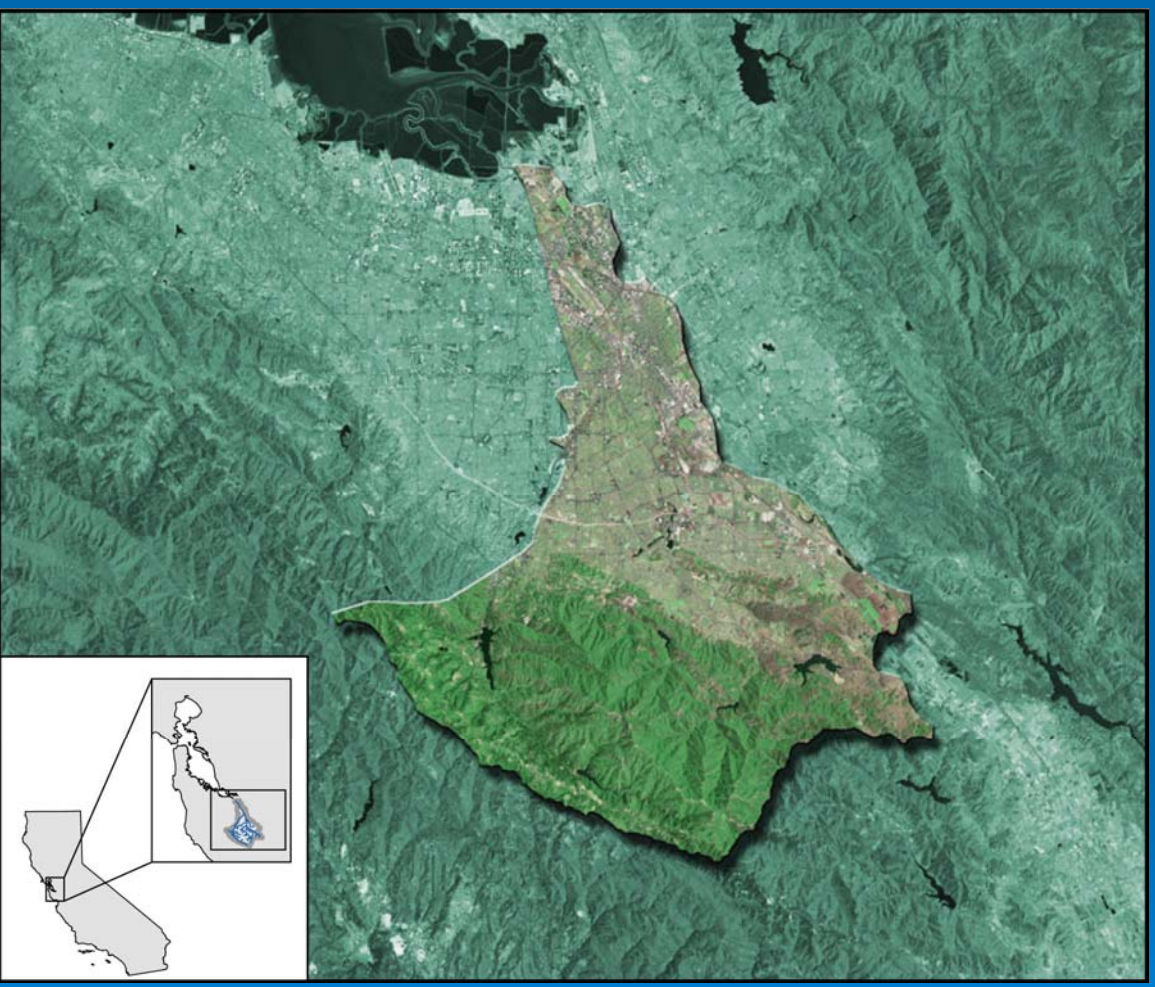
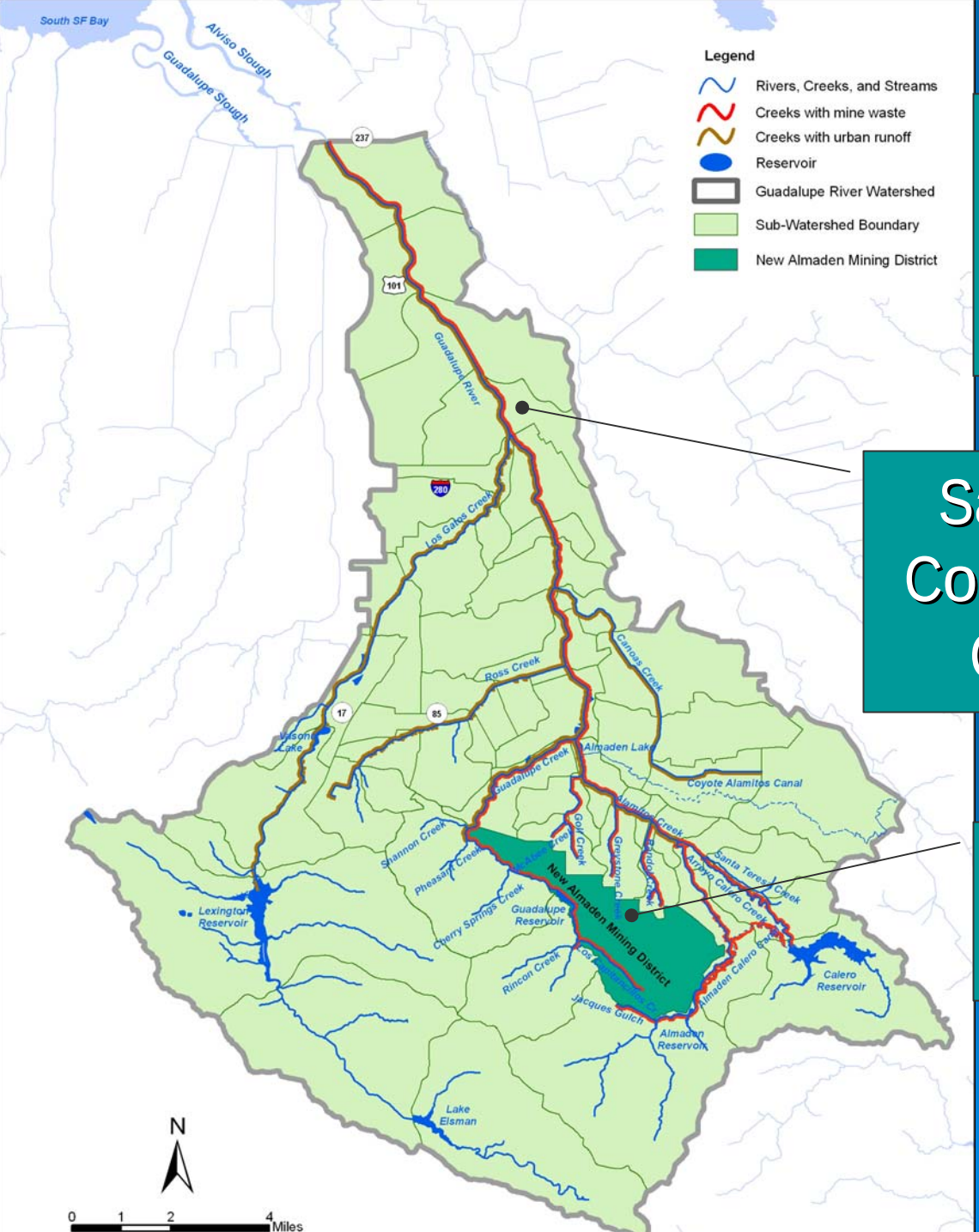


Guadalupe River Watershed Mercury TMDL

Carrie Austin
SF Bay Water Board



Welcome to the Guadalupe River Watershed!

San Jose Convention Center

New Almaden Mining District

Citation: figure by Tetra Tech

TMDL Elements

- Problem Statement
- Numeric Targets
- Source Analysis
- Linkage Analysis
- Allocations
- Implementation

CONCEPTUAL MODEL

Mercury Behavior in the Guadalupe River Watershed

Scientific Basis of the TMDL

Initial Project Phases

- "Synoptic Survey" (Dry Season Sampling)
  - 30 water samples
  - 15 sediment samples
- Draft Conceptual Model
  - Testable hypotheses
  - Write Sampling Plan

Major Sampling Phases

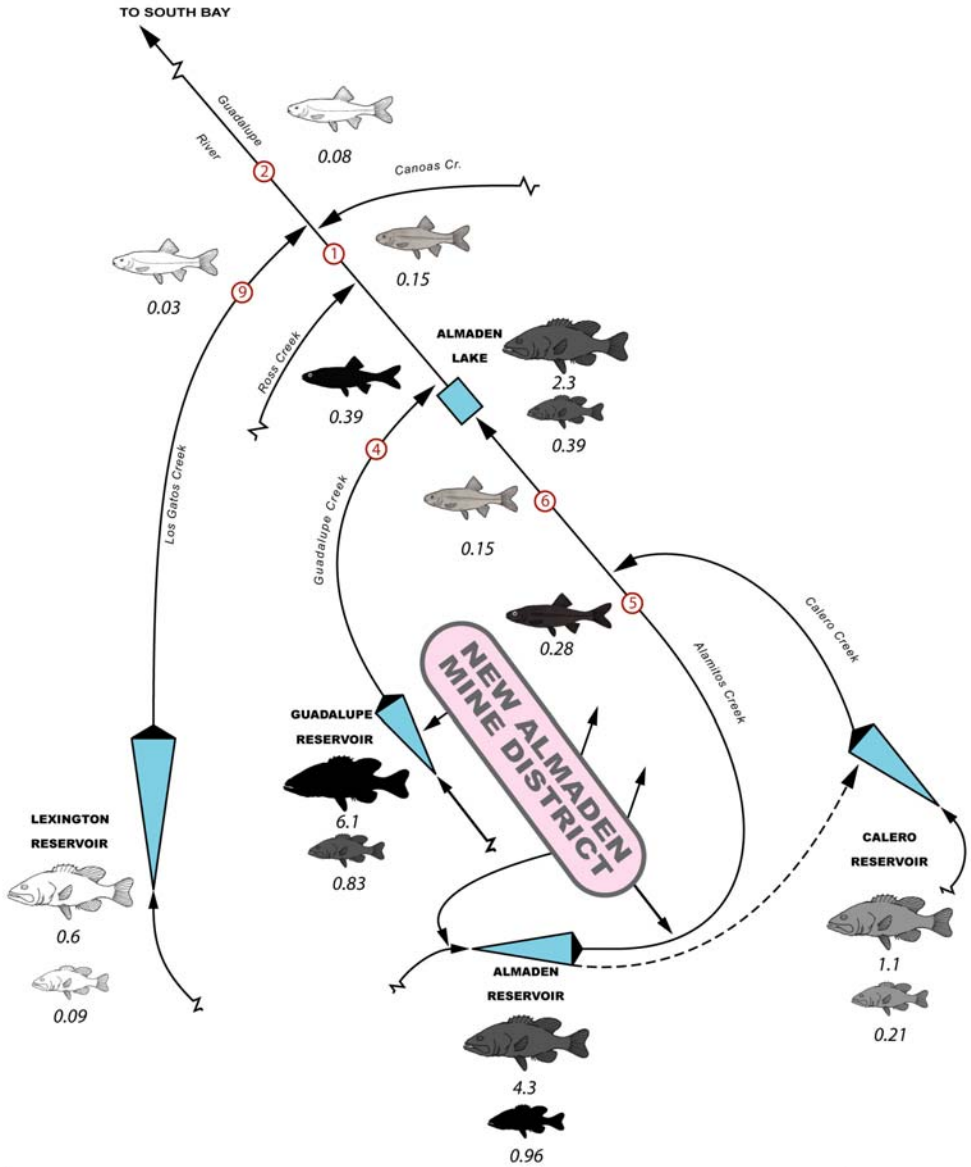
- Wet Season Sampling
  - 105 water samples
  - 30 sediment samples
- Dry Season Sampling
  - 60 water samples (2 reservoirs)
  - 300 fish (40-cm, 8-cm, 5-cm)

Major Reports

- Data Collection Report
- Final Conceptual Model Report

TMDL Elements in Conceptual Model

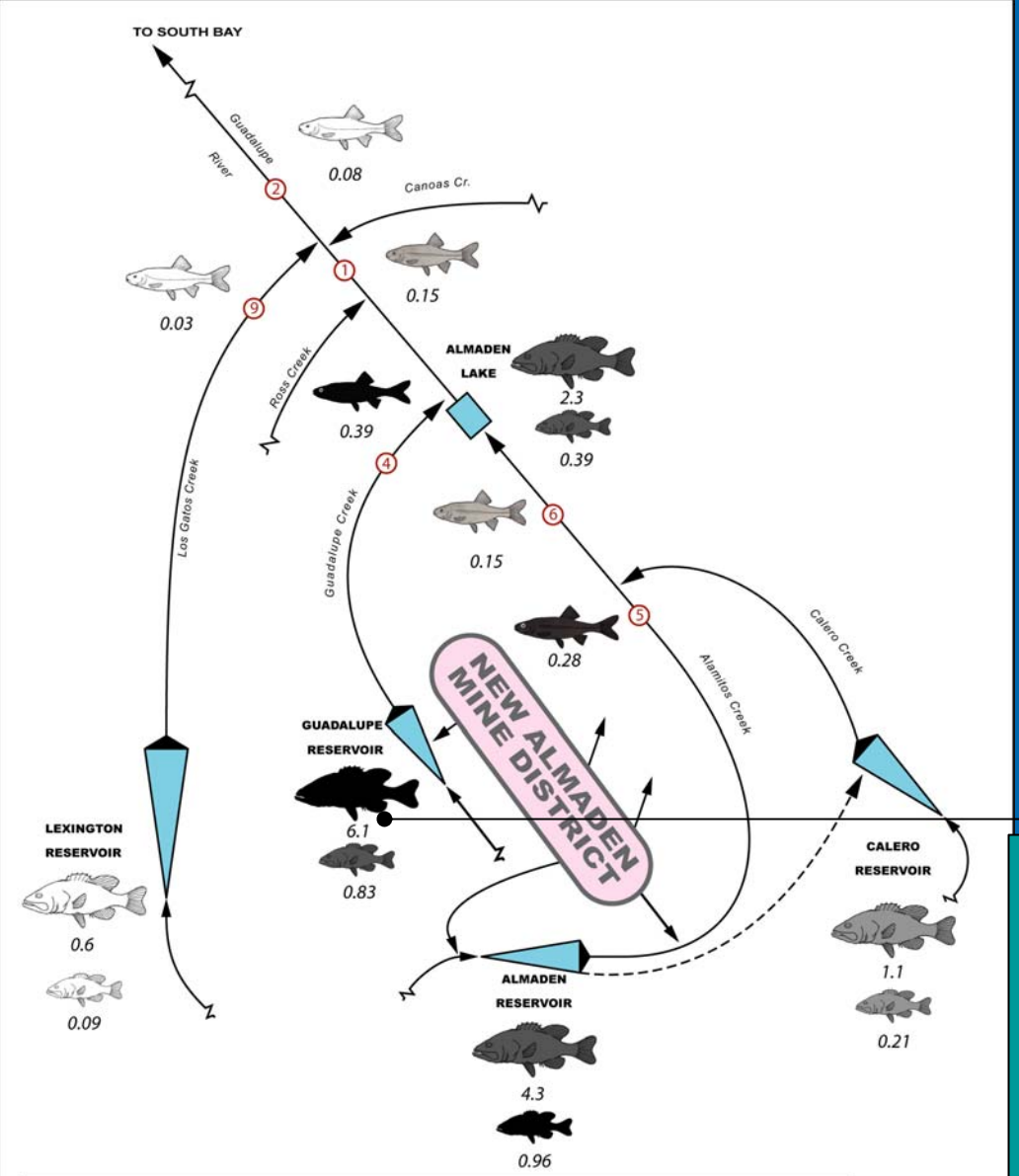
➢Problem Statement	Main environmental concern: “fishable”
• Source Analysis • Linkage Analysis	Is it safe for humans and wildlife to consume the fish?



Problem: Mercury Contaminated Fish

Citation: Figure 3-25

Final Conceptual Model Report (Tetra Tech 2005)

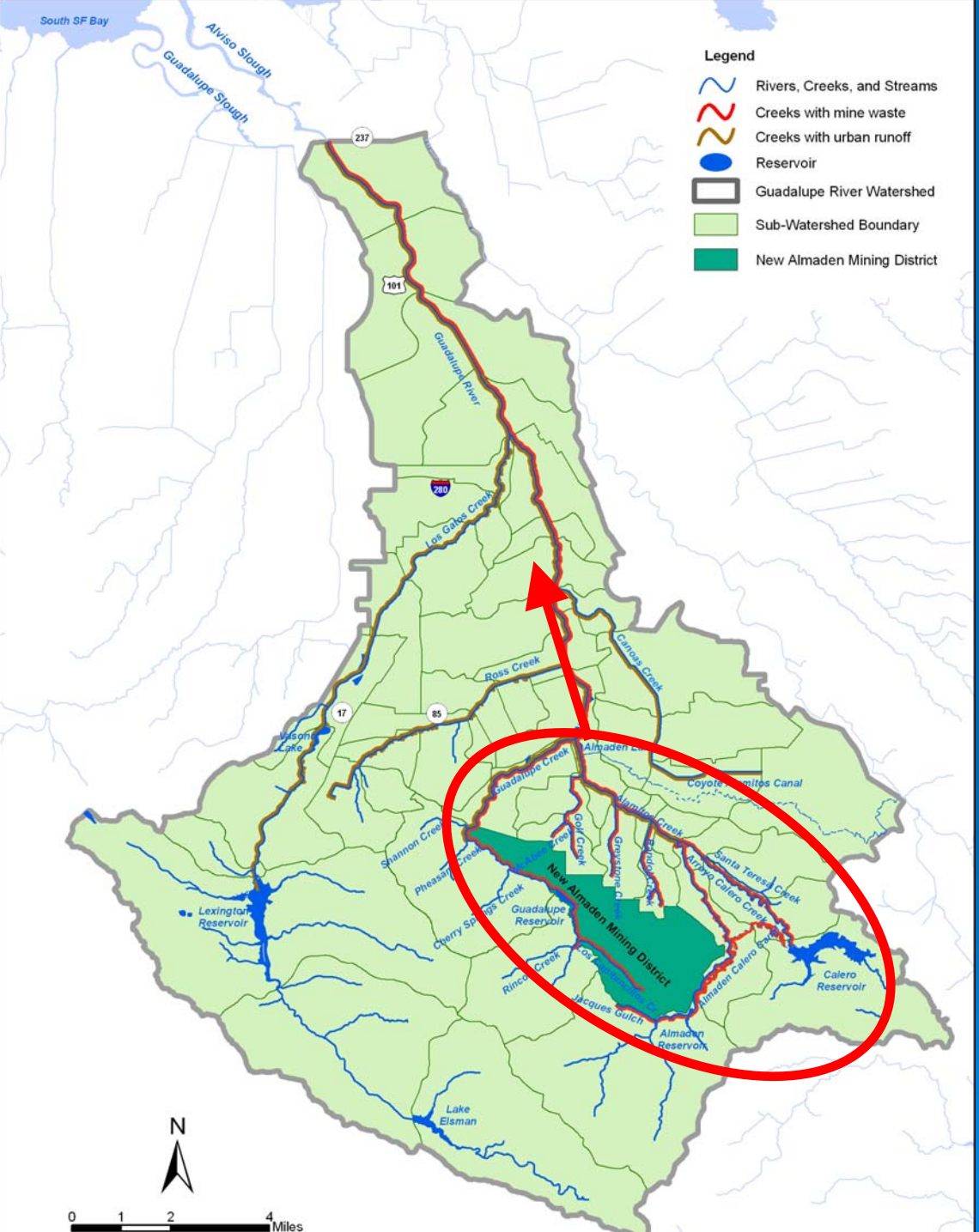


Problem: Mercury Contaminated Fish

Guadalupe Reservoir: 6 ppm average in 40 cm Largemouth bass

TMDL Elements in Conceptual Model

- Problem Statement
- Source Analysis
- Linkage Analysis



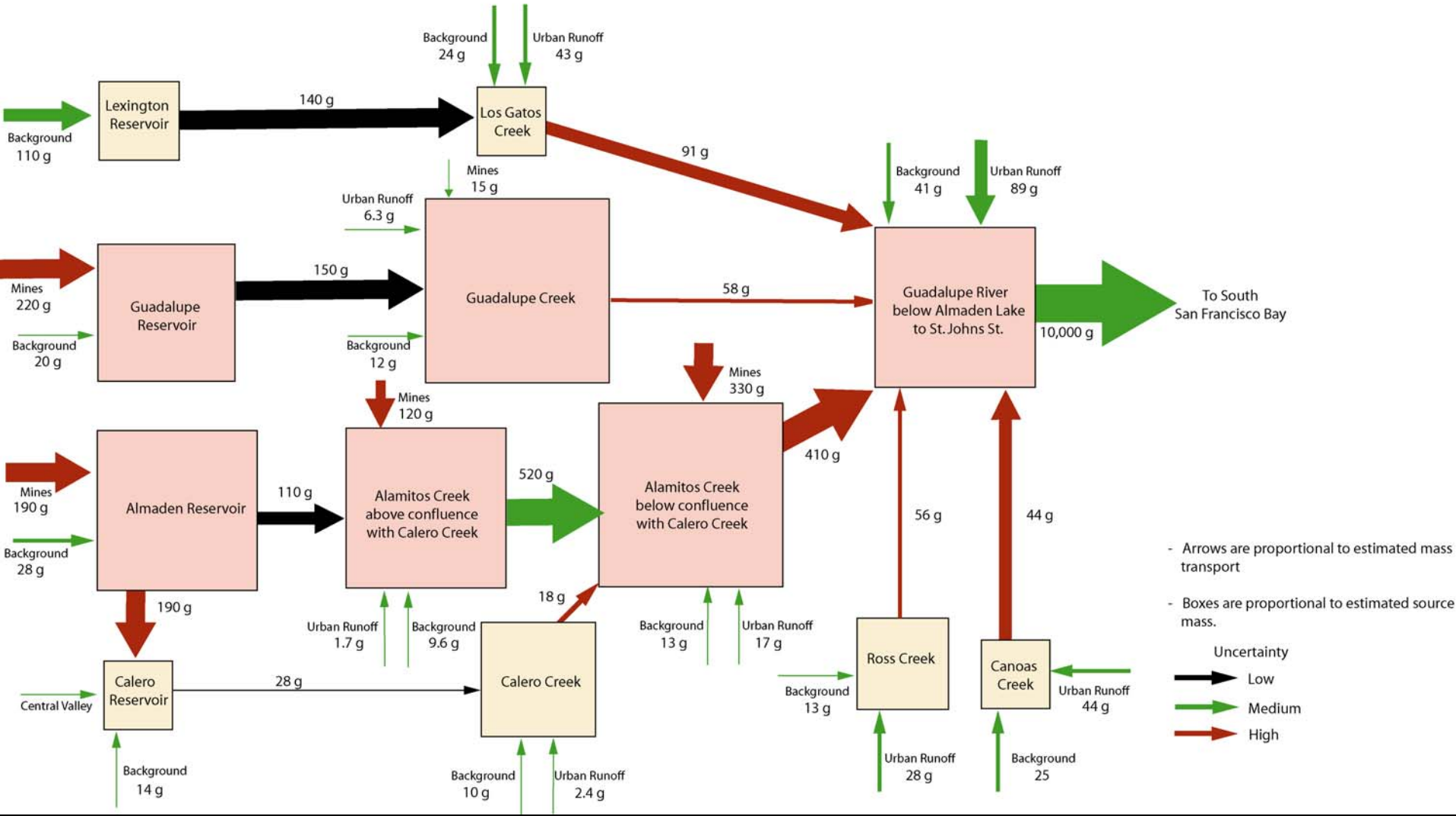
Four Sources

- Mining Waste
- Urban Runoff
- Atmospheric Deposition
- Natural Hg in soil

Citation: figure by Tetra Tech

Wet Season Total Mercury Loads

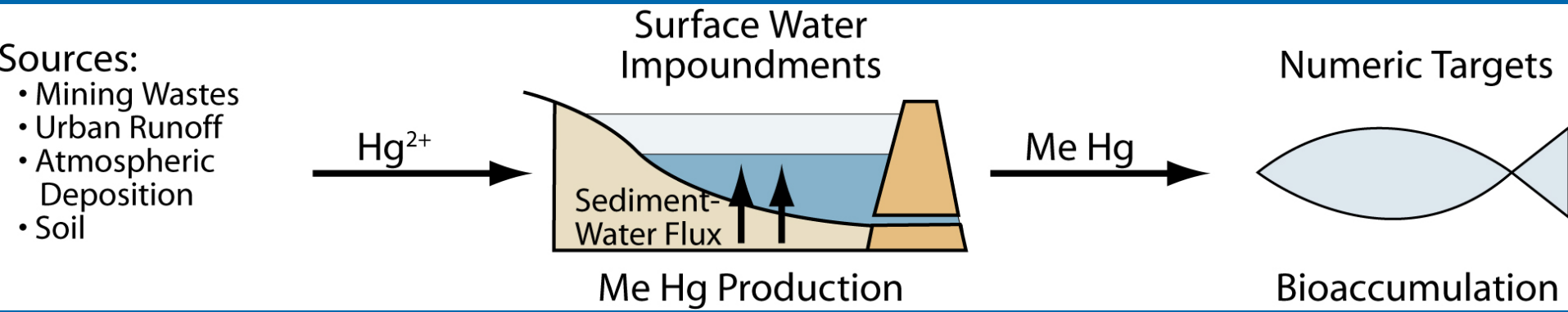
(10/1/2003 to 5/31/2004)



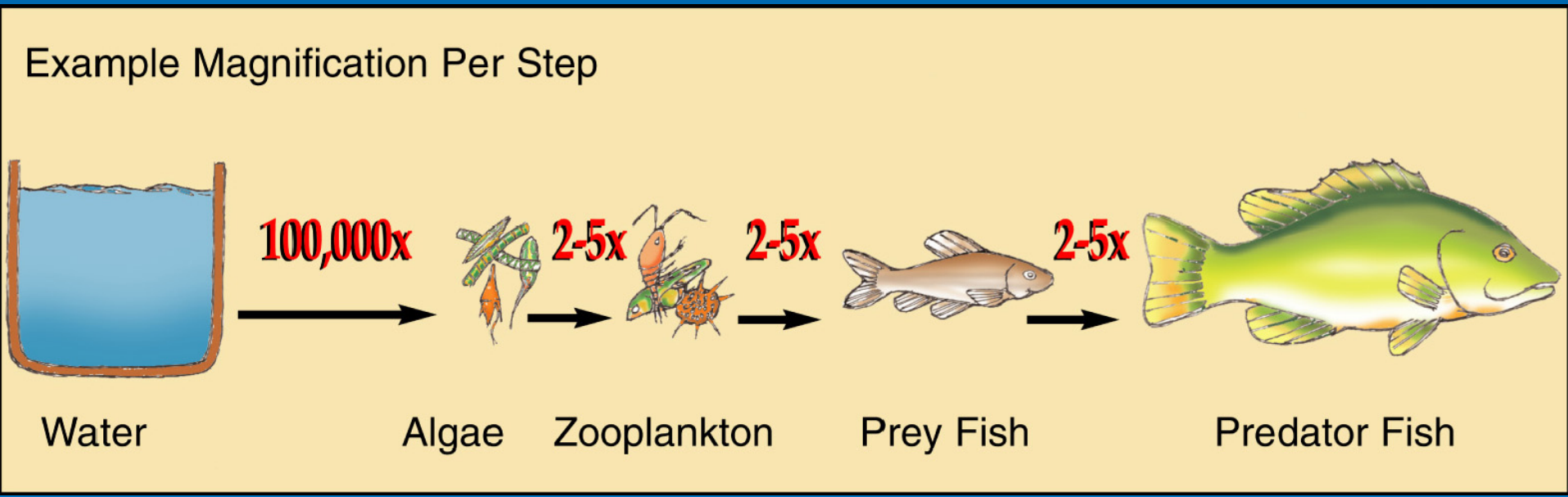
TMDL Elements in Conceptual Model

• Problem Statement • Source Analysis ➢ Linkage Analysis	Sources (Inorganic Mercury) ⬇ Linked Targets (Bioaccumulation of Organic (methyl) Mercury)

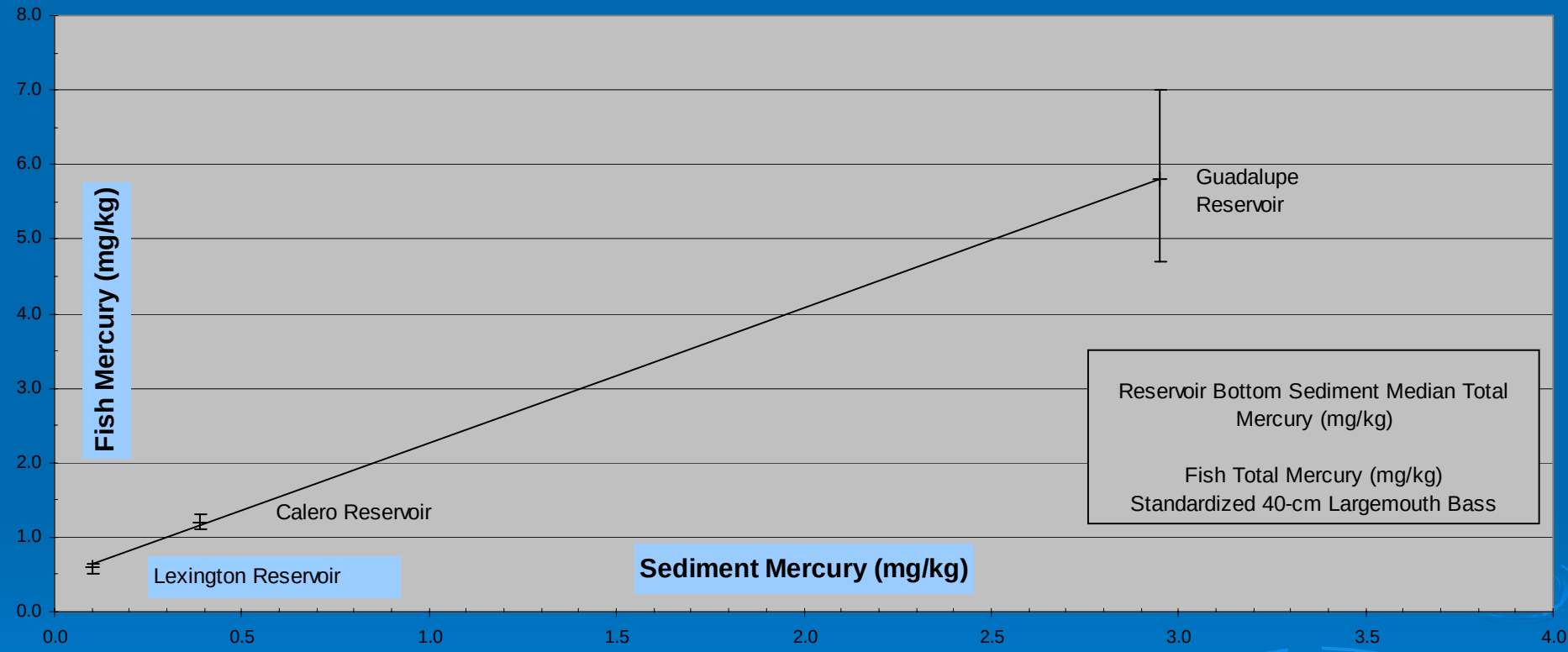
Linkage Between Sources, Methylmercury, and Targets

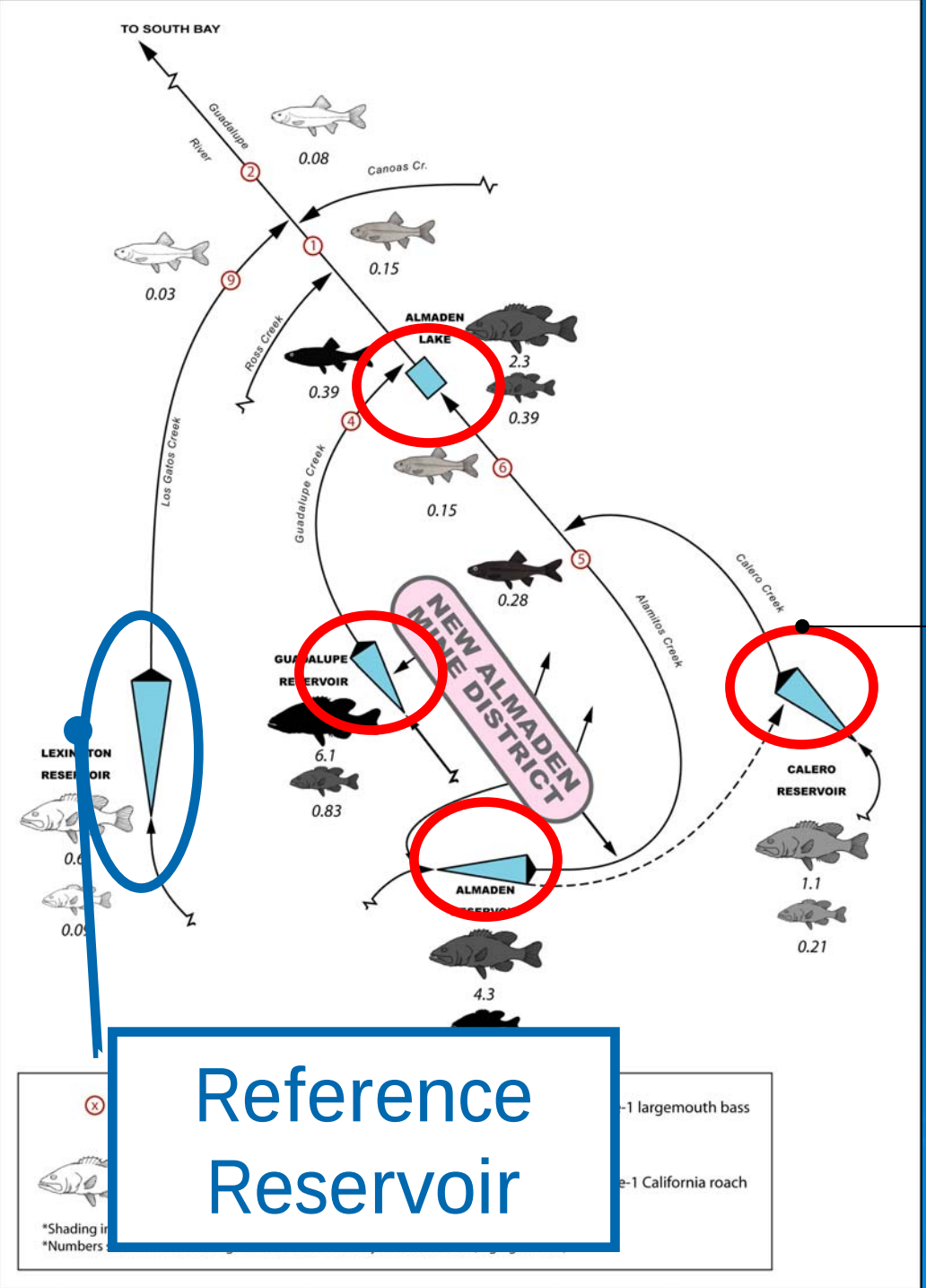


Food Chain Biomagnification of MeHg



Lower $[Hg]_{sed}$ → Lower $[Hg]_{fish}$



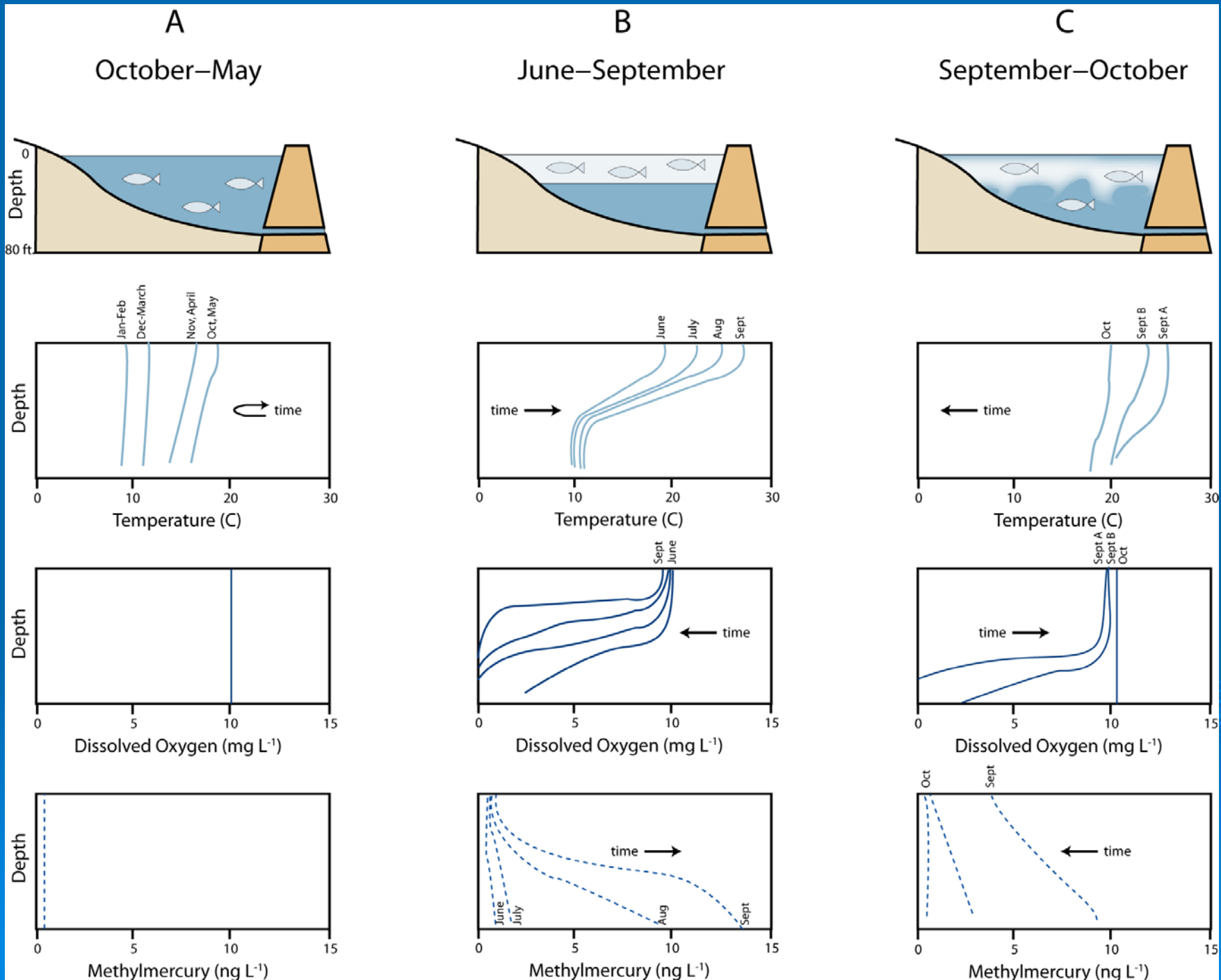


Methylmercury Production in Anoxic Waters is Key

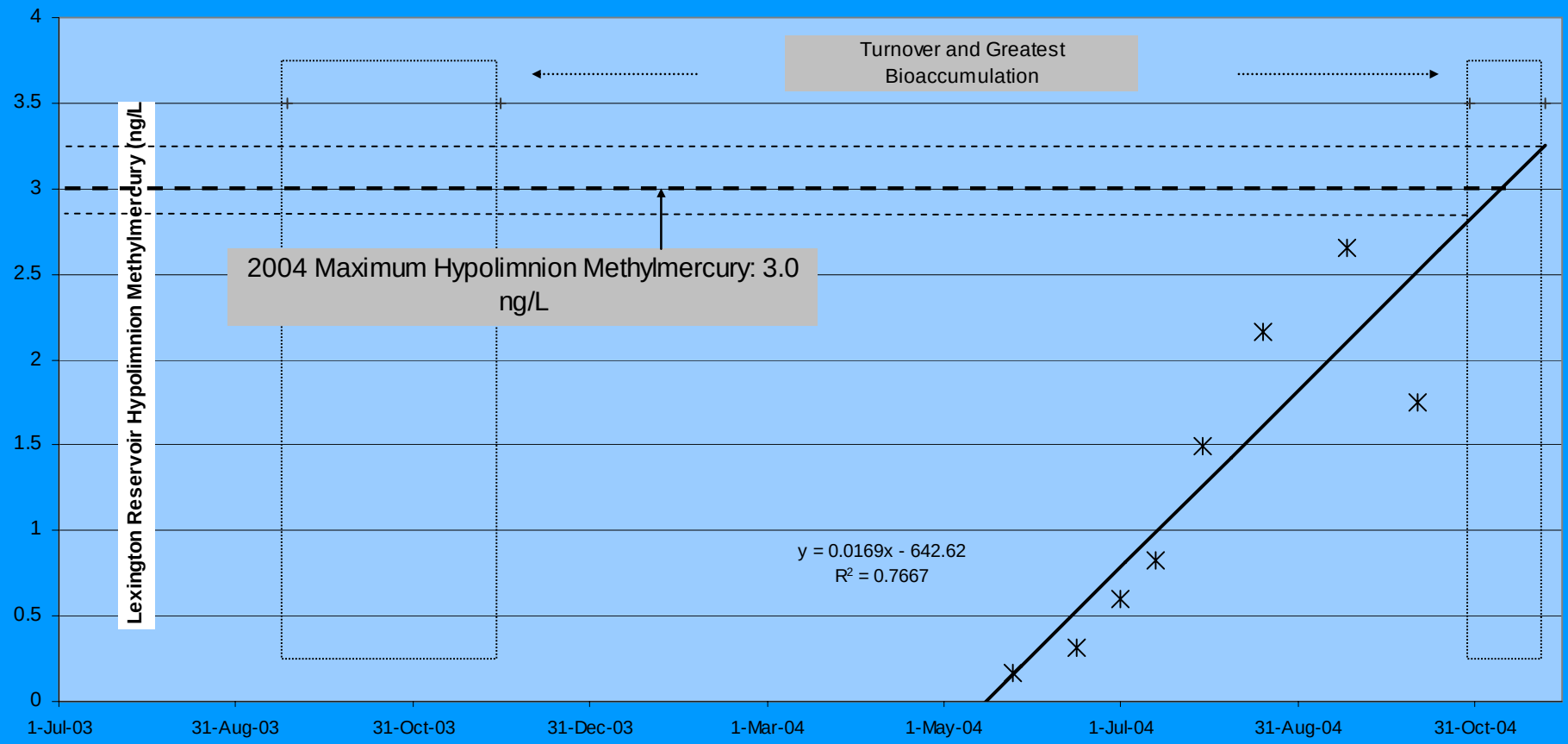
"Impoundments"

Citation: Figure 3-25

Final Conceptual Model Report (Tetra Tech 2005c)


A
October–May
B
June–September
C
September–October
Depth
0
80 ft
Jan-Feb
Dec-March
Nov, April
Oct, May
time
Temperature (C)
June
July
Aug
Sept
Oct
Sept B
Sept A
Dissolved Oxygen (mg L-1)
Methylmercury (ng L-1)

Seasonal Hypolimnion MeHg



TMDL Elements

- Problem Statement
- **Numeric Targets**
- Source Analysis
- Linkage Analysis
- Allocations
- Implementation

Numeric Targets = Goals or endpoints which equate to attainment of Water Quality Standards = "Fishable"

Wildlife Targets

TL3 Fish 50 – 150 mm	TL3 Fish 150 – 350 mm
0.05 ppm	0.10 ppm
USFWS calculation	

Human Health Targets

Typical Size and Species of Fish Consumed	Equivalent in TL4 Fish (40 cm Largemouth bass)
0.3 ppm	0.6 ppm
USEPA MeHg criterion	

Target = $\frac{\text{BW x Dose}}{\text{Consumption}}$

BW = Body Weight

Dose = Safe Dose of MeHg

Consumption = Fish Intake at Trophic Level

TMDL Elements

- Problem Statement
- Numeric Targets
- Source Analysis
- Linkage Analysis
- ➢ Allocations
- Implementation

TMDL = total allowed pollutant amount

TMDL = combination of the allocations to point and non-point sources

Impoundment & Mining Allocations

Based on Fish in Reference Reservoir meet Targets ("Fishable")

40-cm Largemouth bass:

0.6 ppm < 0.66 ppm TL4 human health target

Age-1 Largemouth bass:

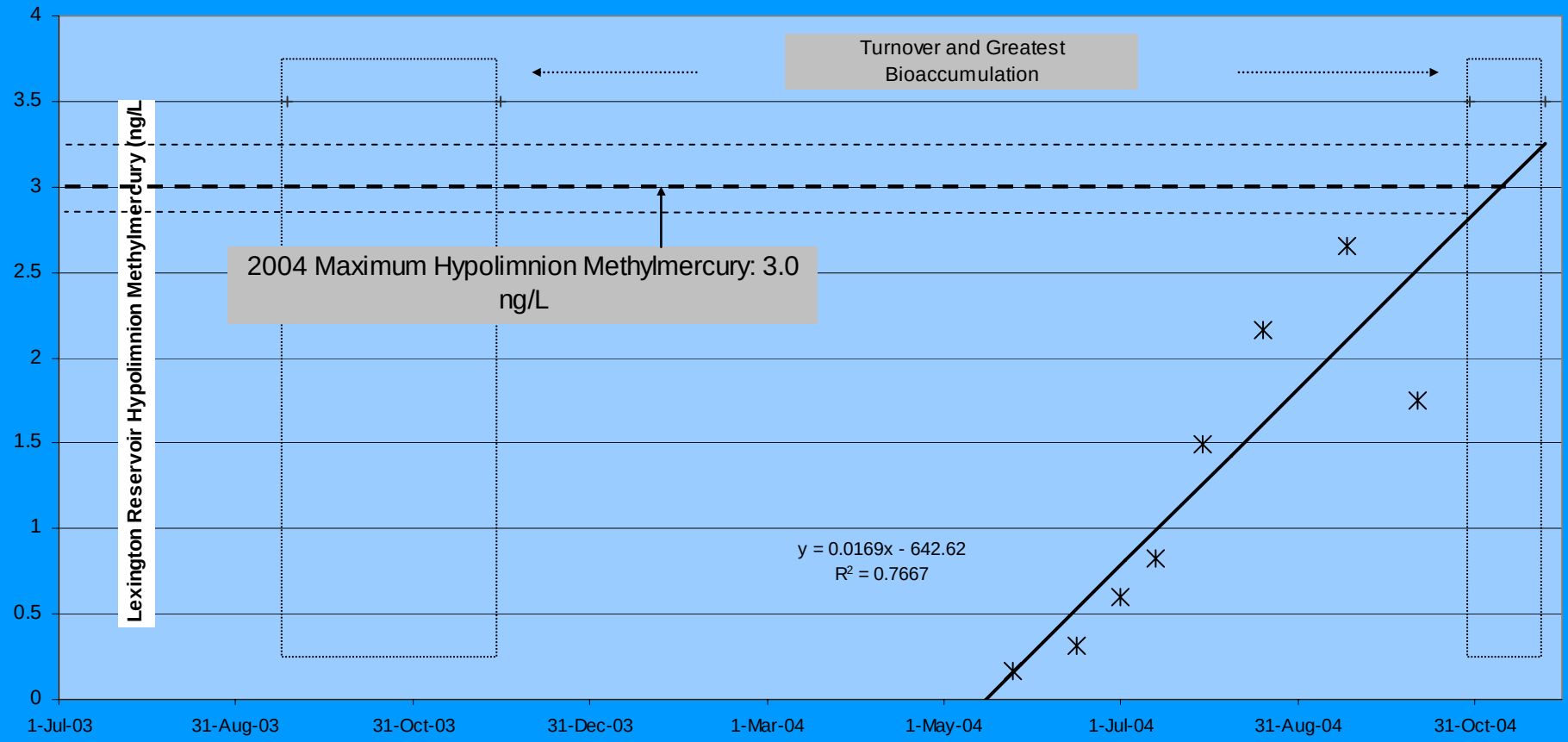
0.09 ppm @ 89 mm length equals

0.045 in TL3 < 0.05 ppm wildlife target

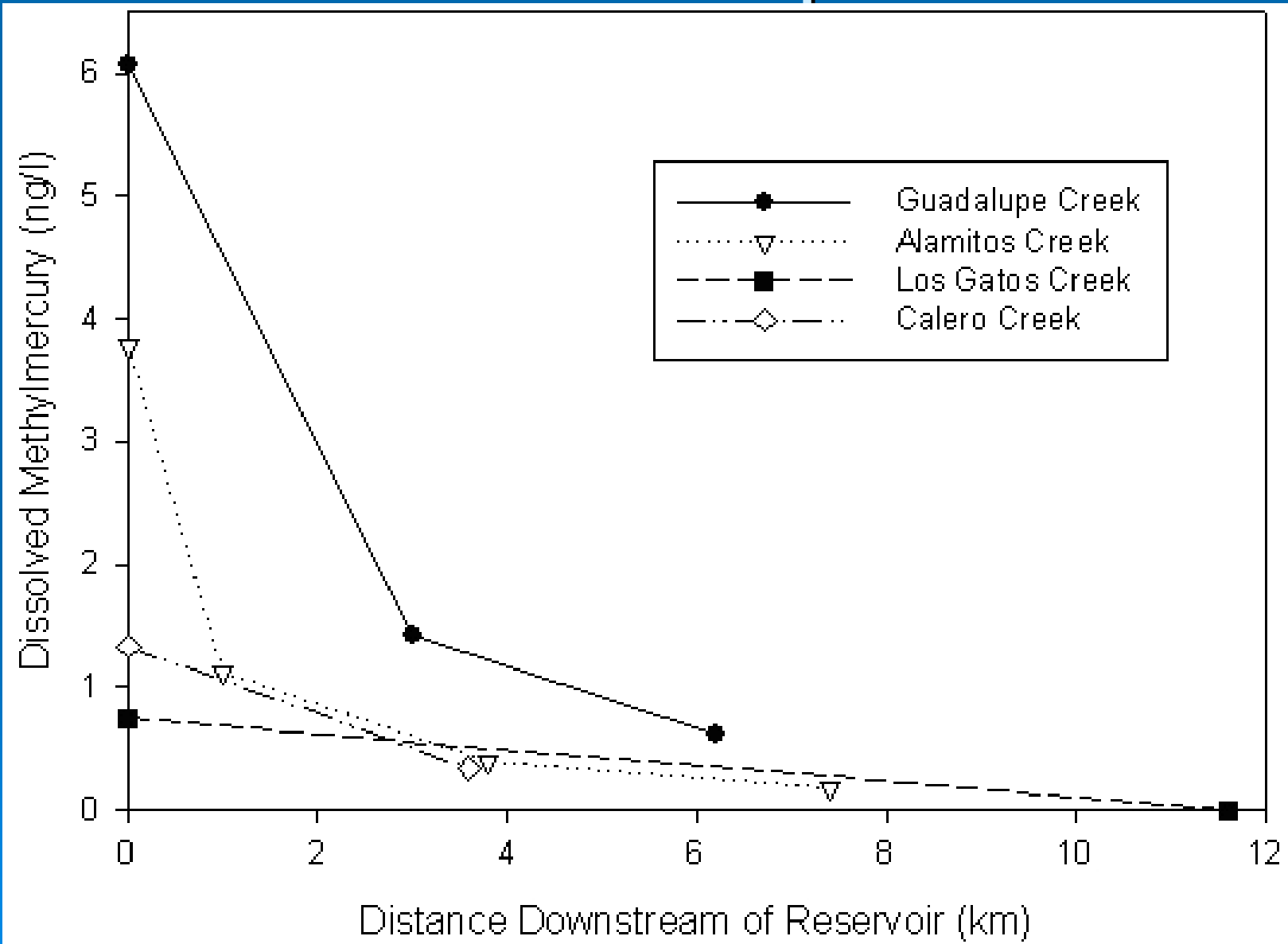
Standardized 40 cm Largemouth Bass in Bay Area Waterbodies (mg/kg wet wt)

Waterbody	Total Hg (mg/kg)
Guadalupe Reservoir	5.8
Almaden Reservoir	3.6
Lake Almaden	2.1
Stevens Creek Reservoir	1.4
Anderson Reservoir	1.3
Calero Reservoir	1.2
Soulajule Reservoir	1.1
Del Valle Reservoir	0.9
Nicasio Reservoir	0.8
Lexington Reservoir	0.6
Lake Chabot	0.6
Lafayette Reservoir	0.4

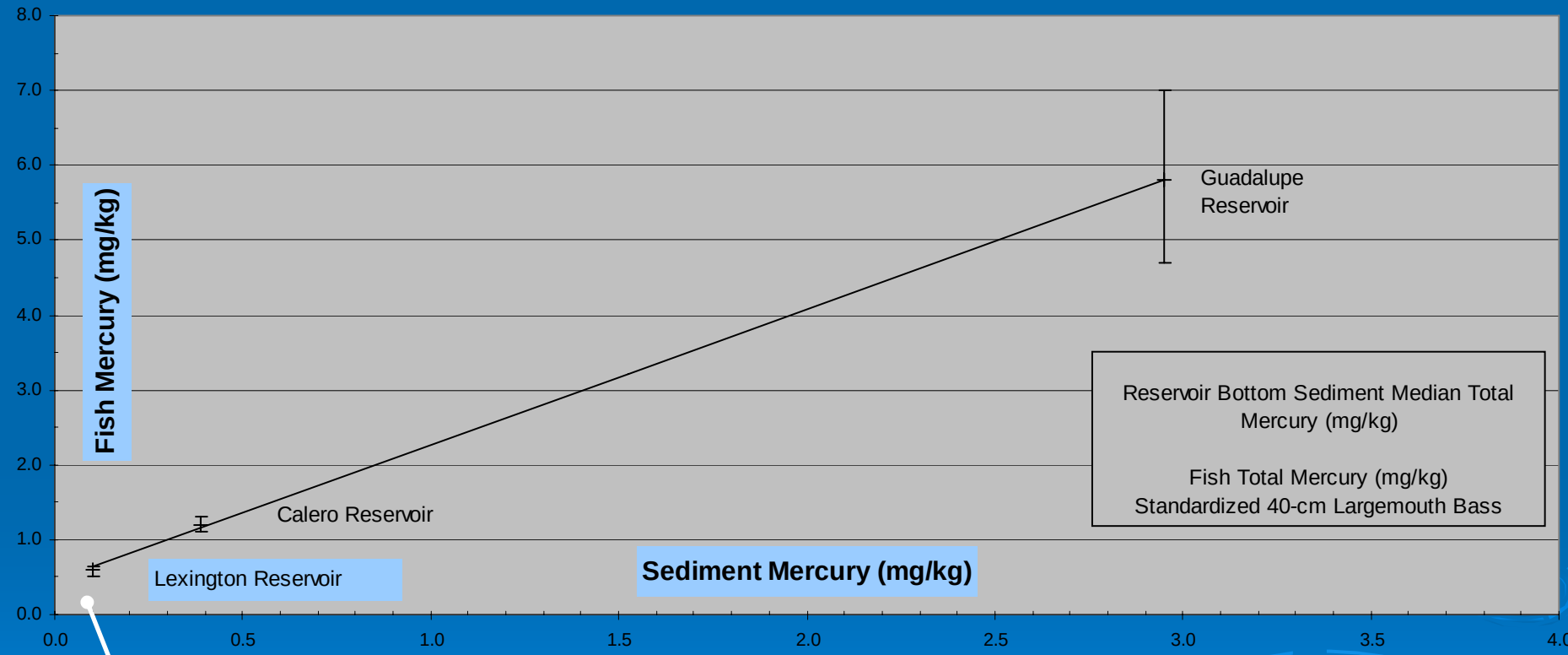
Allocation: Hypolimnion MeHg



Downstream Implications



Mining Waste Allocation



0.1 ppm $[Hg]_{soil}$ into impoundments

TMDL Elements

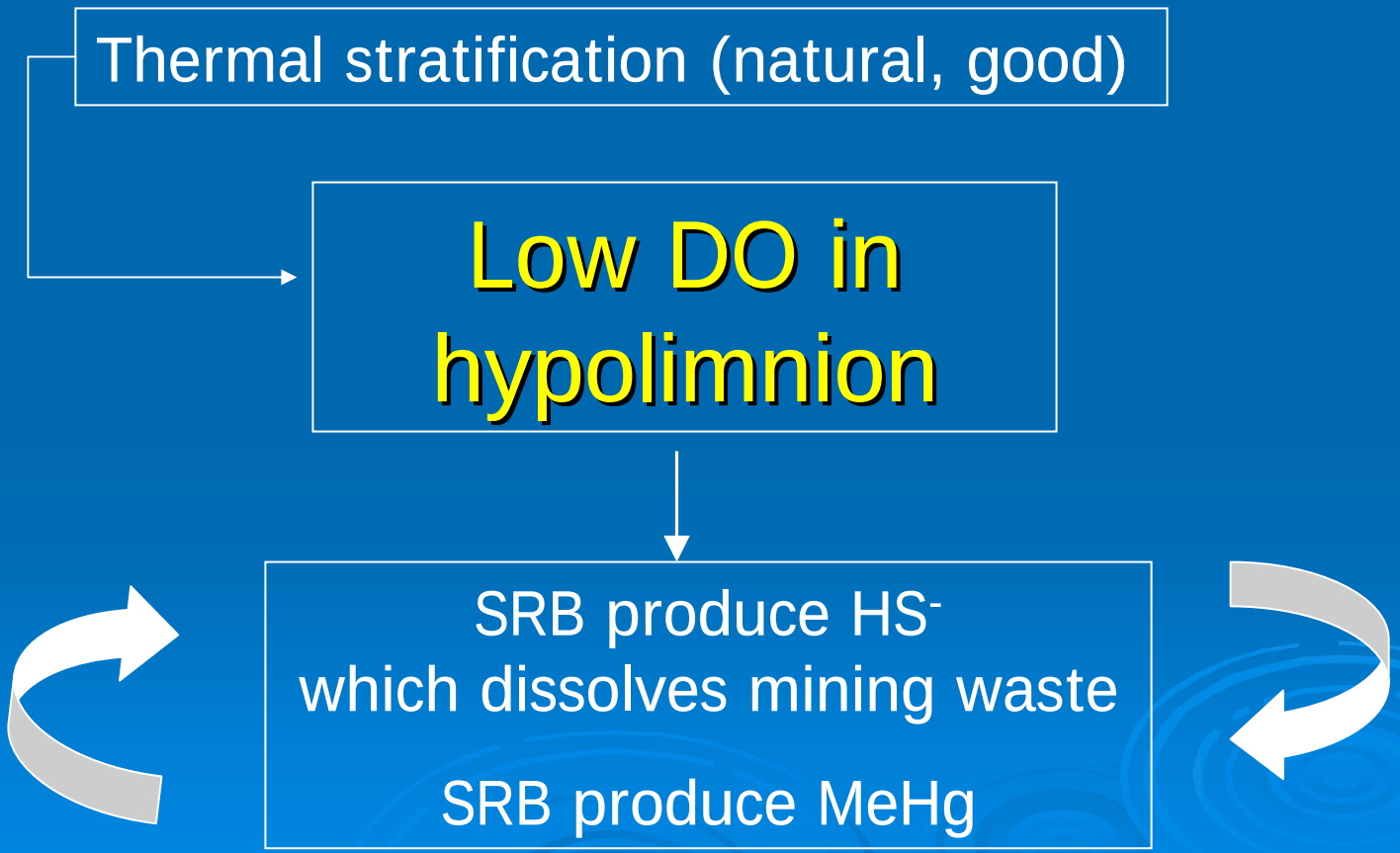
- Problem Statement
- Numeric Targets
- Source Analysis
- Linkage Analysis
- Allocations
- Implementation

Start in Headwaters: New Almaden

0.1 ppm mercury
in erodable soil fines
transported in runoff

BMPs for erosion control
w/in 10 yrs

Impoundment MeHg Production



Is Oxygen the Solution to MeHg?

Thermal stratification (natural, good)

oxygenated hypolimnion

Summary

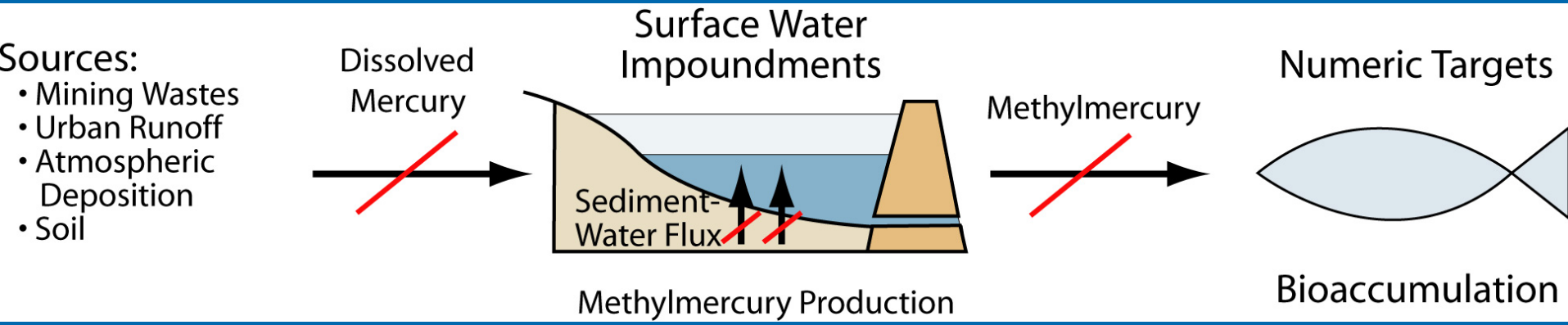


Figure S-1 Solving the Mercury Problem

Citation: figure prepared by Tetra Tech