ESA Stakeholder Workshop: Aquatic Exposure Breakout Groups

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June 29 and 30, 2016

Overview

- Background – what did EPA do in the BEs?
- Breakout Group 1 - Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4
  - Charge Questions
- Breakout Group 2 - Evaluation of Aquatic Exposure Modeling Estimates
  - Charge Questions

Background

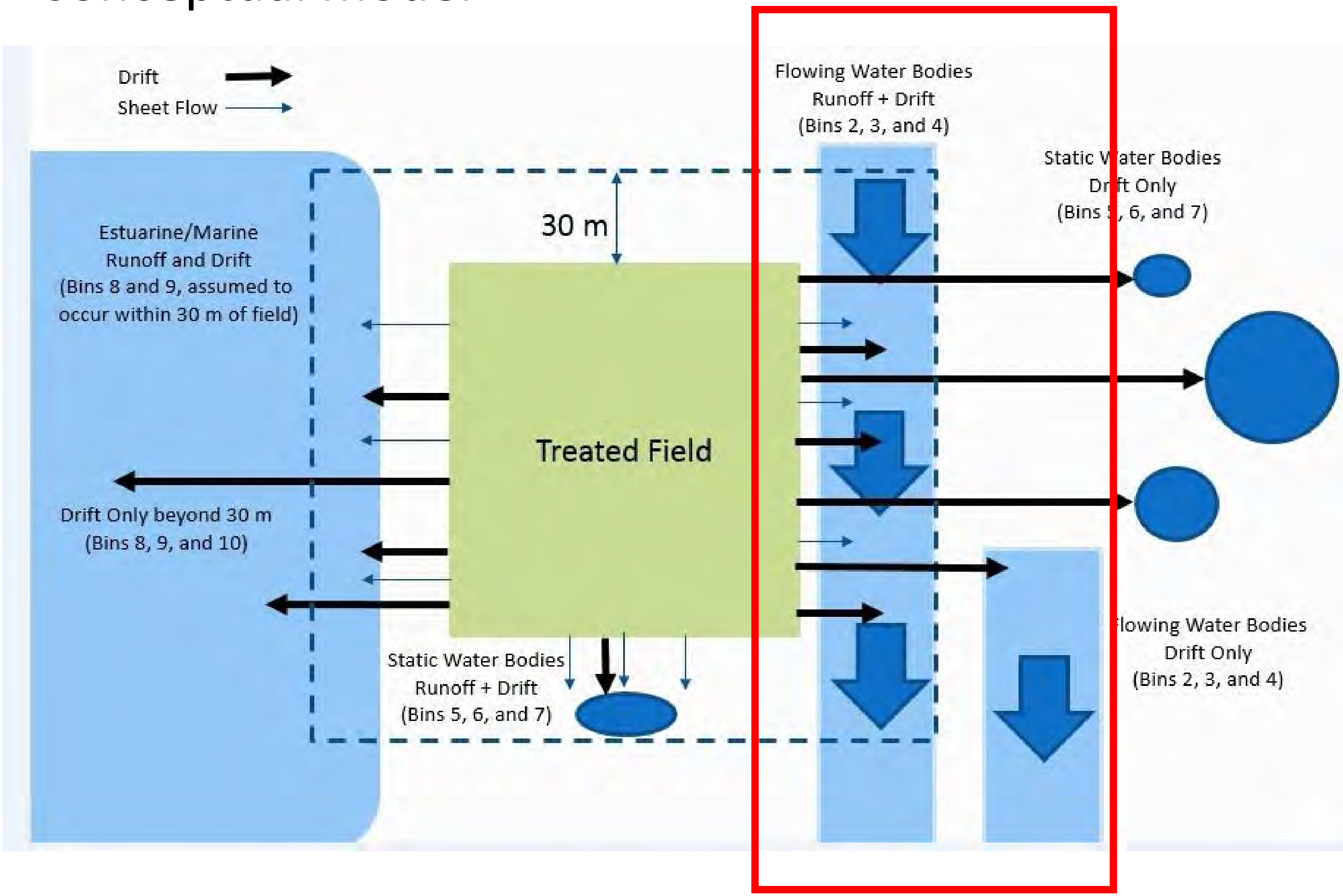
- Estimating aquatic exposures
  - Aquatic Bins:

Generic Habitat	Depth (meters)	Width (meters)	Length (meters)	Flow (m^3/s)
1 – Aquatic-associated terrestrial habitats	NA	NA	NA	NA
2- low-flow	0.1	2	Length of field[1]	0.001
3- Moderate-flow	1	8	Length of field[1]	1
4- High-flow	2	40	Length of field[1]	100
5 – Low-volume	0.1	1	1	0
6- Moderate-volume	1	10	10	0
7- High-volume	2	100	100	0
8- Intertidal nearshore	0.5	50	Length of field	NA
9- Subtidal nearshore	5	200	Length of field	NA
10- Offshore marine	200	300	Length of field	NA

[1] length of field – The habitat being evaluated is the reach or segment that abuts or is immediately adjacent to the treated field. The habitat is assumed to run the entire length of the treated area.

Background

- Estimating aquatic exposures
  - Conceptual model

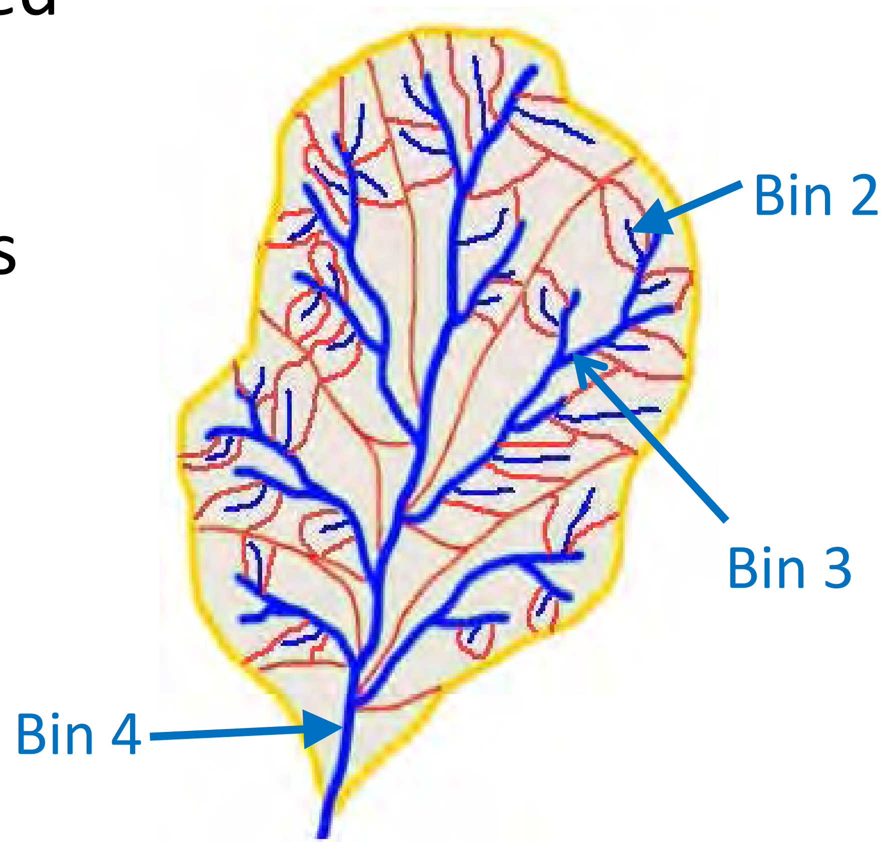


Background

- Regional analysis done at HUC 2 level
- Watershed sizes developed using a log-log regression of catchment area versus flowrate
- Watershed assumed to be a square, so length of waterbody same as length of watershed
- Use of Pesticide Root Zone Model/Variable Volume Water Model (PRZM/VVWM) and Pesticide in Water Calculator (PWC) interface

Background

- In the context of watershed hydrodynamics, the three flowing bins (2, 3, and 4) represent aquatic habitats which would ideally be representative of streams that are sequentially connected within a watershed.



Background

- EECs derived using existing tools/models for the higher-flowing habitats (Bins 3 and 4) in the draft BEs were extremely high and seemed to defy both professional judgement and typical patterns seen in contaminant monitoring data
  - Initial modeling generated Bin 3 and 4 EECs that exceed those generated for Bin 2, as well as EECs for the static bins
- Explored refinements to methodology
  - Addition of baseflow
  - Daily average versus instantaneous peak
  - Area-weighted curve numbers

Background

- A qualitative approach was used in the draft BEs for use in assessing these bins.
  - Use of monitoring data to demonstrate a downward trend in the magnitude of peak exposures
  - Published studies showed a reduction in exposures as one moves down a watershed network
  - 5-fold reduction in exposure from Bin 2-like streams to Bin 3-like streams and a 10-fold reduction from Bin 3-like streams to Bin 4-like streams
  - Qualitative comparison of volumes and flowrates also suggested a reasonably conservative magnitude of exposure expected in Bins 3 and 4

Background

- NAS Report – page 54
  - “pesticide fate and transport models do not provide information on the watershed scale; they are intended only to predict pesticide concentrations in bodies of water at the edge of a field on which a pesticide was applied.”
  - “different hydrodynamic models are required to predict how pesticide loadings immediately below a field are propagated through a watershed or how inputs from multiple fields (or multiple applications) aggregate throughout a watershed.”
- Is the use of standard field-scale models appropriate for estimating concentrations in larger flowing waterbodies draining a watershed?

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- Bottom Line
  - How do we estimate environmental concentrations in Bins 3 and 4 that are protective of the species inhabiting these waterbodies and are scientifically defensible and make hydrologic sense?

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (1):

  - **EPA explored several factors in using the PWC, including incorporation of a baseflow and use of the daily average instead of the instantaneous peak EEC. What are the strengths and weaknesses of these modifications? Are there other modifications that can be made and what are their strengths and weaknesses?**

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (2):
  - **How appropriate are the methods used in the draft BEs to develop field/watershed sizes and waterbody lengths for these Bins? What reasonable alternatives could be used to model watershed processes that allow for accurate estimation of possible exposure concentrations (including the maximum) in these flowing bins based on product labeling?**

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (3):
  - **For the bins (3 and 4) that represent larger flowing systems, what ways of incorporating the effects of dispersive mixing and/or peak desynchronization into concentration estimates are reasonable?**

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (4):
  - **What are the strengths and weaknesses of alternative mechanistic or regression-based watershed models such as the Soil and Watershed Assessment Tool (SWAT), the Hydrological Simulation Program-Fortran (HSPF) and the Watershed Regressions for Pesticides (WARP) for simulating aquatic pesticide concentrations at the temporal resolution and national scales required for ESA assessment? Are there other watershed models that should be considered?**

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (5):

  - **What is the desired and appropriate spatial scale for EECs for Bins 3 and 4? Specific PWC EECs were developed for HUC2 regions. Can or should the EECs for Bins 3 and 4 be at a finer spatial scale given a nationwide consultation?**

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- Regardless of the model employed, the EECs from any model need to be conservative (*i.e.*, protective of the species of concern) and scientifically defensible in order to be used for risk assessment purposes

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- Field-scale models (e.g., PRZM/VVWM)
  - Compare model outputs to edge-of-field monitoring data, where pesticide monitoring data is associated with pesticide-applications under well-described conditions
- Watershed models (e.g., SWAT, SAM, WARP)
  - Aggregates exposure across a larger area
  - Field-scale monitoring data, and the associated well-described conditions for all locations in the watershed, can be extremely difficult to obtain and, as a watershed model aggregates exposure, it may not be necessary

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- NAS Report – page 49
  - "If pesticides are to be used without jeopardizing the survival of listed species and their habitats, the estimated environmental concentrations (EECs) to which the organisms and their habitats will be exposed need to be determined. Chemical fate and transport models are the chief tools used to accomplish that task."

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- NAS Report – page 54
  - "in evaluating models, general monitoring data and field studies need to be distinguished. General monitoring studies provide information on pesticide concentrations in surface water or ground water on the basis of monitoring of specific locations at specific times…not associated with specific applications of pesticides under well-described conditions, such as application rate, field characteristics, water characteristics, and meteorological conditions. General monitoring data cannot be used to … to evaluate the performance of fate and transport models."

Breakout Group 2 Evaluation of Aquatic Exposure Modeling Estimates

- NAS Report – page 54
    - "pesticide fate and transport models do not provide information on the watershed scale; they are intended only to predict pesticide concentrations in bodies of water at the edge of a field on which a pesticide was applied."
    - "different hydrodynamic models are required to predict how pesticide loadings immediately below a field are propagated through a watershed or how inputs from multiple fields (or multiple applications) aggregate throughout a watershed."
- No further discussion provide in NAS report on the monitoring data requirements needed to evaluate watershed models

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- How does one evaluate the results generated from a watershed model?
- Proposal - use multiple lines of evidence to evaluate the range of scientifically-defensible EECs for each flowing bin
  - Consider available edge-of-field monitoring data and edge-of-field modeled estimates from PRZM5
  - Incorporate results from multiple watershed models, as appropriate
  - Consider statistical approaches to estimate confidence bounds around general monitoring data collected at a “greater than daily” time step (i.e., SEAWAVE Q and bias factors)

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- CHARGE QUESTION (1):
  - **In what ways are a "multiple lines of evidence" approach appropriate for evaluating the results from a watershed model? What would be the "lines of evidence" and sources of information?**

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- CHARGE QUESTION (2):
  - **How can different types of monitoring data be distinguished? What metadata requirements (*e.g.*, use info, sample frequency, etc.) can be used to distinguish types of monitoring data?**

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- CHARGE QUESTION (3):
    - **What roles can the various types of monitoring data play in the evaluation of results from a watershed model (e.g., general monitoring doesn't predict maximum but has other roles)?**

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- CHARGE QUESTION (4):
  - **What other approaches are available for evaluating results from watershed models?**

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- CHARGE QUESTION (5):
  - **To what extent can we rely on historical monitoring data when product labeling has changed and application-specific information is lacking?**

Breakout Group 2
Evaluation of Aquatic Exposure Modeling Estimates

- CHARGE QUESTION (6):
  - **Are there new or different types of monitoring that could be employed to further our understanding of aquatic modeling estimates?**

QUESTIONS?