Effects of Climate Change on Critical Estuarine Habitat: Eelgrass

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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

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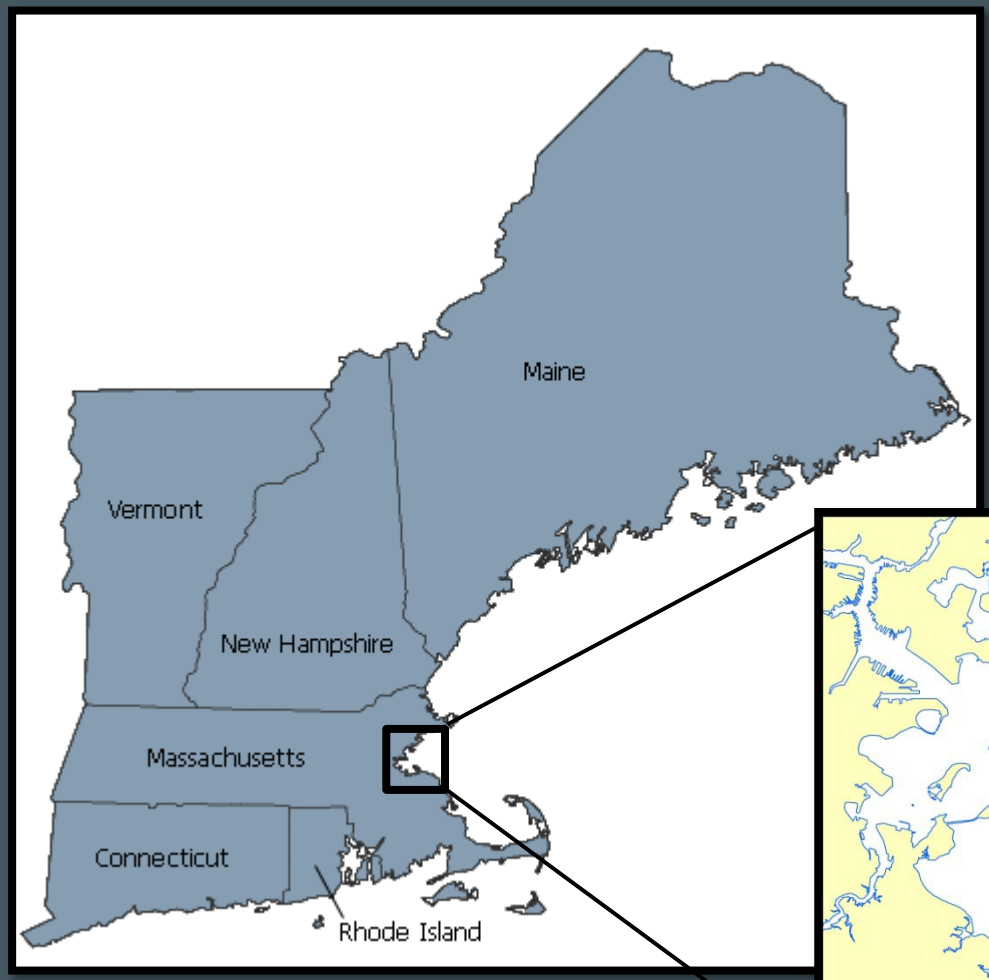
Boston Harbor



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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

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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

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Sites Identified for Transplanting

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

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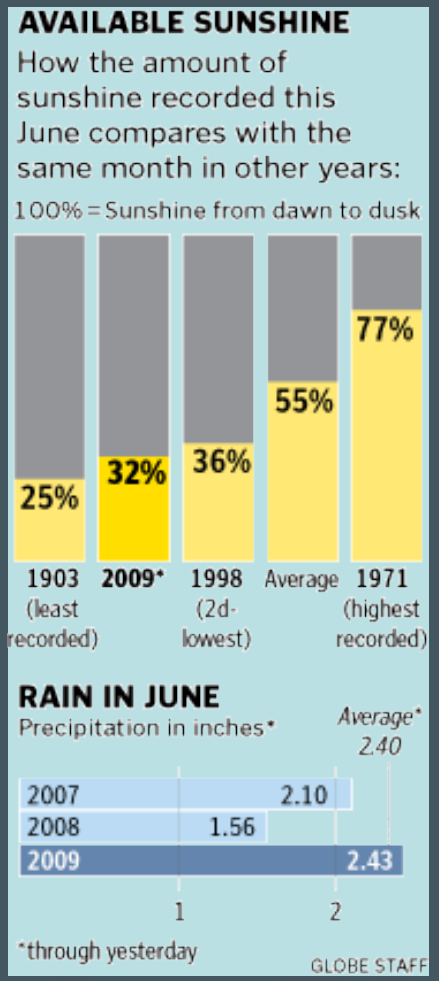
Environmental Conditions in 2009

- 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://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

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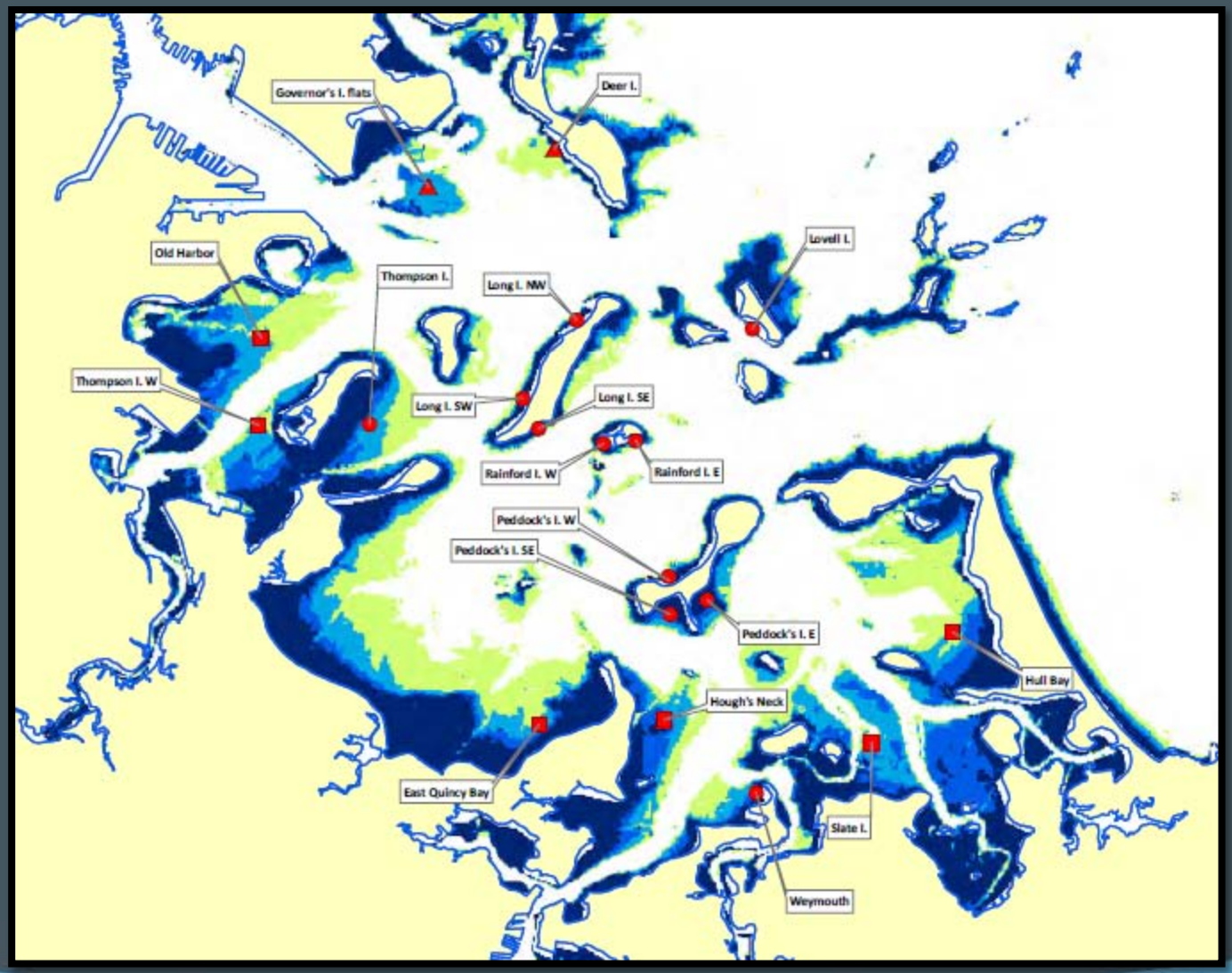
Boston Harbor PAR



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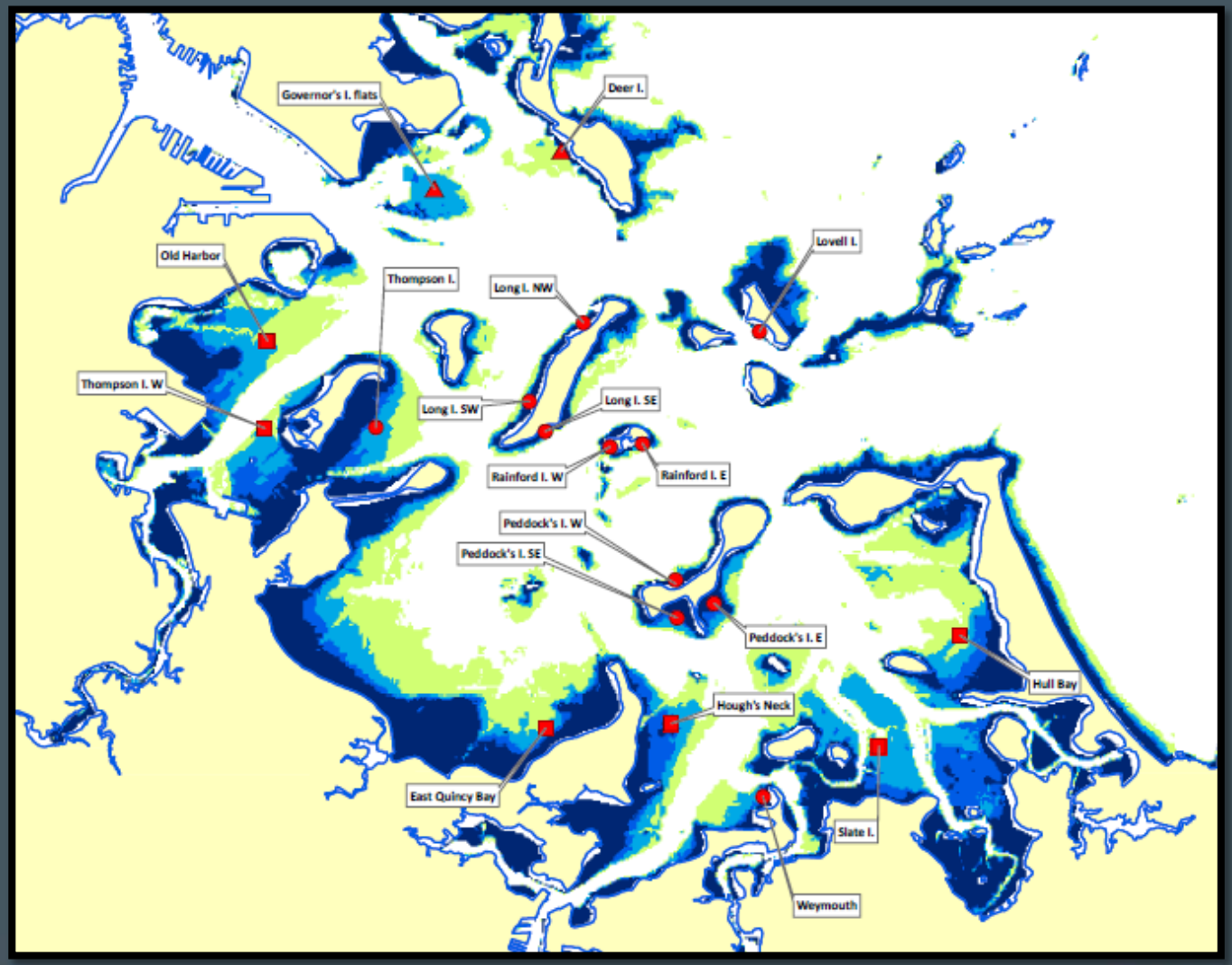
Reduced PAR due to increased tides



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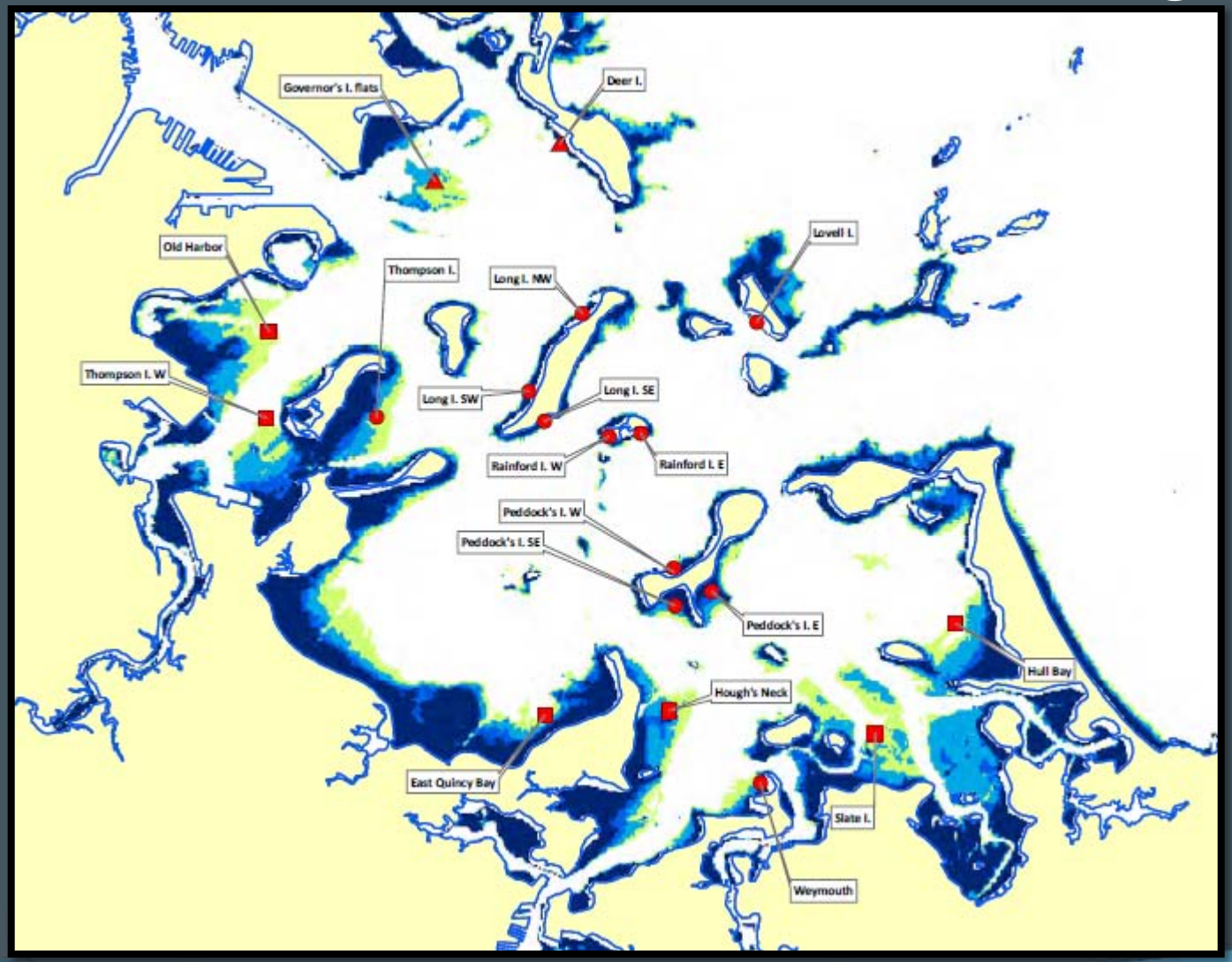
Reduced PAR due to tides and light



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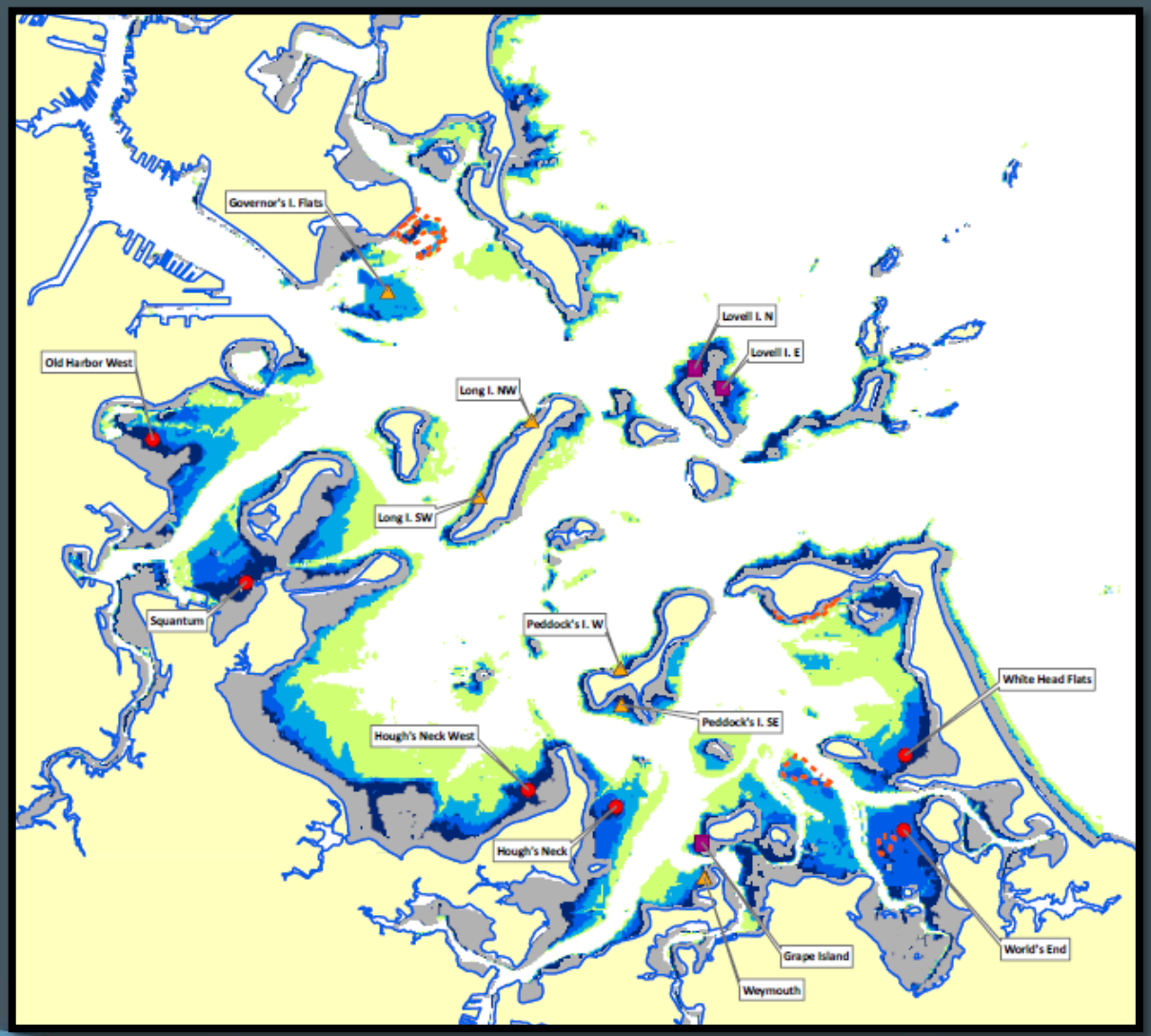
Existing eelgrass beds



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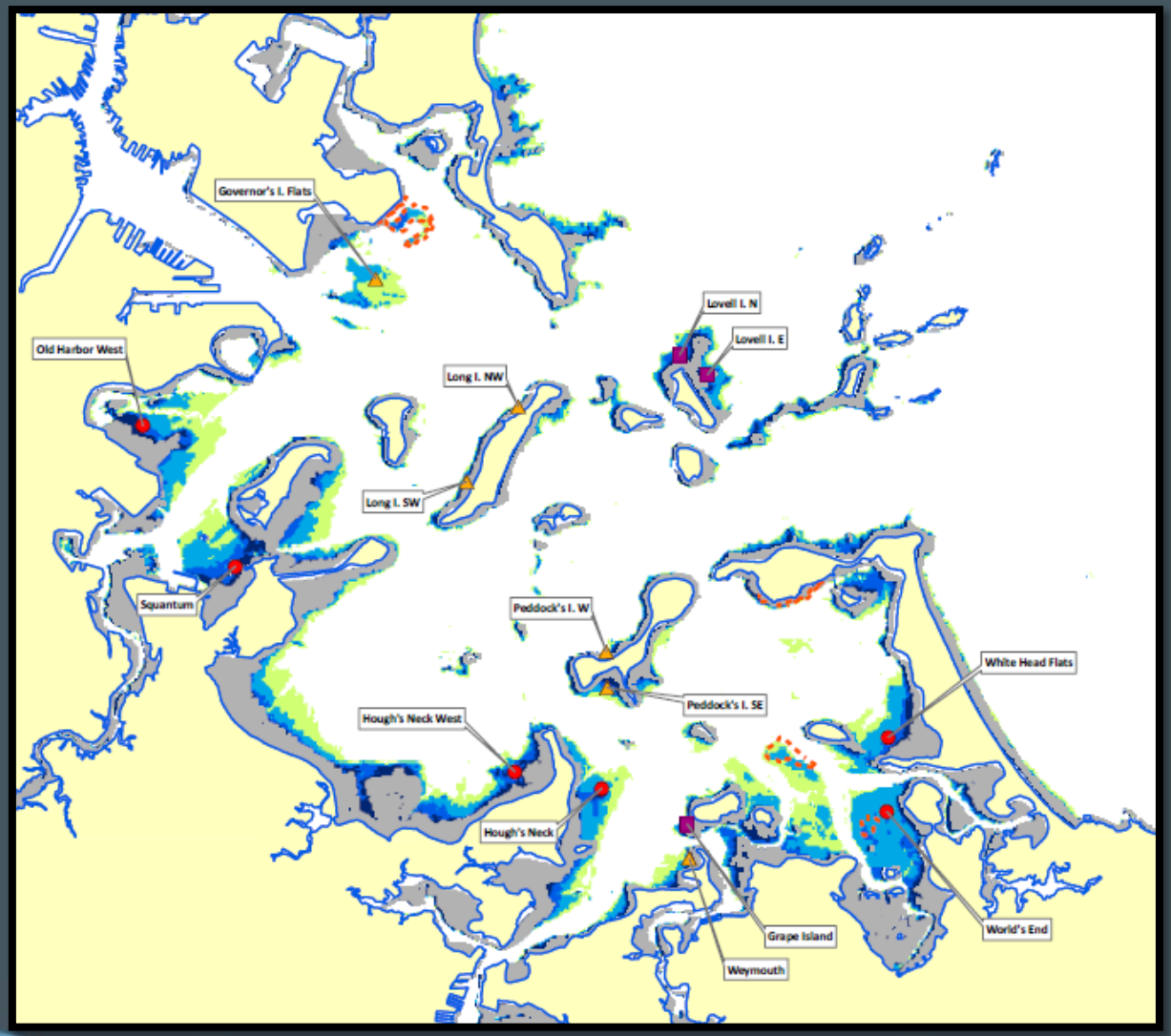
Existing eelgrass beds with reduced PAR



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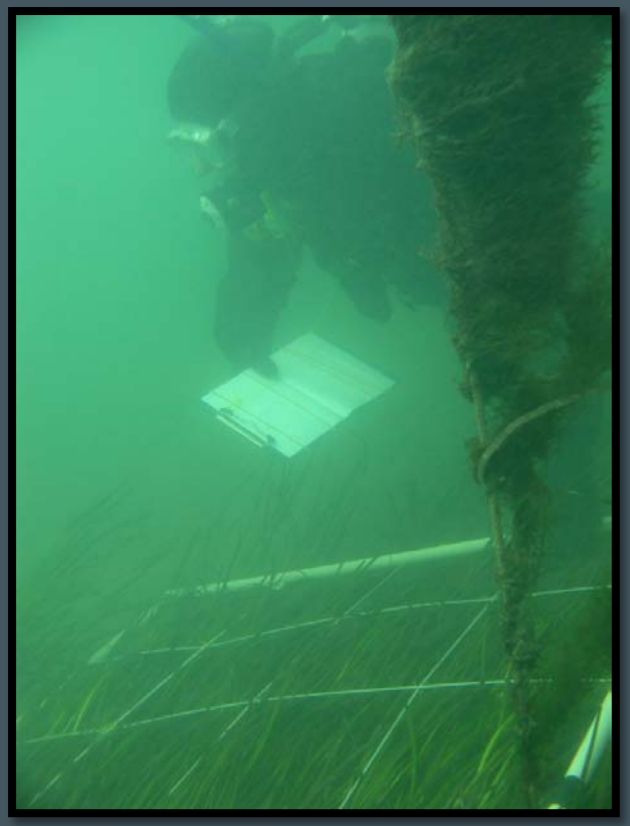
Next Steps

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



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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

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