



RELEASE NOTES FOR BRCH GUI (BRCH-J)

Version 2-0-0 05-14-2018

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Homepage: <http://rivermechanics.net>

Application Description

The National Weather Service (NWS) developed a procedure for predicting the breach characteristics and the outflow hydrograph emanating from a breached earthen dam. The procedure known as the Breach Erosion Model (NWS BREACH) computes the shape of the dam breach opening, the time of failure, the outflow hydrograph, and the tailwater elevation hydrograph. The original FORTRAN code was developed in 1984 with the last major enhancement in 1991. A theoretical description of the model is in the NWS BREACH documentation¹.

NWS developed a JAVA Tool (BREACH GUI) which may be used to create the input data file, run it through the BREACH application, display an animation of the dam breach formation, and display the hydrographs and rating curve graphically. Although it was developed in 2004, BREACH GUI was never officially released. The last beta release was in 2005.

BRCH Release Version

The last official release of the NWS BREACH model was in 1999. Although the source code is that of the 1999 version, the executable in the NWS package is actually the 1997 version of the NWS BREACH model. Refer to the BRREAD.ME file in the NWS bundle to see the differences between the two versions. The results for some data sets may vary slightly between the two models.

In 2010, the RiverMechanics Group (RM) changed the name of Breach Erosion Model from NWS BREACH to BRCH (Version 1-0-0) because it is not affiliated with NWS. The source code in BRCH (2010) is identical to the code in NWS BREACH (1999) with the exception of changes noted below. NWS BREACH and BRCH Version 1-0-0 produce the same results

Version 2-0-0 of the Breach Erosion Model (BRCH) is available for release. The changes made to this version may result in noticeable changes in the output when compared to NWS BREACH and BRCH (2010). This is due to corrections made as stated below. BRCH Version 2-0-0 has been extensively tested using over 50 datasets and is more robust than any version of the BREACH model since its development.

All release versions of BRCH have been tested and compared to the results of NWS BREACH (1999).

Changes in BRCH Version 2-0-0

The following changes have been made to the FORTRAN code since the 2010 release.

Surface Area (RSA) vs. Elevation (HSA) Table – There was a bug in the code when the table contained eight values. There was also a problem when the table had less than 8 values and the computed water level was below the minimum elevation that was read-in. This resulted in a spillway flow half of what it should have been. The bugs have been fixed by assigning a size (NHSA) to the table array. Now the correct flow is computed.

Top Width (BSTW) vs. Elevation (HSTW) Table – There was a bug in the code when the table contained eight values. There was also a problem when the table had less than 8 values and the computed water level was beyond the range of the table. This bug was fixed by assigning a size (NCS) to the table array. Now, the computed cross section properties are correct.

Maximum Breach Bottom Width (BMX) – The maximum breach width is set to the dam crest length when a negative value is computed.

Computed Tailwater Elevation (TWD) – The tailwater elevation was not computed when the reservoir was in fill mode (KG = -1). The code has been modified to allow the tailwater elevation to be computed if there is spillway flow. Also, the algorithm to compute tailwater elevation under all conditions has been enhanced.

Piping Failure Algorithm Changes – An error was found in the computation of the breach length (PPP) and depth of breach (HP) after a piping breach collapse. Although these changes result in more accurate computations of these parameters, there is little change in the peak outflow. Also, the reservoir is now allowed to fill when the water level is below the bottom of the breach (which acts like a newly formed dam).

Time Step Limits – The minimum computational time step (DTH) is set to 0.0001. The maximum time step for reservoir filling (DTHFIL) is set to 0.5. If the inflow hydrograph is steady-state, then DTHFIL is set to 0.5.

Average Internal Friction Angle (AFRA) – This parameter now prints out correctly. It was erroneously printing out a value of zero.

Metric Option – The input and output may now be displayed in metric units. The input parameters (in metric units) are converted to English units for computations. Although the computations are done in English units, all output information, including debug information, is displayed in metric units.

gFortran90 Compiler – The code has been modified to be gFortran90 compliant. This includes initializing parameters, changing read/write statements, and formatting. These improvements allowed several data sets to run to completion which previously would not do so.

Cosmetic Changes – Headings have been added to the debug output. The format fields and spacing have been increased in the output table. The format field for the DBG input parameter has been increased. Excess headings for the output, when DBG=0.001 and TPR>0, have been removed.

BRCH-J Release Version 2-0-0

In 2010, the BREACH GUI (BREACHJ) was released as developed at NWS. Since it is not affiliated with NWS, the name of the GUI in the latest version (2-0-0) has been changed to BRCH-J to be consistent with the BRCH application. Major changes have been made to the GUI; however the results have not been impacted except for changes in the animation views as noted below. BRCH-J has been extensively tested using the BRCH datasets and is more robust and representative of the theoretical assumptions than the version developed at NWS.

Changes to BRCH-J

The following changes were made to the BRCH GUI since the 2010 release version.

- **Metric Option** – The input and output may be displayed in metric units.
- **Failure Regions** – All failure regions (KG) are included in the animation.

- ***Animation*** – The animation views in the output component of the BRCH GUI have been overhauled to better reflect the BREACH application’s representation of a breach failure. The water surface is allowed to attenuate throughout the breach process. Backwater affects are also represented. The previous version assumed a horizontal water surface throughout the breach progression.

Known Bugs

- ***Short-Cut Arrow Keys*** – In the BRCH-J animation, the arrow keys may be used along with the slider bar to control the animation after the PAUSE button has been selected. The up arrow and right arrows cause the animation to move forward in time. The down arrow and left arrows cause the animation to move backward in time. When the slider bar is pushed all the way to the right, it does not show the end of the simulation because of a bug. The work-around is to go back in time a few steps using the arrow keys and hit the RESUME button.
- Directory names accessed by the program cannot have spaces in them.

System Information

Operating Systems – Windows 2000, XP, Vista, Windows 7-10. Windows processor can be 32-bit or 64-bit.
Linux Fedora 27 with 64 bit processor.

Language – Java 1.8+

Default Directory – C:\RiverMechanics\BRCH-J for Windows or ~/RiverMechanics/BRCH-J for Linux

Windows Installation Instructions

The installation package for BRCH-J Version 2-0-0 (brchjInstall-050118.exe) can be downloaded from the RiverMechanics.net website. When executed, the Install Shield will copy the files in Tables 1 & 2 into the c:\RiverMechanics\BRCH-J folder. The user has the option to change the path. If the path is changed, the brchGUI.bat file must be manually modified to reflect the new path location. A shortcut (BRCH GUI) is placed on the desktop. The user must have JAVA installed on their computer in order to run the BRCH GUI.

Linux Installation Instructions

To install BRCH-J Version 2-0-0, do the following:

1. Download the brchj-installation-Linux-051418.zip file from the RiverMechanics.net website.
2. Unzip the linux-installation-051418.zip file which contains the .sh installation shell script file.
3. Open a terminal window, and change to the directory containing the .sh file.
4. Type “. brchjLinuxInstall051418.sh” (*Note: there is a space after the dot*).
5. BRCH-J will be installed in the root folder ~/RiverMechanics/. All the files in Tables 1 and 3 will be copied to the BRCH-J folder. If the root folder is changed, it must be created prior to running the shell script.
6. A BRCH-J icon will be placed on the desktop.

- To run the program, double-click on the icon. A “Untrusted Application Launcher” message will pop up. Select the “Trust and Launch” option, and the **BRCH GUI** image will appear on the desktop. The BRCH GUI will also open.

Table 1. Files within the Installation Package (Common to Both Windows & Linux)

<ul style="list-style-type: none"> • <i>brchGUI.jar</i> – Java archive file for BRCH-J application • <i>brchGUI.ico</i> – BRCH-J icon • <i>BRCH GUI User’s Guide.pdf</i> – this file • <i>BRCH GUI Release Notes 051418.pdf</i> – release notes for BRCH and BRCH-J • <i>BRCH Input Summary.pdf</i> – updated Input/Output summary which was extracted from the NWS BREACH paper (<i>breach.pdf</i>) • <i>breach.pdf</i> – the last NWS BREACH documentation • <i>BRREAD.ME</i> – text file containing history of changes to NWS BREACH 	<ul style="list-style-type: none"> • <i>Example Input Files</i> <ul style="list-style-type: none"> ▪ <i>Bsmbot2.dat</i> ▪ <i>Clay.dat</i> ▪ <i>Lawn.dat</i> ▪ <i>Peru.dat</i> ▪ <i>Redrock.dat</i> ▪ <i>Teton.dat</i>
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Table 2. Additional Files within the Windows Installation Package

<ul style="list-style-type: none"> • <i>brch-jinstall-51418.exe</i> – Installation program • <i>brch-x32.exe</i> – Fortran executable for BRCH application (32-bit) • <i>brch-x64.exe</i> – Fortran executable for BRCH application (64-bit) • <i>brchGUI.bat</i> – batch file to execute BRCH-J

Table 3. Additional Files within the Linux Installation Package

<ul style="list-style-type: none"> • <i>brchj-installation-Linux-051418.zip</i> – Compressed file containing common files (.zip) and installation program (.sh) • <i>brchjLinuxInstall051418.sh</i> –Shell script to install BRCH-J • <i>brch-j-linux-installation.zip</i> – Contains files common to Windows & Linux and the BRCH executable • <i>brch-lx</i> – Fortran executable for BRCH application

Acknowledgements

The initial development of the BREACH GUI was done by members of the River Mechanics Group at the National Weather Service Office of Hydrology in 2004 under the direction of Janice Sylvestre. The key developers of the BREACH model were Dr. Danny Fread and Janice Sylvestre. The NWS ceased developing BREACH after 2005.

Warranty

There is no warranty (implied or otherwise) associated with BRCH-J or BRCH. The software is made available as-is. The developer is not responsible for the results generated by the application.

HISTORY (Changes in Previous Releases)

The following represent all changes made to NWS BREACH (1999) up to the BRCH Version 1-0-0.

Changes to BREACH (brch.exe) (August 2010)

All of the algorithms in brch.exe are identical to the algorithm in the 1999 version of BREACH with the exception of those changes noted below. Some cosmetic changes were also made. When comparing the output files of 1999 version and the current version (2010) of the BREACH model, the results in the hydraulic table are the same. The user may see slight differences in formatting when compared to the NWS version of BREACH. The name of the executable file has been changed from breach.exe to brch.exe to distinguish it from the NWS application. The following changes were made to the FORTRAN code.

- **Breach Outflow** – If the tailwater elevation exceeds the pool elevation the breach outflow is set to zero. Previously, the model would blow-up because of a negative head used in the breach outflow equation.
- **Format Change** – The field for the area-elevation curve has been increased from 10 digits to 12 digits in the output file. This allows the user to have surface areas in excess of 100 million acres. Previously, the output would display “*” in the fields. Also, a deliberate space has been added between each parameter in the output table to ensure the values of the parameters do not run together.
- **Initial Tailwater Elevation** – The initial tailwater elevation (TWD) has been set to the bottom elevation of the cross section. Previously, TWD was erroneously defined as a depth rather than as an elevation.

Features in BREACHJ (August 2010)

The following enhancements have been added to BREACHJ.

- **Input GUI** – The BREACH GUI allows the user to enter the data in a simple, easier way. A detailed description of the input parameters is in the BREACH documentation (breach.pdf). There is also a graphical display of some of the input data (i.e., inflow hydrograph, area-elevation curve, cross section, and spillway rating curve).
- **Output GUI** – After reading in or creating the input file, the BREACH GUI will run the BREACH application (brch.exe) and generate the output file with a “.out” extension. It will then generate an animation of the dam breach showing the breach opening as well as display the outflow hydrograph, the tailwater elevation hydrograph, and the rating curve. The user may pause the animation and replay any position of the breach. The Output GUI will also produce an Output Display Panel which shows the finalized graphs and table view in the Breach Animation.