FTABLE-BUILDER TUTORIAL

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FOREWARD

FTABLES are commonly known as hydraulic function tables are depth-area-volume-flow relationships that represent natural and engineered channel cross-sections. HSPF users can build FTABLES for free-flowing natural channels or storm sewers using the HSPF BMP Tool. To build complex FTABLES that represent low impact development (LID) practices, we added FTABLE Builder to the HSPF BMP toolbox. Unlike other HSPF BMP Tools, FTABLE Builder does not calculate FTABLES using channel shapes and dimensions, but it provides users with the flexibility to build FTABLES by joining FTABLES calculated with the GRAY Tool or FTABLES calculated with the GREEN Tool. For example, if a user wants to build an FTABLE for a relatively large natural channel, the user can use the GRAY Tool. However, if the user wants to build an infiltrating channel, the user must use the GRAY tool to build parts of the FTABLE, but needs to estimate infiltration using the GREEN tool. To join FTABLE parts calculated with the GRAY and GREEN tools, users must use the FTABLE Builder. In addition to allowing users to build FTABLES using components calculated by the GRAY and GREEN Tools, the FTABLE Builder also allows users to edit FTABLES and ensure that FTABLES built with the FTABLE Builder fit in the UCI file without issues.

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1. INTRODUCTION

The FTABLE Builder tool was developed to add additional functionality for calculating total flow obtained from different control structures in FTABLES created from using HSPF BMP Toolkit (HBT) tools.

The tool was developed to overcome the following issues related to HBT tools:

- To calculate total flow from all or few control devices.
- To calculate total flow from multiple control devices of same shape located at different elevations.
- To create FTABLES with user specified data (such as data from excel)

The tool users can upload data in two different formats- UCI File format obtained from HBT tools (**Figure A1-Appendix A**), and column format (**Figure A2- Appendix A**).

2. WORKING WITH THE TOOL

This section details the steps involved to calculate total flow obtained from different control structures (selected by user) and to create modified FTABLES using data obtained from HBT tools or user specified column format data.

Note: *Whenever a different Source data/type option is selected on the main window, all data on the table is cleared.*

Using the tool with FTABLE data obtained from HBT tools is first discussed followed by using column format data.

2.1. UCI File Format or FTABLE data obtained from HBT tools

In this section, calculation of total flow from different control structures or from multiple similar shape structures located at different elevations will be discussed using data obtained from HBT Tools.

In the current example, data is obtained from the Storage BMP/ GRAY Tool, which can be accessed at following link:

http://www.epa.gov/athens/research/HSPFWebTools/gray/index.html

2.1.1. Calculating total flow for different control structures

Input data is obtained using a Circular channel with 3 different control structures (V-Notch weir, Broad Crested and Trapezoidal weir). Total flow will be calculated under the assumption that flow obtained from V-Notch and Broad Crested weirs is combined, however, flow from a Trapezoidal weir has to be in visible in FTABLE.

Step 1: Open/Run the tool.

Step 2: Select Source Data/Type to be handled i.e., **"FTABLE UCI Format"** for the current example **[Figure 1]**.

Step3: Click **Import Data button [Figure 1]** to open Import Data Window **[Figure 2]**.

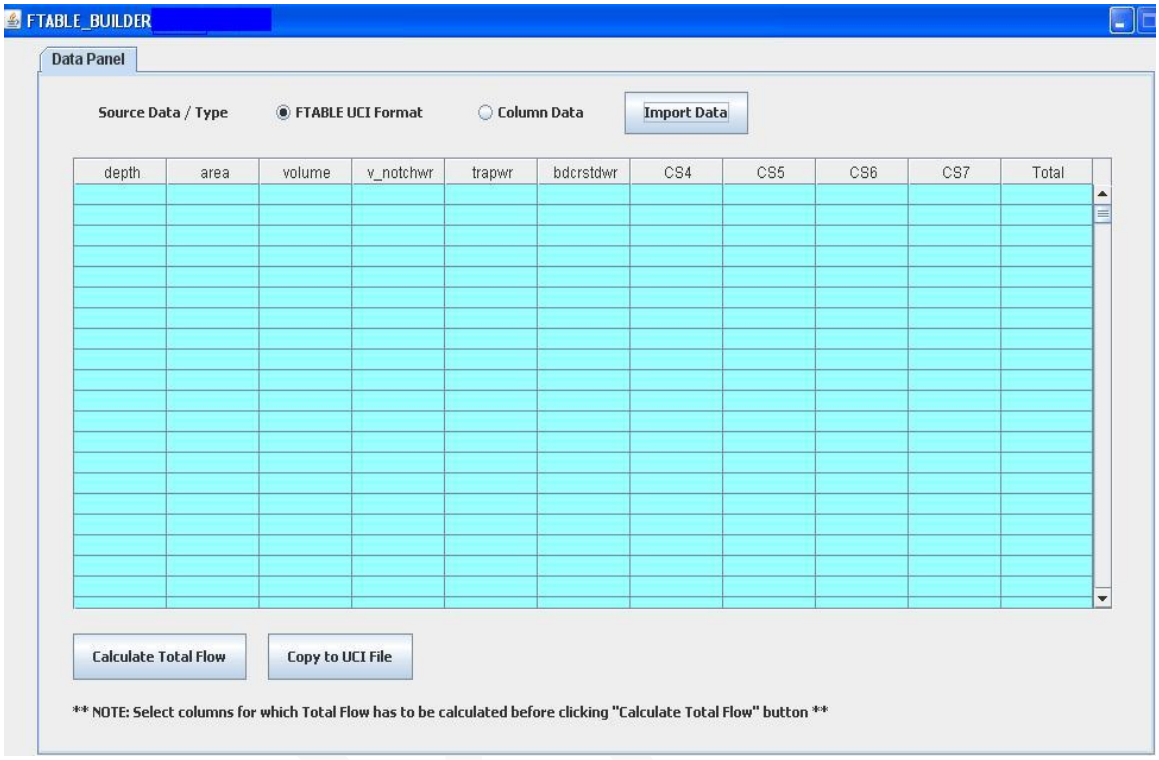


Figure 1: Main Page

Step 4: Paste the UCI format data (or data obtained from GRAY Tool **[Figure 2]**. Select **Export all columns radio button [Figure 2].**

Step 5: Click **Import Data button [Figure 2]** to import the data columns into the table on the **Main Page [Figure 3]**.

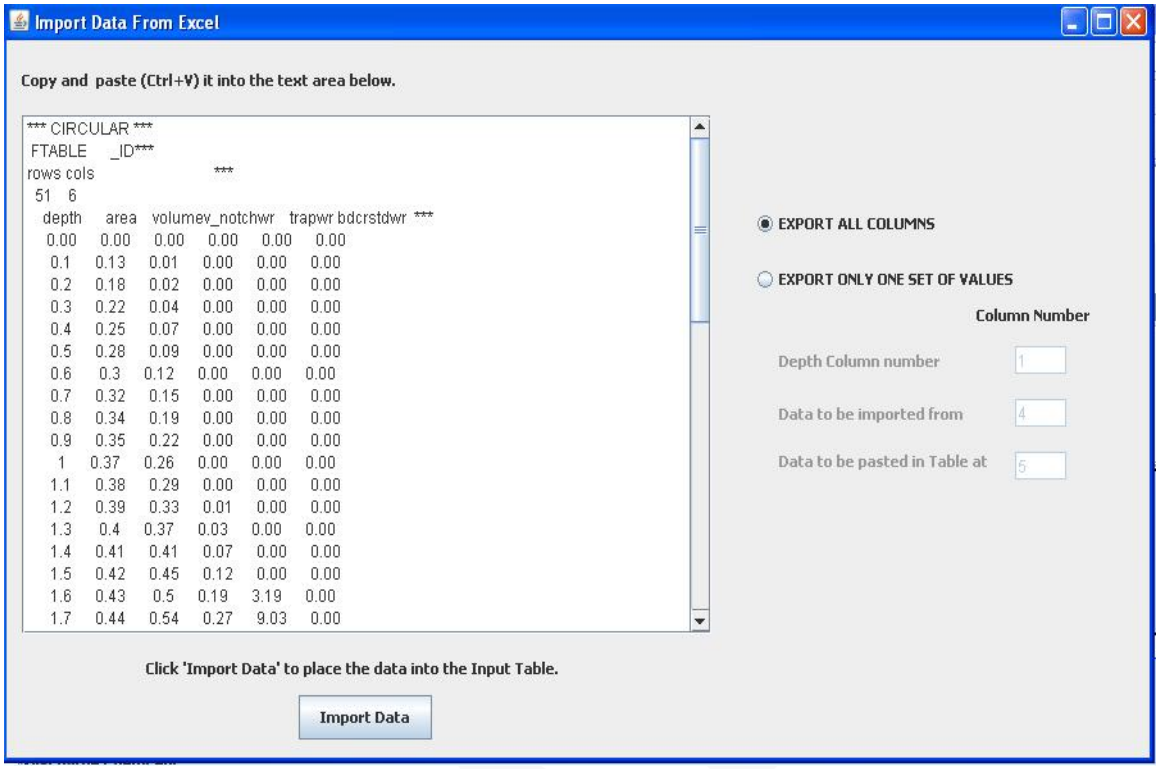


Figure 2: Import Data window

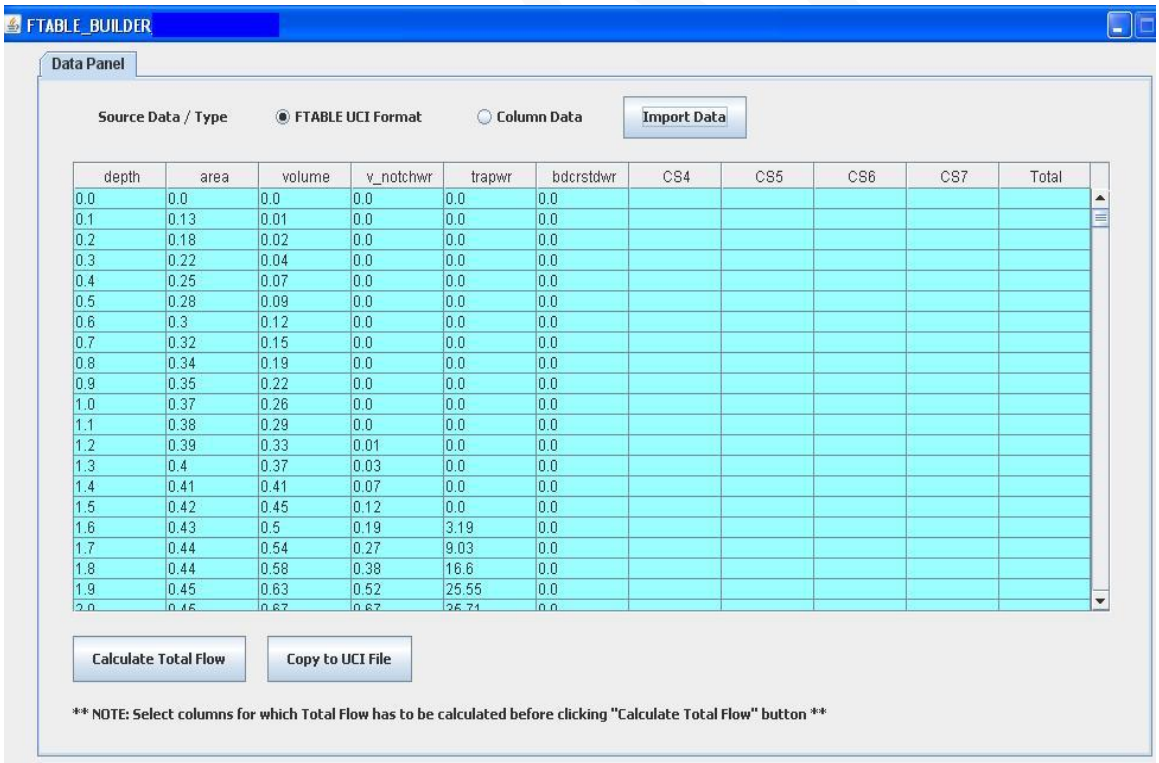


Figure 3: UCI Format data imported

Step 6: Select columns for which the total flow has to be calculated i.e., flows from trapezoidal and broad crested weirs **[Figure 4]**.

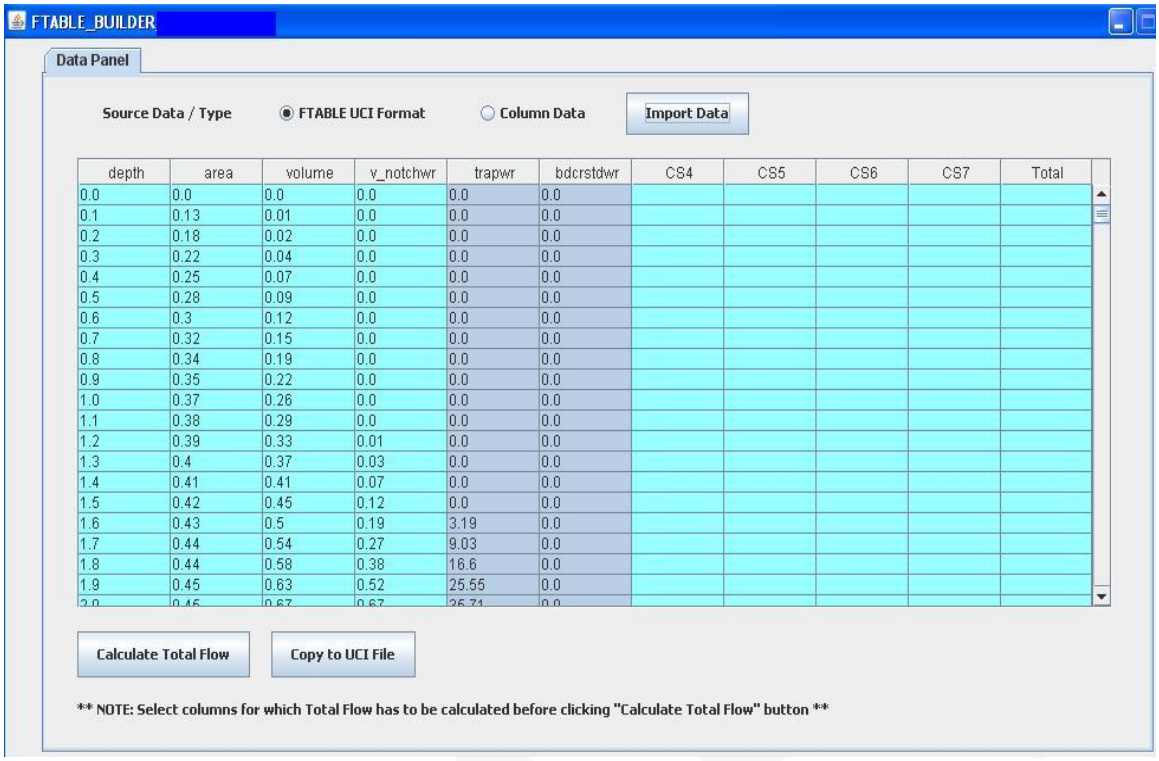


Figure 4: Selection of columns for calculating total flow

Step 7: Click **Calculate Total Flow button [Figure 4]** to calculate total flow **[Figure 5]**.

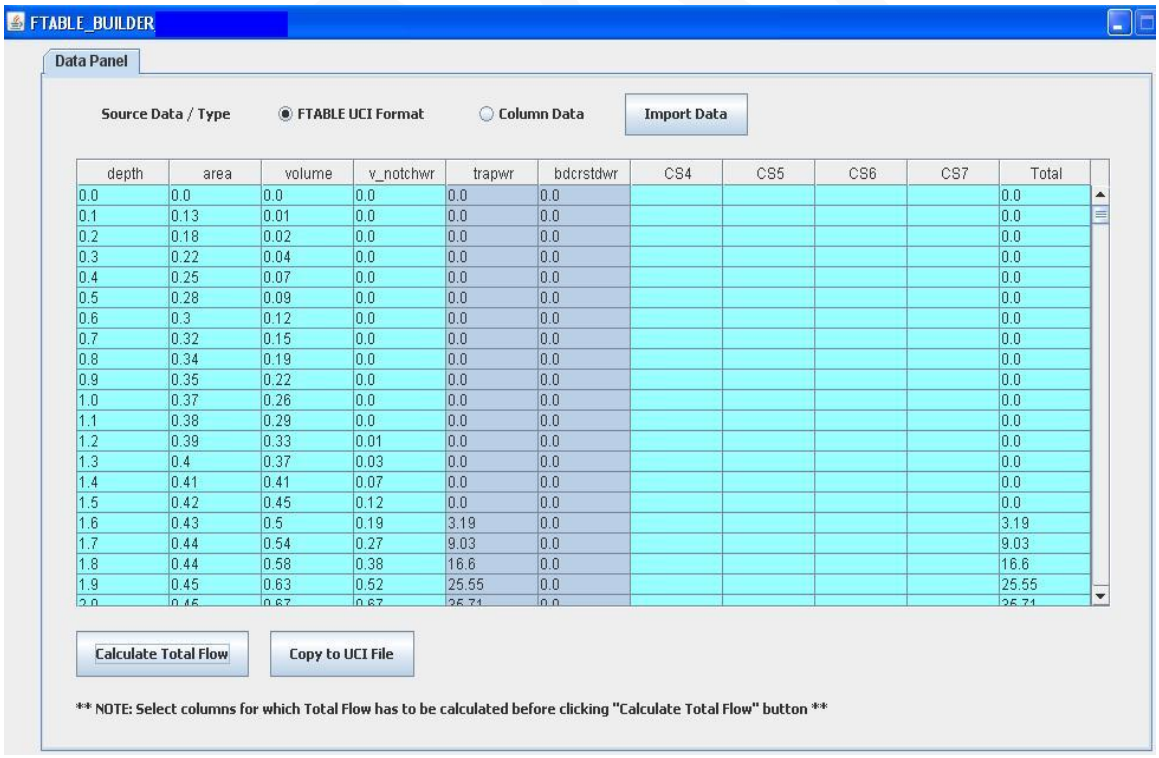


Figure 5: Calculation of total flow

Step 8: Click **Copy to UCI File button [Figure 5]** to open **UCI File Data window [Figure 6]** which display the updated UCI raw data with total flow.

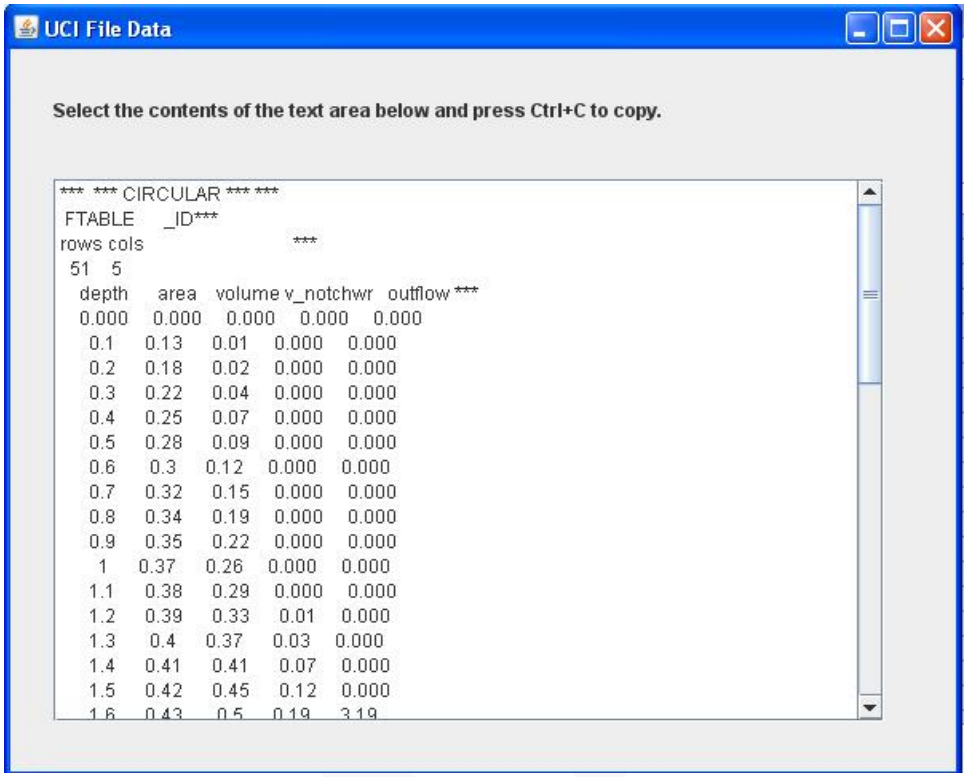
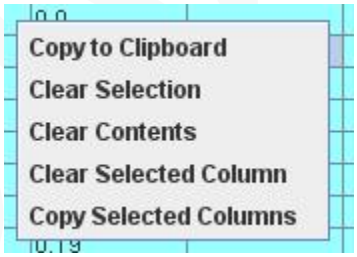


Figure 6: Formatted UCI File data

Exporting Modified FTABLE Data

Step 9: The formatted data can be exported/copied by selecting the data (using Ctrl+A) and press Ctrl+C.

Note: *Additional options for exporting data can be accessed by right clicking on the table.*



2.1.2. Calculating total flow for similar shaped control structures located at different elevations

This section details the calculation of total flow from similar shaped control devices located at different elevations. Since the same control device cannot be used multiple times in HBT tools, the user must generate two or more sets of FTABLES for the same control device at different elevations/invert levels.

Users must first upload all columns of an FTABLE for the first elevation after which the tool will provide an option to upload flow data from additional FTABLES that were created using different elevations for the same shape. Using multiple flows, the tool can calculate total flow and a modified FTABLE can be generated.

Note: *This option assumes that the total depth and increments of depth are the same for all trials/FTABLES.*

The two sets of FTABLES used in the current example are obtained from the GRAY Tool using only a triangular notch at different invert levels (i.e., 0.5 and 1 feet) **[Appendix A-3 and Appendix A-4].**

Repeat Steps 1 to 5 of Section 2.1.1 to upload all columns of the FTABLE data for the first elevation, into the table.

Note: *In the Import Data window [Figure 2] select* ***Export all columns*** *radio button.*

Figure 7 illustrates uploaded data for the control device located at the first invert level/ elevation i.e., 0.5 feet.

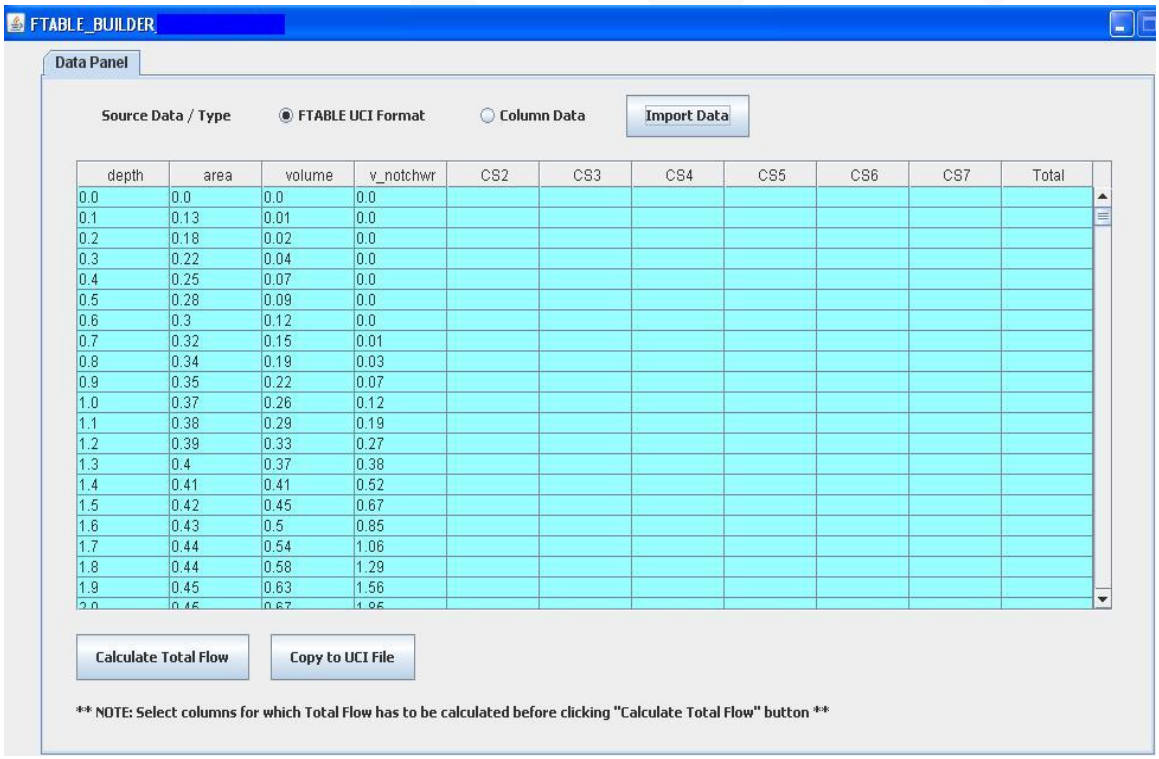


Figure 7: Data uploaded for control device located at first invert level

Repeat Steps 1 to 3 of Section 2.1.1, for the second dataset i.e., FTABLE data for the control device located at a different elevation/invert level.

Step 4: In the **Import Data window [Figure 8]**, select the **Export Only One Set of Values radio button** and paste the second FTABLE data.

In the ***Depth Column number textbox*** enter the column number containing depth values for the pasted data, by default the value is 1.

In the ***Data to be imported from textbox***, enter the column number to be imported from the pasted data (i.e., 4 - flow data of the second control device).

In the ***Data to be pasted in Table textbox***, enter the table column number into which the flow data will be uploaded into i.e., 5 for the current example.

Repeat Steps 5 to 9 of Section 2.1.1 to upload data into the table [Figure 8] and to create a modified FTABLE [Figure 9] for the control devices located at different elevations.

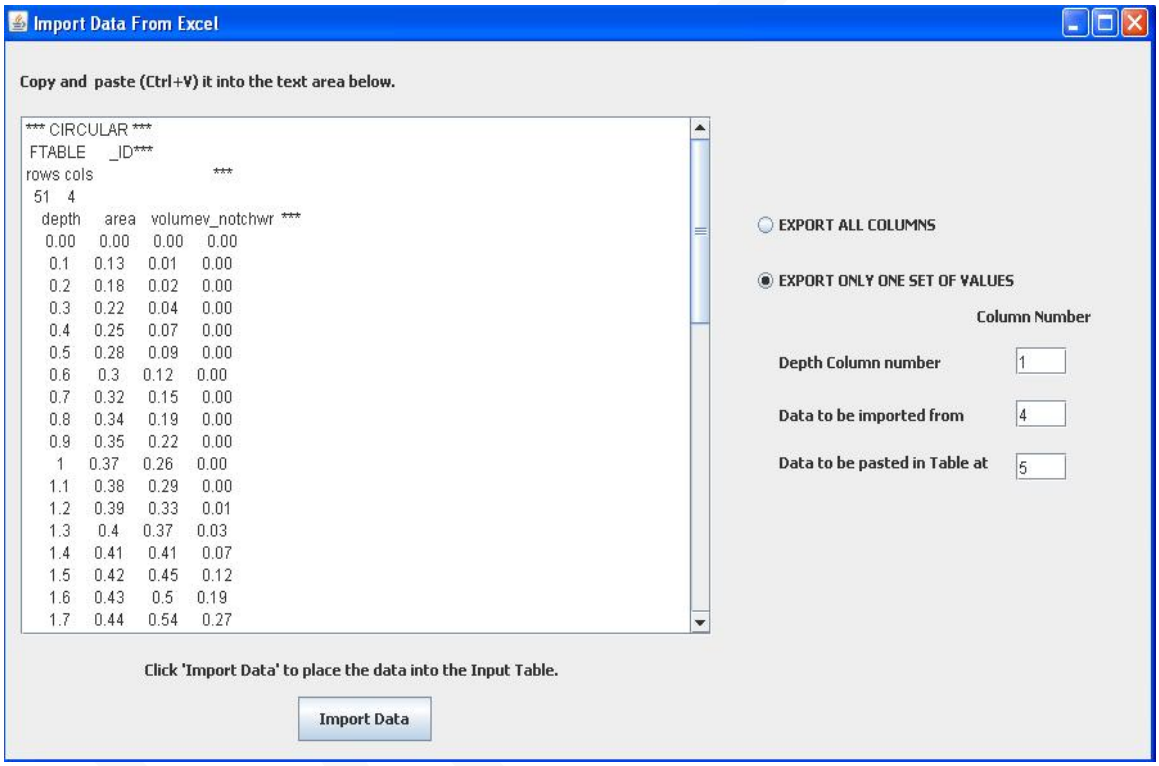


Figure 7: Importing flow data of second control device of similar shape and at a different invert level.

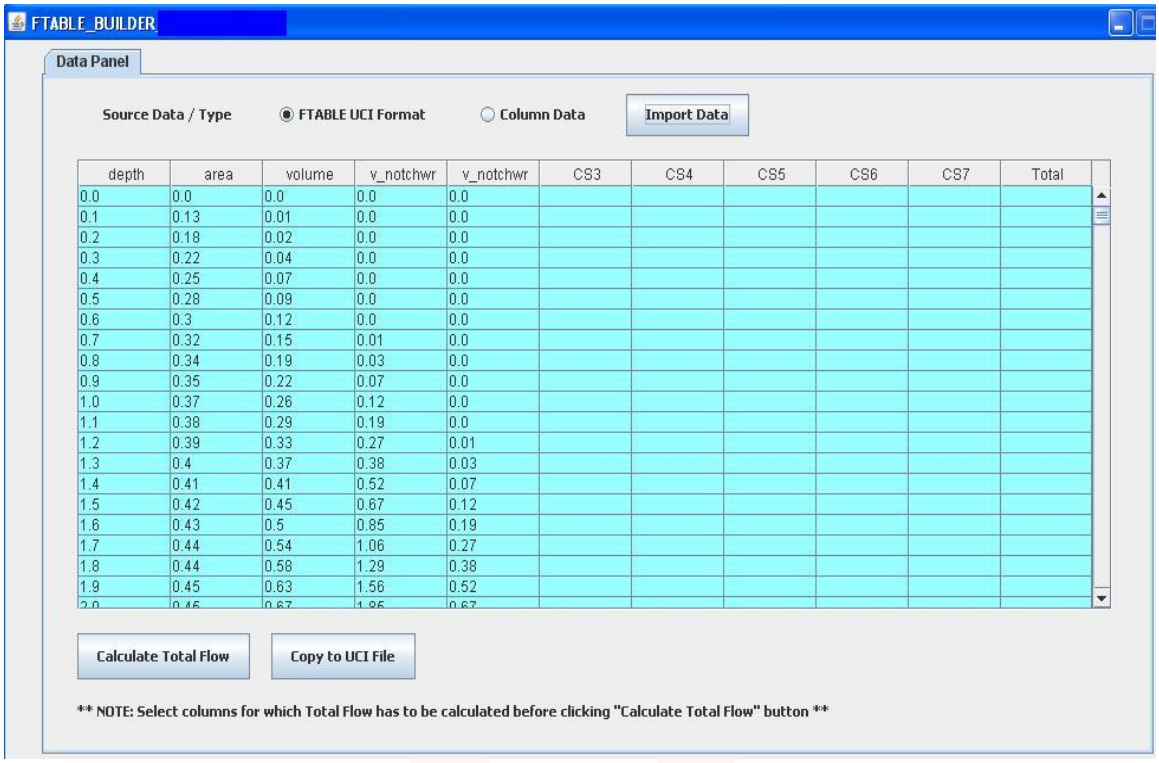


Figure 8: Data uploaded for control device located at second invert level

Figure 9 illustrates final formatted UCI formatted data which can be copied or exported

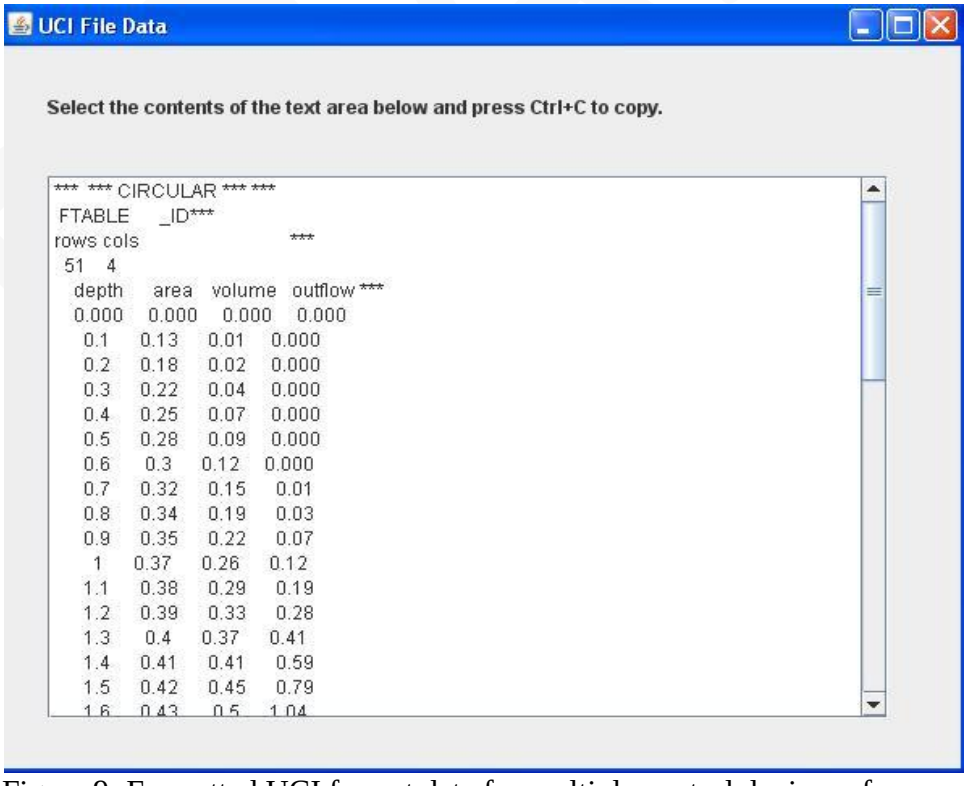


Figure 9: Formatted UCI format data for multiple control devices of similar shape but located at different elevations.

2.2. Column Format

In addition to handling FTABLE data obtained from the HBT tools, the tool can also format user specified column format data **[Figure A2]** to a FTABLE.

The steps followed to format column format data are similar to those used to handle FTABLE data obtained from HBT tools (**Section 2.1.1)**. The user must select the **column format** radio button on the main window **[Figure 8]** for **Source data/ type option**.

In the import data window **[Figure 7],** the user will only have the option, **Export all columns**.

Figure 10 shows the import data window with the sample column format pasted into the table.

The number of columns to be imported must be specified for column format but is not needed for the FTABLE UCI format option.

Repeat the steps of section 2.1.1 with the above mentioned changes to format column format data to FTABLE data.

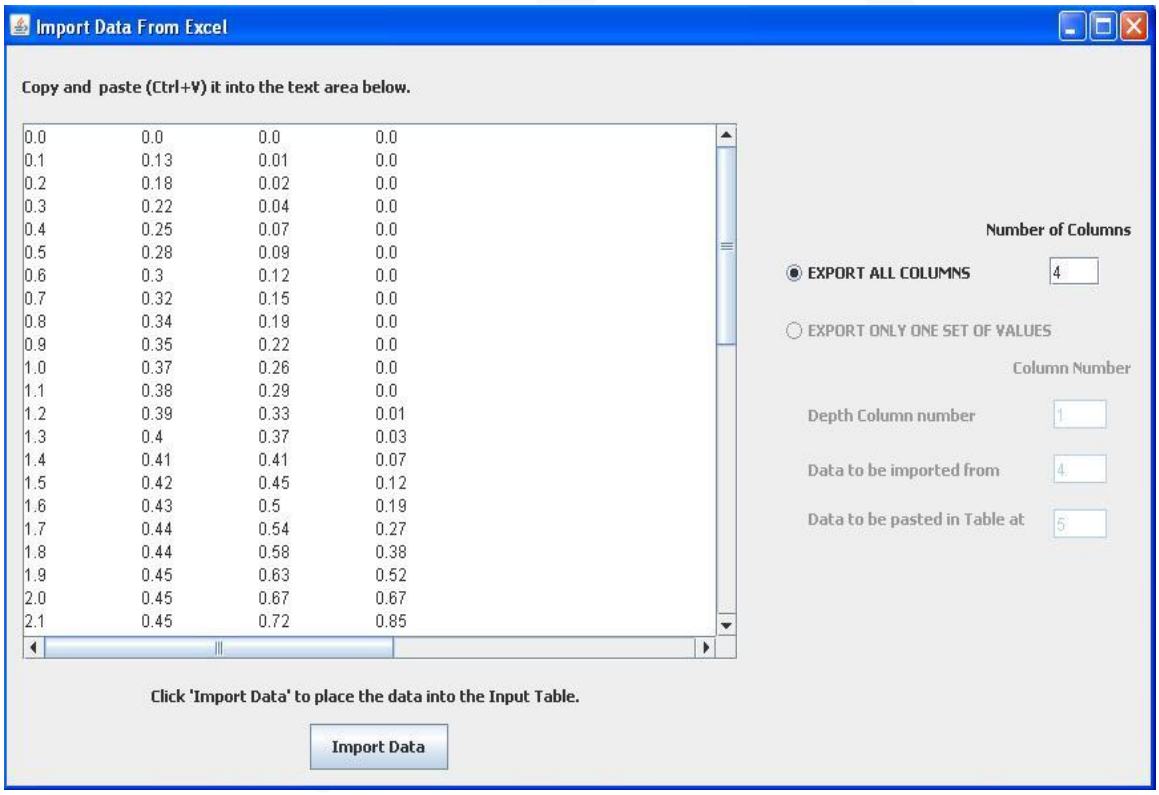


Figure 10: Import data window for column format data.

APPENDIX - A

```
*** RECTANGULAR ***
 FTABLE    _ID***
rows cols                  ***
 11   7
   depth     area   volumerctnglrwr udrdrnorf  riserorf infiltration  ***
 0.00000  0.33058  0.00000  0.00000  0.00000  0.00000  1.33334
     0.1  0.33058  0.03306  0.00000  0.00000  0.00000  1.33334
     0.2  0.33058  0.06612  0.00000  0.00000  0.00000  1.33334
     0.3  0.33058  0.09917  0.00000  0.00000  0.00000  1.33334
     0.4  0.33058  0.13223  0.00000  0.00000  0.00000  1.33334
     0.5  0.33058  0.16529  0.00000  0.00000  0.00000  1.33334
     0.6  0.33058  0.19835  0.00000  0.00000  0.00000  1.33334
     0.7  0.33058   0.2314  0.00000  0.00000  0.00000  1.33334
     0.8  0.33058  0.26446  0.00000  0.00000  0.00000  1.33334
     0.9  0.33058  0.29752  0.00000  0.00000  0.00000  1.33334
       1  0.33058  0.33058  0.00000  0.00000  0.00000  1.33334


END FTABLE_ID***
```

Figure A1: Sample UCI file to be imported (obtained from HDT tools)

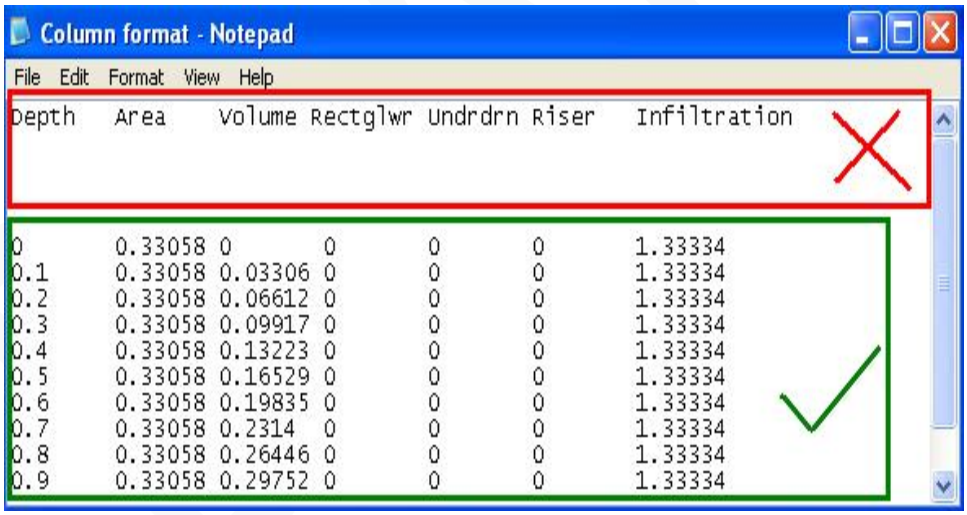
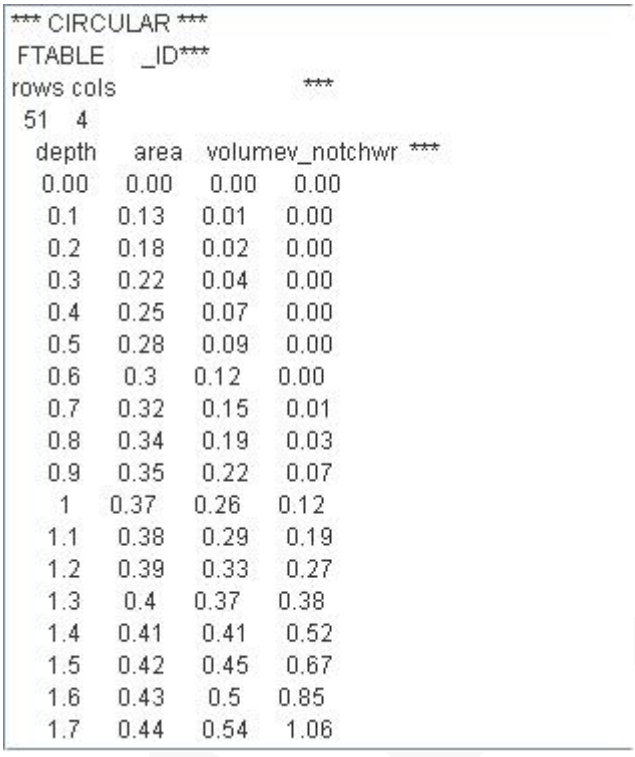
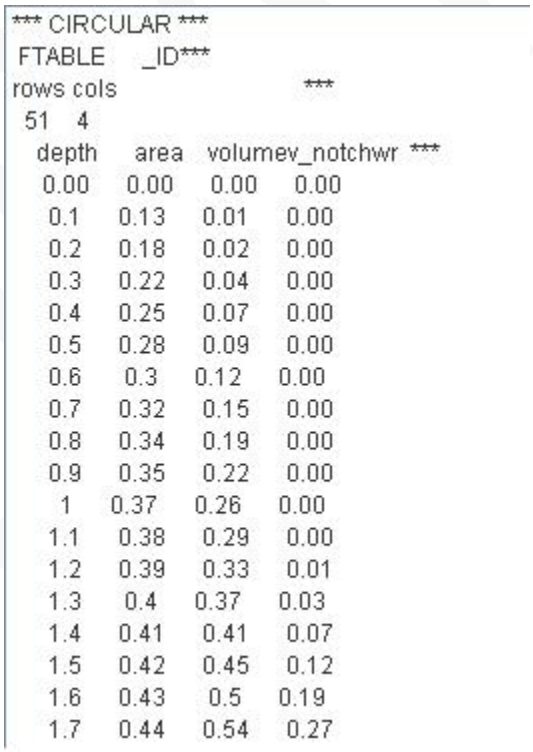


Figure A2: Sample column format data to be imported



```
*** CIRCULAR ***
 FTABLE     _ID***
rows cols                    ***
 51    4
   depth     area    volumev_notchwr  ***
    0.00     0.00     0.00     0.00
     0.1     0.13     0.01     0.00
     0.2     0.18     0.02     0.00
     0.3     0.22     0.04     0.00
     0.4     0.25     0.07     0.00
     0.5     0.28     0.09     0.00
     0.6      0.3     0.12     0.00
     0.7     0.32     0.15     0.01
     0.8     0.34     0.19     0.03
     0.9     0.35     0.22     0.07
       1     0.37     0.26     0.12
     1.1     0.38     0.29     0.19
     1.2     0.39     0.33     0.27
     1.3      0.4     0.37     0.38
     1.4     0.41     0.41     0.52
     1.5     0.42     0.45     0.67
     1.6     0.43      0.5     0.85
     1.7     0.44     0.54     1.06
```

Figure A3: UCI File data obtained from GRAY Tool using V Notch weir with an invert value of 0.5.



```
*** CIRCULAR ***
 FTABLE     _ID***
rows cols                    ***
 51    4
   depth     area    volumev_notchwr  ***
    0.00     0.00     0.00     0.00
     0.1     0.13     0.01     0.00
     0.2     0.18     0.02     0.00
     0.3     0.22     0.04     0.00
     0.4     0.25     0.07     0.00
     0.5     0.28     0.09     0.00
     0.6      0.3     0.12     0.00
     0.7     0.32     0.15     0.00
     0.8     0.34     0.19     0.00
     0.9     0.35     0.22     0.00
       1     0.37     0.26     0.00
     1.1     0.38     0.29     0.00
     1.2     0.39     0.33     0.01
     1.3      0.4     0.37     0.03
     1.4     0.41     0.41     0.07
     1.5     0.42     0.45     0.12
     1.6     0.43      0.5     0.19
     1.7     0.44     0.54     0.27
```

Figure A4: UCI File data obtained from GRAY Tool using V Notch weir with an invert value of 1.0