Hydraulics
2023 CFL Annual A/E Meeting

Outline

- CFL Hydraulics Team
- Upcoming FHWA hydraulics publications
- 2D modeling guidance
- Q/A – Open discussion

CFL Hydraulics Team

- Luis Calderón PE – Hydraulics Team Lead
- Aaron Estep PE – Hydraulic Engineer
- Amanda Peters EI – Hydraulic Engineer
- Trevor Moulton EI – Hydraulic Engineer

Upcoming Publication Updates

- HDS-2 Highway Hydrology and Course NHI 135067 Practical Highway Hydrology
- HEC-19 Evolving Topics in Hydrology
- HEC-16 Highways in the River Environment: Roads, Rivers, and Floodplains
- HEC-18, HEC-23
- Schedule TBD

Upcoming Tech Briefs

- Hydraulic Considerations for Deep Abutment Foundations
- Schedule TBD

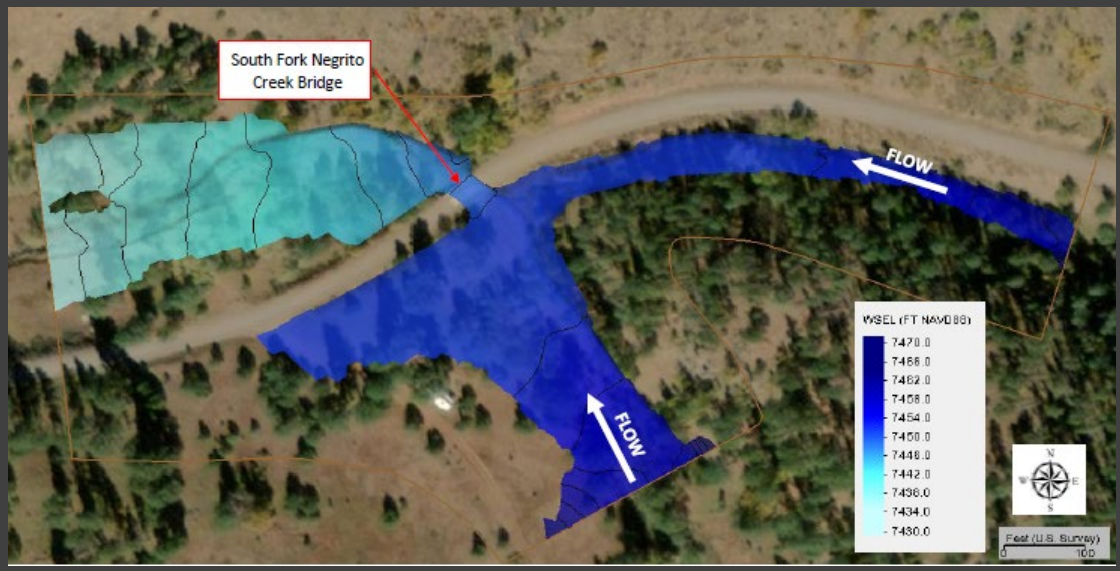
2D CFL Internal Projects

- Pre-EDC – HEC Reference documents, FESWMS
- EDC-4 (2017-2018)
- EDC-5 (2018-2019)
- Fully implemented

CFL Internal Projects

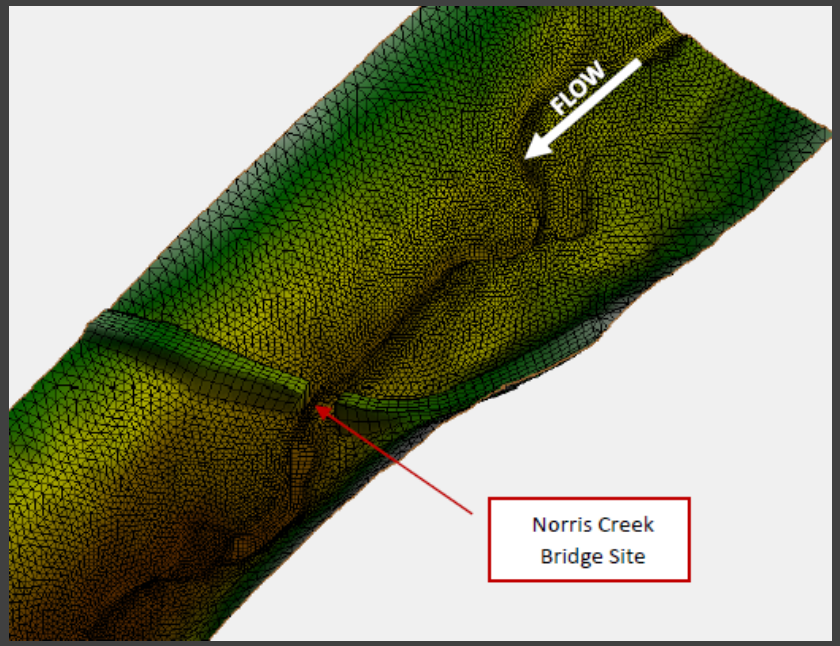
- Bridges and scour
- Culverts (riverine, cross drainage)
- Bank protection
- Low water crossings

CFL Internal Projects



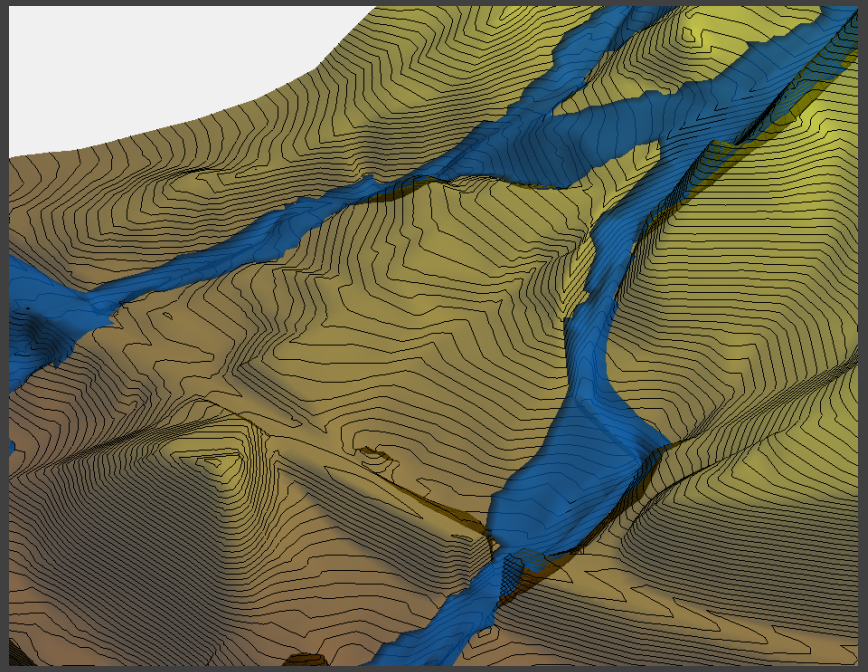
Gila National Forest, NM

CFL Internal Projects



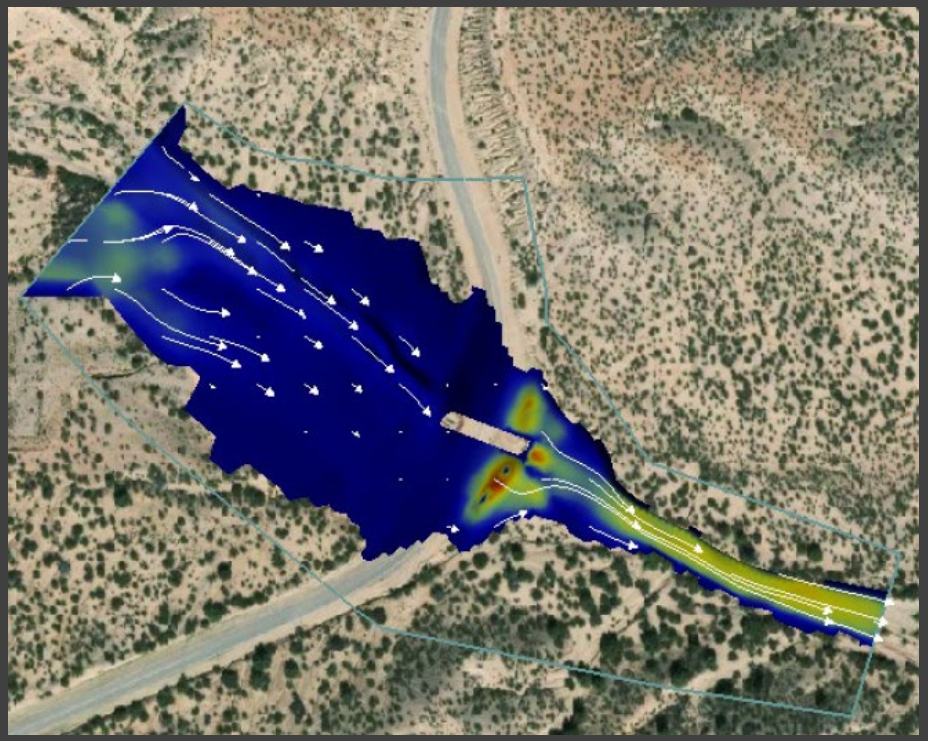
Sierra National Forest, CA

CFL Internal Projects



Sequoia National Park, CA

CFL Internal Projects



Elephant Butte State Park, NM

2D Hydraulic Modeling for Highways in the River Environment

Table 2.1. 1D versus 2D modeling

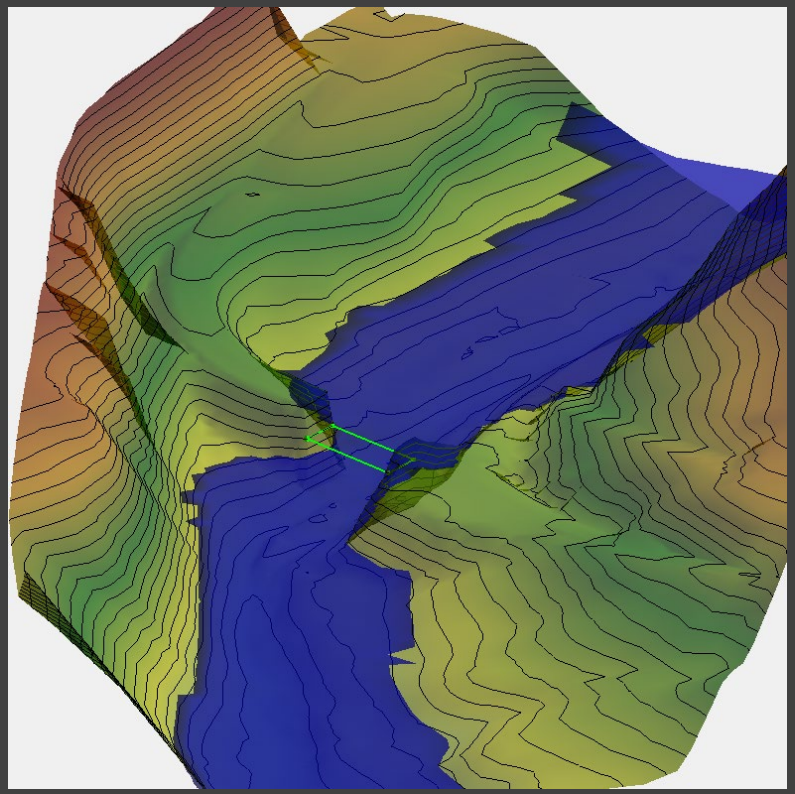
Hydraulic Variables	1D Modeling	2D Modeling
Flow direction	**Assumed** by user	**Computed**
Flow paths	**Assumed** by user	**Computed**
Channel roughness	**Assumed** constant between cross sections	Roughness values at individual elements used in computations.
Ineffective flow areas	**Assumed** by user	**Computed**
Flow contraction and expansion through bridges	**Assumed** by user	**Computed**
Flow velocity	**Averaged** at each cross section	**Computed** at each element
Flow distribution	**Approximated** based on conveyance	**Computed** based on continuity and momentum
Water Surface Elevation	**Assumed** constant across entire cross section	**Computed** at each element

CFL A/E SOW 2D Guidance

- SRH-2D default: Bridges, Scour (Standard SOW)
- Exceptions discussed and agreed during scoping/PDP
- Other hydraulic elements: A/E recommends approach, discussed and agreed to during scoping/PDP.
- Hydraulic survey limits adjusted as needed (availability of topo data, national map, FLMAs)

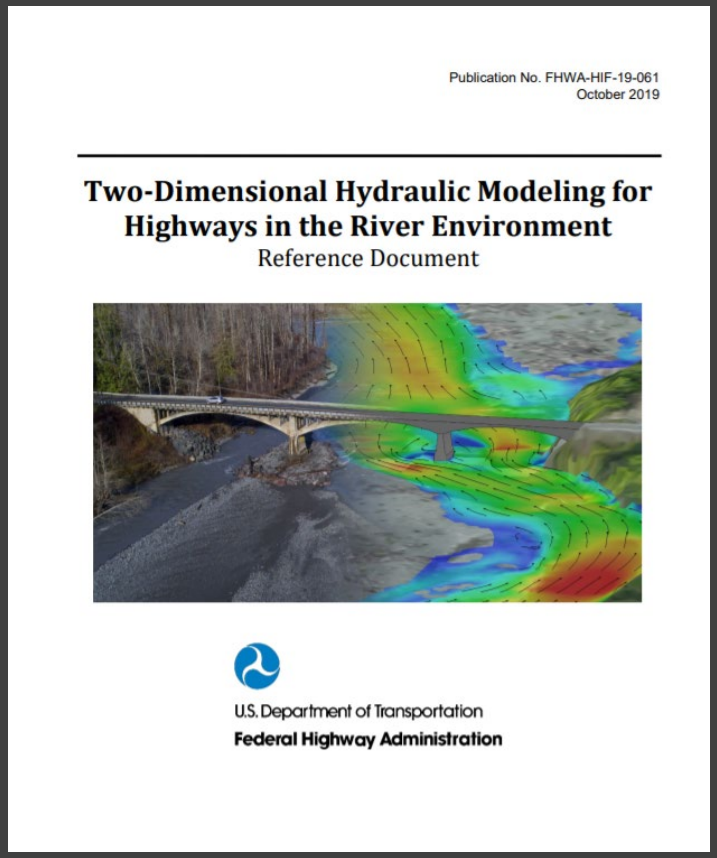
FHWA 2D Modeling Resources

- 2D Hydraulic Modeling for Highways in the River Environment – FHWA HIF-19-061
- 2D Users Forum
- NHI 135095 Two-Dimensional Hydraulic Modeling of Rivers at Highway Encroachments (In-person or virtual)



FHWA 2D Modeling Resources

- 2D Hydraulic Modeling for Highways in the River Environment
- 2D Modeling Fundamentals
- Data and Model Development
- Review and Calibration
- Model Results



Q/A

- Is StreamStats sufficient for us to get drainage flows for a project site?

Q/A

- Standard errors
- Gage network density
- FFA vs. Regression
- Watershed changes (e.g. wildfire)
- Options:
  - Confidence limits/prediction intervals
  - Gage comparisons, similar watersheds
  - Rainfall-runoff models
  - Indicators: e.g. bankfull flow
  - Site history/Engineering judgment

Questions?

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