



**US Army Corps  
of Engineers**  
Hydrologic Engineering Center

---

# **HEC-RAS**

# **River Analysis System**

## ***Release Notes***

Version 6.0  
May 2021

## Introduction

Version 6.0 of the River Analysis System (HEC-RAS) is now available. This Version supersedes Version 5.0.7, and all previous versions.

A list of the bugs fixed between versions 6.0 and 5.0.7 can be found below under the “Problems Repaired” section of this document.

## Installation

The installation program and all documentation for HEC-RAS Version 6.0 are available on the HEC website at <http://www.hec.usace.army.mil>. This new release is installed independently of any previous versions of the software. Users may have the new version and previous versions of HEC-RAS software installed simultaneously for parallel use or testing. HEC-RAS Version 6.0 is fully compatible with projects developed in any previous version of the software.

**Warning!**

Once a project has been opened in HEC-RAS Version 6.0 and saved, it may not be possible to open the project with an older version of the software and reproduce the old results. Therefore, users should make a copy of their project before opening it in 6.0.

The new installation package for HEC-RAS Version 6.0 is designed to be easy to use. Installation process includes steps of selecting a directory for the HEC-RAS Version 6.0 software files and making other settings (e.g., creating a desktop shortcut, if desired). Use the following steps to install the program on the Microsoft Windows® operating system:

1. Download the HEC-RAS Version 6.0 installation package from the HEC website to a temporary folder on the computer.
2. Run the installation program. In Windows Explorer, double-click the icon for the installation program. Note, you need administrator privileges to run the installer.
3. Follow the on-screen prompts to install the program.

**Warning!**

HEC-RAS Version 6.0 and newer will only run on 64-bit Windows operating systems, including 64-bit versions of Windows 7, 8.0, 8.1, and 10. Also, make sure your operating system is up to date with all of the Microsoft patches for that version of the operating system before trying to install HEC-RAS.

## HEC-RAS 6.0 New Features List

The following is a list of the major new features that have been added to HEC-RAS 6.0 since version 5.0.7. Many additional minor features/upgrades have also been made to the software.

1. **Spatial Precipitation and Infiltration for 2D, SA, and XS.** We have added the ability to make use of spatially and time varying precipitation and infiltration to 2D Flow Areas, Storage Areas, and between 1D cross sections. We are using three infiltration methods, two that are simple (Initial and Constant Loss method and the SCS method), and one more detailed method (Green and Ampt method).
2. **Bridge Hydraulics inside of 2D Flow Areas.** This option allows users to lay out a bridge inside of a 2D Flow Area. The bridge's hydraulic properties are processed into a family of curves, just like in 1D. This family of curves will be used to compute the forces due to the bridge based on the flow through the bridge opening, as well as flow over top of the bridge. These forces are then applied to a special version of the 2D momentum equation across the faces that make up the centerline of the bridge.
3. **HECRAS Mapper Editing Tools.** We have finished all the editing tools for structures, extracting n values for 1D cross sections, ineffective flow areas, blocked obstructions, and XS high ground option in RAS Mapper. HEC-GeoRAS is no longer needed for creating HEC-RAS models.
4. **1D Finite Volume Solver.** We have added a 1D Finite volume solver. This will be optional to turn on, as the default will still be the 1D Finite Difference solver for compatibility with previously developed models. This method allows for 1D channels to start out dry or go dry during the simulation. This new solver is a more stable solution scheme than the current 1D finite difference scheme, especially for steep streams and modeling very low flows.
5. **Wind forces to HEC-RAS 1D and 2D.** We have added wind forces to both 1D and 2D modeling in HEC-RAS. This will require either gaged wind speed and direction data, or gridded wind speed and direction data. When gaged data are entered, an interpolation algorithm is used for the speed and the direction. When gridded data are used, the program uses the cross sections and cell centers to get the speed and direction from the gridded data
6. **Computational Speed Improvements for 2D.** We have improved the computational speed by further parallelizing the 2D code. 2D models should be at least 20 to 50% faster than the previous version.
7. **DSS7.** The program uses a new version of DSS (DSS7). The new DSS7 libraries allow for: larger files sizes; faster reads/writes; smaller time steps (can

- go down to a 1 second time step for DSS hydrographs, the DSS6 library is limited to a 1-minute time step).
8. **Enhancements to Pump Stations in 2D Areas.** The program now allows pumps to be connected to 2D areas by specifying an X and Y coordinate for the “To” and “From” location of a pump. Now pumps can be connected to 2D areas, 1D cross sections, and Storage Areas in any combination.
  9. **New Breach Time Series Plot.** We add a new time series plot that has three graphic windows all on the same plot. The top graphic is the headwater and tail water surface elevations vs time. The middle plot is the velocity through the breach vs time. And the bottom plot is the breach width and depth vs time. Final specifications for the new breach plot were based on MMC requirements.
  10. **New Hydrograph Plotter.** We have redesigned the hydrograph plotter, to be compatible with the new DSS7 file formats. The new plotter still plots all the same information as before, but with a new look and feel.
  11. **Physically Based Breaching Option.** We add a third breaching option for dam and levees. This is a true physics based breaching method based on Dr. Wue’s DLBreach program.
  12. **3D Graphics/Animations:** We added a true 3D viewer option. Users will be able to visualize the terrain and water in 3D. The water can be animated in time. Users can fly around the model to have different views of the system in 3D.
  13. **Raster Calculator in HEC-RAS Mapper.** A raster calculator has been added to RAS Mapper in order to allow users to make their own mapper layers out of combining and mathematically manipulating existing map layers.
  14. **Terrain Modification Tools.** This option allows users to modify terrain with lines and polygons, as well as specific options for channels and levees. Additionally, generic shapes, like circles and rectangles have also be added. Users will also have options for removing terrain (i.e. existing levees).
  15. **Enhancements to Grid/Mesh Generation Tools.** We have made improvements to the Breaklines and Refinement Regions meshing tools. They do a better job of not deleting cells around nearby breaklines and mesh refinement regions.
  16. **Initial Conditions for 2D Areas.** Currently, defining initial conditions inside of 2D areas is very limiting. Initial conditions can be dry, a single elevation, or set using a restart file from a previous run. We have added an option where you can use output for a date/time from any plan in the model that has already been run. This works even if your current plan has different geometry features.
  17. **Iterative Matrix Solvers.** We have added new matrix solvers for 2D that can potentially speed up the computations. They are optional, as they can potentially cause model instability in some cases.

18. **New SWE 2D solver in HEC-RAS.** We have added a third equation solver for 2D modeling in HEC-RAS. This third solver is a full shallow water equation solver but does a better job at conserving momentum than our current SWE solver. The new method is an explicit solver and requires smaller time steps, therefore it takes longer to run in many cases.
19. **New Turbulence Methods.** We added a new and more robust turbulence modeling option for 2D modeling with the full Shallow Water equations.
20. **Remove Dummy Cells Around 2D Outer Boundary.** Currently, the 2D mesh has dummy cells around the entire 2D outer boundary. This is unnecessary and adds to the computational time and memory usage. We have removed all of unnecessary boundary cells from the matrix solution, and then only use these dummy cells where there are external boundary conditions. This has improved the speed of the code and reduced the memory footprint.
21. **Non-Newtonian Fluids option for 1D and 2D.** Mud and debris flow capabilities have been added to both 1D modeling and 2D modeling in HEC-RAS.
22. **2D Sediment Transport Computations.** We have added the ability to perform full blow sediment transport, erosion, and deposition modeling to the 2D solver in HEC-RAS.
23. **New 1D Sediment Features.** There are many new 1D sediment features that have been added to HEC-RAS.
24. **Water Quality Computations.** There are new water quality features that have been added to HEC-RAS.
25. **New Debug Report Zip File Option.** We have updated the option that allows users to create what we call a “Debug Report” zip file. When selecting this option from the File menu of the main RAS window, users will now be able to include the terrain, Manning’s n layers, etc... into the zip file.

## Problems Repaired

This section provides all the bugs found in a previous version of HEC-RAS and the fix included in the subsequent version of HEC-RAS. The bugs and fixes provided are listed in descending order beginning with the fixes made for HEC-RAS Version 6.0 from the bugs found in Version 5.0.7 and finishing with the fixes made for Version 5.0 from the bugs found in Version 4.1.

### Repaired for HEC-RAS Version 6.0

The following is a list of bugs that were found in HEC-RAS Version 5.0.7 and fixed for Version 6.0:

1. **Pilot Channel through Bridges.** If you used the Pilot channel option all the way through a bridge and were also using the Pressure and Weir flow option for high flow at the bridge, the program was using the wrong elevation for checking for pressure flow. The program could go into a pressure/weir flow calculation sooner than it should have.
2. **SA/2D Area Connection and Rating Curve.** The program was connecting the rating curve to the wrong cells if you were running the model in metric units, were using a rating curve at an SA/2D Area Connection, and if you did not put in coordinates for the centerline.
3. **SA/2D Area Connections with Culverts connected to Storage Areas.** The interface was allowing SA/2D Area Connections to have culverts that were lower than the bottom of the storage area. This was causing initial conditions problems and model stability problems. The program was using the lowest point in the storage area as the water surface against the culvert, which then resulted in a flow being computed, that should have been zero. This problem is now trapped by the software, and the user must raise the culvert above the storage area minimum elevation or lower the storage area minimum below the culvert elevation.
4. **Geospatial Centerlines for Gate Openings.** If a user had more than one gate group in a structure (lateral structure or SA/2D Area Connection), and they put in geospatial coordinates for the centerlines of the gates, the software was failing with an "Unresolved Eternal". The arrays for the geospatial data were not being dimensioned properly. This has been fixed.
5. **User defined Rules when structure is connected to 2D flow Area.** There was a bug when applying Rules to structures connected to 2D Flow Areas. Rules for a SA/2D Hydraulic Connection will work if it is connected to 1D storage areas on both sides. If either, or both, sides are connected to a 2D flow area, the rules will not work. This has been fixed.

6. **Volume accounting Error.** A bug was fixed in the volume accounting output for version 5.0.6, but this inadvertently caused a bug in the volume accounting for version 5.0.7. If a user has a model with 2D areas and one or more storage areas, but no 1D reaches, the volume accounting fails to account for the final volume left in the storage areas. It shows up as blank and is interpreted as zero. This made it appear like there was a large volume error that did not exist. This was only a Volume Accounting output problem, not a computational problem.
7. **Bug in Using a Rating Curve for a Gate.** If a rating curve was put in for a gate, and the user only put in two values for the rating curve, such as 0.0 and max gate opening. Then if the user was using a time series of gate openings to control the gates, and put the gate at max opening the entire time, the program was not using the max gate opening. Instead if the water surface was below the top of gate it was using max water surface to go into the curve with that as gate opening. It should have used the user specified gate opening and just go to the curve and use the flow they put in.
8. **1D/2D Lateral structure Connection across a Bridge and using the 2D Equations to compute flow transfer.** If a user connected a lateral structure from a 1D river to a 2D flow area and was using the "Normal 2D equations" for the flow transfer, and if there were bridges, the software had a bug in that it was allowing water to leave the 2D area across the lateral structure in the bridge computational zone (between the two cross sections that bound the bridge). No flow was supposed to go in or out of this region, due to the fact that the 1D bridge/culvert solution cannot change the flow in the middle of the bridge/culvert.
9. **1D/2D Lateral Structure Connection with 2D Equations for Overflow and additional hydraulic outlet (Culvert, gates, rating curve, or time series flow).** If the user has a lateral structure connected to a 2D flow area that contains one of the hydraulic outlet types (culvert, gates, rating curve, or time series of flow), and they selected to use the 2D Equations to compute the overflow, the program was only computing flow through the hydraulic outlet, and not over the weir with the 2D equations. This was being reported as weir flow, but it was not.
10. **Internal SA/2D Hydraulic Connection issue.** After entering a new internal SA/2D Area Connection inside of a 2D area and then trying to run the model, an error message would state the internal structure is "Not connected to any cross section". This was obviously not correct, as it is an internal structure. To fix the problem, the user had to re-select the head water and tailwater connections from the connection drop downs on the SA/2D Hydraulic Connection editor.
11. **Later Inflow not showing up in Unsteady Flow Editor.** If a user had a lateral inflow connected to a storage area, it was not always showing up in the Unsteady Flow Data editor. This was an issue due to the flow file being used with two different geometries/plans. When you open the unsteady flow editor there should be a lateral inflow connection to the storage area. It was not showing up, however

- it was in the flow file. If you ran the model it actually used the flow and runs correctly. You just can't see it in the flow file. This problem has been fixed.
12. **Rating Curves in SA/2D Connections - Metric Units.** If you had a metric units data set and you tried to use the rating curve option in an SA/2D Area Connection, the program was not converting any of the stage and flow data to English units for the computation engine.
  13. **1D Reach connected to same 2D Area (upstream and downstream).** If you had a 1D river reach directly connected to the same 2D flow area, both at the upstream end and downstream end, the program was getting confused on what to set for the initial conditions.

## Repaired for HEC-RAS Version 5.0.7

The following is a list of bugs that were found in HEC-RAS Version 5.0.6 and fixed for Version 5.0.7:

1. **Manning's n Regions Override Bug.** If you used the Manning's n Region option in the RAS Geometry editor (Not RAS Mapper), there may be an issue with your final Manning's n values not being correct within that Region. Unfortunately, in previous versions of HEC-RAS Geometry editor (5.0.6 and earlier), if you draw a Manning's n Region polygon in the counter clockwise direction, a negative area was computed for the polygon (the shapefile standard is to store it in the clockwise direction). Because the polygon had a negative area, the polygon was actually not being used to override any of the Manning's n values.

This problem has been fixed in version 5.0.7. Users can draw these polygons in any direction.

2. **Uniform Lateral Inflow Bug.** When using a uniform lateral inflow along a 1D river reach, HEC-RAS was not correctly putting all of the flow into the river from the uniform lateral inflow hydrograph when the lateral inflow extended across a bridge/culvert or an inline structure. The bug was caused due to HEC-RAS not using the length across the bridge/culvert or inline structure to compute the total lateral structure length, which is then used in computing the flow per foot along the lateral structure. The flow is then put in between the cross sections based on the flow per foot computed, times the length between the cross sections. However, no flow was being put in between the cross sections upstream and downstream of a bridge/culvert or an inline structure. Therefore, that portion of the flow was not being put into the river. This mistake was introduced in version



5.0.4 and has been in the program since this version. This mistake has been fixed for HEC-RAS version 5.0.7.

If you used a work around for this problem in the previous versions, remember to change the model back to the normal way of using uniform lateral inflows with no flow modifiers.

3. **Floodway Inundation Boundary Mapping Issue:** Inundation Boundary polygons created by RAS Mapper for floodway analysis were not properly created if cross-section station-elevation data started with non-zero stationing. This problem did not occur for stationing data that starts at zero.
4. **RAS Mapper not Saving all Breakline Options Issue:** The program was not saving all options when the user activates the option to “Enforce a 1 Cell Protection Radius” for some data sets. This was a problem as you continue to edit/modify your mesh, as those breaklines may not function as you intended them to.
5. **External SA/2D Hydraulic Structures Issue.** The issue would happen for external SA/2D Hydraulic Connections (i.e. connecting a storage area to a 2D area, or a 2D area to another 2D area) when the length of the station/elevation data did not match the length of the structure centerline for cases when a geo-referenced centerline was used for the structure. The program connects to the 2D cells only based on the geospatial centerline and its length. If the station/elevation data has a length that is longer than this line, then the computational engine has a length of the structure that is not connected to any actual cell, and this causes the program to make incorrect flow calculations if that part of the structure is wet. The program now checks for this and does not allow a user to have a centerline and station/elevation data that are not the same length.
6. **Lateral Structure Connection to 2D Area Issue.** There was a problem where the GUI was sending an extra 2D face point at either the beginning or end of a lateral structure connection. If a user tried to start a lateral structure with exactly the same coordinates as a facepoint, sometimes a round off of the numbers cause the interface to think it needed an additional facepoint in front of or at the end of the lateral structure connection to the 2D area. This was causing unsteady flow computations to go unstable with no message as to what the problem was.
7. **1D Velocity and DV Mapping in RAS Mapper Issue.** In version 5.0.6, if you have cross sections that do not start at a zero stationing, RAS Mapper was not correctly mapping velocity and Depth x Velocity in the 1D model region.
8. **Alternative Overbank Deposition Method Issue.** The new overbank deposition algorithm in 5.0.6 was not connected to the Exner 5 and Active Layer methods (they used the old method by default). Only the Exner 7 method was being used (so turning it off did not revert to the old method). The new method (which limits

- overbank bed change to deposition for a whole computation increment, rather than a mixing time step) and the old method are now available for all three mixing methods.
9. **Max Water Surface Profile Issue.** If a user had model “Warmup” turned on, the software was incorrectly including the initial condition at the beginning of the model warmup, as possible results for the maximum water surface elevations during the run. The maximum water surface elevations should not include any of the warmup time solutions. This has been fixed in 5.0.7. Also, if no model warmup is turned on, then the maximum water surface elevations should potentially include water surfaces at time zero (from the initial conditions backwater computations). This is how this works now in version 5.0.7.
  10. **1D Unsteady Flow Encroachments.** The program was not allowing the user to put an encroachment at the cross section just upstream of a culvert. If the user put an encroachment upstream of the culvert, a bad water surface was being computed at this location (It was getting a water surface like 4000 ft in the air).
  11. **RAS Interface is not Catching Bad Data for Internal SA/2D Hyd Conn.** A 2D flow area with an internal SA/2D hydraulic structure must start and end at a face point. Enforcing it as a breakline will snap it to the face points. The program will no longer let you run a model where the internal structures do not start and stop at a face point.  
  
**WARNING:** when users first try a simulation in version 5.0.7 and there are internal structures that do not start and stop at face points, then the simulation will not run and the program will tell you the locations in which you need to fix this problem.
  11. **RAS Unsteady Flow Sediment Transport Computations.** The software was not running any unsteady flow sediment transport models. This was due to a mistake added just before release with the HDF file reads.
  12. **Bridge/Culvert Editor HTAB Curves.** When you open HEC-RAS and a geometry file, the bridge/culvert curves get loaded into memory. From the Bridge/Culvert editor there is a button called "HTAB Curves" that allows you to plot these curves (and edit them). However, if you change the HTAB parameters that went into making the curves, rerun the model, and then click the HTAB Curves button, you would still see the original curves when the project was loaded, and not the new updated curves from the run.
  13. **Plotting Observed Daily Instantaneous Data Problem.** HEC-RAS was not plotting daily instantaneous time series data correctly for the hydrograph plots and profile plots. The data normally has meta data that says when the data was measured, for example “0600” on the day. But HEC-RAS was always plotting it at 2400 on the day.

14. **SA/2D Hydraulic Connection Culvert Issue.** We received some data sets where users were drawing the centerline for a hydraulic connection from left to right in a specific direction, but then they were telling the software that the Headwater and Tailwater were the opposite of that. Additionally, they were drawing culverts from downstream to upstream. This was causing several issue.

**WARNING!!!** The software now checks for this issue (above) and will not run if encountered. A message will appear telling the user that the direction they drew the structure centerline is inconstant with how they have headwater and tailwater defined, or they have drawn their culverts, gates, rating curves, or flow time series from downstream to upstream. HEC-RAS requires the user to draw the structure centerline from left to right while looking downstream, and for the headwater and tailwater connections to reflect that (HEC-RAS will automatically connect it that way, but a user could change it). Additionally, all centerlines drawn for hydraulic outlets (culverts, gates, rating curves, time series of flows) must be drawn across the structure from upstream to downstream.

15. **Storage Area Initial Elevations Problem.** Unfortunately, a bug was added to version 5.0.6 that stopped it from correctly initializing the elevations of storage areas whose initial elevations were left blank (undefined) in the Unsteady Data Flow editor. In 5.0.6, the program did not initialize the storage area elevations at all. SA's that are hydraulically connected to the river with a lateral structure should be set to the same water surface as the river across the lateral structure. This was not happening. All storage areas were being left dry at the start of the simulation.
16. **Storage Area Elevation Points Filter in RAS Mapper.** There was an occasional issue in RAS Mapper that when a storage area elevation relationship was extracted from the terrain, occasionally it would end up with thousands of points. The points filter routine had a precision issue that was causing this.
17. **Maximum Depth for Storage Areas.** If a user had storage areas that were not connected to anything else (i.e. they only had a flow hydrograph attached to it). HEC-RAS was not correctly reporting the maximum water surface elevation. The hydrograph plots were correct, but the maximum inundation plot in RAS mapper was wrong.
18. **Dredge Material Unit Weight Issue.** Dredged cohesive material used the cohesionless unit weight to convert from mass to volume. Dredged material now uses the correct unit weight.
19. **Import of Vertical Manning's n values.** When importing an existing HEC-RAS model into another existing model, if the mode to be imported had vertical Manning's n roughness specified at cross sections, those values were not being imported.



## Repaired for HEC-RAS Version 5.0.6

The following is a list of bugs that were found in HEC-RAS Version 5.0.5 and fixed for Version 5.0.6:

1. **Simplified Physical Breaching:** Unfortunately, it was found that HEC-RAS version 5.0.5 was not allowing overtopping failures to breach within the Simplified Physical Breaching method. One of the data fields for this option was inadvertently removed from the input data screen. Models developed with previous versions still worked, because the required input data was in the Plan files, but new models developed from scratch would not breach due to the missing data field.
2. **2D Modeling- Three or more Rating Curves connected to a single 2D Area:** If three or more boundary condition rating curves were connected to a 2D flow area, there was a computational problem and the program would not run.
3. **Unsteady Flow Reach Computational order:** If a system has a 1D reach upstream of a 2D area and 1D reach downstream of a 2D area, for some models (not all) the reach order for computations was getting changed when the geometry was saved. This was causing the model to stop running on the first unsteady flow computational time step. A work around was to go to the Geometry editor, select the **Tools** menu, then select **Reach Order for Computations**. Simply check the box that says “Use the User Specified Order for Unsteady Flow Computations”. This will fix the reach order and allow the model to run. This was fixed for version 5.0.6.
4. **Steady Flow Modeling and Minor Losses upstream of Bridge/Culvert:** There was a bug in steady flow modeling when the user entered additional minor loss coefficients just upstream (the cross section just and upstream outside of the structure) of a culvert or a bridge. The work around was to remove these minor loss coefficients from the cross sections just upstream of the culvert or bridge. You could account for minor losses by increasing the normal contraction and expansion coefficients. This was fixed for version 5.0.6.
5. **Sediment Transport Active Layer Issue:** Version 5.0.6 changed the active layer approach (including a significant bug fix) that changed its behavior substantially.
6. **Overbank Deposition:** When HEC-RAS computes bed change outside the movable bed limits (a user option) it only deposits and never erodes outside these limits. HEC-RAS will deposit in the overbank not only every computation increment, but every mixing time step. Version 5.0.6 includes an option (which often works much better) that allows positive and negative overbank change between mixing time steps, as long as the total bed change outside the movable bed limits remains zero or positive for each computational increment.

7. **Levee Plotting Inconsistencies:** Plotting levees in the geometric editor is inconsistent, sometimes they do not show up. This was due to an issue of editing data in RAS Mapper, and then the information was not transferred correctly to the Geometry editor.
8. **RAS Mapper - Reversing a river reach fails to reverse cross sections:** When you reverse the river feature in RAS Mapper, the cross-sections should have reversed direction to match the correct orientation. They should also have been renamed accordingly.
9. **2D Mesh Refinement Regions:** The 2D mesh refinement regions were not transferring into newer versions of the software correctly. All the mesh points were there, but the refinement region was not, and it could not be edited or changed.
10. **RAS Mapper – Junctions/New Option:** Junctions automatically get formed when two or more reaches are combined. The option to create a new Junction from the menu was not needed and was causing problems when users applied the option.
11. **RAS Mapper - Cross Section Filter:** If a cross section was filtered in RAS Mapper, enough points could have been removed to slightly change the cross section cut line. This caused the software to rename the river station of the cross section.
12. **Duplicate Perimeter Points in 2D Flow Area Boundary:** If a user digitized a 2D Flow Area boundary, and inadvertently clicked twice at the same location, two points with the same X, Y coordinates ended up in the polygon. This was creating mesh generation problems in that area, and it was not obvious to the user what the issue was. Duplicate points are now automatically removed.
13. **Manning’s n Layer for 2D Flow Computations:** The Manning’s n layers created from land cover and user defined shape files did not have a “No Data” option in the table. This was causing a problem in that if a 2D face intersected with an area of the Manning’s n layer that had no data, then no Manning’s n value was assigned. The Manning’s n value table now has a No Data row in which you can assign a value, if no value is assigned, all faces with no data will default to the Manning’s n supplied as the default value for that 2D Flow Area.
14. **RAS Mapper – Junction Lengths:** If a user edited the cross sections upstream of a junction, the junction reach lengths were not getting updated.
15. **RAS Mapper – Junction Editing:** When editing Junction data in RAS Mapper, the Junction Description and the computational method was getting lost.

16. **RAS Mapper – Bridge Descriptions:** When editing the cross section just upstream of a bridge or culvert in RAS Mapper, the description data for that structure was being lost.
17. **2D Mesh Property Tables for New Versions of RAS:** When you load a data set that was built in an older version of HEC-RAS into a newer version, the software must update the mesh and recompute the property tables in order to run. This was not working all the time, and the first time you tried it the software would fail to run.
18. **Lateral Structure with Out of System option:** If the user did not connect a lateral structure to anything, the flow was set to “Out of System”. Which meant it would compute it and send it out of the river system. The program was incorrectly reporting the wrong computed flows for this situation. However, it was actually using the correct flows. This was just an output reporting problem.
19. **Simplified Physical Breaching Issue:** There were some data sets that would not breach for overtopping or piping failures with Simplified Physical Breaching turned on. There were several problems which have been corrected for this breaching method.
20. **Exporting Channel Terrain Data:** In some instances, the exporting of channel terrain was resulting in incorrect channel data between cross sections. There were some bugs in using the bank lines and the interpolation surface.
21. **SA/2D Hydraulic Connection Output:** The SA/2D Hydraulic connection was not using the breach centerline location for outputting the headwater and tailwater elevations.
22. **RAS Mapper Naming Issues:** There were some inconsistencies in which characters were allowed for use in both naming and renaming objects.
23. **Plan Short ID issue:** HEC-RAS was allowing users to put in a blank name for the short ID. This was causing many problems.
24. **Elevation Controlled Gates and DSS:** If a user was getting the observed data (Stage and/or Flow) from DSS, then the program was not correctly using it.
25. **Metric Issue with Weir Profile:** If users were working in metric, and an error came up with the length of a lateral weir, the error message was written out in English units.
26. **Cross Section Interpolation Issue:** If a user had a reach of cross sections, and the very last cross section had extremely large reach lengths, the cross section interpolation algorithm was not working correctly for that reach.

27. **Internal BC Lines within 2D Flow Areas:** When a user went to draw an internal BC Line within a 2D Flow Area, the program was dropping the first point. In addition, if you only used two points for the line, then the program was dropping the first one and leaving only a single point with the name.
28. **RAS Mapper – Polygon Create Issue:** If you went to create a polygon in RAS Mapper, then canceled the operation when asked for a name, the program would create the polygon anyway with a blank name.
29. **RAS Mapper and Geometry Editor Conflict:** If you are currently editing a geometry layer in RAS Mapper, then open the same Geometry in the RAS Geometry editor, there was a conflict between what was being edited and saved. The program now locks you out of the Geometry editor if you are editing in RAS Mapper.
30. **RAS Mapper Cross Section Edge Lines and Interpolation Surface Issue:** If the edge lines were very sinuous between two cross sections, the interpolation surface was not always following the edge lines smoothly.
31. **RAS Mapper and Geometry View Extents issue:** RAS Mapper was changing the geometry editor View extents, even after a user would set them.
32. **RAS Mapper 1D Velocity Mapping Issue:** If a user set the velocity subsections for a 1D model to 1, 1, 1 (meaning only one velocity in the left overbank, channel, and right overbank), RAS Mapper was not plotting the velocity correctly.
33. **Unsteady Flow Boundary Conditions Editor Plotting Issue:** There is an option to plot all boundary conditions hydrographs in the unsteady flow boundary conditions editor. However, boundary conditions that were not being used by the currently opened geometry data and plan are still stored but not displayed or used for the current plan. However, the plot button was showing all hydrographs stored in that flow file, even if they were not relevant to the currently opened Plan.
34. **Breach Repair – Multiple Breaches:** If you have a breach that is set with a Date and Time, and you use the breach repair option. Once the breach is repaired it will immediately breach again, then repair, then breach again, etc. If a breach is set up with a Time and Date, and a repair option, it should only breach once, then repair once.
35. **RAS Mapper and 2D Flow Area Point Generation:** For a small number of data sets there was a problem in generating the 2D Flow Area computational points from RAS Mapper.
36. **GUI Data Checking Error for Deleted Boundary Conditions:** If a user deleted an internal Boundary Condition for a 2D Area, then extended the time window,



- the user interface was still checking that data and reporting an error, saying that it did not extend out far enough to cover all of the computational time.
37. **Manning's n Override regions Table.** If a user attached a Manning's n layer to a geometry file, then put in Manning's n override values, then switched to a different Manning's n layer, the Manning's n override table was still showing the n values associated with the previously connected Manning's n layer.
  38. **1D Automatic Calibration of Manning's n Values:** When using metric data sets, the computation engine was writing the final flow vs roughness values out in English units. Additionally, some of the tables may not have had any flow data.
  39. **Max Only Output Issue:** If a user selected that they only wanted the "Max WS Only" output for RAS Mapper, the computational engine was writing out the output for every computational time step, creating a huge HDF output file.
  40. **Interior BC Line Issue:** If you laid out an interior BC Line boundary conditions, but then changed the mesh significantly, the interior BC Line was displaying a wrong connection to the wrong cells.
  41. **Channel Terrain export issue:** Some data sets were getting very jagged edges for the channel at the beginning or end of the channel reach. This was a triangulation issue.
  42. **Terrain Stitching causing bad water surface boundary:** When multiple terrain data layers with different resolutions are used to make a terrain data set, HEC-RAS uses "Stitching" to merge the edges of the terrain data layers. This was causing some minor issues in mapping the water surface boundary in those areas.

## Repaired for HEC-RAS Version 5.0.5

The following is a list of bugs that were found in HEC-RAS Version 5.0.4 and fixed for Version 5.0.5:

1. **2D Manning's n Regions:** Unfortunately, it was found that HEC-RAS version 5.0.4 was not applying the Manning's n value changes that users were specifying in the Geometry data as Manning's n override regions. This problem has been fixed in version 5.0.5

### WARNING!

If you were using Manning's n override regions in HEC-RAS 5.0.4 for 2D flow areas, these Manning's n values were not being applied to the 2D Flow Area property tables. Any model using this feature with version 5.0.4 must be rerun, as the results will change.

2. **RAS Mapper Stored Maps Issue:** If a user created a stored map, and wanted to use the "Horizontal" rendering mode, the stored map was still being computed with the "Sloping" rendering mode.
3. **Lateral Structure with Spatial X, Y Coordinates for Centerline:** If the user was using spatial X, Y coordinates for the centerline of a lateral structure connected to a 2D area, occasionally the software appeared to be using the User override connections for the TW connection. It was actually not doing that, as it was using the spatial connection based on the structure centerline coordinates system. This was just a minor interface problem, but it did not affect the computations.
4. **Lateral Structure Connection Error Message:** If the user tried to connect two different Lateral structures to the same 2D cell face, and they were using the 2D equations to compute the overflow across the lateral structure, an error message would open to inform the user that this is not allowed. However, it was listing the wrong cell number for the problem cell.
5. **User Defined Rating Curve inside an SA/2D Hydraulic Connection:** If the user was using the new option to define a rating curve as part of a SA/2D Hydraulic Connection, inside of a 2D Flow Area, and did not specify spatial coordinates for the rating curve connection, the software was making the connection to the cells immediately next to the structure, but it was off by one cell (i.e. the connection was one cell to the right of where the centerline connection should have been).
6. **Advanced Time Step Control:** A new option called "Adjust Time Step Based on Time Series of Divisors" was added to version 5.0.4., If a user changed a value in the table for the divisor, then it was not being stored or used.

7. **Rename River Reach Issue:** Occasionally, lateral structure connections were getting mixed up if the user renamed a river reach, and the reach contained lateral structures, and there was more than one reach in the model. Additionally, if the Lateral structure had “User Defined Stationing” connections, these connections could also be mixed up.
8. **Lateral Structure Weir/Embankment Points filtering:** If the user tried to filter more than one lateral structure’s centerline coordinates at one time, the coordinates were being lost for all of the structures.
9. **Split Flow Optimization for a Steady Flow Model:** When performing a split flow optimization for a lateral structure within a steady flow simulation, if the user entered an initial guess for the flow, the program was using that guess for every iteration.
10. **SA/2D Hydraulic Connection and Non-Georeferenced Culverts:** For non-georeferenced culverts, the program was setting the downstream centerline equal to the upstream centerline even if the user had entered a different value.
11. **Variable Time Step for 1D Rivers with Junctions:** The Courant value for a cross section immediately upstream of a junction was using the cross section length not the junction length. If there was no length entered, or an incorrect length entered on the last cross section upstream of a junction, this would produce an incorrect calculation of the Courant number, and then an incorrect calculation of what time step to use.
12. **SA/2D Hydraulic Connection with Rating Curve or Time Series of Flows:** If a SA/2D Hydraulic Connection had only a georeferenced rating curve or georeferenced time series (no other outlet types), then an incorrect access violation error might be generated.
13. **Hydraulic Design Pier Scour:** Editing the “a” value in the pier scour editor caused the editor to crash if the skew angle was not specified. A parameter check was added to correctly flag cases where the skew angle is not defined.
14. **Uniform Lateral Inflow with Sediment Time Series:** Pairing Uniform Lateral Inflow with a sediment time series brought the total sediment in at each XS from the upstream cross section to the downstream cross section. The program was corrected to uniformly distribute the sediment between cross sections.
15. **Active Layer Pass through Method:** Active Layer mixing method was depositing mass in Pass through Mode.
16. **Sediment Time Series Plot:** The new sediment time series plot was offset by one day.

17. **Krone-Partheniades Method for Cohesive Sediment:** When selecting the Krone-Partheniades method (based on the HEC6 version), the software was defaulting to the HEC-RAS version, only if the Active layer mixing method was also selected. This issue was corrected so that the HEC6 version of the Krone-Partheniades method is used when it is selected.

## Repaired for HEC-RAS Version 5.0.4

The following is a list of bugs that were found in HEC-RAS Version 5.0.3 and fixed for Version 5.0.4:

1. **2D Full Saint Venant Equations:** In the shallow water 2D solver, it was noticed that some simulations had flattened velocity profiles across the direction of flow. Numerical diffusion in the advection terms was identified as the cause of the problem, particularly the scheme used for tracking velocity and velocity interpolation in the middle of cells. The interpolation formula was changed and is now computed using a more compact stencil, resulting in less numerical diffusion and more accurate results. This issue “may” change the results of previously developed models.

**WARNING!**

In general, the new formulation will have less numerical diffusion, and therefore potentially higher velocities and lower water surface elevations. Previously developed/calibrated models may need to have minor Manning’s n value adjustments (increased Manning’s n values) and/or increased turbulent diffusion coefficient (or turn turbulence on if it was not previously on) in order to reproduce previous version results. Additionally, due to possible higher velocities and lower water surfaces, the user may need to use a smaller computation interval to maintain model stability. Keep in mind that Version 5.0.4 now has a variable time step that can be used to improve model stability and reduce run times.

2. **2D Turbulence Modeling:** In the shallow water 2D solver, the algorithm used to compute the Laplacian terms in the turbulent dissipation term was found to be numerically sensitive to abrupt changes in the flow field and the boundary conditions. This problem became more evident when the numerical dissipation in the advection was reduced (see item 1 above). Complications arose from the fact that the numerical solver relies mainly on normal velocities across faces while tangential velocities are back-calculated. The discretization of the Laplacian was reformulated in the field and near boundaries, resulting in a smoother more realistic turbulent dissipation.

**WARNING!**

This change may cause answers from previous runs to be different. Users may need to adjust the turbulence coefficients to get the similar results as the previous version. Additionally the new turbulence formulation is more sensitive to the time step, and may require the user to use a smaller time step to keep the calculations stable.

3. **2D Diffusion Wave Equations:** In the Diffusion Wave solver, it was noted that the solution was not accurate near dry cells or wet cells that were separated by dry faces. It was discovered that water surface gradients were computed in those cases as if the cells were hydraulically connected. Special cases were added to the gradient calculation to deal with dry regions.

- 4. Connections to 2D Flow Areas:** A bug was found in both the Lateral Structure (LS) and the SA/2D Hydraulic Connection for connections to 2D Flow Areas. If the length of the structure was significantly greater than or less than the length of the 2D flow area boundary that it was connected too, the partitioning of the structure length that was connected to each individual cell was not correct. The net effect of this is that either too much, or not enough of the structure was being attached to the correct cells. The beginning and the end connection were always correct, it was just the stationing in the middle that had some error in it.

**WARNING!**

This bug correction may cause data sets to get different results, especially in the area of where the structure is connected to the 2D Flow Area.

- 5. 2D Rating Curve Boundary Condition:** For the rating curve boundary condition connected to a 2D area, all previous versions of HEC-RAS would compute a conveyance weighted water surface from all the wet cells along the boundary condition. That water surface was used to then go to the rating curve and get a flow rate to use to pull flow out of the 2D area. It was discovered that this caused a problem for data sets that were using rainfall. For a dry 2D flow area, in which rainfall is applied, all of the boundary cells have a small amount of water. The conveyance average water surface was being computed as a high water surface: This was because the terrain varied underneath the boundary condition. The net effect is that it was computing way to high of a flow from the rating curve, due to a bad computed water surface elevation. So the rating curve boundary condition has been changed, such that it only uses the water surface elevation from the lowest wet cell along the boundary condition line. Then that water surface is used to get a flow from the rating curve.

**WARNING!**

This software change will potentially cause different answers to be computed for data sets that used downstream rating curves connected to 2D Flow Areas. If the water surface in that area was highly one dimensional, the difference will be small. If the water surface along the 2D boundary was highly multi-dimensional (i.e., the water surface varied a lot along the boundary condition, then the differences may be more significant).

- 6. 3-Dimensional (3D) Cross Section (XS) Plot Button Error:** If the user has a data set with no 1D reaches, and the 3D Multi Cross Section plotting button is clicked, then the entire program would crash. This issue has been fixed.
- 7. Background Maps Window:** When selecting the Background Map button the editor was going behind all of the open windows. This has been fixed so the editor now opens on top.

8. **Boundary Condition (BC) Line Flow and Stage Plots:** In the Geometry Data editor when a BC Line was selected and the Stage/Flow Hydrograph plot was clicked, the window opened, but the plot was the wrong plot "Type" and did not have the requested location. This issue has been fixed.
9. **Steady Flow Velocity Output in RAS Mapper:** The velocity maps were not working correctly for steady flow hydraulic models that were in metric units. This issue has been fixed.
10. **1D Velocity Mapping.** There was a bug in the mapping of the 1D cross section velocity in RAS Mapper. The velocity profile for the main channel was actually being put into only half of the channel. The remainder of the velocity mapping was actually the velocities in the overbank area. This was only a plotting issue and not a computational issue. Computed water surfaces and velocities were correct, just not being mapped correctly in RAS Mapper.
11. **2D Unsteady Lateral Structures Using 2D Equation Domain:** The following user-entered mistake did not have a check/error flag in HEC-RAS Version 5.0.3: It is a mistake to have two different lateral structures (1D river to 2D area) connected to the same 2D area at the exact same cell (so that a specific cell gets flow from two different lateral structures) and either (or both) lateral structures using the Normal 2D Equation domain. (This issue may have resulted in a large volume error being reported). The user would fix this issue by either setting both lateral structures to use the weir equation, or, by breaking up the cell so that no one cell does not receive flow from both lateral structures.
12. **Steady Flow (Multiple Opening/RAS Mapper):** The water surface just downstream of a multiple opening was not being plotted correctly in RAS Mapper.
13. **Steady Flow (Mixed Flow):** The water surface at a hydraulic jump was not being plotted correctly in RAS Mapper.
14. **Unsteady (Lateral Structure Gates):** For a lateral structure with gates, the gate flow was not being computed correctly if there was reverse flow (i.e., the tailwater is higher than the headwater).
15. **Volume Accounting:** The method for performing the volume accounting was modified. For instance, if a dam break model had very little inflow/outflow, but large internal flows (large initial conditions in reservoir and stream), the volume accounting was reporting much larger volume errors than were truly happening.
16. **Double Counting Quasi-Unsteady Lateral Sediment Loads:** All HEC-RAS 5.0.x versions, including Version 5.0.3 introduced lateral sediment loads (from rating curves or time series) twice, once upstream and once downstream of the specified cross section, double counting these loads. HEC-RAS Version 5.0.4 only brings the

load in downstream of the cross section (making it more like unsteady flow), while previous versions brought the sediment load in upstream of the XS.

17. **USDA-ARS Bank Stability and Toe Erosion Model (BSTEM):** Several bugs were fixed in the BSTEM algorithms and BSTEM output. Primarily, the material that failed from the bank was not added to the main sediment transport model correctly. Additionally, bank failure/toe scour could stall when the bank became vertical and the longitudinal cumulative volume curve was not computing volume change correctly for bank failures.

### Repaired for HEC-RAS Version 5.0.3

The following is a list of bugs that were found in HEC-RAS Version 5.0.1 (and Version 5.0.2) and fixed for Version 5.0.3:

1. **Floodway Encroachments at Culverts:** Floodway Encroachments method 1 was not working correctly for culverts. This bug was introduced in Version 5.0.1 when a previous problem with encroachments at bridges was fixed. Both culverts and bridges are now working correctly with all encroachment methods.
2. **2D Turbulence Modeling:** There was a bug in the Turbulence modeling in all previous versions to Version 5.0.2. The X component of the turbulence was unfortunately using the Y component of the velocity instead of the X component. This was fixed before the release of Version 5.0.2.
3. **Flow Distribution at Bridges:** The flow distribution output was not working correctly for the cross sections inside of a bridge.
4. **2D Flow Area Internal Hydraulic Structures.** Previously internal hydraulic structures with culverts or gates was attempting to compute a sloping water surface upstream and downstream of the culvert/gate, based on the water surface in all the cells connected to and just outside of the culvert/gate entrance and exit. This was causing many instability problems with internal culverts/gates inside of 2D Flow Areas. This has been changed to just use a flat water surface inside of each cell connected to the upstream and downstream end of any culvert/gate inside of a 2D Flow Area.
5. **SA/2D Area Connection and Rules.** If the user tried to use rules for controlling gates in a storage area/2-dimensional (SA/2D) area connection, when connecting a storage area to another storage area, the Operating Rules editor would not allow the user to put in the initial conditions of the gate, as well as the gate opening and closing rates.
6. **Simplified Physical Breaching.** If the simplified physical breaching option was selected, and the mass wasting option was not being used, there was a bug and the breach would not start correctly.



7. **Simplified Physical Breaching.** For some data sets this option was producing no breach at all when it should have produced a breach. This was a Version 5.0.2 bug.
8. **Breach with a Restart File Option.** An Unsteady flow run that started with a restart file was not breaching correctly.
9. **Breaching with Lateral Structures.** The flow through the breach was not being displayed correctly in the detailed Lateral Structure output table. It was being computed correctly.
10. **Zero Manning's n Value in 2D Flow Areas.** Users were allowed to enter a zero value for Manning's n values within a 2D Flow Area. This is no longer allowed.
11. **Unsteady Flow Encroachment Editor.** The Unsteady Flow Encroachment editor would not allow the user to leave a left or right encroachment as a blank (meaning no encroachment on that side).
12. **RAS Mapper.** Several minor RAS Mapper interface and plotting bugs were fixed.
13. **RAS Mapper- Exporting 1D Cross Sections as Terrain.** There was a bug when exporting 1D cross sections as a terrain file. If the user had a system with a river reach on a sharp bend, and very few cross sections had been drawn through the bend, then RAS Mapper would not stay within the main channel bank stations for the 1D terrain export.

**RAS Mapper – Inundation Mapping Around Culverts.** There was a mistake in outputting a water surface for the cross section just upstream of a culvert. The software was writing a zero water surface elevation for the output that is used to perform the inundation mapping. This was causing the mapping to show up as being dry at the culvert and just upstream of the culvert.

## Repaired for HEC-RAS Version 5.0.1

The following is a list of bugs that were found in HEC-RAS Version 5.0 and fixed for Version 5.0.1:

1. **Unsteady Flow with Pumps:** A pumping station that is connected "From" a storage area had a bug that could generate an "access violation" error.
2. **Unsteady Flow with Rating Curves at Structures:** The rating curves for: inline structure outlet rating curve, lateral structure outlet rating curve, and user defined gate rating curves (both inline and lateral) have been changed so that unsteady will no longer extrapolate past the top or bottom of the curve. A warning will be generated the first time this happens.

3. **Unsteady Flow with an SA/2D Hydraulic Conn between two 2D Areas:** There was a bug when a SA/2D connector has a 2D area on the upstream side. This bug would sometimes show up as an "access violation" error.
4. **Steady Flow Analysis (Encroachments at Bridges):** There was a bug when type 1 encroachments were specified immediately adjacent to a bridge opening. The encroachment was being set to the opening. The left encroachment was set to the left side of the bridge opening and the right encroachment was being set to the right edge of the opening.
5. **Unsteady Flow with 2D Areas/Internal Hydraulic Connector:** For a hydraulic connector inside of a 2D area, the DSS output for headwater and tailwater had a bug. The reported values were "one cell" away from the intended values. For a connection that was entirely inside of a single cell, this resulted in a reported water surface of "0.0". This was only a reporting issue.
6. **1D Velocity Plotting in RAS Mapper for Metric Data Sets:** 1D RAS Mapper maximum velocity plot was wrong for SI data sets.
7. **Unsteady flow Lateral Structure connected to a 2D flow area:** For a lateral structure connected between a 1D river and a 2D area, the lateral structure was pulling the water out of the river at the wrong cross section location. The flow was being removed from the 1D river upstream of the location it should have been removing it from.
8. **User Interface – Right Bank of Main channel:** If the project had a cross section with a vertical wall at the right bank of the main channel, the interface was displaying the main channel bank station at the bottom of the vertical wall. The computations were correct, this was just a visual problem in the interface.
9. **User Interface – Storage Area Elevation Volume Curves:** A new option to compute elevation vs volume curves for storage areas was occasionally coming up with negative volumes.
10. **User Interface – FIPS Compliance:** The interface was using a routine to compare data that was determined to not be FIPS compliant. This routine has been removed and replaced with one that is FIPS compliant.

## Repaired for HEC-RAS Version 5.0

The following is a list of bugs that were found in HEC-RAS Version 4.1 and fixed for Version 5.0:

1. **Unsteady (User Defined Gate Curves):** User defined gate curves for storage area connections were not working.

2. **Unsteady Flow Post Processing (Pump):** If a pump group had more than one pump that was on, only the flow from one pump was being summed. So the total flow of the pump group was wrong as was the total flow of the pump station. This bug did not affect the unsteady flow pump computations nor the pump DSS output.
3. **Steady Flow (Bridges/Cross Sections with Lids):** For the internal bridge cross sections (or other cross sections with lids), if there was more than one Manning's n value in the channel, the program was not correctly compositing the channel Manning's n value. For bridges, this would only affect the answers using the energy method (the other methods, such as pressure/weir were not affected).
11. **Unsteady Flow Post Processing:** The inline structure output was not showing the breach flow and breach velocity. This has been fixed.
12. **Steady Flow (Bridge/WSPRO):** The WSPRO method uses its own methodology to compute the friction/expansion loss between the exit cross section and the cross section immediately downstream/outside of the bridge. This computation was not correct and tended to slightly over predict the energy losses.
13. **Steady flow (bridge/WSPRO):** For the WSPRO bridge method, the energy downstream of the bridge was not being correctly outputted. (The WSPRO method recomputed the downstream water surface. The displayed/outputted energy did not reflect the recomputed water surface.)
14. **Unsteady Flow Post processing (overflow gate):** For lateral structures, the flow through an overflow gate was not always being output.
15. **SI Sediment Volume Bug:** HEC-RAS Version 4.1 did not convert sediment mass into volume correctly in SI units, generally under predicting deposition volume substantially.
16. **Wilcock Transport Function:** HEC-RAS Version 4.1 included a bug in the Wilcock transport function that generally caused it to substantially under predict transport.
17. **Lateral Structures:** A lateral structure that is connected "to a point between two XS's" could get a wrong error message that the "the distance to the upstream cross section is greater than cross section length".
18. **Unsteady Flow (Advanced Rules):** For the advanced rules, using the "lookback" option (lag, average, etc.) was not working for storage areas.
19. **Steady Flow (Inline Structures):** The program was not allowing the water surface upstream of an inline structure to be less than water surface downstream. In rare cases, it is possible that the hydraulic computations should give an answer where the upstream energy is higher than the downstream energy, but the upstream water surface is lower than the downstream. This can happen for a weir that is highly

submerged but still has a high enough velocity that the upstream velocity head is significantly larger than the downstream velocity head.

20. **Steady Flow (Bridges):** If the edge of the bridge opening is a vertical wall, and the water surface is within this vertical wall (that is, the water surface is above the bottom of the wall and below the top of the wall), the wetted perimeter of this wall was not being included in the computations).
21. **Steady Flow (Weir):** For highly submerged, sharp crested weirs the program was computing slightly too much flow.
22. **Steady Flow (Lateral Structures):** A lateral structure that only has a rating curve (no weir, culvert, no gates) had an output problem that could cause the output for the next cross section downstream to be wrong.
23. **Steady flow (culvert):** If the elevation of the road/weir dropped below the bottom/invert of the lowest culvert, the program could not converge on a "weir only" solution.
24. **Unsteady flow HTAB (culvert):** If the elevation of the road/weir dropped below the bottom/invert of the lowest culvert, the curves were not correct.
25. **Steady flow (culvert storage connector):** For a storage area connector where the water surface in the two storage areas was less than 0.5 feet and there were at least two culverts with an invert (minimum elevation for flow) greater 0.5 feet, the program could lock up.
26. **Steady flow (blocked obstruction with bridge/lid):** If a cross section with a lid (or a bridge cross section) had a blocked obstruction that "poked through" the lid, the wetted perimeter was not being computed correctly.
27. **Unsteady flow (junctions):** The "Energy Balance Method" for a junction flow split (the flow splits into multiple reaches in the downstream direction), was not always working correctly.
28. **Unsteady flow (roughness factors):** The flow roughness factor and the seasonal roughness factor associated with geometric data had a bug that caused them to be applied to the wrong range of cross sections. This bug did not affect the roughness factors that were entered as part of the Plan data, only those entered in the geometric editor.
29. **Unsteady flow (Modpuls/Hydrologic routing):** Having both multiple Modpuls regions and lateral inflows in the same reach was causing a bug that was screwing up the lateral inflows.

30. **Unsteady flow (Navigation Dams):** For navigation dams, the starting gate open was being set to the minimum which usually caused a very high starting water surface behind the dam. The gate setting is now being determined based on the target water surface.
31. **Unsteady flow (Advanced Rules):** If an advanced rule operation had been used to set a desired flow (for a given gate group) and then a later rule operation set a specific gate opening height (for that gate group) the program was continuing to use the desired flow operation instead of overwriting it with the designated gate opening height.
32. **Steady flow (culvert):** For a steep culvert, where the flow at the inlet starts out supercritical (and the inlet is not submerged) but the flow has a hydraulic jump (and the outlet is submerged) the program was using the outlet answer (and reporting outlet control) when it should have been using the inlet control answer.
33. **Steady flow (culvert):** For a steep culvert, where the outlet is submerged and the original, subcritical outlet answer, shows that the inlet is not submerged, but the inlet answer shows a submerged inlet and "drowned" hydraulic jump, the program was not reporting the correct, full flowing outlet answer.
34. **Unsteady flow (hydraulic curves):** For the hydraulic bridge curves and hydraulic rating curves, the program was sometimes incorrectly reporting a, "extrapolated above rating curves" when in fact it had not had to extrapolate.
35. **Sediment (Long Cum Mass Change):** minor bug when erosion punched through the cover layer and eroded down into the surface layer during a single computation increment.
36. **All (Rating Curve/Bridges):** If a cross section immediately upstream of a bridge has a rating curve, it was causing the program to crash.
37. **Sediment (Overbank Deposition):** Material that was being deposited in the overbank, outside of the moveable limit, was not being removed from the sediment going to the next cross section. Therefore, the sediment was being double accounted.
38. **Sediment (Dredging/Cumulative Out):** The longitudinal cumulative mass output was not correctly including dredged output. Output bug only.
39. **Sediment (Exner7):** The Exner7 bed mixing option had several bugs.
40. **Sediment (Hydraulic Averaging):** the hydraulic averaging between cross sections was improved so as to not allow hydraulic average over cross sections with big flow changes.

41. **Steady Flow (Culverts):** For a culvert that was partially filled in with sediment, the reported depths for critical depth and normal depths were not correct. The depths included the filled in depth. This was only a reporting error, not a computation error.
42. **Sediment (Scour Bottom):** If a cross section had a large amount of scour in a single computation interval, and this scour exceeded the scour bottom (maximum allowable scour) the extra scour was not being handled correctly (it was being allowed to "overshoot").
43. **Unsteady (Modified Puls):** If a model has multiple modified puls regions and the different modified puls regions have not been entered from upstream to downstream, this could have caused an error in RAS.
44. **Sediment (Mass Correction):** Didn't work correctly if XS was scouring and depositing at the same time (overbank deposition, channel scour).
45. **Sediment Hydraulic Design:** The hydraulic design computations for sediment transport capacity had a problem with transport through bridges.
46. **Sediment (Retention Option):** This option did not work at junctions.
47. **Unsteady (Levee Breaching and User Specified XS):** There was a bug if the user had entered a levee breach at a lateral structure that also had user specified cross sections on the tailwater side.
48. **Sediment (Active Method/Krone):** The Krone deposition method was not working correctly for the sediment active layer method.
49. **Geometry (Lateral Structure):** If the lateral structure (LS) was set up to have multiple cross sections on the tailwater (TW) side, and it was set to use default computed intersections (on the TW side), and the LS extended past the end of the reach, HEC-RAS was reporting the wrong error message.
50. **Unsteady (Levee and Dam breach):** For the levee and dam breach, the right side slope was being ignored. The left side slope was being applied to both the left and right sides.
51. **Unsteady (Navigation Dam):** If the user had selected to use a gate change time increment (e.g., only operate the gates every four hours), the gate(s) were incorrectly limited to moving only for a single time step. For instance, if the gate open rate was 0.5 feet/minute and the time step was set to one minute, when it came time to operate the gate, the gate would only raise a maximum of 0.5 feet. If the time step was thirty seconds, the gate would only raise a maximum of 0.25 feet (until the next time increment for the gate operations).

52. **Unsteady (Junctions):** For unsteady flow at junctions, if the user selected the energy balance method, RAS was computing the energy losses based on the downstream reach lengths entered in the cross section editor. This has been fixed so that it is now using the reach lengths entered in the junction editor.
53. **Unsteady (Dam/Levee breach):** The default growth shape was changed so that the vertical erosion rate is equal to the horizontal erosion rate for HEC-RAS Version 5.0. Version 4.1 used different erosion rates for vertical vs horizontal growth, and was computed to get to the maximum depth and width at the same time. This change can make a big difference to the computed peak flow vs the HEC-RAS Version 4.1. If users need to reproduce the Version 4.1 results, then the vertical/horizontal growth rate ratio can be specified.
54. **Steady Flow (Supercritical/Mixed Flow):** For supercritical flow, the reported friction loss was the friction loss between the current cross section and the upstream cross section (instead of the current and the downstream). This same issue also applied to reported headloss, friction slope and contraction and expansion losses. This was an output problem, and not a computational issue.
55. **Sediment (Exner5/Partheniades):** For the Exner5 bed mixing option, when using the Krone/Partheniades option, if the given cross section has more than 10% clay that was a bug that could artificially limit the amount of erosion or prevent erosion altogether.
56. **Unsteady (Post Processor):** Setting the Detailed Output Interval to "Max Only" did not work correctly. (Post processor would not run.)
57. **Unsteady (Warmup):** The program previously did at least one warmup time step (even if number of warmup time steps was set to zero). This is no longer the case. If the number of warmup time steps is set to zero, the initial results/output (at time zero) are from the initial steady flow backwater.
58. **Unsteady (Flow vs. Roughness):** The flow roughness factors for negative flows (reverse flows) was not correct. The program will now take the absolute value of the flow before performing the roughness lookup.
59. **Unsteady (Flow Roughness):** If the flow was smaller than the first value in the table (the first value was not zero) then the program was transitioning the roughness to 1.0 (no change) as the flow went to zero. Instead, it now uses the bottom value in the table, and not transitioning.
60. **Steady/Unsteady (Rating Curve on Lateral Structure):** The distance field on the lateral rating curve (for a lateral structure) was not being used correctly. It is now being used (and the value is based on the lateral structure stationing not the distance to the upstream cross section).

61. **Unsteady (SA Connector with Breach):** If a storage area (SA) connection had a breach and the SA connector was set to "Compute Using Curves" the breach was being ignored.
62. **Unsteady (Pump Rules):** For the advanced pump rules (these are the rules specific to pumps, not the general Advanced Rules), there was a bug if a day of month was entered as a single digit. For example, "1Jan2012" would not work, but "01Jan2012" would work.
63. **Sediment (Concentration):** The sediment concentration output was wrong. This issue has been fixed.
64. **Unsteady (Navigation Dam):** The option to use both hinge control and pool control was sometimes not working.
65. **Steady and Geometric Preprocess (Bridges/Culverts):** Cross sections with ineffective flow areas can have multiple critical depths. The program was sometimes not using the best answer. The most likely situation that this bug would show up is for the unsteady flow preprocess internal boundary curves where the curve suddenly "shot up" for no apparent reason.
66. **Unsteady (IB Stage/Flow at Inline Structure with Elevation Controlled Gates):** When using the (internal boundary) IB Stage/Flow option at an inline structure to force a known stage or known flow, the program will now operate the gates in order to match the gate opening to the forced stage or flow. When the user entered IB Stage/Flow "runs out", the program will revert to "normal" gate flow for the inline structure. For the case where the inline structure is using elevation controlled gates (as opposed to time series gates), the gate openings should match the flow condition when the IB runs out.
67. **Preprocess/Unsteady (HTAB Points):** The number of allowable points in the cross section lookup tables has been increased to 500.
68. **Converting Bridge to Cross Sections with Lids is No Longer Supported:** This option was causing stability problems in some unsteady flow models. For the next Version it was determined that computing the bridge curves was a much better option.
69. **Unsteady (Inline Culvert Flap Gates):** For culverts in an inline structure, the positive flap gate option was not working correctly.
70. **Unsteady/Steady (Lateral Structure Crossing Bridge):** A lateral structure that crossed a bridge showed flow leaving the river between the bridge sections when in fact flow was not being removed from the river. No lateral structure flow is removed between the bridge sections and the output now reflects this.



71. **Unsteady (Culvert/Encroachments):** For unsteady flow, encroachments adjacent to culverts were not working correctly causing the internal boundary curves to be incorrect.
72. **Unsteady Flow (Ungaged Area Computations):** If the pre-processor was run by itself, then unsteady was run by itself and that unsteady plan had ungaged areas, then the ungaged option may not work correctly.
73. **Unsteady Flow (Ungaged Area Computations):** If the gage for an ungaged area was next to a lateral structure that had user specified intersections, there was a problem with the unsteady flow computations.
74. **Unsteady Flow (Lateral Structures):** The computations (derivatives) for highly submerged lateral structures was adjusted for speed and stability. This may cause differences in answers for some data sets.
75. **Unsteady Flow (Ungaged Area Computations):** If the ungaged area option was used with a data set that had time slicing (and this includes the "Flow Monitor" on hydrographs) a bug would result.
76. **Unsteady Flow (IB Stage/Flow):** The internal boundary flow (IB stage/flow hydrograph) option was not using the user specified flow during the initial backwater.
77. **Unsteady Flow (SA to SA Connector):** The interpolation methodology was changed from a horizontal to a vertical method.
78. **Unsteady Flow (HTAB):** A bug in how the curves transitioned from open flow to pressure flow. (Subroutine HBS\_LIM3)
79. **Unsteady Flow (Lateral Structure):** The user specified cross section intersections did not work for some data sets.
80. **Unsteady Flow (SA Connector with Culvert):** There was a bug for when the invert of a culvert was higher than the low point in the weir.
81. **Unsteady Flow (DSS Hydrograph Output):** Monthly DSS hydrograph output was not being output correctly to DSS.

## Support Policy

Technical support for program users within the Corps of Engineers is provided through an annual subscription service. Subscribing offices can expect full support from HEC staff in the routine application of the program. Users are strongly urged to consult with HEC staff on the technical feasibility of using the program before beginning a project with unique requirements. Extended support for large or complex projects can be arranged under a separate reimbursable project agreement.

Reporting of suspected program errors is unrestricted and we will reply to all correspondence concerning such errors. We are continuously working to improve the program and possible bugs should always be reported. Reports should include a written description of the steps that lead to the problem and the effects that result from it. If we cannot reproduce the reported problem, we may ask you to send a copy of your project.

Report program errors through the following channels:

- Go to our web site at [www.hec.usace.army.mil](http://www.hec.usace.army.mil) then go to the HEC-RAS support page.
- Send email to [hec.ras@usace.army.mil](mailto:hec.ras@usace.army.mil) on the internet.
- Write to:  
U.S. Army Corps of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, CA 95616 USA.