1 FOREWORD

Foreword

The U.S. Army Corps of Engineers' River Analysis System (HEC-RAS) is software that allows you to perform one-dimensional steady flow hydraulics; one and two-dimensional unsteady flow river hydraulics calculations; quasi Unsteady and full unsteady flow sediment transport-mobile bed modeling; water temperature analysis; and generalized water quality modeling (nutrient fate and transport).

The first version of HEC-RAS (version 1.0) was released in July of 1995. Since that time there have been several major releases of this software package, including versions: 1.1; 1.2; 2.0; 2.1; 2.2; 3.0, 3.1, 3.1.1, 3.1.2, 3.1.3, 4.0, 4.1, 5.0 and now version 6.0 in 2020.
The HEC-RAS software was developed at the Hydrologic Engineering Center (HEC), which is a division of the Institute for Water Resources (IWR), U.S. Army Corps of Engineers.

The software was designed by Mr. Gary W. Brunner, leader of the HEC-RAS development team. The user interface and graphics were programmed by Mr. Mark R. Jensen, Alex Kennedy, Anton Rotter-Sieren, Cameron Ackerman, and Stanford Gibson. The steady flow water surface profiles computational module and the majority of the one-dimensional unsteady flow computations modules was programmed by Mr. Steven S. Piper. The One-dimensional unsteady flow matrix solution algorithm was developed by Dr. Robert L. Barkau (Author of UNET and HEC-UNET).
The two-dimensional unsteady flow modeling capabilities were developed by Gary W. Brunner, Ben Chacon (Resource Management Consultants, RMA), Steve S. Piper, Mark R. Jensen, Alex J. Kennedy, and Alex Sanchez.

The sediment transport interface module was programmed by Mr. Stanford A. Gibson. The quasi unsteady flow computational sediment transport capabilities were developed by Stanford A. Gibson and Steven S. Piper. The Unsteady flow sediment transport modules were developed by Stanford A. Gibson, Steven S. Piper, and Ben Chacon (RMA). Special thanks to Mr. Tony Thomas (Author of HEC-6 and HEC-6T) for his assistance in developing the quasi-unsteady flow sediment transport routines used in HEC-RAS. The two-dimensional sediment transport modules were developed by Alex Sanchez and Stanford Gibson. The Debris flow capabilities in HEC-RAS (1D and 2D) were developed by Stanford Gibson and Alex Sanchez. Most of the sediment output was designed by Stanford Gibson and Alex Sanchez and programmed by Anton Rotter-Sieren.

The new 2D plotting library and plots (Breach Plot, Hydrographs, and DSS viewer) were developed by Mark R. Jensen, Anton Rotter-Sieren, and Ryan Miles (RMA).

The new 3D visualization tool was developed by Anton Rotter-Sieren and Alex Kennedy.

The water quality computational modules were designed and developed by Mr. Mark R. Jensen, Dr. Cindy Lowney and Zhonglong Zhang (ERDC-RDE-EL-MS).

The spatial data and mapping tools (RAS Mapper) were developed by Mark R. Jensen, Cameron T. Ackerman, Alex J. Kennedy, and Anton Rotter-Sieren. Special thanks to Mr. Will Breikreutz for his assistance in developing the RAS Tile server.

The interface for channel design/modifications was designed and developed by Mr. Cameron T. Ackerman and Mr. Mark R. Jensen. The stable channel design functions were programmed by Mr. Chris R. Goodell.

The routines that import HEC-2 and UNET data were developed by Ms. Joan Klipsch. The routines for modeling ice cover and wide river ice jams were developed by Mr. Steven F. Daly of the Cold Regions Research and Engineering Laboratory (CRREL).

Many other HEC staff members have made contributions in the development of this software, including Vern R. Bonner, Richard Hayes, John Peters, Al Montalvo, and Michael Gee. Mr. Matt Fleming was the Chief of the H&H Division, and Mr. Chris Dunn was the director during the development of this version of the software.

This manual was written by Mr. Gary W. Brunner. Chapter 12 was written by Cameron T. Ackerman and Gary W. Brunner. Chapter 13 was written by Mr. Chris R. Goodell.

HEC-RAS uses the following third-party libraries:

1. Hierarchical Data Format (HDF) – HEC-RAS uses the HDF5 libraries in both the User Interface and the Computational engines for writing and reading data to binary files that follow the HDF5 standards. The HDF Group: http://www.hdfgroup.org/HDF5/
2. Geospatial Data Abstraction Library (GDAL) – HEC-RAS uses the GDAL libraries in the HEC-RAS Mapper tool. These libraries are used for all Geospatial data rendering, coordinate transformations, etc. GDAL: http://www.gdal.org/
3. Bit Miracle LibTiff .Net. LibTiff.Net provides support for the Tag Image File Format (TIFF), a widely used format for storing image data. Bit Miracle: http://bitmiracle.com/libtiff/
4. Oxyplot – 2 dimensional X-Y plots in HEC-RAS Mapper. Oxyplot: http://oxyplot.org/
5. SQLite – Reading and writing database files. SQLite: https://www.sqlite.org/
6. cURL - HTTP support for GDAL http://curl.haxx.se/
7. Clipper – an open source freeware library for clipping and offsetting lines and polygons. http://www.angusj.com/delphi/clipper.php