Floodwater Clearance

The importance of adequate clearance to the 100-year flood level is critical. In New Jersey, the minimum standard for bridges is 1-foot clearance to the 100-year flood level. Subsequent to canoeing the Pochuck Creek several times, it became very evident to the project engineer that the Pochuck Creek has a chronic log jam problem. There are no less than 27 major log jams upstream and downstream of the Pochuck Quagmire Bridge. Some of these log jams are so extensive that they have developed their own ecosystems complete with soil and vegetation. These log jam dams also act to raise the flood levels by obstructing flow. It became obvious that a 1-foot clearance to floodwaters would be insufficient to pass floodwater carried debris, especially trees! The clearance to the 100-year flood level of the Pochuck Quagmire Bridge at the creek centerline is 6.68 feet and 4.5 feet at the platforms at either end. This is indicated on Plan Sheet 1. The walkway is approximately 12 feet above top of bank. Due to its location in a broad, level, open valley, the Pochuck Quagmire Bridge appears unusually elevated; however, it is not. The field inventory of similar structures showed that a 14-foot clearance to the normal water level was typical. However, most of the bridges are in narrow valleys where the steep side slopes make the bridge look diminutive. The Pochuck Quagmire Bridge only appears excessively elevated by virtue of its location in relation to visual landmarks.

The importance of proper floodwater clearance is emphasized. Floodwater driven debris is the most frequent factor in the destruction of such bridges. Suspension bridges are susceptible to floodwater damage as the strength of the bridge is parallel to the axis of the cables not with the direction of the river. The history of trail bridge destruction and associated deaths, which the author is aware of, due to floodwaters is lengthy. The following are known cases:

- 1973 Appalachian Trail Clarendon Gorge Suspension Bridge in Vermont destroyed - 1 death.
- 1973 Deerfield Creek Suspension Bridge in Vermont destroyed.
- 1973 Schoolhouse Road Suspension Bridge in Vermont destroyed (30 feet clear of river).
- 1995 Wilson Creek Suspension Bridge in North Carolina - 2 deaths.
- 1995 Hastings Trail Suspension Bridge, Wild River, WMNF in Maine, destroyed - $142,675 replacement cost.
- 1996 January 20th snow meltdown and ice jams damaged the Winooski Wonder Suspension Bridge and three other snowmobile suspension bridges in Vermont.

Proper clearance to floodwater is critical!

The Wilson Creek Bridge destruction is especially tragic. Wilson Creek is located in Caldwell County in western North Carolina. In mid-January of 1995, a Scout Troop from Atlanta, Georgia, was camping in Pisgah National Forest. Four to nine inches of rain fell over the weekend causing extensive flooding. Three scouts were crossing a private suspension bridge when the bridge dipped under their weight. The torrent tore the bridge from its foundation and swept two of the scouts to their death.

The Hastings Trail Bridge in White Mountain National Forest highlights the destructive power of floodwater driven debris. On October 22, 1995, Hurricane Opal dropped up to 10 inches of rain in Vermont and New Hampshire. The Wild River drains the eastern slope of the White

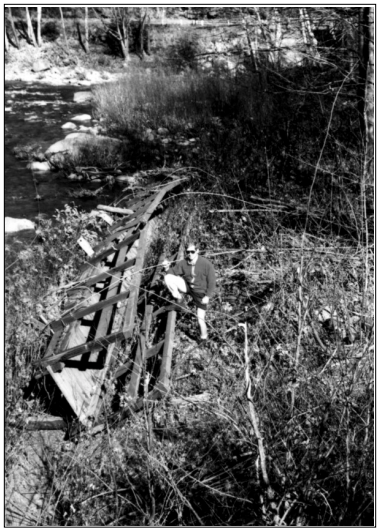

Photo 52. Tibor Latincsics and remains of the Hastings Trail Suspension Bridge. *Photo courtesy of Mr. Tibor Latincsics.*

Photo 53. The timber towers were sheared at the base by floodwater driven debris. *Photo courtesy of Mr. Tibor Latincsics.*

Photo 54. Hastings Bridge walkway remains flung downstream. *Photo courtesy of Mr. Tibor Latincsics.*

Mountains. In this case, the floodwaters picked up an old logging bridge and carried it downstream. The Hastings Trail Bridge was a 180-foot suspension bridge with a 17-foot clearance to the normal water level of the Wild River. However, the logging bridge snagged on the low hanging wind guys of the bridge. The impact force and hydrodynamic loads sheared the bridge towers at their base. Twenty-thousand pounds of buried concrete deadmen were plucked out of the soil and flung 200 feet downstream. Proper clearance to floodwater is critical!

The Hastings Creek Bridge was reconstructed in the Fall of 1997, to USDA Forest Service specifications. The new 180-foot bridge has a clear travel lane dimension of 5.5 feet to allow snowmobile traffic. There is a paved road directly to the site. The original tower foundations were reused. The replacement cost for the bridge superstructure by a professional contractor was $142,675.

Identifying the 100-Year Flood Level

Identification of the 100-year flood level can be made one of several ways. The project engineer investigated every option. Within the State of New Jersey, most major watercourses have had a hydrologic and hydraulic study performed by the NJDEP Flood Study Section. This was the first place to look to determine the 100-year flood level. Studied watercourses are known as delineated watercourses, and they have recognized 100-year flood levels. The Pochuck Creek is probably the largest non-delineated watercourse in New Jersey. There is no NJDEP recognized flood level data. The second step was to check the Federal Emergency Management Agency (FEMA) Flood Insurance maps. The Pochuck Creek is also an unstudied FEMA watercourse, although the FEMA maps indicated a 100-year flood elevation of 400 feet above sea level based on the highwater mark of floods dating to 1937. The Army Corps of Engineers did not have any specific flood data for the Pochuck Creek.

The last resort was to perform a Hydraulic Engineering Center-II (HEC) analysis. A downstream gauging station provided the stream flows for the 2-, 10-, 25-, and 100-year storms. The HEC-II computer analysis models stream flow through a channel and overbank reach as steady open channel flow. Among the results are the water surface elevation and velocity of flow. The project engineer performed this analysis to check if