Chapter X: Climate Change Adaptation and the Peconic Estuary

I. Adaptation to the Impacts of Climate Change

The United State Environmental Protection Agency (EPA) created the Climate Ready Estuaries program in 2008 as a means of building local capacity to adapt to the impacts of climate change within existing national estuary program sites. The fundamental process to prepare for and enact an adaptation strategy involves four basic steps:

- Perform a Vulnerability Assessment – A vulnerability assessment is intended to explore and articulate the key vulnerabilities and risks facing a resource. They may vary in scope from focusing on a single resource (i.e. tidal wetlands) to an entire geographic area (i.e. the Peconic Estuary). Such assessments will often identify areas where information is lacking and can provide insights into new research priorities in addition to informing future management decisions and actions.

- Develop an Adaptation Plan – An adaptation plan lays out a vision for how a community or an entity can take steps to reduce the vulnerabilities it faces from the impacts of climate change. These plans may include an array of different adaptation strategies, ranging from habitat restoration to policy change, and should focus not only on the potential negative impacts of climate change but on how to exploit any positive changes that might occur.

- Implement the Adaptation Plan – Implementation really begins during the creation of the adaptation plan by including a wide range of stakeholders and partners in the planning process. Greater involvement and buy-in to the process will increase the likelihood that partners will commit the necessary capacity and resources to see the plan succeed. Given the realities of limited budgets and resources, carefully choosing which adaptation actions to begin with, and how those small successes might yield future success, is an essential component of successful implementation.

- Monitor and Review - Future climate projections will always carry some level of uncertainty. Continuing to monitor the health of the ecosystems and regularly reviewing and adjusting adaptation and management strategies accordingly is the most effective means of accounting for this uncertainty over the long term.

II. Climate Change in the Peconic Estuary

The Intergovernmental Panel on Climate Change (IPCC) stated in its 2007 Fourth Assessment Report that there was a greater than 90% chance that increases in global mean temperature and average sea level rise were attributable primarily to human actions, in particular the releasing of carbon dioxide (CO_2) and other greenhouse forcing gasses, in to the atmosphere.[1] No scientific body of national or international standing maintains an opinion disputing this assertion.

These climatic changes and trends have already had, and will continue to have, far reaching impacts on the world's people and natural resources. Climate factors can generally be broken in to two broad categories, atmospheric and oceanic, with a number of sub-categories such as temperature and precipitation. As addressed above, understanding these changes and how they will impact local natural resources and the human uses that rely upon them is essential when devising management plans for any natural resource or geography.

Atmospheric Changes

Temperature

Since 1970, global annual average temperatures have risen by more than 1.5^{o} Fahrenheit (F) with even greater increases across the Northeastern U.S.[2] This trend is expected to increase under current greenhouse gas emissions scenarios, with conservative projections for the Long Island region ranging from 4^{o} to 7.5^{o} F by 2080.[3] With no clear path towards a global reduction of greenhouse gas emissions in sight, these projections are likely to be revised upwards as the response time for actions to reduce CO_2 emissions ensures that there will continue to be elevated levels of CO_2 emitted to the atmosphere for the next several decades.[4]

In addition to annual average temperature, seasonal variation in temperatures is being affected by increased emissions of greenhouse gasses. While average annual temperatures have increased 1.5^{o} F in the Northeast over the last three decades, average winter temperatures have increased almost 4^{o} F during that same time frame.[5] These seasonal differences are expected to continue, with higher variability and uncertainty surrounding summer temperature increases, from 6^{o} to 14^{o} F by 2100, than winter temperature increases, from 8^{o} to 12^{o} F over the same period.

Seasonal variations also lend themselves to higher likelihoods of extreme temperature events such as heat waves. Between 1971 and 2000 there was an average of 14 90^{o}+ days in New York City and two heat waves – three or more days of 90^{o}+ temperatures – a year. By the 2080s it is expected that there will be between 37 and 64 90^{o}+ days (a 2.5 to 4 fold increase) and that the city will see 5 to 8 heat waves

[1] IPCC 2008
[2] NECIA 2006; USEPA 2009
[3] NYS CAC 2010
[4] IPCC 2008
[5] NECIA 2006

a year, lasting an average of 5 to 7 days each. On the opposite extreme, the number of days below freezing (32° F) is expected to decrease by as much as half, from an average of 72 to between 36 and 49 days by the 2080s.[6] While New York City has a higher average temperature than the surrounding areas, the projected general trends hold true for the Peconic Estuary region as well.

Precipitation

Whereas trends regarding temperature increase are clear - global and regional temperatures are rising - the trends around precipitation, particularly regionally, are more uncertain. To date, there has been a 5 to 10% increase in annual precipitation above 1900 levels across the Northeast region.[7] Future projections for Long Island range from 0 to 10% increase by 2050 and a 5 to 10% increase by 2080[8]; however, seasonal variability in these projections implies that certain times of the year may in fact experience less precipitation. September and October project to have slightly less precipitation in many climate models while much of the predicted increase in annual precipitation is expected to fall during winter months.[9]

While increases in annual precipitation are expected to be relatively minor, the amount of precipitation falling as part of an "extreme" precipitation event (more than 1, 2 or 4 inches falling over the course of one day),[10] and the frequency of such events is expected to increase, accelerating from the trend observed during the late 20th century.[11] The amount of precipitation in any one rain event is expected to increase as much as 10 to 15% by 2100, and their frequency is expected to increase by nearly the same amount over the same time frame.[12]

Warmer summers, which will result in higher rates of evaporation, and a lack of corresponding increase in summer precipitation will also likely result in higher incidences of drought throughout the region.[13] The frequency of drought events in New York City is expected to double by the 2050s and increase by a factor of five by the 2080s.[14] Given the slightly elevated average temperature of New York City relative to its surrounds, these projections may overstate the specific expected future for the Peconic Estuary region; however they do capture the substantial trend towards drier, hotter summers.

[6] NPCC 2009
[7] Frumhoff et al, 2007
[8] NYS CAC 2010
[9] NPCC 2009
[10] NPCC 2009
[11] Frumhoff et al, 2007
[12] USEPA 2009
[13] NPCC 2009
[14] NPCC 2009

Oceanic Changes

Ocean Temperature

Oceanic surface temperatures have been increasing along the coastal Northeast over the course of the last century. A 1^{o} increase in surface temperature has been experienced regionally in the last 100 years.[15] Based on the work of the Intergovernmental Panel on Climate Change, regional surface temperatures could see additional increases of 4^{o} to 5^{o} F (under a low emissions scenario) or as much as 6^{o} to 8^{o} F (under a high emissions scenario) over the next century.[16] While work has yet to be done on the temperature changes experienced within the Peconic Estuary, work being done in the Long Island Sound suggests that temperatures are rising at a faster rate – 1.8^{o} F per every 100 years – than the regional average.[17]

Ocean Acidification

As an increasing amount of carbon dioxide (CO_2) is released to, and accumulates in, the atmosphere there is a similar increase in the amount of CO_2 that is transmitted to the oceans. When CO_2 dissolves in salt water a series of chemical reactions take place that result in a decrease in the overall pH of the water, meaning that the water has become more acidic.[18]

Research suggests that oceanic pH is lower now than any time in the last 420,000 years.[19] There has been a 30% increase (a reduction of .1 pH unit) in ocean acidity in the last century[20] and, if current trends continue, the average pH of the oceans could drop by as much as .5 pH units relative to preindustrial levels.[21]

Sea Level Rise

Globally sea levels are rising in part due to expansion of oceanic waters is average temperatures increase and in part due to increased amounts of available freshwater from melting glaciers and land based ice. Whereas historical data indicate almost no sea level rise occurring for the last two millennia, during the course of the 20^{th} century global sea levels rose approximately 8 inches.[22] The IPCC has concluded that global sea level rise will continue, with a projected average rise between 7 and 23 inches by the year 2100.[23] This projection does not account for what is known as the "rapid ice melt" scenario

[15] Frumhoff et al, 2007
[16] Frumhoff et al, 2007
[17] O'Donnell, 2010
[18] USEPA 2009
[19] Hough-Guldberg et al. 2007
[20] Caldeira and Wickett 2003
[21] Caldeira and Wickett 2005
[22] GCRP 2009
[23] IPCC 2008

– a scenario that takes in to account a significant enough increase in global average temperatures to result in the melting of nearly all of the planets land based ice. If such a scenario were to occur projections for global sea level rise would be considerably higher.

Locally, the accelerated rate of sea level rise is projected to exceed the global average. The New York State Sea Level Rise Task Force, the New York State Energy Research and Development Authority's ClimAID assessment, the New York State Climate Action Council effort, and the New York City Panel on Climate Change all used the same set of localized sea level rise projections, developed by the Center for Climate Systems Research at Columbia University. Sea level is expected to increase from 2 to 5 inches by the 2020s, 7 to 12 inches by the 2050s, and 12 to 23 inches by the 2080s.[24] If the rapid ice melt scenario is factored in, those projections become 5 to 10 inches by the 2020s, 19 to 29 inches by the 2050s, and 41 to 55 inches by the 2080s.[25]

Table X: Summary of Climate Factors for the Peconic Estuary Region[26]

	Baseline	2020s	2050s	2080s
Average Temperature	55° F	+ 1.5° to 3° F	+ 3° to 5° F	+ 4° to 7.5° F
Average Precipitation	46.5 in	+ 0 to 5%	+ 0 to 10%	+ 5 to 10%
Projected Sea Level Rise	NA	2 to 5 in	7 to 12 in	12 to 23 in
Projected Sea Level Rise (Rapid Ice-Melt Scenario)	NA	5 to 10 in	19 to 29 in	41 to 55 in

[24] NPCC 2009, NYS SLRTF 2010, NYS CAC 2010
[25] NPCC 2009, NYS SLRTF 2010, NYS CAC 2010
[26] NPCC 2009, NYS SLRTF 2010, NYS CAC 2010

III. Climate Change Adaptation Actions for the Peconic Estuary Program

Though the Peconic Estuary Program (PEP) has not yet taken part in the Climate Ready Estuaries program, the four basic steps articulated above should serve as guiding principles for any climate change adaptation efforts that the PEP engages in. In light of that, the PEP should consider the following actions as it prepares for the impacts of climate change.

1. ***Conduct a Climate Change Vulnerability Assessment for the Peconic Estuary Region***

   While a number of tools and predictions about the impacts of climate change exist, there has not been a comprehensive vulnerability assessment performed for the Peconic Estuary and its natural habitats. Such an effort is an essential piece to provide the necessary underpinnings for any adaptation strategies that the PEP chooses to pursue. The PEP should first look to the work of the New York State Sea Level Rise Task Force, the Long Island Sound Study's work as part of the Climate Ready Estuaries program, the New York State Energy and Research Development Authority's ClimAID report, the New York State Climate Action Council's Draft Report, amongst other resources to build on work that has already been performed for the region. Additionally, resources such as the Coastal Resilience mapping tool (coastalresilience.org) and the Nature Conservancy's Climate Wizard (climatewizard.org) may be useful in exploring future climate conditions for the region.

2. ***Identify Information Gaps and Develop a Climate Change Research Agenda***

   The process of performing a vulnerability assessment will invariably demonstrate areas where the understanding of the science is simply insufficient to make informed management decisions. While considerable research is ongoing on the global impacts of changes to the Earth's climate system, improving the local understanding of those impacts, and further refining the suite of projections of future climate scenarios locally, are essential steps in continuing to update and improve the management of the Peconic Estuary system.

3. ***Review and Update the Existing Actions and Steps in the Peconic Estuary Program's Comprehensive Conservation and Management Plan***

   Given the tremendous amount of work that has gone in to the Peconic Estuary Program's Comprehensive Conservation and Management Plan (CCMP), the first step in developing an appropriate strategy for determining the impacts of climate change on the health of the Peconic Estuary system is to identify existing strategies and actions in the CCMP that should be revisited and updated in the face of climate change. A quick review of the CCMP identified the following actions as likely needing to account for the impacts of climate change, though a more thorough analysis should be conducted.

- *Nutrient Pollution Chapter (Chapter 3); Pathogens Chapter (Chapter 5); Toxics Chapter (Chapter 6)*

Potential Impacts:

Changes in precipitation patterns, in particular the projected increases in total precipitation and extreme rain events, will likely lead to increased land based runoff of nutrients, herbicides, and pesticides and may also lead to increased atmospheric deposition. Additionally increases in sea level will likely result in regular inundation of septic systems in coastal communities, either through regular tidal cycles or elevation of the groundwater level. This, in turn, will lead to increases in the amount of nitrogen and pathogens transmitted directly to estuarine waters.

Increased nitrogen loading to the waters of the Peconic Estuary will result in more frequent harmful algal blooms, reduced visibility in the water column and a general degradation of coastal habitats. Excessive pathogens may lead to more frequent closures of bathing beaches and shellfishing areas. Herbicides and pesticides are increasingly being linked to losses of seagrasses and other marine habitats which provide important feeding and nursery habitat for recreational and commercial fisheries.

Specific Actions to Review:

- N-3: Implement a quantitative Nitrogen Load Allocation Strategy for the Entire Estuary
  - As recommended, a TMDL was developed for the entire estuary. However, given projected climate change impacts the loading models used to inform the development of the TMDL should be reviewed and updated to incorporate and address future conditions.
- N-5: Implement Nonpoint Source Control Plans
  - Source Control Plans, where completed, should be reviewed to incorporate and address the newly revised nitrogen loading information developed under Action N-3. Where Source Control Plans do not exist, they should be developed and implemented based on a thorough understanding of climate change impacts.
  - Septic setbacks from ground and surface waters should be reviewed and modified to account for increases in sea level rise and elevation of the groundwater table.
  - Innovative and alternative waste disposal systems that reduce nitrogen loading should be promoted and employed wherever practicable.
- N-6: Use Land Use Planning to Control Nitrogen Loading Associated with New Development
  - Develop recommendations for clearing restrictions and clustered development as a means of reducing nitrogen loading to groundwater and surface water.
  - Develop and distribute guidance on low maintenance vegetation.

- P-12: Identify Sources and Loadings of Nonpoint Sources of Pathogens
  - Ensure that the impacts of climate change have been accounted for in the identification of pathogen sources and loading (Step P-12.1).

        - Land cover analyses (Step P-12.4) and stormwater runoff loadings should be reevaluated and updated to account for projected changes in precipitation patterns.
    - P-13: Develop and Implement Nonpoint Source Control Plans for Pathogens
        - Source Control Plans, where completed, should be reviewed to incorporate and address the newly revised pathogen loading information developed under Action P-12. Where Source Control Plans do not exist, they should be developed and implemented based on a thorough understanding of climate change impacts.

    - T-4: Reduce Loadings of Pesticides and Herbicides within the Peconic Estuary
        - Similar to the approaches taken with nitrogen and pathogens, sources of pesticide and herbicide loading should be identified. In the development of this process, projections of future precipitation patterns should be considered as they may change areas and amounts of loading.

- *Habitat and Living Resources Chapter (Chapter 4)*

Potential Impacts:

Climate change will exacerbate the already existing threats to the natural resources of the Peconic Estuary. In areas with significant coastal development and shoreline hardening, coastal habitats will be prevented from migrating landward as sea levels rise. Changes in air and water temperatures may lead to species composition shifts, with the potential for increasing abundance of species once thought to be more southerly, as conditions will become less favorable for species that are adapted towards cooler climatic conditions. Increasingly acidic oceanic waters will limit the ability of calcifying organisms as they build shells or skeletons.

Specific Actions to Review:

- HLR-1: Use Critical Natural Resource Areas (CNRAs) to Develop and Implement Management Strategies to Protect High Quality Habitats and Concentrations of Special Emphasis
    - CNRA boundaries may need to be redrawn and redesigned to be more adaptable to future climate conditions (HLR-1.1, HLR-1.2). Climate change may result in shifting of important spawning, breeding, nursery and feeding habitats (e.g. breeding and forage grounds for piping plovers may be directly impacted as sea levels continue to rise) and protection strategies need to be flexible to account for these future scenarios.
    - Management recommendations and plans (HLR-1.3) should include the impacts of climate change in addition to those impacts currently identified.
- HLR-2: Manage Shoreline Stabilization, Docks, Piers and Flow Restriction Structures to Reduce or Prevent Additional Hardening and Encourage Restoration of Hardened Shorelines to a Natural State

        - Using available sea level rise and marsh migration tools and modeling, identify areas where shoreline hardening should be prohibited to allow for the natural adaptation of coastal habitats to future climate scenarios.
    - HLR-7: Develop and Implement an Estuary-Wide Habitat Restoration Plan
        - Reassess existing Estuary-Wide Habitat Restoration Plan to incorporate the impacts of climate change (HLR-7.1).
    - HLR-8: Develop and Implement Specific Restoration Projects
        - Identify restoration project sites where the reconnection of disrupted natural processes will result in ecosystems that are more readily able to adapt to the impacts of climate change.
    - HLR-15: Utilize Land Use Planning, BMPs, and Other Management Measures to Reduce the Negative Impacts of Human Uses and Development on the Estuary System
        - Work with Peconic Estuary towns and municipalities to develop master or comprehensive management plans that increase the level of protection of natural resources by identifying, accounting for, and addressing the impacts of climate change. For example, guide capital investments away from highly vulnerable areas to sea level rise.

- *Critical Lands Protection Chapter (Chapter 7)*

Potential Impacts:

As temperatures increase, sea levels change, groundwater tables rise, and precipitation falls in increasingly larger amounts and intensity, high value habitats may move or change to keep pace with these changes. The dynamic nature of the region's natural resources will require a protection strategy and process that is able to effectively conserve critical lands both where they exist today and where they may exist in the future. Moreover, applying the lens of climate change may in fact change the designation of any particular parcel as "critical" and is an essential criterion that needs to be considered when creating any system for land protection.

Specific Actions to Review:

- CLPP-1: Develop a PEP "Critical Lands" Map and List Based on Applying the PEP Criteria
    - The PEP criteria the guide the designation of "Critical Lands" should be updated to include future climate scenarios, in particular future sea levels.
    - The "Critical Lands" map and list should be reassessed and updated based upon revised PEP criteria (CLPP-1.5, CLPP-1.6)
- CLPP-2: Continue to Refine the CNRA Boundaries with Results of the Work from the PEP Natural Resources Subcommittee
    - Please see HLR-1 section above.
- CLPP-6: Identify a Process for Using Smart Growth Tools, Sustainable Development Initiatives, and Ordinance Modifications, etc. to Assist Communities in Assigning Development to Appropriate Areas

- Work with local municipalities to visualize the potential impacts of future climate scenarios on human communities and natural resources
- Develop model code and ordinances that address future climate scenarios and direct development towards less vulnerable, less ecologically sensitive areas

- *Public Outreach and Education Chapter (Chapter 8)*

The CCMP has an extensive chapter on Public Education and Outreach. As currently written, the actions address both general outreach and education as well as specific issue based outreach efforts on pathogens (POE-3), nutrients (POE-4), toxics (POE-5), and habitat protection and sustainable resource use (POE-6). Instead of pursuing a specific climate change outreach strategy, incorporating the projected impacts of climate change on each of these specific issue based efforts will provide a clearer context for stakeholders to understand and appreciate the message. Increasingly evidence suggests that focusing on locally relevant issues and impacts has a greater impact in terms of building support and motivating action to address climate change than broad based, large scale climate change educational campaigns that are disconnected from the local experience.

Potential outreach activities include:

- Incorporating climate change information into interpretive signage around the Peconic Blueway Trail, in particular focusing on the dynamic nature of coastal habitats and how those habitats may change over time;
- Working with CACs and municipalities to incorporate marsh migration demonstration projects into existing habitat restoration efforts;
- Creating "climate friendly" schools similar to the ongoing "storm water friendly" schools projects;
- Framing outreach messages around the concept of a "dynamic estuary" or shorelines – including how changes in climate will affect that dynamism; and,
- Including projections of future precipitation patterns in storm water runoff outreach efforts to community members.

- *Incorporate Climate Change Impacts in to all Monitoring Actions*

There are monitoring actions associated with most of the broad CCMP strategic areas to track the health of the resource and the effectiveness of management actions. Incorporating changes in climate factors, and the impacts of those changes on the health of the Peconic Estuary ecosystem, in to existing monitoring efforts is a logical next step to better inform future management decisions. The PEP could also serve as a data clearinghouse of sorts to ensure that all relevant climate factors are easily accessible and located in one area. In addition to collecting this data it, along with all other monitoring data on environmental factors, should be made readily available to use and inform environmental management and decision making in the broader Peconic Region.

4. ***Develop and Implement a Climate Change Adaptation Plan for the Peconic Estuary Region***

The PEP is ideally situated to serve as a convening body to gather together the relevant interests and individuals to help guide the region to a more climate adapted future, a role that other estuary programs have played to varying degrees throughout the country. Once a proper vulnerability assessment is completed it may become clear that the proposed updates to the CCMP contained in this document do not address all of the actions necessary to move the human communities and natural resources of the Peconic Region towards a future that is less vulnerable to the impacts of climate change.

The PEP should create a working group, standing committee or a task force that is tasked with developing a climate change adaptation plan. Such an effort should include input from local municipalities, state agencies, federal agencies as well as local stakeholder groups including the PEP CAC and relevant not-for-profits such as The Nature Conservancy, the Peconic Land Trust, or Group for the East End. Potential additional partners could include academic institutions such as Stony Brook, Cornell or Columbia, as well as the Brookhaven National Lab.

Considerable information already exists that could be used to jumpstart this effort, including maps of potential future sea levels, guidance documents on local government policy approaches for climate change adaptation, and state and federal programs that may help to guide and implement any plan that is developed. Moreover, private or public sources of funding may be available to further this effort and should be explored in the early phases.

5. ***Establish a Regular Review and Update of Climate Change Adaptation Actions Based on the Current State of Climate Science***

The uncertainty surrounding future climate conditions not only calls for increased monitoring and research, it also requires a regular assessment of strategies to ensure that they are relying upon the most current understanding of climate science. Given the regular review of the CCMP that is supposed to occur as a part of the PEP, linking a review of the climate science and the proposed climate adaptation actions to the CCMP review process may provide the least administrative burden and result in the most scientifically informed suite of actions.

References Cited

Caldeira, K. and M.E. Wickett. 2003. Anthropgenic Carbon and Ocean pH. Nature 425:365.

Caldeira K., and M.E. Wickett. 2005. Ocean Model Predictions of Chemistry Changes from Carbon Dioxide Emissions to the Atmpsphere and Ocean. 2005. Journal of Geophysical Research 110:1-12.

Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles. 2007. *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions.* Synthesis report of the Northeast Climate Impacts Assessment (NECIA). Cambridge, MA: Union of Concerned Scientists (UCS).

GCRP (United States Global Changes Research Program). 2009. *Global Climate Change Impacts in the United States.* Cambridge University Press. Available at: http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/full-report

Hoegh-Guldberg, O.,P.J. Mumby, A.J. Hooten, R.S. Steneck, P. Greenfield, E. Gomez, C.D. Harvell, P.F. sale, A.J. Edwards, K. Caldeira, N. Knowlton, C.M. Eakin, R. Iglesias-Prieto, N. Muthiga, R.H. Bradbury, A. Dubi, and M.E. Hatziolos. 2007. Coral reefs under rapid climate change and ocean acidification. Science 318:1737-1744.

Intergovernmental Panel on Climate Change (IPCC). *Climate Change 2007*: *Synthesis Report,* Geneva: IPCC, 2008.

New York City Panel on Climate Change (NPCC). *Climate Risk Information.* New York, NY: February 17, 2009.

New York State Climate Action Council (NYS CAC). *New York State Climate Action Plan Interim Report*. November 2010. Available at: http://www.nyclimatechange.us/InterimReport.cfm

New York State Sea Level Rise Task Force (NYS SLRTF). *Report to the Legislature.* December 31, 2010. Available at: http://www.dec.ny.gov/docs/administration_pdf/slrtffinalrep.pdf

Northeast Climate Impacts Assessment (NECIA). 2006. *Climate Change in the U.S. Northeast.* Published October 2006. Available at: http://www.climatechoices.org/assets/documents/climatechoices/NECIA_climate_report_final.pdf

O'Donnell, James as cited in Burgeson, John. "Tropical Fish are Moving in as Long Island Sounds Heats Up." ctpost.com 19 July 2010. Accessed 16 Feb. 2011 http://www.ctpost.com/news/article/Tropical-fish-are-moving-in-as-Long-Island-Sound-581383.php#page-2.

U.S. Environmental Protection Agency (EPA). *Lessons Learned from the Climate Ready Estuaries Program*. June 2011. Accessed at: http://water.epa.gov/type/oceb/cre/upload/CRE_Lesson_Learned_508.pdf

U.S. Environmental Protection Agency (EPA). 2009. *Synthesis of Climate Change Drivers and Response in Long Island Sound.* November 13, 2009. Accessed at: http://longislandsoundstudy.net/wp-content/uploads/2011/03/LISS-Synthesis-of-CC-Impacts-Memo.pdf