HEC-RAS Data Requirements for Unsteady Flow Models

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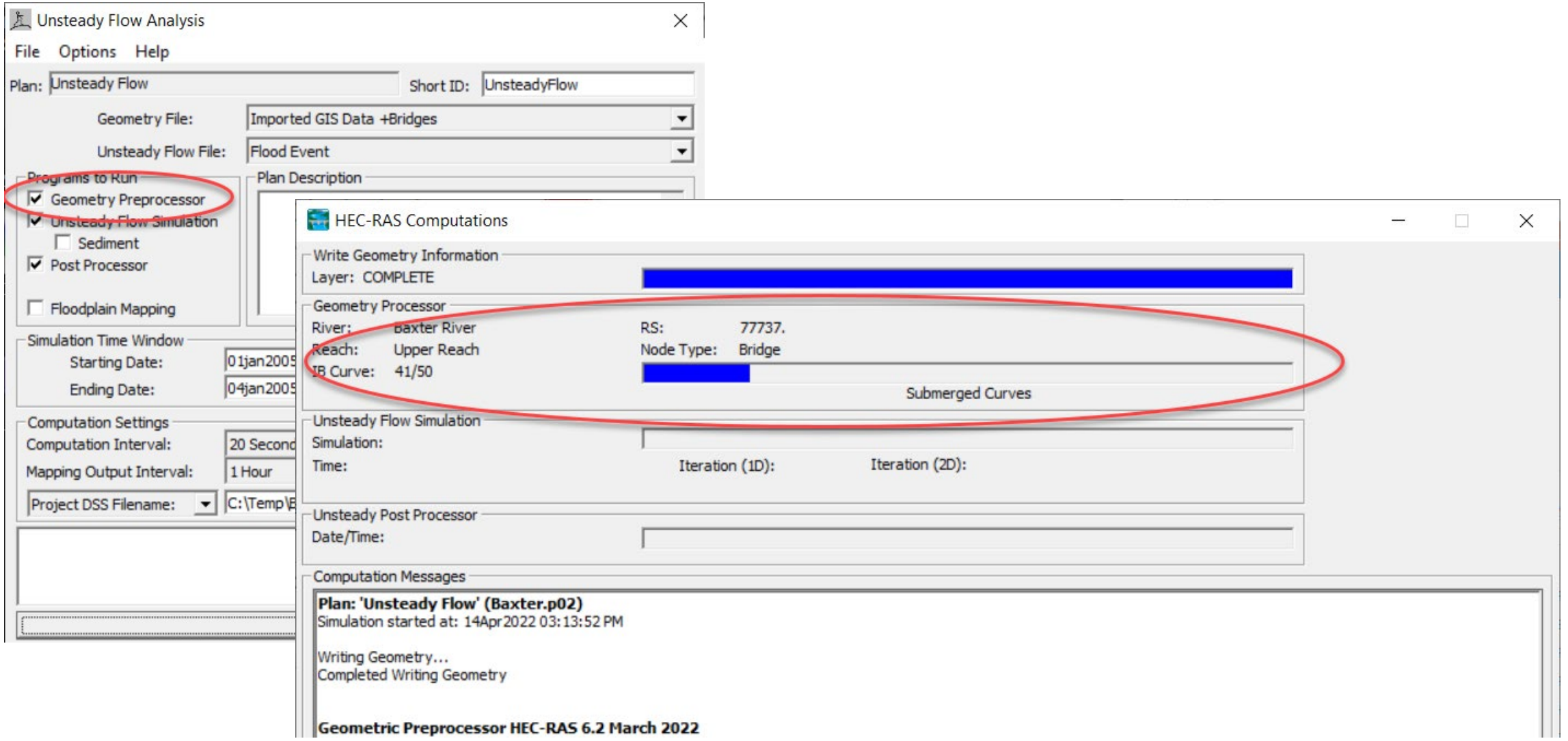
Overview

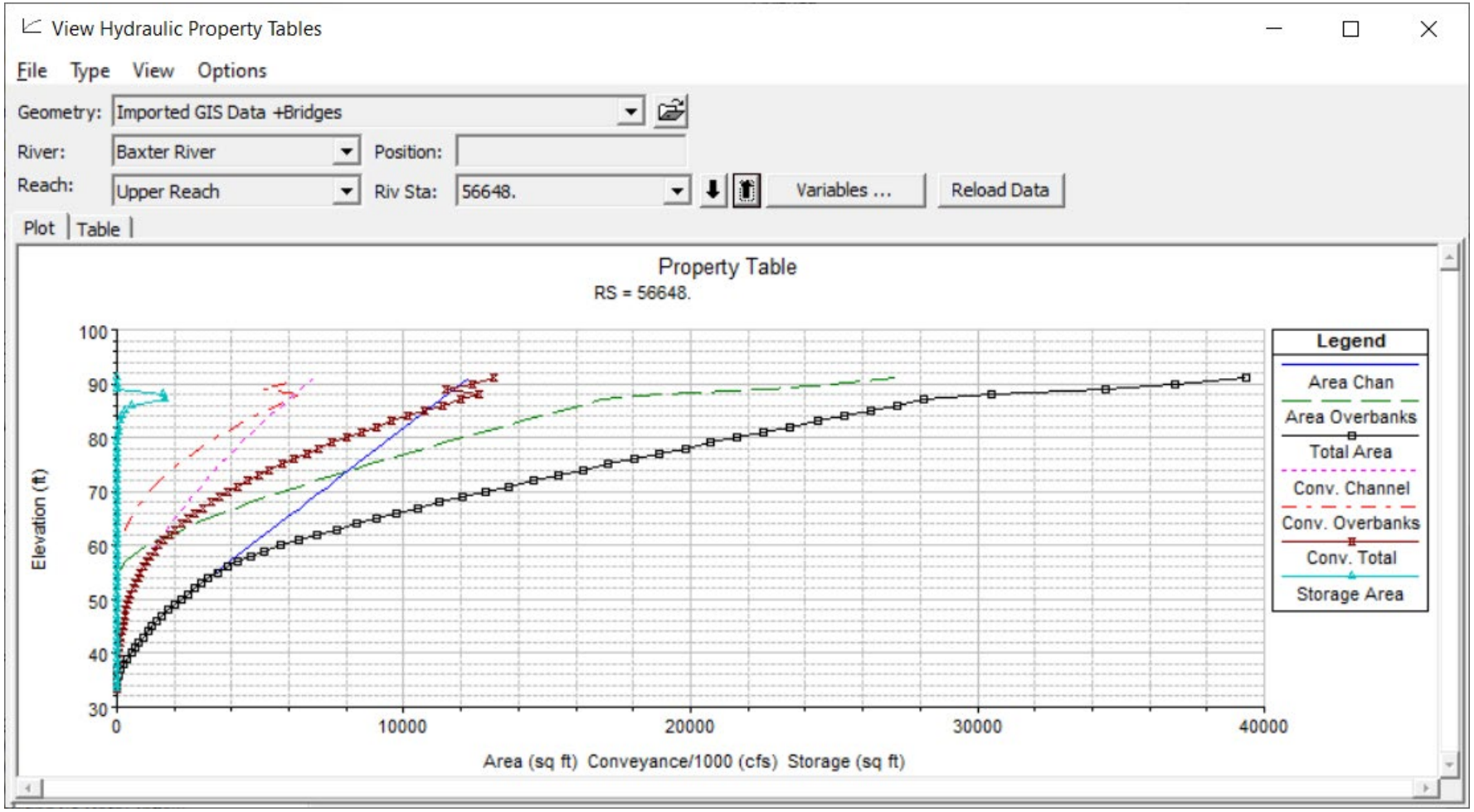
- Geometry Preprocessor
- Hydraulic Computations
- Manning's *n* Values
- Ineffective Flow Areas
- Blocked Obstructions
- Levees

Geometry Preprocessor



Geometry Preprocessor

- Processes geometric data into a series of hydraulic tables and rating curves.



Geometry Preprocessor

- Why do we use it for unsteady flow?
  - Instead of calculating hydraulic variables for each cross-section during each iteration, the program interpolates the hydraulic variables from the tables.

Computations Summary

Computation Task	Time(hh:mm:ss)
Writing Geometry	2
Writing Event Conditions	<1
Preprocessing Geometry	2:46
Unsteady Flow Computations	22
Writing to DSS	<1
Post-Processing	38
Complete Process	3:48

- Hydraulic Variables: Conveyance, Area, Storage, Top Width

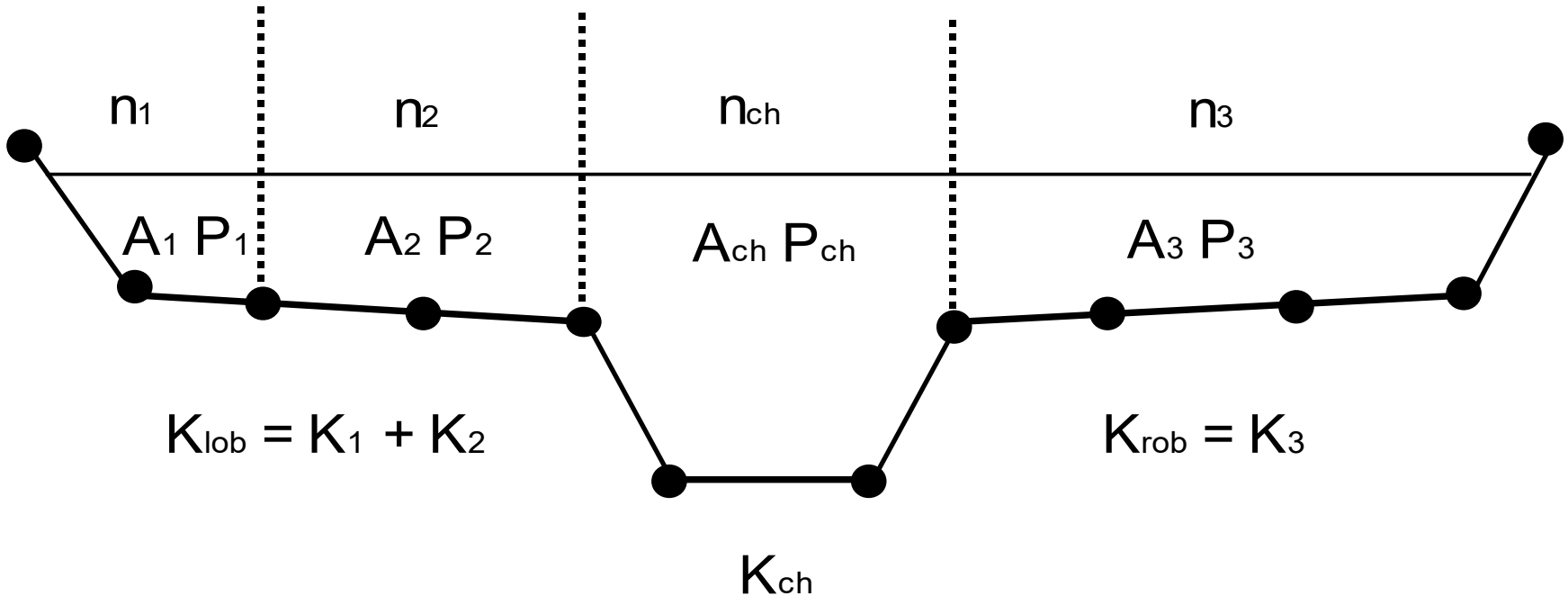
Conveyance Calculations

- Manning's Equation

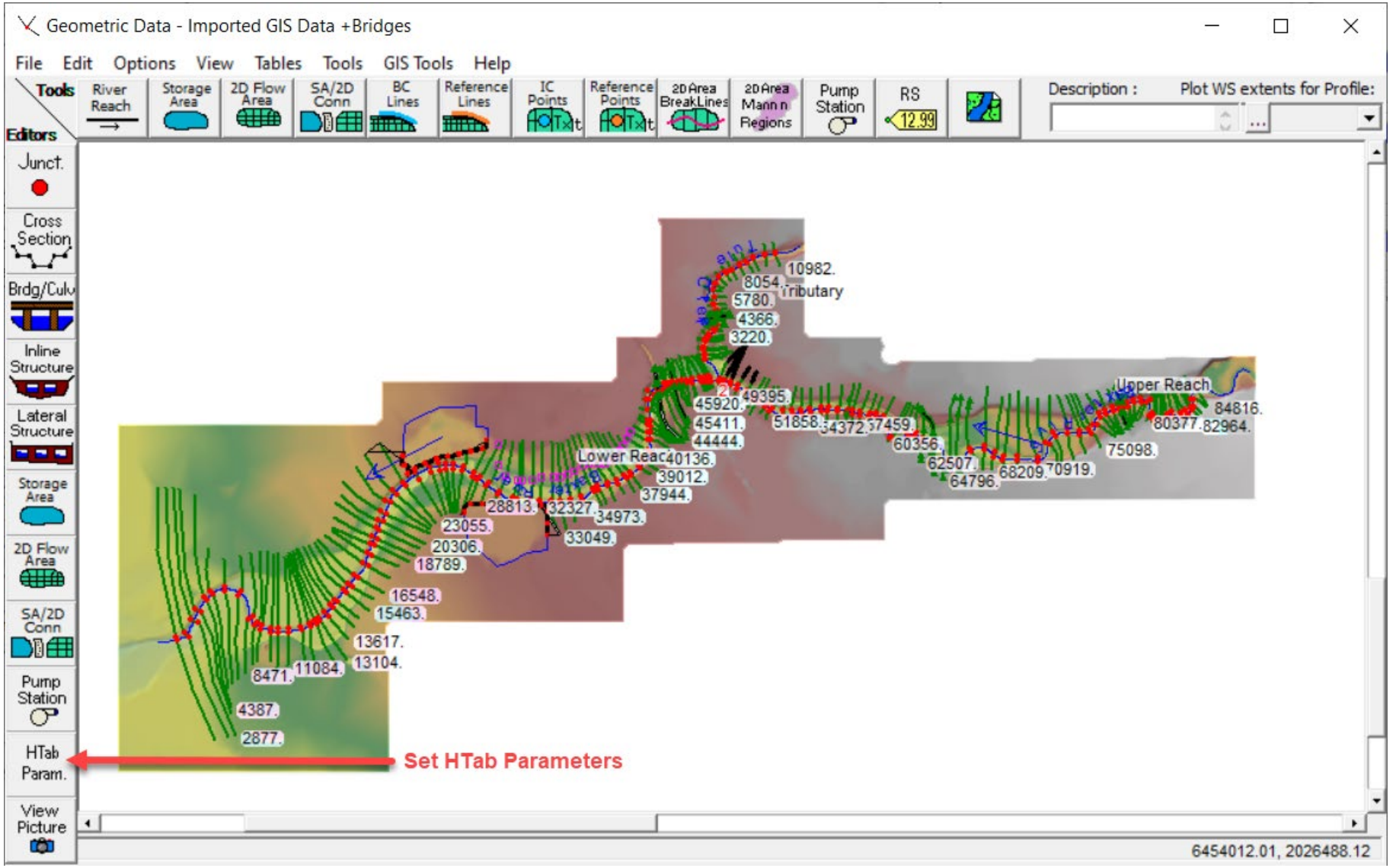
$$Q = K S_f^{1/2}$$

$$K = \frac{1.486}{n} A R^{2/3}$$

Conveyance Calculations



Cross Section Table Parameters



Cross Section Table Parameters

- Starting Elevation, Increment, Number of Points

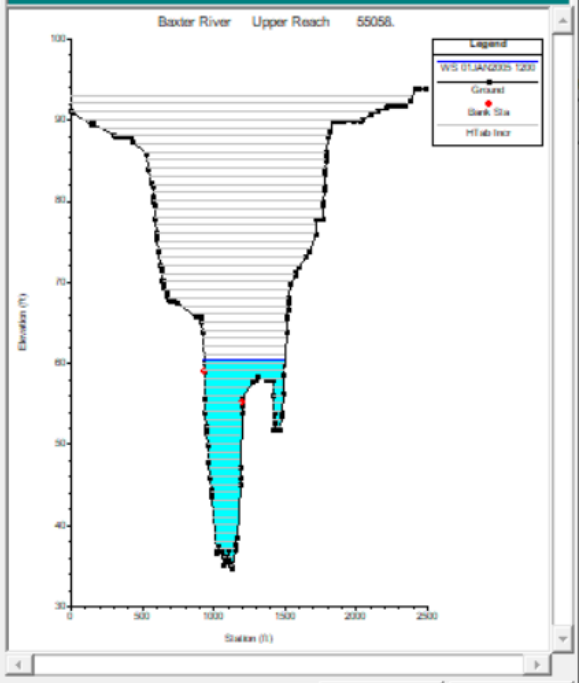
Cross Section Table Properties

River: Baxter River
Reach: Upper Reach

Selected Area Edit Options: Add Constant ... | Multiply Factor ... | Set Values ... | Copy Invert | Reset Defaults

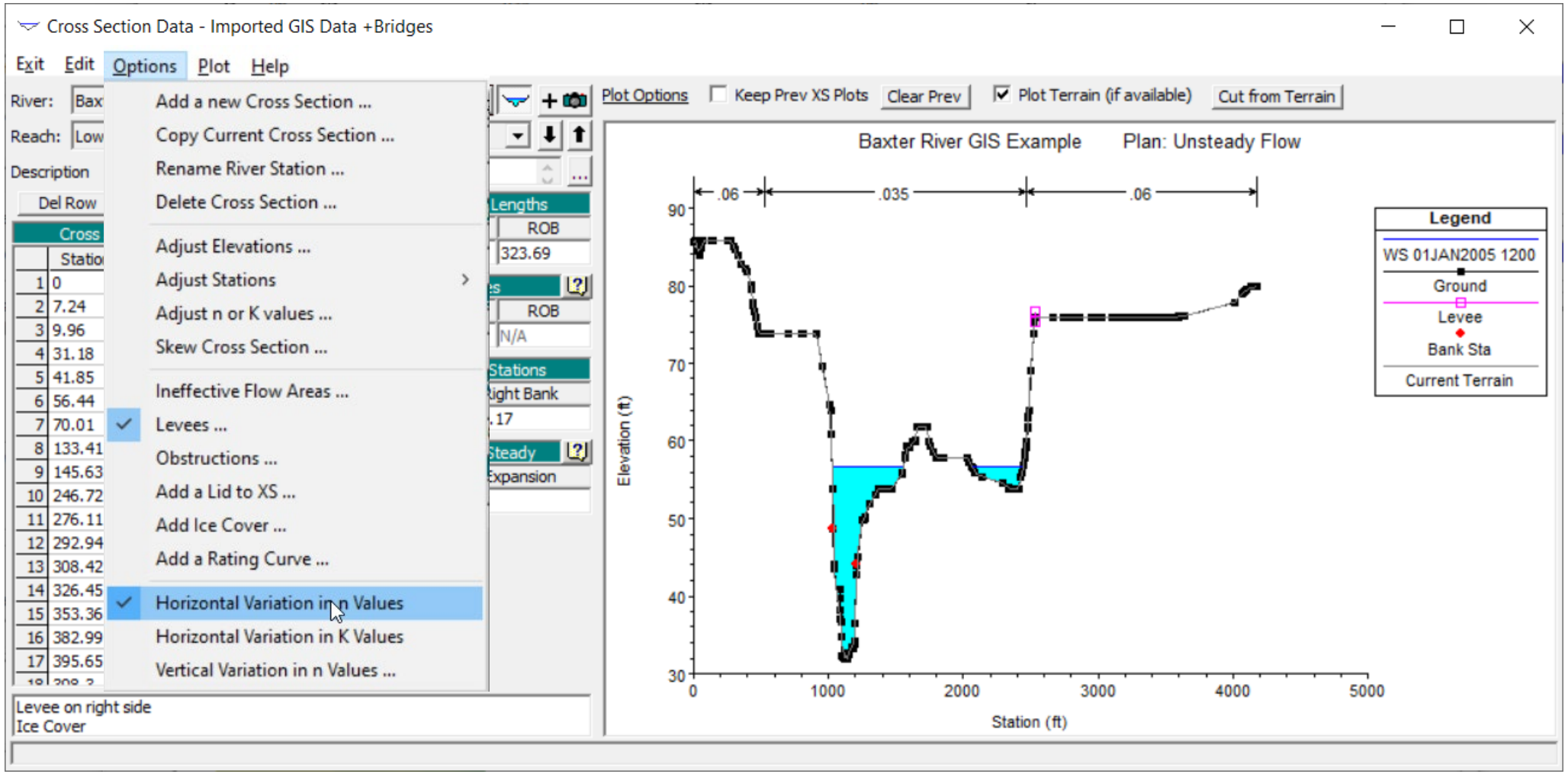
	RS	Chan Min	Starting El	Increment	Points(20-500)	LOB	Chan	ROB
	Vertical Discretization (hydraulic properties)					Horizontal (velocity mapping)		
38	62507.	30	30.5	1	73	5	5	5
39	61976.	32.02	32.52	1	71	5	5	5
40	61506.	28.7	29.2	1	75	5	5	5
41	60356.	28	28.5	1	73	5	5	5
42	59797.	26.57	27.07	1	72	5	5	5
43	58912.	23.23	23.73	1	72	5	5	5
44	58425.	27.88	28.38	1	67	5	5	5
45	58021.	29.88	30.38	1	65	5	5	5
46	57459.	32.75	33.25	1	59	5	5	5
47	56999.	33	33.5	1	59	5	5	5
48	56648.	33.48	33.98	1	57	5	5	5
49	56106.	34.4	34.9	1	56	5	5	5
50	55483.	34.6	35.1	1	59	5	5	5
51	55058.	34.6	35.1	1	59	5	5	5
52	54372.	34.6	35.1	1	57	5	5	5
53	53861.	34.07	34.57	1	56	5	5	5
54	53267.	33.75	34.25	1	56	5	5	5
55	52676.	33.3	33.8	1	52	5	5	5
56	51858.	35.22	35.72	1	49	5	5	5
57	51497.	35.5	36	1	48	5	5	5
58	50871.	35.55	36.05	1	56	5	5	5
59	50517.	36.18	36.68	1	53	5	5	5
60	50002.	35.39	35.89	1	54	5	5	5

Cross section plot is for the current row in the table



OK | Cancel

Manning's n Values



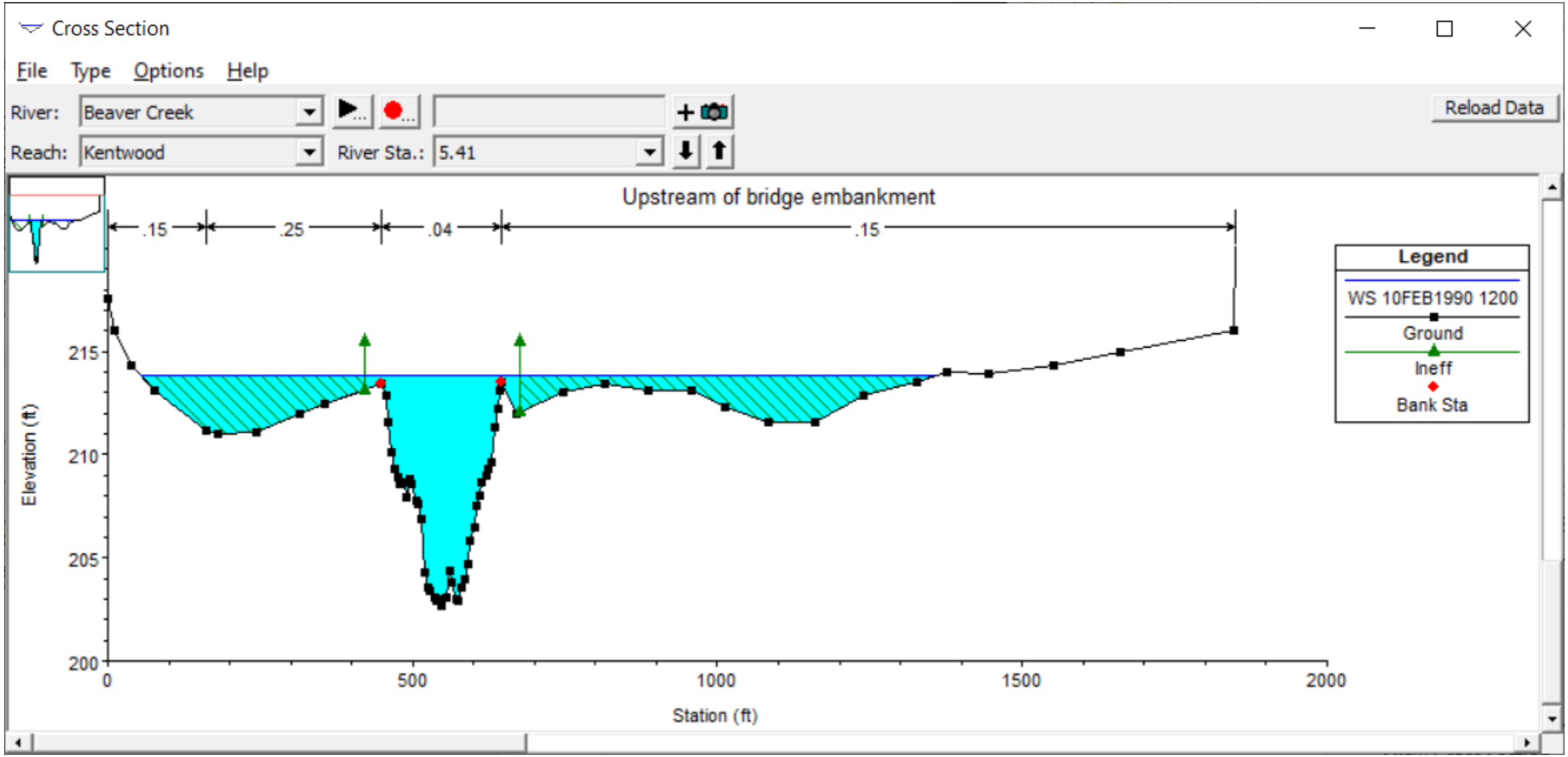
Ineffective Flow Areas

- Areas where water is not actively being conveyed. The velocity of water in the downstream direction is close to zero.
- This water is included in the storage calculations and other wetted cross section parameters, but it is not included as part of the active flow area.

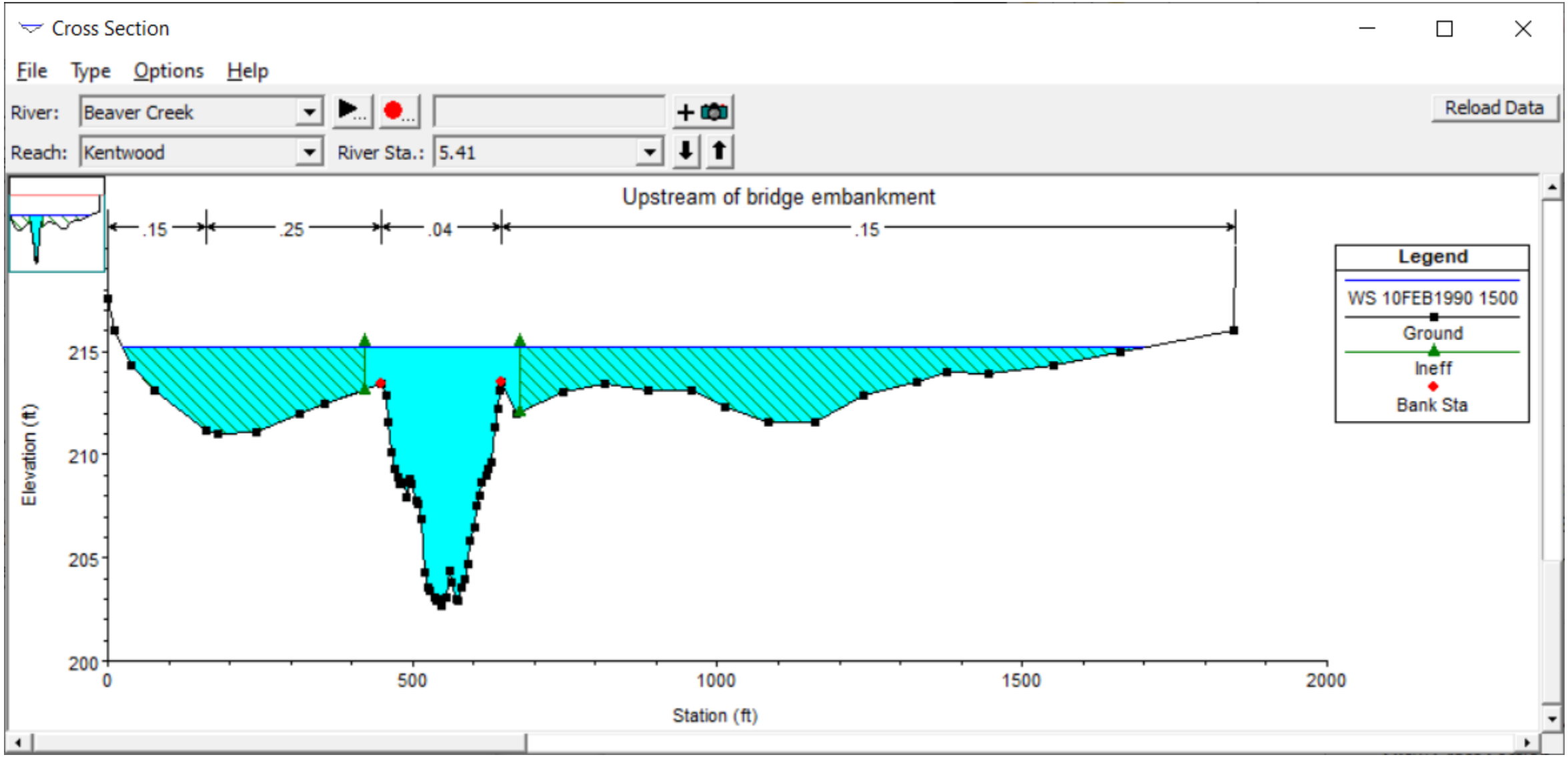
Ineffective Flow Areas Requirements

- Ineffective Flow Stations
  - Left and/or right ineffective flow stations denote the location of the ineffective flow areas along the cross section.
- Trigger Elevations
  - Water elevation at which the ineffective flow area begins to convey flow (non-permanent) or remains ineffective (permanent).

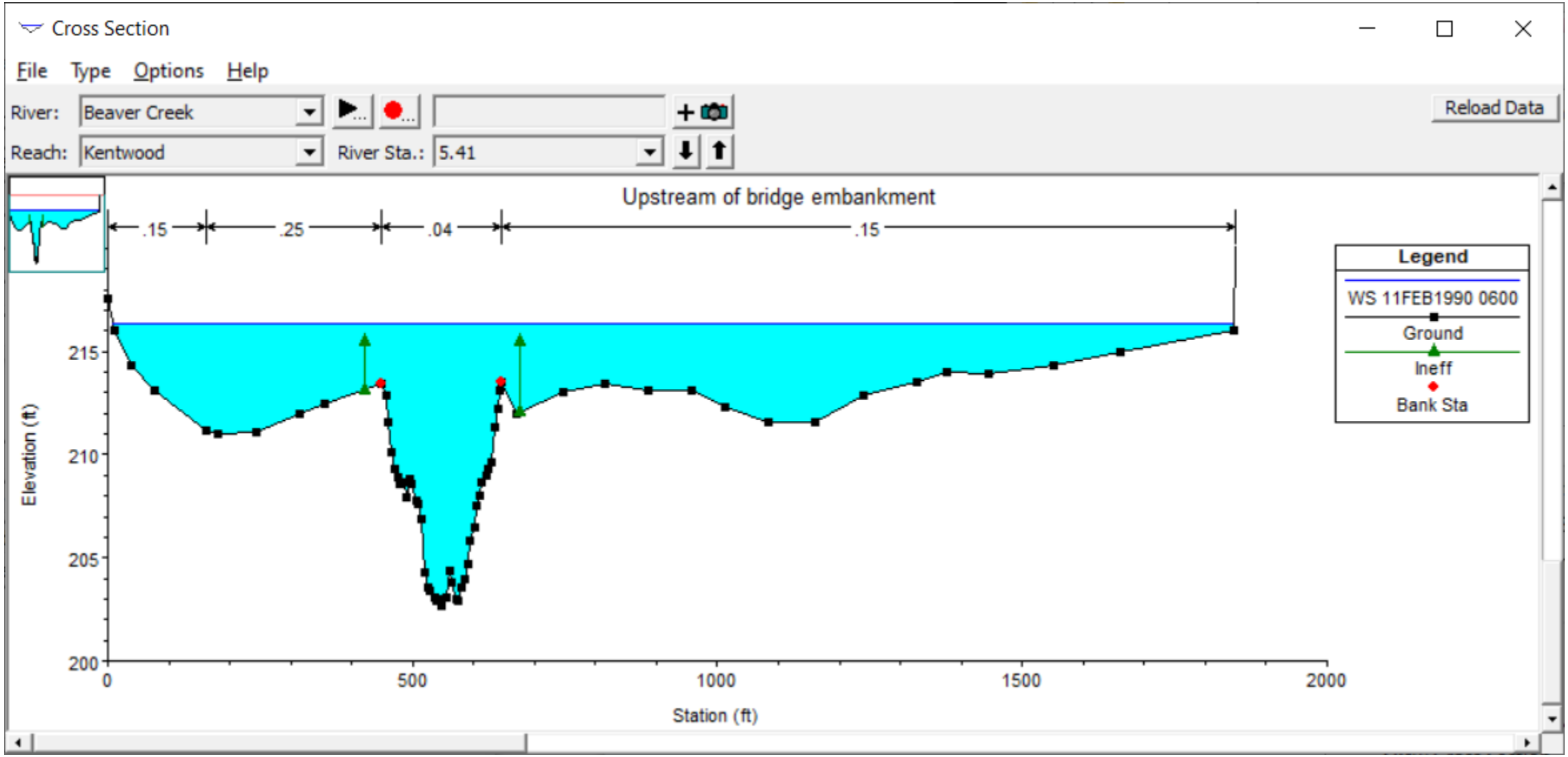
Non-Permanent Ineffective Flow Area



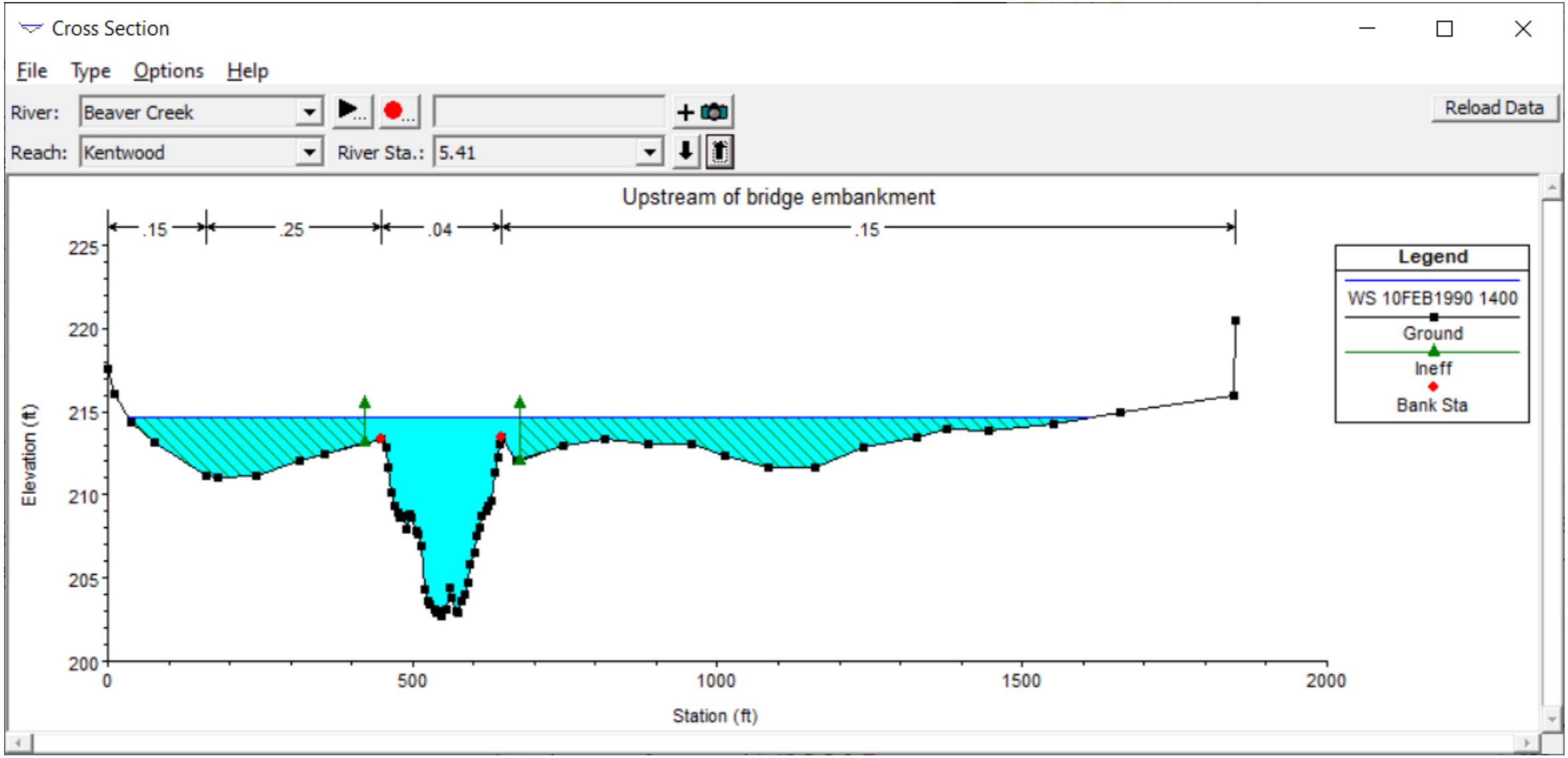
Non-Permanent Ineffective Flow Area



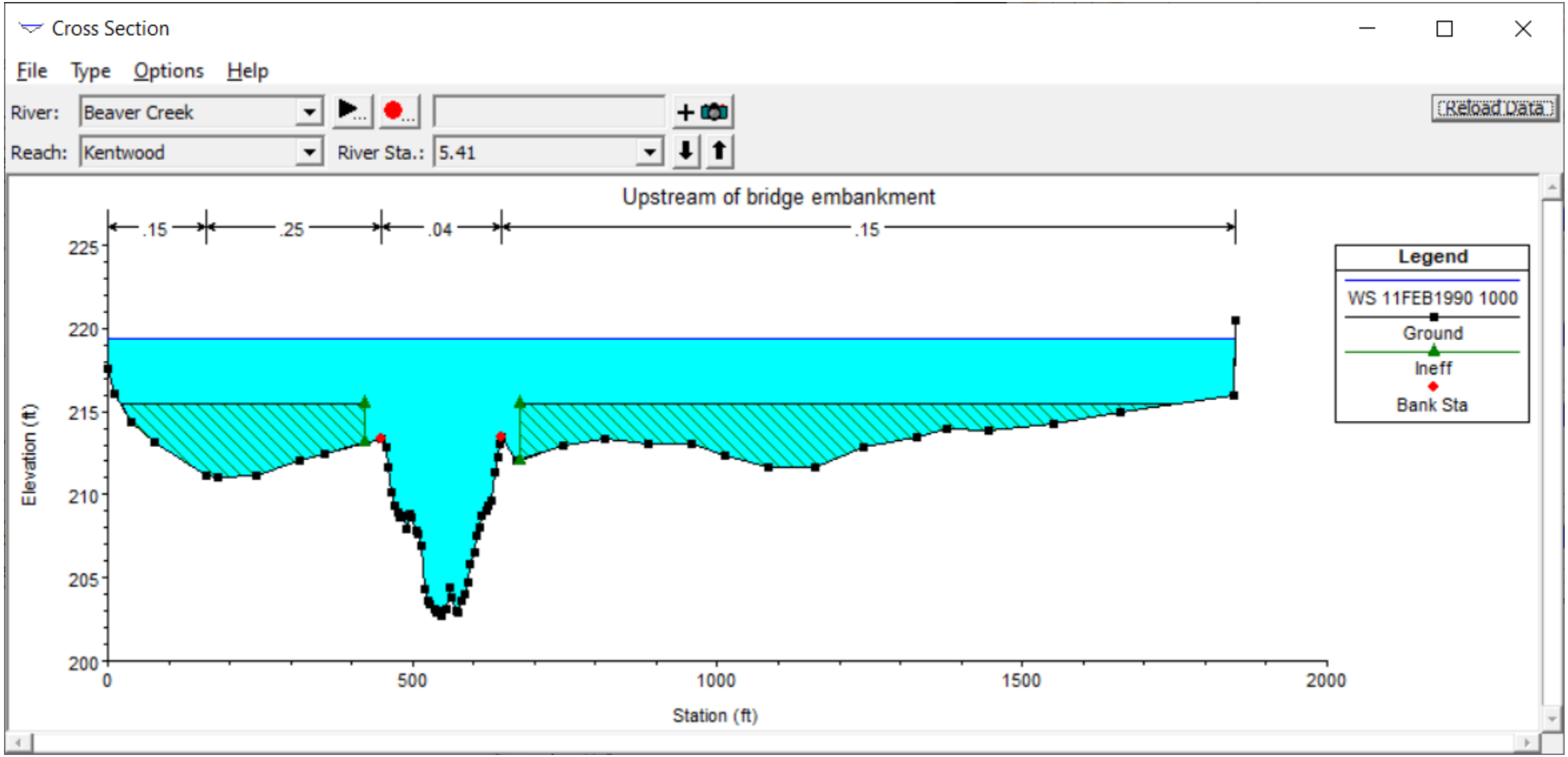
Non-Permanent Ineffective Flow Area



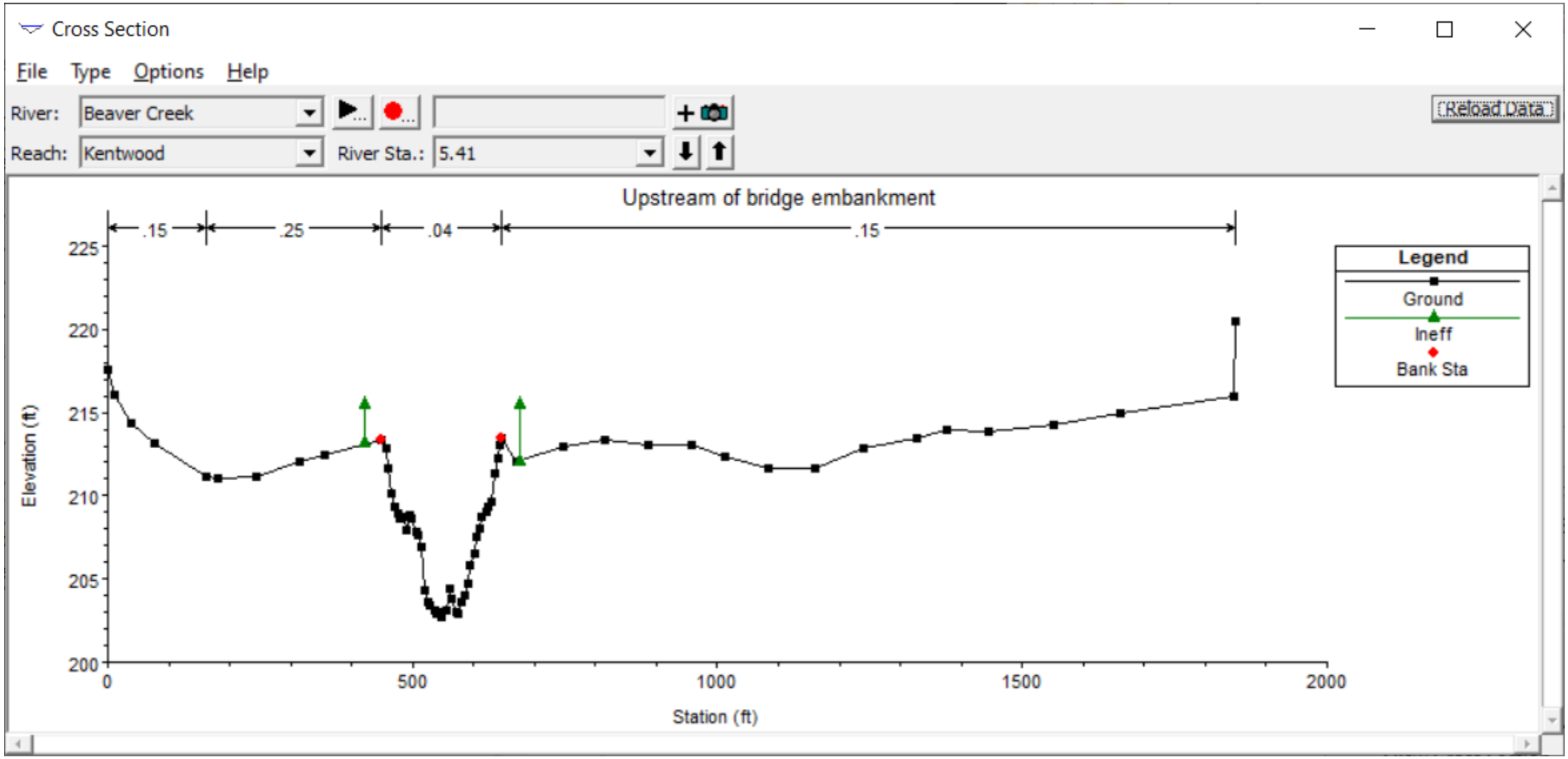
Permanent Ineffective Flow Area



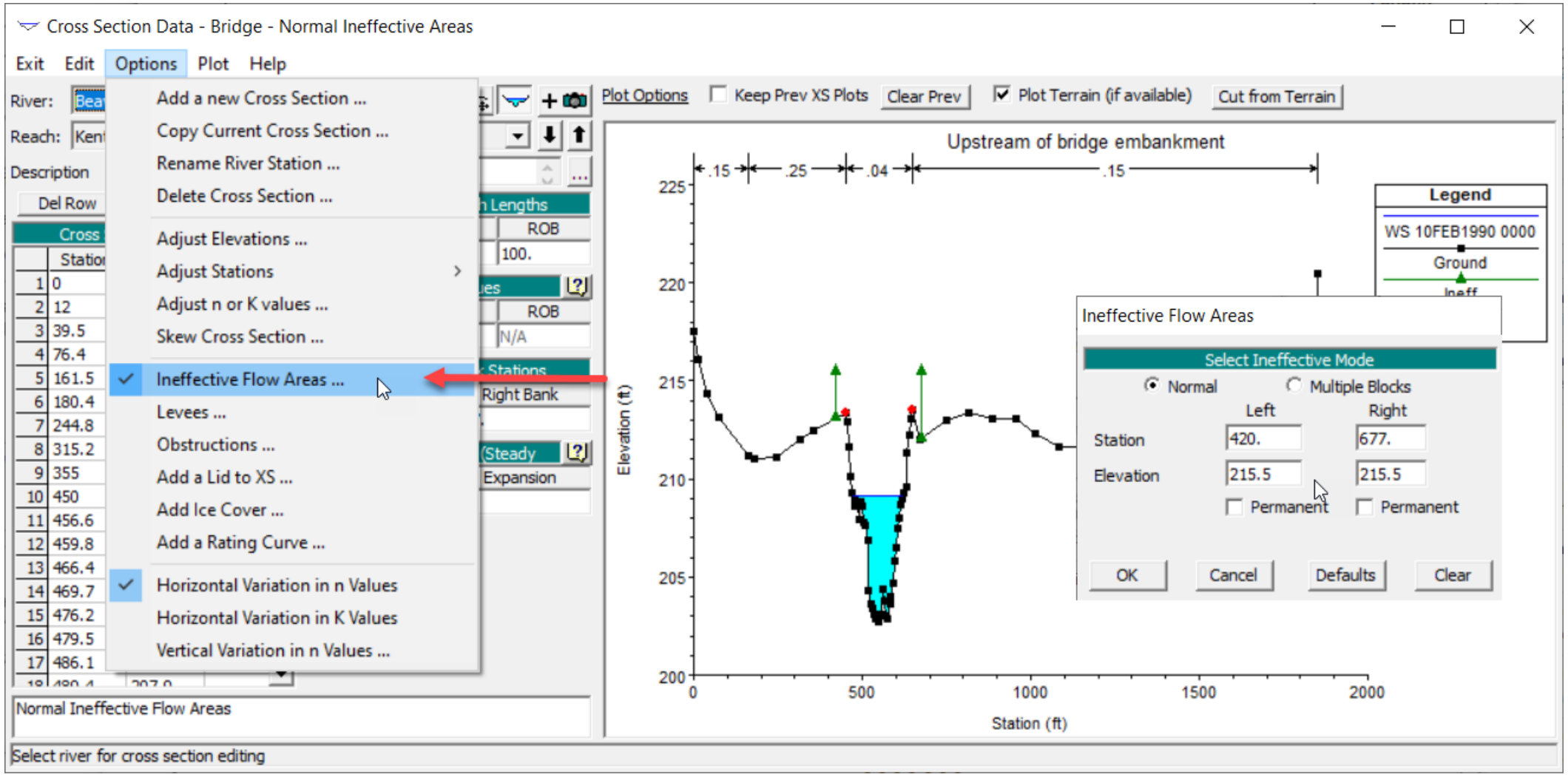
Permanent Ineffective Flow Area



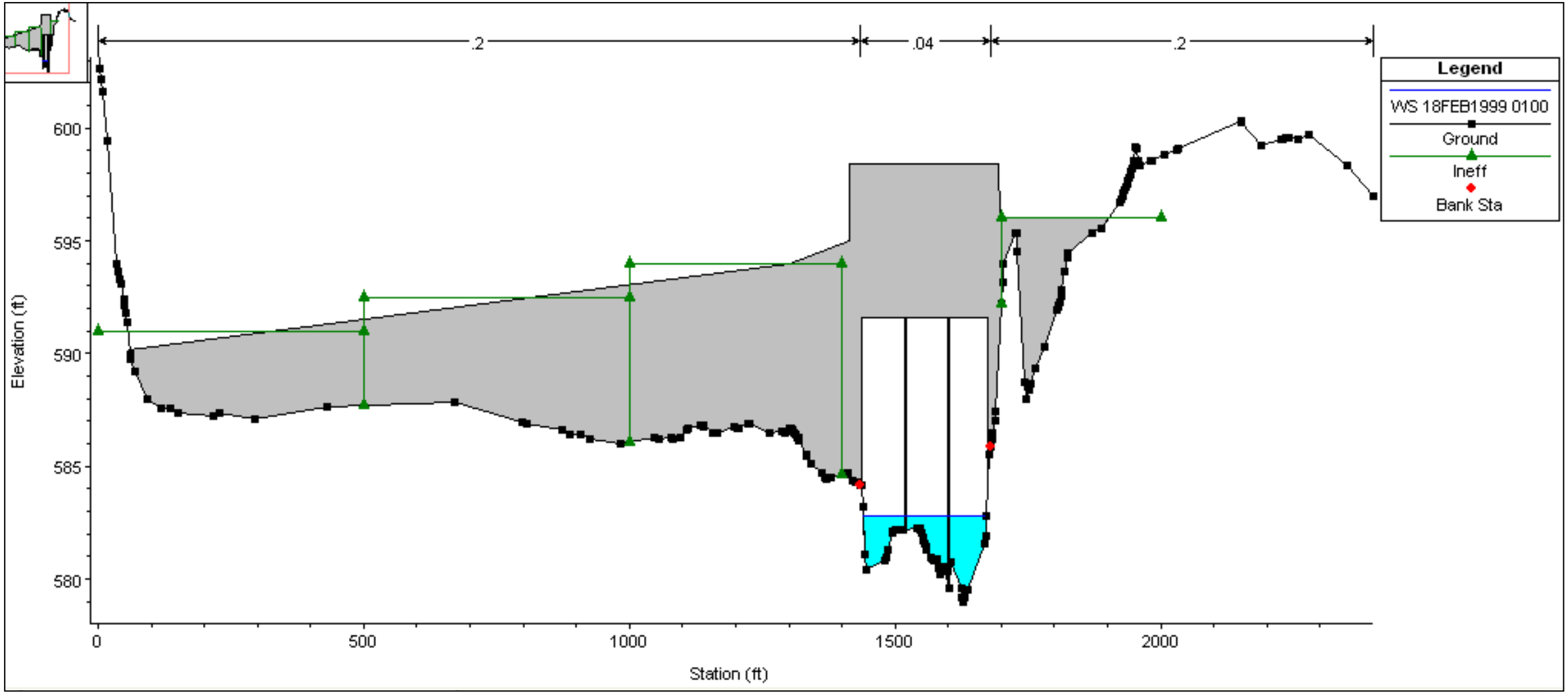
Normal Ineffective Flow Areas



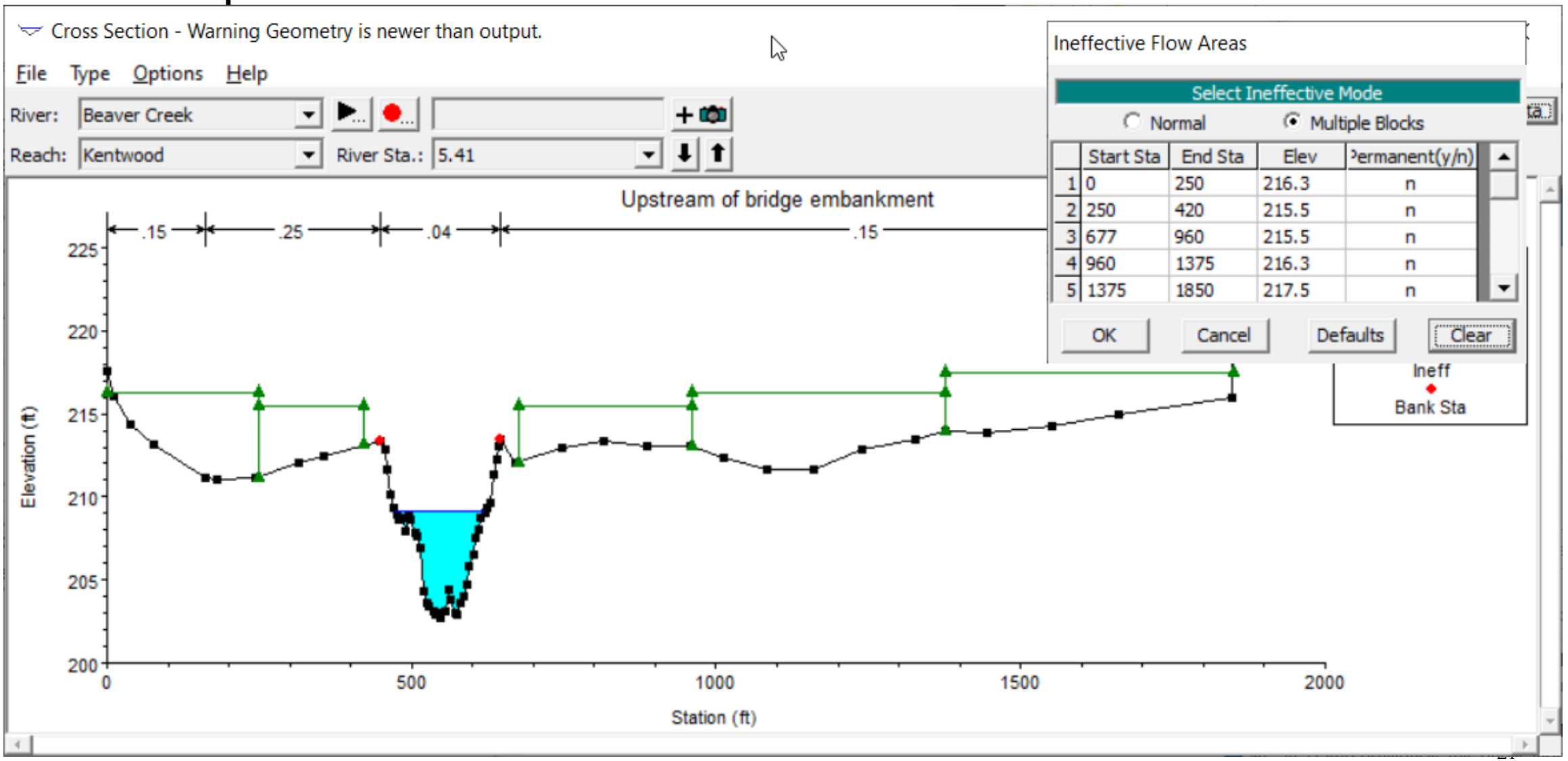
Normal Ineffective Flow Areas



Multiple Ineffective Flow Areas

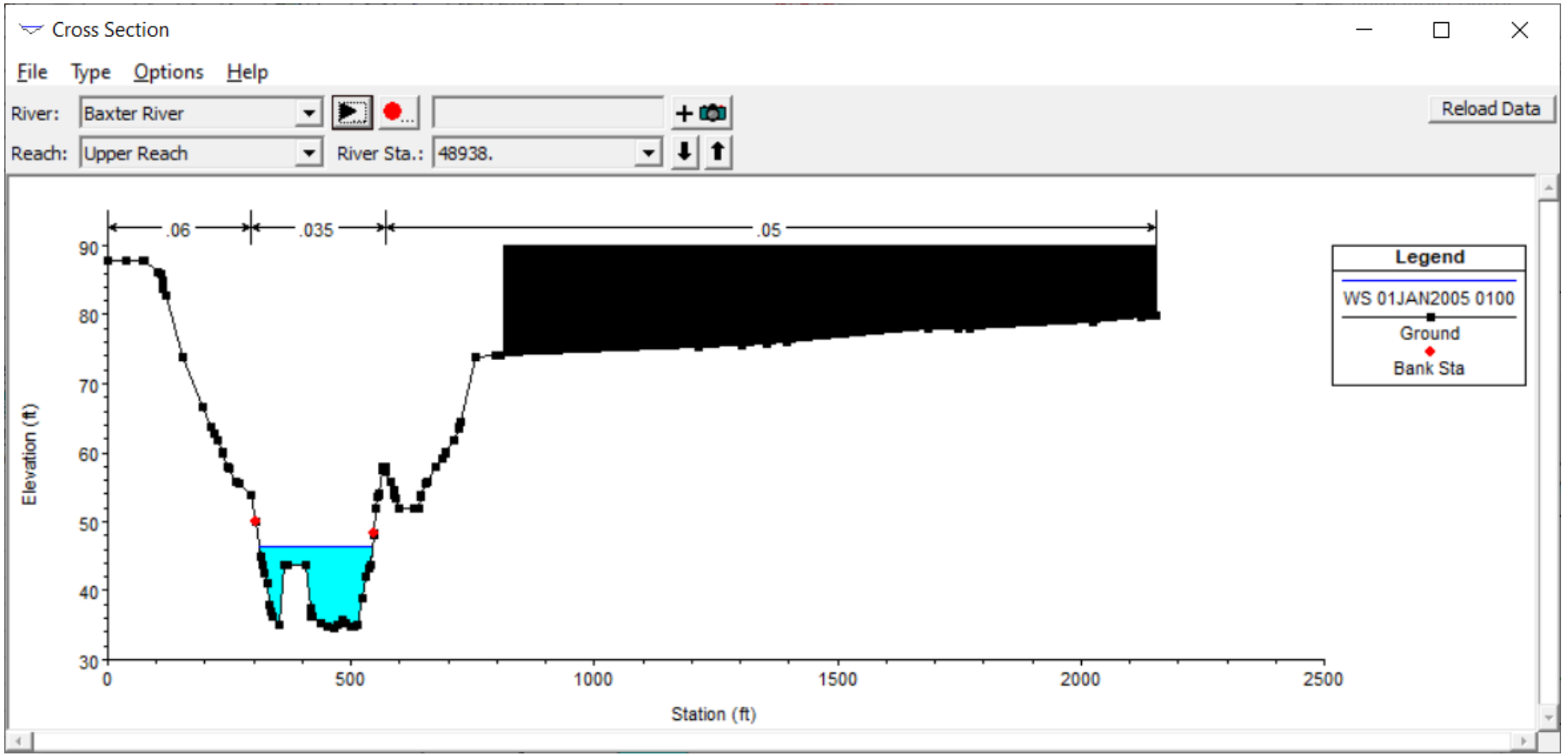


Multiple Ineffective Flow Areas

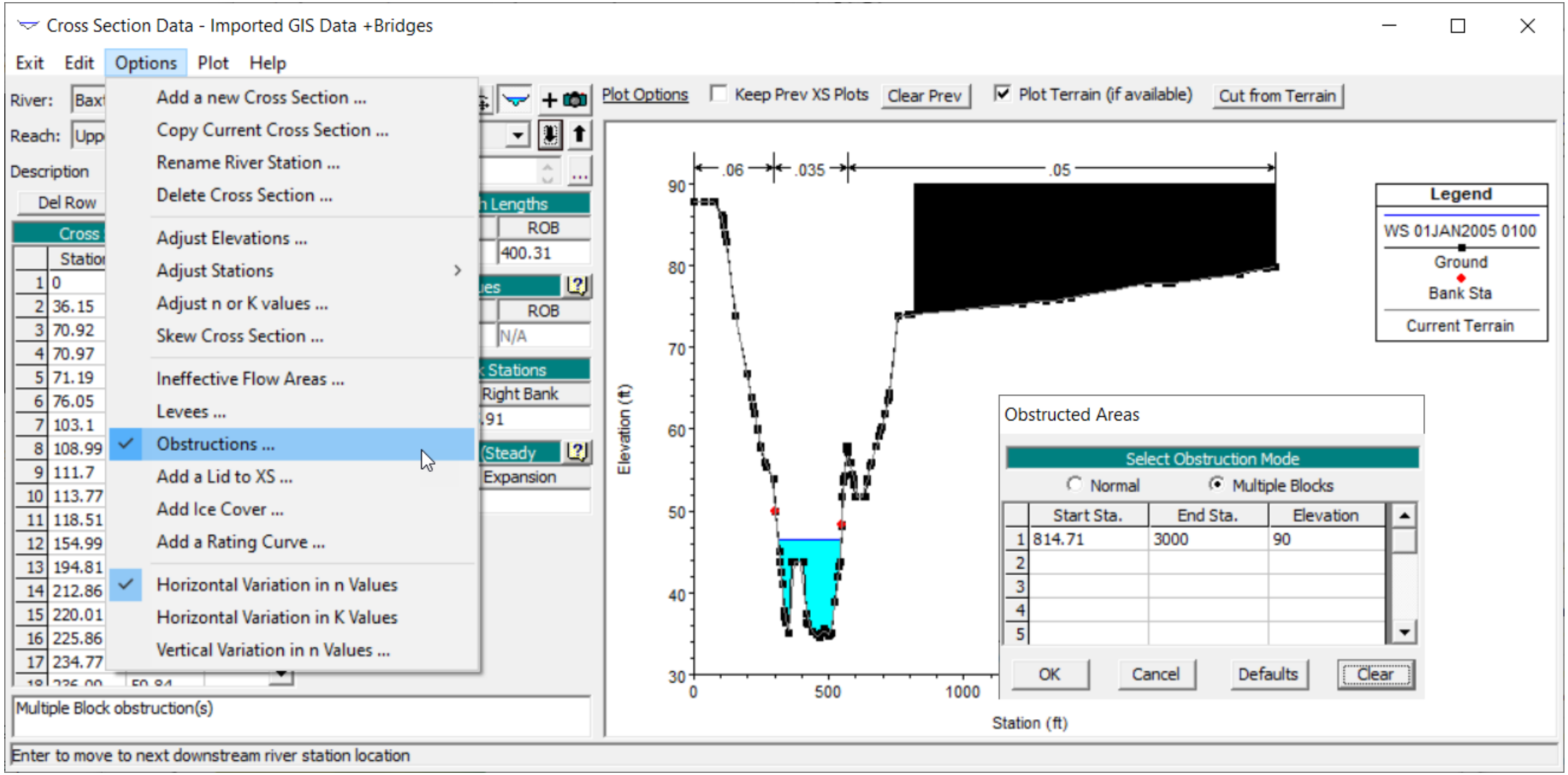


Blocked Obstructions

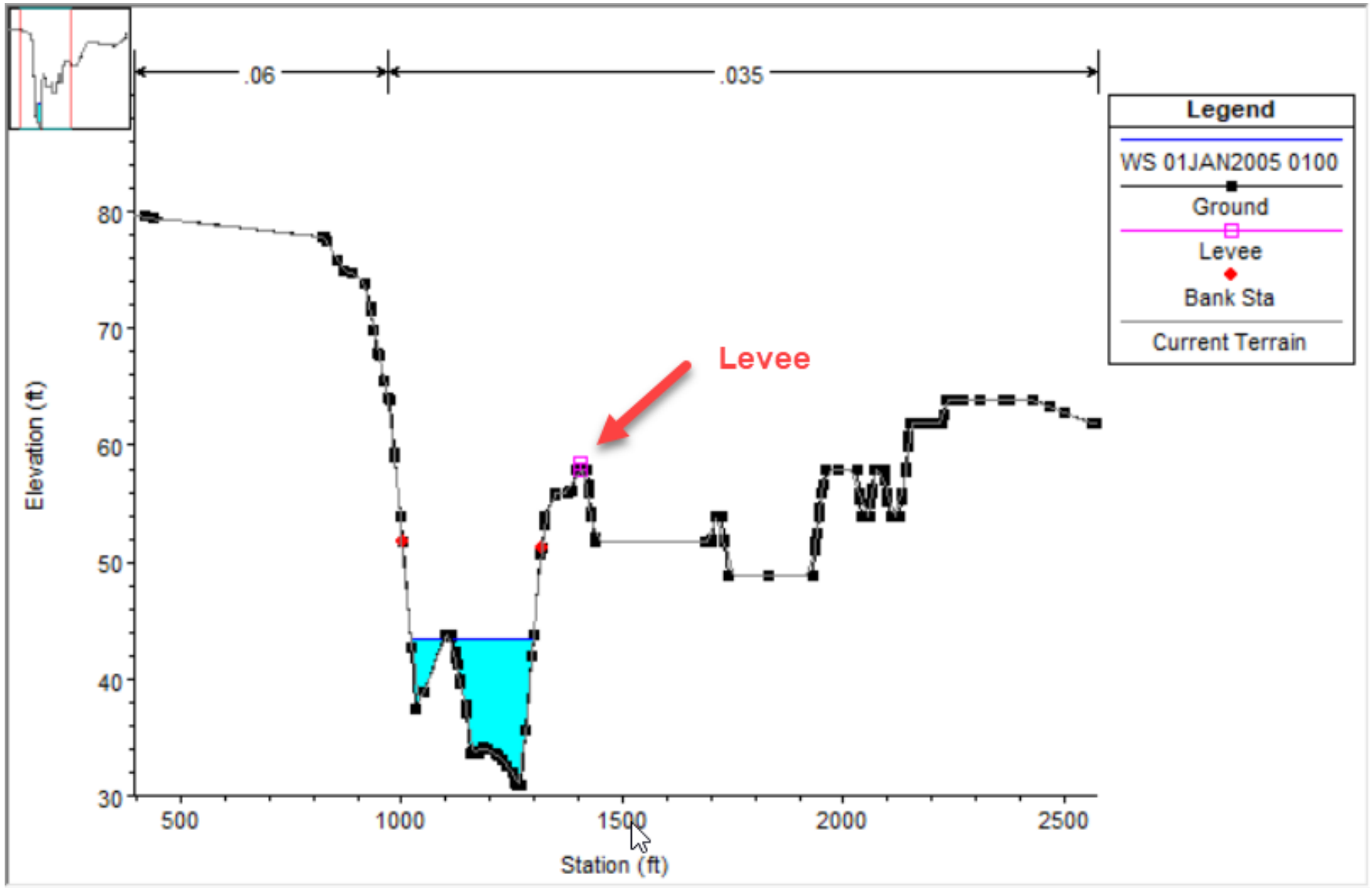
- Decreases Flow Area, Adds Wetted Perimeter



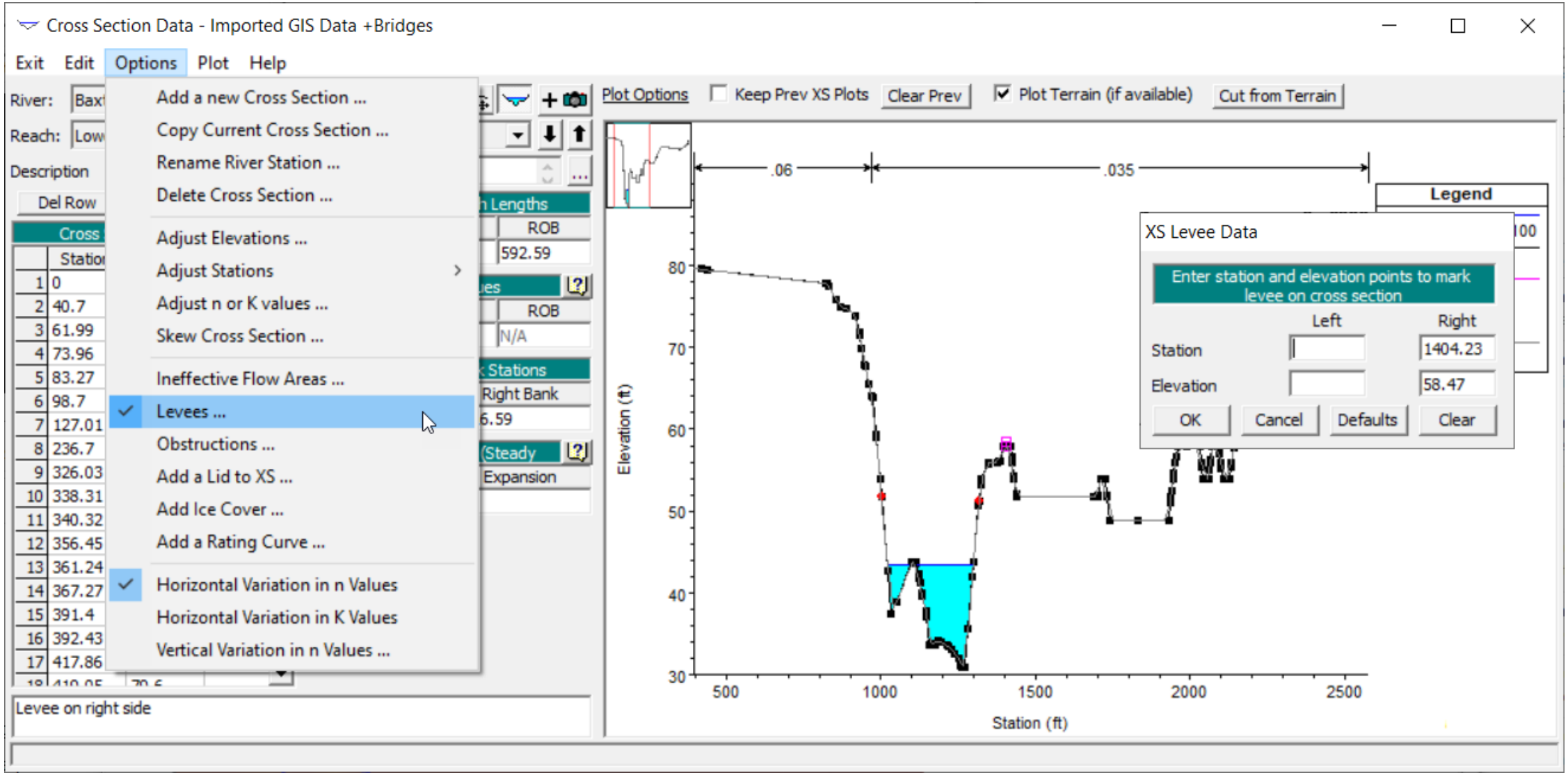
Blocked Obstructions



Levees

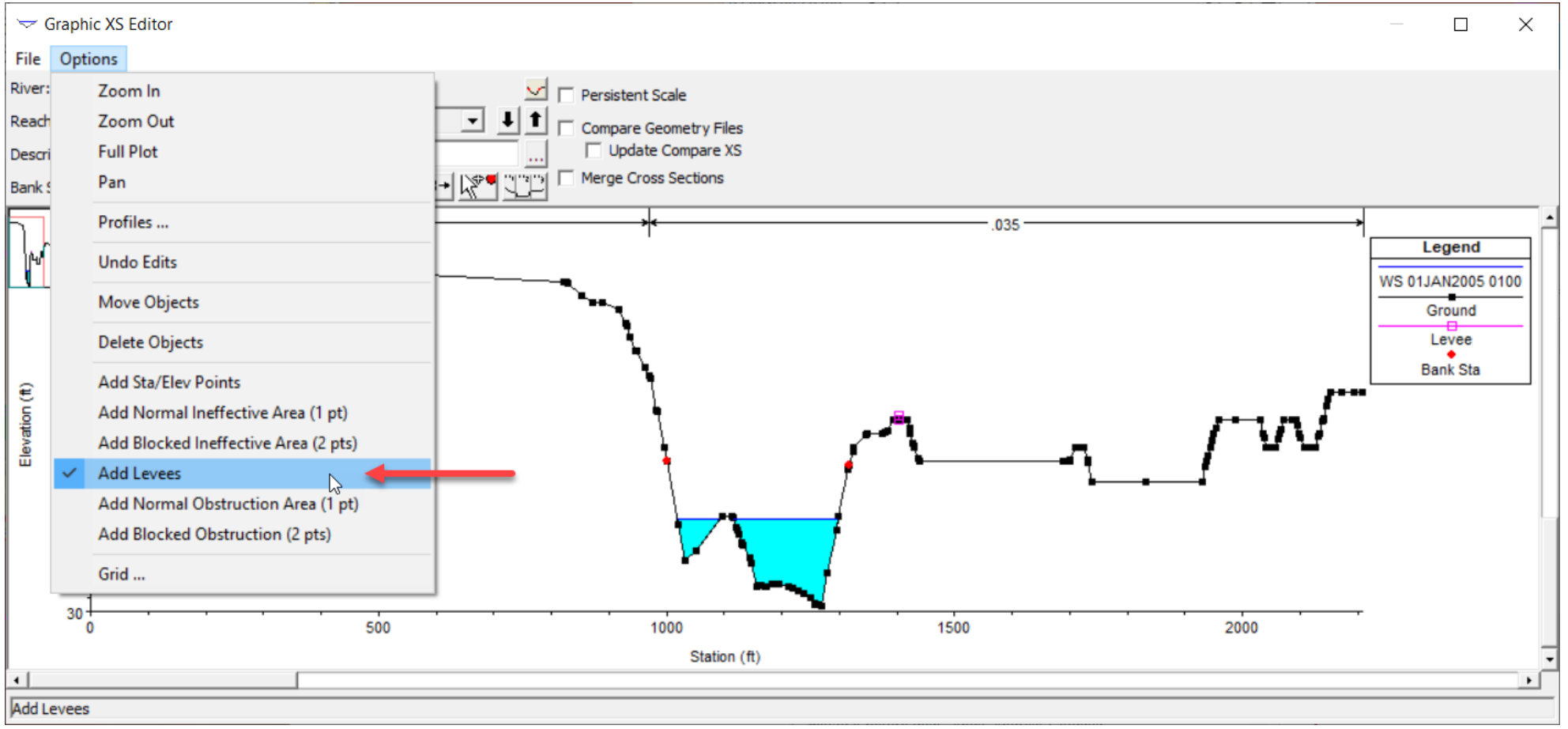

.06
.035
Legend
WS 01JAN2005 0100
Ground
Levee
Bank Sta
Current Terrain
Levee
Elevation (ft)
80
70
60
50
40
30
500
1000
1500
2000
2500
Station (ft)

Levees

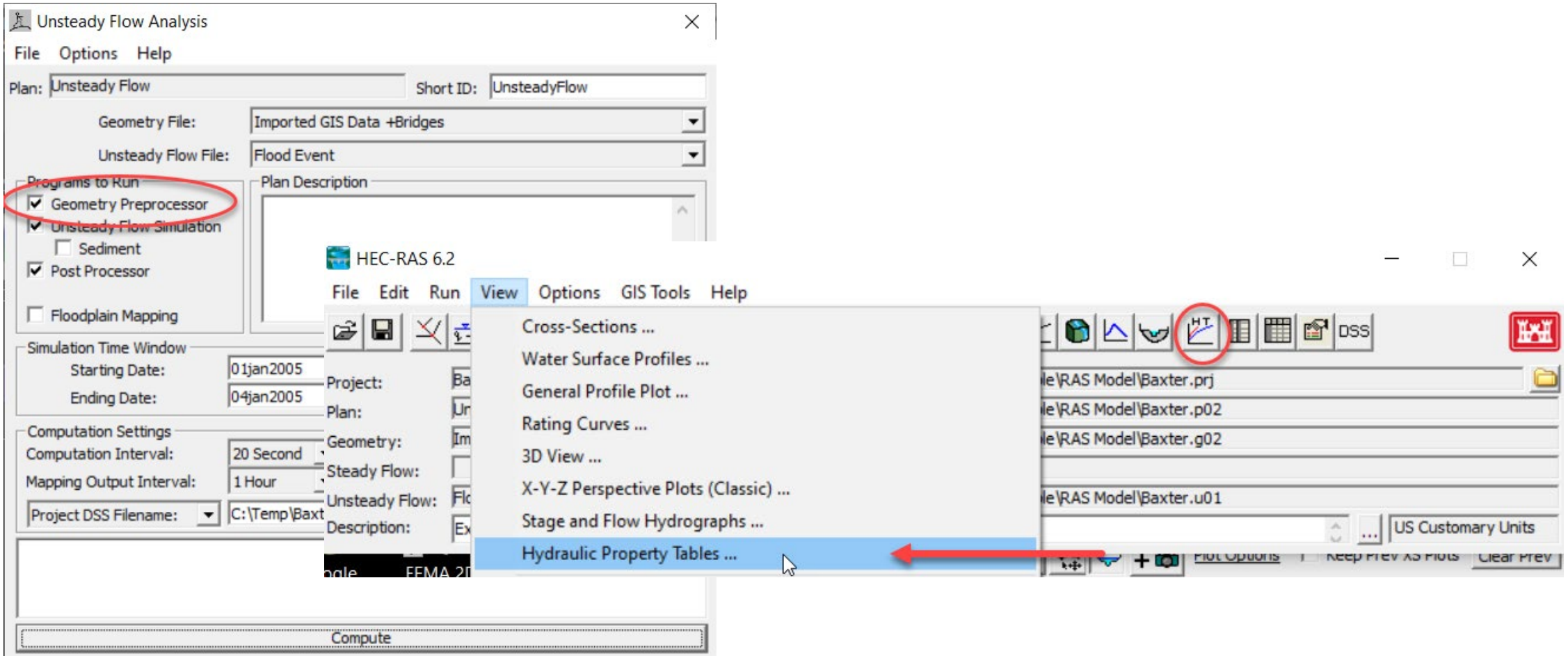

Cross Section Data - Imported GIS Data +Bridges
Exit
Edit
Options
Plot
Help
Add a new Cross Section ...
Copy Current Cross Section ...
Rename River Station ...
Delete Cross Section ...
Adjust Elevations ...
Adjust Stations
Adjust n or K values ...
Skew Cross Section ...
Ineffective Flow Areas ...
Levees ...
Obstructions ...
Add a Lid to XS ...
Add Ice Cover ...
Add a Rating Curve ...
Horizontal Variation in n Values
Horizontal Variation in K Values
Vertical Variation in n Values ...
Plot Options
Keep Prev XS Plots
Clear Prev
Plot Terrain (if available)
Cut from Terrain
.06
.035
Legend
XS Levee Data
Enter station and elevation points to mark levee on cross section
Left
Right
Station
1404.23
Elevation
58.47
OK
Cancel
Defaults
Clear
Elevation (ft)
Station (ft)
Levee on right side

Graphical Cross Section Editor

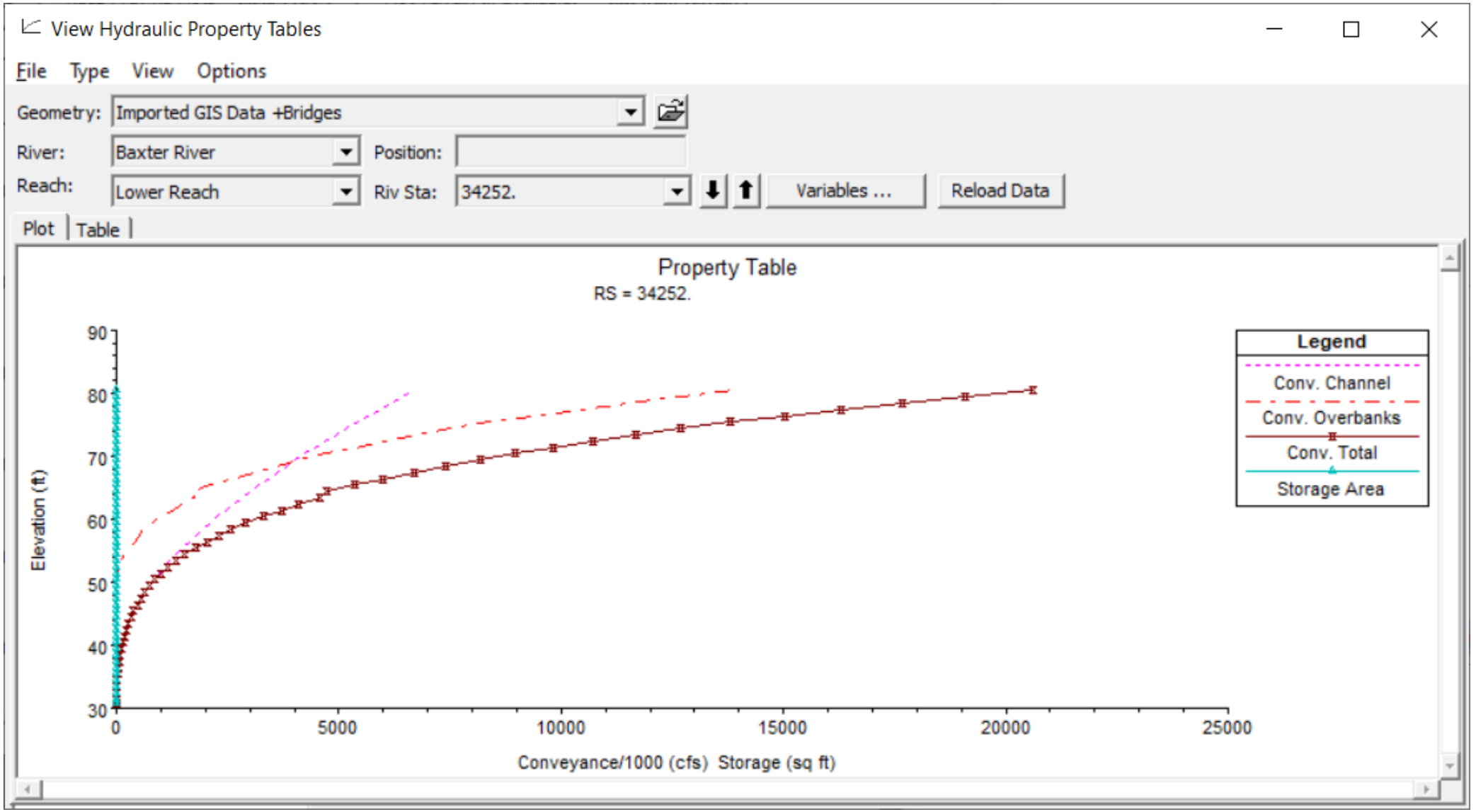
- Located in the Geometric Data Editor under the Tools menu.



Geometry Preprocessor and HTab Curves



Hydraulic Property Plot



Hydraulic Property Table

View Hydraulic Property Tables

File Type Options

Geometry: Imported GIS Data +Bridges

River: Baxter River

Reach: Lower Reach Riv Sta: 34252. Variables ... Reload Data

Plot Table

Minimum Elevation: 30.91 Chan Length: 652.64 Avg Overbank Length: 635.515 Preiss WD: Preiss Elev:

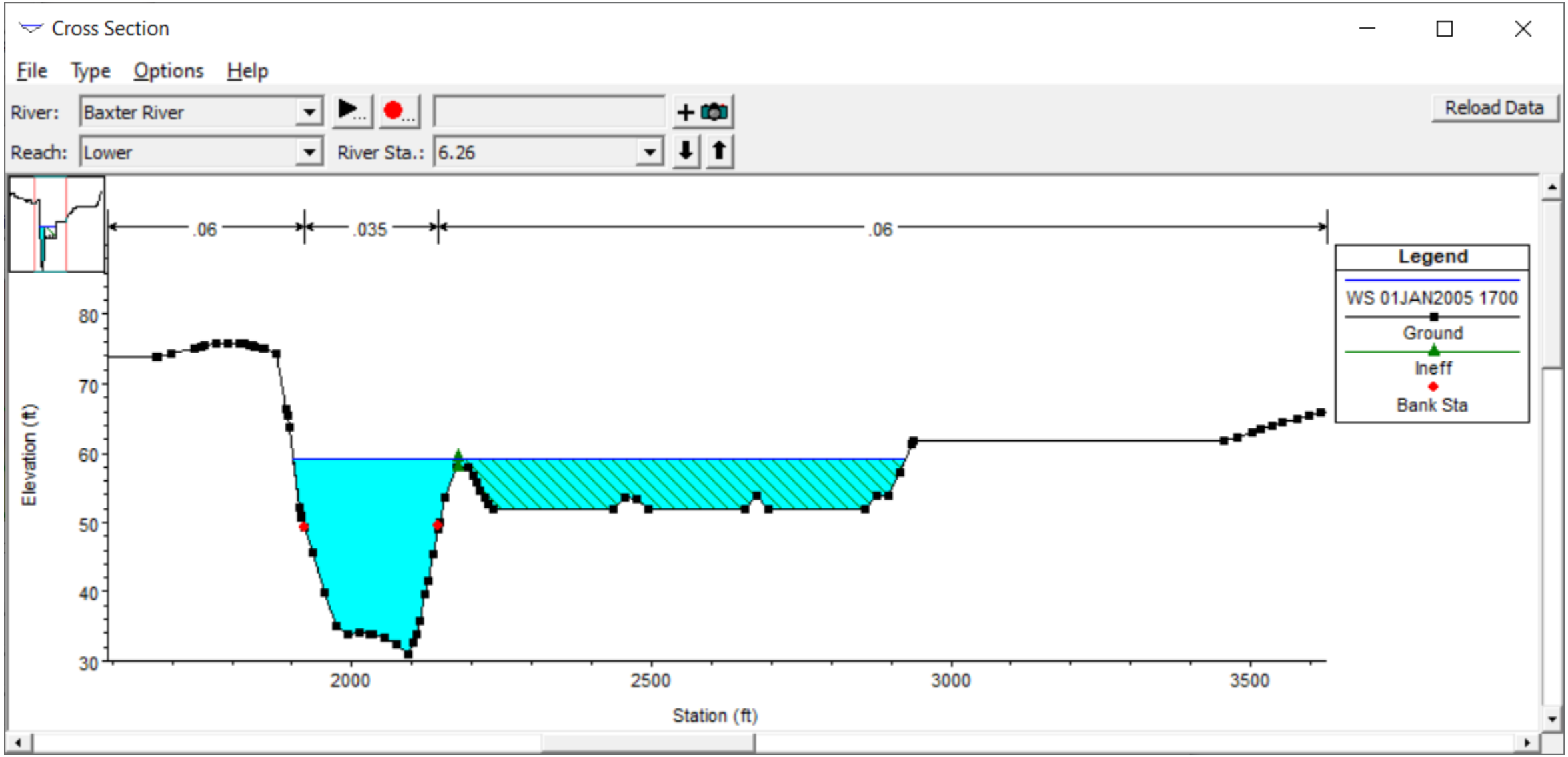
	Elevation (ft)	Area Chan (sq ft)	Area L+R (sq ft)	Area Total (sq ft)	Storage Area (sq ft)	Conv Ch (cfs)	Conv L+R (cfs)	Conv Total (cfs)	Top Width (ft)	Alpha
1	31.40	5.77	0.00	5.77	0.00	128	0	128	15.23	1.00
2	32.40	27.41	0.00	27.41	0.00	1058	0	1058	31.24	1.00
3	33.40	70.81	0.00	70.81	0.00	3428	0	3428	57.54	1.00
4	34.40	166.20	0.00	166.20	0.00	8605	0	8605	122.42	1.00
5	35.40	291.14	0.00	291.14	0.00	21286	0	21286	127.46	1.00
6	36.40	421.20	0.00	421.20	0.00	38283	0	38283	132.73	1.00
7	37.40	556.63	0.00	556.63	0.00	59219	0	59219	138.23	1.00
8	38.40	705.04	0.00	705.04	0.00	79279	0	79279	160.95	1.00
9	39.40	878.18	0.00	878.18	0.00	104514	0	104514	183.97	1.00
10	40.40	1072.06	0.00	1072.06	0.00	136291	0	136291	203.20	1.00
11	41.40	1284.32	0.00	1284.32	0.00	173850	0	173850	221.32	1.00
12	42.40	1514.44	0.00	1514.44	0.00	217518	0	217518	238.44	1.00
13	43.40	1760.98	0.00	1760.98	0.00	267393	0	267393	254.65	1.00
14	44.40	2031.63	0.00	2031.63	0.00	317288	0	317288	281.71	1.00
15	45.40	2315.72	0.00	2315.72	0.00	389980	0	389980	286.47	1.00
16	46.40	2604.57	0.00	2604.57	0.00	468887	0	468887	291.23	1.00
17	47.40	2898.18	0.00	2898.18	0.00	553876	0	553876	295.99	1.00

Geometry and Unsteady Flow

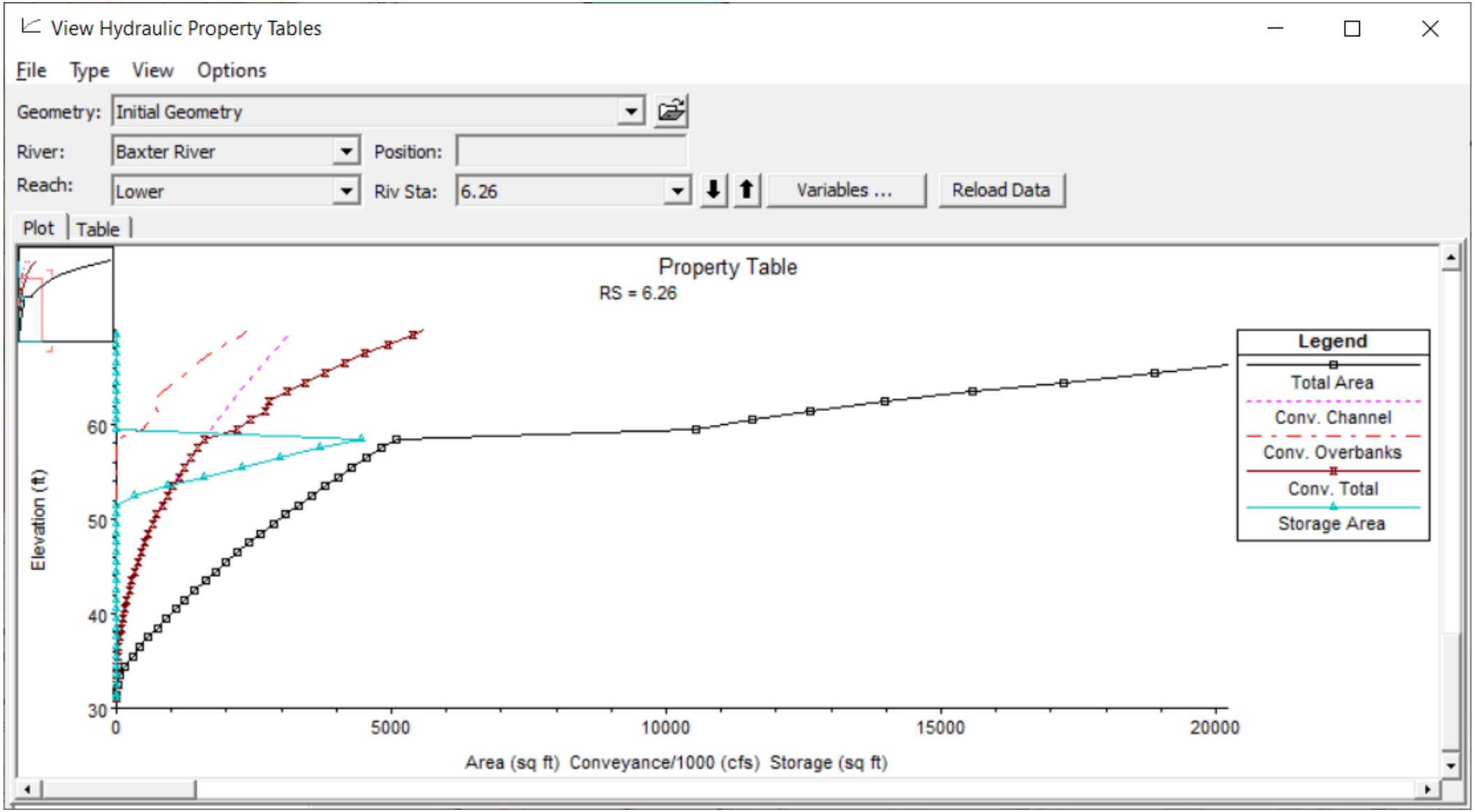
- What is going to happen to the water when it gets out of the channel?

- Ineffective Flow Areas
- Levees
- Conveyance Calculations Using Subdivisions

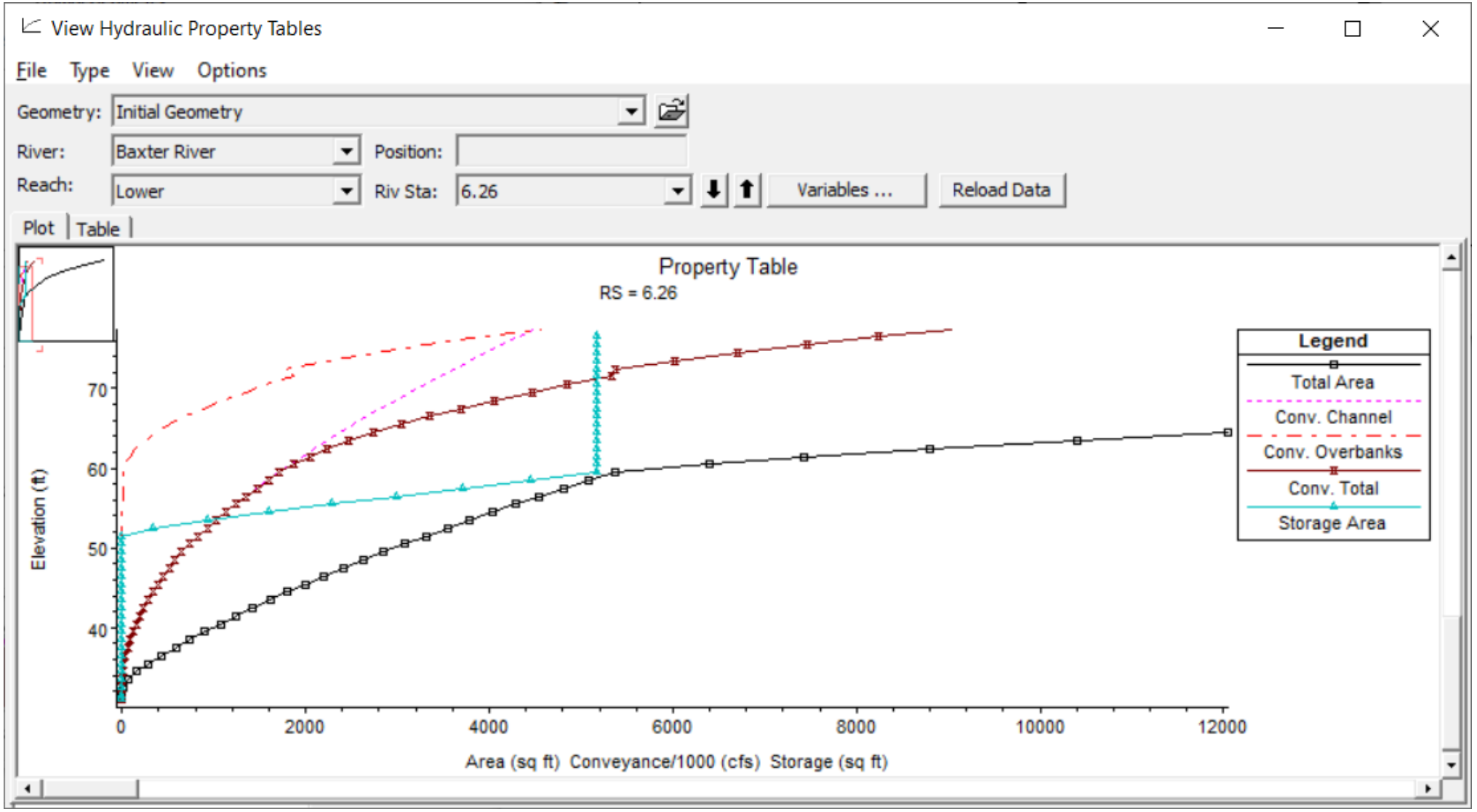
Ineffective Flow Areas



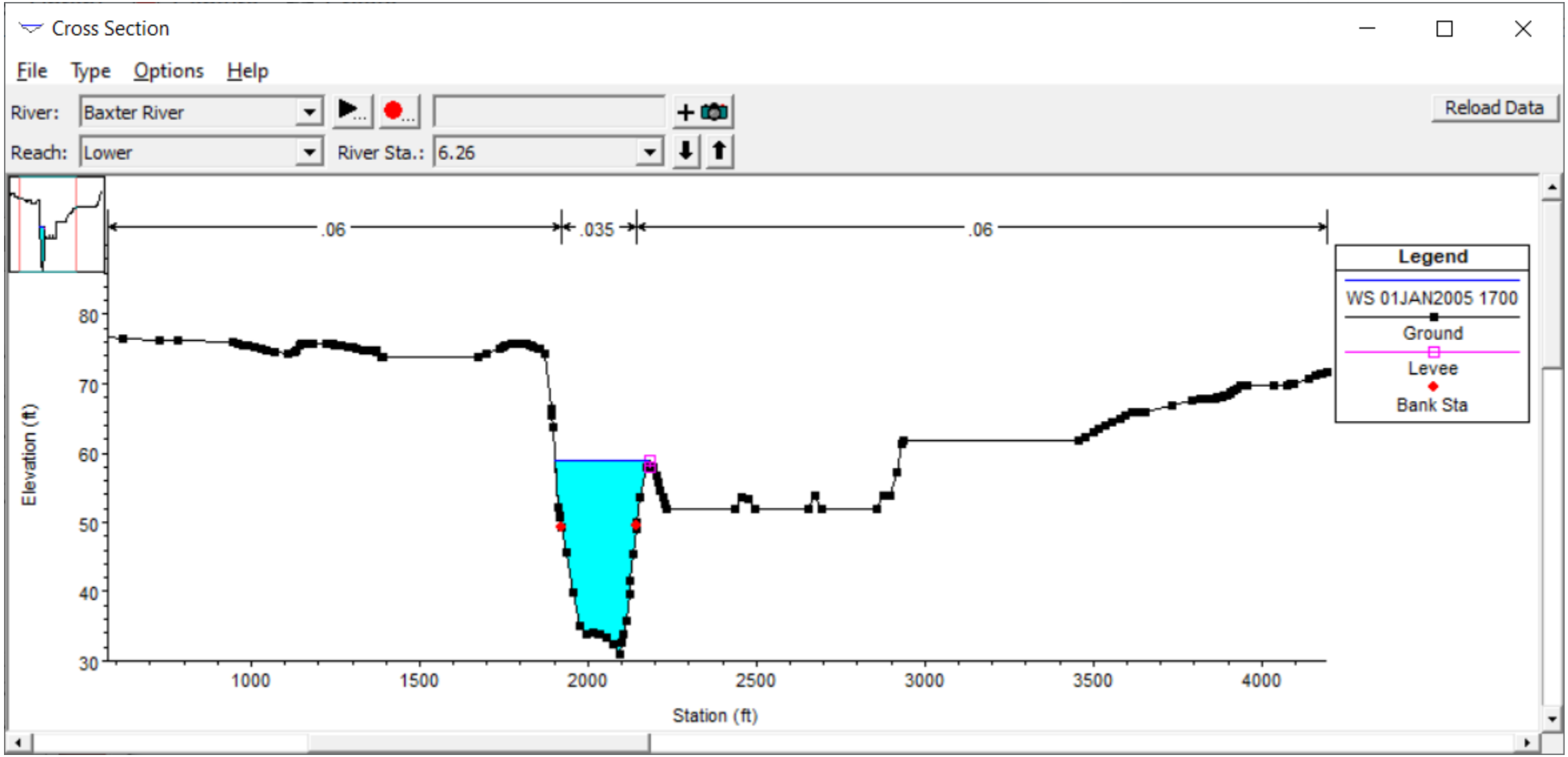
Non-Permanent Ineffective Flow



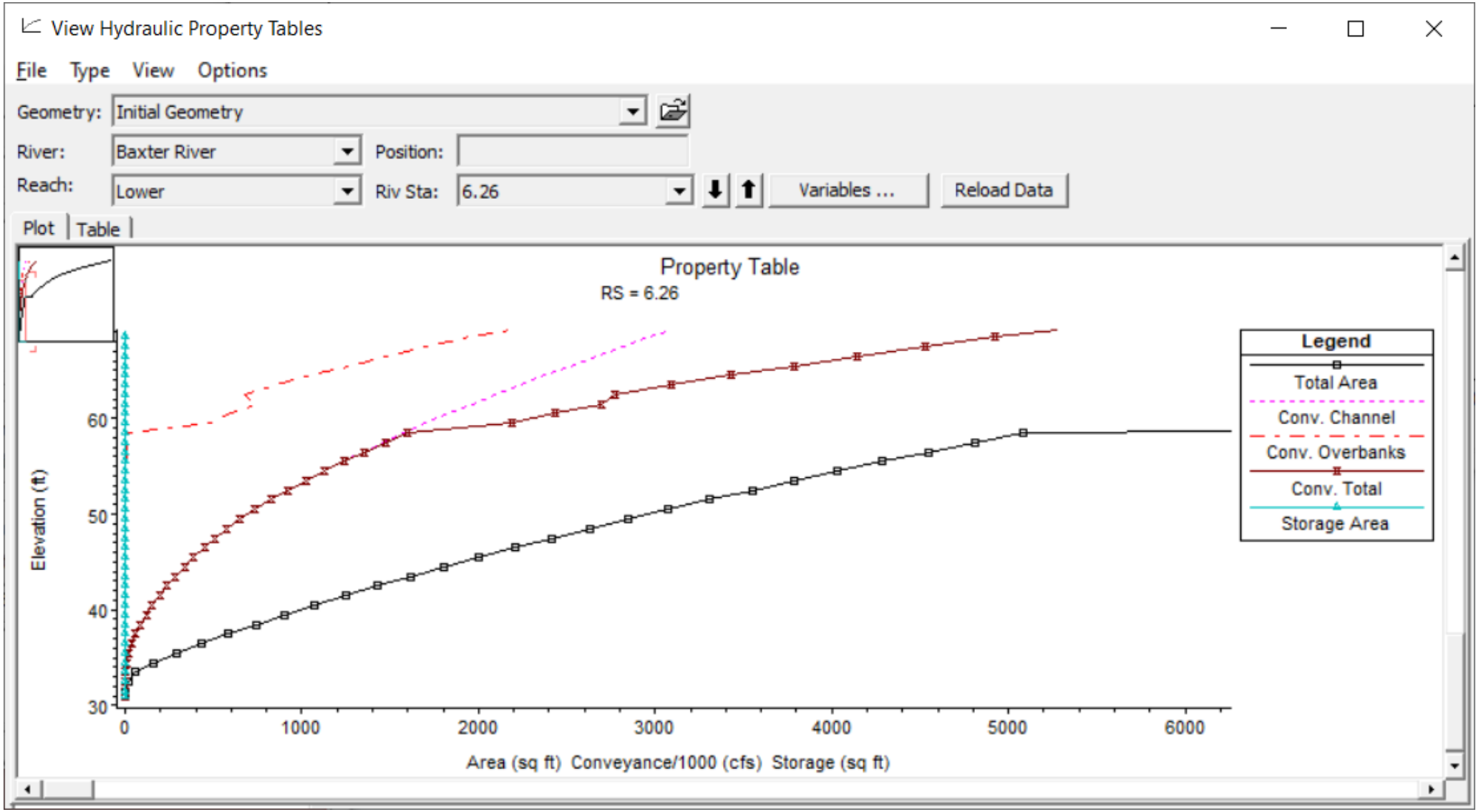
Permanent Ineffective Flow Area



Levees


Cross Section
File Type Options Help
River: Baxter River
Reach: Lower
River Sta.: 6.26
Reload Data
.06
.035
.06
Legend
WS 01JAN2005 1700
Ground
Levee
Bank Sta
Elevation (ft)
80
70
60
50
40
30
1000
1500
2000
2500
3000
3500
4000
Station (ft)

Levees

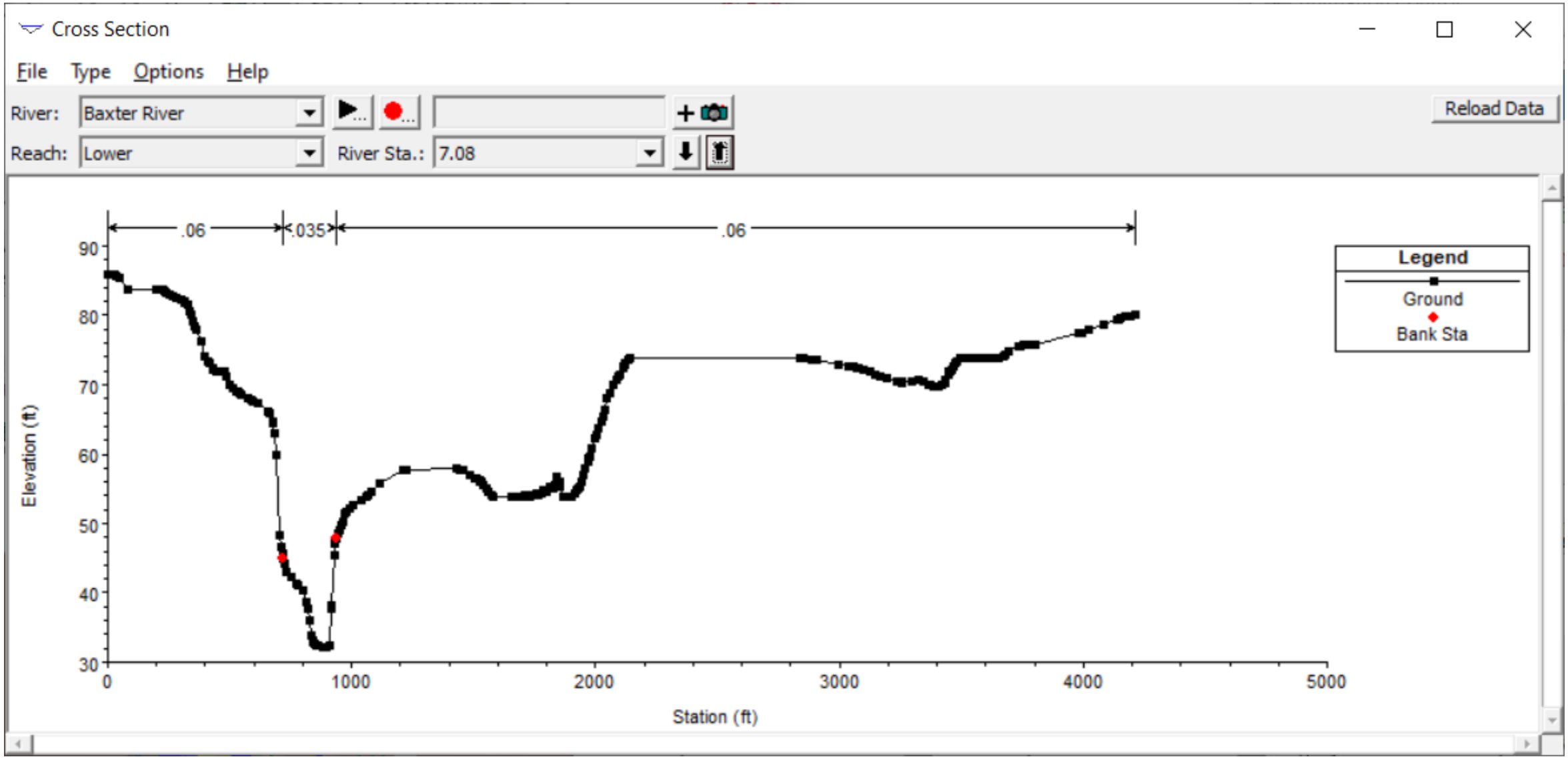

View Hydraulic Property Tables
File Type View Options
Geometry: Initial Geometry
River: Baxter River
Position:
Reach: Lower
Riv Sta: 6.26
Variables ...
Reload Data
Plot
Table
Property Table
RS = 6.26
Legend
Total Area
Conv. Channel
Conv. Overbanks
Conv. Total
Storage Area
Elevation (ft)
30
40
50
60
0
1000
2000
3000
4000
5000
6000
Area (sq ft) Conveyance/1000 (cfs) Storage (sq ft)

Storage Area Option

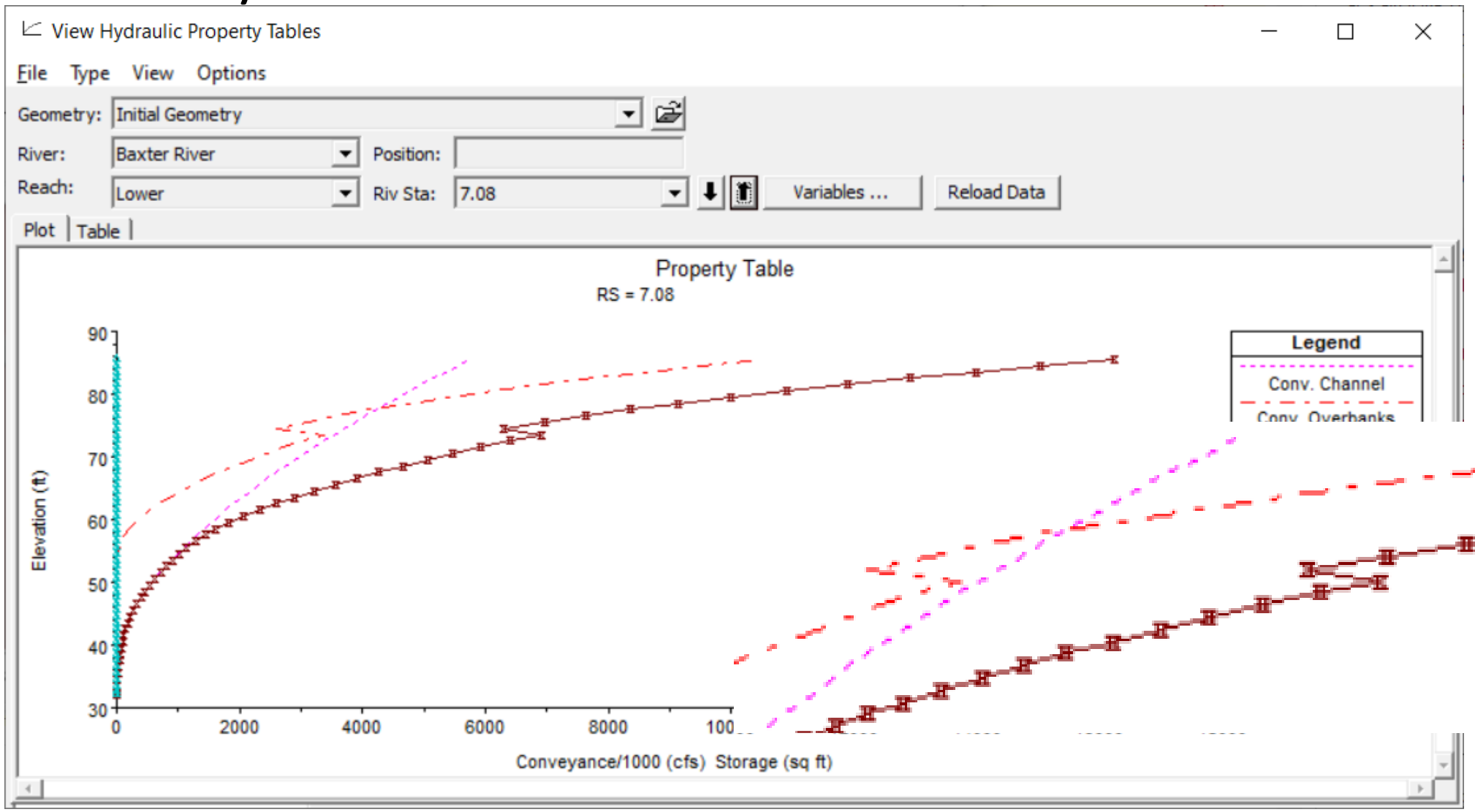
- What if adding a levee or ineffective flow area has a significant affect on the conveyance and storage relationships?

- Alter the cross section by terminating it at the beginning of the problem area and model the area that was deleted with a lateral weir and off-stream storage area or 2D flow area.

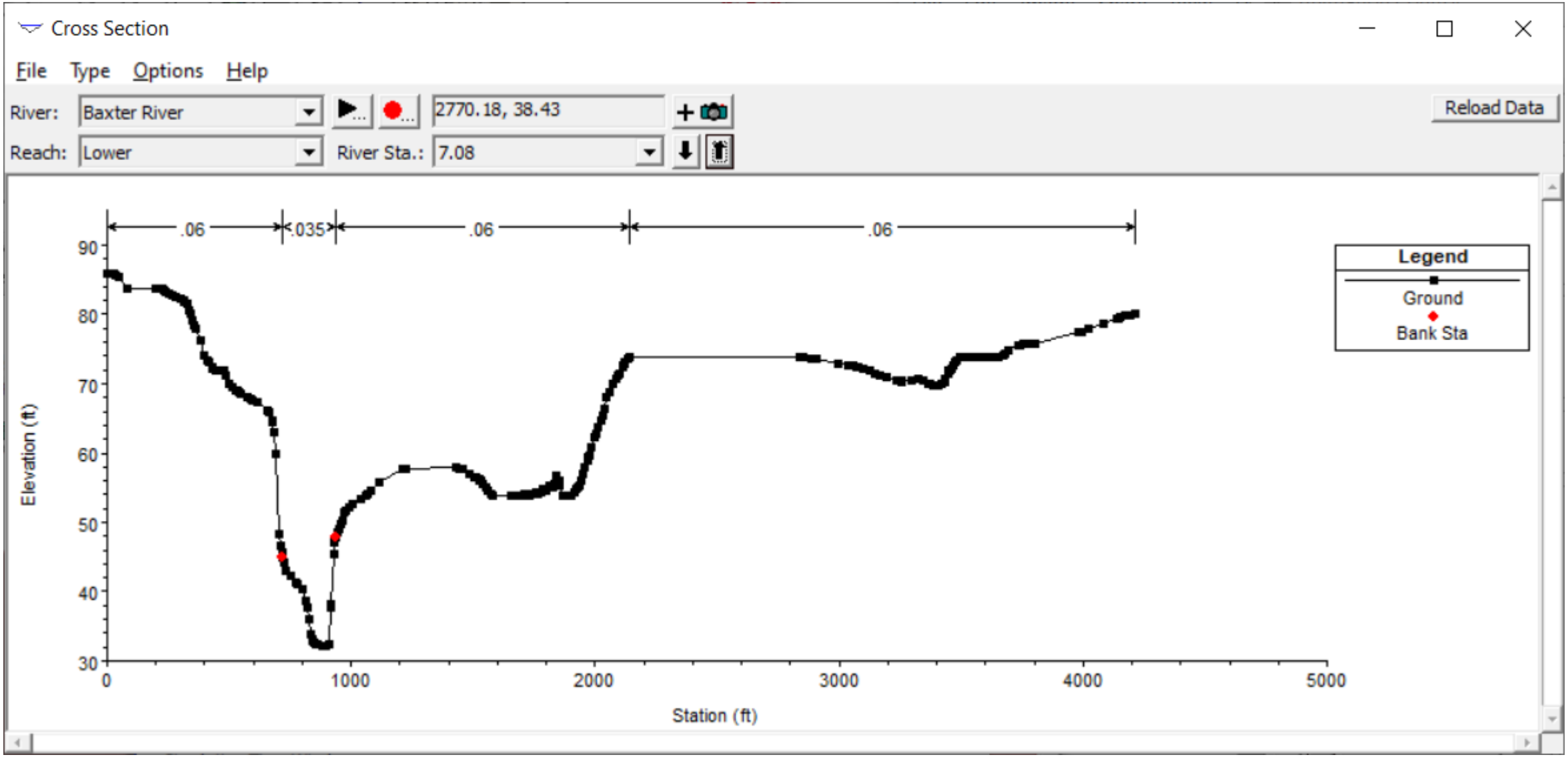
Conveyance Subdivisions



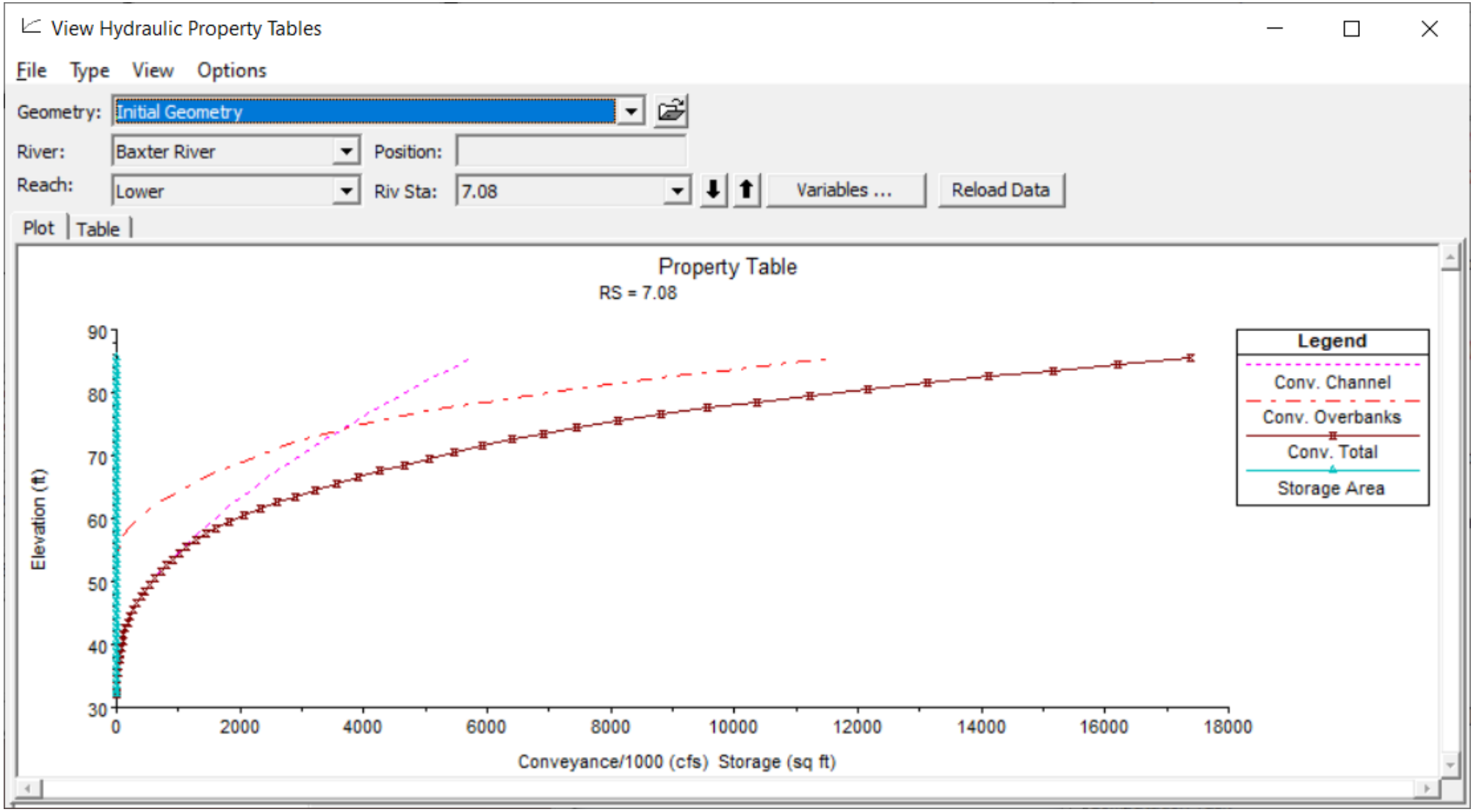
Conveyance Subdivisions



Conveyance Subdivisions



Conveyance Subdivisions



Questions?

US Army Corps of Engineers