Peconic Estuary Program and Shinnecock Indian Nation Climate Vulnerability Assessment Services

Draft Results: CLPS Criteria, Maps and Climate Risks

Land Use Stakeholder Meeting

June 5, 2019

Meeting Overview

- Introductions
  - Dr. Joyce Novak, Director, Peconic Estuary Program
- Recap of Climate Ready Assessment Services
- Presentation
- Discussion
- Conclusion

Climate Ready Assessment Services Project

Project Recap

USEPA Climate Ready Estuaries Program

- Peconic Estuary Program (PEP) and Shinnecock Indian Nation (Nation)
  - Update Critical Lands Protection Strategy (CLPS) criteria
    - PEP only
    - Incorporate into the Comprehensive Conservation and Management Plan (CCMP)
  - Perform Climate Vulnerability Analysis for PEP and Nation
    - Identify risks and rank priorities
  - Develop Action Plans
    - PEP specific actions
      - › Tools for municipalities and other stakeholders to evaluate land in Peconic watershed
    - Nation specific actions

Six Steps

Quality Assurance Project Plan (QAPP)	• Governs Entire Process • Approved by U.S. Environmental Protection Agency (USEPA)
Develop New Screening Criteria	• Develop new CLPS screening criteria and priorities • Complete
Stakeholder Outreach	• Government and Land Use Stewards • Public
GIS Analysis	• Map inundation and wetland migration related to climate change • Use Sea Level Affecting Marshes Model (SLAMM) results • Identify parcels that meet one or more of the CLPS criteria.
Climate Change Vulnerability/Risk Assessment	• USEPA's guidance: *Being Prepared for Climate Change, a Workbook for Developing Risk-based Adaptation Plans*
Identify Solutions and Prepare Reports	• Identify opportunities to develop green coastal protection to protect against imminent ***and*** long-term climate change effects • Emphasize nature-based solutions

Previous Stakeholder Meetings

- September 21, 2018 Land Use Stakeholder Meeting
  - Revised existing and developed new CLPS screening criteria and priorities
- January 7, 2019 CCMP Meeting
  - Identified PEP climate risks
    - Sea level rise (SLR)
    - Increased storm surge/flooding
    - Increased land-based run-off
    - Temperature and species changes
    - Rising Groundwater
- January 29 2019, Shinnecock Indian Nation Meeting
  - Identified the Nation's climate risks

Today's Goals

- Present and Discuss Mapping Results
- Present and Discuss CLPS Criteria Ranking
- Present and Discuss PEP Vulnerability Assessment Tables

Maps and CLPS Criteria

Peconic Estuary Program

Updated CLPS Criteria

Class 1: Habitat and Water Quality Protection

- Contains or will contain freshwater or tidal wetlands as predicted by SLAMM or identified by U.S. Fish and Wildlife Service 1994 NWI data
- Located within 1,000 feet of the shoreline of a bay, tidal creek, or the Peconic River
- Located within or has potential to connect to a Critical Natural Resource Area or a Significant Coastal Fish and Wildlife Habitats

Class 2: Inundation Areas

- Located within a present-day flood zone
- Located in areas that will become inundated as predicted by NOAA's Coastal Inundation mapper at next earliest climate scenario

Class 3: Groundwater Protection

- Located within a zone of groundwater recharge travel time area between 0-25 years
- Located in areas with predicted increases in the saltwater interface elevation that will impact groundwater quality and elevation, causing flooding at the surface
- Located in special groundwater protection area (100 + year recharge)

BASE MAPS

Peconic Estuary Climate Ready Assessment

Present Tidal and Fresh Marsh Extent

SLAMM Habitat Category*

- Fresh Marsh/Swamp
- Tidal Marsh

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM deterministic model

0 2.5 5 10 Miles

N

The Nature Conservancy

*SLAMM categories are crosswalked from National Wetlands Inventory

Peconic Estuary Climate Ready Assessment

Future Tidal and Fresh Marsh Extent: 2025 Medium Scenario (6" SLR)

SLAMM Habitat Category*

- Fresh Marsh/Swamp
- Tidal Marsh

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM deterministic model

0 2.5 5 10 Miles

N

The Nature Conservancy

*SLAMM categories are crosswalked from National Wetlands Inventory

Peconic Estuary Climate Ready Assessment

Future Tidal and Fresh Marsh Extent: 2055 High Medium Scenario (21" SLR)

SLAMM Habitat Category*

- Fresh Marsh/Swamp
- Tidal Marsh

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM deterministic model

0 2.5 5 10 Miles

N

The Nature Conservancy

*SLAMM categories are crosswalked from National Wetlands Inventory

Peconic Estuary Climate Ready Assessment

Future Tidal and Fresh Marsh Extent: 2100 High Medium Scenario (47" SLR)

SLAMM Habitat Category*

- Fresh Marsh/Swamp
- Tidal Marsh

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM deterministic model

0 2.5 5 10 Miles

N

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*SLAMM categories are crosswalked from National Wetlands Inventory

Peconic Estuary Climate Ready Assessment

Significant Coastal Fish and Wildlife Habitats (SCFWH)

Significant Coastal Fish and Wildlife Habitats

Data source: NYS DOS 2015

0 2.5 5 10 Miles

N

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Peconic Estuary Climate Ready Assessment

FEMA 100-year Floodplain

FEMA Flood Hazard Area

100 yr floodplain*

*A, AE, V, VE zones

Data sources:
FEMA 2009 Flood Hazard Areas

0 2.5 5 10 Miles

N

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Peconic Estuary Climate Ready Assessment

Inundation 2025 Medium Scenario (6" Sea Level Rise)

Medium 2025 Scenario - 6" SLR

Future Inundation*

*flooded at least once every 30 days

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM inundation frequency

0 2.5 5 10 Miles

N

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Peconic Estuary Climate Ready Assessment

Inundation 2055 High Medium Scenario (21" Sea Level Rise)

High Medium 2055 Scenario - 21" SLR

Future Inundation*

*flooded at least once every 30 days

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM inundation frequency

0 2.5 5 10 Miles

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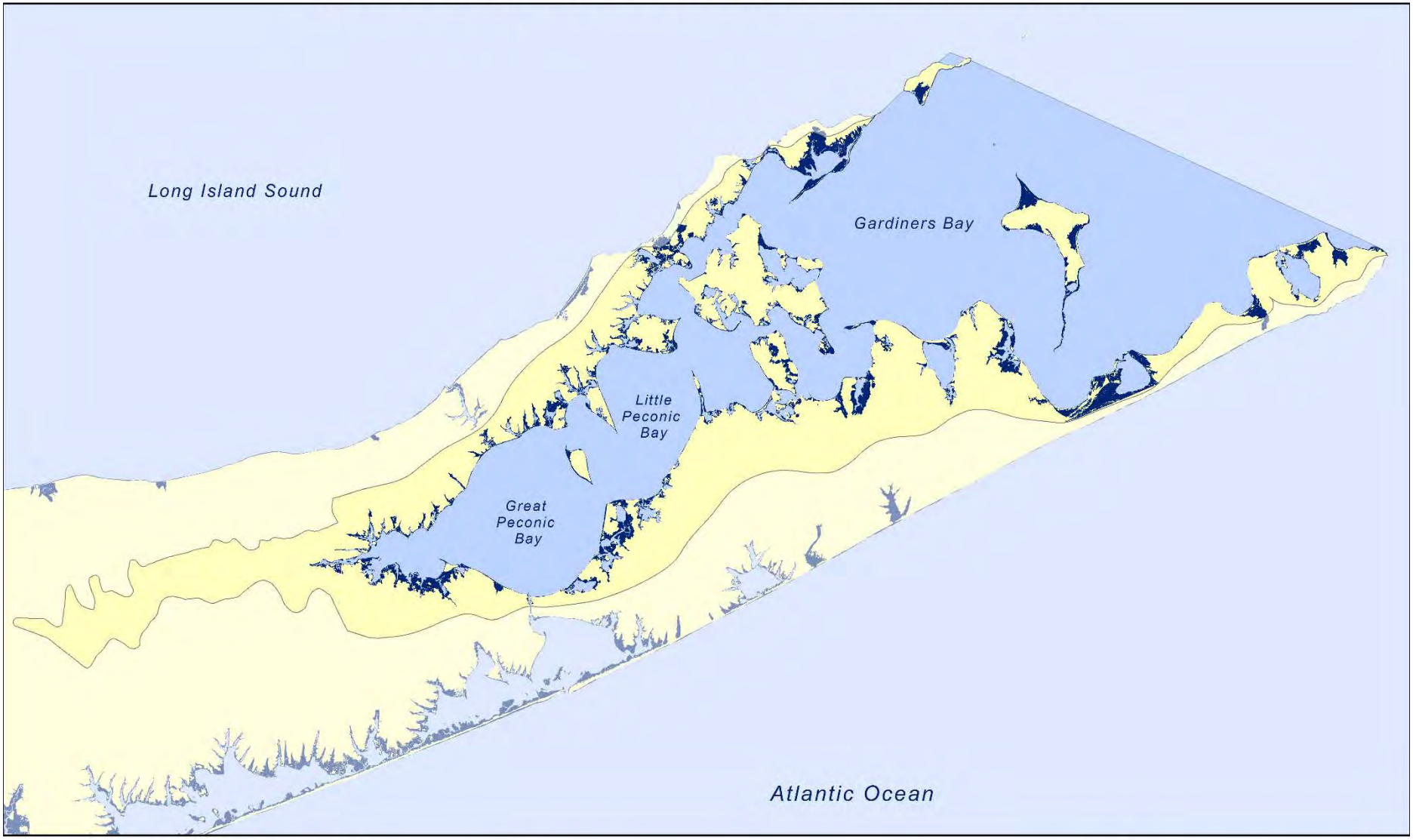
Peconic Estuary Climate Ready Assessment

Inundation 2100 High Medium Scenario (47" Sea Level Rise)



High Medium 2100 Scenario - 47" SLR

Future Inundation*

*flooded at least once every 30 days

Data sources:
NYSERDA/Warren Pinnacle 2015
SLAMM inundation frequency

0 2.5 5 10 Miles

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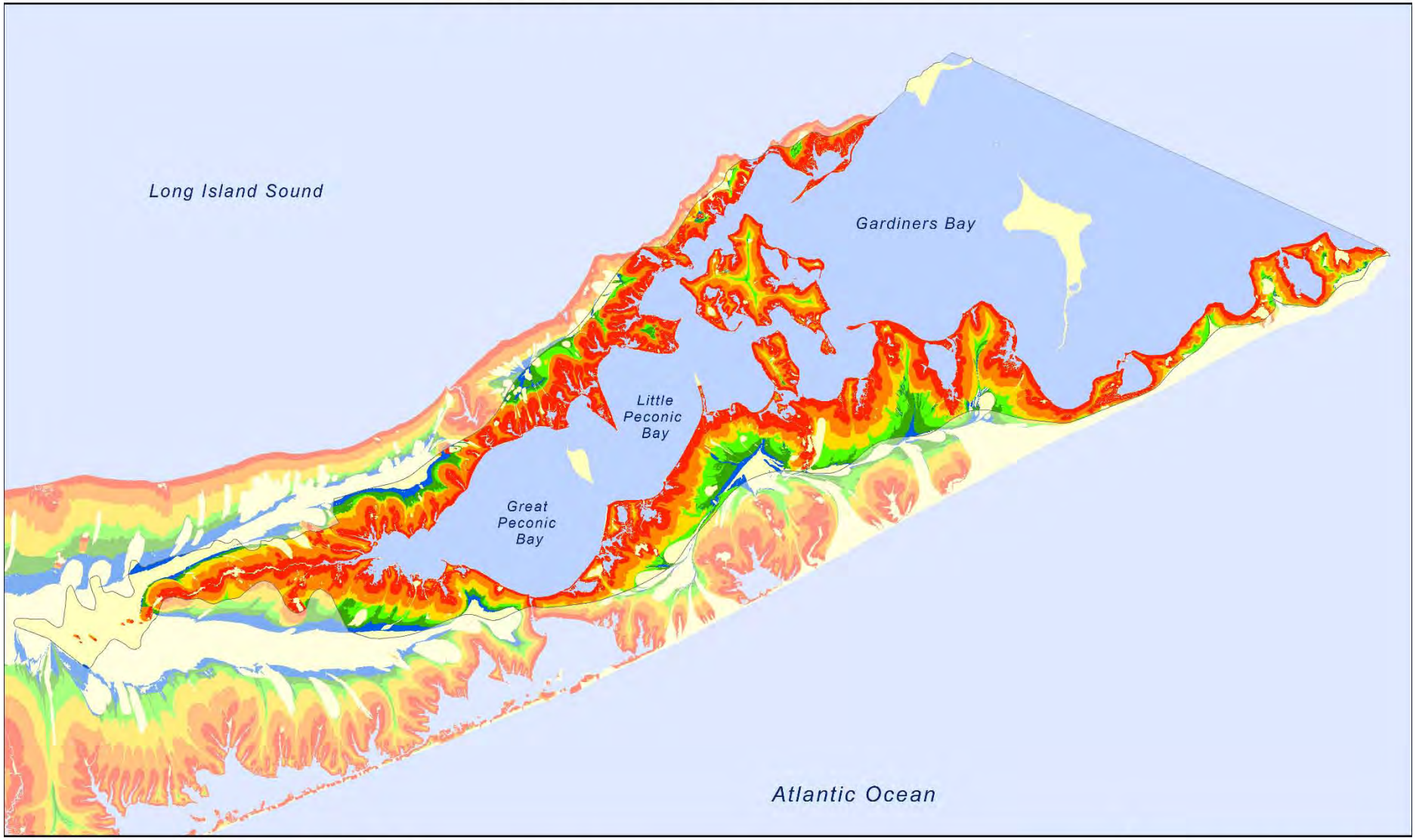
Peconic Estuary Climate Ready Assessment

Groundwater Travel Time to Surface Waters



Groundwater travel time to surface waters

- 2 years
- 10 years
- 25 years
- 50 years
- 100 years
- 200 years

Data sources:
Suffolk Co./CDM Smith
Groundwater Travel Time

0 2.5 5 10 Miles

N

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Peconic Estuary Climate Ready Assessment

Shallow Depth to Groundwater (10 feet or less)

Depth to Groundwater

- 10 feet or less - 2016
- 10 feet or less - after 34" sea level rise

Data sources:
USGS Depth to Groundwater 2016
Suffolk Co./CDM Smith
Rising groundwater table

0 2.5 5 10 Miles

N

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Peconic Estuary Climate Ready Assessment

Special Groundwater Protection Areas (SGPAs)

Special Groundwater Protections Areas (SGPAs)

Data source:
NYS DEC 2016
Critical Environmental Areas

0 2.5 5 10 Miles

N

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CLPS Ranking Strategy Assumptions

- Includes Both Developed and Undeveloped
  - Developed (Suffolk County Land Use 2016)
    - Land uses other than "Vacant, Recreation & Open Space"
    - Includes farmland
- “Current” Scenario
  - Based on existing base maps and the 6 inch SLR SLAMM estimates for inundation and marsh areas
- Depth to groundwater for the 47 inch SLR scenario
  - Based on the 34 inch SLR projection predicted by the CDM groundwater model

Data Sources Used in Mapping

Relevant CLPS Criteria/Vulnerability Assessment Risk	Data Set	Source
Property and zoning status	Suffolk County Tax Map Data	Suffolk County Real Property Tax Service Agency
Inundation areas and sea level rise Future tidal marsh potential	Sea Level Affecting Marshes Model (SLAMM)	NYS Energy Research and Development Authority (NYSERDA)/Warren Pinnacle Consulting, Inc.
Freshwater or tidal wetland	National Wetlands Inventory (NWI)	US Fish & Wildlife Service (USFWS)
Present-day flood zone	Digital Flood Insurance Rate Map Database, Suffolk County, New York	Federal Emergency Management Agency (FEMA)
Significant habitat and water quality	Significant Coastal Fish and Wildlife Habitats	NYS Department of State (DOS)
Current groundwater table	Depth to groundwater mapping	U.S. Geological Society (USGS)
Rising groundwater table	Depth to groundwater after 34" SLR	Suffolk County/CDM Smith
Surface water protection	Groundwater travel time to surface waters	Suffolk County / CDM Smith
Special groundwater protection area	Critical Environmental Areas (CEA) in NYS	NYS Department of Environmental Conservation (DEC)

Sea Level Rise Projections

Long Island Projections (in inches of SLR relative to 2000-2004 baseline)					
	Low	Low- Medium	Medium	High- Medium	High
2020s	2	4	**6**	8	10
2050s	8	11	16	**21**	30
2080s	13	18	29	39	58
2100	15	21	34	**47**	72

Source: 6 NYCRR Part 490, Projected Sea-level Rise

Criteria Assumptions

	Criteria		
	Current (6" SLR)	2025 (21" SLR)	2100 (47" SLR)
Provides Habitat and Water Quality Protection	Contains freshwater or tidal wetland	Will contain freshwater or tidal wetland	Will contain freshwater or tidal wetland
	Located within Significant Coastal Fish and Wildlife Habitat	--	--
Identify Inundation Areas	Located within a flood zone	--	--
	Inundation beyond shoreline	Inundation beyond shoreline	Inundation beyond shoreline
Groundwater Protection	Located within 0 - 25 year groundwater recharge zone	--	--
	10' or less depth to groundwater	--	10' or less depth to groundwater
	Located within a special groundwater protection area	--	--

CLPS Ranking Strategy (Undeveloped)

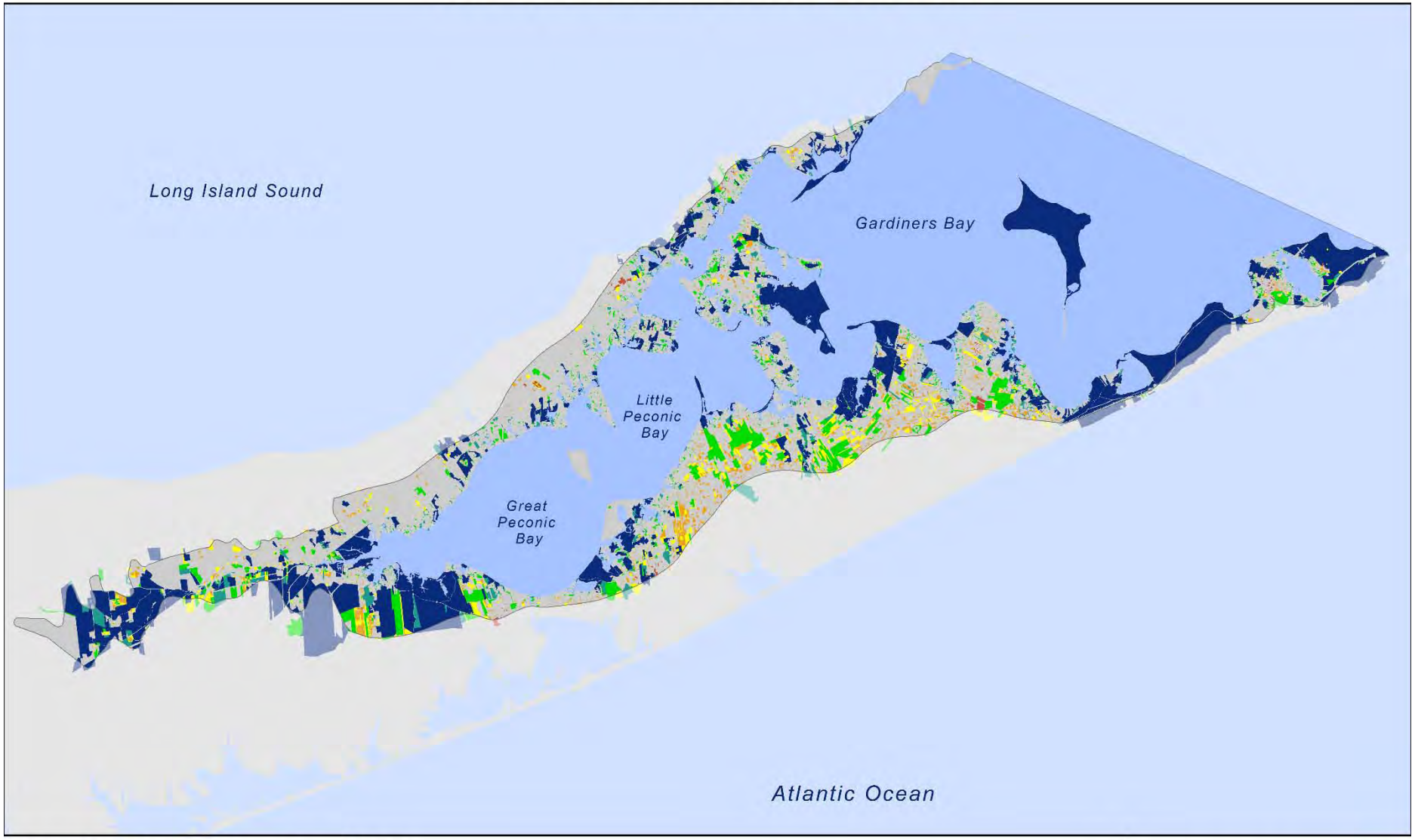
Potential prioritization categories	Current (6" SLR)	Score	2025 (21" SLR)	Score	2100 (47" SLR)	Score
1: Nearshore undeveloped land	Undeveloped land that is within 1000' of the shoreline	1	Undeveloped land: Undeveloped land that will be within 1000' of the shoreline	1	Undeveloped land: Undeveloped land that will be within 1000' of the shoreline	1
2a: Priority land aggregates	Parcels of any size that meets one criterion	1	Parcels of any size that will meet at lease one criterion	1	Parcels of any size that will meet at least one criterion	1
2b: Priority land aggregates	Multiple parcels of any size that meets at least one criterion from two classes and forms an aggregate of >= 10 acres	2	Multiple parcels of any size that will meet at least one criterion from two classes and forms an aggregate of >= 10 acres	2	Multiple parcels of any size that will meet at least one criterion from two classes and forms an aggregate of >= 10 acres	2
2c: Priority land aggregates	Multiple parcels of any size that meets at least one criterion from three classes and forms an aggregate of >= 10 acres	3			Multiple parcels of any size that will meet at least one criterion from three classes and forms an aggregate of >= 10 acres	3
3a: 10 Up	Parcels >=10 acres that meet one criterion	1	Parcels >=10 acres that will meet one criterion	1	Parcels >=10 acres that will meet one criterion	1
3b: 10 Up	Parcels >=10 acres that meet at least one criterion from two classes	2	Parcels >=10 acres that will meet at least one criterion from two classes	2	Parcels >=10 acres that will meet at least one criterion from two classes	2
3c: 10 Up	Parcels >=10 acres that meet at least one criterion from three classes	3			Parcels >=10 acres that will meet at least one criterion from three classes	3
4a: Adjacent to Protected	Parcels of any size that are adjacent to protected lands >= 2 acres and contain one criterion	1	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain one criterion	1	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain one criterion	1
4b: Adjacent to Protected	Parcels of any size that are adjacent to protected lands >= 2 acres and contain at least one criterion from two classes	2	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain at least one criterion from two classes	2	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain at least one criterion from two classes	2
4c: Adjacent to Protected	Parcels of any size that are adjacent to protected lands >= 2 acres and contain at least one criterion from three classes	3			Parcels of any size that are adjacent to protected lands >= 2 acres and will contain at least one criterion from three classes	3
Notes:	**Maximum score**					**27**

Undeveloped = Vacant and Wild, Forested, Conservation Lands and Public Parks property classifications

*Based on 34" SLR projection included in CDM groundwater model prediction.

Peconic Estuary Climate Ready Assessment

Prioritization Score (Undeveloped Parcels)



Prioritization Score - Undeveloped Parcels

0	2	6 - 8
1	3 - 5	9 - 27

0 2.5 5 10 Miles

N

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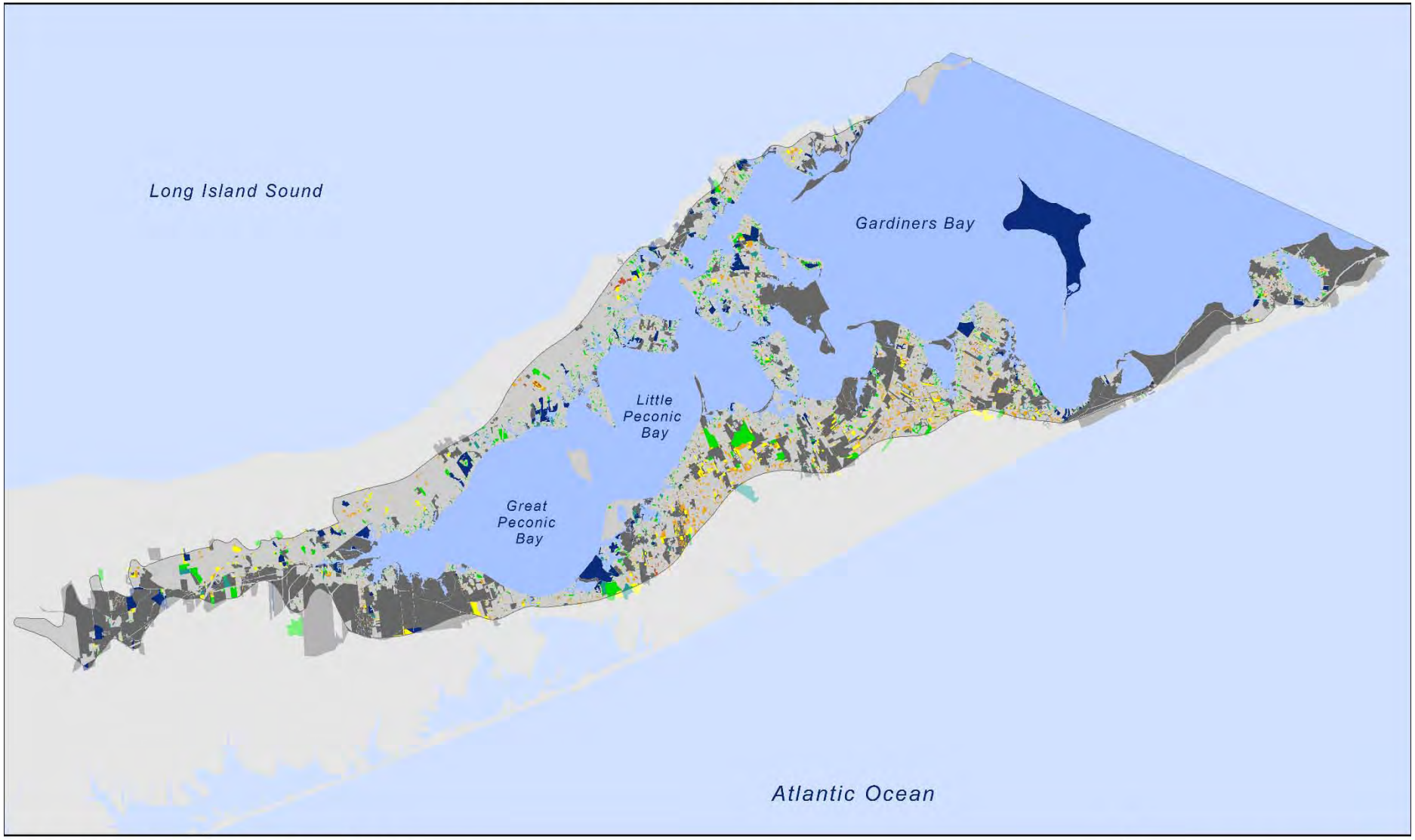
Peconic Estuary Climate Ready Assessment

Prioritization Score (Undeveloped Parcels)



Prioritization Score - Undeveloped Parcels

0 2 6 - 8 Protected Lands

1 3 - 5 9 - 27

0 2.5 5 10 Miles

N

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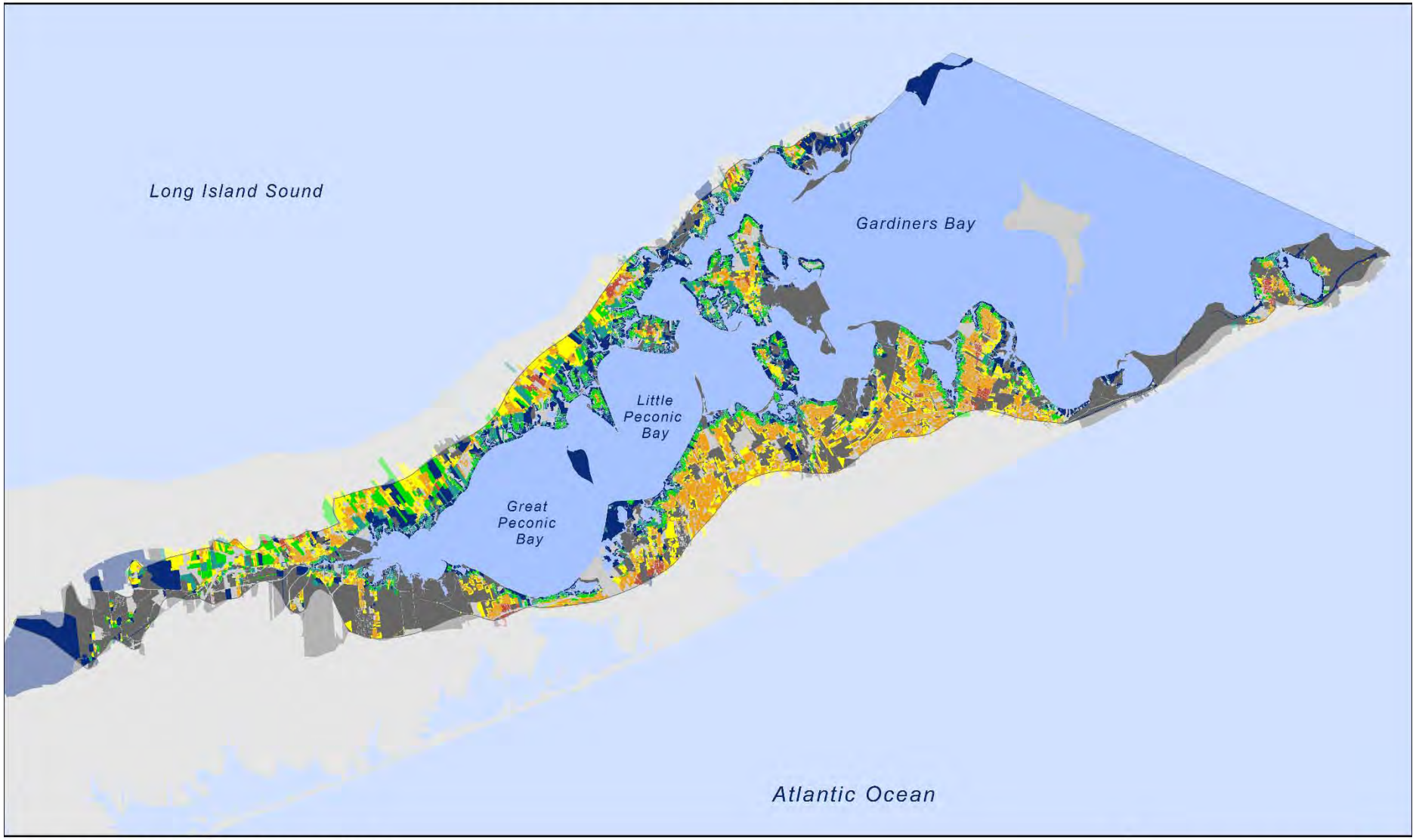
CLPS Ranking Strategy (Developed Land)

Potential prioritization categories	Current (6" SLR)	Score	2025 (21" SLR)	Score	2100 (47" SLR)	Score
1: Nearshore developed land	Land that is within 1000' of the shoreline	1	Land that will be within 1000' of the shoreline	1	Land that will be within 1000' of the shoreline	1
2a: Priority developed land	Parcels of any size that meets one criterion	1	Parcels of any size that will meet at least one criterion	1	Parcels of any size that will meet at least one criterion	1
2b: Priority developed land	Parcels of any size that meets at least meets at least one criterion from two classes	2	Parcels of any size that will meet at least one criterion from two classes	2	Parcels of any size that will meet at least one criterion from two classes	2
2c: Priority developed land	Parcels of any size that meets at least meets at least one criterion from three classes	3			Parcels of any size that will meet at least one criterion from three classes	3
3a: 10 Up	Parcels >=10 acres that meet one criterion	1	Parcels >=10 acres that will meet one criterion	1	Parcels >=10 acres that will meet one criterion	1
4a: Adjacent to Protected	Parcels of any size that are adjacent to protected lands >= 2 acres and contain one criterion	1	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain one criterion	1	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain one criterion	1
4b: Adjacent to Protected	Parcels of any size that are adjacent to protected lands >= 2 acres and contain at least one criterion from two classes	2	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain at least one criterion from two classes	2	Parcels of any size that are adjacent to protected lands >= 2 acres and will contain at least one criterion from two classes	2
4c: Adjacent to Protected	Parcels of any size that are adjacent to protected lands >= 2 acres and contain at least one criterion from three classes	3			Parcels of any size that are adjacent to protected lands >= 2 acres and will contain at least one criterion from three classes	3
Maximum score						25

Peconic Estuary Climate Ready Assessment

Prioritization Score (Developed Parcels)



Prioritization Score - Developed Parcels

0 | 2 - 3 | 5 - 7 | Protected Lands

1 | 4 | 8 - 22

0 2.5 5 10 Miles

N

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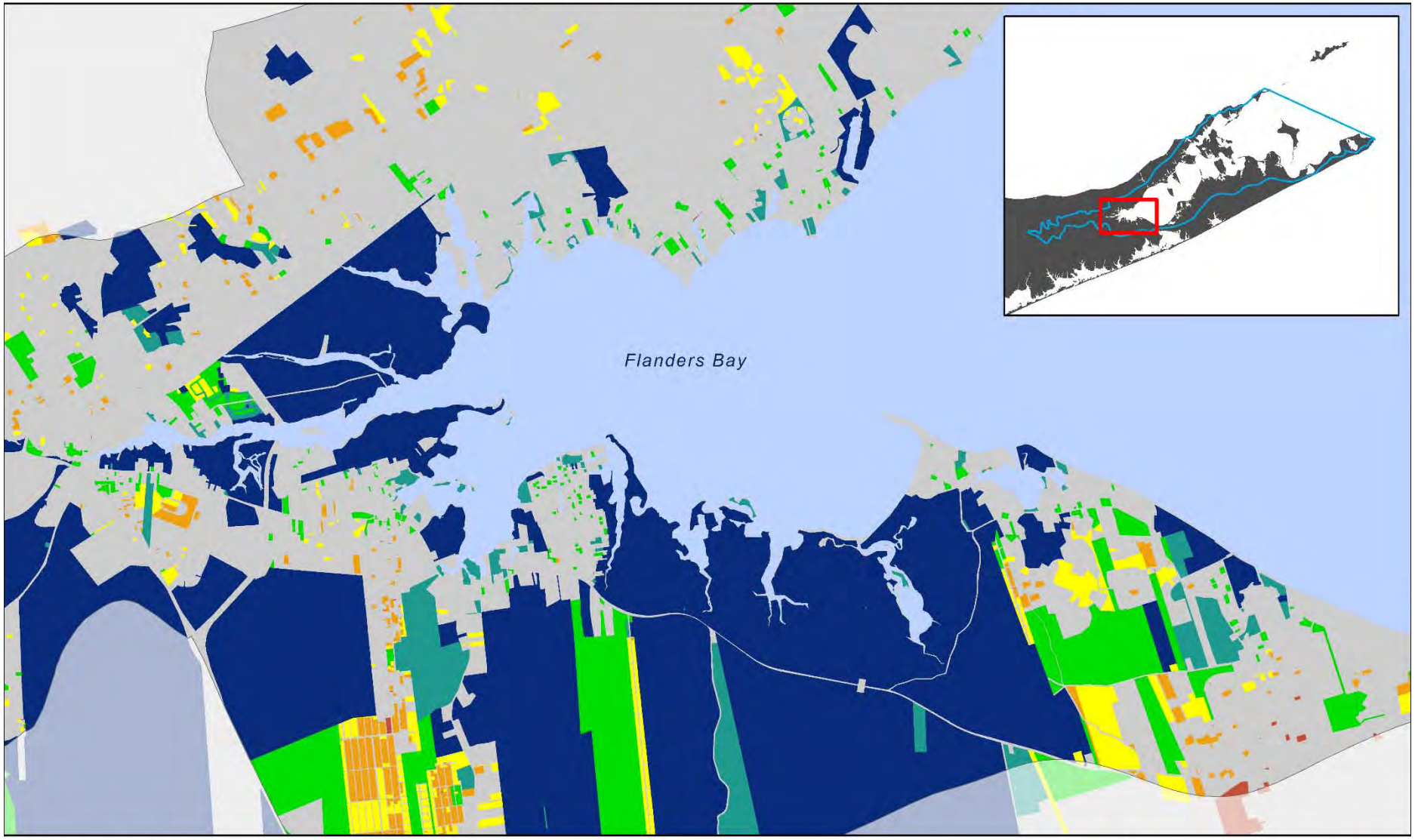
Three Examples

Peconic Estuary Climate Ready Assessment

Flanders Bay - Prioritization Score (Undeveloped Parcels)



Prioritization Score - Undeveloped Parcels

0	2	6 - 8
1	3 - 5	9 - 27

0 0.5 1 2 Miles

N

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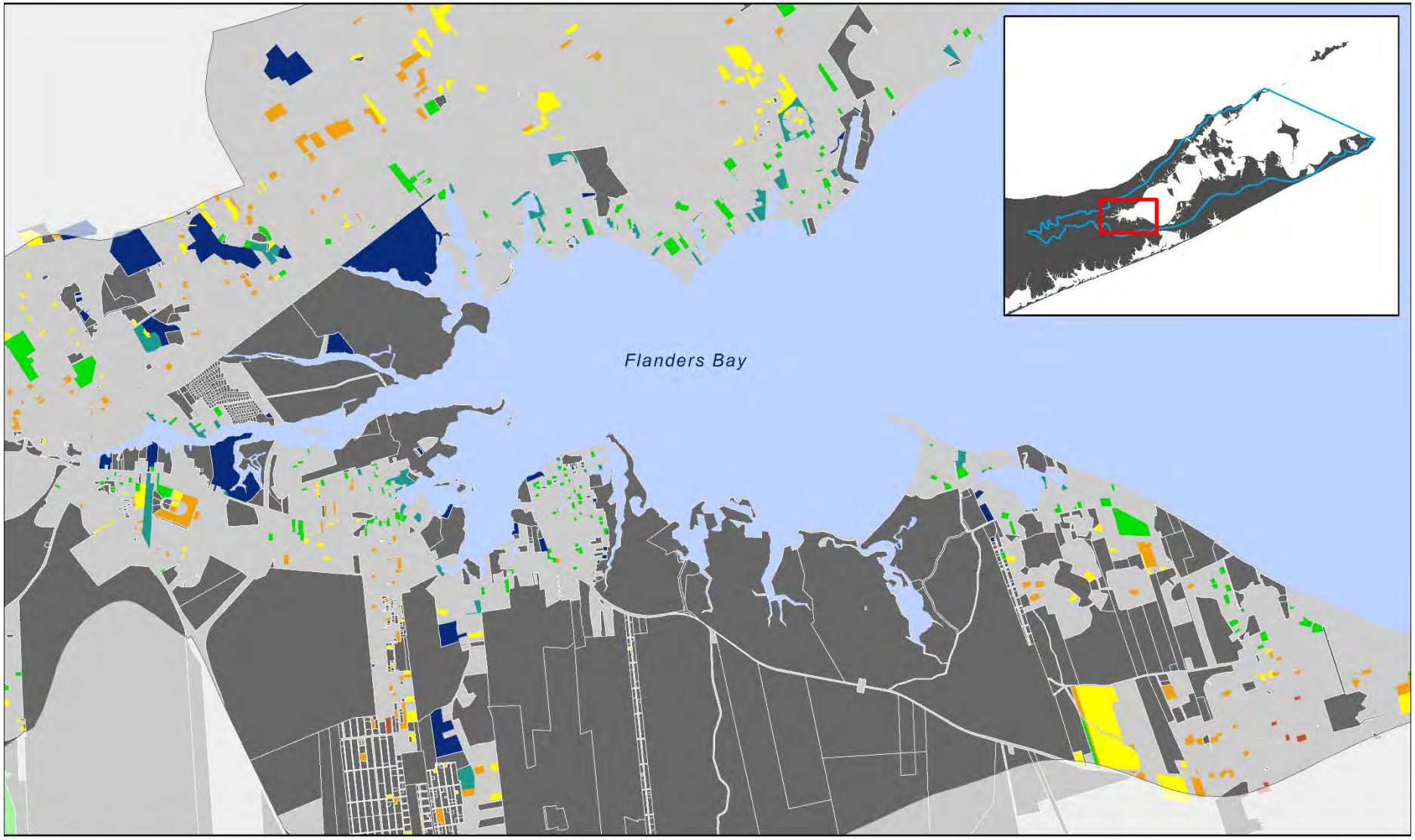
Peconic Estuary Climate Ready Assessment

Flanders Bay - Prioritization Score (Undeveloped Parcels)



Prioritization Score - Undeveloped Parcels

0
1
2
3 - 5
6 - 8
9 - 27
Protected Lands

0 0.5 1 2 Miles

N

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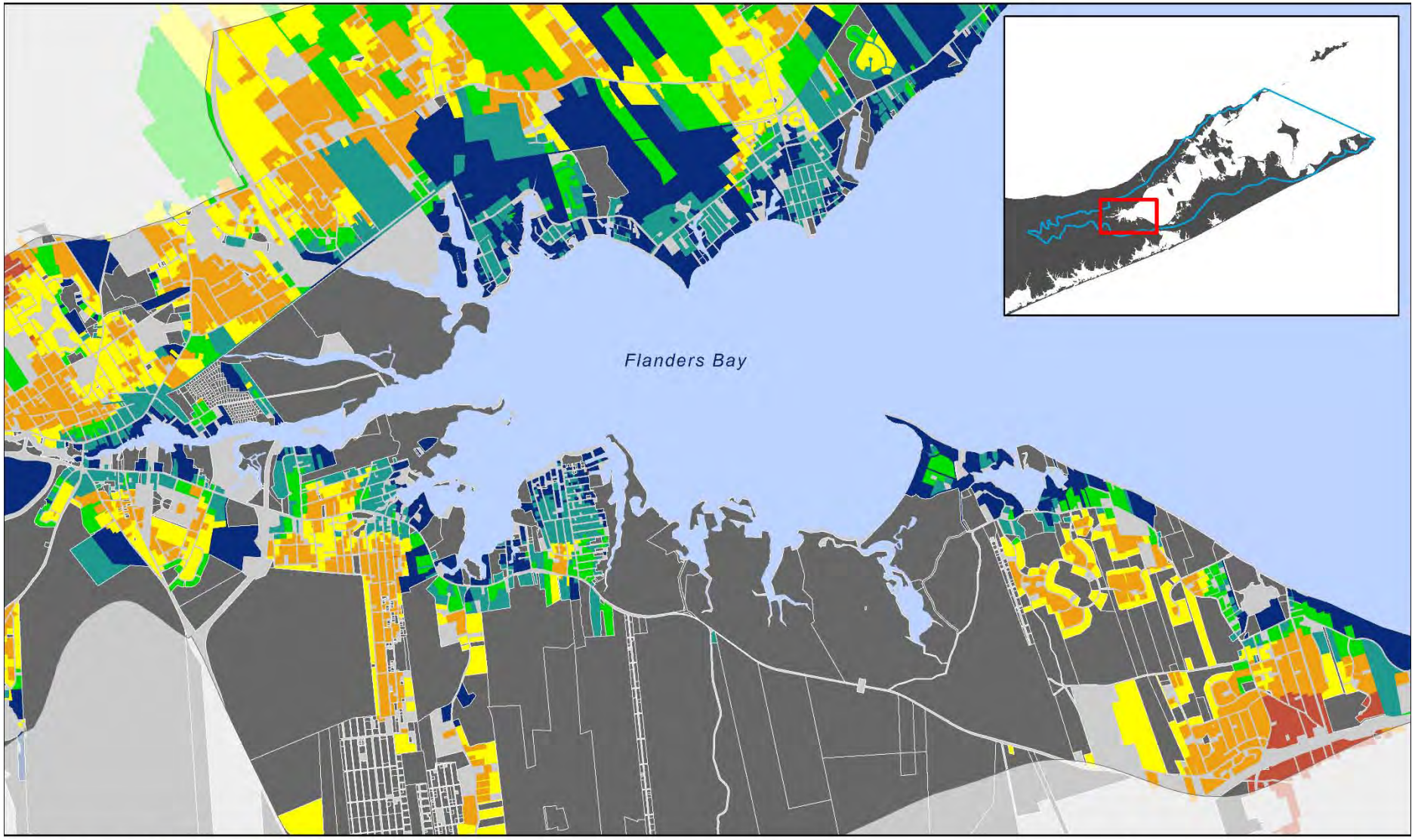
Peconic Estuary Climate Ready Assessment

Flanders Bay - Prioritization Score (Developed Parcels)



Prioritization Score - Developed Parcels

0
1
2 - 3
4
5 - 7
8 - 22
Protected Lands

0 0.5 1 2 Miles

N

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Peconic Estuary Climate Ready Assessment

Napeague Bay - Prioritization Score (Undeveloped Parcels)

Prioritization Score - Undeveloped Parcels

0	2	6 - 8
1	3 - 5	9 - 27

0 0.5 1 2 Miles

N

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Peconic Estuary Climate Ready Assessment

Napeague Bay - Prioritization Score (Undeveloped Parcels)

Prioritization Score - Undeveloped Parcels

0
1
2
3 - 5
6 - 8
9 - 27
Protected Lands

0 0.5 1 2 Miles

N

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Peconic Estuary Climate Ready Assessment

Napeague Bay - Prioritization Score (Developed Parcels)

Prioritization Score - Developed Parcels

0
1
2 - 3
4
5 - 7
8 - 22
Protected Lands

0 0.5 1 2 Miles

N

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Peconic Estuary Climate Ready Assessment

Orient Harbor - Prioritization Score (Undeveloped Parcels)

Prioritization Score - Undeveloped Parcels

0	2	6 - 8
1	3 - 5	9 - 27

0 0.5 1 2 Miles

N

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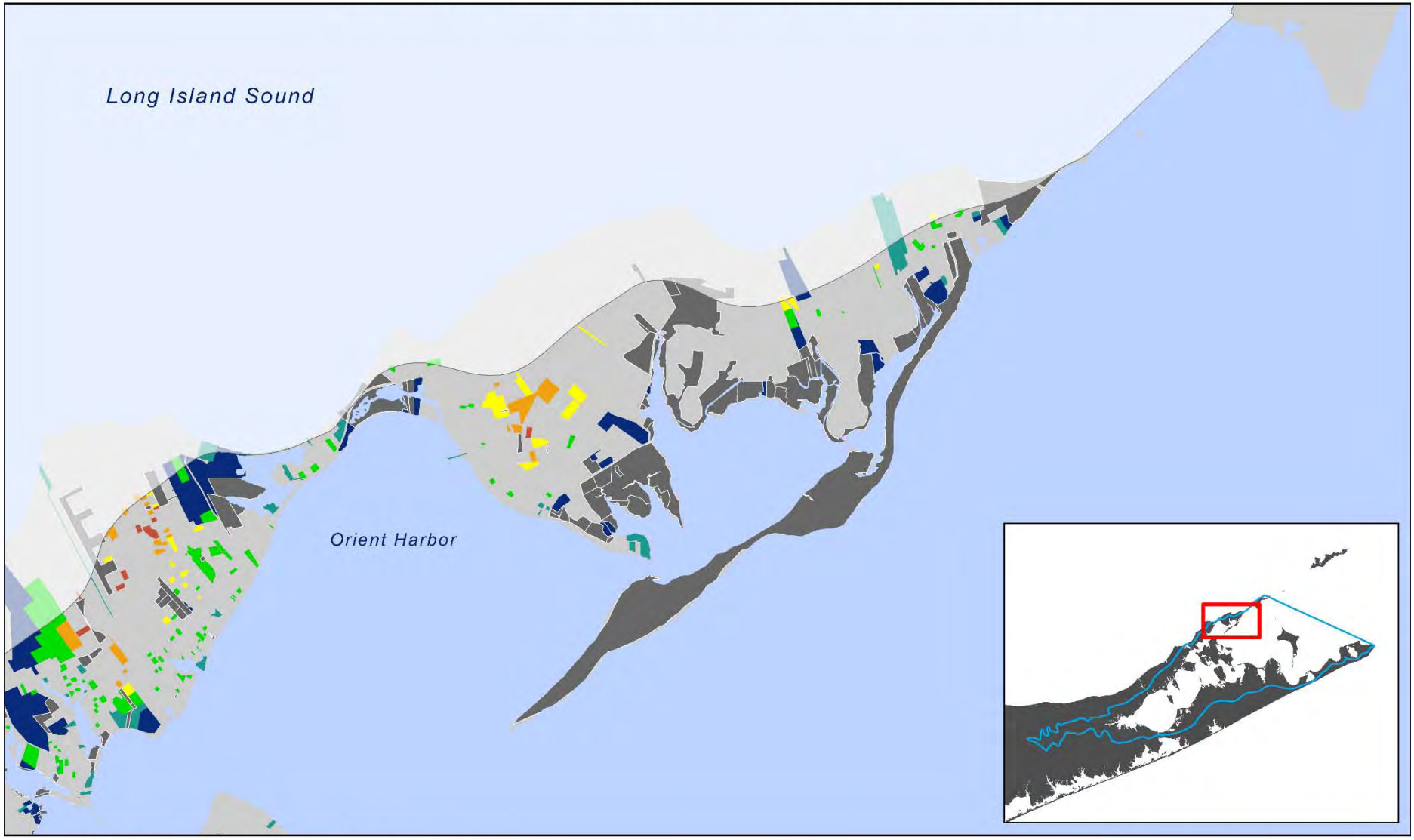
Peconic Estuary Climate Ready Assessment

Orient Harbor - Prioritization Score (Undeveloped Parcels)



Prioritization Score - Undeveloped Parcels

0 | 1 | 2 | 3 - 5 | 6 - 8 | 9 - 27 | Protected Lands

0 0.5 1 2 Miles

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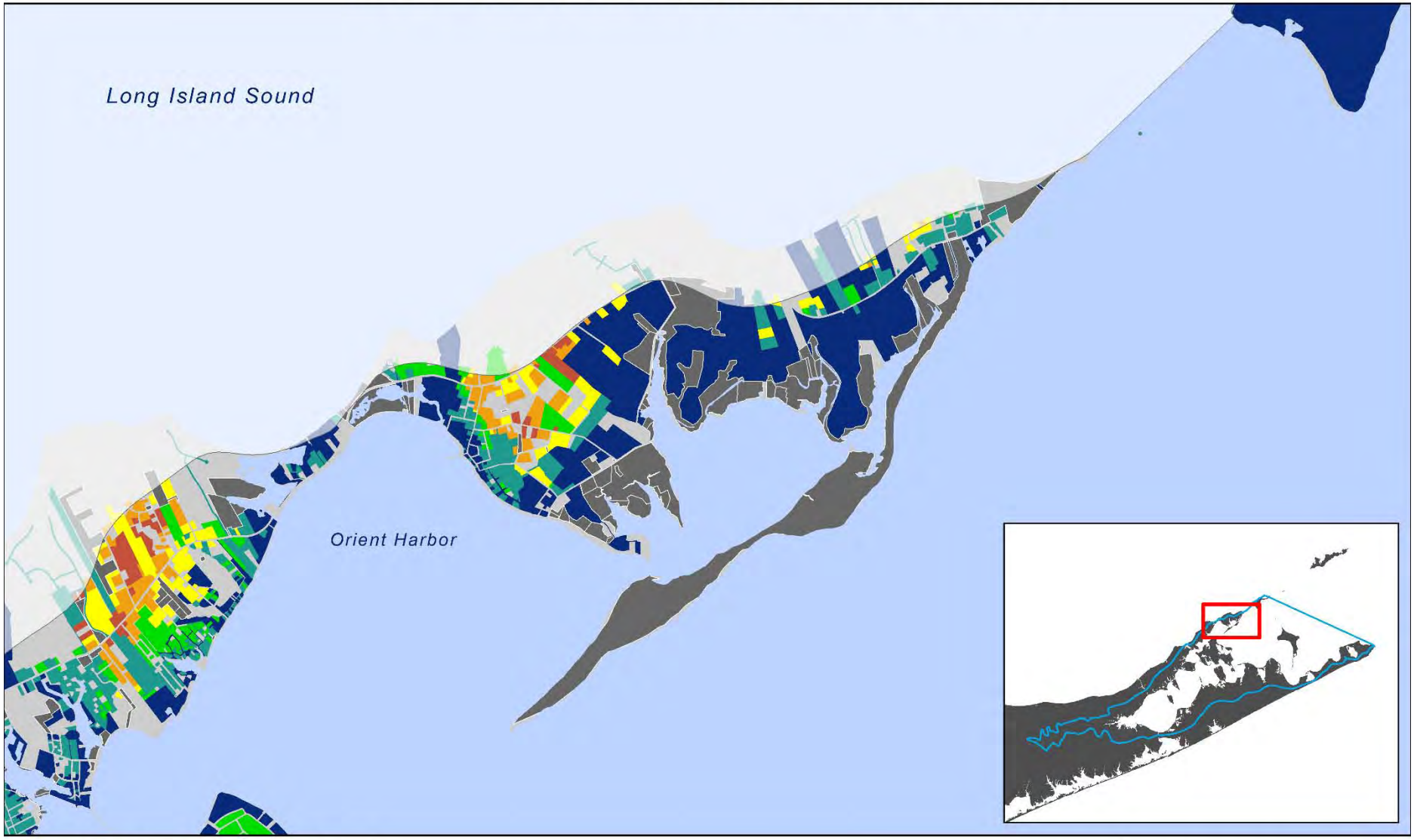
The Nature Conservancy

Peconic Estuary Climate Ready Assessment

Orient Harbor - Prioritization Score (Developed Parcels)



Prioritization Score - Developed Parcels

0 | 1 | 2 - 3 | 4 | 5 - 7 | 8 - 22 | Protected Lands

0 0.5 1 2 Miles

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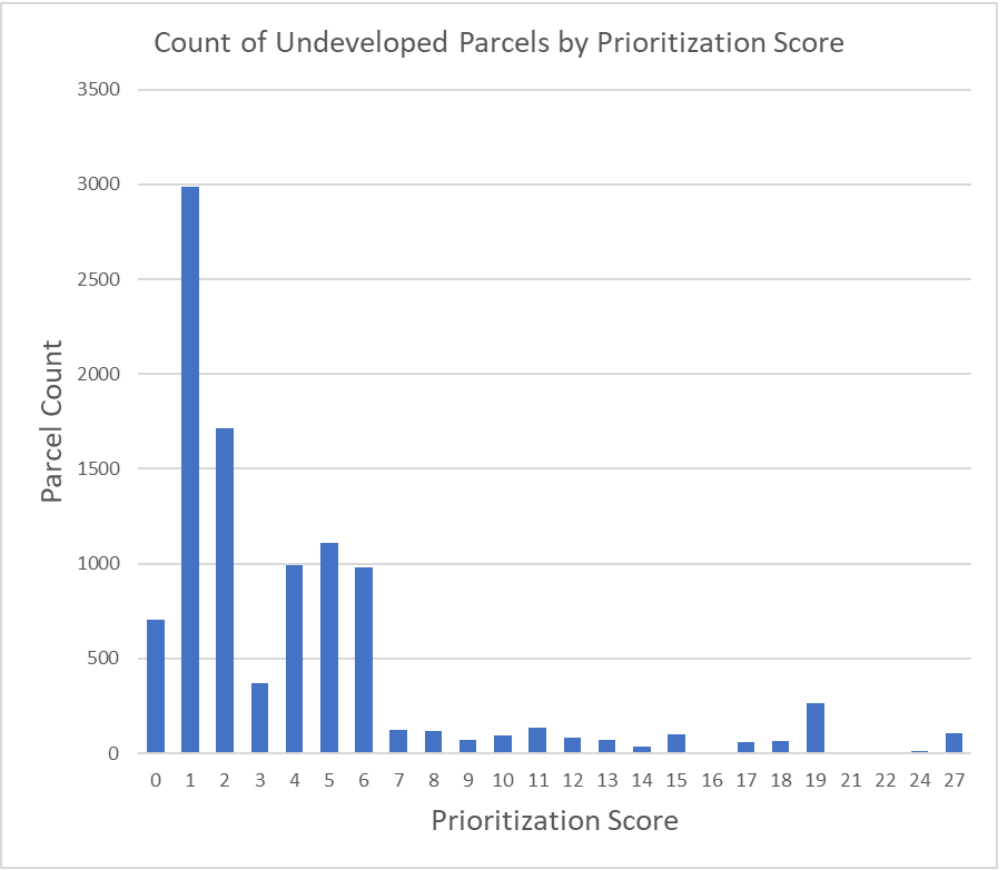
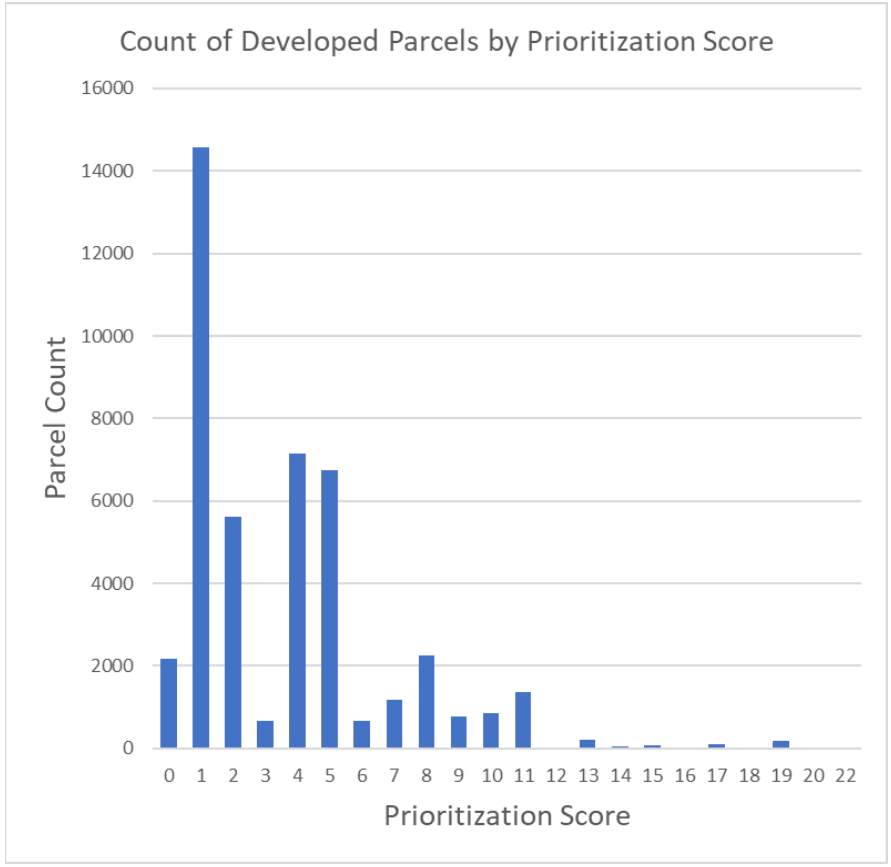
CLPS Ranking Summary





Undeveloped Parcels: 10,215 (of which 6,170 are “unprotected”)
Developed Parcels: 44,748
Total: 54,963

Vulnerability Assessment

Peconic Estuary Program and
Shinnecock Indian Nation

PEP Vulnerability Assessment Process

- Define Goals
  - PEP CCMP
  - Stakeholders
- Define and Rank Risks
  - Developed risks specific to the Peconic Estuary
  - Uses mapping results, expert consultations, available data and scientific reports to rank risks
- Goal
  - Develop priorities
  - Identify adaptation scenarios

Perform Risk Analysis

- 5 categories
  - Consequence
  - Likelihood
  - Spatial extent of the impact
    - Site (e.g., a few waterfront lots, a bridge, a sewage treatment plant)
    - Place or region (e.g., community, harbor, state park, wildlife refuge, sub-watershed)
    - Extensive (most of the watershed or most of the estuary)
  - Time horizon until the problem begins
  - Habitat type

Risk Assessment: Habitat Protection

Protect current and predicted areas of critical natural habitat (tidal wetlands, eel grass meadows, uplands and beaches and dunes) in the watershed.

Likelihood (probability) of occurrence				
	High	1. Warmer atmosphere may lead to more rain.	1. Warmer atmosphere/changing seasons may increase invasive species (for example, southern pine beetles are already a threat to pine trees). 2. Warmer waters may affect freshwater systems, especially shallow rivers, streams (reduced DO) 3. Increased drought may decrease Peconic River and tributary flows and may limit freshwaterinput into brackish systems. Lower flow could affect diadromous fish if there are redcued flows during their migration period. 4. Increased droughts during growing seasons may affect species in upland watershed areas 5. Increased storms will increase erosion of shoreline habitat and eelgrass. 6. Sea level rise may increase eelgrass bed depths decreasing sunlight penetration	1. Warmer waters may decrease eelgrass viability 2. Sea level rise will flood/drown wetlands. If wetlands are not able to migrate, sea level rise could lead to wetland habitat loss. 3. Sea level rise will decrease nearshore habitat areas (beach, tidal flats etc.) if habitats are not able to migrate. 4. Increased acidification may affect the suitability for shellfish, fish, eelgrass and other species that also serve as habitat
	Medium	1. Rising groundwater may lead to habitat changes (ponding) 2. Times of drought may reduce freshwater input into tidal wetlands 3. Increased drought may stress land based species and lead to more foraging/grazing which could have a secondary affect on habitat (for example deer foraging) 4. Sea level rise will increase saltwater intrusion changing habitat type. For example, saltwater intrusion may pose a threat to diadromous fish that need freshwater habitats for spawning and nursery areas.	1. Rising groundwater may increase connectivity between systems (especially freshwater) which may bring non-point pollution sources closer to the Estuary and could affect mixing and water quality and lead to more saltwater intrusion. 2. Rising groundwater may lead to more freshwater ponds, leading to more vector control (pesticides, mechanical control), which could have a secondary impact on habitats. 3. Warmer atmosphere/changing seasons may change plants ranges (affecting habitats) 4. Warmer water species changes may change existing habitats 5. Times of drought may affect freshwater systems in terms of temperature (more pronounced) 6. Increased storm frequency and intensity storms will lead to more stormwater runoff/and flooding into the Estuary, increasing non-point pollution and turbidity, and decreasing water clarity in nearshore habitats. 7. Sea level rise may increase connections between marine and groundwater systems and lead to secondary impacts on critical habitats (example: increased connectivity may increase availability of non-point source pollution into habitats) 8. Coastal acidification may be magnifies through synergies with reduced DO, increased nutrients etc.	
	Low	1. Warmer atmosphere/changing seasons may lead to less snow 2. Warmer waters may affect wetland viability 3. Warmer waters may exacerbate nutrient loading 4. Warmer waters may lead to stratification		
		Low	Medium	High
		Consequence of impact		

Risk Assessment: Water Quality

Protect water quality in the Peconic Bay, tidal creeks, and the Peconic River.

Likelihood (probability) of occurrence				
	High	1. Increased droughts may increased pressure to irrigate (increased irrigation causes dewatering of local adjacent wells)	1. Increased storm frequency and intensity storms may lead to more storm water runoff into the Estuary, increasing non-point pollution and turbidity, and decreasing water clarity	1. Warmer atmosphere/changing season may result in longer growing seasons, which may result in more inputs of chemicals and nutrients into estuary (because people spray longer/apply more fertilizer) 2. Sea level rise may bring homes and other infrastructure closer to estuary waters and habitat, decreasing areas for migration/buffering
	Medium	1. Increased droughts may decrease recharge to groundwater table.	1. Rising groundwater tables increases risks of infrastructure affecting water quality (septics/sewers) 2. Increased droughts may reduce freshwater water levels which could lead to more DO issues (warmer waters) 3. Increased droughts may decrease freshwater flow limiting freshwater input into brackish systems 4. Sea level rise may bring septics/sewers/storm drains closer to estuary waters, increasing nitrogen, pathogen and toxics loading 5. Sea level rise may bring increase saltwater intrusion into brackish and freshwaters systems	1. Warmer waters may lead to prolonged algae blooms and increased production of, new species of HABs 2. Warmer waters may affect species used to improve water quality (shellfish, marine plants). 3. Coastal acidification may affect shellfish viability, which will affect water quality 4. Coastal acidification may affect marine plants viability, which affects water quality
	Low	1. Warmer atmosphere/changing seasons may result in species shifts which could affect water quality, for example increased pathogens due to increases in geese and other exploding populations	1. Drier climate may increase invasive species. 2. Increased droughts may reduce connectivity between systems (especially freshwater)	
		Low	Medium	High
		Consequence of impact		

Categorizing Risks

See attached worksheets

Next Steps

Report and Strategies

Next Steps

- Draft Reports
  - PEP
  - Nation

Peconic Estuary PROGRAM

1. Memorializes CLPS Criteria
2. Identifies Climate Risks and PEP Priorities
3. Identifies Adaption Strategies
    1. Funding Priorities
        1. Grant Solicitations
        2. PEP Funded Projects
    2. Education and Outreach
        1. Public Outreach
        2. Curriculum
    3. Toolbox for Stakeholders
        1. GIS Layers
        2. CLPS Criteria