Total Maximum Daily Loads for PCBs in the Trinity River

Segments 0829, 0806, 0841, & 0805

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Texas Commission on Environmental Quality

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presenting

Introduction

- Section 303(d) of the federal Clean Water Act (CWA) requires States to identify water bodies that do not meet applicable water quality standards

- Pursuant to the CWA and development of the 303(d) list, the Texas Commission on Environmental Quality (TCEQ) is responsible for development of Total Maximum Daily Loads (TMDLs)

Introduction

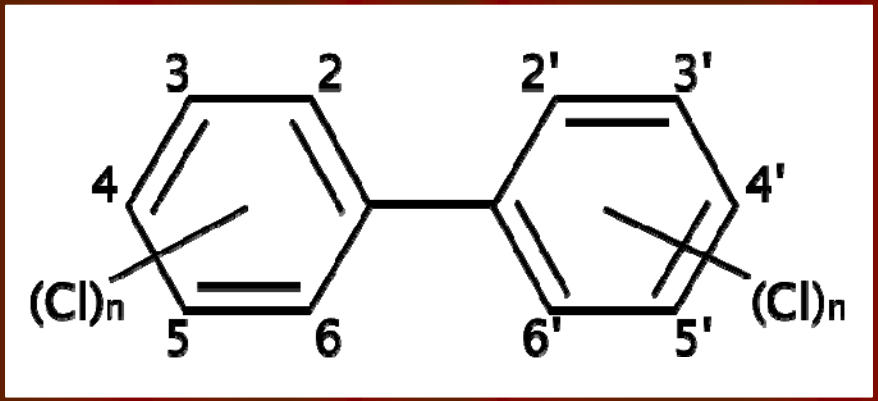
- The goal of a TMDL is to determine the amount (or load) of a pollutant that a body of water can receive and still support its designated uses
- That allowable load is then allocated among all sources of pollution within the watershed
- Measures to reduce the pollutant loads are developed

Impaired Segments/Assessment Units

- Texas Department of State Health Services (TDSHS) issued Aquatic Life Order 14 (AL-14) and Fish Consumption Advisory 25 (ADV-25) in 2002 due to "PCBs in fish tissue" for 150 miles of the Trinity River

- As a result the TCEQ placed four segments (nine Assessment Units (AUs)) of the Trinity River on the CWA 303 (d) list due to impairment of the "fish consumption" designated use

Polychlorinated Biphenyls (PCBs)

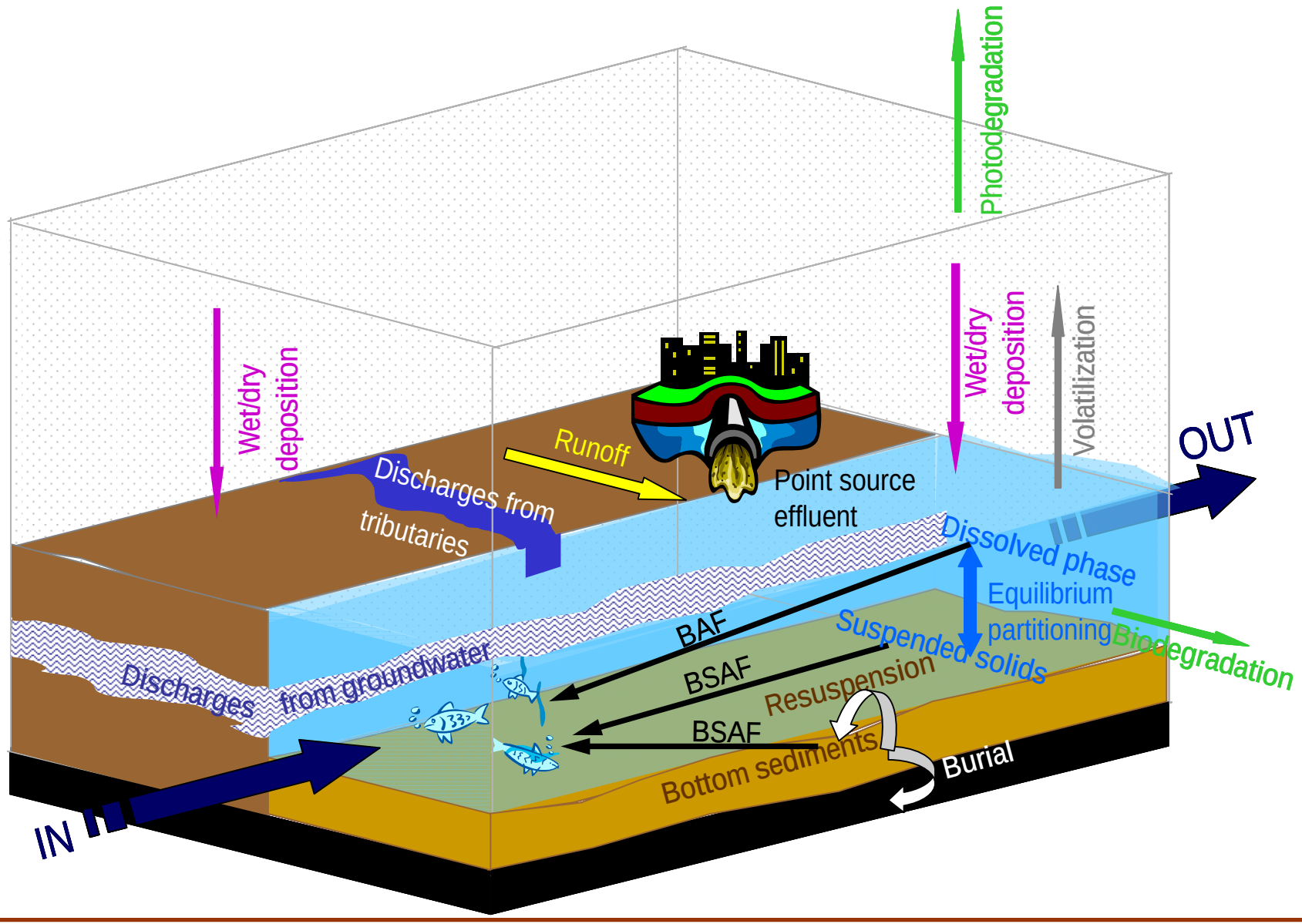


- A group of 209 compounds, known as PCB congeners
- From 1 to 10 chlorines on 2 connected benzene rings
- Properties and toxicity vary, but all poorly soluble in water
- Tend to be associated with sediments in aquatic systems
- Highly resistant to degradation
- Residence times in aquatic systems on the order of decades

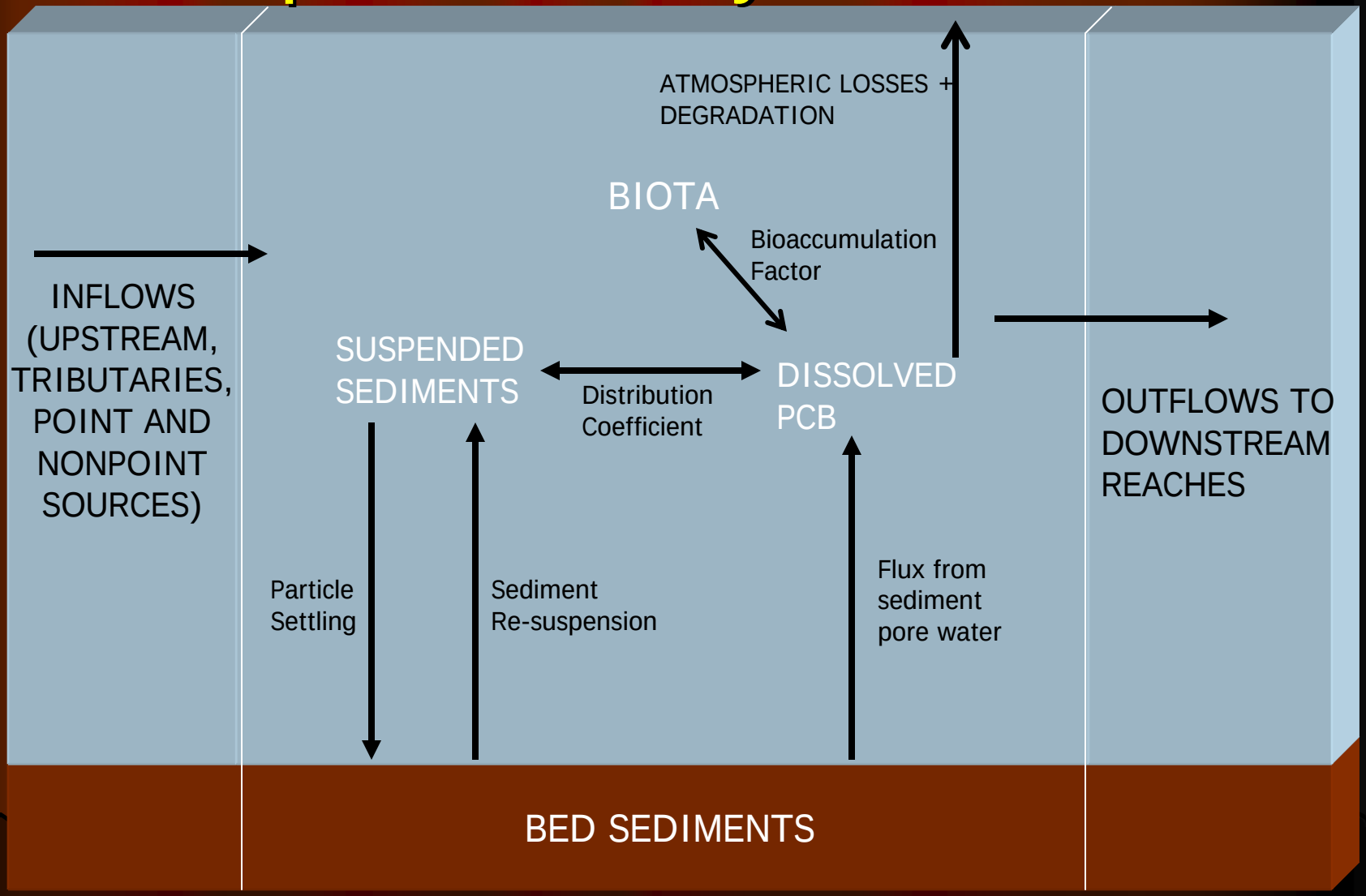
Polychlorinated Biphenyls (PCBs)

- Sold in the USA under trade name Aroclor
- Used mainly as
  - Dielectric fluids in transformers
  - Heat transfer fluids
  - Heat-resistant hydraulic fluids
- Myriad other uses
- Production, distribution and new use banned in 1976 by Toxic Substances Control Act (TSCA)

PCB Conceptual Model



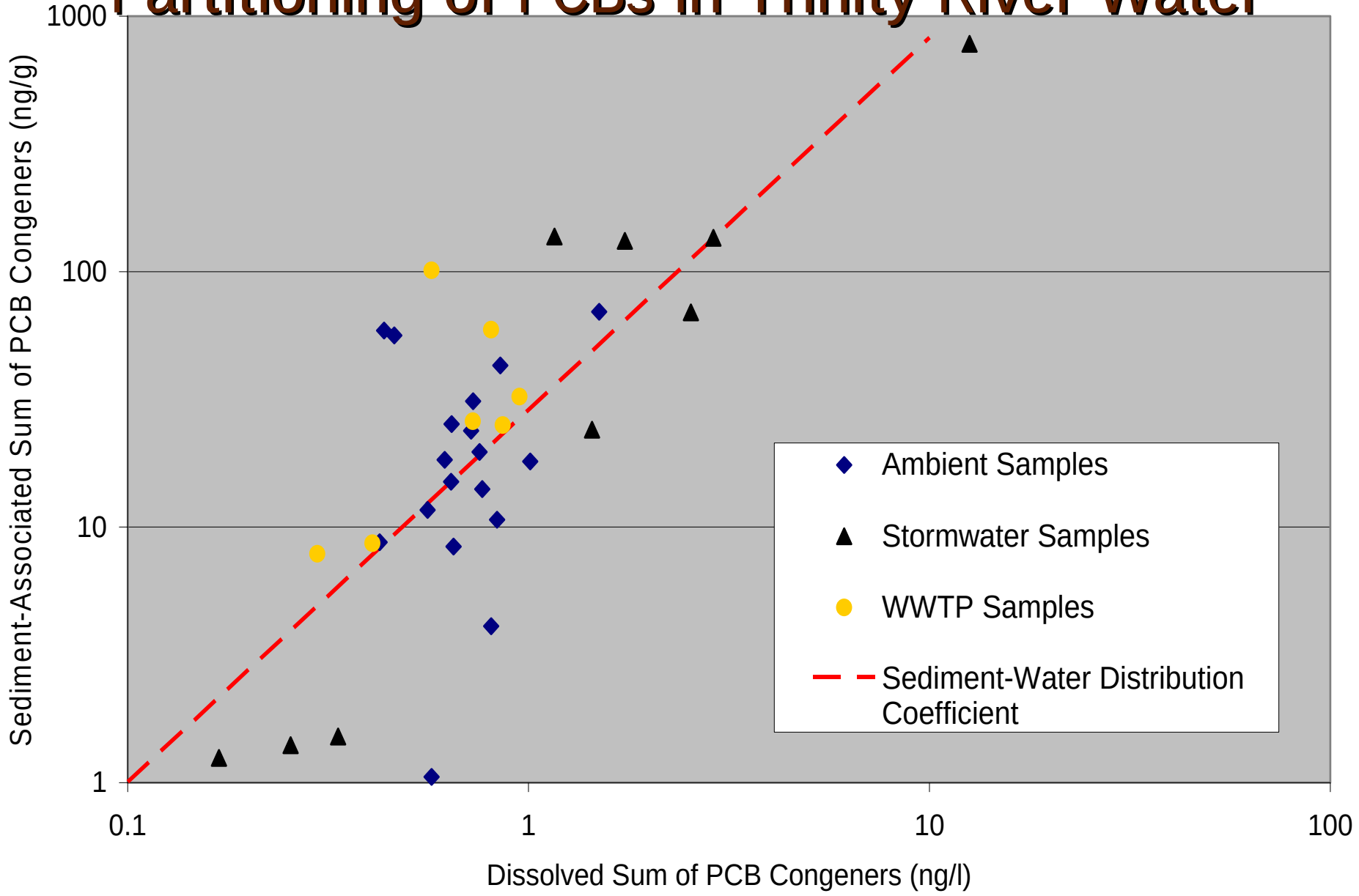
Mass Balance Model Will Capture the Key Processes



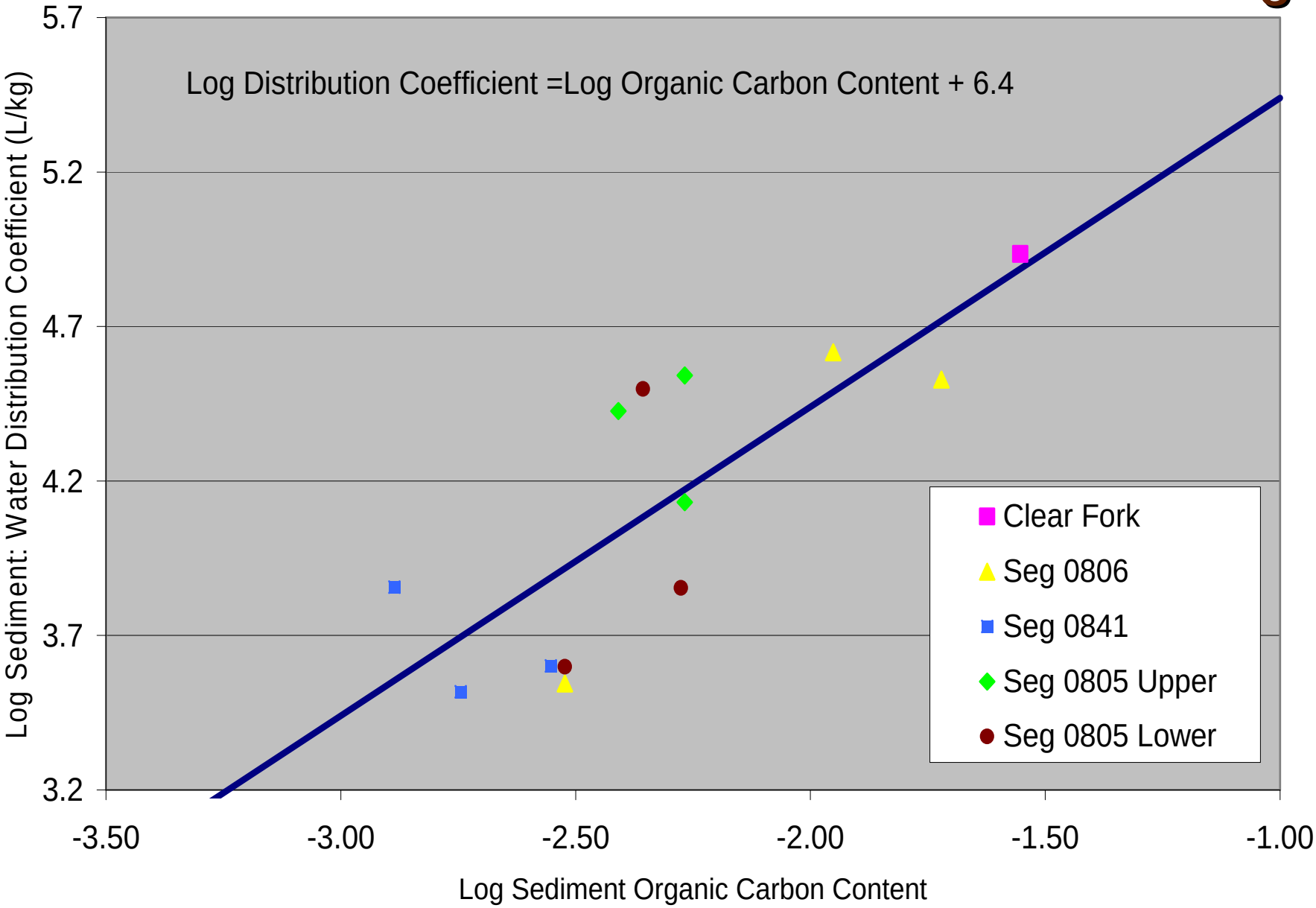
PCB fate in water is largely controlled by their partitioning to sediments

- PCBs and water mix like oil and water
- Given the chance, PCBs dissolved in water will tend to “sorb” to suspended or bed sediment particles
- Organic particles can absorb a large amount of PCBs relative to most mineral particles.
- This is also why fish “bioaccumulate” PCBs to high levels
- Among minerals, clays can take up more PCB than silt or sand due to greater surface area.
- PCB uptake by sediments is controlled largely by their organic content.
- Given enough time, an equilibrium distribution of PCB concentrations between dissolved and sediment phases occurs

Suspended Sediment : Dissolved Phase Partitioning of PCBs in Trinity River Water



Bed Sediment-Dissolved Phase Partitioning

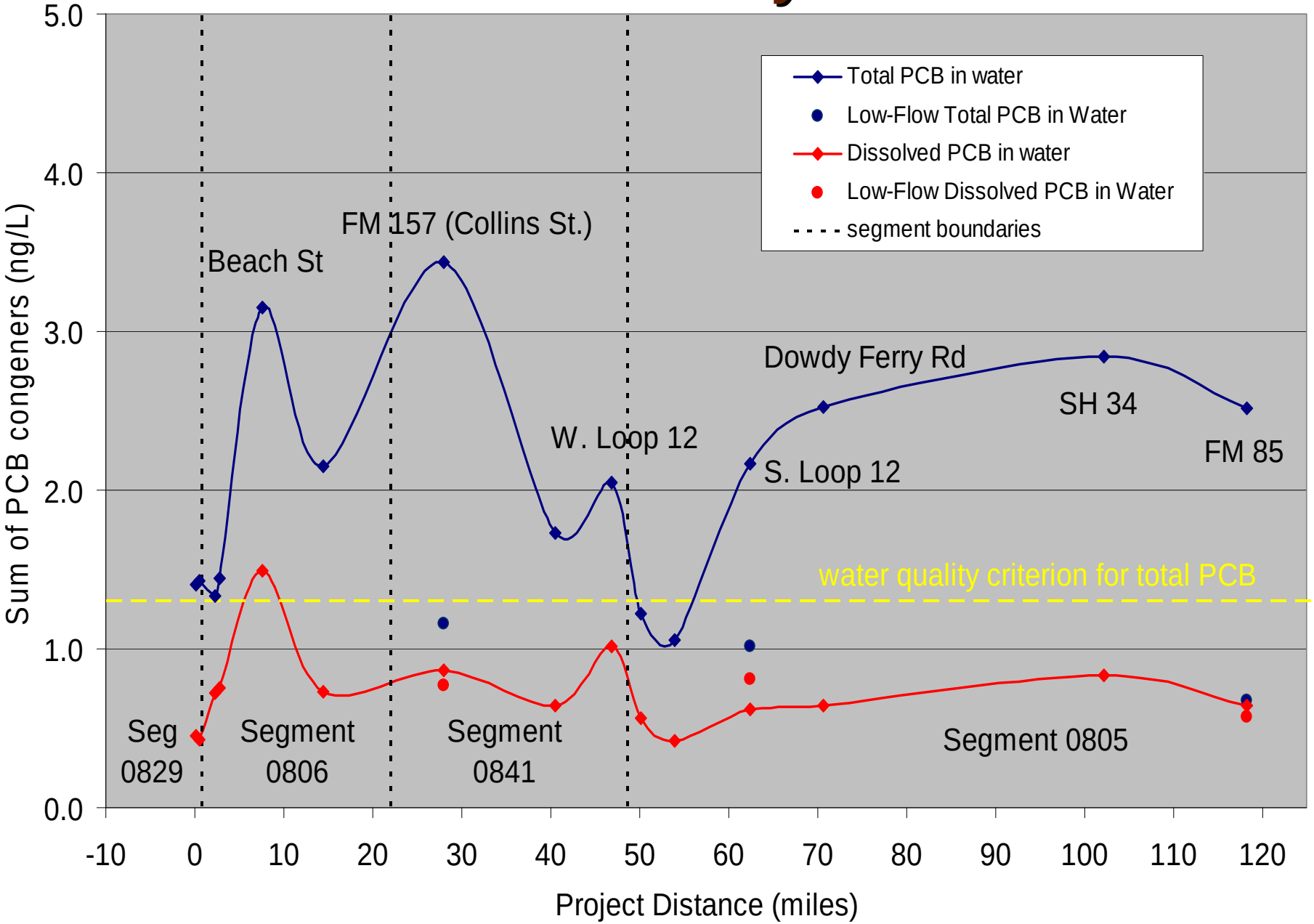


Data Collection

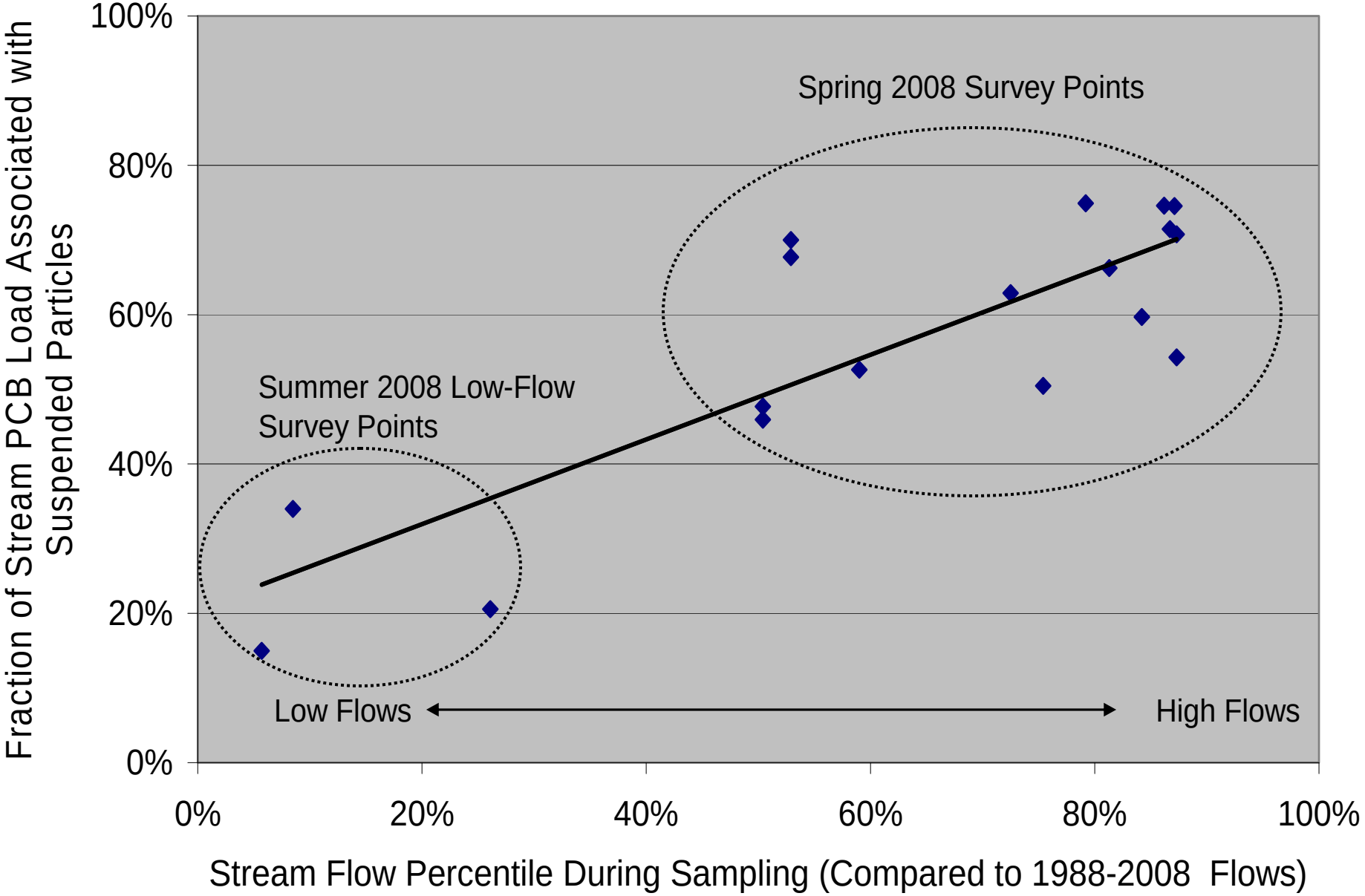
March – August 2008

- In-stream PCB concentration measurements
  - 18 measurements at 13 main stem sites
- Sediment PCB concentration measurements
  - 77 measurements at 32 main stem and 43 tributary sites
- PCB loads from wastewater discharges
  - 8 measurements at 4 facilities
- PCB loads from storm water
  - 9 measurements at 5 sites
- Individual PCB congeners measured by EPA Method 1668A
  - results presented reflect sum of “detected” congeners

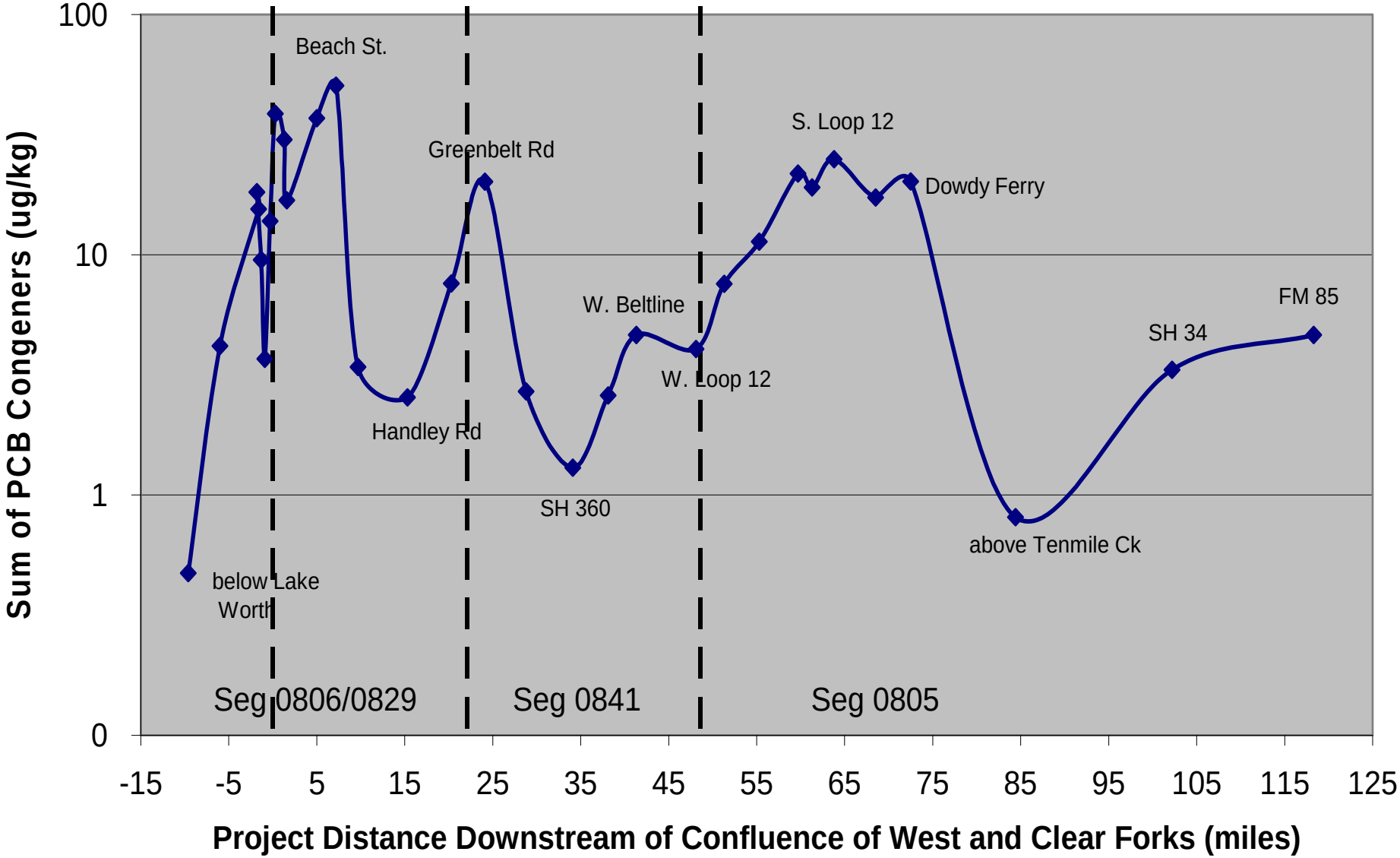
PCB Levels in Trinity River Water



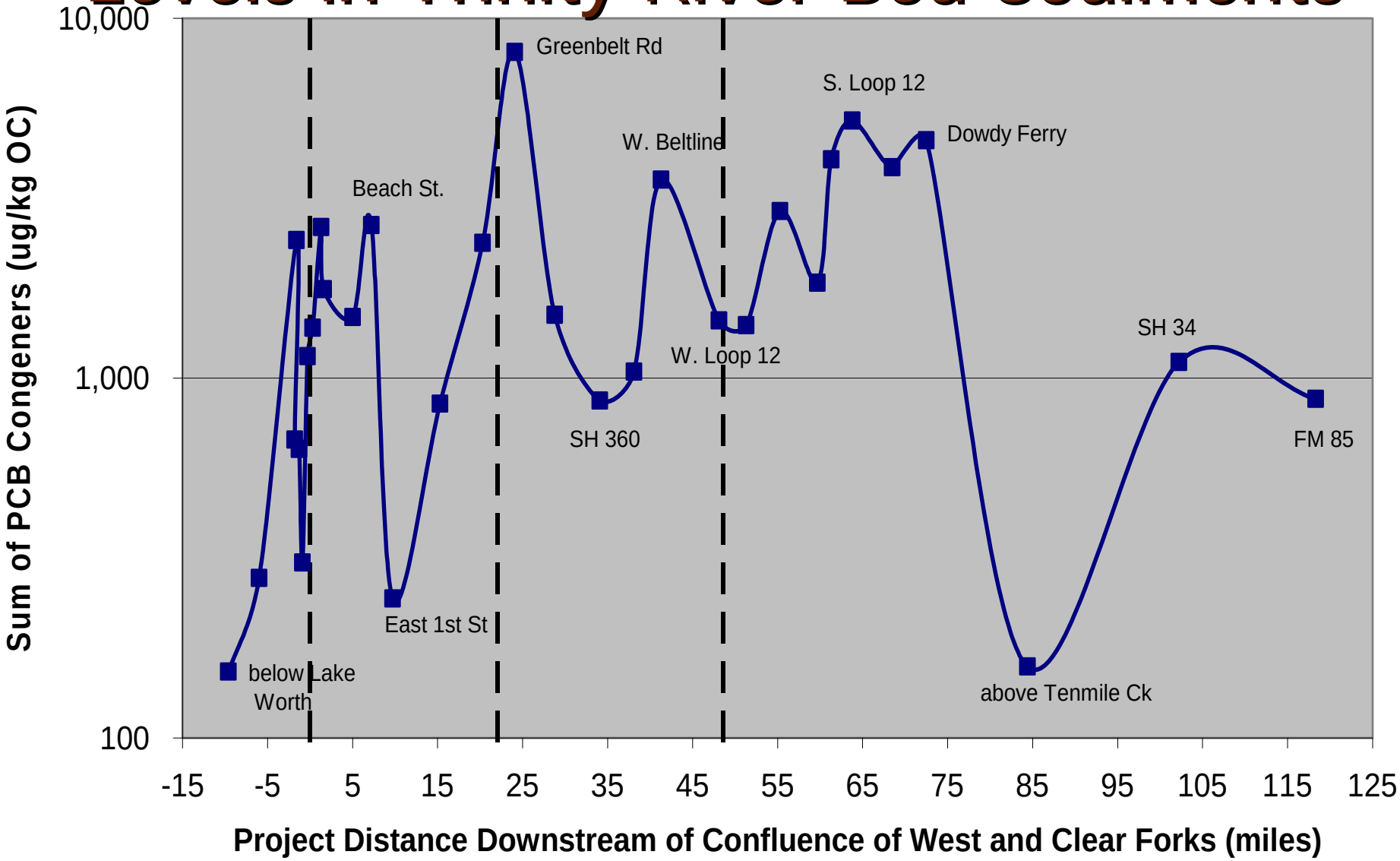
Flow Dependence of Suspended PCB Levels



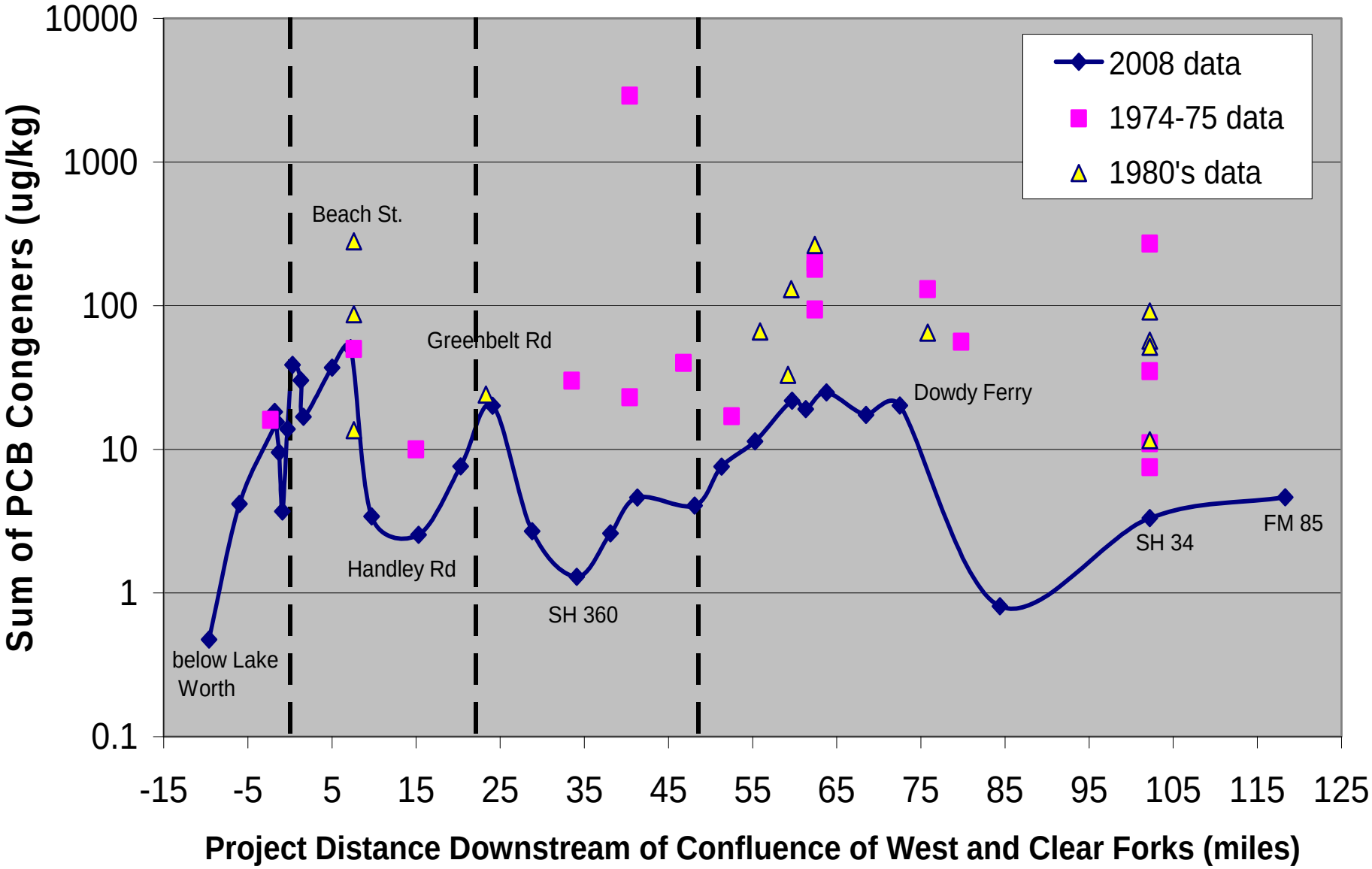
PCB Levels in Trinity River Bed Sediments



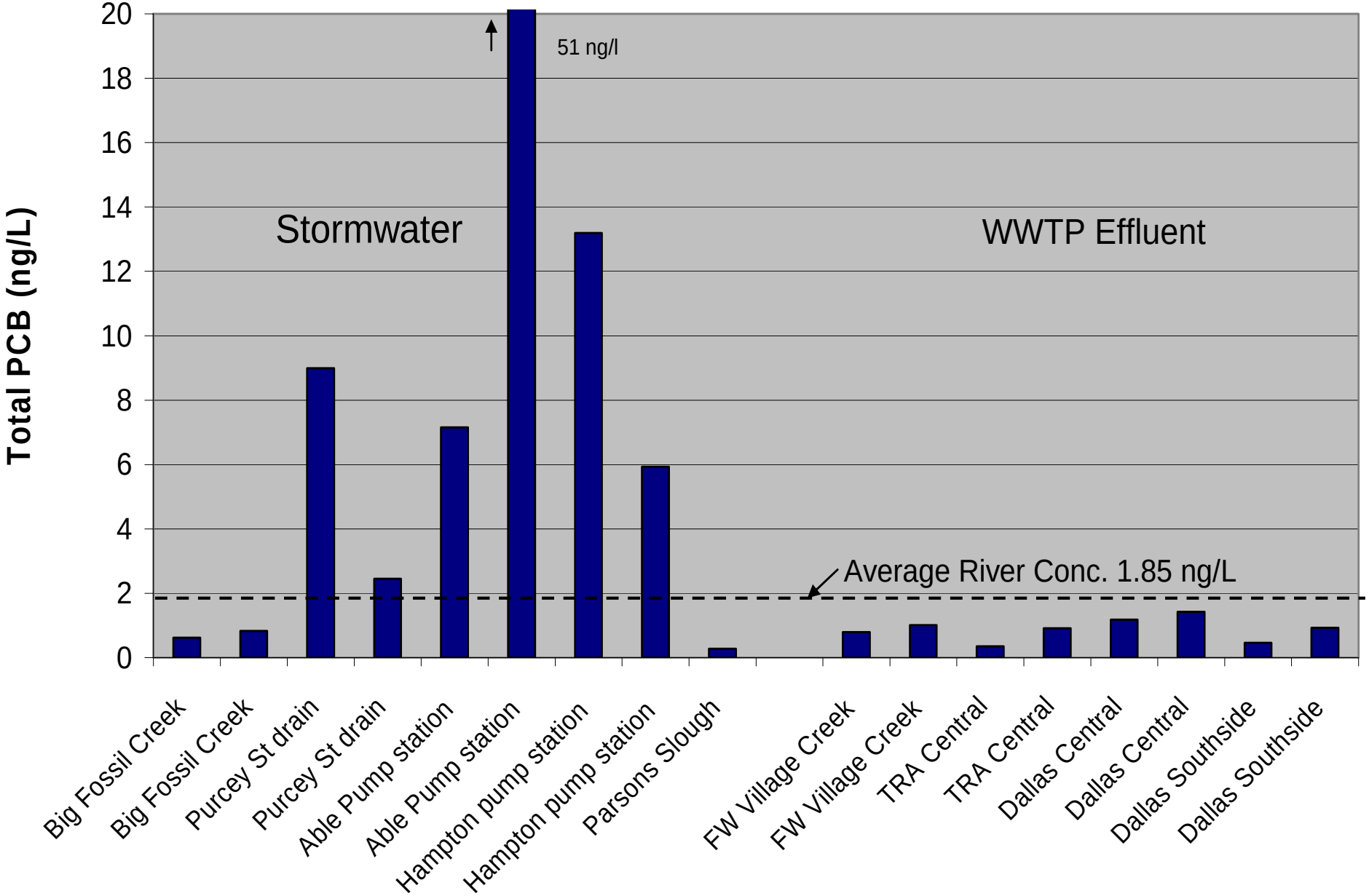
Organic Carbon Normalized PCB Levels in Trinity River Bed Sediments



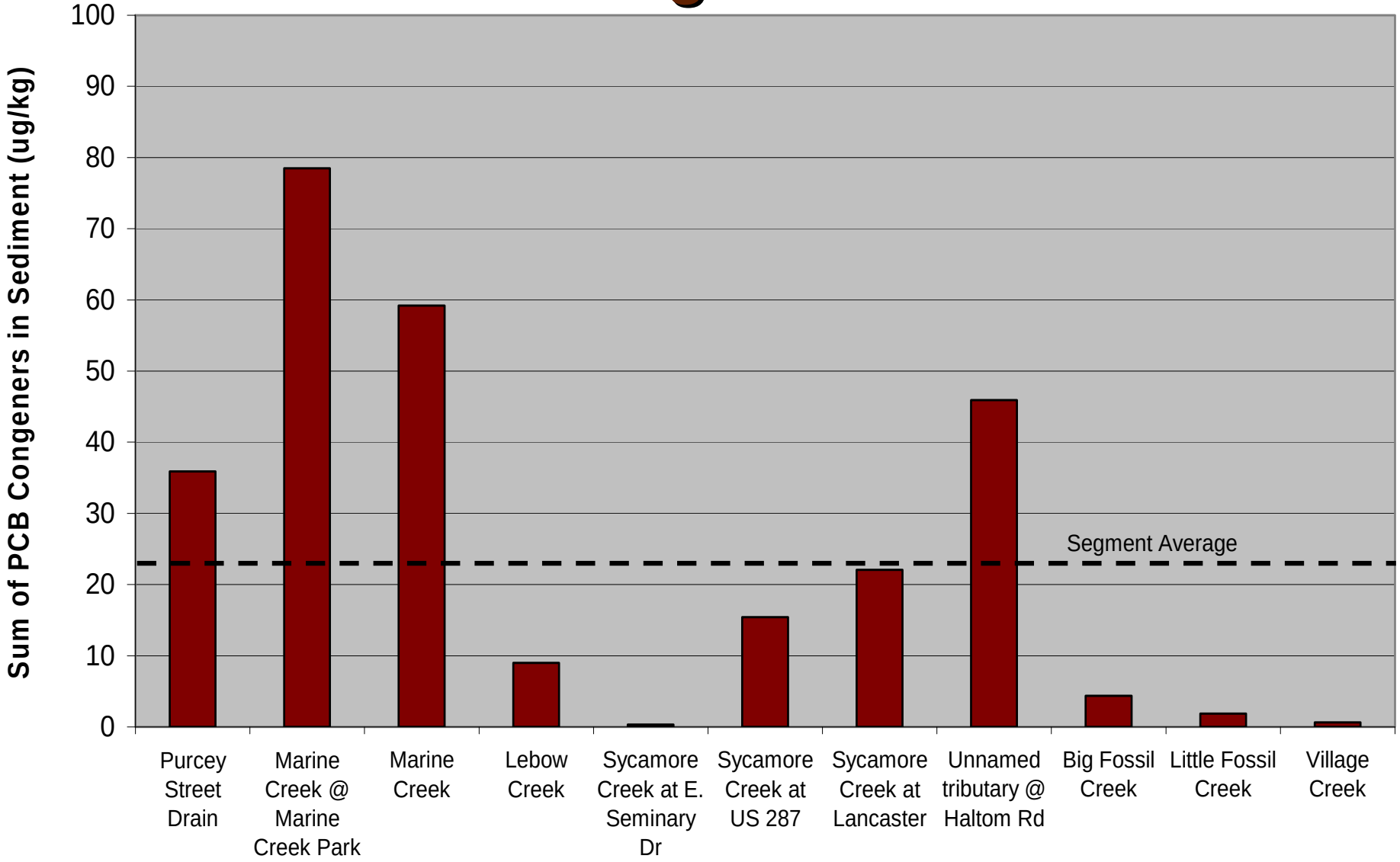
Historical Bed Sediment PCB Levels



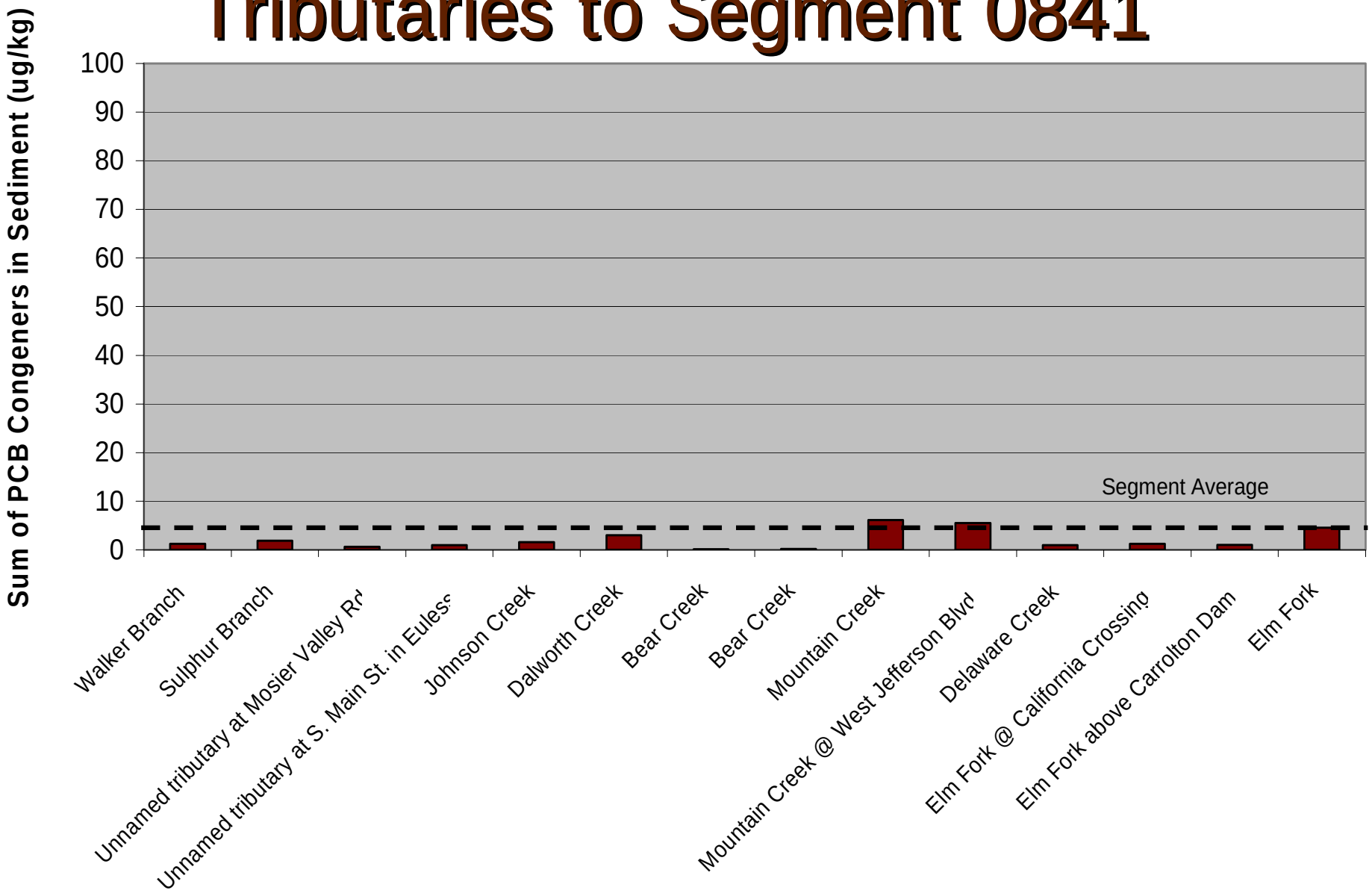
PCB Sources: Stormwater and WWTP Effluent



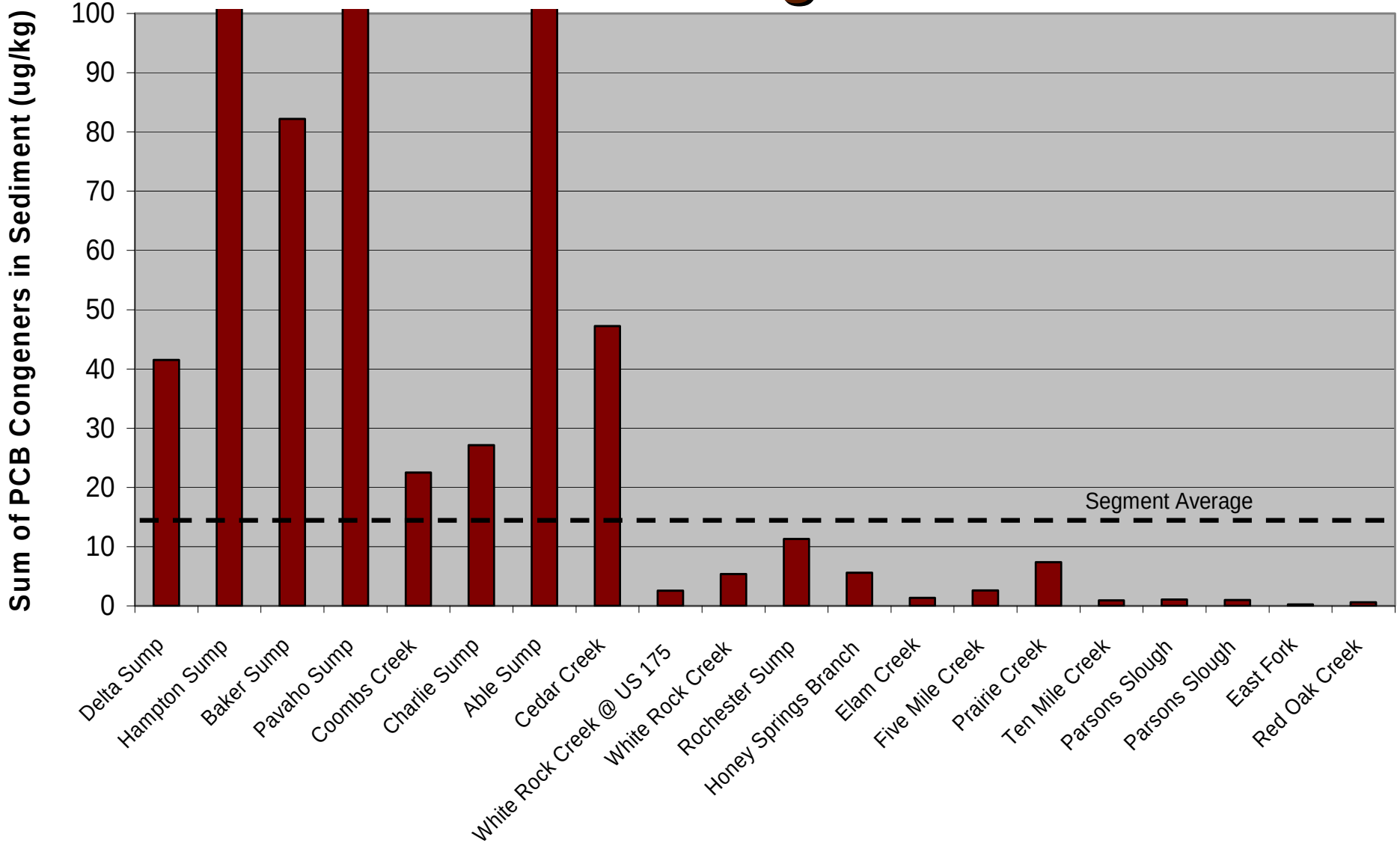
PCB Levels in Bed Sediments of Tributaries to Segment 0806/0829



PCB Levels in Bed Sediments of Tributaries to Segment 0841



PCB Levels in Bed Sediments of Tributaries to Segment 0805



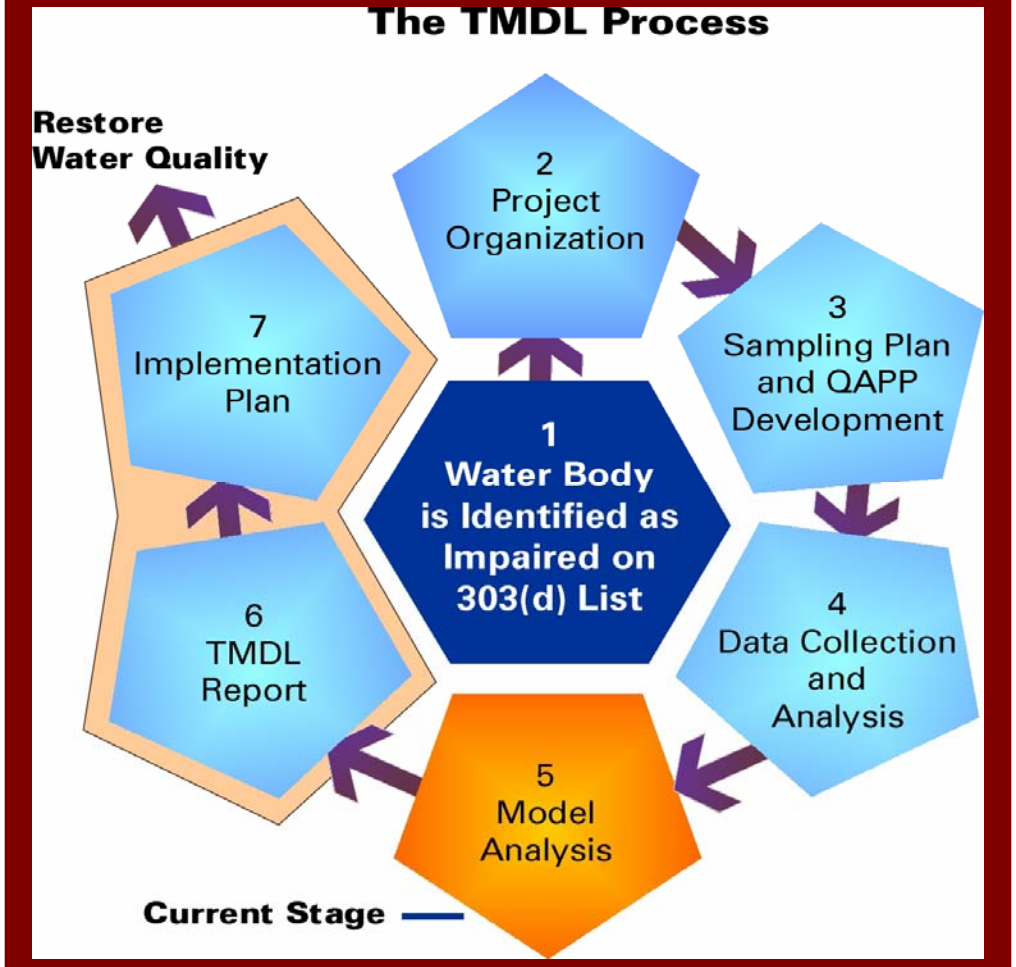
Observations

- Total PCB levels in water exceeded water quality criteria in 13 of 18 samples from the Trinity River
- Total PCB levels in storm water from older, densely developed urban areas are much higher than those in-stream, but low in rural and suburban areas
- Total PCB levels in wastewater effluent were generally lower than ambient levels in the river

Observations

- PCB levels in sediment appear to have declined since the 1970s and 1980s in Segment 0805 and 0841, but perhaps not in Segment 0806
- The range in PCB levels in tributary sediments indicates continuing local sources in some areas

TMDL Process and Project Schedule



Next Steps: Modeling and TMDL Development

- Model under development to:
  - assist in determining the TMDL and quantify pollutant loads
  - evaluate future loading scenarios and load reductions
- Instream model is a multiple-box mass balance model
- Instream segmentation and hydraulics based on TCEQ Qual-TX models
- Watershed runoff and suspended sediment loading from tributaries using GWLF model
- Modeling expected to be complete late this month
- Modeling report expected this summer

Questions?

- For further questions:

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