Bolsa Chica Ecological Risk Assessment

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The Superfund Process

Current

- Site Discovery
- NPL Ranking/ Listing
- Remedial Investigation (RI)
- Feasibility Study (FS)

To Be Completed

- Public Comment Period
- Record of Decision (ROD)
- Remedial Design
- Remedial Action

Community Involvement Activities Occur Throughout the Superfund Process

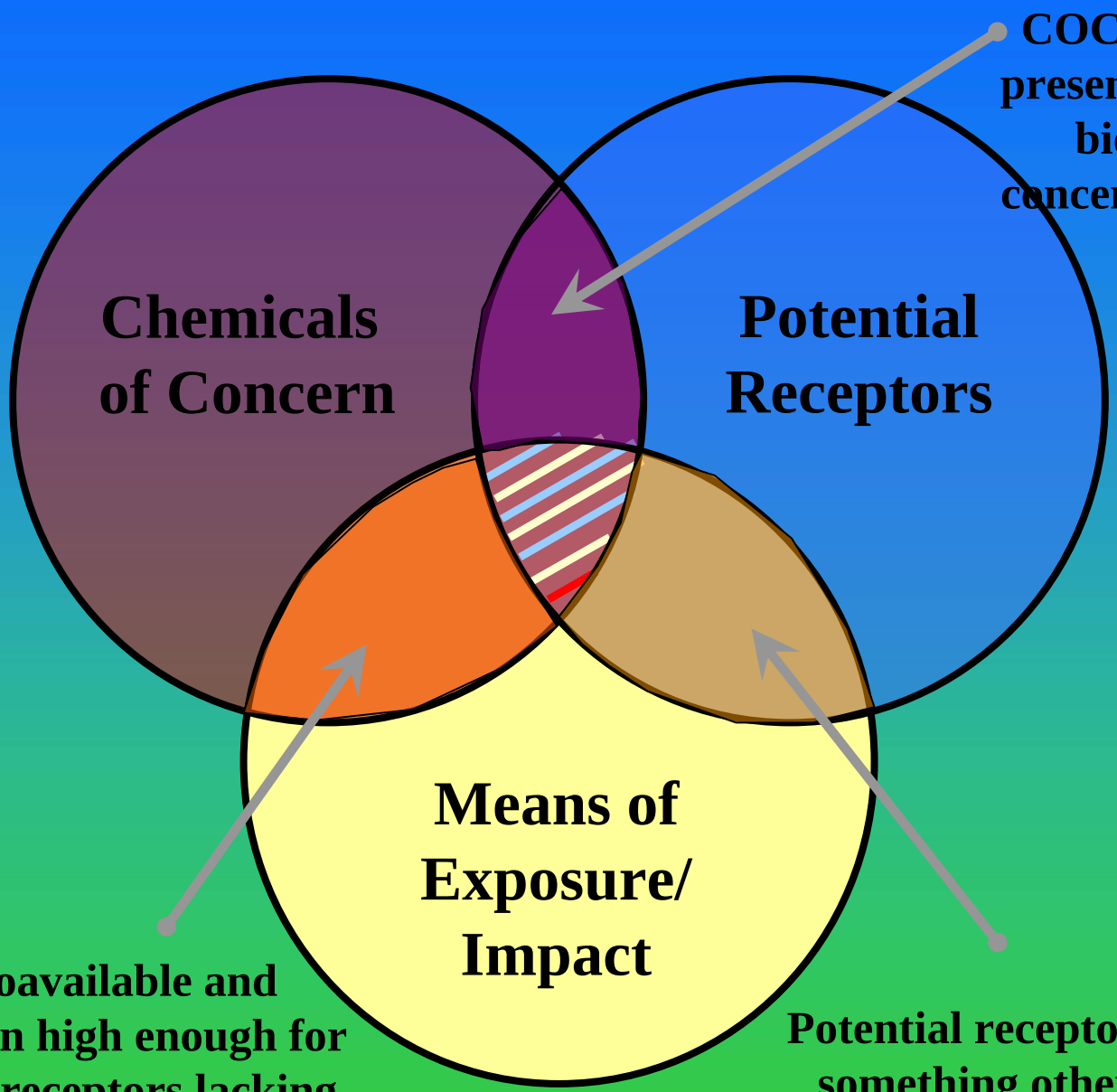
REMEDY SELECTION

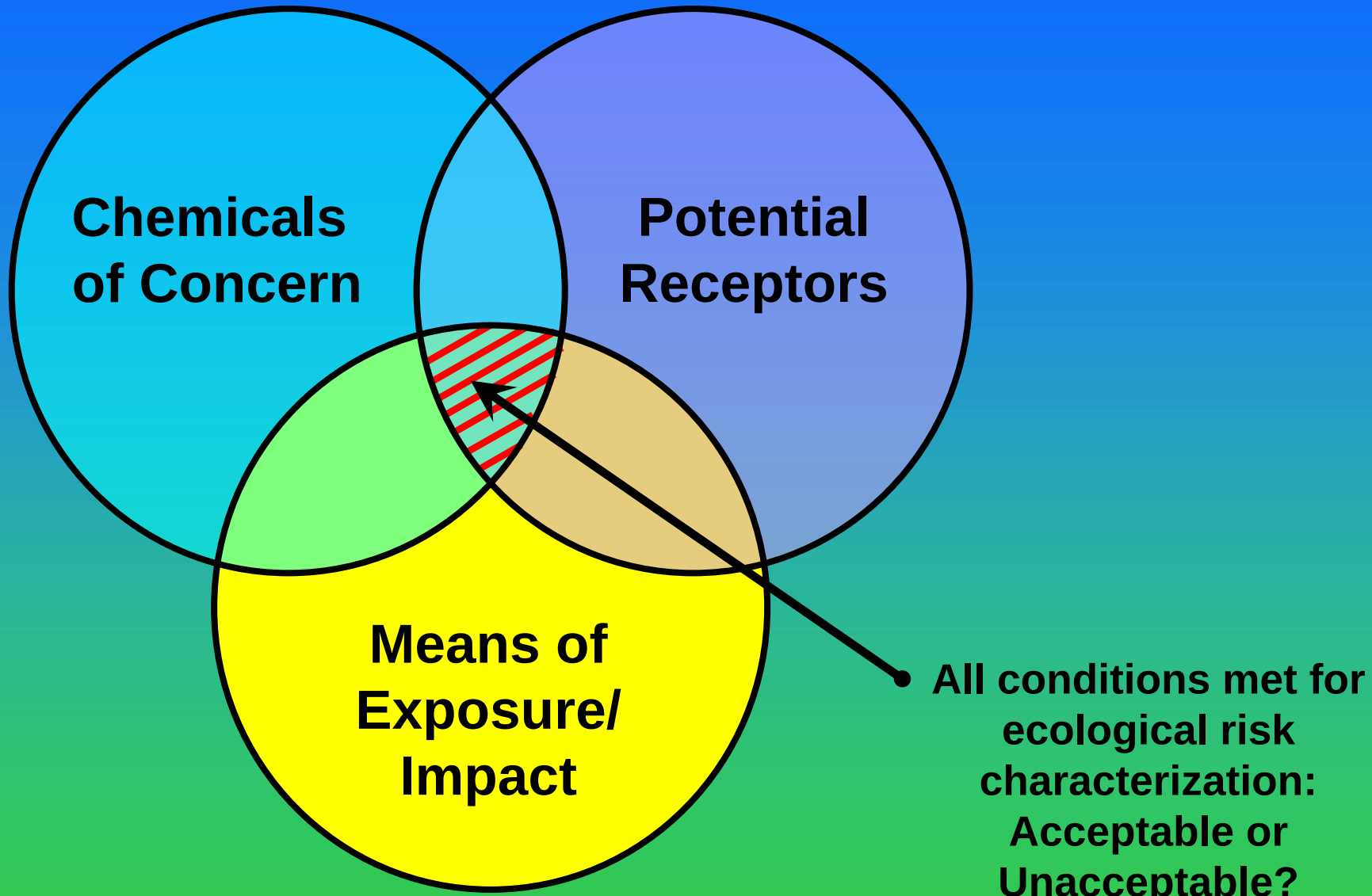
Nine Criteria Analysis

1. Overall Protection of Human Health and the Environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-term Effectiveness
4. Reduction of Toxicity, Mobility or Volume (TMV) Through Treatment
5. Short-term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance

FINAL REMEDY

Ecological Risk Assessment Fundamentals




Chemicals of Concern
Potential Receptors
Means of Exposure/ Impact
All conditions met for ecological risk characterization: Acceptable or Unacceptable?

Ecological Risk Assessment Guidance for Superfund:

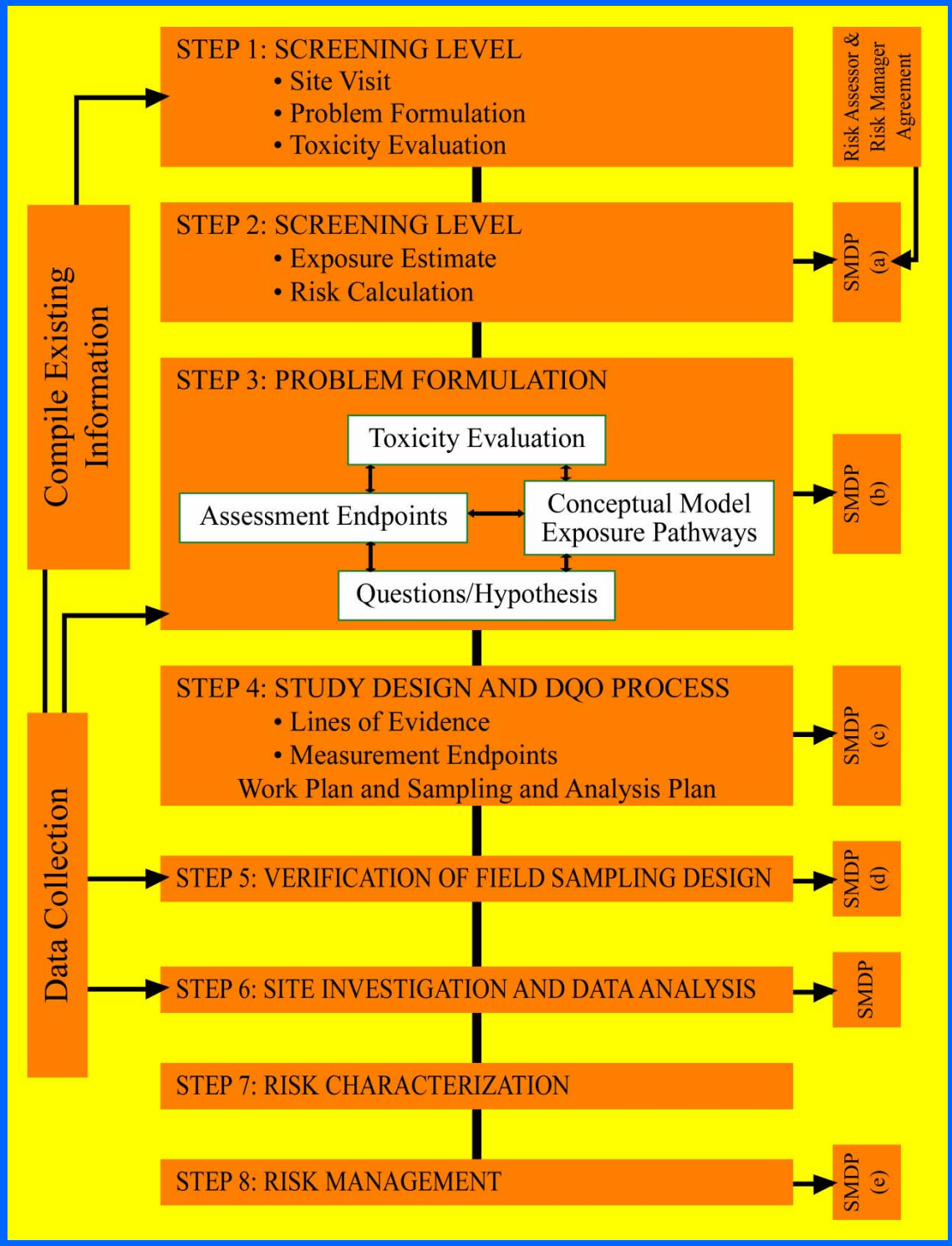
Process for Designing and Conducting Ecological Risk Assessments

Interim Final

EPA 540-R-97-006 June 1997

http://www.epa.gov/superfund/programs/risk/tooltrad.htm

8-Step Ecological Risk Assessment Process for Superfund



Guidelines for Ecological Risk Assessment

Risk Assessment Forum

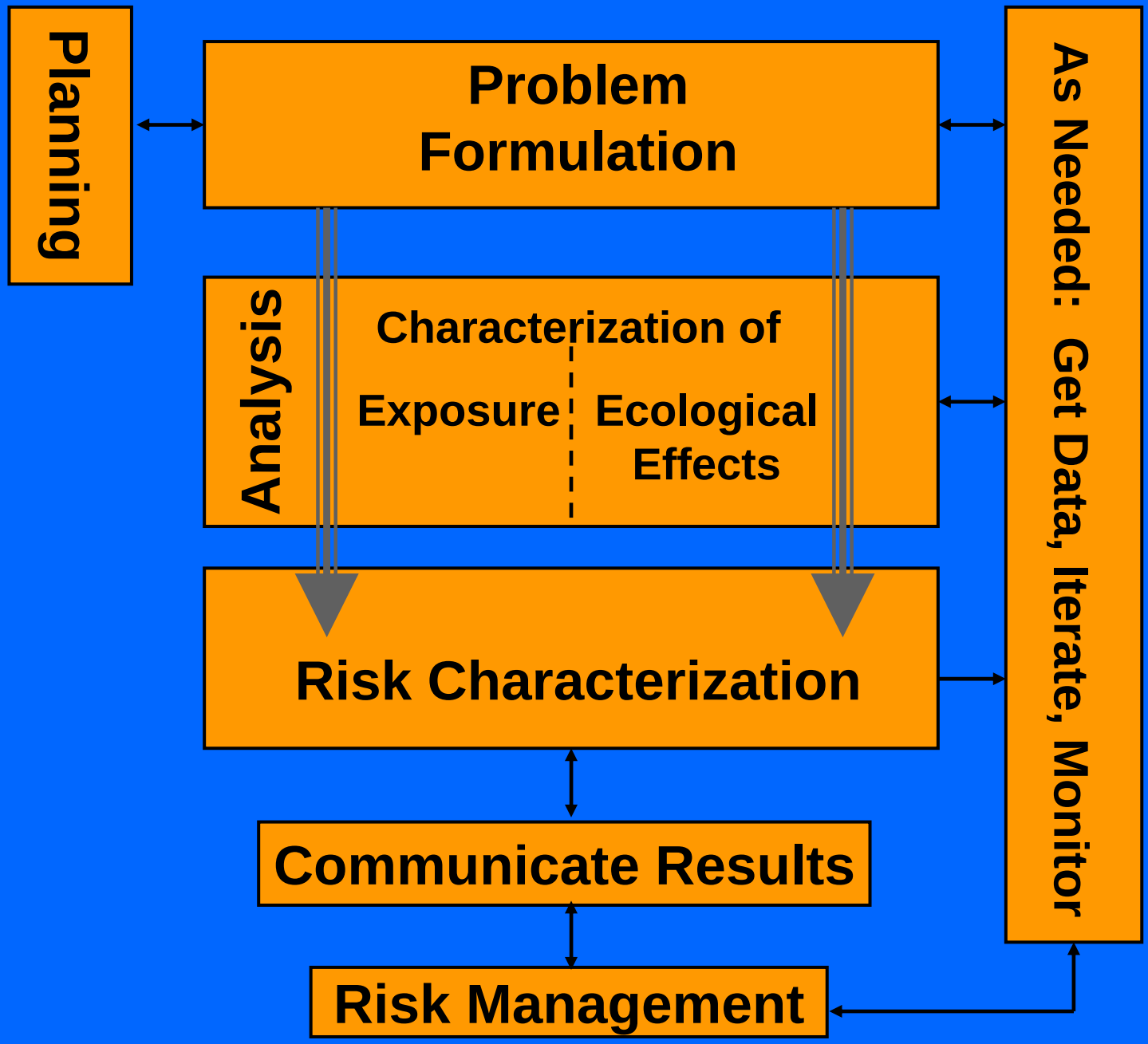
U.S. Environmental Protection Agency

Washington, DC

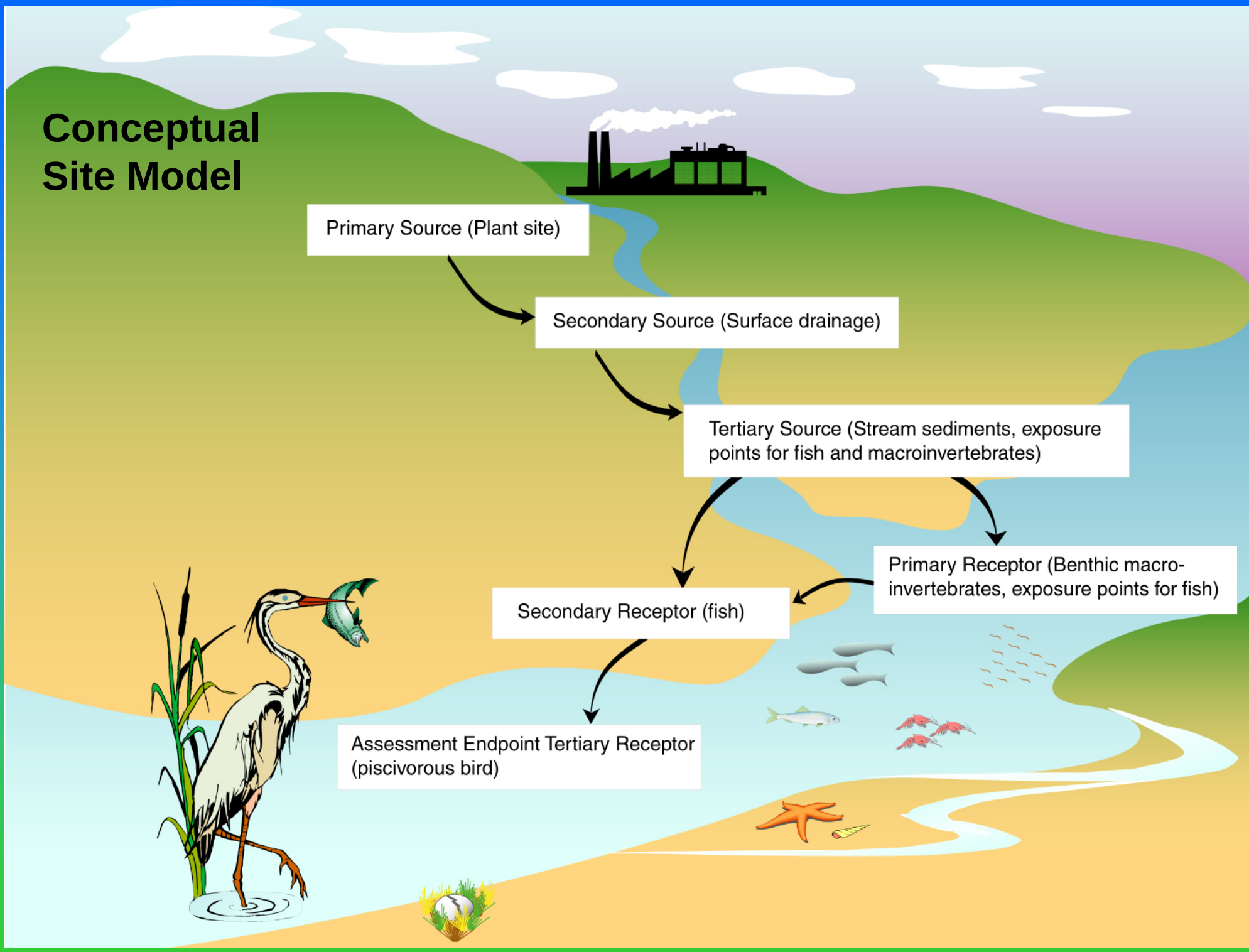
EPA/630/R-95/002F April 1998 Final

http://www.epa.gov/superfund/programs/risk/tooltrad.htm

Ecological Risk Assessment



Conceptual Site Model



Stressor Types

- **Chemical Stressors: industrial chemicals, pesticides, fertilizers, smog, auto exhaust, radionuclides, etc.**
- **Physical Stressors: logging, road construction, dredging/filling wetlands, etc.**
- **Biological Stressors: over fishing, introduced organisms such as starlings or brown tree snakes**

Stressor and organisms: Issues which are difficult to quantify or champion

- If a habitat exists, something will inhabit it
- Organisms must live in their own environment and may not be able to avoid exposure to stressors
- “Stressed” areas sometimes are “attractive”
- Life history contributes to significance of stressor effects

Endpoints

- **Assessment Endpoints: The questions we ask about the ecological health of a site and/or particular resources we choose to protect**

- **Measurement Endpoints (a.k.a. Measures): Our means of gathering data to satisfy the assessment endpoints**

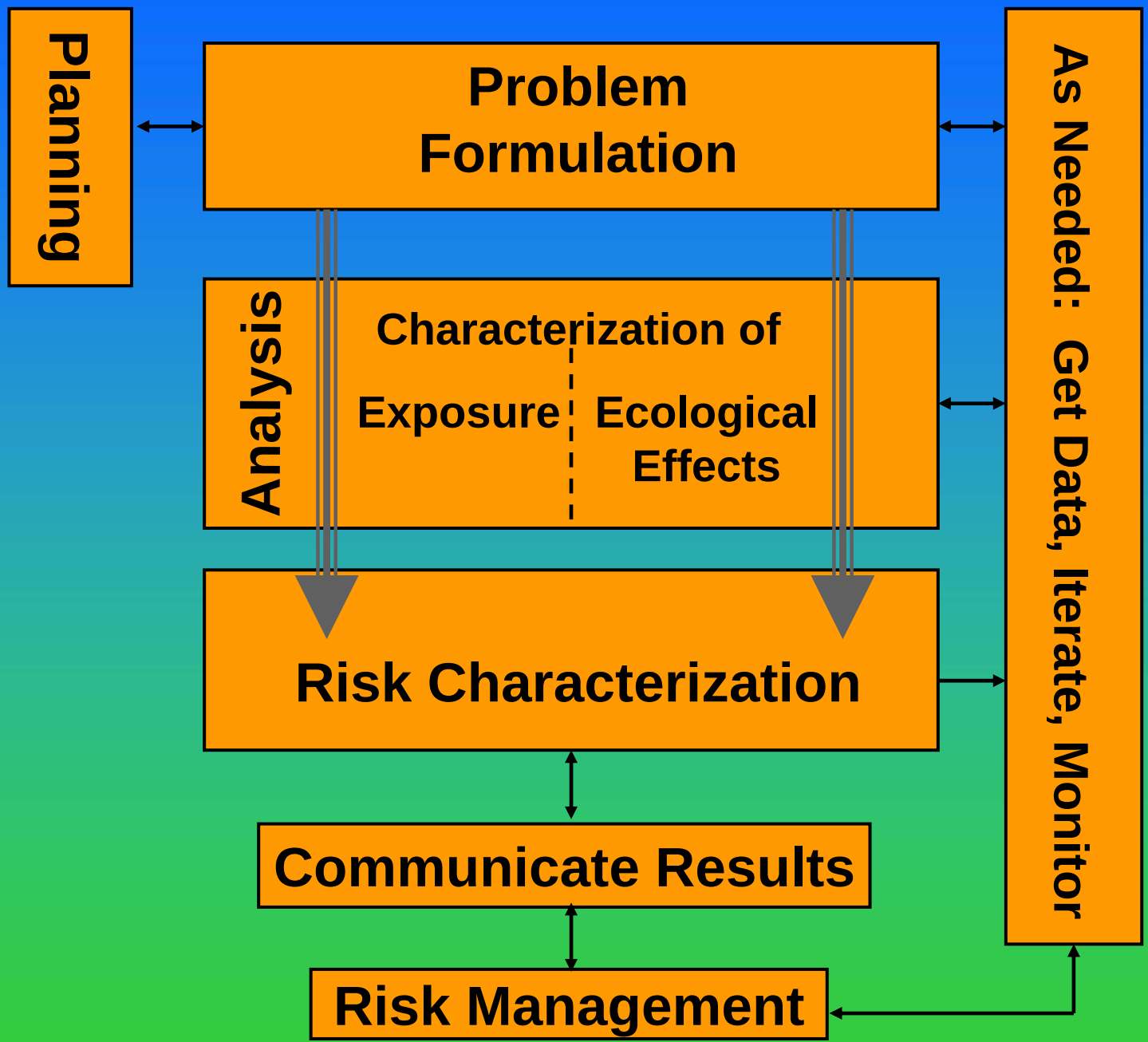
Assessment Endpoints

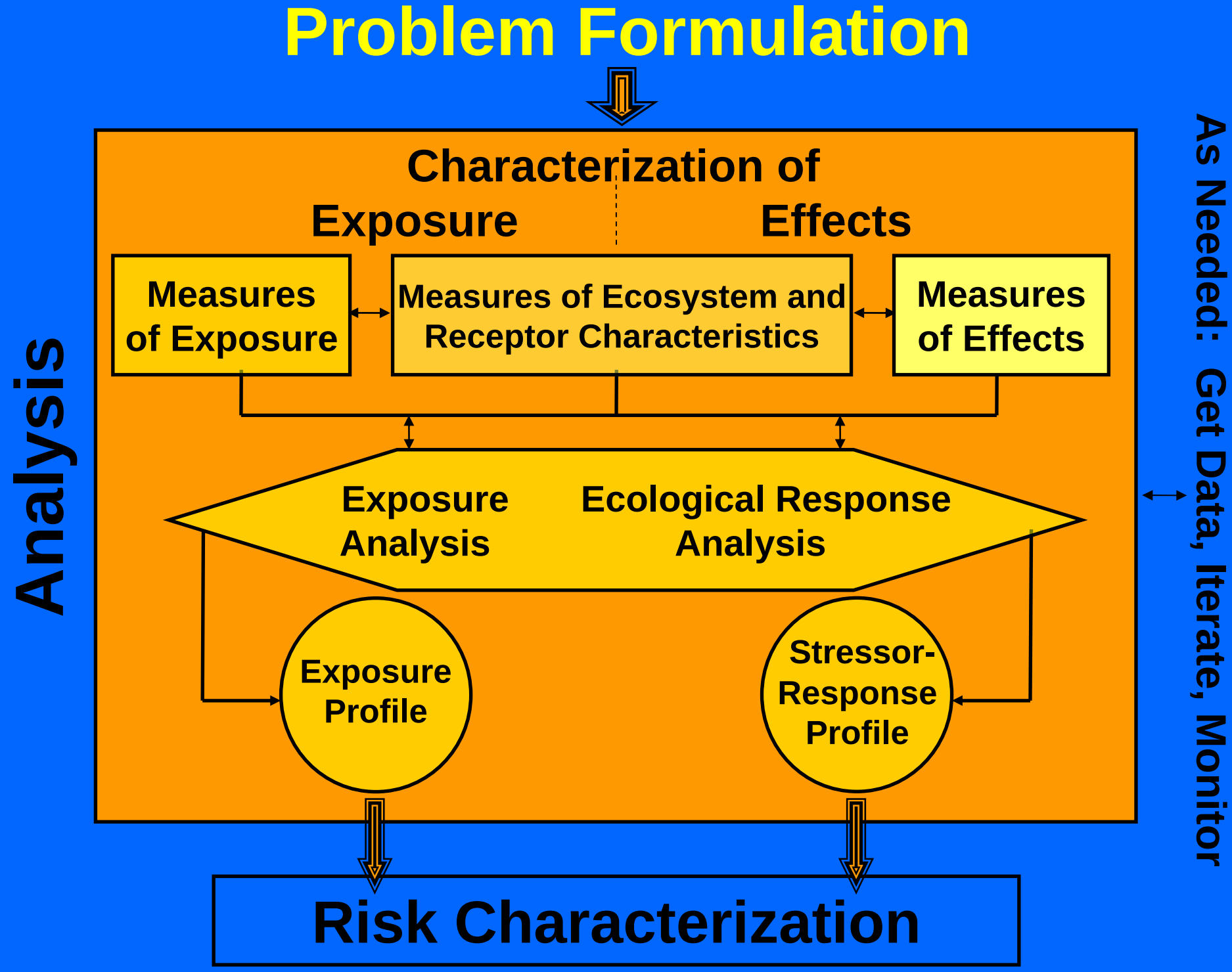
- Identify spatial and temporal extent
- Based on
  - Ecological relevance
  - Susceptibility to stressors
  - Relevance to management goals

Some Types of Measurement Endpoints

- **Exposure**
- **Effects (e.g. Toxicity &/or Bioaccumulation)**
- **Ecosystem and Receptor Characteristics (e.g. Biotic Indices)**

Ecological Risk Assessment




Problem Formulation
Characterization of
Exposure
Effects
Measures of Exposure
Measures of Ecosystem and Receptor Characteristics
Measures of Effects
Exposure Analysis
Ecological Response Analysis
Exposure Profile
Stressor-Response Profile
Analysis
As Needed: Get Data, Iterate, Monitor
Risk Characterization

Why Would Anybody Ever Want Go Through All This?

- Optimize use of resources
- Determine and agree on what needs to be examined
- Ensure that nothing is overlooked
- ARARS & Resource Trustees

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FINAL REMEDY

Some Toxicity Benchmarks

(N.B. Some are concentrations, some are doses.)

- **Ambient Water Quality Criteria (State and U.S. EPA)**
- **Sediment Effects Range-Low and -Median (NOAA)**
- **CCME Envir. Quality Guidelines**
- **EPA/DOD/DOE/Industry Soil Screening Levels**
- **Benchmarks used by EPA Regions or by State and other local governments**
- **Scientific literature**

Hazard Quotients

- **The on-site concentration or dose of a contaminant divided by a literature-based estimate of the toxicity (no or low effect level) of the contaminant for a particular receptor (aka toxicity benchmarks)**
- **Make sure analysis of contaminant chemistry is valid (e.g., detection limits lower than benchmarks)**
- **HQ>1 indicates possibility of harm to the receptor**

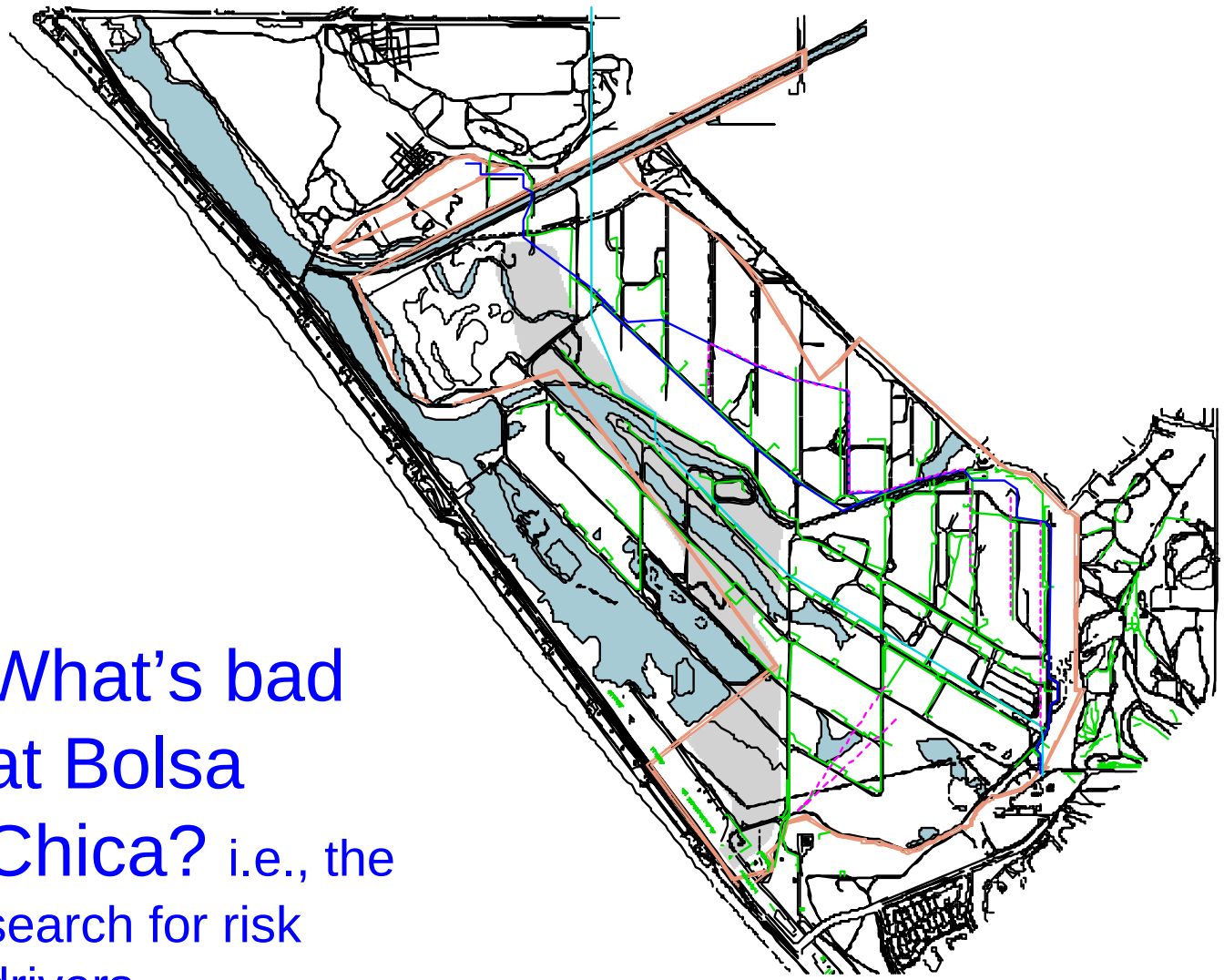
Multiple Lines of Evidence

- **Hazard Quotients: exposure dose modeling with comparison to (literature-based) toxicity benchmarks**
- **Tissue analysis or food web modeling for bioaccumulation**
- **Toxicity bioassays**
- **Community bioassessment/biotic indices**

Risk Description

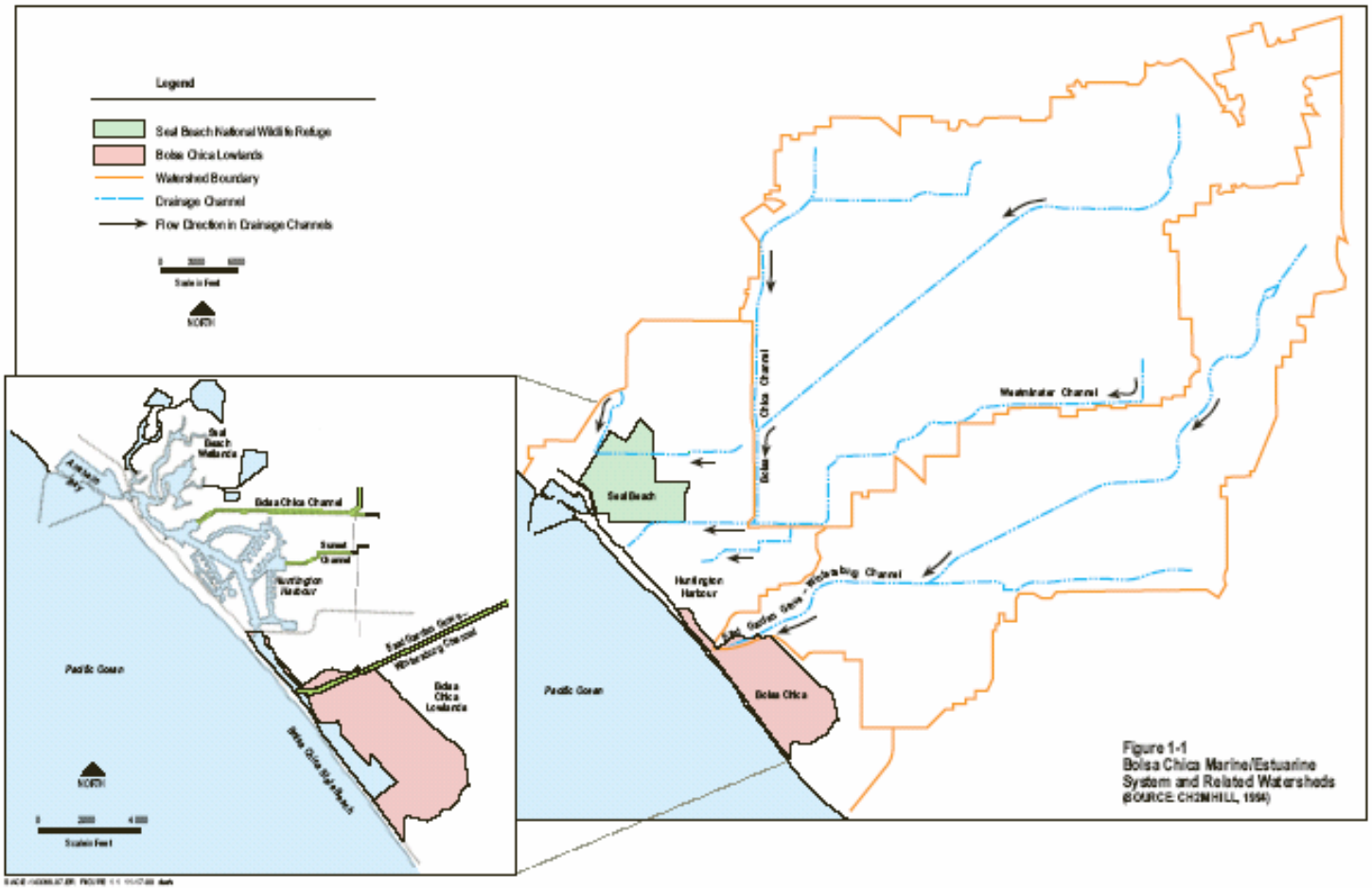
- **Lines of Evidence**
  - **relevance to assessment endpoints**
  - **relevance to conceptual model**
  - **data quality and sufficiency**
  - **causality (RISK DRIVERS)**
  - **magnitude/direction of uncertainty (CONFOUNDING FACTORS)**

Bolsa Chica Wetlands



What's bad at Bolsa Chica? i.e., the search for risk drivers

Bolsa Chica Location



Bolsa Chica Existing Habitat

Figure 2-4
Bolsa Chica Lowland and Pocket Area Habitat Map

TETRA TECH BOLSA CHICA

Bolsa Chica Restoration Plan

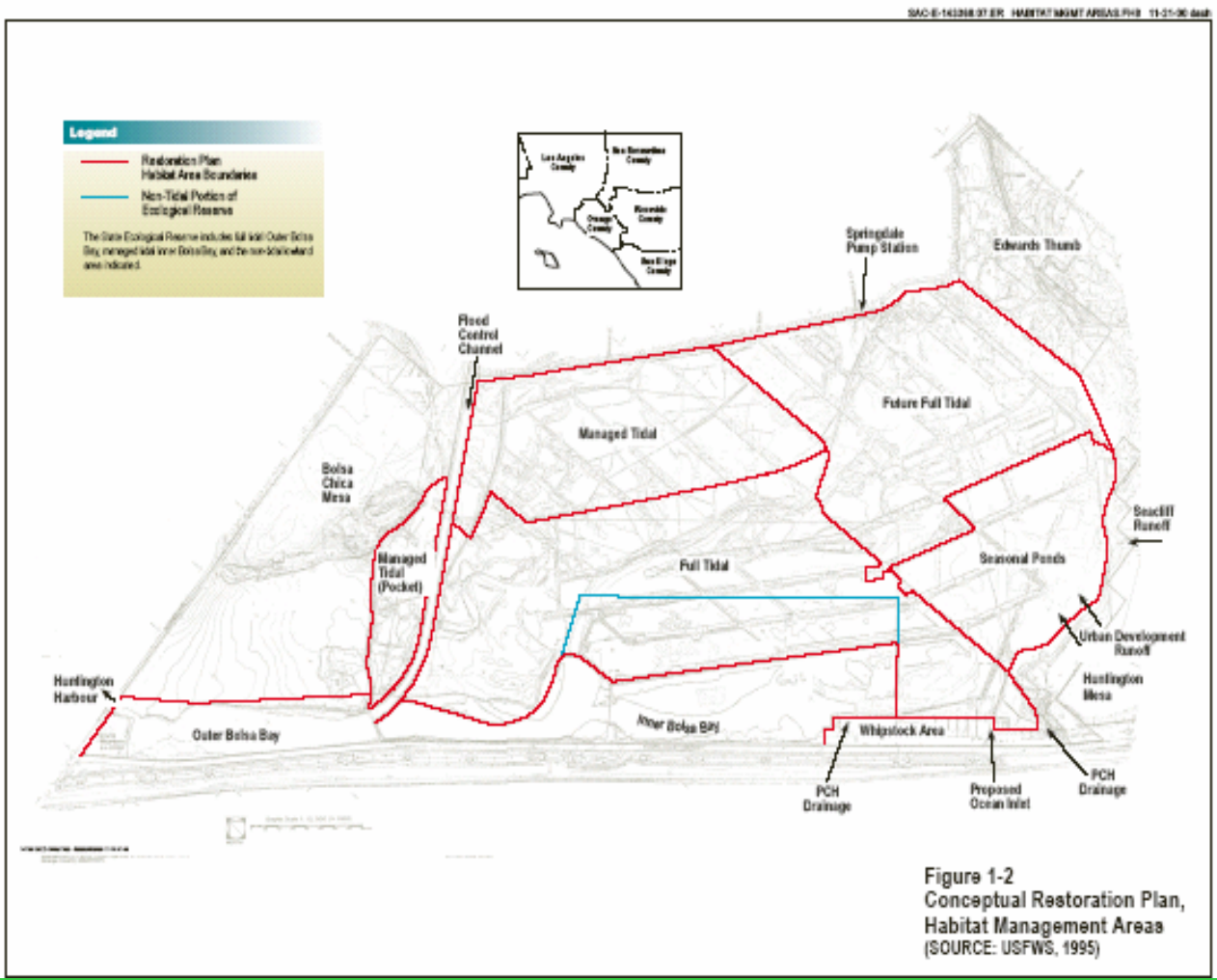


Figure 1-2
Conceptual Restoration Plan,
Habitat Management Areas
(SOURCE: USFWS, 1995)

Expected Contaminant Sources

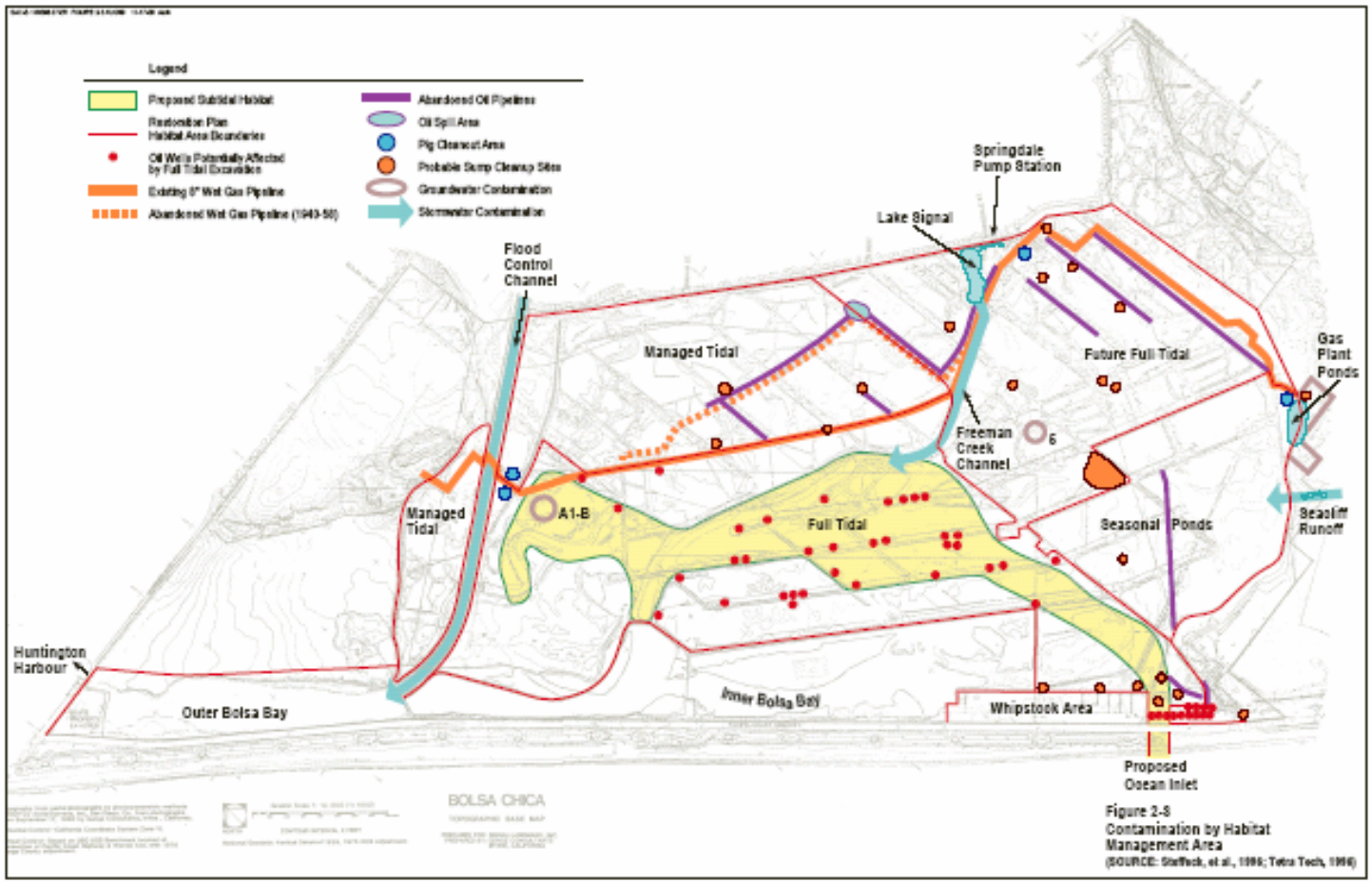
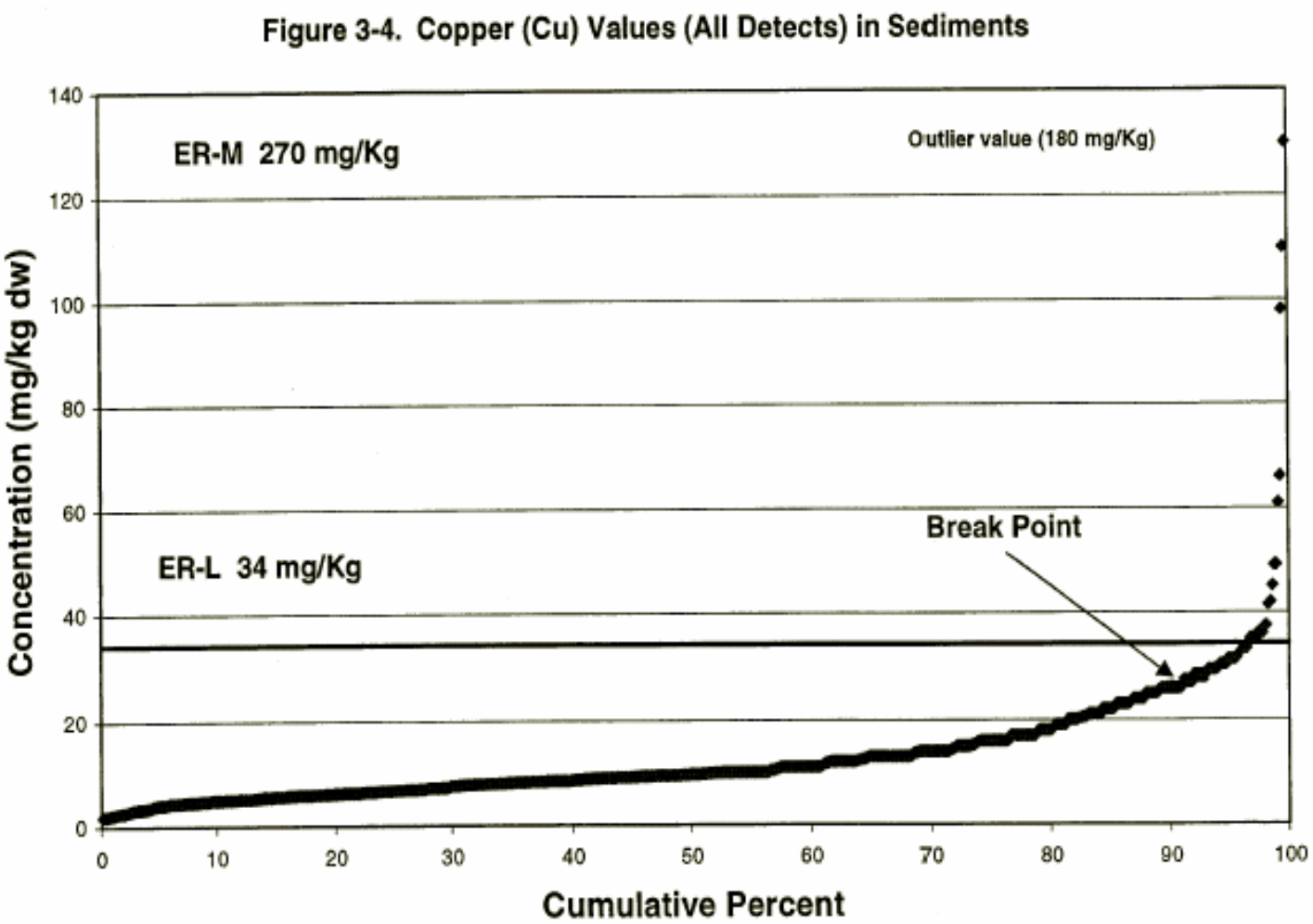


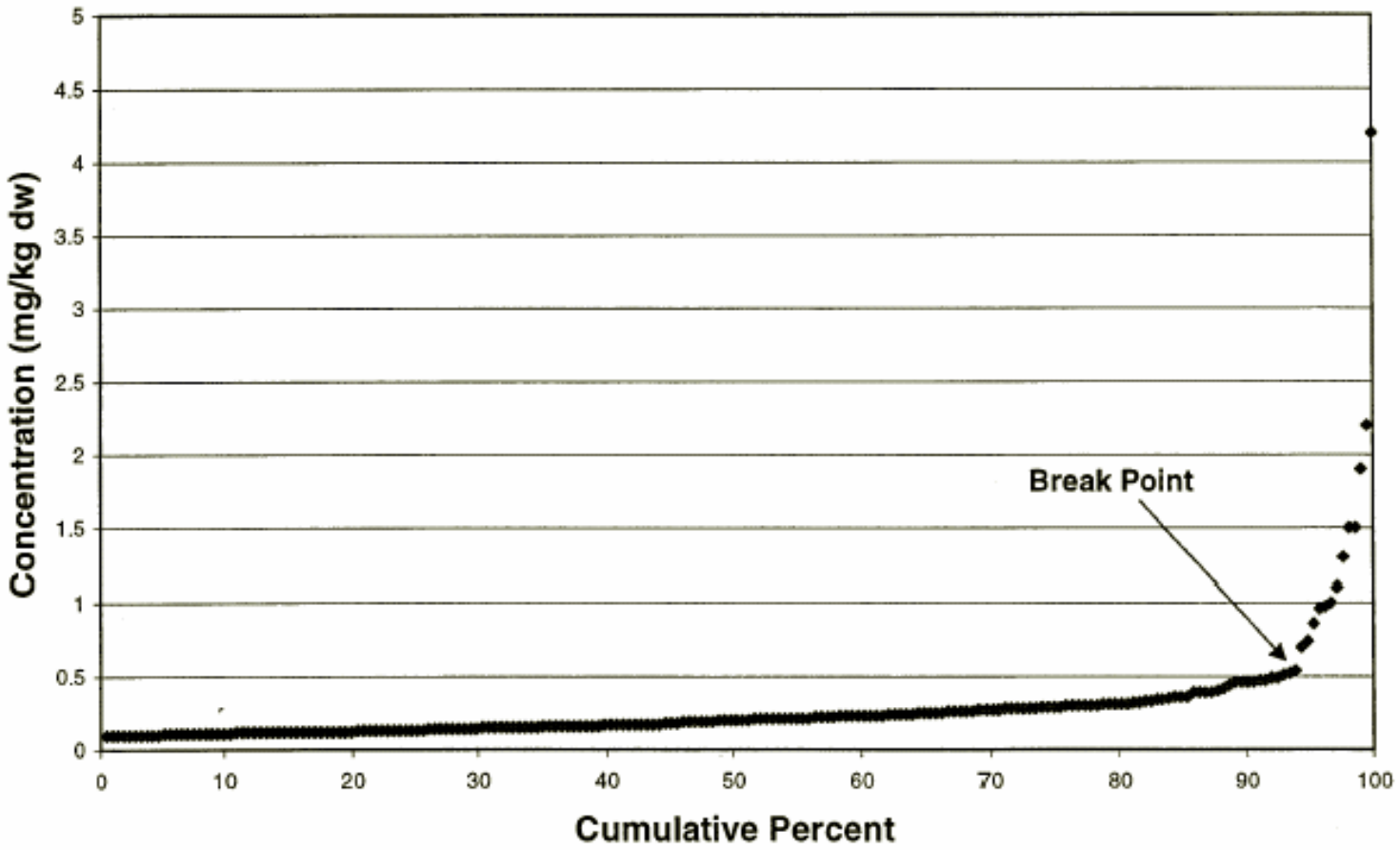
Figure 2-8
Contamination by Habitat Management Area
(SOURCE: Stoffleck, et al., 1996; Tetra Tech, 1996)

Bolsa Chica Background Evaluation Cu

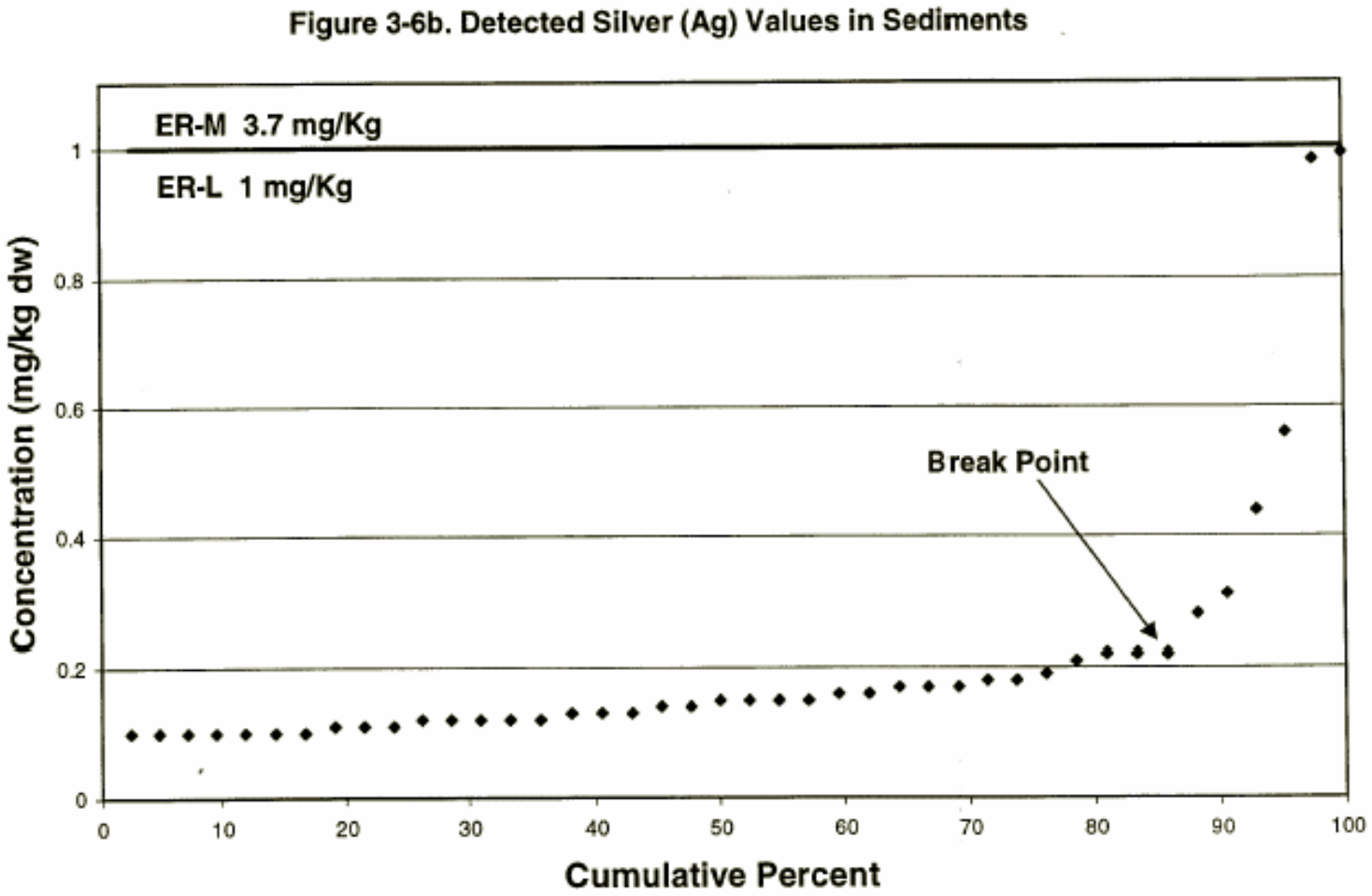


Bolsa Chica Background Evaluation
Se

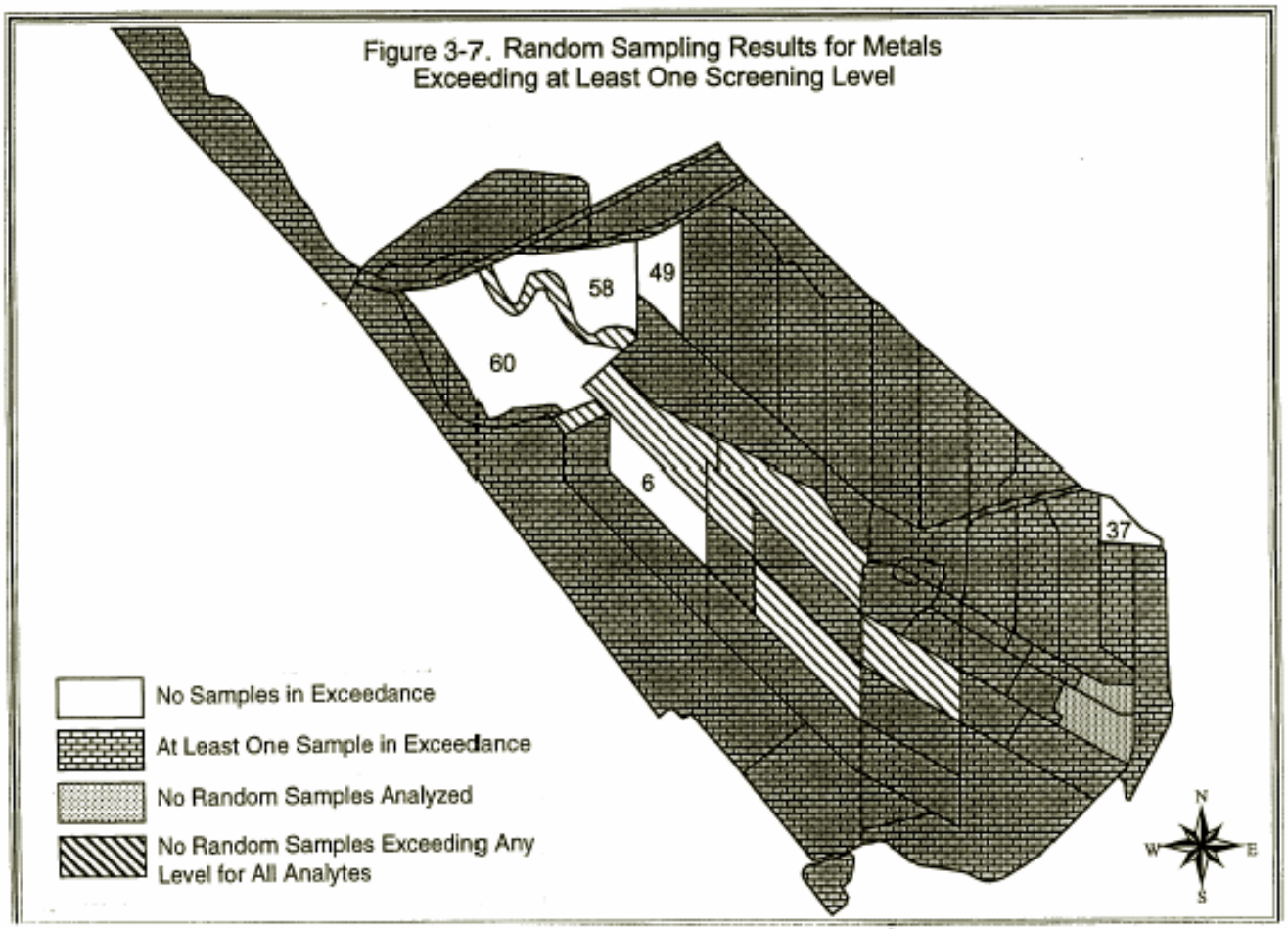
Figure 3-5b. Detected Selenium (Se) Values in Sediments



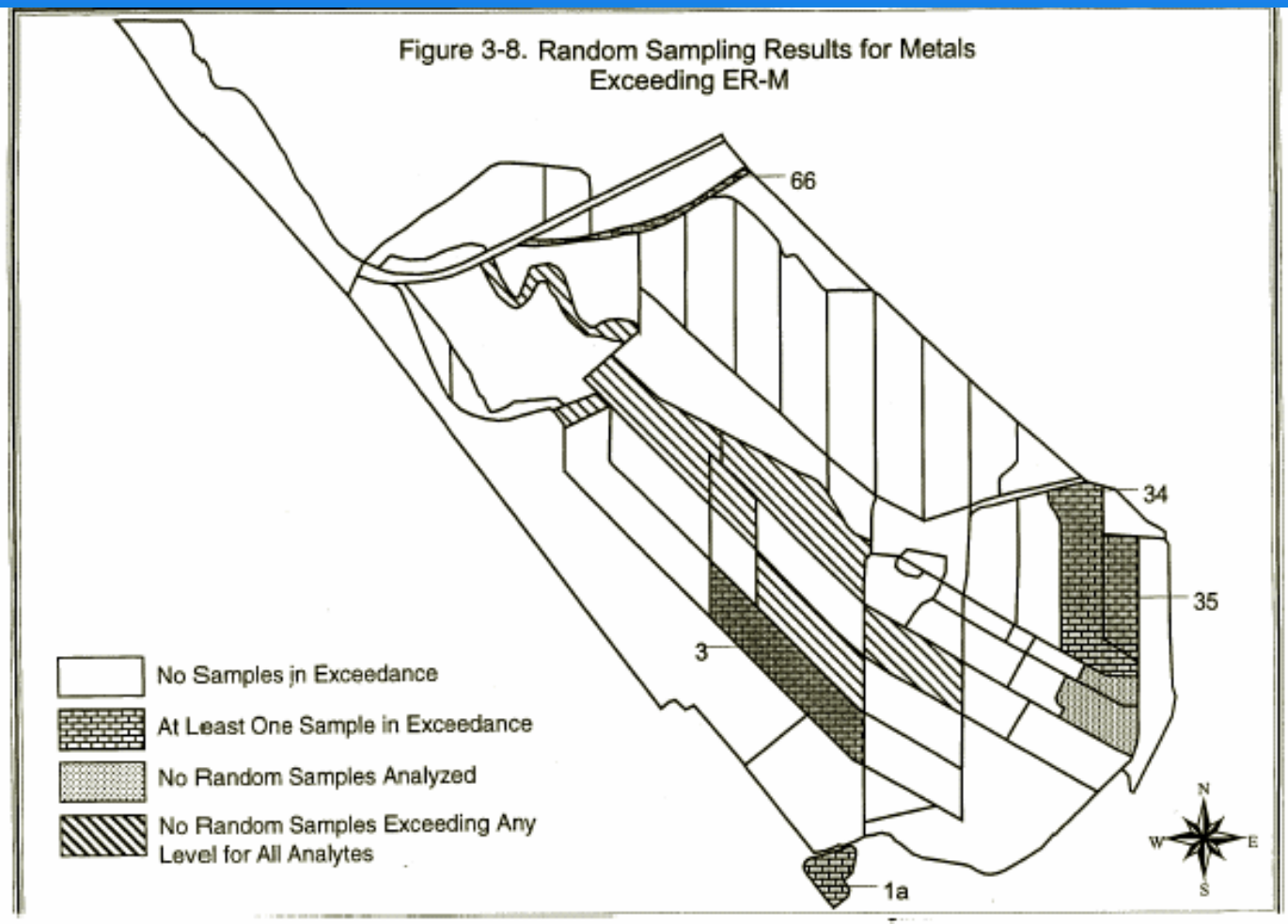
Bolsa Chica Background Evaluation Ag



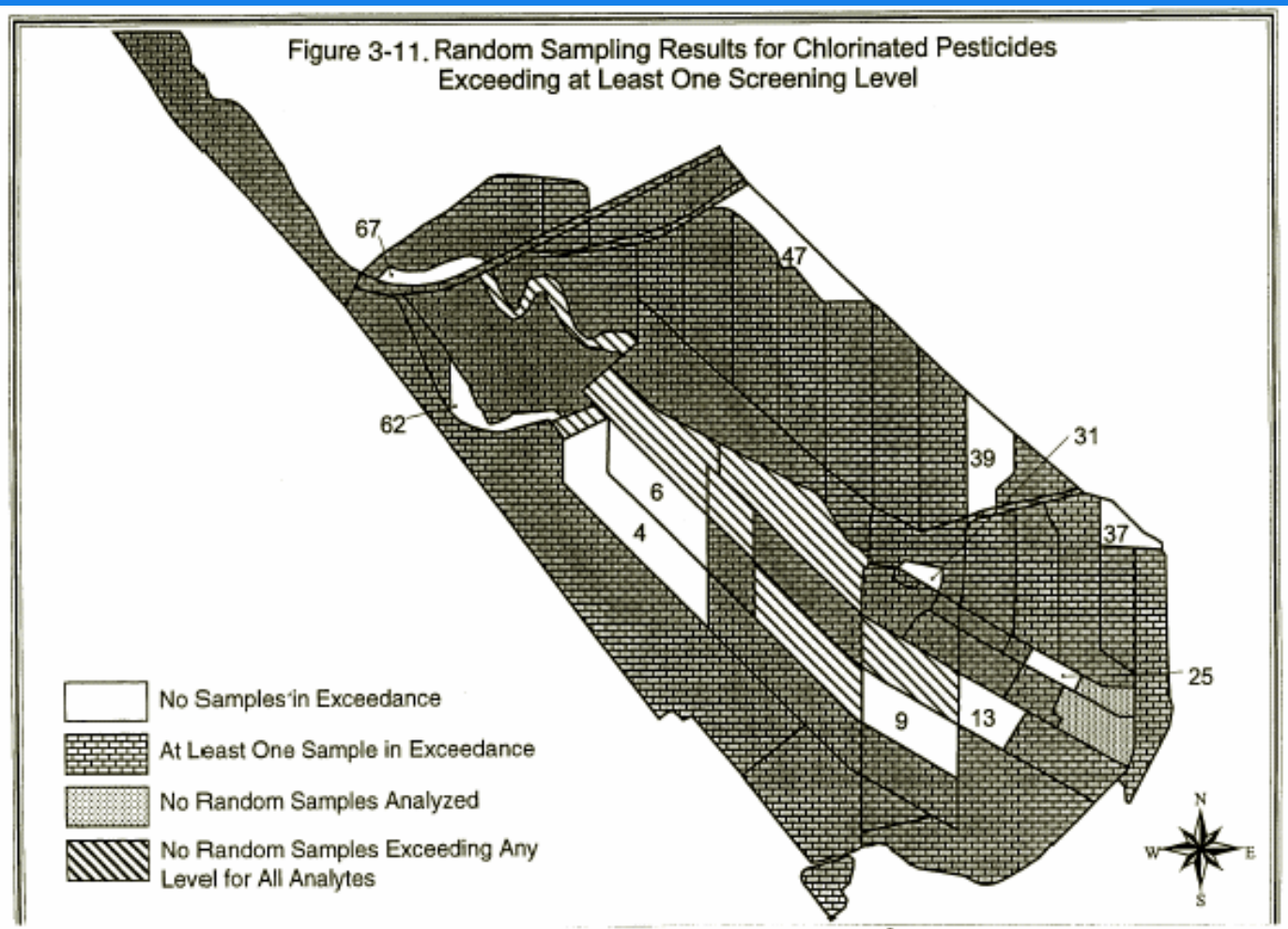
Comparison to Ecotox Benchmarks, All Metals



Comparison to ERMs Metals



Comparison to Benchmarks, Chlorinated Pesticides



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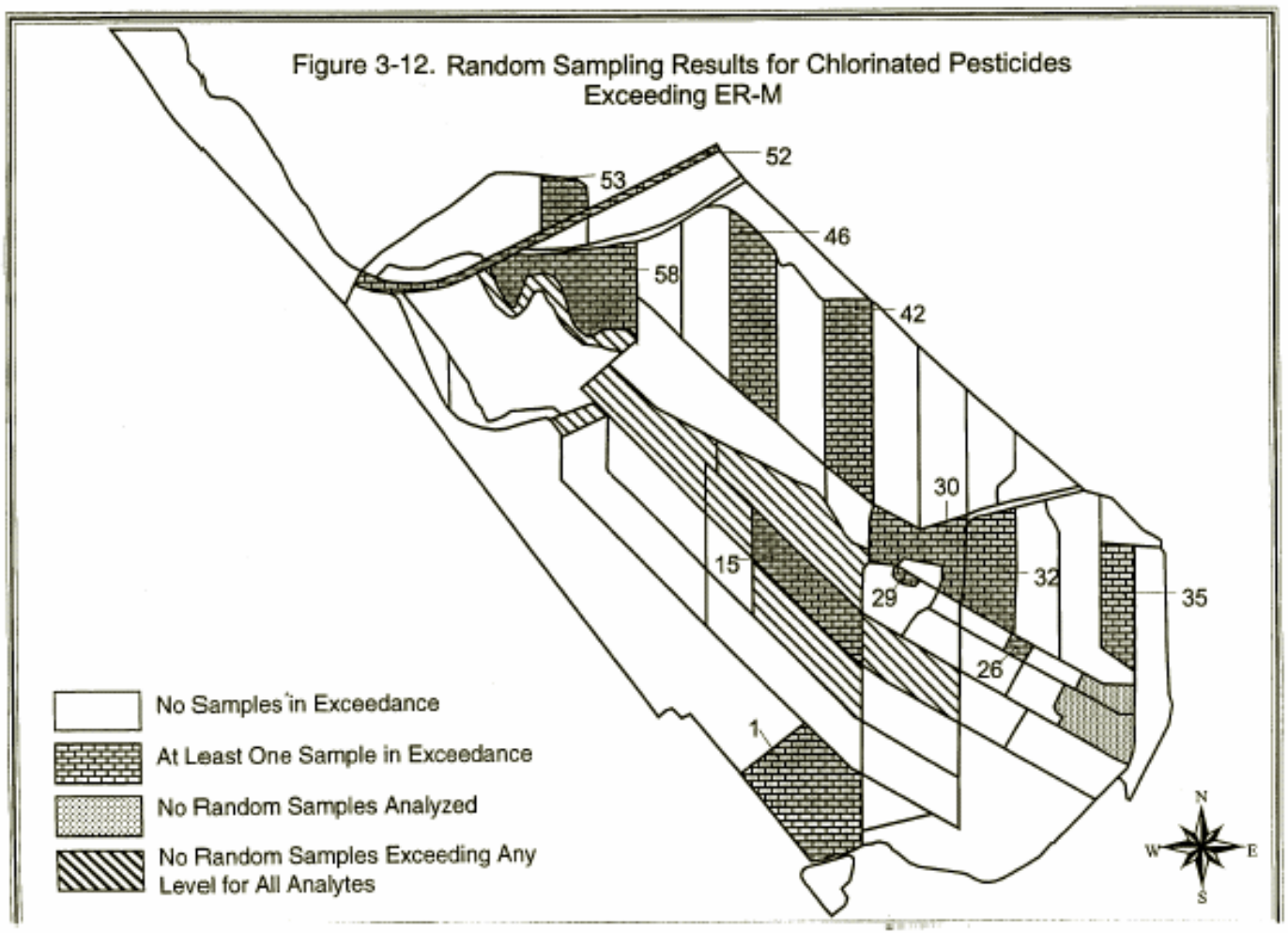
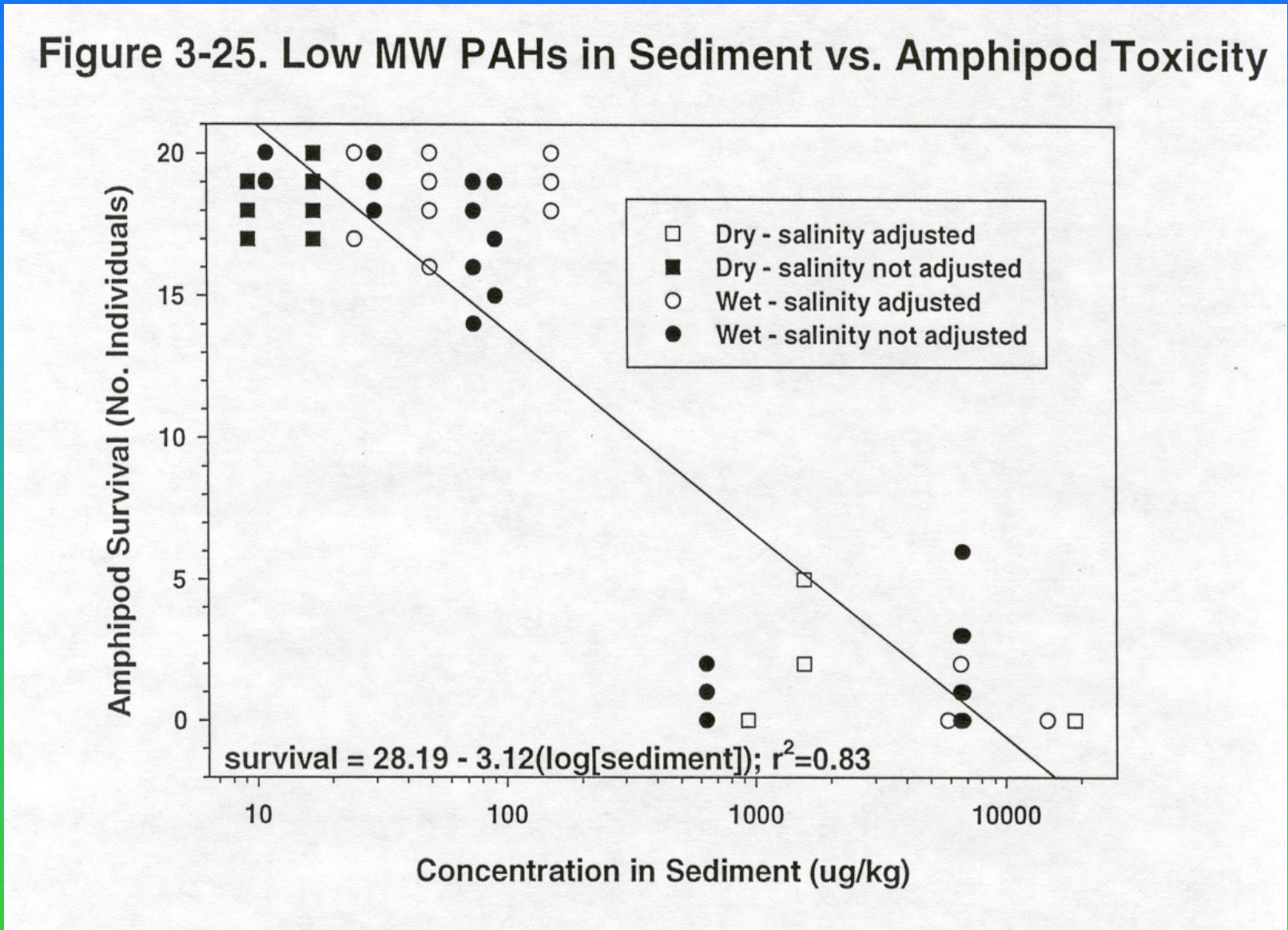


Bolsa ERA

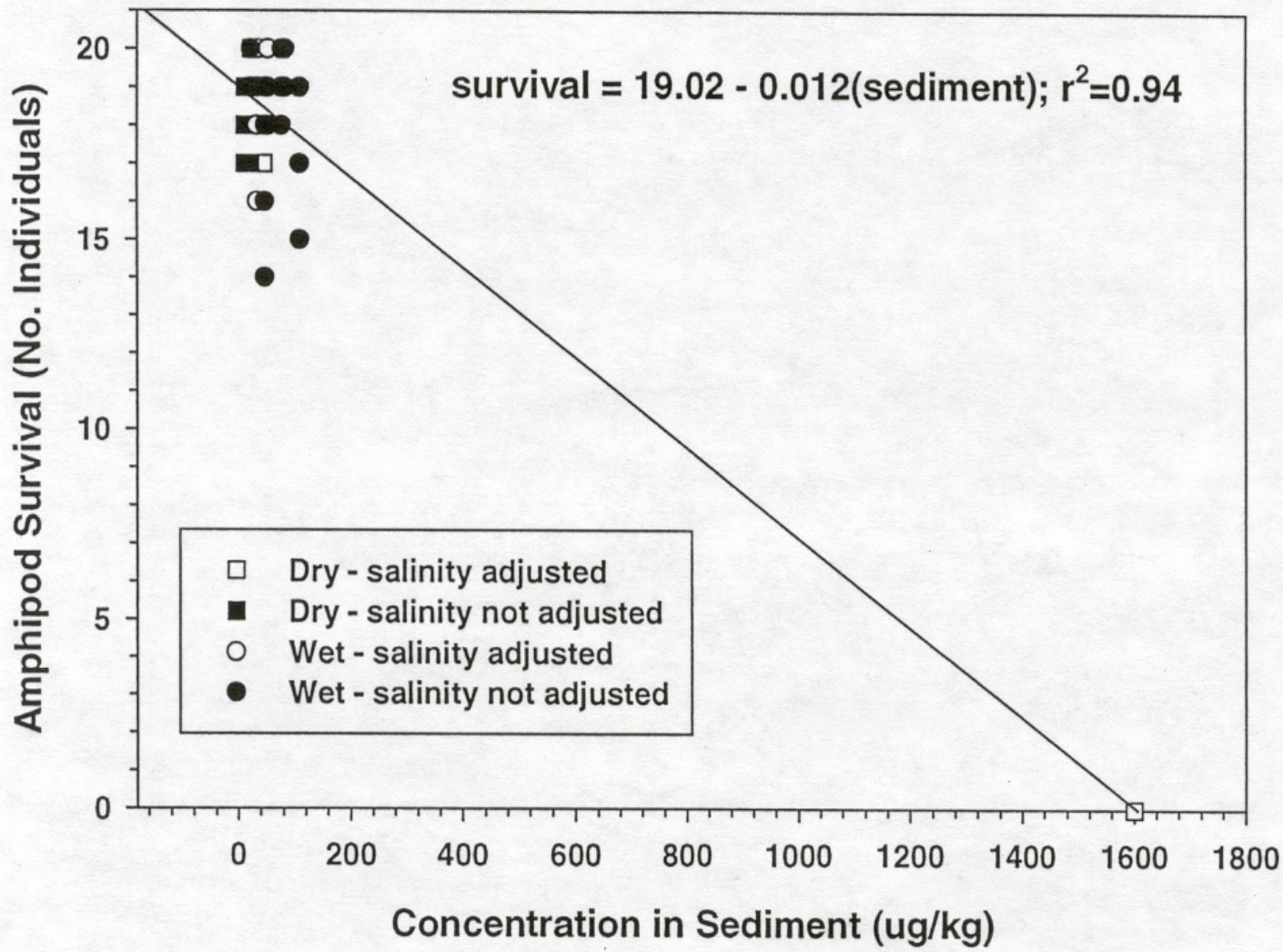
Exposure/Response?



Bolsa ERA

Exposure/Response?

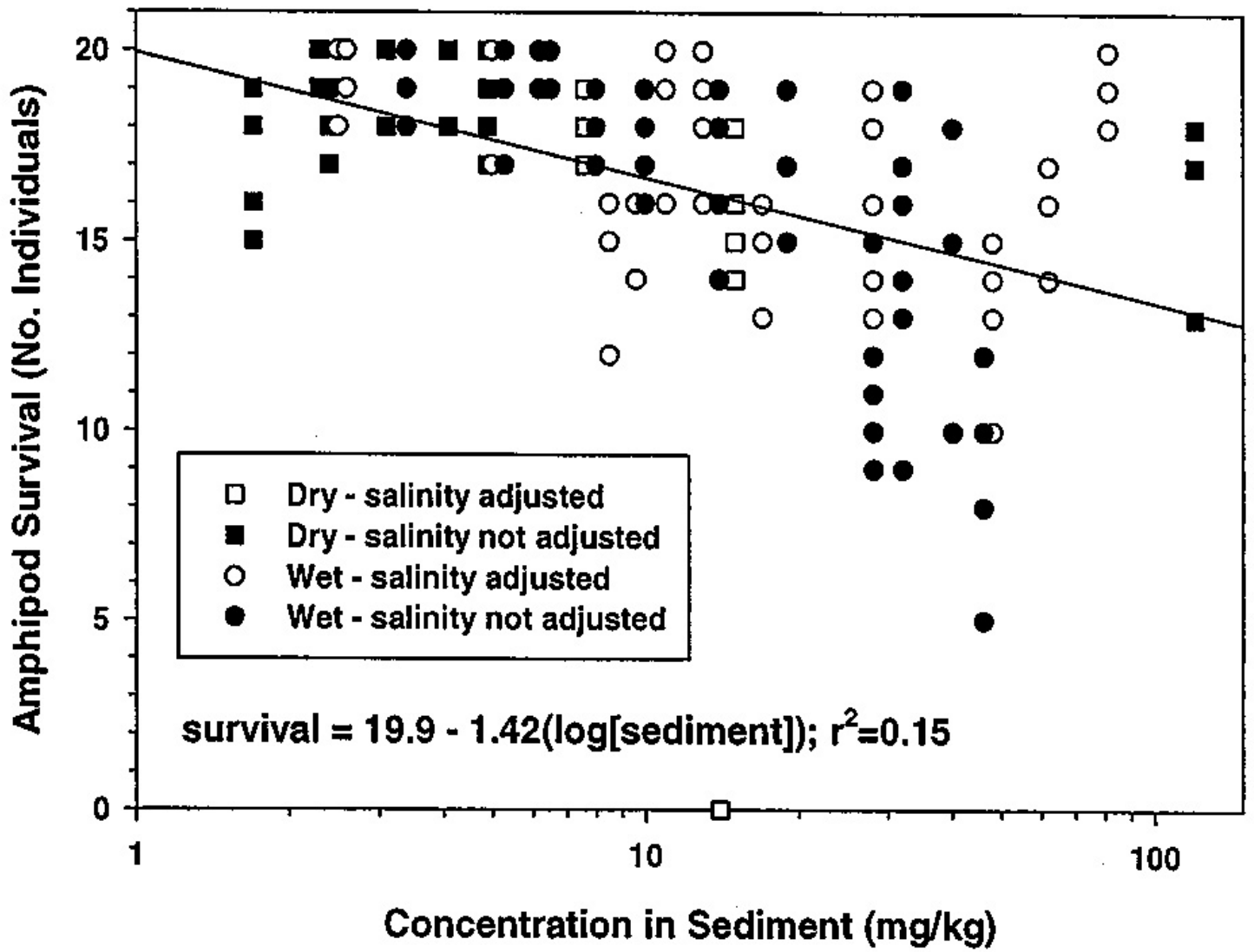
Figure 3-23. Chrysene in Sediment vs. Amphipod Toxicity



Bolsa ERA

Exposure/Response? Confounding factors?

Figure 3-17. Arsenic in Sediment vs. Amphipod Toxicity



ENDPOINTS

Assessment Endpoints	Measurement Endpoints	Data Needs
Habitat Structure and Function	Soil Concentrations	Contaminant Concentration
Food Base for Small Mammals and Birds	Effects on Food Base	
	- Acute	Seed Germination Mortality of Earthworms Mortality of Grass Species
	- Chronic	Growth of Plants Seed Germination
Food Chain Impact	Uptake of Contaminants in Food Items	Uptake in Native Grasses Uptake in Small Mammals Uptake in Earthworms Uptake in Amphibians
Productivity of Small Mammals	Small Mammal Reproduction Effects	Testes Weight Sperm malformation