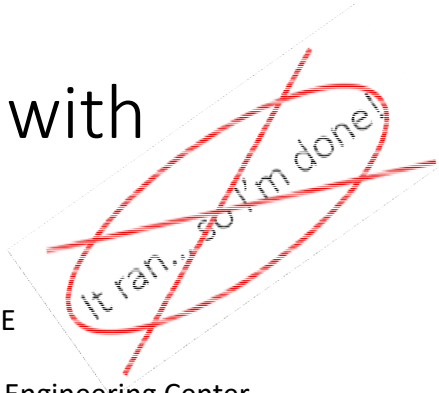
Troubleshooting with HEC-RAS



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Introduction

- Built in Data Checking
- Errors Warnings and Notes
- Steady Flow Computational Errors
- Log Output
- Reviewing and Debugging Normal Output

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The HEC-RAS software is designed to continue its computations all the way through completion, even when the user has entered poor data. Because of this, the fact that the program executes a complete run does not necessarily mean that the results are good. The user must carefully review the results to ensure that they adequately represent the study reach and that they are reasonable and consistent. The HEC-RAS software is an engineering tool, it is by no means a replacement for sound engineering.

The HEC-RAS software contains several features to assist the user in the development of a model; debugging problems; and the review of results. These features include: built in data checking; an Errors, Warnings, and Notes system; and a computational Log Output file. In addition to these features, the user can use the graphical and tabular output to review the results and check the data for reasonableness and consistency.

Built in Data Checking: Checking as it is Entered

- Minimum and maximum range checks
- Alpha and numeric data checks
- Increasing order of stations
- Data consistency
- Data deletion warnings
- File management warnings

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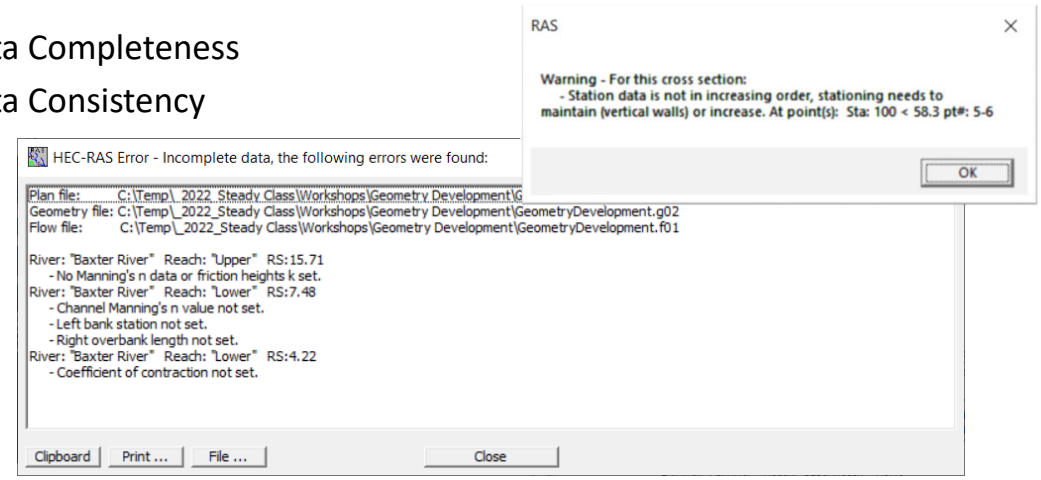
This type of data checking occurs whenever the user enters data into a single data field or table. Once the user leaves a particular data entry field or table, the program will automatically check that data for reasonableness. The following is a list of some of the types of data checks that are performed:

Minimum and maximum range checking for variables.
Alpha and numeric data checks. This is done to ensure that the right type of data is entered in each field.
Increasing order of station for cross sections, bridge deck/roadway, and abutments.
Data consistency checks (i.e. when the main channel bank stations are entered, the program checks to see if they exist in the cross section station and elevation data).
Data deletion warnings. When you delete data the software will give you a warning before it is deleted.
File management warnings (i.e. program will give you a chance to save the data to the hard disk before the program is closed, or a different data set is opened).

Built in Data Checking: Before Computations

- Data Completeness
- Data Consistency



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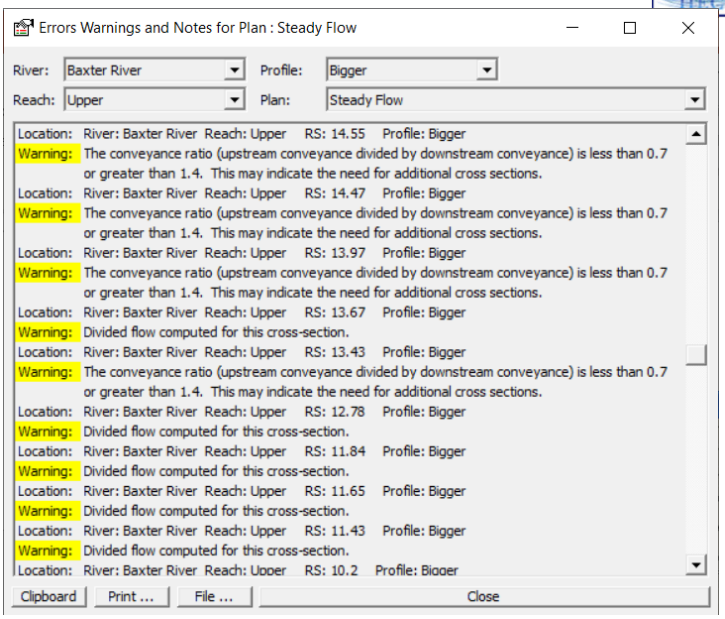
The second type of data checking is performed to evaluate the completeness and consistency of the data. This type of data checking occurs before the computations take place. When the user presses the Compute button on the Steady Flow Analysis window, the program will perform a series of data checks before the computations are allowed to proceed. If any data errors are found, the program will not perform the computations. The following is a list of some of the types of checks that are made during this time:

Data completeness. These data checks insure that all of the required data exists for the entire data set. If any missing data are found, a complete list of all the missing data and their specific locations is displayed on the screen

Data consistency. This type of data checking is performed to ensure that the data is consistent with the computations that are being requested. For example, if the user asks to perform a mixed flow regime computation, the program checks to ensure that upstream as well as downstream boundary conditions have been specified. Likewise, if an encroachment analysis is requested, the program checks to ensure that the number of profiles lines up with the number specified in the encroachment data. There are several other checks of this type.

Errors Warning Notes

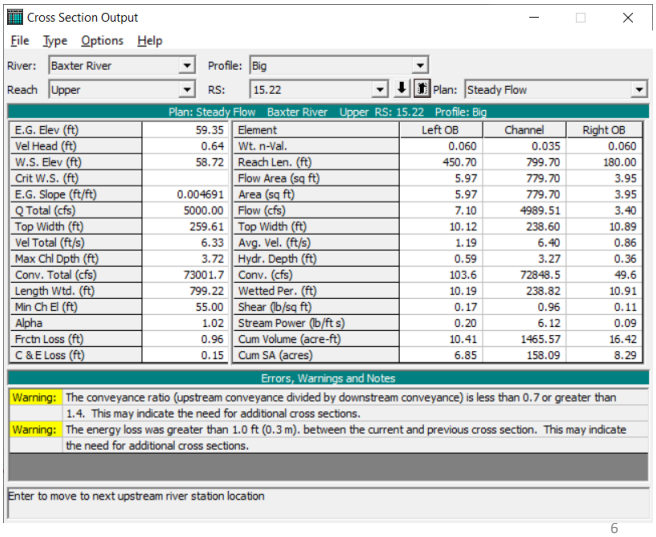


The HEC-RAS software has a system of Errors, Warnings, and Notes that are passed from the steady flow computation program to the user interface. During the computations, the steady flow computation program will set flags for at a particular node (nodes are cross sections, bridges, culverts, or multiple openings) whenever it is necessary. These message flags are written to the standard output file, along with the computed results for that node. When the user interface reads the computed results from the output file, if any errors, warnings, or notes exist, they are interpreted and displayed in various locations from the interface.

The user can request a summary of all the errors, warnings, and notes that occurred during the computations. This is accomplished by selecting Summary Errors, Warnings, and Notes from the View menu on the main HEC-RAS window. Once this is selected, a window will pop up displaying all of the messages. The user has the options of expanding the window; printing the messages; or sending them to the windows clipboard.

Errors Warning Notes

- Detailed output tables view



Besides the summary window, errors, warnings, and notes will automatically appear on the detailed output tables. When a specific cross section or hydraulic structure is being displayed, any errors, warnings, or notes that were set at that location, for the displayed profile, will show up in the Errors, Warnings, and Notes message box at the bottom of the table.

Errors, Warning, and Notes

- Errors
  - problems prevent program from running
- Warnings
  - may or may not require action from the user
  - user should review to ensure model data is ok
- Notes
  - provide information about how the program is performing computations

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WARNINGS: Warning messages provide information to the user that may or may not require action on the user's part. In general, whenever a warning is set at a location, the user should review the hydraulic results at that location to ensure that the results are reasonable. If the hydraulic results are found to be reasonable, then the message can be ignored. However, in many instances, a warning level message may require the user to take some action that will cause the message to disappear on future runs. Many of the warning messages are caused by either inadequate or bad data. Some common problems that cause warning messages to occur are the following:

Cross sections spaced to far apart. This can cause several warning messages to be set.

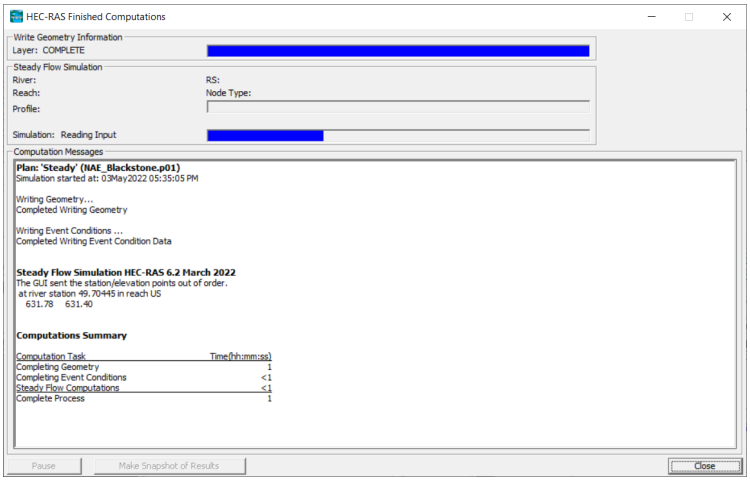
Cross sections starting and ending stations not high enough. If a computed water surface is higher than either end point of the cross section, a warning message will appear.

Bad Starting Water Surface Elevation. If the user specifies a boundary condition that is not possible for the specified flow regime, the program will take action an set an appropriate warning message.

Bad Cross Section Data. This can cause several problems, but most often the program will not be able to balance the energy equation and will default to critical depth.

Steady Flow Analysis Errors

- Steady Flow Computations Crash
  - Reading in data
  - During computations



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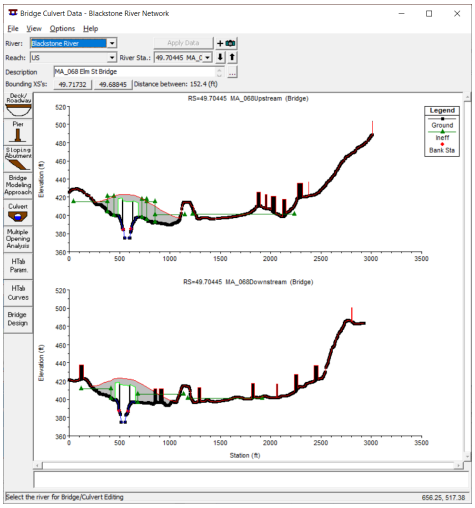
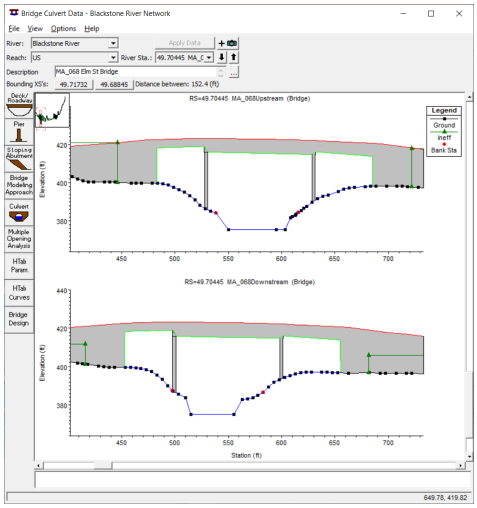
In general there are two places where the steady flow program can crash, reading in data and during computations.

If there is an error reading in the data, then it will report the reach and river station where an error occurred. Look for errors at this section.
An example of this is shown above.

During computations, the steady flow engine writes the river, reach and river station that it is working on . Therefore if the steady flow engine crashes on computations, the first place to look for bad or inconsistent data is at that location.

Steady Flow Errors – Bridge Clipping





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Log Output

- Log Output is a text file created by computation process
- Requires a global and/or node specific levels from 1-10
- Accessed from the Steady Flow Analysis Options menu
- Can be used to see what happened with the computations

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Setting Log File Output Level. This option allows the user to set the level of the Log file. The Log file is a file that is created by the computational program. This file contains information tracing the program process. Log levels can range between 0 and 10, with 0 resulting in no Log output and 10 resulting in the maximum Log output. In general, the Log file output level should not be set unless the user gets an error during the computations that cannot be traced to input errors. If an error occurs in the computations, set the log file level to an appropriate value. Re-run the computations and then review the log output, try to determine why the program got an error.

When the user selects Set Log File Output Level, a window will appear as shown in Figure 5. The user can set a "Global Log Level", which will be used for all cross sections and every profile. The user can also set log levels at specific locations for specific profiles. In general, it is better to only set the log level at the locations where problems are occurring in the computations. To set the specific location log level, first select the desired reach and river station. Next select the log level and the profile number (the log level can be turned on for all profiles). Once you have everything set, press the Set button and the log level will show up in the window below. Log levels can be set at several locations individually. Once all of the Log Levels are set, press the OK button to close the window.

View Log File. This option allows the user to view the contents of the log file.

Reviewing and Debugging a Model

- View Graphics
  - Cross Section
  - Profile Plots
  - XYZ Perspective Plots
- Tables
- Errors Warning Notes
- Summary Tables for Input

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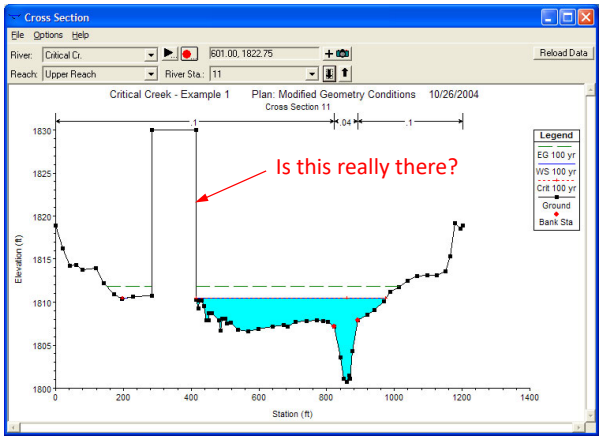
Reviewing and Debugging – Cross Section Plot



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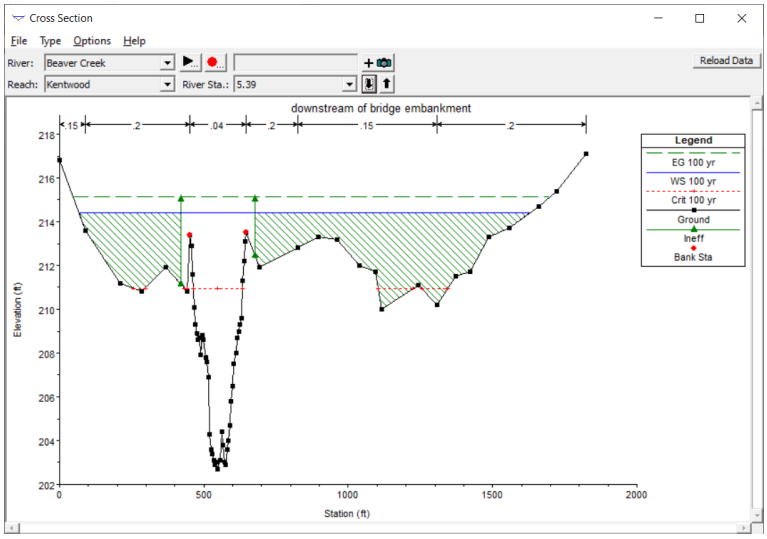
In general, the graphical output should be used as much as possible to get a quick view of the results. The user should look at all of the cross sections with the cross section plotting capability. The cross section plots will assist the user in finding data mistakes, as well as possible modeling mistakes (mistakes in ineffective flow areas, levees, n values, etc...).

Reviewing and Debugging – Cross Section Plot



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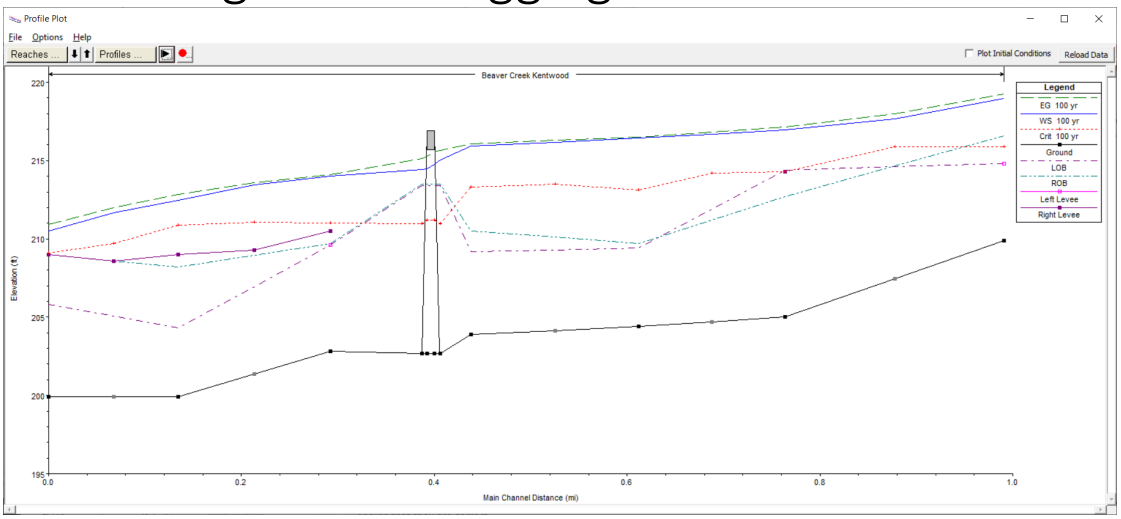
Reviewing and Debugging – Profile Plot



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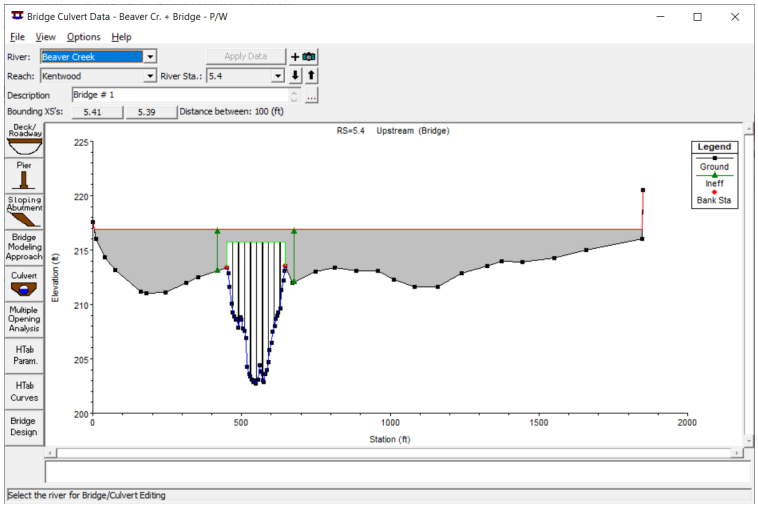
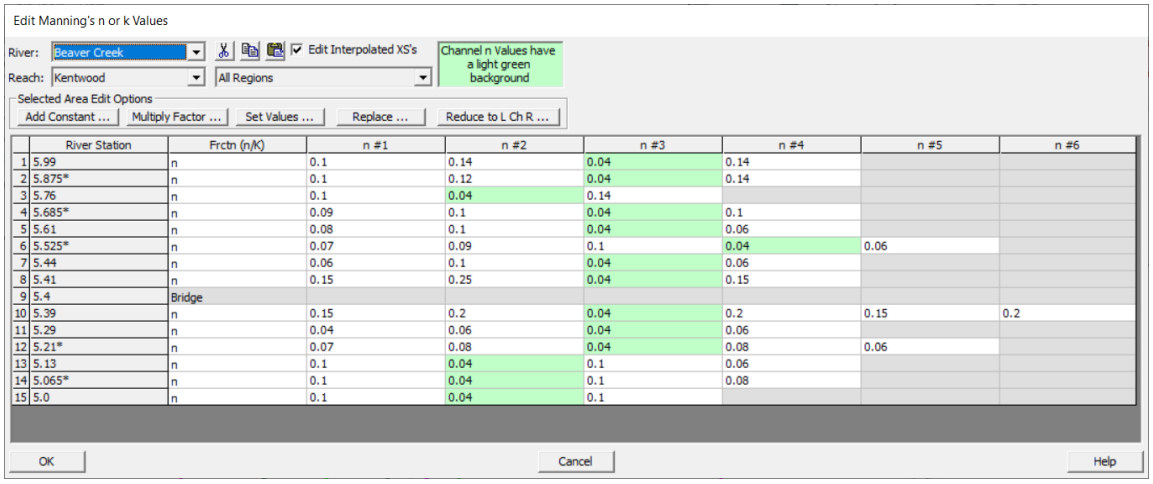
The profile plotting capability is also a way to get a quick overview of the entire study area. The user should look for sudden changes to the energy grade line and the water surface. In general, these two variables should transition smoothly along the channel. If the user finds rapid changes in the energy or the water surface, the results at those locations should be reviewed closely to ensure that they are correct.

Reviewing and Debugging - Bridge Editor

- Highlighting:
  - Red - Weir
  - Green - Lid
  - Blue - Ground



Reviewing and Debugging - Tables



	River Station	Frctn (n/K)	n #1	n #2	n #3	n #4	n #5	n #6
1	5.99	n	0.1	0.14	0.04	0.14		
2	5.875*	n	0.1	0.12	0.04	0.14		
3	5.76	n	0.1	0.04	0.14			
4	5.685*	n	0.09	0.1	0.04	0.1		
5	5.61	n	0.08	0.1	0.04	0.06		
6	5.525*	n	0.07	0.09	0.1	0.04	0.06	
7	5.44	n	0.06	0.1	0.04	0.06		
8	5.41	n	0.15	0.25	0.04	0.15		
9	5.4	Bridge						
10	5.39	n	0.15	0.2	0.04	0.2	0.15	0.2
11	5.29	n	0.04	0.06	0.04	0.06		
12	5.21*	n	0.07	0.08	0.04	0.08	0.06	
13	5.13	n	0.1	0.04	0.1	0.06		
14	5.065*	n	0.1	0.04	0.1	0.08		
15	5.0	n	0.1	0.04	0.1			

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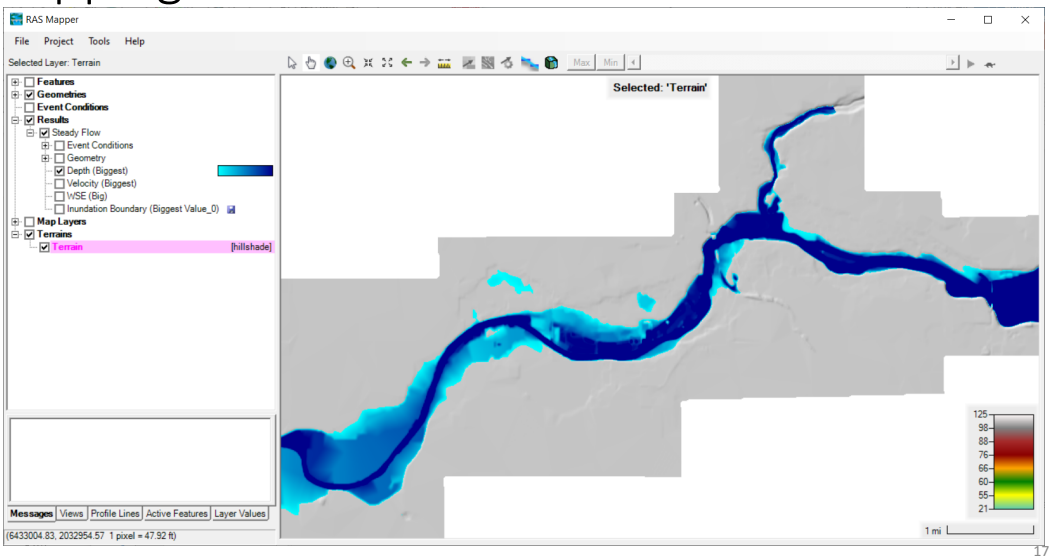
Summary input tables are available from the geometry schematic. There are tables for Manning's n, reach lengths, expansion and contraction coefficients, ice cover, node names, and comparison of GIS cut line length and cross section width.

Mapping



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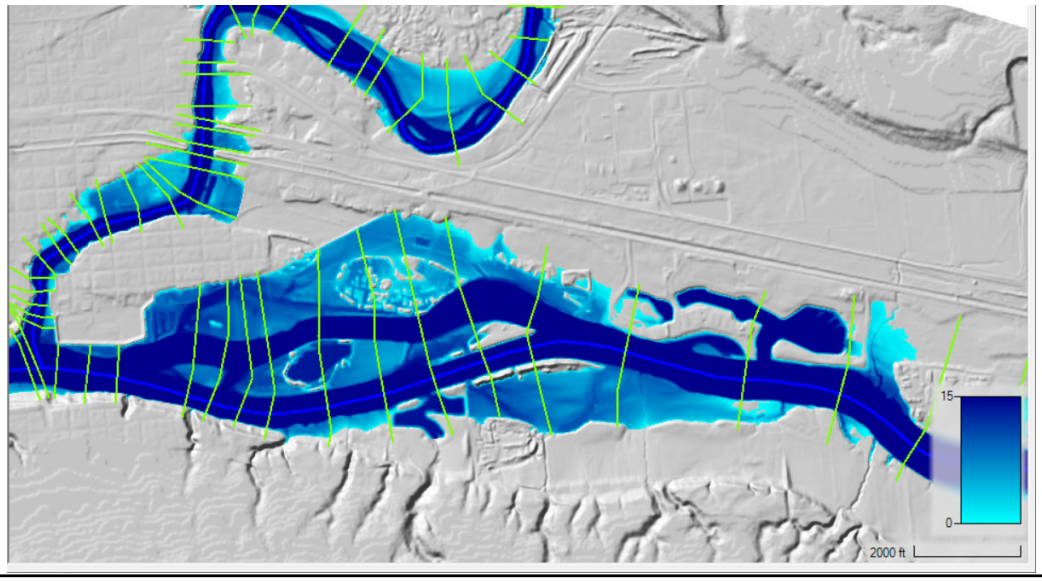
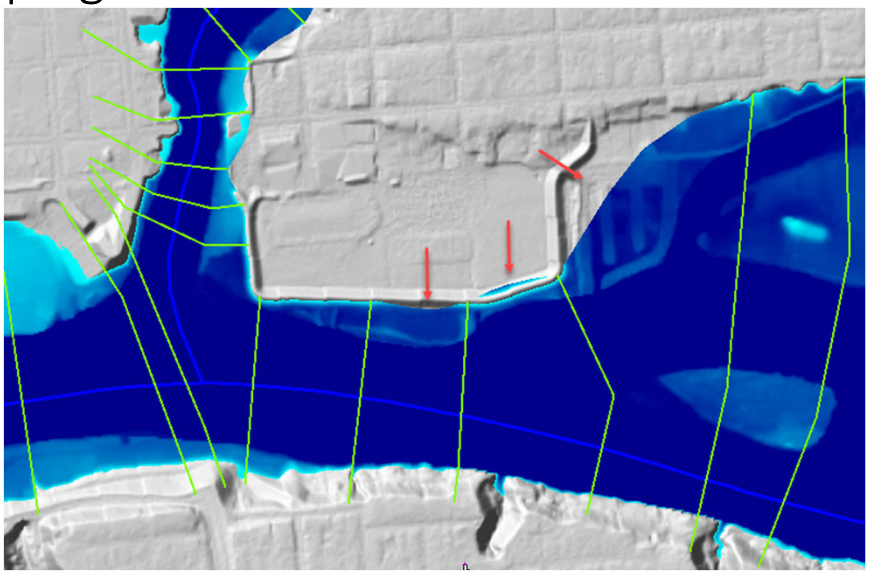
Use RAS Mapper to plot the inundation.
Look for isolated areas of water.

Mapping



Use RAS Mapper to plot the inundation.
Verify Cross Sections include the entire floodplain.

Mapping



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Use RAS Mapper to plot the inundation.
Make sure the Edge Lines go out to edge of the floodplain.

Occurrence of Critical Depth

- Bad cross section data
- Cross sections spaced too far apart
- Wrong flow regime
- Program could not balance energy equation above or below the top of a levee or ineffective area

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During the water surface profile calculations, the program may default to critical depth at a cross section in order to continue the calculations. Critical depth can occur for the following reasons:
1. Bad cross section data: If the energy equation can not balance because of bad cross section data, the program defaults to critical depth.

2. Cross sections spaced to far apart: If the cross sections are spaced to far apart, the program may not be able to calculate enough energy losses to obtain a subcritical water surface at the upstream section.

3. Wrong flow regime: When calculating a subcritical profile, and the program comes to a reach that is truly supercritical, the program will default to critical depth. Likewise, when calculating a supercritical profile, if the reach is truly subcritical, the program will default to critical depth.

4. Program can not balance the energy equation above or below the top of a levee or ineffective flow area: On occasion, when the program is balancing a water surface that is very close to the top of a levee, or an ineffective flow area, the program may go back and forth (above and below the levee) without being able to balance the energy equation. When this occurs, the program will default to critical depth.

Questions?

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