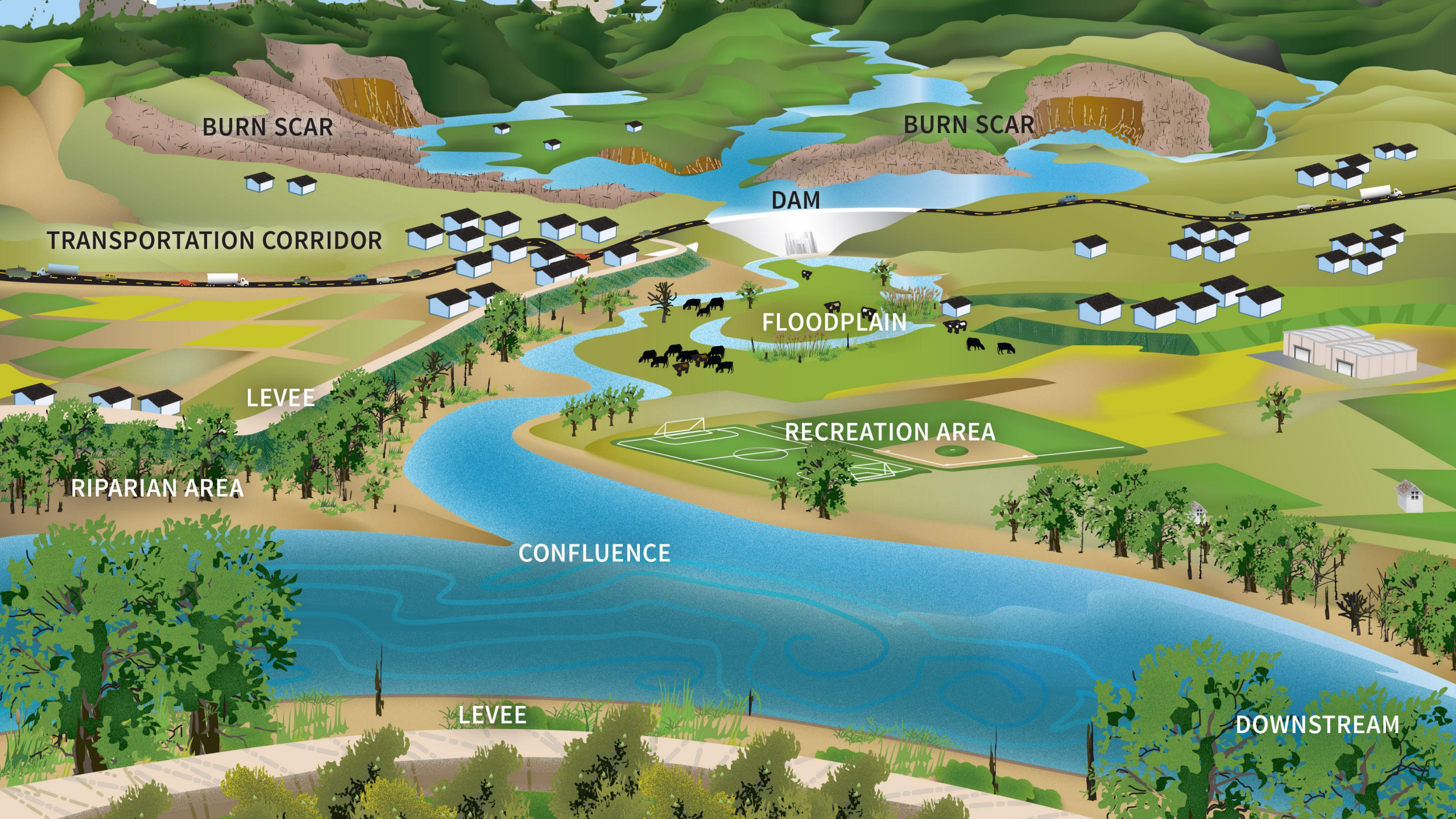
Flood Safety Stakeholder Technical Workshop

Friday April 22, 2022

CALIFORNIA NATURAL RESOURCES AGENCY


BURN SCAR
BURN SCAR
DAM
TRANSPORTATION CORRIDOR
FLOODPLAIN
LEVEE
RECREATION AREA
RIPARIAN AREA
CONFLUENCE
LEVEE
DOWNSTREAM


Riceton
Palermo
Vista Robles
East Biggs
Biggs
Peachton
Gridley
East Gridley
Robinsons Corner
Craig
Fagan

Meeting Facilitation

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Atmospheric Rivers, Major Flooding, and the 100-Year Flood Concept

OCAC Meeting, April 25, 2022

Dr. Michael L. Anderson, State Climatologist

Talk Overview

- Atmospheric Rivers (ARs) and California Water
- Components of Major Floods from ARs to Snow to Runoff
- The 100-year Flood – Statistical Estimates

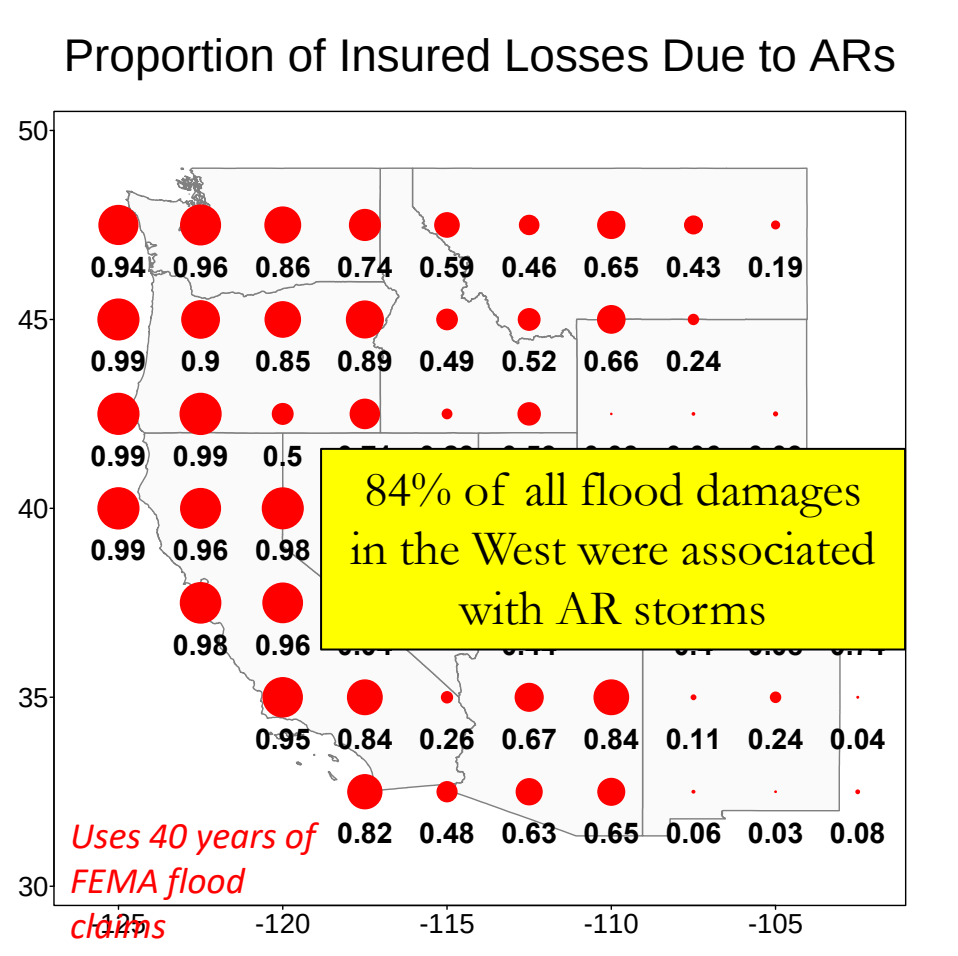
Atmospheric Rivers (ARs)

- Fist identified in 1998 with new satellite technology
- Hundreds of miles wide; thousands of miles long; how 90% of the water vapor moves through atmosphere in 10% of the area
- Interact with winter storms to cause heavy rains/snow in California – key to water supply and flooding

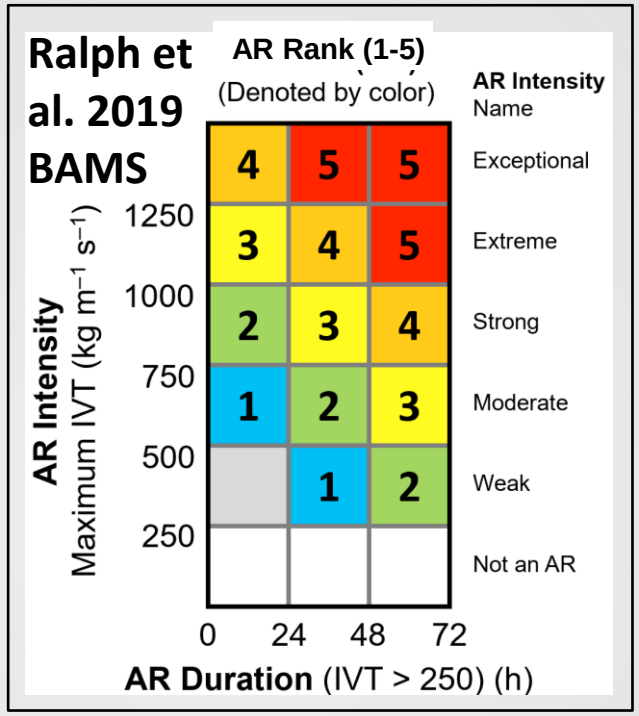
Characterizing an Atmospheric River

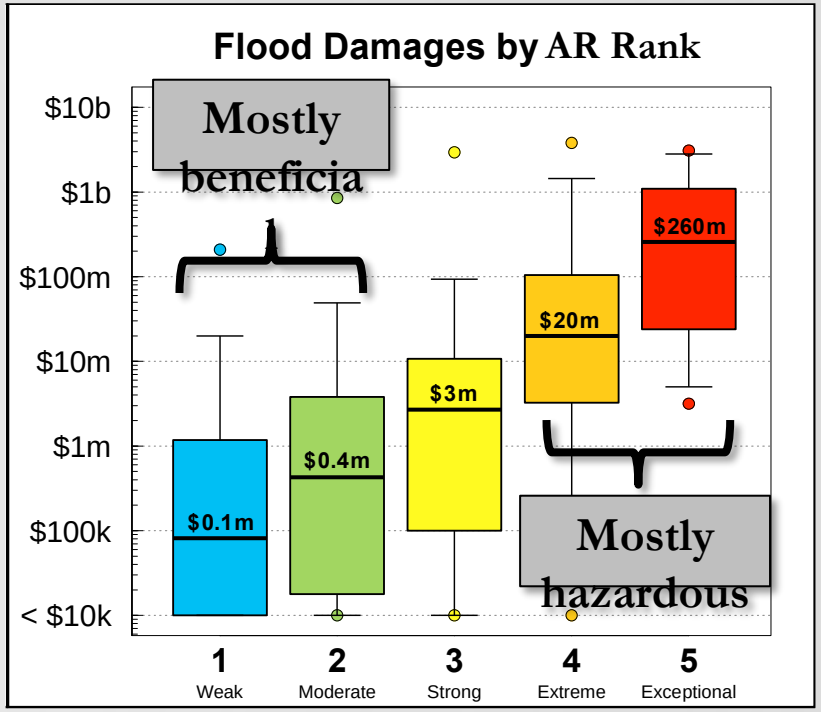
- How much water vapor moving in atmospheric river (Integrated Vapor Transport or IVT)
- Duration – how long is the atmospheric river overhead for a watershed
- Freezing Elevation – where rain turns to snow

ARs drive flood damages in the western U.S.



Corringham, Ralph, Gershunov, Cayan and Talbot, Sci. Advances (2019)





Corringham et al.2019, Science Advances

Flood damages increase exponentially with AR Category

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

Components of a Major Flood

- Prior conditions in watershed including snow
- Large atmospheric river or multiple atmospheric rivers (called atmospheric river families)
- Timing, pace and scale of storms impact the timing pace and scale of runoff
- Observations and forecasts play key roles in managing flood response

Sizing a Flood with Statistics

- The 100-year flood is really a flood that is estimated to have a 1% chance of being equaled or exceeded in any given year
- Sized based on the statistics of the largest independent flows in a given year for as many years as data is available

The 100-Year Flood

- The 100-year flood is a flow peak or volume of water (a threshold) that has a 1% chance of being equaled or exceeded in any given year.
- It is a threshold based on historical events to guide engineering design
- Federal guidelines outline methodologies called Bulletin 17 (currently on Bulletin 17c)

Scenarios and Systematic Evaluations

- Systematic Evaluations use statistical methods for different size floods to establish the threshold of performance of a system to determine a level of protection to meet regulatory or statutory requirements.
- Scenarios use a real or constructed event to evaluate how system and response functions handle that event. ARkStorm is a scenario.

Summary – Key Points

- Atmospheric Rivers (ARs) are key to floods and water supply – timing, pace, and scale determine benefit versus hazard.
- Observations and forecasts key to maximizing benefits and minimizing hazard of AR driven floods.
- Flood evaluations use systematic evaluation of historical statistics (100-year flood) as well as scenario events (ARkStorm).

Q&A

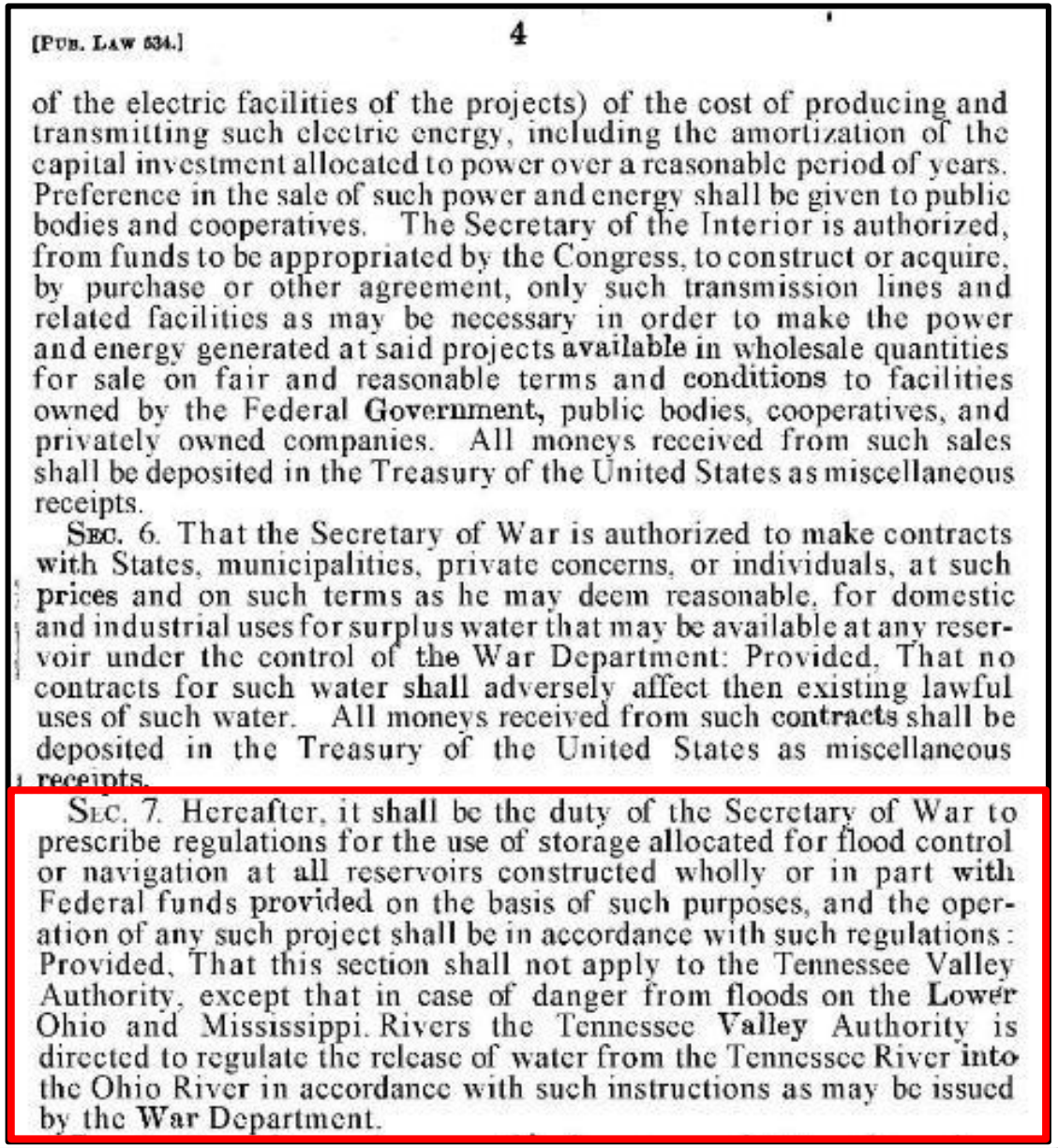
USACE AUTHORITY FOR FLOOD OPS

- Section 7 of the Flood Control Act of 1944 (58 Stat. 890, 33 U.S.C. 709)

- Prescribe flood control rules and regulations for all reservoirs where:

Flood control is an authorized purpose

Reservoir was constructed using Federal funds



[PUB. LAW 534.] 4

of the electric facilities of the projects) of the cost of producing and transmitting such electric energy, including the amortization of the capital investment allocated to power over a reasonable period of years. Preference in the sale of such power and energy shall be given to public bodies and cooperatives. The Secretary of the Interior is authorized, from funds to be appropriated by the Congress, to construct or acquire, by purchase or other agreement, only such transmission lines and related facilities as may be necessary in order to make the power and energy generated at said projects available in wholesale quantities for sale on fair and reasonable terms and conditions to facilities owned by the Federal Government, public bodies, cooperatives, and privately owned companies. All moneys received from such sales shall be deposited in the Treasury of the United States as miscellaneous receipts.

SEC. 6. That the Secretary of War is authorized to make contracts with States, municipalities, private concerns, or individuals, at such prices and on such terms as he may deem reasonable, for domestic and industrial uses for surplus water that may be available at any reservoir under the control of the War Department: Provided, That no contracts for such water shall adversely affect then existing lawful uses of such water. All moneys received from such contracts shall be deposited in the Treasury of the United States as miscellaneous receipts.

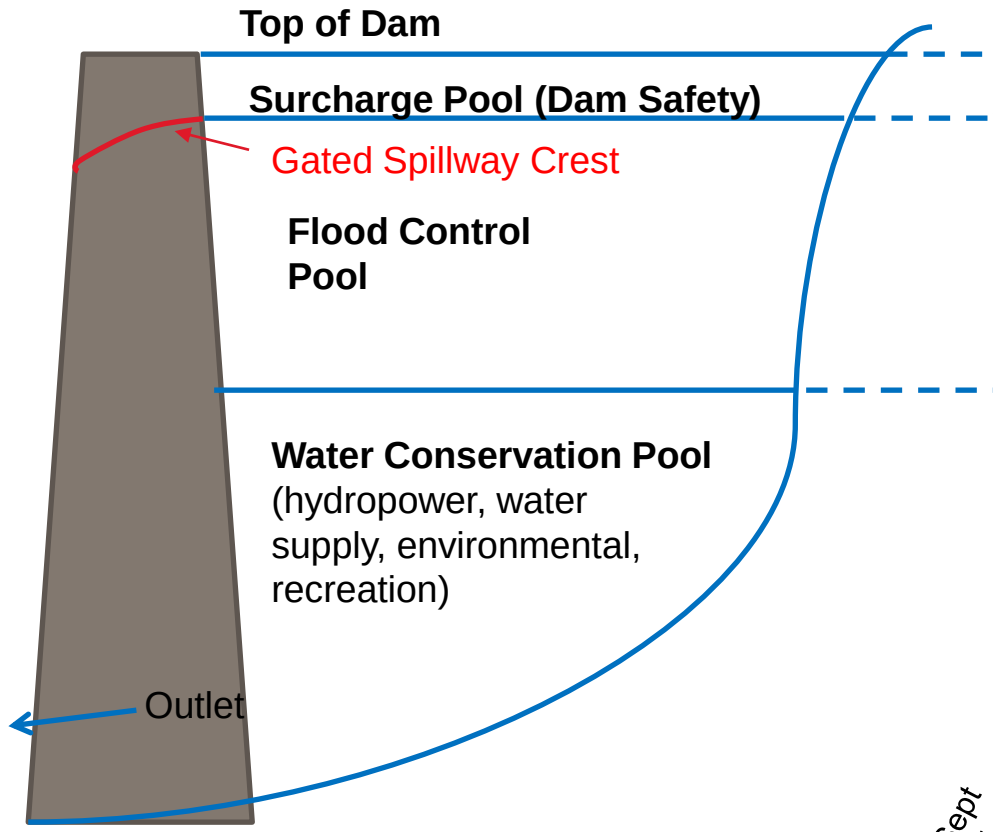
SEC. 7. Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations: Provided, That this section shall not apply to the Tennessee Valley Authority, except that in case of danger from floods on the Lower Ohio and Mississippi Rivers the Tennessee Valley Authority is directed to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the War Department.

Usace wm activities – Oroville dam

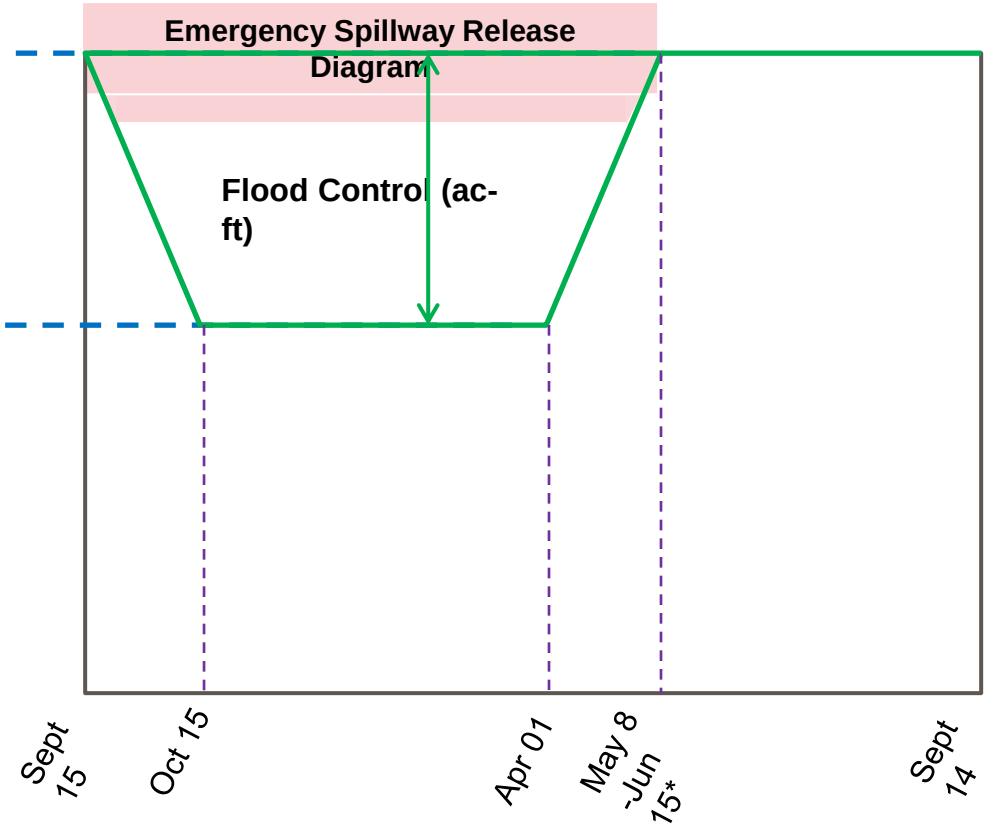
- Oversee flood operations
- Establish operating rules for flood control
- Update water control manuals
- Prepare deviation packages

RESERVOIR OPERATING ZONES

Simplified picture of Oroville Dam-Lake



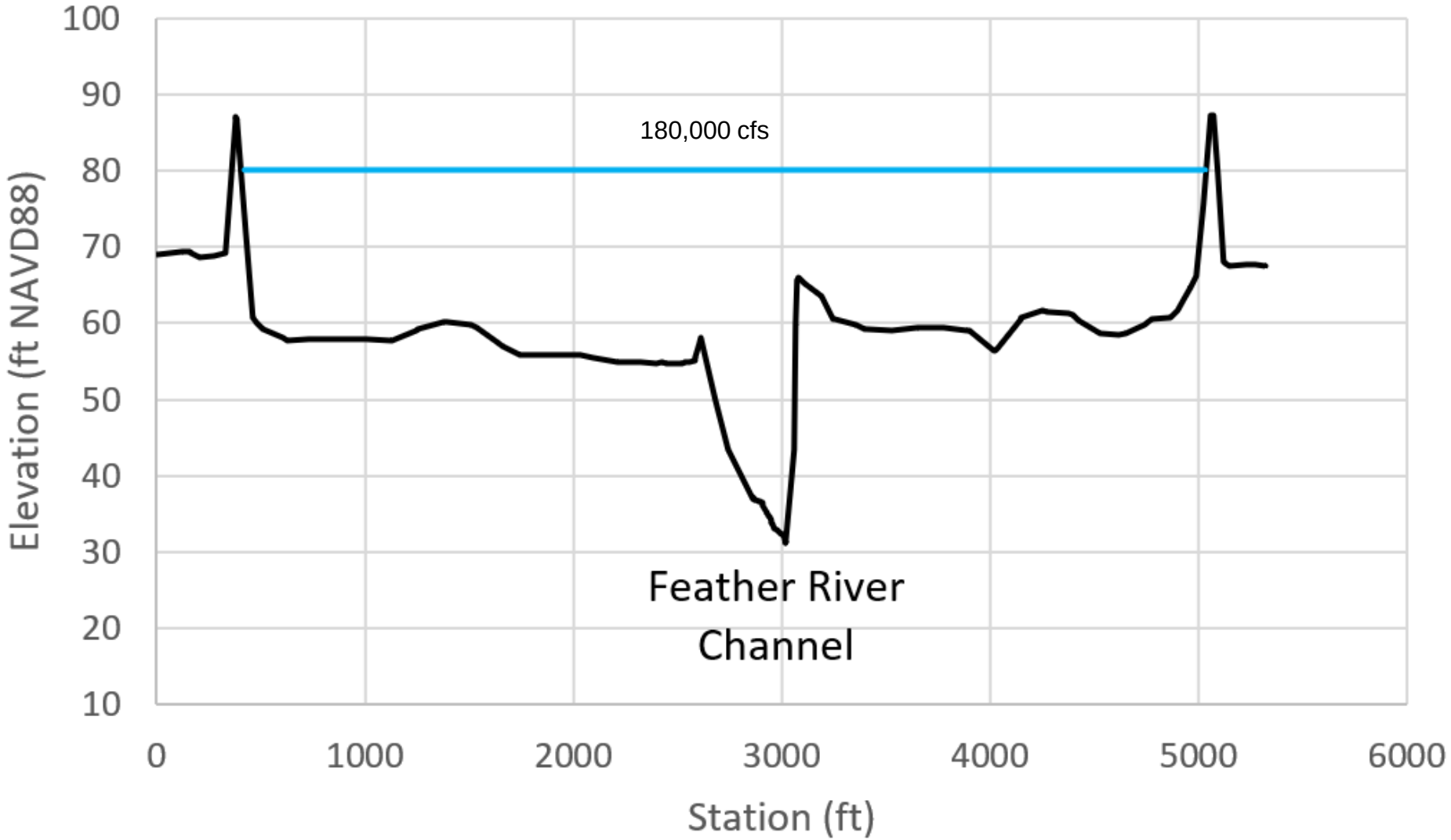
Simplified Water Control Diagram for Oroville Dam-Lake



Note: NOT TO SCALE

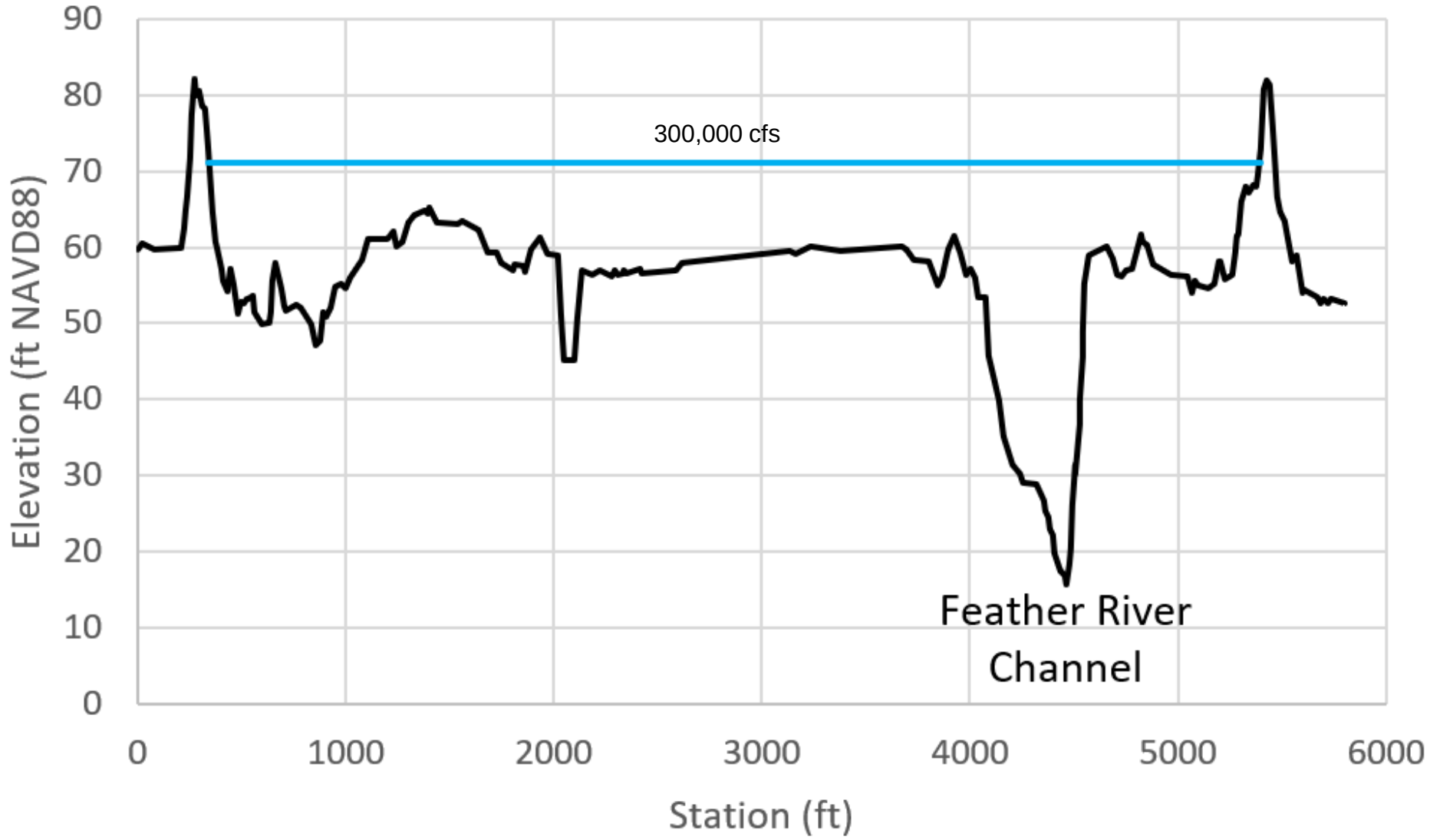
*Varies based on wetness parameter

Oroville dam – d/s objective flows



Feather River between Honcut Creek and Yuba River confluence (RM 32.25)

Oroville dam – d/s objective flows

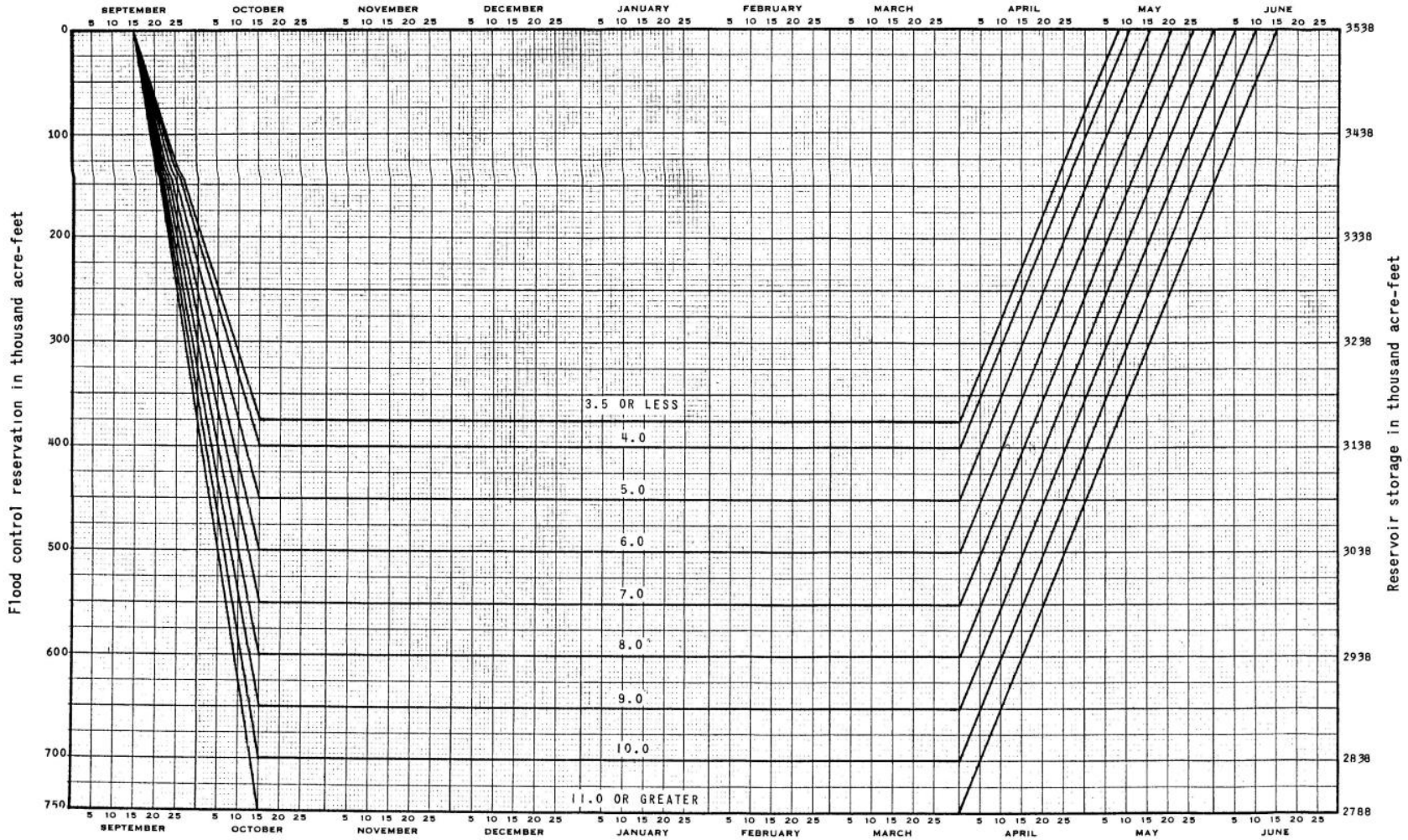


Feather River between Yuba River confluence and Bear River confluence (RM 25.0)

Oroville dam – d/s considerations

Source: California Department of Water Resources [State Plan of Flood Control Descriptive Document]

Oroville dam-lake wcd



USE OF DIAGRAM

1. Parameters are computed daily from the weighted accumulation of seasonal basin mean precipitation by multiplying the preceding day's parameter by 0.97 and adding the current day's precipitation in inches.

2. Except when releases are governed by the emergency spillway release diagram currently in force (File No. 4-13-586), water stored in the flood control reservation, defined hereon, shall be released as rapidly as possible, subject to the following conditions:

   a. That releases are made according to the release schedule hereon.

   b. That flows in Feather River above Yuba River do not exceed 180,000 c.f.s.

   c. That flows in Feather River below Yuba River do not exceed 300,000 c.f.s.

   d. That flows in Feather River below Bear River do not exceed 320,000 c.f.s. insofar as possible.

   e. That releases are not increased more than 10,000 c.f.s. or decreased more than 5,000 c.f.s. in any 2 hour period.

RELEASE SCHEDULE

ACTUAL OR FORECAST INFLOW (WHICHEVER IS GREATER) c.f.s.	FLOOD CONTROL SPACE USED ac-ft	REQUIRED RELEASES c.f.s.
0 - 15,000	0 - 5,000	Power Demand
0 - 15,000	Greater Than 5,000	Inflow
15,000 - 30,000	0 - 30,000	Lesser of 15,000 or maximum inflow
0 - 30,000	Greater Than 30,000	Maximum inflow for flood
30,000 - 120,000	- - - - - - - -	Lesser of maximum inflow or 60,000 c.f.s.
120,000 - 175,000	- - - - - - - -	Lesser of maximum inflow or 100,000 c.f.s.
Greater Than - 175,000	- - - - - - - -	Lesser of maximum inflow or 150,000 c.f.s.

OROVILLE DAM AND RESERVOIR
FEATHER RIVER, CALIFORNIA

FLOOD CONTROL DIAGRAM

Prepared Pursuant to Flood Control Regulations
For Oroville Dam and Reservoir

APPROVED: _____
Major General, USA, Director of Civil Works

APPROVED: _____
Director, Department of Water Resources

Effective Date: _____ File No.: 4-13-585

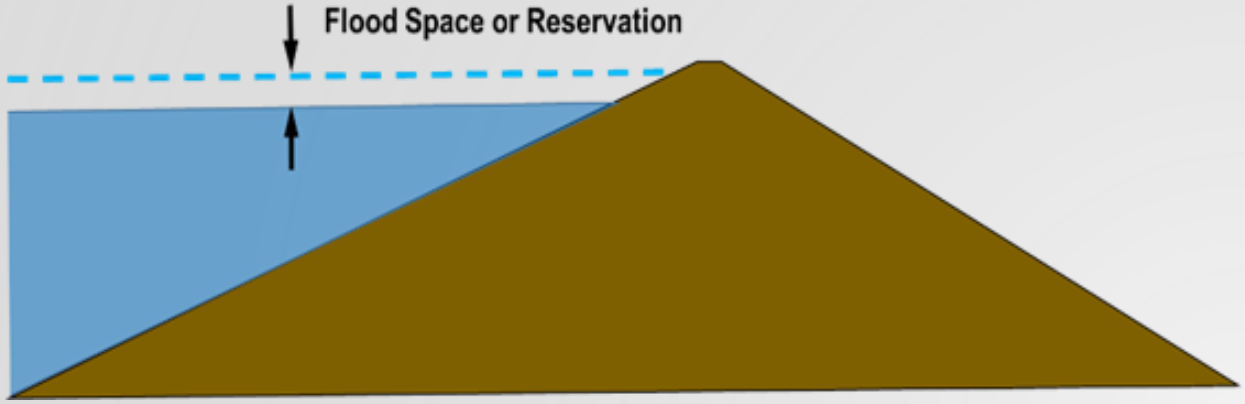
Q&A

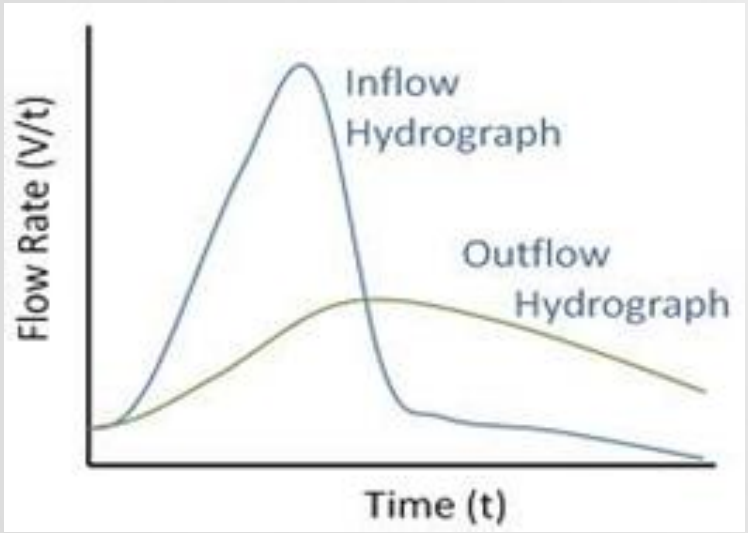
Role of Oroville Dam in Flood Management

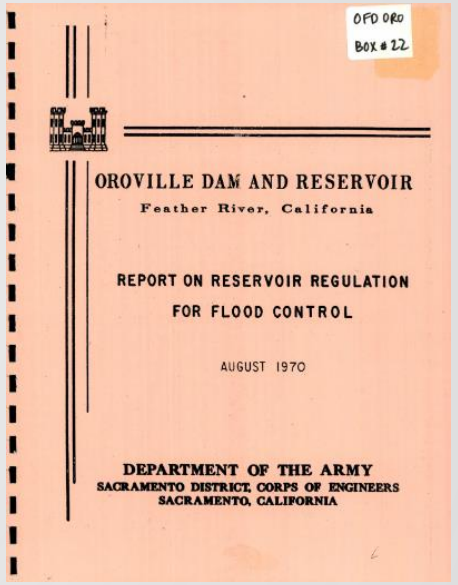
April 22, 2022

John Yarbrough
Assistant Deputy Director- State Water Project

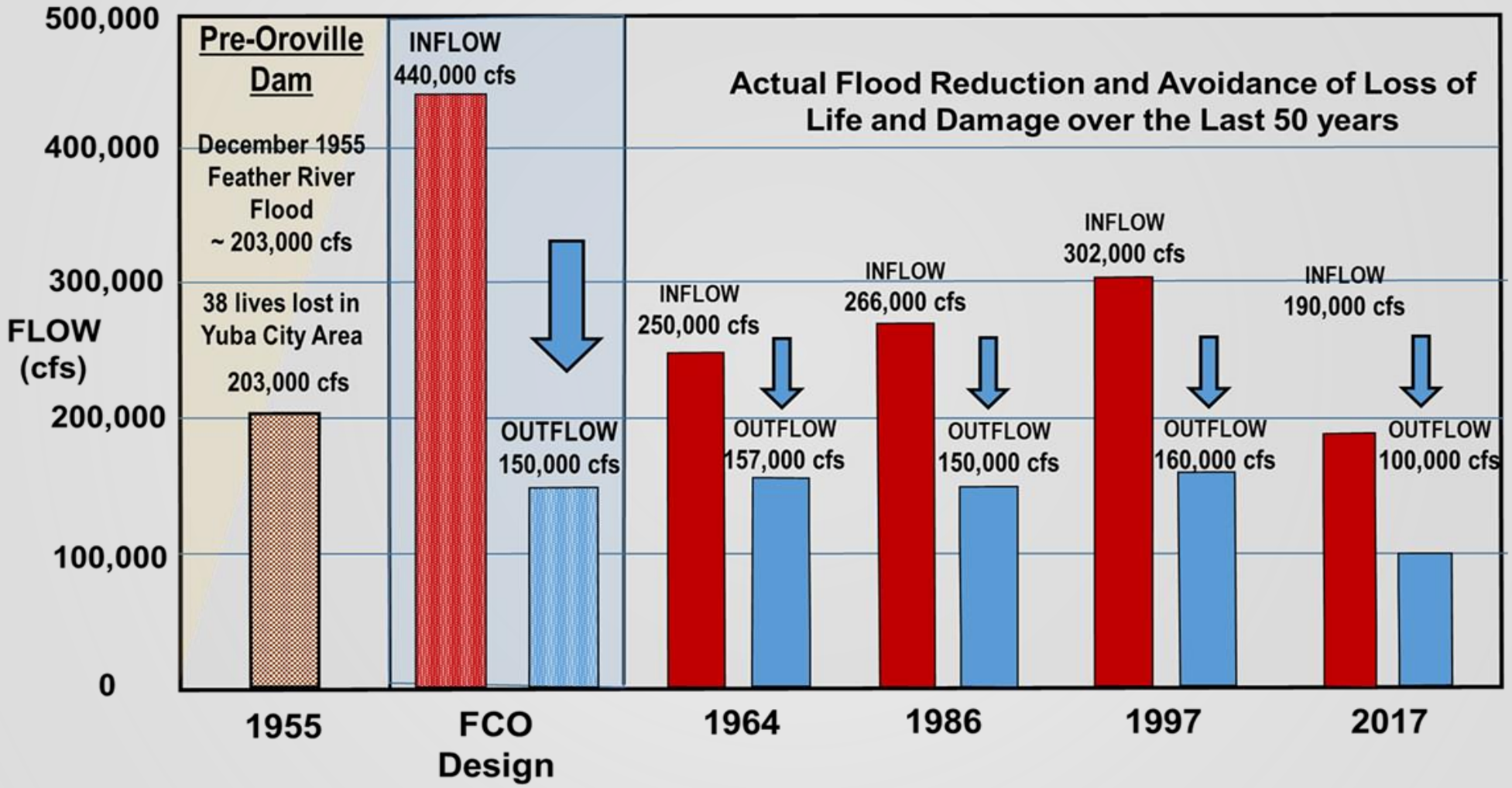
Flood Management from Dams







Flood Operations at Oroville



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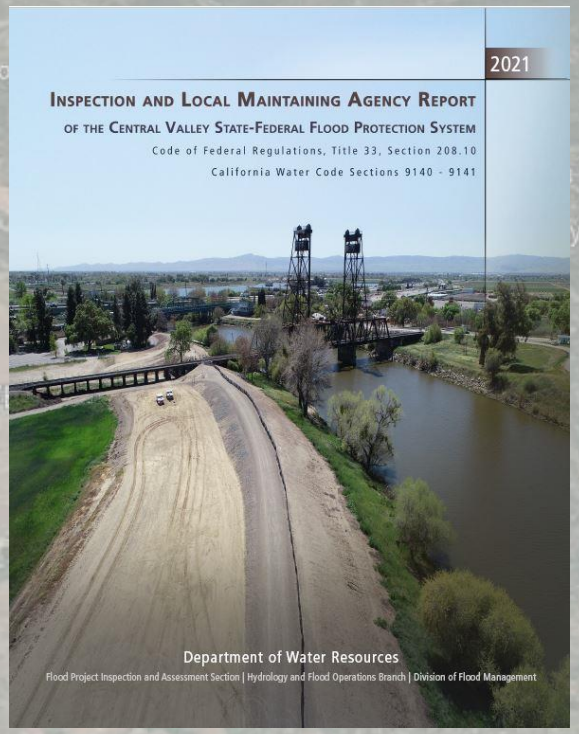
Q&A

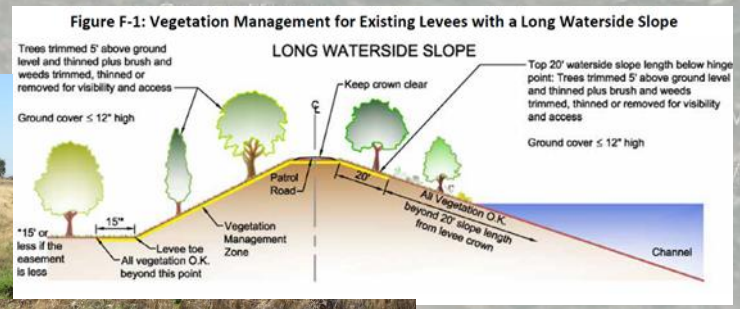
DWR Inspections

- DWR Bi-annual Levee Inspections
- Annual Inspection of:
  - Structures, Pumping Plants, Channels
- Utility Inspections
- Annual Designated Floodway Inspection
- Flood Fight Training And Response
- High Water Staking



Bi-Annual Levee Inspections

- Levee Inspections Performed Spring And Fall
  - Inspected For:
    - Erosion
    - Cracking
    - Animal Burrowing Activity
    - Sloughing Or Instability
    - Trash And Debris
    - Vegetation, Etc.



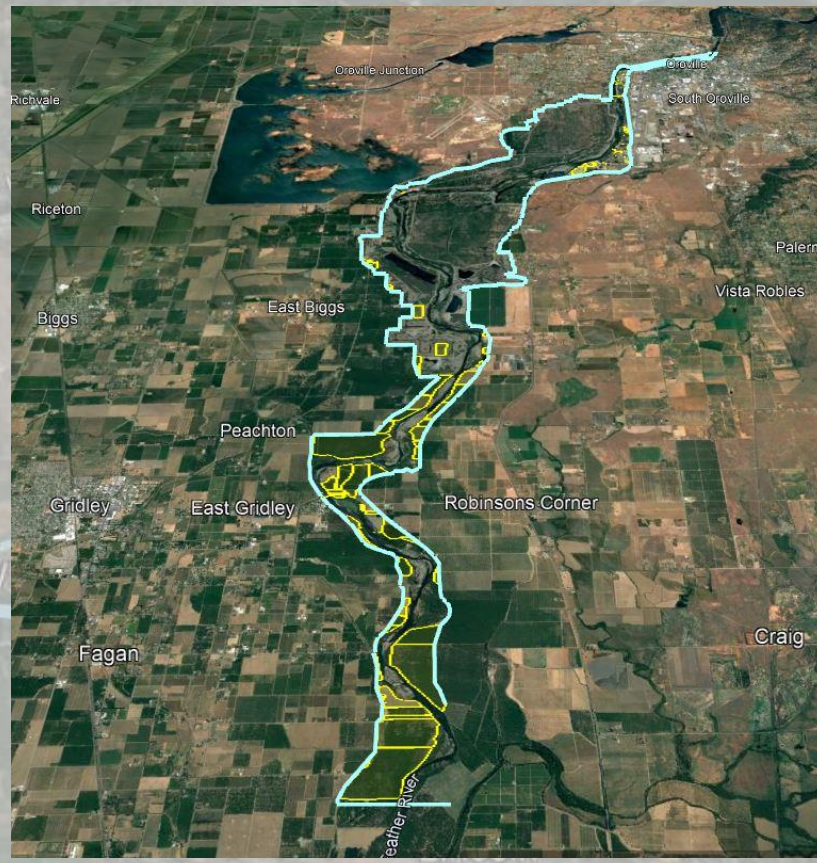
- Reports Provided To Local Maintaining Agencies, The CVFPB And The USACE

Utility Inspections

- Pipes Through The Levees
- Every 5-years
- External Inspections
  - Identify And Report
    - Broken
    - Severely Corroded
    - Missing/Broken Closure Devices
    - Leaks Causing Erosion
- Reports Provided To Local Maintaining Agencies, The CVFPB And The USACE

Designated Floodway Inspections

- Aerial Imagery Review Of Delineated Sections Of Floodways
- Identifies Unauthorized Encroachments
- Reported To The CVFPB
- Helps To Reduce Impact To Capacity Of The Floodway



Flood Fight Training And Response

- Inspectors Teach Flood Fight Skills And Techniques
- Classes Provided Upon Request
- During A Flood Fight, Our Specialists Provide Technical Support When Requested
- Advanced Flood Fight measures

High Water Staking

- Survey Of High-water Marks Throughout The Affected River
- Can Be Used To Update Existing Models Or Validate New Models
- FPIAS Can Perform High Water Staking Upon Request
- Feather River High Water Surveyed after 2017

Q&A

FEMA Floodplain Mapping

- **Risk MAP Discovery and Resiliency Planning**
- **Acquisition of New Topographic Data**
- **New Hazard Studies & Flood Map Revisions**
- **Questions & Answers**

https://msc.fema.gov/nfhl (National Flood Hazard Layer)

FEMA Mapping & Insurance eXchange (FMIX)
FEMA-FMIX@fema.dhs.gov
1-877-336-2627 or live chat (6am to 2pm PT)

FEMA Steps & Engagement Process

RiskMAP Project Lifecycle

Flood Risk Project Production and Mapping Activities

Q&A

Considerations for Safe and Reliable Flood Management in face of Climate Change

Dr. R. Storesund, PE., GE,
Executive Director, UC Berkeley's Center for Catastrophic Risk Management

April 22 2022

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About Rune

- Dual Degree Program UC Santa Cruz/UC Berkeley
  - BA Anthropology (UC Santa Cruz)
  - BS Civil Engineering (UC Berkeley)
- Masters in Geotechnical Engineering (UC Berkeley)
- Doctorate in Civil Systems (UC Berkeley)

- Executive Director, UC Berkeley's Center for Catastrophic Risk Management
- Consulting Engineer, Storesund Consulting
- President & CEO, NextGen Mapping, Inc. (Software Development)
- President & CEO, Storesund Construction, Inc. (Class A, B, C-57)
- President & Director, SafeR^3 (Non-Profit)
- Adjunct Professor, Memorial University of Newfoundland

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS REGION 9

Storesund Consulting

Safety • Risk-Reduction • SafeR^3 • Resilience • Reliability

StoresundConstruction

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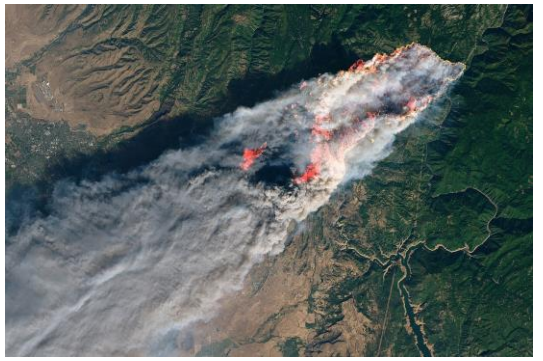
My Disaster Research

- 1986 NASA Challenger
- 2003 NASA Columbia
- 2005 Hurricane Katrina
- 2010 San Bruno PGE Explosion
- 2010 Deepwater Horizon
- 2014 Oso Landslide (WA State)
- 2015 Aliso Canyon Gas Leak
- 2017 Oroville Dam Spillway Failure
- 2017 US Navy Ship Collisions
- 2018 California Wildfires (Butte County)
- 2019 Brumadinho Landslide
- 2019 Boeing 737 MAX
- 2020 Michigan Dam Failures
- 2021 Surfside Condo Collapse
- 2018 to ??? Millennium Tower (ongoing)



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Intriguing Terms

- Extreme Event – period of record; confidence interval?
- Risk – what is the Pf? and Cf? we're talking about?
- Residual Risk – what have we/have we not looked at?

My research finds there is no shared understanding or communication of these terms…mean different things to different people.

For infrastructure, my first question is always "what was it supposed to do?" Turns out, systems are rarely 'overwhelmed'….

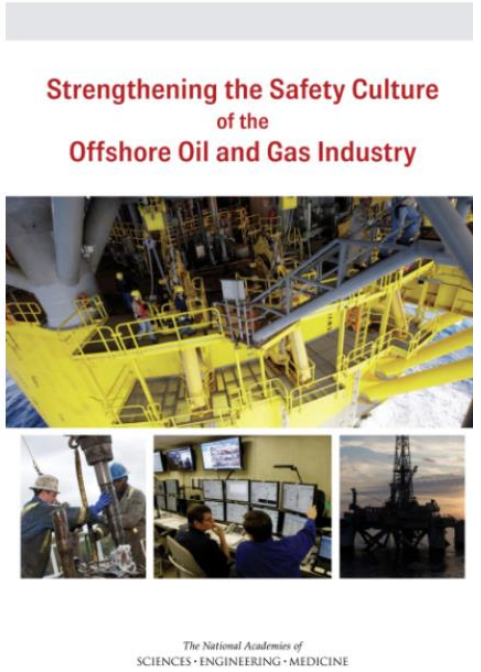
They tend to fail in 'under-whelming' conditions

What is “Safe”?

High Reliability Organizations (HROs)

- Have a clear and explicit concept of “reliability” that is shared consistently across the organization
- Highly integrated reliability and safety-minded organizational culture (widely held assumptions, attitudes, values, and practices)
- Recognize and utilize “uncertainty” as a formal resource
- Use ‘precursor conditions’ as proactive risk-reduction approaches
- Embrace and support “Reliability Professionals”
- Exhibit a strategic degree of organizational flexibility
- Are constantly on the lookout for errors

Deepwater Horizon



Organizational Safety Culture Traits

- Inquiring attitude
- Hazard identification and risk management
- Leadership commitment to safety values and actions
- Effective safety and environmental communication
- Respectful work environment
- Environment of raising concerns
- Personal accountability
- Work processes
- Continuous improvement

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Risk Management Frameworks

Event Types

	Knowable	Unknowable
Preventable	"Probabilities" "Possibilities" Today's Focus!!	"Prevention Through People"
Unpreventable	Risk Transfer Risk Acceptance	Mindfulness

Risk Management and Socio-Technical Systems

Risk Management in systems designed, operated, and managed by people.

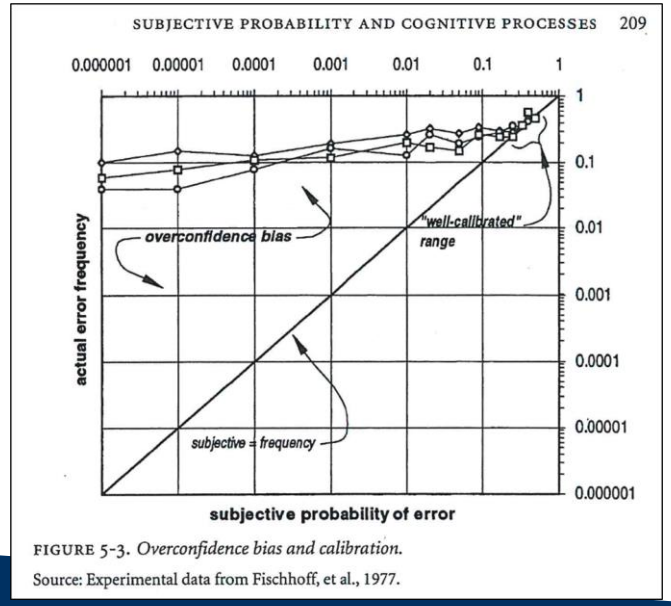
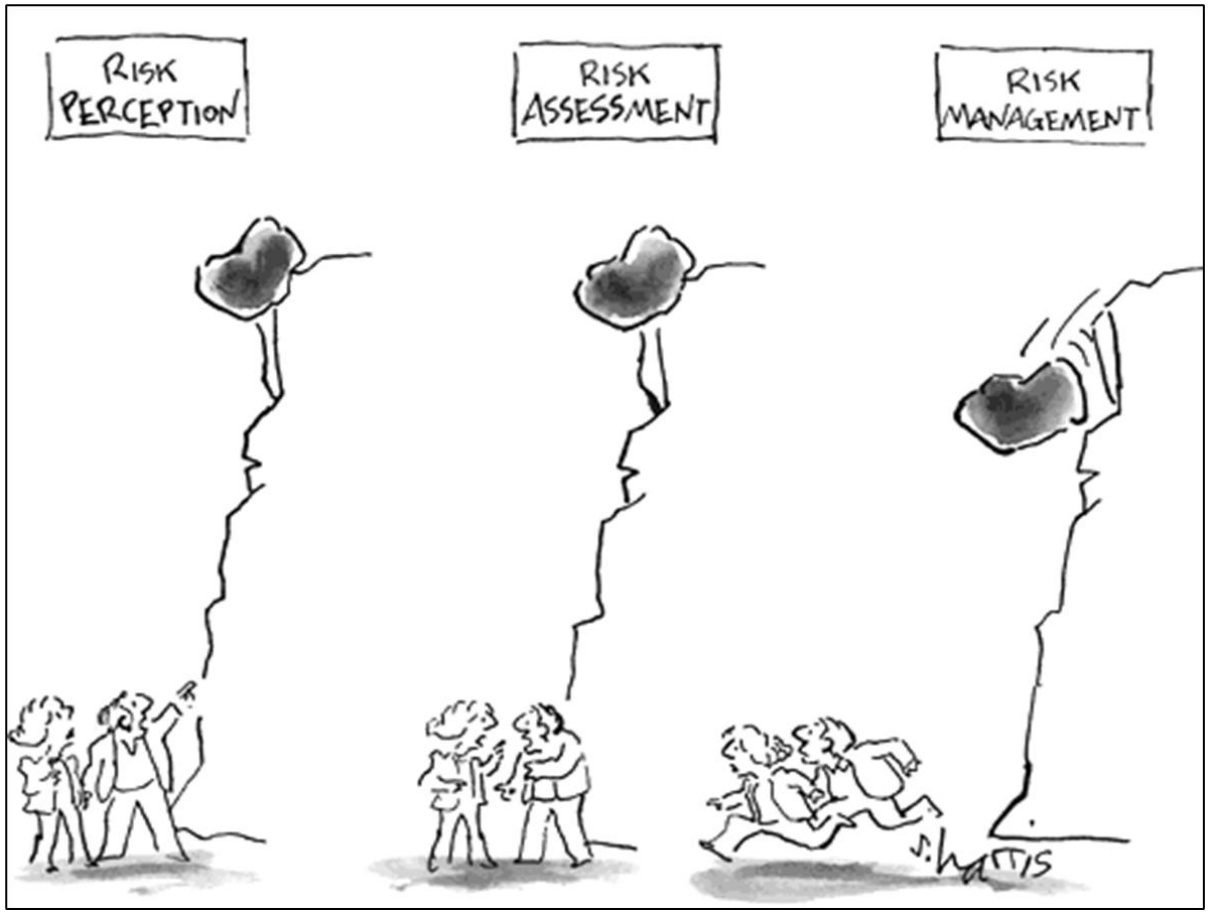


FIGURE 5-3. *Overconfidence bias and calibration.*

Source: Experimental data from Fischhoff, et al., 1977.



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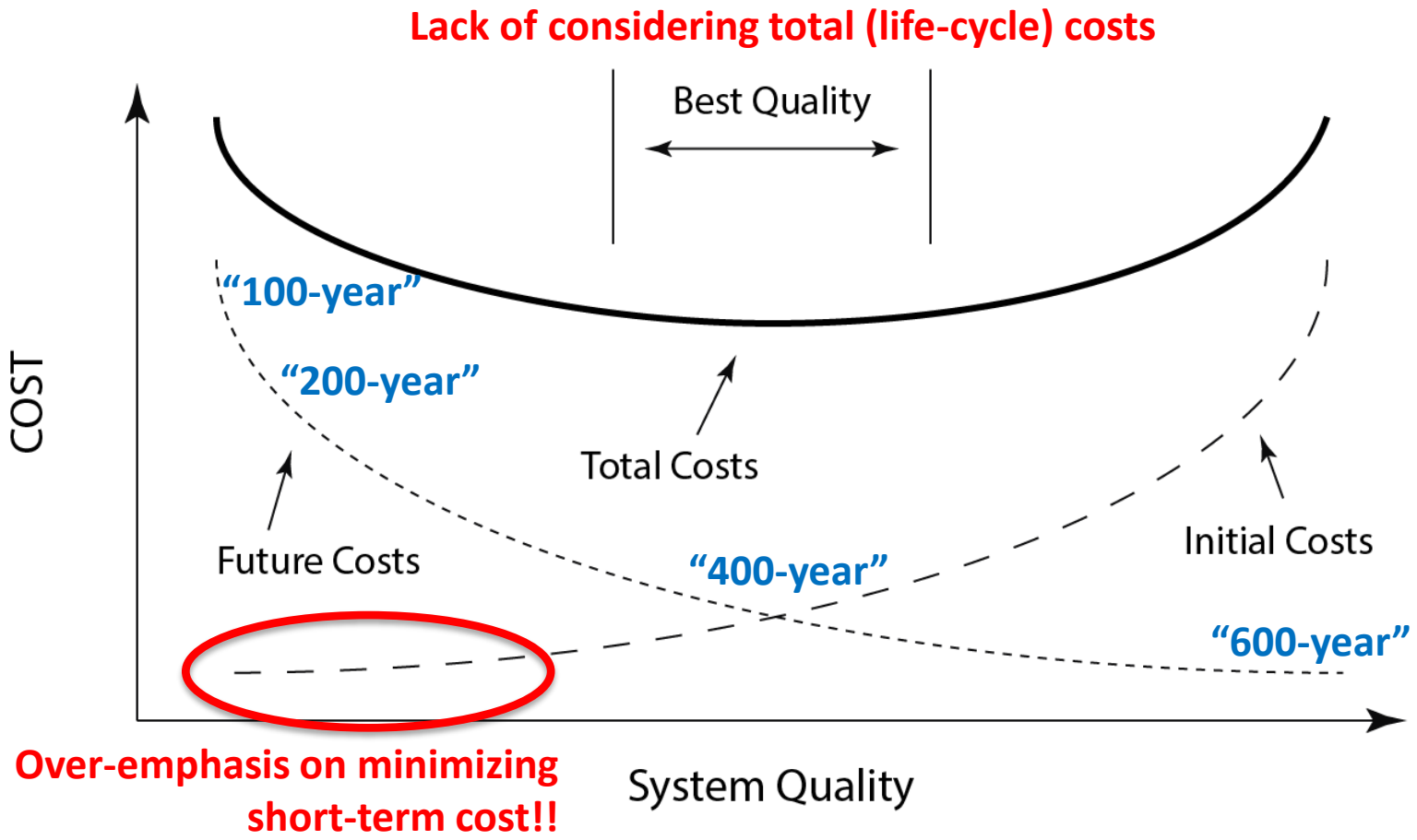
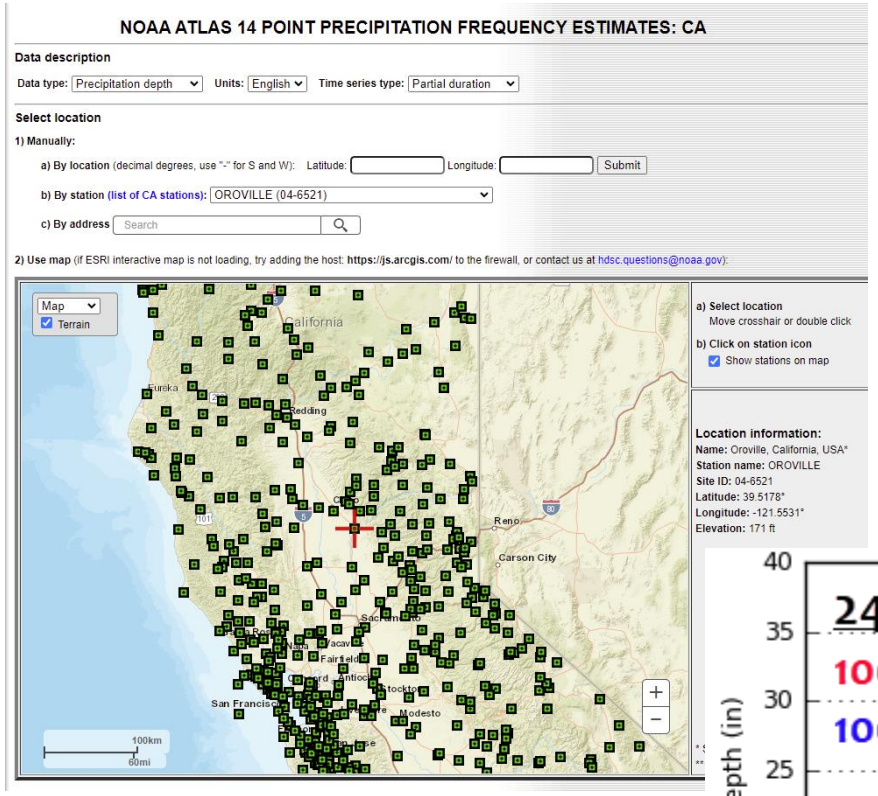
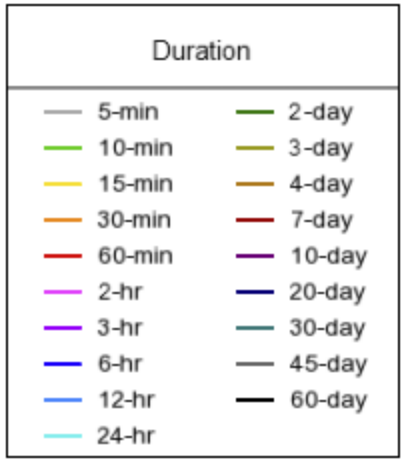
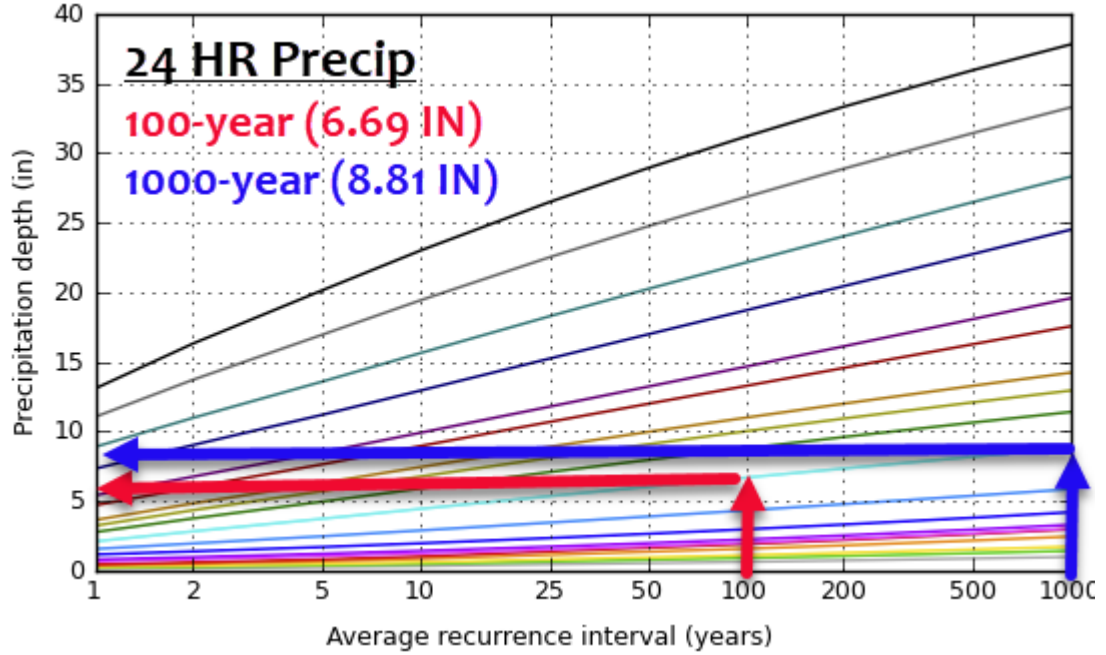
Investment Decisions









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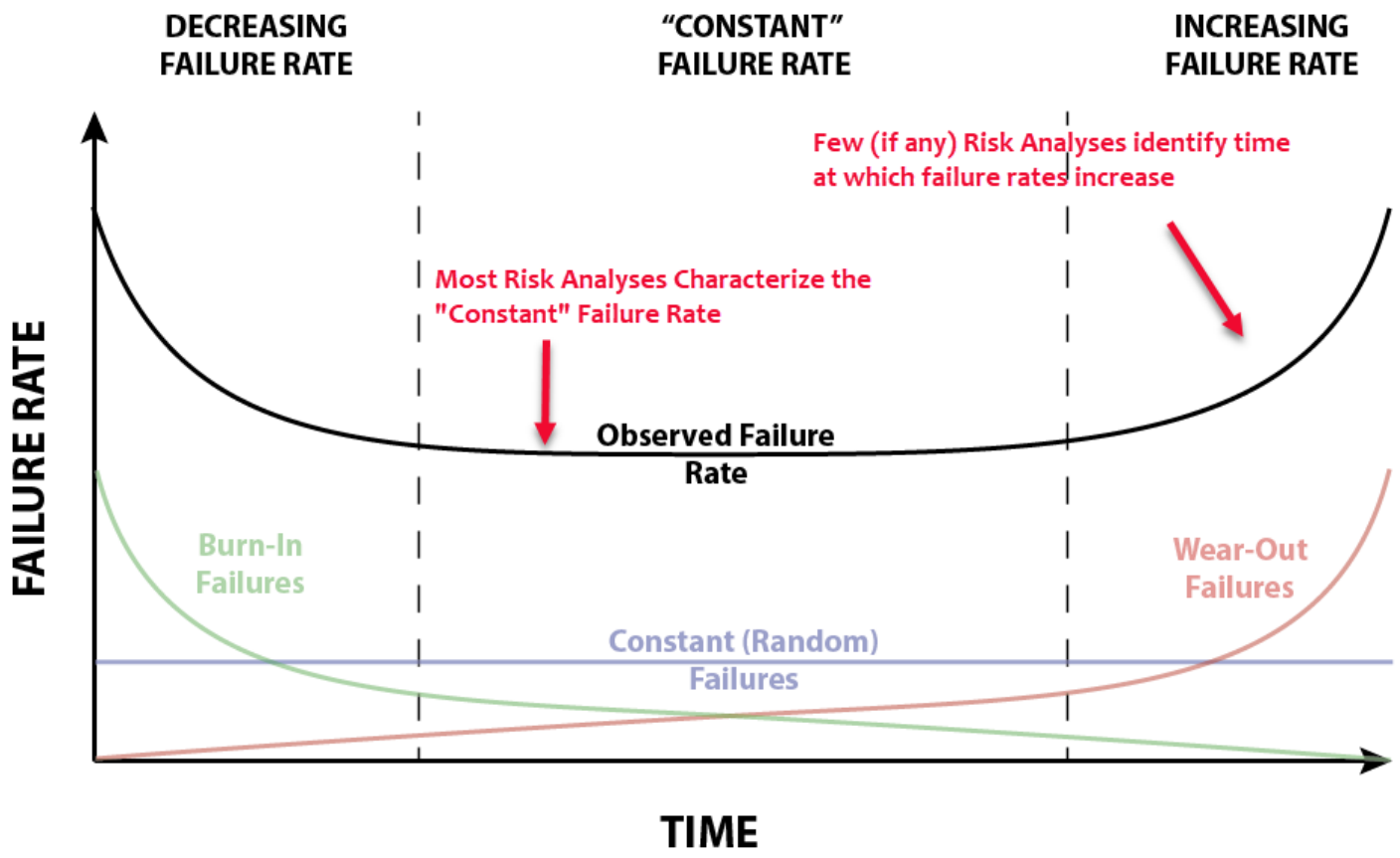
Failure is Time-Dependent



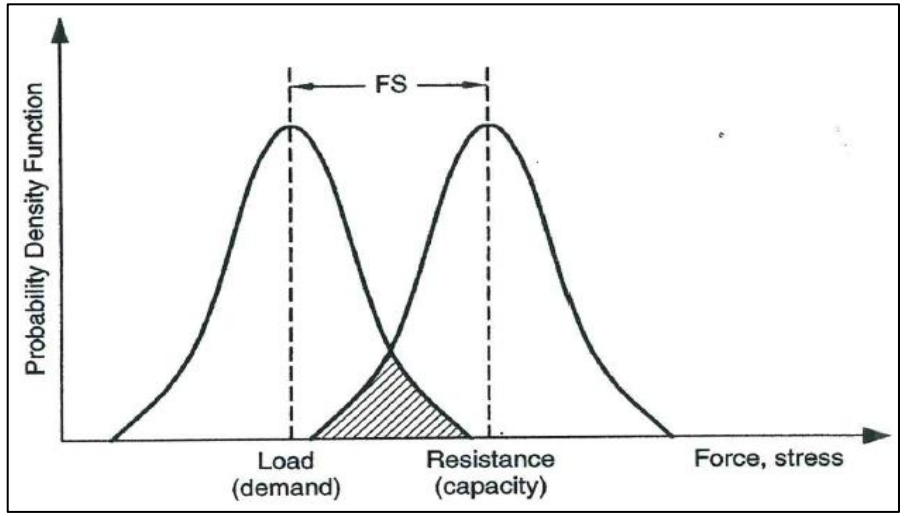
Traditional Risk Analysis (TRA)

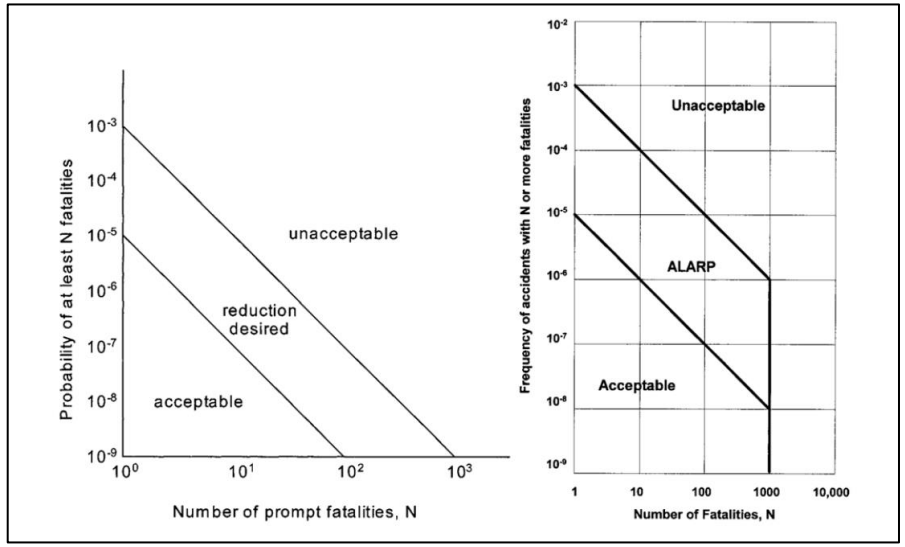
RISK = Pf x Cf

Pf = Probability of Failure

Cf = Consequence of Failure

Frequently, 'Demand' and 'Capacity' distributions are 'imagined' by "Subject Matter Experts" rather than by data or actual system configuration





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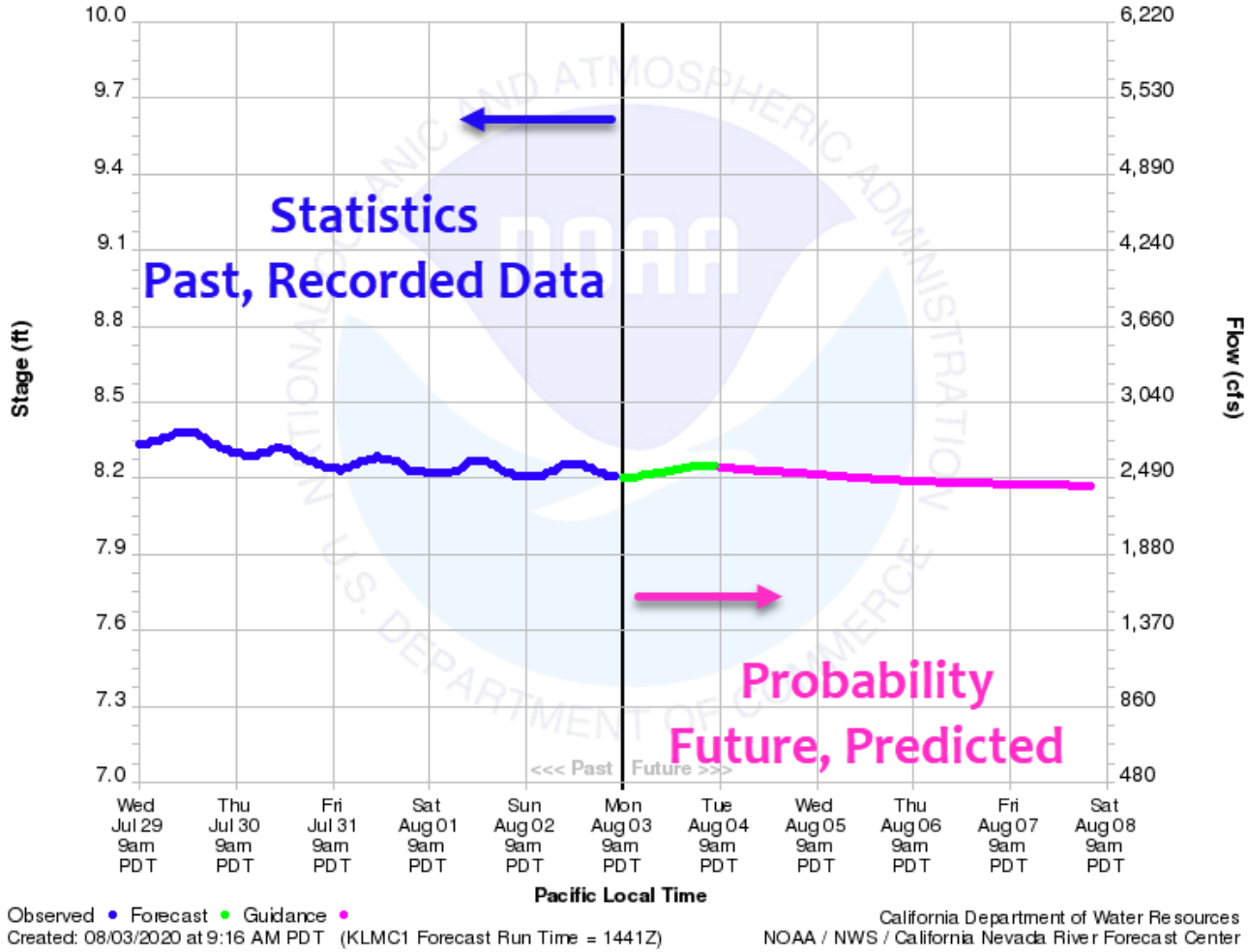
Statistics vs. Probability



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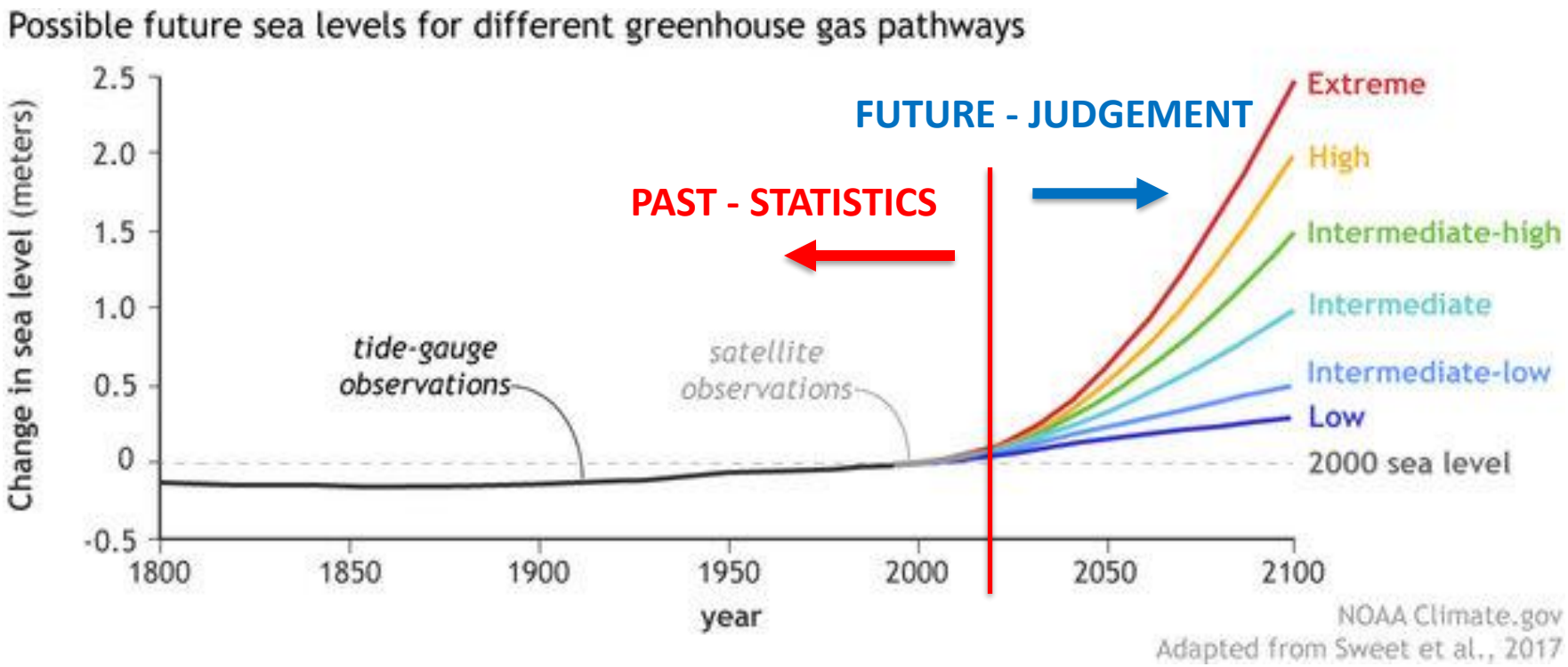

IN THIS CASE, THE PAST IS LIKLEY NOT A PERFECT PREDICTOR OF THE FUTURE

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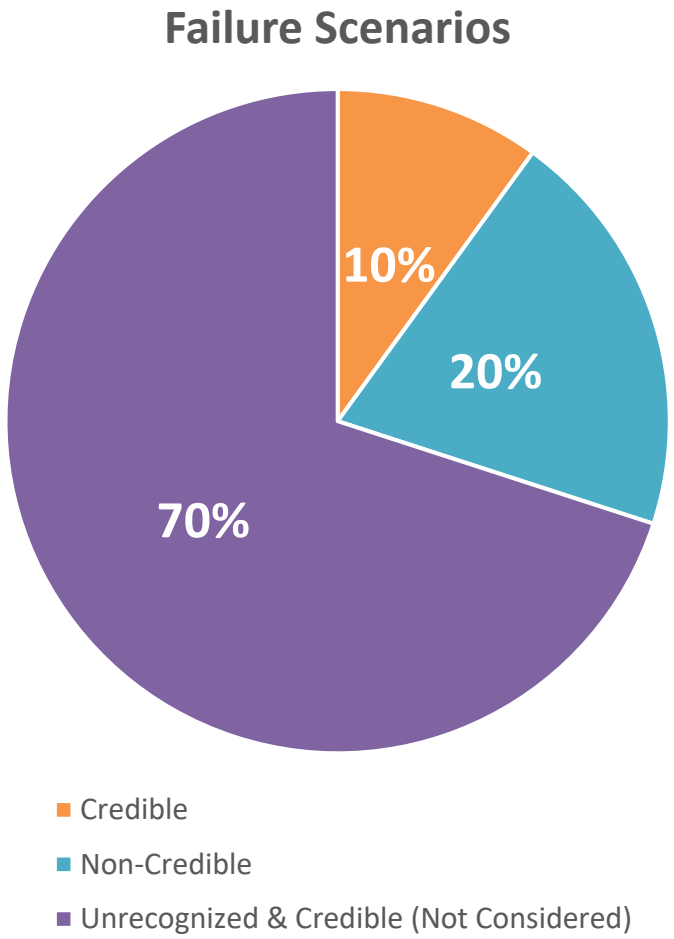
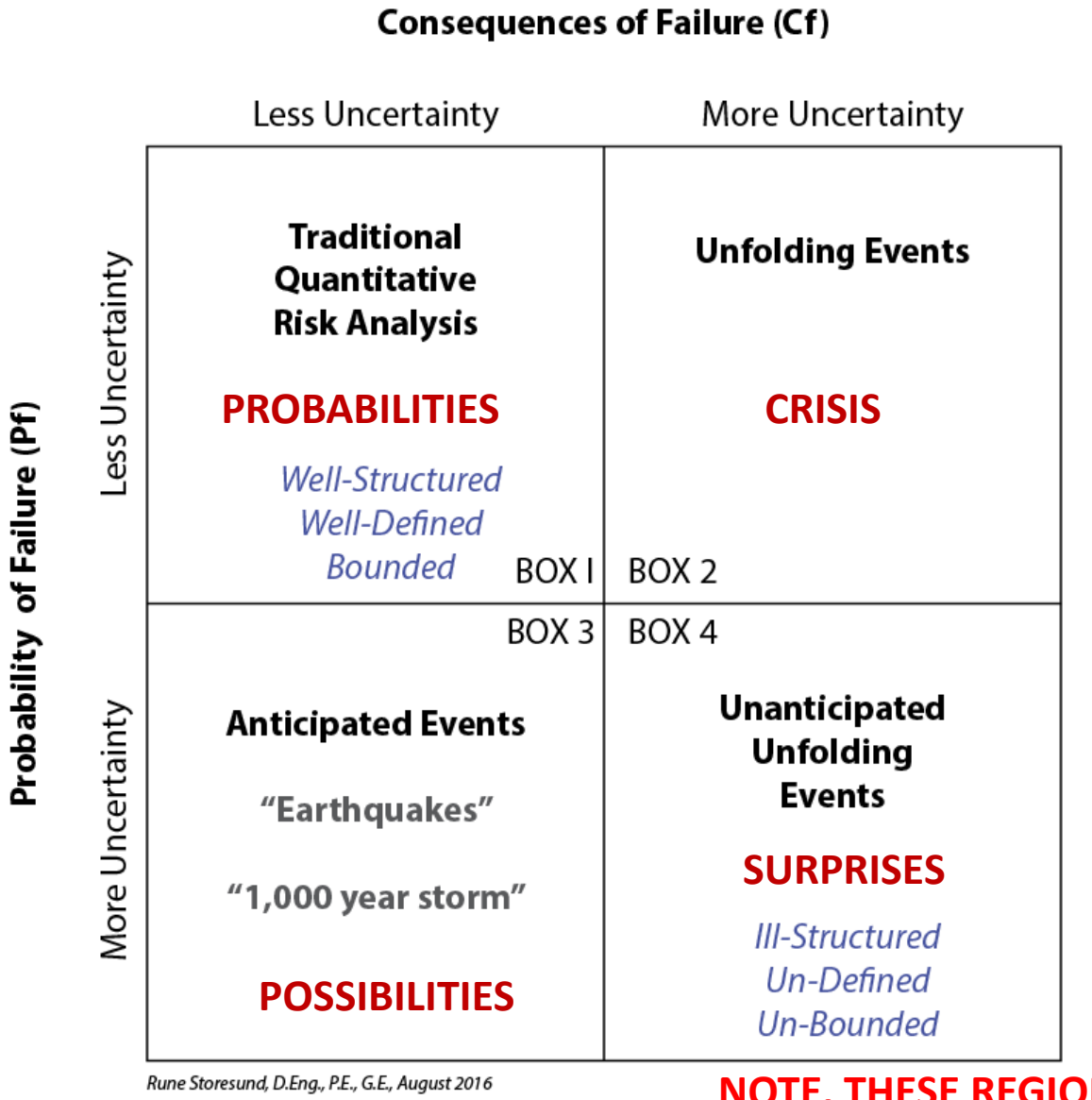
Limited “Imagination” for Scenarios





NEED DIFFERENT TOOLS/METHODS/ STRATEGIES FOR EACH REGION!

NOTE, THESE REGIONS ARE NOT DISCRETE, BUT VERY FLUID AND TIME-DEPENDENT!!

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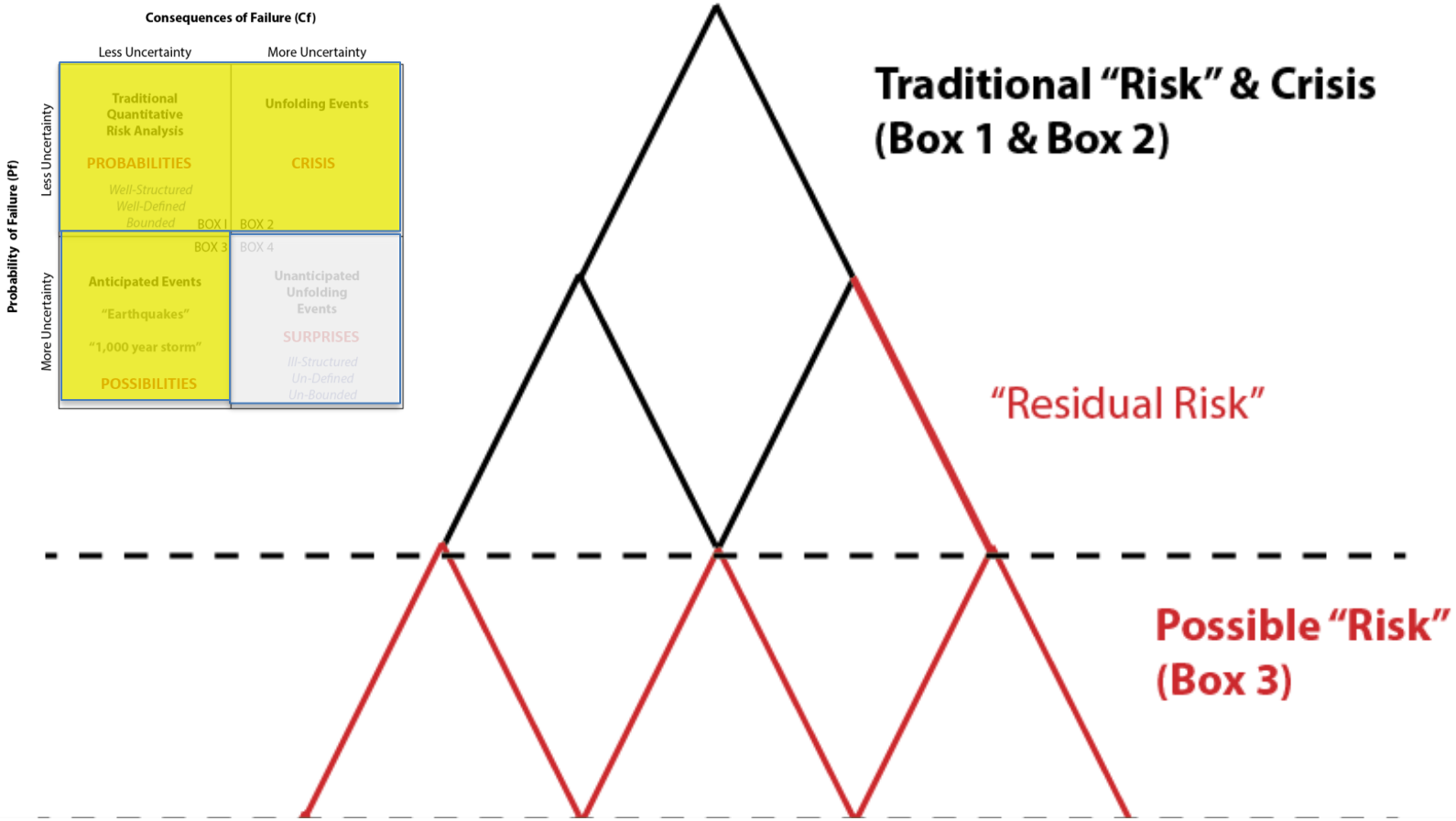

Consequences of Failure (Cf)
Less Uncertainty
More Uncertainty
Probability of Failure (Pf)
Less Uncertainty
More Uncertainty
Traditional Quantitative Risk Analysis
PROBABILITIES
Well-Structured
Well-Defined
Bounded
Unfolding Events
CRISIS
BOX 1
BOX 2
BOX 3
BOX 4
Anticipated Events
"Earthquakes"
"1,000 year storm"
POSSIBILITIES
Unanticipated Unfolding Events
SURPRISES
Ill-Structured
Un-Defined
Un-Bounded
Traditional "Risk" & Crisis
(Box 1 & Box 2)
"Residual Risk"
Possible "Risk"
(Box 3)

Uncertainties

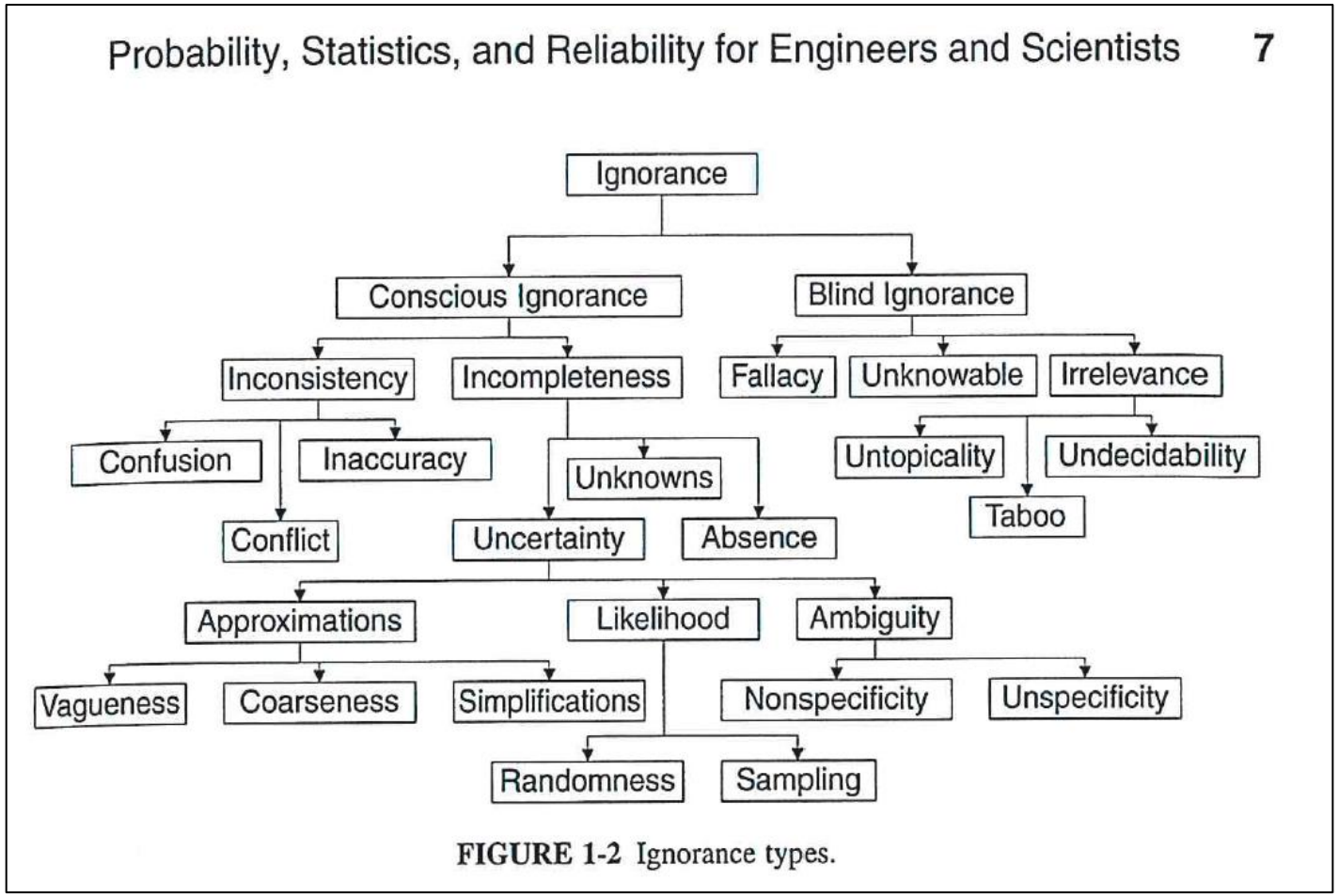
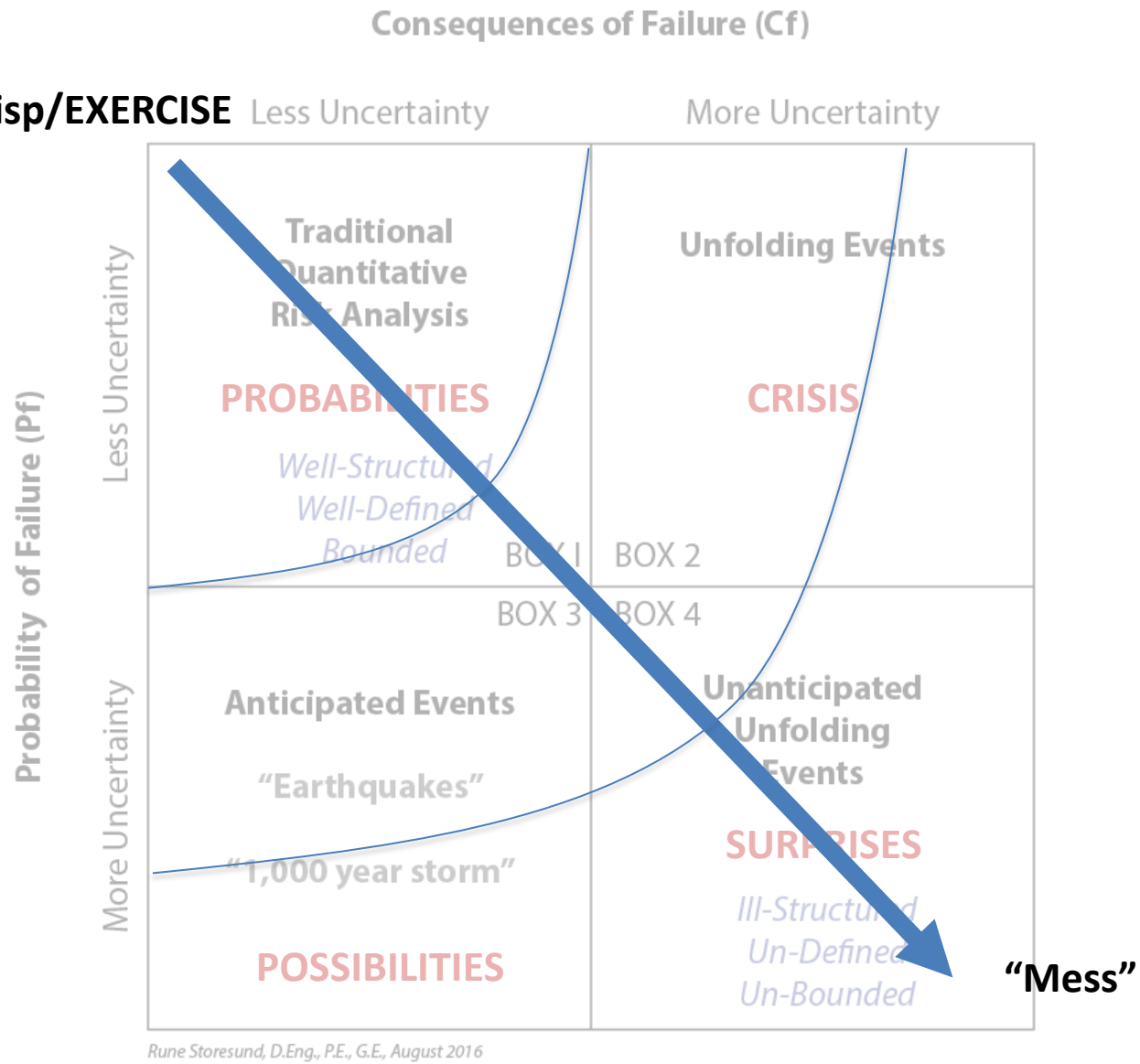


FIGURE 1-2 Ignorance types.



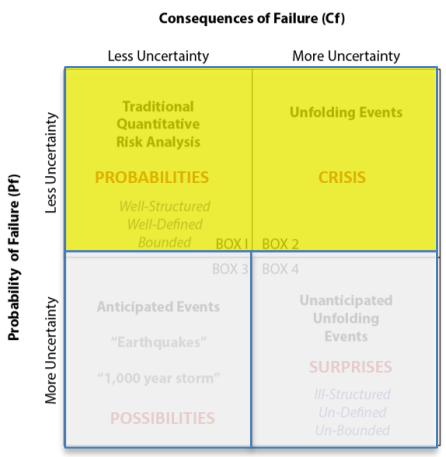
Crisp/EXERCISE

"Mess"

Problem “Crispness”

Crisp **“Messy”**

EXERCISES	PROBLEMS	MESSES
*Bounded *Structured *Well-Defined *Existing Algorithms *Estabslished "Rules" *All stakeholders in strong agreement	*Establish base assumptions *Questions to be answered *Abstracted from messes *Well-Specified *Identify plausible "Rules" *Requires Effective Communication	*Unbounded *Unstructured *Ill-Defined *Heuristics (judgment) *No established "Rules" *Strong Stakeholder Disagreement *Ineffective Communication
Quantitative	Qualitative	Ill-defined
Type I-Analytic / Type II-Crisis	Type III-"Possibilities" Type IV-"Unexpected"	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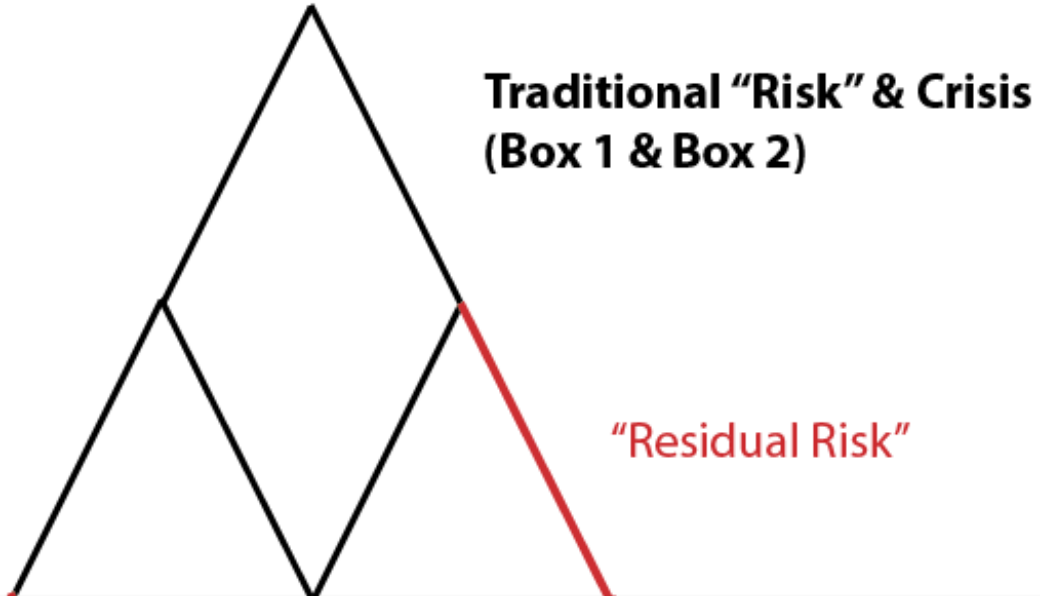
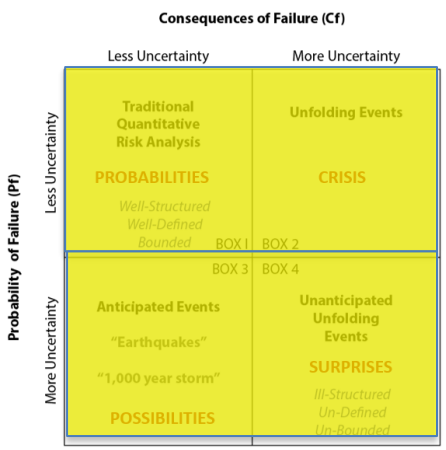
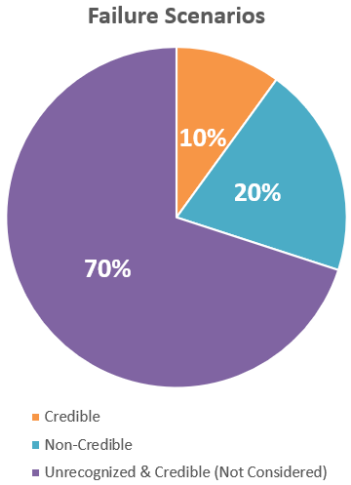

Traditional "Risk" & Crisis
(Box 1 & Box 2)
"Residual Risk"



Traditional "Risk" & Crisis (Box 1 & Box 2)



"Residual Risk"

Believed Credible

Possible "Risk" (Box 3)

Believed Non-Credible

Unimagined "Risk" (Box 4)

Lack of Imagination

Gov. Newsom (April 19, 2022)

https://youtu.be/8Yolbq0xKHI?t=507

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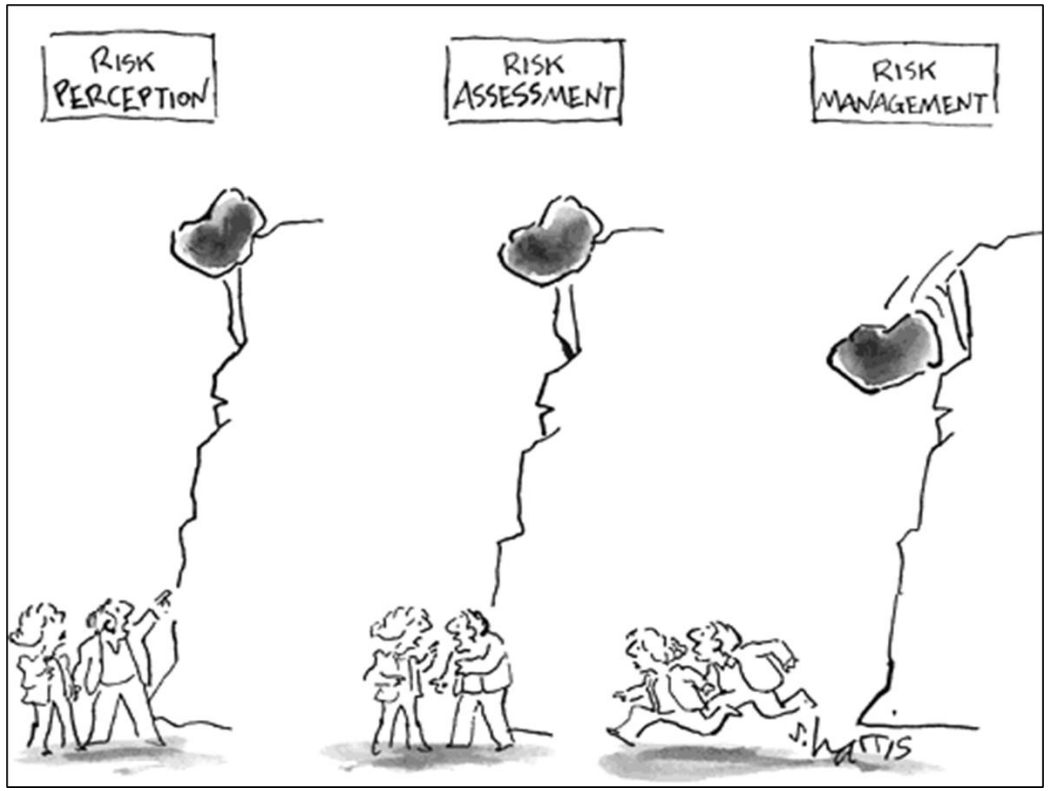
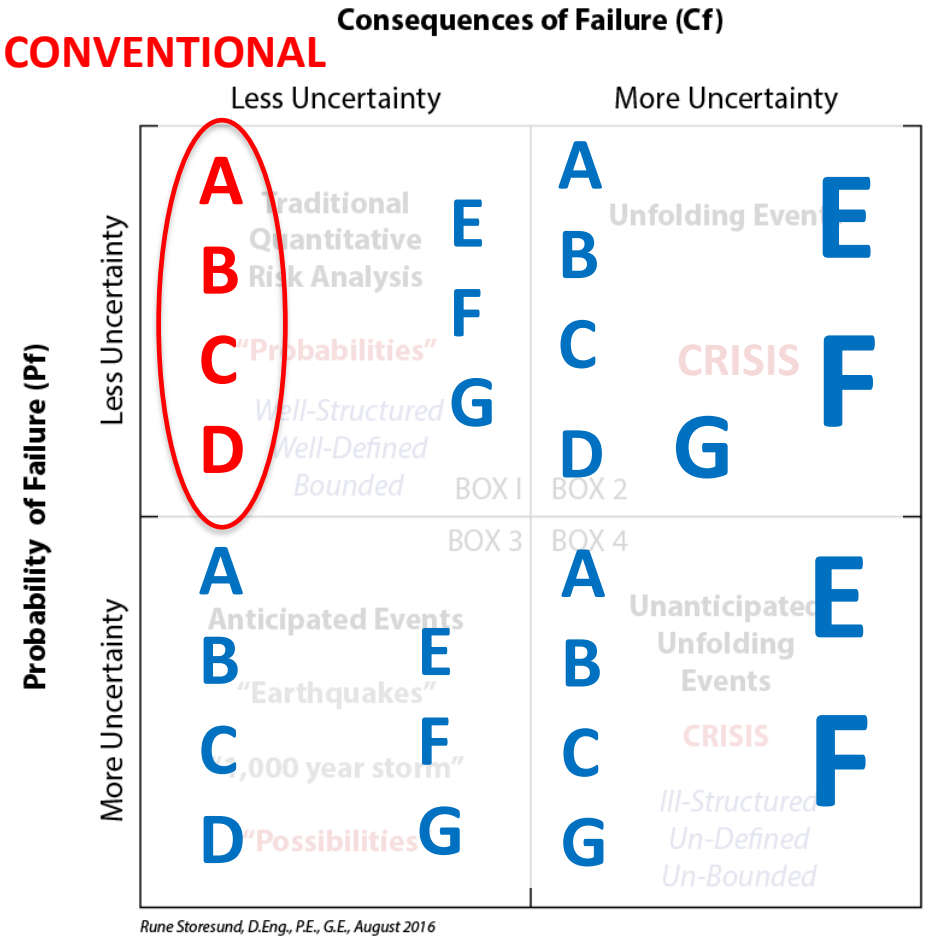
Confronting Belief



Strategies/Tools

- Integrity Management
- Prevention Through People
- Enhanced Regulation
- Uncertainty as a Resource
- Safety Culture Principles
- HRO Principles
- Life-Cycle Management
- Total Cost Analysis
- Embracing 'extreme' thinking
- Crisp Communication (Safe = ???)



LEVERAGE PEOPLE (HRO) & BUILD ORGANIZATIONAL CAPABILITIES ACROSS UNCERTAINTY DOMAINS (BOXES 1-4)

A. Have a clear and explicit concept of "reliability" that is shared consistently across the organization

B. Highly integrated reliability and safety-minded organizational culture (widely held assumptions, attitudes, values, and practices)

C. Recognize and utilize "uncertainty" as a formal resource

D. Use 'precursor conditions' as proactive risk-reduction approaches

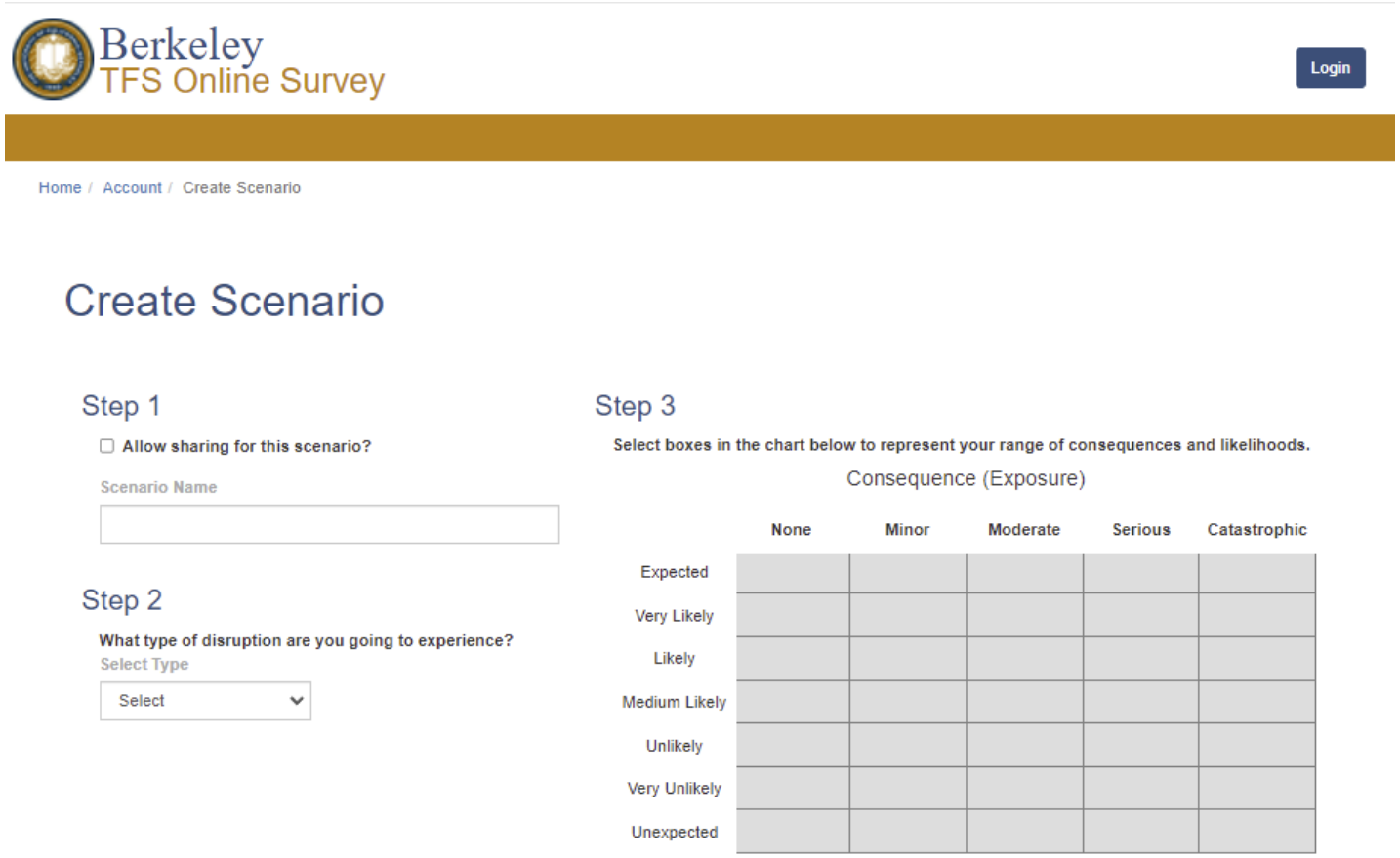
E. Embrace and support "Reliability Professionals"

F. Exhibit a strategic degree of organizational flexibility

G. Are constantly on the lookout for errors

NextGen MAPPING

SCRaM – Crowdsource Tool



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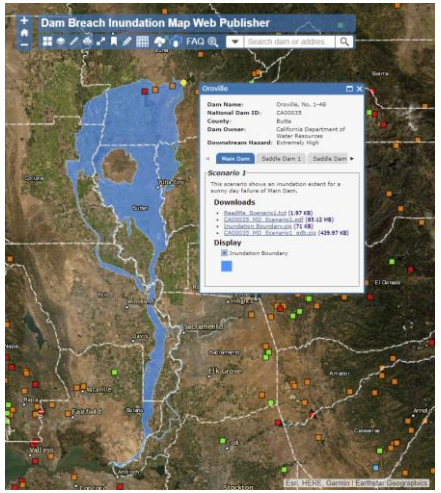
Elevated Releases Study



1997 Oroville Evacuation
@ ~165,000 cfs

ELEVATED OROVILLE DAM RELEASES

VERY LIKELY — **150,000 cfs** — **200,000 cfs** — **300,000 cfs** — **400,000 cfs** — **500,000 cfs** — **625,000 cfs** — **VERY UNLIKELY**

- Drought/Water Shortage
- Floods (Localized Stormwater)
- Severe Weather
  - Extreme Heat
  - Freeze/Winter Storm
- Wildfires

- **Earthquake > Mw 7.0**
- **Full Dam Failure**
- **Volcano**
- **"Ark Storm"**

	Knowable	Unknowable
Preventable	**"Probabilities" "Possibilities"** **Today's Focus!!**	**"Prevention Through People"**
Unpreventable	**Risk Transfer Risk Acceptance**	**Mindfulness**

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32 years ago, 300,000 people flattened the Golden Gate Bridge

Eric Ting, SFGATE
May 25, 2019 | Updated: May 25, 2019 12:34 p.m.

ANTICIPATED
80,000

ACTUAL
800,000

Dr. Rune Storesund, D.E.ng. P.E., G.E.
Executive Director
Center for Catastrophic Risk Management (CCRM)
University of California, Berkeley

rune@berkeley.edu

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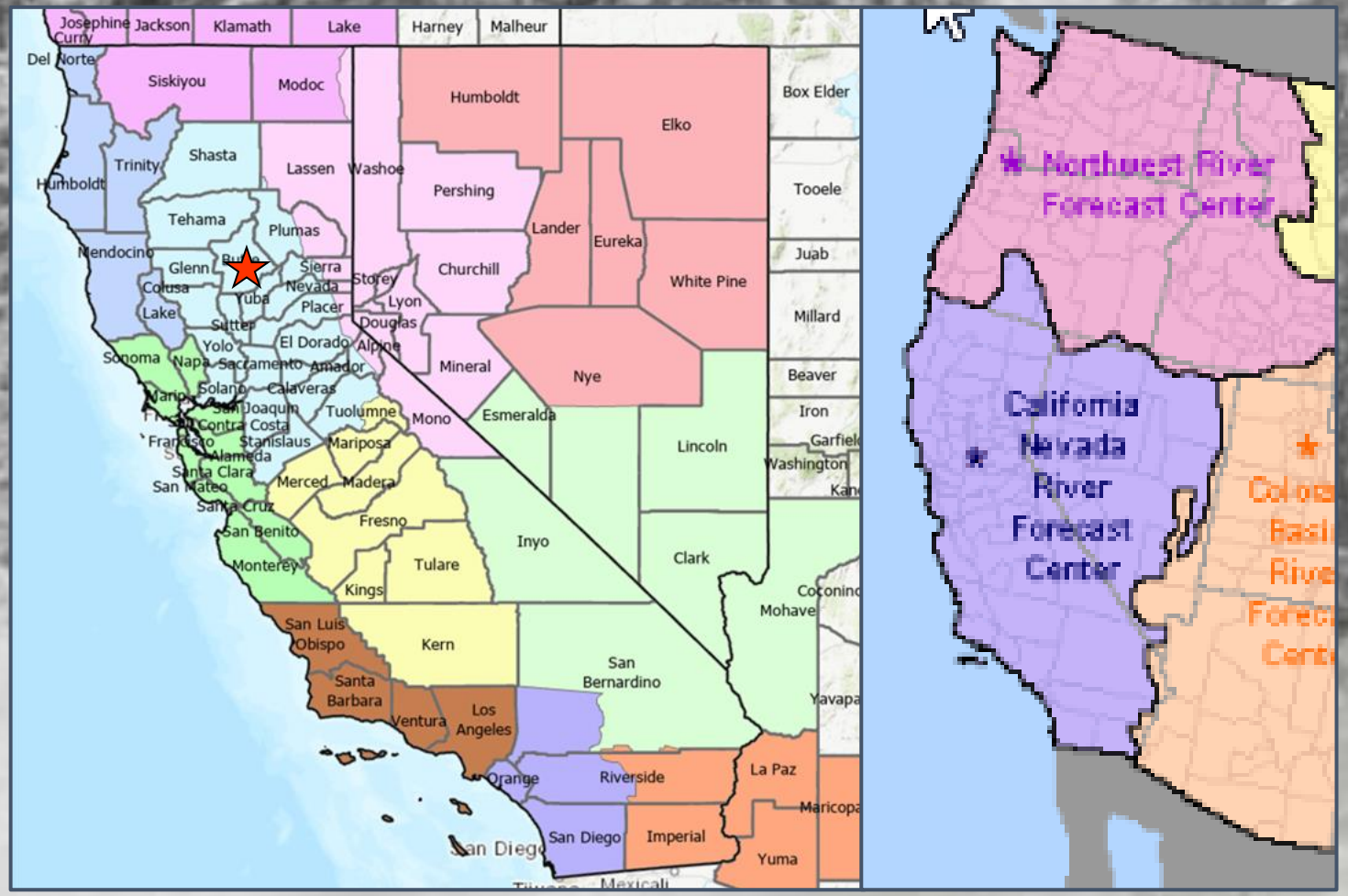
Q&A

NWS/CNRFC Forecasting and Notification

Weather Forecast Office
Sacramento, CA
Friday, April 22

Presenter : Cindy Matthews
Senior Service Hydrologist



10 NWS Offices - (NWS Sacramento)

- Watch Warning Program
- Multiple Aspects of Weather
- EM Interface
- Public Interface
- 24 x 7

CA-NV River Forecast Center

- Hydrologic expertise
- Mainstem Rivers
- Reservoirs
- Snowpack/water supply

…the protection of life and property…

Weather Forecast Distribution - NWS Sacramento

- Partner Email – 3-5 days out – approaching impactful weather

- Watch - Strong possibility of event to occur in next 12 - 48 hours. Occurrence, location, and /or timing is still uncertain

- Warning –Imminent or Occurring – Life threatening
  - Serious, Long or Short Duration Events
  - EAS and WEA messages

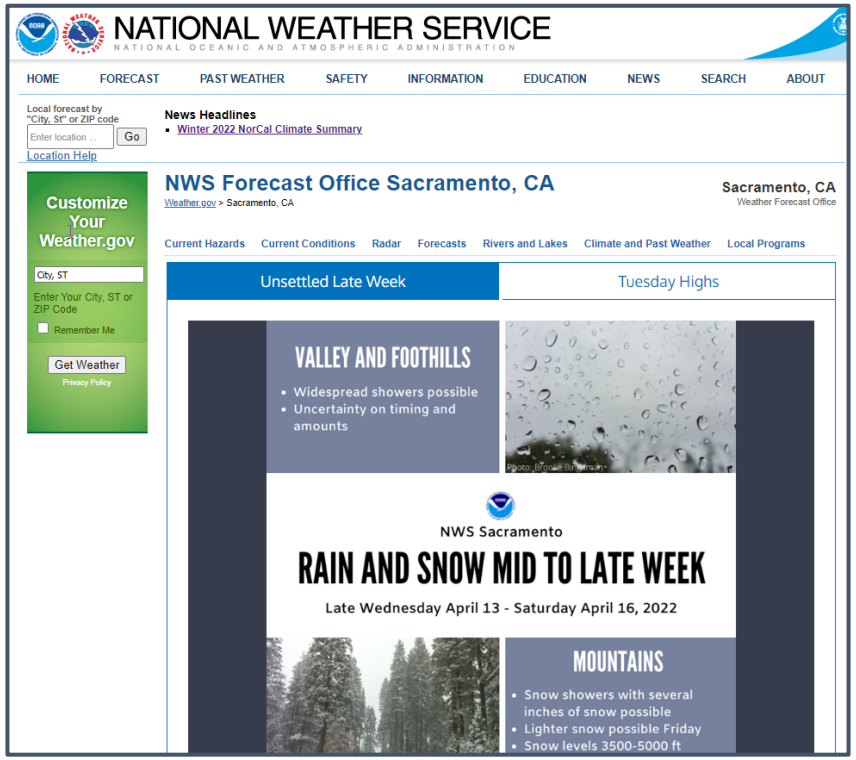
- Advisory – Non life threatening, significant weather events
  - May become life threatening if precautions are not taken

- Statements - Follow up/continuation products

Distribution Services

Social Media

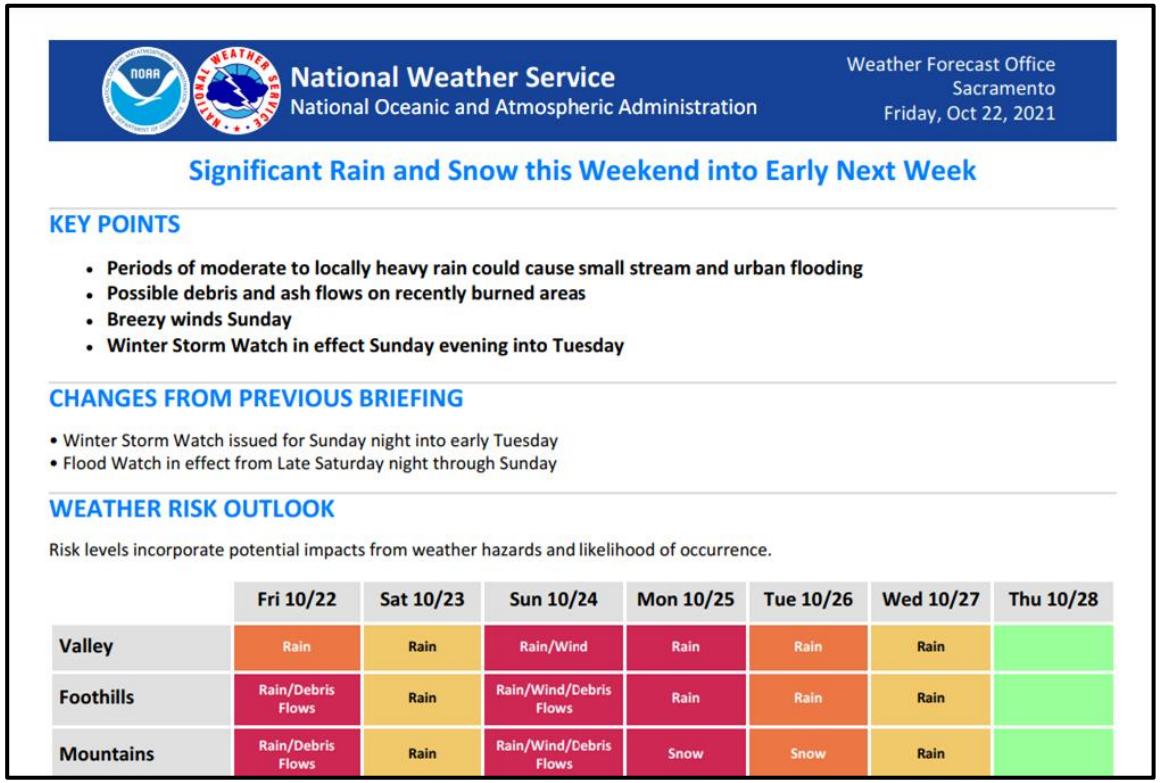
Facebook: NWSSacramento
Twitter: @NWSSacramento



Webpage

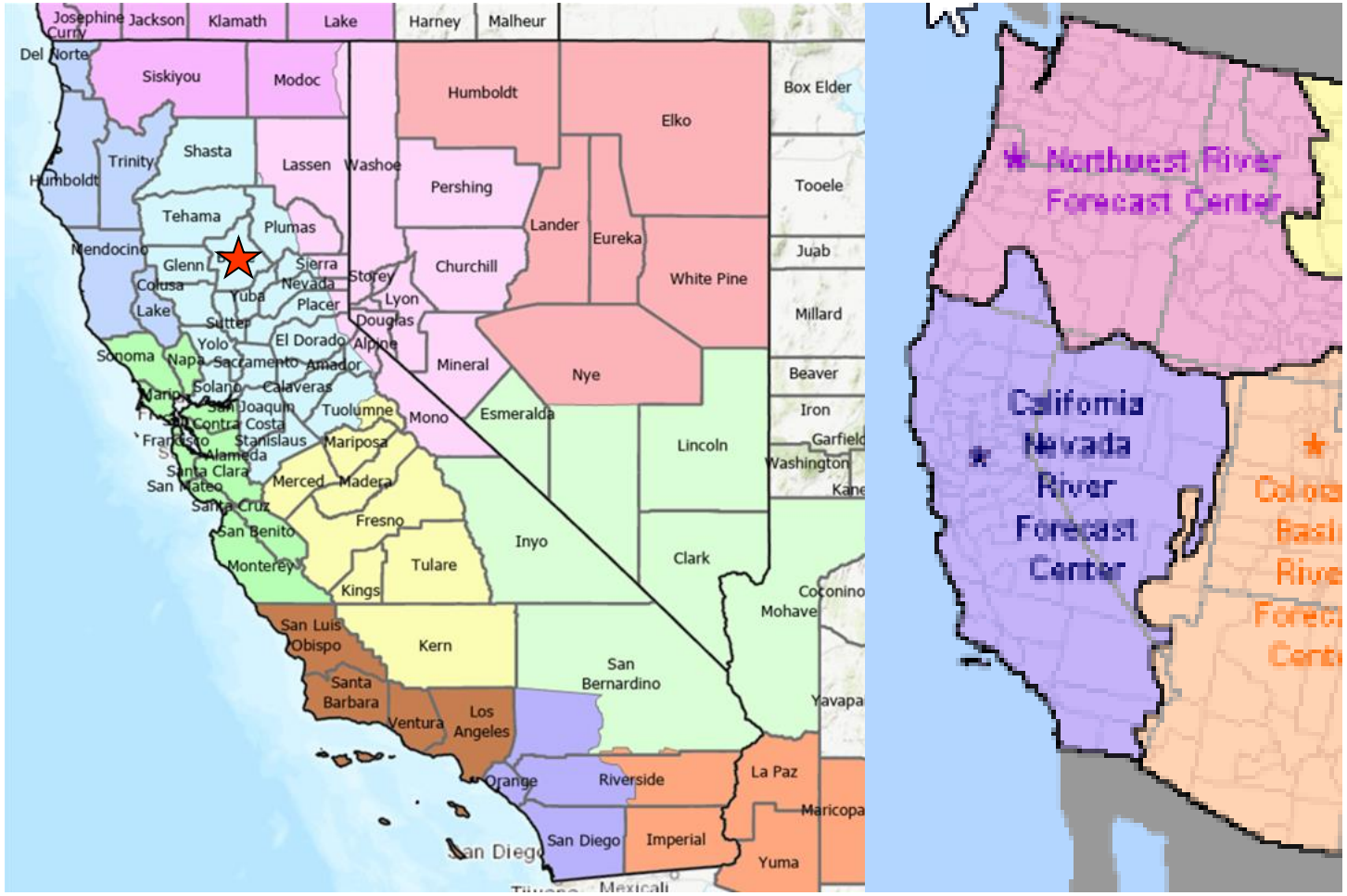
weather.gov/sacramento

EAS & WEA



Partner Emails

California NWS Offices - The CNRFC!



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…the protection of life and property…

CNRFC - Deterministic River Forecasts

Weather Forecast Office
Sacramento, CA
Friday, April 22

Observation Networks

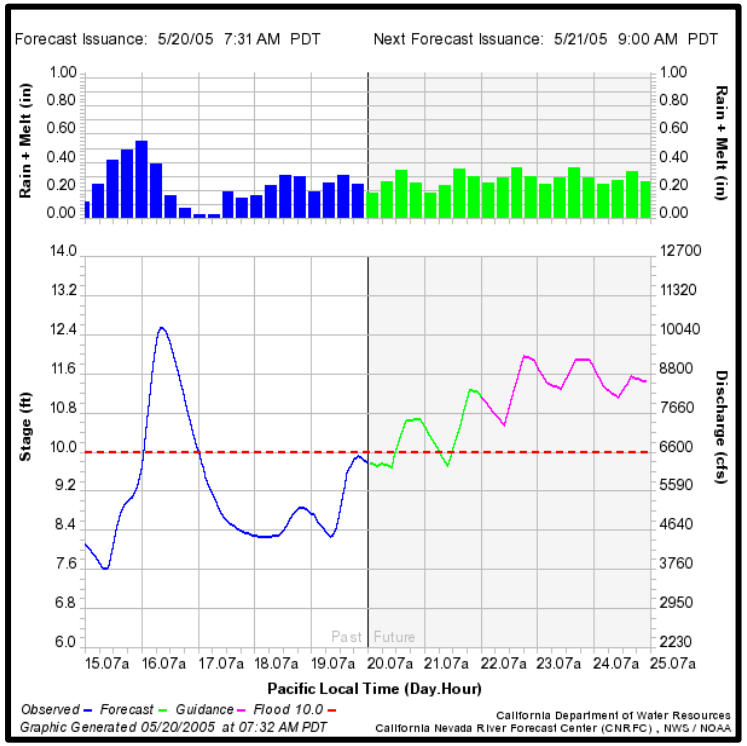
Daily RFC Forecasting
- Data Ingest
- Data QC
- Model Mpdating

Forecast Meteorology

Mean Areal Time Series
- Precipitation
- Temperature
- Freezing Levels

CHPS Hydrologic Models

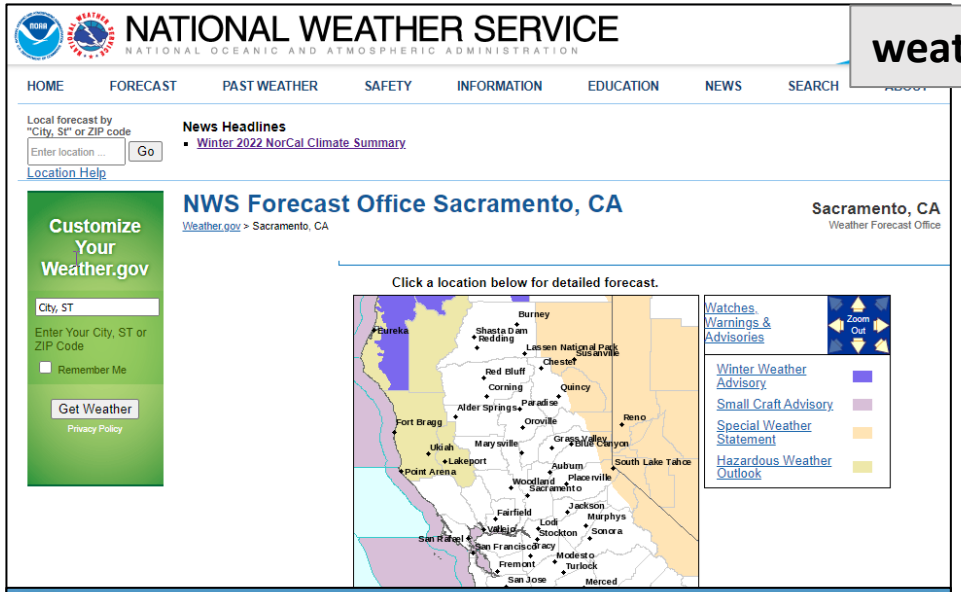
Current Basin Conditions
- Soil
- Snowpack
- Reservoir Levels
- Streamflow
- Reservoir Releases



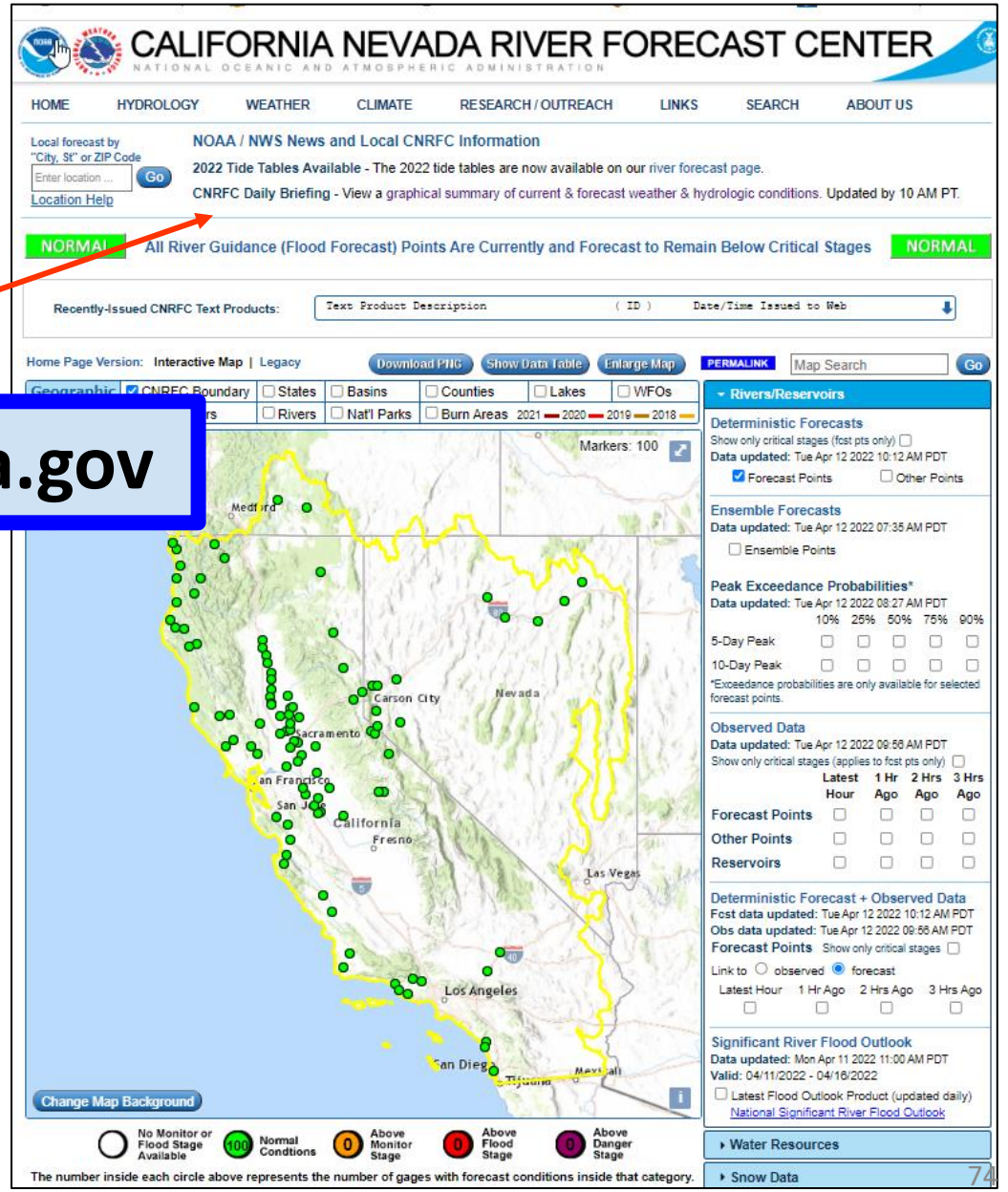
River Forecast Distribution

Weather Forecast Office
Sacramento, CA
Friday, April 22

weather.gov/sacramento



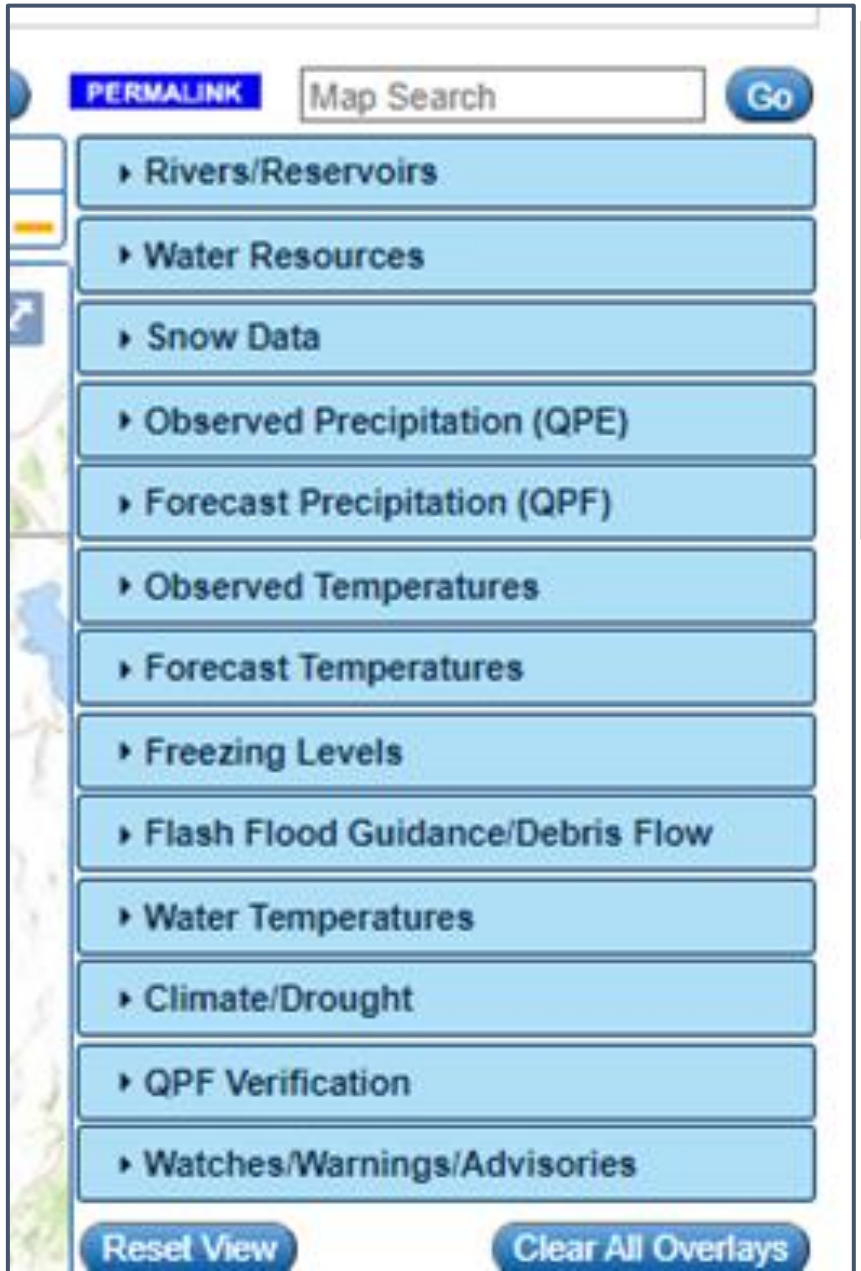
CNRFC.noaa.gov

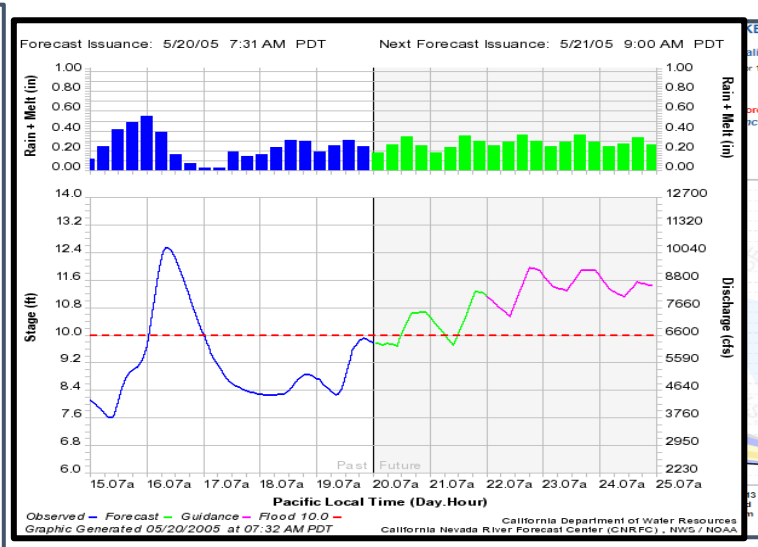


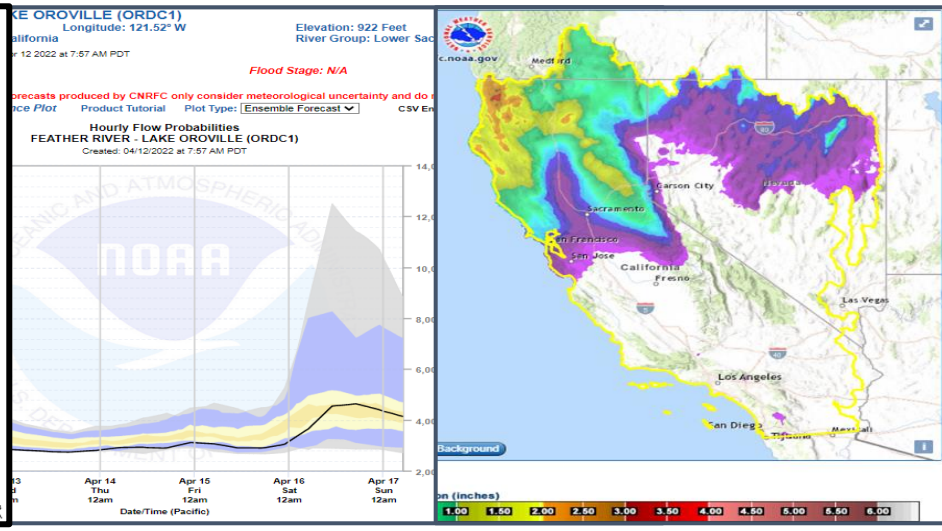
cdec.water.ca.gov

cnrfc.noaa.gov - USE IT!

Weather Forecast Office
Sacramento, CA
Friday, April 22

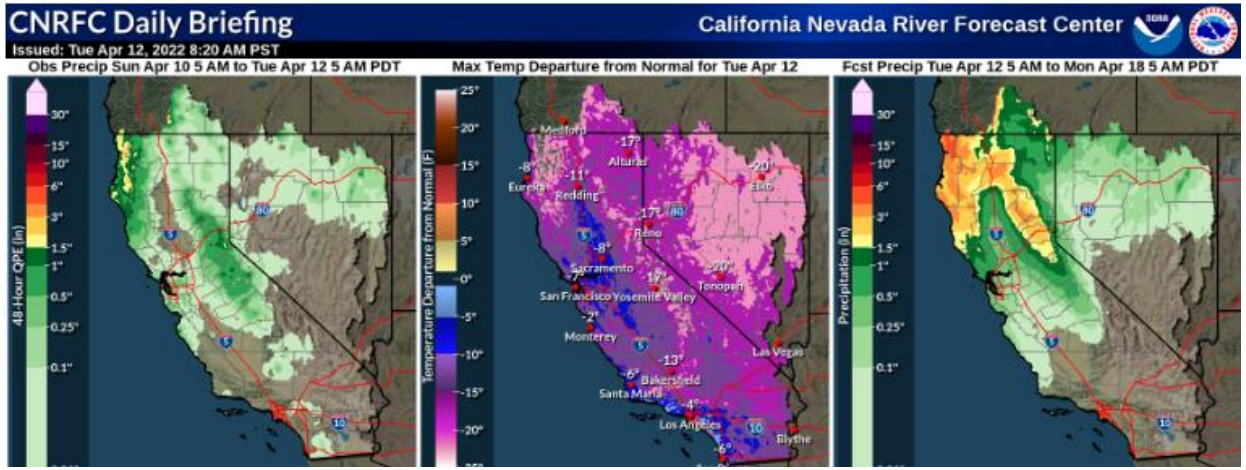






CNRFC Daily Briefing

Last issued: Tue Apr 12, 2022 at 08:21 AM PST (updated daily by 10 AM Pacific Time).
Click image for full-resolution version.



NEW!!! CNRFC Daily Briefing

Additional Communication and Notification

- Emergency Management Contacts
  - Hourly / Daily / Weekly
- Phone, CalWAS, text, video, etc
- iNWS
- CalOES SOC
- County EOC Deployments
- State and Local briefings
- 24x7 NWS Operations access
  - Response
  - Recovery
  - Mitigation
  - Preparedness

Questions?

If you have questions please contact:

NWS SACRAMENTO

cindy.matthews@noaa.gov

916-979-3064

Q&A

5 Minute Break

State-Federal Flood Operations Center

Oroville Dam Citizens Advisory Commission
Technical Workshop

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

Elizabeth Bryson, P.E., Flood Operations

FOC Responds to…

High water / flooding

Large and/or intense storms

Earthquakes / tsunamis

Dam incidents

FOC's Role

Coordinate DWR's response to flooding statewide

FOC Coordination

Provides:

- Situational awareness
- Technical and direct assistance
- Conduit for federal assistance under Public Law 84-99

Does NOT:

- Declare emergencies
- Order evacuations
- Repair levees

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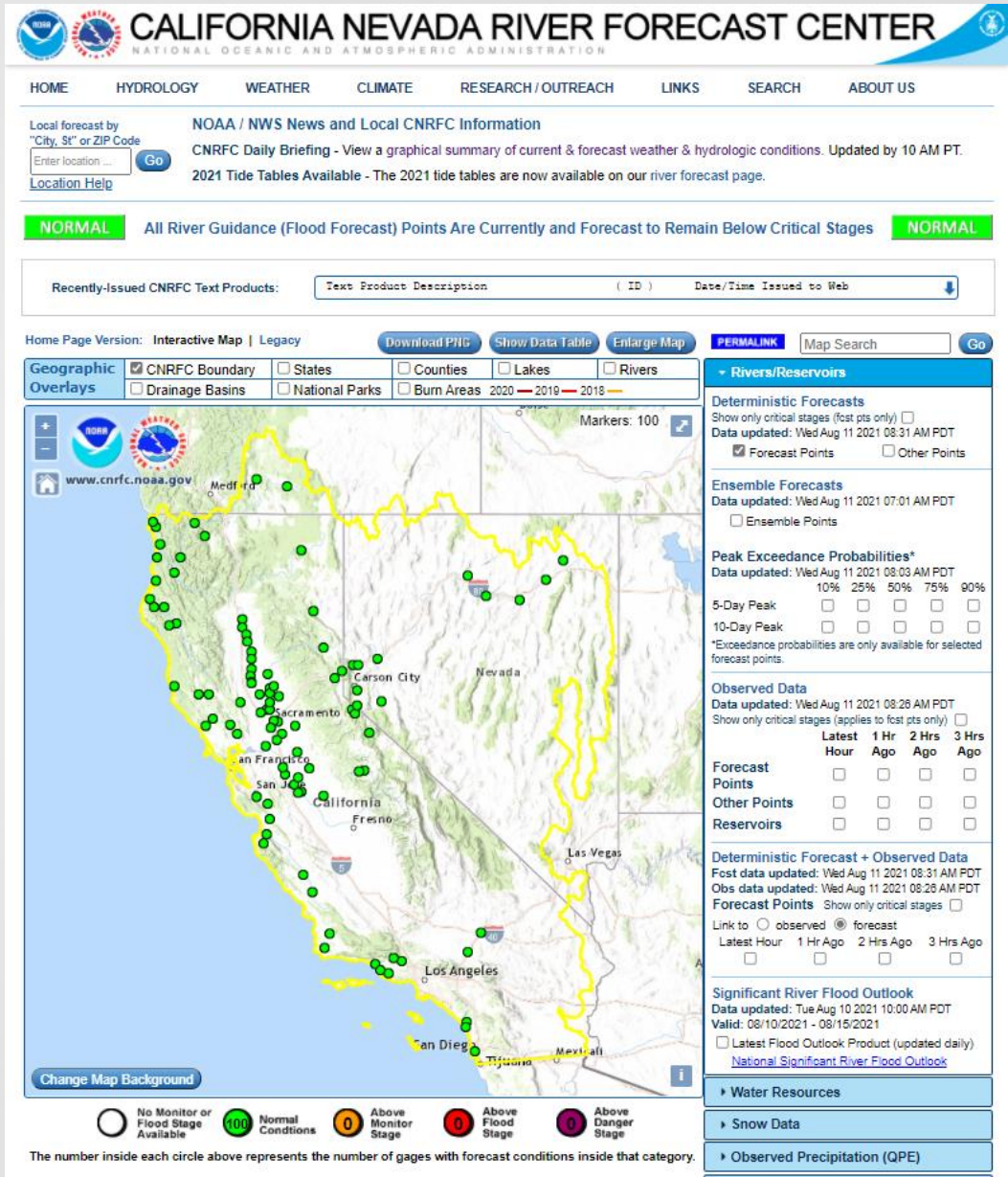
Situational Awareness

Provide year-round daily forecasts of

- Reservoir inflows
- River flows and water levels
- For CA and parts of OR & NV

Users

- Flood Operations Center
- Cooperating Agencies
- State and County Offices of Emergency Services
- Public and media



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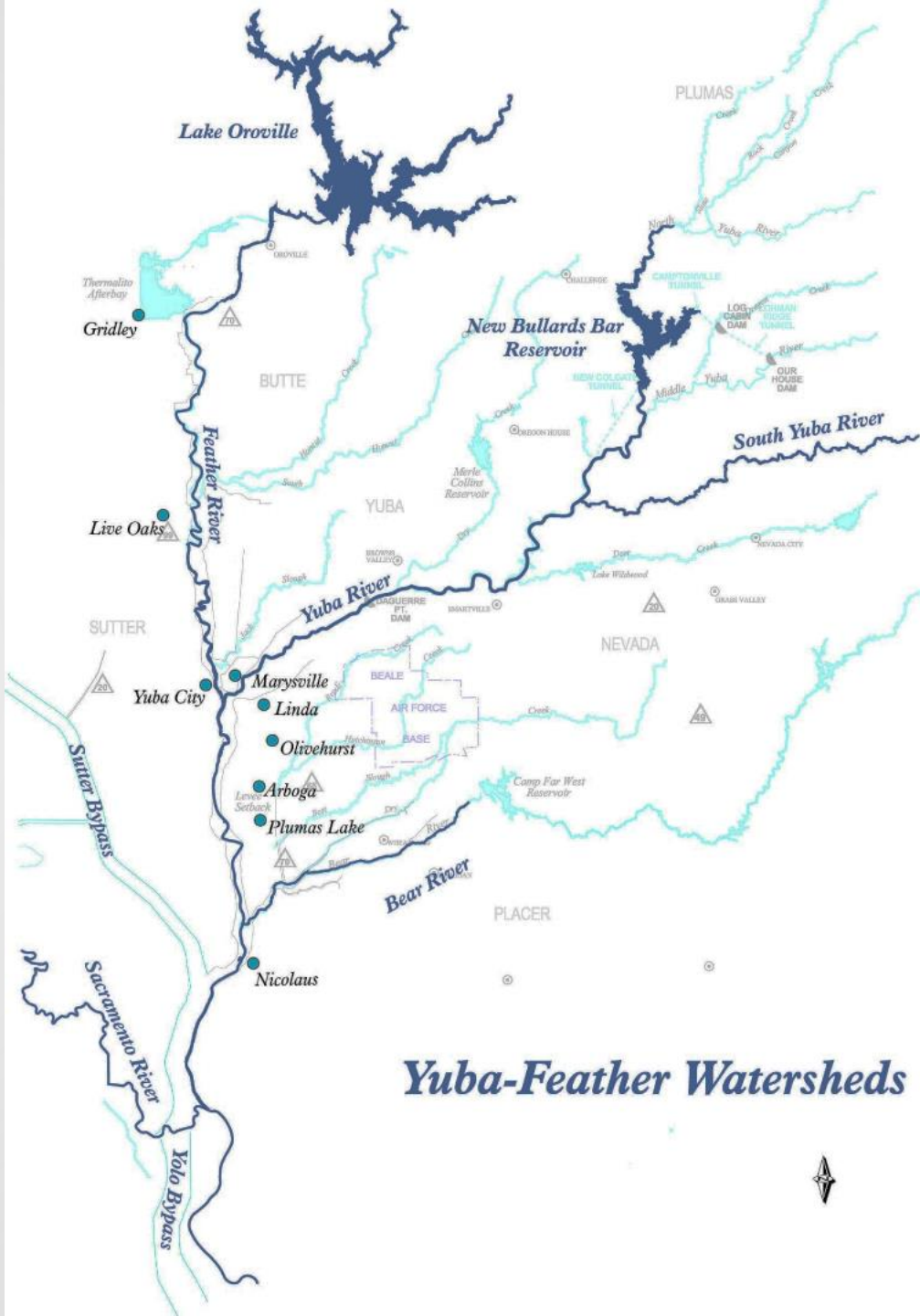
High Water Notifications

Based on river forecasts

Notifications and updates provided to downstream agencies potentially impacted by high river flows and stages

Local, city, county, state & federal partners

These are ***not*** evacuation orders



CALIFORNIA DEPARTMENT OF WATER RESOURCES

FOC's Relationship to Oroville Dam

Notifications and updates provided to downstream agencies potentially impacted by high flows or failure scenario

- LMAs, cities, counties, state & federal partners
- Built-in redundancy

These are ***not*** evacuation orders

Participate in annual meetings and exercises

Contact Information

FLOOD OPERATIONS CENTER

(916) 574-2619 flood_center@water.ca.gov

Resources

California Data Exchange Center (CDEC)

http://cdec.water.ca.gov

CA-NV River Forecast Center (CNRFC)

http://www.cnrfc.noaa.gov/

Q&A

Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Dam Safety Planning Division

Emergency Action Plans

Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Water Code Sections 6160 and 6161

- Owners of state-regulated, jurisdictional dams must submit an Emergency Action Plan (EAP) to Cal OES and DWR if classified as EH, H, or S
- EAP must include a DWR-approved inundation map
- Includes deadlines for submissions
- Cal OES review timelines are given
- Owners must update the EAP, including the map, at a minimum every 10 years

Government Code Section 8589.5

- EAP must be developed in consultation with local public safety agencies
- EAP must adhere to FEMA's Guidelines
  - 6 Elements of an EAP

Emergency Notification Flowcharts	**Responsibilities**
Preparedness Activities	**Inundation Maps**
Response Process	**Additional Info in Appendices**

- Dam owner must conduct an EAP notification exercise with local public safety agencies once a year

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OF EMERGENCY SERVICES

Emergency Action Plans

What is an EAP?

- Identifies potential emergency conditions at a dam
- Specifies actions to be followed to minimize property damage or loss of life
- Based on approved inundation maps, which show critical areas of evacuation in case of a dam emergency

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GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Dam Owner Outreach to Public Safety Agencies

Who

- Those impacted by dam incident
  - Local: law enforcement, fire, OES,
  - State/Fed: NWS, DWR (DSOD, FOC), Cal OES

How

- Meetings, phone calls, etc.

When

- Earlier is better
- Have something to show those groups

Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Incorporating Outreach into Plan

Methods to Meet Statutory Requirement:

- Signature Page
- Narrative explaining which agencies were consulted during development of the plan and what the contributions were
- Agenda, sign-in roster, and minutes from EAP development meeting(s)
- Include the agencies' roles within the EAP

Notification Flowcharts

Flowcharts

- Identifies who is to be notified of a dam safety incident, by whom, and in what order
- One chart or a set of charts may be needed depending on the complexity on the hazards associated with the dam and affected downstream areas
- Should include emergency level, individuals who will conduct notifications, prioritization of notifications, individuals who will be notified

Notification Flowcharts

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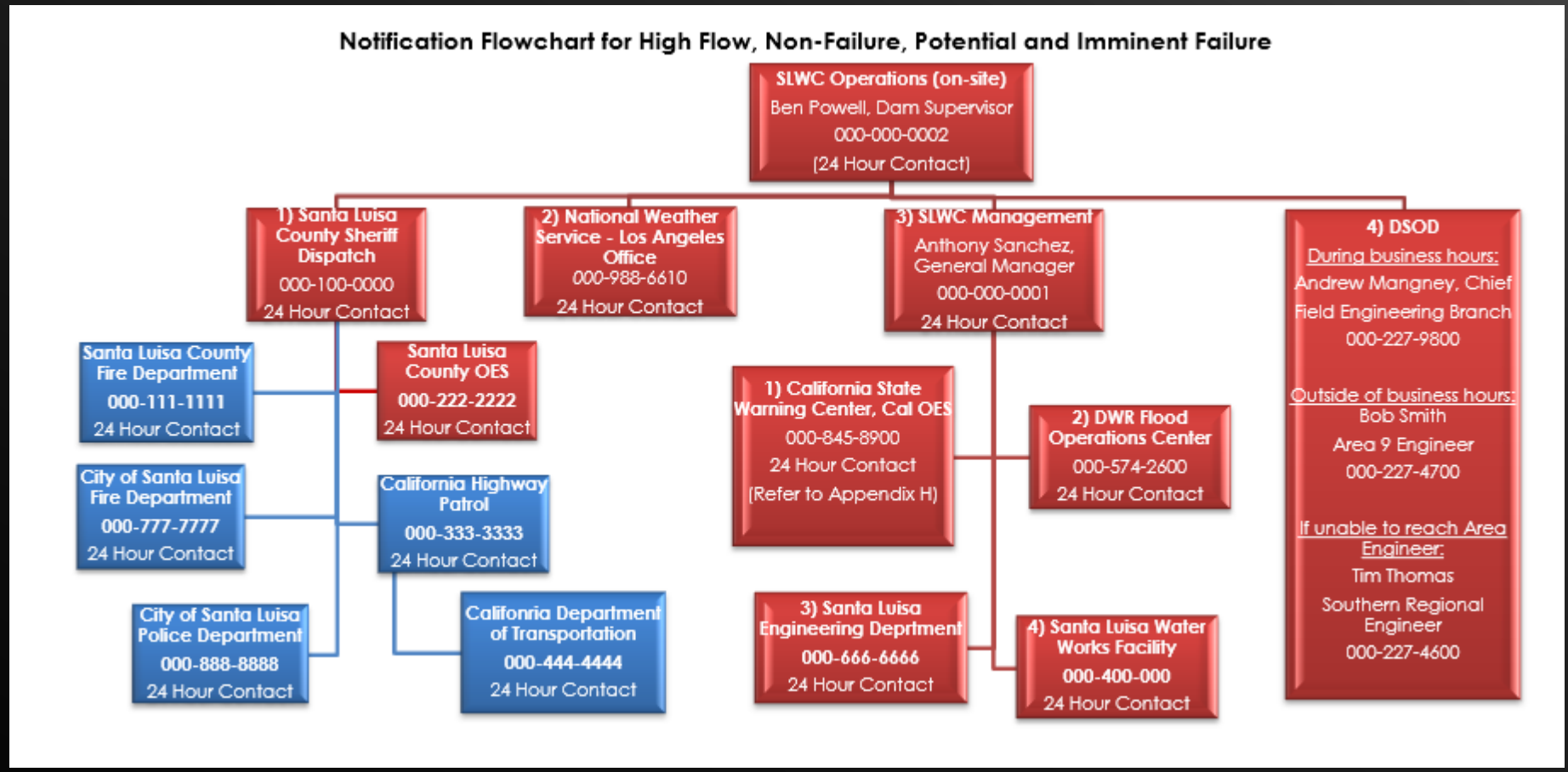


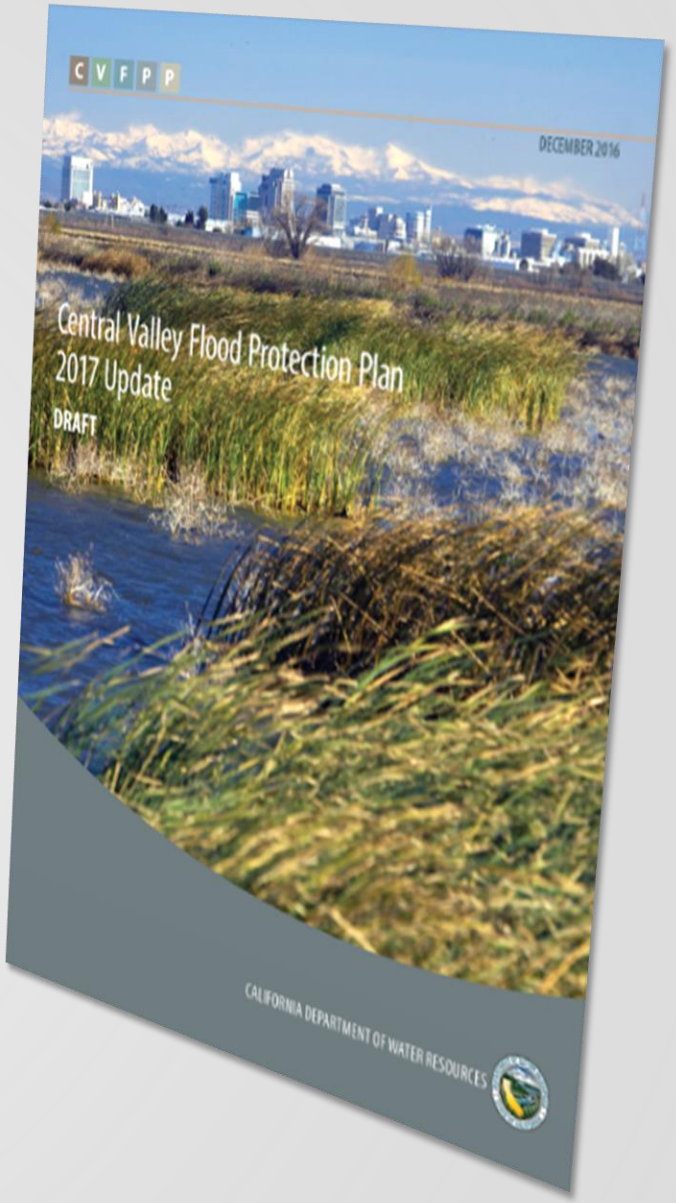
Questions?

Casey Meredith
Dam Safety Planning
Cal OES

Q&A

Making Investments to "Buy Down" Flood Risk

Oroville Citizens Advisory Commission
Flood Management Stakeholder Workshop
April 22, 2022



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WATER RESOURCES

Michael Mierzwa, P.E., State Floodplain Manager
CA Dept. of Water Resources, Division of Flood Management

Outline of Today's Topics

- "Buying Down Risk Concept"
- Central Valley Flood Protection Plan (CVFPP) Overview
- Using the CVFPP to Guide Future Investment Need
- Example of a Risk Assessment from the CVFPP

“Buying Down” Risk

Many of today’s other presentations have focused on understanding flood risk through better understanding of flood hazards, mapping, inspections, forecasting, and sharing information.

OCAC has previously featured presentations on reservoir storage operations.

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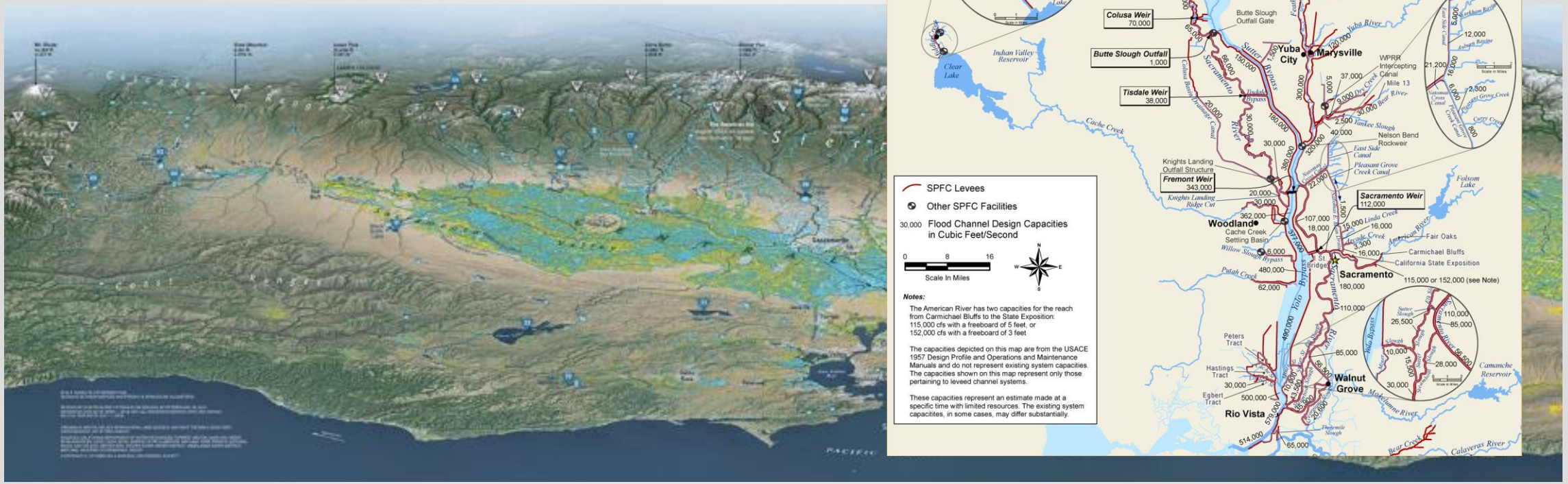
Central Valley Flood Protection Plan

Key Features (as of 2017):

- Land area size of State of Florida
- Highest net agricultural production region in United States
- 1,600 miles of Federal-State levees
- Extensive system of bypasses & floodways
- 2 completely different river basins, each w/ over 5 major rivers
- Over 1.3 million people living in floodplains
- +$80B property / assets at risk



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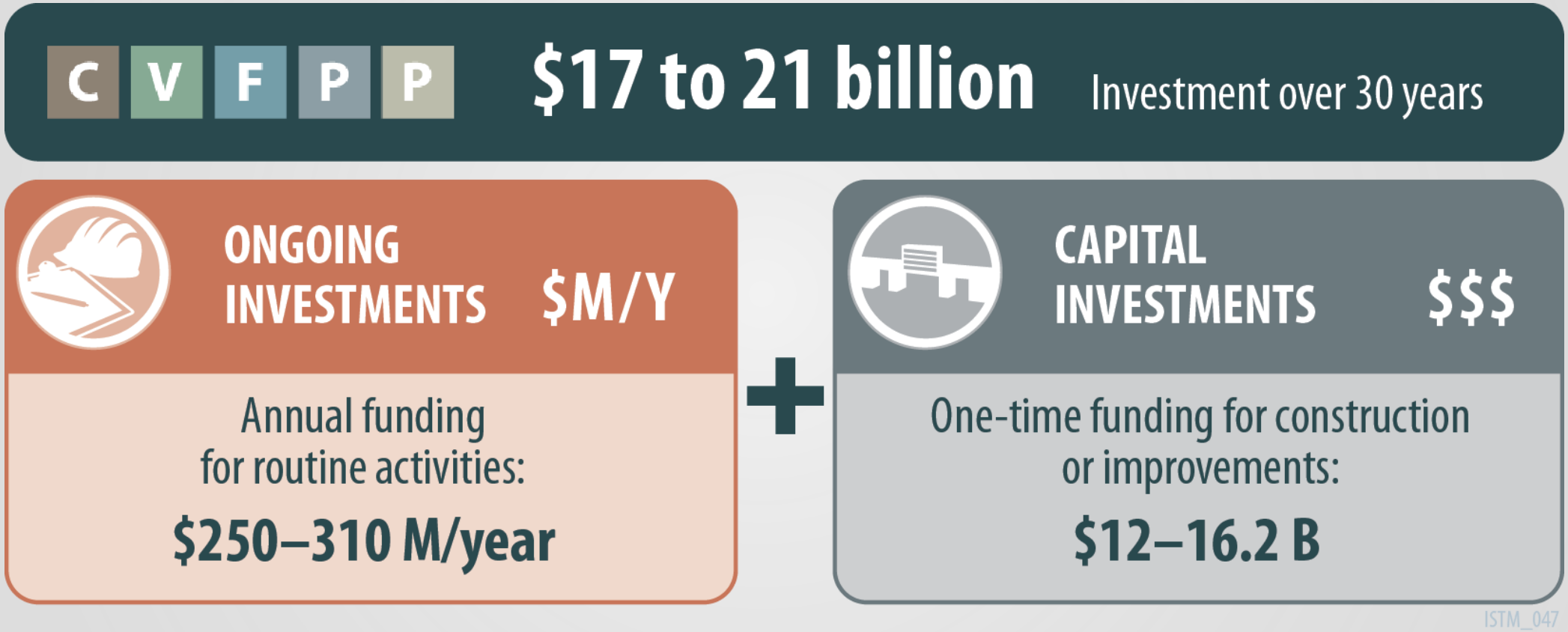
WATER RESOURCES

Recommended 2017 CVFPP Update Investment



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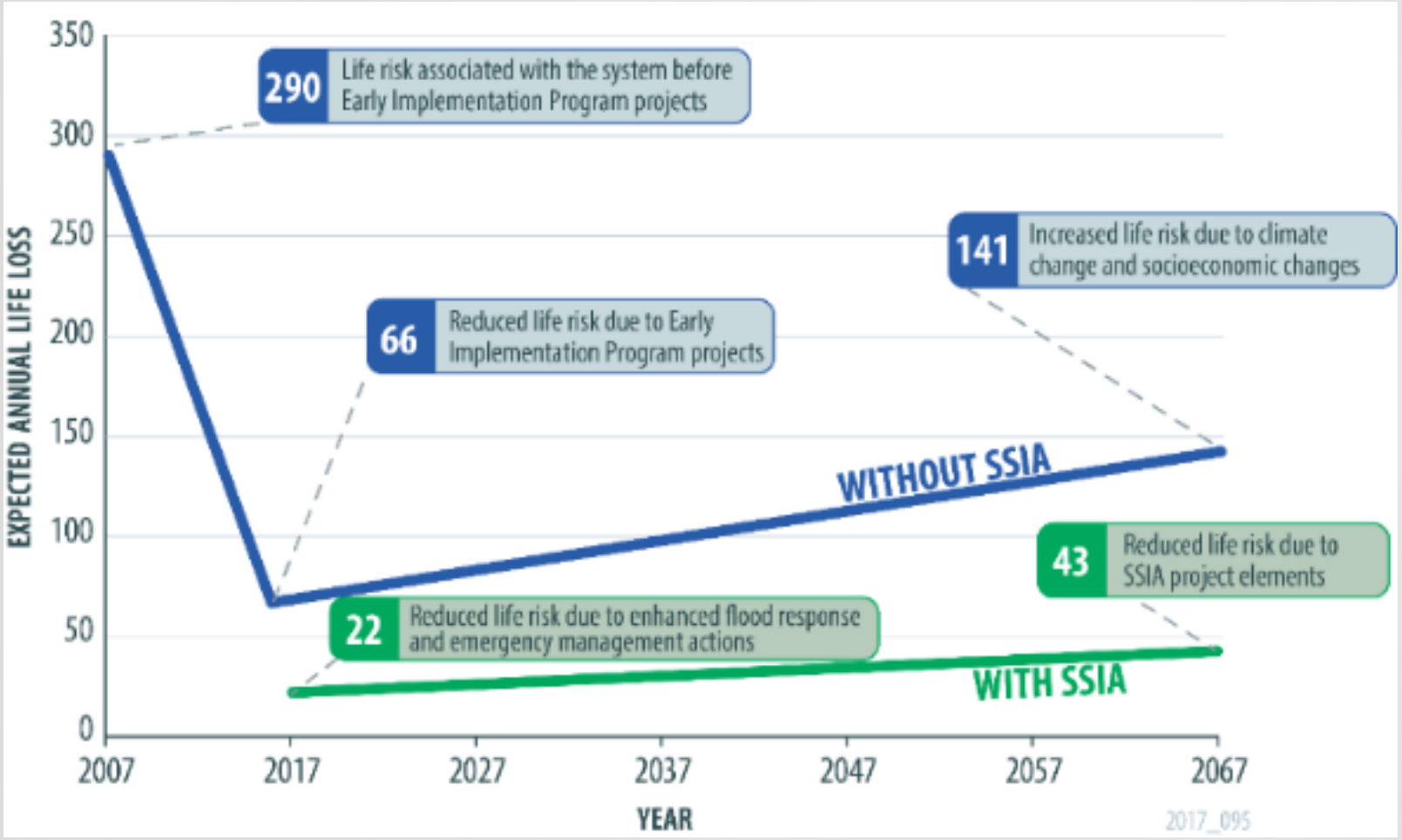
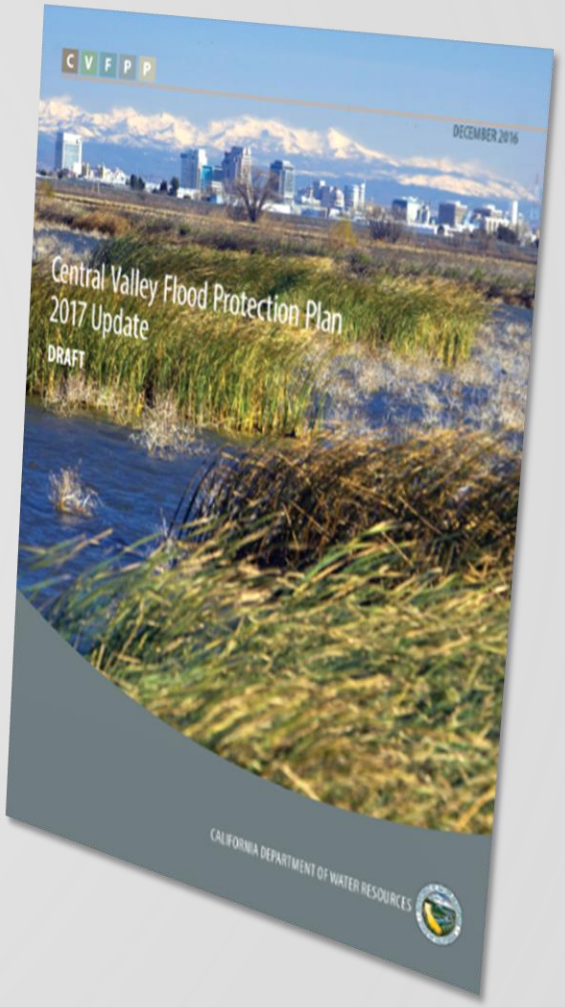
Example of a Risk Assessment





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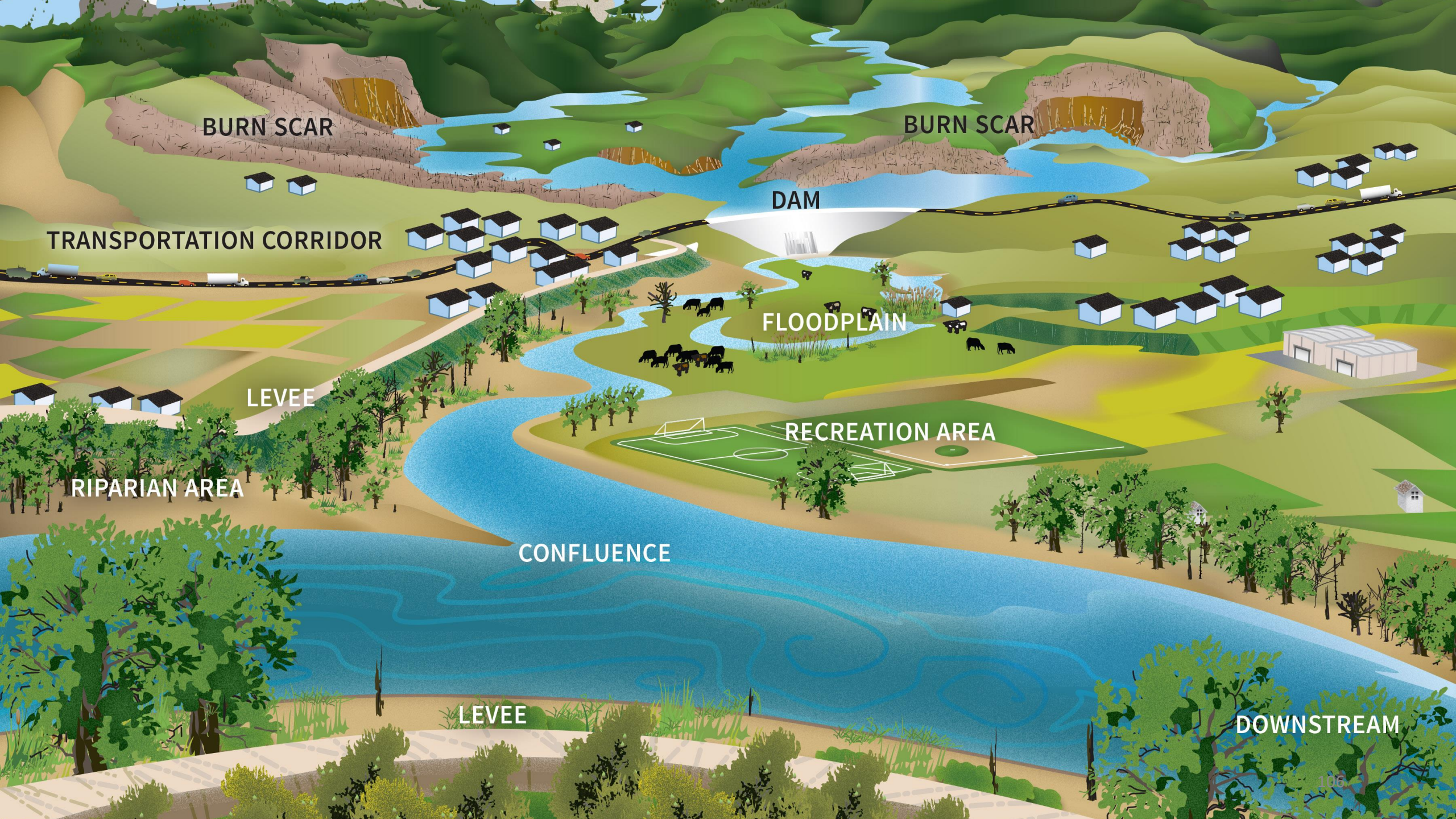
WATER RESOURCES

Q&A

Public Comment


BURN SCAR
BURN SCAR
DAM
TRANSPORTATION CORRIDOR
FLOODPLAIN
LEVEE
RECREATION AREA
RIPARIAN AREA
CONFLUENCE
LEVEE
DOWNSTREAM

Thank You