



U.S. Department of Transportation  
**Federal Highway Administration**

# FHWA Resilience Resources

Resilience Innovations Summit & Exchange  
Oct 9, 2018

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# Why Address Resilience?

- Protect public safety
- Save resources, reduce expenditures
- Risk-based **asset management** plans must address risks associated with current and future environmental conditions (23 CFR 515)
- Assets requiring repeated repair require **analysis of alternatives** (23 CFR 667)
- State and metropolitan **transportation planning** should consider resilience as a planning factor (23 USC 134, 23 CFR 450)

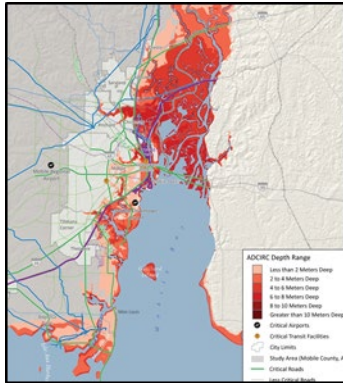


# Resilience Resources

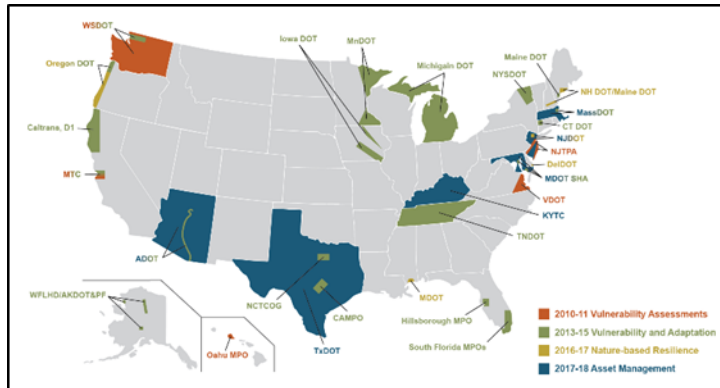
- FHWA
- State DOTs
- MPOs
- University researchers
- State DEQs
- US Geological Survey, USACE, NOAA
- *Climate Science Special Report* (November, 2017, part of the 4<sup>th</sup> National Climate Assessment)

# FHWA Resilience Resources

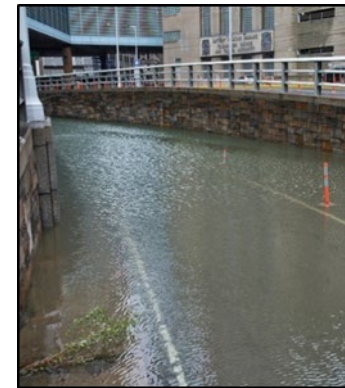
## Gulf Coast 2 Study



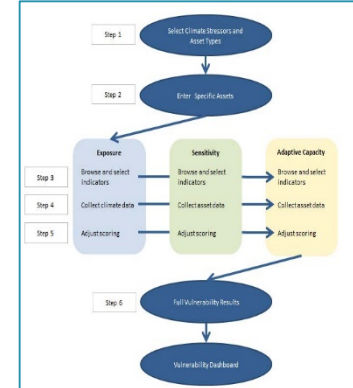
## Resilience Pilots - State DOTs, MPOs, FLMAs



## Hurricane Sandy Project



## Tools

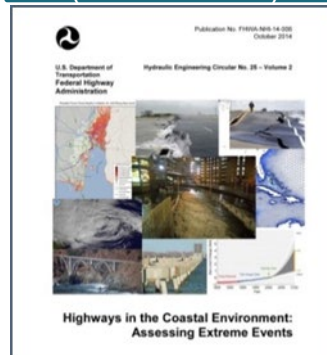


<https://www.fhwa.dot.gov/environment/sustainability/resilience/>

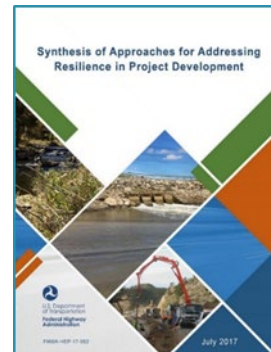
## Vulnerability & Adaptation Framework



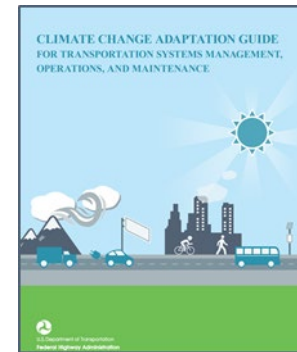
## Engineering Guidance (HEC-25 & 17)



## Project Development



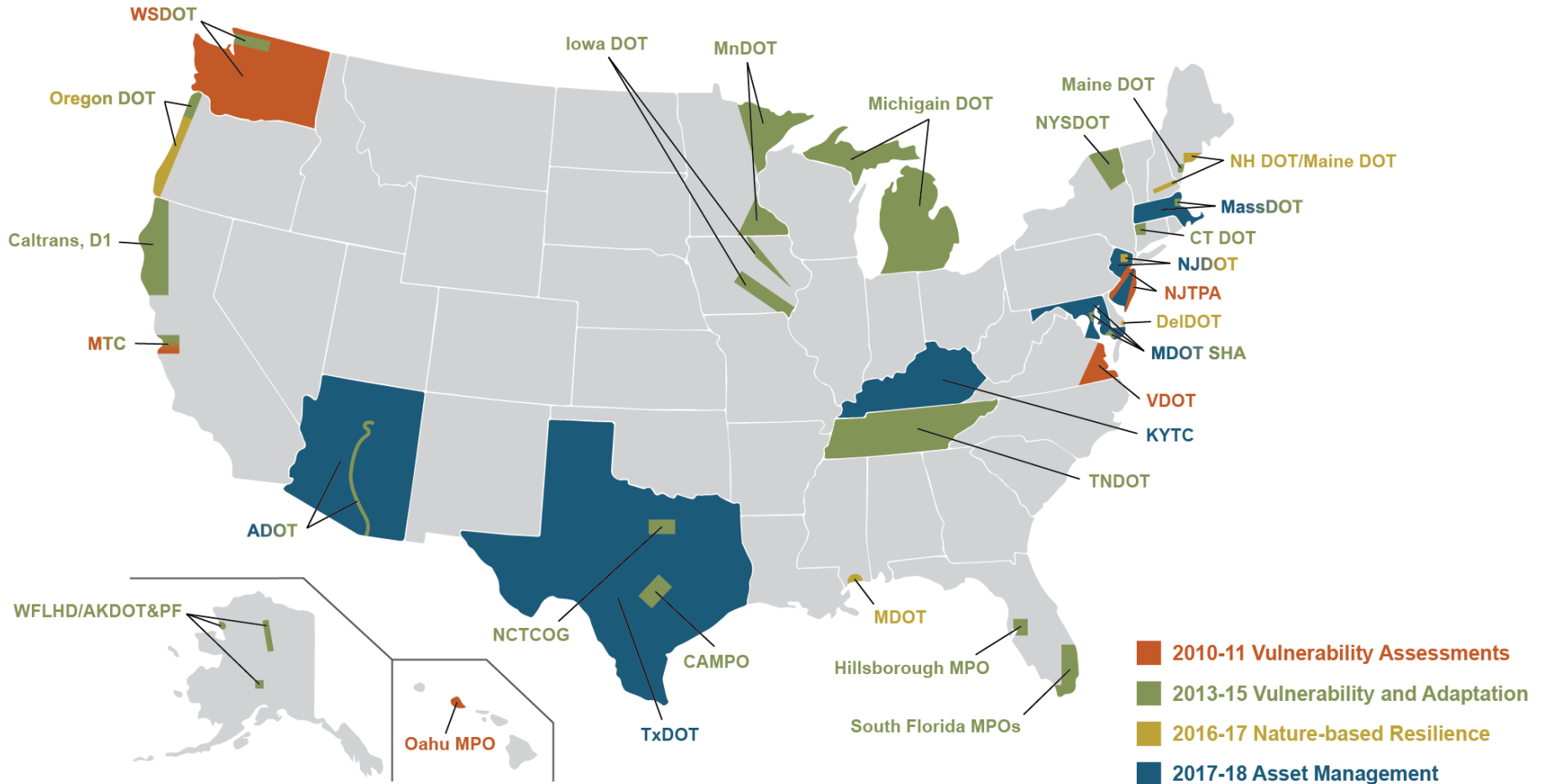
## Operations & Maintenance



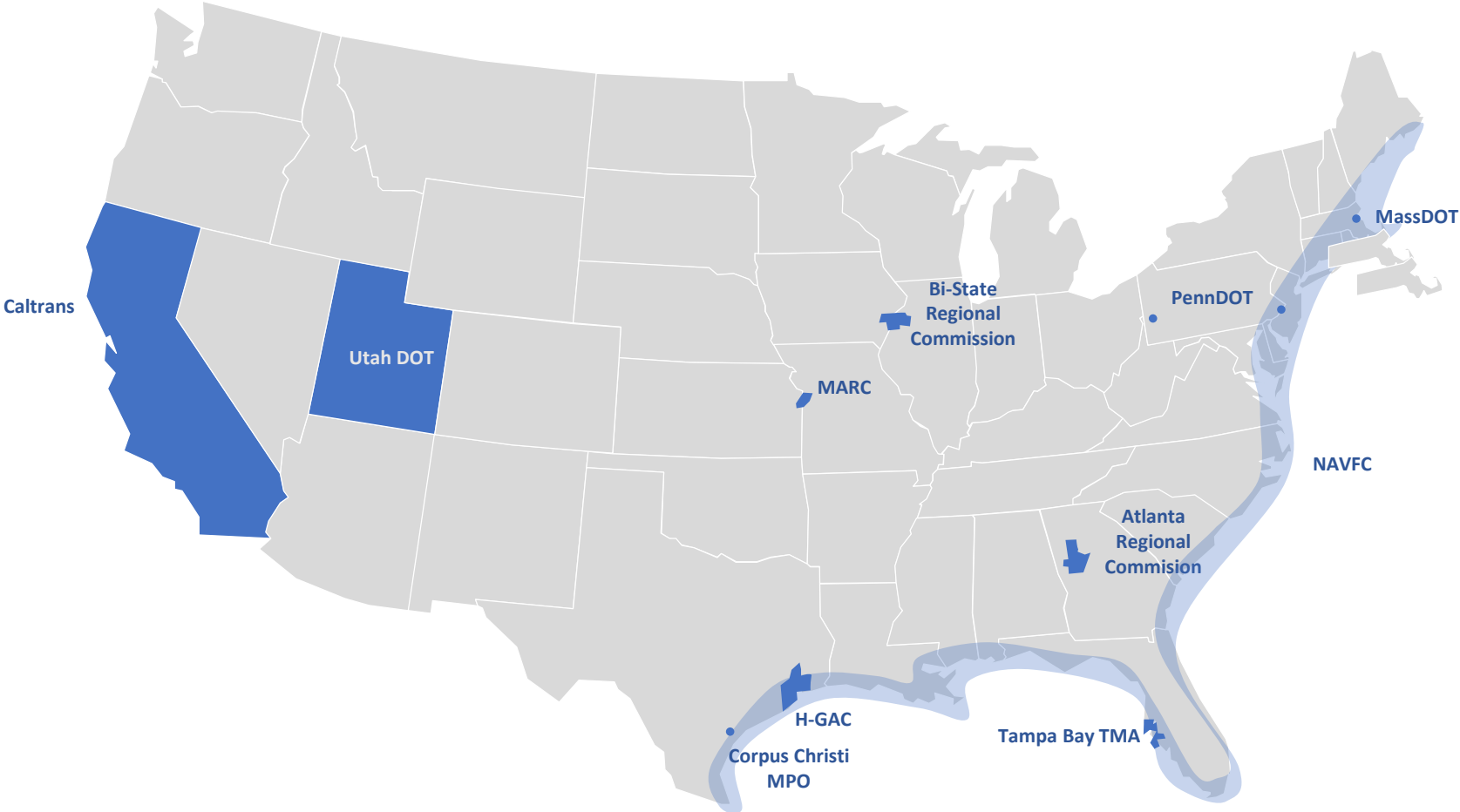
Guidebooks under development on integrating resilience in:

- Asset Management
- Transportation Planning
- Nature-based solutions

# Resilience Pilot Reports



# 2018 – 2020 Pilot program



# FHWA Project: Nature-based Resilience for Coastal Highways

- Goal: Provide research and technical assistance to help state DOTs and MPOs implement nature-based solutions to protect coastal highways from storm surge and sea level rise.
- Build off USACE and NOAA work
- 5 pilot projects completed
  - OR DOT
  - ME & NH DOTs jointly
  - MS DOT
  - DE DOT
  - US Army Corps of Engineers in NJ
- [White paper](#), Winter 2018
- Regional peer exchanges, Spring 2018: AL, CA, DE, NC
- Implementation guide, 2019



Photo Credit: Tina Hodges



Map Credit: Google Earth

# Asset Management & Resilience

## Asset Management and Resilience Pilot Program

- AZ, TX, KY, MD, NJ, MA pilot projects
- Expected late 2018
- Guidebook on addressing resilience in Asset Mgt. (2019)







# What is a “Vulnerability Assessment”?

Goal: Identify, assess resilience concerns, adaptation options

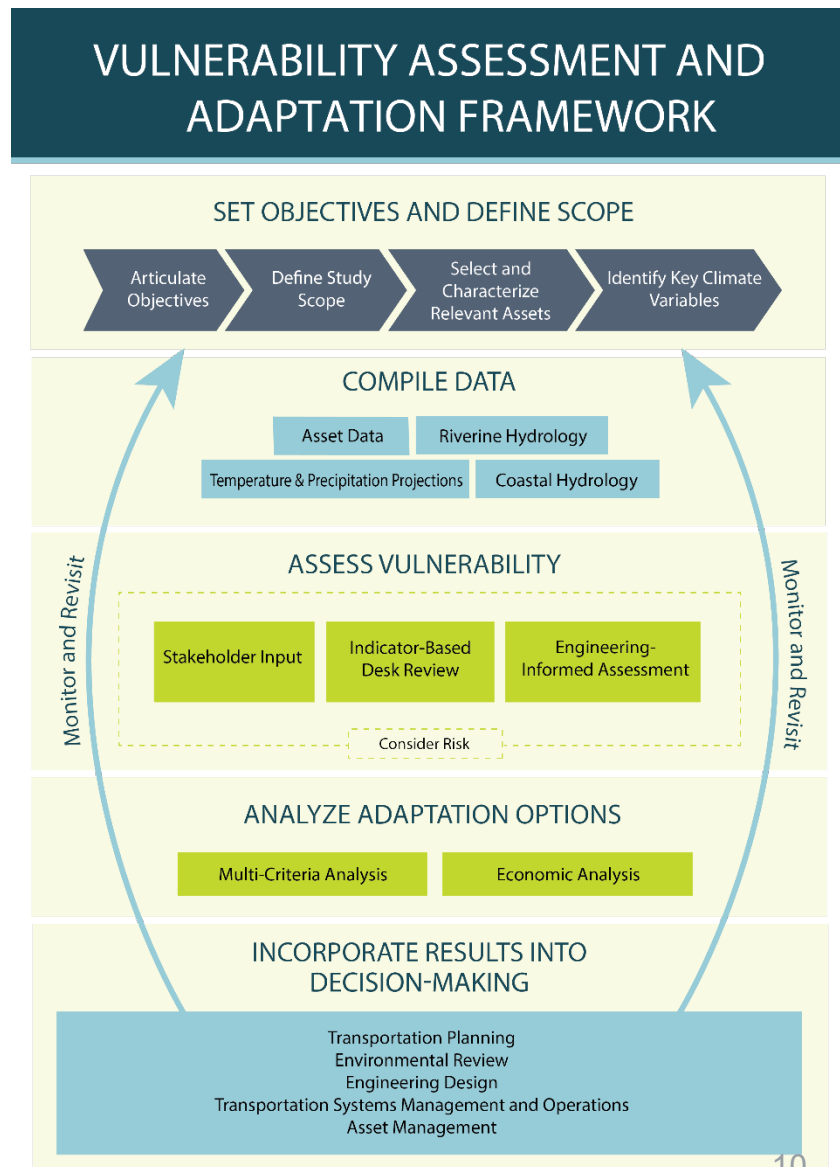
- Where are the highest risk locations?
- How might future changes in precipitation, sea levels, temperatures impact the transportation system? Key facilities?
- Options for improving resilience

## Scale

- System level vulnerability assessment (city or region)
- Project level
  - Framework, Synthesis Report

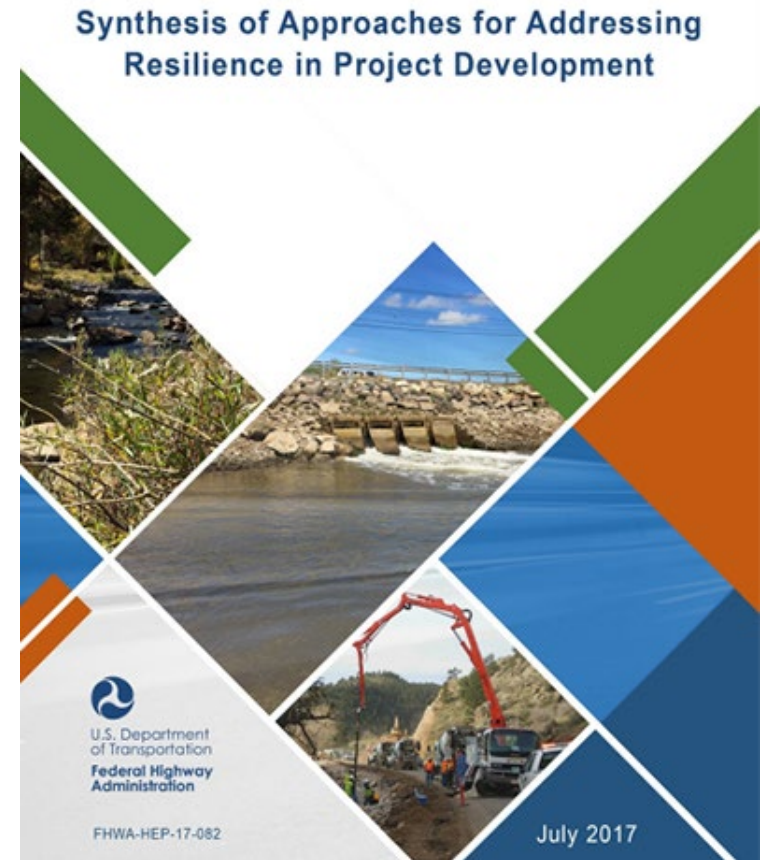
# Vulnerability Assessment and Adaptation Framework, 3<sup>rd</sup> Edition (2018)

- Provides an in-depth and structured **process** for conducting a vulnerability assessment.
- Features **examples** from assessments conducted nationwide.
- Incorporates information from recent FHWA and other U.S. **partner projects**.
- Includes links to **resources and tools**.

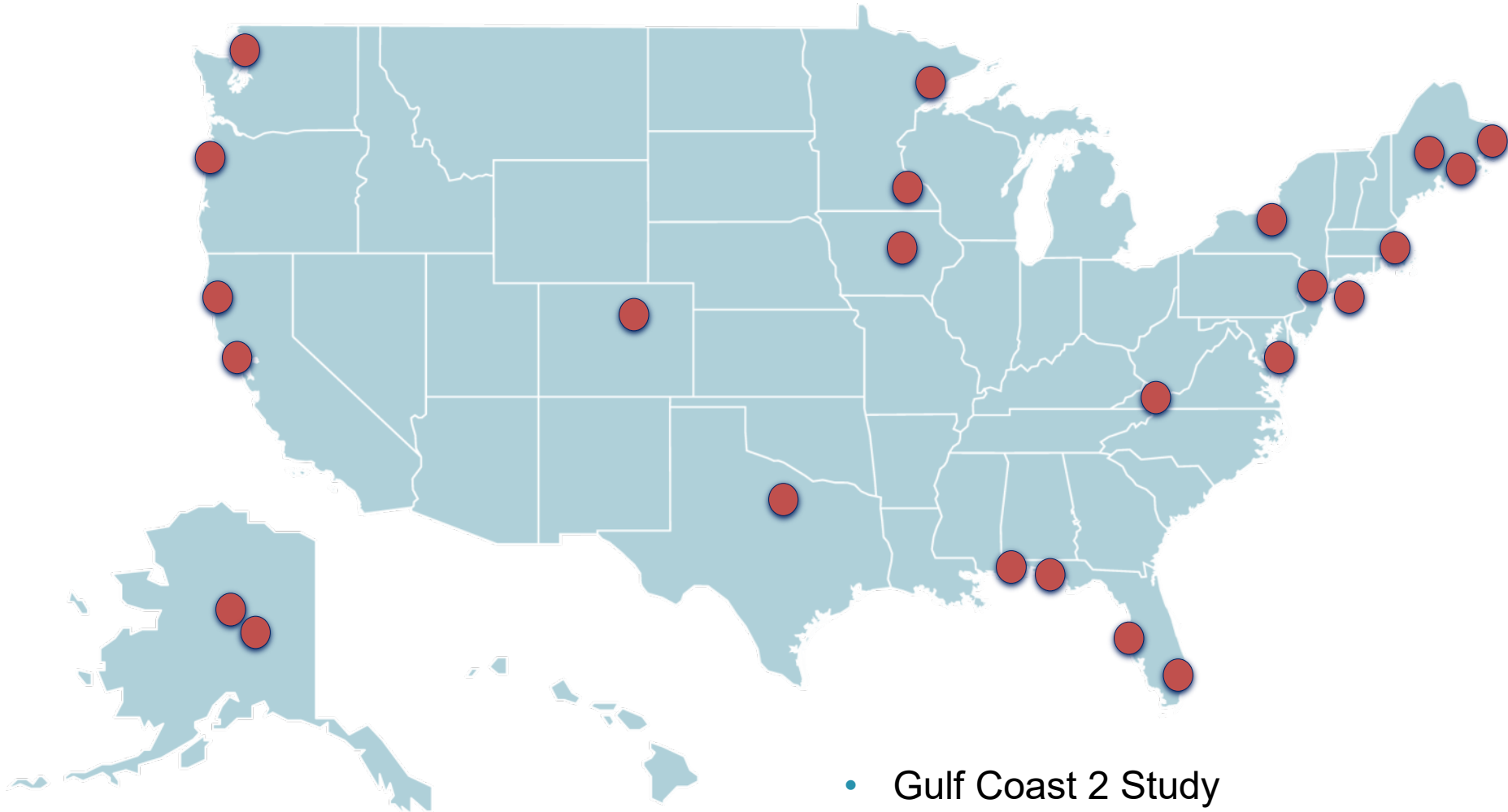


# *Synthesis of Approaches for Addressing Resilience in Project Development (2017)*

- Lessons learned, etc., for four engineering disciplines
  - Coastal Hydraulics
  - Riverine Hydraulics
  - **Pavement and Soils**
  - Mechanical & Electrical Systems
  - Overall Lessons learned for engineering
- Addressing resilience in the project development process
- Economic analysis



# Engineering-Focused Case Studies



- Gulf Coast 2 Study
- Adaptation Pilots
- Post-Sandy Resiliency Study
- TEACR

# Riverine Hydrology

- **Hydraulics Engineering Circular 17**

Highways in the River Environment - Floodplains, Extreme Events, Risk, and Resilience (Second Edition), June 2016

The image shows the front cover of the publication. At the top left is the U.S. Department of Transportation logo. To its right is the text 'Publication No. FHWA-HIF-16-018' and 'June 2016'. Below the logo is the text 'U.S. Department of Transportation Federal Highway Administration'. To the right of this is 'Hydraulic Engineering Circular No. 17, 2<sup>nd</sup> Edition'. The cover features four main visual elements: a photograph of a river in flood, a hydrograph showing discharge over time, a scatter plot of annual peak streamflow from 1949 to 2012, and a photograph of a highway bridge over a river. The title 'Highways in the River Environment - Floodplains, Extreme Events, Risk, and Resilience' is printed at the bottom.

U.S. Department of Transportation  
Federal Highway Administration

Publication No. FHWA-HIF-16-018  
June 2016

Hydraulic Engineering Circular No. 17, 2<sup>nd</sup> Edition

USGS  
USGS 01649500 NORTHEAST BRANCH ANACOSTIA RIVER AT RIVERDALE, MD

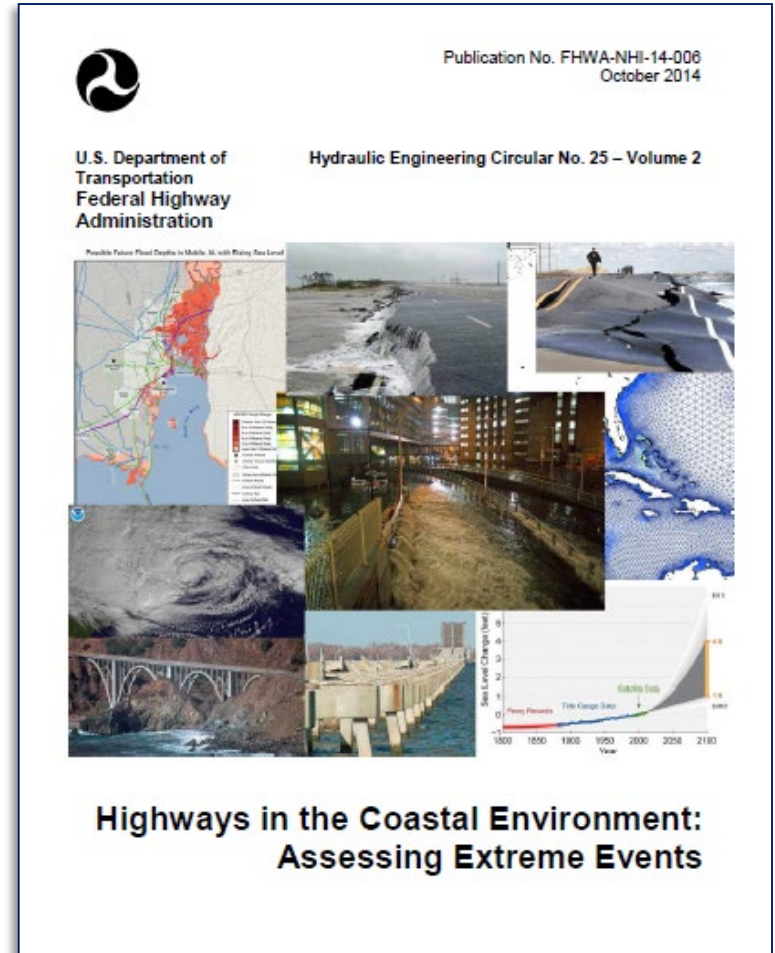
Annual Peak Streamflow, in cubic feet per second

Annual exceedance probability (1/years)

Highways in the River Environment - Floodplains, Extreme Events, Risk, and Resilience

# Coastal Hydrology

- **Hydraulics Engineering Circular 25, Volume 2**  
Highways in the Coastal Environment: Assessing Extreme Events, October 2014.
- Currently being updated





## *Two NCHRP Projects*

### **NCHRP 15-61** (expected completion: 2019)

- Focuses on addressing future conditions in design of roads, bridges, etc.
- Design guide to support hydrologic design for future flood levels.

### **NCHRP 20-101** (undergoing final NAS review)

- Focus: Guidelines for assessing costs and benefits of adaptation measures.

# THANK YOU!

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