

Overview of GW/SW Conceptual Models

*A conceptual model for GW, SW, sediment, and organism dynamics**



P. Bruce Duncan, U.S. EPA Region 10

Remedial Technology Development Forum Oct 29-30, 2002 - Seattle, WA

*** BFD – model *Black, Fuentes, Duncan***

REMINDER FOR THE WORKSHOP

When in doubt/need to simplify, focus on:

- *Contaminated GW discharging thru clean sediments*
- *RTDF needs*

Discussion Points

- Conceptual Models
- Hydrodynamic/Hydrogeological Aspects
- Ecological Considerations
- Biogeochemical aspects
- Tools and approaches to characterize the zone
- Tiered approaches for evaluation

Outline of this Presentation

- *Contrast several conceptual models*
- *Present the logic for an integrative model*
- *Some ideas on value of integrating dynamics*

Take Home Messages

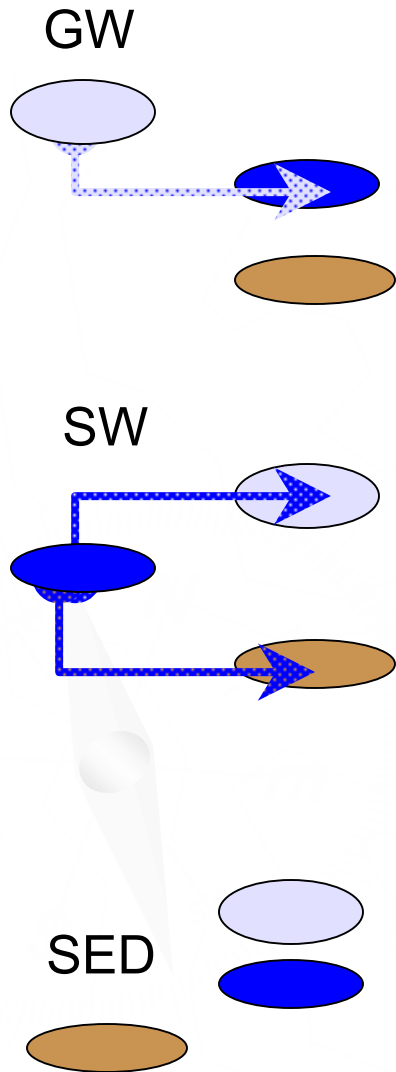
- *Continue to improve our conceptual models*
- *We should enhance our “box” models to include the implied dynamics*
- *Tailor the complexity of the conceptual site models to the site*

Example 1:

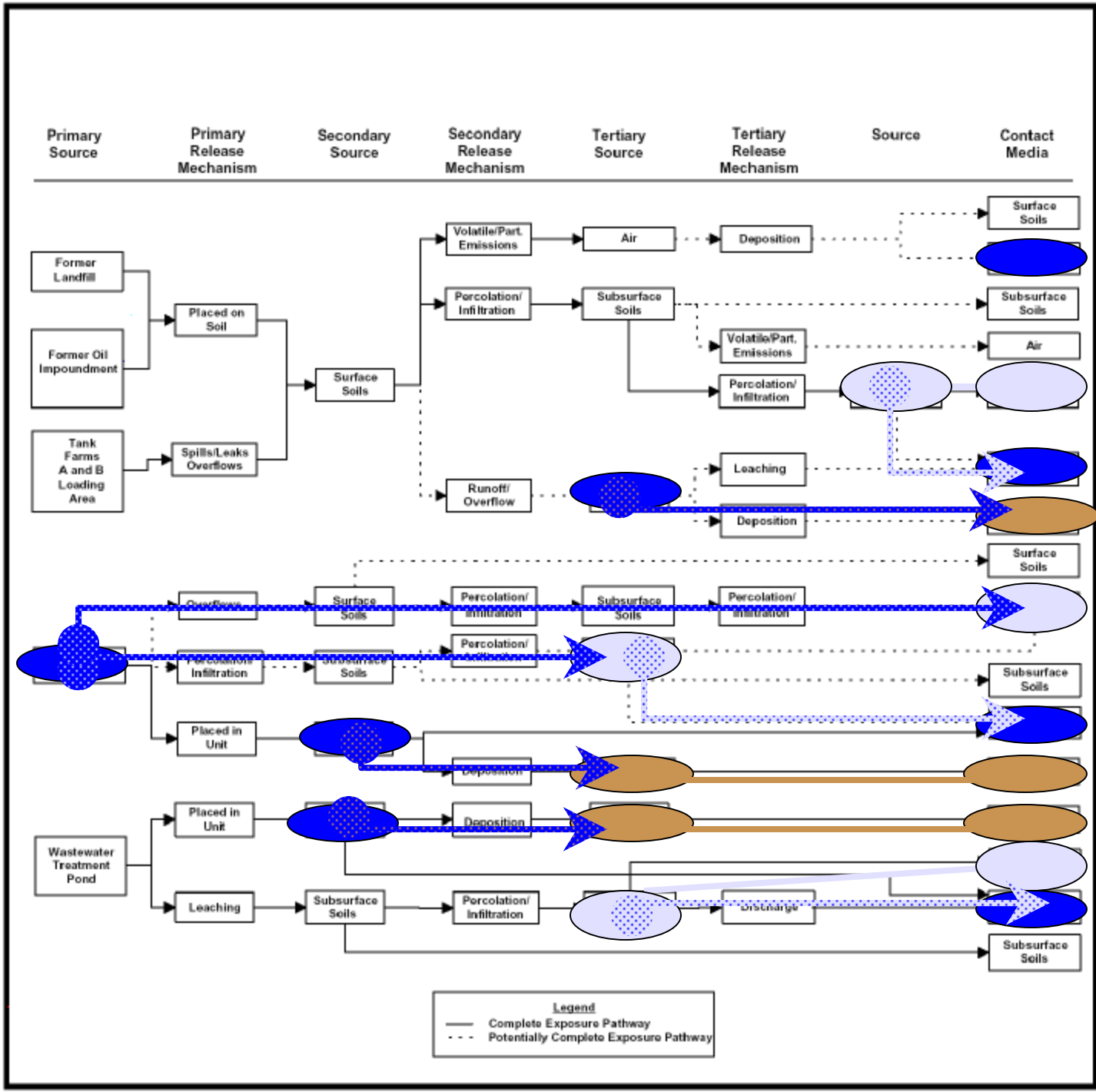
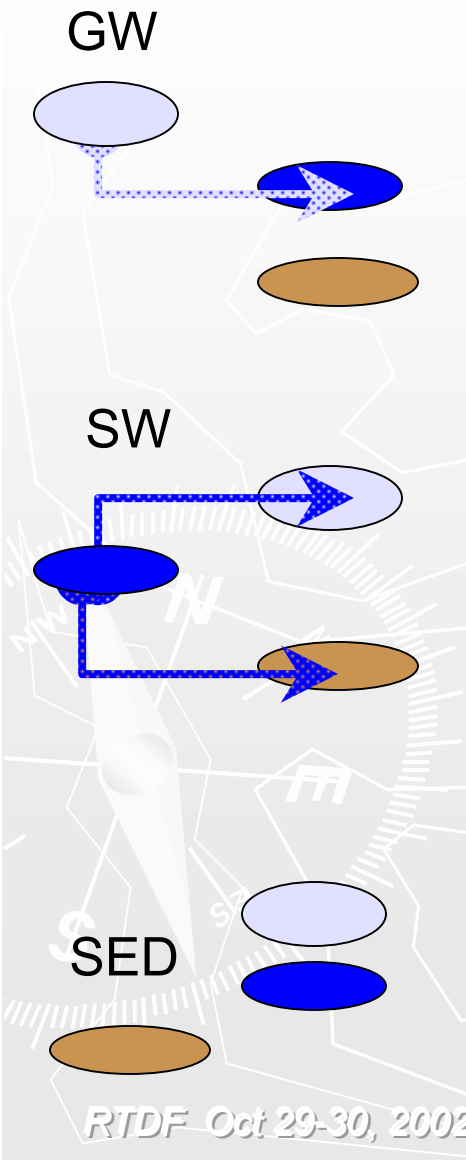
Region 6 Corrective Action Strategy (CAS)

Using the Conceptual Site Model to
Select Performance Standards and
Develop Data Quality Objectives in the
CAS

Typical Conceptual Site Box Model



These circles and arrows indicate Links between GW, SW, & sediment



Pathways not considered in the box model

GW -> Sediment

Sediment -> GW

Sediment -> SW

*Dynamics not considered
(double arrows)*

e.g., GW<->SW

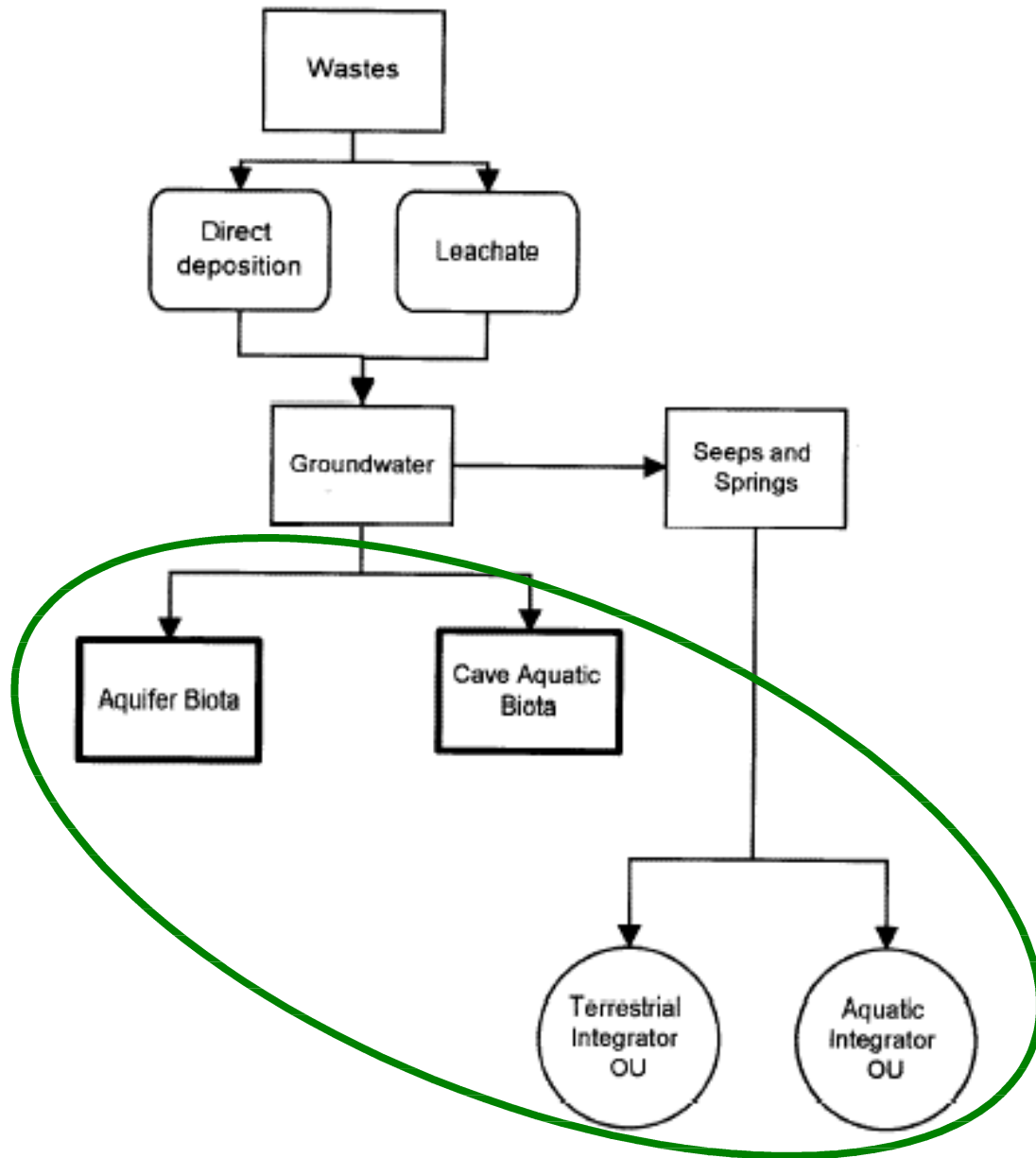
Example 2:

Approach and Strategy for Performing
Ecological Risk Assessments

ORNL document - ES/ER/TM-33/R2

<http://www.esd.ornl.gov/programs/ecorisk/tm33r2p.pdf>

for the U.S. Department of Energy's Oak
Ridge Reservation: 1995 Revision



Receptor exposure

Fig. 6. Transfer of contaminants into and through a groundwater integrator OU.

Example 3:

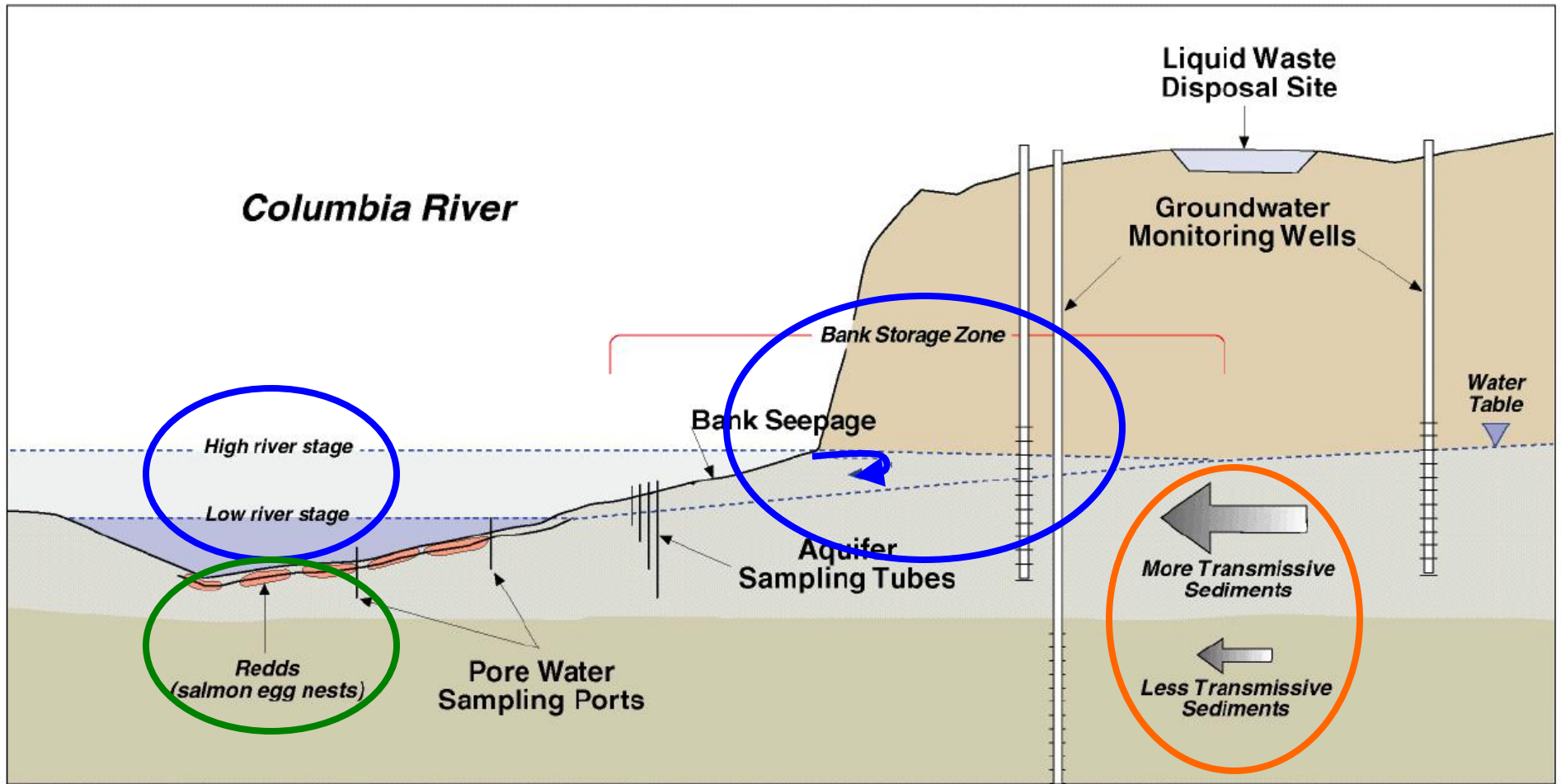
U.S. Department of Energy Hanford Site

***Groundwater/Vadose Zone Integration
Project: Science and Technology***

**Groundwater/River Interface Study: Task Description
Robert E. Peterson**

**Pacific Northwest National Laboratory
*National Academy of Sciences Panel Review, June 28-
30, 2000***

Groundwater/River Interface



Receptor exposure

GW/SW Dynamics

Hydro/geo
Properties

Example 4:

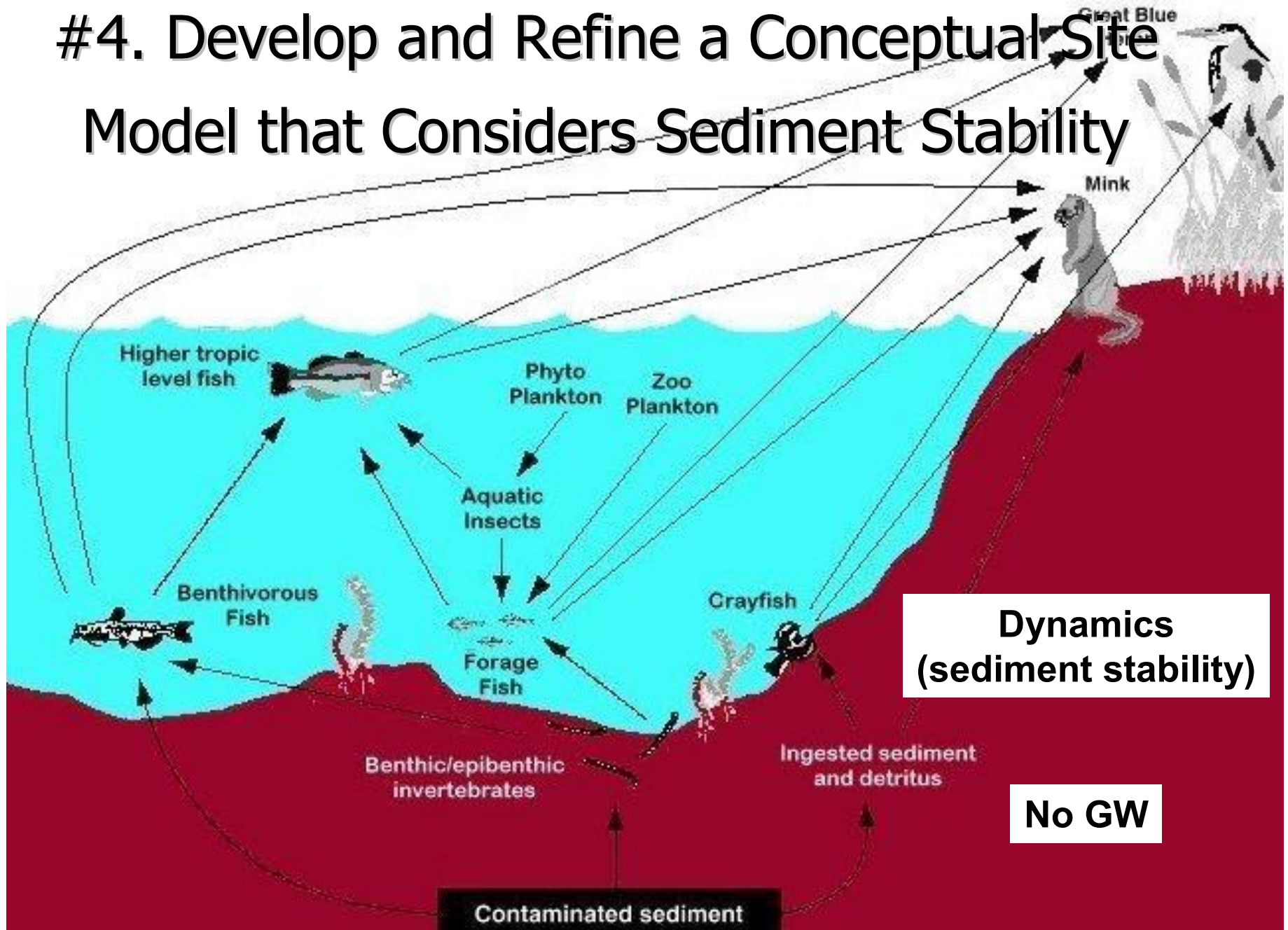
Conceptual model from/for sediment managers

Principles for Managing Contaminated
Sediment Risks

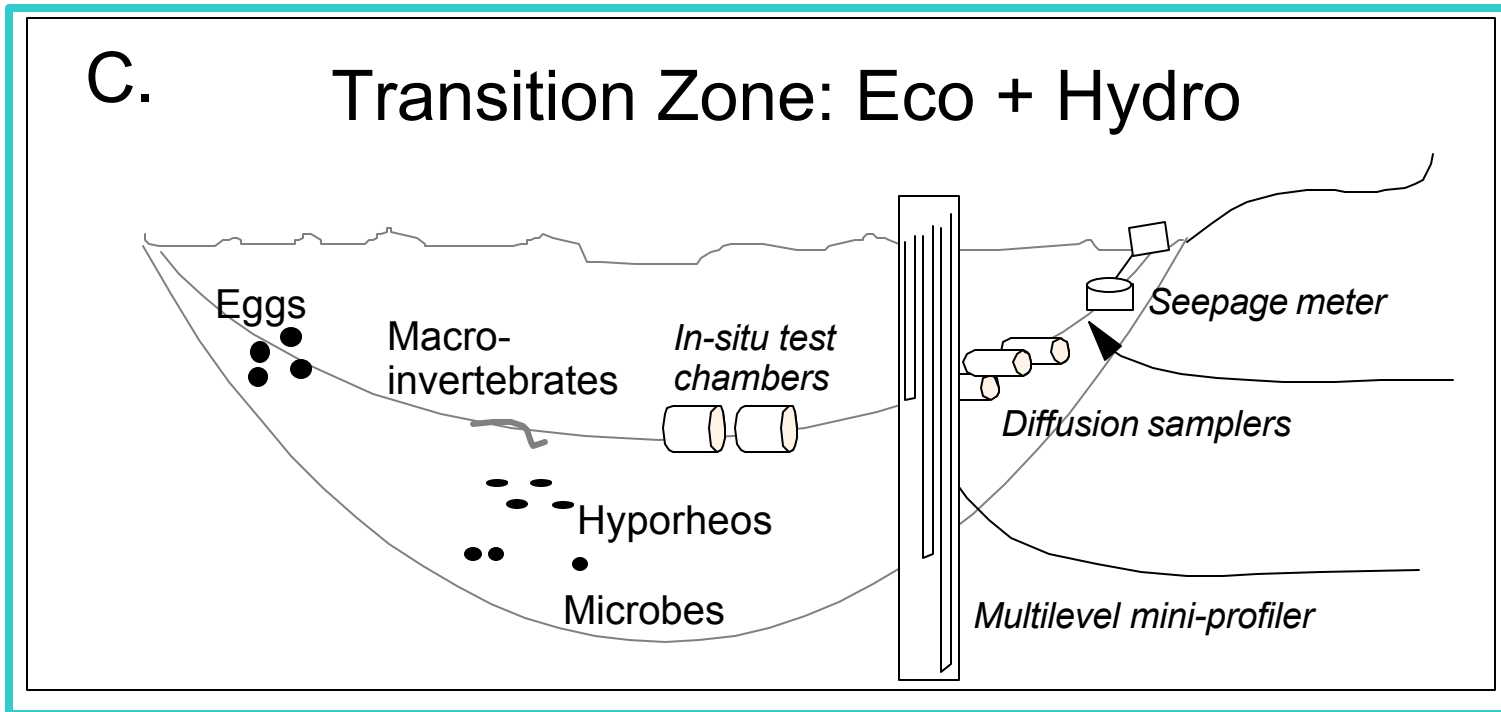
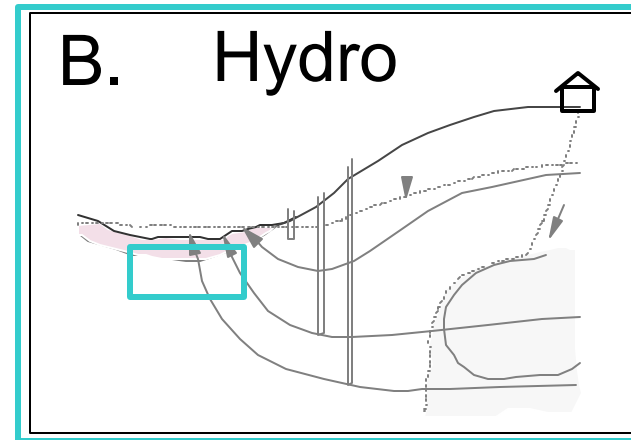
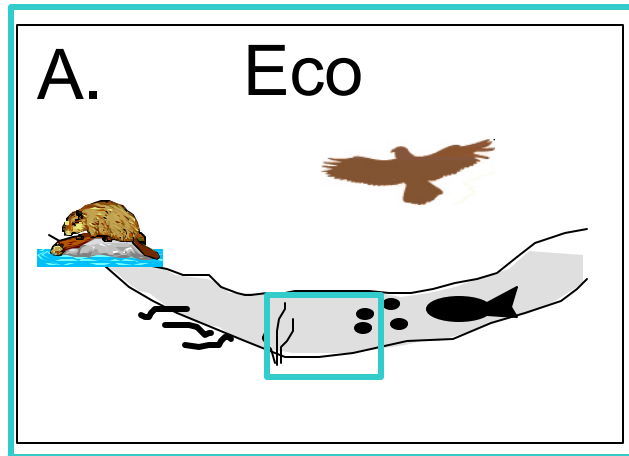
SMARM meeting

sediment management annual review meeting

#4. Develop and Refine a Conceptual Site Model that Considers Sediment Stability

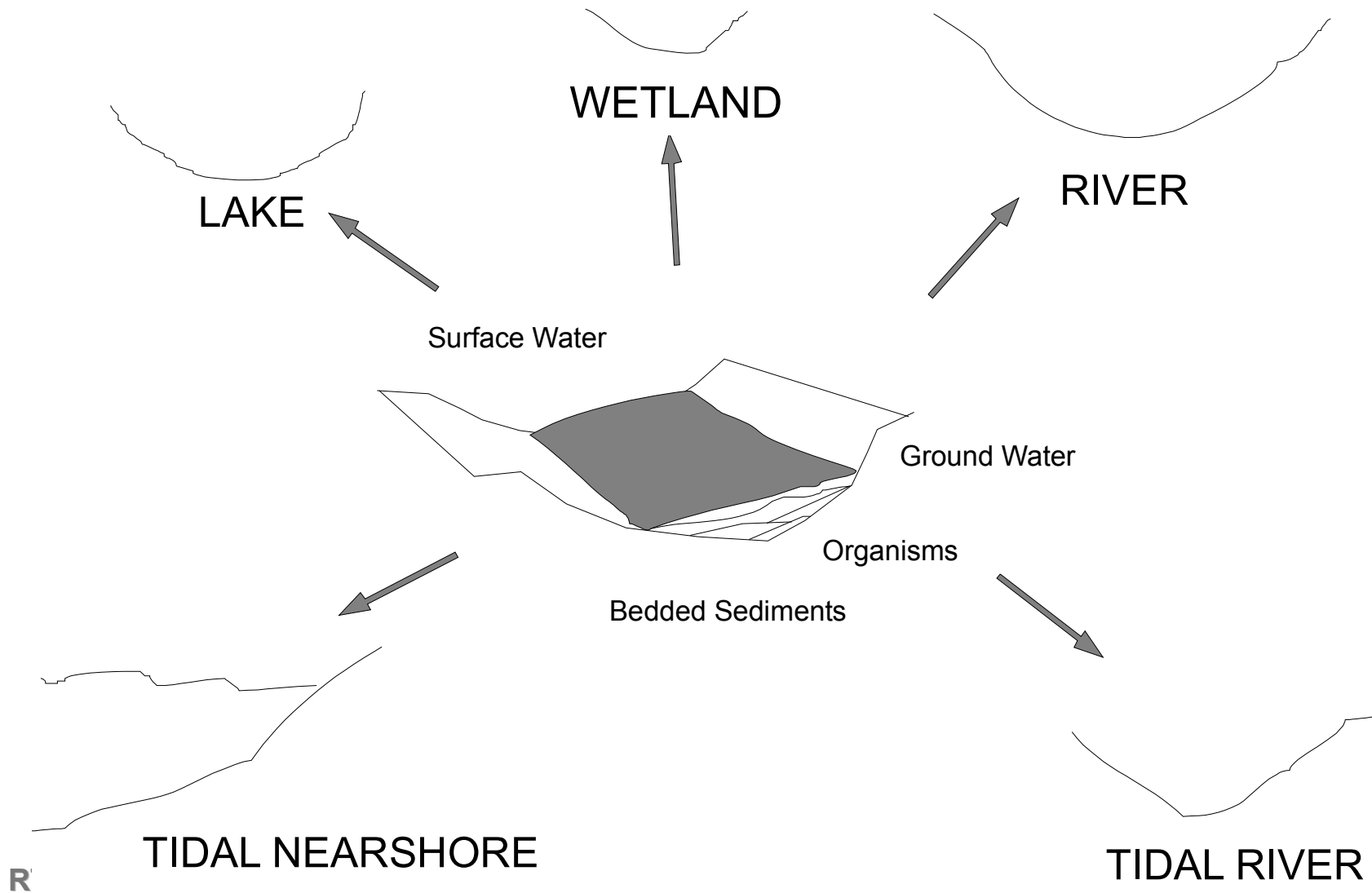


Integrative Conceptual Model

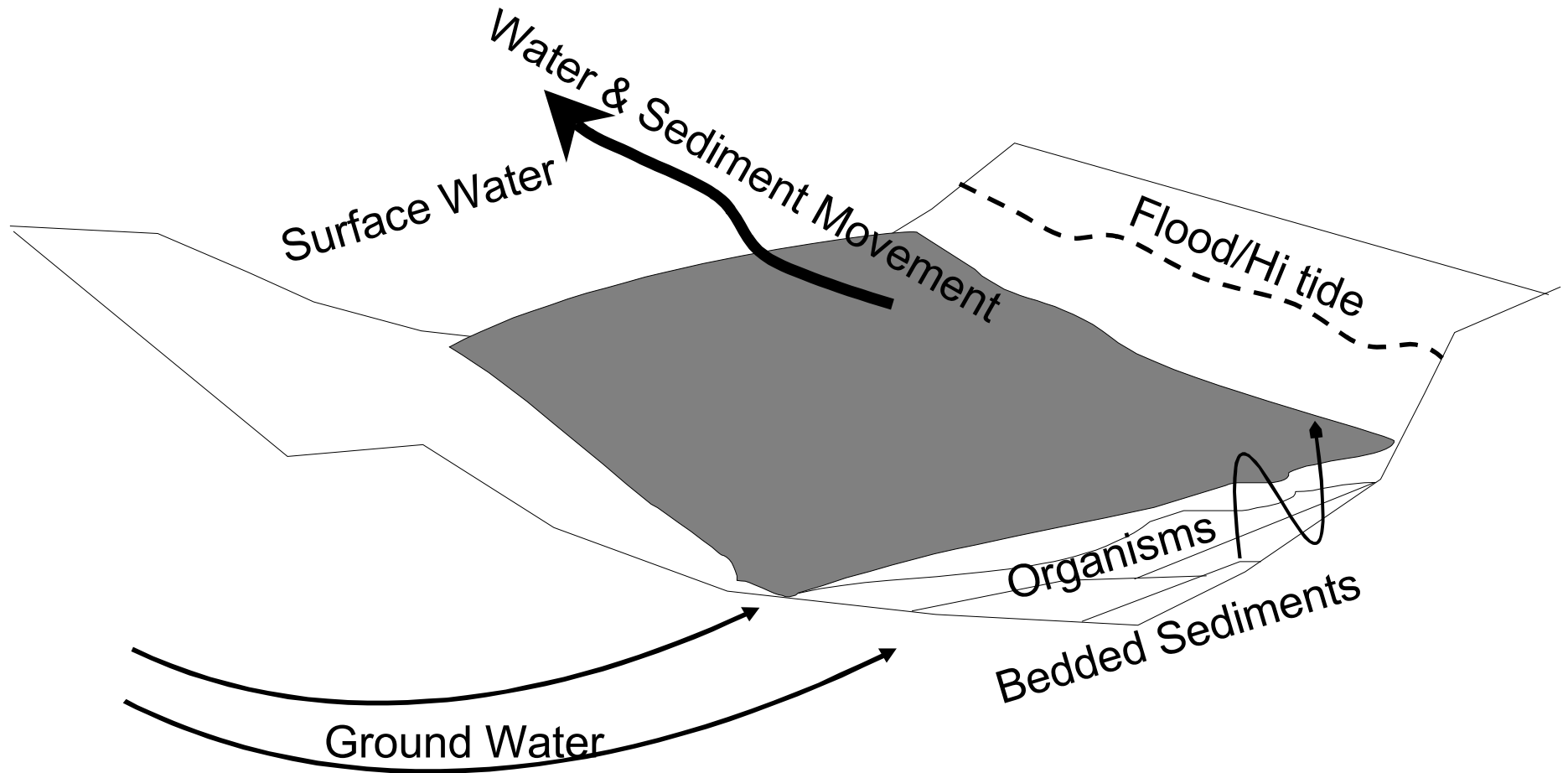


Flexible Conceptual Model

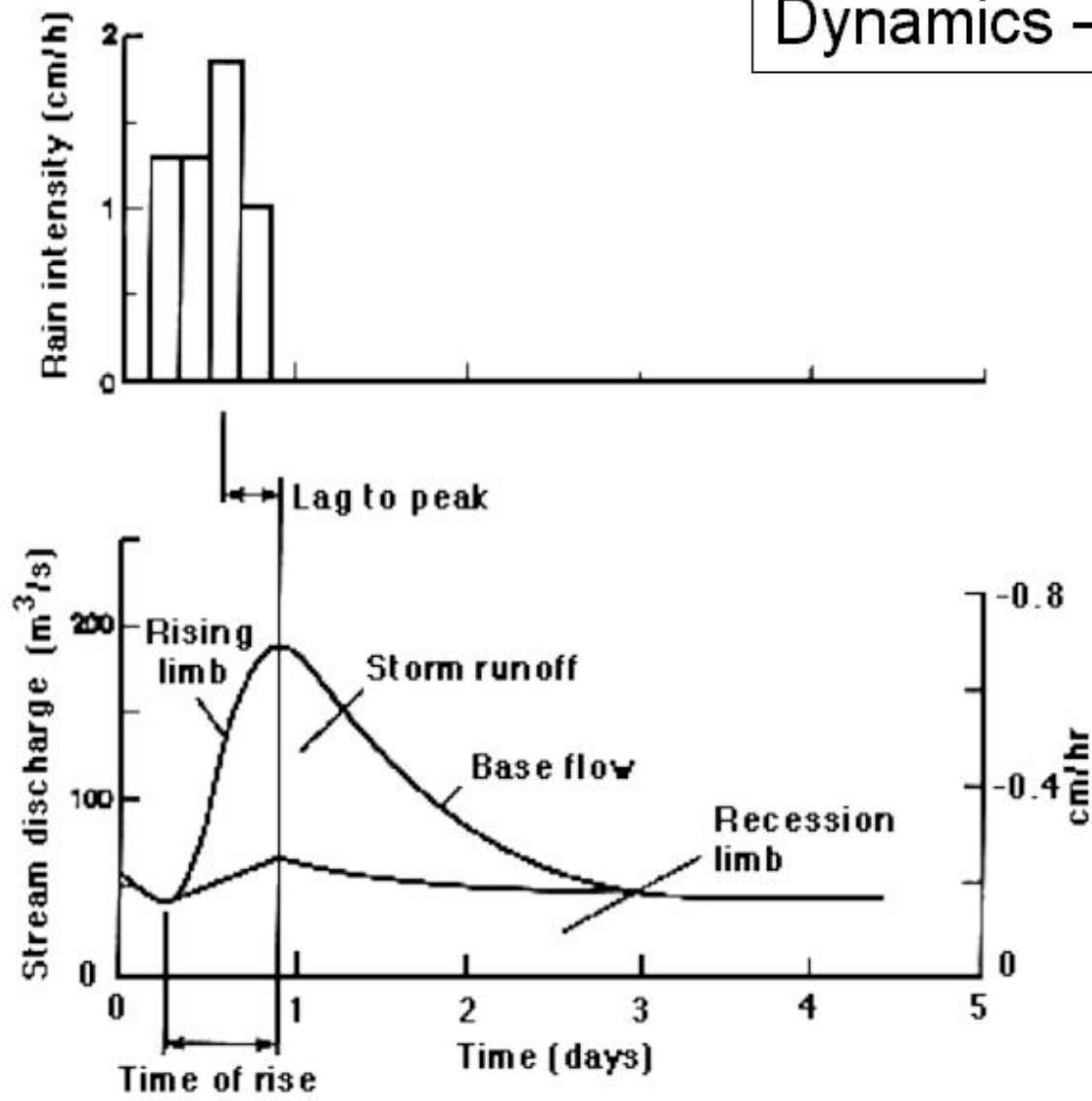
GW/SW/Sediments/Biota



Dynamic Conceptual Model

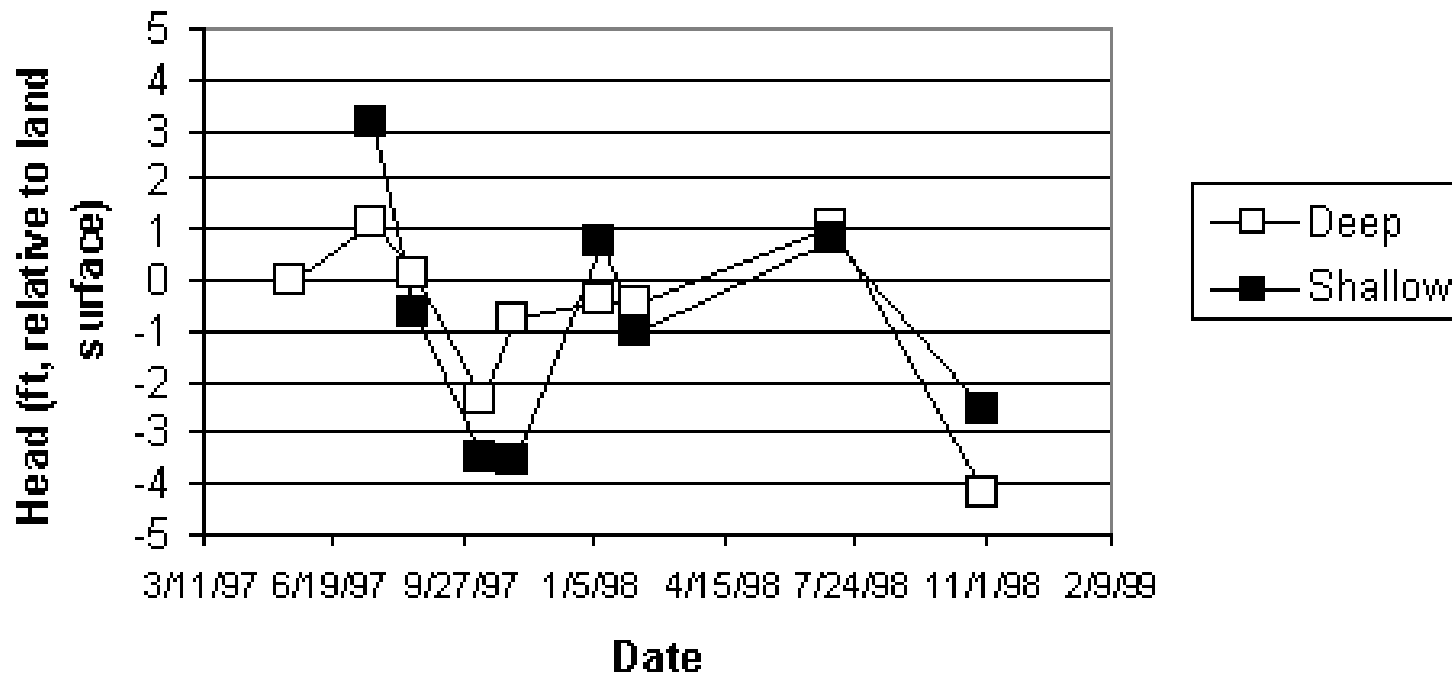


Dynamics – stream hydrograph



Dynamics – lake GW discharge/recharge

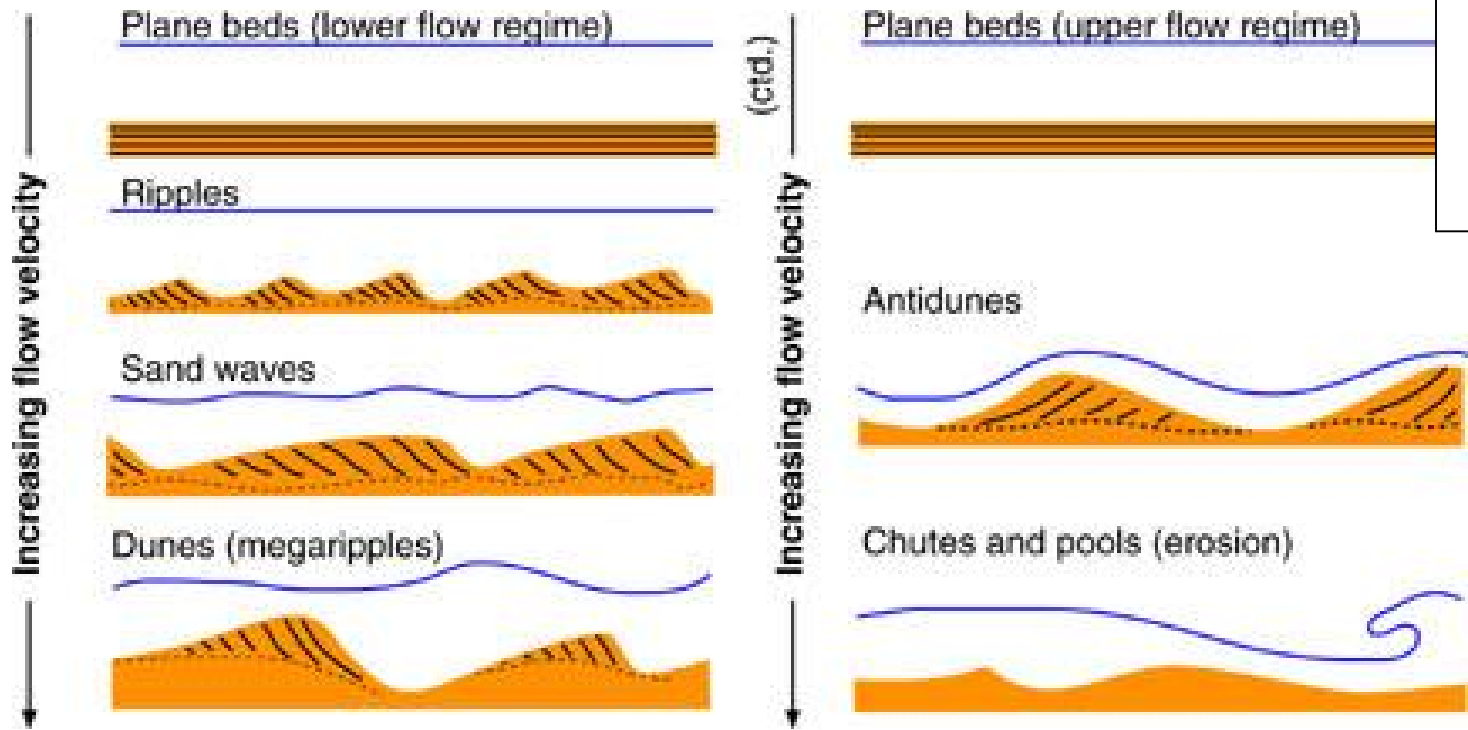
Fig. 1. Hydraulic heads in Metropolis Lake piezometers.



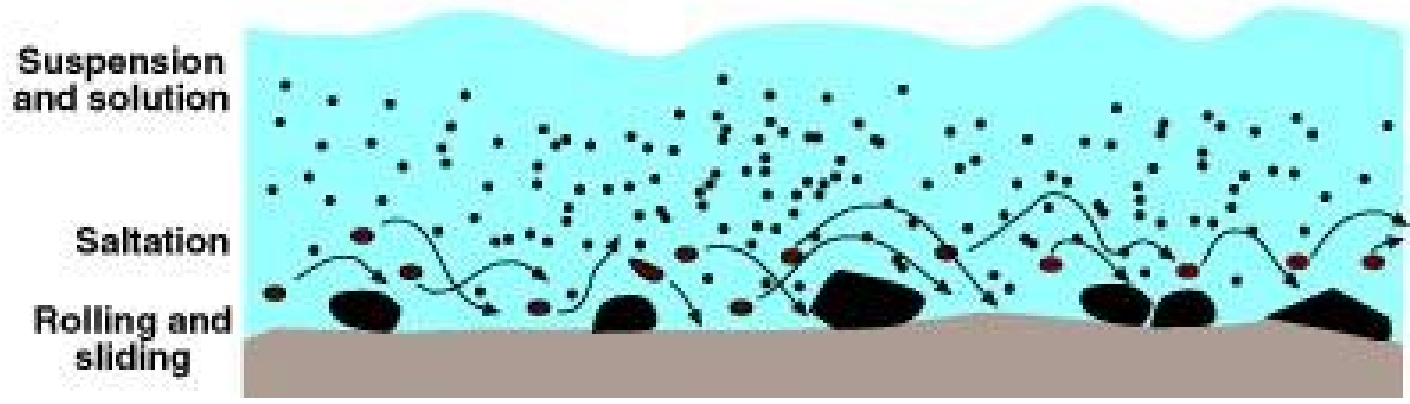
LOWER FLOW REGIME BEDFORMS

UPPER FLOW REGIME BEDFORMS

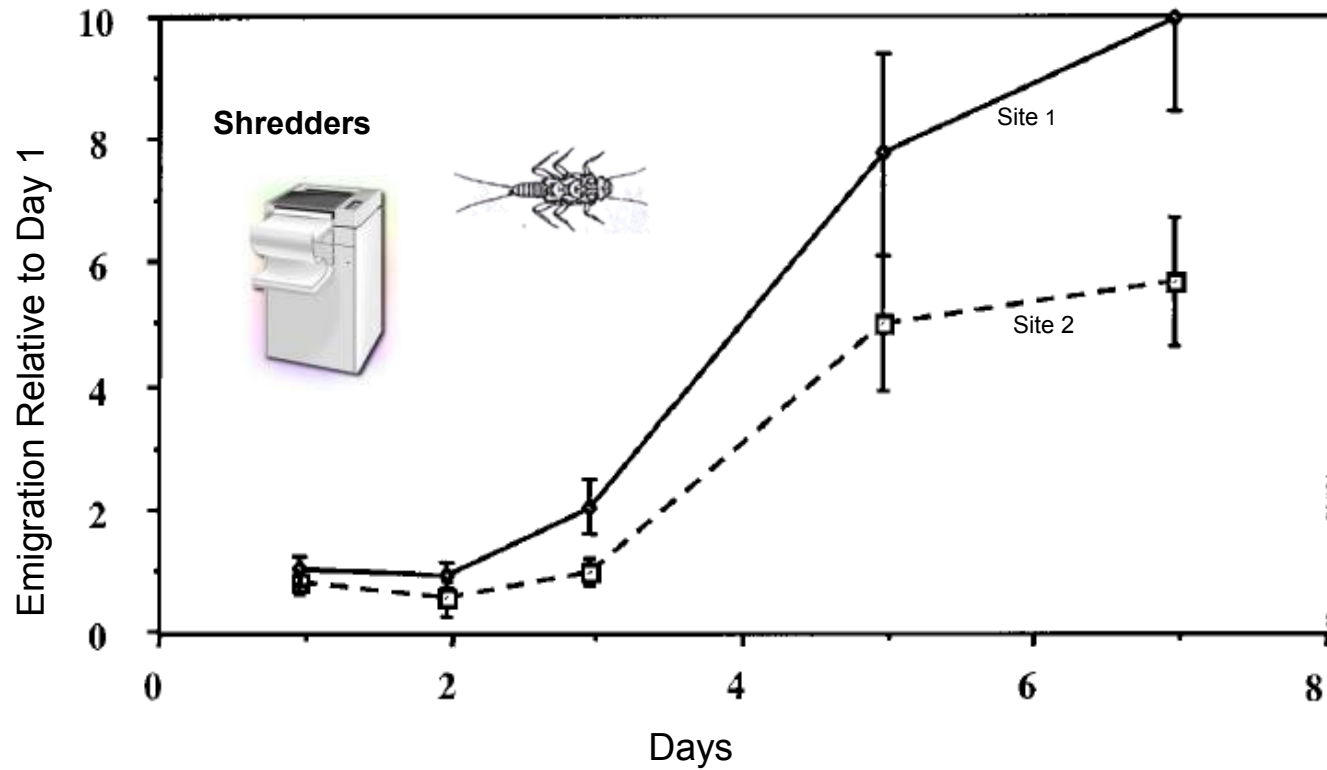
Dynamics –
sediment
suspension &
bedforms



How sediment moves...



Dynamics – stream benthic macroinvertebrate movement



Sources

Hydraulic head under lake

<http://www.uky.edu/WaterResources/SYMP99-GWAT1.HTML>

Stream hydrograph

<http://www.oaa.pdx.edu/CAE/Programs/sti/pratt/images/hydrograph.gif>

Flow/sediment relationships

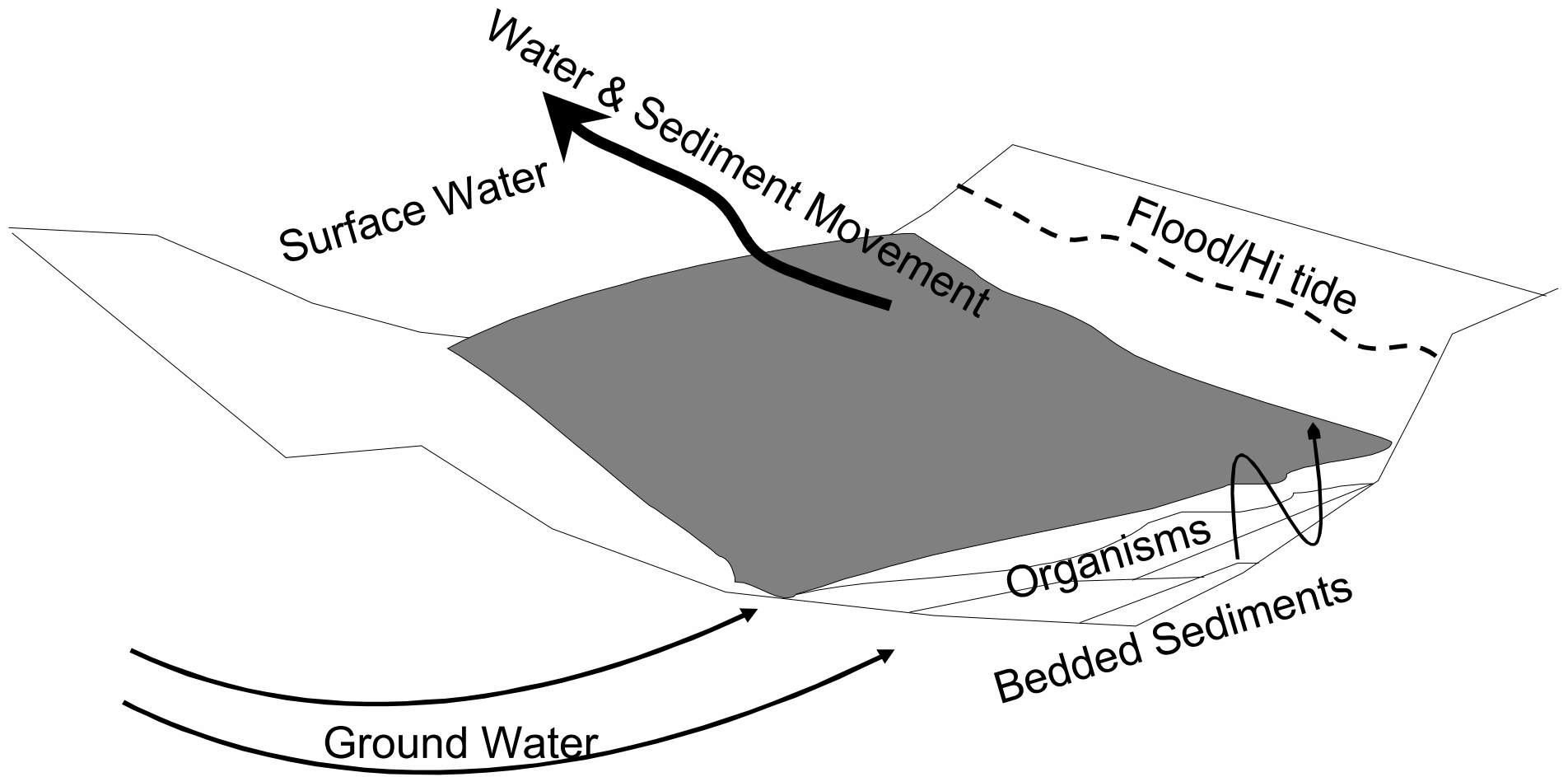
<http://www.usask.ca/geology/classes/geol243/243notes/243week3b.html>

Drift organism density

<http://142.103.180.19/richardson/abstracts/rowe&richardson.pdf>

Discussion Points

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- Ecological Considerations
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Key to success is a Team approach:
manager, ecologist, hydrogeologist