

South River Amendment Pilot Project Update



April 26, 2011

Discussion Topics

- Amendment Pilot Test Concept
- Amendment Pilot Objectives
- Assessment Elements
- Preliminary Success Criteria and Metrics
- Phase I
- Phase II
- Schedule



Amendment Pilot Test Concept

- A potential remedial option being considered to reduce the bioavailability of MeHg in environmental media
- Application of biochar to sediments in a small floodplain pond to test its efficacy



Source: University of Waterloo



Amendment Pilot Test Concept

- Identification of suitable South River floodplain pond sites
- Physical design of pilot site to facilitate quality data collection with minimal disruption
- Benthic invertebrates serve as biological monitor
- Selection of amendment types
- Development of success criteria & metrics



Amendment Pilot Objectives

- Assess efficacy in reducing
 - mercury in physical media
 - bioavailability of mercury to benthic macroinvertebrates
- Assess potential effects on
 - water quality
 - sediment characteristics
 - benthic macroinvertebrates
 - primary productivity
- Demonstrate progress toward innovative remedial strategies

Working Hypotheses

- Addition of amendment will reduce Hg concentrations in porewater by at least 50%
- Addition of amendment will reduce Hg concentrations in benthic invertebrate tissue by at least 50%
- Benthic community structure does not differ among control and amended cells within the pond

Relevant Questions:

- Differences in Hg & MeHg concentrations between treated and control cells
 - Surface water
 - Sediment
 - Benthic invertebrate tissues
 - Porewater
- The time frame over which concentration changes can be measured
- Readily detectable unintended consequences of the treatment



Preliminary Study Metrics

Element	Metrics
Surface water Hg & MeHg	Reduction in concentrations
Sediment Hg & MeHg	Reduction in concentrations
Tissue Hg & MeHg	Reduction in concentrations
Pore water Hg & MeHg	Reduction in concentrations
No unintended impacts to invertebrates	No difference between treated and control cells



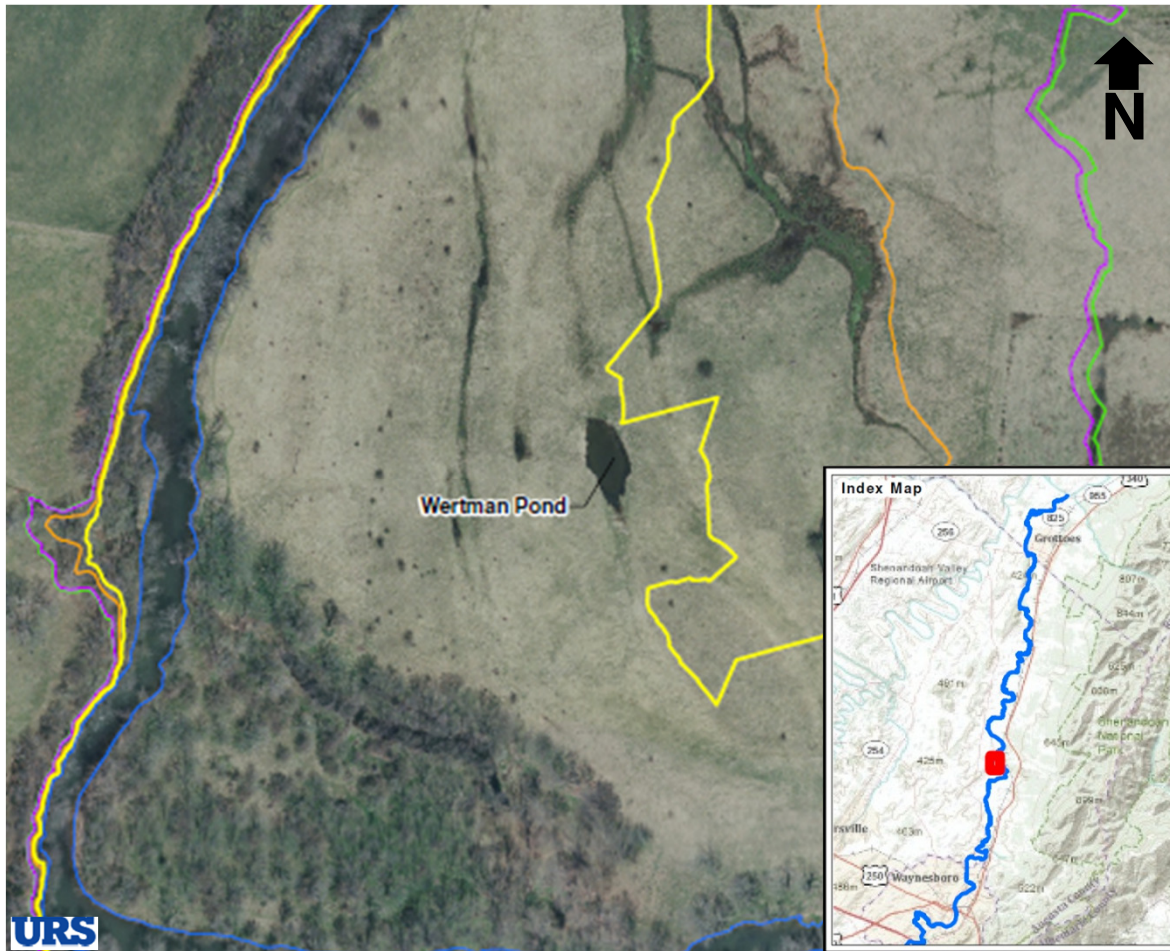
Phased Approach – Phase 1

- Site selection
- Pond characterization
 - Substrate
 - Surface water
 - Groundwater flow
 - Benthic community
 - Wetland delineation
- Permitting Strategy



Phased Approach – Phase 1 (Cont'd)

- Site Location – Wertman Pond (RRM 9.3)



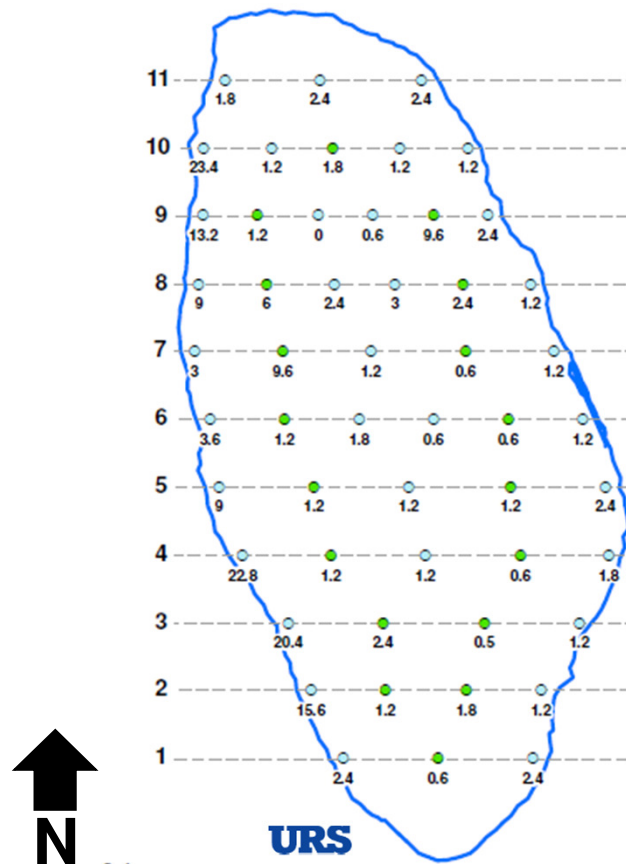
Legend

- South River Shoreline
- 2-Year Floodplain
- 5-Year Floodplain
- 62-Year Floodplain
- 100-Year Floodplain



Phased Approach – Phase 1 (Cont'd)

- Pond Characterization – Substrate Thickness



Legend

● Substrate Thickness & Surface Water Depth Sample Locations

● Surface Water Depth & THg Sediment Sample Locations

--- Sampling Transects

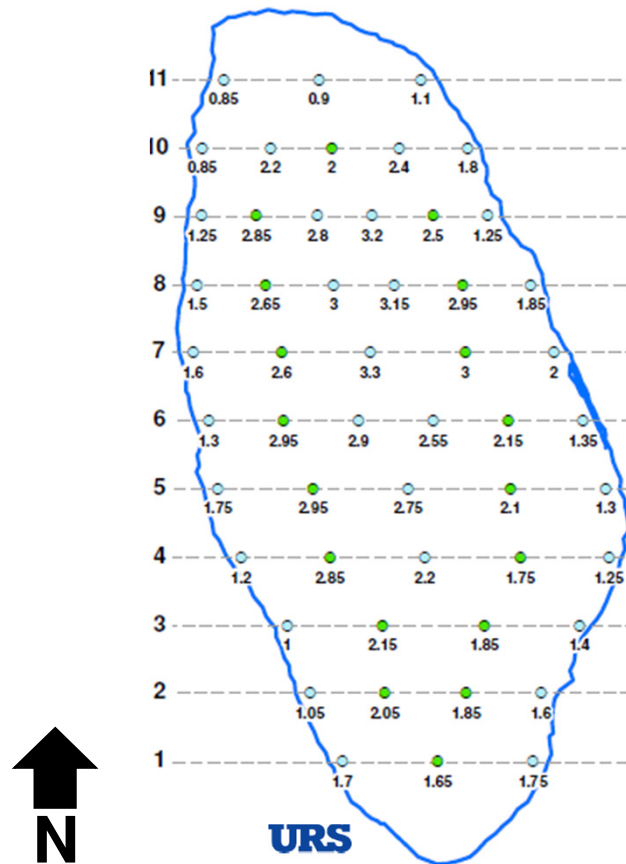
Pond Outline

All locations are approximate

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Phased Approach – Phase 1 (Cont'd)

- Pond Characterization – Water Depth



Legend

- Substrate Thickness & Surface Water Depth Sample Locations
- Substrate, Surface Water Depth & THg Sediment Sample Locations

--- Sampling Transects

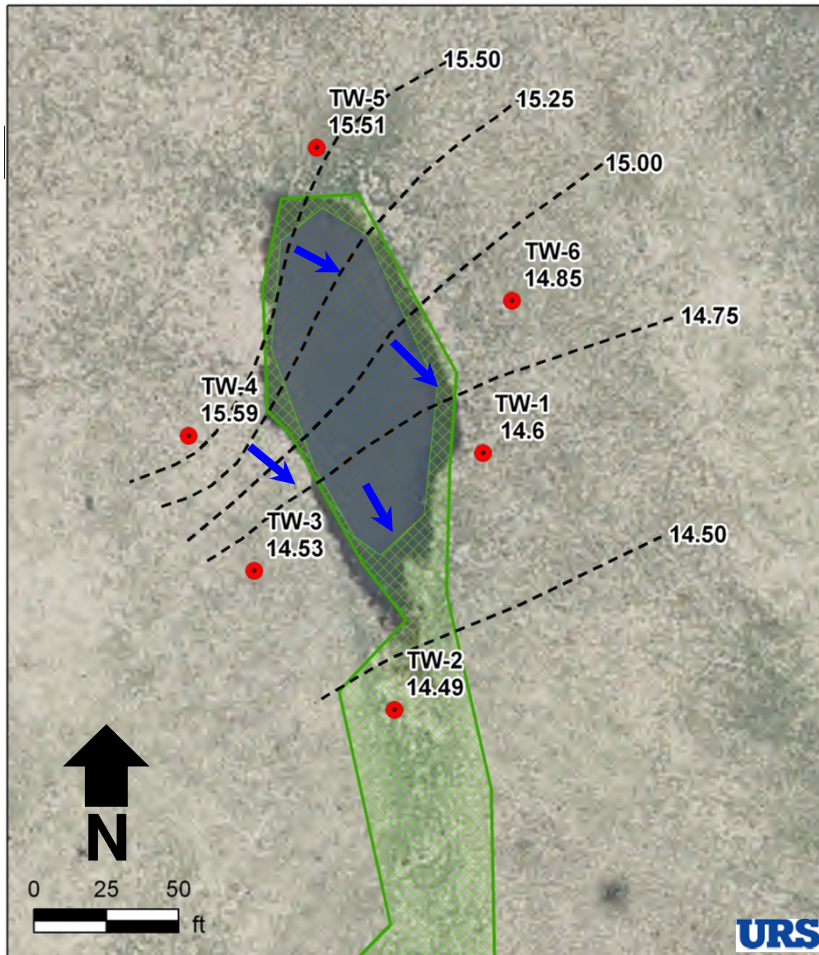
Pond Outline

All locations are approximate

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Phased Approach – Phase 1 (Cont'd)

• Pond Characterization – Groundwater Flow & Delineated Wetlands



Legend

● Piezometer Locations

-- Groundwater Flow Contours (ft)

 Delineated Wetlands

→ Groundwater Flow Direction


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Phased Approach – Phase 1 (Cont'd)

Observed Taxa		
Class or Order	Family	Genus
Oligochaeta		
Arachnida	Hydrachnidae	
Bivalvia	Pisidiidae	
	Sphaeriidae	
Cladocera		
Coleoptera	Elmidae	<i>Dubiraphia</i>
Copepoda		
Diptera	Ceratopogonidae	
	Chironomidae	
	Tabanidae	
Ephemeroptera	Caenidae	<i>Caenis</i>
Gastropoda	Physidae	
	Planorbidae	

Observed Taxa		
Class or Order	Family	Genus
Hemiptera		
Lepidoptera	Crambidae	<i>Elophila</i>
Nematoda		
Odonata	Coenagrionidae	<i>Enallagma</i>
	Lestidae	<i>Lestes</i>
	Libellulidae	
Ostracoda	Ostracoda	
Trichoptera	Phryganeidae	<i>Agrypnia</i>
	Hydroptilidae	



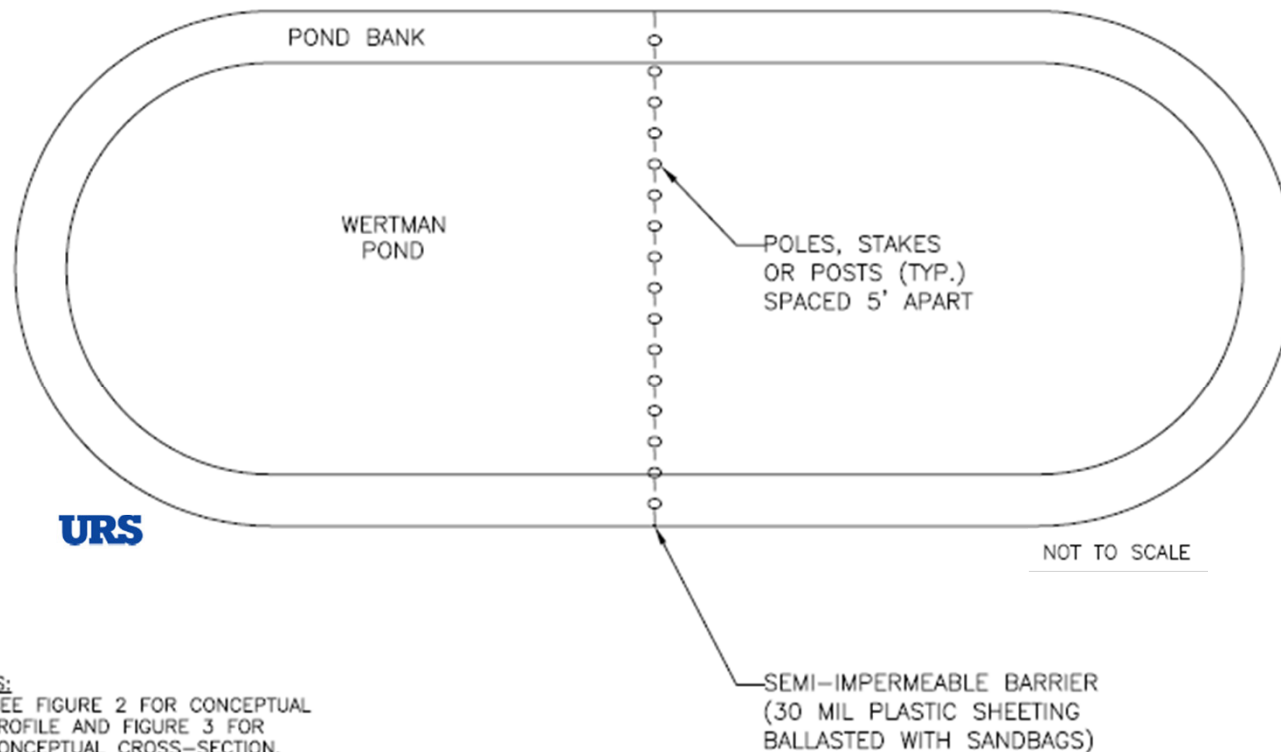
Phased Approach – Phase 2

- Engineering Design
 - Separate pond into cells using simplistic design to achieve goals while causing minimal disruption to area
- Carbon Amendment
 - Biochar must be wetted and manually applied to insure settlement and uniform coverage
 - Cowboy Charcoal is to be used



Phased Approach – Phase 2 (Cont'd)

- Engineering Design – Conceptual Planview



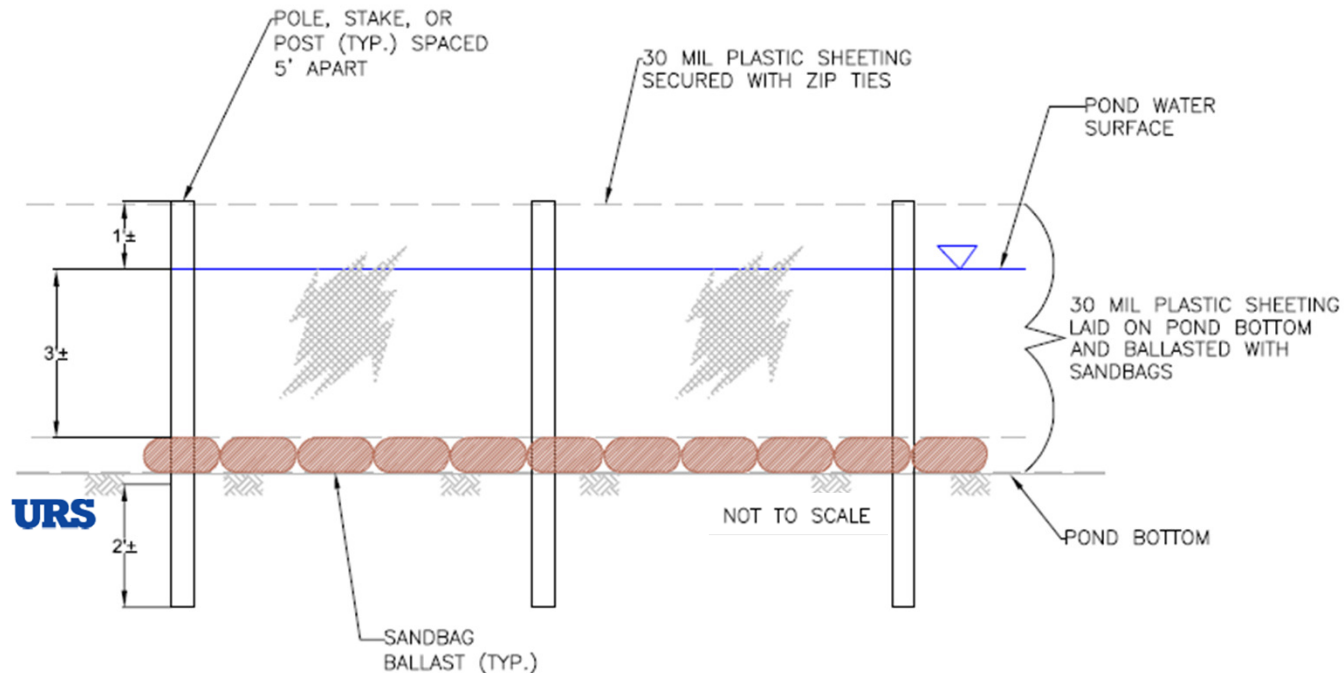
NOTES:

1. SEE FIGURE 2 FOR CONCEPTUAL PROFILE AND FIGURE 3 FOR CONCEPTUAL CROSS-SECTION.

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Phased Approach – Phase 2 (Cont'd)

- Engineering Design – Conceptual Profile



Phased Approach – Phase 2 (Cont'd)

- Monitoring Design
 - Surface water, sediment, pore water, tissues
 - Pre-barrier, baseline and post treatment sampling events



Preliminary Monitoring Scope

MONITORING COMPONENT	ANALYSIS	PRE-BARRIER & BASELINE MONITORING April/May 2011	POST AMENDMENT MONITORING June-Nov
Sediment			
	THg	X	X
	MeHg	X	X
	TOC	X	X
	Black Carbon	X	X
	Grain Size	X	X
	<i>Cations & Anions</i>	X	X
	<i>Sequential Extractions</i>	X	X
	<i>Field Parameters</i>	X	X
Surface Water			
	FTHg & UTHg	X	X
	FMeHg & UMeHg	X	X
	Cations & Anions	X	X
	Physicochemical par.	X	X
	<i>Benthic Flux Chambers</i>	X	X
	SUVA	X	X
Pore Water			
	FTHg	X	X
	FMeHg	X	X
	Physicochemical par.	X	X
	Cations & Anions	X	X
Benthic Invertebrates (<i>Chironomidae</i> & <i>Planorbidae</i>)			
	THg	X	X
	MeHg	X	X
	Tadpoles (Thg & MeHg)	X	



Schedule

- Pre-Barrier Monitoring: April 2011
- Pilot Barrier Placement: May 2011
- Baseline Monitoring: May 2011
- Monitoring: June-Nov 2011
- Report Findings to SRST: Dec/Jan 2011/2012