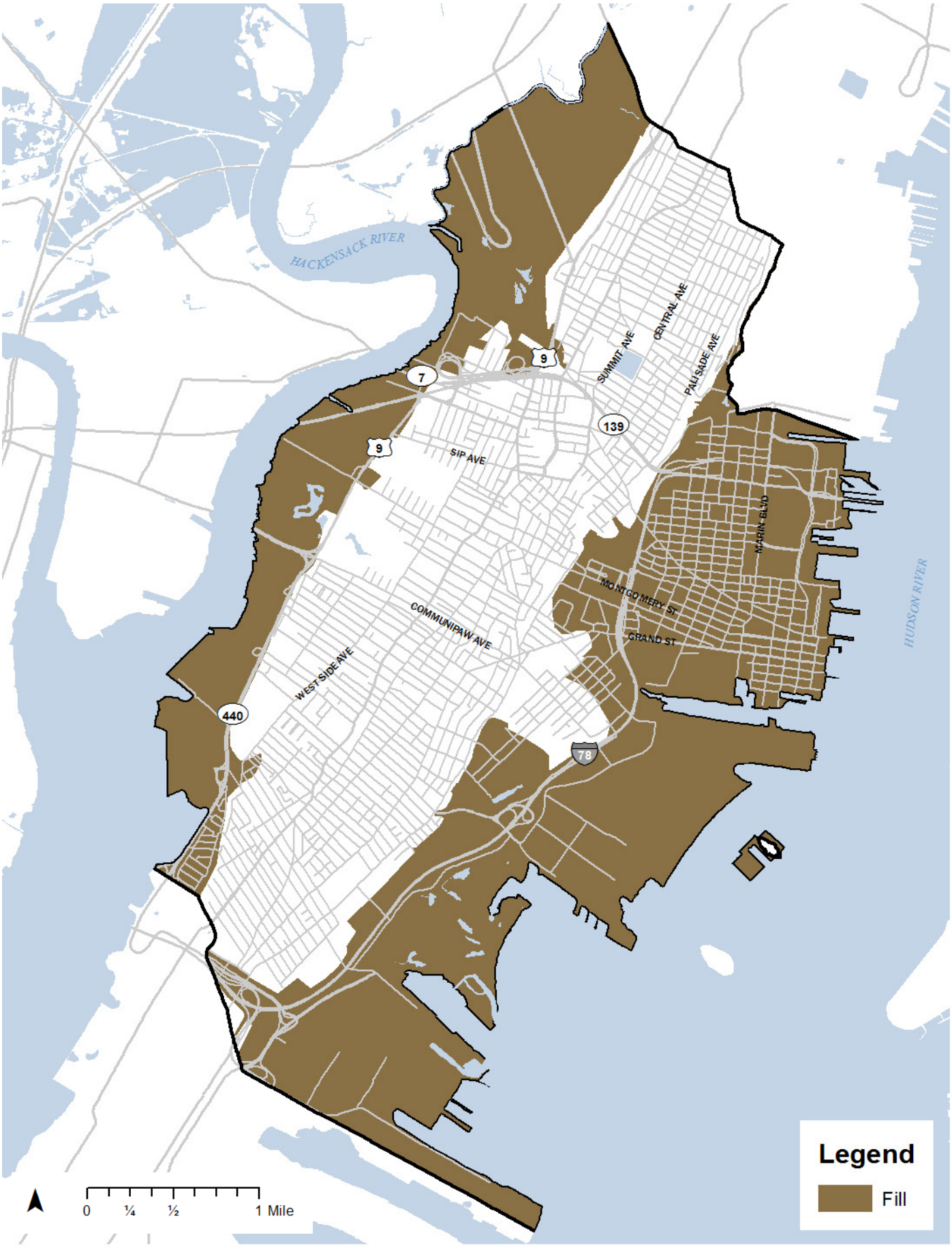
If you review the elevation and slope maps together, you will see that where the contour lines are closer, steeper slopes occur.



Source: https://www.e-education.psu.edu/natureofgeoinfo/sites/www.e-education.psu.edu.natureofgeoinfo/files/image/slope_percent.gif

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Slope		http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Map 5. Historic Fill Map



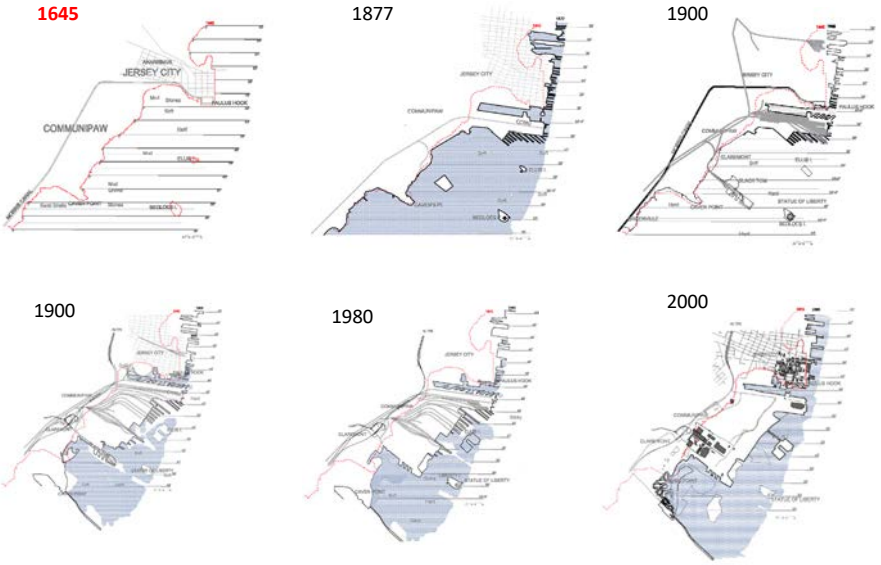
Primary Source: NJDEP

Historic Fill

Early European settlers appreciated the access to the Hudson River they found in the area that is now Jersey City. As transportation technology changed to railroads and larger ships, the Jersey City waterfront was transformed. This transformation required filling wetlands and shallow waters, followed by the building of large piers and railroad yards. Filling of coastal areas has slowed in recent times. This map shows that over half of today's Jersey City is built on fill materials (Map 5). It is particularly important to identify the areas where wetlands were filled when considering development proposals. The lower stability of the underlying peat must be taken into consideration when reviewing the feasibility of new construction.

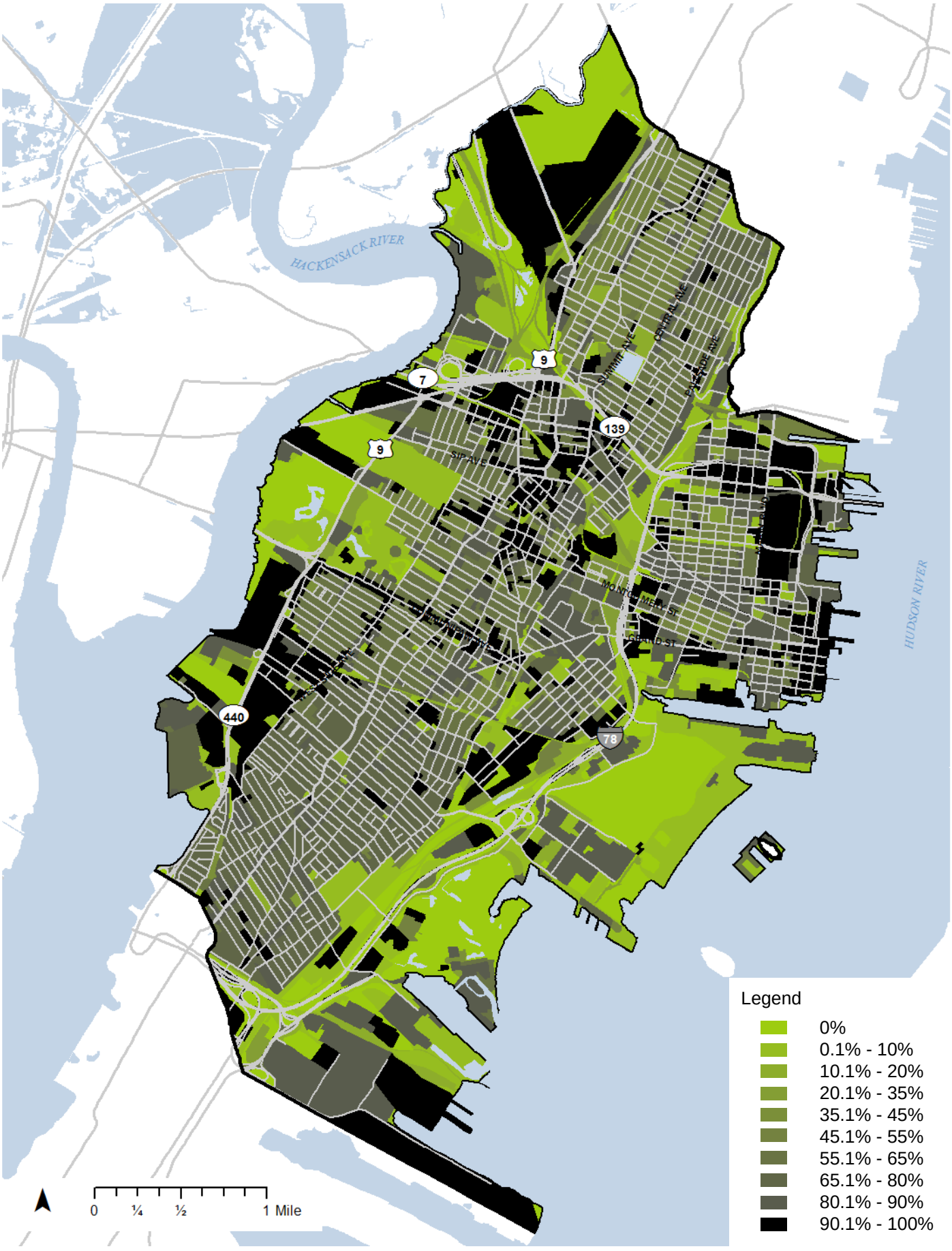
Mody (2015), a Rutgers Graduate student, completed an analysis of the pattern of filling that occurred after European Settlement (Figure 4). Her work shows that the transformation of Jersey City started early in the Colonial period and continues to persist. A more detailed explanation of her study is available in Appendix C.

Figure 4. Pattern of coastal filling along the Hudson River front of Jersey City (Mody 2015).



Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Historic Fill	FILL	http://www.state.nj.us/dep/njgs/geodata/dgs04-7.htm

Map 6. Impervious Surface

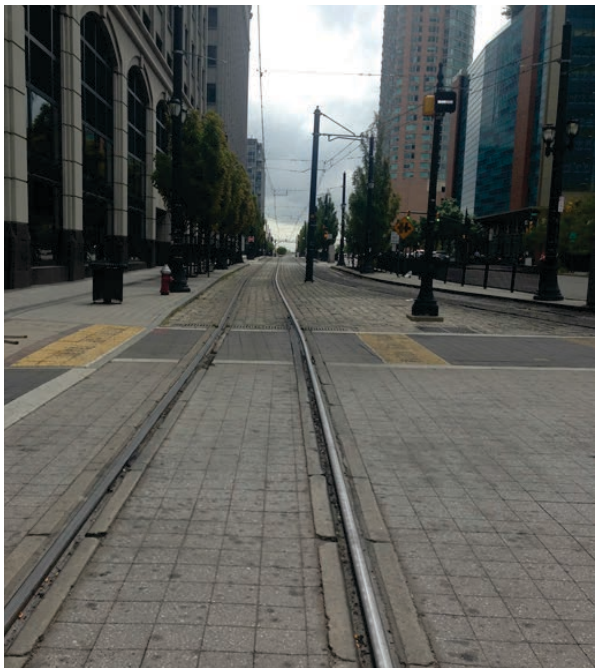


Primary Source: NJDEP

Impervious Surface

In natural systems soils are pervious – that is, water from rain or snow melt can seep into the soil. Map 6 shows the percent impervious surface in areas of Jersey City where water cannot infiltrate, as calculated by NJDEP in 2012. The overall percent impervious area for Jersey City is 53%, base on these data.

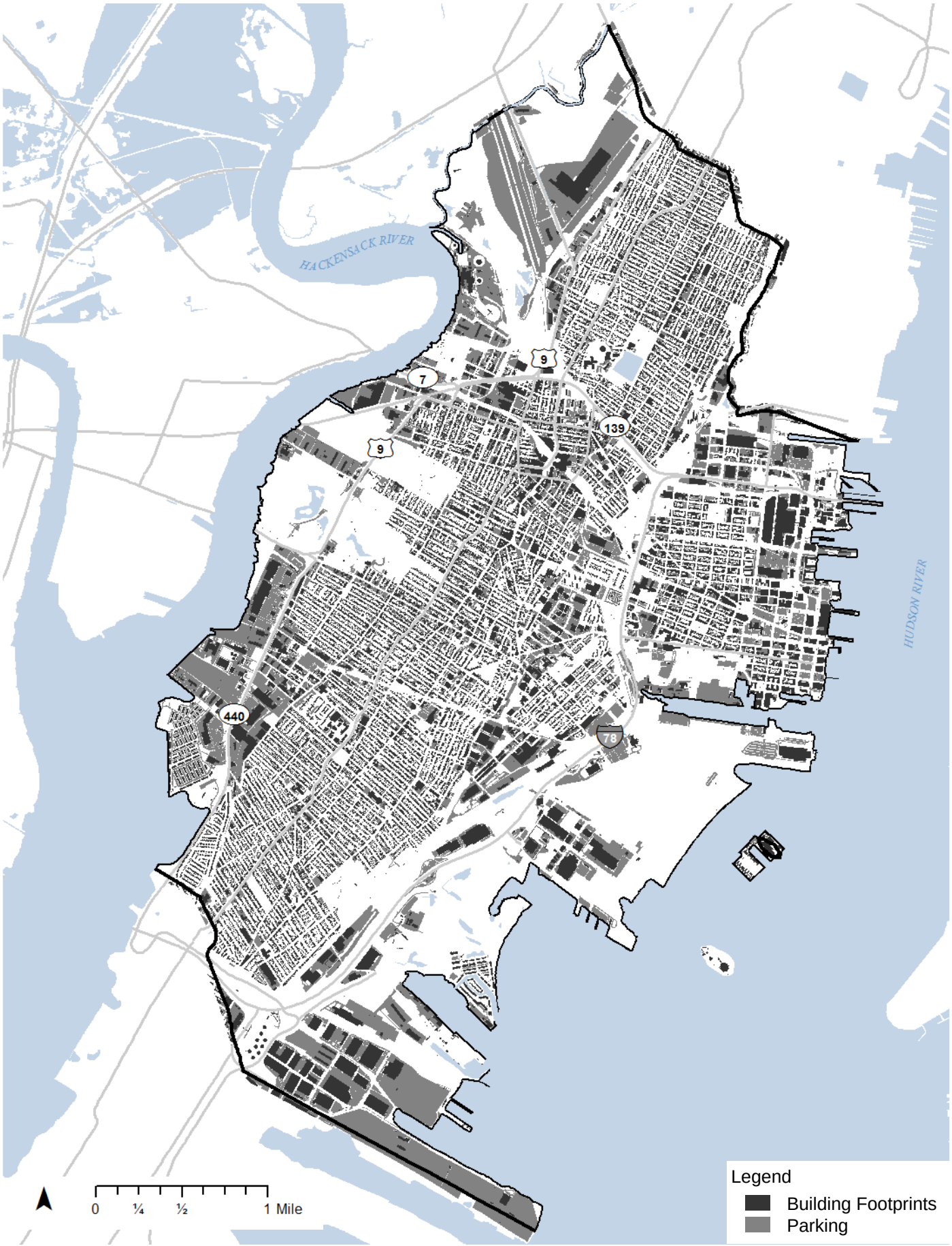
Soil becomes less pervious to water when it is compacted, a situation that is common in urban soils such as those in Jersey City. Soil that is covered, for example, with buildings or parking lots is impervious to water, therefore when it rains or when snow melts, the water is directed into storm sewers. These storm sewers are designed to move water rapidly away from urban areas and release stormwater into rivers, streams, wetlands. This affects stream hydrology, erosion, and water quality.



Hudson Street, looking south, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Impervious Surface	IS12	http://www.nj.gov/dep/gis/lulc12c.html

Map 7. Buildings Footprints and Surface Parking Areas (2008)



Primary Source: Jersey City

Buildings and Surface Parking Areas

While buildings and parking surfaces might not be the first thing that comes to mind when thinking about the environment, they in fact make up most of Jersey City. Buildings fill and define space. Map 7 shows building footprints in black and surface parking in gray.

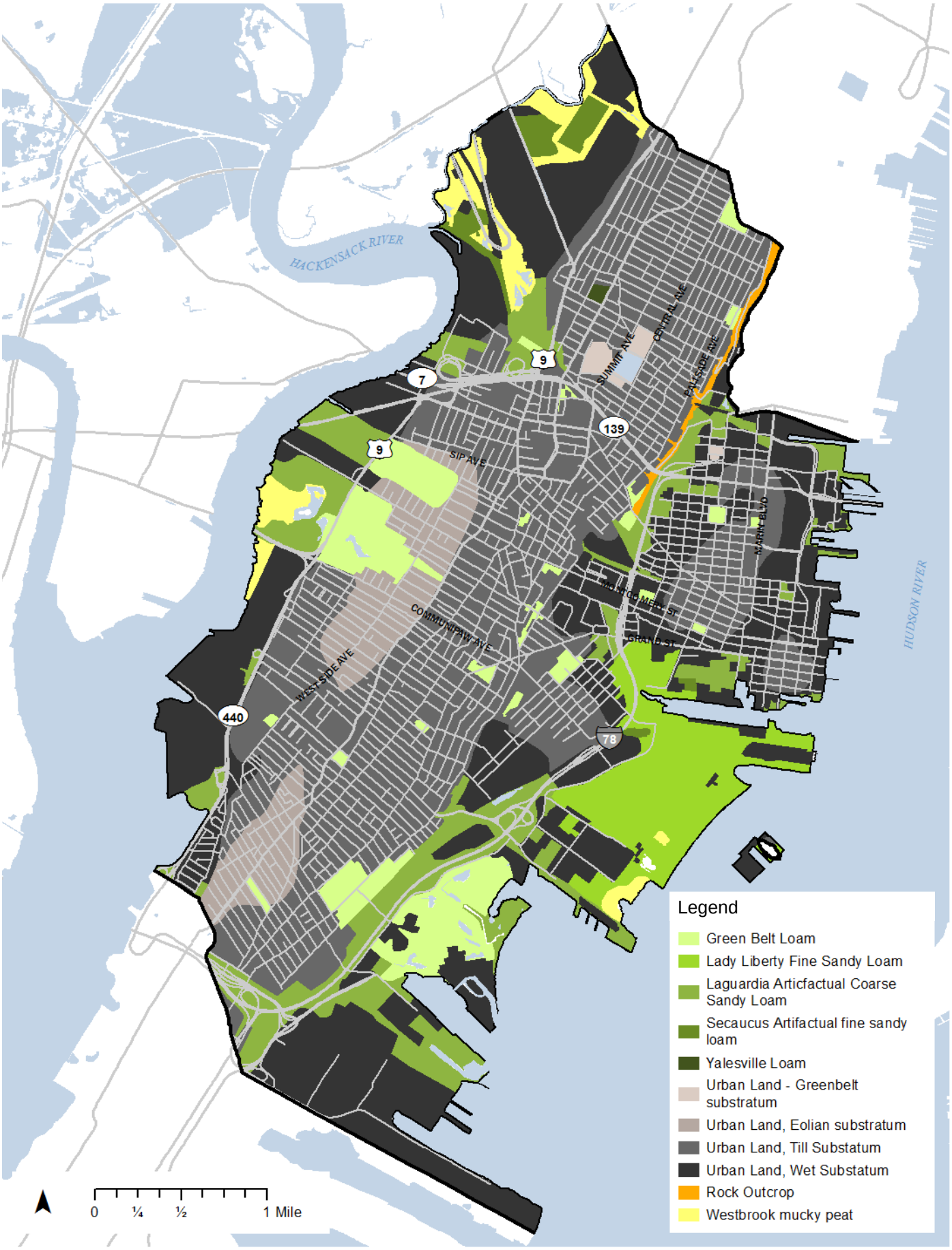
According to the 2008 data from the Jersey City Division of Planning, there are 33,876 buildings in Jersey City. Buildings often influence how an individual perceives a place. If a person walks in a neighborhood with nice brownstones or a retail area with a lot of street activity, they are likely to feel better than when walking in an industrial area with large factories. Note how the size of building footprints vary in areas that you are familiar with. Buildings also use a substantial amount of energy. According to the US Department of Energy buildings account for 40% of all energy consumed. Jersey City has committed to source 80% of their energy from renewable energy by 2050 (http://www.cityofjerseycity.com/uploadedFiles/Public_Notices/Press_Releases/Energy%20Initiatives%20Press%20Release%20(1).pdf). Increasing awareness of Jersey City's building locations and a building's energy use can help the City reduce energy consumption in order to meet this goal in the future.

Furthermore, buildings and parking surfaces constitute the majority of impervious surface in Jersey City. Combining building footprints with surface parking and transportation corridors (streets, roads, highways, railways, etc.) account for 161,607,333 square feet of impervious surface. Using green infrastructure such as green roofs, rain gardens and permeable paving help decrease the amount of impervious surfaces and provide a wide range of benefits.

12th Street, looking south, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Buildings	TYPE	N/A

Map 8. Soil Type



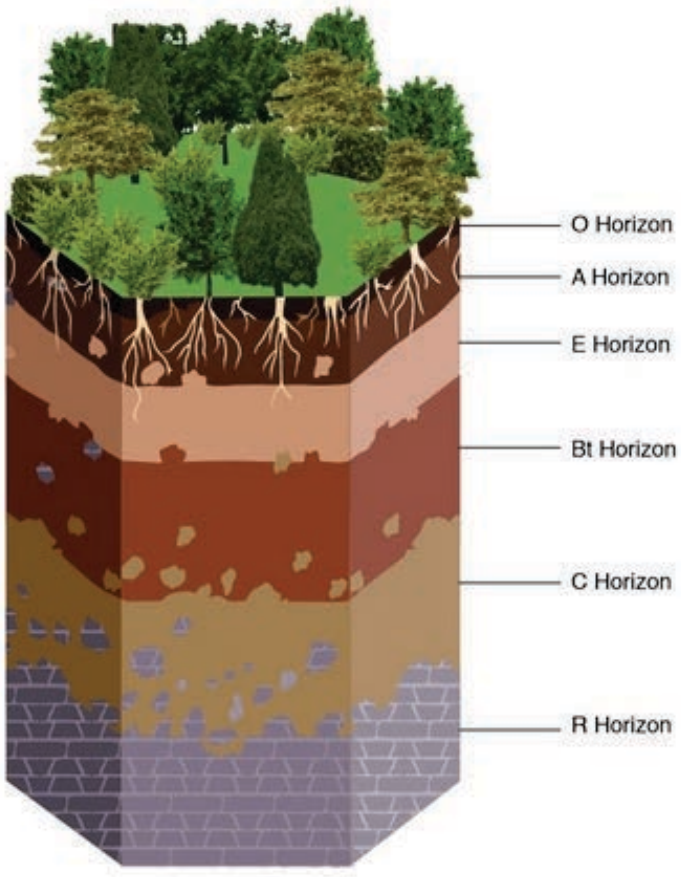
Primary Source: USDA

Soils

The soil classification for Jersey City includes two major categories: urban land and fill as shown in Map 8. In Appendix A, Table 1 provides additional information about the legend and Table 2 provides additional description of the soil characteristics. Leonard Gordon Park is distinct on this map for having the only soil that does not fit into one of these urban soil categories. The soil is composed of Yalesville loam, which was probably much more common in the Jersey City boundaries of the 19th Century. Its presence may be, in part, due to its rocky terrain. Additionally, the land was purchased by Jersey City in 1907, before the land had been developed. The rock outcrop on the east side of the Heights also has a distinct soil category, as are the areas where mucky peat is at the surface.

Urban Land covers about 70% of Jersey City. It is essentially impervious surface. There are four categories that are distinguished by the characteristics of the substratum, such as texture, mineral content, and water distribution. There are also four types of fill; these are distinguished by the type and most common texture of the fill, as well as the drainage class. Specifically, Greenbelt and LaGuardia are well-drained, whereas Secaucus and Lady Liberty are moderately well-drained.

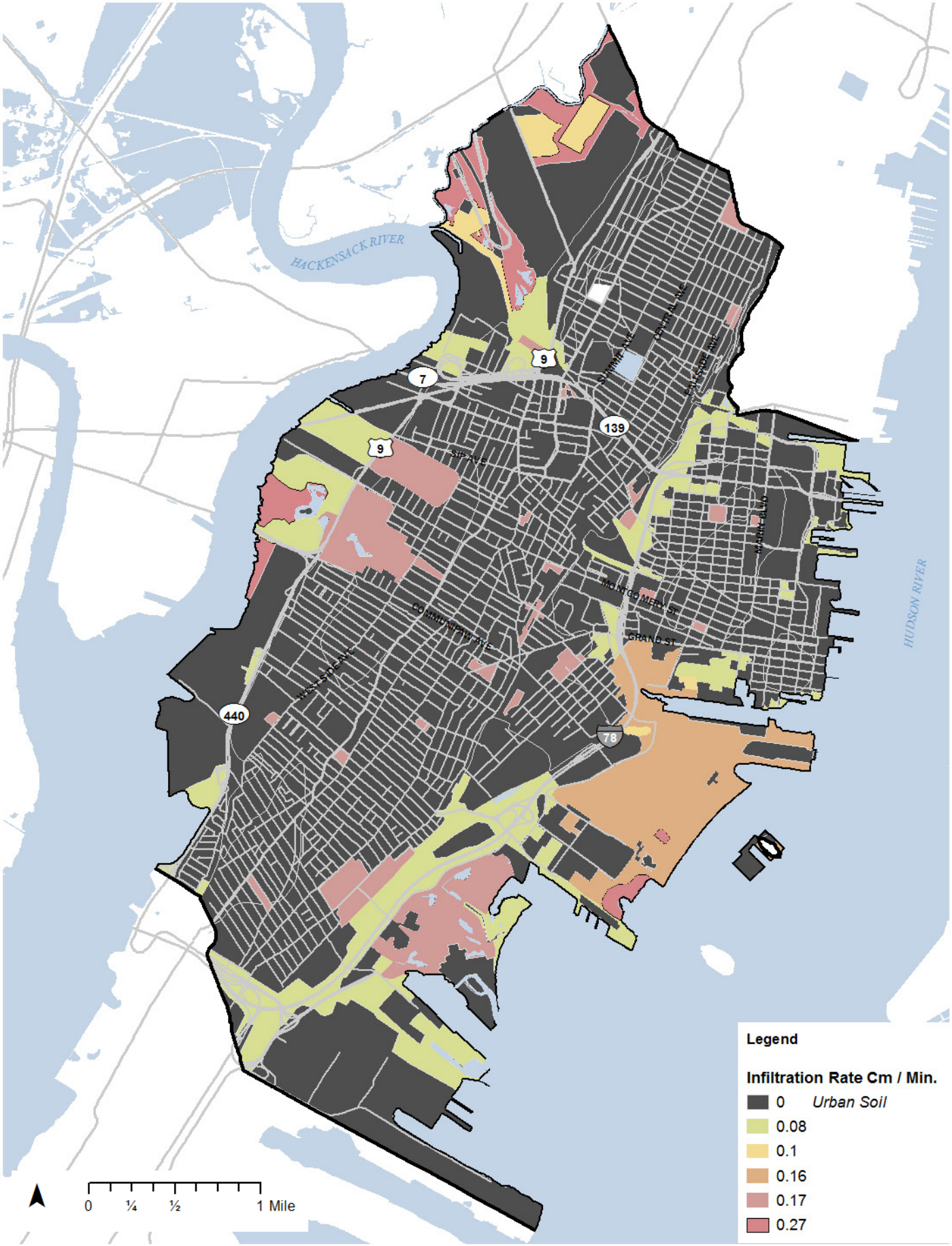
Source: http://krishiworld.com/wp-content/uploads/2012/06/soil.jpg



Source: http://www.nature.com/scitable/content/ne0000/ne0000/ne0000/ne0000/101053472/figure9_v002-01_2_1.jpg

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm

Map 9. Infiltration Rate



Primary Source: NJDEP

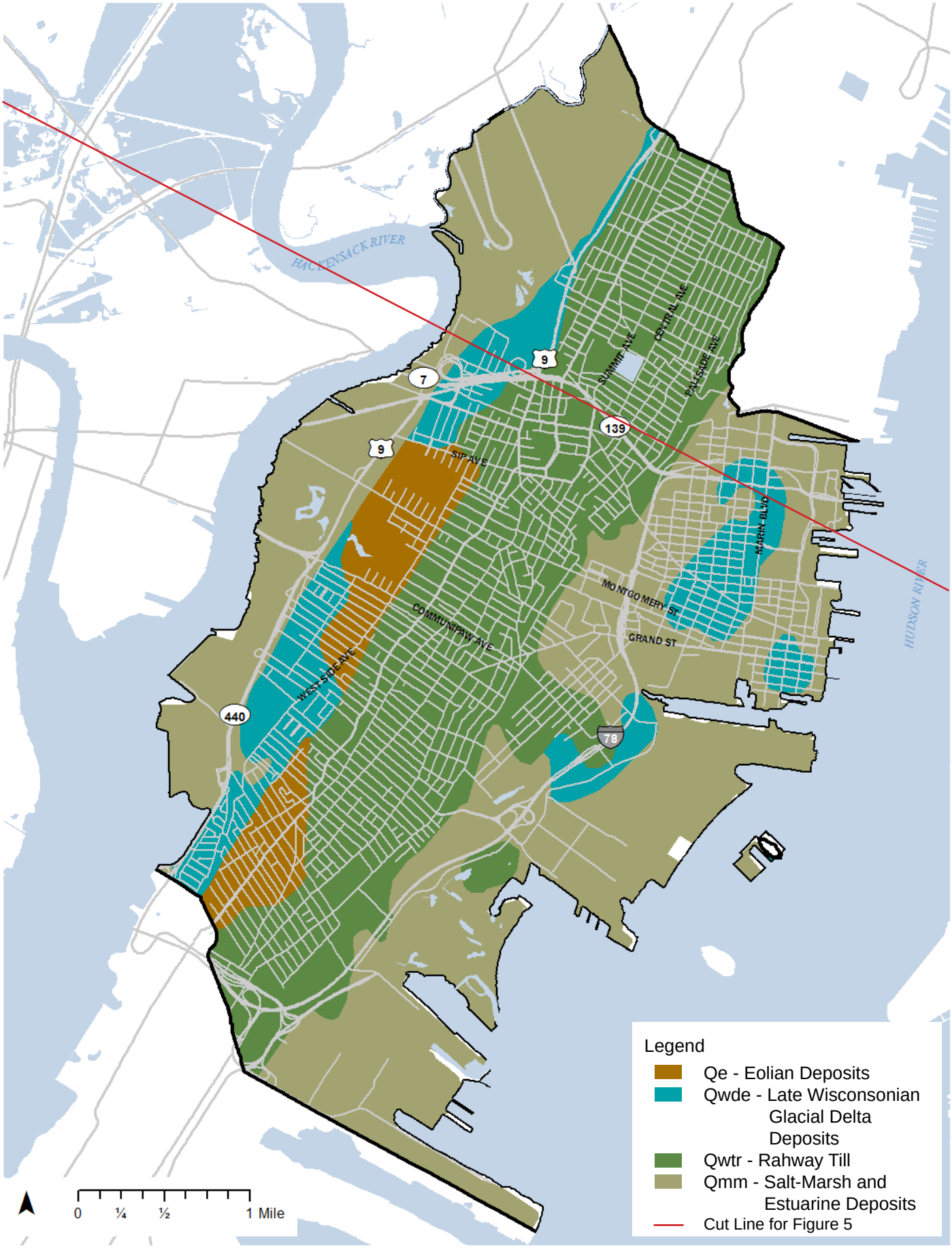
Infiltration Rates

Infiltration rates shown in Map 9 measure the rate at which water can move through soil. The values in the map are measured in volume of water over time that will infiltrate into the soil, in this case centimeters per minute. The rates are assigned to particular soil types and can be associated with the soil types shown in Map 8. These data are derived from the soils data. Because urban soils are highly variable, no calculations of infiltration rates are available. In order to evaluate a site for green infrastructure, the soil infiltration rate would need to be tested carefully at each specific site.

It is useful to compare this map to the Percent Impervious map (Map 6). The Natural Resources Conservation Service (NRCS) estimates infiltration rates for natural soil and fill, but not for urban land. Map 9 shows a range of different infiltration rates for different soil and fill types; however, no data is available for urban land. Impervious Surface (Map 6) and the Infiltration Rate (Map 9) are best used together when considering stormwater problems and green infrastructure proposals.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Infiltration Rates	Available_	http://www.state.nj.us/dep/njgs/geodata/dgs04-7.htm

Map 10. Surface Geology



Primary Source: NJDEP

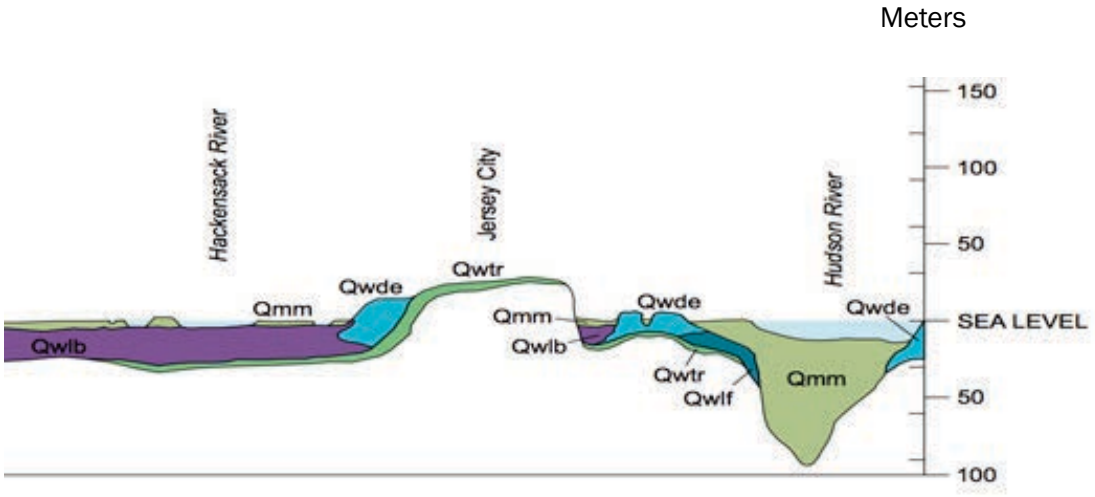
Surface Geology

New Jersey has four major physiographic provinces, the Coastal Plain, Piedmont, Highlands, Ridge and Valley. Jersey City is in the Piedmont physiographic province. The underlying geology of a region largely dictates physiography (or physical geography). Patterns of landforms, slope, soil, etc., are created by the interaction of underlying geologic materials and patterns of weathering. Major surface patterns, such as glaciation, contribute to these forms, as do annual patterns of freezing and thawing.

The categories of Surface Geology refer to patterns that underlay the soil layer and generally align with bedrock geology, while also reflecting the reality of recent geologic processes such as the glacial coverage. Map 10 reveals the pattern of surface geology; Table 3 in Appendix A provides additional description of the characterisitcs. Eolian (or Aeolian) deposits pertain to wind activity and deposition. The Rahway Till indicates that the last glacier deposited materials along the diabase ridge. The other categories reflect sedimentary process and peat production. This geologic layer is important because of its role in soil formation and because it shows areas of great peat depths. This latter information is important in land development. Even when fill is added in these areas, deep pilings are essential for stability.

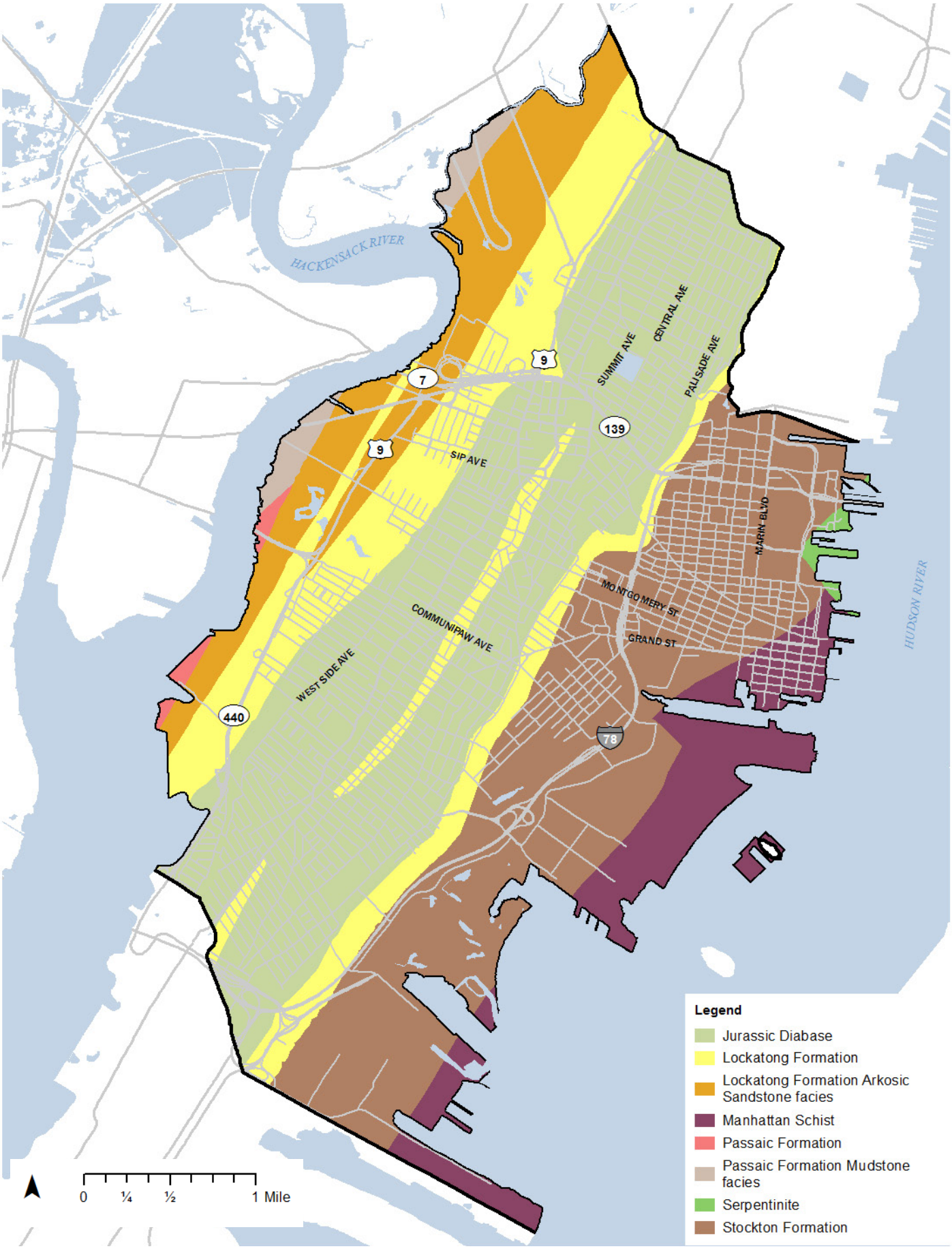
If you go back and look at the elevation map and compare it to this map, you will see that the ridge outlined by the contours is very similar in shape to the area listed as Rahway Till. In addition, Figure 5 shows an elevation for the geologic categories where the red line crosses the surface geology map (Map 10).

Figure 5. Surface Geology Cross Section of New Jersey. Source: NJDEP http://www.state.nj.us/dep/njgs/geodata/dgs07-2.htm (see Map 10 for abbreviations).



Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Buildings	TYPE	N/A

Map 11. Bedrock Geology



Primary Source: NJDEP

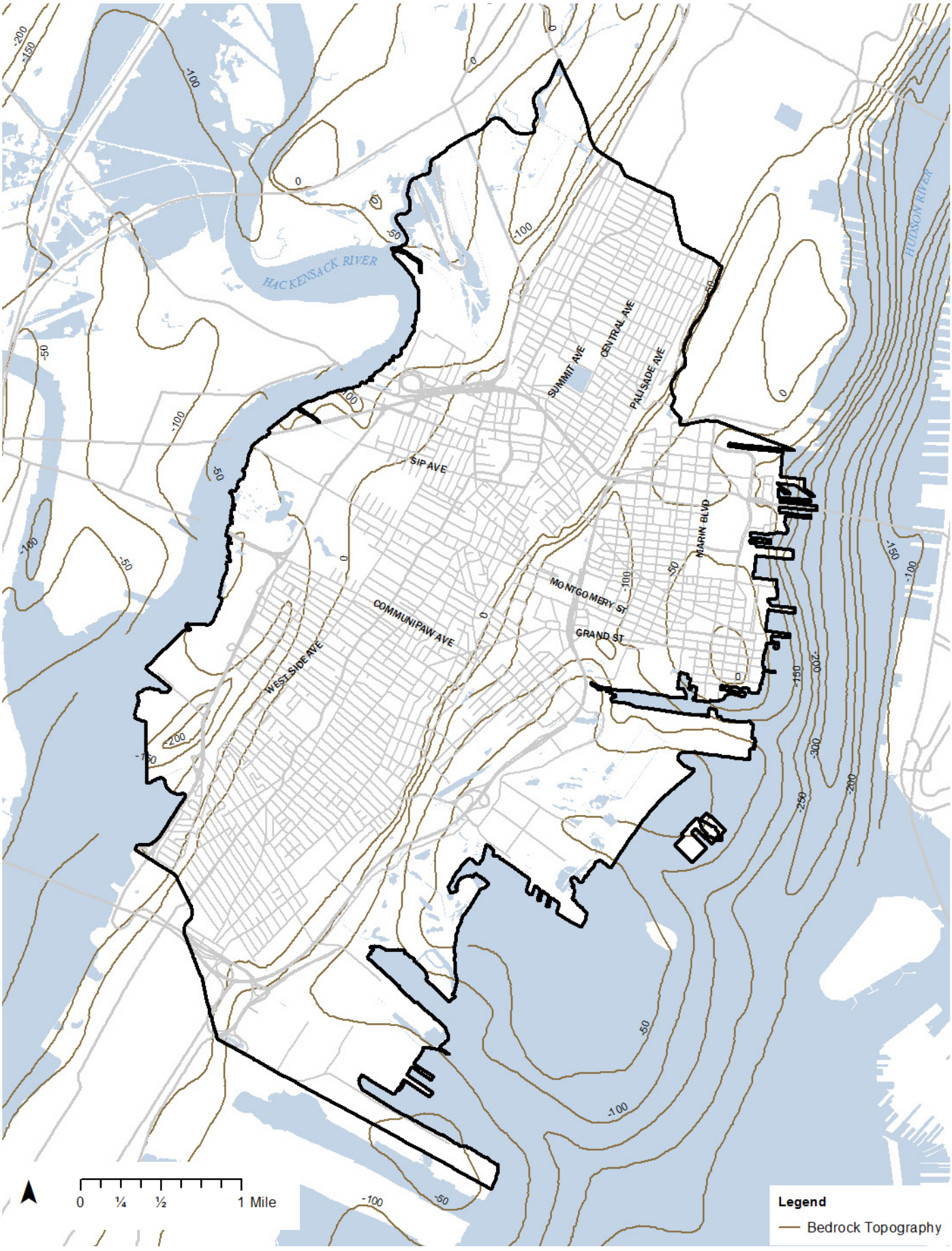
Bedrock Geology

Bedrock geology is the deeper layer of rock below the soil and surface geology. The bedrock geology of Jersey City (Map 11) includes a Jurassic (in the early Mesozoic) diabase ridge that forms the distinctive Palisades north of Jersey City along the Hudson River; additional details are provided in Table 4 of Appendix A. Diabase is a dark-colored igneous rock that is very hard and is often found as intrusions like the Palisades in New Jersey. To the east of this ridge there is Triassic (early Mesozoic) sedimentary rock, including siltstone, shale, sandstone, and conglomerate. This type of rock is the most common type in the Piedmont Region and can be shattered much more easily than the diabase rock. On the west side of the diabase ridge, deposits of beach and estuarine systems form the bedrock.

Rock wall in Bergen Arches, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Buildings	TYPE	N/A

Map 12. Bedrock Geology Below Land Surface (In feet)



Primary Source: NJDEP

Depth to Bedrock

The 50 foot interval contour lines (Map 12) show depth from the surface downward. Within Jersey City, the depth ranges from 0 to 100 feet. In other words, when the depth to bedrock is at or near zero, you can find evidence of the bedrock at the surface. For example, picture the eastern ridge of the Heights.

Depth to bedrock information is particularly important for engineering studies that address architectural or infrastructure development or maintenance. The hard, solid character of the bedrock in the Heights allows for stability of structures in contrast to areas with deep organic materials (like the Meadowlands) that may compress or shift during construction.

Rock wall in Bergen Arches, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Bedrock Topography	Elevation	http://www.state.nj.us/dep/njgs/geodata/topobase.htm

CHAPTER 3. Water and Wetlands

Water and Wetlands

The distribution, presence, and movement of water are environmentally important to human development. In Jersey City, biodiversity is enhanced by the presence of wetlands. Wetlands also provide some flood protection. This chapter focuses on water in Jersey City.

Tidal marsh area in Jersey City.

Map 13. Water Supply Map

Primary Source: NJDEP

Drinking Water

Like many older cities, in the 19th century Jersey City had to develop safe drinking water sources outside its boundaries. Today's drinking water still travels through aqueducts and mains from the Splitrock and Boonton Reservoirs that were established in the early 20th century (Map 13). The land area that drains into this system is approximately 120 square miles and the reservoirs can store up to 11.3 billion gallons of water. The drinking water is treated in the Jersey City Water Treatment Plant, located in Boonton, NJ, and then pumped to storage tanks in Jersey City. The Jersey City Municipal Utilities Authority, with SUEZ as the contract operator, manages this system.

Source: https://www.pinterest.com/pin/365424957234207864/ Boonton Reservoir.

It should also be noted that the Splitrock and Boonton Reservoirs are located within the Highlands region of New Jersey, an environmentally protected area where development is limited and controlled in certain parts in order to protect natural land and water quality. There is constant pressure to relax the regulatory protections of the watersheds where these reservoirs are located. The environmental protection of the Highlands Region is critical to Jersey City's water quality.

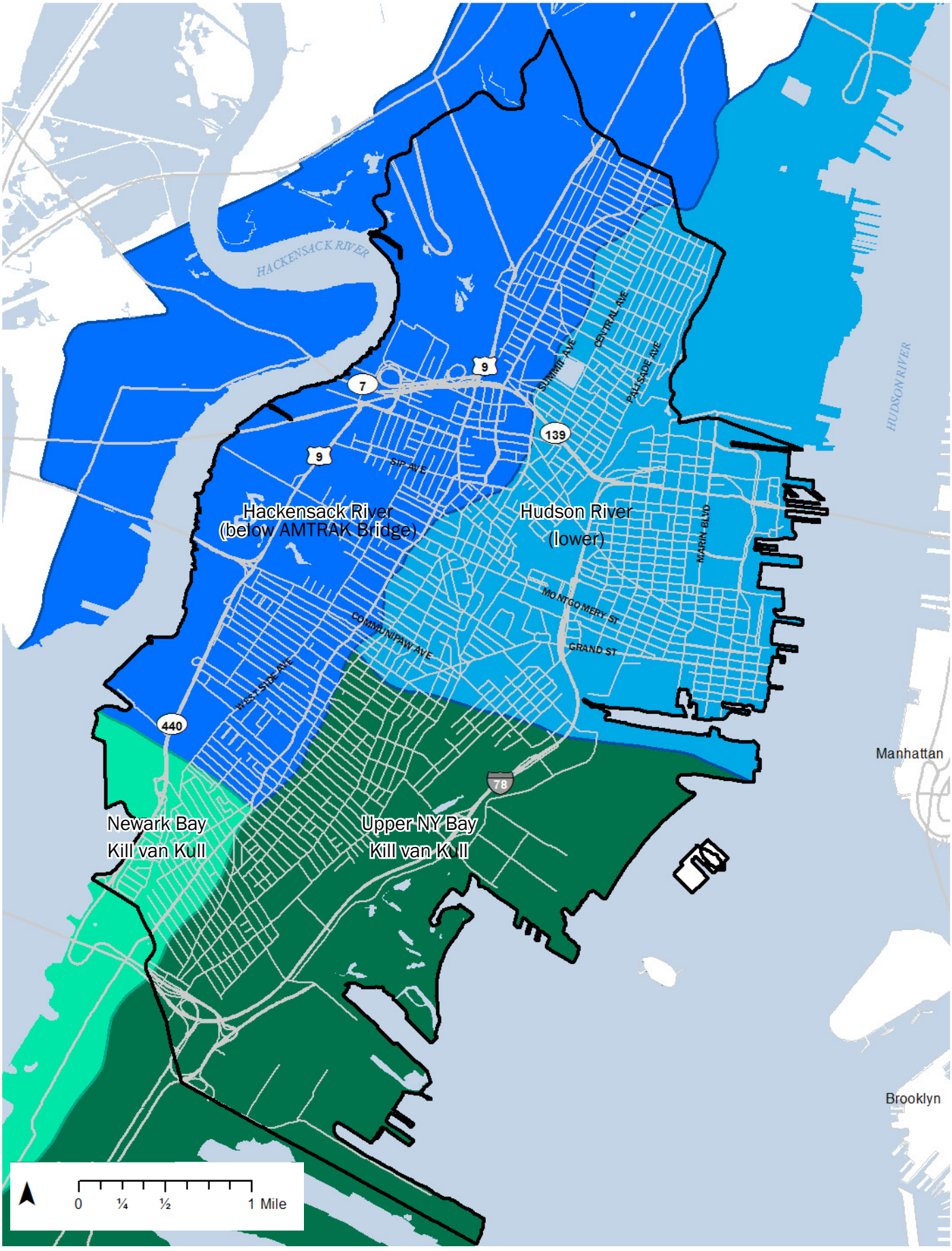
To learn more about the history of Jersey City's water supply, visit:
http://www.cityofjerseycity.org/commission/water.shtml
http://www.njcu.edu/programs/jchistory/Pages/W_Pages/Water%20Supply.htm

To learn more about drinking water quality, visit:
http://www.mysuezwater.com/water-in-my-area/water-quality-reports/07305

To learn more about the Highlands, visit:
http://www.nj.gov/njhighlands/
http://www.njhighlandscoalition.org/

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Bedrock Topography	Elevation	http://www.state.nj.us/dep/njgs/geodata/topobase.htm

Map 14. Subwatersheds (HUC14)



Primary Source: NJDEP

Watersheds

A watershed is the entire land surface that drains into a particular waterway. Jersey City drains into the Hackensack River on its western side and the Hudson River on its eastern side. Within New Jersey there are 20 watershed management areas (WMA's). Each WMA is divided into hydrologic units and identified by hydrologic unit codes (HUC's) of up to 14 digits (http://water.usgs.gov/GIS/huc.html). Jersey City includes four HUC14s within three HUC11s, and two of the State's WMAs.

Map 14 shows Jersey City's inclusion of parts of two WMAs and four sub-watershed areas (HUC 14s). On the North, the Watershed Management Area is Hackensack, Hudson and Pascack Table 2). The eastern sub-watershed, on the north, is Hudson River (lower) and the western sub-watershed, on the north, is Hackensack River (below AMTRAK bridge).

On the South, the Watershed Management Area is Arthur Kill. The eastern sub-watershed is the Upper NY Bay / Kill Van Kull and the western sub-watershed is Newark Bay / Kill Van Kull.

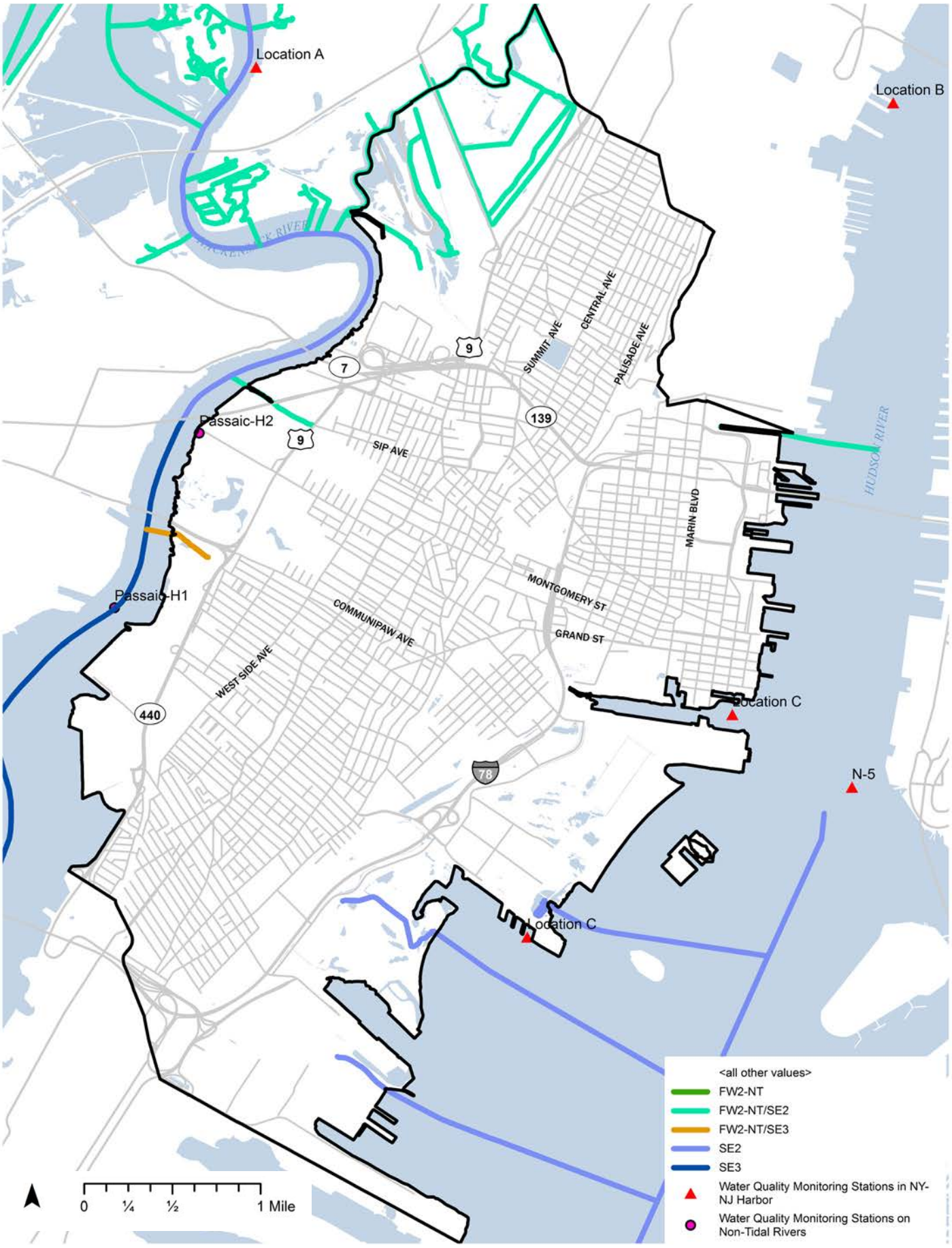
You can learn more about the watershed you live in by visiting EPA's website: https://cfpub.epa.gov/surf/locate/index.cfm

Table 2. Watershed Management Area Names

Watershed Management Area	HUC14	HUC14 Name
Hackensack, Hudson, and Pascack	02030101170030	Hudson River (lower)
Hackensack, Hudson, and Pascack	02030103180100	Hackensack R (below Amtrak bridge)
Arthur Kill	02030104010030	Upper NY Bay / Kill Van Kull
Arthur Kill	02030104010020	Newark Bay / Kill Van Kull

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Subwatersheds	SW_NAME	http://www.nj.gov/dep/gis/stateshp.html#HUC14

Map 15. Surface Water Quality Standards



Primary Source: NJDEP

Surface Water Quality Monitoring and Standards

There are several state and federal programs that collect and store water quality data in and around Jersey City. The first is the New Jersey Department of Environmental Protection's New Jersey Water Quality Data Exchange System (WQDE), the second is the United States Environmental Protection Agency's STOrage and RETrieval (STORET), and the third is USGS National Water Information System (NWIS). These programs measure various aspects of water quality such as biological, chemical and habitat characteristics.

For more information about NJDEP's New Jersey Water Quality Data Exchange System (WQDE): http://www.state.nj.us/dep/wms/wqde/

For more information about EPA's STORET: https://www.epa.gov/waterdata/storage-and-retrieval-and-water-quality-exchange

For more information about National Water Information System (NWIS): https://waterdata.usgs.gov/nwis

There are also New Jersey State standards, as noted on: http://www.nj.gov/dep/wms/bears/swqs_criteria.htm.

The map (Map 15) shows that some waterways vary from fresh to somewhat salty (e.g. FW2-NT/SE2). The map also shows two saline estuarine categories, SE2 and SE3. Their designated uses are listed below and can be found on the following website: http://www.nj.gov/dep/rules/rules/njac7_9b.pdf:

Designated uses of SE2 waters

1. Maintenance, migration and propagation of the natural and established biota;
2. Migration of diadromous fish (fish that spend part of their life in both salty and fresh waters;
3. Maintenance of wildlife;
4. Secondary contact recreation; and
5. Any other reasonable uses.

Designated uses of SE3 waters

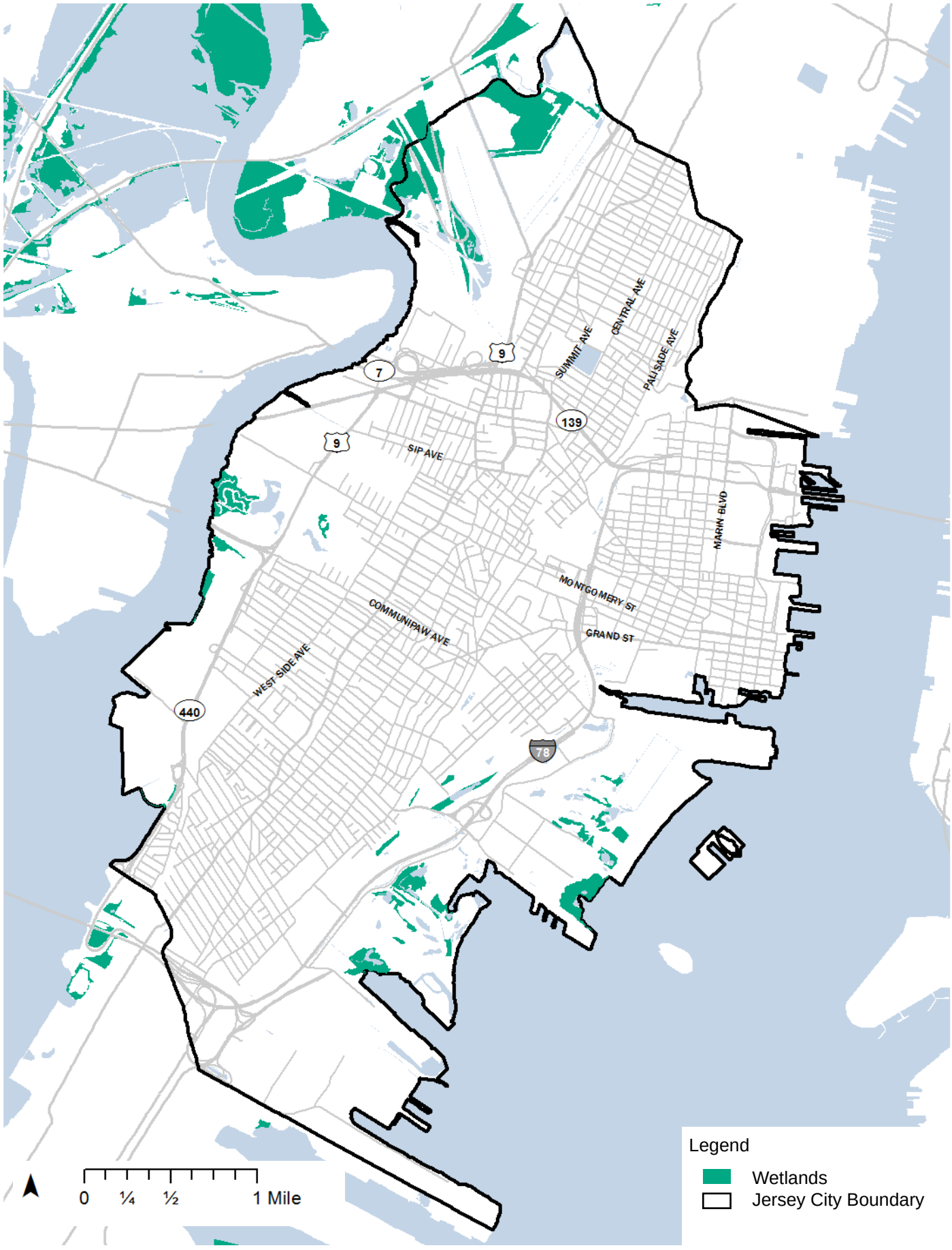
1. Secondary contact recreation;
2. Maintenance and migration of fish populations;
3. Migration of diadromous fish;
4. Maintenance of wildlife; and
5. Any other reasonable uses.

Note the difference in how standard #1 is stated for SE2 waters versus how standard #2 is stated for SE3 – that is, propagation of the natural and established plant and animal communities is a designated use for SE2 waters but not SE3 waters. This causes a regulatory review of new uses that would degrade propagation of the natural and established biota in SE2 waters, but not in SE3.

To view the New Jersey Integrated Water Quality Assessment Report visit: http://www.nj.gov/dep/wms/bears/assessment.htm

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Watershed	WMA_NAME	http://www.state.nj.us/dep/gis/digidownload/metadata/statewide/dephuc12_boundary.htm
Water Main	N/A	N/A

Map 16. Wetlands



Source: NJDEP

Wetlands

There are approximately 414 acres of wetlands in Jersey City. Most of them are connected to tidal processes (Map 16); that is they experience tidal fluctuations from the Hackensack and Hudson Rivers. The wetlands are primarily located in Lincoln Park, the Meadowlands, Liberty State Park and Liberty National Golf Course. Wetlands play an important role in ecosystem services, both because of their function of flood storage and because of the habitat they provide. Until the beginning of the industrial era, coastal wetlands were much more common (Modi 2015 and Appendix C). Since that era, there has been an ongoing process of filling low areas. Modern environmental regulations have slowed this process. Still, the loss of wetlands has increased the city's susceptibility to storm damage and flooding events.

Typical Phragmites marsh edge at high tide.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
2012 Land Cover	TYPE12= WETLAND	http://www.nj.gov/dep/gis/lulc12c.html

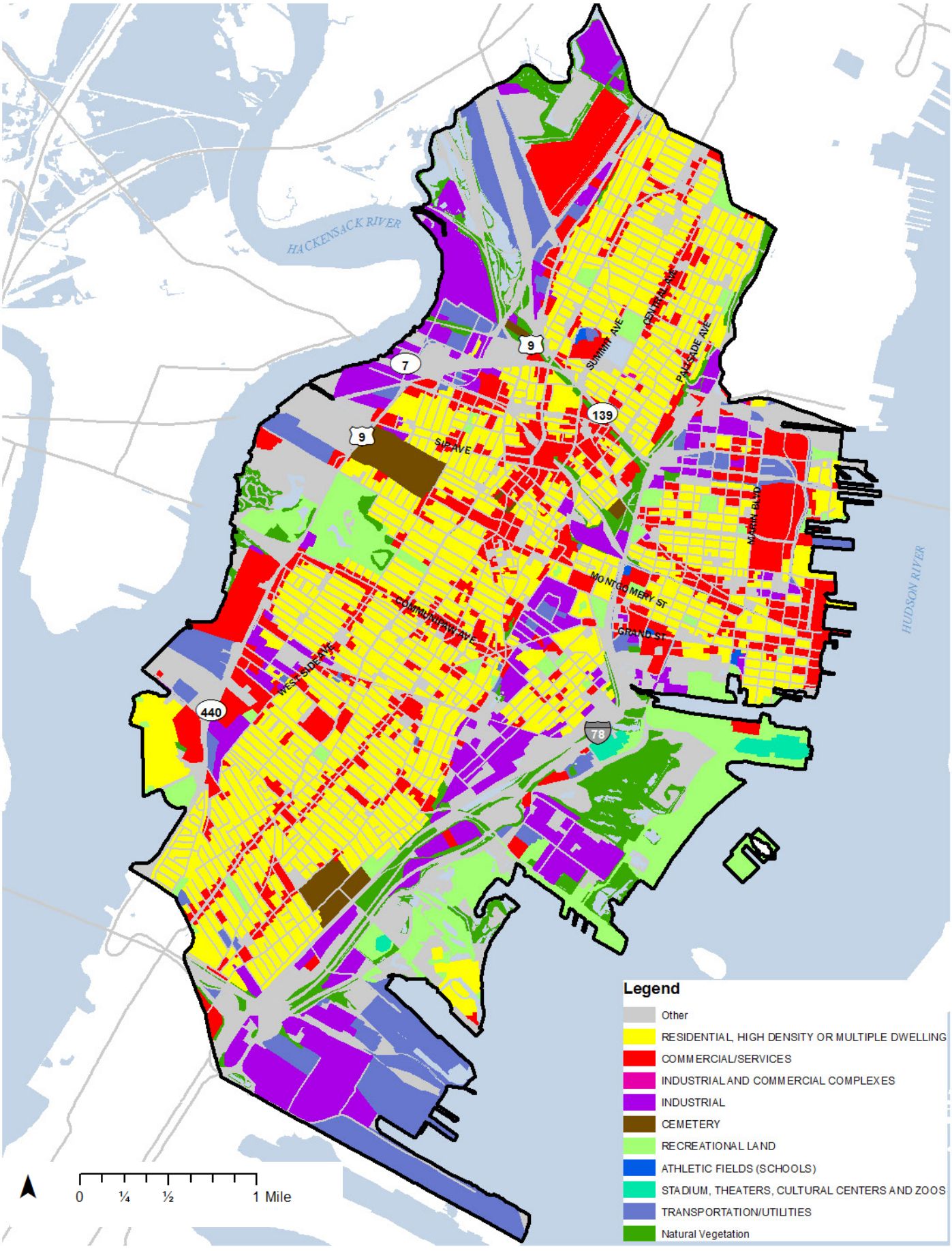
CHAPTER 4. The Biological Environment

The Biological Environment

Moss on rock face in Bergen Arches, Jersey City.

Fall foliage along trail in Bergen Arches, Jersey City.

Map 17. Land Use and Land Cover



Primary Source: NJDEP

Urban Land Use and Land Cover

The New Jersey Department of Environmental Protection periodically creates a map of Land Use and Land Cover. The most recent data set was compiled in 2012. This is this data set is used for this report. There are six general land categories: Agriculture, Barren Land, Forest, Urban, Water, Wetland in the 2012 Land Use/Land Cover data (Table 3). These categories are then sub-divided into more specific categories. For example, the urban category includes Commercial/Services, Residential, Athletic Fields, and Transportation. Map 17 shows the main land use categories found within urban Jersey City. The land use of Jersey City is primarily residential (yellow) and commercial (red), though there is also a substantial amount of industrial (purple) and recreation (green).

The Land Cover map was derived from the NJDEP's Land Use/Land Cover data, which is based on remote sensing and satellite interpretation. The gray is considered other, and is mostly various Land Cover as well, which can be seen in more detail in the Natural Vegetation section (Map 18).

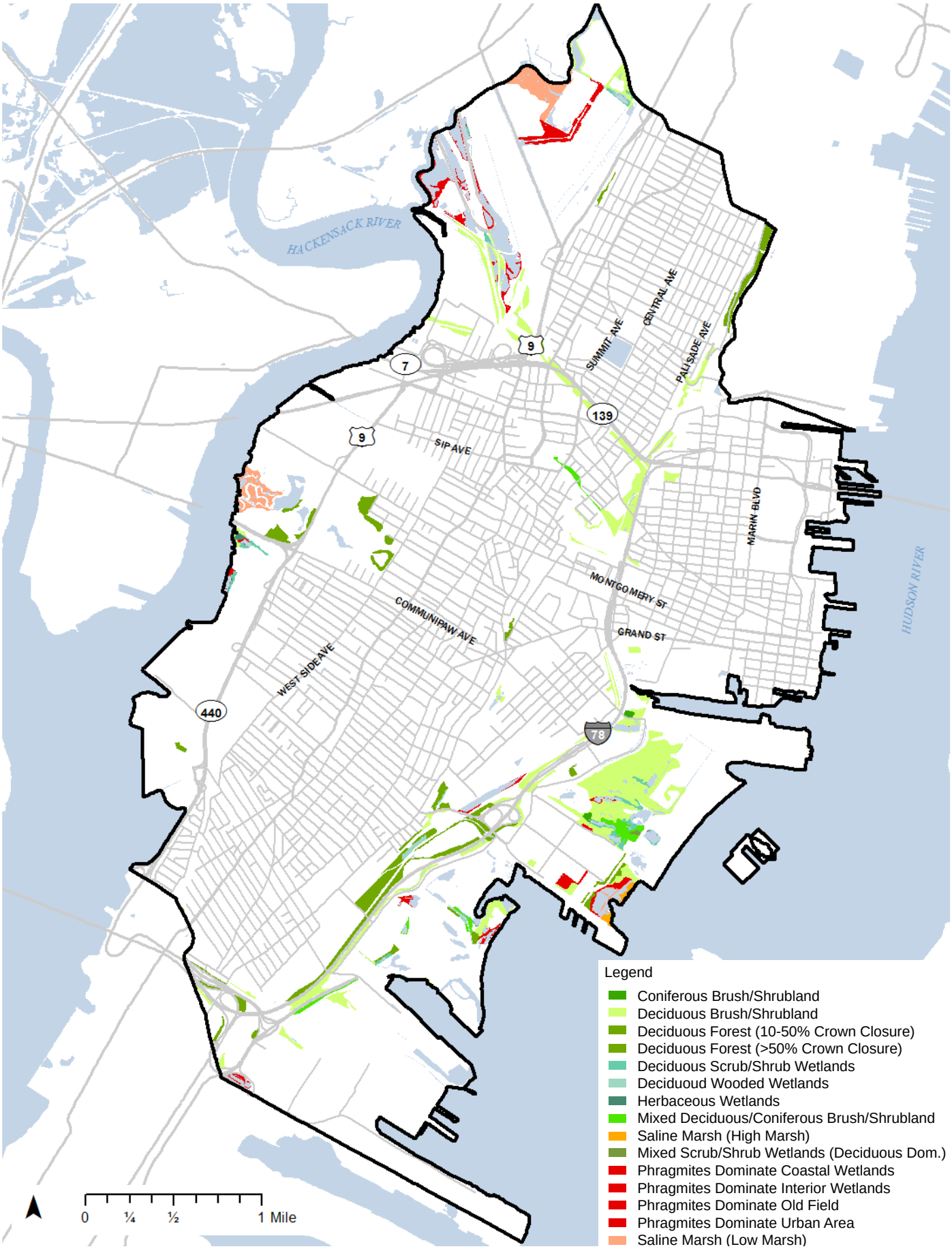
City Hall, Jersey City.

Table 3. Land Use/Land Cover in Acres. Acreage in each of six general land use land cover categories reported by NJDEP 2012 data.

Land Use/Land Cover Type	Sum of ACRES
Barren Land	393.64
Forest	617.29
Urban	8,839.48
Water	11,411.87
Wetlands	236.82
TOTAL	21,499.10

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
2012 Land Cover	TYPE12	http://www.nj.gov/dep/gis/lulc12c.html

Map 18. Natural Vegetation



Source: NJDEP

Natural Vegetation

Despite being highly urbanized Jersey City has a substantial amount of natural vegetation. “Natural Vegetation” is classified as areas where plants grow spontaneously without any maintenance or management; the classification does not necessarily imply high quality habitat. Map 18 shows the largest area of Natural Vegetation is Deciduous Brush/Shrubland. This vegetation runs along routes 78 and 138 as well as within the center of Liberty State Park.

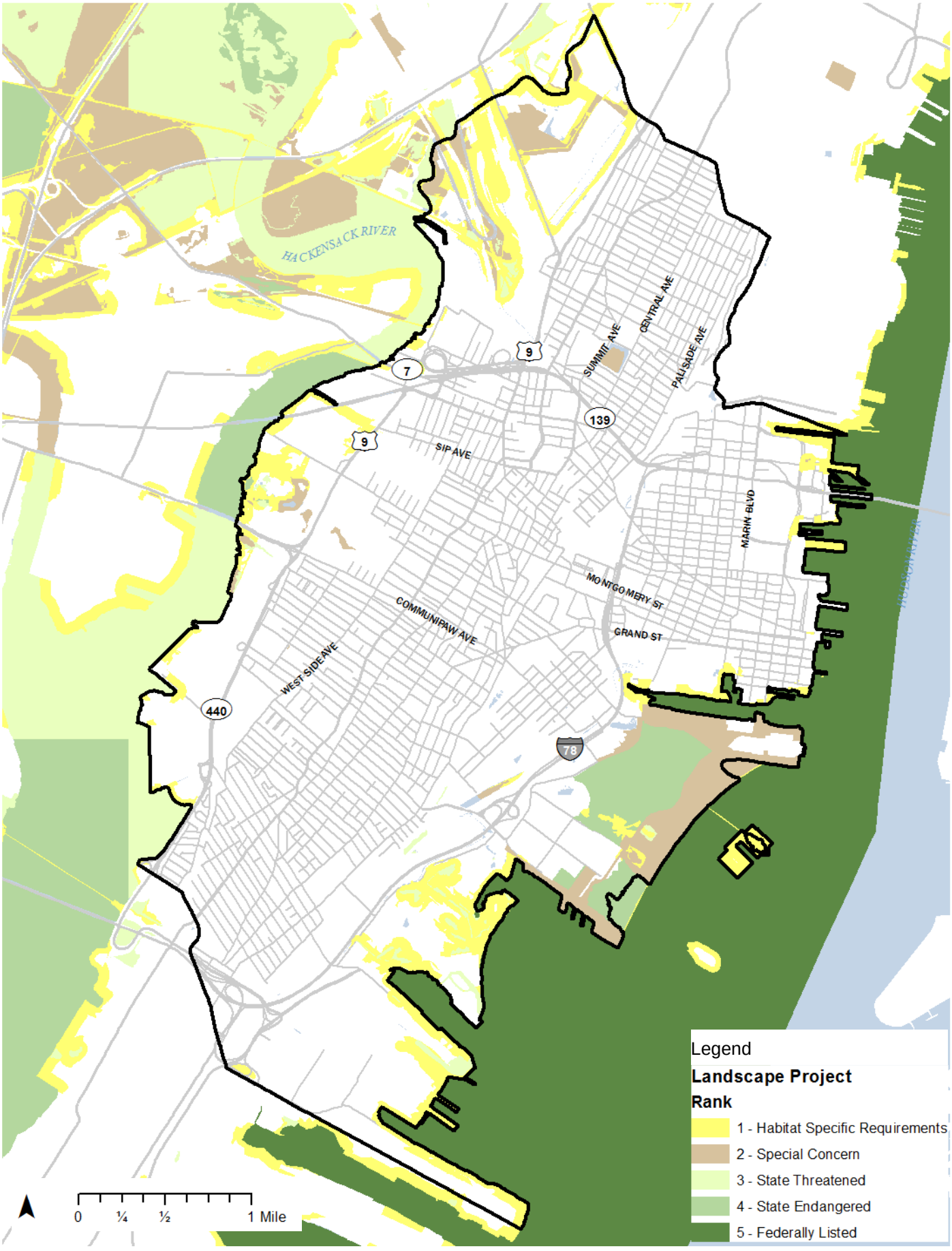
It should be noted that Phragmites australis (common reed, shown in red) is an invasive grass that flourishes in tidal and disturbed soils. Although it does not provide high quality habitat for endangered or threatened animal or plant populations, it is very effective at filtering sediments from water and providing habitat for many common species of birds and mammals.

Typical *Phragmites australis* marsh.

Path along old tracks in Bergen Arches, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
2012 Land Cover	LABEL 12	http://www.nj.gov/dep/gis/lulc12c.html

Map 19. Sensitive Habitat



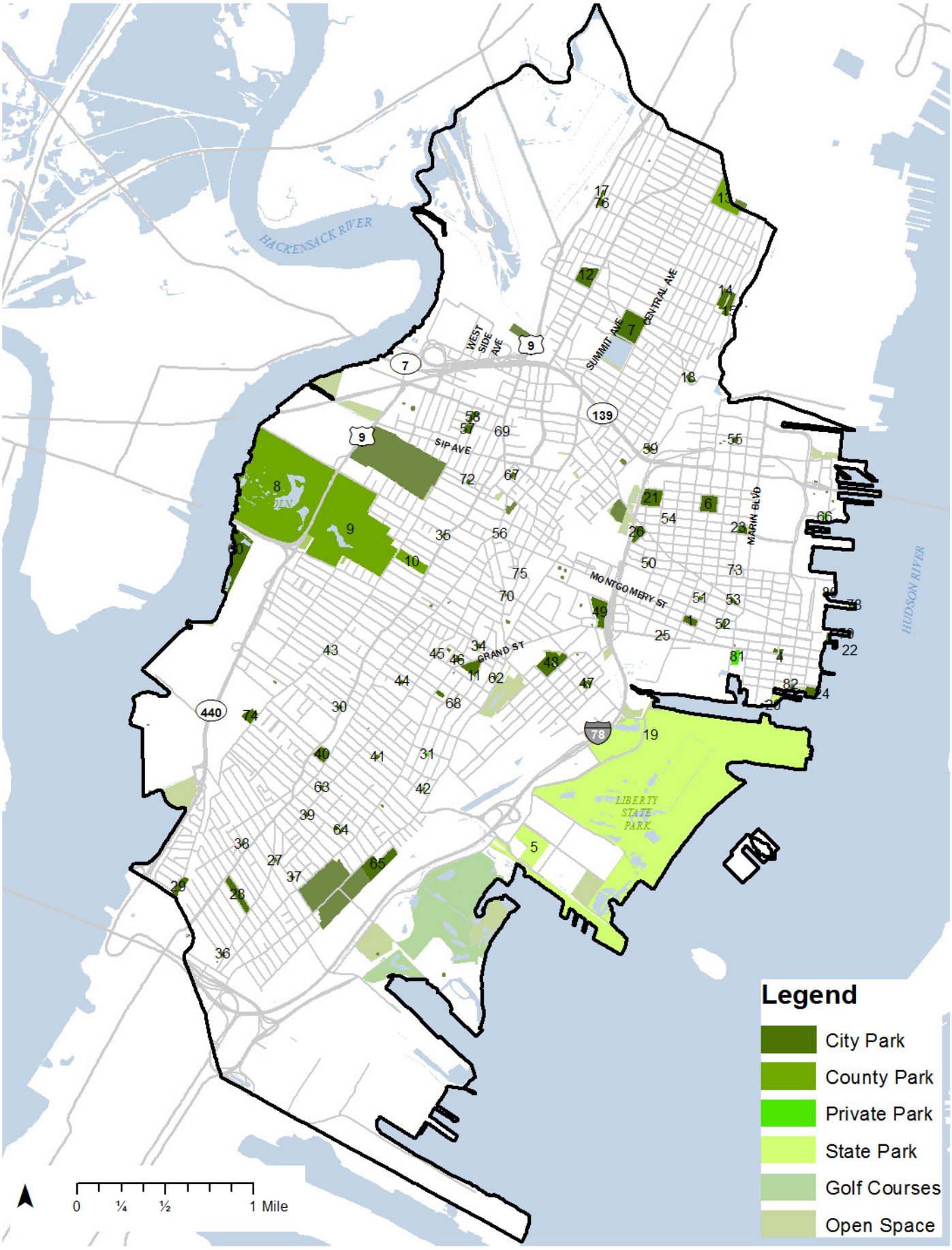
Primary Source: NJDEP

Sensitive Habitat

The habitats outlined in this map (Map 19) are vital habitat areas that provide food, shelter, and breeding grounds for flora and fauna that are of special concern, State listed (Endangered or Threatened), and/or Federally listed (Endangered or Threatened). Properties within these boundaries are subject to special rules and regulations to ensure the preservation of the listed species.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Landscape Project	LNDR	http://www.state.nj.us/dep/gis/landscape.html

Map 20. Parks, Golf Courses and Other Open Space



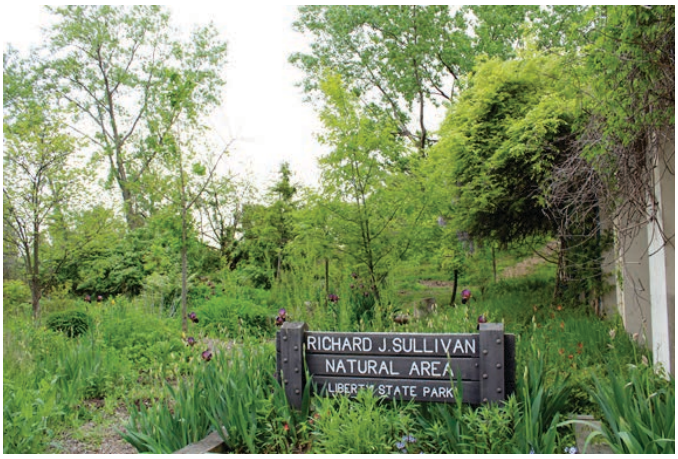
Primary Source: NJDEP

Parks, Golf Courses and Other Open Space

Within Jersey City there are many parks and open spaces used for passive and active recreation (Map 20); Table 5 in Appendix A lists names, owners and sizes of parks. These spaces are owned the City of Jersey City, Hudson County, the State of New Jersey, and various private owners. Perhaps the best known parks in Jersey City are Lincoln Park and Liberty State Park. These are large open spaces located on the western and eastern sides of the City, respectively. Lincoln Park is a County park that is heavily used by City residents for recreation and sports. Liberty State Park is heavily used by visitors from all over the world. Jersey City also has a number of smaller parks spread throughout the city.

To learn more about Jersey City's parks visit: http://www.cityofjerseycity.com/public_works.aspx?id=4874

To learn about the City's Recreation and Open Space Master Plan visit: http://www.jerseycitynj.gov/uploadedFiles/City_Government/Department_of_Business_Administration/Jersey%20City%20Recreation%20Master%20Plan%20(Web)%20_4-2008%20REDUCED.pdf



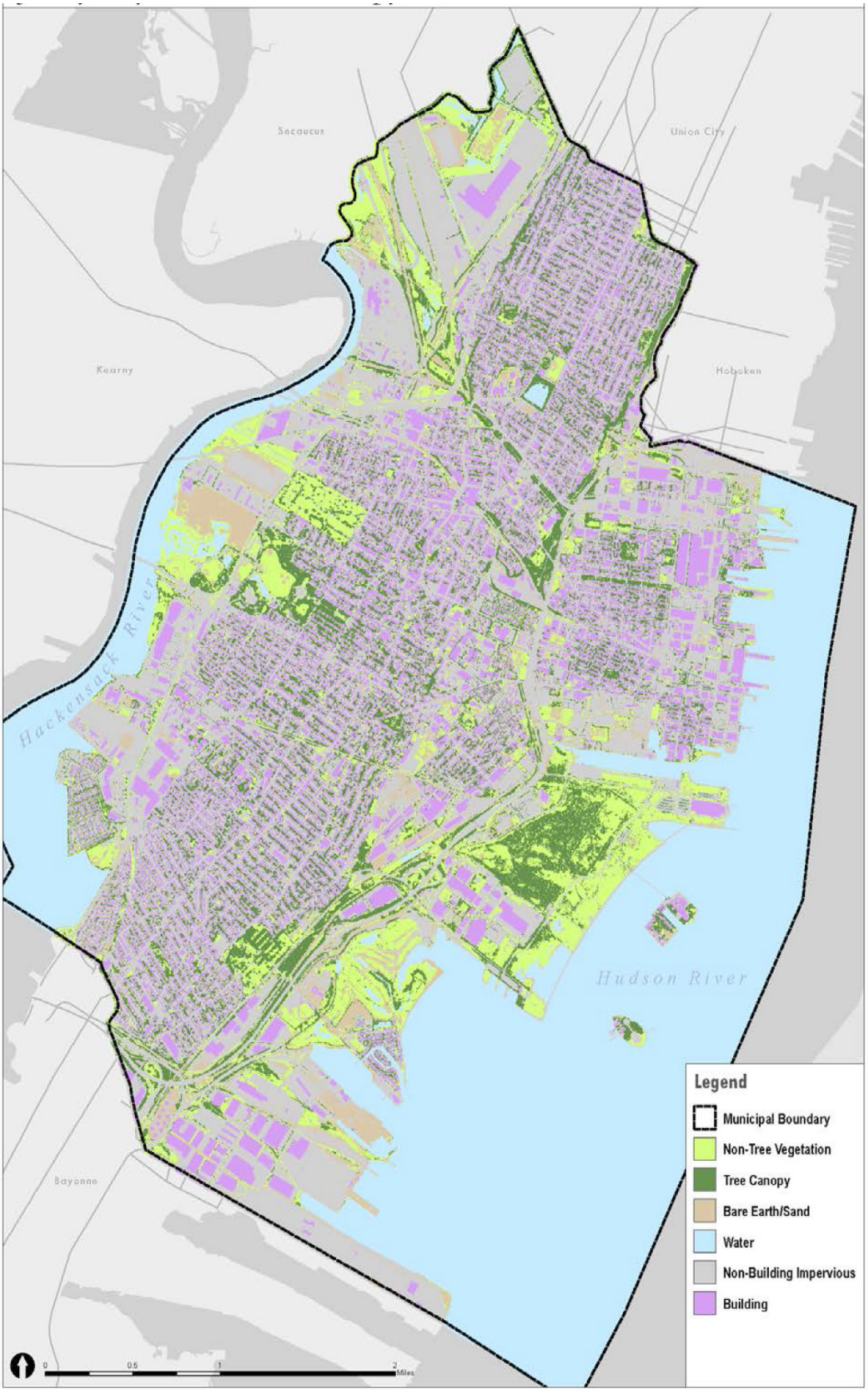
Nature trail at Liberty State Park, Jersey City.


Lincoln Park, Jersey City.


View from Morris Canal Park of downtown Jersey City and Manhattan.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
2012 Land Cover	TYPE12= WETLAND	http://www.nj.gov/dep/gis/lulc12c.html

Map 21. Tree Canopy Assessment



Primary Source: http://www.gicinc.org/PDFs/Jersey_City_Report.pdf

Tree Canopy Assessment

Additional information has been developed through a study sponsored by the Jersey City Environmental Commission and conducted by the Green Infrastructure Center (http://www.gicinc.org/PDFs/Jersey_City_Report.pdf). Their objectives include three goals:

1) Expand Jersey City's Tree Canopy
2) Promote Long Term Viability for City Trees
3) Create a Long-Term Funding Mechanism for City Tree Planting and Care

The project consultants make specific recommendations to help target planting efforts in areas where tree density and tree heath are relatively low. They also emphasize the need for investment in the long-term care of this important and valuable element of the City's green infrastructure. Following the recommendations of the project consultants will improve Jersey City's environment in many ways.

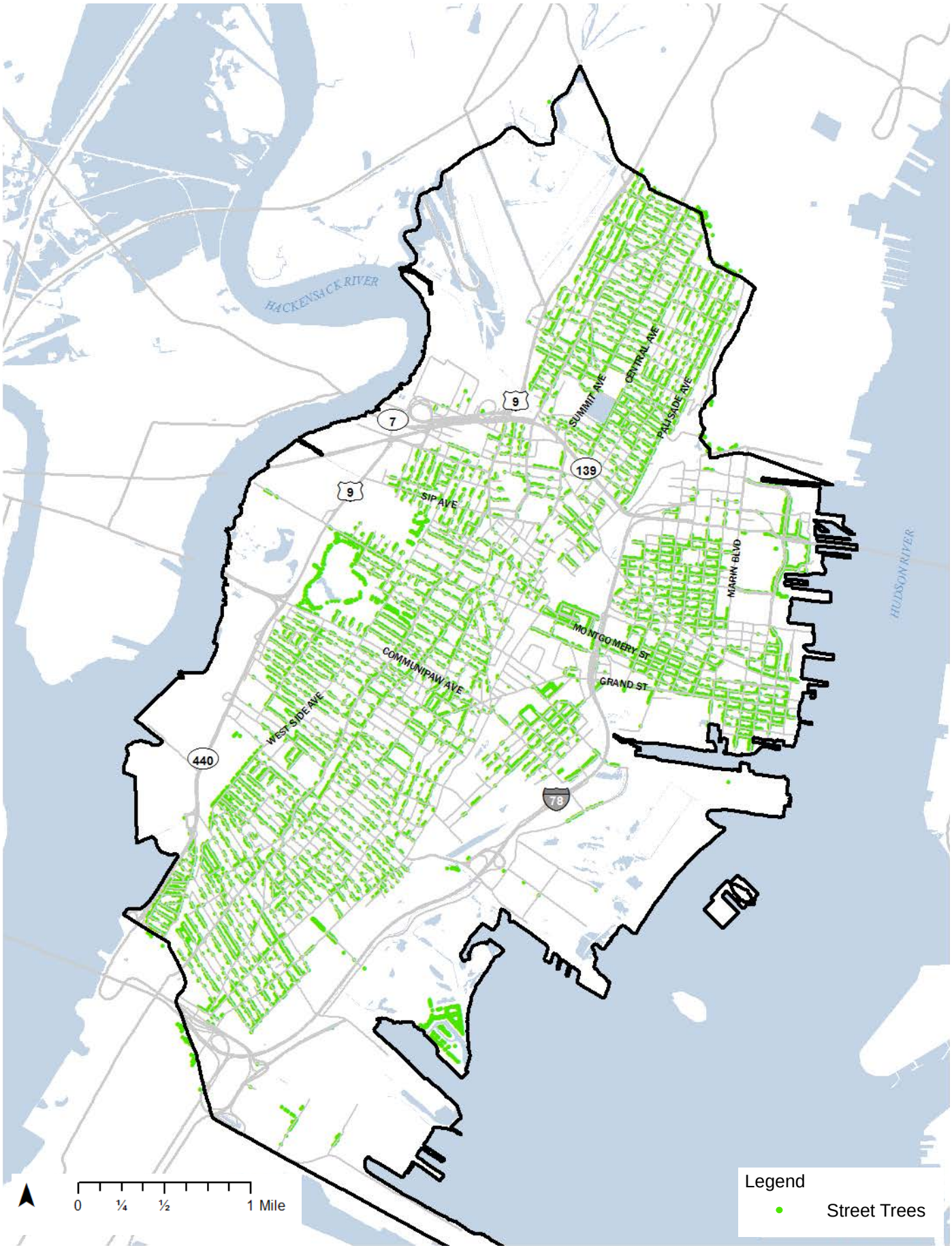
In addition to street trees, a 2015 report to the Environmental Commission included a survey of all discernable vegetation. Map 21 shows the presence of street trees, parks, open spaces and vegetation on private properties. All these categories contribute to the general character of the city.

Horse Chestnut.

Red Horse Chestnut.

Walk through Bay View Cemetery.

Map 22. Street Trees



Primary Source: Jersey City

Street Trees

Map 22 reflects data collected for street trees by the Jersey City Planning Office, and map illustrates the distribution of street trees throughout Jersey City. It only includes trees in public right-of-ways and does not include tree coverage in the yards of private residential properties or public parks.

The Jersey Parks Coalition, Jersey City, New Jersey City University, Sustainable Jersey City, and others have partnered to increase the City's tree canopy (http://jcparks.org/about/city-of-trees/). In addition, the Division of Parks and Forestry is responsible for maintenance and care of city trees and can be contacted for problems or planting requests for street trees (http://www.cityofjerseycity.com/public_works.aspx?id=1430).

London Plane Tree.

Callery pear and crabapple walk in Bayside Park.

American Elm.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Street Trees	Type	N/A

CHAPTER 5. Monitoring and Hazards

Monitoring and Hazards

In addition to the materials presented in this chapter, there is a wealth of information summarized in the Hudson County Hazard Mitigation Plan (2015 update). The County compiles information for all its municipalities and provides summaries in their report updates. In addition to the municipal profiles, they list growth and development projections, history of natural hazards events (e.g. severe storms, flooding), hazard vulnerabilities, and a capability assessment. The capability assessment includes the planning and regulatory tools that are specific to the municipality as well as the fiscal capabilities that are available to the municipality. When the plan is updated, the Municipal Council of the City of Jersey City reviews the document and may adopt the document. The copy found for this report was approved in December of 2014.

The section titled "Mitigation Strategy and Prioritization" begins with a review of past mitigation initiatives and their status and follows with proposed initiatives. The seven proposed initiatives in the 2015 Jersey City Section (9.7), range from enhancing ordinances to purchasing portable generators. The Jersey City Office of Emergency Management works with the County to produce the list and is the lead agency for many of the proposals. The Planning and Engineering Divisions are the lead for a long term initiative that focuses on "the enhancement of ordinances regarding land use, zoning, and placement of large developments within known or changing flood zones especially seniors and handicapped populations who may be more adversely effected by elevation requirements."

Restricted area in liberty State Park, Jersey City.

Map 23. Air Quality Monitoring Stations

Primary Source: NJDEP

Air Quality Monitoring Stations

Jersey City has two New Jersey Department of Environmental Protection air monitoring stations that collect certain air pollution data (Map 23). One called “Jersey City” at 2828 Kennedy Boulevard and the other “Jersey City Fire House” at 355 Newark Avenue. The “Jersey City” Station measures Sulfur dioxide (S02), Carbon monoxide (CO), Nitrogen dioxide (NO2) by parts per million (ppm). The “Jersey City Fire House” Station measures fine particulate (PM2.5 by Micrograms per Cubic Meter of Air (µg/m3). This data is stored and reviewed by NJDEP.

This data is collected daily and is checked to verify that pollutants are in compliance with the National Ambient Air Quality Standards. Current air quality and five day forecasts are available at: http://aqicn.org/city/usa/newjersey/jersey-city-fh/. Weather Bug (https://weather.weatherbug.com/life/air-quality/jersey-city-nj-07306) also reports current air quality reports plus links for information that interprets the information. This is particularly useful for families with concerns about compromised respiratory health. It is possible to find longer term records for air quality at http://www.homefacts.com/airquality/New-Jersey/Hudson-County/Jersey-City.html . This site reports summaries by year; Table 4 shows the data for 2015 with 17 days where ozone levels were unhealthy or very unhealthy, 39 days when ozone levels were unhealthy for sensitive groups, and 105 days when fine particulate concentrations were unhealthy for sensitive groups. These data are typical of annual Jersey City air quality over the past eight years.

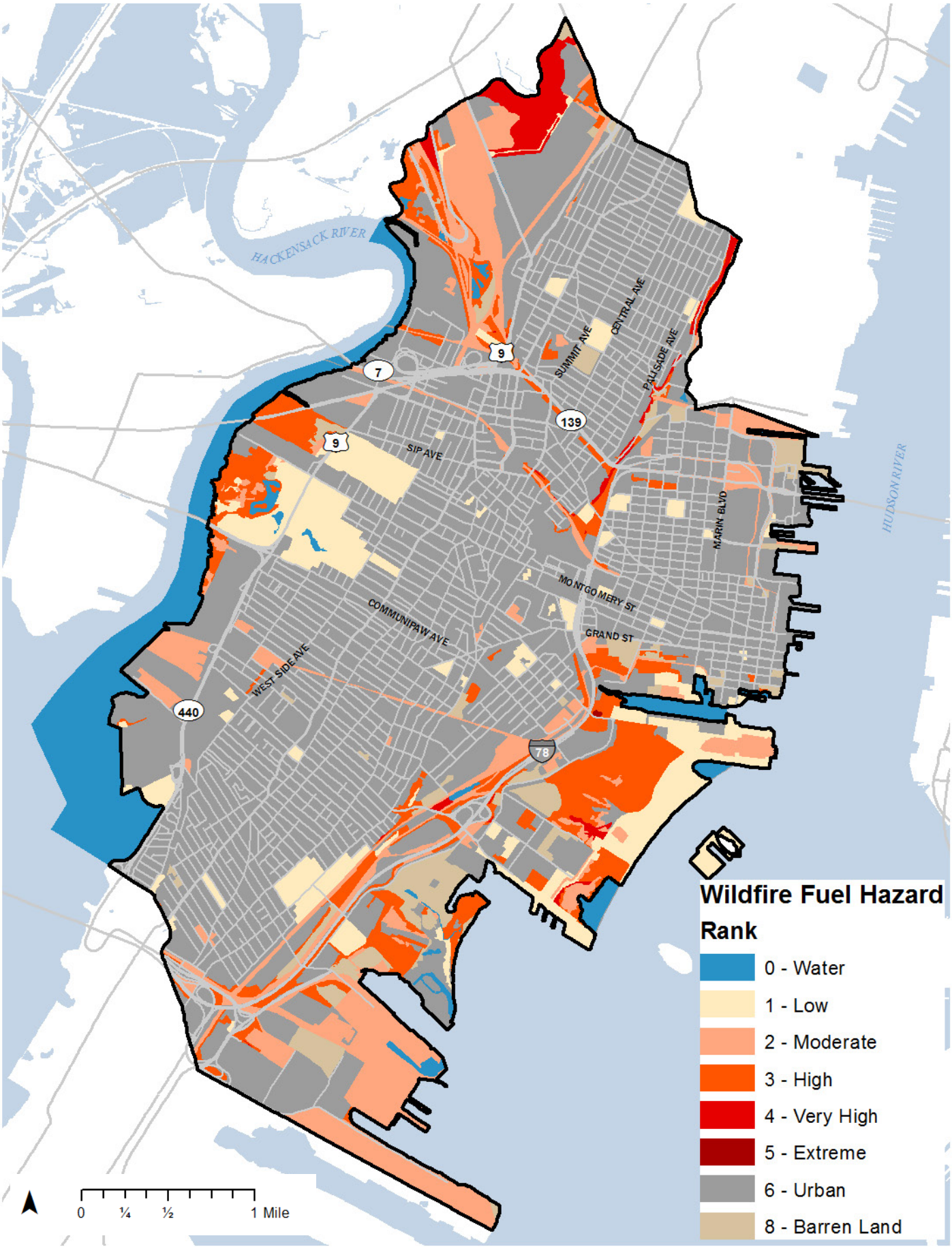
The Environmental Protection Agency also provides air quality data for the area (http://www.jerseycitychromiumcleanup.com/hs/epa.cfm) To learn more about Air Quality in Jersey City and view current reports visit: http://www.njaqinow.net/. Annual reports are available from 1997-2014.

Table 4. Air Quality Index Pollution Summary 2015. The values in the last six columns are the number of day in each Air Quality category, from best to worst. Note that ozone falls below the best category on 54 out of 365 days and the fine particulate matter (PM2.5) falls below the best category 105 out of 406 days.

Pollutant	Stat. Lat & Long	Good %	0-50		101-150	151-200	201-300	301-500
Ozone	40.6702, -74.1261	84.86%	314	39	16	1	0	0
CO	40.7316, -74.0663	100.00%	365	0	0	0	0	0
SO2	40.7316, -74.0663	100.00%	365	0	0	0	0	0
PM10	40.7255, -74.0523	100.00%	119	0	0	0	0	0
PM2.5	40.7255, -74.0523	74.14%	301	105	0	0	0	0

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Air Quality Monitoring Stations	SITE_NAME	http://www.state.nj.us/dep/gis/stateshp.html#AIRQM

Map 24. Wildfire Fuel Hazards



Primary Source: NJDEP

Wildfire Fuel Hazard

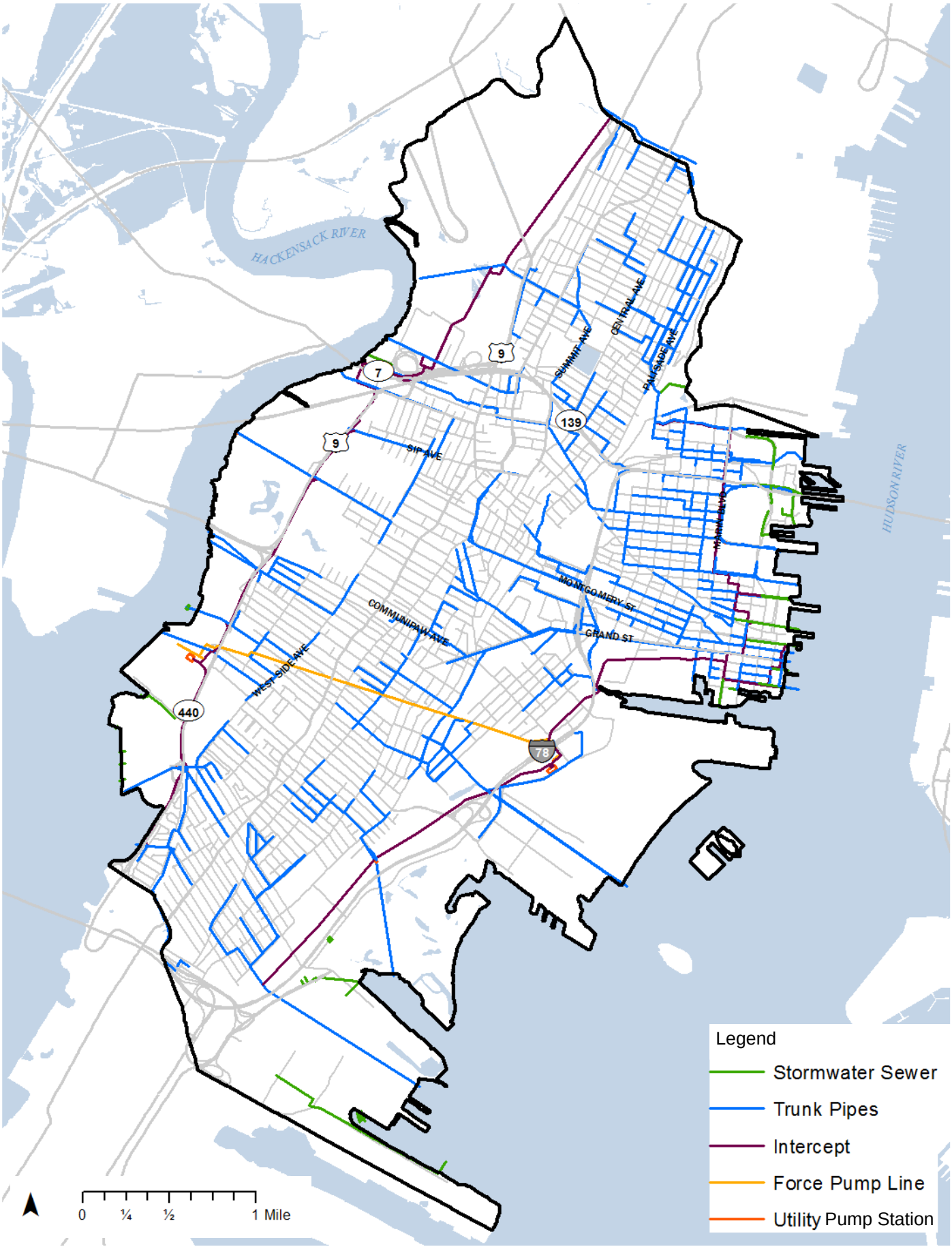
The New Jersey Forest Fire Service and the New Jersey Department of Environmental Protection use the data in this map (Map 24) to provide information on potential Wildfire Fuel Hazard areas. These can range from forests with a large number of dead/ dying trees to dry grassy areas that could provide an increased risk of a fire.

Wildfire fuel refers to the amount of fuel that could burn. Some areas, like the Phragmites australis dominated highway right-of-ways, are much more flammable than other areas, like the forest patch in Liberty State Park. During periods of drought, these areas should be monitored and managed if the potential for fire becomes very high.

Phragmites australis in winter and early spring.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Wildfire Fuel Hazard	FIREDESC	http://www.nj.gov/dep/gis/digidownload/metadata/njfh/hudfh02.htm

Map 25. Sewer Lines



Primary Source: NJDEP

Sanitary Sewer Lines

Map 25 depicts Jersey City's sanitary sewer system. Much of the City's sewer system is serviced by combined sewers, as shown in dark blue. When water flows into the combined sewer system, it travels to an intercept, shown in purple, and is moved by pump stations to the treatment plant. The green lines depict separate sewers that don't include waste water and that drain directly into a river.

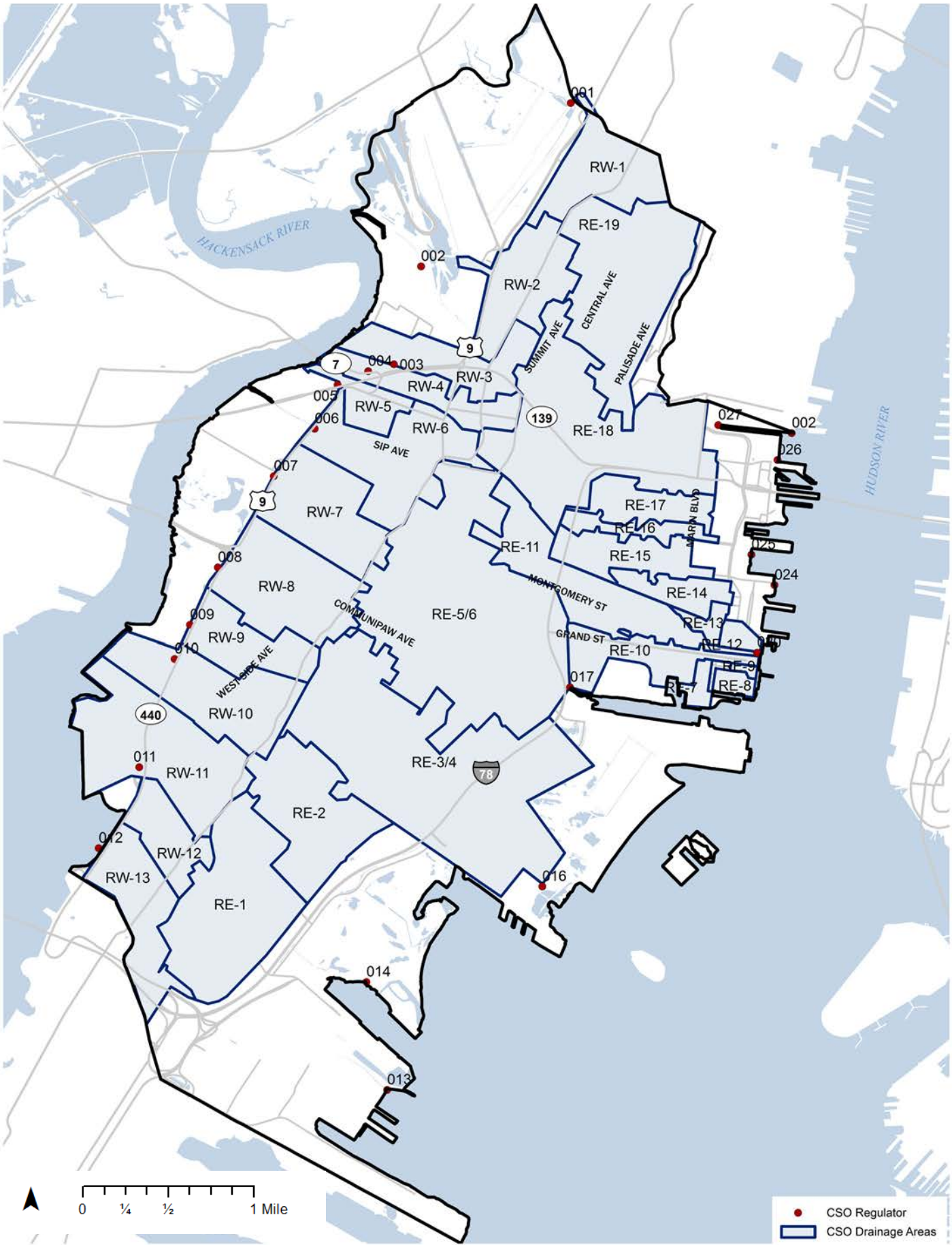
The majority of Jersey City's Sewer system is a combined sewer system, where stormwater and wastewater travel through the same sewer lines and are pumped to a treatment plant. In large rain events, when the sewer system cannot handle the volume of stormwater and untreated sewage, the sewers overflow and the stormwater/wastewater combination is discharged into the receiving surface water body at various outfalls (known as Combined Sewer Overflow or CSO's).

In the past, Jersey City treated its own (incoming) water at the Jersey City Municipal Utility Authority (MUA) on the west side of the city and outgoing sanitary sewage at the treatment plant next to the Liberty Science Center. Currently, Jersey City's sanitary sewage is pumped to the Passaic Valley Sewage Treatment Plant in Newark.

Typical storm sewer pipe.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Sewer Lines	Layer	N/A

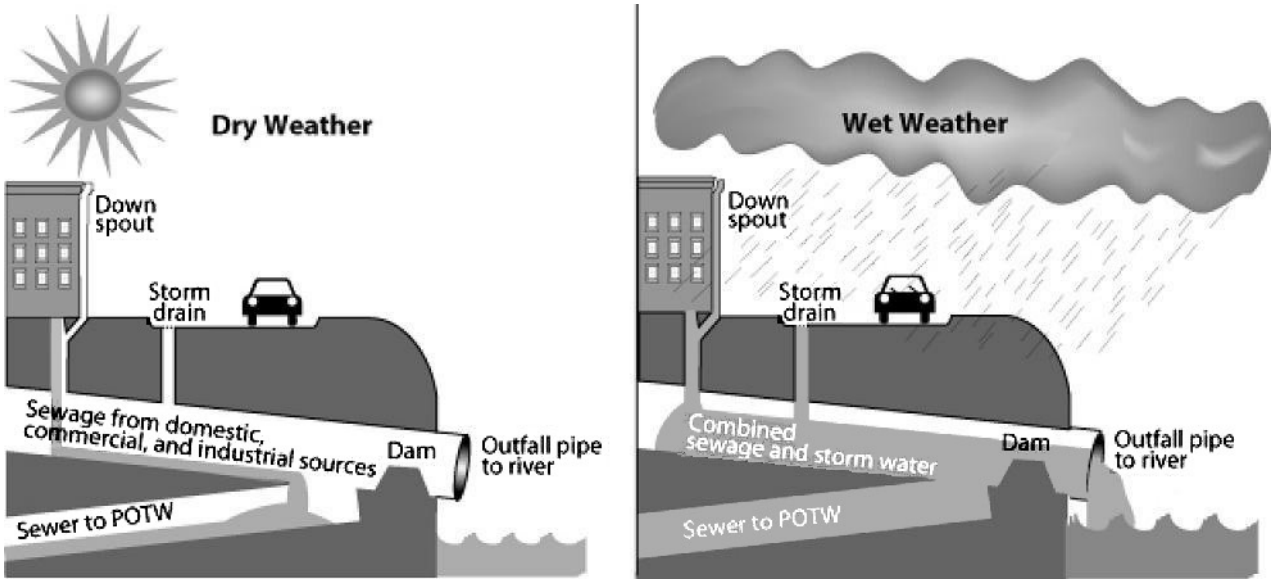
Map 26a. CSO Sewersheds and Outfalls



Primary Source: NJDEP

CSO Sewersheds and Outfalls

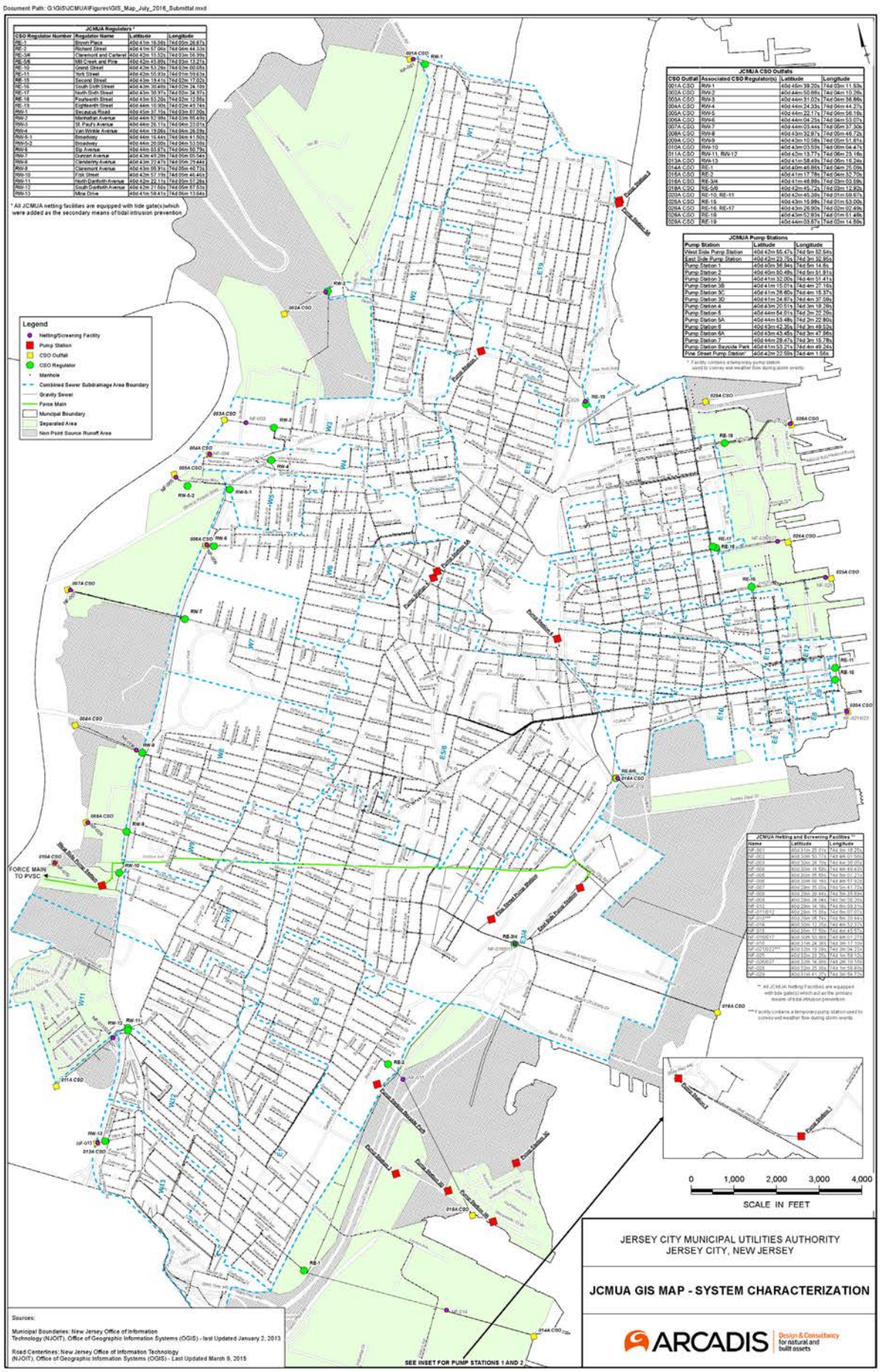
Much of Jersey City' stormwater is collected in sewers that are combined with the City's sanitary waste sewers. This type of system is referred to as "Combined Sewer Overflow" (CSO). A sewershed is defined as the land area that is drained by a particular portion of the sewer system and each sewershed has an regulator point, which is shown as a red circle (Map 26a, Van Abs 2014; http://www.njfuture.org/wp-content/uploads/2014/04/VanAbs_Urban-Water-Infrastructure-Report-Revised-Final-June-2014.pdf). Note that the sewershed areas are designated as either RE or RW – referring to whether the drain goes to the east, i.e. the Hudson River, or the west, i.e. the Hackensack River. Combined Sewer Overflow and drainage areas cause significant water pollution when overflows occur. The Jersey City Municipal Utilities Authority (JCMUA) is beginning additional monitoring, so information about outflow rates and frequency should be available in the future.



Primary Source: USEPA

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
CSO Outflow	N/A	http://njogis.newjersey.opendata.arcgis.com/datasets/0c92cfde43db4bf6963270db7dd62272_3
CSO Drainage Areas	CSO	http://njogis.newjersey.opendata.arcgis.com/datasets/0c92cfde43db4bf6963270db7dd62272_3
Sewer Lines	Layer	N/A

Map 26b. Jersey City Sewer Map



Primary Source: NJDEP

Based on the work by Van Abs (2014) and regulatory requirements, the information has been updated and compiled by JCMUA and the New Jersey DEP. Map 26b shows the additional information and more detailed map that is available at: http://www.state.nj.us/dep/dwq/pdf/cso_sewermap_jersey_city.pdf

This map has not been integrated into the GIS data set produced for this report because it became available during the final phase of work on the report.

More information about the issues and solutions can be found at:

http://njdep.maps.arcgis.com/apps/Viewer/index.html?appid=70dd49de342949ca933e840d0c530fc7

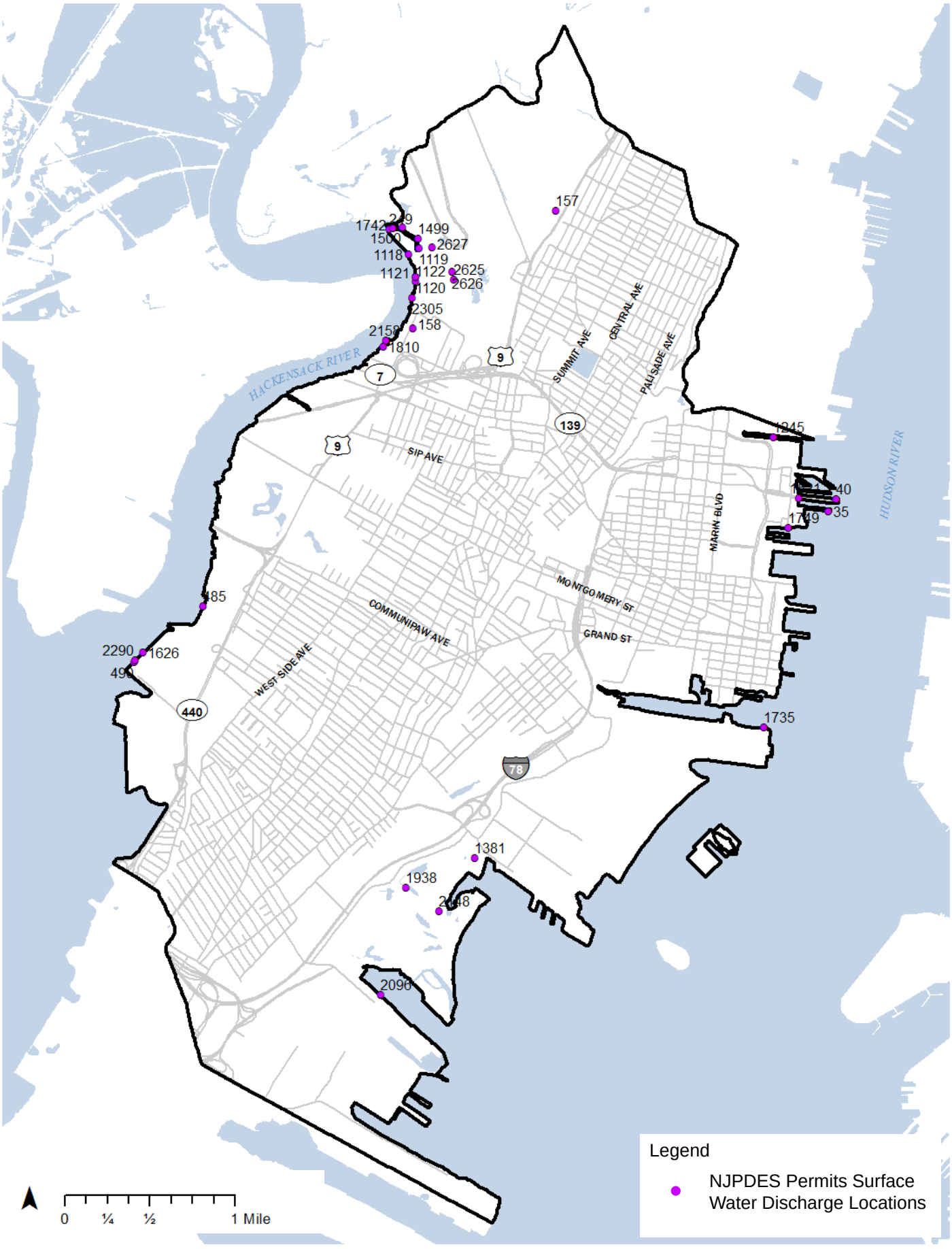
http://www.njfuture.org/wp-content/uploads/2014/05/RIPPLE-EFFECTS-Final.pdf

http://www.nj.gov/dep/dwq/cso-basics.htm

http://www.jerseywaterworks.org/wp-content/uploads/2016/01/NJ-CSOs-by-the-Numbers1.pdf

http://www.jerseywaterworks.org/wp-content/uploads/2016/01/NJ-CSO-Fact-Sheet-1.pdf

Map 27. NJPDES Permits Surface Water Discharge Locations



Primary Source: NJDEP

NJPDES Permits

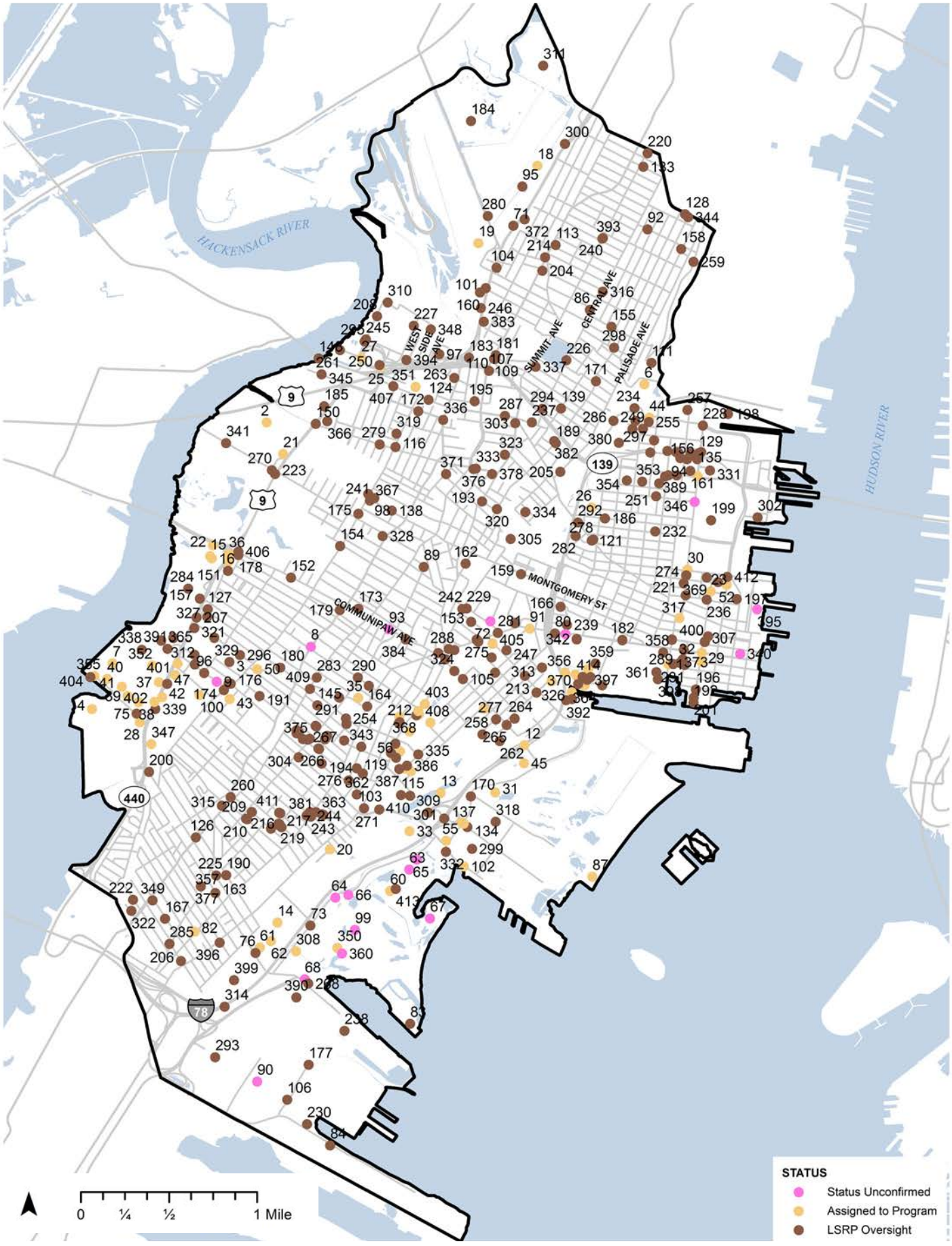
Along with the public sewer system and CSO outfalls, Jersey City has a number of private discharge pipes. The owners of these private outfalls are required to hold a New Jersey Pollutant Discharge Elimination System Permit (NJDEP). This map (Map 27) identifies the locations of surface water discharge points and the receiving waters for the active and terminated pipes. In Appendix A, Table A.6 provides the definition of discharge types and Table A.7 lists the locations and types of discharges.

More information about these types of permits can be found at http://www.nj.gov/dep/dwq/gp_surfacewater.htm

Typical Discharge Pipe.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
NJPDES Permits Surface Water Discharge Locations	FACNAME	http://www.state.nj.us/dep/gis/digidownload/metadata/statewide/Strc_NJPDES_sw_pipe.html

Map 28a. Known Contaminated Sites Oversight



Primary Source: NJDEP

Known Contaminated Sites

Known Contaminated Sites (KCS) are sites where contamination of soil (or ground water) has been confirmed at levels equal to or higher than applicable standards (Maps 28 a, b, and c). These sites can include businesses such as factories, gas stations, or dry cleaners and homes with underground storage tanks.

The New Jersey Department of Environmental Protections (NJDEP), Site Remediation Program (SRP) maintains the database called the Known Contaminated Sites List (KCSL). A full list of sites can be found on the NJDEP website or via the Dataminer database. In the past, the NJDEP Site Remediation Program would oversee and manage the cleanup of known contaminated sites. New Jersey passed the Site Remediation Reform Act (SRRA) in 2009, which designates Licensed Site Remediation Professionals (LSRPs) to manage the cleanup of contaminated sites.

Map 28a shows locations related to Pending sites and sites that are under an oversight program. This map includes sites where remediation is either currently under way, or required but not yet initiated. (A designation of "Pending" indicates that contamination has been confirmed, but remedial work has not begun.) Sites are color-coded based on their status. "Assigned to a Program" means that the NJDEP is still overseeing the cleanup and LSRP means there is oversight by a Licensed Site Remediation Professional. Map 28b shows the sites where NFA (No Further Action) is required; this code was a determination letter used prior to 1997.

Map 28c shows more recent sites where the Remedial Action Outcome (RAO) determination letter has been provided. An A refers to an Area of Concern (part of a site) and an E refers to the entire site.

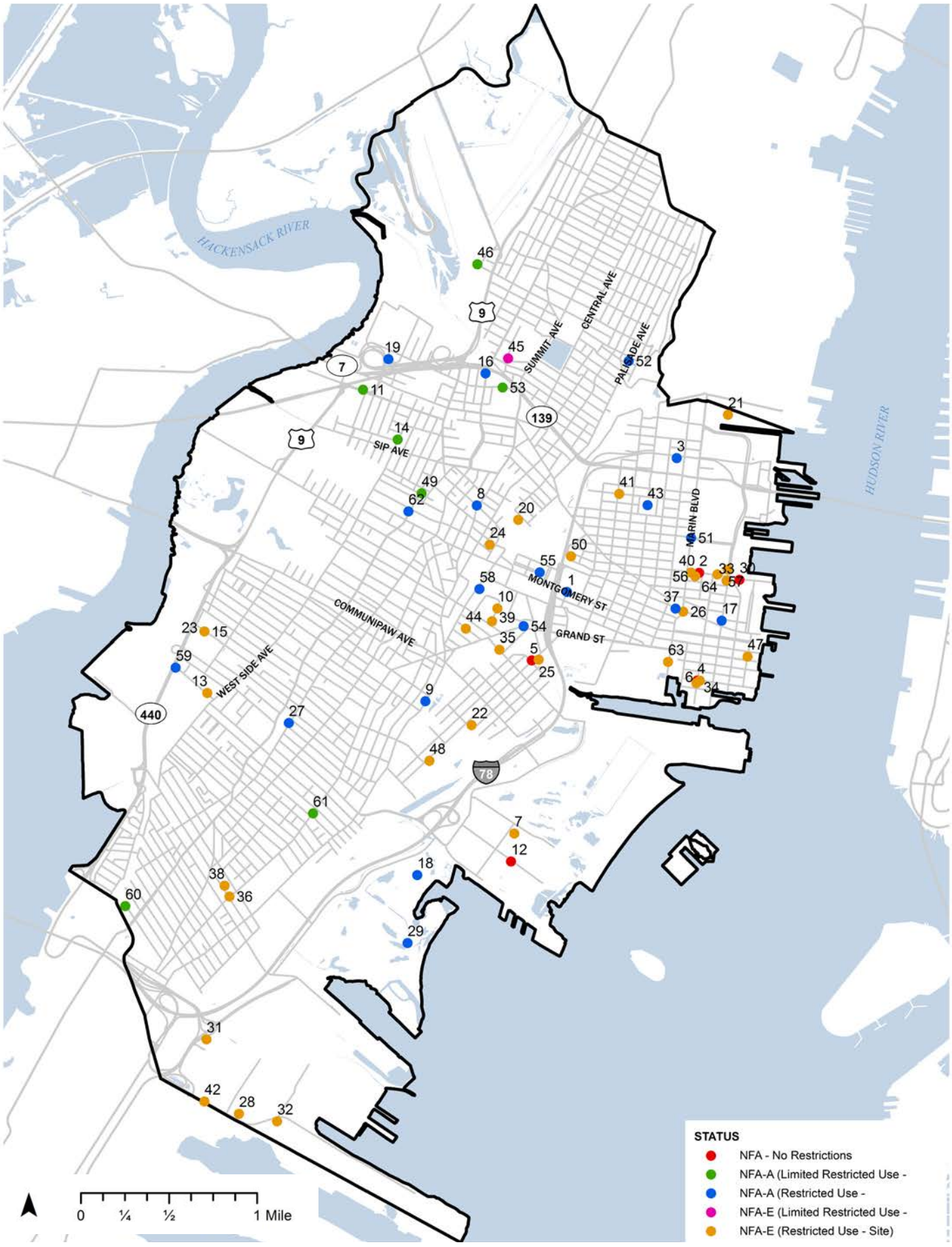
The data used to generate Map 28 and the Table A.8, in Appendix A, are from 2014, therefore it's possible that sites have been added, removed or updated.

To learn more about the Site Remediation Program (SRP) visit: http://www.nj.gov/dep/srp/ .

To view a full list of known contaminated sites, visit: http://www.nj.gov/dep/srp/kcsnj/ or http://datamine2.state.nj.us/dep/DEP_OPRA/

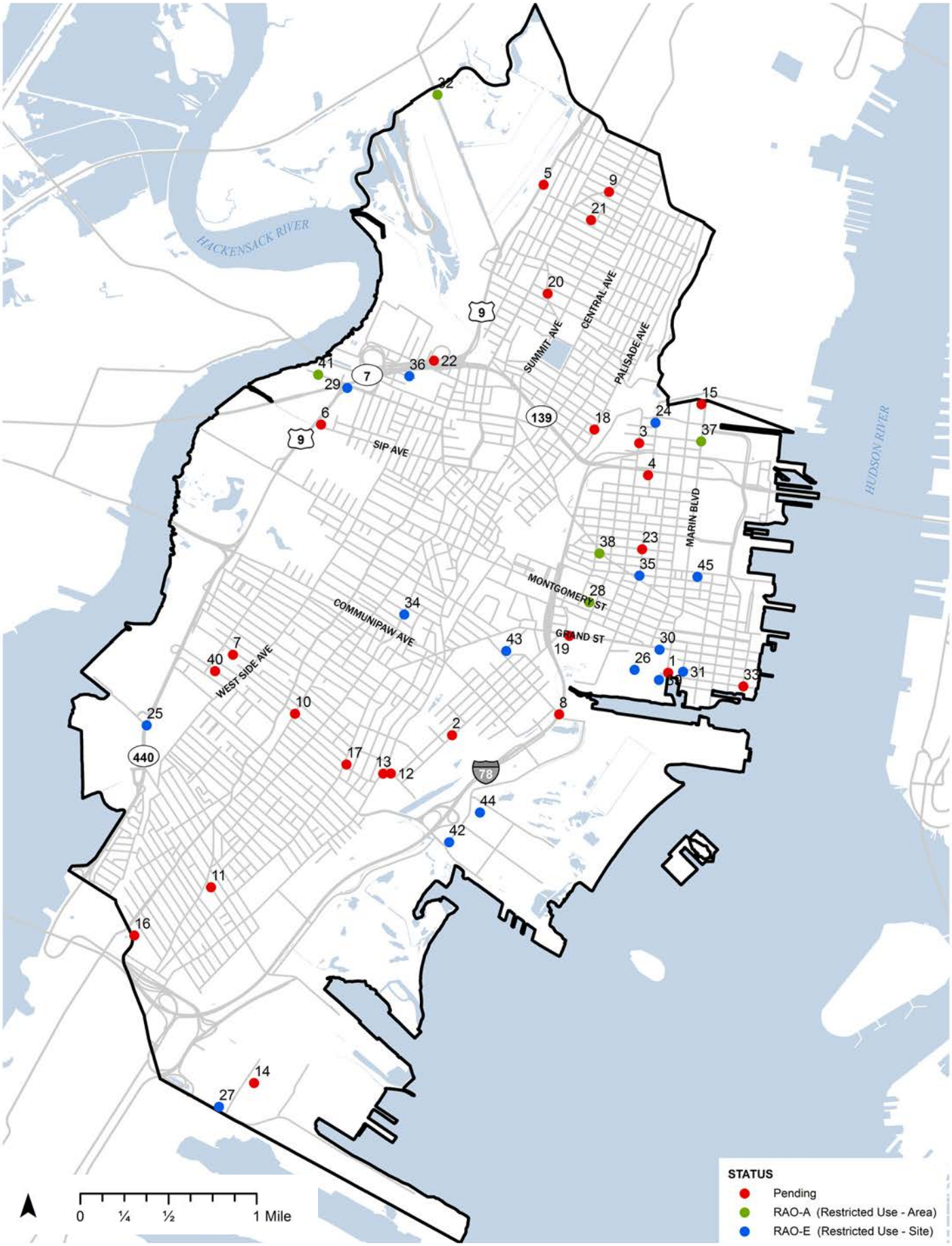
Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
City Water	Type	N/A
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Known Contaminated Sites	Status	http://njogis.newjersey.opendata.arcgis.com/datasets/6f11f6204ffa40a09527c8205aec4425_7

Map 28b. Known Contaminated Sites NFA



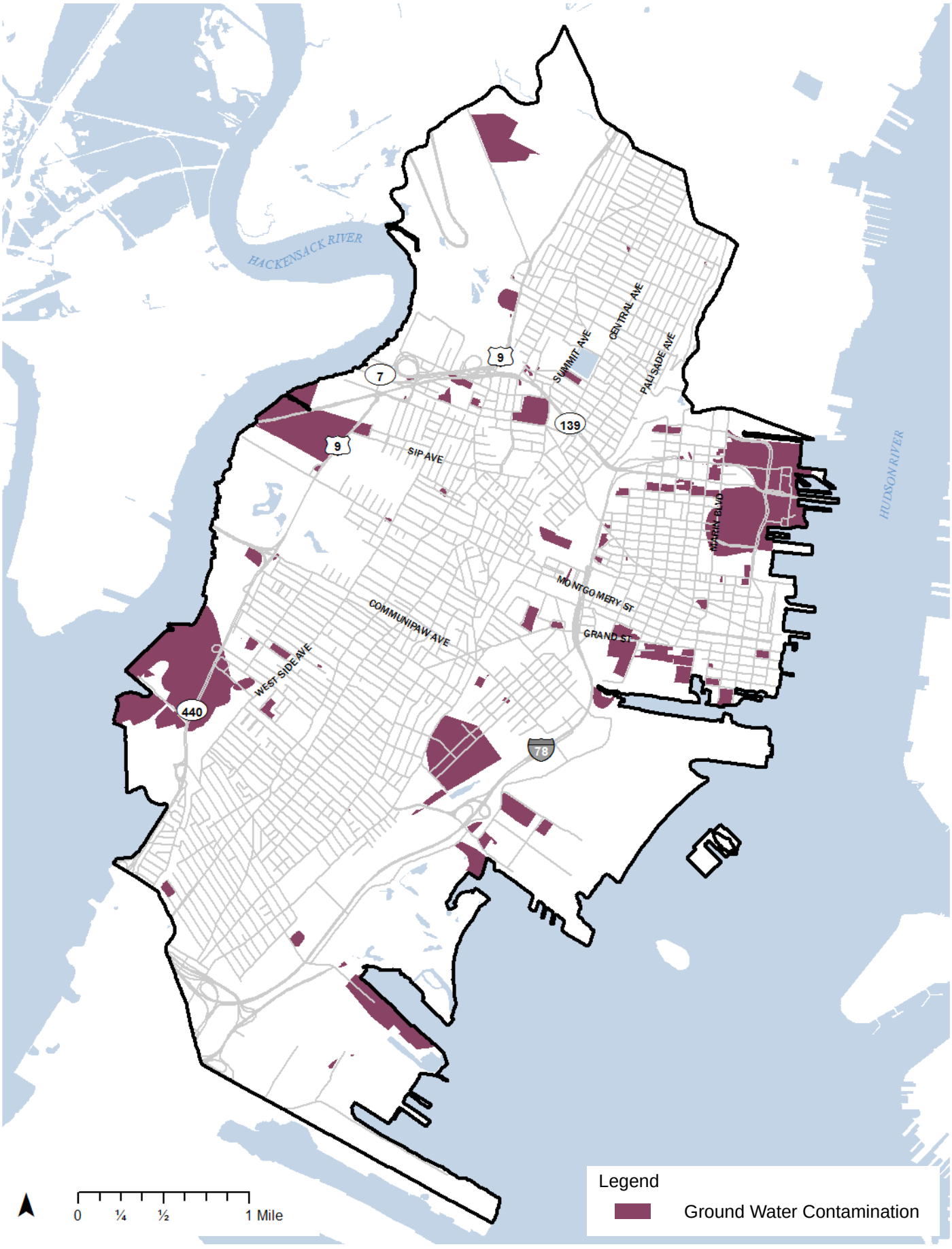
Primary Source: NJDEP

Map 28c. Known Contaminated Sites RAO



Primary Source: NJDEP

Map 29. Ground Water Contamination



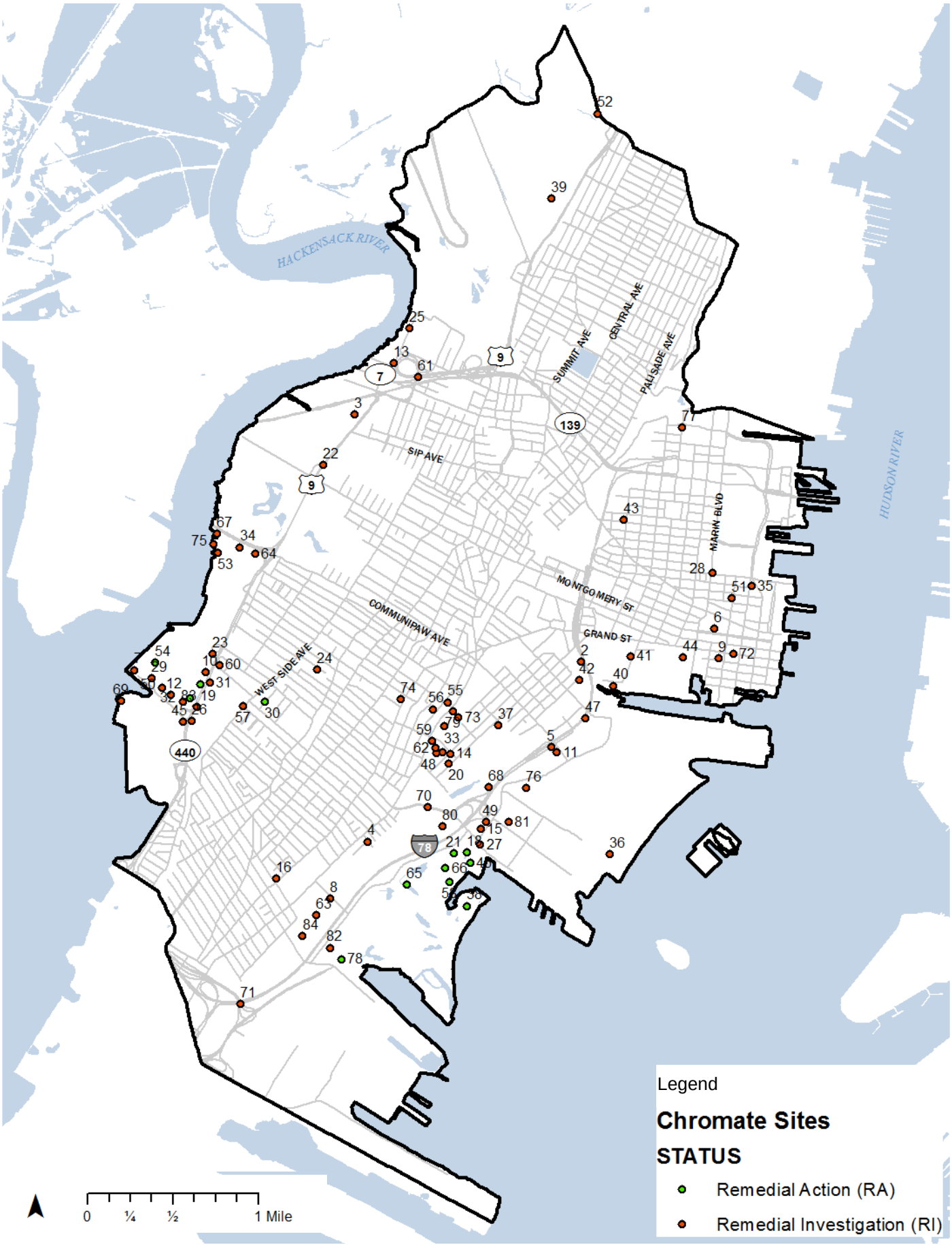
Primary Source: NJDEP

Ground Water Contamination

Similar to the known contaminated sites list, Ground Water contamination areas are sites where specific contaminants exceed ground water quality standards. Map 29 identifies areas where groundwater contamination has been observed, and where appropriate, the NJDEP has established a Classification Exception Area (CEA) in accordance with N.J.A.C. 7:9-1.6 and 1.9(b). A CEA provides notice that ground water pollution exists as a result of discharge from a contaminated site, and therefore the groundwater does not meet NJDEP ground water quality standards. Table A.9, in the appendix, provides additional details about the contaminants that have been reported.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Ground Water Contamination	PI_NAME	http://njogis.newjersey.opendata.arcgis.com/datasets/ddde3cb3a18740849d6c911e-49086cea_16

Map 30. Chromate Sites



Primary Source: NJDEP

Chromate Waste Sites

While chromate waste sites are listed in the Known Contaminated Sites section, we decided to provide additional information about these sites since chromium waste is an especially major issue in Jersey City.

Chromate waste, also known as hexavalent chromium, is a toxic by-product of stainless steel production. Stainless steel was heavily produced in Jersey City in the first half of the 20th century and the chromate waste was left throughout the city and incorporated into some of the materials that were used as fill.

Jersey City has numerous chromate waste sites. Most are located along NJ-440 next to Stadium Plaza Shopping Center, Home Depot, along Garfield Avenue and between Liberty National Golf Course and Liberty State Park, although there are a number of additional sites scattered throughout the city.

In his book Protecting New Jersey's Environment: From Cancer Alley to the New Garden State Thomas J. Belton describes growing up in Jersey City and playing in the chromate waste which they used to call "Mud". He also discusses the illegal ways chromate waste was disposed of throughout the city.

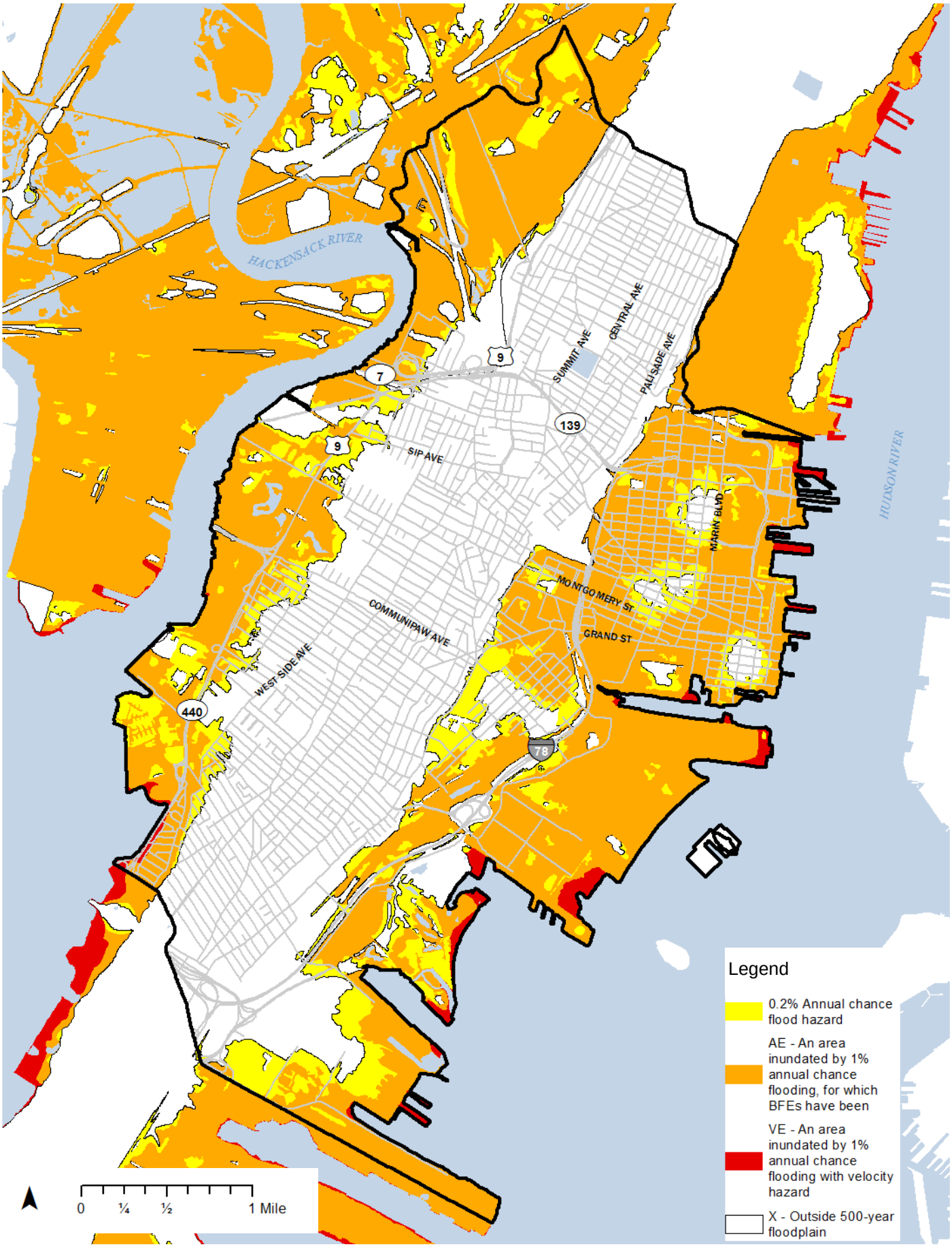
In 2011, the state of New Jersey reached a settlement with Honeywell International Inc., Occidental Chemical Corp, and PPG Industries, Inc.to clean up a number of sites in Jersey City. The initiative is called the Chromium Cleanup Partnership. To learn more visit:
http://www.state.nj.us/dep/srp/siteinfo/chrome/
http://chromiumcleanup.com/
http://www.garfieldavenuerenewal.com/

Map 30 shows Chromate Waste Sites in Jersey City. The data is from 2006, though dates back to 1995, therefore some of the sites may have been remediated. Table A.10 provides some of the contamination information that was used to make the map.

Former Roosevelt Drive-In Theater site during remediation.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
City Water	Type	N/A
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
Chromate Sites	Status	http://njogis.newjersey.opendata.arcgis.com/datasets/ed5549b6bff140fda40e69d5dd251843_8

Map 31. FEMA PFIRM Flood Insurance Rate Map



Primary Source: NJDEP

FEMA Flood Zones

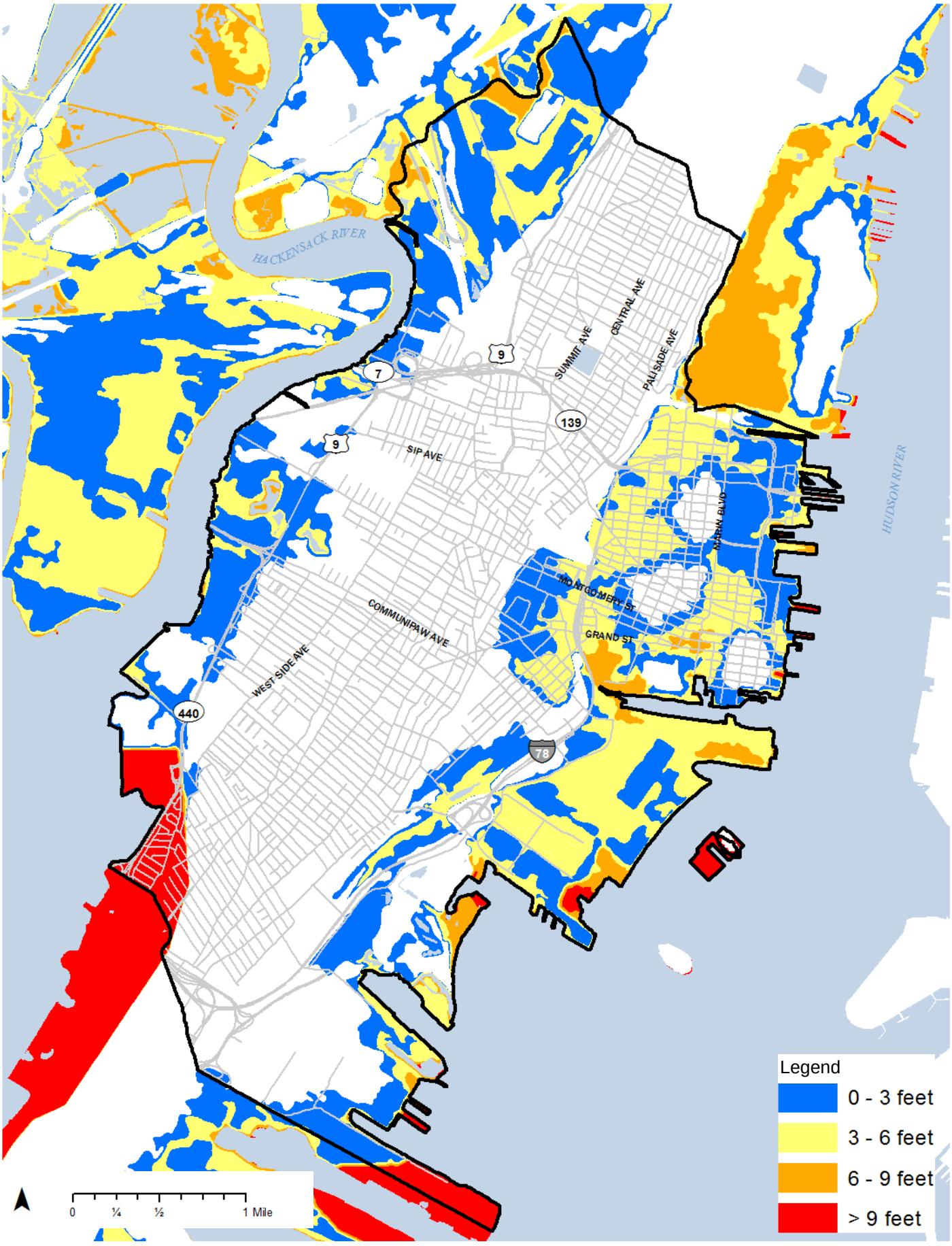
The Federal Emergency Management Agency's (FEMA) Flood Hazard Zones are part of the FEMA - National Flood Hazard Layer data, which is derived from the FEMA - Flood Insurance Rate Map (FIRM). The zones are used for understanding where flooding occurs and setting flood insurance rates. The zones include various categories, such as "1% Annual Chance Flood Hazard" (100-year flood zone), "0.2% Annual Chance Flood Hazard" (500-year flood zone) and "areas of minimal flood risk".

Large portions of the low-lying area on both sides of Jersey City, especially Lincoln Park, the Meadowlands, Downtown Jersey City, Liberty State Park, and Liberty National Golf Course are in the "1% Annual Chance Flood Hazard zone," which is also known as a "Base Flood," or a 100-year storm (Map 31).

Overview from J. Owen Grundy Park, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
2014 FEMA Preliminary Flood Zones	FLD_ZONE	http://www.region2coastal.com/view-flood-maps-data/view-preliminary-flood-map-data/

Map 32. SLOSH Category 1 Flood Zones (flooding heights)



Primary Source: NJDEP

SLOSH Flood Zones

The “Sea, Lake, and Overland Surges from Hurricanes” or SLOSH model is developed by the National Weather Service (NWS) and used to calculate storm surge heights and the extents of inundation for hurricane evacuation (Map 32). Storm surge heights are influenced by a variety of factors, such as storm size and speed of winds, the angle of approach to the shoreline, as well as hurricane intensity categorized by the Saffir-Simpson hurricane scale, ranging from one to five. The following map shows the storm surge heights of a Category 1 hurricane. Similar to the FEMA Flood Zone Map, the low-lying areas of Jersey City are prone to storm surge flooding. Flooding heights typically range from 0 to 9 feet, although in some areas the flooding is more than 10 feet. For more information and to see SLOSH maps for Hurricane Categories 1-4 visit: NJ Floodmapper (http://slrviewer.rutgers.edu/).

View of Liberty State Park from downtown, Jersey City.

Layer name	Attribute Column Name	Source
Jersey City Boundary	SHAPE	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
State Water	GNIS_NAME	http://www.nj.gov/dep/gis/digidownload/metadata/statewide/nhdwaterbody2002.htm
River Labels	NAME	http://www.state.nj.us/dep/gis/stateshp.html
Streets	SLD_Name	http://www.state.nj.us/transportation/gis/data.shtm
Highway Labels	ROUTE	http://www.nj.gov/transportation/gis/data.shtm
Highways	SHAPE	http://www.nj.gov/transportation/gis/data.shtm
SLOSH Category 1 Flood Zones	Depth	N/A

CHAPTER 6. Answering Some Questions

Question 1

Within urban areas, natural processes are strongly mediated by built forms. This has come up when discussing factors such as impervious surfaces and soil infiltration. This chapter works to integrate and synthesize information about planning and census data with natural resources through a series of questions that might become important to the growth of Jersey City in the near future.

Question 1. What has changed since the 1988 (Vaccari) and 1993 (Vaccari and Witt) Environmental Resources Inventories?

Climate: In 1988, scientists were just beginning to discuss effects attributable to a changing climate(http://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html?pagewanted=all). Therefore, it is logical that Vaccari (1988) does not reference these issues. Today, there is general agreement amongst scientists that change is occurring and that we face the probability of more frequent and stronger storms (https://statesummaries.ncics.org/nj).

The level of risk is also rising. Risk is not simply the probability of an occurrence; risk is the probability of occurrence multiplied by the projected value of the damage. Within New Jersey, in general, and Jersey City specifically, the density of buildings, infrastructure and people near the water is increasing. In other words, the risks of storm damage are increasing because both the projected value of the damage and the frequency of severe storms are increasing.

Geology: In the section on geology, Vaccari (1988) discusses the rate of filling that has occurred in Jersey City since the early period of European settlement. In addition to describing patterns such as those illustrated in Maps 5 and 10, he comments on the fact that fill produced at three chromate sites contains several percent chromium and was used as fill at many sites in Jersey City and throughout Hudson County. This describes the source of the sites displayed in Map 30 Chromate Sites, and leads to a recommendation that a fully independent survey of these sites be made 5 and 20 years after they are remediated. Although the remediation process is highly regulated and no contamination should be found, this recommendation reflects the abundance of caution that the City should take in protecting its future residents from the health risks of chromium exposure.

Dr. Vaccari also reports the results of soil borings in several locations by a number of investigators. This information (pages 18-23 of the ERI) is available through the Rutgers Library System.

Table 5. Frequency of hurricanes and tropical storms reported since 1990 compared to those in the previous forty years. The 48 severe storms that occurred between 1950 and 1990 gives a rate of 1.2 severe storms per year. This data appears to support the prediction of increasing frequency of severe storms.

	Number of recorded storms affecting New Jersey			
Month	Number of storms 1950-1990	% of Storms	Number of Storms 1991-2016	% of storms
June	4	8	6	12
July	3	6	4	8
August	13	27	16	31
September	22	46	17	33
October	6	13	8	15
November	0	0	1	2
TOTAL	48 (1.20 per year)		52 (2.08 per year)	

Water: In 1988, as today, surface water flow is primarily associated with stormwater flow in Jersey City. Vaccari (1988, p.29) stated 1976 wastewater flow and projected flow for 2000. Table 6 shows his data plus data from a current report (http://www.jcmua.com/About%20the%20JCMUA.htm). The Passaic Valley Sewerage Authority currently receives Jersey City wastewater via a pipe under the Hackensack River (PVSA; http://www.nj.gov/pvsc/)

Vaccari (1988) states that no groundwater extraction occurs in Jersey City and attributes the groundwater contamination to the industrial history of chromium in Jersey City.

Air Quality: Dr. Vaccari provides an excellent overview of air quality concerns and data. Today, the monitoring is reported regularly, online and in weather reports.

Noise: Jersey City's new Noise Ordinance (https://www.documentcloud.org/documents/2824731-Revised-Jersey-City-noise-ordinance.html) addresses the concerns reported in Vaccari (1988)

Ecology: Vaccari and Witt (1993) review basic ecology and its application to urban systems before they begin their review of the types of ecological systems that occur in and around Jersey City. In particular, it is valuable to update their concern regarding their warnings about consuming fish caught in local waters. NJDEP posts current information and advisories at:

http://www.nj.gov/dep/dsr/fishadvisories/publications.htm#more

http://www.nj.gov/dep/dsr/fishadvisories/2016-fish-advisories.pdf

As of 2016, there are fish consumption advisories for PCB's, Dioxin, and Mercury. Polychlorinated biphenyls (PCBs) were commercially produced for industrial application in heat transfer systems, hydraulic fluids and electrical equipment. They were later incorporated into other uses such as printing inks, paints and pesticides. The manufacture of PCBs was stopped in 1979 because of evidence that PCBs build up in the environment and cause harmful effects. PCBs tend to stay mostly in soil and sediment, but are also found in the air and water. Once they enter the food chain, they have a tendency to be absorbed into fat tissue. PCBs build up in fish to levels that are hundreds of thousands of times higher than the levels in the surrounding water. When people consume fish that have already accumulated PCBs, the PCBs then accumulate in their bodies.

PCBs have been shown to cause cancer in animals, and there is evidence that PCBs may cause cancer in exposed humans. PCBs have also been shown to cause a number of serious health effects besides cancer in humans and animals, including effects on the nervous system of the developing fetus, the immune system, and the reproductive system. Studies have shown that unborn and young children are most at risk to PCB exposure. Because PCBs take a long time to leave the body after they accumulate, women who plan to become pregnant should follow the more restrictive consumption advice before becoming pregnant. For more information go to: https://www.epa.gov/pcbs/learn-about-polychlorinatedbiphenyls-pcbs

Table 6. Estimates of average daily wastewater flow in million gallons per day (MGD), as reported in Vaccari (1988) for 1976 and 2000.

Source	1976	2000 (est.)	2015
Domestic and Commercial	30.8	32.45	
Industrial	4.95	6.75	
Infiltration and Inflow	32.0	7.7	
TOTAL	67.74	46.9	50*

* JCMUA reports nearly 50MGD at http://www.jcmua.com/About%20the%20JCMUA.htm

Dioxin is the most toxic member of a large chemical family of related dioxins and furans. Dioxin is an unwanted industrial byproduct formed through numerous processes, including production of chlorinated phenol products such as herbicides, the incineration of municipal solid waste, and creation of paper products using bleach. Most of what we know about dioxin has been obtained through animal toxicity testing in the laboratory and representative wildlife species. Dioxin produces a number of effects in animal testing, including suppression of the immune system, impaired reproduction, birth defects in some species tested, a skin condition called chloracne, alterations in liver function, and cancer. The U.S. National Toxicology Program has classified dioxin as a known human carcinogen. For more information go to: https://www.epa.gov/dioxin/learn-about-dioxin

In addition, Vaccari and Witt's description of wetlands includes:

> "Caven Point pier is located at the Natural Area's Southern Boundary and is frequently used by fisherman and bird watchers. Man's impact on Caven Point Natural Areas has been limited and is probably not permanent. The Natural Area is protected, it is not a recreation area and therefore is subject to less intrusion by man."

This area is now Liberty National Golf Course and does not serve the same function as the tidal marshes that were here. Tidal marshes, even small fringe marshes, like the ones that survive in the golf course, contribute to the regional biodiversity and deserve protection and monitoring.

More recently, the Lincoln Park Wetland Restoration (Jersey City, N.J.) received about $10.5 million in 2009 to restore 30 acres of a larger 80-acre coastal wetland in the urban industrialized area of the Hackensack River basin. This restoration includes 22 areas of low marsh, 11 acres of open water / mudflats, 2 acres of High Marsh, 4 acres of Scrub Shrub, and 3 acres of park areas. Spartina patens, Spartina alterniflora, and Baccharis halimifolia are some of the several wetland species of wetland plants that were planted as part of this restoration. Although the project did not add wetland area, this type of restoration supports regional biodiversity and other ecological functions.
http://www.habitat.noaa.gov/highlights/landfillturnedurbanoasis.html
http://www.louisberger.com/our-work/project/lincoln-park-wetlands-restoration-new-jersey-us

Table 7. Local Fish Warnings. Hudson River From the NY-NJ borderline (near Alpine, NJ) downstream of the NY-NJ borderline on the Upper New York Bay (at Bayonne, NJ) (From NJDEP, 2016)

Species	General Population* Eat No More Than	High Risk Population* Eat No More Than
Striped Bass*	Four meals per year	Do Not Eat
White Perch	One meal per year	Do Not Eat
White Catfish	Do Not Eat	Do Not Eat
American Eel *	One meal per year	Do Not Eat
Blue Crab	One meal of 7 crabs per week- Do not eat Green Gland (hepatopancreas) Discard cooking liquid	One meal of 7 crabs per week- Do not eat Green Gland (hepatopancreas) Discard cooking liquid
Winter Flounder	One meal year per month	One meal year per month

*High Risk Individuals: Infants, children, pregnant women, nursing mothers and women of childbearing age are considered to be at higher risk from contaminants in fish than members of the general public. People within this category should be particularly careful about following the advisories, because of the greater potential for PCBs, dioxin and mercury to affect the development of the fetus, infant, and young child.

General Population: Includes all others not in the high risk category. PCB advisories for the General Population are presented in meal frequencies (for example: one meal per month or four meals per year). This range is based on an estimated 1 in 10,000 risk of cancer during your lifetime from eating fish at the advisory level. This means that one additional cancer may occur in 10,000 people eating fish at the advisory level for a lifetime.

Several lists of species were given for areas in and around Jersey City by Vaccari and Witt (1993). The lists were products of several research and monitoring programs. This information was not included in this ERI due to the fact that today there are online resources for this type of information. For example, by submitting the longitude and latitude coordinates for Jersey City, one can access the Global Biodiversity Species site (http://www:gbif.org). On this site, species or areas can be surveyed for occurrences. For instance, the site reports over 18,000 records of birds for Jersey City on 2015; these records include over 200 distinct bird species (Table 8). This type of resource is being used by urban ecologists to describe the biodiversity of cities (e.g. https://www.nceas.ucsb.edu/projects/12592)

Table 8. Selected examples of very common and less common bird species recorded for Jersey City during 2015 (from Global Biodiversity website). Detailed lists can be generated for plants, fish, insects, mammals, birds, etc.

Common Name	Latin Name	# Records
Mallard duck	*Anas platyrhynchos* Linnaeus, 1758	549
Herring gull	*Larus argentatus* Pontoppidan, 1763	574
Northern mockingbird	*Mimus polyglottos* (Linnaeus, 1758)	522
European starling	*Sturnus vulgaris* Linnaeus, 1758	576
American Robin	*Turdus migratorius* Linnaeus, 1766	459
Redhead (duck)	*Aythya americana* (Eyton, 1838)	3
Wilson's warbler	*Cardellina pusilla* (A. Wilson, 1811)	8
Bobolink	*Dolichonyx oryzivorus* (Linnaeus, 1758)	5
Nashville warbler	*Oreothlypis ruficapilla* (A. Wilson, 1811)	6
Prairie warbler	*Setophaga discolor* (Vieillot, 1809)	6

Question 2

Question 2: What are the differences between the ERI and the Jersey City Stormwater Management Plan (2008)?

The Jersey City Stormwater Management Plan (Malcolm Pirnie 2008) is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. The Management Plan should be used in conjunction with the ERI. Although much of the same information regarding water, stormwater and green infrastructure is touched on, the Management Plan provides greater detail in calculations and regulations. The Environmental Commission should be aware that this document is supposed to be updated regularly and should request the timeframe for updates.

Question 3

Question 3: How does this report relate to the Jersey City Environmental Commission's Recommendations on Green Infrastructure Initiatives?

The Jersey City Environmental Commission has produced an excellent statement of intention for green infrastructure best management principles. For these principles to be put into action, soil studies for new projects must be carefully reviewed: for soil infiltration capacity and intended rates, for soil amendment proposals, and for monitoring or verifying as-built conditions. The Hudson County Soil Survey (2015) classifies much of Jersey City as Urban Soils and there are few data that can be mapped for these areas. It is necessary that site-specific soils information be collected if there is any expectation of stormwater infiltration and storage.

The Environmental Commission is advisory, not regulatory, but they can and should be careful reviewers of site plans and reports related to the environment in order draw attention to any stormwater functions that are proposed in a written document are substantiated in technical plans as well as demonstrated and monitored in actual practice.

Question 4

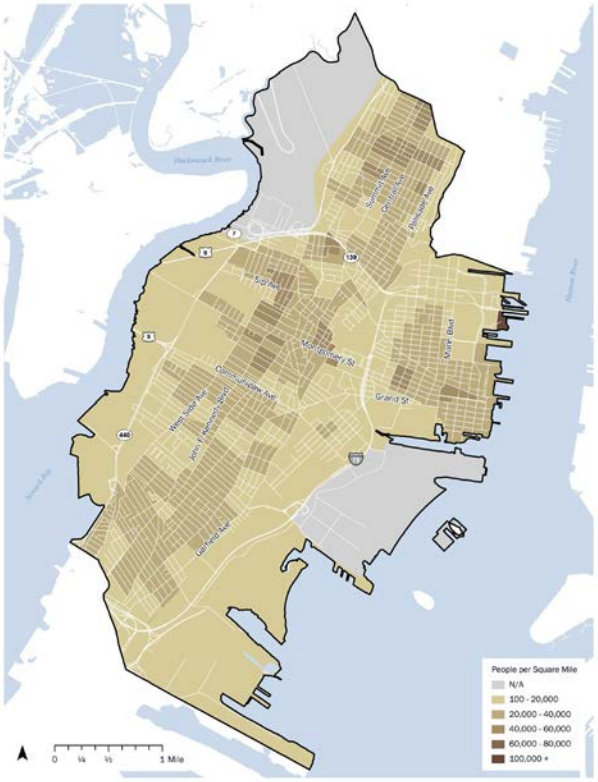
Question 4: How does this report relate to the Jersey City Tree Canopy report?

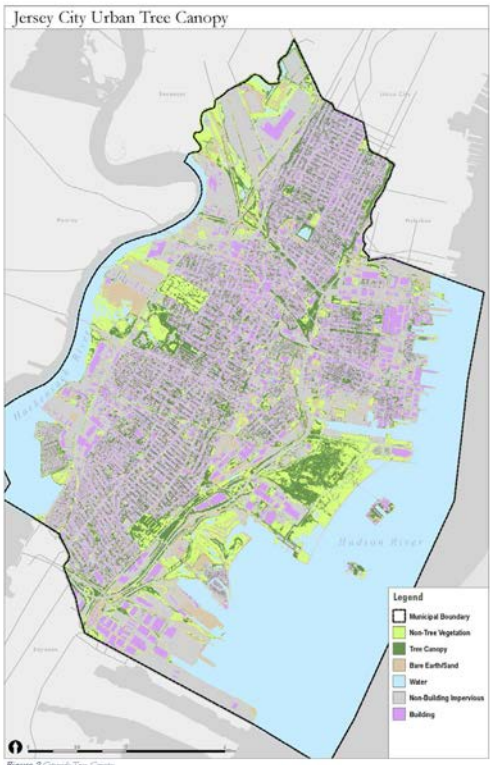
The Tree Canopy study proposes planting and maintenance guidelines that fit within current best management practices. Trees, in designed landscape and forest patches provide many green infrastructure functions. Supporting and moving forward on the Tree Study recommendations should be a high priority for the City. The Environmental Commission could further this effort by continuing the dialogue with the Department of Public Works and the Division of Parks and Forestry, working on grant proposals for funding the urban forest and its management, or supporting initiatives that come from NGO's, schools, etc.

In reviewing some of the maps produced in the Tree Study, we note that there are distinct areas where there is a low level of greenness; some of these are residential zones while others are commercial. Specific approaches to greening these two categories are appropriate. In residential areas where many residents are renters, it is important that the health and environmental benefits of tree cover is clearly communicated to residents as well as landowners. In more commercial areas, it makes sense to promote green infrastructure in terms of economic benefits in addition to health and environmental issues. Programs like "Complete Streets" have been adopted and implemented successfully in other municipalities. The New Jersey Department of Transportation supports Complete Streets and therefore should implement Complete Street standards when working on projects in Jersey City. All development and redevelopment proposals should also support Complete Street goals.

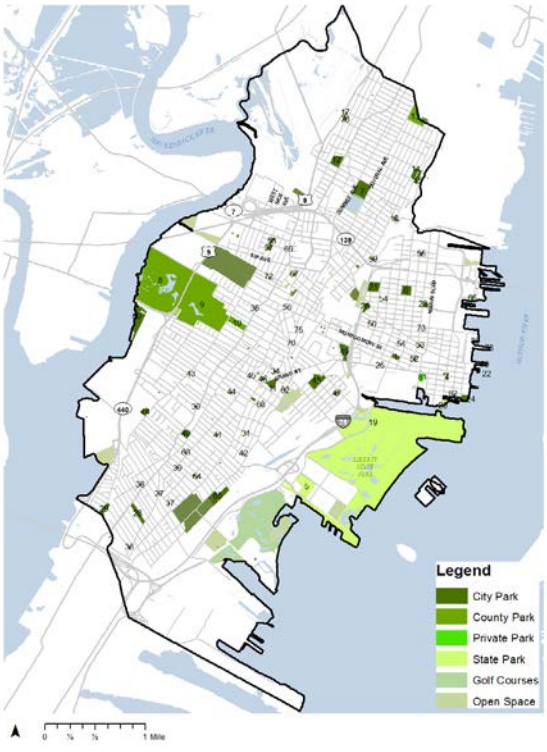
Belmont Avenue, Jersey City.

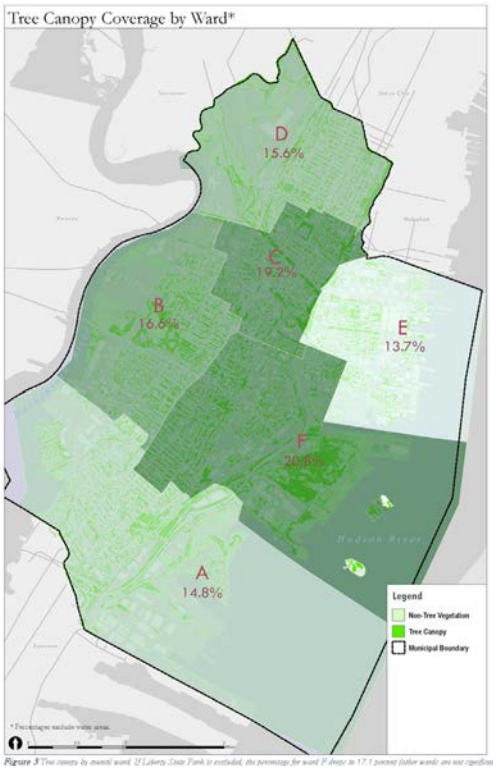
Maps 33 a & b. Comparison of greenness and population density patterns.



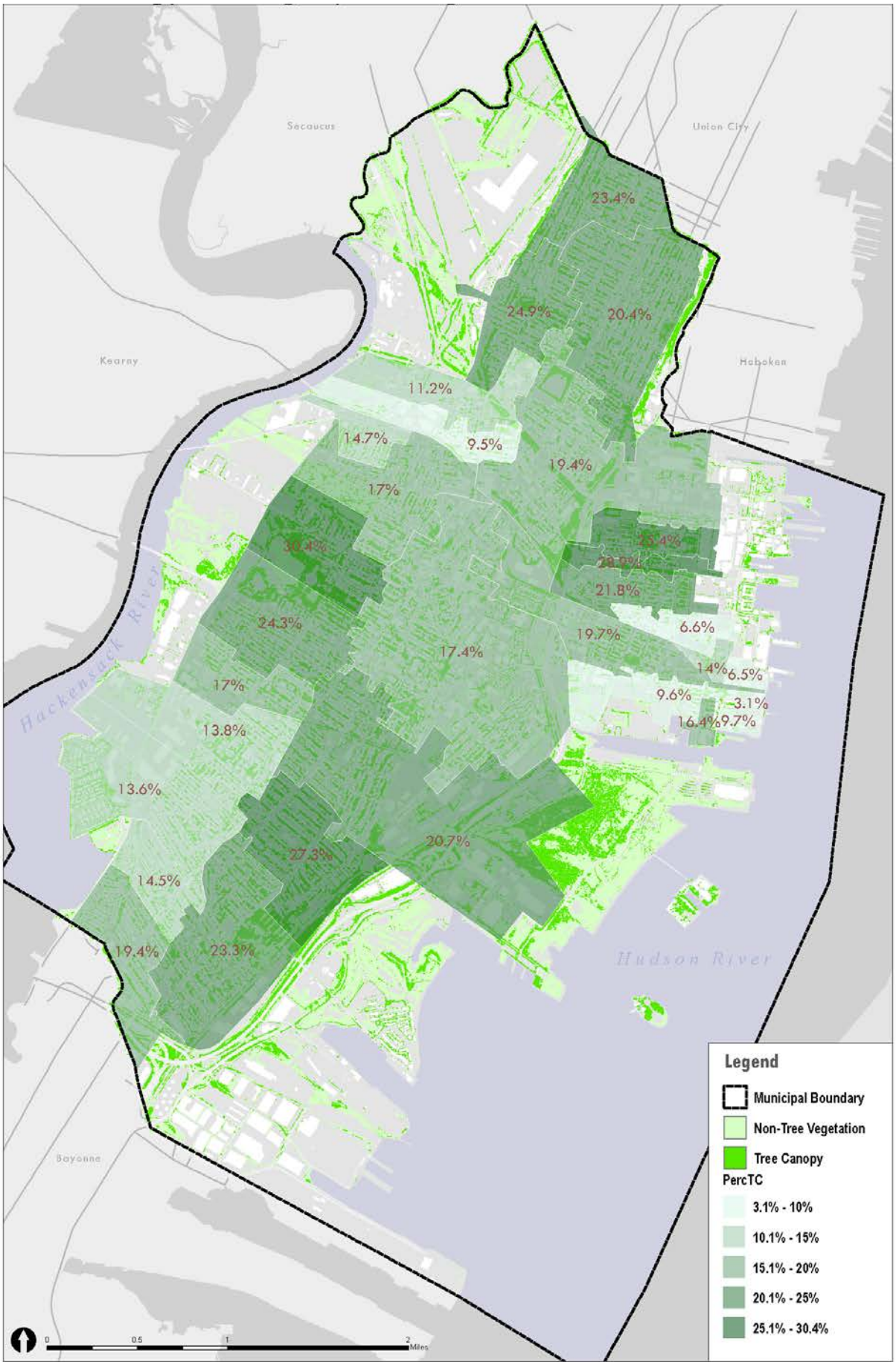


Maps 34 a & b. Comparison of parks and tree canopy per person





Maps 35. Percent Tree Cover by Sewershed



Primary Source: NJDEP

Question 5

Question 5: So what?

This report presents a mountain of data. Each data set is presented with some interpretation of data into useful information. Ultimately, the goal is to help the reader move up the ladder of knowledge (Figure 6) so that they have enough insight to develop wisdom about future impacts on the environment.

The map comparisons in Question 4 begin to show how to take the process of interpretation further by comparing estimates of population to greenness and asking if greenness is equally accessible to all residents of Jersey City. One might look at these maps and find areas that are not well served by the parks because it takes more than 5-minutes to walk from some residential areas to a park or because the acreage of park is small compared to the population size. Another way to look at Maps 33 and 34 is to identify areas with low street tree and tree canopy for tree planting efforts. Map 35 provides another useful view, by showing where tree cover is low in sewersheds and thereby indicating areas of need or priority for tree planting.

The Environmental Commission and other groups within Jersey City have expressed interest in developing more green infrastructure. Where is it most needed and how much is appropriate? Map 26 shows the sewer-sheds that are responsible for combined sewer overflows (CSO's). One JCMUA has up-to-date outflow data, they can identify how much outflow occurs with a typical storm (e.g. 1.5" precipitation per day). This will give a target for identifying how much green infrastructure, that includes infiltration to ground water, is needed in each sewer-shed. Map 29 shows areas where groundwater contamination has been recorded. Significantly increasing infiltration to the groundwater in these areas could lead to movement of the contaminated water towards the rivers; so, caution is appropriate in and near these areas. This same caution would be applied to sites with known contaminants (Map 28), and especially Chromate (Map 30). In contrast, sites with NJPDES Surface Water Discharge are already monitored and discharging into the rivers (Map 27).

In addition to contamination, soil infiltration must be considered in designing green infrastructure. Map 9 shows infiltration rates from 0.1 to 0.27 cm/min for soils derived from fill. Higher infiltration rates are generally preferred. However, much of the soil is classified as "Urban Land" and no infiltration rate is predicted. This means that any proposal for green infrastructure on these soil types would need to include site specific soil testing for infiltration rates. Further, these tests cannot be generalized because the materials (and therefore the infiltration) in Urban Land can vary from parcel to parcel and even within a parcel.

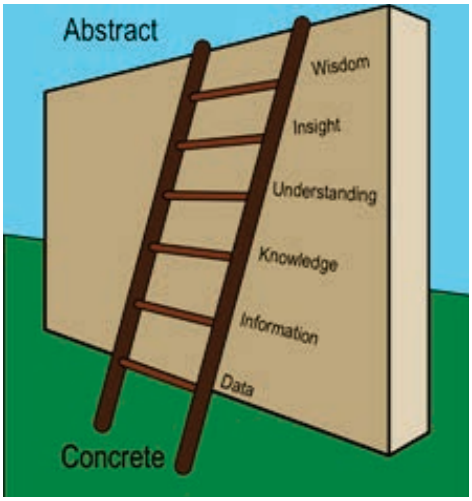


Figure 6. From data to wisdom. Source: http://joyfulpublicspeaking.blogspot.com/2013/09/the-ladder-of-abstraction-and-data.html

Conclusion

In conclusion, this is an important time for the Jersey City Environmental Commission to support the application of best management practices for stormwater management, biodiversity, environmental justice, and environmental health. As within any large and complex organization, it takes extra effort to coordinate between organizational units. The Environmental Commission can take on the roles of both the clearinghouse for environmental information as well as the environmental advisory role it holds now by collaborating with the many divisions, offices, departments, and centers that make up the municipal government of Jersey City. It can also develop open lines of communication with Hudson County offices, such as the Division of Planning, their Open Space, Recreation and Historic Preservation Trust Fund, and the County Park System, where green infrastructure issues and practices are being discussed and applied.

Bike Share program, in front of City Hall, Jersey City.

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*Note: Dates indicate year of access if there is a weblink.