MEMO TO: Craig Hurless, Planning Board Engineer, City of Cape May

FROM: Technical Team for NJDEP's "Building Ecological Solutions for Community Coastal Hazards" program

RE: Ecologically Based Coastal Hazard Mitigation Strategies

DATE: September 8, 2017

Thank you for the opportunity to assist Cape May City in advancing ecologically based strategies to mitigate the impacts of coastal and tidally influenced flood hazards. Our assistance is offered through the NJDEP Office of Coastal and Land Use Planning's "Building Ecological Solutions to Community Coastal Hazards" program*. This memorandum summarizes our recommendations to the Borough for the sites and issues presented to our team in December 2016. Please share it with the other meeting attendees from the City and with your Mayor.

Oceanfront at Wilmington Avenue

Background

The seawall and dunes near the intersection of Beach Avenue and Wilmington Avenue are periodically breached and the ocean waters flow downhill along Beach Avenue and flood the historic district and Frog Hollow neighborhood. The breach is primarily due to two reasons: first, the alignment of Beach Avenue in this area juts out towards the ocean, creating a narrow beach that increases the exposure of the dunes. In addition, the sea wall in this constrained area is relatively short and the waves can easily overtop the wall.

The city has been working with the US Army Corps of Engineers to help address the problem through periodical beach replenishments. However, any sand that is placed in front of the seawall, or covering it, is quickly eroded, because the narrow beach cannot efficiently supply sediment to the dune or protect the dune toe from wave action. It appears by the straight nature of the shoreline that the beach is not eroding at an excessively high rate in this area, but rather that the angle of the seawall (and the development behind it) is encroaching on the beach.

A pumping station had been installed in the Frog Hollow neighborhood, but the volume of water from the breached dune and sea wall now exceeds the pumping capacity of the system.

The dunes have also been periodically planted to increase stability; however, the vegetation is trampled by beach visitors. This occurs despite the signs prohibiting access and an elevated public walkway nearby.

While a continuous beach nourishment and dune enhancement program may help reduce the overtopping and erosion of this dune, widening this section of the coast to accommodate the angle in the seawall without the use of structures will be difficult. Nature will want to straighten the coastline, so creating a bump out in the shoreline will only be a temporary solution.

Recommendations

- Raise the seawall
  Elevating the low section of the seawall would help reduce the flooding if the dune breaches.

- Build a groin
  An effectively designed groin might widen the beach in front of the problem area. As discussed above, the dune at the site is unstable due to the narrow beach fronting it and the beach is narrow because the seawall angles seaward. A groin would cause a local reorientation of the shoreline. A modification of the existing outfall pipe at this location may be as effective as a groin.

- Extend dune into roadway
  Increase the width of the beach and dune by building a dune into the roadway (Beach and Wilmington Avenues). This would involve terminating both roads at the driveways of the residences nearest the corner. This may or may not necessitate relocating the existing seawall or building a new seawall to serve as a structural core to the dune. This would provide the space required to connect the more stable dunes to the east and west of the site, and a wider beach to sustain it.

  Information that would be useful when considering the above options:

  - Elevation of the sea wall at this location.
  - An analysis of the historical data on the performance of past beach nourishment projects to determine if they have made difference at this location.
  - An evaluation of the wave climate. The natural forces at this location may not be adequately ameliorated by the hybrid seawall and dune. Should structural solutions be pursued, a detailed physical modeling study should be performed to optimize the design.

- Prevent dune trampling by pedestrian traffic
  The recommendations below will limit the number of pedestrians choosing to cross the dune and improve the chance that dune vegetation thrives, which will help to trap additional sand and minimize erosion. These recommendations include:

  - Install dune fencing more aggressively with the aim of preventing anyone from taking a route other than the wooden walkway.
  - Install signage with both a warning and education about the importance of the dune.
  - Target residents and seasonal visitors of this beach area for education and outreach regarding the importance of this dune to Cape May City. There is an opportunity here to teach residents and visitors about the importance of dunes and dune vegetation. This may result in better maintenance of the dunes at beach access points and better retention of sand. One way to do

this would be collaborating with local surf shops, fishing shops, and realtors and providing informational material for them to distribute to those who might use the area.

- Heavily plant the dune with native dune grasses, forbs, and shrubs. As a deterrent to dune trespassers, consider planting or seeding poison ivy, which is an excellent native wildlife plant and thrives in dunes. Community involvement in a planting project at the location would make this more effective by helping to build interest in preserving the plantings and the dune. Coordination with the USACE would be needed during beach replenishment projects so that sand does not bury the plants during replenishment activities.
- Construct a second walkway with a viewing platform at the foot of Wilmington Ave. The walkway would roughly parallel the exiting walkway, but would provide a more direct path to the beach and a platform for viewing the surf.

Harborfront beaches along Delaware Avenue

Background

Delaware Avenue is an important access road to the Coast Guard Station, but incurs repeated flooding and erosion. Although the road has been repaired and riprap placed along the shoreline, the flooding and erosion problems have, and will continue to, persist and intensify. The City is considering a project that includes riprap and a living shoreline along the water's edge. This hybrid shoreline design would be constructed by the USACE in partnership with either the State or the City, although details have yet to be worked out.

Recommendations

- Build a vegetated berm with a living shoreline
  The city may want to consider a living shoreline in this area backed with a vegetated berm. The berm is necessitated by the desire to limit flooding of the roadway. The berm could contain a structural core constructed of rocks, geo-tubes, gabions, or even a bulkhead. Consider constructing a living shoreline in front of the berm. The living shoreline would be both aesthetically pleasing as well as ecologically beneficial. As part of a living shoreline, it is likely that an offshore sill or breakwater would be needed. A sill or breakwater can be constructed of a variety of materials, however, rock is most common.

  For this option, the site analyses described in the NJ Living Shorelines Engineering Design Guidelines (http://www.nj.gov/dep/cmp/docs/living-shorelines-engineering-guidelines-final.pdf) should be conducted.

Cape Island Creek / Perry Street area

Background

Cape Island Creek is routed underground between West Perry Street and Broadway. The creek is controlled by sluice gates, a pumping station, and a piping system. Flooding occurs on the streets where the creek should flow aboveground. This is a result of inadequate conveyance piping infrastructure that is currently

used for both stream and storm water. It appears that the infrastructure cannot handle the volume of the stream and storm water and can back up onto the surrounding properties through storm drains and manhole covers.

In addition, the tide gate that controls the water flow is maintained and operated by Cape May County for this stream may not be functioning efficiently. As tidal conditions permit, the gate is open and allows outflow from South Cape May Meadows. As tidal waters flow in from the harbor, the gate mechanically closes once the tide reaches a certain height, preventing outflow from the Meadows. Unfortunately, when the harbor floods, Cape Island Creek backs up, overtopping the gate, flowing into the culvert back toward the Meadows.

Recommendations

- Daylight (uncover) the creek
  The predicted effects of climate change are likely to exacerbate the flooding problem, disrupting the community on a more frequent basis. We encourage the City to work with the county to ensure the existing gate is functioning and that a well-vetted operational plan is in place. In addition, the city should take a long-term view of this issue and the affected neighborhood and consider options that might include participating in a buy-out program that would enable the stream to be daylighted and allow for more flood storage.

- Increase storm water infiltration
  Because the stream and storm water share the same pipes, storm-water-reduction practices and green infrastructure could help mitigate the problems in the near term. While more information is needed to understand the issue, we recommend the City consider:
  - Swales on properties to slow storm water runoff
  - Rain barrels to capture roof runoff, which would otherwise enter into the storm-drain system.
  - Rain gardens, on both public and private properties, to increase water infiltration into the soils and recharging ground water.

  The City should investigate other green infrastructure options as well. Rutgers University's Water Resources Program (http://www.water.rutgers.edu/) may offer free consultation for green infrastructure projects.

  Another useful reference is the Homeowner's Stormwater Handbook (http://s3.amazonaws.com/delawareestuary/pdf/stormwater-guide.pdf) developed by the Partnership for the Delaware Estuary.

Information that would be useful when considering the preceding recommendations:

- A detailed hydrologic study of the drainage infrastructure system, which should include a flow study of the Cape Island Creek to understand the flow rate into and out of the sluice gates, the average amount of rain going into the system, and the options to reduce impervious ground cover in the area.
- Verification that all existing pipes are obstruction free and that all drainage structures (culverts, sluice gates, etc.) are operating as intended.

Other Ecological Recommendations for Coastal Resiliency

Below are more general ecological recommendations for coastal resiliency that the City may want to consider in all future projects. A comprehensive list of these best practices may be found in the document entitled Building Ecological Solutions to Coastal Community Hazards - A Guide for New Jersey Coastal Communities, which is a product of this NFWF-funded project.

Oceanfront at Wilmington Avenue

- Incorporate sea level rise and coastal dynamics into beach management plans.
- Survey beach and dune complexes to identify points of vulnerability, such as:
  - Sediment depletion
  - Gaps in dunes
  - Low dunes
  - Footpaths cutting through dunes
  - Absence of vegetation

- Replace cut-through footpaths with elevated dune walkovers wherever possible to reduce dune erosion and vulnerabilities to storm surge.
- Conserve, restore, and protect native dune vegetation. Consider ways to restore, create, and strengthen dune complexes that incorporate native, dune-building vegetation and plugs gaps in existing dune formations. Detailed guidance is provided on dune design, plant selection, and planting methods in the NJ Sea Grant Dune Manual *Dune It Right*. Promote the use of native dune vegetation in local landscaping.
- Use native dune vegetation as protective hedgerows around properties to capture sand and storm deposits.
- Establish and enforce local ordinances that protect dunes, including native dune plants and beach-dwelling wildlife.
- Participate in coastal community networks to share lessons from beach and dune management
- Provide educational signage and outdoor learning opportunities to advance understanding of beach and dune benefits

Harborfront beaches along Delaware Avenue

- Instead of stabilizing shorelines with rigid armoring such as bulkheads, coastal communities should consider and prioritize "living shorelines" practices.

  Living shorelines are a broad suite of erosion control practices that, unlike rigid armoring, are designed to absorb wave energy while still maintaining some of the natural processes and ecological integrity of the shore zone. Certain types of living shorelines have been shown to survive a Category 1 hurricane better than bulkheads. Some of the design considerations include fetch, boat wakes, nearshore gradient, substrate consistency, tide range, and sun exposure. Both materials and configurations vary widely based on site conditions, but can include coconut-fiber logs, rock sills and breakwaters, sandy fill, plants, and shellfish. Engineering and ecological expertise are necessary to plan and execute this technology. Stevens Institute has developed useful Living Shorelines Engineering Guidelines. NOAA has developed Guidance for Considering the Use of Living Shorelines. Partnership for the Delaware Estuary has developed a host of resources, including practitioner's guidance for living shorelines using shellfish and other site-appropriate biological materials. In addition, VIMS has online teaching modules about living shorelines.

Cape Island Creek / Perry Street area

- Consider moving, elevating or removing property and infrastructure in hazard-prone areas
- Support community buy-out programs in these areas
- Reduce impervious surfaces to decrease stormwater runoff and flooding
- Encourage use of Low Impact Development (LID) strategies in municipalities
- Promote rain barrels
- Promote the use of green roofs
- Increase native tree canopy
- Inventory, inspect and test storm water basins
- Improve function of existing storm water basins

Attendees of the December 18, 2016, Meeting

Cape May City
Louis Belasco, CTA, Tax Assessor
Craig Hurless, PE PP CME, Planning Board Engineer
Edward Mahaney, Mayor

BESCCH Technical Team
Kaitlin Collins, Partnership for the Delaware Estuary
Jon Miller, PhD, Stevens Institute of Technology
Angela Padeletti, Partnership for the Delaware Estuary
Megan Rutkowski, NJ Department of Environmental Protection
Bill Shadel, CERP, Shadel Environmental LLC (consultant to National Wildlife Federation and Sustainable Jersey)
Stacy Small-Lorenz, PhD, National Wildlife Federation
Linda Weber, AICP PP, Sustainable Jersey
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Additional contributor to this memo
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