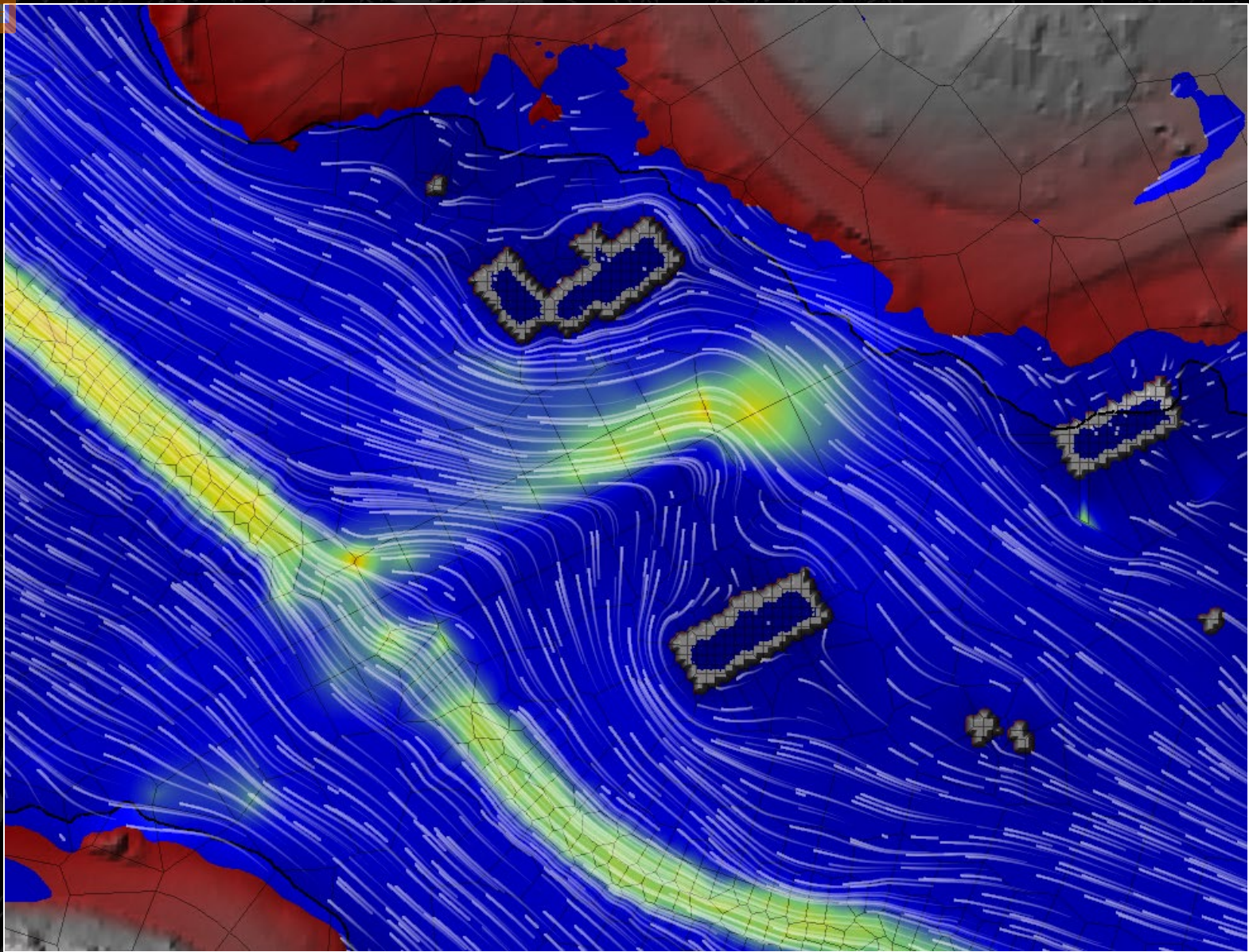




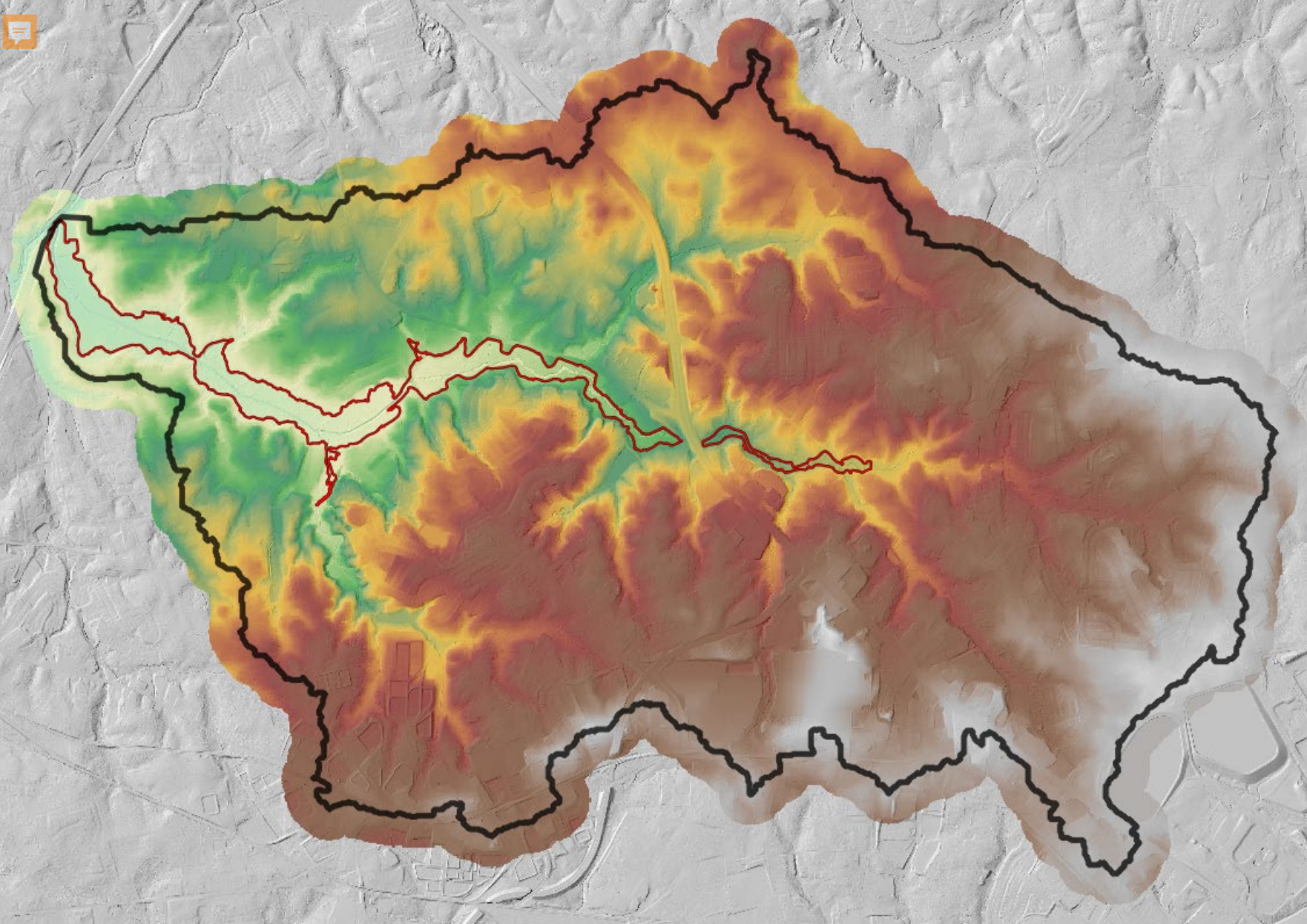
# Gum Branch Rain-On-Grid Modeling & 2D Encroachment Analysis

Challenges and Successes in Developing a  
2D FEMA Floodway for Gum Branch

*SCAHM Conference*  
*March 19, 2024*



**FLOODFOCUS**  
ENGINEERING



## Gum Branch Watershed Summary:

### General Watershed Information

- **Drainage Area** – 5.6 sq. mi.
- **FEMA Model Length** – 3.2 mi.
- **Landuse** – Commercial / Industrial; Residential

### Effective FEMA Model Information

- **7 Hydraulic Structures**
  - 3 bridges
  - 4 culverts
- **Hydrology** – HEC-HMS rainfall runoff
- **Crossings Overtopped by Base Flood**
  - Coulwood Dr.
  - Birchwood Dr.
  - Valleydale Rd.
  - Caldwell Williams
  - Old Plank Rd.
- **Inundated Buildings** – 43

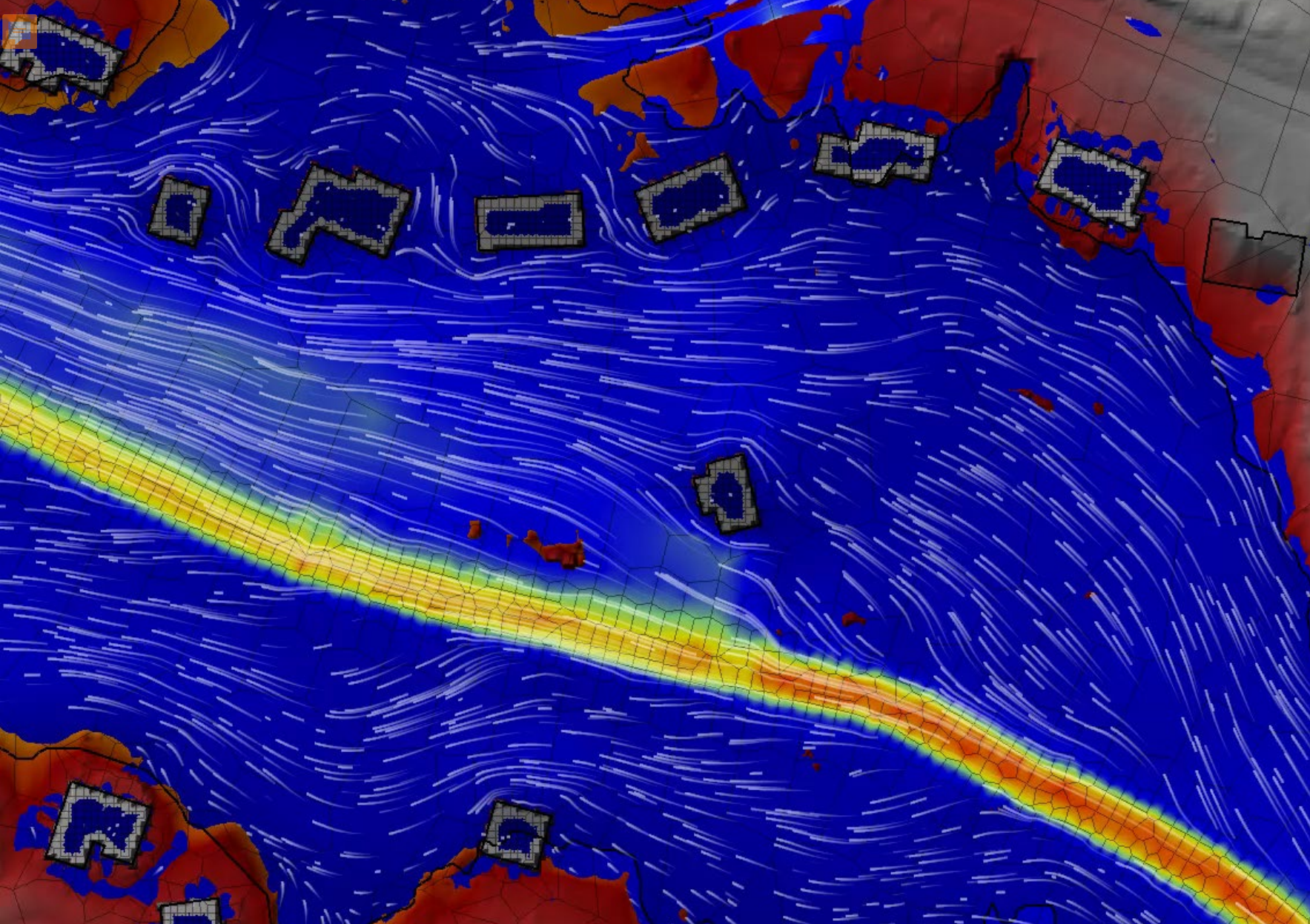


## Final 2D Computational Mesh Details

- ***Number of Cells:*** 41,394
- ***Nominal Cell Size:*** 100 ft
- ***50 hydraulic structures***
  - 3 bridges
  - 47 culverts
    - *Open system pipes w/ diameter > 3ft*
    - *Most 2ft to 2.5ft pipes also included*
- Breaklines included to reflect roads and significant topographic features
- Existing conditions landuse data derived from Mecklenburg County GIS data consistent with dataset used in the PMR2 Gum Branch hydrologic modeling conducted by Baker
  - Revisions made to reflect areas of significant development (NCDOT facility @ Craig St., Compost/Recycling Center @ Valleydale Rd., etc.) apparent in aerial imagery.

## Final Simulation Statistics

- ***Storm Event:*** 100-year
- ***Run Time:*** 1hr 41mins
- ***Simulation Length:*** 24hrs
- ***Volume Accounting Error:***
  - -0.5903 ac-ft
  - 0.04170 percent
- ***Precipitation Depth:*** 7.29 inches
- ***Precipitation Excess:*** 4.73 inches



## *Level of Mesh Detail*

Building footprints reflected in the DEM have observable impact on flow / velocity vectors

### *Downstream of Gum Branch Road*

- Inundated structures in left and right overbanks redirect flow. Flow vectors depicting lower velocity areas between and just downstream of structures.

### *At Gum Branch Road*

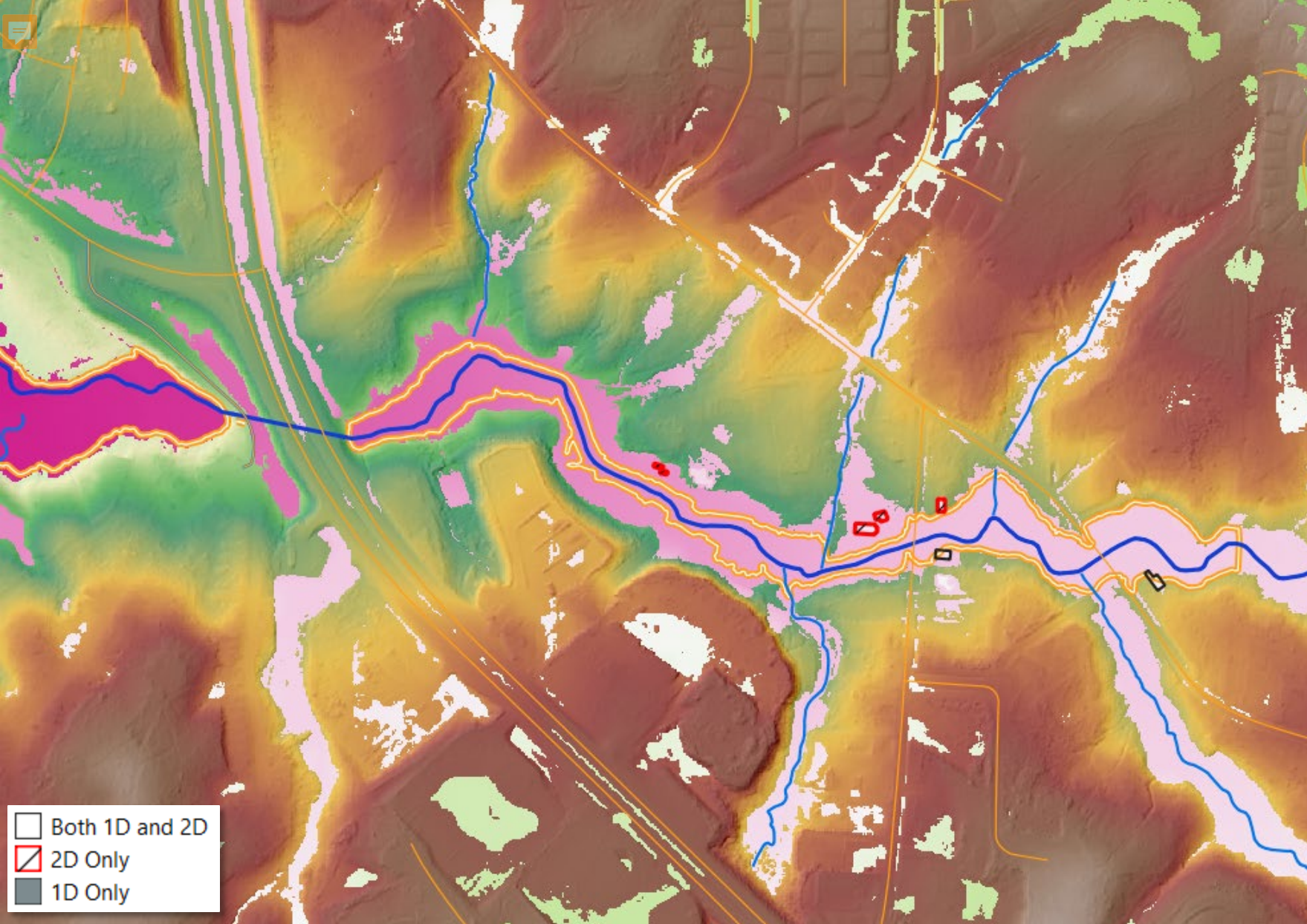
- Flow vectors illustrate contraction and expansion of flow as flood wave passes through the structure opening. Additional detail shows the impact of the structures on velocity vectors at the confluence with the minor system tributary.

### *In Vicinity of Coulwood Drive*

- Inundated structures impact flow approaching the structure. Pavement reflected in the n-value coverage results in high velocity flow along Brimwood Trail

### *Upstream of Coulwood Drive*

- Low velocity flow observed adjacent to inundated structures in right overbank



## 2D Model Results Summary:

### 2D Flood Risk Information

- **Overtopped Crossings**
  - Coulwood Dr.
  - Birchwood Dr.
  - Valleydale Rd.
  - Caldwell Williams
  - Old Plank Rd.
- **Inundated Buildings – 49**
  - **8 structures outside of the 1D SFHA** included in 2D floodplain
  - **2 structures in 1D SFHA excluded** from the 2D floodplain (in Long Creek backwater area)
- **100-Year WSEL Comparison: 2D vs 1D**
  - Average WSEL change = **+1.58 feet**
  - Maximum WSEL change = **+4.67 feet**
    - Occurs immediately upstream of Old Plank Road
  - Minimum WSEL change = **-0.29 feet**
    - Occurs at XS 16396







## FEMA 2D Floodway Guidance

### Section 5.1.2

- Inflows for FW run (5.1.2.1)

*“When a ROG model is used as the base flood comparison for a floodway analysis, the modeler has two options. They can elect to continue using the entire ROG domain to perform the floodway analysis or they can choose to reduce the ROG model to a smaller domain... **When the modeler elects to use a reduced domain, the direct flow along the stream and drainage basins to the main stem should be extracted and inputted into the river corridor project area. Flow hydrographs can be extracted from the ROG model along both main flooding sources and key tributaries at the confluence near the floodplain fringe and inserted into the floodway model as internal boundary conditions** with lengths comparable to the flood extents introduced by the tributary”*

## Guidance for Flood Risk Analysis and Mapping

### Floodway Analysis and Mapping

December 2020



FEMA

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# FEMA 2D Floodway Guidance

## Section 5.1.2

- Initial Encroachment Screening (5.1.2.2)

*“Two commonly used initial screening or binning approaches to consider are the DxV approach and the Australian Flood Hazard Curves approach.”*

<https://knowledge.aidr.org.au/media/3518/adr-guideline-7-3.pdf>

- Encroachment Types (5.1.2.3)

*“Raised Terrain at Floodway Fringe: The terrain is **manually manipulated by raising terrain elevations substantially** at the tested floodway fringe to confine all flow within the encroached floodway”*

Table 1: Combined hazard curves – vulnerability thresholds

| Hazard Vulnerability Classification | Description                                                                                                                                |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| H1                                  | Generally safe for vehicles, people and buildings.                                                                                         |
| H2                                  | Unsafe for small vehicles.                                                                                                                 |
| H3                                  | Unsafe for vehicles, children and the elderly.                                                                                             |
| H4                                  | Unsafe for vehicles and people.                                                                                                            |
| H5                                  | Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure. |
| H6                                  | Unsafe for vehicles and people. All building types considered vulnerable to failure.                                                       |

Table 2: Combined hazard curves – vulnerability thresholds classification limits

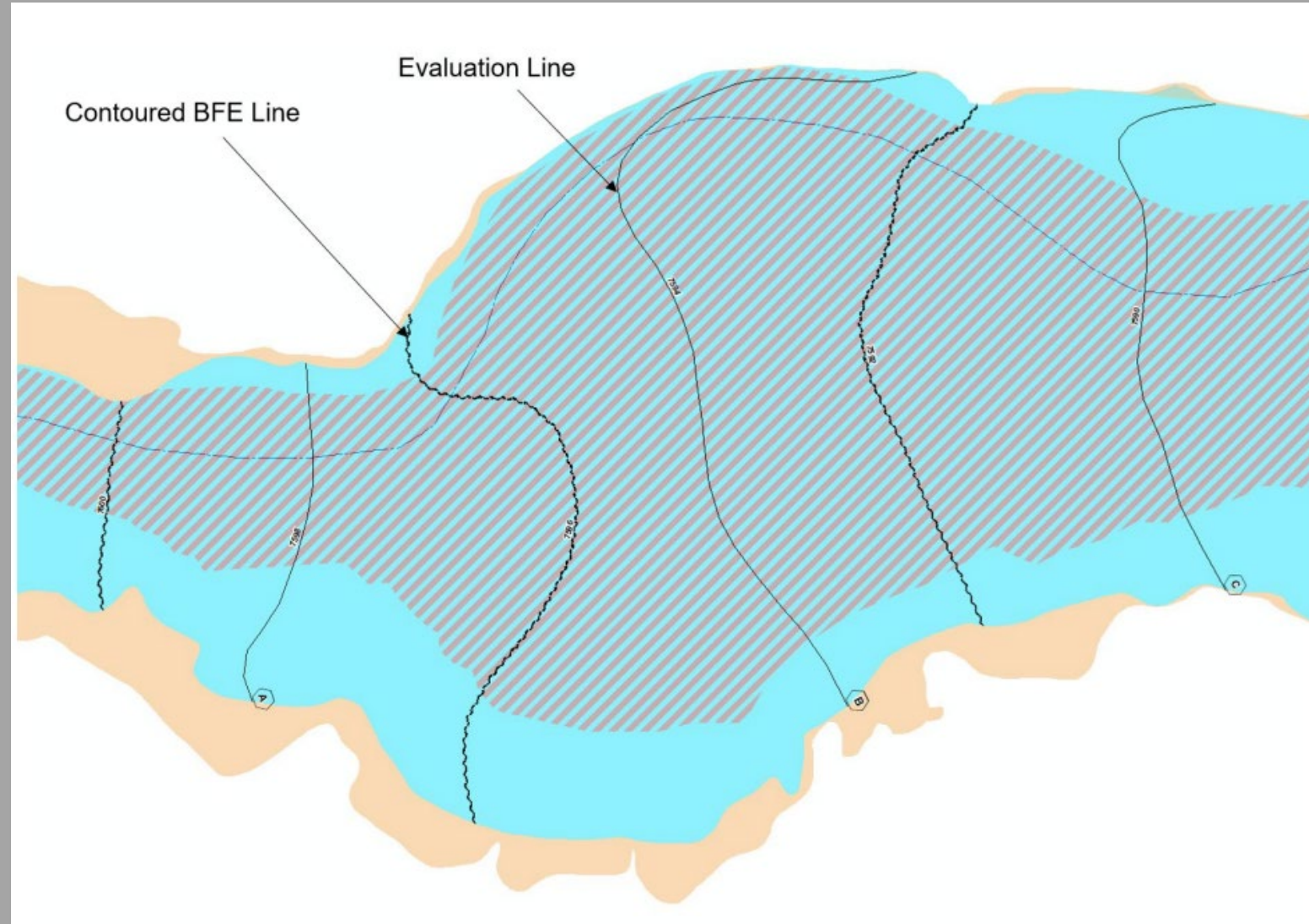
| Hazard Vulnerability Classification | Classification limit<br>(D and V in combination) |                    | Limiting still water depth<br>(D) |       | Limiting velocity<br>(V) |       |
|-------------------------------------|--------------------------------------------------|--------------------|-----------------------------------|-------|--------------------------|-------|
|                                     | m <sup>3</sup> /s                                | Ft <sup>2</sup> /s | m                                 | Ft    | m/s                      | Ft/s  |
| H1                                  | $D \cdot V \leq 0.3$                             | 3.23               | 0.3                               | 0.98  | 2.0                      | 6.56  |
| H2                                  | $D \cdot V \leq 0.6$                             | 6.46               | 0.5                               | 1.64  | 2.0                      | 6.56  |
| H3                                  | $D \cdot V \leq 0.6$                             | 6.46               | 1.2                               | 3.94  | 2.0                      | 6.56  |
| H4                                  | $D \cdot V \leq 1.0$                             | 10.76              | 2.0                               | 6.56  | 2.0                      | 6.56  |
| H5                                  | $D \cdot V \leq 4.0$                             | 43.06              | 4.0                               | 13.12 | 4.0                      | 13.12 |
| H6                                  | $D \cdot V > 4.0$                                | 43.06              | -                                 | -     | -                        | -     |

## FEMA 2D Floodway Guidance

### Section 5.1.2

- 2D Floodway Validation (5.1.2.4)

*“Elevations and surcharge must be reported in a format that is consistent with regulatory FIS and FIRM products. In order to achieve this consistency, and in order to align with floodway evaluation techniques upon which the CFR regulations were originally based, the use of 2D floodway ‘**evaluation lines**’ is recommended. Evaluation lines in 2D floodway analysis may be thought of as virtual hydraulic cross sections similar to the physical cross sections used in 1D modeling and reported in the floodway data table...”*



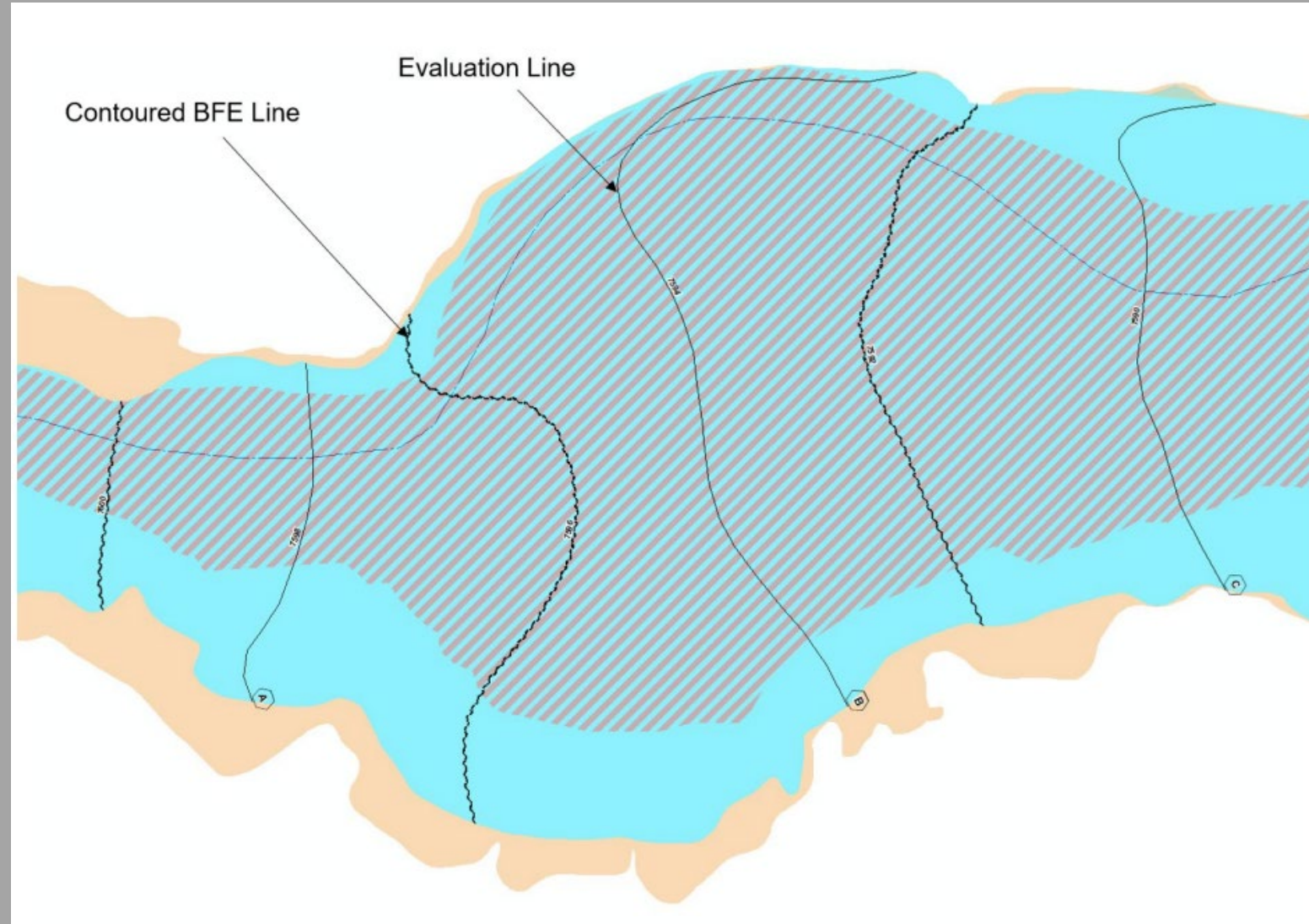
## FEMA 2D Floodway Guidance

### Section 5.1.2

- 2D Floodway Validation (5.1.2.4)

***“Evaluation lines should be placed at key hydraulic locations to capture and report the resultant surcharge. Examples of key hydraulic locations will vary depending on the characteristics of the stream but will likely include:***

- Expansions and contractions in the floodplain*
- Upstream and downstream of existing structures*
- Upstream, downstream, and at the location of significant hydraulic controls*
- Where significant changes occur in the modeled topography*
- At divergence and confluence of split flow paths or divided flow paths”*



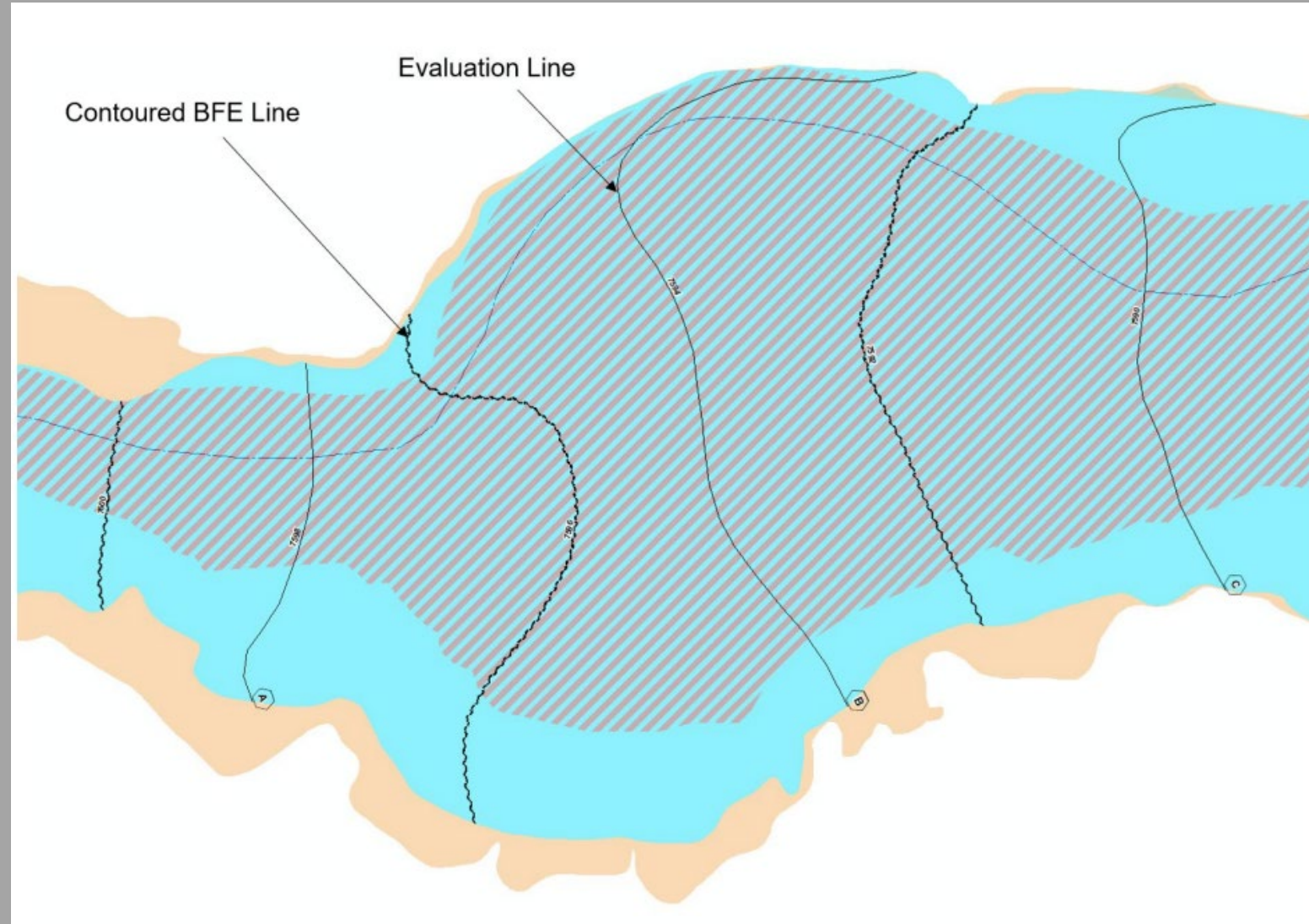
## FEMA 2D Floodway Guidance

### Section 5.1.2

- 2D Floodway Validation (5.1.2.4)

General considerations for plotting evaluation lines on FIRMs:

- “The maximum rise between plotted evaluation lines should not exceed 10 feet.*
- Evaluation lines may be shown similar to ‘lettered’ cross sections on FIRMs. ‘Lettered’ evaluation lines should not be further than 2 inches of map distance apart.*
- Evaluation lines should be stored in the S\_XS database layer and attributed similar to cross sections*
- In general, evaluation lines should avoid complex areas such as confluences if possible.”*



# FEMA 2D Floodway Guidance

## Section 5.1.2

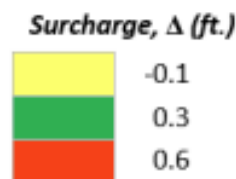
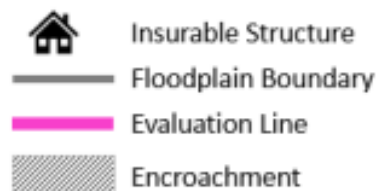
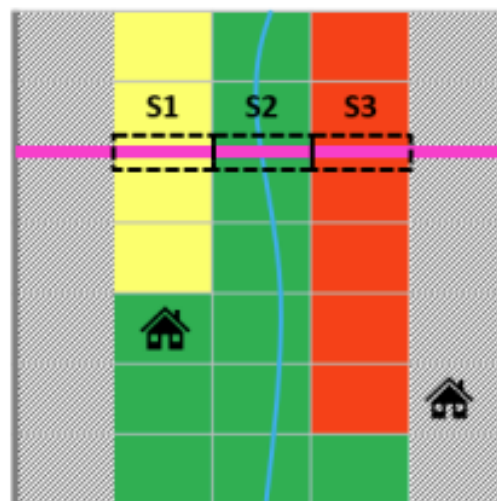
### • 2D Floodway Validation (5.1.2.4)

"Surcharges calculated on evaluation lines should be based on **averaging of all cells or nodes that intersect the evaluation line** and averaging should be done using a suitable weighting method... Averaging shall only be allowed if all cell results across an evaluation line are **between -/+0.5 foot of the allowable surcharge range** and **do not have surcharges outside of the maximum allowable surcharge on insurable structures.**"

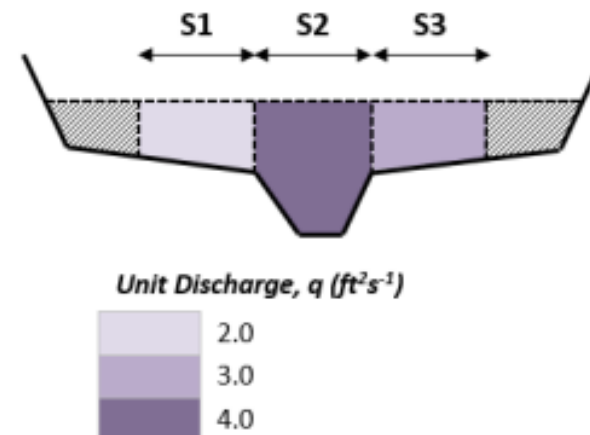
- 1 Evaluate weighted surcharge average and individual cell surcharges against criteria. Adjust criteria where more restrictive state surcharge requirements exist.

| Criteria | Description                                                                                                                   | Pass | Fail |
|----------|-------------------------------------------------------------------------------------------------------------------------------|------|------|
| 1        | BFE average is within allowable surcharge range of 0.0 to 1.0 feet.                                                           | ✓    |      |
| 2        | All cells overlapping insurable structures are within the allowable surcharge range of 0.0 to 1.0 feet.                       | ✓    |      |
| 3        | All cells considered in the BFE average are within the allowable surcharge range $\pm 0.5$ feet (-0.5 to 1.5 feet)            | ✓    |      |
| 4        | All cells <b>not</b> considered in the BFE average are within the allowable surcharge range $\pm 0.5$ feet (-0.5 to 1.5 feet) | ✓    |      |

- 1 Calculate surcharge at each cell, and divide BFE line into segments



- 2 Calculate unit discharge for each segment



- 3 Calculate unit discharge weighted surcharge average ( $\bar{\Delta}_{BFE}$ ) for all segments along BFE line

$$\bar{\Delta}_{BFE} = \frac{\Delta_{S1}q_{S1} + \Delta_{S2}q_{S2} + \Delta_{S3}q_{S3}}{q_{S1} + q_{S2} + q_{S3}}$$
$$\bar{\Delta}_{BFE} = \frac{(-0.1)(2.0) + (0.3)(3.0) + (0.6)(4.0)}{2.0 + 3.0 + 4.0}$$
$$\bar{\Delta}_{BFE} = 0.34 \text{ ft.}$$

# FEMA 2D Floodway Guidance

## Section 8.0

- Floodway Data Table

*“When creating a FDT based on a HEC-RAS unsteady flow floodway analysis, the Mapping Partner should use floodway parameters (floodway width, section area, mean velocity of with floodway and without-floodway water-surface elevation) associated with the **maximum discharge** at each cross section or evaluation line from the unsteady floodway run.”*

## FIS Report Technical Reference

Example of Floodway Data Table with evaluation line references:

| LOCATION                   |                       | FLOODWAY <sup>1</sup> |                         |                           | 1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION <sup>2</sup> (FEET NAVD88) |                  |               |          |
|----------------------------|-----------------------|-----------------------|-------------------------|---------------------------|---------------------------------------------------------------------------|------------------|---------------|----------|
| CROSS SECTION <sup>2</sup> | DISTANCE <sup>3</sup> | WIDTH (FEET)          | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/ SEC) | REGULATORY                                                                | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| A                          | 82,440                | 1,395                 | 23,879                  | 4.9                       | 22.2                                                                      | 22.2             | 23.2          | 1.0      |
| B                          | 84,620                | 2,208                 | 42,275                  | 2.7                       | 22.8                                                                      | 22.8             | 23.8          | 1.0      |
| C                          | 86,800                | 2,500                 | 45,371                  | 2.6                       | 23.1                                                                      | 23.1             | 24.1          | 1.0      |
| D                          | 89,600                | 3,921                 | 72,926                  | 1.6                       | 23.3                                                                      | 23.3             | 24.3          | 1.0      |
| E                          | 121,600               | 5,548                 | 88,146                  | 1.3                       | 24.0                                                                      | 24.0             | 25.0          | 1.0      |
| F                          | 123,550               | 6,965                 | 129,249                 | 0.9                       | 24.0                                                                      | 24.0             | 25.0          | 1.0      |
| G                          | 126,250               | 7,598                 | 138,886                 | 0.8                       | 24.0                                                                      | 24.0             | 25.0          | 1.0      |
| H                          | 128,400               | 6,440                 | 125,613                 | 0.9                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| I                          | 130,300               | 7,170                 | 133,927                 | 0.8                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| J                          | 132,250               | 6,701                 | 128,508                 | 0.9                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| K                          | 133,050               | 7,198                 | 131,137                 | 0.8                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| L                          | 135,700               | 6,116                 | 113,706                 | 1.0                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |

<sup>1</sup>Values reported are based on averages calculated across evaluation lines. Refer to model result grids for modeled variability in elevation and surcharge across the floodway.

<sup>2</sup>Floodway computed by 2-D or hybrid 1-D 2-D model at this location

<sup>3</sup>Feet above mouth

TABLE 23

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: INUNDATION RIVER



# FEMA 2D Floodway Guidance

## Section 8.0

- Floodway Data Table

“When a 2D or hybrid 1D-2D model is used by the Mapping Partner, they should create evaluation lines as described in section 5.1 to report the appropriate parameters in the FDT at key locations. The Mapping Partner should use the appropriate template from the FIS Report Technical Reference to ensure users are aware that the values reported in the FDT are based on a 2D or 1D-2D hybrid model”

Example of Floodway Data Table with evaluation line references:

| LOCATION                   |                       | FLOODWAY <sup>1</sup> |                         |                           | 1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION <sup>2</sup> (FEET NAVD88) |                  |               |          |
|----------------------------|-----------------------|-----------------------|-------------------------|---------------------------|---------------------------------------------------------------------------|------------------|---------------|----------|
| CROSS SECTION <sup>2</sup> | DISTANCE <sup>3</sup> | WIDTH (FEET)          | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/ SEC) | REGULATORY                                                                | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| A                          | 82,440                | 1,395                 | 23,879                  | 4.9                       | 22.2                                                                      | 22.2             | 23.2          | 1.0      |
| B                          | 84,620                | 2,208                 | 42,275                  | 2.7                       | 22.8                                                                      | 22.8             | 23.8          | 1.0      |
| C                          | 86,800                | 2,500                 | 45,371                  | 2.6                       | 23.1                                                                      | 23.1             | 24.1          | 1.0      |
| D                          | 89,600                | 3,921                 | 72,926                  | 1.6                       | 23.3                                                                      | 23.3             | 24.3          | 1.0      |
| E                          | 121,600               | 5,548                 | 88,146                  | 1.3                       | 24.0                                                                      | 24.0             | 25.0          | 1.0      |
| F                          | 123,550               | 6,965                 | 129,249                 | 0.9                       | 24.0                                                                      | 24.0             | 25.0          | 1.0      |
| G                          | 126,250               | 7,598                 | 138,886                 | 0.8                       | 24.0                                                                      | 24.0             | 25.0          | 1.0      |
| H                          | 128,400               | 6,440                 | 125,613                 | 0.9                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| I                          | 130,300               | 7,170                 | 133,927                 | 0.8                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| J                          | 132,250               | 6,701                 | 128,508                 | 0.9                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| K                          | 133,050               | 7,198                 | 131,137                 | 0.8                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |
| L                          | 135,700               | 6,116                 | 113,706                 | 1.0                       | 24.1                                                                      | 24.1             | 25.1          | 1.0      |

<sup>1</sup>Values reported are based on averages calculated across evaluation lines. Refer to model result grids for modeled variability in elevation and surcharge across the floodway.  
<sup>2</sup>Floodway computed by 2-D or hybrid 1-D 2-D model at this location  
<sup>3</sup>Feet above mouth

|          |                                                                                      |                                   |
|----------|--------------------------------------------------------------------------------------|-----------------------------------|
| TABLE 23 | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>FLOOD COUNTY, STATE<br>AND INCORPORATED AREAS | FLOODWAY DATA                     |
|          |                                                                                      | FLOODING SOURCE: INUNDATION RIVER |



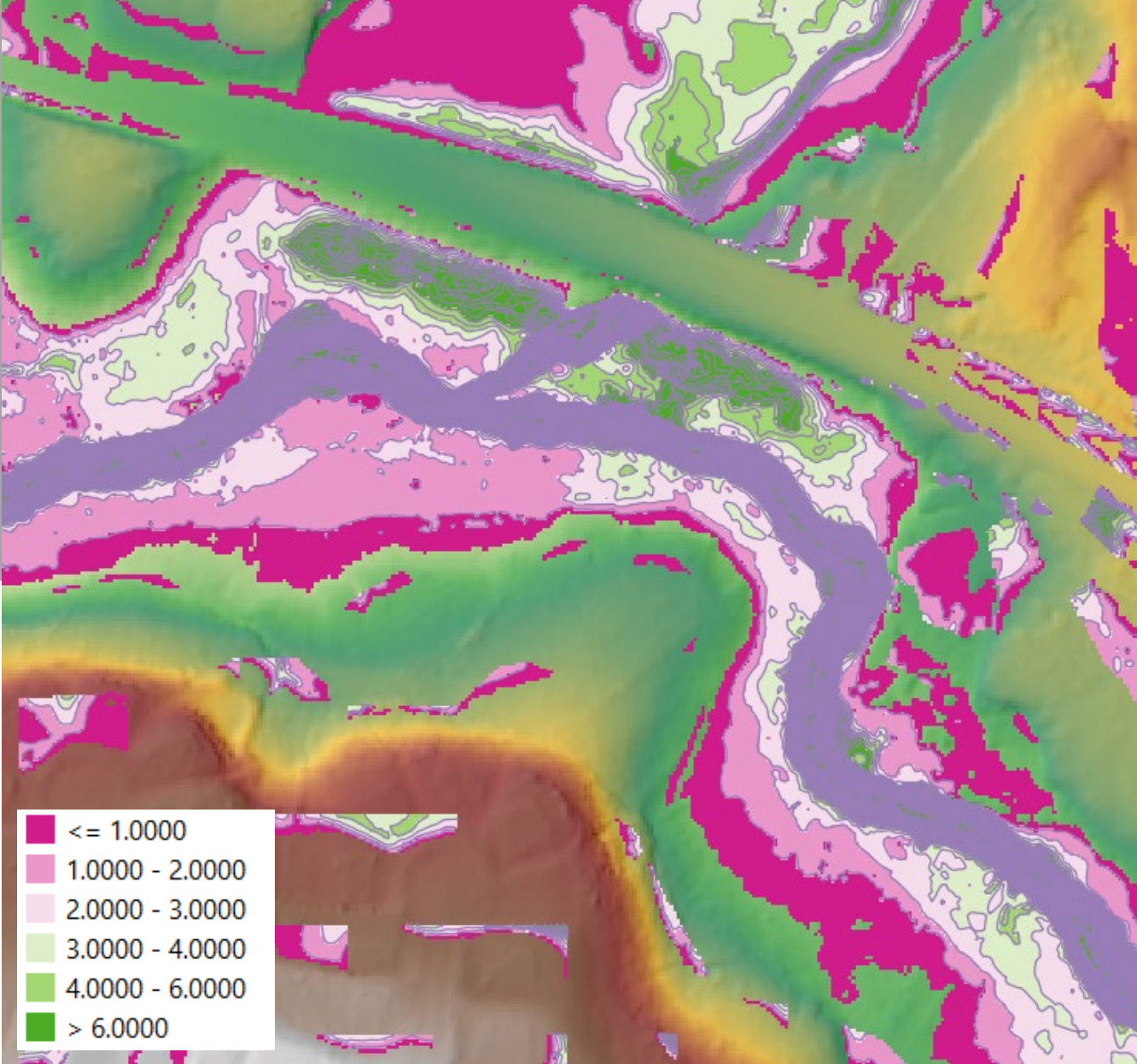
# Development of the Gum Branch 2D Encroachment Analysis

Choose a constant / uniform DxV value in the initial screening that may produce an acceptable floodway.

- A DxV value that is **too low** may produce surcharges that fall within the acceptable range, but result in a floodway that is **excessively wide**
- A DxV value that is **too high** may produce encroachments that **exceed the allowable maximum surcharge**.

Table 2: Combined hazard curves – vulnerability thresholds classification limits

| Hazard Vulnerability Classification | Classification limit (D and V in combination) |       | Limiting still water depth (D) |       | Limiting velocity (V) |       |
|-------------------------------------|-----------------------------------------------|-------|--------------------------------|-------|-----------------------|-------|
|                                     | m³/s                                          | Ft²/s | m                              | Ft    | m/s                   | Ft/s  |
| H1                                  | $D \cdot V \leq 0.3$                          | 3.23  | 0.3                            | 0.98  | 2.0                   | 6.56  |
| H2                                  | $D \cdot V \leq 0.6$                          | 6.46  | 0.5                            | 1.64  | 2.0                   | 6.56  |
| H3                                  | $D \cdot V \leq 0.6$                          | 6.46  | 12                             | 3.94  | 2.0                   | 6.56  |
| H4                                  | $D \cdot V \leq 1.0$                          | 10.76 | 2.0                            | 6.56  | 2.0                   | 6.56  |
| H5                                  | $D \cdot V \leq 4.0$                          | 43.06 | 4.0                            | 13.12 | 4.0                   | 13.12 |
| H6                                  | $D \cdot V > 4.0$                             | 43.06 | -                              | -     | -                     | -     |



## Floodway Iteration 1

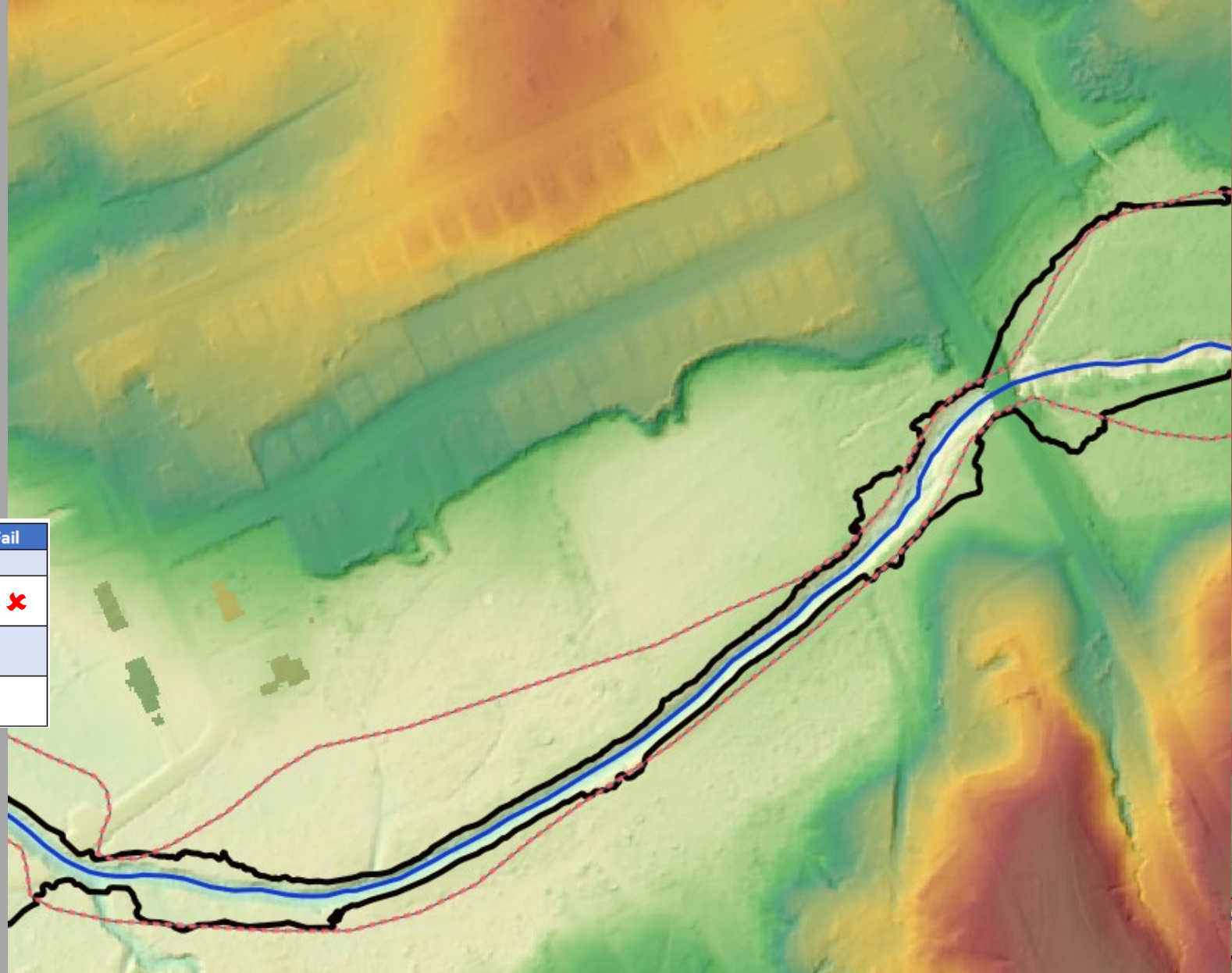
Constant  $DxV = 6 \text{ ft}^2/\text{s}$  (approx. ARR H3)

- Surcharges in upper reaches conformed with 0.5' FEMA FW surcharge requirement stipulated by CMSWS
- Surcharges downstream of effective station 9456 exceeded the 0.5' FEMA FW tolerance.

➔ **Criteria #2 Violated**

| Criteria | Description                                                                                                                  | Pass | Fail |
|----------|------------------------------------------------------------------------------------------------------------------------------|------|------|
| 1        | BFE average is within allowable surcharge range 0.0 to 0.5 feet.                                                             |      |      |
| 2        | All cells overlapping insurable structures are within the allowable surcharge range of 0.0 to 0.5 feet.                      |      | ✗    |
| 3        | All cells considered in the BFE average are within the allowable surcharge range +/- 0.5 feet (-0.5 to 1.0 foot).            |      |      |
| 4        | All cells <i>not</i> considered in the BFE average are within the allowable surcharge range +/- 0.5 feet (-0.5 to 1.0 foot). |      |      |

**Iteration Conclusion ➔ Adjust  $DxV$  to  $2 \text{ ft}^2/\text{s}$**



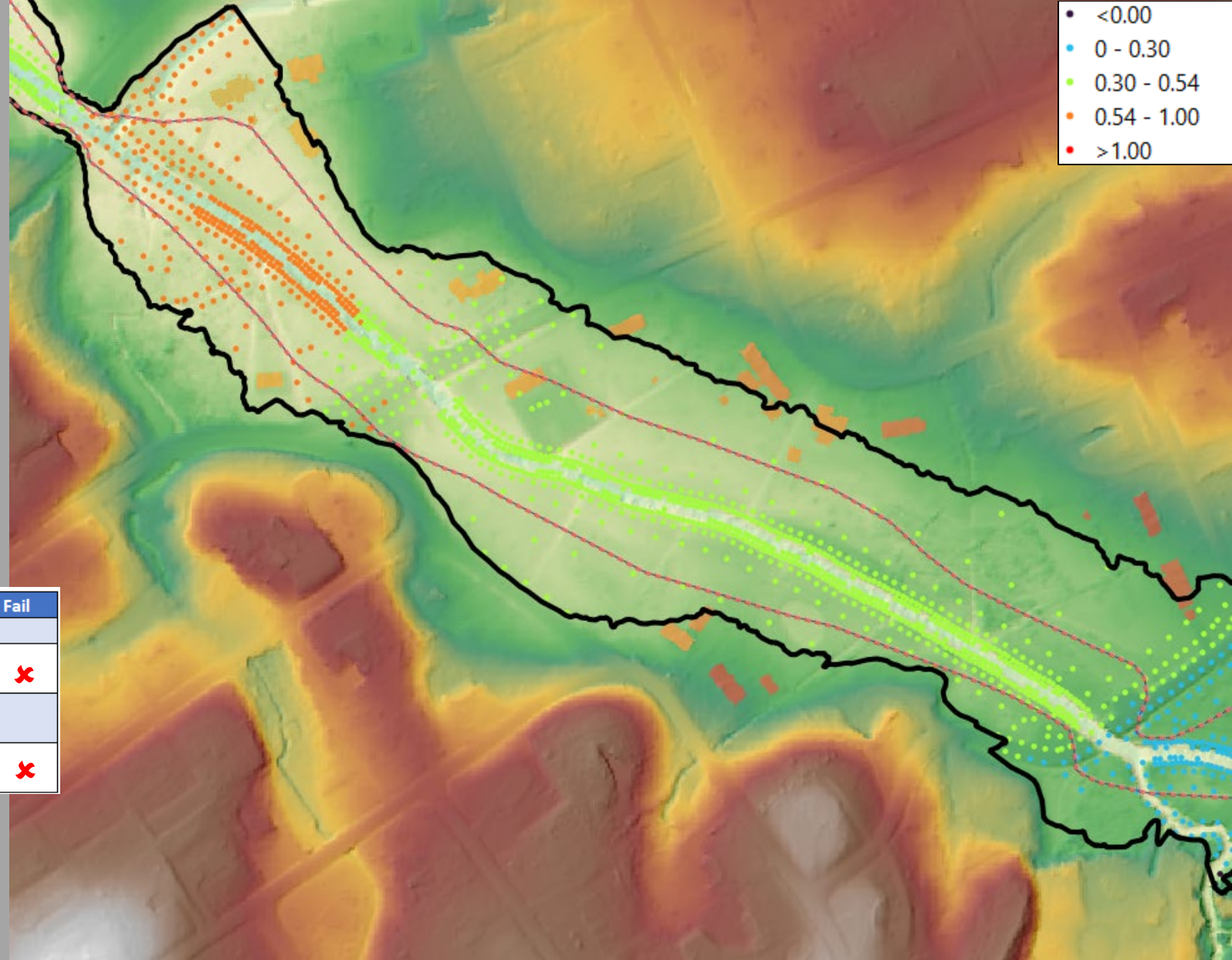
## Floodway Iteration 2

Constant  $DxV = 2 \text{ ft}^2/\text{s}$  (below ARR H1)

- Surcharges at all cells just upstream of Gum Branch Rd are above allowable surcharge range.  
→ **Criteria #1 Violated**
- Surcharges impacting insurable structures are above the allowable surcharge range  
→ **Criteria #2 Violated**
- Surcharges near confluence with Long Creek are outside of the allowable surcharge range  $\pm 0.5'$   
→ **Criteria #3 Violated**

| Criteria | Description                                                                                                                    | Pass | Fail |
|----------|--------------------------------------------------------------------------------------------------------------------------------|------|------|
| 1        | BFE average is within allowable surcharge range 0.0 to 0.5 feet.                                                               | ✓    |      |
| 2        | All cells overlapping insurable structures are within the allowable surcharge range of 0.0 to 0.5 feet.                        |      | ✗    |
| 3        | All cells considered in the BFE average are within the allowable surcharge range $\pm 0.5$ feet (-0.5 to 1.0 foot).            | ✓    |      |
| 4        | All cells <b>not</b> considered in the BFE average are within the allowable surcharge range $\pm 0.5$ feet (-0.5 to 1.0 foot). |      | ✗    |

**Iteration Conclusion → Use different  $DxV$  values at various locations along the length of Gum Branch**



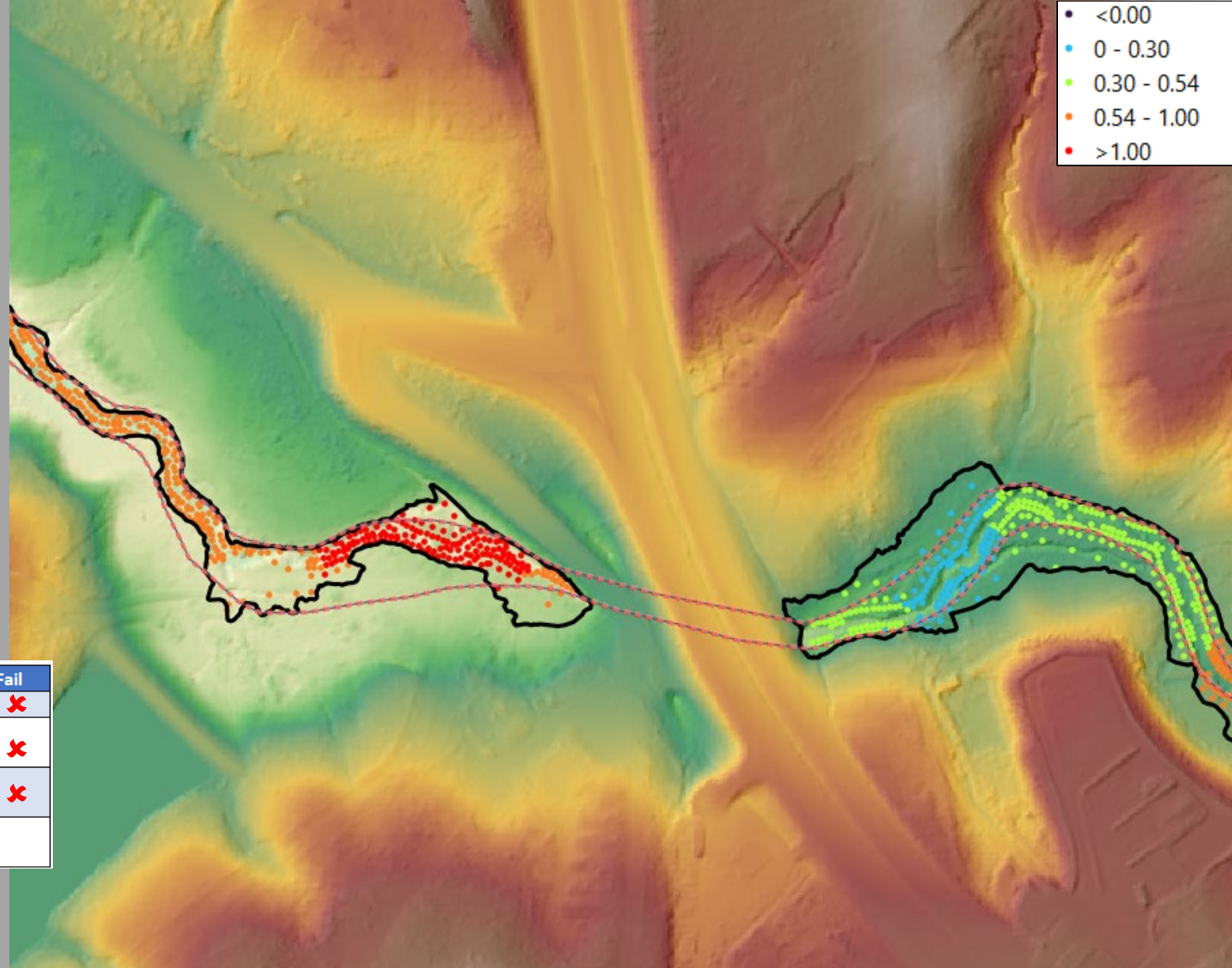
### Floodway Iteration 3

#### Composite DxV (approx. H3 to below H1)

- Surcharges at all cells between Gum Branch Rd and Coulwood Dr are above allowable surcharge range. Additional excessive surcharges present near Brookshire Blvd.  
→ **Criteria #1 Violated**
- Surcharges impacting insurable structures remain above the allowable surcharge range.  
→ **Criteria #2 Violated**
- Surcharges downstream of Brookshire Blvd are outside of the allowable surcharge range +/- 0.5'  
→ **Criteria #3&4 Violated**

| Criteria | Description                                                                                                                  | Pass | Fail |
|----------|------------------------------------------------------------------------------------------------------------------------------|------|------|
| 1        | BFE average is within allowable surcharge range 0.0 to 0.5 feet.                                                             |      | ✗    |
| 2        | All cells overlapping insurable structures are within the allowable surcharge range of 0.0 to 0.5 feet.                      |      | ✗    |
| 3        | All cells considered in the BFE average are within the allowable surcharge range +/- 0.5 feet (-0.5 to 1.0 foot).            |      | ✗    |
| 4        | All cells <b>not</b> considered in the BFE average are within the allowable surcharge range +/- 0.5 feet (-0.5 to 1.0 foot). |      |      |

**Iteration Conclusion → Adjust the composite DxV and recompute surcharges**

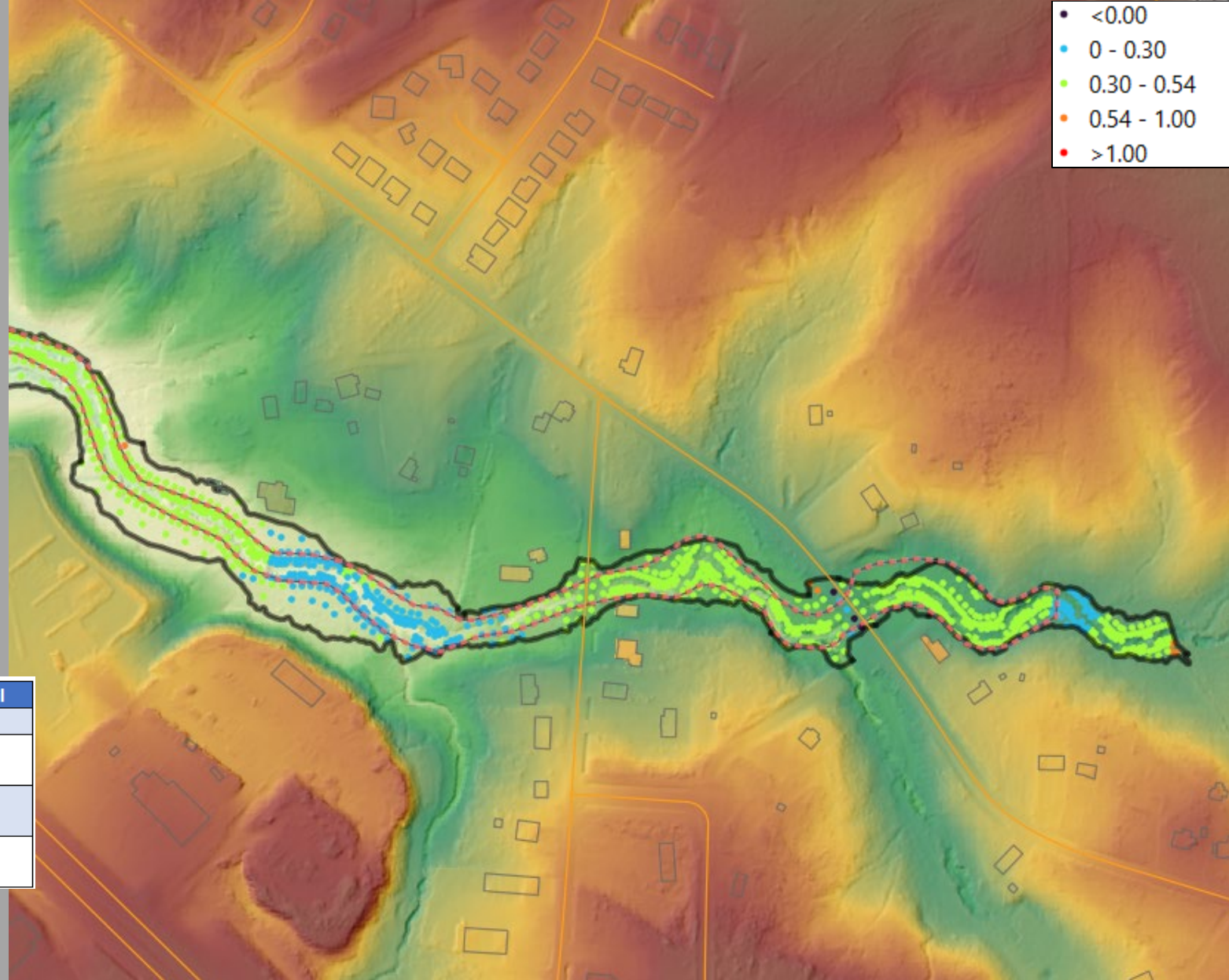


## Floodway Iteration 4

### Composite DxV (approx. H3 to below H1)

- Excessive surcharges have been resolved. BFE average within allowable 0.0' to 0.5' range.  
→ **Criteria #1 Satisfied**
- No structures impacted by surcharges greater than the allowable 0.5ft maximum at any location within the FEMA domain  
→ **Criteria #2 Satisfied**
- No surcharges beyond the “allowable surcharge range +/- 0.5ft” threshold present anywhere within modeled area  
→ **Criteria #3 & 4 Satisfied**

| Criteria | Description                                                                                                                  | Pass | Fail |
|----------|------------------------------------------------------------------------------------------------------------------------------|------|------|
| 1        | BFE average is within allowable surcharge range 0.0 to 0.5 feet.                                                             | ✓    |      |
| 2        | All cells overlapping insurable structures are within the allowable surcharge range of 0.0 to 0.5 feet.                      | ✓    |      |
| 3        | All cells considered in the BFE average are within the allowable surcharge range +/- 0.5 feet (-0.5 to 1.0 foot).            | ✓    |      |
| 4        | All cells <b>not</b> considered in the BFE average are within the allowable surcharge range +/- 0.5 feet (-0.5 to 1.0 foot). | ✓    |      |



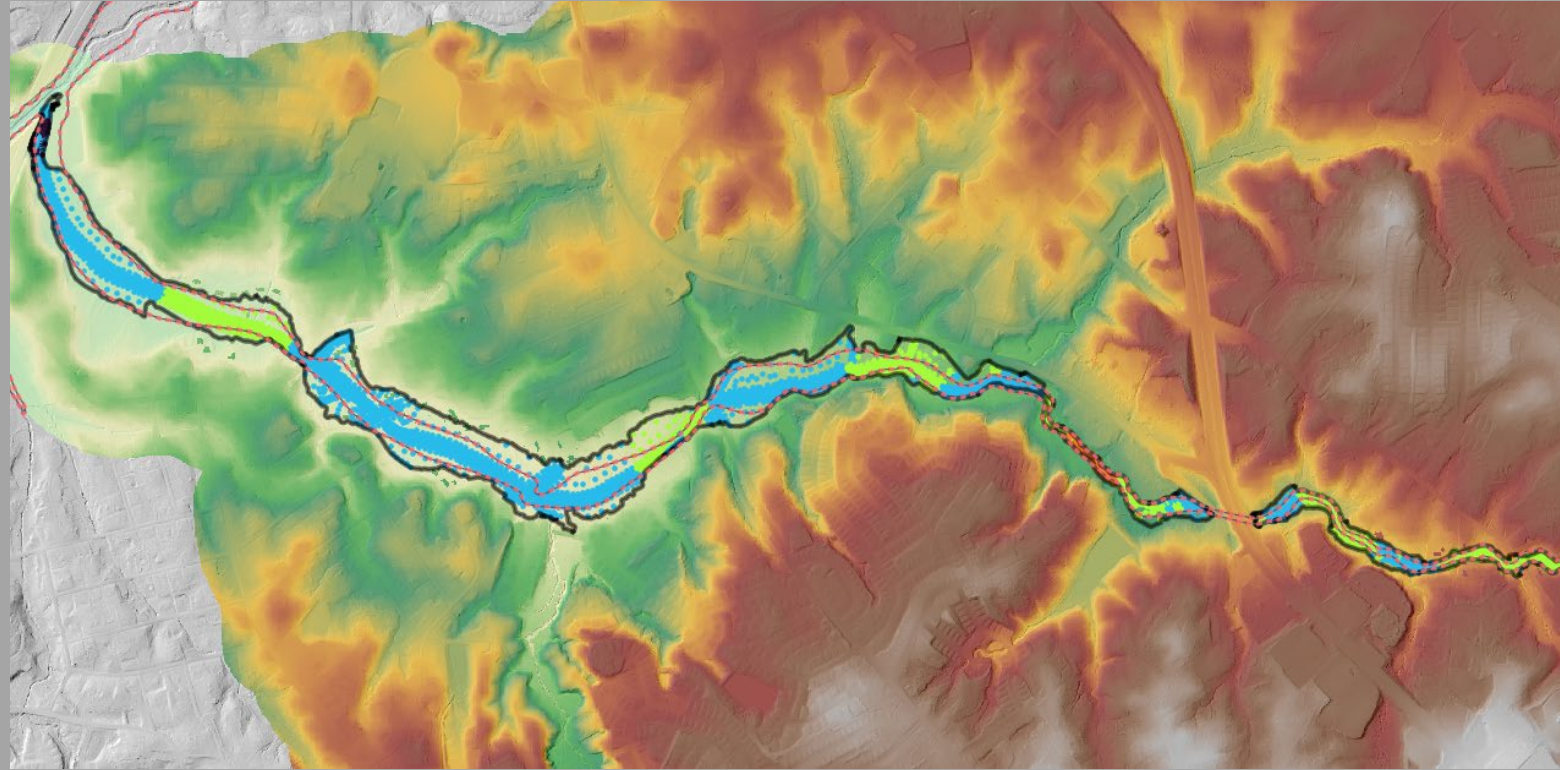
## *Floodway Iteration 4*

Composite DxV (approx. H3 to below H1)

### **HOWEVER:**

- Approximately 500ft reach of surcharges greater than the allowable 0.5ft maximum surcharge exists downstream of Brookshire Blvd.
- Surcharges less than 0.30ft at significant portions of the FEMA domain, with floodway width noticeably increased from effective.

**Iteration Conclusion → Iteration 4**  
**Floodway is Acceptable, but adjust the composite DxV to optimize where possible**

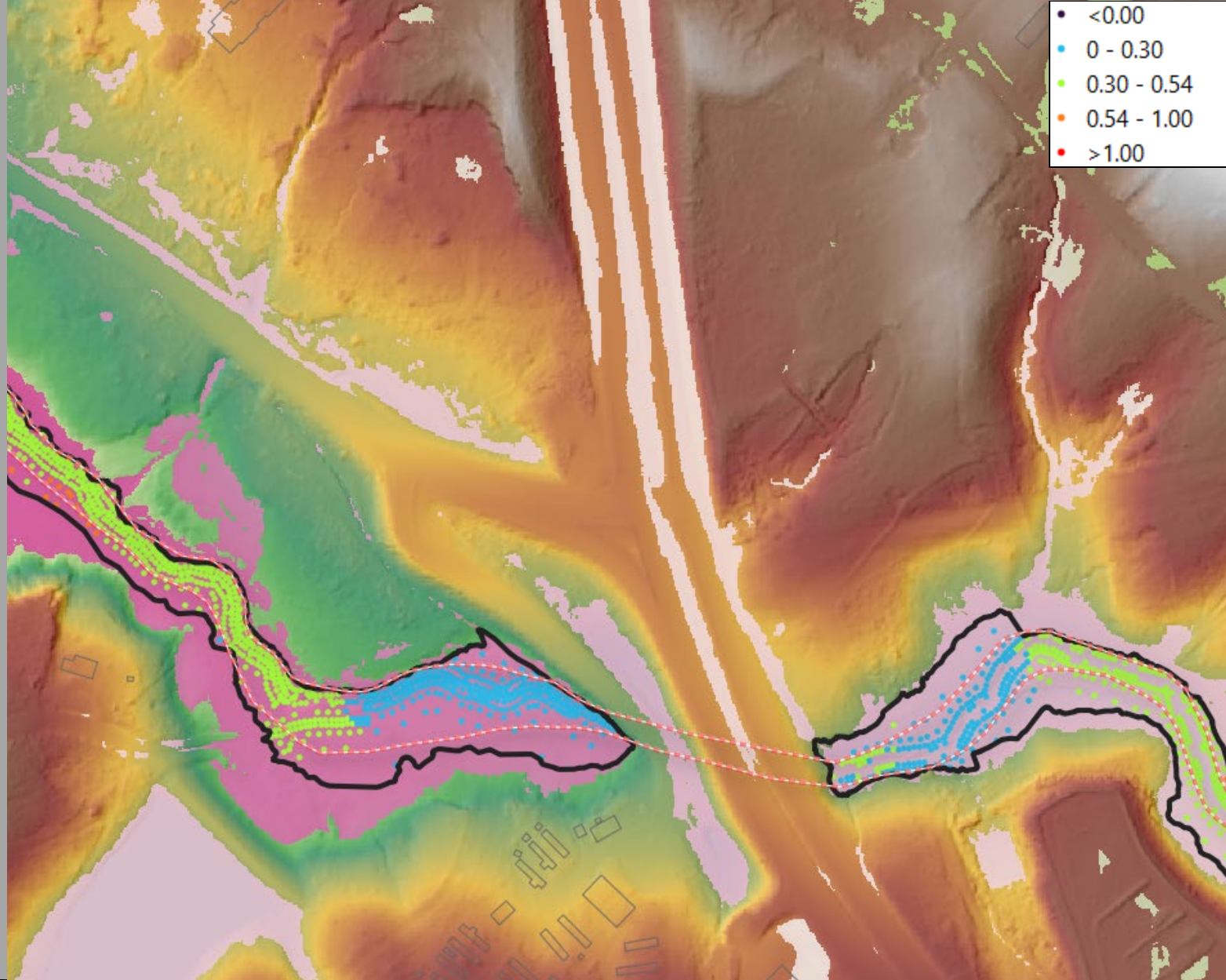


## Floodway Iteration 5

Composite DxV (approx. H3 to below H1)

- BFE average within the allowable 0 to 0.5ft surcharge range at all locations within the FEMA domain  
→ **Criteria #1 Satisfied**
- No structures are impacted by surcharges greater than the allowable 0.5ft maximum at any location within the FEMA domain  
→ **Criteria #2 Satisfied**
- No surcharges beyond the “allowable surcharge range +/- 0.5ft” threshold present  
→ **Criteria #3 Satisfied**
- Increased prevalence of surcharges between 0.3ft and 0.5ft within the FEMA domain

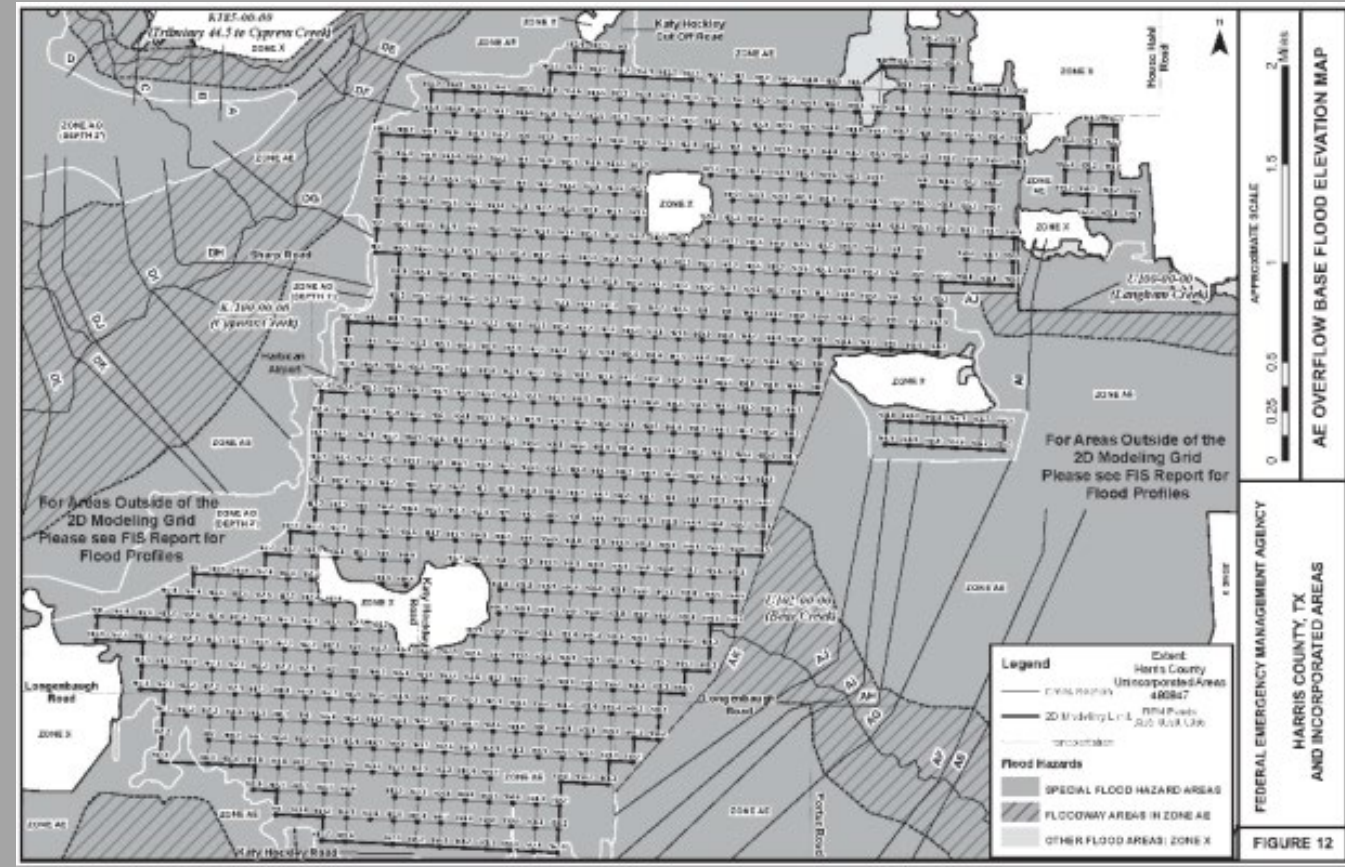
**Conclusion → FEMA FW Acceptable!**

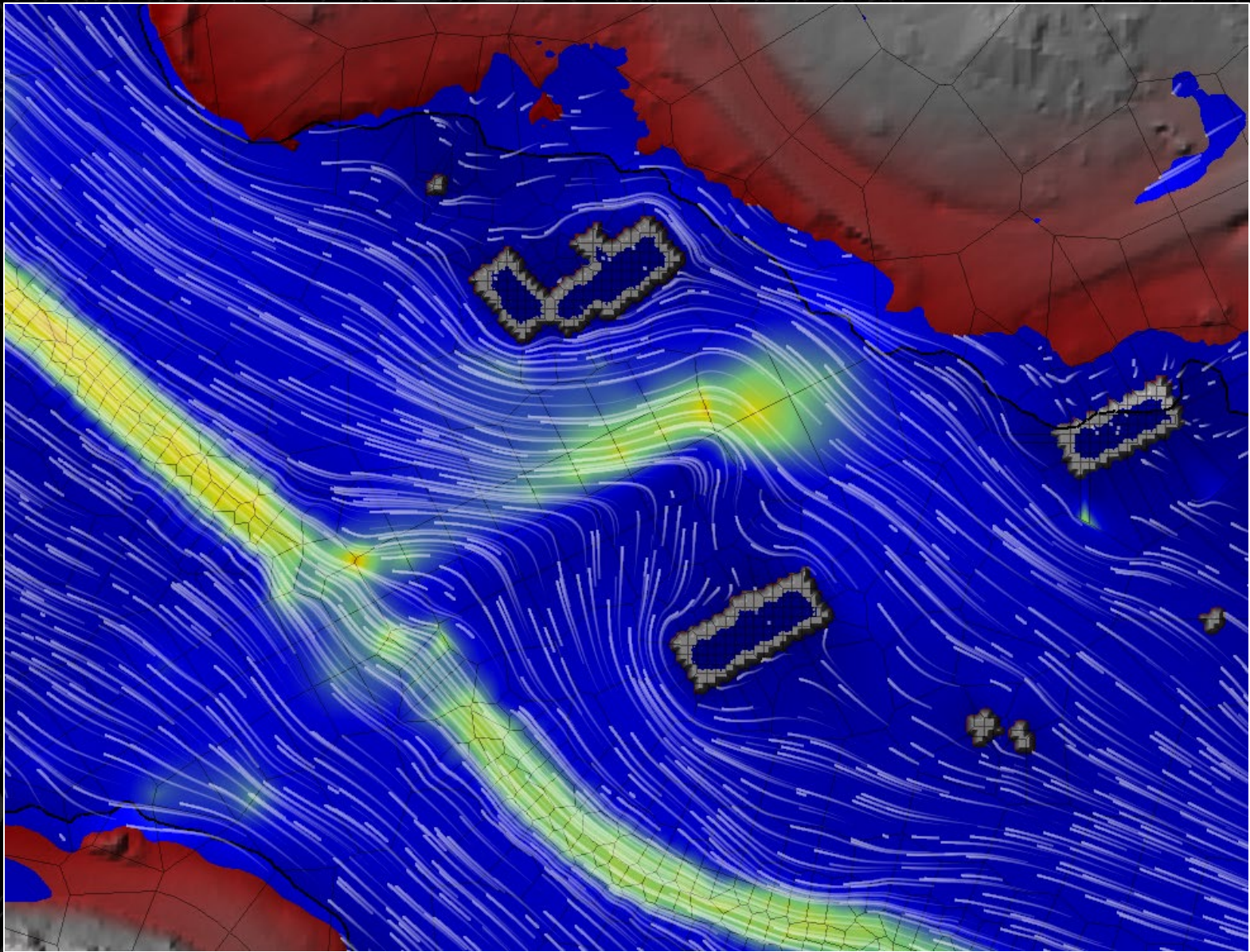


## Next Steps

Further effort remains before model can be considered “Finalized”:

- Calibrate model using November 2020 storm event (and potentially others)
- Compute finalized hypothetical events and future conditions 100-year event using calibrated model
- Further optimize and smooth FEMA floodway to ensure that the resulting encroachment area is not excessively wide or irregular
- Compute Community Encroachment Area
- Generate FIS attachments
  - FWDT
  - FIS 2D inserts
  - WSEL profiles (if desired)
  - SODT





Questions?

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