



Resource Economics to Support Contaminated Dredge Sediment Management Decisions

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Sediment Management Working Group (SMWG)

**Contaminated Sediment Beneficial Use
Workshop**

March 26-27, 2024

Environmental Risk-Benefit Analysis (33+ Years Experience each)

- OMB Cost-Benefit Analysis
- Co-authored the first formalized NEBA framework
 - Recognized by the USEPA, the USEPA Science Advisory Board (USEPA SAB), NOAA, IPIECA, AMSA, etc.
- Pioneered ecosystem service valuation approaches within:
 - Net Environmental Benefit Analysis (NEBA); and
 - Natural Resource Damage Assessment (NRDA)

PROFILE

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A Framework for Net Environmental Benefit Analysis for Remediation or Restoration of Contaminated Sites

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ABSTRACT / Net environmental benefits are gains in value of environmental services or other ecological properties attained by remediation or ecological restoration minus the value of adverse environmental effects caused by those actions. Net environmental benefit analysis (NEBA) is a methodology for comparing and ranking net environmental benefits associated with multiple management alternatives. A NEBA for chemically contaminated sites typically involves comparison of several management alternatives: (1) leaving contamination in place;

(2) physically, chemically, or biologically remediating the site through traditional means; (3) improving ecological value through onsite and offsite restoration alternatives that do not directly focus on removal of chemical contamination; or (4) a combination of those alternatives. NEBA involves activities that are common to remedial alternatives analysis for state regulations and the Comprehensive Environmental Response, Compensation, and Liability Act, post-closure and corrective action permits under the Resource Conservation and Recovery Act, evaluation of generic types of response actions pertinent to the Oil Pollution Act, and land management actions that are regulated with regulatory agencies in flexible regulatory environments (i.e., valuing environmental services or other ecological properties, assessing adverse impacts, and evaluating remediation or restoration options). This article presents a high-level framework for NEBA at contaminated sites with subframeworks for natural attenuation (the contaminated reference state), remediation, and ecological restoration alternatives. Primary information gaps related to NEBA include non-monetary valuation methods, exposure-response models for all stressors, the temporal dynamics of ecological recovery, and optimal strategies for ecological restoration.

Net environmental benefit analysis (NEBA) is a methodology for identifying and comparing net environmental benefits of alternative management options, usually applied to contaminated sites. Net environmental benefits are the gains in the value of environmental services or other ecological properties attained by remediation or ecological restoration minus the value of adverse environmental effects caused by those actions. (Restoration, as defined here, refers to actions that directly improve environmental services or other ecological properties, onsite or offsite, in contrast to remediation, which focuses on chemical removal.) A NEBA for chemically contaminated sites typically involves the

comparison of the following management alternatives: (1) leaving contamination in place, allowing natural attenuation; (2) removing or isolating contaminants through traditional remediation; (3) improving ecological value through onsite or offsite restoration that does not involve removing contaminants; or (4) a combination of these alternatives. An example of a combination of actions is the remediation of localized soil contamination combined with natural attenuation and the planting of trees. NEBA involves valuing environmental services or other properties, assessing adverse impacts, and evaluating remediation or restoration options. These activities are common to remedial alternatives analysis under state contaminated site regulations and the US Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); post-closure and corrective action permits under the Resource Conservation and Recovery Act (RCRA); evaluation of generic types of response actions pertinent to the US Oil Pollution Act (OPA); land-management actions that

KEY WORDS: NEBA; Net environmental benefit analysis; Ecological risk assessment; Petroleum; Remediation; Ecological restoration

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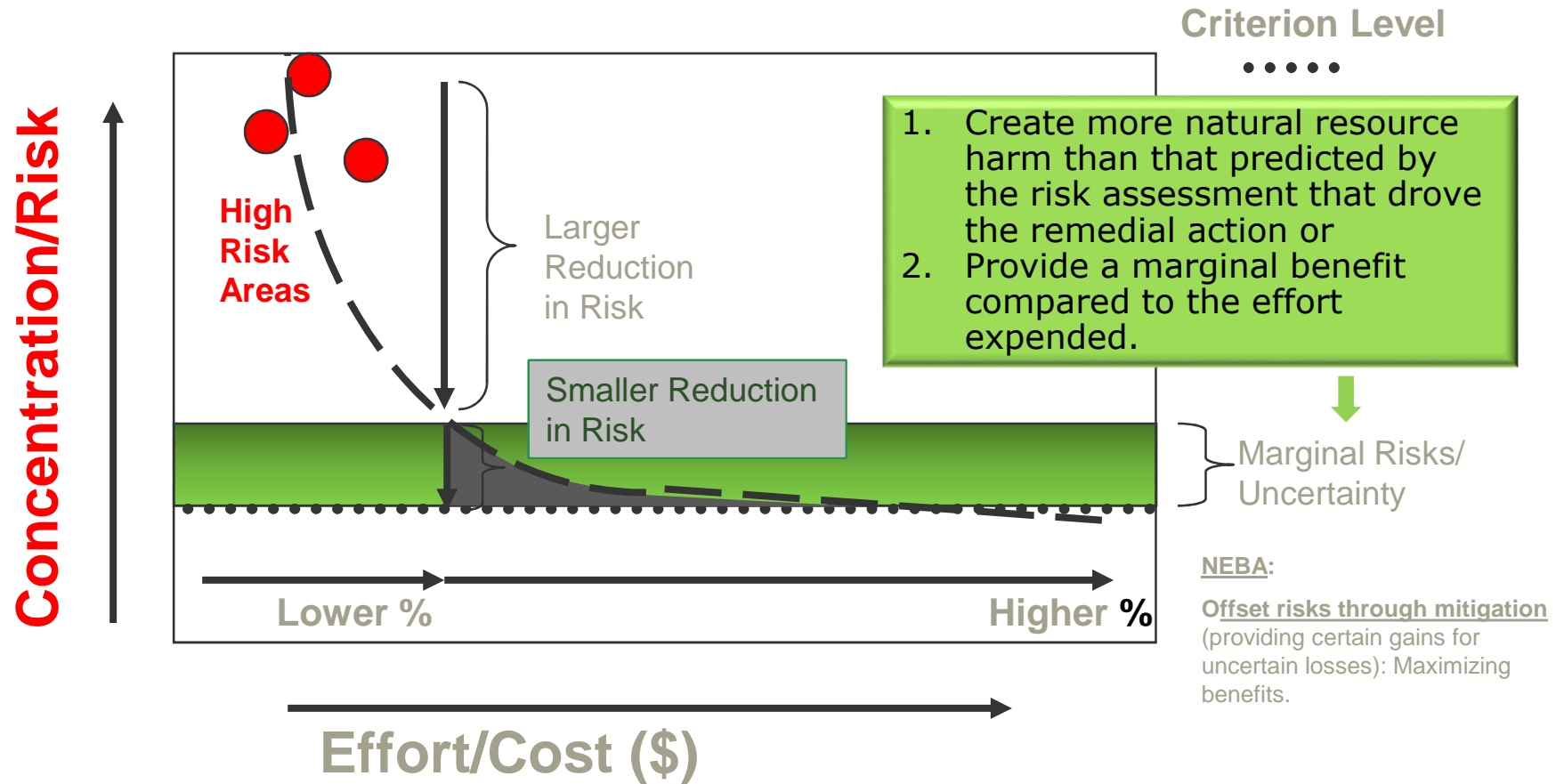
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Net Environmental Benefit Analysis: Balancing Risks and Benefits *(From 2004 First Formalized NEBA Framework)*

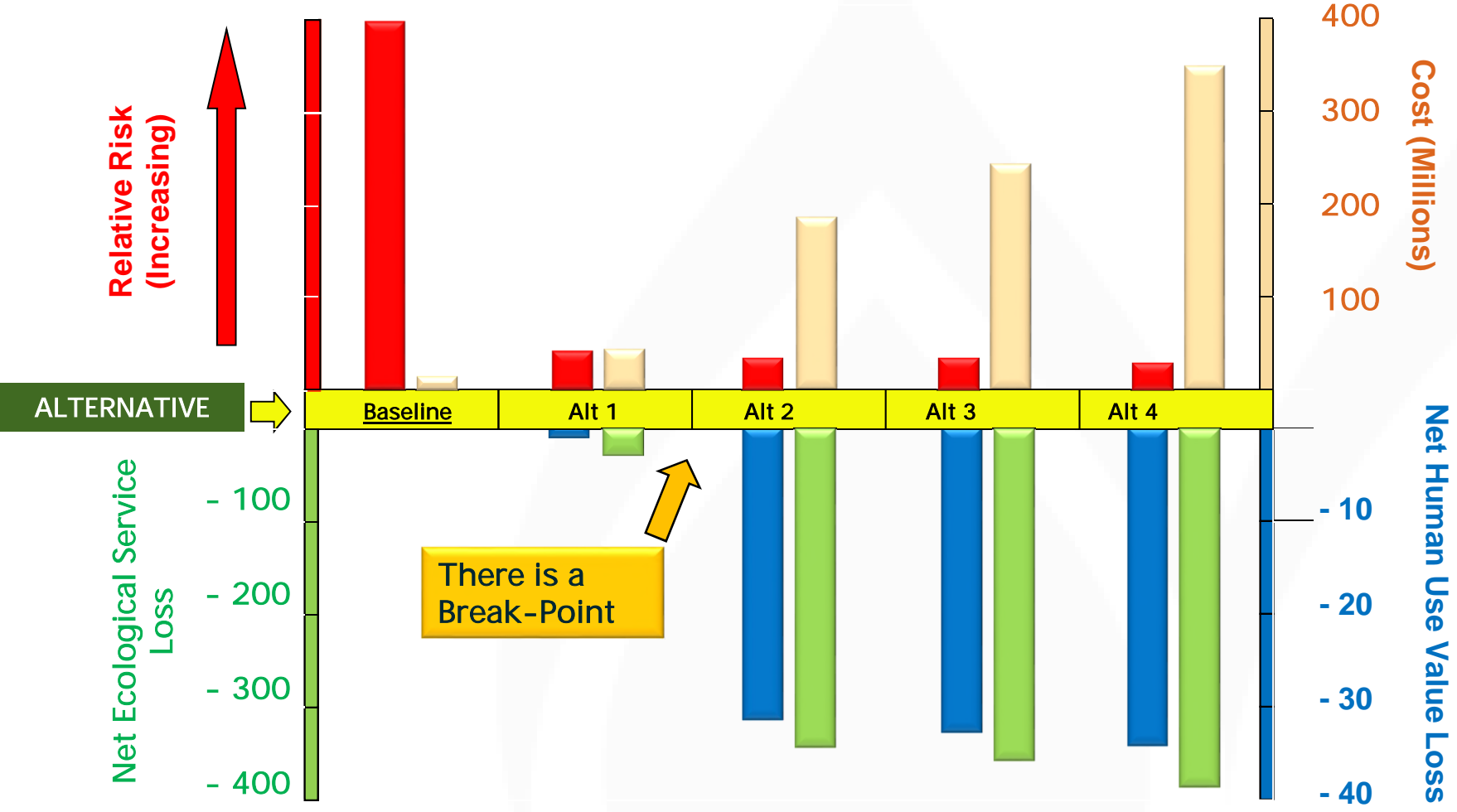
- “The NEBA framework should be useful when the balance of risks and benefits from an action at a site is ambiguous. That ambiguity arises when:
 - **The site retains significant ecological value;**
 - **When the actions are themselves environmentally damaging;**
 - **When the ecological risks from the in-situ condition are relatively small, uncertain, or limited to a component of the ecosystem.”**
- In the context of contaminated dredge sediment management, the NEBA framework directly addresses the ambiguity that can arise when making decisions regarding the selection of appropriate disposition of contaminated sediments.



NEBA: Risk/Benefit of actions Why Consider Tradeoffs?



NEBA RESULTS: RISK, BENEFIT AND COST PROFILE CHANGES FOR OPTIONS



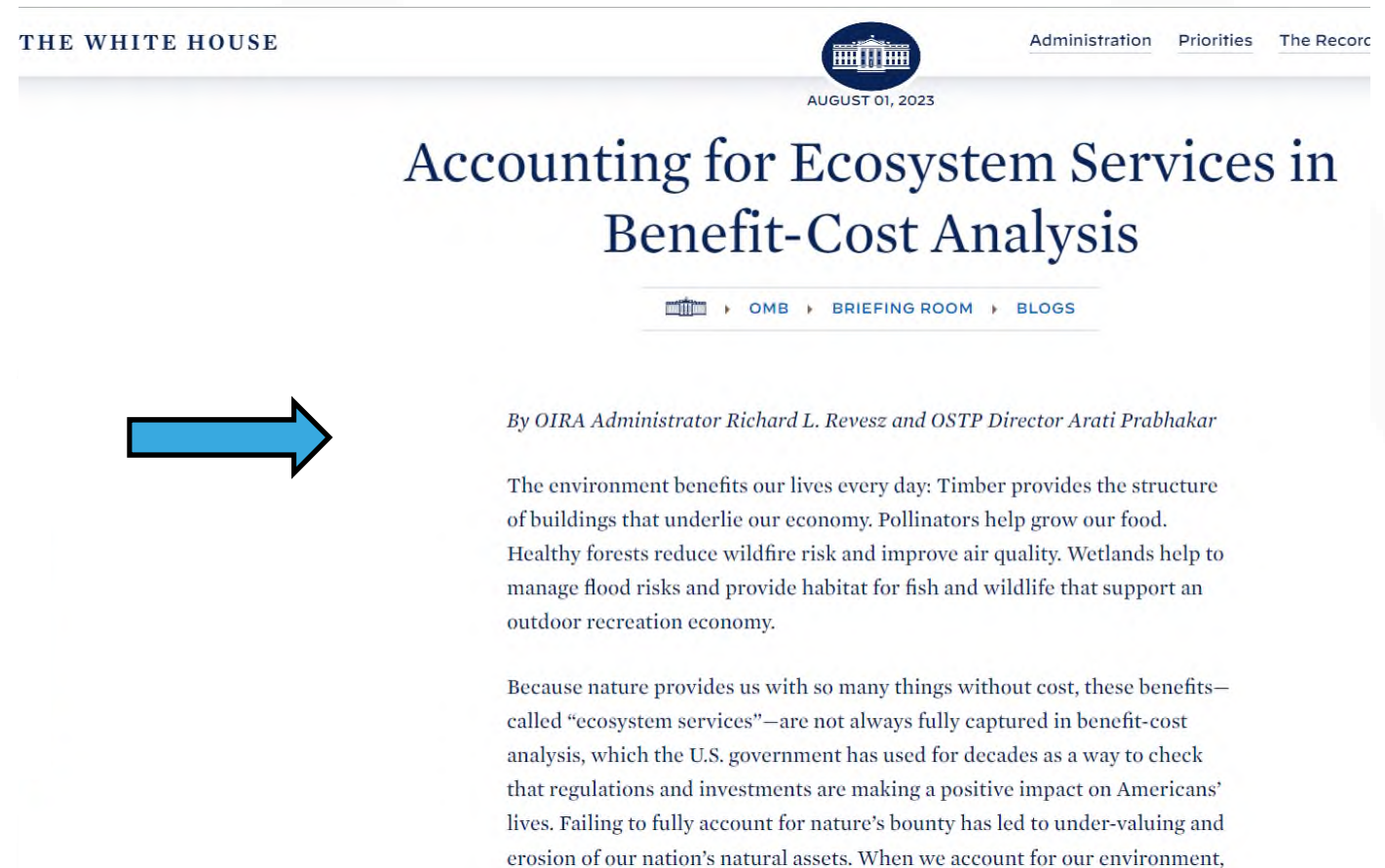
NEBA is a Recognized framework

<p>A Framework for Restoring Sites</p> <p>January 2013</p> <p>R. A. Efroymson J. P. Nicolette G. W. Suter II</p> <p>Environmental Science</p>	<p>PROFILE A Framework for Restoring Sites</p> <p>REBECCA A. EFROYMSON Environmental Sciences Oak Ridge National Lab Oak Ridge, Tennessee</p> <p>JOSEPH P. NICOLETTE CH2M Hill Atlanta, Georgia 30346</p> <p>GLENN W. SUTER II National Environmental Protection Agency US Environmental Protection Agency Cincinnati, Ohio 45268</p> <p>ABSTRACT / Net environmental services by remediation or ecological services or other ecological services or other ecological services (Restoration, as defined directly improve environmental properties, or remediation, which focus on chemical contamination.</p> <p>Net environmental services methodology for identifying environmental benefits or costs usually applied to cost-benefit analysis. The services or other ecological services or other ecological services (Restoration, as defined directly improve environmental properties, or remediation, which focus on chemical contamination.</p> <p>KEY WORDS: NEBA; Net Environmental Benefit Assessment; Remediation</p> <p>Published online August 2012 *Author to whom correspondence should be addressed: Efraymson@kuborn.gov</p> <p>Environmental Manager</p>	<p>INTERFACIAL CENTERS TRC LABORATORY</p> <p>Ecology</p> 	<p>EPA United States Environmental Protection Agency</p>   <p>Science Advisor Office of the Administrator</p>	<p>Operational Net Environmental National Oceanic and Atmospheric Administration</p> 	<p>FINANCIAL</p> <p>The assessment will provide mechanistic advice, Environmental</p>	 <p>9</p> <p>EXPERIENCE WITH RESTORATION OF ENVIRONMENTAL DAMAGE¹</p> <p><i>Joseph P. Nicolette, Barbara J. Goldsmith,² Richard J. Wenning, Timothy R. Barber, and Fabio Colombo</i></p> <p>Published March 14, 2013 Chapter 9</p>
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Federal Guidance and Regulations Incorporating Ecosystem Services

- 2023 White House OMB Guidance
Office of Management and Budget (OMB), in collaboration with the Office of Science and Technology Policy (OSTP), released the **federal government's first-ever guidance** on accounting for ecosystem services in benefit-cost analysis.



THE WHITE HOUSE

Administration Priorities The Record

AUGUST 01, 2023

Accounting for Ecosystem Services in Benefit-Cost Analysis

OMB BRIEFING ROOM BLOGS

By OIRA Administrator Richard L. Revesz and OSTP Director Arati Prabhakar

The environment benefits our lives every day: Timber provides the structure of buildings that underlie our economy. Pollinators help grow our food. Healthy forests reduce wildfire risk and improve air quality. Wetlands help to manage flood risks and provide habitat for fish and wildlife that support an outdoor recreation economy.

Because nature provides us with so many things without cost, these benefits—called “ecosystem services”—are not always fully captured in benefit-cost analysis, which the U.S. government has used for decades as a way to check that regulations and investments are making a positive impact on Americans’ lives. Failing to fully account for nature’s bounty has led to under-valuing and erosion of our nation’s natural assets. When we account for our environment,



Example Applications

NEBA-CA Offshore Oil and Gas Decommissioning

Persian Gulf, Australia, California, North Sea, Caribbean, Gulf of Mexico, Gulf of Thailand
– Decommissioning Option Selection



Land Conservation Valuation

AL, FL, GA, TN, SC

Valuing conservation easements based on T&E (threatened and endangered) species (120 parcels across 5 U.S. Southeastern States), including expert testimony and Report Development

Ecosystem Service Metrics



Site Remediation, Risk Assessment and NEBA Superfund Site

Macon, GA Superfund Site



Conducting a NEBA Analysis of remedial options to support remedial alternatives selection for PCB cleanup

Natural Resource Damage Assessment (NRDA) & Spill Response

California, Texas



Supporting formal NRDA cases associated with oil releases

Emergency Response and subsequent trustee agency negotiations

CONTAMINATED SEDIMENT DREDGED MATERIAL MANAGEMENT



*Strategies
Designed to
Balancing the
Risks, Benefits
and Tradeoffs
Associated with
Competing
Alternatives*



How Would This Work? Case Study Example

Options	Ocean Disposal	Landfilling	Useful Material Pozzolanic Stabilization Soil	Uplands Wetlands Shoreline Resiliency
Distributional Impacts				
Spatial Environmental Benefits (dSAYs) and/or (\$)				
GHG and other pollutants				
HH risks Residents/users Workers Transportation Eco risks				
Regional Economic Impacts (USEEIO) Direct Indirect				
Costs				



Discussion



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