VULNERABILITIES TO CLIMATE CHANGE

The Piscataqua Region Estuaries Partnership (PREP) is a collaborative watershed program that works in New Hampshire and southernmost Maine to protect and restore the Great Bay Estuary and Hampton-Seabrook Estuary. In 2008, PREP was awarded a $50,000 grant from the U.S. Environmental Protection Agency's "Climate Ready Estuaries" initiative to conduct a detailed vulnerability assessment of how climate change is likely to impact existing road and stream networks within the Oyster River watershed, which is an important coastal river that empties into the Great Bay Estuary in New Hampshire.

Due to climate change, the frequency of extreme rainfall events is increasing in New England. At the same time, watersheds are being altered by impervious surfaces associated with development, such as roads, roofs, and parking lots. Both of these factors contribute to greater quantities of water running off the land and increase the potential for damaging floods. Many of the culverts currently found under New England's roads were not designed to safely pass the amount of water that can be anticipated due to these changes. This means that during future flood events road/stream crossings are likely to fail, which could result in damage to infrastructure and property, loss of life, and degradation of aquatic ecosystems.

THE NATIONAL ESTUARY PROGRAM IN ACTION

Piscataqua Region Estuaries Partnership

To address these challenges, PREP convened a technical team to conduct a climate adaptation pilot project in the Oyster River watershed in southeastern New Hampshire. The immediate objective of the project is to identify specific road/stream crossing culverts that are threatened with failure as a result of impacts from increasingly extreme storm events due to climate change, as well as from future hydrologic modifications due to watershed development. The intent of the project is to develop a practical adaptation strategy to proactively reduce negative climate change impacts on stream habitat and road infrastructure.

The study approach utilizes geographic information system (GIS) watershed modeling techniques to examine the hydrologic impact of several climate change and land use scenarios on existing culvert infrastructure. Through the field efforts of staff from PREP, the Town of Durham, the NH Fish and Game Department, and the Strafford Regional Planning Commission, all the major culverts in the watershed (110 culverts) were assessed and mapped with a standardized protocol.

Data on culvert capacity, vegetation cover, slope, soils, permeability, roads, and land use have been compiled into a GIS model that calculates runoff volumes for current and projected future precipitation patterns. For the model of future conditions, two build-out analyses were developed for the study watershed

based on current zoning ordinance regulations: one that assumes full build-out based on existing patterns of development, and one that incorporates available Low Impact Development (LID) techniques. Global climate model output is being used as the basis to estimate mid-21st century storm event magnitudes and return intervals for various global greenhouse gas emission scenarios developed by the Intergovernmental Panel on Climate Change.

Utilizing the model results, the project team is developing recommendations for culvert improvements based on risk, cost, and infrastructure lifespan considerations. Project results provide a specific climate adaptation plan strategy to local communities, evaluate the contribution of LID techniques in mitigating development impacts at the watershed scale, and provide a repeatable methodology for application to other National Estuary Programs and other coastal watersheds. "We wanted a project that could demonstrate tangible environmental, economic, and social impacts associated with climate change," says Derek Sowers, PREP Project Manager. Sowers hopes this project will act as a catalyst for inspiring local communities to take other proactive measures to adapt to changing conditions. Sowers notes, "Citizens and community leaders need to understand that climate change impacts are happening and will only get more severe over the next 50 years – we can plan for and adapt to those impacts now or respond to them in crisis mode as they play out in our communities and incur much greater environmental and economic costs."

Visit **www.prep.unh.edu** to learn more about this and other PREP efforts.

EPA's National Estuary Program (NEP) is a unique and successful coastal watershed-based program established in 1987 under the Clean Water Act Amendments. The NEP involves the public and collaborates with partners to protect, restore, and maintain the water quality and ecological integrity of 28 estuaries of national significance located in 18 coastal states and Puerto Rico.

For more information about the NEP go to www.epa.gov/owow/estuaries.