

Sediment Sampling Update

Preliminary Total and Methyl Mercury Data

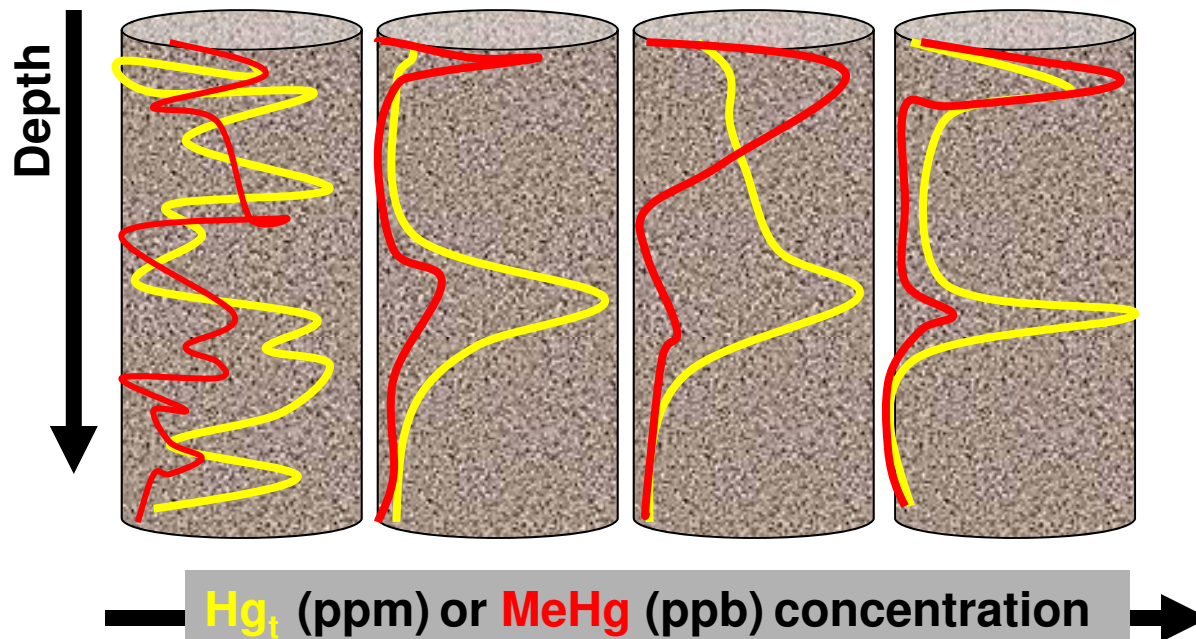
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Sediment Sampling Plan - Review

- Specific Questions to be Answered

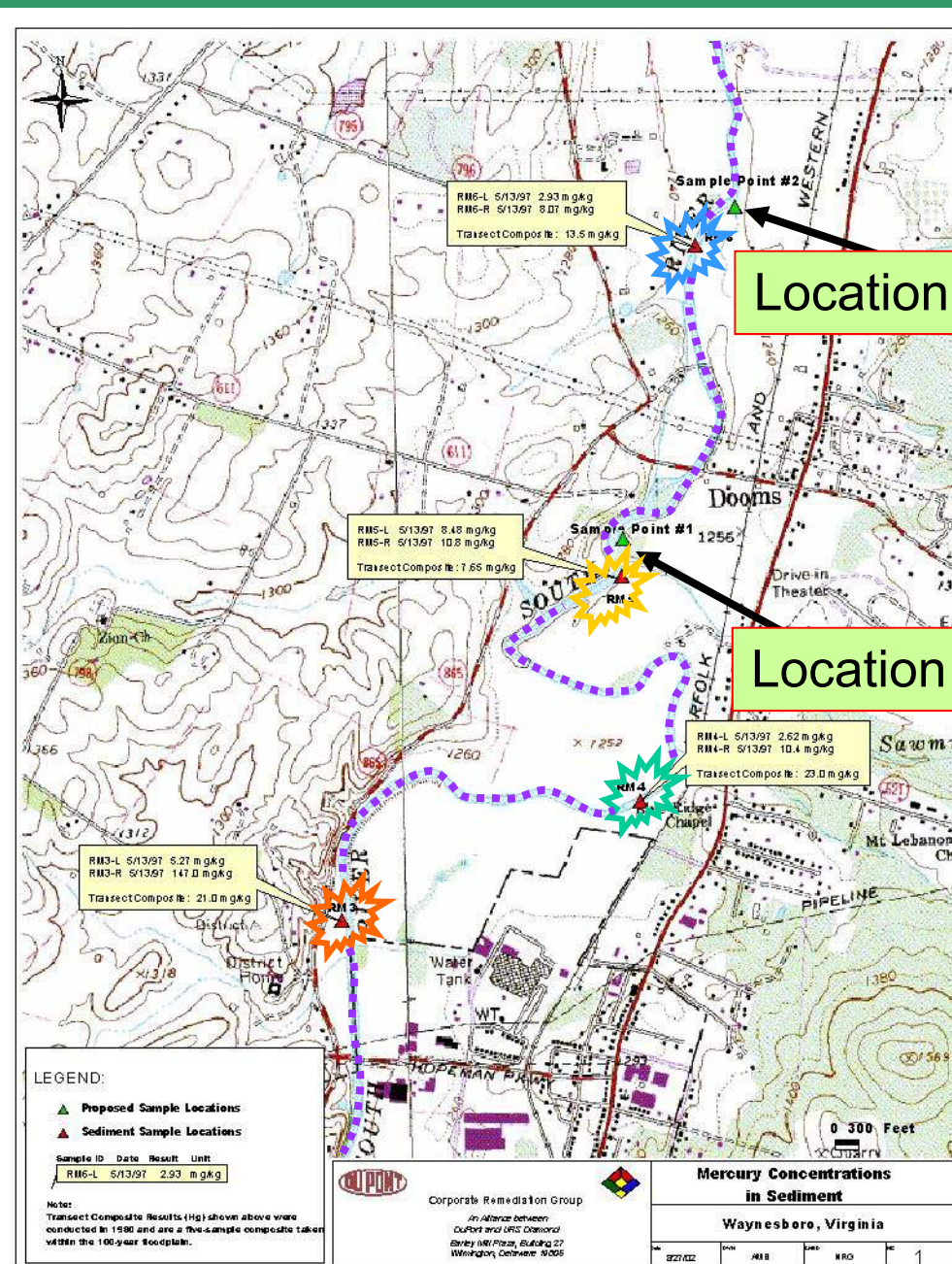
- Can we develop a history of mercury inputs to the river from Hg_t and MeHg profiles in vertical cores?
- What is the relationship between Hg_t and MeHg profiles in vertically stratified cores? (coincident? Separated?)
- Are floodplain soils a source of mercury to the river sediments?



Sampling Locations

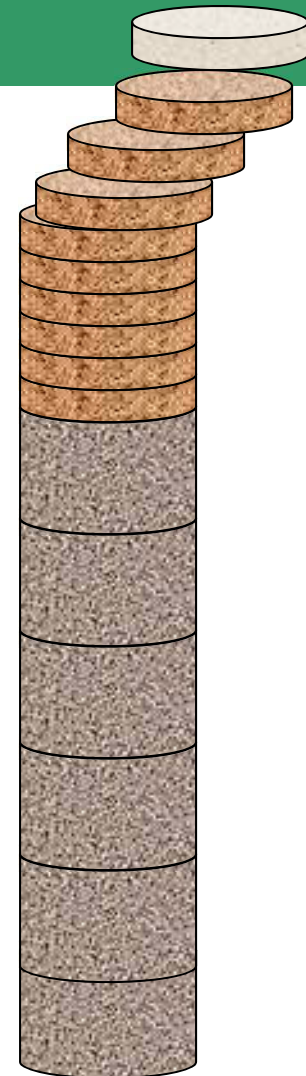
Sediment Hg (ppm)

Left Bank	Right Bank	Transect Composite
2.93	8.07	13.5
8.48	10.8	7.65
2.62	10.4	23.0
5.27	147.0	21.0



Core Analyses

- Core Sections
 - 2 cm intervals to 20 cm;
 - 5 cm remainder of length or to 100 cm
- MeHg each section for top 20 cm and every 10 cm
- Hg total for every section
- TOC every section
- Grain Size for each clear horizon
- $^{137}\text{Cs}/^{210}\text{Pb}$ dating if Hg horizons found



Processing Cores

- Cores were processed in shed on DuPont plant site.
 - Three coring sites at each site.
 - Three cores collected from each sub-site
 - Cores were opened and examined, photographed and logged
 - Two most comparable cores were selected for further analysis
 - Samples were either over-nighted to analytical labs or returned to DE for storage (stable isotope samples)
- Preliminary Total Hg data was discussed with Turner and Rudd prior to moving forward with selection of samples for MeHg and stable isotope analysis.

Site 1: Collection of Sediment Core 1-3 with Mallet



Site 1: Measuring Depth to Core Surface



Site 1: Removing Core

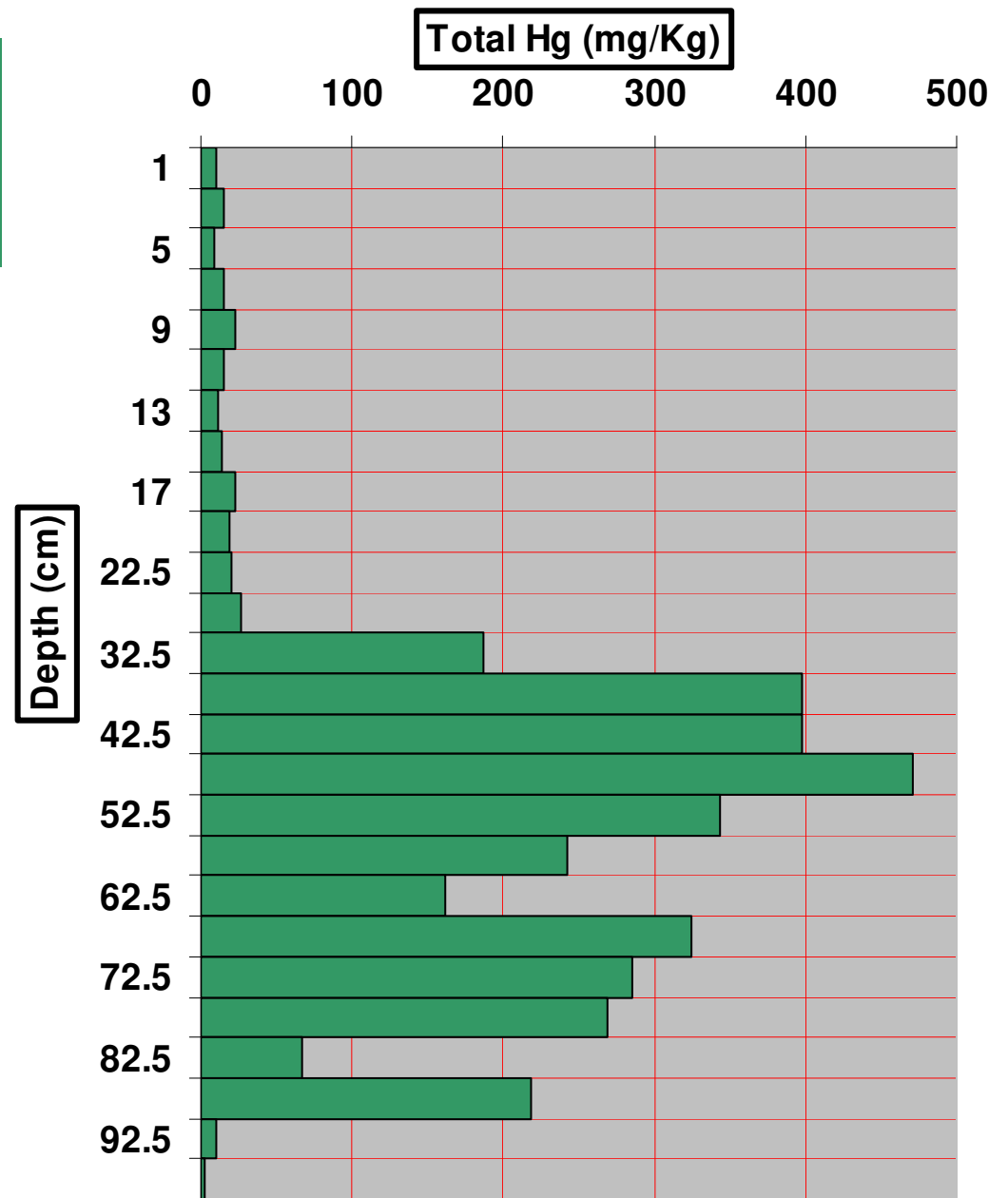


Site 1: Capping Core for Transport



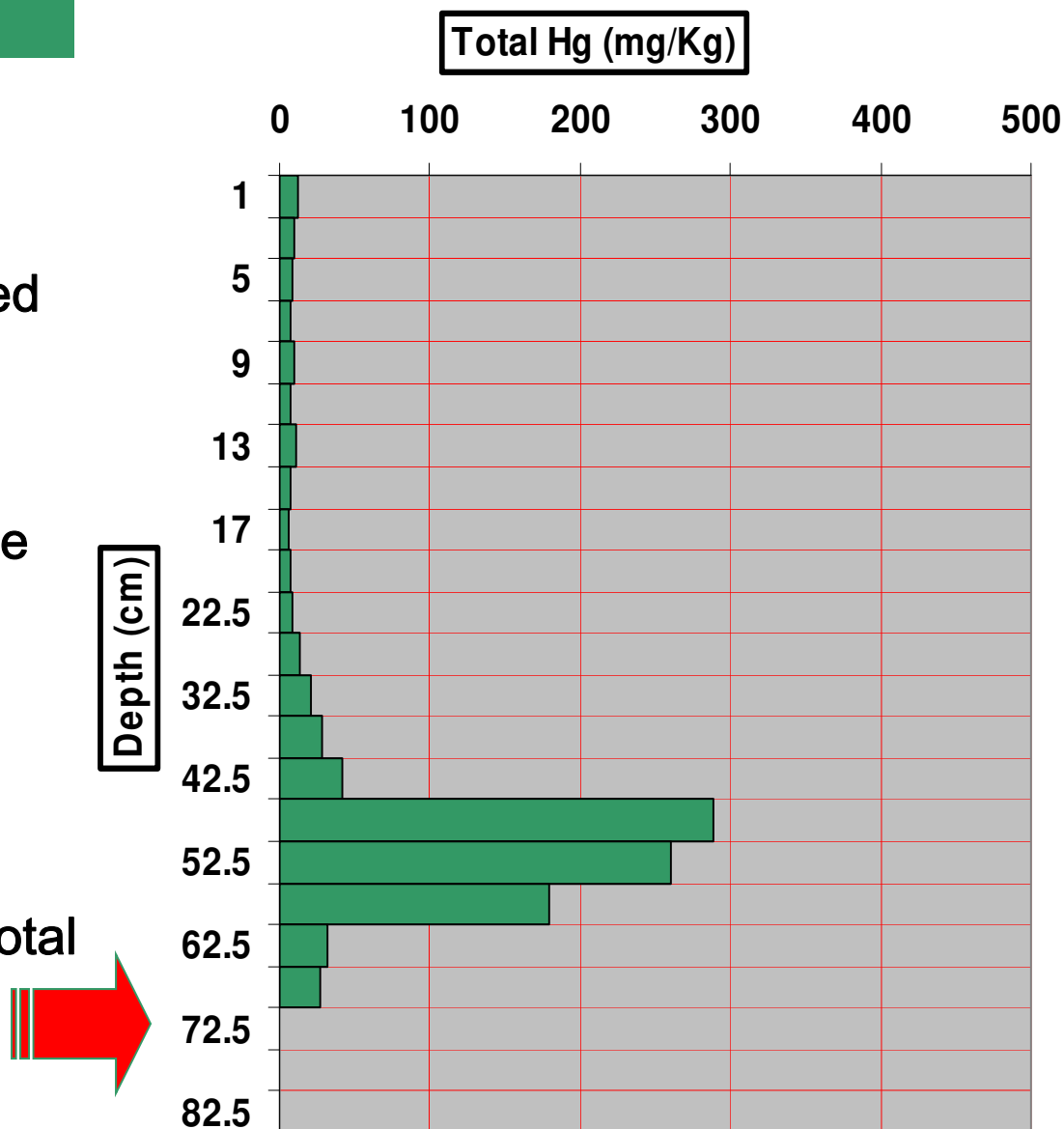
Site 1 (Dooms' Dam) – Core 3

- Distinct horizon of elevated total Hg at 32 to 85 cm.
- Below 85 cm Hg total decreases significantly.



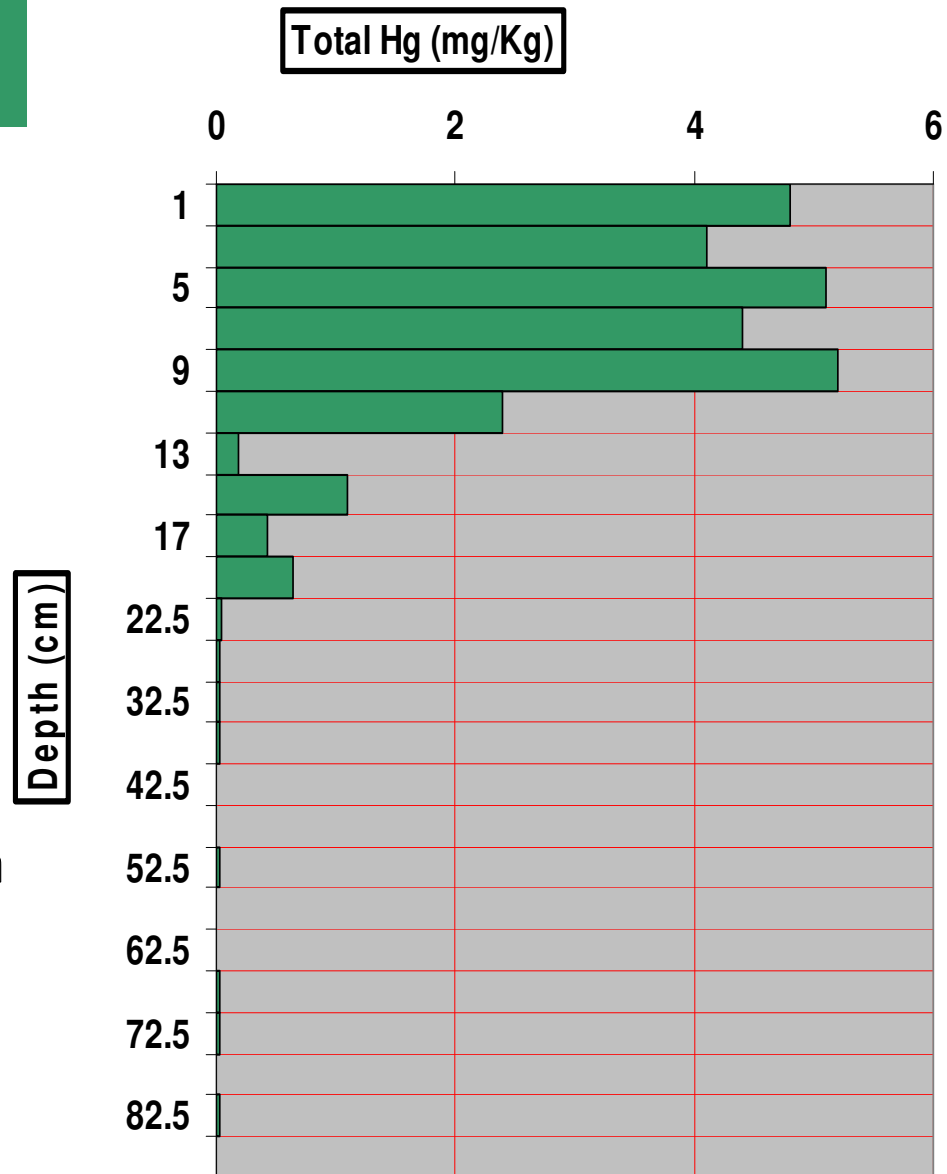
Site 1 (Dooms' Dam) – Core 4

- Distinct horizon of elevated total Hg at 32 to 65 cm
- Below 65 cm Hg total decreases significantly
- Selected for stable isotope analysis
- Between 70 and 85 cm Total Hg = 0.23 – 1.2 ppm



Site 1 (Dooms' Dam) – Core 8

- Low levels of mercury in surficial sediments only.
- Traces of Hg in deeper sediments
- Suggests different depositional history than previous site 1 cores
- Possibly representative of recent sediment deposition only



Site 2: Independent Observer (self appointed)



Site 2: Collection of Sediment Core 1-3 with Mallet (upper-most part of tributary)

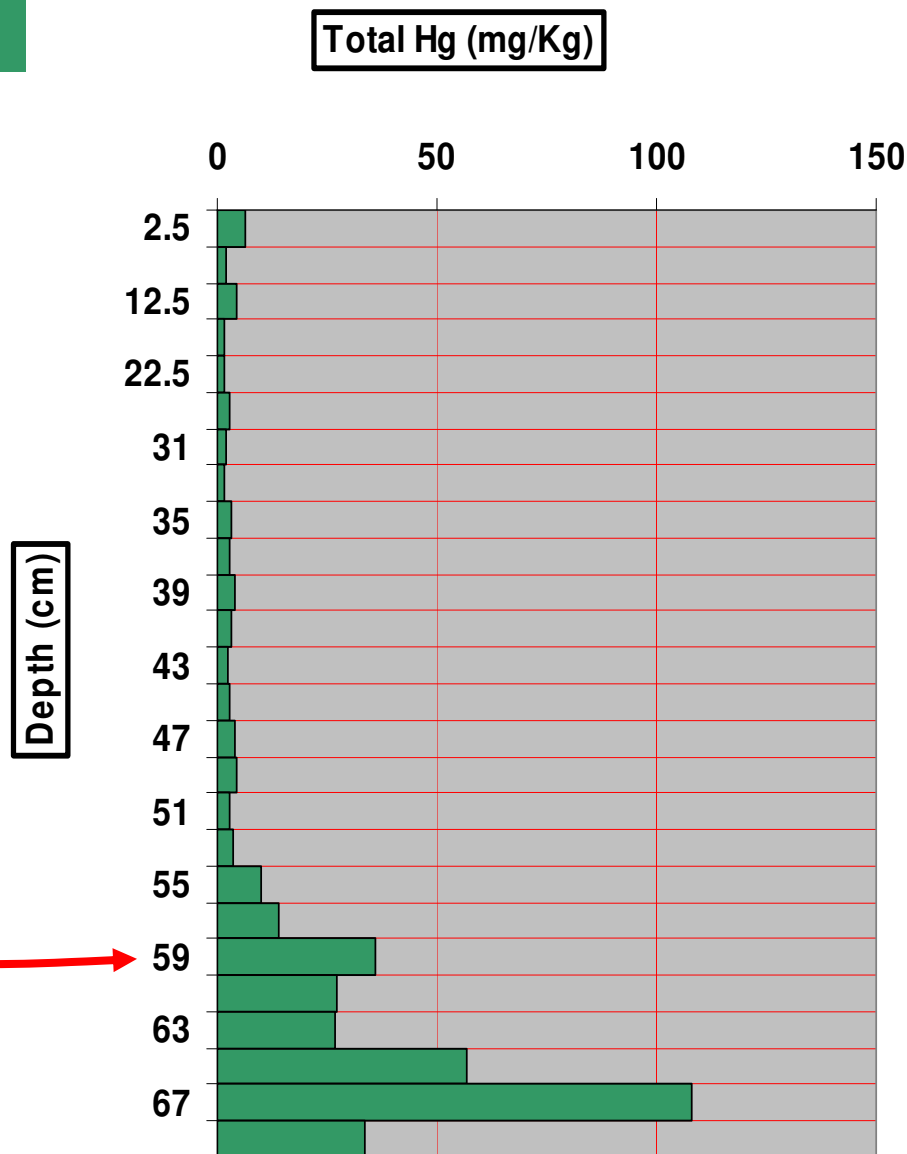


Site 2: Collection of Sediment Cores 7-9 with Vibra – Corer (mouth of tributary)



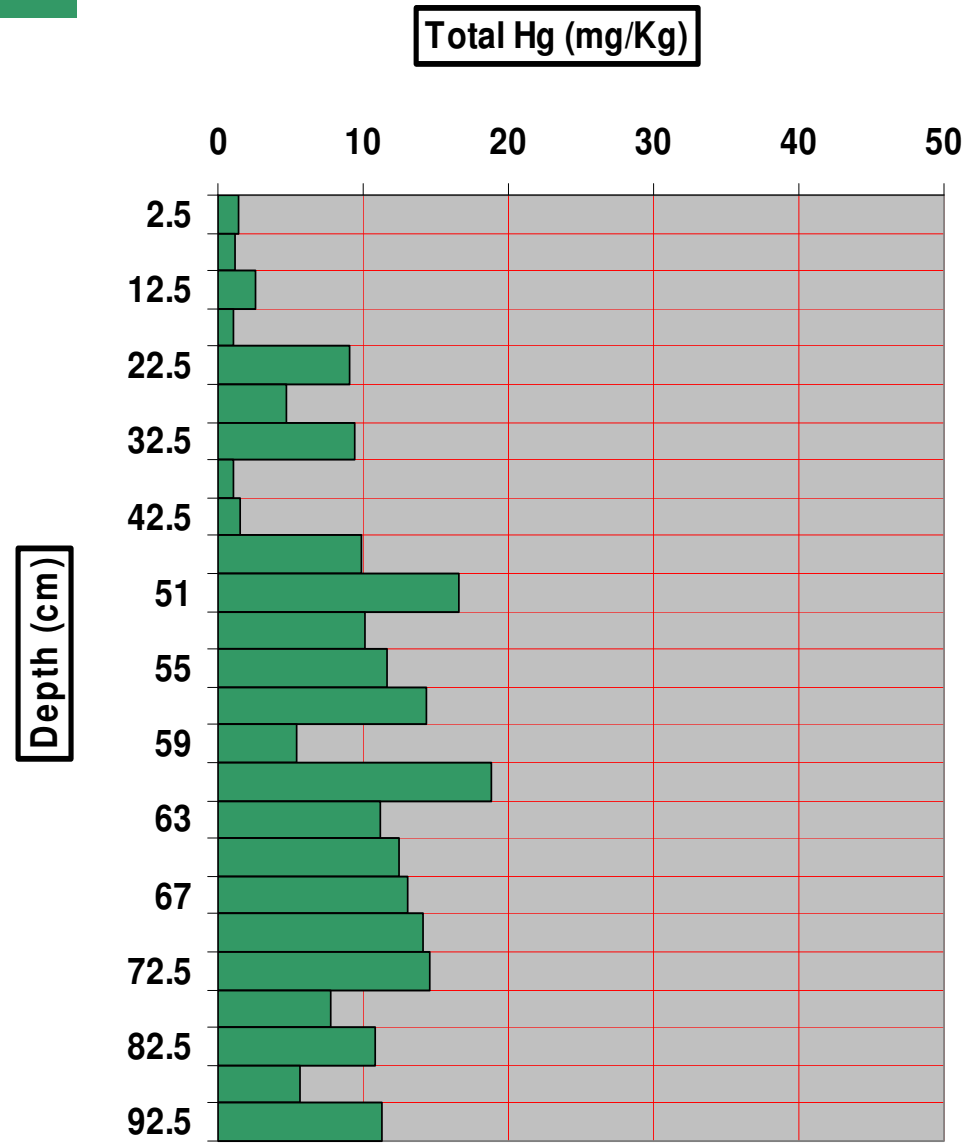
Site 2 (Tributary) – Core 2

- Uppermost site on tributary
- Surface soils are dry and covered with vegetation
- Core collected by driving with mallet
- Selected for stable isotope analysis
- Note significant decrease in Hg total above ~ 59 cm



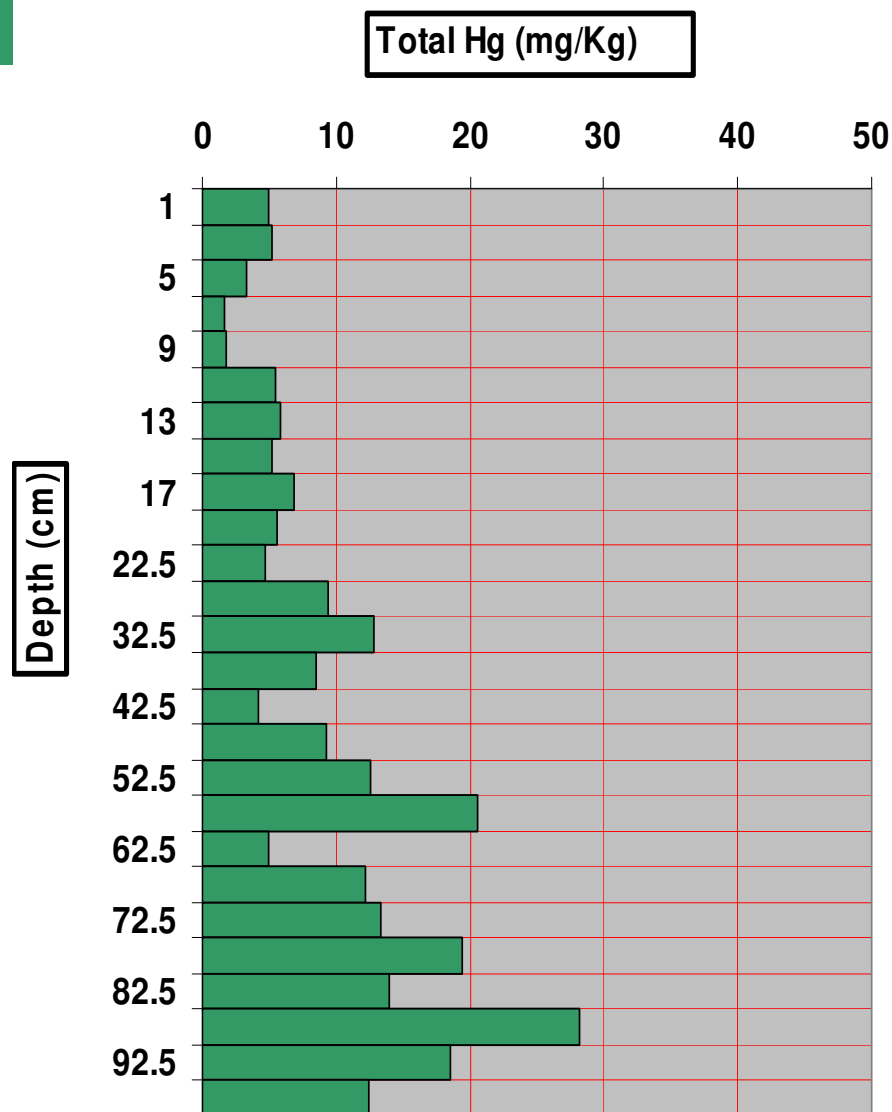
Site 2 (Tributary) – Core 6

- Mid-way along tributary
- Surface soils are dry and covered with vegetation
- Core collected by driving with mallet
- Although surface layers are lower in Hg total as compared to deeper layers, there is no distinct layer of Hg

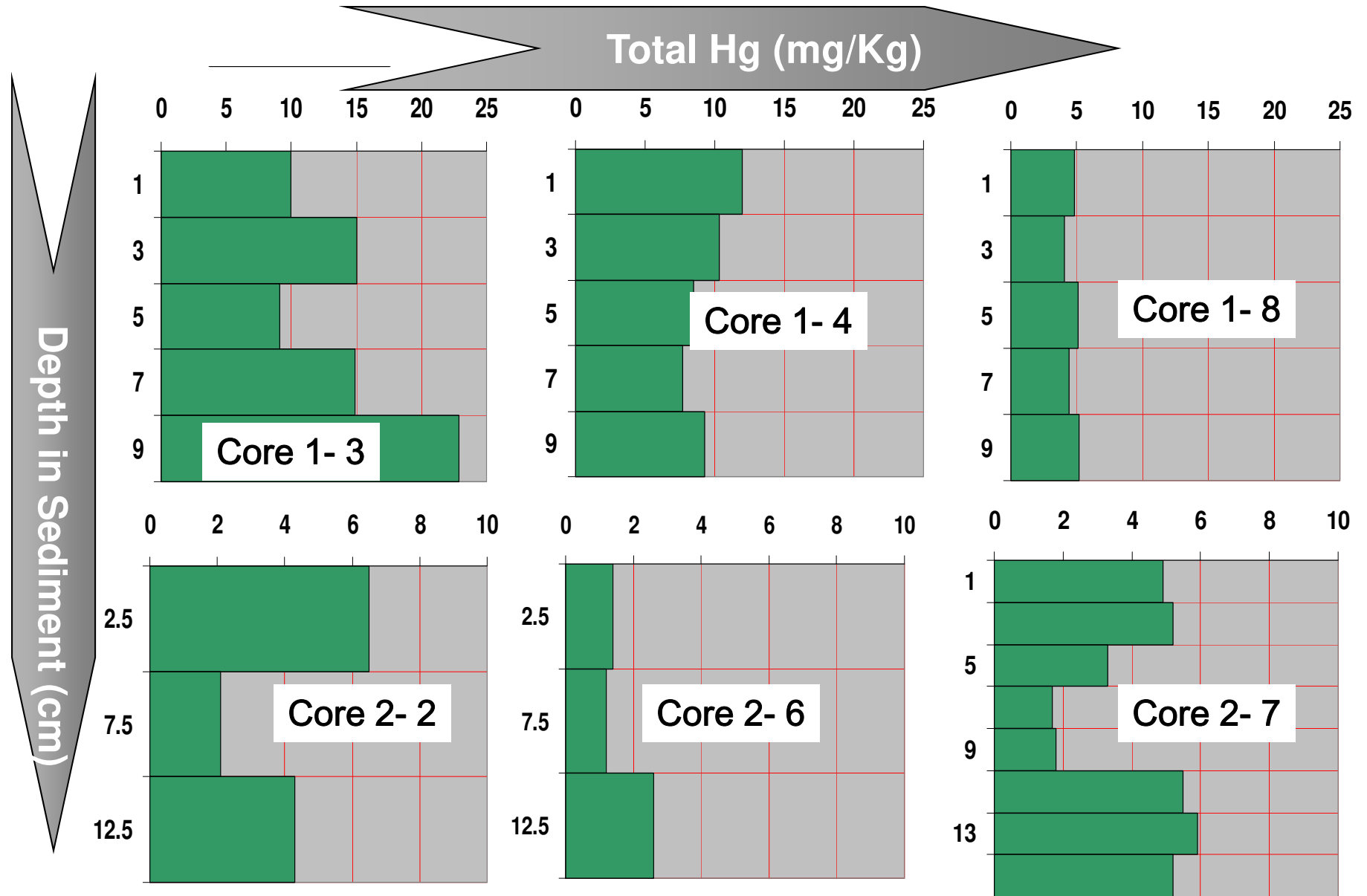


Site 2 (Tributary) – Core 7

- Collected in edge of river bay
- Surface was submerged
- Core collected by driving with mallet
- Although surface layers are lower in Total Hg as compared to deeper layers, there is no distinct layer of Hg



Hg Total in Surficial Sediments

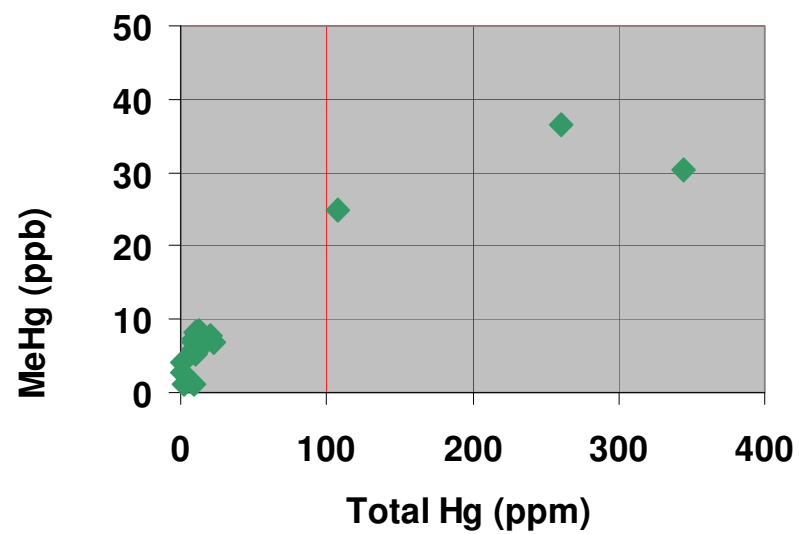


MeHg in Select Core Sections

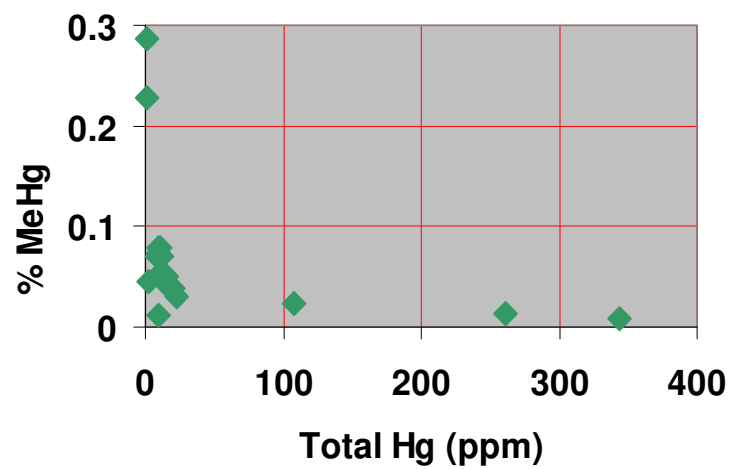
- Focused on surficial sediments and selected deep sediments where Total Hg is highest (on advice of Rudd and Turner)
- % MeHg decreases with depth - - even if Hg total increases

Site	Core	Depth (cm)	Total Hg (ppm)	MethylHg (ppb)	Ratio MeHg: Hgt	% MeHg
1	3	1	10.0	5.2	0.00052	0.05
1	3	3	15.0	7.6	0.0005	0.05
1	3	5	9.1	6.8	0.00074	0.07
1	3	9	22.9	6.9	0.0003	0.03
1	3	22.5	20.3	7.8	0.00039	0.04
1	3	52.5	344.0	30.4	0.000088	0.01
1	4	1	12.0	8.4	0.0007	0.07
1	4	3	10.3	8.1	0.00079	0.08
1	4	5	8.5	5.9	0.0007	0.07
1	4	9	9.3	7.3	0.00078	0.08
1	4	52.5	261.0	36.6	0.00014	0.01
2	2	67	108.0	24.8	0.00023	0.02
2	7	1	1.4	4.0	0.00286	0.29
2	7	3	1.2	2.7	0.000228	0.23
2	7	5	2.6	1.2	0.00045	0.04
2	7	9	9.1	1.1	0.00012	0.01
2	7	72.5	14.6	6.4	0.00044	0.04

Total Hg vs MeHg and % MeHg



Total Hg vs % MeHg



Experimental Logic

-Cost Optimization

Collect cores and
bring to central
processing site

Section and process
cores until best 5 cores
are collected.

Analyze 3 cores
for Hg_{total} and MeHg

Distinct Hg_{total} Horizons?

NO

Do not date core

YES

Send sections for dating

Dates Discernable?

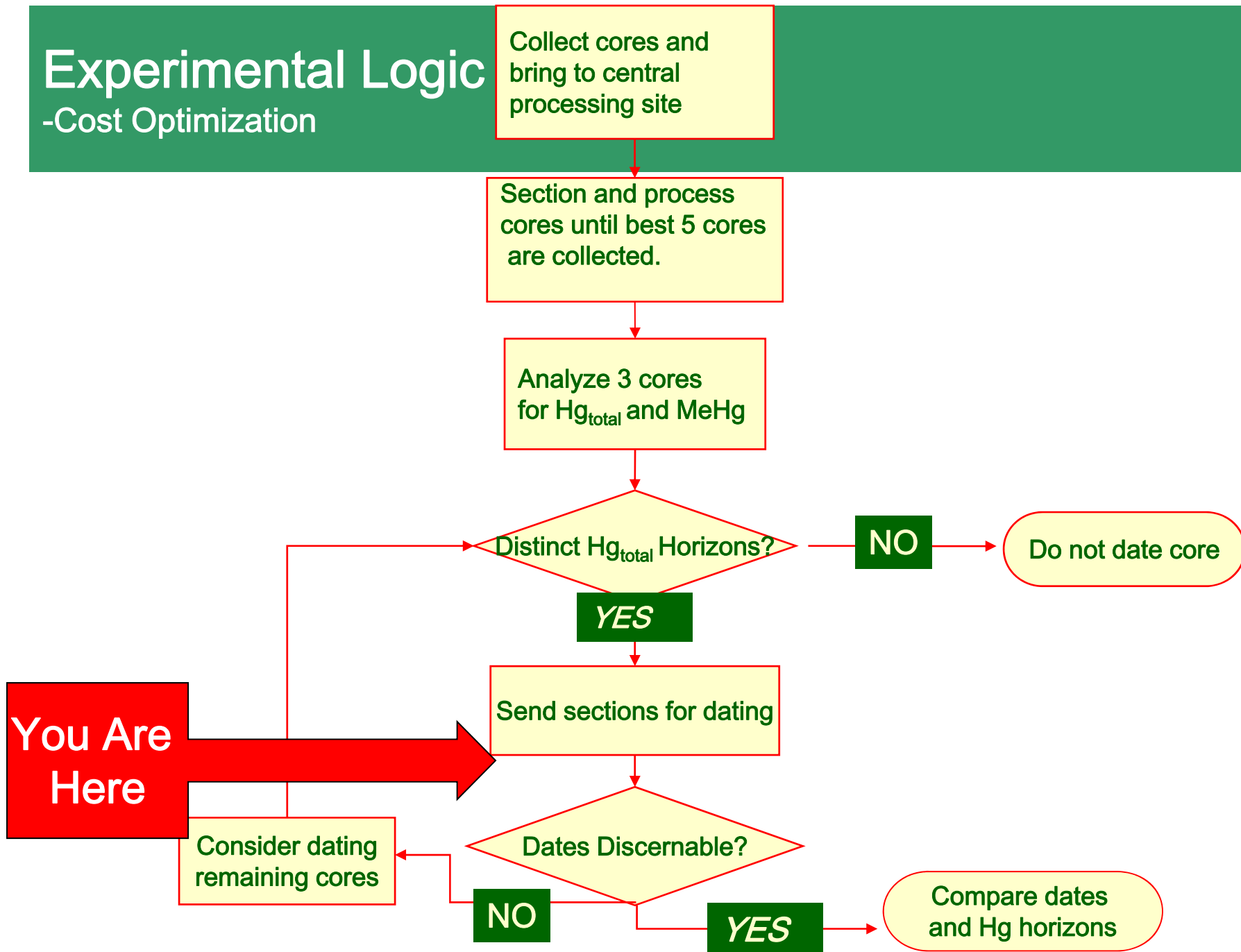
NO

YES

Compare dates
and Hg horizons

Consider dating
remaining cores

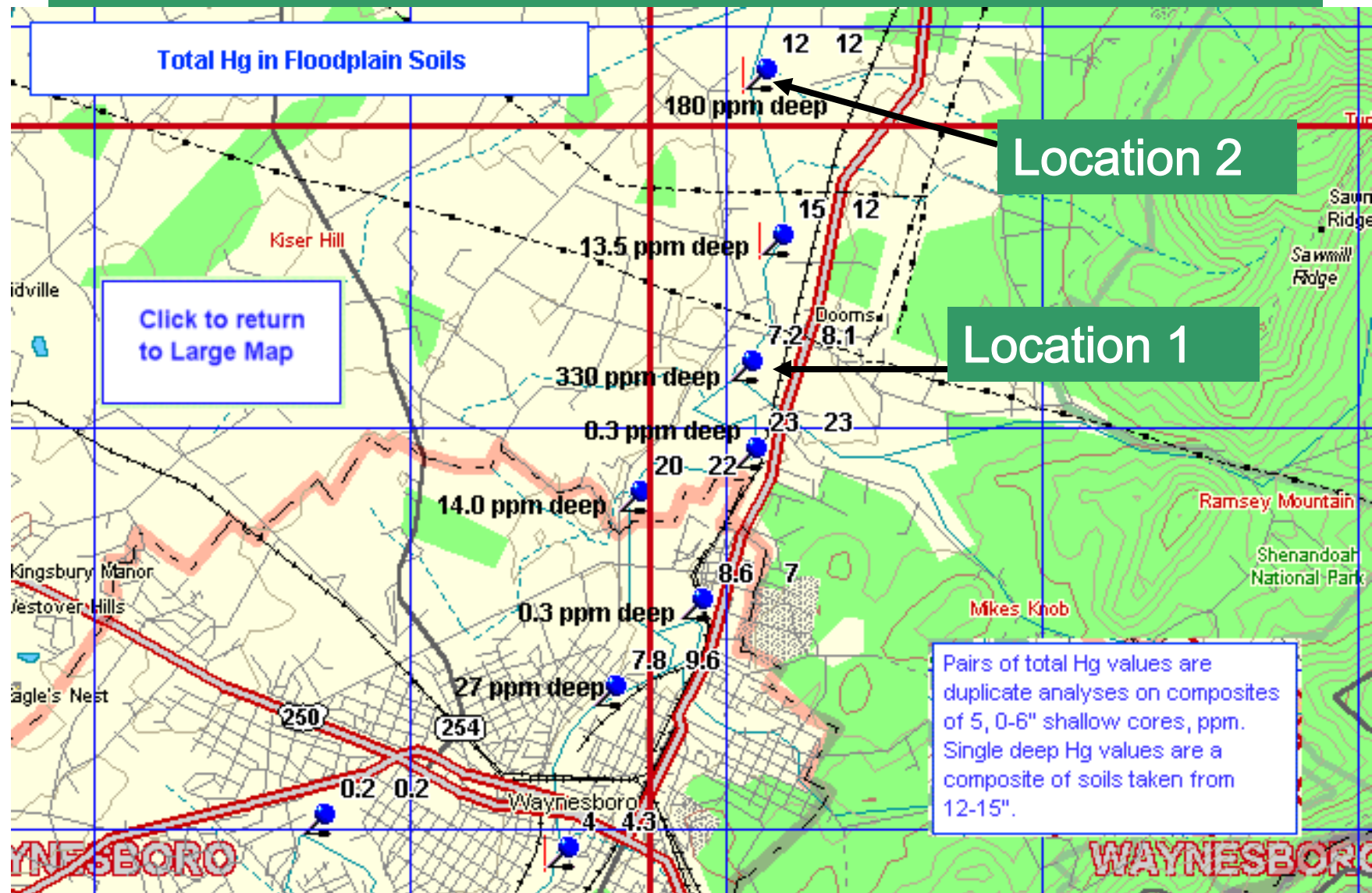
You Are
Here



Storm/Flood Actions

- Clean solids flush into the system from watershed.
- Clean solids mix with shallow/available solids in the floodplain and river bed.
- As water recedes, most solids settle out on the floodplain. Some leave downstream.
- There is a gradual movement of Hg with solids in the downstream direction. Very gradual.
- With each mixing, surface Hg lessens, depending on Hg in shallow/available floodplain and river solids.
- Question: Do recent, slightly (but sufficiently) elevated, shallow Hg readings suggest some high conc. availability?

Floodplain Soils - above Dooms Dam



Outcropping Locations?

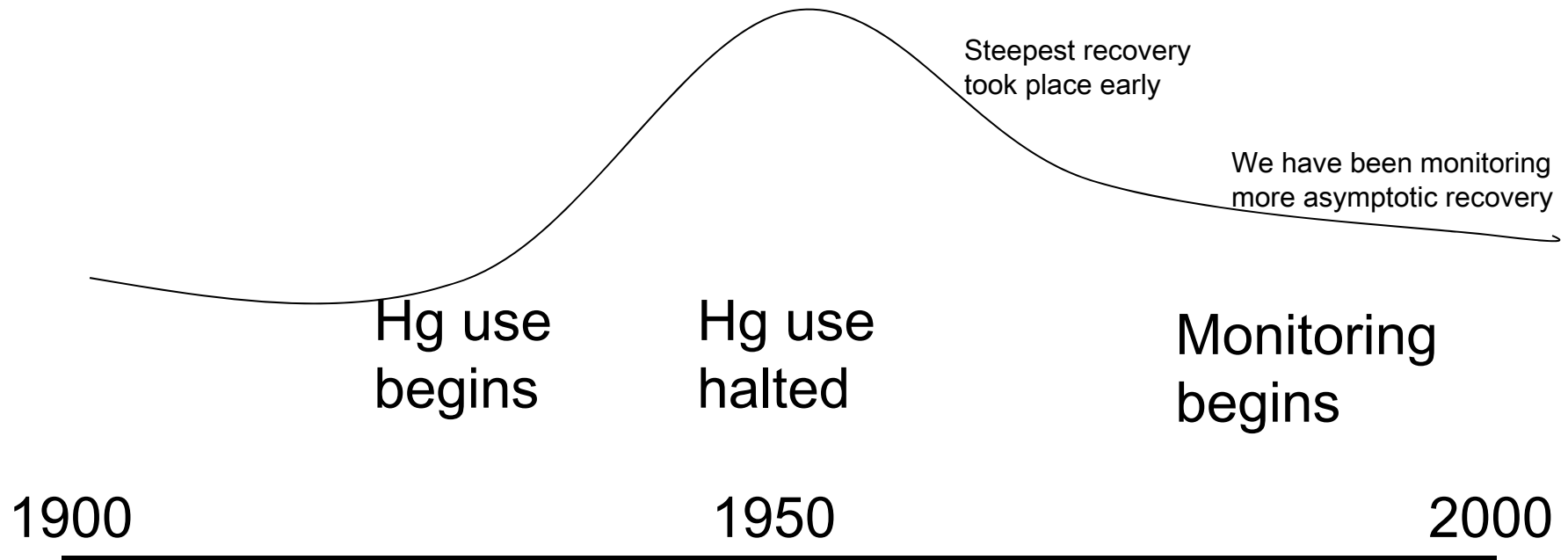


Where Banks Erode...

- pinch-out or layer-cake?



Hypothetical Timeline - for shallow concentrations



Observations/Questions

- Clear evidence of release time period, followed by cleaner deposition. But still not clean enough to halt MeHg?
- What is driving the elevated shallow Hg?
- Mixing high Hg band outcroppings 10:1 to 50:1 with clean solids entering system?
- Could adsorption/sedimentation from water column explain elevated shallow Hg?