Dewberry Takes on Sea Level Rise Challenges for Vulnerable Communities

Consulting engineering firm Dewberry has developed a strong position in the emerging climate change adaptation and resilience market based on its long history of hazard risk assessment, mitigation planning and engineering. Brian Batten, senior coastal scientist and technical leader, estimated that 10 to 12 of Dewberry’s 2,000 staff are engaged with climate change on a regular basis.

“We have a core group of people who are working on climate change on a daily basis,” Batten told CCBJ. “Our scientists or engineers are applying our skills in considering climate change across our practice areas, especially in support of coastal flooding and transportation” said Batten, who has a doctorate in coastal oceanography. “In support of our clients, we are also working to integrate resilience principles, including climate change, into all areas of Dewberry’s services.”

Recent and current projects incorporating climate change include leading pilot efforts for FEMA to develop an advisory sea level rise project, assisting the Transportation Research Board in creation of future climate hazard information and an adaptation guidebook for the nation’s airports, developing future floodplain maps for New York State, and leading the City of Virginia Beach’s Comprehensive Planning Study for Sea Level Rise and Recurrent Flooding.

The five-year project for Virginia Beach will include “a comprehensive risk assessment of community assets to future flood conditions, which will be used to inform the development of an array of adaptation actions,” according to Dewberry’s April 2015 news release. Dewberry will evaluate the feasibility and cost-benefit ratios of multiple strategies “to improve flood resilience and help to ensure the long-term sustainability of Virginia Beach.”

“The risk-informed approach that we are applying will allow the city to understand what strategies will perform best so they can apply the appropriate planning, design and infrastructure improvements to adapt to sea level rise anticipated over the next 50 years,” said Batten.

While Dewberry’s fee hadn’t been determined at CCBJ’s deadline, the city council has budgeted $3 million “to specifically identify the potential impact of SLR” and develop a Comprehensive City Response Plan to SLR and recurrent flooding, led by Dewberry, according to the city’s response to an inquiry from Moody’s Investor Services.

Moody’s June 2015 report on sea level rise and recurrent flooding in low-lying Hampton Roads region underscores the region’s challenges. Its economy is tied to its vast natural harbor, home of the world’s largest naval base, Naval Station Norfolk. Sea level rise combined with development and subsidence puts Virginia Beach, Norfolk, Hampton, Newport News and other coastal towns—not to mention Naval facilities—at increasing risk of flooding during storms and high tides.

The Hampton Roads Planning District Commission recently ranked “rising sea levels and other potential impacts of climate change” as one of seven major threats to the region’s economy. (The others: slow growth for the ports; decrease in DoD spending; continued deterioration of infrastructure; competition from other states for military bases; lack of high-speed broadband; and lack of a regional water strategy.)

Climate change also figures in the “Opportunities: Objectives, Strategies and Actions” section of HPRDC’s September 2015 Regional Economic Development Strategy. Specifically, developing long-term adaptation strategies; and utilizing the region’s modeling and simulation industry to develop tools to support leaders in developing these strategies.

“The communities in the Hampton Roads region know they have an issue. They’re already feeling the effects of sea level rise with more frequent floods and floods caused by spring tides or small coastal storms. These kinds of things weren’t happening 30 to 50 years ago,” said Batten.

“Virginia Beach doesn’t have as big a problem as Norfolk, although they do have certain neighborhoods where they experience regular flooding, primarily from decreased performance of the stormwater system, and that was not an issue 20 years ago,” said Batten. “That’s why it’s so high on their radar. They have good observational records, and they know these events have become worse and a lot more frequent.”

Mapping the coming floods

In a climate change services contract with the New York State Energy Research and Development Authority, Dewberry is “developing future floodplain maps for all lower New York, except for the city,”
said Batten. “Most studies have focused on inundation or changes to the regulatory floodplain. Here, we’re looking at everything from the 10-year floodplain to a 500-year floodplain.”

Batten and his colleague Mat Mampara made a presentation about the study at the June 2015 Association of State Floodplain Managers annual conference. Study results show the enormous amount of valuable and densely populated coastal real estate that will be at risk from coastal flooding for the Hudson Valley and Long Island.

The study leveraged FEMA flood hazard data and state-adopted sea level rise scenarios to “illustrate future flood hazards across a wider spectrum of flood events,” said Batten. In broad strokes, sea level rise will cause the 10-year floodplains to expand at one and a half to two times the rate of the 100-year floodplain, said Batten. “Those areas have almost a 100% probability of flooding over a typical 30-year mortgage duration. We think that’s a huge area for future hazard mitigation interest.”

A key challenge for the study—and a priority area for future research, Batten believes—is getting the most out of the limited amount of modeling that research budgets usually allow. Without detailed modeling, it’s especially difficult to predict the non-linear impacts of sea level rise that depend a great deal on topography and changes in land use and development.

**Making the most of precious modeling dollars**

“We’ve seen a lot of studies that simply raise up the water level like a bathtub and assess risk and vulnerability,” said Batten. While Batten says research has shown that this is a good approach for low sea level rise scenarios of 0.5 meters or less, “it’s the higher, end-of-century scenarios where non-linearity really increases.”

“Most of that non-linearity comes in back bay areas where you start to see changes in the pathway, from overtopping of structures, barrier islands or from where marshes go away,” said Batten. “Also, wave effects introduce another component of non-linearity.”

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- Brian Batten, Dewberry

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Potential changes to the landscape also must be modeled. “When we look 50 to 75 years into the future, we can’t just model the water levels because the landscape is not going to be the same, and that will have important effects on flood propagation,” said Batten.

But numerical modeling to render useful future flood risk maps is expensive. Without applying sophisticated modeling, a community can do a “broad-brush vulnerability assessment using linear superposition” for fee amounts less than $50,000, depending on complexity,” said Batten. “If you have to start doing a significant amount of modeling, the cost of the effort can easily double or triple. Given the uncertainty in the projections, in many cases bathtub approaches are a great tool to inform adaptation planning.”

FEMA commissioned RAMPP, a joint venture of Dewberry and URS (subsequently acquired by AECOM) to perform an initial proof-of concept study in Puerto Rico, and a follow-on pilot study in Florida to develop a “sea level rise advisory layer.” The product is envisioned to be non-regulatory and is designed to inform communities about future changes to their coastal flood hazards to guide adaptation planning. Dewberry has served as the technical lead of these efforts.

The pilots themselves will compare detailed modeling to approximate methods, and work to inform needs for broader production. “We’re trying to look at some of the modeling we’ve done to determine when, and in what environments does sea level rise result in flooding becoming non-linear,” said Batten. “And is it somewhat consistent from one geography to another, or is it completely site-specific?”

“What FEMA is trying to figure out is, if we have to produce this information in the future, how should we produce it?” said Batten. “At what point can we just use simple approaches and at what point do we have to do modeling? And how much modeling do we have to do to produce information that’s reliable for some decision-making and that we can stand behind?”

AECOM and Michael Baker are running a similar FEMA pilot effort for San Francisco. This effort is focused on West Coast hazard conditions and is assessing how wave run-up, overtopping and coastal erosion are affected by various scenarios of sea level rise.

**Communities find the money**

As Batten reflected on the local government clients his firm has assisted with climate change work, funding for the efforts come from a wide variety of sources, including grants from NOAA, EPA, state coastal zone management funds, or municipal budgets.

As discussed in the page one overview to this issue, a typical baseline project is a broad community risk and resilience study or a coastal resilience study, with a budget typically on the order of $25,000 to $50,000. “Many of these efforts are being funded by NOAA grants, or post-Sandy resiliency dollars” said Batten.
Other Dewberry climate resilience projects include “everything from looking at specific municipal infrastructure to broader flood risk vulnerability and mitigation projects and specific shoreline protection projects,” said Batten. “We’ve seen an array of different scopes, but all steps in the right direction of improving resilience.”

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