ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Flood and Geologic Hazards

Floods are the most frequent and costly natural disaster that occurs in New Hampshire. While the floodplain adjacent to every Granite State river is prone to flooding, the steep terrain in much of the state means that rivers and streams themselves can change, through the processes of erosion and channel migration. New Hampshire has endured multiple flood events in recent years that have washed out culverts, undermined bridges and roads, and eroded streambanks. During winter, the state's rivers are also prone to the formation of ice jams. These ice jams have created flood issues and risks in several locations during the past three years.

In response to these flood hazards, the New Hampshire Geological Survey (NHGS) continues to focus its expertise to address flood events and the potential for river erosion, streambank failures, stream crossing washouts and ice jams. The power of running water can alter the landscape in ways that cannot be readily predicted before they occur.

Floods pose inundation risks to properties and infrastructure in floodplains adjacent to rivers, but there is also danger from sudden channel scouring and riverbank collapse, bridge abutment failure and culvert washouts, or even wholesale changes in

the course of rivers. The risks are highest during active flood events, when rivers and streams, with high velocities, have the greatest ability to erode and shape the streambeds and banks, particularly in steeper terrain north and west of Concord. The most dramatic kind of erosion event, known as an "avulsion," occurs when a river cuts through one of its banks and erodes an entirely new path, usually abandoning its old path in the process. Such an event occurred on the Suncook River in the Town of Epsom during the Mother's Day Flood of 2006 when Huckins Mill Dam and Bear Island were bypassed by a new channel that cut through an area of wetlands and a working gravel pit. When sudden changes of a river occur, or infrastructure such as stream crossings fail, the effects on property owners and natural ecosystems can be long-lasting.

Flooding in the News

While flooding in New Hampshire does not typically gain the national media attention that other states receive, flood issues do occur on a regular basis. In recent years, the South Branch Piscataquog River at New Boston has had concerns with ice jams, a phenomenon which also occurs on the Pemigewasset River at Plymouth and Holderness. Both of these sites have had ice jams annually since 2017. Any location in the state directly adjacent to a river or coastline can experience flooding and potential erosion. Besides impacts to buildings and infrastructure in floodplains, recent damage has been greatest where bridges and culverts were unable to convey flood flows, enhancing erosion; or where channel constrictions have led to material deposits that reduce the capacity of a river or stream to convey flood flows, or enhance ice jam formation and attendant flooding.

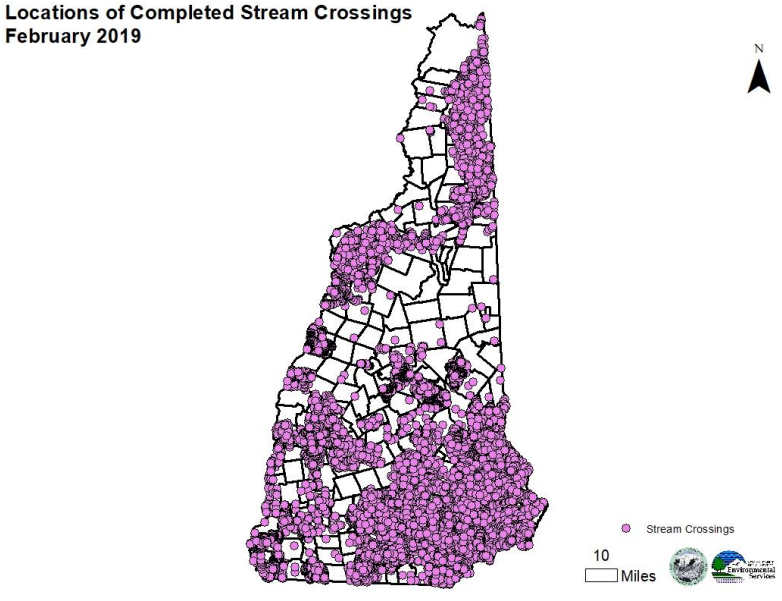
New Hampshire has experienced continual reminders that brooks in small watersheds can flood and cause clogged culverts and erosion damage if the right ingredients come together. In 2018, a succession of three thunderstorms produced 4 inches of rain in 90 minutes in the Dublin and Harrisville areas. A year earlier (2017), multiple culverts failed in Grafton County when they could not convey the flows created by a summer thunderstorm complex. Later in 2017, program staff responded to concerns from the October storm, including the Shelburne area (photo of effects at left).

NHGS continues to be contacted by units throughout state government, towns and cities, and the public regarding the river and stream processes that are creating these concerns throughout the state.

Town and city officials, and citizens, in New Hampshire have become increasingly aware of their vulnerability to flood and river hazards and the need to plan accordingly. NHGS, in partnership with units throughout the New Hampshire Department of Environmental Services (NHDES) and other state and federal agencies, performs assessments of rivers and streams at sites of concern in the state and provides results to state agencies, and towns and cities, via maps and reports. NHGS' recent flood data collection efforts have been focused on stream crossing (culvert) assessments, and in local site evaluations, in support of state agencies, towns, and cities, related to flood hazards, as needed.

Data Collection and Assessments to Support Flood Hazards and Mitigation

Fluvial geomorphology, a science that examines how river processes shape the landscape near these landscape features, contributes both to flood hazard mitigation and broader rivers management. Both New Hampshire and Vermont have led efforts to incorporate fluvial geomorphology science into decision-making at the state level. New Hampshire's efforts have focused on stream crossing and local site assessments, to understand site condition and assist in making sound management decisions. New Hampshire's stream crossing efforts initiated by an event in October 2005, when a blocked culvert catastrophically failed in Alstead, resulting in extensive damage and the loss of seven lives. After this event, New Hampshire began to focus efforts on conducting stream crossing assessments, in order to identify crossings that pose future public safety risks and to prioritize crossings most in need of replacement. Culverts not sized properly for the streams that flow through them can cause erosion directly downstream and prevent fish from migrating to points upstream, impacting watershed-based aquatic habitat.



To address these concerns, four state agencies, including NHDES, the New Hampshire Department of Transportation, Fish & Game, and the Department of Safety, Division of Homeland Security and Emergency Management, have partnered to manage New Hampshire stream crossing assessments. The State of New Hampshire has modified a stream crossing assessment protocol, initially developed in Vermont, for its own use. Since 2009, a total of 7,680 crossings (about 45% of the known total) that have been assessed statewide using this protocol, are present in the statewide stream crossing database (figure left). Of this number, 2,547 have been assessed by NHGS staff and interns. NHGS also provides training to all data collectors statewide and performs

quality assurance review on all collected stream crossing data in the state. Finalized data is placed into a scoring tool which ranks crossings (especially culverts) for their compatibility with river form and process (geomorphic compatibility; figure below right). Once data passes NHGS quality review, they become publicly available in real-time, complete with the geomorphic compatibility scores, and photos, in collaboration with the NHDES Wetlands Bureau (Aquatic Restoration Web Mapper; link provided below). Towns and cities can use the culvert data, combined with other information in the Aquatic Restoration Web Mapper as a guide to prioritize those crossings most in need of retrofit or replacement and to support requests for funding to address these issues.

Category Name	Screen Score	Threshold Conditions	Description of structure-channel geomorphic compatibility
Fully compatible	20<GC≤25	n/a	Structure fully compatible with natural channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. A similar structure is recommended when replacement is needed.
Mostly compatible	15<GC≤20	n/a	Structure mostly compatible with current channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. Minor design adjustments recommended when replacement is needed to make fully compatible.
Partially compatible	10<GC≤15	n/a	Structure compatible with either current form or process, but not both. Compatibility likely short term. There is a moderate risk of structure failure and replacement may be needed. Re-design suggested to improve geomorphic compatibility.
Mostly incompatible	5<GC≤10	% Bankfull Width + Approach Angle scores ≤ 2	Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.
Fully incompatible	0≤GC≤5	% Bankfull Width + Approach Angle scores ≤ 2 **AND** Sediment Continuity + Erosion and Armoring scores ≤ 2	Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.

Beyond stream crossing assessments, given requests from state government units and municipalities, NHGS staff has increasingly focused on providing site-specific assessments and interpretations that directly address the particular flood-related concerns of local emergency management officials. NHGS employs its scientific expertise to identify the potential for erosion and streambank failures to cause damage to property and infrastructure, and to assist municipalities in preparing for and responding to flood events. Also, in partnership with the NHDES Dam Bureau, NHGS provides technical advice and assistance to towns and cities in their efforts to deal with ice jams. Such assistance is periodically provided in concert with the New Hampshire Silver Jackets, for which NHGS is the lead. The Silver Jackets is part of an Army Corps of Engineers initiative to bring together state and federal agencies to offer municipalities technical assistance in flood risk management and reduction.

Stream Crossing Data Access

Final stream crossing data are available by accessing the Aquatic Restoration Web Mapper, located at http://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=21173c9556be4c52bc20ea706e1c9f5a.

More information

For more information about stream crossing and flood hazards assessment efforts in New Hampshire, contact Shane Csiki, Ph.D., CFM, Flood Hazards Program Administrator at the New Hampshire Geological Survey, NHDES, at (603) 271-2876, or by email: Shane.Csiki@des.nh.gov.