A photograph of a flooded street in a residential area. A person in a blue raincoat is riding a red bicycle through the water. Another person in a red raincoat is standing on the right side of the street, holding a red and black umbrella. The street is lined with trees and a "RESIDENT PARKING 8 AM - 10 AM WEEKDAYS" sign is visible on the right. The water is murky and reflects the overcast sky.

# THE GROWING THREAT OF URBAN FLOODING: A NATIONAL CHALLENGE 2018

## VOLUME 2: SURVEY REPORT AND COMMENTS

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Center for Disaster Resilience

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Center for Texas Beaches and Shores





## Urban Flooding in the United States: A Growing National Challenge

### 1. Background of the Study

Floods of all types present significant economic and social challenges in the United States and around the globe. Losses continue to grow and the potential impact of climate change and population increases are expected to accelerate this rise. Hurricanes Maria, Harvey, and Irma have reemphasized the magnitude of the impacts that floods pose to the nation. Primary attention has been focused on the flooding that results from the overflow of rivers and from high water along coastlines as a result of sea level rise, tidal variability, and coastal storm surges. However, contemporary analysis in the United States and abroad indicate that a growing segment of flood losses occur because of flooding outside the 1% annual chance flood zone (the regulatory floodplain) of the US National Flood Insurance Program (NFIP) in both coastal and riverine environments. Much of this flooding occurs in more densely occupied urban areas where it has been considered as “stormwater or sewer problems” whose impacts are frequently seen as local and relatively minor. In many of these impacted areas, the population is socially and economically vulnerable and unable to deal with the flood threats it faces on a recurring basis and whose economic resources do not lead to the tracking and reporting of this type of flooding.

Unfortunately, little data are available to determine the extent of losses in these areas, most of which are not mapped with any detail under the NFIP and where the very nature of the hazards (street overflow, sewer backup, groundwater, etc.) are not clear. Although property owners in most of the areas are eligible to purchase flood insurance under the NFIP, problems of lack of understanding of the risks, affordability, policy exclusions (basements), and owner-renter relationships result in limited participation by residents in federal or commercial insurance programs. Pioneering work by the Center for Neighborhood Technology (CNT) and the State of Illinois have identified significant losses within the Chicago metropolitan area and the state that are occurring outside the regulatory floodplain. The State reported that flooding in urban areas in Illinois caused, between 2007 and 2014, at least \$2.319 billion in documented damages, of which \$1,240 billion were private claims that typically represent basement flooding and sewer backup and that over 90% of urban flooding damage claims from 2007 to 2014 were outside the FEMA Special Flood Hazard Area. Unfortunately, little analysis has been conducted at the national level.

The University of Maryland Center for Disaster Resilience and the Texas A&M Center for Texas Beaches and Shores, with the support of the Hagler Institute for Advanced Study at Texas A&M University, are conducting a scoping analysis of the extent and consequences of urban flooding and identifying potential solutions for mitigation of such flooding. With the cooperation of the Federal Emergency Management Agency, the National Oceanic and Atmospheric Administration, the

Small Business Administration and the Census Bureau, the study team has analyzed data concerning reported flood losses across the country. However, since the majority of these data apply to riverine and coastal flooding and since federal assistance is not normally provided for smaller non-riverine/coastal events, it has been difficult to more precisely identify where urban flooding is a problem for communities. It is clear from the data that has been obtained and spatial analysis of claim locations that substantial flood losses occur outside the 1% floodplain of the NFIP and, in many cases, in areas not connected directly to riverine or coastal sources.



## Urban Flooding in the United States: A Growing National Challenge

### 2. The Survey

**THIS SURVEY IS FOCUSED ON THOSE OPERATING AT THE COMMUNITY LEVEL.** It is designed to fill in data gaps and solicit information concerning community experience with urban flooding. While it is primarily focused on officials at the community level, **THE VIEWS OF THOSE WHO OVERSEE OR SUPPORT COMMUNITY EFFORTS ARE ALSO IMPORTANT AND WILL BE APPRECIATED.** Where a question is not relevant to your position, skip it.

We would appreciate your assistance in completing the survey. You may complete part of the survey, sign out and then return later to complete, although we would urge you to complete in one session.

If you do not want to answer a question, are unfamiliar with the topic of the question, or do not know the answer, please skip to the next question.

If you have questions about the survey, please feel free to contact Dr. Gerry Galloway, University of Maryland at [gegallo@umd.edu](mailto:gegallo@umd.edu) and/or 571-334-2103. This survey has been reviewed by the University of Maryland IRB and determined not to be Human Subject Research.



## Urban Flooding in the United States: A Growing National Challenge

### 3. Respondent Information

**Your name and other personal information will not be released or associated your responses unless we contact you and you give us permission.**

\* 1. Name (if you do not wish to provide your name, enter 'Decline')

☐ Decline

☐ Name

2. For whom do you work?

☐ City or Town Government - Floodplain Management

☐ City or Town Government- Storm and/or Wastewater Management

☐ County, Parish or Township Government

☐ Regional Governing or Planning Organization

☐ State Government

☐ Consultant to City or Town Government

☐ Consultant

☐ NGO

☐ Other (please specify)

3. What is the title of your position? (Optional)

4. In what state do you work?

5. Email Address (Optional) (will assist in any follow-up)



6. Phone Number (Optional)

7. Work Address (Optional)



Urban Flooding in the United States: A Growing National Challenge

4. Survey Questions

\* 1. What is the name of your community (if you work in or provide oversight of more than one community, report on the community of your choice or complete a separate questionnaire for each. If you do not wish to be affiliated with a specific community, so indicate))

☐ Not affiliated with a specific community

☐ Community name

2. What is the population of your community? (2010 or later census, if available)

3. What is the approximate area of your community (square miles)

4. Is your community subject to flooding from nearby rivers or coastal activity?

☐ Yes

☐ No

Comment (Optional)

5. Is Your community enrolled in the National Flood Insurance Program (NFIP)

☐ Yes

☐ No

☐ Comment (Optional)

6. is your community subject to any urban flooding (flooding not caused by river overflow or coastal flooding)?

☐ Yes. Continue with next question

☐ No. Move to next section (after question 23).

☐ Comments (Optional)

7. What is the extent of the urban flooding that occurs in your community?

☐ Urban flooding occurs in only a few areas in the community

☐ Urban flooding occurs in numerous areas in the community

☐ Urban flooding occurs throughout most of the community

☐ Other condition (comment below)

Comment (Optional)



8. Approximately what percentage of your urban flooding is outside of (not in ) the FEMA designated 100-year (1% annual chance) floodplain/SFHA?

- ☐ None. It is all within the FEMA 100-year floodplain/SFHA
- ☐ Amount - enter percentage

9. What are the consequences of the urban flooding in your community"

- ☐ Minor. No disruption of effected area
- ☐ Minimal. Short term minor economic consequences. Relocation or evacuation not normally necessary.
- ☐ Moderate. Effected areas are disrupted; some areas evacuated or not habitable; dollar losses small but of consequence to those impacted; roads closed for short periods.
- ☐ Significant. Effected areas are essentially shut down; homes and or basements flooded; economic losses are significant; requires temporary relocation of some; roads close for several hours; community infrastructure damaged.
- ☐ Disastrous. Equivalent to a major coastal or riverine flood; major community disruption; temporary relocation of many in effected areas; severe economic losses in effected areas; break up of social cohesion.
- ☐ Other (enter details below)

Comment

10. On average, how often does moderate, significant or disastrous urban flooding occur in your community? (For definitions see question 9).

- ☐ Weekly
- ☐ Monthly
- ☐ Several month a year
- ☐ Yearly
- ☐ Other (Specify in Comment box)

Comment (optional)

11. On average, how many people are affected by a moderate urban flood? (Moderate= Effected areas are disrupted; some areas evacuated or not habitable; dollar losses small but of consequence to those effected. roads closed for short periods)

12. Approximately what percentage of the losses of those affected by a moderate urban floods are covered by NFIP policies?

- ☐ under 10 percent
- ☐ 11- 25 percent
- ☐ 26-50 percent
- ☐ 51-75%
- ☐ More than 75 percent

Comment (Optional)

13. Approximately what percentage of the losses of those affected by a moderate urban floods are covered by commercia (non-government)l insurance policies?

- ☐ under 10 percent
- ☐ 11- 25 percent
- ☐ 26-50 percent
- ☐ 51-75%
- ☐ More than 75 percent

Comment (Optional)



14. What is the economic status of the majority of those affected by moderate urban flooding?

- ☐ Low Income
- ☐ Moderate Income
- ☐ Upper income
- ☐ Other (please specify)

15. Approximately what percentage of properties affected by urban flooding are rental properties?

- ☐ Under 25 percent
- ☐ 25- 49 percent
- ☐ 50-75 percent
- ☐ Over 75 percent

Comment (Optional)

16. What are the principal causes of the urban flooding? (select all applicable)

- ☐ Inadequate drainage system
- ☐ Aging infrastructure
- ☐ Upstream development
- ☐ Groundwater problems
- ☐ Increased local runoff
- ☐ Sewer back-up
- ☐ Development in low elevation areas
- ☐ Changes in runoff over time
- ☐ Highway and road obstructions

Other causes (please specify)

17. What urban flooding mitigation methods are being used in your community to reduce the flooding?  
(Select all applicable)

- ☐ New drainage system/plan
- ☐ Back-up prevention gates
- ☐ Stormwater storage (surface)
- ☐ Stormwater storage (underground)
- ☐ On-site detention
- ☐ Building codes that require reduced runoff
- ☐ Bio swales
- ☐ Rain gardens
- ☐ Green roofs
- ☐ Aquatic buffers
- ☐ Impervious cover reduction
- ☐ Watershed planning and control
- ☐ Improved models
- ☐ Buyout/building relocation
- ☐ Home retrofit
- ☐ Dams within municipality
- ☐ Dams in watershed outside municipality
- ☐ Structure elevation
- ☐ Levees/floodwalls
- ☐ Paved channels
- ☐ Other (please specify)



18. What prevents moving ahead with mitigation activity (select all applicable)

- ☐ Lack of funding
- ☐ Land use conflicts in execution of plans
- ☐ Magnitude and/or complexity of problem
- ☐ Lack of priority in community
- ☐ Opposition to mitigation measures
- ☐ Lack of personnel to manage mitigation (capacity)
- ☐ Lack of political will
- ☐ Other (please specify)

19. If your urban flooding areas outside the SFHA are not currently mapped, do you have plans to identify and map these areas?

- ☐ Yes
- ☐ No
- ☐ Comment (Optional)

20. In planning its infrastructure maintenance and upgrades, is the community considering that the weather events that are causing the urban flooding may increase in frequency and severity over the next decades?

- ☐ Yes
- ☐ No. If no, can you comment below (optional)?
- ☐ Other (please specify)

21. Does your community have maps, reports or news articles about your urban flooding? If so, can you share those with the study group?

- ☐ No. We do not have that such information readily available.
- ☐ Yes, we have some information, but need to discuss it with you before we share it. Please contact us.
- ☐ Yes, we have some information and will email it to you at [gegallo@umd.edu](mailto:gegallo@umd.edu) or call at 571-334-2103
- ☐ Other (please specify)

22. Do you believe those impacted by the urban flooding understand the risk that they face and its potential to become more severe?

- ☐ Yes
- ☐ No
- ☐ Comment (Optional)

23. Do you consider urban flooding to be of significant concern to your community? (Select all applicable)

- ☐ Significant to elected officials
- ☐ Significant to those affected
- ☐ Significant to the community at large
- ☐ Significant to those responsible for flood and stormwater management
- ☐ Not a significant problem for the community even though it occasionally occurs; considered a nuisance
- ☐ Other (please specify)





### 5. Wrap-Up

1. This survey seeks to provide information to support a preliminary analysis of the extent and consequences of urban flooding the United States. The questions that have been asked above will provide basic information to support a scoping level analysis. If you have additional thoughts on the urban flooding challenge, please provide that information in the box below:

2. Would you like a representative of the study team to call you to discuss your urban flooding experience? If so please indicate the appropriate contact name and phone number.

☐ Yes (Provide contact information below)

☐ No

Contact number and best day/time for call

3. if you would like a copy of the survey results (on completion of the study), please indicate below:

☐ Yes (Be sure you entered email address in question 2 of respondent information)

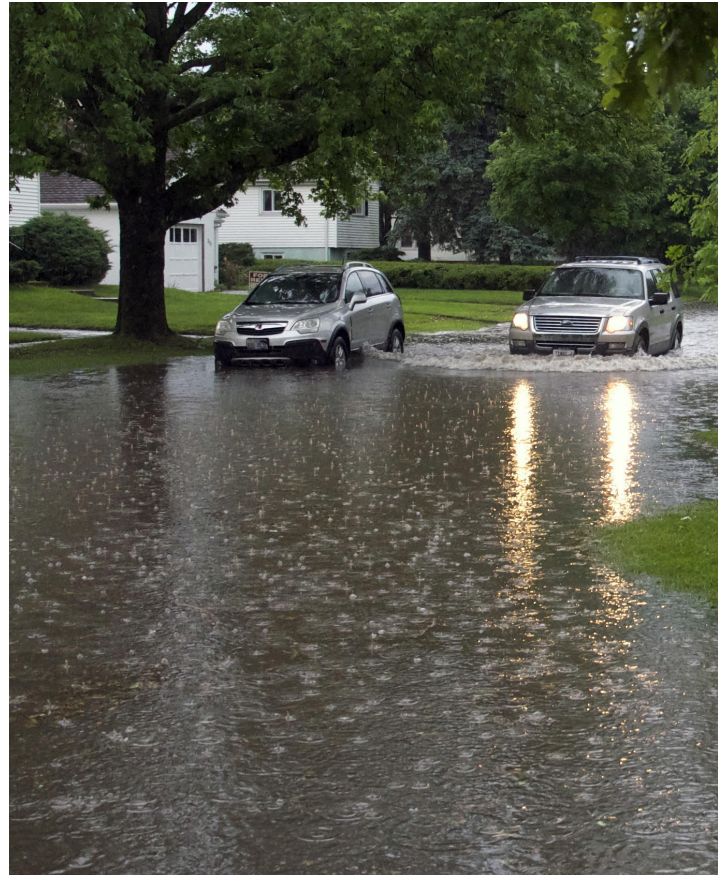
☐ No

THANK YOU VERY MUCH FOR YOUR PARTICIPATION IN THIS SURVEY.



# GENERAL COMMENTS BY RESPONDENTS TO SURVEY

(Since Survey was non-attribution, personal and community data has been removed from answers. They have not been otherwise edited.)



CHAMPAIGN, ILLINOIS PHOTO BY C. ELIANA BROWN

**582 RESPONDENTS PROVIDED INFORMATION ON THEIR PLACE OF EMPLOYMENT.  
103 SUBMITTED GENERAL COMMENTS THAT COULD BE INCLUDED BELOW.**

City or Town Government - Floodplain Management	189
City or Town Government- Storm and/or Wastewater Management	114
County, Parish or Township Government	114
Regional Governing or Planning Organization	20
State Government	26
Consultant to City or Town Government	21
Consultant	28
NGO	5
Other (Federal government, city government, university, business, etc.)	65

<b>Total</b>	<b>582</b>
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**Q31 This survey seeks to provide information to support a preliminary analysis of the extent and consequences of urban flooding the United States. The questions that have been asked above will provide basic information to support a scoping level analysis. If you have additional thoughts on the urban flooding challenge, please provide that information in the box below:**

1. [hope that] the elected officials would be more concern and allocate monies to help, and use the grants that are available.
2. The areas being impacted by urban flooding are those that were built prior to our agency's existence. The system was taken over from the cities and standards were changed to reduce impacts due to urban flooding and continue to change to mitigate the climate impacts. While a Corps system protects the community from stream flows up to the 200 year event, urban flooding continues due to the magnitude of storms that exceed the capacity of the urban storm drainage system. Very few in the community recognize this reality.
3. A big part of what we do is deal with infrastructure that was constructed years ago with no consideration for drainage. So we are in the process of retrofitting that infrastructure (i.e. - adding storm drains to existing roads), which increases the costs because of traffic control, utility coordination, etc.
4. Until the surrounding areas begin monitoring growth and building, there is always a possibility of increase flooding inside the city limits of Erin. Until the creeks are relieved of continued growth of vegetation and buildup of gravel, the possibility of flooding is a given.
5. Most of our flooding issues are attributed to the surcharge of storm water in our coastal marshes and estuaries.
6. We face and extreme threat from catastrophic wild fire on the mountain to the east of town due to a very unhealthy overgrown forest as a result of a century of fire suppression and revocation of grazing permits and the stopping of logging. The fuel load on the mountains is extreme. When it burns (eventually all forest burn) if the fuel and underbrush have not been reduced by two thirds before then the floods and debris flow that will go with it from our very steep mountain slopes will wipe our city off the map. The process to increase the fuel load mitigation is onerous to the extreme, taking years (decades) to get meaningful process going. Ignorance of correct forest management by the leave-it-all-natural-and-untouched-environmentalists is at the root of the problem and it will lead to the destruction of our watershed, wildlife, recreation, lifestyle and historic City if emergency action is not taken before it is too late. Our past flooding is of no consequence compared to what we face if things stay as they are.
7. The urban flooding discussion cannot be limited to infrastructure issues. Communities, developers and residents need to understand that no one can build at ground level, that "freeboard" needs to be applied throughout communities, just being above the street isn't enough. We need to learn that "storing" rainwater in the backyard is good. We need to be ready to flood where we stand. Infrastructure leads us to conveying as much runoff as we can, but what overall impact will this have on groundwater recharge, overuse of our rivers and streams.
8. The way FEMA hazard mitigation grants work are a significant barrier to implementing good, pre-emptive, forward thinking solutions to localized/urban flooding hazards. Funding requirements and eligible projects could be improved to incentivize much better mitigation actions
9. Because of the urban development around our community as well as upstream, the river has a very flashy flow to it during larger rain events. Understanding that there is a price for all construction as well as for build-able area, it would be nice if storm water basins could release storm waters at a slower rate so as to not have a wave of water in the river within the 24 hour period of an event. Reducing the flashy flow will reduce erosion as well as provide better, habitat and recreational opportunity during all times of the year.
10. It's important to raise the awareness of "localized" floodplain management. Too often developers, builders, and engineers only consider the FEMA designated floodplains.
11. I don't know that the instances are documented very well such that a plan could be formulated to address the issues in the future. Quite frankly the worst of the flooding occurs when stormwater practices for new projects are not followed or fully functional and thus cannot hold back significant rain events. It also seems that project designs address the on site stormwater but do not go far enough to ensure that off site drainage has been maintained to handle any run off.
12. Funding/grant money should become more available to allow communities to acquire property regularly impacted by urban flooding, especially to those communities that take an active role in floodplain management and compliance. When attempting to detain upstream stormwater run-off, we are often faced with State and Federal wetland regulation that are equivalent to those of a developer trying to construct a mall and 1,000 car parking area, which is ironic because during our regularly scheduled Floodplain Compliance Audit, the same people ask what measures we have taken to control urban flooding. There should be a different level of review with an emphasis/goal on assisting local governments to control urban flooding.
13. As communities move towards a large reduction in losses and claims in the SFHA the focus of communities, policy makers, and developers should be to reduce losses in non SFHA areas due to extreme rain events and aging infrastructure.
14. It's difficult to retrofit existing neighborhoods that have a flooding problem. It's much easier to implement flood mitigation measures during the planning process. People don't want to deal with it upfront, but when a flood comes it is fresh in their memories.
15. In my experience, the problem is a complicated socio/economic/behavioral study that sometimes produces appropriate results, but very often meets untimely delays, political barriers, and misunderstanding or miscommunication about future flood risks.
16. A long time ago I was chair of [deleted] committee. For years during that time and after, I have sought to get chairs from several [deleted] committees to share thoughts and concerns about urban flooding. I got a few positive reactions, but nothing really happened. That tells me, in retrospect, that many of us humans are uncomfortable with "the big picture" and with complexity. I am gratified that you are doing what you are doing. Let me make it relevant to mid-October 2017. In [deleted] we have experienced wildfires in or immediately adjacent to population centers, followed inevitably by floods and mudslides (and other geologic phenomena). The fires in California will lead to huge "urban flooding" problems in the near future. Then switch your focus to Puerto Rico. Who will ensure that detailed flood risk mapping and careful and comprehensive stream restoration happens there. Who will make sure that the riskiest of the bottomlands become open space, greenways, trails, green streets and green alleys, parks, etc.? Who will "invent" new bottomland management components and strategies? In the strongest terms possible, I urge the technical committees at [deleted] to create collectively a new committee devoted to urban flooding, and linked closely with the work of the existing committees. Likewise, colleges and universities in various parts of the country with interests in various pieces of the "urban flooding pie" (engineering, planning, sociology, anthropology, political science, geography, biology, psychology, etc.) need to find ways to work together. I also urge that we work on an ecologically and geologically based understanding of the different climatic, meteorologic, vegetative, and hydrologic patterns that exist in the US. Denver and Santa Fe are not Seattle or Boston, but if we are thoughtful, we can note both the differences and the similarities.
17. Mostly lack of long term regional planning could have addressed a large portion of urban flooding.
18. Thanks for your good work in this important area. I teach clean water act programs to stormwater managers, including many in Texas, and I refer to [deleted] in discussing the importance of post-construction stormwater controls.

19. I believe a network of local experts who are familiar with local problems comprise solutions. Then on a broader scale bring that to a table by networking on the county level. Address the particular watershed as a whole with each county and municipality with their input and possible solutions. Representatives of the Watershed, being from the municipality level meet with State and Federal Representatives come together and address funding for that Watershed and solutions presented for each municipality within that area of the watershed, areas outside of the municipalities would be represented by the county they are in prior to meeting with a plan.
20. As a rural community there are urban flood challenges. Existing development standards include LID design requirements for new development. Water quality and reduced runoff volumes are elements of the storm water system. The city of [deleted] is located in a high mountain valley with approximately 800-1000 square miles at the headwaters of the Continental divide that drain through the jurisdiction. Flooding is a real risk and recent annexations have included prohibition of development with Special Flood Hazard Areas.
21. We have passed ordinances that require infiltration of the first inch. We have passed ordinance that requires re-development projects to model the runoff as if the pre-development conditions were grassland.
22. Sea level rise is an issue for us. We have been using the results provided by the UW Climate Impacts Group <https://cig.uw.edu/>
23. Our county is becoming more & more developed, and we have a well-developed Stormwater program to address much of this. However, we lack the urgency to do anything about our current stormwater management issues for a number of reasons: 1) political will is not supportive; 2) Most of the flooding occurs in low-income areas; 3) Flooding is not widespread when it does occur (like the 2010 Nashville flood that affected all income levels and thus prompted an aggressive, progressive policy shift that requires low impact development); and 4) the general population does not understand stormwater infrastructure and / or are unwilling to maintain the part of the system that is on their property (easements, swales, storm drains, etc.), which cuts the streams off from their floodplains and exacerbates flooding conditions now even in times of moderate rain events. Whew!
24. I continue to hear people talk about "the 100 year flood". That old adage has caused citizens to truly believe that if they flooded a year ago they'll never experience flooding in the remainder of their lives. I'd like to see FEMA/the government, air more t.v. ads to get the word out. I would also like to see our Town's FIRMS updated. There are a lot of in-numbered A Zones that I'd like to see studied. That would make my job easier. Now, I just tell citizens they must build a minimum of 3 ft. above the highest adjacent grade. I try to get them to build higher but they don't want to, even if they're beside a creek.
25. I think this is a very important and worthwhile area for more attention. The NFIP flood mapping program as currently designed is not funded or set up to work the detailed analysis necessary to identify urban flood risk. Good area for policy analysis and discussion to find inexpensive but effective ways to ID and address urban flood risk.
26. Urban flooding in coastal communities is different from that found in non-coastal communities because of the convergence of coastal/tidal events, sea level rise and other rain events that occurs. Sea level rise and climate change mean that there needs to be a much greater focus on planning, resilience and adaptation in coastal communities and not simply mitigation strategies. Perhaps I am reading too much into the form of the questions, but it seemed to me that there was a clear mitigation bias. Norfolk has been working with TAMU on the excellent resilience scorecard they have developed and I would recommend that you have some in-depth discussions with Phil Berke and Jaimie Masterson.
27. Change has been slow to reduce or avoid new concrete in communities that know or should know that they are creating more vulnerabilities. Strategies that might be helpful would be the availability of a model ordinance that distinguishes property taxes or development fees based on the stormwater outcomes. For example, concrete would carry a fee while pervious pavement or other water capture that would otherwise be impervious would have lower fees or trigger a lower property tax. States and federal agencies might include in the preferences for competitive grants points for jurisdictions with these types of incentives. Points could be awarded for jurisdictions that limit or require mitigation for the removal of trees or grading that removes natural fluctuations in the land - both of which are sinks for stormwater. The same could be said for incentives or regs that limit fill in the floodplain or other floodprone areas or encourage or require first floors to be wet floodproofed or at least designed for minimal damage in a 1 foot flood event. There are few models that provide politically palatable options for reducing flood risk.
28. The driving issues in urban areas vary greatly across regions and the nation. There is no one-size-fits-all issue or answer nationally. Responses to the questions depend heavily on what is meant by the question. Several responses did not seem to reflect the full context of the issue, or local conditions.
29. The City has identified areas of concern and taken action to correct or reduce the localized flooding issues. The City continues to address localized flood areas and areas designated in known and mapped special flood hazard areas and diligently requires elevation of new structures in special flood hazard areas consistent with the NFIP requirements.
30. we struggle with tried and true engineering methods of detaining storm water vs. green infrastructure solutions. More information and a better understanding of GIs positive effects would be helpful in finding affordable solutions in our urban flood prone areas.
31. The City of [deleted] is working on the problem at this time, we have added larger stormwater tiles in areas to help the flooding and remove the water faster.
32. Urban flooding, generally affects the poor at higher levels than more prosperous segments of our society. Additionally, the majority of public housing and poor neighborhoods developed 40 to 50 years ago, at a time when well-to-do urbanites traded town-homes for suburban life and that urban vacuum created low-cost opportunities for the bottom middle class to become first time home owners. These traditionally high flood prone areas evolved from middle class to low middle class to working poor neighborhoods and now they're in areas that are prime for commercial redevelopment as our urban centers continue to expand outward. It is time that we look at getting a do-over. An opportunity to re-imagine what public housing should look like, feel like, and be instead of what we allowed it to become. We should find new areas that can be re-developed into mixed-use sporadic housing that doesn't create a conglomeration of the downtrodden but a co-mingling of our poor with middle class home owners that encourages opportunity and discourages blight. Then communities can redevelop the once blighted flood-prone areas by first improving the infrastructure and flood mitigation measures then planning the public space into parks and functional spaces designed to promote holistic urban development. We essentially trade valuable and location driven living for invaluable living then convert the invaluable living space into viable and important public and private entrepreneurial opportunities. It could be a win - win.



33. My personal opinion is that it is critically important to be careful about the nuances that exist within the realm of urban flooding and the solutions that can help deal with it. Based on your questions, it seems you are well-aware - I just want to emphasize this point because I have read so many policy papers and news articles that do not address the nuances and complexities of urban flooding. The shortcomings of using the 1% chance SFHA to identify properties at-risk are already well known and documented. The methods used to identify riverine SFHAs are quite different from those used to identify coastal SFHAs, and reconciling where these areas intersect/overlap has historically been very problematic. I can't begin to imagine the difficulty of adding urban flood zones as well - particularly when urban flooding may be the result of so many different factors. It is very difficult to model accurately, and I would advocate against any policy solutions that attempt to delineate urban flood zones in the manner that SFHAs are delineated and used for insurance and regulatory purposes. I have also seen literature and news articles that conflate solutions to urban flooding in very problematic ways. E.g. on-site surface systems like rain gardens intended to manage small (1-2") storms (typically used for water quality); with detention systems designed to manage larger (10-100 year) storms; or with living shorelines/wetlands systems designed to manage tidal surges. Indeed, these approaches might all be classified as using natural and beneficial functions, but they are certainly not equivalent. There are also effective solutions that do not use NBF, such as backflow preventers, tide gates, and subsurface storage basins. It could be very problematic if - at the federal level - perverse incentives are created to use one method over another, when the latter might better address the local problem.
34. [Deleted] was developed and exist on a bluff. The urban flooding that occurs in the heart of the central city is mainly attributed to existing drainage infrastructure that predates today's design standards. Or insufficient pipe sizes for the now fully developed urban areas. The [deleted] city has many socio-economically depressed areas. These areas were developed when building codes allowed dense neighborhoods to be constructed without adequate buffers in close proximity to streams. There has been little improvements due to lack of funding, State permit approval and in some cases will. These streams have widened significantly and are often at bank full threatening homes in some cases.
35. The Town of [deleted] has very few problem with flooding. Our flood areas are small streams and wet weather ditches. Our topography is of hills and valleys--very little floodplain.
36. This area's drainage system is absolutely horrific. The lack of funding makes it very difficult to fix the flooding in this area.
37. We are currently working on watershed plans for our entire county to identify what the issues are, where they are and what is required to resolve or minimize the effects.
38. A large part of the area that is in the SFHA has not ever flooded. The largest area is on a Stormwater conveyance system (ditch). There was significant improvements made to the drainage system before FEMA declared it a floodway. The area has not flooded since the area was improved.
39. The problem in most communities is lack of enforcement. Communities need a comprehensive plan to address development, infrastructure needs, stormwater runoff and building codes. When a community doesn't address these issues it only exacerbates other problems and continued urban sprawl eats up rural areas causing flooding, erosion and infrastructure malfunction. Only 1/3 of the state has building codes which enforcement is not uniform and the other 2/3 do not enforce floodplain regulations or even bother to look at stormwater.
40. [Deleted] County is a largely rural county with limited resources to address urban flooding. There is no priority or discussion of climate change or sea level rise. County government priority is based on keeping spending low and limiting growth to targeted areas of the county. At the same time, urban flooding is a relatively small problem for the county compared to surrounding cities that are on the coast and suffer much more urban flooding and nuisance flooding. We have only about 20 properties that are classified as repetitive loss properties under the National Flood Insurance Program.
41. Education of the community is very difficult; trying to balance development and preservation of permeable surfaces.
42. In small communities such as ours, it is difficult to answer some of the questions as there are multiple answers. The officials are elected for staggered terms, many are ignorant of storm water runoff or urban flooding and the lack of funding is a big issue.
43. Lack of education about new low impact development designs. Developers and builders are more likely to follow status quo than to develop new methods of construction and stormwater control measures.
44. We would be more than willing to participate in further discussion on this subject
45. we are rural area and farming is our problem several farmers do a good job the ones that own the ground THE PROBLEM IS cash rent farmers where they have to get as much out of the ground as they can so there goes the waterways and plowing the ground before spring. give the ones that DO IT RIGHT A PAT ON THE BACK KICK THE OTHER ONES IN THE ASS WITH FINES.
46. As City Engineer I have had the opportunity to witness our community efforts with respect to flood-proofing measures and other flood mitigation initiatives. While the City [deleted] is fortunate to have the protection of the [deleted] against coastal flooding it has been a challenge to obtain the funding to make the improvements and upgrades that are deemed necessary from an engineering perspective for urban flooding as well as upgrades on the hurricane barrier system itself. The non-glamorous infrastructure needs compete with more visible public enhancement efforts for the limited dollars available and unfortunately more often than not fail to get funded.
47. Federal or State funding sources for smaller local drainage improvement projects would help communities like ours to do more to mitigate the flooding issues we have.
48. Mapping urban flooding risk would be so helpful!
49. As communities move forward with their planning processes, planning for stormwater should not be ignored. Stormwater management must be part of the overall planning/zoning process. Stormwater management is not only about considering the flooding potential within FEMA designated floodplains, adjacent to creeks and rivers, or designing a drainage system to convey the standard 10yr event, it is also about understanding the characteristics of each watershed and how new development can create its own microcosm of flooding potential, be it 640 acres or only 6.4 acres. As we reshape the land, and install drainage systems that are typically designed to convey runoff well below the ever increasing intensities that are becoming more the norm than not, we must always ask ourselves how does the stormwater find relief. If overland relief is ignored, then that new roadway can become a dam for tomorrow's miniature urban reservoir of flooding. If floodprone areas are not protected and allowed to be filled, be they FEMA or Local, then what we thought was floodprone is actually larger and the impacts and the costs become unmanageable.
50. Most of our urban flooding is due to the structures allowed to be placed within flood plains and the older sections of towns and older subdivisions which were built before the drainage standards were in place. Since the new standards have been in place the only flooding in the newer subdivisions built since then have been heavy rainfalls that swamp the 10 year storm capacity of the system.
51. Many urban flooding conditions can be substantially addressed through land use regulations. They can also be exacerbated by the lack of regulations. It's not really a surprise that the areas of the country with some of the highest losses are areas resistant to regulation.
52. Another major design issue we face with urban flooding is street flooding and its threat to motorists/potentially causing accidents. We have gone away from using open ditches as they eroded and were a maintenance headache along curbed streets. I feel we can still have curbed streets and utilize less expensive/less erosive controls to get stormwater into ditches and away from the streets. The streets should not be considered the secondary flow path once sewer capacity is exceeded.
53. the biggest challenges with flooding are ,funding, and dealing with the different entities to get something accomplished.

54. Folks need to be educated regarding low risk flood policies. I've been to flooded homes where the owners said their insurance agent told them they couldn't get flood insurance because they were in Zone X. Small (5-lot) "subdivisions" that don't require full platting and engineering often bear the brunt of the damage outside the SFHA. Too many homes crammed onto smaller lots, one on top of the other. Poorly designed or badly maintained roads account for a good deal of the citizen complaints during heavy storm events. Some are dedicated right of way, but many are basically private property and maintained by a local owner with a tractor.
55. When building outside of a known floodplain there should be studies done prior to see what effect it will have on that particular water shed as well as the water shed down stream. While the building being built in these areas may not experience any flooding, other areas that may be just out side of the floodplain may experience impact in the future. FIRMS need updating and planning needs to be addressed on a more global scale, regional planning between municipalities, counties, and states that share water sheds.
56. Lots of information is available on our web site. Many of our projects are oriented towards helping to identify problem areas, and developing solutions. Projects can be undertaken by communities, by communities working with the Flood Control District. We have programs for large projects (traditional CIP) and also for small projects. The small projects usually have to have documented flooding. Hopefully the final report will include information on ways that communities are working on to solve these problems. Feel free to contact me if you have questions, or need some clarification.
57. I drive urban communities and take pictures of problems. Swales are not well maintained, infrastructure is aging, and people do not want to elevated their homes (too \$\$). It's also tough on communities to police the floodplain and identify substantially damaged structures. You want to tell a poor person they have to pay \$20K to raise their home (even after ICC gives them \$30K)? So now their home is worth nothing? Not so easy is it? But we need to hold the line and insist on following the NFIP. Eventually we will become flood resistant.
58. We are a community that takes our role in flood protection seriously, we are members of the NFIP and have a CRS rating of Class 6. Our flooding issues are moderate and typically short-lived. During the 60s we had significant flooding of structures that lasted for a prolonged period. Since that time a rules have been enacted that required greater flood protection regulations, in addition many projects for flood protection and storage have been completed.
59. One issue we keep having is FEMA grants really only apply to repetitive loss structures when it comes down to it. We have homes with documented losses dating back to the 1970's, which do not carry flood insurance, so we are unable to secure grants for these structures. There should be another grant process that includes another category for documented losses, but specifically for uninsured structures.
60. Urban flooding is being driven by supposed increases in storm severity and frequency. Forecasting of such is not an exact science and using historic data to predict such is at best a guess. Public funding should not be used for a political issue.
61. Because we also have riverine flooding in the cities and County it's difficult to separate the two causes.
62. NFIP FIRM maps, although useful to some extent have done somewhat of a disservice in communicating flood risk to the general public. There is a sense that if I'm in the SFHA, I'll be flooded and if I'm out of the SFHA, I won't ever be flooded. Further FIRM maps (at least in the Midwest) imply that flooding only occurs in riverine scenarios, and not in local areas.
63. My immediate concern is the definition of urban flooding. I want to make sure that I am providing accurate information. [Deleted] r County is primarily rural, but there are pockets of homes that have issues.
64. PLANNING IS THE KEY. IGNORING THE PLEAS OF DEVELOPERS AND PROPERTY OWNERS IS THE ONLY WAY TO ENSURE FUTURE LOSSES WILL BE MINIMIZED. THEIR ONLY CONCERN IS MONETARY AT THE PRESENT TIME NOT FUTURE LOSSES. FORCING COMPLIANCE IS THE NORM. NOT THE EXCEPTION
65. Developers don't want to bother with issues which affect their bottom line. Owners don't want you to tell them how they should build to alleviate flooding issues. My house, not in flood plain, leave me alone.
66. The answers I have given are my best guess based on my limited experience in the City (past five years or so). We had a very large event in 2013 which is where we saw the majority of issues outside of the mapped 100-year floodplain, which included a large number of basement flooding and sewer surcharge issues that appeared to be related to a high water table and the antecedent moisture condition caused by long-duration rainfall events that are quite different from what is mapped by FEMA. We have developed a city-wide master plan of improvements for major storm sewer and channels based on a custom prioritization schema, and we are working to study and prioritize improvements for local storm sewer systems as well. The [deleted] is the main partner for stormwater master planning and CIP projects throughout the [deleted] Metro Area, and we strongly urge you to contact them to discuss this project.
67. concerns over urban stormwater management (quantity) needs to be as significantly scrutinized as water quality issues.
68. since the creation of our Stormwater Utility we have noticed that our problems stem from obstructions to the path of stormwater. We actively clean our storm system of debris, concentrate on "hot spots" that we know collect obstructions and encourage property owners through outreach materials to maintain their own drainage swales in their back and side yards. We have also observed that the areas that are flooding have always flooded - that the current property owners either do not remember or it hasn't happened for 10 years so it has never happened in their eyes. As long as the design of the subdivision was done competently and the sewer system is clean and obstructions are free in our area in our region the system appears to be working. But we have only been a utility a short time.
69. Two staff within department on floodplain management; drainage and stormwater within different department. We manage planning and building and work with applicants to understand risk and need to mitigate. Always know that there is more that we can do and would like to do.
70. Most of the community was developed post-FIRM, so major flooding impacts are limited. Older part of City are hampered by inadequate drainage systems. As interest in redeveloping these areas increases, stormwater management becomes an increasingly important concern. Newer parts of the City, developed within the last 15 years, are experiencing more groundwater issues.
71. This appears to be a relevant and timely area of study. Concerns about climate change tend to drive resources toward preparation for major events (without adequate resources to actually address them) while reducing the resources/interest to address more frequent events. Tools to better optimize approaches and gain public support would be of value.
72. I think 2 dimensional rain on grid analysis provides the best information for revealing urban flooding issues.
73. Several colleagues and I have developed "Challenge of Urban Flooding" presentation and workshop that we have delivered at several venues (including TFMA, ASFPM, INAFSM). Main conclusions: 1) "Solving" urban flooding is not financially viable for most communities. 2) Focus spending first where public safety is threatened (hazardous crossings). 3) Mitigation should look to lessen flooding and include financial ROI analysis. 4) "Managing flooding in place" is a philosophy I advocate: detention vs. conveyance improvements for existing flooding to prevent adverse downstream impacts. 5) Regional detention is more effective and cost-efficient than numerous on-site detention systems.
74. Managing stormwater where it falls is important for new development; also, as redevelopment or urban infill occurs, implementing stormwater management techniques are equally important as a requirement to limit the rate and volume of stormwater to overloaded, aging systems. What is out of sight it usually out of mind, until a problem occurs, so it is important that the need for these techniques is understood and accepted by developers and community political representatives.

75. A large portion of our urbanized flooding issues come from a local university that is expanding in development. Despite efforts, the University is not required to meet our drainage ordinances and continues to increase runoff within areas of the city that were not previously subject to flooding. City officials have tried to work with the University to mitigate these issues, but the university continues to build without accounting for increased drainage. Due to the University being their own MS4, we are also unable to work on a water quality angle.
76. Addressing flooding in urban environments seems to be an issue that has not yet been adequately addressed either through BMP's for Urban Environments by FEMA or State government agencies. Too often, FEMA likes to promote mitigation measures that are more suitable to traditional coastal environments like building elevation projects, etc. which are not feasible in dense urban environments where 4 and 5 story brownstones are predominant. Additionally, funding in CSO communities for infrastructure modernization seems to be lacking in order to properly address the issues that many communities face. Development in older communities such as those in [deleted] County has outpaced infrastructural upgrades as it relates to storm and wastewater management.
77. Until a shift in thought that just lets the issue be handled by the next generation or future politician, then it will never be fully addressed. Money is a very large motivator and until there is a solid way to make money off of urban flooding, then major political and economic powers will not address the issue, until everyone is swimming to safety.
78. Most of our problems are related to slope development that occurred before development was controlled. The newer communities that we have are better regulated. We in a continual retrofit cycle on the old communities that is limited by funding because of the scale of the problem compared to the population of the city.
79. The recent executive order from the White House regarding lowering standards for certain buildings is significantly adverse to wise planning.
80. Upgrading failing infrastructure is important.
81. The only way to reduce it is to make changes in how we develop and to go back and retrofit development that is causing issues.
82. Challenges of urban flooding include large public cost of numerous small projects to minimize or reduce flood risk to a few affected private properties. Because retrofit storm sewer upgrades are expensive and usually disruptive, they are not as highly prioritized as major stormwater projects such as arterial roadway bridge or culverts, regional detention ponds, etc. Often the repetitive flooding has been going on for so many years in older areas of towns, that it is just considered business as usual, even for the property in some cases
83. The NFIP has enabled development in flood prone areas with standards designed to reduce risk to individual policy holders and to the NFIP Fund at the expense of stormwater impacts at the community level. NFIP regulations, particularly 44CFR 60.3.(C) (10) where when no regulatory floodways are designated requires communities to determine that the cumulative effects of existing and anticipated development will not increase the BFE by more than 1-foot. The NFIP has generated know procedures or compliance requirements to ensure that communities are doing this. A cycle emerges where flooding gets more frequent, deeper and expanding outside of areas designated as flood zones.
84. The Village of [deleted] is a prime example of a community that faces urban flood issues. [Deleted] is not adjacent to a major tributary receiving water, but has several isolated neighborhoods that face significant urban flooding during even moderate events. While these locations are few, the impact felt by these residents is massive. Although these are small areas within the community, the Village continues to struggle with the concept of allocating major capital funding to help only a small contingent of the community. Due to this struggle, these areas continue to go unmitigated.
85. It's generally a variety of factors that contribute to poor and inadequate drainage and urban or localized flooding. We don't have great soils originally, so clay and other soil types make stormwater infiltration BMPs difficult to construct. Density of development leaves little space for other types of BMPs and solutions like underground chambers are generally only possible on private property requiring additional relationships and capital to make those happen. These older areas of town have smaller public ROWs (three rods v four), so there is little room within the public ROW for BMPs as well. We were hit hard by Hurricane Irene five years ago which keeps the topic in recent memory, but balance between grand list growth on our beautiful lakefront property , and safety of our citizens who are served by volunteer fire departments, is constantly a challenge.
86. We need FEMA to establish flood elevations in all "A" Flood Zones just like in the "AE" Flood Zones.
87. The sewer systems and subdivision designed in the 50-60 have inadequate sewer and overland flow routes. Small creeks and tributaries have been filled and houses built on them.
88. Green infrastructure, unless designed larger than necessary for achieving water quality benefits, will not significantly impact urban flooding problems.
89. Addressing urban flooding requires making hard choices that affects existing development and may require the removal of existing development. Getting willing participants in that process can be tough and even then it can be cost prohibitive. In [deleted] County urban flooding really only occurs in areas developed prior to the formation of the [deleted] County Flood Control District (deleted)) and the subsequent strengthening of Floodplain Management Ordinance in the years since.
90. The lack of flooding in the regulatory floodplain shouldn't be viewed as a failure to map where flooding occurs, as those were only meant to map riverine flooding. The limitations of FEMA maps are simply not understood by the public, which is where improvements need to be made. Urban flooding is acknowledged but not mapped in a well-organized fashion. Some communities know flooding zones from complaints and modeling studies, others do not. Most of the information, if it exists, is not easily available to the public. This is the issue. Once it is identified, it needs to
91. I am in support of treating stormwater runoff like a utility. Each parcel would contribute to providing conveyance and management of stormwater to a place of adequate capacity. Easement and rights of way would be established to protect conveyance resources and parties responsible for maintenance would be identified.
92. I am responsible for environmental planning for 49 municipalities that range from densely developed inner ring suburbs of [deleted] to more suburban communities. The survey asked that my responses address one community. I selected my own suburban community due to my familiarity with its conditions. The county has numerous municipalities, both inland and along the [deleted] Riverfront, that experience severe flooding in low-lying areas with poor drainage. Many of these areas have under-sized drainage facilities, poorly maintained facilities, or none at all. There are also many homes in the county, including my own which is on top of a hill, that experience basement flooding due to groundwater. While stream/floodplain management is an important topic to address, so are the impacts of flooding from other causes.
93. We have storm water management. We are rural. To us, in our area, it seems like we are being regulated to fix problems that were created by lack of planning in downstream communities.
94. My area of concern is mitigation of future potential pollution sites as they are exposed to flooding and sea level rise for which these sites were not designed for. Houston area and Hurricane Harvey are a wake call for this area of concern. Business as usual must end, and cleaning up our environment must continue at full throttle before our food and water resources are beyond repair and use.

95. I think that urban flooding problems are well known in the public works departments, but there is little political will to raise taxes to properly maintain and upgrade stormwater facilities as needed. Our communities frequently vote against any tax increases. Politicians and public works departments need to do a better job of explaining that infrastructure has a service life and needs to be replaced, that the hydrology of the community changes with development, and that projected climate change makes further exacerbate existing problems with the system.
96. The most significant and constant & unaddressed cause of flooding in Overland Flow, caused by insufficient attention to lot design local drainage at the subdivision block and lot level slab-on-grade construction, especially when on-site drainage impacts more than 2 lots before it reaches public conveyance, such as public streets and storm sewers.
97. Riverine flooding is the main flooding challenge that many communities in the Delaware Valley region face. However, they also face issues of tidal flooding and sea level rise, which if combined, could be disastrous. Communities are thinking about this issue and want to address flooding, but often don't have the resources to undertake mitigation strategies. Also, most municipalities approach mitigation as property acquisition.
98. We need to ensure that we approach this from the point of view that, if we ever knew what a 100, 500, or 1000 year storm or flood is; we simply must realize that the extent of large and infrequent events is highly uncertain and we must design and maintain such systems to reflect such uncertainty in a variable and uncertain climate.
99. Our region has been in a prolonged population boom, so many of our residents are relatively new to their homes and surroundings. Local agencies do a good job with annual "flood awareness" outreach, but nothing can fully prepare new residents for the problems they haven't yet seen themselves.
100. The one thing that has worked the best in this location is design criteria that mandates consideration of extreme event flow in the design of new or redesigned street and storm sewer systems. Storm sewer is designed for some frequent storm event, but roadway high points are designed to cascade to an appropriate outfall location (or storm sewer size is increased). Major reduction in risk for those areas built in last 40 years.
101. There is an unwise reliance upon modeling results to identify hazards.
102. We don't talk enough about the tension between drainage and flood mitigation. For example, the urban drainage system (inlets, pipes, etc..) in [deleted] only can drain about 1" per hour. Many argue for a more robust system, but improving that system will only deliver runoff to the major streams and bayous at a higher rate, and those systems are already overtaxed. A major obstacle to mitigation is economics. The federal government wants to see benefits in excess of costs, and essentially takes the position that many times it is more economical to accept current risk and do nothing. Perhaps, but this also becomes in conflict with concept of flood mitigation. I've studied urban flooding in cities throughout [deleted]. Almost always, more land is needed to restore historic drainage, floodplains, and even provide detention. There is a cost, and on top of that, it requires political will to move people.
103. We know that in our area, urbanization increases run off by about 300 percent. Finding ways to either utilize or infiltrate that extra water will go a long ways to solving future issues. We have tried to be proactive in not just sticking to a one size fits all answer for new developments, but rather allowing developments offer up solutions that work better for them, but still reduce the flows by the desired amount.