

*The Interagency Collaborative for Environmental Modeling and
Monitoring (ICEMM)*

2018 Annual Meeting

April 24, 2018

Working Group 4 - Surface
Water and Watershed Water
Quality Modeling



Technical Focus of Workgroup

The focus of this workgroup is to collaborate on the development of surface water and watershed water quality models to simulate nutrient, associated material (nitrogen, phosphorus, carbon, sediment, organic matter, pesticides, and fecal coliform bacterial), contaminant transport, uptake, loss, transformation, and recycling, and vegetation dynamics and uptake.

The models are being formulated so they can be extended beyond the range of calibration, making them useful for analysis of future scenarios such as restoration efforts and implementation of BMPs. Also, the models will be available to and usable by a broad audience.

Workgroup Members

AGENCY	MODELERS	Contact Information
U.S. Army Engineer Research and Development Center (ERDC) Institute for Water Resources - Hydrologic Engineering Center (IWR-HEC)	Billy Johnson – Vicksburg, MS/Davis, CA Todd Steissberg – Davis, CA	billy.e.johnson@usace.army.mil todd.e.steissberg@usace.army.mil
Environmental Protection Agency (EPA)	Yongping Yuan – RTP, NC	Yuan.Yongping@epa.gov
U.S. Nuclear Regulatory Commission (NRC)	Mark Fuhrmann – Rockville, MD Meredith Carr – Rockville, MD	Mark.Fuhrmann@nrc.gov Meredith.Carr@nrc.gov
U.S. Geological Survey (USGS)	Rick Webb – Denver, CO Allen Gellis – Denver, CO	rmwebb@usgs.gov agellis@usgs.gov
U.S. Bureau of Reclamation (USBR)	Blair Greimann – Denver, CO	bgreimann@usbr.gov
Department of Agriculture/Agriculture Research Service (ARS)/Texas A&M University	Ron Bingner – Oxford, MS Jeff Arnold – Temple, TX Jaehak Jeong – Temple, TX	Ron.Bingner@ARS.USDA.GOV jeff.arnold@ars.usda.gov jjeong@brc.tamus.edu
National Science Foundation (NSF)	Not Filled	
Department of Energy (DOE)	David Lesmes – Washington DC Joshua Linard – Grand Junction, CO	david.lesmes@science.doe.gov joshua.linard@lm.doe.gov

Working Group 4 Webinar Series

Overview of Agricultural Non-Point Source Pollution Model (AGNPS)	Ron Bingner	USDA - Agricultural Research Service
Water, Energy, and Biogeochemical Model (WEBMOD)	Rick Webb	USGS - U.S. Geological Survey

More Topics being discussed for future webinars

Nutrient Simulation Module (NSM)

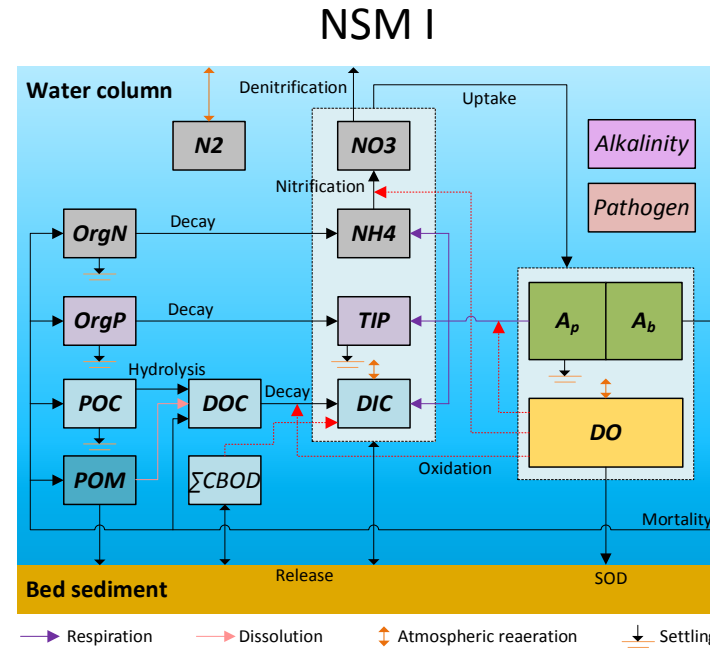
NSM includes two kinetics: NSMI, NSMII. The levels of NSM are determined by the number of interacting state variables involved in water quality simulation and the degree of their interactions.

NSMI simulates nutrients and eutrophication processes using 16 state variables. Water quality state variables may be individually activated or deactivated.

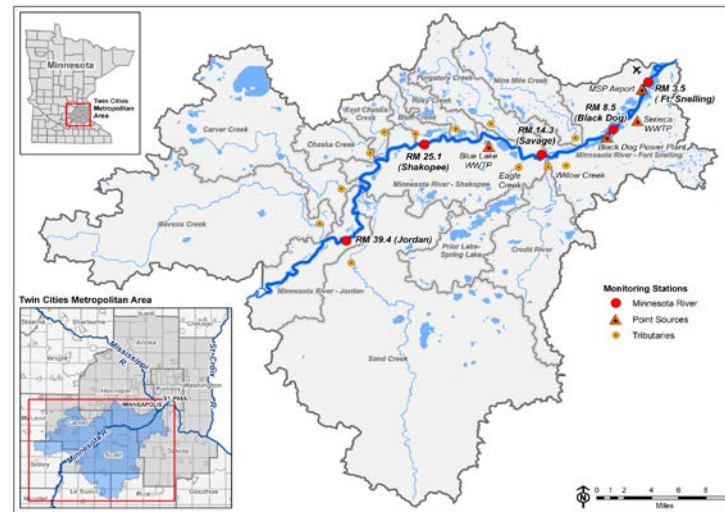
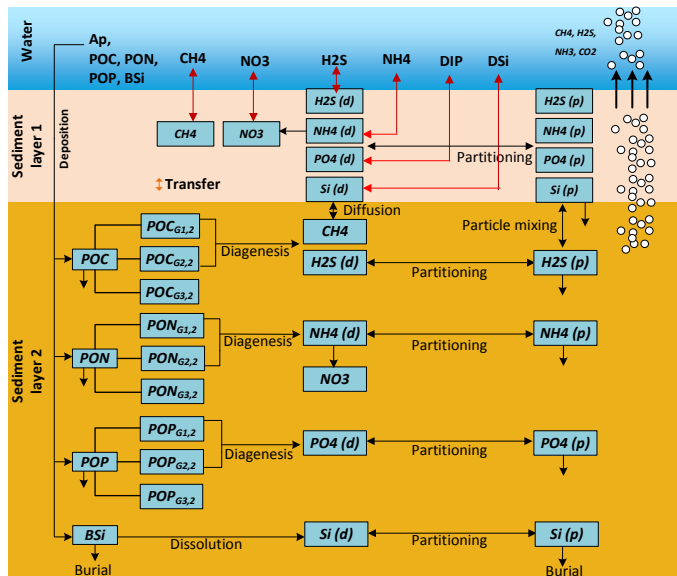
Using 24 state variables, NSMII simulates nutrients and eutrophication processes in the water column. Sediment oxygen demand and nutrient release can be simulated using zero-order approach or a sediment diagenesis module.

[NSM Technical Report](#)

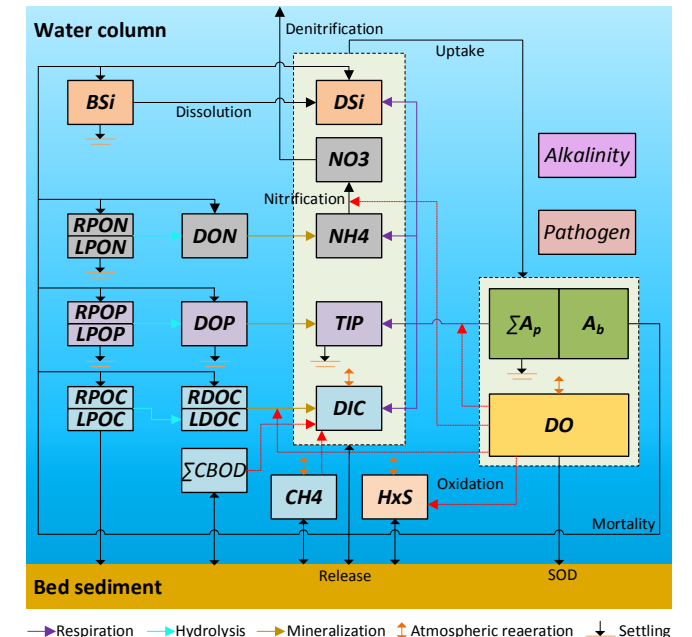
[NSM Testing Report](#)



Sediment Diagenesis

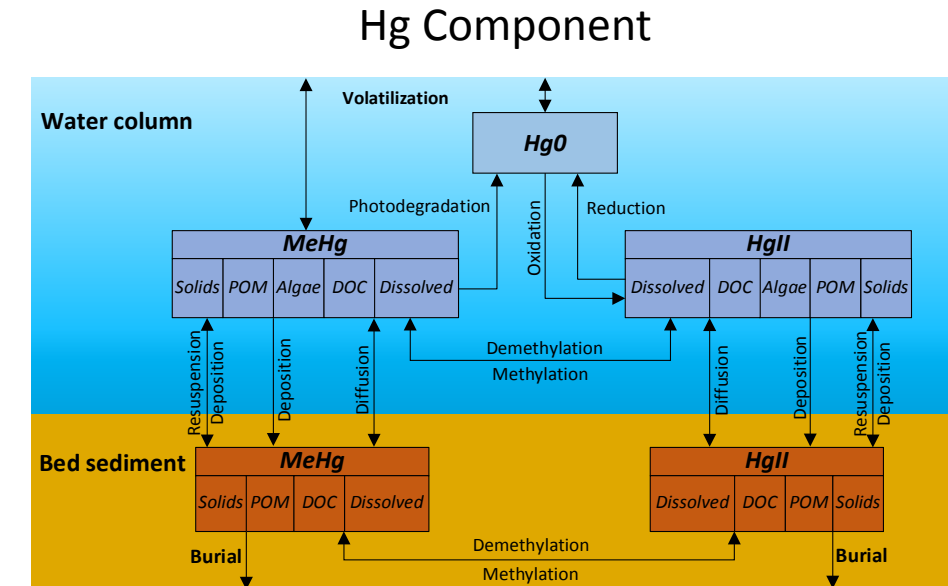
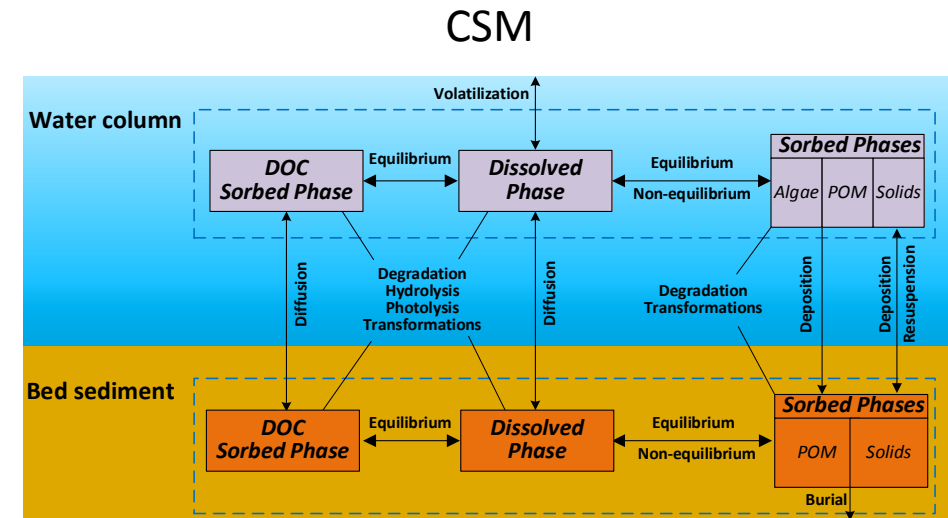


NSM II



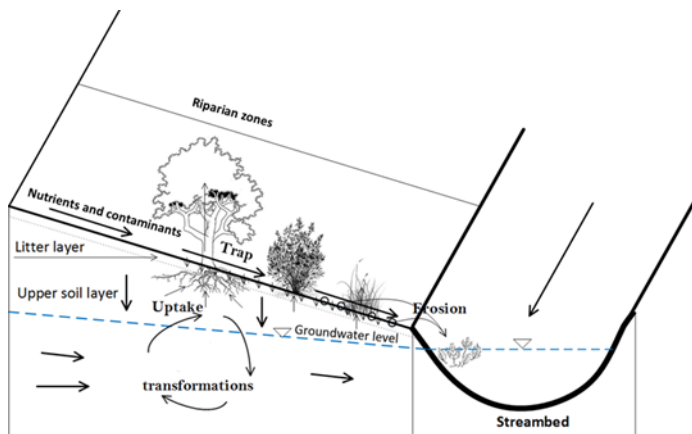
Contaminant Simulation Module (CSM)

CSM is capable of modeling contaminants in an aquatic system as influenced by the following processes; ionization, multi-phase partitioning, degradation, photolysis, hydrolysis, volatilization, generalized second-order reaction, and transformations where one chemical undergoes a reaction and is transformed to a daughter product. Any process in CSM can be ignored by use of switches where such processes are not applicable. Each contaminant in the water column is subject to adsorption and desorption with dissolved organic carbon (DOC) and solids. The dissolved phase in the bulk water (aqueous phase), the adsorbed phase to DOC in the bulk water, and the adsorbed phases to organic and inorganic solids are simulated in CSM. Two types of contaminant partitioning options are included for algae and solid particulates; equilibrium and non-equilibrium in which adsorption/desorption can be affected by rate limiting processes. The water column exchange with underlying sediments and exchange with the atmosphere are also simulated in CSM. The CSM can model multiple contaminants in one simulation. The contaminants themselves are arbitrary, in that the specific contaminant to be simulated is defined through the specification of processes and kinetic rates.

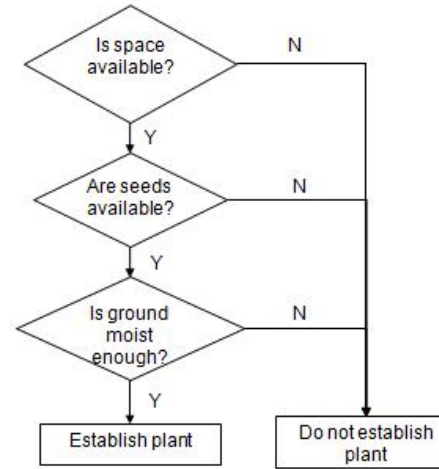


Riparian Vegetation Simulation Module (RVSM)

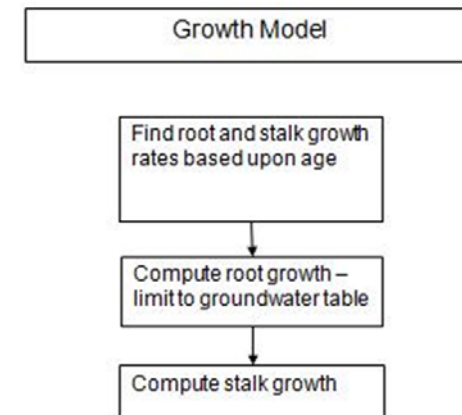
RVSM can track the establishment, growth, and mortality of vegetation on several hundred cross sections with several hundred points per cross section, and multiple vegetation types at each point. After establishment of the plant, the growth of roots, stems, and canopies are simulated, and the rules for plant survival through competition between plant types can also be defined. Modes of plant mortality can include desiccation, inundation (drowning), scour, competition, and shading.



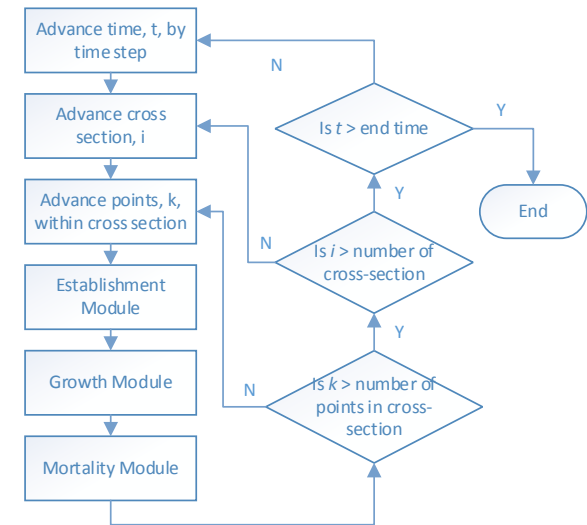
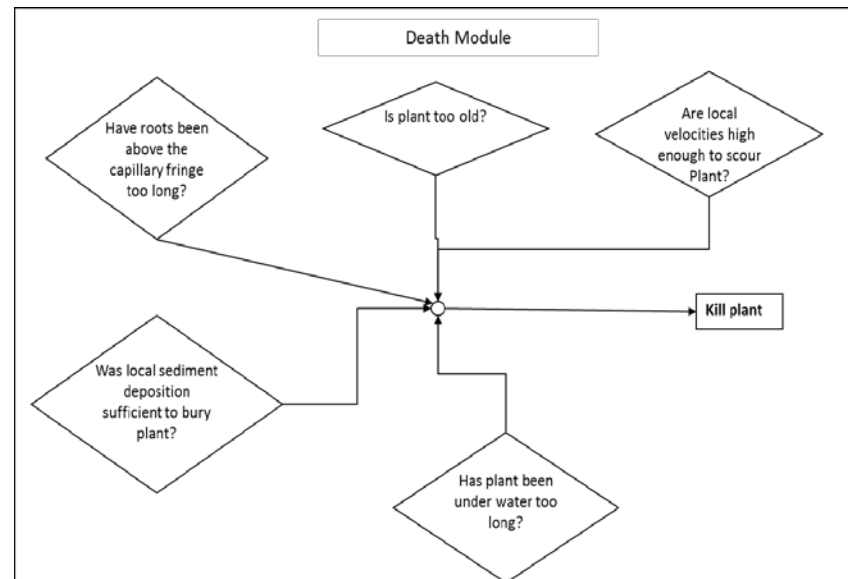
Recruitment Module



Growth Model

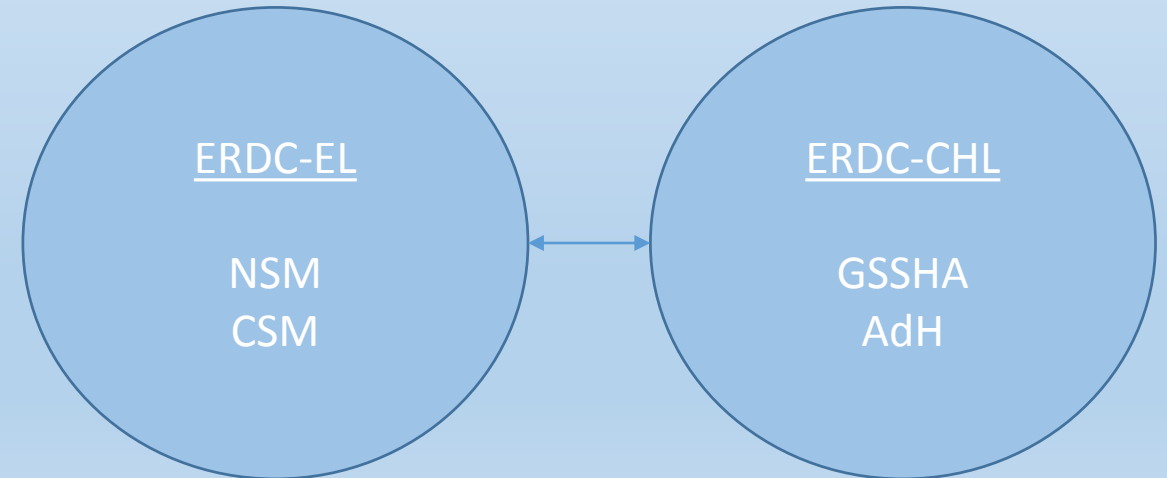
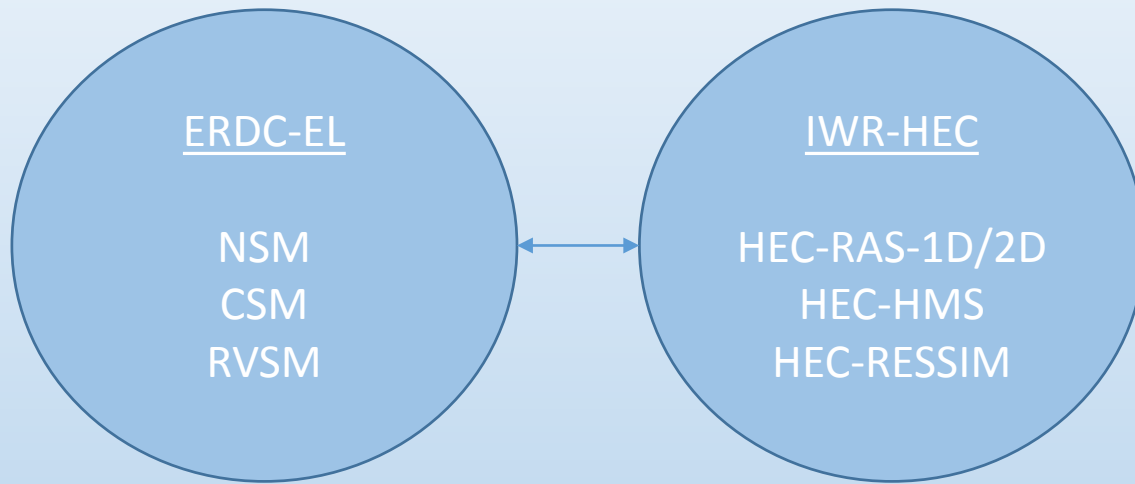


Death Module



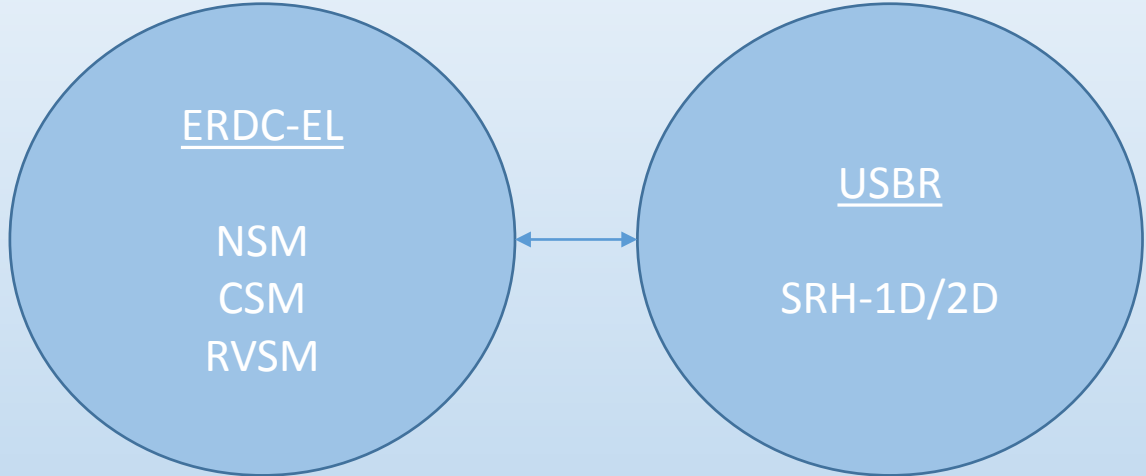
Joint Collaboration – Within USACE

HEC-RAS – River Analysis System
HEC-HMS – Hydrologic Modeling System
RESSIM – Reservoir Simulation System
GSSHA – Gridded Surface Subsurface Hydrologic Analysis System
AdH – Adaptive Hydraulic System

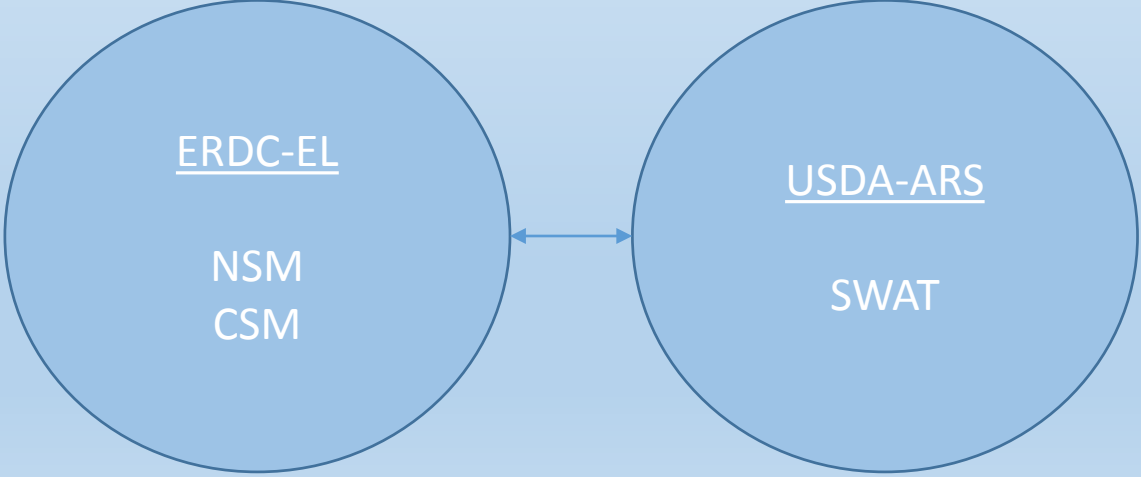


NSM – Nutrient Simulation Module
CSM – Contaminant Simulation Module
RVSM – Riparian Vegetation Simulation Module

Joint Collaboration – USACE and Other Agencies



SRH – Sediment and River Hydraulics Model
SWAT – Soil and Water Assessment Tool



NSM – Nutrient Simulation Module
CSM – Contaminant Simulation Module
RVSM – Riparian Vegetation Simulation Module

Group 4 – Successes

- Information Exchange – Webinar series has been successful in imparting knowledge to other group members.
- Some limited collaboration – ERDC-EL has been successful in engaging some working group partners on joint collaboration. Motivated by ERDC R&D needs.

Group 4 – Challenges

- How do we move past just information exchange and more collaboration among other working group members?
- Is there a way to incentivize agencies to share and work closer together on model development?