



U.S. Department
of Transportation

**Federal Highway
Administration**

Implementing Regional Resilience Projects: New Hampshire Department of Transportation

New Hampshire Department of Transportation (NHDOT) has numerous initiatives to enhance inter- and intra-agency resilience planning; incorporate sea level rise, flooding, and storm surge readiness into transportation operations; and work with other state government branches to execute resilience policies.

Key Takeaways

- NHDOT partners with other state and regional agencies and with additional transportation and climate stakeholders to prepare for impacts and collaborate on resilience measures. Two such partnerships are the Infrastructure and Climate Network (ICNet) and State Environmental Resilience Group (SERG).
- NHDOT assessed two nature-based infrastructure resilience projects—a bank erosion mitigation project and a living shoreline.

For more information:

New Hampshire Department of Transportation Climate Change Information,
<https://www.nh.gov/dot/climate-change/index.htm>,
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Resilience Context

New Hampshire is vulnerable to environmental stressors such as sea level rise, heavy rainfall and snow, flooding, and storm surge and has experienced several significant impacts in recent years to coastal roadways and inland stream banks and waterways. NHDOT maintains roads, bridges, sea walls, ditches, culverts, and other transportation infrastructure in the state's jurisdiction and repairs damage caused by storms and heavy rainfall. The agency's resilience projects include replacing culverts or other roadway infrastructure, stabilizing banks, and creating living shorelines. Due to limited resources and funding, NHDOT aims to prevent the damage typically caused by smaller, more frequent storms, which tend to cause significant damage over time. As discussed in a 2014 NHDOT report, precipitation is expected to increase in both frequency and intensity and lead to episodic rises in stormwater and resulting streamflow, icing and winter flooding, and sea level. Since 1926, sea levels have risen about six inches in Portsmouth, and this rate will continue to accelerate in the decades ahead.

The State of New Hampshire does not currently have a definition of resilience or a resilience plan, but NHDOT and several other state agencies convene periodically to discuss ways to consider sea level rise and changes in temperature and precipitation patterns in their decisions and to think proactively about resilience. In 2018, NHDOT, Maine DOT, and the Federal Highway Administration (FHWA) conducted a resilience-oriented pilot project to assess the potential of nature-based solutions in protecting coastal roadways and bridges in the two states.¹ NHDOT also has formed an internal transportation taskforce that focuses on changing future environmental conditions and sea level rise preparedness. In addition, NHDOT is an active member of two organizations—the Infrastructure and Climate Network (ICNet) and State Environmental Resilience Group (SERG)—that help to further resilience and climate measures.

¹Federal Highway Administration. August 2018. Two Northeastern DOTs Consider Green Infrastructure Techniques for Coastal Highway Resilience: A Joint Study with Divergent Outcomes. https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/northeastern/.

Resilience Initiatives at the Agency

Resilience Network: Infrastructure and Climate Network

NHDOT has been active in ICNet, a network of over 60 individuals and organizations consisting of scientists, engineering researchers, academics, federal, state, and local policymakers, transportation agencies, the National Weather Service, permitting agencies such as the National Oceanic and Atmospheric Administration and the Environmental Protection Agency, students, and private practitioners. ICNet is “dedicated to accelerating climate science and engineering research in the Northeastern U.S.” and focuses on changing environmental conditions, sea level rise impacts, and adaptation for sustainable bridges, roads, and transportation networks.² It was established in October 2012 and received initial funding support from the National Science Foundation.

For seven years, from 2013-2019, ICNet organized workshops at which participants discuss new research and implementation projects, challenges, and opportunities. Working groups were formed from these workshops to address specific issues in communication, uncertainty, asset management, vulnerability, planning, and policy. NHDOT credits the ICNet for driving its efforts toward resilience.

Resilience Coordination: State Environmental Resilience Group (SERG)

SERG is a quarterly convening of New Hampshire state agencies to discuss legislation, standards for preparedness, and help each other achieve their climate and sea level rise preparedness goals. The genesis for SERG was the New Hampshire Coastal Risk and Hazards Commission’s report (Figure 1), in which the commission expressed its intention of resilience being integrated in municipalities located along the Atlantic Ocean and near the Great Bay estuary in the face of future adverse environmental conditions such as storm surge, sea level rise, and extreme precipitation. SERG coordinates efforts among NHDOT, NH Department of Environmental Services (NHDES), NH Department of Safety, NH Department of Natural and Cultural Resources, and NH Fish and Game Department. NHDOT’s aim with SERG is to share its efforts to ensure seamless connections with the other state agencies. This helps NHDOT utilize its limited resources efficiently. As a result of NHDOT’s involvement with SERG, the agency completed an audit of existing state statutes, rules, and agency policies governing state properties, projects, and actions in the coastal and Great Bay regions. Changes were identified to enable NHDOT’s authority on actions necessary to prepare for flood risks, such as projected storm surge, sea-level rise, and precipitation events. NHDOT contributes an important perspective because it has already implemented resilience projects and produced reports that inform the group’s work and promote resilience.

Resilience Implementation: Living Shoreline Project, Log Jam Monitoring, and Culvert Design

NHDOT assessed the potential for green infrastructure that is intended to protect a section of Route 1B in Portsmouth, NH where the state anticipates rising sea levels. Living shoreline projects involve erosion control measures and the strategic placement of plants, stone, sand fill, and other structural organic materials. Through this pilot project, FHWA partnered with NHDOT to show the ecological benefits of elevating Route 1B to restore habitat and protect the coast in that vicinity. More information can be found in the [final report](#) from the pilot. NHDES oversees living shoreline projects along the New Hampshire coast that are in various phases of construction and monitoring. In March 2019, NHDES published a “Living Shoreline Site Suitability Assessment” of living shoreline potential in New Hampshire.

NEW HAMPSHIRE COASTAL RISK AND HAZARDS COMMISSION



Final Report and Recommendations November 2016

Figure 1. Cover of the report that generated the impetus for SERG

²Infrastructure & Climate Network. “The ICNet.” <http://theicnet.org/>.

Another NHDOT resilience project involves engineering a log jam—an aquatic habitat restoration method used to establish streambank stabilization and protect infrastructure. Bank erosion can severely impact unprotected roads and highways near streams. In 2020, NHDOT installed root balls along a bend of the Magalloway River adjacent to Route 16 in Errol, NH. Many roads and highways exist close to streams that exhibit lateral instability (bank erosion). Extreme bank erosion, due to repeated flooding events, required road relocation and streambank stabilization in this area. By pursuing a natural in-stream solution instead of conventional armoring to mitigate bank erosion and stabilize channels, NHDOT will save approximately \$101,000. The three-year project involves monitoring—eight months of pre-construction and two years of post-construction—that focuses on hydraulics, structural changes, and flora and fauna. The site is inspected regularly for necessary repairs or maintenance. NHDOT is fully documenting the project to help fill the gap in available research about the success of engineered log jams, not yet widely employed in the United States. The report will also cover road planning, design, permitting, construction, and maintenance.³

Another NHDOT resilience effort evaluates roadways for water drainage. The agency uses the latest rainfall intensity duration frequency curves from the Northeast Regional Climate Center housed at Cornell University to incorporate trends such as increased rainfall and storm intensity into sizing new drainage structures and performing in-kind structure replacements. For new projects, NHDOT evaluates the risk and may incorporate a 15 percent increase on rainfall rates for a future projection. NHDOT is also directed by NHDES through a Memorandum of Agreement to consider bank-full width in its culvert design and to construct larger transportation structures to withstand greater rainfall and flooding. These redesigned structures will better accommodate higher hydraulic flow and avoid overflows that lead to infrastructure damage. NHDOT has not updated its culvert design standards in many years so this resizing effort will incorporate more current environmental concerns into the agency's approach to design.

Support for Resilience in the NH State Legislature

NHDOT has received some legislative support to promote resilience initiatives, despite some resistance to projects such as building higher sea walls along the coast. One recent legislative measure created the New Hampshire Coastal Risk and Hazards Commission, which ultimately recommended establishment of SERG (discussed above) and was signed into law by the Governor of New Hampshire in July 2013.

State Agencies Required to Audit Laws, Regulations, and Procedures Governing Coastal Regions

In June 2016, the Governor of New Hampshire signed Chaptered Law 195/Senate Bill 452, which requires that certain state agencies review existing laws, regulations, and procedures that govern coastal regions. This law allowed authorities to take appropriate actions to enhance resilience preparedness in New Hampshire communities to prepare for flood risks such as storm surge, rising sea level, and heavy precipitation. Law 195/SB 452 specifically included NHDOT, NHDES, NH Fish and Game Department, and NH Division of Historical Resources. Because New Hampshire has no statewide resilience plan, this legislation aimed to fill the gap in resilience policy and increase resilience practices across state agencies. In October 2018, NHDOT issued its audit report to the public.⁴ The audit includes key aspects such as considering storm surge, sea level rise, and flood risks in property acquisition and the requirement to reference “Chapter 195, Laws of 2016” for work conducted in the state's coastal and Great Bay regions and for applications for bridge aid and state aid for Class I, II, and III Highways.

³ The National Academies of Sciences, Engineering, and Medicine. November 20, 2018. “Log Jam Monitoring.” Research in Progress. <https://rip.trb.org/View/1568550>.

⁴ New Hampshire Department of Transportation. October 28, 2018. Letter to Governor Sununu regarding “SB 452-FN, an act requiring certain state agencies to conduct an audit of laws governing coastal regions to enable authorities to take appropriate actions.” <https://www.nh.gov/dot/climate-change/documents/sb452-10-2018-final-report.pdf>.

Coastal Resilience and Economic Development Measure Passes Senate

On August 5, 2019, the New Hampshire State Senate passed SB 285, entitled “Establishing a coastal resilience and economic development program.”⁵ The law without signature funds resilience measures for ten years. The law directs NHDOT to consider response actions to impacts to state highways and properties by sea level rise, storm surge, and extreme precipitation events. The law also directs NHDOT to establish procedures to redesign and reconstruct highways damaged by these events and to coordinate implementation with impacted communities, businesses, planning commissions, and corresponding departments. The law gives municipalities authority to unify and create revitalization districts and creates a coastal resilience and cultural and historic reserve district, fund, and commission.

Next Steps

NHDOT will continue the log jam monitoring project along Route 16. Additionally, the agency will continue to improve its culvert sizing to reflect bank-full width and accommodate larger water flows.

Resources

- **NHDOT’s Website:** <https://www.nh.gov/dot/index.htm>.

This website links to relevant resources such as resilience webpages and resources, partnerships, and publications.

- **Green Infrastructure Pilot Project in Maine and New Hampshire:**
https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/northeastern/.

An August 2018 report detailing a Federal Highway Administration, Maine DOT, and NHDOT resilience pilot project to consider potential of nature-based solutions in Maine and New Hampshire.

- **October 2018 NHDOT Audit Report:** <https://bit.ly/3aagsq5>.

NHDOT developed an audit report of Senate Bill 452.

- **Resilience Project – Log Jam Monitoring:**
<https://rip.trb.org/View/1568550>

The Transportation Research Board’s Research in Progress database includes an abstract and link for more information on NHDOT’s engineered log jam natural bank stabilization project along Route 16 in Errol, New Hampshire.

Transportation Resilience and Durability Case Study Series

The Federal Highway Administration is developing a series of case studies exploring resilience and durability efforts at transportation agencies across the United States. The case studies are developed through in-depth interviews with a geographically diverse range of transportation agencies. These case studies explore how resilience and durability factor into various phases of transportation decision-making, the scales and types of resilience and/or durability projects at the agencies, and the types of resilience addressed.

⁵New Hampshire Senate. August 5, 2019. Senate Bill 285. <https://legiscan.com/NH/text/SB285/id/1878371>.