

Mesocosm Development for Manipulative Experiments

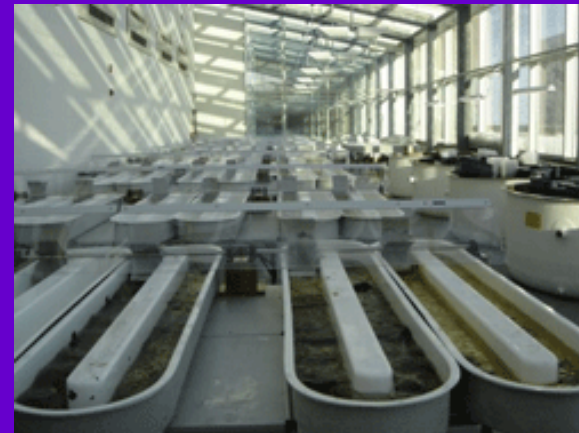
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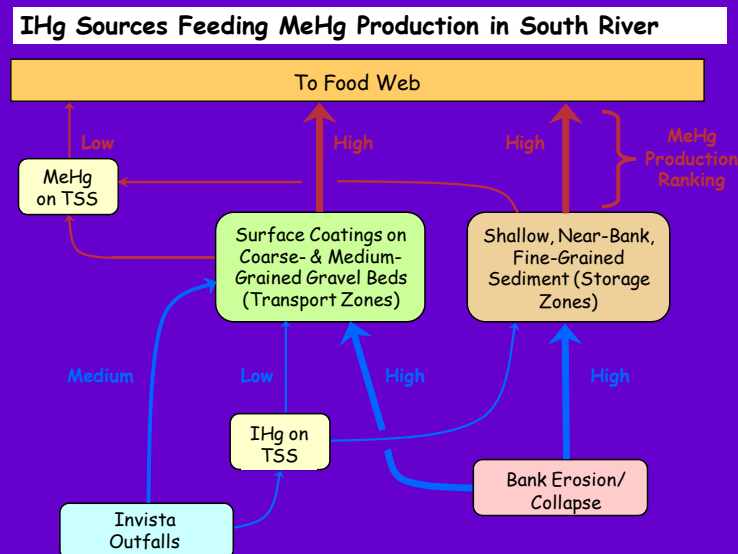
What is a Mesocosm?

- A scaled-down representation of the real-world environment that can be used for experimentation
- Bridges the gap between laboratory and field experiments



Why a Mesocosm?

- Growing need for manipulative experimentation
 - Test elements of working conceptual model
 - Test potential remedial strategies
- Mesocosms provide an appropriate platform for performing manipulative experiments
 - Level of environmental realism, while still allowing control of critical variables



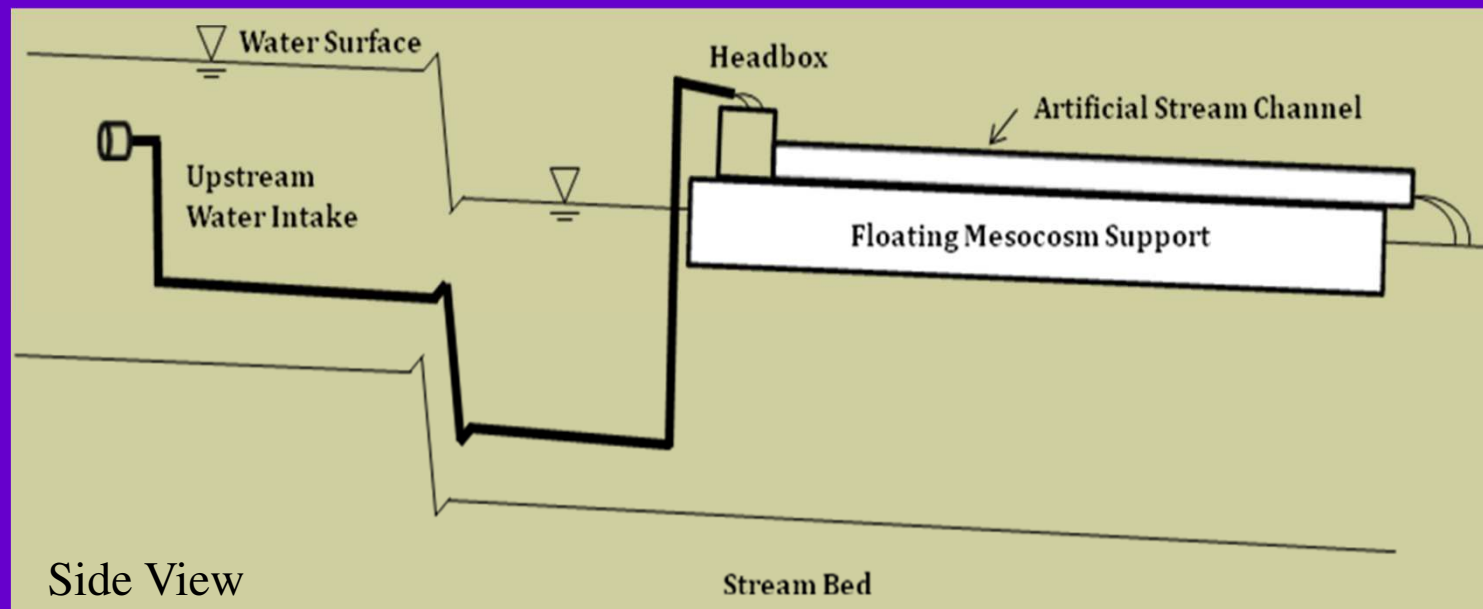
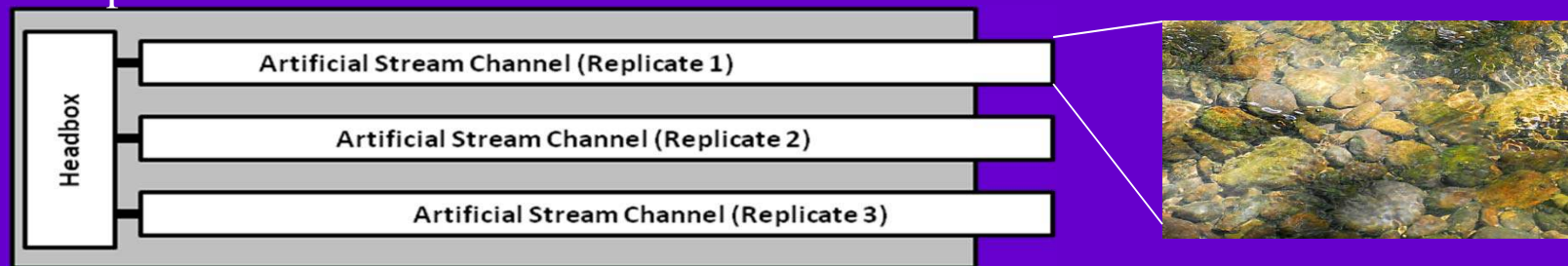
Plans for the Summer

- Task 1 – Research, design, and construct an experimental mesocosm in the South River
- Task 2 – Field test mesocosm design
- Task 3 – Manipulative experimentation
 - Relative importance of waterborne or sediment-derived mercury
 - Impact of hyporheic flow on mercury uptake

Mesocosm Design

- Task 1 – Research, design, and construct an experimental mesocosm in the South River

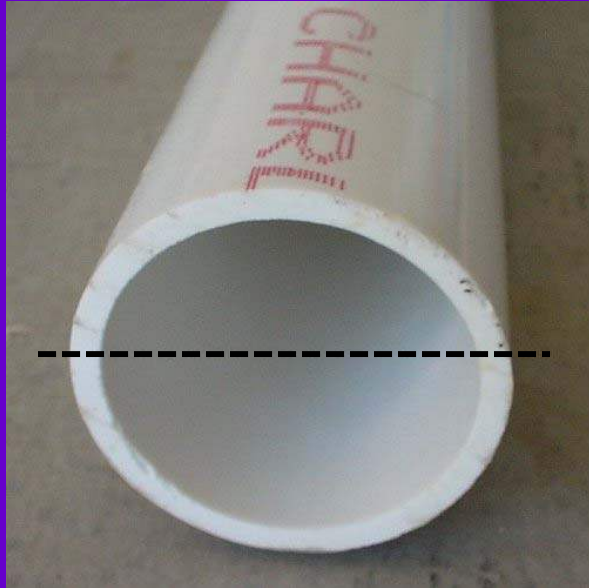
Top View



Side View

Stream Bed

Possible Materials



PVC pipe



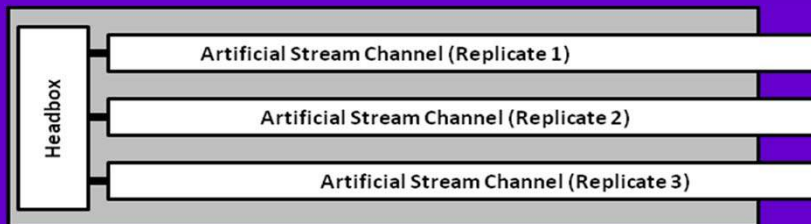
Channel Drains

Extruded PVC Channel Drain



Field Testing

- Task 2 – Field test mesocosm design
 - Does the mesocosm physically perform well under a range of conditions?
 - Is Hg uptake in mesocosm periphyton similar to river periphyton?
 - Place sterilized rocks in river and mesocosm
 - Measure Hg in periphyton at various intervals of growth



Vs.



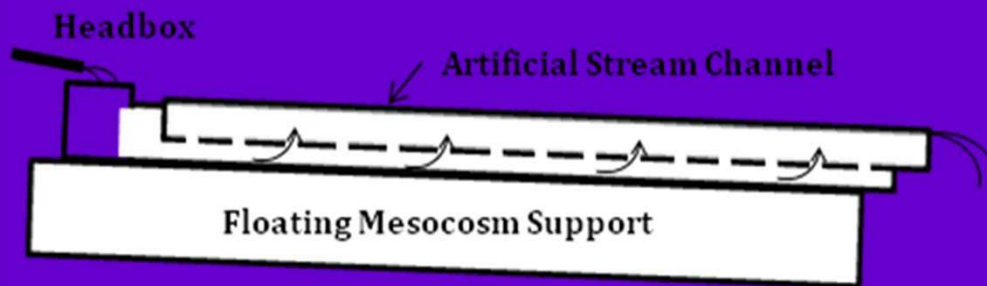
Experiment 1

- What is the relative importance of waterborne or sediment-derived mercury in determining uptake into the biological community?
- 2x2 experimental design with clean/dirty water and clean/dirty sediment

| | | Sediment Source | |
|--------------|--------------------------|--------------------------|------------------|
| | | Uncontaminated Tributary | South River |
| Water Source | Uncontaminated Tributary | Negative Control | Treatment 1 |
| | South River | Treatment 2 | Positive Control |

Experiment 2

- What is the relative importance of hyporheic flow in determining Hg uptake into the biological community?
- Similar set-up to previous experiment, but with and without hyporheic flow



| | | Sediment Source | |
|--------------|--------------------------|---|---|
| | | Uncontaminated Tributary | South River |
| Water Source | Uncontaminated Tributary | Negative Control (w/ hyporheic) | Treatment 1 (w/ hyporheic; w/out hyporheic) |
| | South River | Treatment 2 (w/ hyporheic; w/out hyporheic) | Positive Control (w/hyporheic) |

Additional Experiments

- Simulated bank erosion additions
- Impact of nutrient enrichment (or reductions) on Hg uptake in periphyton
- Pilot scale trials of remedial options involving adsorbents or capping