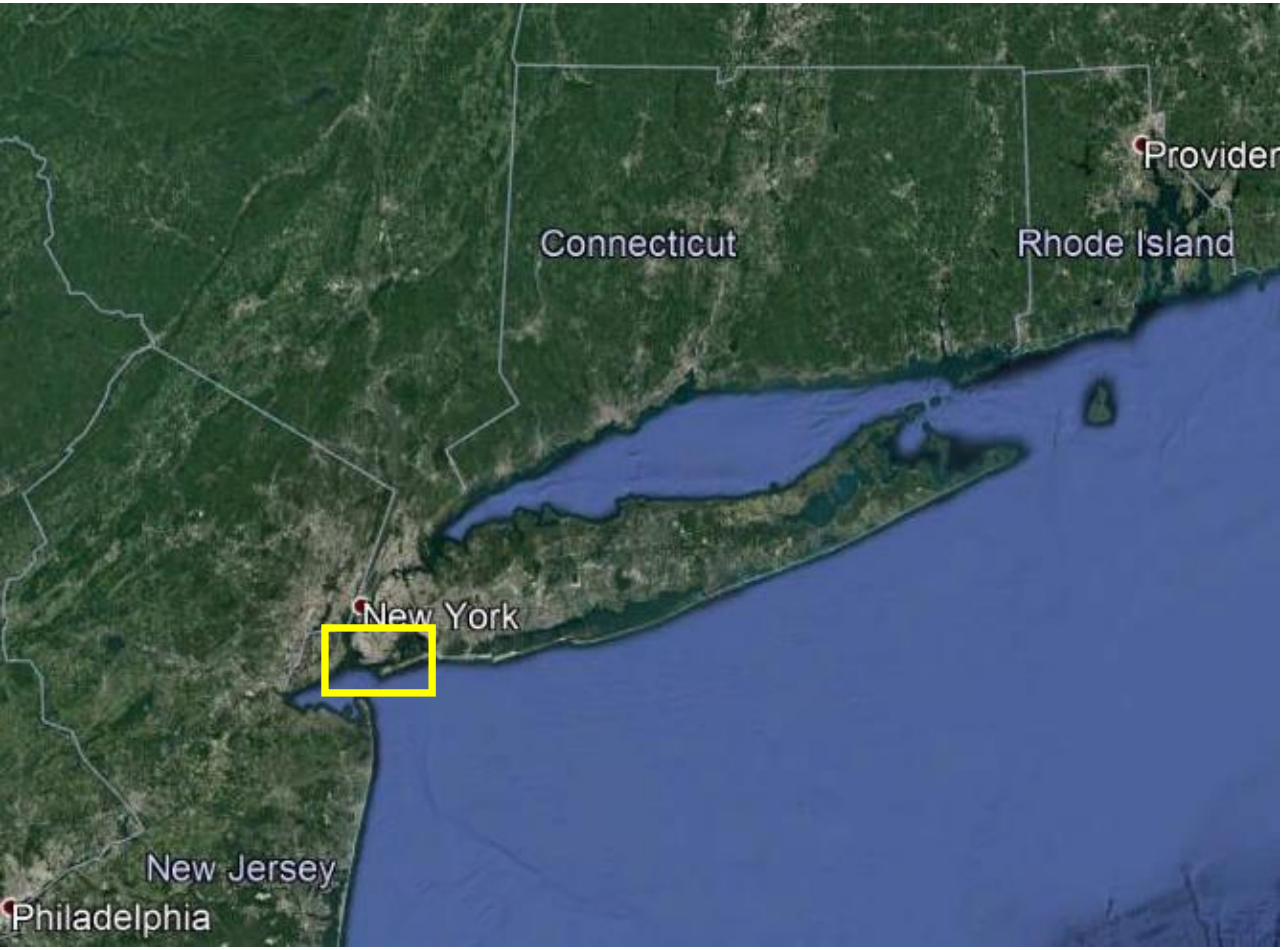
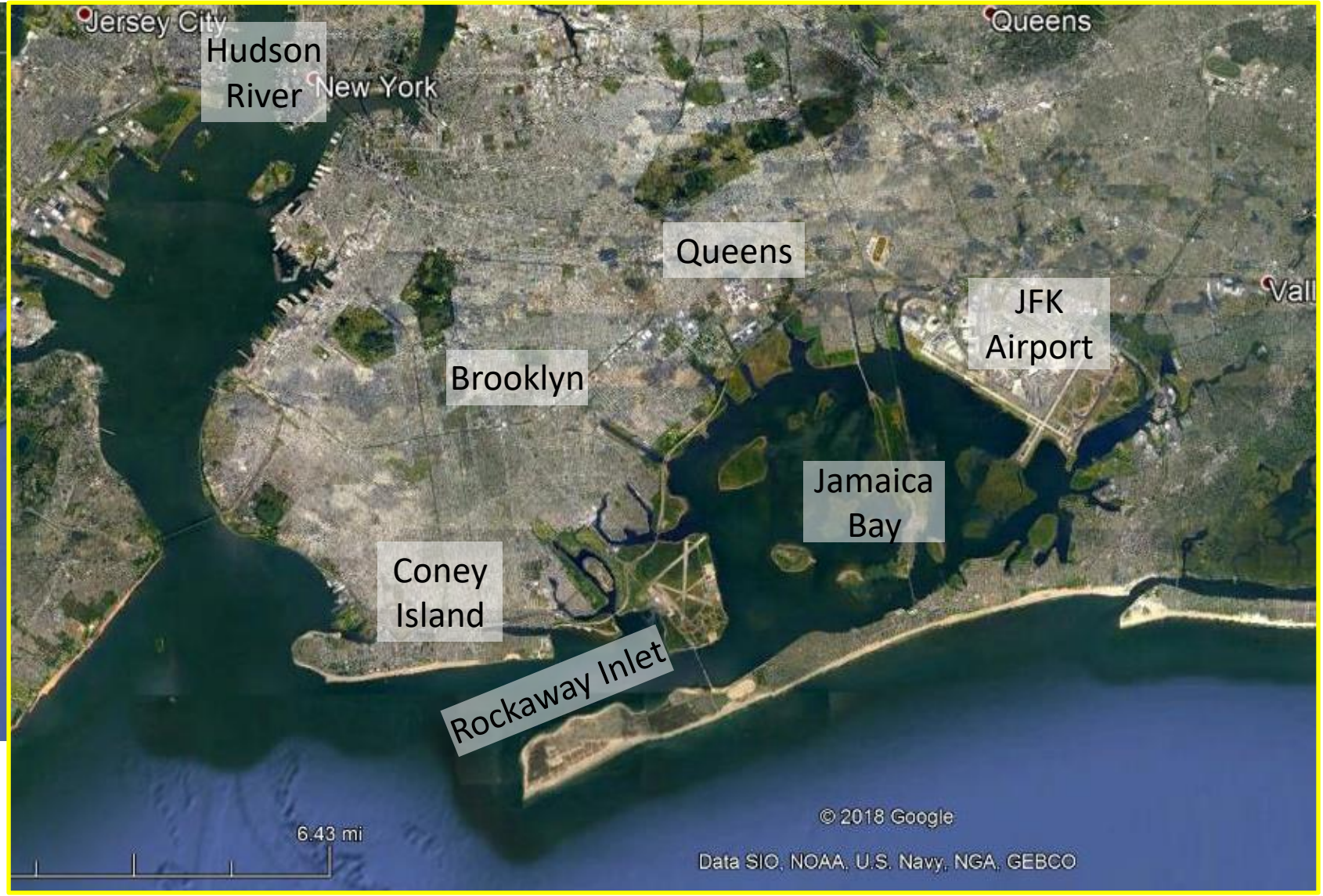
Integrated Modelling To Predict Landscape Evolution, Flooding, And Water Quality In Jamaica Bay, NY

Heather D. Smith, Ph.D., P.E., Philip Orton, Ph.D.,
Eric W. Sanderson, Ph.D., Jordan Fischbach, Ph.D.

Jamaica Bay, NY



Jamaica Bay, NY



Jamaica Bay, NY

Process & Goals

Reduce flood risk

Improve habitat and ecosystem function

Improve water quality

Process & Goals

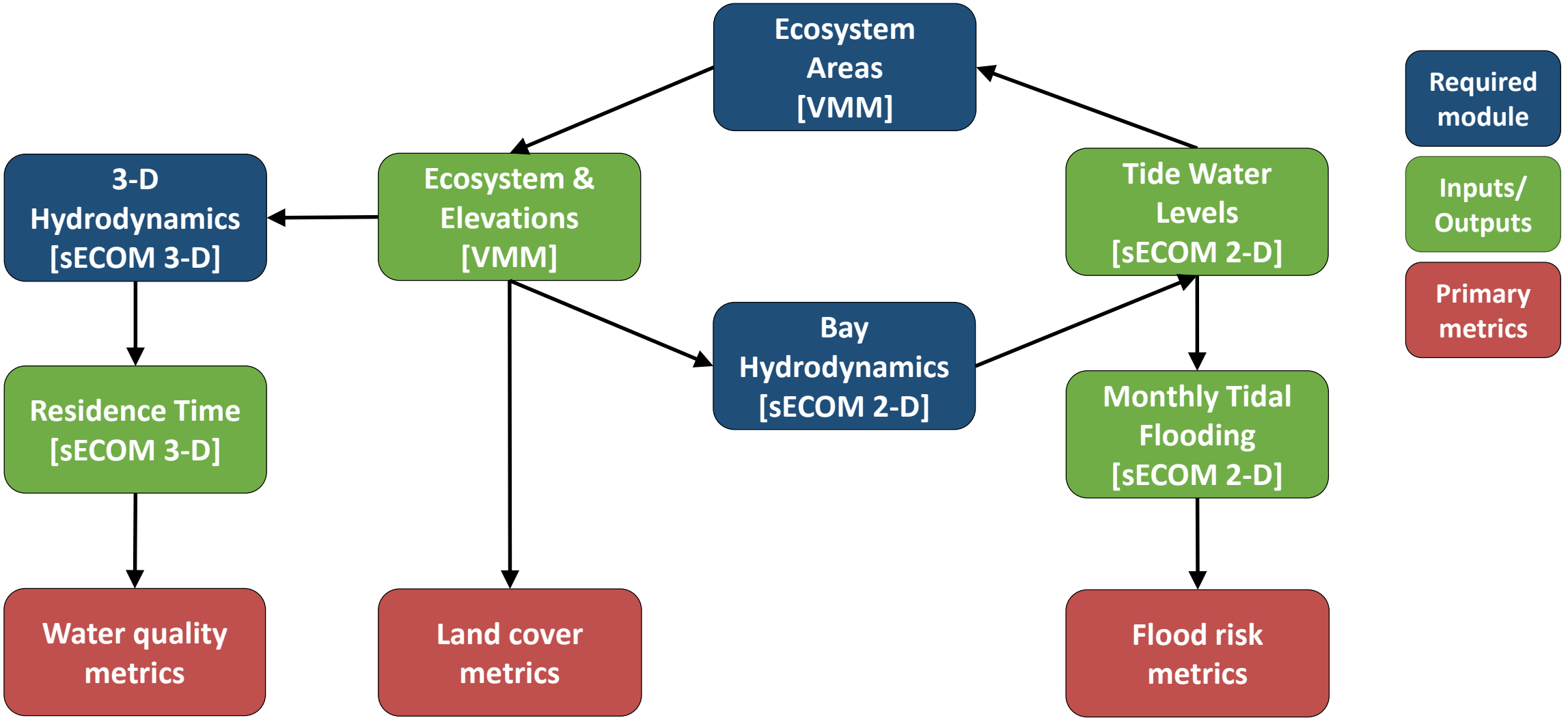
Public Agency & Stakeholder Meetings

- Narrowing Rockaway Inlet
- Shallowing Grassy Bay
- Whole Bay Shallowing
- Marsh Island Restoration
- Perimeter Restoration

Integrated Modelling Framework

- Reduce flood risk
- Improve habitat and ecosystem function
- Improve water quality

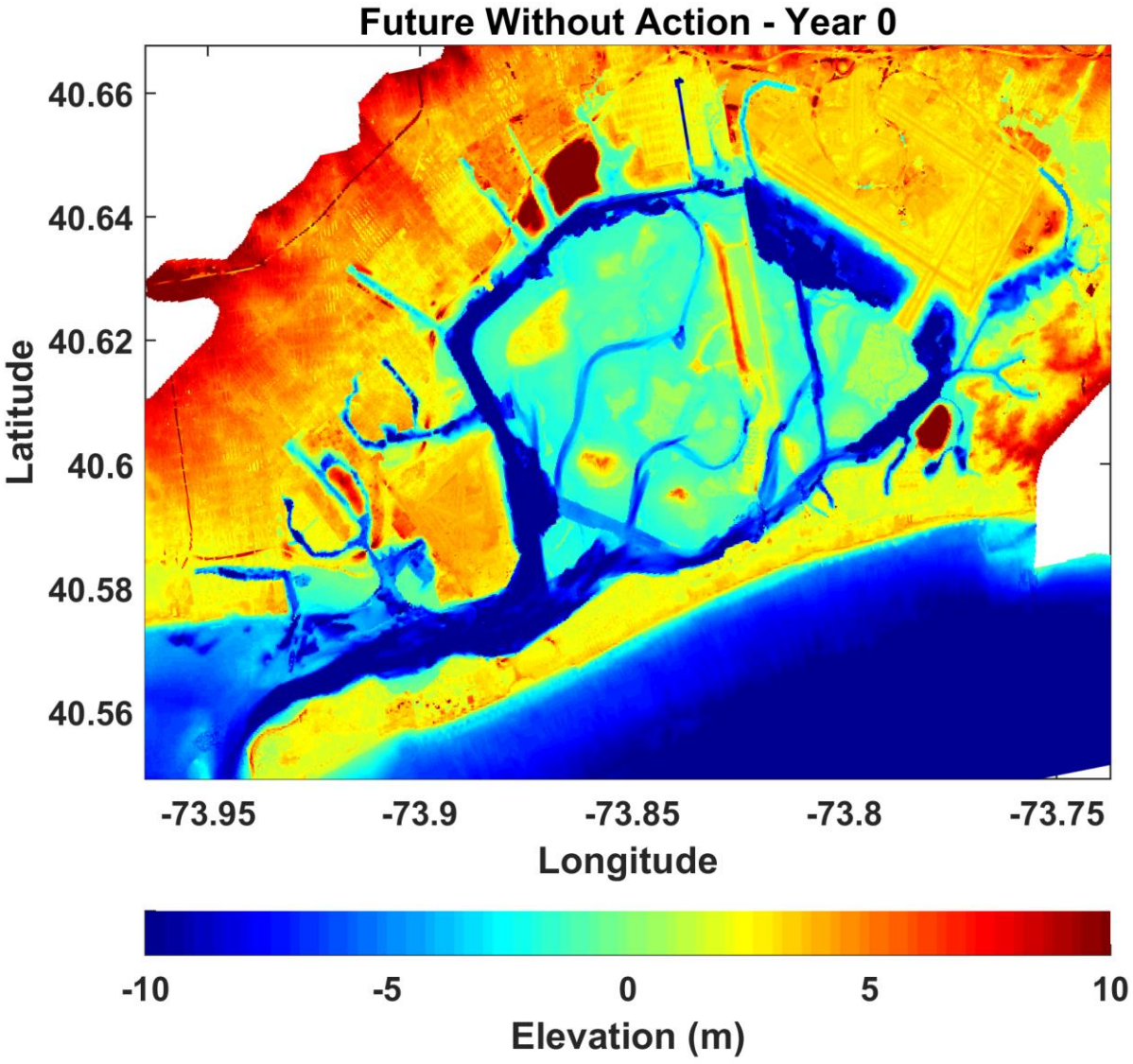
Modelling Framework

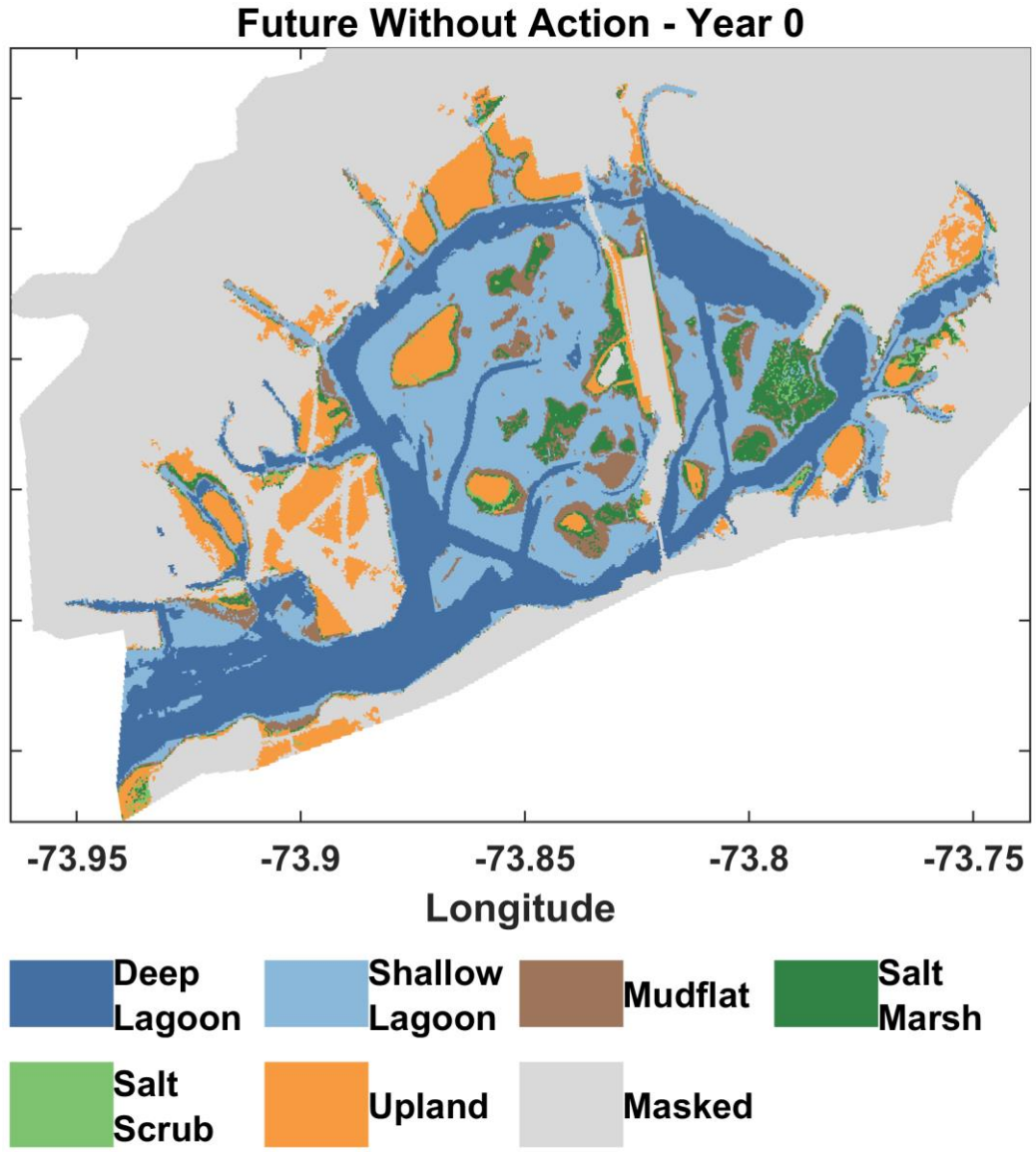


Limitations of the Analysis

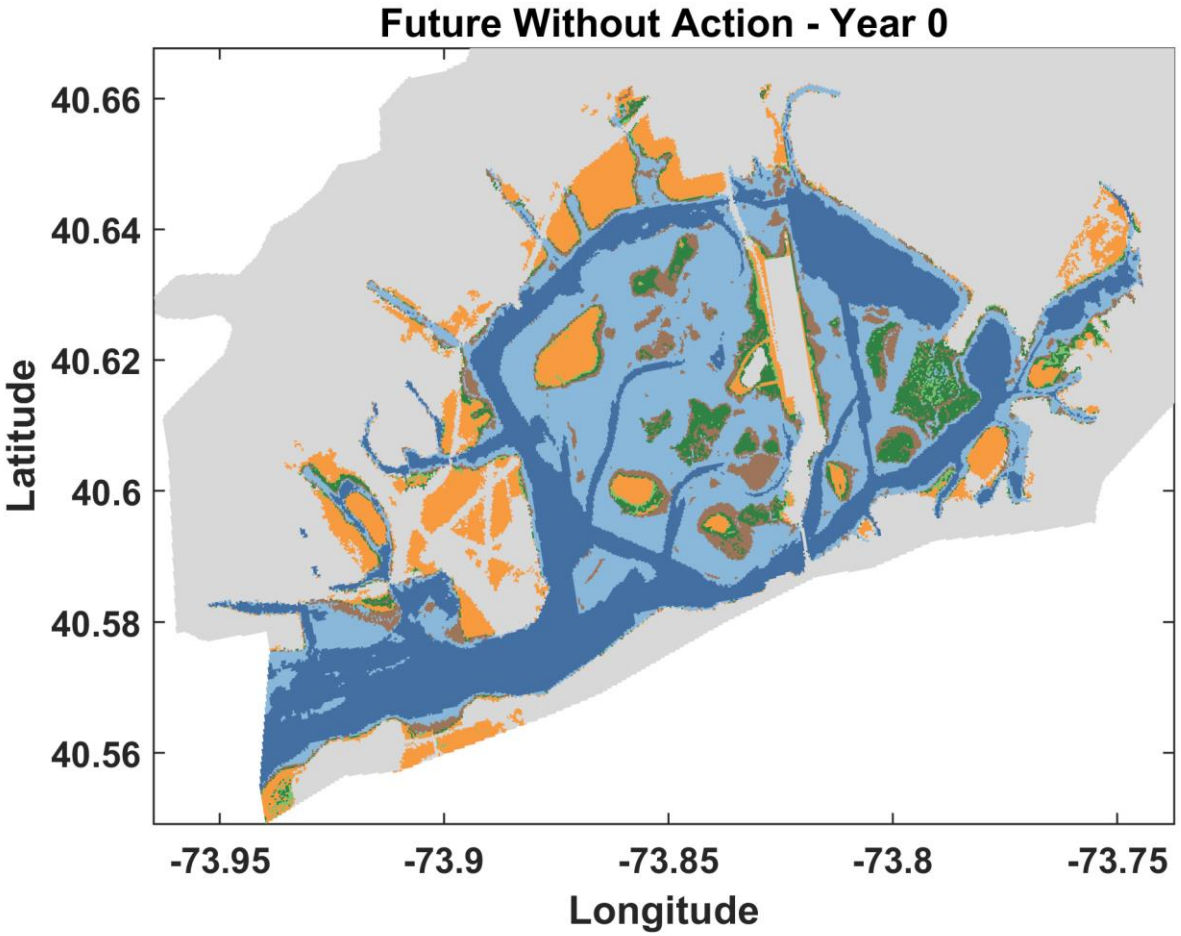
- Calculations performed at 30 m resolution
- Horizontal marsh evolution at the boundaries in visionmaker marsh (VMM) is constrained by the built “mask” and some areas that were not modeled
- Vertical marsh processes are modeled, but these do not include:
  - Wave impact
  - Horizontal edge erosion
  - Marsh chemistry
  - Sediment dynamics
- Storm surge flood risk reduction was not considered

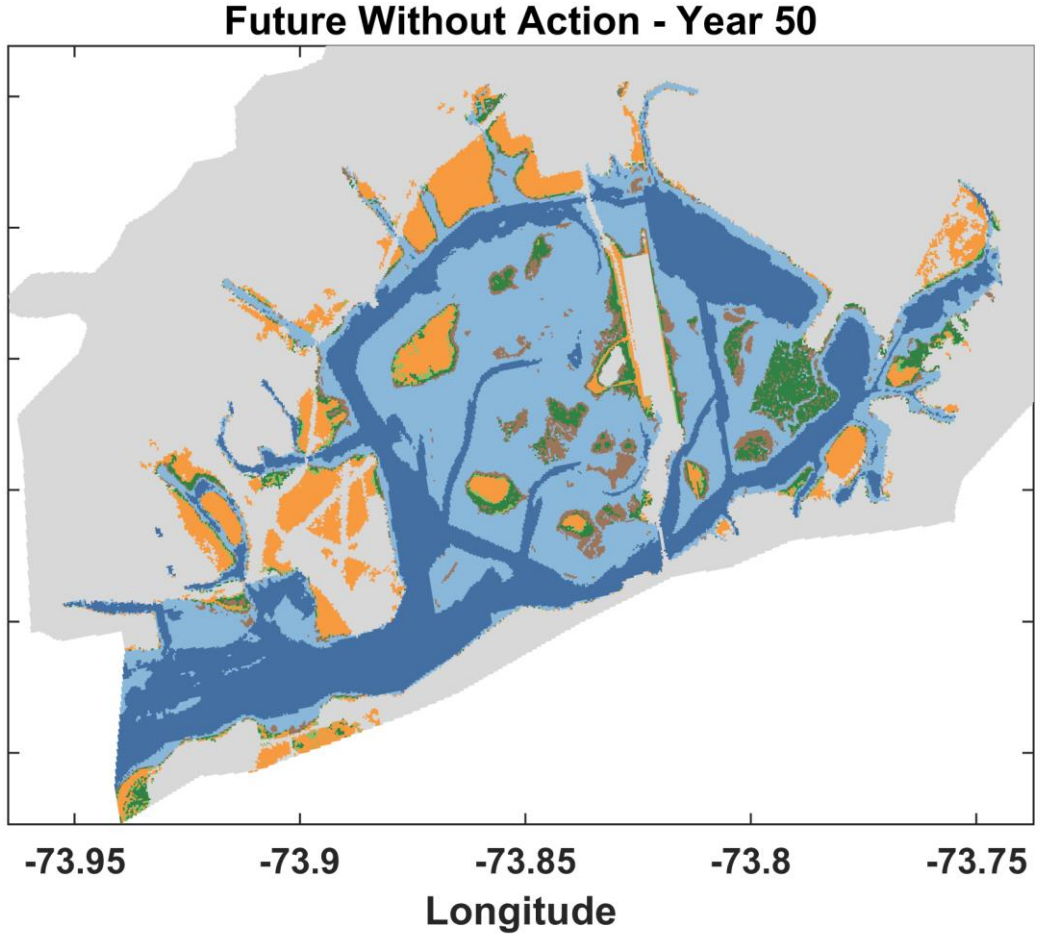
Current Landscape





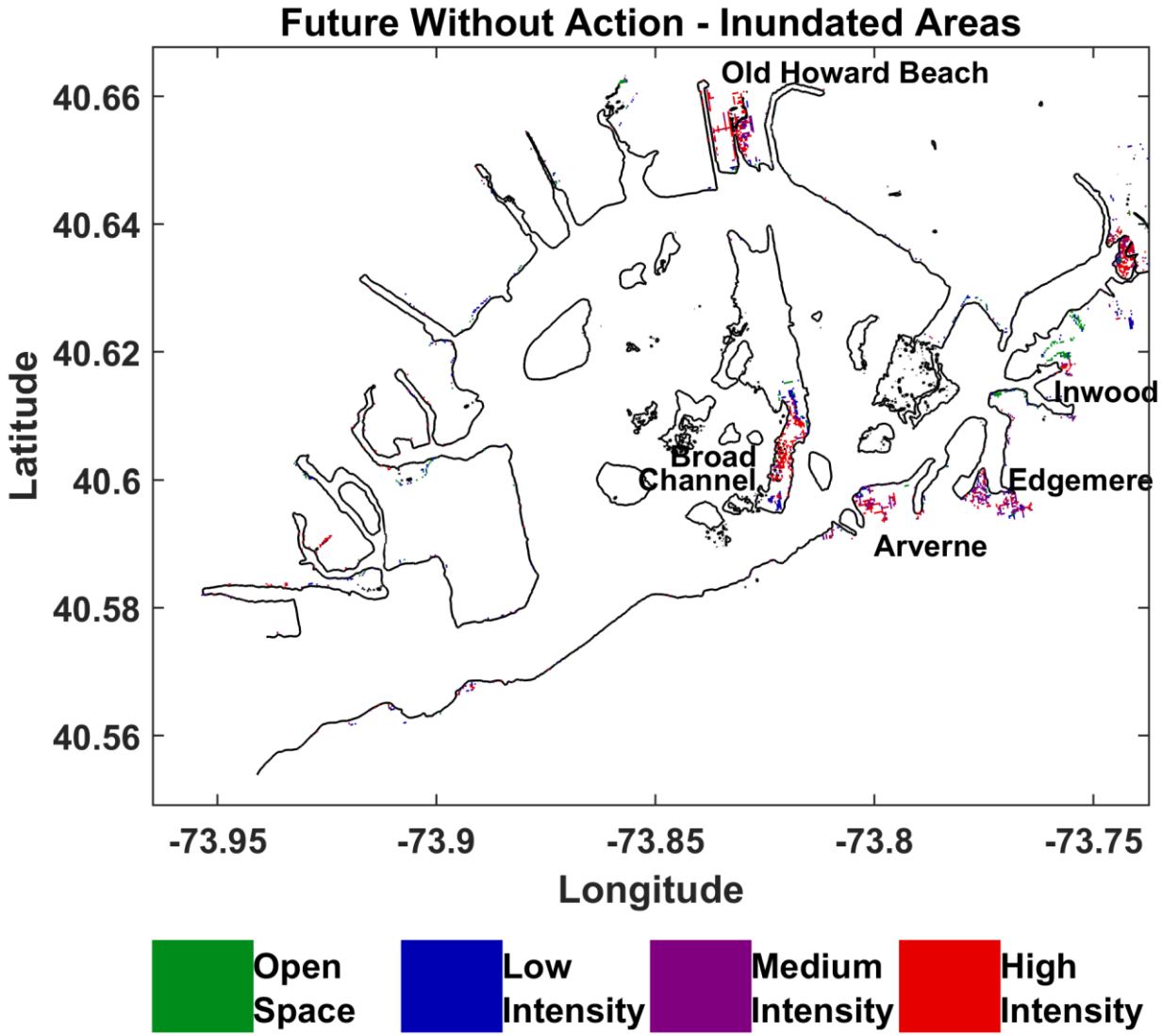
Future Without Action - +43 cm SLR



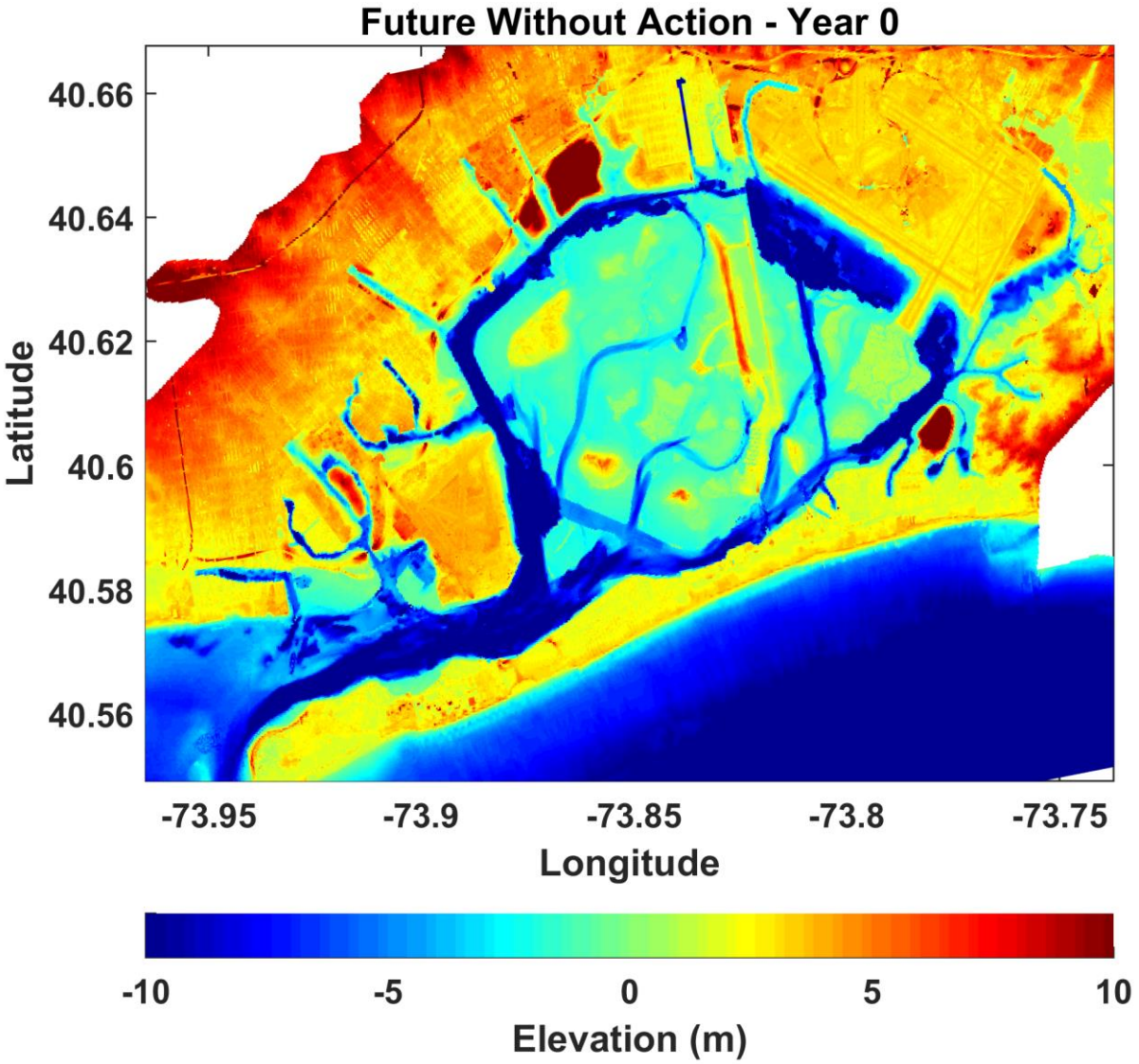


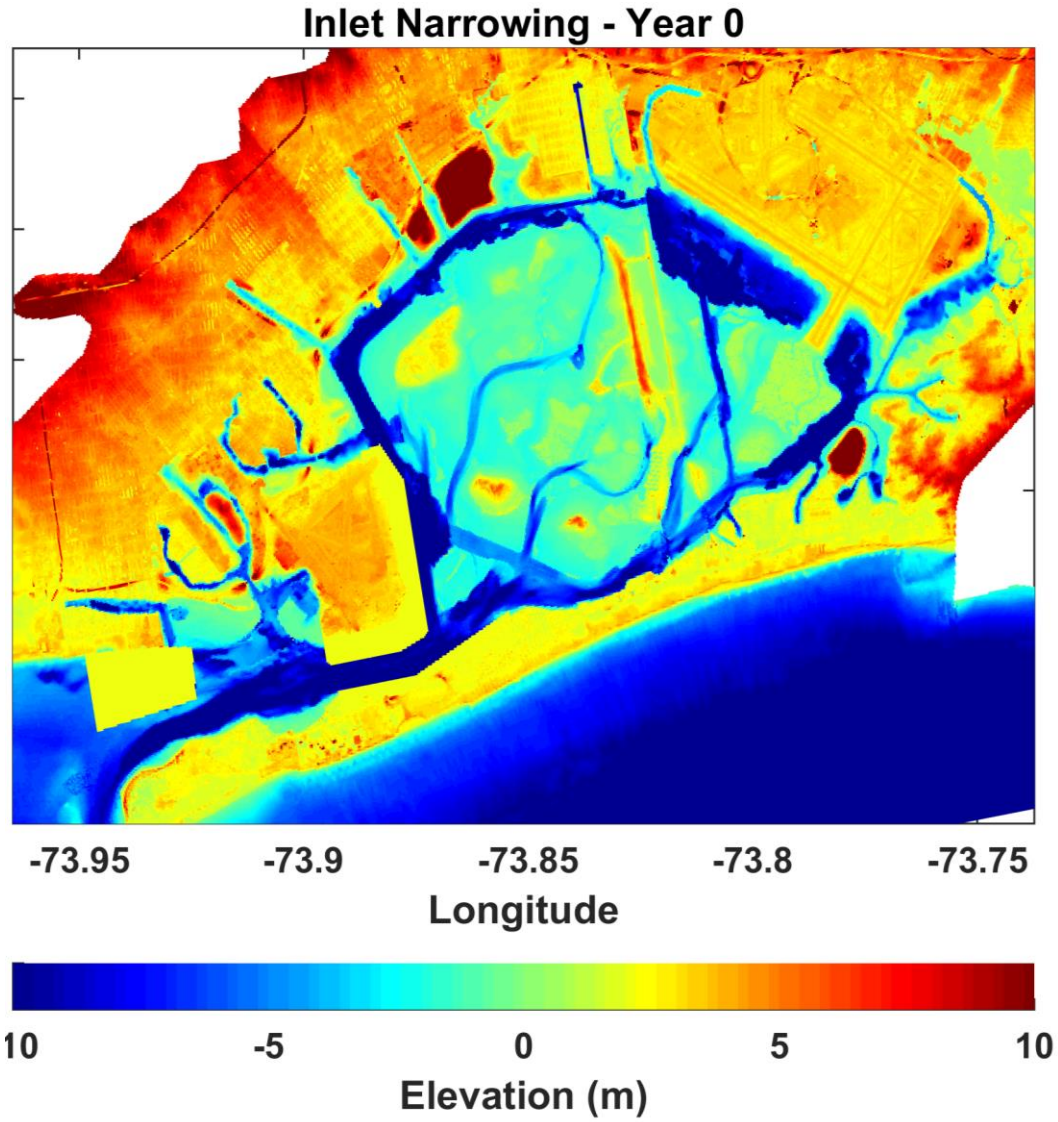
13% loss in salt marsh
10% loss in salt scrub
10% loss in upland

Future Without Action

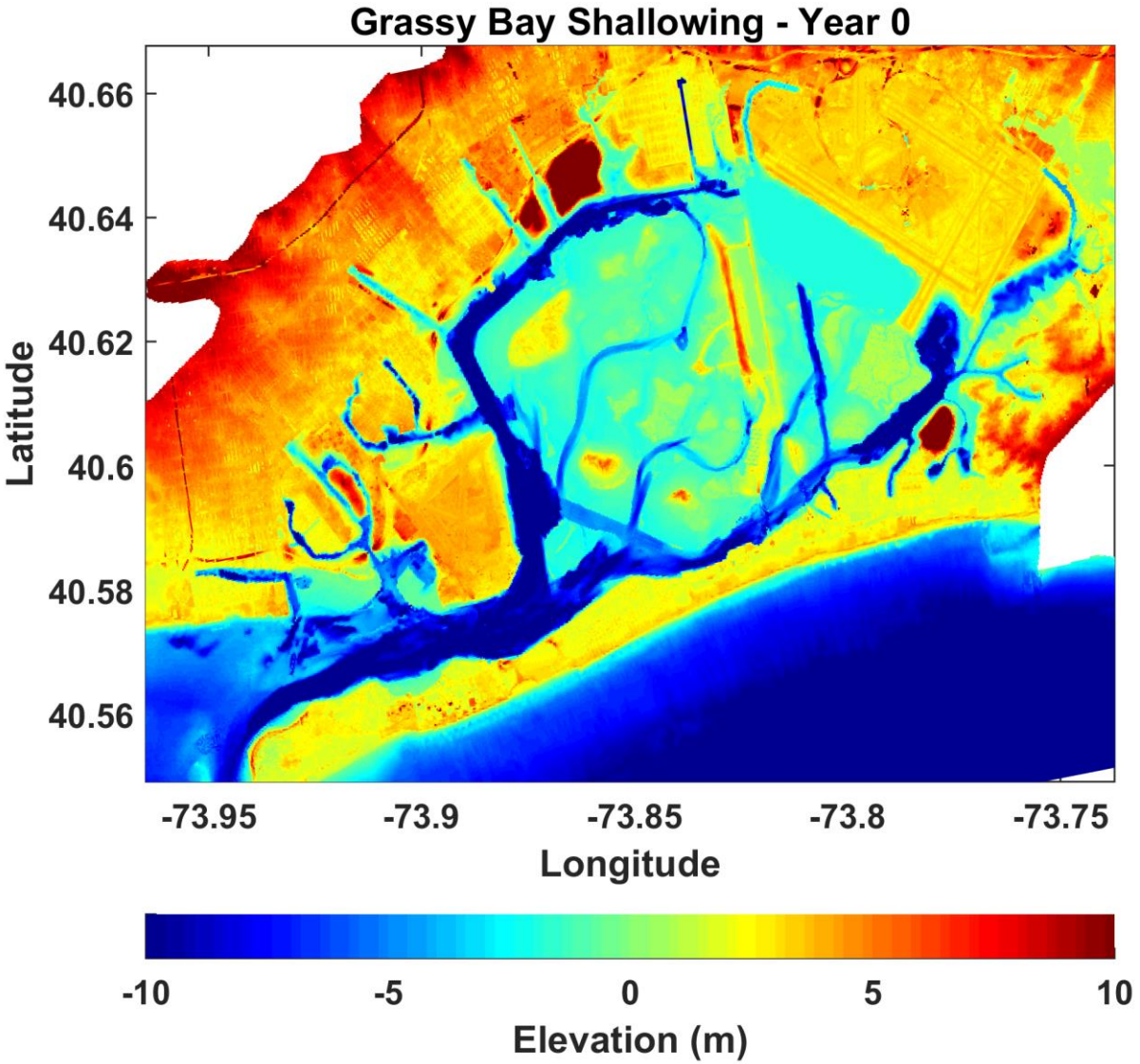


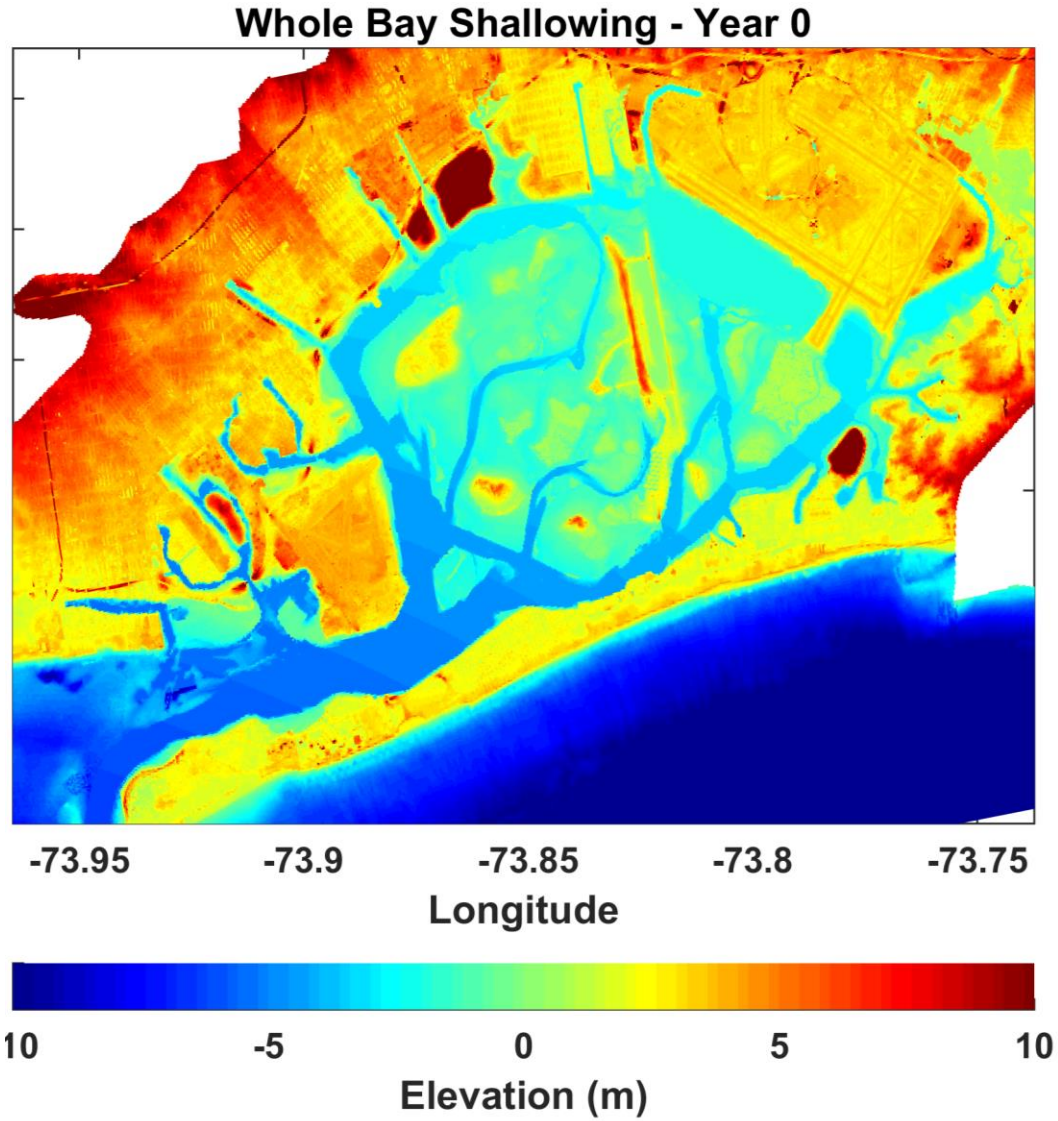
Sensitivity Tests



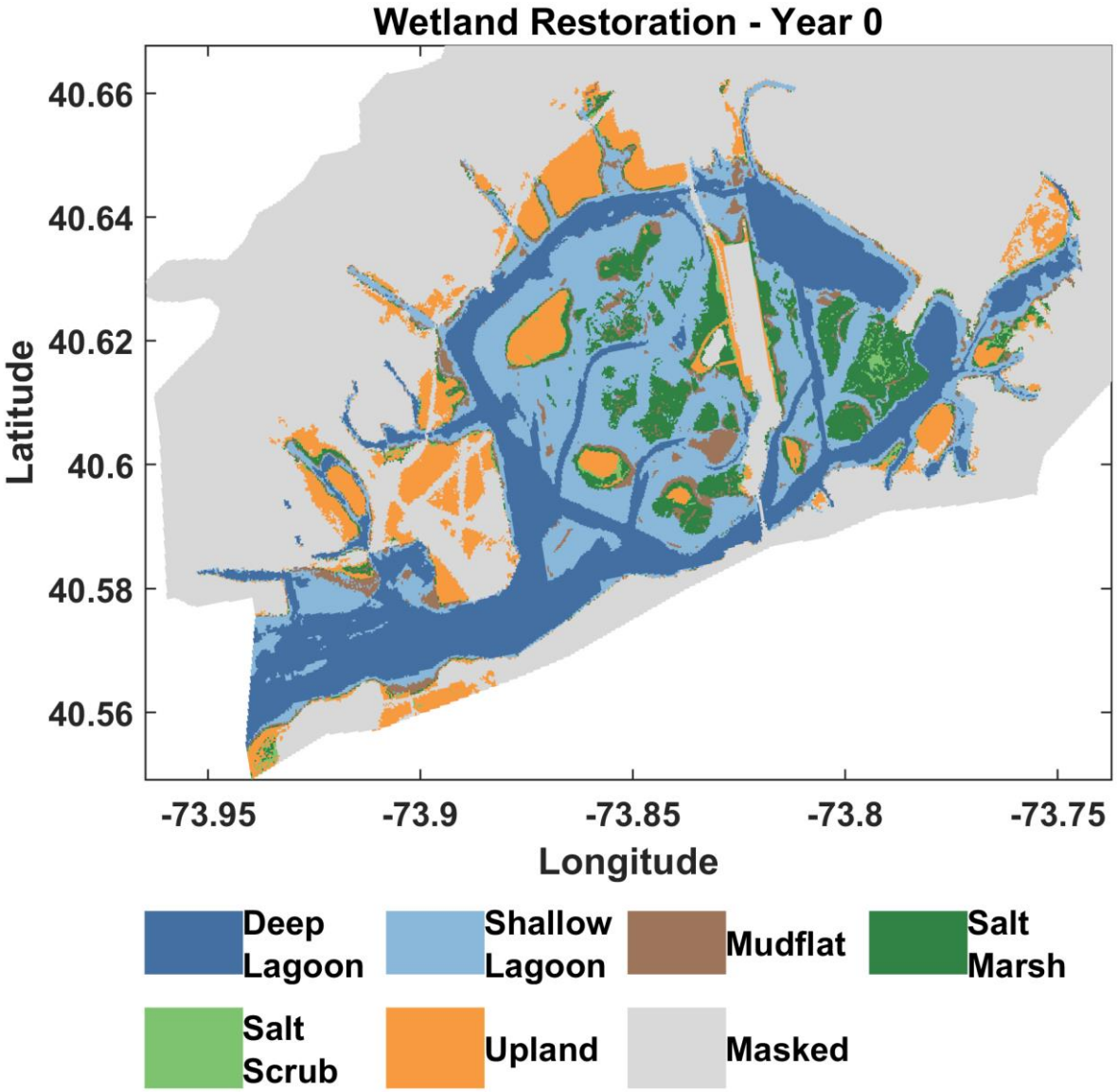


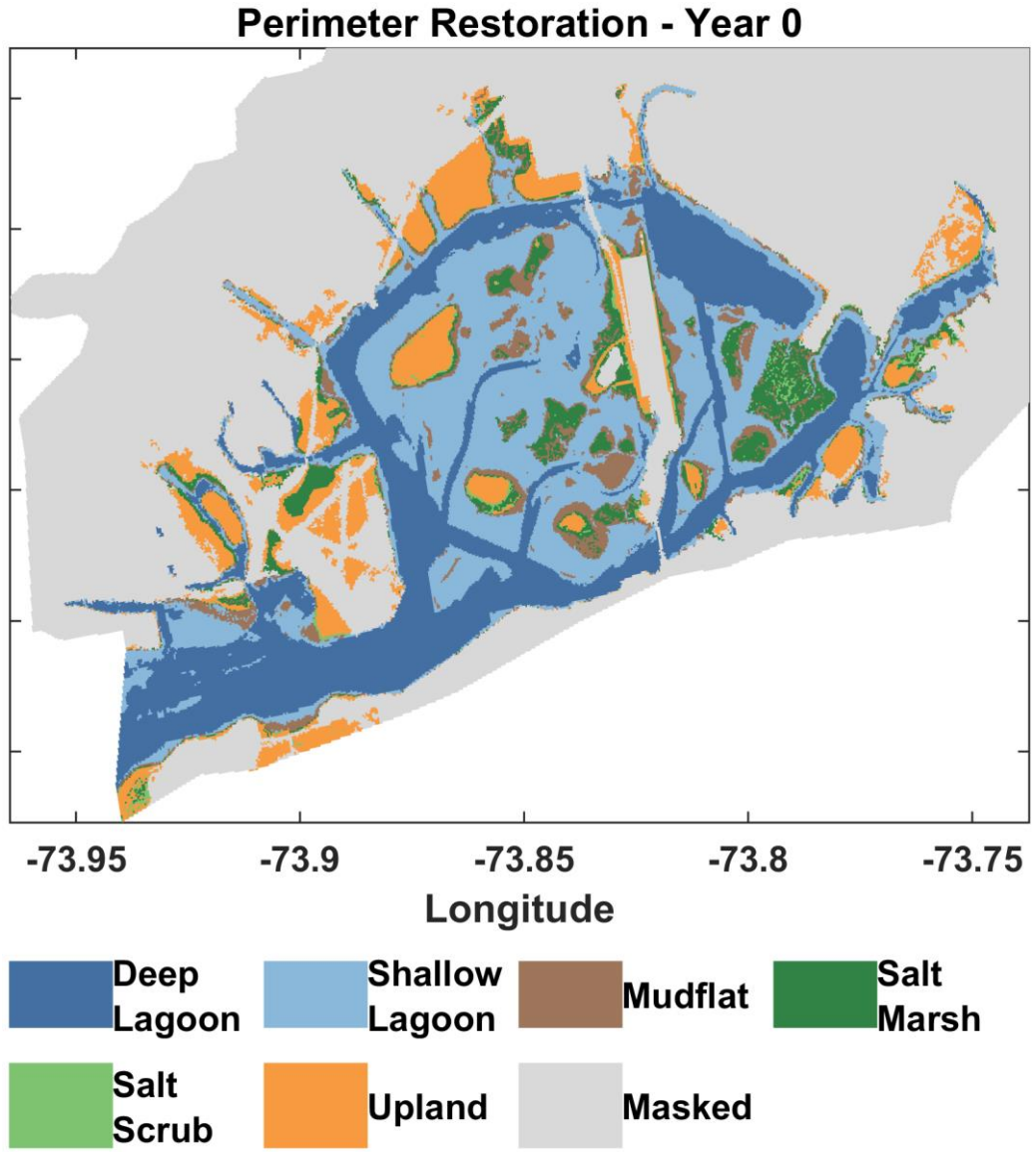
Sensitivity Tests





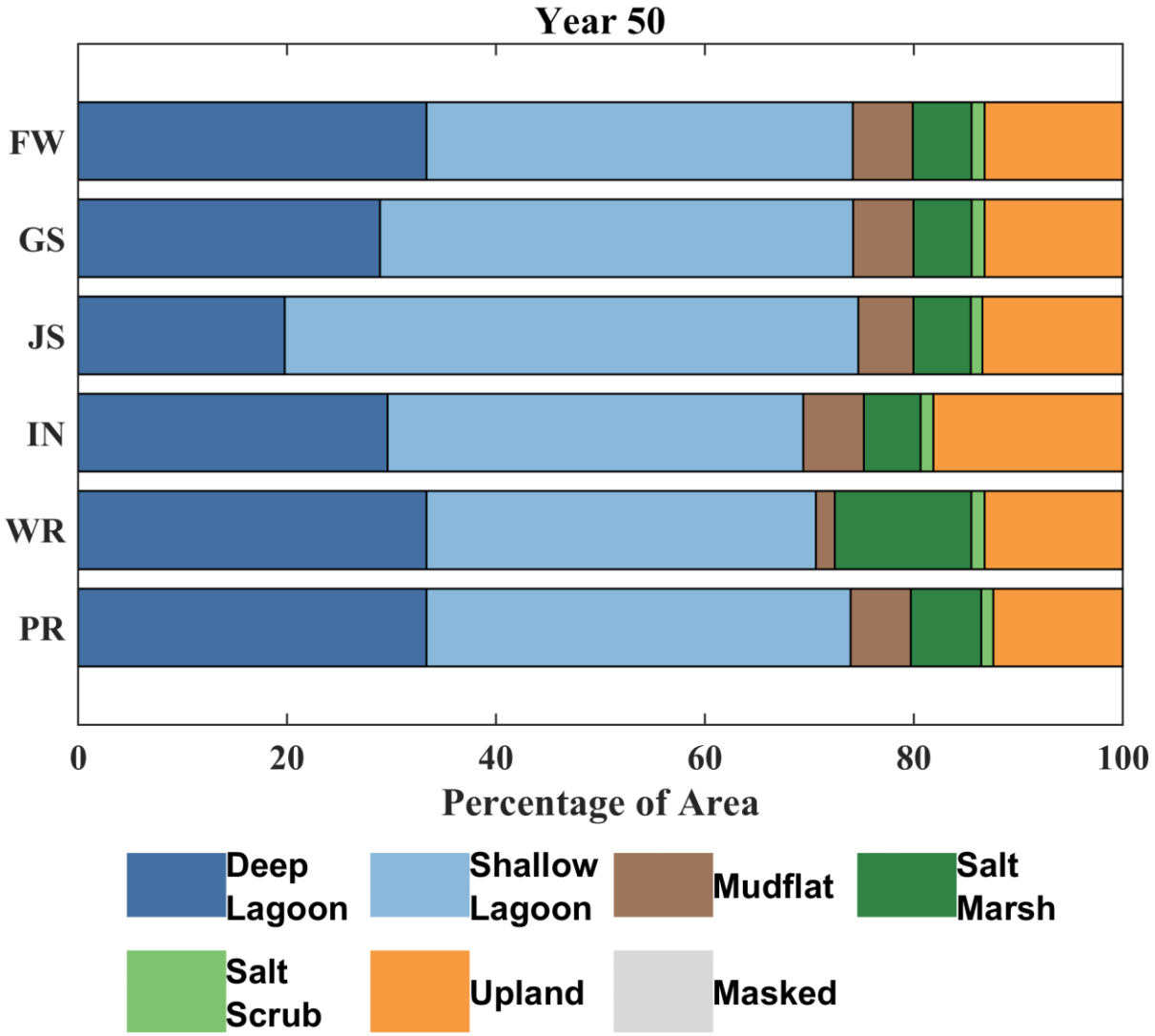
Sensitivity Tests



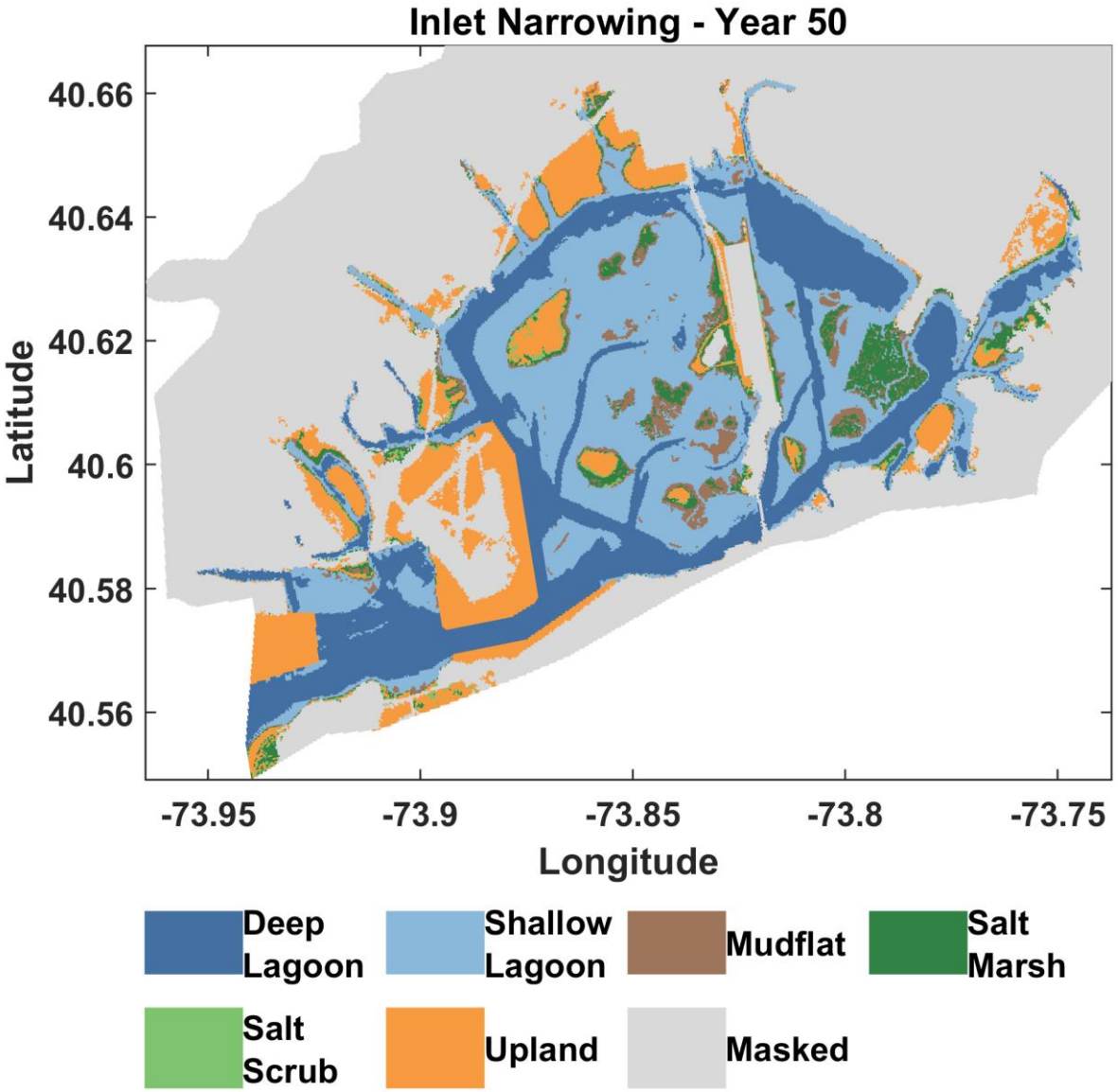


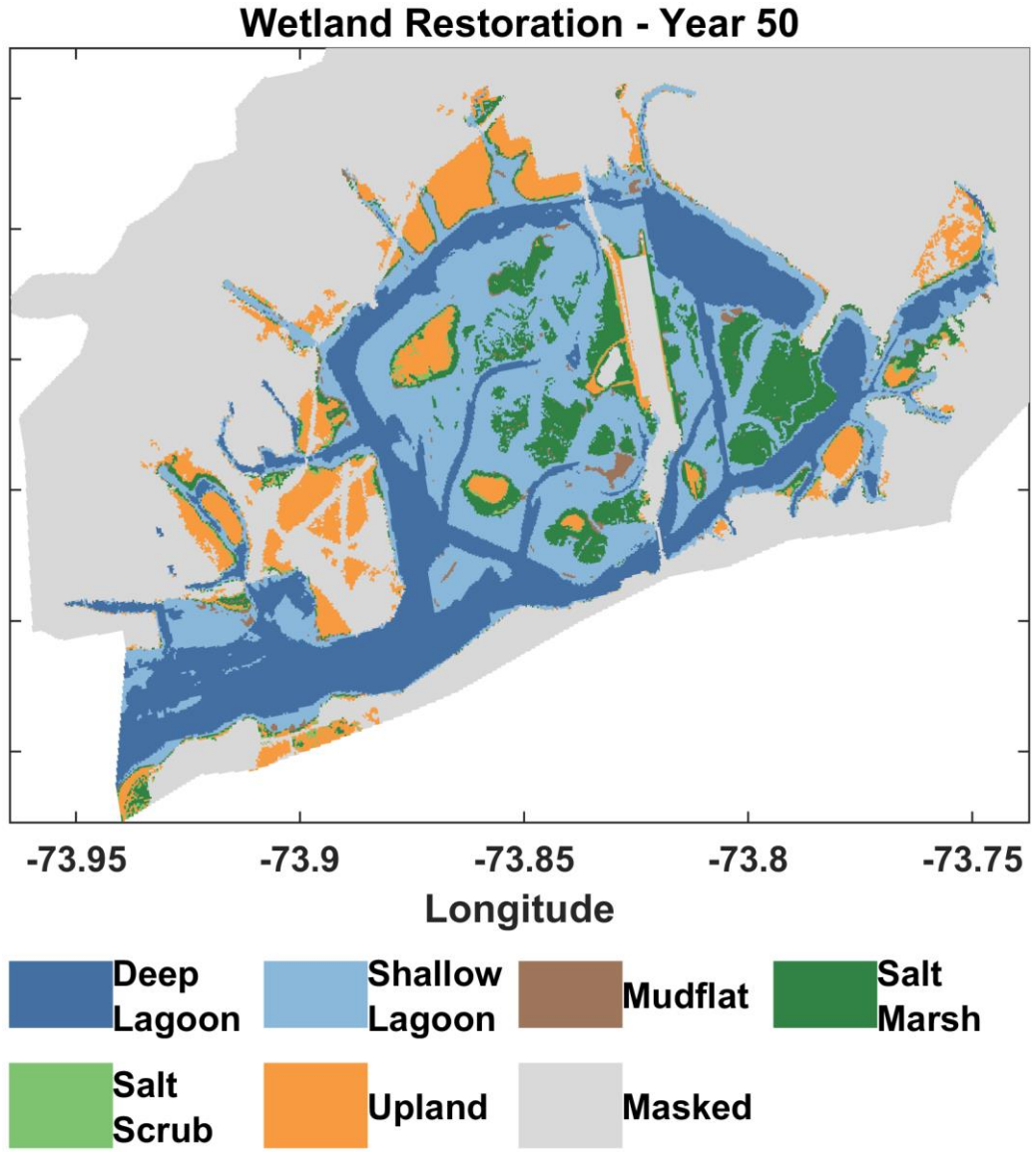
Landscape Evolution

- Grassy Bay Shallowing (GS)
  - 1% loss of marsh and scrub
- Whole Bay Shallowing (JS)
  - 2.5% loss of marsh, 11% loss in salt scrub
- Inlet Narrowing (IN)
  - 3% loss of marsh and scrub
- Wetland Restoration (WR)
  - 132% gain in marsh, 1.5% gain in scrub
- Perimeter Restoration (PR)
  - 20% gain in marsh, 8% loss in scrub



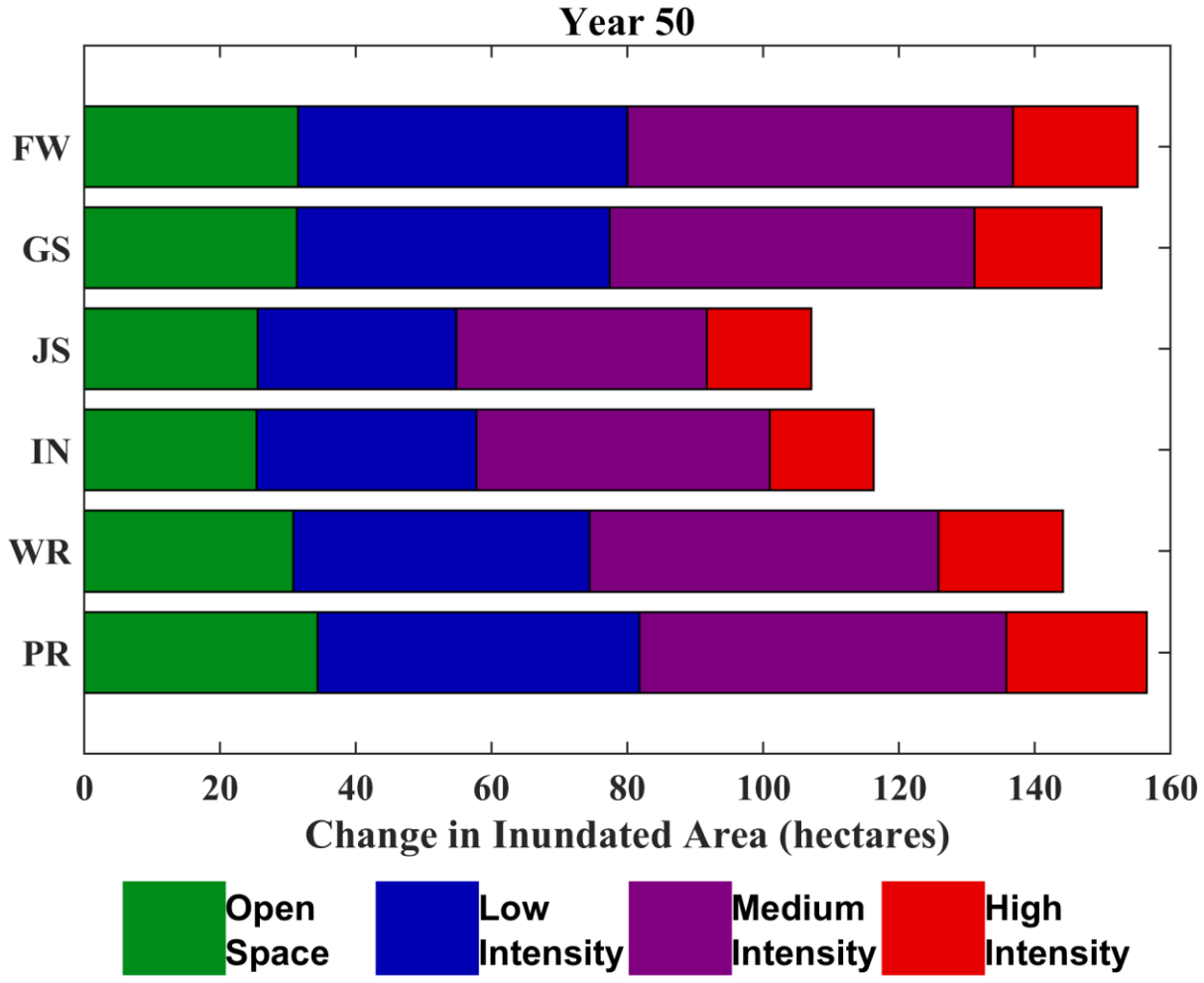
Landscape Evolution



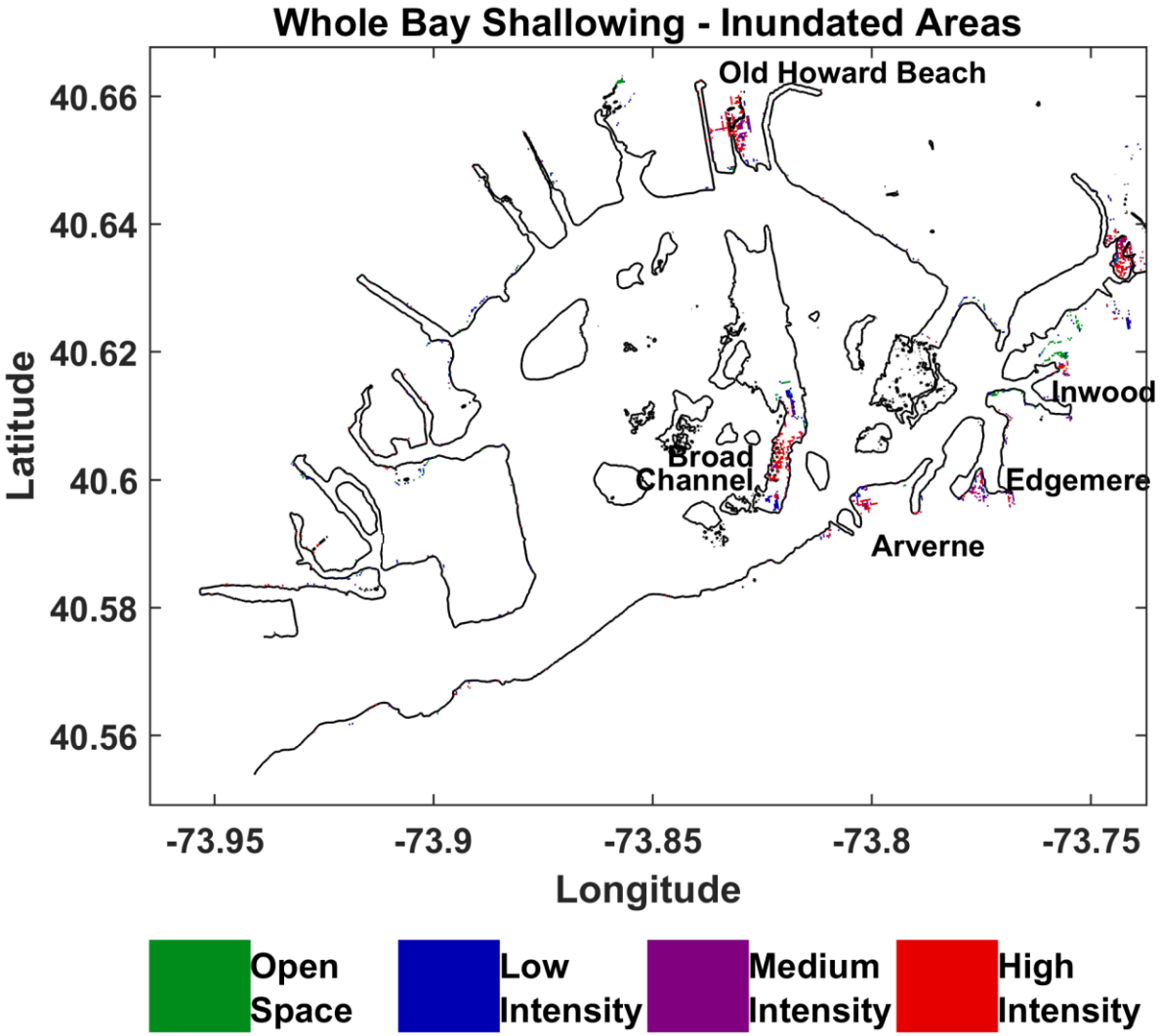


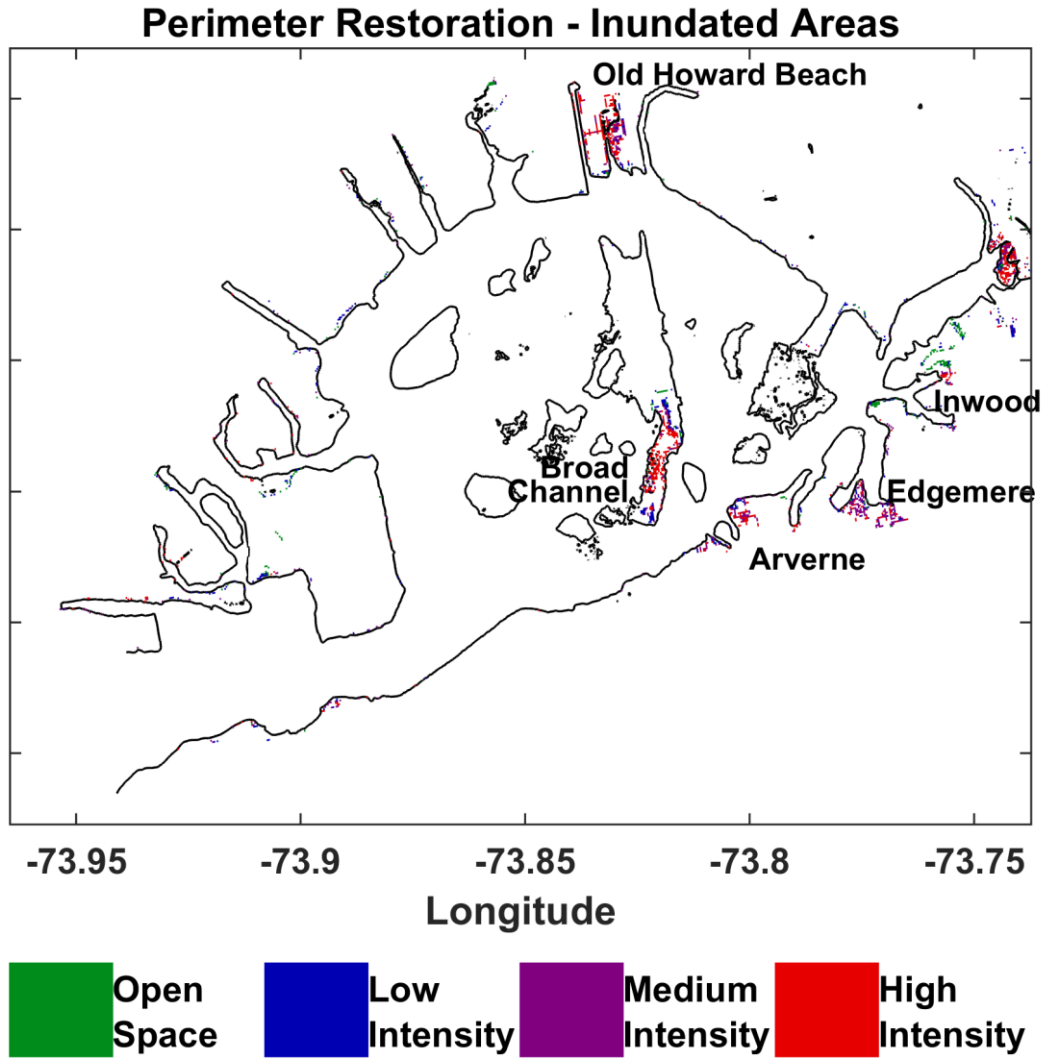
Inundation Change

- Grassy Bay Shallowing (GS)
  - 3.5% reduction in inundated area
- Whole Bay Shallowing (JS)
  - 31% reduction in inundated area
- Inlet Narrowing (IN)
  - 25% reduction in inundated area
- Wetland Restoration (WR)
  - 7% reduction in inundated area
- Perimeter Restoration (PR)
  - 1% gain in inundated area



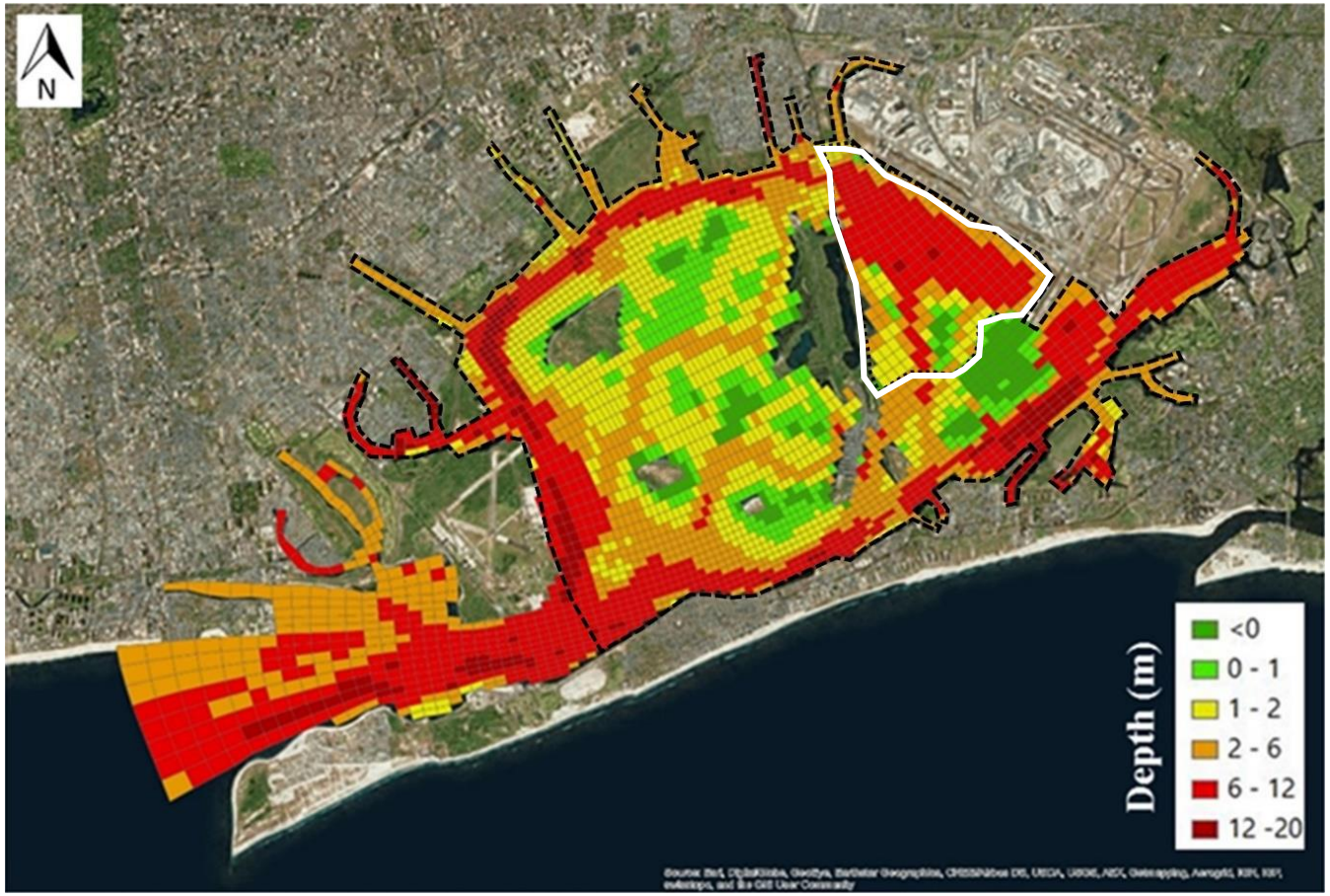
Inundation Change





Water Quality Change

Test	Grassy Bay	Whole Bay
FW	6.2 days	17.0 days
GS	-66.9%	-12.2%
JS	-58.1%	-24.0%
IN	-25.5%	-18.3%
WR	+58.6%	+6.2%
PR	+33.0%	+3.2%



Conclusions & Observations

- Marsh island restoration provides most benefit for marsh and scrub habitats.
- Whole Bay shallowing provides most benefit for inundation reduction.
- Whole Bay shallowing provides most benefit for residence time reduction.
- Restoration options considered here are not able to address all three metrics at the same time.
  - Further testing (not presented here) considered options in combination.
- Uncertainty in sea level rise dwarfs the changes observed in any single sensitivity test
- Linear response in the tide was observed with increase in sea level