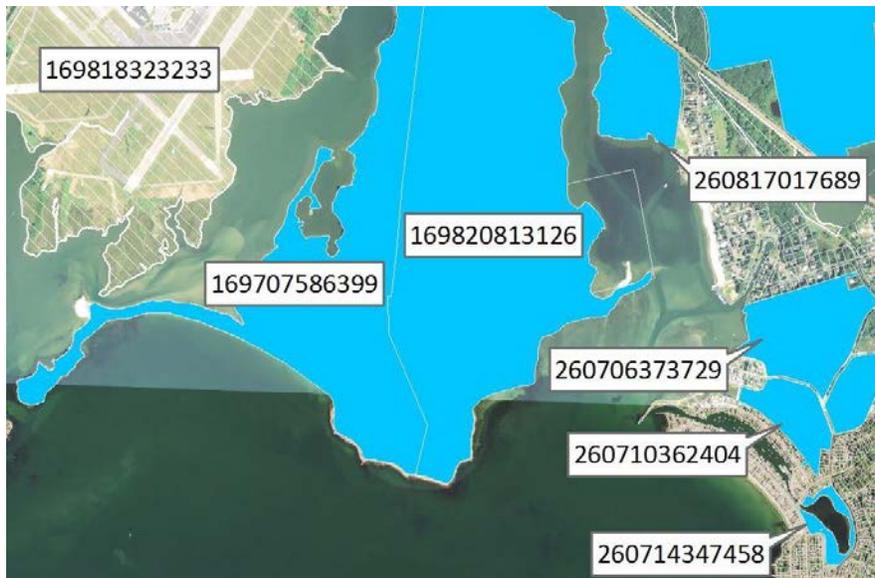


A Salt Marsh Advancement Zone Assessment of Groton, Connecticut



Front cover image: Open space and unprotected parcels critical to the conservation of marsh advancement corridors in Groton; from the accompanying Comprehensive Map Book of Groton, 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 Groton'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 Groton 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, runways, 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 Groton by the 2080s is projected to be 1,470.5 acres, with 1,172.5 acres (79.7%) having suitable (Yes) land cover for wetland advancement. The other 298.0 acres (20.3%) 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	1,172.5	79.7
No	298.0	20.3
Total	1,470.5	100.0

Marsh Advancement in Open Space Parcels

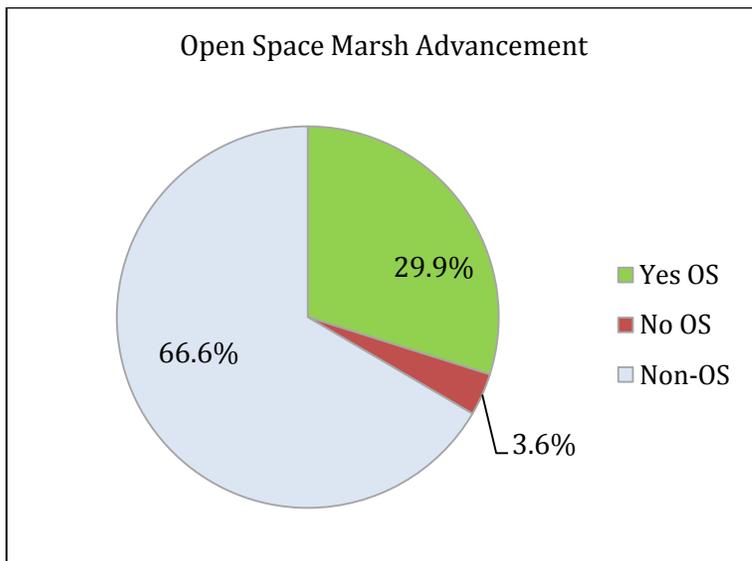
Open space (OS) properties are a critical component of long-term community resilience because they currently have little to no development and are the most likely areas to remain undeveloped through the 2080s. The recognition of the role of these parcels in future wetland extent and improved resilience in Groton 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: Areas of open space suitable for marsh advancement
- No OS: Areas of open space unsuitable for marsh advancement
- Non-OS: Unprotected areas both suitable and unsuitable for marsh advancement

Groton’s open space parcels contain 491.8 acres of total marsh advancement area with 439.2 acres (29.9% of total) having a land cover suitable for future wetlands (Yes OS). Further analysis of the 978.7 acres of unprotected parcels (Non-OS) can be found in the following “Marsh Advancement in All Parcels” section.

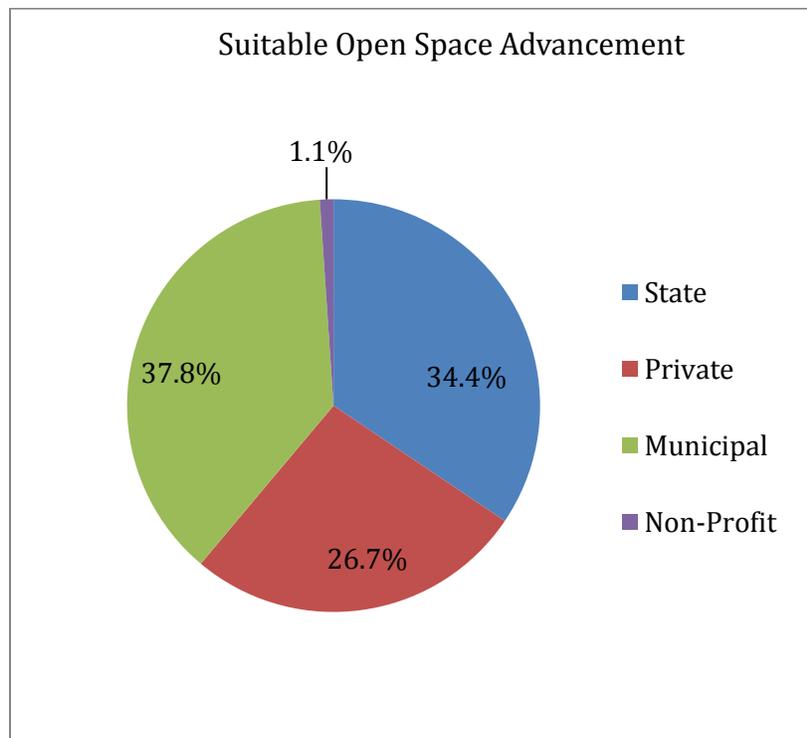


Open Space Marsh Advancement	
OS type	Acres
Yes OS	439.2
No OS	52.6
Non-OS	978.7
Total	1,470.5

Suitable Open Space Advancement by Owner

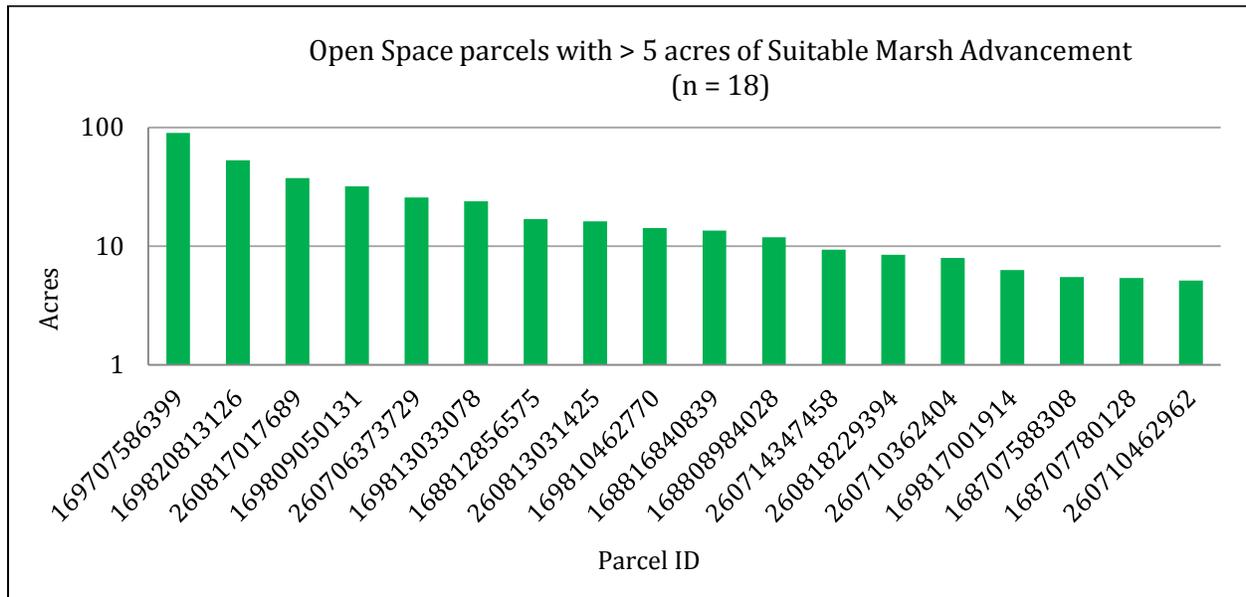
The State of Connecticut owns the greatest share of suitable open space for marsh advancement accounting for 151.2 acres (34.4%) most of which occurs on Bluff Point State Park. The Town of Groton owns 166.1 acres (37.8%) mostly occurring on designated open space properties. Private owners hold the next greatest share of suitable open space with 117.1 acres (26.7%). Non-Profit organizations own the smallest share with 4.8 acres.

Suitable Open Space Advancement			
Owner type	Acres	Total "yes" OS (%)	Total "yes" adv (%)
State	151.2	34.4	12.9
Municipal	166.1	37.8	14.2
Private	117.1	26.7	10.0
Non-Profit	4.8	1.1	0.4
Total	439.2	100.0	37.5



Suitable Advancement by Open Space Parcel

Groton has 88 open space parcels that intersect the full extent of marsh advancement by the 2080s. There are 18 open space parcels that each provides more than 5 acres of advancement area with a total aggregate of 382.2 acres (87.0%) of Groton’s suitable open space marsh advancement area. The top two open space parcels together contribute 142.7 acres (32.4%) of suitable advancement area and are both part of Bluff Point State Park.



Open Space parcels with > 5 acres Suitable Marsh Advancement				
Parcel ID	Acres	Total "yes" OS (%)	Owner	Map Book Page #
169707586399	89.8	20.4	State	12
169820813126	52.9	12.0	State	12
260817017689	37.4	8.5	Private	12
169809050131	31.8	7.2	Municipal	12
260706373729	25.7	5.9	Private	12,13
169813033078	23.9	5.4	Municipal	12
168812856575	16.9	3.8	Municipal	12
260813031425	16.2	3.7	Municipal	12
169810462770	14.2	3.3	Municipal	12
168816840839	13.5	3.1	Municipal	12
168808984028	11.9	2.7	Municipal	12
260714347458	9.3	2.1	Private	13
260818229394	8.4	1.9	Municipal	13
260710362404	8.0	1.8	Private	12
169817001914	6.3	1.5	Private	12
168707588308	5.5	1.3	Municipal	12
168707780128	5.4	1.2	Private	12
260710462962	5.1	1.2	Private	13
Total	382.2	87.0		

Marsh Advancement in All Parcels

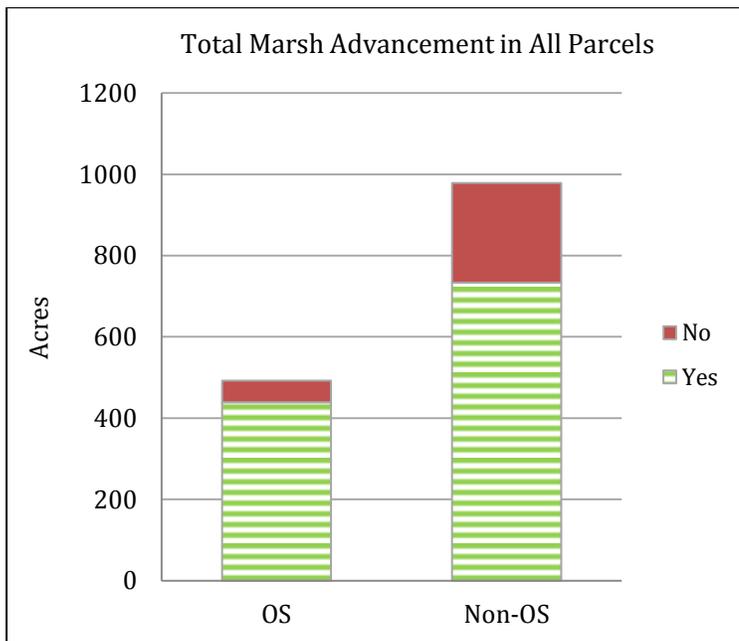
This section incorporates all parcels into the analysis of suitable marsh advancement. These results help put the open space analysis into perspective, as well as identify important unprotected parcels in Groton’s marsh advancement landscape.

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

Groton’s open space parcels are made up of state land, parks and recreation properties, cemeteries, conservation non-profit properties, public schools, subdivision open space set-asides, and other private properties. 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

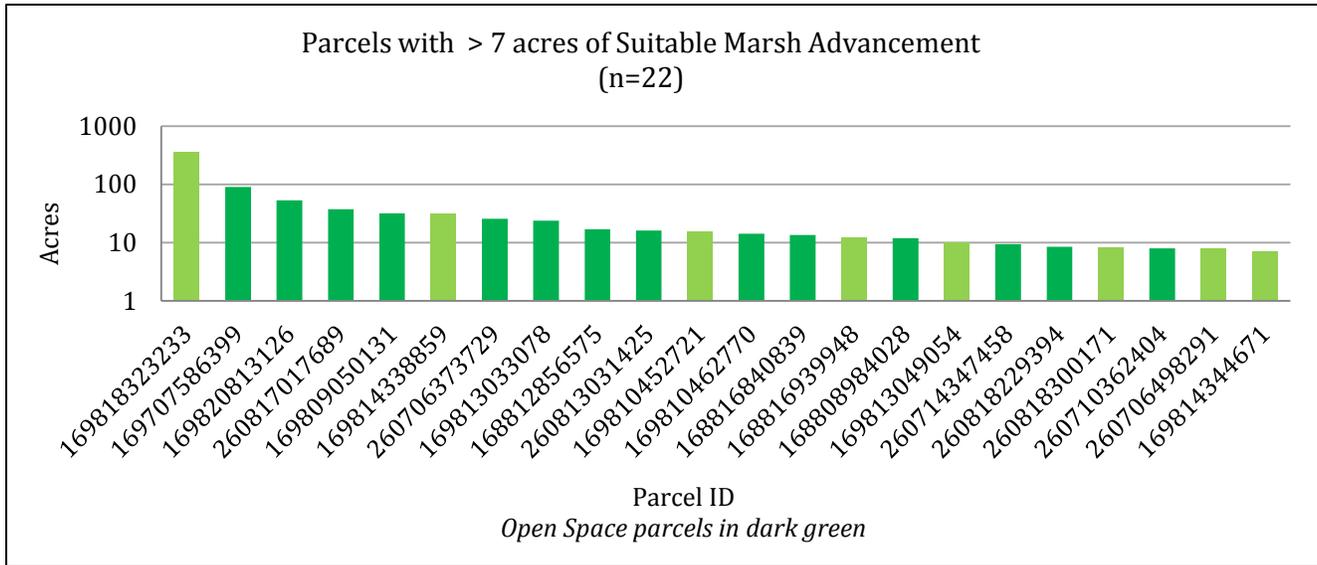
Open space parcels contain 439.2 acres (37.5% of total) of suitable marsh advancement zone. The other 733.3 acres of land suitable for marsh advancement (62.5% of total) are unprotected and generally occur on residential, commercial, or industrial properties. The unprotected suitable areas will receive significantly more 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 Groton’s wetland resources in the future, and 2) a large amount of current development (245.3 acres) will be in direct conflict with rising sea levels and advancing marshes.



Total Marsh Advancement			
Parcel type	Yes	No	Total
OS	439.2	52.6	491.8
Non-OS	733.3	245.3	978.6
Total	1,172.5	297.9	1,470.5

Suitable Advancement by All Parcels

There are 1,404 parcels in Groton that provide areas of suitable marsh advancement, but only 22 parcels offer suitable areas greater than 7 acres. This small subset provides 811.8 acres of marsh advancement zone or 69.3% of Groton’s overall total. The specific parcels can be viewed via the corresponding Map Book pages (Appendix) indicated in the table below.



Parcel ID	Acres	Total yes adv (%)	Map Book Page #
169818323233	360.0	30.7	8,12,20,24,36
169707586399	89.8	7.7	12
169820813126	52.9	4.5	12
260817017689	37.4	3.2	12
169809050131	31.8	2.7	12
169814338859	31.1	2.7	8,12,20,32
260706373729	25.7	2.2	12,13
169813033078	23.9	2.0	12
168812856575	16.9	1.4	12
260813031425	16.2	1.4	12
169810452721	15.4	1.3	8,12,20,32
169810462770	14.2	1.2	12
168816840839	13.5	1.2	12
168816939948	12.3	1.0	8,12,19,31
168808984028	11.9	1.0	12
169813049054	10.1	0.9	8,12,19,31
260714347458	9.3	0.8	13
260818229394	8.4	0.7	13
260818300171	8.1	0.7	8,12,25,37
260710362404	8.0	0.7	12
260706498291	7.8	0.7	9,13,25,37
169814344671	7.1	0.6	8,12,20,32
Total	812.0	69.2	

Appendix – Map Book

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

The Nature Conservancy

Protecting nature. Preserving life.®



Comprehensive Map Book of Groton, Connecticut



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Inset Maps

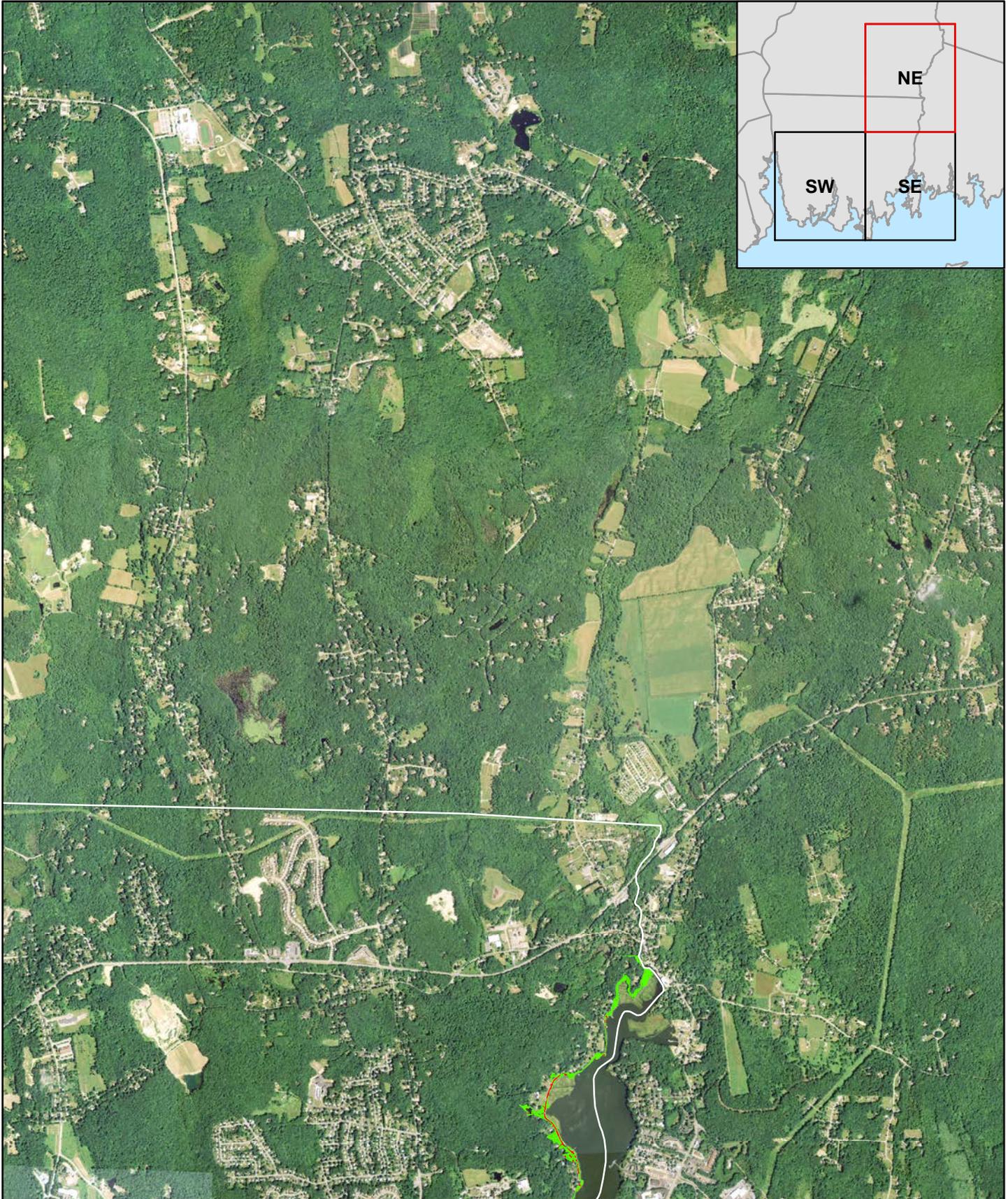
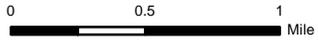
Unprotected Parcels	15
Advancement per Parcel	27

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Marsh Advancement by the 2080s

Town of Groton, CT

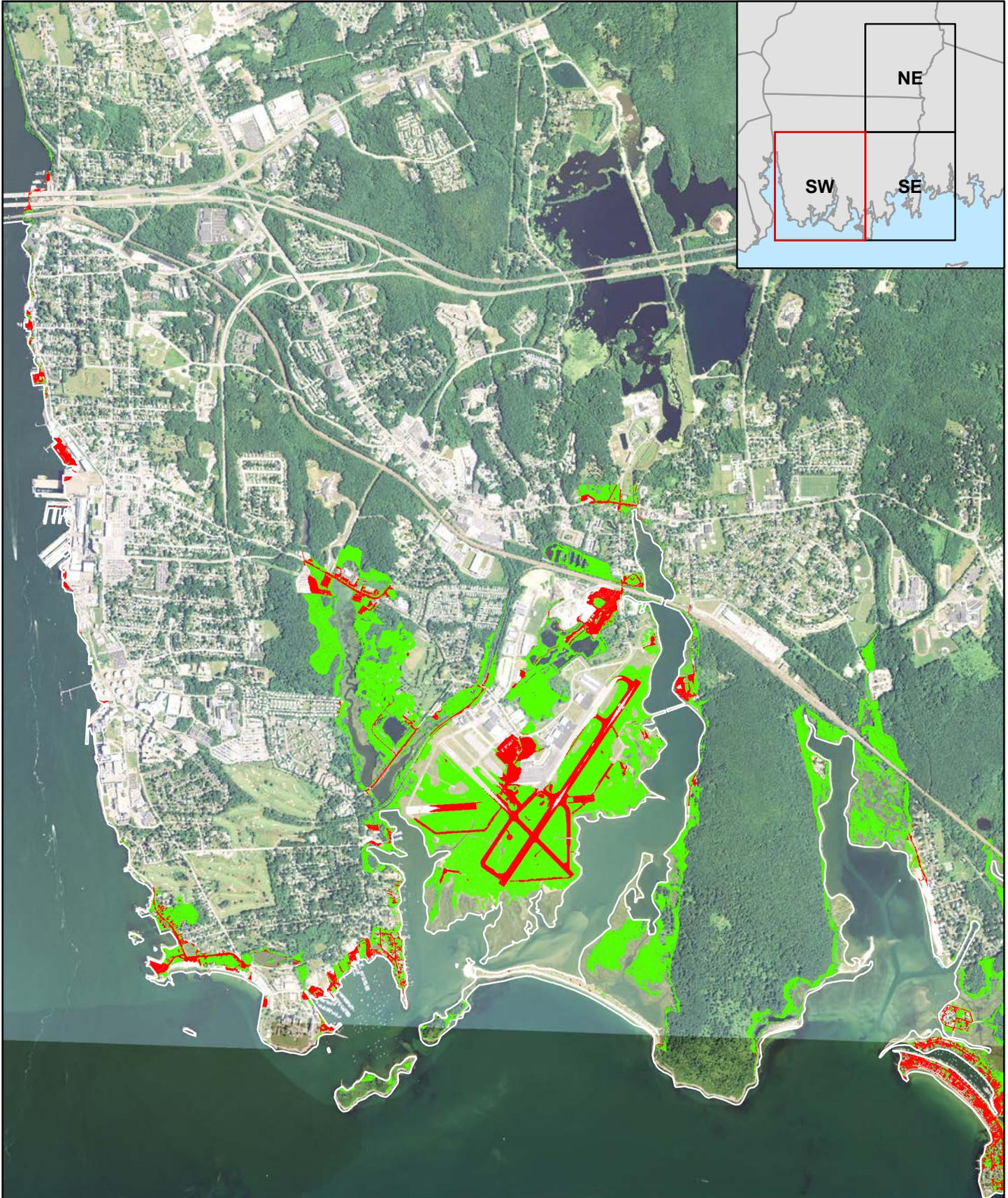
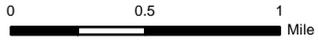
Marsh Advancement - NE



Marsh Advancement by the 2080s

Town of Groton, CT

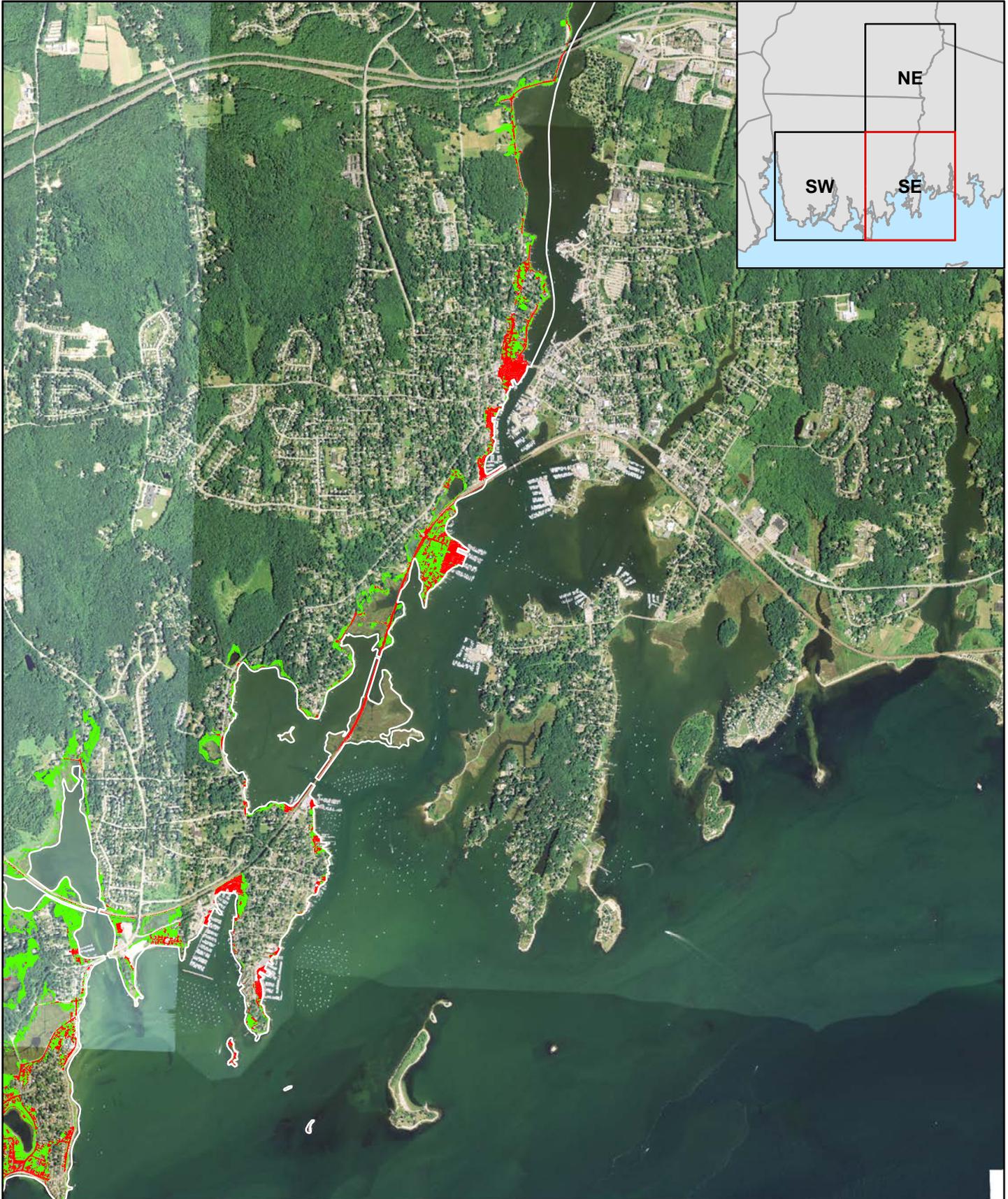
Marsh Advancement - SW



Marsh Advancement by the 2080s

Town of Groton, CT

Marsh Advancement - SE

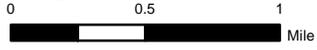


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Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - NE



Parcels

 Unprotected Non-OS

Marsh Advancement by 2080s

 Developed Land Cover

 Forest, Grass, Ag Land Cover

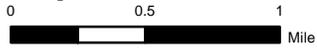
Note: Only Non-OS parcels with > 7 acres of suitable advancement are shown.



Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - SW



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

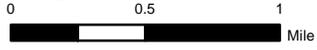
Note: Only Non-OS parcels with > 7 acres of suitable advancement are shown.



Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - SE



Parcels

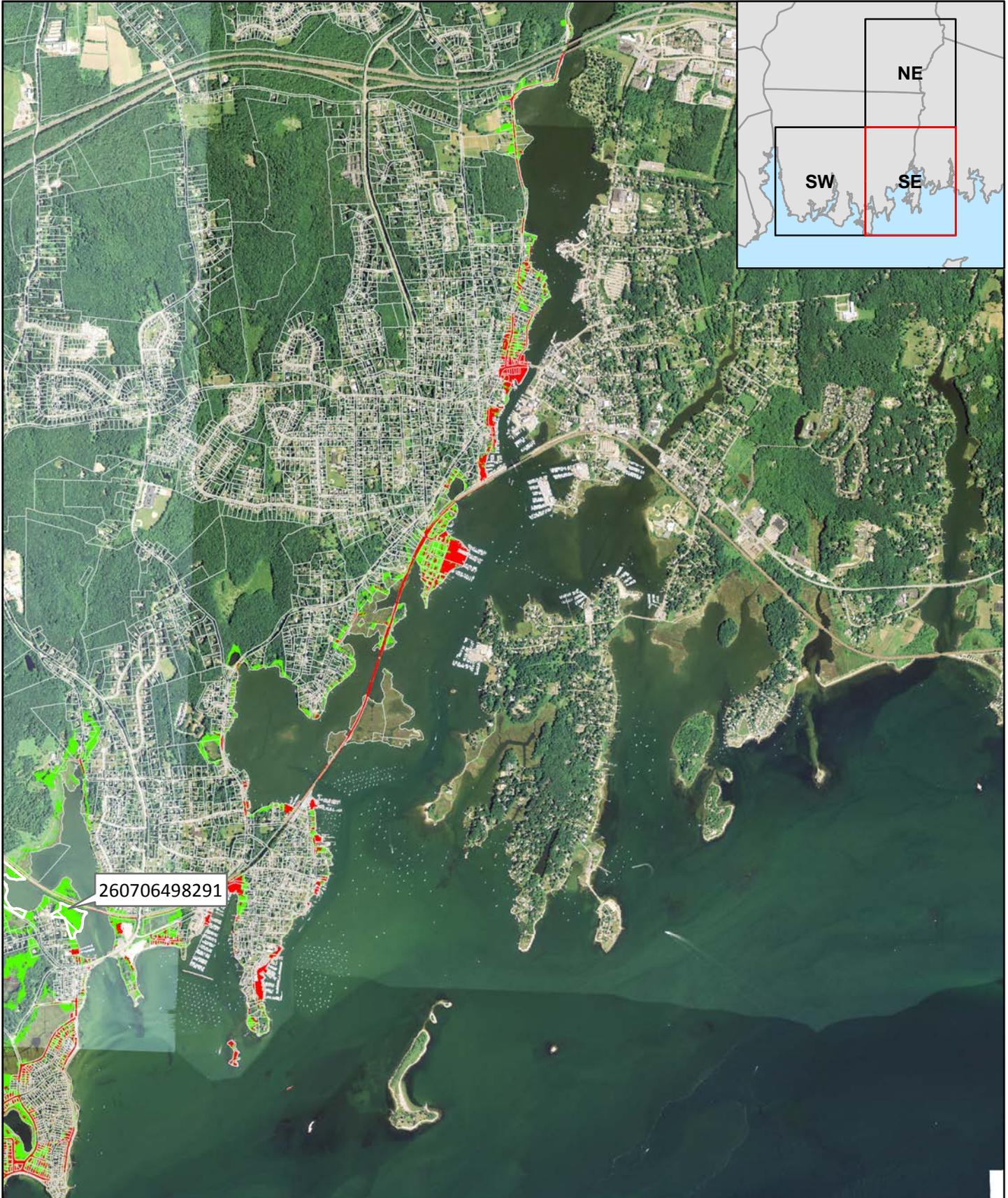
 Unprotected Non-OS

Marsh Advancement by 2080s

 Developed Land Cover

 Forest, Grass, Ag Land Cover

Note: Only Non-OS parcels with > 7 acres of suitable advancement are shown.



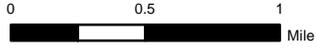
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Marsh Advancement by the 2080s

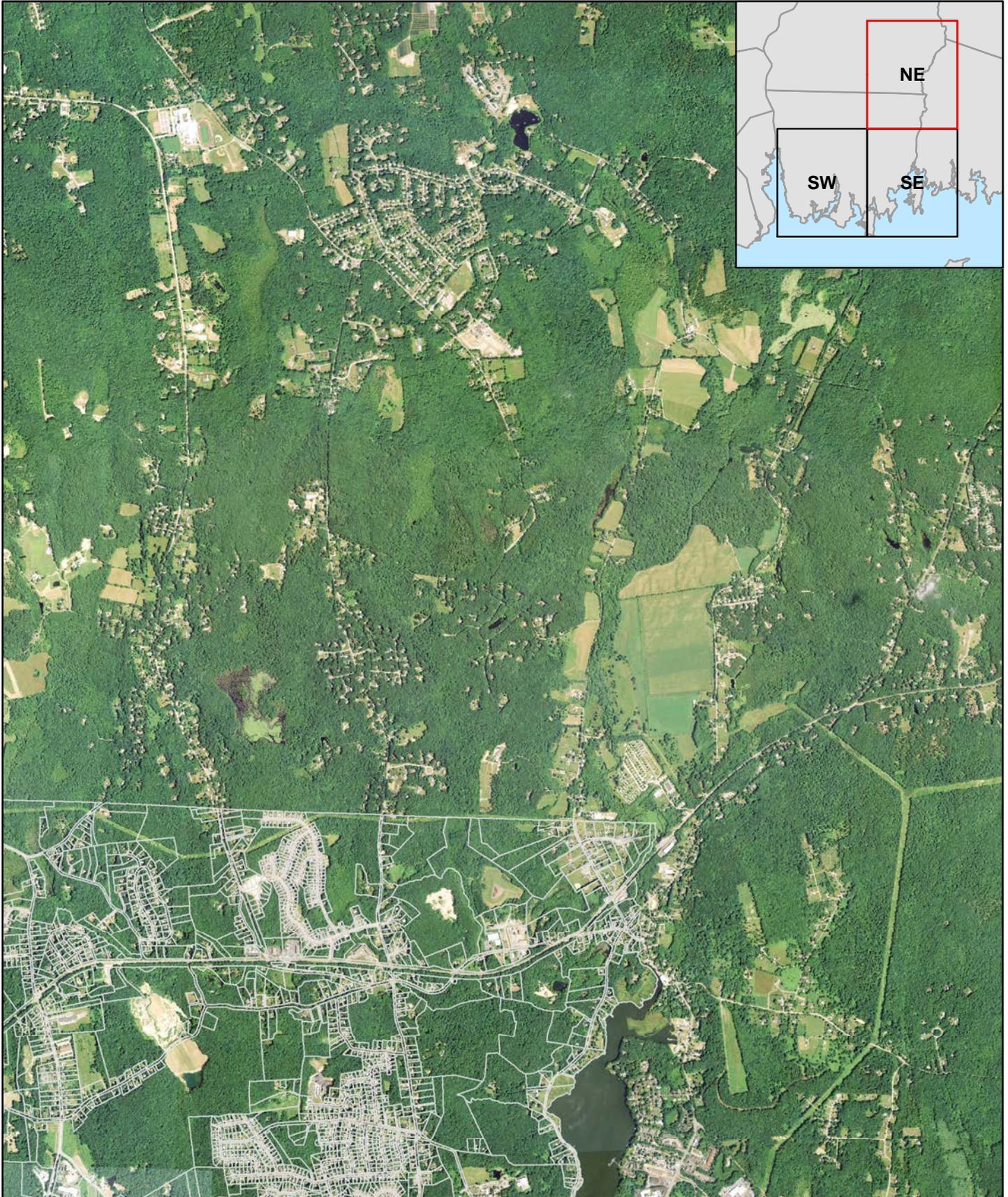
Town of Groton, CT

Critical Parcels - NE



Note: Only Non-OS parcels with > 7 acres of suitable advancement and OS parcels with > 5 acres of suitable advancement are shown.

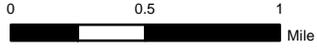
Parcels	
	Unprotected Non-OS
	Protected OS



Marsh Advancement by the 2080s

Town of Groton, CT

Critical Parcels - SW



Note: Only Non-OS parcels with > 7 acres of suitable advancement and OS parcels with > 5 acres of suitable advancement are shown.

Parcels

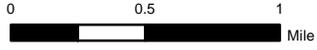
- Unprotected Non-OS
- Protected OS



Marsh Advancement by the 2080s

Town of Groton, CT

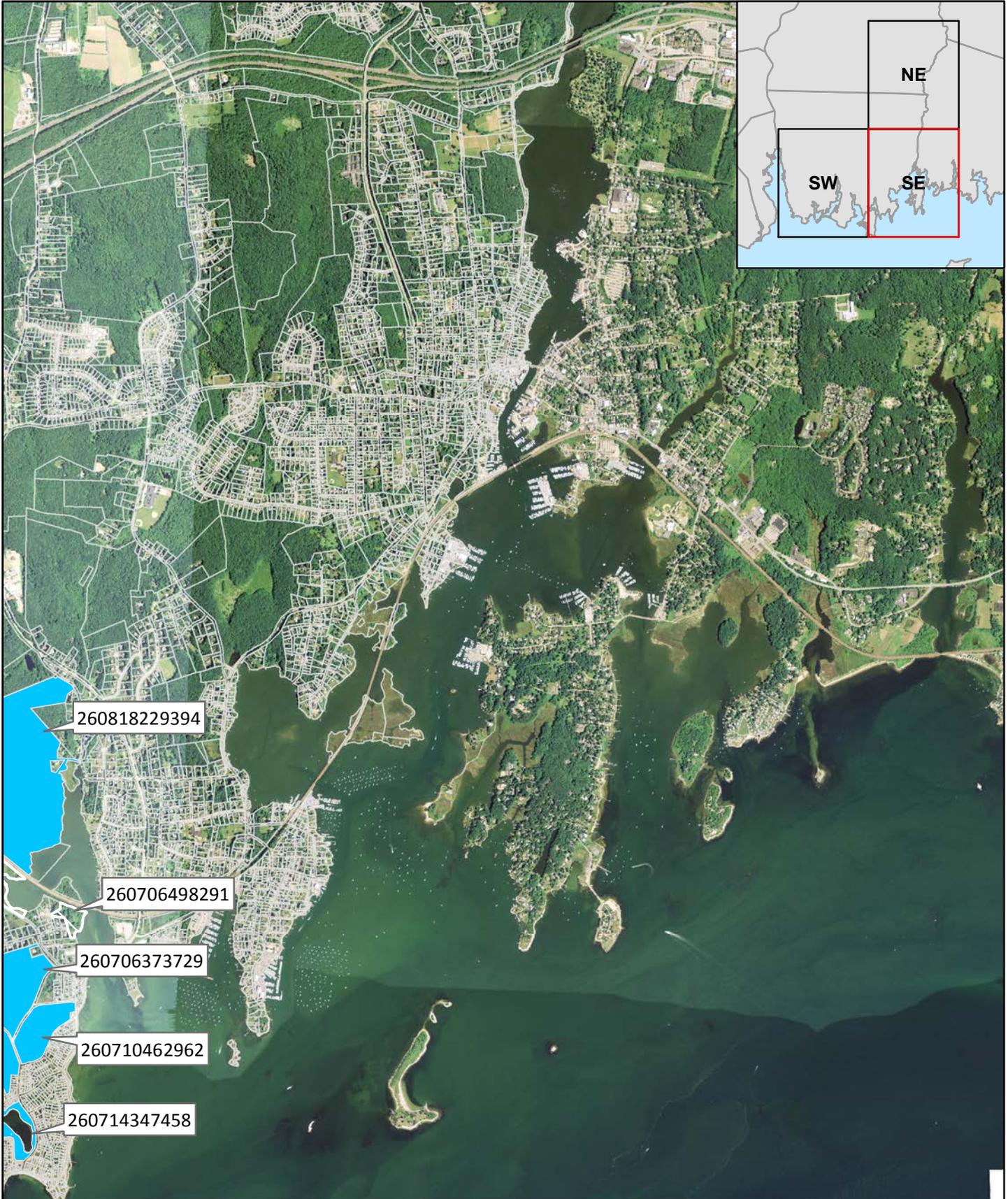
Critical Parcels - SE



Note: Only Non-OS parcels with > 7 acres of suitable advancement and OS parcels with > 5 acres of suitable advancement are shown.

Parcels

-  Unprotected Non-OS
-  Protected OS

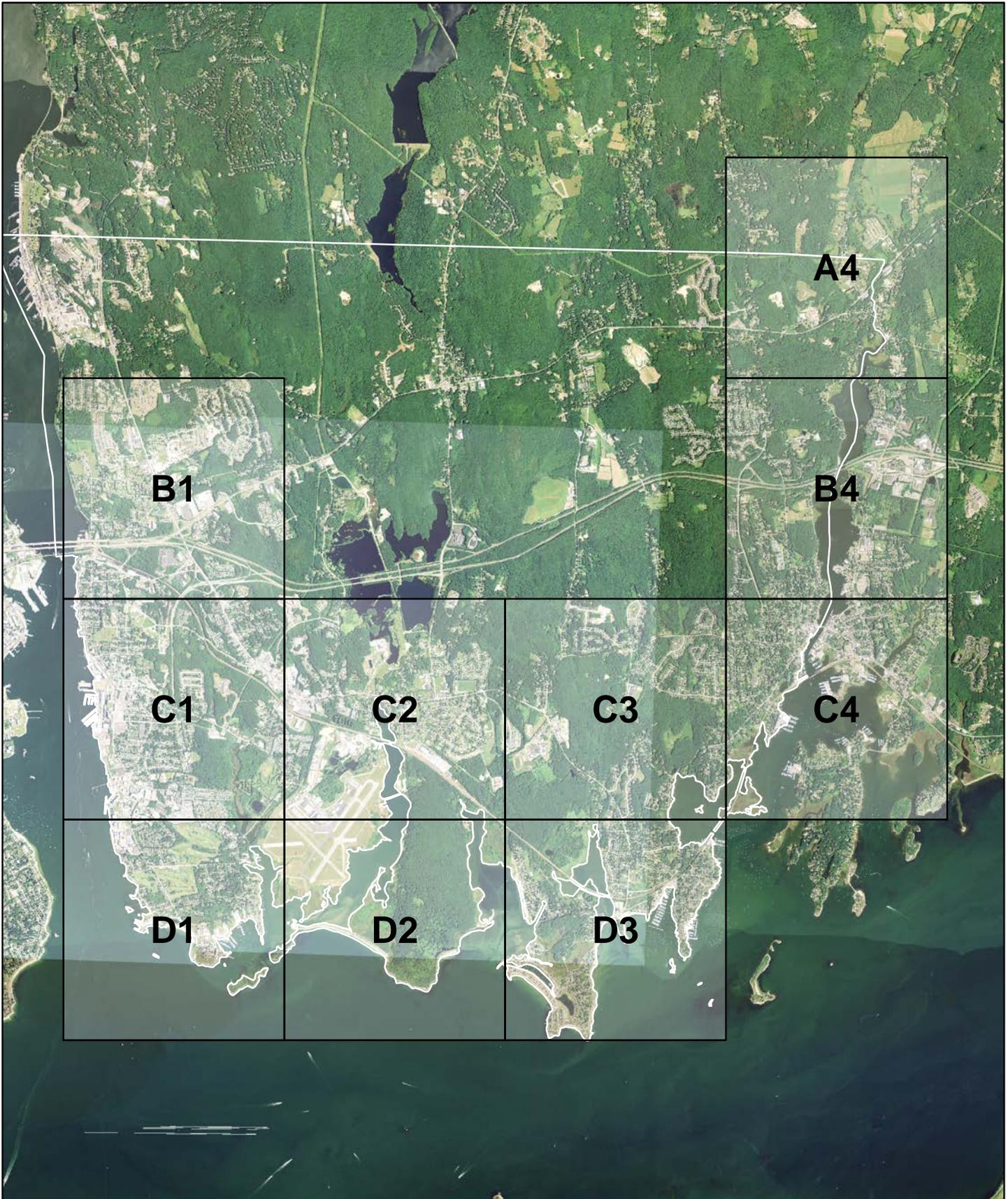


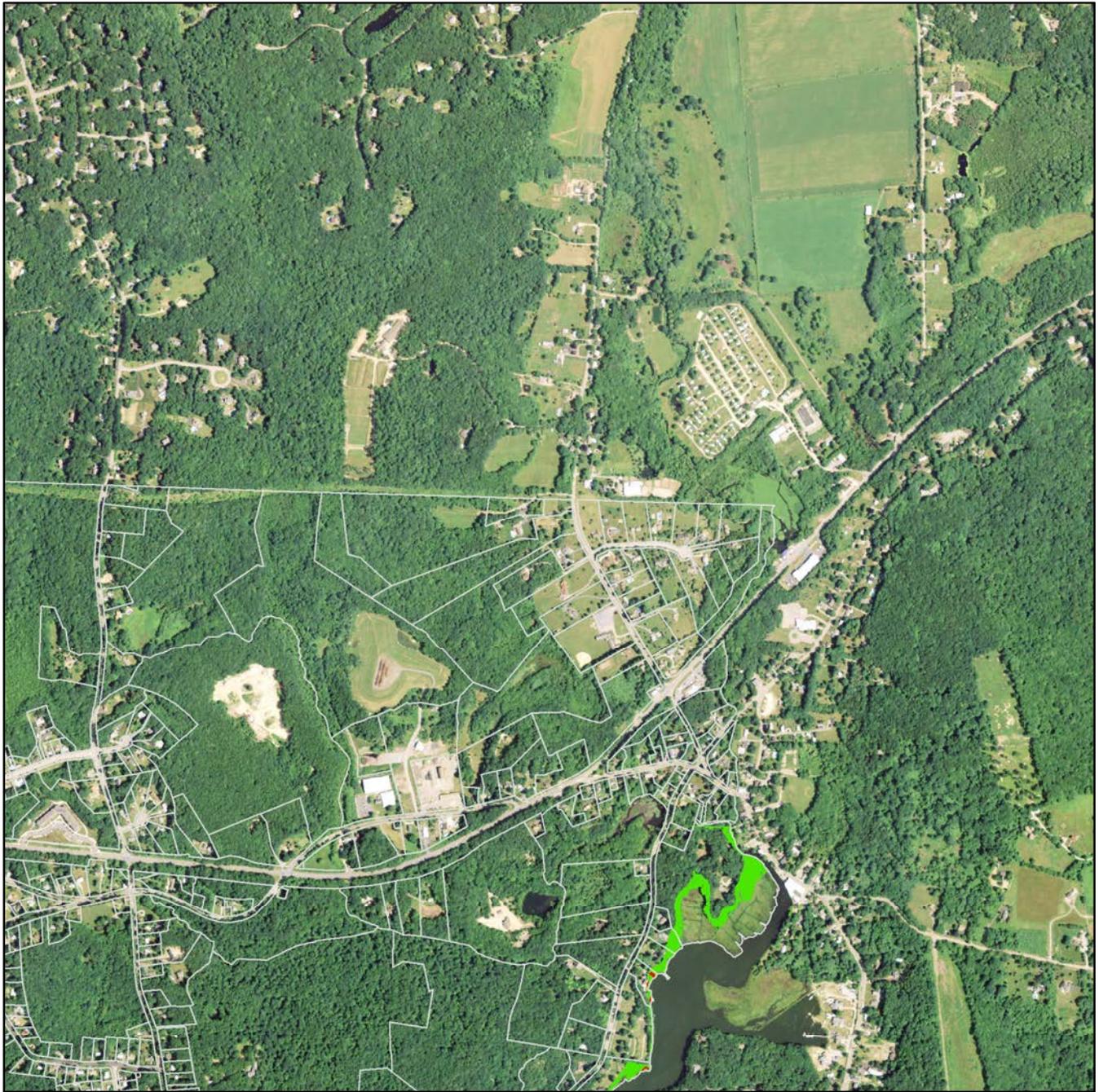
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Marsh Advancement by the 2080s

Town of Groton, CT

Map Index - Unprotected Parcels





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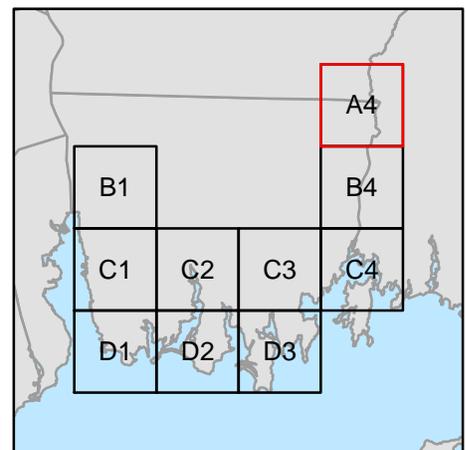
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map A4



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





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Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map B1

Parcels

 Unprotected Non-OS

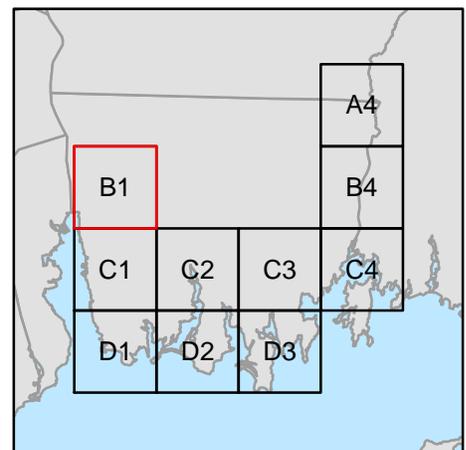
Marsh Advancement

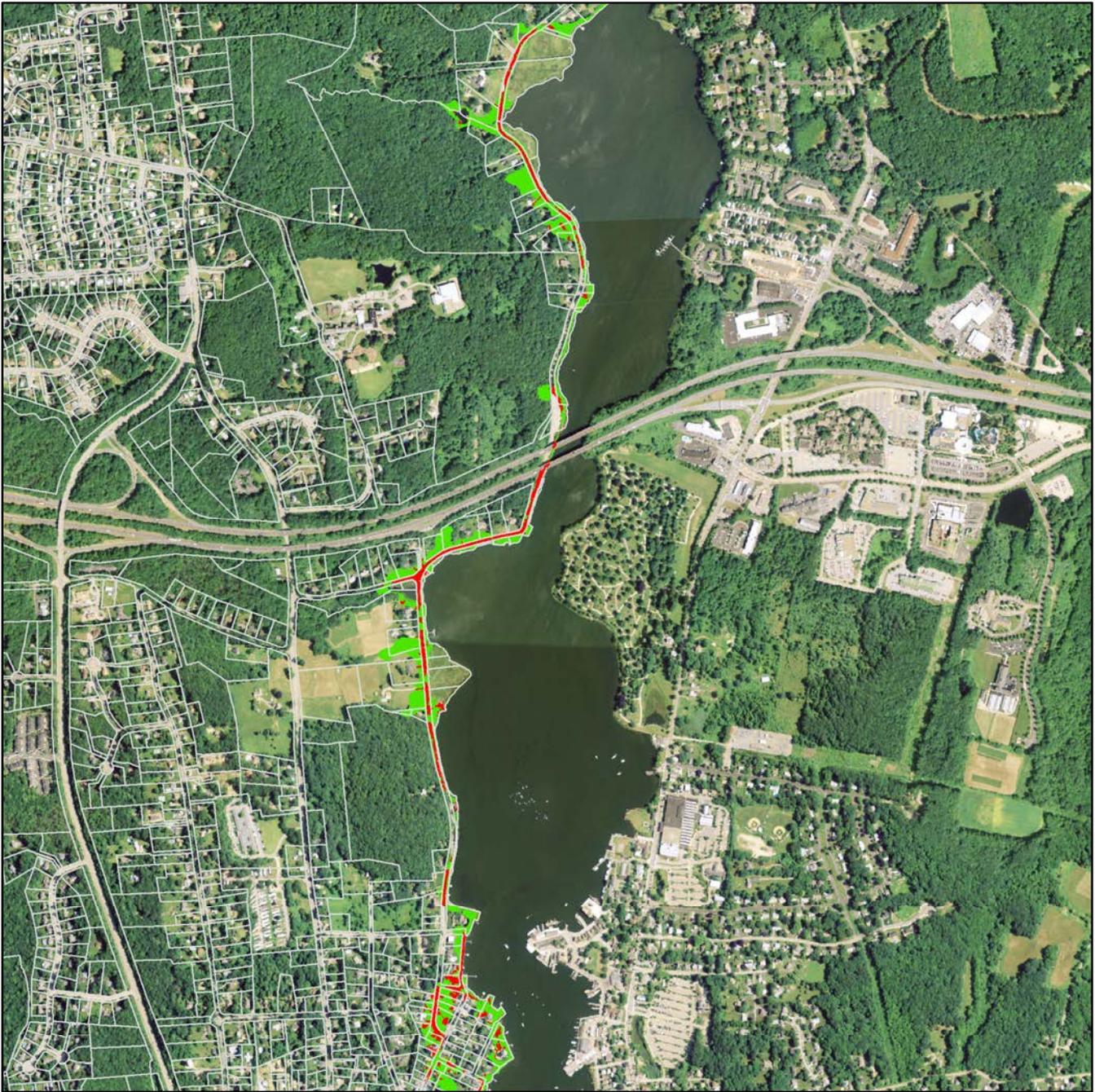
 Developed Land Cover

 Forest, Grass, Ag Land Cover



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





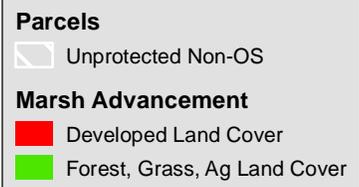
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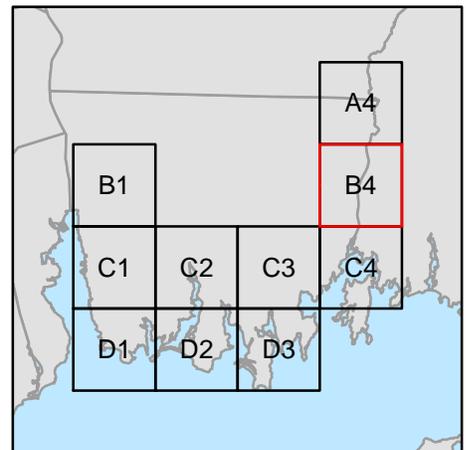
Marsh Advancement by the 2080s

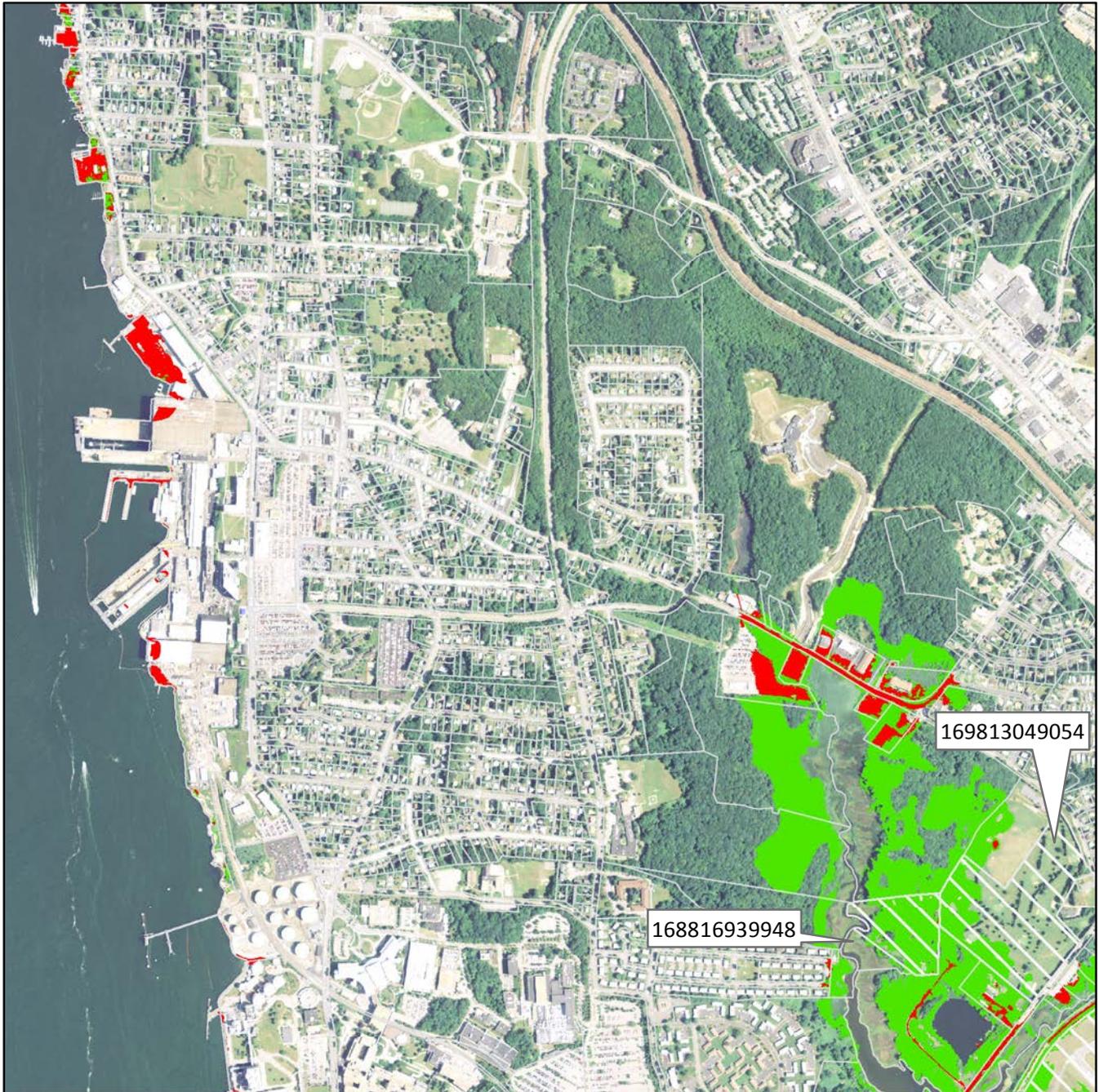
Town of Groton, CT

Unprotected Parcels - Map B4

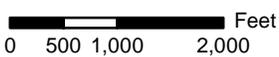


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





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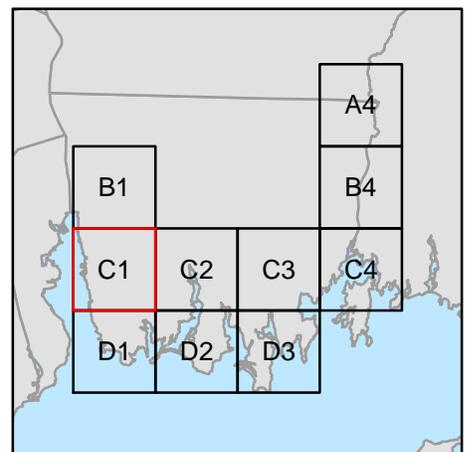
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map C1

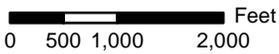
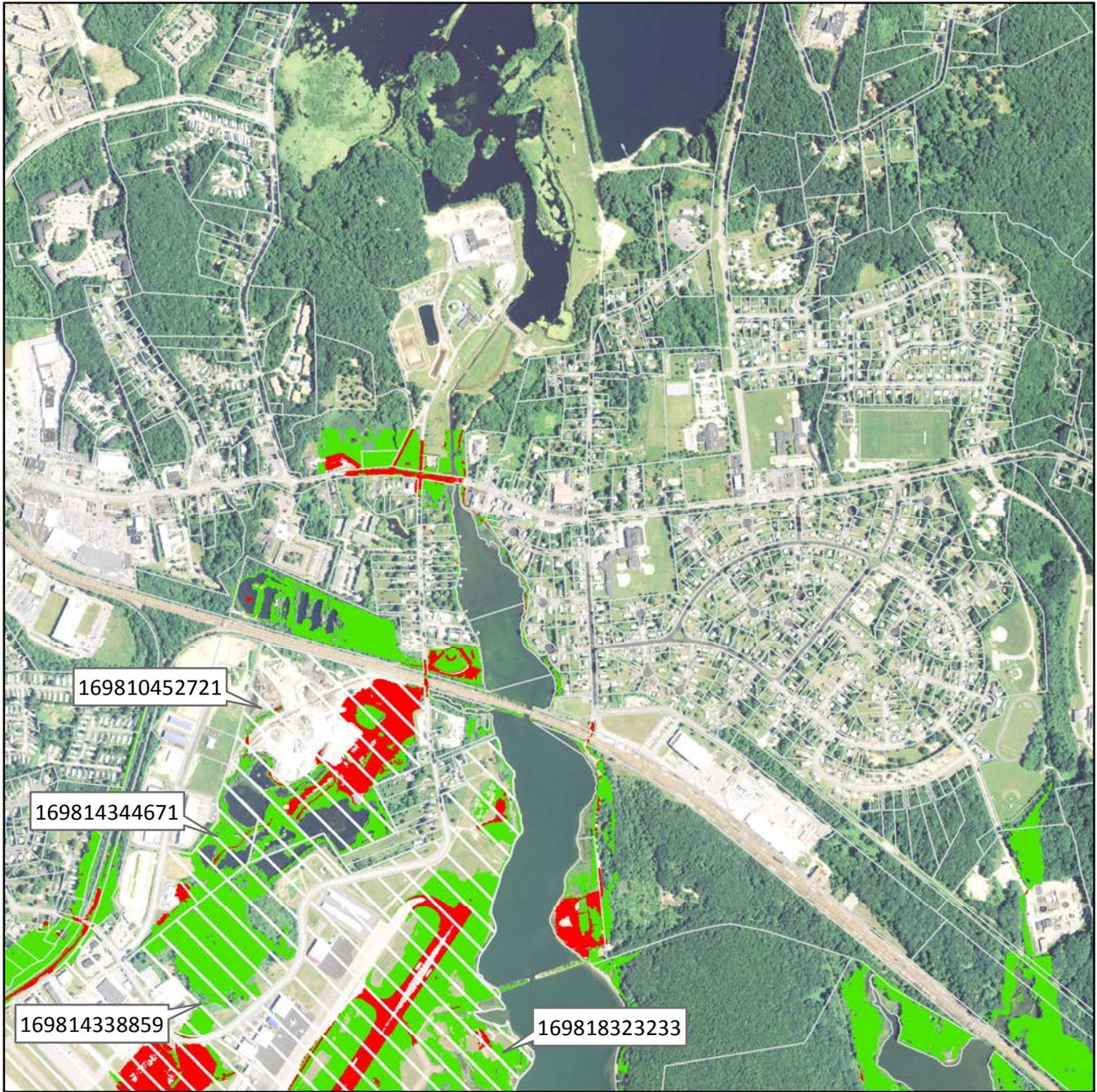


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



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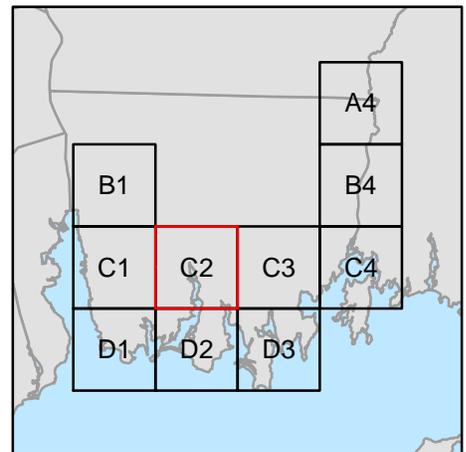
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map C2

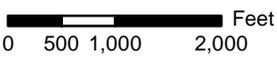
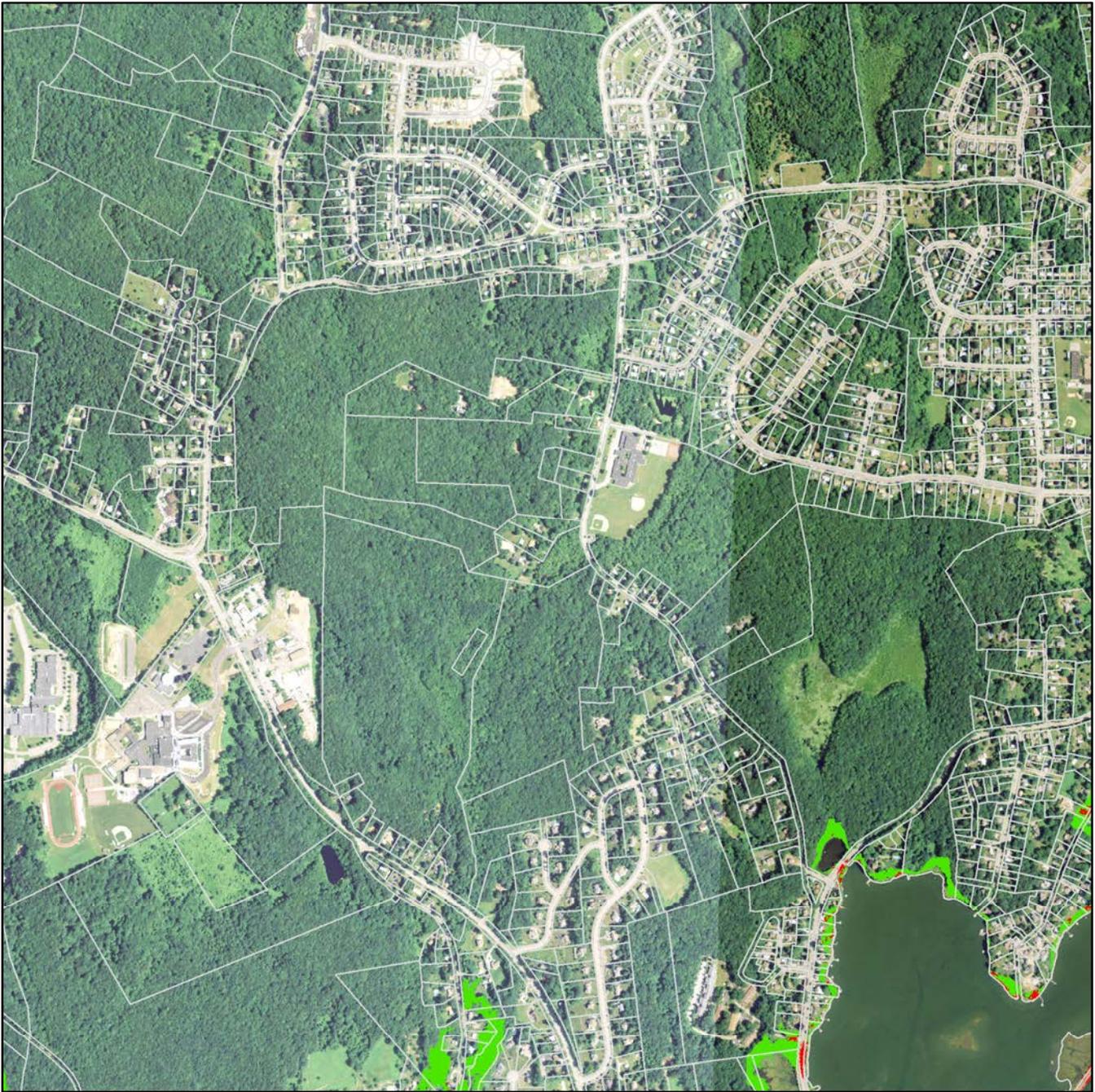


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



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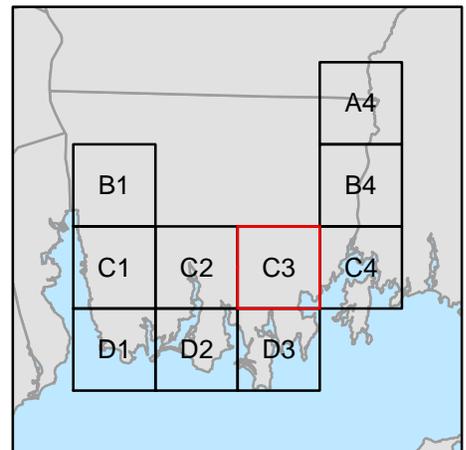
Marsh Advancement by the 2080s

Town of Groton, CT

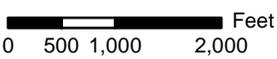
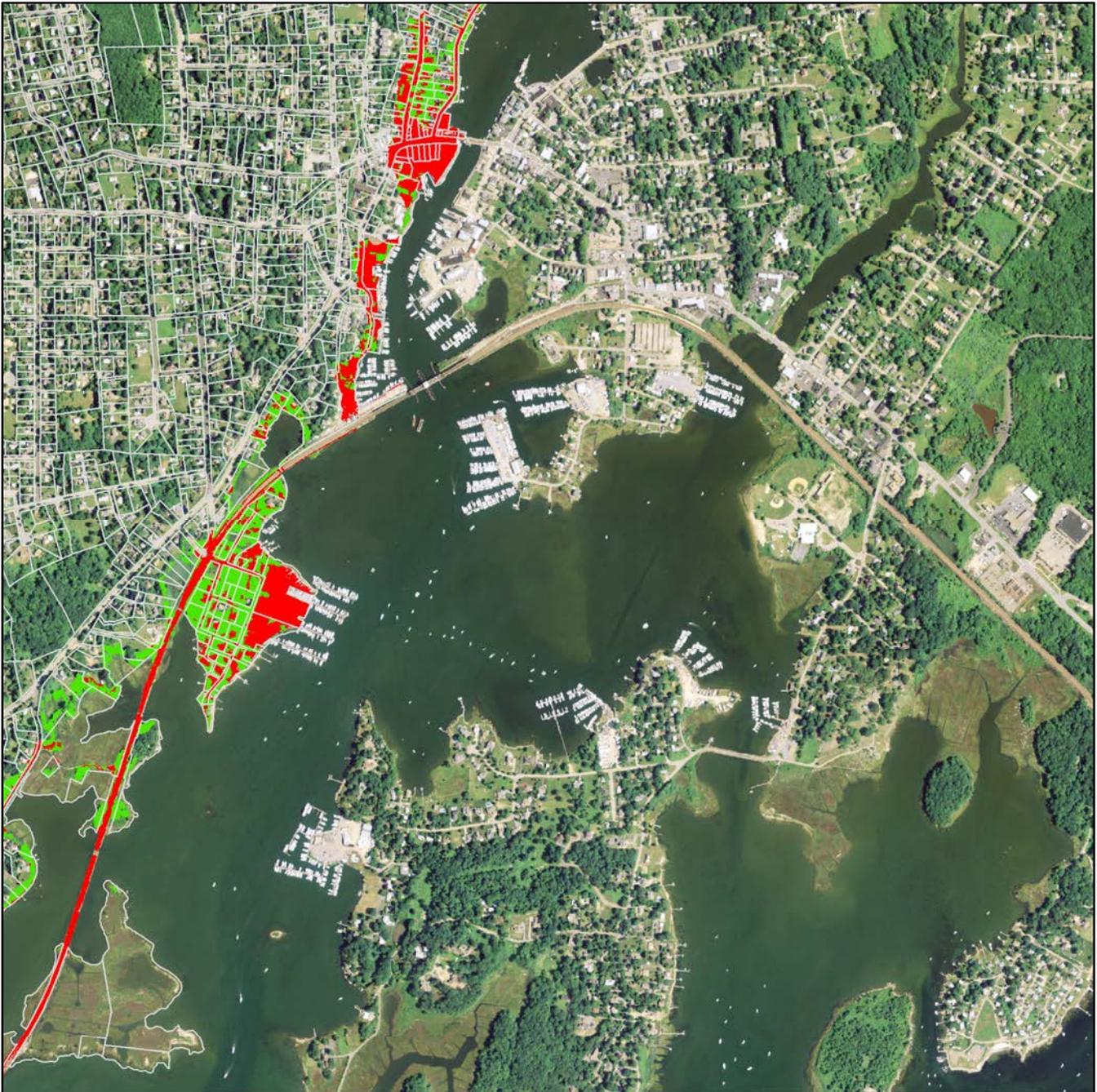
Unprotected Parcels - Map C3



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



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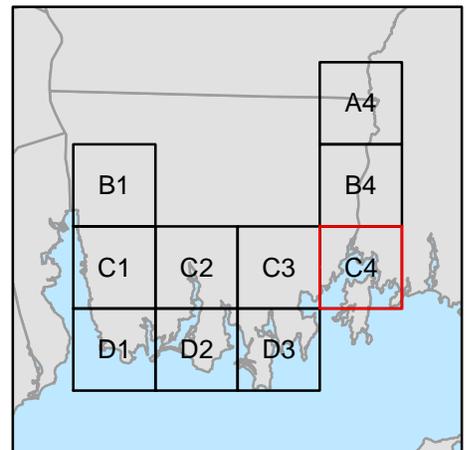
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map C4



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





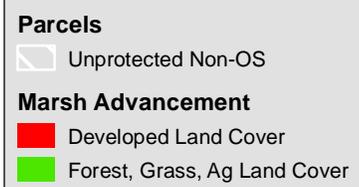
see page 24

0 500 1,000 2,000 Feet

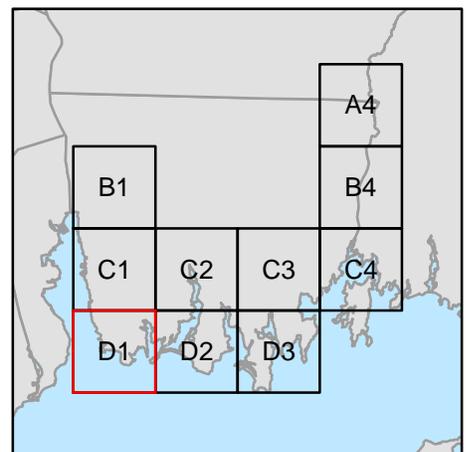
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map D1



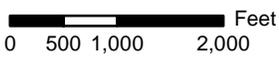
Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





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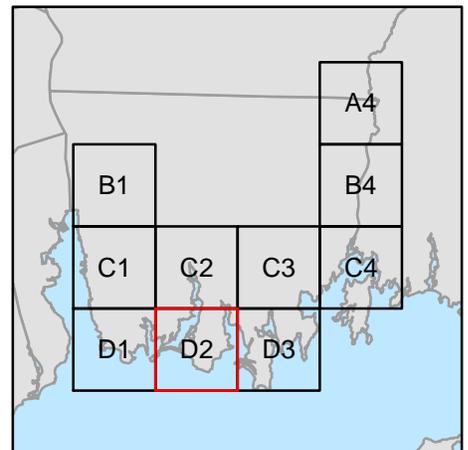
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map D2



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



see page 24



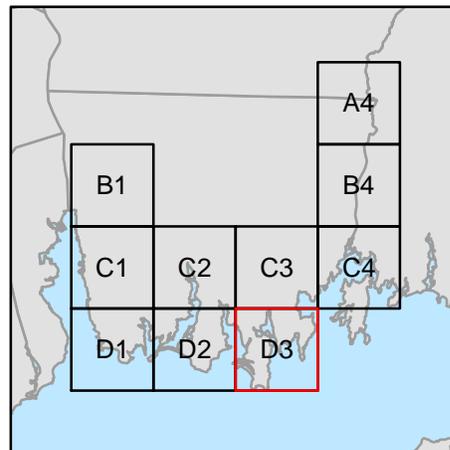
Marsh Advancement by the 2080s

Town of Groton, CT

Unprotected Parcels - Map D3



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.

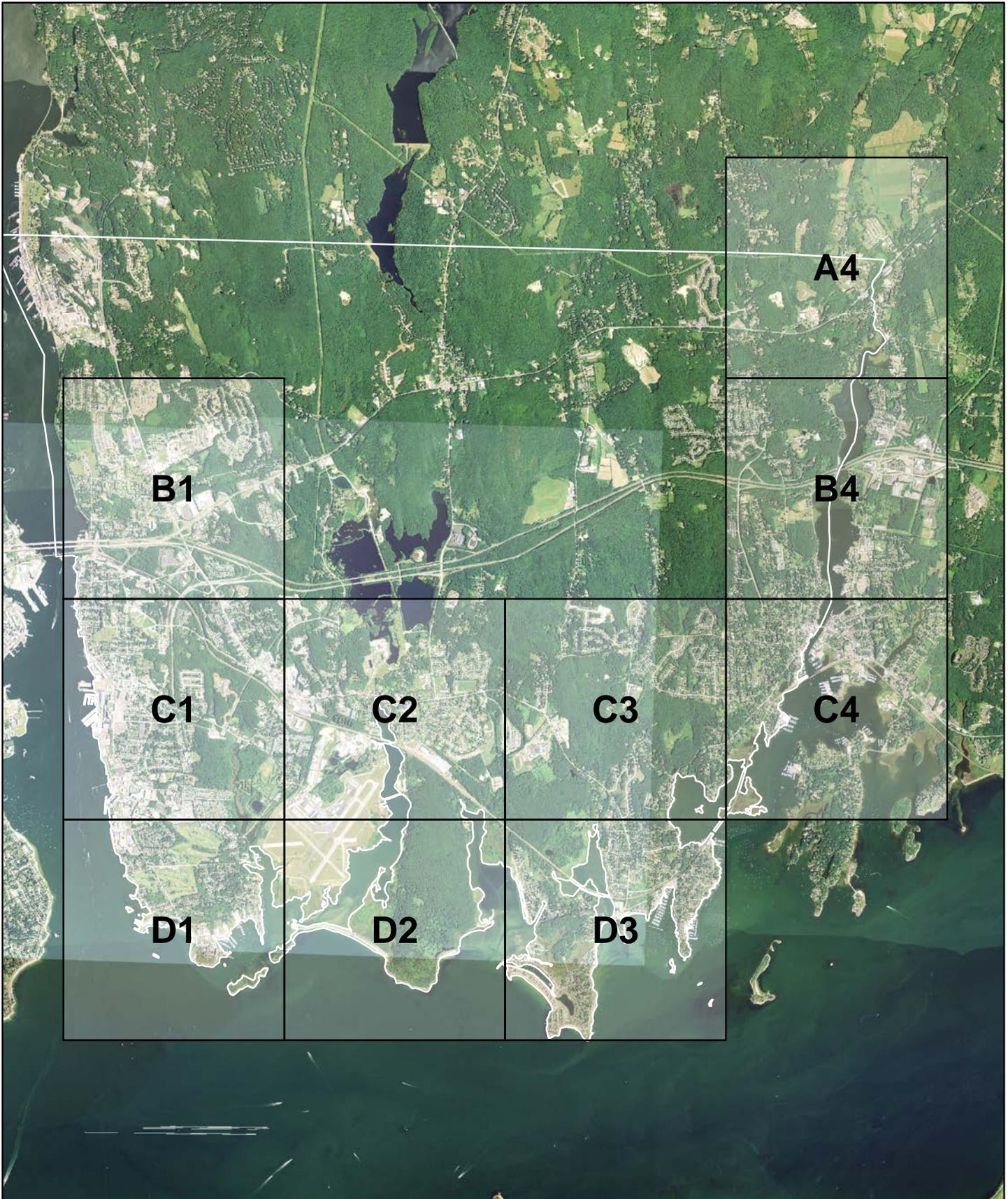


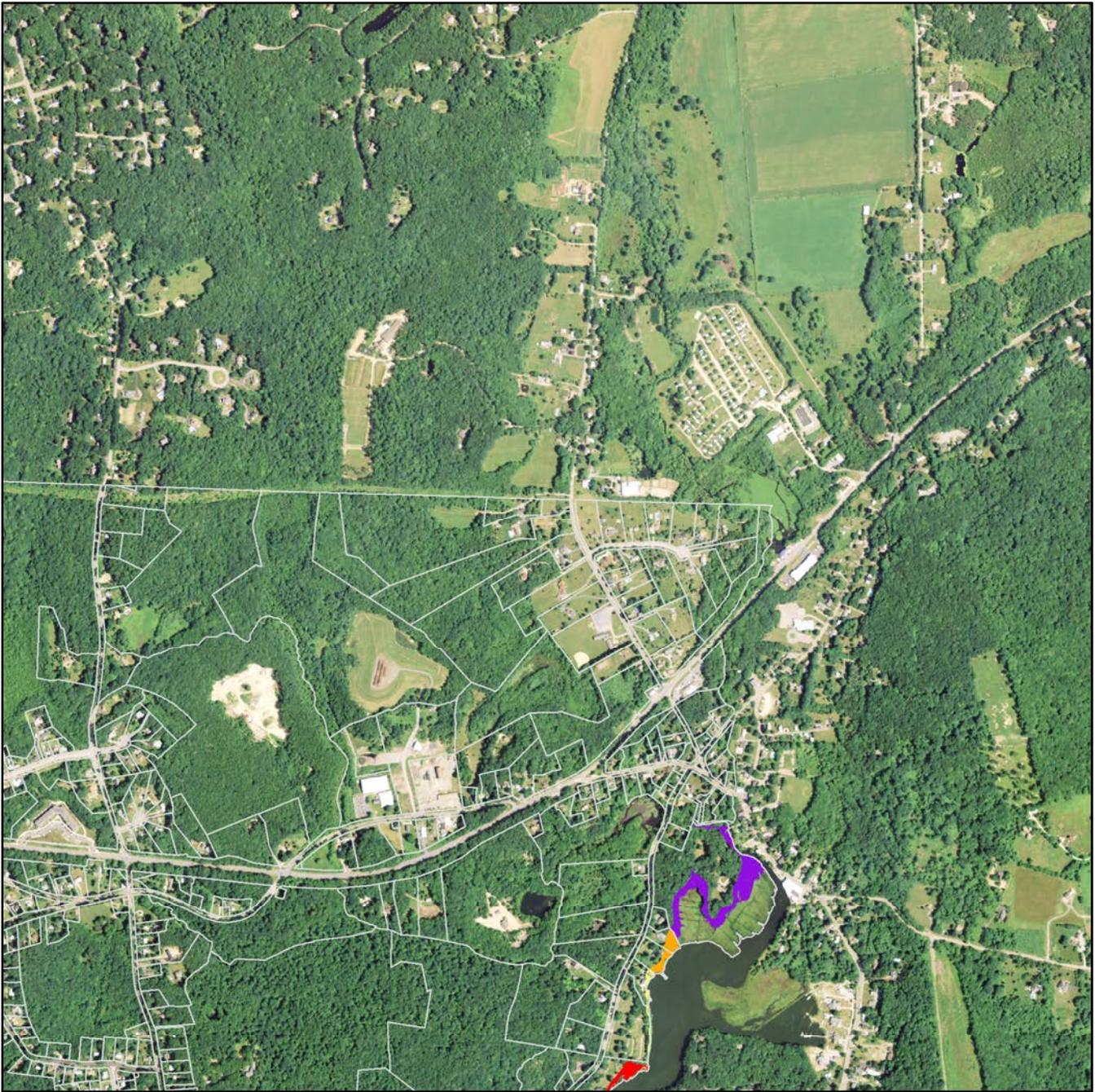
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Marsh Advancement by the 2080s

Town of Groton, CT

Map Index - Advancement per Parcel





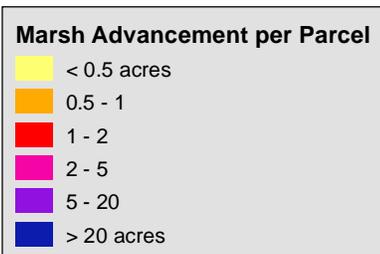
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see page 30

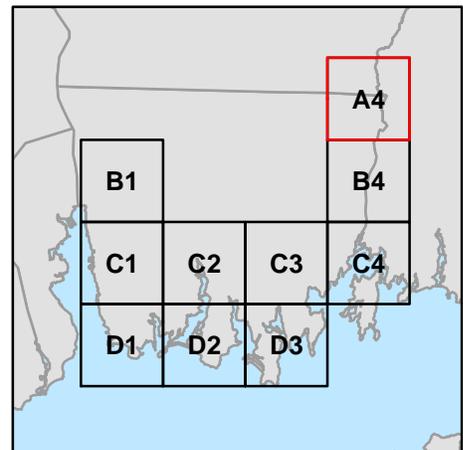
Marsh Advancement by the 2080s

Town of Groton, CT

Advancement per Parcel - Map A4



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





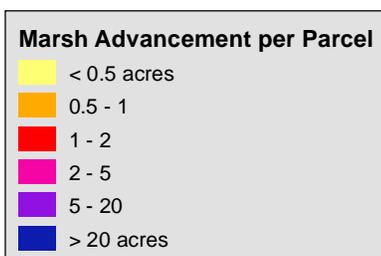
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see page 31

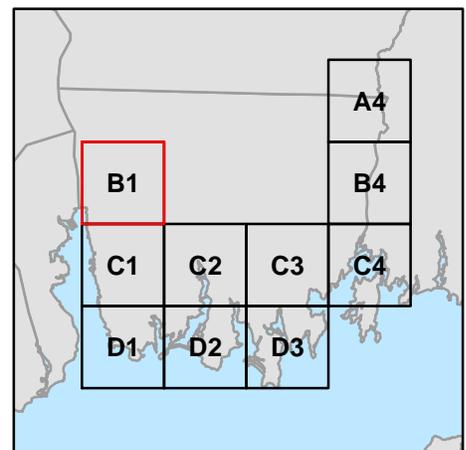
Marsh Advancement by the 2080s

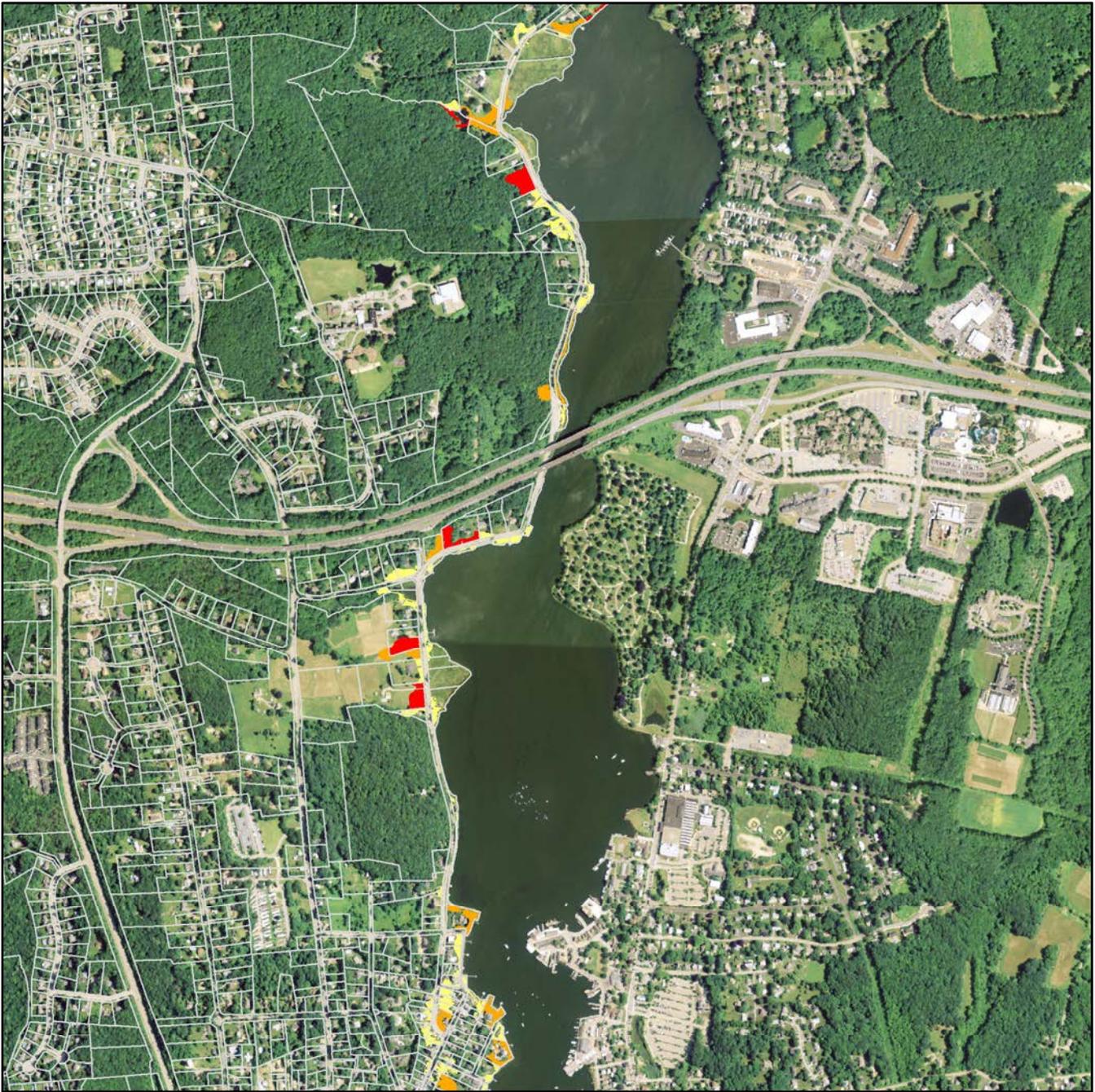
Town of Groton, CT

Advancement per Parcel - Map B1



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





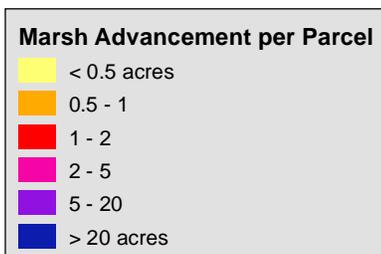
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see page 34

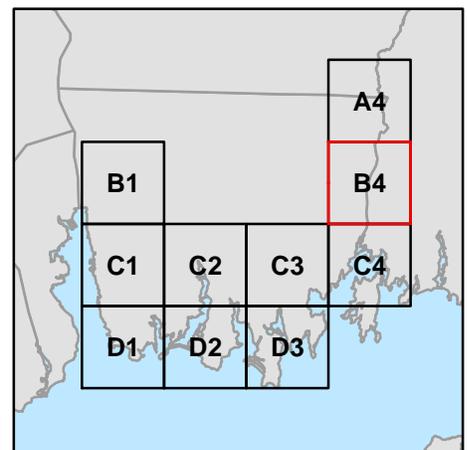
Marsh Advancement by the 2080s

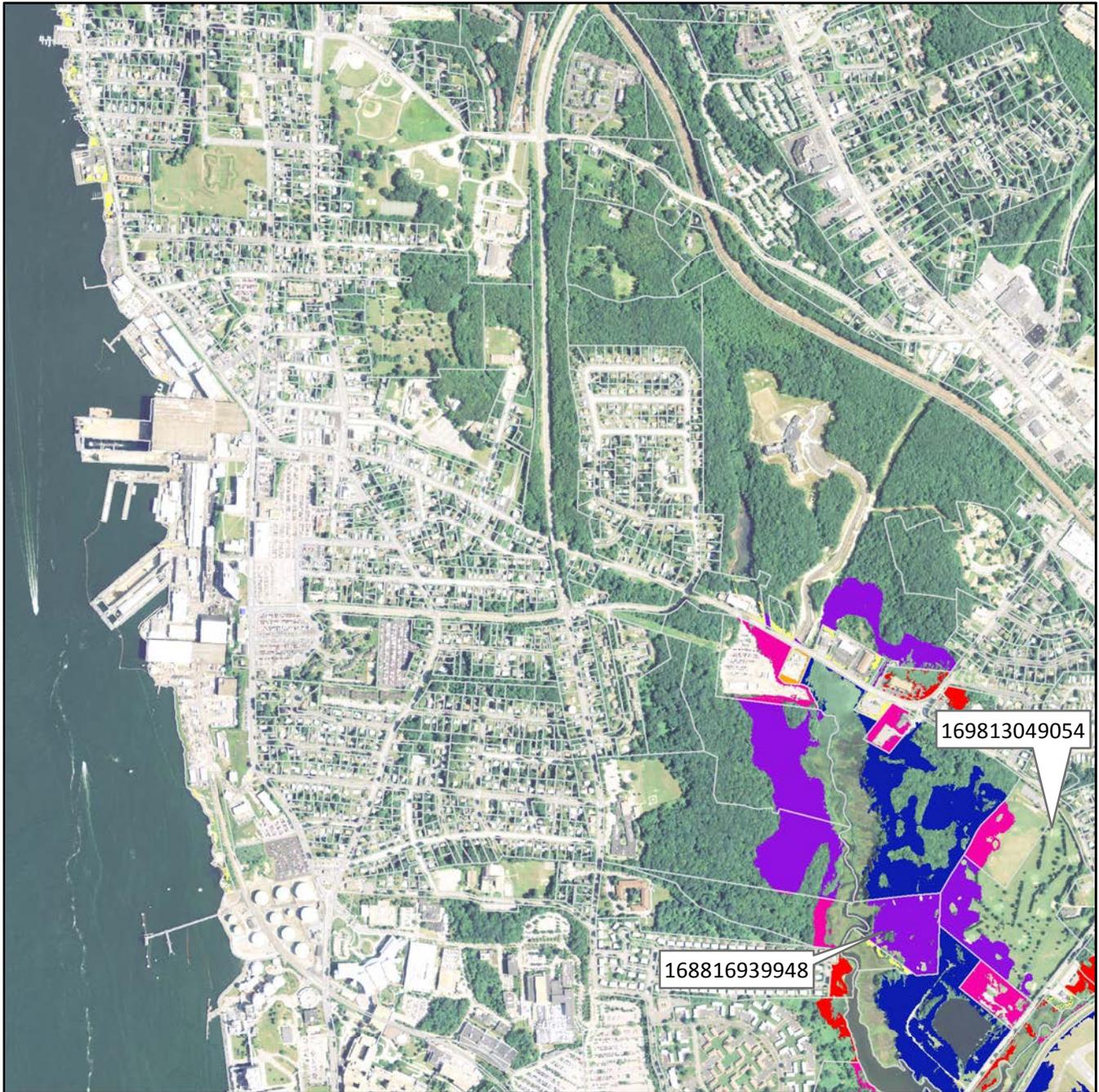
Town of Groton, CT

Advancement per Parcel - Map B4

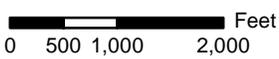


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





see page 32

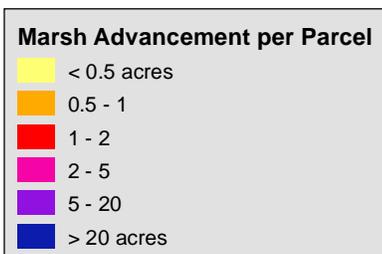


see page 35

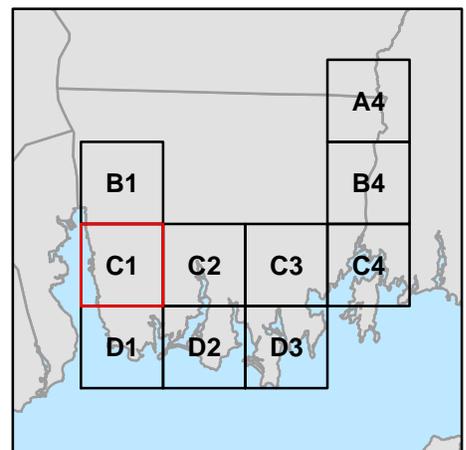
Marsh Advancement by the 2080s

Town of Groton, CT

Advancement per Parcel - Map C1

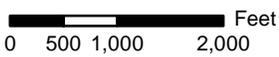
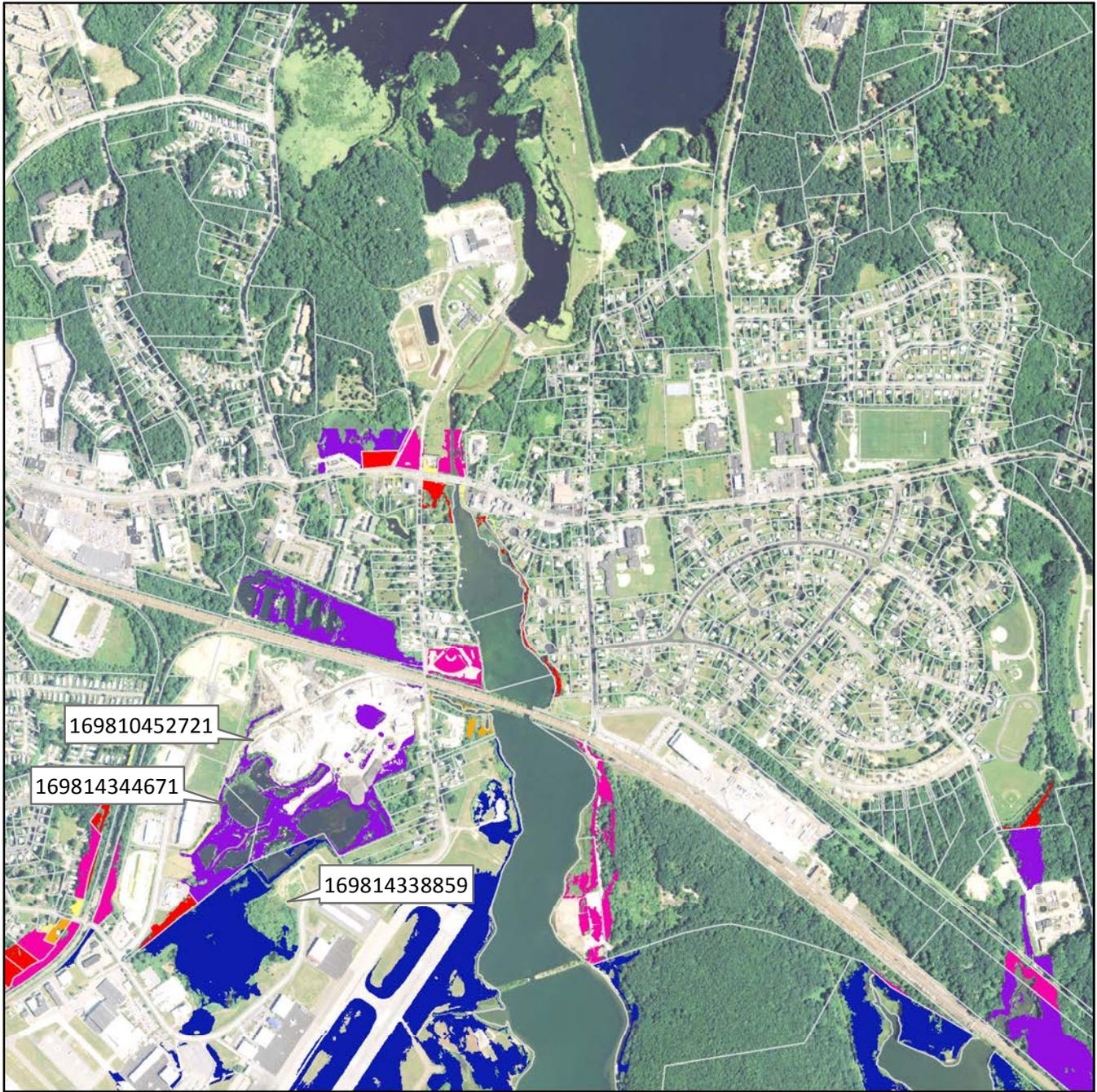


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



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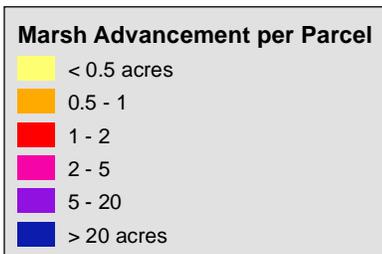


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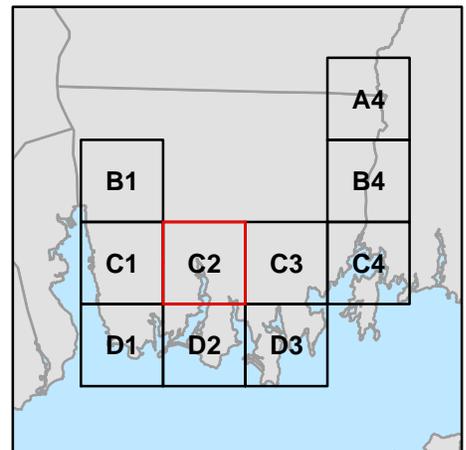
Marsh Advancement by the 2080s

Town of Groton, CT

Advancement per Parcel - Map C2

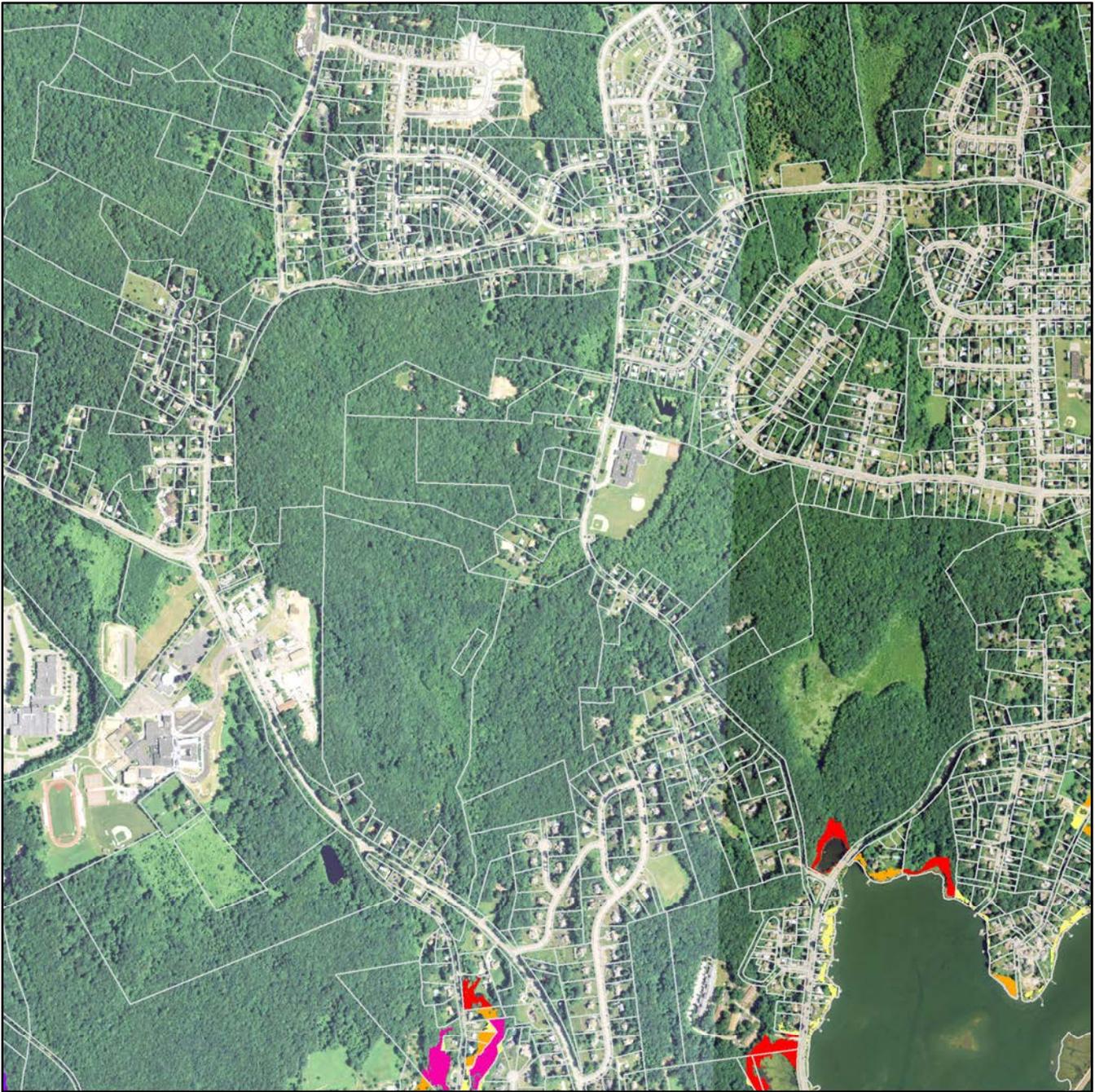


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



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see page 34



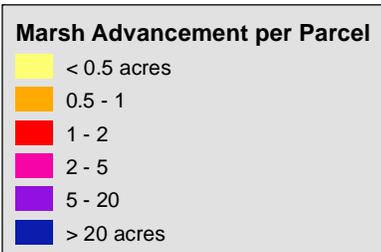
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see page 37

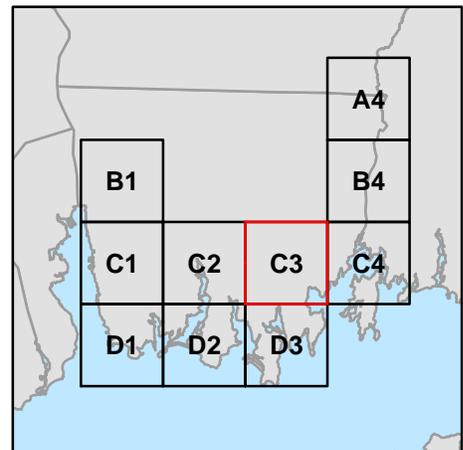
Marsh Advancement by the 2080s

Town of Groton, CT

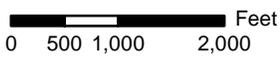
Advancement per Parcel - Map C3



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



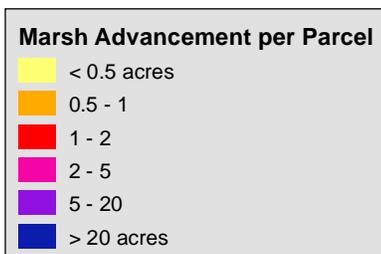
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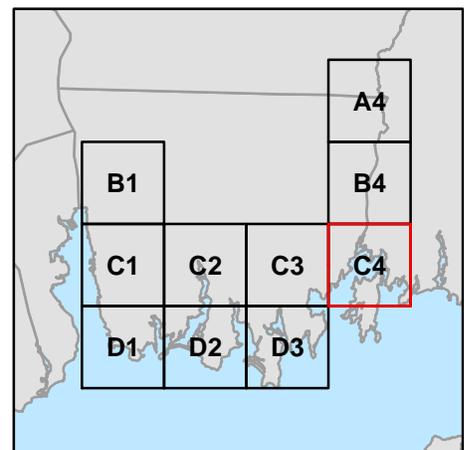
Marsh Advancement by the 2080s

Town of Groton, CT

Advancement per Parcel - Map C4

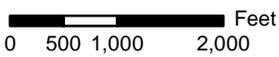


Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





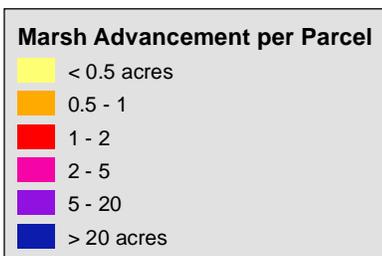
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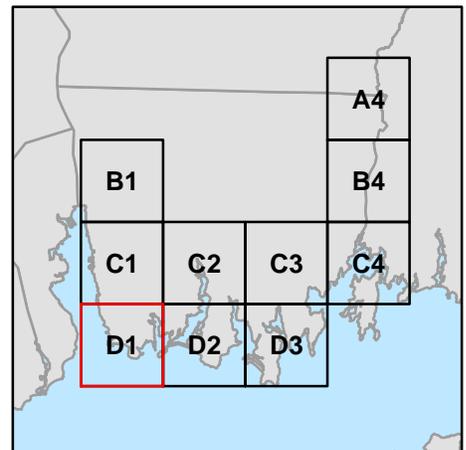
Marsh Advancement by the 2080s

Town of Groton, CT

Advancement per Parcel - Map D1



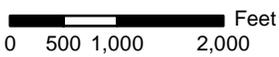
Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.





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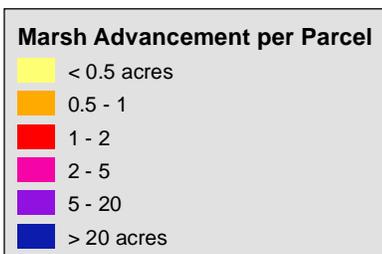
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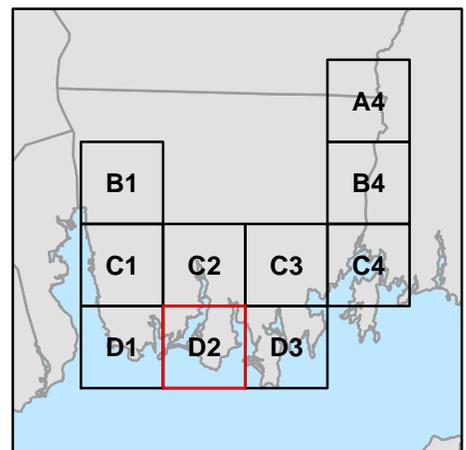
Marsh Advancement by the 2080s

Town of Groton, CT

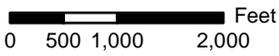
Advancement per Parcel - Map D2



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.



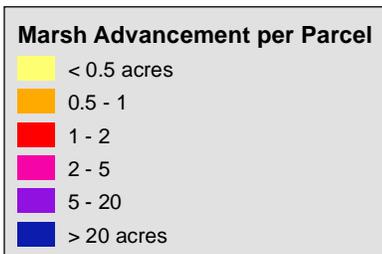
see page 36



Marsh Advancement by the 2080s

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Advancement per Parcel - Map D3



Note: Only Non-OS parcels with > 7 acres of suitable marsh advancement are shown.

