



## Ice jam flood risk reduction strategies

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Flood risk reduction measures for urban areas in commonly address floods associated with riverine flooding and coastal storm surges of various origins. However, all too often in the northern United States, floodplain management plans and natural hazard mitigation response plans do not account for the increased flood stages associated with ice jams, even though ice-induced floods can occur on a time scale comparable to flash floods arising from extreme precipitation. Additional ice impacts, including structural damage, geomorphological and sediment transport, and environmental effects, can impact the implementation of emergency response plans as well as causing considerable damage. The denser and generally more valuable residential, commercial, industrial, and infrastructure development in urban areas is particularly vulnerable to the combination of water, ice, and cold temperatures associated with ice jam floods. Unfortunately, since ice jams are generally highly localized compared to open-water riverine floods, damages at each location are often insufficient to justify conventional flood-control measures such as dams and levees. As the major provider of planning, engineering, and construction for flood and coastal storm damage reduction measures in the United States, the U.S. Army Corps of Engineers has taken the lead in developing ice jam mitigation and control measures. Following over thirty years of research and development in the area of ice jam mitigation and control, they have developed a number of innovative, low-cost, environmentally acceptable ice jam hazard risk reduction measures. This paper presents state-of-the-art ice jam flood risk strategies suitable for implementation in urban areas and current measures under development.