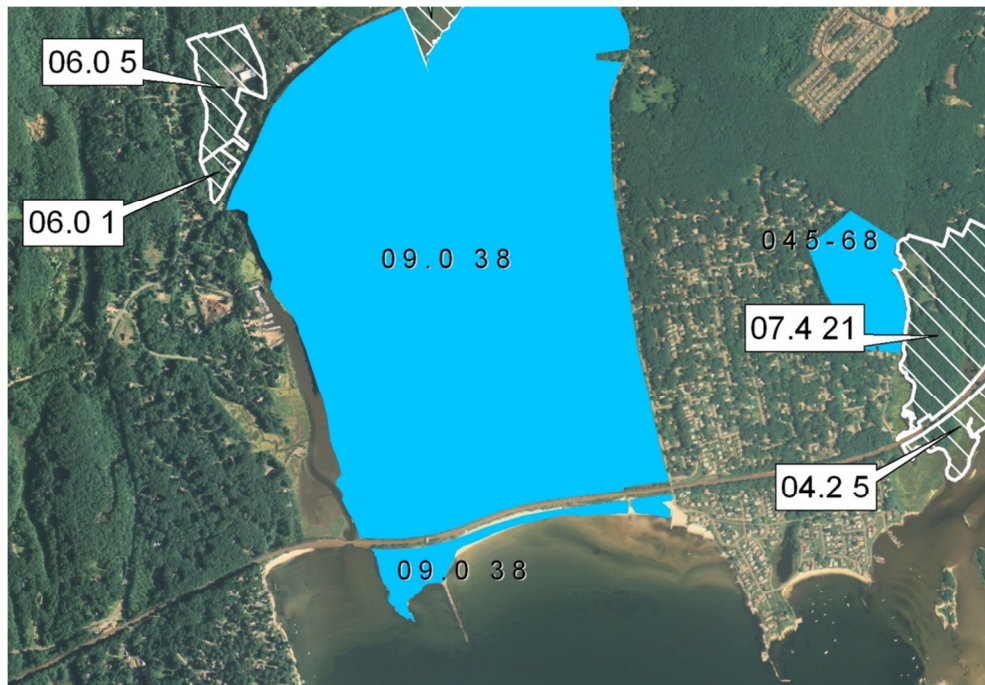


A Salt Marsh Advancement Zone Assessment of East Lyme, Connecticut



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

Table of Contents

Introduction	2
Suitable vs. Unsuitable Advancement.....	3
Marsh Advancement vs. Wetland Extent	3
Planning for the Future	3
Total Marsh Advancement.....	4
Protected Open Space Advancement	4
Total OS Advancement.....	4
Suitable OS Advancement by Owner	5
Suitable Advancement by OS Parcel	6
All Parcels.....	7
Total Advancement: OS vs. Non-OS.....	7
Suitable Advancement in All Parcels.....	8
Appendix	9

RECOMMENDED CITATION:

Pardo, S. and A. W. Whelchel. 2013. A Salt Marsh Advancement Zone Assessment of East Lyme, Connecticut. The Nature Conservancy, Coastal Resilience Program. Publication Series #1-B, New Haven, CT.

Introduction

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

There is a universal recognition by coastal communities in Connecticut that natural infrastructure – wetlands, forests, floodplains - is a cost effective, long-term solution to help make people, infrastructure and natural systems more resilient to 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, serve to buffer the shoreline and rivers as natural defenses against hazards such as storm surge, inland flooding, and sea level rise. The presence of natural resources in the state – in particular beaches/dunes, salt marsh, 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. There are also opportunities to integrate the services (surface runoff storage and infiltration, wave attenuation, pollutant sorption, etc...) provided by natural infrastructure via new development, redevelopment, or realignment activities. Economically important co-benefits from natural infrastructure include services such as improve filtering of pollutants from runoff, erosion control, and improved aesthetics and desirable public amenities. Taken in total, the immediate and longer-term management of and for natural infrastructure by the State, Towns, private property owners, non-profit organizations, and others will help to reduce the hazard risk and improve the resilience within 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 migration or 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 with sea levels into areas now considered uplands. In order to clearly identify where this will occur along East Lyme'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 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 for securing advancement into suitable sites to ensure the persistence of natural resources in East Lyme 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 tables and figures 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 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 at the same time it is inevitable. There is an abundance of existing property, infrastructure and natural resource 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 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 by the 2080s is projected to be 364 acres, with 324 acres (89%) considered to be suitable sites for wetland migration. Currently, 39 acres (11% of total) are occupied by built structures and associated infrastructure (“urban”).

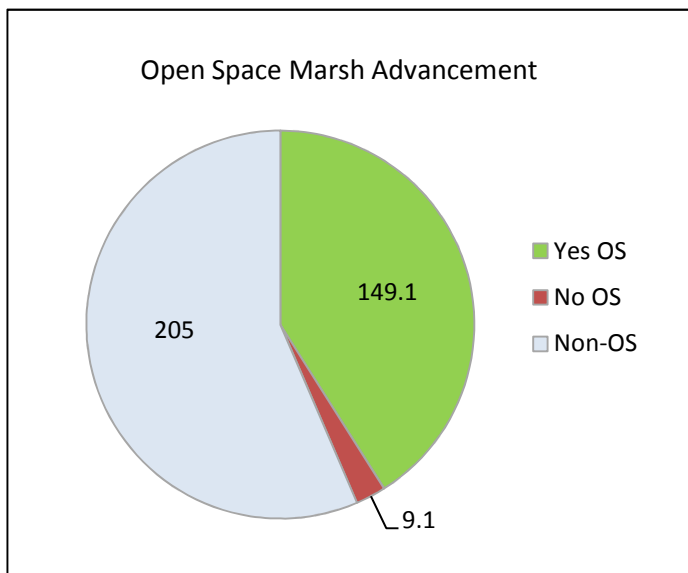
Total Marsh Advancement by 2080s		
Marsh Adv	Acres	Percent (%)
Yes	324.2	89.2
No	39.3	10.8
Total	364	100

Protected Open Space Advancement

Existing protected open space (OS) consists of state or municipal parks, conservation easements on private property, or simply properties owned by land trusts. The unifying characteristic of these properties, and what makes them a critical component of long-term community resilience, is that 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 East Lyme is vital information for land management, economic development, and planning.

Total OS Advancement

Protected OS parcels contain 158 acres of marsh advancement area with nearly that entire sum (149 acres – 41% of total) classified as suitable for future wetlands (Yes OS). Further analysis of the larger proportion of unprotected open space parcels (Non-OS) can be found in the “Unprotected Open Space Advancement” section below.

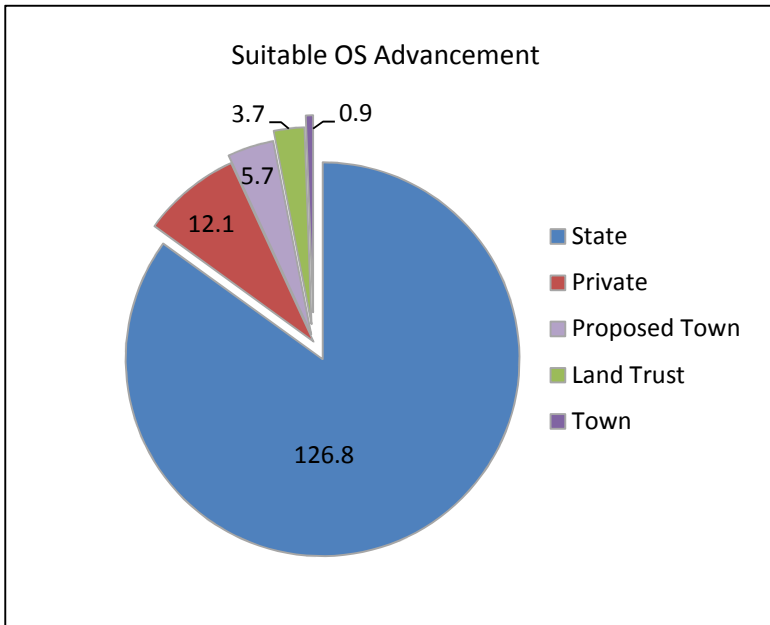


Open Space Marsh Advancement		
OS type	Acres	Percent (%)
Yes OS	149.1	41.0
No OS	9.1	2.5
Non-OS	205	56.5
Total	364	100

(next page)

Suitable OS Advancement by Owner

The State of Connecticut is the largest owner of protected suitable advancement in East Lyme by far with 127 acres of suitable advancement, or 85% of the protected total. This area accounts for a significant portion of overall suitable advancement (protected and unprotected) as well, with a 39% share. Private owners (i.e. The Nature Conservancy) are a distant second with 12 acres of suitable advancement, while the Town's OS parcels contain less than 1 acre of suitable advancement. Proposed Town OS parcels would make a notable contribution of close to 6 acres of suitable advancement.

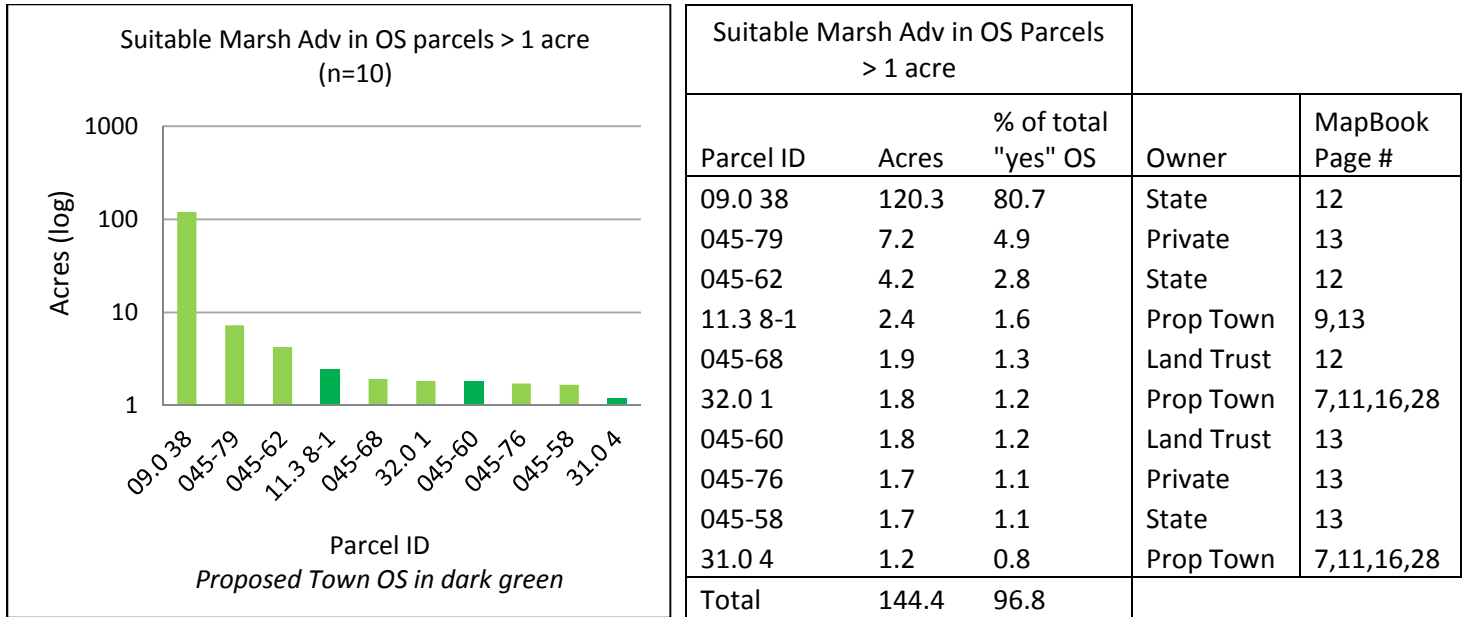


Suitable OS Advancement			
Owner type	Acres	% of total "yes" OS	% of total "yes" adv
State	126.8	85.0	39.1
Private	12.1	8.1	3.7
Proposed Town	5.7	3.8	1.7
Land Trust	3.7	2.5	1.2
Town	0.9	0.6	0.3
Total	149.1	100	46.0

(next page)

Suitable Advancement by OS Parcel

There are 52 protected OS parcels that contain suitable advancement in East Lyme but the Rocky Neck State Park (09.0 38) accounts for 120 acres, or a whopping 81% of the total. This amount is at least two orders of magnitude larger than most other OS parcels with measurable advancement, hence the necessity of a log scale in the bar chart below. There are a total of 10 parcels with greater than 1 acre of advancement but none of them are currently owned by the Town. However, several proposed OS parcels (11.3 8-1, 32.0 1, 31.0 4) are included in that select group, making them prime candidates for acquisition.



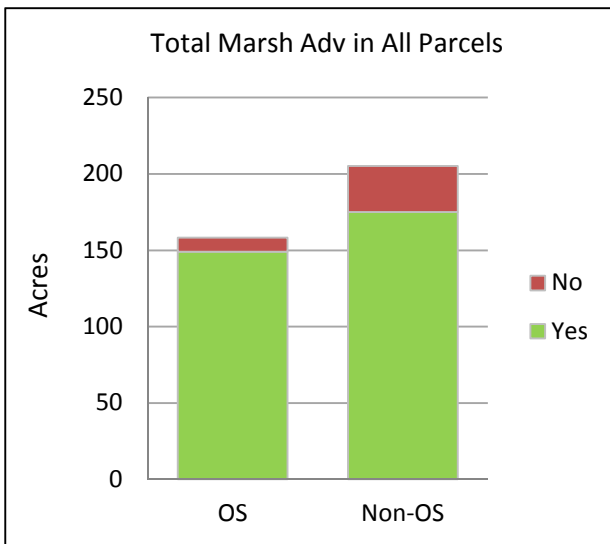
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All Parcels

This section provides an analysis of suitable marsh advancement in all parcels, whether they are classified as protected open space or not. The results help to put the OS analysis into perspective, as well as identify important unprotected private parcels in the advancement landscape.

Total Advancement: OS vs. Non-OS

The total advancement found in unprotected parcels (Non-OS) parcels is 175 acres, which is slightly greater than total protected (OS) advancement at 149 acres. Other towns along the Connecticut coast find a much larger separation between the two, with the difference in this case being the disproportionately large advancement area of Rocky Neck State Park.

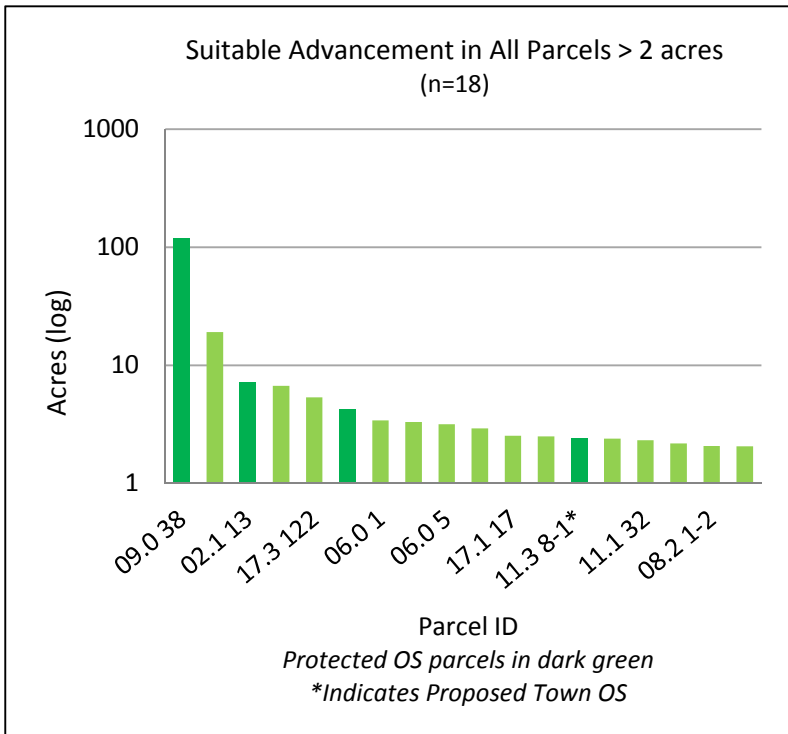


Parcel type	Yes	No	Total
OS	149.1	9.1	158
Non-OS	175	30.2	205
Total	324.1	39.3	364

(next page)

Suitable Advancement in All Parcels

There are 700 parcels of property with suitable marsh advancement, but only 18 contain greater than 2 acres. This small subset accounts for the majority of suitable advancement at 195 acres, or 60% of the overall total. Moreover, Rocky Neck State Park (parcel 09.0 38) is still two orders of magnitude greater than most of the other parcels in the group and 37% of the overall total. The parcel dataset did not include ownership information, but using the OS analysis as a guide it is safe to assume that no currently Town-owned parcels are amongst this selected sample. However, parcel 11.3 8-1, with 2.4 acres of suitable advancement, has been proposed for OS acquisition by the Town.

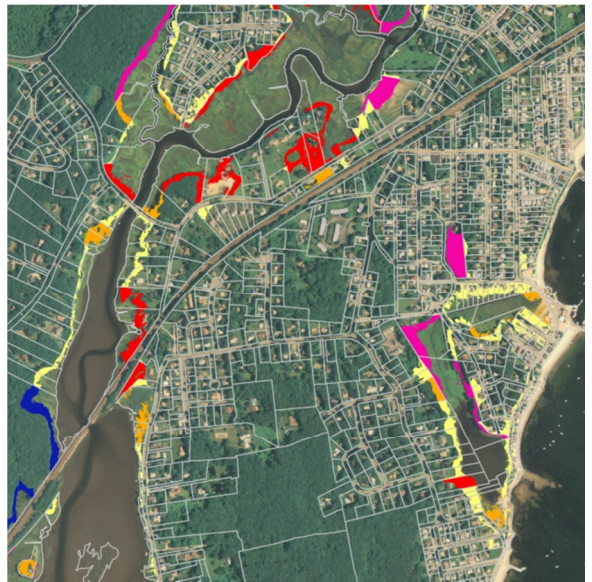


Suitable Marsh Adv in All Parcels > 2 acres			
Parcel ID	Acres	% of total yes adv	MapBook Page #
09.0 38	120.3	37.1	12
07.4 21	19.1	5.9	8,12,20,33
045-79	7.3	2.2	13
09.0 39	6.7	2.1	8,12,20,32
17.3 122	5.4	1.7	9,13,18,30
045-62	4.2	1.3	12
06.0 1	3.4	1.1	8,12,20,32
04.2 5	3.3	1.0	8,12,24,36
06.0 5	3.2	1.0	8,12,20,32
08.2 24	2.9	0.9	9,13,22,34
17.1 17	2.5	0.8	9,13,18,30
10.4 48	2.5	0.8	9,13,20,33
11.3 8-1*	2.4	0.8	9,13,20,33
17.3 216	2.4	0.7	9,13,18,30
11.1 32	2.3	0.7	9,13,20,33
11.1 30	2.2	0.7	9,13,22,34
08.2 1-2	2.1	0.6	9,13,22,34
08.4 71	2.1	0.6	9,13,22,34
Total	194.5	60	

Appendix

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

Comprehensive Map Book of East Lyme, Connecticut



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-- Table of Contents --

Overview Maps

Marsh Advancement	3
Unprotected Parcels	7
Critical Parcels.....	11

Inset Maps

Unprotected Parcels.....	15
Advancement per Parcel	27

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Marsh Advancement by the 2080s

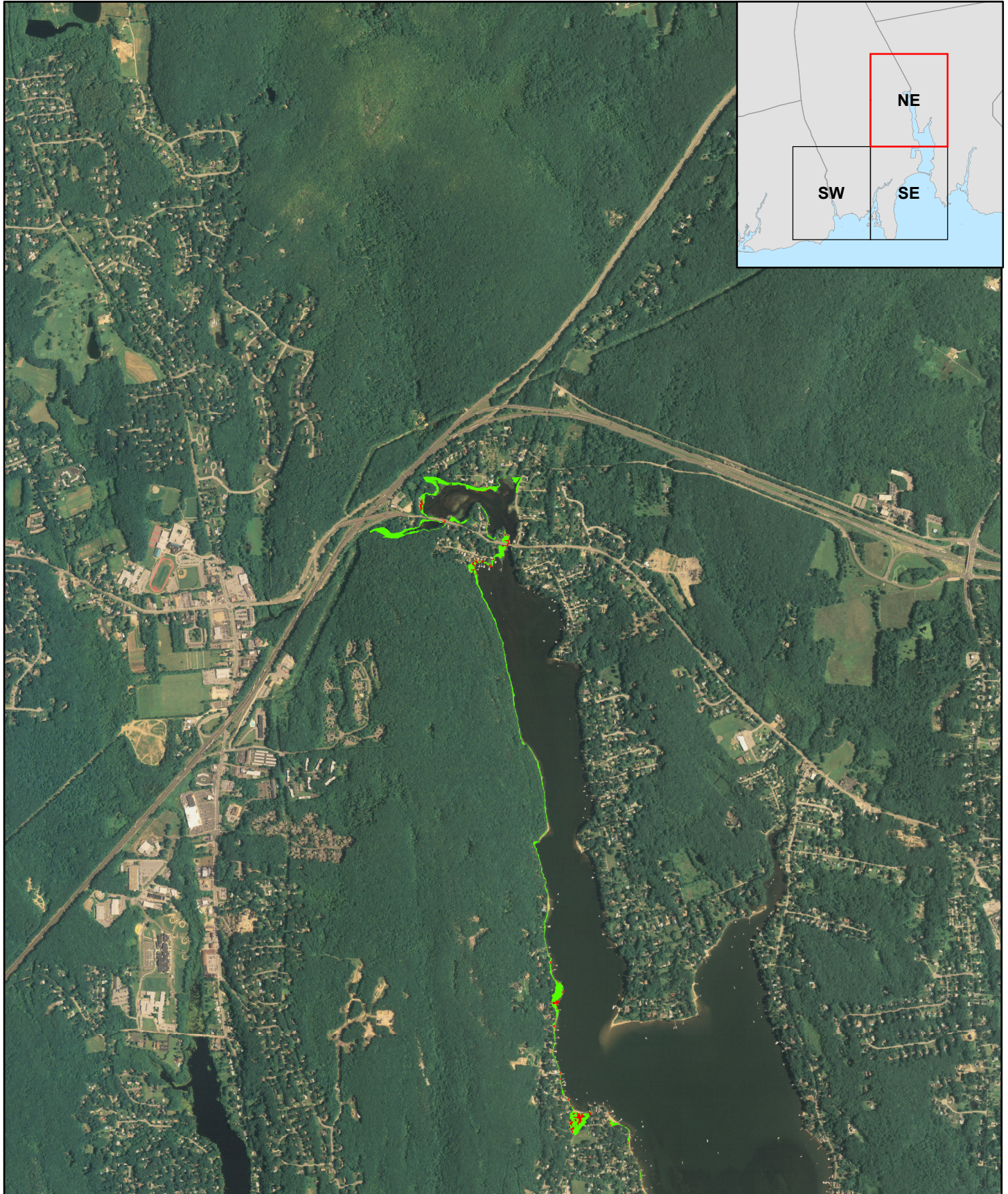
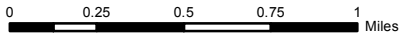
Town of East Lyme, CT

Marsh Advancement - NE



Marsh Advancement by 2080s

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



Marsh Advancement by the 2080s

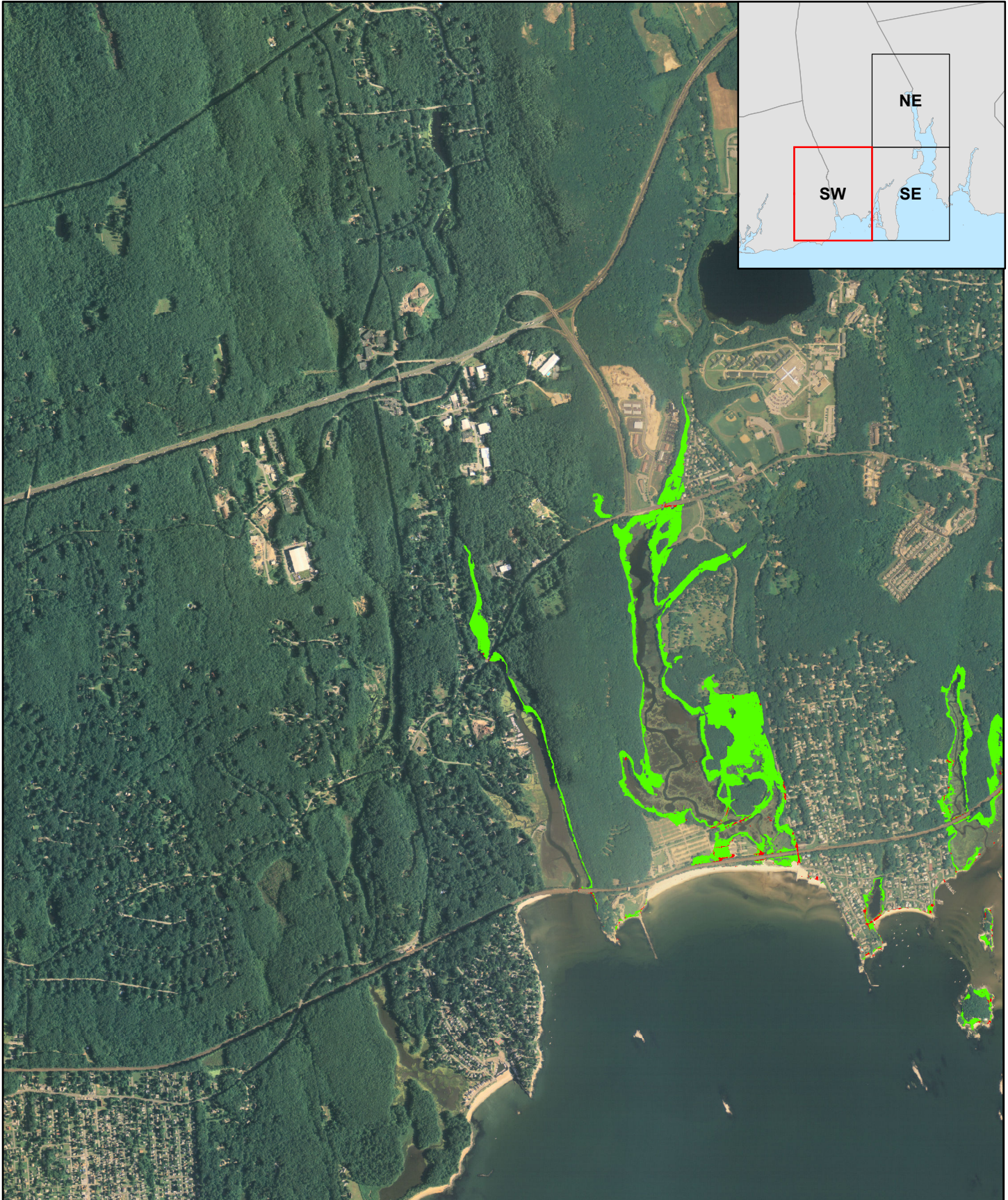
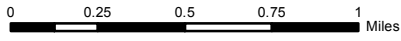
Town of East Lyme, CT

Marsh Advancement - SW



Marsh Advancement by 2080s

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



Marsh Advancement by the 2080s

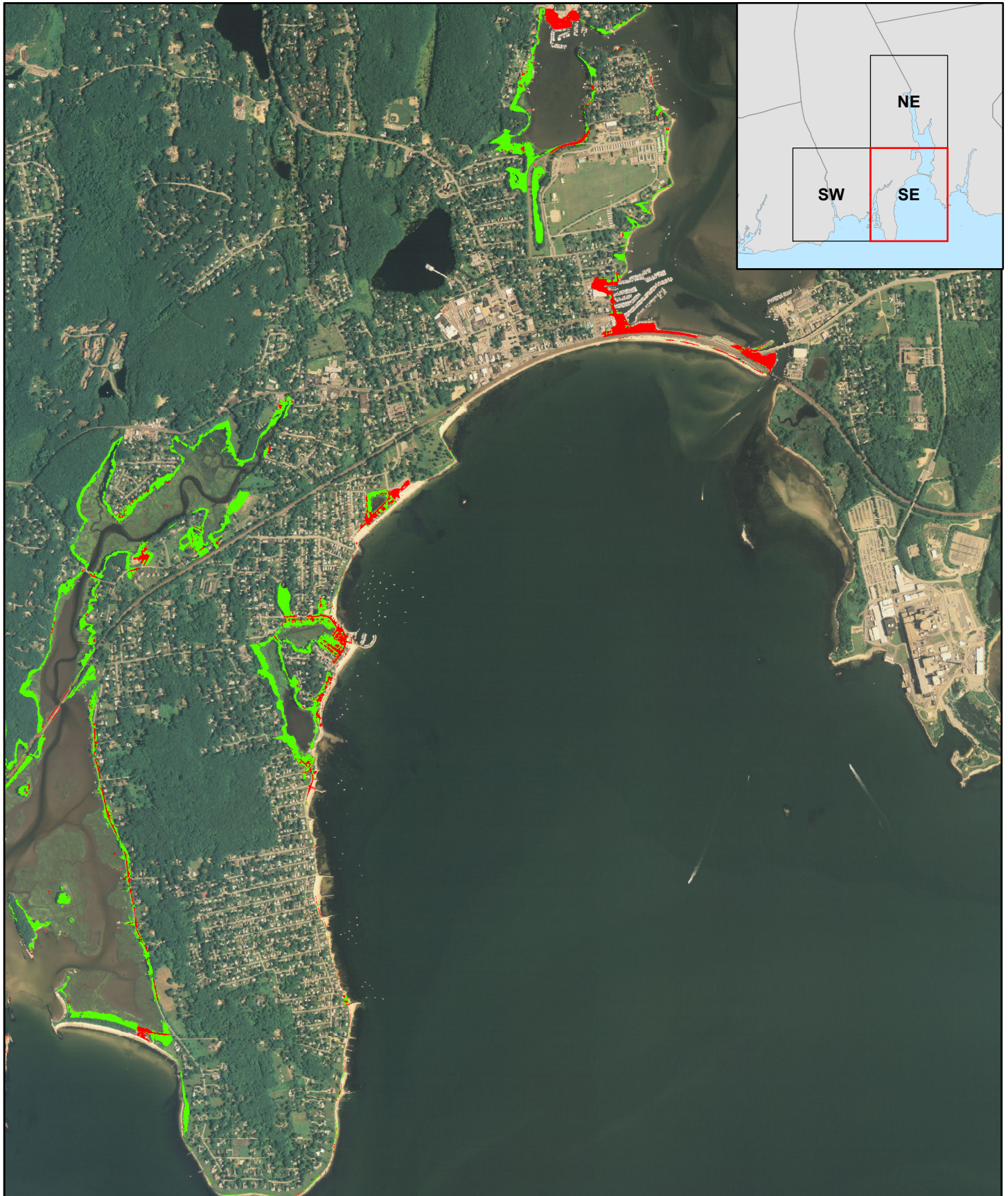
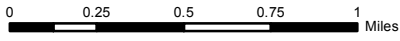
Town of East Lyme, CT

Marsh Advancement - SE



Marsh Advancement by 2080s

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

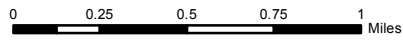


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Marsh Advancement by the 2080s

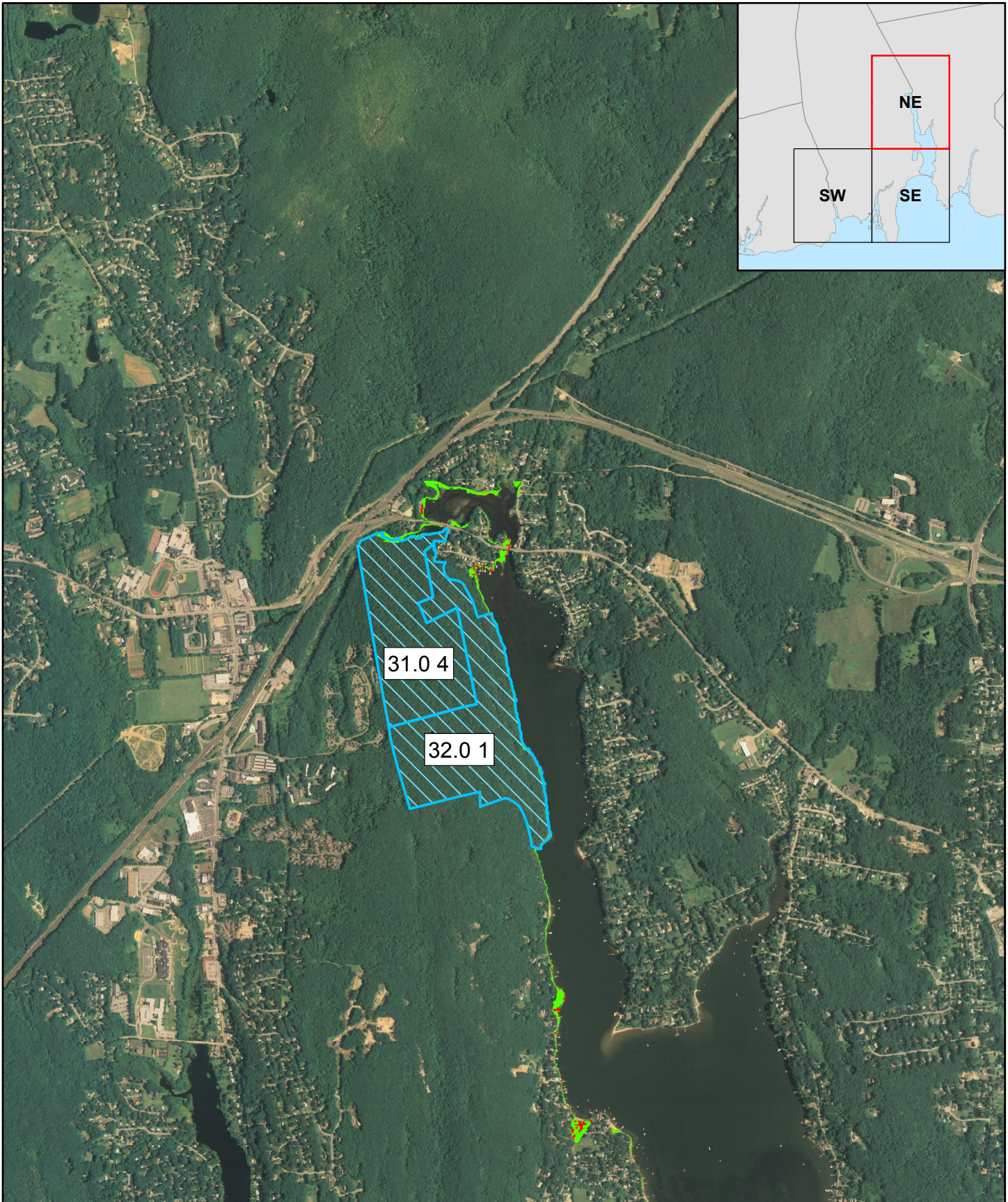
Town of East Lyme, CT

Unprotected Parcels - NE



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

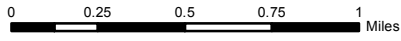
Note: Only Non-OS parcels with > 2 acres of suitable (green) advancement and Proposed OS parcels with >1 acre are outlined and labeled.



Marsh Advancement by the 2080s

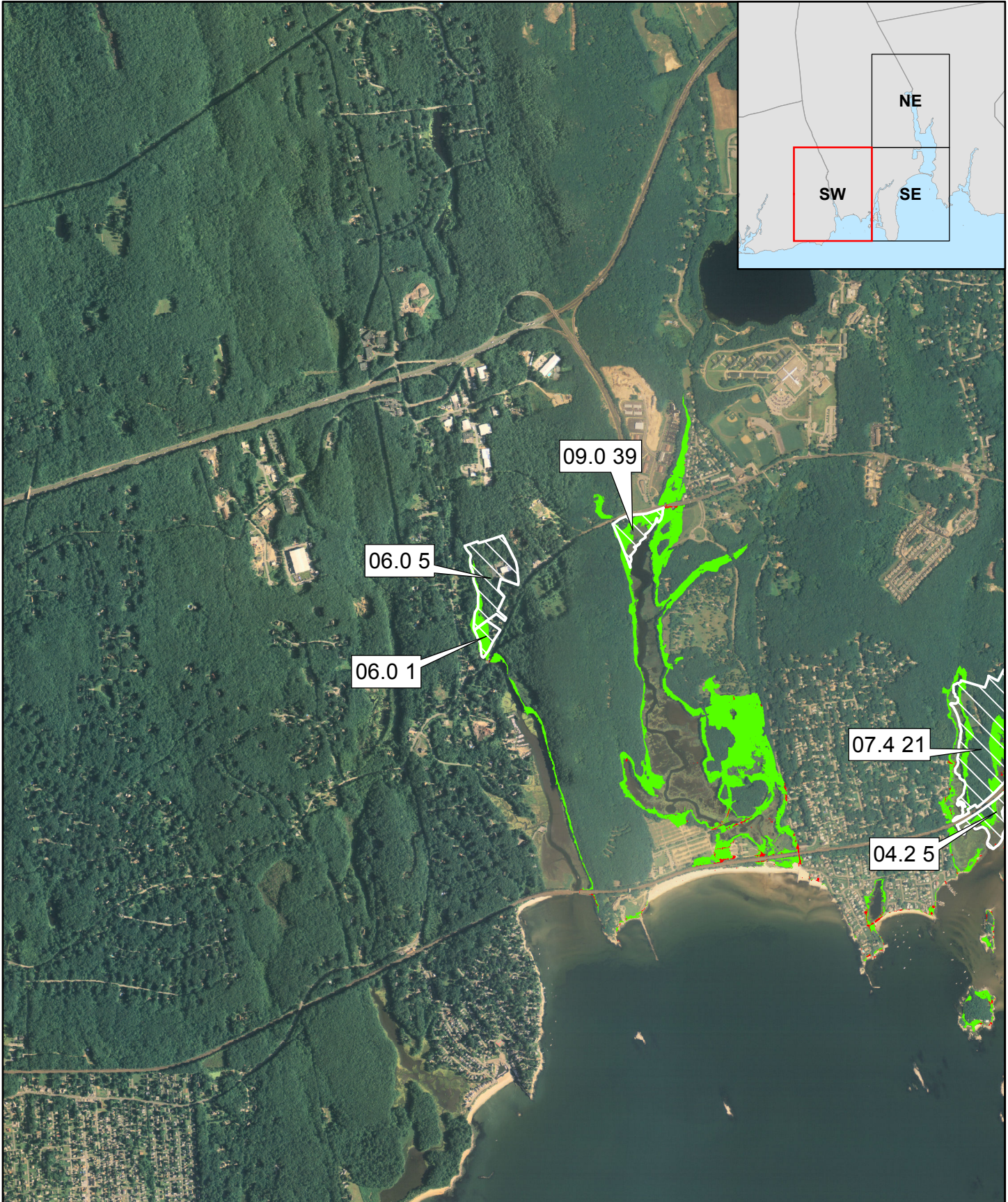
Town of East Lyme, CT

Unprotected Parcels - SW



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

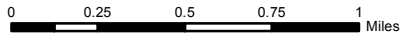
Note: Only Non-OS parcels with > 2 acres of suitable (green) advancement and Proposed OS parcels with >1 acre are outlined and labeled.



Marsh Advancement by the 2080s

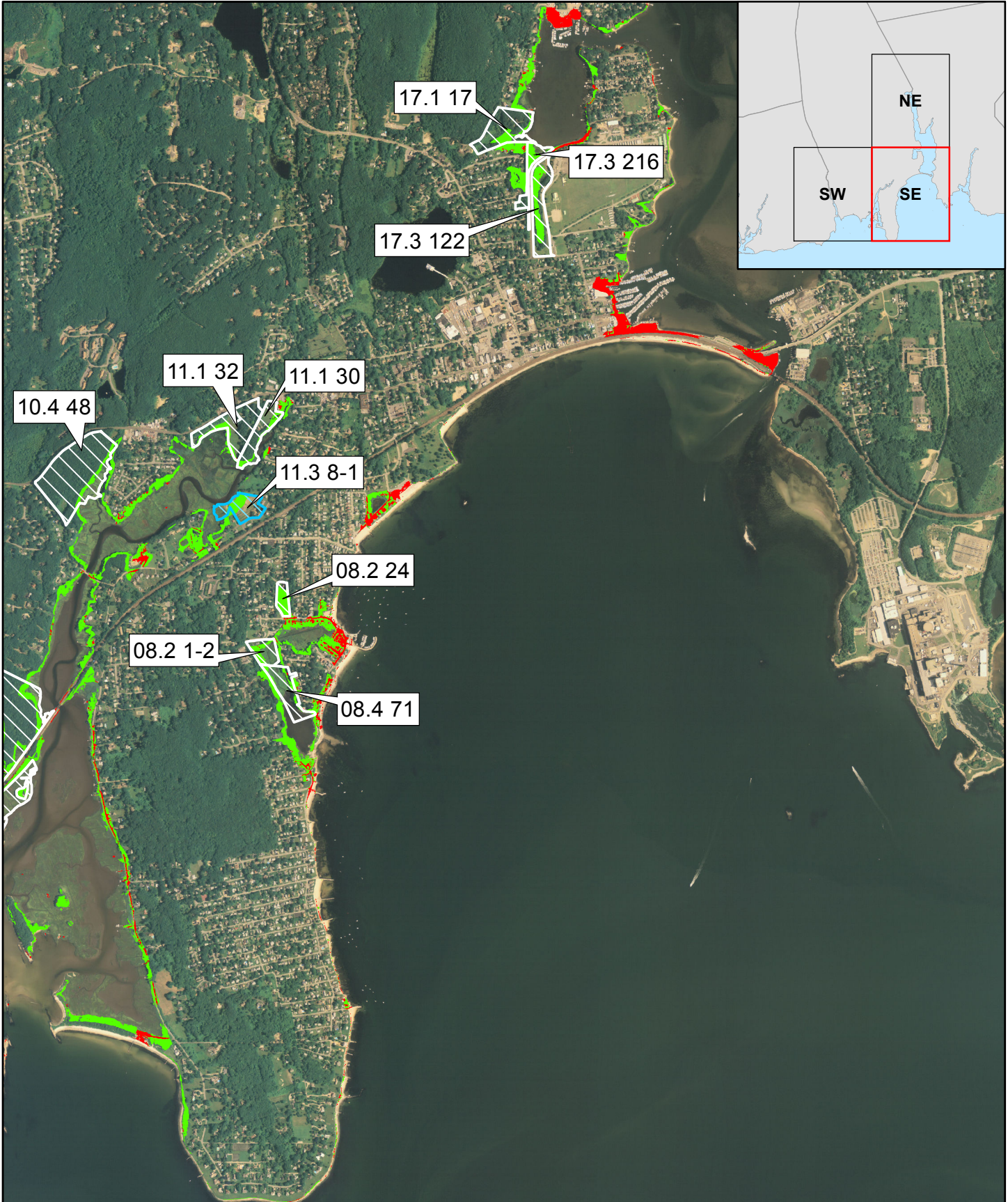
Town of East Lyme, CT

Unprotected Parcels - SE



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

Note: Only Non-OS parcels with > 2 acres of suitable (green) advancement and Proposed OS parcels with >1 acre are outlined and labeled.



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Marsh Advancement by the 2080s

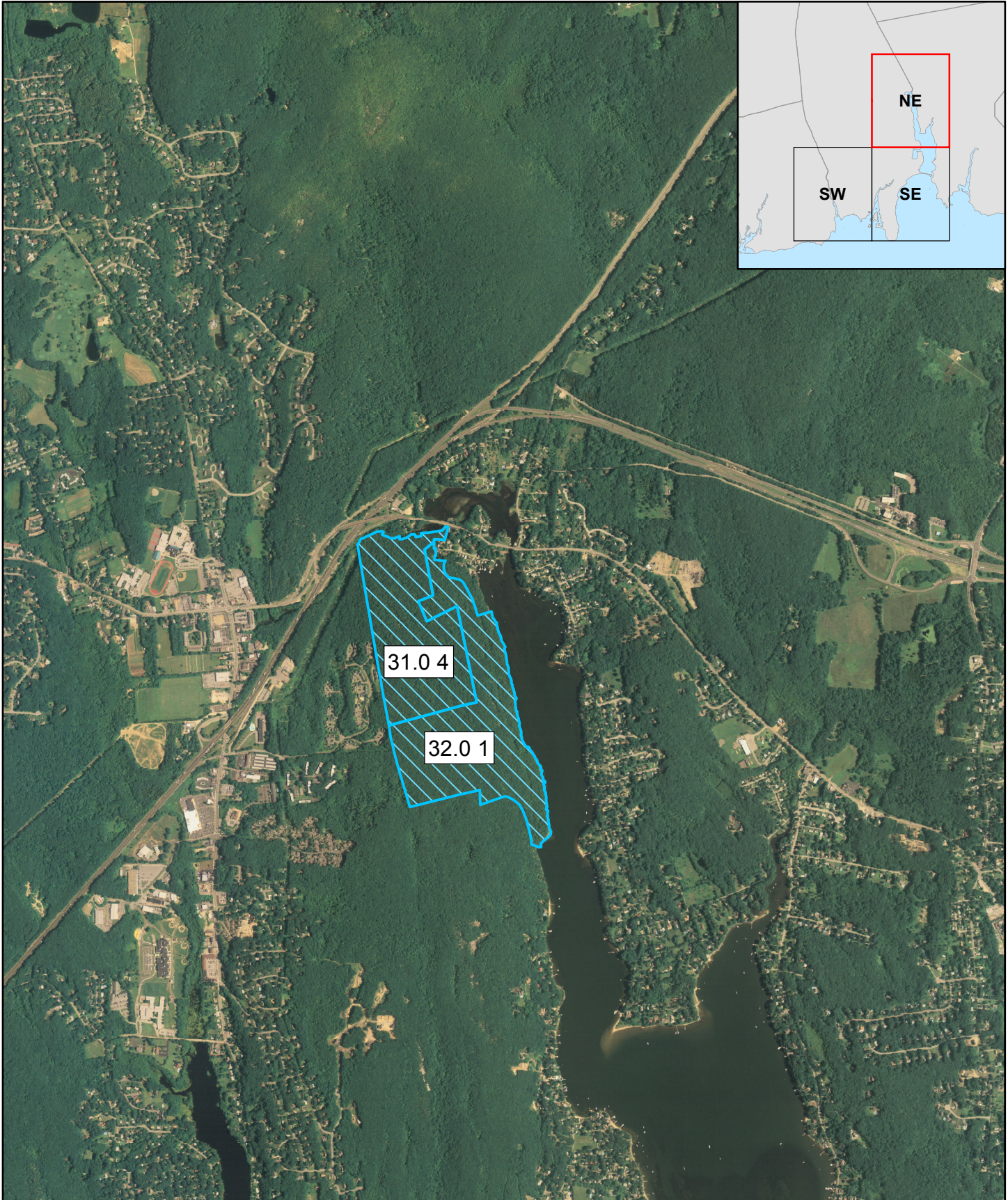
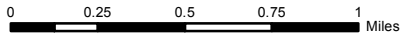
Town of East Lyme, CT

Critical Parcels - NE

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

Parcels

-  Proposed OS
-  Unprotected Non-OS
-  Protected OS






Marsh Advancement by the 2080s

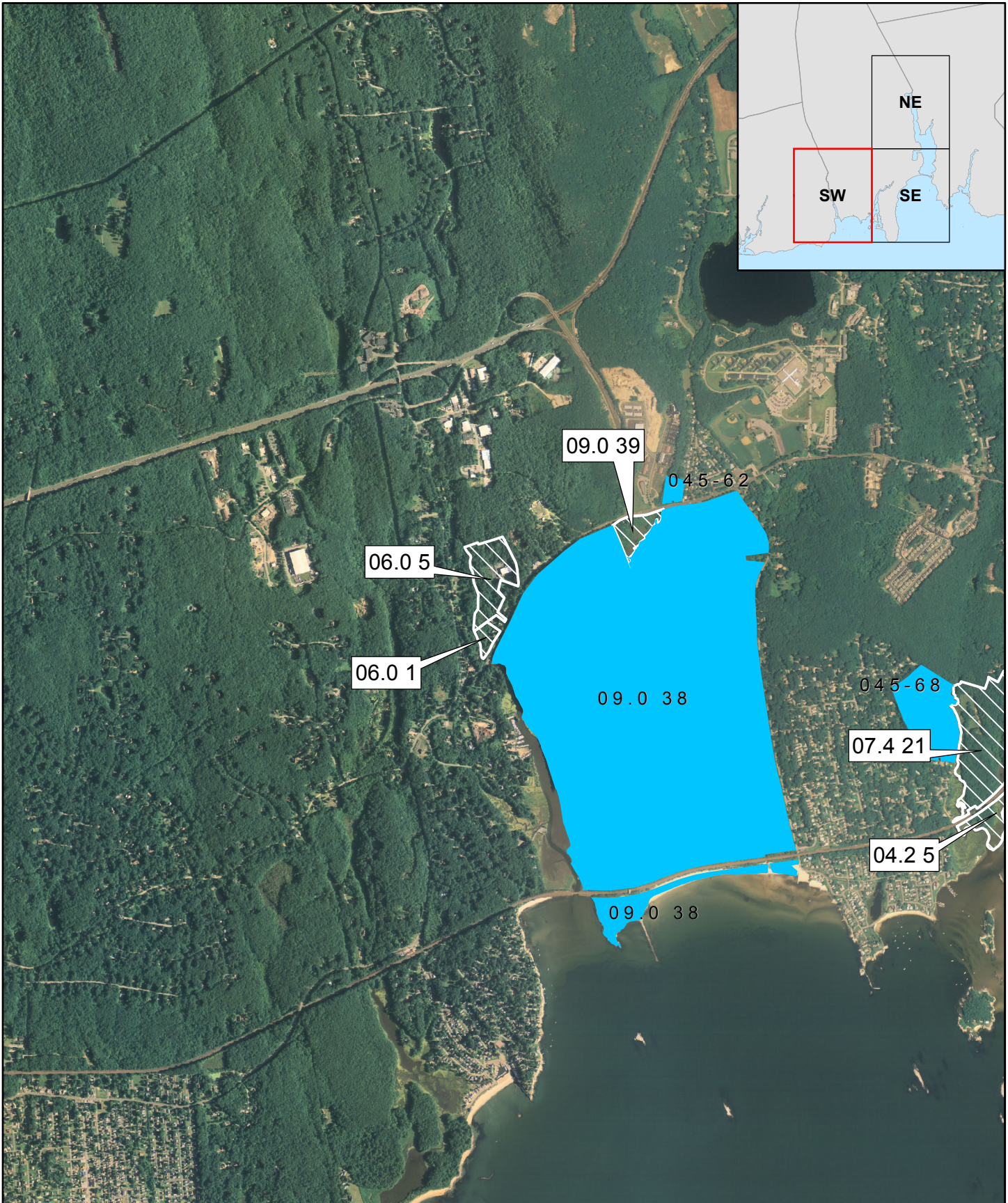
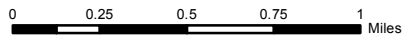
Town of East Lyme, CT

Critical Parcels - SW

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

Parcels

-  Proposed OS
-  Unprotected Non-OS
-  Protected OS



Marsh Advancement by the 2080s

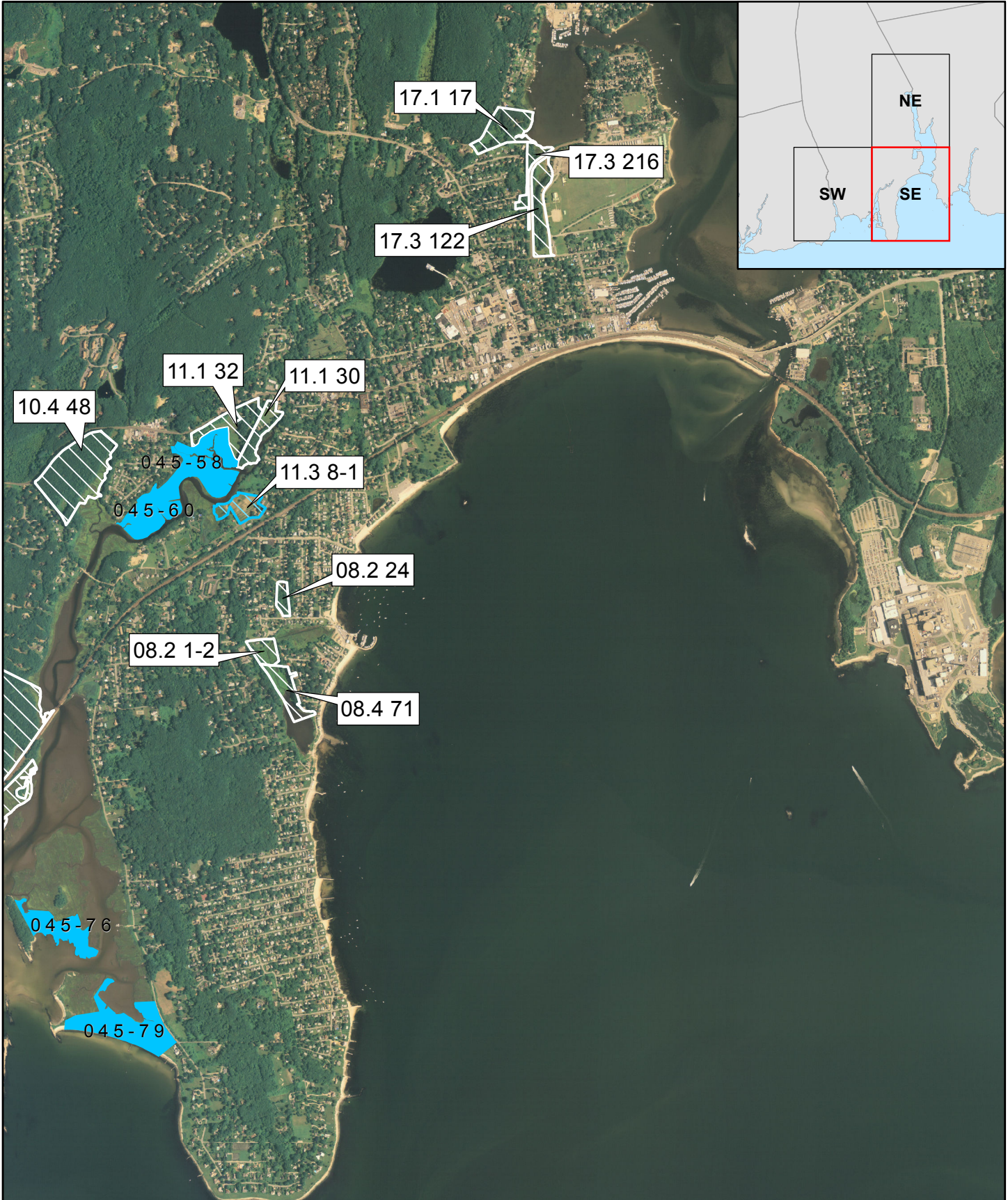
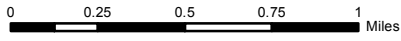
Town of East Lyme, CT

Critical Parcels - SE

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

Parcels

- Proposed OS
- Unprotected Non-OS
- Protected OS

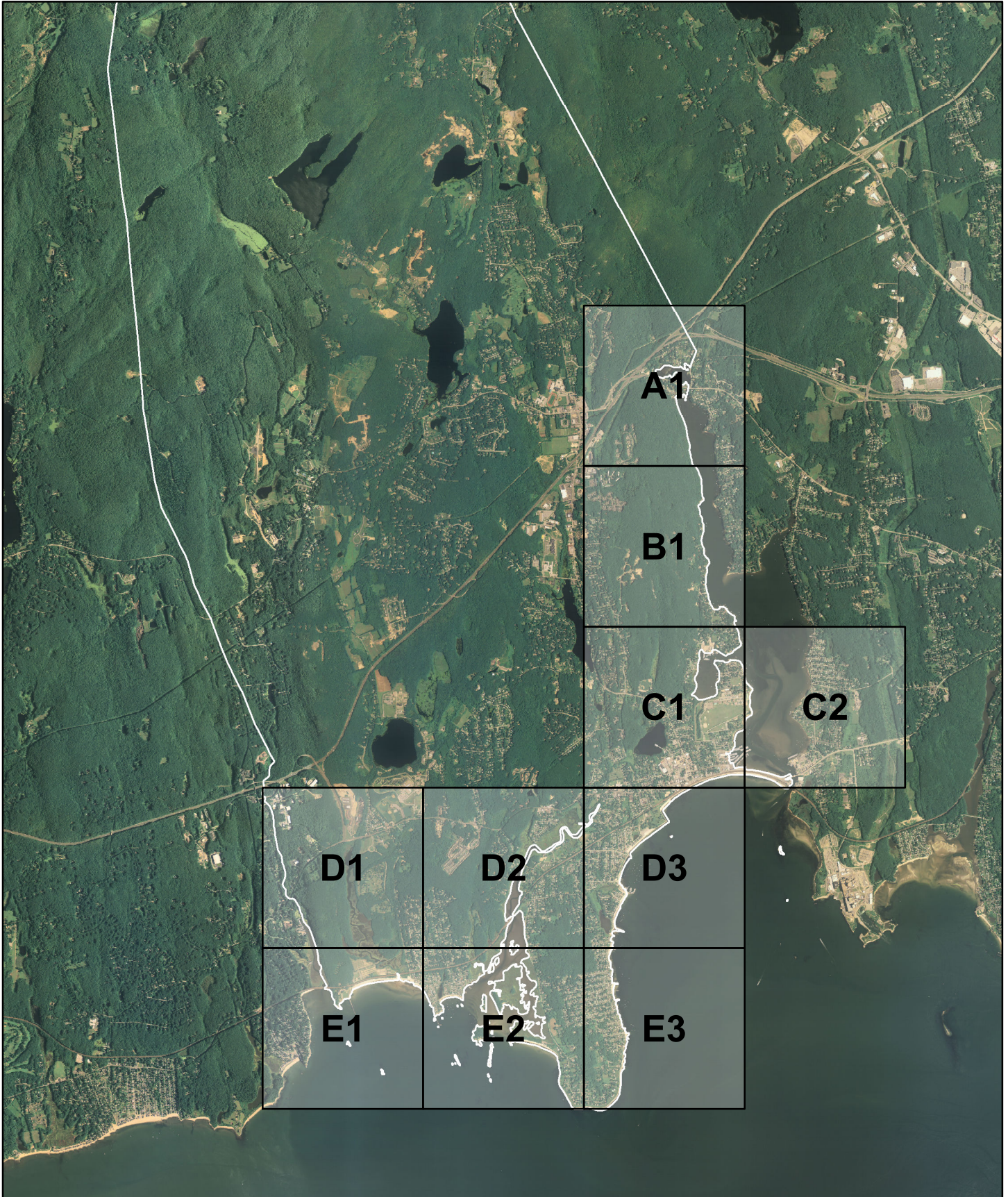


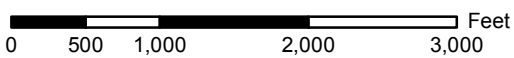
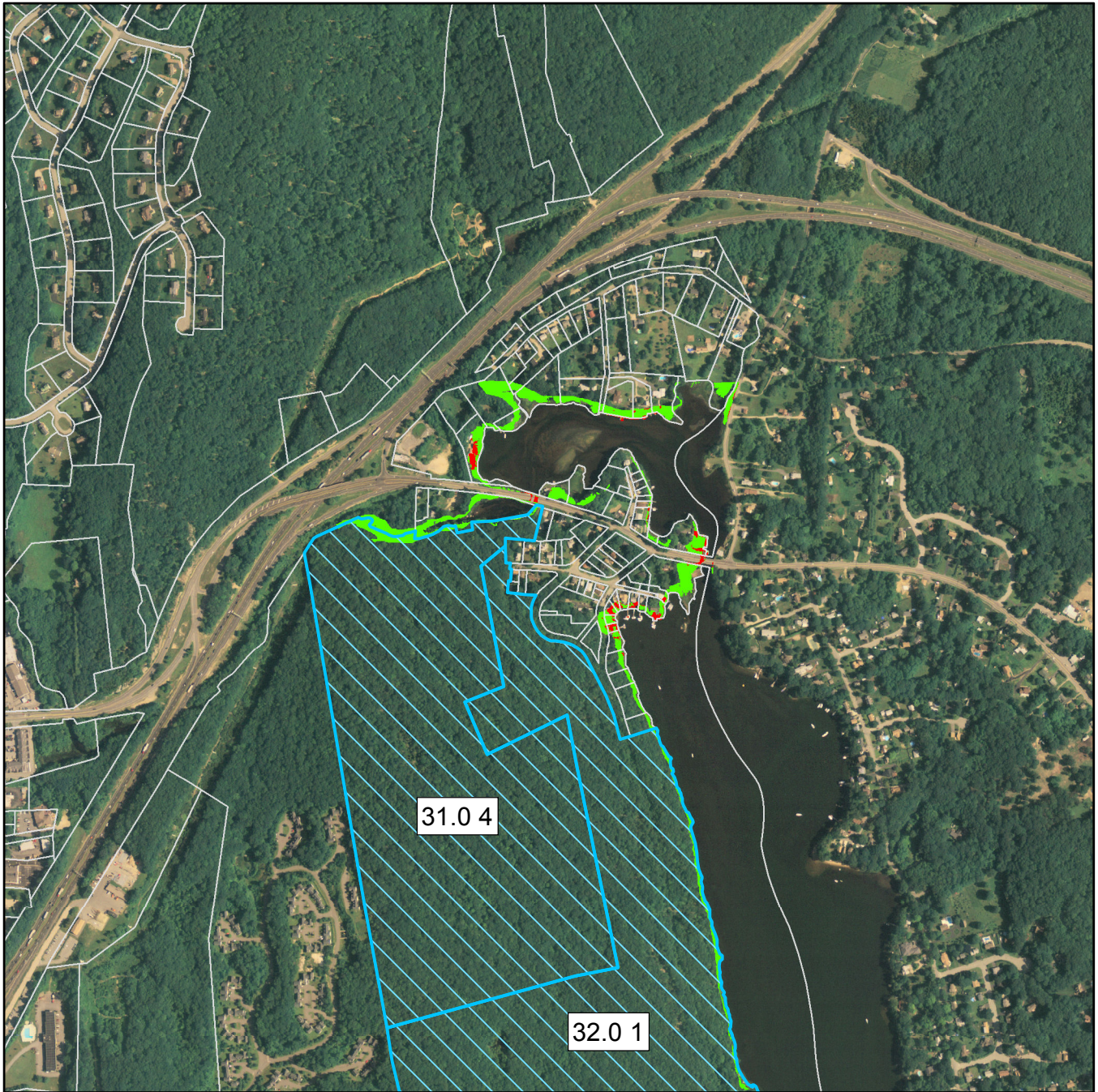
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Marsh Advancement by the 2080s

Town of East Lyme, CT

Map Index - Unprotected Parcels





see page 17

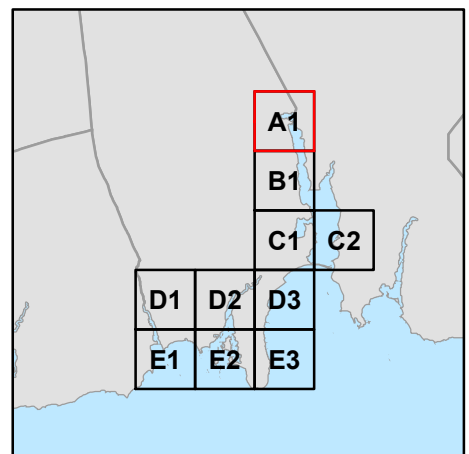
Marsh Advancement by the 2080s

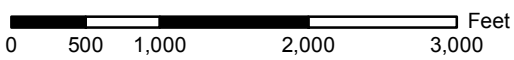
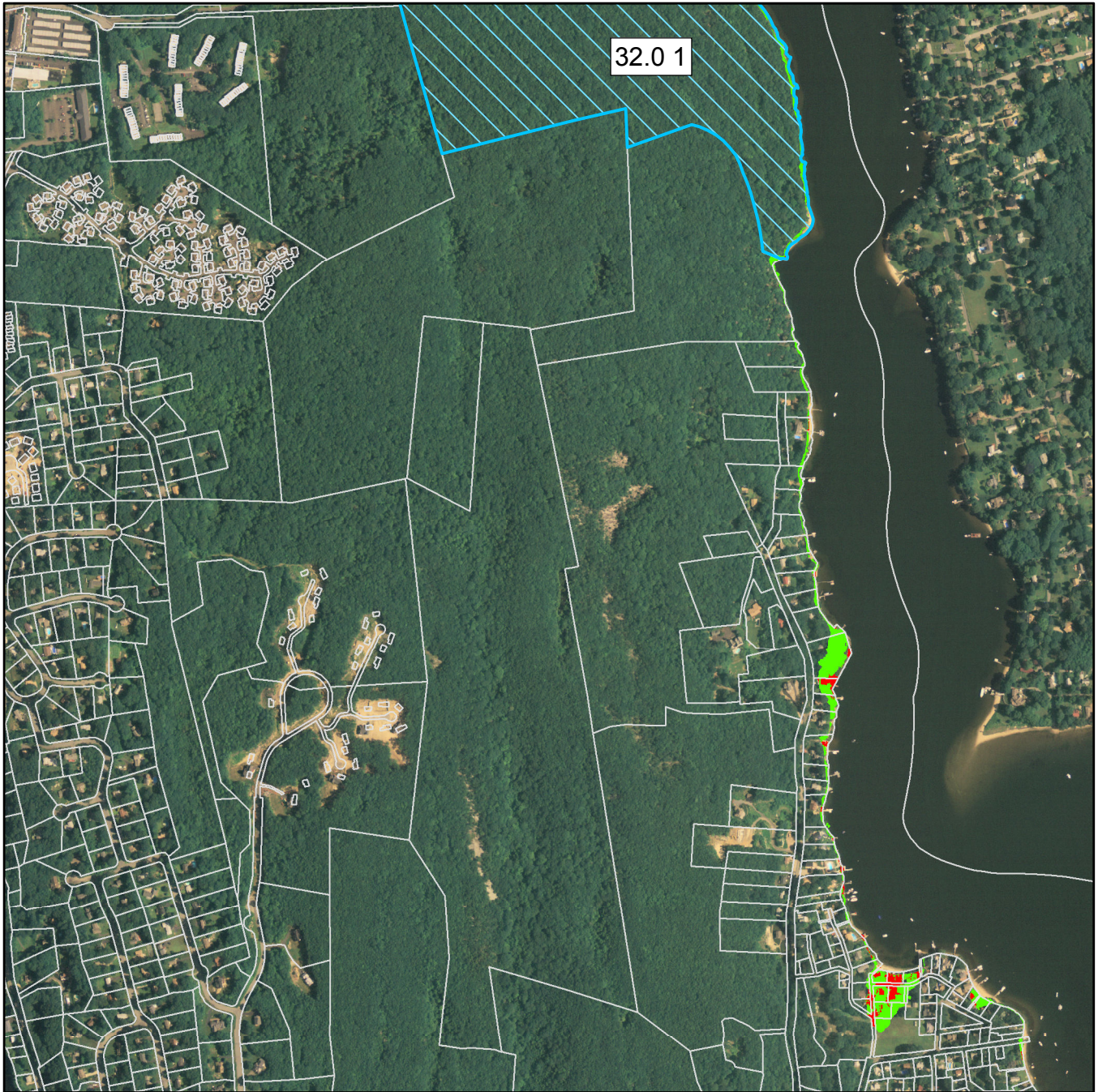
Town of East Lyme, CT

Unprotected Parcels - Map A1



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.





see page 18

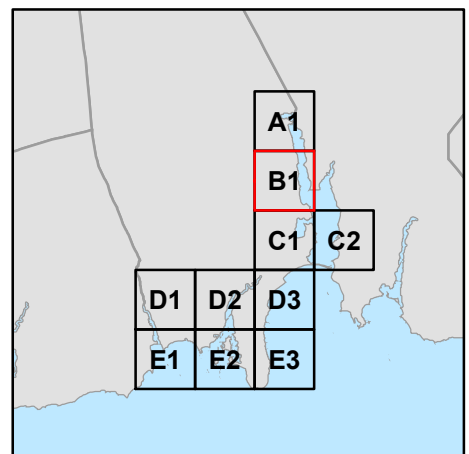
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map B1

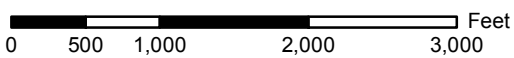


Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.





see page 19



see page 22

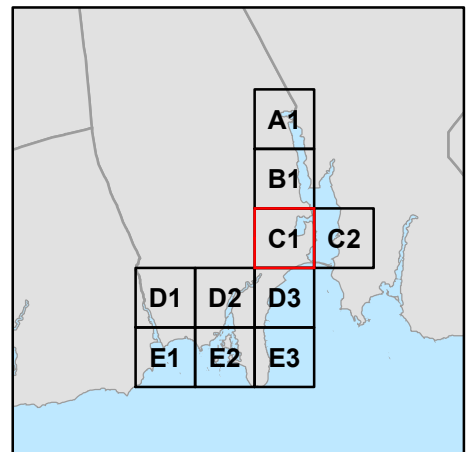
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map C1



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.



see page 18



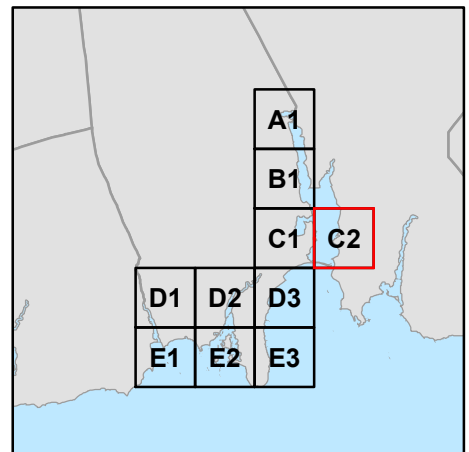
Marsh Advancement by the 2080s

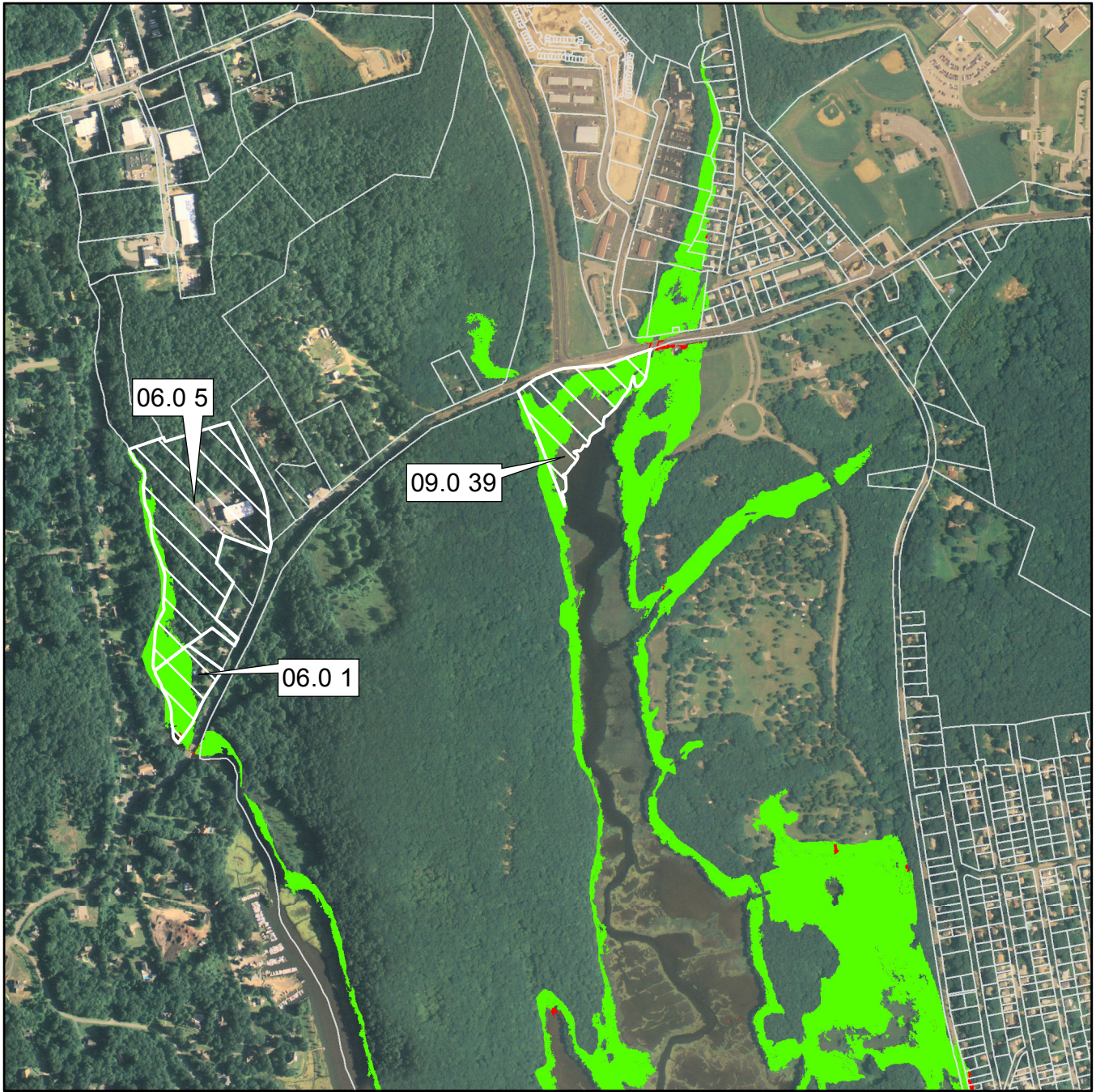
Town of East Lyme, CT

Unprotected Parcels - Map C2



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.





see page 21



see page 23

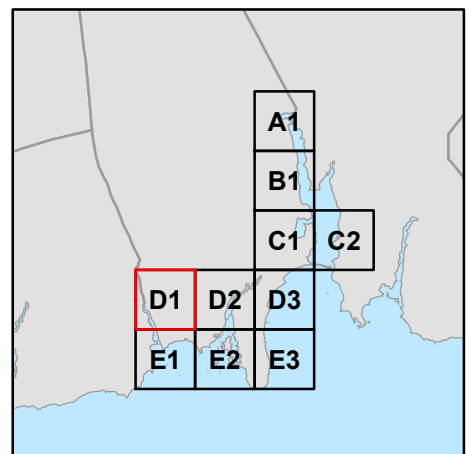
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map D1

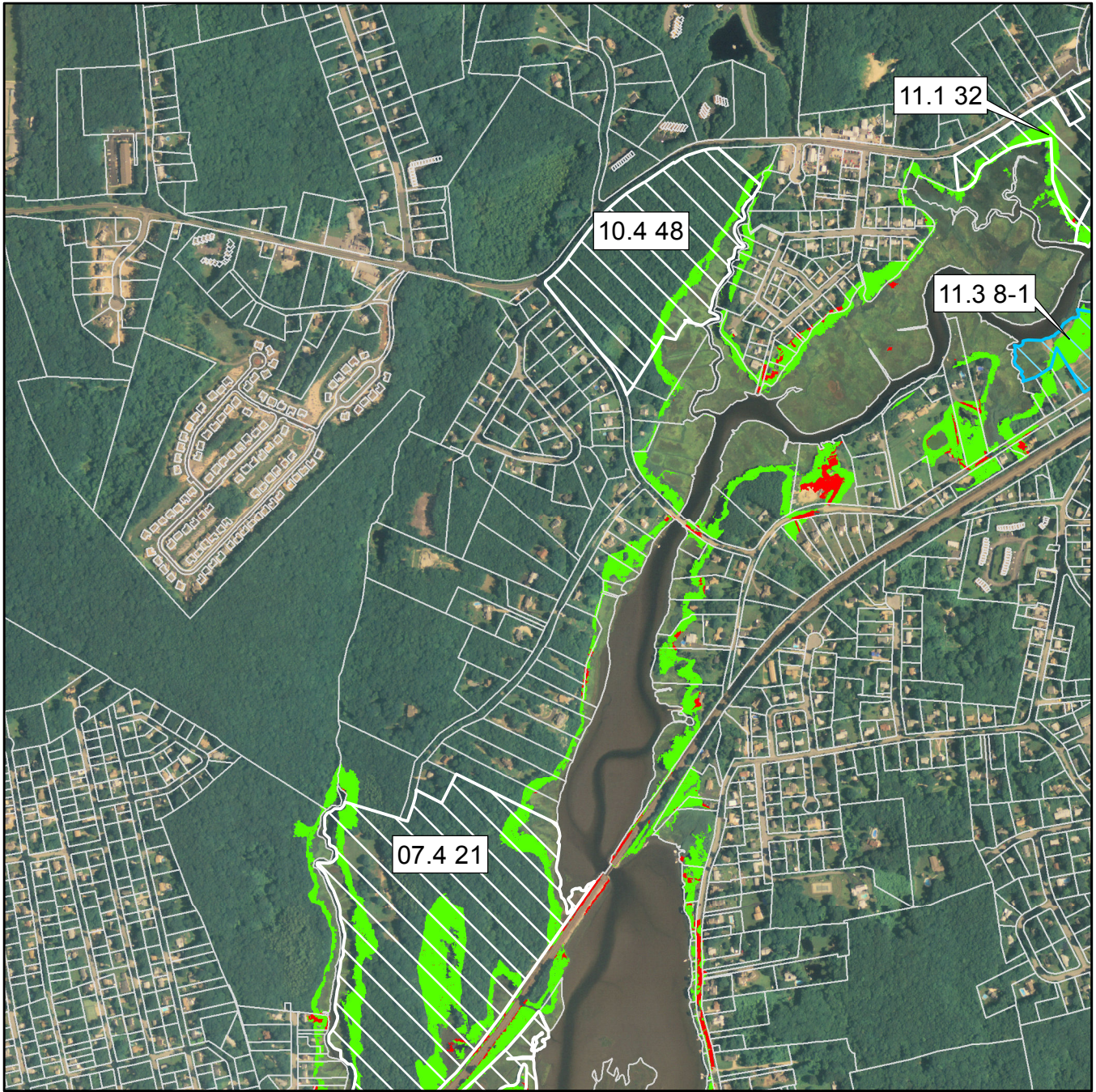


Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.



see page 20

see page 22



0 500 1,000 2,000 3,000 Feet

see page 24

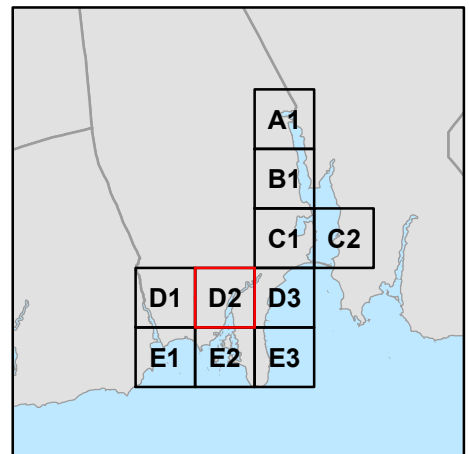
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map D2



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.



see page 21



see page 25

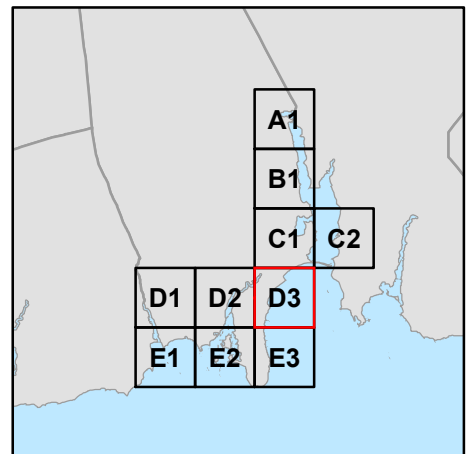
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map D3



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.





see page 24



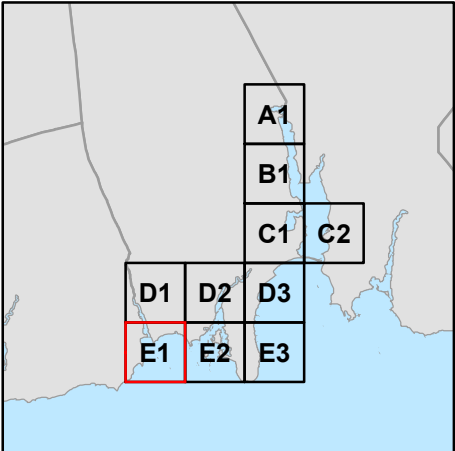
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map E1



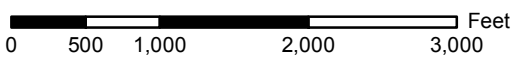
Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.





see page 23

see page 25



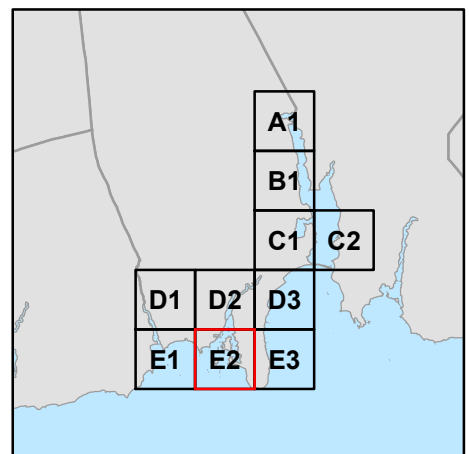
Marsh Advancement by the 2080s

Town of East Lyme, CT

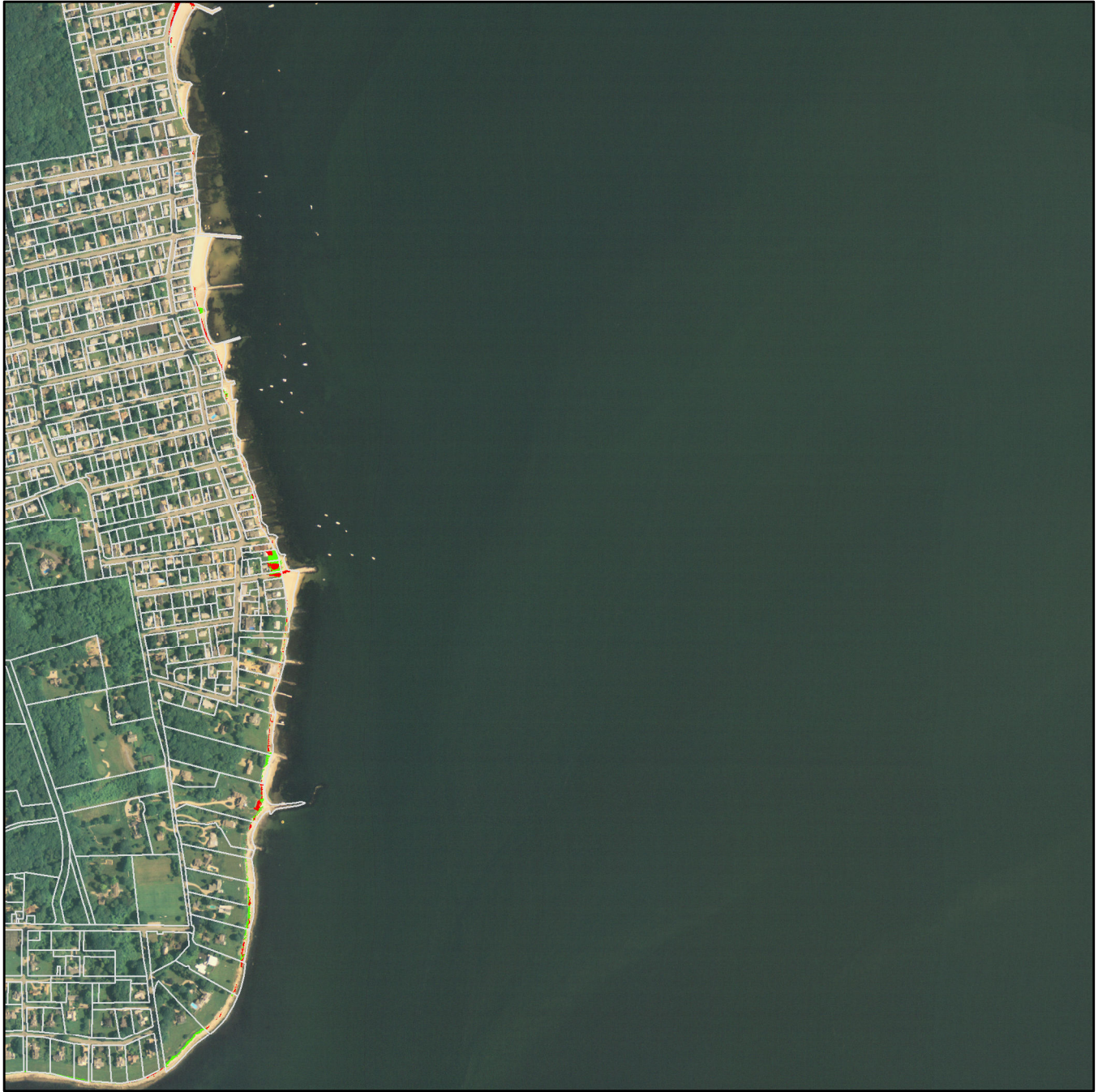
Unprotected Parcels - Map E2



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.



see page 24



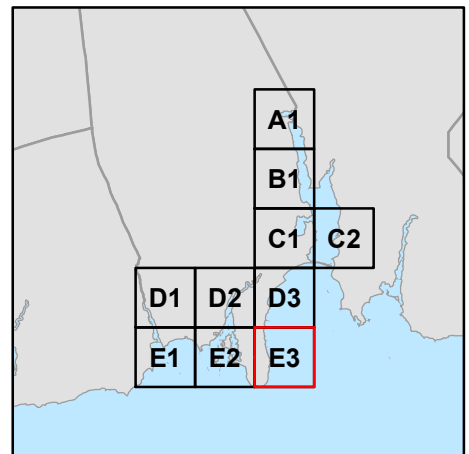
Marsh Advancement by the 2080s

Town of East Lyme, CT

Unprotected Parcels - Map E3



Note: Only Non-OS parcels with > 2 acres of "green" marsh advancement and Proposed OS parcels with > 1 acre are shown.

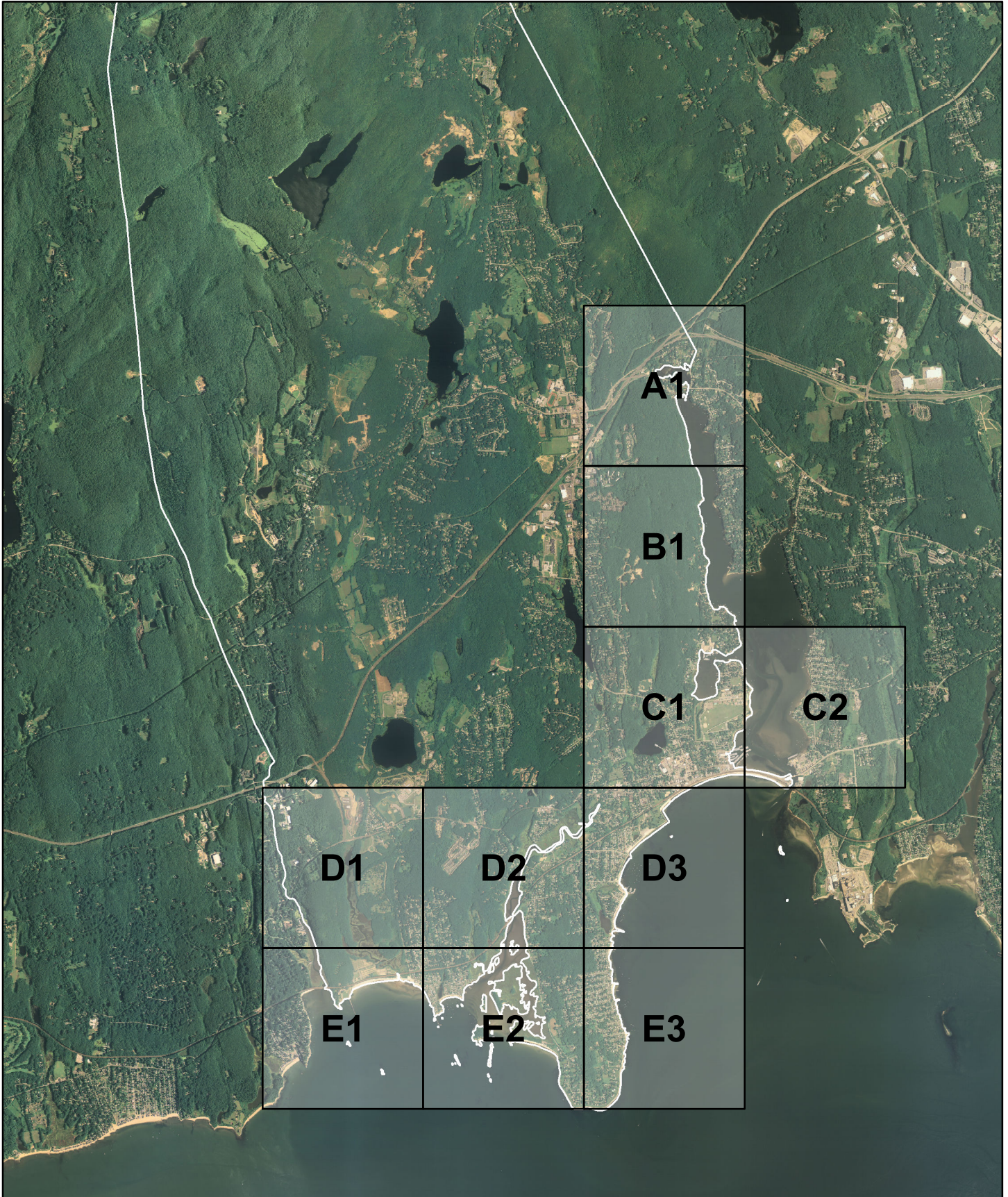


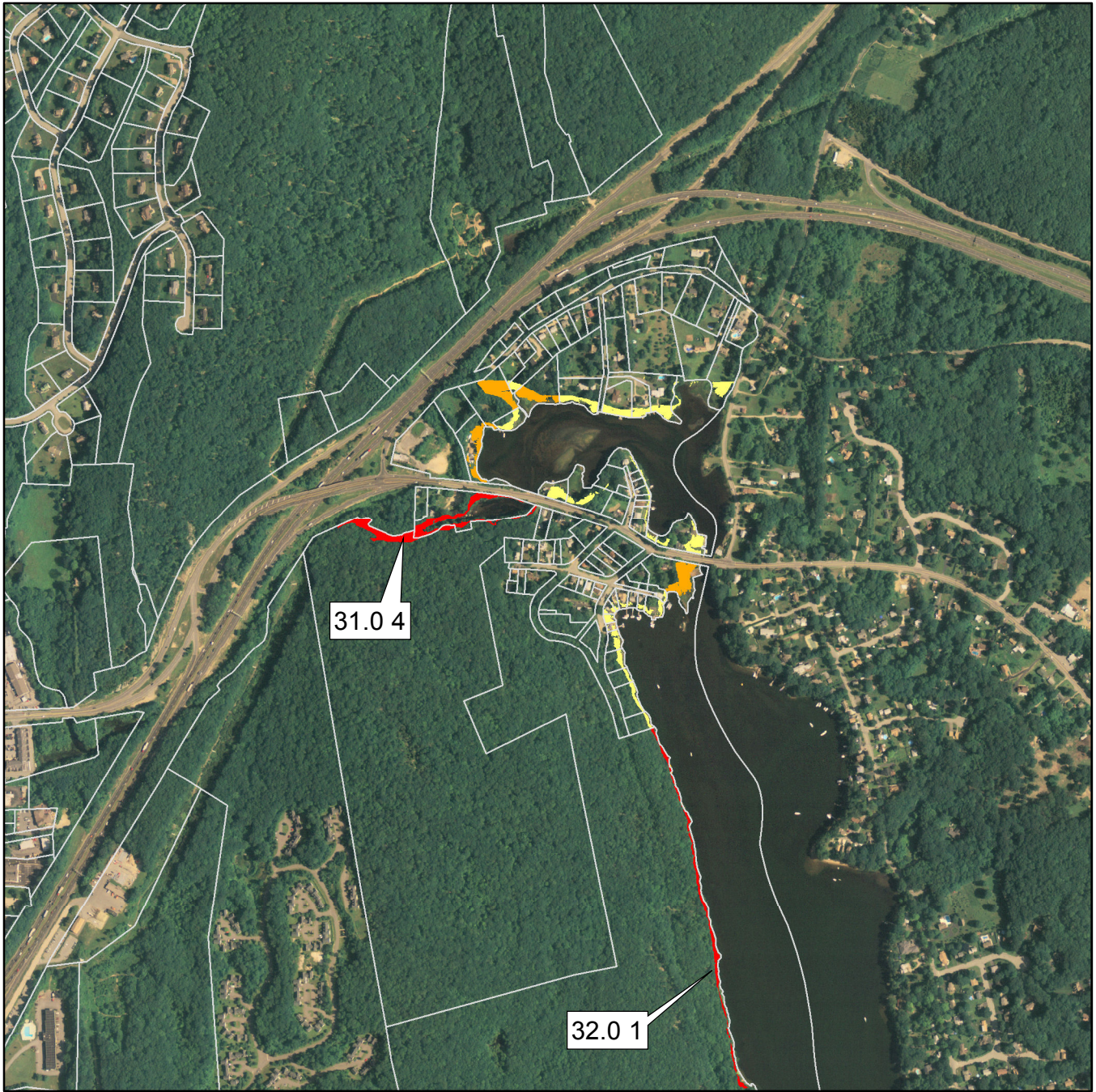
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Marsh Advancement by the 2080s

Town of East Lyme, CT

Map Index - Advancement per Parcel



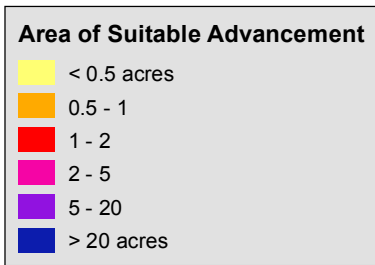


see page 29

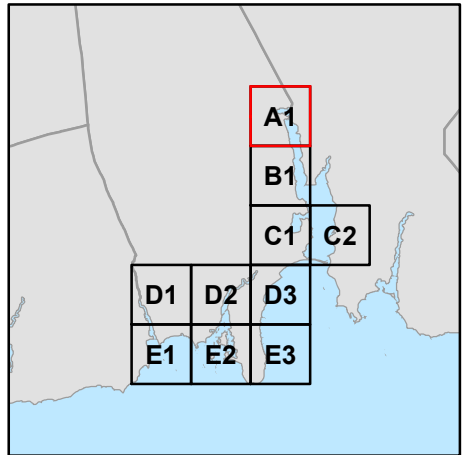
Marsh Advancement by the 2080s

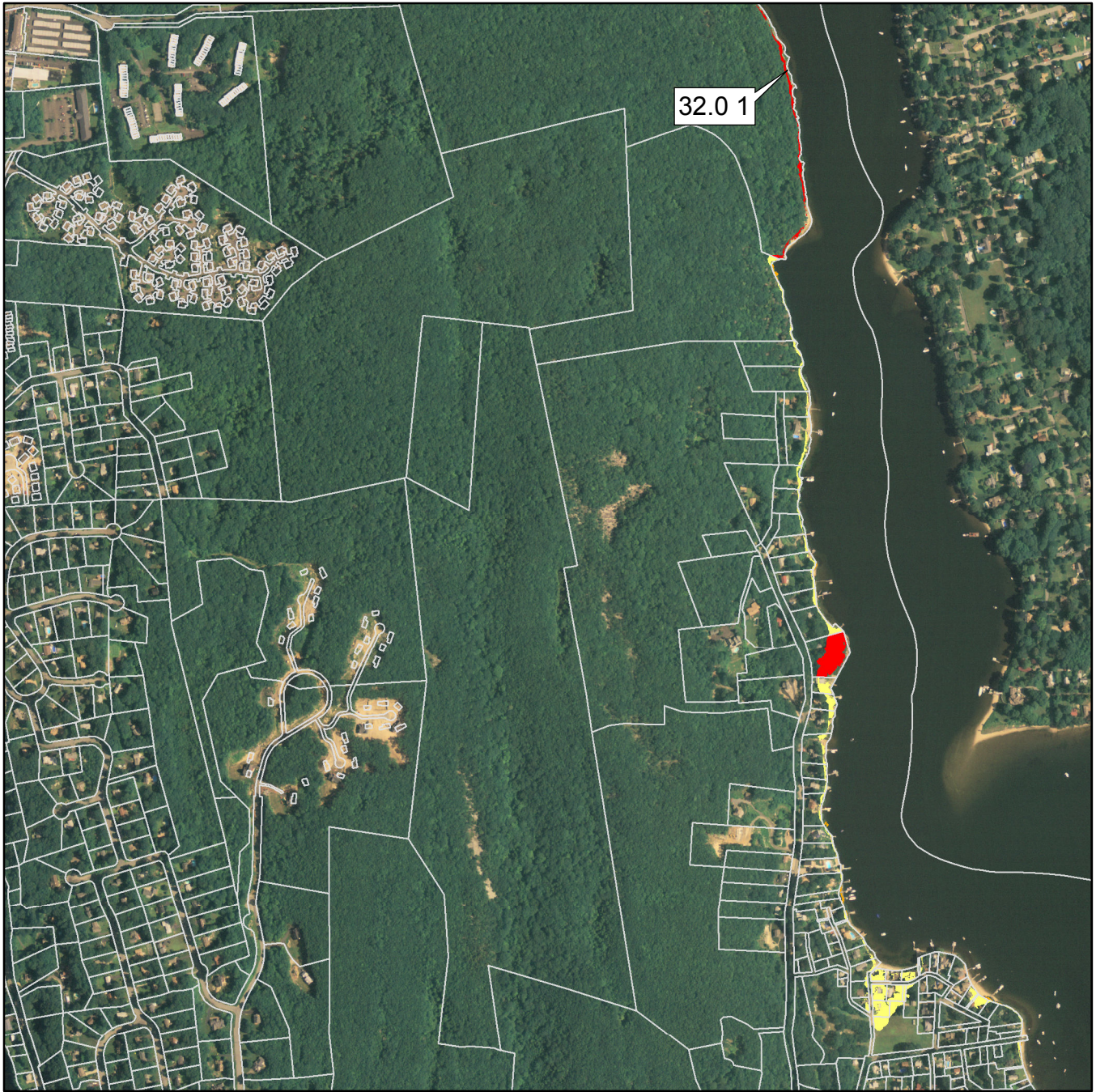
Town of East Lyme, CT

Advancement per Parcel - Map A1



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



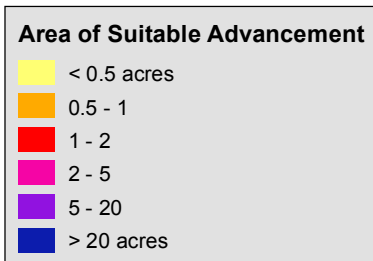


see page 30

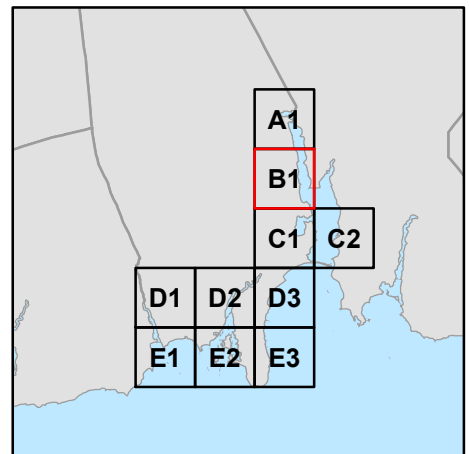
Marsh Advancement by the 2080s

Town of East Lyme, CT

Advancement per Parcel - Map B1



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





see page 31

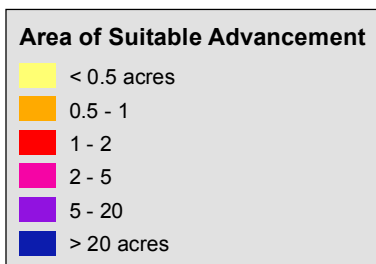


see page 34

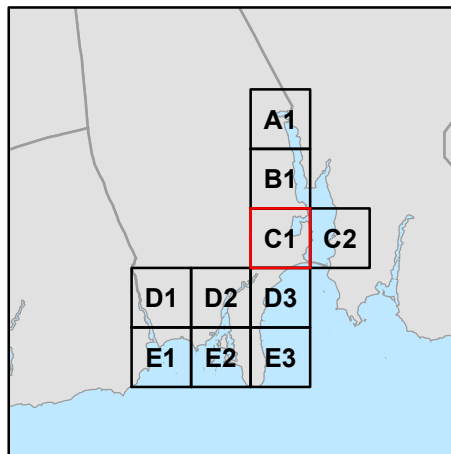
Marsh Advancement by the 2080s

Town of East Lyme, CT

Advancement per Parcel - Map C1



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



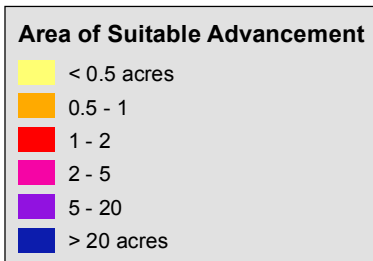
see page 30



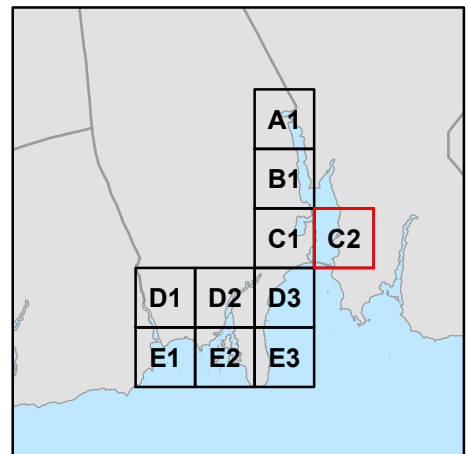
Marsh Advancement by the 2080s

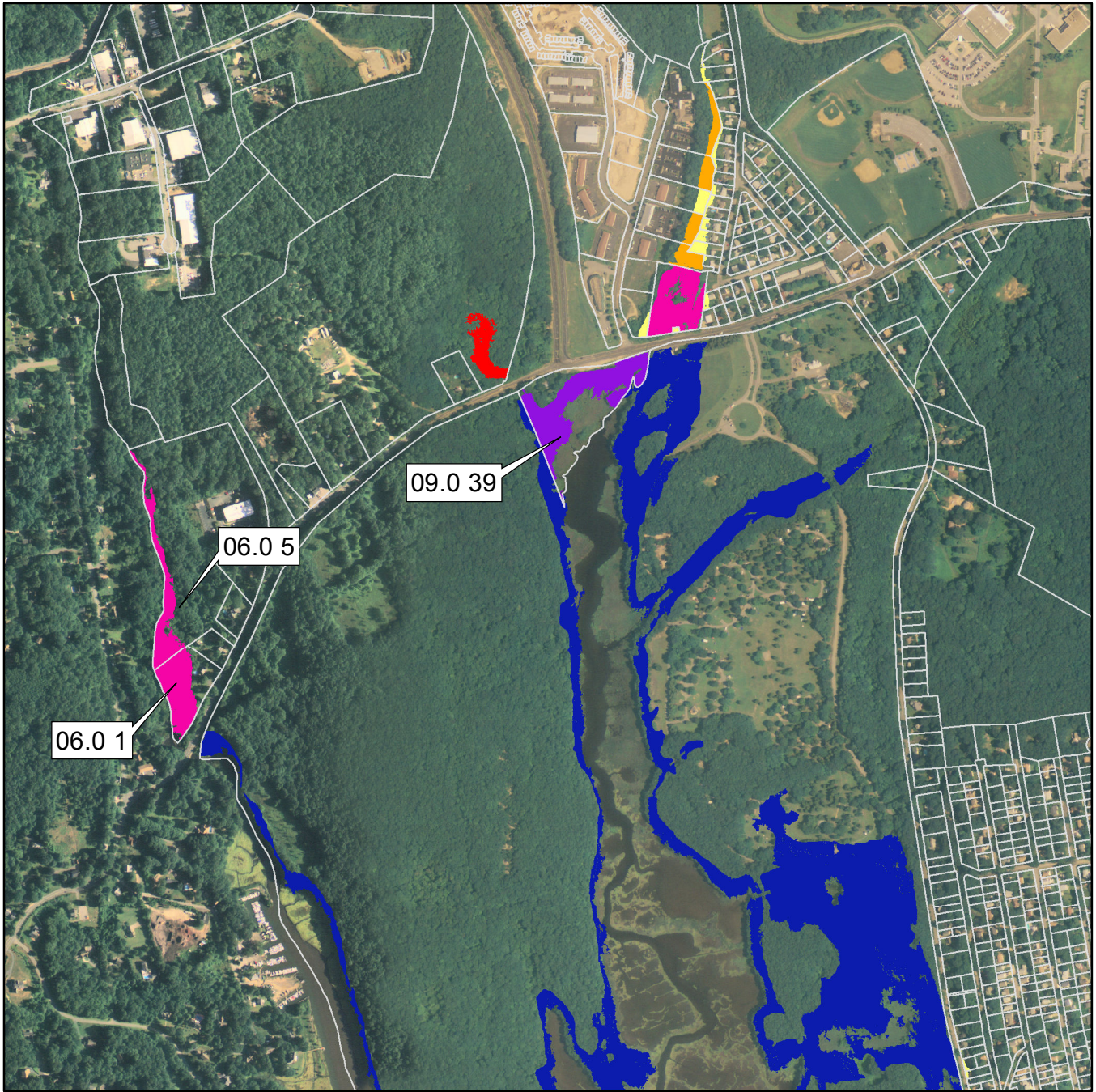
Town of East Lyme, CT

Advancement per Parcel - Map C2



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





see page 33

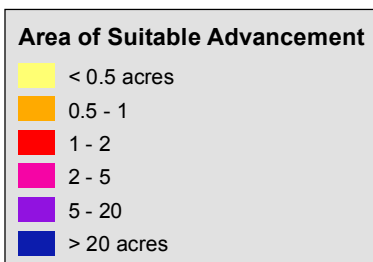


see page 35

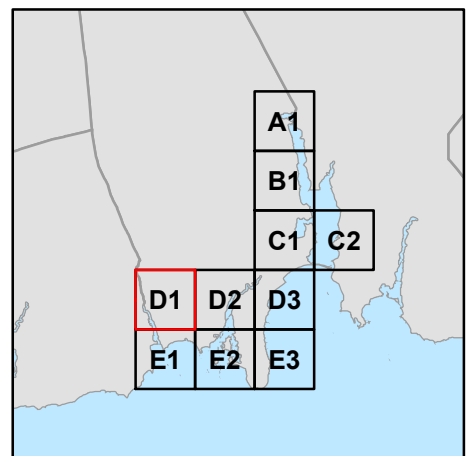
Marsh Advancement by the 2080s

Town of East Lyme, CT

Advancement per Parcel - Map D1

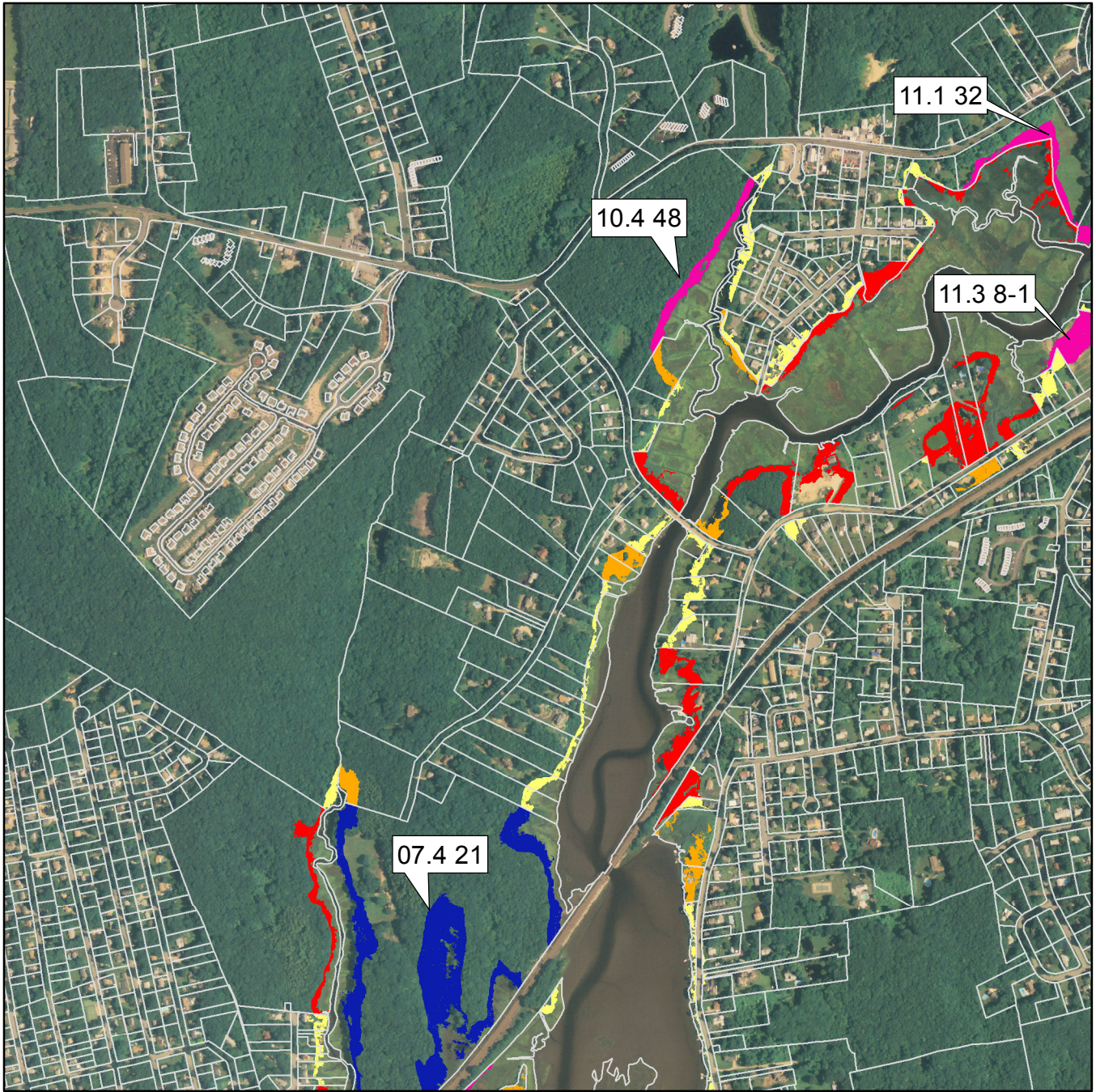


Note: Only Non-OS parcels with > 2 acres of suitable marsh advancement and Proposed OS parcels with > 1 acre are labeled.



see page 32

see page 34



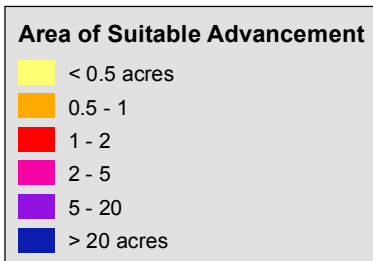
0 500 1,000 2,000 3,000 Feet

see page 36

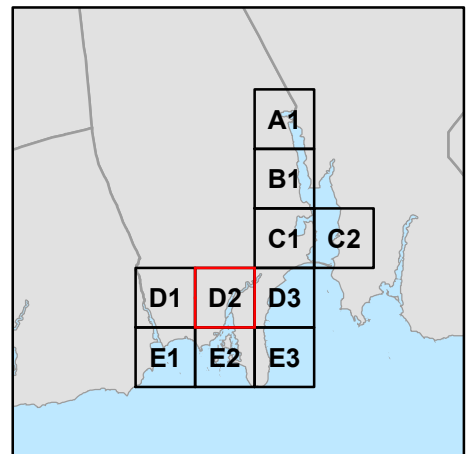
Marsh Advancement by the 2080s

Town of East Lyme, CT

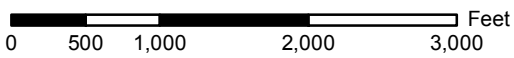
Advancement per Parcel - Map D2



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



see page 33

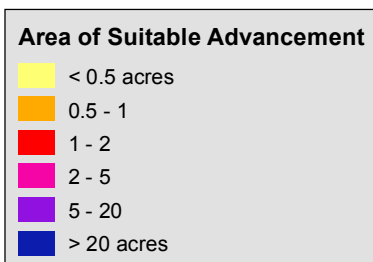


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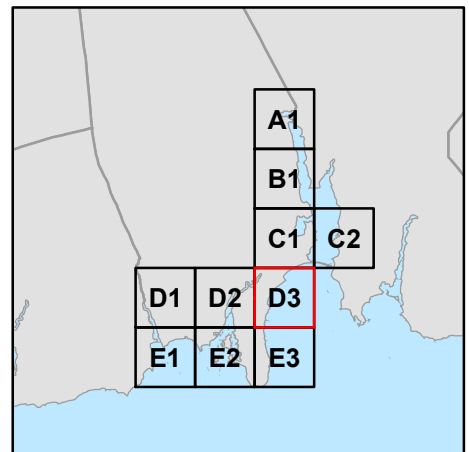
Marsh Advancement by the 2080s

Town of East Lyme, CT

Advancement per Parcel - Map D3



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





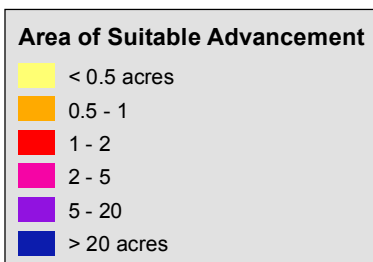
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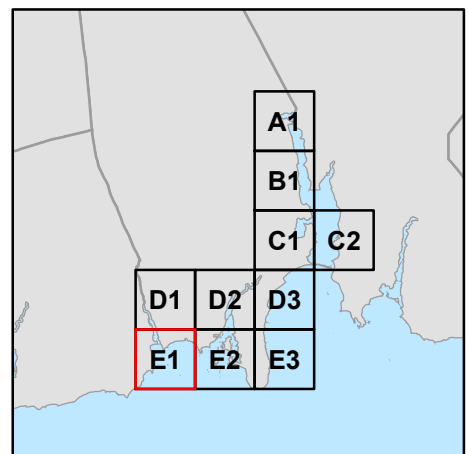
Marsh Advancement by the 2080s

Town of East Lyme, CT

Advancement per Parcel - Map E1



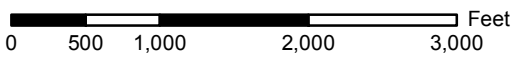
Note: Only Non-OS parcels with > 2 acres of suitable marsh advancement and Proposed OS parcels with > 1 acre are labeled.





see page 35

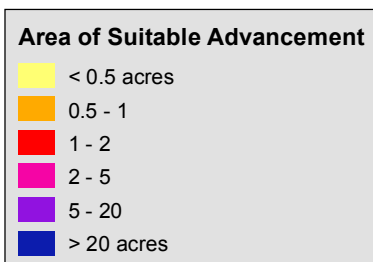
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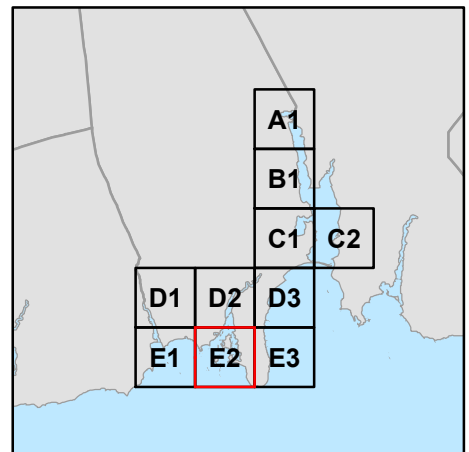
Marsh Advancement by the 2080s

Town of East Lyme, CT

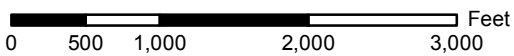
Advancement per Parcel - Map E2



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



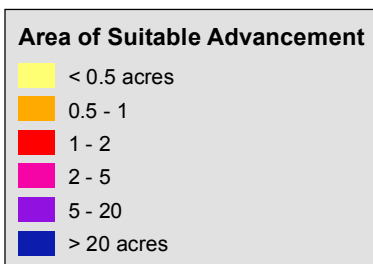
see page 36



Marsh Advancement by the 2080s

Town of East Lyme, CT

Advancement per Parcel - Map E3



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

