MAINTAINING RESILIENCY OF STORMWATER AND RESTORATION PRACTICES

CRWG – APRIL 20, 2020

OUTLINE

- Background/Refresher
- Climate Change and Stormwater Survey
- Managing Current and Future Flood Risks in Urban Landscapes
- What's Coming Next

REMIND ME ABOUT THIS PROJECT

- **Who:** CSN and the USWG

- **What:** Two project "tracks"
  - Track 1: GIT Funded Project for County-Scale Projected IDF Curves for Chesapeake Bay Watershed
  - Track 2: Research and Management Synthesis to Improve Resiliency of Stormwater Infrastructure

- **When:** September 2019 through November 2020

TELL ME MORE ABOUT TRACK 2 PLEASE

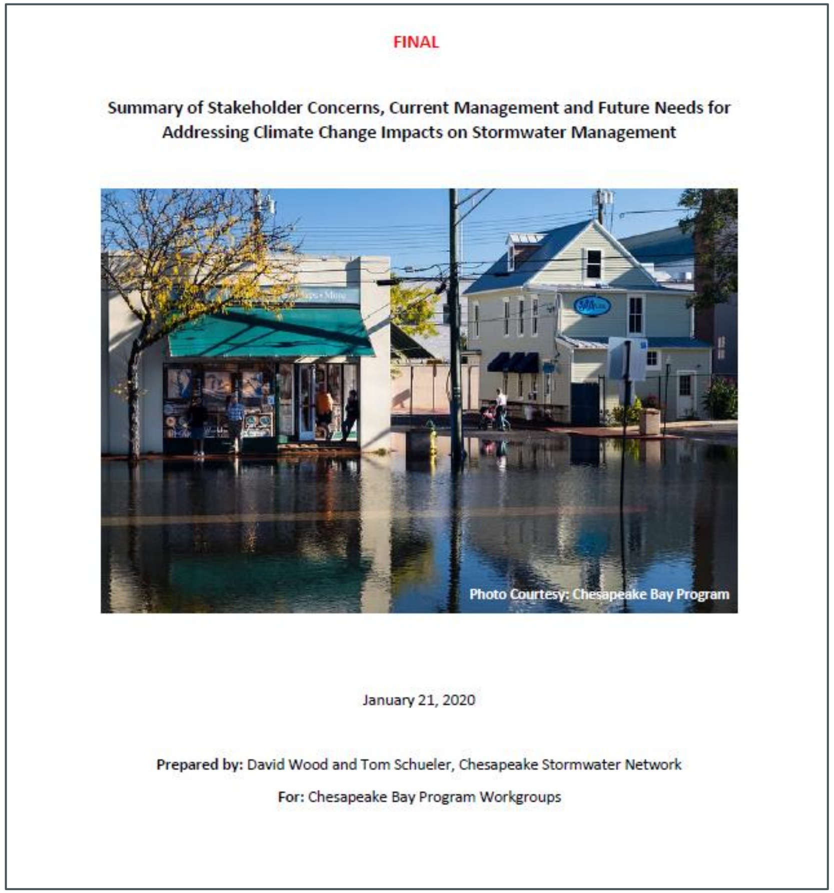
- **Memo 1:** Summary of Stakeholder Concerns, Current Management and Future Needs for Addressing Climate Change Impacts on Stormwater Management
- **Memo 2:** Review of Current Stormwater Engineering Standards and Criteria for Rainfall and Runoff Modeling in the Chesapeake Bay Watershed
- **Memo 3:** Synthesis of Precipitation Analyses Used to Derive Intensity-Duration-Frequency (IDF) Curves
- **Memo 4:** Vulnerability Analysis of Urban Stormwater BMPs and Restoration Practices

Stakeholder Workshop: "Gather" key stakeholders to review key findings and develop action plan

SURVEY RESULTS

MEMO

- Summarizes Key Findings
- Overview of Methods and Response Demographics
- Full Survey Results in Appendix B



FINAL

Summary of Stakeholder Concerns, Current Management and Future Needs for Addressing Climate Change Impacts on Stormwater Management

Photo Courtesy: Chesapeake Bay Program

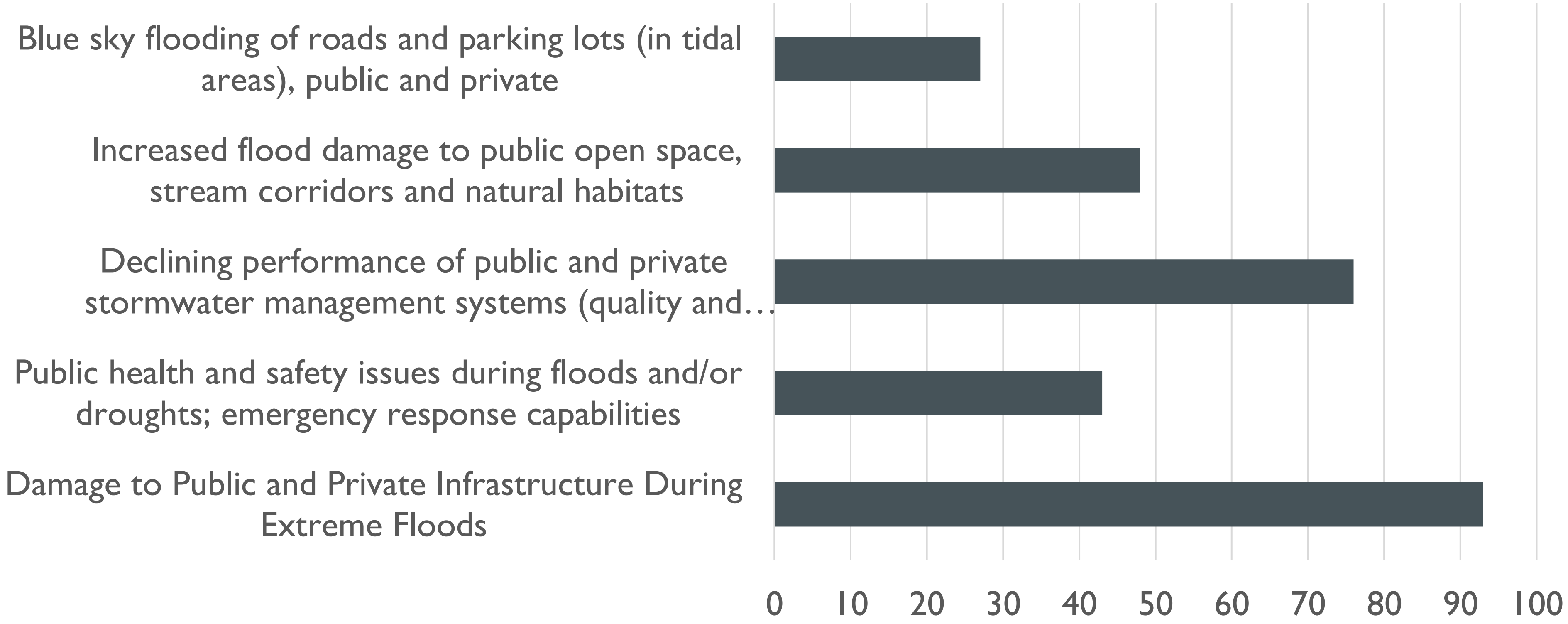
January 21, 2020

Prepared by: David Wood and Tom Schueler, Chesapeake Stormwater Network

For: Chesapeake Bay Program Workgroups

TAKEAWAY 1

- Biggest Concern is damage to public and private infrastructure – particularly roads, bridges and culverts – caused by large storm events



WHAT'S AT RISK?

Public Infrastructure

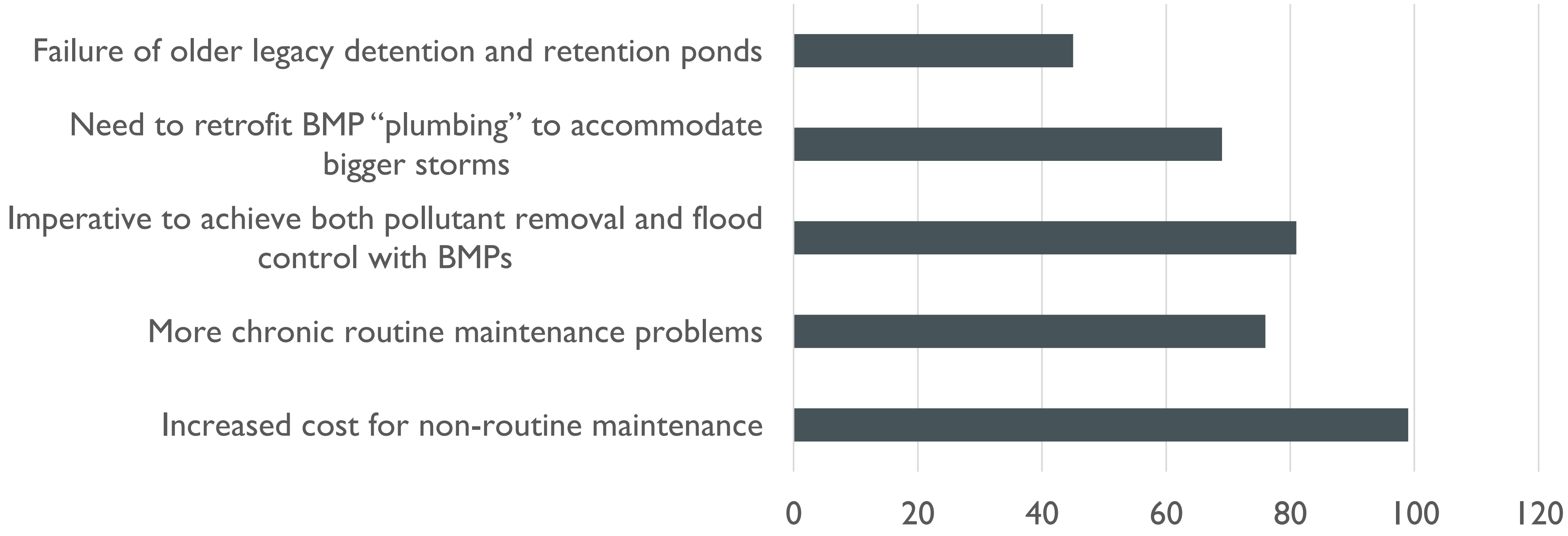
- Sewer pipe network
- Roads, streets and storm drains
- Bridges, culverts and crossings
- Water pipe distribution system
- Dams, embankments and flood control practices
- Public stream restoration projects
- Public stream corridor or waterfront
- Wastewater treatment plants and public works yards (floodplain)

Private Property

- Expansion of 100 year floodplain insurance boundaries
- Residential flood damage
- Shoreline engineering to prevent erosion
- Bank erosion/tree canopy loss
- Failure of privately- owned stormwater systems

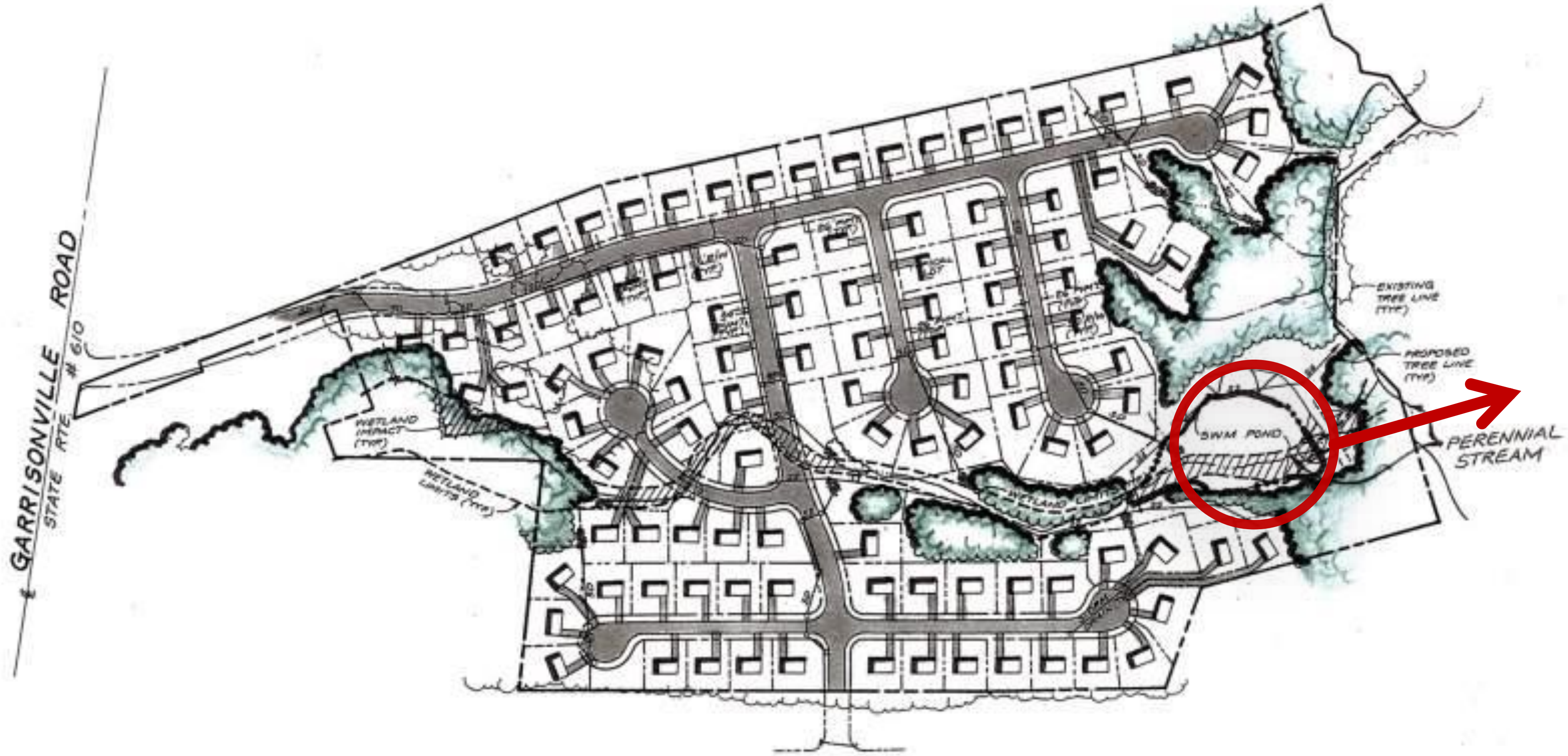
TAKEAWAY 2

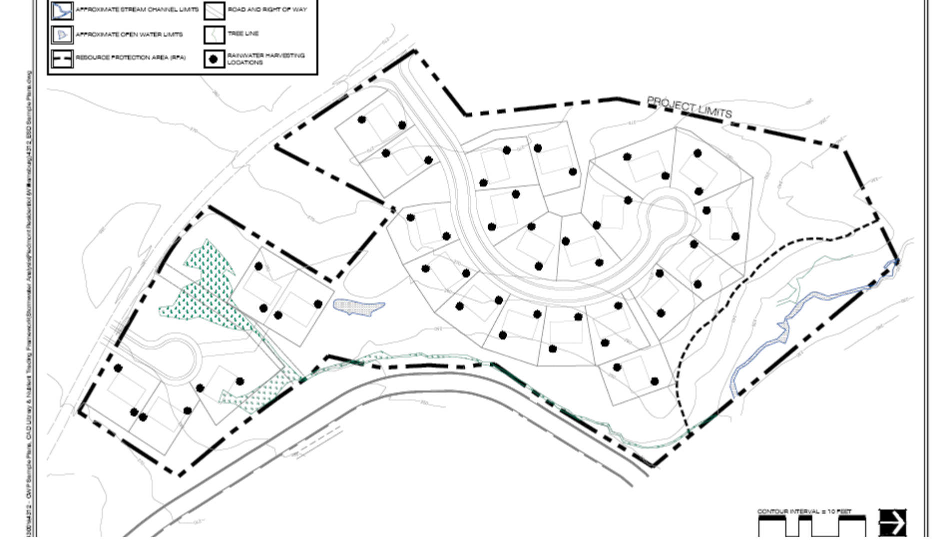
- Everyone is concerned with how to pay for the necessary maintenance and upgrades, as well as to plan for future resilience.

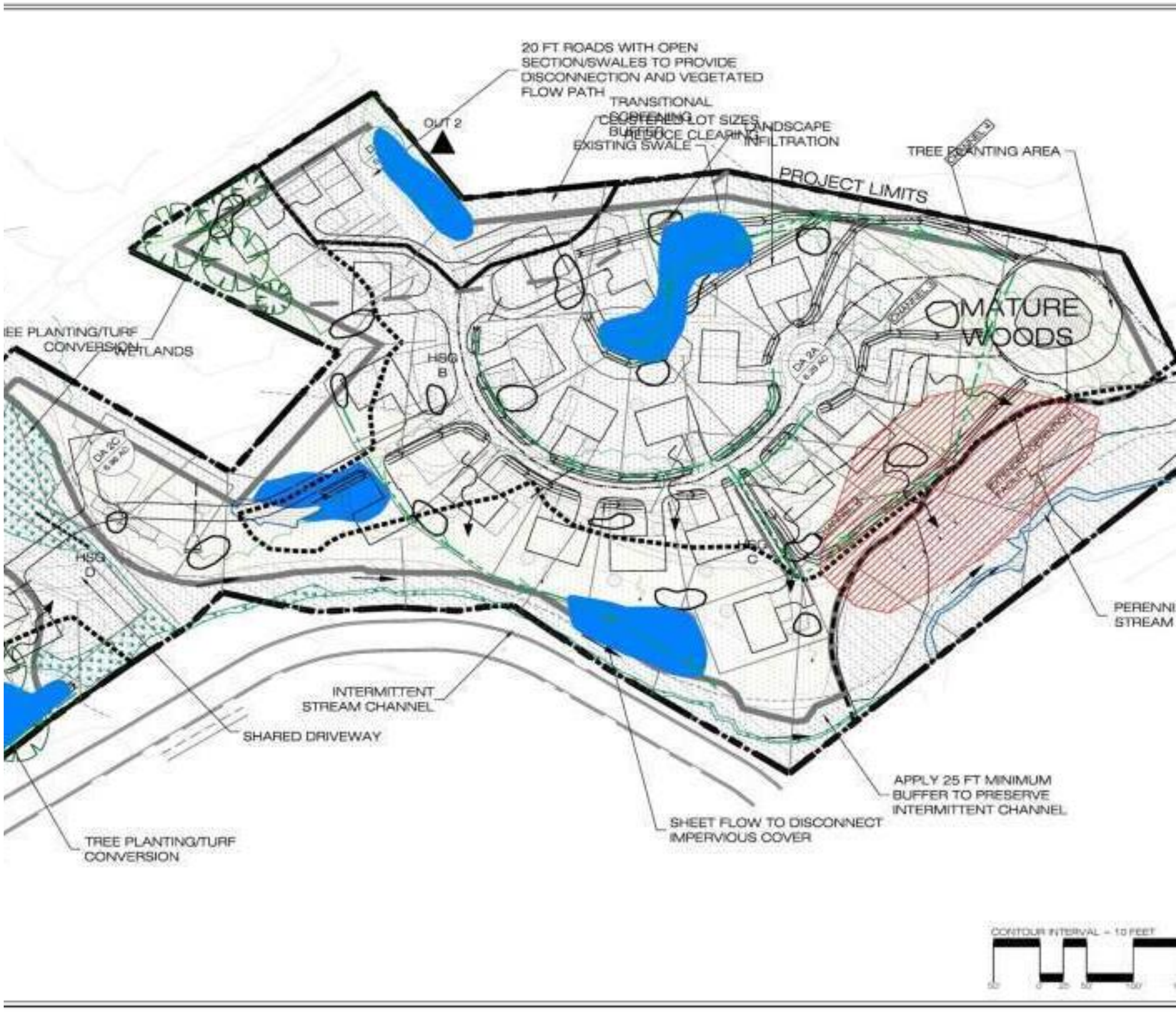


THE OLD BMP INSPECTION MODEL

One big pond:







THE NEW "MANY-BMP" MAINTENANCE MODEL

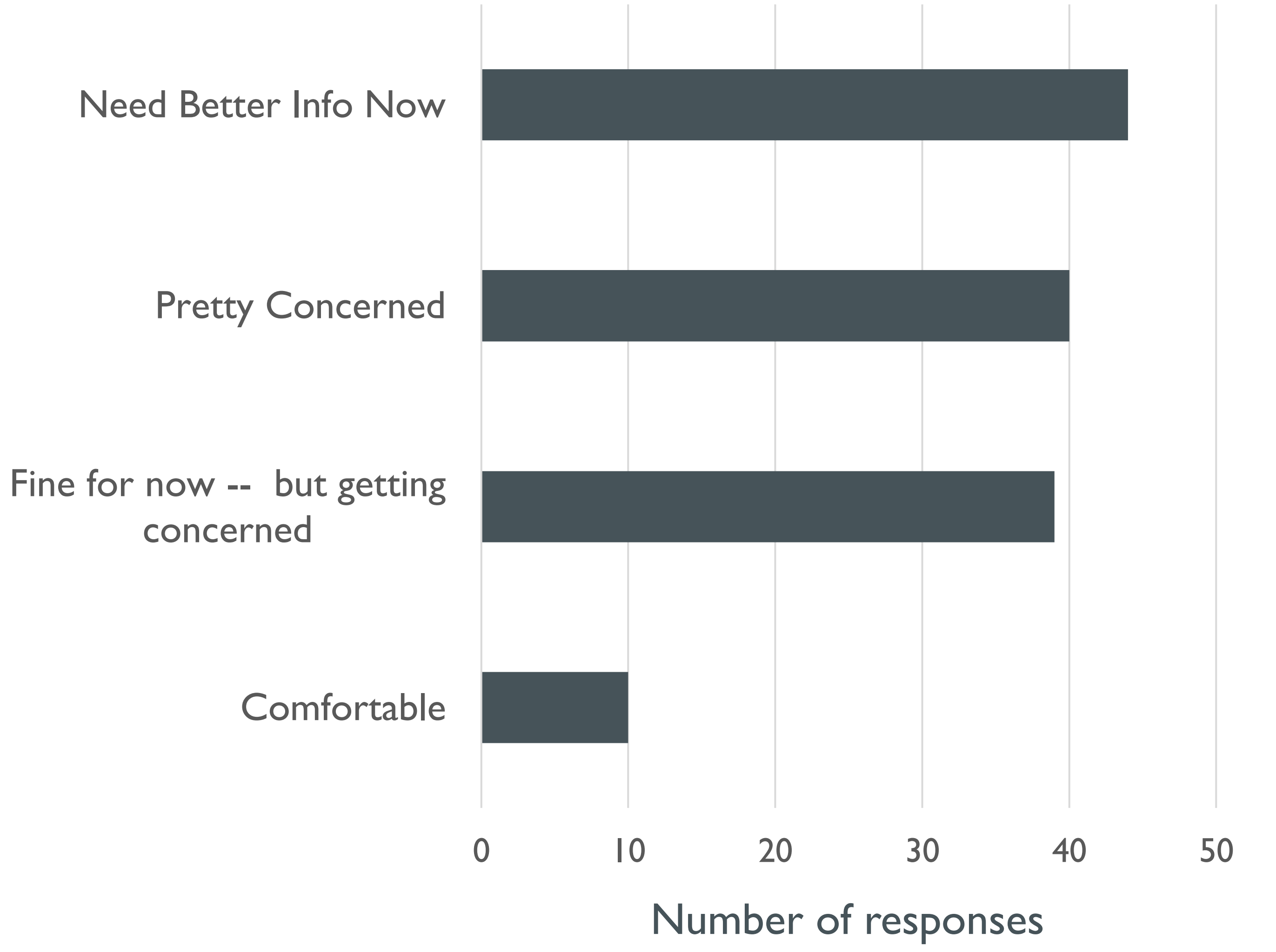
- 24 disconnections
- 18 swale sections
- 14 rain gardens
- 5 bioretention areas
- 4 tree planting areas
- 6 sheet flow credits

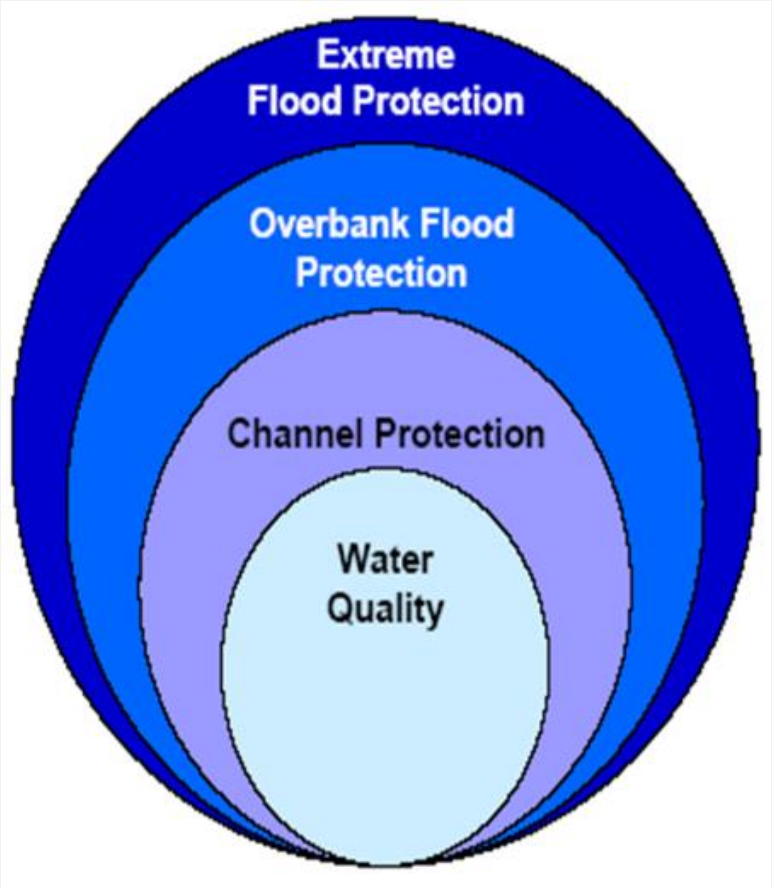

MAINTENANCE

- Bed Erosion
- Sedimentation
- Inlet Erosion

TAKEAWAY 3

- Respondents are not comfortable with the current quality and utility of engineering design criteria on future rainfall intensity





Water Quality criteria refers to the storage needed to capture and treat the runoff from a set storm event to remove pollutants such as nitrogen, phosphorus and sediment. For most states in the Chesapeake Bay watershed, this means capturing and treating the 90th percentile, or 1”, rainfall event.

Channel protection criteria are set to ensure that runoff can be stored and released in a gradual manner so that storm events will not cause erosion in downstream channels.

Channel Conveyance (Overbank Flood Protection) criteria are designed to prevent an increase in the frequency and magnitude of storm events that overflow the channels, causing flooding.

Extreme Flood Protection criteria is to prevent flood damage from large storm events, maintain the boundaries of the pre development 100-year FEMA floodplain, and protect the physical integrity of BMP control structures.

"TYPICAL" SIZING CRITERIA*

Objective	Design Storm
Water Quality	90th percentile storm event
Channel Protection	1 or 2 year
Channel Conveyance	10 year
Roads/Bridges/Culverts	Varies by road size, 10 to 100 year
Dam Safety	100 year or PMF
Floodplain Management	100 year

*Varies by jurisdiction, these are provided as most common examples

THE DATA SOURCES

Summary of Design Rainfall Events in the State of Maryland			
Return Frequency for 24-hr storm event [1]	Mean Rainfall depth (inches)	Range across MD (inches) [2]	% change from TP 40 to Atlas 14[3]
1-year	2.6	2.4 to 3.0	-1%
2-year	3.2	2.9 to 3.6	-2%
10-year	5.0	4.5 to 5.6	-5%
100-year	7.1	6.2 to 8.1	16%

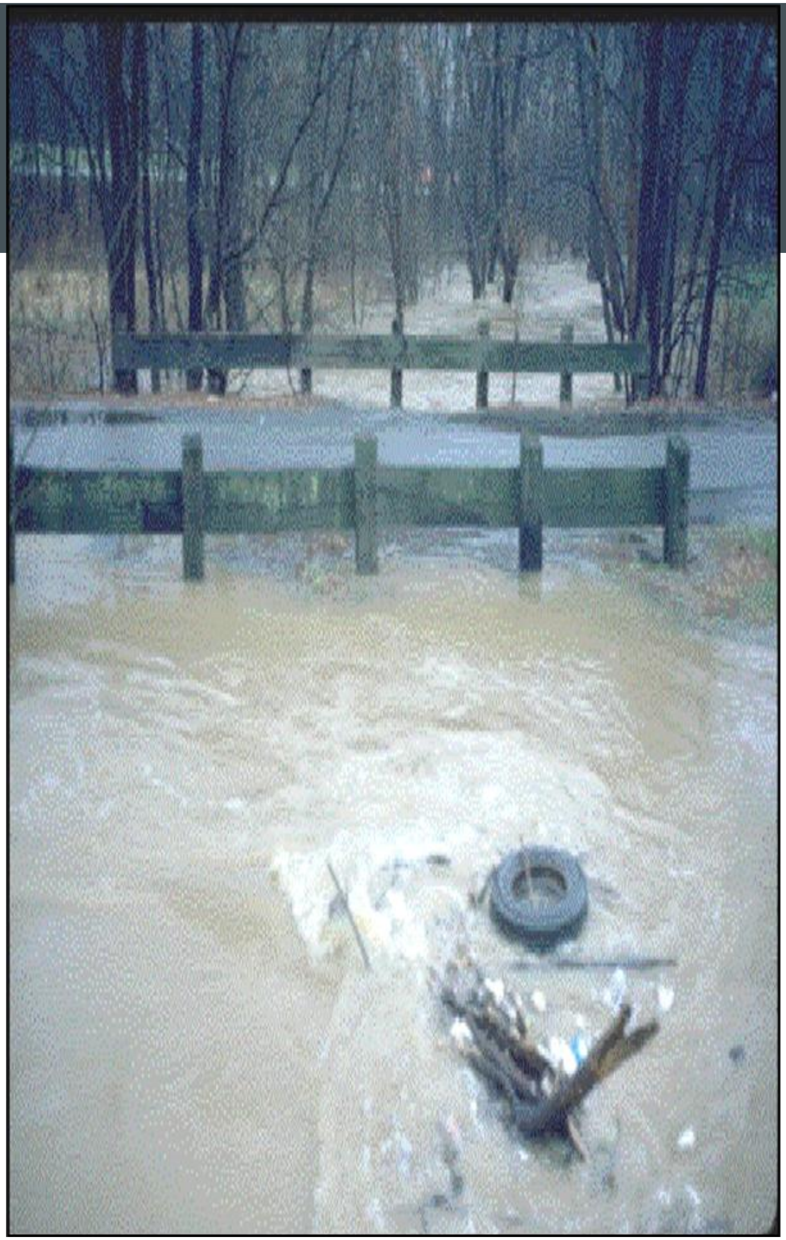
[1] values for a range of MD counties, as reported in MDE (2000) which primarily derived from TP-40 rainfall analysis from 1970's - 1990's. All values are shown approximate, and designers should rely on the most updated versions in their region for actual engineering design .

[2] high end of range usually occurs near coast and lower end of range occurs in the mountains

[3] Based on an average of Frederick, Annapolis, and Salisbury

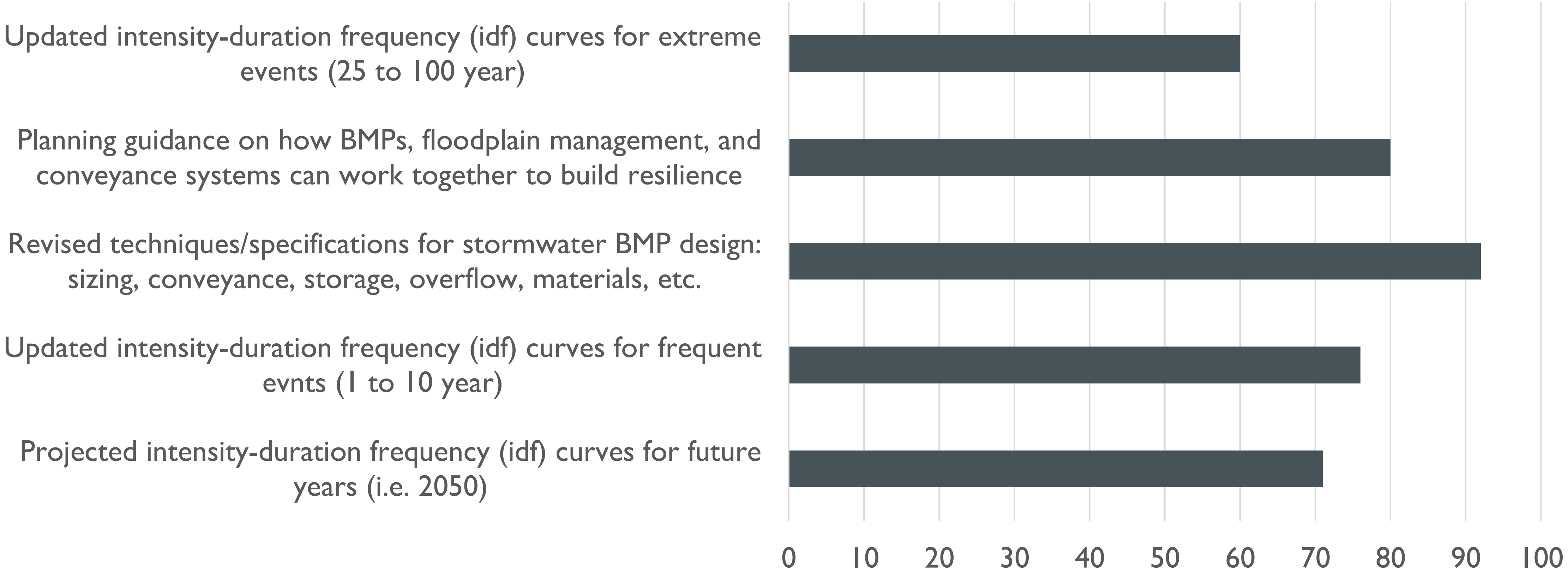
FOCUSING ON THE LARGE EVENTS

- Communities are most concerned with large impacts
- Most additional precip is going to the largest 10% of storms
- Floodplain management and dam safety have the most direct impacts on public health and safety



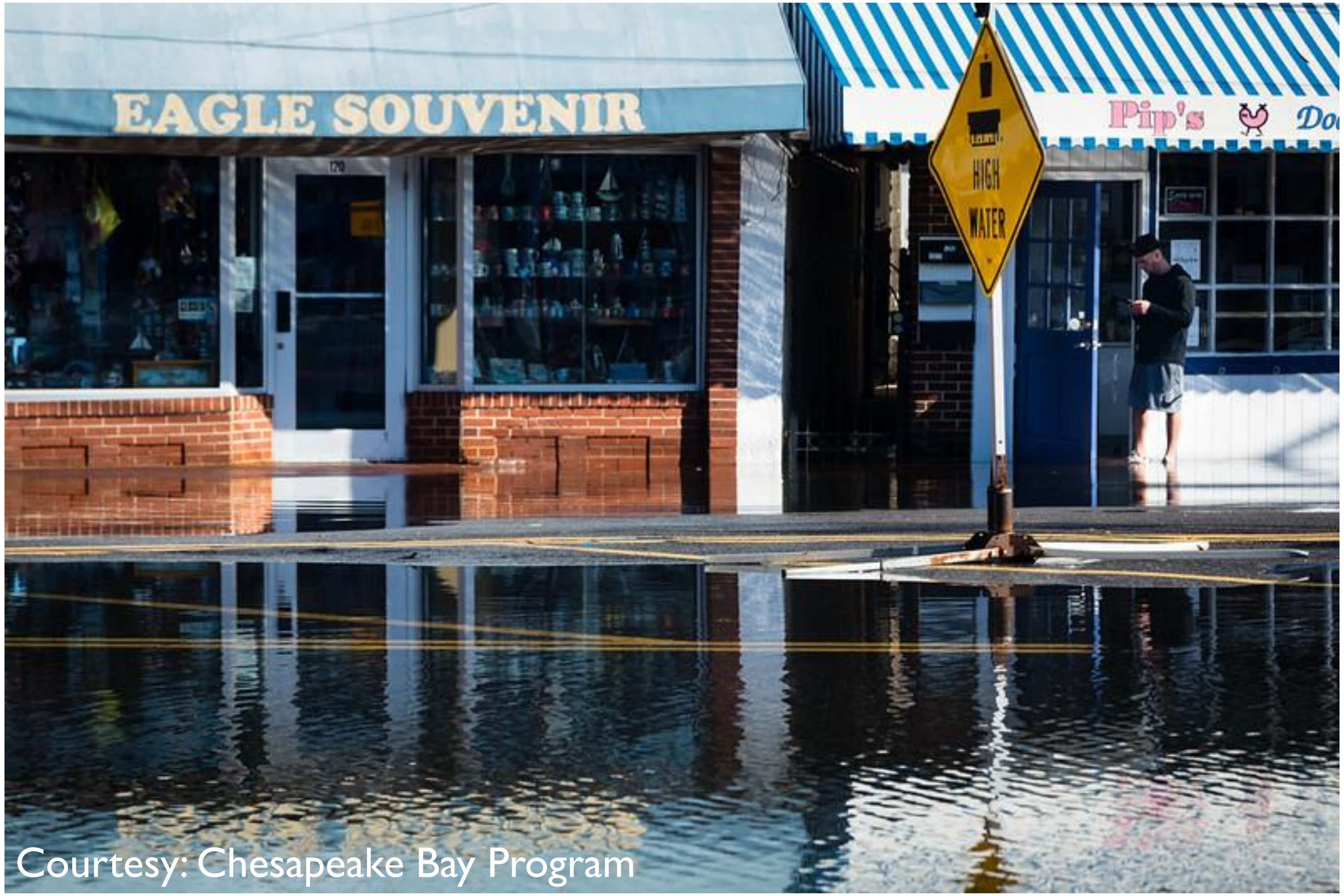
TAKEAWAY 4

- All tools are useful, but if we need new designs, give us new design specs



TAKEAWAY 5

- Responses were generally consistent across community sizes and geographies



Courtesy: Chesapeake Bay Program

DIFFERENCES ACROSS THE WATERSHED

- Headwater States and Small Communities – cost and resource constraints magnified
- Small Communities – more interested in easing maintenance burdens and planning guidance
- Large Communities – more interested in retrofitting existing practices
- State Agencies – more interested in projected IDF curves
- Local Govs – more interested in historic IDF curves

WHAT'S COMING NEXT

WHAT IS COMING NEXT

- Memo 2: State-By-State Summary of Current Engineering Standards

Table 1

Range of Urban Stormwater Design Criteria and Engineering Models Potentially Influenced by Future Changes in Rainfall Depths, Intensity or Hourly Distributions [1, 4]

Management Objective	**Design Storm**	**Purpose(s)**	**Engineering Models**
Recharge	Annual rainfall depth for site HSG	Promote infiltration & groundwater recharge	Equation = runoff coefficients
Water Quality (WQv)	90% frequency hourly rainfall event [2]	BMP sizing to remove pollutants in urban runoff	Simple Method, runoff capture equation or SWMM
Channel Protection	One-year storm event	Prevent downstream bank erosion	NRCS TR-55 and TR-20
Channel Conveyance	2 and/or 10-year storm event	Sizing of swales, channels, storm drain pipes, and detention ponds	NRCS models or SWMM
Road Drainage & Culvert Design	10 and/or 25-year storm event	Protect road infrastructure from erosion	Rational method
Dam & Bridge Safety	100-year storm event or greater [3]	Design of embankments, risers and emergency spillways	
Floodplain Delineation		Lateral and vertical boundaries of existing and ultimate 100-yr floodplain	
Stream and Floodplain Hydraulics		Protect roads, sewer and other public infrastructure. Maintain stability of stream/floodplain restoration projects	TR-20, HEC-2, HEC-RAS 2D and 3D models, and others

WHAT IS COMING NEXT

Memo 3: Summary of Current Science on Local Precipitation Projections

- CBPO Climate Assessment Findings for Rainfall Volume and Intensity
- Projected IDF curve development work
- Design and management considerations

WHAT IS COMING NEXT

Memo 4: BMP Vulnerability Analysis

- Change in pollutant removal performance due to climate change
- Best practices to improve resilience (retrofits, sizing, maintenance)
- Traditional stormwater practices and "Bay BMPs"

QUESTIONS?