






The Benefits and Appropriate Use of Base Flood Approximate Shapefiles to Calculate Zone A Base Flood Elevations

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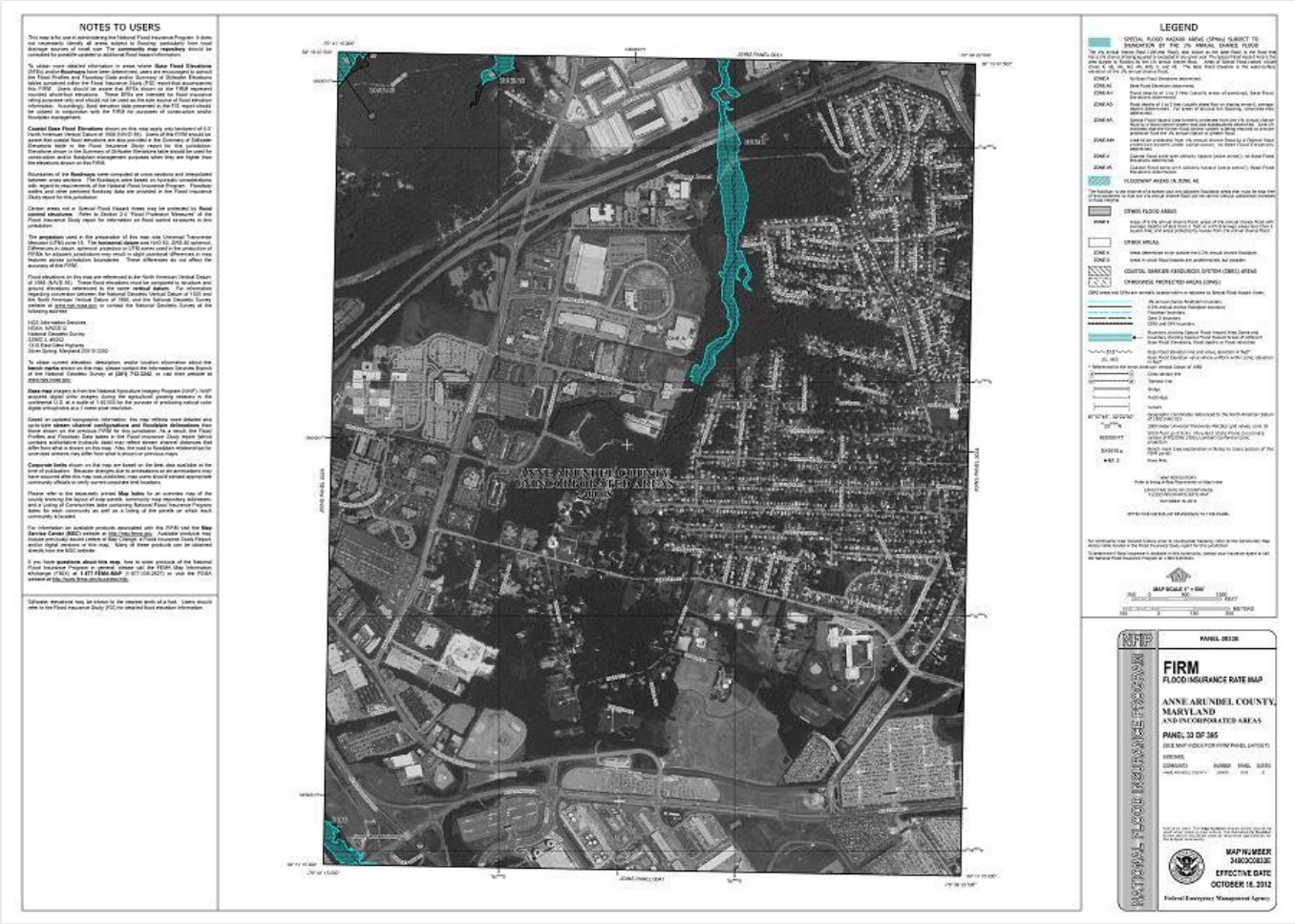
Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs)

- Identify flood hazards
- Zone designations identify the type of flooding or study
- Zone AE based on detailed studies
- Zone A based on approximate studies






Base Flood Elevations (BFEs) and Zone A Flooding

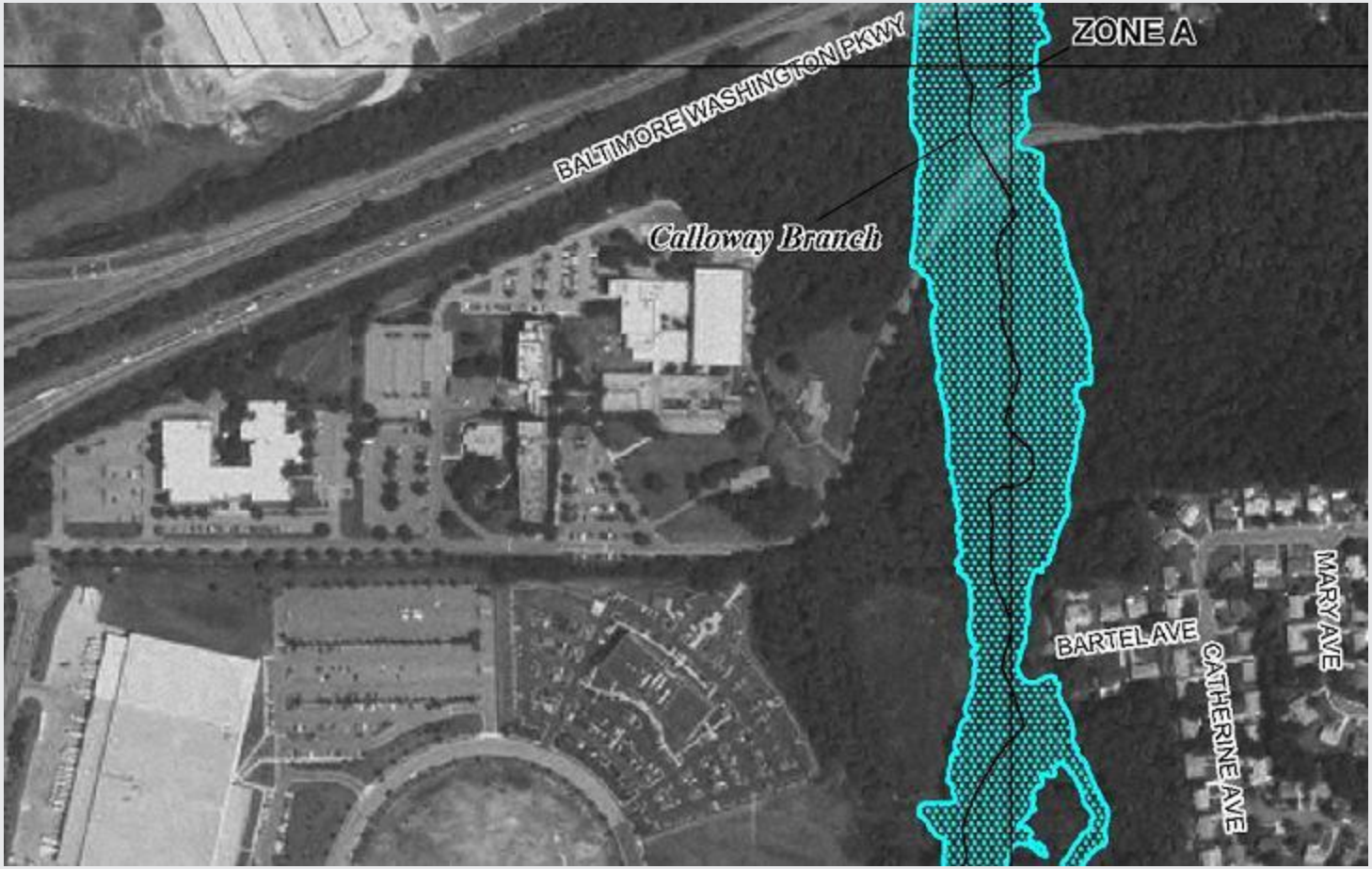
Base Flood Elevation

- The 100 year flood elevation
- 1% chance of occurring any given year
- Zone AE on FIRMs show BFEs

Zone A Flooding

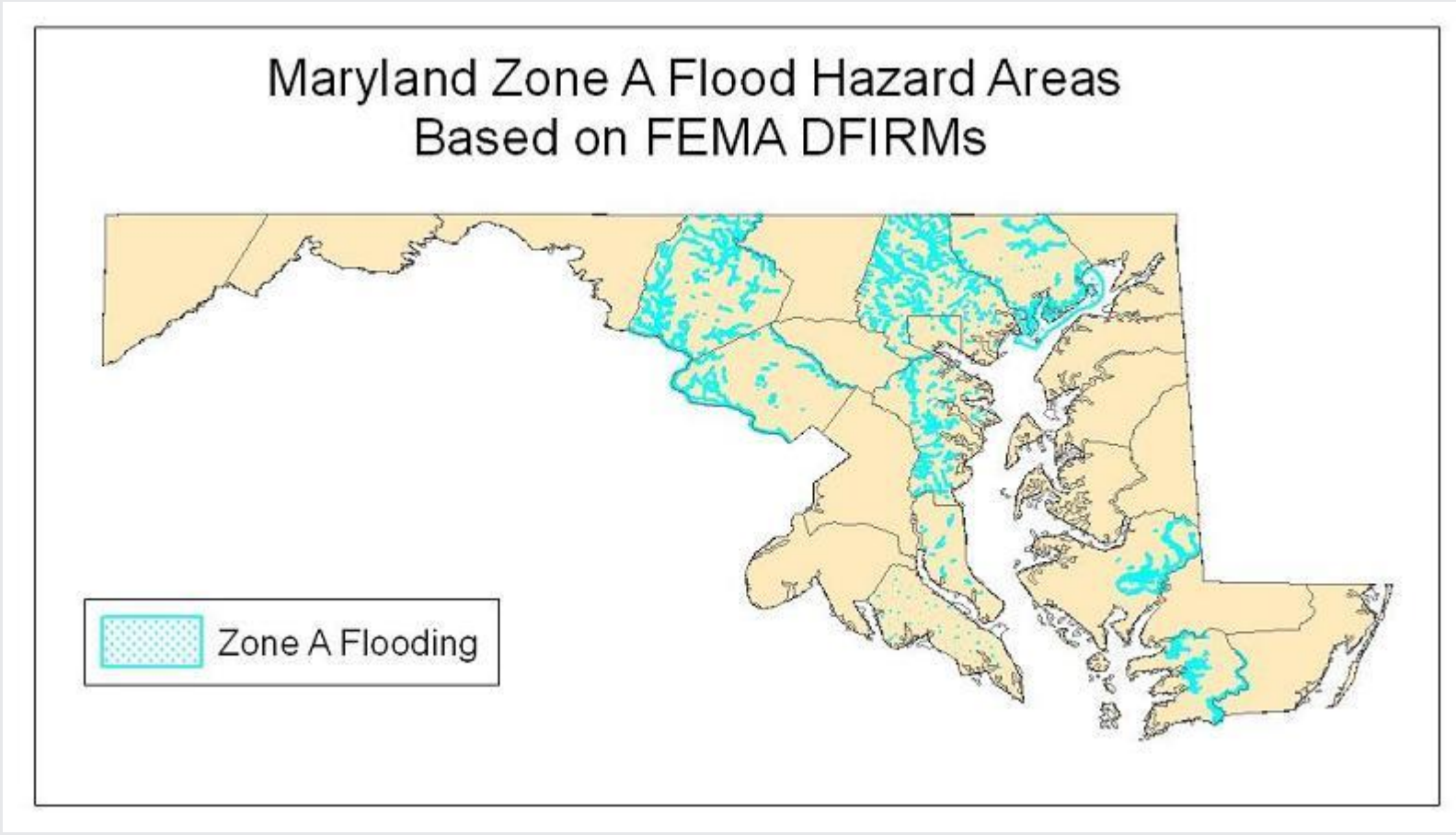
- Usually found in remote or sparsely populated areas where detailed studies are cost prohibitive
- No BFEs on FIRMs
- Difficult for the general public to determine their BFE

Zone A Flooding in Developed Areas



Zone A flooding still exists in developed areas due to budget limitations or building after the study was done.

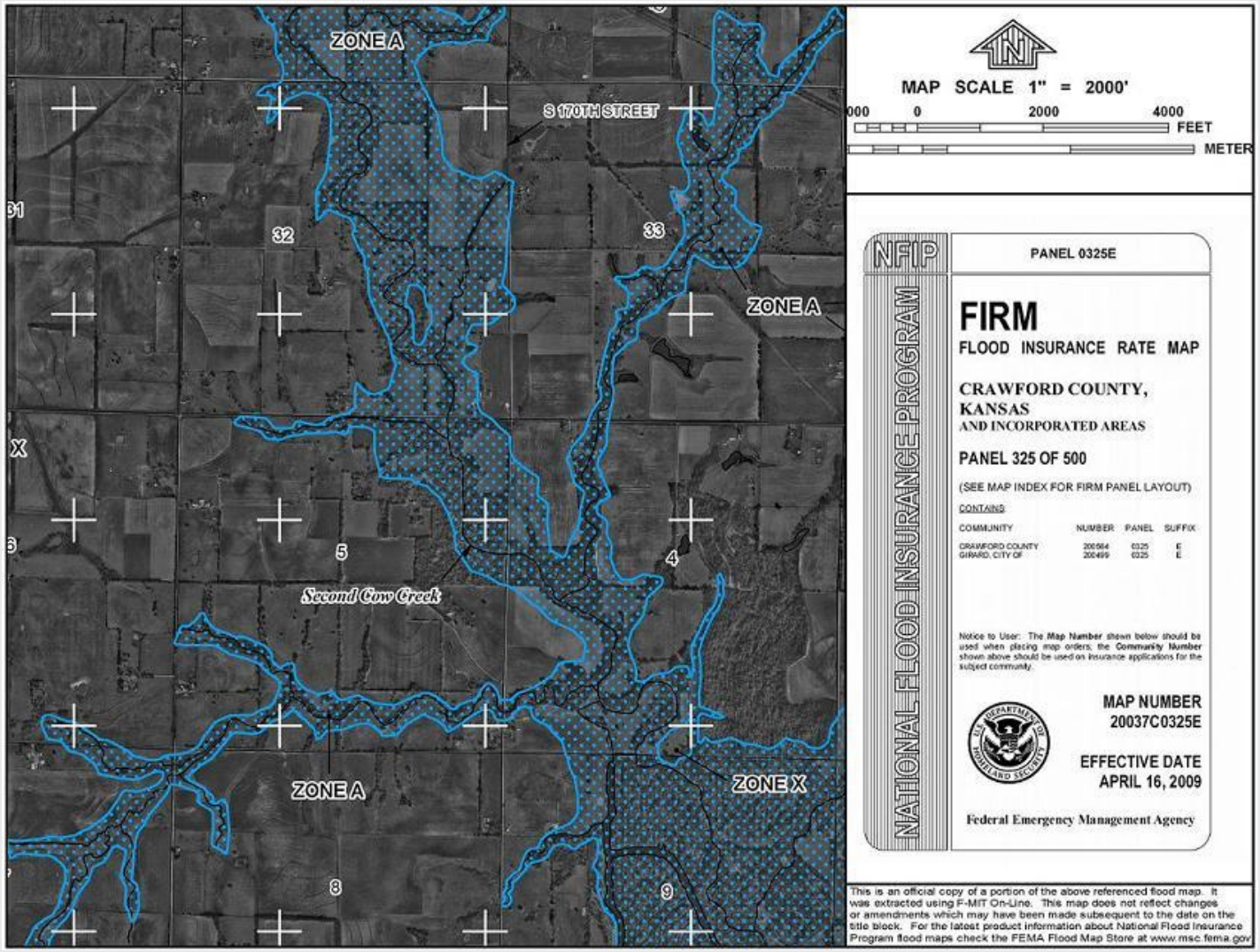


Only 9 counties and 1 city in Maryland currently have DFIRMs



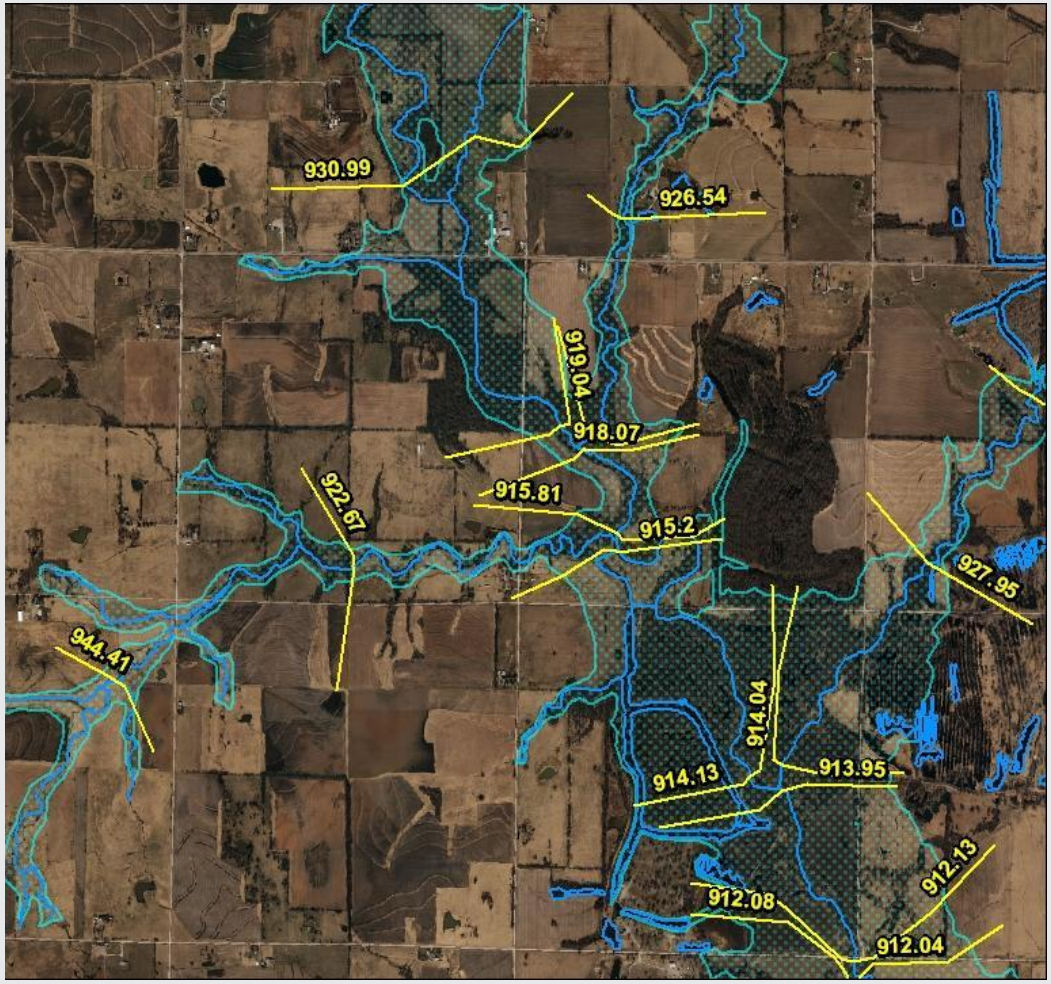

Zone A Flooding in Kansas






Kansas' Solution to Zone A Flooding: Base Flood Approximate (BFA) Cross Sections

- Not published on FEMA's paper FIRMs
- Only available through Digital Flood Insurance Rate Maps (DFIRMs)






Comparison of Study Types

Approximate Studies

- Potentially cheaper
- Can be quicker to complete
- Remote data acquisition makes studies in remote areas easier to undertake
- Best suited for low population density areas
- If sufficient LiDAR data exists, BFAs may be very easy to implement
- Public must use online map viewer, which can be confusing

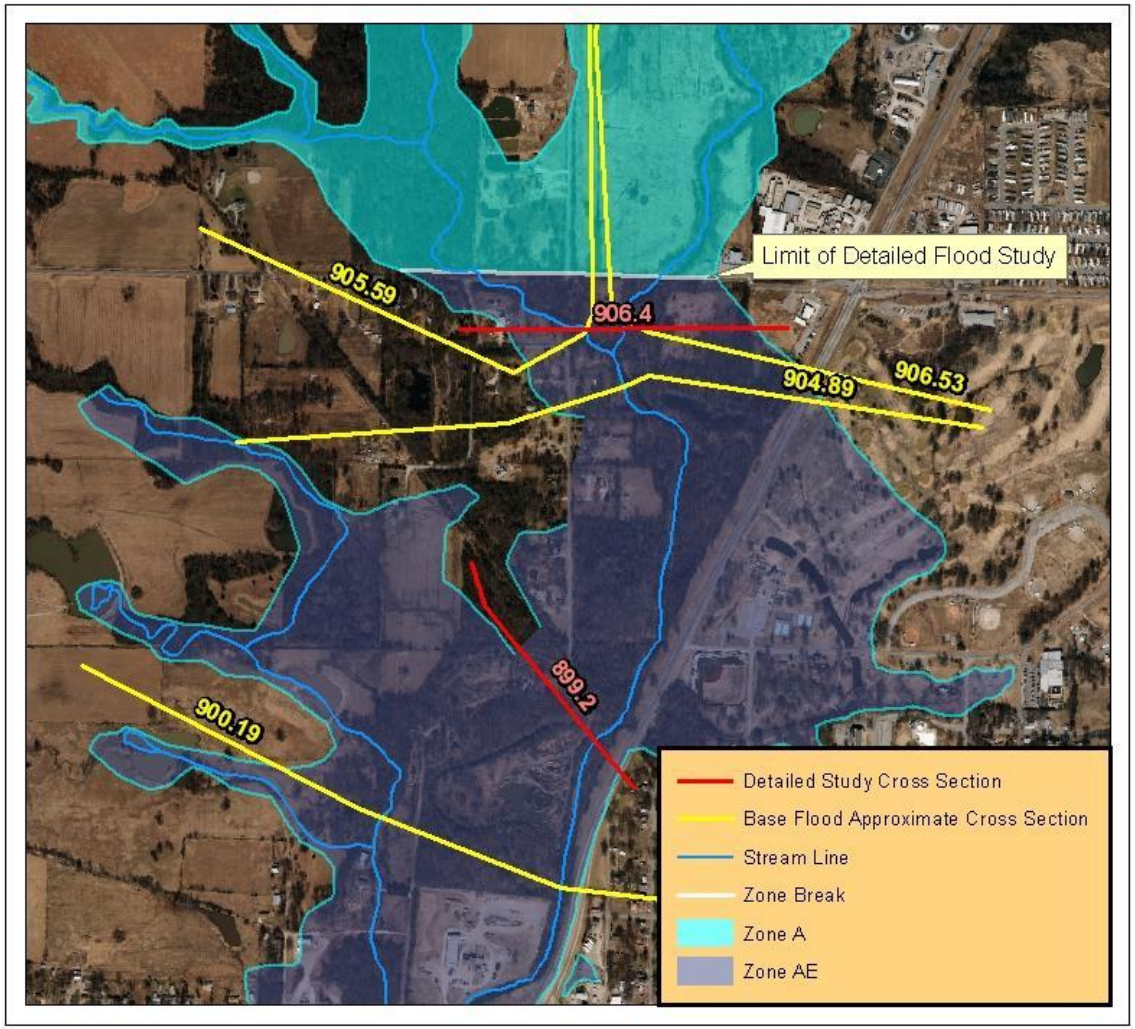
Detailed Studies

- More accurate BFEs
- Requires local survey work and cross sections of streams
- Suitable for densely populated areas
- BFEs published on paper FIRMs and easier for general public to access




BFA Cross Section Accuracy vs. Detailed Studies

- Some BFA studies have slightly overlapped Detailed Studies, allowing BFE comparison
- BFA values are usually close to Detailed Studies
- BFA studies are in sparsely populated areas, so potentially lower accuracy impacts fewer people

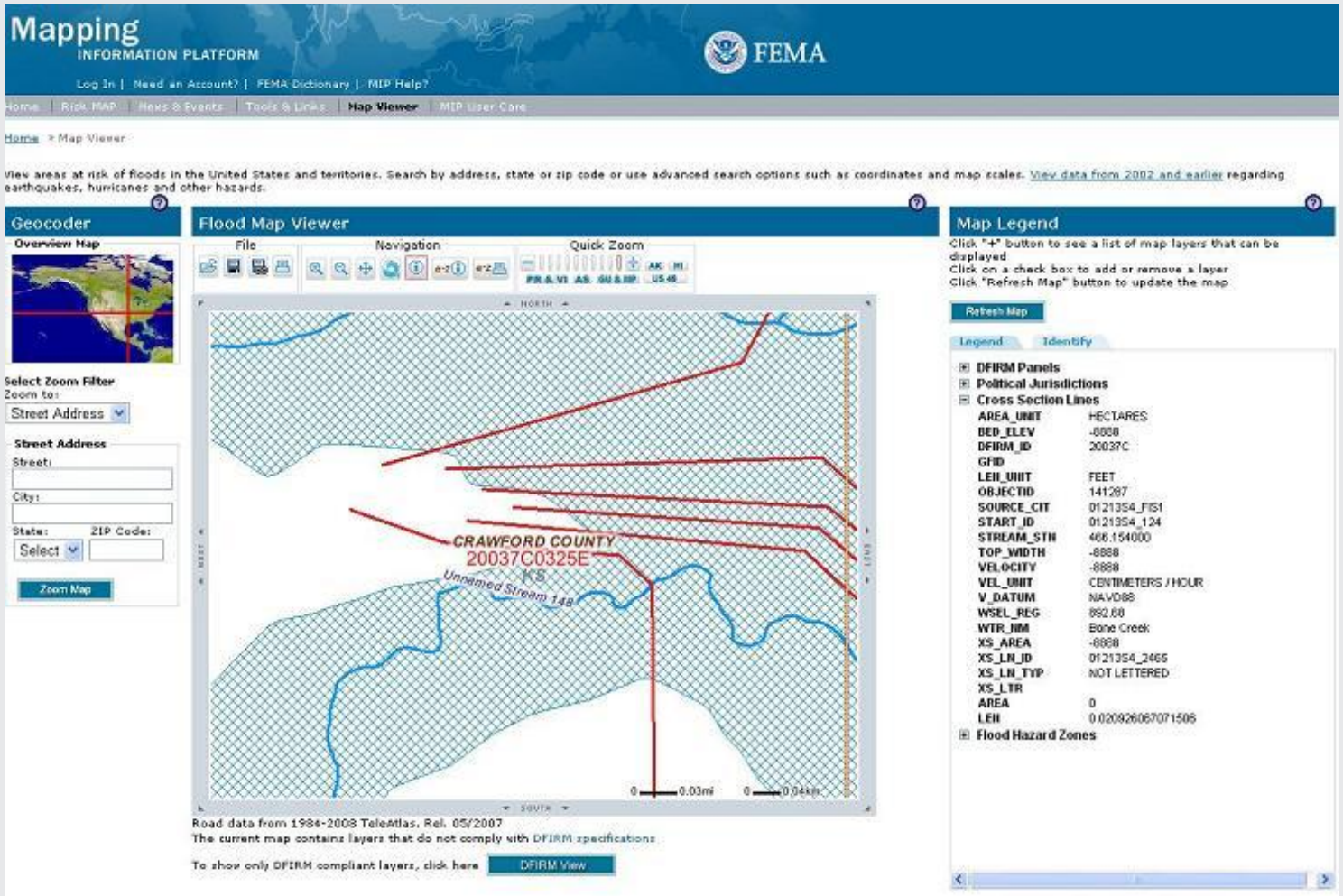





FEMA's Flood Map Viewer

hazards.fema.gov

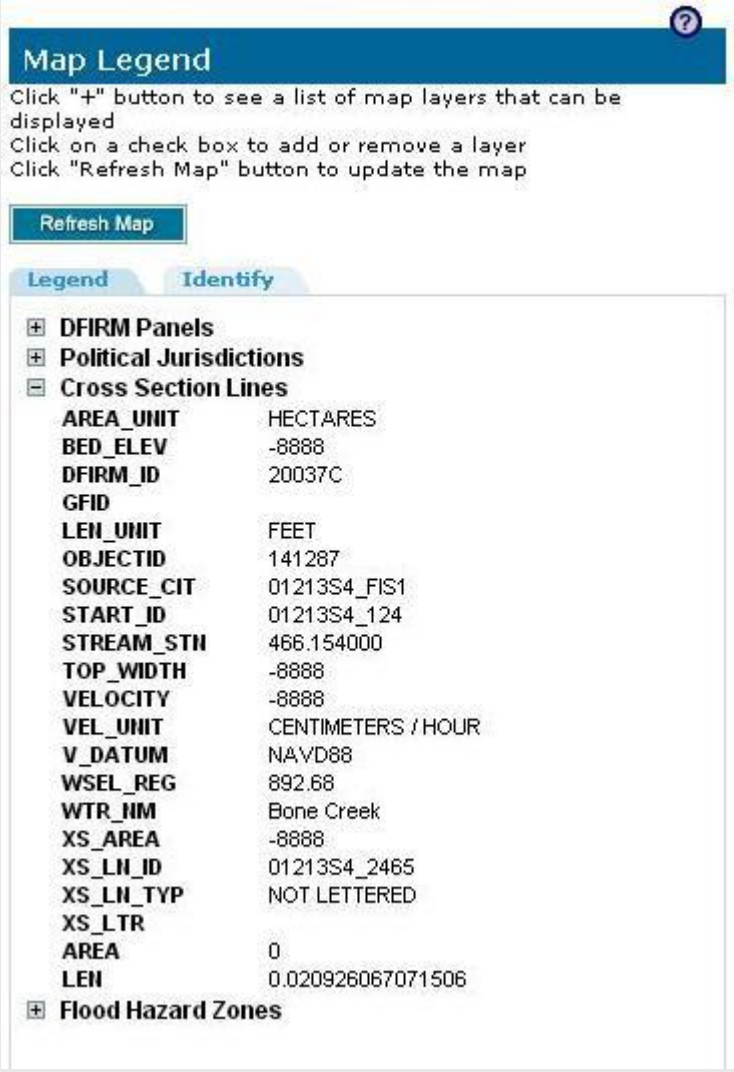
- Located under Map Viewer tab, no direct web address
- BFA Cross Section values are unlabeled
- Unintuitive interface
- Lengthy process to determine cross section value






Determining the BFA Cross Section Value using FEMA's Flood Map Viewer

- Select *Identify All Visible Layers* tool
- Click on cross section to identify
- Click the *Identify* tab
- Expand Cross Section Lines section
- Have experience working with FEMA's DFIRMs in order to even attempt to read the results



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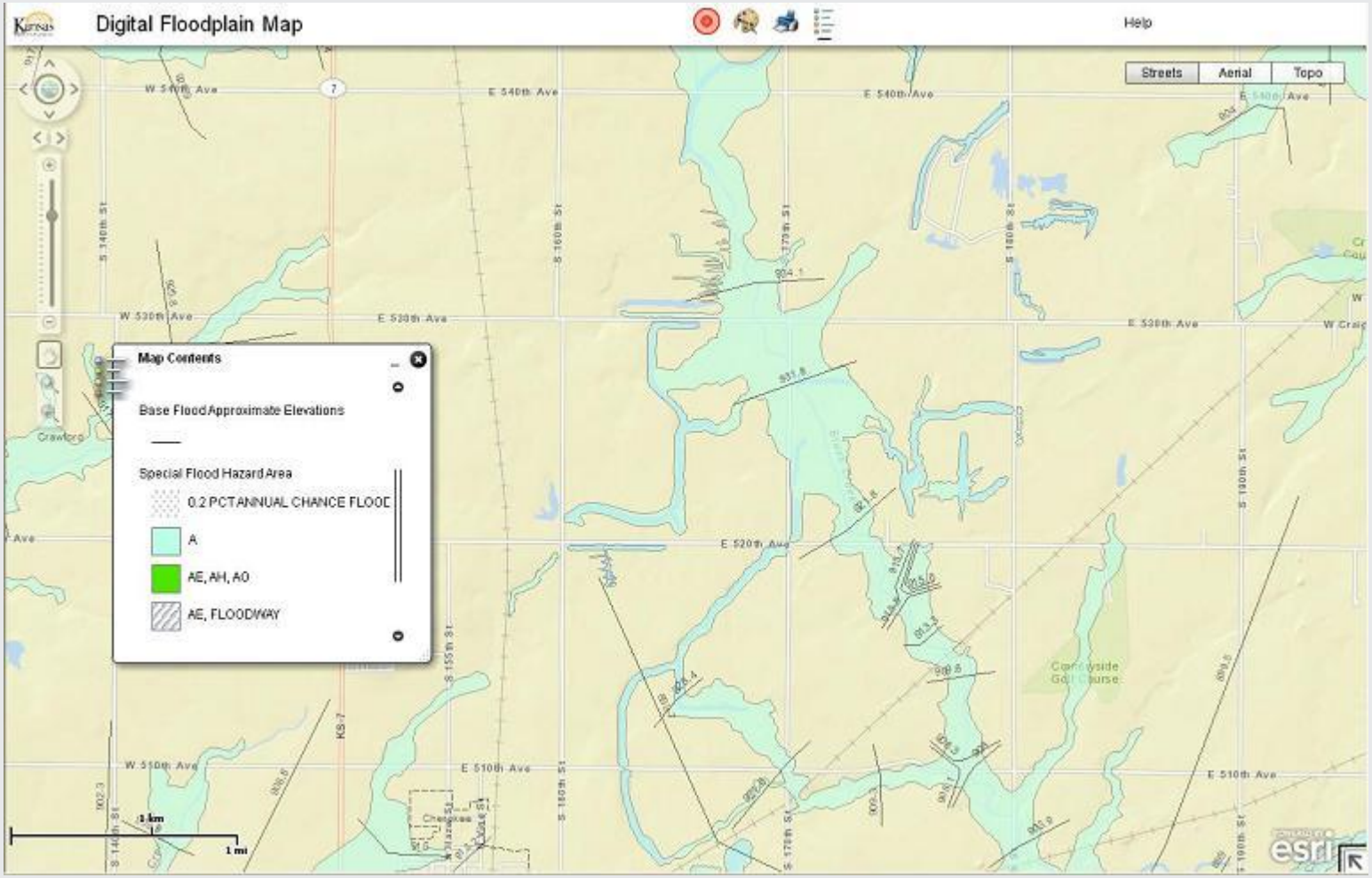
Kansas Department of Agriculture's Digital Floodplain Map Viewer

gis.kda.ks.gov/ksfloodplain

- Direct web address to viewer
- BFA Cross Section values are labeled
- More responsive and intuitive interface
- Not compatible with all browsers






How to build a BFA Template in ESRI's ArcMap

Required Shapefiles From FEMA DFIRM:

- s_fld_haz_ar.shp – Flood Hazard Area
- s_fld_haz_ln.shp – Flood Hazard Boundary Lines
- s_wtr_ln.shp – Stream Centerline (used in developing BFAs, do not use aerials in lieu of this shapefile)
- s_xs.shp – Detailed and Approximate Study Cross Sections

Additional Data Needed:

- Recent aerial photo to locate structures
- Parcel boundaries in order to determine BFEs for properties




How to build a BFA Template in ESRI's ArcMap

- Symbology:
  - s_fld_haz_ar.shp – by fld_zone value field
  - s_fld_haz_ln.shp – by ln_typ value field
- Label s_xs.shp by wsel_reg field to display BFA values

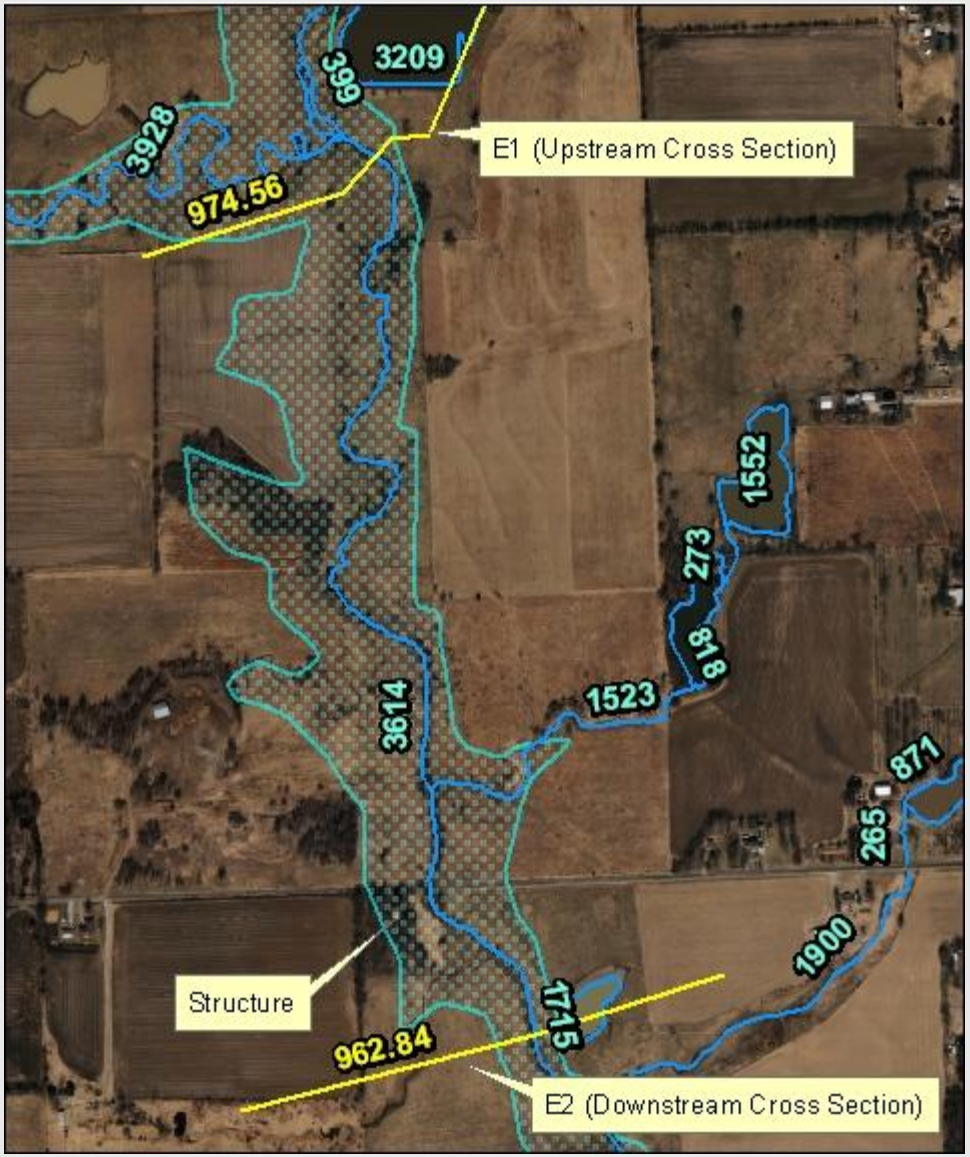



Calculating a Zone A BFE

- When structure or property is located between BFA cross sections, interpolation is used to determine the BFE
- Interpolation formula:
  - BFE = E2 + EL
  - EL = D1((E1-E2)/D2)
  - E1: Upstream BFE
  - E2: Downstream BFE
  - D1: Distance between downstream BFE and upstream edge of structure or property
  - D2: Distance between upstream and downstream BFE

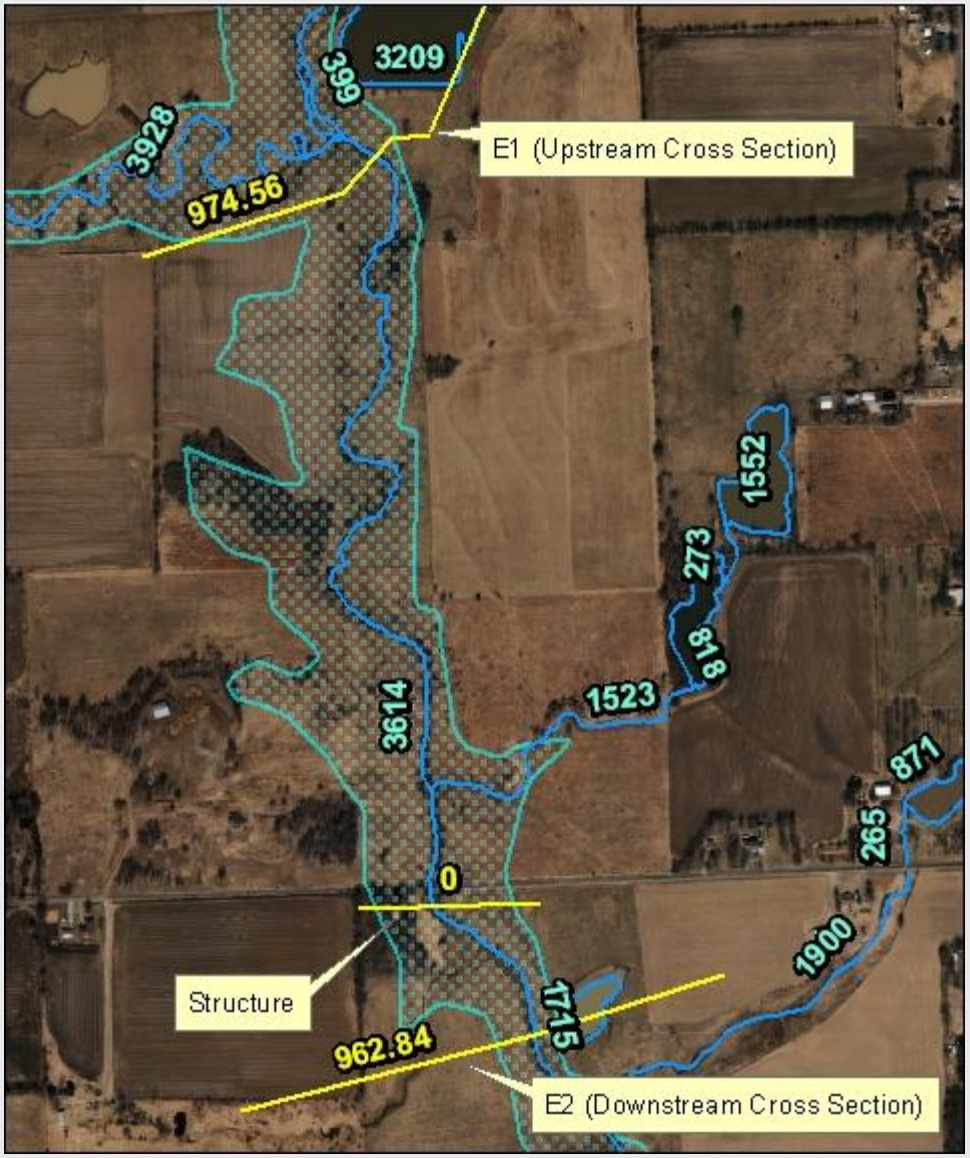
Calculating a Zone A BFE Step 1

- Identify structure or property and appropriate upstream and downstream cross sections
- All units are in feet
- E1 = 974.56
- E2 = 962.84



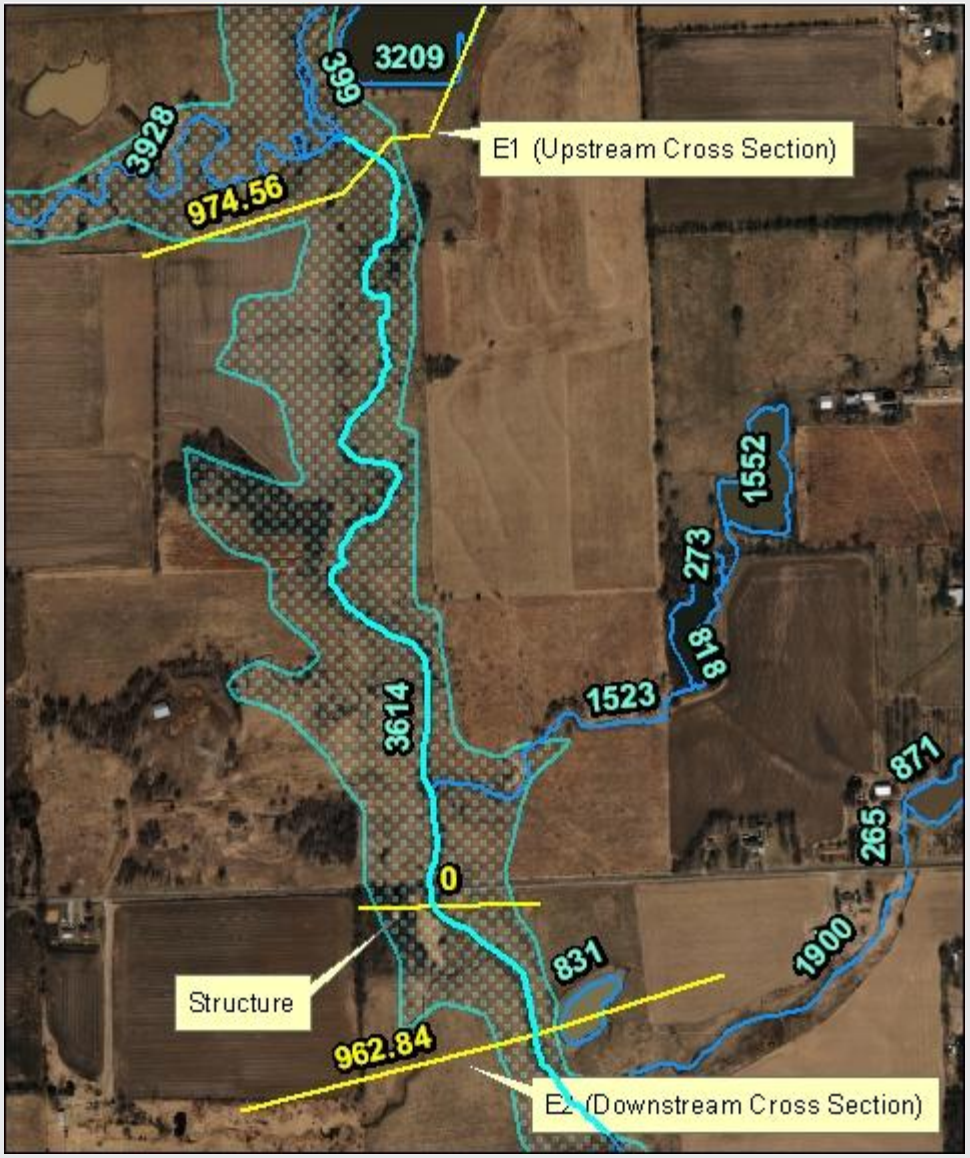
Calculating a Zone A BFE Step 2

- Create cross section at upstream edge of structure or property using the Sketch Tool in the Editor Toolbar



Calculating a Zone A BFE Step 3

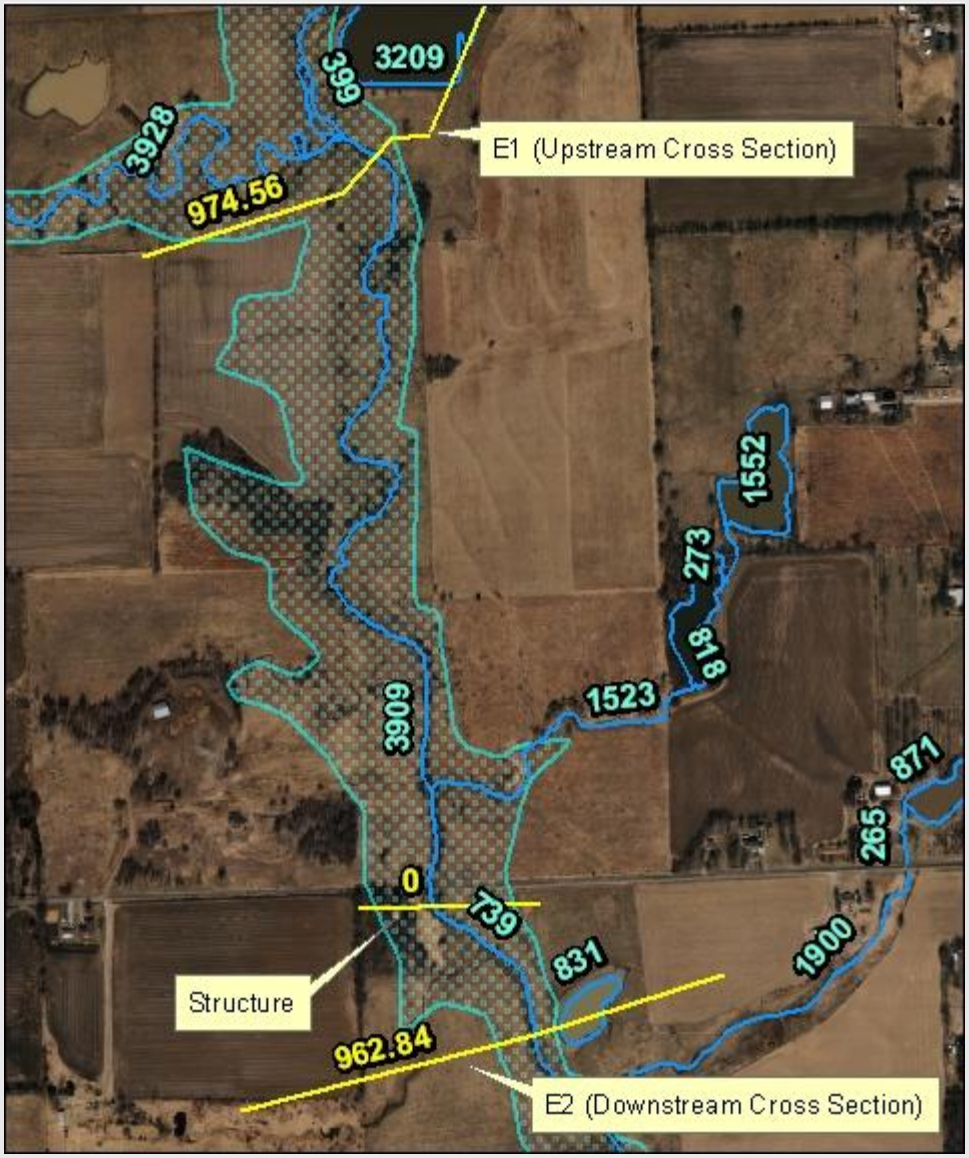
- Select stream line(s) between upstream and downstream cross sections, merging into 1 line if necessary





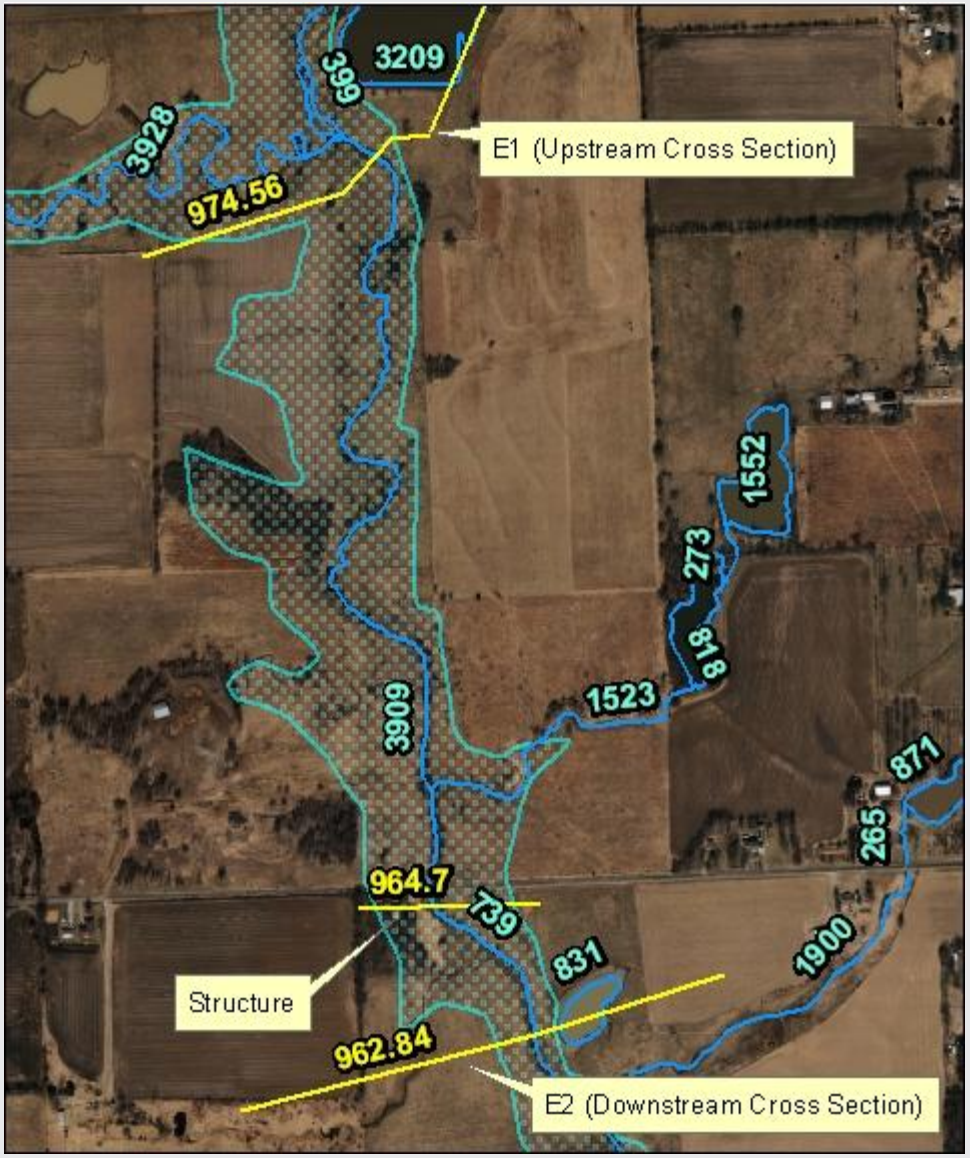

Calculating a Zone A BFE Steps 4 and 5

- Turn snapping on for s_xs.shp and s_wtr_ln.shp. Use the split tool to split the stream line at the 3 intersections with the upstream, downstream, and your structure/property's cross section
- Calculate the stream line length in feet in the attribute table
- D1 = 739
- D2 = 3909 + 739 = 4648



Calculating a Zone A BFE Step 6

- Interpolate using the formula and enter the new cross section's value into the attribute table
- E1 = 974.56
- E2 = 962.84
- D1 = 739
- D2 = 3909 + 739 = 4648
- EL = 739*((974.56-962.84)/4648 = 1.86
- BFE = 962.84 + 1.86 = 964.7 feet





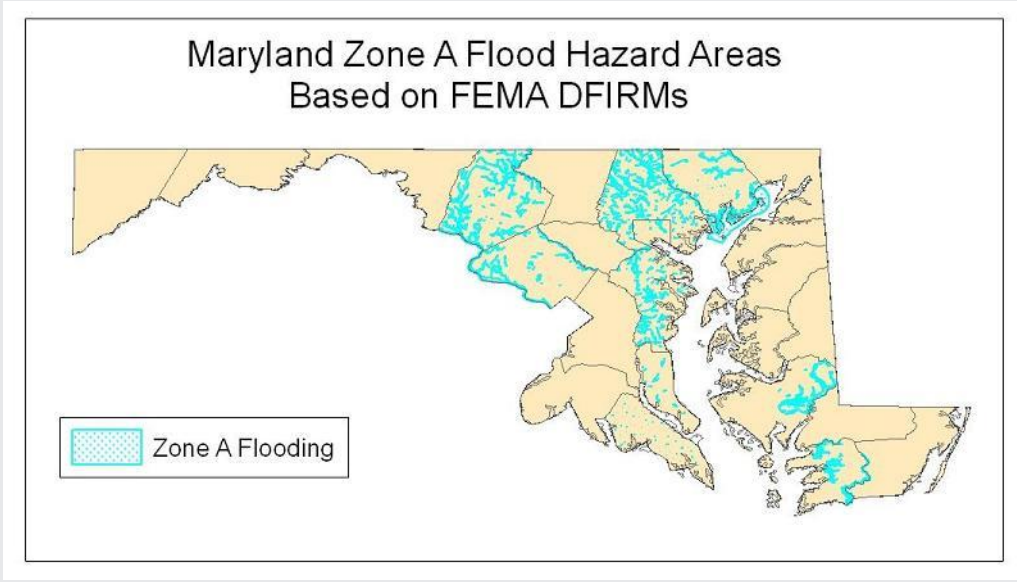

Limits of BFA Cross Section Interpolation

- Structure or property is up or downstream of the last BFA Cross Section in the study, no second cross section to interpolate between
- Extreme distances between BFA Cross Sections limit usefulness
- If a stream line does not exist between BFA Cross Sections, user must estimate distances using aerial, stream may not be obvious
- If a dam or culvert between cross sections greatly alters the BFE
- Lower accuracy when slope between cross sections changes drastically




Would Base Flood Approximate Cross Sections Benefit Maryland?

- Maryland has a number of Zone A Flood Hazards
- Some areas of Maryland are experiencing significant development
- BFAs are not very beneficial if extensive development will occur in an area and a detailed study will be required in the near future



- BFAs would be beneficial in areas where development is not likely, especially if acceptable LiDAR data already exists and a BFA study could be easily implemented
- A simple online DFIRM viewer should be created with BFA studies in order to maximize their utilization




Questions?

Sources

- FEMA Mapping Information Platform https://hazards.fema.gov/
- FEMA Map Service Center http://msc.fema.gov/
- Kansas Department of Agriculture http://gis.kda.ks.gov/
- Crawford County, Kansas GIS Department http://www.crawfordcountykansas.org/cco.nsf/web/GIS
- Geo.Data.gov