CLIMATE VULNERABILITIES

The Protect and Restore America's Estuaries (PRAE) Act was signed into law on January 13, 2021. The PRAE Act amended Clean Water Act Section 320 by requiring each National Estuary Program to develop a comprehensive conservation and management plan that "addresses the effects of recurring extreme weather events on the estuary, including the identification and assessment of vulnerabilities in the estuary and the development and implementation of adaptation strategies." In 2016, EPA contracted Battelle to follow the workbook steps described in *Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans* (EPA, 2014) to develop vulnerability matrices for the Northeast National Estuary Programs. In 2019, the Partnership supported a report by the University of Connecticut's Dr. Juliana Barrett titled *Long Island Sound Study Vulnerability Assessment Outreach* that adapted Battelle's vulnerability matrices and tailored them to the Long Island Sound region, based on feedback from Long Island Sound experts. This vulnerability assessment conducted a comprehensive review of the stressors and risks impacting the achievement of goals related to pollution control; habitat; fish, wildlife, and plants; as well as recreation and public water supplies. The information in the 2019 report continues to be valid and relevant to assessing climate risks to the CCMP goals. Moving forward, the Partnership plans to update the existing vulnerability assessment to evaluate climate vulnerabilities to the updated CCMP goals.

Warmer temperatures, changes in precipitation, increasing storminess and extreme weather events, sea level rise, and ocean acidification will pose risks to the water quality and habitat goals set by National Estuary Programs across the nation. A description of these stressors in the Long Island Sound region can be found in Appendix E of the *Long Island Sound Study Vulnerability Assessment* Outreach.

The following section summarizes how the existing vulnerability assessment relates to the Long Island Sound Partnership's 2025 CCMP goals. Three overarching climate risks, along with the likelihood and consequence of each risk (H/M/L), are identified for each CCMP goal. The technical descriptions for each objective and action in Appendix B highlight the extreme weather events that the action addresses and explains how the action serves as an adaptation strategy for climate vulnerabilities of the associated objective and goal. Each action in the 2025 CCMP is considered part of the adaptation strategy.

Clean Waters and Healthy Watersheds

Risk: Increased storm intensity and frequency will lead to heightened risks to public health due to impacts on wastewater and stormwater infrastructure, reducing ability to meet water quality goals in nearshore waterways and beaches for primary contact recreation, shellfish, and floatable debris.

Likelihood of Occurrence: High
Consequence of Impact: High

Risk: Warmer water temperatures may increase algal growth, including harmful algal blooms that impact aesthetics and availability of certain habitats to wildlife. In some cases, algal blooms can produce harmful toxins impacting shellfish, human recreation, and aquatic species.

Likelihood of Occurrence: High
Consequence of Impact: Medium

Risk: Warmer water temperatures may decrease dissolved oxygen due to reduced solubility, increased respiration and remineralization rates, and increased thermal stratification. Concurrent climate-driven changes in streamflow, wind, and sea level will also impact dissolved oxygen dynamics. Low dissolved oxygen limits the distribution and survivability of pelagic and benthic species.

Likelihood of Occurrence: High
Consequence of Impact: Medium

Thriving Habitats and Abundant Wildlife

Risk: Shoreline erosion, exacerbated by increased storminess and sea level rise, may lead to loss of beaches, wetlands, islands, bluffs, eelgrass, and salt marshes, and their associated fish and wildlife.

Likelihood of Occurrence: High
Consequence of Impact: High

Risk: Warmer water and coastal acidification may cause habitat to become unsuitable for species, their larvae or juveniles, and their food sources.

Likelihood of Occurrence: High
Consequence of Impact: High

Risk: Increased storminess in upstream habitats may cause stream erosion, resulting in high turbidity and sedimentation and decreased salinity, due to greater precipitation resulting in increased streamflow.

Likelihood of Occurrence: High
Consequence of Impact: High

Sustainable and Resilient Communities

Risk: Increased storminess may increase the vulnerability of drinking water and wastewater infrastructure due to flooding.

Likelihood of Occurrence: High
Consequence of Impact: High

Risk: Sea level rise may cause beaches or public access sites to be lost to coastal erosion or inundation.

Likelihood of Occurrence: High
Consequence of Impact: Medium

Risk: Installation of bulkheads, sea walls, and revetments to limit coastal inundation from sea level rise may reduce waterfront public access and degrade natural shorelines that are vital to many species.

Likelihood of Occurrence: High
Consequence of Impact: Medium

Informed and Engaged Public

Risk: Increased storminess may bring more frequent or more intense storms that may impact coastal public access sites and decrease recreational opportunities.

Likelihood of Occurrence: High
Consequence of Impact: Medium

Risk: Warmer water temperatures may alter species composition, potentially leading to the absence of certain desirable recreational fish.

Likelihood of Occurrence: High
Consequence of Impact: Medium

Risk: With warmer water and increased storm activity and intensity, there may be fewer opportunities for the public to safely recreate on the water.

Likelihood of Occurrence: High
Consequence of Impact: Low