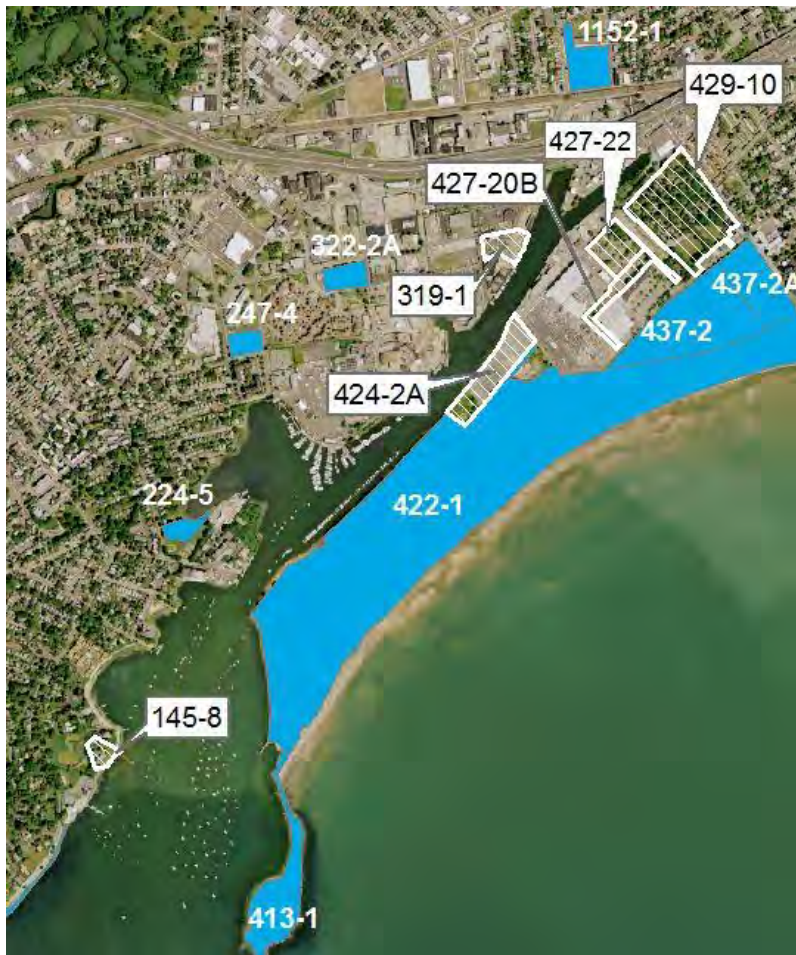


A Salt Marsh Advancement Zone Assessment of Bridgeport, Connecticut



Front cover image: Open space and unprotected parcels critical to the conservation of marsh advancement corridors in Bridgeport; from the accompanying Comprehensive Map Book of Bridgeport, Connecticut.

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RECOMMENDED CITATION:

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ACKNOWLEDGEMENTS:

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Introduction

In 2006, The Nature Conservancy established the Coastal Resilience Program (www.coastalresilience.org) that provides tools and a solution framework to reduce the ecological and socio-economic risk of hazards and comprehensively improve community resilience. The Program focuses on helping decision-makers explore locally relevant, downscaled, flooding scenarios from sea-level rise and/or storm surge, analyze the potential ecological, social and economic impacts of each scenario at a local, regional, and state scale, and facilitate solutions to address these issues. Since 2006, The Nature Conservancy has assisted many coastal and inland communities in Connecticut by providing this critical information and a comprehensive, community-based process that improves overall resilience and sustainability.

There is a universal recognition by coastal and inland communities in Connecticut and elsewhere that natural infrastructure – wetlands and forests - is a cost effective, long-term part of the solution to help protect people, infrastructure and natural systems from extreme weather and climatic change. Fortunately, our state has a remarkable diversity and abundance of natural resources that provide habitat for wildlife and fisheries, enhance the aesthetics and quality of life for residents, and, of course, defend the shoreline and rivers against storm surge, inland flooding, and sea level rise. The presence of natural resources across the state – in particular salt marsh, beaches/dunes, forested headwaters, and river floodplains – is the result of previous recognition and commitment to long-term conservation and the requisite balance with socio-economic growth. In order to maintain these natural resources it will require 1) routine and on-going management activities as well as the restoration of degraded areas, 2) forward-looking planning to accommodate changes in habitat composition and location due to climatic change and 3) enforcement, modification and/or development of new land use policies and growth strategies. Opportunities also exist to account for and integrate the services or co-benefits provided by natural infrastructure via new development, redevelopment, or realignment activities. Economically important services/co-benefits from natural infrastructure include wave attenuation, improved water storage and filtering of pollutants from surface runoff, erosion control, and improved aesthetics and desirable public amenities. Taken in total, the immediate and longer-term management of natural infrastructure by the state, towns, private property owners, non-profit organizations, and others will help to reduce hazard risk and improve resilience across Connecticut.

While longer-term changes in temperature and precipitation patterns will alter the species composition and type of habitats in a given location, the more immediate implication is the upslope advancement of habitats such as salt marsh in response to continued sea level rise. Sea level rise and the impacts of flooding have and will continue to alter the presence and abundance of natural resources in Connecticut. One of the most noticeable changes is occurring at the shoreline's edge where salt marsh is in the process of advancing upslope into areas now considered uplands. In order to clearly identify where this will occur along Bridgeport's shoreline, The Nature Conservancy presents the following report to assist with future planning for natural resources in the context of overall risk reduction and resiliency improvement for the community. Ultimately, it is our hope that this report will serve to inform the community about

future marsh advancement locations, current land use of those locations and which parcels are critical to ensure the persistence of natural resources in Bridgeport longer term.

The Salt Marsh Advancement Model used in this analysis was co-developed by The Nature Conservancy and the University of Connecticut's Department of Natural Resources Management and Engineering. A full discussion of the Model and underlying methodology is beyond the scope of this report, but a few important details are needed to put the following analysis into context and define how to use the results for planning and implementation.

Suitable vs. Unsuitable Advancement

In the following figures and tables suitable advancement areas are abbreviated as “Yes” and unsuitable areas are abbreviated as “No”. Suitable areas are classified based on the current land cover type - “forest” or “agrigrass” - and as such are expected to convert to salt marsh as hydrologic conditions change due to sea level rise, in the absence of further land use conversion. Land cover types classified as “urban” (i.e. roads, buildings, parking lots, etc...) are considered to be unsuitable for salt marsh advancement at this time. Though much of our analysis is grouped by parcel ID and associated characteristics, these classifications – suitable and unsuitable – exist independent of the parcel boundaries. In other words, a given residential parcel can have both suitable (lawn) and unsuitable (building footprint) advancement areas.

Marsh Advancement vs. Wetland Extent

There is a key distinction in this report between the current wetland extent in a municipality and the marsh advancement areas analyzed herein. Marsh advancement areas include only the future projected wetland extent clipped to current upland land cover. Therefore, no assumption should be made about net gain or loss of current wetland extent based on this advancement area analysis. Another key consideration is that in some cases the identified advancement area will include land that converts to wetlands and subsequently to open-water over time. This further demonstrates that net change in both existing and future wetland extent should not be inferred from our analysis.

Planning for the Future

The advancement and eventual establishment of coastal marshes will occur over the course of several decades and as such our analysis extends out to the 2080s. The rate of change is slow and decadal, yet inevitable. There is an abundance of existing property, infrastructure and natural infrastructure assets clustered along the Connecticut coast and communities will need to formulate growth and realignment plans well in advance of the 2080s scenario presented here. The following data analysis and associated map book (Appendix) can assist with a resilient transition through the presentation of marsh advancement areas and an accounting of the projected changes to coastal property.

Total Marsh Advancement

The full extent of marsh advancement in Bridgeport by the 2080s is projected to be 1,134.2 acres, with 466.6 acres (41.1%) having suitable (Yes) land cover for wetland migration. The other 667.6 acres (58.9%) are occupied by built structures and associated infrastructure and are unsuitable for marsh advancement (No), currently.

Total Marsh Advancement by 2080s		
Marsh Adv	Acres	Percent (%)
Yes	466.6	41.1
No	667.6	58.9
Total	1,134.2	100.0

Marsh Advancement in Open Space Parcels

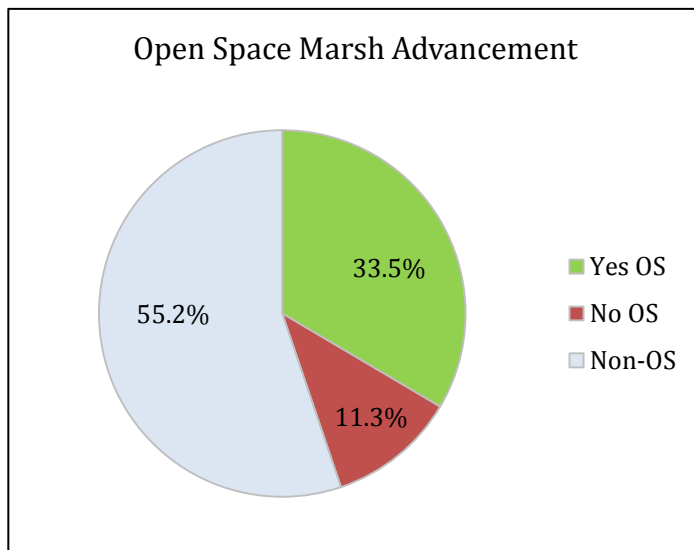
Open space (OS) properties are a critical component of long-term community resilience because they currently have little to no development and are the most likely areas to remain undeveloped through the 2080s. The recognition of their role in future wetland extent and improved resilience in Bridgeport is vital for strategic land management, economic development, and planning.

Total Advancement in Open Space Parcels

The following three categories are considered in this section:

- Yes OS: Protected open space suitable for marsh advancement
- No OS: Protected open space not suitable for marsh advancement
- Non-OS: Unprotected parcels both suitable and not suitable for marsh advancement

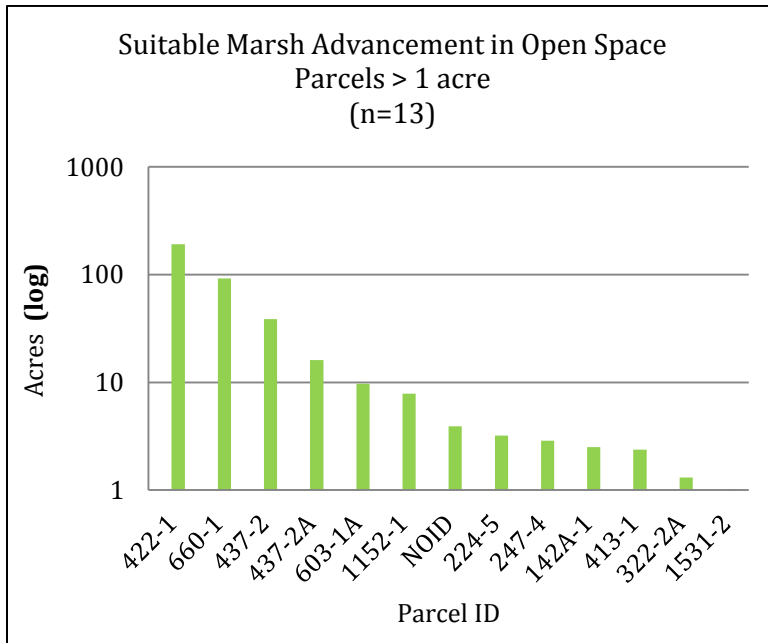
Bridgeport’s protected open space parcels contain 508.2 acres of total salt marsh advancement area with 379.8 acres (56.9%) having a land cover suitable for future wetlands (Yes OS). Further analysis of the 159.4 acres of unprotected parcels (Non-OS) can be found in the following “Marsh Advancement in All Parcels” section.



Open Space Marsh Advancement	
OS type	Acres
Yes OS	379.8
No OS	128.4
Non-OS	159.4
Total	667.6

Suitable Advancement by Open Space Parcel and Owner

There are 15 protected open space parcels in Bridgeport that provide areas of suitable marsh advancement. Of these parcels, 13 provide greater than 1 acre of suitable marsh advancement area and all are currently owned by the city of Bridgeport. Seaside Park (Parcel ID 422-1) accounts for 192 acres, or 41.1%, of the total suitable advancement in open space parcels. This amount is an order of magnitude larger than most other open space parcels with significant marsh advancement potential, hence the need to use a log scale in the bar chart below.



Suitable Marsh Advancement in OS Parcels > 1 acre				
Parcel ID	Acres	Yes OS (%)	Owner	Map Book Page #
422-1	191.9	50.5	City	12, 13
660-1	92.3	24.3	City	13
437-2	38.8	10.2	City	12
437-2A	16.1	4.2	City	12
603-1A	9.7	2.6	City	13
1152-1	7.8	2.1	City	12
NOID	3.9	1.0	City	13
224-5	3.2	0.8	City	12
247-4	2.9	0.8	City	12
142A-1	2.5	0.7	City	12
413-1	2.4	0.6	City	12
322-2A	1.3	0.3	City	12
1531-2	1.0	0.3	City	11
Total	373.9	98.4		

Marsh Advancement in All Parcels

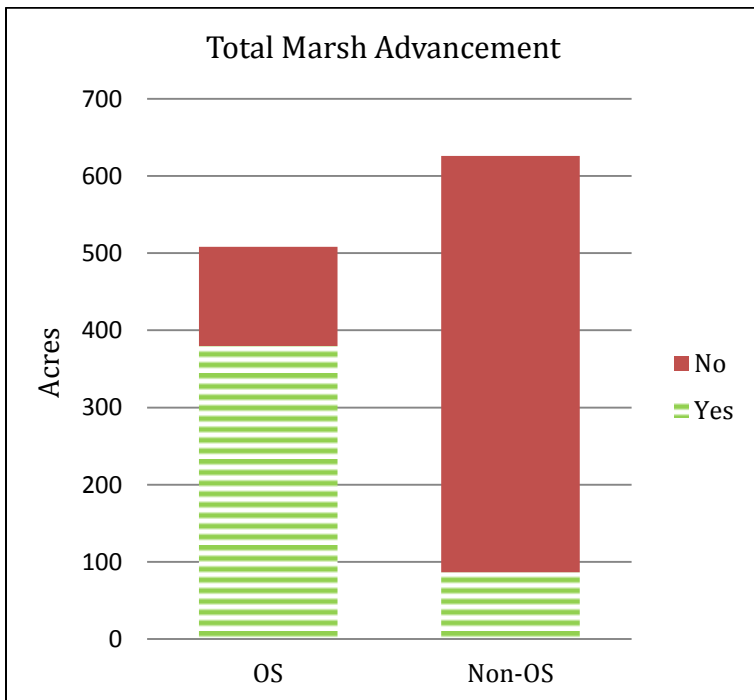
This section incorporates all parcels into the analysis of suitable marsh advancement. These results help put the open space analysis into perspective, as well as identify important unprotected parcels in Bridgeport’s marsh advancement landscape.

Total Advancement in All Parcels (OS vs. Non-OS)

Bridgeport’s existing open space parcels are made up of municipal parks and designated municipal open space properties, principally. This section provides an analysis of suitable areas for marsh advancement on these open space parcels versus all other parcels. These two types of parcels are designated as:

- ‘OS’ for open space parcels
- ‘Non-OS’ for all other parcels

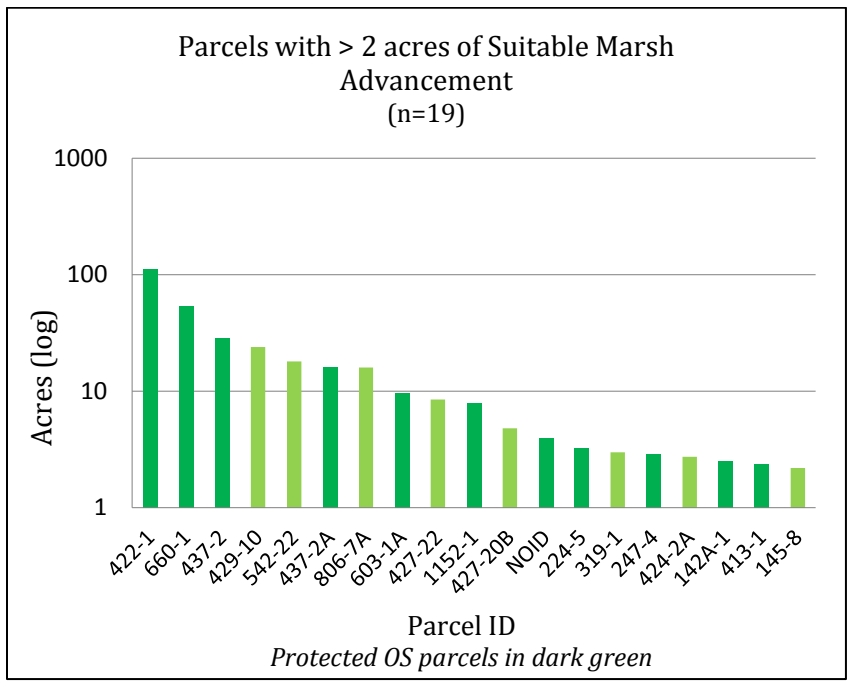
Protected open space parcels contain 379.8 acres of suitable marsh advancement area (81.4% of total). The remaining 86.8 acres of land suitable for marsh advancement (18.6% of total) are unprotected and generally occur on residential, commercial or industrial properties. The unprotected suitable areas will receive a large amount of the marsh advancement by the 2080s. This information has two important implications for future planning: 1) today’s unprotected properties will play a vital role in maintaining Bridgeport’s wetland resources in the future, and 2) a large amount of current development (539.2 acres) will be in direct conflict with rising sea levels and advancing marshes.



Parcel type	Yes	No	Total
OS	379.8	128.4	508.2
Non-OS	86.8	539.2	626.0
Total	466.6	667.6	1,134.2

Suitable Advancement by Parcel

There are 1,042 parcels in Bridgeport that provide areas of suitable marsh advancement, but only 19 parcels offer suitable areas greater than 2 acres. This small subset accounts for the majority of suitable advancement at 320.5 acres, or 68.7% of the overall total. Moreover, Seaside Park (Parcel ID 422-1) is still two orders of magnitude greater than most of the other parcels in the group providing 23.8% of Bridgeport’s overall suitable marsh advancement. All of the unprotected open space parcels from this selection are privately owned with the exception of Parcel 806-7A, or Steele Point. The city currently owns this property which could provide nearly 16 acres of marsh advancement; however plans for its redevelopment are underway.



Parcels with > 2 acres of Suitable Marsh Advancement			
Parcel ID	Acres	Total Yes adv (%)	Map Book Page #
422-1	111.0	23.8	12,13
660-1	53.4	11.4	13
437-2	28.5	6.1	12
429-10	23.8	5.1	8,12,22,34
542-22	18.0	3.8	9,13,18,23,30,35
437-2A	16.1	3.5	12
806-7A	16.0	3.4	9,13,18,30
603-1A	9.7	2.1	13
427-22	8.5	1.8	8,12,22,34
1152-1	7.8	1.7	12
427-20B	4.8	1.0	8,12,22,34
NOID	3.9	0.8	13
224-5	3.2	0.7	12
319-1	3.0	0.6	8,12,22,34
247-4	2.9	0.6	12
424-2A	2.7	0.6	8,12,22,34
142A-1	2.5	0.5	12
413-1	2.4	0.5	12
145-8	2.2	0.5	8,12,25,37
Total	320.5	68.7	

Appendix – Map Book

Please consult your Marsh Advancement Resource Disc for the complete dataset of suitable and unsuitable advancement per parcel.

Comprehensive Map Book of Bridgeport, Connecticut



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Marsh Advancement by the 2080s

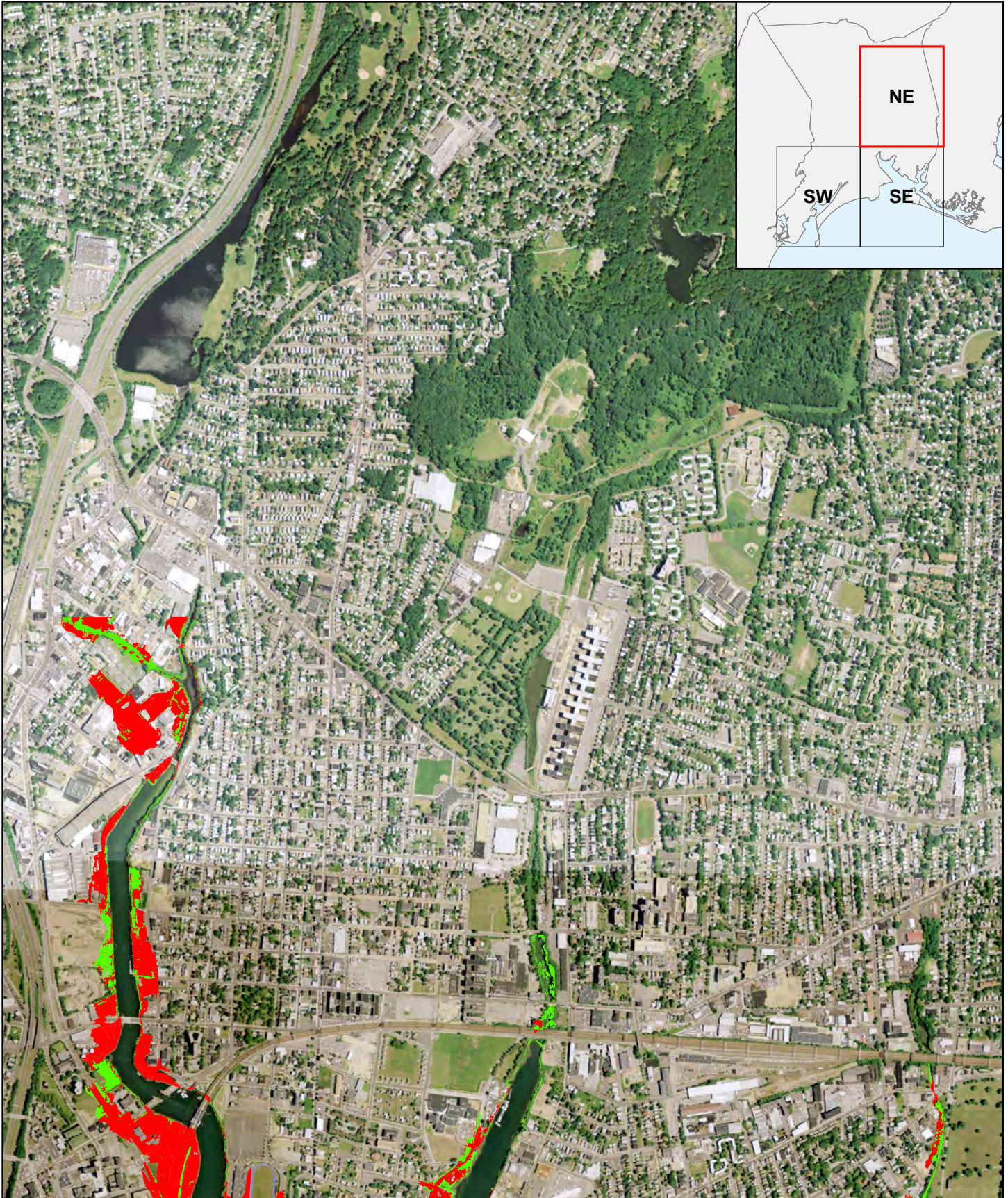
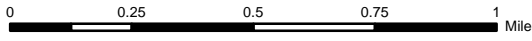
City of Bridgeport, CT

Marsh Advancement - NE



Marsh Advancement by 2080s

- Developed Land Cover
- Forest, Grass, Ag Land Cover



Marsh Advancement by the 2080s

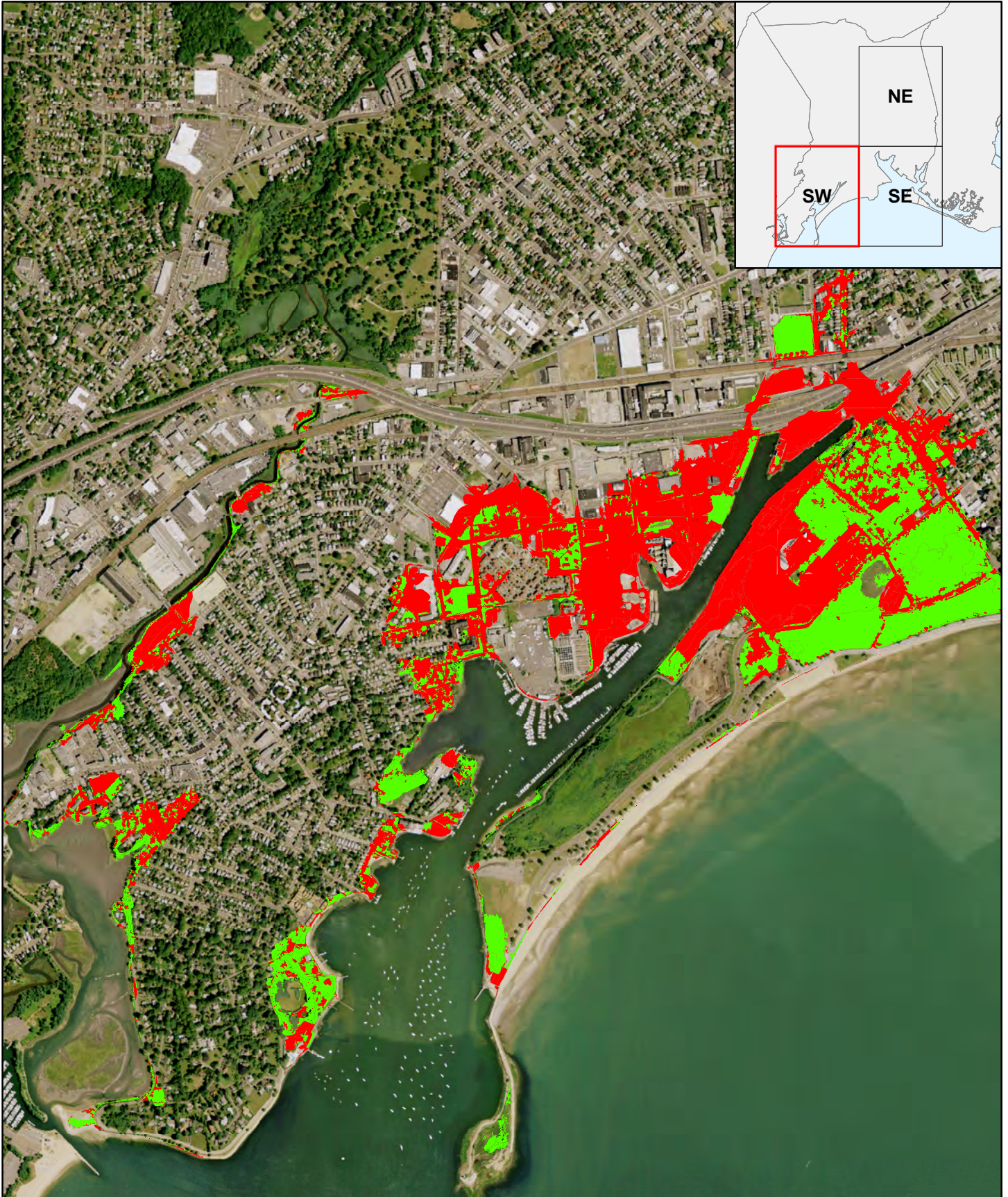
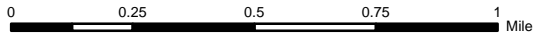
City of Bridgeport, CT

Marsh Advancement - SW



Marsh Advancement by 2080s

- Developed Land Cover
- Forest, Grass, Ag Land Cover



Marsh Advancement by the 2080s

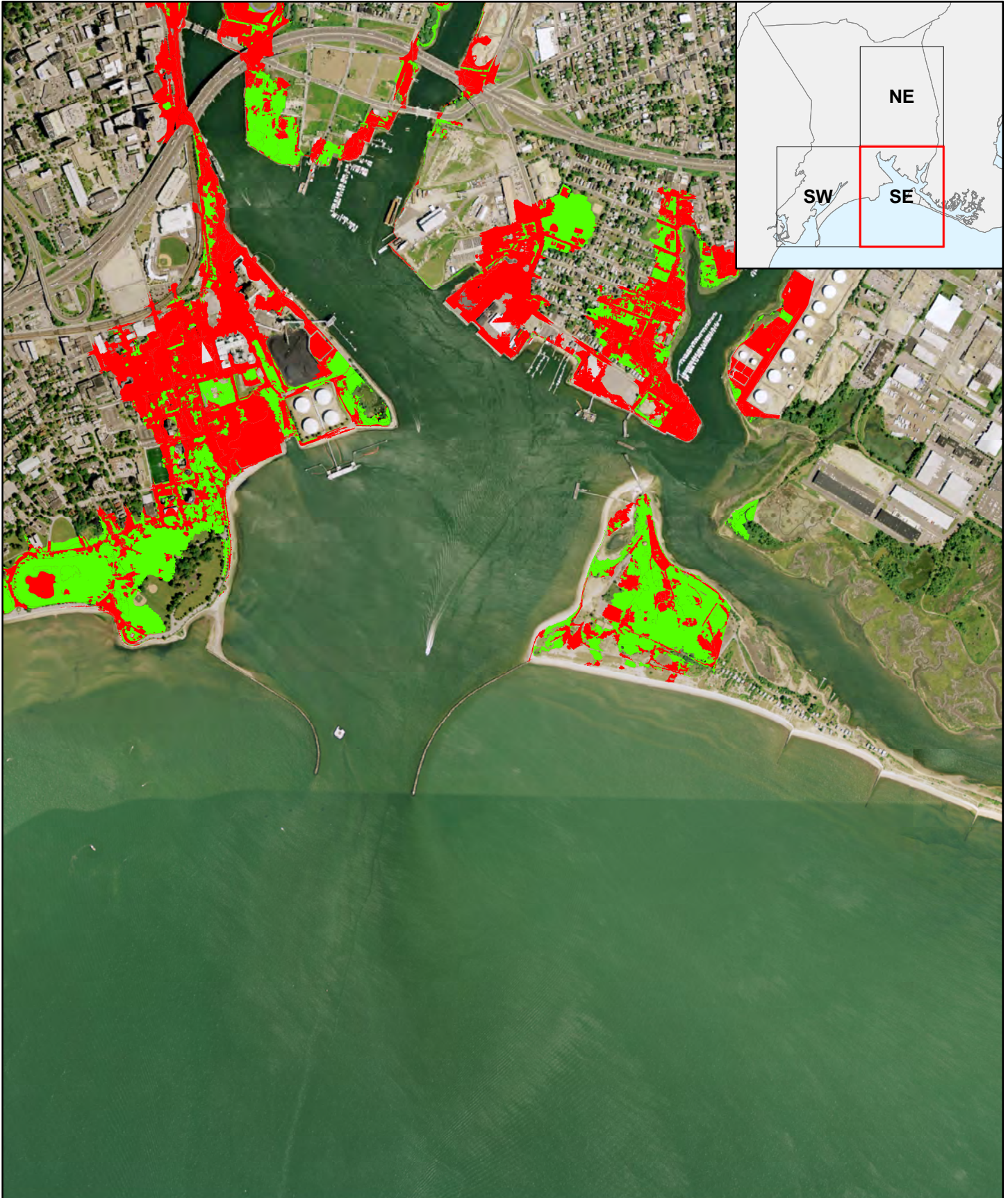
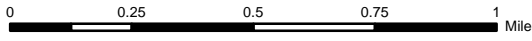
City of Bridgeport, CT

Marsh Advancement - SE



Marsh Advancement by 2080s

- Developed Land Cover
- Forest, Grass, Ag Land Cover

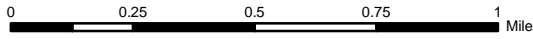


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Marsh Advancement by the 2080s

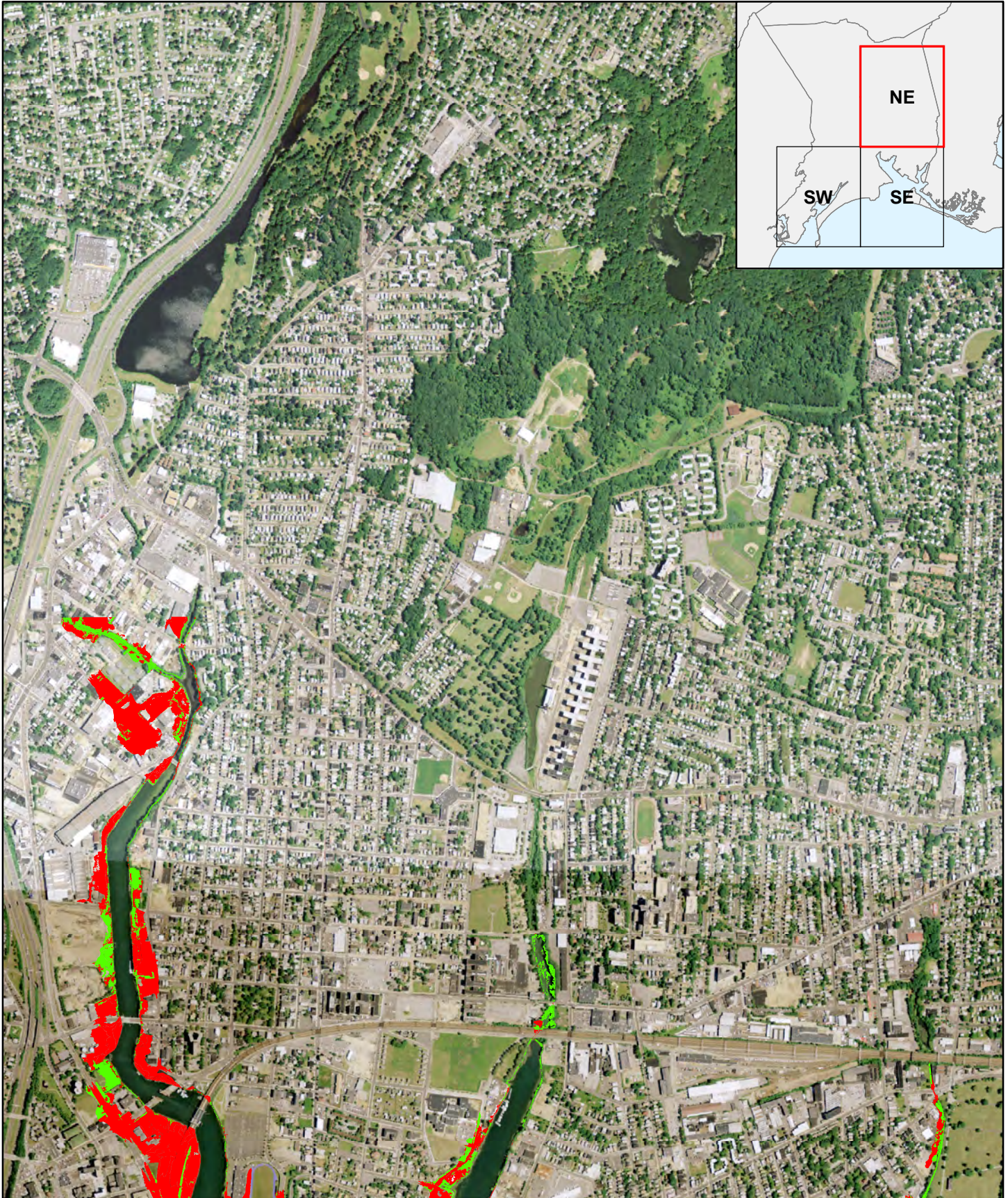
City of Bridgeport, CT

Unprotected Parcels - NE



Parcels		Marsh Advancement by 2080s	
	Unprotected Non-OS		Developed Land Cover
	Unprotected Non-OS		Forest, Grass, Ag Land Cover

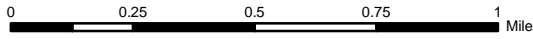
Note: Only Non-OS parcels with > 2 acres of suitable (green) advancement are outlined and labeled.



Marsh Advancement by the 2080s

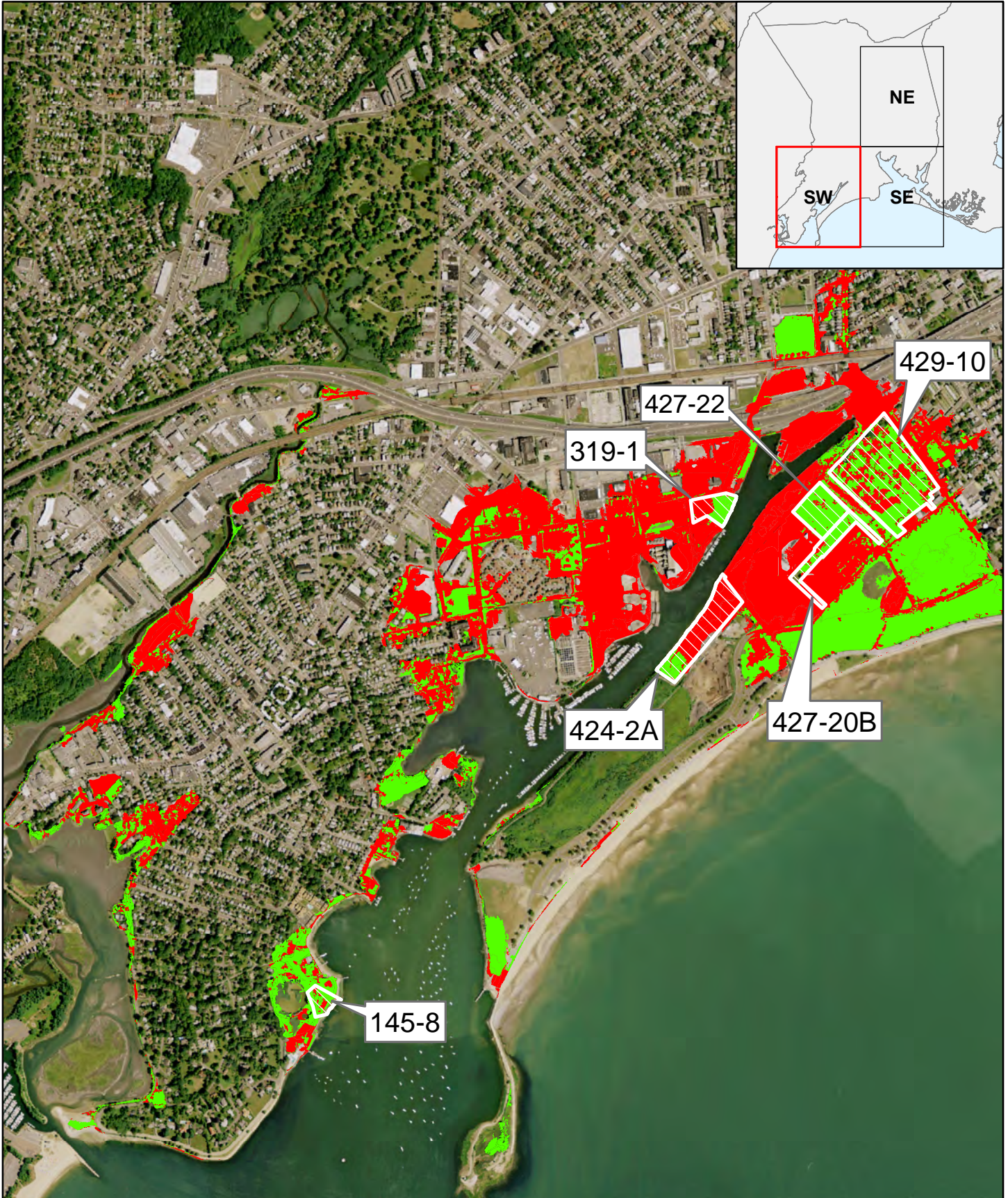
City of Bridgeport, CT

Unprotected Parcels - SW



Parcels		Marsh Advancement by 2080s	
	Unprotected Non-OS		Developed Land Cover
			Forest, Grass, Ag Land Cover

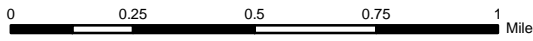
Note: Only Non-OS parcels with > 2 acres of suitable (green) advancement are outlined and labeled.



Marsh Advancement by the 2080s

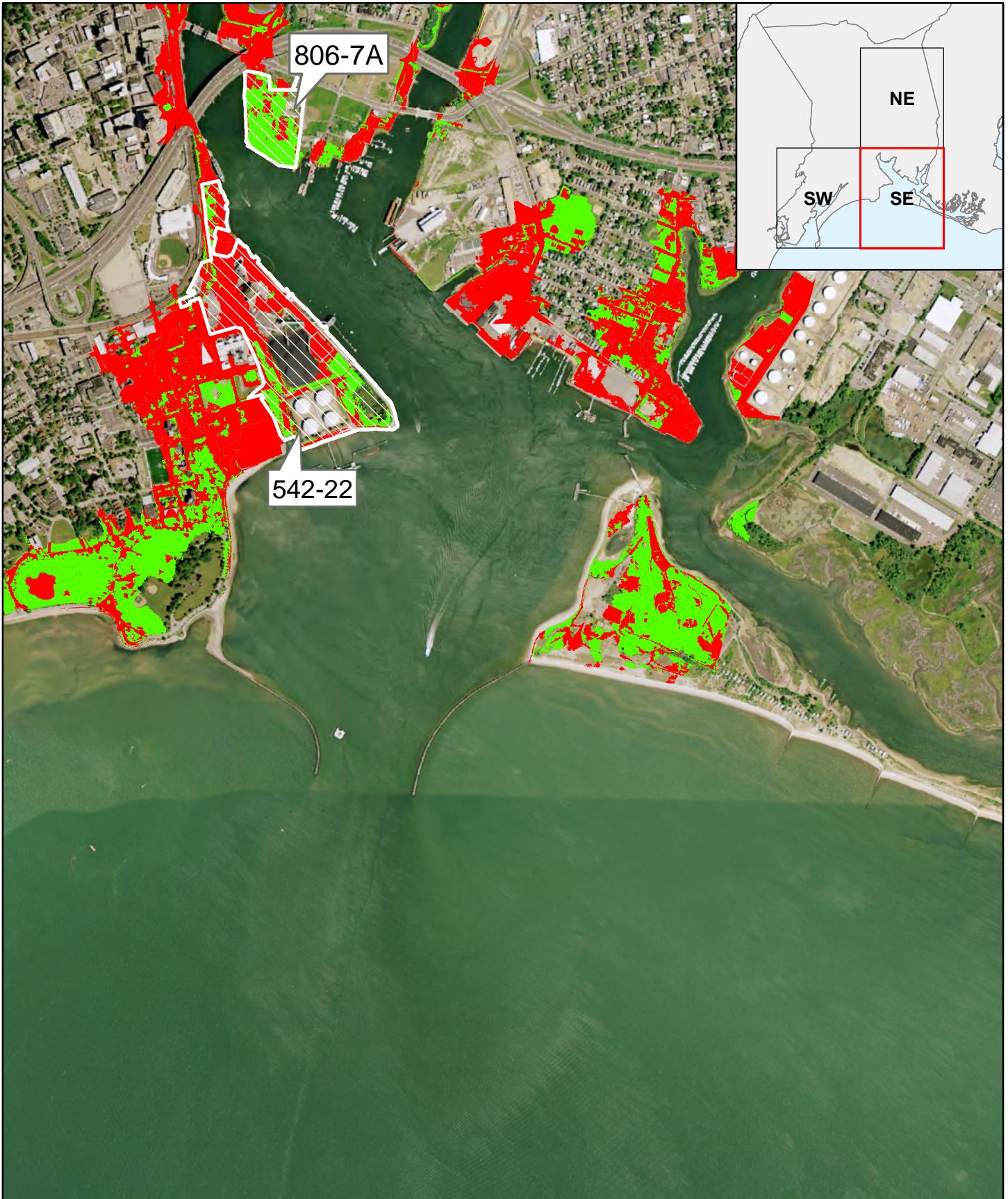
City of Bridgeport, CT

Unprotected Parcels - SE



Parcels		Marsh Advancement by 2080s	
	Unprotected Non-OS		Developed Land Cover
			Forest, Grass, Ag Land Cover

Note: Only Non-OS parcels with > 2 acres of suitable (green) advancement are outlined and labeled.



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Marsh Advancement by the 2080s

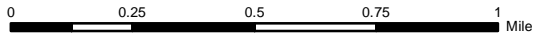
City of Bridgeport, CT

Critical Parcels - NE

Note: Only Non-OS parcels with > 2 acres of suitable advancement and OS parcels with > 1 acre of suitable advancement are shown.

Parcels

-  Protected OS
-  Unprotected Non-OS



Marsh Advancement by the 2080s

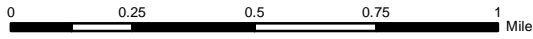
City of Bridgeport, CT

Critical Parcels - SW

Note: Only Non-OS parcels with > 2 acres of suitable advancement and OS parcels with > 1 acre of suitable advancement are shown.

Parcels

- Protected OS
- Unprotected Non-OS





Marsh Advancement by the 2080s

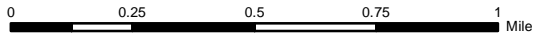
City of Bridgeport, CT

Critical Parcels - SE

Note: Only Non-OS parcels with > 2 acres of suitable advancement and OS parcels with > 1 acre of suitable advancement are shown.

Parcels

-  Protected OS
-  Unprotected Non-OS

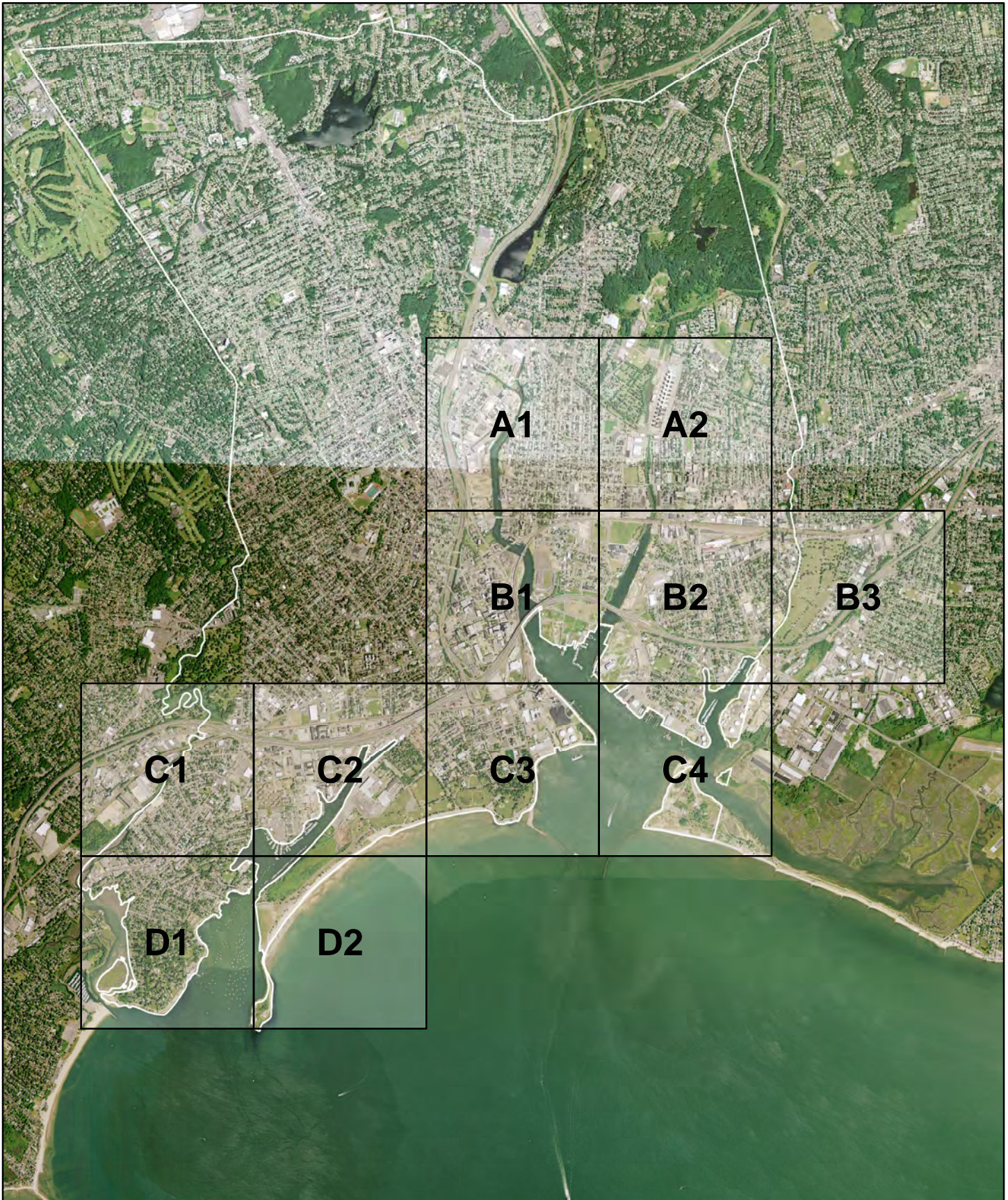


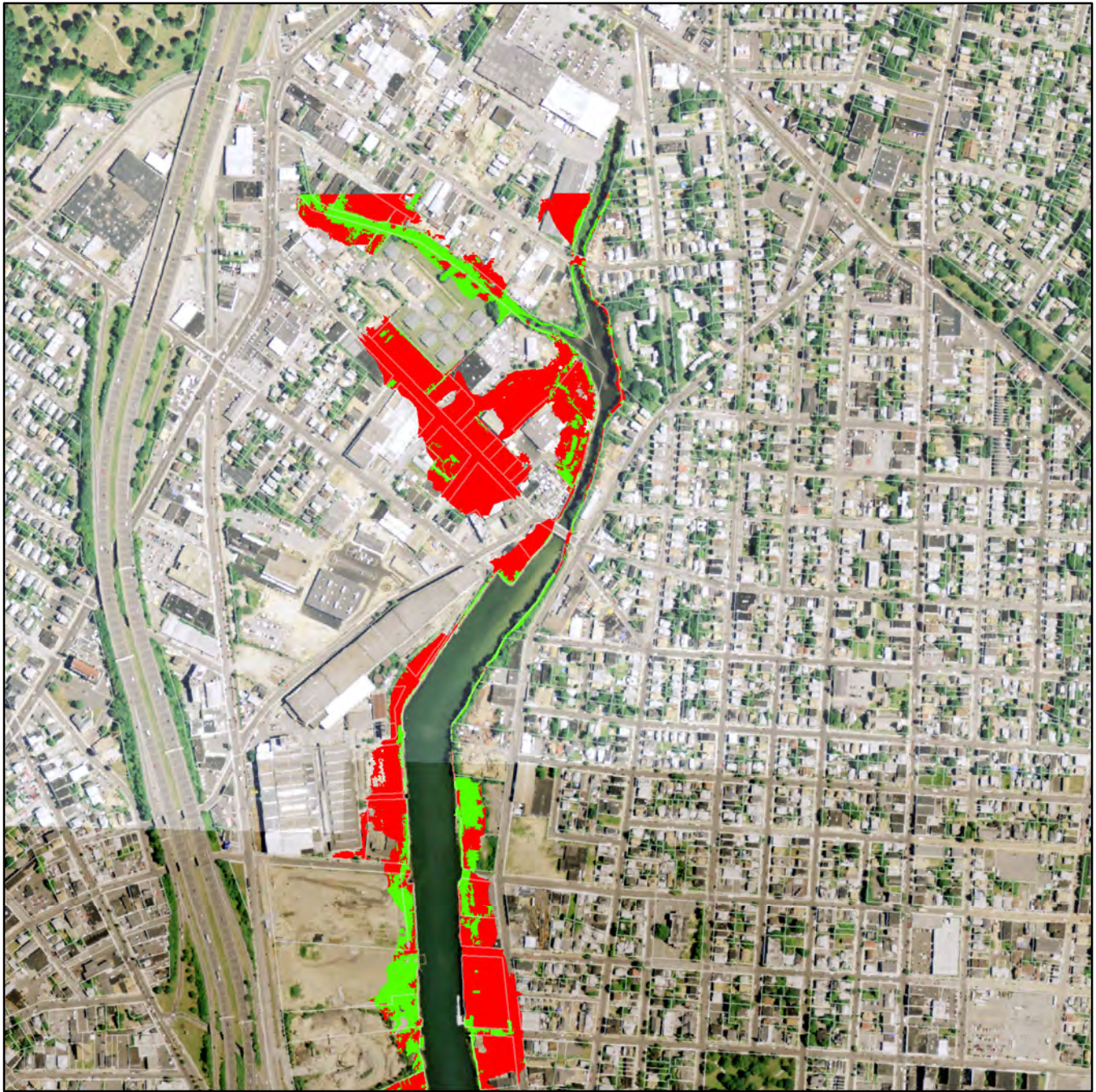
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Marsh Advancement by the 2080s

City of Bridgeport, CT

Map Index - Unprotected Parcels





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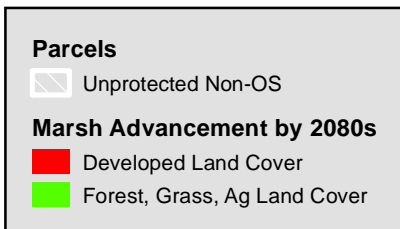
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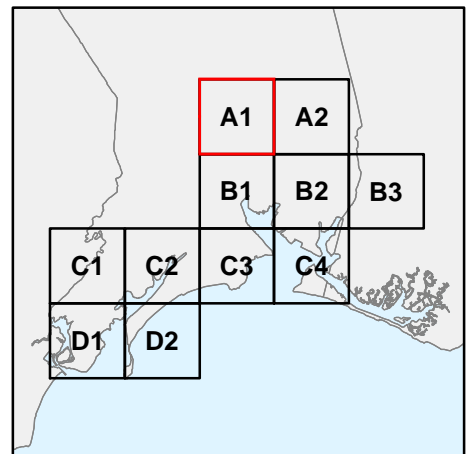
Marsh Advancement by the 2080s

City of Bridgeport, CT

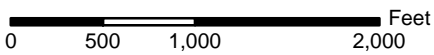
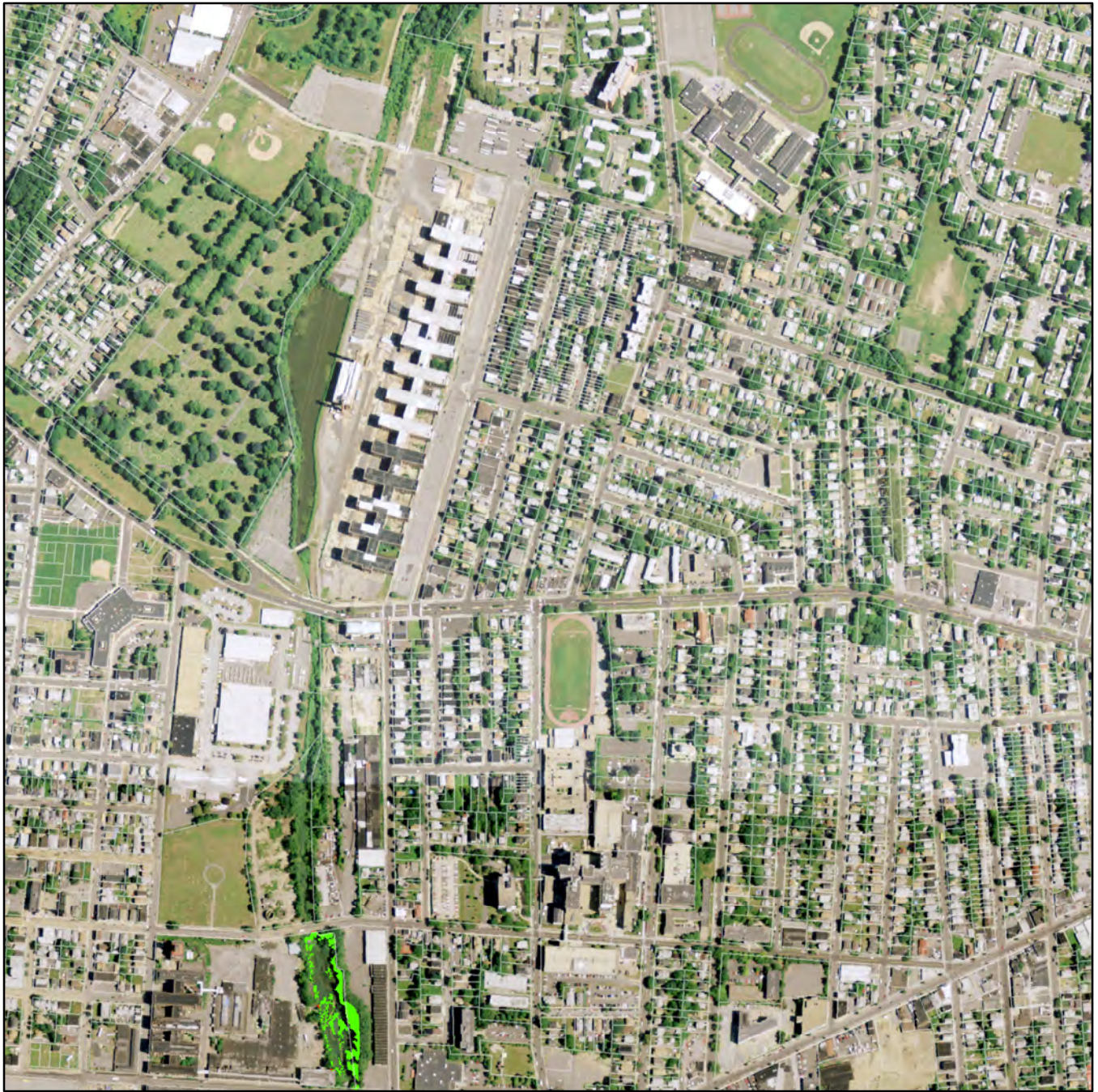
Unprotected Parcels - Map A1



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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Marsh Advancement by the 2080s

City of Bridgeport, CT

Unprotected Parcels - Map A2

Parcels

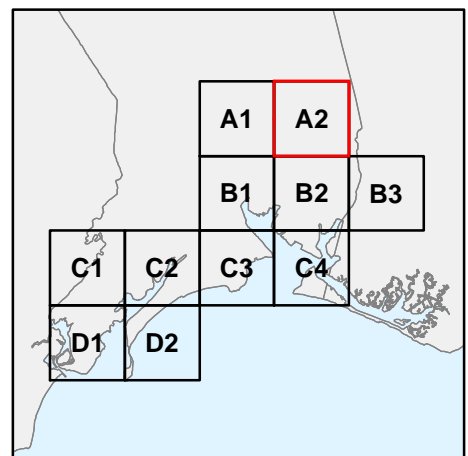
- Unprotected Non-OS

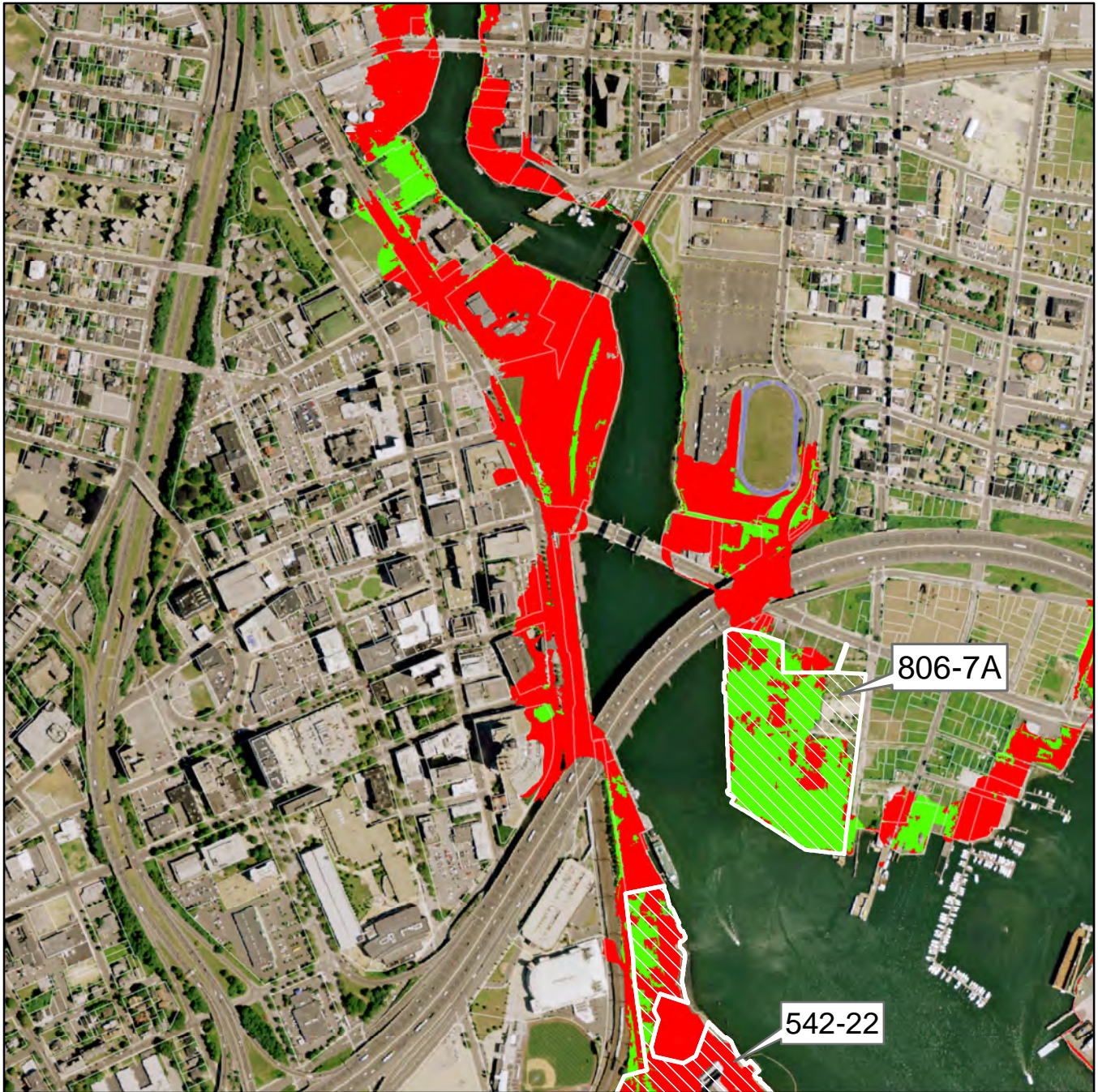
Marsh Advancement by 2080s

- Developed Land Cover
- Forest, Grass, Ag Land Cover

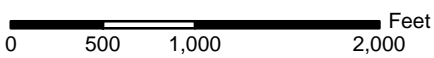


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





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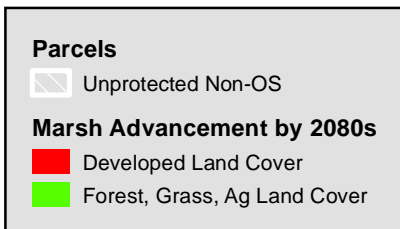


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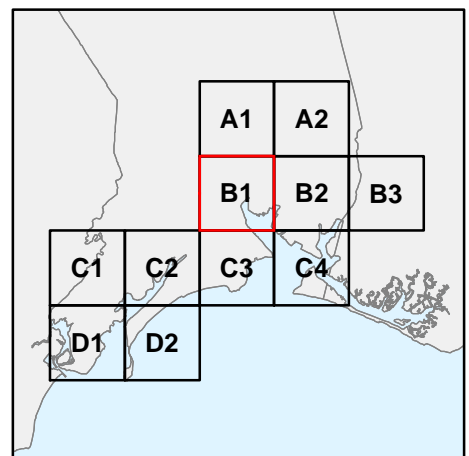
Marsh Advancement by the 2080s

City of Bridgeport, CT

Unprotected Parcels - Map B1

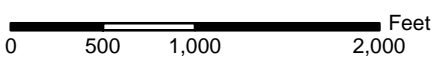
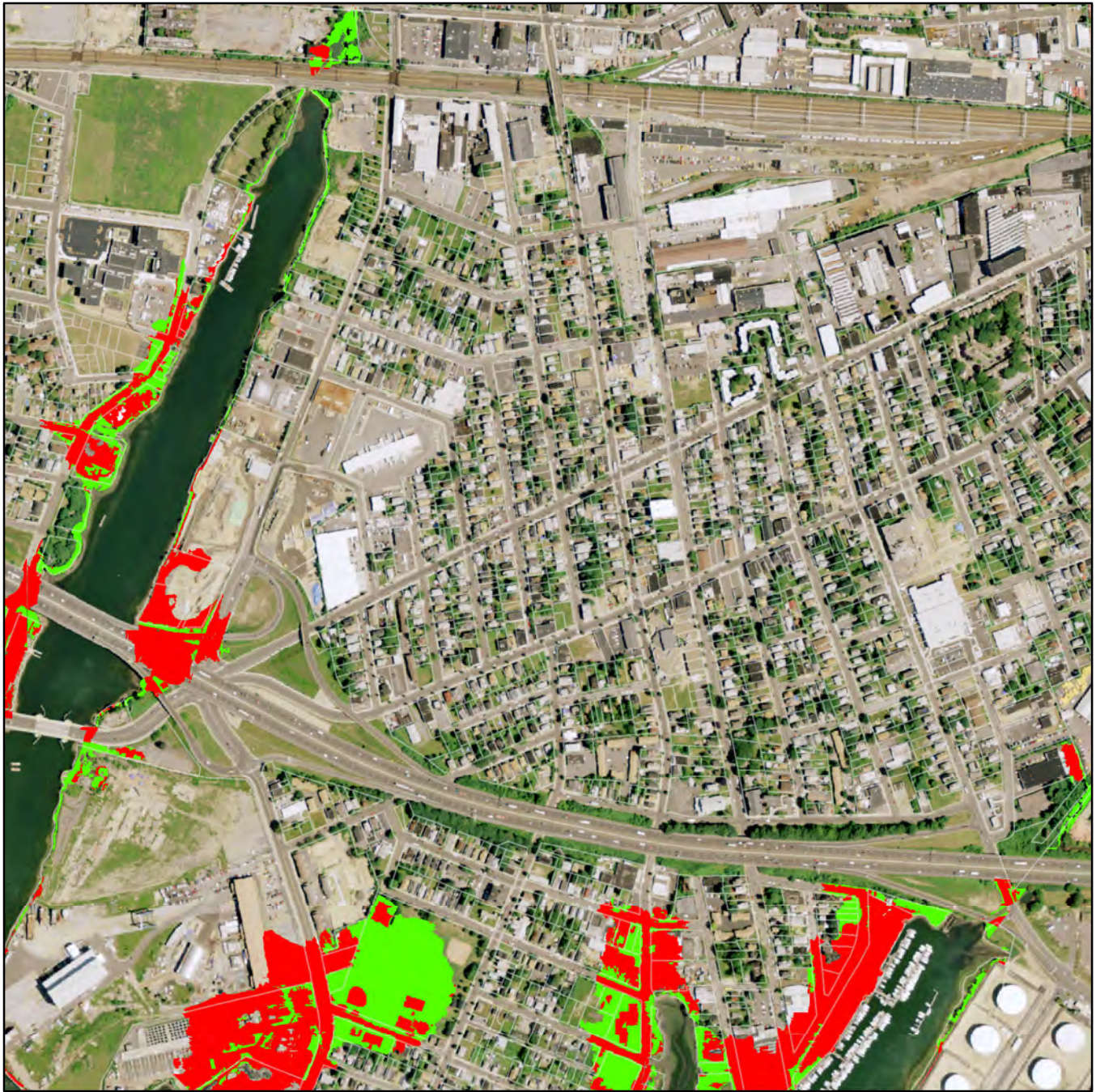


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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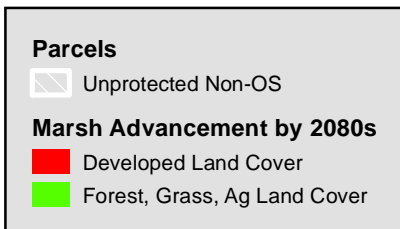


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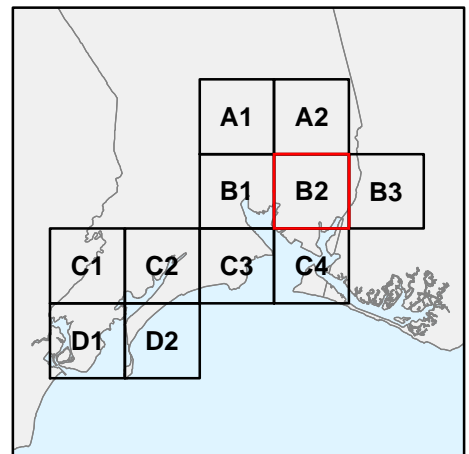
Marsh Advancement by the 2080s

City of Bridgeport, CT

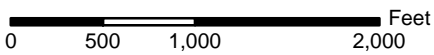
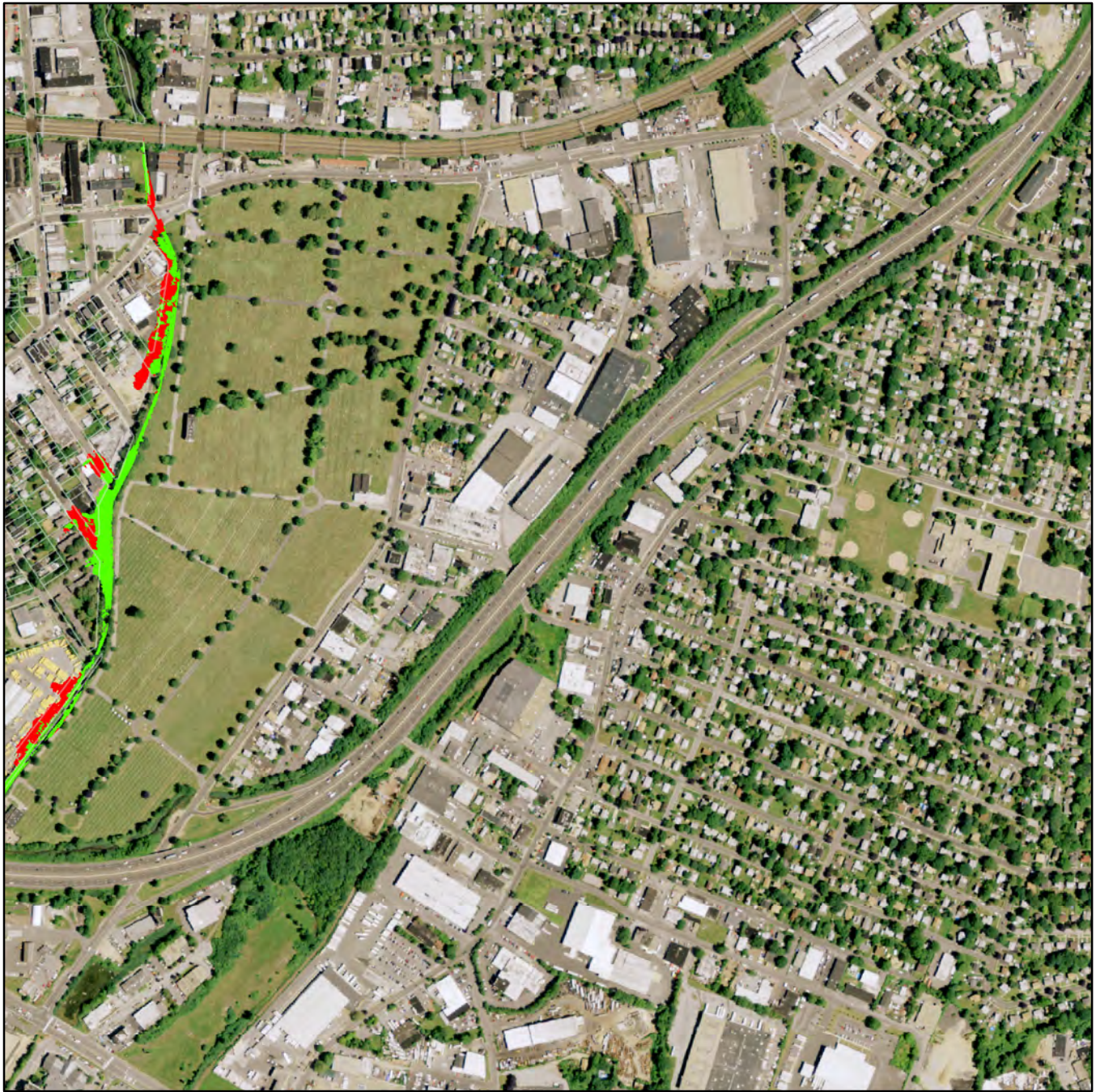
Unprotected Parcels - Map B2



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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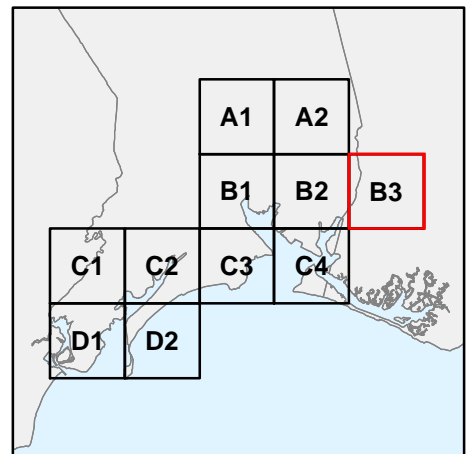
Marsh Advancement by the 2080s

City of Bridgeport, CT

Unprotected Parcels - Map B3



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





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Marsh Advancement by the 2080s

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Unprotected Parcels - Map C1

Parcels

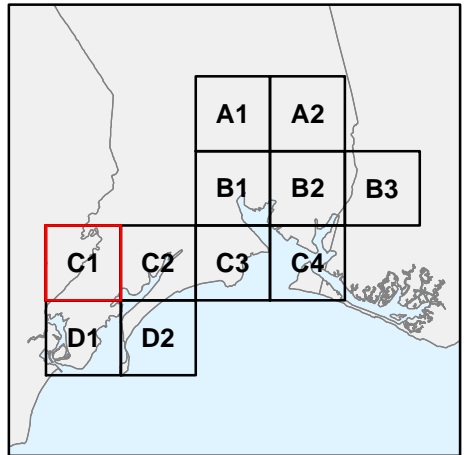
- Unprotected Non-OS

Marsh Advancement by 2080s

- Developed Land Cover
- Forest, Grass, Ag Land Cover

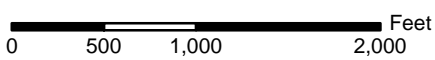
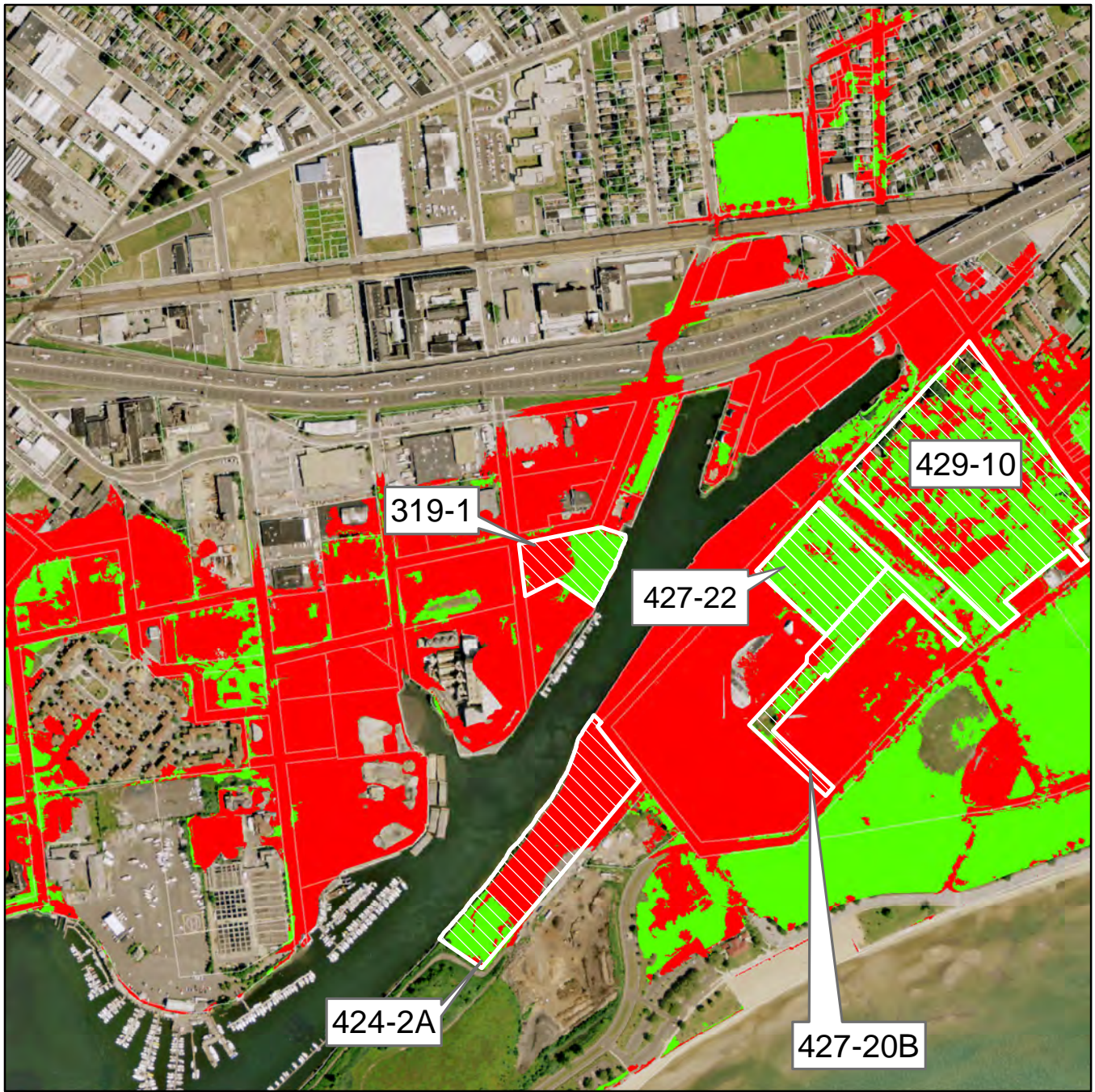


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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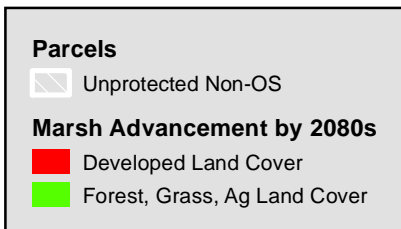


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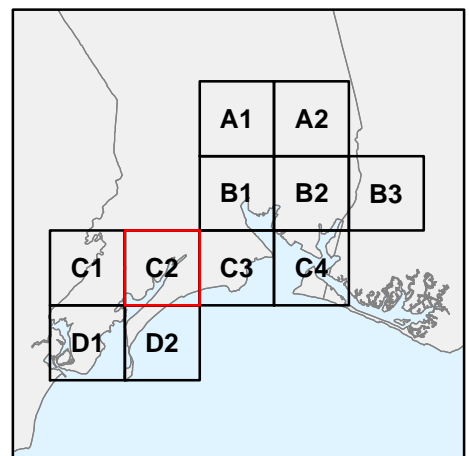
Marsh Advancement by the 2080s

City of Bridgeport, CT

Unprotected Parcels - Map C2



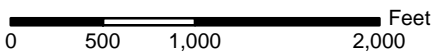
Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





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Marsh Advancement by the 2080s

City of Bridgeport, CT

Unprotected Parcels - Map C3

Parcels

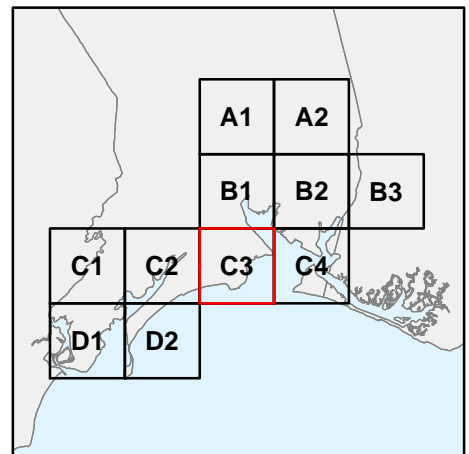
- Unprotected Non-OS

Marsh Advancement by 2080s

- Developed Land Cover
- Forest, Grass, Ag Land Cover



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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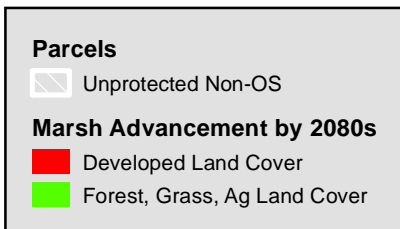


0 500 1,000 2,000 Feet

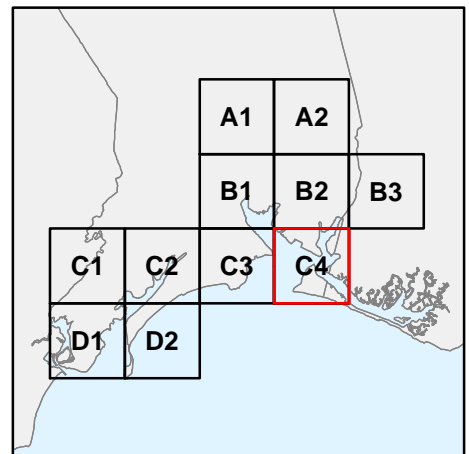
Marsh Advancement by the 2080s

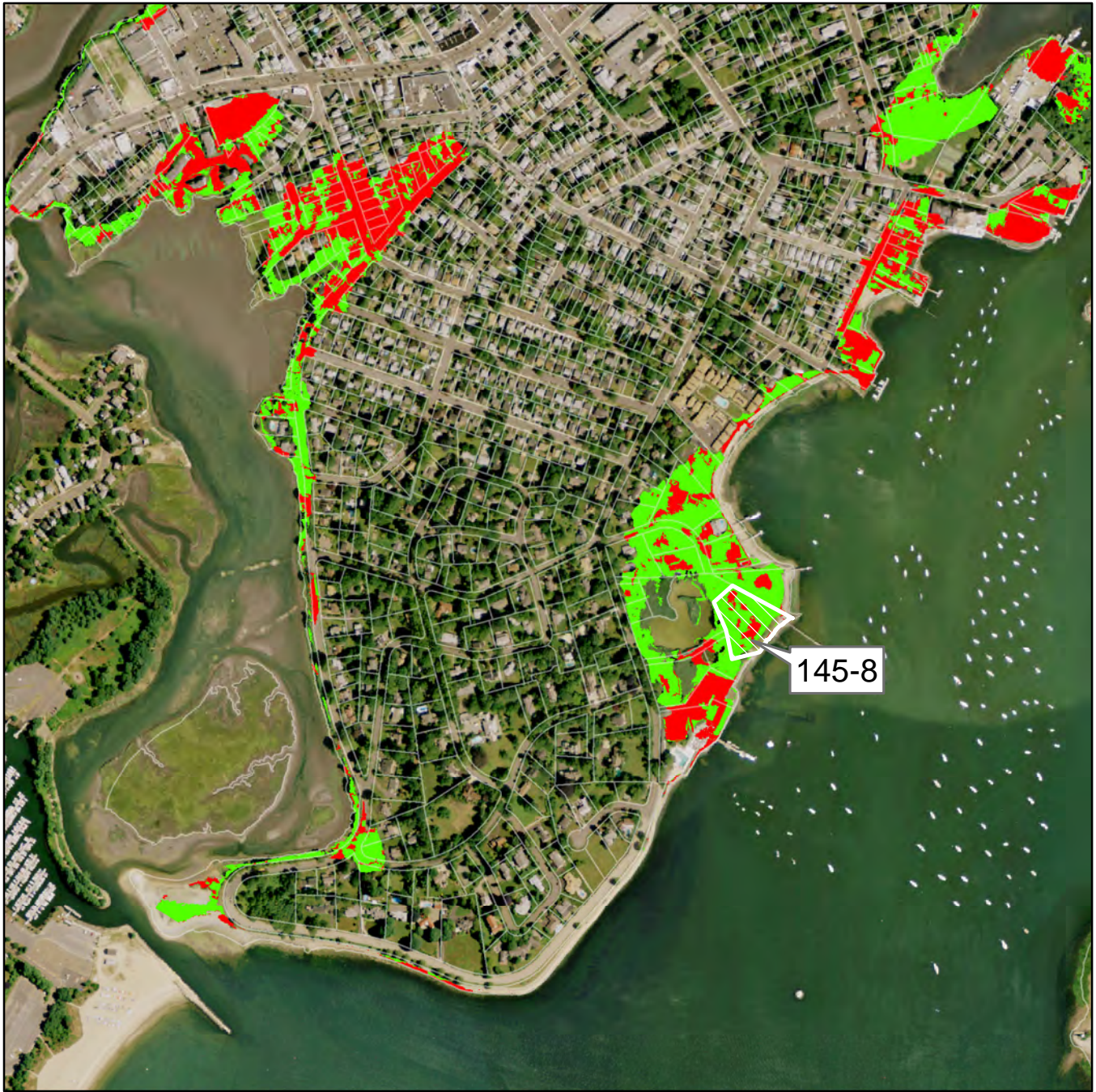
City of Bridgeport, CT

Unprotected Parcels - Map C4

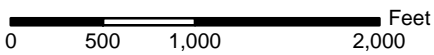


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





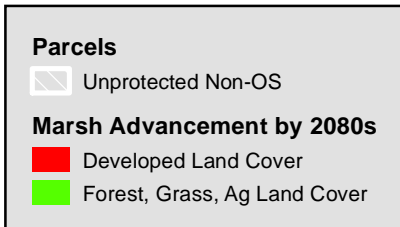
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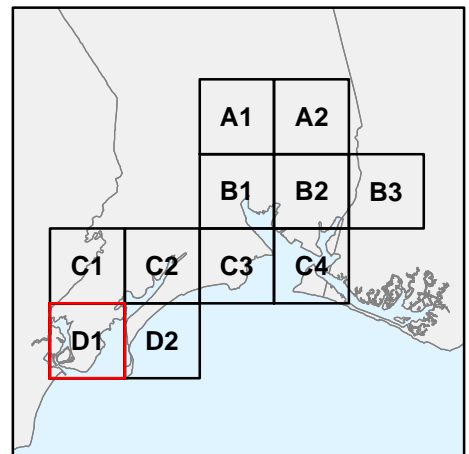
Marsh Advancement by the 2080s

City of Bridgeport, CT

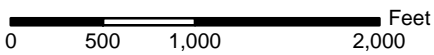
Unprotected Parcels - Map D1



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



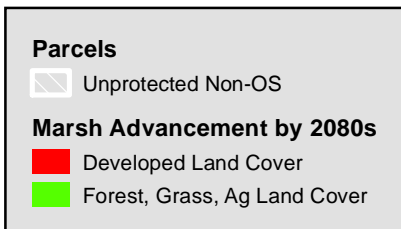
see page 25



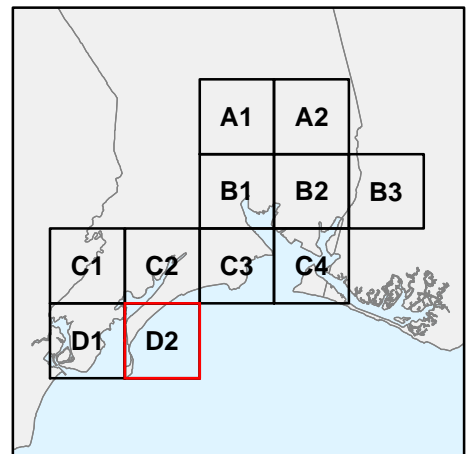
Marsh Advancement by the 2080s

City of Bridgeport, CT

Unprotected Parcels - Map D2



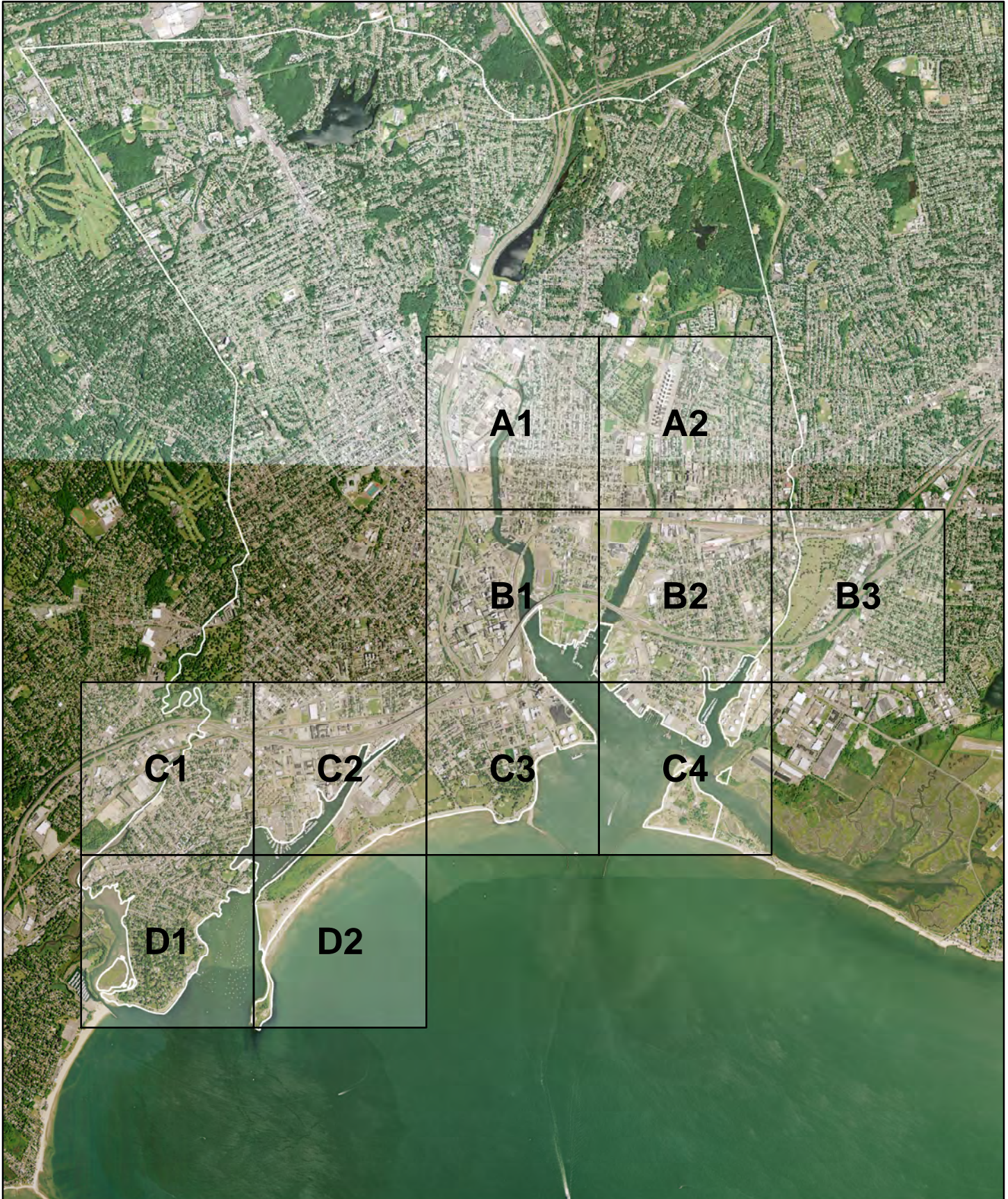
Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.

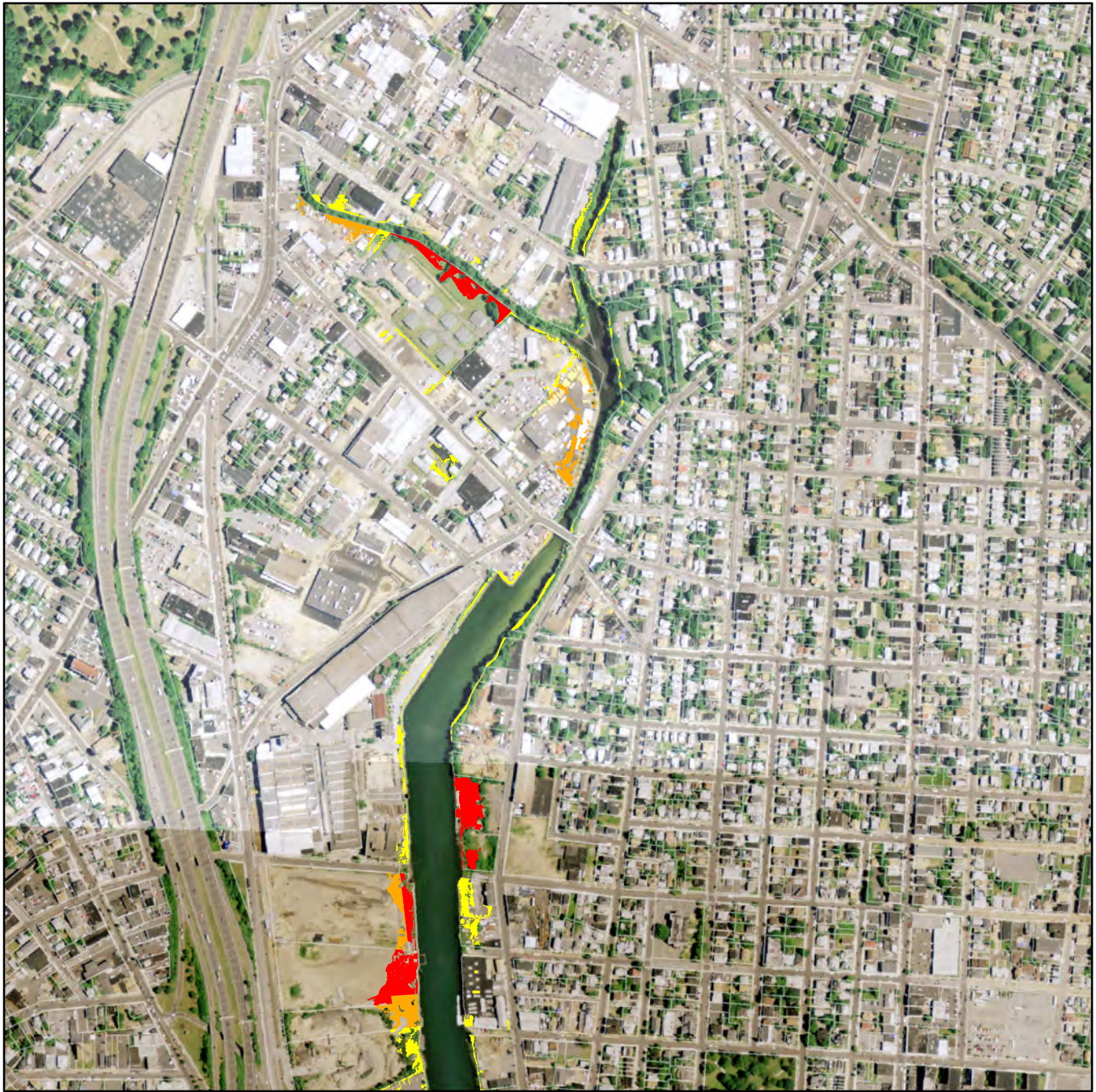


Marsh Advancement by the 2080s

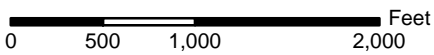
City of Bridgeport, CT

Map Index - Advancement per Parcel





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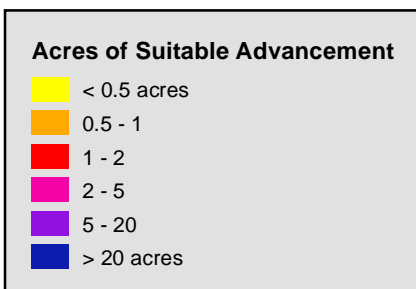


see page 30

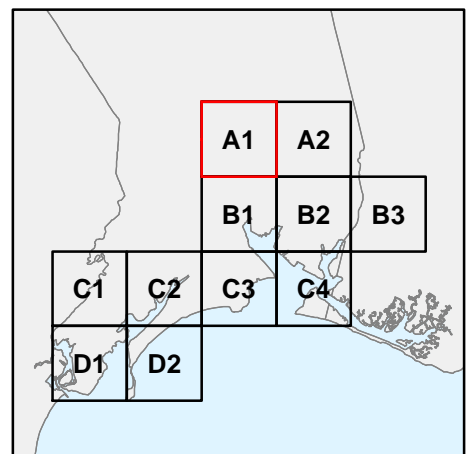
Marsh Advancement by the 2080s

City of Bridgeport, CT

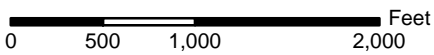
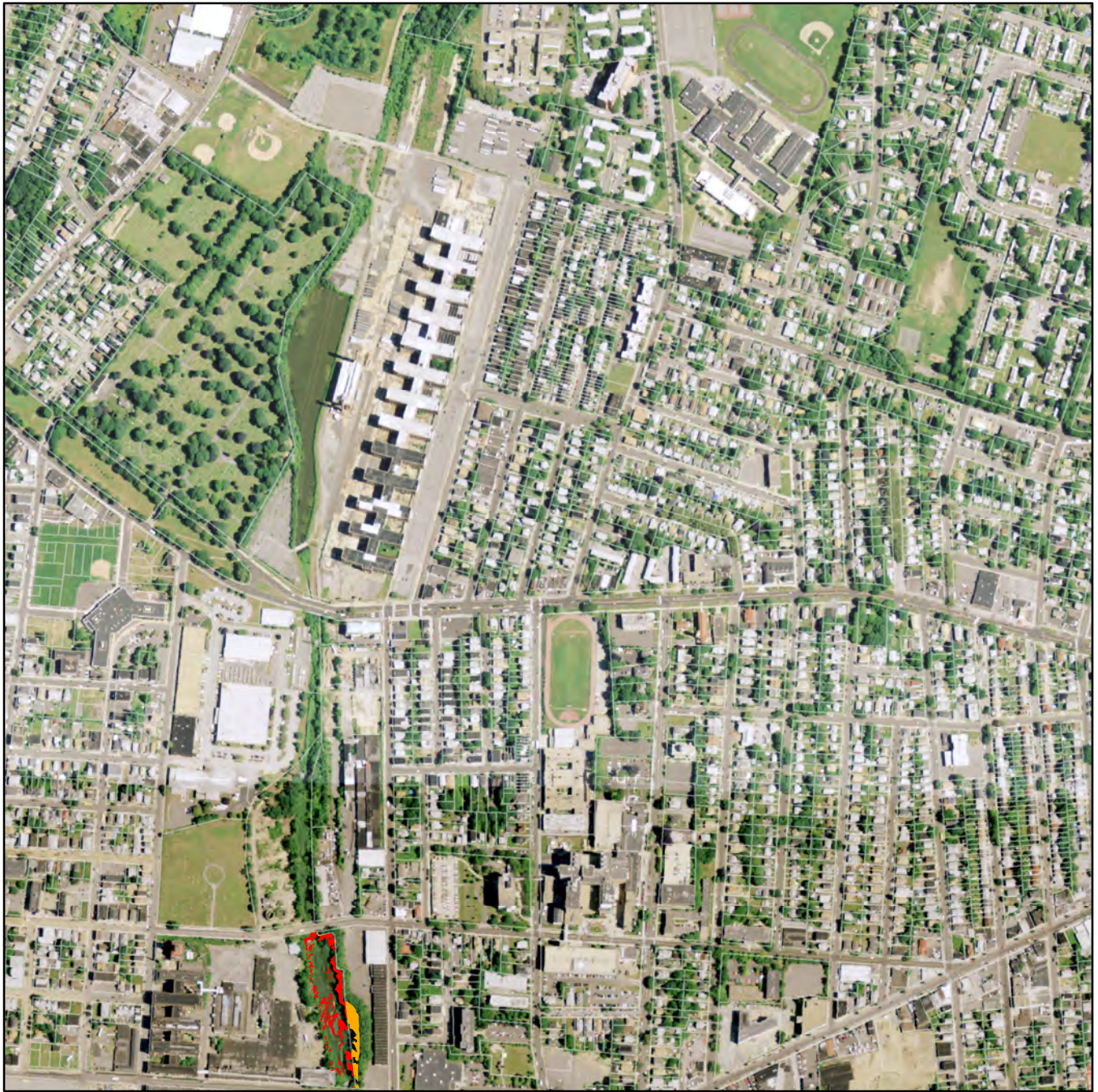
Advancement per Parcel - Map A1



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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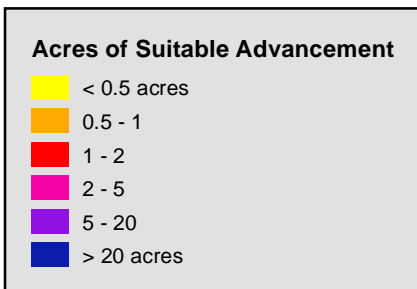


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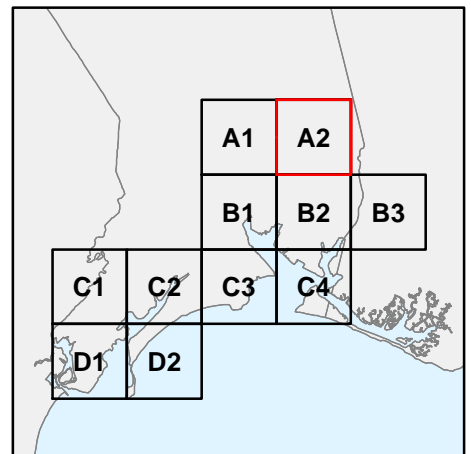
Marsh Advancement by the 2080s

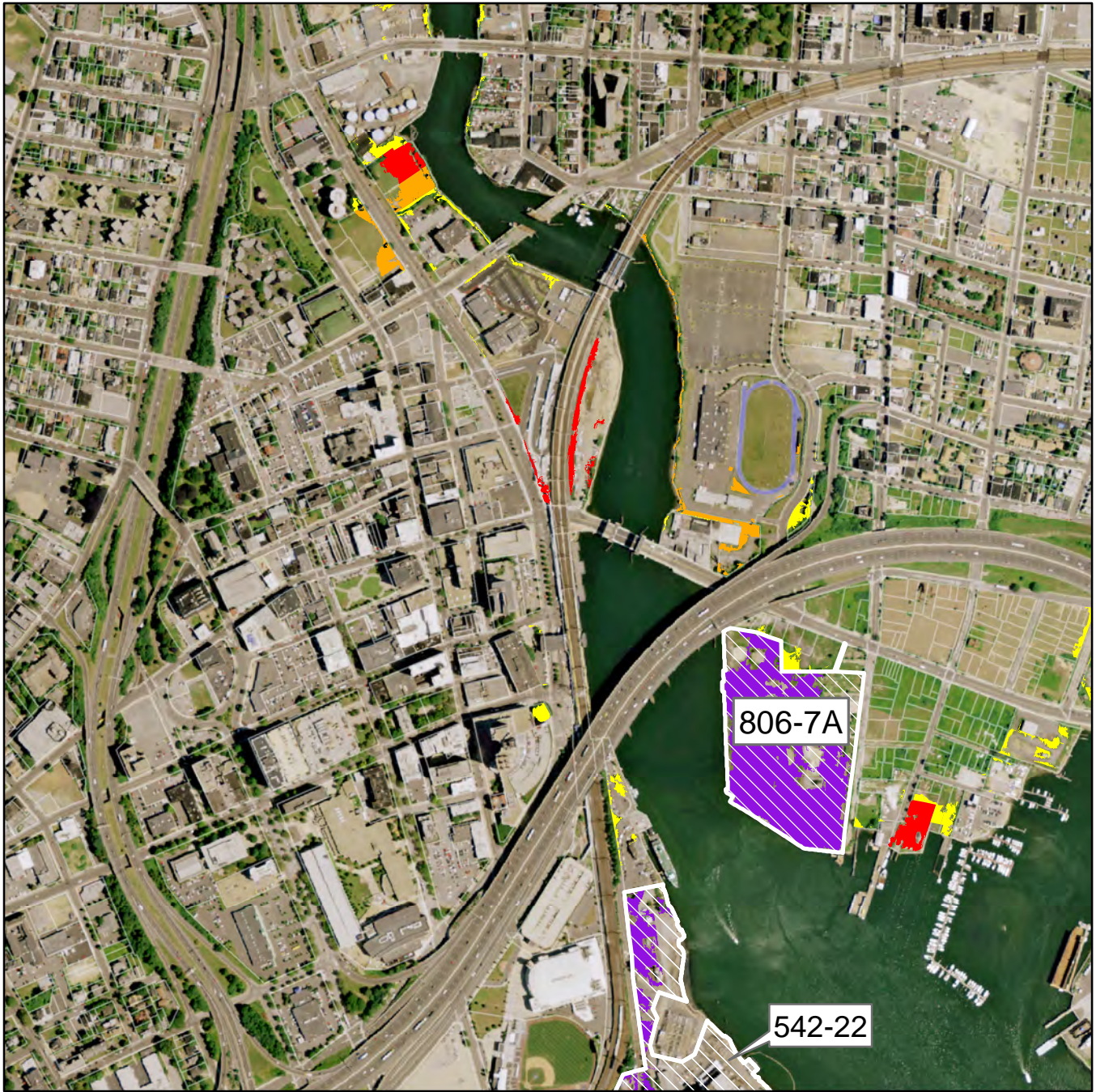
City of Bridgeport, CT

Advancement per Parcel - Map A2

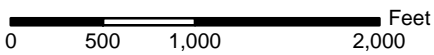


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





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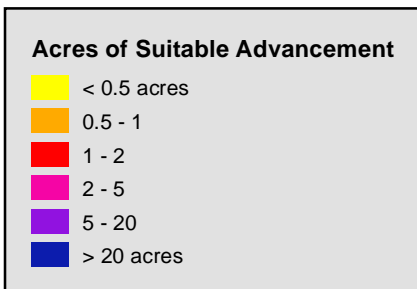


see page 35

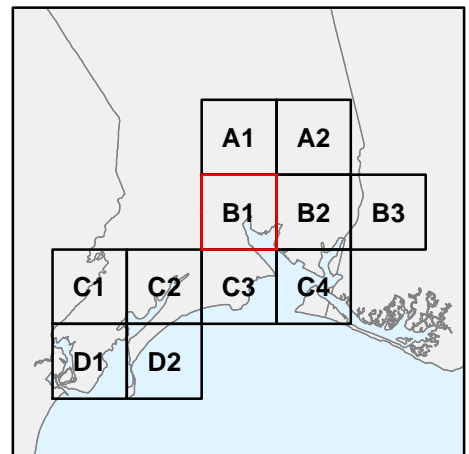
Marsh Advancement by the 2080s

City of Bridgeport, CT

Advancement per Parcel - Map B1

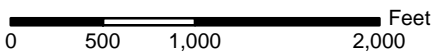
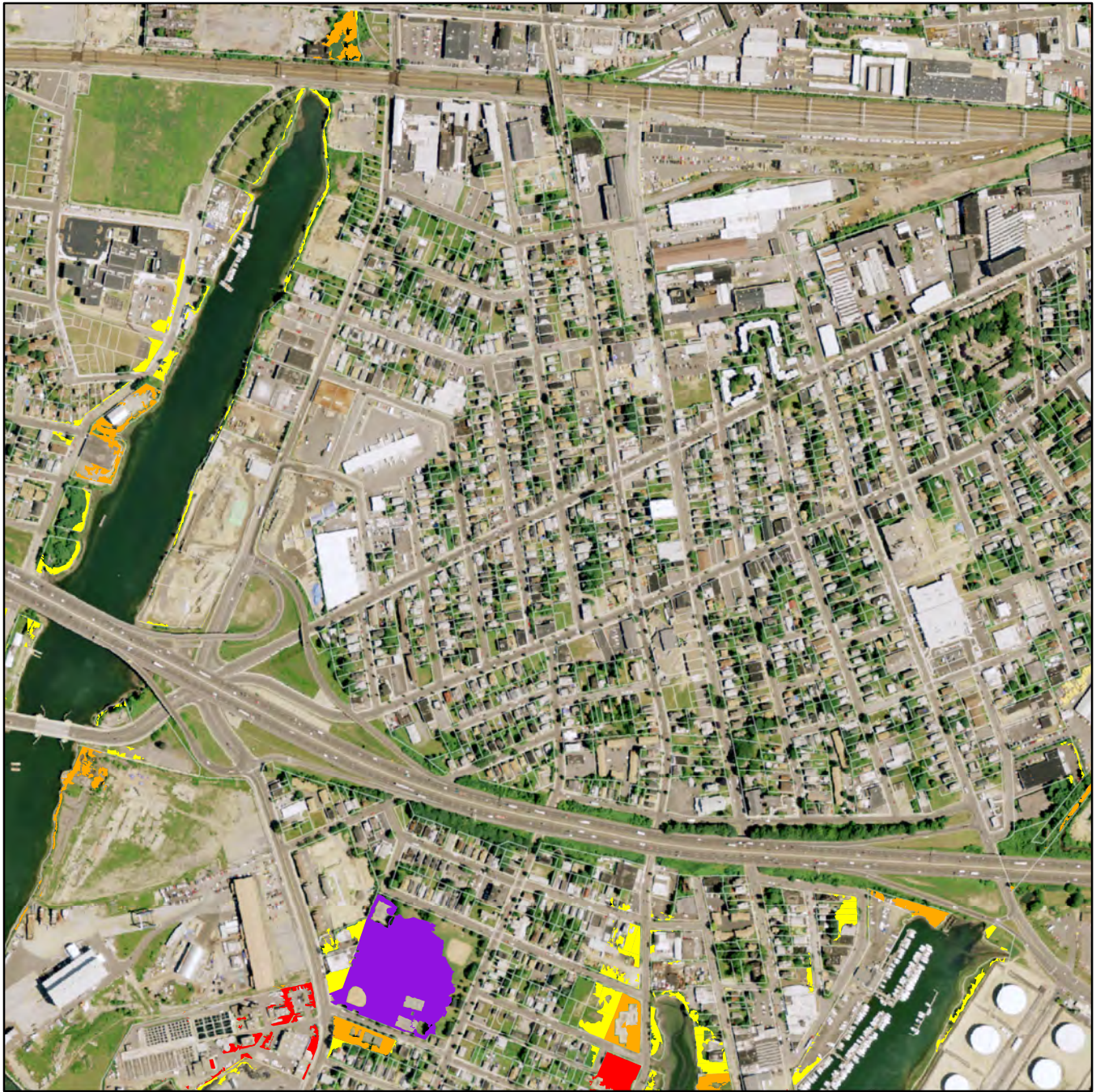


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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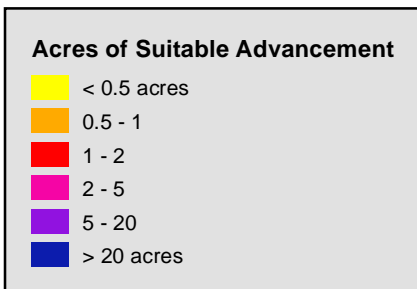


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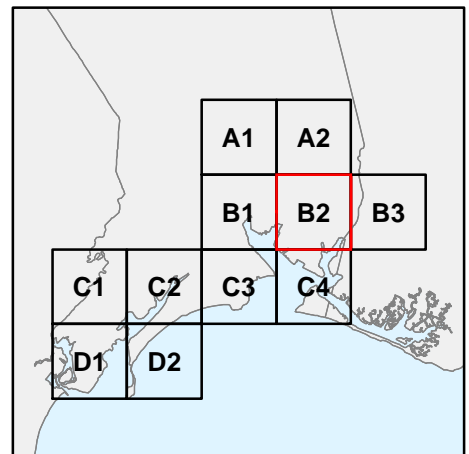
Marsh Advancement by the 2080s

City of Bridgeport, CT

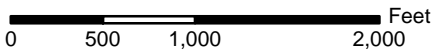
Advancement per Parcel - Map B2



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



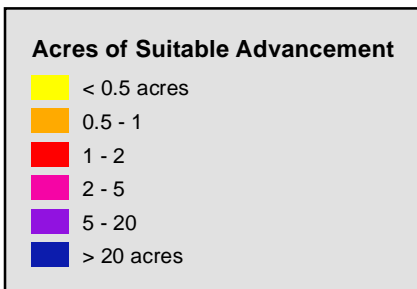
see page 31



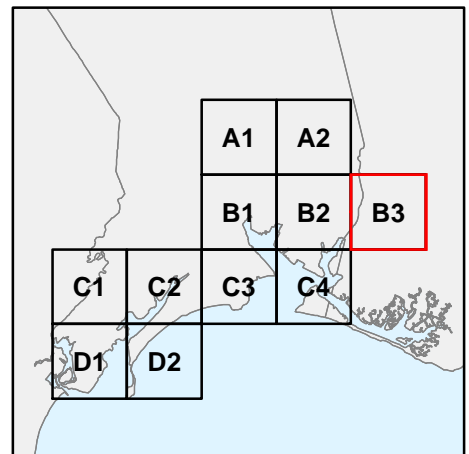
Marsh Advancement by the 2080s

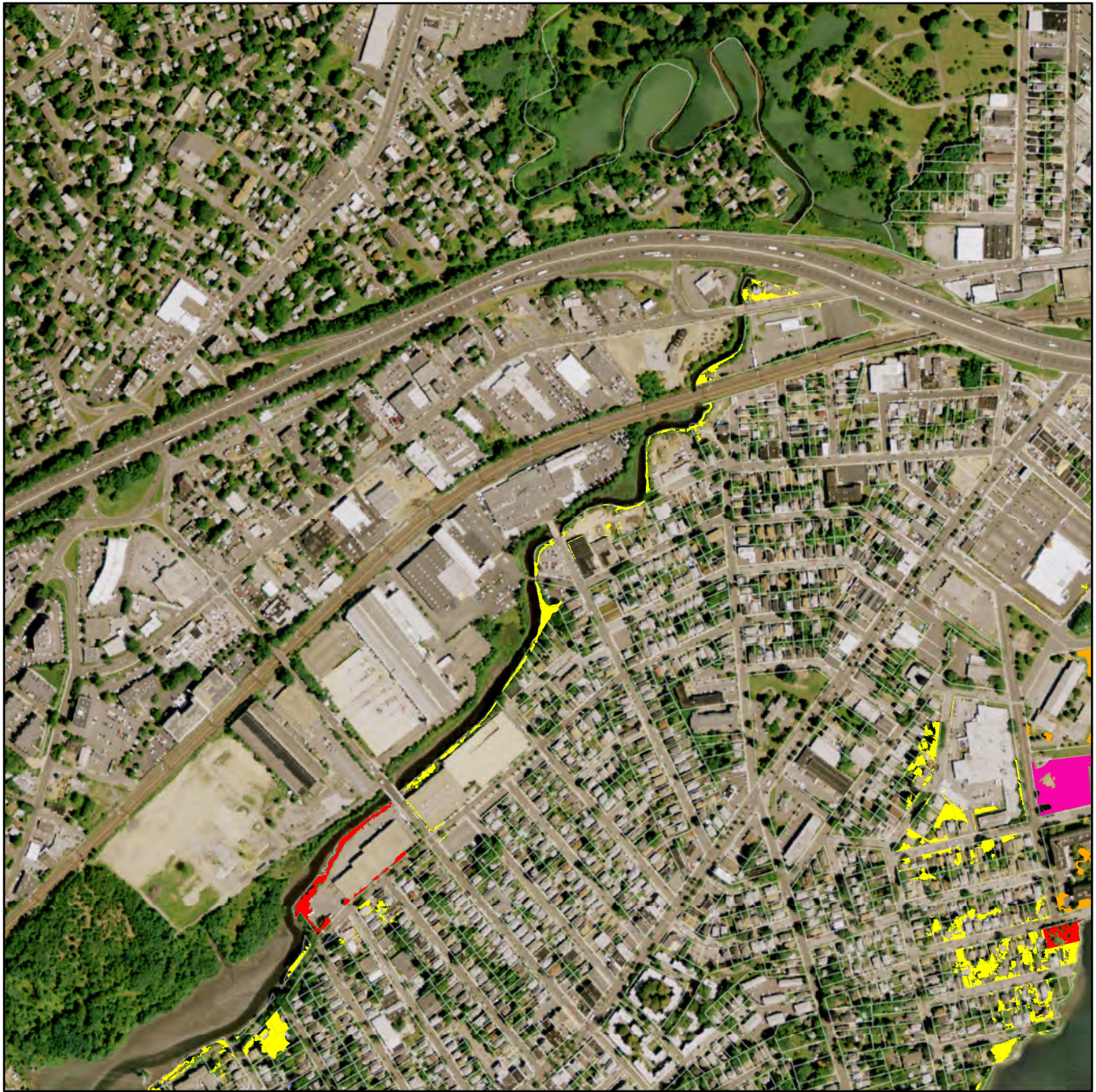
City of Bridgeport, CT

Advancement per Parcel - Map B3



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





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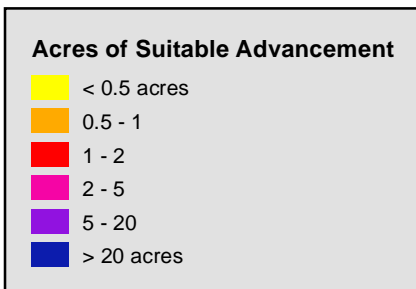
0 500 1,000 2,000 Feet

see page 37

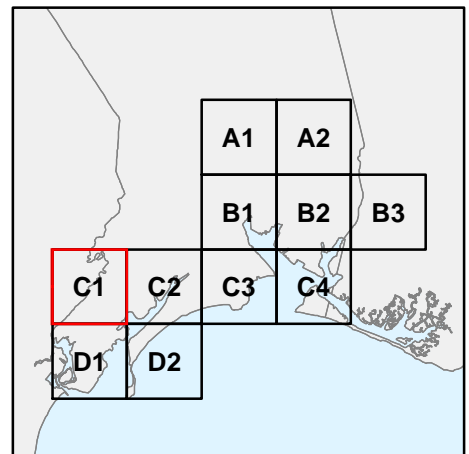
Marsh Advancement by the 2080s

City of Bridgeport, CT

Advancement per Parcel - Map C1

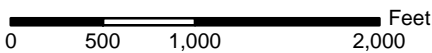


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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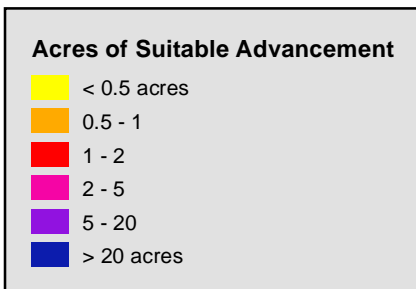


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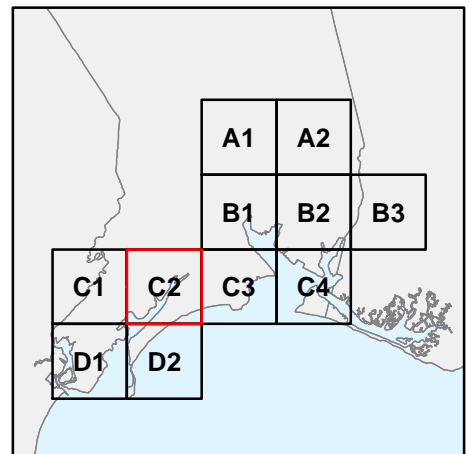
Marsh Advancement by the 2080s

City of Bridgeport, CT

Advancement per Parcel - Map C2



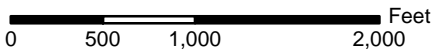
Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





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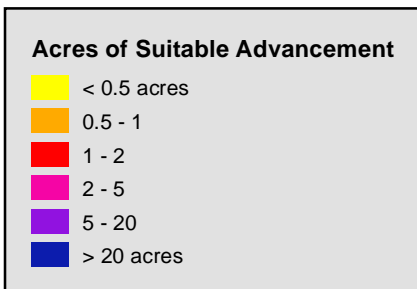
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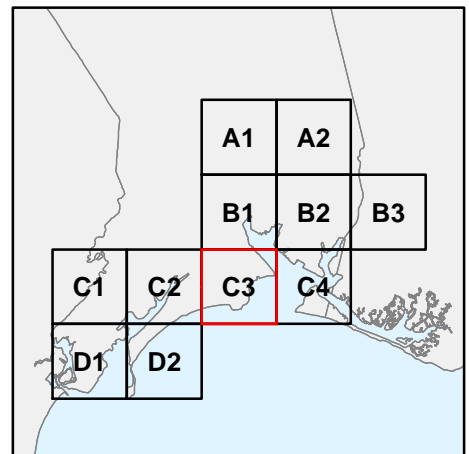
Marsh Advancement by the 2080s

City of Bridgeport, CT

Advancement per Parcel - Map C3



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



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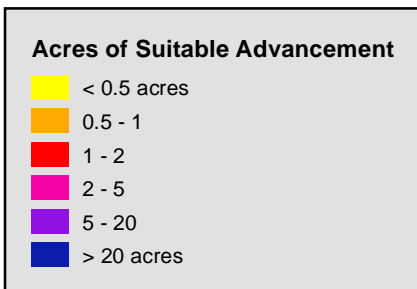


0 500 1,000 2,000 Feet

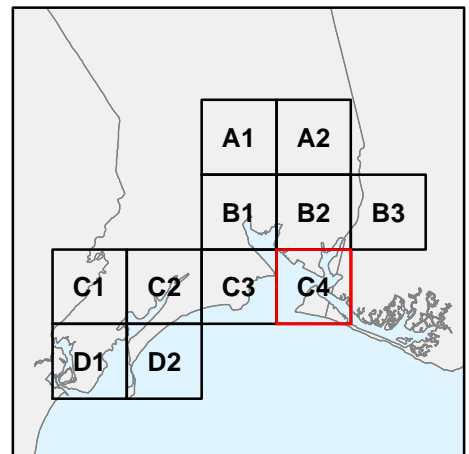
Marsh Advancement by the 2080s

City of Bridgeport, CT

Advancement per Parcel - Map C4

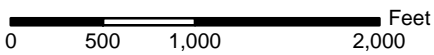


Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.





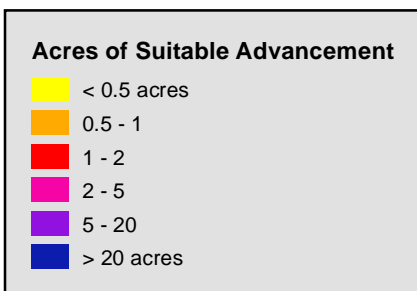
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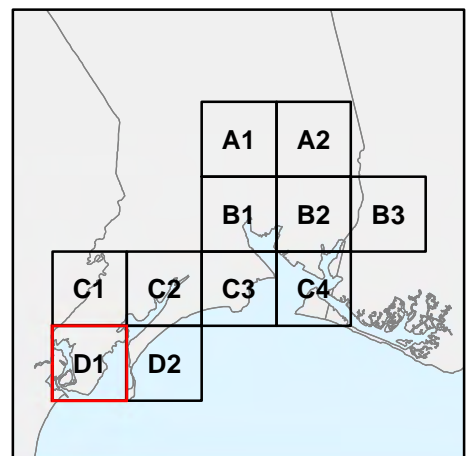
Marsh Advancement by the 2080s

City of Bridgeport, CT

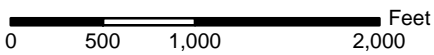
Advancement per Parcel - Map D1



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.



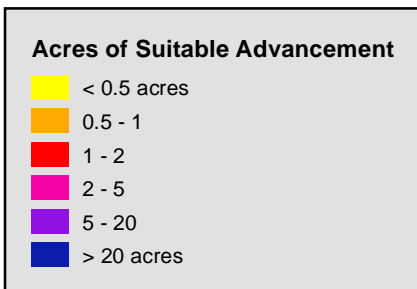
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Marsh Advancement by the 2080s

City of Bridgeport, CT

Advancement per Parcel - Map D2



Note: Only Non-OS parcels with > 2 acres of suitable advancement are shown.

