



# Effects of Climate Change on Critical Estuarine Habitat: Eelgrass

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November 15, 2010

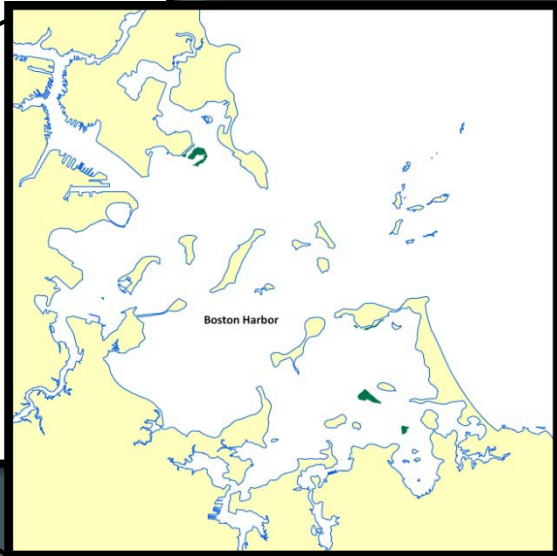
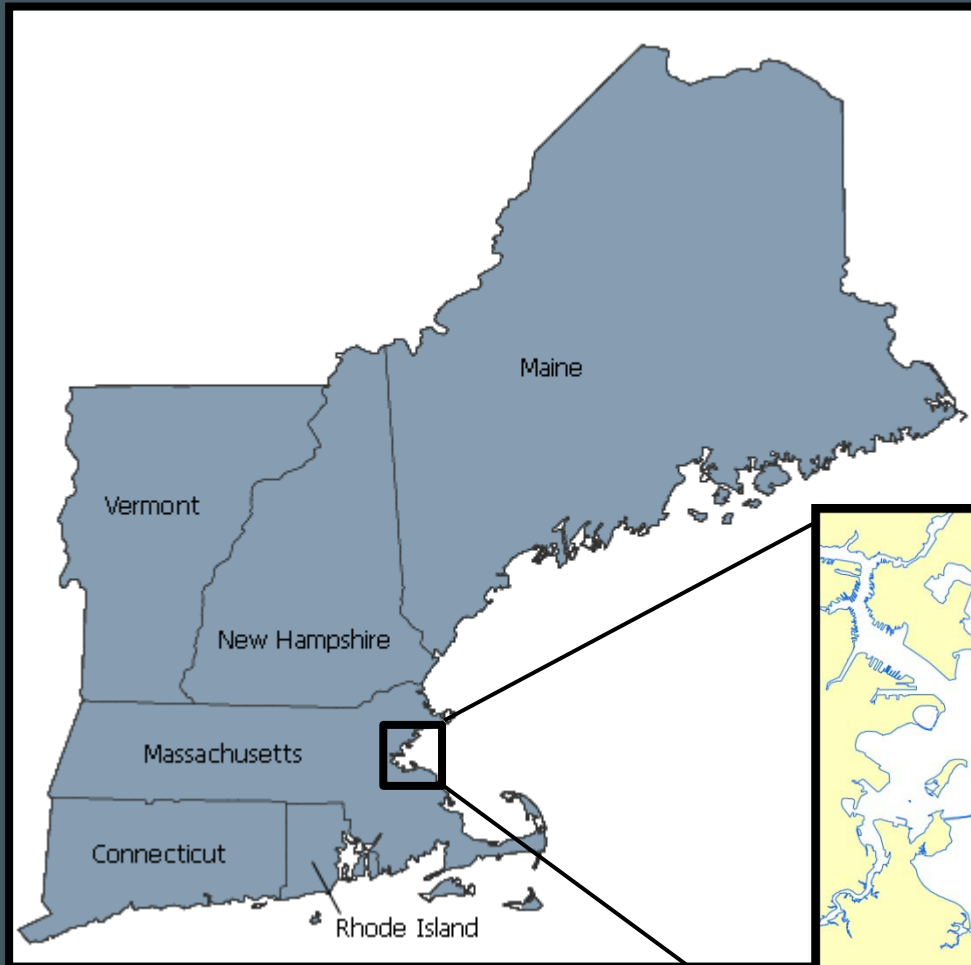
# Acknowledgements

- Tay Evan, Mass DMF
- Alison Leschen, Waquoit Bay NERR
- John Vavrinec, Battelle
- Ron Thom, Battelle
- Paul Martin, TRC Environmental

# Introduction

- Eelgrass is an important, limited resource in Boston Harbor
- Improvements in water quality may allow opportunity to restore this resource
- Recent water-dependent projects have impacted existing eelgrass resources

# Boston Harbor



# Background

- Mitigation for impacts associated a natural gas pipeline
- Multi-stage program
  - Massachusetts Division of Marine Fisheries
    - Site selection
    - Test and full scale planting
  - TRC Environmental / Battelle
    - Expanded site selection model
    - Test transplanting
- Mitigation site selection & transplanting 2003-09
- Site conditions in 2009 effected by climate conditions

# Site Selection

- Used PTSI/TSI Method (Davis, 1999; Short et al. 2002)
  - Evaluate historical and existing eelgrass conditions to identify potential sites
- Battelle revised approach that incorporated modeled exposures and light availability
- Light availability is key parameter
  - Collected as part of test-transplanting phase
  - Modeled as part of PTSI

# Preliminary Transplant Model Scoring

## MDMF

Parameter
Depth
Sediment
Historical SAV Distribution
Exposure (energy)
Current SAV Distribution
Water Quality
Bioturbation

## Battelle

Parameter
Light Availability
Dessication
Temperature
Salinity
Wave Energy
Sediment Type

# Sites Identified for Transplanting

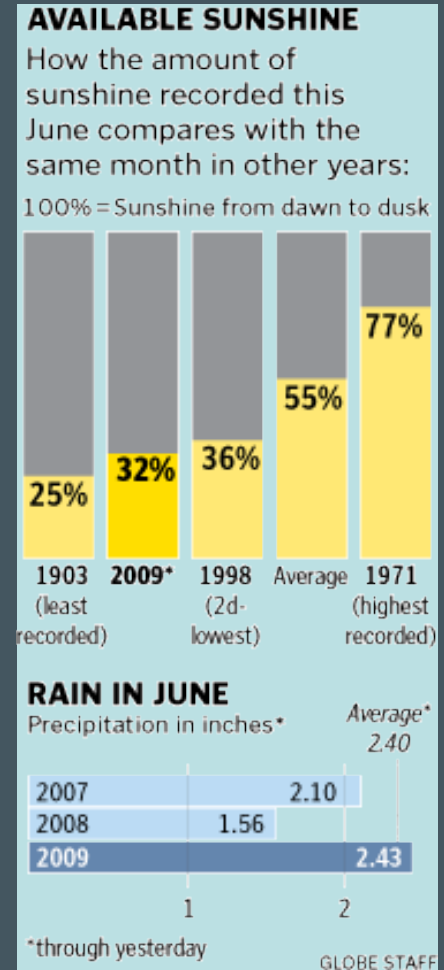
- Good results
  - Peddock's Island
  - Long Island
  - Governor Island flats
  - Deer Island flats
- Poor results
  - Slate Island
  - South Thompson Island

# Environmental Conditions in 2009

- Unusual high tides in June and July
  - High tides as much as 2.0 ft above normal
- Rainfall / cloud cover
  - Rainfall slightly above average
  - Available sunshine near record low

[http://tidesandcurrents.noaa.gov/publications/EastCoastSeaLevelAnomaly\\_2009.pdf](http://tidesandcurrents.noaa.gov/publications/EastCoastSeaLevelAnomaly_2009.pdf)

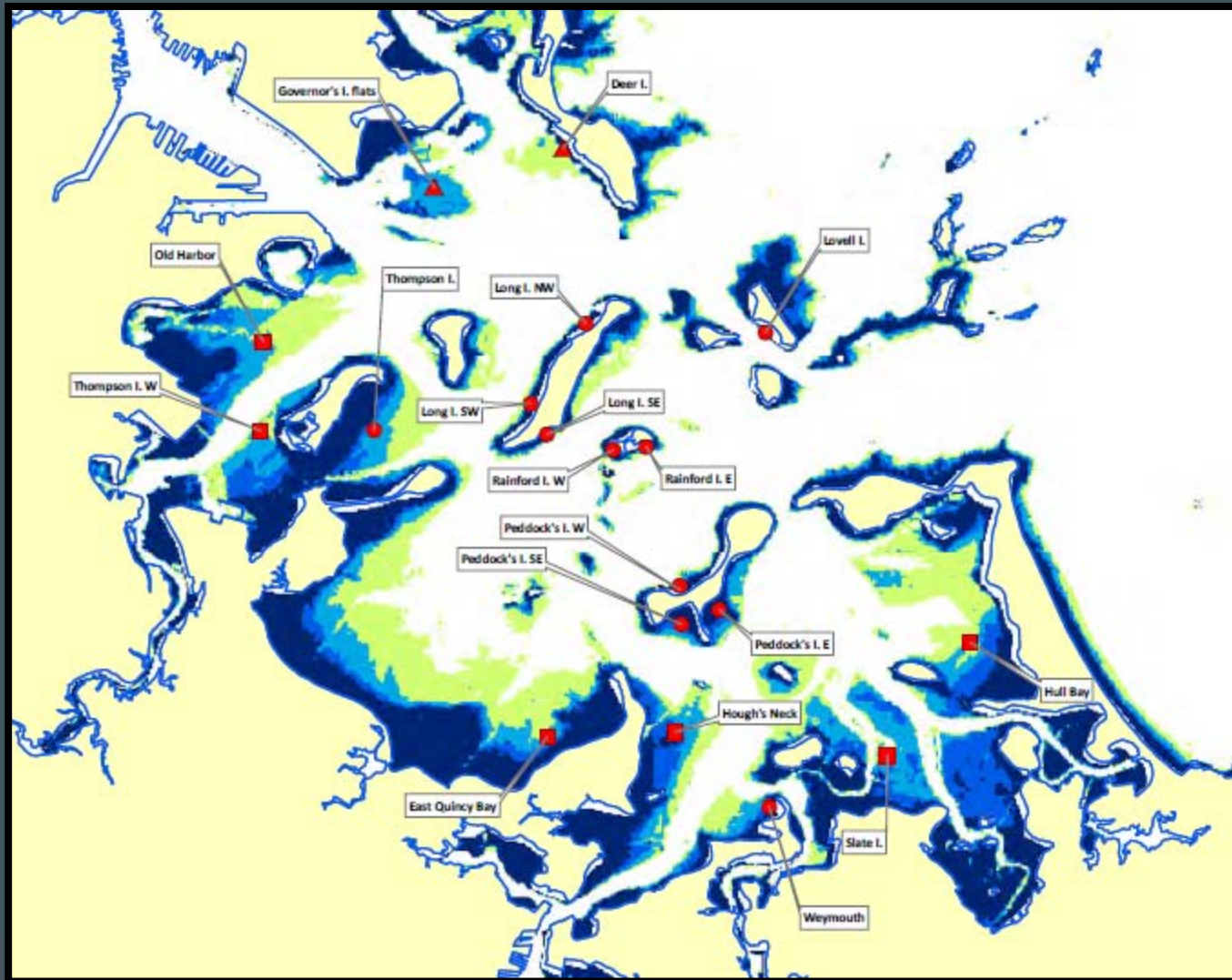
<http://www.boston.com/bostonglobe/>



# Methods

- Evaluate impact of 2009 conditions on eelgrass
- Light availability predictions revised
  - Depth increased by 0.1 m to simulate the higher than normal tides
  - Reduced incoming PAR by 10% as a surrogate for:
    - Increased cloud cover
    - Rain
    - Increase turbidity due to wind and runoff
- Re-evaluated restoration areas identified by the MDMF model and 2009 test transplant sites that had poor survival

# Boston Harbor PAR



**LEGEND**

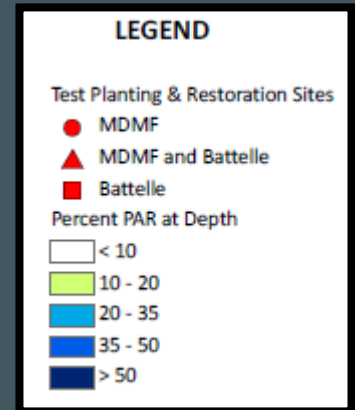
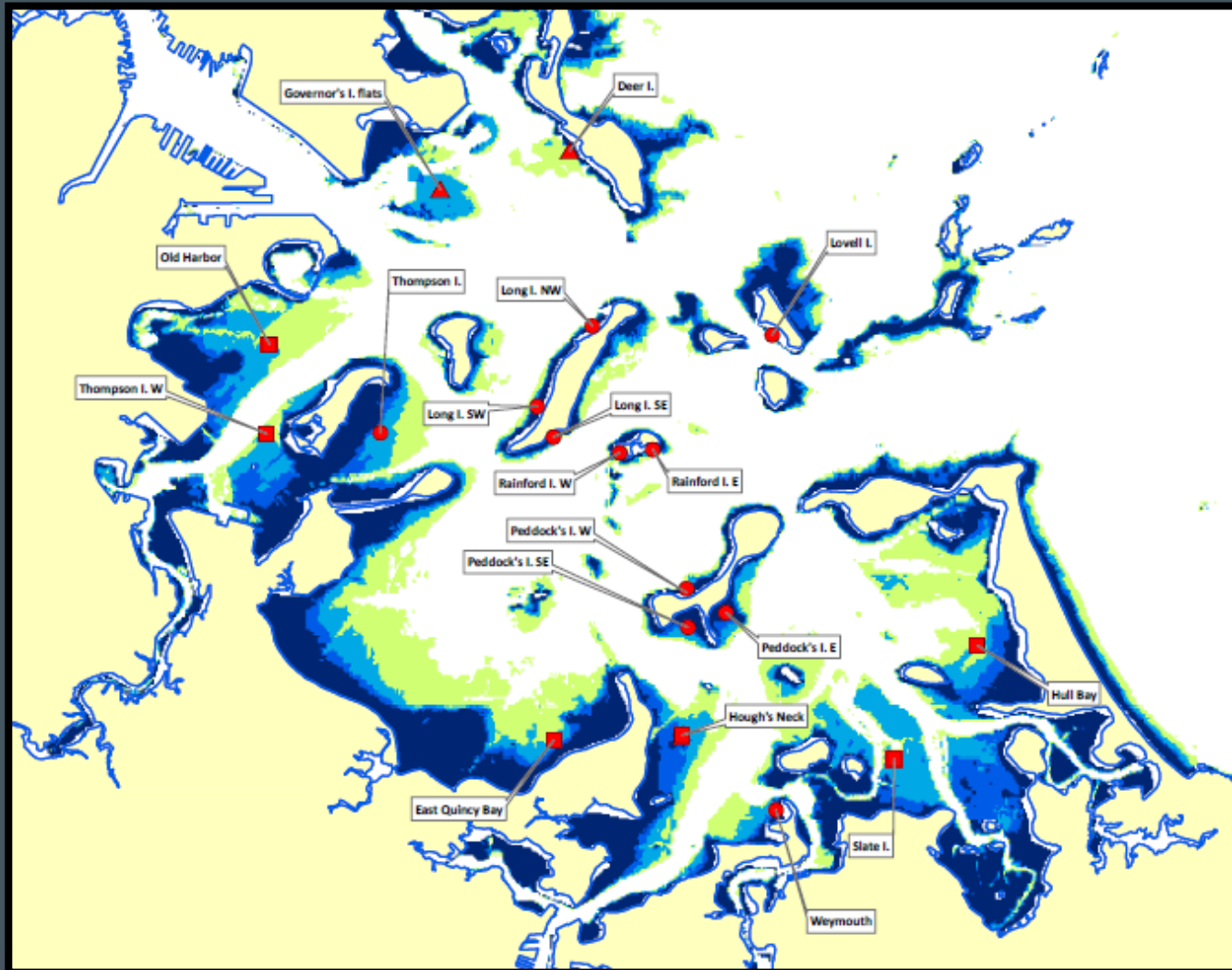
Test Planting & Restoration Sites

- MDMF
- ▲ MDMF and Battelle
- Battelle

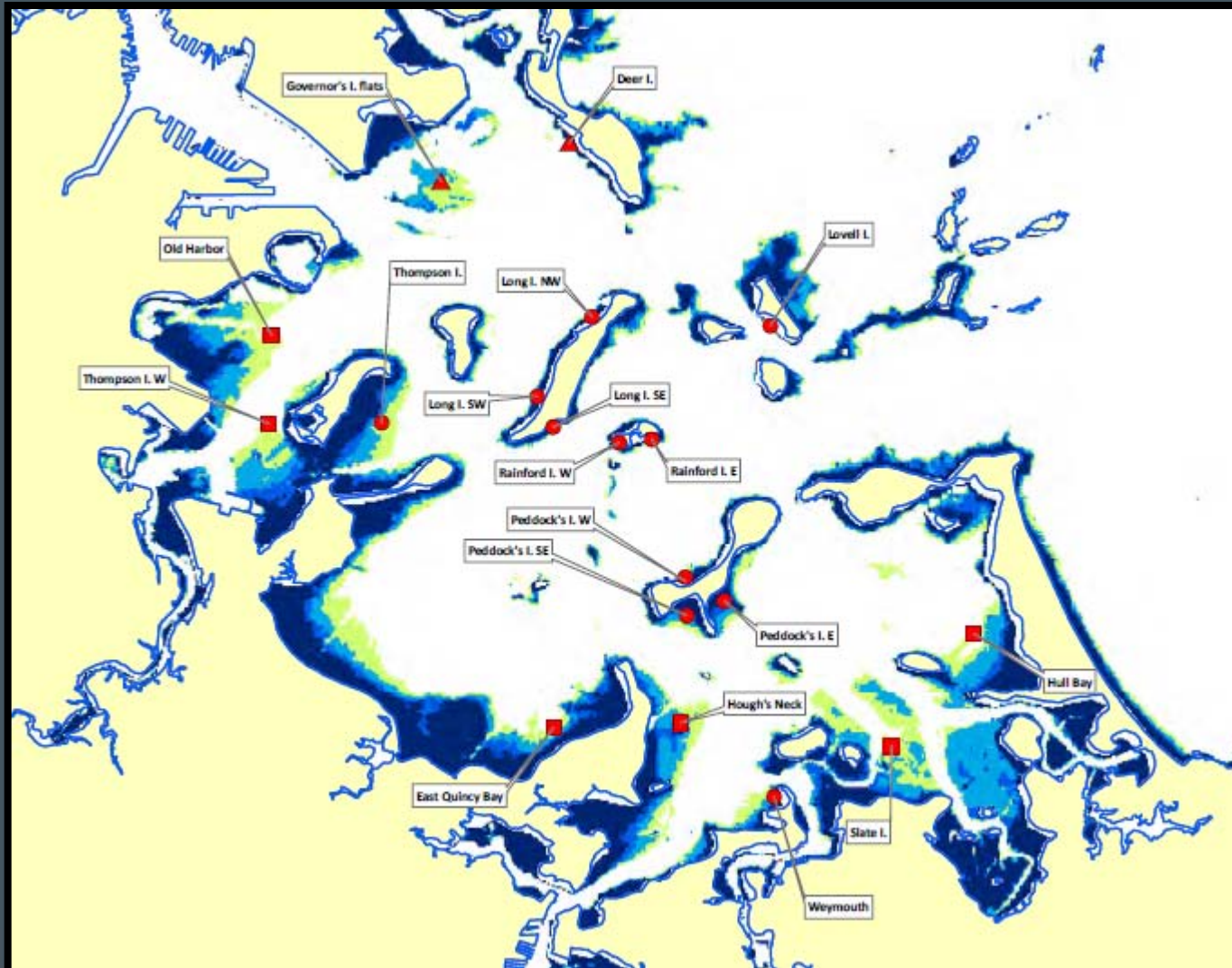
Percent PAR at Depth

- < 10
- 10 - 20
- 20 - 35
- 35 - 50
- > 50

# Reduced PAR due to increased tides



# Reduced PAR due to tides and light



**LEGEND**

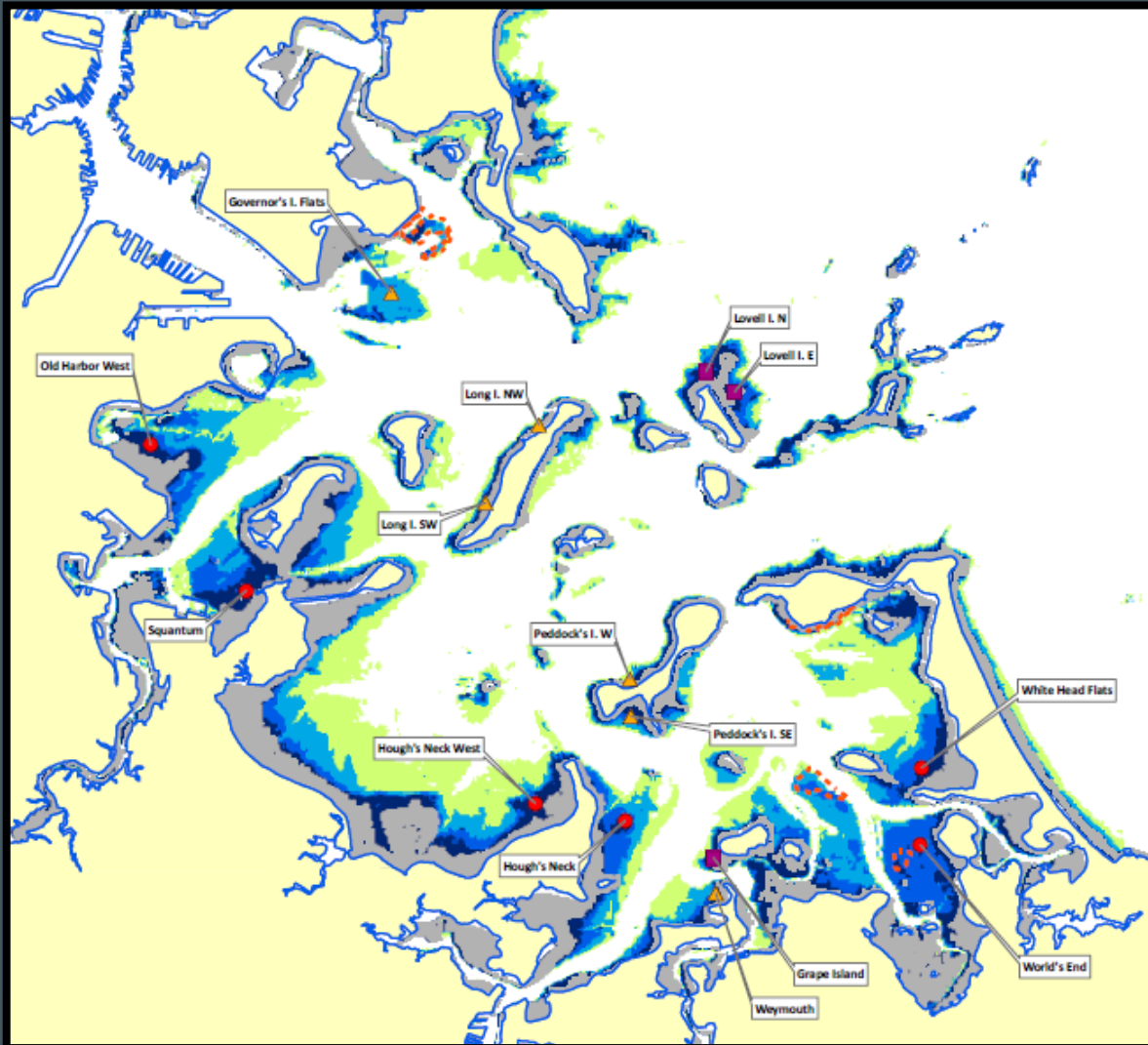
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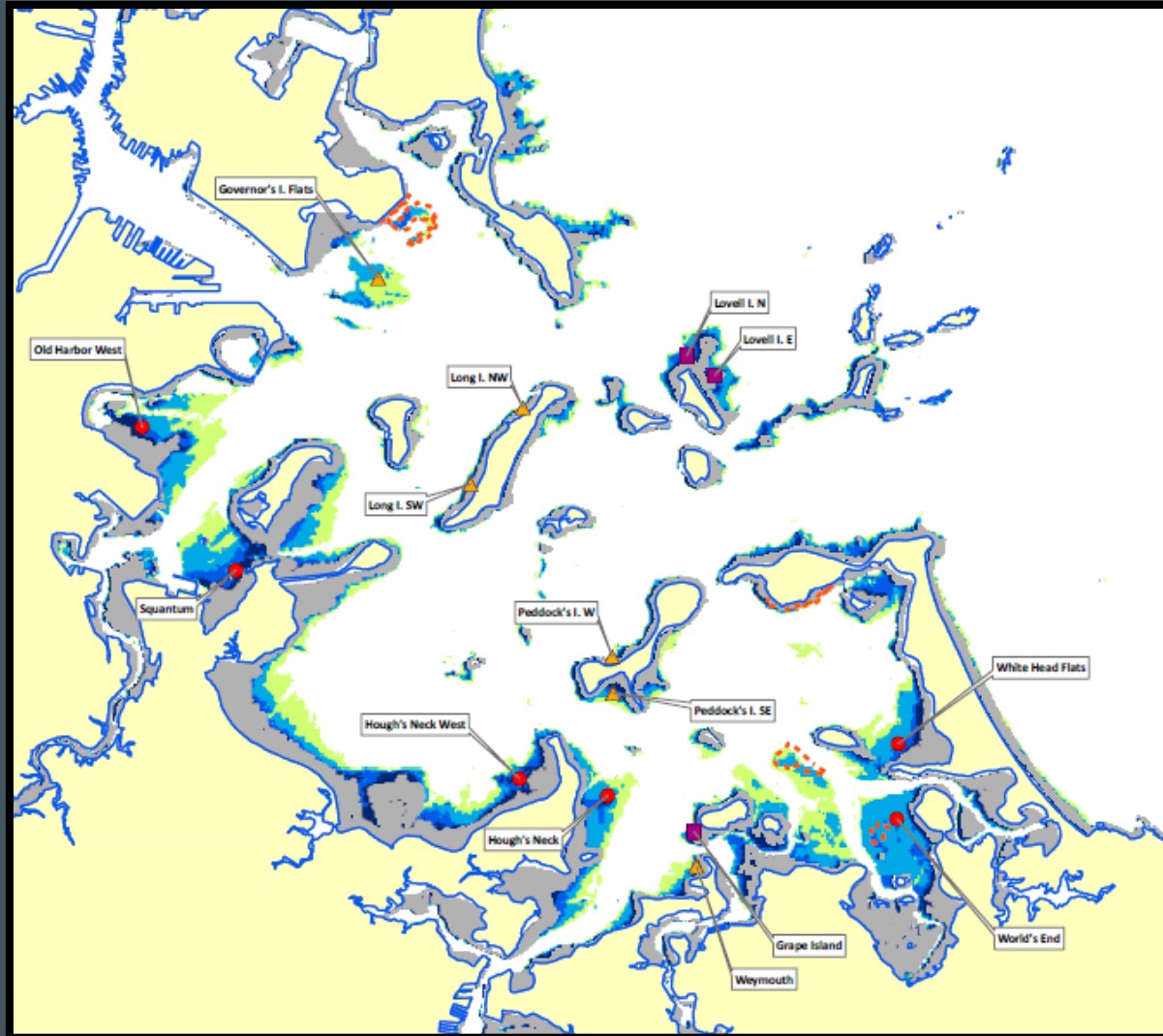
Percent PAR at Depth

- < 10
- 10 - 20
- 20 - 35
- 35 - 50
- > 50

# Existing eelgrass beds



# Existing eelgrass beds with reduced PAR



# Next Steps

- Quantify area of potential planting sites
  - Sediment data
  - Bathymetry
  - Sidescan sonar
- Sensitivity analysis
  - Transplanting results
  - Water quality



# Conclusions

- Changes to water surface elevations and PAR limits size and suitability of sites
- Shoreline conditions limit shifting (succession) of beds into adjacent areas
- Relationship between water quality and SLR important

