

Chapter 9

Plotting with PLOT2

Graphical displays are often the most effective method of presenting input data and computed results. Plots of the cross-sectional data can often provide helpful information for screening the input and for analysis of computed results. Profile plots of water surface elevation, or other variables, provide an overview of the results, distributed over the study reach in a way that tables of numbers cannot. The following chapter describes the capabilities of the PLOT2 program and the procedures for obtaining graphical displays of HEC-2 cross sections, computed profiles, and rating curves.

9.1 Purpose of PLOT2 Program

Computer program PLOT2 was developed to provide a quick and simple graphical display of cross-sectional data and computed results from HEC-2. The PLOT2 program provides the capability to plot cross-sectional data, including the changes to the section caused by the HEC-2 options that modify section data. Also, profiles and rating curves of the output variables, available on TAPE95, can be plotted. Default settings for options allow plotting with a minimum of effort. Plots can be displayed on the screen or directed to an HP 7475A (or equivalent) pen plotter. Screen displays of plots can be printed on DOS GRAPHICS compatible printers using the print screen <PrtSc> option. Files can also be created for use by word processors. The program was developed using GRAPHMATIC and PLOTMATIC subroutines by Microcompatibles, Inc.

9.2 Program Operation

Cross section plots can be developed from HEC-2 input data files. For cross section plots, the water surface elevation can also be plotted from the HEC-2 computed results on TAPE95. Profile plots and rating curves are developed from the TAPE95 file; therefore, **you must first run HEC-2 before plotting profiles with PLOT2.**

PLOT2 is called from MENU2 by moving the cursor to line **3**. and pressing the <SPACE BAR> until **Run PLOT2** is displayed; then press <ENTER>. To execute PLOT2 as a separate program, from the DOS prompt enter:

PLOT2

The program will respond with a PLOT2 Title Page. Press any key and the PLOT2 Menu will appear; see Figure 15. The PLOT2 Menu allows you to call the menus for the Profile, Cross-section, or Rating Curve plot routines. The up and down arrows move the cursor through the options. Pressing the <ENTER> key selects the highlighted option. Also, the number of the option can be entered to make a selection. The screen colors can be changed by using the function keys F9 and F10 for background and foreground colors, respectively.



Figure 15
PLOT2 Main Menu

9.3 Output Devices

The graphic displays from PLOT2 can be directed to the screen or an HP 7475A pen plotter. Either of the following graphics cards (or their equivalent) is required: Color Graphics Adapter, or Enhanced Color Graphics Adapter, or Video Graphics Array. The plot device is set in the Plotting Options Menu, which can be called from the Profile, Cross-section, or Rating curve Menus (see Figure 19). The options are selected by using the <SPACE BAR> to toggle through the **Plot device** options. The choices are:

VIDEO GRAPHICS ARRAY
ENHANCED GRAPHICS ADAPTER
COLOR GRAPHICS ADAPTER for the console

and: **HP7470, 7475, 7550, 7580, 7585/86 Series Plotters**

A printed copy of the plot on the screen can be obtained, provided your printer is set to graphics mode. For IBM Graphics compatible printers, use the DOS **GRAPHICS** command prior to executing PLOT2. Also, there are several commercial programs to set your printer to graphics mode for high resolution graphics. Then generate the desired plot on the screen, and use the Print Screen <PrtSc> entry on your keyboard to copy the plot on your printer.

9.4 Pen Plotter Setup

Pen plotter graphics are directed to the plotter via COM1. The output port can be changed in the Plotting Options Menu by setting the **Plot device** to HP7475A and then moving the cursor to **Plot sent to** and using the <SPACE BAR> to toggle through the choices: two COM ports (COM1 or COM2) or an output file PLOT.HP. The PLOT.HP file allows you to create the plots on a computer without a plotter, and then transfer the file to another computer for plotting. Also, the plotter **Baud rate** default setting of 2400 can be set from 1200 to 9600. Just before the plots are written, the switch settings are displayed to the screen; see Figure 16. Press the <SPACE BAR> to plot, or press <Esc> to cancel the plot.

The plot operation uses PLOTMATIC routines from Microcompatibles, Inc. The following instructions for the printer settings are from their documentation. The plotter can be switched for certain parameters (e.g., BAUD rate, length of word, parity, programmed on state, paper dimensions) on the rear panel of the plotter, as described in the Operator's Manual. The switches should be set for a 2400 BAUD transmission rate, 8 bit word, one stop bit, no parity, programmed on state (Y/D switch set to D), and the US - A4 switch should be set to US (indicating 8.5 X 11 inch paper). The A4 size paper can still be used with your plotter even with the dip switch set to US. This switch just defines the active plotting region. Review the Operator's Manual for switch selection, and insure that the specified choices have been made.

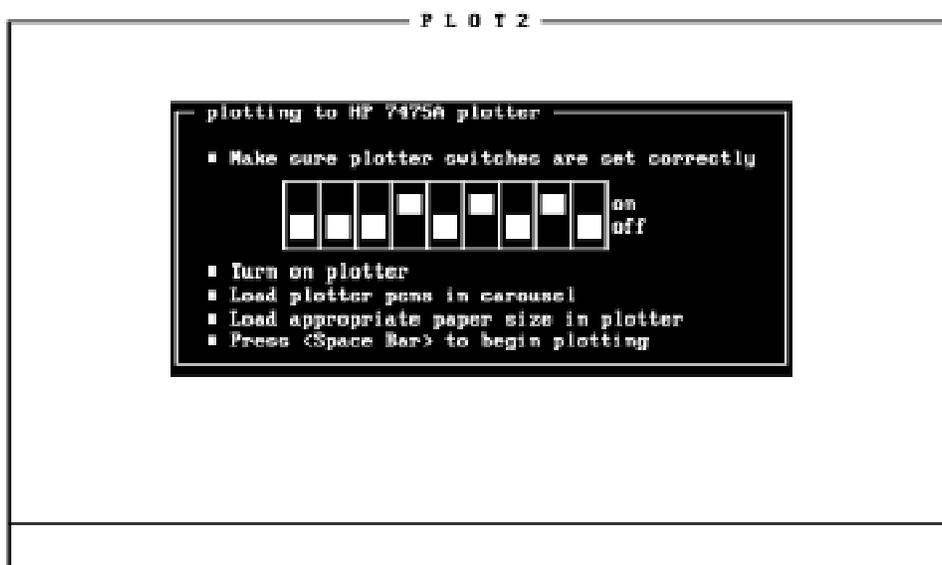


Figure 16
Pen Plotter Switch Setting

9.5 Profile Plots

Profile plots can be developed for any of the variables written to TAPE95. The default settings in the menus for profile plots assume that water surface profiles will be plotted. To develop profile plots, move the cursor to **1. Plot profiles** in the Main Menu, and press <ENTER>, or enter <1>. The Profile Plots Menu, shown in Figure 17, will appear.



Figure 17
PLOT2 Profile Plots Menu

In the **Profile Plots Menu**, **Profile options** and **Plotting options** provide menus to specify what will be plotted, what options will be used, and to title and label your plot. The menus are called by moving the cursor to the choice desired and pressing <ENTER>. The menu for **Profile options** is shown in Figure 18, and the menu for **Plotting options** is shown in Figure 19.

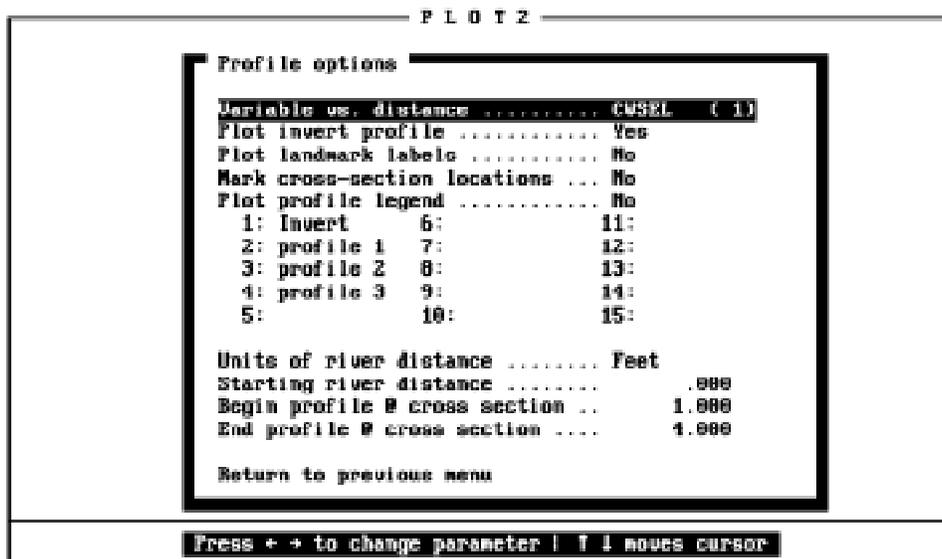


Figure 18
PLOT2 Profile Options Menu

There are two files indicated at the bottom of the Profile Plots Menu. The **HEC2 TAPE95 file name** is the HEC-2 program intermediate output file TAPE95, which is the input file for Profile Plots. The file name can be changed by entering a new file name in its place, or by entering a question mark <?>. The question mark entry will provide a menu of file names in the default directory. Use the cursor keys to highlight the desired file, and press <ENTER>. The selected file name will transfer into the Menu location. The **Landmark Label filename** has no default value. If this option is requested (see Figure 18. PLOT2 Profile Options Menu), then the file name must be entered.

The input file names should be defined before entering either options menu because data are obtained from the HEC-2 binary file to define default values for several options. To enter the **Profile options**, move the cursor to that location, and press <ENTER>.

The first line in the Profile Options Menu is for selecting the **Variable vs. distance** to plot. The default variable for this selection is CWSEL for Computed Water Surface Elevation. The variable code number is (1), as defined in the HEC-2 User's Manual Input description for the J3 record. To select a different variable to plot, the right and left cursor arrows may be used to toggle through the entire list of variables available. The variable name and code number are displayed for each variable.

Once the desired variable to plot is displayed, the up and down cursor keys can be used to move through the options in the menu. The **Plot invert profile** option has a default choice of **Yes**, which means that the invert profile will be plotted with the profile plot of the selected variable.

The **Plot landmark labels** option has a default choice of **No**. To change these options, move the cursor to the option, and use the <SPACE BAR> to toggle the choices between **Yes** and **No**.

The landmark label requires a file containing: distance, variable code number, and label. An example of the landmark file is shown below:

4000 1	{Distance Variable}
UNKNOWN BRIDGE	{Label to display}
6000 1	{Distance Variable}
USGS GAGE	{Label to display}

This file can be created with any text editor.

Mark cross section locations option has a default value of **No**. You can toggle to **Mark** or **Mark & number** using the <SPACE BAR> while the option is highlighted. The profile plot will then show arrow marks, or marks and numbers, at cross section locations.

Plot profile legend has a default value of **No**. If legends for the profile plots are desired, move the cursor to that option, and press the <SPACE BAR> to change the option to **Yes**. The cursor keys can then move the cursor to profile 1:, etc. At each location enter the appropriate legend; up to eight characters are allowed. If the **Plot invert profile** option is set to **Yes**, the legend label **Invert** will be shown for the first profile.

The **Units of river distance** has a default value of **Feet**; but this can be changed to **Miles**, **Meters**, or **Kilometers** using the <SPACE BAR> to toggle through the choices. The 1988 version of HEC-2 reads the units and starting distance, if given, on TAPE95.

Starting river distance is set to **0.000**. A different starting value can be entered. The entered value is added to the channel reach lengths to define the horizontal distance along the profile plot. Care should be taken to ensure that the **Units of river distance** and **Starting river distance** are consistent with the units used for the model reach lengths.

Begin profile @ cross section and **End profile @ cross section** options have the starting and ending cross section numbers for the data set (SECNO on the X1). The values are read from the binary output file, TAPE95. The default values provide a plot for the entire study reach. The starting and ending section numbers for the profile plot can be changed by using the vertical cursor arrow keys to the option and then using the horizontal cursor arrow keys to toggle through the section numbers. The program will not allow the starting section number to be equal, or upstream from the ending section number.

After all the profile options have been set, move the cursor to **Return to previous menu** and press <ENTER>. The **Profiles Plots Menu** will be displayed. The second option on the menu is **Plotting options**. Move the cursor to that option, and press <ENTER>. The Plotting Options Menu, shown in Figure 19, provides for two titles on the plot. The **Title 1**: displays the title information input on the third title record (T3), as read from TAPE95. The title can be edited, or replaced, depending on the insert mode setting; press <Ins> to change from insert to overwrite. **Title 2**: allows you to enter a second title.

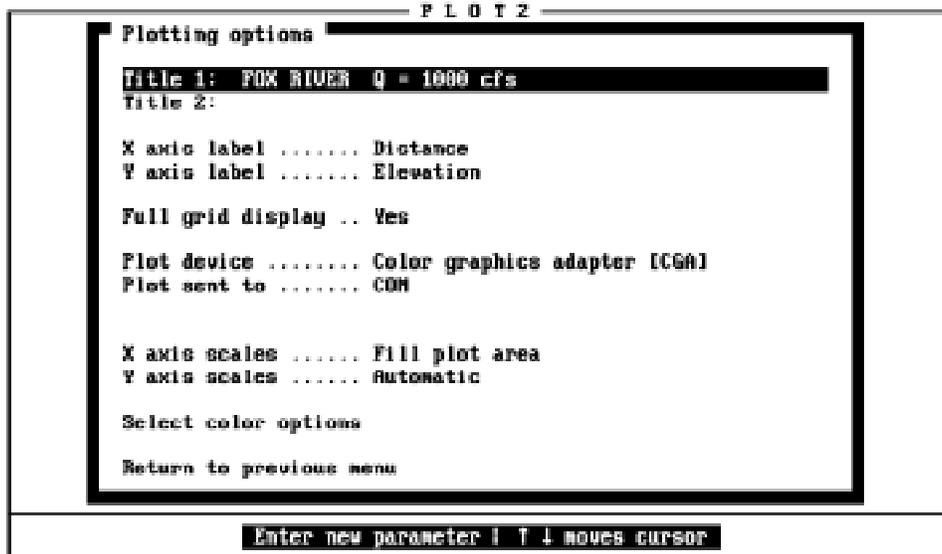


Figure 19
PLOT2 Plotting Options Menu

If the plot axes need a different label, move the cursor to the appropriate axis and enter, or edit, the label. A plotted grid can be added to the plot by moving the cursor to **Full grid display** and pressing the <Space Bar> to change the **No** to **Yes**.

The **Plot device** can be changed, as described in Section 9.3. For screen displays, the correct graphics adapter for your computer should be displayed. If it is not correct, the screen plot will appear as assorted characters. If an HP pen plotter is selected as the plot device, the **Plot sent to** will display **COM1**, the default. The output port can be toggled to **COM2**, by using the <SPACE BAR>. Also, a file **PLOT.HP** can be selected.

The **X axis scales** default is **Fill plot area**, while the **Y axis scales** are set to **Automatic** for each plot. Press the <SPACE BAR>, and the following options are provided: scales set to 1, 2, or 5 times a power of 10, Fill plot area, and Max scale for all. Fill plot area would normally be used for one scale while fixing the other scale. Max scale for all provides a fixed scale based on the maximum range of the data values.

Select color options provides a menu to set the pen number for pen plots and the line colors for **EGA color screen** displays. The **Color options** menu is shown in Figure 20. For profile plots, the options are for the Text, Axis, and the profiles to be plotted.

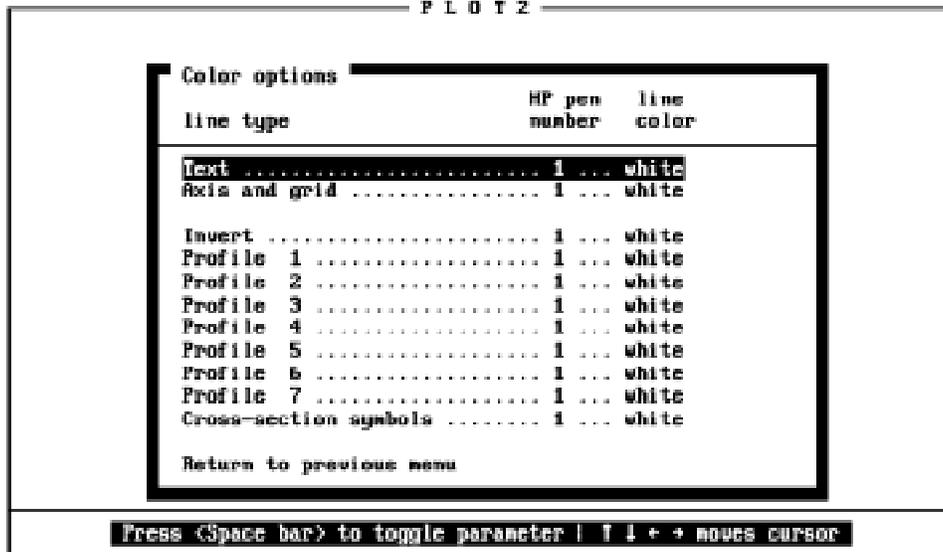


Figure 20
PLOT2 Profile Colors Options Menu

When complete, move the cursor to **Return to previous menu** and press <ENTER>. The Escape Key <Esc> will also return you to the previous menu. The Profile Plots Menu, shown in Figure 17, will be displayed.

When all desired options are set, move the cursor to **Plot profiles** to initiate the plot. The program will respond:

Plot all profiles (y/n)?

If yes, enter <y>, and the plot will go to the plot device defined in the Plotting Options Menu. If no, enter <n>, and a profile selection menu, as shown in Figure 21, will appear indicating the profiles available. The cursor location highlights the profile number. Use the cursor arrow keys to move through the choices, and press <ENTER> to select profile numbers to plot. The selected profile numbers will show an arrow marker. After selecting the desired profiles, press <c> to continue the plot.

If the **Plot profile legend** option was selected, a choice between the legend at the top or bottom of the plot is offered with the following:

Legend box top or bottom (t/b)

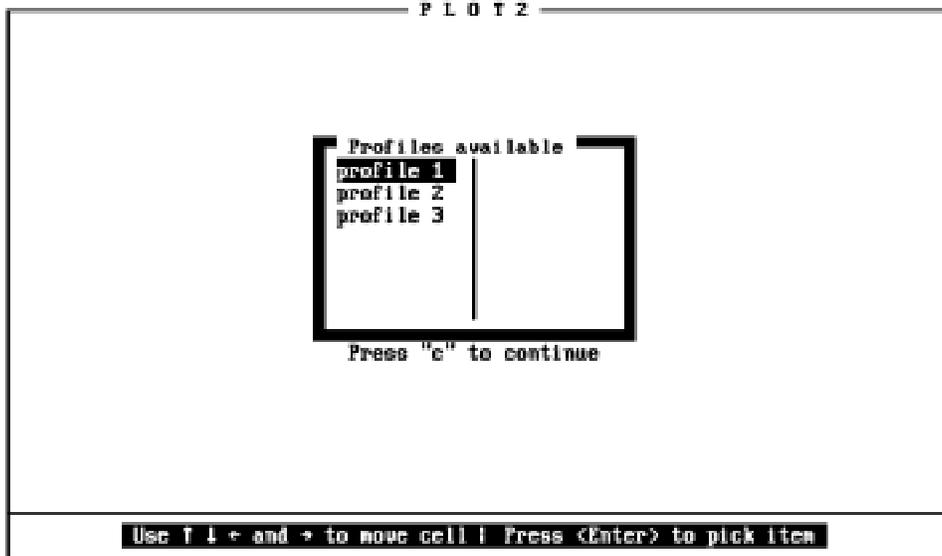


Figure 21
Profile Selection Menu

Enter your choice, and then the plot will be sent to the designate output device. If the plot is displayed to the screen, it will stay there until you press <ENTER>. If you want to copy the plot to your printer, press the Print Screen key <PrtSc> while the plot is on the screen. **Remember that you must enter the DOS GRAPHICS command** before entering PLOT2. Check your DOS manual, the GRAPHICS command may be limited to CGA graphics. Figure 22 provides an example EGA graphics profile plot, with the legend on top.

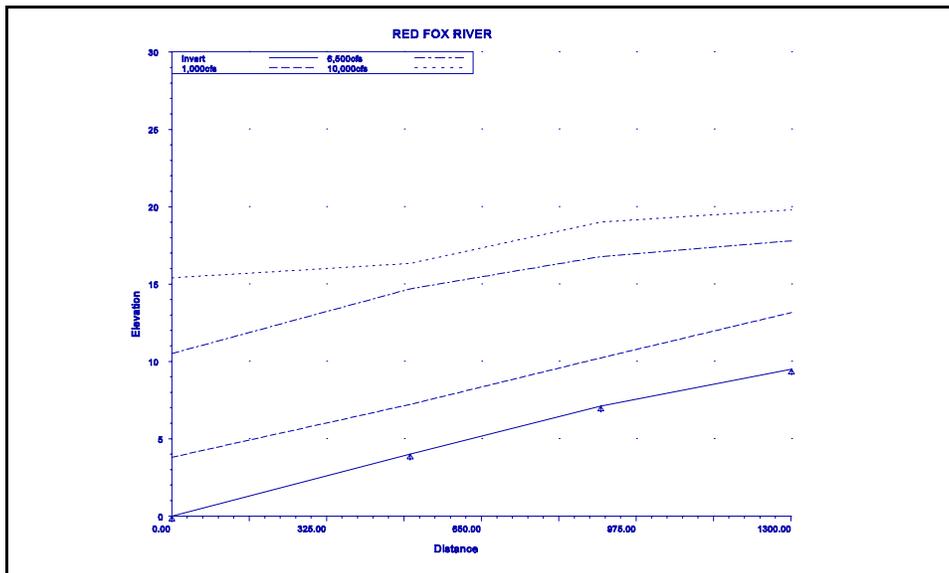


Figure 22
Example Profile Plot

When you have completed all the desired profile plots, return to the Main Menu by moving the cursor to that location and pressing <ENTER>. The Escape Key <Esc> will also return you to the Main Menu.

From the Main Menu, you can call cross-section plots or exit the program.

9.6 Cross-Section Plots

You enter cross-section plots from the Main Menu by moving the cursor to **2. Plot cross sections** and pressing <ENTER>, or by entering <2>. A sample **Cross-Section Plots Menu** is shown in Figure 23. From the menu you can call menus to define **Cross-section options** and **Plotting options**.

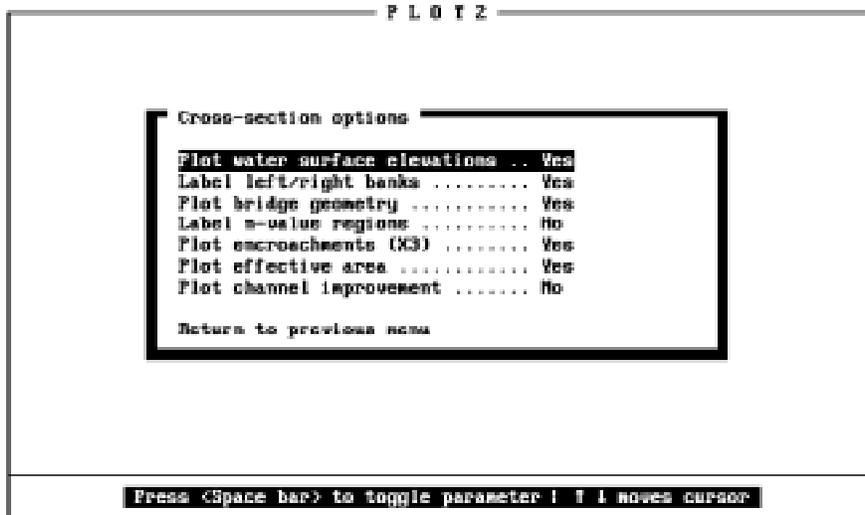
The **HEC2 input file name** must be entered for cross-section plots. There is no default; the menu will display **(specify)**. (If you are operating from MENU2, the file names will be transferred to PLOT2.) The input file name can be entered from the keyboard or a question mark <?> can be entered. The question mark entry will provide a menu with the file names available in the directory. The cursor keys will move the cursor around the file names, and pressing <ENTER> will transfer the highlighted filename into the menu.

The **HEC2 Tape95 file name** is only required if the water surface elevation is to be plotted with the cross section. The default file name, TAPE95, can be changed, as described above for the input file name.



Figure 23
PLOT2 Cross-Section Plots Menu

Move the cursor to: **Cross-section options**, and press <ENTER> to select the items to plot. The **Cross-section Options Menu** is shown, with the default settings, in Figure 24. Use the up and down cursor keys to select an option, and press the <SPACE BAR> to toggle between **Yes** and **No**.



**Figure 24
PLOT2 Cross-Section Options Menu**

If channel improvement is to be plotted, there are five choices: Field 6 to Field 10. The field number defines the field of the CI record to obtain bottom width information. (See HEC-2 Input Description for the CI record for a complete description.)

When the plotting options are properly set, move the cursor to **Return to previous menu**, and press <ENTER>. Pressing <Esc> will also return you to the **Cross-section plots** menu.

In the **Cross-section plots** menu, move the cursor to **Plotting options**, and press <ENTER> to define titles, axes labels, and add a grid to the plot. Figure 25 shows the **Plotting options** menu with its default settings.



**Figure 25
PLOT2 Plotting Options Menu**

With the cursor positioned at **Title 1:**, type in the first title line. Then move the cursor to **Title 2:**, if desired, and enter the second title line. For **X axis label**, the default label **Distance** may be used, or an alternative label may be written over the default label. Units, if appropriate, can be added on the same line. Similarly, for the **Y axis label** the default label **Elevation** may be used, modified with units added, or replaced by entering a new label. A **Full grid display** is provided with the plot. To turn off the grid, move the cursor to that line, and press the <SPACE BAR> to toggle the choice from **Yes** to **No**.

As described in Section 9.4, options for graphics adapter and output device can be selected. For HP pen plotters, the output port can be set to COM1 or COM2, as appropriate.

The **X axis scales** default is **Fill plot area**, and the **Y axis scales** default is **Automatic** for each plot. To change the scale, press the <SPACE BAR> and the following options are provided: scales set to 1, 2, or 5 times a power of 10, Fill plot area, and Max scale for all. Fill plot area would normally be used for one scale while fixing the other scale. Max scale for all provides a fixed scale based on the maximum range of the data values.

Select color options provides a menu to set the pen number for pen plots and the line colors for EGA color screen displays. The **Color options** menu is shown in Figure 26. For cross-section plots, the options are for the Text, Axis, and the section features to be plotted.

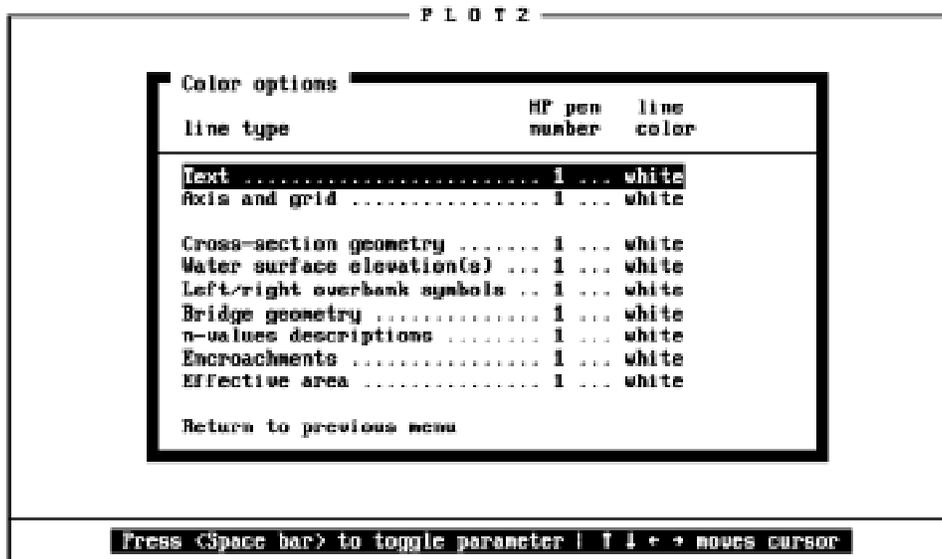


Figure 26
PLOT2 Cross-Section Color Options Menu

After the plotting options have been defined, move the cursor to **Return to previous menu** and press <ENTER>. Or press <Esc> to return.

In the Cross-section Plots menu, move the cursor to **Plot cross sections**, and press <ENTER>. If the input data file name is not defined correctly, the program will provide the following message:

PLOT2 cannot continue until the appropriate input files have been specified.

Press <ESC> to continue.

Return to the Cross-section Plots menu and check the file names. Remember to provide the drive and directory, if necessary. You can enter <?> to review the files in the default directory.

If the file names are correct, the program will provide the following message:

Plot all cross-sections (y/n)?

If all cross sections are to be plotted, enter <y>, or press <ENTER> and the program will start plotting with the first cross section in the data set. If you enter <n>, the program will provide a menu of cross sections available. The cursor arrow keys will move the cursor around the listing of cross-section numbers. To plot a cross section, press <ENTER> while the cursor is on the desired cross section. Figure 27 is an example cross-section plot with Manning's n values and water surface elevations plotted for three profiles.

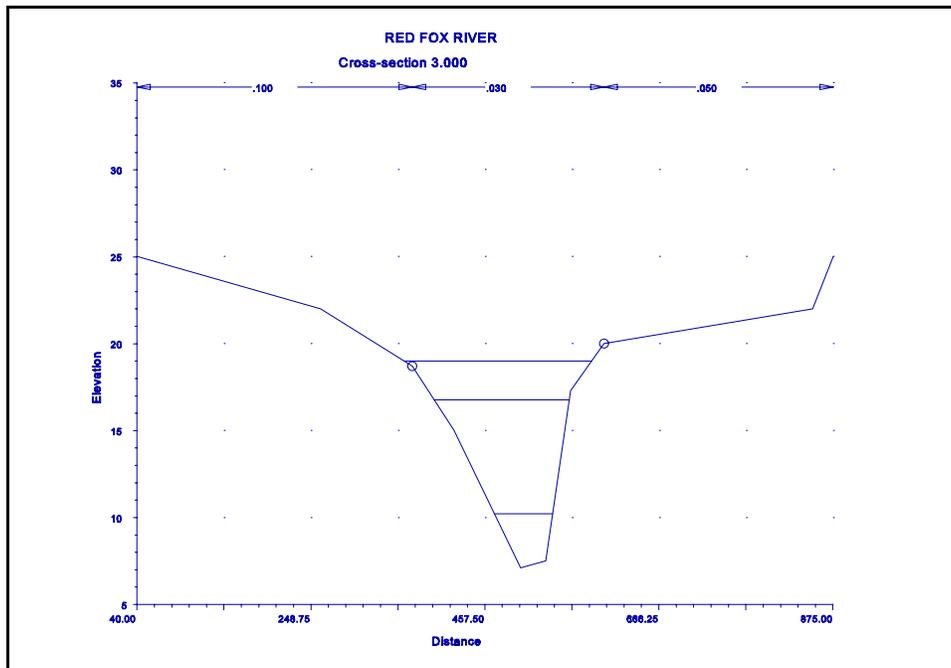


Figure 27
Example Cross-Section Plot

With the cross-section plot on the screen, you can obtain a printed copy of the display by entering <PrtSc>. Be sure that you have set your printer to graphic mode. Check your DOS manual, the GRAPHICS command may be limited to CGA graphics. To clear the plot from the screen, press <ENTER>. If you are selecting cross sections to plot from the menu of available cross sections, the program will return to that menu. If you are plotting all cross sections, the program will plot the next section.

When plotting has been completed, press <Esc> to return to the Cross-section Plots menu. To return to the main menu, press <Esc> or move the cursor to **Return to previous menu** and press <ENTER>.

From the PLOT2 Main Menu, you can enter <4> or move the cursor to **4. Exit PLOT2** and press <ENTER> to leave the PLOT2 program. Or you can plot Rating curves by pressing <3>. The **Rating Curve Plot Menu**, shown in Figure 28, will appear.



Figure 28
PLOT2 Rating Curve Plot Menu

9.7 Rating Curve Plots

The rating curve option is called from the PLOT2 Main Menu by moving the cursor to **3. Plot rating curves** and pressing the <ENTER> key, or by entering <3>. The rating curve menu, shown below, appears. The two options menus have default values, so you can start plotting rating curves immediately. However, selecting **Rating curve options** will display the menu shown in Figure 29, with the default settings as shown.

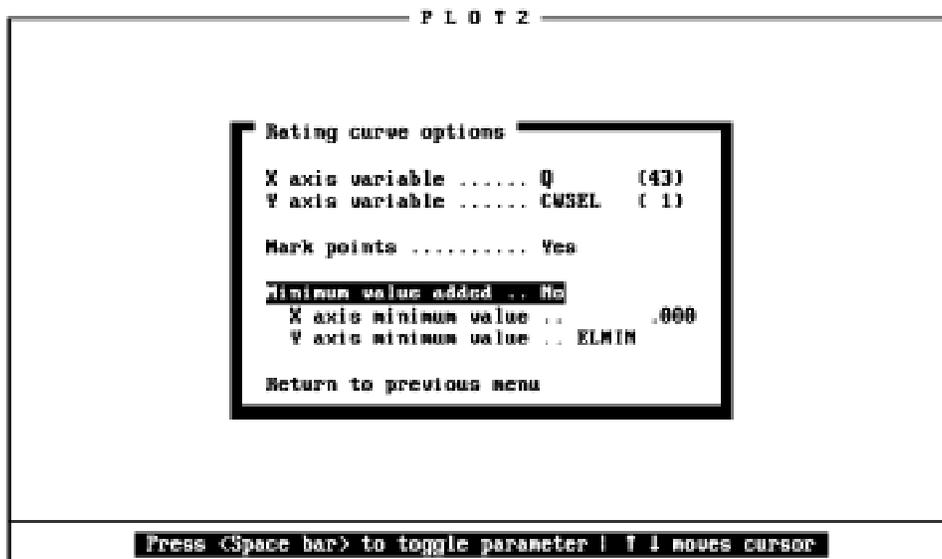


Figure 29
PLOT2 Rating Curve Options Menu

The **Rating curve options** menu allows you to define the variables to plot, mark the computed points, and add a minimum value. Default minimum values are 0.0 for most variables and the minimum cross-section elevation (ELMIN) for elevation variables. The default variables to plot, shown in Figure 29, are flow (**Q** variable 43) versus computed water surface elevation (**CWSEL** variable 1). The variables can be changed by pressing the left cursor arrow to decrease, or the right cursor arrow to increase, the variable number. The sequential order of the variables is listed in the input description for the **J3** record. The order is the same as the order of the variables in TAPE95. Refer to the input description to see the sequential order of the variables.

Move the cursor down to **Mark points** by pressing the down arrow. The default is to mark the computed points with a circle. The option can be turned off by pressing the <SPACE BAR> to change **Yes** to **No**.

The minimum value can be added by moving the cursor down to **Minimum value added** and pressing the <SPACE BAR> to change **No** to **Yes**. The default is 0.00 for variables that would typically have a zero minimum. The zero minimum can be modified by entering a numeric value. The alternate default is the minimum cross-section elevation (**ELMIN**) for elevation variables like water surface and energy elevation.

If the default settings are acceptable, you can quickly return to the rating curve menu by pressing escape <Esc>. After setting the options, you can return by moving the cursor to **Return to main menu** and pressing <ENTER>. Pressing <Esc> does not save the changes you make.

The **Plotting options** menu is called by moving the cursor to that line and pressing <ENTER>. The menu shown in Figure 30 will appear.

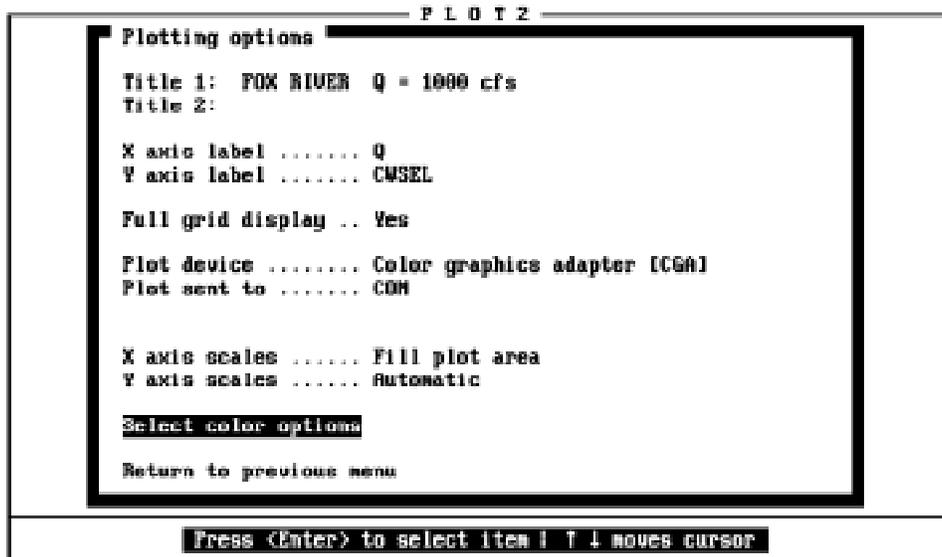


Figure 30
PLOT2 Rating Curve Plotting Options Menu

The rating curve **Plotting options** menu is similar to the other menus for plotting options. The default **Title 1:** is the title from the **T3** record, fields 2-4. The title can be edited using insert and delete keys, or replaced by typing over it.

The **X** and **Y axis labels** are set to the variable names selected for plotting in the rating curve options menu. The label can be changed by using the cursor to highlight the line, and entering a new label. For example, you may want to change **Q** to **Flow in cfs**.

A **Full grid display** is provided, by default. To eliminate the grid, highlight that option, and press the <SPACE BAR> to change **Yes** to **No**.

The **Plot device** and **Plot sent to** options are the same as described in Section 9.4. Also, the scales options are the same as previously described. The pen number, for pen plots, and the line color, for EGA color graphics display, can be set by moving the cursor to **Select color options** and pressing the <SPACE BAR>. The menu shown in Figure 31 will be displayed.

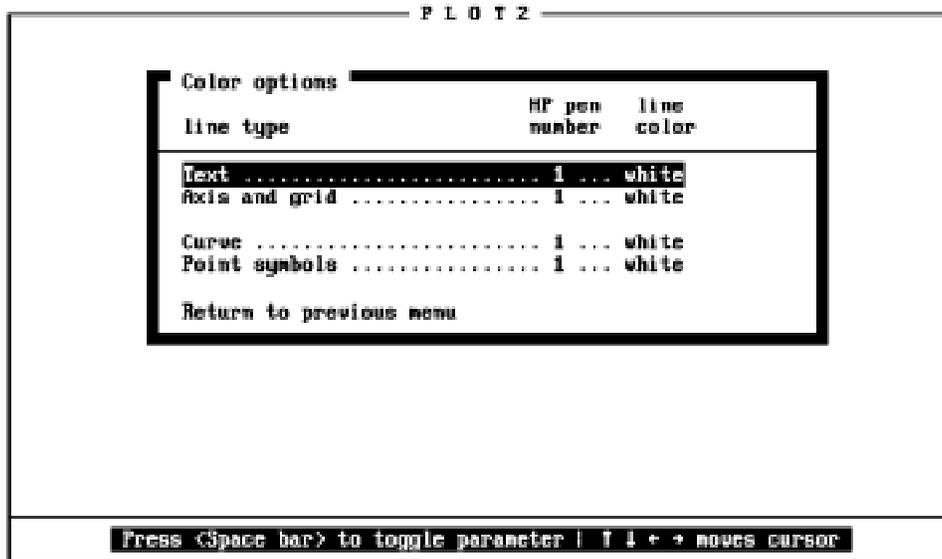


Figure 31
PLOT2 Rating Curve Color Options Menu

The cursor location is indicate by the highlighted line and a blinking marker. One column is for the pen number, and the other is the color of the plot lines for the screen display. The <SPACE BAR> is used to toggle through the choices. The left and right cursor arrows move the marker between columns, and the up and down arrows move the highlighted line.

Pressing escape <Esc> will return you to the **Plotting options** menu without any changes to the default color settings. If you change the settings, move the cursor to the bottom line, **Return to previous menu**, and press <ENTER>.

From the rating curve menu, move the highlighted line to **Plot rating curves** and press <ENTER>. The following message will be displayed:

Plot all cross-sections (y/n)?

Pressing <y> or <ENTER> will give you a rating curve for every cross section. Pressing <n> will give you a menu of available cross sections. Use the up and down cursor arrow keys to highlight the section numbers, and press <ENTER> to select the desired cross sections. When you have selected the desired section numbers, press <c> to start plotting. Figure 32 is an example of the EGA graphics plot. After each plot, press the <SPACE BAR> or <ENTER> to obtain the next plot. If you are plotting to the screen, you

can use the print screen option <PrtSc> to obtain a copy of the plot on a graphics compatible printer set to graphics mode. Check your DOS manual, the GRAPHICS command may be limited to CGA graphics.

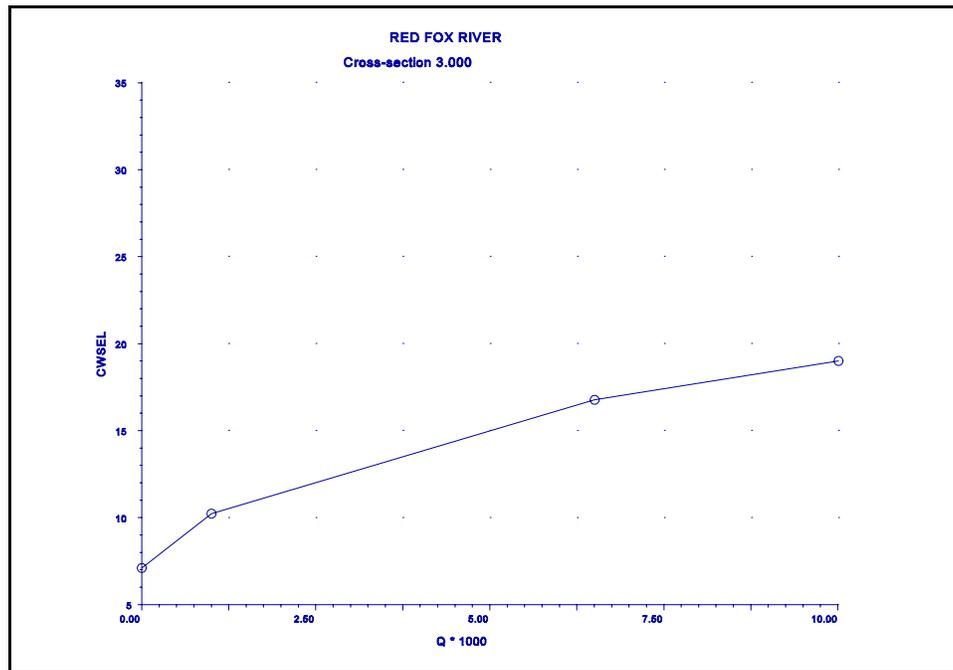


Figure 32
Example Rating Curve

After you have completed plotting, return to the PLOT2 main menu, and move the cursor to line **4. Exit PLOT2** and press <ENTER>, or simply press the <4> key. If you called PLOT2 from MENU2, you will be returned to MENU2. If you called PLOT2 from DOS, you will be returned to the DOS prompt.