

#### Risk Categories

**Unknown** – Because RTVs are not available, risk cannot be evaluated.

**None** Exposures do not exceed any available effects levels.

**Uncertain** – Exposures exceed the no-effect level, but risk cannot be quantified because a low-effect level is not available ("U" is used in summary tables).

**Some Possible** – Exposures exceed no-effect levels but not chronic low-effect level Risk ("C" used in summary tables).

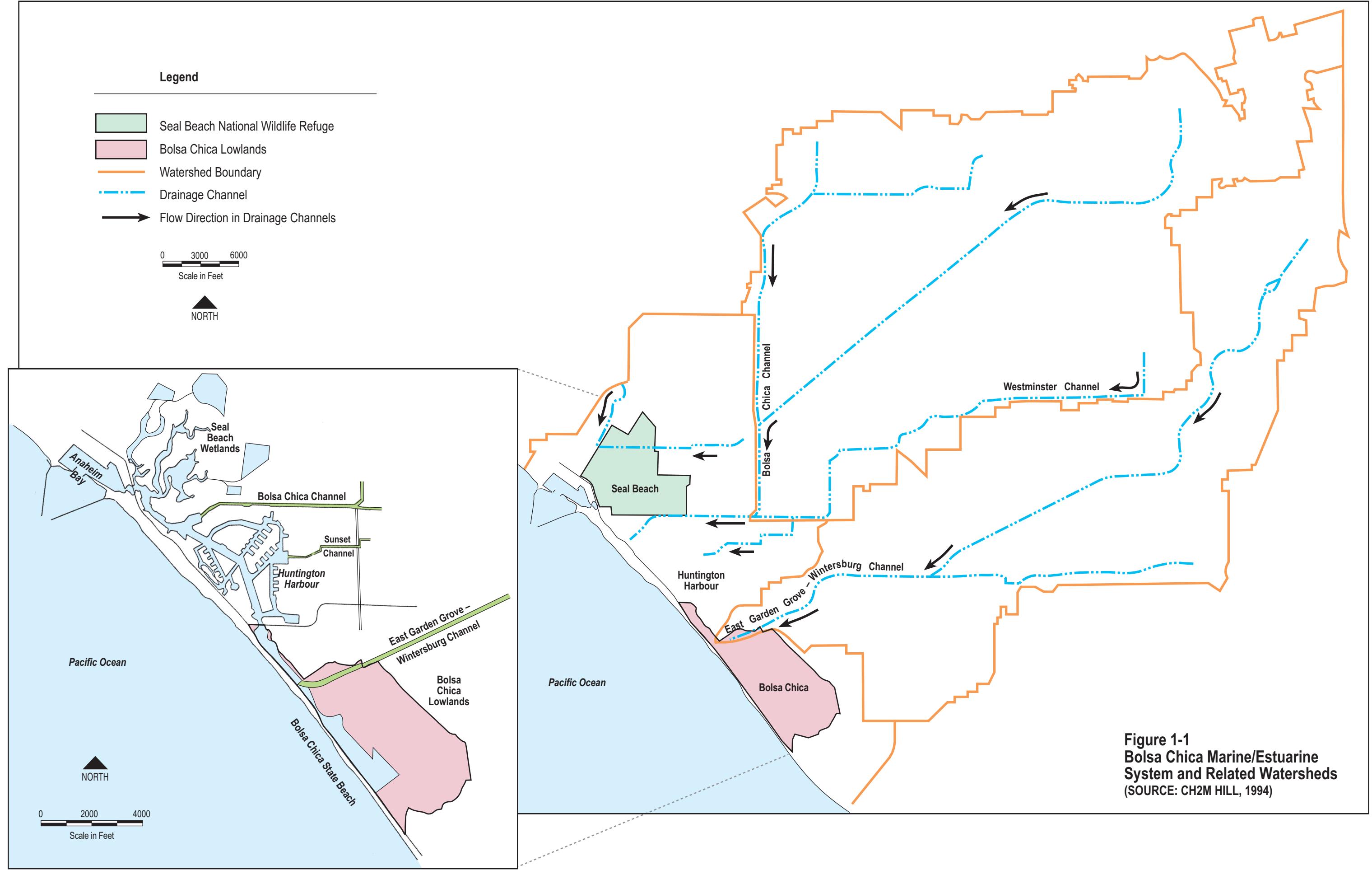
**Possible** – Exposures exceed chronic effects level but not acute effects level Risk ("B" used in summary tables).

**Probable** – Exposures represent the highest-level risk that could be quantified ("A" is used in summary tables).

#### Key

- COEC – Chemical of Ecological Concern
- COPEC – Chemical of Potential Ecological Concern
- RTV – Reference Toxicity Value
- HQ – Hazard Quotient
- NOEC – No observed effect concentration
- NOAEL – No observed adverse effect level
- ER-L – Effects range-low
- ER-M – Effects range-median
- LOEC – Lowest observed effect concentration
- LOAEL – Lowest observed adverse effect level

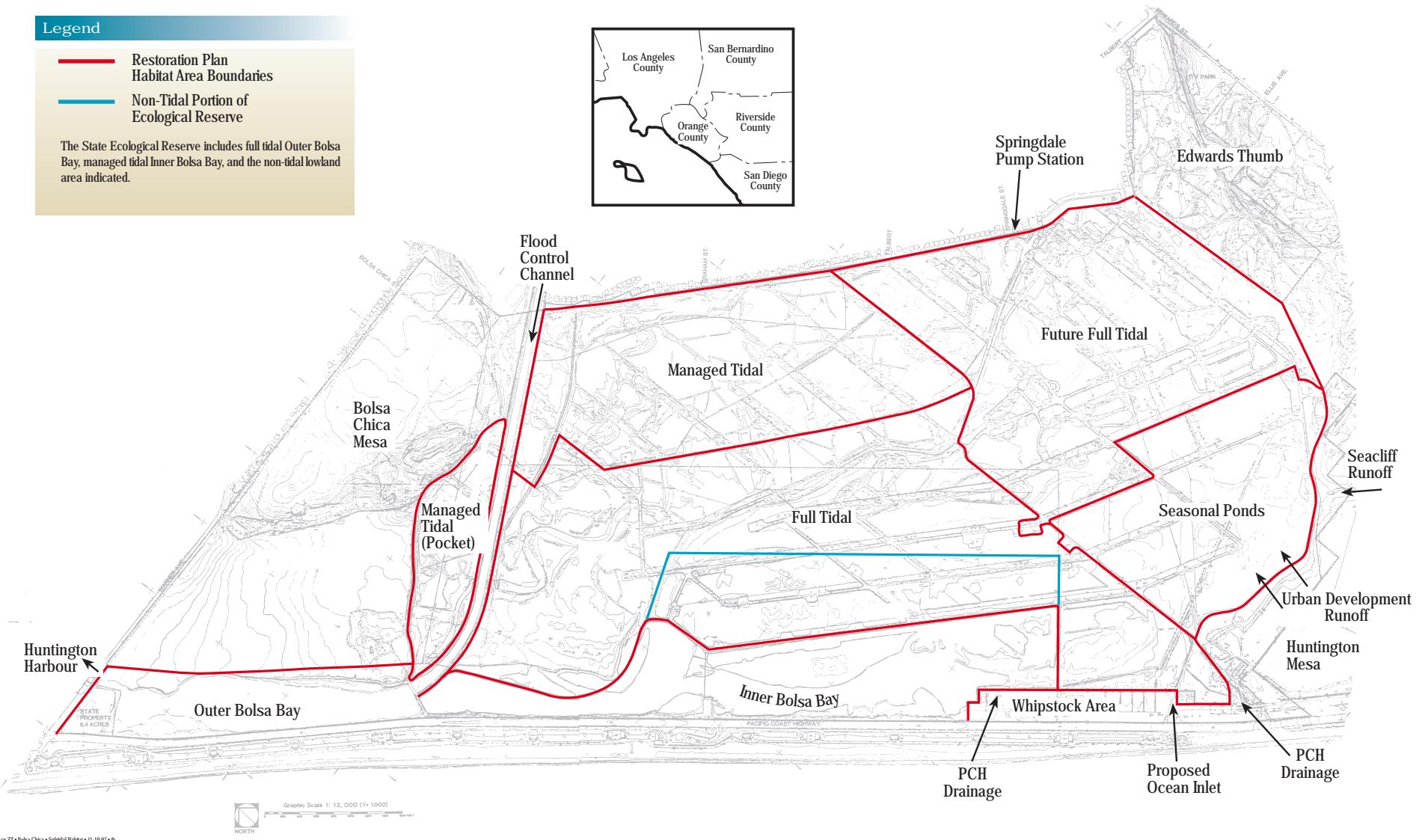
Figure ES-1  
Selection of Chemicals of Ecological Concern



**Legend**

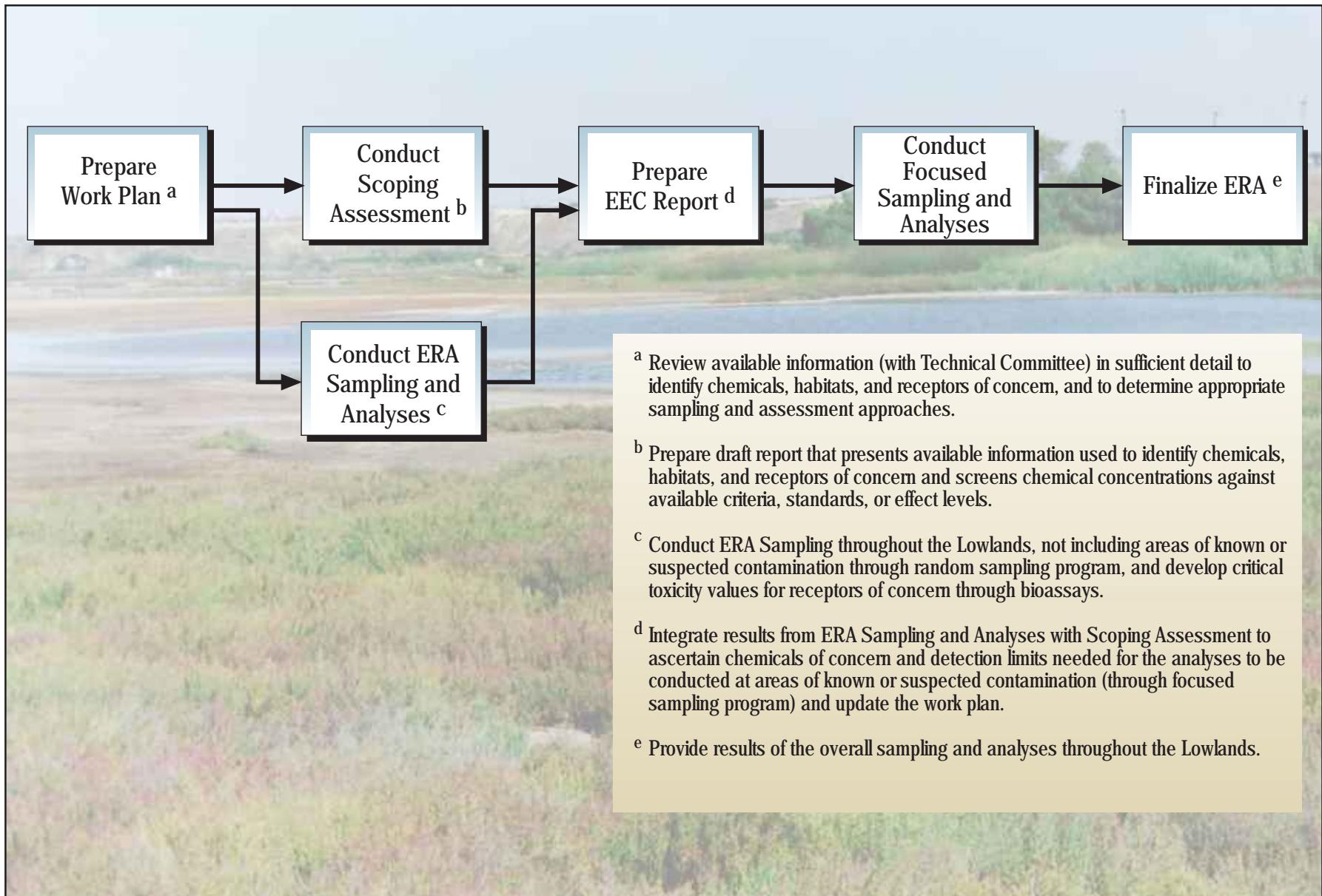
- Restoration Plan  
Habitat Area Boundaries
- Non-Tidal Portion of  
Ecological Reserve

The State Ecological Reserve includes full tidal Outer Bolsa Bay, managed tidal Inner Bolsa Bay, and the non-tidal lowland area indicated.



14485.c.ZZ • Bolsa Chica • Subtidal Habitat • 11-10-97 • b  
Intersection of Pacific Coast Highway & Warner Ave. WMA 1910  
Orange County adjustment.

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



**Figure 1-3**  
Phased Approach to Ecological Risk Assessment for Bolsa Chica Lowlands

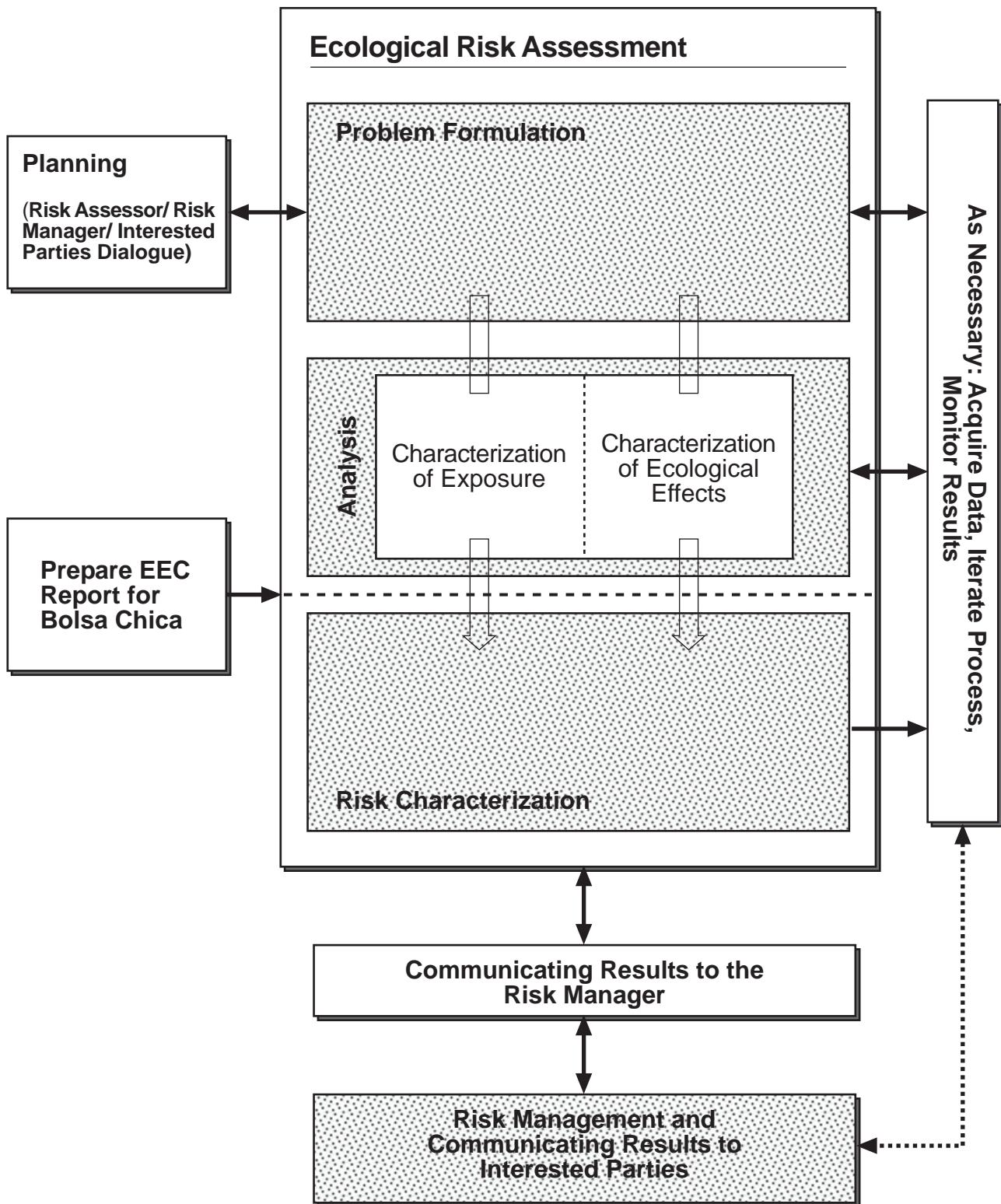
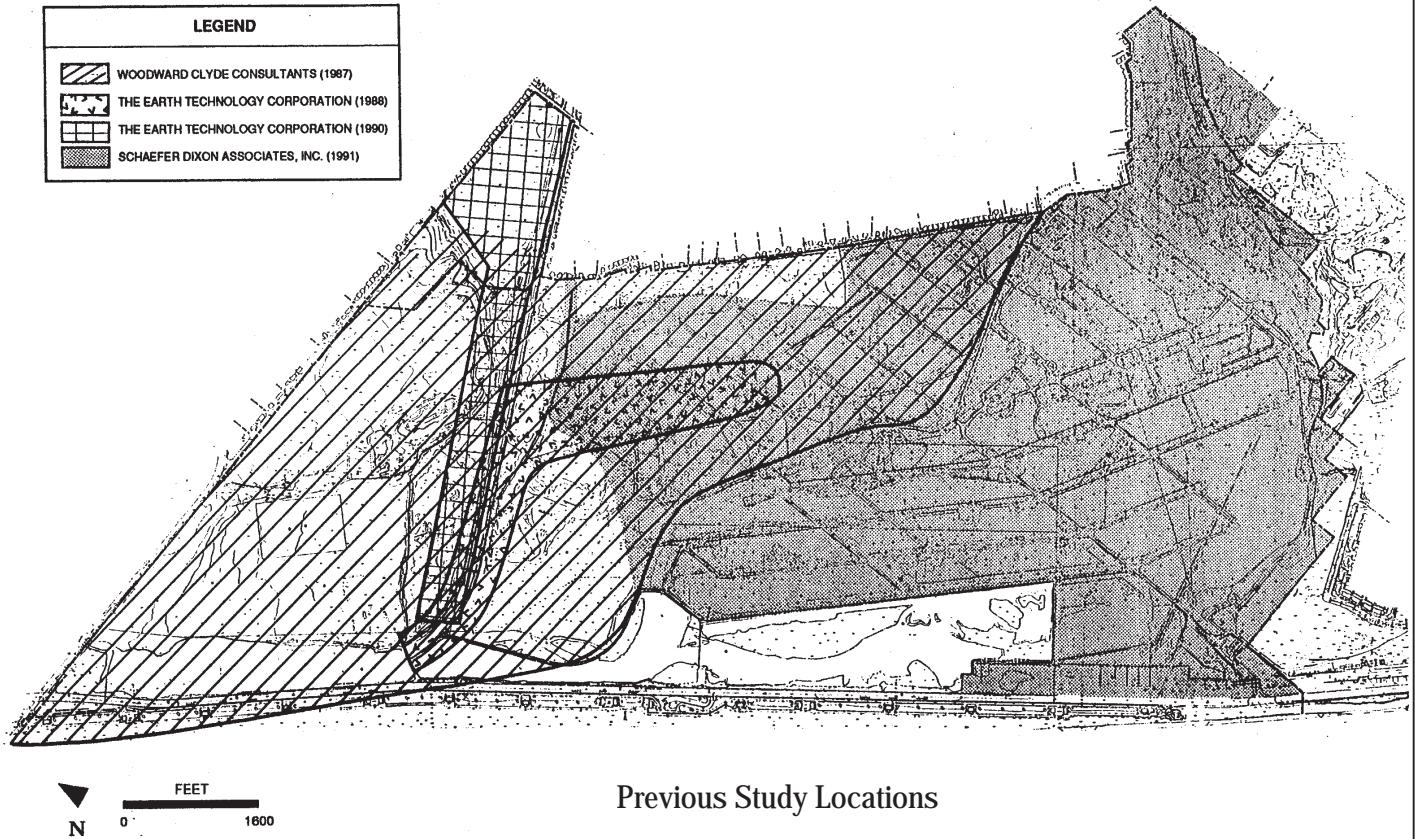
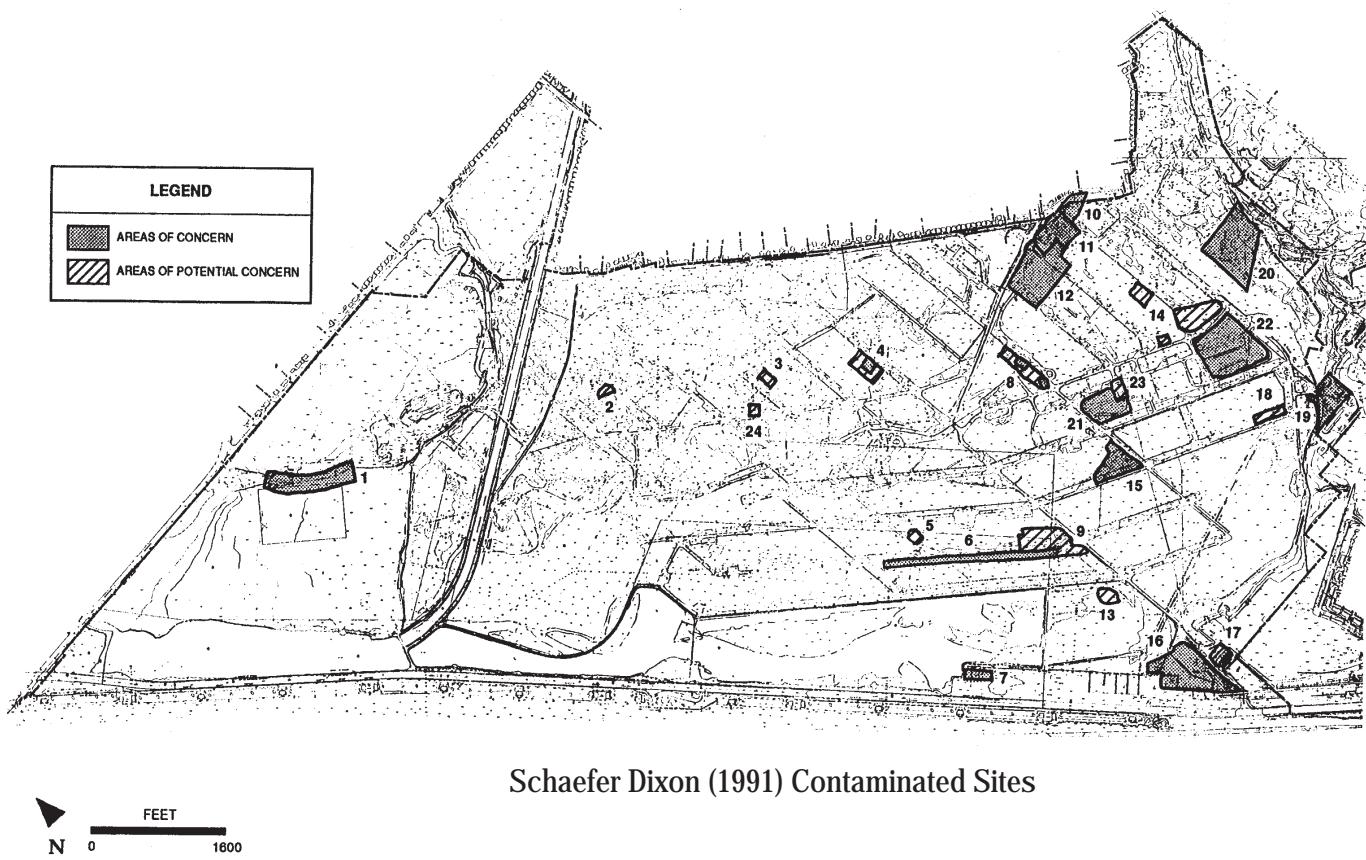


Figure 1-4. Framework for Ecological Risk Assessment (modified from U.S. EPA, 1998).

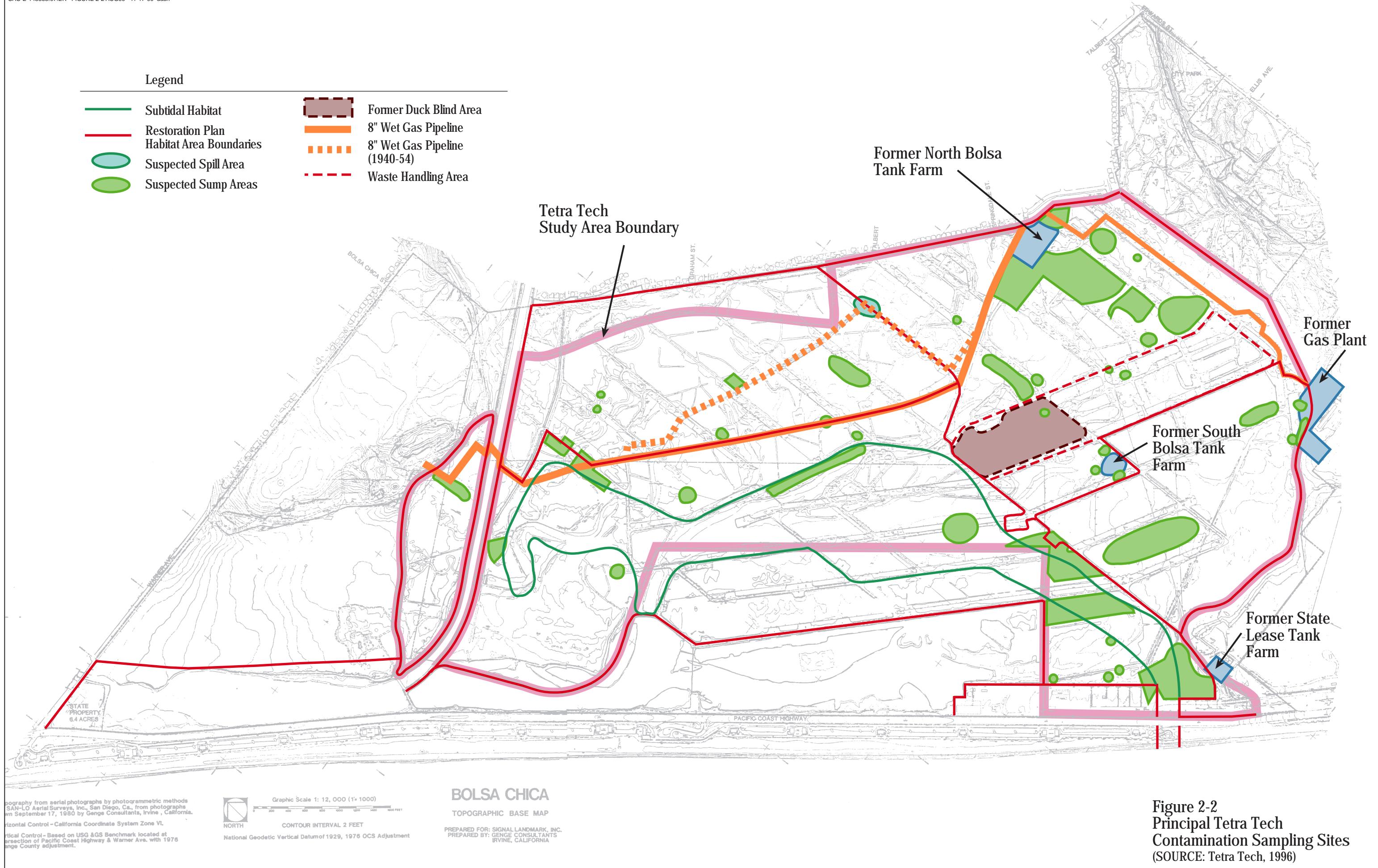


Source: Base map: Williamson and Schmid, 1992



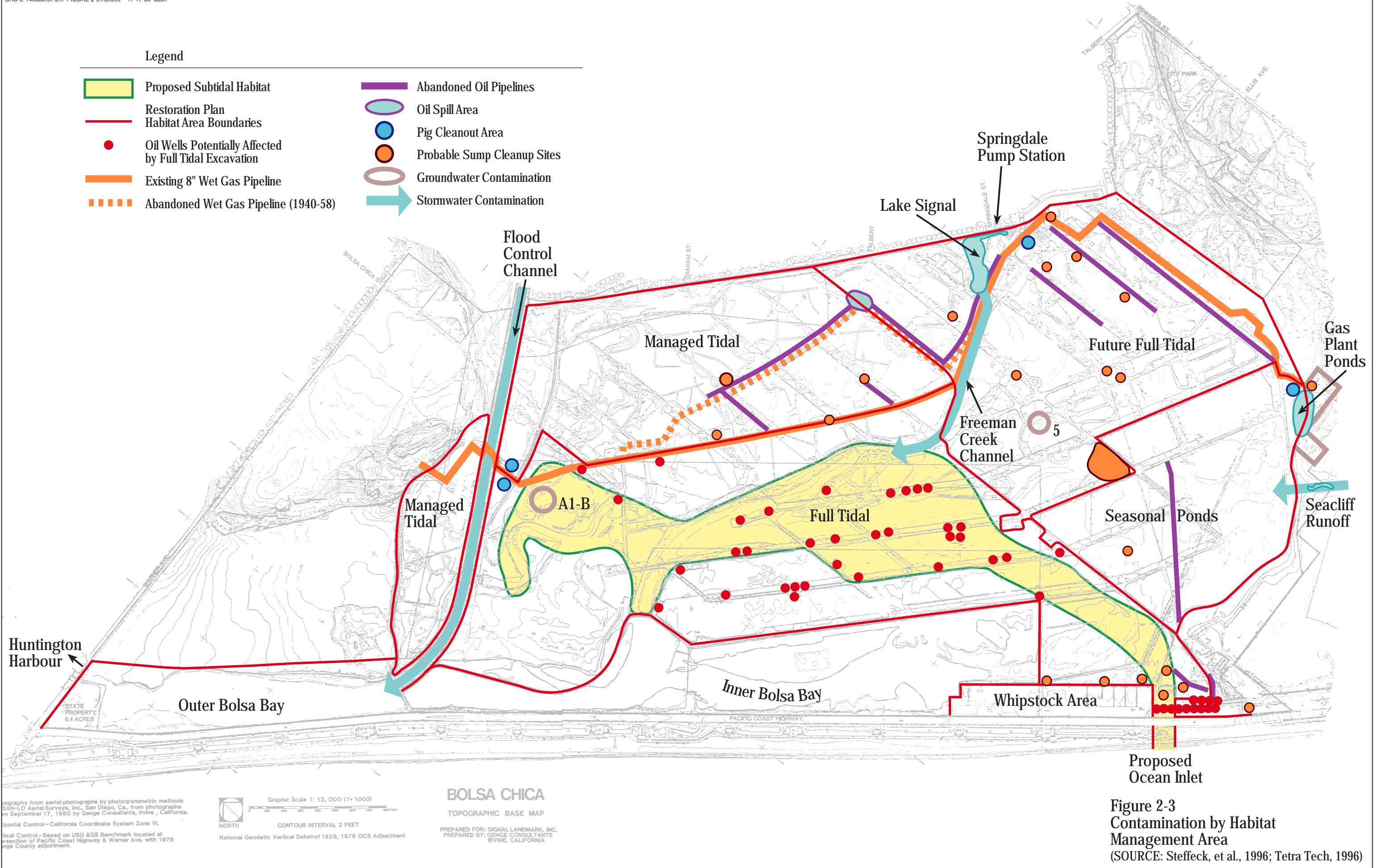
Source: Schaefer Dixon Associates, Inc. 1991

Figure 2-1  
Previous Contamination Studies



## Legend

- Proposed Subtidal Habitat
- Restoration Plan Habitat Area Boundaries
- Oil Wells Potentially Affected by Full Tidal Excavation
- Existing 8" Wet Gas Pipeline
- Abandoned Wet Gas Pipeline (1940-58)
- Abandoned Oil Pipelines
- Oil Spill Area
- Pig Cleanout Area
- Probable Sump Cleanup Sites
- Groundwater Contamination
- Stormwater Contamination



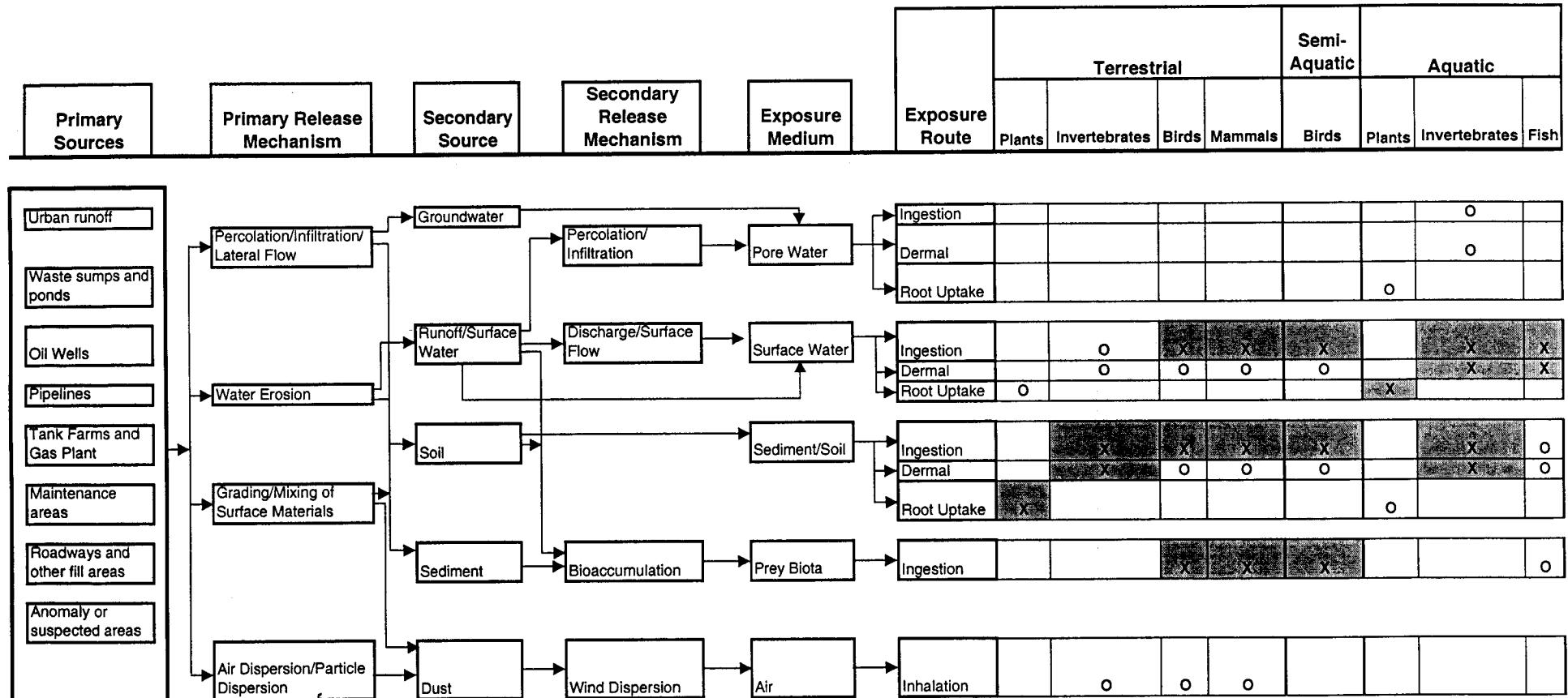
**Figure 2-3**  
Contamination by Habitat  
Management Area  
(SOURCE: Steffeck, et al., 1996; Tetra Tech, 1996)

Figure 2-4

Bolsa Chica Lowland and Pocket Area Habitat Map



**Figure 2-5 Ecological Conceptual Site Model for the Bolsa Chica Lowlands**



**Notes:**



Potentially complete exposure pathway; considered major and retained for evaluation in the ERA.

Potentially complete exposure pathway, but considered minor and not retained for evaluation in the ERA.

Figure 3-1  
Ecological Risk Assessment Sampling Locations



CH2MHILL




Figure 3-2

## Focused Sampling Locations






Figure 3-3

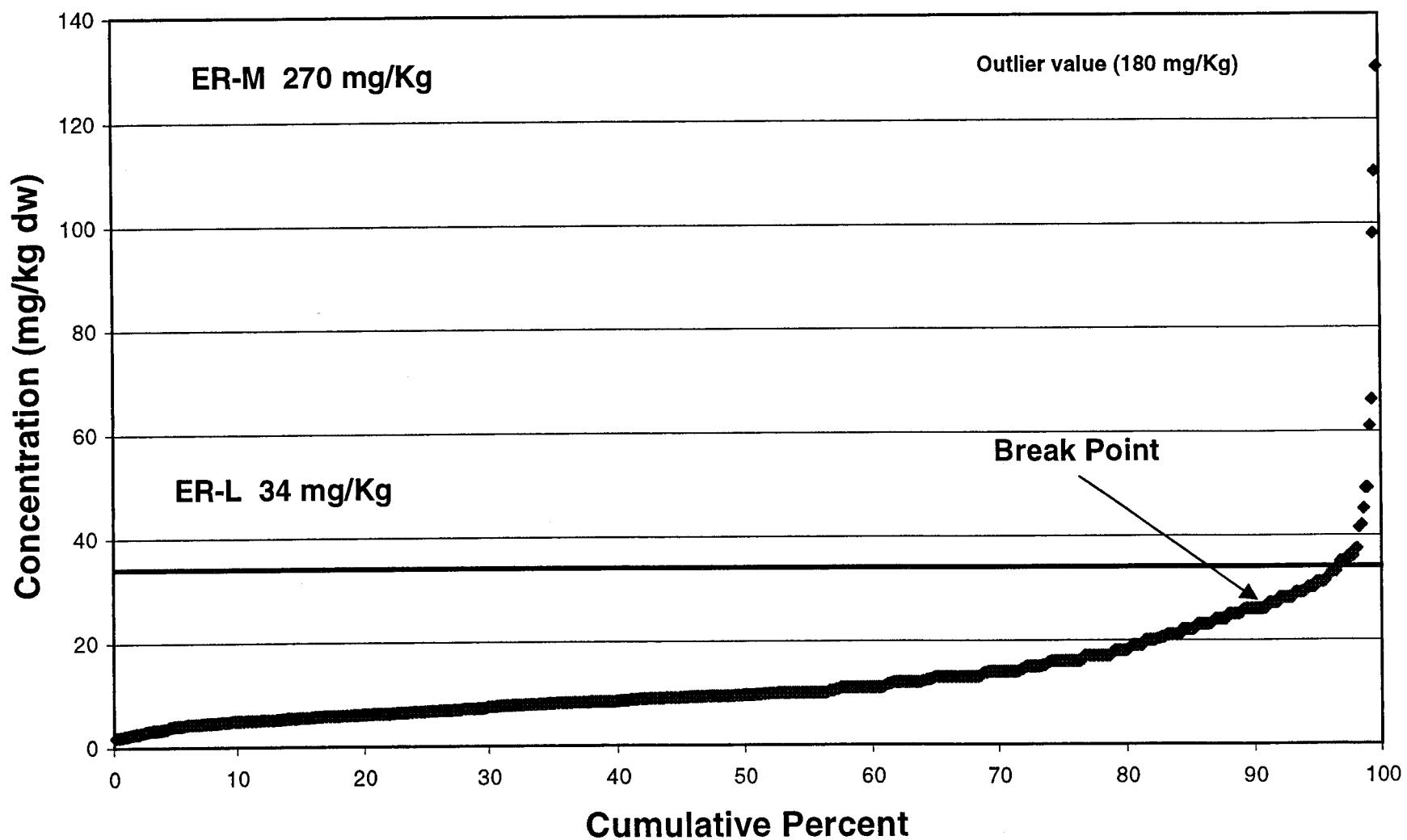
## Tetra Tech Sampling Locations



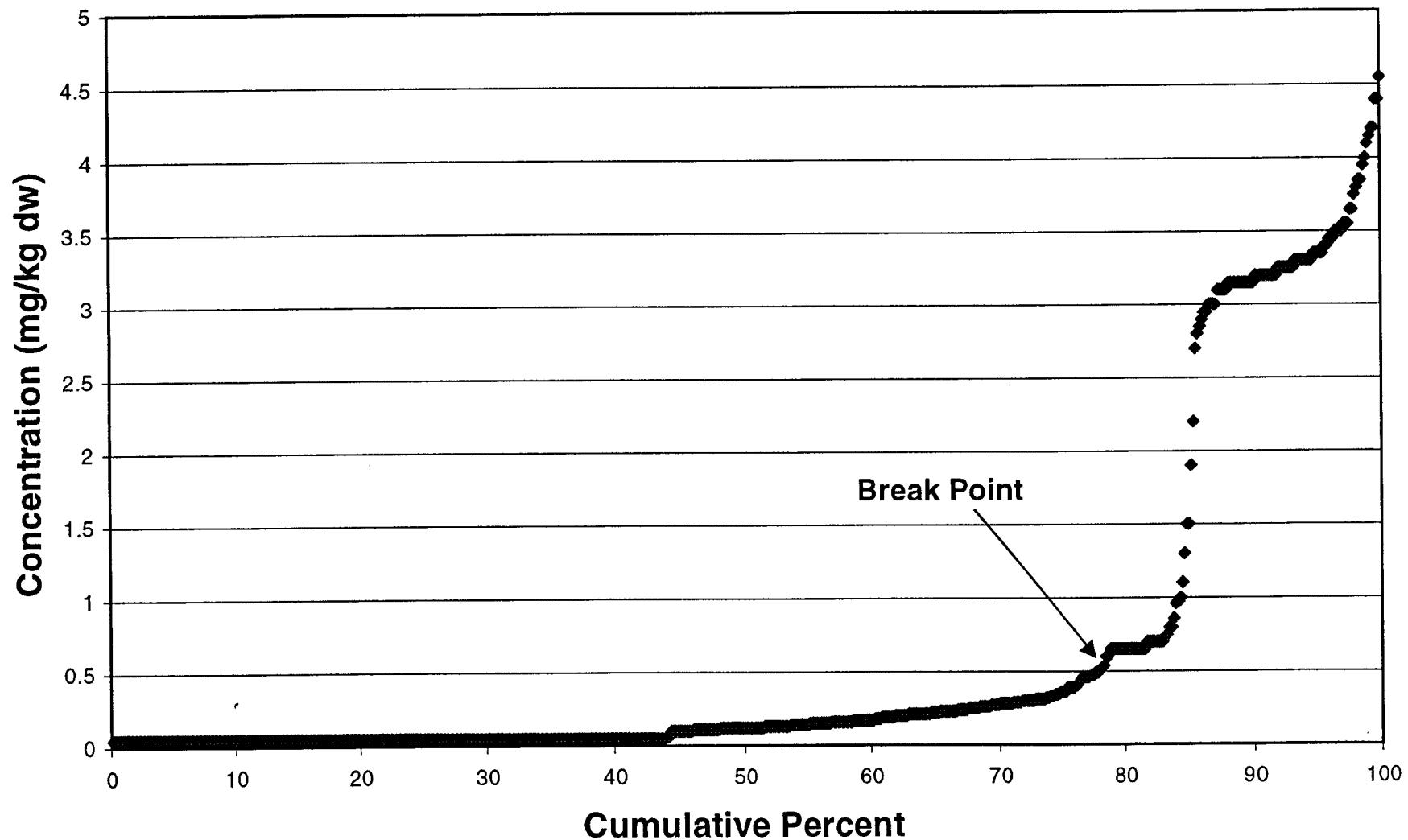
**CH2MHILL**



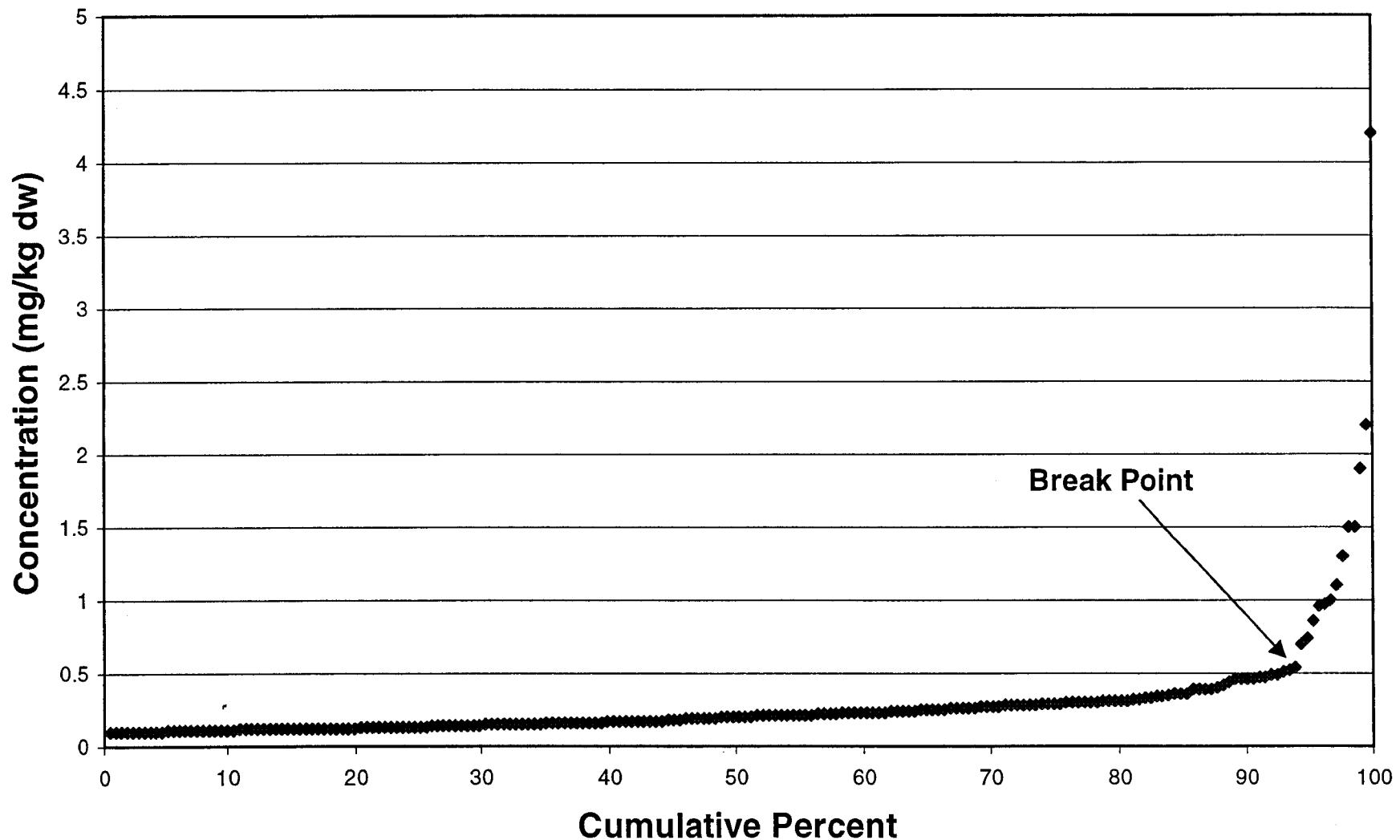
**Figure 3-4. Copper (Cu) Values (All Detects) in Sediments**



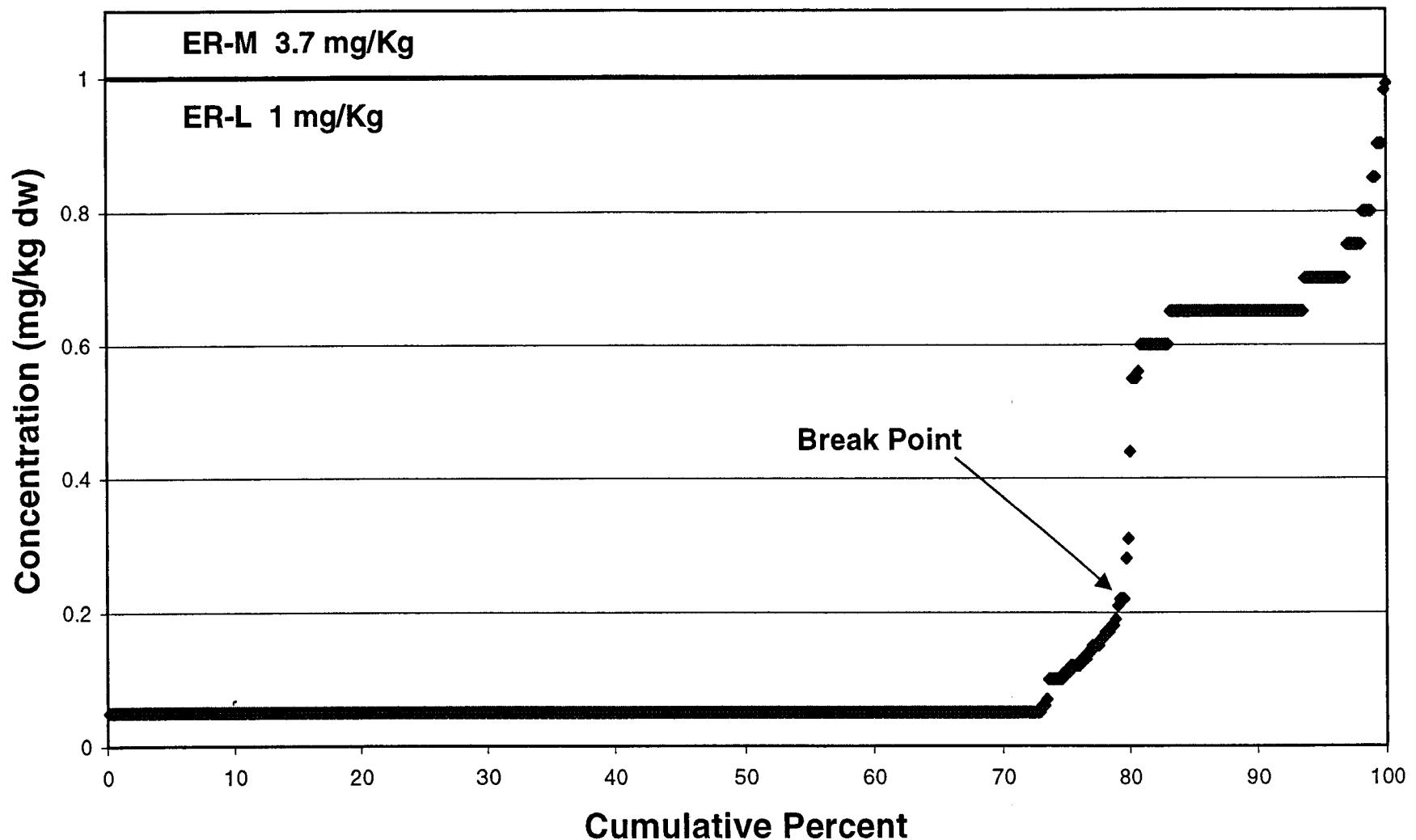
**Figure 3-5a. Selenium (Se) Values (Including Non-detects) in Sediments**



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



**Figure 3-6a. Silver (Ag) Values (Including Non-detects) in Sediments**



**Figure 3-6b. Detected Silver (Ag) Values in Sediments**

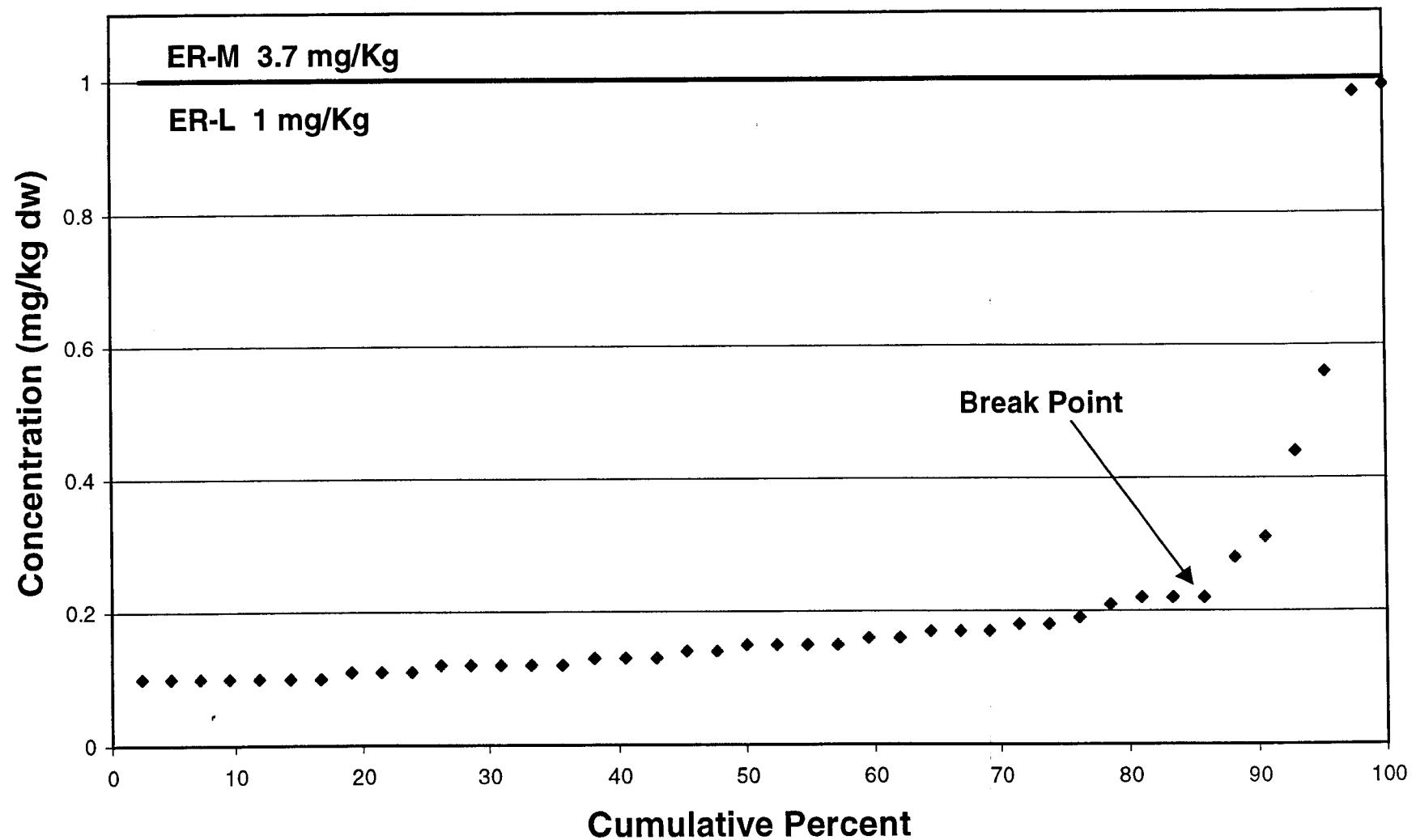


Figure 3-7. Random Sampling Results for Metals  
Exceeding at Least One Screening Level

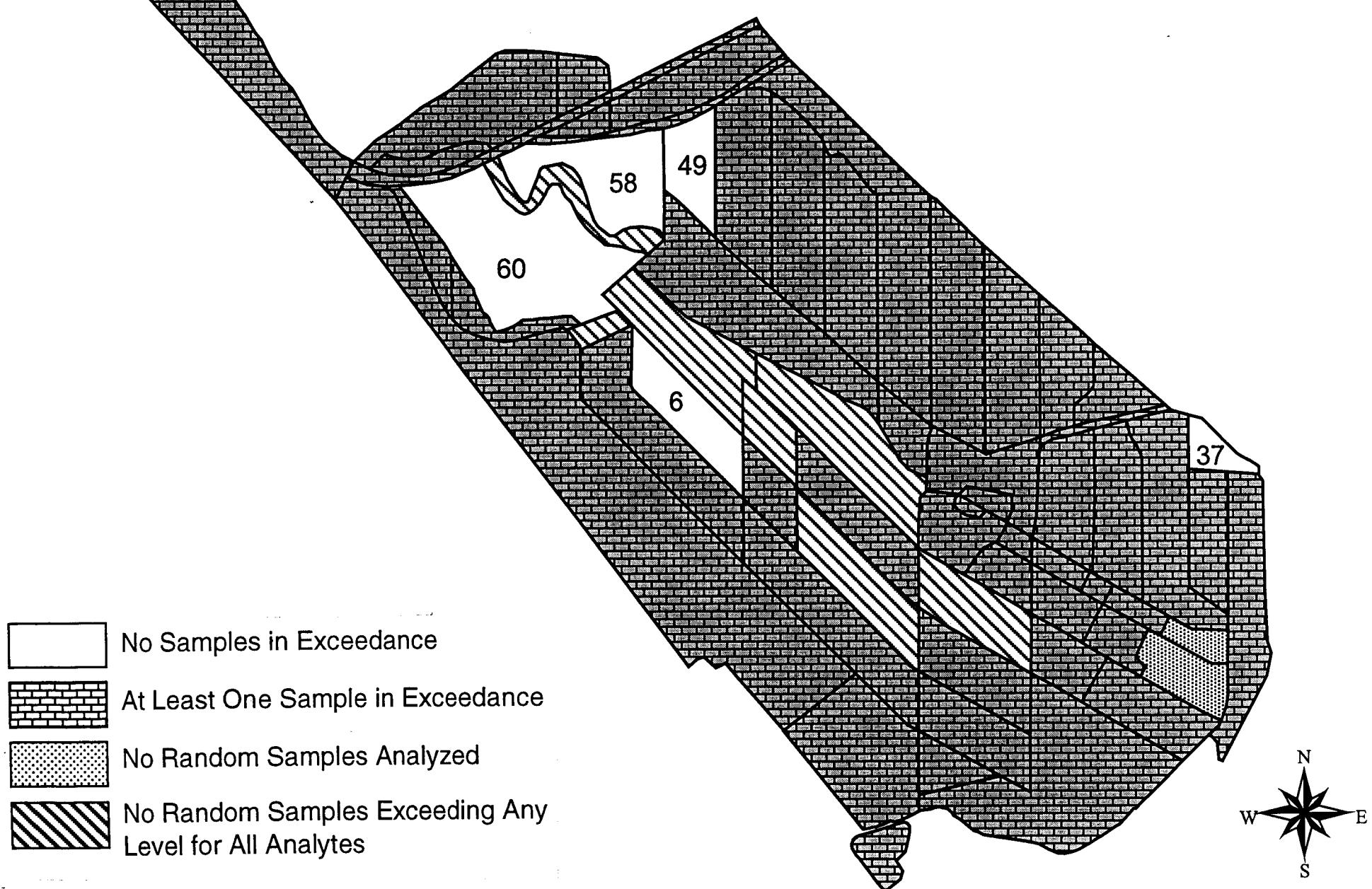


Figure 3-8. Random Sampling Results for Metals  
Exceeding ER-M

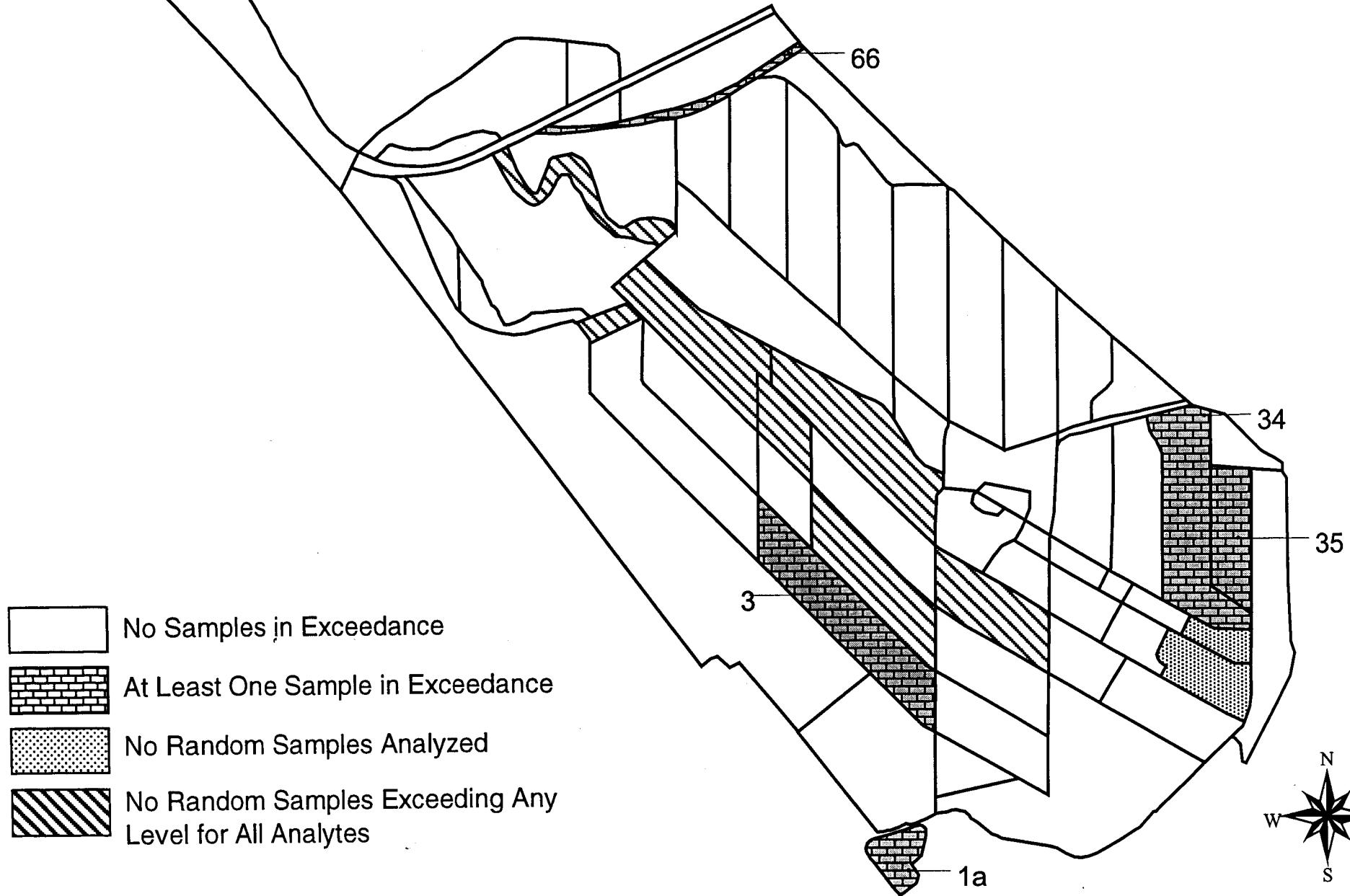


Figure 3-9. Random Sampling Results for Petroleum Hydrocarbons  
Exceeding at Least One Screening Level

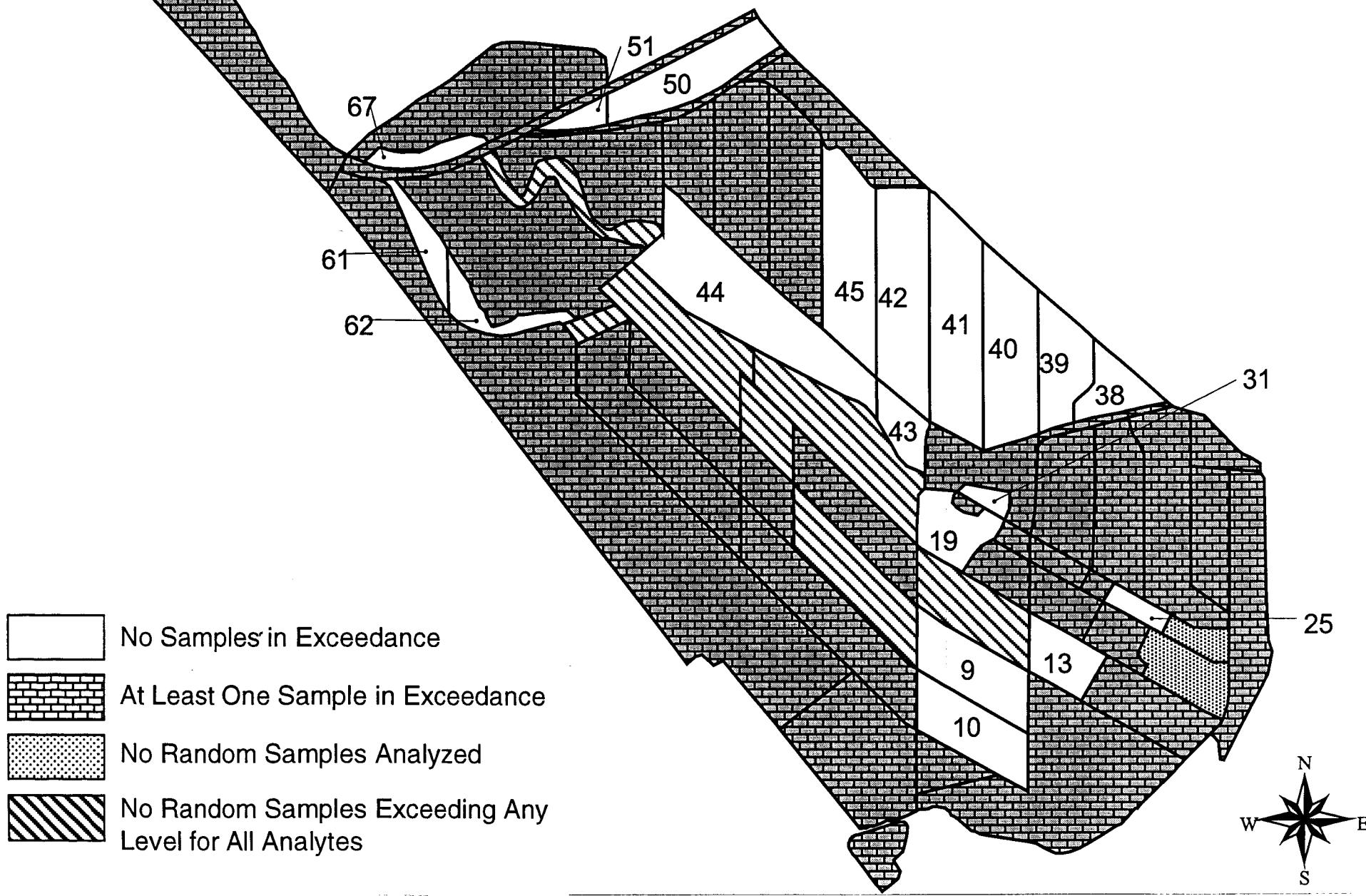


Figure 3-10. Random Sampling Results for Petroleum Hydrocarbons Exceeding LC50

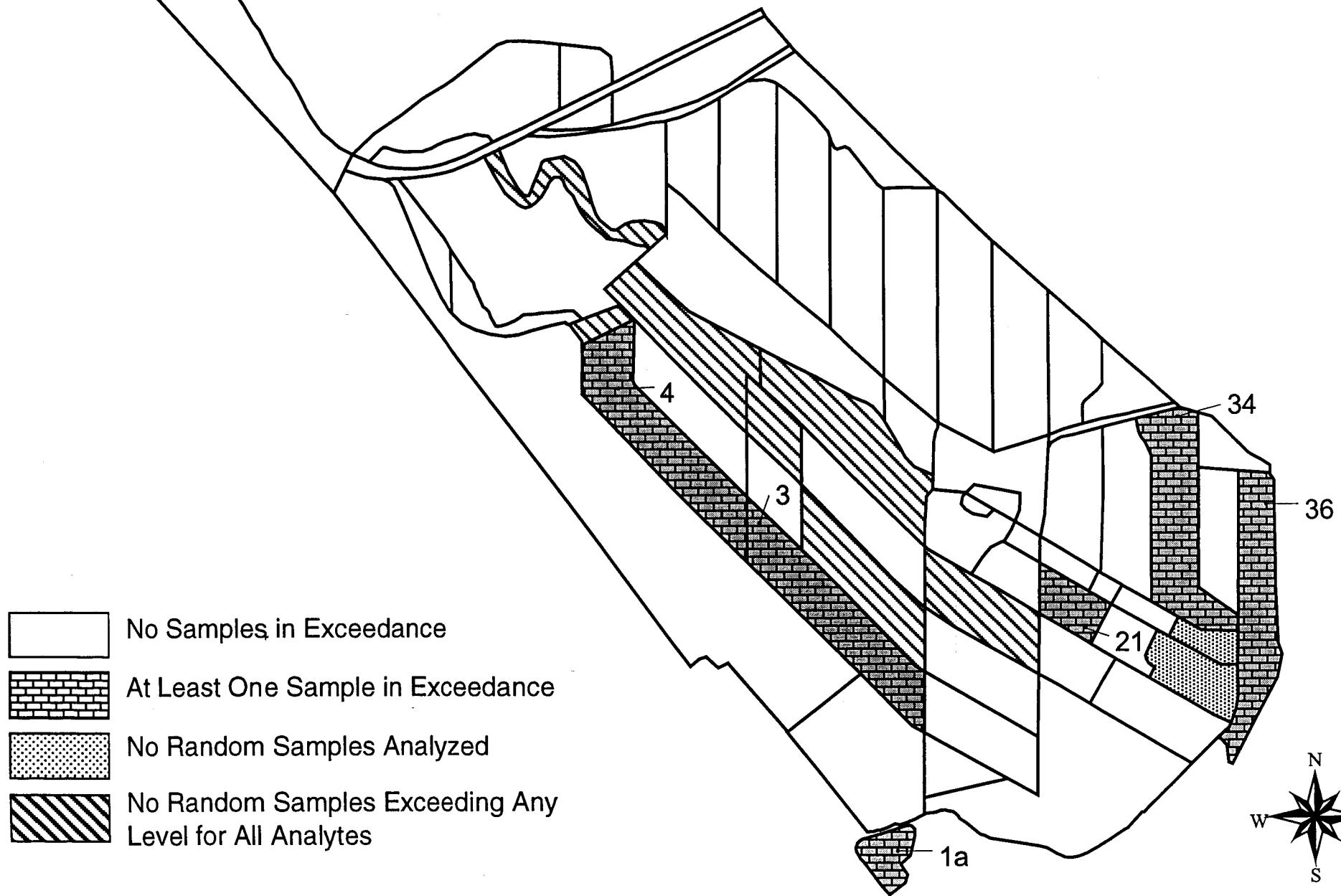


Figure 3-11. Random Sampling Results for Chlorinated Pesticides  
Exceeding at Least One Screening Level

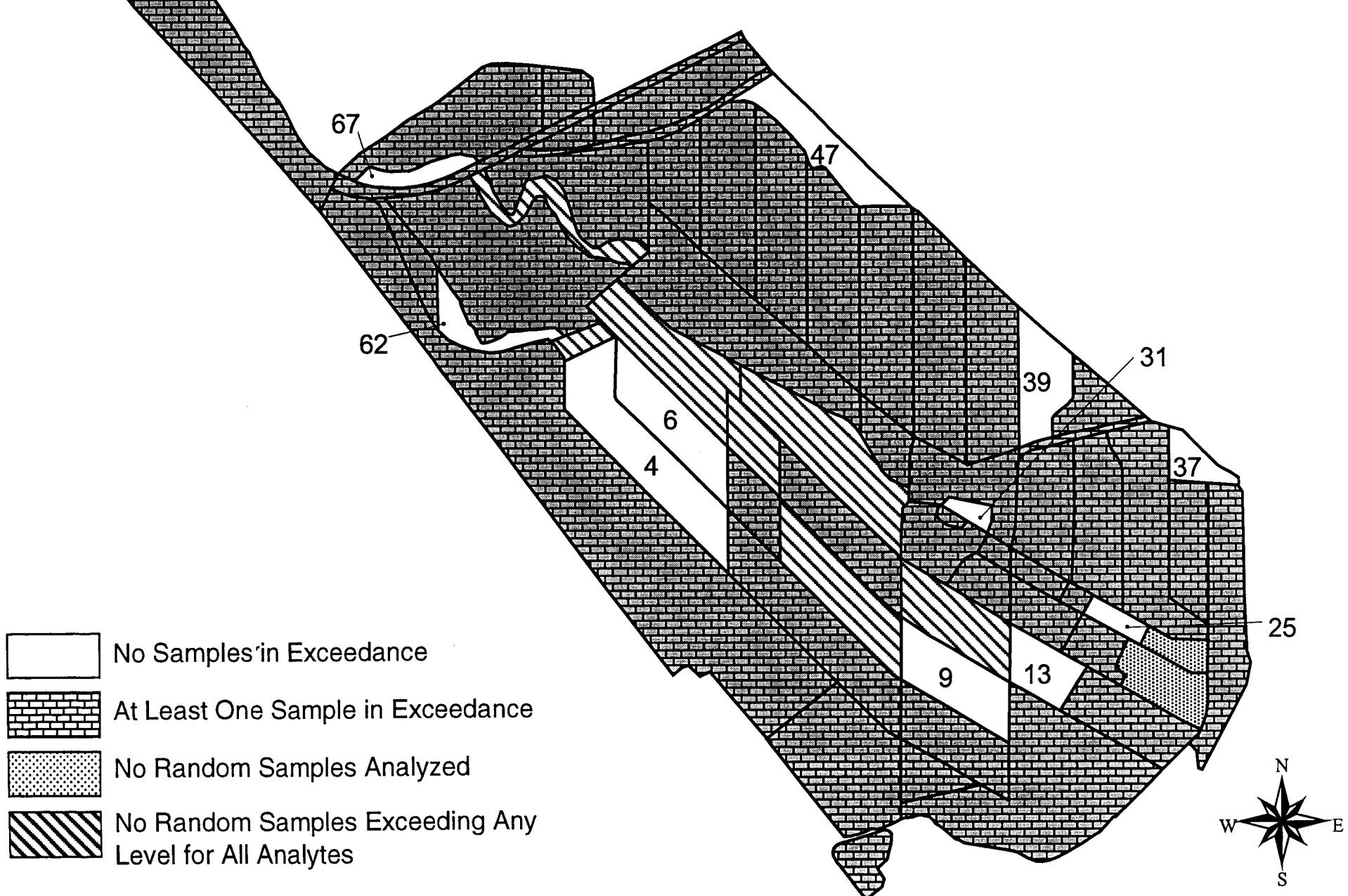


Figure 3-12. Random Sampling Results for Chlorinated Pesticides Exceeding ER-M

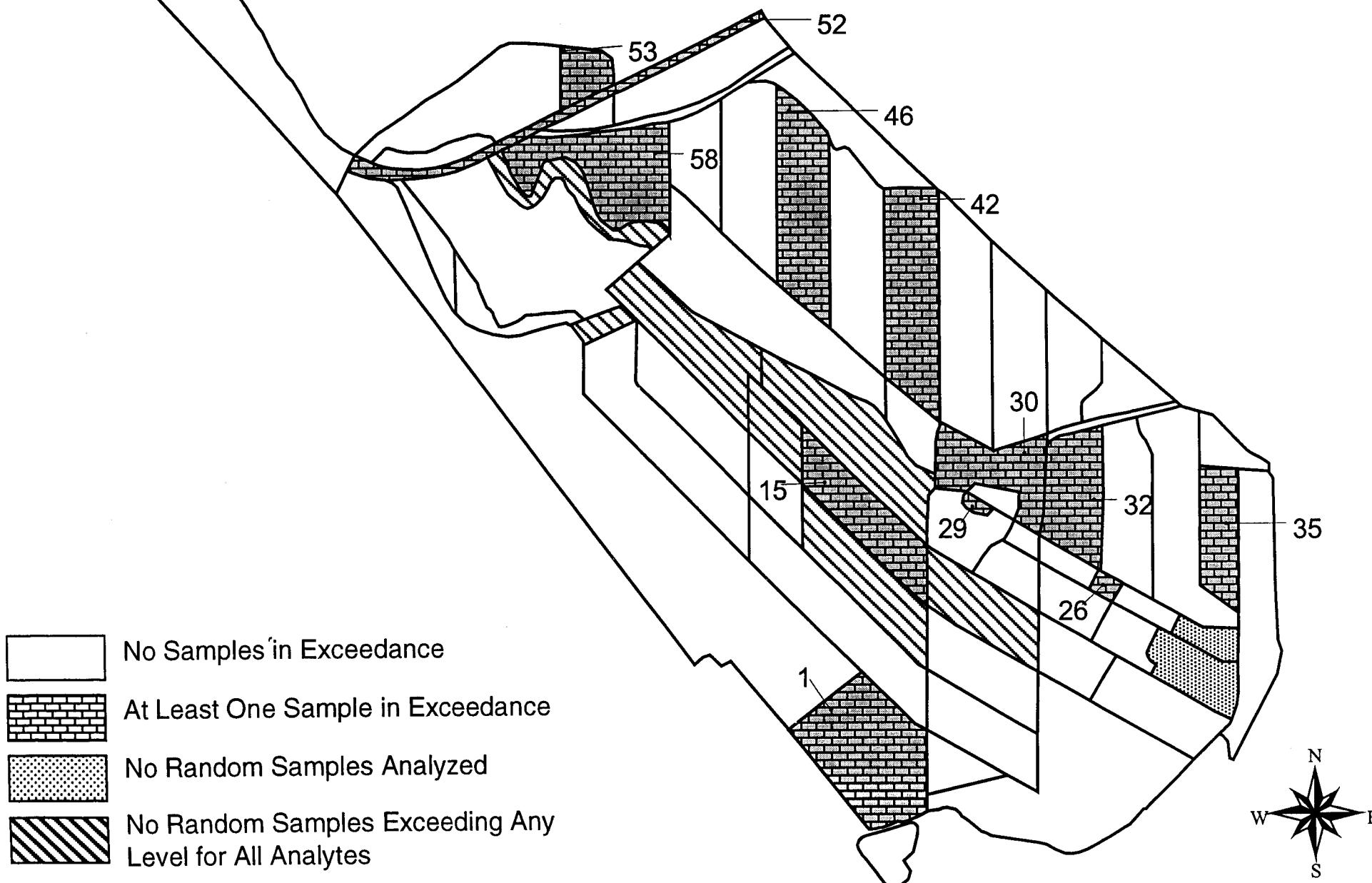


Figure 3-13. Random Sampling Results for PCBs  
Exceeding at Least One Screening Level

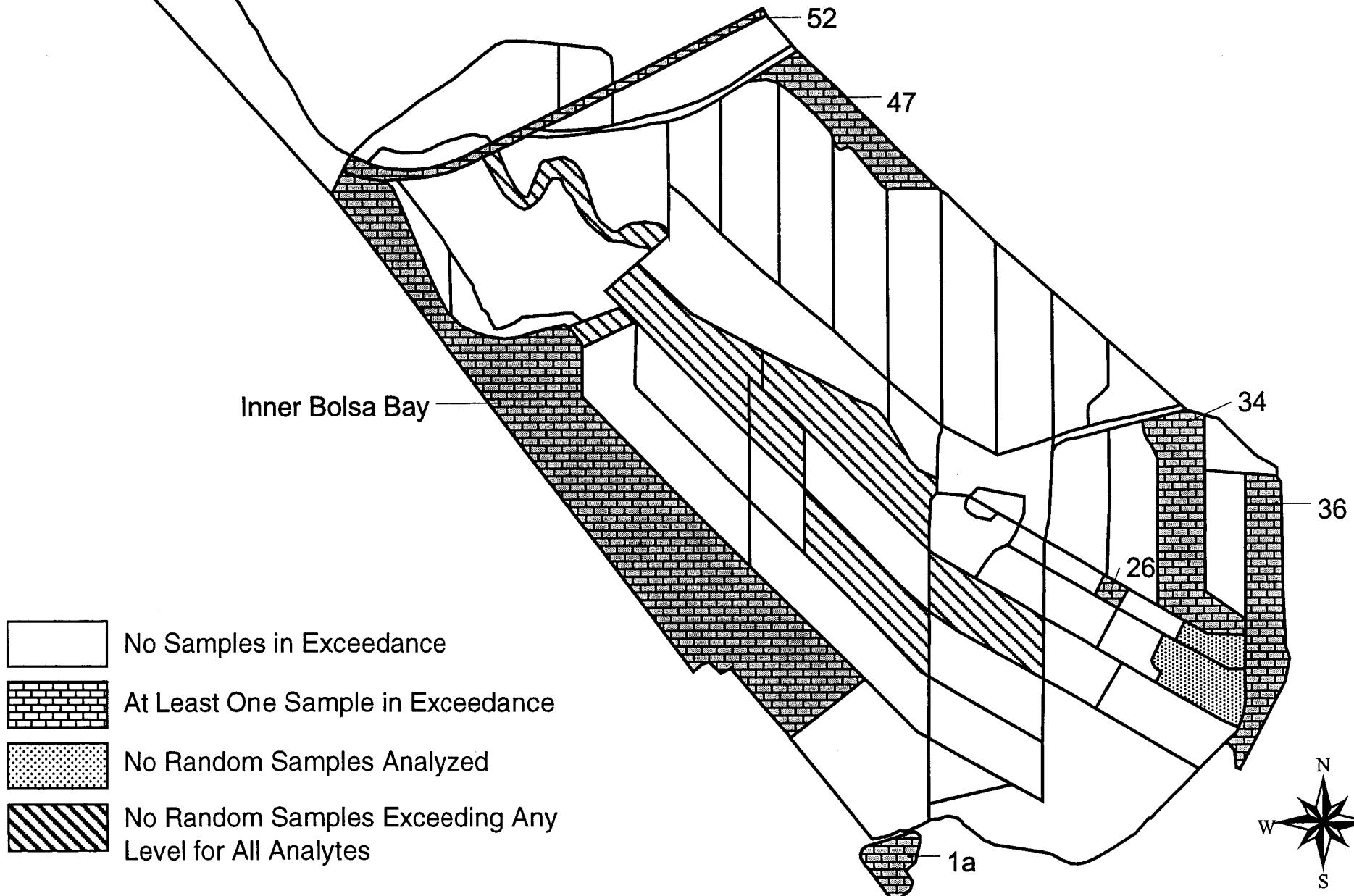


Figure 3-14. Random Sampling Results for PCBs  
Exceeding ER-M

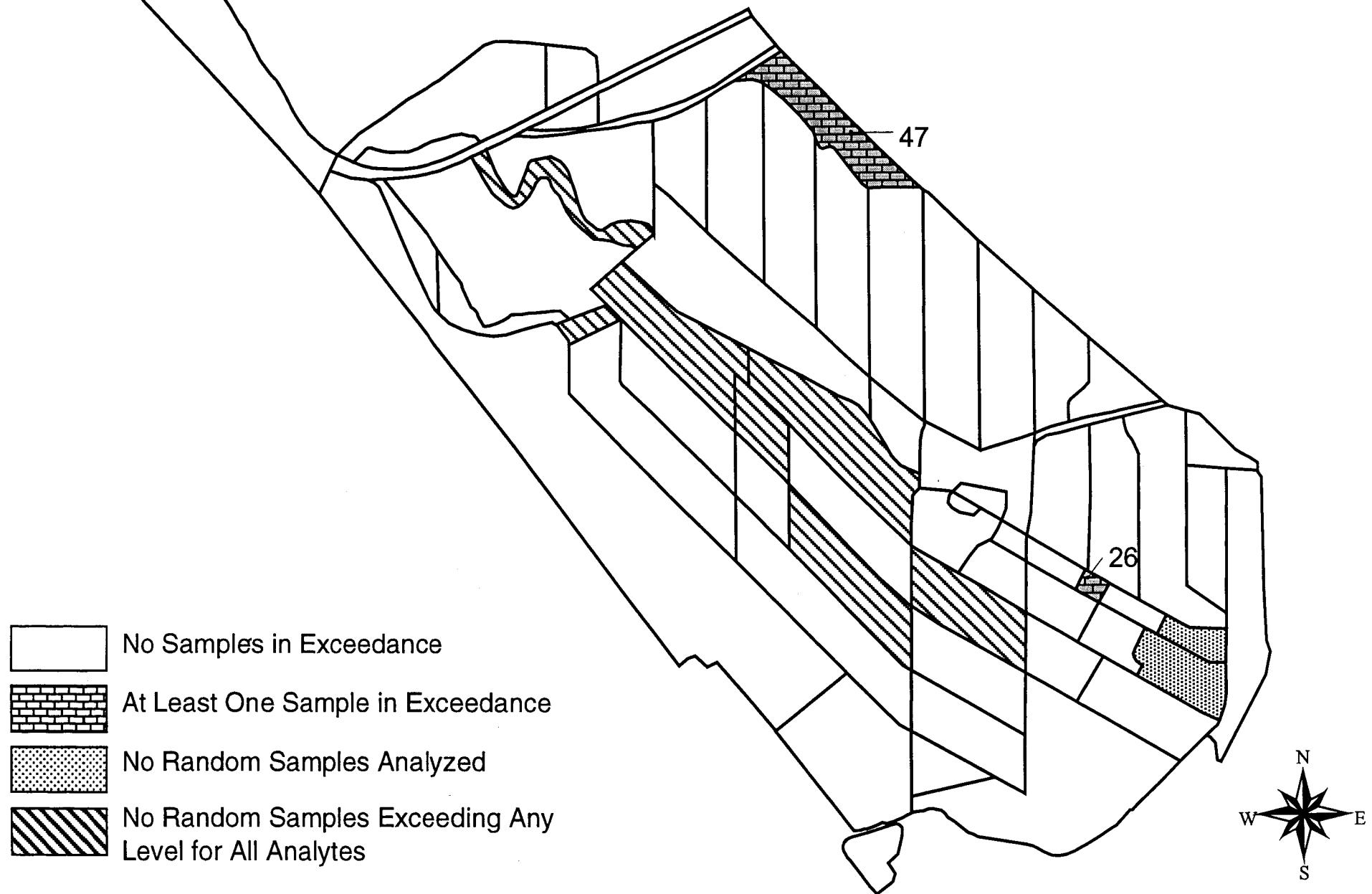


Figure 3-15. Random Sampling Results for Phthalate  
Exceeding at Least One Screening Level

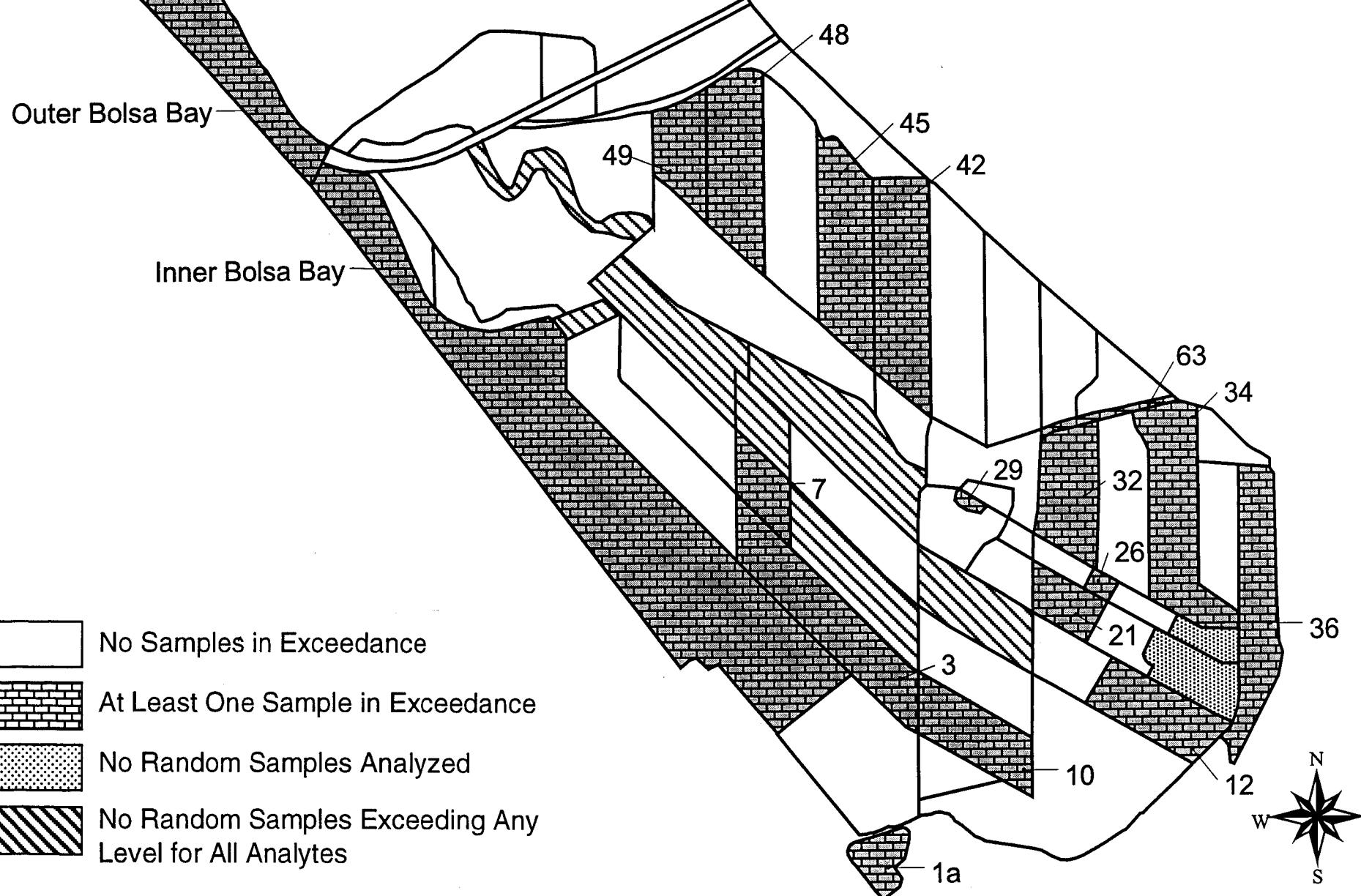
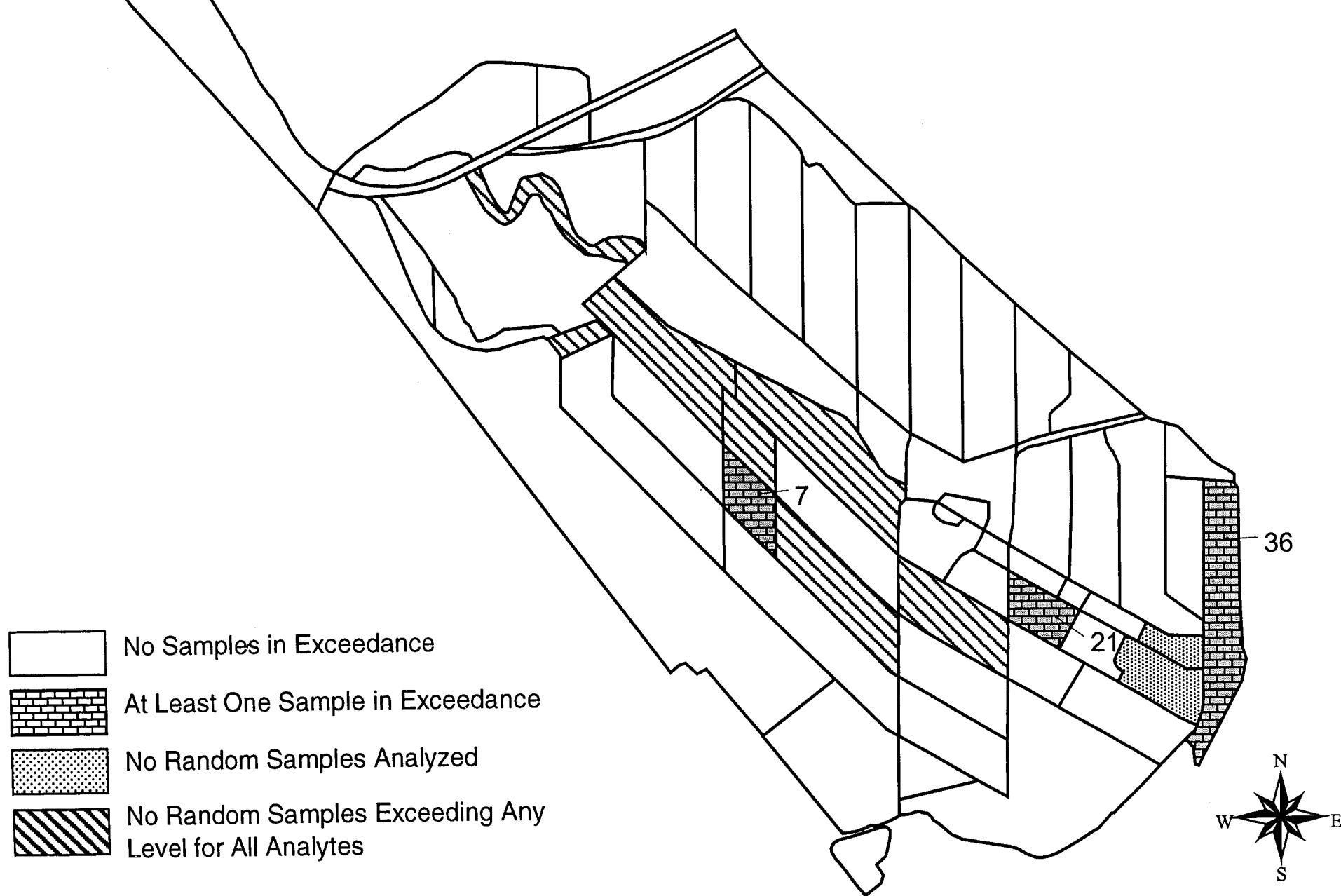
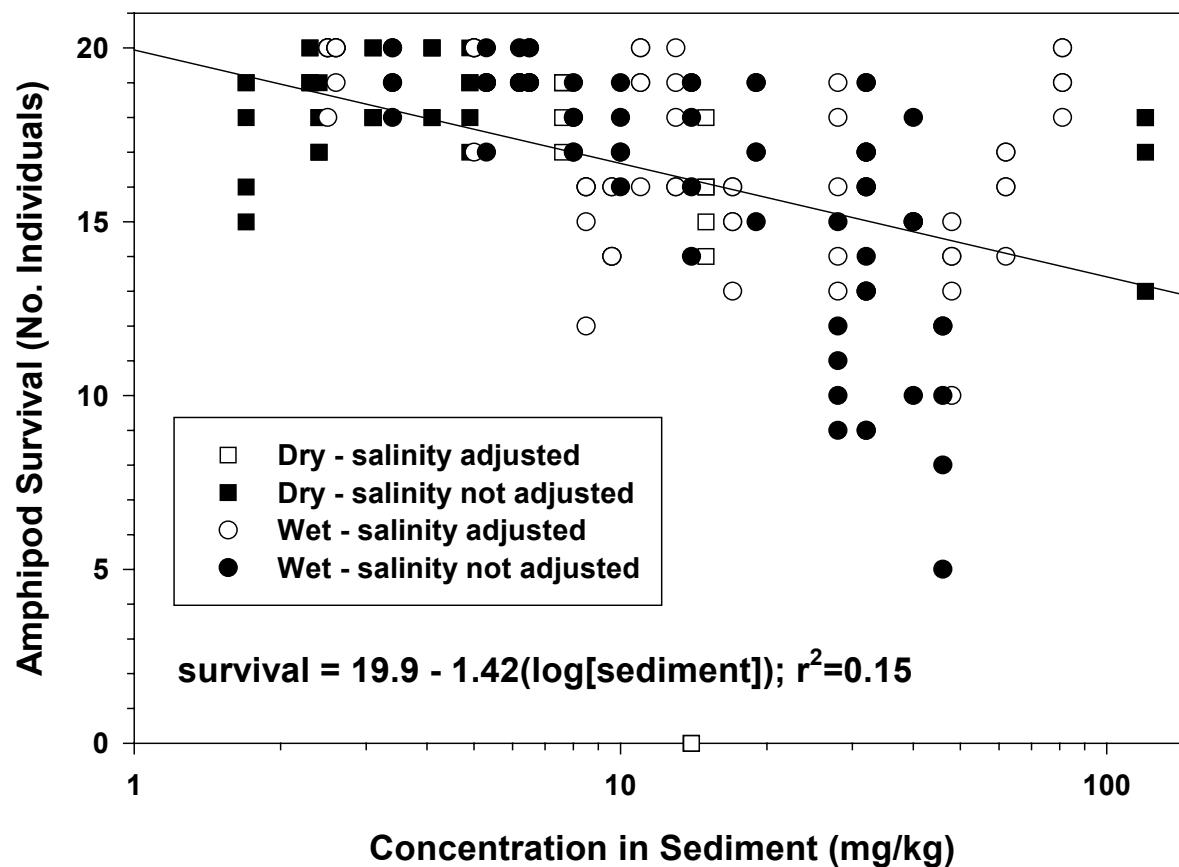


Figure 3-16. Random Sampling Results for Phthalate  
Exceeding LC50

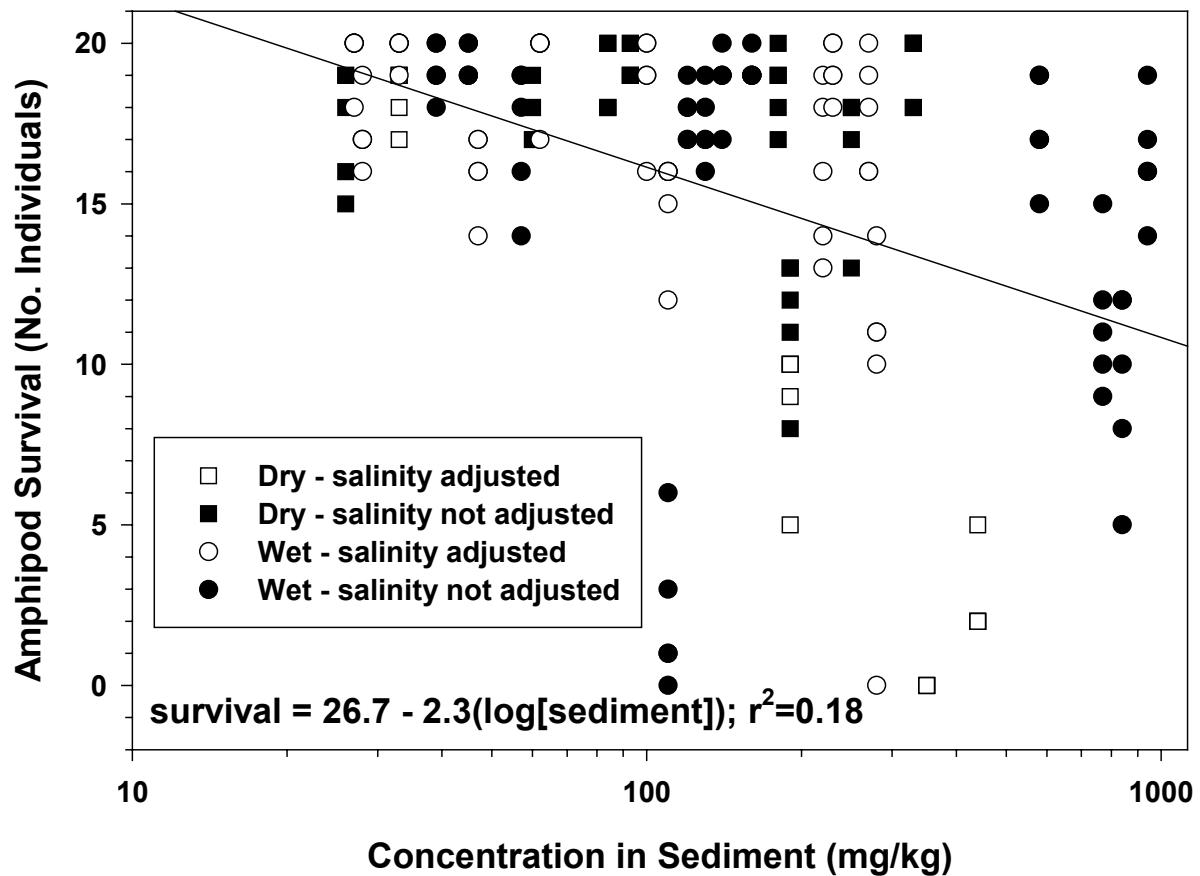


**Figure 3-17. Arsenic in Sediment vs. Amphipod Toxicity**



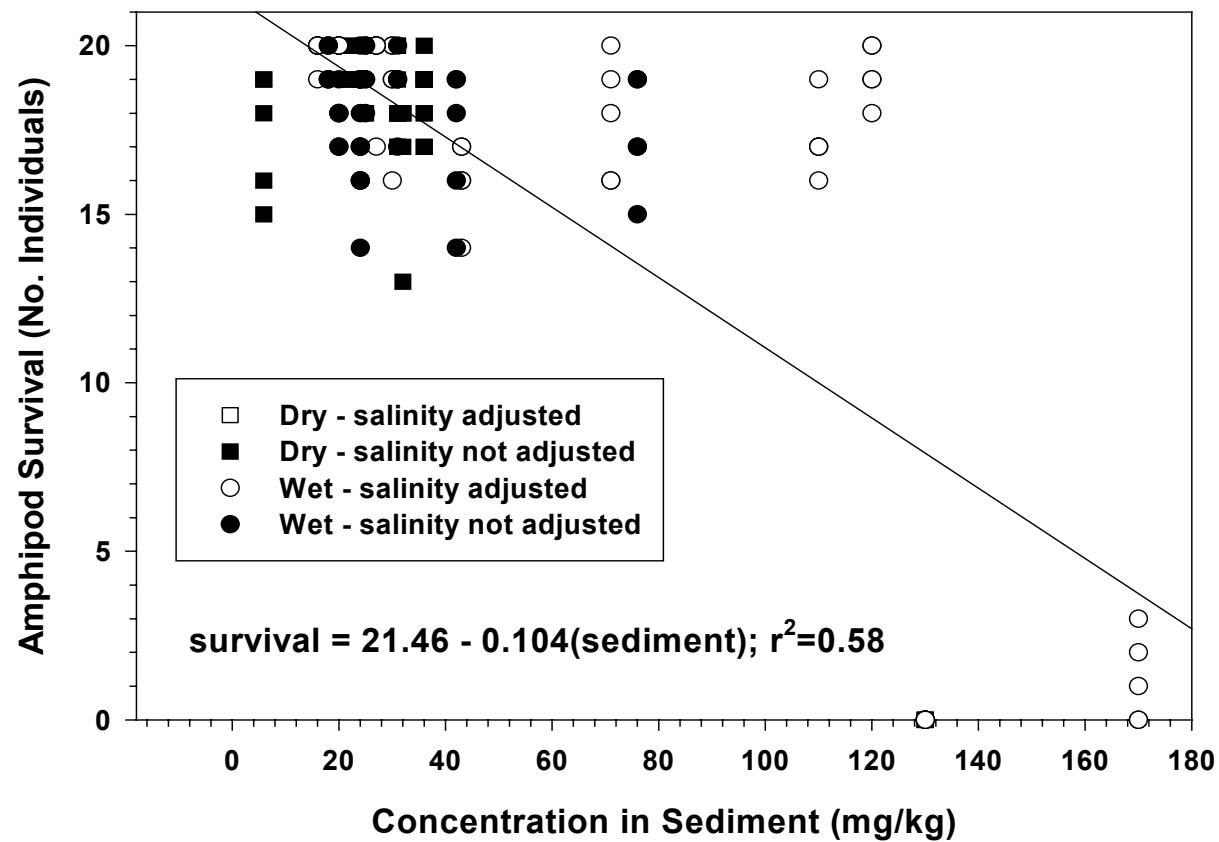
Note: This figure is an example; full data are presented in Appendix H.

### Figure 3-18. Barium in Sediment vs. Amphipod Toxicity



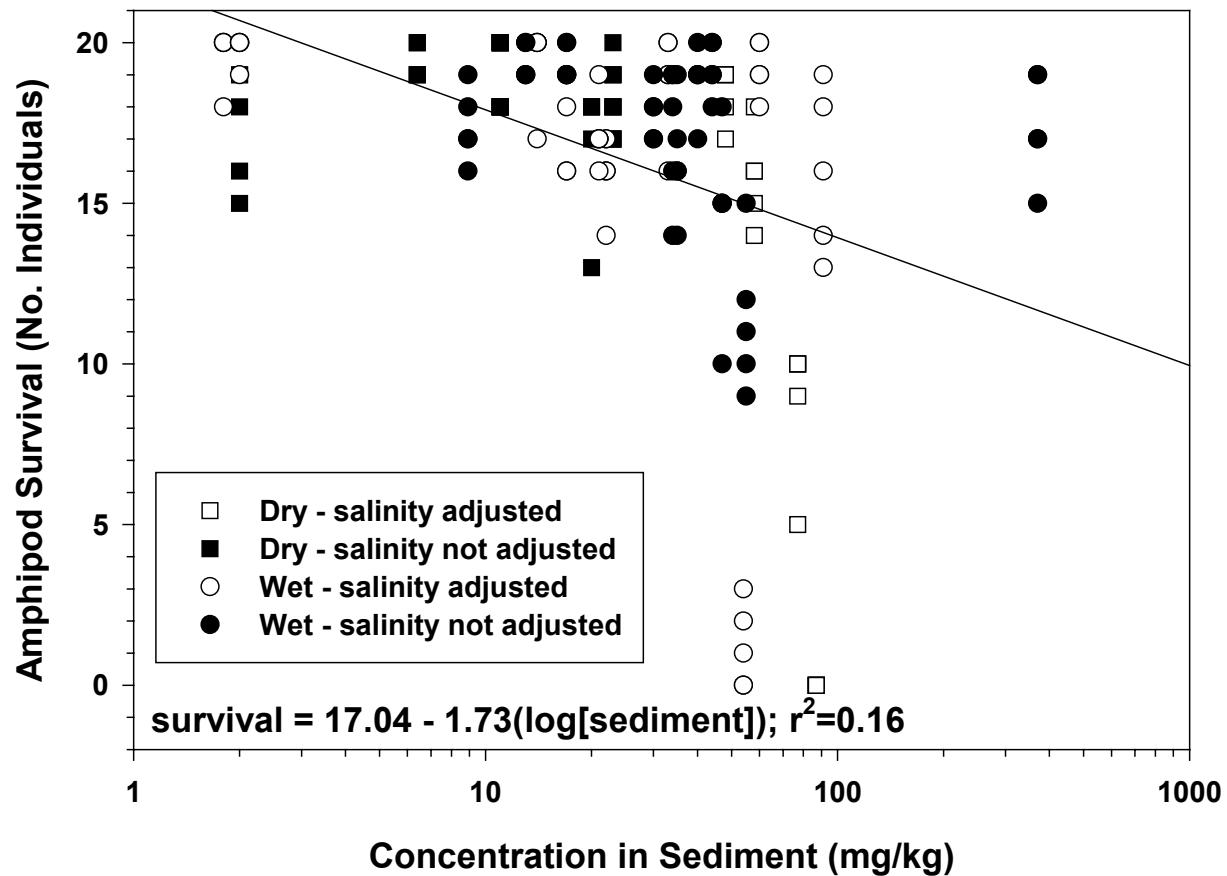
Note: This figure is an example; full data are presented in Appendix H.

## Figure 3-19. Chromium in Sediment vs. Amphipod Toxicity



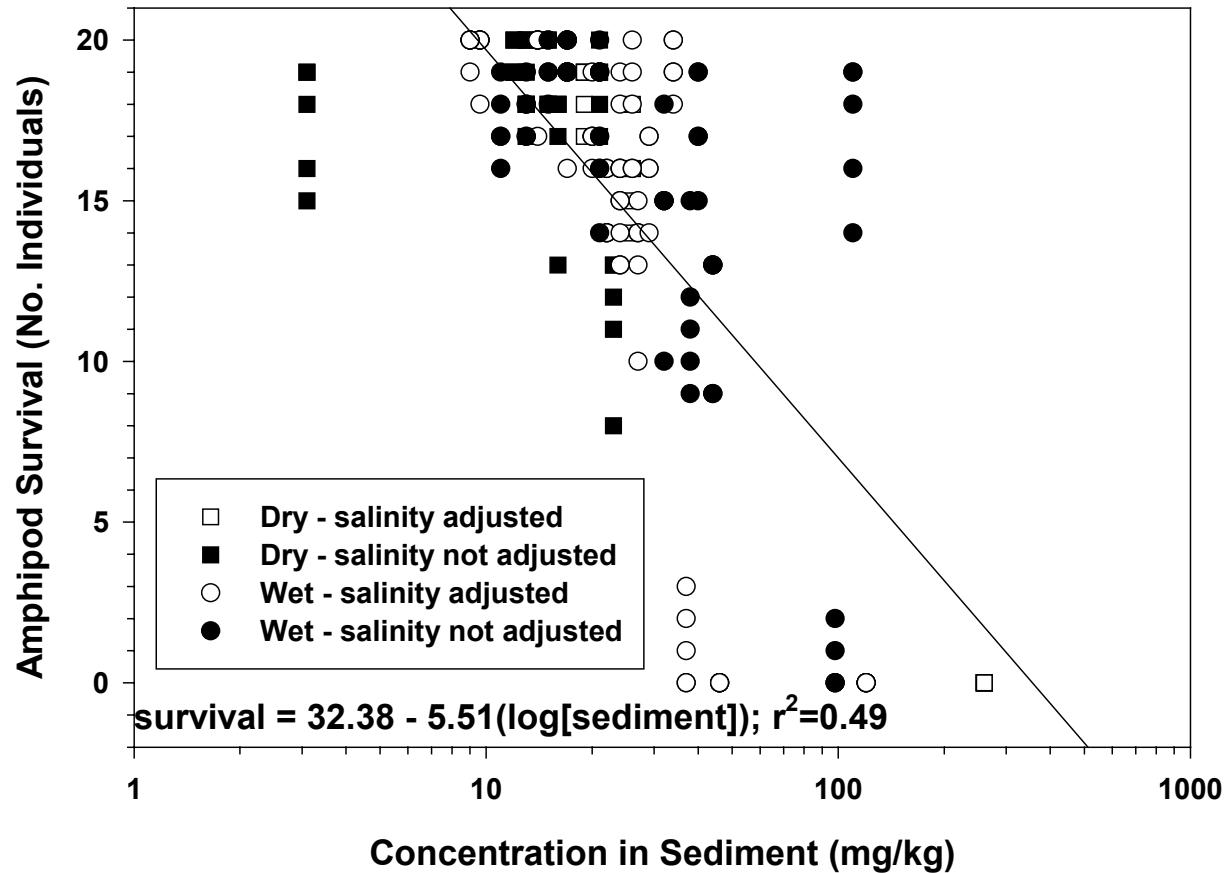
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-20. Lead in Sediment vs. Amphipod Toxicity**



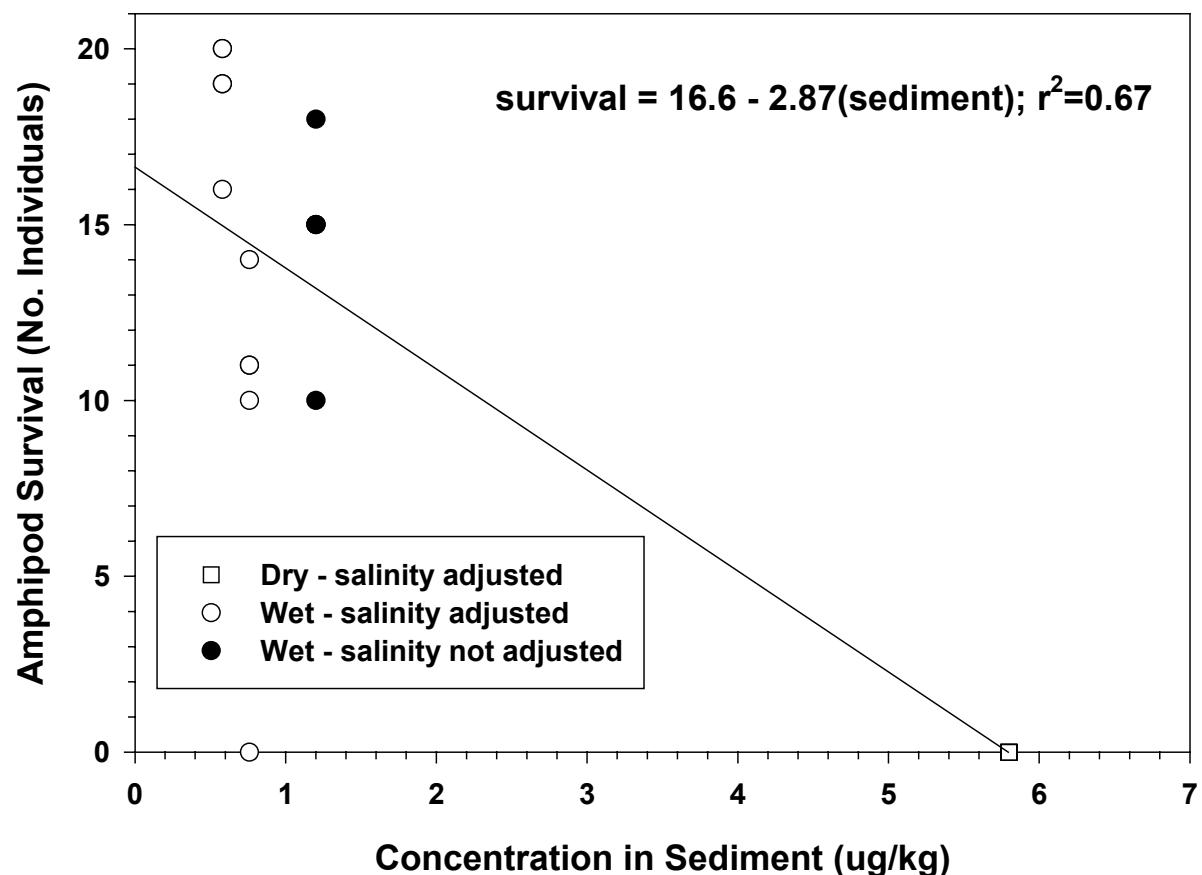
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-21. Nickel in Sediment vs. Amphipod Toxicity**



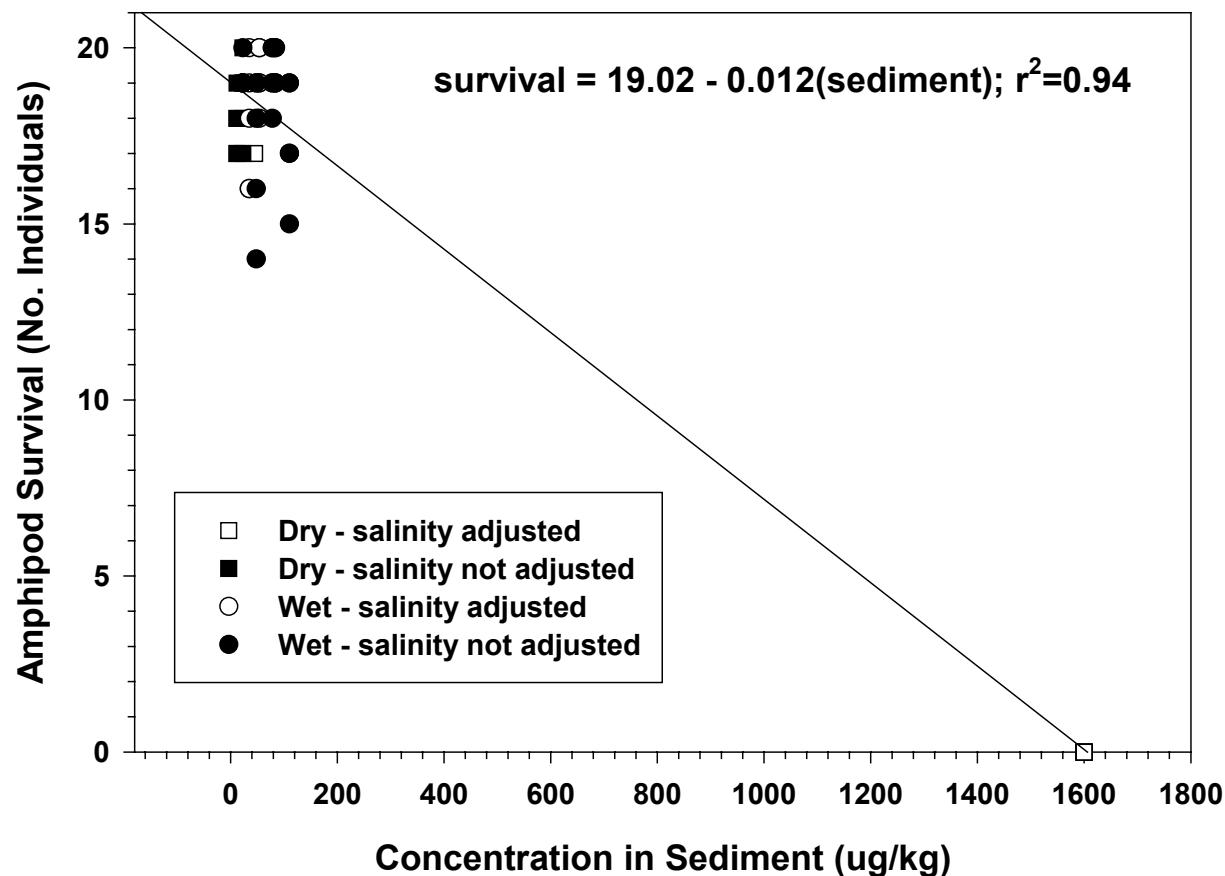
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-22. Aldrin in Sediment vs. Amphipod Toxicity**



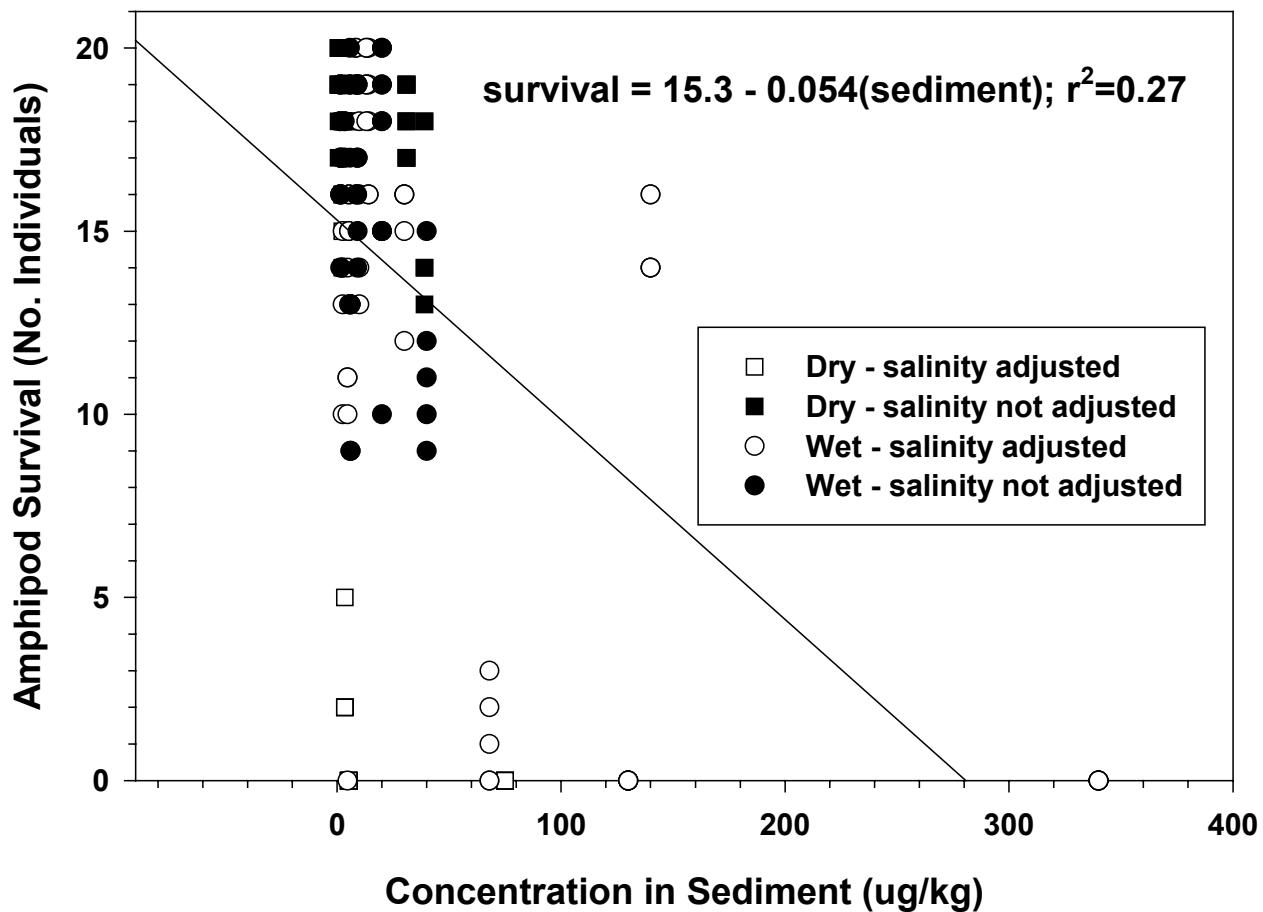
Note: This figure is an example; full data are presented in Appendix H.

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



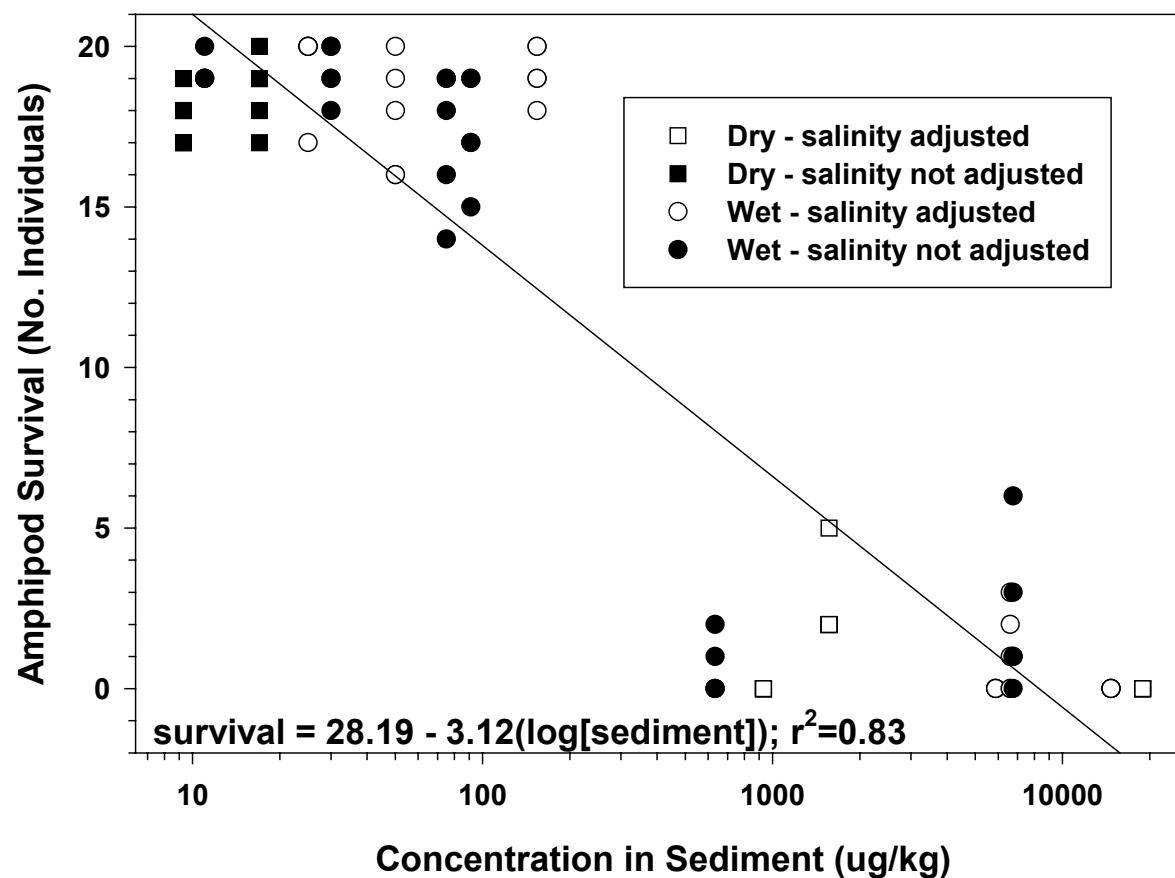
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-24. 4,4'-DDE in Sediment vs. Amphipod Toxicity**



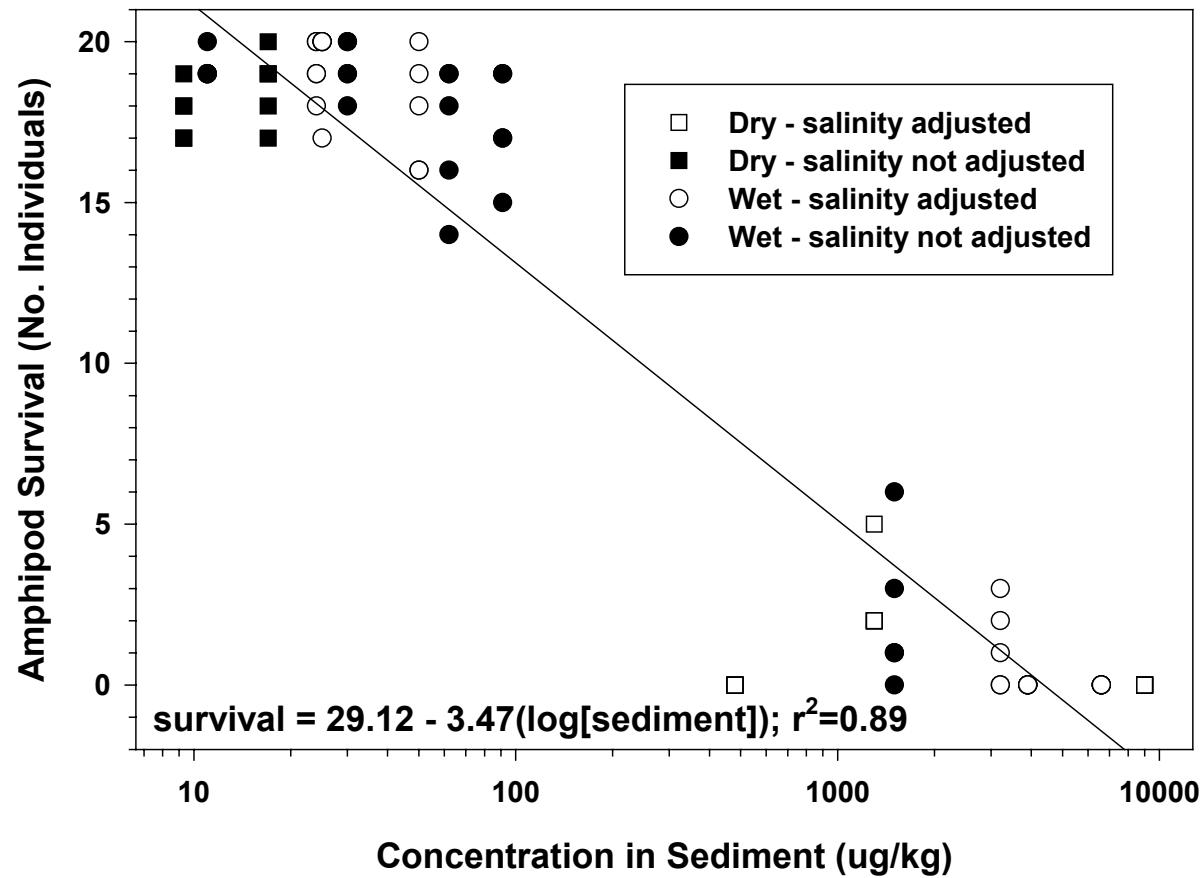
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-25. Low MW PAHs in Sediment vs. Amphipod Toxicity**



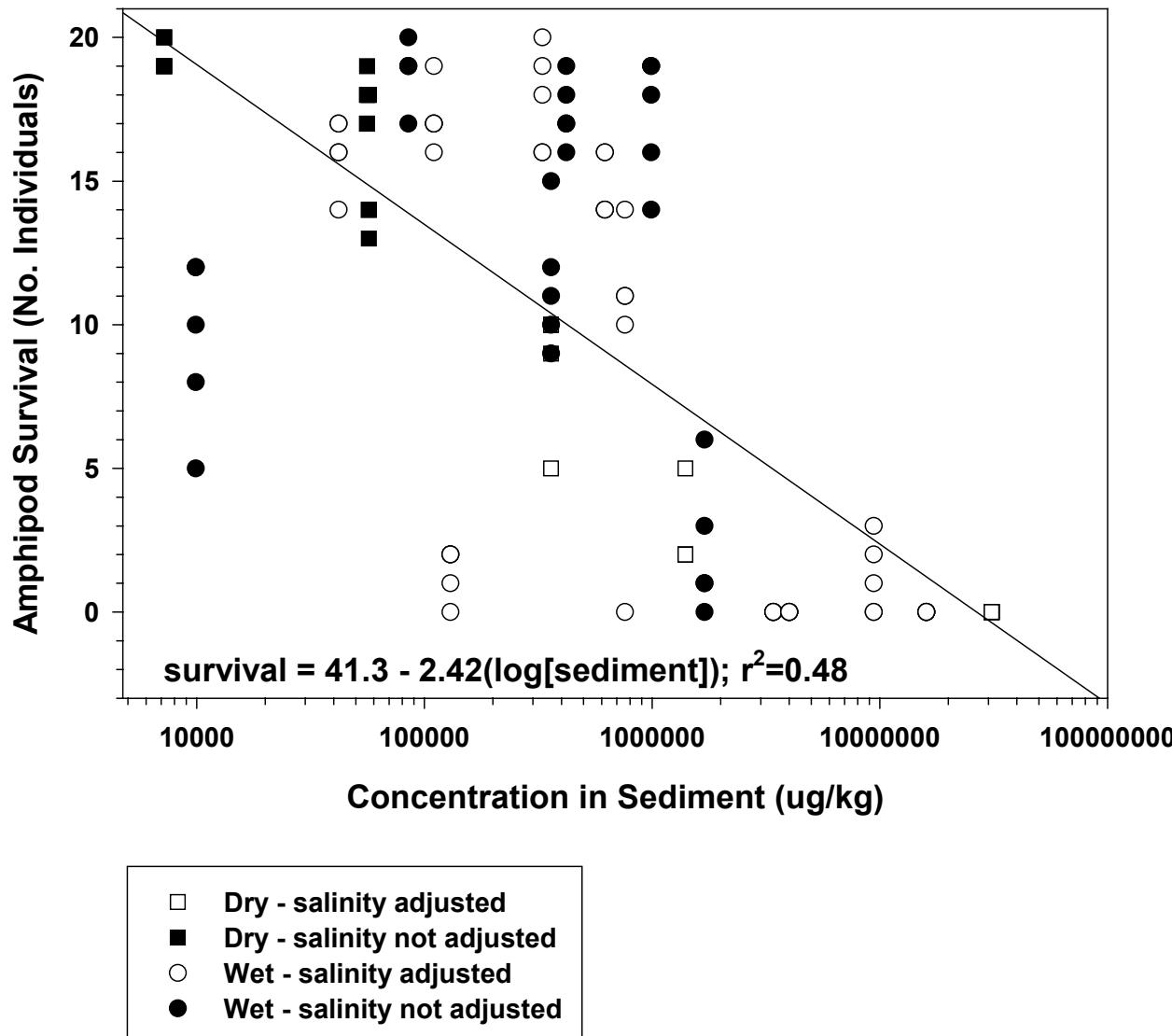
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-26. Phenanthrene in Sediment vs. Amphipod Toxicity**



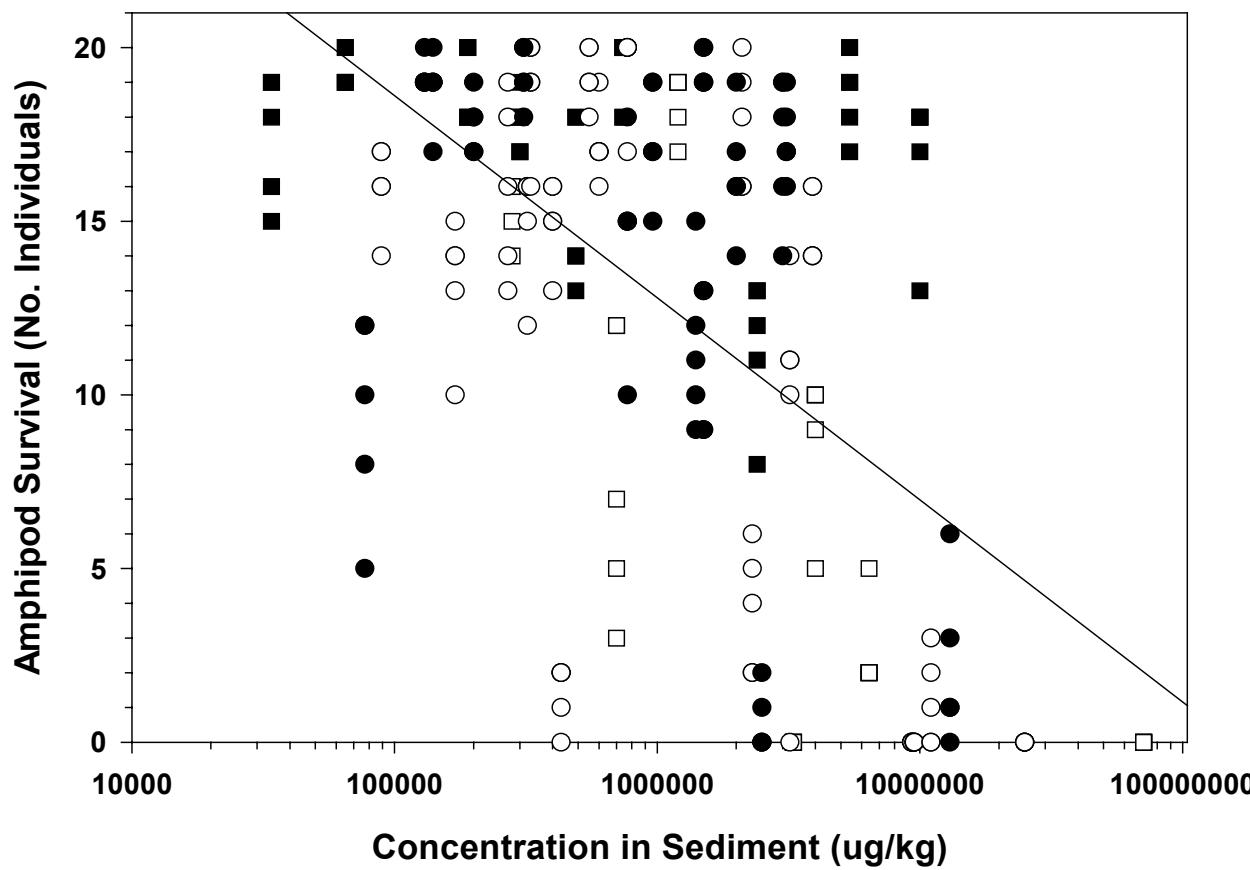
Note: This figure is an example; full data are presented in Appendix H.

## Figure 3-27. TPH Diesel in Sediment vs. Amphipod Toxicity



Note: This figure is an example; full data are presented in Appendix H.

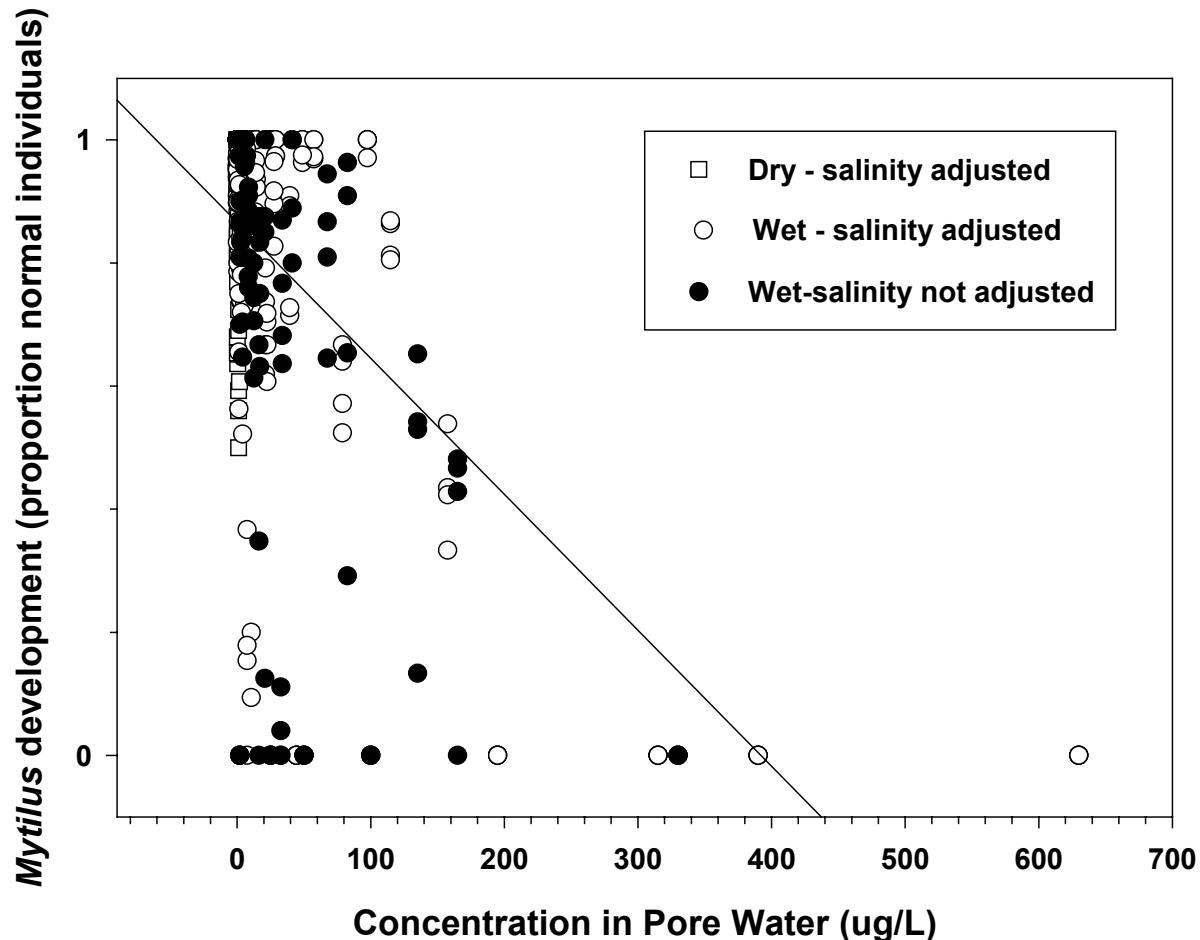
## Figure 3-28. Waste Oil in Sediment vs. Amphipod Toxicity



- Dry - salinity adjusted
- Dry - salinity not adjusted
- Wet - salinity adjusted
- Wet - salinity not adjusted

Note: This figure is an example; full data are presented in Appendix H.

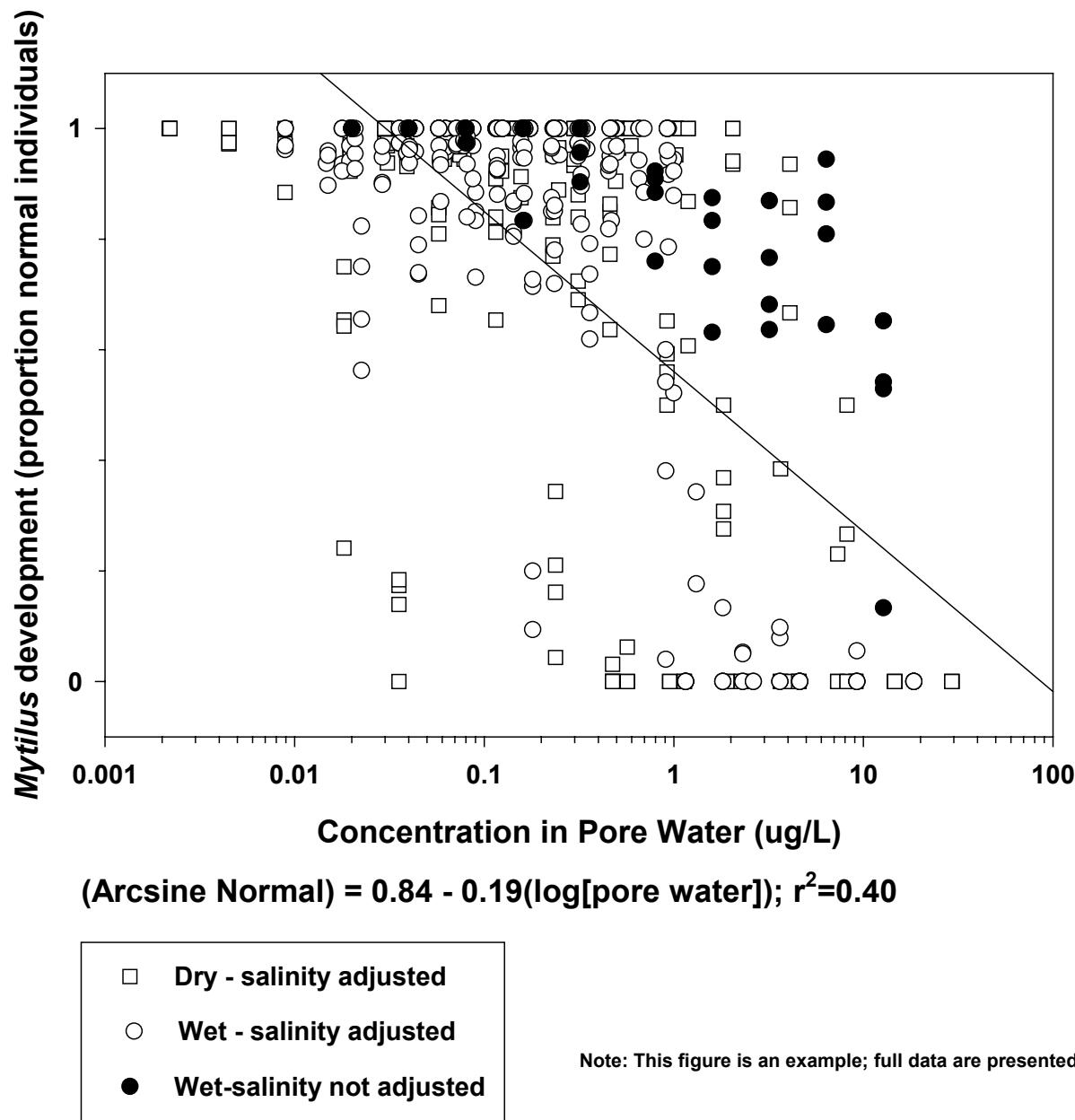
**Figure 3-30. Arsenic in Pore Water vs. *Mytilus* Toxicity**



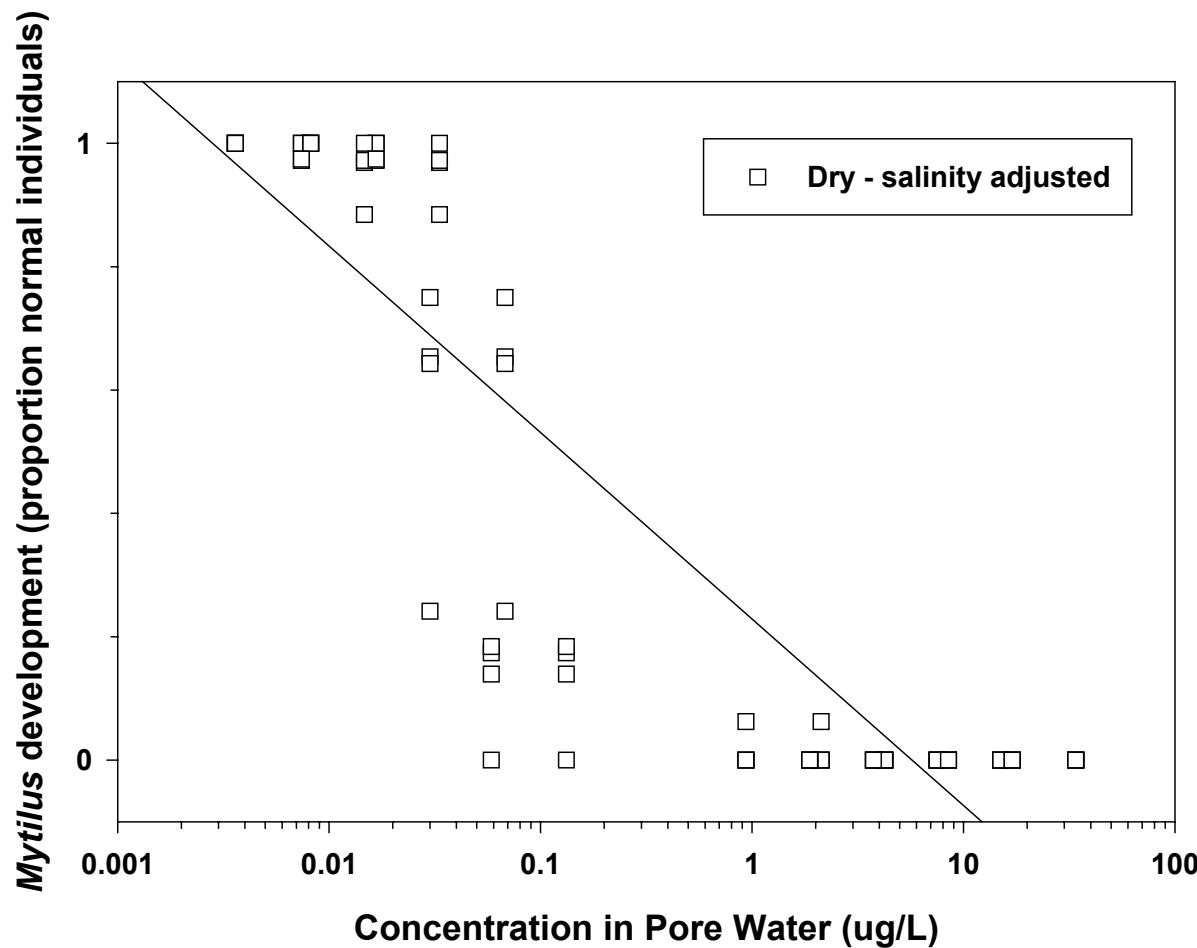
$$(\text{Arcsine Normal}) = 1.28 - 0.0033(\text{pore water}); r^2=0.35$$

Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-31. Lead in Pore Water vs. *Mytilus* Toxicity**



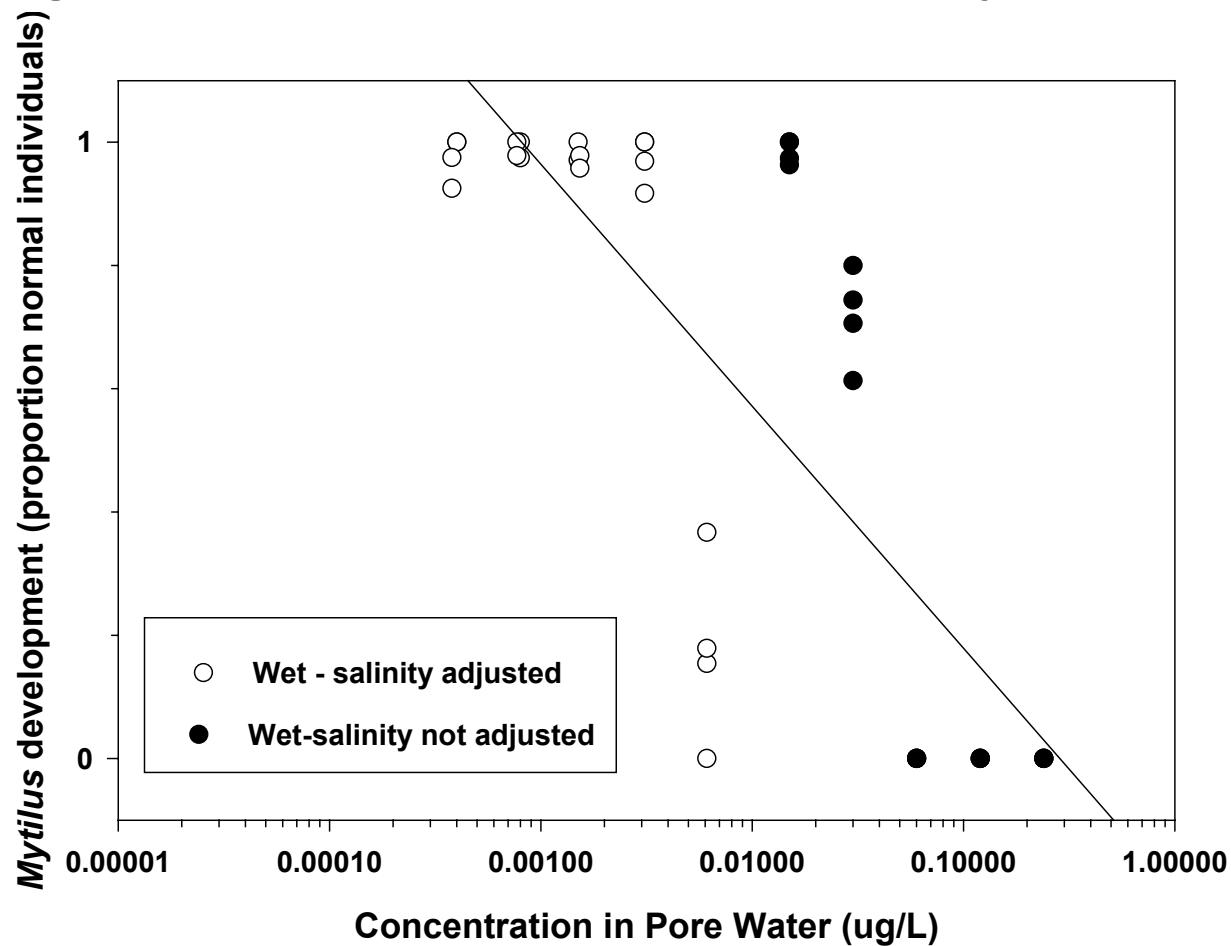
**Figure 3-32. Acenaphthene in Pore Water vs. *Mytilus* Toxicity**



$$(\text{Arcsine Normal}) = 0.36 - 0.20(\log[\text{pore water}]); r^2=0.82$$

Note: This figure is an example; full data are presented in Appendix H.

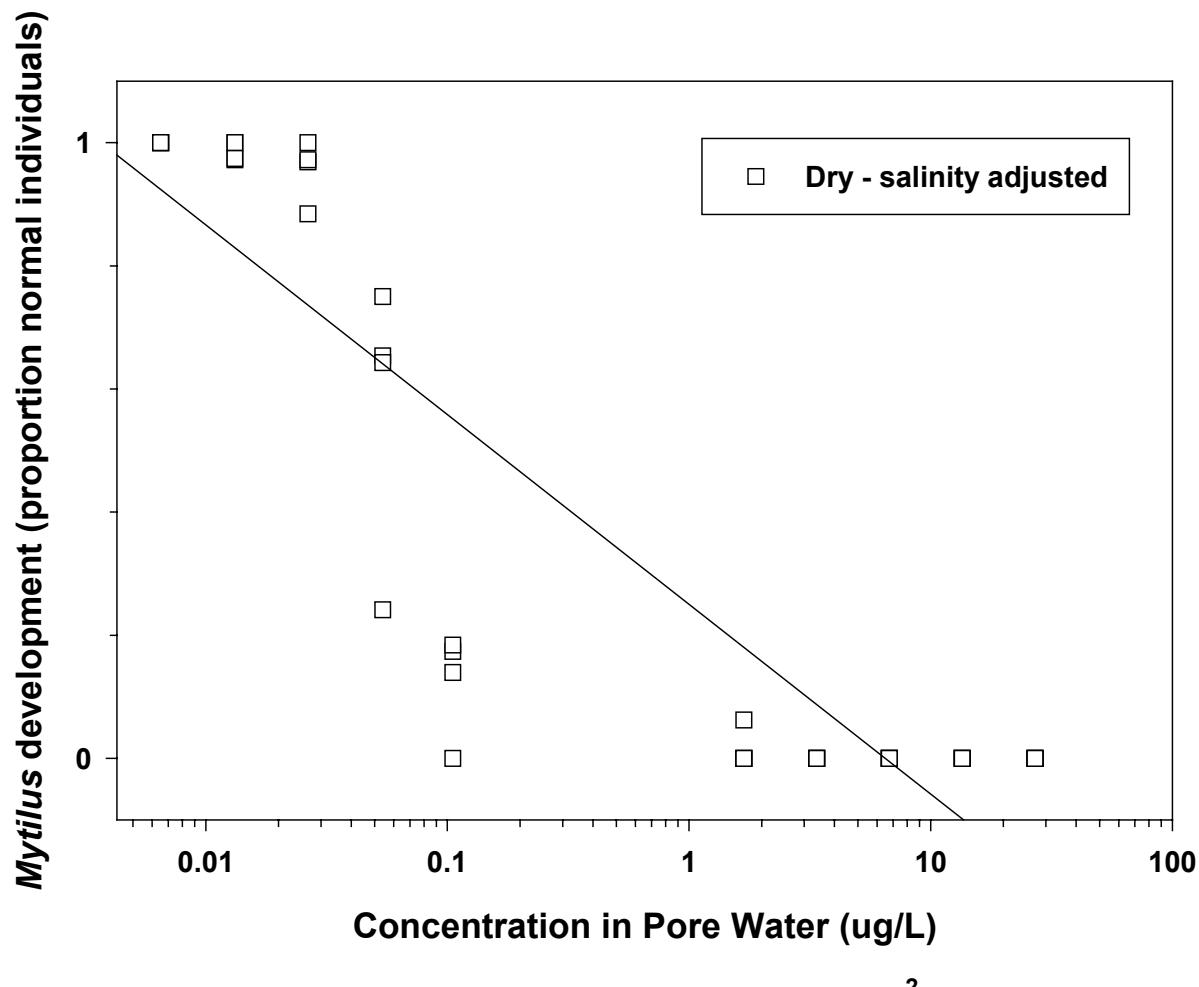
**Figure 3-33. BHC alpha in Pore Water vs. *Mytilus* Toxicity**



$$(\text{Arcsine Normal}) = 0.32 - 0.26(\log[\text{pore water}]); r^2=0.65$$

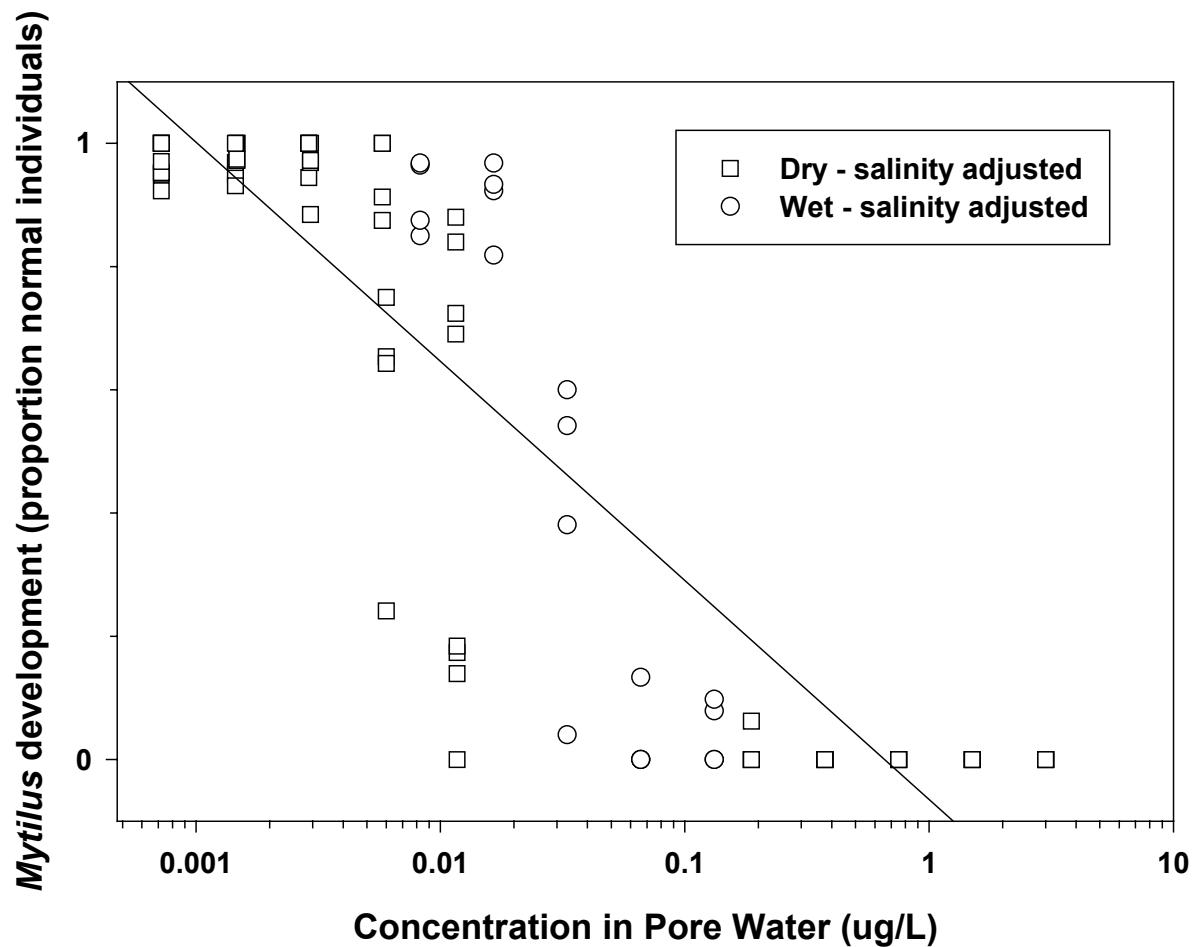
Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-34. Chrysene in Pore Water vs. *Mytilus* Toxicity**



Note: This figure is an example; full data are presented in Appendix H.

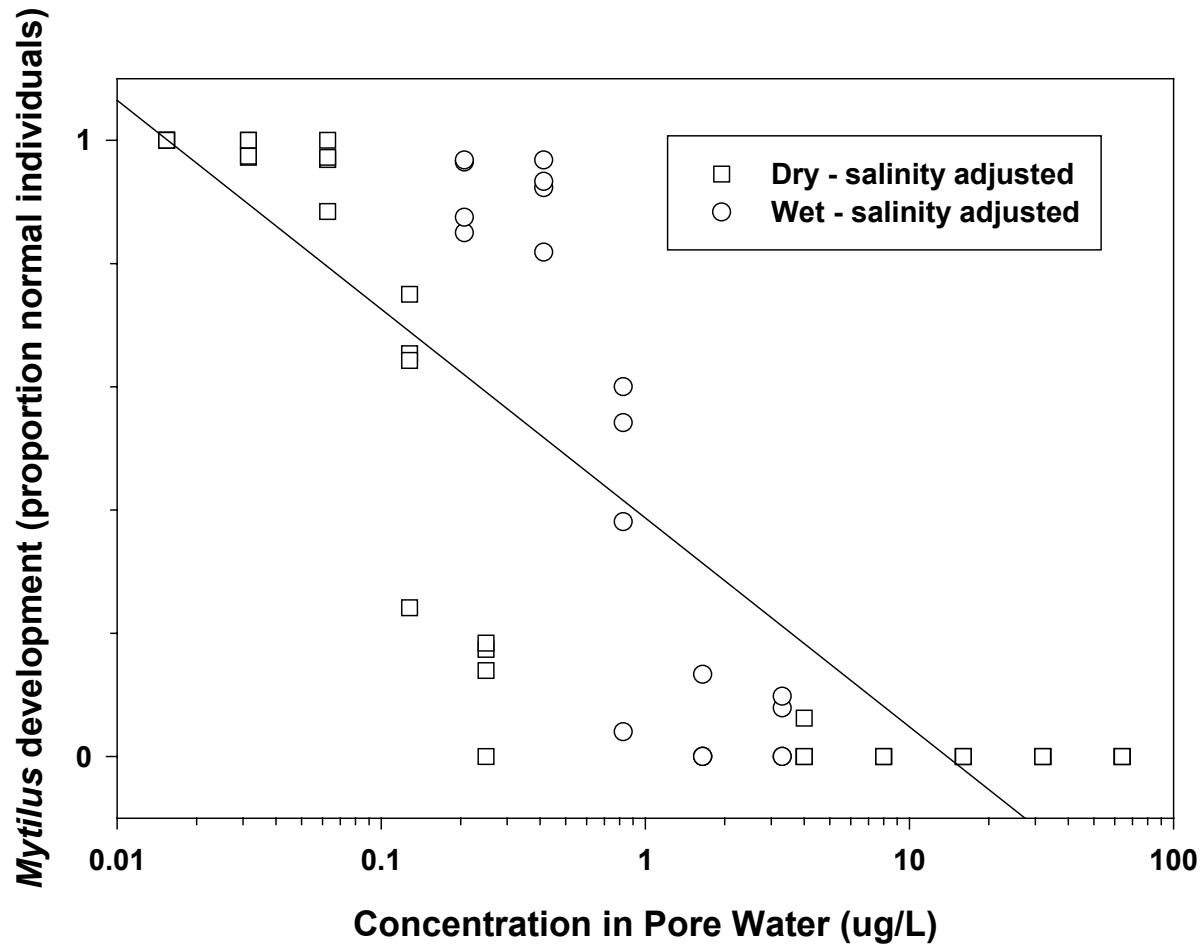
**Figure 3-35. Endosulfan Sulfate in Pore Water vs. *Mytilus* Toxicity**



$$(\text{Arcsine Normal}) = 0.08 - 0.23(\log[\text{pore water}]); r^2=0.79$$

Note: This figure is an example; full data are presented in Appendix H.

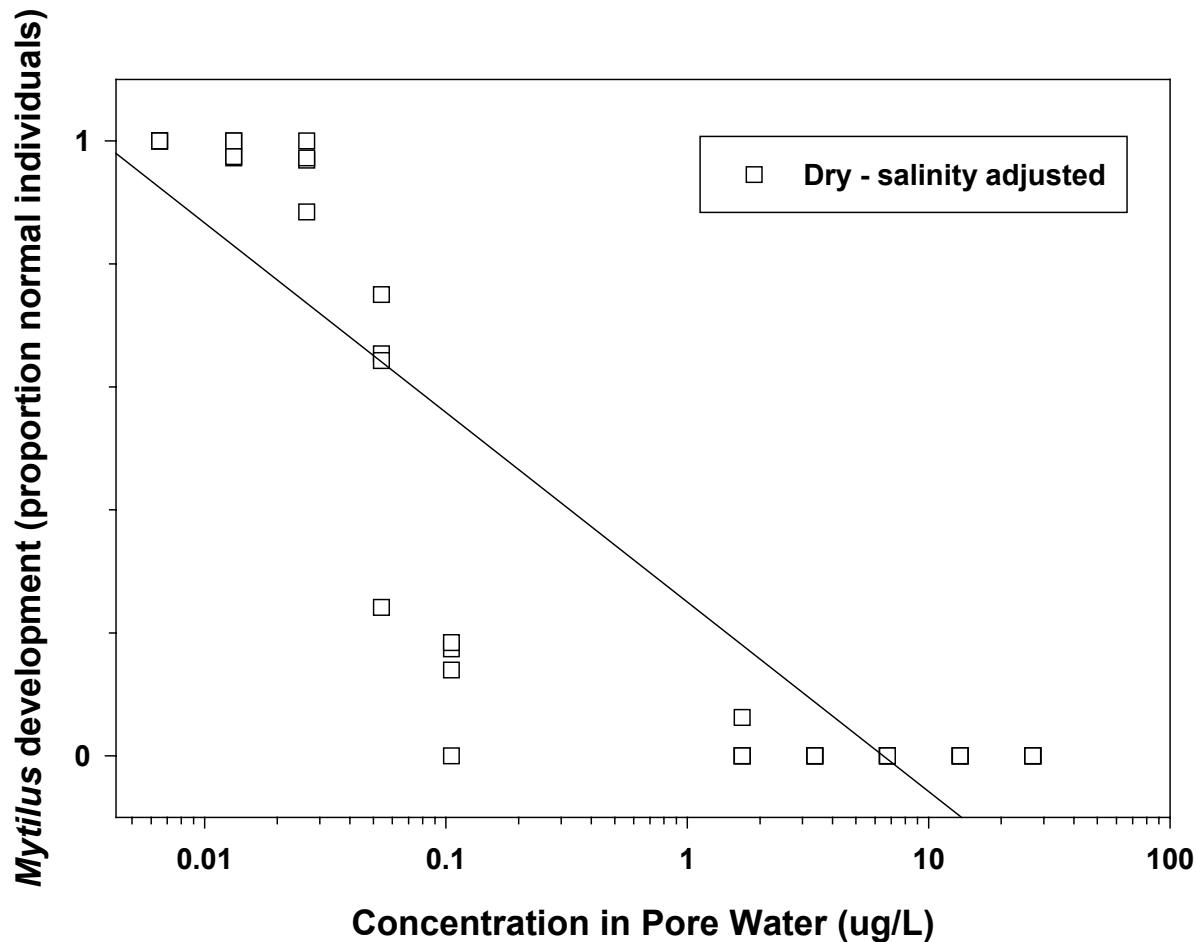
**Figure 3-36. Fluorene in Pore Water vs. *Mytilus* Toxicity**



$$(\text{Arcsine Normal}) = 0.59 - 0.22(\log[\text{pore water}]); r^2=0.76$$

Note: This figure is an example; full data are presented in Appendix H.

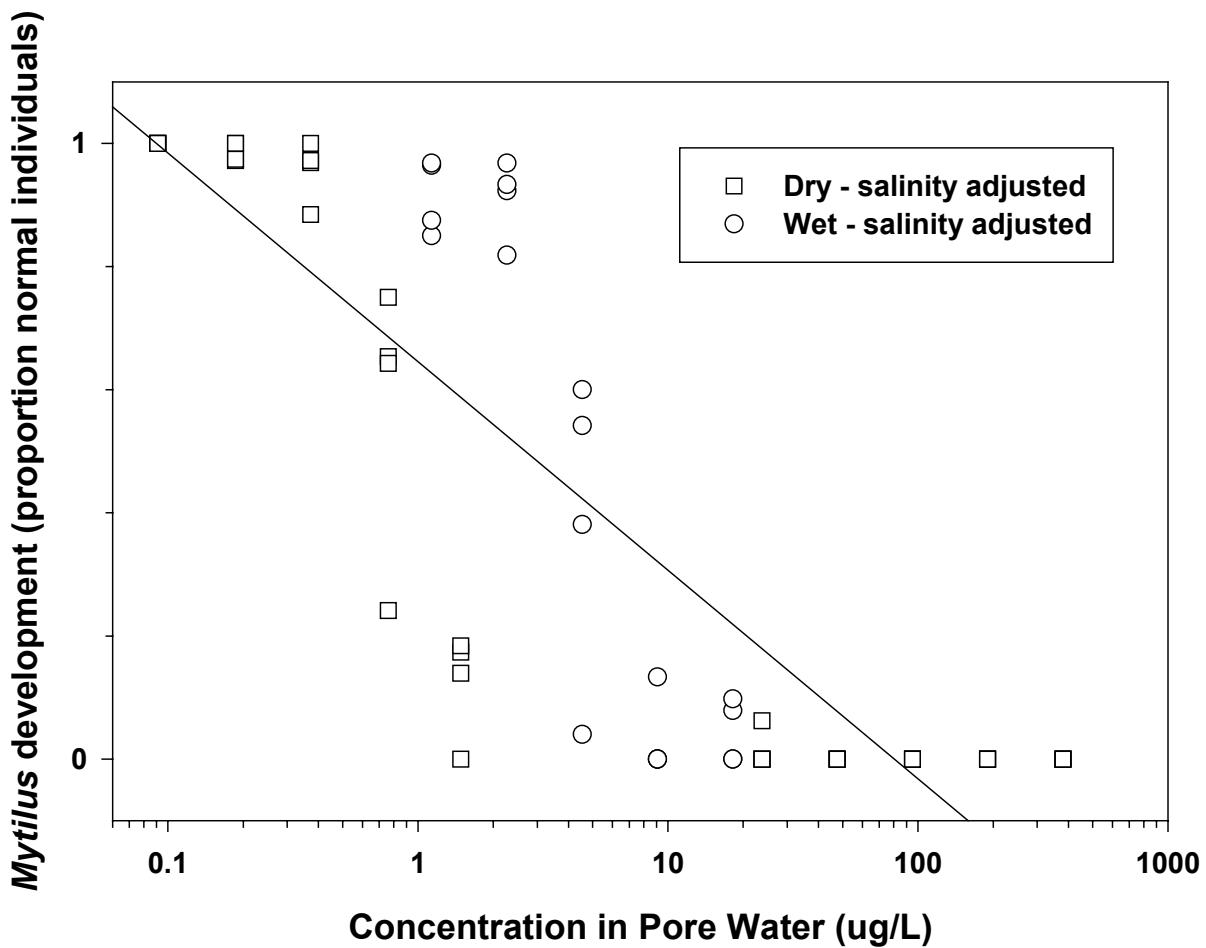
**Figure 3-37. High MW PAHs in Pore Water vs. *Mytilus* Toxicity**



$$(\text{Arcsine Normal}) = 0.39 - 0.20(\log[\text{pore water}]); r^2=0.83$$

Note: This figure is an example; full data are presented in Appendix H.

**Figure 3-38. Total PAHs in Pore Water vs. *Mytilus* Toxicity**



$$(\text{Arcsine Normal}) = 0.98 - 0.22(\log[\text{pore water}]); r^2=0.76$$

Note: This figure is an example; full data are presented in Appendix H.