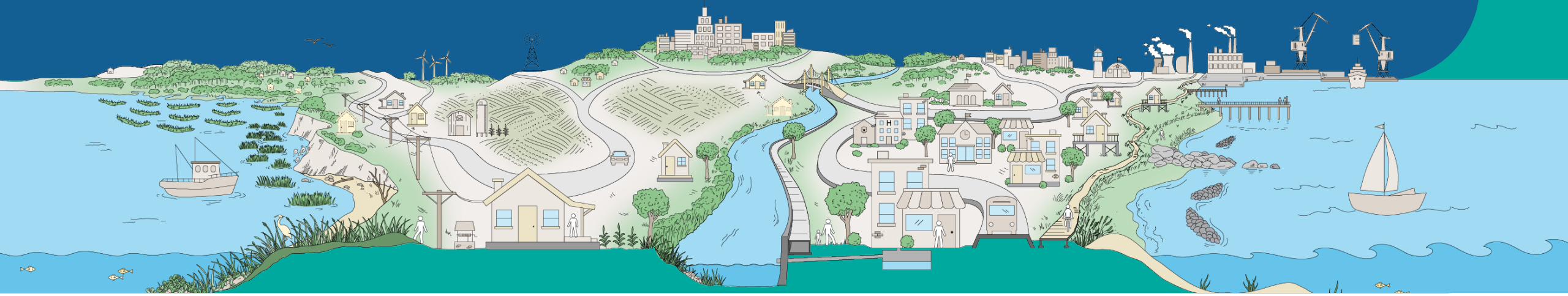
VIRGINIA FLOOD PROTECTION MASTER PLAN

Identify Flood Resilience Strategies

4.4 In-Person Meeting: April 22nd, 2025



VIRGINIA FLOOD PROTECTION MASTER PLAN

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Identify Flood Resilience Strategies

In-Person Meeting Objectives

1. Understand the purpose, scope, and process of the Virginia Flood Protection Master Plan.
2. Understand how the strategies build off the plan's Vision, Goals, Objectives, and Gaps.
3. Review and provide input on all draft Strategies.
4. Review initial results from the plan's statewide impact analysis.

Meeting Agenda

- Welcome & Team Introductions
- Development of Draft Strategies
- *Break*
- Small Group Discussions on Draft Strategies
- *Working Lunch Break – Presentation on Flood Impact Study*
- Complete Small Group Discussions on Draft Strategies
- Wrap Up
- Next Engagement Opportunities

DCR
Virginia Department of Conservation & Recreation

DCR Office of Resilience Planning

Planning for a flood resilient future.

Matt Dalon

Program Manager

Carolyn Heaps-Pecaro

Resilience Planner

Ellie Plisko

VCU Wilder Fellow

Gabrielle Rosario

VASG Coastal and Marine Policy Fellow

VIRGINIA FLOOD PROTECTION MASTER PLAN

DCR Office of Resilience Planning

Planning for a flood-resilient future.

What we do: Distribute knowledge and coordinate action to achieve a flood-resilient future for Virginia through informed planning and proactive intergovernmental solutions.

Why we do it: We envision a Virginia where state-led solutions effectively confront present and future flood risks. Through aligned collective action, we will increase resilience and minimize the impacts of flooding statewide.

DCR Office of Resilience Planning

Planning for a flood-resilient future.

Develop and Implement State-led Flood Resilience Plans

Coordinate Action

Supply Data, Information and Resources

Conduct Outreach and Engagement

VIRGINIA FLOOD PROTECTION MASTER PLAN

Planning Team

ARCADIS

emergent method

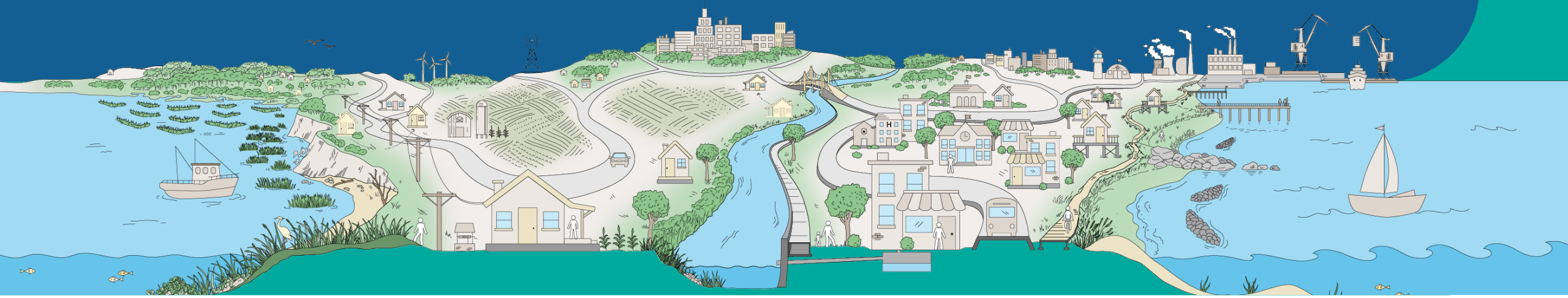
Hirschman Water & Environment, LLC
Stormwater & Stewardship

LAUNCH! Consulting

THE WATER INSTITUTE

VIRGINIA FLOOD PROTECTION MASTER PLAN

The Virginia Flood Protection Master Plan (VFPMP) will be an actionable plan for the Commonwealth to use in crafting policies and programs to mitigate the impacts of flooding on people, the economy, and the environment.



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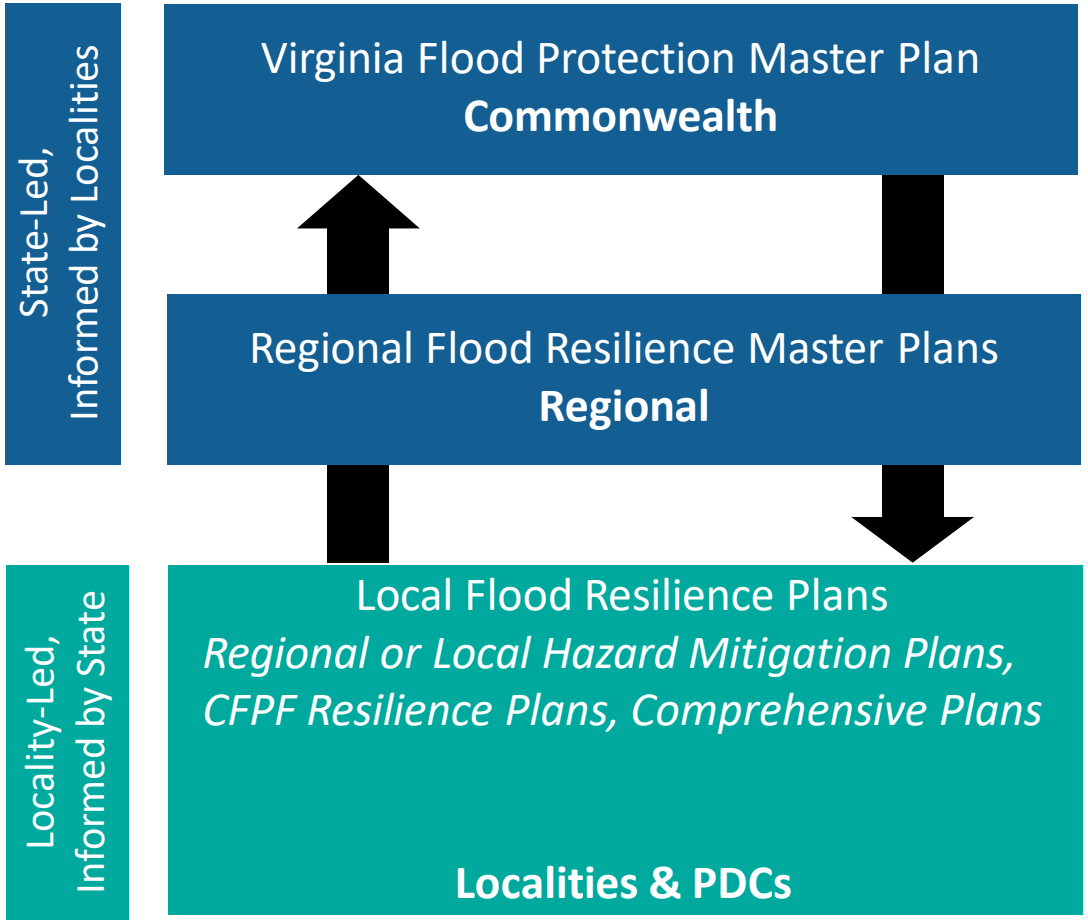
Understanding VFPMP's Role in Virginia's Flood Resilience Planning Efforts

- The Virginia Flood Protection Master Plan is intended to inform smaller scale plans and vice-versa
- The primary end users of the Virginia Flood Protection Master Plan will be Virginia state agencies
- Focus on state agencies will allow for flood resilience planning to spread throughout state initiatives and flow down into regional & local programs

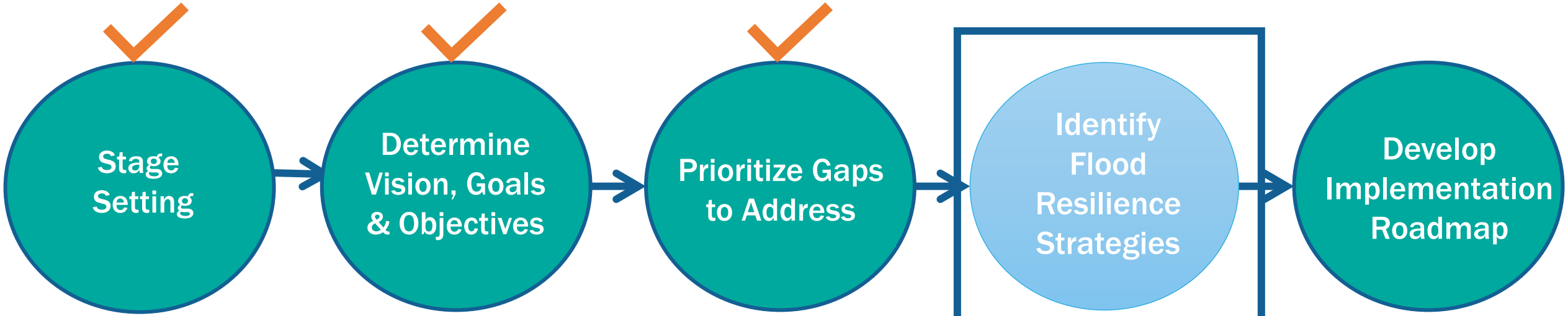


VIRGINIA FLOOD PROTECTION MASTER PLAN

VFPMP Final Products

Written PDF Plan	The full plan document designed for state leadership, and appendices designed for use by practitioners.	Audience: Governor & GA
Implementation Guide	A summary of the policy and program strategy designed for quick reference.	Audience: State Agencies
StoryMap & Data Viewer	A summary of the major plan elements that allows for interactive engagement.	Audience: Public
VFPMP Webpage	General plan information (purpose, process, & results). Periodically updated with progress/metrics tracking.	Audience: Public

KEY POINTS IN COLLABORATIVELY DEVELOPING THE VFPMP



Identify past and current flood resilience successes and challenges to inform the develop of initial VFPMP goals.

Define clear desired outcomes to guide the Virginia Flood Protection Master Plan.

Identify and prioritize data, resource, and capacity gaps in statewide management of flood risk.

Identify statewide actions that can be taken within the next five years to address gaps and strengthen Virginia's flood resilience.

Outline mechanisms, timelines, responsible parties, required resources, and success metrics to guide implementation.

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APPROACH TO STRATEGY DEVELOPMENT

Where we are going

Timeframe: 2025-2045

Vision

Long-term aspirations and desired outcomes for flood risk reduction across Virginia

Goals

Succinct statements of what needs to be accomplished to move towards the Vision

Objectives

Provide the basis for evaluating alternatives and measuring progress towards goals

How we get there

Timeframe: 2025-2030

Strategies

Actionable approaches to address gaps in the current state of practice and advance the plan's goals

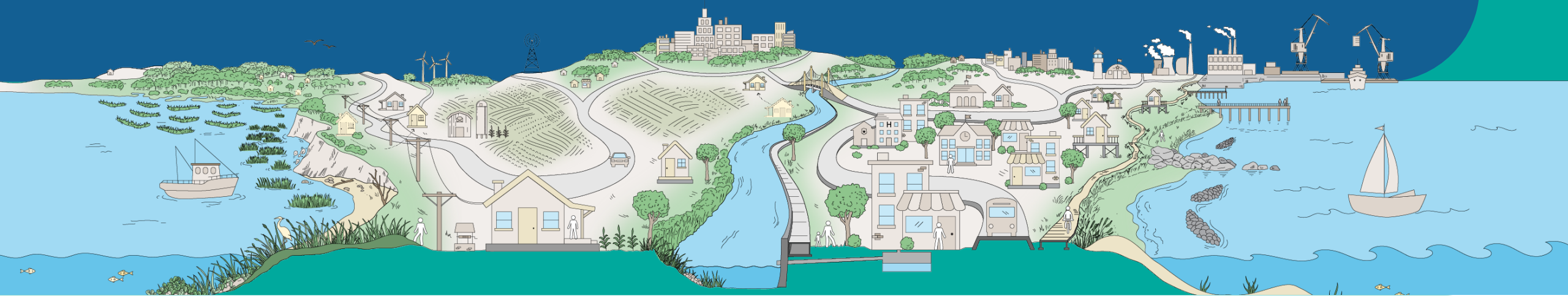
Implementation Roadmap

Outline the specific steps and mechanisms to implement the strategies and actions identified

VIRGINIA FLOOD PROTECTION MASTER PLAN

STRATEGIES MUST HELP ACHIEVE PLAN VISION

A thriving Commonwealth proactively addressing flood risks to further strengthen the resilience of communities, the economy, and the environment now and into the future.



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STRATEGIES MUST ALIGN WITH PLAN GOALS AND OBJECTIVES

A. Mitigate current and future flood risks statewide.

A1. Reduce negative effects on human health from flooding.

A2. Reduce negative impacts to vulnerable populations from flooding.

A3. Reduce flood damage to buildings and infrastructure.

A4. Reduce economic disruptions and losses from flooding.

A5. Reduce negative effects to natural and cultural resources from flooding.

B. Advance lasting and unified strategies to address flood risk.

B1. Increase understanding of current and potential future flood risks.

B2. Strengthen the ability to prepare for and manage flood risks.

B3. Increase the adaptability and effectiveness of flood resilience strategies to potential future conditions and regional interests.

B4. Increase the return on public investments in flood resilience.

B5. Increase the accessibility of flood resilience resources, opportunities, and information for all Virginians.

C. Capture additional benefits through flood resilience.

C1. Improve health and quality of life through flood resilience.

C2. Boost the economy through flood resilience.

C3. Enhance the natural environment through flood resilience.

STRATEGIES MUST HELP ADDRESS PRIORITY GAPS

Prioritized Gaps	
P1. Coordination among state agencies to streamline flood resilience strategies and reduce redundancies.	S1. Staff capacity and data management resources for coordination between federal, state, and local agencies during events to ensure targeted event response.
P2. Funding resources for long term resilience planning that supports a wide breadth of needs at both the state and local government levels.	S2. Staff capacity and funding resources for additional grant application and management support to local governments.
P3. Access to up-to-date data resources that support long-term flood resilience planning and resource allocation decisions.	S3. Funding resources for asset maintenance.
P4. Community knowledge and capacity to take proactive steps to reduce vulnerability to flooding.	S4. Reliance on non-permanent federal funding posing challenges in sustaining flood resilience programs.
P5. Staff capacity hindering collaboration, technical assistance provision, and funding outreach efforts.	S5. Staff capacity and resources to coordinate technical assistance for funding and program initiatives to address long-term flood resilience goals.
P6. Robust decision-making frameworks and capacities to facilitate long-term planning efforts and resource allocation decisions.	S6. Staff capacity for integration of flood resilience tools.
P7. Staff capacity and resources for interdepartmental data aggregation and coordination for comprehensive flood risk assessments, including those for state-owned assets.	S7. Staff capacity to address and assist with federal and state regulations.

DRAFT STRATEGIES v. POSSIBLE ACTIONS

Strategies

Higher-level policy/program Strategies that build flood resilience and meet plan Objectives.

Timeframe: next **five years**, with longer-term relevance as the plan is updated over the next 20 years.

Room for **flexibility in how implemented**, to accommodate changing administrations and allow for alignment with agency-specific plans.

Characteristics:

- Broad and overarching.
- Focused on "what".
- Aimed at aligning resources and initiatives toward goals and objectives.
- Sets the foundation for decision-making and prioritization.

Possible Actions

Illustrative examples of the kinds **of more detailed recommended actions** that can support the implementation of Strategies in the near term.

This content will be **revised and refined with stakeholder input** as part of what will be included in the Implementation Roadmap.

Timeframe: next **two years**, with ability to be annually updated to advance the plan over the next five years.

Characteristics:

- Specific and focused on execution.
- Can be targeted at and customized by agencies.
- Focused on "how" to achieve the strategy.
- Often short- to medium-term in nature and measurable.
- Can be one of many actions supporting the broader strategy.

STRATEGIES ARE ORGANIZED BY STAKEHOLDER-IDENTIFIED THEMES

Meaningful Coordination

We are actively increasing awareness and understanding of flood resilience efforts across state agencies and programs, leveraging existing coordination bodies to improve flood resilience outcomes.

Enhanced Capacity

We are actively integrating comprehensive staff training and development opportunities with strategic workforce planning to effectively manage and expand flood resilience efforts.

Sustainable Funding

We are actively enhancing flood resilience through strategic financial management of existing and potential funding.

Reliable Data Systems

We are actively acquiring, managing, and sharing flood resilience-related data across agencies to inform decision-making and guide policy and program administration.

Proactive Adaptation

We are actively implementing innovative flood resilience solutions to enhance financial outcomes, adaptively manage both planning and standards, and prioritize Nature-Based Solutions where suitable.

Supported Localities

We are actively enhancing partnerships with localities to preserve assets, expand engagement, provide technical assistance, and develop flood resilience resources and guidance.

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Meaningful Coordination

DRAFT Strategies:

- Coordinate with key staff across state agencies to increase their awareness of and responsiveness to flood resilience.
- Leverage existing coordination bodies and non-governmental entities to advance flood resilience.

Stakeholder Feedback:

- Overall general support of these strategies – important to have strong coordination across agencies to maximize the effectiveness and efficiency of the state's overarching flood resilience efforts

Enhanced Capacity

DRAFT Strategies:

- Expand the flood resilience knowledge base of state agencies.
- Routinely assess and optimize state agency roles and responsibilities in flood resilience.

Stakeholder Feedback:

- Important that the increased knowledge gained at the state agency level also trickles down to regional and local stakeholders
- 2nd strategy is new – focus should not only be on consistent technical knowledge, but also on the accessibility of resources and personnel

Sustainable Funding

DRAFT Strategies:

- Explore new funding mechanisms to expand flood resilience (programs, infrastructure, etc.).
- Inventory and optimize existing funding resources for flood resilience.

Stakeholder Feedback:

- Overall general support of these strategies – critical that current funding resources are leveraged statewide, as well as identifying new financial sources

Reliable Data Systems

DRAFT Strategies:

- Establish a state-wide comprehensive flood data management program.
- Establish data-informed decision-making frameworks for prioritizing flood resilience actions.

Stakeholder Feedback:

- Important that these resources are made with users in mind – what makes the most sense for each use case? How do we make these resources reliable for agencies and stakeholders to use consistently?

Proactive Adaptation

DRAFT Strategies:

- Invest in innovative flood resilience solutions to improve the Commonwealth's financial wellness and economic competitiveness.
- Expand support for the deployment and maintenance of Nature-Based Solutions to improve ecosystem health.
- Leverage regular updates of plans, policies, regulations, and codes to incorporate flood resilience best practices.

Stakeholder Feedback:

- Great support for incorporating NBS
- Added 3rd strategy to maximize on-going efforts

Supported Localities

DRAFT Strategies:

- Expand engagement with flood risk and resilience concepts statewide to promote increased understanding.
- Provide comprehensive technical assistance for local governments on flood resilience.
- Explore state agency pathways for supporting communities in managed retreat and voluntary relocation.

Stakeholder Feedback:

- Combined technical assistance strategies into one strategy
- Moved 3rd strategy from Proactive Adaptation to Support Localities theme to highlight the important of local coordination

BREAK

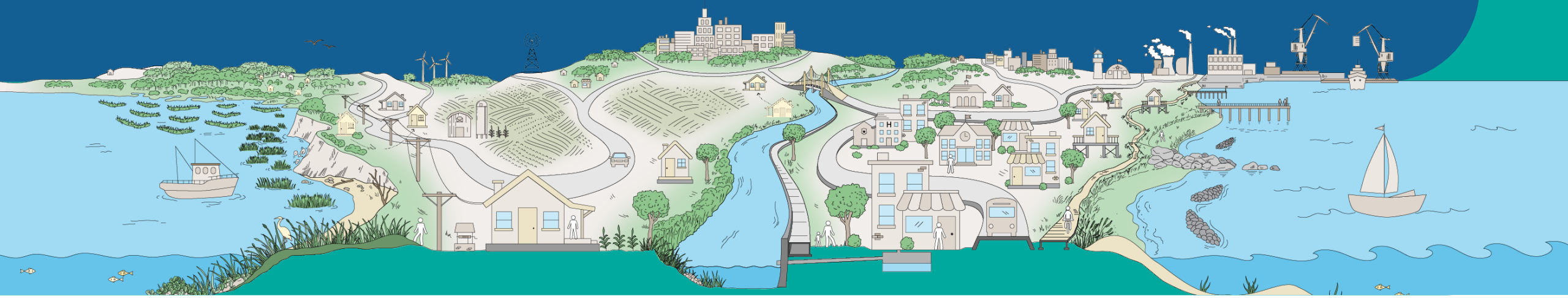
1. Pick-up stakeholder packet

2. Sit at your group table based on assignment in stakeholder packet

Questions to Guide Discussion

- Do these feel like the right strategies for this theme?
- What adjustments need to be made to the strategies?
- What could Virginia do to further advance this strategy?
- Are there any additional strategies you would propose?

Flood Impact Study Report Out



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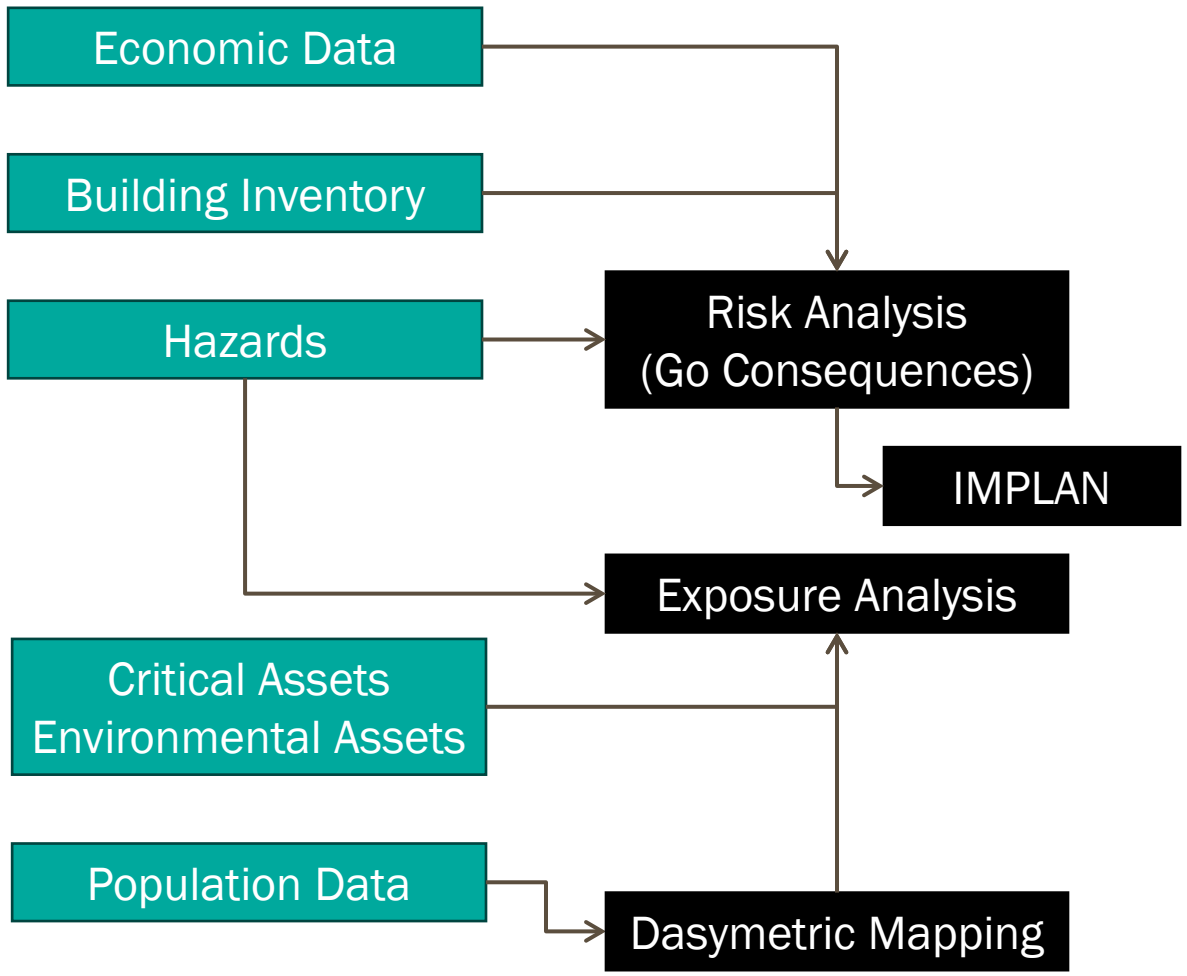
Introduction to VFPMP Flood Impact Study

- A Flood Impact Study was conducted as part of the Virginia Flood Protection Master Plan development process
- The analysis provides, for the first time, a baseline for flood impacts statewide using common methods, assumptions, and inputs and allowing for comparison across geographies
- The results of this analysis serve to complement and augment understanding of flood impacts from existing models at other spatial scales (e.g., those used in the Coastal Resilience Master Plan or at local scales)
- This presentation is intended to familiarize core stakeholders with the inputs, tools, and types of outputs of the Flood Impact Study, but is not exhaustive – much more data exists and will be made available via an online Data Viewer as the VFPMP is finalized

Inputs to Impact Methodology

Economic Data	Data from sources such as the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, the U.S. Census Bureau, and the U.S. Department of Agriculture from IMPLAN (2023)
Building Inventory	Locations and characteristics from National Structure Inventory and Lightbox SmartFabric Professional Virginia Parcels (via HIFLD Secure).
Hazards	Extents and depths of inland and coastal defended flood layers statewide. Includes coastal, pluvial, and fluvial flood sources. Multiple return periods and climate scenarios at ~10m resolution (1/3 arcsecond) from Fathom (2024).
Critical Assets Environmental Assets	Large, multisource data set consolidating information from HIFLD Secure as well as various federal and state agencies.
Population Data	Population and demographic data from 5-Year American Community Survey data at the census tract from the US Census Bureau (2020).

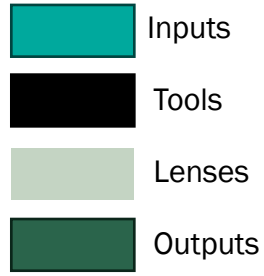
Tools Used for Impact Methodology



The tools used for the impact methodology combine data inputs to better understand risk in various forms.

Tools like Go Consequences and IMPLAN are used together to understand the risks to the built environment and economic activity under different flooding hazard scenarios.

Combining hazard information with asset inventories and/or population data provides insight into the exposure of people and assets to flooding impacts.



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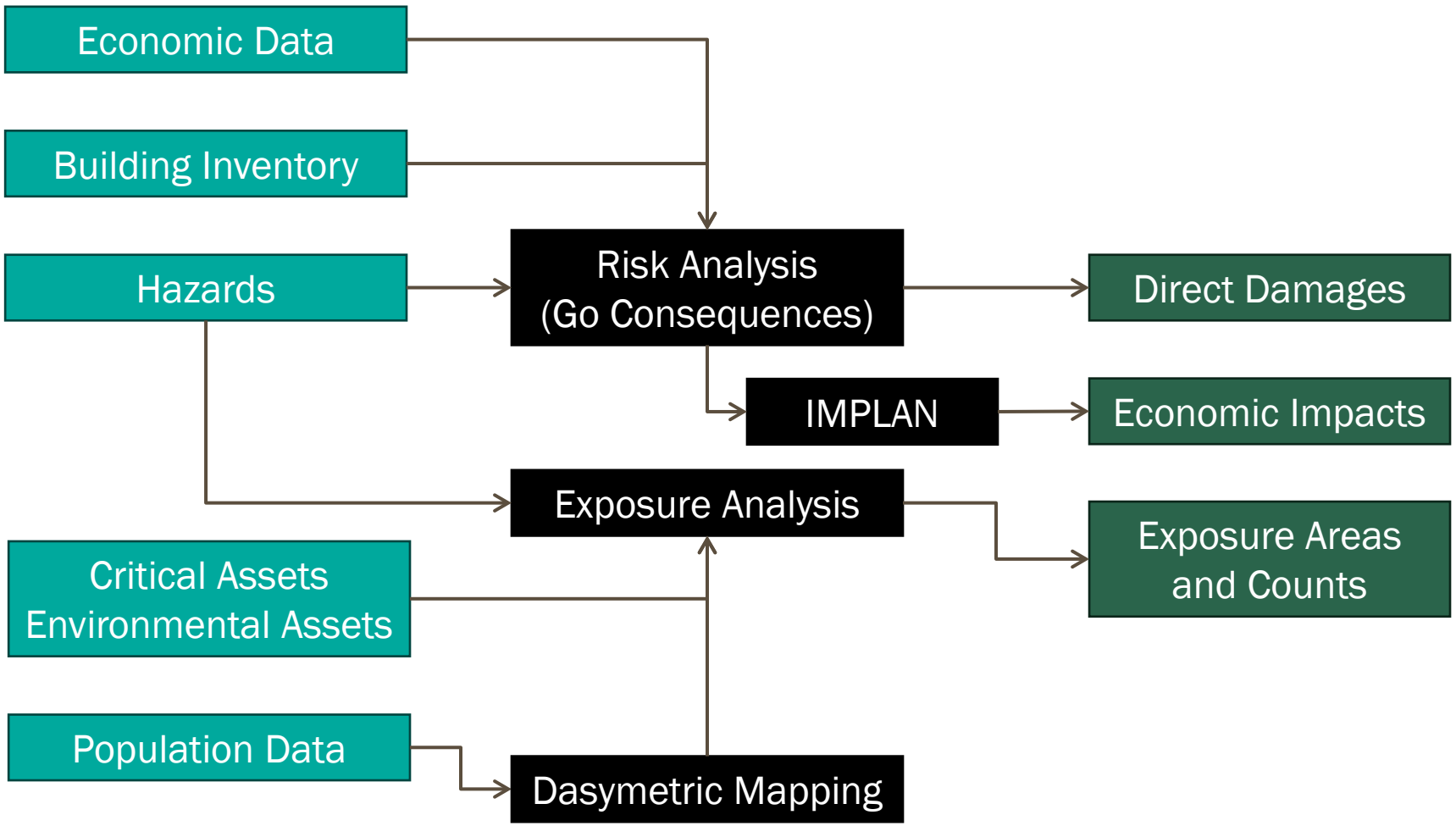
Initial Outputs of Impact Methodology



Inputs
Tools
Lenses
Outputs

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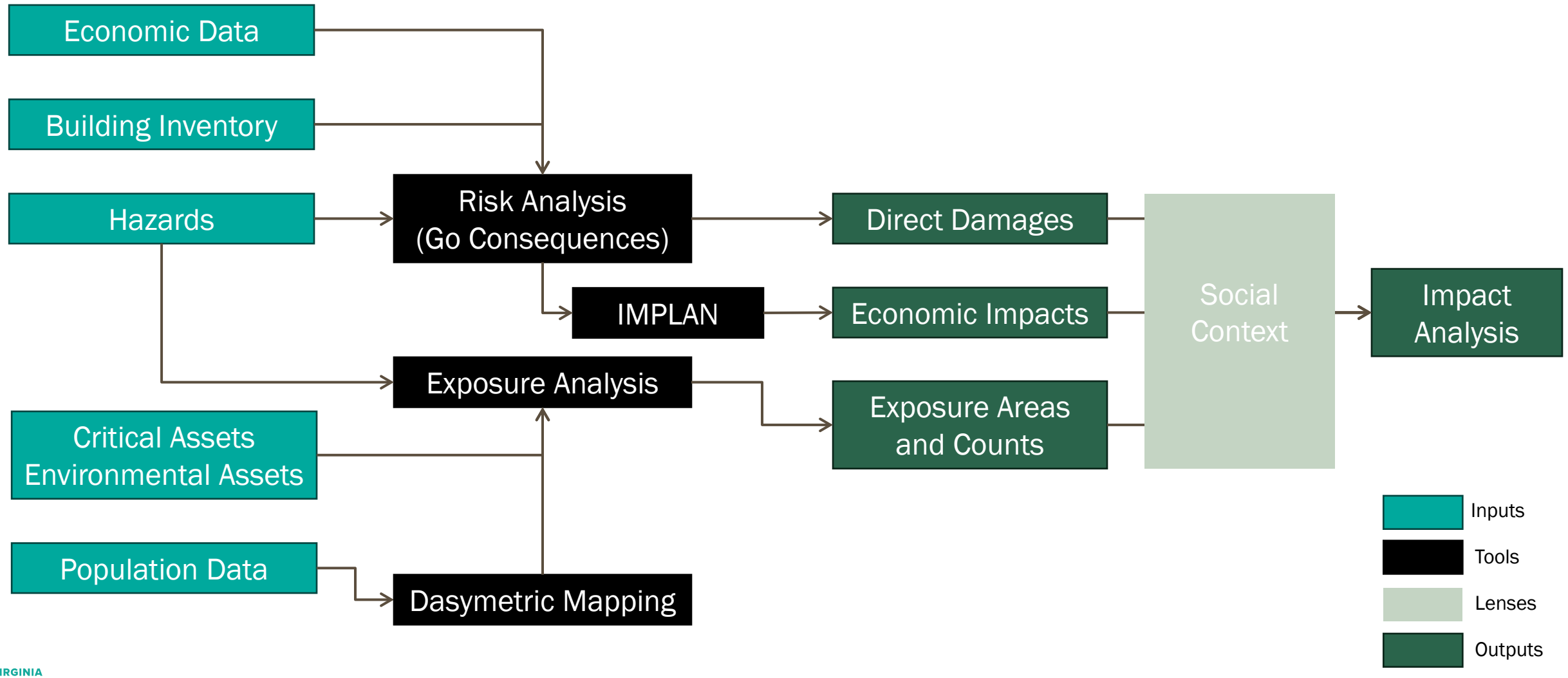
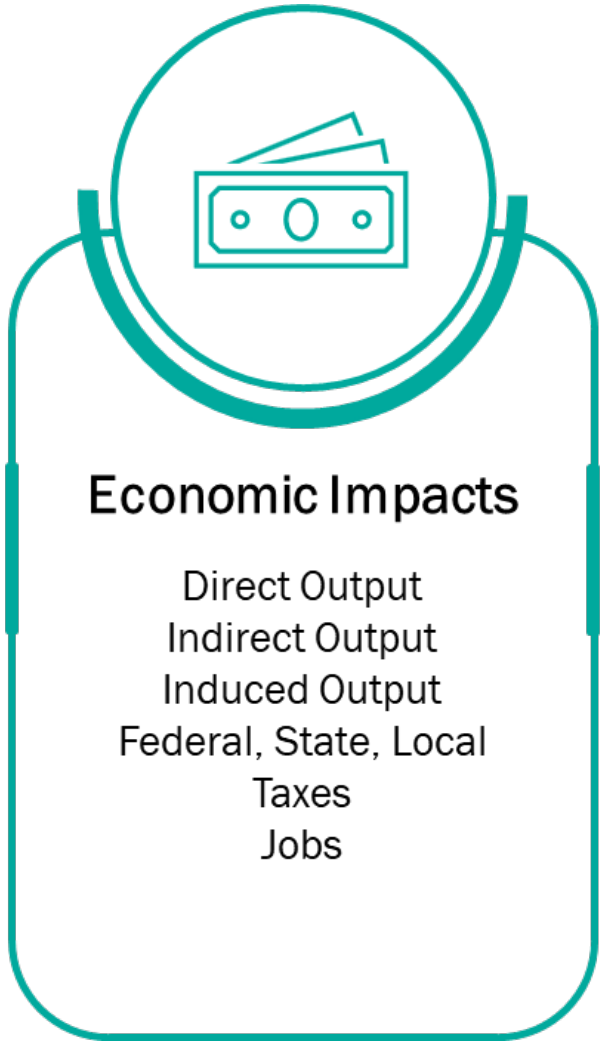
Context and Final Output of Impact Methodology



Initial Outputs of Impact Methodology

Direct Physical Damages

Damages to Structures
Contents and Inventory Loss



Economic Impacts

Direct Output
Indirect Output
Induced Output
Federal, State, Local Taxes
Jobs

Exposure Counts

Buildings
Built Infrastructure
Human Infrastructure
Natural Infrastructure
Community Resources
Population
Land Cover

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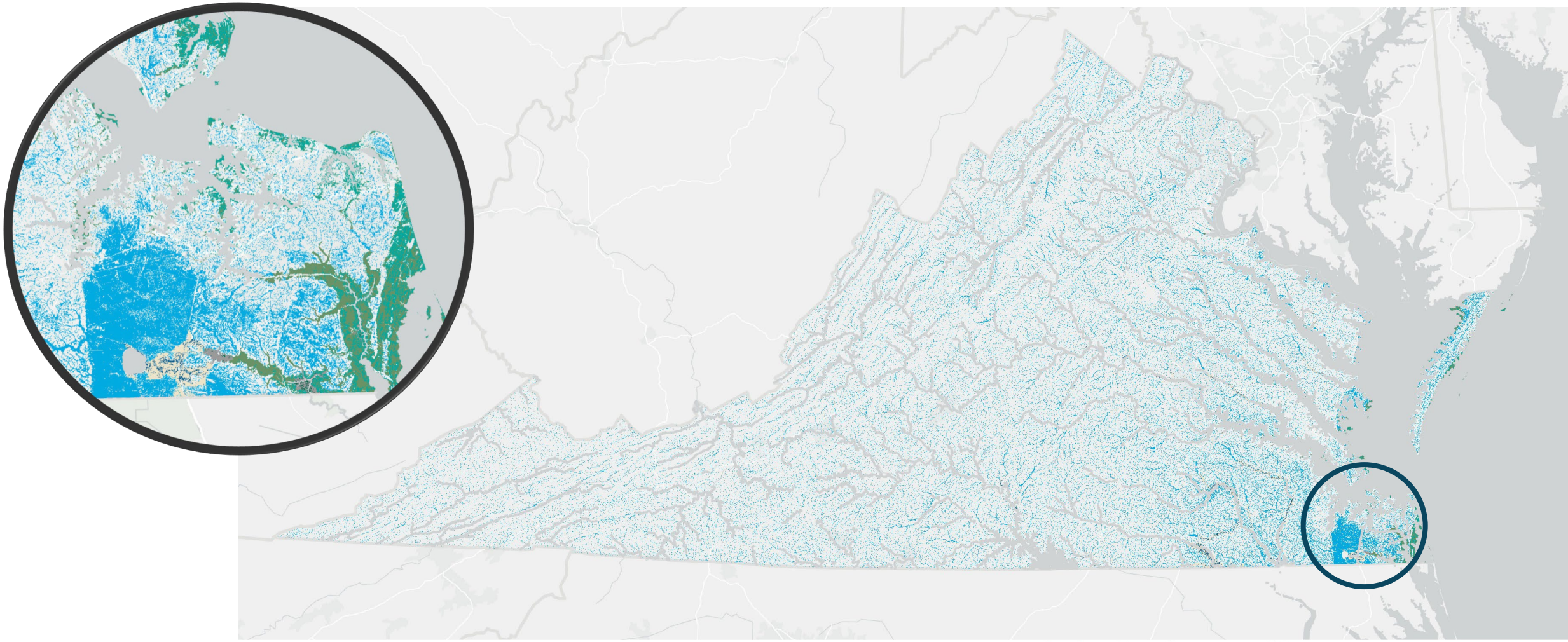
VFPMP Flood Impact Outputs

2020 Flood Types Present (1.0% AEP)



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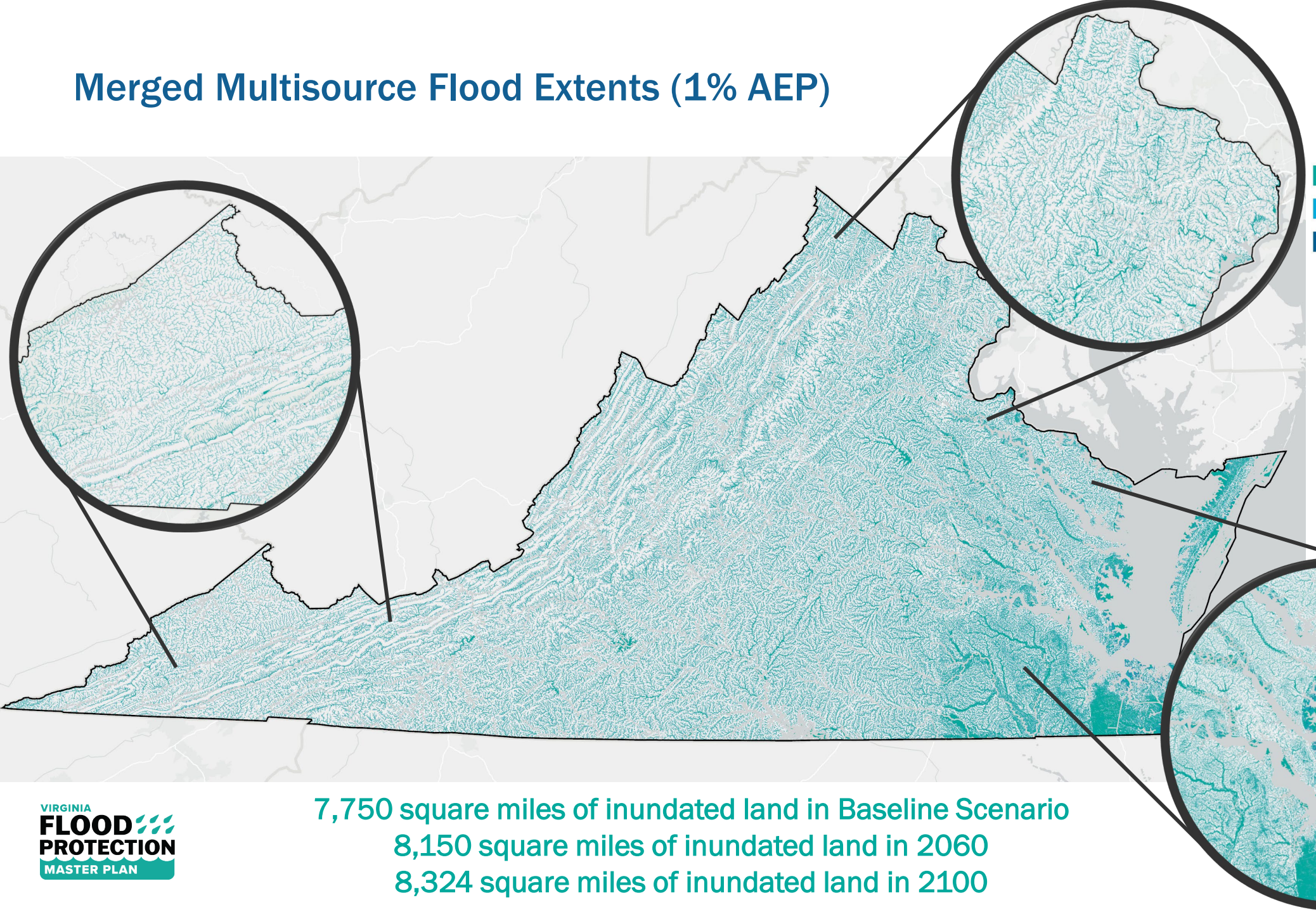
Merged Multisource Flood Extents (1% AEP)



1% AEP Baseline (2020)
1% AEP Future (2060)
1% AEP 2100

Merged Multisource Flood Extent refers to the largest flood extent across Coastal, Pluvial, and Fluvial data for a single return period, time horizon, and climate scenario.

Climate Scenario:
SSP2-4.5
50 Percentile Confidence Interval

7,750 square miles of inundated land in Baseline Scenario
8,150 square miles of inundated land in 2060
8,324 square miles of inundated land in 2100

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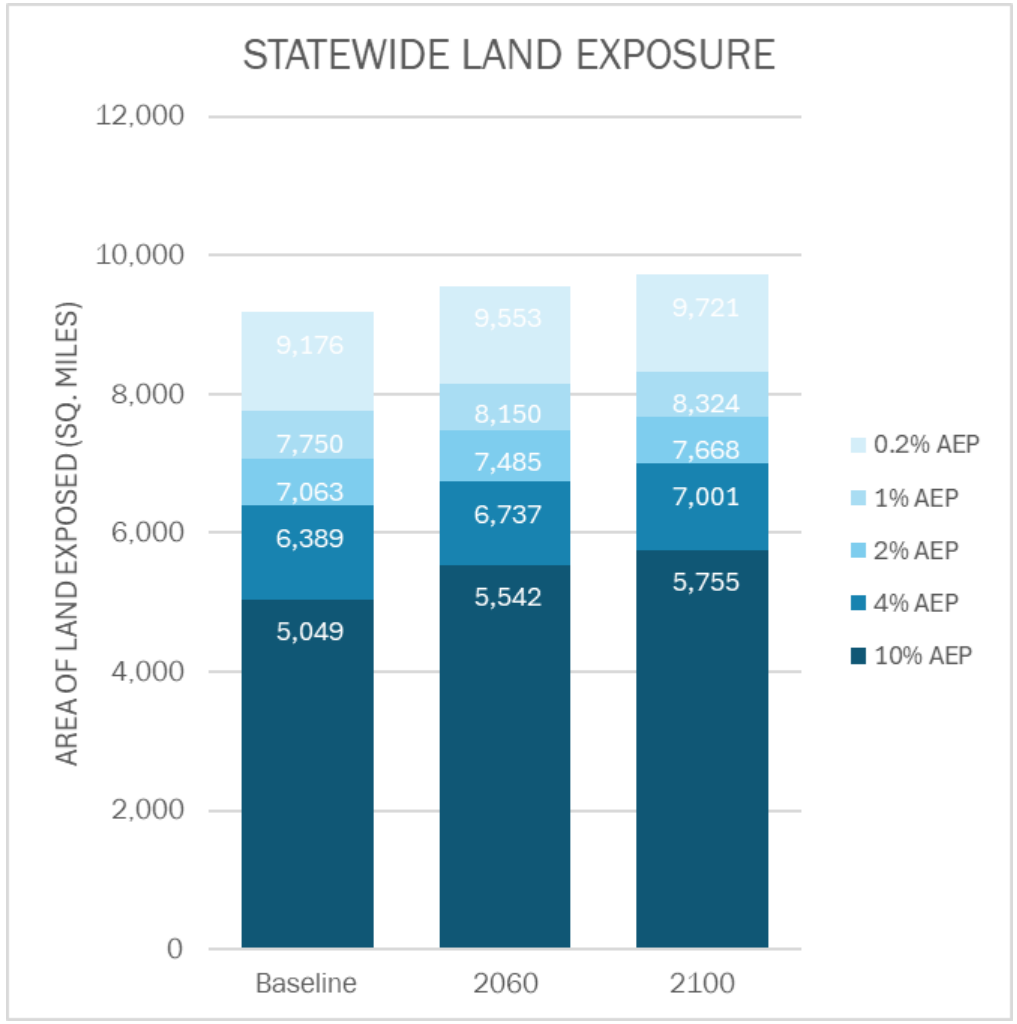
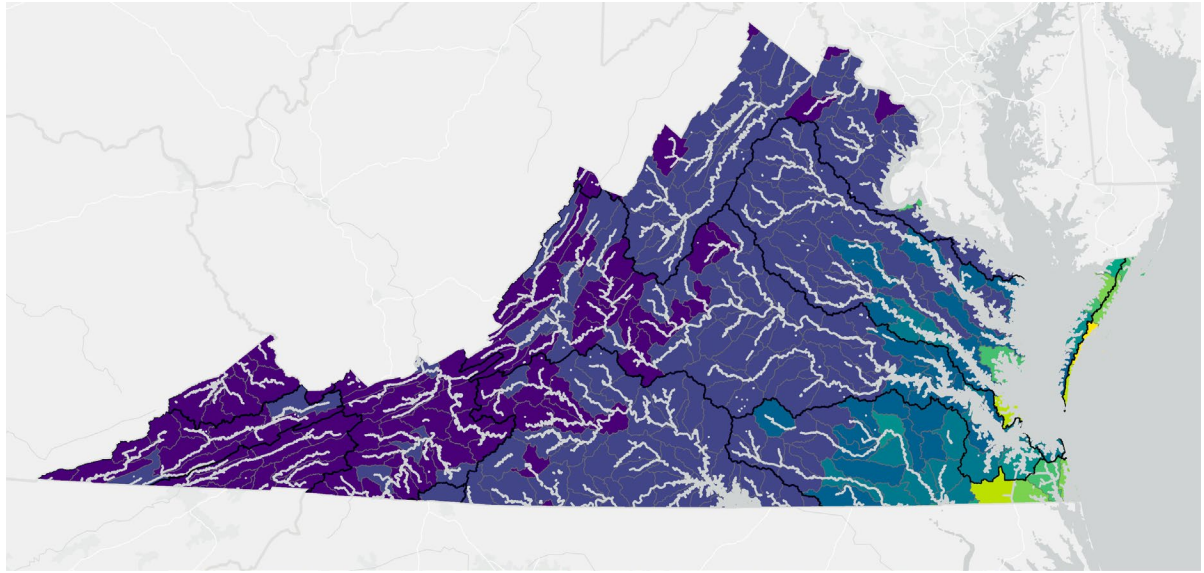
Land Exposure (1% AEP)

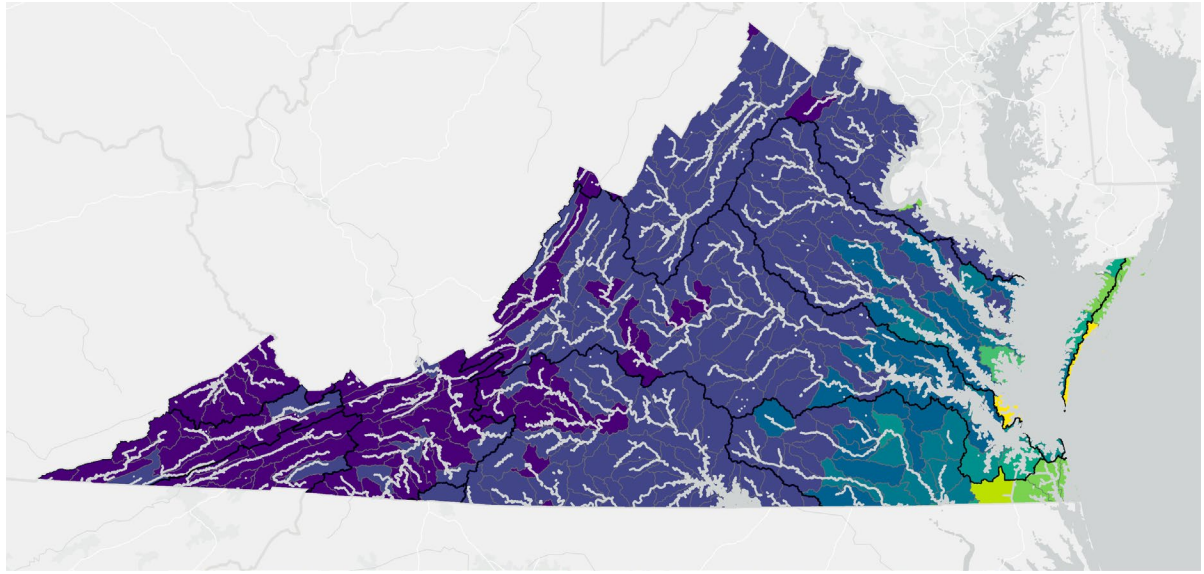


Land exposure per FEMA 2020 100 Year Flood Event is 2,139 sq miles

HUC-6 Proportion of Flood-Exposed Land (1% AEP) - Baseline



HUC-6 Proportion of Flood-Exposed Land (1% AEP) - 2060



Pct. of land exposed

0% 80%

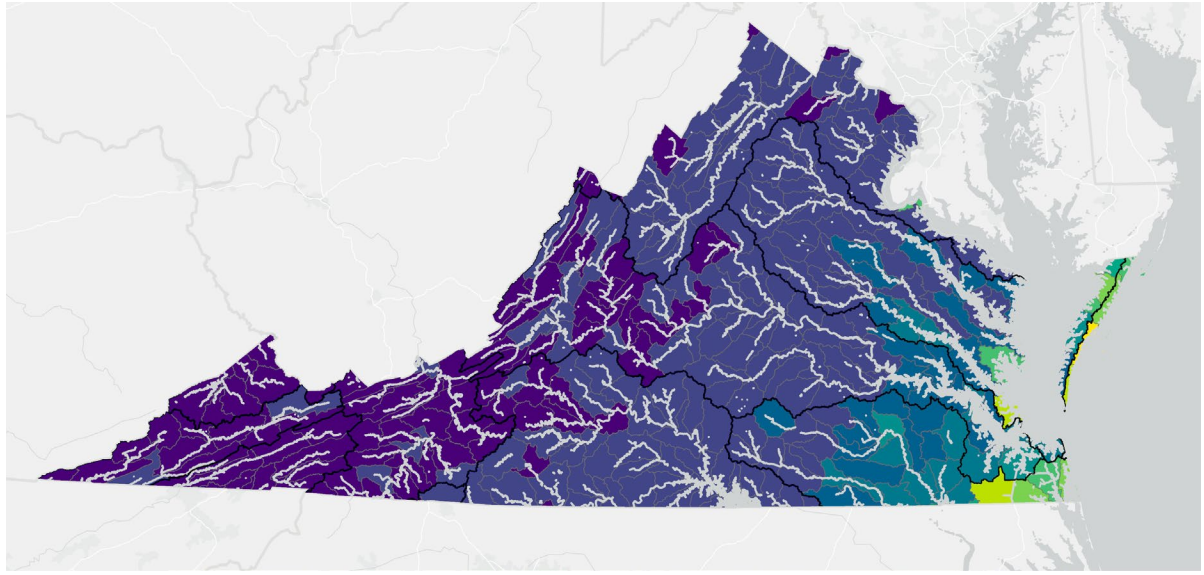
Land Exposure (1% AEP)

HUC6	Total Land (Square Miles)	Baseline (2020)		Future (2060)	
		Exposed Land Area	Percent of Total Land Area Exposed	Exposed Land Area	Percent of Total Land Area Exposed
Albemarle-Chowan	**6,618**	**1,595**	**24%**	**1,666**	**25%**
Big Sandy	1,753	72	4%	76	4%
French Broad-Holston	2,017	124	6%	132	7%
James	14,127	1,622	11%	1,707	12%
Kanawha	5,209	348	7%	367	7%
Lower Chesapeake	**9,733**	**1,619**	**17%**	**1,725**	**18%**
Mid Atlantic Coastal	**440**	**276**	**63%**	**285**	**65%**
Potomac	8,626	869	10%	917	11%
Roanoke	10,119	994	10%	1,030	10%
Upper Pee Dee	118	10	8%	10	9%
Upper Tennessee	3,944	220	6%	233	6%
Total	**62,706**	**7,750**	**12%**	**8,150**	**13%**

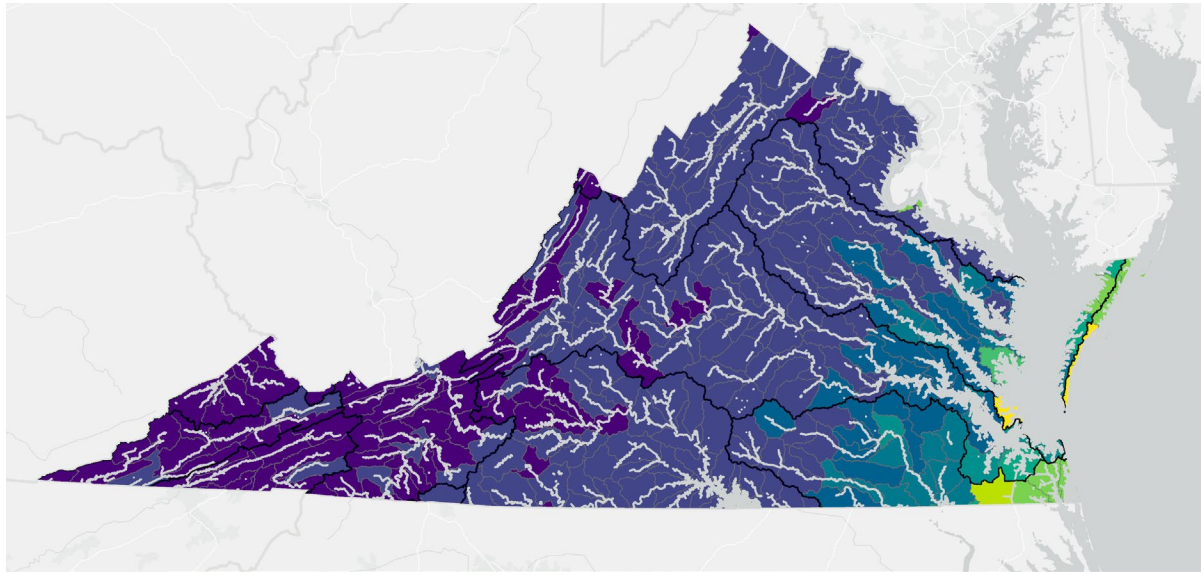
[1] Bolded rows show top three HUC6s by percent exposure

VIRGINIA FLOOD PROTECTION MASTER PLAN

HUC-6 Proportion of Flood-Exposed Land (1% AEP) - Baseline



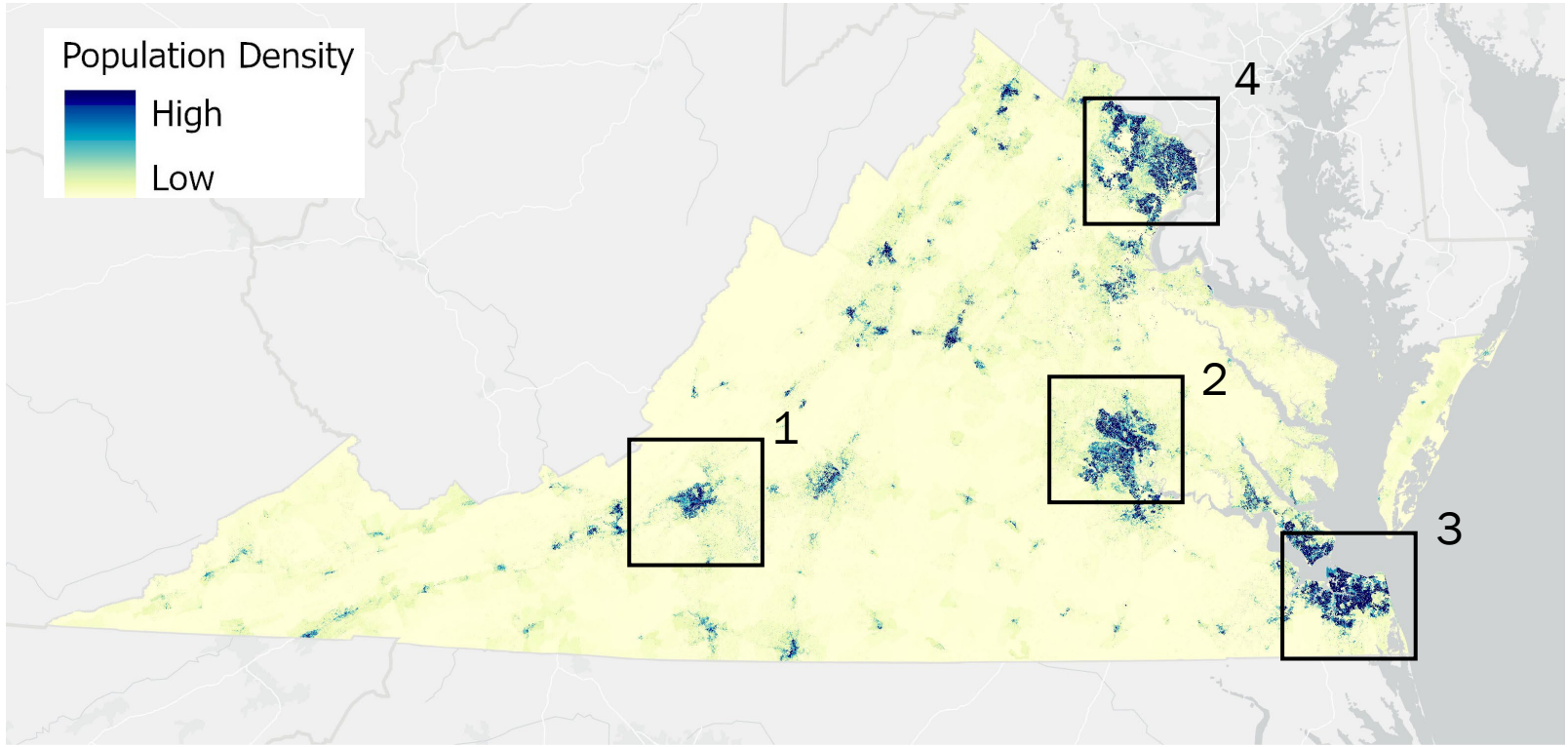
HUC-6 Proportion of Flood-Exposed Land (1% AEP) - 2060

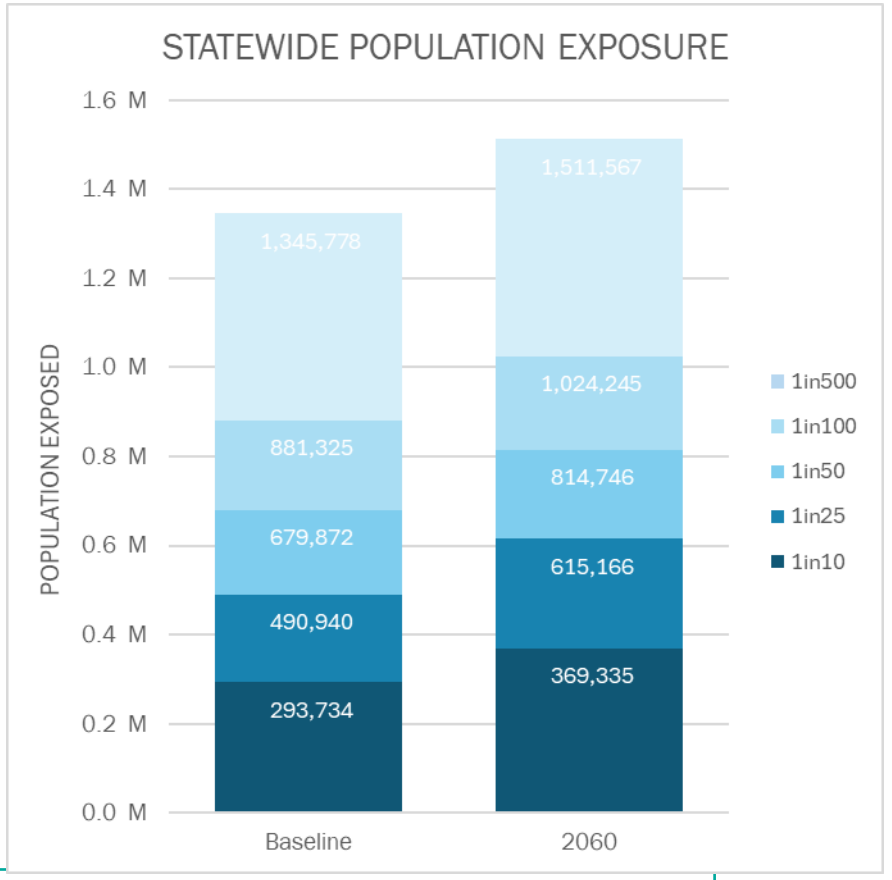


Pct. of land exposed

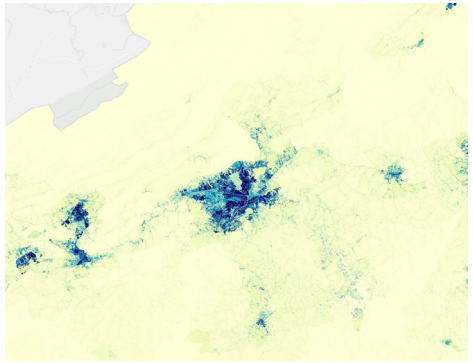
0% 80%

Population Exposure (1% AEP)

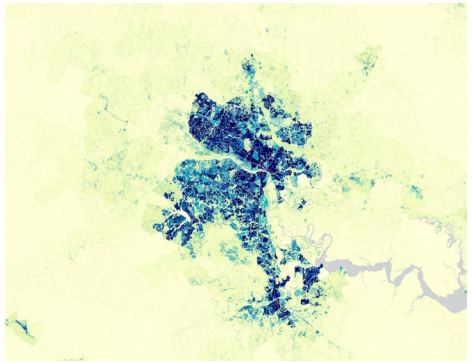




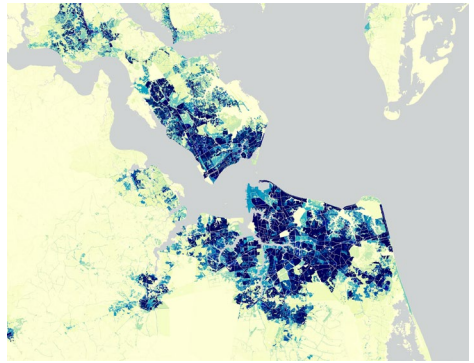
Baseline Dasymetric Mapping Inset Maps:



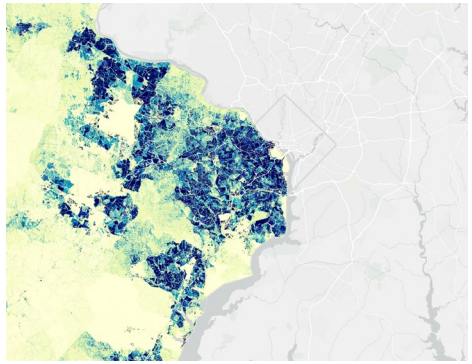
1 - City of Roanoke



2 - City of Richmond



3 - Hampton Roads



4 - City of Alexandria

VIRGINIA FLOOD PROTECTION MASTER PLAN

Population Exposure (1% AEP)

HUC6	Total Population[1]	Baseline (2020)[1]		Future (2060)[1]	
		Exposed Population	Percent of Total Population Exposed	Exposed Population	Percent of Total Population Exposed
Albemarle-Chowan	588,437	90,318	15%	101,574	17%
Big Sandy	67,539	2,699	4%	2,814	4%
French Broad-Holston	146,623	10,133	7%	10,779	7%
James	3,082,905	311,438	10%	379,297	12%
Kanawha	338,549	17,809	5%	18,914	6%
Lower Chesapeake	1,613,922	205,300	13%	247,613	15%
Mid Atlantic Coastal	78,751	19,314	25%	21,601	27%
Potomac	4,003,410	157,618	4%	171,576	4%
Roanoke	1,076,285	55,088	5%	57,833	5%
Upper Pee Dee	7,080	599	8%	624	9%
Upper Tennessee	200,430	11,010	5%	11,620	6%
Total	**11.20 M**	**0.88 M**	**8%**	**1.02 M**	**9%**

[1] Total population and exposure based on baseline population
[2] Bolded rows show top three HUC6s by percent exposure

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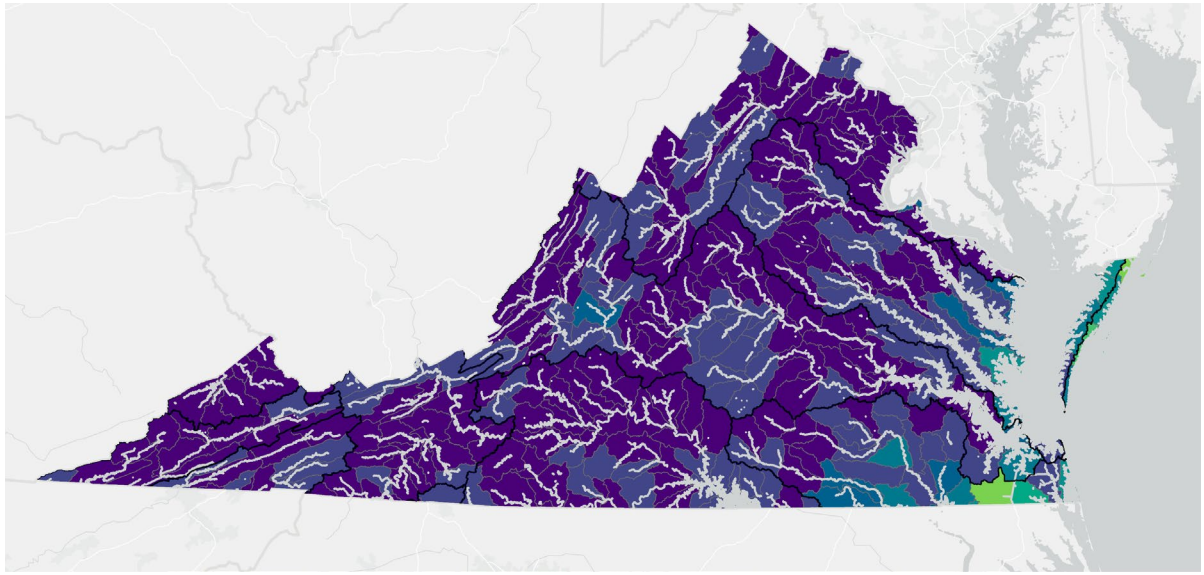
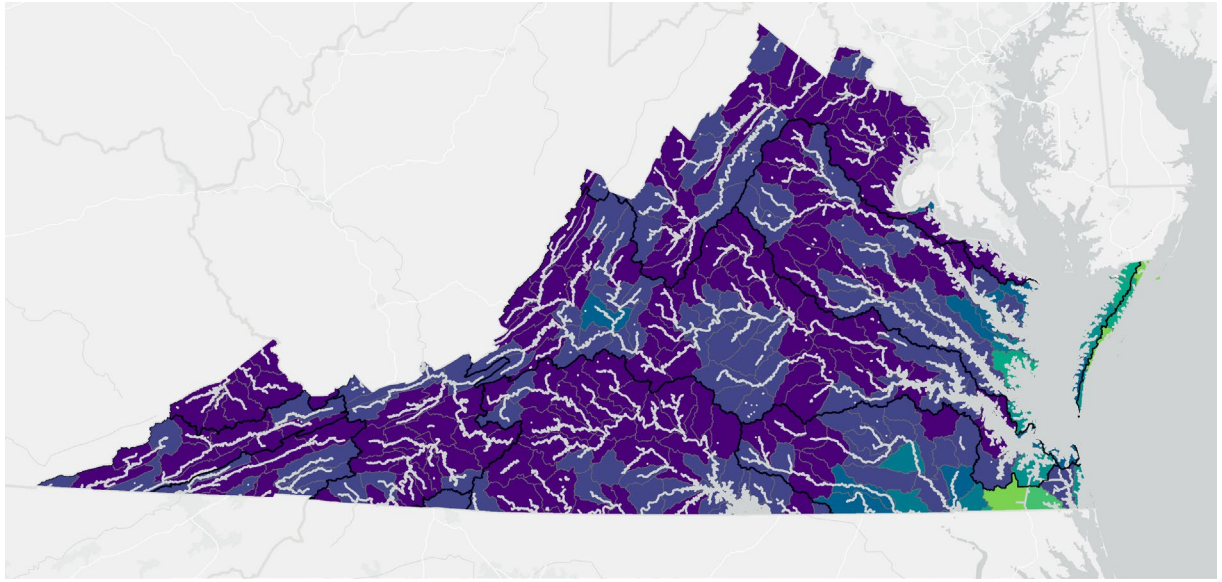
HUC-6 Proportion of Flood-Exposed Population (1% AEP) - Baseline



HUC-6 Proportion of Flood-Exposed Population (1% AEP) - 2060

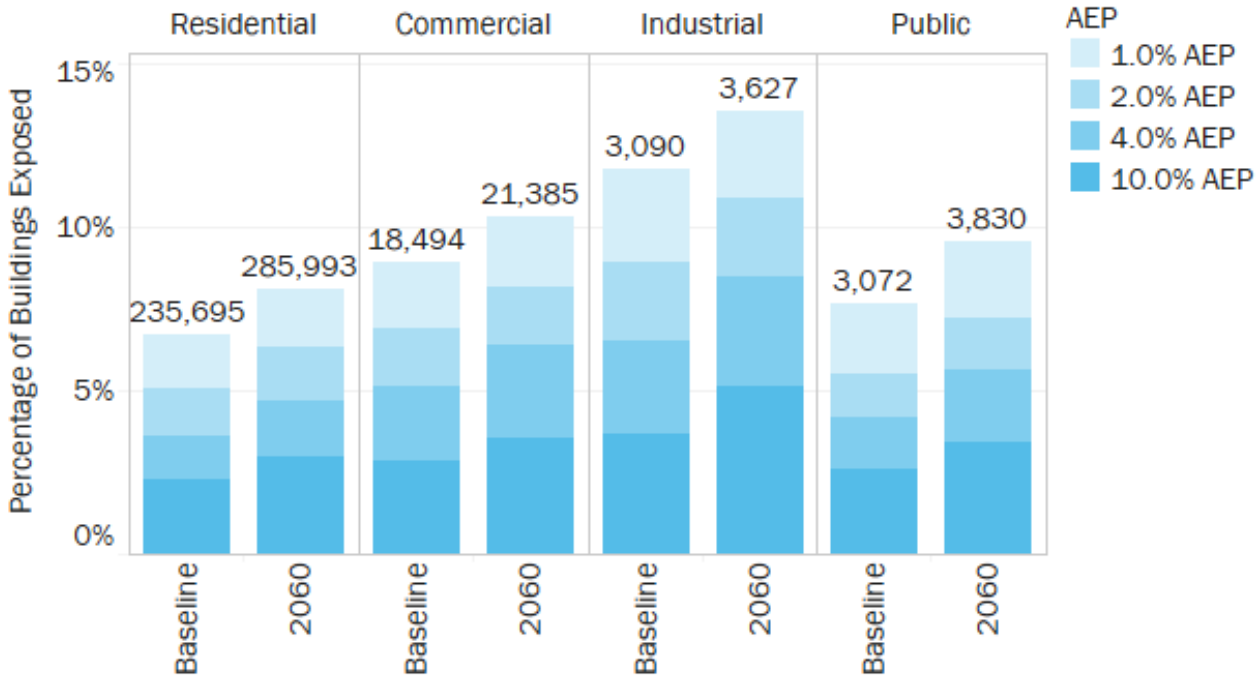


Building Exposure by Reporting Category

The results show that the Baseline merged multisource flooding exposes over 260,000 buildings to flooding in the 1% AEP event. By 2060, the impacts of flooding from the 1% AEP event potentially impact over 314,000 buildings.

The reporting categories with the top percent of buildings exposed include:

1. Industrial
2. Commercial
3. Public



260,351 buildings exposed in Baseline Scenario (1% AEP)
314,835 buildings exposed in Future Scenario (1% AEP)

119,334 buildings exposed in FEMA Baseline Scenario (1% AEP)

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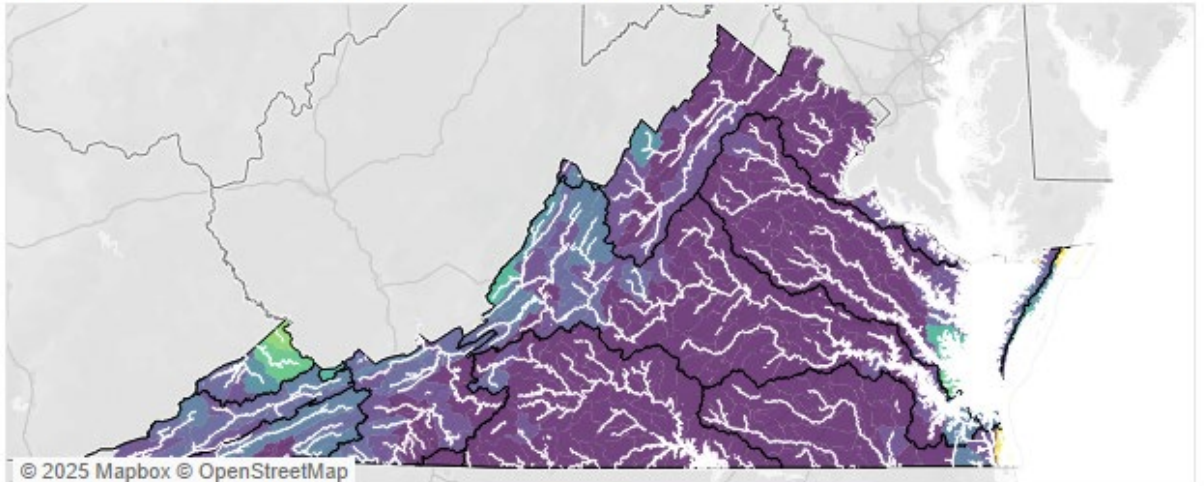
Building Exposure (1.0% AEP)

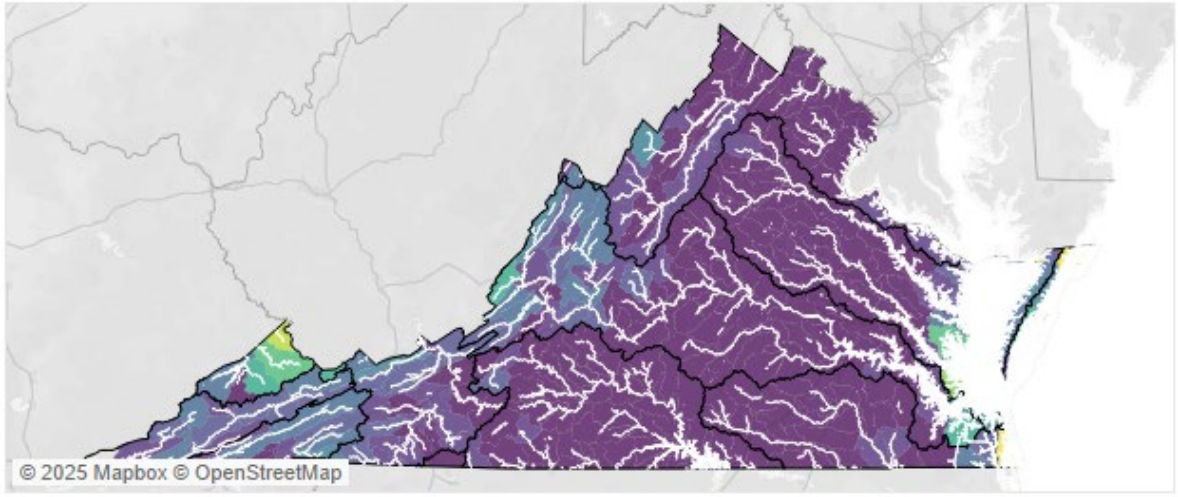
HUC6	Total Buildings[1]	Baseline (2020)[1]		Future (2060)[1]	
		Exposed Buildings	Percent of Total Buildings Exposed	Exposed Buildings	Percent of Total Buildings Exposed
Albemarle-Chowan	205,980	21,101	10%	24,846	12%
Big Sandy	24,463	7,663	31%	7,898	32%
French Broad-Holston	89,651	10,971	12%	11,626	13%
James	1,147,505	75,517	7%	98,973	9%
Kanawha	163,023	11,806	7%	12,638	8%
Lower Chesapeake	611,936	65,127	11%	84,344	14%
Mid Atlantic Coastal	29,491	13,549	46%	14,972	51%
Potomac	970,867	28,883	3%	32,265	3%
Roanoke	472,844	13,477	3%	14,291	3%
Upper Pee Dee	8,073	219	3%	230	3%
Upper Tennessee	76,027	11,478	15%	12,143	16%
Total	**3,804,425**	**260,351**	**7%**	**314,835**	**8%**

[1]Total Buildings and exposure counts are based on baseline building inventory
[2] Bolded rows show top three HUC6s by percent exposure

HUC-6 Proportion of Flood-Exposed Buildings (1.0% AEP) - Baseline



HUC-6 Proportion of Flood-Exposed Buildings (1.0% AEP) - 2060



Pct. of buildings exposed

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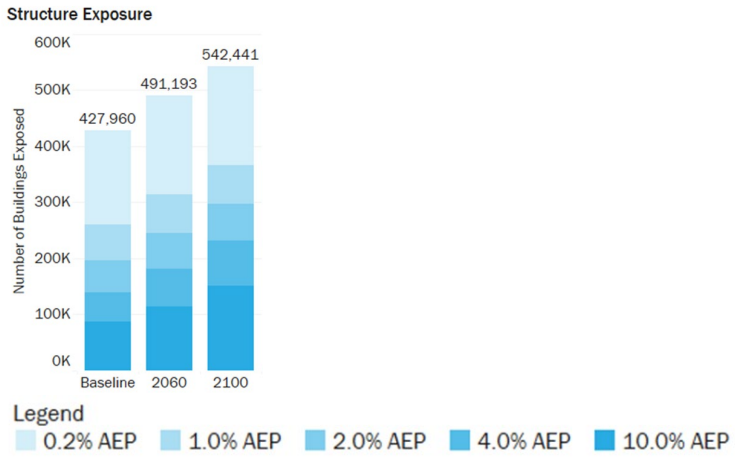
VFPMP Data Viewer Examples

Alternative Views that could be used in the Data Viewer with Statewide Impact Analysis Results

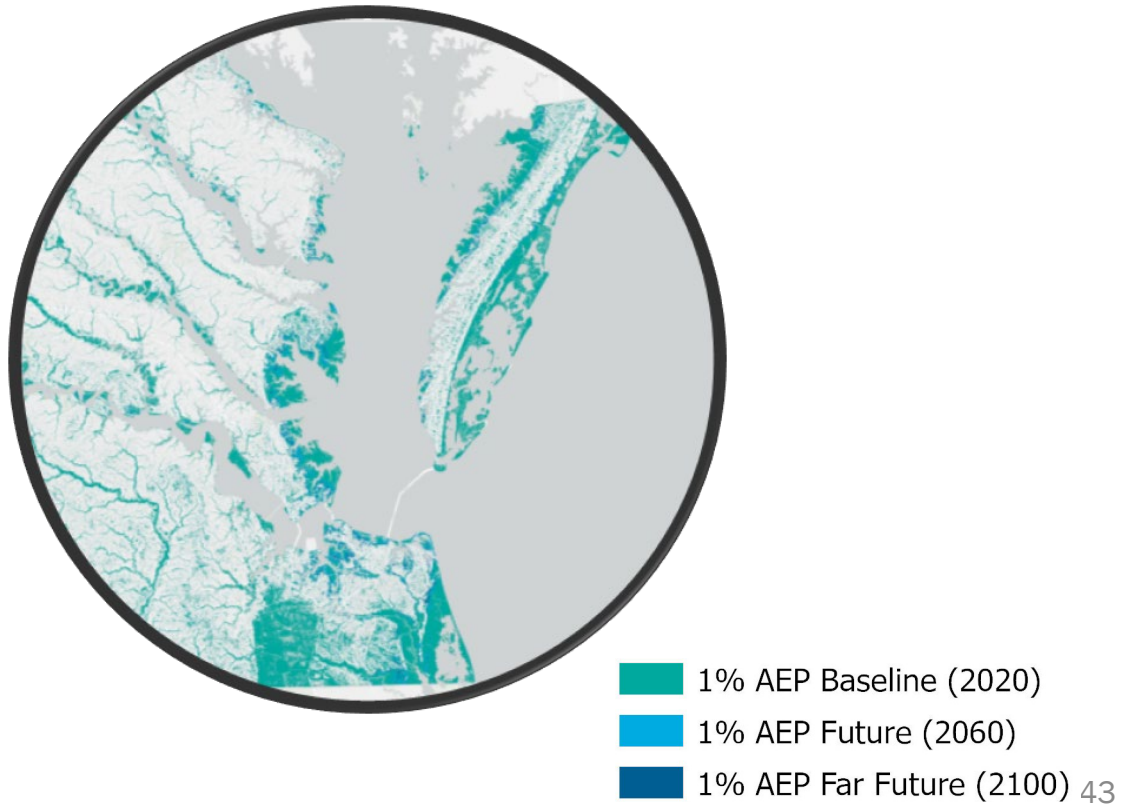
VFPMP Data Viewer

One of the components of the VFPMP will include a Data Viewer or Story Map that will enhance the stakeholders access to the VFPMP and impact analysis results. Alternative visualizations could be used in the Data Viewer including:

- Ability to view economic data at individual county level
- Side-by-side chart viewing of data: Baseline, 2060, and 2100 or Baseline, 2060 50th percentile, and 83rd percentile. (e.g., structure exposure below)



- Ability to zoom in and view flood extents, dominant flood type or flood types present rasters in a specific area (i.e., NFIP, HUC10 etc.).



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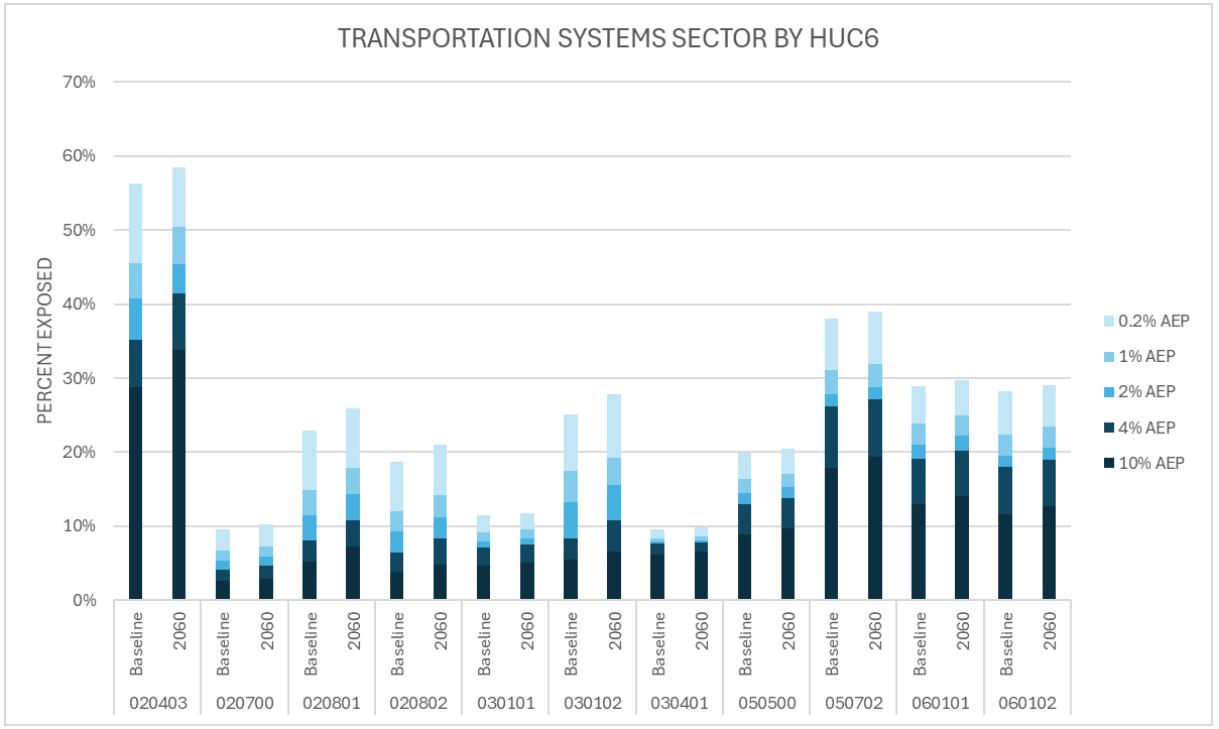
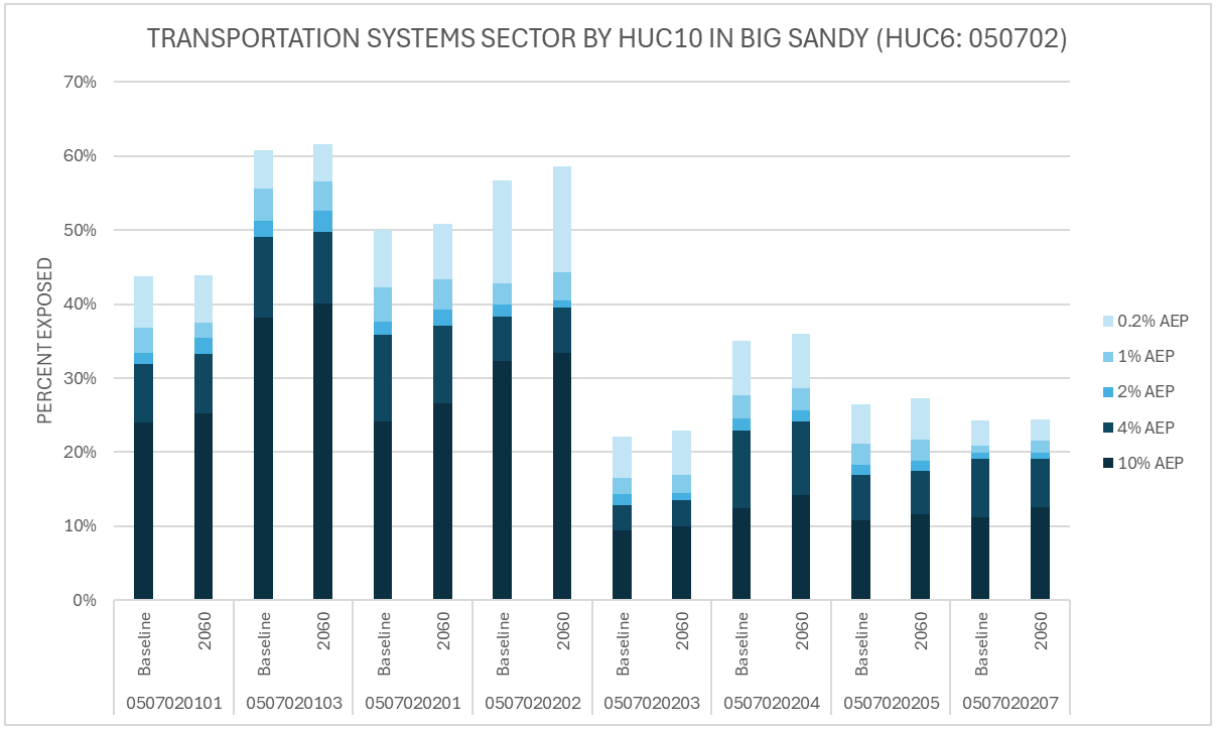
VFPMP Data Viewer

- Ability to view exposure and damage results at a chosen NFIP or HUC10, or aggregation of those units (e.g., County and HUC8).





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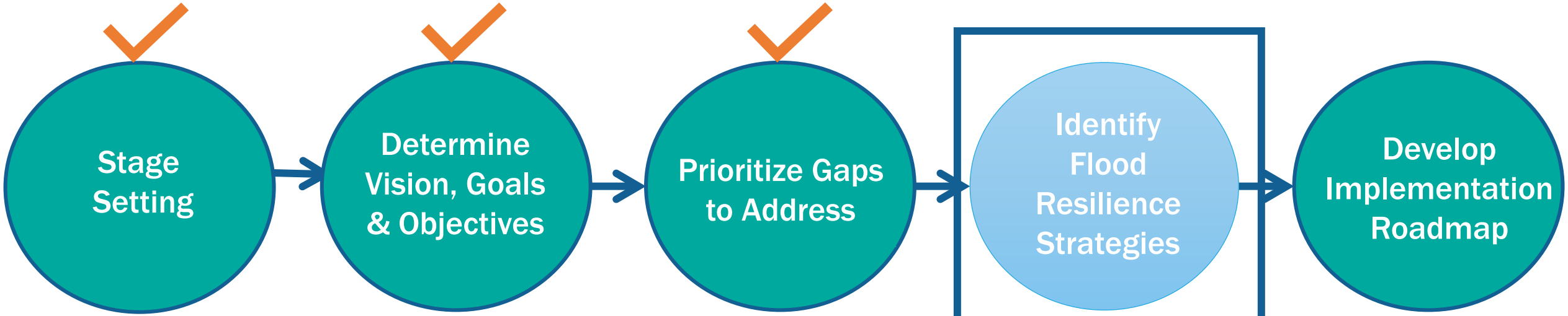
Questions?

Questions to Guide Discussion

- Do these feel like the right strategies for this theme?
- What adjustments need to be made to the strategies?
- What could Virginia do to further advance this strategy?
- Are there any additional strategies you would propose?

KEY POINTS IN COLLABORATIVELY DEVELOPING THE VFPMP



Identify past and current flood resilience successes and challenges to inform the develop of initial VFPMP goals.

Define clear desired outcomes to guide the Virginia Flood Protection Master Plan.

Identify and prioritize data, resource, and capacity gaps in statewide management of flood risk.

Identify statewide actions that can be taken within the next five years to address gaps and strengthen Virginia's flood resilience.

Outline mechanisms, timelines, responsible parties, required resources, and success metrics to guide implementation.

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Large Group Discussion

- Which of these strategies do you see as the most challenging to implement? Why?
- Who else needs to be a part of implementing these strategies?
- What would make it easier for your agency to implement these strategies?
- Which of these strategies are most currently aligned with your agencies' work?
    - What are you already doing to advance these strategies?
- Which of these strategies could be undertaken by your agency?
- What questions do you have about implementing actions to support these strategy?

NEXT ENGAGEMENT OPPORTUNITIES

Implementation Roadmap

- In-Person Workshop: June 25th
- Virtual Feedback Session: July 24th

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DCR Virginia Department of Conservation & Recreation | ARCADIS

VIRGINIA FLOOD PROTECTION MASTER PLAN

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