2016 International SWAT Conference in Beijing, China

Plug In Water Quality Modules in the SWAT Model

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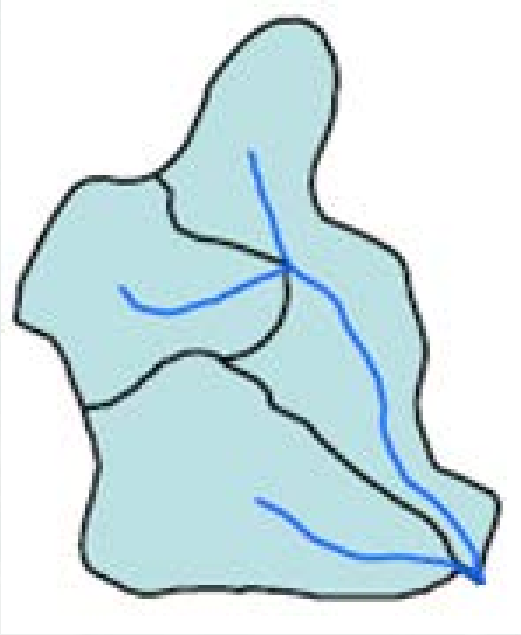

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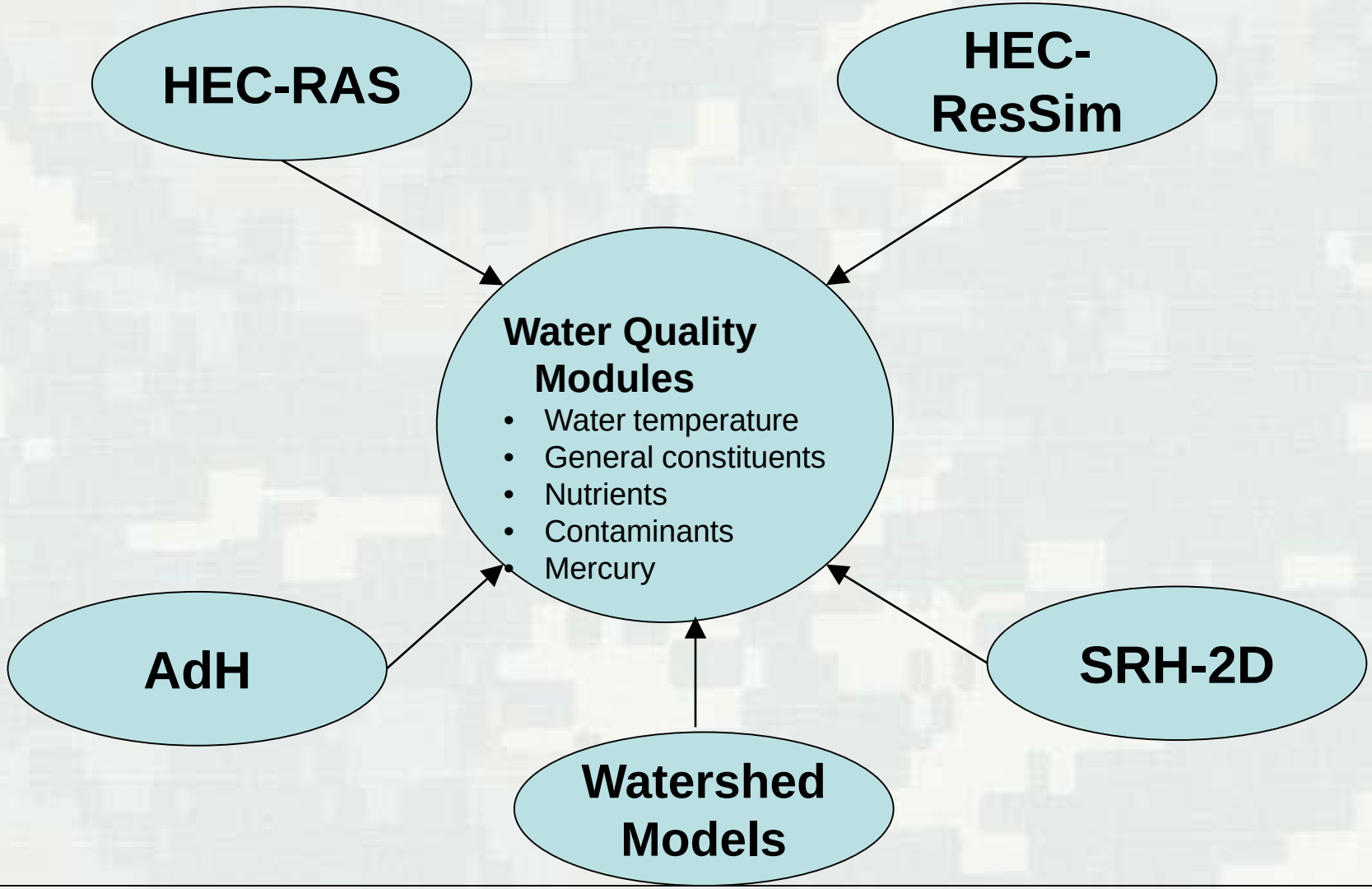
Water Environment | Scientists Engineers

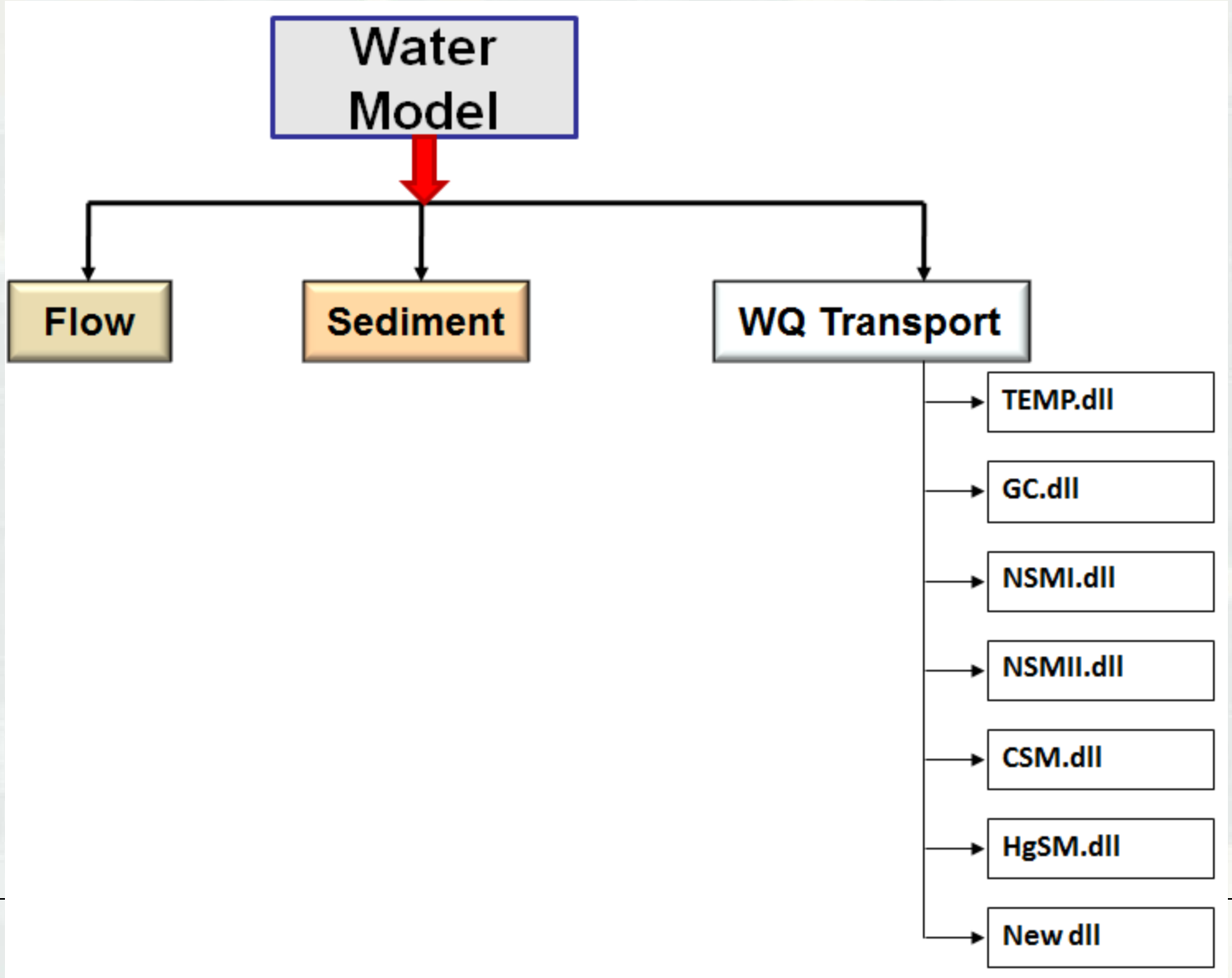
Outline

- Plug in water quality modules
- Integrating water quality modules into SWAT
- Model verification and evaluation

Plug In Water Quality Modules

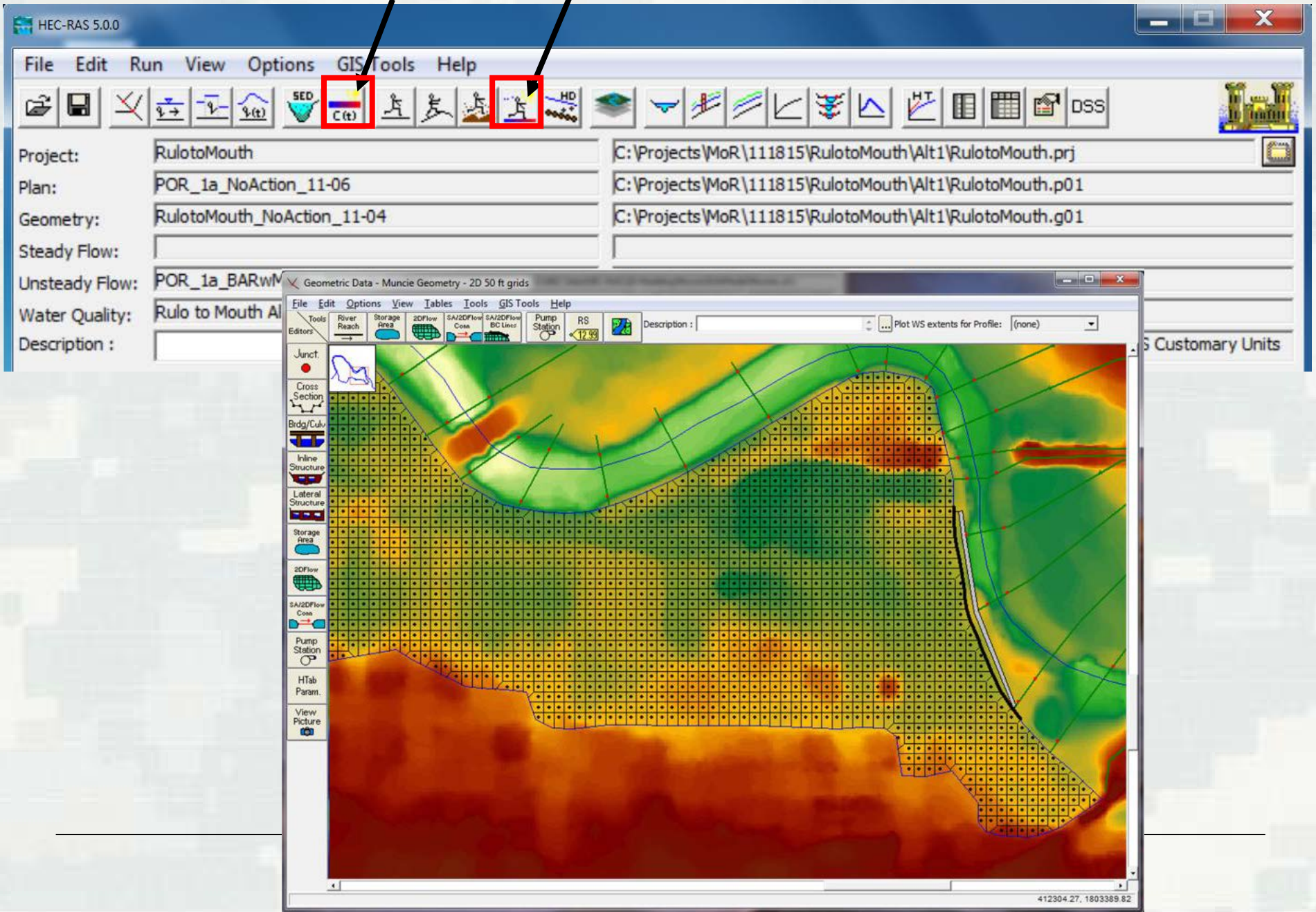


Plug In Water Quality Modules

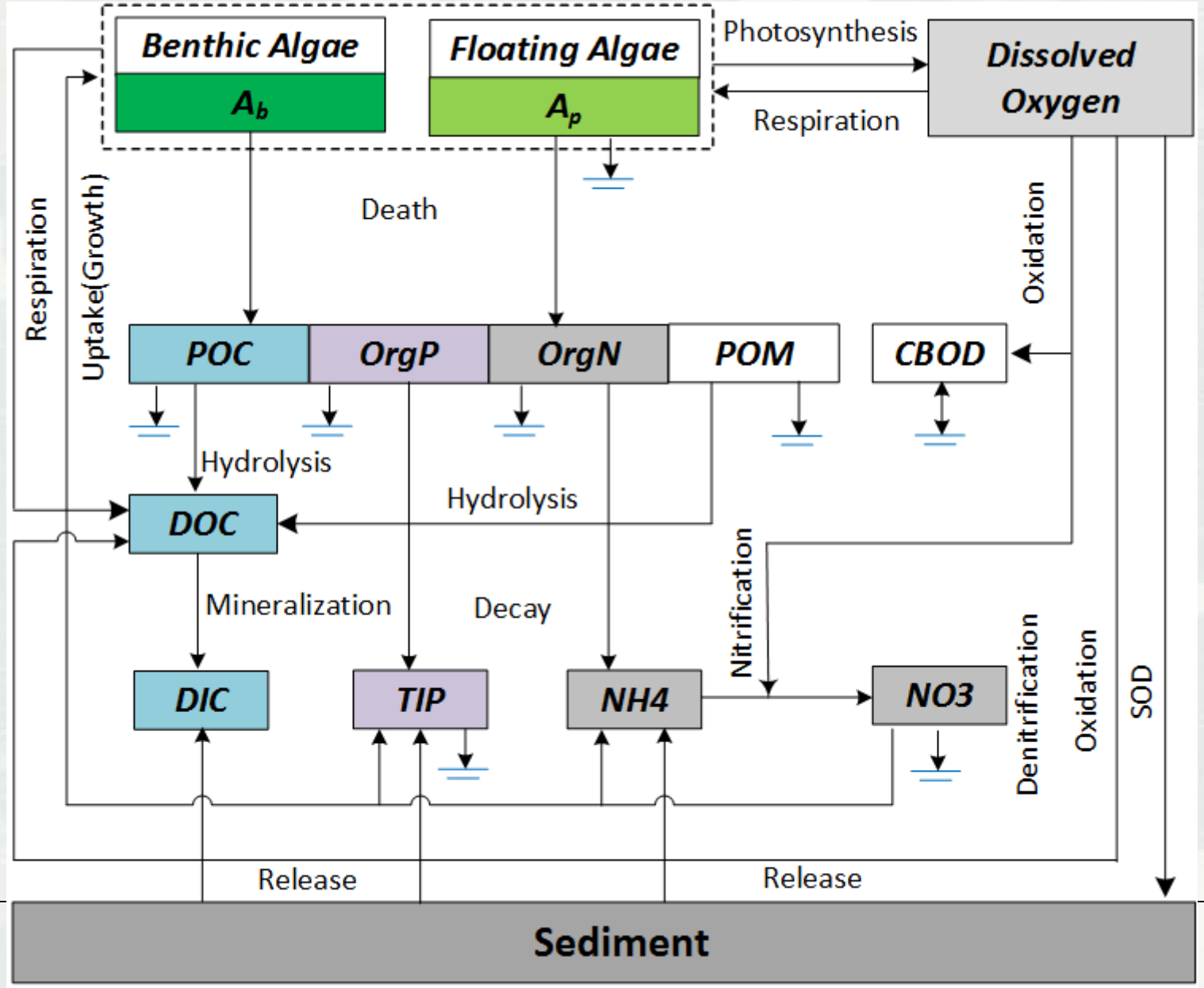


Water Quality Data

Water Quality Analysis



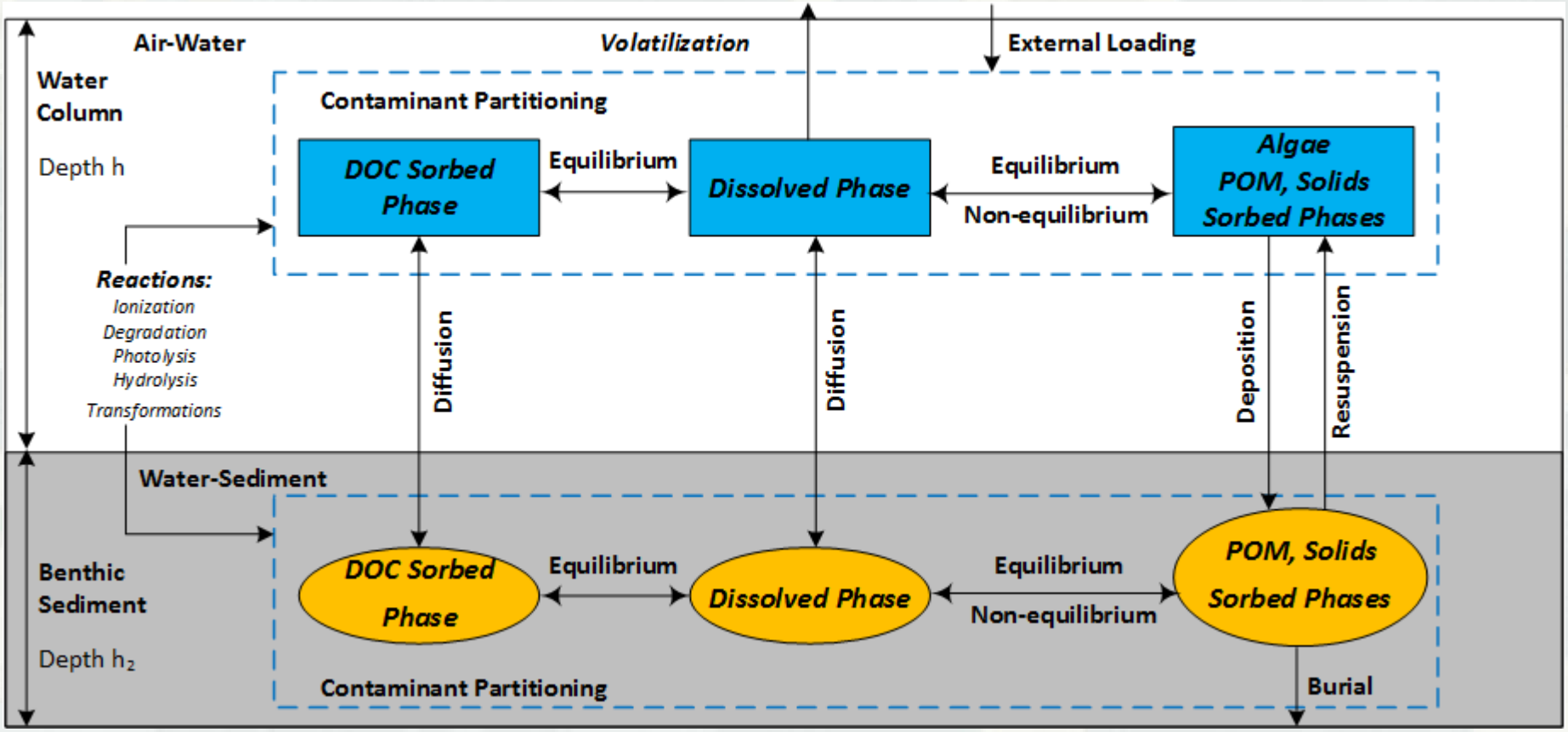
Nutrient Simulation Module I (NSMI)



Nutrient Simulation Module I (NSMI)

- State variables (16)
  - Algae (phytoplankton, benthic)
  - Nitrogen (OrgN, NH4, NO3)
  - Phosphorous (OrgP, TIP)
  - Carbon (POC, DOC, DIC)
  - Organic matter (POM, POM_2)
  - CBOD
  - DO
  - Alkalinity
  - Pathogen
- Derived variables
  - Algal biomass
  - TON, TKN, TN, DIP, TOP, TP, TOC, $CBOD_5$
  - Light attenuation, oxygen reaeration rate, pH

Contaminant Simulation Module (CSM)

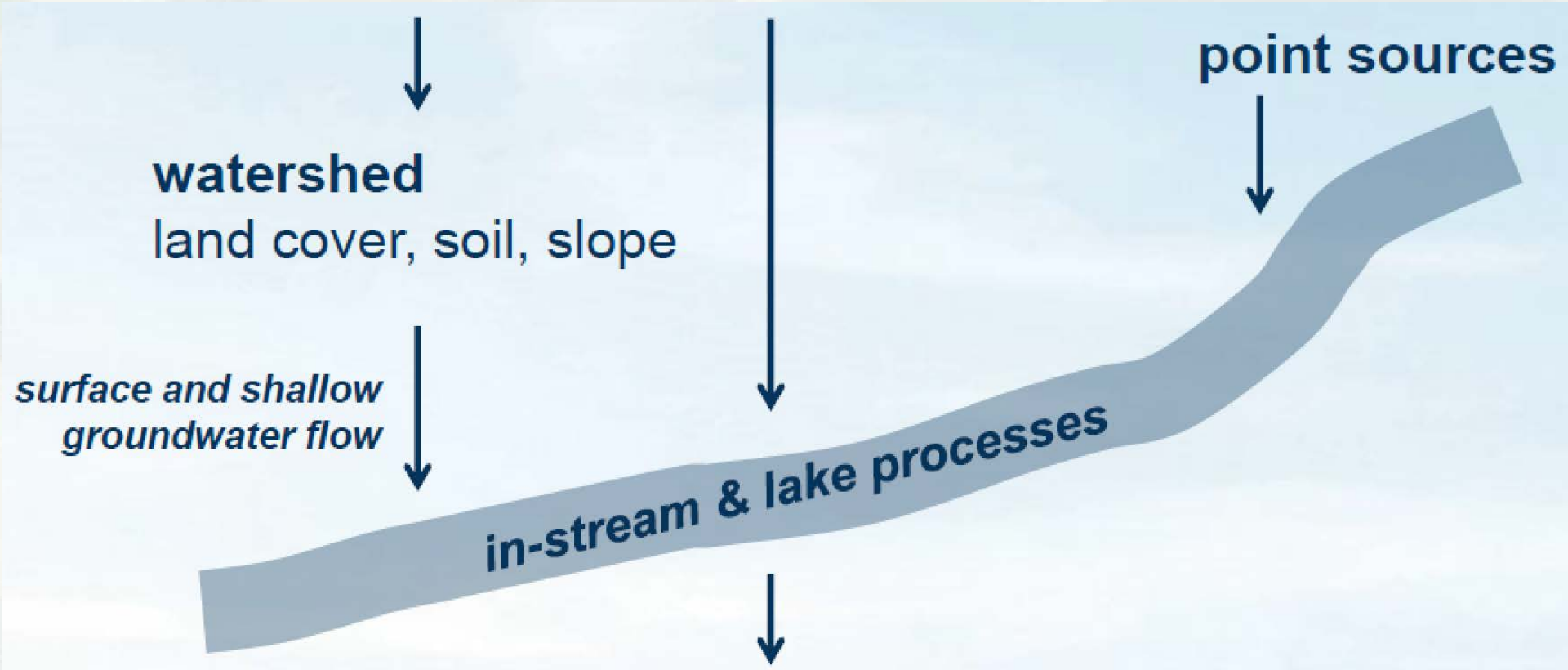


Contaminant Simulation Module (CSM)

- Multi-media kinetics
  - Water column
  - Underlying sediment layer
- Multiple phase partitioning (equilibrium and non-equilibrium)
  - Water
  - DOC (Dissolved Organic Carbon)
  - Algae
  - Organic matter
  - Inorganic solids
- Eight (8) biochemical transformation processes
  - Ionization (5 species)
  - Degradation
  - Hydrolysis
  - Photolysis (Photodegradation)
  - Volatilization
  - User-defined extra reaction (second-order)
  - Transformations and daughter products

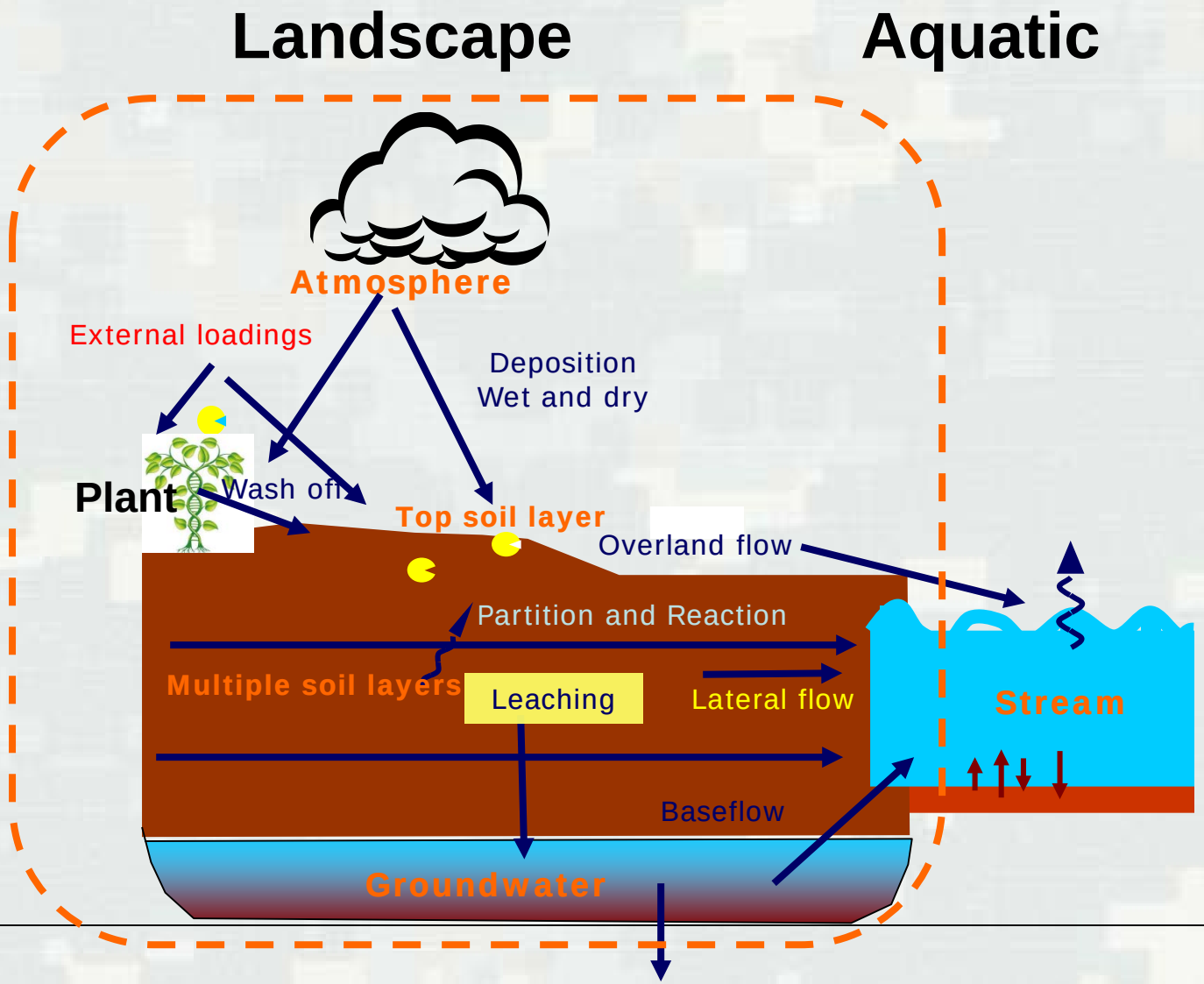
Soil and Water Assessment Tool

Weather (precip, air temp, etc.)



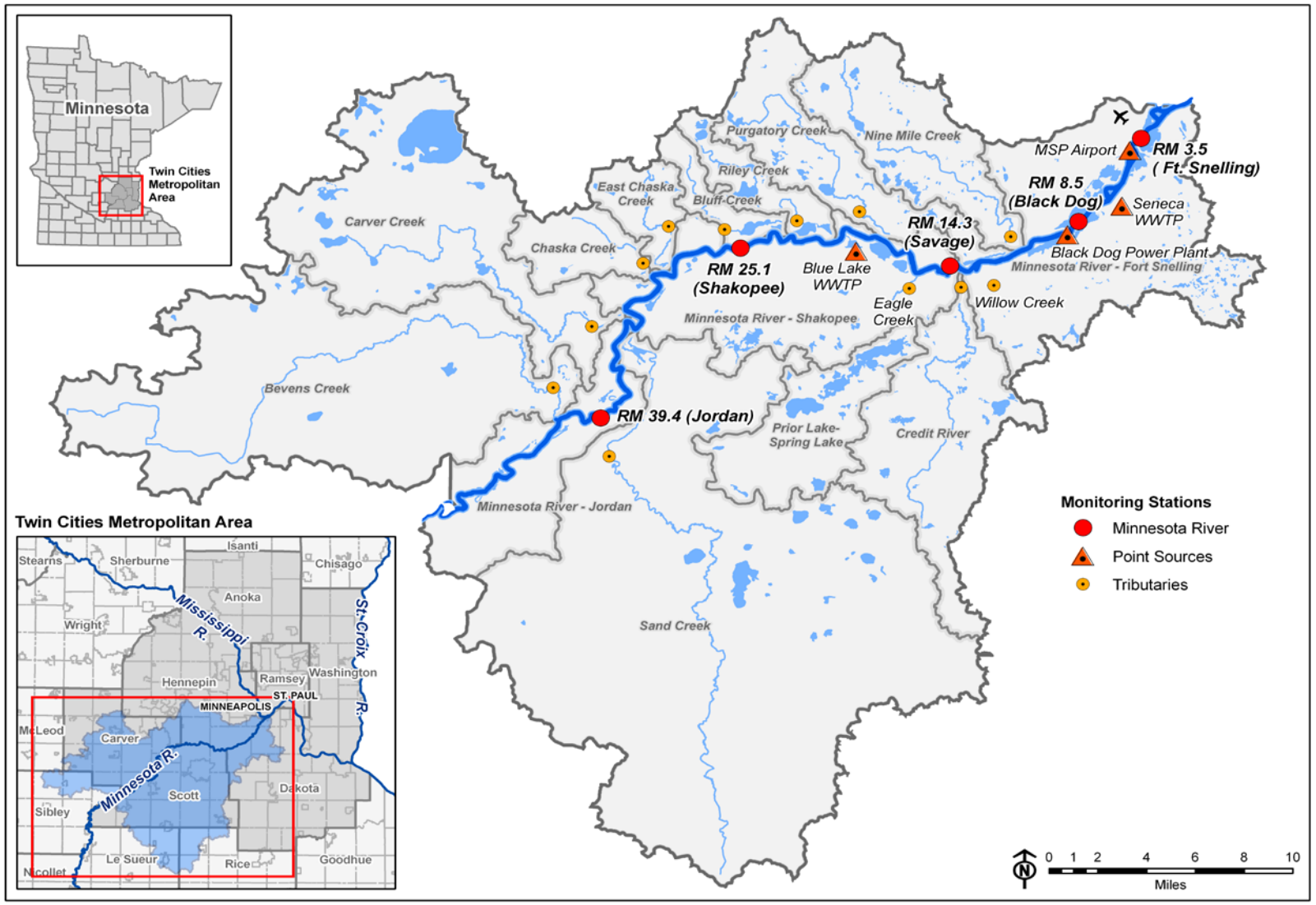
Watershed outlet

Contaminant Simulation Modules in SWAT

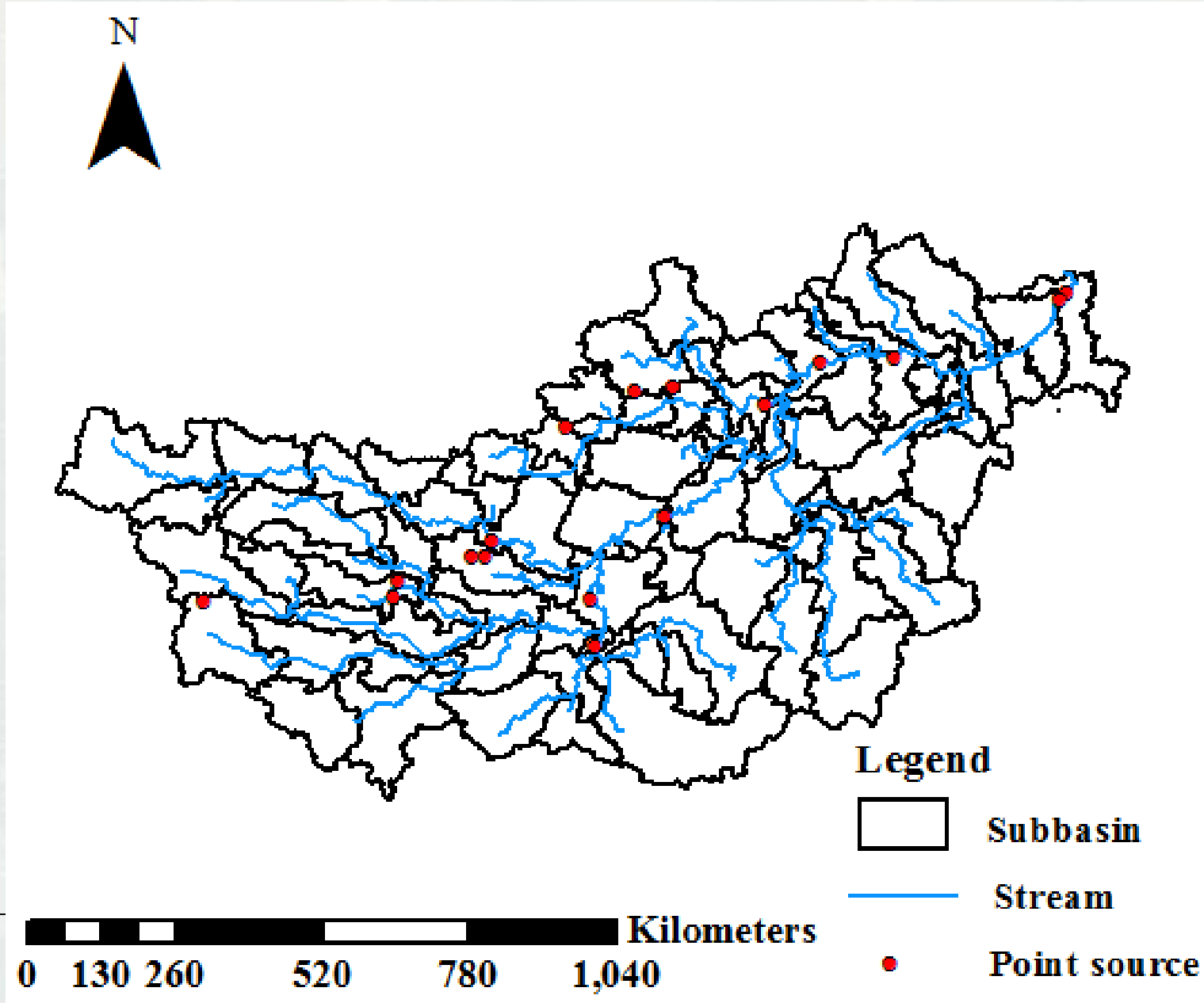


Model Testing and Verification - Proof of Concept

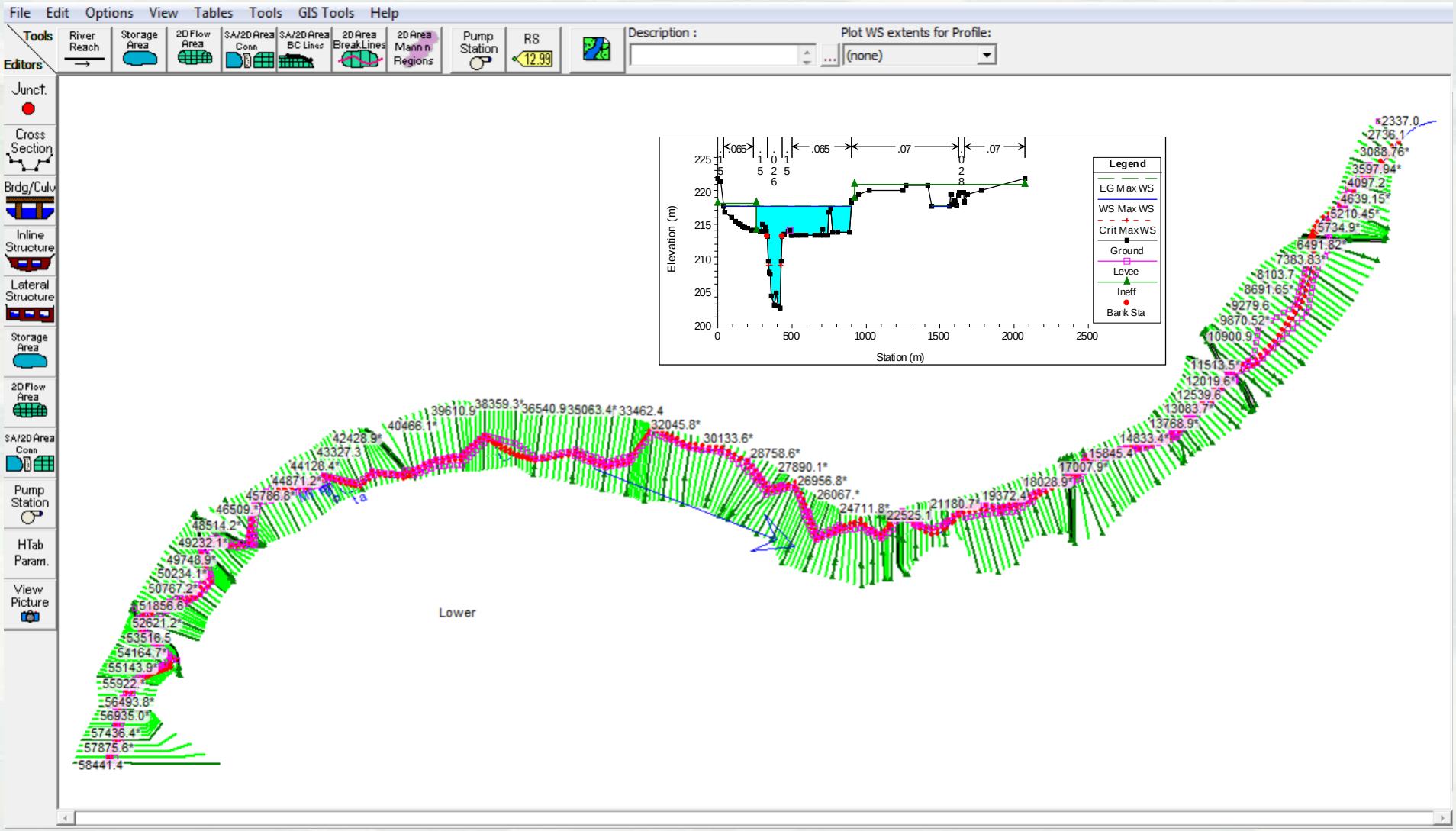
Lower Minnesota River Watershed



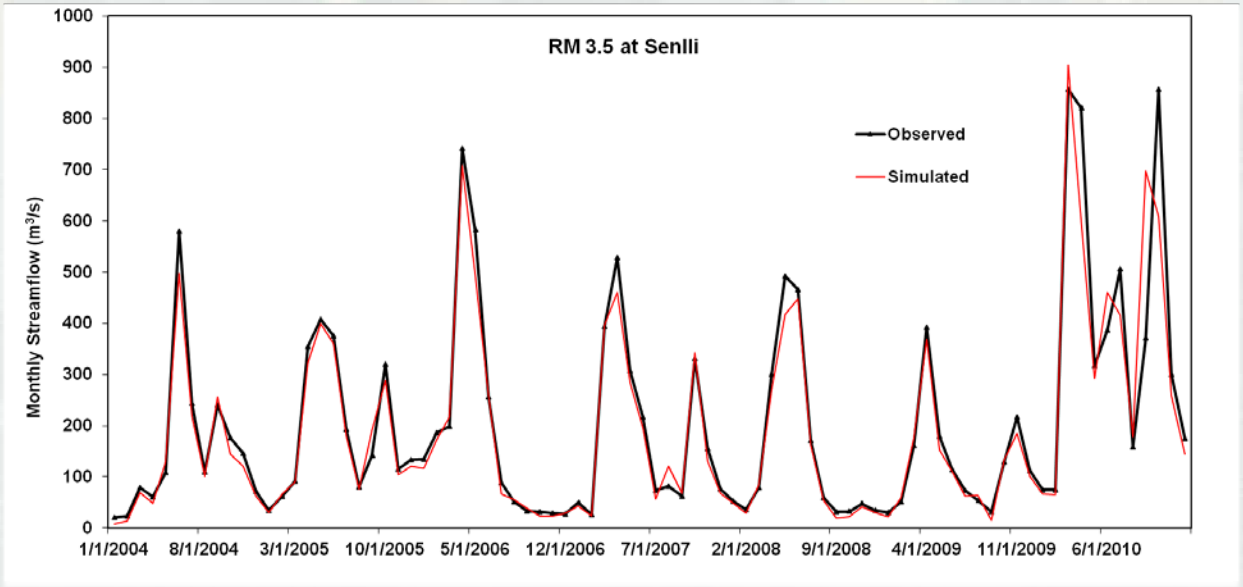
SWAT Model

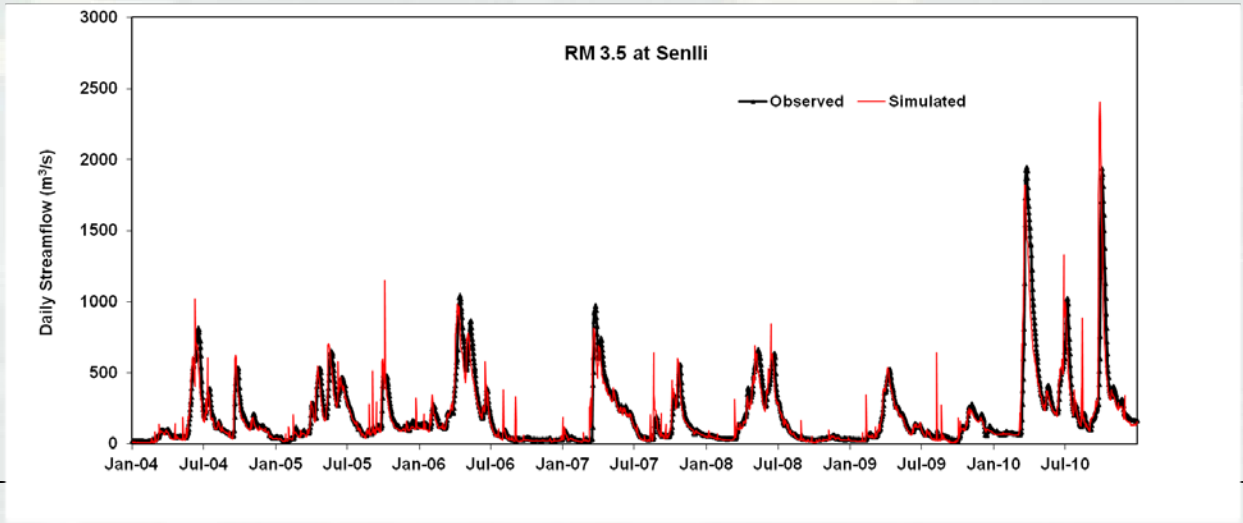

N
Legend
Subbasin
Stream
Point source
Kilometers
0 130 260 520 780 1,040

Mainstem HEC-RAS Model

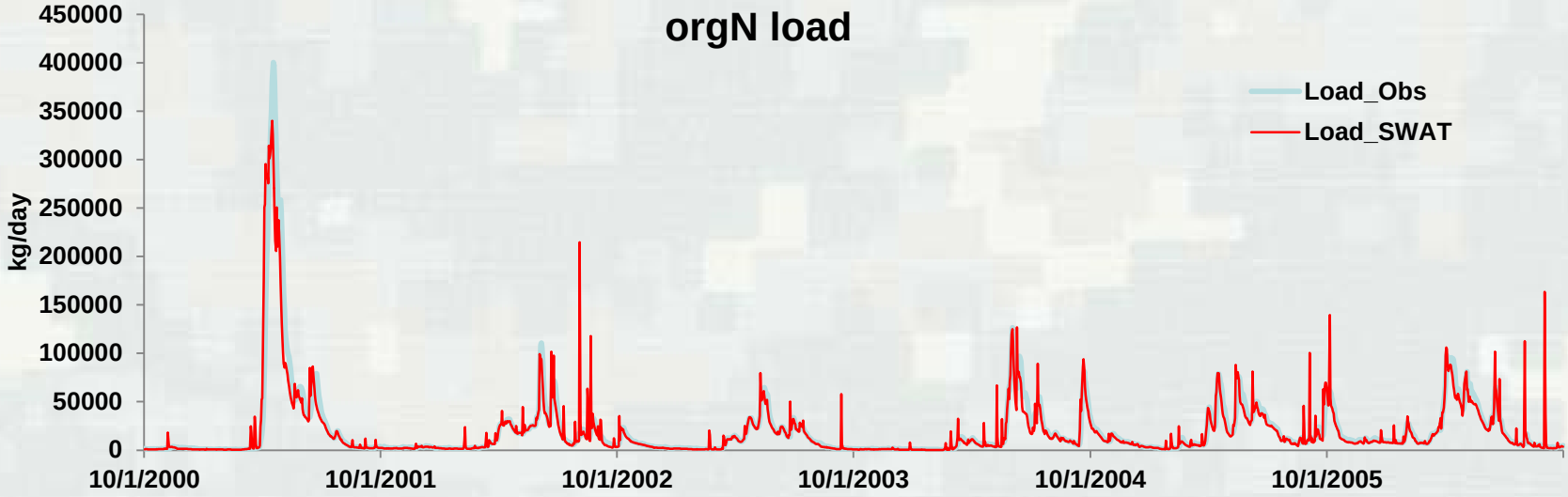


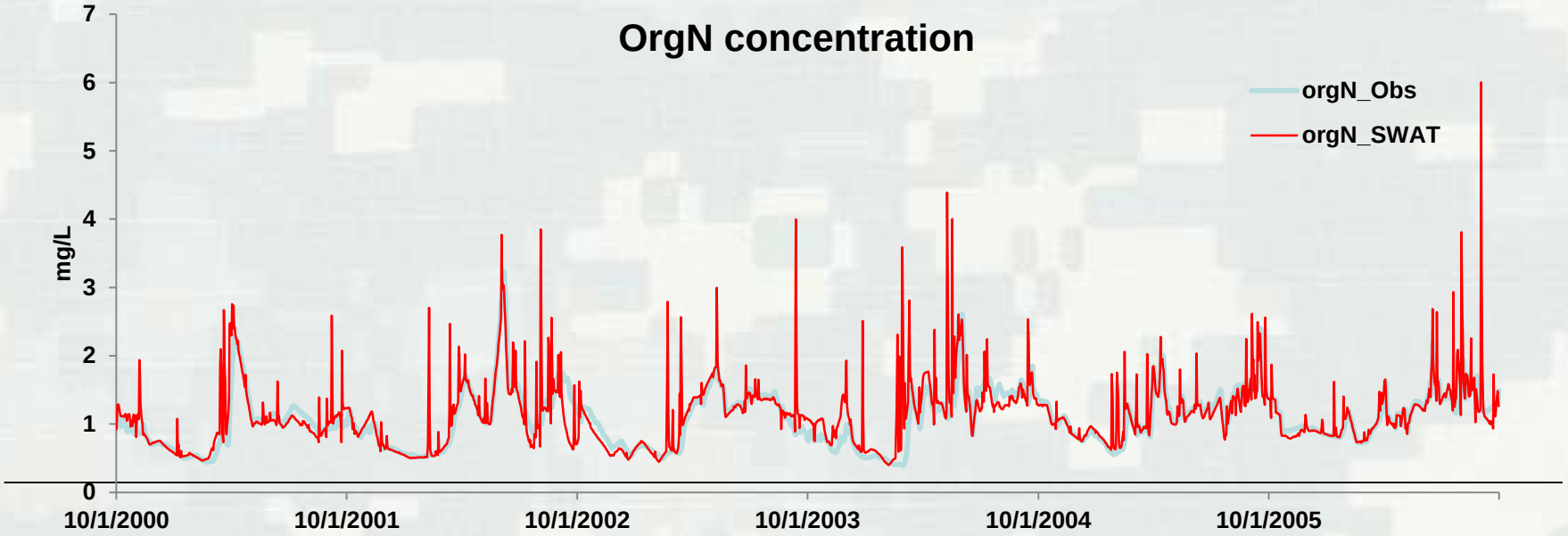
Modeled and Observed FLow



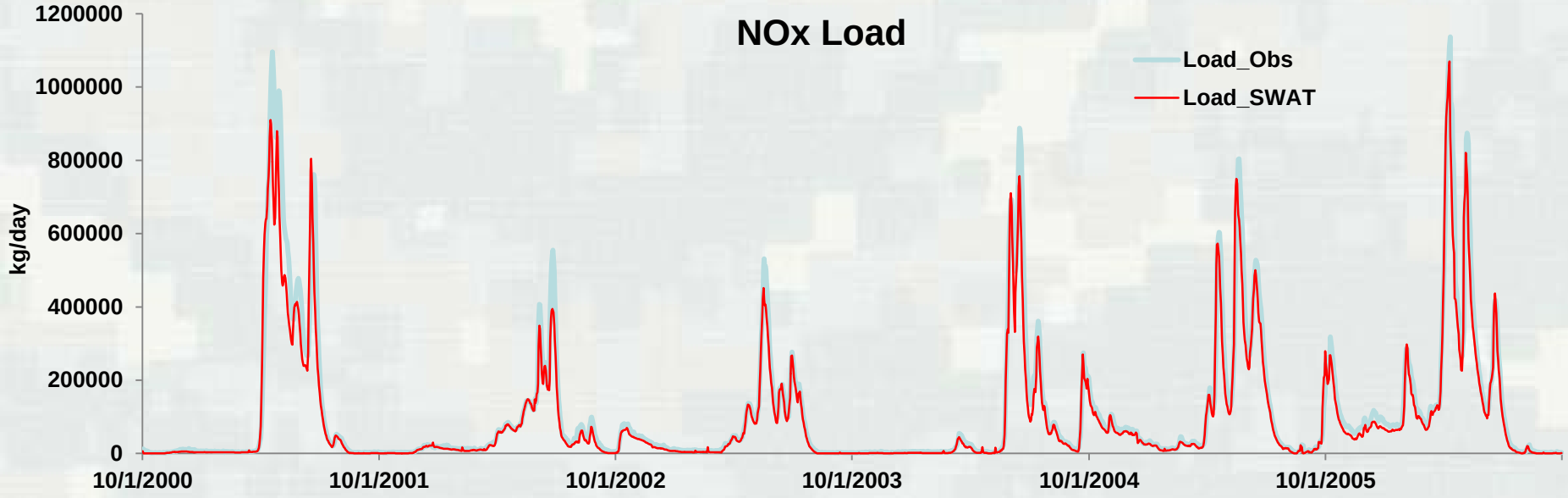


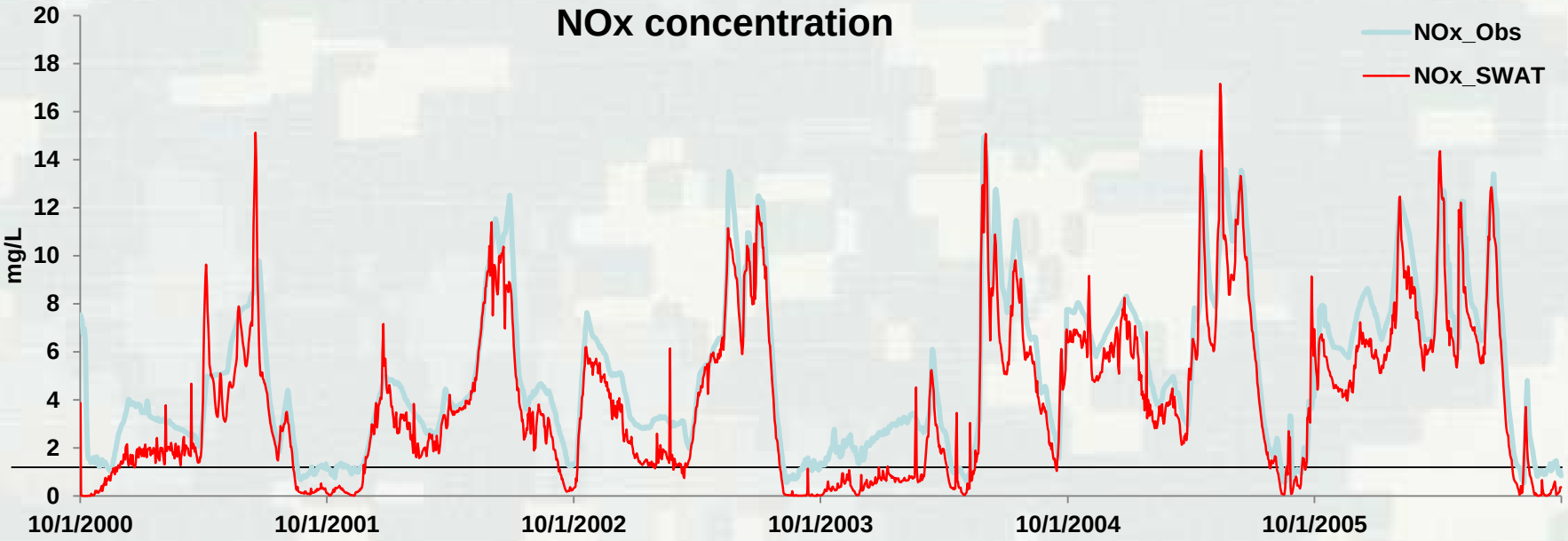
Modeled and Observed orgN



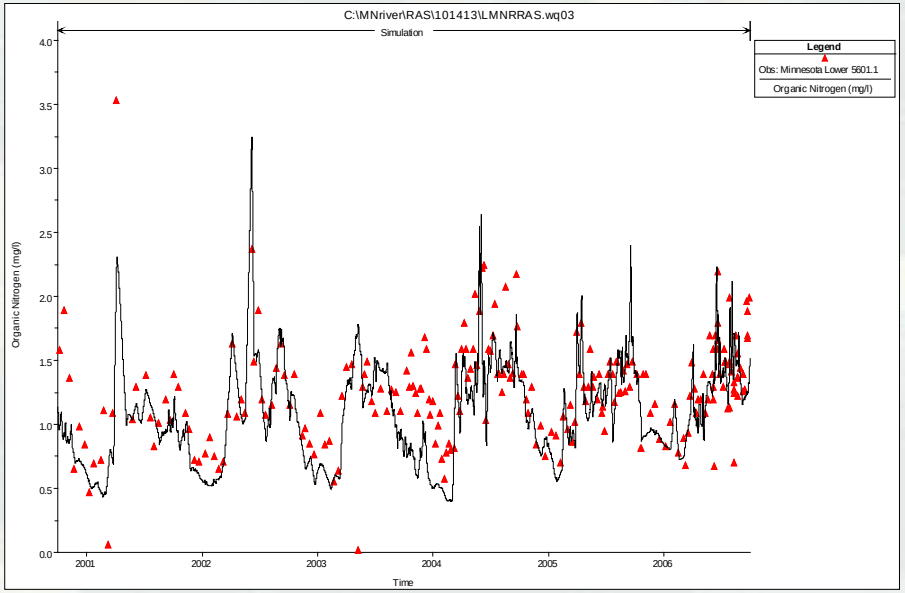


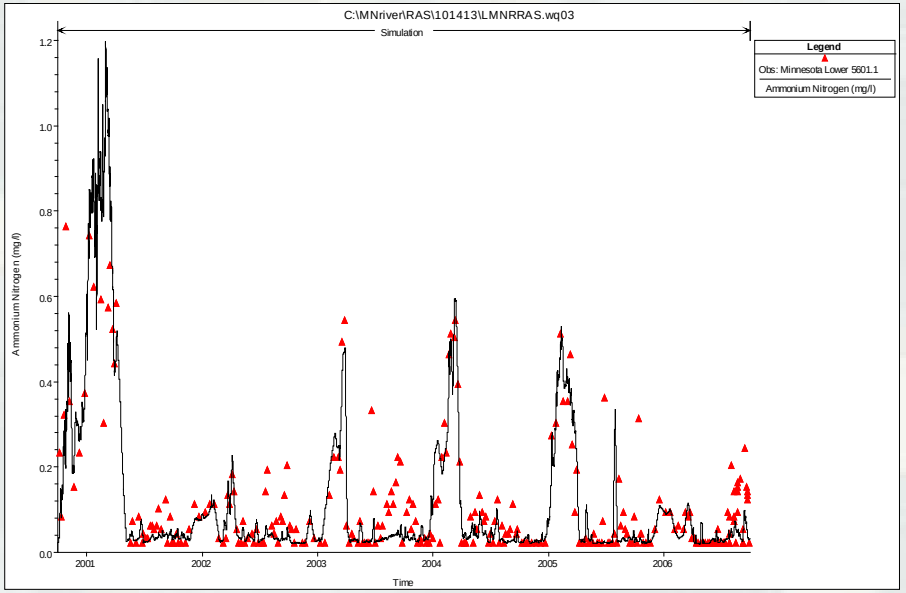
Modeled and Observed NO_3+NO_2

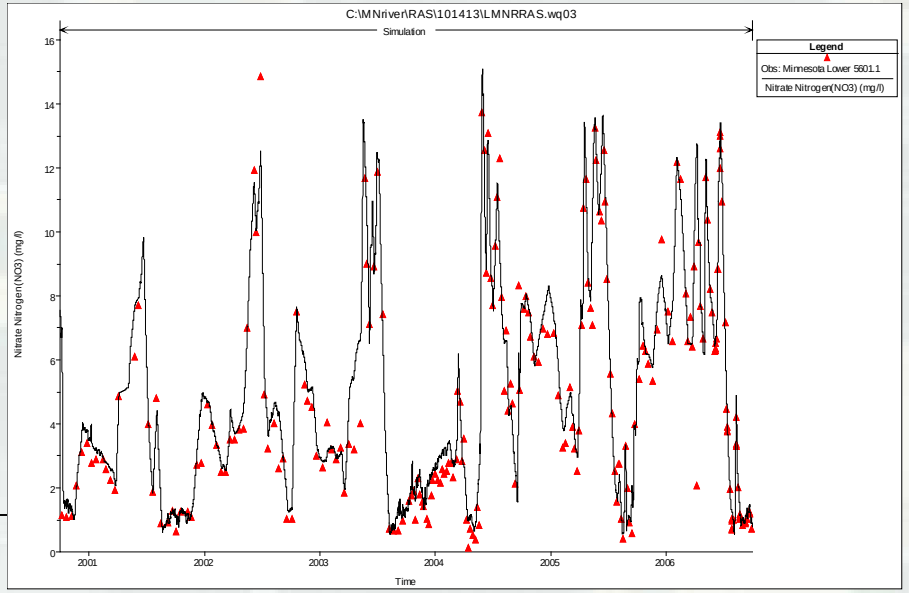




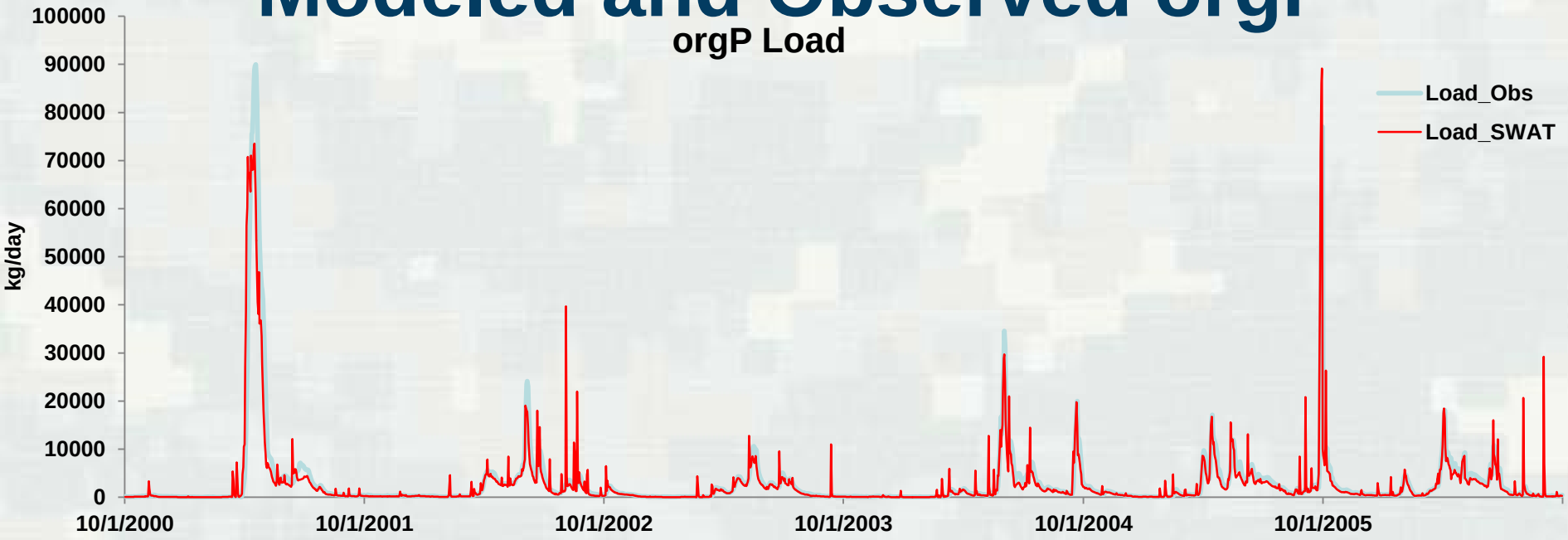
HEC-RAS Modeled and Observed Data

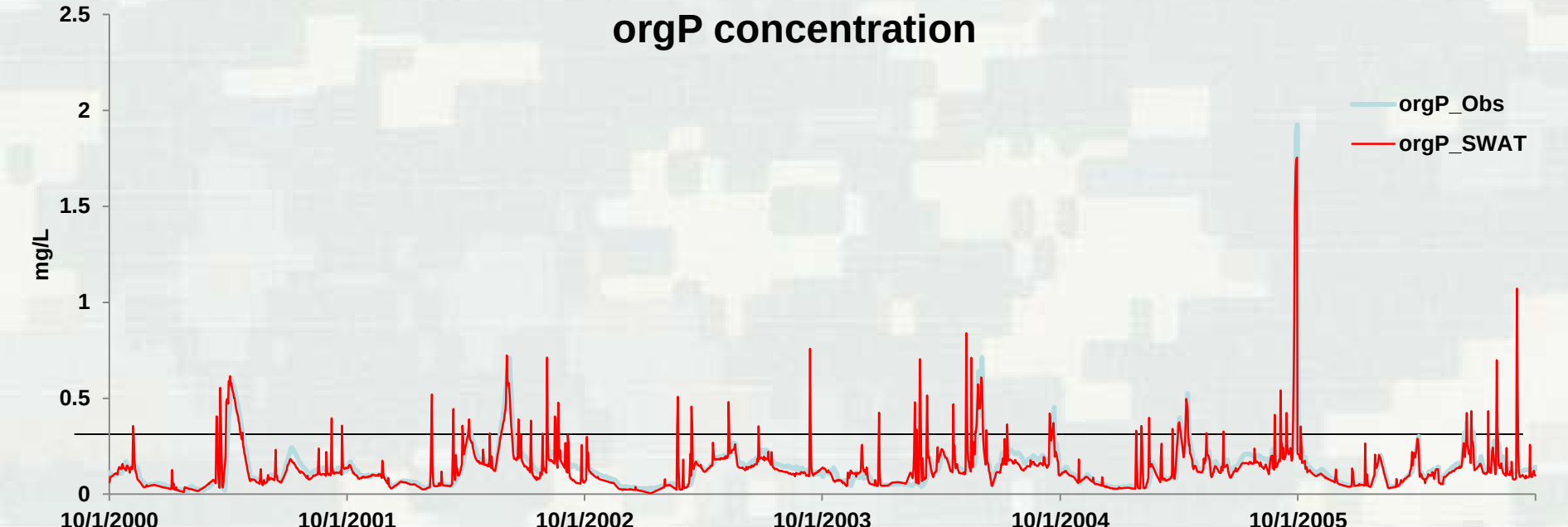




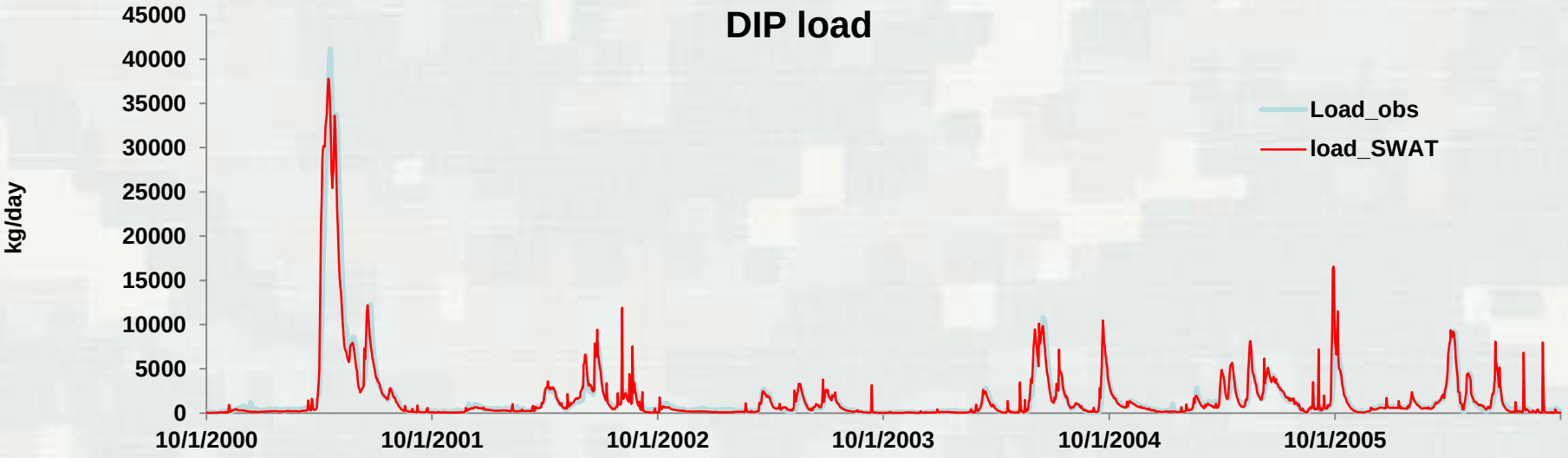


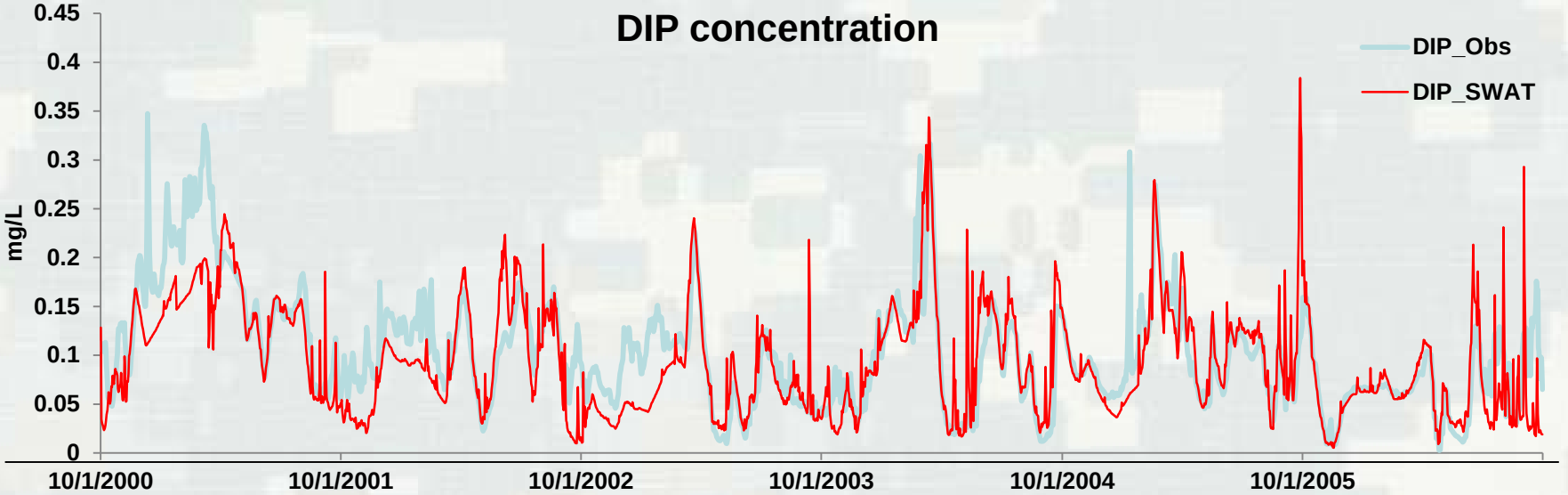
Modeled and Observed orgP



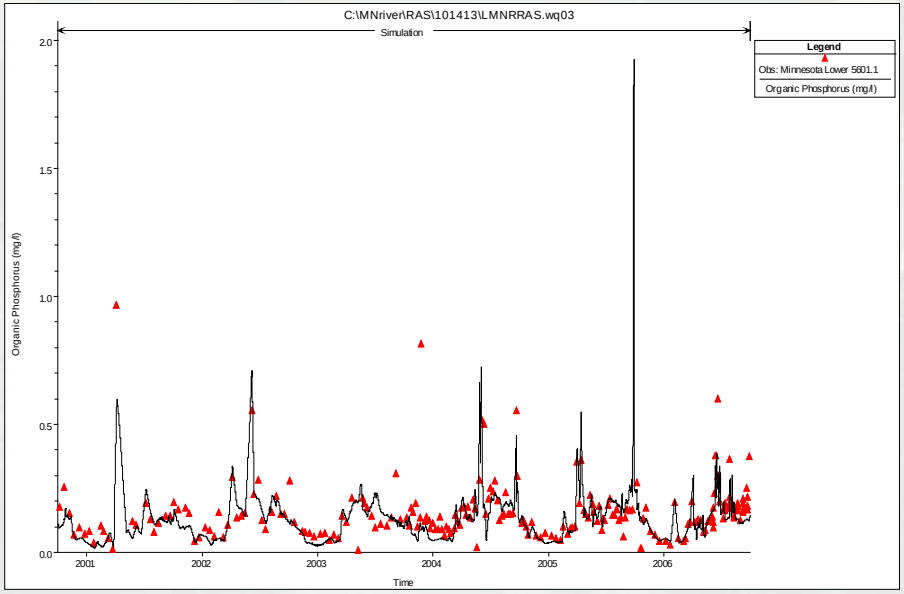


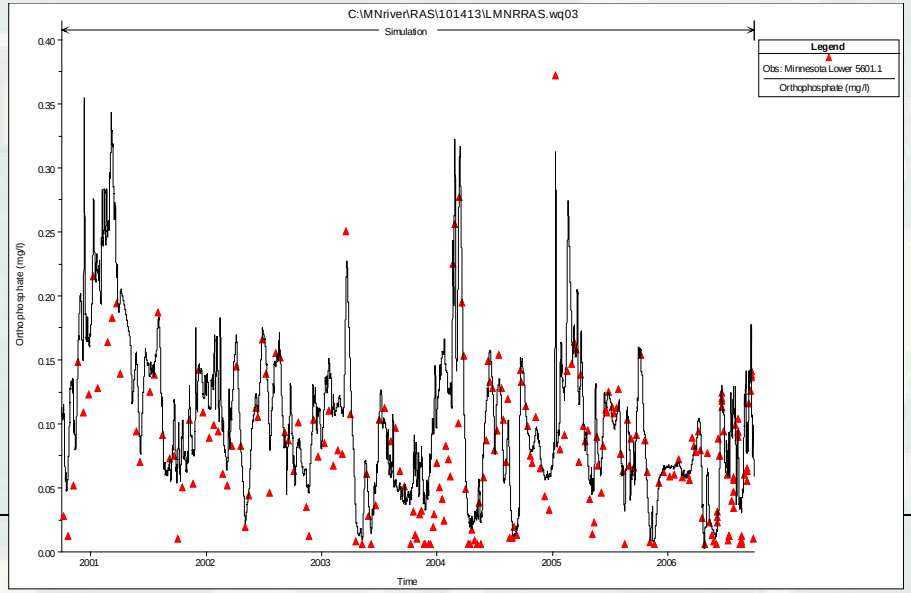
Modeled and Observed DIP



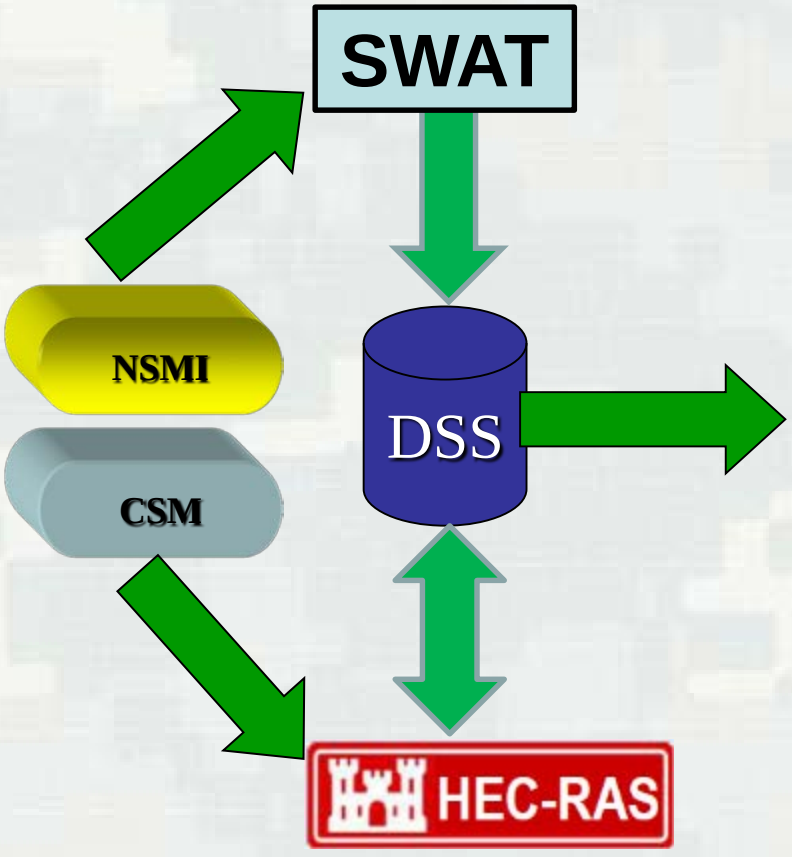


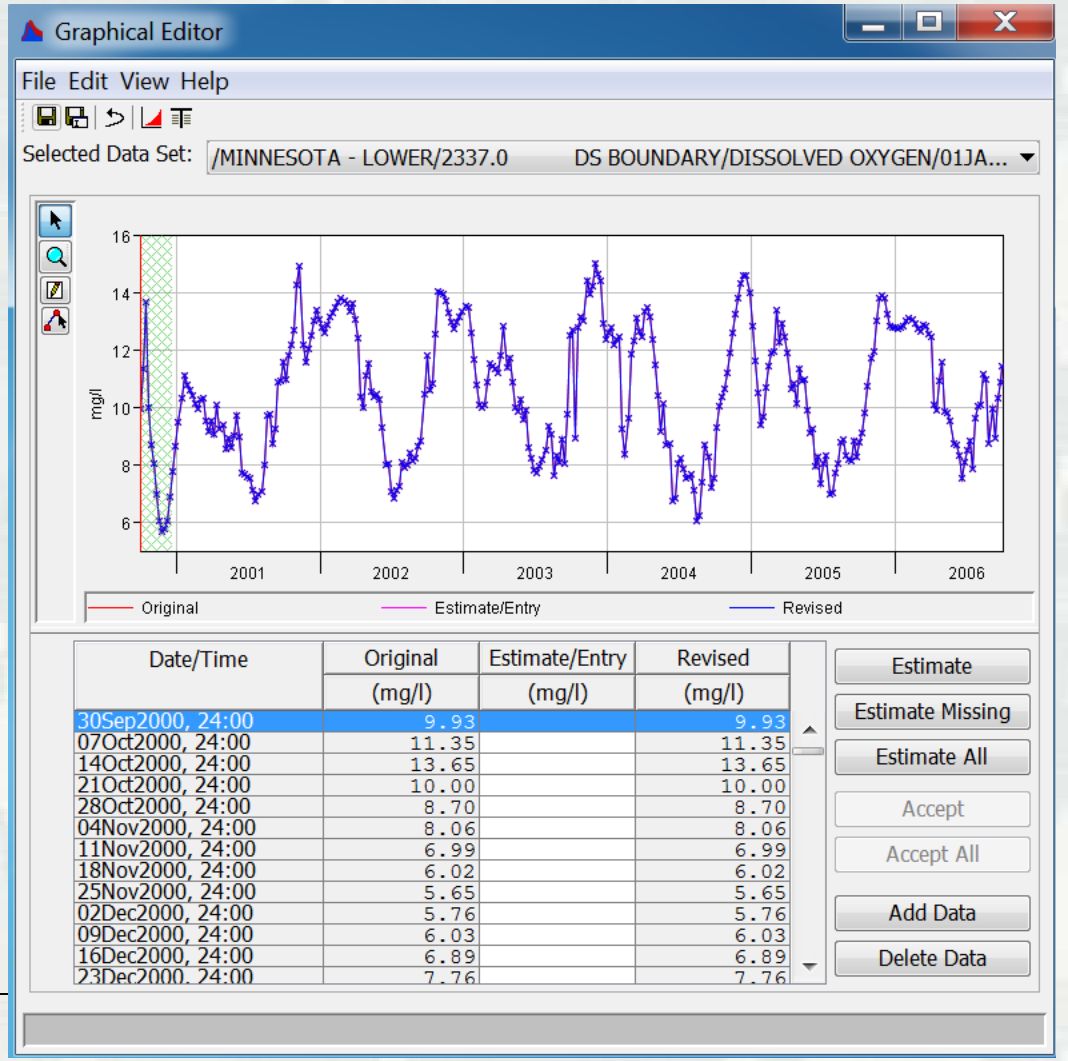
HEC-RAS Modeled and Observed Data





Integrated Watershed and Riverine Modeling Systems





Summary

- Water quality modules (NSM and CSM) have been integrated into SWAT
  - Further testing and verification
  - Refining model linkage
- Weakness of the SWAT in-stream and water body processes
  - Simplified hydrological routing
  - Simplified water quality processes
- Linked SWAT and riverine (HEC-RAS) modeling system in support of environmental and ecosystem studies

Questions/Comments?

Thank You

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