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Modeling Recontamination, Background, and Natural Recovery: Three Sides to the Same Coin

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Addressing Sediment Contamination is Essential for Safe and Healthy Rivers

- Many river sediments are contaminated from long-history of commercial/industrial activities
- Sediment contaminants can have adverse impact on the health of a river system
- Remediation is complicated
  - Complex sediment processes
  - Multiple potential contaminant sources
- Getting it done right the first time is important
  - Portland Harbor estimate: $1.49 billion (EPA 2019)
  - LDW estimate: $440 million (EPA 2014)

Cost estimates have been adjusted to 2025 dollars using the U.S. BLS CPI Inflation calculator

Understanding Non-Point Source Contributions is Essential for Successful Remedy

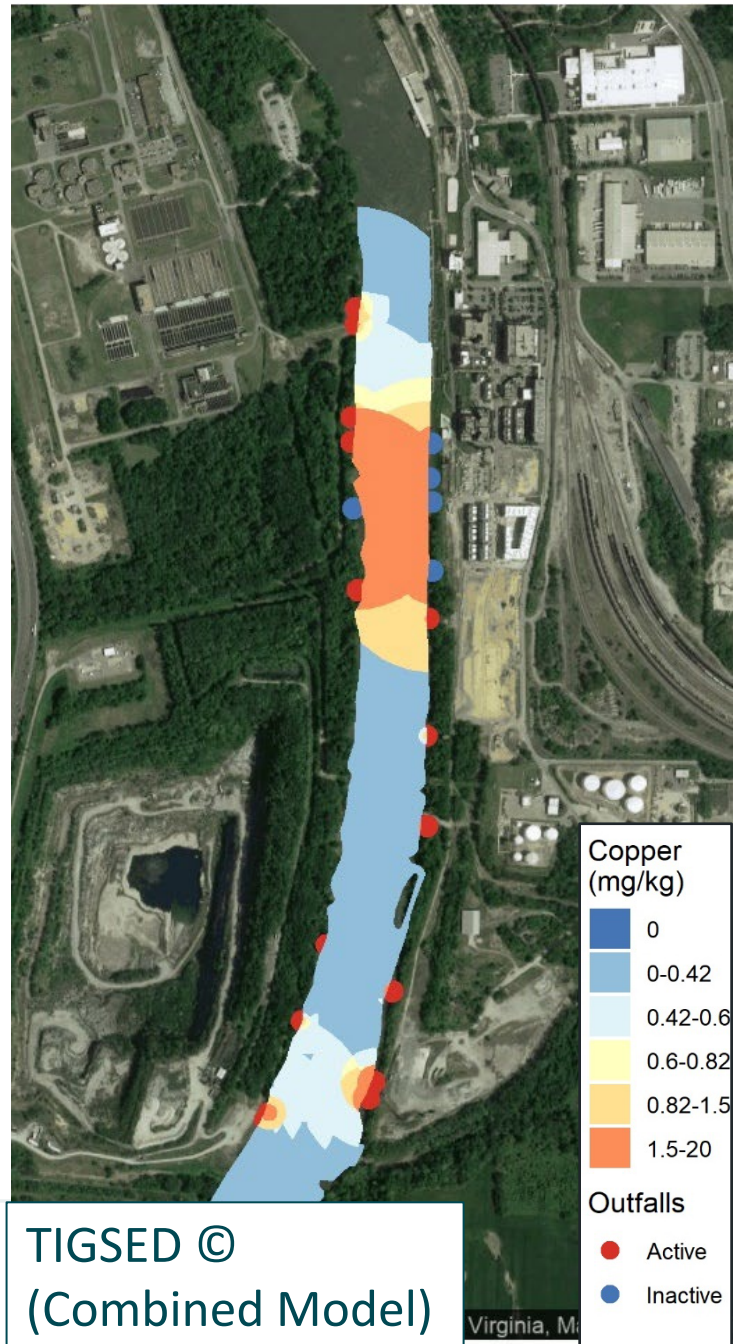
- Accurate background source contribution needed to develop appropriate remediation goals
- Designing remedy requires assessment of re-contamination risk from unaddressed sources
- Long-term remedy effectiveness relies on monitored natural recovery
- Identifying post-remedy changes in source contributions early can reduce re-contamination risk

Stormwater discharges

Sediment transport

Contaminant Fate and Transport Models Provide Understanding of Source Interactions

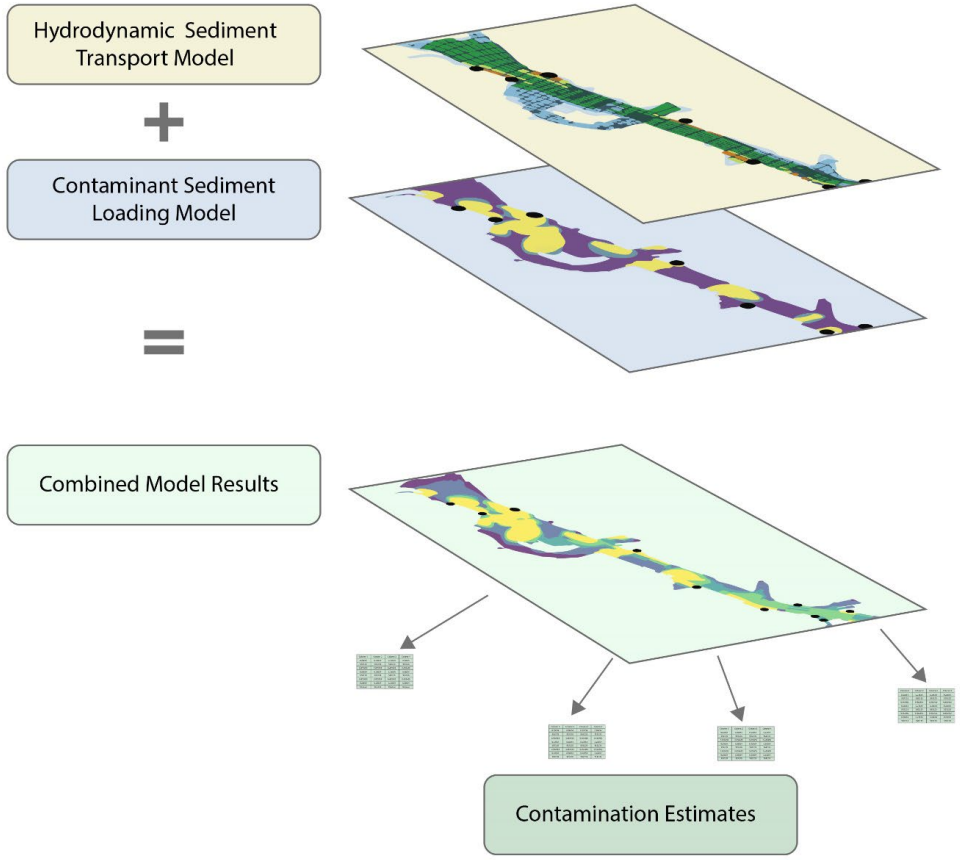
- Models can evaluate entire river system accounting for complex interactions
- Predict current and/or future conditions
- Can assesses uncertainties
- Different models have different pros and cons and selection should be project and goal specific
- Combined models (TIGSED©, BCM, LTE) offer good balance
  - Pros: finer resolution, accurate, quick
  - Cons: medium costs, detailed inputs



TIGSED © (Combined Model)

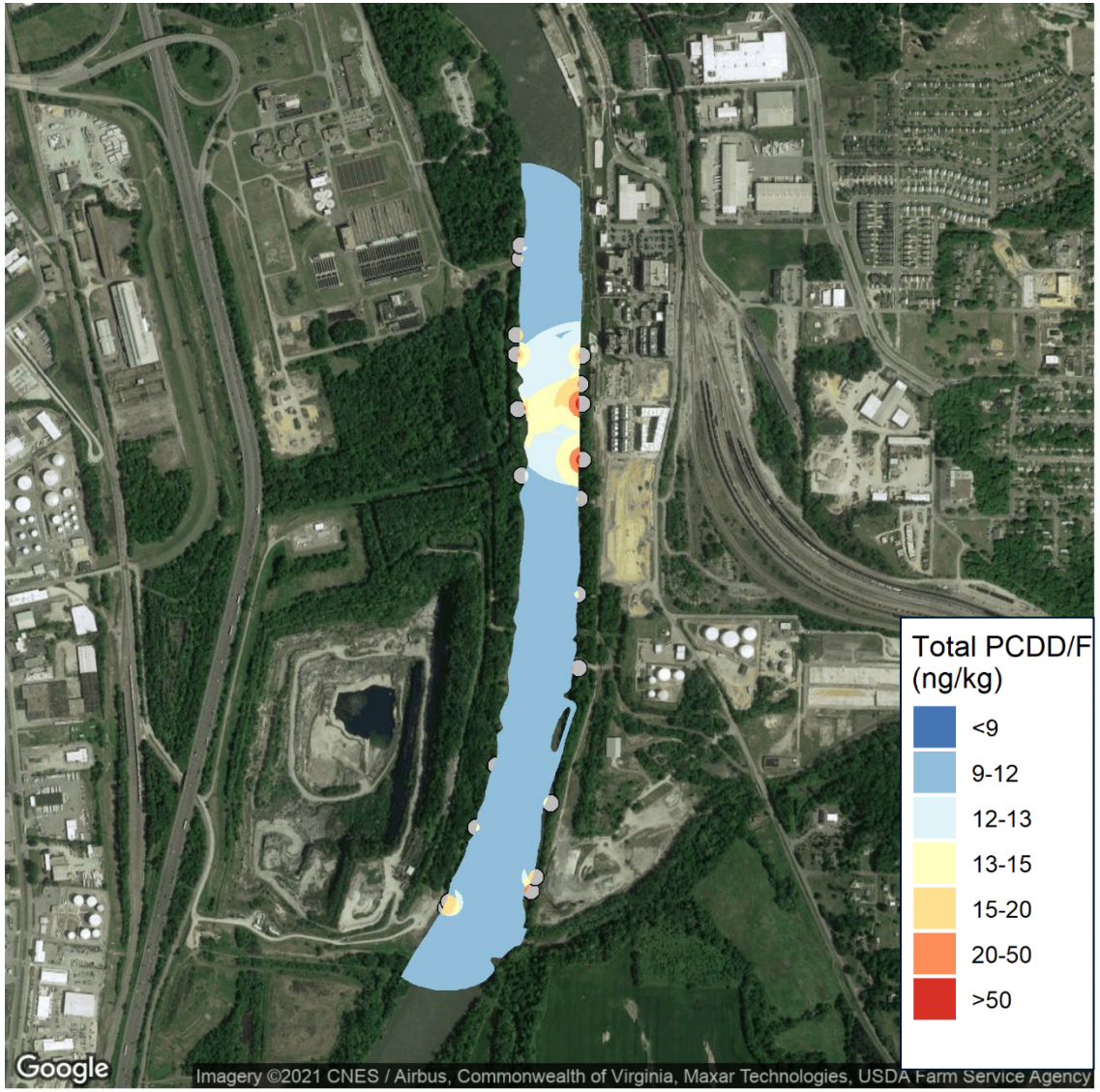
What Does a Combined Model Look like?

- Combine contaminant loading box model and hydrodynamic sediment transport models
- Model grid is based on hydrodynamic sediment transport model grid and other box model inputs
- Combined Models have proven track record
  - Willamette River: TIGSED
  - Swan Island Basin: SEDCAM-based
  - Thea Foss Waterway: WASP-based
  - Lower Duwamish Waterway (LDW): BCM
  - Newtown Creek: long-term equilibrium (LTE) model



Models Can Evaluate Background During Remedial Investigation

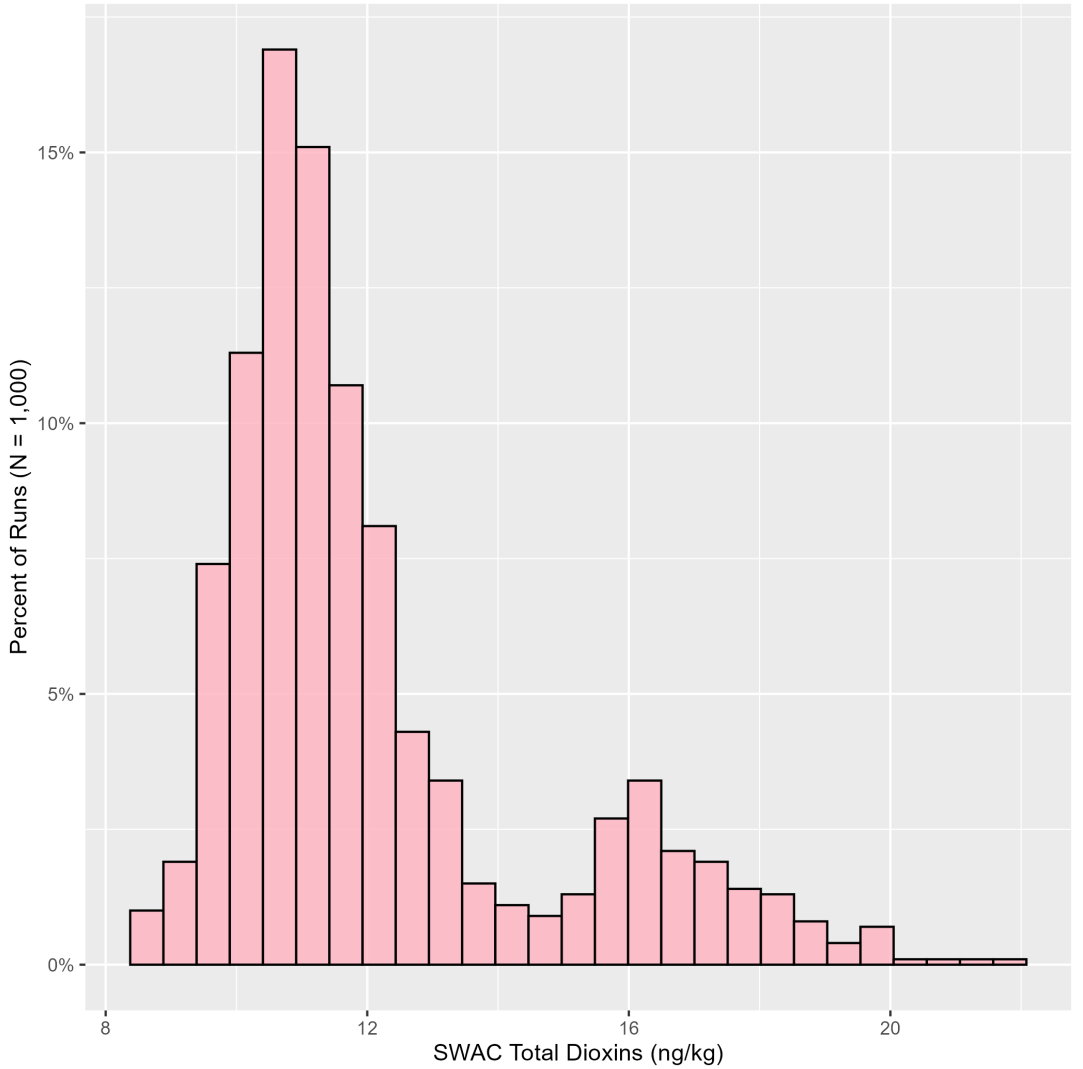
- Models can be used during the RI/FS phase to Estimate achievable background conditions
  - Helps setting remediation goals
- Early development also allows model calibration against later design phase data
- Example: Modeling total PCDD/F background concentrations



Data presented on this slide are for demonstration only and do not represent actual conditions

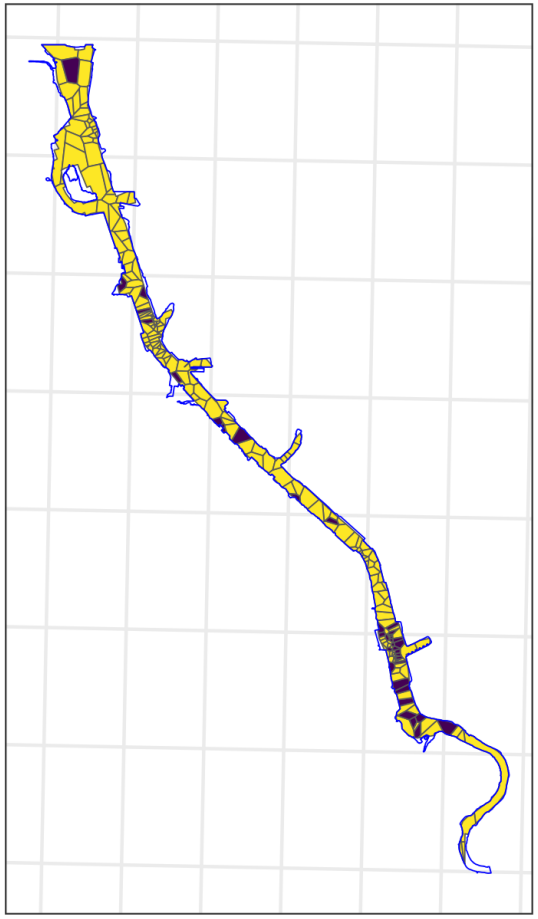
Uncertainty Analysis Provides Further Support for Background Values

- Probabilistic estimate of PCDD/F background based on variation in
  - Stormwater concentration
  - Upstream sediment concentration
  - Rainfall rate
  - Aerial deposition rate
- Surface-weighted average concentration shows range of potential background concentrations

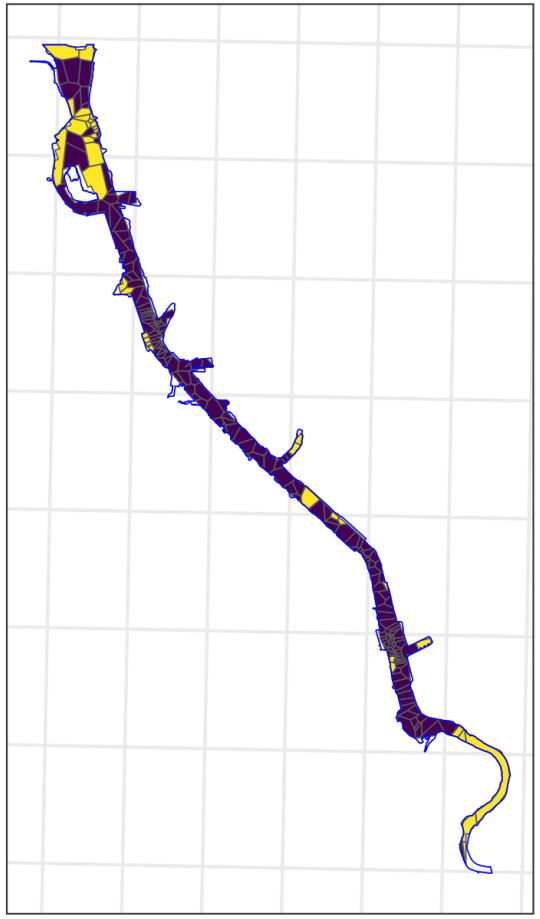


Remedial Design Benefits from Contaminant Modeling

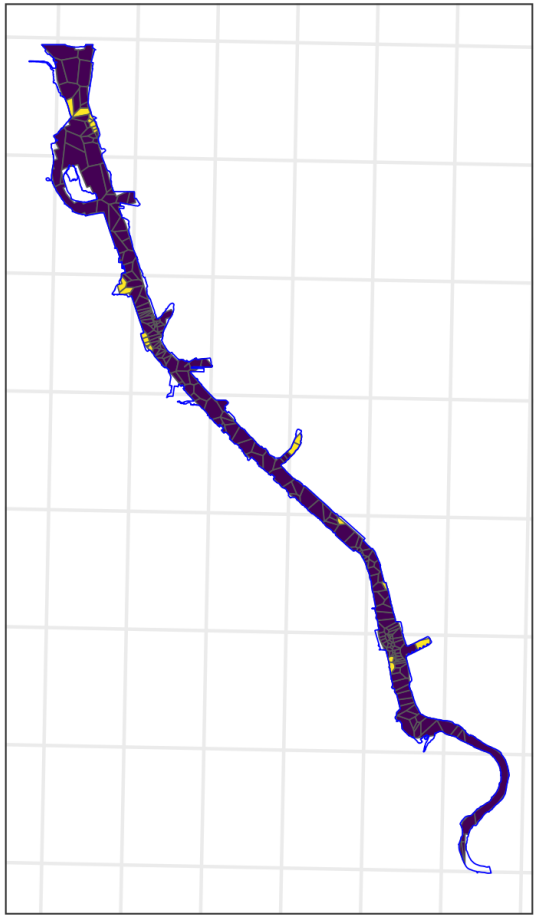
Baseline



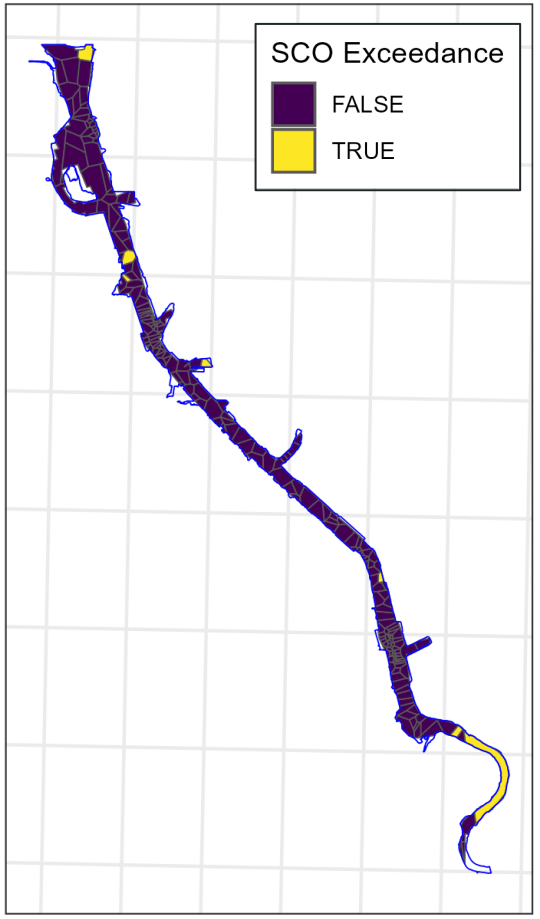
MNR



EMNR



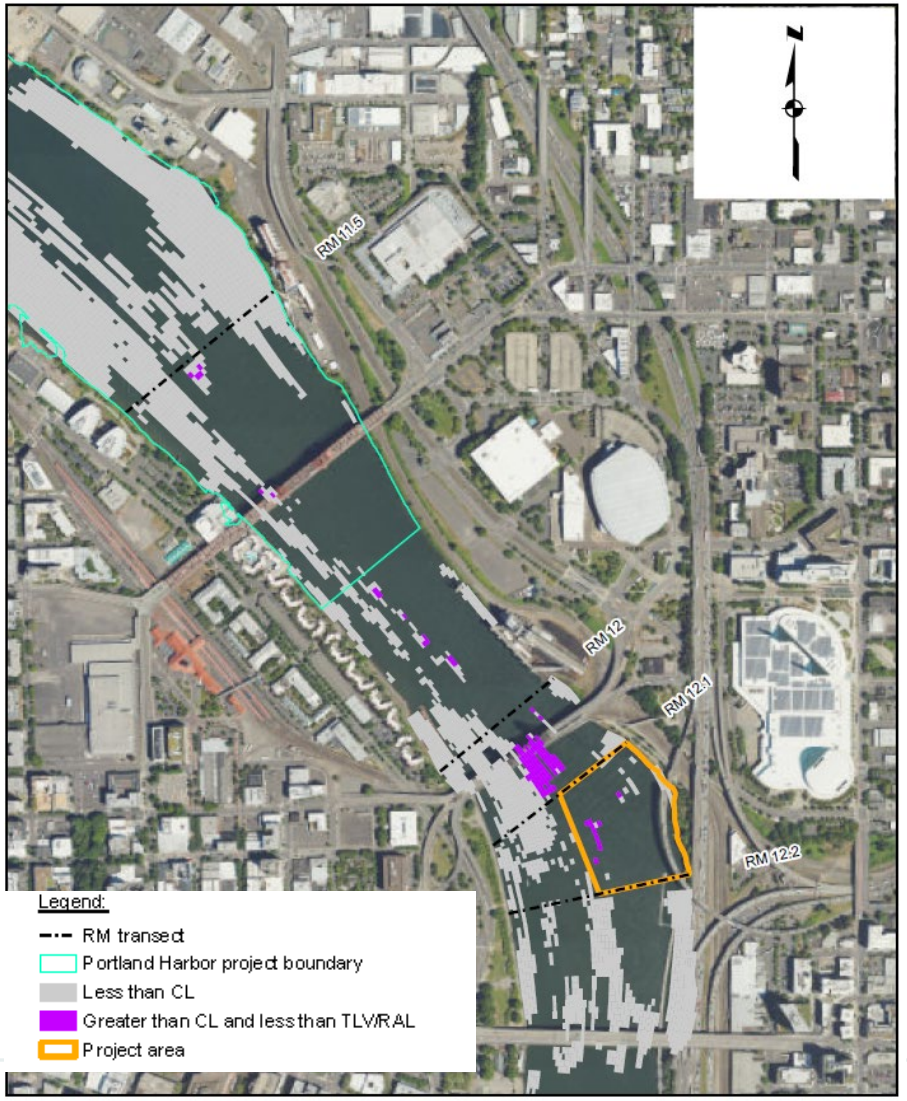
Capping



Modeling results rely on general assumptions and are not meant to imply any specific remedial design

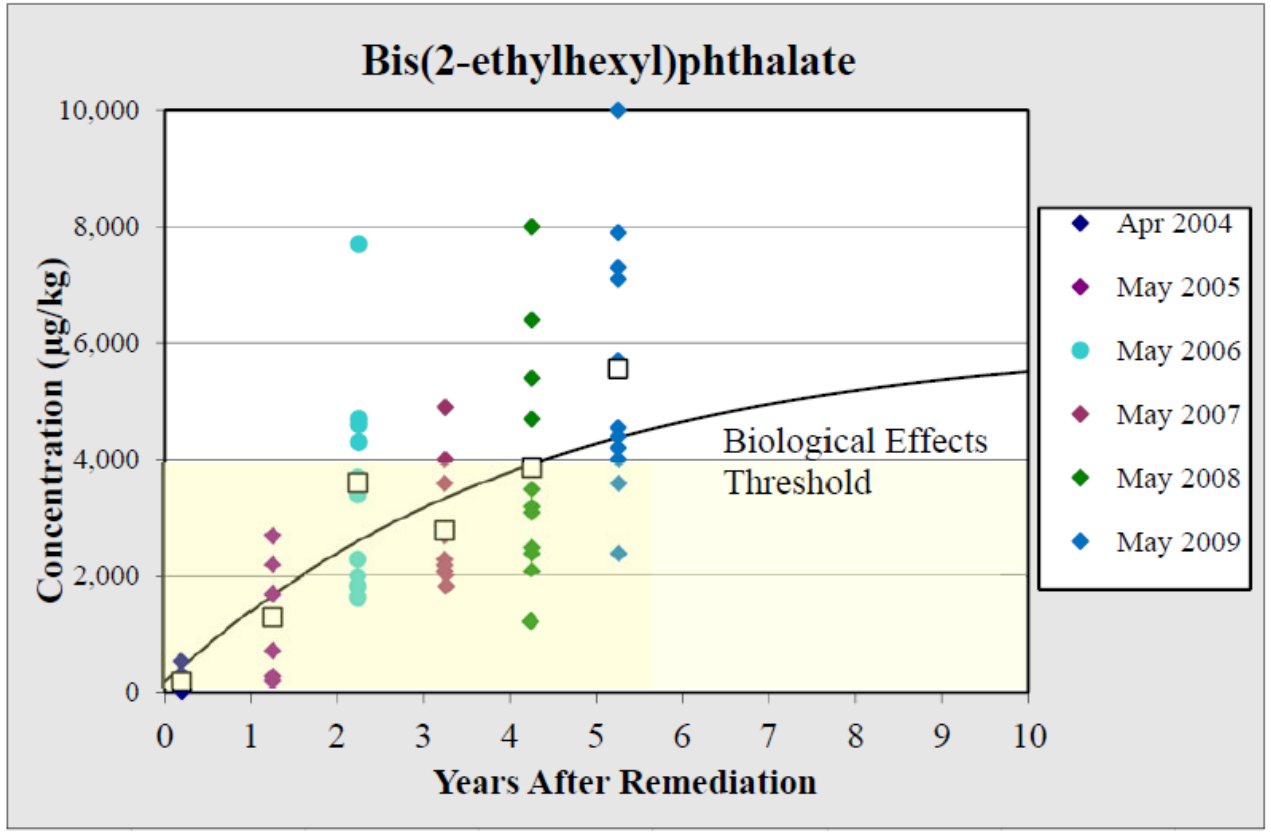
Contaminant Modeling Assess Recontamination Risk

- Identifying risks for recontamination prior to remedy construction saves time and money
  - EPA Region 10 requires source control sufficiency assessments during design
- Contaminant models can evaluate a range of potential future conditions assessing risk
- Example: Downtown Reach Willamette River De Minimis Evaluation



Post-Remedy Models Can Identify Issues Early

- Comparing sampling to model results can confirm model prediction
- Sampling results can update model predictions identifying re-contamination early
- Example: WASP model for Thea Foss Waterway successfully predicted recontamination



Monitoring and Modeling the Effects of Stormwater Source Controls on Sediment Quality in Tacoma, Washington
Dana B. de Leon, P.E., Mary L. Henley, P.E., and Todd M. Thornburg, Ph.D.

Contaminant Transport Models Are Effective Tool

- Contaminant transport models can be used to
  - Develop background values
  - Assesses re-contamination risk
  - Model MNR and EMNR during design
  - Identify issues and risk post-remedy
- Approach to contaminant modeling depends on the system and modeling goals
- Key to success is identifying model goals and develop the appropriate model early

Thank You

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