



# Pluvial Flood Modeling User Guide Feedback Workshop

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July 2024

# Facilitators



**Arthur Kay, CFM**  
Resilience Planner,  
DCR



**Seth Lawler, PhD**  
Sr. Program  
Manager,  
Computational  
Scientist, Dewberry



**Liz Foster**  
Sr. Resilience  
Planner, Dewberry

# Meeting Purpose

- We will provide an overview of the pluvial modeling and data products
- Stakeholders are encouraged to provide feedback for what to include or prioritize in the User Guide
- There will be a written survey at the end – also feel free to email us with any follow-ups
- We will incorporate feedback into the final User Guide available Fall 2024 (anticipated)

# Agenda

**10 minutes**

Welcome and Introductions

**20 minutes**

Pluvial Flood Modeling Overview

**15 minutes**

Discussion of Potential Use Cases

**15 minutes**

User Guide Overview and Feedback

**2 minutes**

Adjourn

# Participant Introductions

We invite you to unmute and share:

1. Your name and title / role
2. The organization/community you are representing
3. Why you chose to attend this Feedback Workshop

# Coastal Resilience Master Plan Phase I



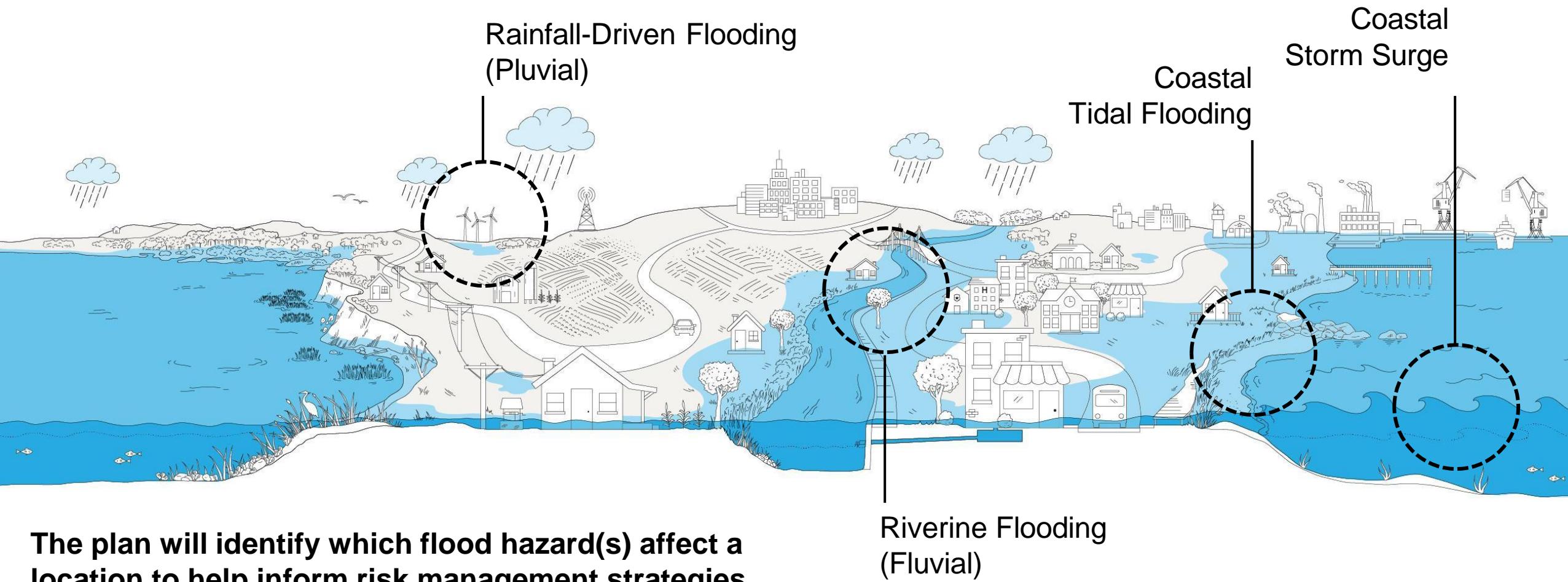
- A call to action for the Commonwealth
- Input from 2,000+ stakeholders
- Focused on impacts of tidal and storm surge coastal flooding
- Supported by the Coastal Resilience Database and Web Explorer



Office of Governor Ralph S. Northam  
Commonwealth of Virginia



# CRMP Phase II: Additional Sources of Flooding



# CRMP Phase II: Planning Scenarios

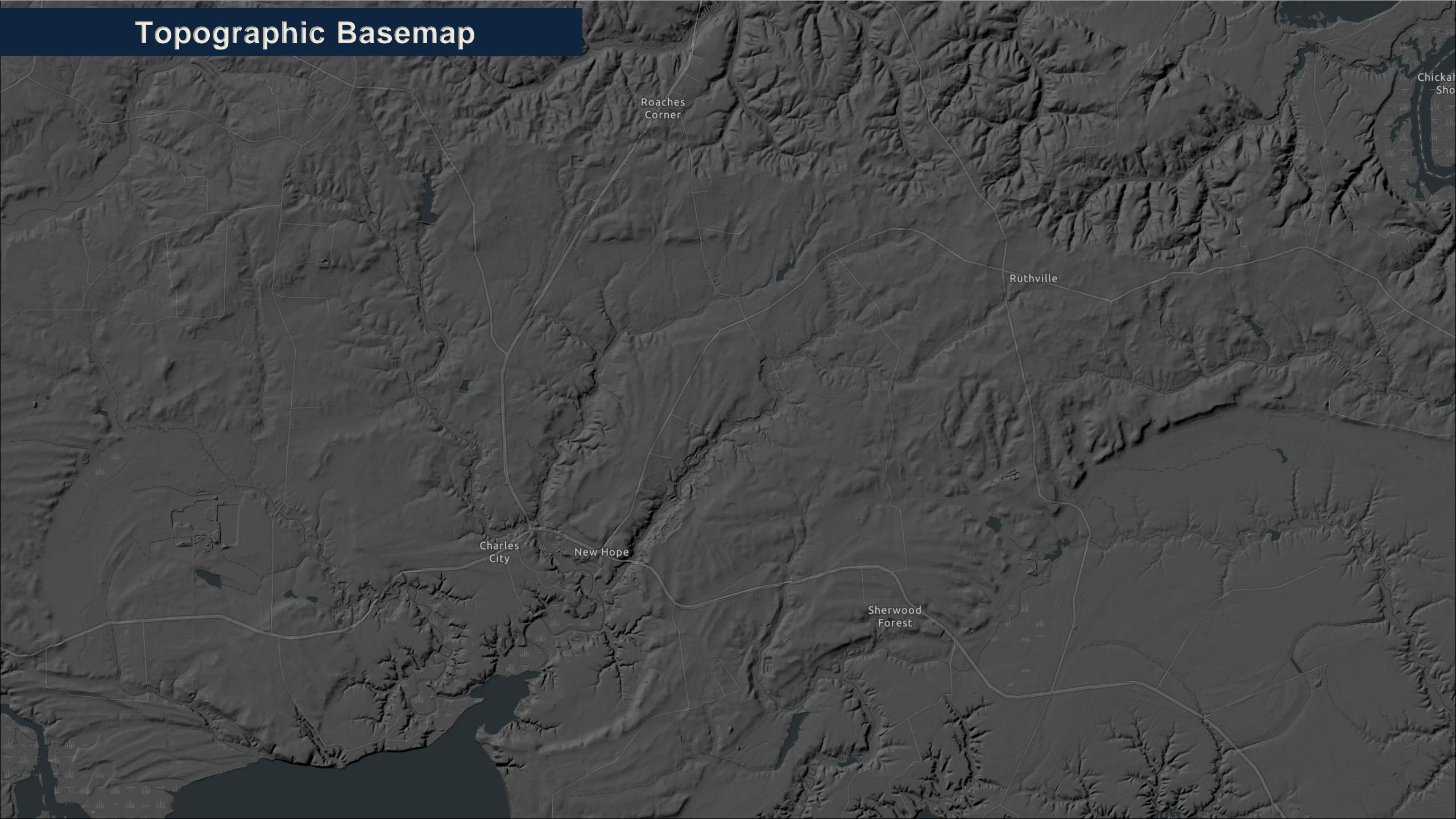
	Reference Scenario	Planning Scenarios			
Planning Horizon	2000-2020	Near Future ~2030-2060		Far Future ~2060-2100	
Risk Tolerance	-	Moderate	Low	Moderate	Low
Coastal	2020 CRMP	2040 CRMP	2060 CRMP	2060 CRMP	2080 CRMP
Pluvial	Atlas 14	2020-2070 RCP 4.5 Median	2020-2070 RCP 4.5 90 <sup>th</sup> %	2050-2100 RCP 4.5 Median	2050-2100 RCP 4.5 90 <sup>th</sup> %
Fluvial	FEMA	FEMA	FEMA	FEMA	FEMA

Notes:

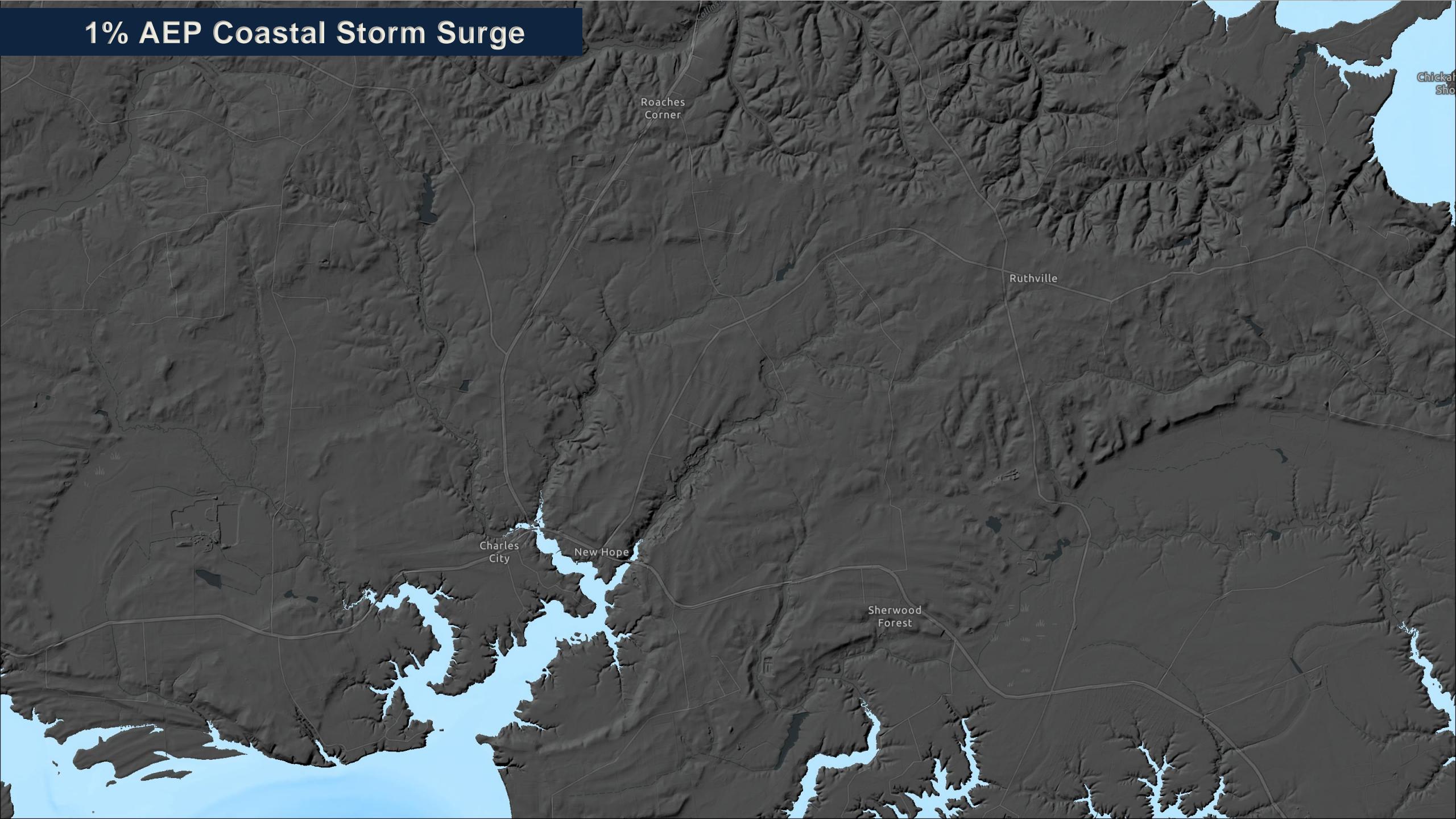
Coastal: 2020 CRMP MSL adjusted based on tidal observations. 2040, 2060, & 2080 CRMP based on NOAA 2017 Intermediate-High Relative Sea Level Rise Projection

Pluvial: Precipitation values from Atlas14 and MARISA RCP 4.5 projections will be rounded to the nearest return interval pluvial model using conventional rounding

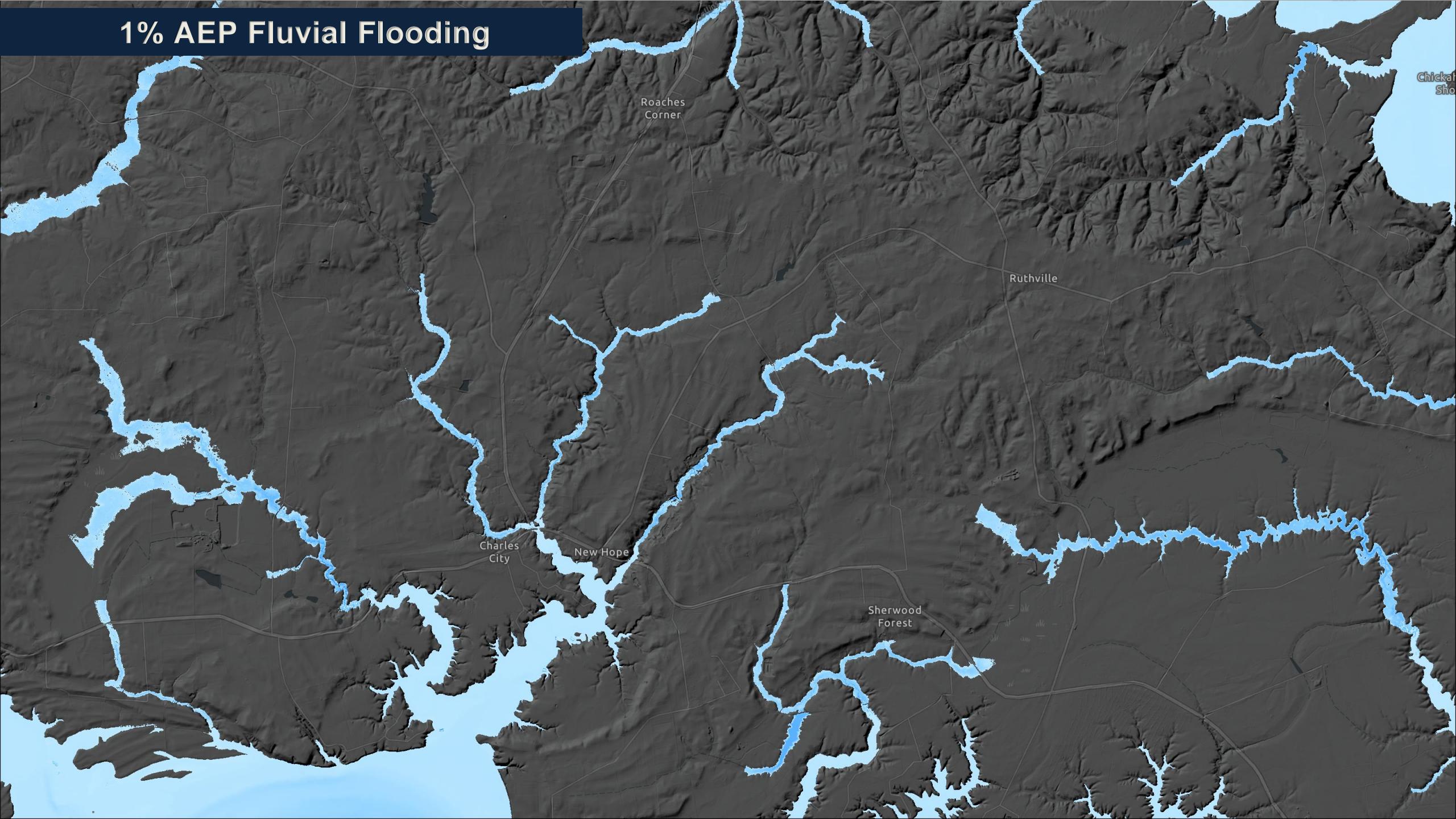
# Topographic Basemap



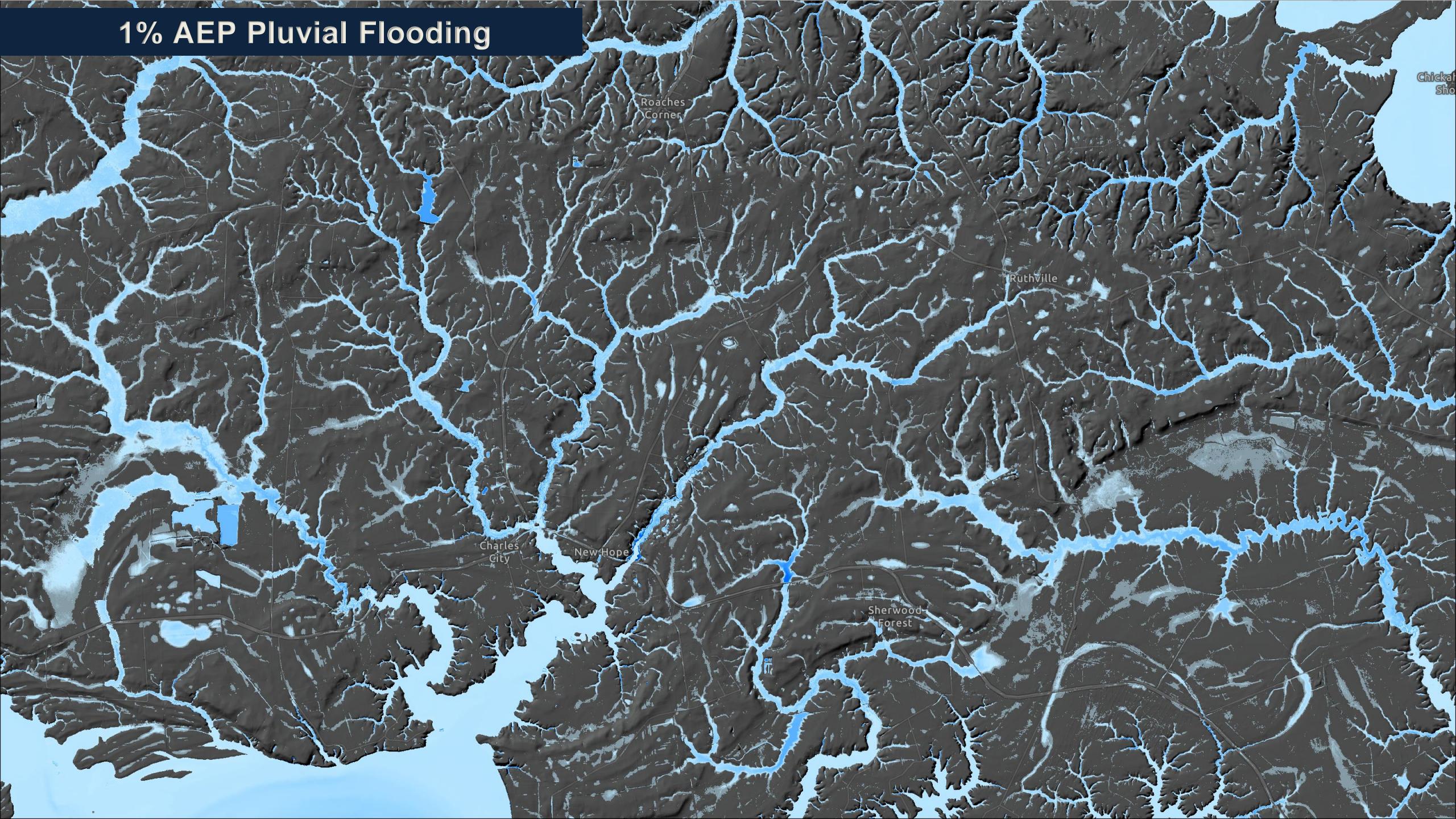
# 1% AEP Coastal Storm Surge



# 1% AEP Fluvial Flooding



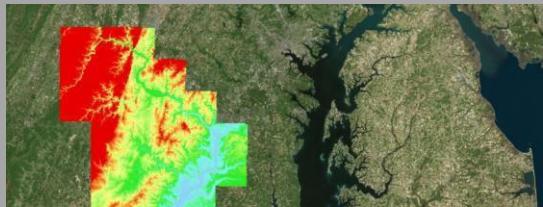
# 1% AEP Pluvial Flooding



# Pluvial Flood Modeling Overview

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# Modeling: Data Inputs



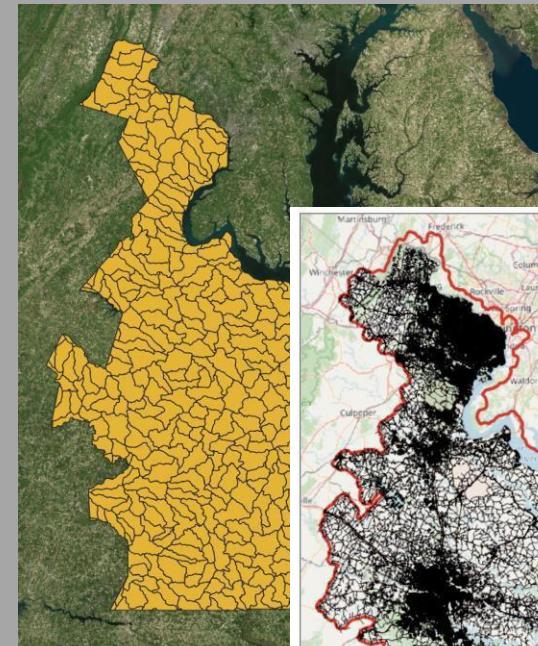
Topo



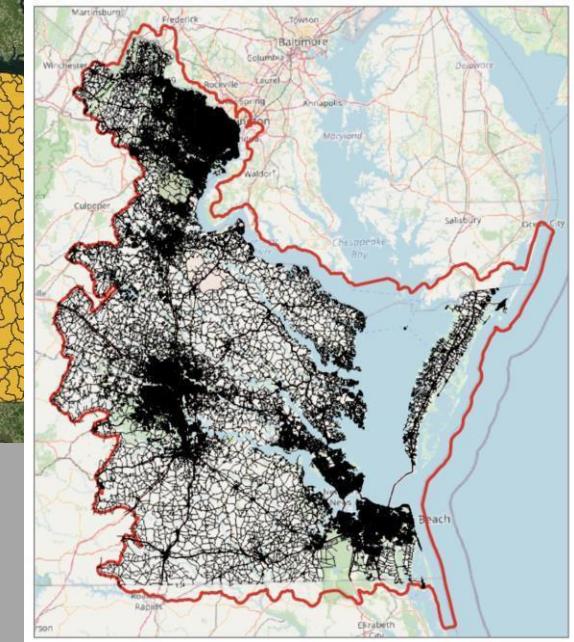
Friction



Infiltration

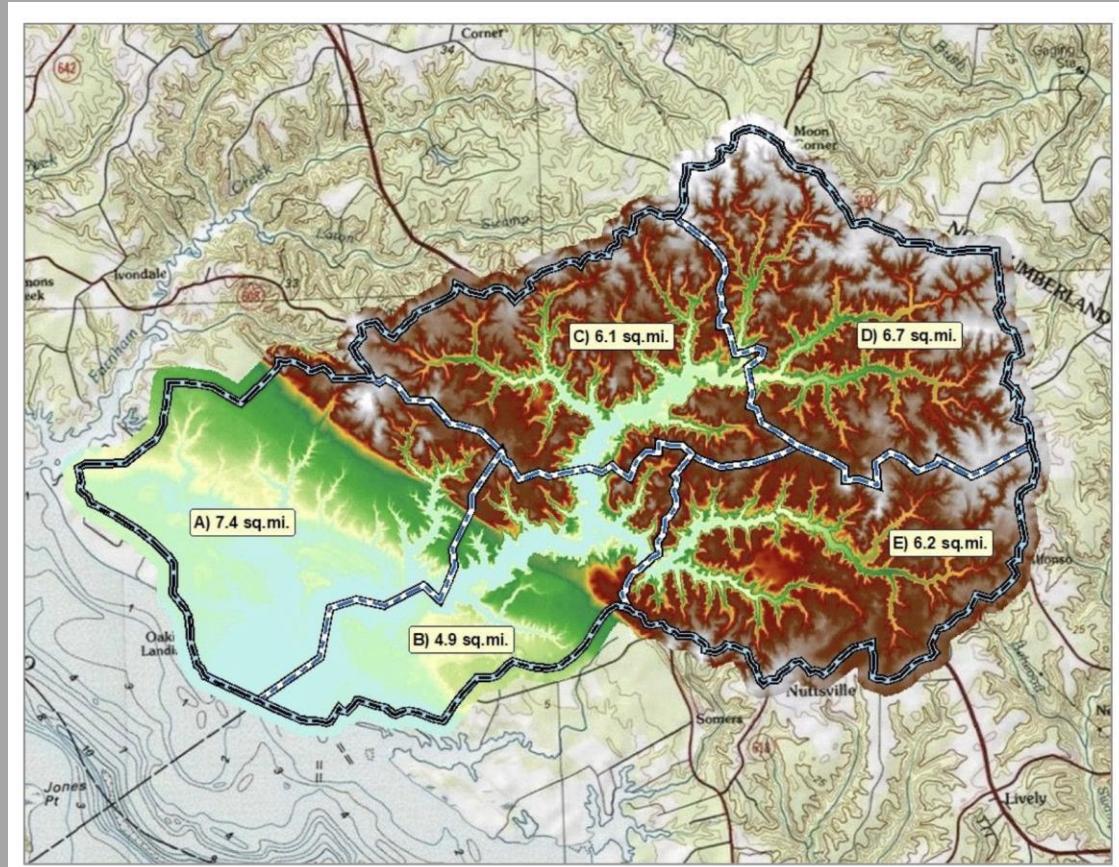
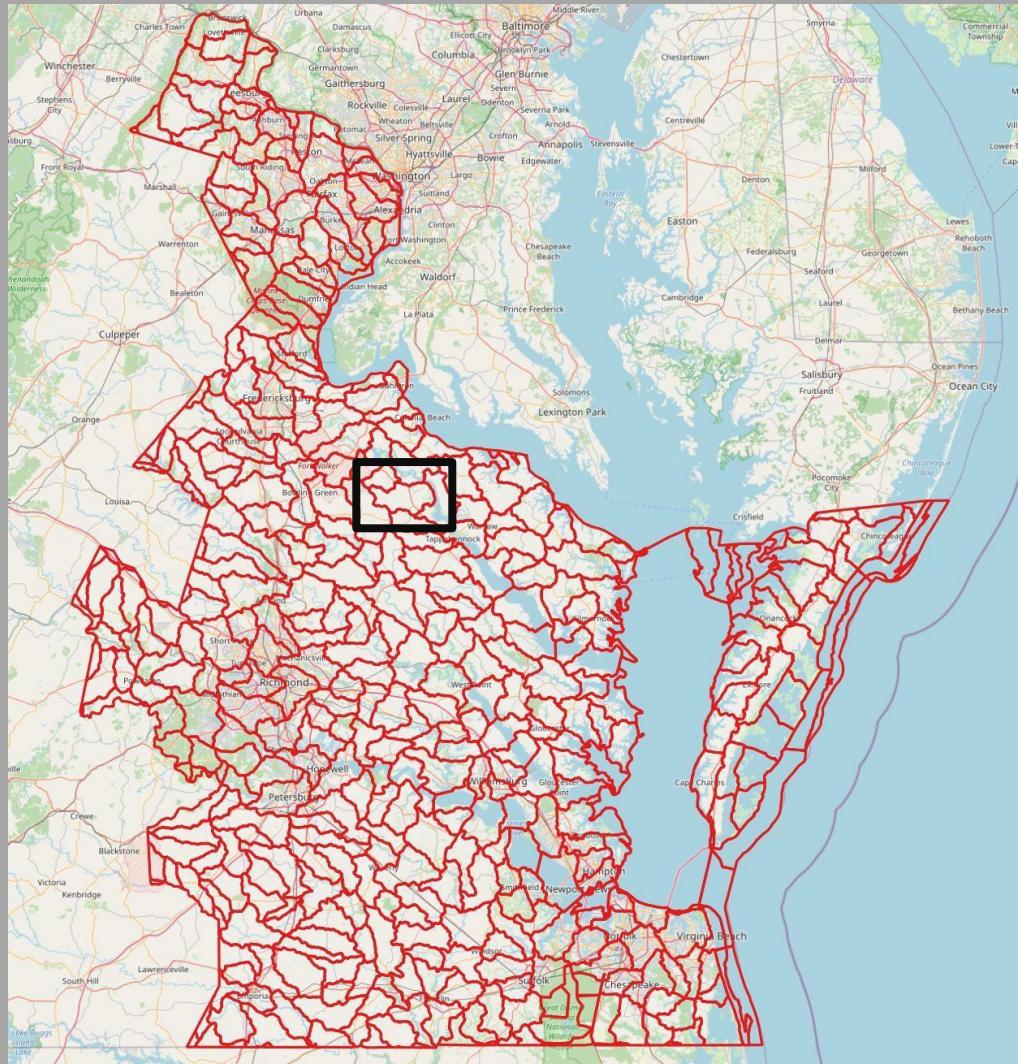


HUC's

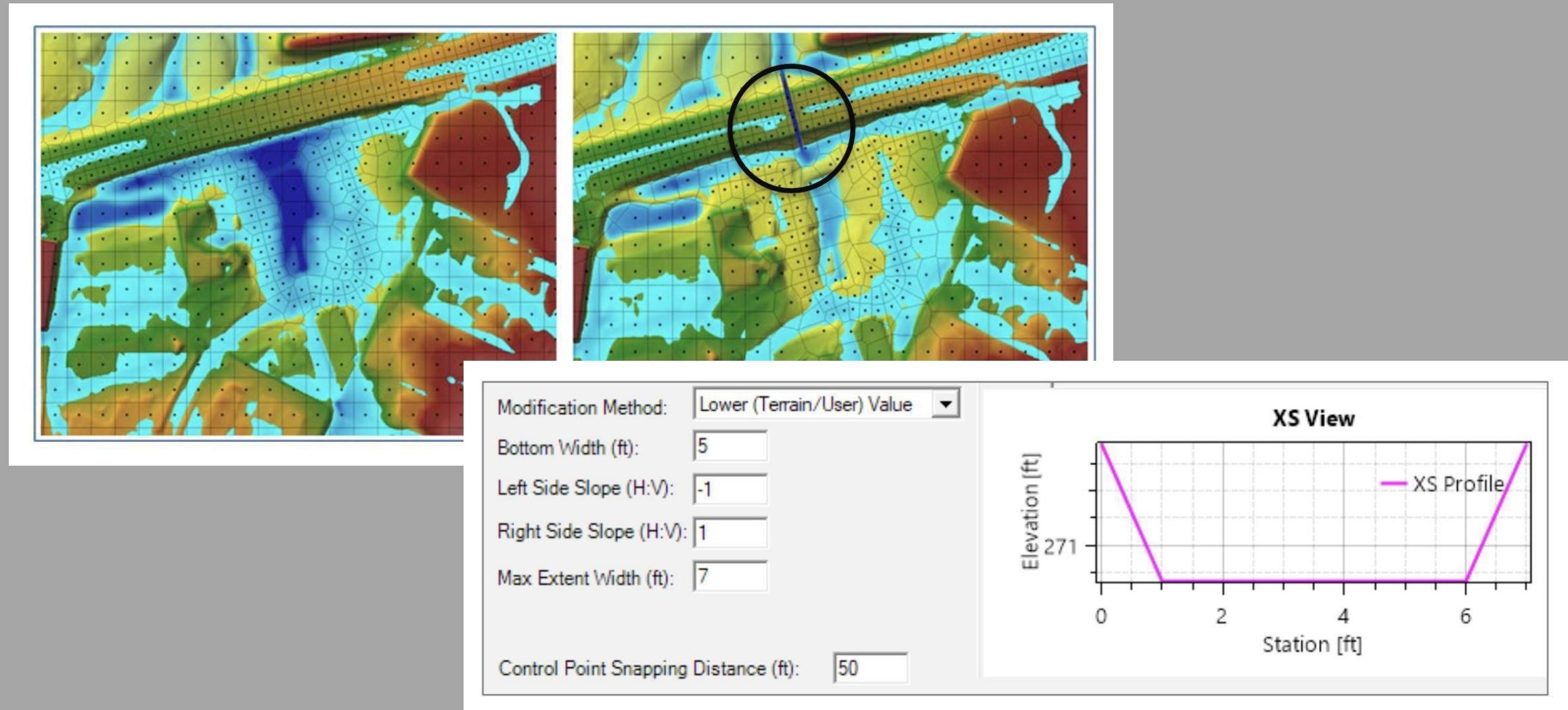


Transportation

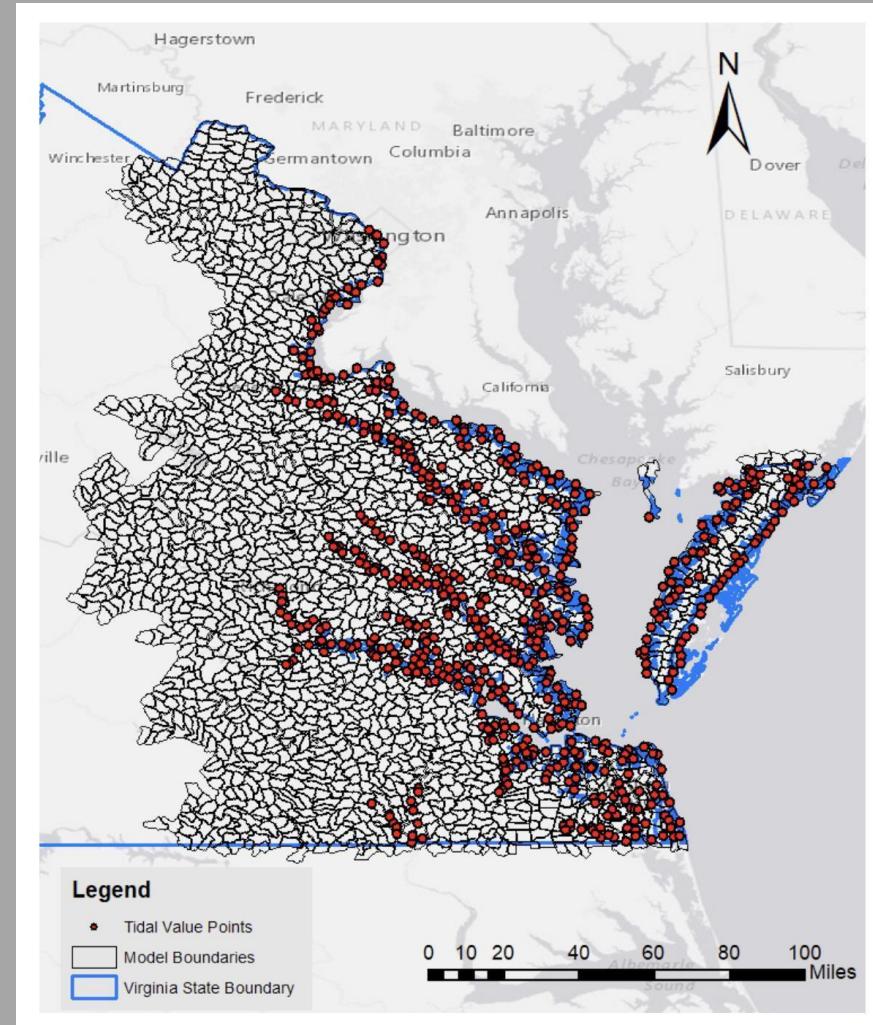
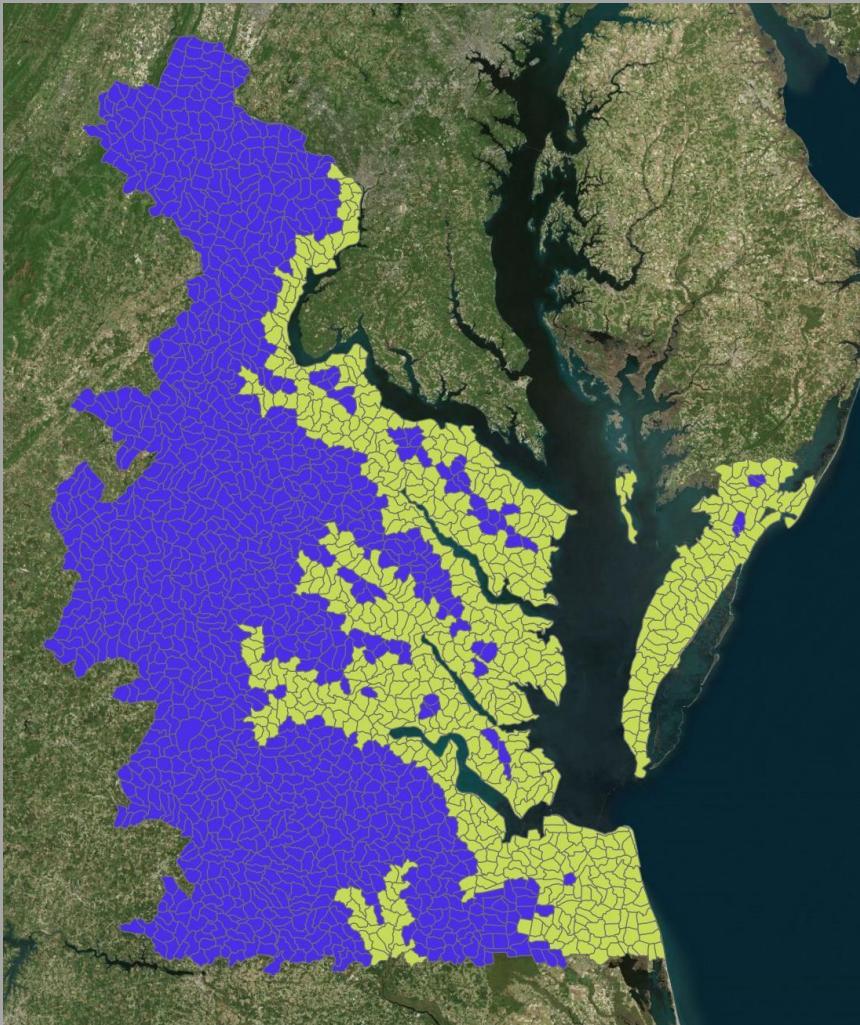
# Modeling: Basin Development



# Modeling: Geometry



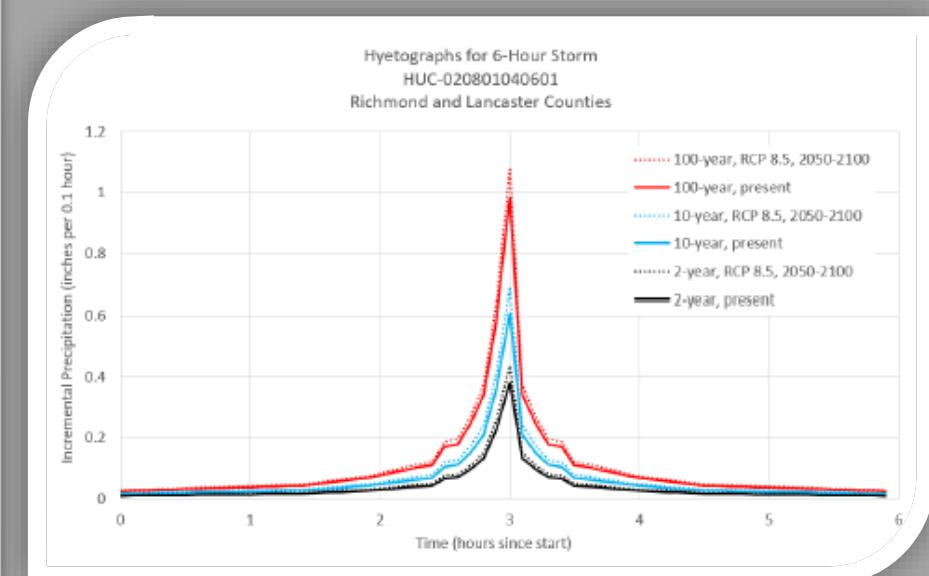
# Modeling: Boundary Conditions



# Modeling: Forcing

HEC-RAS Plan	Storm Duration (Hours)	Precipitation (Inches)
p01	2	1
p02	2	1.5
p03	2	2
p04	2	2.5
p05	2	3
p06	2	3.5
p07	2	4
p08	2	4.5
p09	2	5
p10	2	5.5
p11	2	6
p12	2	6.5
p13	2	7
p14	2	7.5
p15	2	8
p16	2	8.5
p17	2	9
p18	2	9.5
p19	2	10
p20	2	10.5
p21	2	11
p22	2	11.5
p23	2	12
p24	6	1
p25	6	2
p26	6	3
p27	6	4
p28	6	5
p29	6	6
p30	6	7
p31	6	8
p32	6	9
p33	6	10
p34	6	11
p35	6	12

HEC-RAS Plan	Storm Duration (Hours)	Precipitation (Inches)
p36	6	13
p37	6	14
p38	6	15
p39	6	16
p40	6	17
p41	24	2
p42	24	3
p43	24	4
p44	24	5
p45	24	6
p46	24	7
p47	24	8
p48	24	9
p49	24	10
p50	24	11
p51	24	12
p52	24	13
p53	24	14
p54	24	15
p55	24	16
p56	24	17
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p58	24	19
p59	24	20
p60	24	21
p61	24	22
p62	24	23
p63	24	24

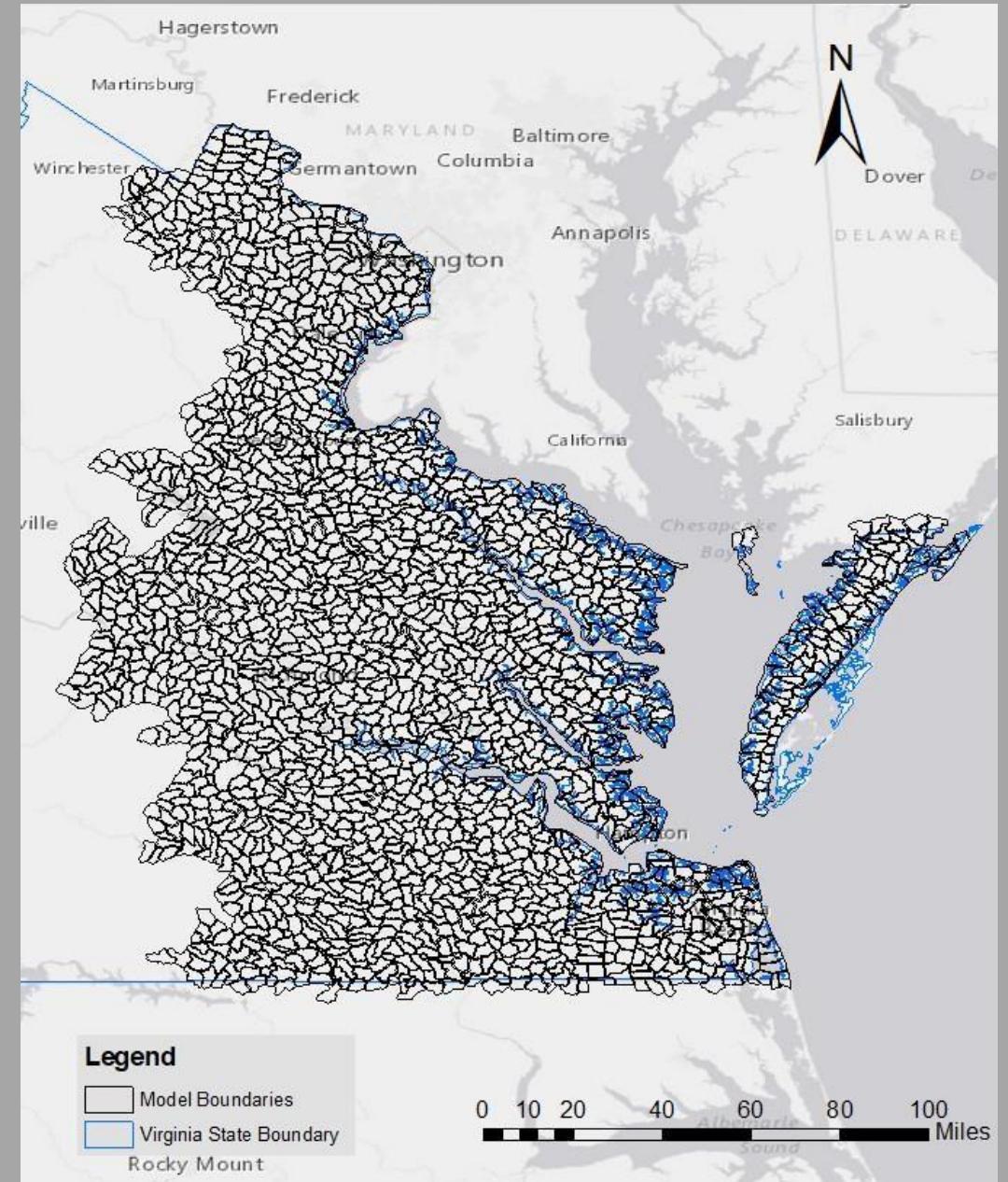


# Modeling: Summary

18 Cities & 38 Counties

1,830 Models

>275,000 Simulations



# Group Discussion

What questions do you have  
about the new modeling?

What are your initial thoughts on  
how this may help your  
community's needs?

# Data Access

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# Open Data Hub

<https://crmp-vdcr.hub.arcgis.com/>

Model / Download  
Access



Data Preview



**CRMP Pluvial Model Catalog App**

[Explore](#)

**Pluvial Depth Grid 100yr (24hr Present)**

[Explore](#)

**Coastal Flood Exposure and Social Vulnerability..**

[Explore](#)

**Flood Story View and Submit App**

[Explore](#)

**SVI Census Block Group Map**

[Explore](#)

**AWS Open Data Portal S3 Bucket**

[Explore](#)

**Coastal Flood Hazard (2020, 2040, 2060, 2080...)**

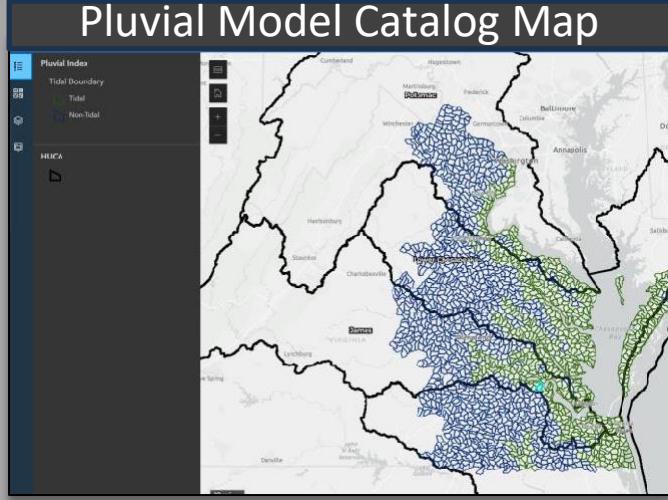
[Explore](#)

**Community Context**

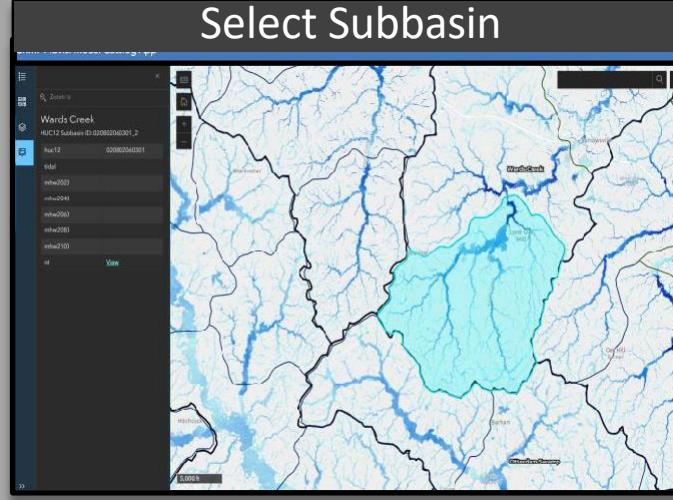
[Explore](#)

# Pluvial Model Catalog Navigation

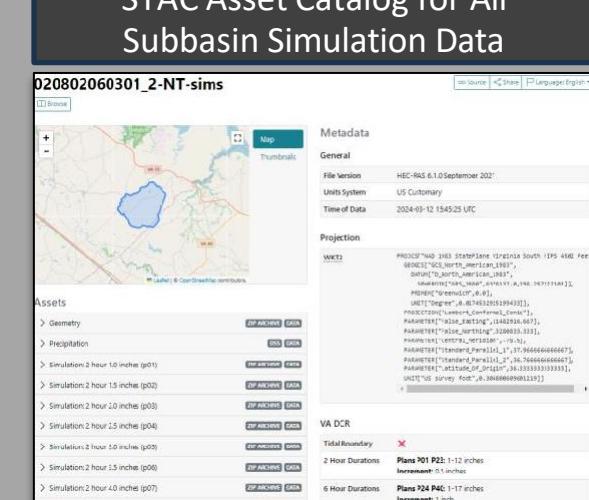
Pluvial Model Catalog Map



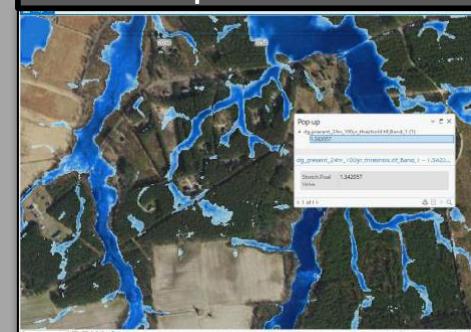
Select Subbasin



STAC Asset Catalog for All Subbasin Simulation Data



Depth Grids



RAS Models



Users can utilize the map to navigate or location search to access data for their area of interest

# STAC Catalog

(SpatioTemporal Asset Catalog)

Granular access to download all interval simulations

Both Model files and the result depth grids files

### 020802060301\_2-NT-sims

Map | Thumbnails | Browse

Metadata

General

File Version	HEC-RAS 6.1.0 September 2021
Units System	US Customary
Time of Data	2024-03-12 15:45:25 UTC

Projection

WKT2

```
PROJCS["NAD_1983_StatePlane_Virginia_South_FIPS_450"
GEOGCS["GCS_North_American_1983",
DATUM["D_North_American_1983",
SPHEROID["GRS_1980",6378137.0,298.257222101]]
PRIMEM["Greenwich",0.0],
UNIT["Degree",0.0174532925199433]],
PROJECTION["Lambert_Conformal_Conic"],
PARAMETER["False_Easting",11482916.667],
PARAMETER["False_Northing",3280833.333],
PARAMETER["Central_Meridian",-78.5],
PARAMETER["Standard_Parallel_1",37.96666666666667]
PARAMETER["Standard_Parallel_2",36.76666666666667]
PARAMETER["Latitude_of_Origin",36.33333333333333],
UNIT["US survey foot",0.304800609601219]]
```

VA DCR

Tidal Boundary

2 Hour Durations **Plans P01 P23: 1-12 inches**  
**Increment: 0.5 inches**

6 Hour Durations **Plans P24 P40: 1-17 inches**  
**Increment: 1 inch**

24 Hour Durations **Plans P41 P63: 2-24 inches**  
**Increment: 1 inch**

Assets

- > Geometry [ZIP ARCHIVE](#) [DATA](#)
- > Precipitation [DSS](#) [DATA](#)
- > Simulation: 2 hour 1.0 inches (p01) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 1.5 inches (p02) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 2.0 inches (p03) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 2.5 inches (p04) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 3.0 inches (p05) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 3.5 inches (p06) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 4.0 inches (p07) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 4.5 inches (p08) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 5.0 inches (p09) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 5.5 inches (p10) [ZIP ARCHIVE](#) [DATA](#)
- > Simulation: 2 hour 6.0 inches (p11) [ZIP ARCHIVE](#) [DATA](#)

### 020802060301\_2-nt-dgs

Map | Thumbnails | Browse

Metadata

General

Description This item includes Depth-Grid assets derived from HEC-RAS simulations (link to model data below) included in the CRMP Pluvial Flood Hazards analysis.

Time of Data 2024-04-29 1:37:13 UTC

VA DCR

Tidal Boundary

Assets

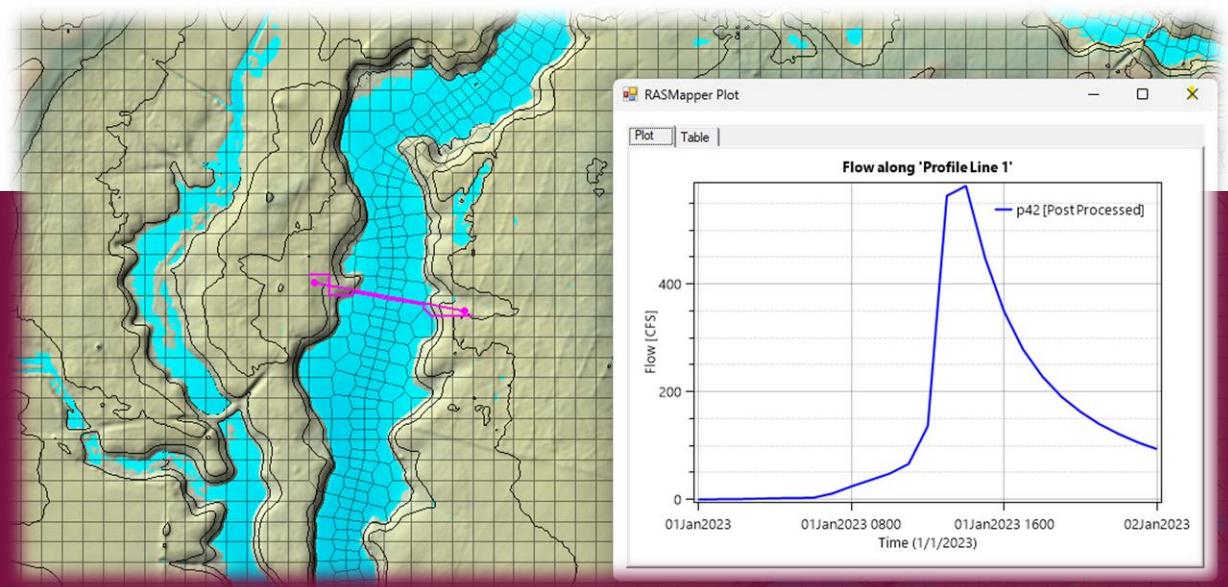
- > Simulation: 2 hour 1.0 inches (p01) [SHOWN](#) [RAS-DEPTH-GRID](#) [COG](#)
- > Simulation: 2 hour 1.5 inches (p02) [RAS-DEPTH-GRID](#) [COG](#)
- > Simulation: 2 hour 2.0 inches (p03) [RAS-DEPTH-GRID](#) [COG](#)
- > Simulation: 2 hour 2.5 inches (p04) [RAS-DEPTH-GRID](#) [COG](#)
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- > Simulation: 2 hour 5.5 inches (p10) [RAS-DEPTH-GRID](#) [COG](#)
- > Simulation: 2 hour 6.0 inches (p11) [RAS-DEPTH-GRID](#) [COG](#)
- > Simulation: 2 hour 6.5 inches (p12) [RAS-DEPTH-GRID](#) [COG](#)
- > Simulation: 2 hour 7.0 inches (p13) [RAS-DEPTH-GRID](#) [COG](#)

# Product Benefits and Limitations

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# Product Benefits (1/3)

- Pre-developed base models ready for use
- Combines both hydrologic and hydraulic processes into one model
- Simulates complex surface runoff and flow dynamics that are not captured in a 1D or hydrologic modeling approach

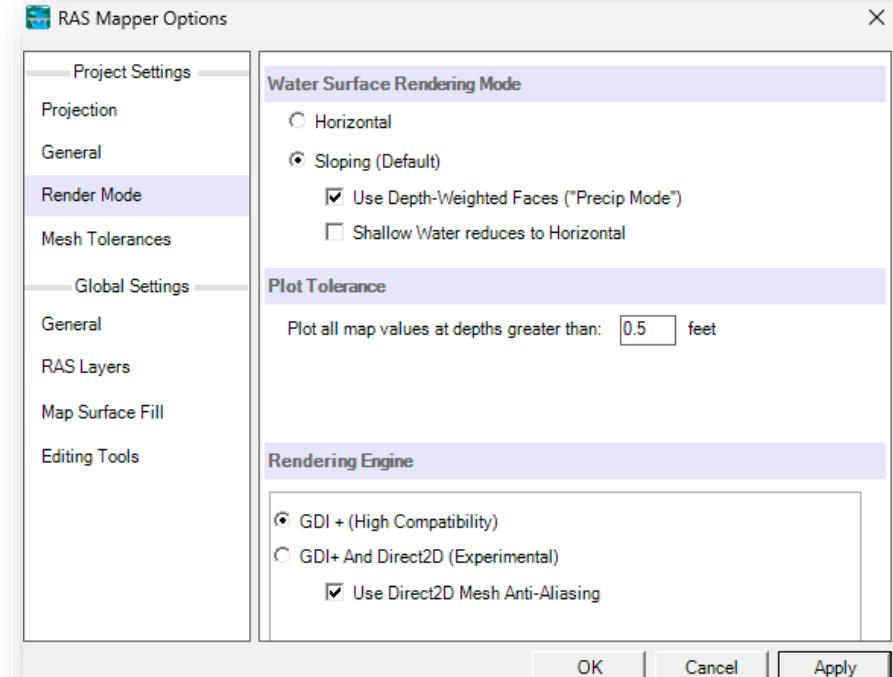


# Product Benefits (2/3)

- Results for extreme events can be compared and used for high-level planning
- Rainfall used in models covers almost all return period storms including frequent events
- Models can be refined for a very small portion of the watershed and rerun without making refinements to the entire model

# Product Benefits (3/3)

- Terrain modifications can be added
- Tidal inundation mapping can be generated from the models by adjusting the model's tailwater boundary condition
- Model results can be exported and brought into GIS for maps and figures
- The model results can all be shown graphically in ways that people unfamiliar with flood models can grasp



# Product Limitations

- Cells size in context of other potential applications and resolving flow pathways
- Pipe networks and many culverts are not modeled. Results for small storm events carried by pipe networks may show flooding issues where there is none
- Models are Rain-on-Grid only and do not contain 1D river reaches or cross sections
- Results cannot be compared directly with FEMA 1D HEC-RAS model results

# Use Cases

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# Floodplain Management

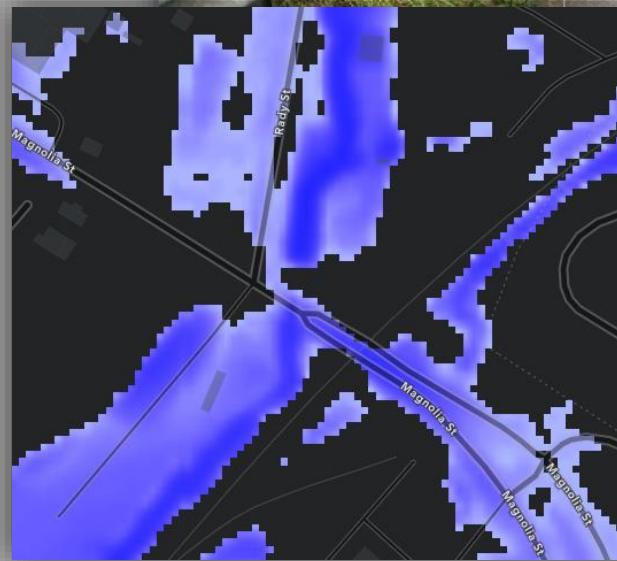


Homes that have experienced flooding, but were mapped outside 2014 effective SFHA

- Approximate (non-regulatory) floodplain extents
- Land cover change (pre- and post-development)
- Overland flow relief
- Tailwater elevations for hydraulic grade line computations
- Extracting profiles and cross-sections
- 1-ft or zero rise analysis

# Public Works

- Baseline flood hazard data for H&H
- Baseline flood hazard data for design standards
- Roadway overtopping analysis
- Extract Tailwater Elevations for Hydraulic Grade Line Computations
- Approximate size of culvert or bridge openings
- Compound flood modeling



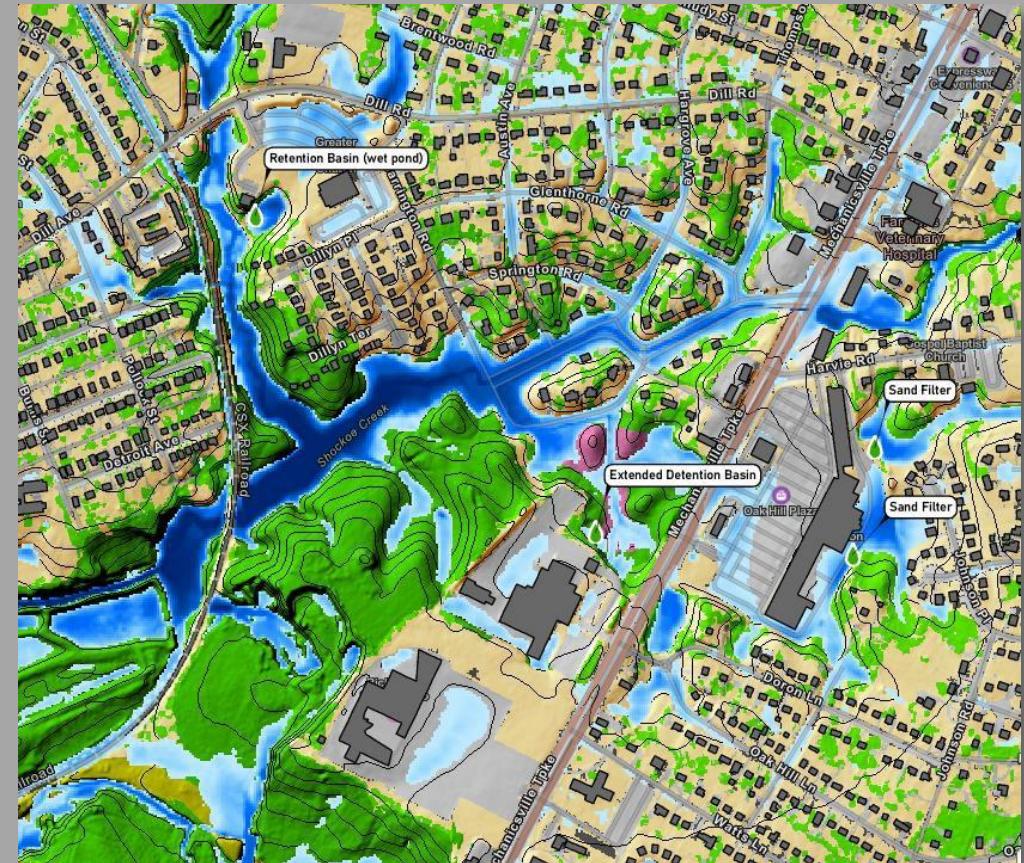
# Parks and Environmental Management

- Conservation planning
- Agricultural land planning, BMP siting
- Restoration and conservation priorities
- Property acquisition
- Public access planning
- Data Input for Habitat Suitability Analysis



# Planning and Zoning

- Community awareness and vulnerability assessments
- Evacuation route planning

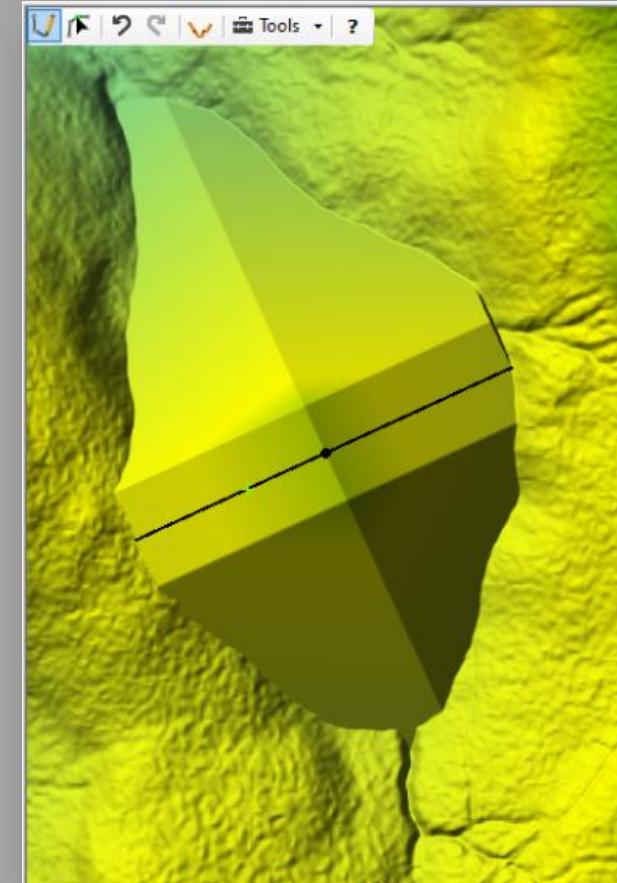


# Model Modifications

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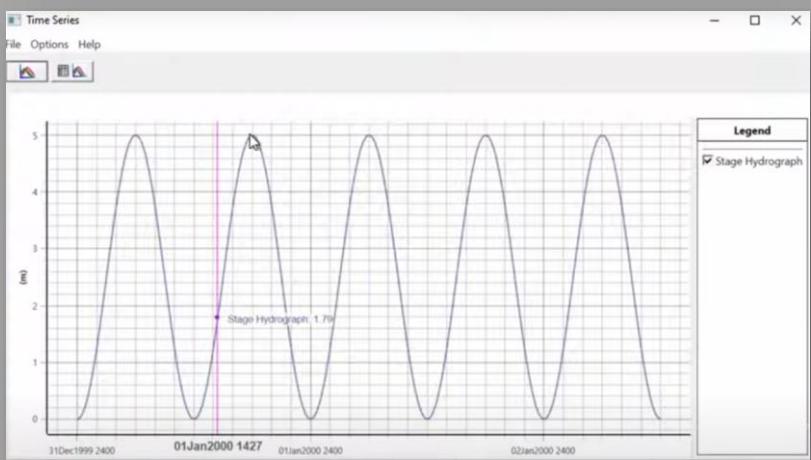
# Terrain Modifications

- Represent channels, digging lakes, etc. for HEC- RAS and other applications
- Assess dam and levee impacts to upstream and downstream properties
- Terrain modifications in GIS (e.g., add roadway embankment, calculate fill volume)
- Represent projects for CLOMRs



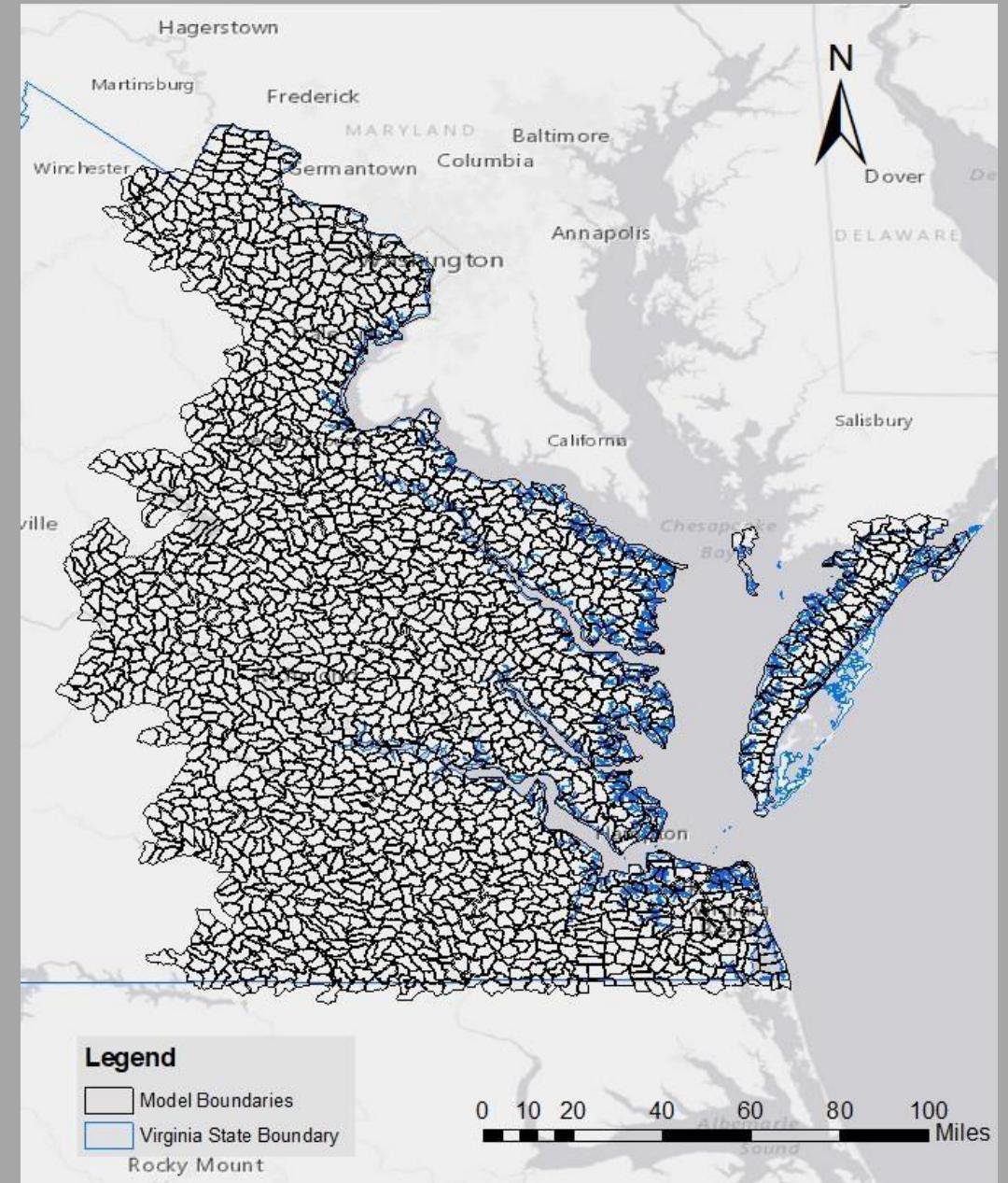
# Model Inputs

- **Land Cover Changes:** Analyze impacts and affects of changes to land cover conditions by creating new infiltration and friction rasters
- **Tidal Boundary Conditions:** Tidal inundation mapping can be generated from the models (e.g., add a tidal stage hydrograph BC)



# Group Discussion

How might your organization/community use the new pluvial flood modeling?

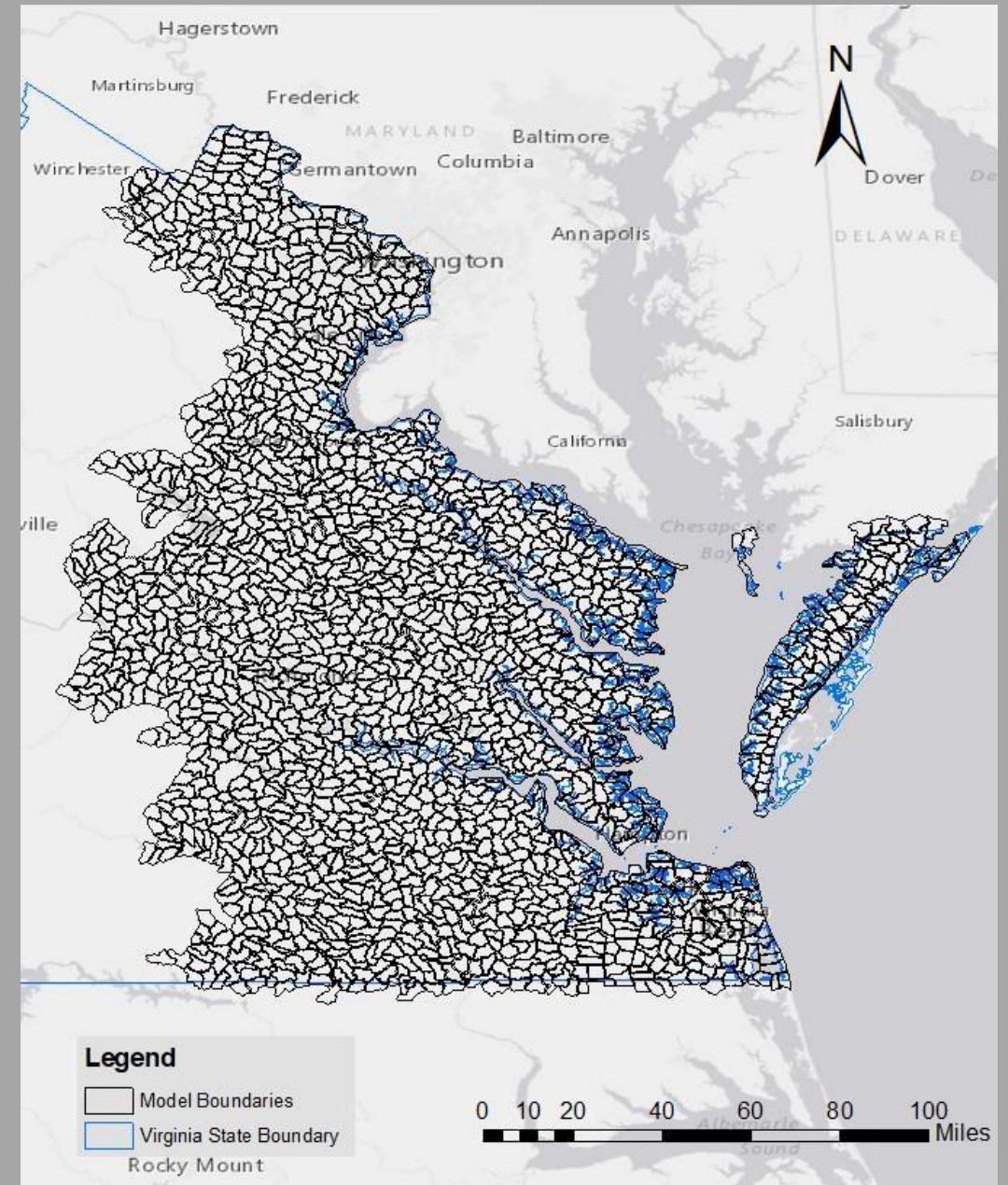


# Draft User Guide

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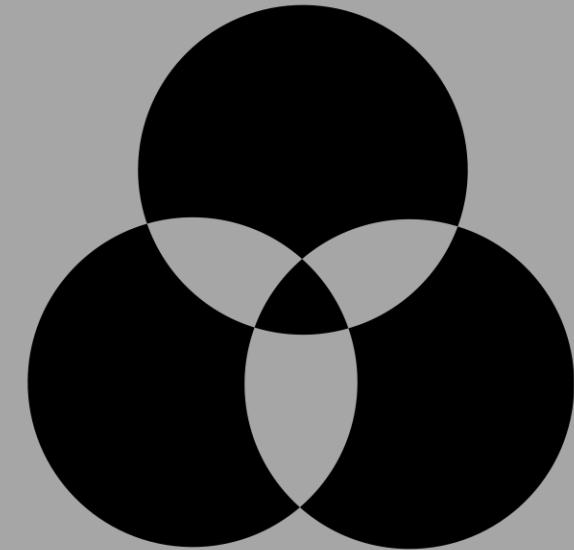
# Group Discussion

What other use cases would you recommend DCR consider when developing a *User Guide*?



# Who is the Audience?

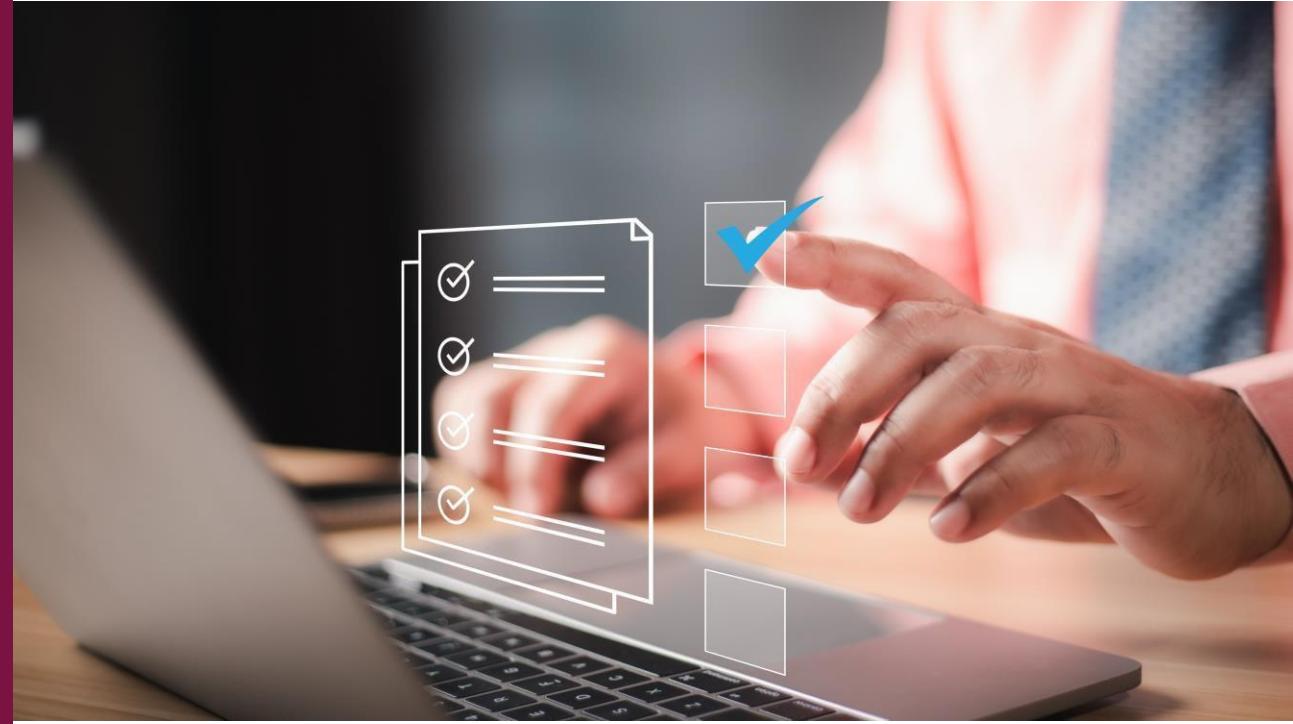
- **Primary Audience (Managers)**
  - Local, regional, and state government staff who influence or scope flood resilience policy, plans, and/or projects.
    - i.e. state agency program managers, public utility managers, floodplain administrators.
- **Secondary Audience (Modelers)**
  - Practitioners with knowledge of operating HEC-RAS who wants to modify for potential applications.
    - i.e public and private-sector engineers, planners, consultants, university researchers/students.



Created by Mister Pixel  
from Noun Project

# Polling Questions

1. 7 questions to collect further feedback
2. Your answers are not anonymous
3. We will share the results live with the group for discussion



# Group Discussion

What other suggestions do you have about how we can improve the *User Guide*?



# Next Steps

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# Thank you!

Arthur Kay  
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Computational Scientist, Dewberry  
[slawler@dewberry.com](mailto:slawler@dewberry.com)