Shoreline Characterization and Change Analyses

North Shore Region

Regional Coastal Erosion Commission Workshop

Gloucester - May 28, 2014

SHORELINE CHARACTERIZATION

Description

Coastal landforms, habitats, developed lands, and hardened coastal structures (collectively referred to as "classes") were identified at the immediate, exposed shoreline for coastal Massachusetts. Protected harbors and estuaries were generally excluded. Classes were identified for every ~50 meters of assessed shoreline and summarized by percentage of total assessed shoreline for each community.

Methods

A transect approach was used to identify classes along the shoreline. This approach allows us to examine features along any given ~50 m segment of shoreline. It provides more information at a finer scale than one where areal coverage of features are summarized within a specified shoreline buffer. Analysis can be expanded to include additional information on the order in which features occur moving landward, their landward extents, and the rates at which they co-occur along the shoreline.

Data sources include the 2011 USGS-CZM Shoreline Change Project's contemporary shoreline (MHHW) and transect data, CZM and DCR's Coastal Structures Inventory data, MassDEP's Wetlands map data, and MassGIS's 2005 Land Use data.

Shoreline Change Project transects generally occur every ~50 meters along exposed shoreline (Fig. 1). Assessed shoreline segments begin and end with shoreline midpoints between transects (Fig. 2). Attributes for hardened coastal structures, wetlands and landforms, and other land use/land cover features were spatially joined to transects, then to their respective shoreline segments (Fig.3). More than 50 classes from multiple source datasets were identified in this process. Classes were aggregated into 11 bins to make analysis and reporting more meaningful. Data were further processed to generate class/bin summaries, as shown in the community bar charts below. *Natural Upland is comprised of Forest and Brushland/Successional land cover classes only.*

Fig. 1. Transects less than or equal to 200 m from intersection points (yellow) with contemporary shoreline.

Fig. 2. Shoreline segments of ~ 50 m split using intersection midpoints (green).
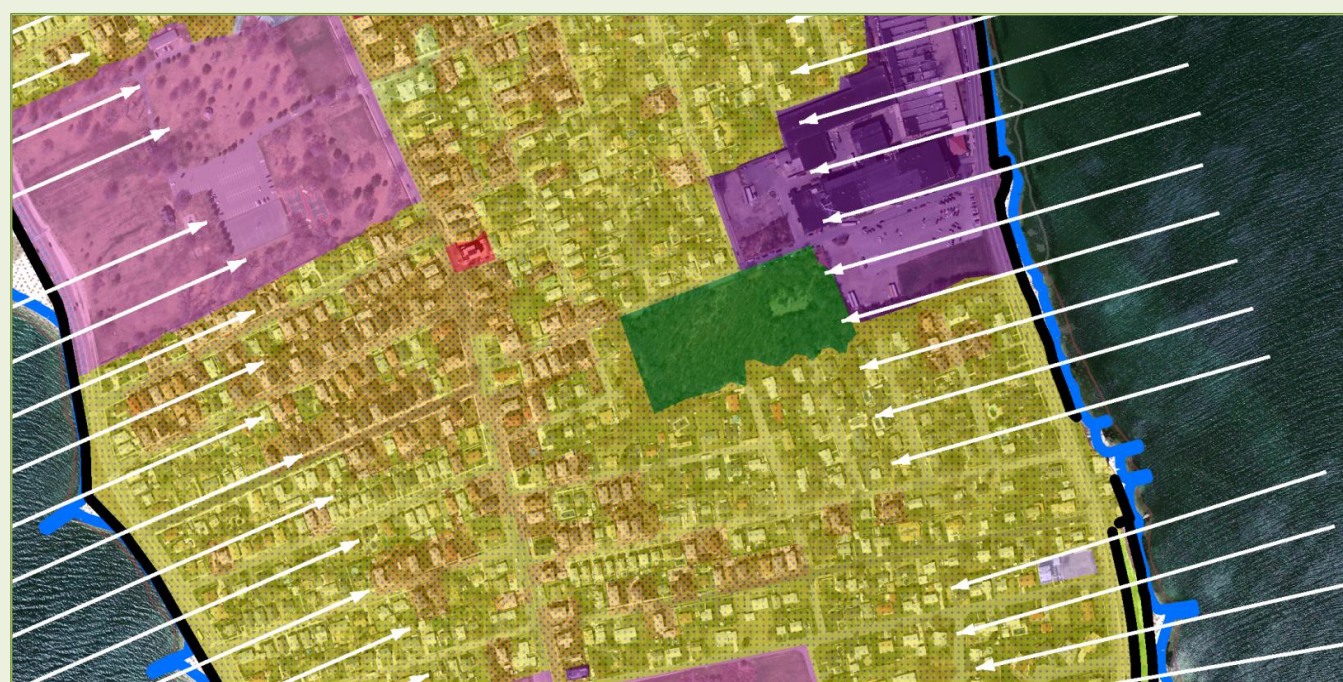

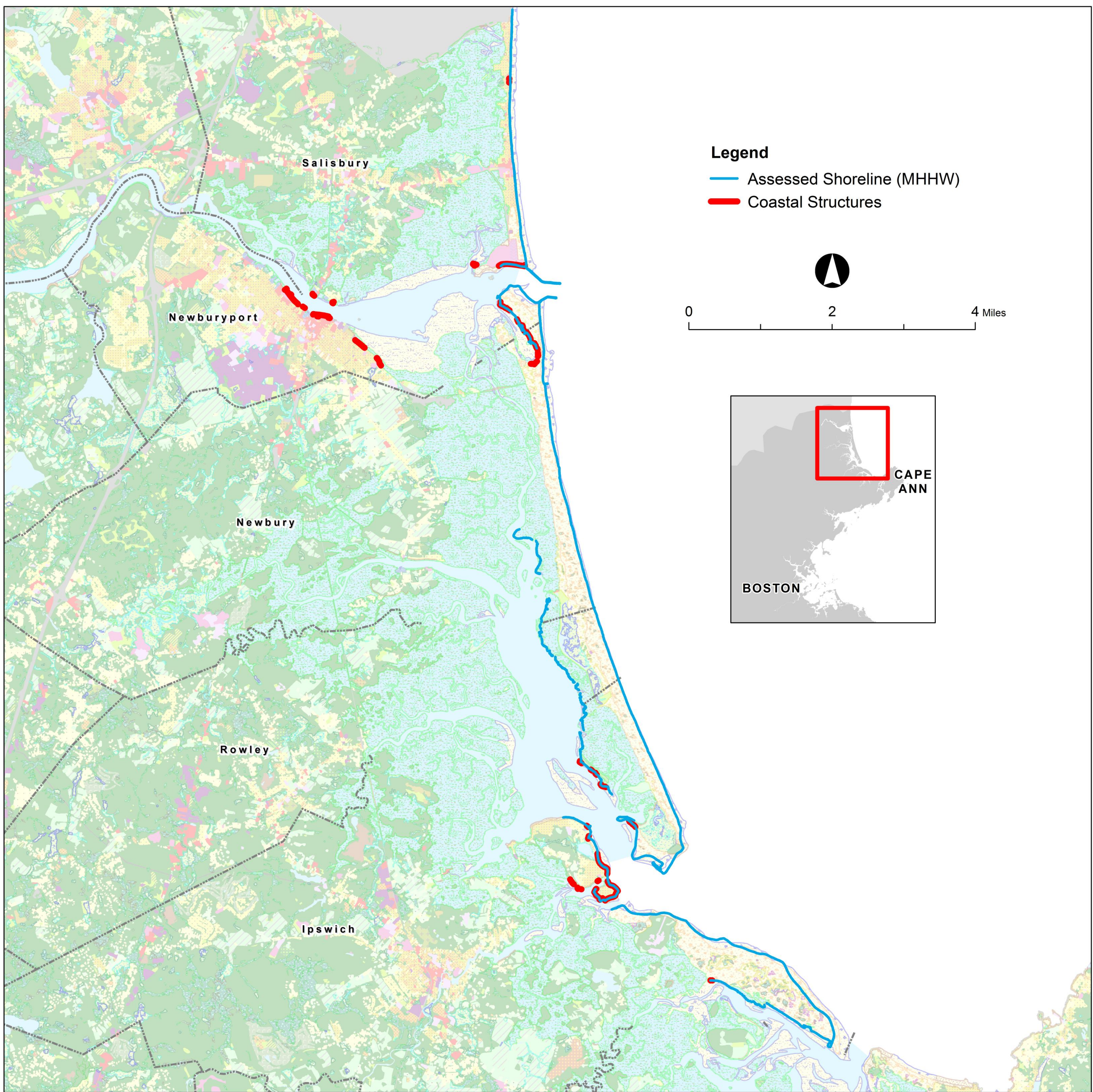Fig. 3. Land use, wetland, and coastal structure (black line) features with assessed shoreline (blue line) and transects.
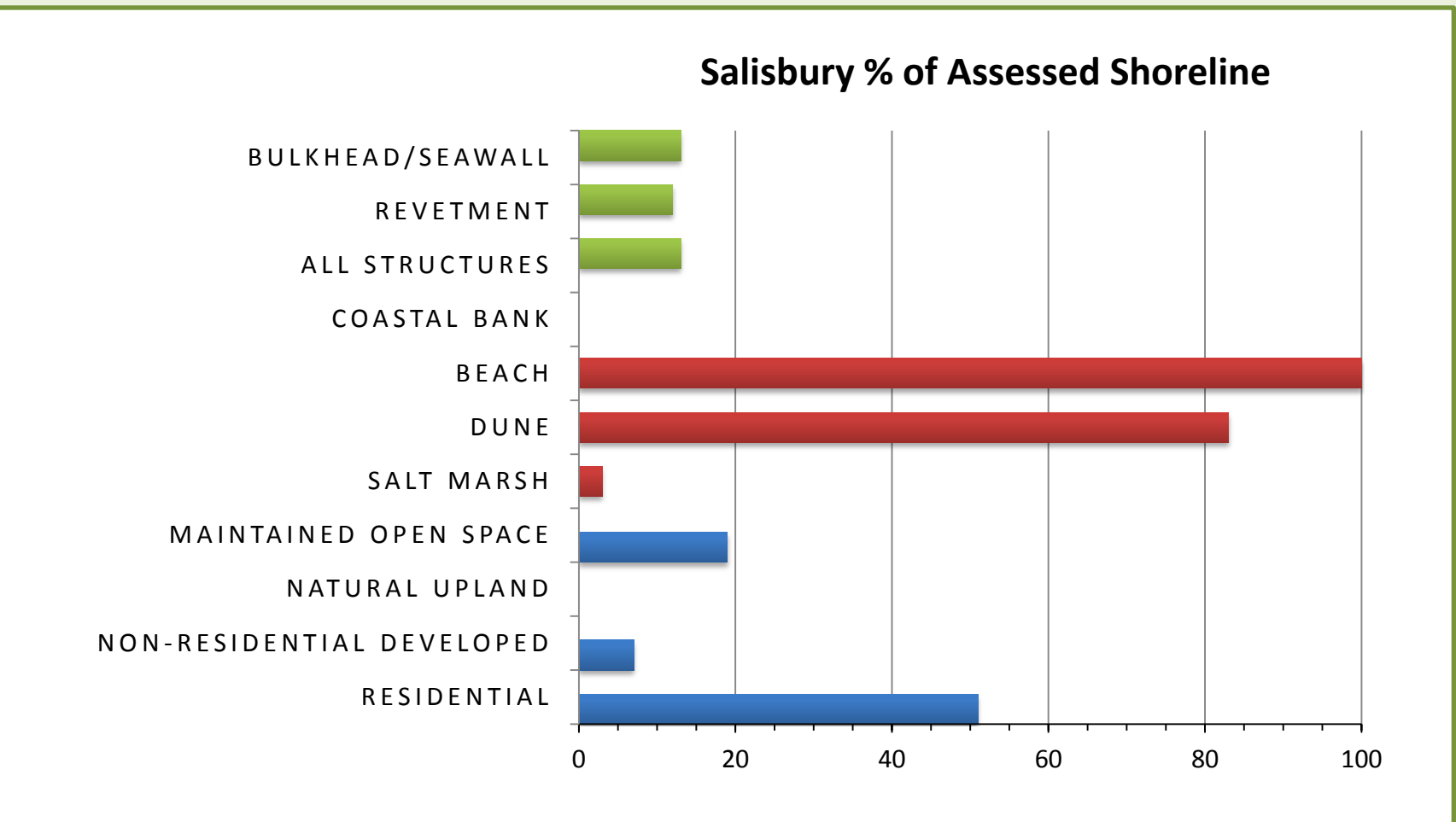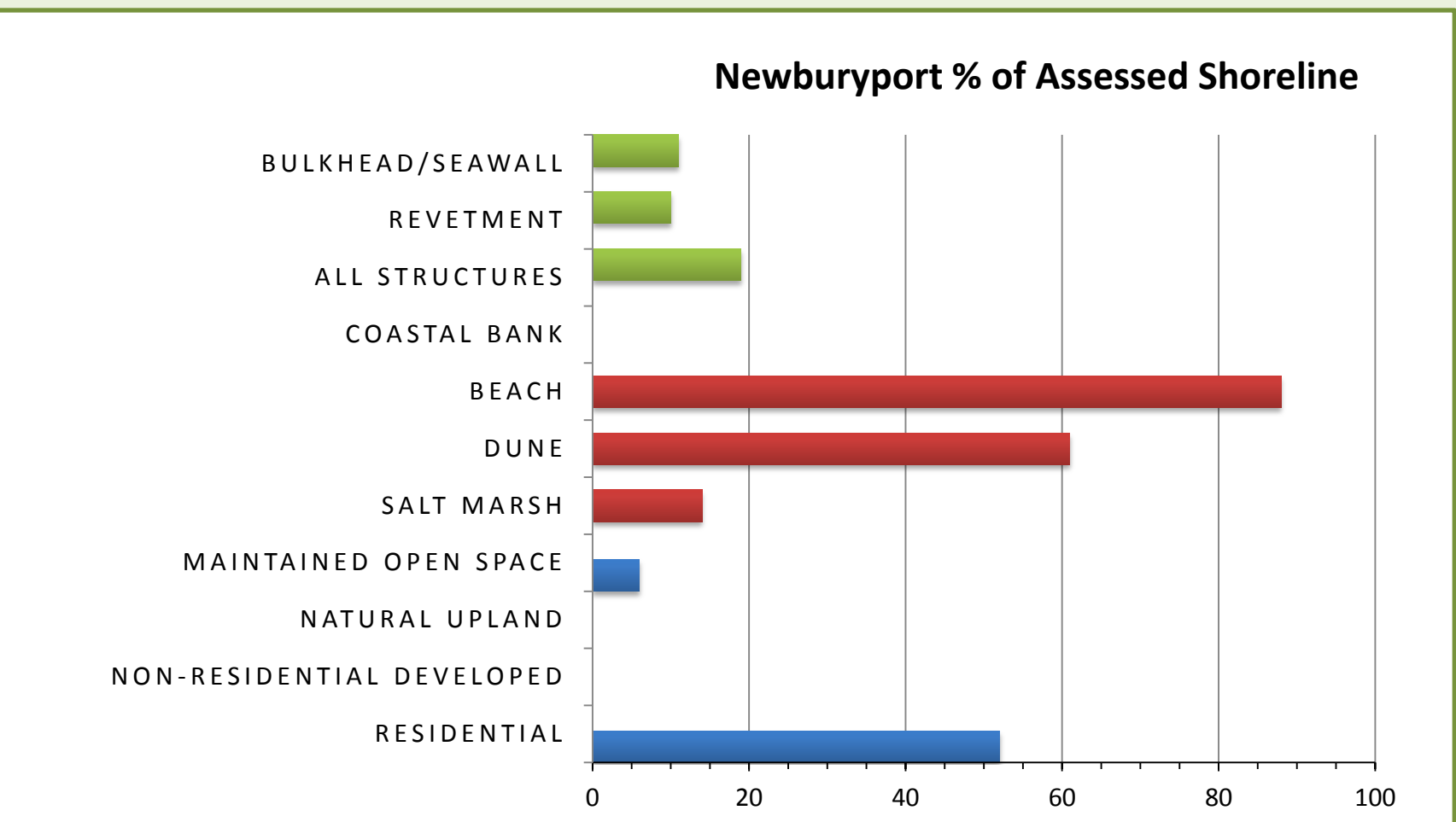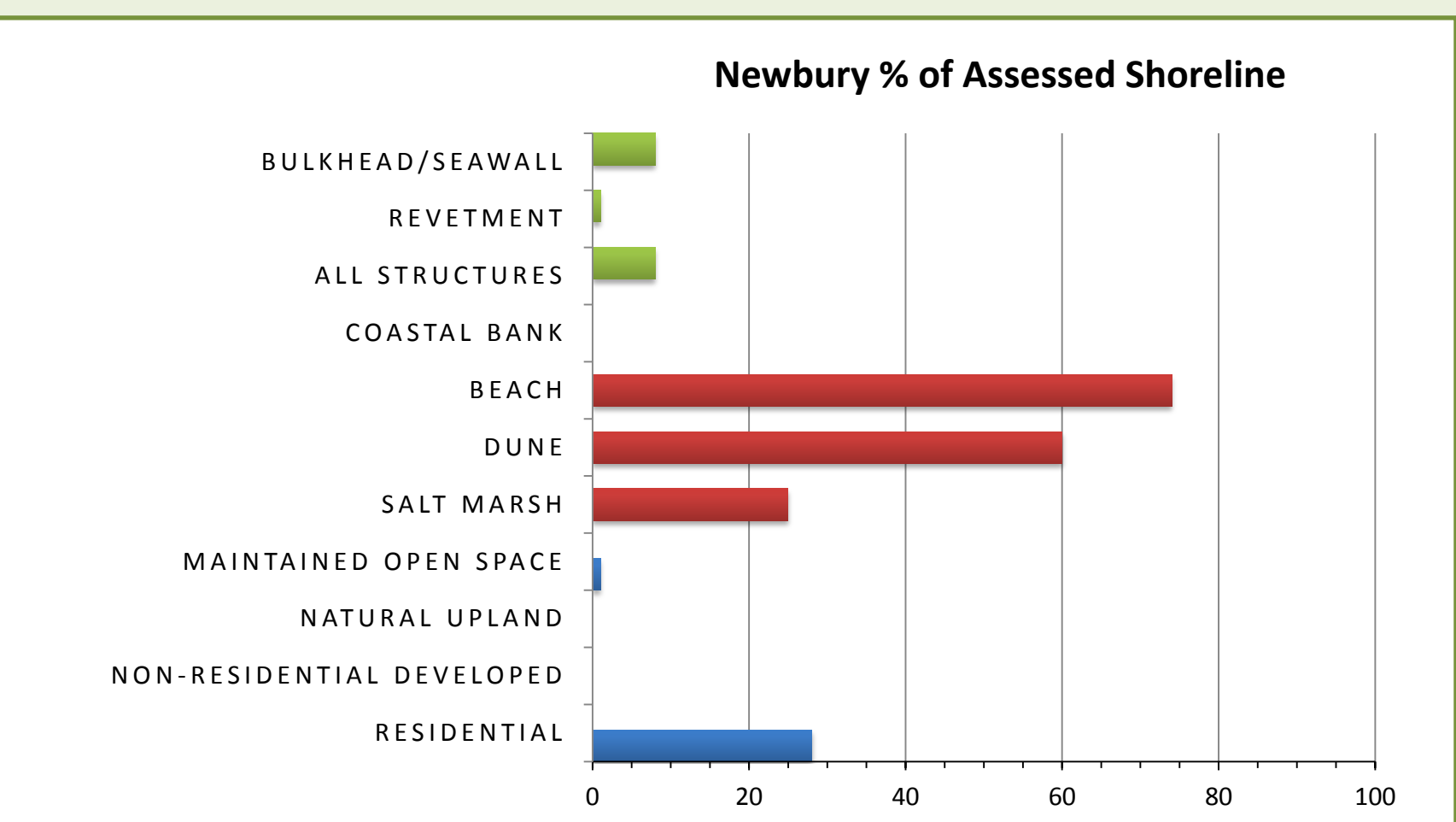
Legend
— Assessed Shoreline (MHHW)
— Coastal Structures

Salisbury

Salisbury % of Assessed Shoreline

Newburyport

Newburyport % of Assessed Shoreline

Newbury

Newbury % of Assessed Shoreline

Ipswich

Ipswich % of Assessed Shoreline

Rowley

Rowley % of Assessed Shoreline
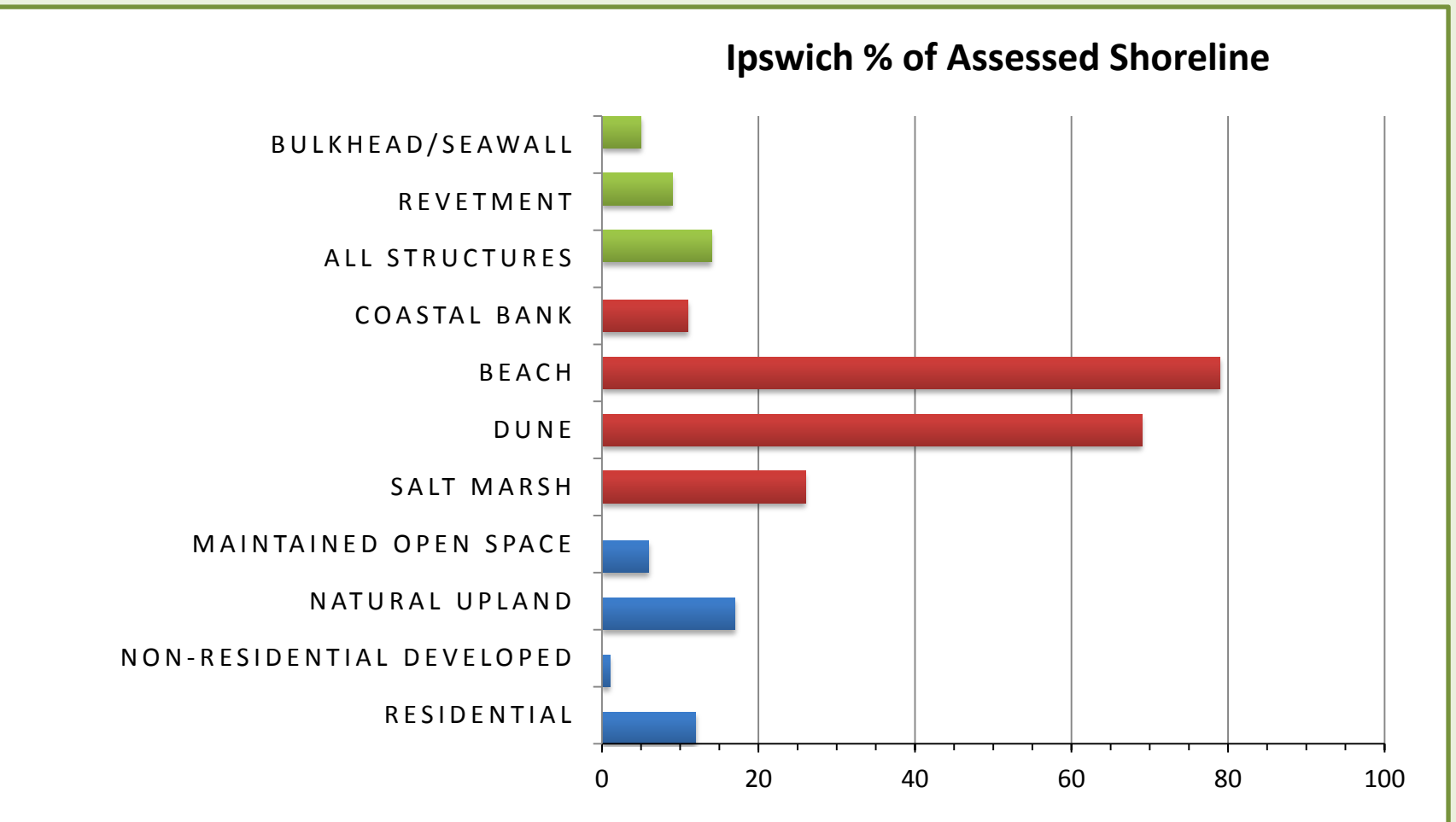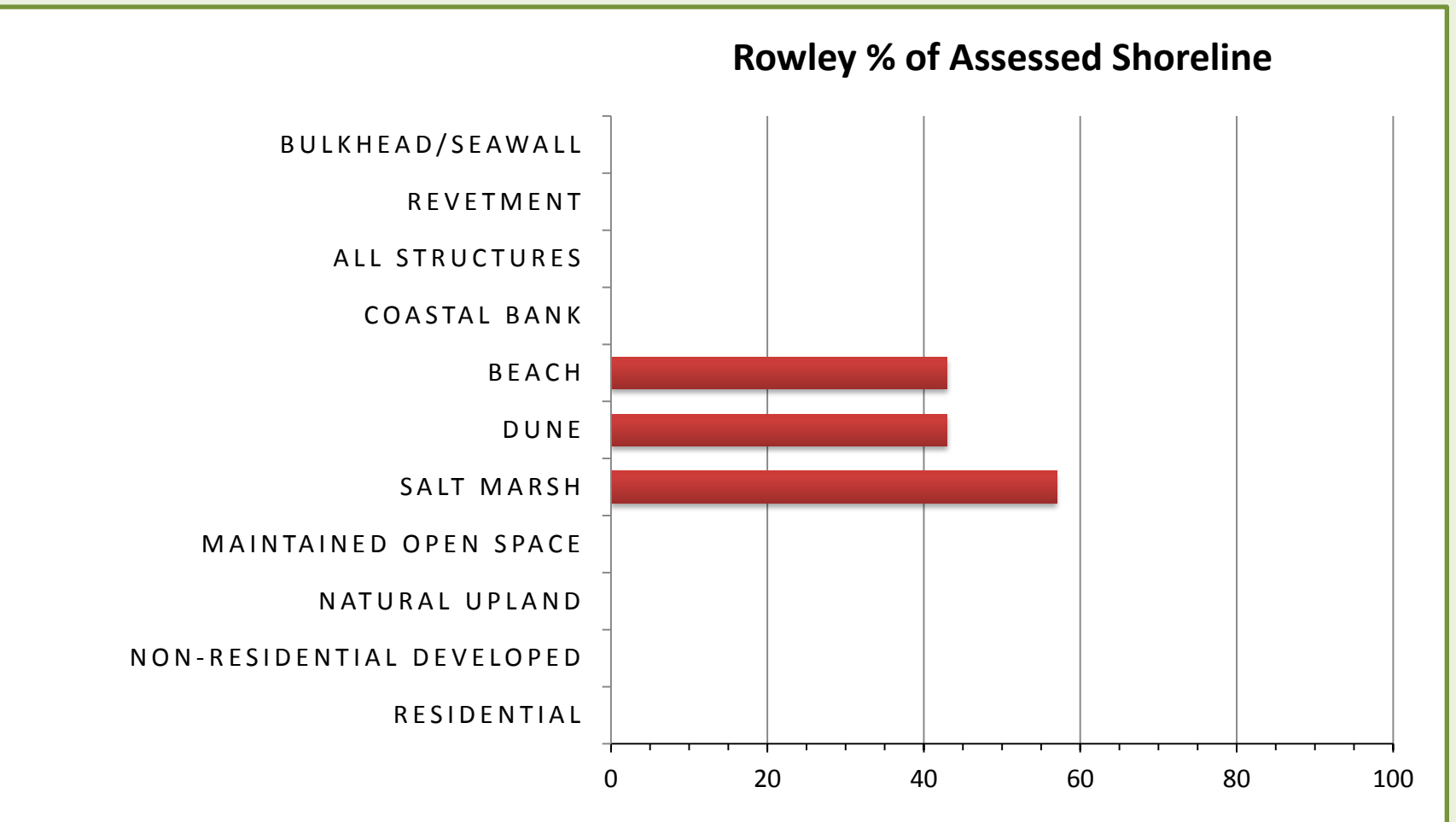
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Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Coastal Erosion Commission

SHORELINE CHARACTERIZATION (CONTINUED)

Swampscott

Swampscott % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Salem

Salem % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Manchester

Manchester % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Gloucester

Gloucester % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Map labels: Seaugs, Lynn, Revere, Salem, Beverly, Swampscott, Marblehead, Manchester, Nahant, Gloucester, Rockport

Inset map: CAPE ANN, BOSTON

Legend
— Assessed Shoreline (MHHW)
— Coastal Structures

0   3   6 Miles

Lynn

Lynn % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Marblehead

Marblehead % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Beverly

Beverly % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

Rockport

Rockport % of Assessed Shoreline

- BULKHEAD/SEAWALL
- REVETMENT
- ALL STRUCTURES
- COASTAL BANK
- BEACH
- DUNE
- SALT MARSH
- MAINTAINED OPEN SPACE
- NATURAL UPLAND
- NON-RESIDENTIAL DEVELOPED
- RESIDENTIAL

(axis: 0 20 40 60 80 100)

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North Shore Region

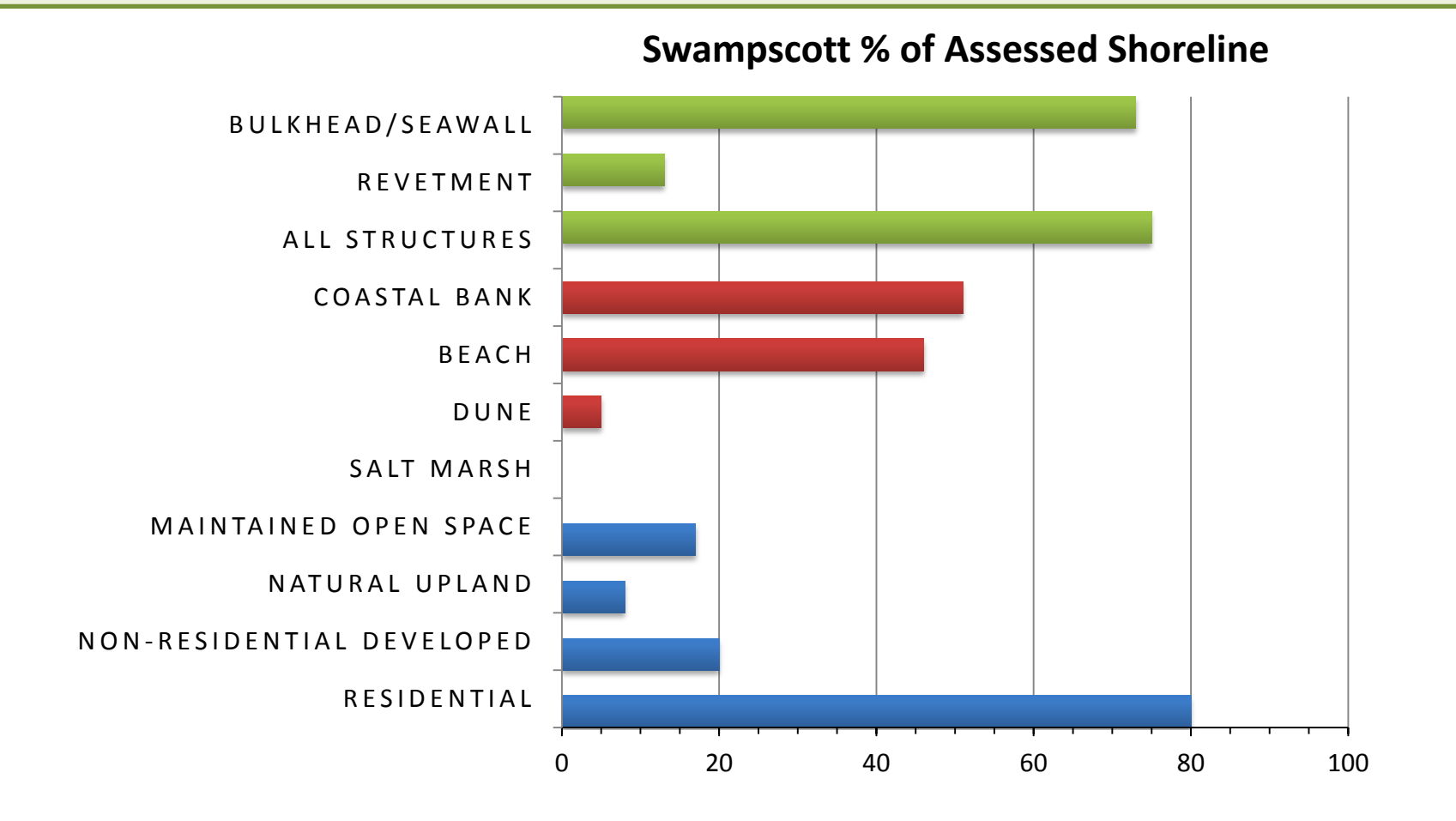Regional Coastal Erosion Commission Workshop

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Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
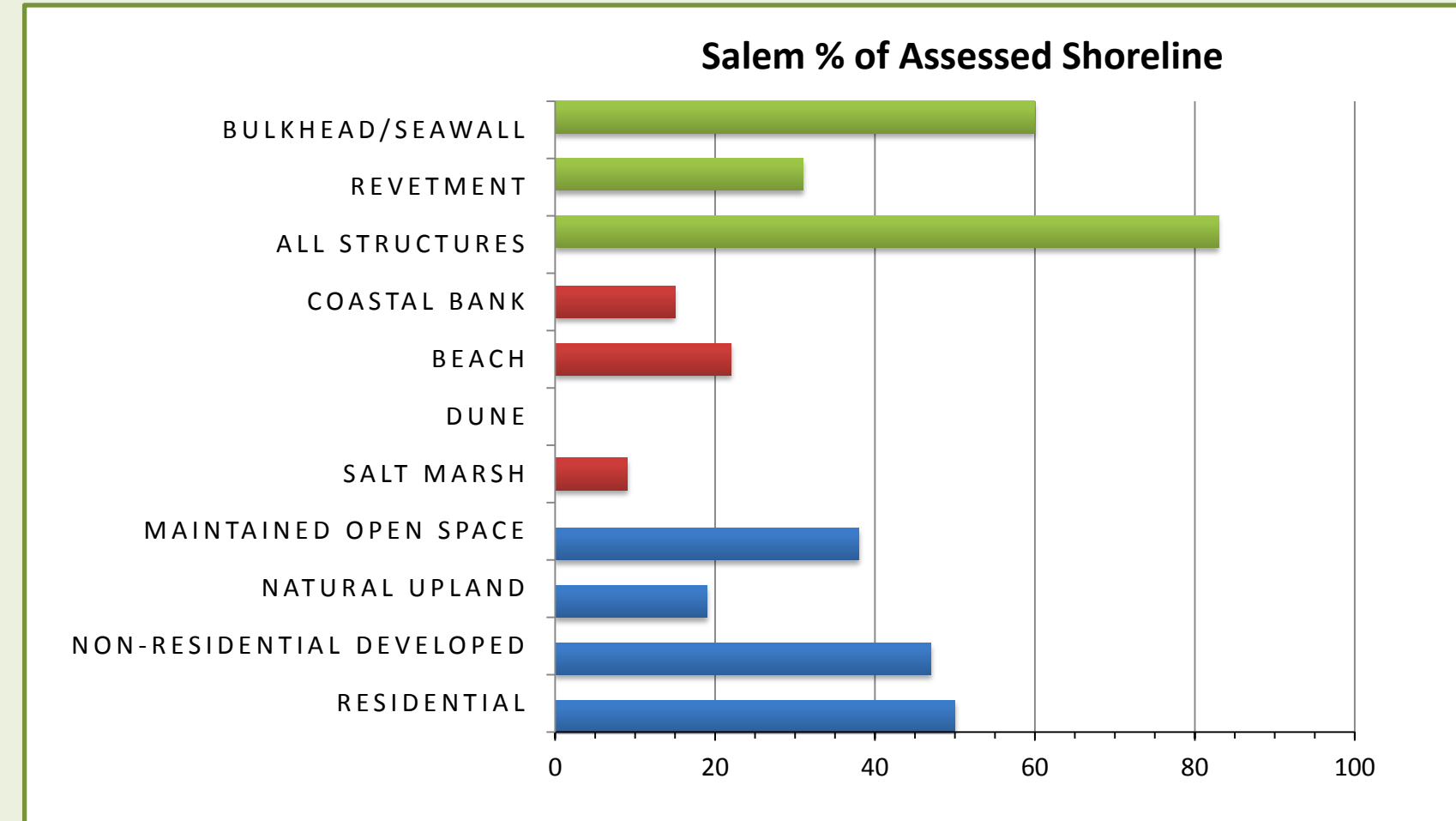Coastal Erosion Commission
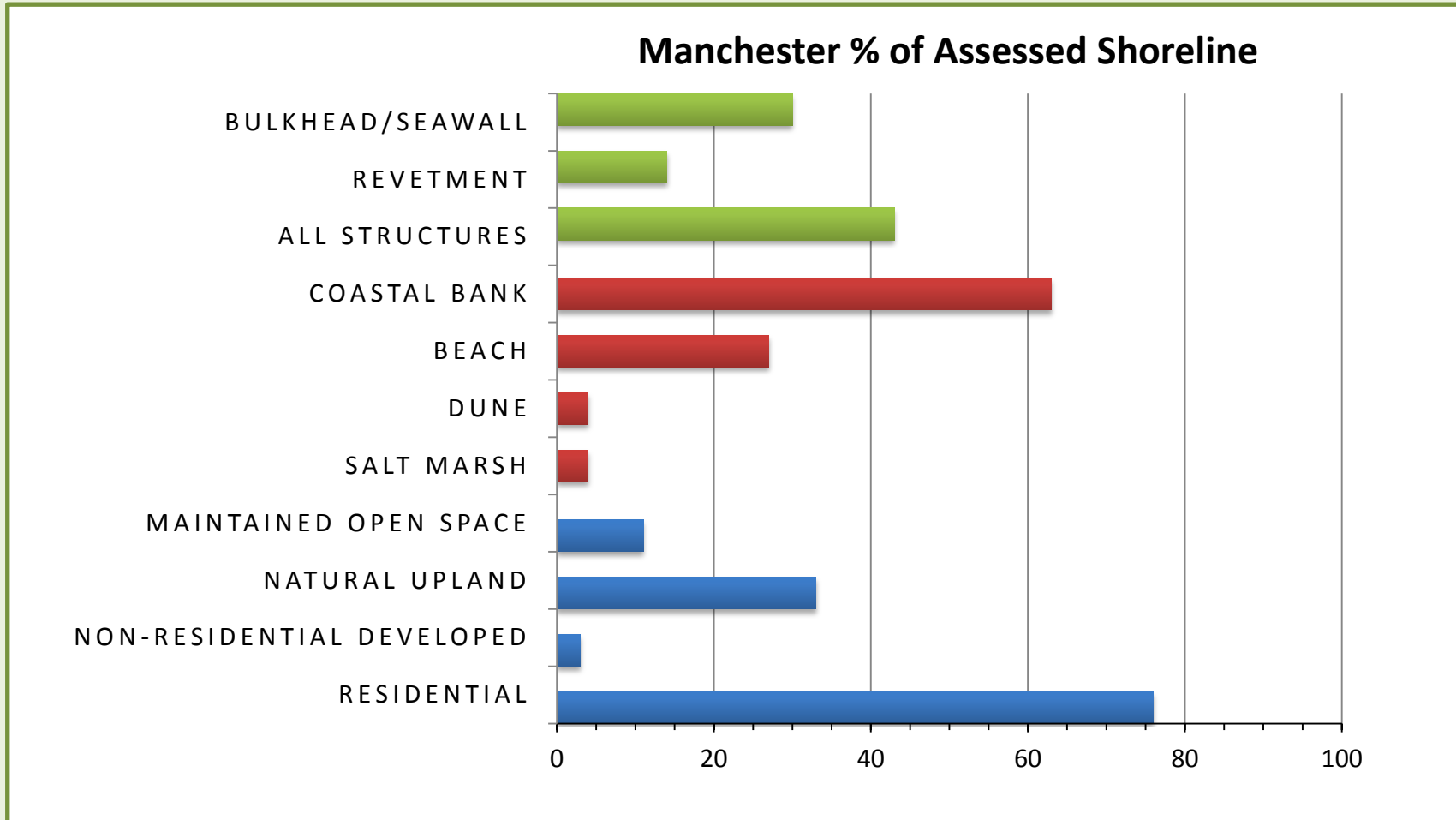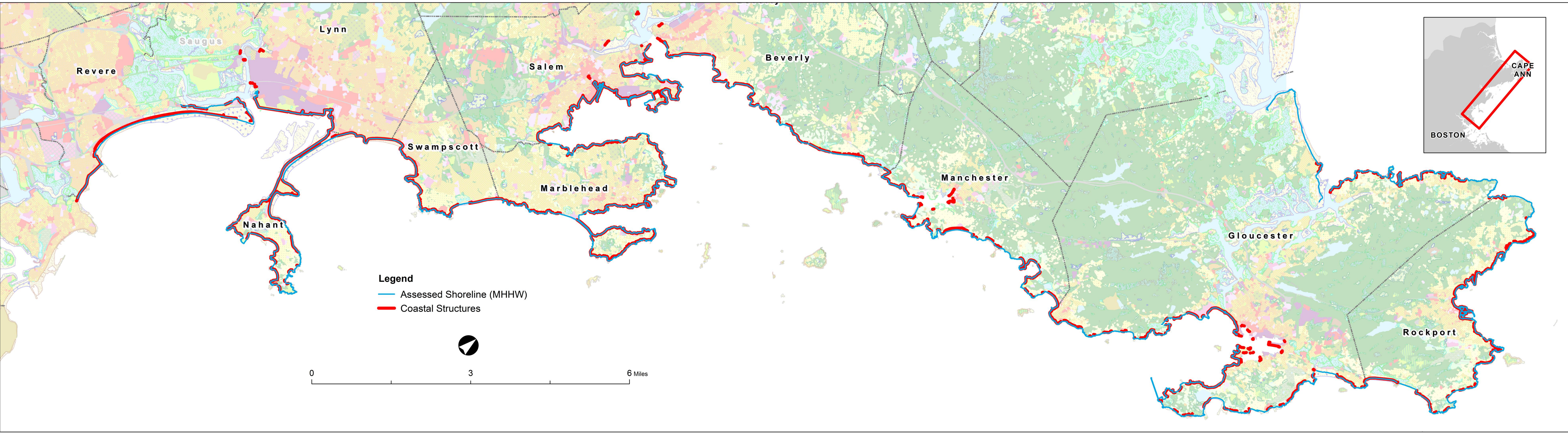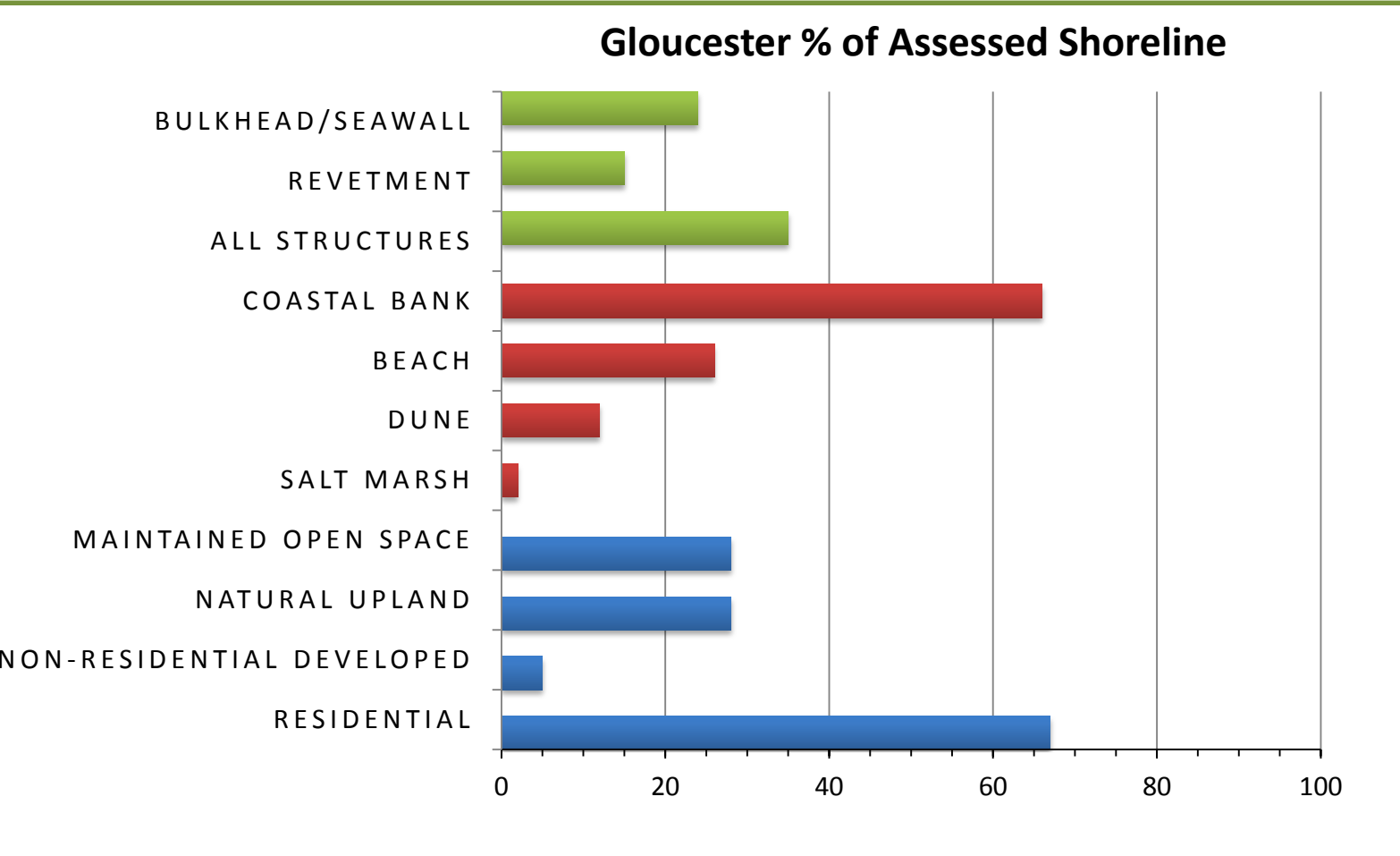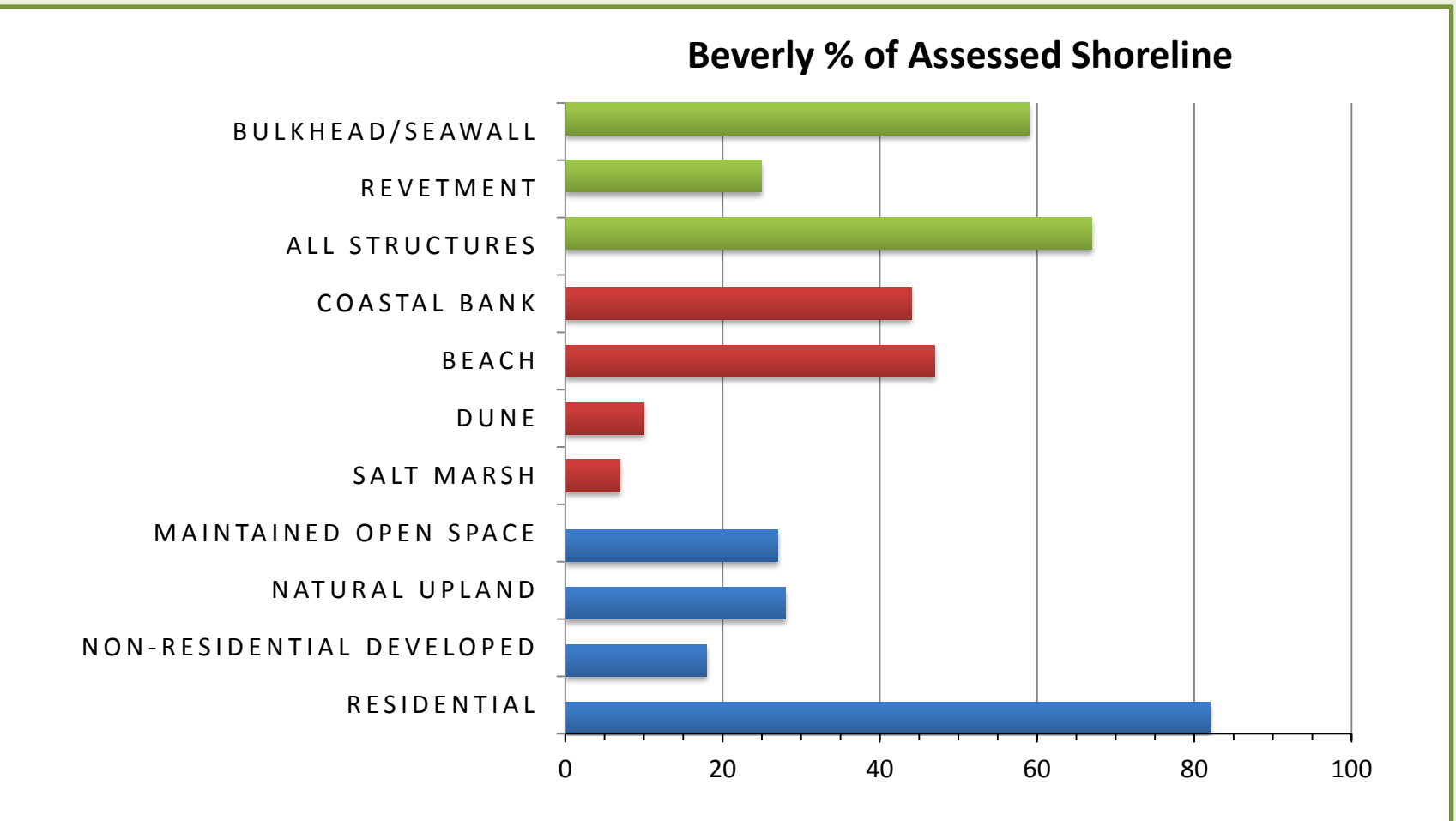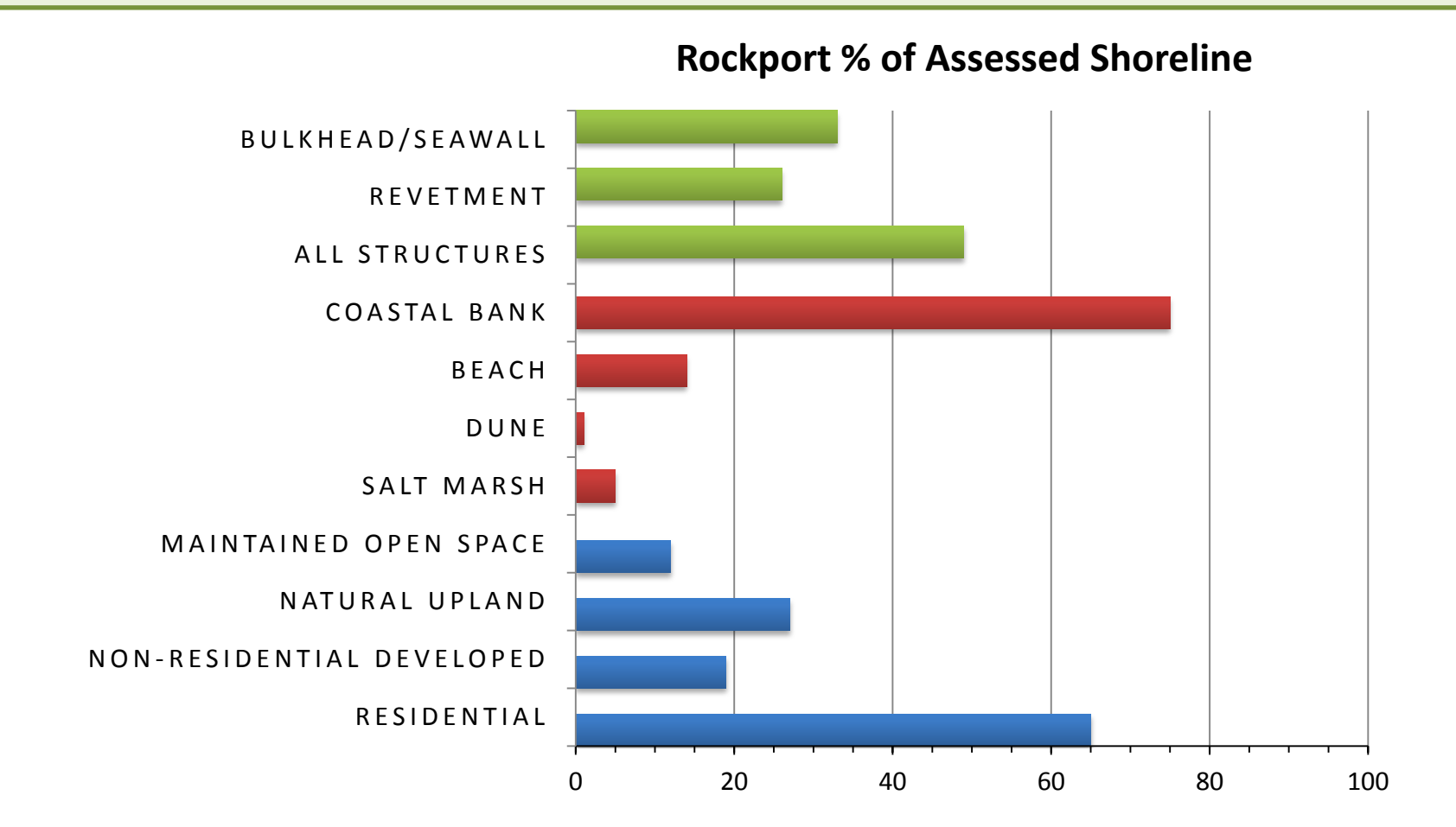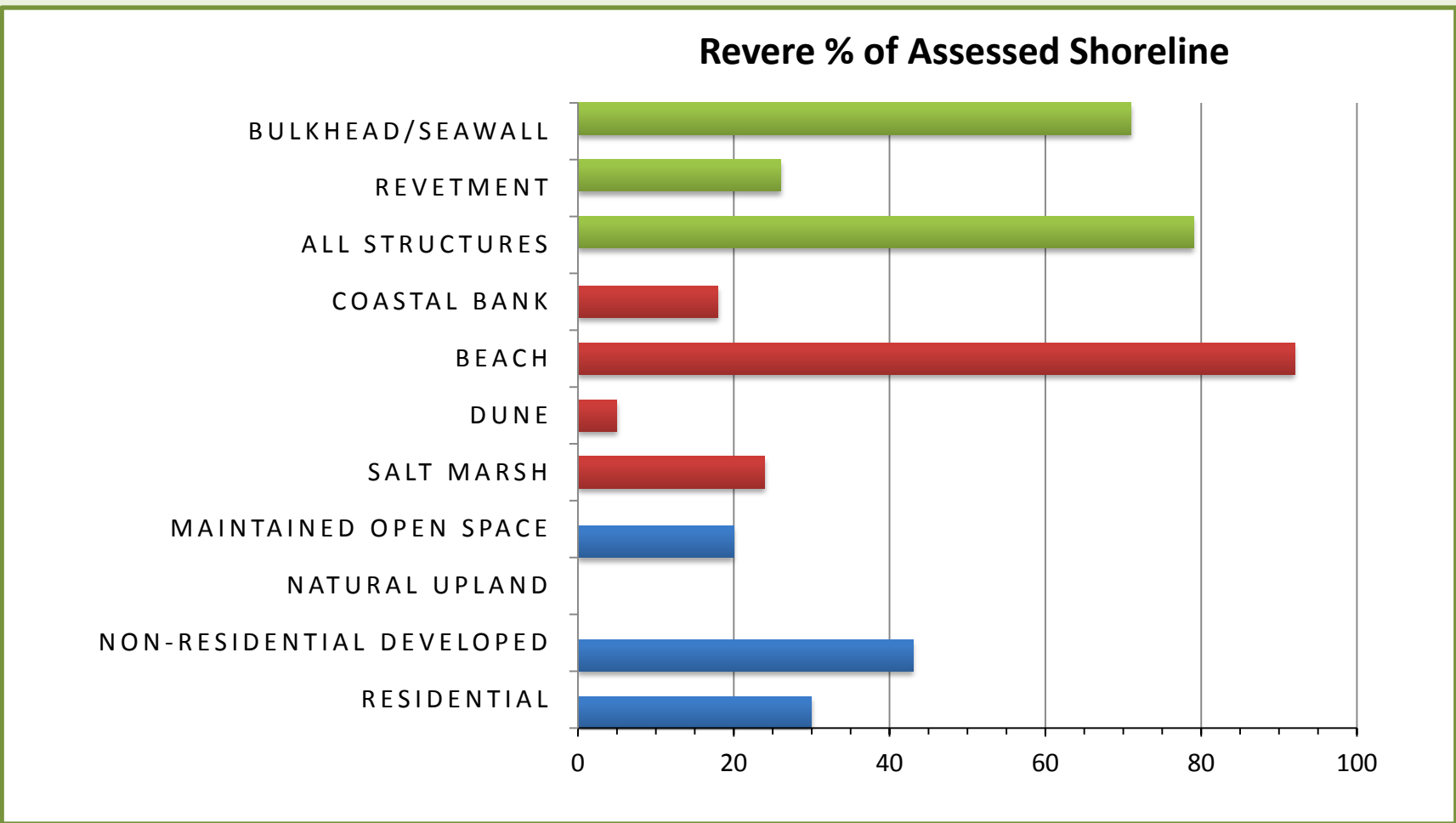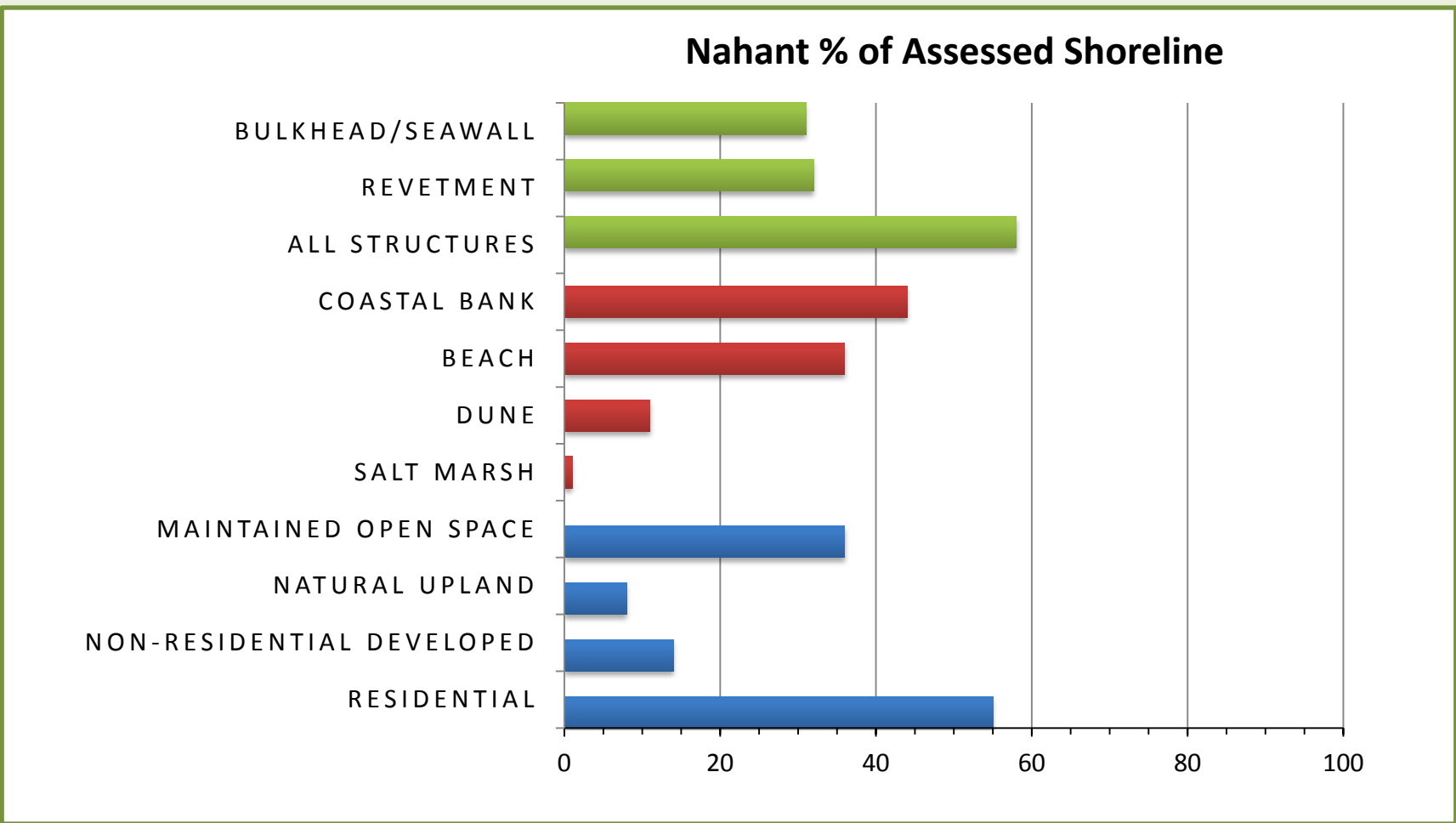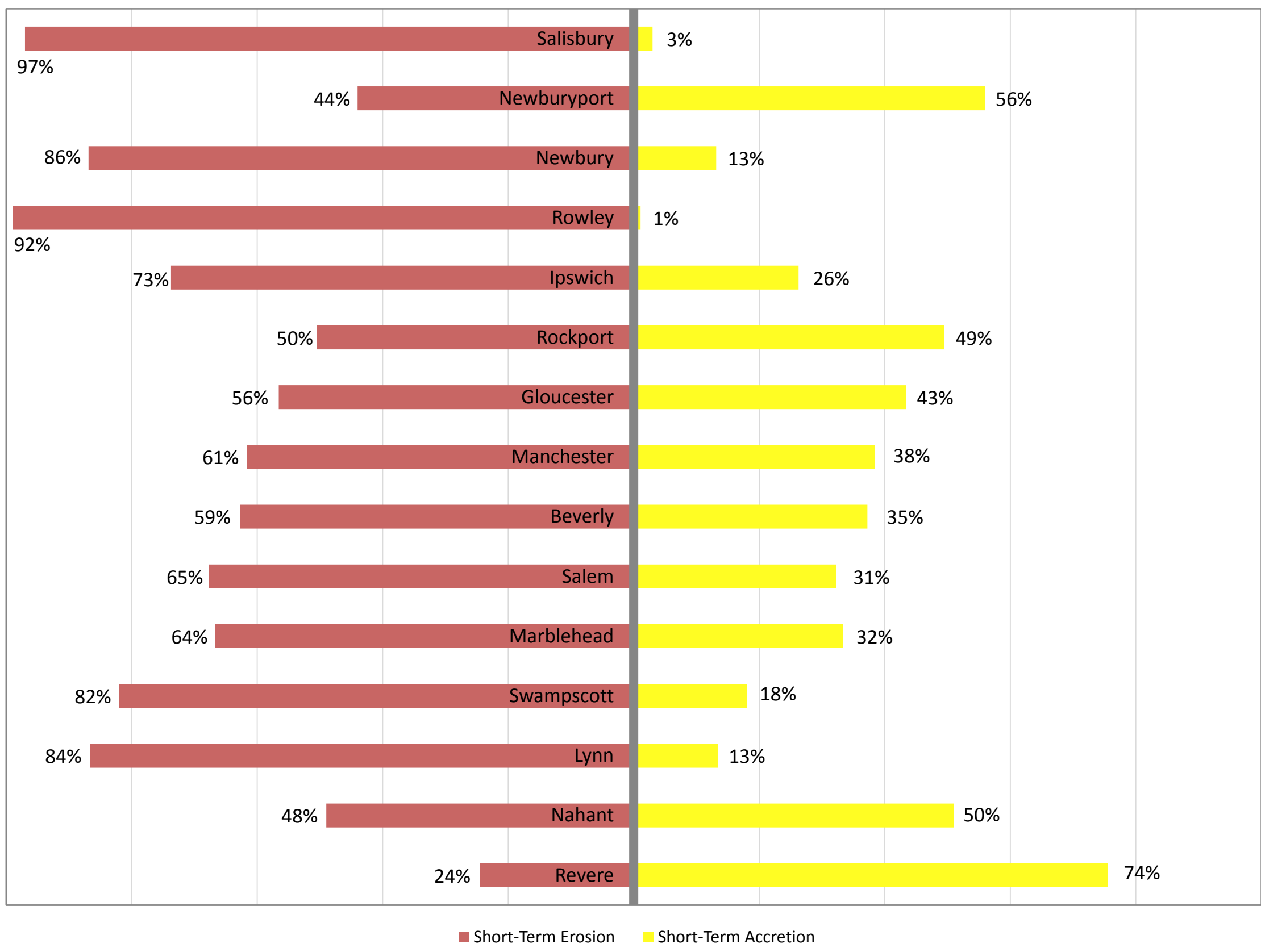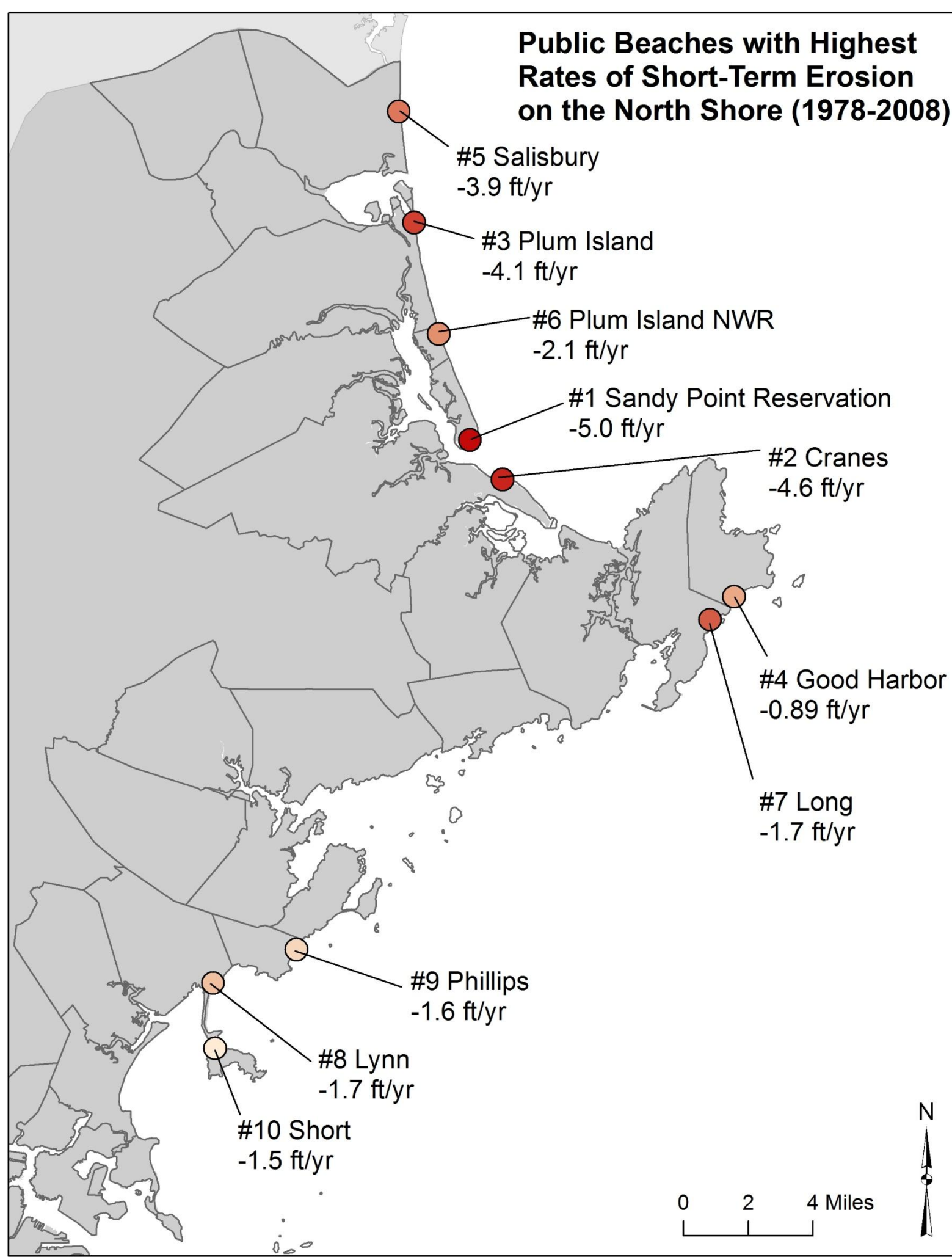

SHORELINE CHARACTERIZATION (CONTINUED)

Revere

Revere % of Assessed Shoreline

(Horizontal bar chart with categories: BULKHEAD/SEAWALL, REVETMENT, ALL STRUCTURES, COASTAL BANK, BEACH, DUNE, SALT MARSH, MAINTAINED OPEN SPACE, NATURAL UPLAND, NON-RESIDENTIAL DEVELOPED, RESIDENTIAL; x-axis 0 to 100)

Nahant

Nahant % of Assessed Shoreline

(Horizontal bar chart with categories: BULKHEAD/SEAWALL, REVETMENT, ALL STRUCTURES, COASTAL BANK, BEACH, DUNE, SALT MARSH, MAINTAINED OPEN SPACE, NATURAL UPLAND, NON-RESIDENTIAL DEVELOPED, RESIDENTIAL; x-axis 0 to 100)

SHORELINE CHANGE

Public Beaches with Highest Rates of Short-Term Erosion on the North Shore (1978-2008)

- #5 Salisbury -3.9 ft/yr
- #3 Plum Island -4.1 ft/yr
- #6 Plum Island NWR -2.1 ft/yr
- #1 Sandy Point Reservation -5.0 ft/yr
- #2 Cranes -4.6 ft/yr
- #4 Good Harbor -0.89 ft/yr
- #7 Long -1.7 ft/yr
- #9 Phillips -1.6 ft/yr
- #8 Lynn -1.7 ft/yr
- #10 Short -1.5 ft/yr

0 2 4 Miles

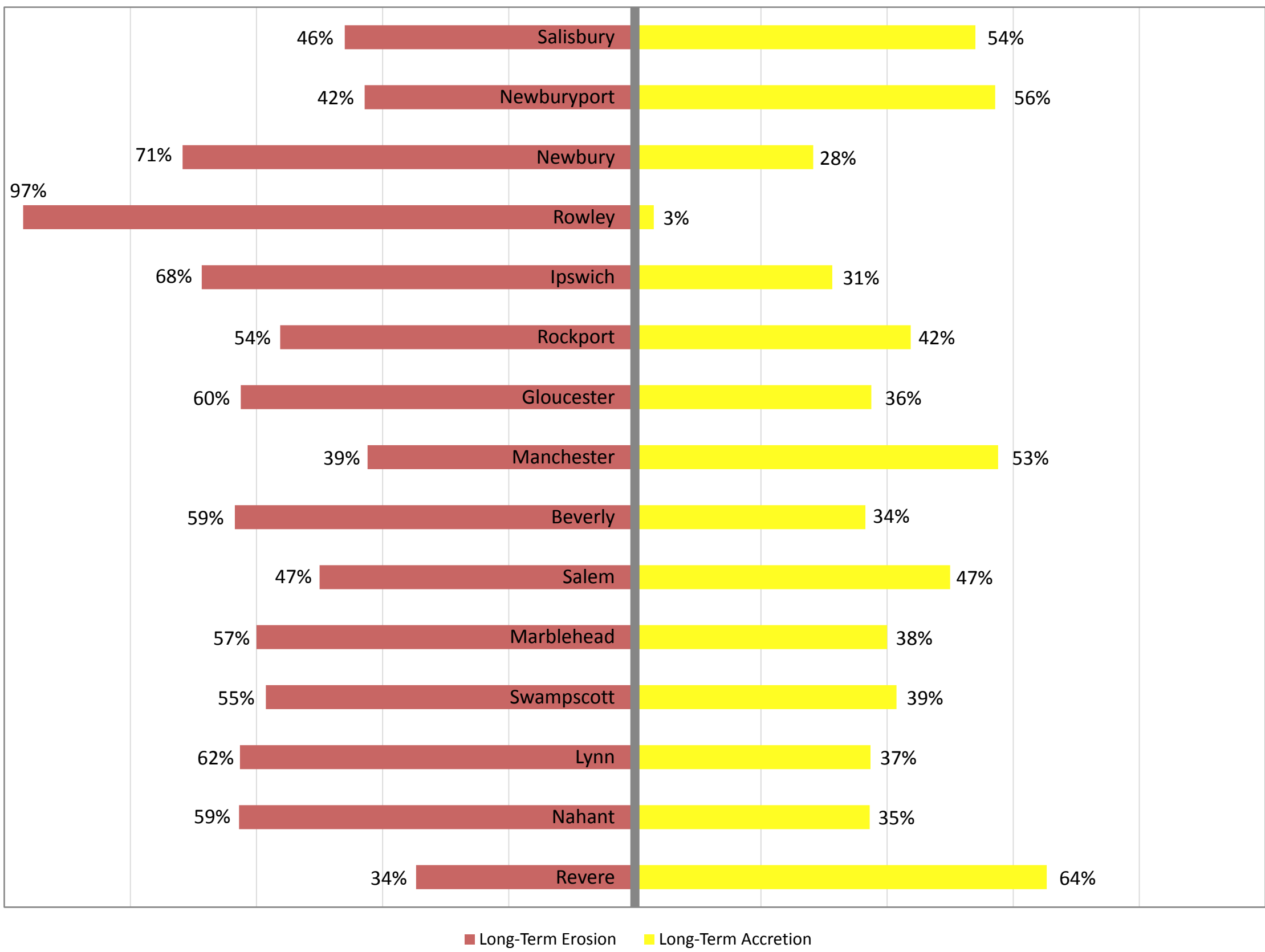| Community	Short-Term Erosion	Short-Term Accretion
Salisbury	97%	3%
Newburyport	44%	56%
Newbury	86%	13%
Rowley	92%	1%
Ipswich	73%	26%
Rockport	50%	49%
Gloucester	56%	43%
Manchester	61%	38%
Beverly	59%	35%
Salem	65%	31%
Marblehead	64%	32%
Swampscott	82%	18%
Lynn	84%	13%
Nahant	48%	50%
Revere	24%	74%

Short-term erosion and accretion trends (1970-2009) per community in the North Shore region. This plot denotes dominant *direction*, not magnitude, of shoreline movement based on the number of shoreline change transects in each town.

Public Beaches with Highest Rates of Long-Term Erosion on the North Shore (1847-2008)

- #5 Plum Island NWR -0.71 ft/yr
- #2 Cranes -1.1 ft/yr
- #7 Pebble -0.38 ft/yr
- #1 Cape Hedge -2.1 ft/yr
- #3 Long -0.89 ft/yr
- #4 Good Harbor -0.89 ft/yr
- #6 Devereux -0.56 ft/yr
- #8 Phillips -0.28 ft/yr
- #9 Lynn -0.27 ft/yr
- #10 Short -0.26 ft/yr

0 2 4 Miles

Community	Long-Term Erosion	Long-Term Accretion
Salisbury	46%	54%
Newburyport	42%	56%
Newbury	71%	28%
Rowley	97%	3%
Ipswich	68%	31%
Rockport	54%	42%
Gloucester	60%	36%
Manchester	39%	53%
Beverly	59%	34%
Salem	47%	47%
Marblehead	57%	38%
Swampscott	55%	39%
Lynn	62%	37%
Nahant	59%	35%
Revere	34%	64%

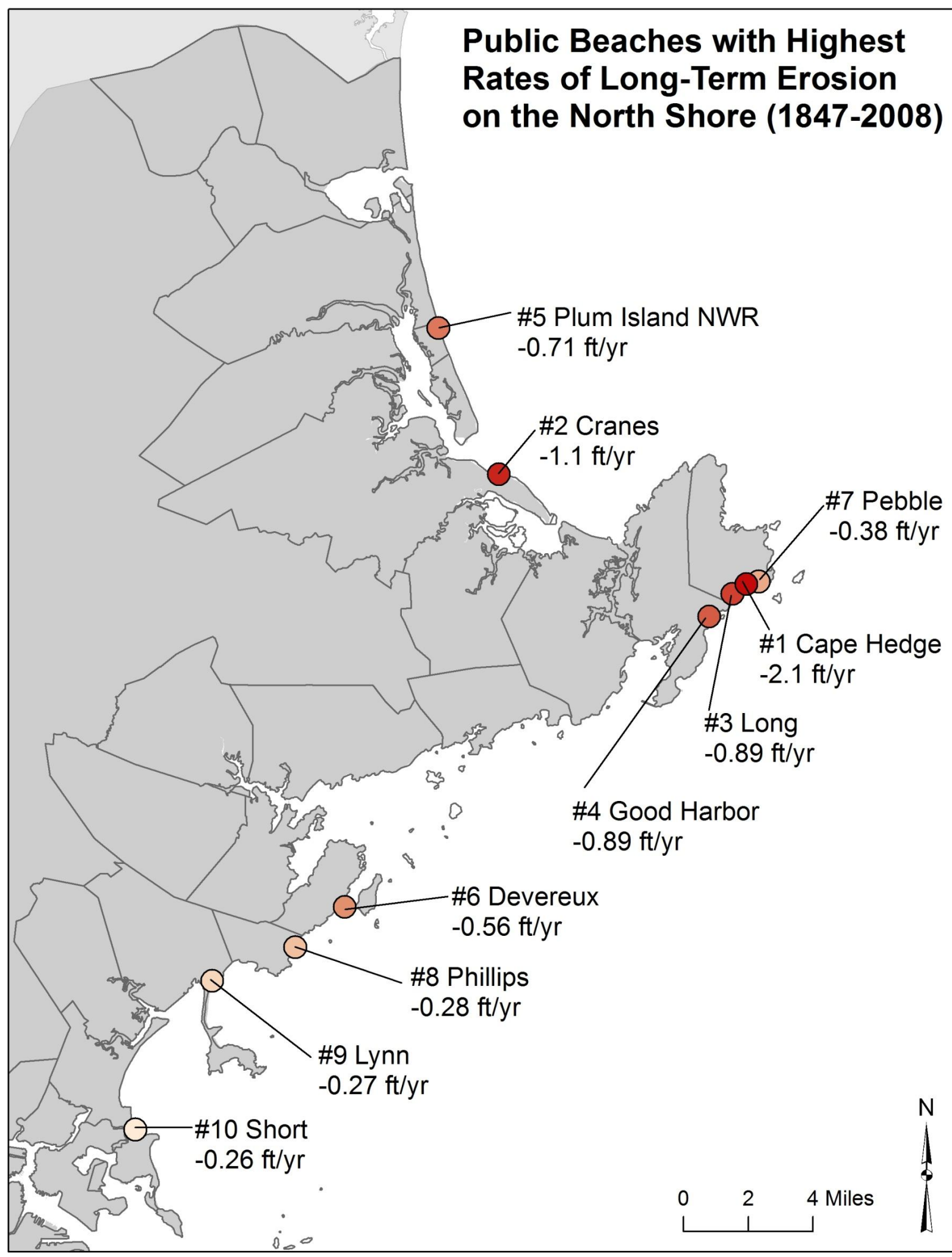Long-term erosion and accretion trends (1844-2009) per community in the North Shore region. This plot denotes dominant *direction*, not magnitude, of shoreline movement based on the number of shoreline change transects in each town.