COWI

MEMO

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1 Introduction

1.1 Context

The offshore wind Maritime Technical Working Group (M-TWG), led by the New York State Department of State (DOS) and supported by NYSERDA, is an unofficial, non-decision-making advisory entity formed to engage regional stakeholders with maritime and/or offshore wind responsibilities and interests working to advance offshore wind (OSW) development. Developed in collaboration with M-TWG members', the M-TWG's 2021 Shared Research Agenda identified the need to understand use patterns at designated anchorage areas and common practice anchorage areas. This Anchorage Area Assessment seeks to provide objective data regarding anchoring practices that will be useful for shared learning and to enhance decision making on responsible OSW development practices.

1.2 Scope of Work

The primary goal of this Anchorage Area Assessment ("Task") is to identify areas within New York State waters commonly used by vessels as anchorages and to quantify the frequency with which vessels use those areas.

The present Task builds upon the framework and analysis developed as part of the 9GW Port Uses and Navigation Assessment Report (COWI, 2022) by using the vessel traffic models developed through that study to interpret anchorage area use patterns in New York State. Key questions identified in the 2021 Shared Research Agenda also shaped the technical approach and the outline of this memo, whose main purpose is to:

- Assess the locations of informal, common practice anchorage areas (CPAA)

- Provide insights as to what extent those CPAA match designated anchorage areas (DAA), and to what extent these CPAA are outside of those designated areas.

- Provide metrics regarding each of those Anchorage Areas describing the number of vessels present, the number of anchorage events, etc.

1.3 Documents Reviewed

In preparing this memo, COWI reviewed the following:

- USCG. USCG-2020-0172 Port Access Route Study: Seacoast of New Jersey including offshore approaches to the Delaware Bay. 2020; available from Federal Register :: Port Access Route Study: Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware

- USCG. USCG-2020-0278 Port Access Route Study: Northern New York Bight. 2020; available from Federal Register :: Port Access Route Study: Northern New York Bight

- COWI. Offshore Wind Ports - Cumulative Vessel Traffic Assessment. Final Report. 2022

- Hudson River Safety, Navigation & Operations Committee (HRSNOC). REPORT ON NDAA HUDSON RIVER ANCHORAGE STUDY. 2021

- 33 CFR § 110.155 – Port of New York.

- 33 CFR § 110.60 – Captain of the Port, New York.

1.4 Workflow

To assist in understanding the overall approach to the extraction, transformation, and loading of the AIS data, a flowchart is shown in Figure 1. The flow chart outlines the main steps described in this memo.

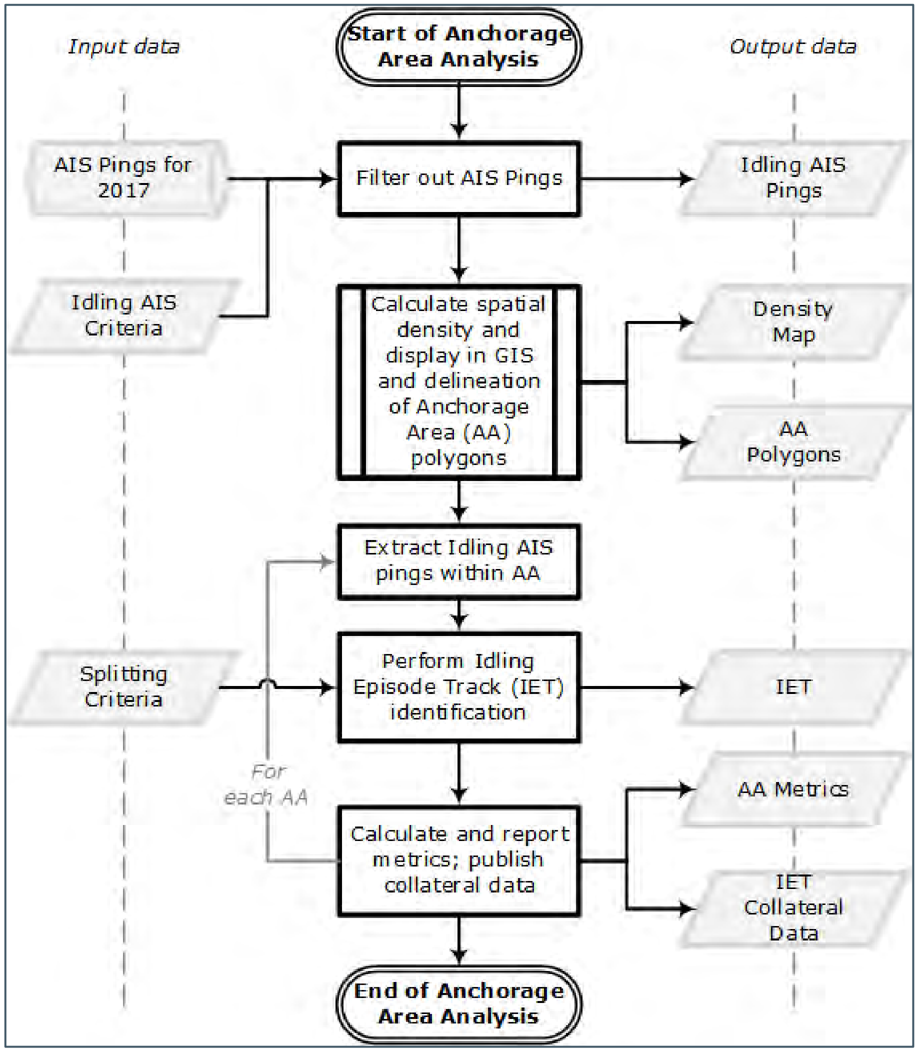

Figure 1 *Flowchart illustrating the approach implemented to analyze anchorage areas within the project area.*

2 AIS Data

2.1 Geographical Extent

The scope of this assessment is limited to the geographical bounds defined by the Project Design Envelope (PDE) as per the 2022 COWI Offshore Wind Ports Study.

2.2 Data Source

Using the same vessel traffic data model developed by COWI in 2022[1], Automatic Identification System (AIS) data spanning calendar year 2017 was analyzed. The automatic identification system (AIS) is an automatic tracking system that uses transceivers on ships and is used by vessel traffic services (VTS). AIS information supplements marine radar. The AIS data obtained by COWI consists of a series of individual “AIS pings” that contain several features describing the movement of a vessel at a given time, including Position, Speed Over Ground, Heading, Length, Draft, etc. Some of these attributes are automatically computed from GPS signal (e.g., speed over ground), while some are reported manually (e.g., vessel particulars). All the AIS data was downloaded from MarineCadastre.gov and processed according to the Extraction-Transformation-Load pipeline documented in the 2022 COWI report.

2.3 AIS Disclaimer

As mentioned in the 2022 Port Access Route Study (PARS) for New Jersey, there are inherent limitations associated with using AIS data to estimate and provide insights into vessel traffic:

> "*AIS traffic data does not capture all vessels that operate in the study area. Federal and international carriage regulations stipulate only certain vessels are required to send and/or receive AIS signals. This includes but is not limited to: vessels of 65 feet or greater, towing vessels of 26 feet or greater, vessels certificated for 150 or more passengers, dredging vessels near a channel, fishing vessels, and vessels over 300 gross tons on an international voyage. A full description of applicability and general United States requirements can be found in 33 CFR 164.46. Despite these limitations, AIS traffic data provides a satisfactory representation of the traffic in the study area. Deep draft and large vessels are required to broadcast an AIS signal; the counts of these vessels as well as their geographic locations area assumed to be accurate. The transit patterns for vessels that are not required to broadcast on AIS, such as small recreational vessels, are apparent even if these vessels are undercounted in the data set. This is based on the assumption that since a portion of the population of vessels not required by law to carry AIS voluntarily comply, these vessels provide a representative sample of the whole population*."

[1] Offshore Wind Ports – Cumulative Vessel Traffic Assessment, COWI, 2022, public link was not available at the time of writing this memo.

2.4 Note on AIS Data and Barge Traffic

Barges are not equipped with AIS transponders; therefore, they cannot be identified explicitly using AIS data. COWI acknowledges the results of a recent report by HSNOC for the Hudson River, who mentions that anchoring capacity in that area is insufficient and causes risks to navigation. The report also pointed out that “Except in emergencies, commercial vessels of 300 gross tons and greater and all tank vessels, including tank barges, anchoring in the Captain of the Port Long Island Sound Zone inside the line of demarcation shall anchor in the anchorage grounds: New London CT 6 Anchorage grounds; Bridgeport CT- 1 Anchorage grounds”. These two anchorage grounds are both outside of the study area. Nonetheless, there is no direct way to identify idling barge activity using AIS data alone as the barges are not equipped with AIS transponders. However, the tugs responsible for propelling those barges do broadcast AIS. The movement of barges is accounted for within the vessel class for "Tug-Tow".

3 Methods and Metrics

3.1 Idling AIS Pings Generation

3.1.1 Approach

To identify anchorage areas, COWI first filtered out AIS pings using criteria related to speed over ground and distance from shore. Together, these filtered AIS Pings are referred to as idling AIS Pings. They form the basis of the entire analysis that follows.

3.1.2 Idling AIS Pings Criteria

The primary filter used to identify Idling AIS pings is based on Speed Over Ground (SOG). It is based on the criterion used and stated in the NJ PARS.

- Speed Over Ground (SOG) is between 0 and 1 knots (inclusive). This is consistent with the 2020 PARS of Seacoast of New Jersey including Offshore Approaches to the Delaware Bay, Delaware (see Enclosure 4 to the NJ PARS Anchorage Analysis). We note that the NNYB PARS did not specifically state what SOG criterion was used to filter out idling AIS Pings.

That criterion is consistent with the NJ PARS. Furthermore, above the NJ PARS speed criterion, COWI implemented the following:

- COWI only retained AIS pings located more than 1000 ft away from the shoreline to reduce the potential for moored vessels to influence the anchored vessel population. That criterion was particularly relevant when dealing with narrow waterways found in inland areas. For larger areas such as the Lower NY

Bay, the value of this filter is not as high because there are no obvious nearshore facilities for vessels to congregate to.

A summary of the criteria used to generate the necessary data point population to delineate Common Practice Anchorage Areas is provided in the table below.

Table 1 Summary of filtering criteria used to extract AIS data points of Anchoring Vessels from the 2017 AIS database.

Filter ID	Filter Criterion	Parameters	Included in 2020 PARS for New Jersey seashore?
01	Speed Over Ground	Between 0 and 1 knot	Yes ✔
02	Location from shoreline	1000 ft from shoreline	No ✕

3.2 Density Analysis and Anchorage Area Delineation

Using the identified Idling AIS pings, COWI computed the resultant spatial density using GIS. Regions of high density were visually identified and delineated. These regions of high density are referred to as Anchorage Areas (AA).

3.3 Common Practice vs. Designated Anchorage Areas

COWI distinguished between the following sub-classes of Anchorage Areas:

- A Designated Anchorage Area is an official area delineated per Code of Federal Regulations where a high density of Idling AIS pings is expected. The DAA outlines were obtained from the USA Anchorage Areas dataset provided by NOAA (https://www.fisheries.noaa.gov/inport/item/48849), consistent with the definitions provided in the US Code of Federal Regulations, 33 CFR Part 110 Anchorage Regulations.[2]

- Special anchorage areas (referred to as DAA Special herein) are defined in 33 CFR § 109.10, Special anchorage areas. Special anchorage areas allow vessels

[2] COWI uses the latest data of anchorage area available from NOAA Office for Coastal Management at the time of the study. However, COWI acknowledges that Anchorage Grounds #26 and #28 were reconfigured (https://charts.noaa.gov/OnLineViewer/12327.shtml) and downsized in 2016 (https://www.govinfo.gov/content/pkg/FR-2016-03-31/pdf/2016-07307.pdf). Anchorage Ground #27 (Romer Shoal and Flynns Knoll sections) was disestablished in 2015 (https://www.govinfo.gov/content/pkg/FR-2015-01-15/pdf/2015-00465.pdf).

of less than 65 feet in length (20 meters) to anchor without anchor lights. They also allow vessels of less than 65 feet in length, and barges, canal boats, scows, or other nondescript craft to anchor without required sound signals.

- Common Practice Anchorage Area (CPAA) are regions where there is a high density of Idling AIS pings, but that is outside a known Designated Anchorage Area (DAA). Unlike DAA, CPAA are not officially designated. The delineation of these areas is informal.

3.4 Anchorage Area Metrics

3.4.1 Definition

To assist with the description of selected Anchorage Areas, COWI defined the following metrics:

- **Surface Area**: this is the surface area of the AA being analyzed. This quantity is measured in square miles (sq mi).

- **Number of Idling AIS pings**: this is the total count of Idling AIS pings observed within an AA polygon, for all vessels and for all idling episode tracks. It is calculated for the entire year.

- **Number of unique Idling Episode Tracks (IET)**: this is the total count of Idling Episode Tracks recorded in an AA polygon. An Idling Episode Track is a unique object identifiable using a vessel MMSI, a track ID, and a container polygon. It contains a collection of Idling AIS pings that are logically connected. It is calculated for the entire year.

- **Number of unique Idling Episode Tracks (IET) with a duration of 30 minutes or more**: same as the metric prior but for episodes that last more than 30 minutes. It is calculated for the entire year.

- **Average duration of Idling Episodes**: this is the mean of the duration of all idling episodes within an AA polygon, regardless of vessels. This metric is measured in minutes and calculated for the entire year.

- **Median duration of Idling Episodes**: this is the median duration of all idling episodes within an AA polygon, regardless of vessels. This metric is measured in minutes and is calculated for the entire year. A median metric is more robust to extreme outliers than an average metric and will represent frequent events better; on the flip side that same metric will necessarily skew toward shorter, more frequent events, especially for an exponential distribution as the one observed for idling episodes.

- **Total duration of Idling Episode Tracks**: this is the sum of all idling episodes identified within an AA polygon. This metric is measured in days, hours, minutes, and seconds. It is calculated for the entire year.

- **Occupancy metric**: this is a calculated metric using the *total duration of IET* within that AA polygon for year 2017 divided by the *surface area* of that AA polygon. This metric is measured in hours per square mile (hr/sq mi).

3.4.2 Building Idling Episode Tracks

Some of the metrics require the creation of an intermediate quantity which is referred to as Idling Episode Track (IET). A Track is defined a sequence of idling AIS pings connected logically.

To build those IETs the analysis first joined all Idling AIS pings related to the same vessel into a single Idling Episode Track (IET). The main identifier at that stage is the MMSI code. That track was then broken-down using Track Splitting Criteria. These Track Splitting Criteria are used by the Marine Cadastre as part of their ArcGIS extension[3]. Specifically, a Track is split if any of the AIS pings are separated by:

- either (1) a time difference between two consecutive Idling AIS pings greater than 30 minutes; OR

- (2) a distance between two consecutive Idling AIS pings greater than 1 statute mile.

If any of these are false then the Track is split. That process was repeated until all Idling AIS pings were classified into their own track. One of the outcomes of this classification process is that each IET can be uniquely identified using the vessel MMSI, and a Track ID.

4 Findings

4.1 Visual Assessment of DAA Occupancy

Though a formal assessment of occupancy was not performed by COWI, a visual assessment of DAA-to-low-density was performed for the entire PDE. The assessment consisted of locating DAA where a relatively low density of Idling AIS pings was observed based on 2017 points. A summary of results is shown

[3] See https://coast.noaa.gov/data/marinecadastre/ais/AIS_Utilities2018_Desktop.zip for the source code.

hereafter, along with visual illustrations in Figures A.1 through A.15 attached to this memo.

- In the Lower New York Bay (East and West), due to the size of the DAA, most DAA have low density of idling AIS pings. Romer Shoal and Flynns Knoll have measurably low density compared to Anchorage 25 (see Figure A.1 and Figure A.2).

- In the Upper New York Bay all DAAs are well occupied, with a high density of Idling AIS pings observed (see Figure A.3).

- The Great Neck area features a balance of under- and well-used DAAs (based on visual information); Anchorage to the East seem to be less used than Anchorage 4 for instance. We note in that area the presence of a CPAA near (but outside of) Anchorage 5 (see Figure A.4). It was singled out for an in-depth analysis (see Figure 4).

- Both Northport and Port Jefferson anchorages seem to be used sparingly compared to the anchorage areas near Staten Island which based on industry experience are known for their relatively high anchorage density (see Figure A.5).

- Riverhead anchorage features a comparatively low density of Idling AIS pings (see Figure A.6).

- In the absence of DAAs, Gardiners Bay, Peconic River, and Sag Harbor Bay, however, are scattered with idling vessels (see Figure A.7). Of them Sag Harbor Bay presents a CPAA that was further analyzed (see Figure 2).

- A few clusters of idling vessels can be spotted near Montauk in Napeague Bay and Fort Pond Bay (see Figure A.8).

- Very few idling vessels are present at Shinnecock Bay (see Figure A.9).

- Very few idling vessels are present near Fire Island (see Figure A.10, Figure A.11, and Figure A.12).

- Very limited number of vessels are idling offshore of Long Beach, Long Island (see Figure A.13).

- A few idling vessels can be spotted in Jamaica Bay (see Figure A.14).

- In the Hudson River area, the results of the geospatial analysis indicate that all areas located toward New Jersey seem to be well-used; Anchorage 18a does not show Idling AIS pings due to COWI's avoidance of offshore points within 1000 ft of the shoreline (see Figure A.15).

4.2 DAA and High-Density Area Alignment

The results of the analysis show that there generally is a strong and positive spatial correlation between zones with a high density of idling AIS pings and designated Anchorage Areas. Physically, it means that the data confirms that the designated anchorage areas function as intended. Only a few notable exceptions were noted where an area featuring high density of idling AIS pings was recorded outside of a known DAA. This is discussed in the next section.

4.3 Selection of Anchorage Areas of Interest

4.3.1 Presentation

The Anchorage Areas in this section were singled out for further in-depth analysis. They were selected for their illustrative value: each represent a distinct type of area that are commonly encountered throughout the PDE. Based on the process described in Section 3, COWI identified the following AAs of interest. For each, a brief justification of why these were selected for in-depth analysis is provided.

- Sag Harbor Bay is a CPAA (outside of a designated area) with relatively high density of Idling AIS Pings which are mainly pleasure crafts/sailing.

- Jones Point is another CPAA well outside of a designated area located in a region where little idling activity was reported. COWI acknowledges that this CPAA does align with one of the historical anchorage areas in Tomkins Cove as suggested by the HRSNOC Report on NDAA Hudson River Anchorage Study. The vessels in Jones Point CPAA are mostly tugs/tows and vessels identified as “other”.

- Great Neck is another CPAA with a relatively high density of Idling AIS Pings which are mostly tugs/tows and pleasure crafts/sailing.

- Upper New York Bay is representative of a high-density DAA of predominantly commercial type vessels.

- Staten Island (DAA) is representative of a low-density DAA of predominantly tugs/tows and pleasure crafts/sailing.

The above AAs were selected as they provided valuable insights to explain how similar areas are utilized across the PDE.

Anchoring practices are known to differ during episodic storms and periods of restricted visibility. While not analyzed herein, the HRSNOC report identifies five locations used at times of reduced visibility and/or weather avoidance which are within this study's area of interest. They are Hyde Park, Tomkins Cove, Newburgh, Marlboro, and Port Ewen. For the calendar year of 2017 assessed by this study, five non-major storms were recorded (three minor and two moderate) to impact New York.

4.3.2 Spatial Delineation

All figures shown in this section illustrate the density maps of idling AIS pings overlayed by the DAAs. Some of the high-density areas match well with the DAAs, e.g., the one in the Upper New York Bay Area (Figure 5). Some of the DAAs have rather low density of idling events, e.g., the DAAs near Staten Island (Figure 6). Moreover, several CPAAs not overlapping the DAAs can be observed, and of them the most prominent ones are near Great Neck, in Sag Harbor Bay, and near Jones Point.

CPAA polygons were drawn based on the Idling AIS ping density maps generated in the GIS.

Figure 2 Idling AIS ping density map overlayed by the Designated Anchorage Area (DAA) at Sag Harbor Bay, Long Island Sound. CPAA is outlined in blue dash line.

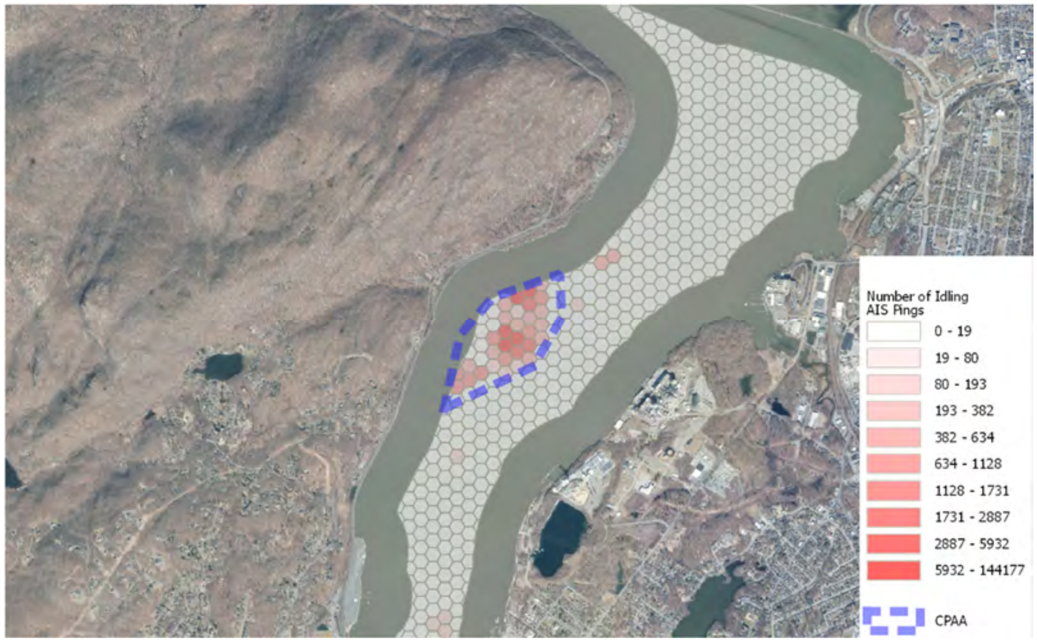

Figure 3 *Idling AIS ping density map overlayed by the Designated Anchorage Area (DAA) near Jones Point, Hudson River. CPAA is outlined in blue dash line.*

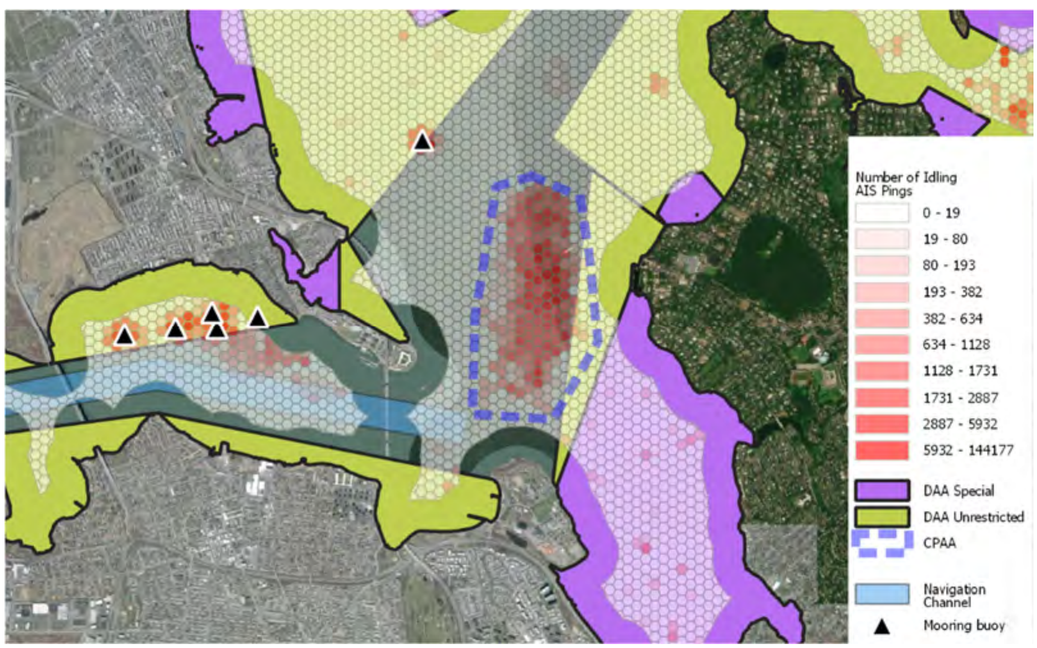

Figure 4 *Idling AIS ping density map overlayed by the Designated Anchorage Area (DAA) near Great Neck, Western Long Island Sound. CPAA is outlined in blue dash line. Locations of mooring buoys follow NOAA Navigation Chart No. 12366.*

Figure 5 *Idling AIS ping density map overlayed by the Designated Anchorage Area (DAA) in Upper New York Bay.* Locations of mooring buoys follow NOAA Navigation Chart No. 12334.

Figure 6 *Idling AIS ping density map overlayed by the Designated Anchorage Area (DAA) near Staten Island, Raritan Bay.*

4.4 Summary of Findings

A summary of all metrics is provided in the table below. The filtered data is presented in the geo-spatial products accompanying this memo.

Table 2 Summary of metrics for all Common Practice Anchorage Areas (CPAAs) and Designated Anchorage Areas (DAAs) outlined in the memo.

AA ID	Area [sq mi]	Number of Idling AIS pings in 2017 [-]	Number of unique IET in 2017 [-]	Number of unique IET in 2017 [-] lasting longer than 30 minutes	Average duration of IET in 2017 [min]	Median duration of IET in 2017 [min]	Total duration of IET in 2017 [dd hh:mm:ss]	Occupancy metric [hr/sq mi]
Sag Harbor Bay (CPAA)	0.822	298808	1772	947	564.8	39.0	695 00:59:32	20293.2
Jones Point (CPAA)	0.167	9882	44	33	569.3	676.5	17 9:28:10	2499.8
Great Neck (CPAA)	0.875	125178	383	264	473.6	212	125 22:54:12	3454.7
Upper New York Bay (DAA)	5.384	2752847	15981	9378	366.4	52.2	4066 7:42:6	18126.2
Staten Island (DAA)	76.204	454481	5151	2009	211.8	16.8	757 14:38:53	238.6

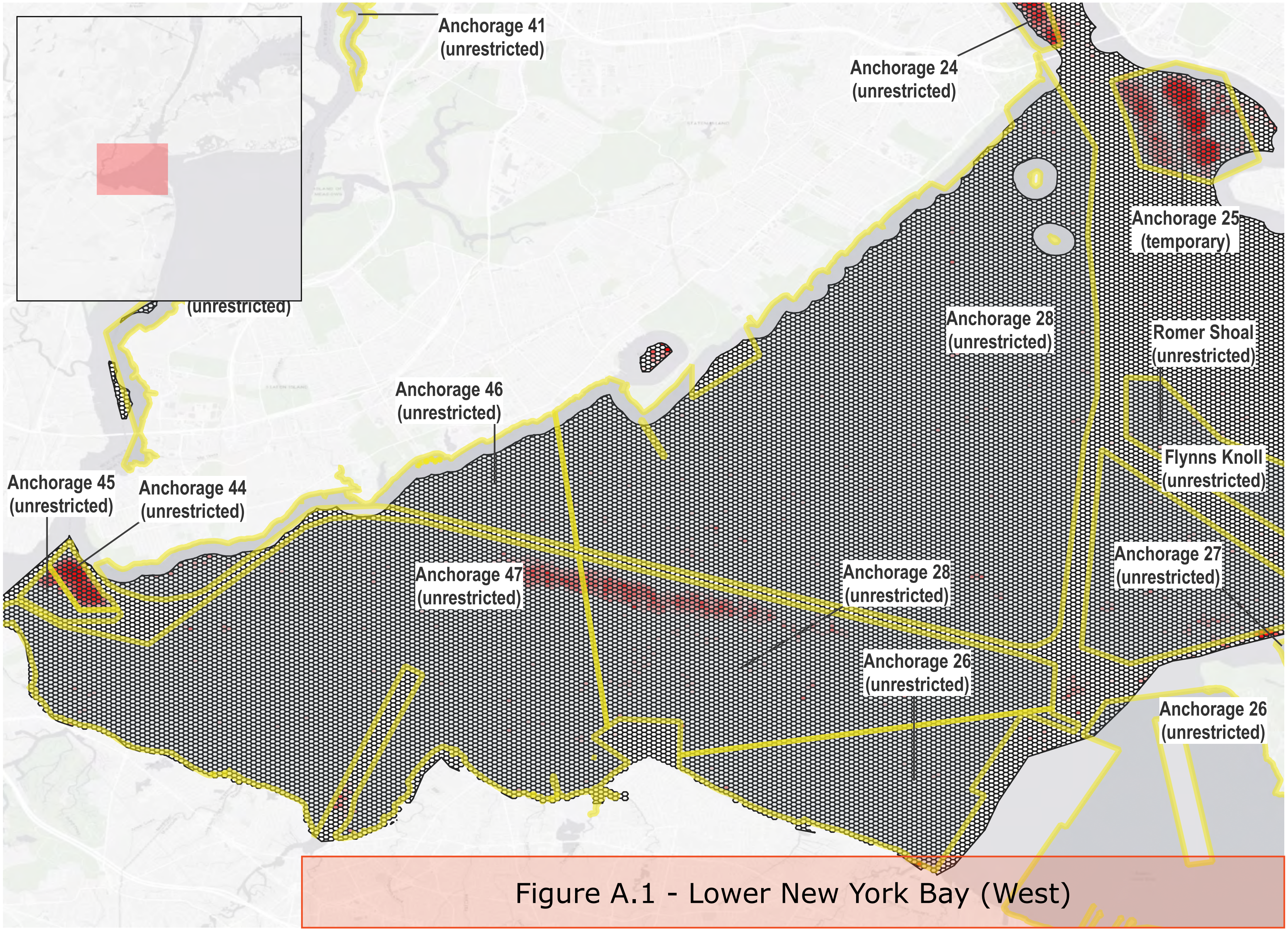

Figure A.1 - Lower New York Bay (West)

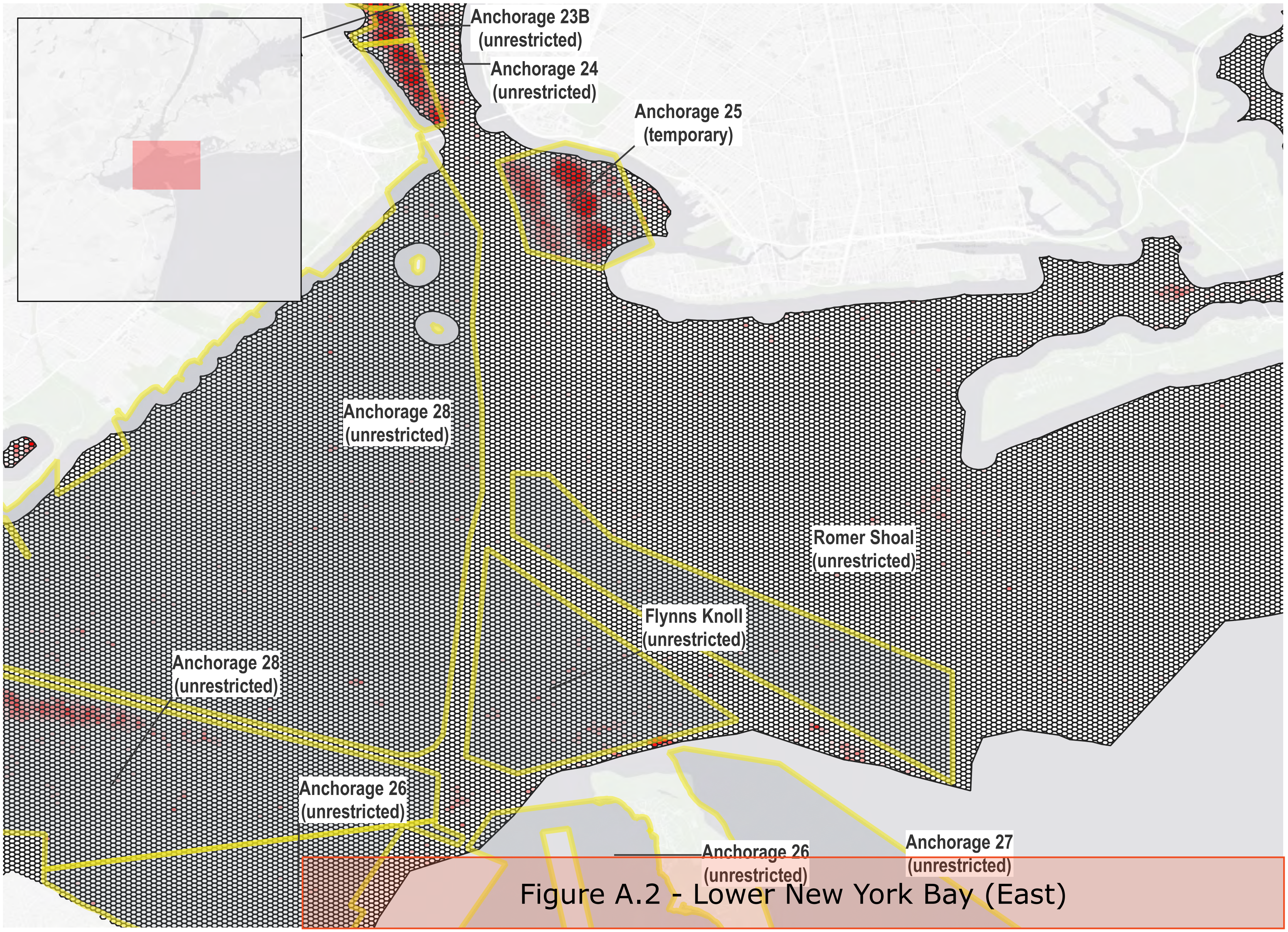

Figure A.2 - Lower New York Bay (East)

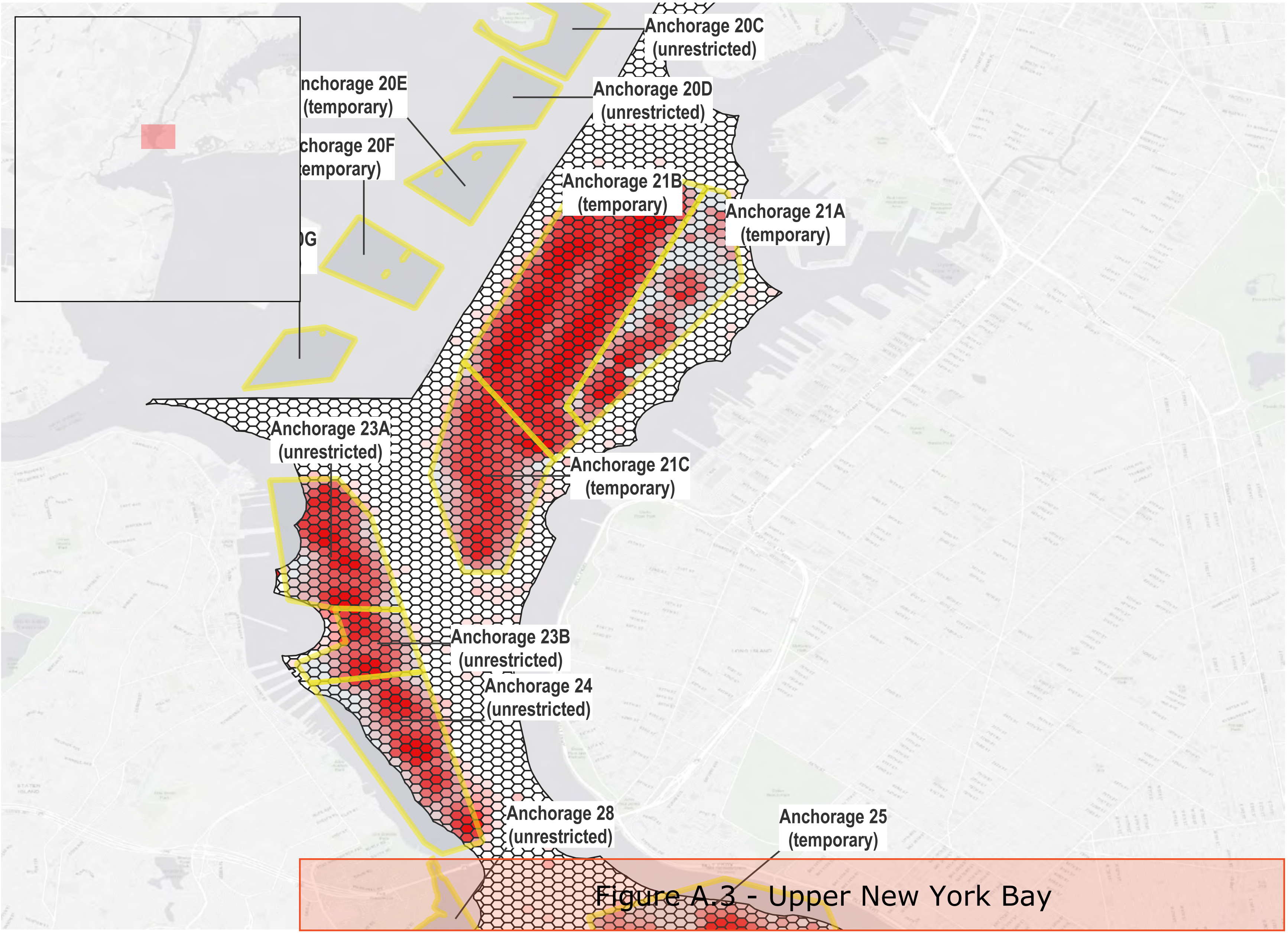

Figure A.3 - Upper New York Bay

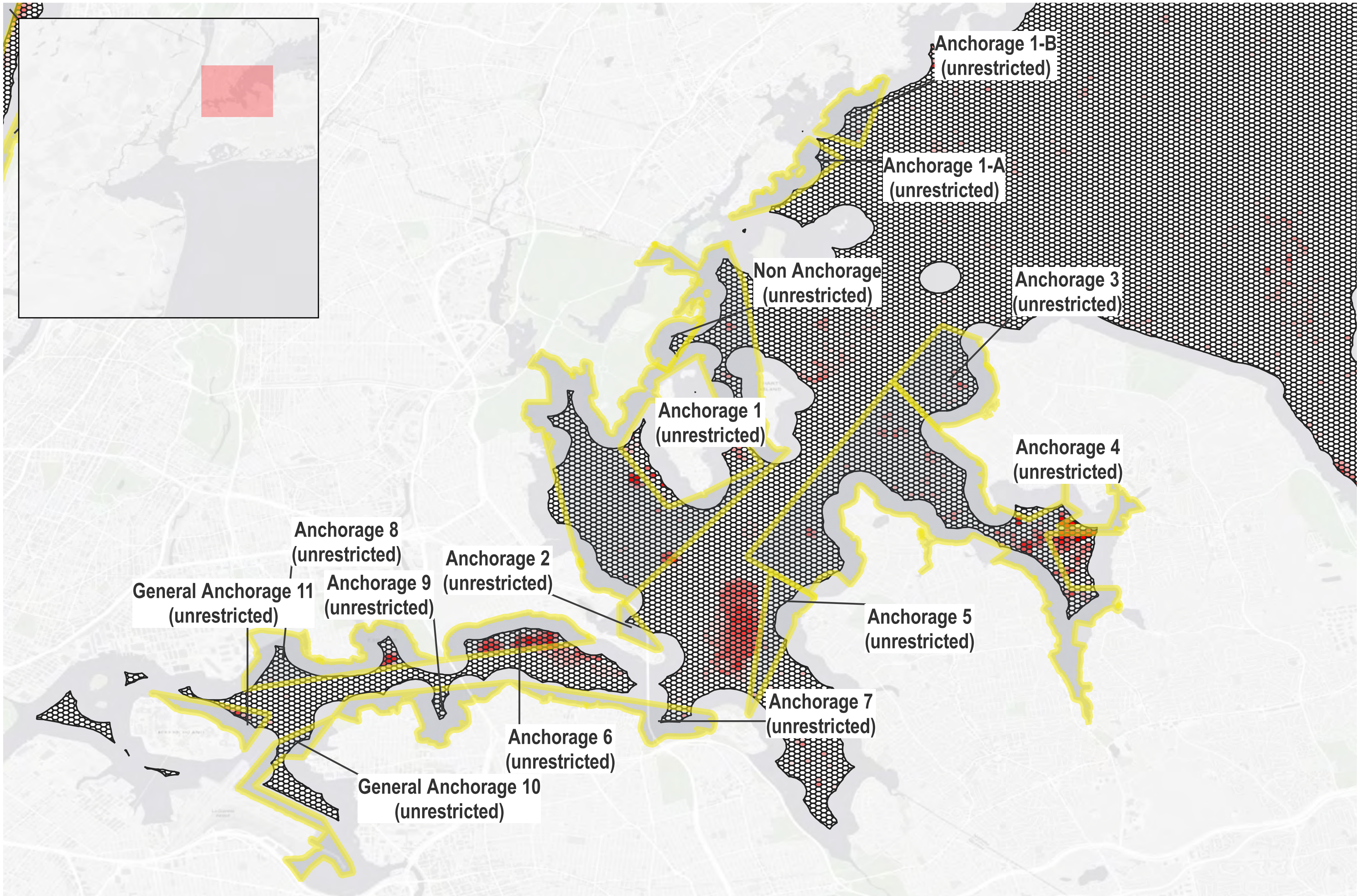

Figure A.4 - Great Neck

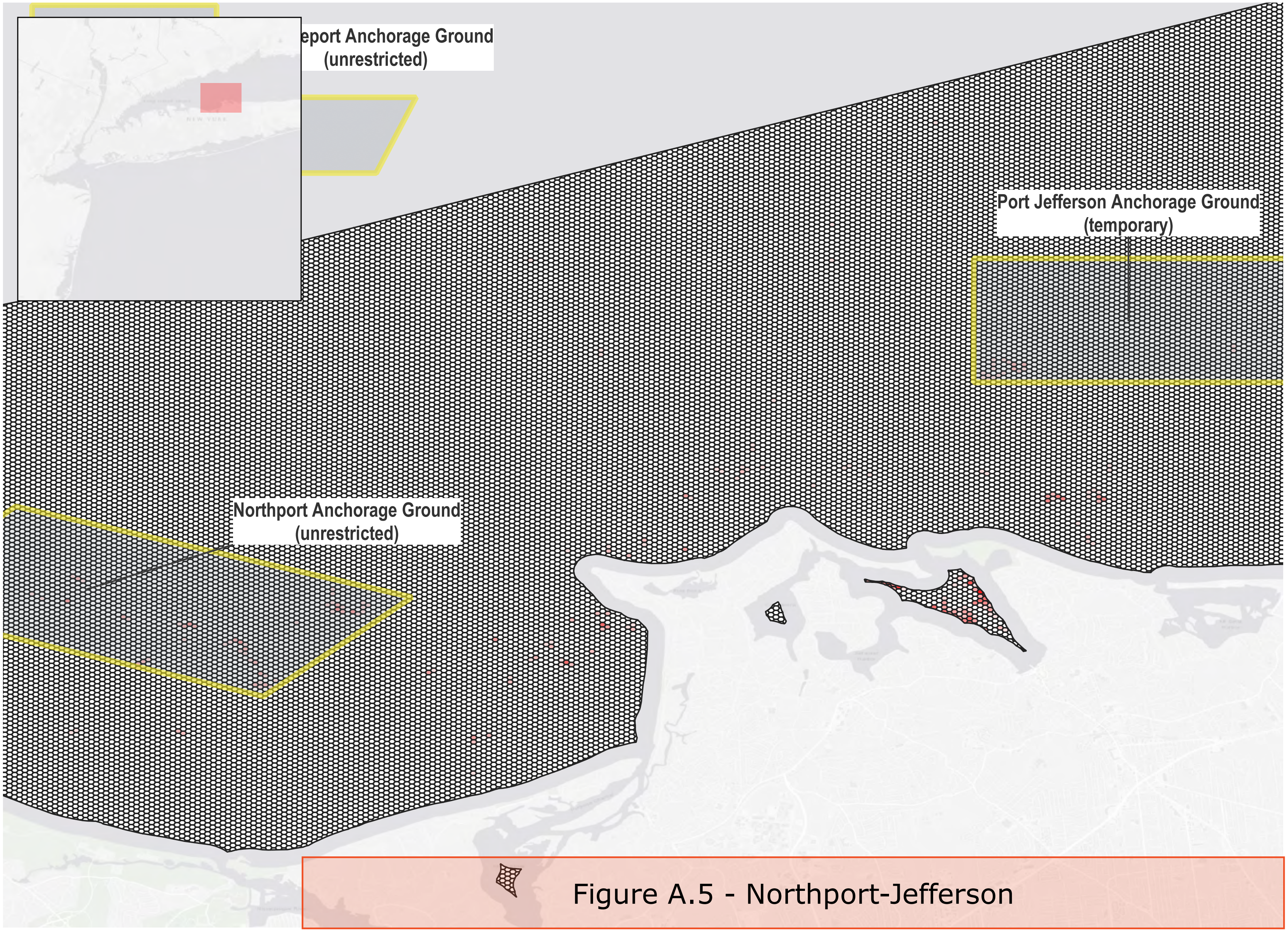

Figure A.5 - Northport-Jefferson

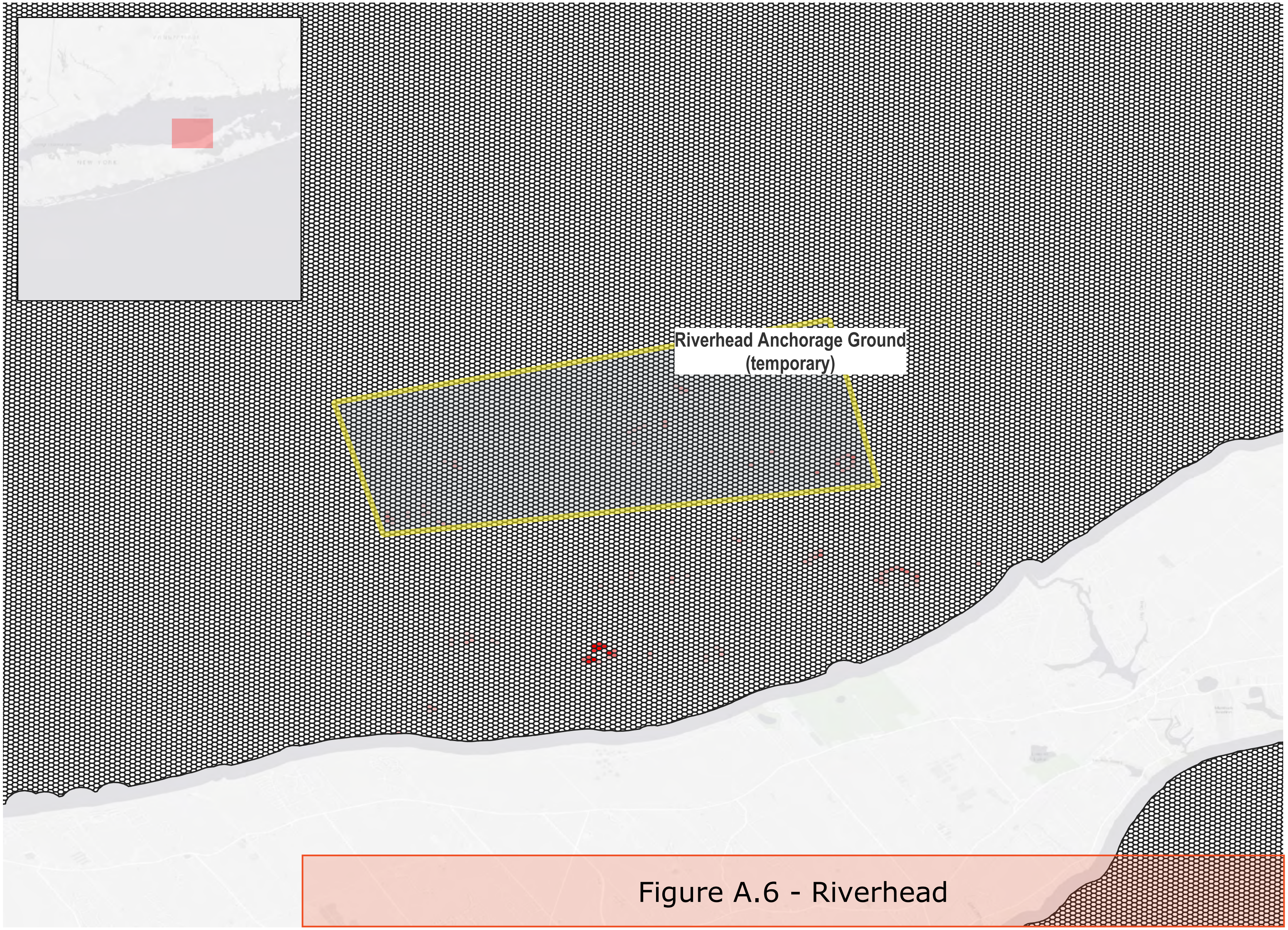

Figure A.6 - Riverhead

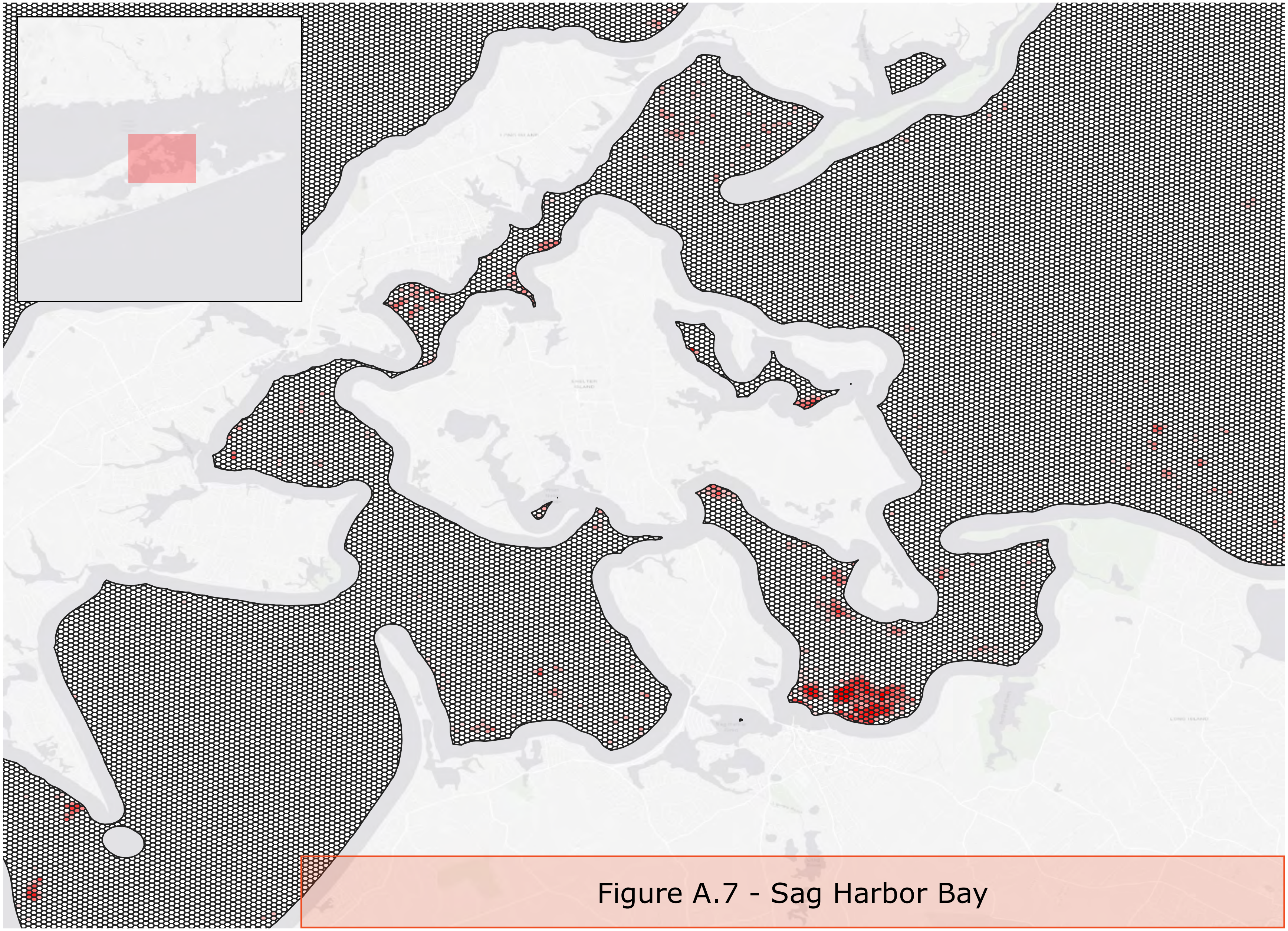

Figure A.7 - Sag Harbor Bay

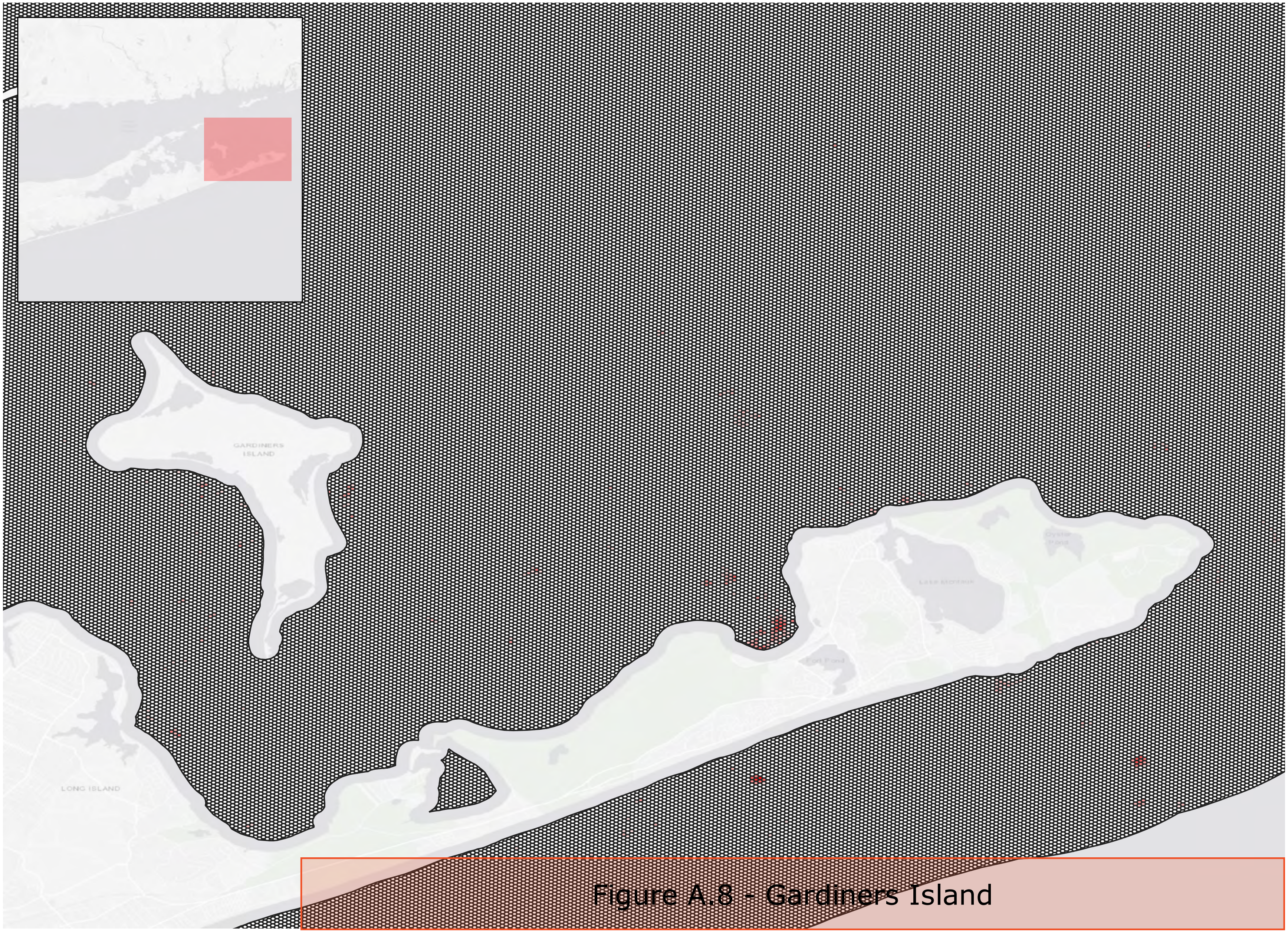

Figure A.8 - Gardiners Island

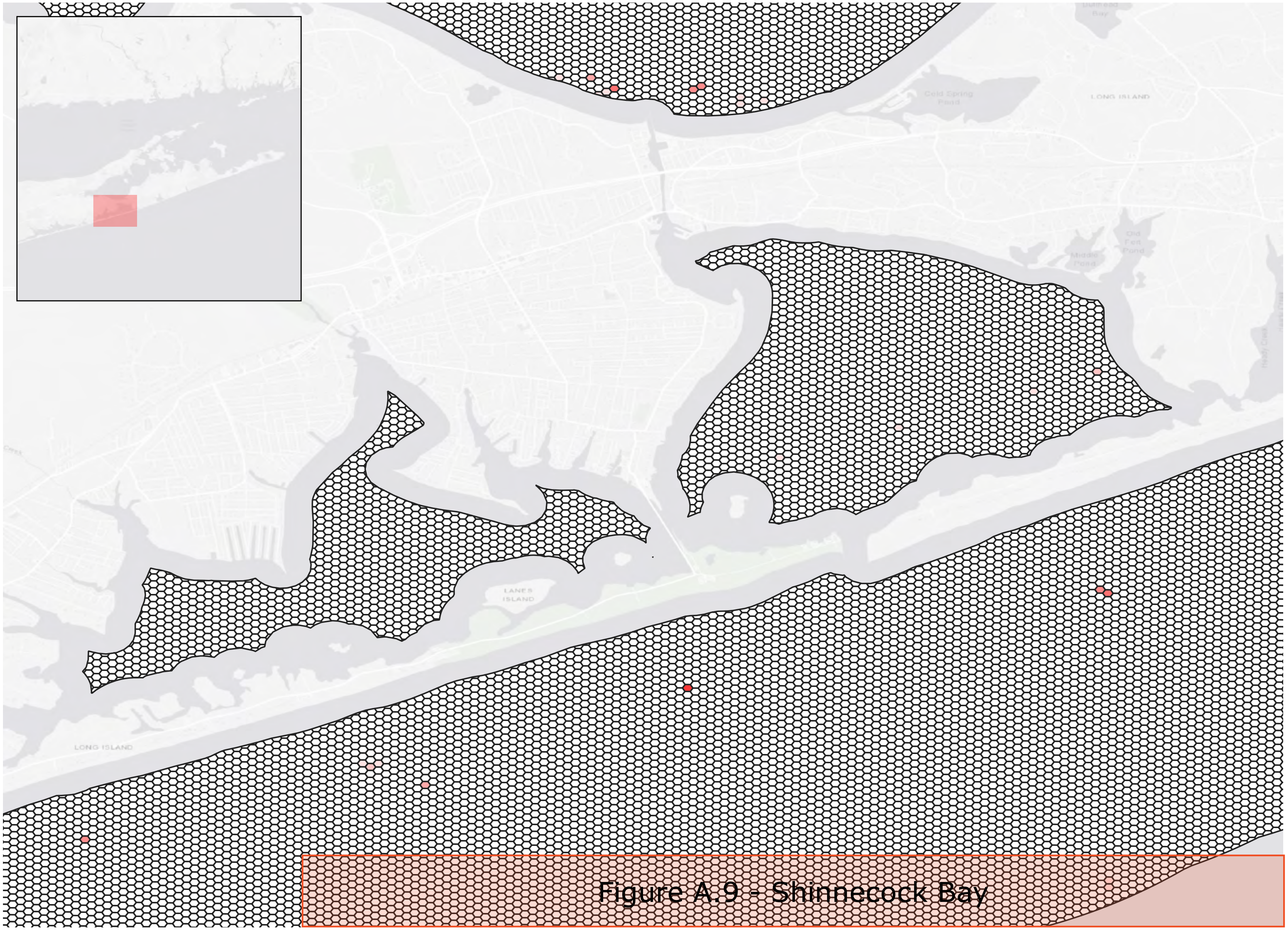

Figure A.9 - Shinnecock Bay

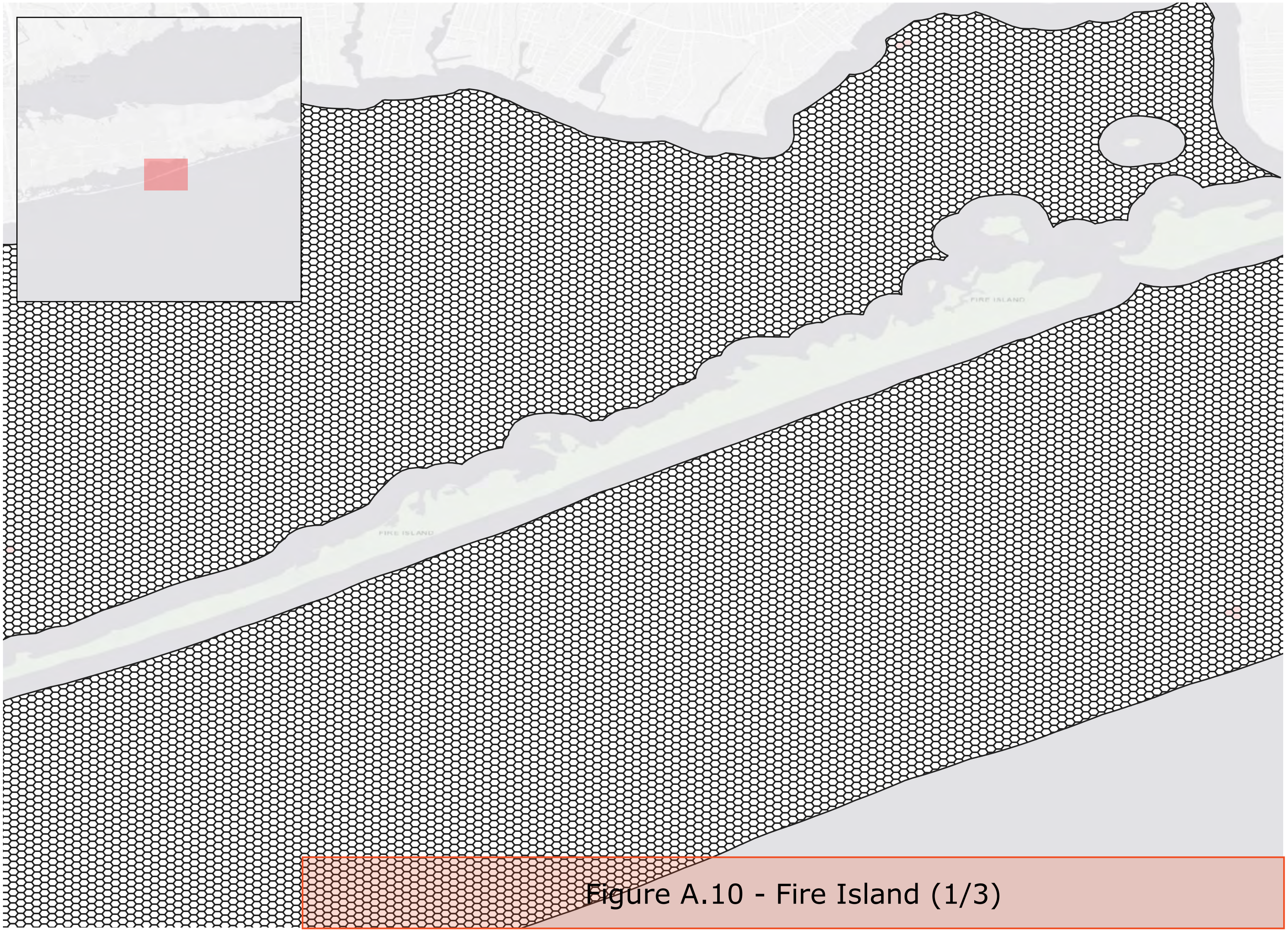

Figure A.10 - Fire Island (1/3)

Figure A.11 - Fire Island (2/3)

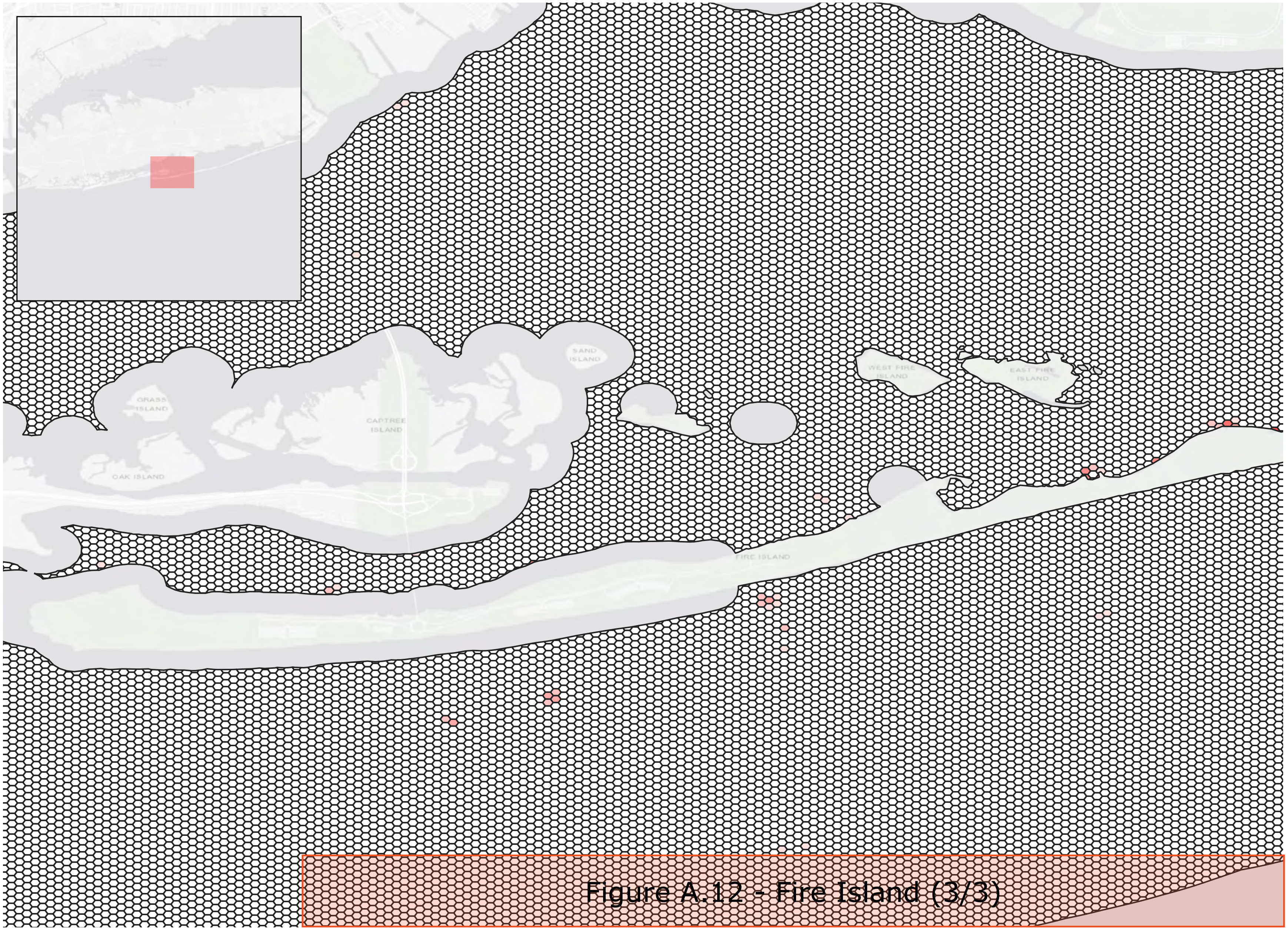

Figure A.12 - Fire Island (3/3)

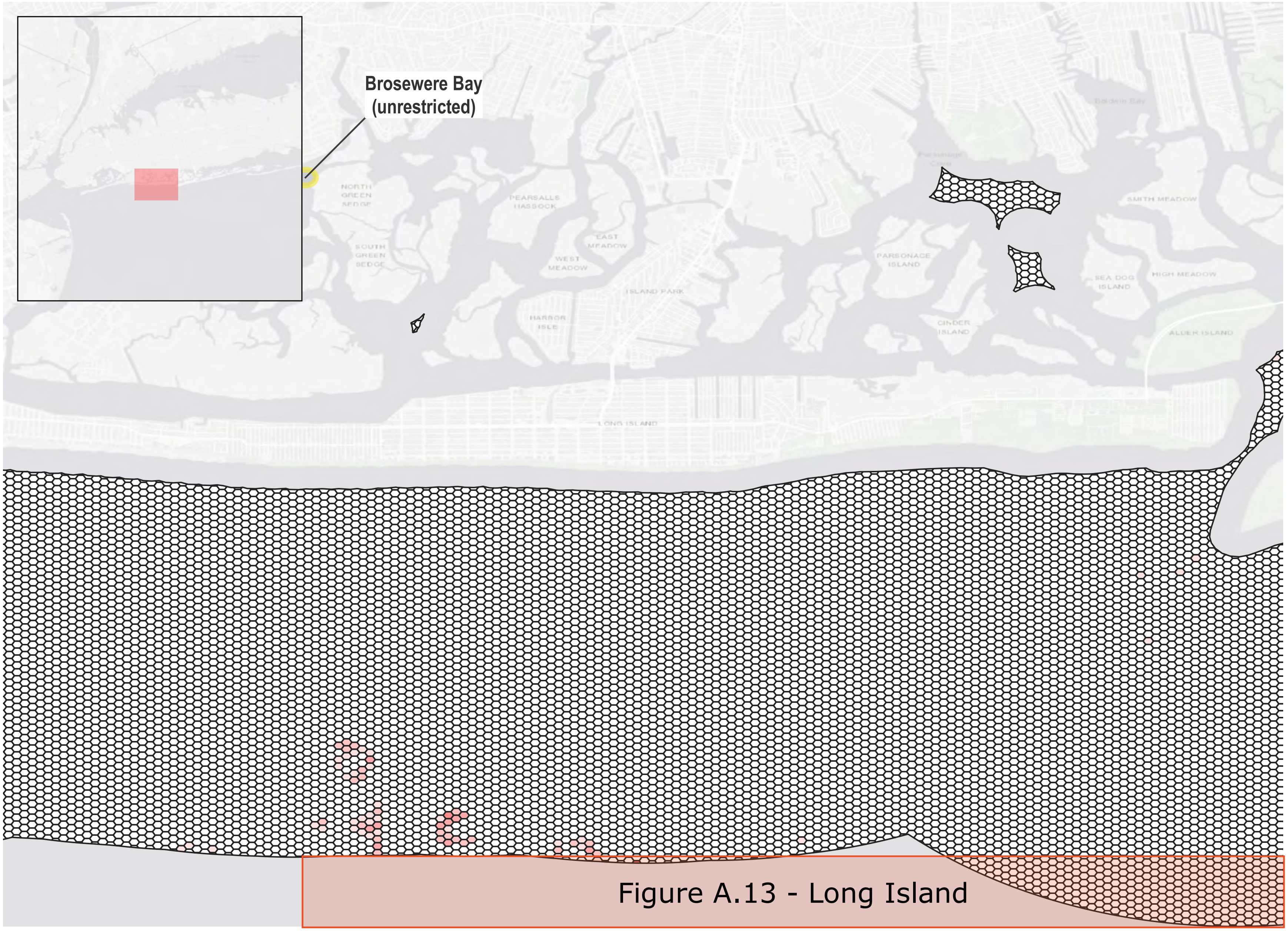

Figure A.13 - Long Island

Figure A.14 - Jamaica Bay

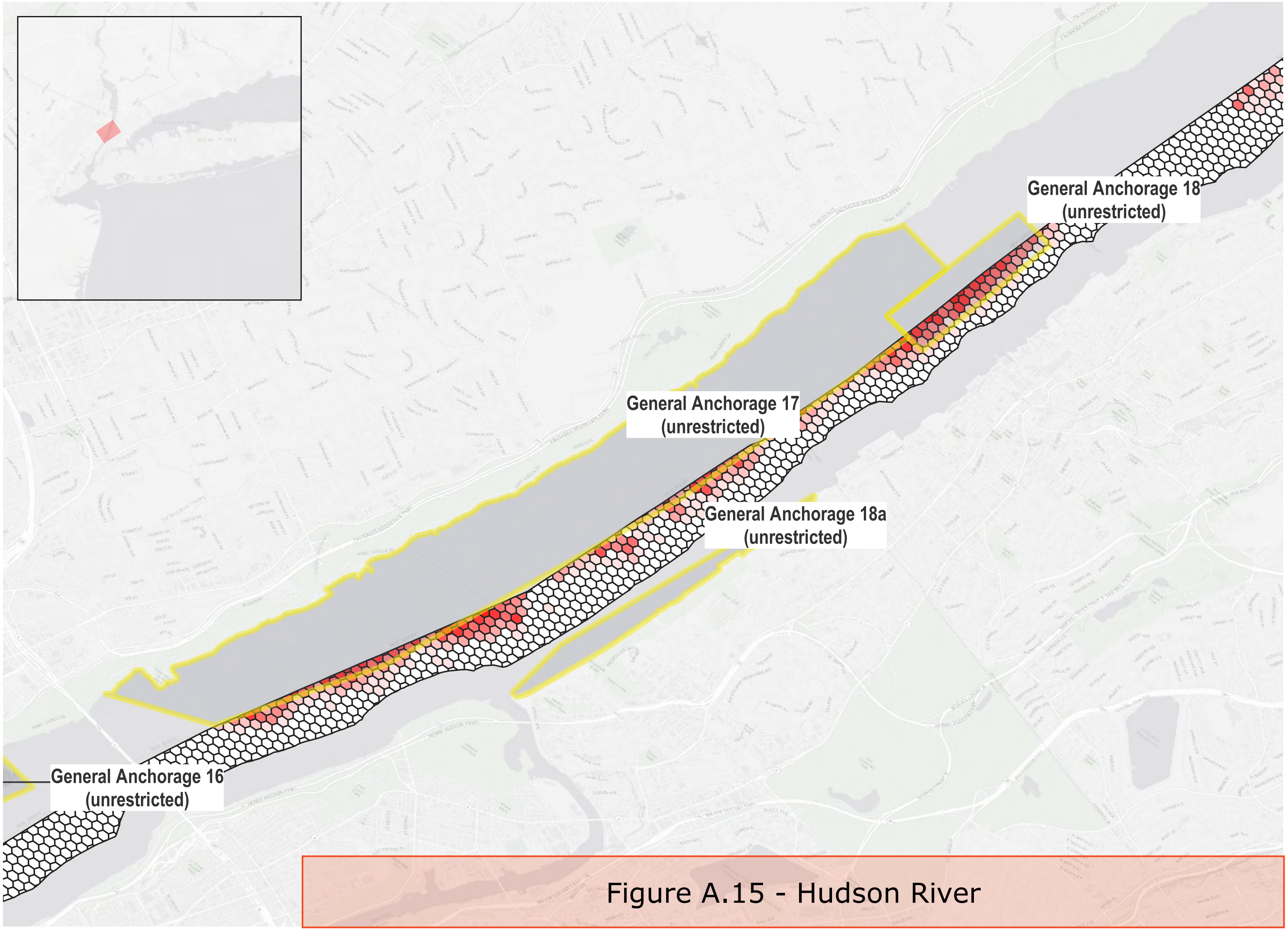

Figure A.15 - Hudson River