vantage point

Past and Future in a More Frequently Inundated World

In April, I traveled to The Ocean State of Rhode Island to attend a different kind of conference. Organized by the Newport Restoration Foundation, the four-day meeting was entitled, "Keeping History Above Water." While the historic host city is imminently—and currently—under siege by rising seas, there were historic preservationists, architects, engineers, and others from all across the country concerned about saving heritage sites. Despite the title of the program, the subject matter applied to more than just saving historic buildings and sites from rising waters and changes in weather patterns, being relevant to more than just those particular cultural assets.

Newport's lively waterfront is both a blessing for income and aesthetics, and a curse for managing floods.

Like nearly any locale with "port" in its name, Newport grew up around a sailing tradition, with merchants and fishermen making this a busy site along the Atlantic Coast. Naturally, businesses and homes arose nearby to serve and house those who worked the docks. As often also happens, a goodly portion of the current-day port is built on fill to accommodate developmental demands.

Fast forward a few centuries, and we see those structures (now categorized as historic but still in very active use) are now suffering from increasingly inundated basements and flooded streets—even several blocks in and on a slight rise from the current waterfront. In one area I visited, sump pumps run 24/7. The basements filled and overflowed during Superstorm Sandy, and "nuisance" street flooding is an increasingly common event.

If proximity to water was part of their *raison d'etre*, do we lose historic context and character when we either elevate or relocate structures? Are there other ways to save them from the relentless advance of the sea and rise of groundwater? That was at the heart of the meeting, primarily focusing on coastal towns, but pertinent to every part of the country. What are the social and economic impacts of whatever adaptation we choose to implement?

One enormously expensive but possible approach is to raise the entire streetscape: road, infrastructure, lots, and buildings. Variations of this actually have been done—to a highly limited degree, of course—especially where infrastructure really matters, as when it serves as the only escape route. In 2004 Congress authorized $2 million to reconstruct and elevate Sea Isle Boulevard in Cape May County, New Jersey as a high priority project under the Transportation Equity Act. In late 2014 the estimated 6-year, $12.7 million project finally got underway to raise this connector between the mainland and the barrier island 4.5 feet to allow it to function during floods.

But is that even high enough? While scientists may not agree on the amount of sea level rise, they do agree on significant increases by 2100. Rough cumulative estimates from those who study climate, or glacial stability, or ocean warming, range from 3 to 7 feet in that time frame, with variations in different parts of the world (and even in the US). Inundation mapping, available from many websites including NOAA, USGS, and *geology.com/sea-level-rise*, provide shocking visual impact of disappearing coastal and inland areas due to incrementally rising water levels.

How about "amphibiating" buildings? One of the speakers in Newport researched that prospect here in the United States and found that structures have been rising and lowering with changing water levels in some parts of Louisiana for 40 years. These are riverine areas, where foundations need only rise and descend without having to withstand sideways buffeting by tides. Elizabeth English (currently of University of Waterloo School of Architecture in Cambridge, Ontario) studied those homes, and initiated the Buoyant Foundation Project (BFP) to promote a low-cost approach to such housing. The simplified

On a hill in Philadelphia, a sign warns of flooding due to historic burial of streams, combined sewers, and too much impervious surface.

explanation is that a fixed outer foundation houses an inner floatable foundation, so when the outer one fills with water, the inner one rises, keeping the building's interior dry. BFP has presented hybrids in which the lowest floors float but not the whole structure, keeping the overall building height fixed. FEMA currently does not credit any variants of floating structures toward lowering flood insurance premiums because they are not permanently elevated. Dr. English has hope that will change.

I joined a session of "Game of Floods" developed by Marin County, California. Given a community with a power plant, a section of historic homes, neighborhoods of residences and shopping centers, sea level rise, and limited resources, what would you protect first, and how? If historic coastal buildings are sacrificed, tourism suffers. If groceries and other stores relocate, residents have to travel a long distance for basic necessities. If roads along the shoreline erode and sections are closed, evacuation route planning becomes more difficult as fewer remaining roads must handle the full burden. Can alternate sources of energy replace the power plant?

There are no easy answers to any flooding scenario, but talking with people from other backgrounds is a good way to grasp different nuances of proposed solutions. ■

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