HEC RAS tutorial

Example 1:- Critical Creek

Start a new project and write the title and select the folder

From the main HEC RAS Window, select File and then Click New project

Is a steep river comprised of one reach entitled “Upper Reach?”

Geometrical Data

The next step is to enter the necessary geometric data, which consist of connectivity information for the stream system (River system Schematic), cross section data, and hydraulic structure data (bridges, culverts, weirs, etc).

Geometric data are entered by selecting Geometrical Data from the edit Menu on the HEC RAS window.

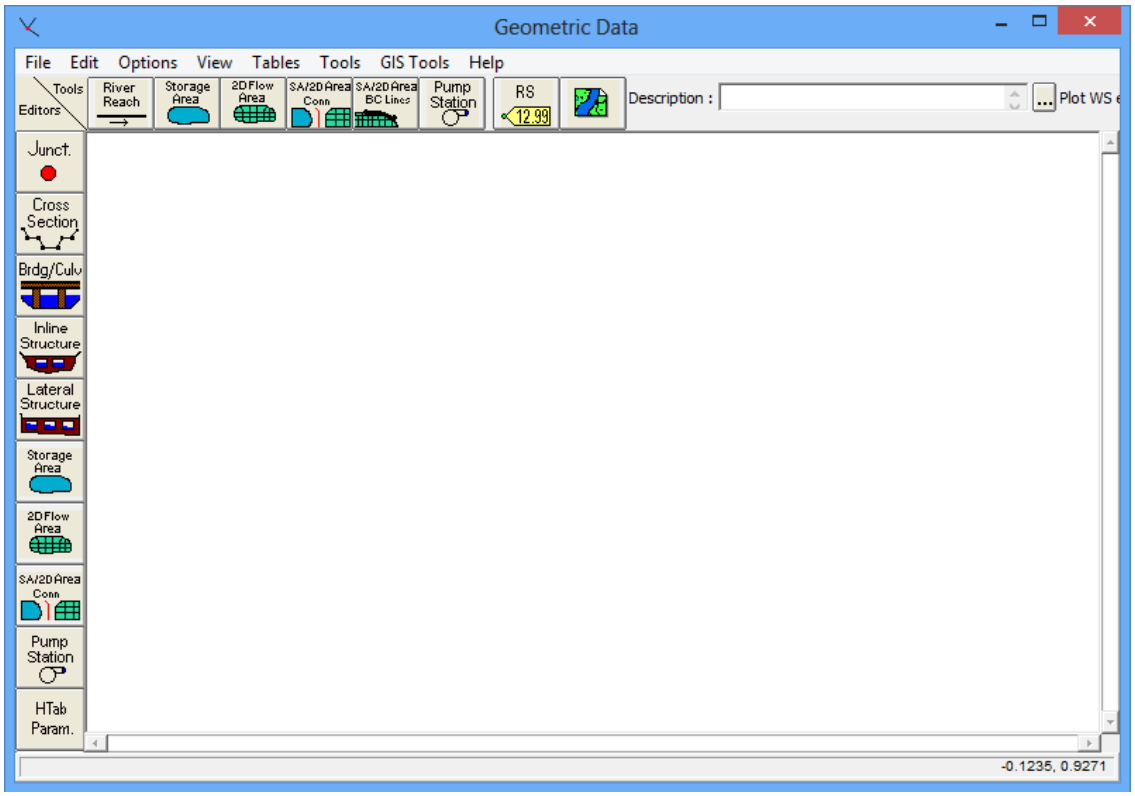
Click Enter/edit Geometric data  button and draw the river rich by clicking 

button.

The river system is drawn on a reach by reach basis, by pressing river reach button and then drawing in a reach from upstream to downstream (in the positive flow direction).

Each reach is identified with a River Name and a Reach Name.

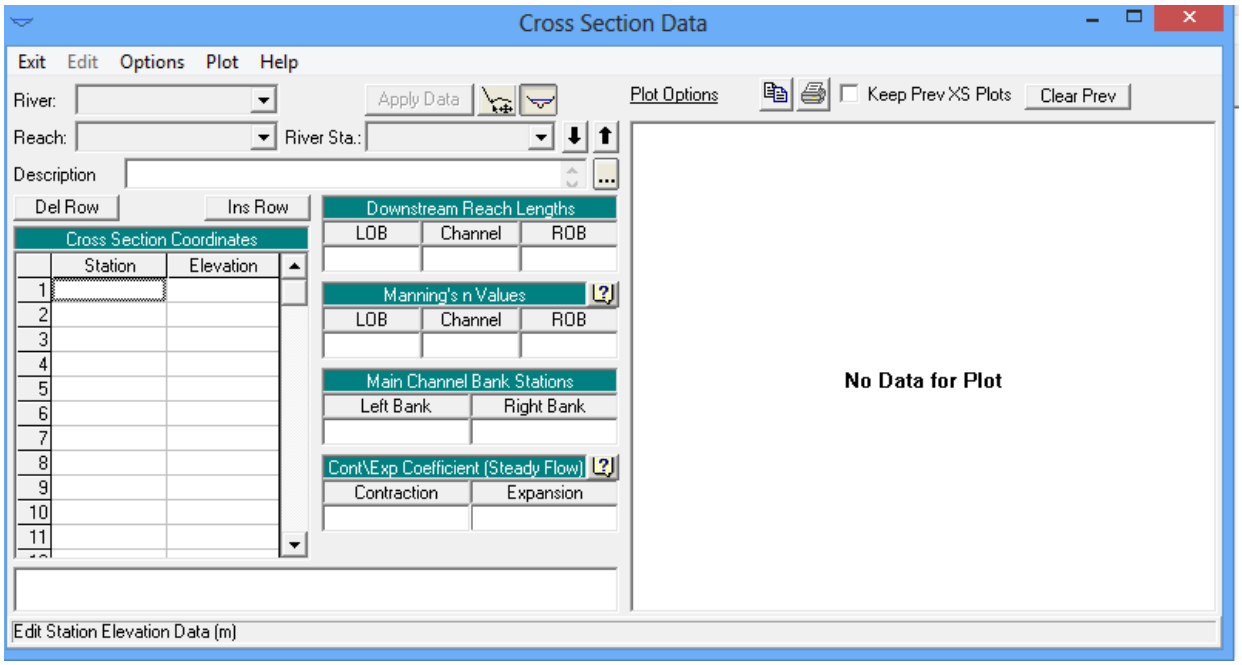
Enter the river name as Critical Cr and Reach name as Upper reach



Cross sections are ordered within a reach from the highest river station to the lowest river station downstream.

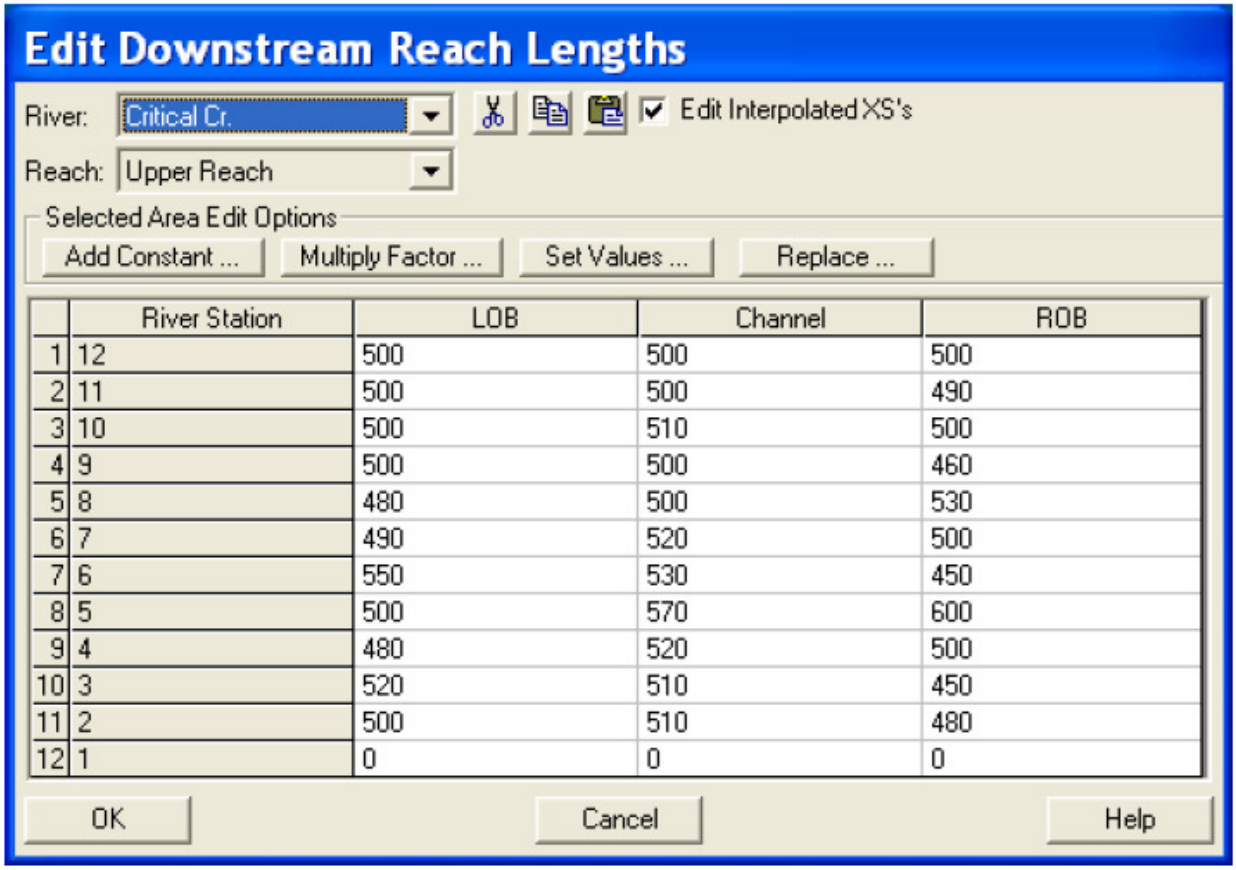
Click cross section 

button from geometrical editor window to enter the cross sectional data as shown in the following figure.



Click option and add a new cross section to add a new river station.

And then enter the cross sectional data one by one given in excel. (Directly copy it from excel to it) and the reach lengths are given in the following figure for each stations.



	River Station	LOB	Channel	ROB
1	12	500	500	500
2	11	500	500	490
3	10	500	510	500
4	9	500	500	460
5	8	480	500	530
6	7	490	520	500
7	6	550	530	450
8	5	500	570	600
9	4	480	520	500
10	3	520	510	450
11	2	500	510	480
12	1	0	0	0

Figure 1-2: Reach Lengths For Critical Creek

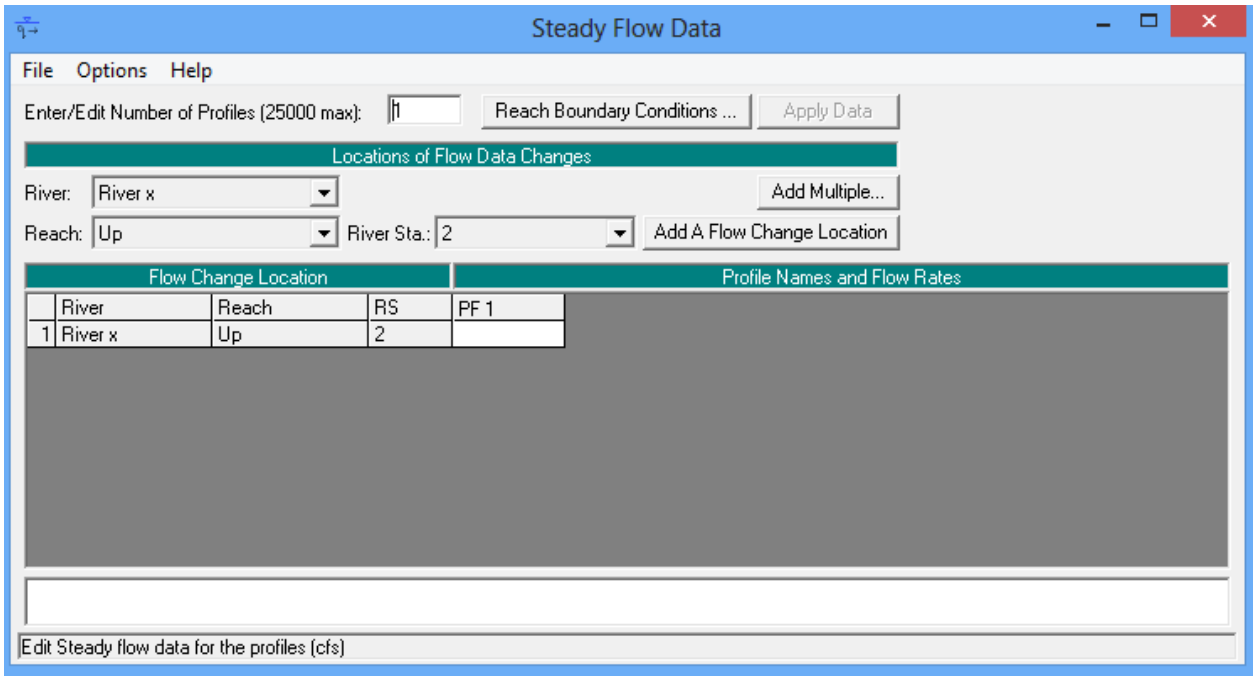
The remaining data consists of Manning's n values of 0.10, 0.04 and 0.10 in the LOB, Main channel and ROB respectively.

Change flow Analysis and modify the geometry based on the errors encountered.

Flow Data

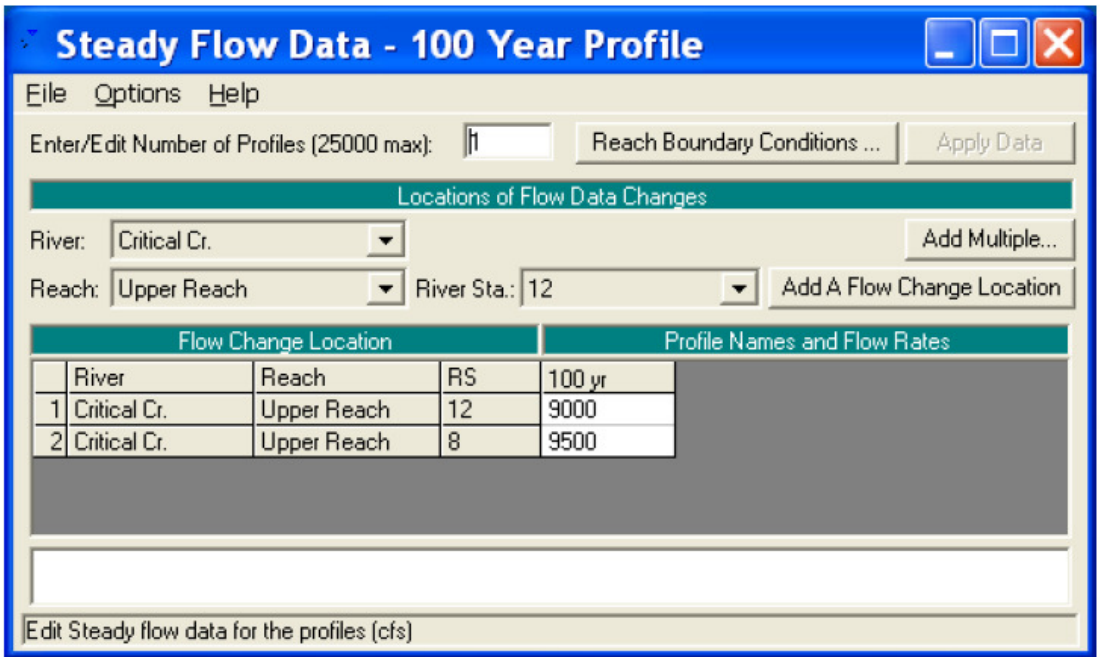
Once the geometric data are entered, the modeler can then enter either steady flow or unsteady flow data.

Click Edit and the steady flow data to enter the flow data. Or click  button on the HEC RAS window.



Put 1 in Enter/Edit Number of profile

Input a steady flow data for 100 yr for cross sections 12 and 8 as 9000 and 9500 cfs.



Next enter the reach boundary conditions for subcritical flow analysis with a downstream normal depth boundary condition of s=0.01ft/ft.

Steady flow analysis

To perform the steady flow analysis, run by selecting the Steady Flow Analysis. Critical Depth Output Option should be selected before performing the analysis to have critical depth calculated at all locations. Next the **flow regime** is selected as "subcritical". Finally compute the analysis.

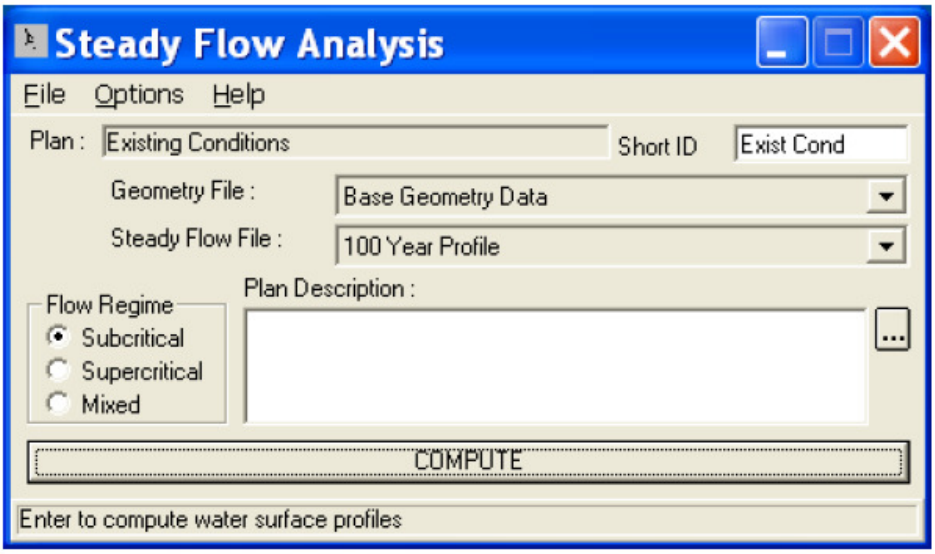


Figure 1-4: Steady Flow Analysis Window

Outputs of Subcritical flow

1. Water surface profiles

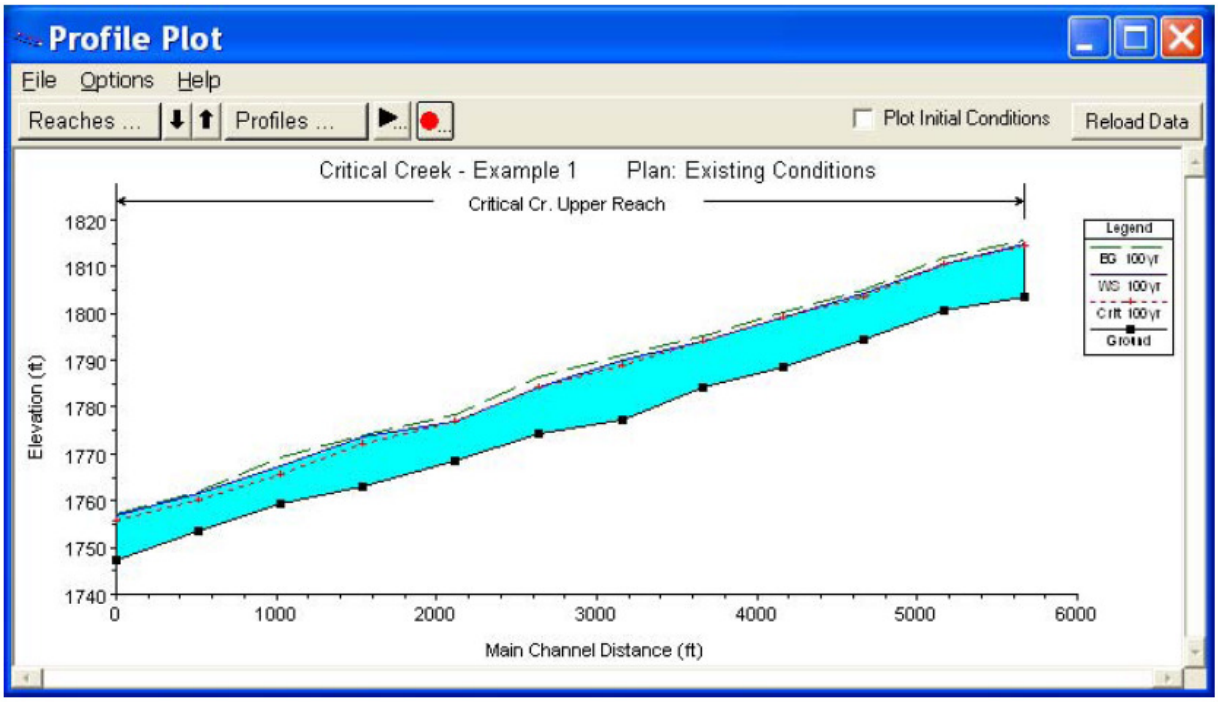
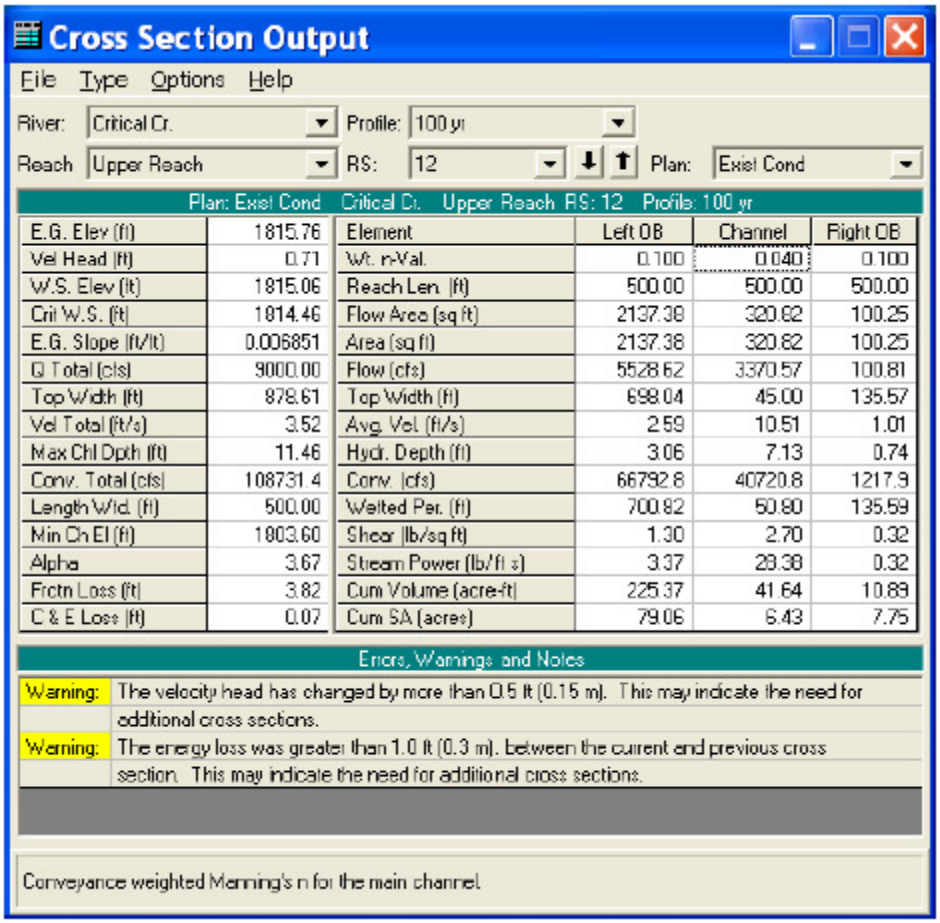


Figure 1-5: Profile Plot for Critical Creek

Select the variables to be selected from options menu.



Cross Section Output

File Type Options Help

River: Critical Cr. Profile: 100 yr

Reach Upper Reach RS: 12 Plan: Exist Cond

Plan: Exist Cond Critical Cr. Upper Reach RS: 12 Profile: 100 yr

E.G. Elev (ft)	1815.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.	0.100	0.040	0.100
W.S. Elev (ft)	1815.06	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	1814.46	Flow Area (sq ft)	2137.38	320.62	100.25
E.G. Slope (ft/ft)	0.006851	Area (sq ft)	2137.38	320.62	100.25
Q Total (cfs)	9000.00	Flow (cfs)	5528.62	3370.57	100.81
Top Width (ft)	878.61	Top Width (ft)	698.04	45.00	135.57
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)	2.59	10.51	1.01
Max Chl Dpth (ft)	11.46	Hydr. Depth (ft)	3.06	7.13	0.74
Conv. Total (cfs)	108731.4	Conv. (cfs)	66792.8	40720.8	1217.9
Length Wtd. (ft)	500.00	Wetted Per. (ft)	700.82	50.80	135.59
Min Ch El (ft)	1803.60	Shear (lb/sq ft)	1.30	2.70	0.32
Alpha	3.67	Stream Power (lb/ft s)	3.37	28.38	0.32
Frctn Loss (ft)	3.82	Cum Volume (acre-ft)	225.37	41.64	10.89
C & E Loss (ft)	0.07	Cum SA (acres)	79.06	6.43	7.75

Errors, Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Conveyance weighted Manning's n for the main channel.

Figure 1-6: Cross Section Table For River Station 12

Check the errors made in the analysis

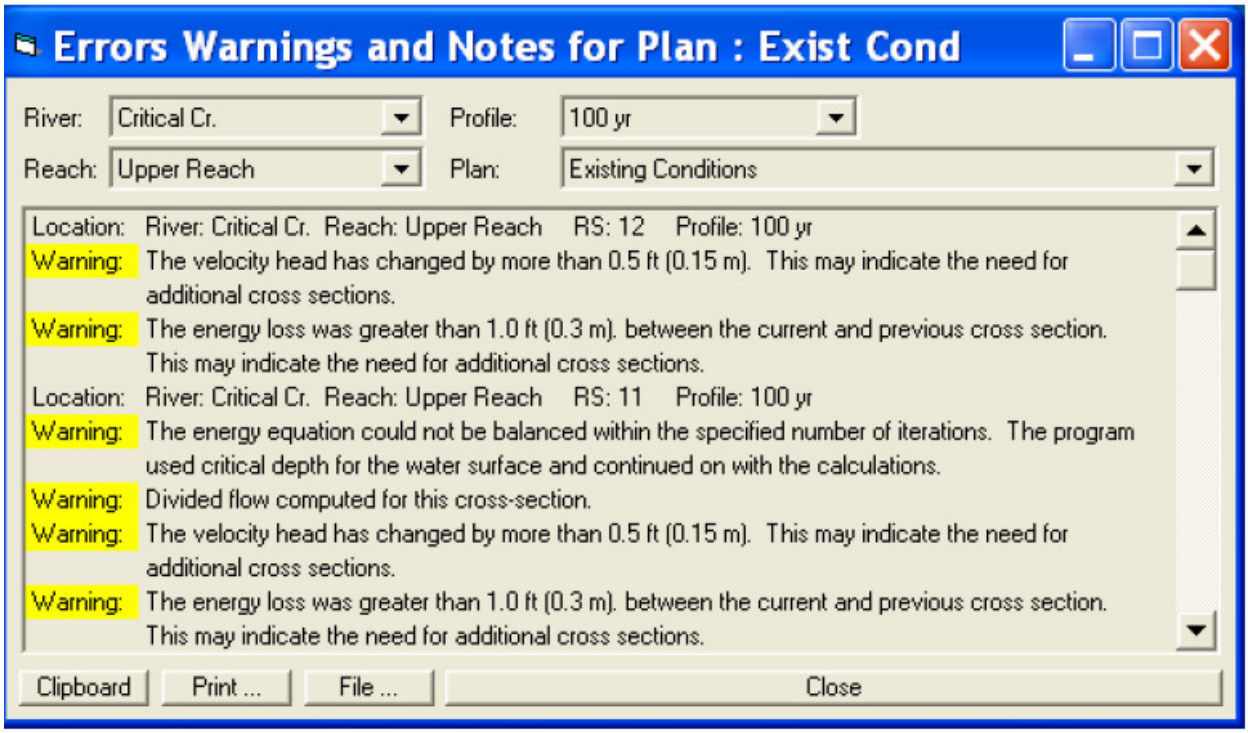


Figure 1-7: Summary of Warnings and Notes for Critical Creek

- **Modify the geometry by interpolating**
- **Modify the flow analysis from supercritical to mixed flow**
- **Run the analysis and review it.**