HEC-RAS 3.1.1

Model Uses   HEC-RAS allows you to perform one-dimensional steady and unsteady flow calculations.

Major Categories   Hydrology and Water Use   <u>Subject Knowledge Level</u>
                                                                                     Intermediate

Minor Categories   Flood; Flow; Run-off; Temperature   <u>Technical Difficulty Level</u>
                                                                                     Advanced

Model Type   Other   <u>Geographic in Nature?</u>
                                                                                     Semi

Abstract
HEC-RAS is an integrated system of software, designed for interactive use in a multi-tasking, multi-user network environment. The system is comprised of a graphical user interface (GUI), separate hydraulic analysis components, data storage and management capabilities, graphics and reporting facilities.

The HEC-RAS system will ultimately contain three one-dimensional hydraulic analysis components for: (1) steady flow water surface profile computations; (2) unsteady flow simulation; and (3) movable boundary sediment transport computations. Currently steady and unsteady flow are available and sediment transport is under development. A key element is that all three components will use a common geometric data representation and common geometric and hydraulic computation routines. In addition to the three hydraulic analysis components, the system contains several hydraulic design features that can be invoked once the basic water surface profiles are computed, including bridge scour computations, uniform flow computations, stable channel design, and sediment transport capacity.

The current version of HEC-RAS supports steady and unsteady flow water surface profile calculations. New features and additional capabilities will be added in future releases.

Future Developments
Sediment Transport computations and Water Quality analysis will be added in future versions.

Model Limitations
HEC-RAS is a 1-Dimensional modeling program; Requires river bathymetry data; Requires in-depth knowledge of hydrology to manipulate and calibrate the model.

Model Features
User Interface:
The user interacts with HEC-RAS through a graphical user interface (GUI). The main focus in the design of the interface was to make it easy to use the software, while still maintaining a high level of efficiency for the user. The interface provides for the following functions: File management, Data Entry and Editing, Hydraulic Analyses, Tabulation and Graphical Displays of Input and Output Data, Reporting Facilities, On-line help.

Hydraulic Analysis Components:
Currently the steady and unsteady flow components of HEC-RAS are fully implemented for use. The sediment transport component is under development at this time.

Steady Flow Water Surface Profiles:
This component of the modeling system is intended for calculating water surface profiles for steady gradually varied flow. The system can handle a full network of channels, a dendritic system, or a single river reach. The steady flow component is capable of modeling subcritical, supercritical, and mixed flow regimes water surface profiles.

The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation is utilized in situations where the water surface profile is rapidly varied. These situations include mixed flow regime calculations (i.e. hydraulic jumps), hydraulics of bridges, and evaluating profiles at river confluences (stream junctions).
The effects of various obstructions such as bridges, culverts, weirs, and structures in the flood plain may be considered in the computations. The steady flow system is designed for application in flood plain management and flood

insurance studies to evaluate floodway encroachments. Also, capabilities are available for assessing the change in water surface profiles due to channel improvements, and levees.

Special features of the steady flow component include: multiple plan analyses; multiple profile computations; multiple bridge and/or culvert opening analyses; and split flow optimization.

Unsteady Flow Simulation:
This component of the HEC-RAS modeling system is capable of simulating one-dimensional unsteady flow through a full network of open channels. The unsteady flow equation wolver was adapted from Dr., Robert L. Barkau's UNET model (Barkau, 1992 and HEC, 1997). The unsteady flow component was developed primarily for subcritical flow regime calculations.

The hydraulic calculations for cross-sections, bridges, culverts, and other hydraulic structures that were developed for the steady flow component were incorporated into the unsteady flow module.

Data Storage and Management:
Data Storage is accomplished through the use of "flat" files (ASCII and binary), as well as the HEC-DSS. User input data are stored in flow files under separate categories of project, plan, geometry, steady flow, unsteady flow, and sediment data. Output data is predominantly stored in separate binary files. Data can be transferred between HEC-RAS and other programs by utilizing the HEC-DSS.

Data management is accomplished through the user interface. The modeler is requested to enter a single filename for the project being developed. Once the project filename is entered, all other files are automatically created and named by the interface as needed. The interface provides for renaming, mobbing, and deletion of files on a project-by-project basis.

Graphics and Reporting:
Graphics include X-Y plots of the river system schematic, cross-sections, profiles, rating curves, hydrographs, and many other hydraulic variables. A three-dimensional plot of multiple cross-sections is also provided. Tabular output is available. Users can select from pre-defined tables or develop their own customized tables. All graphical and tabular output can be displayed on the screen, sent directly to a printer (or plotter), or passed through the Windows Clipboard to other software, such as a word-processor or spreadsheet. Reporting facilities allow for printed output of input data as well as output data. Reports can be customized as to the amount and type of information desired.

Required Data Types	**Model Outputs**
Inlcudes Geometry Files; Steady Flow Data Files; Unsteady Flow Data Files; Semdiment Data Files; Hydraulic Design Data Files.	The output files are in a binary file format and can only be read from the user interface.

Source
US Army Corps of Engineers

Source (URL)
http://www.hec.usace.army.mil/software/hec-ras/hecras-hecras.html

Hardware Requirements
Intel P3; At least 40mb free disk space (100+ reccomended); CD-ROM Drive; Minimum 32mb RAM (Windows 95, 98, ME) or 64mb RAM (Windows NT, 2000, XP) - 128mb+ Reccomended; A mouse; Color Video Display (Recommend running in Super VGA 1024 x 768).

Supported Platforms

DOS	☐	**UNIX**	☐
Windows	☒	**Macintosh**	☐

Software Requirements
Windows OS

Cost, Licensing and Availability
Free.

HEC will not provide user assistance or support for this software to non-Corps users.