Airports & Global Climate Change – A Critical Planning & NEPA Challenge

Moderator/Speaker
Jennifer Wolchansky
Project Manager
Mead & Hunt

Speakers
Tom Cuddy
Environmental Specialist,
Airport Planning and Environmental Division
FAA Office of Airports

John Lengel
Vice President
RS&H

Airport Climate Adaptation and Resilience:

FAA Perspectives and Future Direction

Presented by: Thomas Cuddy

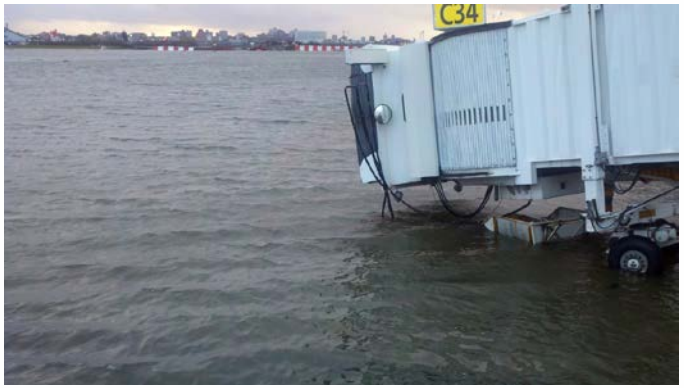
FAA
Office of Airports

Presentation Outline

- Potential climate impacts for airports
- Resilience challenges
- Considering resilience in airport planning
- Examples of resilience measures
- Lessons learned from climate resilience
- Resources on climate resilience

Potential Impacts - Flooding

- More frequent/severe flooding of low-lying infrastructure due to more intense precipitation, sea level rise, and storm surge
- Increased numbers and magnitude of storm surges and/or relative sea level rise
- Culvert and drainage infrastructure damage, due to changes in precipitation intensity, changes in snow melt timing, or rising water tables
- Blocked ground access to airport



We are Airports

FAA Office of Airports

Potential Impacts - Storms

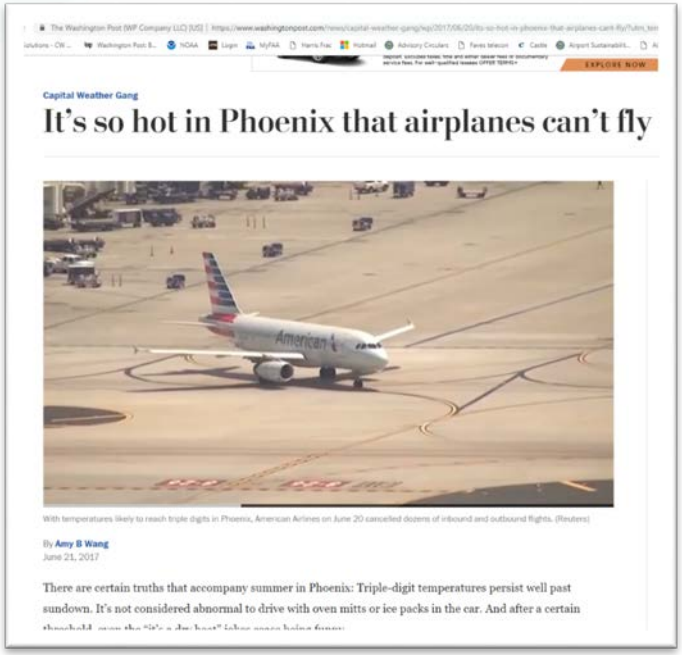
- Increased numbers and magnitude of extreme storms, such as hurricanes and typhoons
- More intense precipitation, storm surges and/or relative sea level rise
- Wind and debris damage
- Internet and cell phone services may be disrupted
- Storm refugees often seek out airport

We are Airports

FAA Office of Airports

Potential Impacts - Heat

- Increased thermal expansion and potential degradation of paved surfaces, due to higher temperatures and increased duration of heat waves
- Reduced aircraft performance on extremely hot days leading to limited range capabilities and reduced payloads
- Electrical fluctuations due to high load demand



Capital Weather Gang

It's so hot in Phoenix that airplanes can't fly

With temperatures likely to reach triple digits in Phoenix, American Airlines on June 20 canceled dozens of inbound and outbound flights. (Reuters)

By Amy B Wang
June 21, 2017

There are certain truths that accompany summer in Phoenix: Triple-digit temperatures persist well past sundown. It's not considered abnormal to drive with oven mitts or ice packs in the car. And after a certain

We are Airports

FAA Office of Airports

Potential Impacts – Sea Level Rise

- More frequent/severe flooding of low-lying infrastructure from sea level rise and associated storm surge
- Increased numbers and magnitude of storm surges as a result of sea level rise (e.g., salt water inundation)
- Culvert and drainage ineffective due to elevated water table

We are Airports

FAA Office of Airports

Resilience Challenges

Requires working across every part of the airport

- Airport Planning and Engineering
- Operational considerations
- Investments

Costs can be high

- Some mitigation is extremely expensive – e.g., flood prevention
- Some less so

Uncertainties

- Hard to know what to plan for
- Looking into the future is imprecise
- Can’t know all the risks

We are Airports

FAA Office of Airports

Considering Resilience at the Airport

- **Airport Planning:**
  - Master Plans and layout plans – should consider future climate
  - Engineering standards – should consider future climate. Some airports have issued ‘specifications’ or ‘planning standards’ that take climate into consideration
  - Environmental impact assessment
  - Plan for irregular operations – e.g. Incident Command System (ICS), or Continuity of Operations Plan (COOP)

We are Airports

FAA Office of Airports

Hardened Infrastructure

FAA's Engineering Services team has started elevating:

- Instruments: Radars and LOC
- Some ATC towers

Generally done on a case by case basis as needed

We are Airports

FAA Office of Airports

Design Airport buildings for resilience

Resilience tips:

- Install concrete buildings on islands, as well as tie downs for LIR masts and shelters
- Plan for electric generators – install plugs on buildings, configure power systems to accommodate vulnerabilities
- Consider unusual foundation designs – e.g., deep piles driven into sand specifically to withstand soil liquefaction in coastal areas, strong storm surge, and to resist hurricane force winds
- Some components can be configured for quick removal in flood prone areas. Include eyelets to ease lifting, and quick disconnects for the electrical

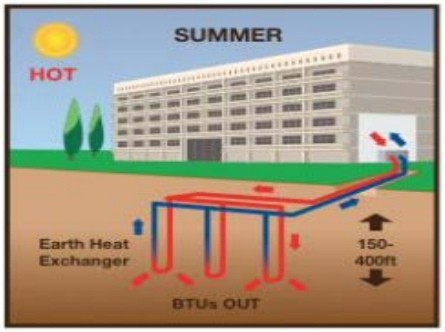
We are Airports

FAA Office of Airports

Airport Sustainability and Energy

The US is seeing a lot of creative energy projects

Energy projects:
Renewable on-airport power generation for electricity and heating/cooling (i.e., solar, geothermal, hydrogen powered electrical energy generation)
Stand-alone energy efficiency upgrades – HVAC, hot water heater, and energy efficient lighting
Airport microgrid as a secondary system to generate and distribute power
Elevating substations and other electrical components, strengthening to withstand flooding and salt water



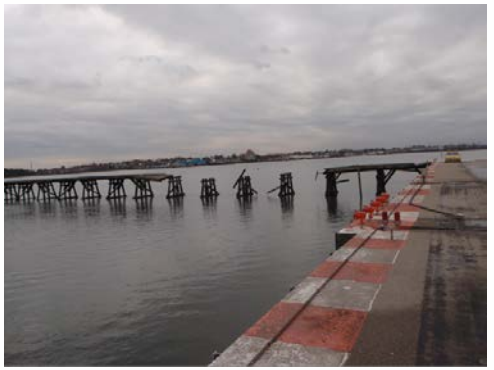
We are Airports

FAA Office of Airports

Lessons Learned on Resilience

Good planning is critical

- There is time to adapt, but plan now – most impacts like sea-level rise are not sudden
- Achieve resilience incrementally
- Know your facility and local climate projections
- Ask “What do I really need to operate the airport safely for the next 20 years or so?”
- Prioritize projects/upgrades and implement them accordingly



Have a plan for extreme or emergency events

- Practice the plan so everyone knows their role

SJU: “We were not improvising”

We are Airports

FAA Office of Airports

Lessons Learned on Resilience

Avoid ‘unanswerable’ issues

- Don’t be too concerned with uncertainties of climate data or ‘quantifying risk’
- You don’t need ‘downscaled’ high-resolution climate data to make reasonable decisions about your airport

There is a lot of climate data readily available

Cost/investment

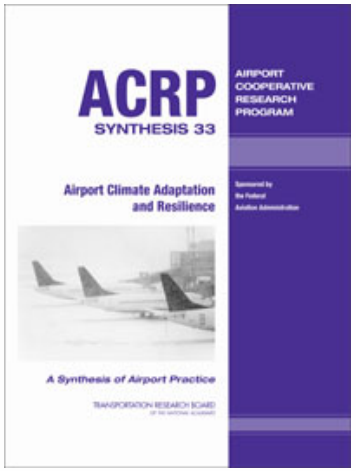
- There is no perfect benefit/cost analysis for decision-making
- Remember that every $1 spent on prevention saves $6 later

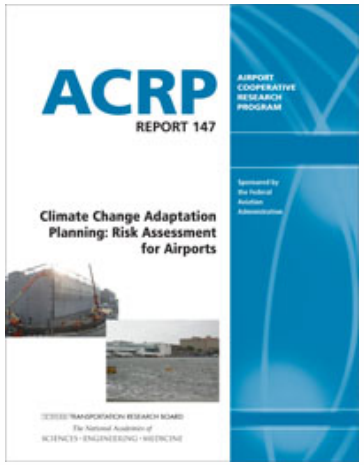
We are Airports

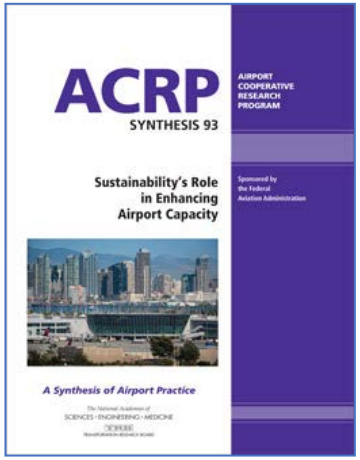
FAA Office of Airports

Airport Resilience Resources

- *Airport Climate Adaptation and Resilience*, 2012 (Synthesis 33)
- *Climate Change Adaptation Planning: Risk Assessment for Airports*, 2015 (Report 147)
- *Using Existing Airport Systems to Manage Climate Risk*, 2018 (Report 188)
- *Sustainability's Role in Enhancing Airport Capacity,* Aug. 2018 (Synthesis 93)







We are Airports

FAA Office of Airports

Contact info

Thomas Cuddy

1-202-267-5869

Thomas.cuddy@faa.gov

FAA Office of Airports

800 Independence Avenue, SW

Washington, DC 20591

We are Airports

FAA Office of Airports

Planning for Airport Climate Resilience

John Lengel Jr., P.E., ENV SP

RS&H Inc.

Vice President – Aviation Environmental Stewardship and Resiliency

RS&H

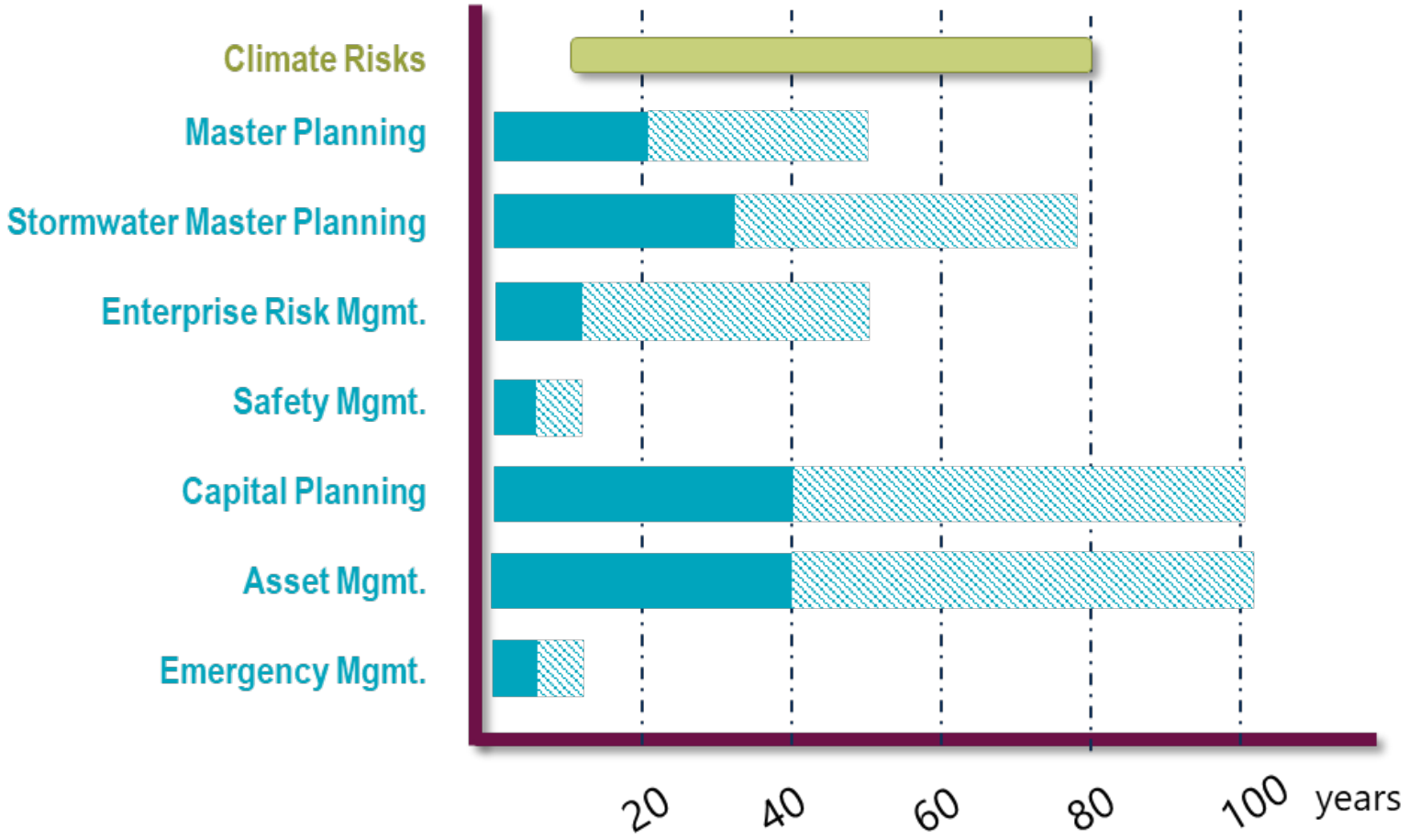
OSAKA, JAPAN -- Kansai International Airport
September 2018, The Mainichi

Climate Challenges Are Approaching Quickly

- IPCC Global Warming Report – October 2018
  - 1.5°C reached between 2030–2052
  - Significant impacts are expected
- UN Report on Climate-related Disasters October 2018
  - 1998-2017 = $2,245 Billion
  - 1978-1997 = $895 Billion
  - Greatest economic losses
    - *USA ($944.8B)*
    - *China ($492.2B)*
    - *Japan ($376.3B)*
    - *India ($79.5B)*
    - *Puerto Rico ($71.7B)*

RS&H

Airport Planning has Long-term Implications



Typical Implementation Horizons for Airport Mgmt. Systems (Adapted from ACRP 188)

RS&H

Insurance and Financial Disclosures Coming

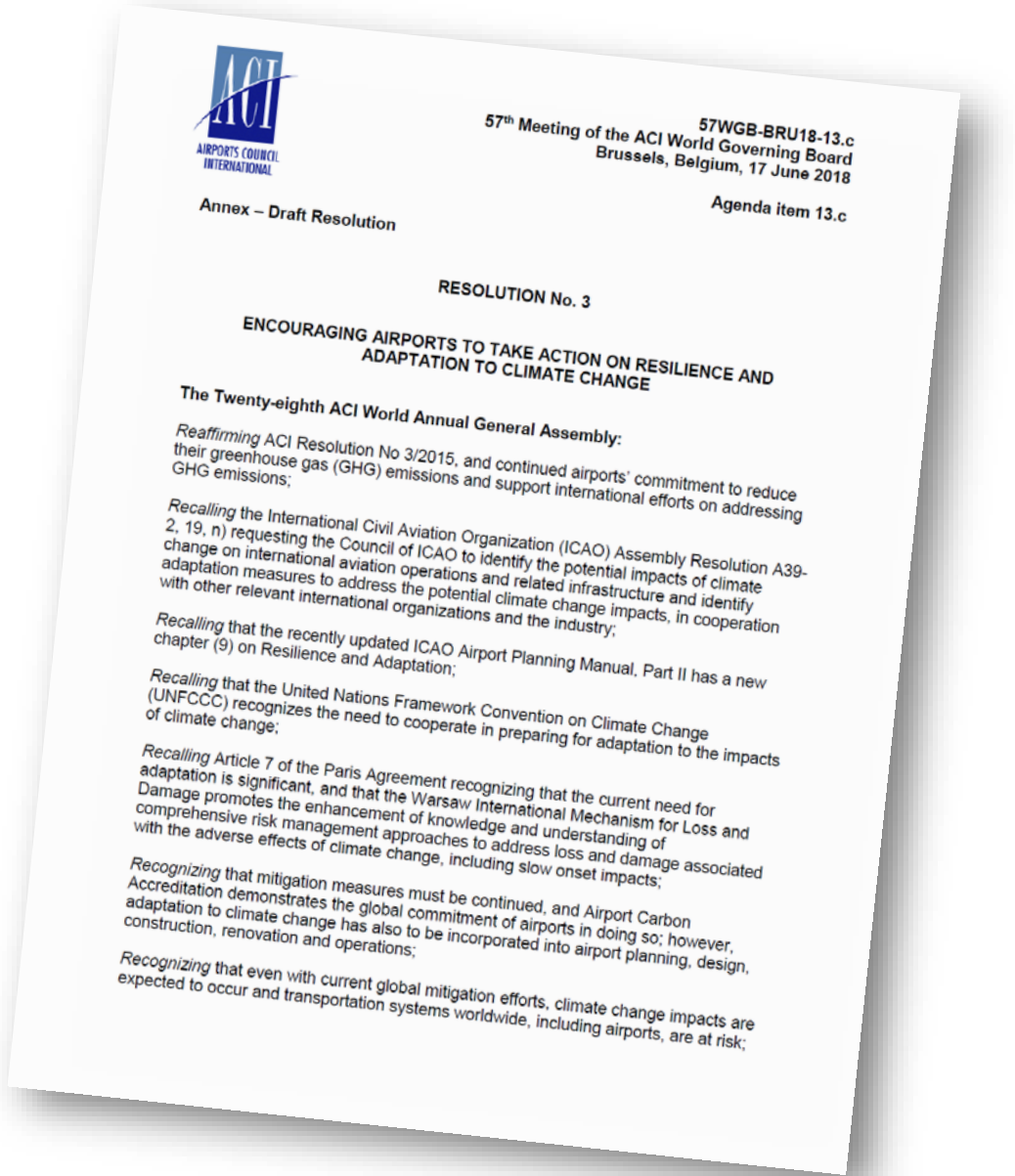
- Zurich Report
  - *Managing the Impacts of Climate Change: Risk Management Responses* – September 2018
- Financial Stability Board's (FSB's) Task Force on Climate Related Financial Disclosure (TCFD)
  - Status Reports September 2018 and June 2019

RS&H

Worldwide the Aviation Industry is Preparing

» ACI Resolution No. 3 (June 2018) Encourages Airports to:

1. Reduce GHG Emissions
2. Assess Impacts of Climate Change on Critical Infrastructure
3. Consider Climate Change in Master Plans
4. Conduct Risk or Criticality Assessments
5. Incorporate into Business Continuity and Emergency Plans



57WGB-BRU18-13.c
57th Meeting of the ACI World Governing Board
Brussels, Belgium, 17 June 2018

Annex – Draft Resolution

Agenda item 13.c

RESOLUTION No. 3

ENCOURAGING AIRPORTS TO TAKE ACTION ON RESILIENCE AND ADAPTATION TO CLIMATE CHANGE

The Twenty-eighth ACI World Annual General Assembly:

Reaffirming ACI Resolution No 3/2015, and continued airports' commitment to reduce their greenhouse gas (GHG) emissions and support international efforts on addressing GHG emissions;

Recalling the International Civil Aviation Organization (ICAO) Assembly Resolution A39-2, 19, n) requesting the Council of ICAO to identify the potential impacts of climate change on international aviation operations and related infrastructure and identify adaptation measures to address the potential climate change impacts, in cooperation with other relevant international organizations and the industry;

Recalling that the recently updated ICAO Airport Planning Manual, Part II has a new chapter (9) on Resilience and Adaptation;

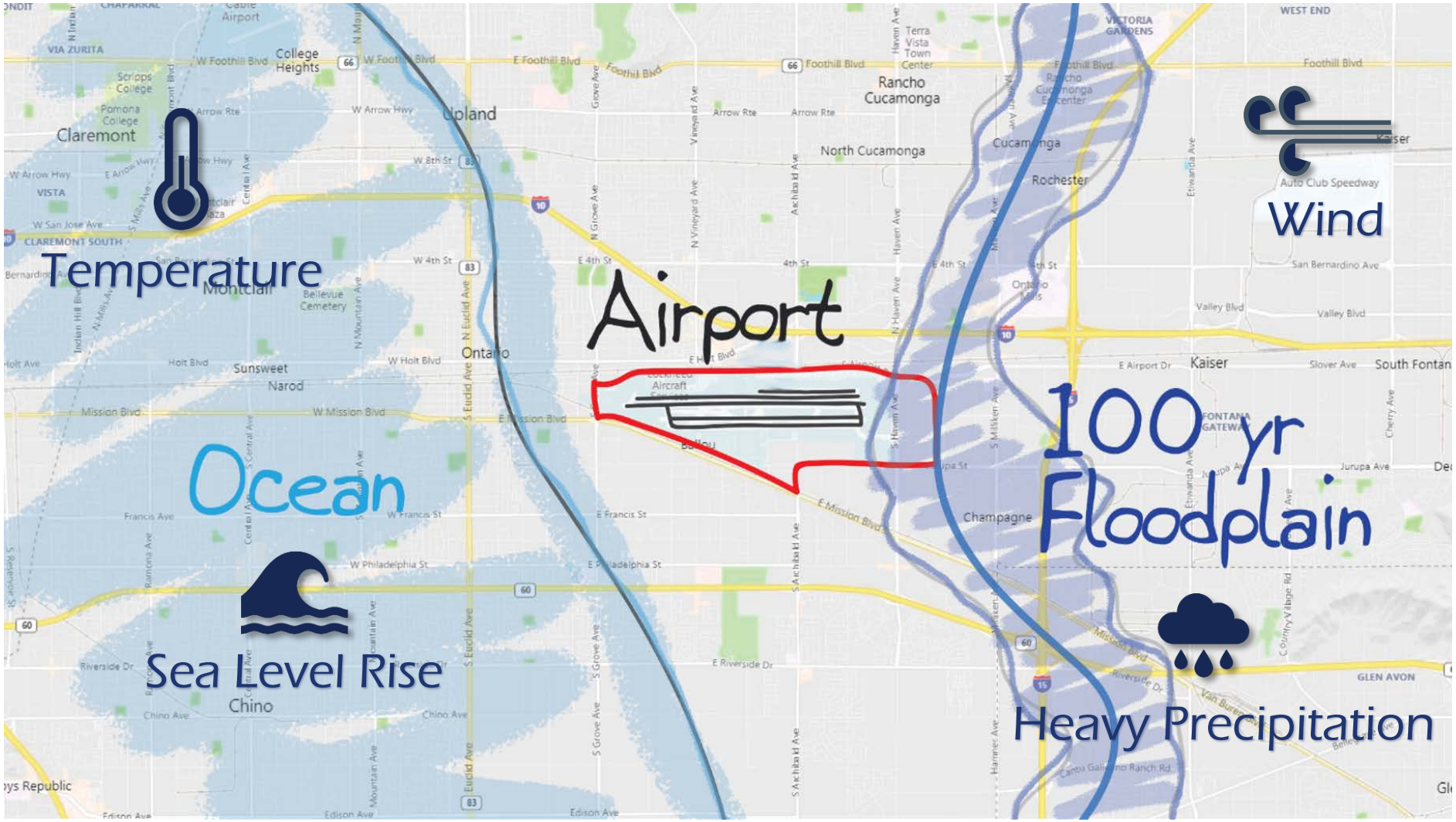
Recalling that the United Nations Framework Convention on Climate Change (UNFCCC) recognizes the need to cooperate in preparing for adaptation to the impacts of climate change;

Recalling Article 7 of the Paris Agreement recognizing that the current need for adaptation is significant, and that the Warsaw International Mechanism for Loss and Damage promotes the enhancement of knowledge and understanding of comprehensive risk management approaches to address loss and damage associated with the adverse effects of climate change, including slow onset impacts;

Recognizing that mitigation measures must be continued, and Airport Carbon Accreditation demonstrates the global commitment of airports in doing so; however, adaptation to climate change has also to be incorporated into airport planning, design, construction, renovation and operations;

Recognizing that even with current global mitigation efforts, climate change impacts are expected to occur and transportation systems worldwide, including airports, are at risk;

Case Study Airport – West Coast Airport

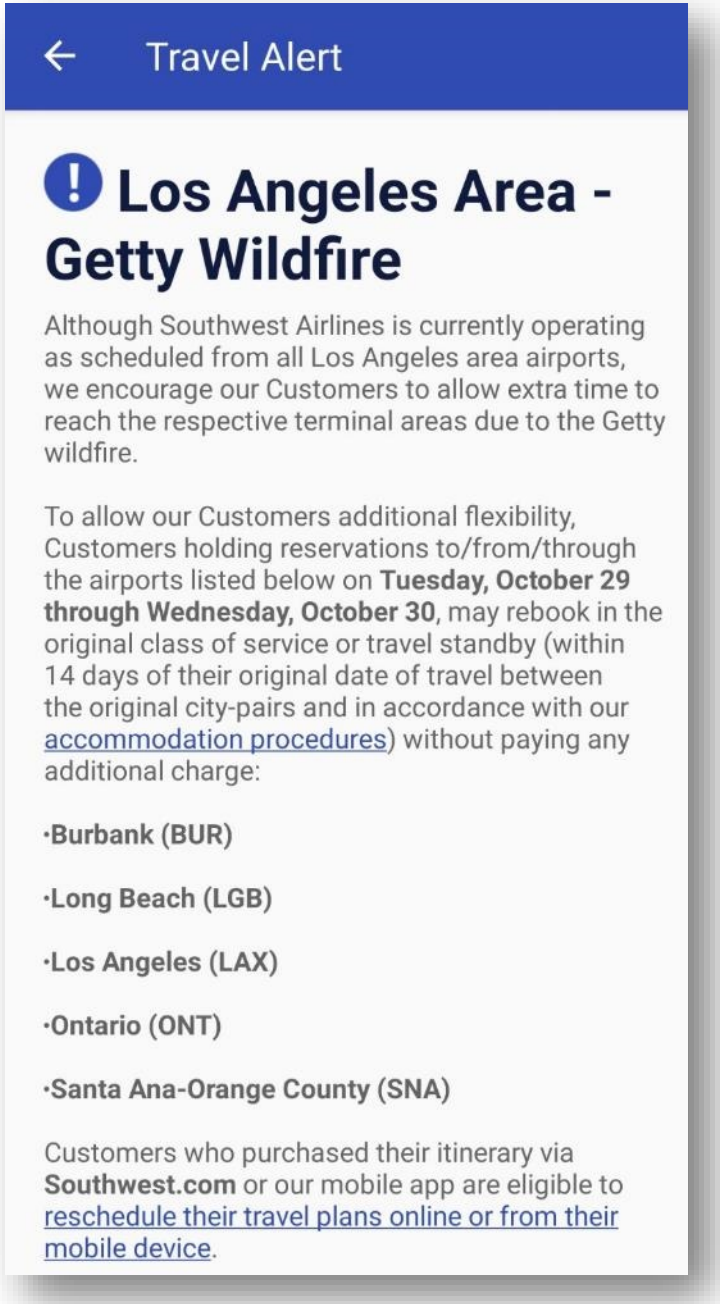


RS&H

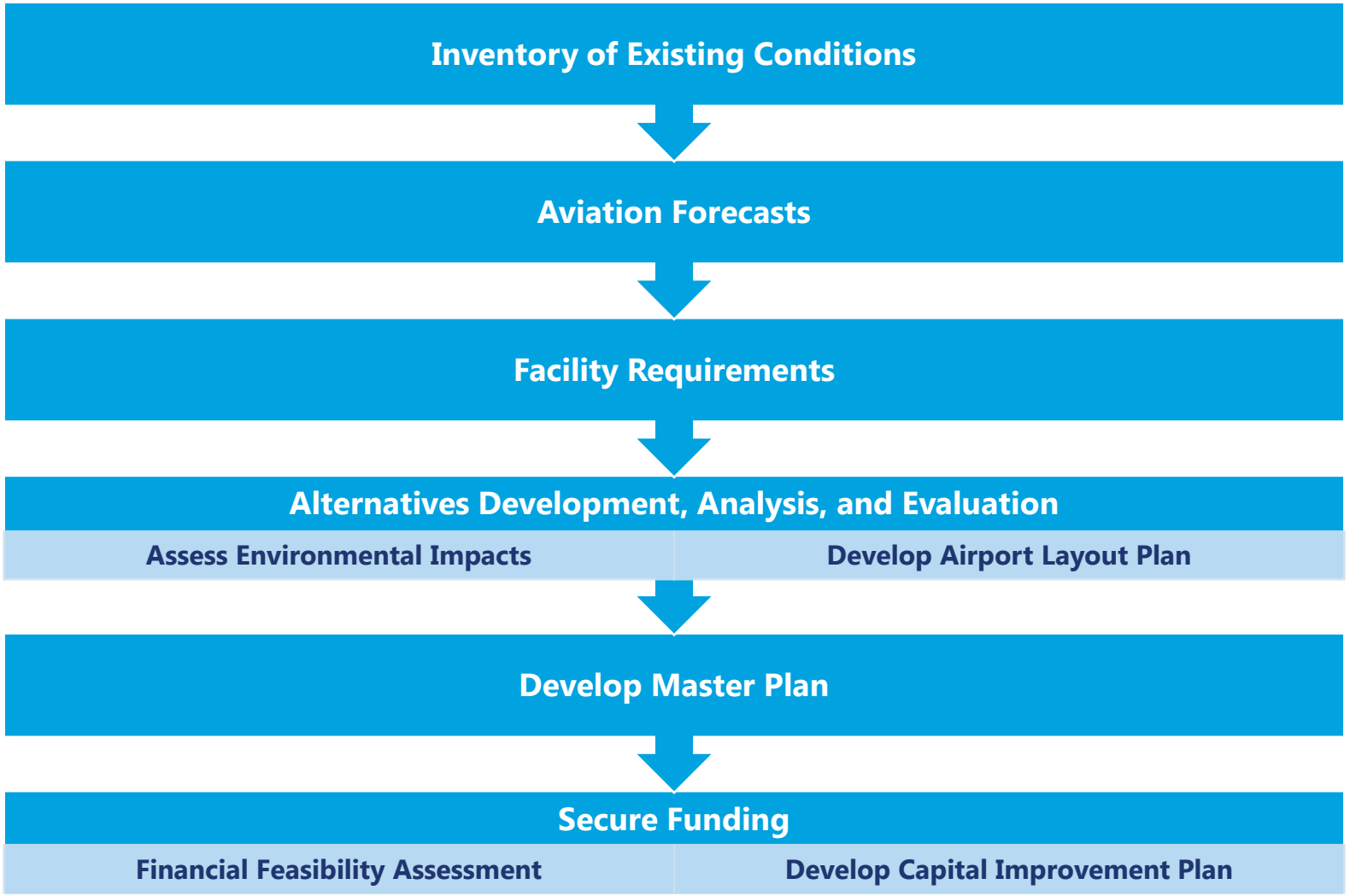
Possible Airport Threats

- Flooding
  - Heavy Precipitation
- Higher Winds
- Higher Temperatures
  - Day and Night
- Electric Disruption
- Wildfire and Smoke
- Higher Utility Costs
  - Increasing Demand

RS&H



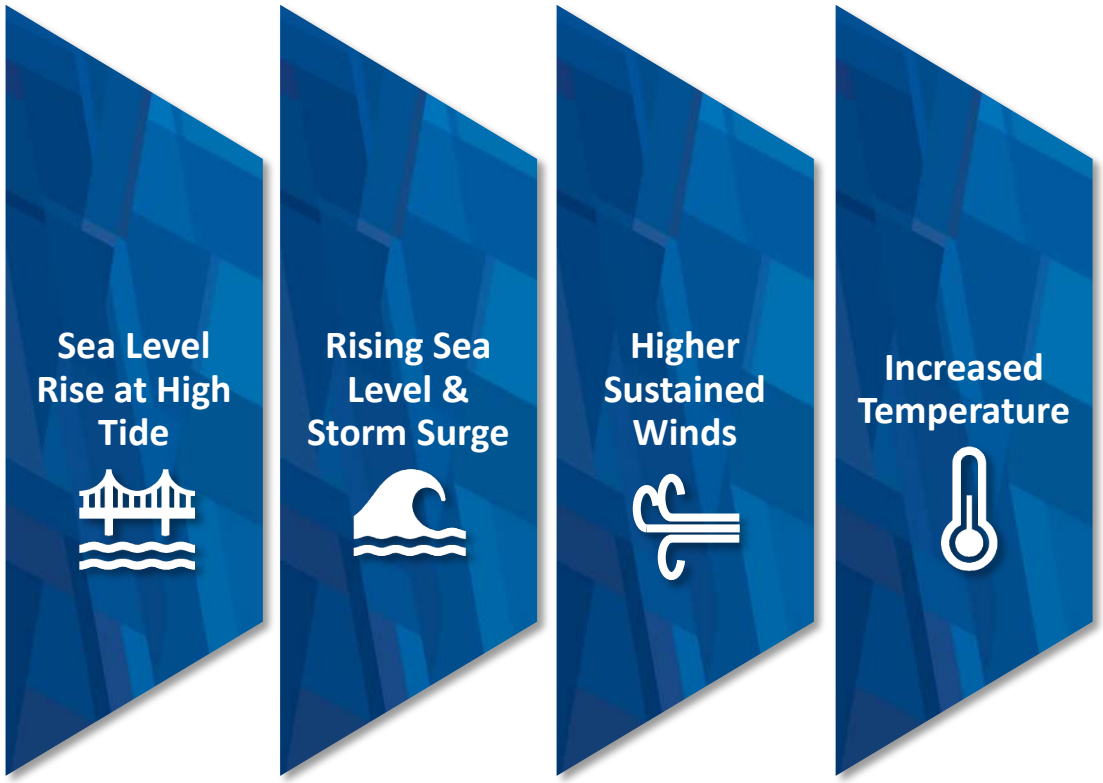
Airport Master Planning Process Opportunities



RS&H

Inventory of Existing Conditions

- Identify Critical Infrastructure
- Identify Climate Impacts
  - Extreme heat
    - *Pavement Integrity*
    - *Worker Exposure (Const and Ops)*
    - *Wildfires and Smoke*
    - *Utility Costs*
  - Sea-level Rise
    - *Tailwater Stormwater Impacts*
    - *Water Quality Impacts*
  - Higher Sustained Winds
    - *Elevated Structures*

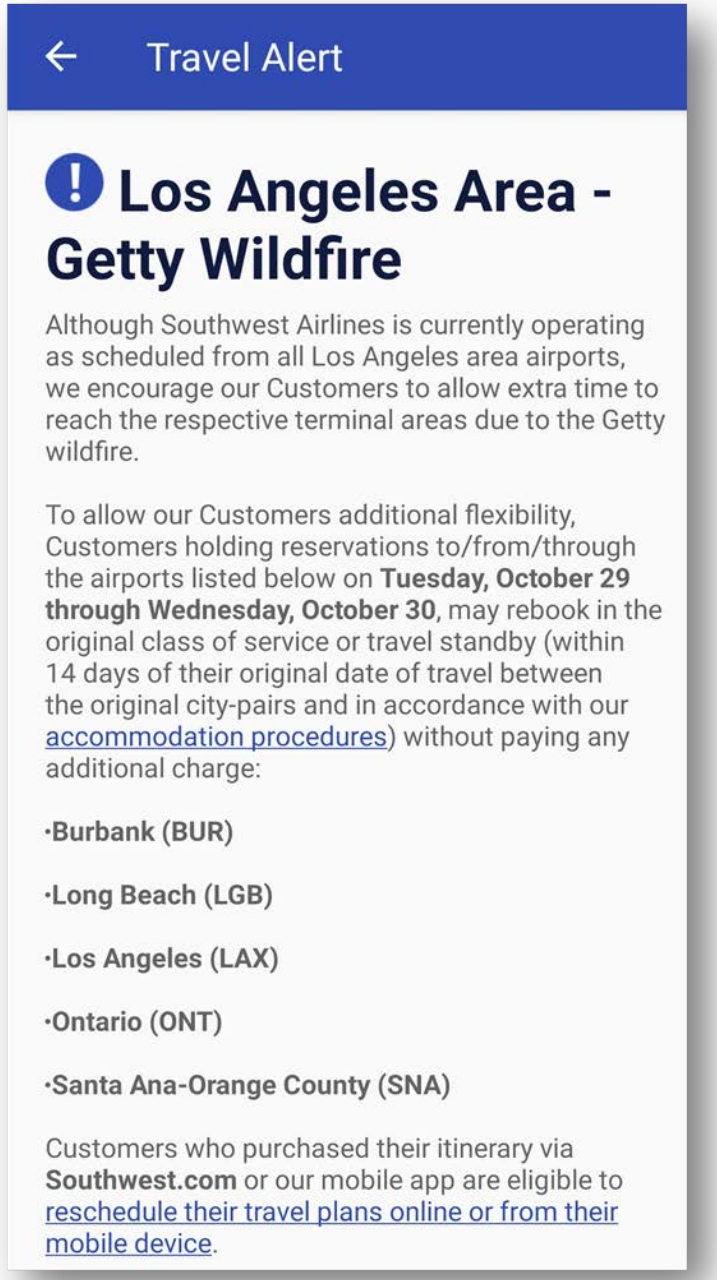


Inventory of Existing Conditions

Assets	Duration of damage / closure
	Pavement condition
Operations	Energy use
	Weather-related flight delays / cancellations
Costs	Staff time spend on weather events
	Cost of damages to infrastructure
Weather	Frequency of storm events
	Frequency of extreme temperature events

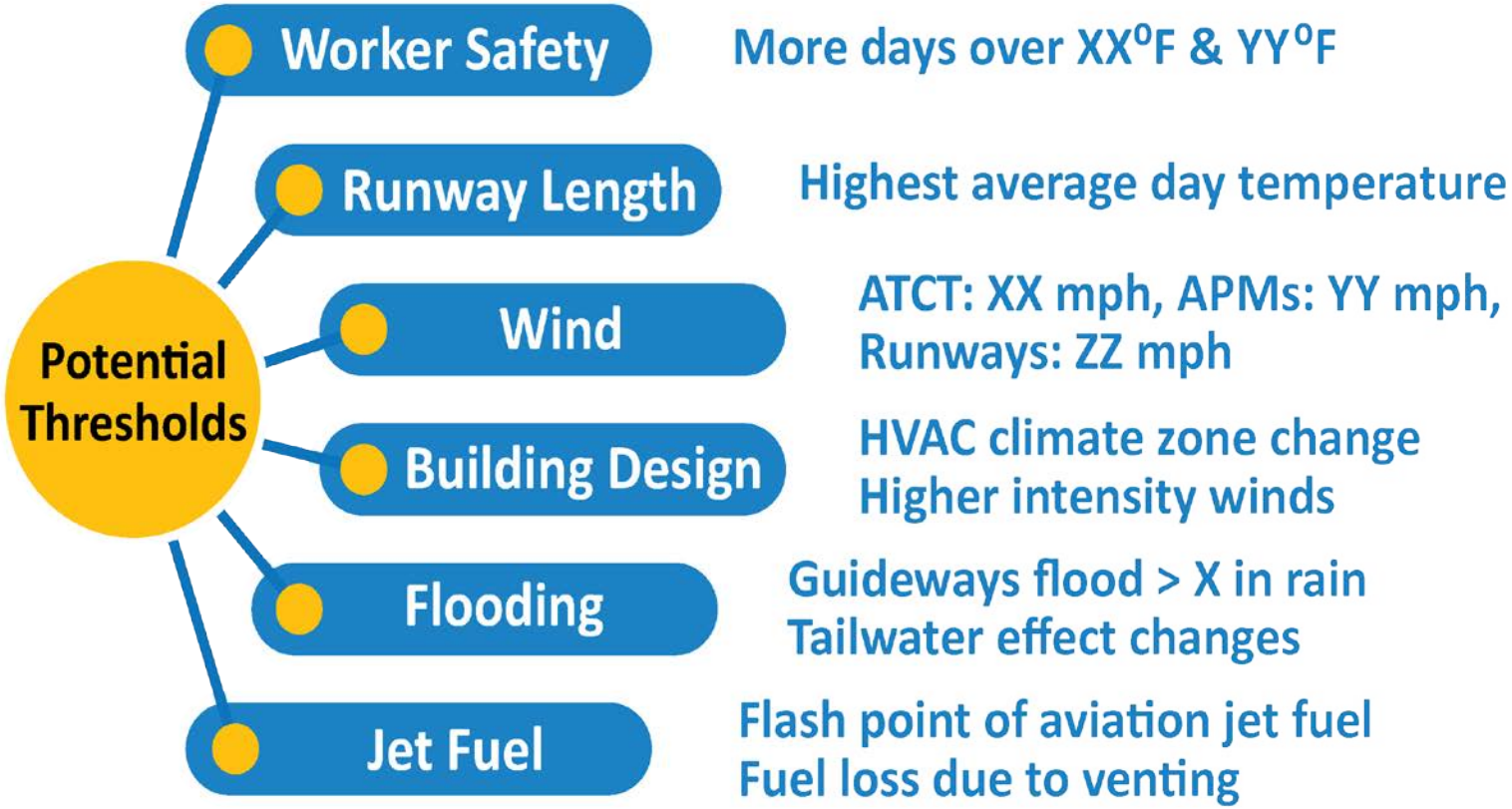
Aviation Forecasts

- How could climate stressor impacts enplanements or operations?
  - Runway length accommodate future aircraft
  - Runway length accommodate future destinations
  - Wind direction and speed effect on runway capacity
  - Fire and smoke impacts on capacity (could an acute impact become chronic?)



Facility Requirements

» Evaluate Thresholds and **Adaptive Capacity**
  – *The ability of an existing asset or operation to cope with the negative effects of climate change*



RS&H

Facility Requirements

Takeoff Runway Length Requirements by Temperature and Aircraft

	Mean maximum daily temperature of the warmest month				
	STD*	STD+15°C	STD+22.2°C	STD+25°C	STD+35°C
	15°C (59°F)	30°C (86°F)	37.2°C (99°F)	40°C (104°F)	50°C (122°F)
Boeing 737-600	7,000 ft. (2,134 m)	7,600 ft. (2,316 m)	10,000 ft. (3,048 m)	n/a	11,500 ft. (3,505 m)
Boeing 737-700/-700W	9,200 ft. (2,804 m)	10,000 ft. (3,048)	12,500 ft. (3,810 m)	n/a	15,000 ft. (4,572 m)
Boeing 737-800/-800W/BBJ2	7,800 ft. (2,377 m)	8,100 ft. (2,469 m)	n/a	10,100 ft. (3,078 m)	15,000 ft. (4,572 m)

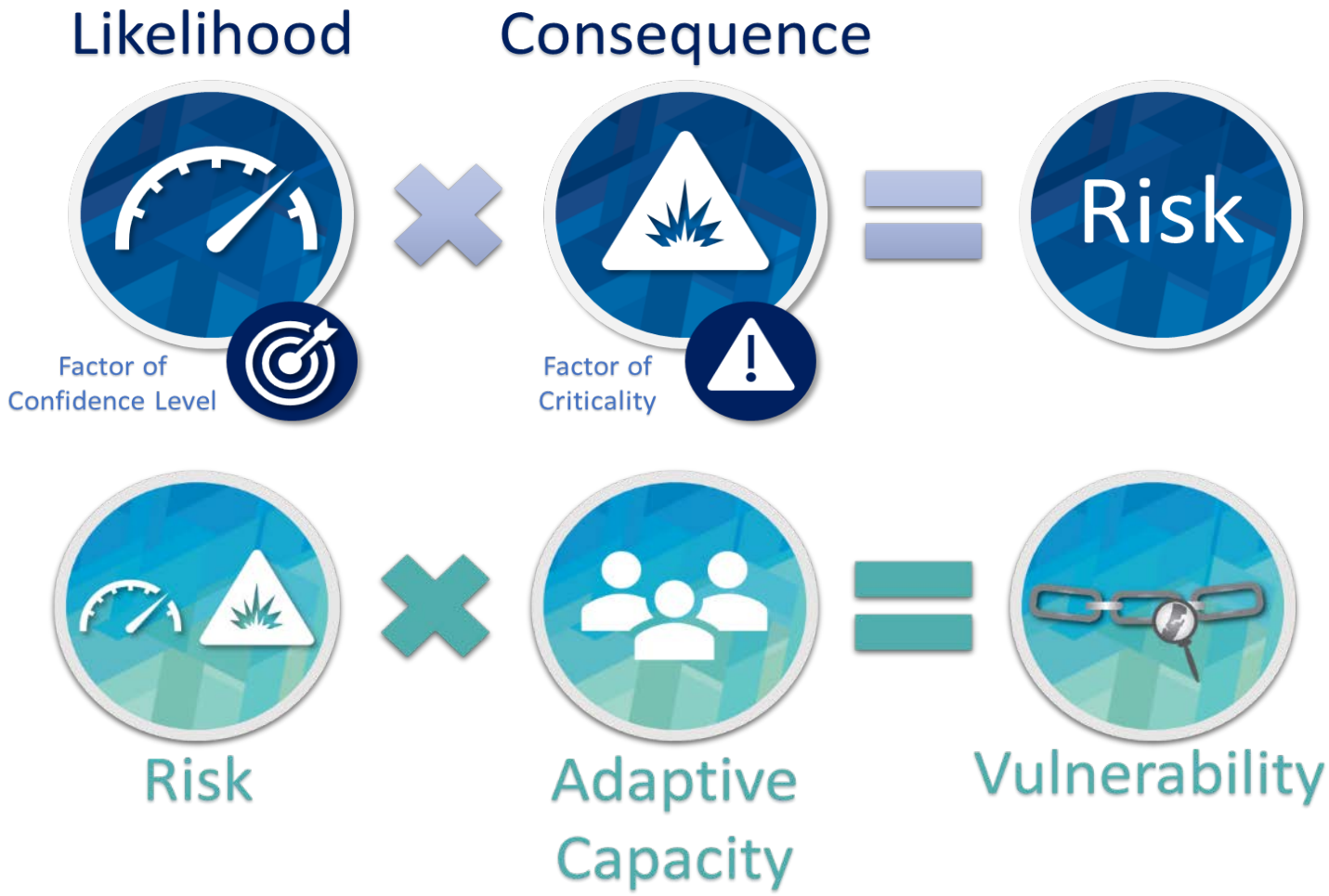
Source: Boeing, 2013

All values assume the following conditions: maximum aircraft takeoff weight, sea level, dry runway, zero wind, zero runway gradient, air conditioning off, and optimum flap setting.

*STD = Standard Day

Facility Requirements

Conduct Risk and Vulnerability Assessment



RS&H

Facility Requirements

Conduct Risk and Vulnerability Assessment

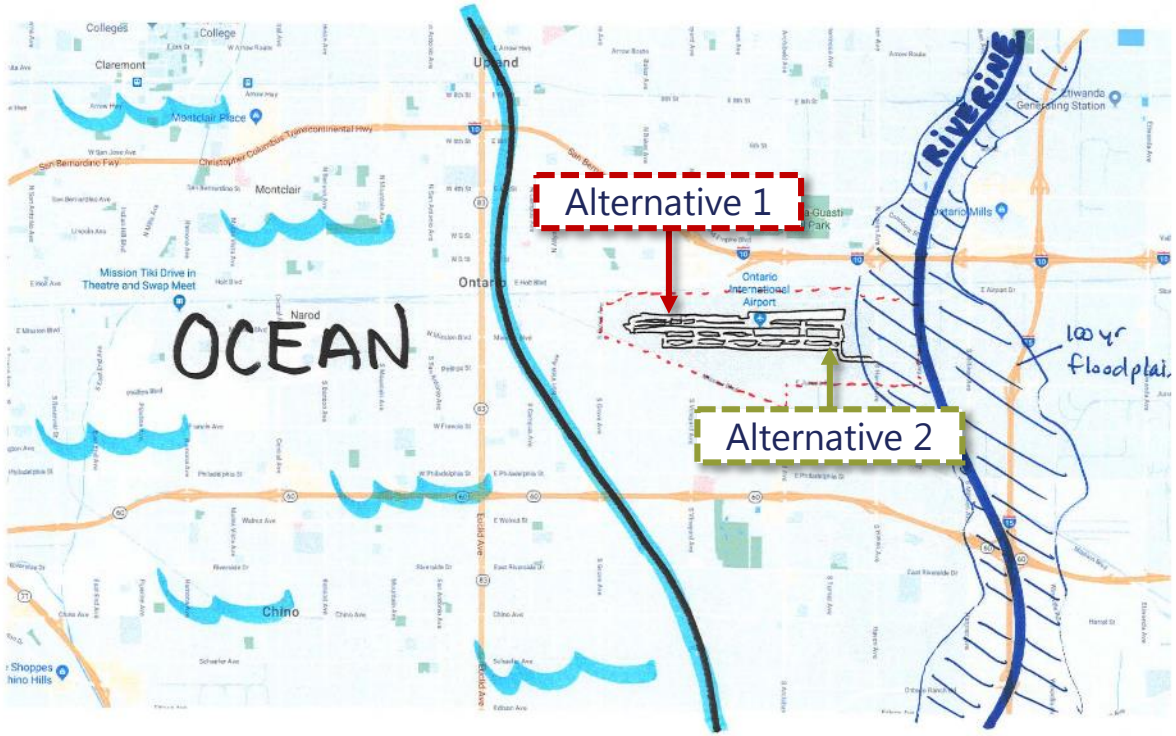
CONSEQUENCES					
LIKELIHOOD	Negligible	Minor	Moderate	Major	Catastrophic
Rare	LOW	LOW	LOW	LOW	LOW
Unlikely	LOW	LOW	MODERATE	MODERATE	MODERATE
Possible	LOW	MODERATE	MODERATE	HIGH	HIGH
Likely	LOW	MODERATE	HIGH	HIGH	EXTREME
Almost Certain	LOW	MODERATE	HIGH	EXTREME	EXTREME

RS&H

Alternatives Development

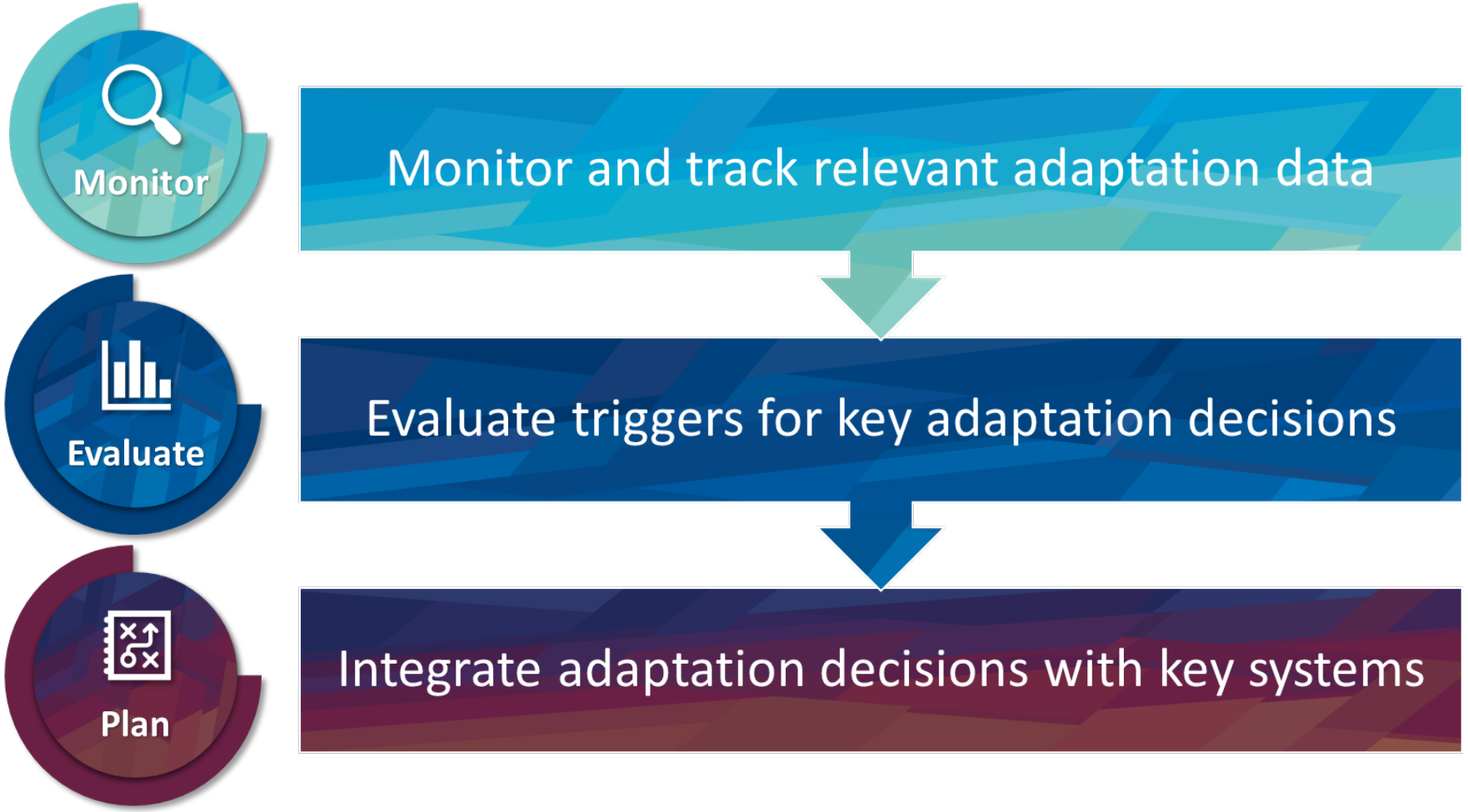
- Prioritize high risk and high vulnerabilities
- Preferred alternative selection
  - Siting to avoid flooding
  - Runways sited to accommodate increases in temperatures
  - Buildings with greater cooling capacities
  - Utility costs and reliability
- Evaluate cost-benefit and timeframes

Alternative Analysis: New Airfield Electrical Vault



RS&H

ALP and Master Plan Update



RS&H

Adaptive Management Considerations

- Risks and Vulnerability Uncertainty
  - May change in time as certainty in science, scale, and timeframe increases
- Financial and Insurance Disclosures
  - Monitor requirements
- Airport and Regional Performance
  - Collaborate regionally
  - Review data to improve performance over time

RS&H

Many Factors Have Uncertainty

RS&H

The World, it is a changing – Will we plan for it?

NEPA, Climate Change, and Thinking Ahead

Jen Wolchansky

Mead & Hunt

How does NEPA currently address Climate Change?

- **August 2016**: Guidance issued for considering effects of climate change and GHG emissions

AMBIGUOUS

> ***"…where… tools, methodologies, or data inputs are not reasonably available to support calculations… agencies include a qualitative analysis in the NEPA document…"***

- **June 2019**: Draft guidance issued to provide updated interpretation of NEPA requirements

> ***Directs agencies to quantify emissions where they are "substantial enough to warrant quantification."***

STILL AMBIGUOUS

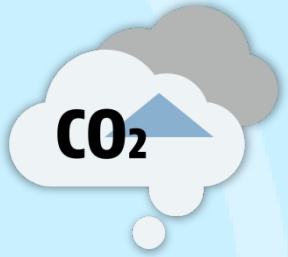
How does FAA NEPA policy address Climate Change?

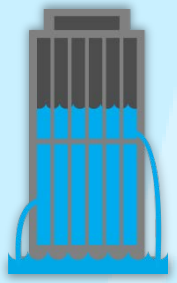
- **FAA Order 1050.1F - Environmental Impacts: Policies and Procedures**
  - Stand-alone Impact Category
- **1050.1F Desk Reference:**
  - Study Area
  - Quantitative vs Qualitative Analysis
  - No Significance Threshold

AVIATION SPECIFIC

"…it is clear that minimizing GHG emissions and identifying potential future impacts of climate change are important for a sustainable national airspace system…."

How do We Evaluate Climate Change Impacts?

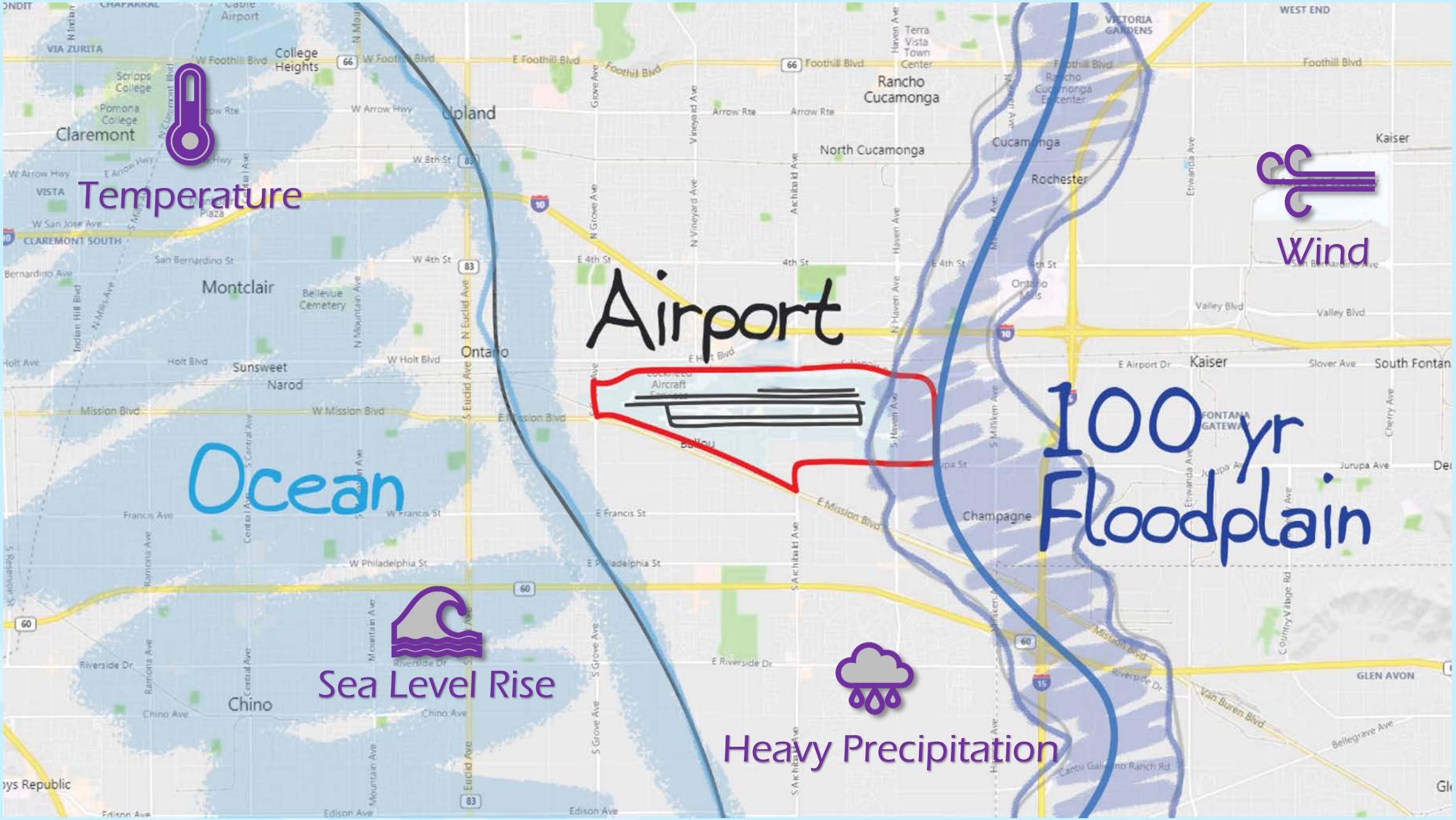




- The effect of a proposed project on climate change
- The effect of climate change on a proposed project.

How Can We Better Integrate Climate Change within the NEPA Process?

- Scoping
- Purpose and Need
- Environmental Consequences
- Alternatives
- External Influences


Temperature
Wind
Airport
Ocean
100 yr Floodplain
Sea Level Rise
Heavy Precipitation
Claremont
Upland
Rancho Cucamonga
North Cucamonga
Rochester
Montclair
Ontario
Sunsweet
Narod
Champagne
Chino
Kaiser
Foothill Blvd
Holt Blvd
Mission Blvd
Francis Ave
Riverside Dr
Chino Ave
Valley Blvd
Jurupa Ave
Edison Ave
GLEN AVON
WEST END
VICTORIA GARDENS

NEPA Process: *Scoping*

- Identification of Issues
- Agency Coordination
- Public Interest

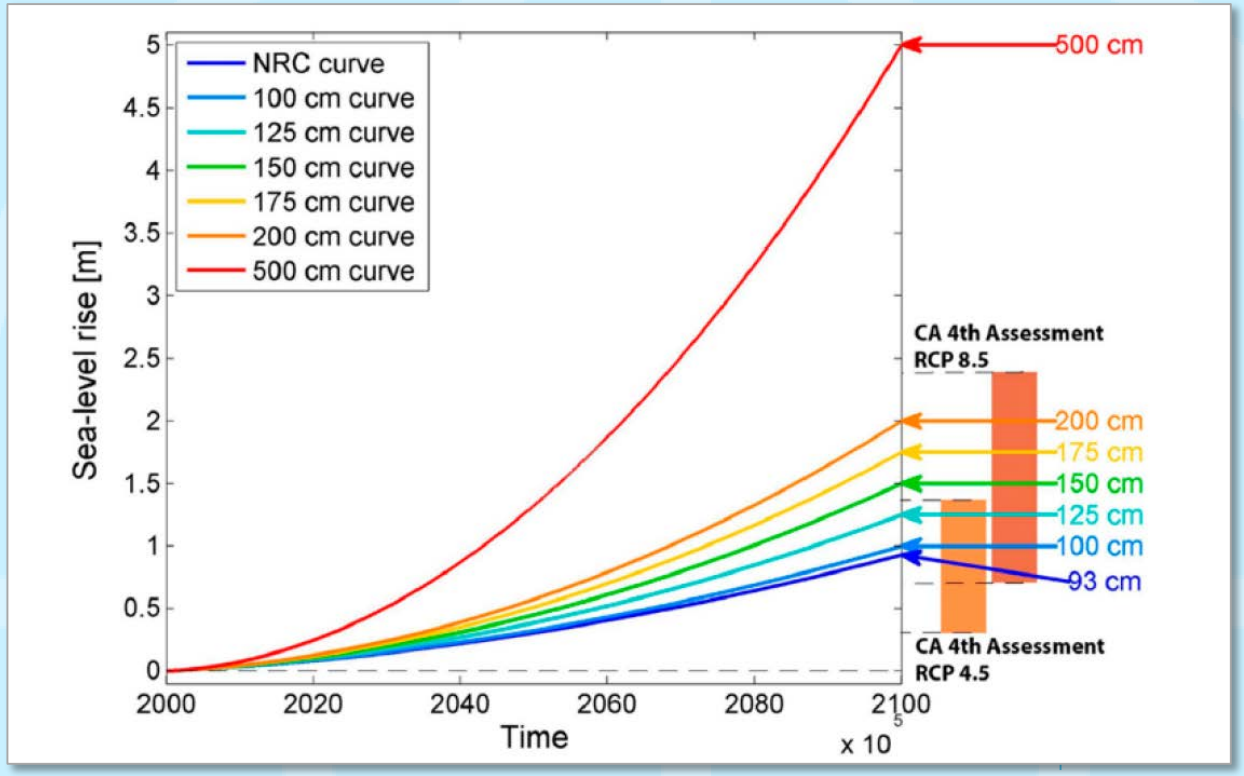
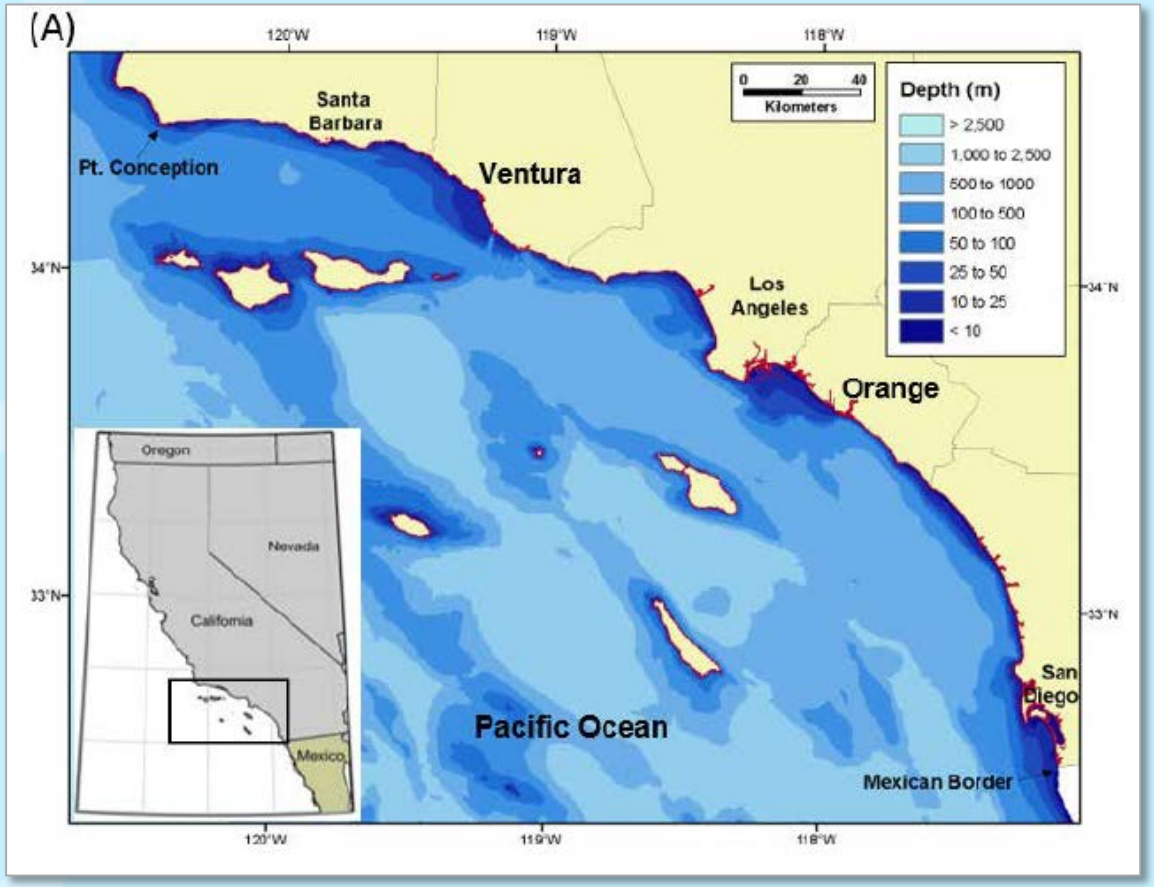
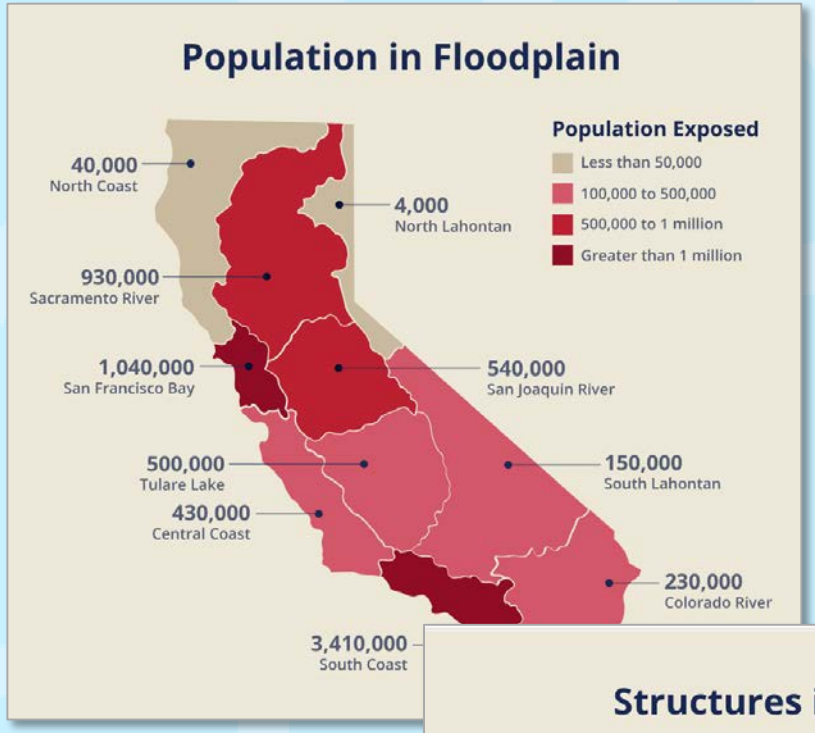


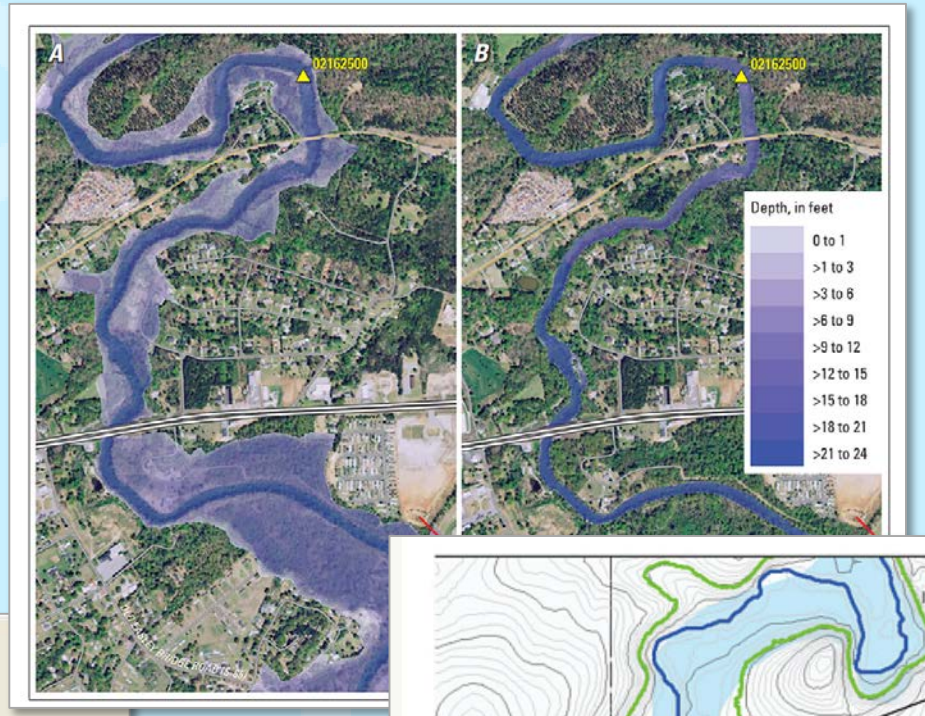
Table 7: Area (km²) flooded due to sea level rise and the 100-year projected coastal storm

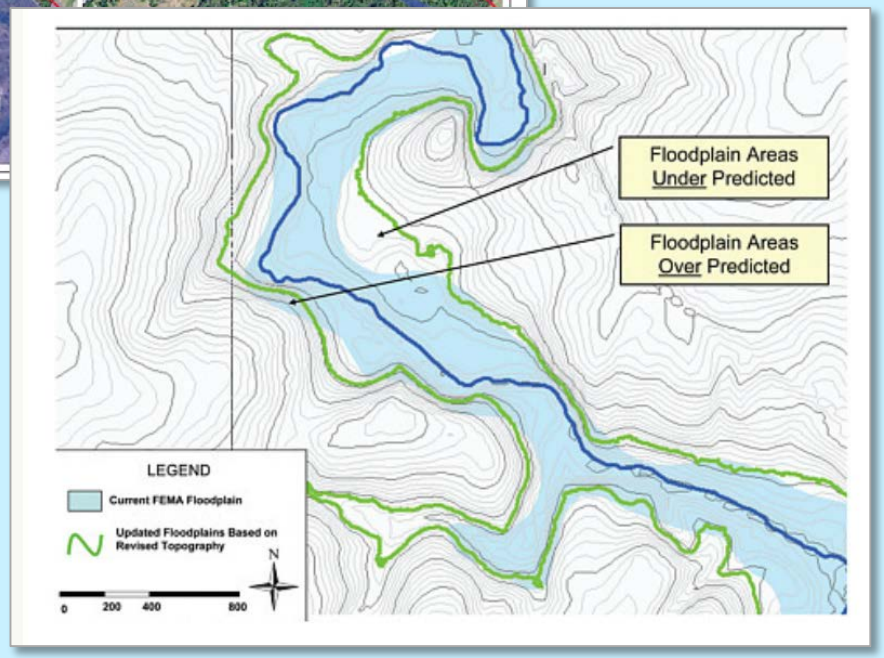
	Sea level rise (cm)								
County	**25**	**50**	**75**	**100**	**125**	**150**	**175**	**200**	**500**
Santa Barbara	7.0	7.4	7.8	8.6	9.3	10.1	13.1	15.9	21.0
Ventura	15.6	17.5	20.4	27.2	41.5	45.8	51.0	62.4	96.1
Los Angeles	6.8	10.4	13.2	16.3	19.2	23.1	28.6	39.0	97.7
Orange	4.8	9.8	12.9	21.1	26.2	30.7	54.0	58.8	105.1
San Diego	10.5	13.2	17.8	22.8	30.4	35.7	44.3	50.1	94.7



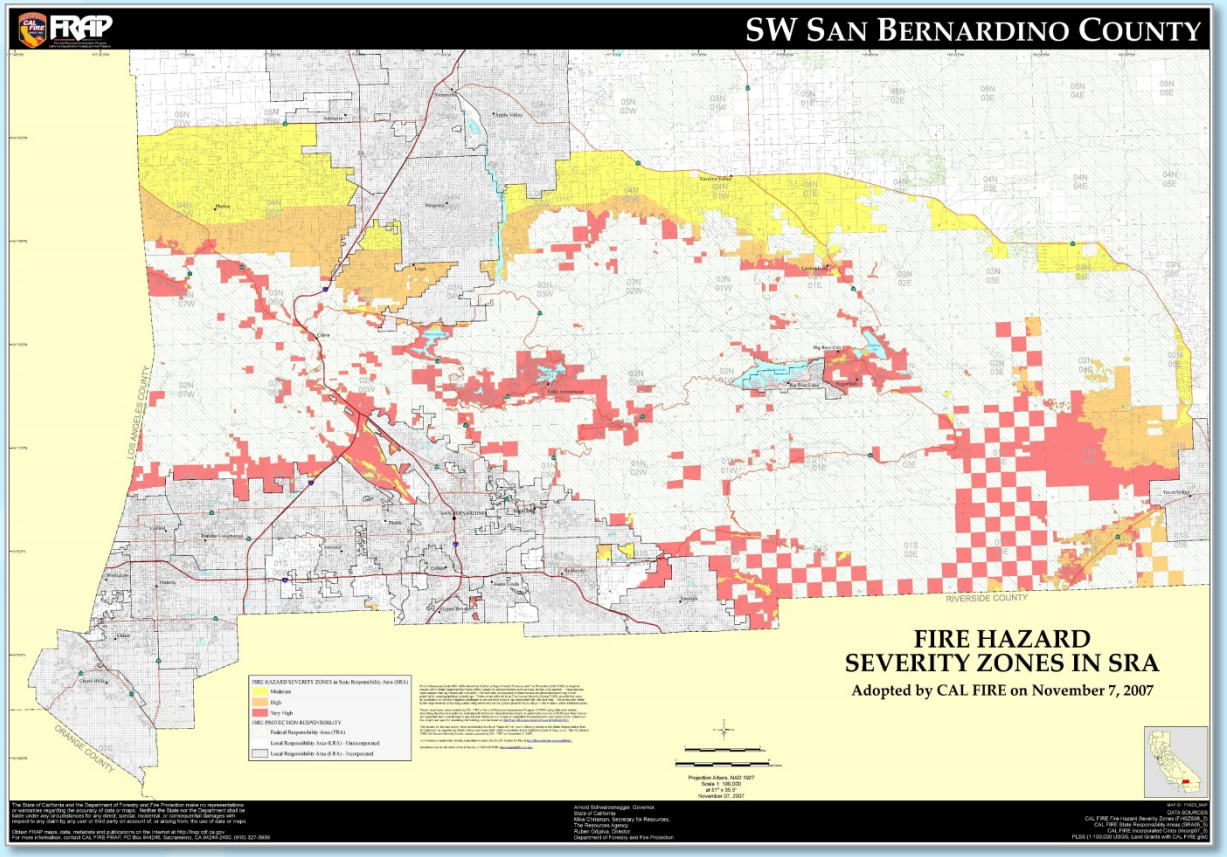
Source: Assessing and Communicating the Impacts of Climate Change on the Southern California Coast. *A Report for:* California's Fourth Climate Change Assessment, August 2018.







Sources: U.S. Army Corps of Engineers, California Department of Water Resources. U.S. Geological Survey (USGS) flood-inundation maps



Source: State of California Department of Forestry and Fire Protection, Fire and Resource Assessment Program.

NEPA Process:
Purpose & Need

- **Is it the "Right" Need?**
- **Is the Purpose Affected?**

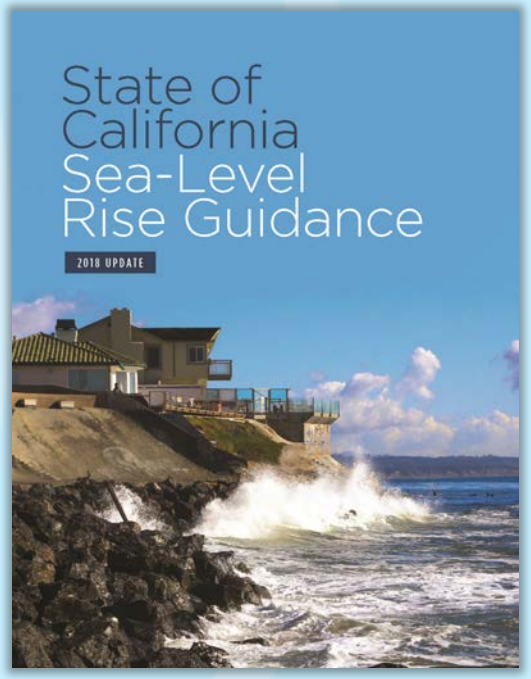
NEPA Process: *Environmental Consequences*

- ***Climate Science Data***
- **Increase in GHGs?**
- **Integration of climate change threats with project impacts?**

NEPA Process: *Alternatives Analysis*

- **Will climate change affect ability to meet purpose and need?**
- **Impact of project ON climate change**
- ***Climate adaptive design***

NEPA Process:
External Influences



- **Local, State, Regional Requirements**
- **Public Involvement**

What is our Responsibility?

Moody's Buys Climate Data Firm, Signaling New Scrutiny of Climate Risks

A damaged home in Mexico Beach, Fla., after Hurricane Michael last October.
Hector Retamal/Agence France-Presse — Getty Images

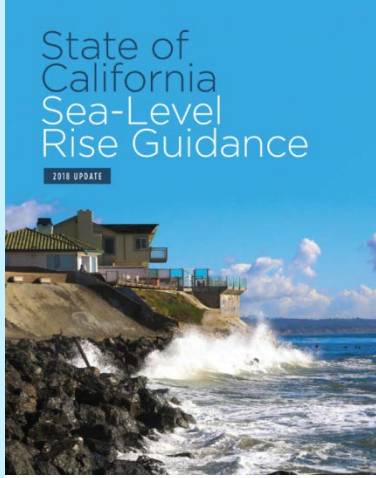
Thank You!

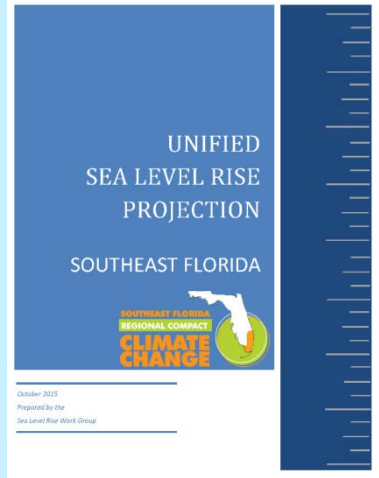
JEN WOLCHANSKY
Senior Environmental Planner, Mead & Hunt
Jen.Wolchansky@meadhunt.com

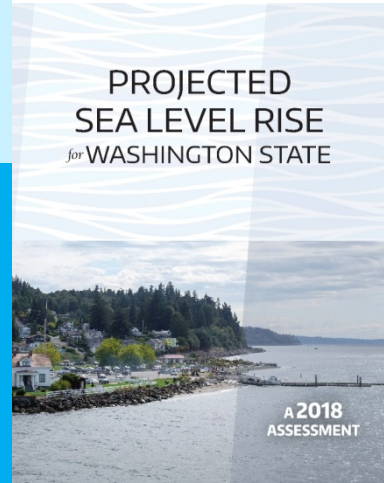
Mead &Hunt

Climate Science and Data Resources

- U.S. Climate Resilience Toolkit https://toolkit.climate.gov/
- FEMA https://www.fema.gov/climate-change
- IPCC https://www.ipcc.ch/data
- NOAA SLR Viewer: https://www.coast.noaa.gov/digitalcoast/tools/slr
  - Also identify state and regional sea level rise projections
- Downscaled climate data (e.g., CMIP, NASA, Cal-Adapt in California, others)








WHO WANTS TO BE A
MILLIONAIRE
WHO WANTS TO BE A

ACI's June 2018 *Resolution No. 3: Encouraging Airports to Take Action on Resilience and Adaptation to Climate Change*

Resolved which of the following?

A. Consider Steps to Reduce GHGs Emissions

B. Conduct Risk and Criticality Assessments

C. Consider Impacts in Airport Master Plans

D. All of the Above

What term is used to define the ability of an existing asset or operation to cope with the negative effects of climate change?

A. Adaptive Management

B. Critical Vulnerability

C. Adaptive Capacity

D. Asset Failure Effect

Which element of the Airport Master Planning Process is not likely affected by climate change?

A. Facility Requirements

B. Alternatives Development

C. Forecast

D. None of the Elements

At what step in the NEPA process should climate change first be considered?

A. Scoping

B. Purpose and Need

C. Alternatives

D. Env. Consequences

A runway extension project in Hot Desertville must take into account potential increases in temperature. What element in the NEPA process would this climate change consideration MOST affect?

A. Scoping

B. Purpose and Need

C. Alternatives

D. Env. Consequences

Which one of these external influences can ultimately drive the NEPA process in addressing climate change?

A. Local Requirement to conduct a CAP

B. Well Informed Public

C. Mandatory use of Resilient Design Guidelines

D. All of the Above

Climate impacts are best considered in which of the following documents?

A. A Sustainable Master Plan or Management plan

B. An Airport EMS

C. Airport Capital Improvement Plan

D. All Plans that the Airport Has

High water tables, increased intensity of storms, and more extreme hot days are considered what?

A. Unavoidable acts of God

B. Foreseeable impacts to consider in airport planning

C. Insurance terms

D. Engineering averages


WHO WANTS TO BE A
MILLIONAIRE
WHO WANTS TO BE A