

FEQinput—An Editor for the Full Equations (FEQ) Hydraulic Modeling System

Introduction

The Full Equations Model (FEQ) is a computer program that solves the full, dynamic equations of motion for one-dimensional unsteady hydraulic flow in open channels and through control structures. As a result, hydrologists have used FEQ to design and operate flood-control structures, delineate inundation maps, and analyze peak-flow impacts. To aid in fighting floods, hydrologists are using the software to develop a system that uses flood-plain models to simulate real-time streamflow.

Input files for FEQ are composed of text files that contain large amounts of parameters, data, and instructions that are written in a format exclusive to FEQ. Although documentation exists that can aid in the creation and editing of these input files, new users face a steep learning curve in order to understand the specific format and language of the files.

FEQinput provides a set of tools to help a new user overcome the steep learning curve associated with creating and modifying input files for the FEQ hydraulic model and the related utility tool, Full Equations Utilities (FEQUTL). The current capabilities of FEQinput include

- displaying descriptions of lines of file input,
- searching for a given string of text within an opened file,
- navigating large files with block buttons that allow users to jump to a specific section of the file,
- single line and multiline tools editing of the text files that update the display descriptions,
- saving new input files or modifying existing ones, and
- automatic running of the respective program with the input file and simultaneous display of the output.

These capabilities are discussed in the following sections.

Loading Files

The user loads a file to FEQ or FEQUTL by opening an input file, modifying, saving the changes, and then running the input file in the chosen program. These processes are described in the sections below.

Opening FEQinput

The FEQinput application contains a main panel and a sidebar panel (fig. 1). FEQ and FEQUTL input files are displayed in the main panel, and a description of the selected line of the input file is displayed in the sidebar panel. To open an input file, a user will click the File menu and then click on Open .FEQ file for an FEQ file or Open .FTL file for an FEQUTL file. Not all input



Figure 1. The FEQinput interface has the main panel (left) and a sidebar (right).

files will have an .feq or .ftl extension, so in the case of a different extension, select All Files from the file selection dropdown menu (fig. 2). After a file is opened, its path and filename will be displayed in the bottom-right corner of the program interface.

Reading Input Lines

After a file is opened, its contents will be displayed on the left-side table in the program interface (fig. 3). The table contains three columns: the line number, a code for each line, and the contents of each line. The code is a small combination of alphanumeric characters that FEQinput uses to identify and interpret the contents of a line. The code column can help the user find lines that the program cannot read, such as code: NOREAD, and fix any mistakes within those lines.

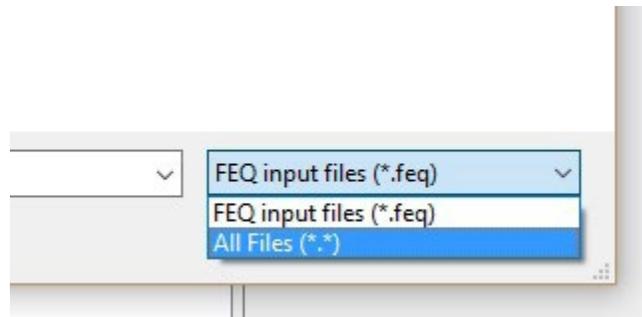


Figure 2. Example of choosing which type of file to open.

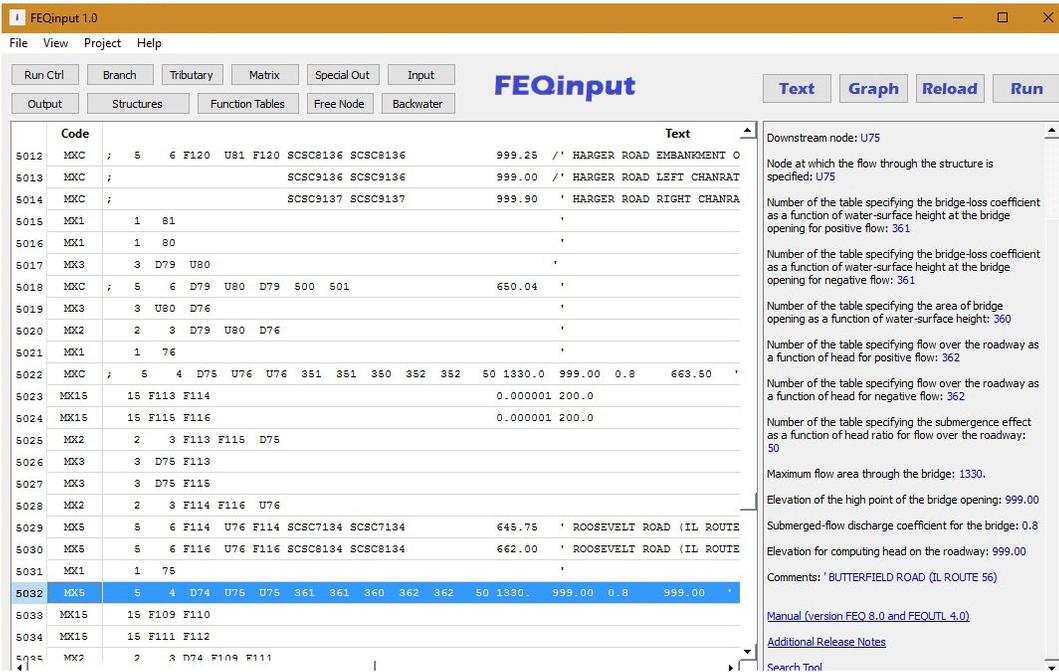


Figure 3. FEQinput interface with opened file. The left side displays the input file while the right panel displays definitions and parameters of the selected (blue) line.

The contents of each line of the input file are displayed in the third column. Each line of the input file is placed on a table row. To have FEQinput interpret the contents of a line, the user can click on the desired line. A description of the contents of the line (such as FEQ command name or user input values), along with definitions and parameters, is displayed on the right side of the main FEQinput window (fig. 3). A link to the online FEQ or FEQUTL manual is also available. When input files are reopened or reloaded, the table columns may automatically resize to fit the visible rows. The table columns can be resized by dragging the column headers.

Navigating and Searching in Files

While some input files can be as short as a few hundred lines, other files can range from thousands to tens of thousands of lines. To expedite navigation through these files, FEQinput includes several navigation options in addition to the scrollbar or the arrow keys. For FEQ files only, the program provides navigation buttons at the top left corner of the window (fig. 4). When clicked, these buttons navigate to a specific section of the input file. If the input file does not contain a section, the button for that particular section is disabled.

Another way to navigate within the input files is to do a search. The search bar, which is located at the bottom left corner, provides an easy way to find a desired line of input, such as section headers, parameters, or comments (fig. 5). To use the search feature, type the desired phrase and click on search. For FEQ files only, a dialog with extra options will open with the option to search within a block. This option limits the search to only a specific section of the file. The search is not case-sensitive.

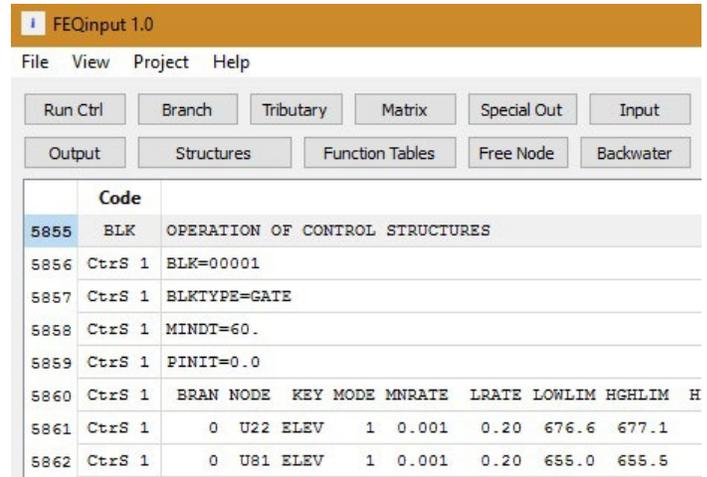


Figure 4. Navigation buttons for FEQ files.

Editing Files

In addition to helping the user understand the contents of an input file, FEQinput allows the user to modify the file and see how the modifications will be interpreted by FEQ or FEQUTL. The file can be modified by using single line or multiline editing.

Single-Line Editor

A single line is edited directly in the display table (fig. 6). To edit a single line, the user can double-click on it. After the line's contents are modified, FEQinput will interpret the changes when the user presses the enter key and selects the line again. If the modified line does not provide the required or expected results, the user can reload back to the previous version of the line. A user can initiate reload in three ways: by clicking the

5872	CtrlS 3	BLK=00003
5873	CtrlS 3	BLKTYPE=GATE
5874	CtrlS 3	MINDI=60.0
5875	CtrlS 3	PINIT=0.0
5876	CtrlS 3	BRAN NODE KEY MODE MNRATE LRATE LOWLIM HGH LIM HRATE LPRI NPRI HPRI DPDT
5877	CtrlS 3	0 U22 ELEV 1 0.001 0.20 676.0 676.5 0.50 1
5878	CtrlS 3	0 F32 ELEV 1 0.001 0.20 680.0 680.5 -2.00 3

Find this text

Figure 5. The search bar is in the bottom left corner of the program window.

to editing a file in Windows Notepad. To load the multiline editor, the user must click on the Text button in the top right corner (fig. 7) or select multiline text from the View menu. After editing the text file using the multiline editor, the user must click on the Apply Edits button at the bottom right corner of the editor to load the changes into the main table to display and interpret the modified text. This function is useful for copying and pasting large lines of text or adding or removing lines from the input file.

Saving Files

If the user is satisfied with the changes made to the input file, the user can save the changes into the original file by selecting Save from the File menu or by pressing CTRL+S. If the user prefers to have different files of the different versions, the user can save the changes into a new file by selecting Save As from the File menu or by pressing CTRL+SHIFT+S.

It should be noted that even though changes are made to an input file and the model is run or reloaded through FEQ or FEQUTL, these changes will not be written into the file until the user chooses to save the file. This enables testing of the changes prior to committing to those changes.

Running Models

Once an input file is properly modified or inspected, the user can run this file with FEQ or FEQUTL by clicking the Run button at the top right corner, or by selecting Run from the Project menu, or by pressing CTRL+R. If the program runs correctly, the model output will open in a new window (fig. 8). This output is saved in the same

folder as the FEQinput executable with the name “output.” For a model to run correctly, the FEQinput executable file should be in the same directory as the FEQ or FEQUTL executable files. For FEQUTL, the executable files also must be located in the same directory as the input file.

Additional Information

FEQinput does not require administrative privileges to install and run. To install the program, the user can download the installation package and double-click on the file named “feqinput.msi.” The installation package is available at <https://il.water.usgs.gov/proj/feq/software/feqinput/>. FEQinput supports input files for any version of FEQ and FEQUTL, but it works best on files made for FEQ version 10.61 or higher. Formatting inconsistencies and errors in files may prevent FEQinput from functioning as intended.

Run Ctrl Branch Tributary Matrix Special Out Input

Output Structures Function Tables Free Node Backwater

FEQinput

Code	Text
5855	BLK OPERATION OF CONTROL STRUCTURES
5856	CtrlS 1 BLK=00001
5857	CtrlS 1 BLKTYPE=GATE
5858	CtrlS 1 MINDI=60.
5859	CtrlS 1 PINIT=0.0
5860	CtrlS 1 BRAN NODE KEY MODE MNRATE LRATE LOWLIM HGH LIM HRATE LPRI NPRI HPRI DPDT
5861	CtrlS 1 0 U22 ELEV 1 0.001 0.20 676.6 677.1 0.50 2 2 4 0.5
5862	CtrlS 1 0 U81 ELEV 1 0.001 0.20 655.0 655.5 0.50 1 1 3 0.5
5863	CtrlS 1 0 F58 ELEV 0 0.00 0.00 660.0 667.5 -2.00 1 1 1 1.0
5864	CtrlS 1 -1
5865	CtrlS 2 BLK=00002
5866	CtrlS 2 BLKTYPE=GATE
5867	CtrlS 2 MINDI=60.
5868	CtrlS 2 PINIT=1.0
5869	CtrlS 2 BRAN NODE KEY MODE MNRATE LRATE LOWLIM HGH LIM HRATE LPRI NPRI HPRI DPDT
5870	CtrlS 2 0 F58 ELEV 0 0.00 0.00 660.0 667.5 -2.00 1 1 1 1.0
5871	CtrlS 2 -1
5872	CtrlS 3 BLK=00003
5873	CtrlS 3 BLKTYPE=GATE
5874	CtrlS 3 MINDI=60.0
5875	CtrlS 3 PINIT=0.0
5876	CtrlS 3 BRAN NODE KEY MODE MNRATE LRATE LOWLIM HGH LIM HRATE LPRI NPRI HPRI DPDT
5877	CtrlS 3 0 U22 ELEV 1 0.001 0.20 676.0 676.5 0.50 1 1 3 0.5
5878	CtrlS 3 0 F32 ELEV 1 0.001 0.20 680.0 680.5 -2.00 3 3 1 1.0

Figure 6. An example of the single-line editor.

reload button at the top right corner, selecting Reload from the Project menu, or by pressing CTRL+SHIFT+R. The single-line edit functionality is easily understood and used by first-time users or for modifying simple parameters. It is important to note that because the FEQ format alternates between using spaces, variable types, headers, and code words as part of the formatting parameters, the user must keep in mind the position, number of characters, and variable-type of the object when editing a line.

Multiline Editor

The second form of editing input files is done via a multiline editor. This tool allows users to edit the input text file in its raw format through a simple text editing interface. This is similar

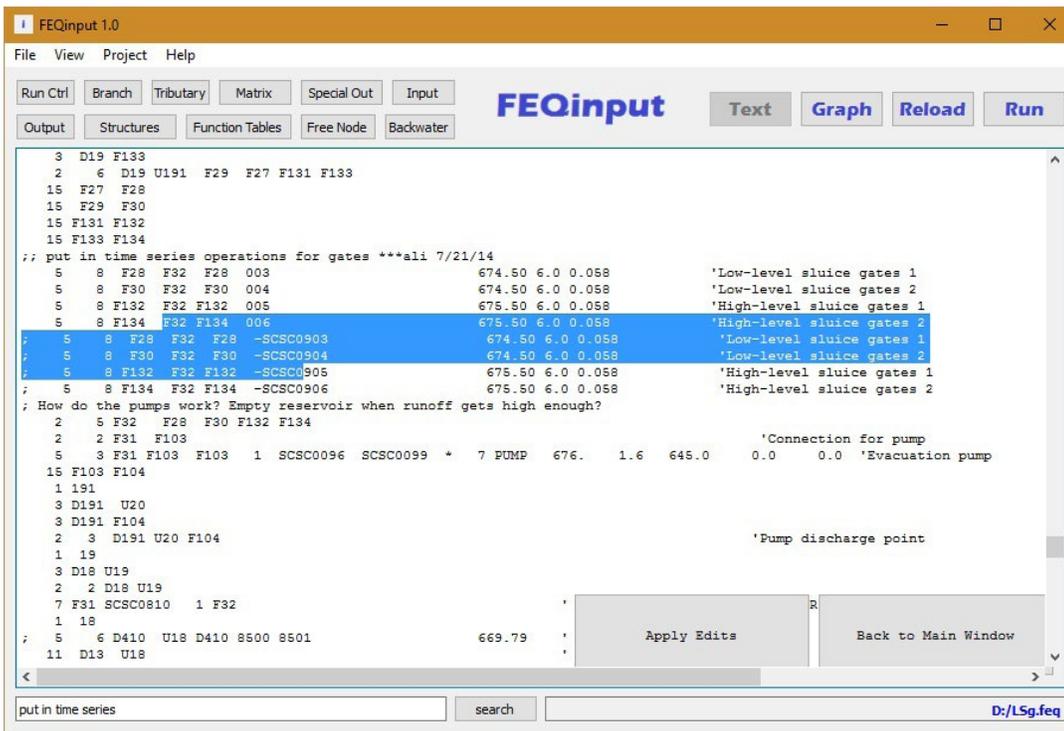


Figure 7. An example of the multiline editor.

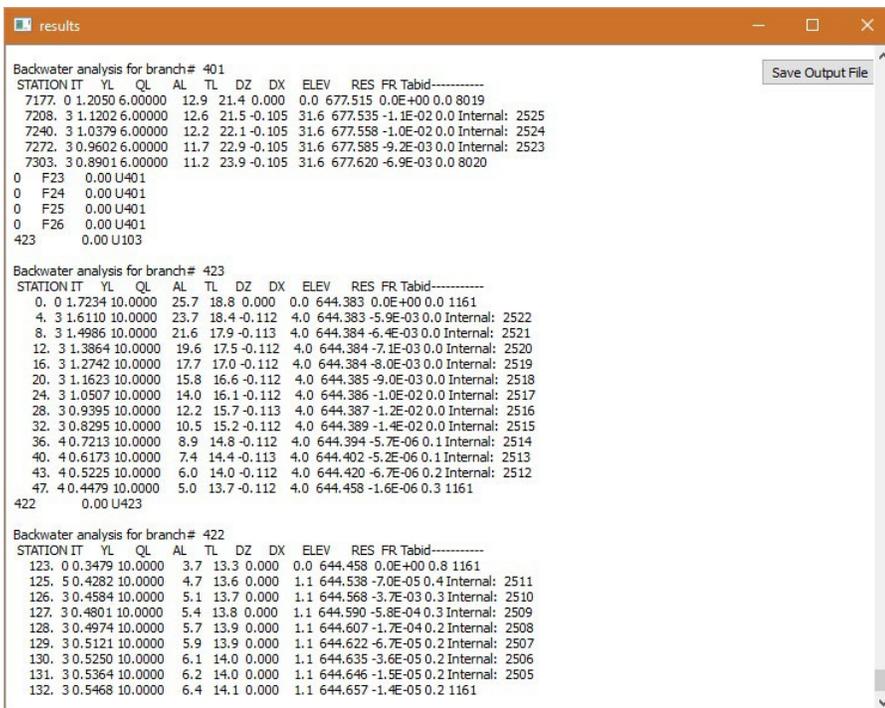


Figure 8. An example model output file.

Summary

Both new and experienced users can benefit from the capabilities of FEQinput. Different ways to edit input files give the user enough flexibility to work at any desired pace. FEQinput provides a simple and quick solution for users to work with to become familiarized and experienced with FEQ models.

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