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September 6, 2020

Mayor John J. Tecklenburg
P.O. Box 652
Charleston, South Carolina 29402

Dear Mayor Tecklenburg,

I am writing to thank you again for arranging the meeting between me and Matt Fountain, Director of the Department of Stormwater Management. I have the greatest respect for Mr. Fountain. We listened to each other and I think that we came to understand one another's point of view.

I still do not believe that the City of Charleston has acted in compliance with the 2013 Stormwater Design Standards Manual in its evaluation of the stormwater application for the proposed Central Park development. Since this is not the most important thing that I want to discuss with you, I have moved my discussion of the stormwater manual to an appendix at the end of this letter.

The City of Charleston has not required the proponents of the Central Park development to use sufficient rigor in verifying the accuracy of the input data for their stormwater model.

The configuration and condition of drainage channels and stormwater pipes would be examples of input data.

I am not blaming the Department of Stormwater Management in this matter. Typically, the standard for rigor in the verification of input data comes from the office of the Mayor or City Manager.

There is nothing in the stormwater manual that specifies that input data for stormwater models must be accurate. There is no need to specify this because, in the absence of accurate input data, nothing in the stormwater manual would make any sense. The assumption of accurate input data would be included under generalizations in the manual, such as "This manual is not intended to restrain or inhibit engineering creativity, freedom of design, or the need for engineering judgment... The Stormwater Design Standards Manual is not intended as a textbook or a comprehensive engineering design reference. It was developed under the assumption that the user possesses a thorough understanding of stormwater control design, construction, and land development."



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In my insistence on rigor, I am not simply being a retired hydrology professor. I was quite moved when I heard Councilmember Ross Appel refer to flooding on James Island as an “existential threat.” By this, I understood that flooding threatens the continued human inhabitation of James Island. In the face of this threat, I would require the accuracy of the input data for a stormwater model to be 99.9% (not an exaggeration).

I encourage you to pose the following questions to the Department of Stormwater Management:

- 1) Are you 99.9% confident that the proponents of the Central Park development have used accurate input data in their stormwater model?
- 2) Are you 99.9% confident that the Central Park development would not increase flooding in the surrounding neighborhoods?

It would be a privilege if I could help the City of Charleston address these issues. I have over 40 years of experience with hydrologic modeling and risk assessment. As you know, I was born in Charleston and lived at 9 Devereaux Avenue. I would welcome the opportunity to give back to my birthplace.

Best wishes,

Steven H. Emerman

cc: Matt Fountain, Director, Department of Stormwater Management
Ross Appel, Councilmember
Dudley Gregorie, Councilmember
Carol Jackson, Councilmember

Appendix: Non-Compliance with 2013 Stormwater Design Standards Manual



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Appendix: Non-Compliance with 2013 Stormwater Design Standards Manual

The critical passage in the 2013 stormwater manual is the following:

“Flooding exists in many locations around the City where development densities have increased to the point that stormwater controls have become overwhelmed... The following design criteria shall be used for projects discharging to receiving waters within these areas: The post-development, peak discharge rates are restricted to ½ the pre-development rates for the 2 and 10-year 24-hour storm event **or to the downstream system capacity, whichever is less...**” (emphasis added).

The passage is repeated almost verbatim in the 2020 stormwater manual:

“Flooding occurs in many locations around the City where development has increased stormwater runoff to the point that stormwater conveyance systems have become overwhelmed. The following design criteria shall be used for projects discharging to receiving waters within these special protection areas: For non-SFR [Single-Family Residence] sites of 0.5 acres or more, the post-development, peak discharge rates are restricted to one-half the pre-development rates for the 50 percent and 10 percent AEP [2-year and 10-year], 24-hour storm events **or to the downstream system capacity, whichever is less.**” (emphasis added)

My interpretation of the above passages is that the downstream system capacity sets a lower bound on the permissible post-development peak discharge rate. That is, it does not matter whether the projected post-development peak discharge rate is one-half or one-third or one-tenth of the pre-development peak discharge rate. If the post-development peak discharge rate would exceed the ability of the downstream stormwater infrastructure to carry away stormwater, the development could not be approved.

The City of Charleston has not required the proponents of the Central Park development to calculate or to take into account the downstream system capacity.

According to Matt Fountain, the system capacity is assessed by comparing the water-surface elevation during a 100-year storm between the pre-development and the post-development states. The water-surface elevations are compared for both the upstream and the downstream neighborhoods. If the changes in water-surface elevations during a 100-year storm can be shown to be negligible, it is said that the system capacity has not been exceeded.

Mr. Fountain’s interpretation does not make sense to me. The passage from the stormwater manual requires the comparison of three quantities:

(1) post-development peak discharge rate



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- (2) pre-development peak discharge rate
- (3) downstream system capacity

The above quantities can be compared only if they are all discharge rates, that is, only if they all have the units of volume per time, for example, cubic feet per second.

The fact that “downstream system capacity” is a discharge rate (with units like cubic feet per second) is further clarified with the expression “whichever is less.” The determination as to which is the larger quantity (pre-development peak discharge rate or downstream system capacity) can be made only if the two quantities have the same units, that is, only if “downstream system capacity” is a discharge rate with units like cubic feet per second.

The fact that “water-surface elevation” and “system capacity” are different concepts is further clarified in the following passage from the 2013 stormwater manual:

“All construction, development and redevelopment activities which disturb one (1) acre or more shall perform an hydraulic analysis to determine the impacts of the proposed development during 100-year 24-hour storm event (precipitation only). The project shall not...Increase water surface elevations **or** reduce system capacity in stormwater system and facilities upstream or downstream of the project” (emphasis added).”

Nearly the identical passage is also found in the 2020 stormwater manual:

“Construction, development, and redevelopment activities that disturb 1 acre or more shall include a hydrologic/hydraulic analysis to determine the impacts of the proposed development during the 1 percent AEP [100-year], 24-hour storm event. For the 1 percent AEP [100-year] Storm Event Analysis, the project shall not:...Increase water surface elevations **or** reduce system capacity in the stormwater system and facilities upstream or downstream of the project” (emphasis added).

The above passages refer to all developments and not just to developments within the Special Protection Areas. Therefore, the requirement of no increase in water-surface elevation (which applies to all developments) cannot be equivalent to the requirement of no exceedance of the downstream system capacity by the post-development peak discharge rate (which applies only to the Special Protection Areas).

In summary, while the Department of Stormwater Management has insisted on a legitimate requirement (no increase in water-surface elevation during a 100-year storm), it is not the requirement that is specified in the stormwater manual (no exceedance of the downstream system capacity by the post-development peak discharge rate).