

Flash Flood Threat Mitigation Efforts in Bangor, Maine



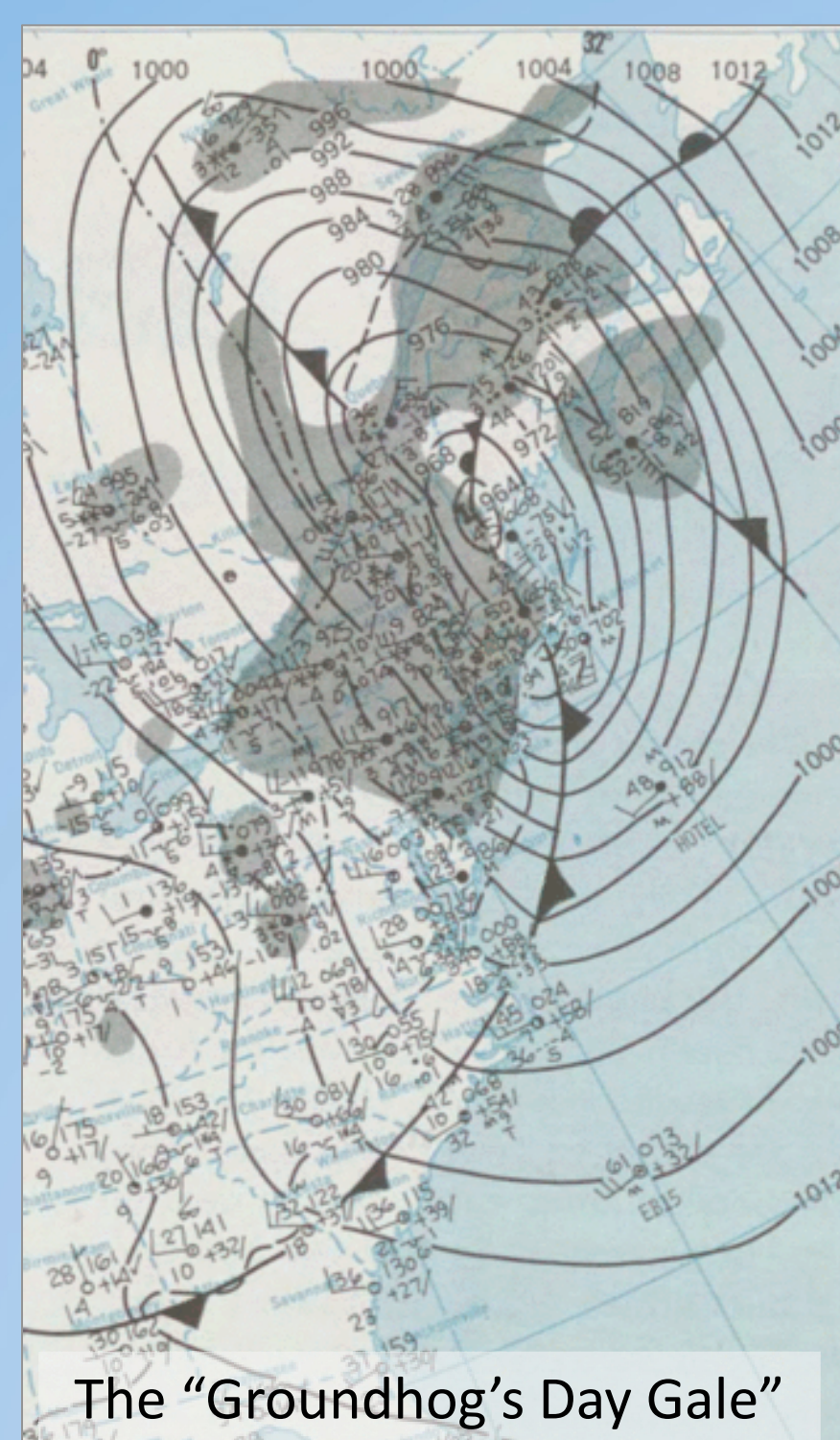
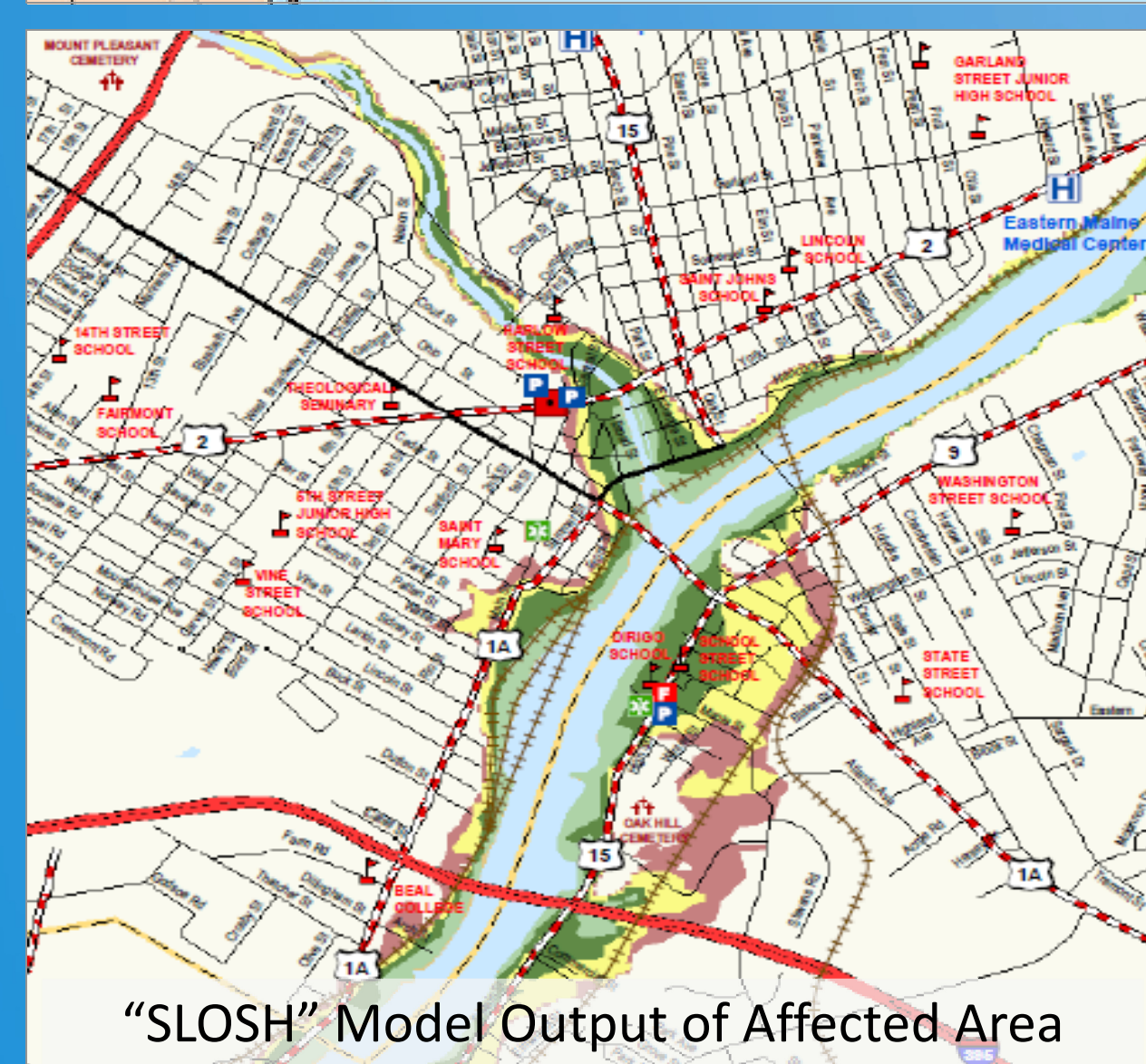
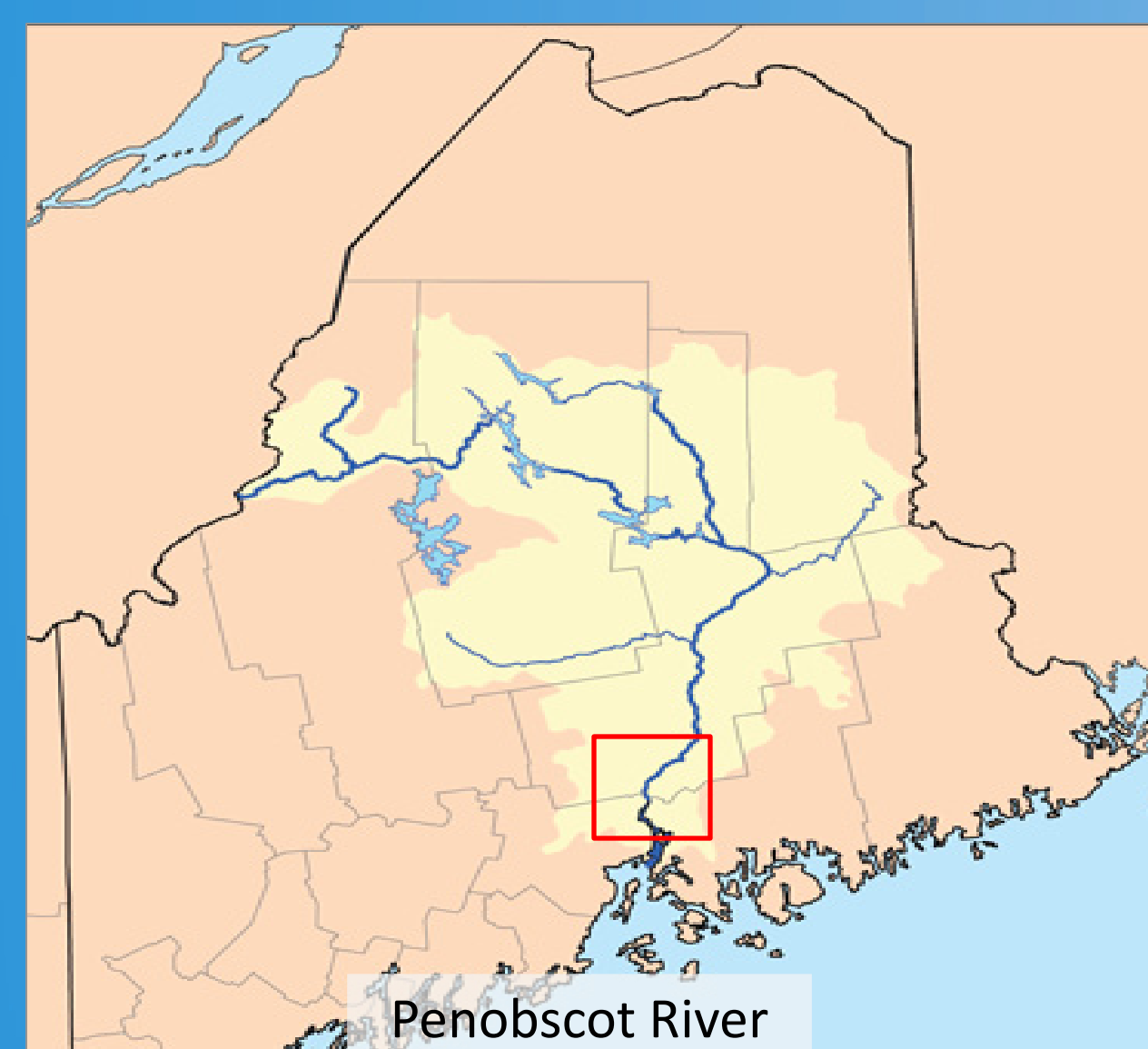
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Abstract

The National Weather Service Forecast Office in Caribou, Maine is responsible for forecasting high impact weather scenarios over its area of responsibility. One of the most challenging of these high impact weather scenarios is flash flooding during reverse tidal surge flooding, known as RTF, events along the Penobscot River, specifically in the downtown commercial district of Bangor, Maine. This poster will outline the problems created by RTF in the Kenduskeag Plaza area of Bangor, discuss the potential impacts of RTF and detail the ongoing and evolving threat mitigation efforts in this arena.

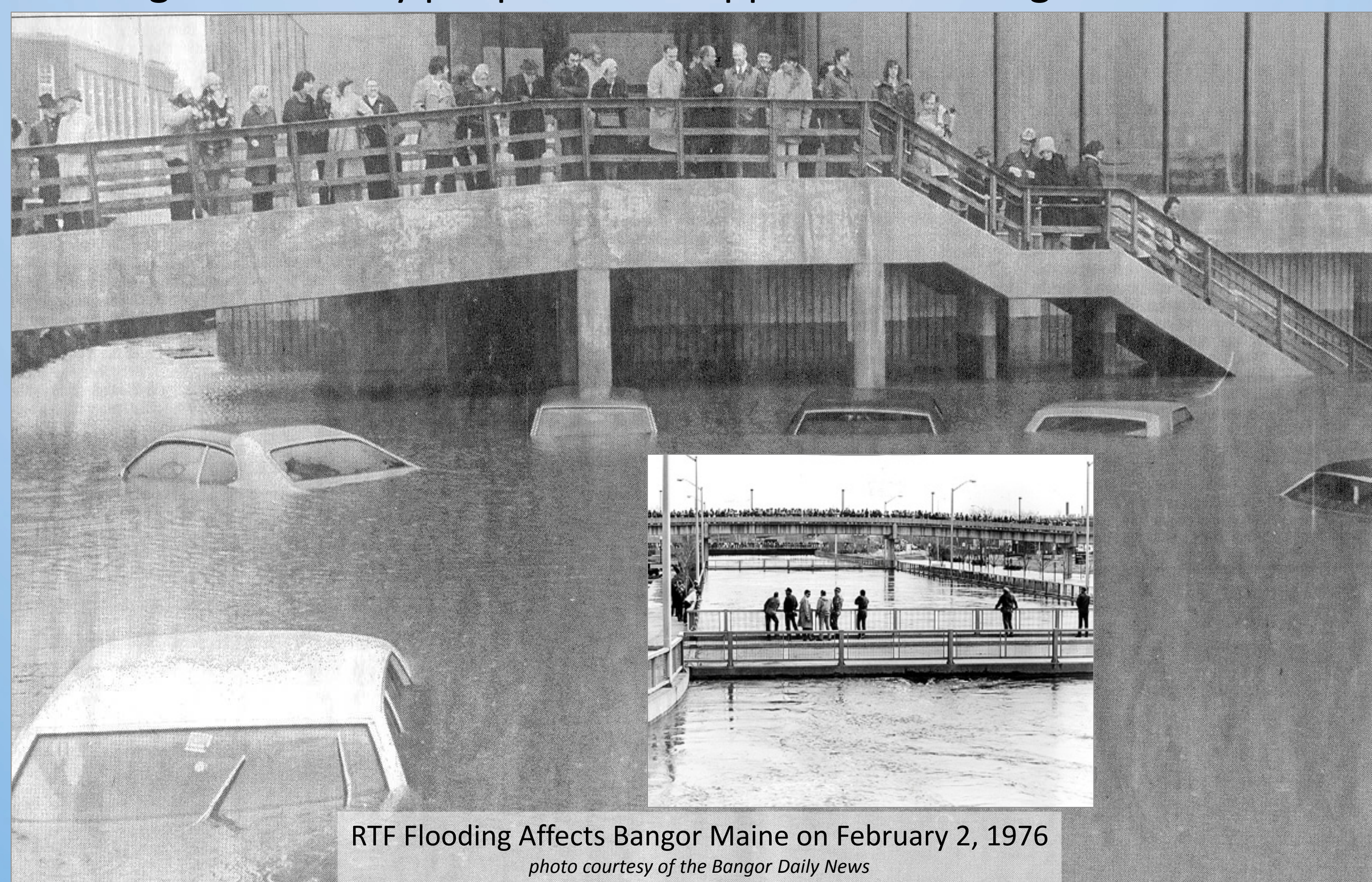
Problem

Reverse tidal flooding (RTF) manifests itself when a strong coastal storm moves inland from Penobscot Bay parallel to the Penobscot River. When these storms occur in conjunction with elevated river levels and/or high tide, flooding can occur as water is pushed inland and up the river basin. RTF events in Bangor, Maine are a grave threat to life and property and have caused millions of dollars of damage in the past. RTF events in downtown Bangor are not uncommon. Over the years, WFO Caribou has gained expertise at recognizing the pattern of events that may lead to reverse tidal flooding along the Penobscot River. This pattern recognition alone has not been sophisticated enough to provide the timely and quantifiable prediction of these events to our affected customers. A program that provides a full spectrum of hydrometeorologic observations, event modeling, timely forecasts and event verification was needed to provide Bangor city officials and emergency managers with the tools necessary for the protection of life and property.

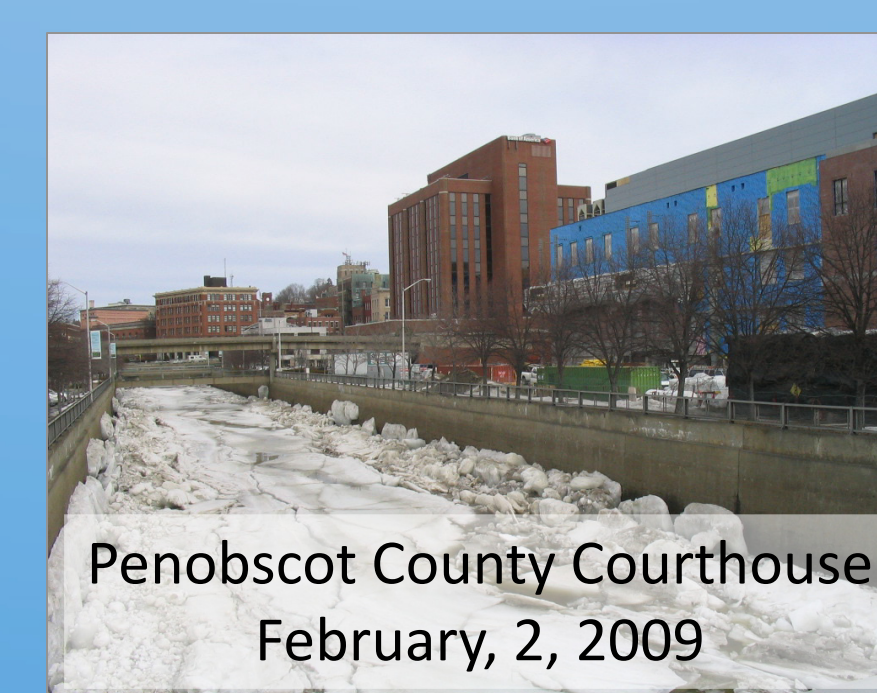
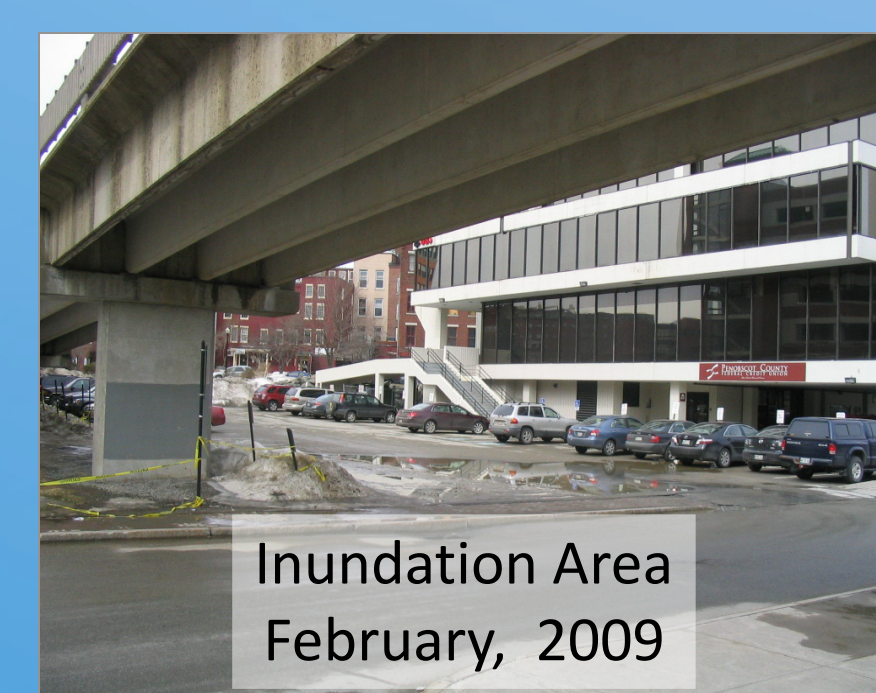


The "Groundhog's Day Gale" of 1976

The best illustration of the dangers of RTF was on February 2nd, 1976. An intense storm, now known as the "Groundhog's Day Gale", skirted just west of the Penobscot River. This storm was accompanied by winds of up to 115 MPH, waves to 14 feet and a storm surge of 5 feet along mid-coast Maine. This storm surge was amplified as it was pushed up the Penobscot River nearly 20 miles, from the Penobscot Narrows toward Downtown Bangor. This wave struck Bangor at 11:15 AM, just over one hour before high tide. The water was estimated to have risen at a rate of one foot per minute, quickly inundating businesses, roads and parking areas to a depth of over 12 feet, more than 17 feet above bankfull and 10 feet above the predicted high tide level. More than 200 cars were submerged and many people were trapped in the rising water.



Other instances of RTF flooding, only at much lower amplitude, were observed November 2005, April 2007, December 2009 and January 2010. Unfortunately, civic expansion continues in the Kenduskeag Plaza to this day, placing more and more people at risk during RTF events.



Impact

Solution

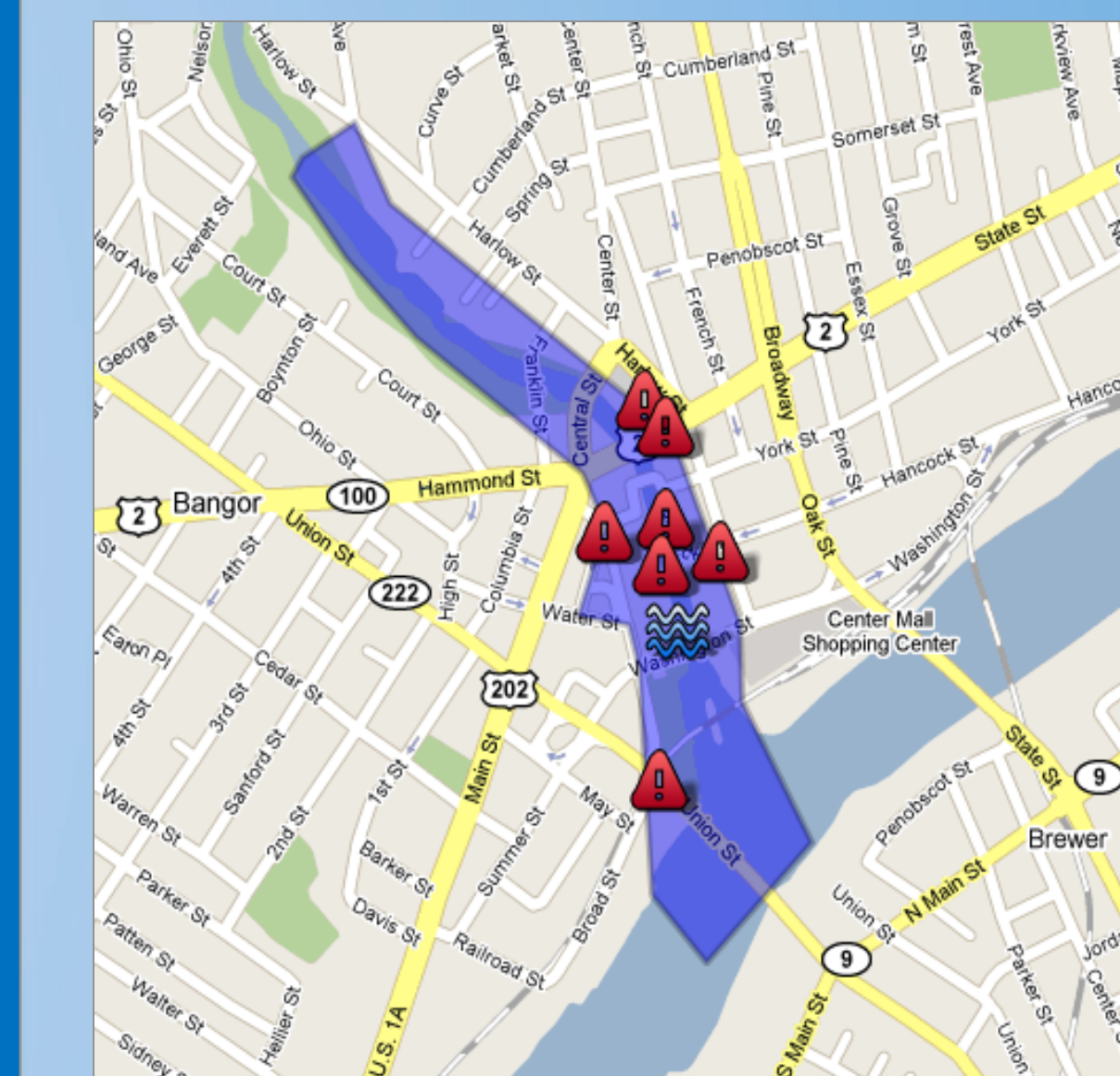
Flash Flood Threat Mitigation Actions

Step 1, Organize Resources

- Inform and educate the affected community.
- Coordinate various agencies.
- Integrate with existing efforts.
- Recruit interested parties and those with the skills required.
- Focus on success!



Step 2, Assess Risk



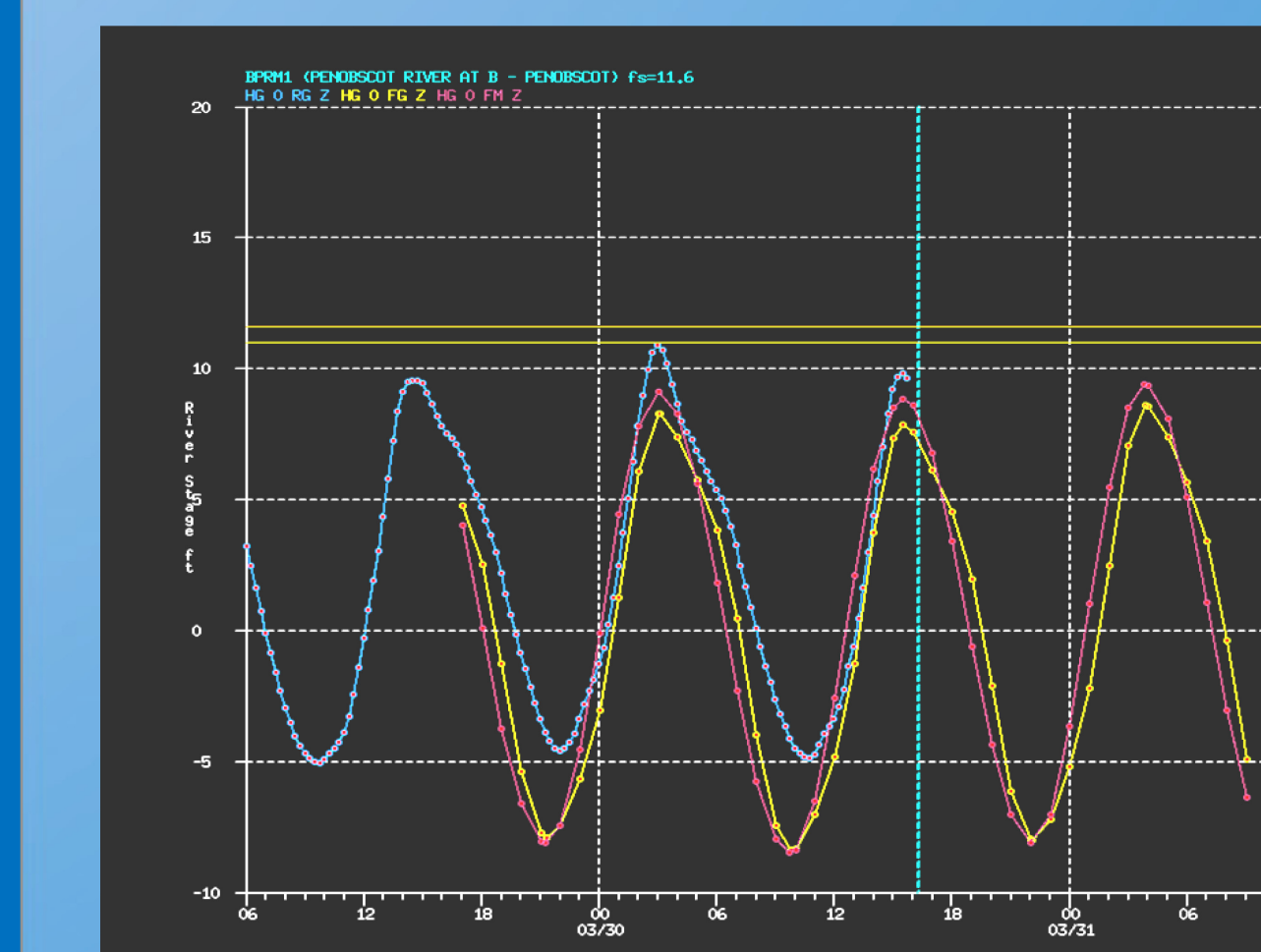
- Identify hydrometeorological factors that may lead to RTF.
- Profile historical events to determine extent of threat.
- Work with local officials to identify additional hazards and access vulnerabilities.
- Determine "cost/loss" of action vs. inaction.
- Collaborate with various stakeholders.

Step 3, Develop Plan

- Identify potential funding sources.
- Identify partner/sponsor agencies.
- Open channels of communication beyond typical NWS channels.
- Develop local policies, procedures and techniques to convey information to decision makers.



Step 4, Implement Plan and Monitor Progress



- Adopt and implement the plan.
- Confirm and clarify responsibilities.
- Evaluate efficacy of the plan.
- Decide what works and what doesn't.
- Make revisions as needed.
- Celebrate success!

References

Federal Emergency Management Agency. (9/11/2009). *Hazard Mitigation Planning Overview*
Morrill, R.A.(1977). *Maine Coastal Flood of February 2, 1976*
Turner, M.A. (2007). *Reverse Tidal Flooding on the Penobscot River in Bangor, Maine*