Being Ready for Natural Disasters

Future Ready: Preparing Cities, Infrastructure and Companies for a Future World

PA Transportation Engineering/Safety Conference

OLINA

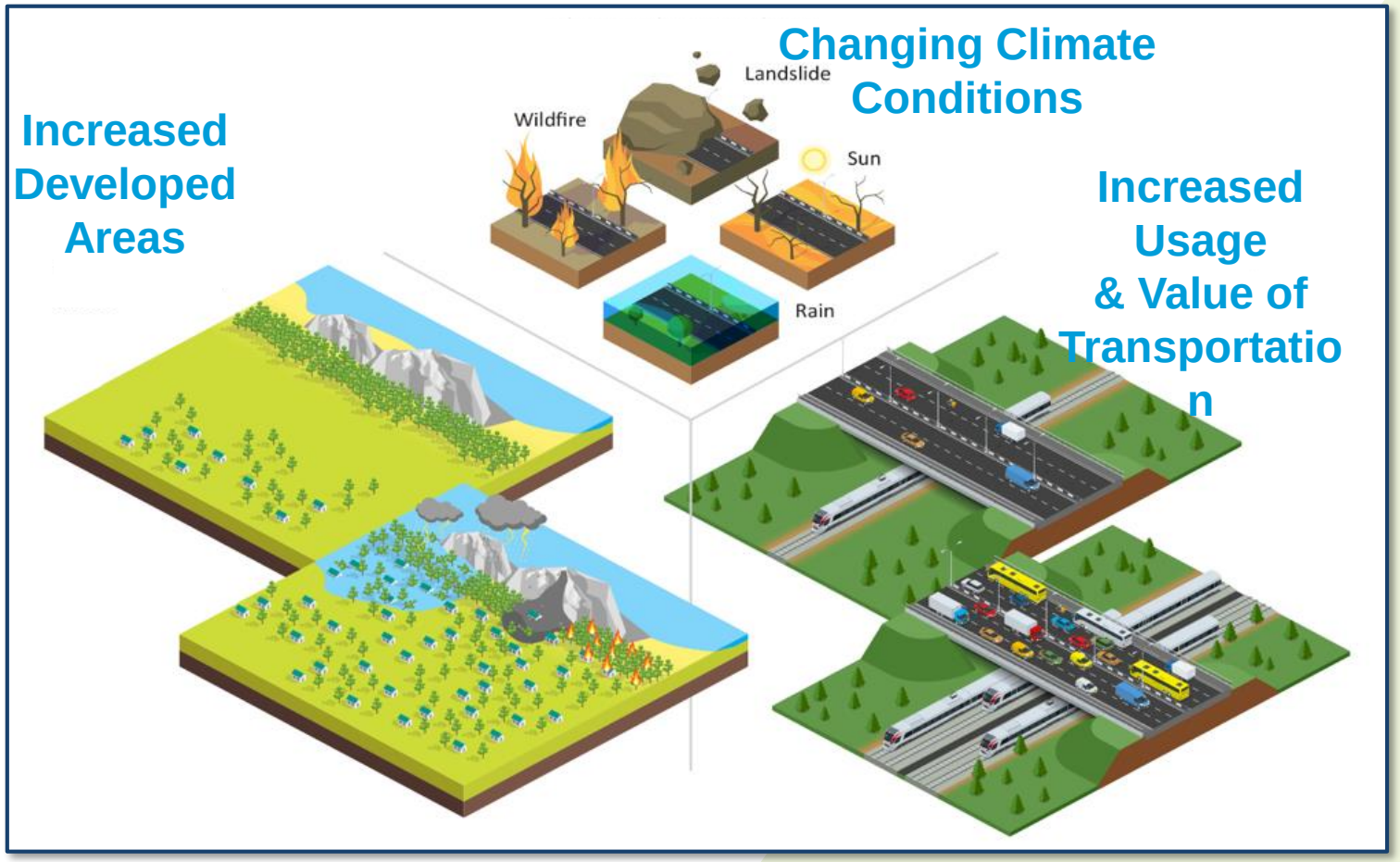
VE

Resilience to Natural Disasters is of interest to every agency as events continue to occur regularly nationwide.

Ready for Extreme Weather / Climate Stressors & Other Risks

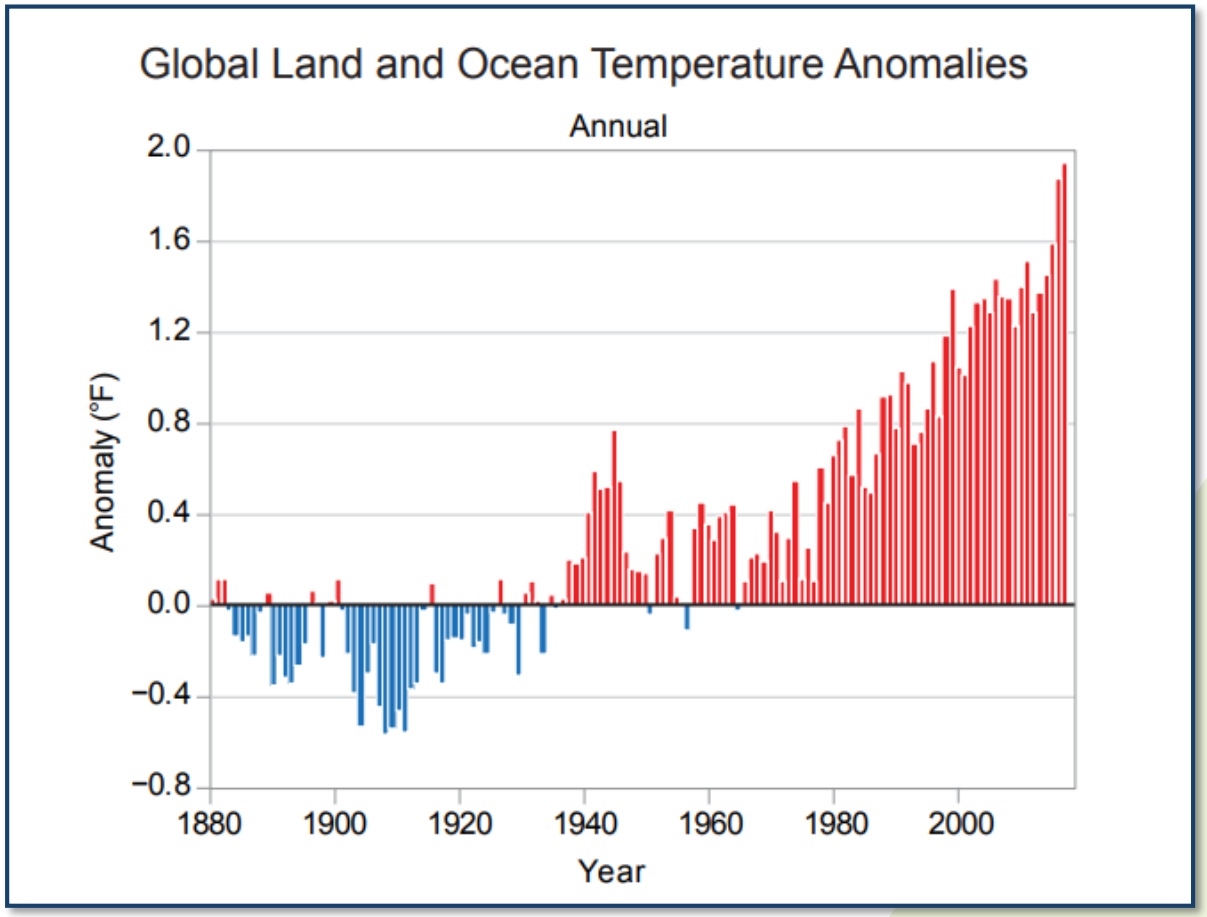
Kierkegaard: "~~Life~~ Engineering can only be understood backwards, but it must be lived forwards."

Ready for Extreme Weather / Climate Stressors & Other Risks

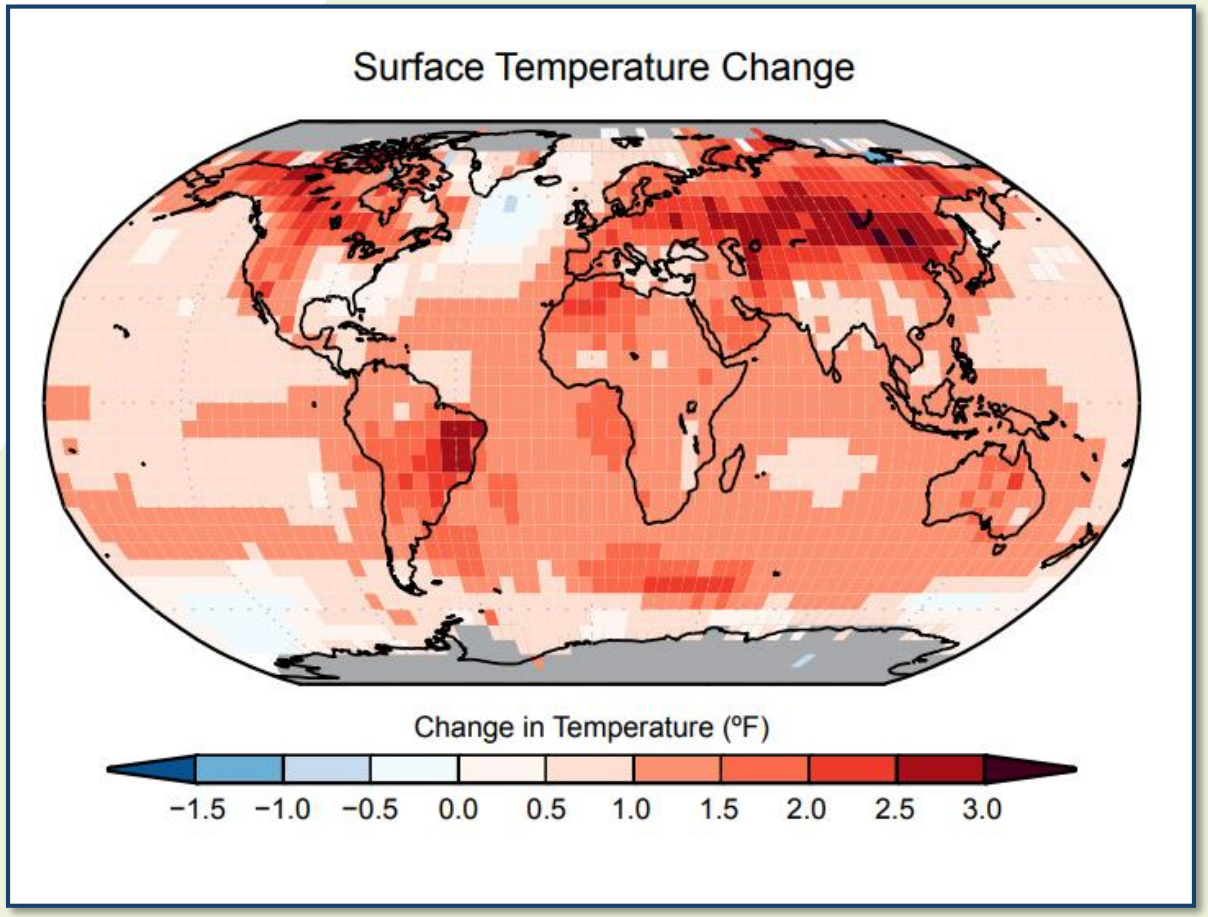


- Extreme Heat
- Precipitation/Flooding
- Wildfire
- SLR/Tsunamis/Storms

TRENDS TO DATE: Observed Temperature



(1901-1960)

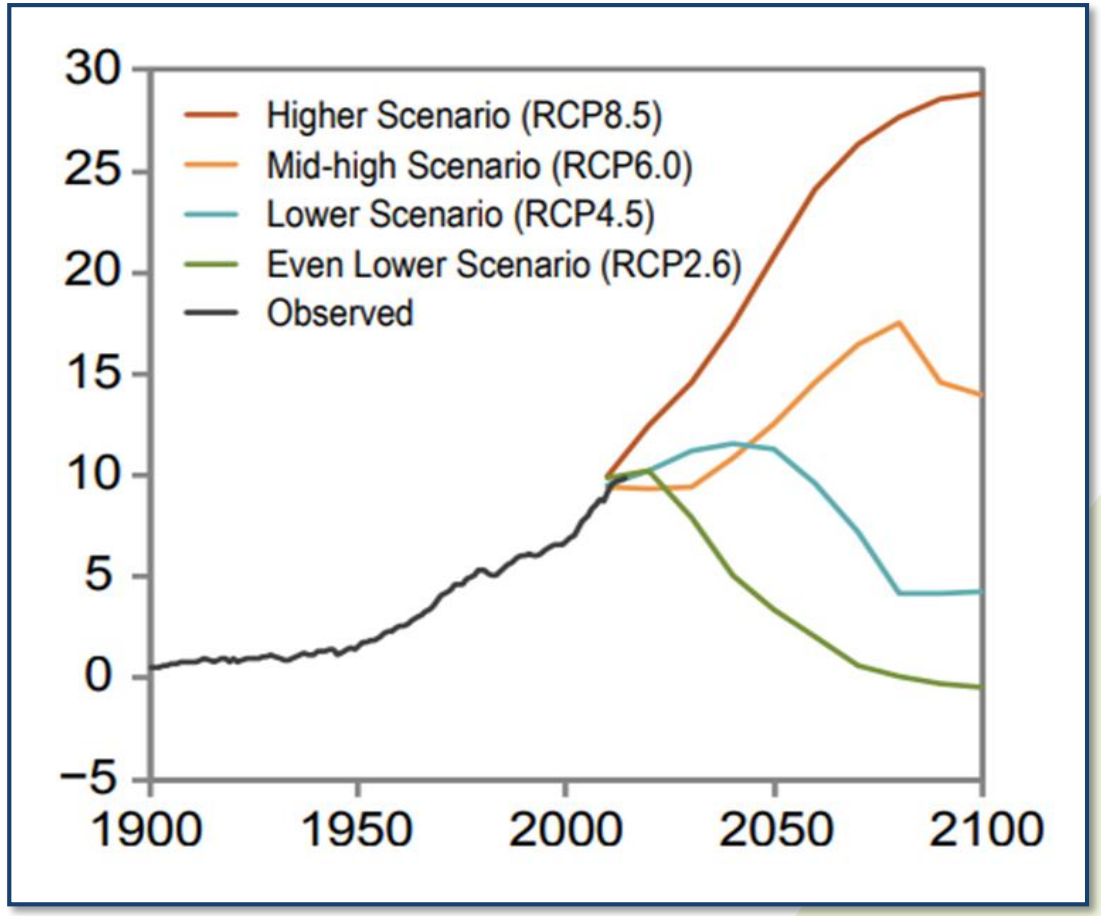


1986–2016 relative to 1901–1960

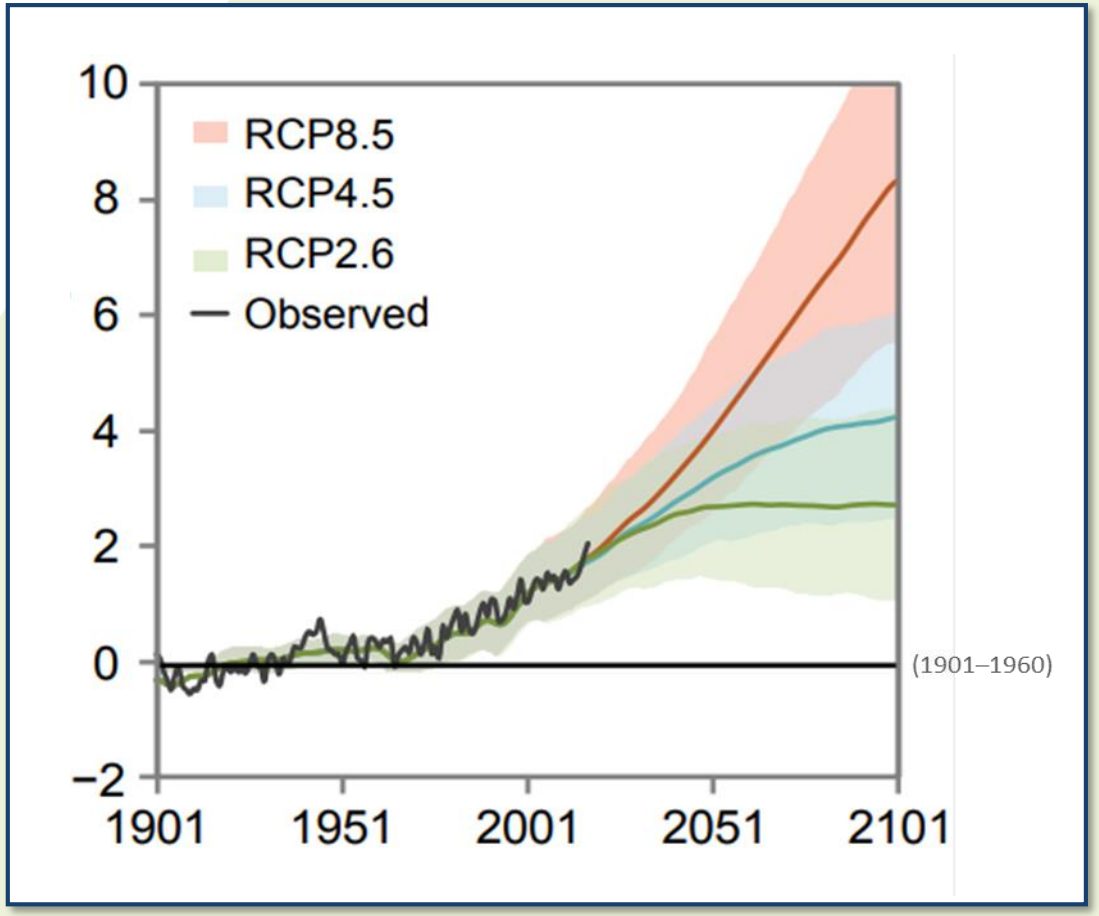
USGCRP 2017

Looking Forward: Global Warming to 2100

Project Annual Global Carbon Emissions



Projected Global Temperatures



Stop emissions today, committed to additional rise ~1.1°F

Accessing and Utilizing Climate Data

NCA4 Climate Science Special Report

NOAA's Sea Level Rise Viewer

LOCA Statistical Downscaling (Localized Constructed Analogs)

- Regional, state, and/or local climate data processed
  - Example, California Heat Assessment Tool
- It's important to utilize climate data tailored for your climate metrics
  - Provide information on conditions may change to measure of harm/threat that has inherent uncertainty
- Analyze the data from a risk perspective:
  - What is the future likelihood the thresholds will be met under a given scenario?

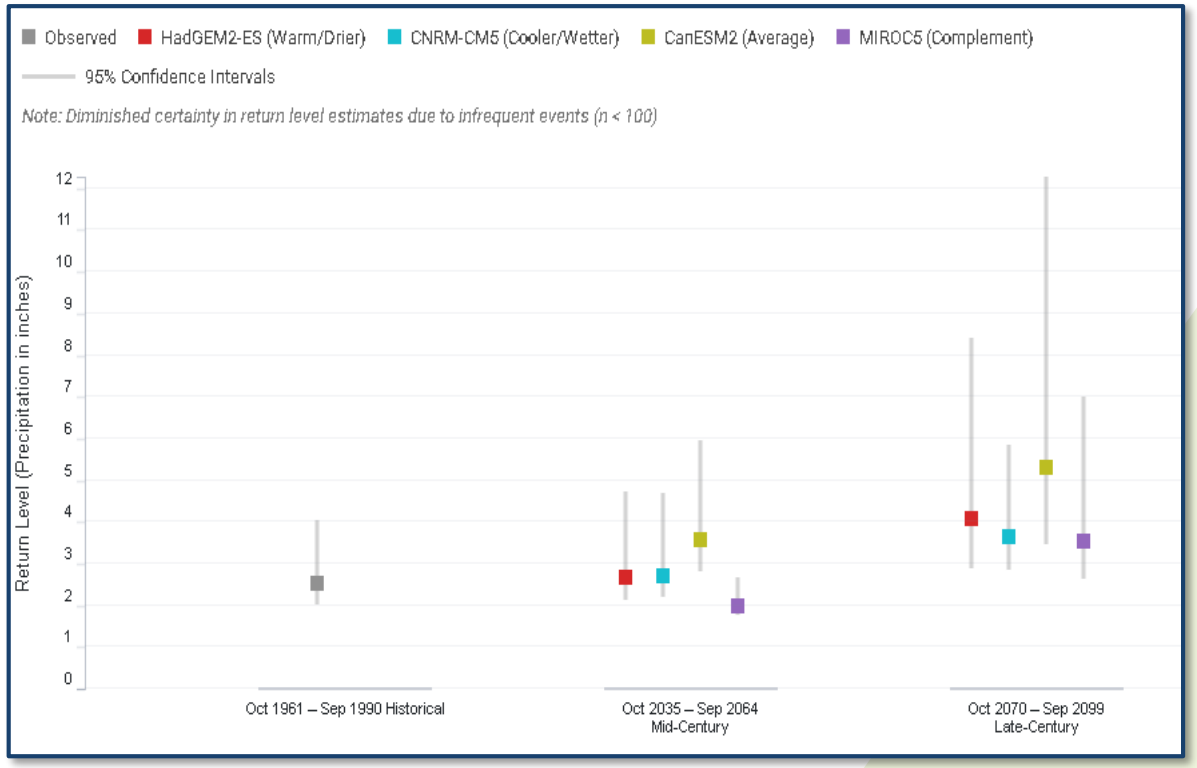
CONSIDERATIONS FOR MODELING

We are 99% sure that the future (storm, climate, etc.) will be like the conditions we are showing here.

CONSIDERATIONS FOR MODELING

We are 99% sure that the future (storm, climate, etc.) will be **not exactly** like the **calculated** conditions **derived from the model** we are showing here.

Design Processes & Integration of Climate Risks



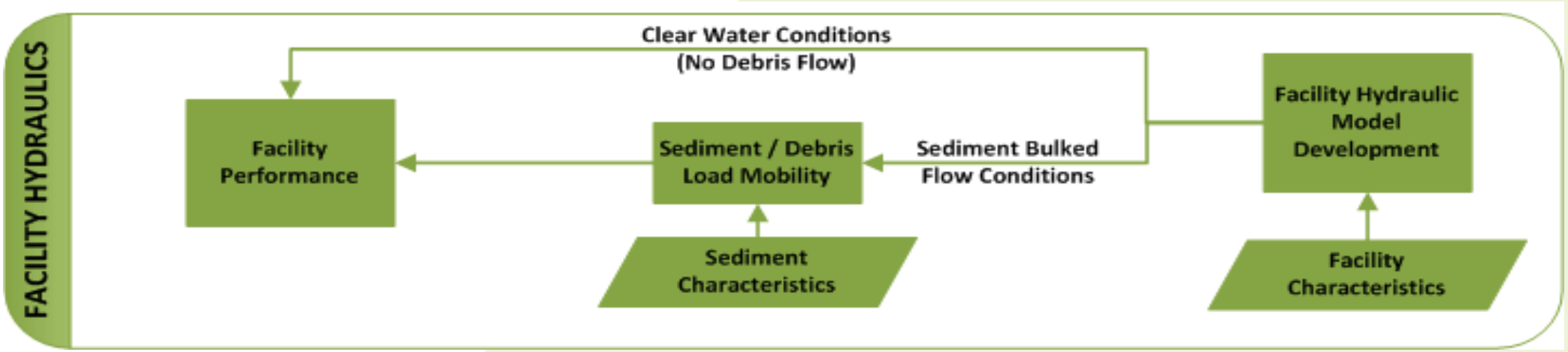
Length of Service (years)	Frequency – Recurrence Interval				
	10-year	25-year	50-year	100-year	500-year
1	10%	4%	2%	1%	0.2%
10	65%	34%	18%	10%	2%
25	93%	64%	40%	22%	5%
50	99%	87%	65%	39%	10%
75	100%	95%	78%	53%	14%
100	100%	98%	87%	63%	18%

"Designing for resilient performance and behavior under adverse conditions does not imply designing for larger discharges... Resilience implies understanding what happens when events occur that are other than the design flow."

FHWA HEC-17

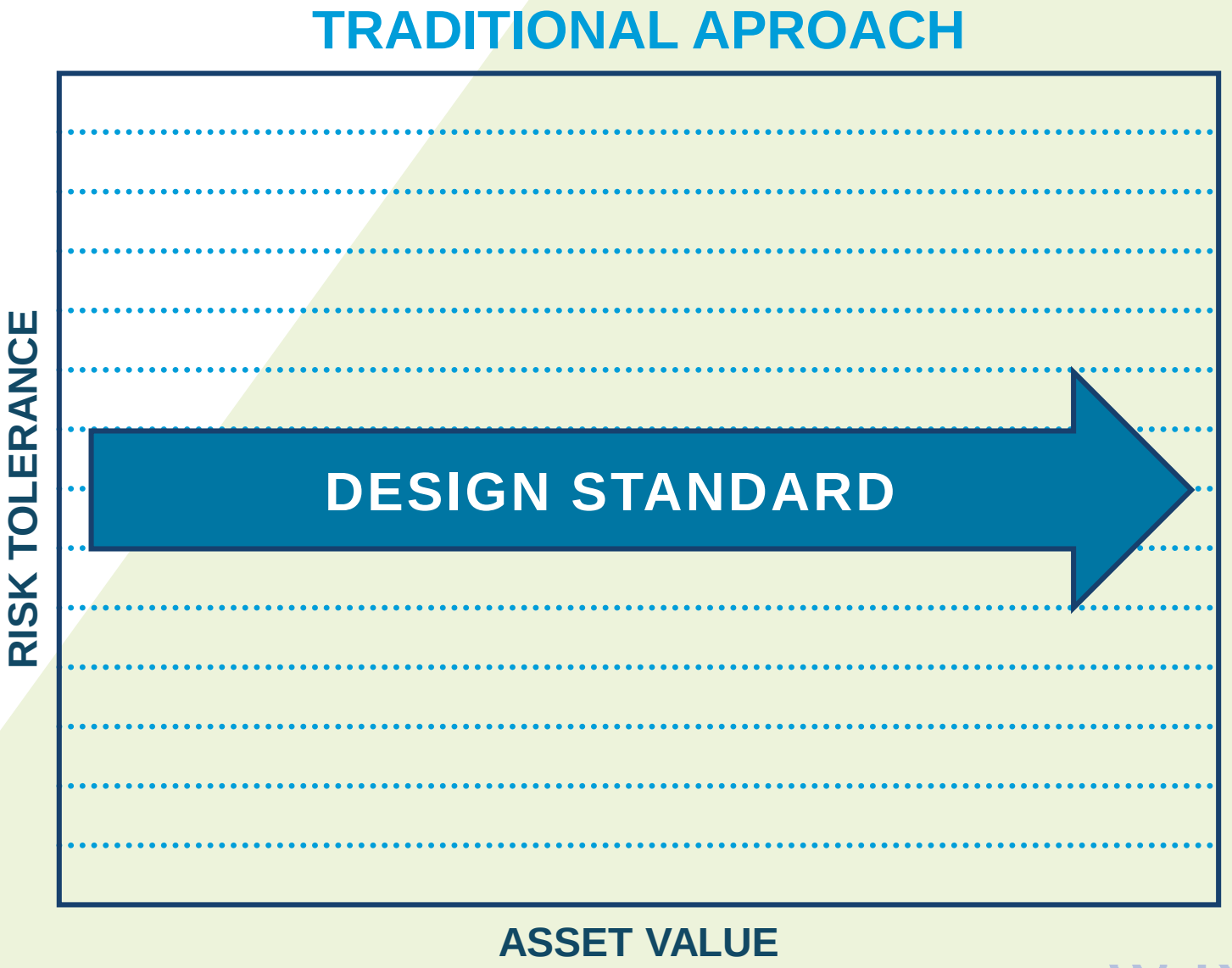
FHWA: Wildlife, Hydrologic Risk, and Climate Change

- Rainfall/runoff modeling of watershed updated for post-wildfire land cover conditions and future projected precipitation
- Findings:
  - ***Precipitation changes increase extreme event flows by up to 45%***
  - ***Wildfire impacts increased extreme event flows by a factor of 1.7 to 3.3 (170% to 330%)***



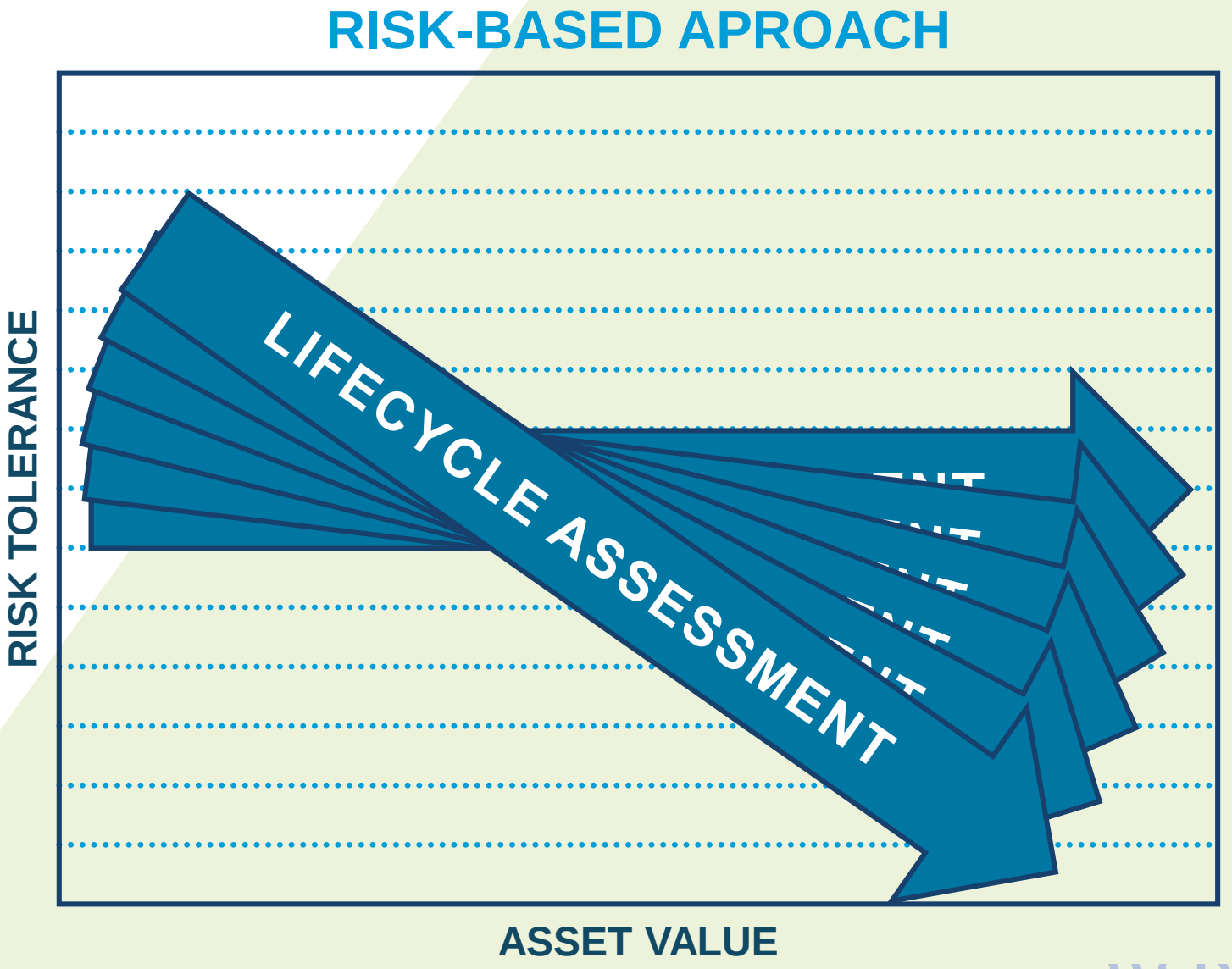
CHANGE Needed for Effective Resiliency

- Limited data basis
- Precedent-based



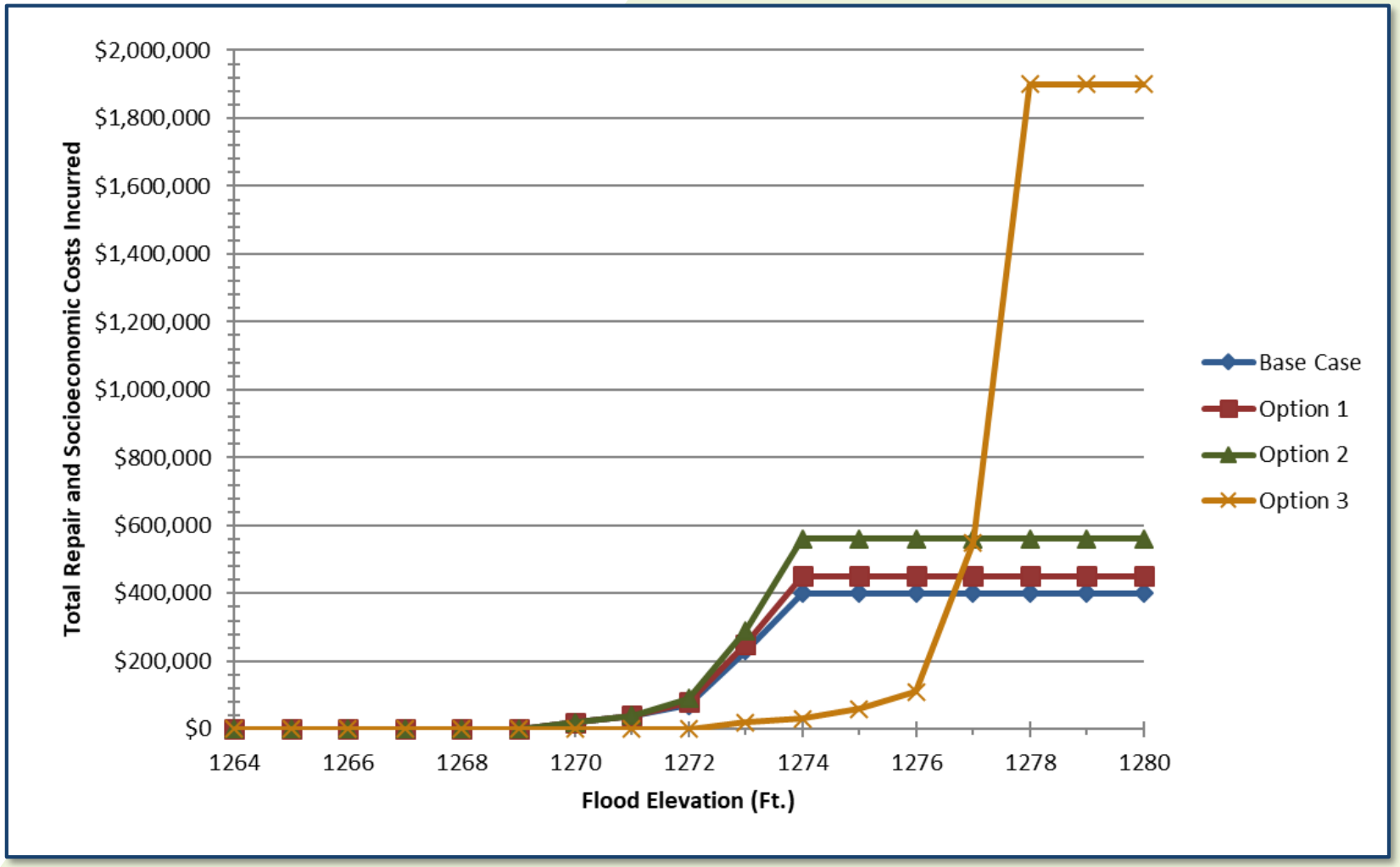
CHANGE Needed for Effective Resiliency

- Event-related damage
- Repair/outage periods
- Social/economic/ environmental costs
- Changing stressor conditions
- Recurrence uncertainties
- Full assessment of potential future conditions



Develop Asset Depth-Damage Functions

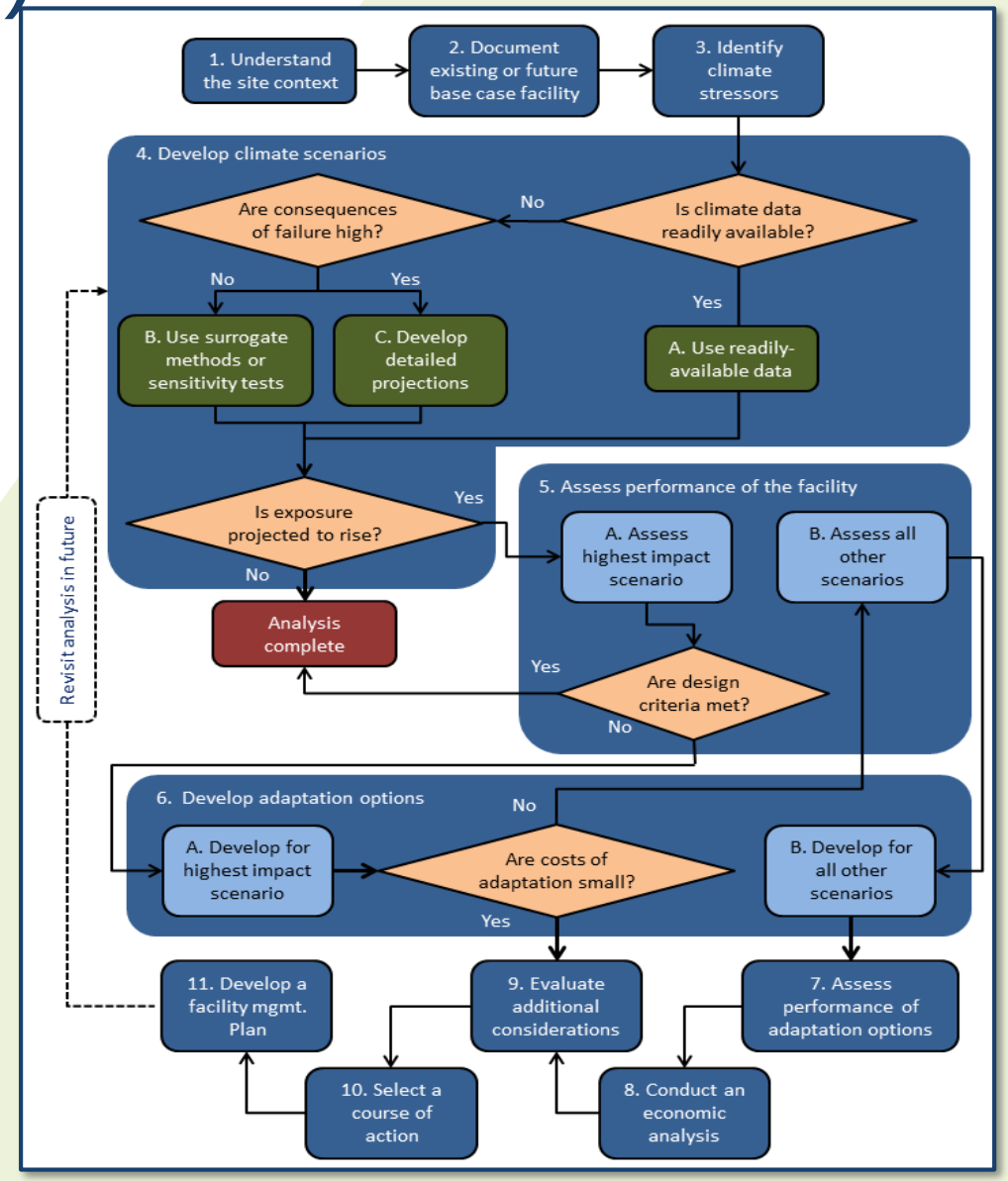
- Create depth-damage function for each selected asset
  - Functions relate depth of flooding to its costs
  - Engineering analyses
  - Economic analyses



Adaptation Decision-Making Assessment Process (ADAP)

U.S. Department of Transportation
Federal Highway Administration

- An effective approach to respond to climate stressors and uncertainties
  - ✓Scenario Assessment – Multiple Future Conditions
  - ✓Assess Consequences Over an Asset Lifecycle
  - ✓Cost Effectiveness Measure – BCA/NPV



Current Resilient Policies & Direction

STATE

Restore PA - After spring and summer storms caused more than $125 million of damage from flooding and landslides on state roadways last year, most of the money for rural and commercial roadway improvements had to be repurposed for emergency repairs. Conservation districts…also face increased need from the unprecedented rainfall.

FEMA

Building Resilient Infrastructure and Communities (BRIC) is designed to incentivize innovative infrastructure projects with the potential of increasing resilience prior to a major disaster. The BRIC program will be funded as a 6% set-aside from disaster grants.

FHWA

Betterments policy direction has been updated - (are eligible) only where clearly economically justified to prevent future recurring damage. Economic justification must weigh the cost of betterment against the risk of eligible recurring damage and the cost of future repair (23 CFR 668.109 (b)(6)).

MOODY'S

Governments that are at risk for higher risks of climate shock are asked to explain how they are prepared to deal with the weather events associated with climate shocks.

THANK YOU

Questions & Answers