SRST Remedial Options Program 2016 Research and Remediation

NR Grosso

SRST Meeting

January 20, 2015

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SRST ROPS 2016

1. **Phase 1 A Interim Measures AOC4 (Anchor QEA / AECOM)**
2. **Phase 1 B Design**
3. **Enhanced Adaptive Management Model Training (Christy Foran, USACE)**
4. **Reactive Capping Simulations and Pore Water Monitoring (Danny Reible, Texas Tech University)**
5. **Characterization /Treatment of Sediment / Soil (Carol Ptacek, Waterloo)**
6. **Stable Mercury Isotope Analysis (Joel Blum, U Michigan)**
7. **Dynamic Mercury Cycling Model (Reed Harris)**
8. **Floodplain Soil Amendment Pilot (Ceil Mancini, Bill Reese, AECOM)**
9. **Verification of Aquanty HydroGeoSphere Model (Steve Berg, Aquanty / AECOM)**

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Reactive Capping Simulations and PW Monitoring
Danny Reible, Texas Tech University

Identify capping design element parameters through laboratory mesocosms and modeling

Increase understanding of the bioavailable pool of mercury and geochemical processes in the South River through pore water measurements

Capping of sands: Has the effect of driving sediment more anaerobic, increasing precipitation of reduced Hg phases. Also, increased sorption within cap. Minor increases in MeHg with reduction. Migration into (sand or amended) cap minimal.

Capping of Gravels: Benefits of capping gravel insignificant compared to capping sands/ silts.

Modeling Long term effectiveness of caps (post storm bank seepage): Even thin sorbing layer with modest capacity can substantially reduce seepage of Hg out of banks due to flooding-drainage cycle. Caps may not be needed if clean soil cover on bank stabilization provides same benefits.

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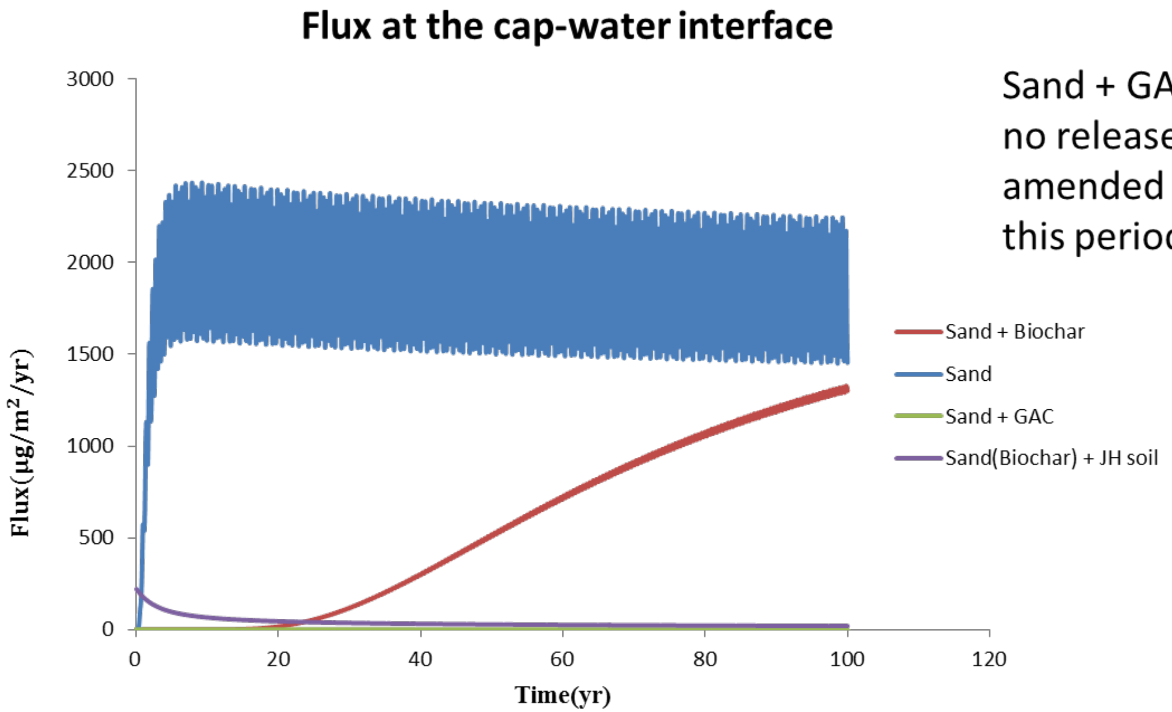
Hg flux for different capping materials



Sand + GAC effectively no release through the amended cap layer in this period

Neglects any net groundwater flow to river and assumes inundation and drainage equal
Neglects any changes in Hg porewater concentration due to reduction beneath a saturated cap

Sand-biochar + JH Soil -) is 15cm Sand-Biochar with 15cm JH soil layer on top

Initial THg concentration in JH soil: 0.0928ug/L (solids 0.078±0.01 mg/kg

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Characterization /Treatment of Sediment / Soil
Carol Ptacek, Waterloo

Characterize the leaching behavior of SR soil and sediment and test treatments that can be utilized in the South River. Objectives of treatment are to minimize Hg mobilization and transport; prevent production of MeHg; reduce contributions of nanoparticulate and colloidal Hg.

- Removal with biochar is > 80%. Greater Hg removal for high T (600ºC) than for low T (300ºC) biochars. Hardwood biochars are best (geochemistry – low sulphase release, low DOC release)

- Column experiments (advection) show effective removal of Hg through treatment layer (sand + bioochar) even with 3.3 wt. % biochar.

- Floodplain conditions – variably saturate experiments – effective treatment of Hg and minimal production of MeHg

- Layered Treatment Columns to simulate bank treatments - All biochar columns currently have similar declines in Hg concentrations (not yet at capacity) while Hg concentrations in the column with no biochar are increasing across the clean soil layer

- Blending contaminated soils with biochar is moderately effective in static systems but not as effective in flow through systems. Try other additives?

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Dynamic Mercury Cycling Model - Reed Harris

Develop a mechanistic model of mercury fate and transport that will allow prediction of outcomes under different remediation scenarios

- Calibration of the model is well underway

- After calibration is complete, different remediation scenarios will be tested

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Stable Mercury Isotope Analysis
Joel Blum, U Michigan

Explore stable Hg isotopes as a tool for forensics and Hg fate and transport

- Hg isotopes in water samples show a mixing pattern between background Hg isotopes and Outfall 001 Hg isotopes.
- However, a 3 end-member mixing model needed to explain isotopic variation. Additional work will be undertaken to understand a potential third mercury source.

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Verification of Aquanty HydroGeoSphere Model
Steve Berg, Aquanty / AECOM

Field program to verify the modeling results of post-storm volume of bank face seepage and GW flow through field.

This work is still tentative. Possible locations to be scoped – Basic Park may be one option.

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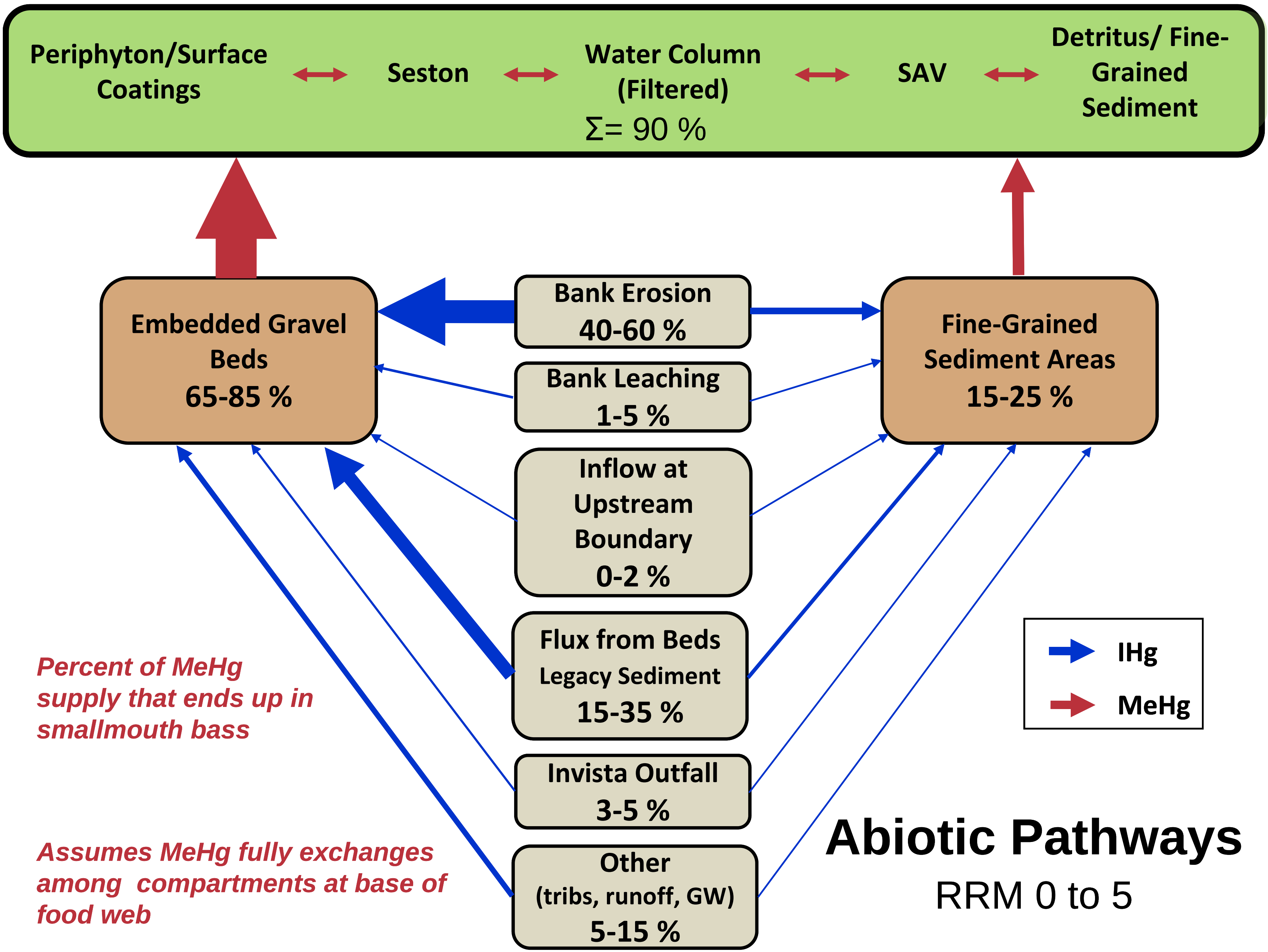
Other Slides

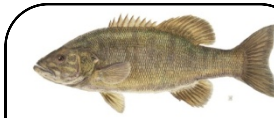

Periphyton/Surface Coatings
Seston
Water Column (Filtered)
Σ= 90 %
SAV
Detritus/ Fine-Grained Sediment
Embedded Gravel Beds 65-85 %
Bank Erosion 40-60 %
Fine-Grained Sediment Areas 15-25 %
Bank Leaching 1-5 %
Inflow at Upstream Boundary 0-2 %
Flux from Beds Legacy Sediment 15-35 %
Invista Outfall 3-5 %
Other (tribs, runoff, GW) 5-15 %
Percent of MeHg supply that ends up in smallmouth bass
Assumes MeHg fully exchanges among compartments at base of food web
IHg
MeHg
Abiotic Pathways
RRM 0 to 5

Biotic Pathways: Updated

Smallmouth Bass

Top Down Approach (*DRAFT*)

Emphasizes relative importance of final MeHg pathways to smallmouth bass.



Piscivorous Fishes
Smallmouth Bass
Σ = 100%

Omnivorous Fishes
Forage Fish
50-55%

Invertivorous Fishes
Redbreast Sunfish
5-10%

Terrestrial Invertebrates
Ant, Beetle, and Spider
1-5%

Invertivorous Aquatic Invertebrates
Dragonfly and Damselfly
1-5%

MeHg

Omnivorous Aquatic Invertebrates
Caddisfly
1-5%

Omnivorous Aquatic Invertebrates
Crayfish
20-25%

Detritivorous / Herbivorous Aquatic Invertebrates
Mayfly
5-10%

Detritivorous Aquatic Invertebrates
Midge
1-5%

Periphyton / Surface Coatings ↔ **Seston** ↔ **Water Column (Filtered)** ↔ **SAV** ↔ **Detritus / Fine-Grained Sediment**

90%