south river
SCIENCE TEAM

Ecological Study
Expert Panel Review

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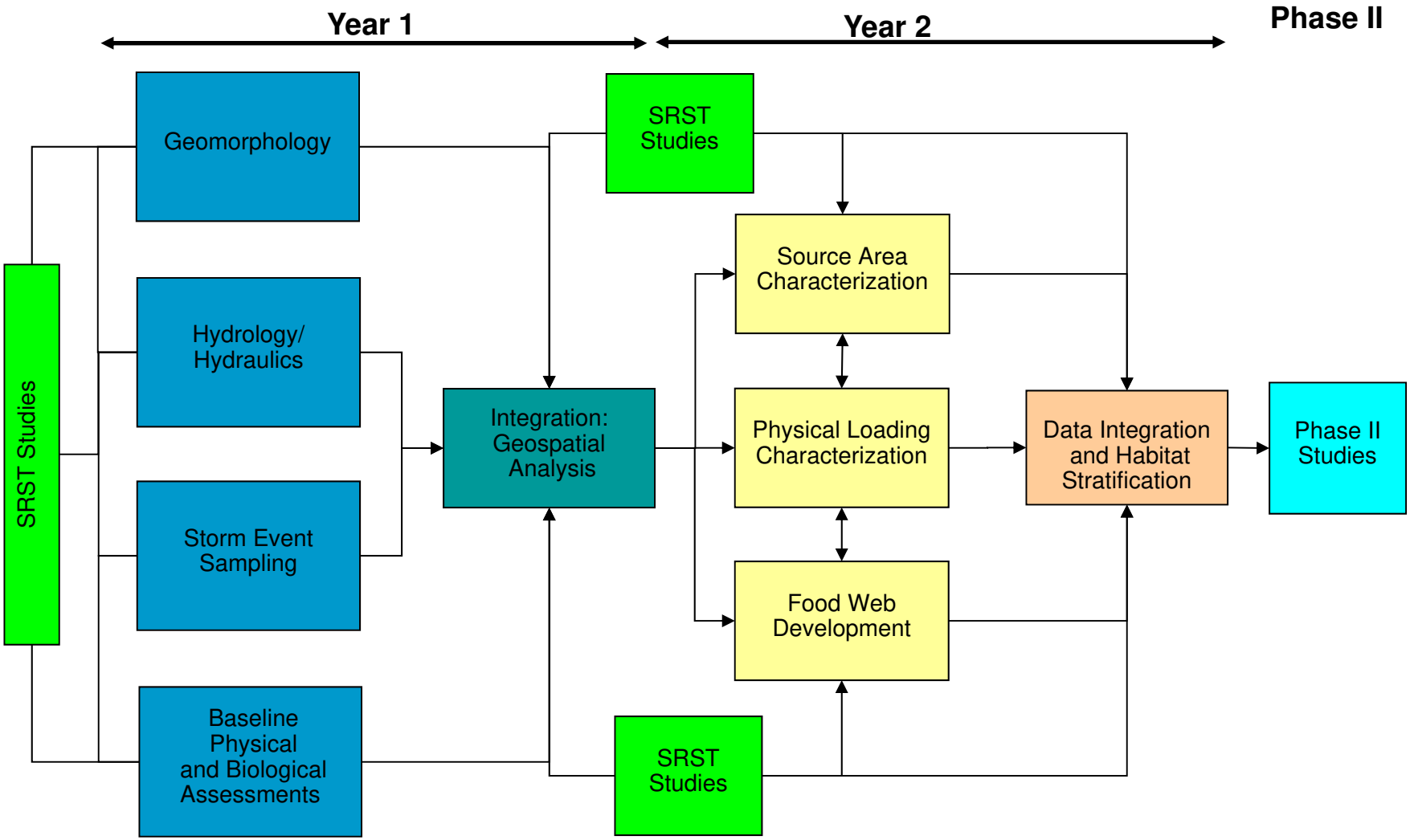
Overview: Phase I Ecological Study



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Goals and Objectives for Ecological Study: Transitioning from Phase I into Phase II

Collect and integrate data from numerous SRST activities to:

1. Characterize potential sources (i.e. physical media) of Hg to the South River System
2. Determine loading rates and the relative importance of various major potential sources of Hg to the South River system
3. Describe and rank various river and floodplain habitats (substrate types) with favorable overall conditions for methylation

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2008 Studies

- Evaluated potential sources of Hg to the South River
  - Sampled sediment deposits in late 2007
  - Participate in VADEQ floodplain study
- Conducted a targeted tributary and floodplain loading study between RRM 0 to 10
- Continued baseline monitoring
- Conducted an integrated MeHg study for various river environments

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Scheduled Activities for 2009

- Complete comprehensive statistical data evaluation
- Currently planning for Phase II studies to begin by Spring 2009
- Meet with NRDC in November 2008

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Simplified Mercury Budget

- Prepared a simplified, short-time scale budget based on May 2008 integrated loading study
- Goals:
  - Estimate the relative importance of sources between RRM -2.7 and RRM 9.9
  - Provide a framework to plan future work
  - Identify potential data needs
- Limitations:
  - Short time frame
  - Small sample sizes

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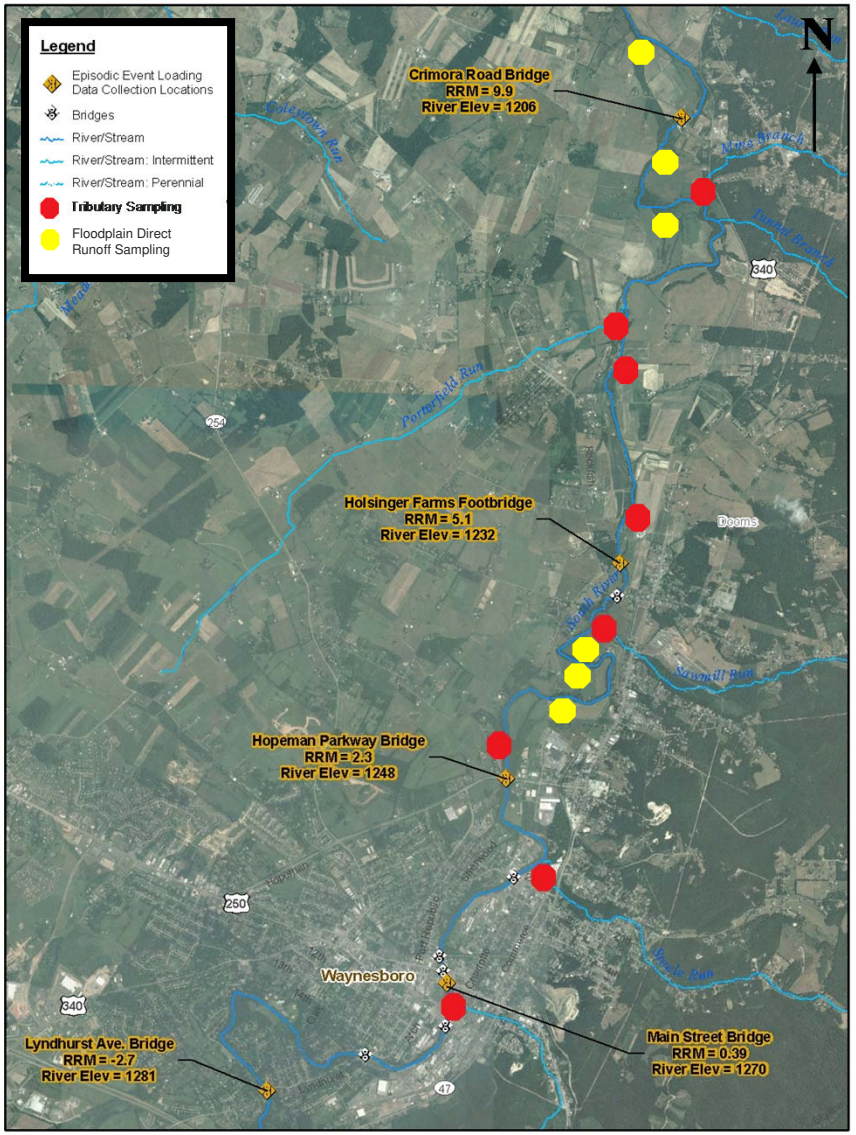
May 2008 Study Design

- Study Area: RRM -2.7 to RRM 9.9
  - Baseline data confirm Hg loading
  - Highest THg & MeHg concentrations in sediment and soil
  - Geomorphology data indicate:
    - Lower river gradient
    - Greater floodplain area
    - Higher % of eroding banks
  - Greater storage of fine-grained sediment
  - Closest to historic release point
- Timing:
  - May 2008



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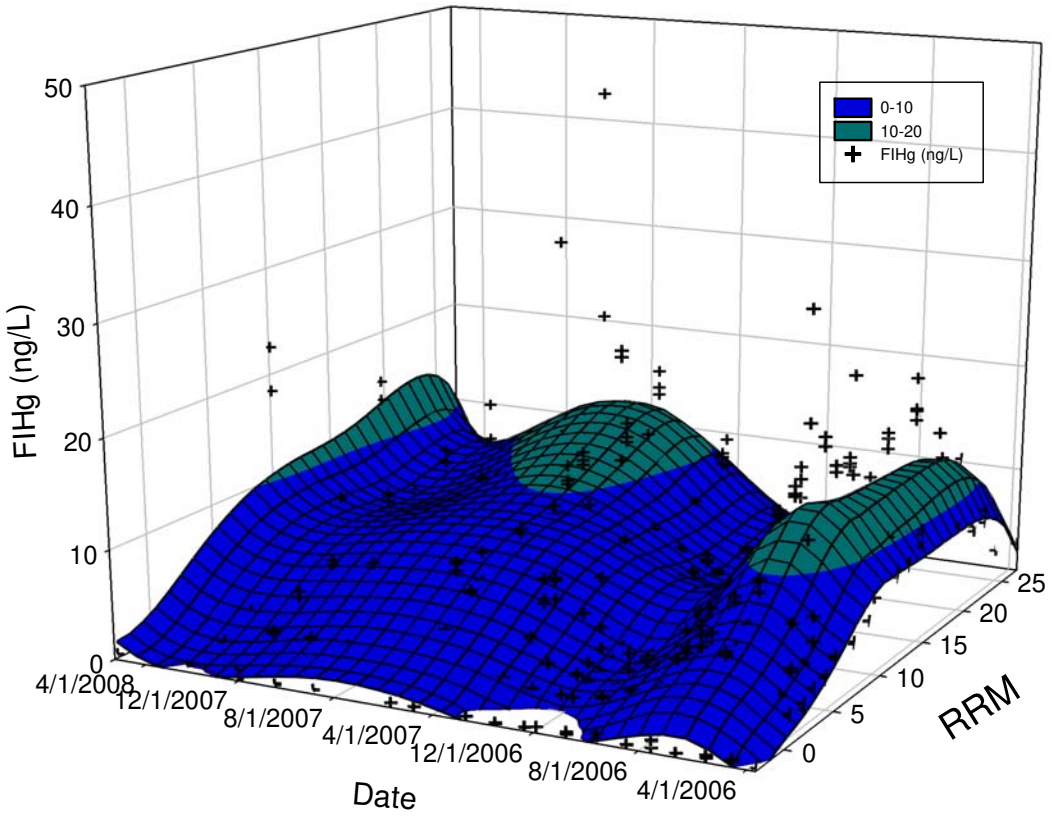
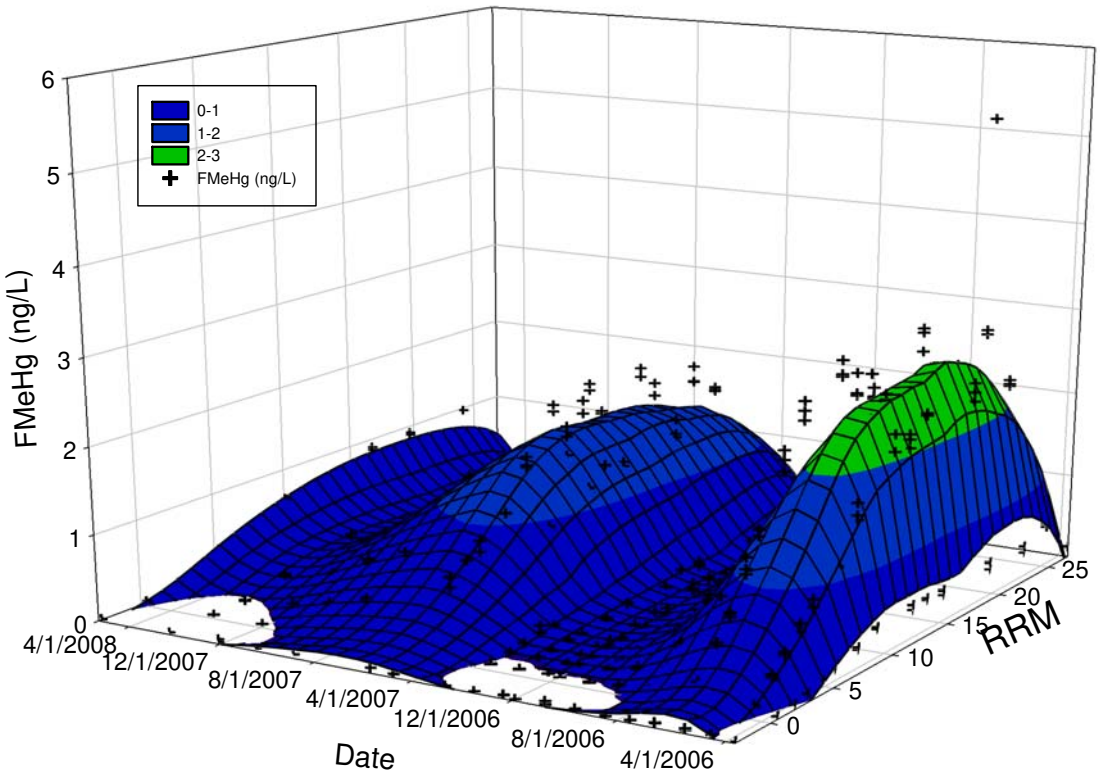
Background Data from Baseline Sampling

Filtered Inorganic Mercury (FIHg)
Time Series Baseline Data
South River 2006-2008



Background Data from Baseline Sampling

Filtered Methylmercury (FMeHg)
Time Series Baseline Data
South River 2006-2008



Methods

- Measured discharge (Q) and IHg and MeHg loads at tributaries and bridges (May 2008) 7 days after storm
  - Baseline conditions
- Point sources (Invista, Waynesboro STP, Genicom outfall) used median measured values or data from NPDES permits/TMDL
- Focused on filter-passing concentrations to allow for use of BFC and GW data
- Added tributary flows and point source flows and assumed that groundwater made up difference (33%) from flow observed at RRM 9.9
- Used median concentrations to calculate groundwater contributions (RT Geosciences/UES, EPA)
- Used median fluxes from FGCM deposits and gravel beds (May and June 2008)

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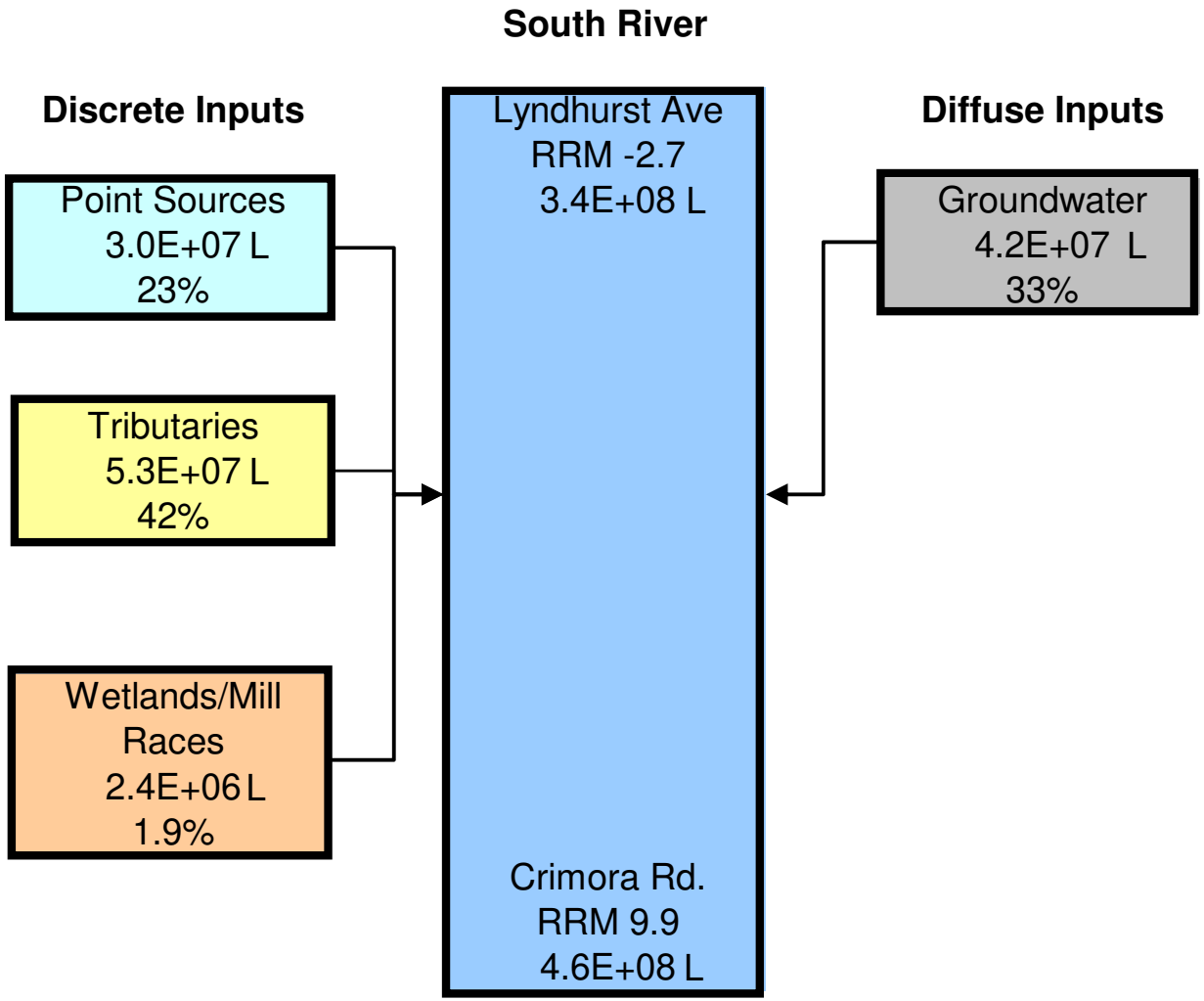
Water Balance (liters per day)



Water Balance

- Able to account for observed discharge increase
- Groundwater accounts for 33% of discharge in river
  - Consistent with water budget monograph (30-70%)
- Strong foundation to assess FIHg and FMeHg contributions from various sources

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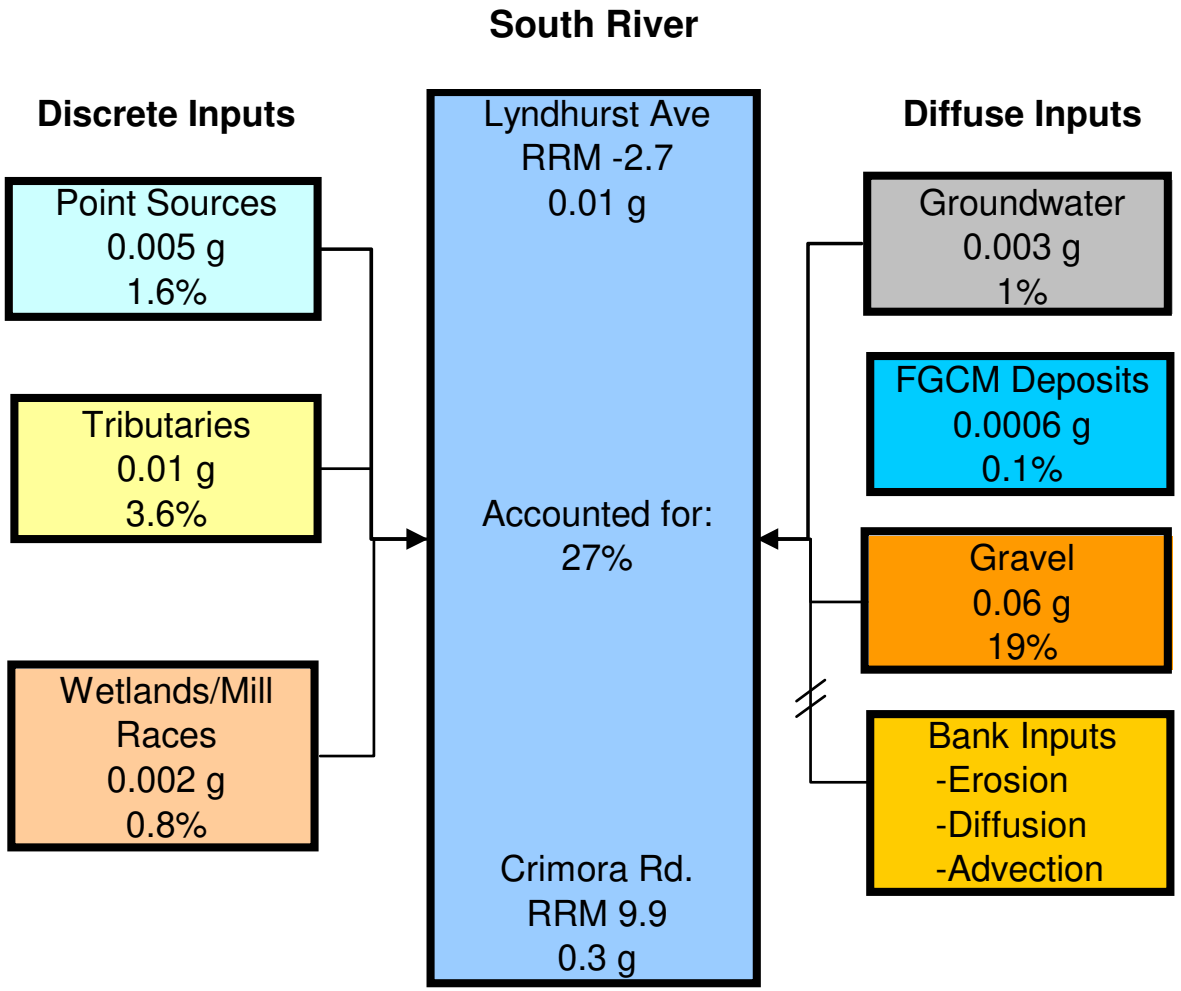
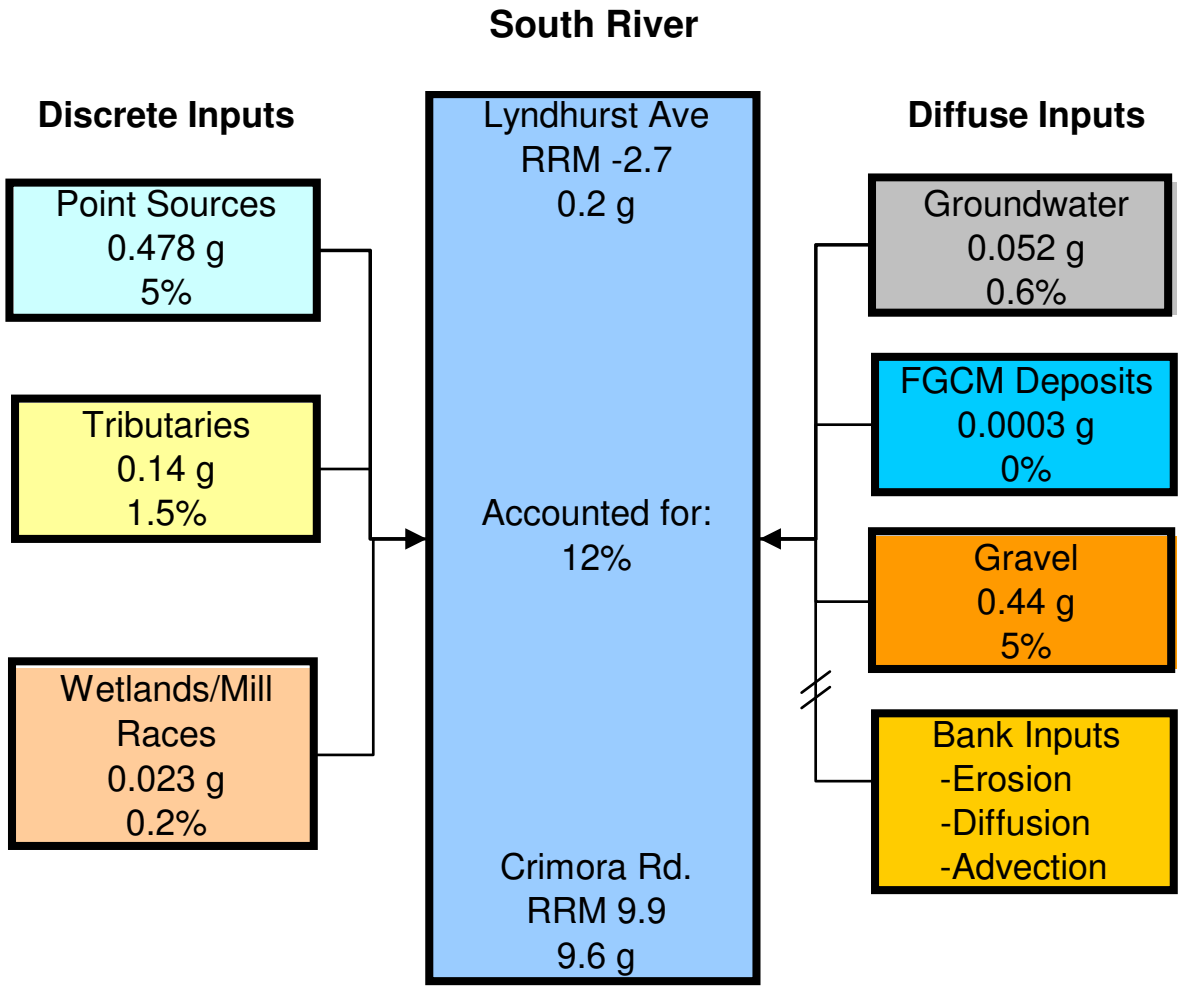
Filtered Methylmercury (FMeHg)



Filtered Inorganic Mercury (FIHg)



Can Near-Bank Processes Account for 90% of FIHg Load?

Previous Study Observations:

- Soil erosion processes are active year-around and observations suggest soils settle at foot of bank (particularly in spring)
- SW THg concentrations higher near bank than center-channel
- Filtered porewater THg at Basic Park (RRM 2.0) ranged from 84.1 to 1824 ng/L (RTGeosciences)
  - Maximal fluxes based on Fick's first law on the order of 300 - 500 ng/m^2/hr, similar to fluxes predicted from surface water
  - Based on soil extraction data, wet/dry cycles could support higher porewater concentrations than those observed

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Next Steps for Phase II Ecological Study

- Refine estimates and uncertainty
- MeHg Loading
  - Additional BFC deployments in embedded gravels
  - More intensive Spring sampling in 2009
  - Reduce focus on FGCM deposits
  - Continued efforts with SRST
- IHg Loading
  - Develop a study to characterize near-bank loading processes
    - Focus work in reach between RRM 5.1 and 9.9
    - Need to understand bank erosion rates, near-bank pore water, and soil dissolution rates

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