Sediment Quality Assessment Study at the B Street/Broadway Piers, Downtown Anchorage, and Switzer Creek, San Diego

Phase I Sampling and Analysis Plan

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Prepared by:
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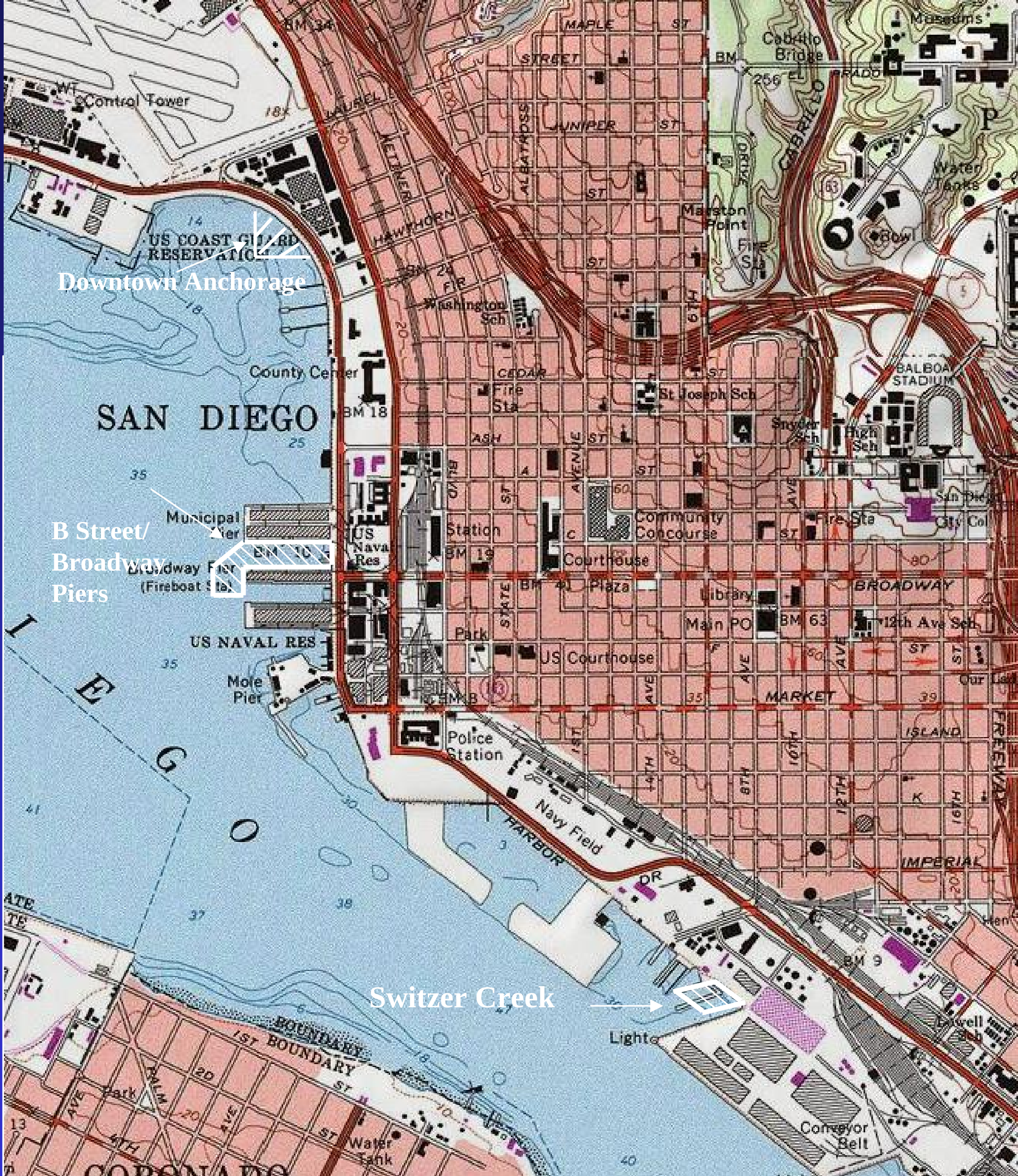
Davis, CA

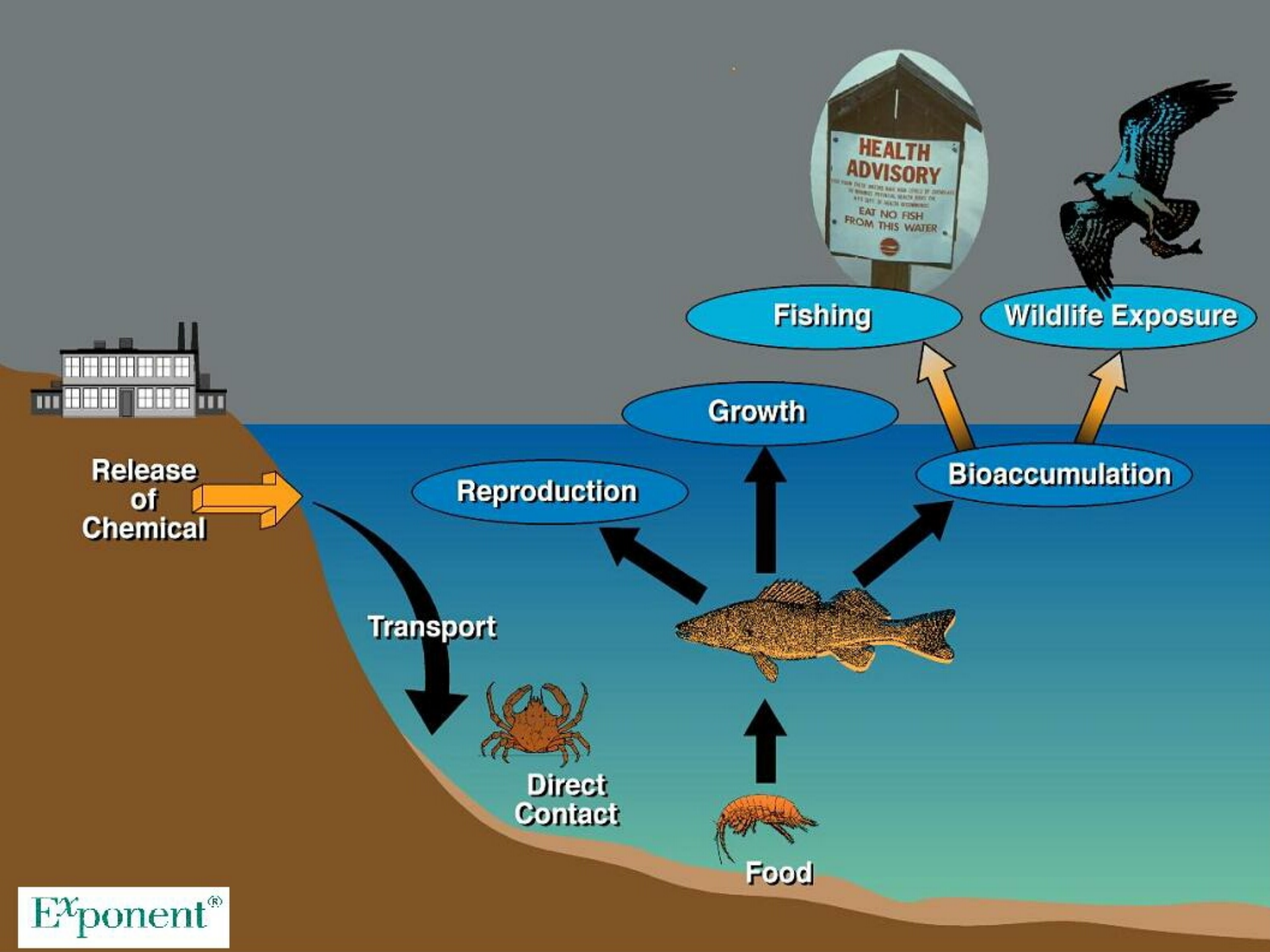
In cooperation with:
San Diego Regional Water Quality Control Board
City of San Diego
Port of San Diego

and

Steven Bay
Southern California Coastal Water Research Project
Westminster, CA



Downtown Anchorage
B Street/
Broadway
Piers
Switzer Creek
SAN DIEGO
US COAST GUARD
RESERVATION
Control Tower
County Center
Municipal
Pier
Broadway Pier
(Fireboat Sta)
US NAVAL RES
Mole
Pier
Police
Station
Navy Field
HARBOR
DR
Light
Conveyor
Belt
Washington
Sch
Fire
Sta
St Joseph Sch
Station
Courthouse
Plaza
Community
Concourse
Library
Main PO
Park
US Courthouse
12th Ave Sch
Fire Sta
City Col
BALBOA
STADIUM
High
Sch
Marston
Point
Cabrillo
Bridge
Museums
Water
Tanks
Bowl
BROADWAY
MARKET
ISLAND
IMPERIAL
FREEWAY
MAPLE
JUNIPER
LAUREL
HAWTHORN
CEDAR
ASH
BOUNDARY
CORONADO
Water
Tank


HEALTH ADVISORY
EAT NO FISH FROM THIS WATER
Fishing
Wildlife Exposure
Growth
Reproduction
Bioaccumulation
Release of Chemical
Transport
Direct Contact
Food

Exponent®

Phase I
Measure Spatial Extent and Magnitude of Sediment Impacts

Measure sediment quality indicators at many stations:

Sediment contamination

Sediment toxicity

Benthic community structure

Bioaccumulation

Identify and map areas of impaired or potentially impaired beneficial uses:

Aquatic life

Human health

Wildlife

Phase II (TMDL Actions)

Determine cause of impairment

Sediment/Porewater TIEs

Additional sediment/tissue chemistry

Document key indicators of impact

Temporal study of toxicity and benthic community impacts

Determine sources

Spatial analysis of data

Historical data review

Watershed/facility sampling

Phase III (Cleanup Actions)

Identify indicator chemicals

Calculate aquatic life cleanup levels

Porewater chemistry/toxicity

Derive cleanup levels using AET, EqP, or other methods

Calculate human health cleanup levels

Resident seafood tissue analysis

Risk modeling

Calculate wildlife cleanup levels

Resident animal tissue analysis

Risk modeling

Determine cleanup boundaries

Core sampling

TMDL Implementation

Implement Source Control

Verify Source Reduction

Cleanup Implementation

Evaluate remedial options for site cleanup

Implement Cleanup Actions

Sampling

Moss Landing Marine Laboratories (Russell Fairey)

Chemical Analyses
(CRG Laboratories – Rich Gossett)

- Trace elements
- Pesticides
- PCBs
- Polycyclic aromatic hydrocarbons (PAHs)
- Total Organic Carbon

Physical Analyses
(AMEC – Barry Snyder)

- Sediment Grain Size

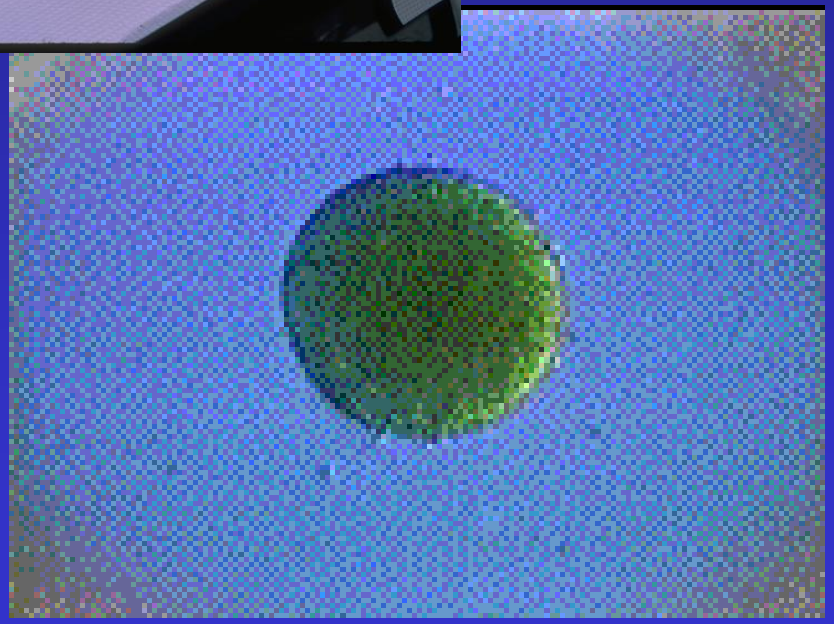
Laboratory Toxicity Testing (UC Davis – Marine Pollution Studies Lab)

Amphipod 10-d survival test

- Measures acute effects

Mussel embryo development @ sediment-water interface

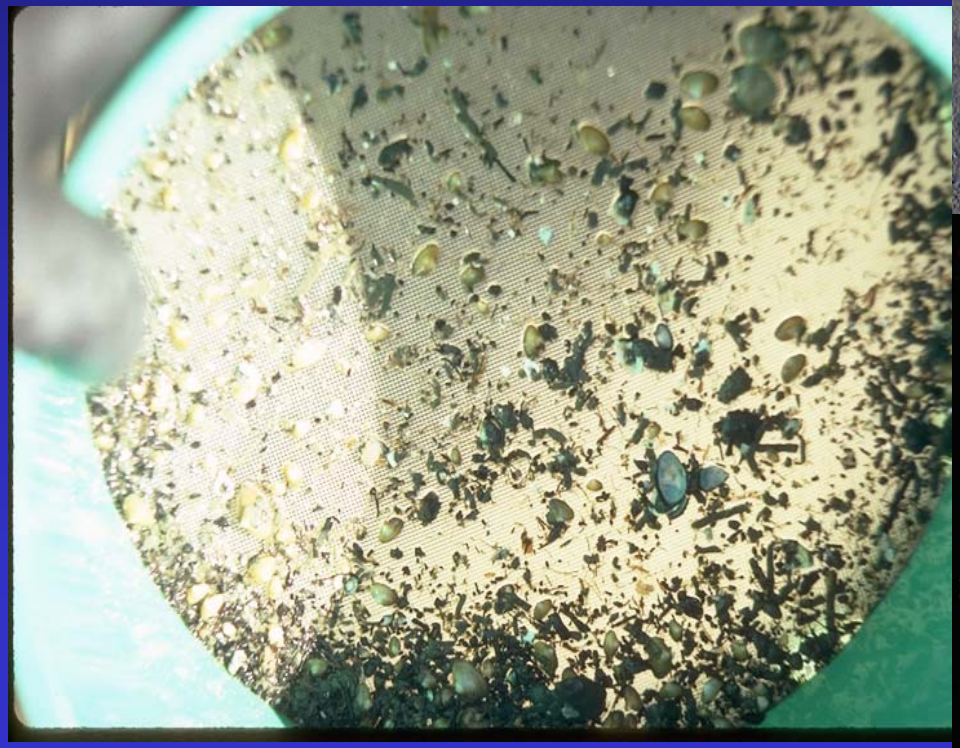
- 48-h exposure
- Sublethal endpoint



Sea Urchin Fertilization test in porewater

Benthic Community Characterization
(Jim Oakden – Moss Landing Marine Laboratories)

- Measure of chronic impacts
- BPTCP methods/Bight ’98 methods



Bivalve molluscs

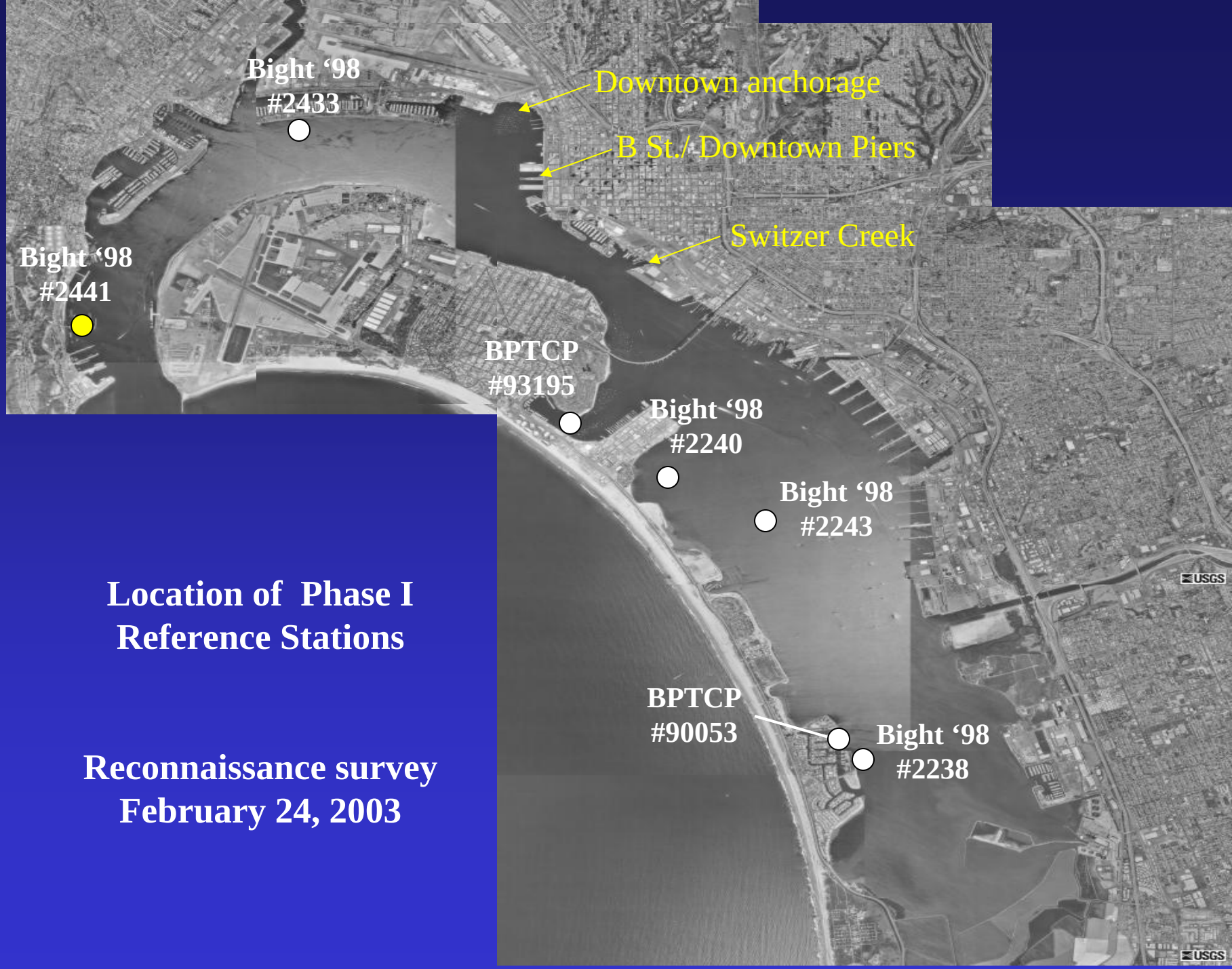
Crustacea

Polychaetes

Bivalve (*Macoma nasuta*) 28-d sediment bioaccumulation test (AMEC/CRG labs)

U.S. EPA / U.S. ACOE methods

- **Measures contaminant uptake from sediments**
- **Data may be used to evaluate potential for food chain transfer**



Location of Phase I Reference Stations

Reconnaissance survey
February 24, 2003

Reference station reconnaissance toxicity test results

Station#	Amphipod survival*	SWI embryo dev.**
2238	80%	99% (70%)
2240	79%	92% (62%)
2243	91%	93% (55%)
2433	92%	93% (53%)
90053	52%	96% (49%)
93195	81%	95% (51%)
Control	97%	95% (62%)

*Control adjusted survival, ** sea urchin embryo development

Reference Station Chemistry Results

Chemical	2238	2240	2243	2433	90053	93195	Guideline#
Metals (ug/g dry)							
Cadmium	0.24	0.15	0.11	0.25	0.23	0.17	4.21
Copper	82.2	98.8	60.6	59.6	100	138	270
Lead	24.2	34.9	20.5	18.9	26.1	47.9	112.2
Silver	0.8	1.13	0.72	0.65	1.03	1.21	1.77
Zinc	235	227	128	134	275	283	410
Organics (ng/g dry)							
Tot Chlordane*	2.5	2.5	2.5	2.5	2.5	2.5	6
Dieldrin*	0.5	0.5	0.5	0.5	0.5	0.5	8
Tot. PAHs (ng/ g oc dry)	5.4	28.1	25.6	64.9	11.5	36.5	1800
Tot. PCBs*	18	18	18	18	18	18	400
SQGQ1**	0.237	0.272	0.188	0.189	0.271	0.322	
TOC (%)	1.62	1.30	0.74	1.01	1.43	1.53	
Grain Size							

*all values below MDL

** after Fairey et al. 2001

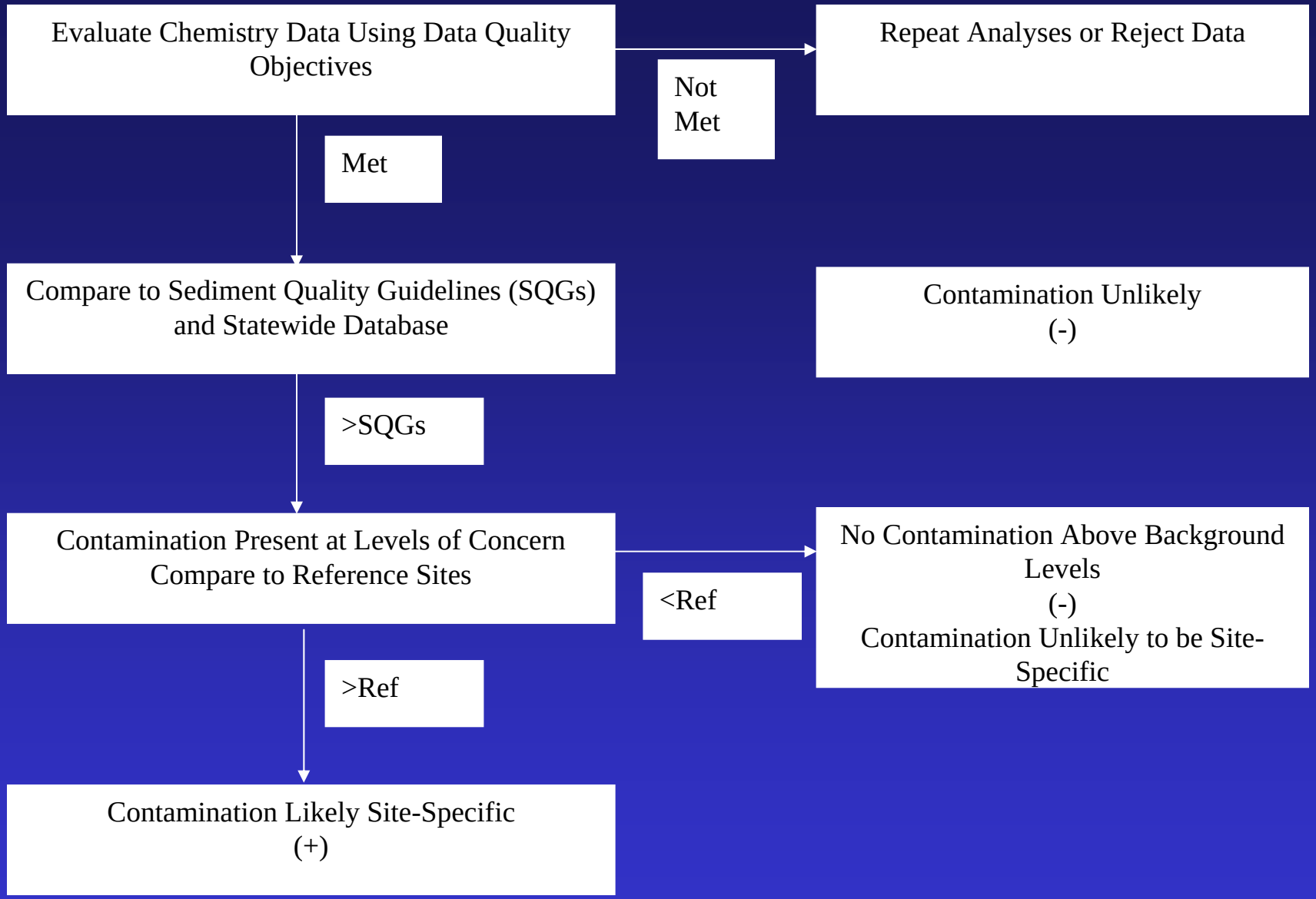


Figure 4-1. Procedure for assessing sediment chemistry data. Symbols in parentheses indicate the classification of the station as either contaminated (+) or uncontaminated (-) relative to the potential for impacts on aquatic organisms or humans.

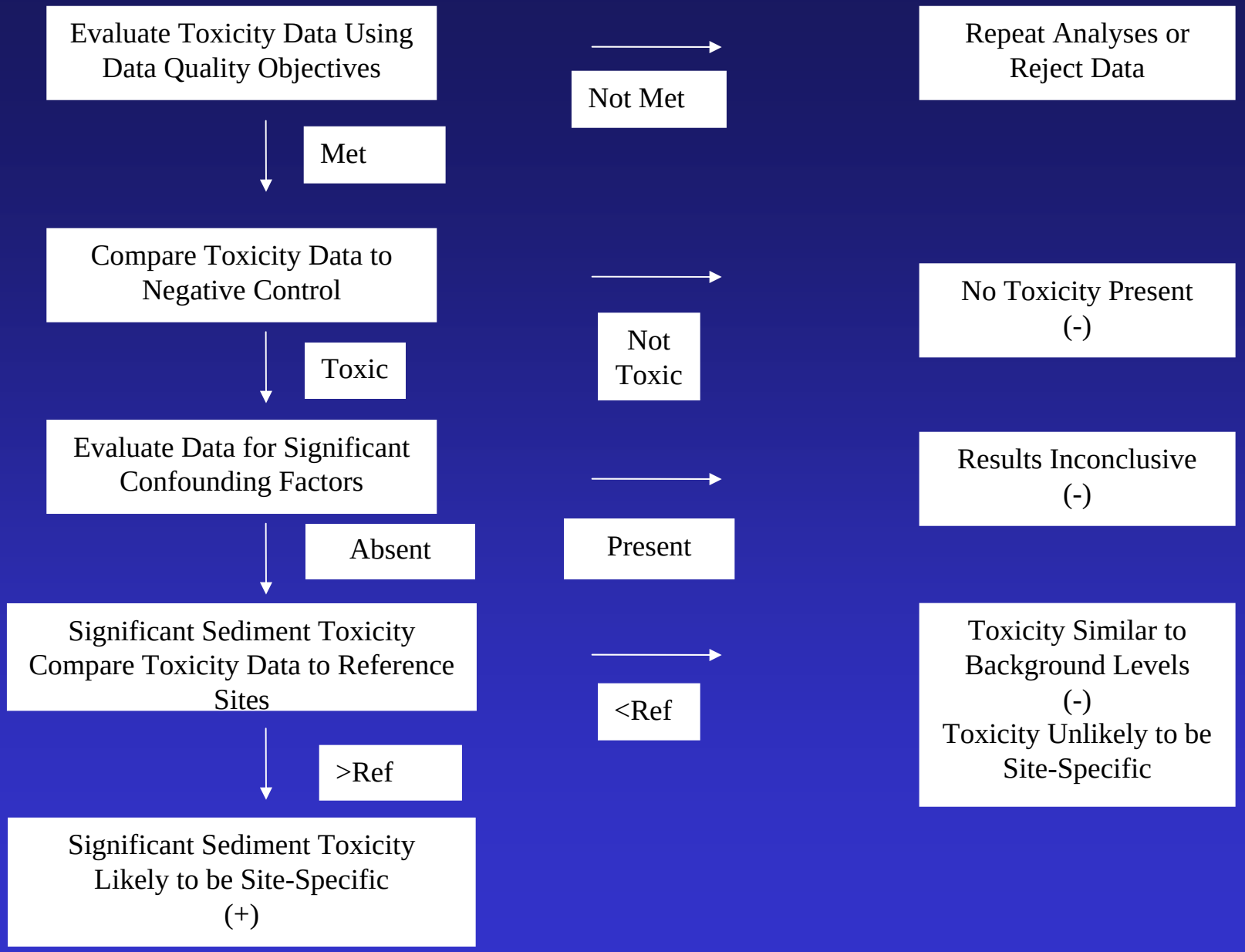


Figure 4-2. Procedure for assessing sediment toxicity data. Symbols in parentheses indicate the classification of the station as either impacted (+) or unimpacted (-) relative to the potential for effects on aquatic organisms.

Weight-of-Evidence Decision Matrix

Sediment Contam.	Toxicity	Degraded Benthos	Bioaccum-ulation	Beneficial Use Impairment		Recommended Action
				Aquatic Life	Human/ Wildlife	
				Highly	Possible	Phase II studies
+	+	+	+	Likely		Phase III studies
						Refine Health Assess.
+	-	+	-	Likely	Unlikely	Phase II studies?
+	+	-	-	Likely	Unlikely	Phase III studies?
+	-	+	+	Likely	Possible	Phase II studies?
+	+	-	+	Likely	Possible	Phase III studies?
						Refine Health Assess.
+	-	-	+	Unlikely	Possible	Refine Health Assess.
-	-	-	+	Unlikely	Possible	Refine Health Assess.
+	-	-	-	Unlikely	Unlikely	No further action
				Highly	Highly	
-	-	-	-	Unlikely	Unlikely	No further action

Toxicity Identification Evaluations (TIEs)

- **Phase I – characterization: e.g., metals vs organics, ammonia, H_2S**
- **Phase II – identification: specific metal or organic compound(s) responsible for toxicity**
- **Phase III – confirmation**
- **Consider confounding factors: grain size, ammonia, pH etc.**

Once identified, chemical responsible for toxicity are emphasized for later studies :

Source identification and control

Phase II studies: Contract process initiated
Studies to begin in 2004

- **Causes of impairment**
- **Temporal variability**
- **Sources of contaminants**

Sediment TMDL Projects
@

B Street / Broadway Piers

Downtown Anchorage

Switzer Creek

Anderson@ucdavis.edu
831-624-0947

Toxic Hotspot Designation:
Bay Protection Toxic Cleanup Program
(Fairey et al. 1996, 1998)

B Street/Broadway Piers:

Benthic community degradation

Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), copper, chlordane, and chemical mixtures

Downtown Anchorage:

Toxicity

Metal and organochlorine pesticide contamination

Benthic community degradation.

Switzer Creek:

Toxicity

Benthic community degradation

Elevated concentrations of copper, PAHs, chlordane and chemical mixtures