









ACKNOWLEDGEMENTS

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- DOI Urban Waters Federal Partnership and the National Water Quality Program of USGS, MDE

PRESENTATION OVERVIEW

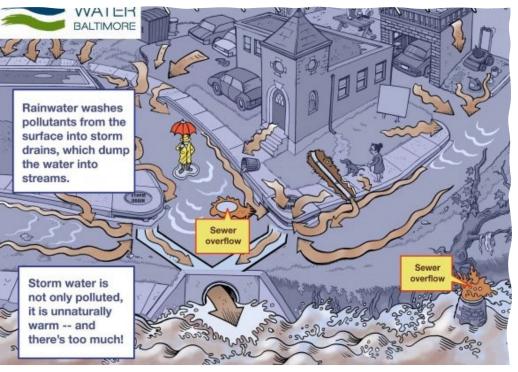
- Introduction to the study area
- Major findings –watershed/stream and wastewater sources of PCBs
- Updated Conceptual site model (CSM)
- Implications for management





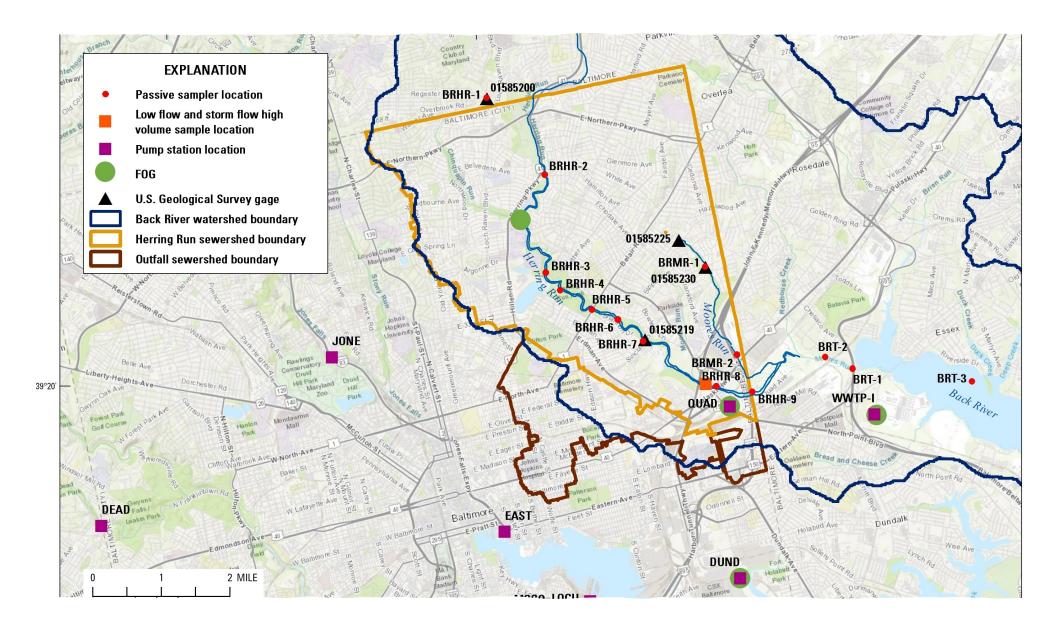






WHY THE BACK RIVER?

- 8-digit watershed in Patapsco basin (142 sq. km, or about 35,000 ac)
- Highly urbanized, 87 percent developed, > 35 percent impervious cover
- Home to Back River WWTP
- PCB TMDL for the oligonaline tidal portion of the Back River approved in 2011, WLA assigned to the WWTP and to MS4 for non-tidal tributary reductions



Why Measure the Freely Dissolved?

- PCB TMDLs are driven by human exposure from fish consumption
- Bioaccumulation factors are based on the freely dissolved concentration calculated for sediment porewater and water column
- Passive sampler allow us to measure the freely dissolved concentration directly

$$BAF = \frac{\frac{[PCB]_{fish}}{\%Lipid}}{[PCB]_{water} * \%freely-dissolved}$$

Table B-3: tBAF, Baseline BAF, Adj-tBAF, and Water Column tPCB Threshold Concentrations for Each Species

Species Name	Number of Fish	tBAF (L/kg)	Baseline BAF (L/kg)	Adj-tBAF (L/kg)	Median Fd (%) ¹	Median Lipid (%)	Water Column tPCB Threshold Concentration (ng/L)
Atlantic Menhaden	3	52,839	5,821,080	50,928	18.4	4.8	0.77
American Eel	8	87,820	3,552,616	68,496	19.0	10.5	0.57
Brown Bullhead Catfish	2	12,238	5,624,244	17,062	18.4	1.6	2.29
Channel Catfish	11	110,196	16,663,399	131,632	18.4	4.0	0.30
Common Carp	5	65,955	5,817,415	65,352	22.0	5.1	0.60
White Perch	21	53,840	13,374,718	59,156	22.1	2.0	0.66

Note: ¹Median value of the freely-dissolved percentage of the total tPCB concentration for water column samples within each fish's home range.



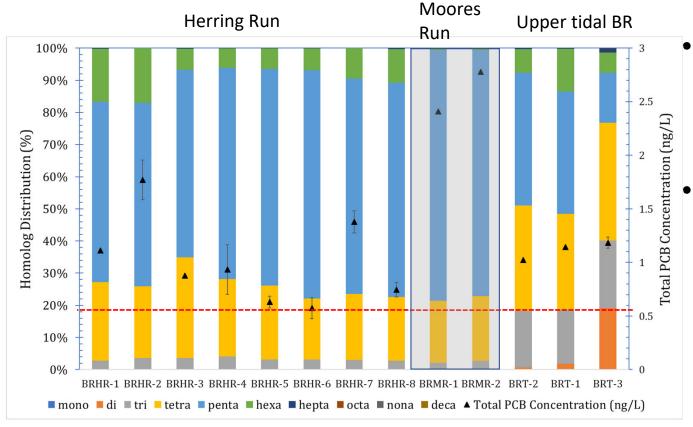






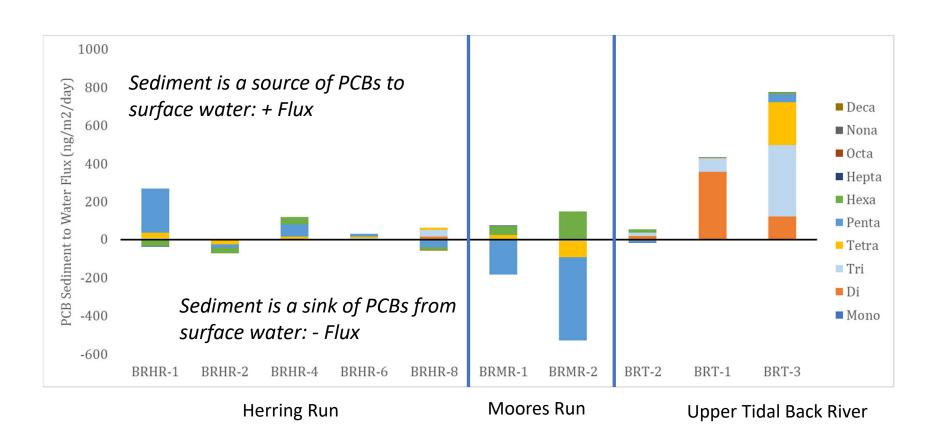
Low-Flow Conditions

PCBs - Low-Flow Conditions



- Most locations exceed 0.57 ng/L target to meet "fishing designation" in TMDL
- Load Estimates:
 - Idlewylde: 0.01 g/d (3.7 g/yr)
 - Sinclair: 0.16 g/d (59 g/yr)
 - Radecke: 0.02g/d (8.8 g/yr)

Is sediment a source or a sink for PCBs?



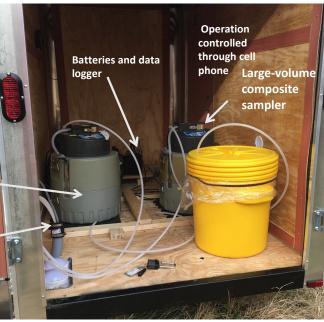




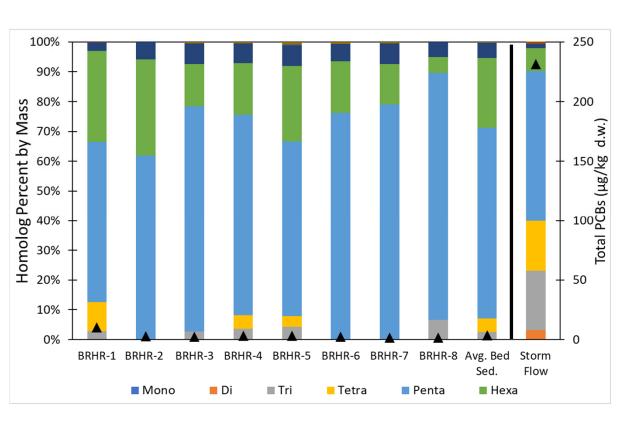
Discrete sampler

Inlet lines





PCBs - Stormflow Conditions



- Event load May 2019 storm: 16.6 g (14 –hr period), two orders of mag. greater than low flow daily load but not reflective of bioavailability
- Possible total mass load for WY2019 would exceed 400 g/yr in Herring Run
- High uncertainty, but role of contaminated stormwater warrants additional attention

PCBs in the Sanitary Sewer System





Effluent sampling Influent sampling



Cake sampling

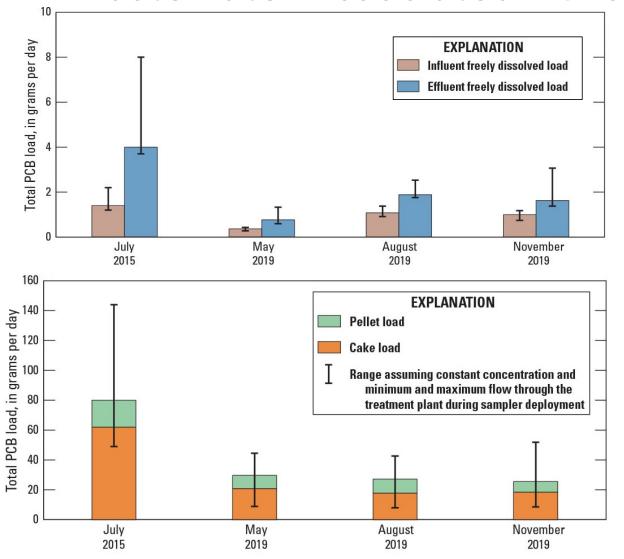
FOG sampling



Pellet sampling



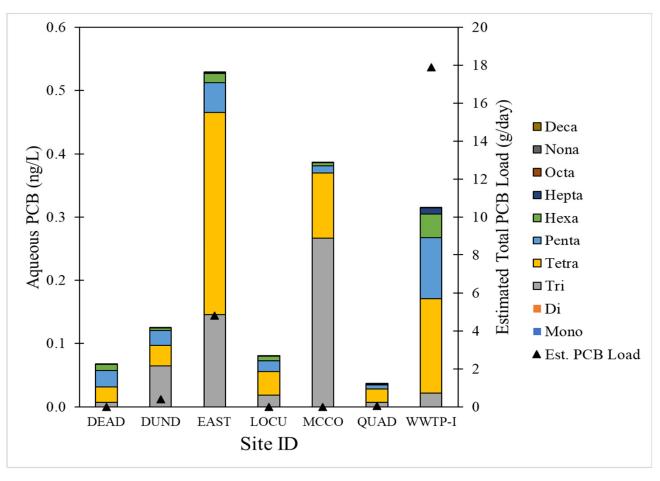
Wastewater Associated PCBs - BRWWTP



- Reduction in overall mass loading compared to 2015 study*, effluent still remains a primary contributor to Back R
- Suggests that ENR other capital improvements may result in reduced PCBs to and from the plant

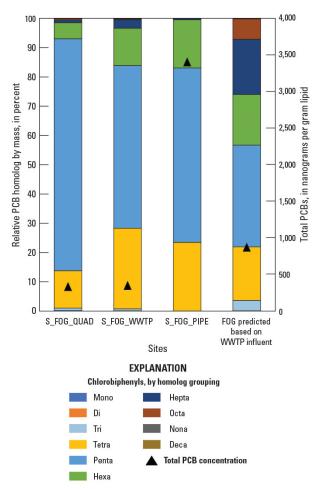
^{*}Needham, T.P., and Ghosh, U., 2019, Four decades since the ban, old urban wastewater treatment plant remains a dominant source of PCBs to the environment: Environmental Pollution, v. 246, p. 390–397.

Wastewater Associated PCBs – Pump Stations

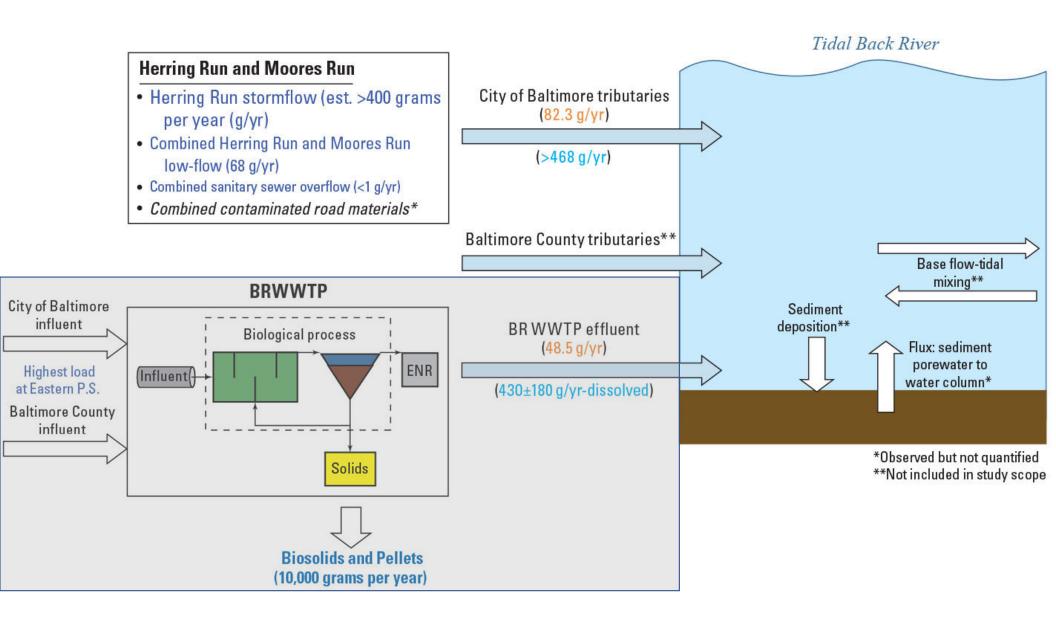


- Variations in freely dissolved conc. apparent, with largest contribution to influent attributed to Eastern Ave. (also largest flow rates, so highest loads)
- Quad Ave was lowest conc. and low flow compared to Eastern

Wastewater Associated PCBs- Fat, Oil, Grease



- Hypothesized by Needham and Ghosh (2019) that FOG could be source of PCBs to new sewage
- Samples collected from sampler lines/WWTP as well as a pipe during replacement.
- Able to extract and detect PCBs in FOG.
- PCBs in newer materials < PCBs in older, immobile material



Implications for Management

- No apparent sediment hot spots in nontidal tributaries
- Higher concentrations in Moores Run compared to Herring run may suggest a watershed source and may reflect the lower discharge compared to Herring Run
- While there is uncertainty associated with stormflow contribution and effects to Back River are unknown, the large mass delivered suggests additional investigation of this mechanism is warranted.
- Resolution on PCB sources in the watershed could provide potential for targeted watershed control of contaminated storm sediment.





Implications for Management

- Passive samplers/freely dissolved concentrations can provide clues to areas of the sanitary sewer system that require further investigation. This sewershed trackdown to refine source should be considered as the watershed source trackdown.
- Evidence for considerable reductions in WW system with ENR and capital improvements and maintenance, additional reductions may be observed with continued efforts.
- Opportunities for further reduction are likely within the system itself prior to the plant influent.





Thank you for your attention!

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