Development of a Unified Hydrologic Foundation For The South Atlantic Landscape Conservation Cooperative (SALCC)

Prepared by: Bob Dykes and Michele Cutrofello
919-541-6000

Watershed Flow and Allocation Model (WaterFALL™)
A Highly Scalable, Distributed Hydrologic Model Running on NHDPlus

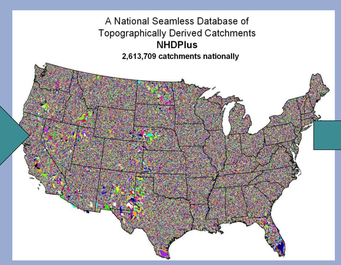
*The South Atlantic Landscape Conservation Cooperative has selected RTI"s new **Water**shed **F**low and **All**ocation model (WaterFALL) for simulating baseline, altered, and future streamflow regimes across the entire SALCC geography. The project will be led by the Nature Conservancy. The flow simulations generated in the project will be used to support a variety of hydrologic and aquatic studies.*

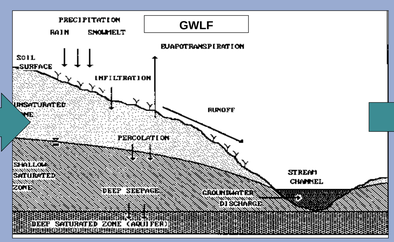
Changes in climate or landscape can affect surface water flows in multiple ways, many of which are a function small-scale geographic and ecological conditions. WaterFALL can be used to evaluate how small-scale changes can impact watershed functions. The system employs a well-established hydrologic model, GWLF, that has been modified to run on EPA's NHDPlus hydrologic network. RTI has indexed additional data layers onto each individual NHDPlus catchment to provide all of the input data needed to parameterize and run the GWLF model within a catchment. Routing routines are embedded to allow the cumulative impacts across any number of catchments in a user-specified watershed to be quantified. Advantages of this architecture include:

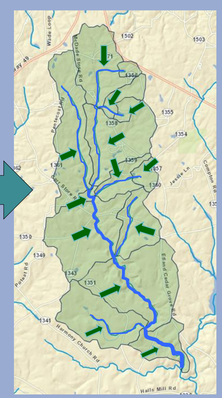
- ***Scalability***. The model can be run on a single catchment or any user-defined group of catchments to include entire watersheds.
- ***Portability***. The model can be run anywhere on the NHDPlus network (i.e. the contiguous U.S.) without any model set up, calibration, or additional data inputs.
- ***Granularity***. The model is distributed across many very small NHDPlus catchments providing heightened sensitivity to geographic variations in land cover and climate variables across a selected study region.
- ***Usability***. The model employs simple graphical interfaces for spatial navigation and a variety of other tools to facilitate "what if?" analyses in real time.

GWLF Input Data are Pre-Indexed to Each NHDPlus Catchment:

- Precipitation
- Temperature
- Land cover
- Soils
- Topography
- Hydrologic parameters
- Other





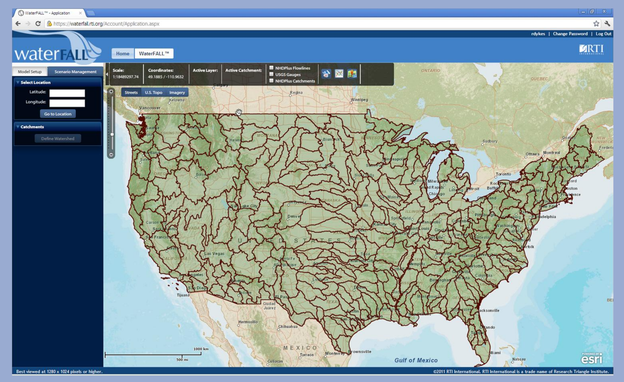


An enhanced version of the GWLF model is parameterized by accessing data layers georeferenced to each NHDPlus catchment. This feature greatly reduces model set-up time and provides a high degree of portability.

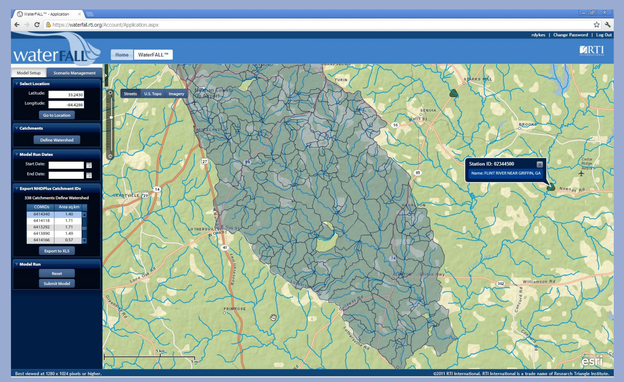
National data sets incorporated into the modeling framework include:

- NHDPlus catchment characteristics (1:100,000 scale)
- SSURGO soils data (USDA NRCS)
- 2001 and 2006 NLCD land use data (MRLC)
- NCDC archive and PRISM-derived daily 4-kilometer gridded precipitation and temperature data (USDA)
- Mean annual average erosivity values (USDA NRCS WCC)
- First and last freeze dates for growing season (NOAA)
- Grid-based hydrologic parameters (e.g., recession coefficients) (NWS)

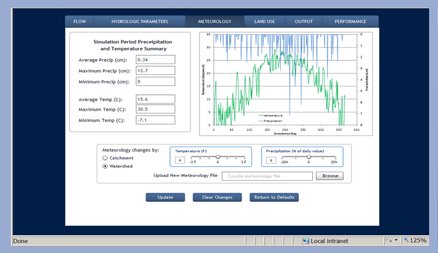
WaterFALL Features and Capabilities



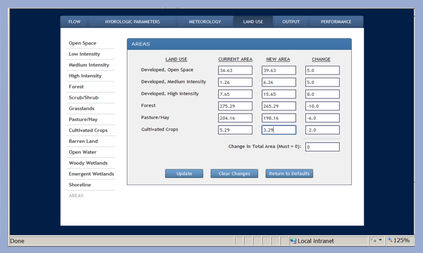
WaterFALL includes sophisticated watershed mapping and navigation tools.



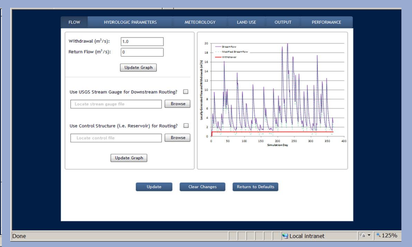
WaterFALL delineation of the White Oak Creek Watershed, an ungauged tributary of the Flint River in Georgia..



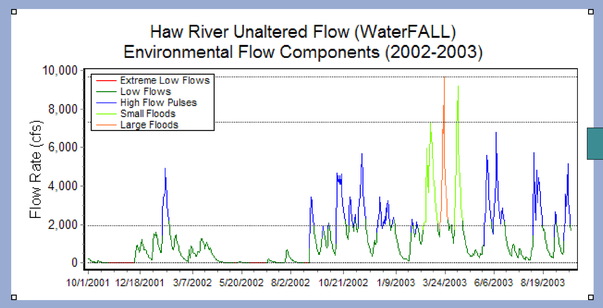
Climate Alteration: Alternative climate data sets can be run, including down-scaled climate change model projections. Sensitivity to variations in precipitation amounts or ambient temperatures can be screened by dragging slider bars.

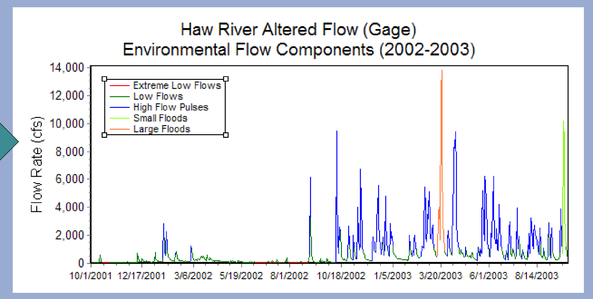


Land Use Alteration: The hydrologic impacts of changes in land use or predominant land cover can be quantified at either a catchment or watershed scale.



Flow Alteration Flow alterations resulting from human withdrawals and returns can be simulated, and modified to identify the downstream impacts of upstream changes in water use rates or patterns.





Example analysis of degree of flow alteration along the Haw River in North Carolina using TNC's Index of Hydrologic Alteration Software. This time-series based software, in addition to other similar packages, can be used to directly interpret WaterFALL output for additional stream classification and alteration activities.