GOWANUS, BKLN

A GIS STUDY MAPPING FLOOD VULNERABILITY AND GREEN INFRASTRUCTURE INVESTMENT

TAHREEM AKIF, FALL 2024
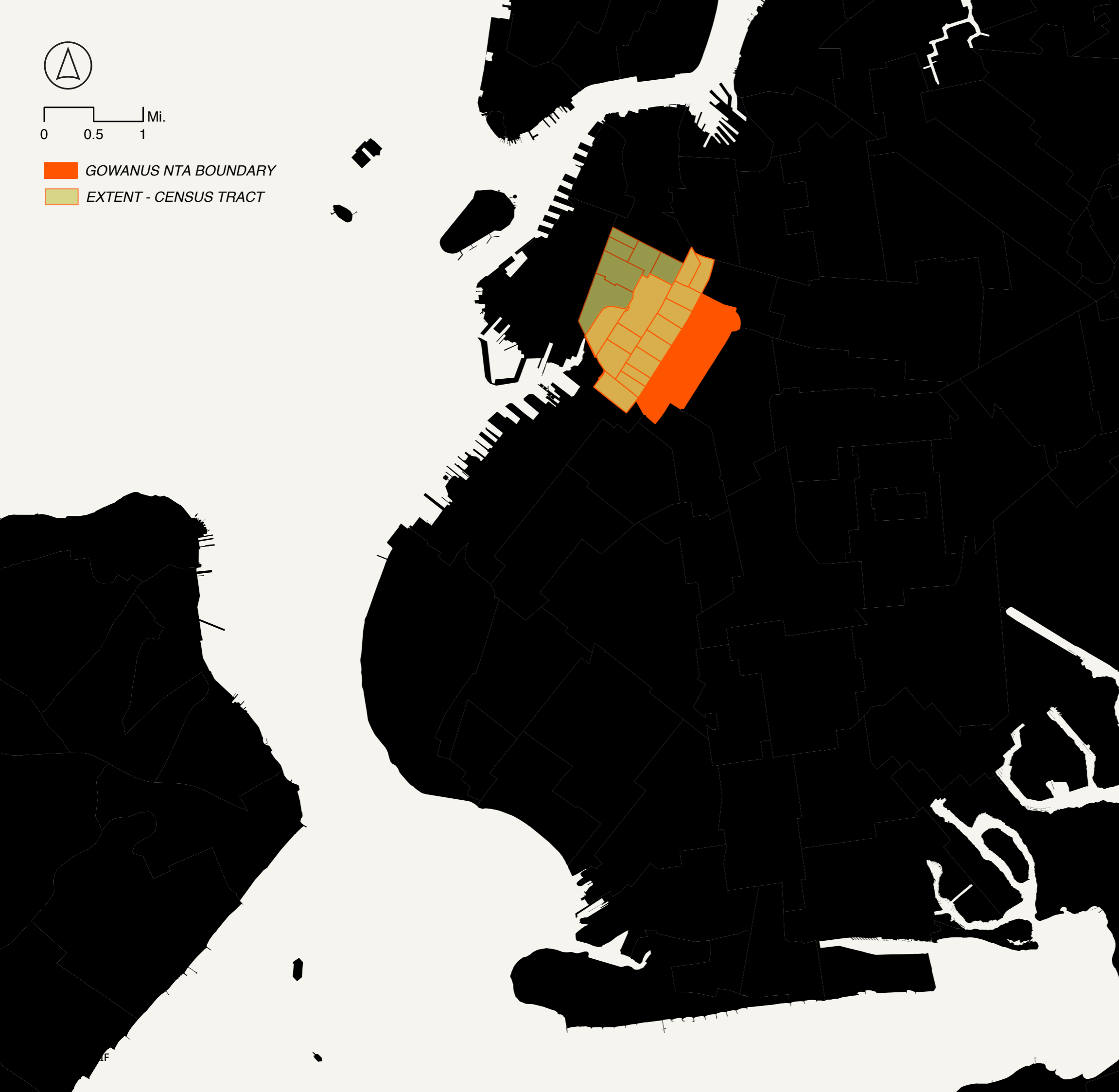
SCOPE.

This project focuses on the census tracts surrounding the Gowanus Canal. The study area is bounded roughly by 4th Avenue to the east and Court Street to the west, extending beyond the traditional boundaries of the Gowanus/Park Slope Neighborhood Tabulation Area (NTA). This adjusted extent ensures the project fully captures:

1. The impacts of Gowanus Canal flooding on adjacent residential and industrial zones.

2. The geographic reach of the ongoing Gowanus Rezoning Plan.

By working at the census tract level, this analysis allows for more precise mapping of flood vulnerability, infrastructure patterns, and demographic disparities within areas directly affected by canal flooding. disproportionately affected by flood damage.

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01 **CONTEXT**
02 DEMOGRAPHIC ANALYSIS
03 COMPLAINTS & INTERVENTIONS
04 RECOMMENDATIONS

HISTORY & BACKGROUND

The Gowanus neighborhood has a long and complex industrial history that shaped both its physical landscape and current environmental challenges. In the 19th and early 20th centuries, the Gowanus Canal served as a critical industrial waterway, facilitating commerce and manufacturing. Factories, tanneries, coal plants, and chemical processing facilities lined its banks, discharging pollutants directly into the canal and surrounding soil. Over decades, this heavy industrial use left a legacy of contamination, making the canal one of the most polluted water bodies in the United States.

In 2010, the Gowanus Canal was designated an EPA Superfund site, leading to ongoing cleanup efforts to remove hazardous materials and restore ecological balance. However, the neighborhood's low elevation and reliance on outdated stormwater infrastructure exacerbated flooding issues over time, particularly as industrial land uses declined and gave way to mixed-use developments.

CURRENT REZONING & FLOODING ISSUES

The Gowanus Rezoning Plan, approved in 2021, represents one of the largest rezoning initiatives in New York City. Covering an 82-block area surrounding the Gowanus Canal, the plan aims to transform this historically industrial neighborhood into a vibrant mixed-use district, introducing new residential, commercial, and public spaces.

While the rezoning promises economic growth and increased housing availability, it raises significant concerns about the area's infrastructure capacity and resilience to flooding. The influx of new residents and developments places added pressure on the neighborhood's already outdated sewer and stormwater systems, which struggle to handle heavy rainfall and frequent flooding.

Future sea level rise projections for 2050 and 2080 indicate worsening flood conditions, particularly in areas directly adjacent to the canal. Without significant infrastructure upgrades, the increased density may exacerbate flood risks, creating an inequitable burden for long-time residents and businesses.
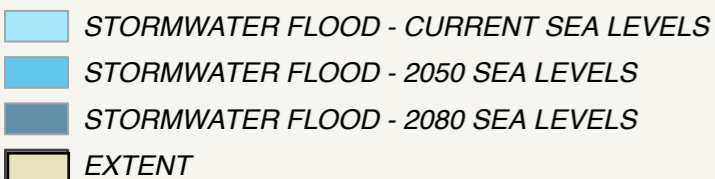
DEFINING THE PROBLEM

This project investigates whether new green infrastructure (GI) interventions in Gowanus are being equitably allotted in relation to areas most vulnerable to flooding. Frequent street flooding— particularly during heavy rainfall—is compounded by the neighborhood's low elevation and proximity to the Gowanus Canal.

While green infrastructure projects such as bioswales, rain gardens, and stormwater retention systems are being implemented to mitigate flood risks, questions remain about their spatial distribution.

By analyzing the overlap between flood-prone areas, NYC 311 complaint data, and current GI investments, this project seeks to uncover patterns of inequity and identify opportunities for targeted, equitable infrastructure interventions.
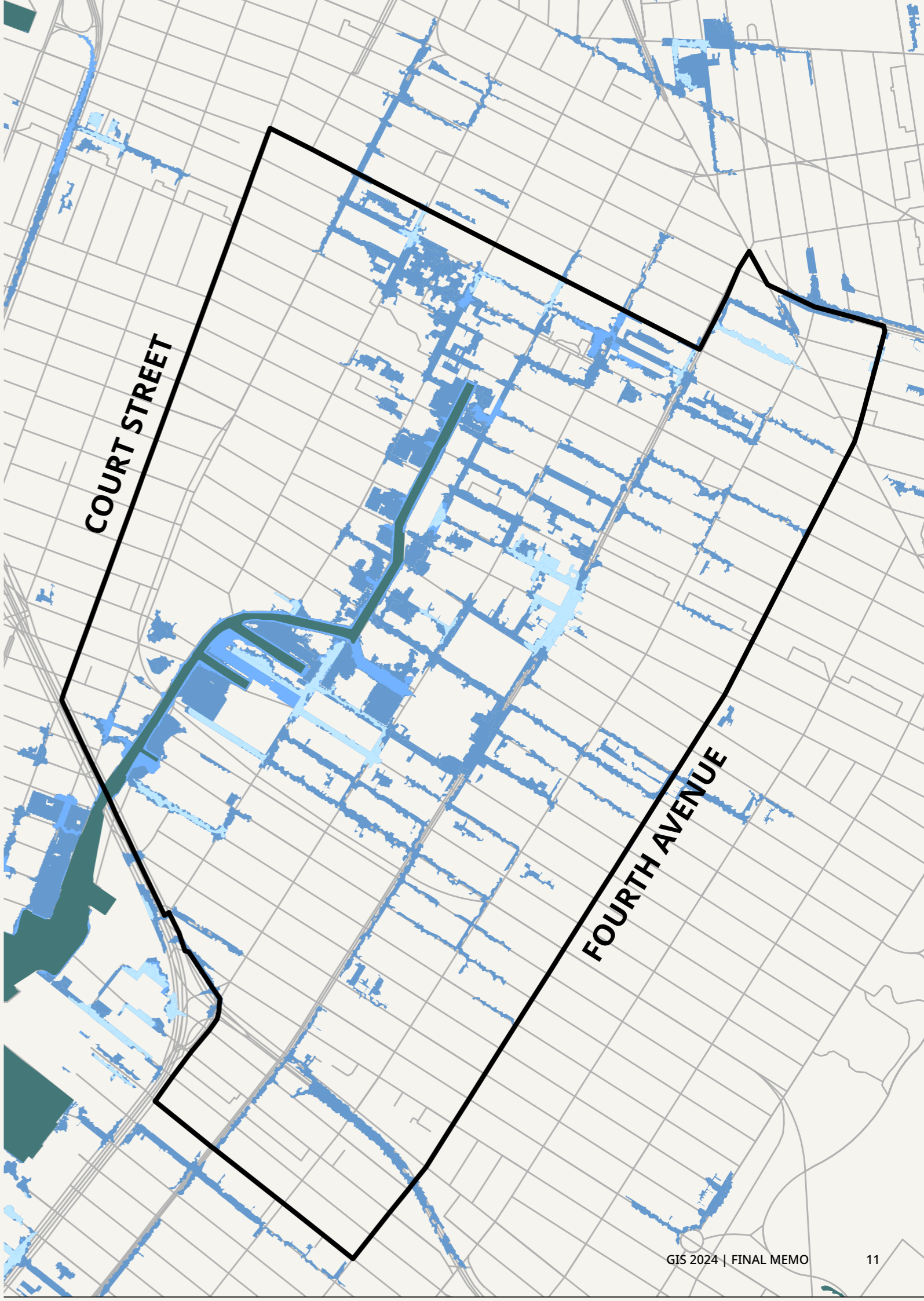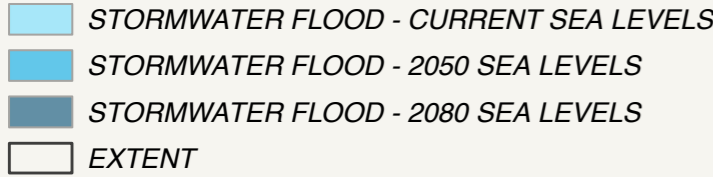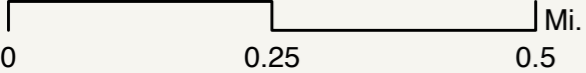
Mi.

STORMWATER FLOOD - CURRENT SEA LEVELS

STORMWATER FLOOD - 2050 SEA LEVELS

STORMWATER FLOOD - 2080 SEA LEVELS

EXTENT

RESEARCH QUESTIONS

1 Which areas in Gowanus are most vulnerable to flooding based on historical data and projections?

2 How does the spatial distribution of flood vulnerability align with demographic factors such as race and transit reliance?

3 How do NYC 311 complaints and current green infrastructure (GI) investments spatially overlay with flood-prone areas?

4 Where should future investments in green infrastructure be prioritized to maximize resilience and equity?

0   0.25   0.5 Mi.

STORMWATER FLOOD - CURRENT SEA LEVELS
STORMWATER FLOOD - 2050 SEA LEVELS
STORMWATER FLOOD - 2080 SEA LEVELS
EXTENT

COURT STREET

FOURTH AVENUE

01 CONTEXT
02 **DEMOGRAPHIC ANALYSIS**
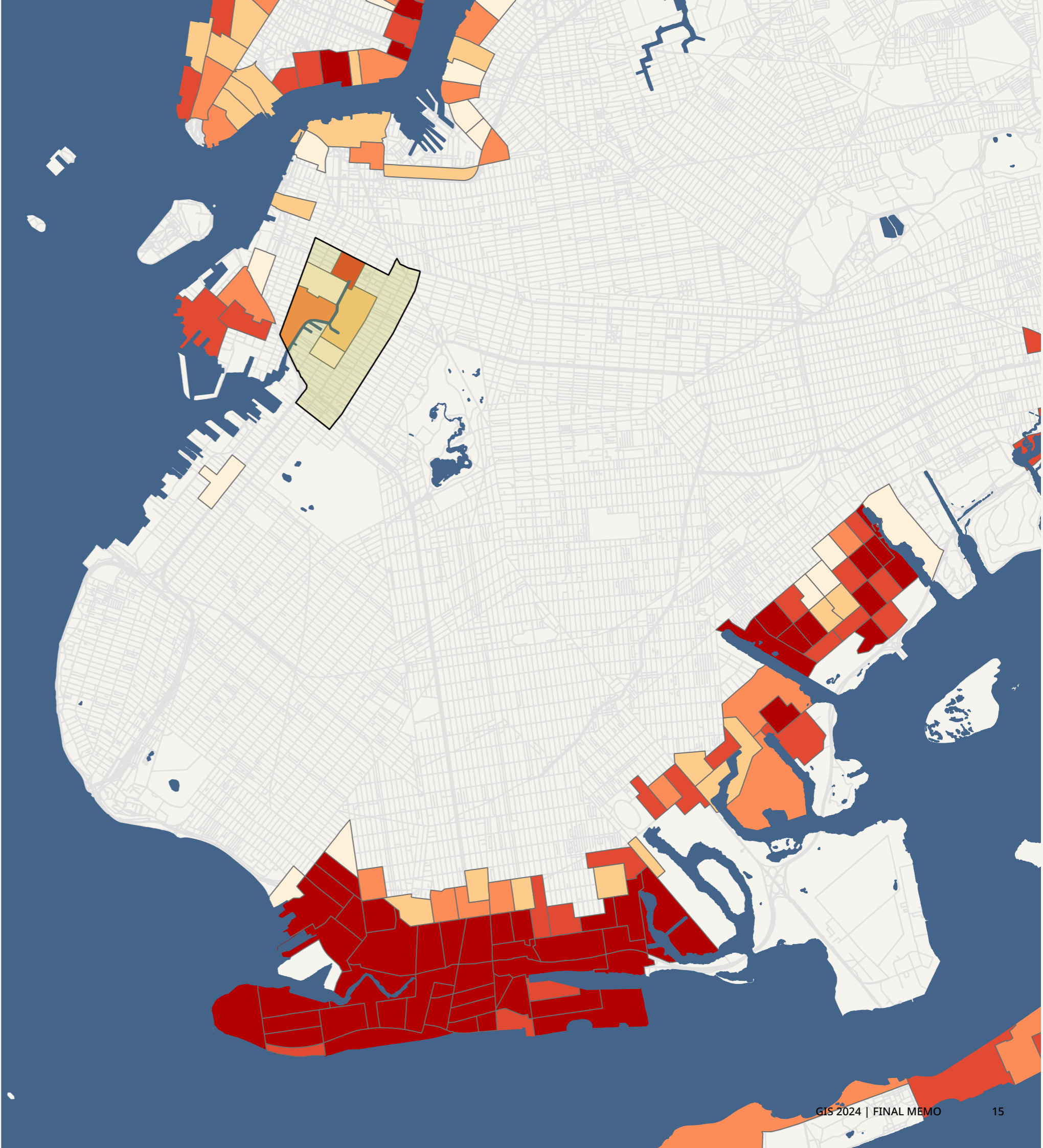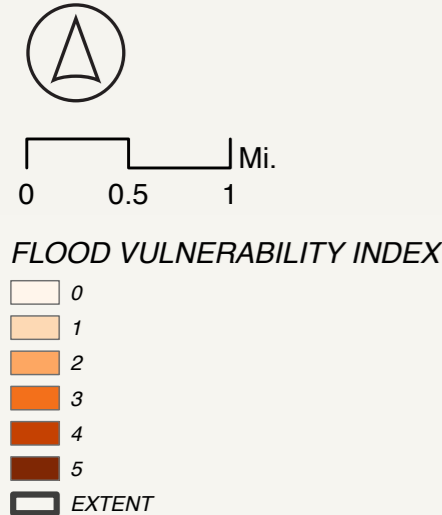03 COMPLAINTS & INTERVENTIONS
04 RECOMMENDATIONS

FLOOD VULNERABILITY INDEX (FVI) - CURRENT DAY

The New York City Flood Vulnerability Index (FVI) is a comprehensive tool developed by the Urban Systems Lab to assess and map the distribution of flood vulnerability across NYC. Its primary goal is to inform and guide flood resilience policies and programs by identifying areas at varying levels of risk.

The FVI evaluates vulnerability through three key components:

1. Exposure to Hazard: Identifies areas likely to experience flooding under different scenarios.
2. Susceptibility to Harm: Assesses the potential impact on communities based on factors like infrastructure quality and population density.
3. Capacity to Recover: Evaluates the ability of affected areas to recover post-flooding, considering socioeconomic factors and available resources.

The index encompasses six hazard-specific FVIs, each corresponding to distinct flood scenarios, encompassing both storm surge and tidal flooding. For this project, the current, 2050, and 2080 FVI to moderate storm surge have been mapped.
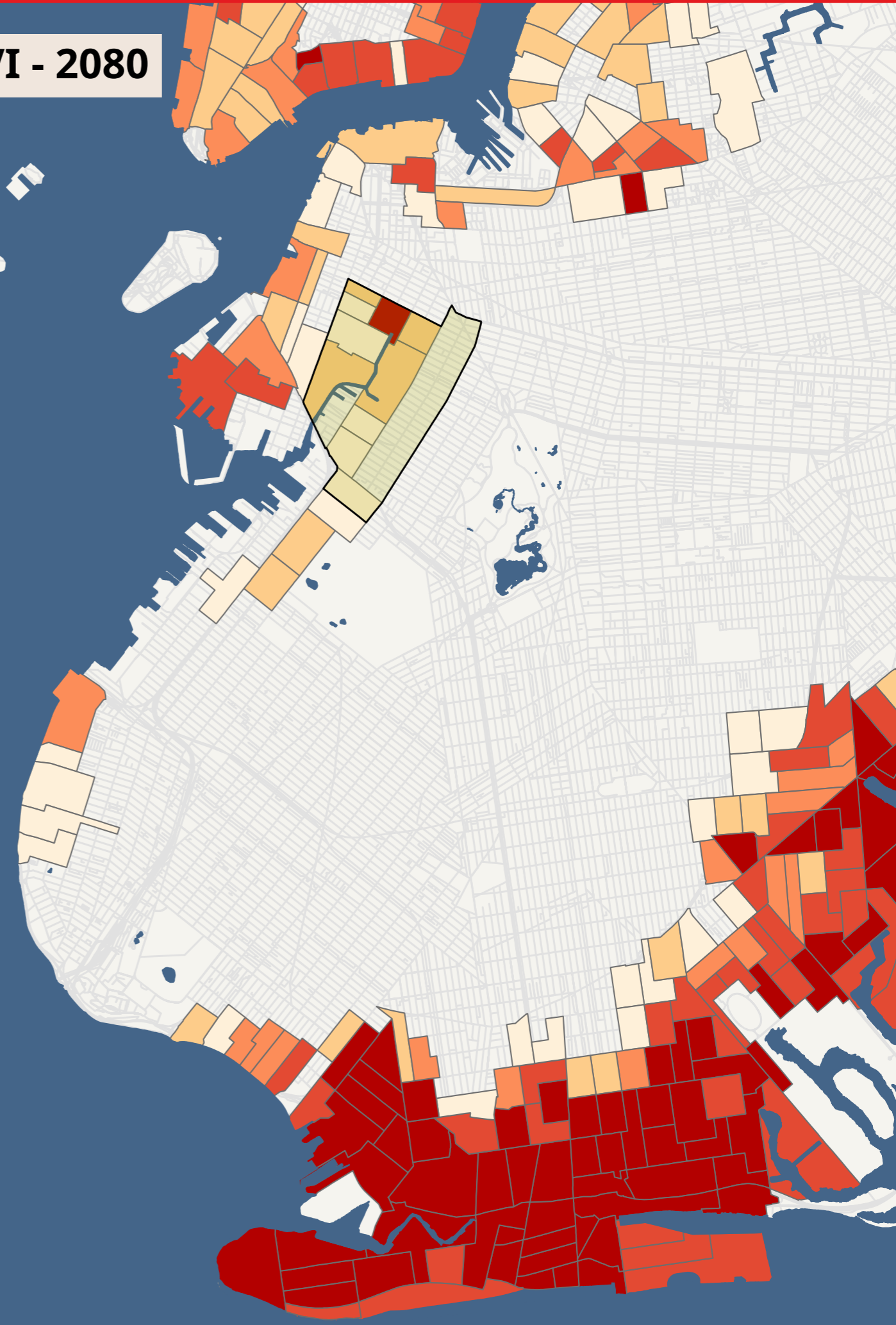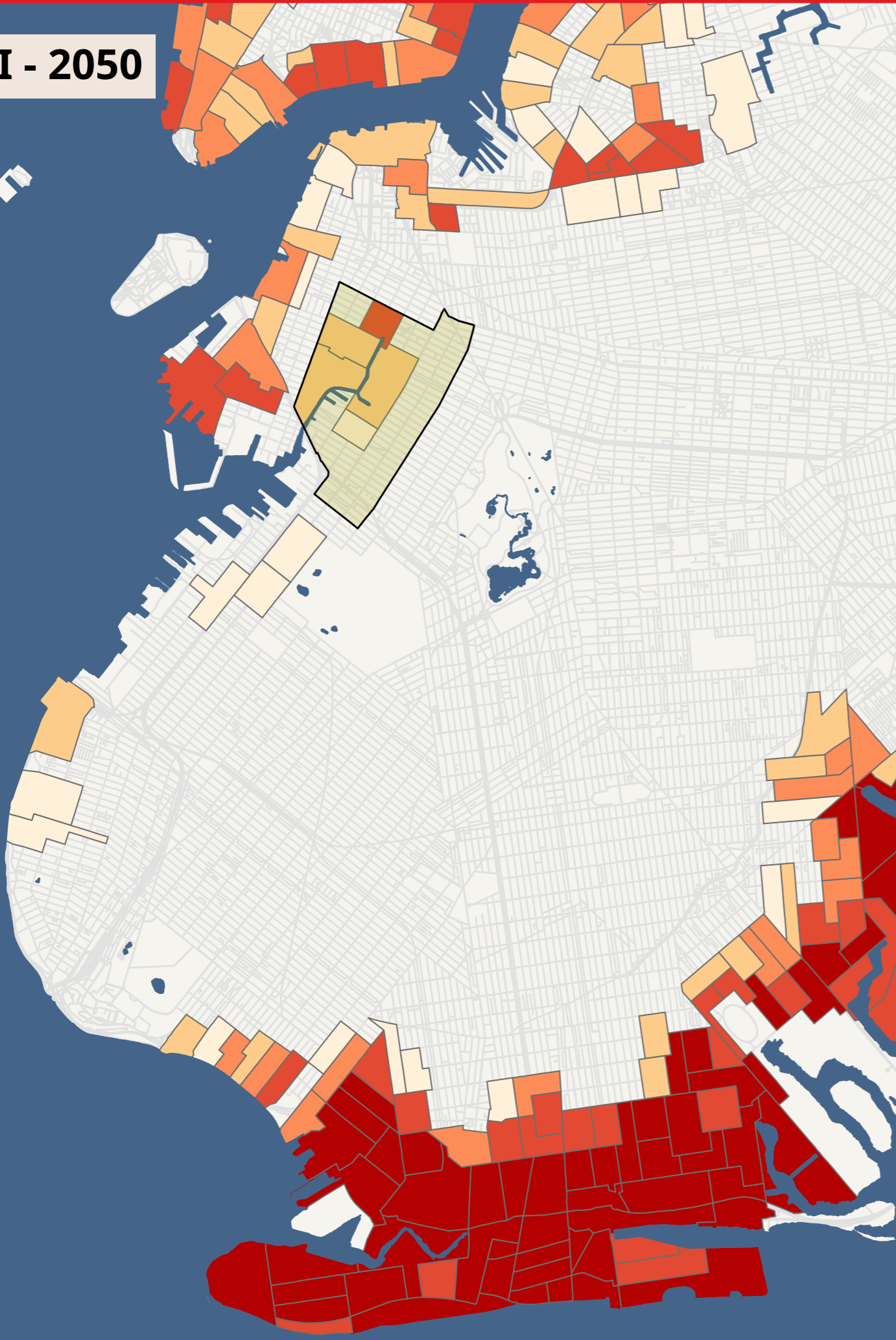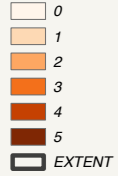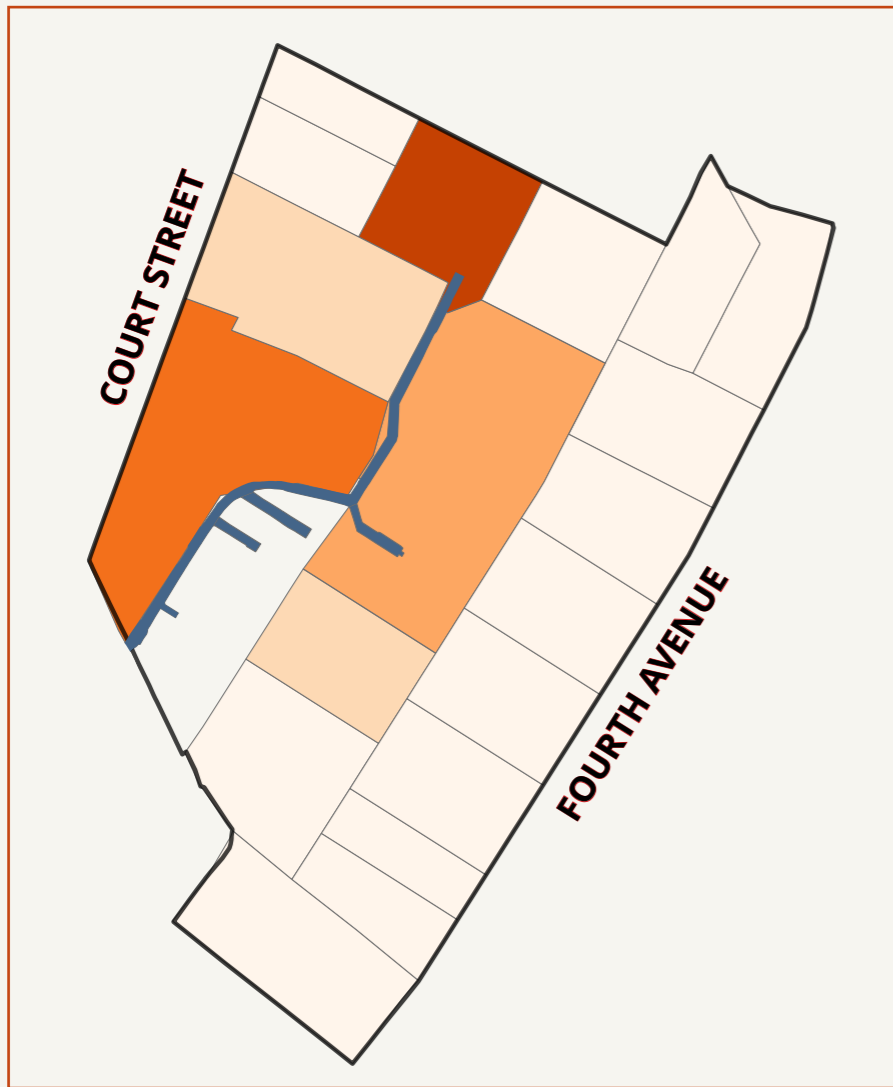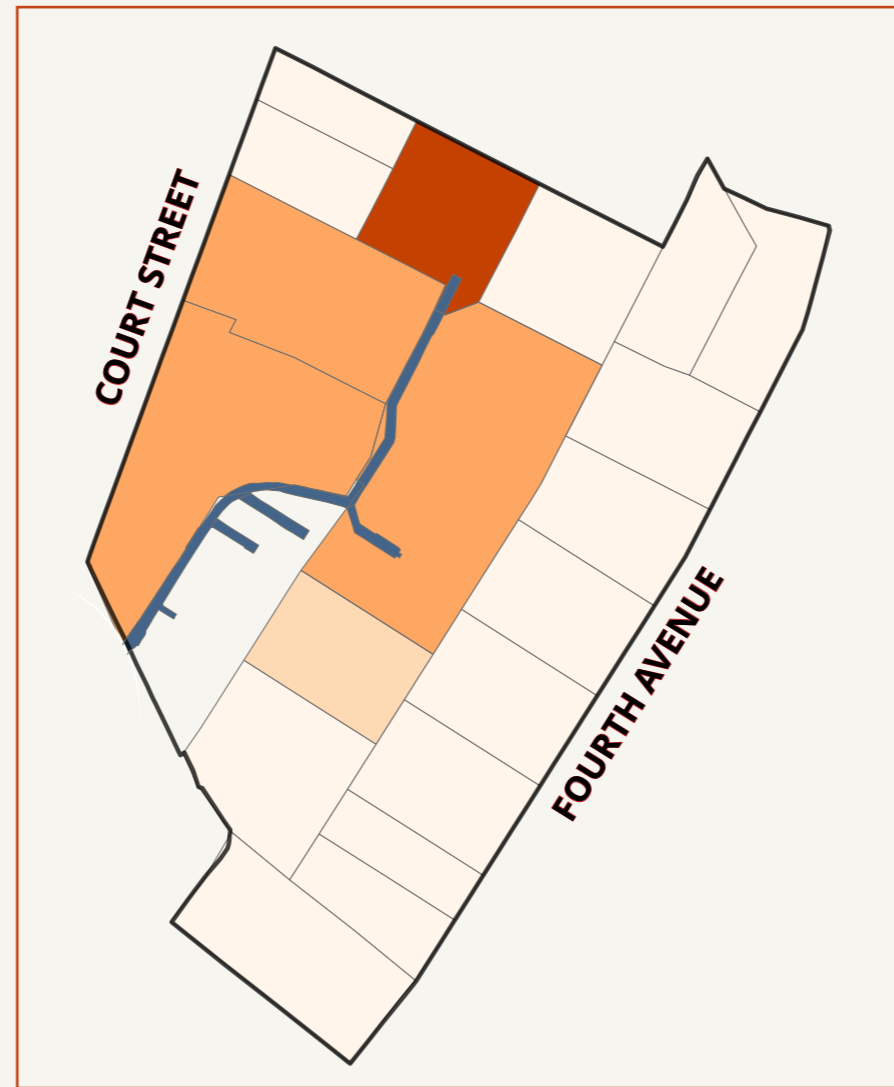
0   0.5   1   Mi.

FLOOD VULNERABILITY INDEX

- 0
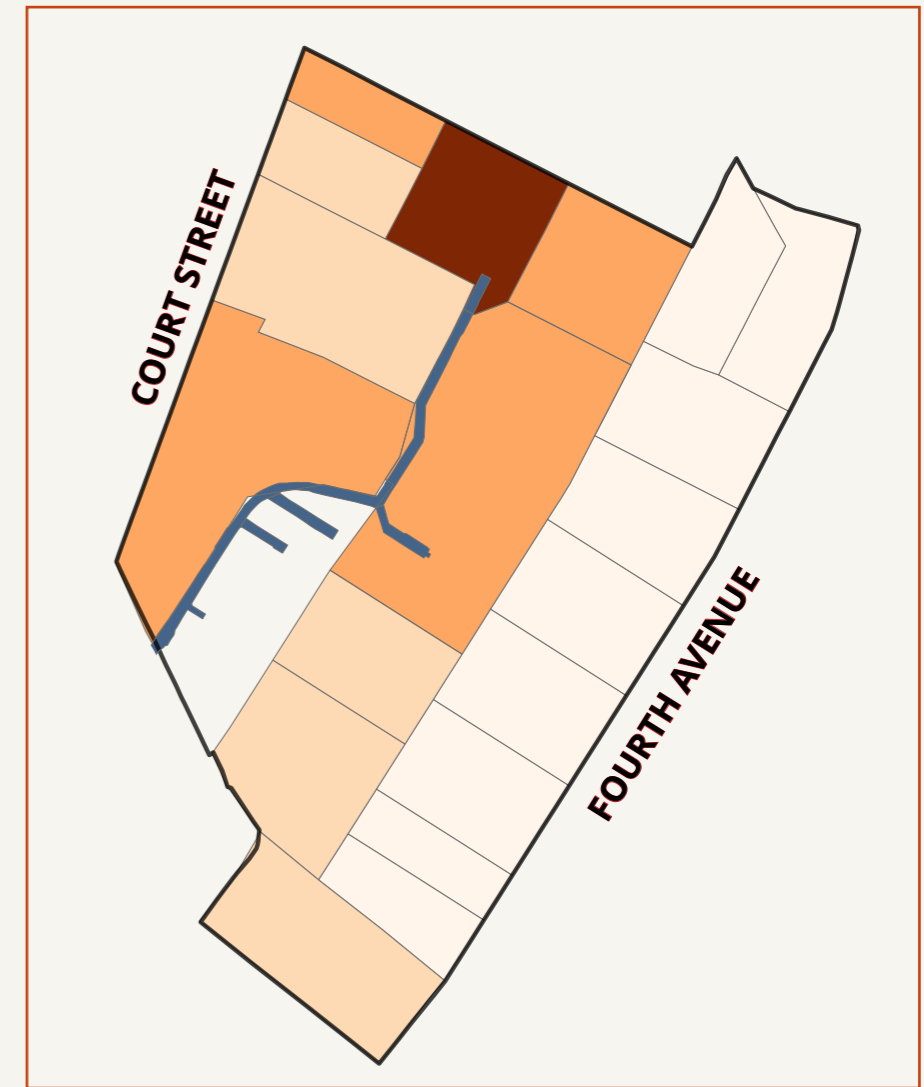- 1
- 2
- 3
- 4
- 5
- EXTENT

FVI - 2050

FVI - 2080

FLOOD VULNERABILITY INDEX
0
1
2
3
4
5
EXTENT

CURRENT STORM SURGE

2050 STORM SURGE

2080 STORM SURGE

DEMOGRAPHICS - COMMUTING POPULATION

Populations that commute to work are concentrated at the North-East and South-East portions of the study extent - not necessarily where we see the highest levels of storm surge flooding.

However, they are impacted by flooded train stations, many of which overlap with current storm surge locations and are efected by heavy rainfall regularly.

0   0.25   0.5   Mi.
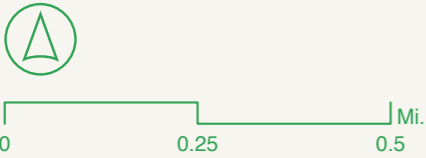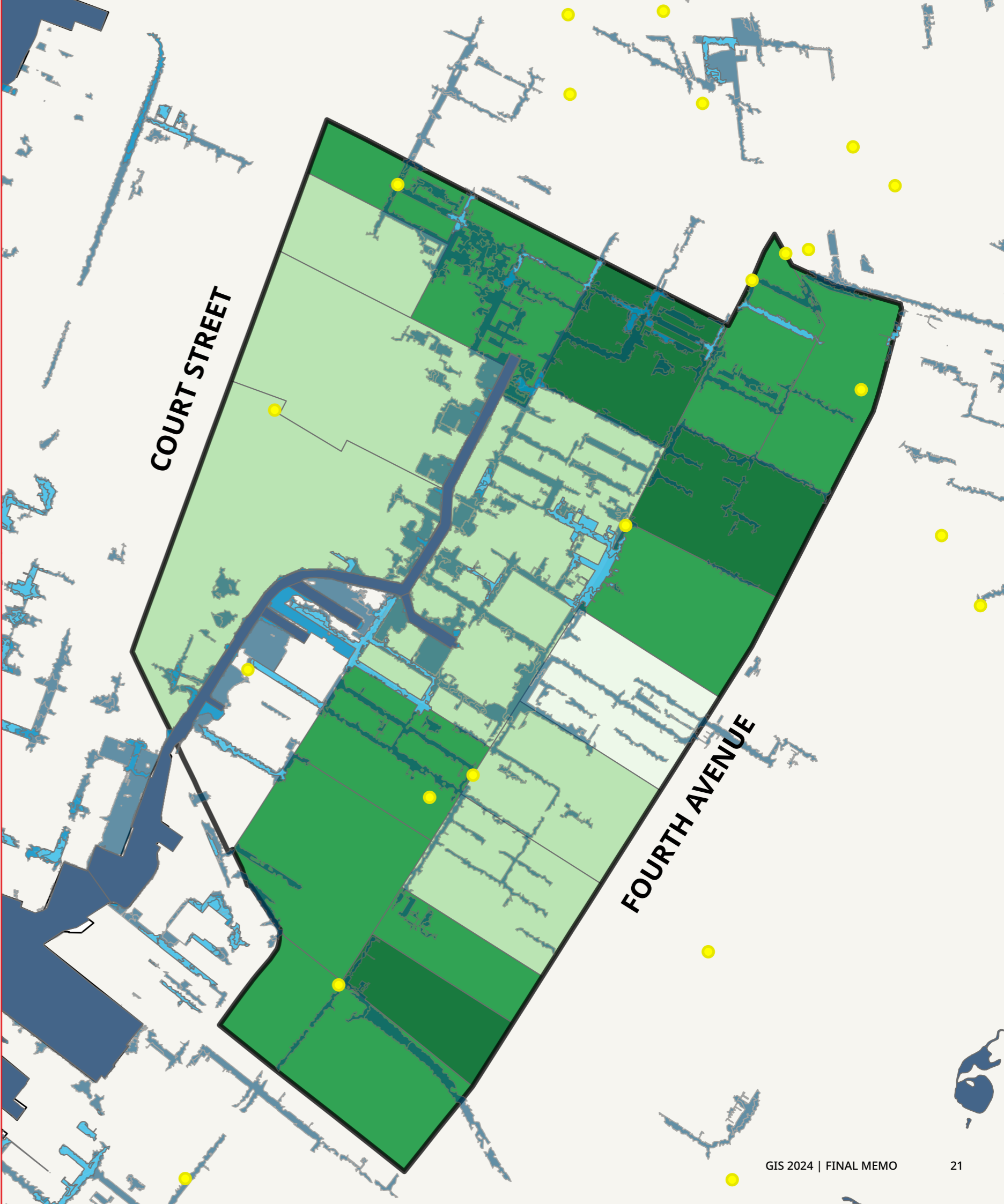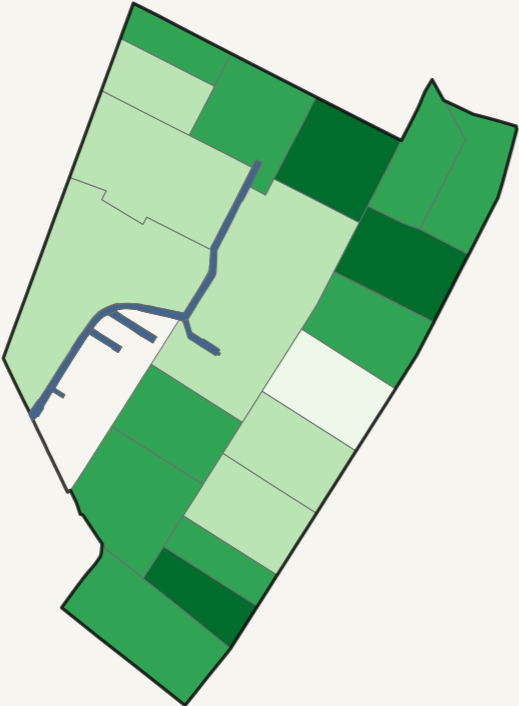
% of POPULATION THAT COMMUTES BY PUBLIC TRANSIT
- 30-40
- 40-50
- 50-60
- 60-70
- SUBWAY STATIONS
- STORMWATER FLOOD - CURRENT SEA LEVELS
- STORMWATER FLOOD - 2050 SEA LEVELS
- STORMWATER FLOOD - 2080 SEA LEVELS
- EXTENT

COURT STREET

FOURTH AVENUE

DEMOGRAPHICS - LOWER INCOME POPULATION

Lower income residents, measured by percentage of population that is below the poverty line, are concentrated at the Northern end of the canal. This matches up with a large portion of current storm surge.

COURT STREET

FOURTH AVENUE

0   0.25   0.5 Mi.
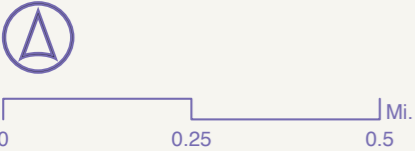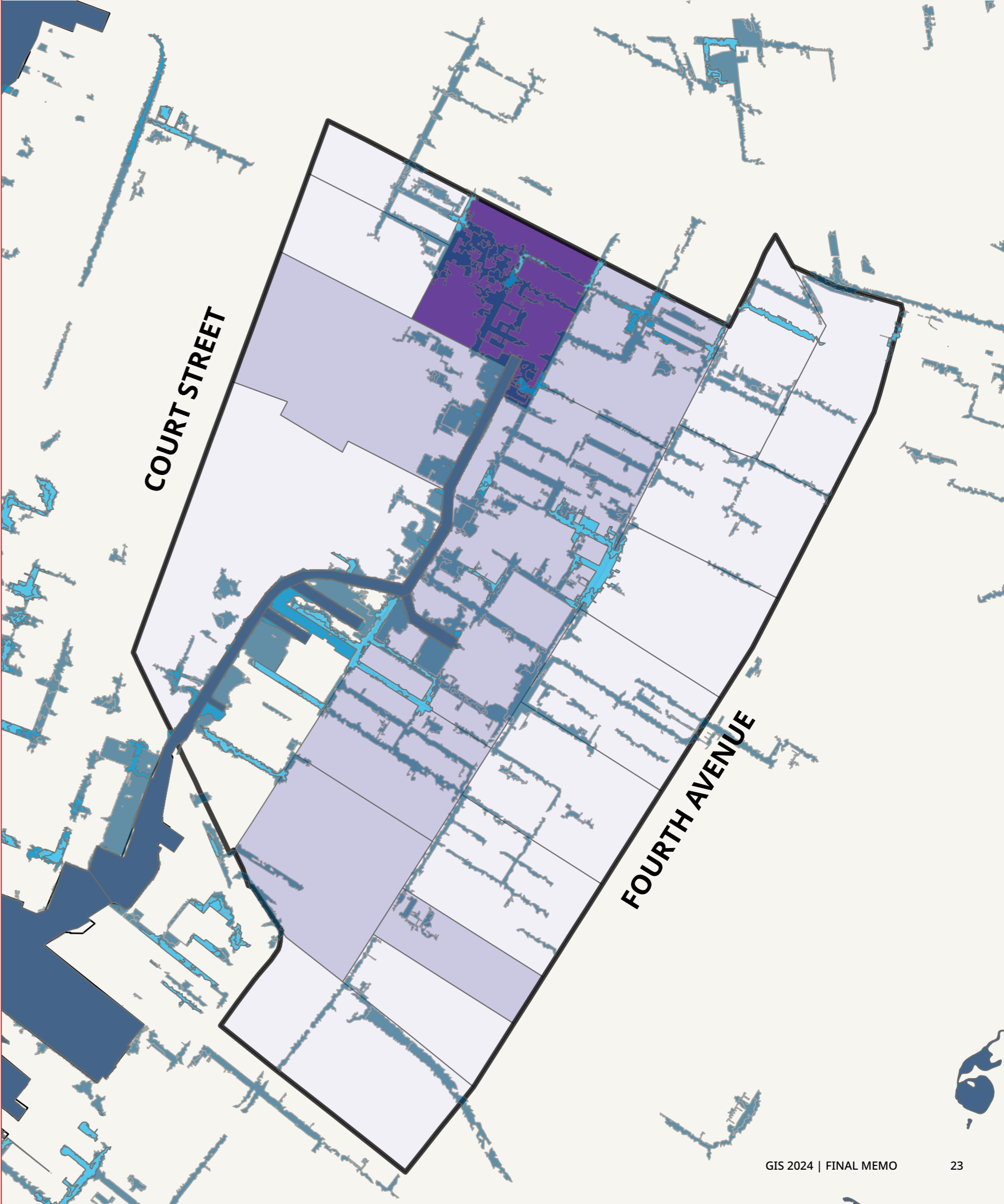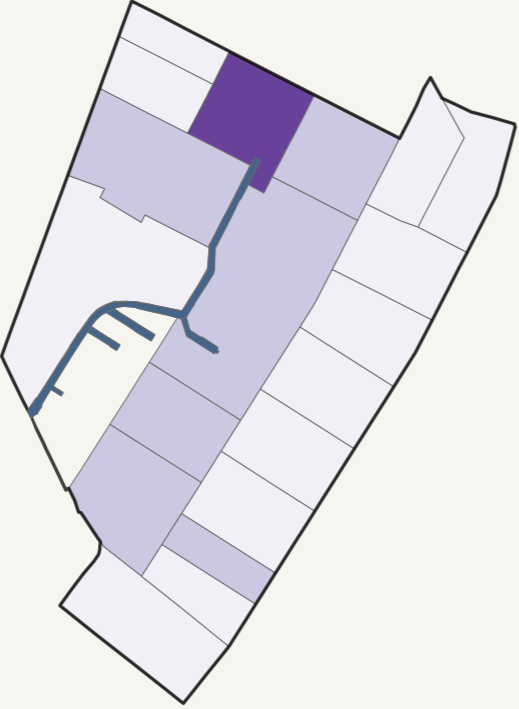
% OF POPULATION BELOW POVERTY LEVEL

- 0-4
- 4-8
- 8-12
- 12-16
- 16-20
- STORMWATER FLOOD - CURRENT SEA LEVELS
- STORMWATER FLOOD - 2050 SEA LEVELS
- STORMWATER FLOOD - 2080 SEA LEVELS
- EXTENT

311 FLOOD COMPLAINTS (& HEATMAP)

Pop-up

Street_flooding_map_XYTableToPoint (3)
- Department of Environmental Protection
- Department of Environmental Protection
- Department of Environmental Protection

Street_flooding_map_XYTableToPoint - Department of Environmental...

OBJECTID	7187
Unique Key	23272413
Created Date	05/21/2012 10:44:00 AM
Closed Date	05/24/2012 10:45:00 AM
Agency	DEP
Agency Name	Department of Environmental Protection
Complaint Type	Sewer
Descriptor	Street Flooding (SJ)
Location Type	<Null>
Incident Zip	11217
Incident Address	168 HOYT STREET
Street Name	HOYT STREET
Cross Street 1	WYCKOFF ST
Cross Street 2	WARREN ST
Intersection Street 1	<Null>
Intersection Street 2	<Null>
Address Type	ADDRESS
City	BROOKLYN
Landmark	<Null>
Facility Type	N/A
Status	Closed
Due Date	<Null>
Resolution Description	The Department of Environmental Protection investigated this complaint and resolved the street flooding.
Resolution Action Updated Date	05/24/2012 10:45:00 AM

1 of 3   987,375.40E 188,914.01N ftUS

Pop-up

Street_flooding_map_XYTableToPoint (1)
- Department of Environmental Protection

Street_flooding_map_XYTableToPoint - Department of Environmental...

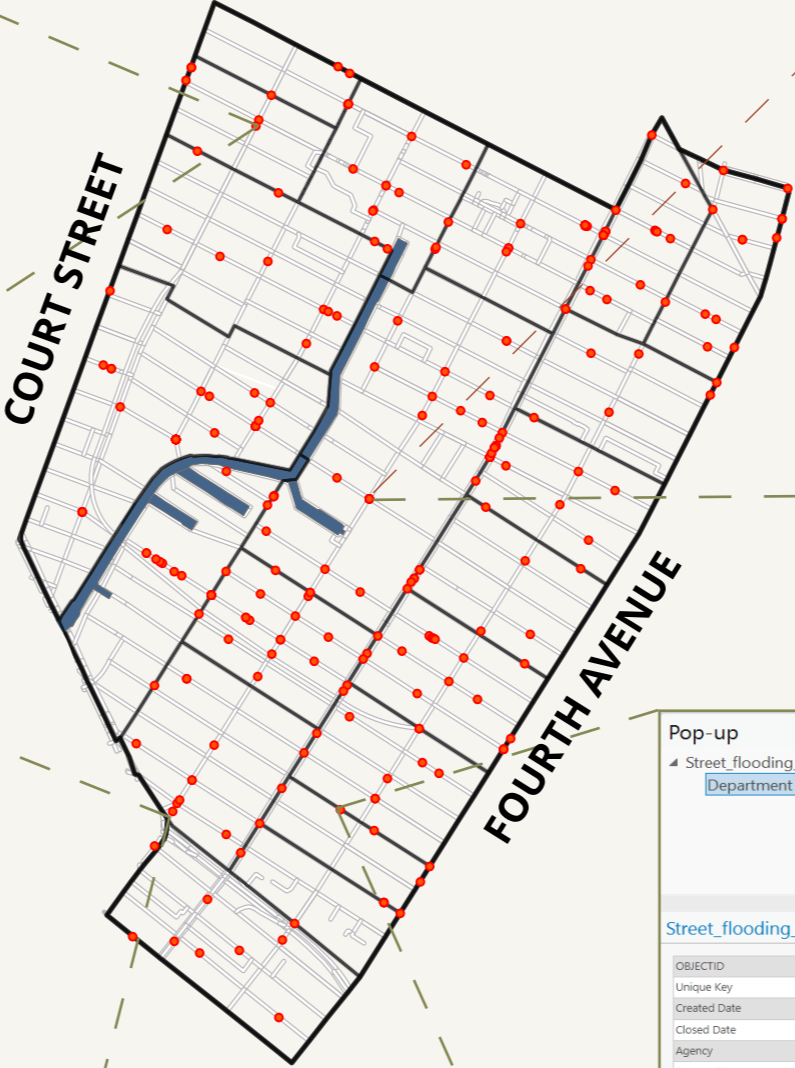| OBJECTID	14701
Unique Key	32261418
Created Date	12/23/2015 06:25:00 PM
Closed Date	12/23/2015 07:20:00 PM
Agency	DEP
Agency Name	Department of Environmental Protection
Complaint Type	Sewer
Descriptor	Street Flooding (SJ)
Location Type	<Null>
Incident Zip	11215
Incident Address	195 3 STREET
Street Name	3 STREET
Cross Street 1	GOWANUS CANAL
Cross Street 2	3 AVE
Intersection Street 1	<Null>
Intersection Street 2	<Null>
Address Type	ADDRESS
City	BROOKLYN
Landmark	<Null>
Facility Type	N/A
Status	Closed
Due Date	<Null>
Resolution Description	The Department of Environmental Protection has investigated this complaint. Surcharge conditions have been confirmed due to rain intensity or volume.
Resolution Action Updated Date	12/23/2015 07:20:00 PM

987,273.40E 185,419.01N ftUS

Pop-up

Street_flooding_map_XYTableToPoint (1)
- Department of Environmental Protection

Street_flooding_map_XYTableToPoint - Department of Environmental P...

OBJECTID	33979
Unique Key	54209043
Created Date	05/18/2022 12:12:00 PM
Closed Date	05/20/2022 09:10:00 AM
Agency	DEP
Agency Name	Department of Environmental Protection
Complaint Type	Sewer
Descriptor	Street Flooding (SJ)
Location Type	<Null>
Incident Zip	11215
Incident Address	595 3 AVENUE
Street Name	3 AVENUE
Cross Street 1	16 ST
Cross Street 2	HAMILTON AVE
Intersection Street 1	<Null>
Intersection Street 2	<Null>
Address Type	ADDRESS
City	BROOKLYN
Landmark	<Null>
Facility Type	<Null>
Status	Closed
Due Date	<Null>
Resolution Description	The Department of Environment Protection inspected your complaint but could not find the problem you reported. If the condition persists, please call 311 (or 212-639-9675 if calling from a non-New York City area code) with more detailed information to submit a new complaint.
Resolution Action Updated Date	05/20/2022 09:10:00 AM

1 of 1   985,723.40E 182,296.01N ftUS

Pop-up

Street_flooding_map_XYTableToPoint (1)
- Department of Environmental Protection

Street_flooding_map_XYTableToPoint - Department of Environmental...

OBJECTID	38442
Unique Key	58960665
Created Date	09/29/2023 09:32:00 PM
Closed Date	10/01/2023 01:05:00 PM
Agency	DEP
Agency Name	Department of Environmental Protection
Complaint Type	Sewer
Descriptor	Street Flooding (SJ)
Location Type	<Null>
Incident Zip	11215
Incident Address	260 13 STREET
Street Name	13 STREET
Cross Street 1	4 AVE
Cross Street 2	5 AVE
Intersection Street 1	<Null>
Intersection Street 2	<Null>
Address Type	ADDRESS
City	BROOKLYN
Landmark	<Null>
Facility Type	<Null>
Status	Closed
Due Date	<Null>
Resolution Description	NYC DEP investigated and determined the sewer or catchbasin was overtaxed due to heavy rain and no further action is required.
Resolution Action Updated Date	10/01/2023 01:05:00 PM

1 of 1   987,305.40E 182,312.01N ftUS
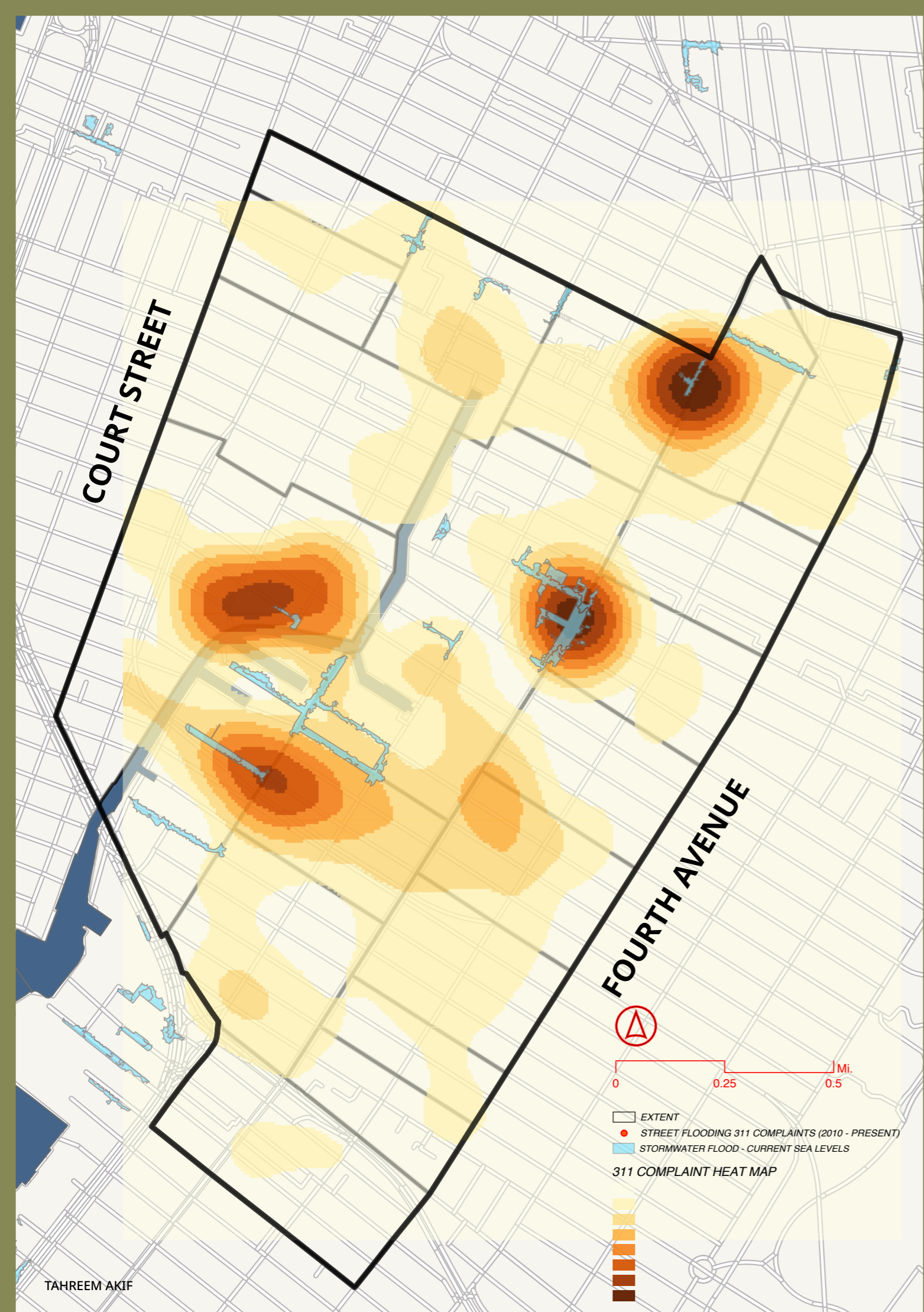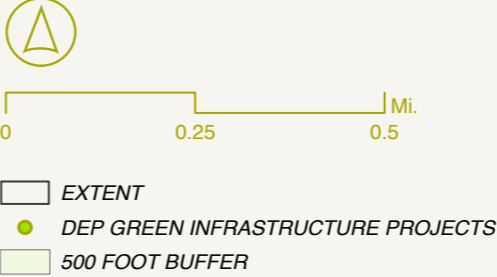
COURT STREET

FOURTH AVENUE

While most reported flood complains were attributed to storms by callers, responses by the Department of Environmental Protection varied. At the West side of the study area, reports of storm surge overwhelming sewers and catchbasins were often confirmed with no subsequent action, or not corroborated by the Department.
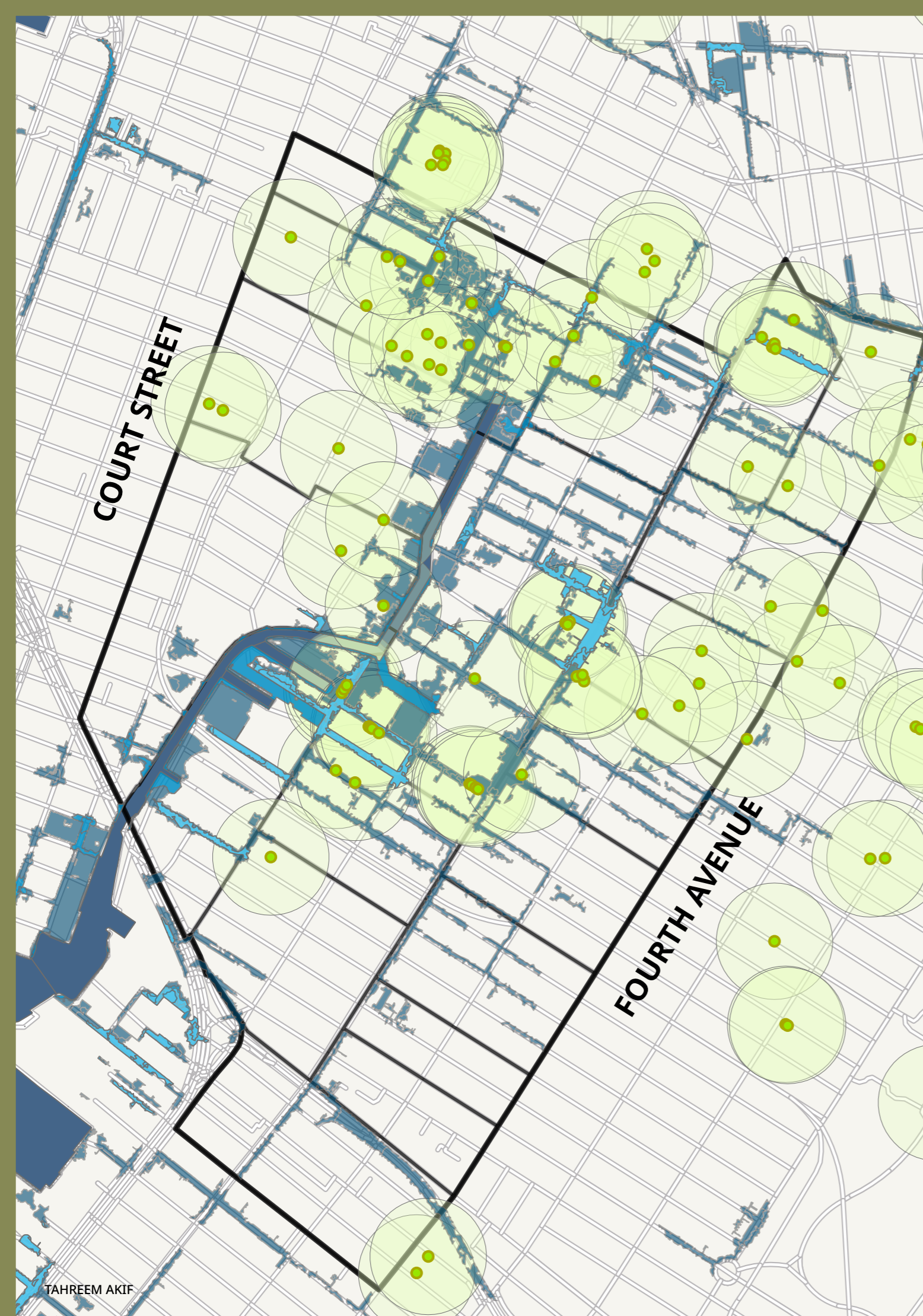
Reports at the North of the canal were often addressed with any obstructions cleared.

Mi.
0   0.25   0.5

□ EXTENT
● STREET FLOODING 311 COMPLAINTS (2010 - PRESENT)
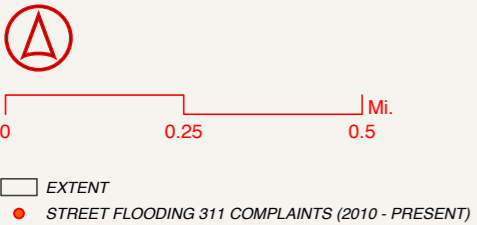
CURRENT DEP GREEN INFRASTRUCTURE INVESTMENT - BUFFER ANALYSIS

DEP green infrastructure (GI) investments a manage stormwater, reduce flooding, and improve water quality through nature-based solutions like bioswales, rain gardens, permeable pavements, and green roofs. They are concentrated towards the North of the canal, which isn't where current storm surges and historic 311 complaints are most prevalent, but is the location of the new rezoning plan.

Mi.
0   0.25   0.5

☐ EXTENT
● DEP GREEN INFRASTRUCTURE PROJECTS
☐ 500 FOOT BUFFER

COURT STREET

FOURTH AVENUE

Mi.
0   0.25   0.5

☐ EXTENT
● STREET FLOODING 311 COMPLAINTS (2010 - PRESENT)
☐ STORMWATER FLOOD - CURRENT SEA LEVELS

311 COMPLAINT HEAT MAP

COURT STREET

FOURTH AVENUE

COURT STREET

FOURTH AVENUE

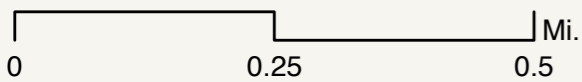# (MULTI-CRITERIA DECISION ANALYSIS) PRIME AREAS FOR NEW INVESTMENT

The MCDA output identifies priority zones where new GI interventions can deliver the greatest impact. These areas are visualized on the overlay maps, with scores ranging from low need (1) to high need (5).

As seen in the overlays in Section 3, current DEP Green Infrastructure investments in the study area overlap well with current storm surge locations and areas with lowest income. As such, this MCDA focuses on the other variables analyzed. The analysis highlights critical sites:

1. **Near high-FVI zones:** Areas adjacent to the Gowanus Canal, with persistent 311 complaints and significant flood exposure.
2. **Gaps in GI coverage:** Locations with minimal or no existing DEP investments, particularly along key corridors like 3rd Avenue and Hoyt Street.
3. **Commuter-heavy intersections:** Zones with a large percentage of public transit-dependent residents, where disruptions to mobility exacerbate social and economic impacts.
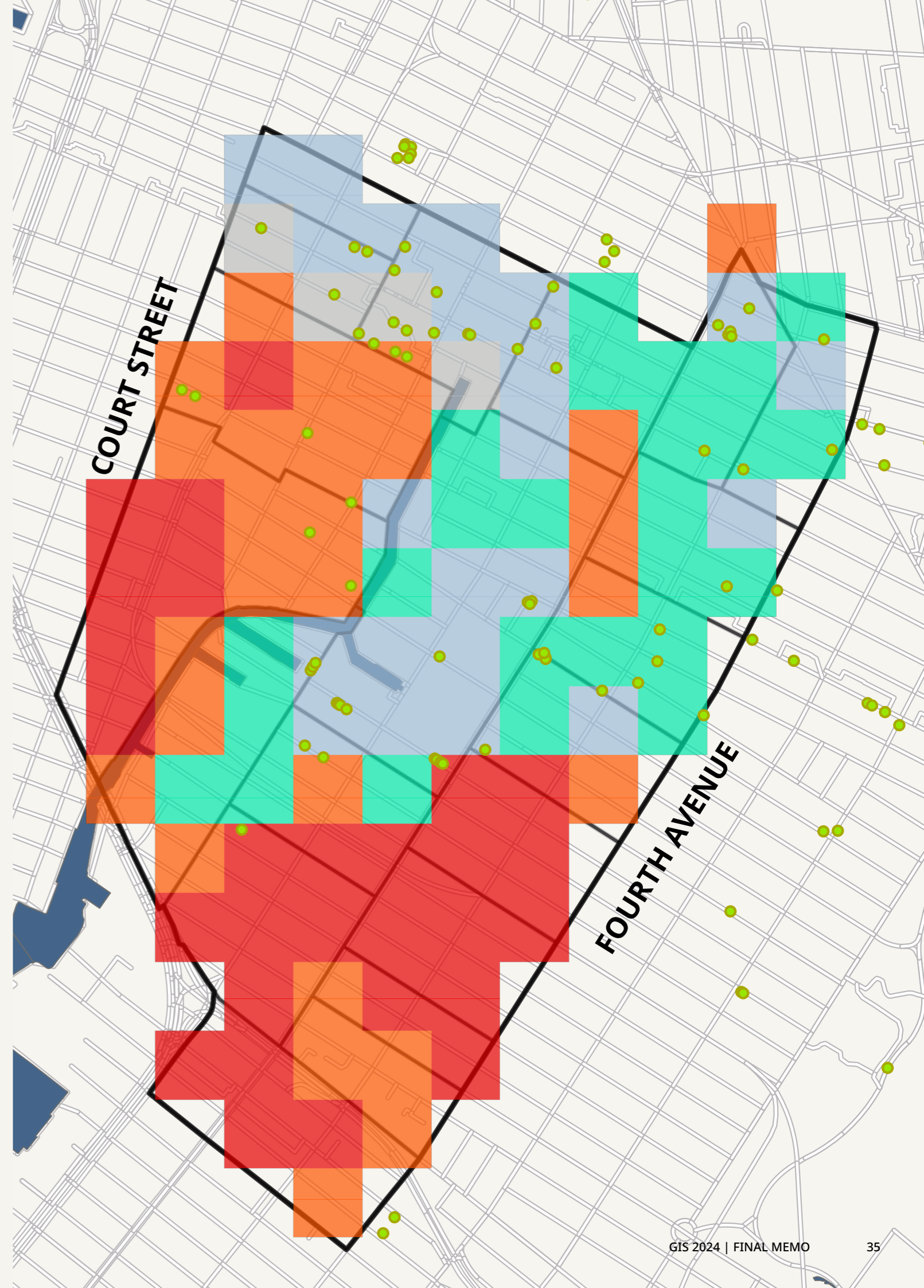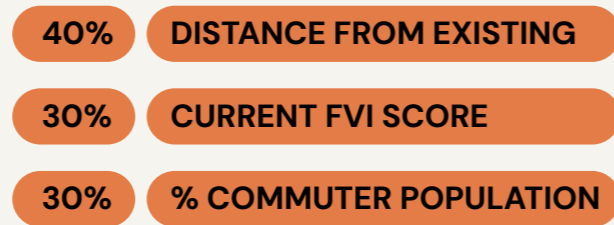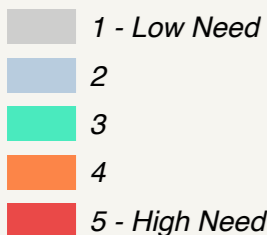
We see that areas at the South of the study area, where we also see a concentration of 311 complaints that remain unaddressed, are where further GI investment by the city is most needed.

To ensure equitable and effective flood mitigation, new green infrastructure (GI) investments should focus on areas identified as high-need by the MCDA analysis. Intersections such as 3rd Avenue and 13th Street, as well as Hoyt Street and Warren Street, are critical zones where persistent flooding overlaps with gaps in GI coverage and high transit reliance. Prioritizing these locations will address chronic vulnerabilities while minimizing disruptions for residents and commuters. Community engagement and regular performance monitoring can further align these interventions with local needs and improve long-term resilience.

0   0.25   0.5 Mi.

▭ *EXTENT*

MCDA - NEW GI INVESTMENT SITE

- ⬜ *1 - Low Need*
- 🟦 *2*
- 🟩 *3*
- 🟧 *4*
- 🟥 *5 - High Need*

40% **DISTANCE FROM EXISTING**

30% **CURRENT FVI SCORE**

30% **% COMMUTER POPULATION**

COURT STREET

FOURTH AVENUE

SOURCES

NYC CENSUS TRACTS 2020 (NYC DCP)

NYC NEIGHBORHOOD TABULATION AREAS (NTAS) 2020 (NYC DCP)

NYC PLANIMETRIC DATABASE: HYDROGRAPHY (NYC OFFICE OF TECHNOLOGY AND INNOVATION VIA NYC OPEN DATA)

NYC FLOOD VULNERABILITY INDEX, 2024 (MAYOR'S OFFICE OF CLIMATE AND ENVIRONMENTAL JUSTICE VIA NYC OPEN DATA)

LION SINGLE LINE STREET BASE MAP (VIA NYC DCP)

NYC STORMWATER FLOOD MAPS (DEPARTMENT OF ENVIRONMENTAL PROTECTION VIA NYC OPEN DATA)

MTA SUBWAY STATIONS, 2024 (VIA DATA.GOV)

ACS 5-YEAR ESTIMATES 2022 - B08141 MEANS OF TRANSPORTATION TO WORK BY VEHICLES AVAILABLE (VIA US CENSUS BUREAU)

ACS 5-YEAR ESTIMATES 2022 - B08122 MEANS OF TRANSPORTATION TO WORK BY POVERTY STATUS IN THE PAST 12 MONTHS

STREET FLOODING MAP, 311 SERVICE REQUESTS FROM 2010-PRESENT (NYC OPEN DATA)

DEP GREEN INFRASTRUCTURE ASSETS (VIA NYC OPEN DATA)