DEVELOPING A FRAMEWORK FOR INCORPORATING CLIMATE CHANGE AND BUILDING RESILIENCY INTO RESTORATION PLANNING CASE STUDY – LOWER COLUMBIA RIVER ESTUARY

Keith Duffy, U.S. Army Corps of Engineers
Ethan Rosenthal, David Evans and Associates
Sandra Coveny, PC Trask and Associates *
Jeremy Lowe, ESA **

April 10-12 2018

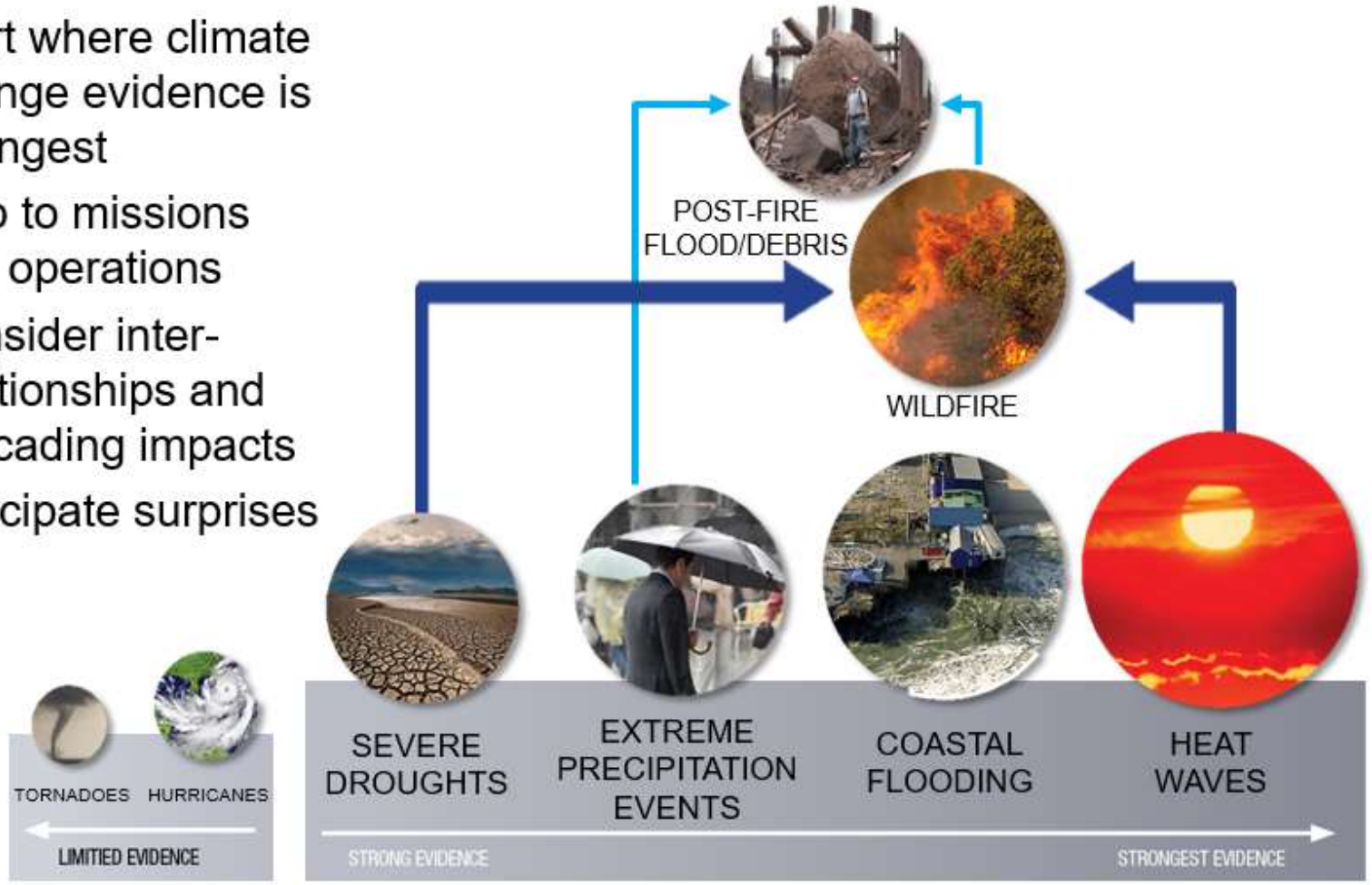
* Now an independent consultant
** Now with San Francisco Estuary Institute and Wolf Water Resources

US Army Corps of Engineers ®
Portland District

U.S. ARMY

GUIDING QUESTION: *"How can the Corps and others develop a replicable framework for incorporating climate change and building resiliency into restoration planning?"*

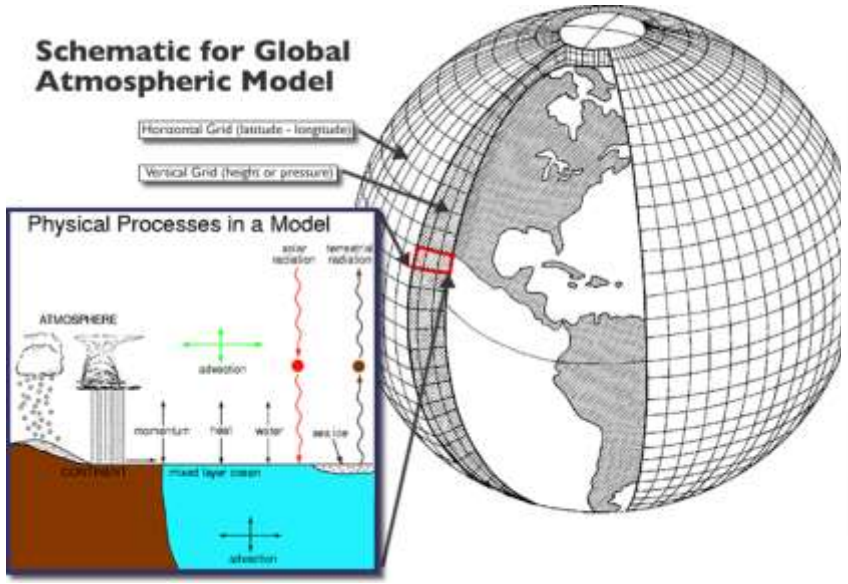
1. Start where climate change evidence is strongest
2. Map to missions and operations
3. Consider inter-relationships and cascading impacts
4. Anticipate surprises

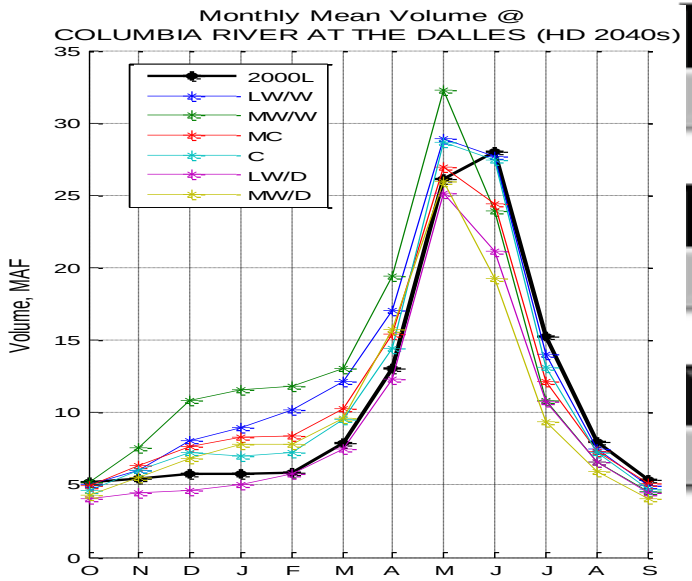


US Army Corps of Engineers ®
Portland District

U.S. ARMY

INCORPORATE CLIMATE CHANGE IN RISK-INFORMED DECISION MAKING





Establish Decision Context

Planning Step1: Specify Problems and Opportunities

Identify Risks — Greater emphasis is placed on explicit recognitions of risk and uncertainty.

Planning Step 2: Inventory and Forecast

Identify and Analyze Risks — Begin Risk Assessment.: Efforts should characterize risk and uncertainties

Planning Step 3: Formulate Alternative Plans

Analyze Risks — Formulate plans that manage risks to acceptable levels

Planning Step 4: Evaluate Effects of Alternative Plans

Evaluate Risks — Finalize Risk Assessment: Qualitative and/or Quantitative Risk Assessment

Planning Step 5: Compare Alternative Plans

Evaluate Risks — Emphasis differences in risk characterizations from preceding steps

Planning Step 6: Select Plan

Risk Management Decision — Choose plan with tolerable risk and ensure risk management strategy in plan implementation

Monitor & Evaluate

Continuously

Consult,

Communicate,

Collaborate,

Repeat planning steps as much as necessary

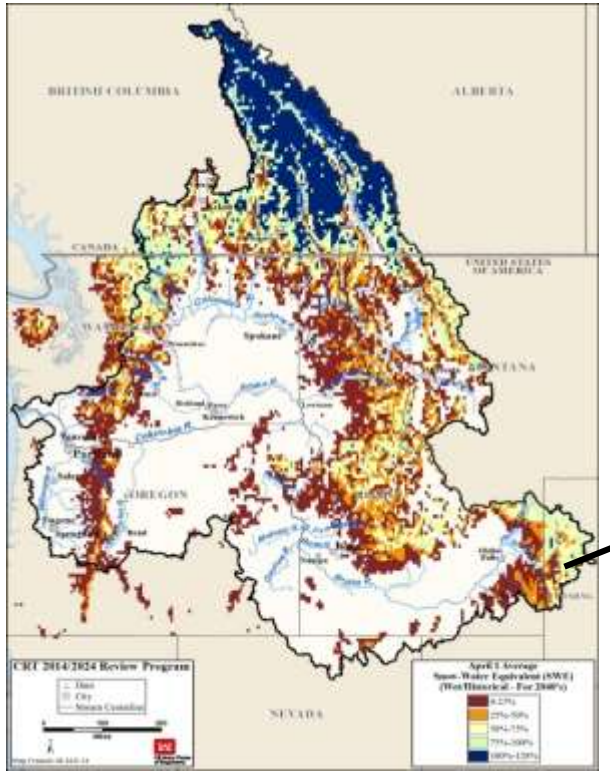
TOOLS

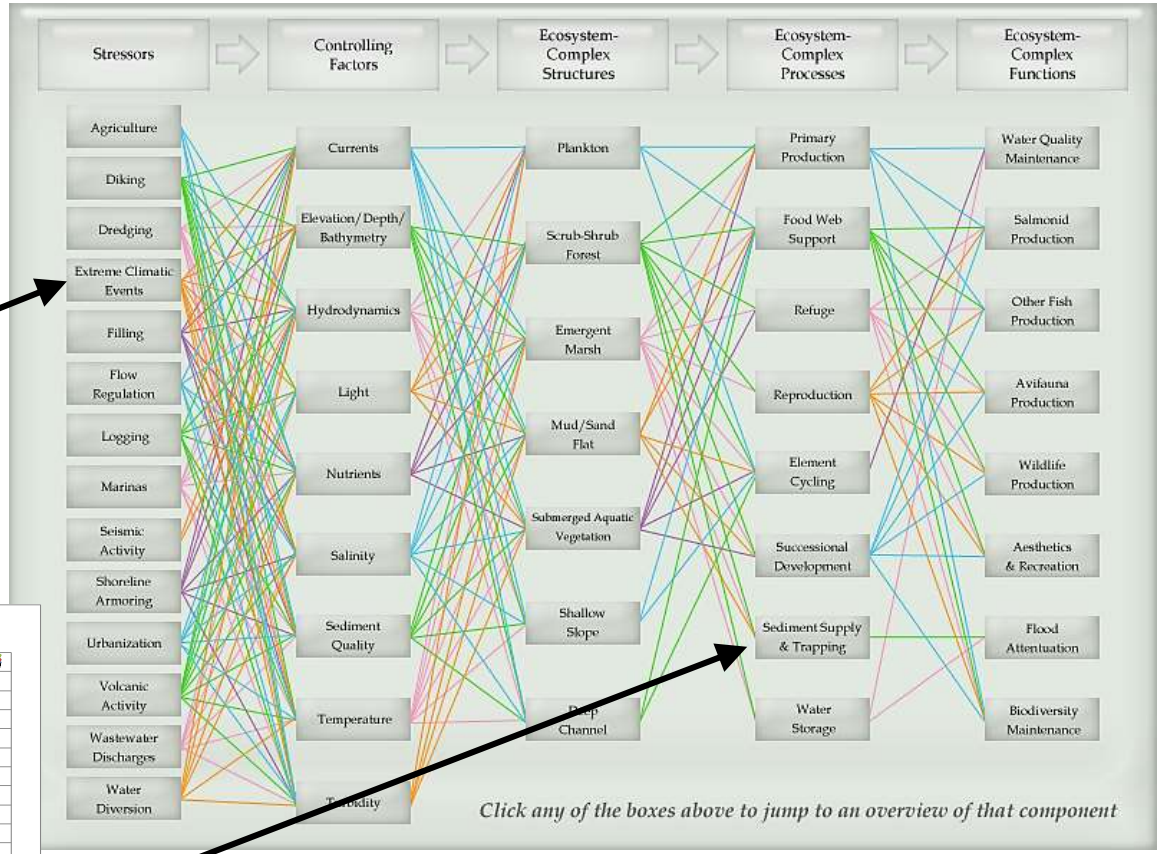
IPCC and Federal information on web for big picture CC context.

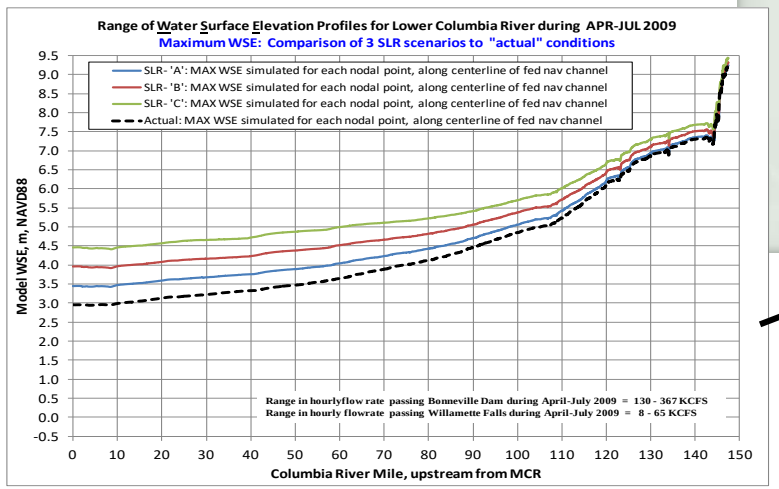
Find GCMs: CMIP3/5 projected temperature changes, precipitation, SWE and streamflow.

Utilize UW (HB 1160)/RMJOC/CRT CC streamflow datasets.

At the local level, use existing conceptual and computational models of the estuary.



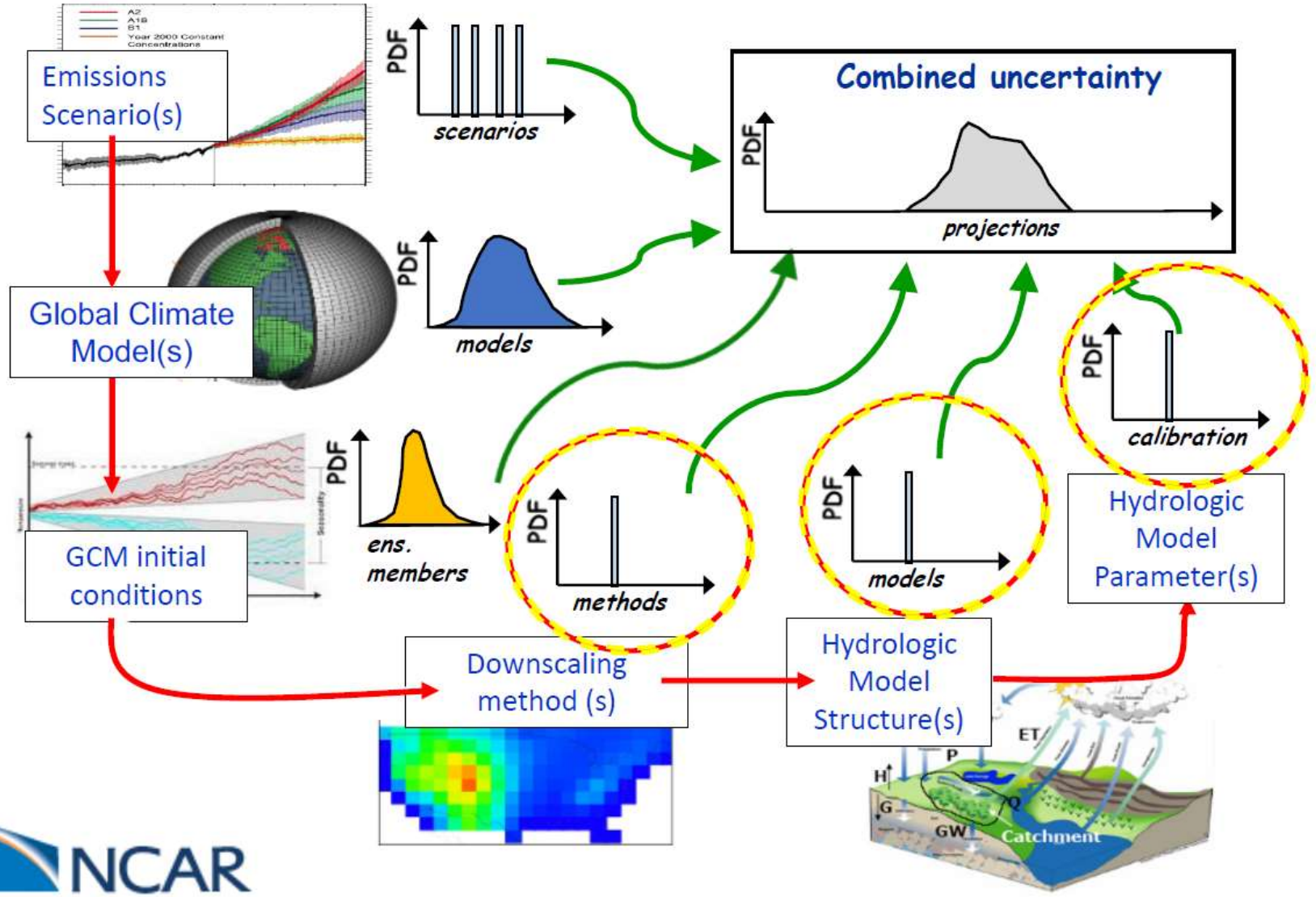




US Army Corps of Engineers ®
Portland District

U.S. ARMY

REVEALING AND REDUCING UNCERTAINTIES



CC planning and adaption are characterized by high levels of uncertainty.

Inherent uncertainty can be addressed by a risk and scenario based approaches.

Put reliance on real observations, e.g. monitoring versus complex computer models.

Do not lose sight of the present conditions.

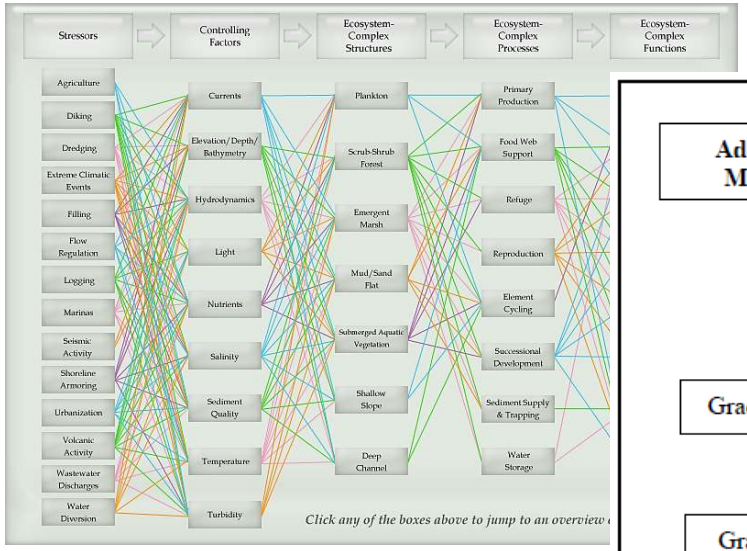
NCAR

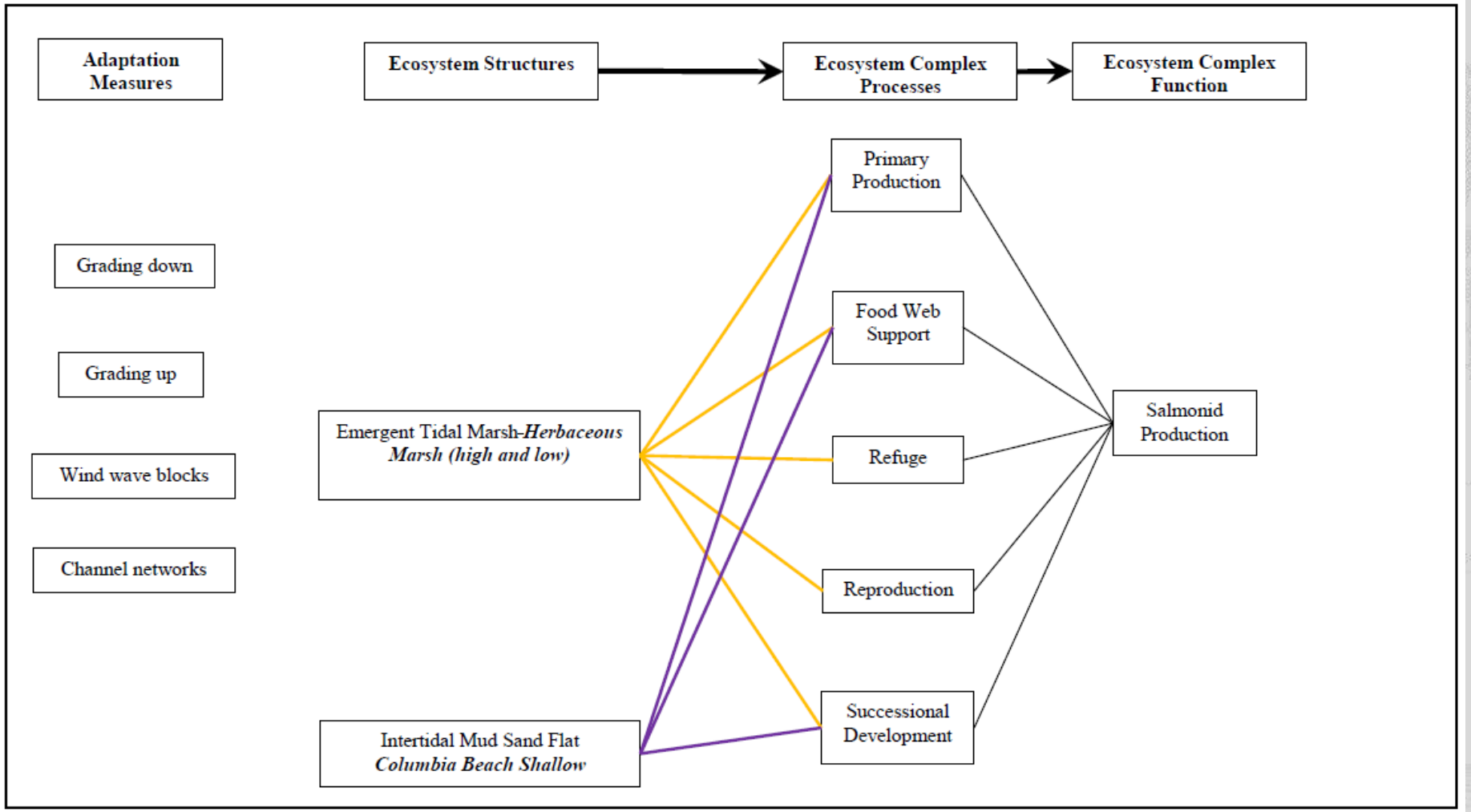
US Army Corps of Engineers ®
Portland District

U.S. ARMY

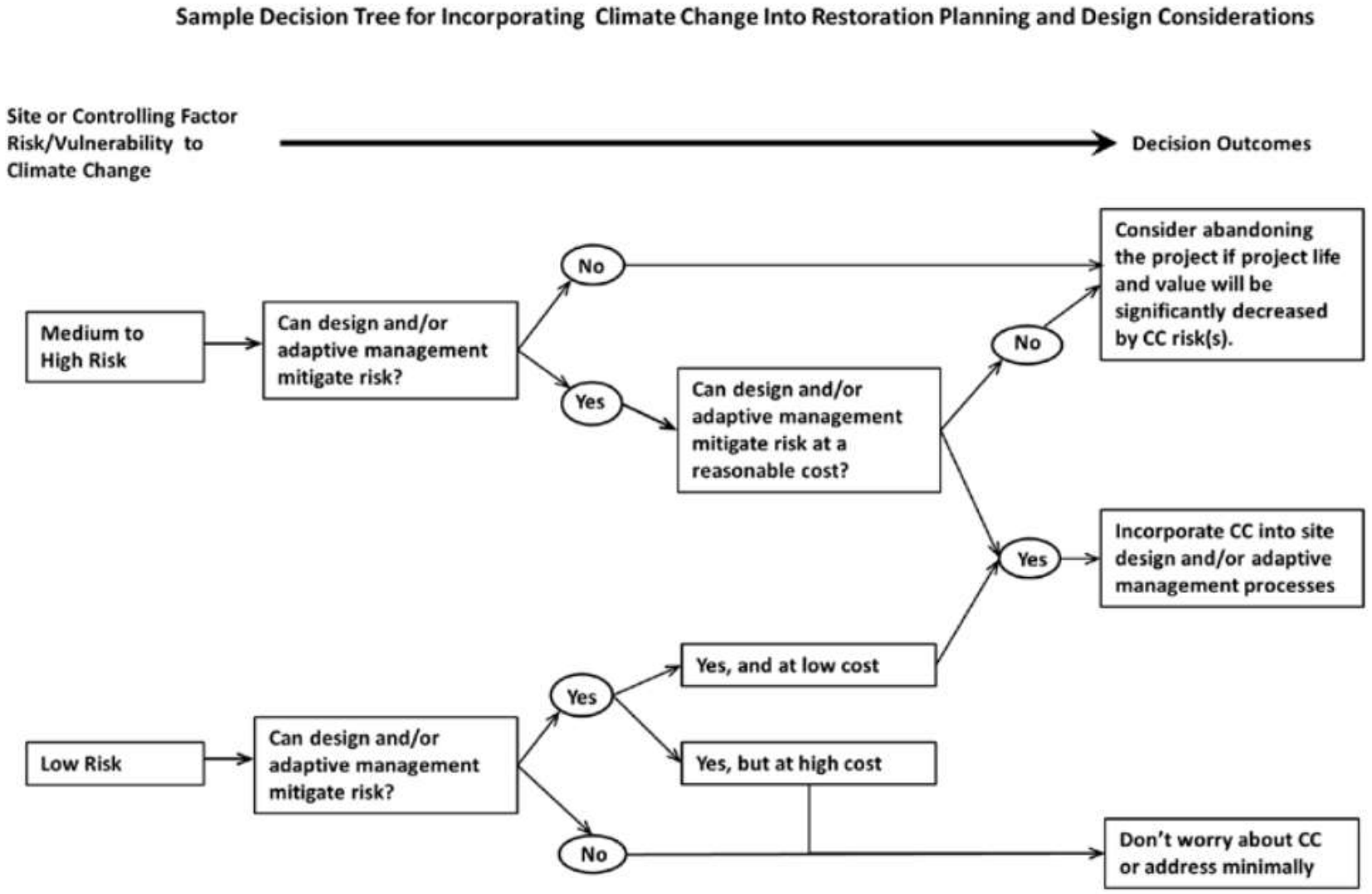
REDUCING COMPLEXITY TO INFORM DECISION MAKING

Simplify by focusing on the things we can affect





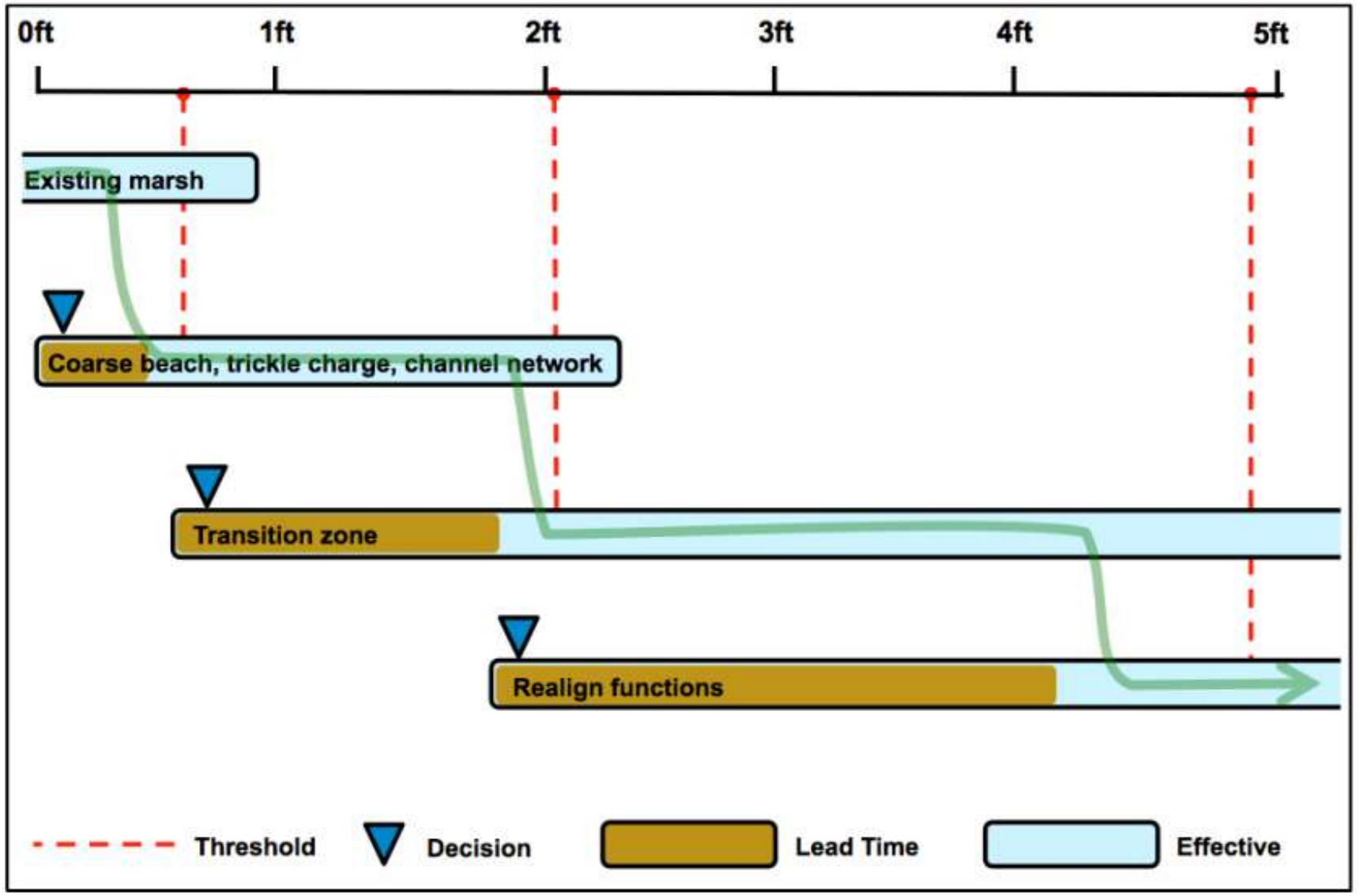
REDUCING COMPLEXITY TO INFORM DECISION MAKING



US Army Corps of Engineers ®
Portland District

U.S. ARMY

Phased Approach to Climate Change Adaptation



US Army Corps of Engineers ®
Portland District

U.S. ARMY

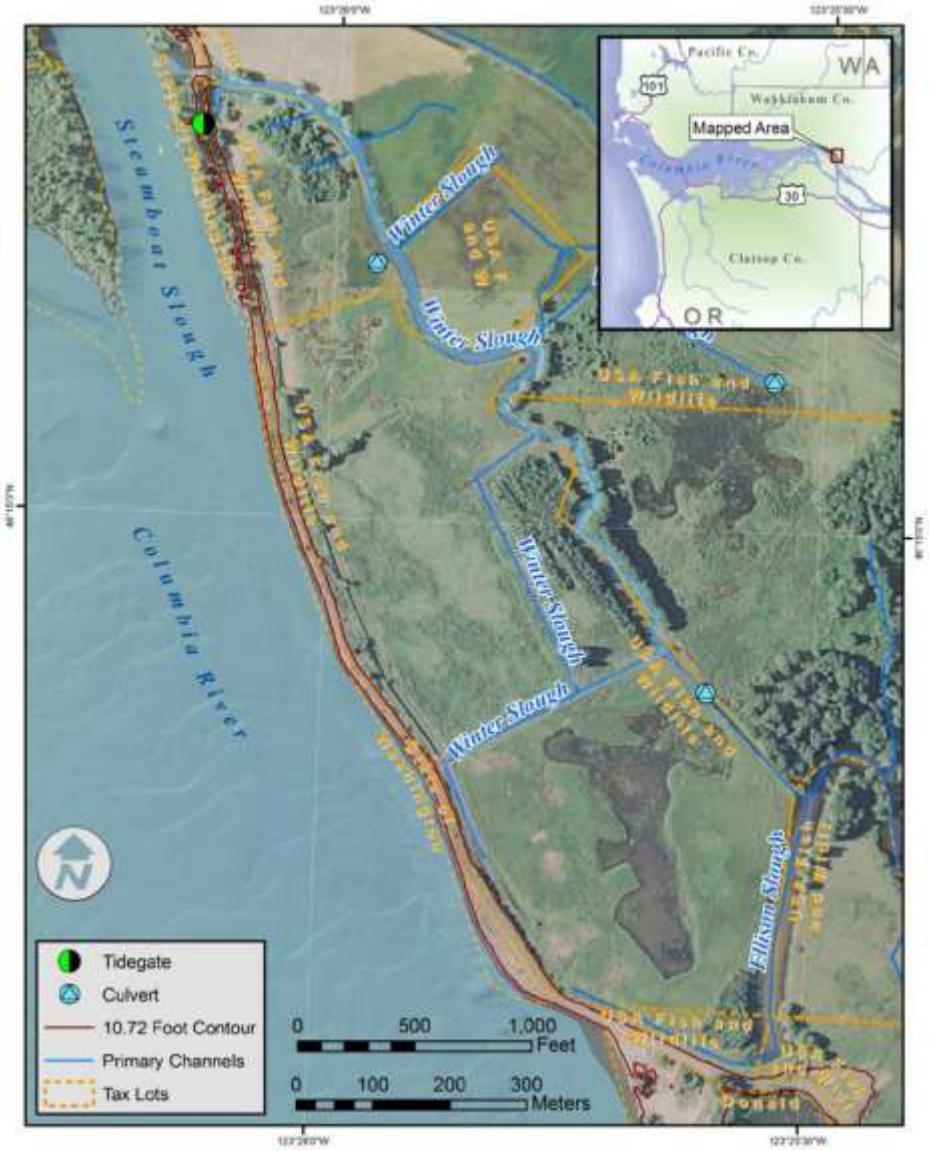
CASE STUDY

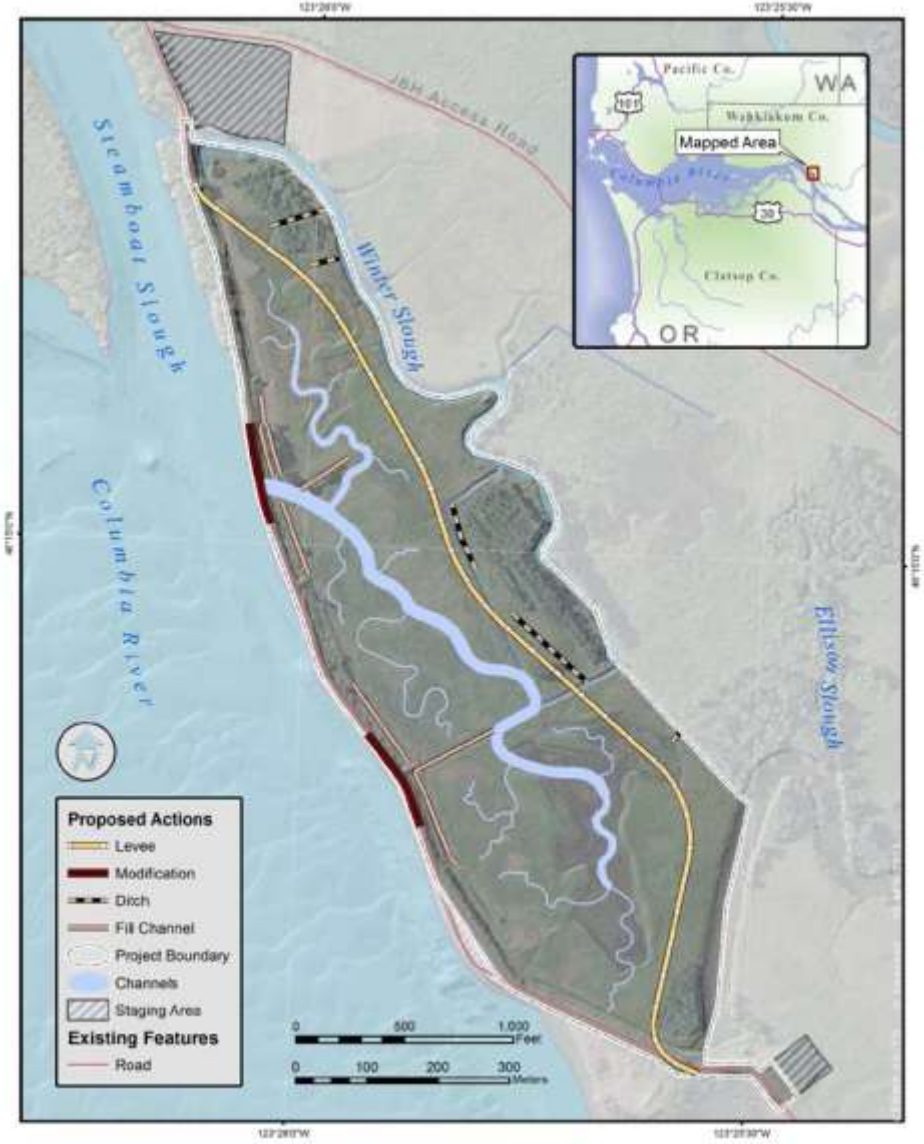
“Steamboat Slough”, an existing Corps project.

What could be done different?

Additional climate change information and understanding.

Incorporation of conceptual models and site context within the estuary.

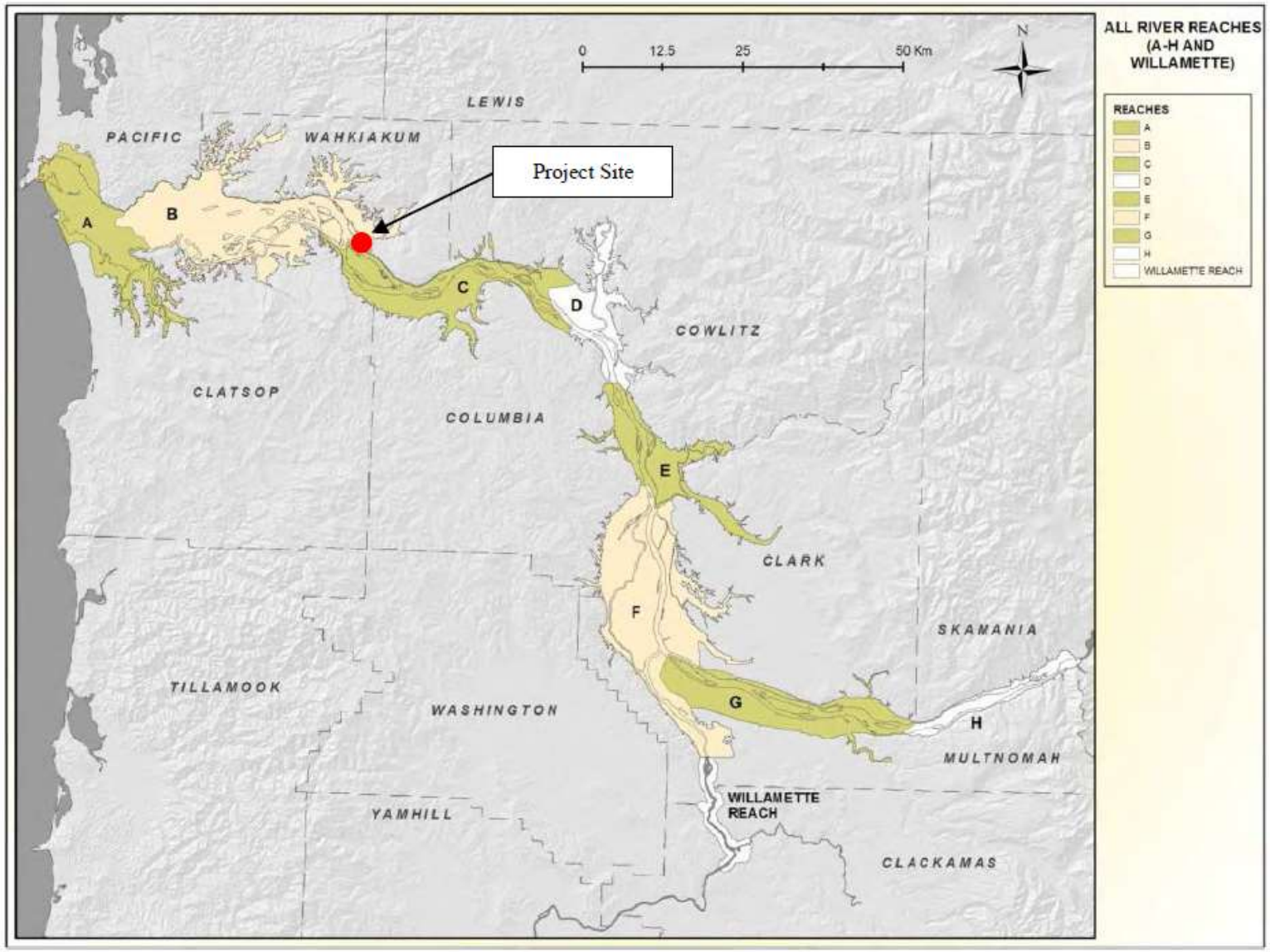




US Army Corps of Engineers ®
Portland District

U.S. ARMY

ESTUARY LOCATION



RM 35.

The project is located in the estuary where tidal hydraulics dominates.

Experiences a mean high tide and low tide of 8.88 to 1.32 feet.

Most of the site, restoration is characterized as mudflat/low marsh habitat.

US Army Corps of Engineers ®
Portland District

U.S. ARMY

POTENTIAL ADAPTATION MEASURES AT STEAMBOAT SLOUGH

#	Management Measure	Objective	Success Criteria
1	Increase setback levee elevation by sea level rise residual (i.e., 1.83 feet at 2064 or 4.18 feet at 2100.)	Match existing flood protection in light of potential increase of sea level rise elevations.	Levee elevation is high enough to provide flood protection to the landward area inhabited by white-tailed deer.
2	Potentially change the channel design so that it self-adjusts. Over-excavate the breach, remove hard point features to allow dynamic change.	Design to current conditions but ensure future capacity for channel to adjust naturally.	Revised design is flexible enough to meet future conditions.
3	Excavate channels deeper.	Greater amount of cold water refugia.	Channels maintain designed depth, which provides cool water during summer.
4	Provide habitat elevation gradients along proposed benches, or a gradual slope instead of benches at single elevation criterion.	Ensure greater vegetative diversity and site flexibility to resist warmer temps and lower precipitation in the summers and changing hydrographs.	Additional areas for plant succession in light of climate change are provided, although this could be constrained by availability of site fill material, etc.
5	Add high spots to marsh surface (i.e., grade) or conduct targeted revegetation to accelerate accretion rates.	Foster marsh accretion processes.	Vegetated wetland habitats keep pace with projected sea level rise.
6	Establish desirable vegetation as conditions change.	Support desired habitat functions over the life of the project.	Plant communities continue to provide desired habitat benefits over the life of the project.

"The Corps and others should adaptively manage the site for future changes without neglecting present site conditions …"

US Army Corps of Engineers ®
Portland District

U.S.ARMY

CONCLUSIONS AND RECOMMENDATIONS (1)

Climate change will alter the future state of the estuary and the evolution of estuarine habitats.

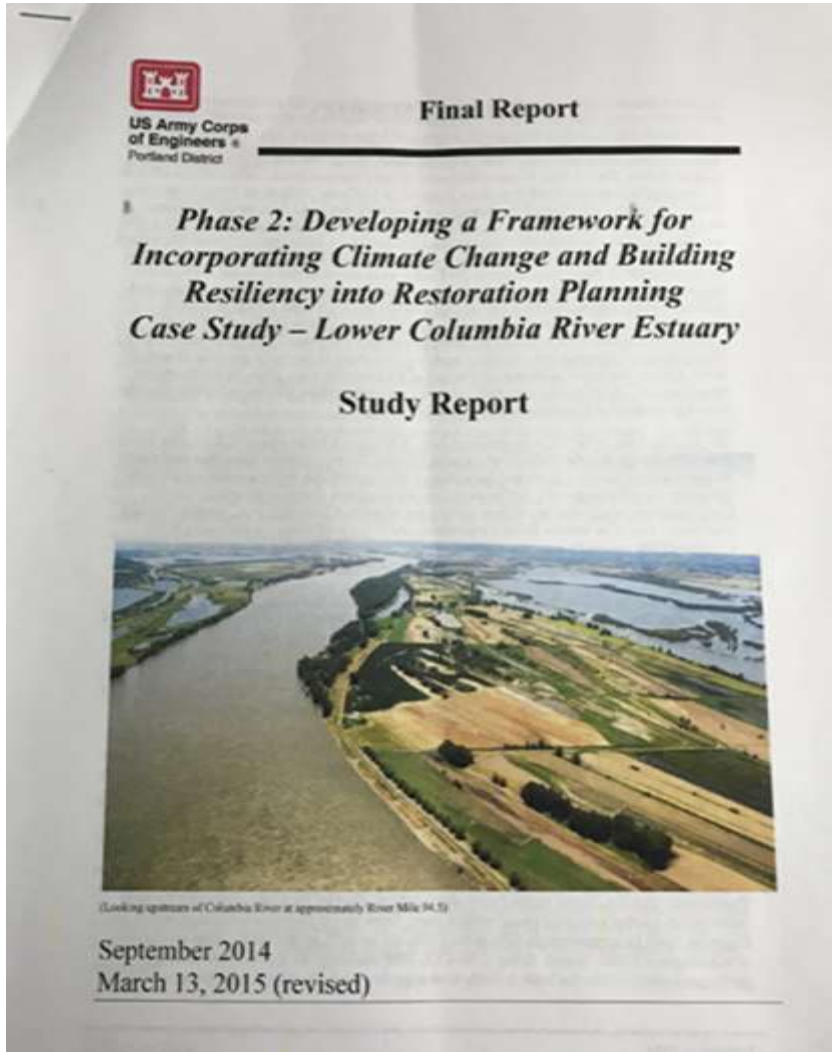
There are significant opportunities to increase future resiliency.

Given complexity of modeling future impacts, there will always be a high degree of uncertainty.

Build in flexibility using real world information and a risk based adaptive approach.

Stress monitoring data and specific threshold to trigger adaptation measures.

Long term, collaborative and innovative funding is critical.



US Army Corps of Engineers ®
Portland District

U.S. ARMY

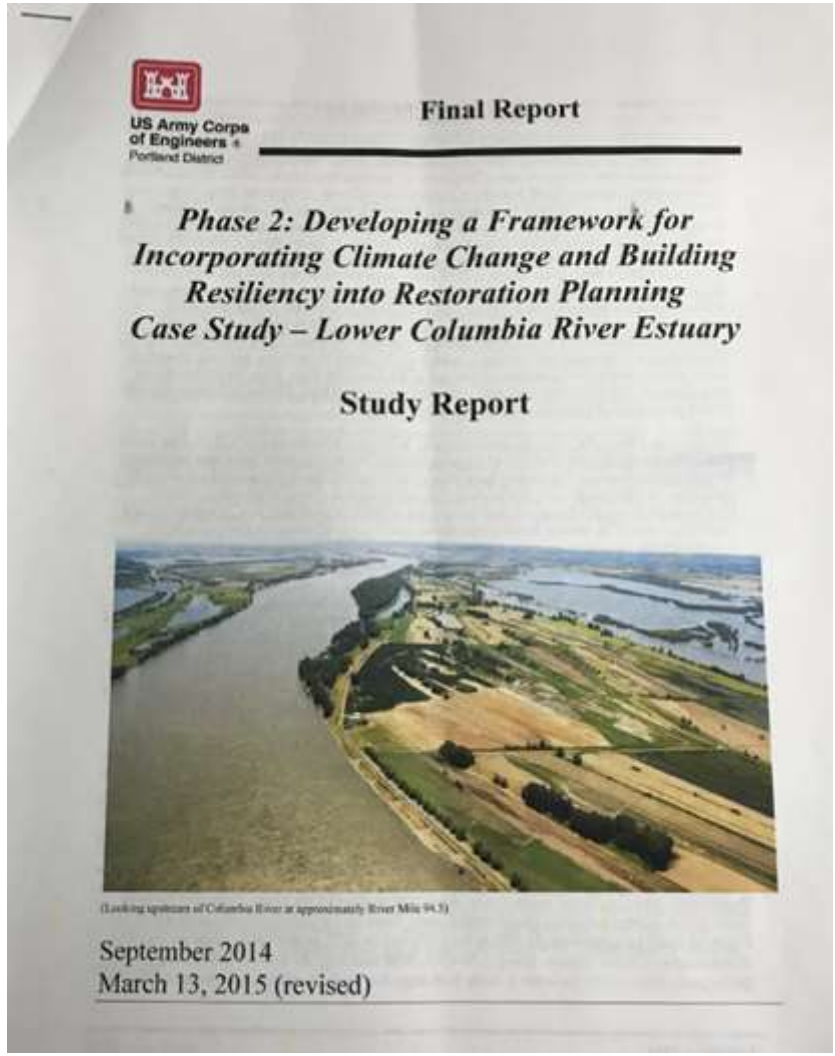
CONCLUSIONS AND RECOMMENDATIONS (2)

There is a need for more planning flexibility. Address with long-term adaptive management partnering agreements.

Integrate with other Corps programs. All efforts should be coordinated, such as hydrosystem management, levee systems, pile dikes, dredging and sediment management projects.

Estuary-wide, long-term monitoring are needed to identify changes and focus attention.

Implementing through large-scale, long-term adaptation strategies will be considerable



US Army Corps of Engineers ®
Portland District

U.S. ARMY

QUESTIONS

© Can Stock Photo

US Army Corps of Engineers ®
Portland District

U.S. ARMY