2020 Specifier Webinar Series – *Designing Efficient and Resilient Stormwater Infrastructure for a Changing Climate*

June 25, 2020 Live Webinar Q&A

Q: Are porous pavements practical in areas with freezing winters, given the deteriorating effects of freeze-thaw cycles?

A: Actually, they work better in these climates as the permeability of the pavement eliminates the hydrostatic pressure associated with pavement buckling during spring thaws in cold climates. In addition, there is less need to apply road salt to permeable pavements, and there is less "black ice" buildup in these areas.

Q: Are the projections of future climate change trends based on Intergovernmental Panel on Climate Change (IPCC) computer models?

A: We believe the National Oceanic and Atmospheric Administration (NOAA) used IPCC data for 2014 and previous times, but that they have their own data after that point. We recommend confirming this with NOAA directly.

Q: Has the impact of widespread use of drain field tiles by farmers been seen in runoff?

A: The tilling of fields creates an increase in runoff compared to a non-tilled field as it provides more efficient flowpaths. Farmers can do many things to mitigate the impacts of agricultural runoff, such as the use of forested buffers around/near streams they discharge fields into or the use of fencing around waterways to keep cattle out. A significant loading factor in agriculture areas is the use of tile drains, which are underground drains – usually perforated – that dewater farm fields. This action reduces the time shallow groundwater is in contact with soil, which reduces the denitrification process that is key to the surface/groundwater interface. The result is discharges of increased nitrogen loading to downstream areas. The focus of our talk was primarily on urban runoff, however, so the discussion on agriculture runoff is a different topic entirely and requires its own unique environmental analysis.

Q: Have you seen development of any pretreatment devices/methods used on construction projects? It seems many projects are approved with perimeter silt fence, rock check dams and periodic stabilization. When these systems are overwhelmed by rate of rainfall or bad timing, discharges often result in regulatory shutdowns and eventual litigation.

A: There are many pretreatment devices/methods. We normally see that term used only in post-construction as a method to reduce sediment loads. Construction projects require reduction of sediment loads as a matter of course. The use of polyacrylamide (PAM) to reduce sediment delivery as well as to increase sedimentation through coagulation can work well. Similar applications have been made using alum, but this is less common and may have more adverse impacts to downstream biota. The use of PAM along with straw coverings and check dams can be very good at reducing erosion rates as well.

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Q: Are storm depth numbers annual or per event?

A: Storm depth numbers are per event. A 100-year storm is normally expressed in terms of the number of inches of rain that falls during the most extreme weather event expected in a 100-year period. The value is expressed as a 24-hour storm, meaning the number of inches of rain that would fall within 24 hours for a 100-year storm is X inches. Annual numbers are just that – the average number of inches of precipitation that falls within a calendar year. Fairfax County, Va., for instance, experiences 42 inches of rain per year on average, but it is not common to express the amount of rainfall in the context of statistical storms (e.g., 100-year, etc.).

Q: You have recommended using updated intensity and duration information; this is easy in Texas using updated NOAA data, but how should I, as a designer, accomplish that where NOAA has not updated?

A: You should contact your state climatological office. Every state has a state climatologist that can provide you with the most updated information and/or help you find that information. There is also a society of state climatologists that can help. Some states were last updated using Atlas 14 back in 2004. It is recommended this information be updated every 10 years, at least, so 2004 data would be considered to be "old" data at this point, which is why some have advocated for a national update using Atlas 14 every 10 years. Search "NOAA and Atlas 14" on the internet, and you can learn more.

Q: How can one sell Low Impact Development (LID) features designed to improve things for 1-10 year average recurrence interval (ARI) events to an owner who notes that they will likely require replacement/extreme rehabilitation after the 50-100-year ARI event?

A: Green infrastructure and low impact development (GI/LID) is designed to address frequent storm events, which are generally considered to be 10-year storm events and less. We are unclear why an owner would replace something after a 50-100-year event. GI/LID features will certainly withstand a 100-year storm better than a gray feature designed for a 1-10-year storm event as it will be more flexible by nature.

Q: How have municipalities successfully handled the routine maintenance of green infrastructure – both costs and education of staff?

A: This is a great question, and one not easily answered. First, the term "successfully" is very tough to define. Municipalities with a "good" maintenance program for green infrastructure (GI) are those with well-trained staff and contractors who understand GI. Also, requirements for maintenance by private property owners who have GI on their property are helpful. One interesting/effective approach on this is using incentives for private properties to provide operations and maintenance (O&M) on these features. You could also ask them for a maintenance easement so the municipality or a contractor can do this work. Requiring maintenance agreements for privately-owned facilities is helpful. There are also new public-private partnership programs that drive the cost for this work down quite a bit. The Philadelphia Water Department's Stormwater Management Incentive Program (SMIP) or its Greened Acre Retrofit Program (GARP) are good examples.

Q: Do you need to complete routine maintenance of porous pavement? Otherwise wouldn't it fill with debris and become ineffective?

A: Yes, permeable pavements definitely need to be maintained. This is part of any stormwater feature, actually. There are vacuum trucks and specialty companies that can provide these services.

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Q: I think it would be good to define how "extreme events" have doubled because climate statistics in the top 5% of all rain events are not the same as something like the 10-year storm.

A: The discussion on the increased frequency of "extreme events" was provided for illustrative purposes to make the point that we are seeing more frequent large storm events. We agree that the top 5% of rain events is not the same as the 10-year storm event.

Q: I think it might also be good to indicate that the 100-year storm in Houston was previously mostly based on data collected for about 50 years since 1948. So, we would expect some change as we get a bigger data set. Some cities have 100-year 24-hour storm depths that have decreased based on more data.

A: We agree that more data can reflect higher or lower statistically defined storms. Also, we agree that storm depths have decreased for some cities with more data included in the analysis. Overall, we're seeing larger precipitation depths as there are many more places that are experiencing these increases than those who are seeing decreases. Warmer temperatures increase the capacity for larger storms due to higher rates of humidity, and since the fuel for larger, convective storms is heat, it should not be surprising that we are seeing these dynamics.

Q: You mentioned "static" stormwater detention. How would this be different from "dynamic" storage?

A: Static stormwater detention is literally a hole in the ground, such as a pond, that captures runoff volumes in a static way, meaning that a pond holding 10,000 gallons at a specific depth will always hold that amount or less, if it silts up. A dynamic storage feature will use these 10,000 gallons of capacity in a dynamic way by speeding up or slowing down the release of runoff. With a dynamic system, you could have the wet volume drawn down when a storm is coming into the area. Then, runoff could be held for a certain amount of time to get maximum treatment, and then release from the system could happen at differing rates that would balance the goals of water treatment, runoff storage needs, downstream channel protection and incoming rates overall.

Q: On one slide of the national map you show a percent change in precipitation. This variance is widespread and yet localized in areas. What are causes? Why is this not more uniform to areas?

A: A climatologist or a meteorologist would be best at answering this question, but our guess on the variability of change in precipitation is related to two major factors: first, micro-climate patterns, which are more significant than you'd realize, and second, the location of data collection and the amount of data collection. If you have a lot of data in one area but less in another, there might be precipitation biases towards deeper data sets. This lack of uniformity of spatial coverage, as well as lack of uniformity in data set history, likely adds to the lack of uniformity overall.

Q: I see the percentage of non-point source discharges have increased to 85%, but has it been quantified? Has the total runoff quantity from non-point source increased as well in the U.S. in the past 30 years?

A: That slide was simply showing the nature of water quality impairments in the U.S. In the past, most of our water quality problems were related to point sources. In contrast, most of our water quality issues today are related to non-point source issues. There was no expression of volumes in that discussion. With that said, there is certainly more runoff today than there was 30 years ago because of two main factors: more urbanization and more intense rain events. A related factor is that we have just recently started to try to address runoff volumes, so we have a lot of work to do in order to get out ahead of the growing runoff volumes.

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Q: Can you talk more about the experimental sponge cities in China?

A: This is an effort by China to incorporate green infrastructure as well as water capture/use technologies and practices to reduce flooding and treat runoff holistically. The scale and pace of urbanization in China far outstrips urbanization in the U.S. and most of the rest of the world. They are now starting to see severe economic and public safety costs associated with environmental health, like air and water pollution and flooding impacts. Green features can address all of these issues, and if done while cities are being developed (instead of trying to retrofit existing urban areas), then it is much more cost-effective and can actually be less expensive than traditional urban drainage and stormwater management. So, they see the value of this approach in a triple-bottom line fashion – economic, environment and social benefits. Here are a few links on the topic:

www.smartcitylab.com/blog/urban-environment/chinas-sponge-cities-are-turning-concrete-green-to-combat-flooding/

www.cnn.com/2017/09/17/asia/china-sponge-cities/index.html,

www.weforum.org/agenda/2019/08/sponge-cities-china-flood-protection-nature-wwf/

www.researchgate.net/publication/303362681_Case_Studies_of_the_Sponge_City_Program_in_China

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