APPLYING ECOSYSTEM GOODS AND SERVICES TO PLAN ARMY CORPS AQUATIC ECOSYSTEM RESTORATION PROJECTS

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NCER April 2024

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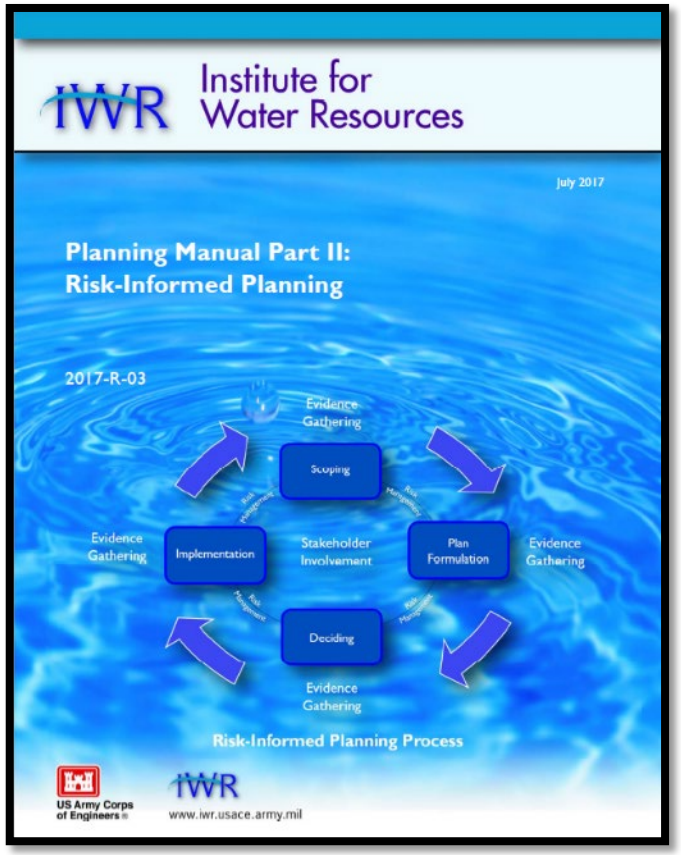
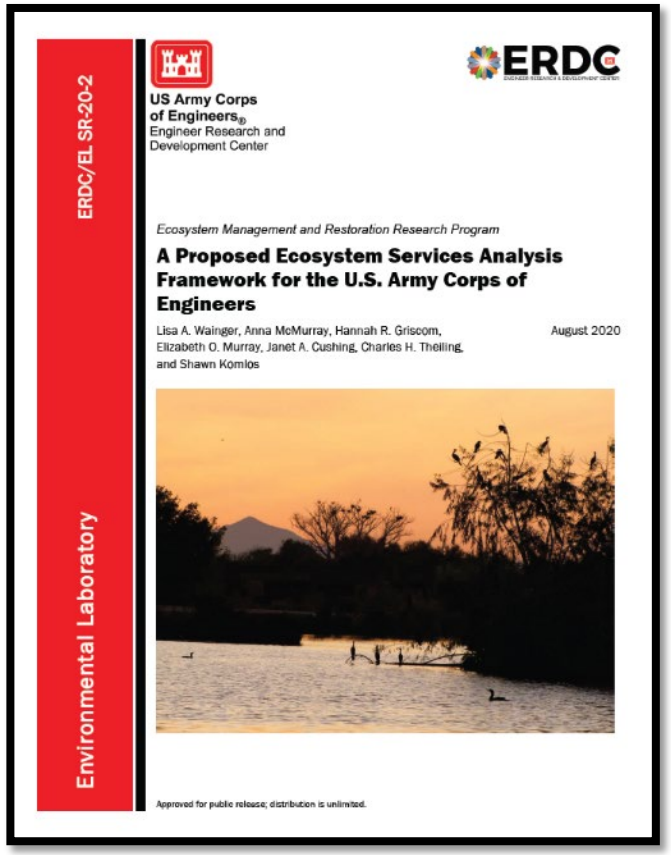
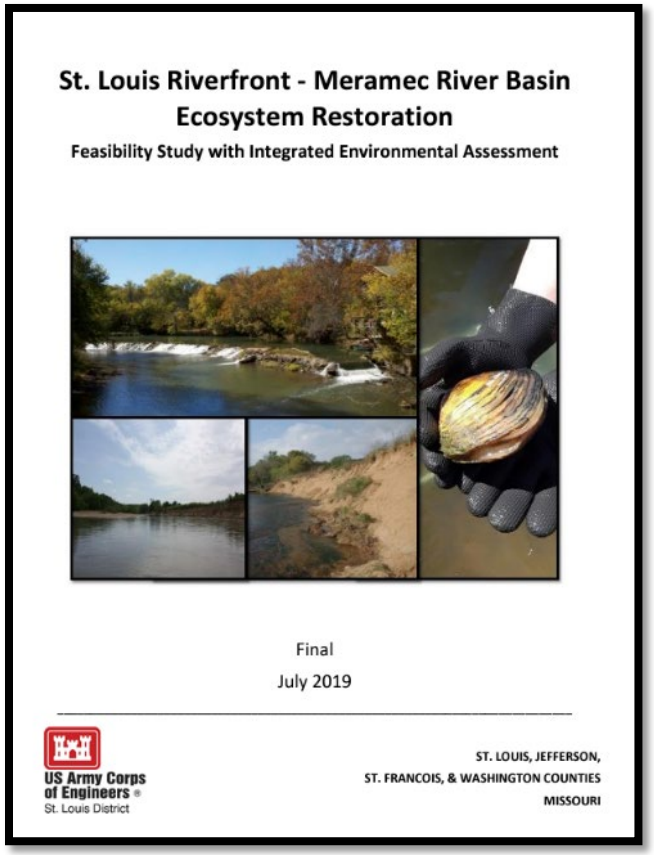
OVERVIEW

Army Corps Aquatic Ecosystem Restoration Mission







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WHAT IS CIVIL WORKS ECOSYSTEM RESTORATION?

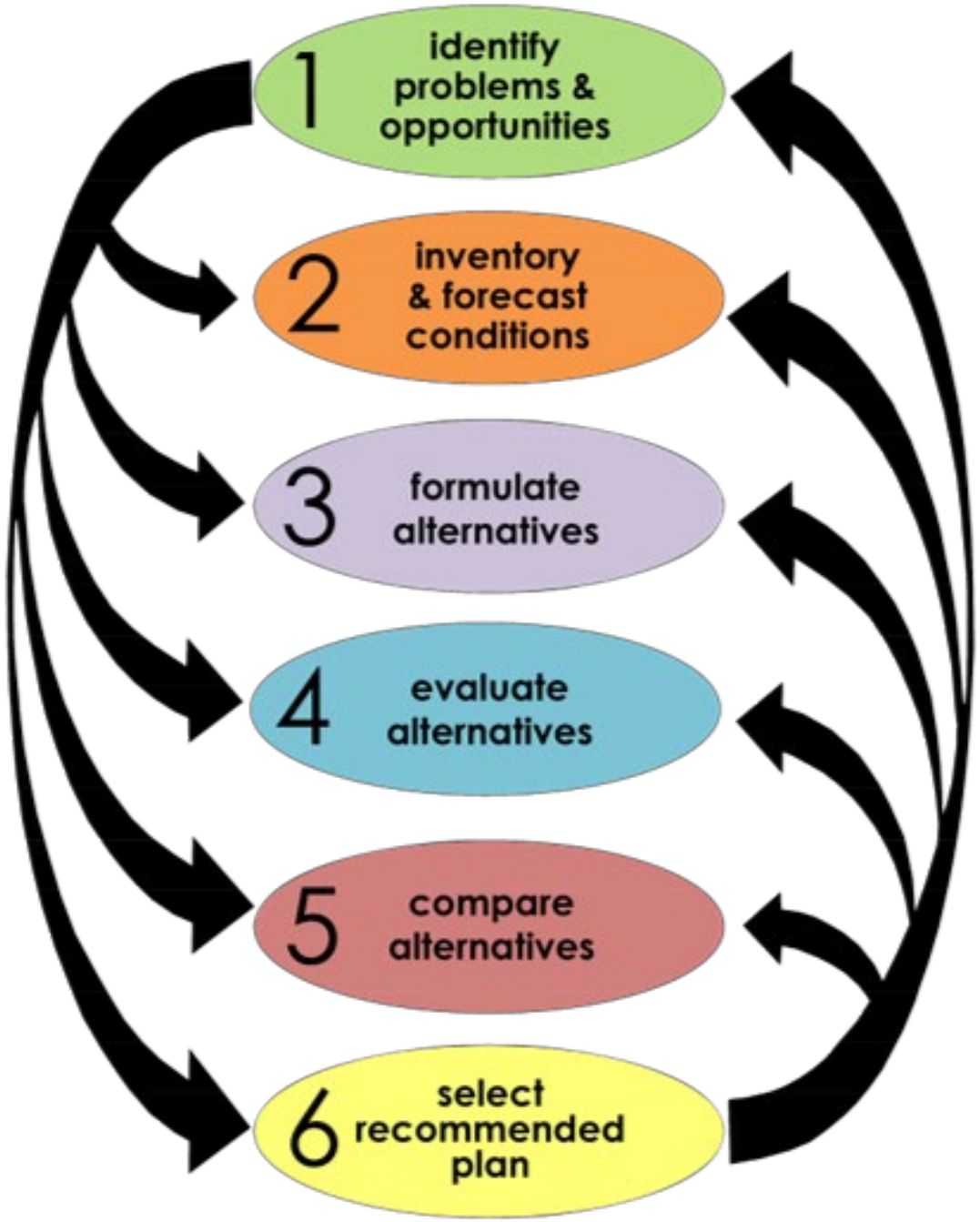
The **OBJECTIVE** of Civil Works ecosystem restoration activities is to **restore** degraded ecosystem **structure, function, and dynamic processes** to a less degraded, more natural condition.

…**Comprehensively examine** the problems contributing to **ecosystem degradation.**

The **INTENT** of restoration is to reestablish the attribute of a **more naturalistic, functioning, and self-sustaining ecosystem.**

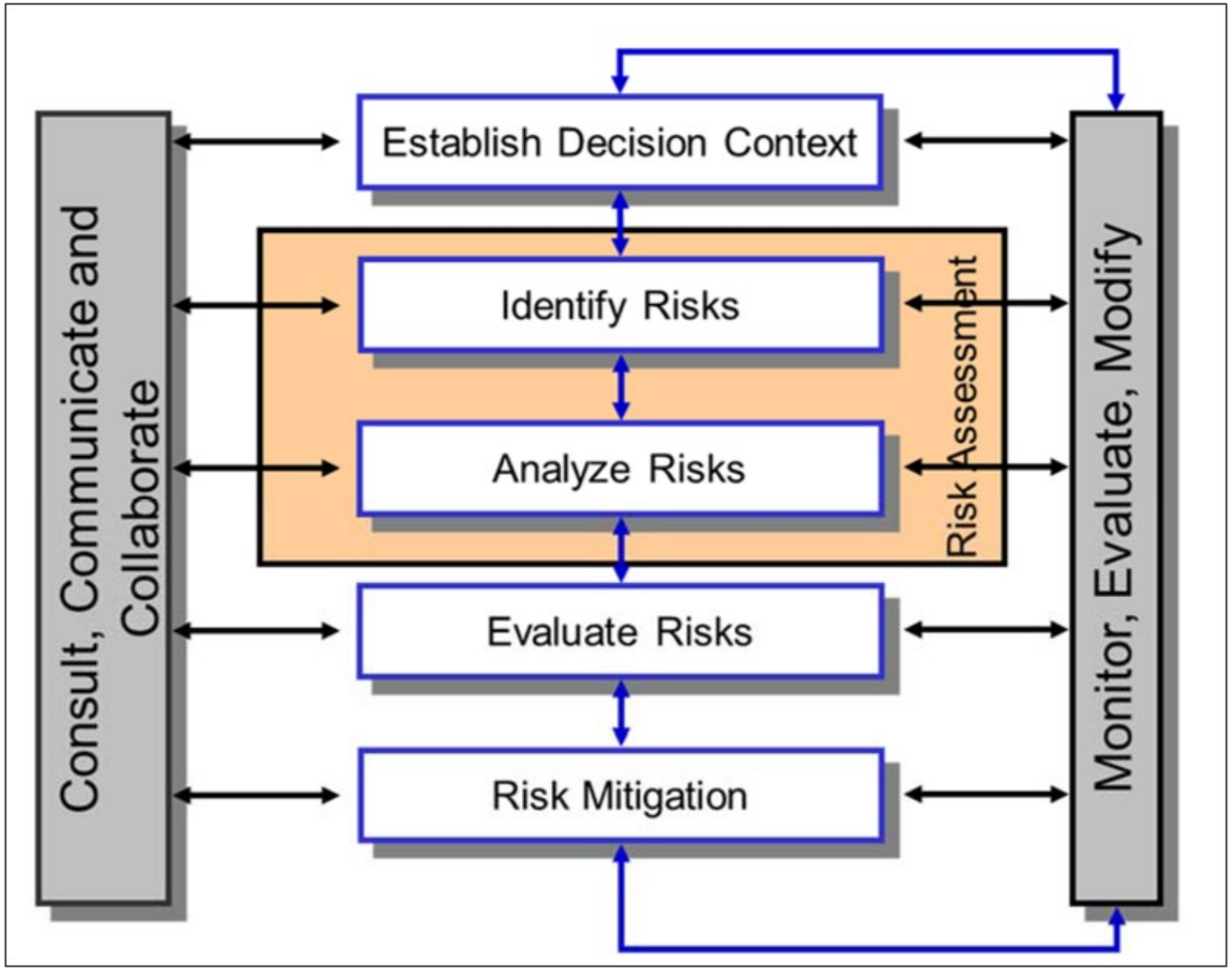
Chapter 6 of ER 1105-2-103

USACE 6-STEP PLANNING PROCESS



from IWR Report 2017-R-03

RISK MANAGEMENT FRAMEWORK



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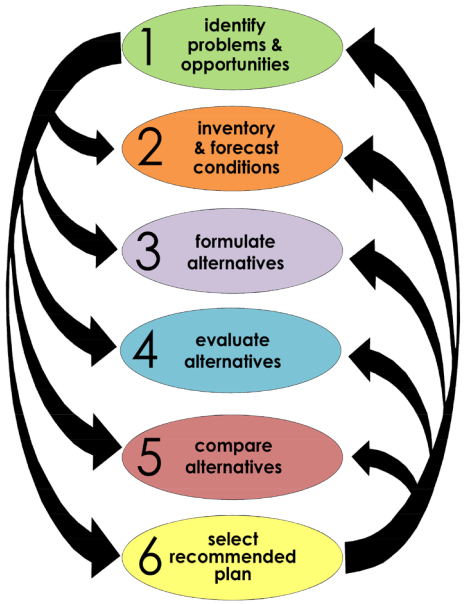

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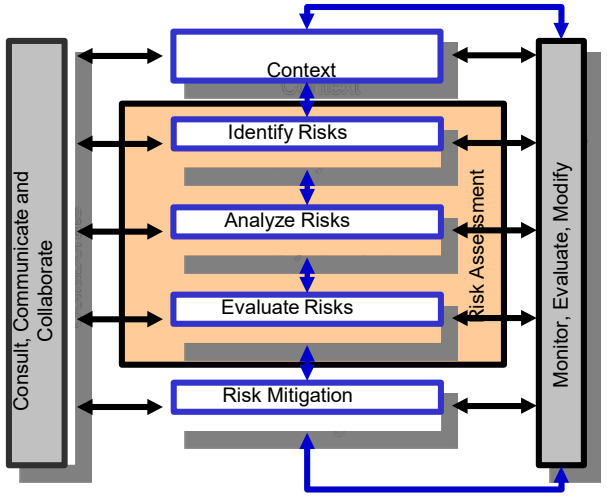

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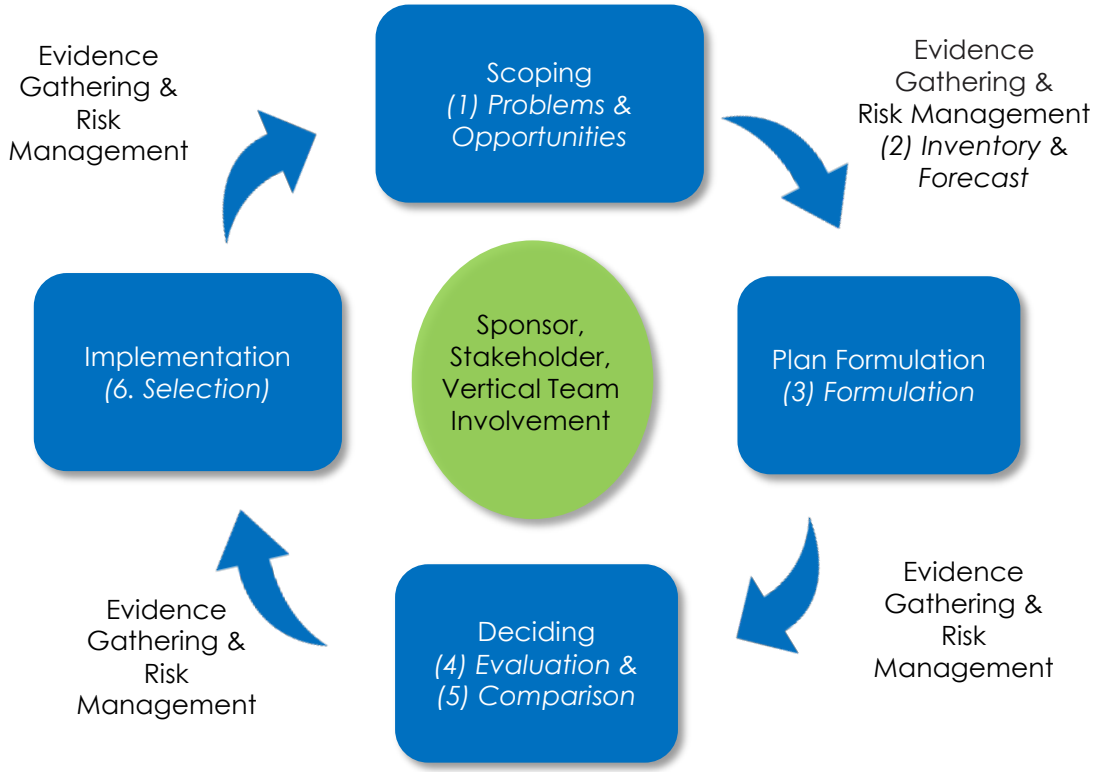
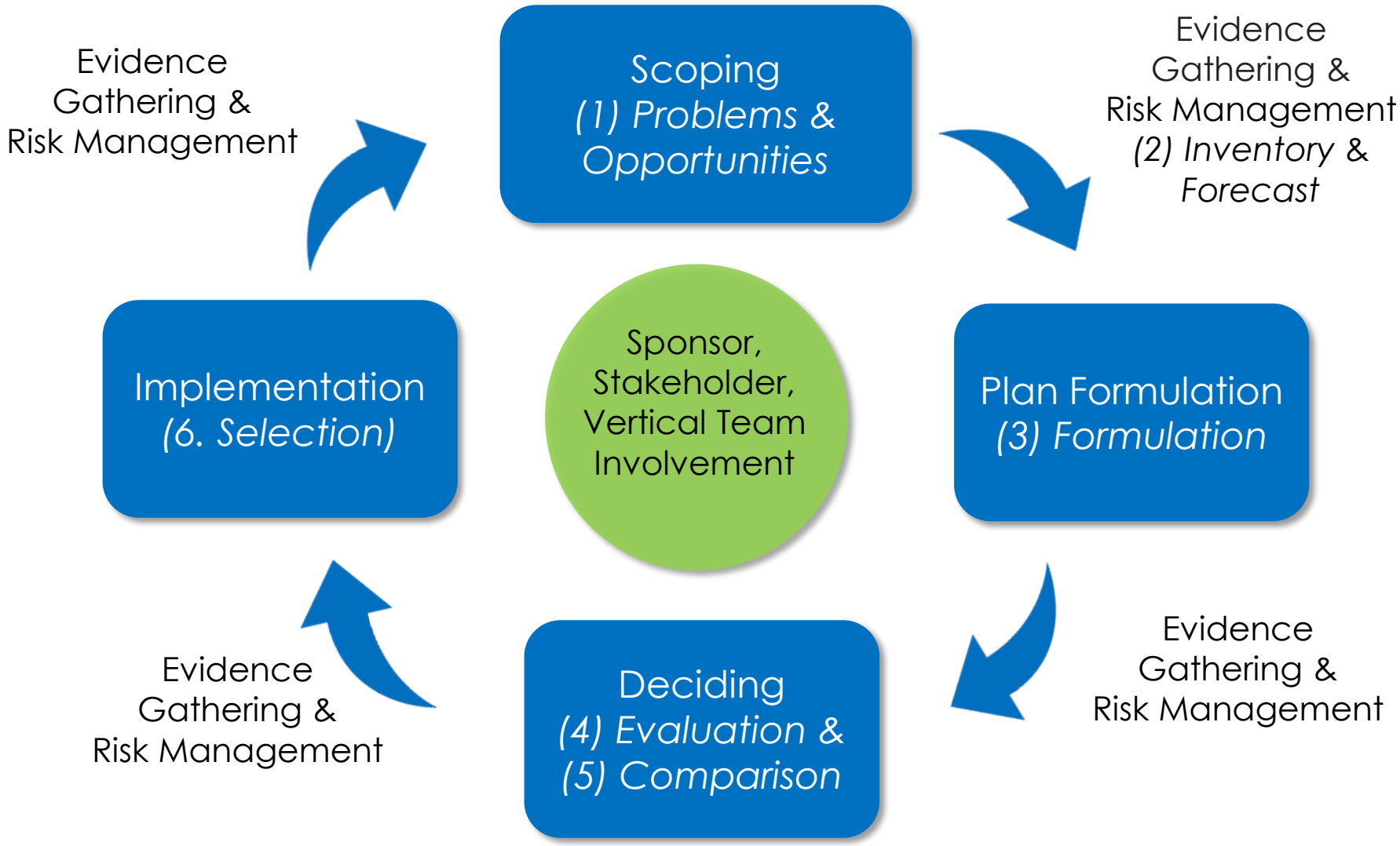


6-STEP + RISK FRAMEWORK = RISK INFORMED PLANNING

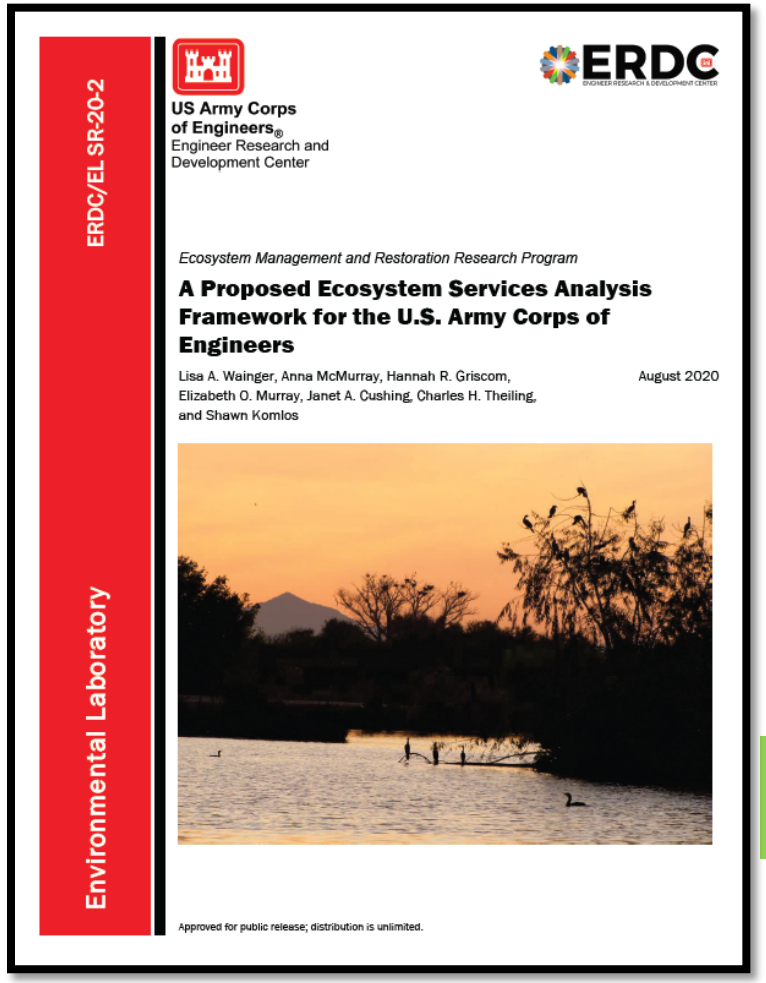
Modified from IWR Report 2017-R-03

RISK INFORMED PLANNING PROCESS



Modified from IWR Report 2017-R-03

Ecosystem goods and services are those aspects provided by nature that benefit humans.[1]



Economic	Raw goods/materials
	Navigation maintenance
Social	Water purification
	Water supply
	Hazard mitigation
	Recreation
	Cultural, spiritual, educational
	Aesthetics
Environmental	Carbon sequestration
	Ecosystem sustainability
	Food provisioning
	Human health support

[1] USACE Agency Specific Procedures Proposed Rule 2024

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Ecosystem Sustainability

[Environmental]

Recreation

[Social]

Aesthetics

[Social]

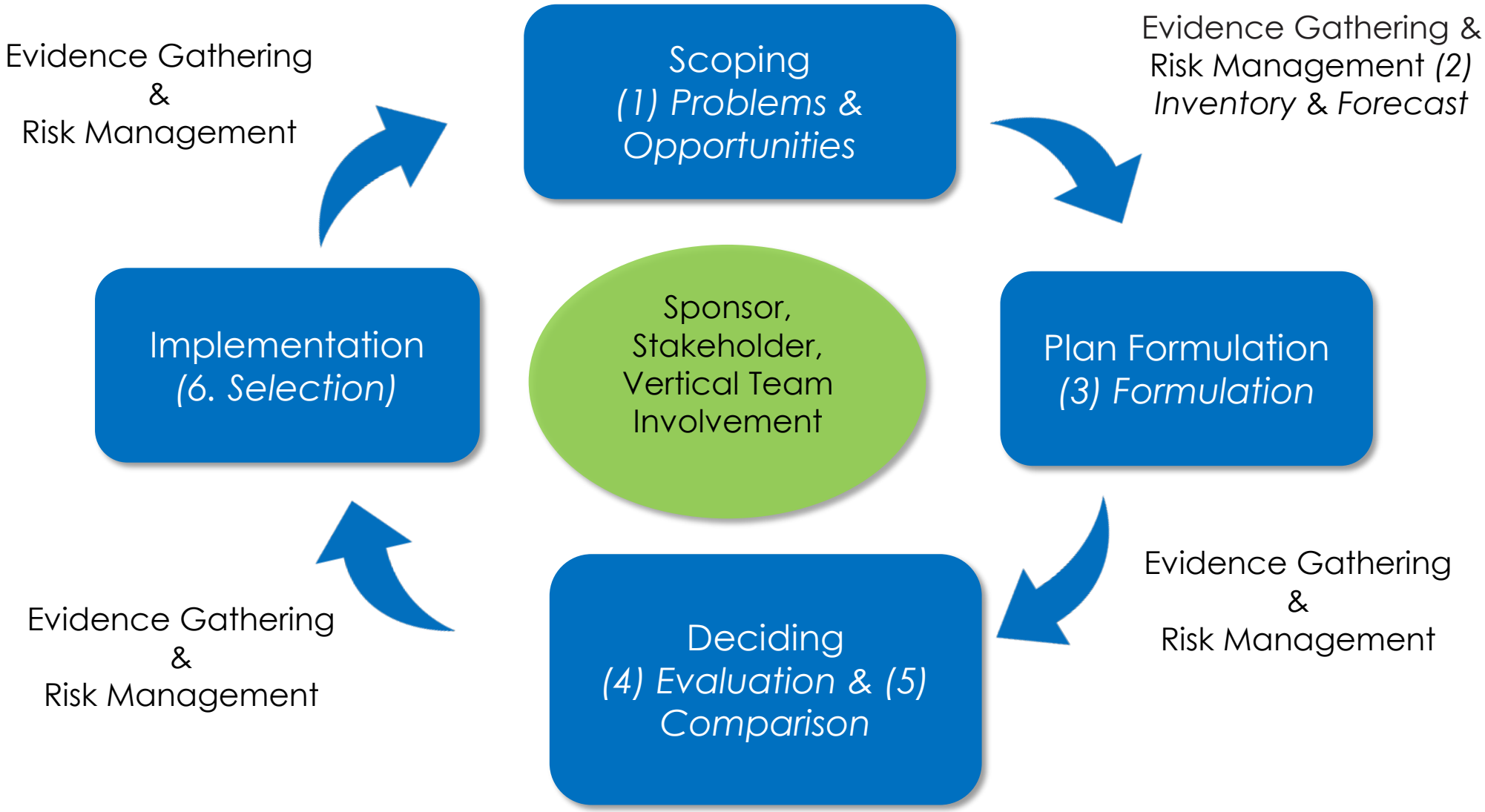
Water/Protect Human Health

[Social]

EGS Considerations for ER Studies

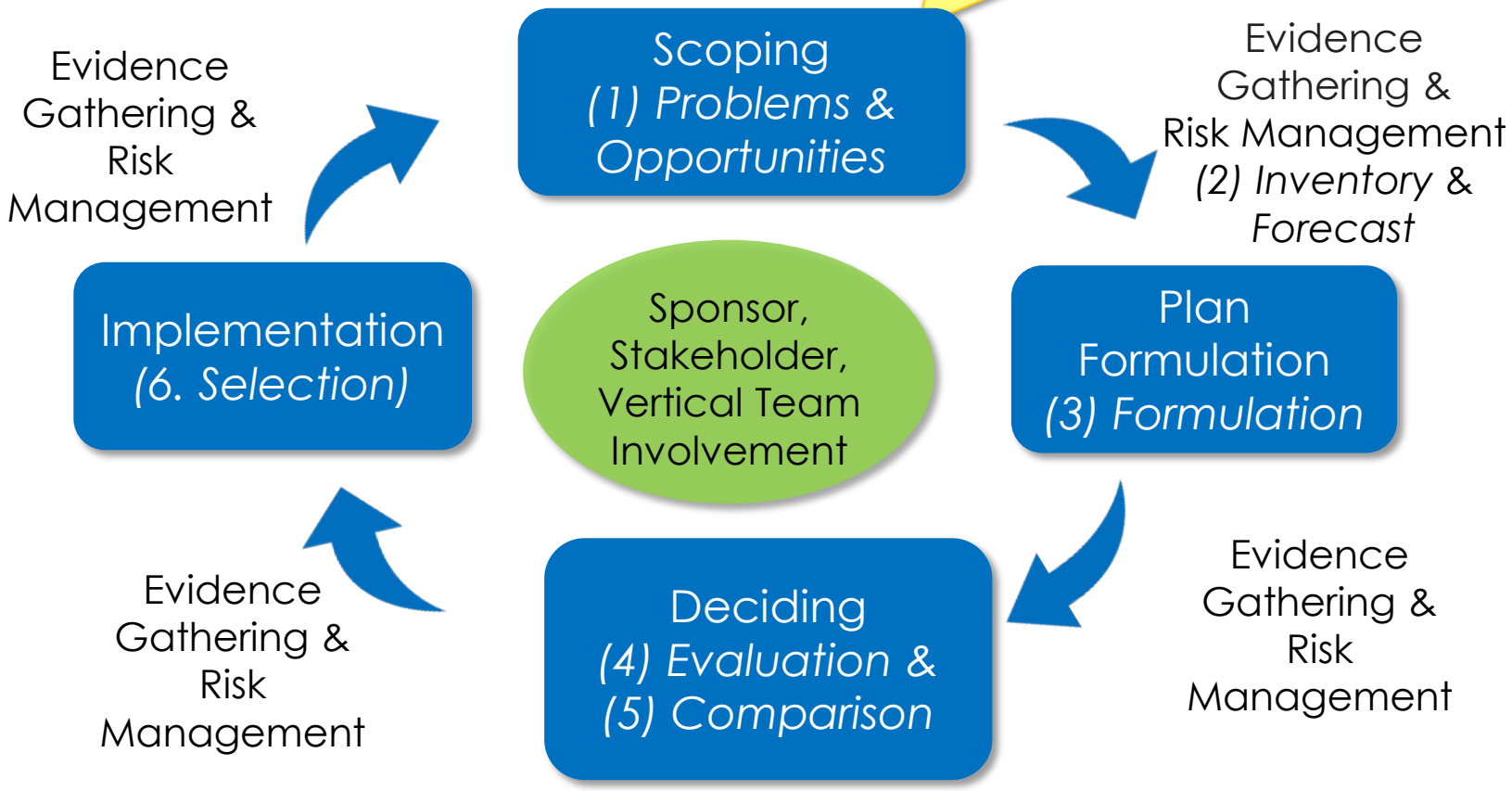
Modified from Table 2 Wainger et al. 2020

INTEGRATING EGS



INTEGRATING EGS

- Identify EGS opportunities
- Build conceptual models (link measures to EGS impacts)



INTEGRATING EGS

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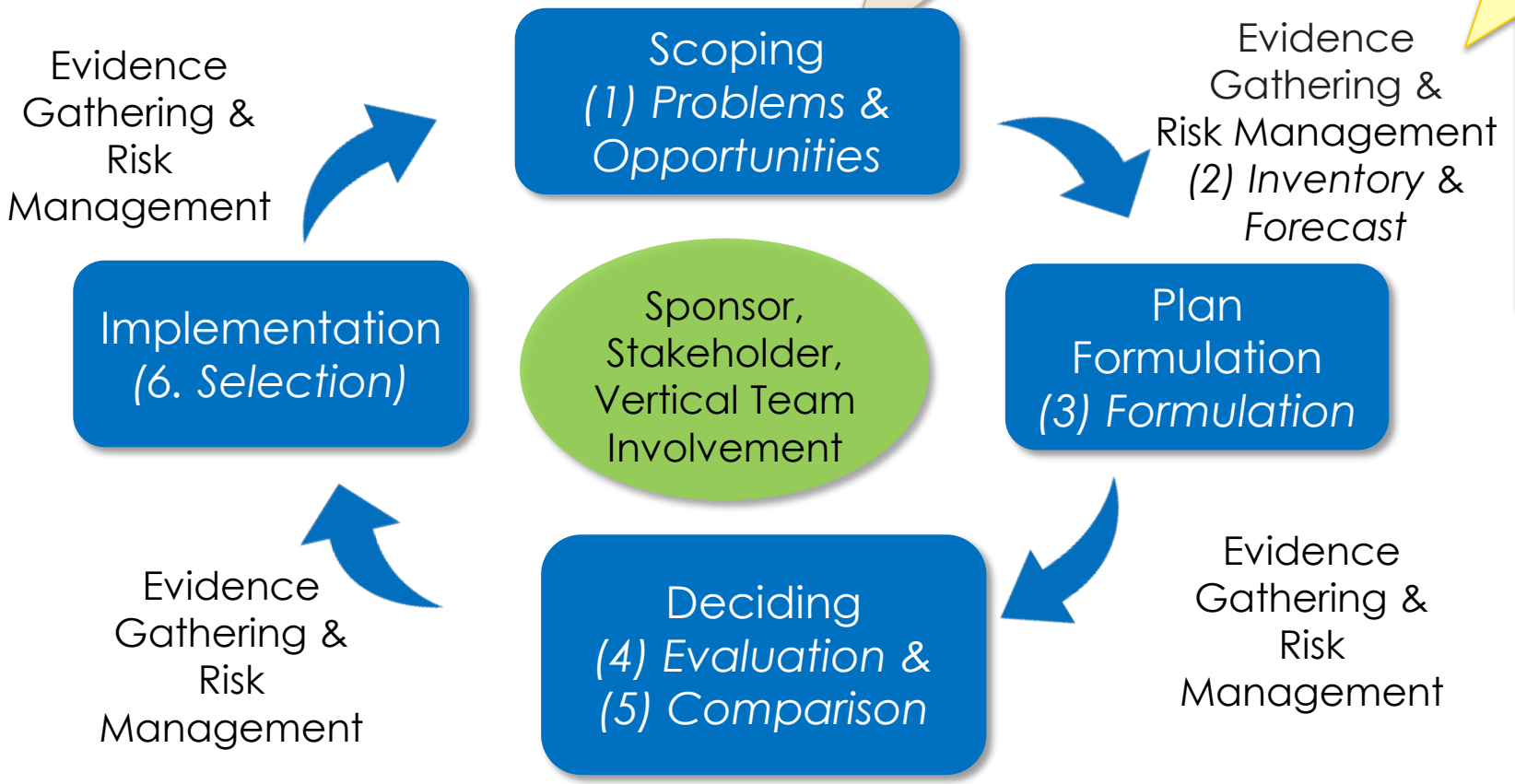

- Identify available data for EGS
- Forecast future conditions

INTEGRATING EGS

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- Identify EGS opportunities
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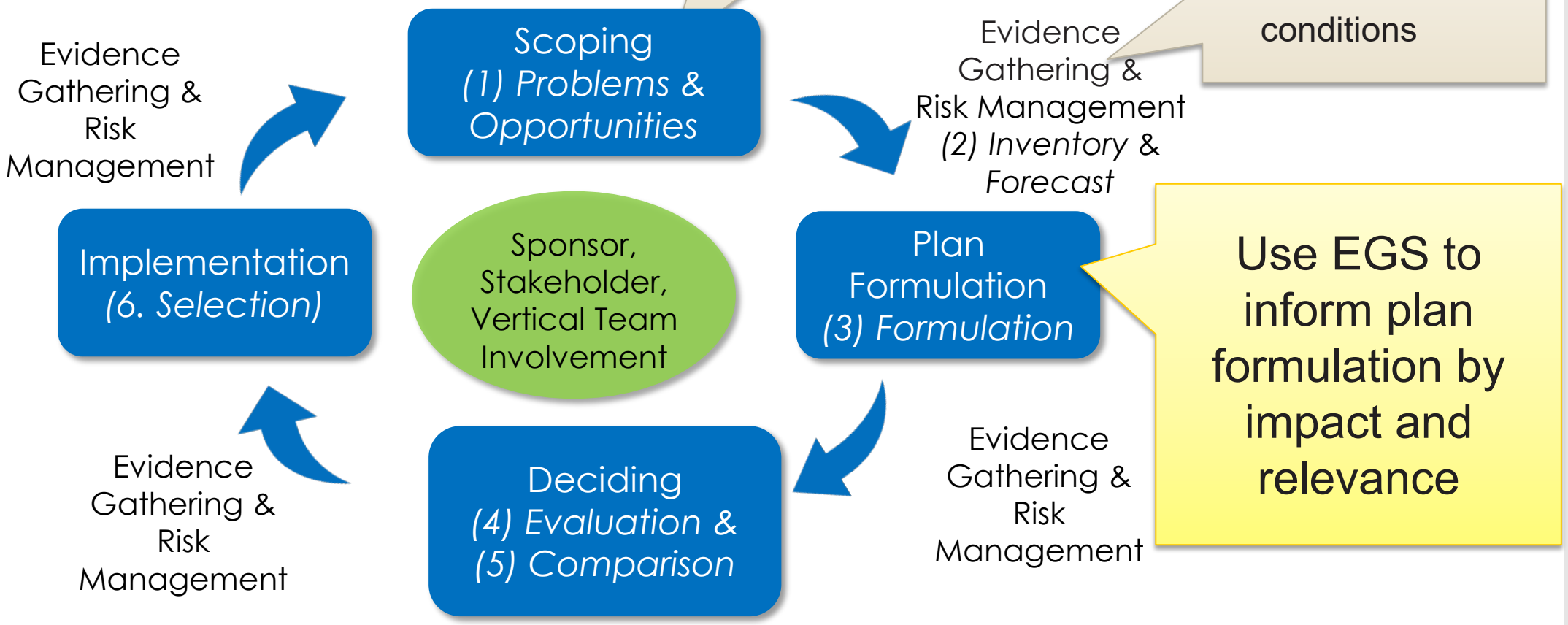
- Identify available data for EGS
- Forecast future conditions



Use EGS to inform plan formulation by impact and relevance

INTEGRATING EGS

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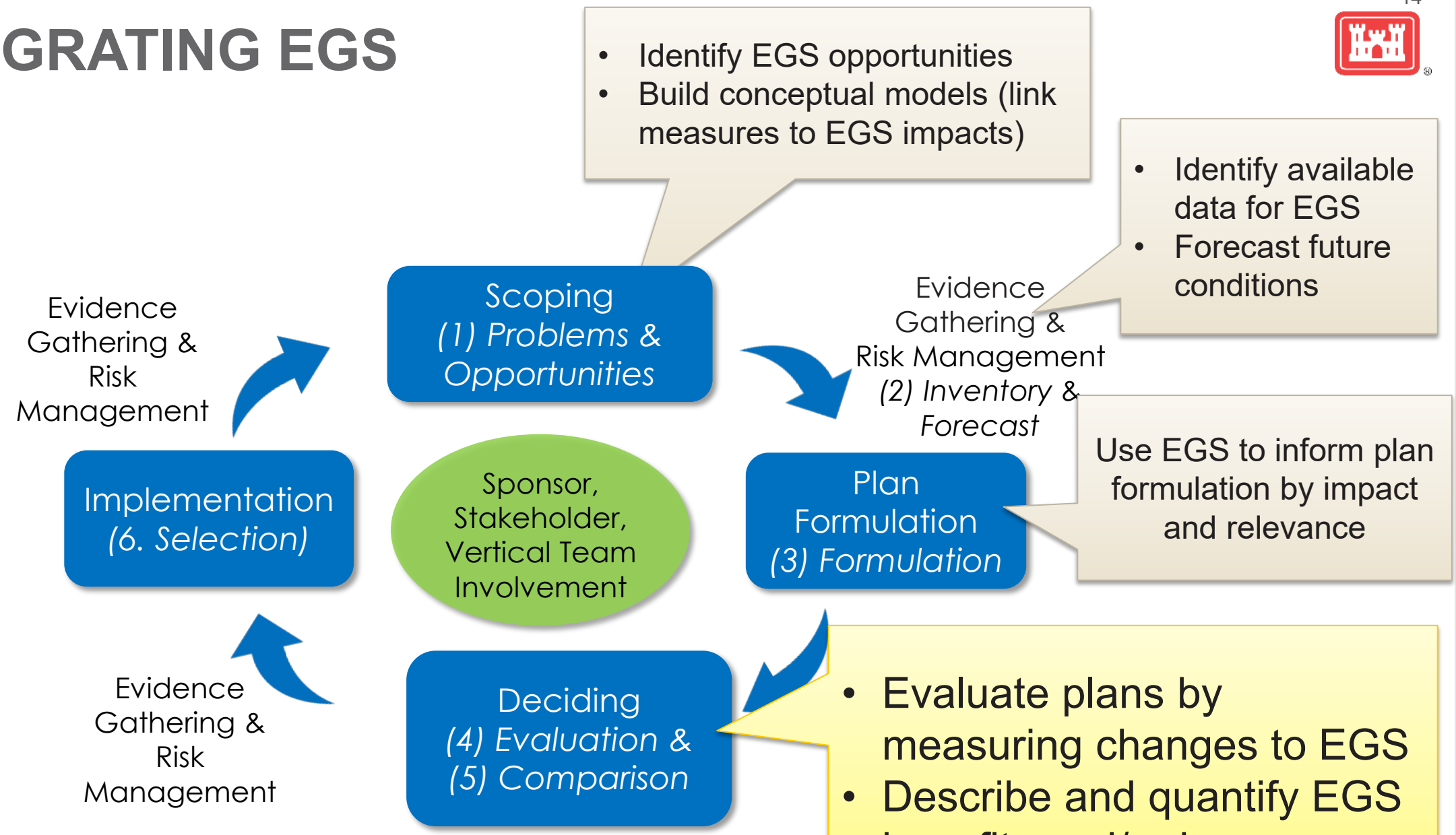

INTEGRATING EGS

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- Identify EGS opportunities
- Build conceptual models (link measures to EGS impacts)

Scoping
(1) Problems & Opportunities

Evidence Gathering & Risk Management
(2) Inventory & Forecast

- Identify available data for EGS
- Forecast future conditions

Plan Formulation
(3) Formulation

Use EGS to inform plan formulation by impact and relevance

Deciding
(4) Evaluation & (5) Comparison

Evidence Gathering & Risk Management

- Evaluate plans by measuring changes to EGS
- Describe and quantify EGS benefits and/or harms

Implementation
(6. Selection)

Evidence Gathering & Risk anagement

Provide summary of EGS benefits and/or harms of selected plan

Sponsor, Stakeholder, Vertical Team Involvement

ST. LOUIS RIVERFRONT - MERAMEC RIVER BASIN ECOSYSTEM RESTORATION STUDY





MISSOURI DEPARTMENT OF NATURAL RESOURCES

U.S. FISH & WILDLIFE SERVICE

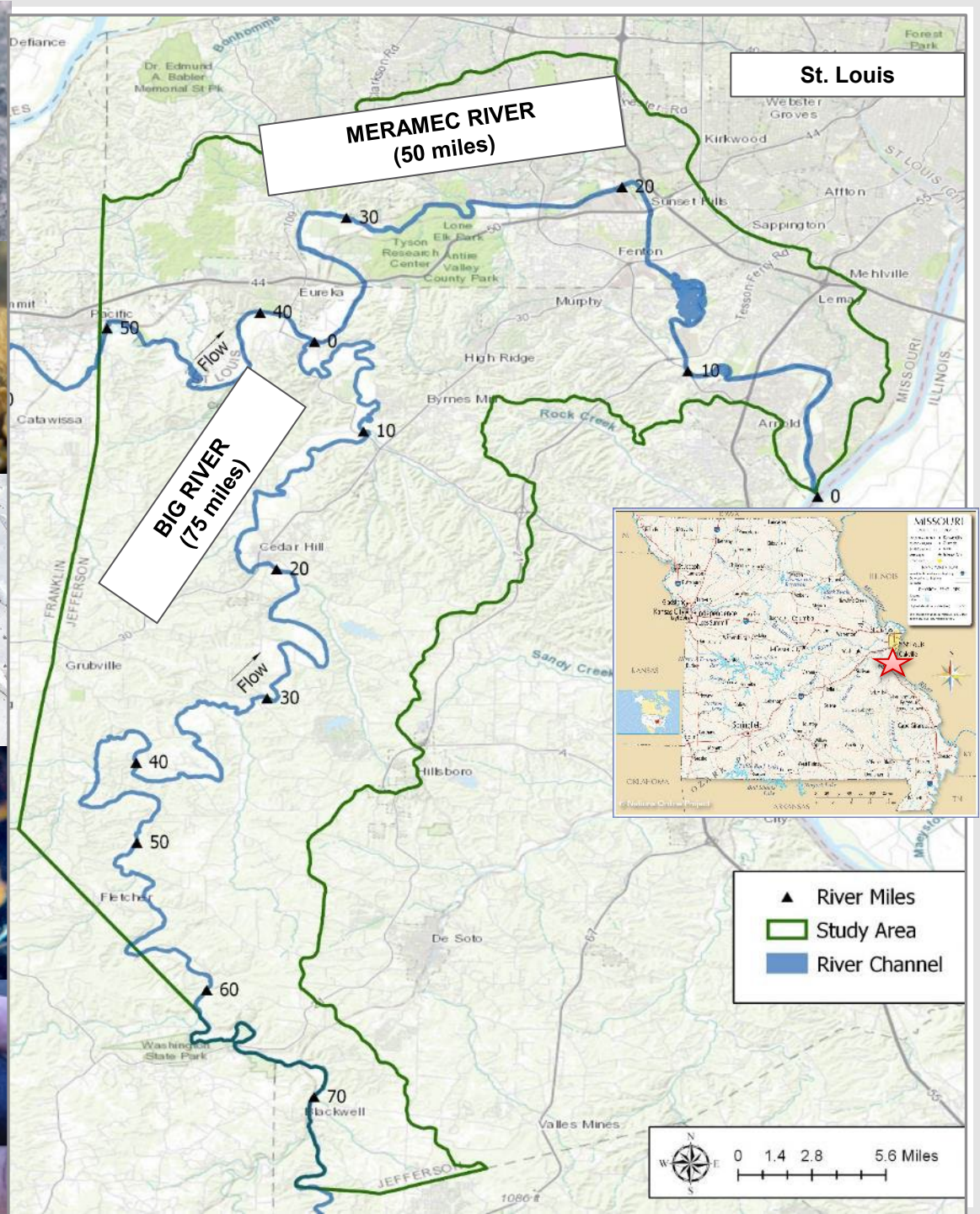
EPA United States Environmental Protection Agency

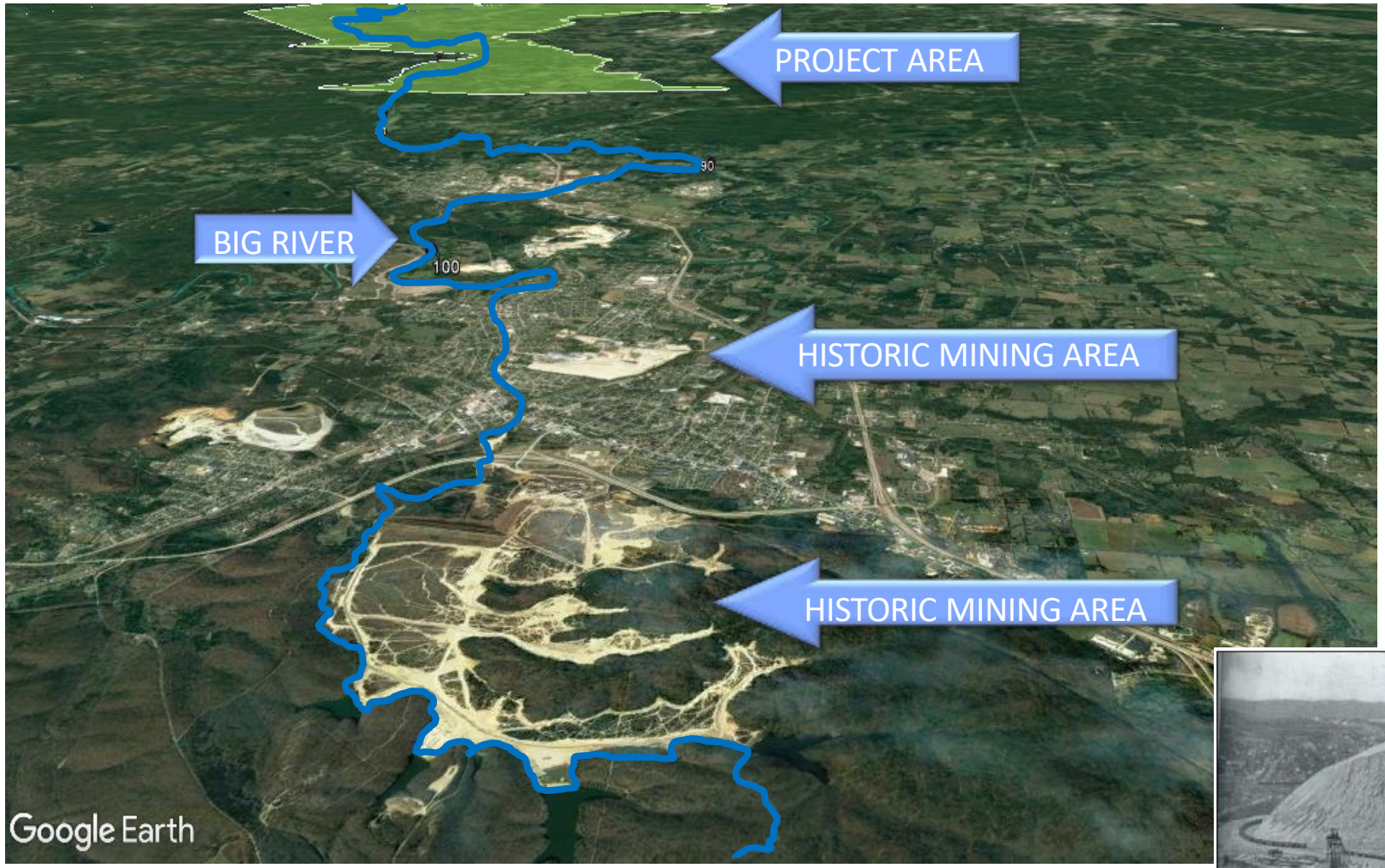
The Nature Conservancy

Lead

EPA to test for lead in Jefferson County's Big River floodplain

BY LEAH THORSEN • > 636-937-6249 Apr 17, 2012 0





Appx 250 million tons of historic mine waste from 1700s-1970s

+

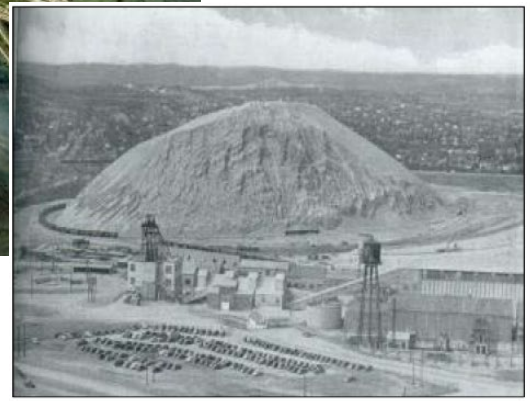
Loss of riparian corridor

+

Bank instability

=

SEDIMENT IMBALANCE



Historic Lead Mining Tailings or "Chat Piles"

Lead Mining "Chat Piles" Today

STEP 1

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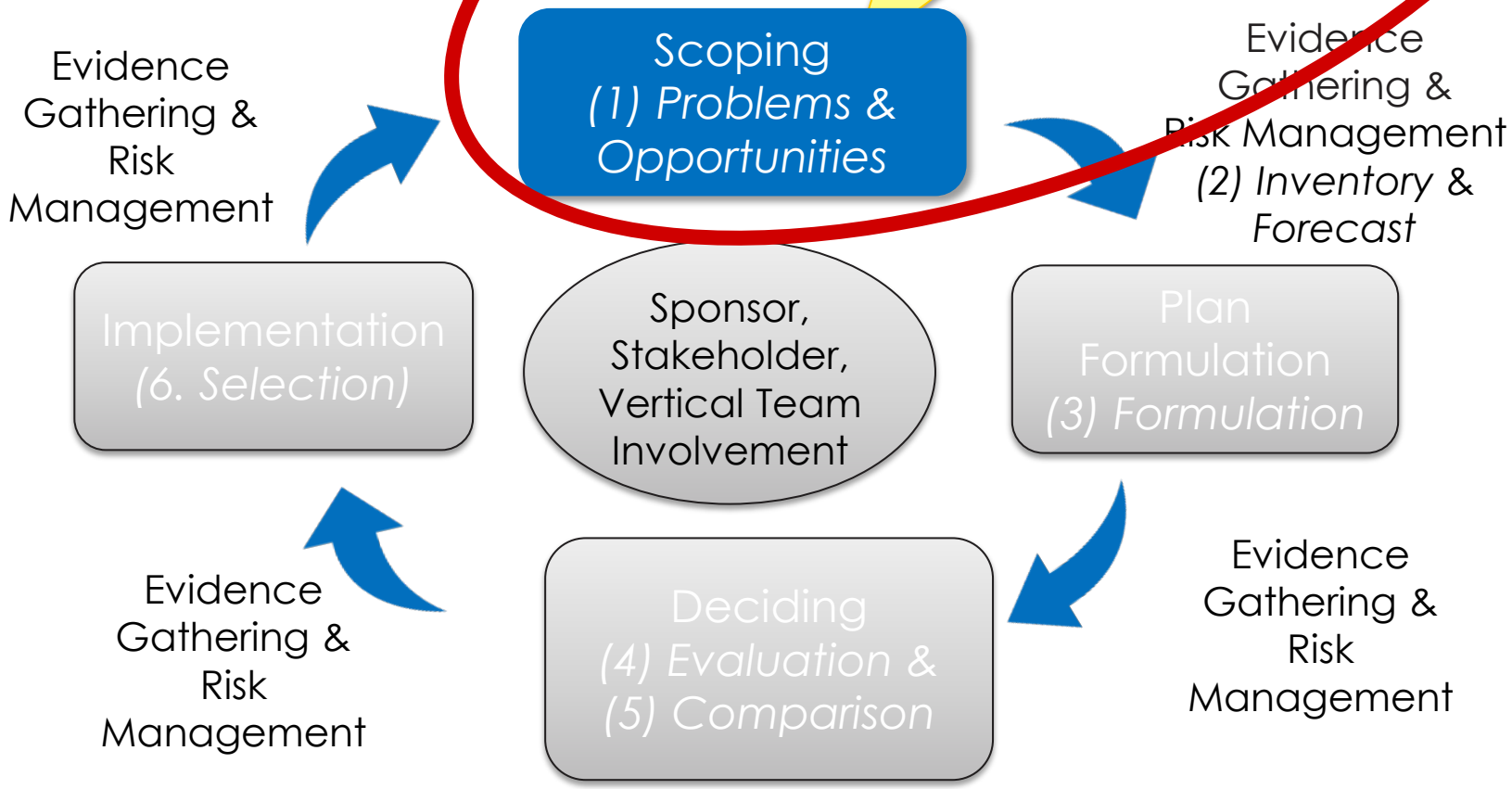
- Identify EGS opportunities
- Build conceptual models (link measures to EGS impacts)



Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Problems
(EGS Category)

EGS Opportunities

Stakeholder Input!

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Problems **(EGS Category)**	EGS Opportunities
Bank Instability and erosion **(Aesthetics)**	
Excessive sediments from historic lead mining (**Water/Human Health; Recreation)**	
Altered Stream Morphology (**Recreation; Aesthetics)**	
Degradation of freshwater mussel habitat **(Ecosystem Sustainability)**	
Loss of riparian corridor **(Ecosystem Sustainability; Aesthetics)**	

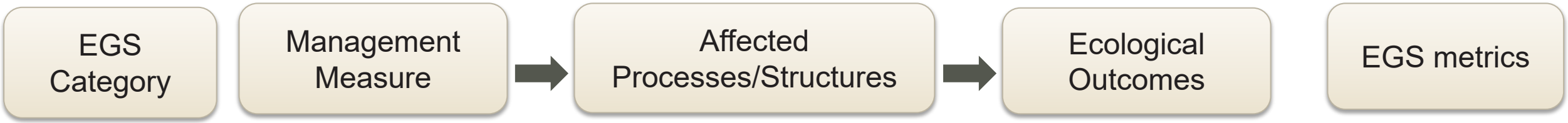
Stakeholder Input!

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Problems **(EGS Category)**	EGS Opportunities
Bank Instability and erosion **(Aesthetics)**	Enhance aesthetic contributions to adjacent residents
Excessive sediments from historic lead mining **(Water/Health; Recreation)**	Remove lead in the sediments to enhance viability for aquatic species and human health
Altered Stream Morphology **(Recreation; Aesthetics)**	Provide recreational opportunities, such as swimming, fishing, canoeing, kayaking
Degradation of freshwater mussel habitat **(Ecosystem Sustainability)**	Support non-use services by enhancing the viability of the freshwater mussel community
Loss of riparian corridor **(Ecosystem Sustainability; Aesthetics)**	Support non-use services by restoring floodplain forest

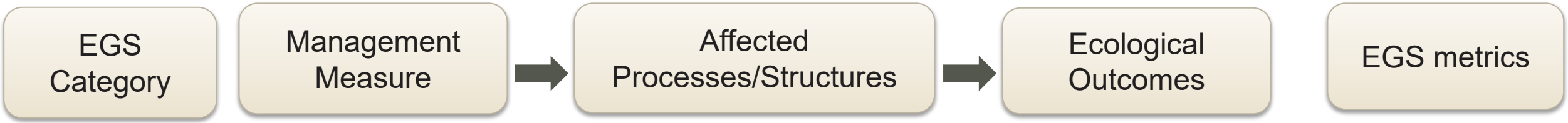
Stakeholder Input!

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection



Conceptual Model diagram for EGS in Meramec River Basin

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection



- Water/Protect Human Health
- Ecosystem Sustainability
- Aesthetics
- Recreation

Conceptual Model diagram for EGS in Meramec River Basin

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

EGS Category → Management Measure → Affected Processes/Structures → Ecological Outcomes → EGS metrics

Water/Protect Human Health

Ecosystem Sustainability

Aesthetics

Recreation

Bank Stabilization
Nature Based Solutions
Revetment
Excavation & Grading

Sediment Capture
Bedload Collectors
Sediment Basins

Reforestation

Conceptual Model diagram for EGS in Meramec River Basin

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

EGS Category → Management Measure → Affected Processes/Structures → Ecological Outcomes → EGS metrics

- Water/Protect Human Health
- Ecosystem Sustainability
- Aesthetics
- Recreation

Management Measures:
- Bank Stabilization
  Nature Based Solutions
  Revetment
  Excavation & Grading
- Sediment Capture
  Bedload Collectors
  Sediment Basins
- Reforestation

Affected Processes/Structures:
- Hydro-geomorphology
  flow, connectivity, sediment, substrate, bank, & channel stability
- Biogeochemistry
  TSS, lead
- Ecological Structure & Processes
  Vegetative cover, species diversity, habitat connectivity

Conceptual Model diagram for EGS in Meramec River Basin

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

EGS Category → Management Measure → Affected Processes/Structures → Ecological Outcomes

EGS metrics

Water/Protect Human Health

Ecosystem Sustainability

Aesthetics

Recreation

Bank Stabilization
Nature Based Solutions
Revetment
Excavation & Grading

Sediment Capture
Bedload Collectors
Sediment Basins

Reforestation

Hydro-geomorphology
flow, connectivity, sediment, substrate, bank, & channel stability

Biogeochemistry
TSS, lead

Ecological Structure & Processes
Vegetative cover, species diversity, habitat connectivity

Reduce migration of excess sediment

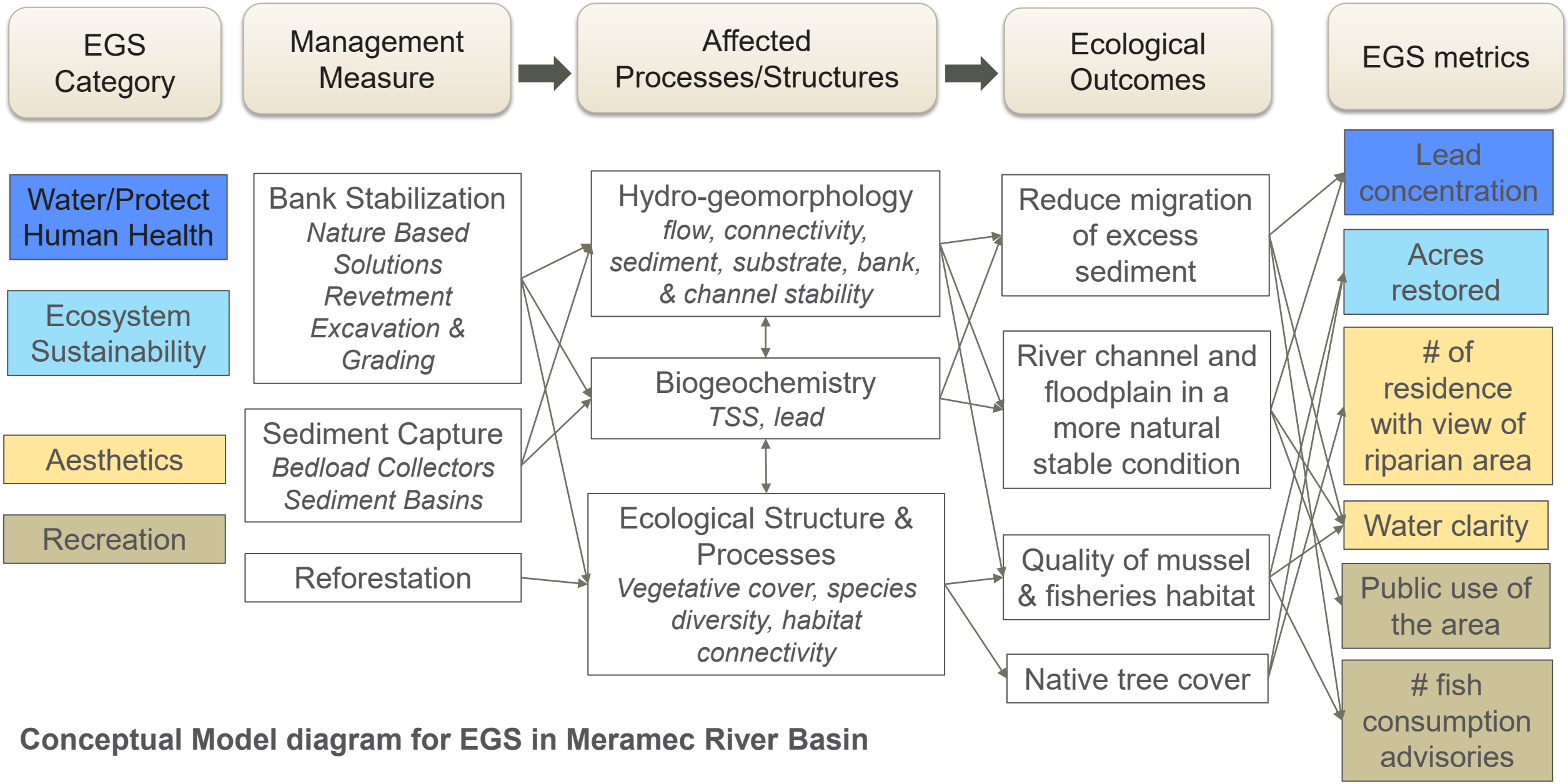
River channel and floodplain in a more natural stable condition

Quality of mussel & fisheries habitat

Native tree cover

Conceptual Model diagram for EGS in Meramec River Basin

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection



Conceptual Model diagram for EGS in Meramec River Basin

STEP 2

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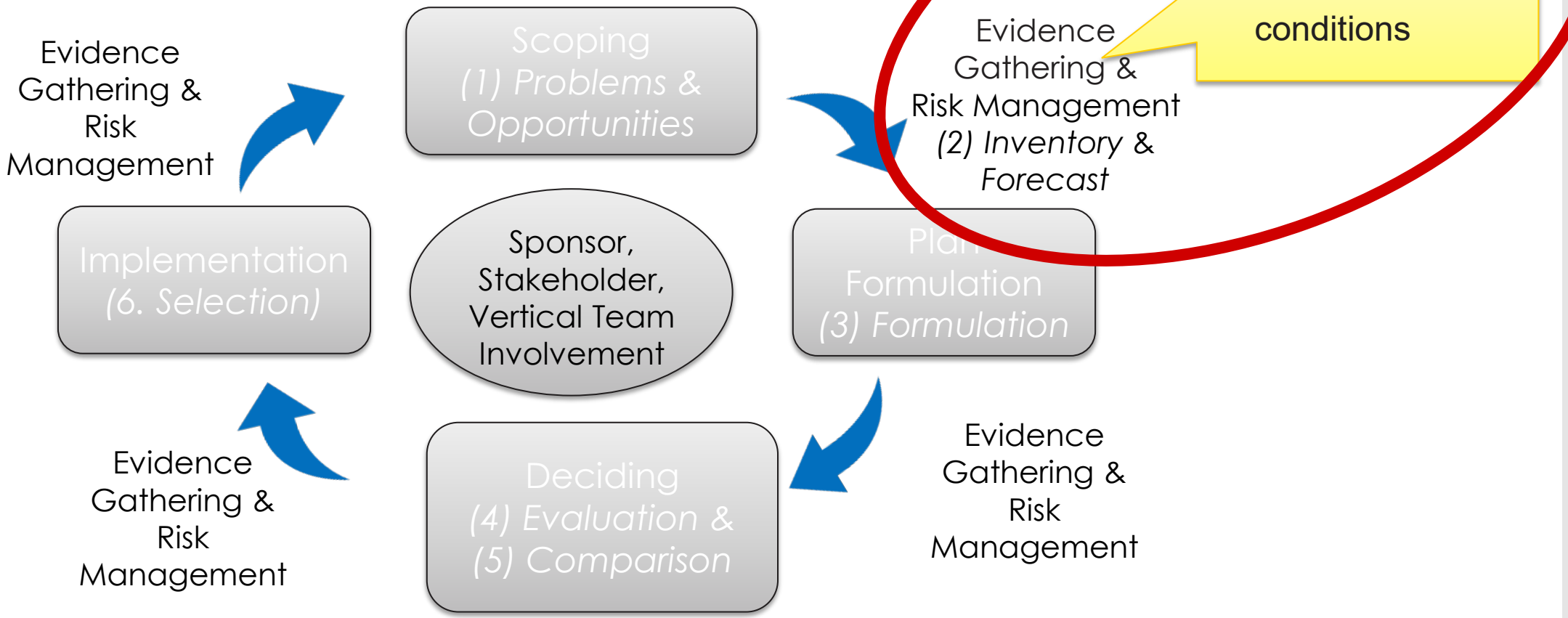
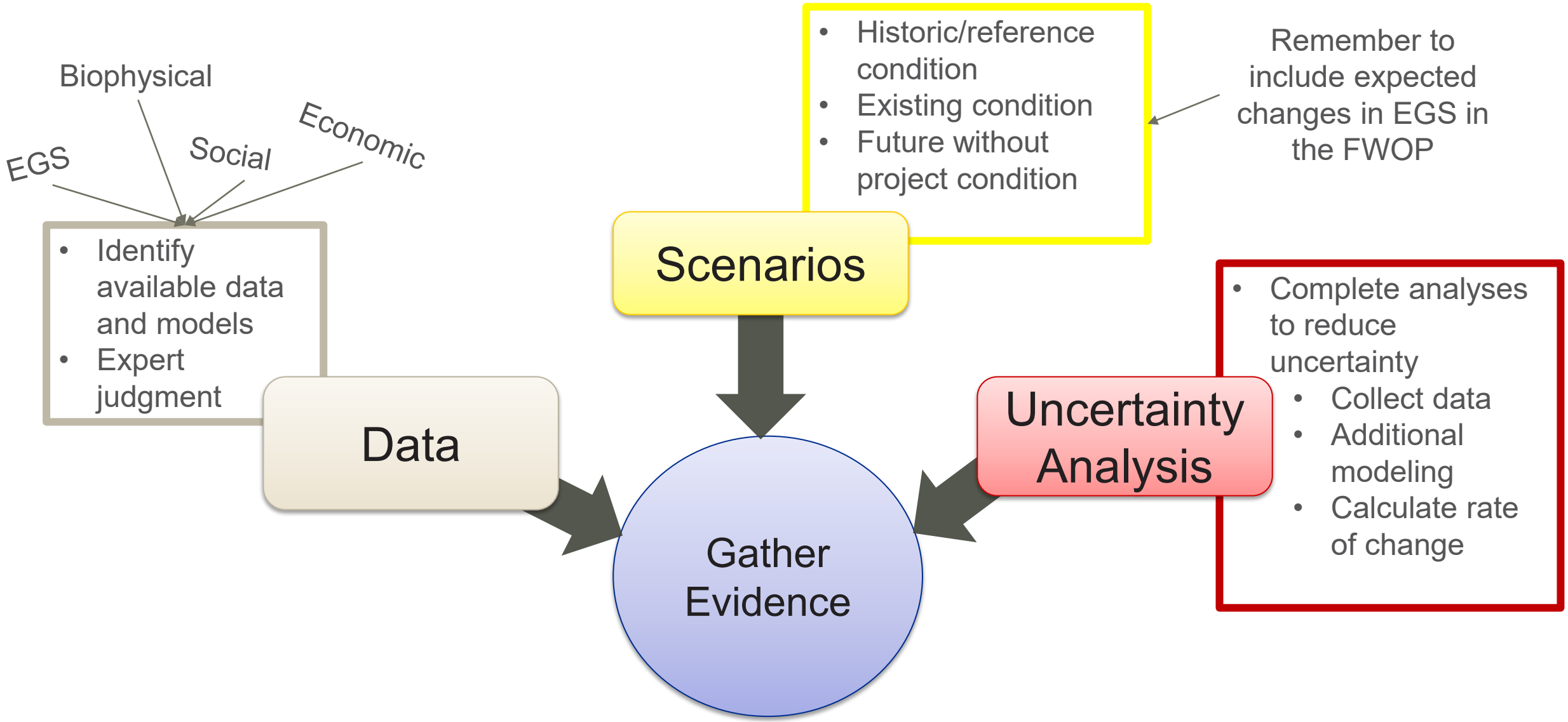


Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection



STEP 3

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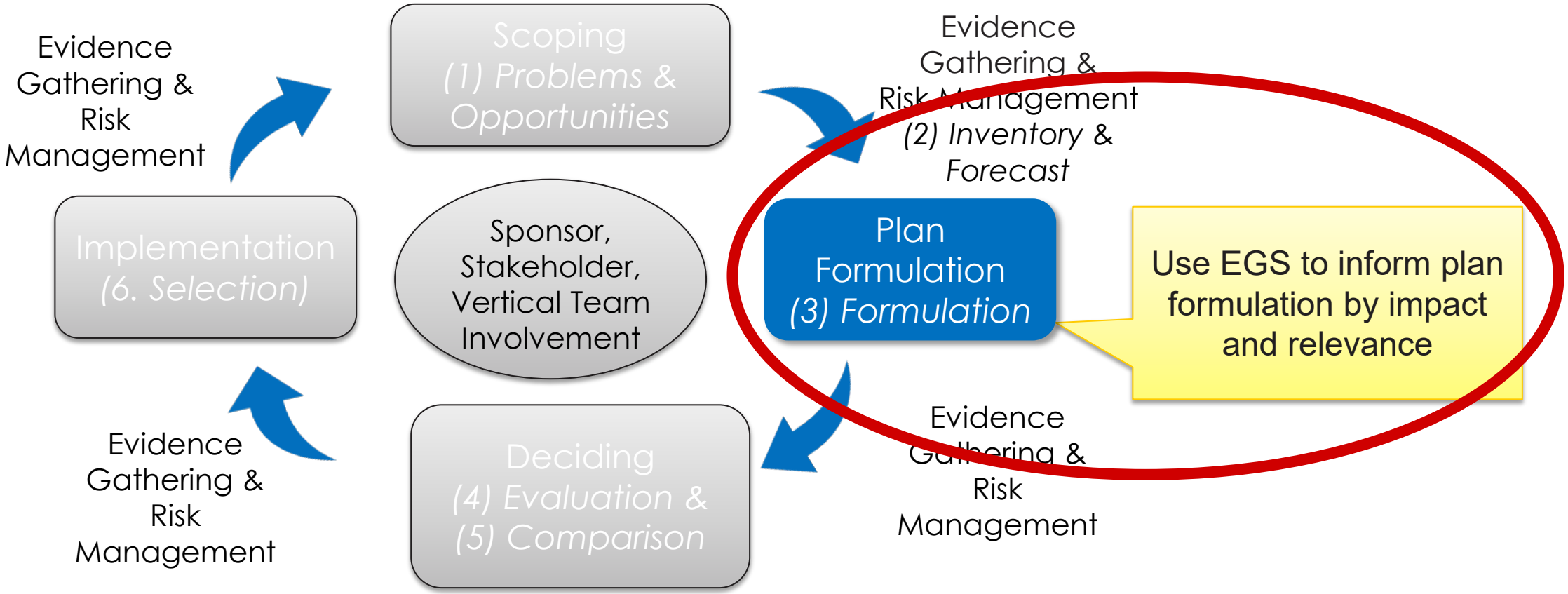

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Measures Screening

- 49 measures were identified as possible solutions
- Evaluated using the 4 P&G criteria
- 23 were eliminated from further evaluation

Alternatives Formulation

- 12 Formulation Strategies were identified
- 2 were eliminated from further evaluation
- 10 Initial Alternatives were identified

Initial Array

- Evaluated using 4 P&G criteria
- 6 - focus array of alternatives + No Action

Final Array

Plan Formulation for Meramec River Basin

STEPS 4, 5, & 6

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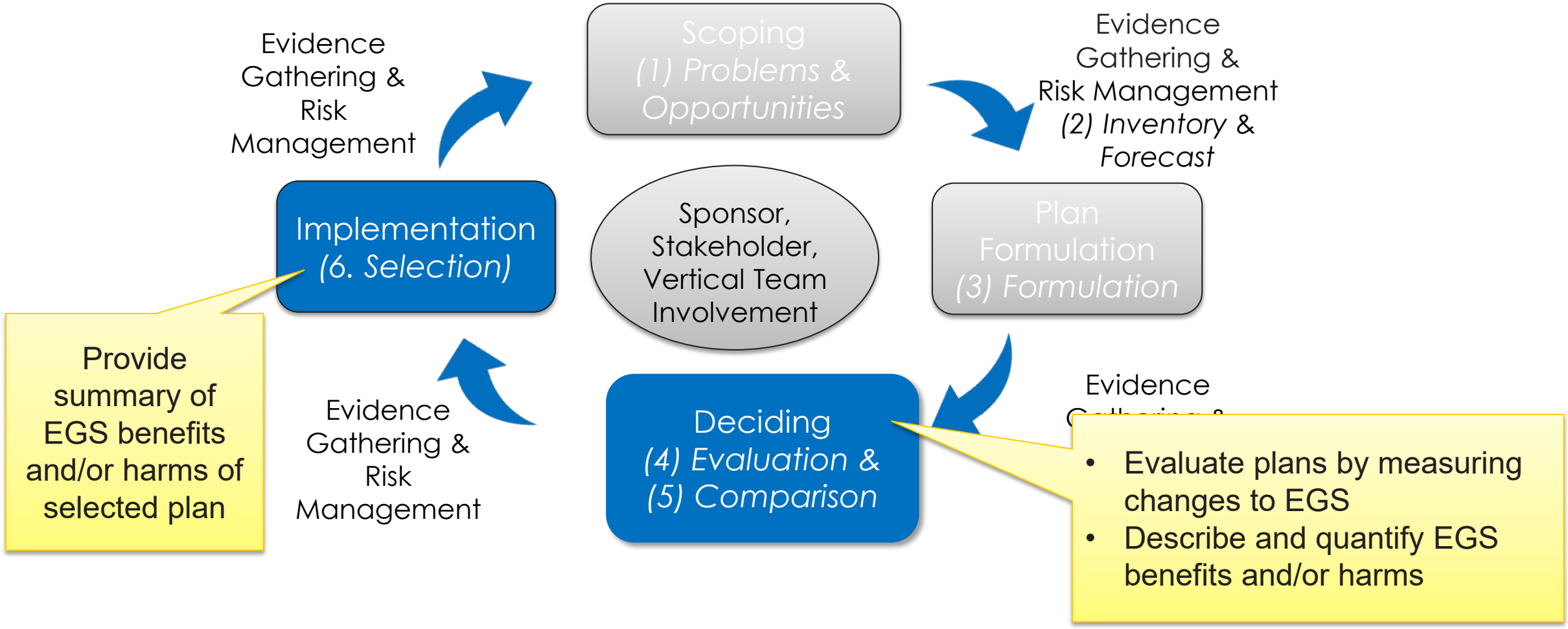

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Effectiveness

Efficiency

Acceptable

Complete

Environmental Quality

Estimated Annualized Cost

Lead Concentration (ppm)

Other Social Effects (human safety/flooding)

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Alternative	Effectiveness	Efficiency	Environmental Quality	Estimated Annualized Cost	Lead Concentration	Other Social Effects (Health/Flooding)
1- No Action	✗	✓	✗	$0	✗	✗
2	✗	✓	✗	$591,000	✗	✓
3	✓	✓	✓	$2,181,000	✗	✓
4	✗	✗	✗	$886,000	✗	✗
5	✓	✓	✓	$3,132,000	✓	✓
6	✓	✓	✓	$4,407,000	✓	✓
7	✓	✓	✓	$5,280,000	✓	✓

✗ LOW ✓ MEDIUM ✓ HIGH

EGS

Simplified Table 6-5 USACE 2019; not all criteria shown

Problems & Opportunities	Inventory & Forecast	Formulation	Evaluation	Comparison	Selection

Alternative	Effectiveness	Efficiency	Environmental Quality	Estimated Annualized Cost	Lead Concentration	Other Social Effects (Health/Flooding)
1- No Action	✗	✓	✗	$0	✗	✗
2	✗	✓	✗	$591,000	✗	✓
3	✓	✓	✓	$2,181,000	✗	✓
4	✗	✗	✗	$886,000	✗	✗
5	✓	✓	✓	$3,132,000	✓	✓
6	✓	✓	✓	$4,407,000	✓	✓
7	✓	✓	✓	$5,280,000	✓	✓

✗ LOW ✓ MEDIUM ✓ HIGH

EGS

Simplified Table 6-5 USACE 2019; not all criteria shown

TELLING THE STORY

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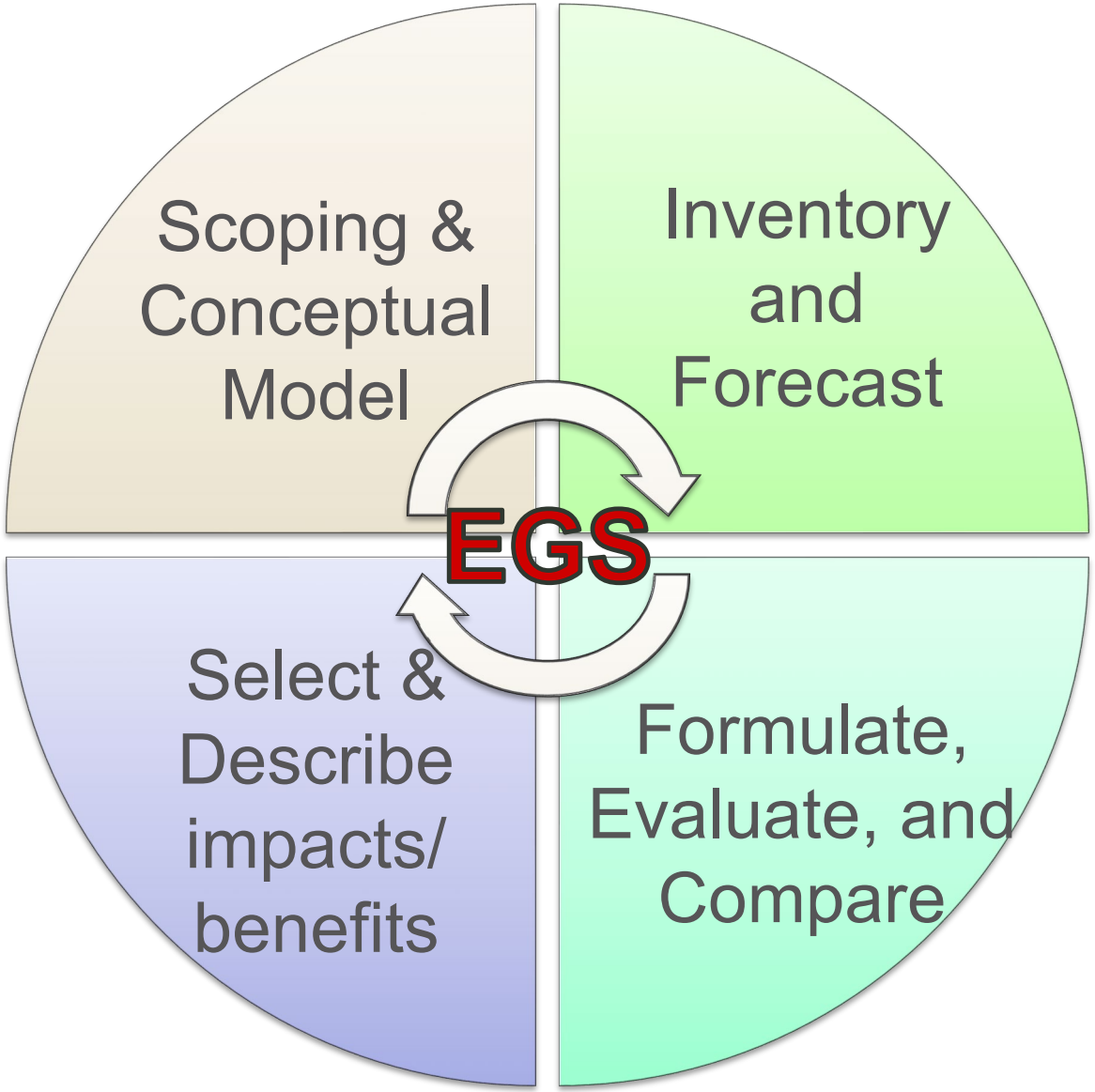

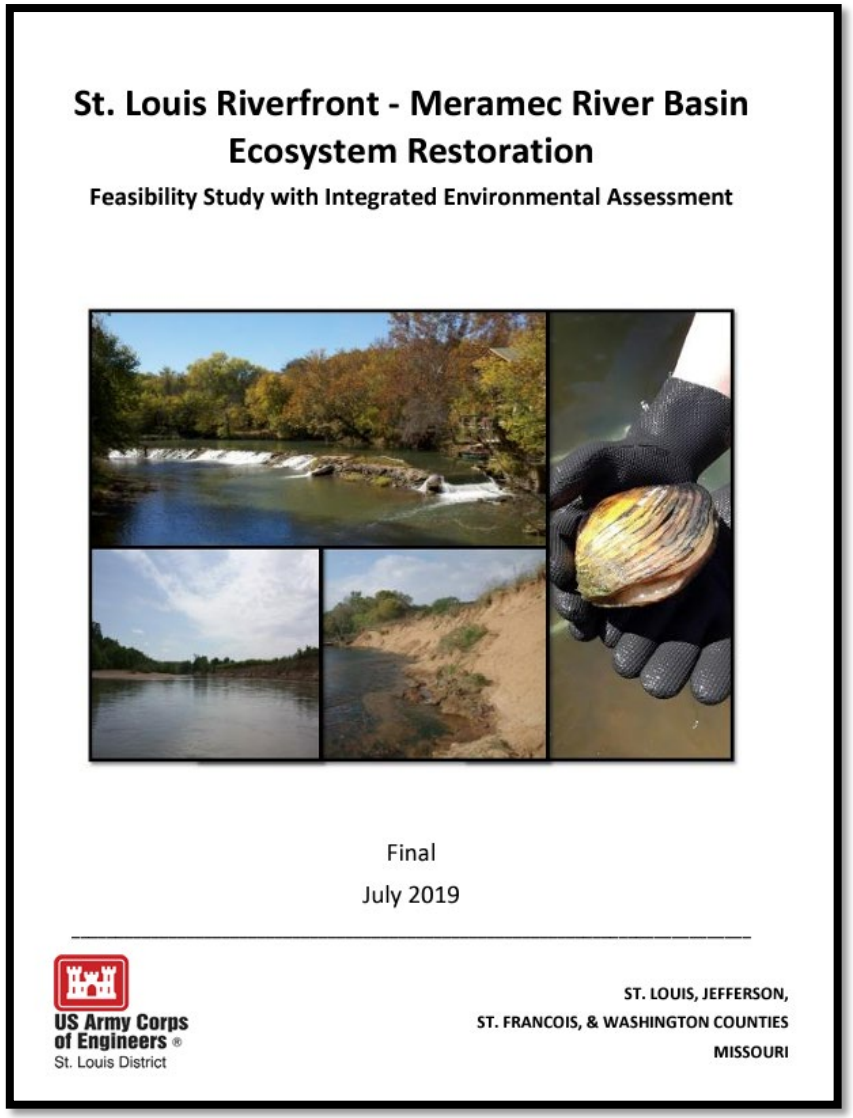

St. Louis Riverfront - Meramec River Basin Ecosystem Restoration

Feasibility Study with Integrated Environmental Assessment

Final

July 2019

US Army Corps of Engineers®
St. Louis District

ST. LOUIS, JEFFERSON,
ST. FRANCOIS, & WASHINGTON COUNTIES
MISSOURI

SUMMARY & NEXT STEPS

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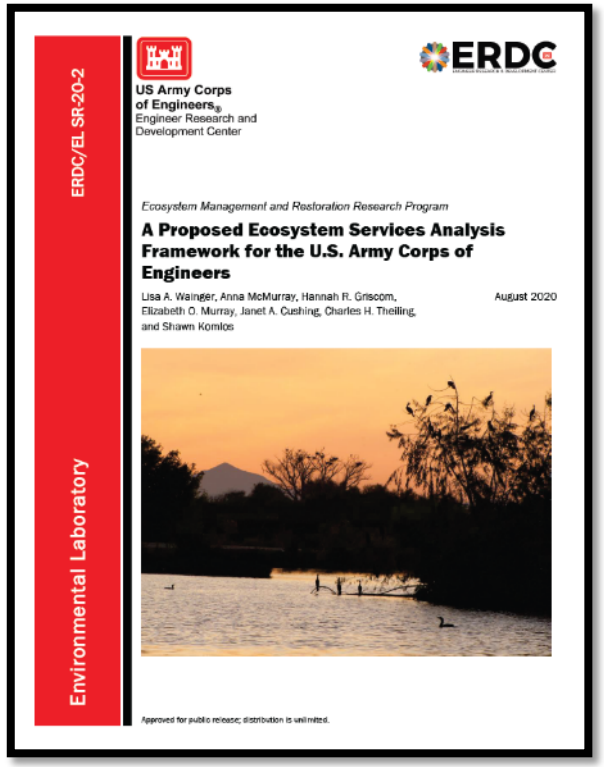
- Use of an EGS approach allows the risk-informed planning process to better anticipate and account for the effects of a Federal Investment
- USACE Agency Specific Procedures & Ecosystem Services



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Learn more here:
https://www.mvd.usace.army.mil/About/Ecosystem-Restoration-Planning-Center-of-Expertise/

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BACKUP SLIDES

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EGS CONSIDERATIONS FOR CORPS AQUATIC ECOSYSTEM RESTORATION PLANNING STUDIES

Theme	Category	Definition	Example EGS Indicator
Environmental	**Ecosystem Sustainability**	The maintenance of ecosystems' structural and functional qualities…and resilience to adapt to change over time	• Native species diversity • Acres restored
Social	**Recreation**	Quantity and quality of recreational opportunities	• Catch per angler • Number of/diversity of ecotourism activities
	Aesthetics	Enjoyment provided by the condition of the landscape	• % view of from residences/commercial properties that is open water
	Water Purification/ Protect Human Health	The filtration and removal of excess nutrients or pollutants	• Pathogen concentration • Frequency of harmful algal blooms

Modified from Table 2 Wainger et al. 2020

Criteria	Metric	Metric used	Methods/Models
NER	Annual Net benefits	The plan that reasonably maximizes net benefits was identified	Chickadee and Mussel model used to identify net benefits High: scored high in 2 of 3 objectives and cost effective Medium: scored medium in 2 of 3 objectives and cost effective Low: All other plans
EQ	Air/Noise/Water Quality, T&E, Cultural, etc.	Environmental impacts quantified for each plan	Coordination with resource agencies and Net Benefits
Other Social Effects	**Reduced health safety, reduced flood benefits**	Reduced sediment used to capture ancillary health and flood reduction benefits	Mussel model annual benefits, same rating as objective 2
Completeness	Includes all actions (including those of others) to achieve outputs	Plans ranked by the potential need for additional actions by others to achieve benefits	PDT discussion determined no additional actions are needed to achieve benefits
Effectiveness	Annual Benefits	Plans ranked by how well they meet project objectives	Objective 1. High: over 1000 AAHUs Low: less than 100 AAHU Objective 2. High: 1000 AAHU and 5 or more bank sites Low: all other plans Objective 3. High: over 500 floodplain AAHU Low: less than 100 AAHU
Efficiency	Annual Net benefits (NER analysis)	Plans evaluated based on cost and benefits	IWR Planning Suite Output
Acceptability	Implementable	Plans evaluated based on degree of potential barriers during implementation	Alternatives were evaluated on whether an EPA ROD was needed to be within policy
Opportunities	**Lead Reduction**	Plans evaluated based on potential to reduce ecological effects of lead on mussels	Lead levels High: below 128 PPM Medium: below 200 PPM Low: above 200 PPM