PLANNING FUNDAMENTALS REFRESH – FUTURE WITHOUT PROJECT (FWOP) CONDITIONS, INVENTORY & FORECAST, AND EVIDENCE GATHERING

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Agenda – FWOP, Inventory & Forecast, Evidence Gathering

- What does the new Planning Guidance, ER 1105-2-103, have to say about these concepts?
- How do FWOP, Inventory & Forecast, and Evidence Gathering fit together?
- Data
- Scenarios
- Analysis
- Uncertainty, level of detail, and characterizing associated risks
- Example from the Meramec River AER Study

KNOWLEDGE CHECK -- PLACE A CHECK AS APPROPRIATE

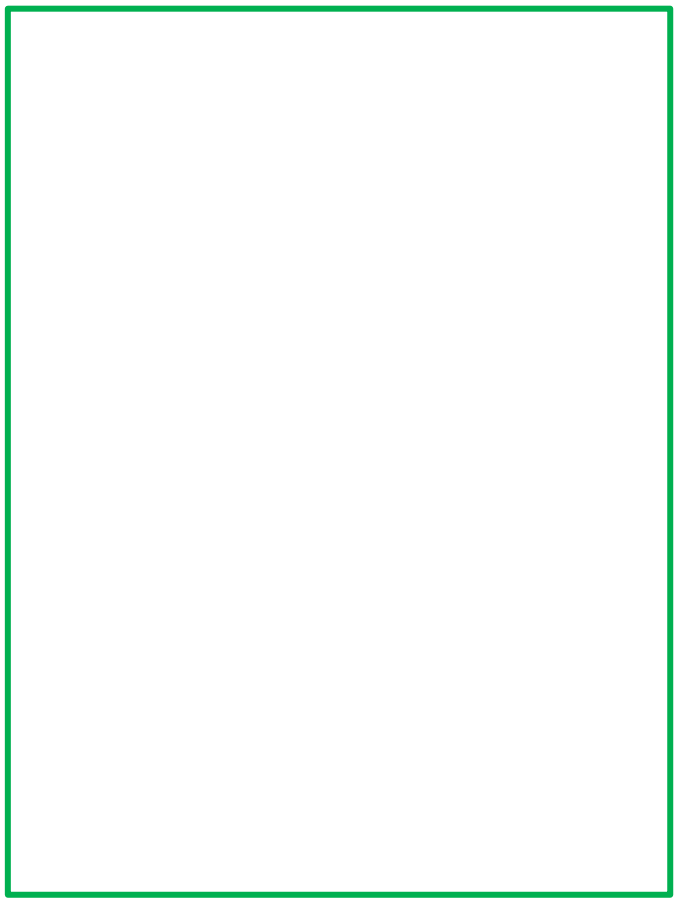
I haven't taken any of the PCC courses	I've taken PCC1 – Civil Works Orientation	I've taken PCC2 – Planning Essentials	I've taken PCC3 – Plan Formulation and Evaluation Capstone

KNOWLEDGE CHECK -- PLACE A CHECK AS APPROPRIATE

I've never heard of the FWOP

I have questions about the FWOP

I know what the FWOP is and have experience developing it



What does our new Planning Guidance, ER 1105-2-103, say about FWOP?

- To evaluate alternatives, must establish **“without-project”** and **“with-project”** conditions
- To develop without-project conditions, we must establish a ***baseline*** condition for the study area
- Baseline begins with the ***existing condition***, which is then projected forward to establish the without-project condition
- Existing conditions ***inventory*** -- includes quantity and quality of current and potential environmental, economic, and social (including health) resources/ services + connections between them
- PDTs must ***forecast*** environmental conditions including climate change, climate variability, and sea level rise

What does our new Planning Guidance, ER 1105-2-103, say about FWOP?

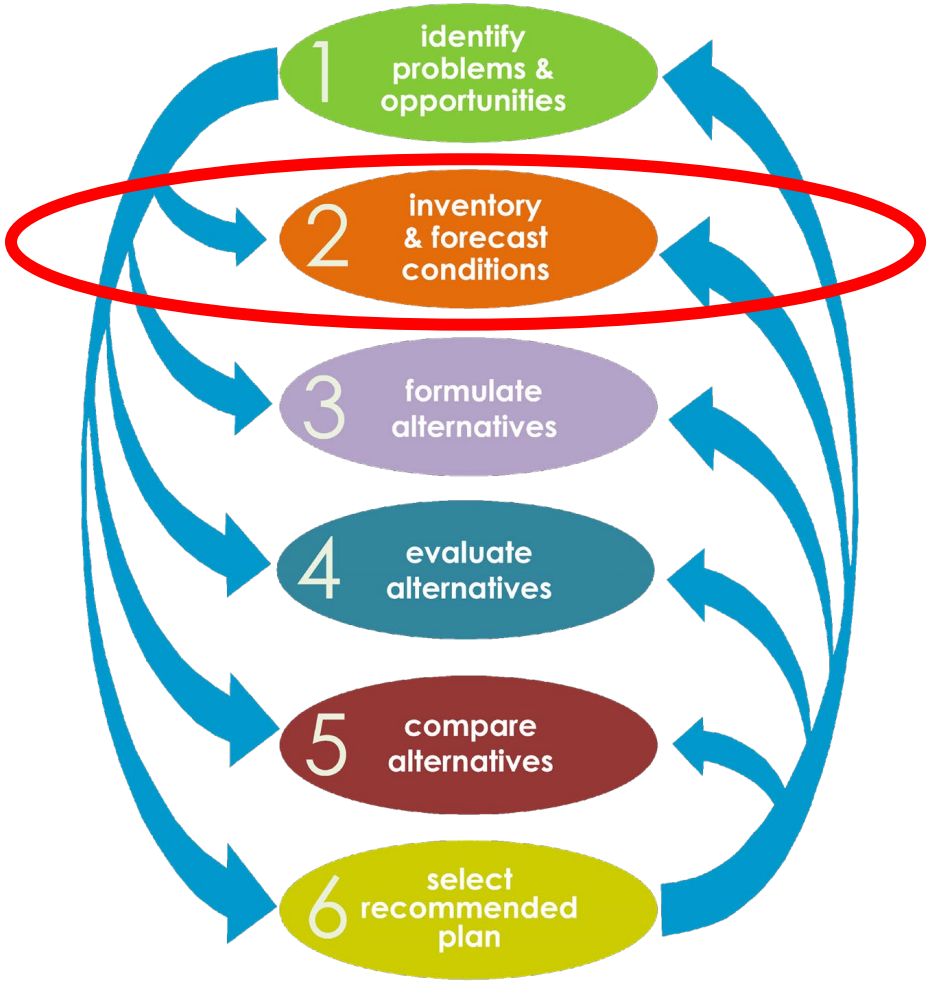
- FWOP: based on existing conditions, trends, and variability in the study area, ***forecast reasonably foreseeable conditions in the absence of a federal action*** over the period of analysis
  - Period of quantitative analysis should typically be ***no more than 50 years***
  - An **additional 50 years** of qualitative analysis should be evaluated for potential climate change/ variability and resiliency considerations
  - Include reasonably foreseeable actions by USACE, other public & private entities
  - **Use 4 P&G accounts** – NED, RED, OSE, EQ – to organize and display FWOP
  - **Level of detail** -- commensurate with rest of the analysis
  - FWOP should be ***policy compliant***
  - Projections of future conditions are ***inherently uncertain***

So, how do FWOP, Inventory & Forecast, and Evidence Gathering fit together?

BLUF:

- Future without project condition is a **scenario** – what will happen in the future in our study area over the period of analysis (usually 50 years) in the absence of the Federal actions we are considering (studying)
- Inventory & Forecast are **step 2** of the USACE 6-step planning process – we are describing (quantitively & qualitatively) the **current conditions (inventory) and projected future conditions (forecast)** for important physical, economic, social (including health) and environmental resources and services in our study area
- ***More on all of this in next slides…***

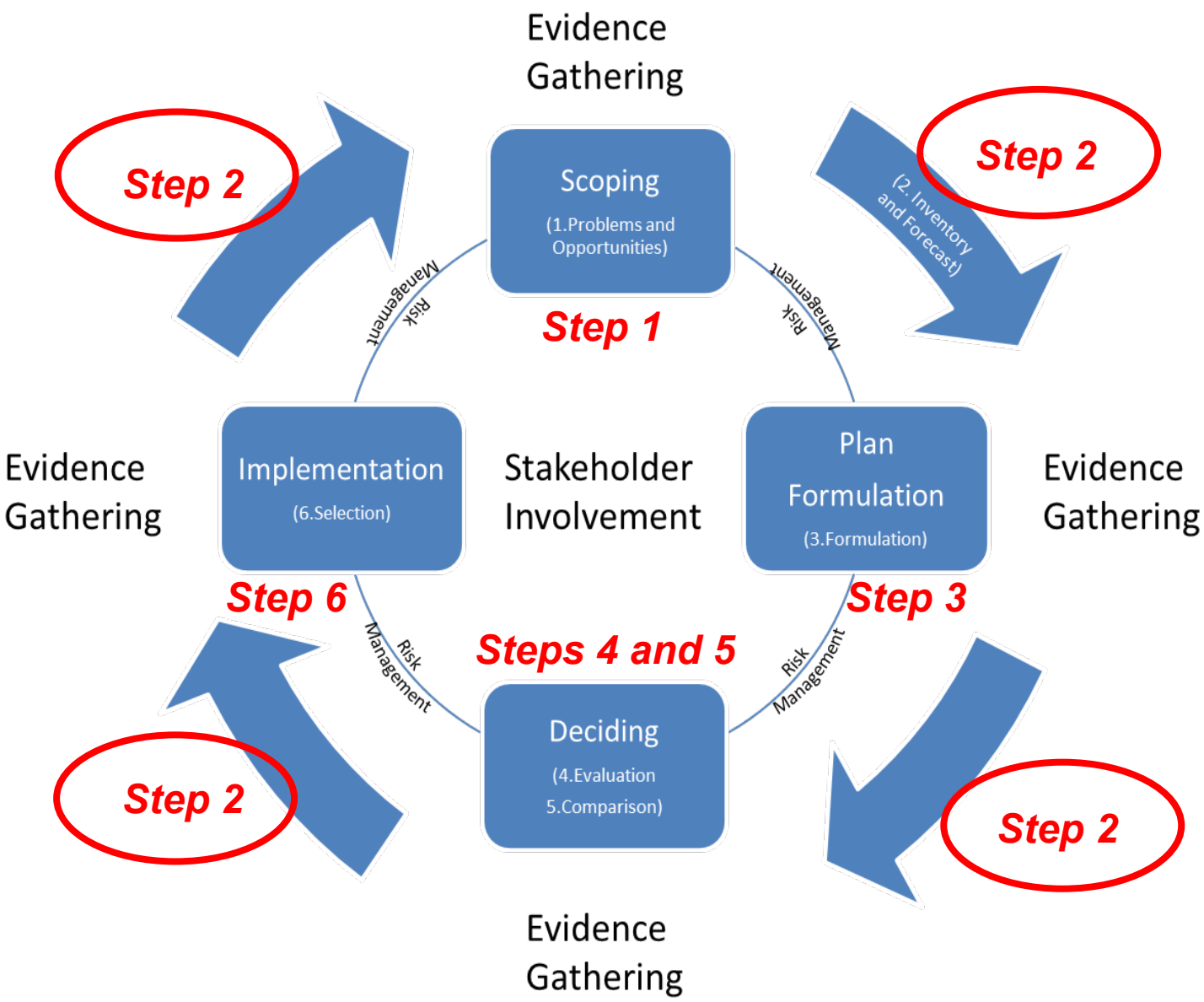
ER 1105-2-103 Six Step Planning Process



Risk Informed Planning

- ***Inventory & Forecast*** do not really fit neatly into step 2, sandwiched between steps 1 and 3 of the planning process, and completed before step 3 commences – they are ongoing tasks

- ***Evidence Gathering*** is a term and an activity coined during the transition to **Risk-Informed Planning** – it does include inventory & forecast, as well as other tasks, but they are recognized as **continuous activities** throughout the entire planning process, as well as iterations of the planning process

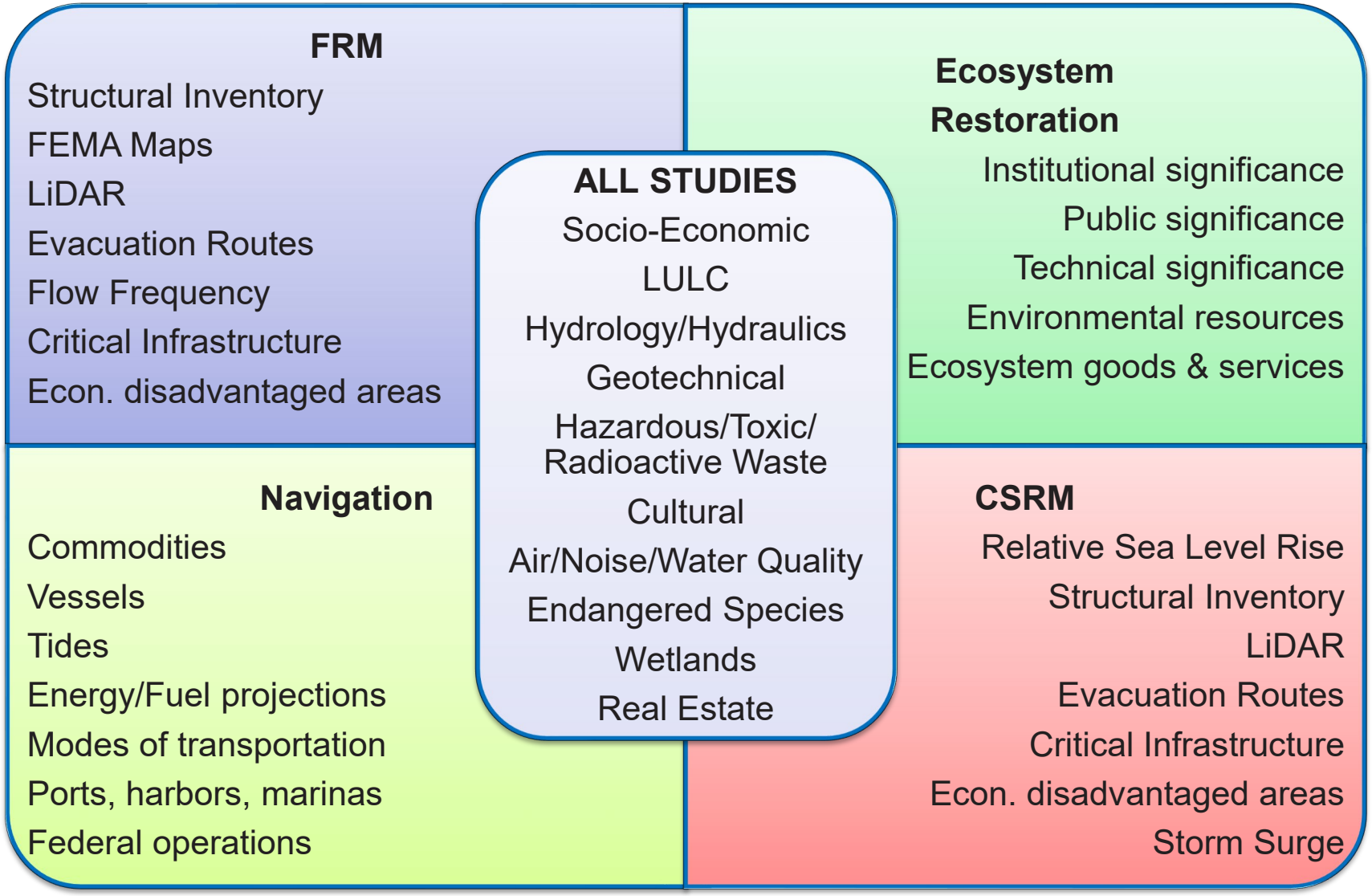


Evidence Gathering

Involves 3 major activities:

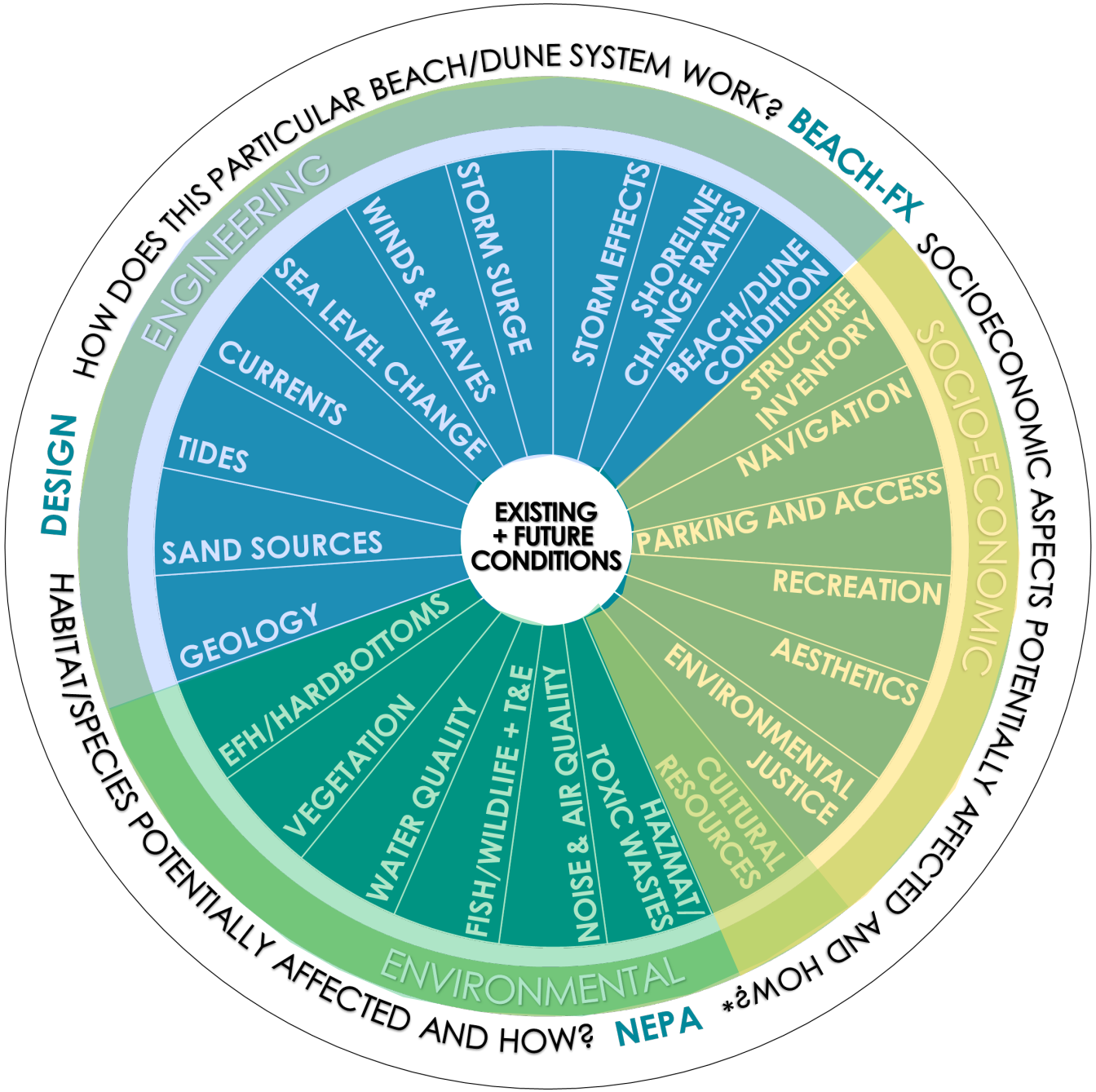
1. Data gathering
   - Type of data needed
   - Level of detail
2. Scenarios
   - Describe past, current, or future conditions
   - What conditions? Critical resources (e.g., physical, demographic, economic, social, cultural, environmental, etc.)
3. Analysis of evidence
   - Quantify/qualify the scenario
   - Identify and account for uncertainty

Evidence Gathering Activity #1: What Types Of Data Are Needed?



What types of data are needed? Typically, the "Three E's": Engineering, Environmental, and Economics

Here is an example of inventory and forecast specific to a coastal storm risk management project ----------→



Evidence Gathering Activity #2: What scenarios need to be developed?

- Historic
- Existing
- Base-year (near-term forecast)
- Future without-project (forecast)
- Future with-project (forecast)

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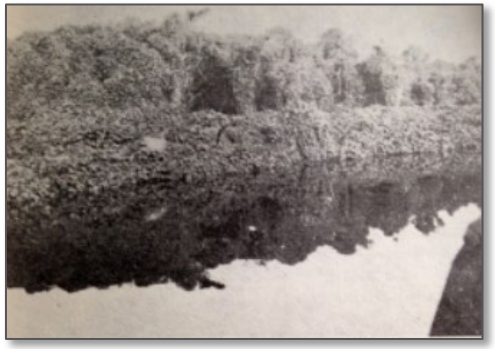


EXISTING/FUTURE WITHOUT PROJECT

FUTURE WITH PROJECT

Historic or Reference Condition Scenario

- Restore Ecosystem: -Structure –Function -Dynamic Processes

Pre-Dam

Existing

Post-Construction

Existing Condition Scenario

- Why Inventory?
  - Better describe and verify problems and opportunities
  - Reduce instrumental uncertainty
  - Make comparisons to with- and without-project scenarios
  - Helps explain significance of your project
  - Make good decisions!

For the baseline ecological conditions on an ER project, what questions would you ask to make sure you are collecting only the information you need?

Forecasting

- What is a forecast?
  - Future condition or scenario
  - Over the period of analysis – typically 50 years
- Why do we forecast?
  - Anticipate future conditions.
  - Understand benefits and effects of alternative plans
  - Identify & adapt to uncertainties.
- Uncertainty
  - Uncertainty is a part of forecasting.
  - Scenario planning

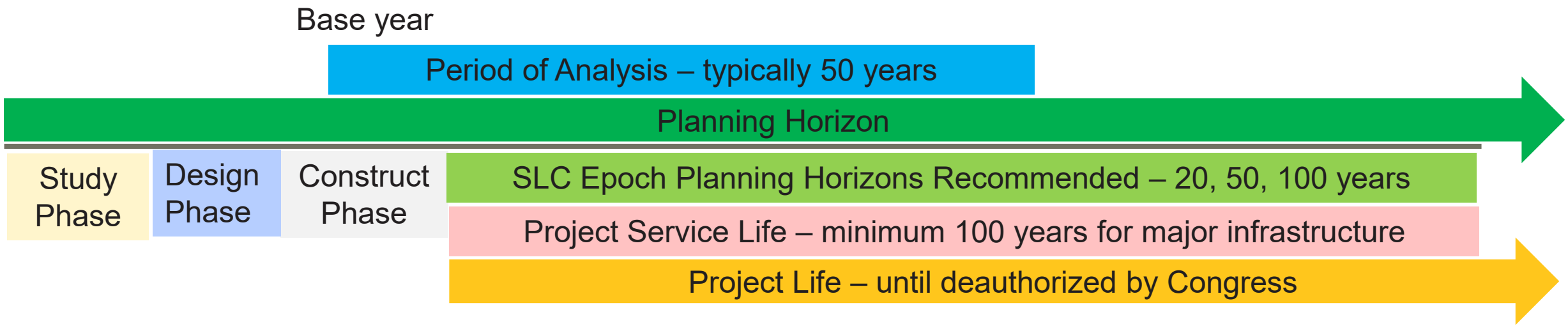
For ecosystem restoration, what might be key concerns you need to understand about the future without project condition?

Period of Analysis and Base Year

- **Period of analysis:**
  - Lesser of either 1) time over which an alternative would have significant effects or 2) a period not to exceed 50 years (except for major multi-purpose reservoir projects which are NTE 100 years)
  - Must be the same period and same base year for all alternatives
  - **Base-year** is the first year in the period of analysis – year when the project is expected to be completed & delivering intended benefits
  - Ensure your construction schedule and ecosystem/mitigation models line up with your economic base year

A note on terminology…

- Baseline (existing conditions) ≠ base year (start of 50-year period of analysis)
- "Planning horizon" and "project life" are not the same as the 50-year period of analysis
  - Once authorized projects are constructed, they last in perpetuity unless deauthorized, so "project life" is essentially forever
  - Planning horizon begins at the start of the study and continues for the project life, so it is also essentially forever



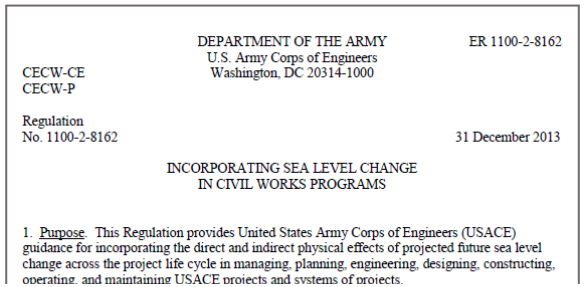
Future Without-Project Condition Scenario(s)

- Single most important scenario!
  - Basis of comparison for alternatives
- Primarily a qualitative effort in the scoping phase (high uncertainty)
  - Identify data gaps and where to focus gathering additional data for quantitative analysis
- Assumptions – trends, actions by others
  - Will problems get worse or go away?
- May have more than one potential without project scenario. Examples – sea level change, inland hydrology analysis
  - Make assumptions using one most likely FWOP to identify TSP/NED
    - Then compare back to other possible FWOPs as sensitivity

Planning with Uncertainty – Sea Level

Sea Level Change

ER1100-2-8162 & EP 1100-2-1



DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

CECW-CE
CECW-P

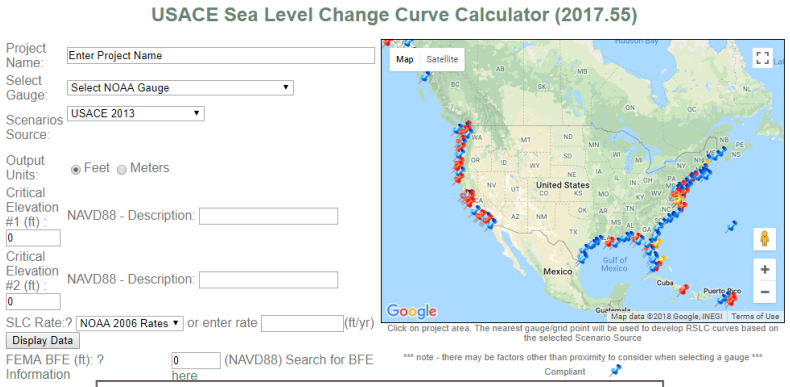
ER 1100-2-8162

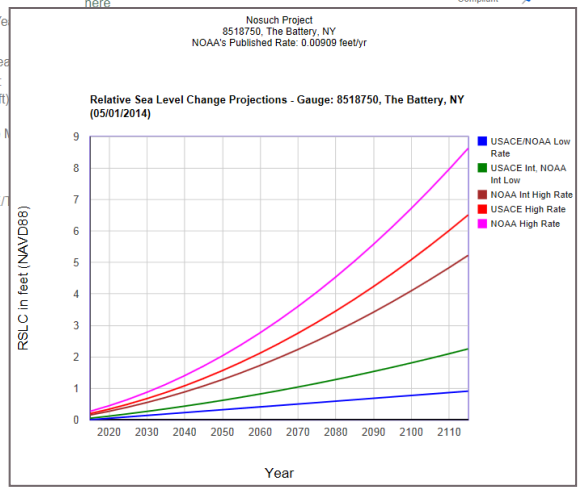
Regulation
No. 1100-2-8162

31 December 2013

INCORPORATING SEA LEVEL CHANGE
IN CIVIL WORKS PROGRAMS

1. Purpose. This Regulation provides United States Army Corps of Engineers (USACE) guidance for incorporating the direct and indirect physical effects of projected future sea level change across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects.





Requirements:

- If SLC is applicable for your study area:
  - Evaluate all Alts vs. all three USACE SLC scenarios

    OR
  - Formulate under one SLC scenario, with sensitivity for the others

Goals:

- Bracket uncertainty
- Show robustness and adaptive capacity
- Document assumptions, methods and results

USACE Tools:

- https://www.usace.army.mil/corpsclimate/Public_Tools_Dev_by_USACE/sea_level_change/
- FRM PCX webinar: https://planning.erdc.dren.mil/toolbox/resources.cfm?Id=0&WId=483&Option=Planning%20Webinars

Planning with Uncertainty – Inland H&H

Inland Hydrology
ECB 2018-14

ENGINEERING AND CONSTRUCTION BULLETIN

US Army Corps of Engineers.

No. 2018-14 **Issuing Office:** CECW-EC **Issued:** 10 Sep 18 **Expires:** 10 Sep 20
10 Sep 20, Rev 1 10 Sep 22

SUBJECT: Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects.

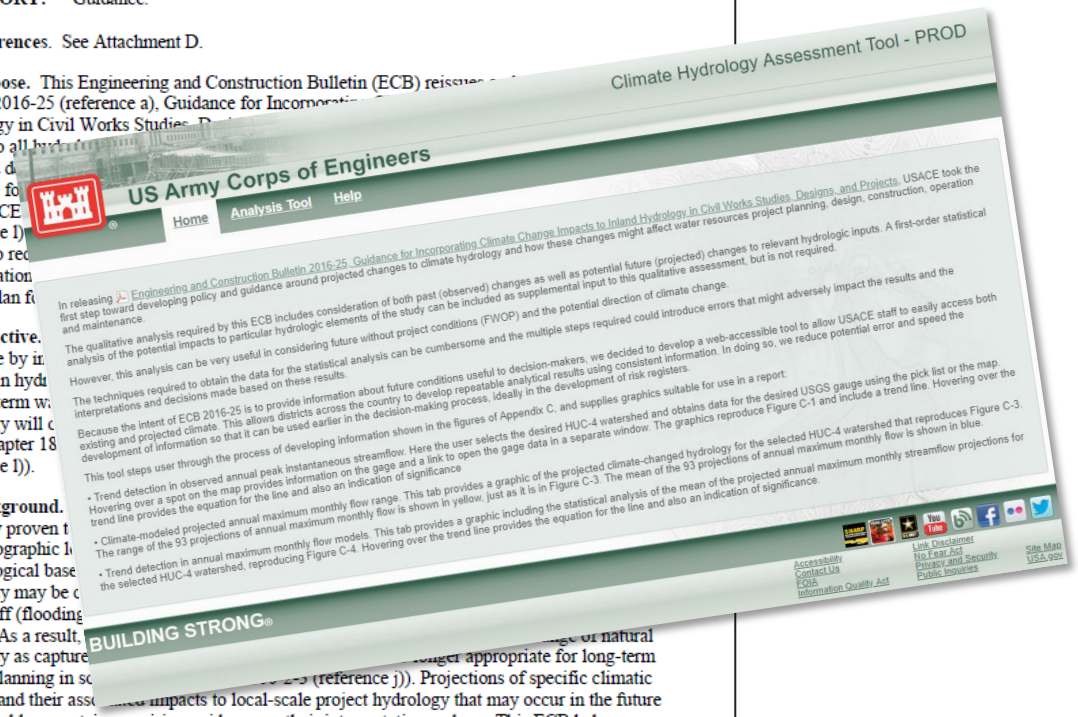
CATEGORY: Guidance.

1. **References.** See Attachment D.

2. **Purpose.** This Engineering and Construction Bulletin (ECB) reissues ... in ECB 2016-25 (reference a), Guidance for Incorporating ... Hydrology in Civil Works Studies, ... applies to all hydr... extended d... guidance fo... the USACE ... (reference l)) ... studies to rec... consideration ... inform plan f...

3. **Objective.** ... resilience by in... impacts in hydr... to short-term w... hydrology will c... (e.g., Chapter 18 ... (reference l)).

4. **Background.** ... generally proven t... some geographic l... climatological base... variability may be c... and runoff (flooding ... regions. As a result, ... variability as capture... project planning in sc... changes and their ass... impacts to local-scale project hydrology that may occur in the future can be highly uncertain, requiring guidance on their interpretation and use. This ECB helps support a qualitative assessment of potential climate change threats and impacts that may be relevant to the particular USACE hydrologic analysis being performed.



Requirements:

- Qualitative (using USACE tools) assessment of potential project vulnerabilities
- If Climate Change will be incorporated into FWOP baseline, prior approval from CP&R CoP required.

Goals:

- To consider and incorporate uncertain climate change impacts in hydrologic studies
- Document assumptions, methods and results

USACE Tools:

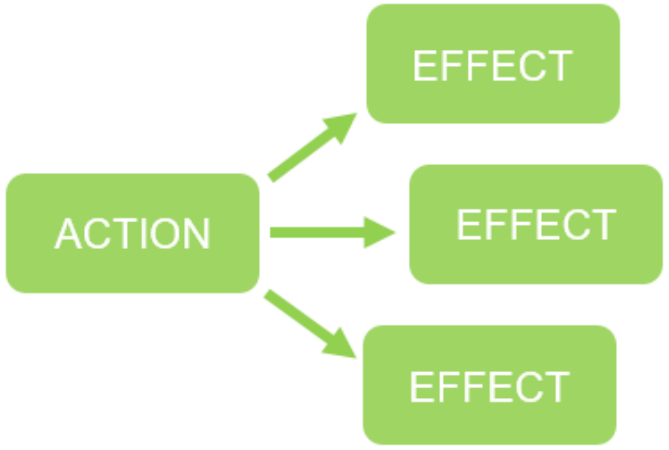
- https://www.usace.army.mil/corpsclimate/Public_Tools_Dev_by_USACE/Climate-Impacted_Hydrology/
- FRM PCX webinar: https://planning.erdc.dren.mil/toolbox/resources.cfm?Id=0&WId=482&Option=Planning%20Webinars

Future With-Project Condition Scenario(s)

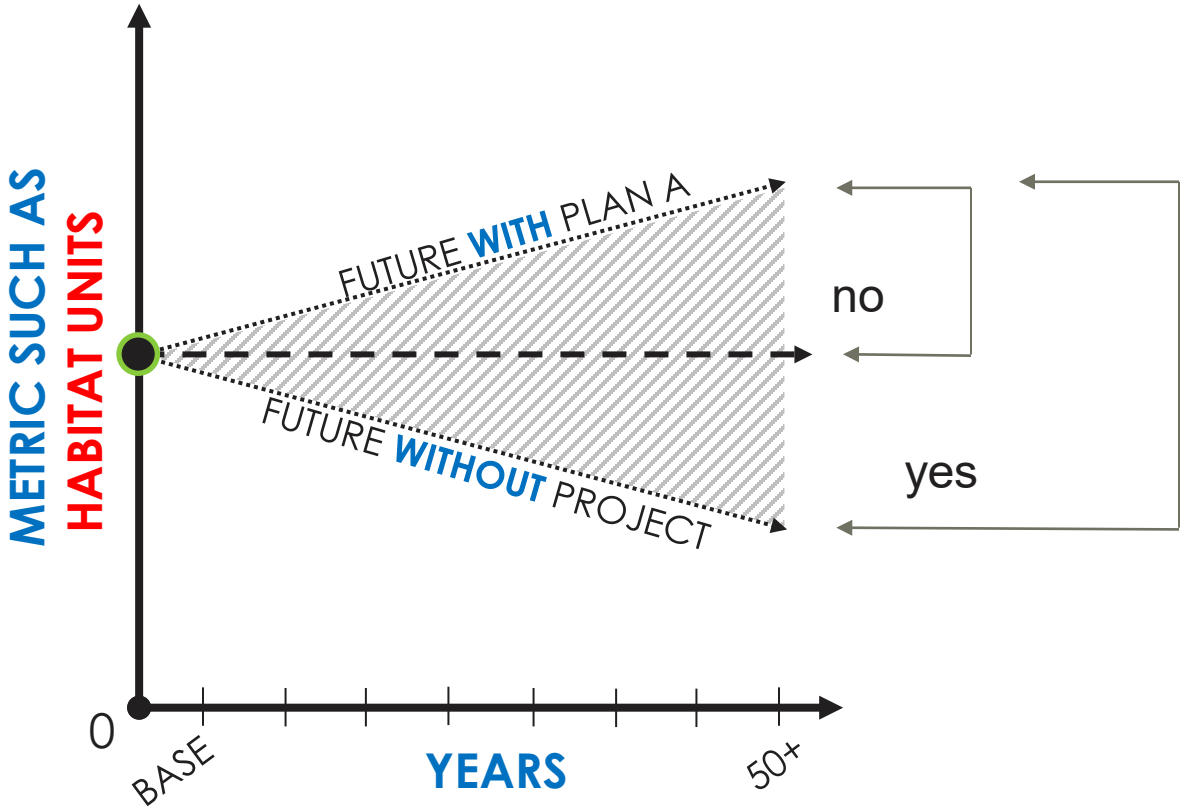
- Most likely future condition if a plan of action is taken
  - What will happen with action?
- Purpose of the with-condition scenario is to provide the narrative for evaluating the plan's effects
- Different with-condition for each plan
- Account for uncertainty in the with condition scenarios
- Document assumptions along the way and TELL YOUR STORY!

A Simple With Condition Example

Consider a flood risk management study. The without condition calls for a future with repeated flooding, a shaky economy in the floodplain, and deteriorating social conditions in the neighborhoods most frequently flooded. Now imagine a with condition that calls for a levee to prevent flooding. The levee is also expected to lead to gentrification of two of the three neighborhoods. The economy will stabilize but not grow.

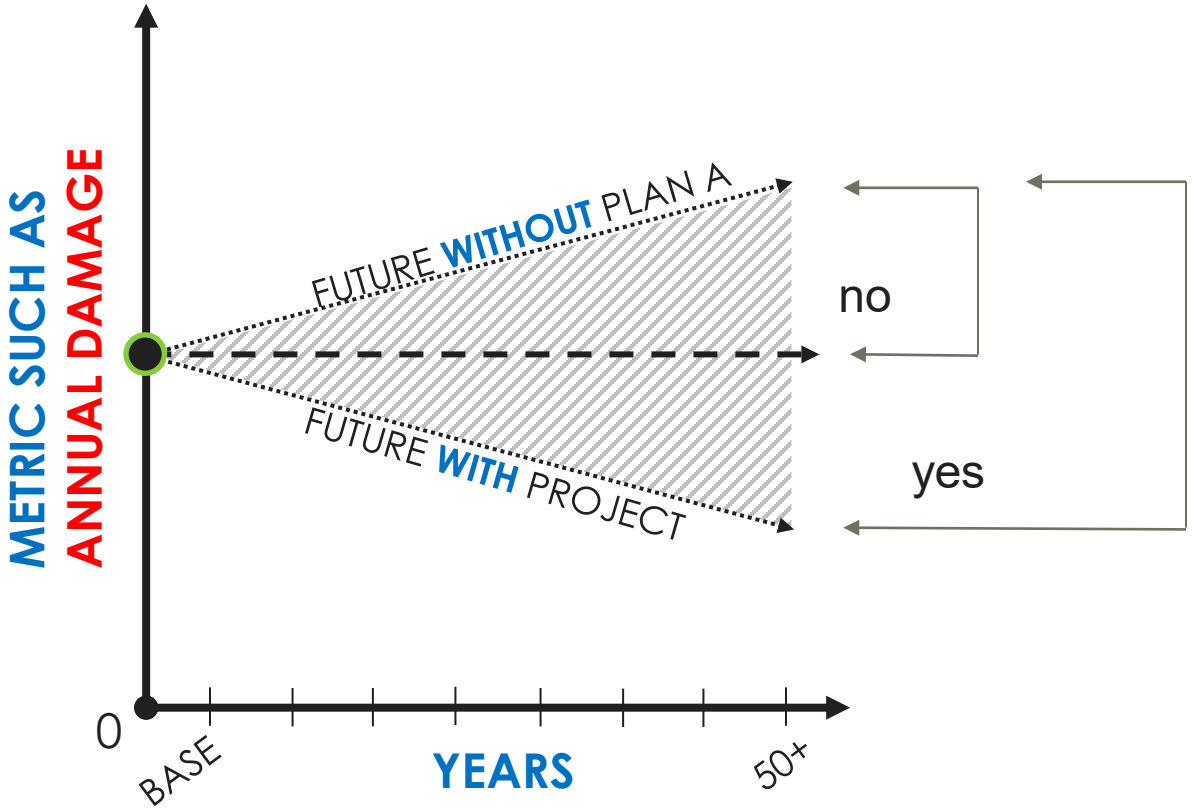


FWOP: The scenario to which we compare our alternatives



- ***The "effects" of any alternative are the difference between FWOP and FWP conditions***
- ***Some of these effects are a special category: they are the "benefits" we use to conduct economic or environmental evaluations to identify NED and NER plans***
- ***Best practice = metrics should reflect planning objectives and decision criteria!***

FWOP: The scenario to which we compare our alternatives



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- ***Best practice = metrics should reflect planning objectives and decision criteria!***

WITH PROJECT ALTERNATIVES COMPARED TO FWOP

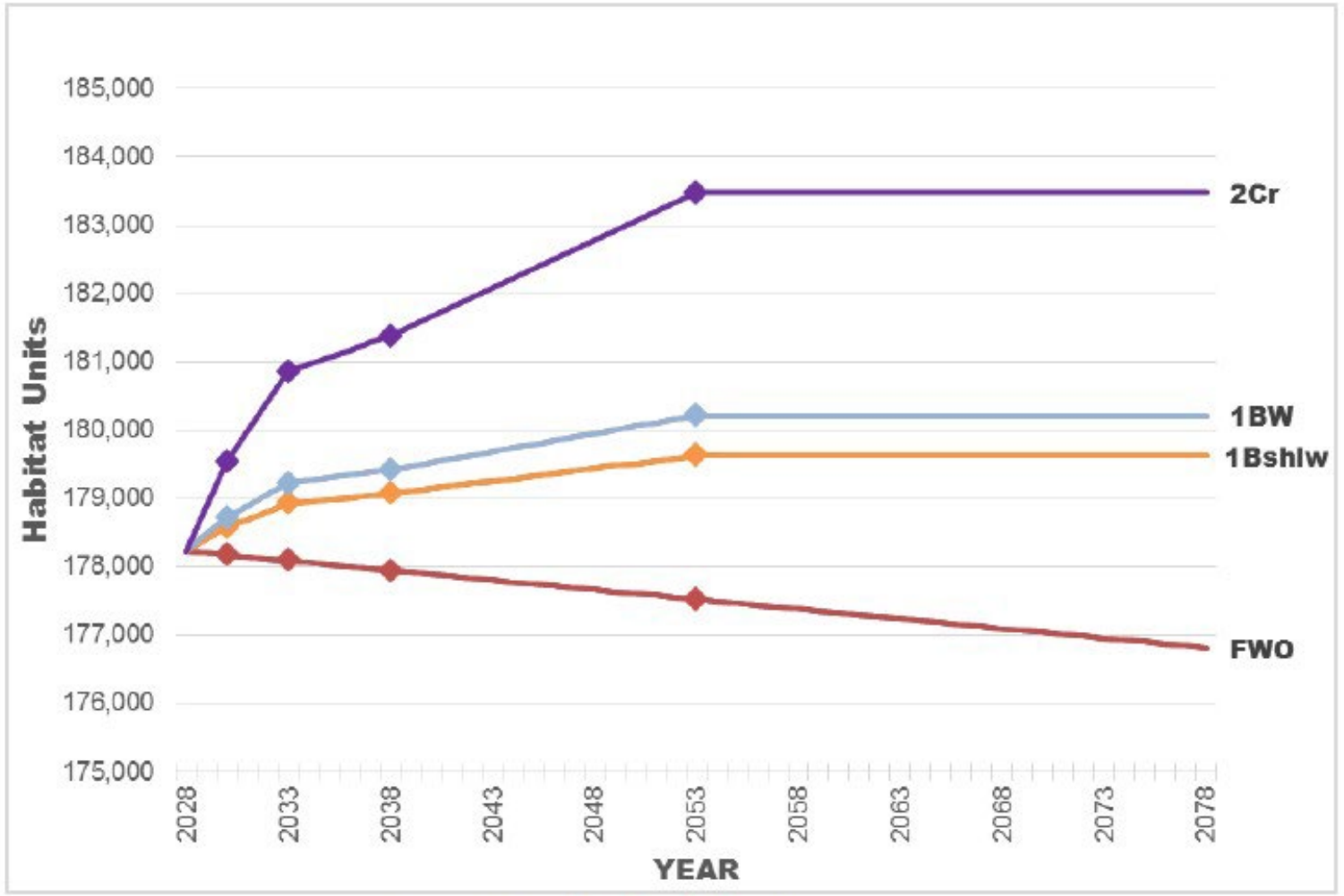

Figure 4-6. Lake Okeechobee HU trajectory.

Evidence Gathering Activity #3: Analysis of Evidence

- Quantify/qualify the scenario
  - How might we *quantify* scenarios?
- Identify and account for uncertainty
  - How might we address uncertainties?
- *Examples in subsequent slides…*

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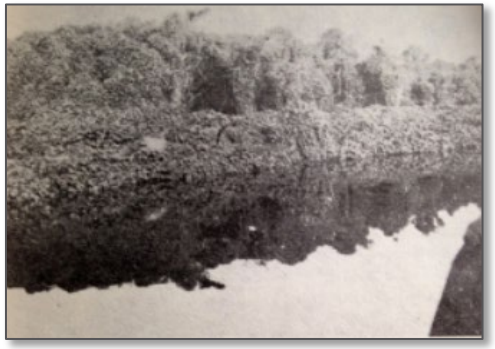
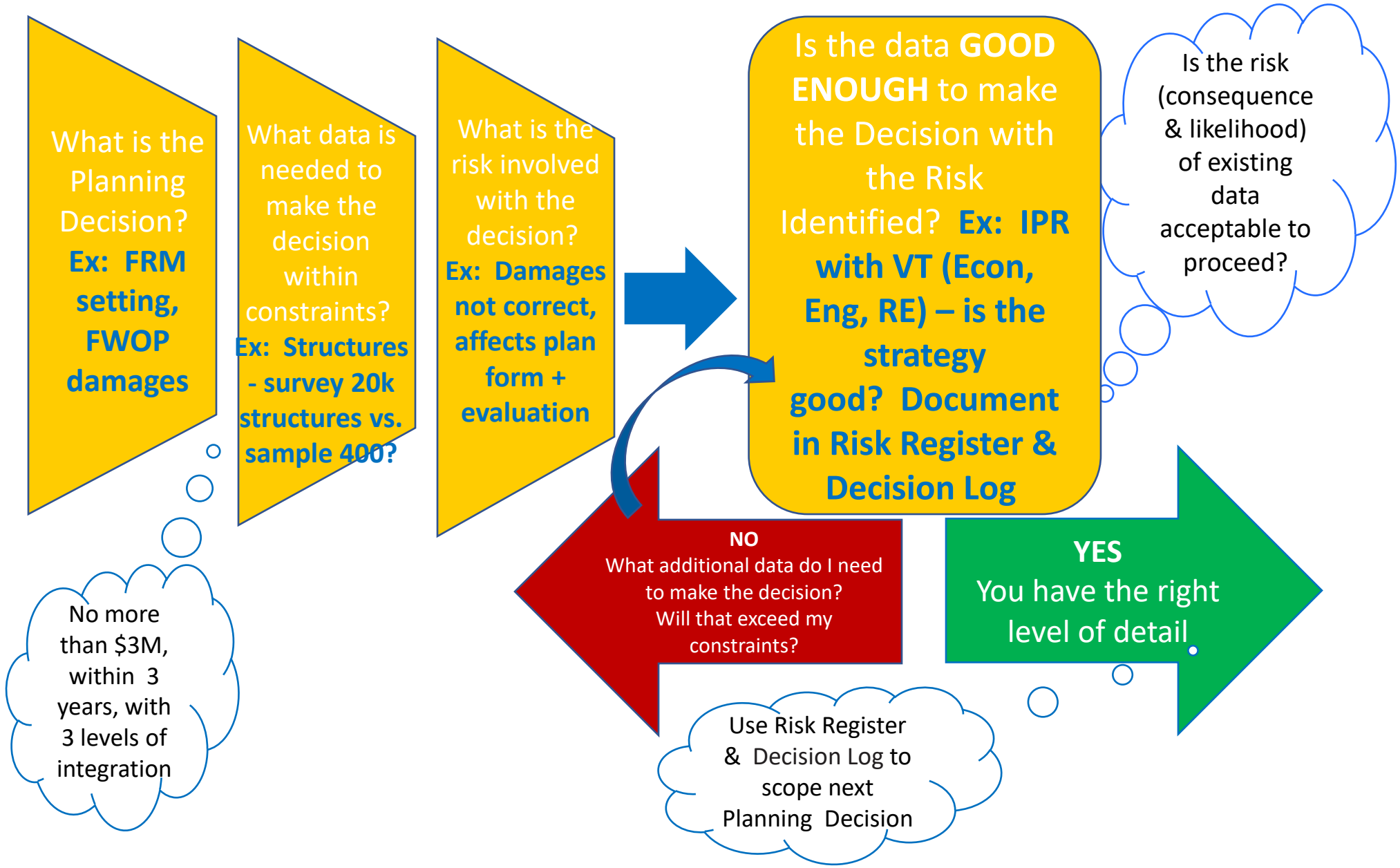


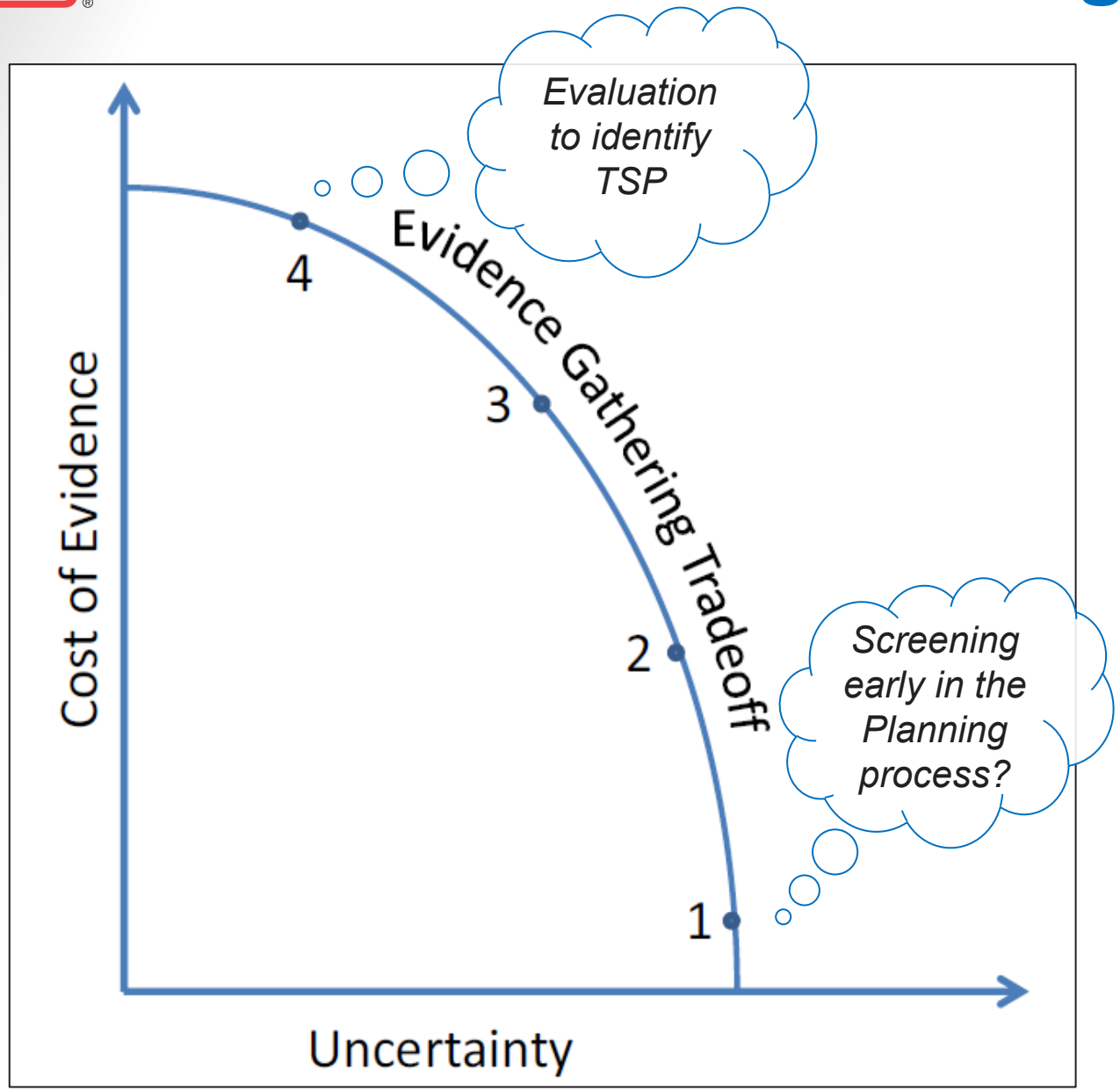
EXISTING/FUTURE WITHOUT PROJECT

FUTURE WITH PROJECT

DETERMINING RIGHT LEVEL OF DETAIL



Level of Detail: Reducing Uncertainty Strategically



Examples:

1. *Ship simulation for NAV study – doing this during feasibility to inform TSP (and reduce risk) rather than waiting until after TSP to verify assumptions (more risk)*
2. *Cultural Resources – PA during feasibility vs doing surveys*
3. *Environmental – new full environmental surveys to establish baseline of env resources vs. using surveys from another agency/GIS data (more risk, less time and cost)*
4. *Geotech – core borings in feasibility vs. pushing off until PED phase?*

Best Management Practices on Evidence Gathering for First Iteration/Scoping

- PDT collect and display existing data for first iteration
- Site visits are useful for evidence gathering
  - Around first iteration
  - Doesn't have to be whole team at one time
  - Document purpose and observations of site visit – railroads, grab samples, wetland identification
- Identify data gaps and uncertainties to help determine what data needs to be collected (and when)
  - Consider if it's critical to the next decision/ shelf life of the data/ constraints for data acquisition?
  - Consider whether running sensitivity analyses over data collection is useful?
  - Ensure you have data for each metric in your alternative analysis

Let's take a recent AER Feasibility Study as an example of developing FWOP scenario(s), collecting relevant data at appropriate level of detail, and analysis of evidence to reduce uncertainty and mitigate risks…

Meramec River Basin Ecosystem Restoration Study

PROBLEMS

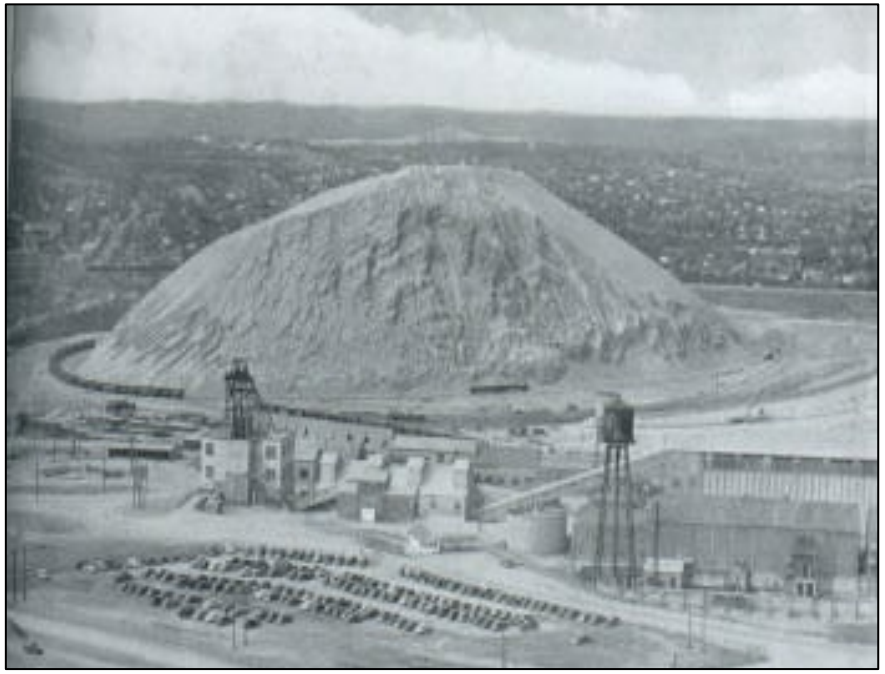
- Bank instability and erosion
- Excessive suspended and bedded sediments from historic mining
- Loss of riparian zone
- Altered stream geomorphology
- Significant decline in freshwater habitat (T&E freshwater mussel species)

OBJECTIVES

- Reduce migration and quantity of excessive sediment
- Increase quantity and quality of riparian corridor
- Restore impacted channels and floodplains in study area to emulate a more natural, stable river

Historic and Existing Conditions

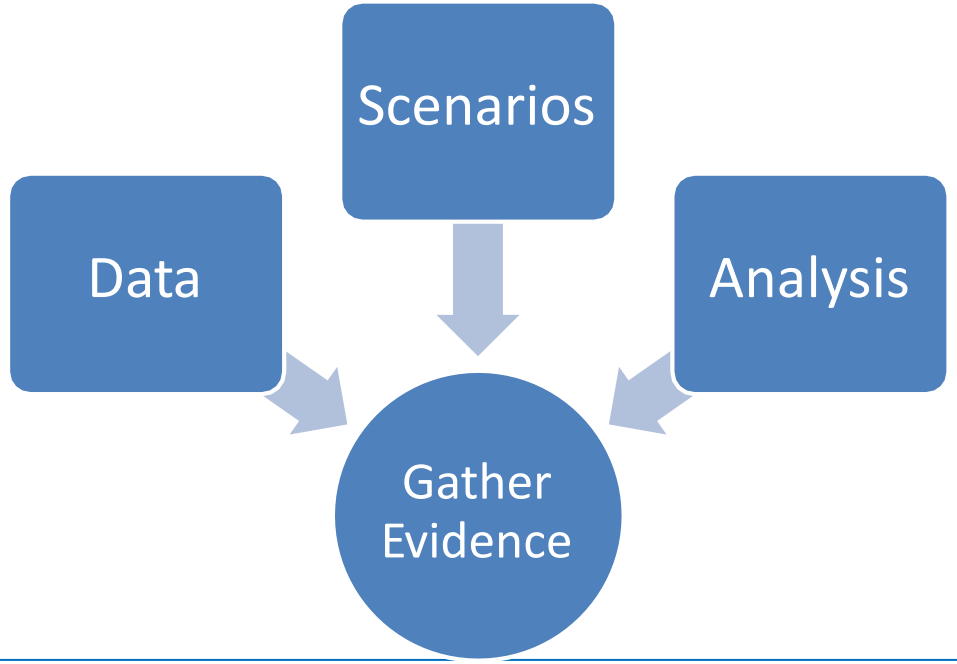
- Lead mining drastically altered the Meramec River Basin, specifically, the Big River (tributary to the Meramec R)
- Approximately 250 million cubic yards of mine waste was produced from 1700s – 1970s causing significant changes to the natural river system



Historic Lead Mining Tailings or "Chat Piles"

Lead Mining "Chat Piles" Today

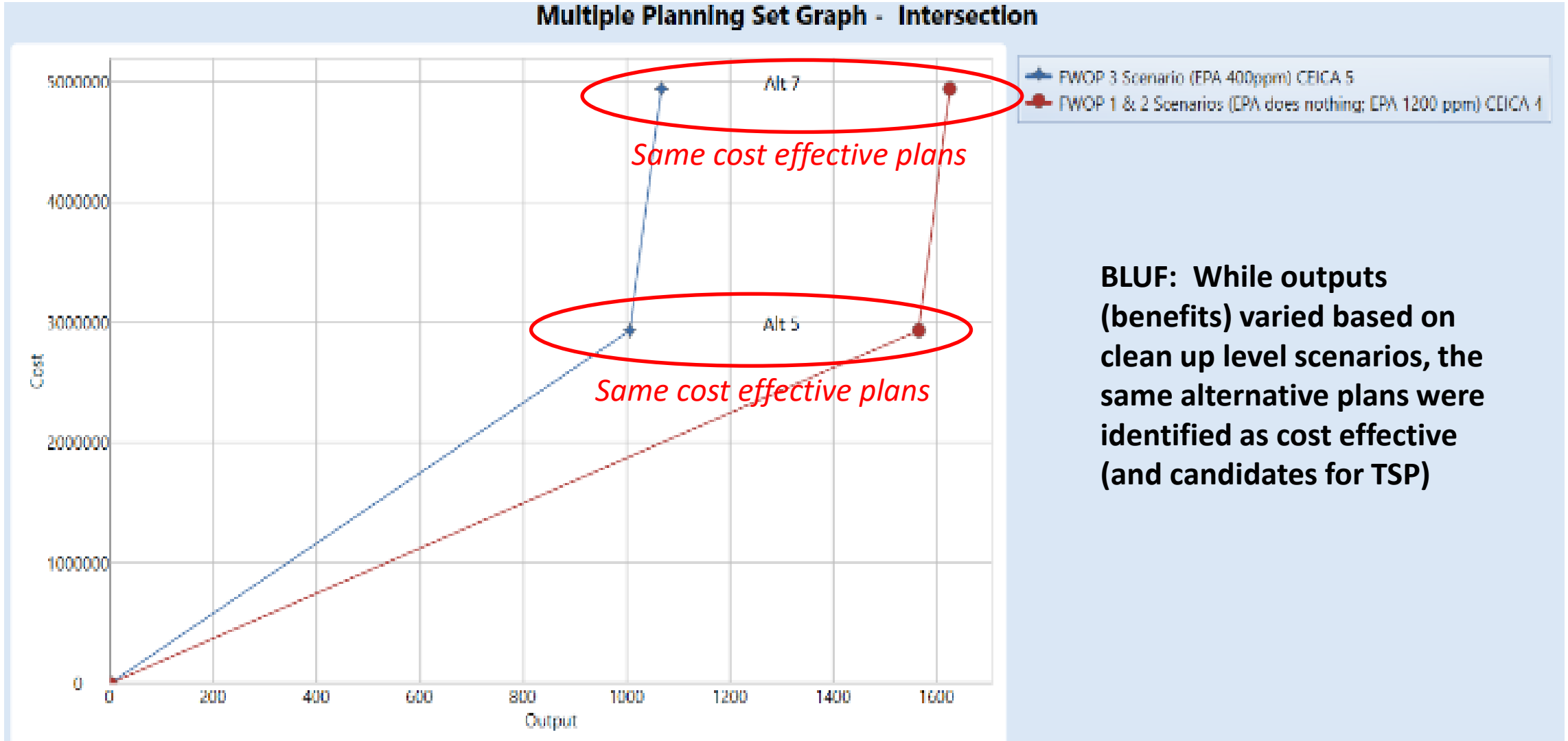
Mussel Habitat: Key data for FWOP



- Mussel Data – We had lots of existing data… leverage data collected by others! ***(aka, the "data you have")***
- Early Gap Analysis: No available Mussel Habitat Suitability Index Model ***(aka, the "data you need")***
- Solution: Created a new mussel model during the study to use for FWOP + benefit quantification ***(aka, "quantify the scenarios")***
- Uncertainty: What work will EPA do and what "clean up level" will they set? ***(aka, "identify uncertainty")***
- Uncertainty Analysis: Ran the habitat model using different "clean up level" scenarios to determine if the recommended plan would change under a different FWOP ***(aka, "account for uncertainty")***

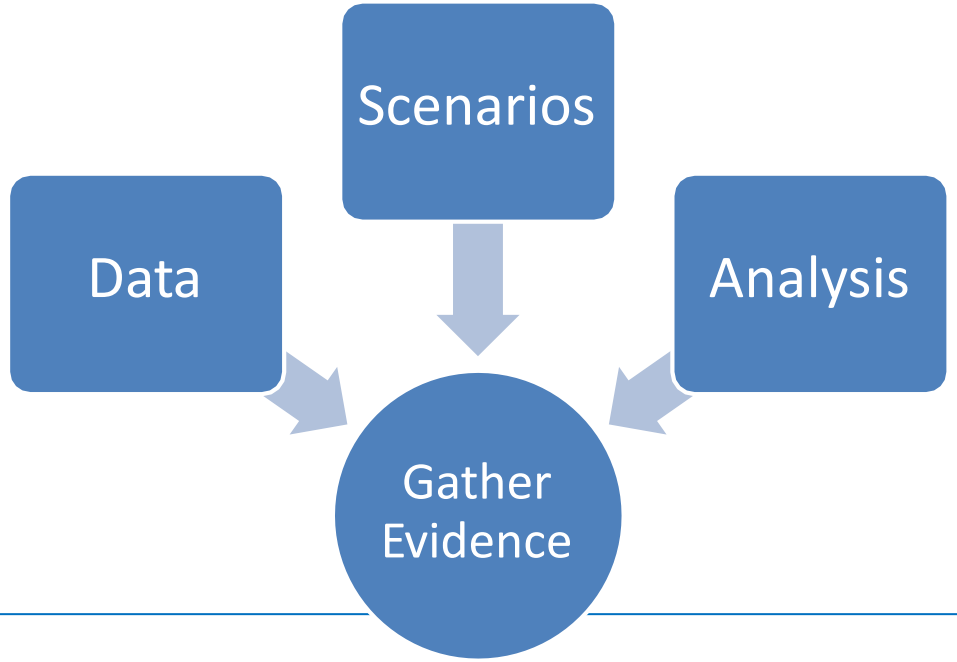
Develop Multiple Possible Scenarios – Sensitivity Analysis

– Ran high and low ranges of probable USEPA clean up levels to see the difference in possible benefits



BLUF: While outputs (benefits) varied based on clean up level scenarios, the same alternative plans were identified as cost effective (and candidates for TSP)

Sediment Migration: key data for FWOP



- ***The data you need:***
  - What is the spatial distribution of sediments?
  - Bed load transport rate and frequency?
  - How much are tributaries sediment contributors?
  - How much does land use and resulting overland flow contribute?
  - How much do mill dams contribute to the sediment migration?

Identify and account for uncertainty:

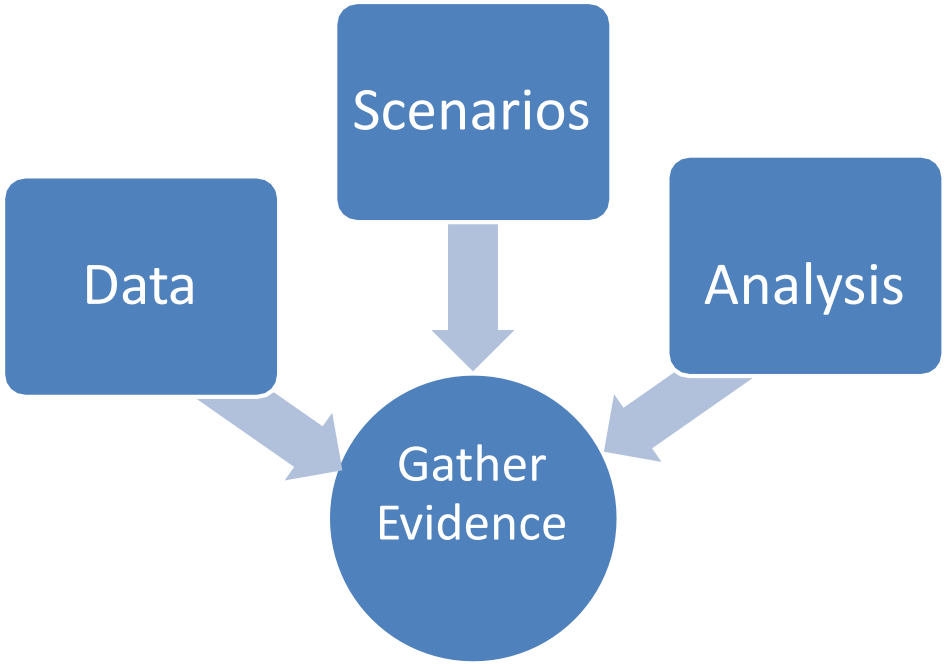
- Determine the contributors and spatial distribution of the sediment through sampling, and HEC-RAS modeling

Communicating Uncertainty and Associated Risks with Data Analysis

Sediment Migration

- Uncertainty re: spatial distribution of sediment, specifically between channel, bars, banks, and floodplain
- Difficult to assess risk of migration and/or reintroduction of sediments
- Difficult to confidently design efficient solutions to stabilize or capture sediment
- Multiple pre-existing in-depth studies and sampling efforts examined and interpreted trends in sediment distribution throughout the study area
- Applied to models that quantified benefits and cost-benefit efficiencies to potential measures (e.g., bank stabilization, bed load collectors and sediment basins)
- Allowed the ratio of types of measures to be adjusted to optimize sediment removal, economics, and habitat units while maintaining a firm understanding of the “upper benefit” limits of each measure

Channel Change Analysis: Key data for FWOP



- ***The data you need:***
  - How much of the banks are eroding, where, why, & will they continue?
  - Will individual bank stabilization have negative impacts up- and down-stream?
- ***Identify and account for uncertainty:***
  - Determine the rate of erosion at each site into the future
  - Determine the radius of curvature of the channel to ensure the channel up- and down-stream will remain stable

Communicating Uncertainty and Associated Risks with Data and Analysis

Channel Change

- Uncertainty: Bank erosion visually identified, but the quantity or distribution of sediment size from those sites was unknown
- High uncertainty: How much bank stabilization needed to meet study objectives?
- Solution:
  - Bank lines from three imagery sets were traced, spanning 26 years, to determine the eroded area
  - Eroded area, combined with bank heights from LiDAR, was used to estimate eroded bank volume and estimated average annual erosion
  - Sensitivity analysis between imagery sets showed the intensity of erosion at 109 different sites varies, but the overall sediment input from the selected banks is relatively constant
- Conclusion:
  - When bank stabilization sites are well-distributed throughout the study area there is no sizable change in benefits
  - Parametric estimates are an accurate way to estimate future benefits regardless of specific bank stabilization sites chosen

Key Take Aways

- Inventory & Forecast takes place as part of "Evidence Gathering" – continuous throughout planning process
- Three main parts to Evidence Gathering: data, scenarios, and analysis of evidence
- Inventory & forecast what? Quantity and quality of current and potential physical, environmental, economic, and social (including health) resources/ services. PDTs must consider and forecast certain conditions/ resources/ aspects
- Purpose of Evidence Gathering is to discern truth and reduce uncertainty
- Level of detail needed only to make decision at hand
- Scenarios describe conditions past, present, future – FWOP is most important
- FWOP: based on existing conditions and trends, forecast reasonably foreseeable conditions in the absence of a federal action over the period of analysis (typically no more than 50 years)
- Refrain from using a single value to represent an uncertain value -- degree of uncertainty should be characterized (quantitatively and/or qualitatively) for all projections

ANY QUESTIONS??

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