

PREPARING FOR INCREASES IN
EXTREME PRECIPITATION EVENTS IN
LOCAL PLANNING AND POLICY ON
MARYLAND'S EASTERN SHORE

Jim Bass
Coastal Resilience Program Manager



EASTERN SHORE LAND CONSERVANCY

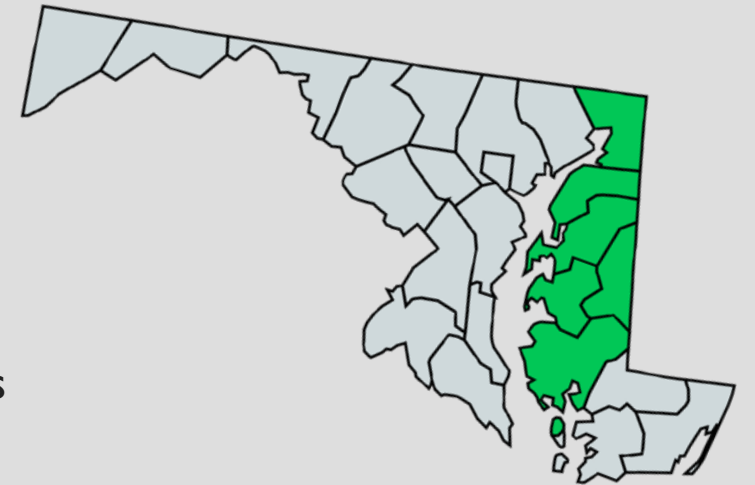
Provide assistance and resources to communities for mainstreaming climate preparedness

- Hazard mitigation plans (Talbot, Dorchester)
- Participatory vulnerability assessments (St. Michaels, Kent, & multi-jurisdiction)

Increase regional capacity for adaptation

- Eastern Shore Climate Adaptation Partnership

Raise the visibility of rural communities and need for assistance and resources





EASTERN SHORE CLIMATE ADAPTATION PARTNERSHIP

The ESCAP “promotes learning and collaboration among Eastern Shore communities to prepare for changes in weather patterns, flooding, and other environmental conditions.”

“The ESCAP is a venue for partners to provide support, education, technical assistance, and resources to help communities build resilience.”

Emergency management, planning, health, public works, administration



EXTREME PRECIPITATION STUDY

Are the regional patterns of extreme precipitation changing?

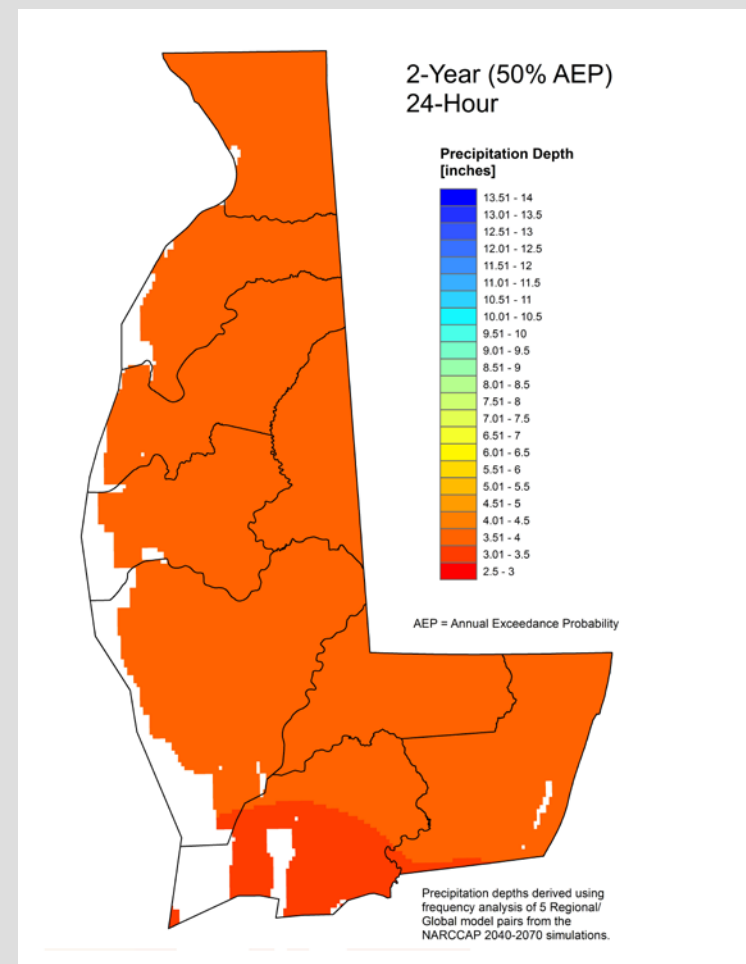
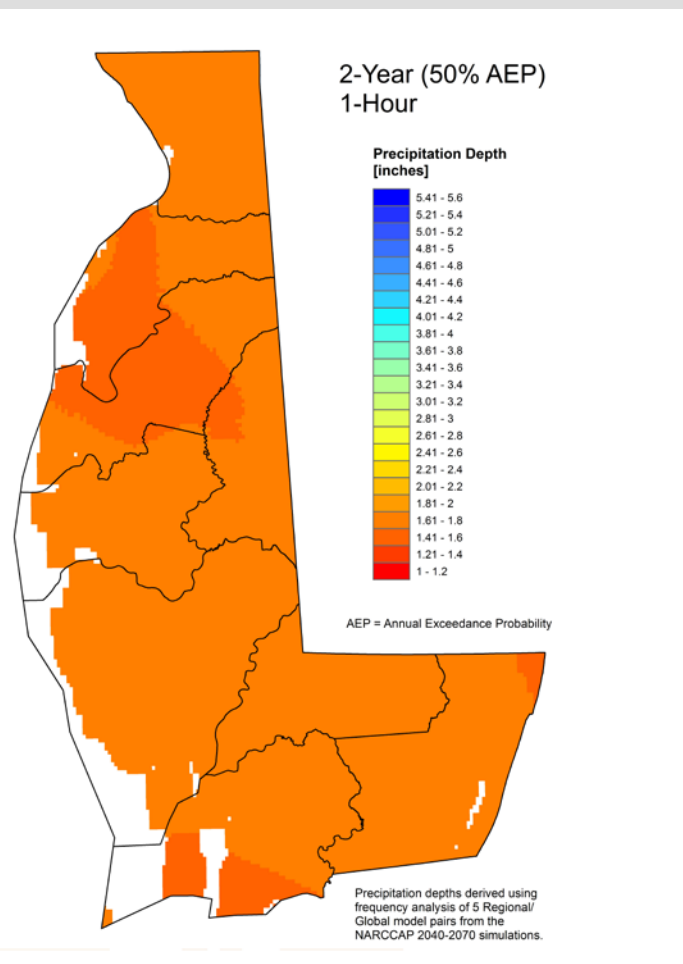
How might extreme precipitation change in the future?

Dr. Kaye Brubaker
Director, Maryland Water Resources Research Center
Civil and Environmental Engineering

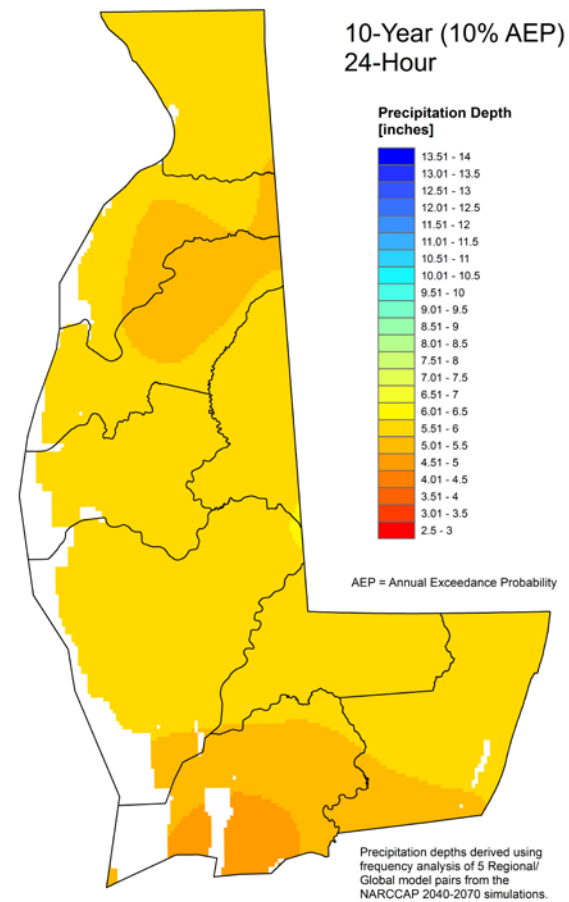
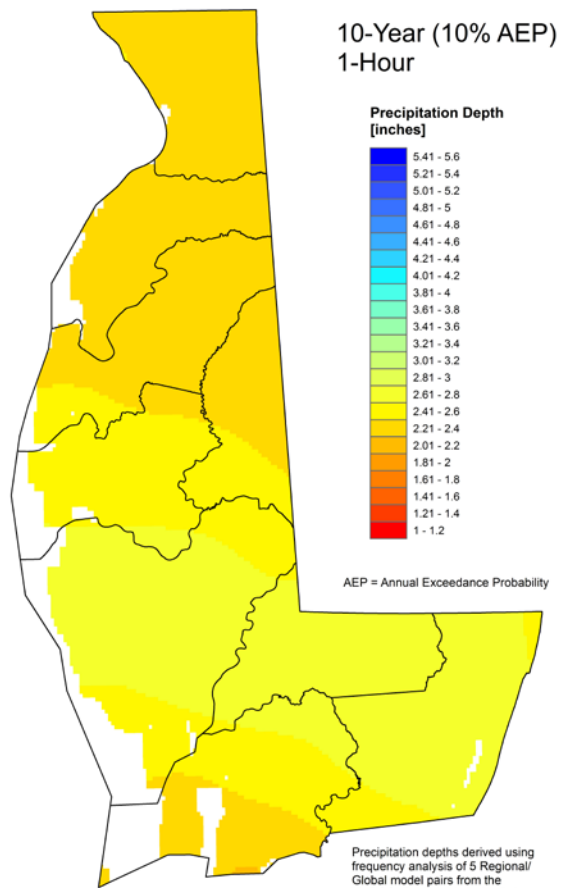


UMD PRECIPITATION DATA

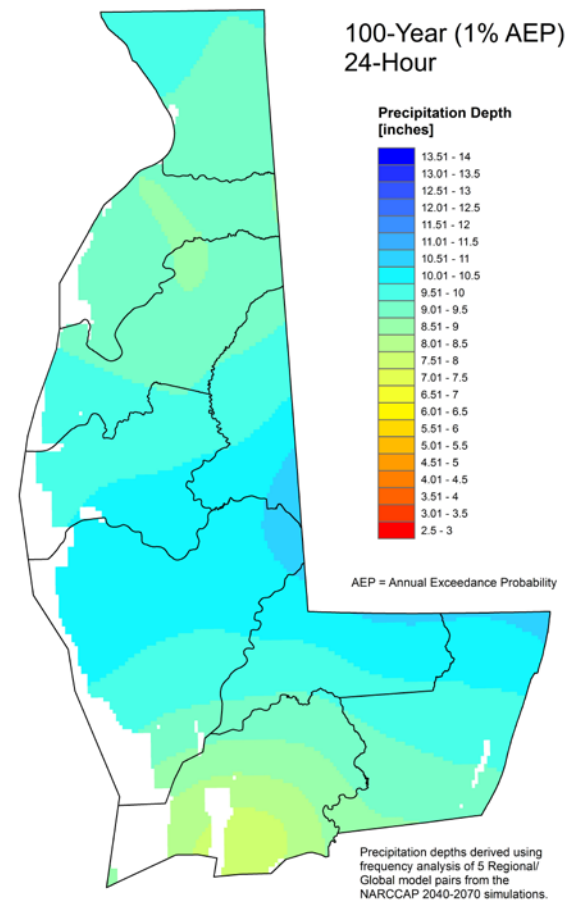
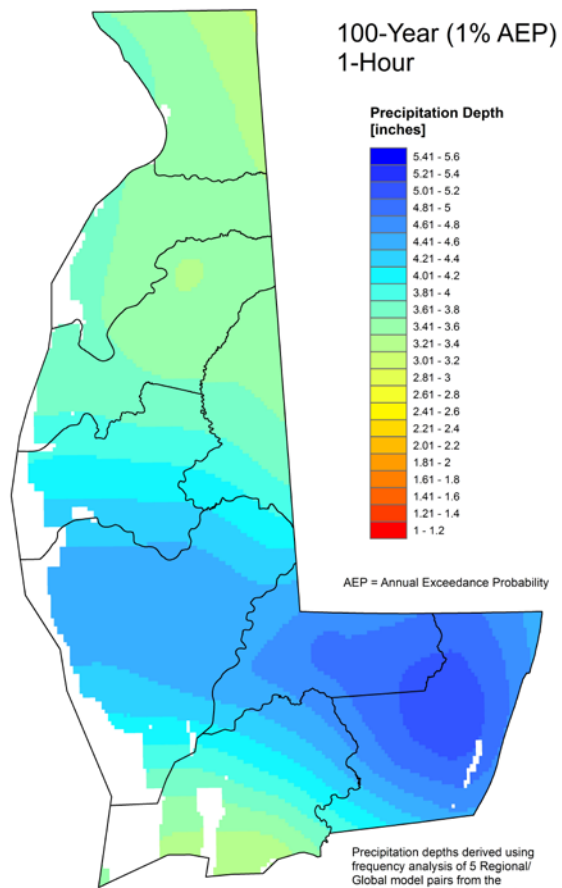
ANNUAL EXCEEDANCE PROBABILITIES



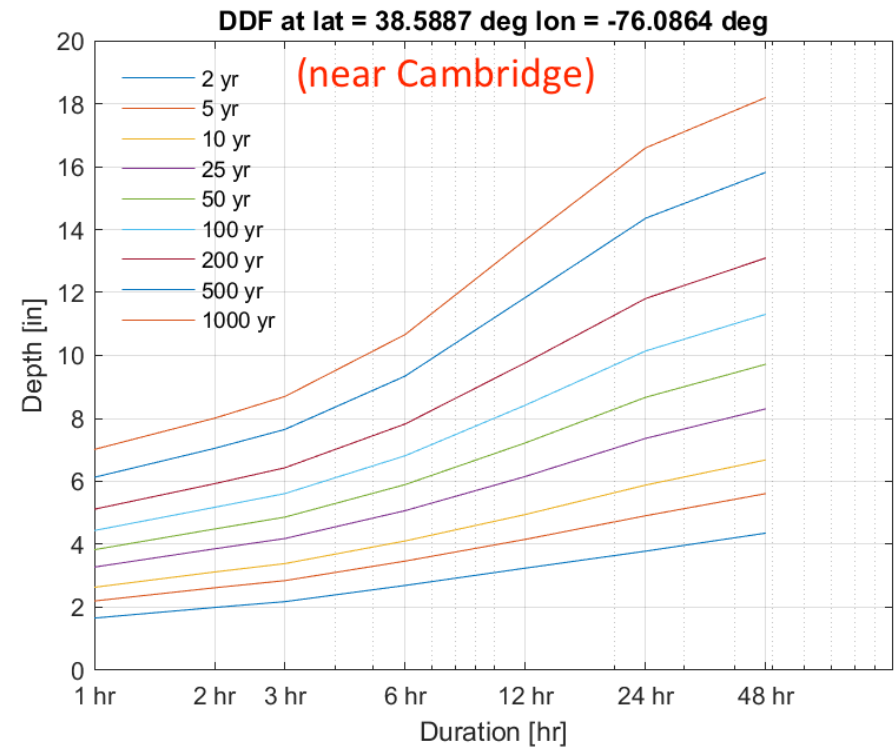
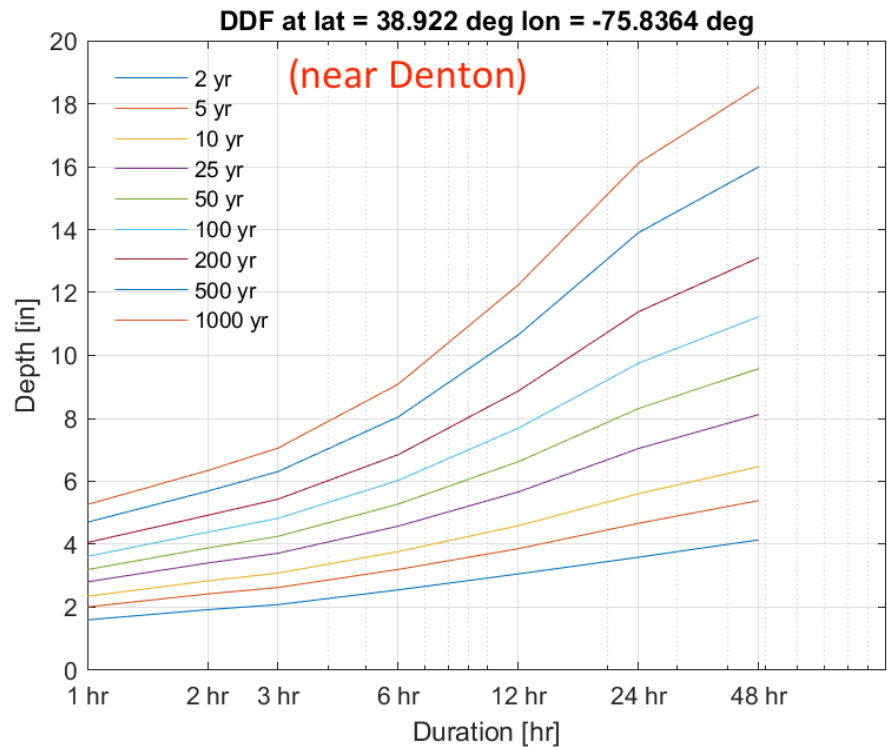
ANNUAL EXCEEDANCE PROBABILITIES



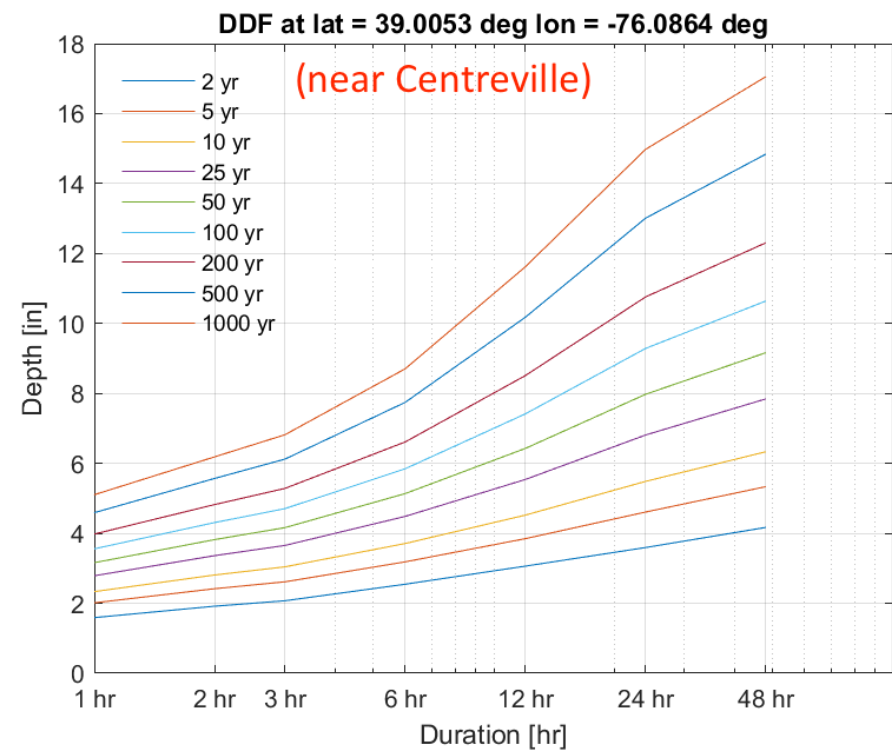
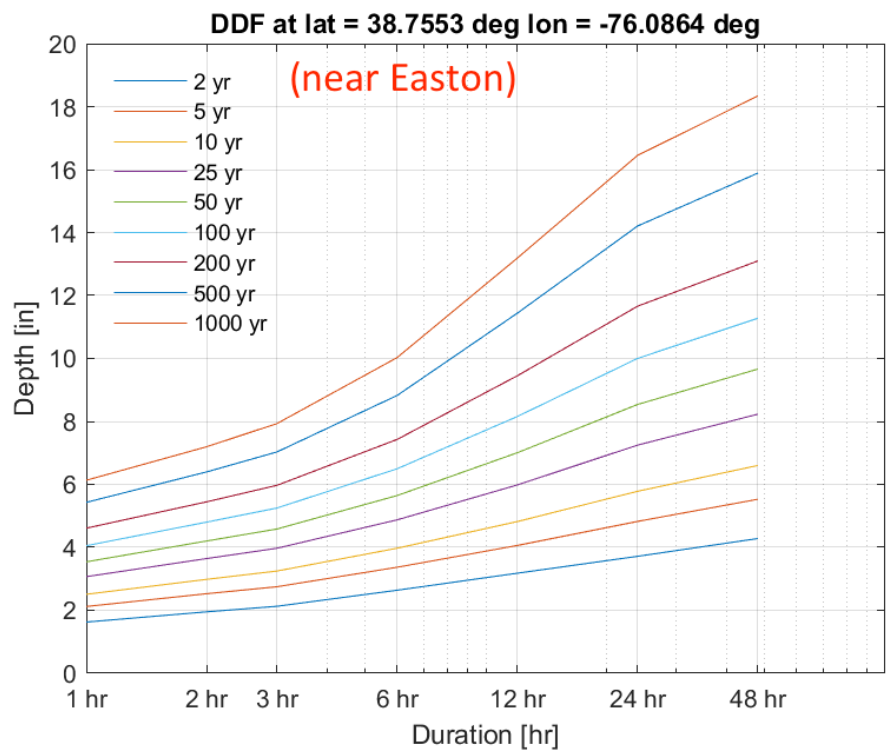
ANNUAL EXCEEDANCE PROBABILITIES



DEPTH-DURATION-FREQUENCY CURVES



DEPTH-DURATION-FREQUENCY CURVES



ESLC PLANNING AND POLICY RECOMMENDATIONS

SEVEN POLICY RECOMMENDATIONS

1. Upgrade infrastructure to reflect future precipitation estimates
2. Utilize hybrid green-gray infrastructure
3. Implement stormwater utility
4. Adopt Executive Order criteria into development standards
5. Create recovery plans which prioritize flood mitigation and future flood risk
6. Restore unutilized agricultural land to natural ecosystem
7. Prepare plans for future funding and grant opportunities

**POLICY OPTION I:
UPGRADE INFRASTRUCTURE TO REFLECT
FUTURE PRECIPITATION ESTIMATES**

UPGRADE INFRASTRUCTURE TO REFLECT FUTURE PRECIPITATION ESTIMATES

Minneapolis stormwater system upgrade studies (2018)

Needs-based infrastructure upgrade recommendations

- Mix of green and gray options

Citywide recommendations include

- Replace existing storm drain pipe system (12-inch pipe) with 24-inch pipe
- Installation of underground stormwater retention system
- Upsize existing or install storm pipe (Sizing examples – 18-inch, 24-inch, 30-inch, 34-inch)
- Install backflow preventers
- Upsize existing 12-inch pipe to double barreled 30-inch storm pipe

UPGRADE INFRASTRUCTURE TO REFLECT FUTURE PRECIPITATION ESTIMATES

Mission Hills, Kansas stormwater open channel and stormwater pipe system master plan (2017)

In addition to underground stormwater systems, Mission Hills utilizes aboveground retaining walls, open channel systems, and stream buffers.

Common upgrades include:

- Realigning channels through rock grade controls in the form of rock riffles
- Pedestrian bridge improvements and height upgrades across channels
- Channel bank reshaping and installations to armor the reshaped slope
- Stream banks that were graded were restored with native vegetation

UPGRADE INFRASTRUCTURE TO REFLECT FUTURE PRECIPITATION ESTIMATES

Stray thoughts for the Eastern Shore:

- Many areas currently have capacity for a 100-year storm.
- Upgrading or upsizing pipes to handle additional water in higher frequency storm events will help to minimize on-street flooding.
 - Cost/benefit analysis
- Unincorporated areas not connected to water/sewer systems
 - ESCAP duty to plan for residents on individual wells and septic systems?

**POLICY OPTION 2:
UTILIZE HYBRID GREEN-GRAY
INFRASTRUCTURE**

UTILIZE HYBRID GREEN-GRAY INFRASTRUCTURE

Gray infrastructure: any human-engineered system for water sources such as pipelines, berms, levees, dikes, or seawalls

Green infrastructure: strategic use of networks of natural lands, working landscapes, and other open spaces to conserve ecosystem values and functions and provide associated benefits to human populations

UTILIZE HYBRID GREEN-GRAY INFRASTRUCTURE

“Resilient Hampton” initiative (2019)

- “Resilience is the bolstering of a community’s inherent strengths in order to alleviate chronic stresses and enable recovery from extreme events and shocks in ways that make the community even stronger than before.”

Green/gray hybrid infrastructure

- Develop a levee in the coastal zone with flood gates
- Embrace the creek system; give room to the creeks to expand and fall with change in climate
- Connect all of the gray infrastructure elements with a green system
- Improve public participation in water management

**POLICY OPTION 3:
IMPLEMENT STORMWATER UTILITY**

IMPLEMENT STORMWATER UTILITY

A stormwater utility fee allows for the community to:

- Create equitable and fair allocation of stormwater management costs
- Support the reduction of flooding and water quality issues stemming from stormwater runoff
- Address and reduces water quality stressors
- Create a stronger accountability for stormwater management spending and generate revenue

IMPLEMENT STORMWATER UTILITY

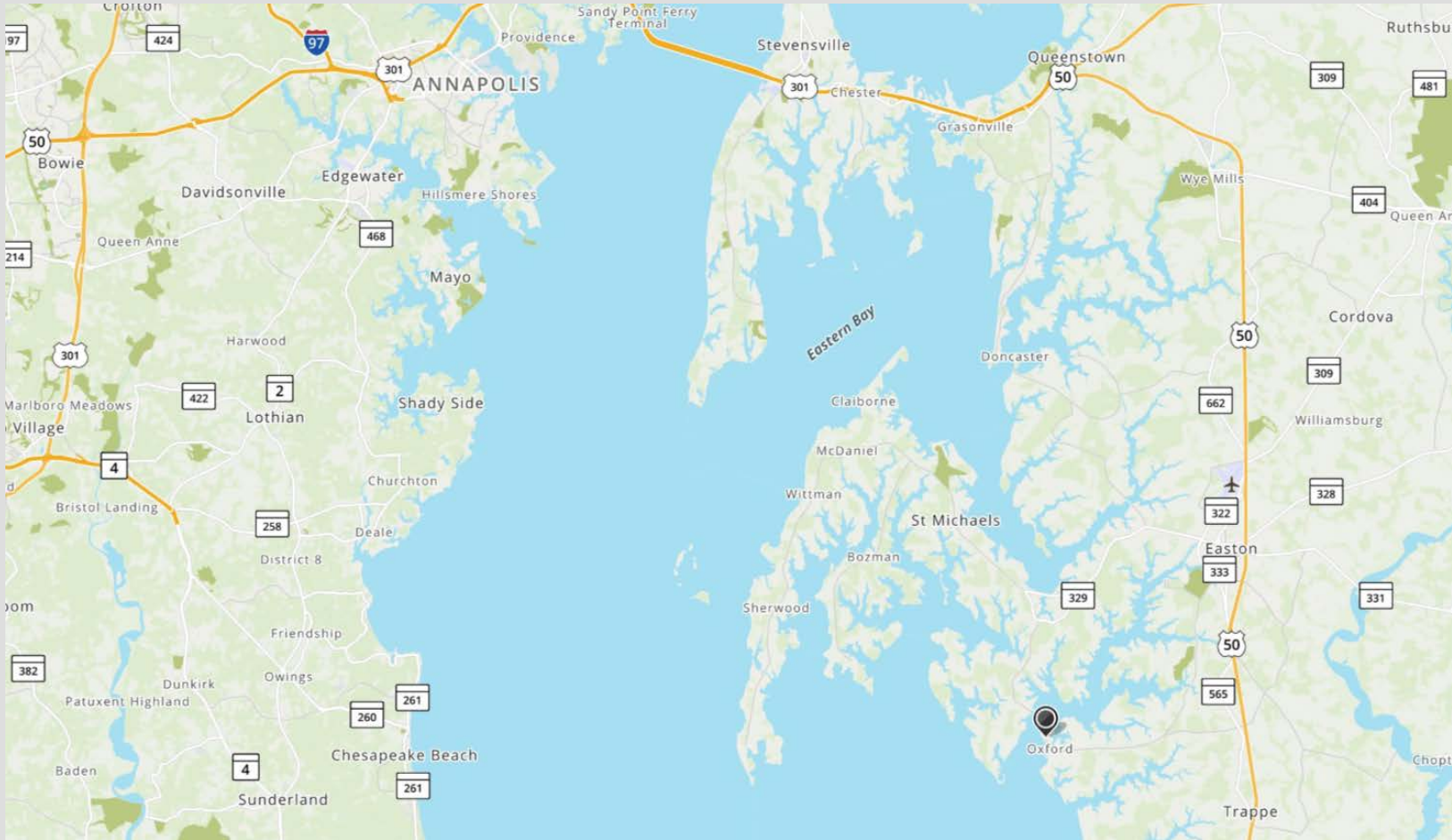
Stormwater utilities are NOT one-size-fits-all

Must be flexible in order to successfully develop and implement programs that best fit the needs of each individual community

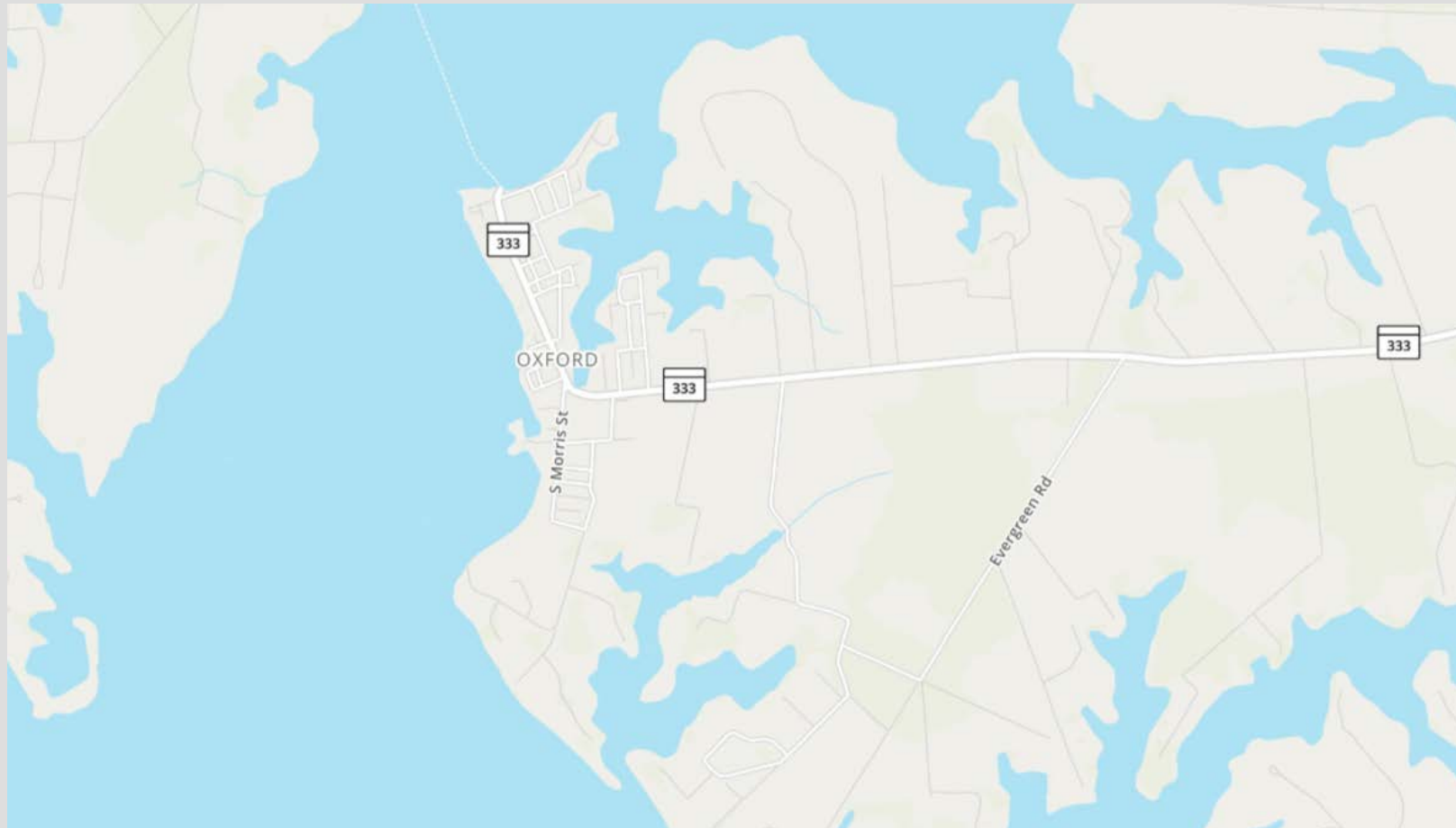
Community considerations should include:

- Land use and development
- Stormwater system issues
- Regulatory mandates
- Economic and socio-political issues

OXFORD CAUSEWAY STORMWATER BIORETENTION



OXFORD CAUSEWAY STORMWATER BIORETENTION



OXFORD CAUSEWAY STORMWATER BIORETENTION



OXFORD CAUSEWAY STORMWATER BIORETENTION



**POLICY OPTION 4:
ADOPT EXECUTIVE ORDER CRITERIA
INTO DEVELOPMENT STANDARDS**

ADOPT EXECUTIVE ORDER CRITERIA INTO DEVELOPMENT STANDARDS

Federal Executive Order 11988

- Requires federal agencies to avoid, whenever possible, the adverse impacts associated with the occupancy and alteration of floodplains.
- Requires avoidance of direct and indirect support of floodplain development wherever there is a practicable alternative.

Purpose: reduce risk of flood loss, minimize impacts of floods on human safety, health, and welfare, while also restoring and preserving the natural and beneficial values served by flood plains

E.O. guidelines address a step-by-step process to be considered during the development of a project with the potential to impact a floodplain.

ADOPT EXECUTIVE ORDER CRITERIA INTO DEVELOPMENT STANDARDS

Maryland Executive Order 01.01.2012.29, Climate Change and “Coast Smart” Construction

- Addresses climate stressors such as sea-level rise, storm events, erosion, coastal flooding, and inundation of low-lying lands.
- Directs state agencies to consider these threats in the siting and design of state structures in order to avoid or minimize their impacts.

2019 Coast Smart Guidelines update

- Clarifies applicability; extends deadlines; technical corrections
- State and local *capital* projects for which at least 50% of the project costs are funded with State funds
- Not applicable for public works contracts of capital projects less than \$500,000

**POLICY OPTION 5:
CREATE RECOVERY PLANS WHICH PRIORITIZE
FLOOD MITIGATION & FUTURE FLOOD RISK**

CREATE RECOVERY PLANS WHICH PRIORITIZE FLOOD MITIGATION AND FUTURE FLOOD RISK

Flooding:

- Most common natural disaster in the world
- 75% of all presidential disaster declarations

“Despite the pressures on politicians and community leaders to return to a period of normalcy as quickly as possible... more and more communities are looking at ways to reduce their future vulnerability. As disasters repeat themselves and the public sees the emotional and financial benefits of mitigation, communities are making the long-term investment in mitigation.”

-Haddow, Bullock, & Coppola (2008)

CREATE RECOVERY PLANS WHICH PRIORITIZE FLOOD MITIGATION AND FUTURE FLOOD RISK

- Resources for incorporating future flood risk into disaster recovery planning:
 - FEMA: *National Disaster Recovery Framework*
 - FEMA: *Planning for Post-Disaster Recovery and Reconstruction*
 - MEMA: *Local Recovery Planning Toolkit*
 - EPA: *Planning for Flood Recovery and Long-Term Resilience*

**POLICY OPTION 6:
RESTORE UNUTILIZED AGRICULTURAL
LAND TO NATURAL ECOSYSTEM**

RESTORE UNUTILIZED AGRICULTURAL LAND TO NATURAL ECOSYSTEM

Goal: determine the most vulnerable natural/agricultural areas to flooding

SLR + XP = significant impact to agricultural lands placed on previously-existing wetlands

- Decreased crop yield
- Loss in farmers' income from once fertile land

Can ESLC/ESCAP provide assistance to farmers dealing with the loss of land and crops?

RESTORE UNUTILIZED AGRICULTURAL LAND TO NATURAL ECOSYSTEM

Financing restoration projects

- U.S. Environmental Protection Agency
- U.S. Fish & Wildlife Service
- Maryland Dept. of Natural Resources

Community Rating System (CRS) Credit

- Open Space Preservation (420)
- Stormwater Management (450)
- Flood Plain Management (510)
- *Up to 25% savings on all federally-backed flood insurance policies*

**POLICY OPTION 7:
PREPARE PLANS FOR FUTURE
FUNDING & GRANT OPPORTUNITIES**

PREPARE PLANS FOR FUTURE FUNDING AND GRANT OPPORTUNITIES

Grants from federal, state, and private partners is crucial to upgrading, expanding, and enhancing stormwater infrastructure

Communities should be set up for success to turn grant applications around quickly and efficiently

Coordinate with a community's capital improvement and investment plan, stormwater master plan, hazard mitigation plan, etc.

PREPARE PLANS FOR FUTURE FUNDING AND GRANT OPPORTUNITIES

“Pre-packaged grant applications”

- Overview of the locality
- Information about the various neighborhoods and sections of the locality
- Overview of the particular agency or department applying for the grant
- Organizational chart

EVALUATIVE CRITERIA

EVALUATIVE CRITERIA

Local governments can evaluate policy options and their respective outcomes by utilizing four criteria, to be weighted by the jurisdiction:

1. Environmental impact
2. Cost effectiveness
3. Political feasibility
4. Social welfare

IN CONCLUSION

REPORT SUMMARY

It's going to keep raining differently. And that sucks for infrastructure, agriculture, and the environment.

Local planning and policy recommendations:

1. Upgrade infrastructure to reflect future precipitation estimates
2. Utilize hybrid green-gray infrastructure
3. Implement stormwater utility
4. Adopt Executive Order criteria into development standards
5. Create recovery plans which prioritize flood mitigation and future flood risk
6. Restore unutilized agricultural land to natural ecosystem
7. Prepare plans for future funding and grant opportunities

WHAT DOES THIS MEAN FOR YOU?

ESLC as technical advisor

This data is Shore-specific but the recommendations are universal

State and Federal partnerships are critical to building regional resilience

JIM BASS

COASTAL RESILIENCE PROGRAM MANAGER

JBASS@ESLC.ORG

(410) 690-4603 x156



Preparing for Increases in Extreme Precipitation Events in Local Planning and Policy on Maryland's Eastern Shore

Megan Granato
MAFSM Annual Conference
November 7, 2019

Maryland Commission on Climate Change (MCCC)

Working Groups

Steering Committee



Mitigation

Adaptation &
Resiliency

Scientific &
Technical

Education,
Communication &
Outreach



Adaptation and Resiliency Working Group ongoing priorities for 2019 status updates

14. Addressing Increased Precipitation at the Local Level

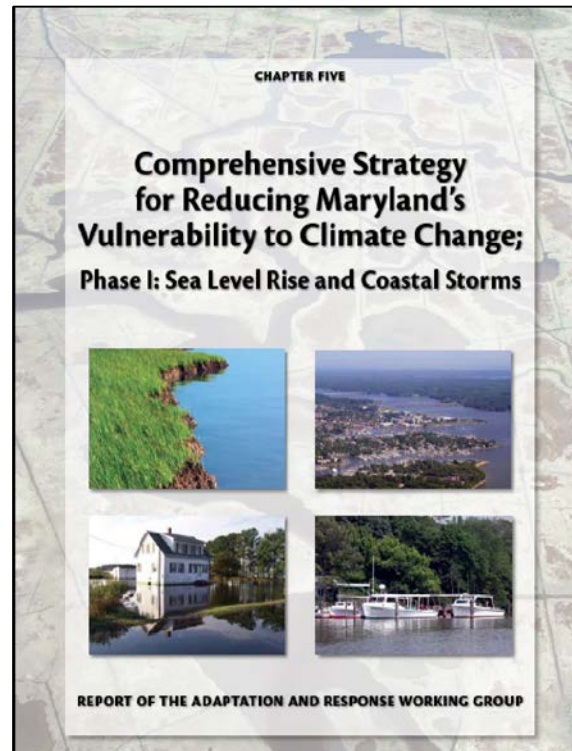
...In 2019, ARWG partners will explore regional downscaled precipitation models, which could help Maryland communities better assess their localized flood risks and plan to become more resilient to precipitation-induced flooding.

Adaptation and Resiliency Working Group

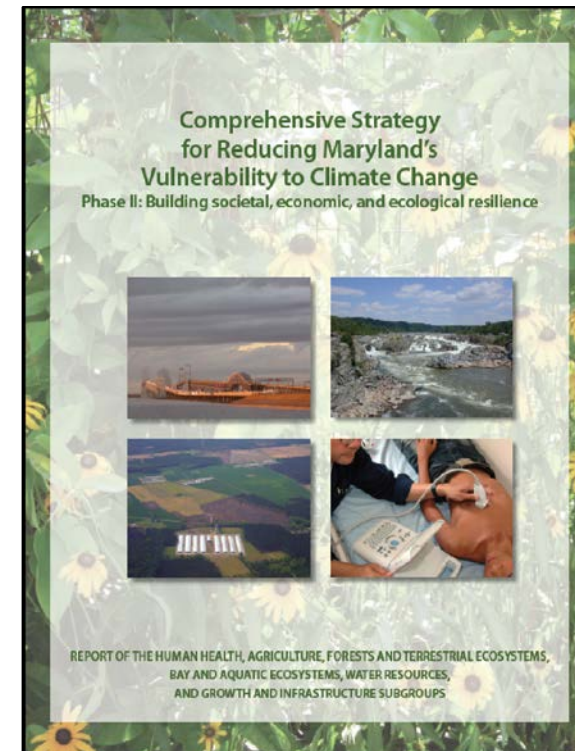
state of the science synthesis questions

1. What is the **state of science** on predicting the characteristics of future storm events, i.e., frequency, magnitude, duration, regional/geographic patterns, as a result of climate change?
 - Are the **current methods sufficient** to generate useful estimates now, or does the state of the science need to evolve further before we should invest in generating estimates?
 - If current methods are not sufficiently robust, what are the **knowledge and data gaps**, e.g., downscaling methods?
2. Who are the **expert researchers** and technical practitioners involved on this subject?
3. Is anyone else working on a similar synthesis?
4. If useful estimates are available now, what type of **tools and resources** do we need to generate to assist our local communities to apply the information?

Applications for Results of Precipitation Studies state-level planning

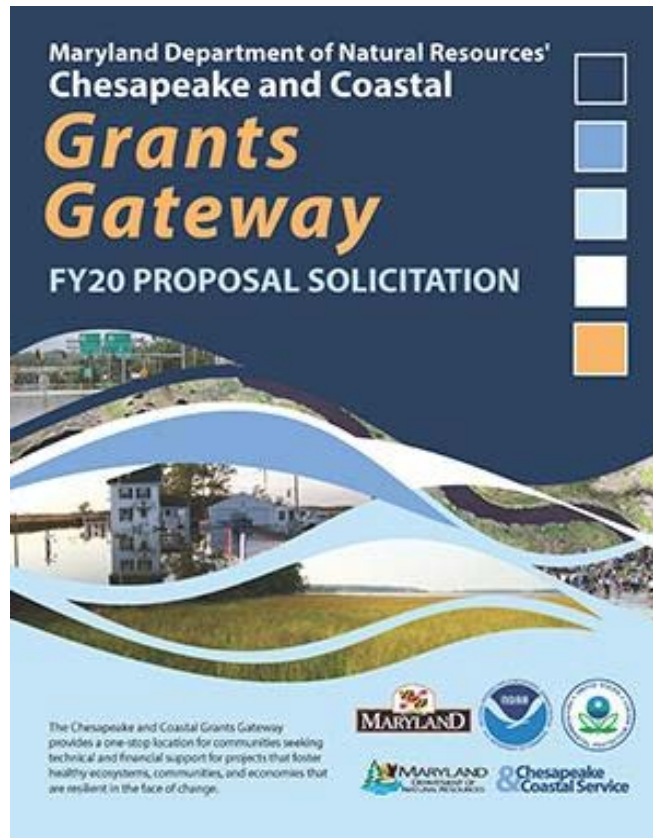


2008



2011

Applications for Results of Precipitation Studies local planning and implementation



<http://dnr.maryland.gov/ccs/Pages/funding/grantsgateway.aspx>

Outcome 2 – Enhance capacity to understand and effectively plan to address flood risks associated with a changing climate

Related Projects and Research

Hyattsville Stormwater Climate Masterplan/ Retrofits Improvement Plan

- Phase 1 – Existing Conditions Assessment
 - Stormwater infrastructure vulnerability
 - How is the existing system managing the design storm?*
 - Hydrological modeling to evaluate how the system may function under **future** precipitation regimes
 - How will the system manage more frequent and intense storms?*
- Phase 2 – Storm Drain Improvements Plan
 - Identifies potential improvements to problems identified in Phase 1, prioritizing green infrastructure
 - Collaborative approach with community involvement



Related Projects and Research

Tetra Tech

- Improving the Resilience of Best Management Practices in a Changing Environment: Urban Stormwater Modeling Studies

<https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=339576>

- Climate Impacts to Restoration Practices Restoration Research Award

cbtrust.org/grants/restoration-research

- State-wide assessment, mid and late century projections for event intensity and duration
- Implications for design of several types of stormwater best management practices

Contact Information:

Megan Granato
Senior Program Director
Maryland Department of Natural Resources
megan.granato@maryland.gov
(410) 260-8799