

**Texas A & M University and U.S. Bureau of Reclamation
Hydrologic Modeling Inventory
Model Description Form**

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Name of Model: Watershed Bounded Network Model WBNM

Model Type: Event-based, rainfall-runoff simulation model. WBNM models natural & urban catchments and contains reservoir routing, surcharging flow diversions, onsite detention storage, culvert hydraulics and scouring embankments.

Model Objective(s): Flood studies on natural and urban catchments, design of flood mitigation works

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Model Structure or Mathematical Basis: Small to large natural catchments (< 1 km² to > 10 000 km²); small to large urban catchments and small developed urban sites (< 1 ha to > 5 000 ha).

Event-based simulation. Deterministic, lumped elements for each subarea, distributed according to stream channel network.

Models rainfall, losses, overland flow, channel flow, storage reservoirs.

Uses nonlinear reservoir routing and Muskingum channel routing.

Precipitation uses Thiessen weights or automatic inverse square weighting depending on distance to rain gauges.

Rainfall losses are initial loss, continuing loss rate, runoff proportion, Horton infiltration.

Culvert hydraulics use US Dept. Transportation method (inlet & outlet control).

Flood routing through dams & flood detention basins uses level pool routing.

Diversion of surcharging flows within the catchment, calculates separate hydrographs for all flow diversions.

Models scouring of overtopped embankments.

Model Parameters: Lag time relations are built into model depending on subarea size. Only one overall lag scaling parameter is required to be calibrated. Channel lag factor is available for modifications to channels, and impervious lag factor is available for impervious surface runoff.

Spatial Scale Employed in the Model: Divides catchment into subareas, depending on stream channel network.

Please see the HMI web page: <http://www.usbr.gov/hmi>

Forms are available in Text file, HTML, MS Word and WordPerfect formats

This effort is being conducted by River Systems & Meteorology Group: <http://www.usbr.gov/rsmg>

Temporal Scale Employed in the Model: Event based, time period from 1 minute to several hours.

Input Data Requirements: Watershed characteristics – topographic map, drainage areas. Climate data – rainfall hyetograph. Streamflow data – recorded hydrograph. Land use – impervious % in urban areas.

Computer Requirements: PC, WIN 95X, 20 MB memory, 64 MB RAM.

Model Output: QA record of input data, calculated hydrographs & summary tables. Output files of culvert hydraulics (inlet & outlet control), time history of scouring embankments. Self checking and volume balances.

Parameter Estimation / Model Calibration: Manual calibration of lag scaling parameter on recorded hydrographs.

Model Testing and Verification: Calibrated on more than 80 natural catchments ranging from 0.1 km² to 10 000 km². Calibrated on 15 urban catchments ranging from 0.1 to 30 km². Calibration results given in documentation.

Model Sensitivity: Peak discharge varies approx. inversely to model lag parameter value.

Model Reliability: Good reproduction of recorded hydrographs has been achieved. Examples of calibrations given in documentation.

Model Application / Case Studies: Has been applied to flood studies by consulting engineering and government organisations, mainly in Australia. The model should apply equally to other regions after calibration using recorded flood data.

Documentation: Software contains 9 pdf documents describing the theory, use and calibration of model, plus 17 sample data runfiles covering a range of applications.

Other Comments: WBNM is a robust model for flood studies on natural & urban catchments. It covers a wide range of catchment sizes, from large natural to small urban, and even models very small developed urban lots. WBNM has built-in culvert hydraulics, surcharging flow diversions, and scouring embankments. WBNM writes detailed results to output files, and contains extensive checking of results. With built-in lag relations, a minimum of data requirements, and just 1 parameter to evaluate, WBNM is a simple but effective and flexible tool for flood studies. WBNM is available for free download from the URL above.