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FLOODPLAIN & FLOODWAY DESIGN

Presented By

Jeff Shaver, PE, CFM, CPESC

March 12, 2019

FIELDS AND STREAMS (2004)

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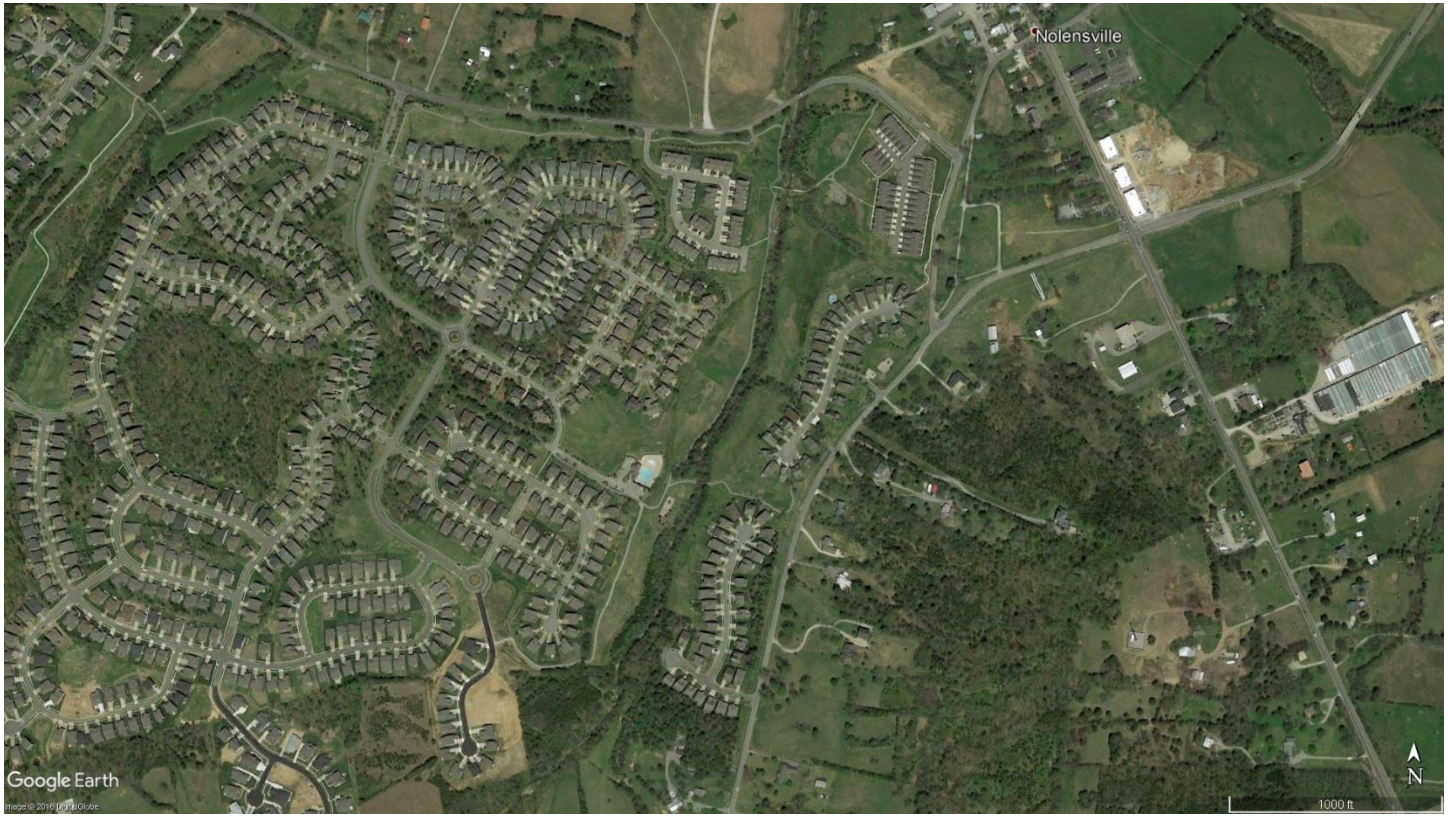
DEVELOPMENTS AND STREAMS (2018)



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STREAMS AND DEVELOPMENTS

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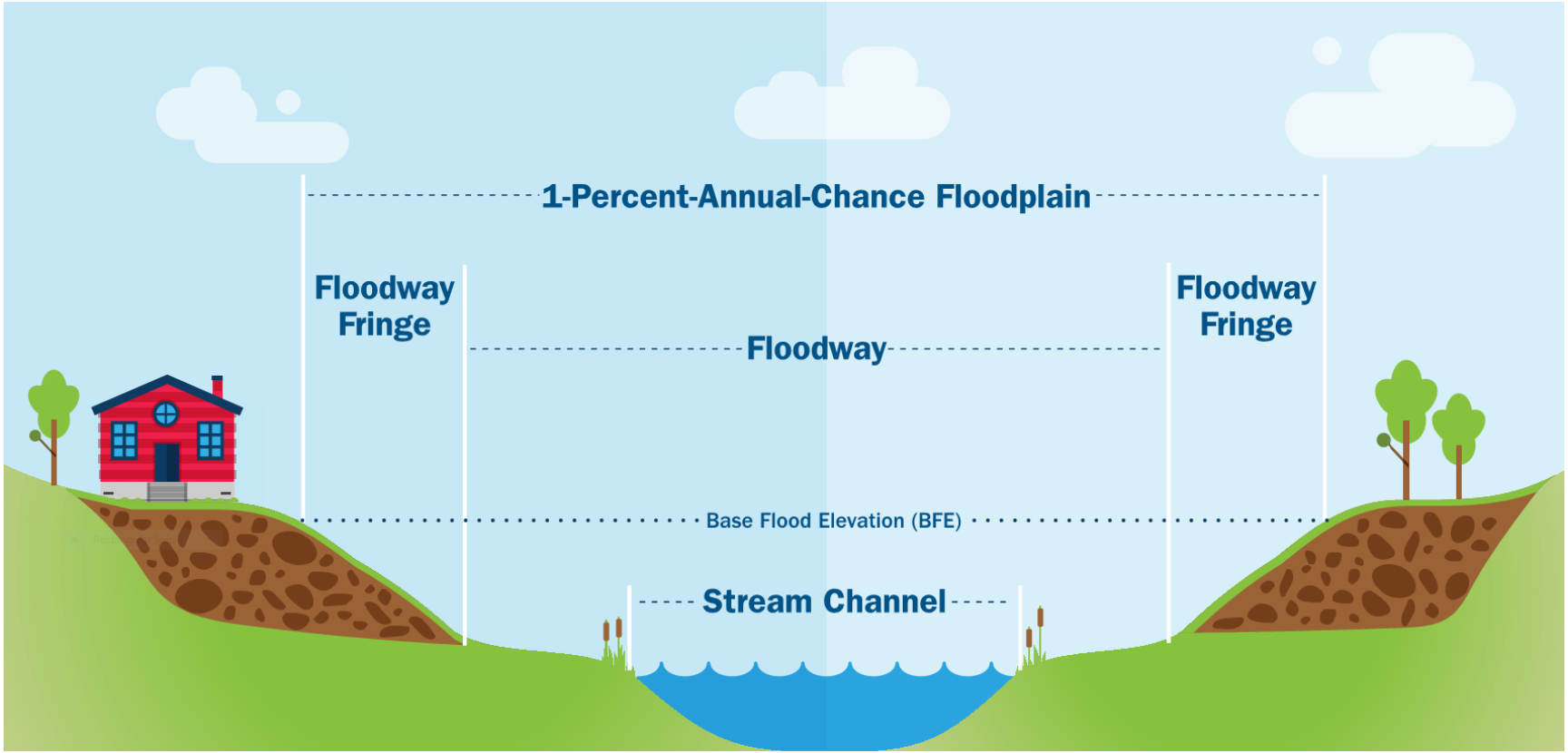
FLOODPLAIN AND FLOODWAY DESIGN



Source: “Regulating Within A Floodway”, North Dakota State Water Commission.

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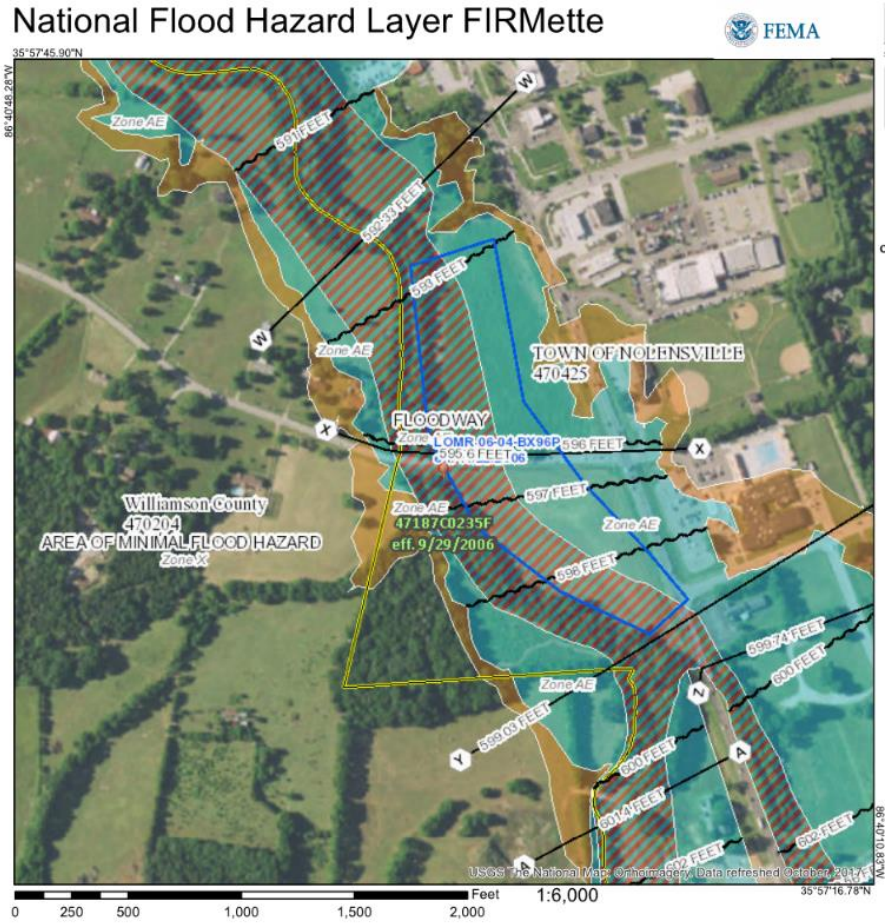
NATIONAL FLOOD INSURANCE PROGRAM

- **Reduce the impact of flooding on private and public structures**
  - Provides affordable insurance to property owners, renters and businesses
  - Encouraging communities to adopt and enforce floodplain management regulations
- **Efforts help mitigate the effects of flooding on new and improved structures**
- **Reduces the socio-economic impact of disasters by promoting the purchase and retention of general risk insurance, but also of flood insurance, specifically.**

Source: https://www.fema.gov/national-flood-insurance-program

STREAMS IN ZONE AE WITH FLOODWAYS



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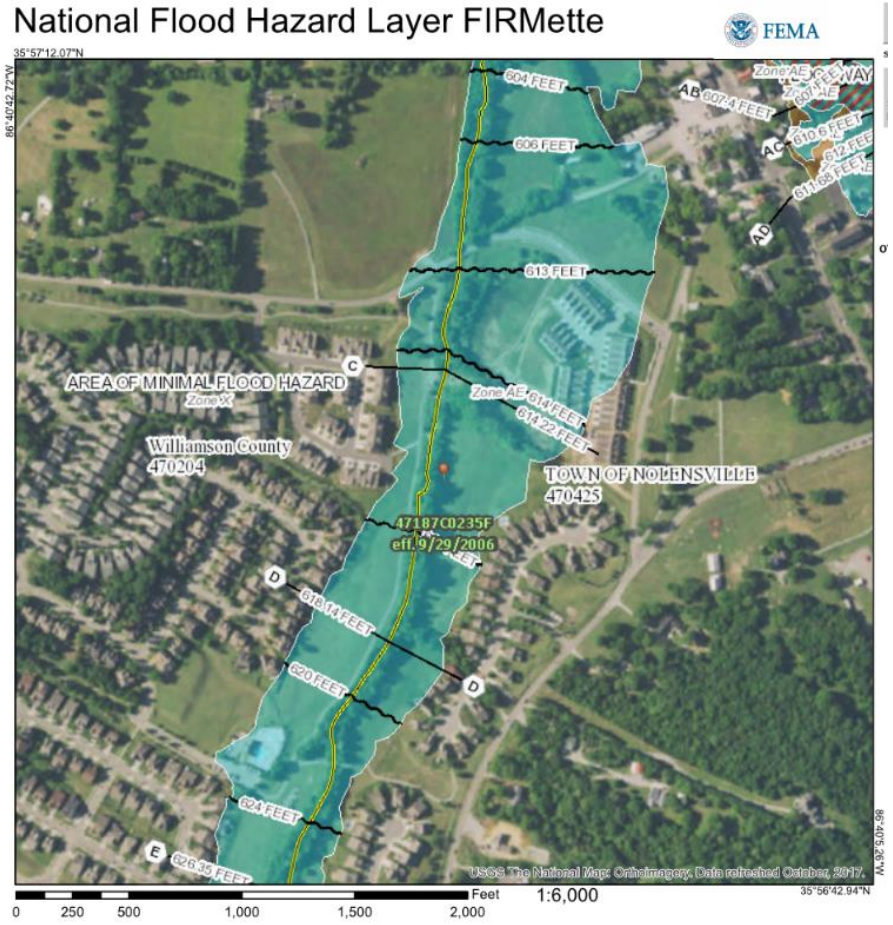
STREAMS IN ZONE AE WITHOUT FLOODWAYS



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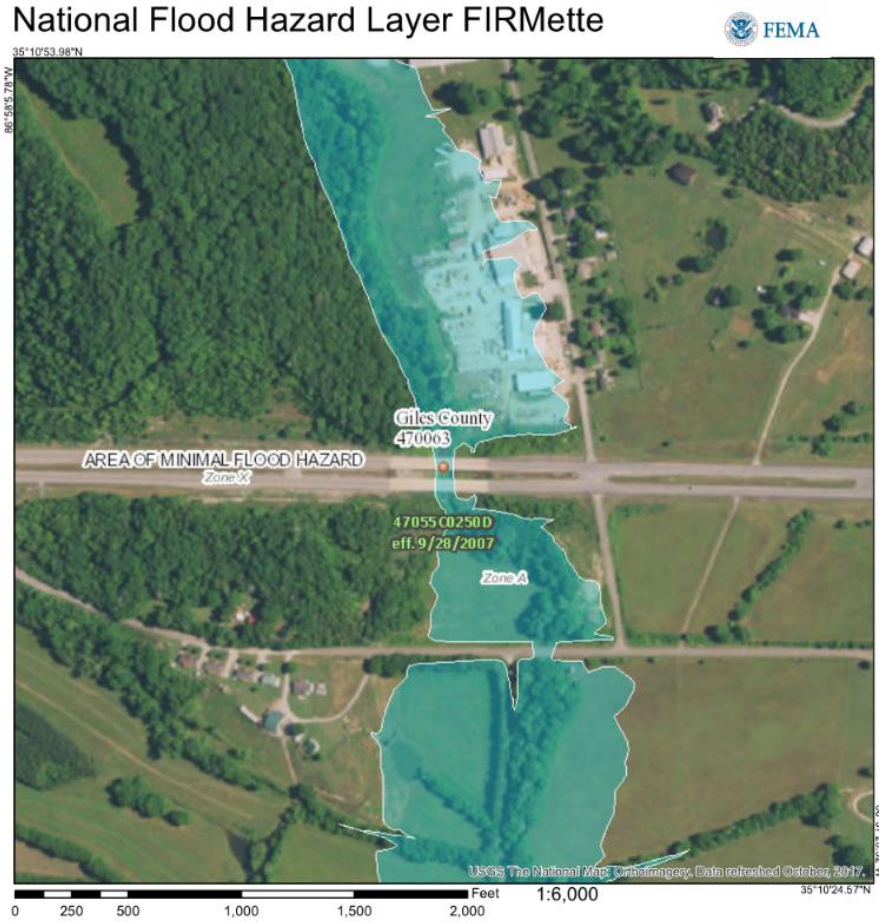
STREAMS IN ZONE A STREAMS



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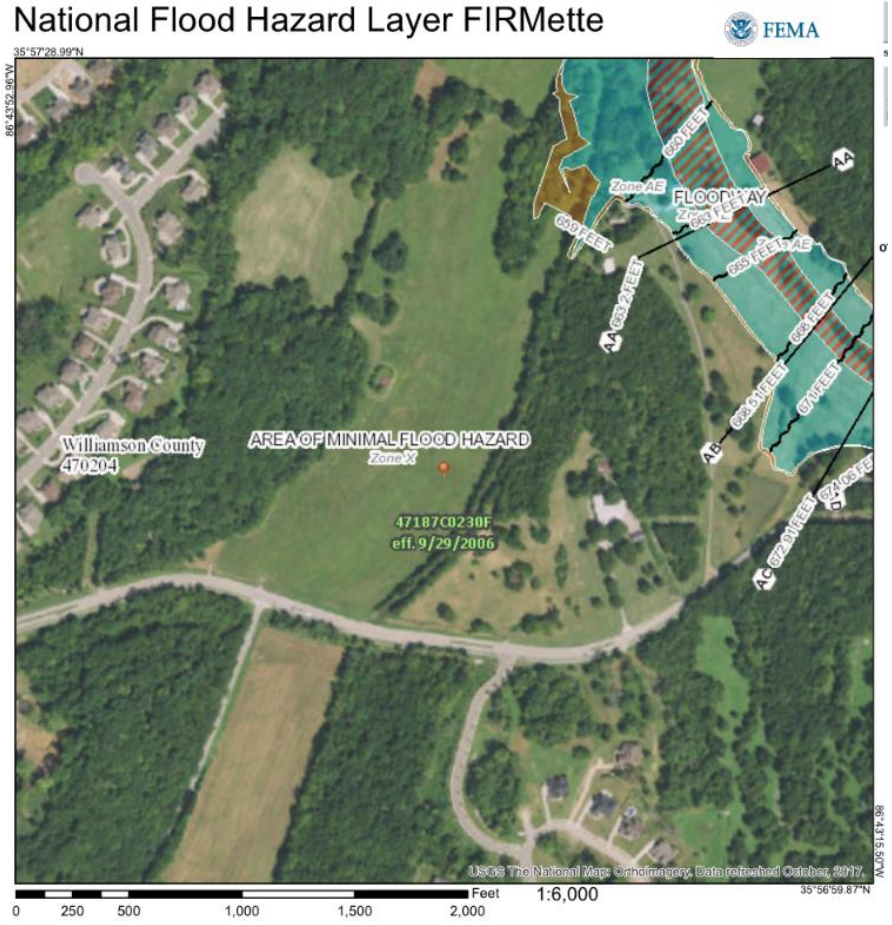
UNMAPPED STREAMS



WHERE DO I START


Easy!

Floodplain Regulations

Floodplain Administrator

NATIONAL FLOOD INSURANCE PROGRAM

State NFIP Coordinator

FEMA

WHERE DO I START

REPORTING/DOCUMENTATION

People need to understand what's going on with the project area and how the study was developed without being there.

"I think you should be more explicit in your explanation of this step."

(Adapted from a cartoon by Sidney Harris, Science 80, Nov/Dec 1979)

REPORTING/DOCUMENTATION

Document data and analysis to enable the results to be readily checked, reproduced, and updated.

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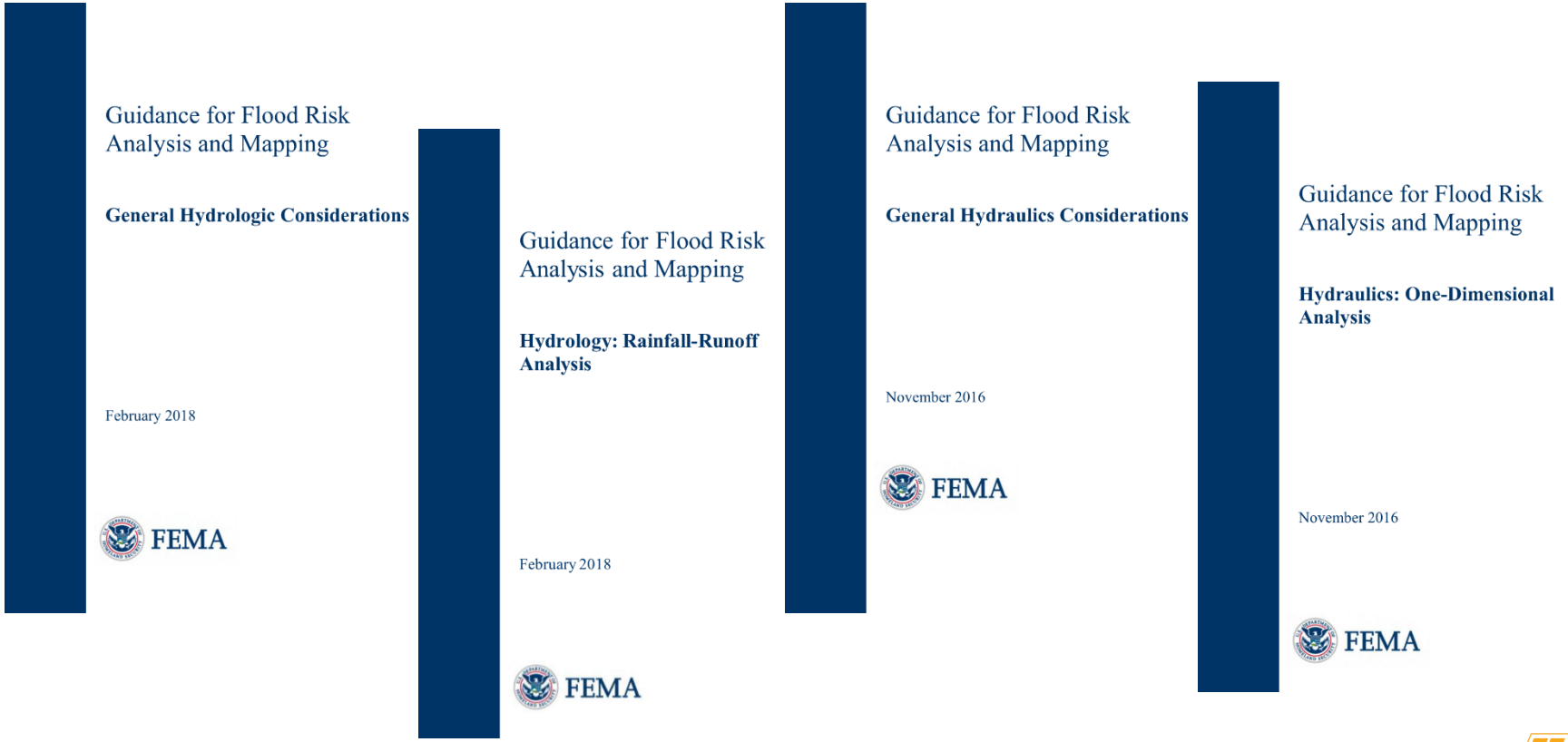
FLOODPLAIN AND FLOODWAY DESIGN

Riverine analyses consist of HYDROLOGIC ANALYSES to determine discharge-frequency relations along the flooding source and HYDRAULIC ANALYSES to determine the extent of floodwaters (floodplain) and the elevations associated with the water-surface of each frequency studied.

Source: FEMA Guidance Document 91 - Hydrology: Rainfall-Runoff Analysis

AVAILABLE GUIDANCE



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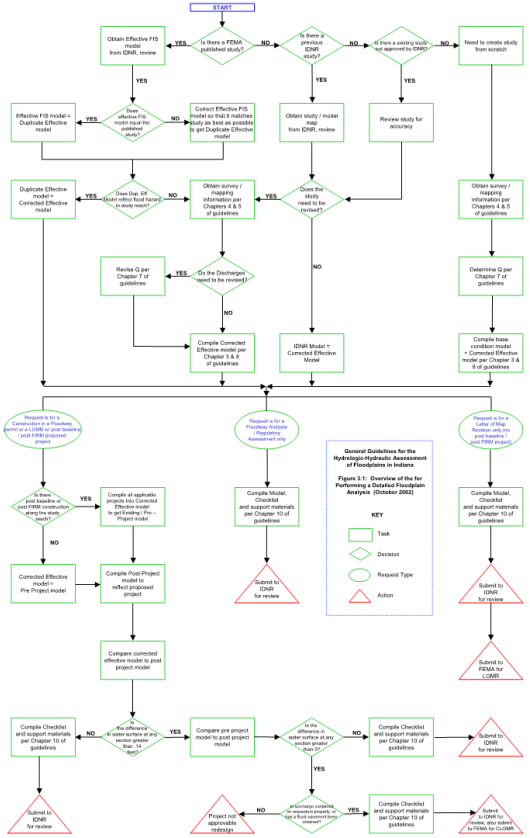
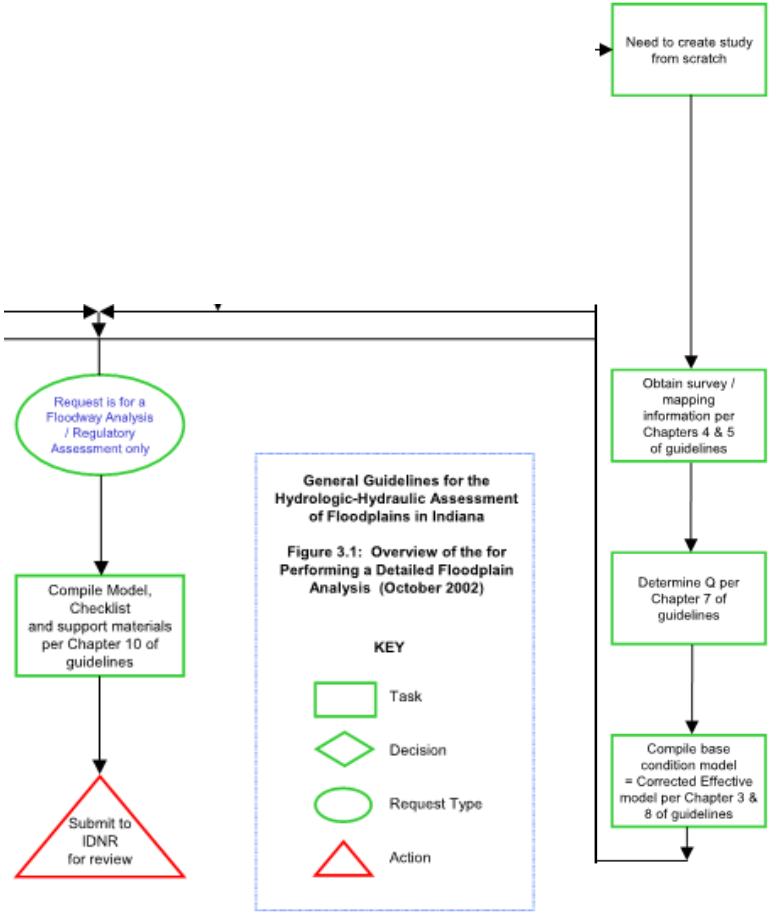
THE PROCESS





Source: The General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana

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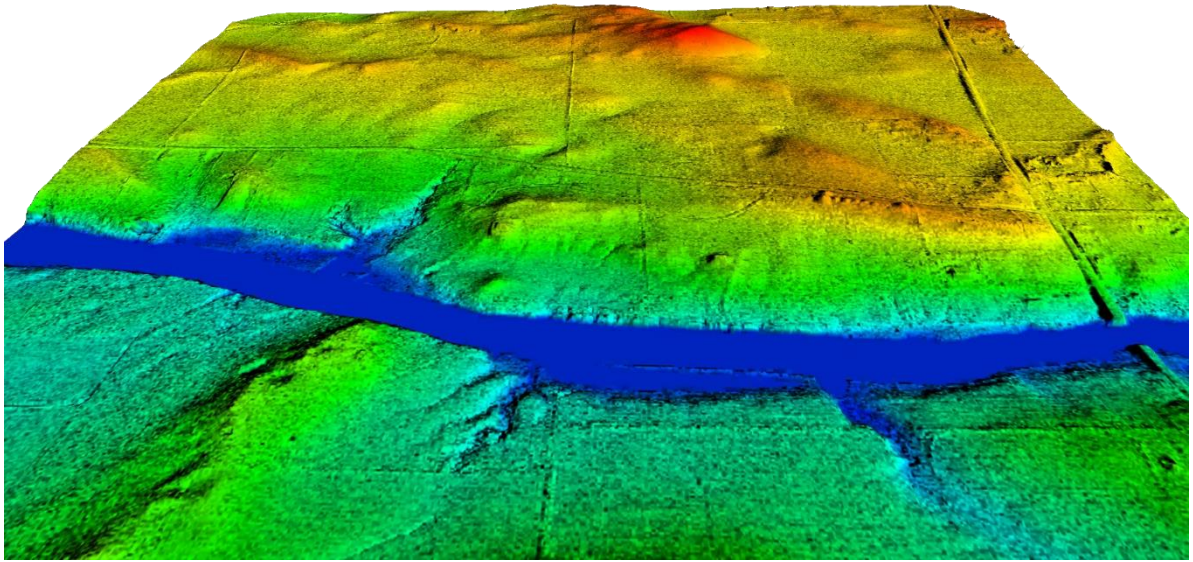
THE PROCESS

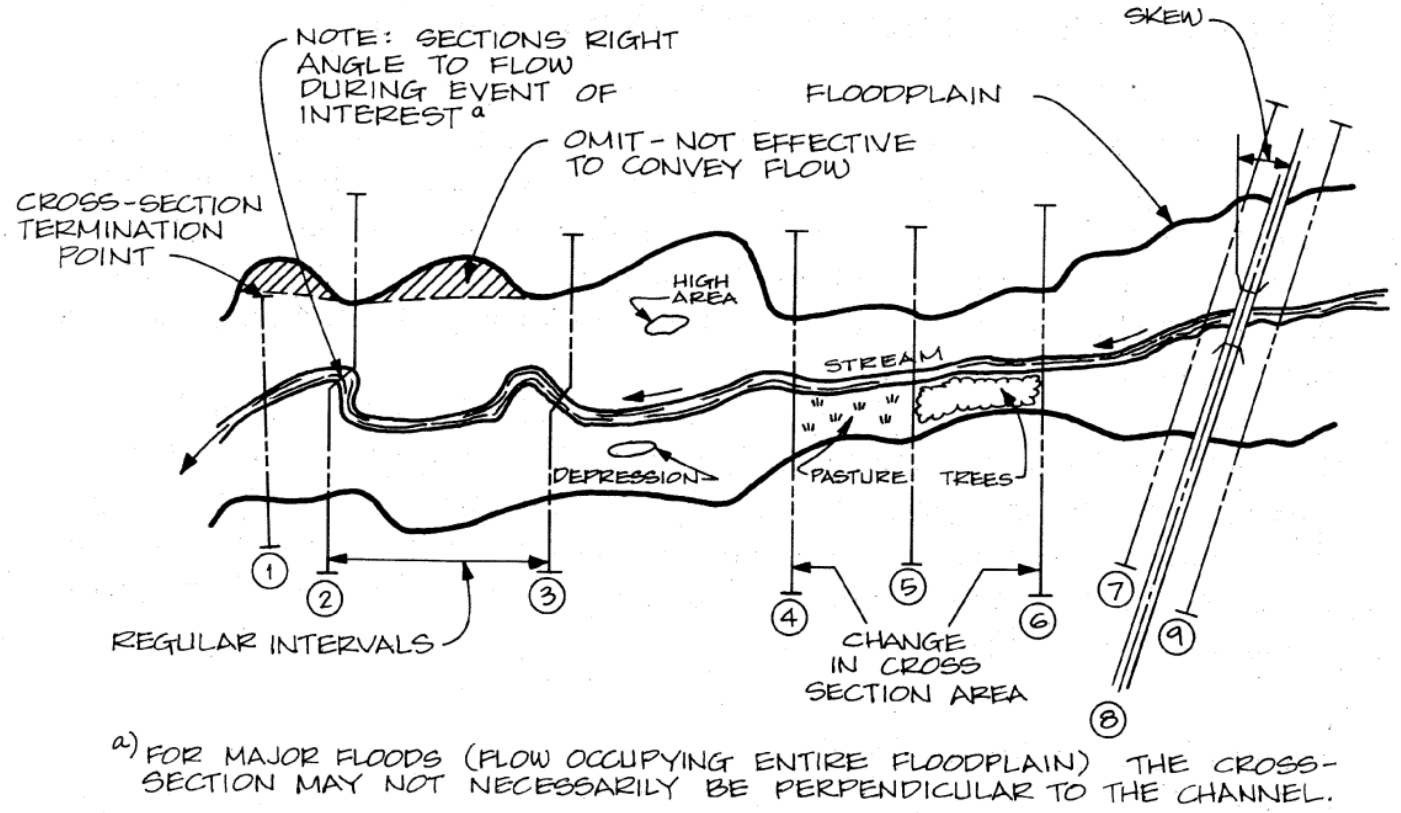
- Data Collection
- Hydrologic Analysis
- Hydraulic Analysis
- Reporting
- Mapping
- Submittal

DATA COLLECTION

- Field Survey
- LiDAR
- Coordinate System
- Datum



DATA COLLECTION



Source: The General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana

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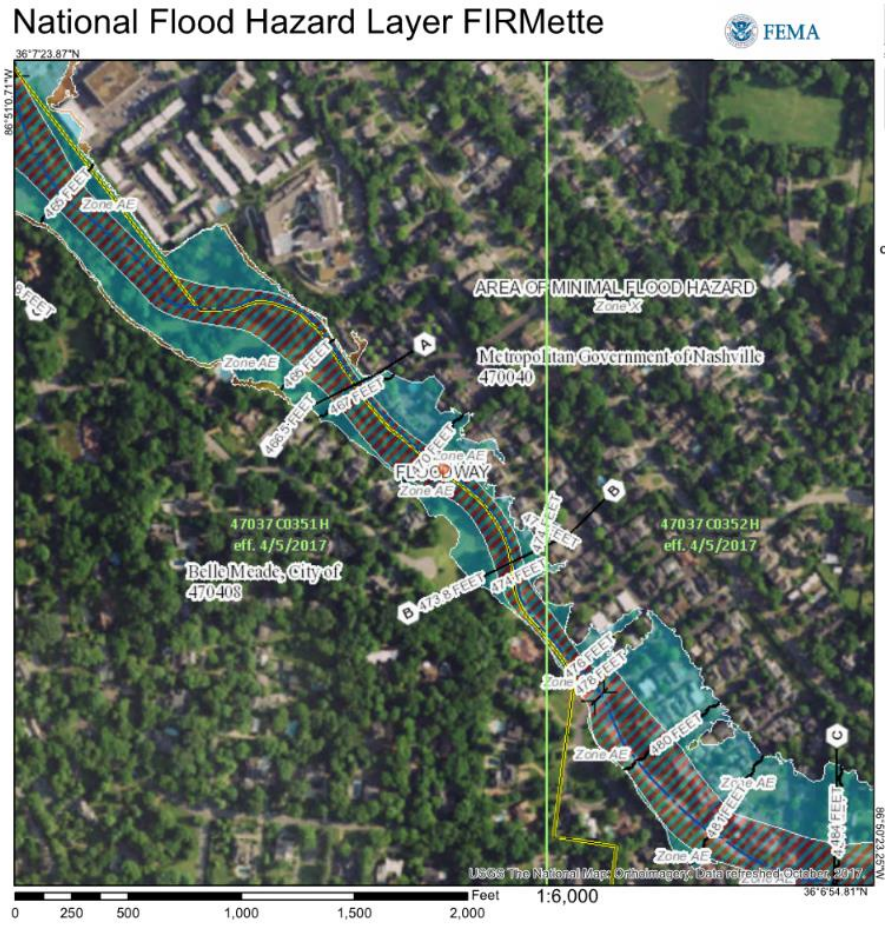

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DATA COLLECTION

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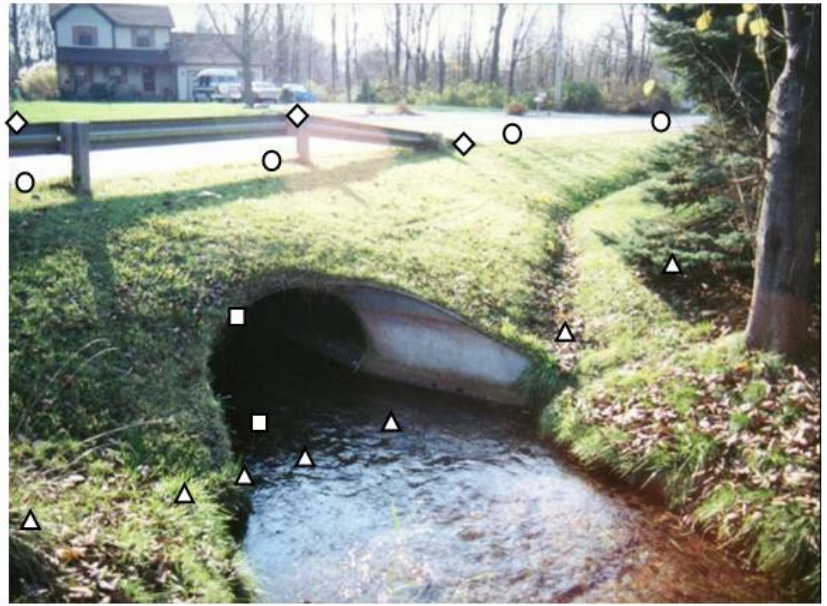
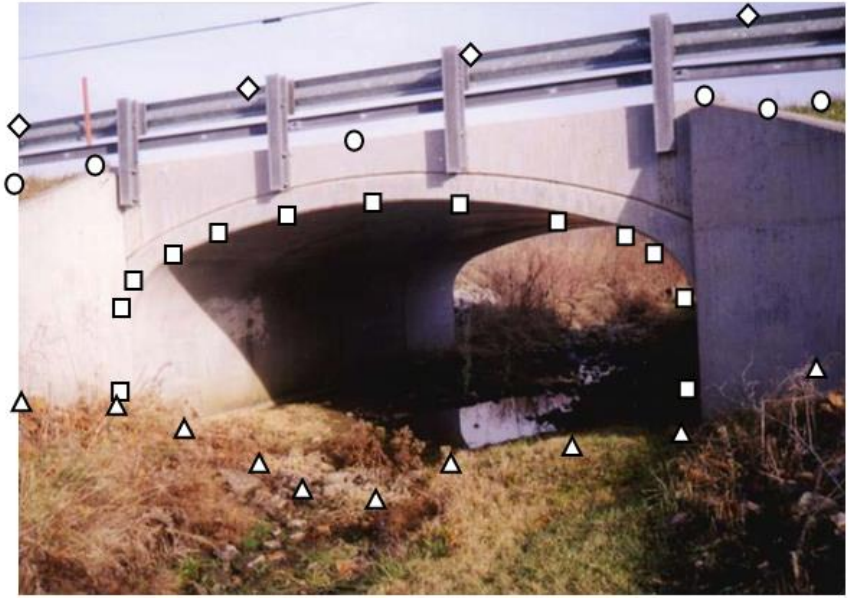
DATA COLLECTION

Symbol	Description
△	Valley cross-section data point
□	Bridge opening low chord profile data point
○	Road profile data point
◇	Guardrail profile data point
⯃	Pier station/elevation/width data point

Source: The General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana

DATA COLLECTION





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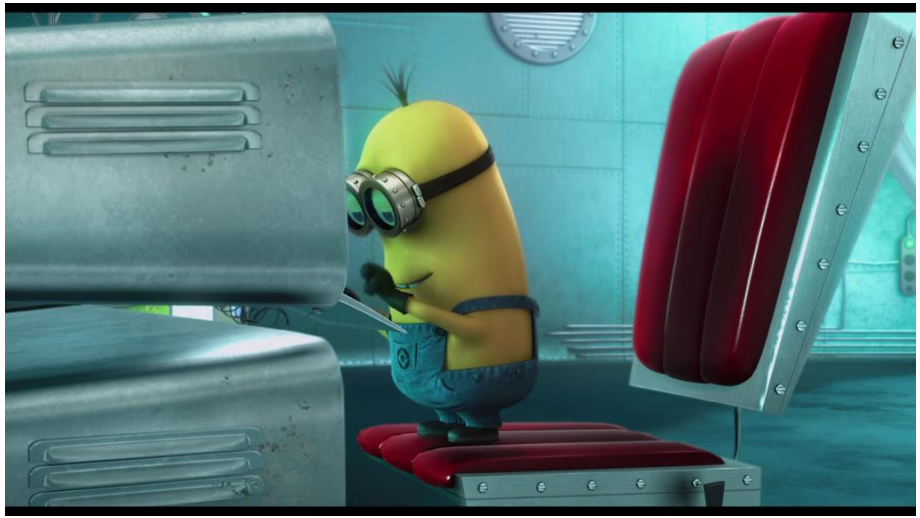
Source: The General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana

DATA COLLECTION

DATA COLLECTION

HYDROLOGIC ANALYSIS

- **Estimates Flood Discharge-Frequency Relationships**
  - 1%-Annual-Chance
  - 0.2% Annual-Chance
- **Identify Study Area**
  - Start at the most downstream sub-basin
- **Select Method**
  - Statistical analysis of stream gage data
  - Statewide regression equations
  - Hydrologic models developed for the watershed



Source: FEMA Guidance Document 71 – General Hydrologic Considerations

HYDROLOGIC ANALYSIS

▶ Statistical Analysis of Stream Gage Data

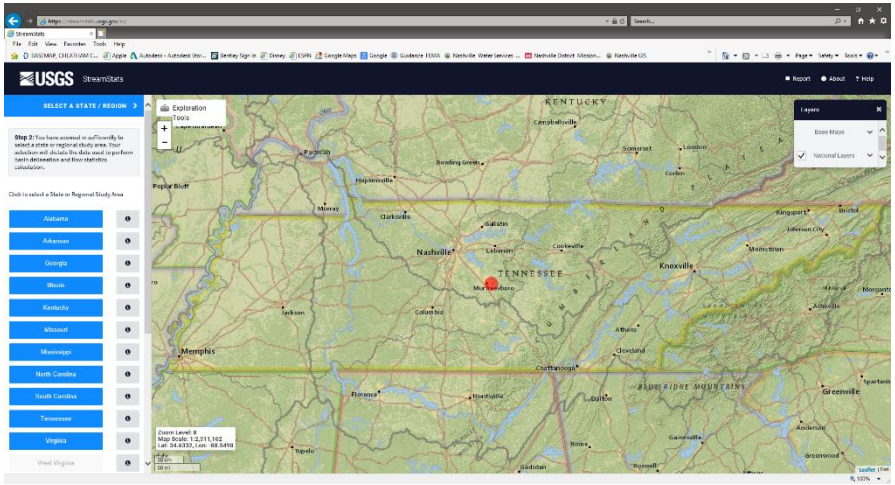
- Length of record is 10 years or longer
- Reflecting existing conditions
- Data applicable to developing peak flow discharges along study reach
- USGS has over 26,000 gaging station sites across United States

Source: FEMA Guidance Document 71 – General Hydrologic Considerations

HYDROLOGIC ANALYSIS

► Statewide Regression Equations

- Ungaged Streams
- Gaged streams where a stream gage analysis is inappropriate
- Flood hydrograph is not required
- Regression equations are applicable to the streams
- USGS has published regression equations across United States

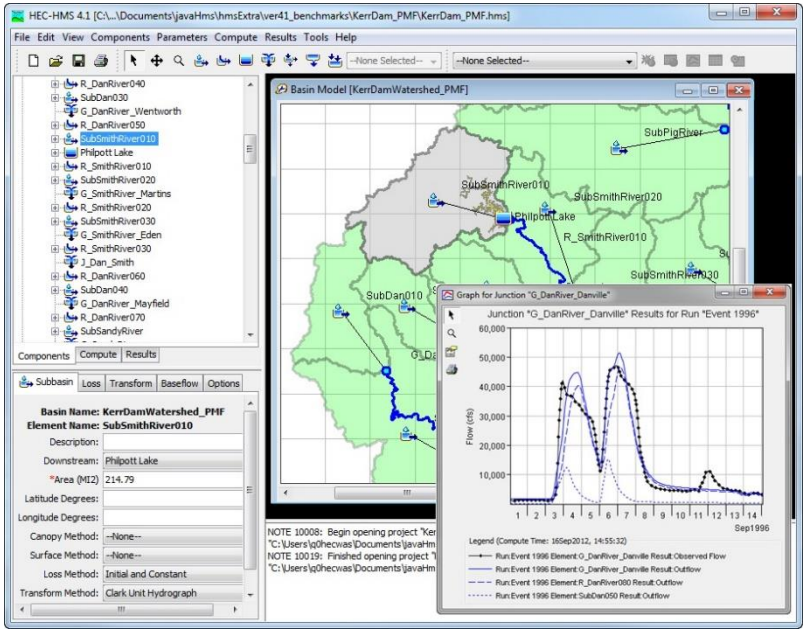


Source: FEMA Guidance Document 71 – General Hydrologic Considerations

HYDROLOGIC ANALYSIS

► Hydrologic Model developed for the watershed

- Must be based on hydraulic models identified in FEMA's acceptable models list
- Data Requirements
  - Sub-basin area and slope, land cover, soil types, channels, reservoir storage, diversions
- Assumptions
- Model Calibration
  - Runoff, Sub-basin response, Routing parameters



Source: FEMA Guidance Document 71 – General Hydrologic Considerations

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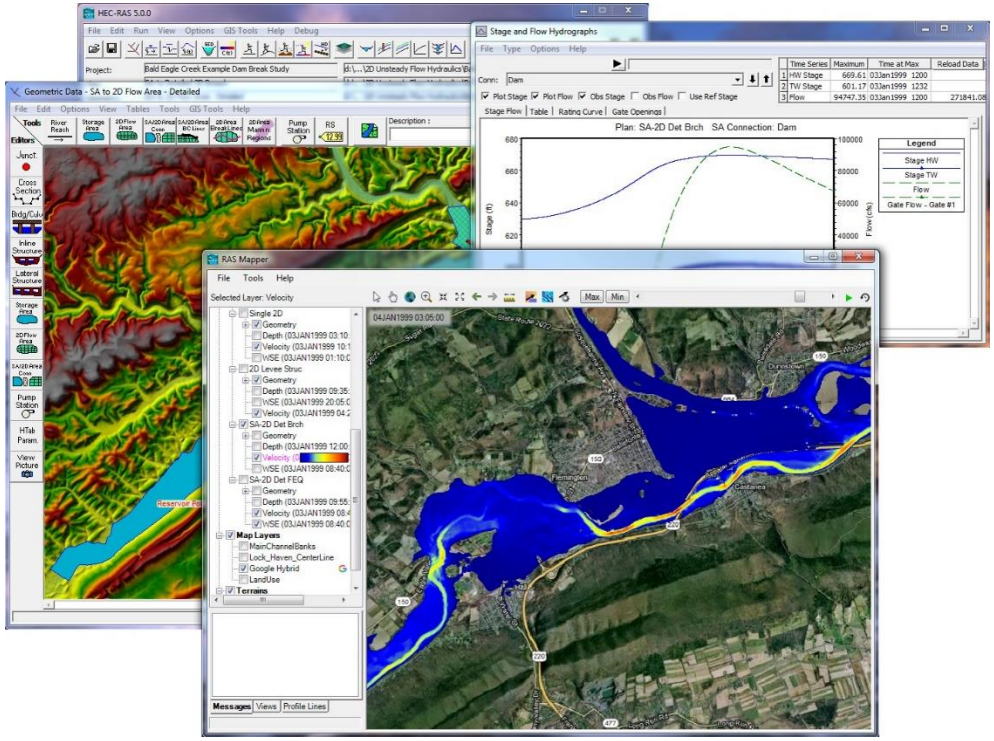
HYDRAULIC ANALYSIS

- Must be based on hydraulic models identified in FEMA's acceptable models list
- One-dimensional steady flow
- One-dimensional unsteady flow
- Two-dimensional steady/unsteady flow
- Floodway analysis



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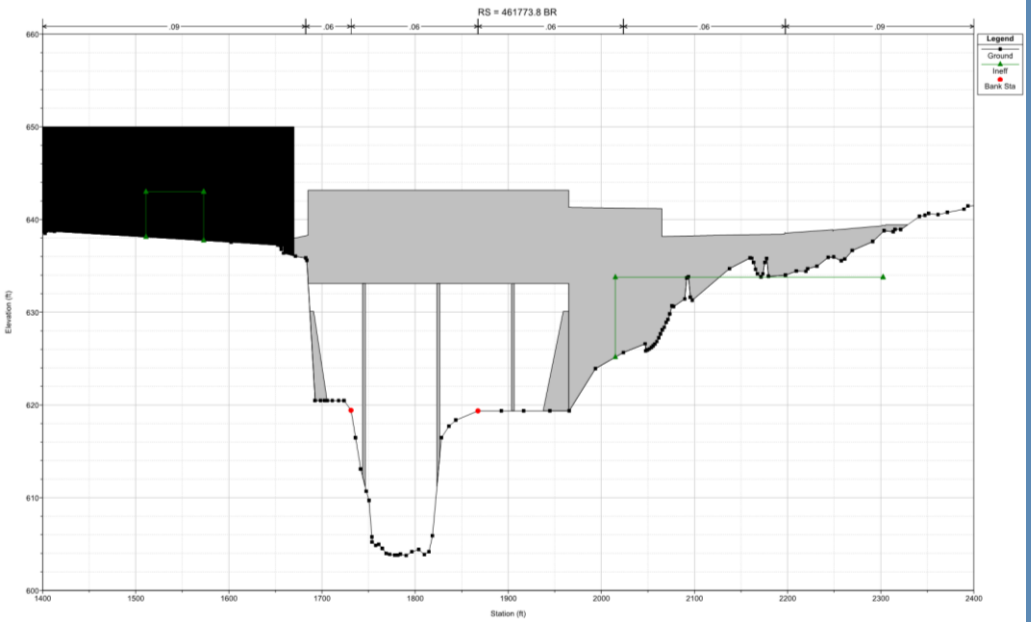
HYDRAULIC ANALYSIS

- **Cross-section data**
- **Hydraulic structures**
  - Bridges and culverts
  - Lateral structures
- **Loss parameters**
  - Manning's n
  - Expansion and contraction
- **Starting water-surface elevations**



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ANALYSIS RESULTS

No-Rise Condition

- Proposed project meets the requirements of 44 CFR Section 60.3(d)(3) and there is No increase in the base flood elevations or floodway elevations, or impacts to the floodway widths.

CONDITIONAL LETTERS OF MAP REVISION (CLOMR) & LETTERS OF MAP REVISION (LOMR)

- Proposed project results in BFE increases as a result of encroachment within a regulatory floodway
- No structures are affected by the increased BFE

SUBMITTALS

- **No-Rise**
  - TN NFIP Guidance Document: No-Rise Submittals
- **CONDITIONAL LETTERS OF MAP REVISION (CLOMR)**
  - FEMA MT-2 Form
- **LETTERS OF MAP REVISION (LOMR)**
  - FEMA MT-2 Form

REPORTING/DOCUMENTATION

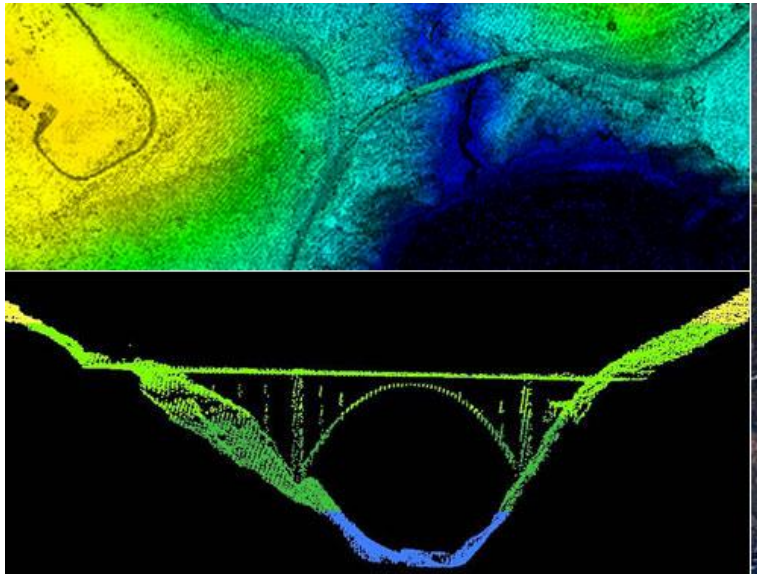
Project Description

- Purpose
- History of project area
- Previous Studies
- Impacts and Benefits
- Photographs

REPORTING/DOCUMENTATION

▶ LiDAR and Field Survey

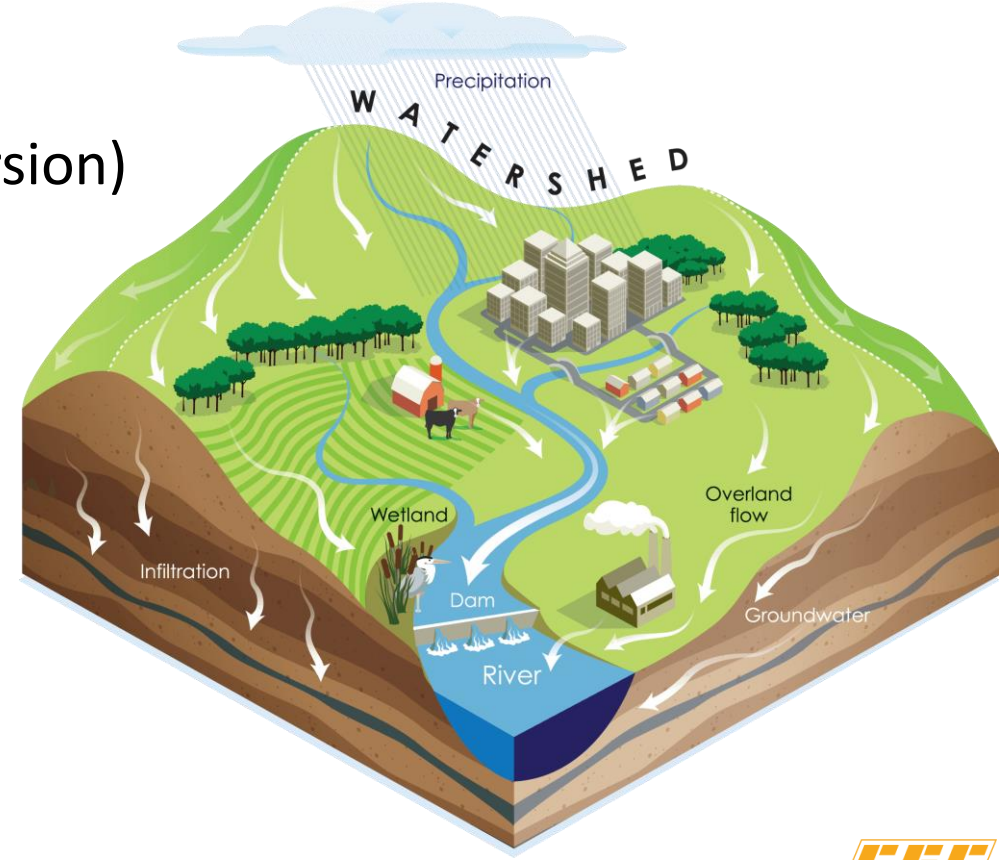
- Source
- Collection Date
- Accuracy
- Coordinate System
- Datum



REPORTING/DOCUMENTATION

▶ Hydrologic Analysis

- Model/Method used (version)
- Assumptions
- Topography
- Sub-basin area and slope
- Land cover
- Soil types



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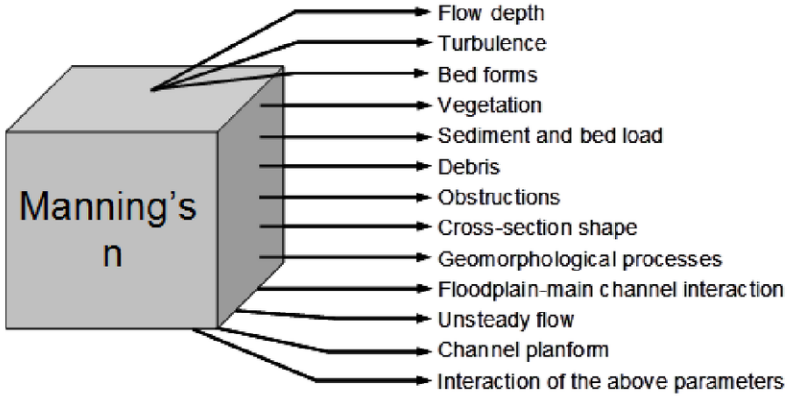
REPORTING/DOCUMENTATION

► Hydraulic Analysis

- Models used (version)
- Assumptions
- Source and method of measuring cross-section data and hydraulic structures
- Method of estimating loss parameters
- Method of estimating starting water-surface elevations



(Source: Adapted from Trieste and Jarrett, 1987)

MAPPING

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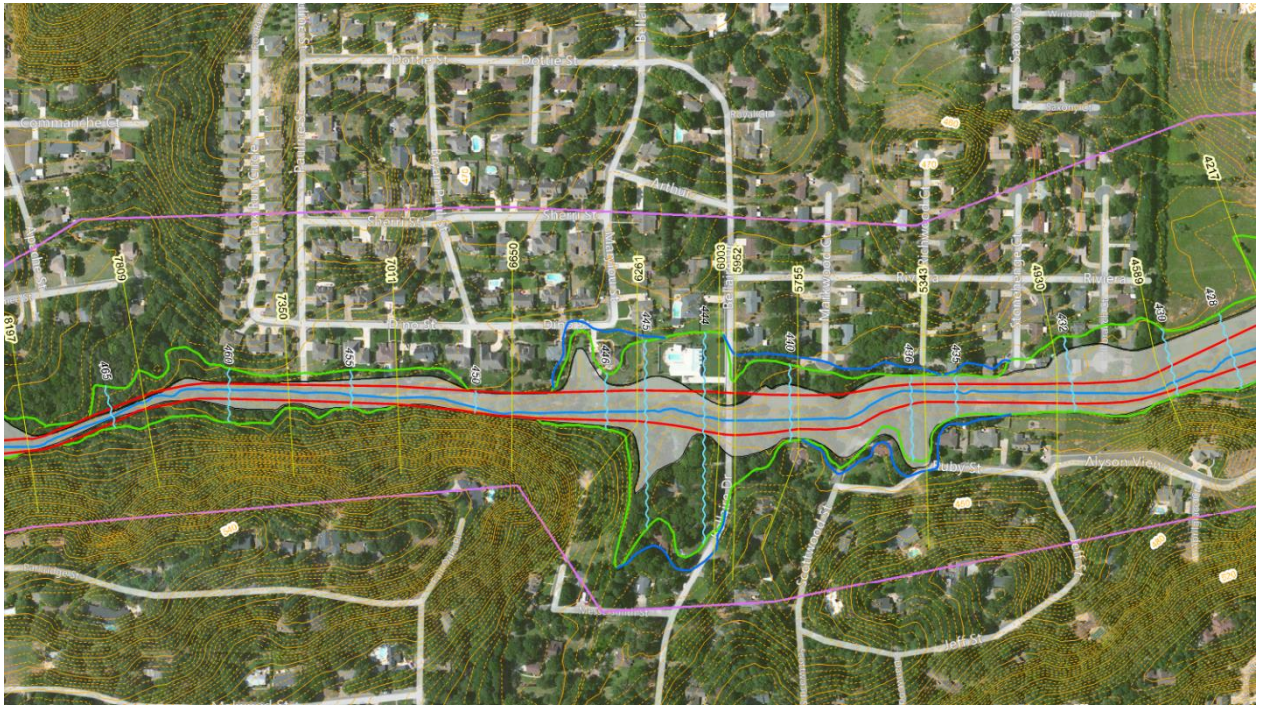
MAPPING



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Questions?

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Connect with us!

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