Comments on June 7, 2019, City of Lewes Flood Study – Marta Nammack 7/30/19

I am pleased that the City of Lewes hired a hydrologist (from AECOM) to prepare the June 7, 2019, City of Lewes Flood Study: Evaluation of Flooding Effects from Canary Creek Development report (Flood Study). The conclusions reached by AECOM in the Flood Study seem to be that the Fishers Cove development, as proposed, will likely impact the adjacent properties with some additional flooding and that the Lewes Waterfront Preserve development will not have any impact. I am not sure how these conclusions fit in with the fact that we (128 New Road) and our neighbors have already experienced significant flooding several times in our front yards. Perhaps AECOM was limited to analyzing the impacts of the proposed Canary Creek developments only on the areas immediately adjacent to the proposed developments? Given the importance of this Flood Study to the City of Lewes' consideration of proposed developments, the Flood Study should be peer reviewed by other independent hydrology experts (if it has not been peer reviewed already). I hope this Flood Study will be expanded to include other areas, especially properties along New Road, east of Park Road.

<u>Background information from Callahan et al. (2017)</u>

I reviewed Callahan et al. (2017),[1] a technical report that AECOM relied on heavily in evaluating the effects of flooding from Canary Creek development. Callahan et al. (2017) state on page 13:

> Regional meteorological conditions that develop from strong onshore winds, mid-latitude cyclones, or tropical storm systems, can cause water levels to be much higher, by up to several feet, than mean sea level. In areas where mean sea level has been rising, so too does inundation frequency relative to fixed-elevation infrastructure on land, including minor/nuisance flood levels as well as extreme water levels from storms or strong winds (Hall et al., 2016). Extreme water levels can cause significant damage and degradation to public/private property and public safety as well as to the natural environment along the shoreline. **Although planning for the eventual, gradual increase in mean sea level is important, planning for the changes in frequency, duration, and intensity of extreme water levels is just as important in many cases.** [*emphasis added*] Sea-level rise will continue to increase the frequency and duration of nuisance flooding and exacerbate the impacts of extreme coastal flooding (Sweet et al., 2014; Tebaldi et al., 2012; Wahl et al., 2015; Little et al., 2015; Lin et al., 2016).

To incorporate sea level rise impacts into the models, AECOM used the three scenarios (5, 50, and 95% probability levels of sea-level rise in Delaware), as recommended by Callahan et al. (2017), and modeled the scenarios out to the year 2100. These probability levels were determined by the Kopp et al. (2014) methodology under the IPCC AR5 RCP 8.5[2] emission

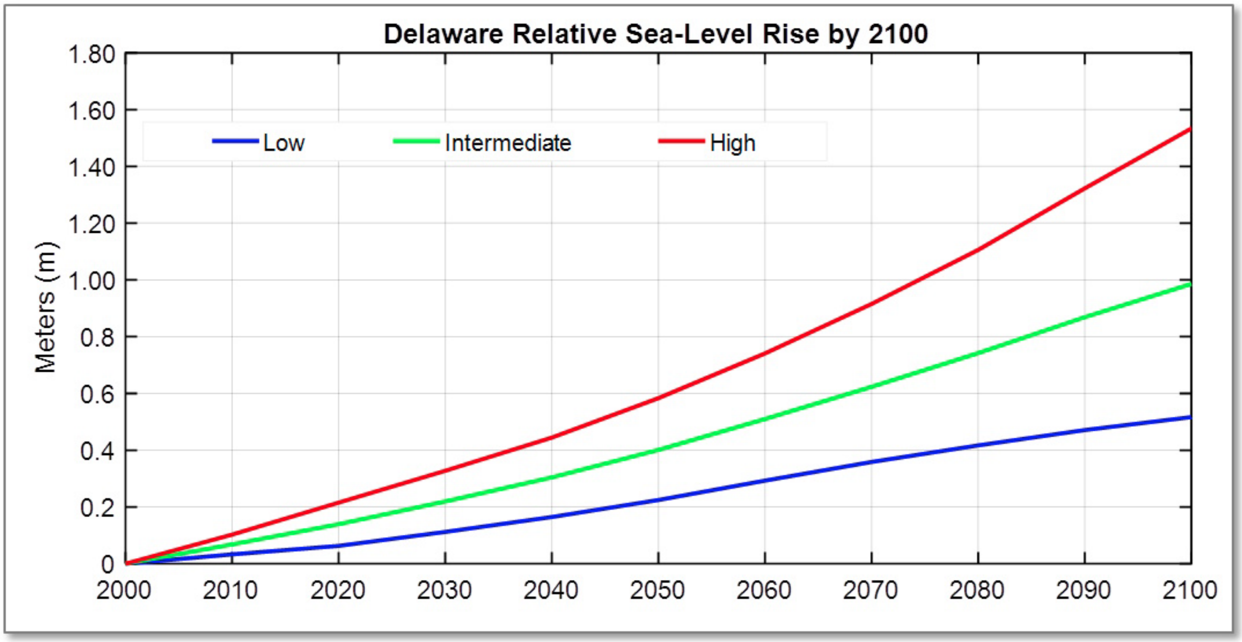
---

[1] Callahan, John A., Benjamin P. Horton, Daria L. Nikitina, Christopher K. Sommerfield, Thomas E. McKenna, and Danielle Swallow, 2017. Recommendation of Sea-Level Rise Planning Scenarios for Delaware: Technical Report, prepared for Delaware Department of Natural Resources and Environmental Control (DNREC) Delaware Coastal Programs. 115 pp.

[2] RCP 8.5 represents the "business as usual" future greenhouse gas emission assumption.

scenario, as the Low, Intermediate, and High SLR planning scenarios, respectively. This equates to 0.52 m (1.71 ft), 0.99 m (3.25 ft), and 1.53 m (5.02 ft) of sea level rise by 2100, relative to the year 2000 mean sea level.

The figure below illustrates the 2017 Delaware SLR planning scenario curves to the year 2100. The Low, Intermediate, and High planning scenarios correspond with the 5%, 50%, and 95% probability levels. As you can see, in the year 2050, the Intermediate planning scenario has a value of 0.4 m, or 1.33 feet. AECOM chose the Intermediate planning scenario because it represents a moderate projection with a 50% chance of being met or exceeded in the next 30 years, or within the length of a typical home mortgage.



Callahan et al. (2017) state on p. 20:

> **General guidance in using Delaware SLR planning scenarios.** Executive Order 41 directs state agencies to address both the causes and consequences of climate change. It recommends that planners and elected officials factor SLR projections into capital improvement projects and land-use decisions with long lifespans or some risk of flooding. Before selecting a SLR scenario to plan from, it is important to understand that SLR is one component of overall flood risk in the state. Delaware communities experience flooding and damage from storms with heavy precipitation, wind, waves, and/or storm surge, as well as from perigean spring tides that cause localized, nuisance flooding. SLR will significantly exacerbate the risk of flooding from these events. Additionally, SLR can cause more gradual effects on the area, such as saltwater intrusion to groundwater supply, drowned coastal agricultural fields and forests, beach erosion and marsh migration, changes in the tourism and real estate industries, public safety, and more. This report does not analyze or offer projections regarding overall flood risk for Delaware towns.

> However, the SLR planning scenarios contained in this report should form a critical piece of the risk assessment and planning process at the state and local level.

I included all of this background information from the Callahan et al. (2017) report because it helps set the stage for AECOM's evaluation, and it helped me understand what was done.

<u>Specific comments</u>

p. 17 - It would be helpful to know the magnitude of the September 2016 coastal storm and rainfall to compare to the various scenarios that are simulated in this report (2-yr coastal storm + 10-yr rainfall event? 10-yr/10yr?).

p. 20 - I do not think relying on simulated data to validate the model when we have no actual survey data is a good idea. A moratorium on development within certain distances of Canary Creek and the Great Marsh until we can collect data for a number of years to validate the model would be more appropriate.

p. 20 - Will the models be re-run once we have detailed specifications on the storm water systems (and, in the case of Tower Hill, concept grading plans) for Fisher's Cove and the Lewes Waterfront Preserve?

p. 21 - The Fishers Cove proposal was changed to include a gabion wall instead of a bulkhead to protect the site from flooding. How does this new proposal change the results of the simulations?

p. 22 - Why didn't AECOM include simulations of 100-yr coastal storm + 100-yr rainfall? And what about 500-yr events? Given the precautionary language included in the Callahan et al. (2017) report, we should be planning and preparing for worst-case scenarios. I have the same concern regarding the choice of a moderate sea level rise planning scenario. AECOM should have run the models using the high sea level rise planning scenario, too, so that we could see the results under a sea level rise scenario that is becoming more likely to be the most accurate one.

p. 29 - AECOM concludes that the simulations for Lewes Waterfront Preserve did not show any adverse effects to the surrounding watershed. But, AECOM states at the bottom of page 29 that the 2-year coastal storm + 100-year rainfall model simulations for Lewes Waterfront Preserve show negligible change in peak flood depth within the marsh surrounding Canary Creek. This means that there is *some* effect. Any change in peak flood depth within the marsh surrounding Canary Creek would seem to indicate that Canary Creek was beyond capacity and could not absorb additional storm water from other areas via ditches. And, had AECOM modeled more severe coastal storm/rainfall events, the peak flood depth might change more significantly.

p. 31-32 Under Section 7.4, AECOM recommends that any limitations the water table, soil saturation, and sea level rise may impose on the capacity of proposed storm water ponds, particularly those intended to dry out between rain events, be considered. I hope this recommendation applies to all future developments, including Lewes Waterfront Preserve (if it is indeed approved and built).

p. 32, Recommendation 7.5 – I suggest inserting, ", repair as necessary," after "Monitor" so that existing swales along New Road can be made to function properly. When it rains hard, the water fills the swale rapidly, and if it is a heavy downpour, one of these days the water will reach our house and other houses that are 100 feet back from the edge of New Road. The water has already moved about 75 feet into our yards in prior rainfall/nor'easter events.

p. 33, Recommendation 7.6 – This is an excellent recommendation. I sincerely hope new developments will be required to use pervious surfaces for driveways, parking lots, and roads. This will help prevent additional flooding during extreme storm events and help prevent contaminants from reaching our waterways.

p. 33, Recommendation 7.7 – Yes, collection of measured water level and discharge data during rainfall and coastal storm events is critical. After all, models are only as good as the data. The uncertainties associated with all of the assumptions that had to be made for these simulations justify using Delaware's "high" SLR planning scenario instead of the "moderate" one. When we are talking about roads needed for evacuation and people's homes, it is essential that we use a more precautionary approach. In other words, the consequence of being wrong about the SLR planning scenario is more severe if the "high" scenario turns out to be more accurate and we didn't look at the "high" SLR planning scenario than if the "moderate" scenario turns out to be more accurate and we didn't look at it. Our homes that we live in and depend on every day for our health, security, and welfare should carry a low tolerance for risk to SLR.

I've copied and pasted some relevant information from DNREC, for the record:
http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Pages/Sea-Level-Rise.aspx

Sea Level Rise and Delaware's Wetlands

Overview: Over the past century, Delaware has experienced a sea level rise of more than one foot. According to the Intergovernmental Panel on Climate Change (IPCC), the rate of sea level rise will increase over the next century. For Delaware, sea level rise is especially concerning because the coastline is no longer able to adapt to the rising waters as naturally as it has been able to in the past. In some areas, human development and alterations to the landscape will prevent wetlands from migrating inland which could contribute to shoreline erosion rates.
With the rising sea and the inability of the land to adapt, Delaware can expect:

- increased inundation and erosion
- increased tidal surges
- increased severity of flooding from severe weather events
- accelerated saltwater contamination of ground water and surface water supplies
- elevated water tables
- loss of critical habitats along our shore

Why is sea level rising in Delaware? With the increase in the average global temperature in recent years, polar regions of the globe that have historically been covered in ice are now melting rapidly. When these regions of glacial ice melt, the resulting water enters our oceans, thus raising the sea level directly. Additionally, as the water heats with the increase in average global temperature, it expands and also contributes to sea level rise. Additionally, Delaware (and the east coast of North America) is experiencing a naturally driven sinking of the land. In other words, the tectonic plate Delaware sits on is naturally sinking compared to the land level of the surrounding tectonic plates. This puts Delaware at increased risk for the impacts of rising sea levels; as the sea is rising, Delaware is sinking, thus the rate of sea level rise in Delaware is faster than in other parts of the world.

How much will sea level rise? The Delaware Department of Natural Resources and Environmental Control (DNREC) has agreed upon three scenarios for local sea level rise in the next century:

- 0.5 meters (low estimate)
- 1.0 meters (intermediate estimate)
- 1.5 meters (high estimate)

Scientists at the DNREC Coastal Programs have developed an easy to use Sea Level Rise map showing the possible inundation of Delaware land based on these three recommended scenarios.

What does this mean for wetlands in Delaware?

As the sea level rises in Delaware, coastal wetlands will be lost due to submergence under the rising sea as well as erosion of the soil by frequent severe storm events. Historically, coastal wetlands were able to handle these events. As the sea levels rose, wetlands were able to migrate inland and adapt to the change in inundation level. However, due to development, roads and infrastructure, wetlands are now unable to migrate inland and thus are gradually eroding away and sinking beneath the rising sea. This leaves coastal residents and businesses less protected from flooding and storms.

For wetlands further inland, rising sea levels mean increased salinity levels. With the saltwater coming in with the high tide further inland, these freshwater wetlands could be changed to more saline systems thus altering the plant and wildlife communities. Freshwater wetlands provide many benefits to Delaware including serving as crucial habitat for important commercial species, rare wildlife, and many recreational opportunities for Delaware residents.

The main point I am trying to make is that we should not underestimate the impacts of coastal storms, severe rainfall events, and sea level rise. If we do not have the data to validate a model, then we should input the more precautionary scenarios into the model. I hope AECOM will model more severe scenarios of coastal storms, rainfall events, and sea level rise so that we have more information in front of those making these important decisions on proposed projects that may impact existing homes in the City of Lewes.