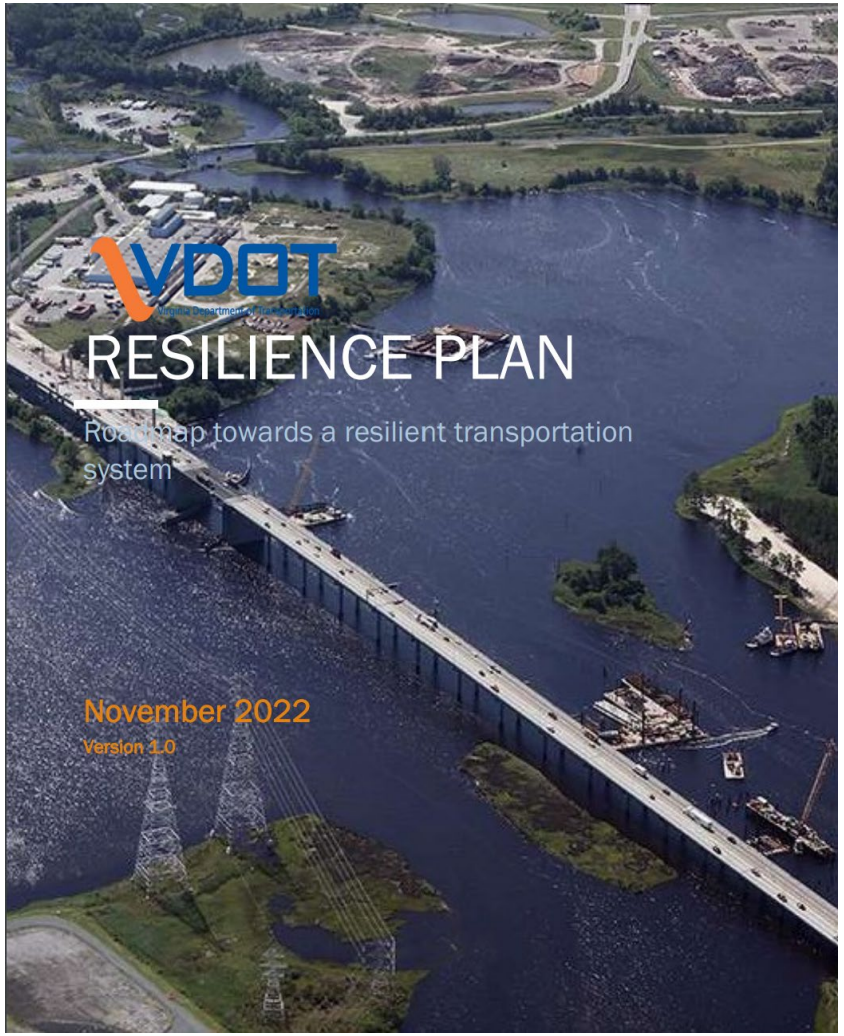
VIRGINIA DOT
RESILIENCE PLAN UPDATE

Transportation Resilience

Resilience is the capability of a transportation project or strategy to anticipate, prepare for, respond to, or recover from significant multi hazard threats with minimum damage and disruption to the transportation network, while preserving and incorporating natural and built infrastructure that helps to mitigate these threats.

Incorporate resilience into existing business practices



Resilience Plan Objectives & Strategies

1. Data Driven Decisions	• Authoritative Datasets • Data and Research Gaps
2. Stakeholder Engagement	• Coordination with Federal, State, MPO, Local Initiatives
3. Identify At-Risk Infrastructure	• Visualization Tool (Asset and Network Vulnerability and Risk Assessment) • Inform focus areas, projects
4. Resilience Measures	• Adaptive Design Criteria (Hydraulics, Materials, Structure and Bridge) • Natural and Nature-Based Solutions • Operational, Maintenance, and Emergency Management Measures • Administrative and Policy Measures
5. Feasibility and Cost Effectiveness Analyses	• Develop Benefit Cost Analysis Tools
6. Funding Opportunities	• PROTECT funding • Other Funding Opportunities

Strategy 1: Data and Research Plan

Promote Data Driven Decisions

- Data and Research Plan to:
  - Identify existing and forthcoming datasets;
  - Evaluate the scope and limitations of existing datasets;
  - Designate authoritative datasets;
  - Identify data gaps and needs

Status Updates:

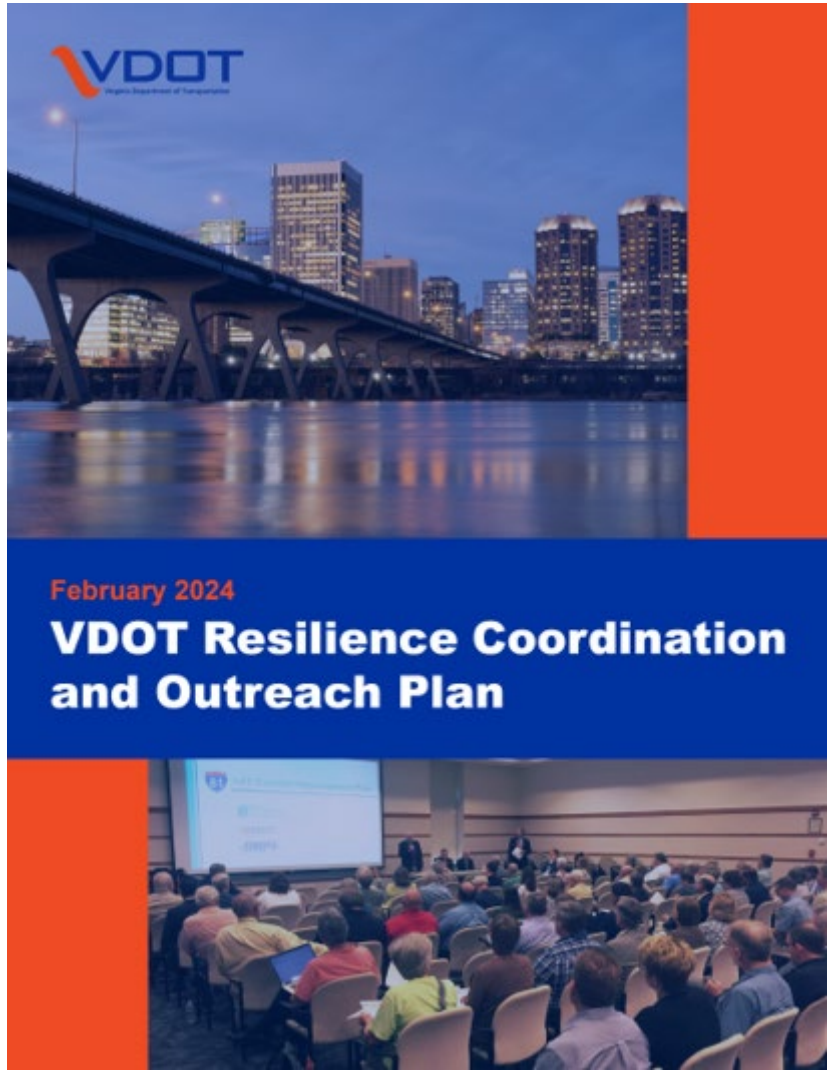
- 16 research projects underway
- Research focuses on hydraulics, materials, and geotechnical impacts, historical flooding, traffic operations, etc.
- Data & Research Plan undergoing reviews

Strategy 2: Coordination and Outreach Plan

- Stakeholder engagement
- Coordination with statewide policy and other local and regional efforts in the Commonwealth

Status Updates:

- Continued coordination and outreach: internal and external
  - CRMP, HRPDC, NVRC, MWCOG, MRRI, Peer Exchanges and Pooled Fund Studies, Resilient VA – Resilience Academy Series, AASHTO CES Annual Meeting
- Coordination and outreach (C&O) plan – completed (2/2024)



Strategy 3: Identify At-Risk Infrastructure

Develop a methodology for determining asset vulnerability

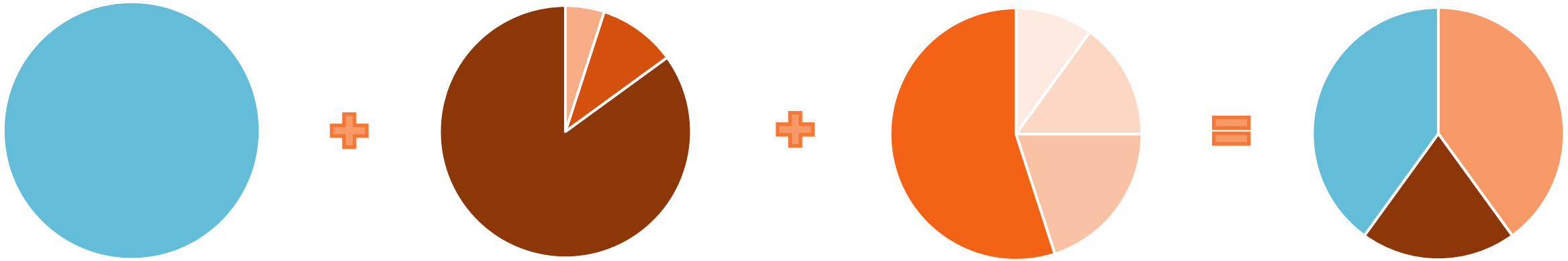
- A risk-based methodology that considers exposure, sensitivity, and criticality would provide a measure of overall vulnerability and a systematic, documented approach for the application of resilience strategies to VDOT assets

Status Update:

- Working towards final At-Risk Infrastructure Visualization Tool in 2024

Methodology

For a given hazard (flooding/landslide), a vulnerability score is calculated based on three components:



Exposure

Whether an asset is located in an area that has or will experience direct effects of climate variability and extreme weather events. Exposure is a prerequisite for vulnerability.

Sensitivity

How an asset responds to, or is affected by, exposure to a climate change stressor. A highly sensitive asset will experience a large degree of impact if the climate varies even a small amount.

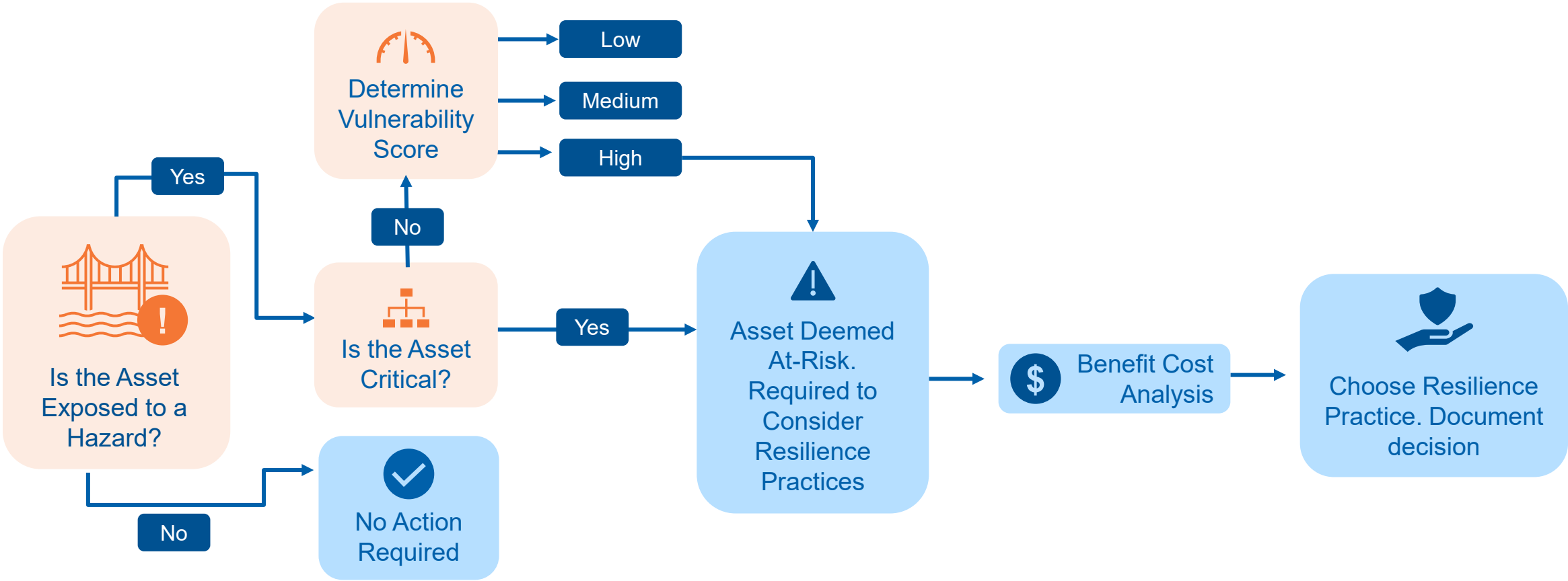
Adaptive Capacity/Criticality

The ability of a transportation asset or system to adjust, repair, or flexibly respond to damage caused by climate variability or extreme weather.

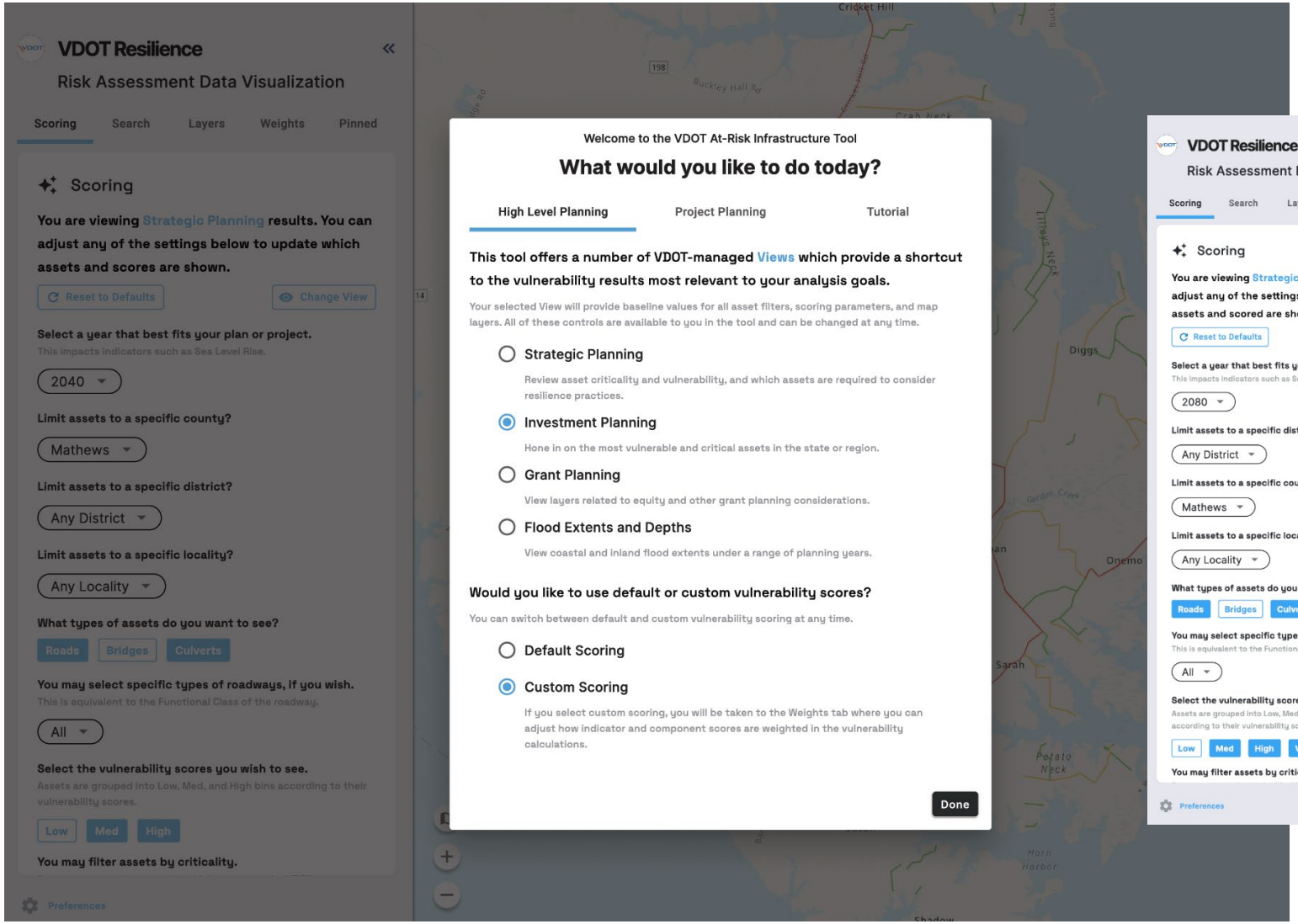
Vulnerability

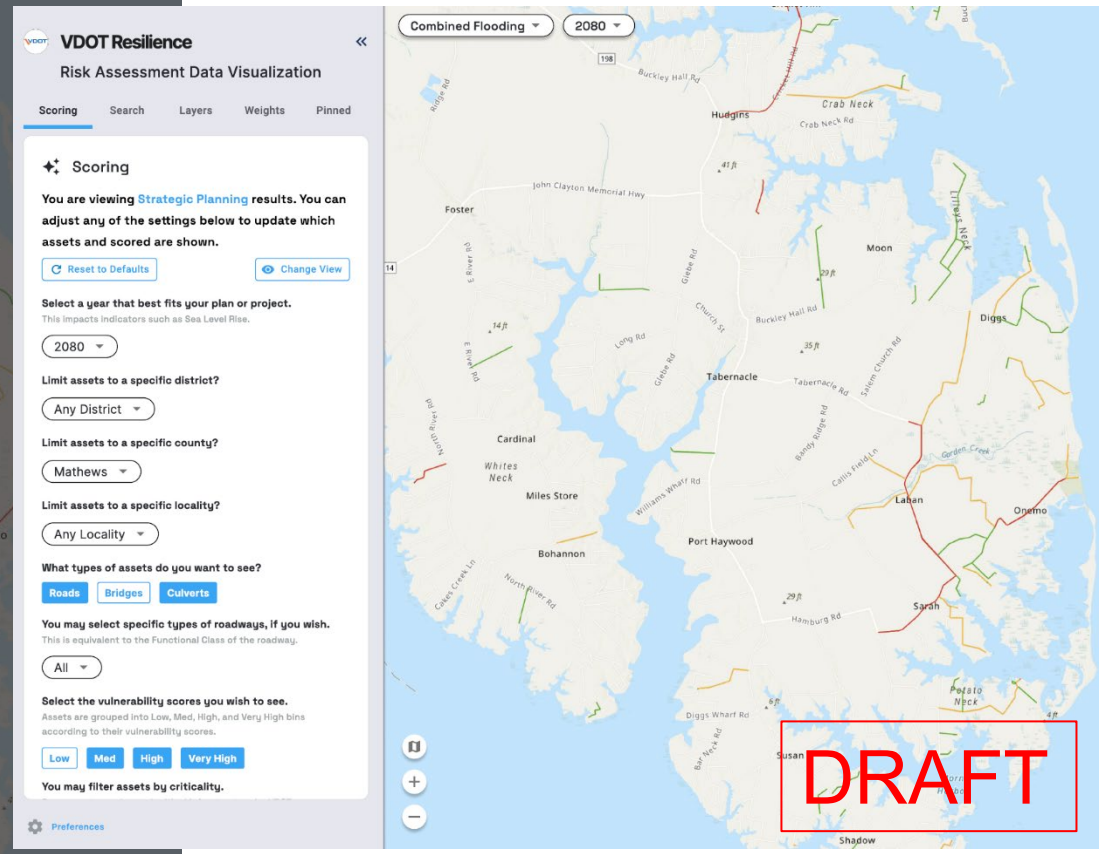
The degree to which a system is susceptible to, or unable to cope with adverse effects of climate change or extreme weather events.

At-Risk Infrastructure Visualization and Decision Support Tool

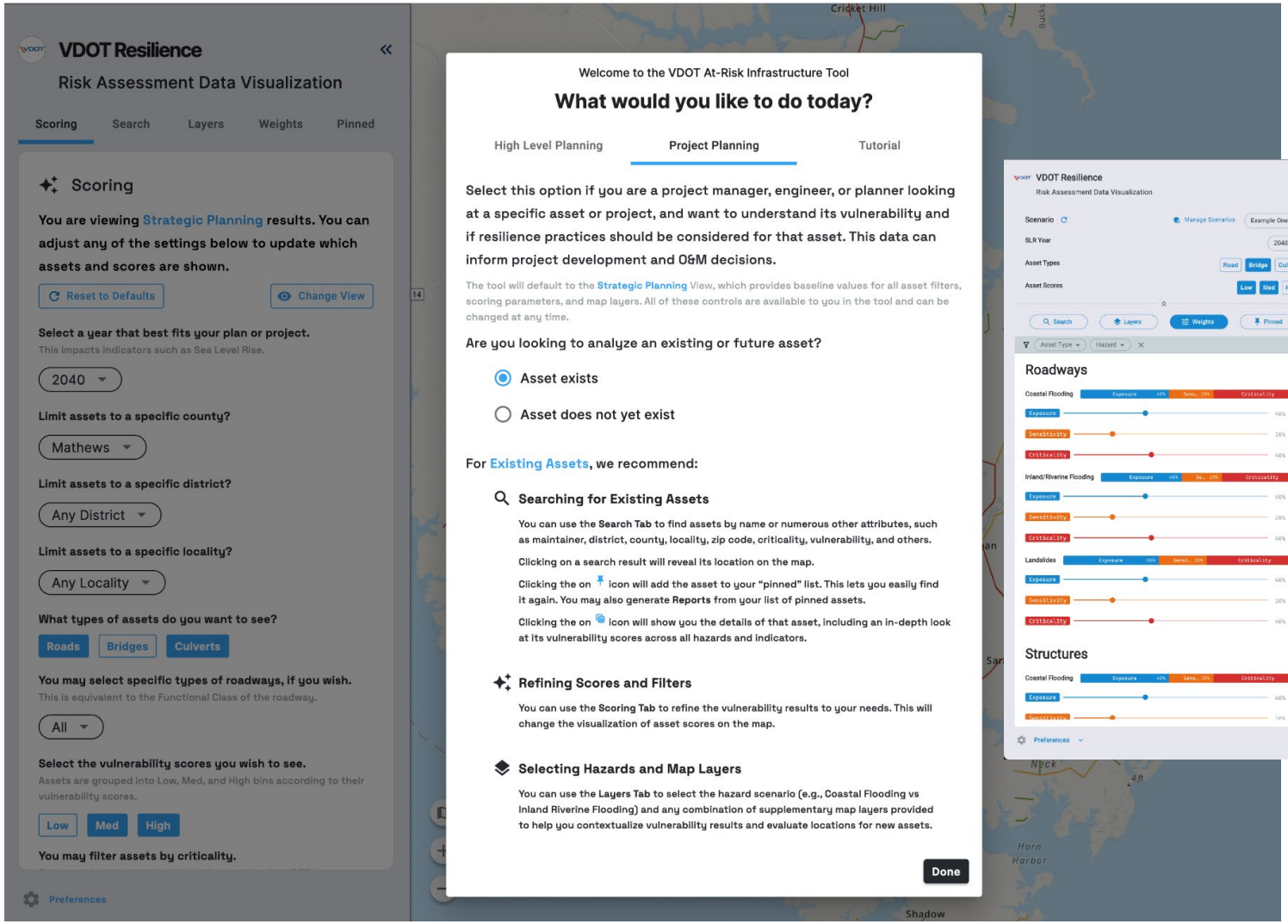


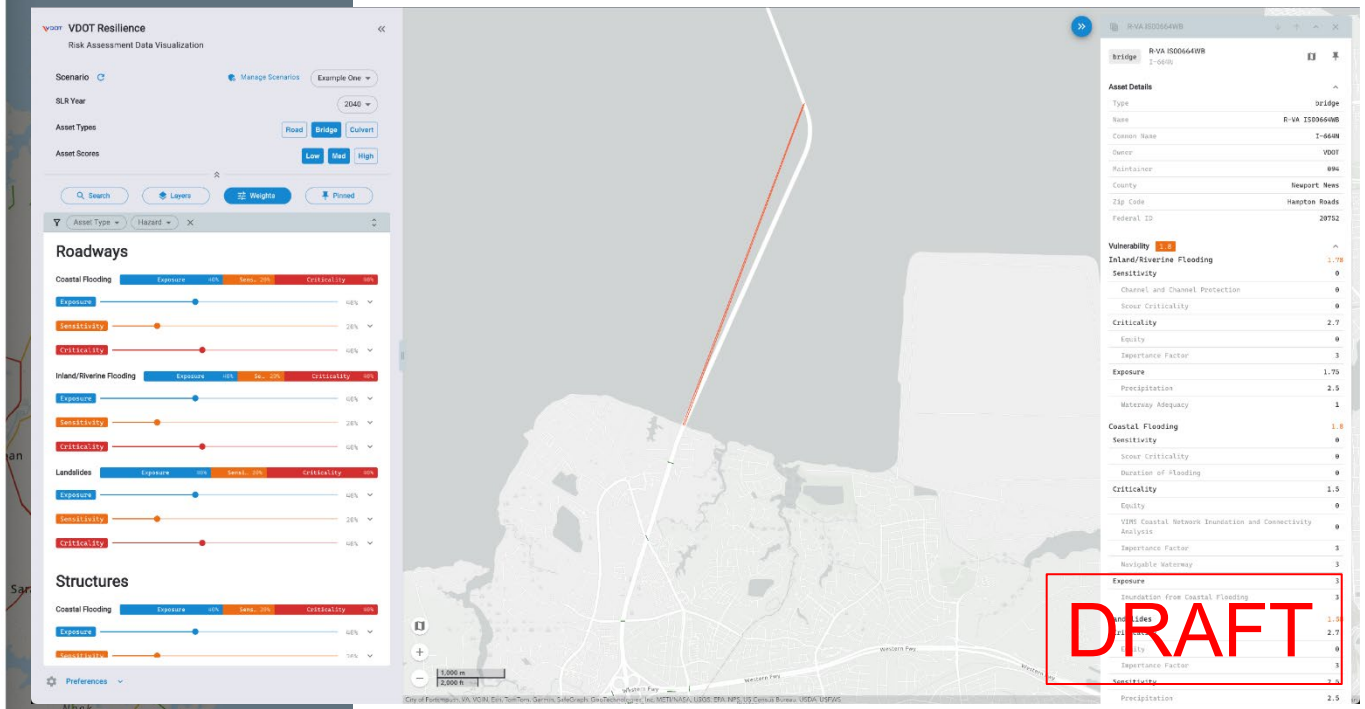
High-Level Planning





Project Planning





Strategy 4: Resilience Practices - Tools in the Toolbox

Resilience Practices Being Evaluated Include:

- Adaptive Design Criteria
  - Structure & Bridge Manual Chapter 33
  - Draft VDOT Drainage Manual Chapter 18
  - Draft Pavement Section 609, and Draft Geotech Section 3
- Other Physical Enhancement Practices
  - Small Scale Flood Barriers
  - Flood Attenuation: Breakwater, Groins, Riverine Veins, Flow Redirection Berms
  - Stormwater Improvements: Drainage/Storage Capacity, Alternative Designs, Newer innovations
  - Slope Stabilization: Revetments and Reinforcements

Strategy 4: Resilience Practices - Tools in the Toolbox

- Other Administrative and Policy Practices
  - Resilient Procurement
  - Enhanced Resilience Practices/Betterments
    - Resilience Certifications
    - Stormwater, Groundwater, and Green Infrastructure
    - Cool Pavements
- Operational, Maintenance, and Emergency Management
  - Enhanced Maintenance Practices in Advance of Weather Events
  - Maintenance Activities for Identified At-Risk Infrastructure
  - Early Warning Device Technology
  - Equipment Design Considerations for ITS and Traffic Operations
  - Power redundancy for ITS and Traffic Operations Equipment
  - Network Redundancy Review
  - Identify Mitigation Opportunities

Strategy 4c: Natural and Nature Based Solutions

Structural solution

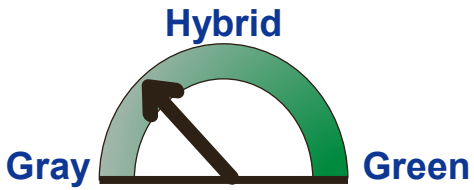
Traditional Seawalls: concrete and riprap

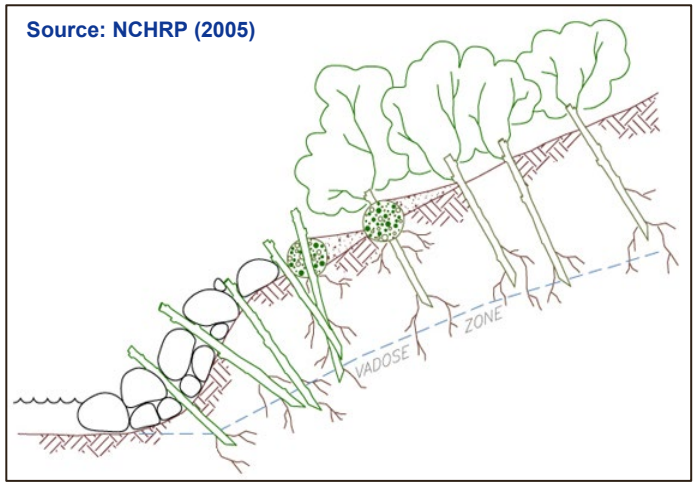
Constructed marsh, including fill and planting.
Can include breakwaters/sills to reduce wave energy

Nature-based solution

Strategy 4c: Natural and Nature Based Solutions

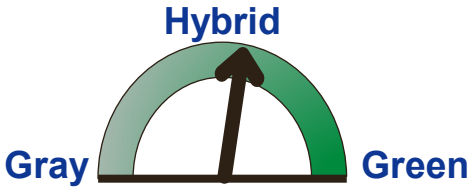
Conceptual Design Alternatives with corresponding benefit cost analysis

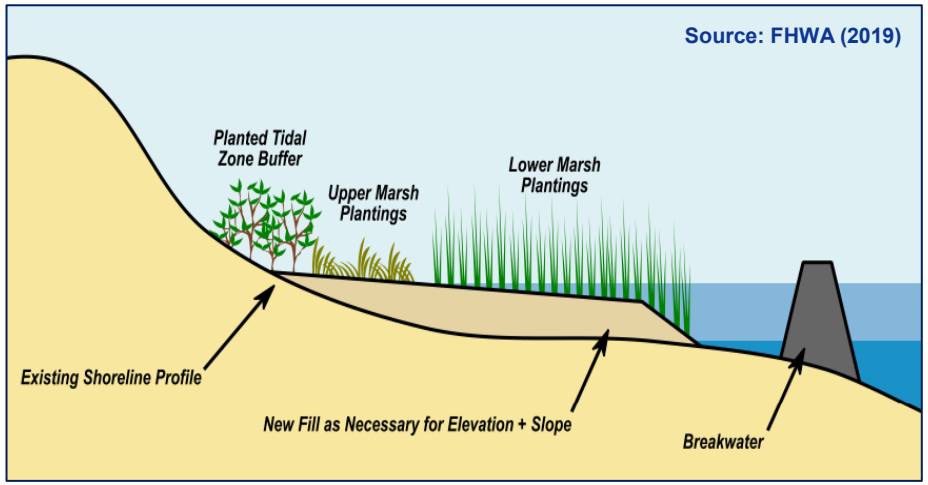




Vegetated Revetment

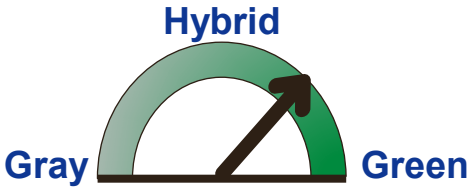
- Simple materials
- Simple construction
- Low ecological benefits
- Low upfront costs

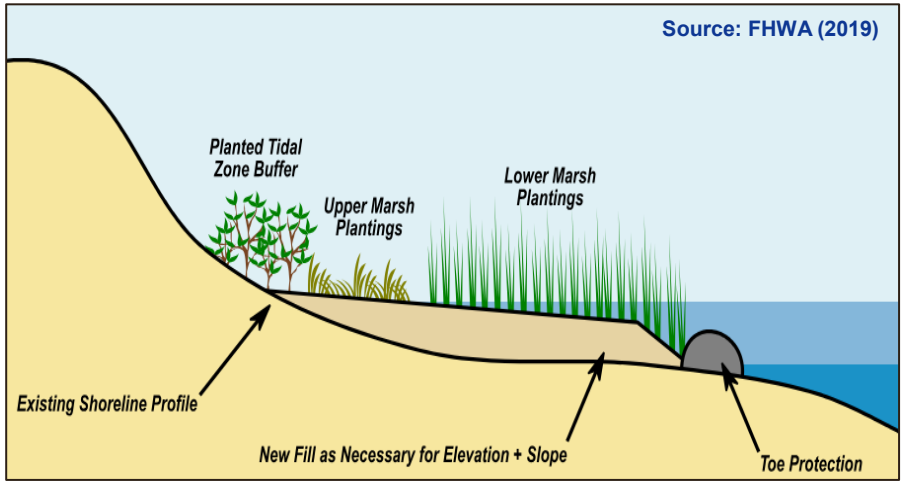




Marsh + Breakwater

- Reduces wave height
- Generates pocket beaches
- Moderate ecological benefits
- Moderate upfront costs





Marsh + Sill

- Attenuates wave energy
- Stabilizes marsh platform
- High ecological benefits
- High upfront costs

Strategy 5: Feasibility and Cost Effectiveness Methodology

- Benefit-Cost Analysis Tool under development

Baseline	Hours of Closure per event		36
Resilient	Hours of Closure per event		24
Δ	Hours of Closure Reduced per year		24
	Miles of Detour		2
Δ	Detour Miles Saved per year		48
	Detour MPH		45
Δ	Detour Hours Saved per year		1.1
	AADT		500
Trucks:	Truck %		20%
	Travel Time Savings per hour	$	33.50
	Vehicle Operating Cost Savings per mile	$	1.32
	Emissions Savings per mile	$	0.336
	Total Truck Benefit per year	**$**	**11,522.13**
Cars:	Car %		80%
	Travel Time Savings per hour	$	19.60
	Vehicle Operating Cost Savings per mile	$	0.52
	Emissions Savings per mile	$	0.119
	Total Car Benefit per year	**$**	**20,631.47**
	Others? All summing to...		
D	**Annual Traffic Benefit**	**$**	**32,153.60**

Strategy 6: Resilience Needs Incorporation into Investment Processes

- Incorporate resilience needs in current investment processes and programs
- Identify opportunities to incorporate resilience into the Department's various funding programs
- Identify new funding opportunities available for resilience projects and initiatives
  - The Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT)

PROTECT Program

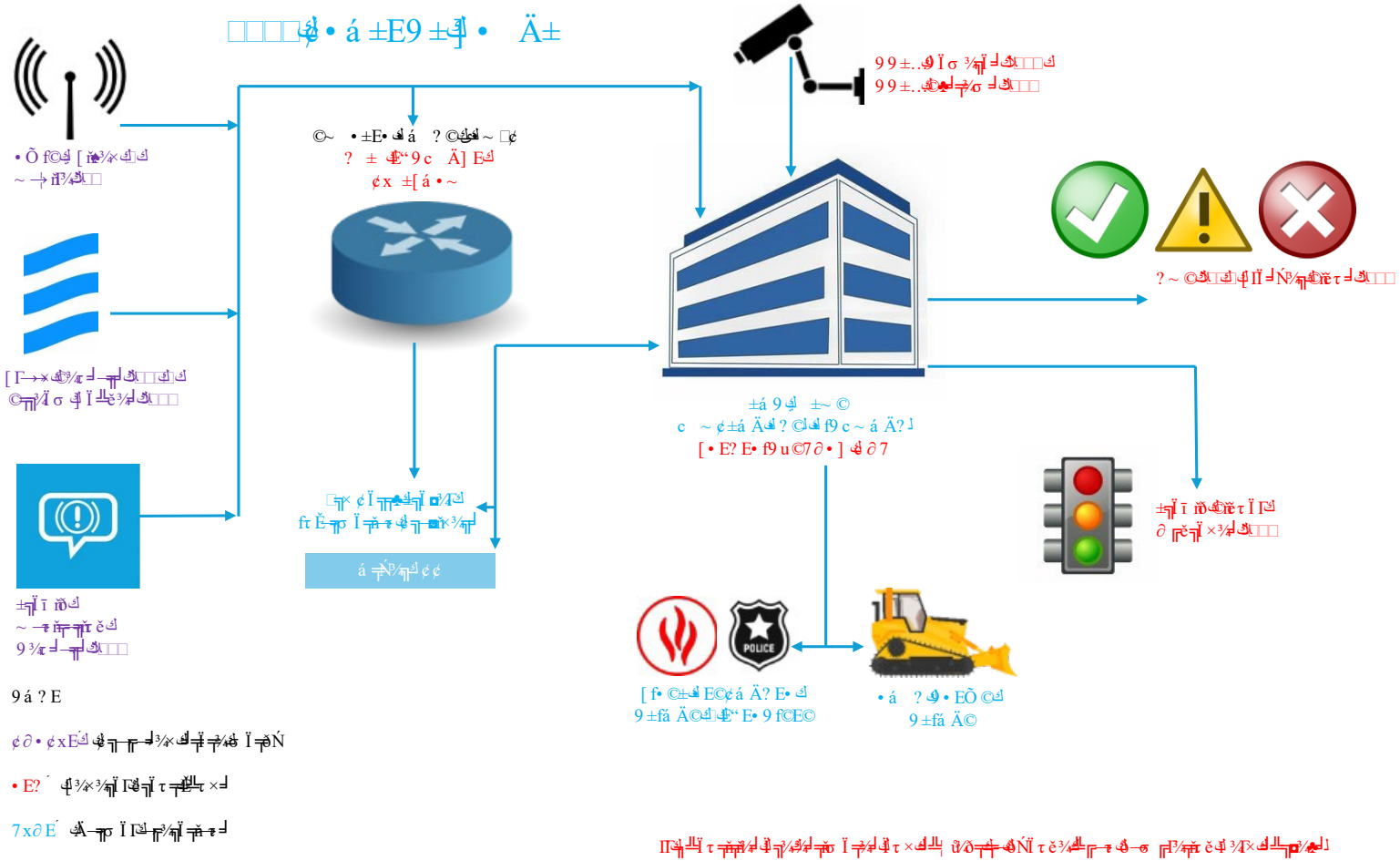
- Formula Funding and Discretionary Grants
  - Coastal Planning Activities, including Resilience Improvement Plan (RIP)
  - Resilience Improvements
  - Community Resilience
  - At-Risk Infrastructure
- Initial formula funding applied to:
  - Resilience planning, research, and capacity building;
  - Evacuation route planning;
  - Hardening and elevation of vulnerable bridges
- VDOT awarded a discretionary grant in 2024

MOVER Grant Project

$5.4M Award +
$1.3M VDOT Match

Hampton Roads | Fredericksburg | Richmond | Central Office

- Closed-Circuit Television (CCTV) Cameras
- Dynamic Message Signs (DMS)
- Road Weather Information System (RWIS)
- Traffic Signal Upgrades (detection for ATSPM)
- Traffic Monitoring Sensors
- Flood Sensors
- Stream Gauges



Thank you