

Common Mistake Examples in Hydraulic Models



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Preface

The purpose of this document is to raise awareness of key and sometimes misunderstood hydraulic principles, limitations of a hydraulic analysis program, and common modeling mistakes. The common issues, ranging from minor to critical, may impair the standard level of quality for the hydraulic analysis and impact the consistency in the deliverables of all FHAD studies. Whenever possible, FHAD studies should be performed in a consistent manner resulting in quality data and deliverables.

This is a living document that may be updated at any time. Please check back for updated versions of the document.

1. Downstream Boundary Conditions

This section is under construction. Please check back for common mistakes in the future.

2. Internal Boundary Conditions

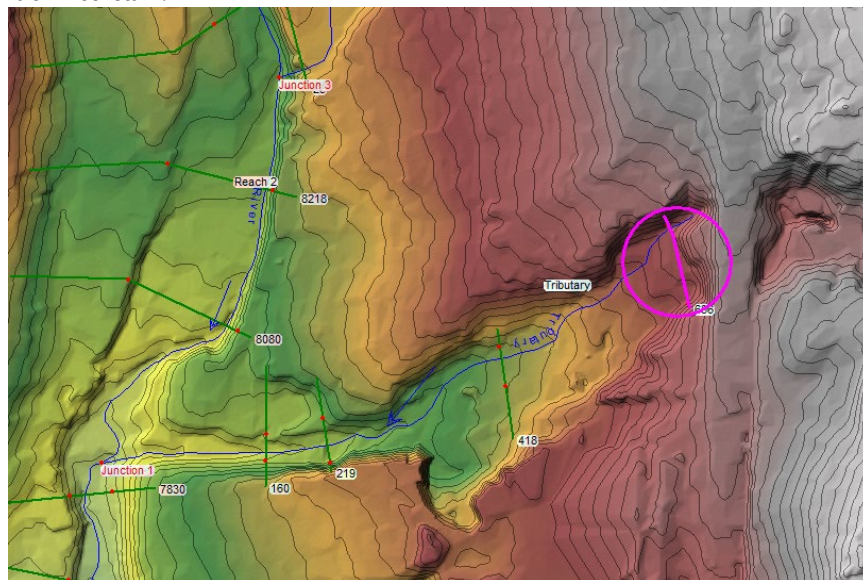
This section is under construction. Please check back for common mistakes in the future.

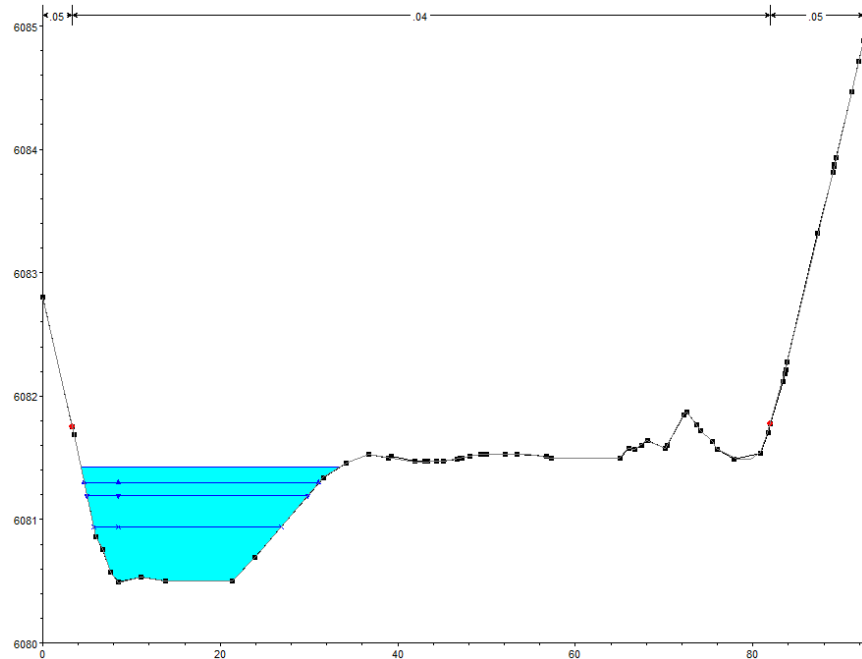
3. Four Cross Section Approach for Bridge and Culvert Modeling

1. The bounding cross sections (#2 and/or #3) are located too far away or too close together.
2. Missing cross section #1 and/or #4.
3. The cross section #1 and/or #4 are located too far away or too close together.
4. Cross sections do not properly account for skew of the bridge or culvert. Cross sections are not parallel to the roadway and perpendicular to channel.
5. The cross sections surrounding a bridge or culvert are incorrectly skewed.

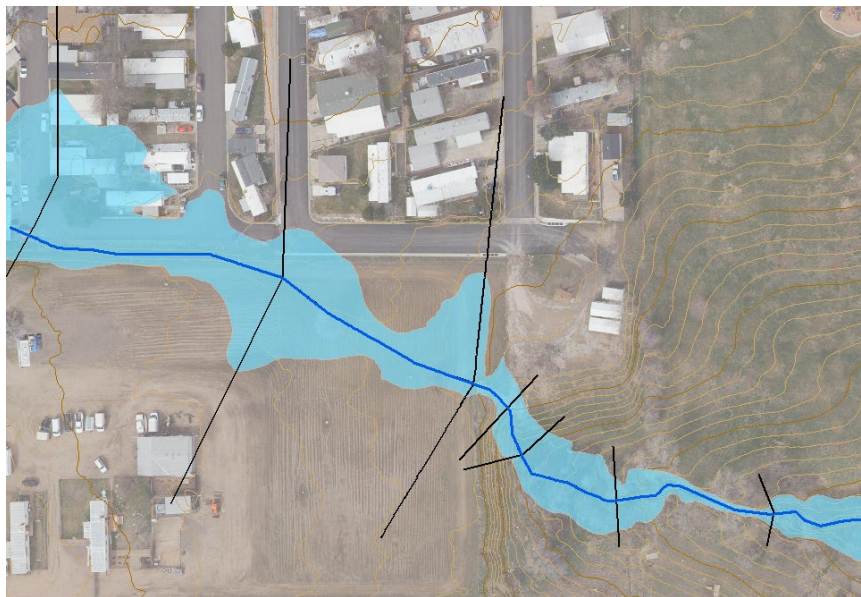
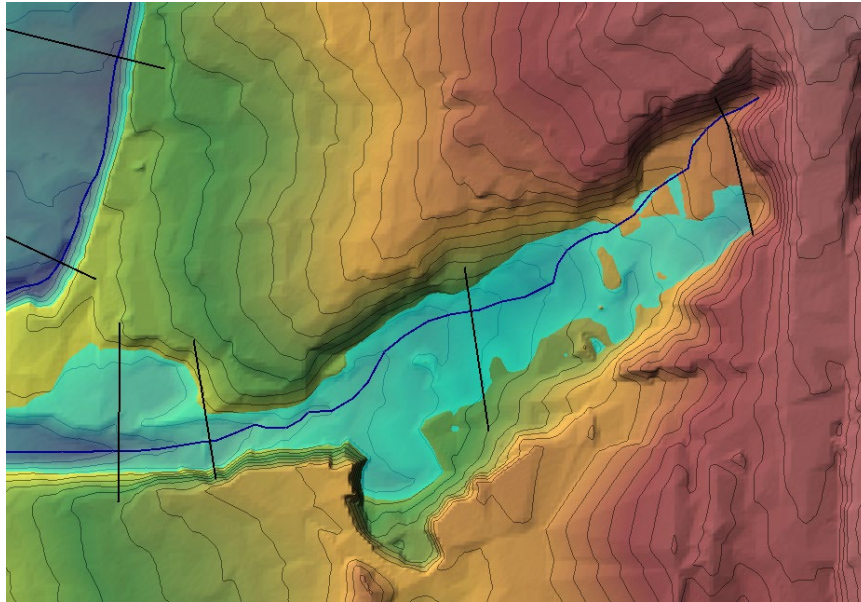
4. Cross Sections

6. Vertical extension of a cross section is not an appropriate approach to containing spills. Vertically extended ends of cross sections indicate potential spill locations.
7. The ends of cross section terminate at a non-levee feature without a supplemental analysis to support the modeling decision.
8. Cross section alignments do not represent flow direction (perpendicular to flow direction) closely.
9. Cross section alignments wrongly project the water surface elevations too far downstream at overbank areas.
10. The following images show a dry main channel in the 100-year event because the cross section alignment does not represent the true flow direction and erroneously projects the water to further downstream.





2. Cross section alignments do not project reasonable water surface elevation at the overbank floodplain.
 - i. The reach lengths at the overland floodplain should be proportioned based on the channel lengths between cross sections. The unproportioned cross section spacing or conjugated cross sections shall be avoided where appropriate.
 - ii. **XS 18800 to 19998. E.G. XS 22767 and 22860 LOB** was bent too much upstream that failed to dictate the LOB overland flow from upstream.
3. Cross section alignments are extended excessively beyond the floodplain boundary.
 - i. The long alignments can cause unnecessary difficulties in managing and viewing the cross section geometry.
 - ii. The excess vertical extent of the end elevations will impact the accuracy of critical depth calculation.
 - iii. It is not mandatory, but it is recommended that cross section alignments be trimmed where appropriate.
4. Bent cross section alignments exaggerate the active conveyance area. Instead, they should have a gradual and smooth transition from one cross section to the next.
5. Cross sections are bent excessively. Such a cross section indicates that a separated flow path or 2D hydraulic analysis may be needed.
6. A cross section is skewed without correction of the station and elevation of the cross section.
7. The automated floodplain delineation shows dry land or significant narrow/necked floodplain without support from the terrain between the modeled cross sections. Such a delineation indicates that there are not sufficient cross sections to represent the grade break and cannot calculate the correct water surface elevations.
 - i. The images below show a stream centerline that is outside the delineated 100-year floodplain and indicates insufficient cross sections to accurately interpolate the 100-year water surface elevations.



1. Contraction and expansion coefficients are not placed where flow velocities increase or decrease significantly. In general, for bridge and culvert modeling, the coefficients should be increased at two upstream cross sections and one downstream cross section.

6. Lateral Structures

1. A lateral structure does not contain the entire length where high flow overtops the bank (similar to uncontained storm events at a cross section).

7. Bank Stations

1. Bank stations are not placed with approximate symmetry to the low flow area.
2. Bank stations are above the 100-year water surface elevation and/or outside the 100-year floodplain.
3. Bank stations are not placed consistently from cross section to cross section.
4. Bank stations are not consistent with vegetation breaks and no horizontal varied Manning's n-values are defined.
5. Both bank stations are placed on the same side of the stream centerline/profile baseline.

8. Ineffective Flow Areas (IEFA)

1. IEFA stations are not based on contraction and/or expansion at crossings.
2. IEFA stations are not based on the distance to the crossing.
3. IEFA stations are inside the bank stations and above the base flood elevation.
4. IEFA station elevations do not represent the point at which flows spill.

9. Floodway

1. The floodway boundary transitions abruptly between cross-sections.
 - i. Cross sections 9917 and 9716.
2. Floodway width transitions are not smooth.
3. The floodway boundary contains ineffective flow areas that are not overtopped or are outside of detention ponds.
 - i. The left floodway boundary between cross-sections 13855 and 12479 is closed off from the floodway upstream, reflecting what would be considered an area of backwater—or ineffective flow area—which is contrary to the definition of a floodway. If the area landward/left of the delineated “island” must be included in the floodway, a continuous flow transition from upstream must be reflected in the delineation.

10. Flood Hazard Delineations

1. Stream channel boundaries or stream centerlines must be shown within the 1%-annual-chance floodplain. if a floodway is developed, the stream must be shown within the regulatory floodway boundaries.