PCB TMDLs in the Tidal Potomac Watershed

Technical Advisory Committee
January 23, 2006

Government of the
District of Columbia
Anthony A. Williams, Mayor

DEQ

MDE

Presentation Overview

1. Review PCB TMDL Project
2. Progress in the TMDL Model
3. Estimating Source Loads
4. Discussion

Jurisdictions' Criteria

	Consumption Advisories Fish Tissue (ng/g)	Water Quality Standards Total PCBs (ng/L)
DC DOH:	20 (EPA)	0.045
MDE:	78	0.64
VADEQ:	54	1.70

A TMDL is required to reduce PCB loads

- Identify all ***sources*** of a given pollutant (e.g., PCBs) within the watershed.
- Calculate the ***amount*** of pollutant entering the estuary from each source.
- Understand pollutant ***fate and transport*** through computer model simulations.
- Calculate the ***pollutant reductions needed***, by source, to attain water quality standards.
- ***Allocate the allowable loading*** to each source and include a margin of safety.

Approach

1. A steering committee formed to coordinate and guide efforts: DC, MD, VA, EPA, ICPRB, MWCOG
2. Collect historical data / develop input loading estimates from major source categories.
3. Collect additional data (quickly) to fill in knowledge gaps for model.
4. Establish process to keep stakeholders in all jurisdictions involved / informed throughout TMDL development.
5. Build model for PCB fate and transport.
6. Run model for PCB reduction scenarios.

TMDL Development Timeline

09/07 – PCB TMDL for DC due to EPA

??/07 – Draft TMDL to stakeholders for review

03/07 – Draft TMDL to state agencies for internal review

09/06 – Finish PCB Model Calibration/Validation and Sensitivity Analyses

12/05 – Finish Hydrodynamic/Salinity Model Calibration/Validation and Sensitivity Analyses

Fall/05 - Technical Advisory Committee begins qtrly meetings

9/05 – LTI develops modeling options

04/05 to 05/06 – new samples collected to better characterize sources

Progress in the PCB TMDL Model

- Vic Bierman – Limno Tech, Inc

Estimating Input Loads

1. Tributary Loads
2. Point Sources
3. Air Deposition
4. Stormwater
5. CSOs
6. Contaminated Sites

1. Tributary Loads

- Cherie Schultz - ICPRB

Non-Tidal Tributary PCB Monitoring Sites

]	AWTA/GMU Water Column Grabs (2002)
[	DCDOH/ANS-SI Water Column Grabs
&	ICPRB/CBL Potomac Fall Line Monitoring
U	MDE/USGS NEB/NWB Anacostia Monitoring
0	USGS Flow Gages
Z	VADEQ Water Column Grabs
z	VADEQ SPMDs - Above HOT

Non-Tidal Trib Load Estimates

- Constituents:
  - Conventional parameters: organic carbon (OC), suspended sediments (SS)
  - PCBs: modeled homologs
- Strategy:
  - Conventional parameters: use CBP WSM5 (assuming success of upcoming Potomac calibration)
  - PCBs: (depending on analysis of upcoming data)
    - Option 1: use dry and wet weather PCB concentrations
    - Option 2: use SS loads and PCB/SS relationship
    - Option 3: use OC loads and PCB/OC relationship

Available PCB Data - Non-Tidal Tribs

- Potomac River at fall line
  - Inputs from upper basin: ~12,000 sq mile drainage area
  - 6 dry weather + 12 wet weather samples
- 22 minor tribs
  - 6 with semi-permeable membrane devices (SPMDs)
  - 11 with 1 dry weather + 1 wet weather grab samples
  - 2 (suburban DC metro) with extensive wet and dry weather monitoring via automatic samplers
  - 3 (urban DC metro) with 4 dry weather + 3 to 6 wet weather grab samples (historical data)

Options for PCB Load Estimates

- Option 1:
  - Group tributary sub-sheds into several land use types, e.g.
    - A: Primarily rural
    - B: Primarily suburban
    - C: Mixed urban/suburban
  - For each sub-shed assign a wet weather and a dry weather PCB concentration, C_{wet} and C_{dry} (mass/volume)
    - Monitored sub-sheds: use actual data
    - Unmonitored sub-sheds: use average of results for land use type
  - Designate dry days and wet days based on daily precip
  - Use sub-shed's daily flow from WSM5, Q (volume/day)

Daily Load (PCB mass/day) $= Q \times C_{dry}$, if dry day

$= Q \times C_{wet}$, if wet day

Options for PCB Load Estimates

- Option 2:
  - Use sub-shed's daily flow from WSM5, Q (volume/day)
  - Use sub-shed's daily SS load from WSM5, C_{SS}(solids mass/volume)
  - Determine relationship between PCB and SS concentrations, α (PCB mass/solids mass)

Daily Load (PCB mass/day) = $Q \times \alpha \times C_{SS}$

Options for PCB Load Estimates

- Option 3:
  - Use sub-shed's daily flow from WSM5, Q (volume/day)
  - Use sub-shed's daily OC load from WSM5, C_{OC}(solids mass/volume)
  - Determine relationship between PCB and OC concentrations, α (PCB mass/solids mass)

Daily Load (PCB mass/day) = $Q \times \alpha \times C_{OC}$

Unresolved Issues

- Will WSM5 calibration results for Sus. Solids and Organic Carbon be acceptable?
- Will SPMD and water column grab data be sufficiently consistent? (comparison sampling events)
- Will statistically significant relationships be found for PCB concentrations and land use? and Sus Solids, and Org. Carbon?

2. Point Sources
3. Atmos. Dep.

- Scott Macomber – Md. Dept. of the Env.

Point Source Loading Estimates

- Similar to DRBC approach
- Load = Flow * Concentration
- VA/MD/DC are sampling municipal wastewater treatment plants (WWTPs)
- Data to be collected
  - PCBs, Organic Carbon (OC)
- Attempting to attain wet and dry weather data

Point Source Loading Estimates

- Flow – Daily flow data from WWTPs that constitute 95% of flow
  - For other 5% annual mean data will be used
- PCBs – Actual data for plants sampled
  - Will be varied based on flow (wet/dry) if possible
- OC – will be estimated using BOD and TSS data if not available

Point Source Loading Challenges

- Development of loads from WWTPs that have not been sampled
  - How do we apply loading estimates from Plant A to Plant B?
- Low detection limit sampling will most likely detect PCBs where there have been none in the past….

Atmospheric Loading Estimate

Data Sources

- Chesapeake Bay Atmos Dep Study (1990 – 1993)
  - Non-urban sampling sites
- Atmos Exchange Over Lakes and Oceans Study (1996-1998)
  - Urban (Baltimore) and non-urban sampling sites
- DC Dept of Heath (2006)
  - Howard Univ conducting particulate and gas phase monitoring – 1 year and 1 site

Atmospheric Loading Estimate

Approach

- Develop mean Urban and Non-urban deposition rates
- Use Urban rates for DC
- Develop a linear gradient that radiates from DC going from the Urban to Non-urban deposition rates at edges of watershed

Atmospheric Loading Challenges

- Limited data sets
- Timing of DC data
- Majority of atmospheric deposition occurs on land that will be assessed using the watershed model
  - Will need to ensure that the load is accounted for appropriately

4. Stormwater

- Bryant Thomas – Va. Dept. Env. Quality

Calculating Loads from MS4 and NPS Urban/Suburban Runoff

- Proposed Methodology -

Basic premise is to apply a Constant Concentration Model (CCM) with flow and pollutant concentration components

$$L_i = A_u \times d_r \times C_i$$

Where,

L_i	=	pollutant load estimate
A_u	=	area of land (urban, suburban)
d_r	=	rainfall runoff depth
C_i	=	constant pollutant concentration

Calculating Loads from MS4 and NPS Urban/Suburban Runoff

- Basic Data Elements Needed -

- **Land Area(s)**
  - **Define the area of focus**
  - **Consider how to classify land-uses (for flow and allocation estimates)**

- **Run-off Volumes**
  - **Expect to use flows from the WSM5**
    - **Ability to calculate flows by land-use**

- **Pollutant Concentration(s)**
  - **EMC values vs. regional values**
  - **How to classify (land-uses for EMC)**
  - **Try to get copies of DRBC research**

Calculating Loads from MS4 and NPS Urban/Suburban Runoff

- Data Sources -

<u>For determining flows</u>:

- **Chesapeake Bay WSM5**
- **Other methods for determining stormwater flows (e.g. rational method)**

***<u>For determining pollutant concentrations</u>*:**

- **National Event Mean Concentration (EMC) Information**
- **Local/regional testing performed by D.C, Virginia and Maryland**

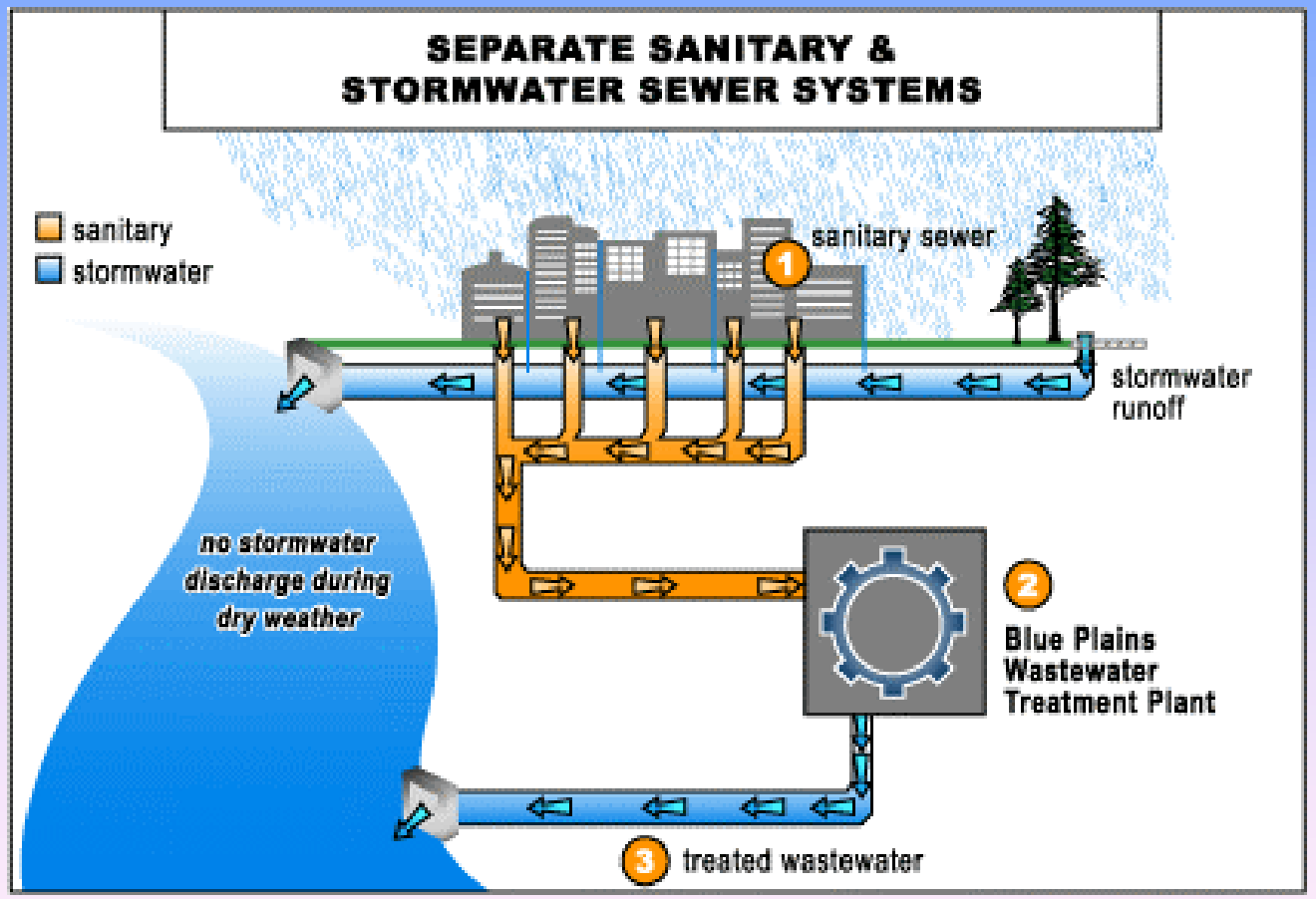
***<u>For classifying Land Area's</u>*:**

- **WSM5 land-use information**
- **National land-use datasets**
- **Local/regional land-use information**
- **MS4 jurisdictional data**

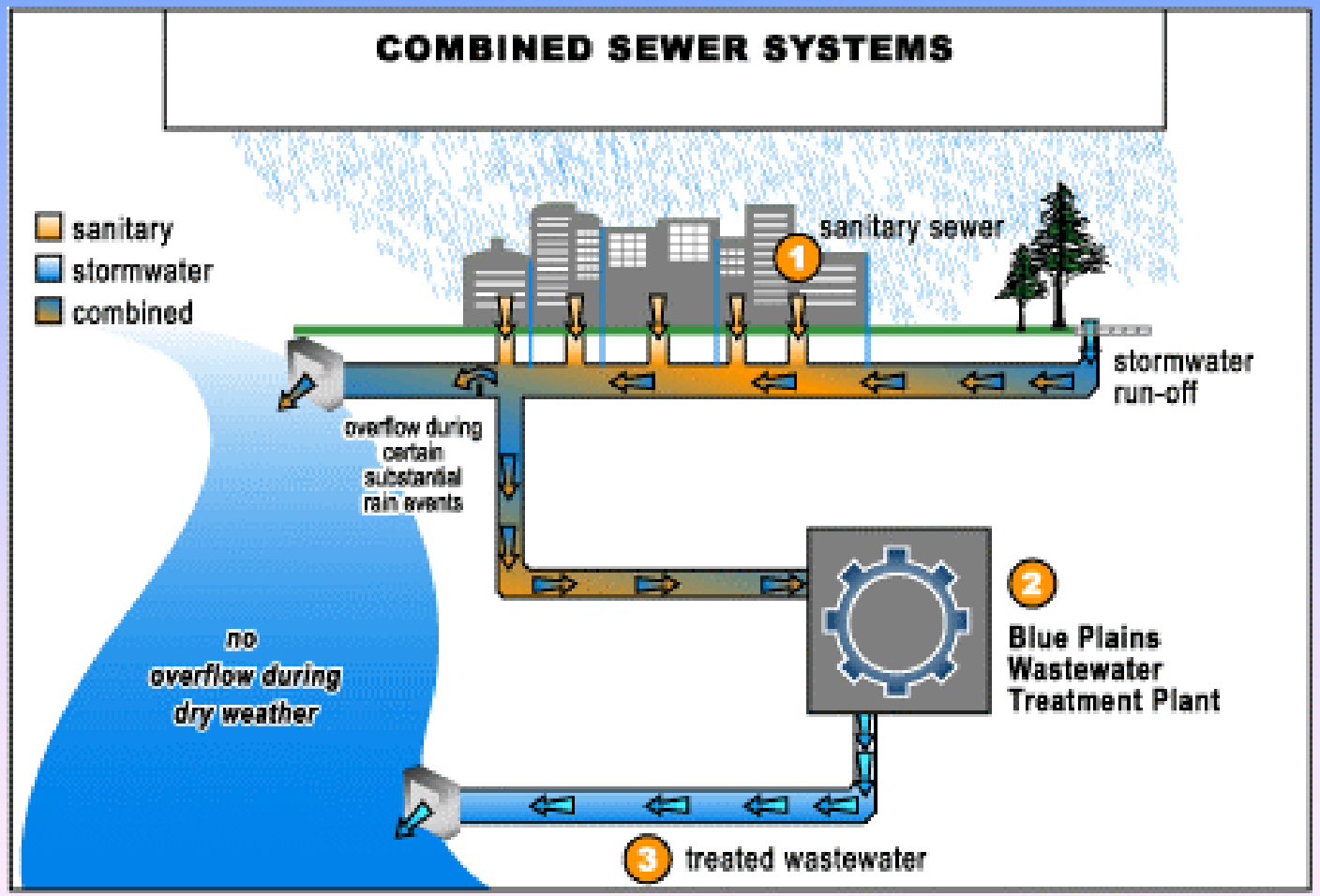
5. Combined Sewer Overflows (CSOs)

- Monir Chowdhury – DC Dept. of Health

Separate Sewer System



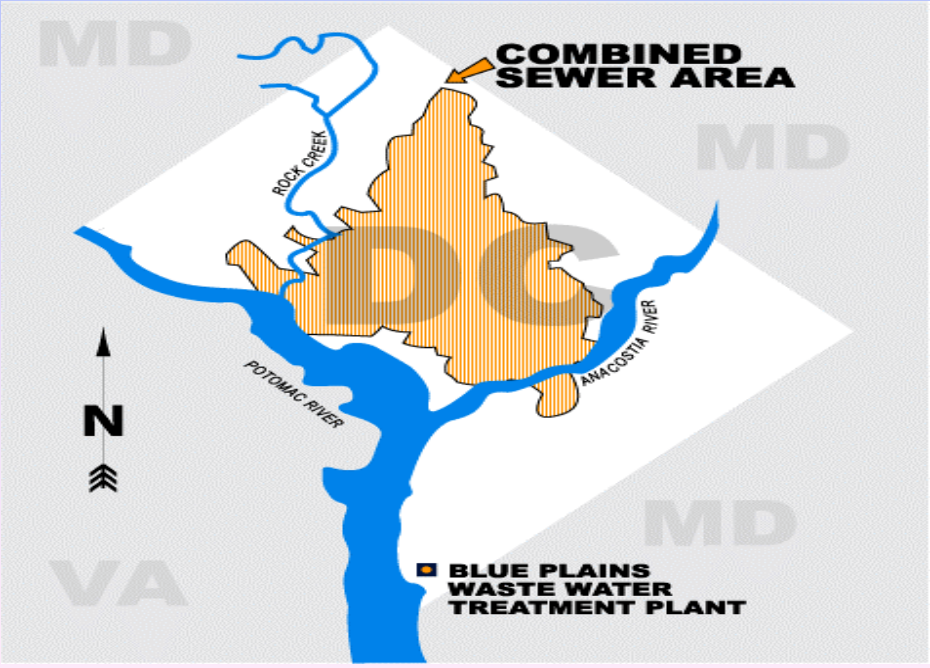
Combined Sewer System (CSS)



CSS in the Study Area

- DC Combined Sewer System

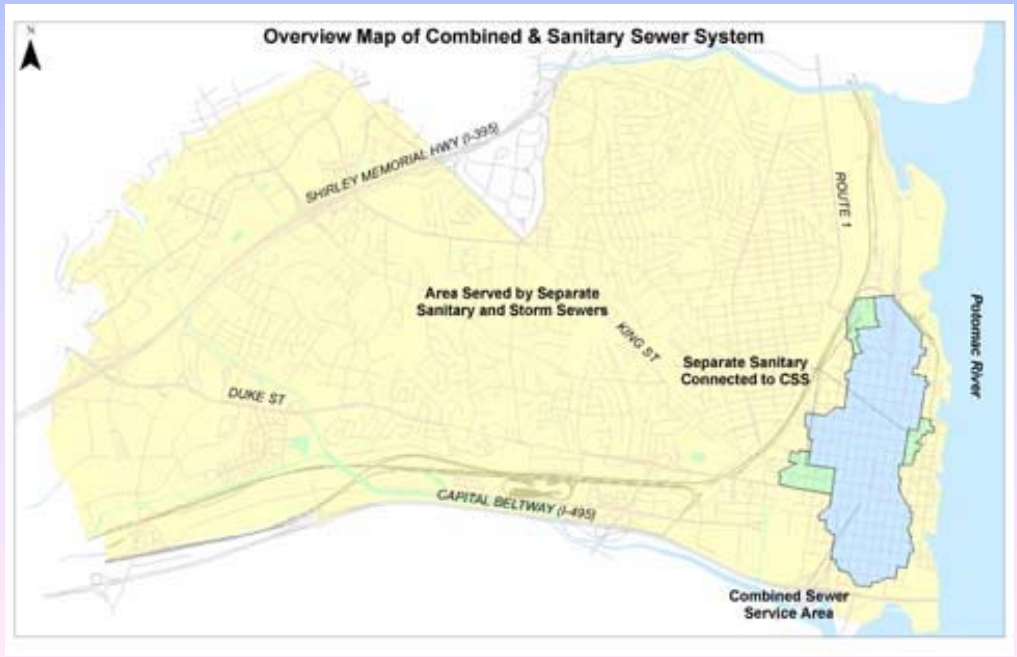
  ~12500 acres, 53 outfalls, Anacostia, Potomac Rock Creek



CSS in the Study Area

- Alexandria,VA Combined Sewer System

  ~540 acres, 4 outfalls, Potomac, Hunting Creek, Hoofs Run



CSO Loadings

- Existing sewer system models for both systems
  - hydrology (rainfall-runoff)
  - hydraulics (pipe network, diversion, pumping and treatment systems, real time control)
- Models to predict overflows for various weather conditions (wet, dry, average)
- DC monitoring study to determine PCB concentrations

6. Contaminated Sites

- Mark Richards – Va. Dept. Env. Quality

Calculating PCB Loads from Contaminated Sites - Proposed Methodology -

- Identify sites where PCBs have been managed or spilled
  - Determine surface soil PCB concentration
- Apply a tool that predicts soil loss from contaminated sites
  - Revised Universal Soil Loss Equation (RUSLE)

Calculating PCB Loads from Contaminated Sites

- Search methods for identifying sites where PCBs have been managed or spilled
  - Search EPA/State Databases
  - Perform File Searches
  - PCB Source Investigation Survey

Calculating PCB Loads from Contaminated Sites

Site Search Hierarchy

- Tier I Sites (readily available information)
  - CERCLA and TSCA sites
- Tier II Sites
  - Non-NPL Federal Facilities or other sites identified thru state site assessment programs
- Tier III Sites (determined thru surveys)
  - Electric Substations, Rail yards, transformer storage yards, etc.

Calculating PCB Loads from Contaminated Sites

Soil loss prediction tool:

- Revised Universal Soil Loss Equation (RUSLE)
  - Considers rain and soil interaction

Load = (Soil loss) x (surface soil PCB conc.)

- Used in the development of the Delaware River PCB TMDL

Calculating PCB Loads from Contaminated Sites

Revised Universal Soil Loss Equation (RUSLE)

$$\text{Soil Loss} = R*K*LS*C*P$$

where:

R = rainfall erosive factor

K = soil erodibility factor

LS = slope length and steepness factor

C = cover and management factor

P = support practices factor

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