

Mass Balance and Mechanistic Investigations

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Tasks

- Characterize Hg Loading Adjacent to Plant Site
 - Moderate to High Flow
 - Baseflow
- Characterize Near-Bank/Near-Bottom Hg Loading Mechanisms
 - Dissolution of bank/bed solids
 - Groundwater

Objectives-Task 1

- Identify specific areas within the plant reach between Wayne Ave and Main St that may be contributing mercury to the South River
- Identify the nature or mechanism(s) of the mercury loading within the plant reach.
- Prepare a detailed water and mercury balance for the plant reach for low to moderate river discharge.

Loading Inputs

Between Key Sample Stations

grams Hg per day

Reaches	RRM	4-Aug	Flood 04	5-Feb	5-Sep
Reference & Plant Reach	-1.5 to 0.3	1	1230	24.4	1.2
Constitution Park to Dooms	0.3 to 5.5	14.6	1689	-14.1	12.9
Dooms to Crimora	5.5 to 10.5	-4.5	374	14.4	-8
Crimora to Harriston	10.5 to 17	0.4	2842	-1.5	-0.3
Harriston to Port Republic	17 to 25	-3.8	211	-5.9	-0.2

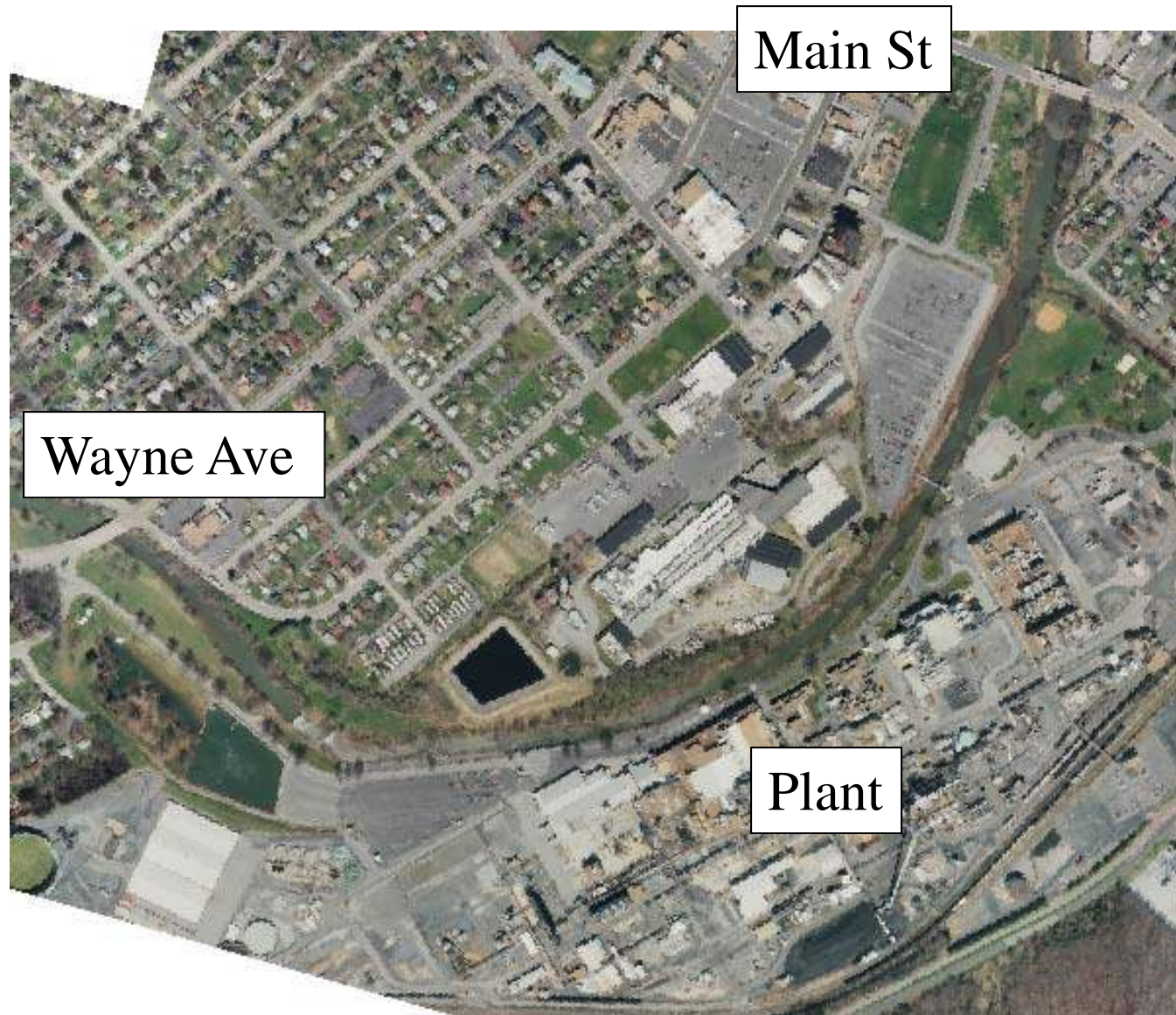
Note: In two instances, plant reach loading was significant portion of all river loading measured.

Possible Sources of Loading

Areas of Study

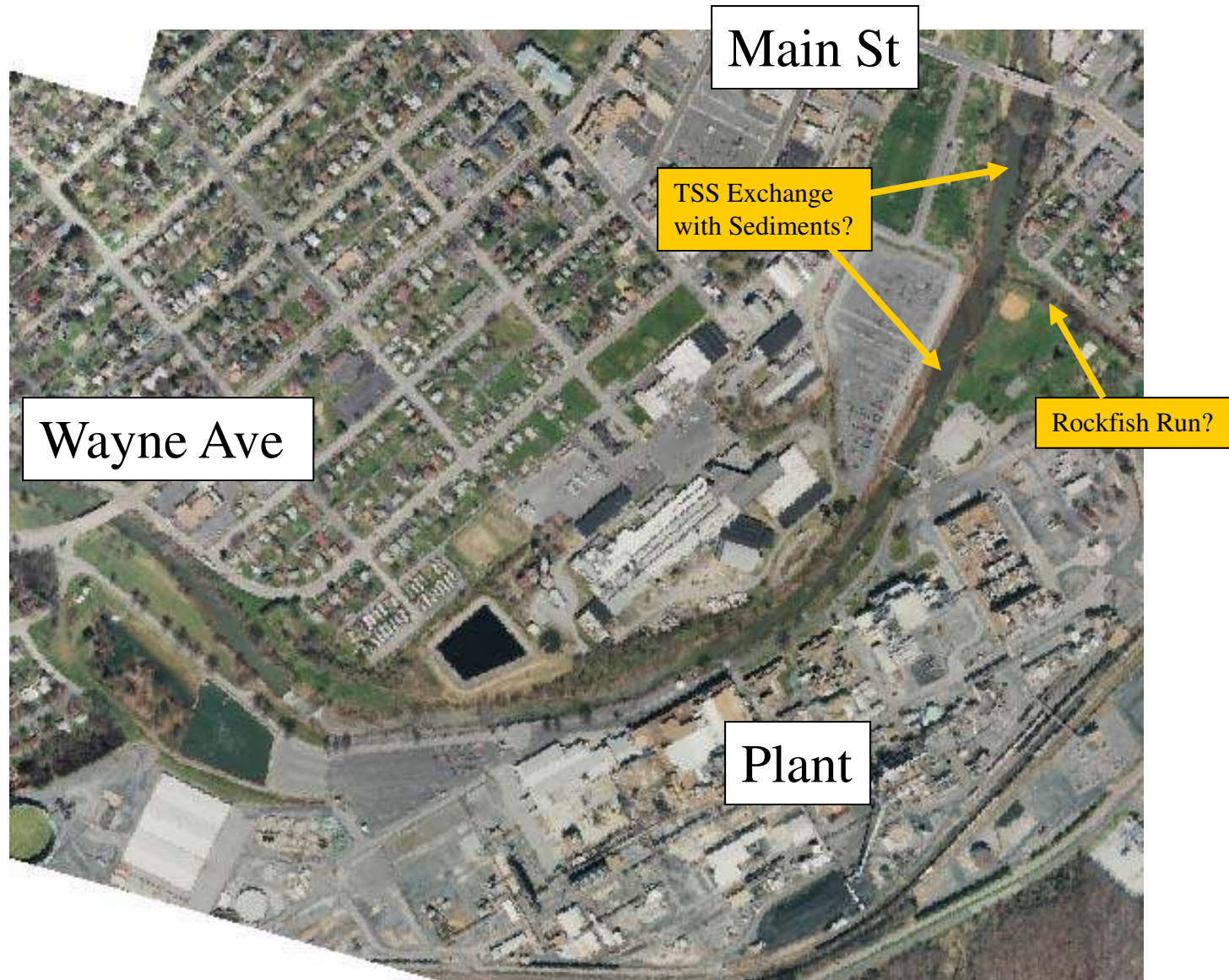
- Unidentified groundwater loading
- Exchange between clean suspended solids entering upstream with elevated Hg sediments in plant reach
- Unidentified outfall loadings from plant
- Bank and/or floodplain soil erosions
- Atmospheric deposition

Study Area - Plant Reach



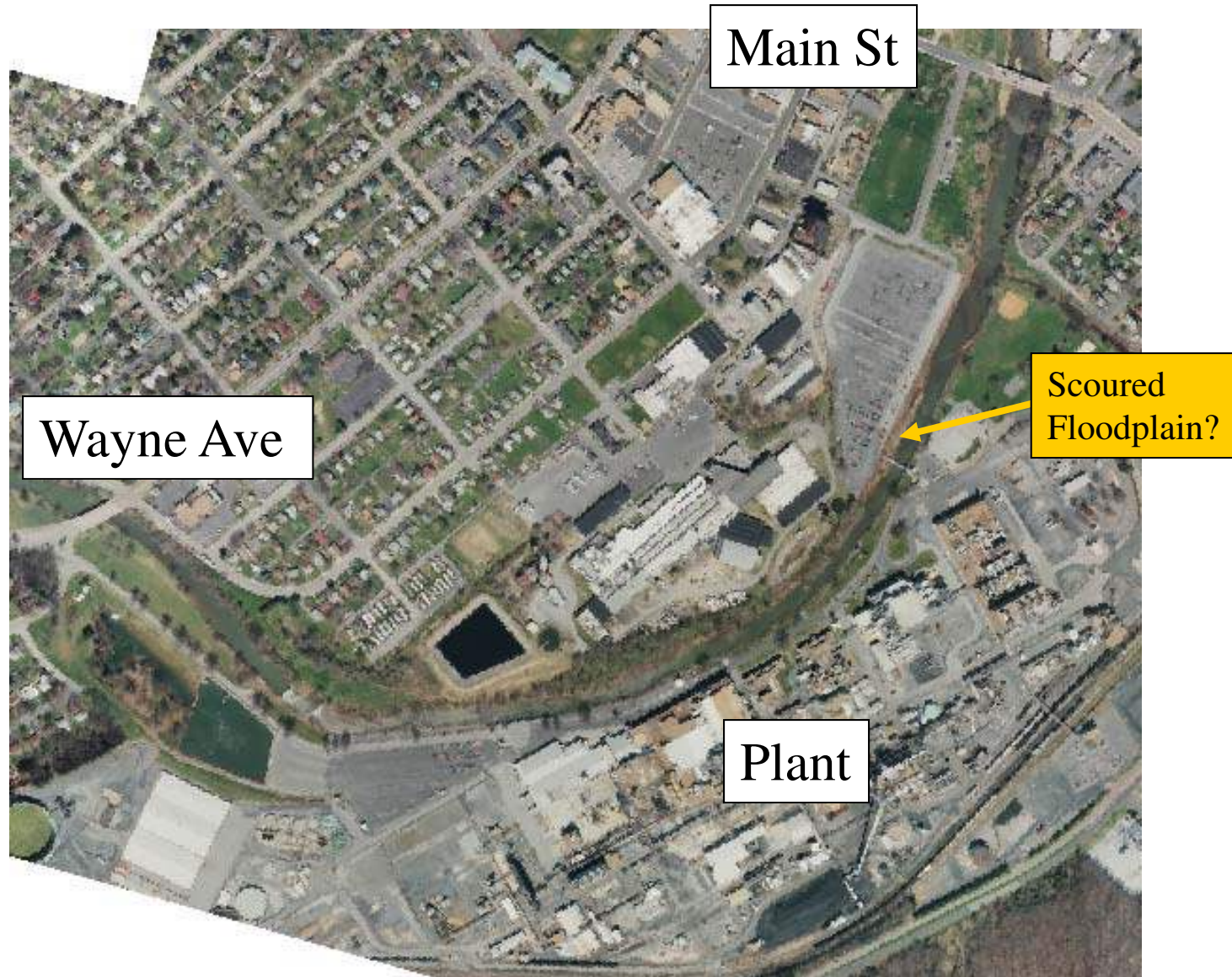
Plant Reach

Possible Explanations for Plant Reach Loading



Plant Reach

Possible Explanations for Plant Reach Loading



Plant Reach Floodplain







Plant Reach Study

Elements - Phase I

- Confirmation of significant loading
- Close-interval surface water sampling along entire reach
- West bank flowing outfall sampling for Hg
- Survey of fine surface sediments in reach
- Survey of floodplain and bank soils
- *Select sub-set for methyl mercury analysis*

Plant Reach Study

Elements - Phase II+

- Details depend on Phase I results...
- Survey of hyporheic zone water
- Detailed survey of floodplain/bank soils
- Close-interval, near-bank and bottom surface water survey in location(s) identified in Phase I.

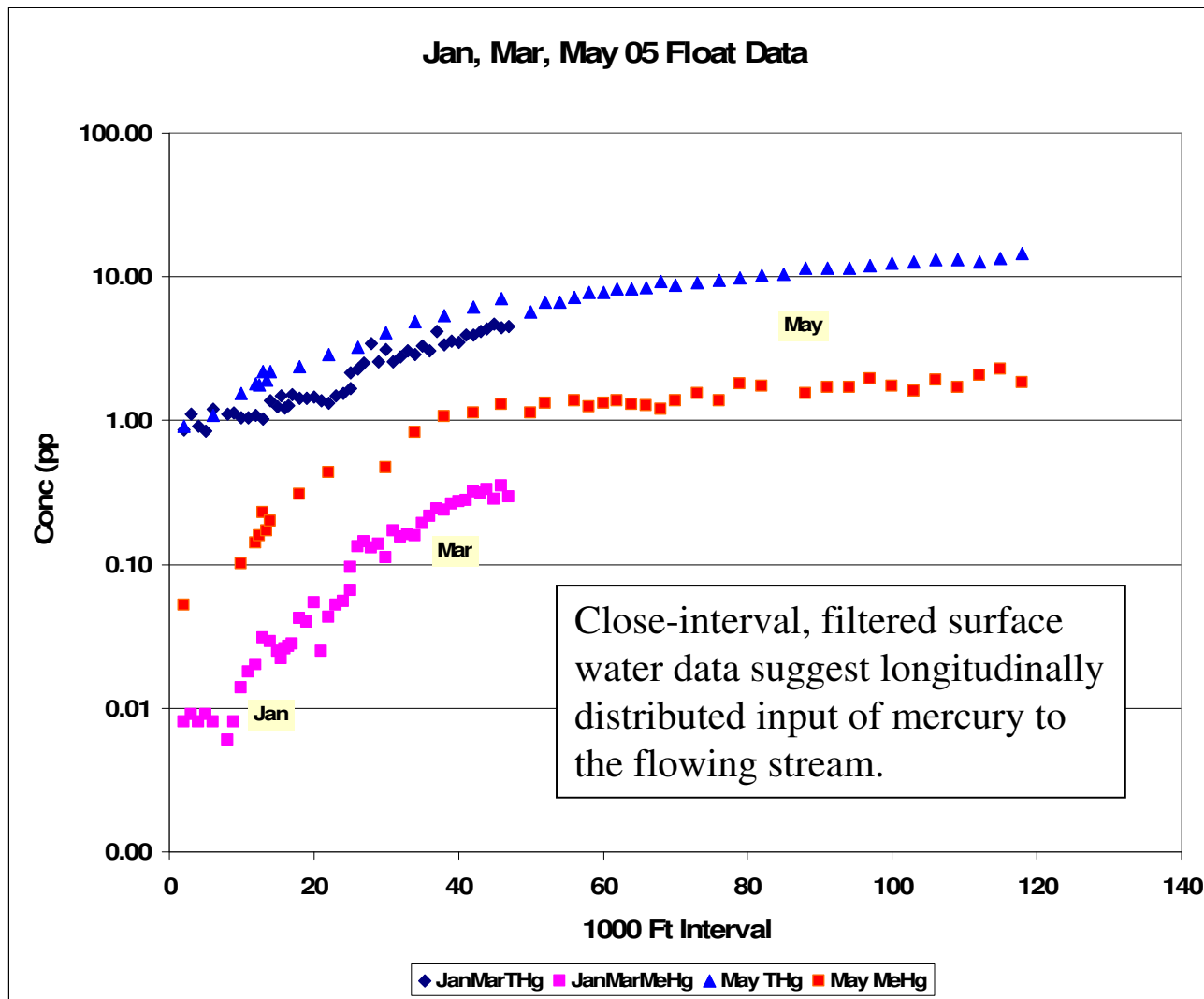
Plant Reach Study

Detailed Reach Material Balance

- Temporary installation of flow gauging equipment, weirs, meters, etc.
- Dye or salt tracers
- Cover main stream and all outfalls and tribs
- Samples taken synoptically
- Larger crew of workers required
- Purpose: To assure that all possible sources are accounted for

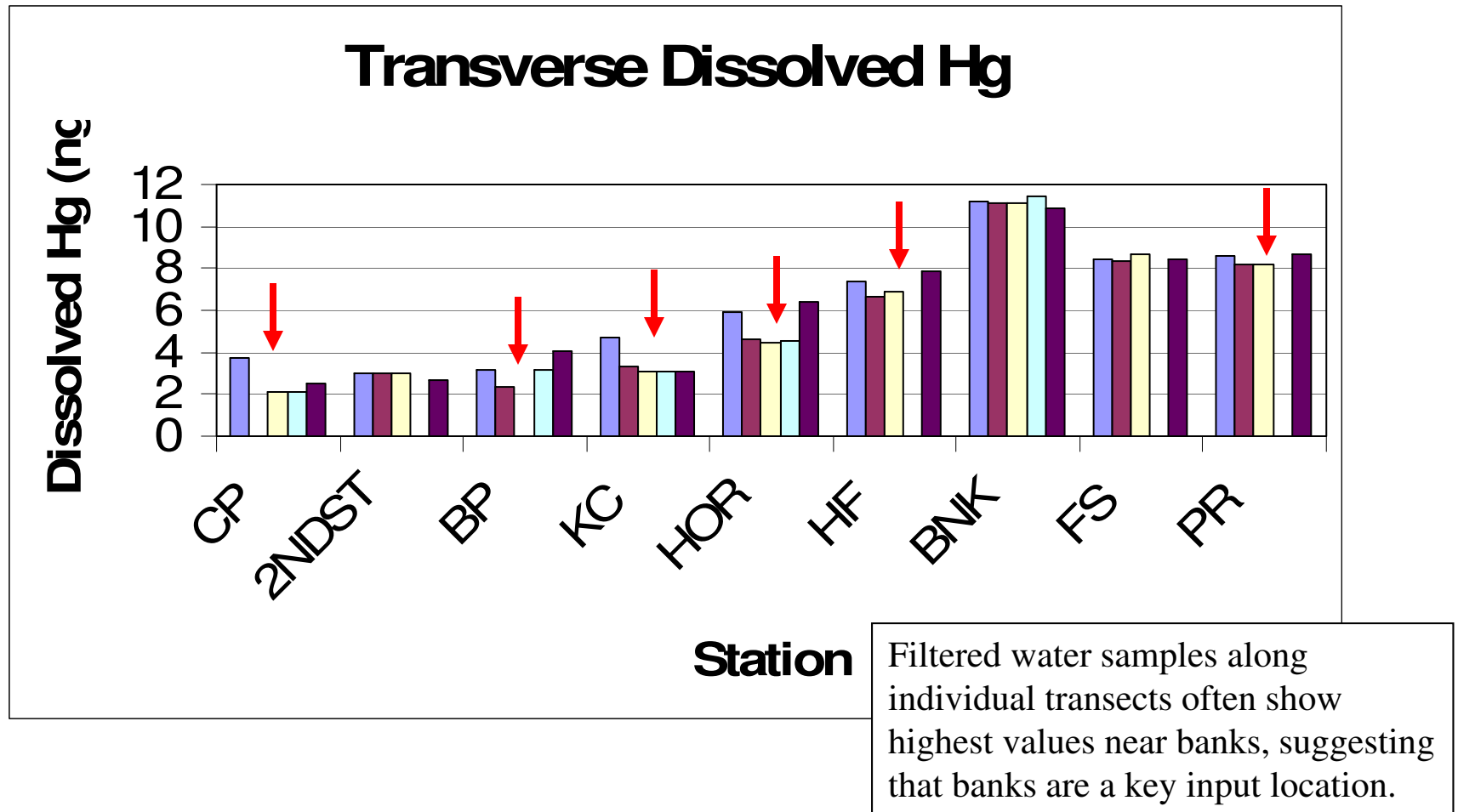
Near-Bank Hg Flux Studies

Near-Bank Study Background



Near-Bank Study Background

Continued



Near-Bank Study

Possible Mechanisms for Near-Bank Input of Hg

- Desorption/diffusion from elevated Hg sediments and soils lining the riverbank.
- Advective transport of Hg with groundwater elevated in Hg.
- Combinations and interactions of the above two mechanisms.
- Main study objective: Develop tools to/and distinguish between the two mechanisms.

Near-Bank Study

Investigative Approaches in Phase I

- Choose location coincident with ecostudy
- Synoptic measurement of
 - Surface water Hg, transverse and longitudinal in study area, to verify elevated near-banks and provide baseline.
 - Near-bank sediments
 - Near-bank sediment pore water/groundwater
 - Sequential extraction of near-bank sediments

Near-Bank Study

Investigative Approaches in Phase II+

- Depending on the results of Phase I...
- Added measurements of
 - Groundwater (landside) concentrations, gradients, discharge to river, etc.
 - Column leach tests, vadose zone samplers, etc.
 - Direct flux/diffusion measurements using DuPont flux chambers or lesser devices
- Quantitative efforts to differentiate mechanisms
- Provide tools for ecostudy/other locations
- Characterize river longitudinally for bank flux?

Near-Bank Study

Have initially chosen Basic Park for Phase I

