

Dam Failure Analysis (DFA)  
&  
Hydraulic Shadow  
(HS)Zoning

It all makes sense!

# It's the Law in Wisconsin

## Wisconsin Administrative Codes:

- NR116 – Floodplain Zoning – Requires zoning below dams
- NR333 – Dam Safety

Currently the only state to require zoning below dams in the HS

# Dam Failure Analysis

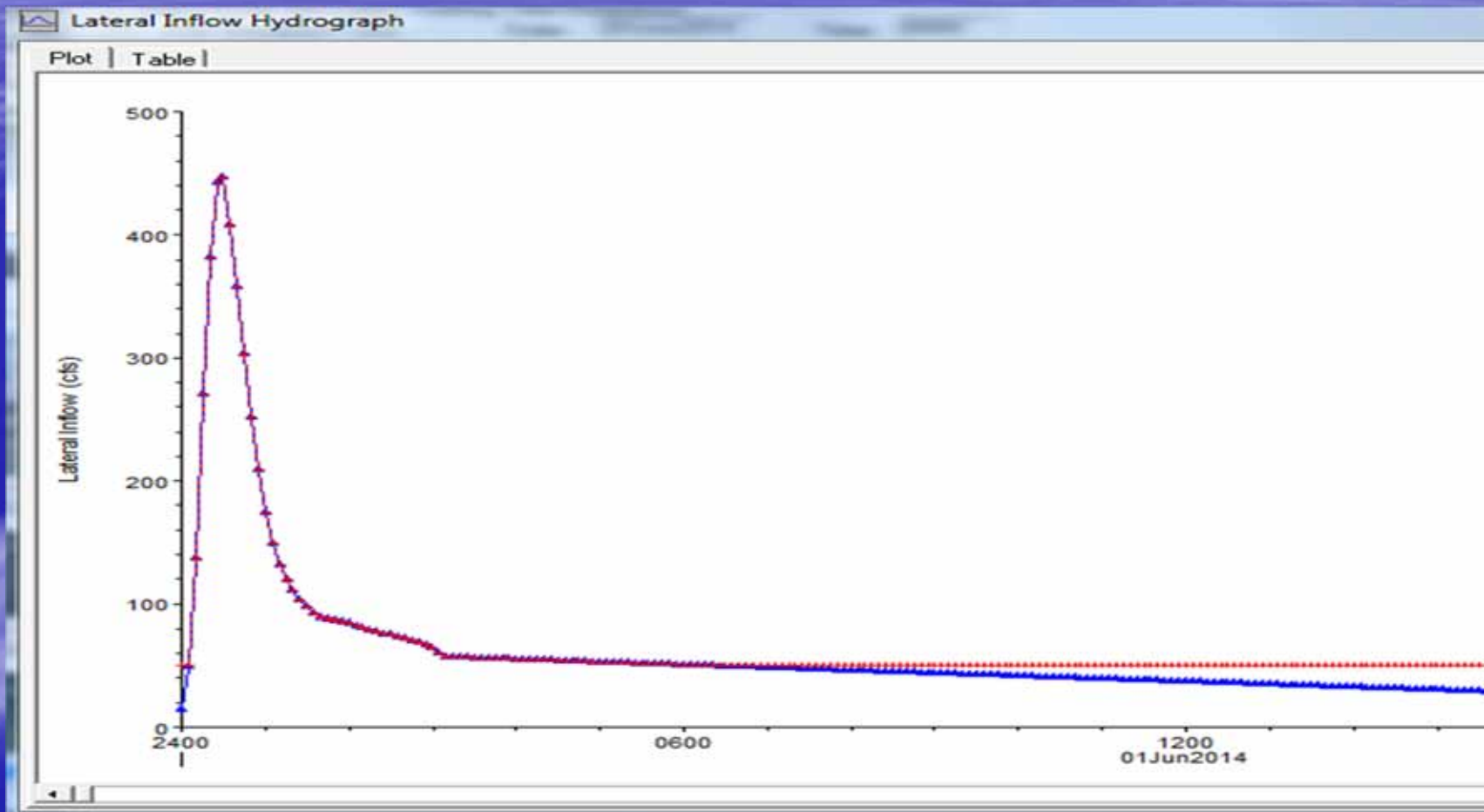
- Data intensive analysis done by engineering consultant
- Determines flood flows if no FIS
- Determines river and channel crossing geometry
- Develops computer model to route flood flows through the dam and then downstream
- Uses dam failure parameters in the model to simulate failure of the dam
- Should not become public record (other than results)



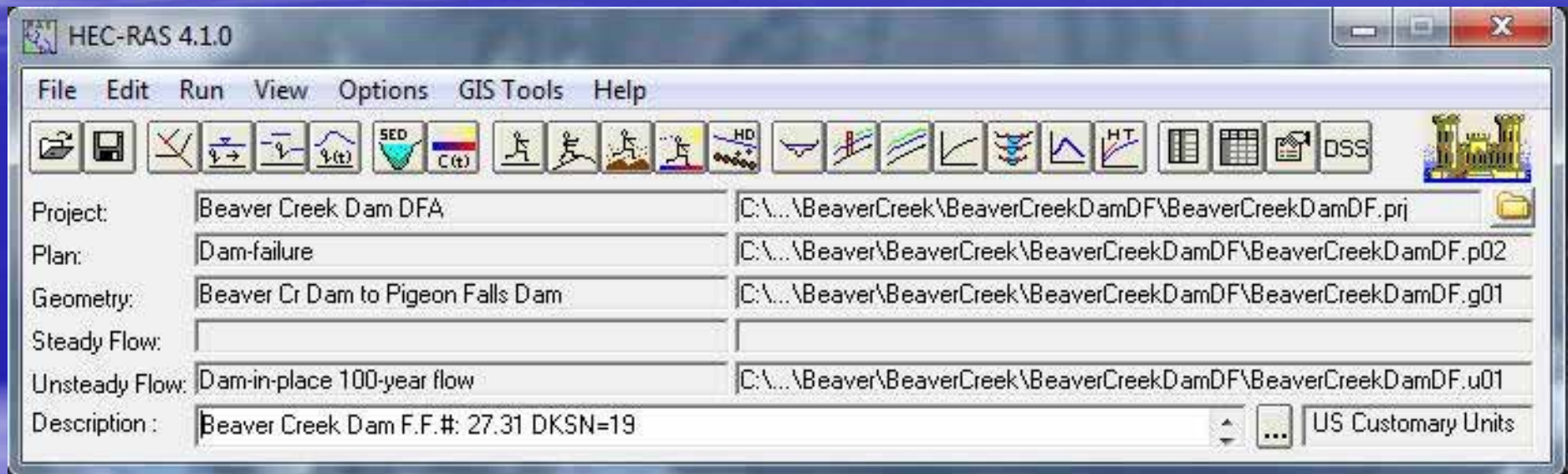
# Hydrology

- Two methods
- Based on statistical analysis
- Results define the magnitude of floods for a range of recurrence intervals
- Computer models have simplified the analyses (HECHMS, TR20, TR55, Regression equations...)

# Inflow Hydrograph

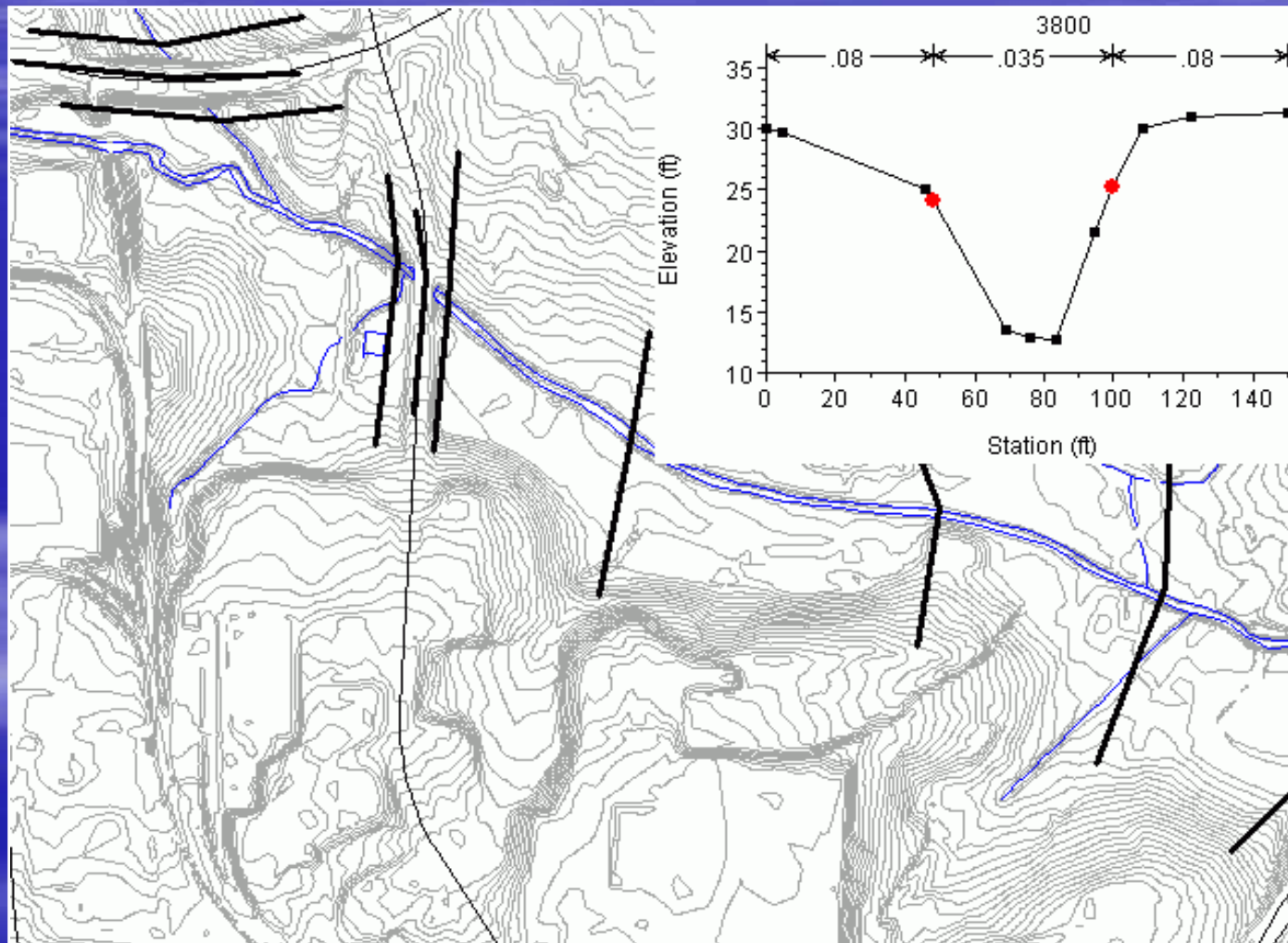


# HEC-RAS Computer Model



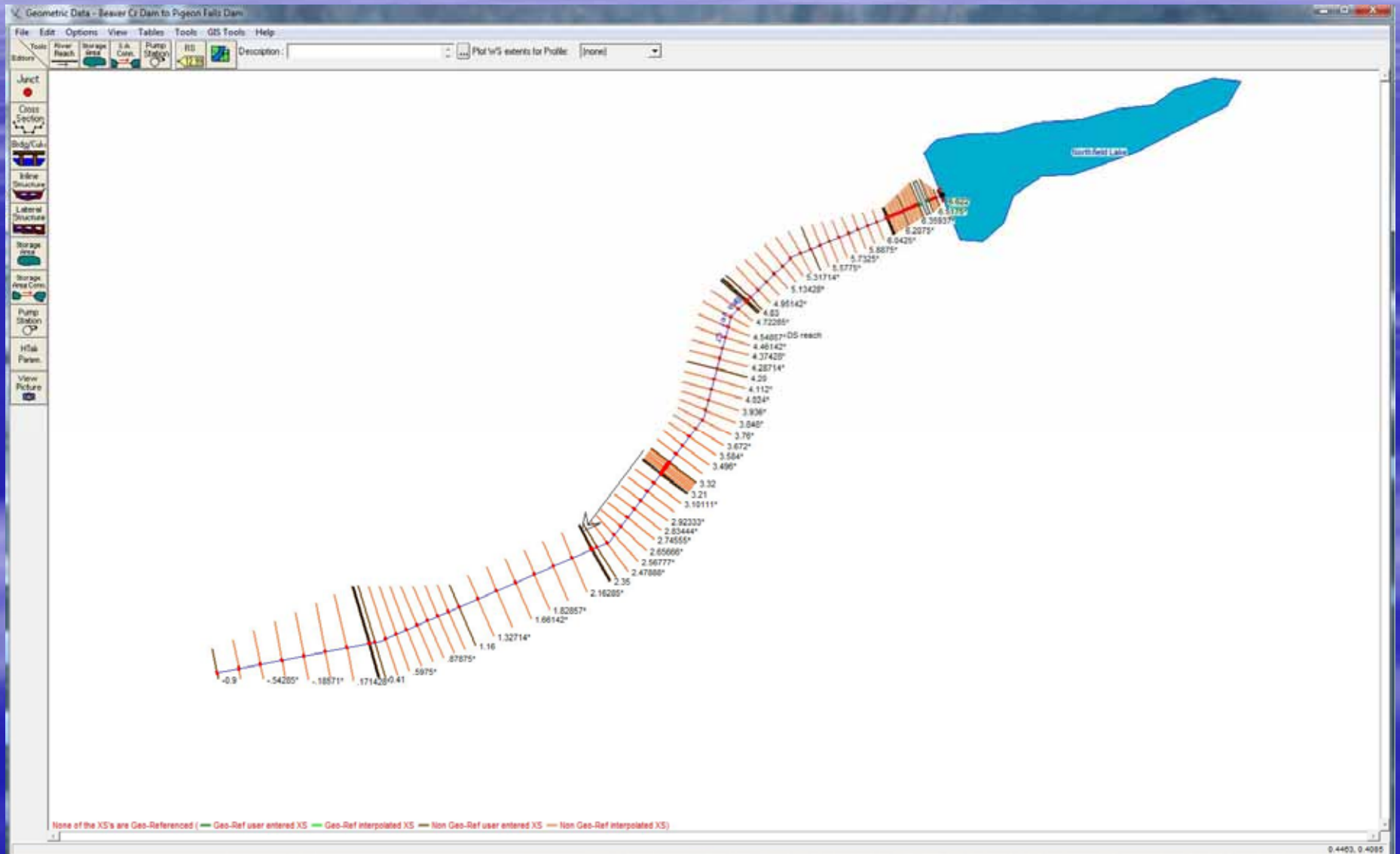
# Hydraulic Modeling

- Cross sections from digital terrain





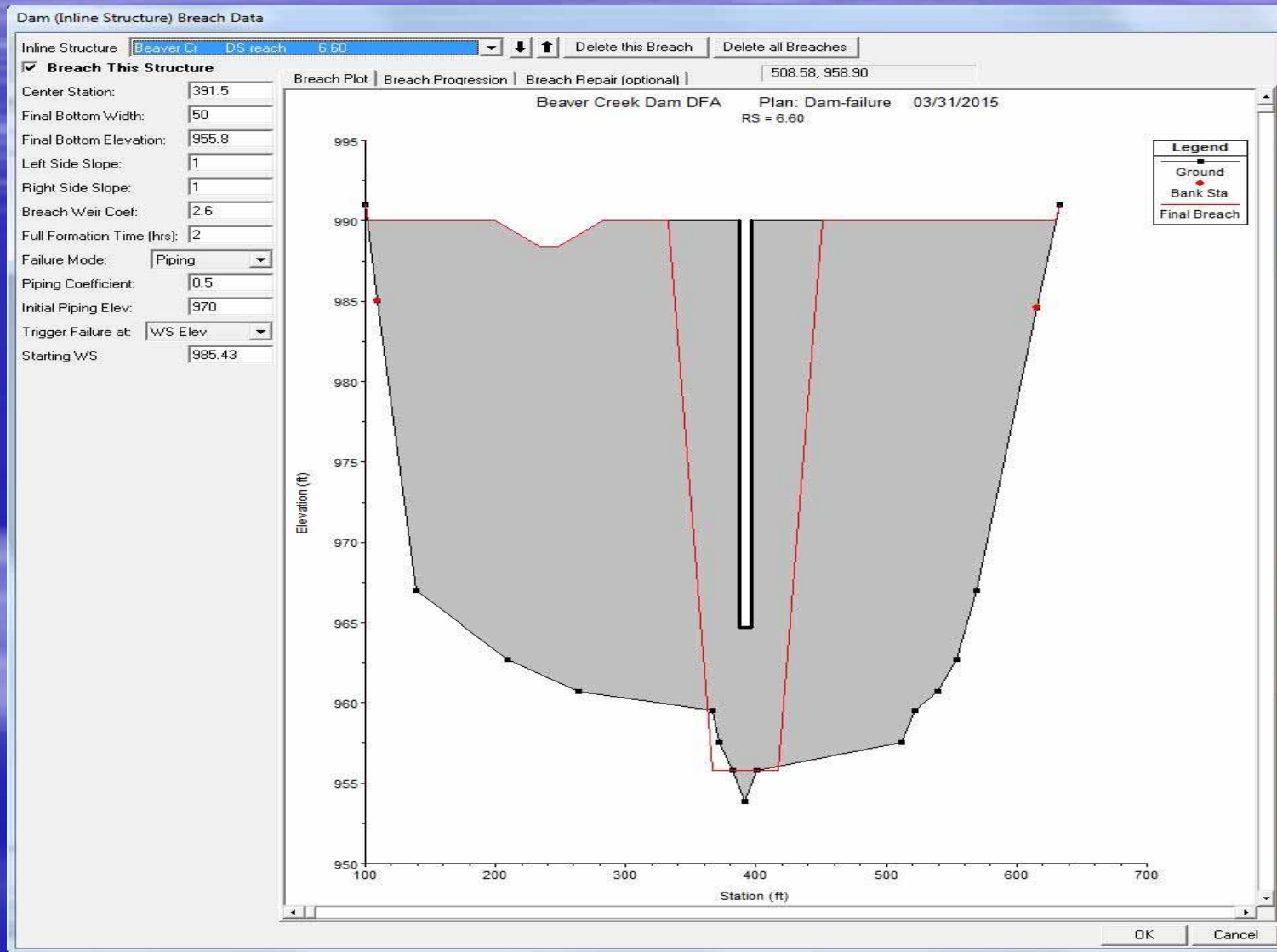
# HECRAS Geometry



# Dam and Breach Parameters

- Structural components of the dam determine breach size, location, formation time...
- Probable failure modes determination
- Does the dam overtop?
  - If yes, breach at overtopping elevation
  - If no, breach at max elevation
- Do the results make sense?????

# HECRAS Inline Structure Input



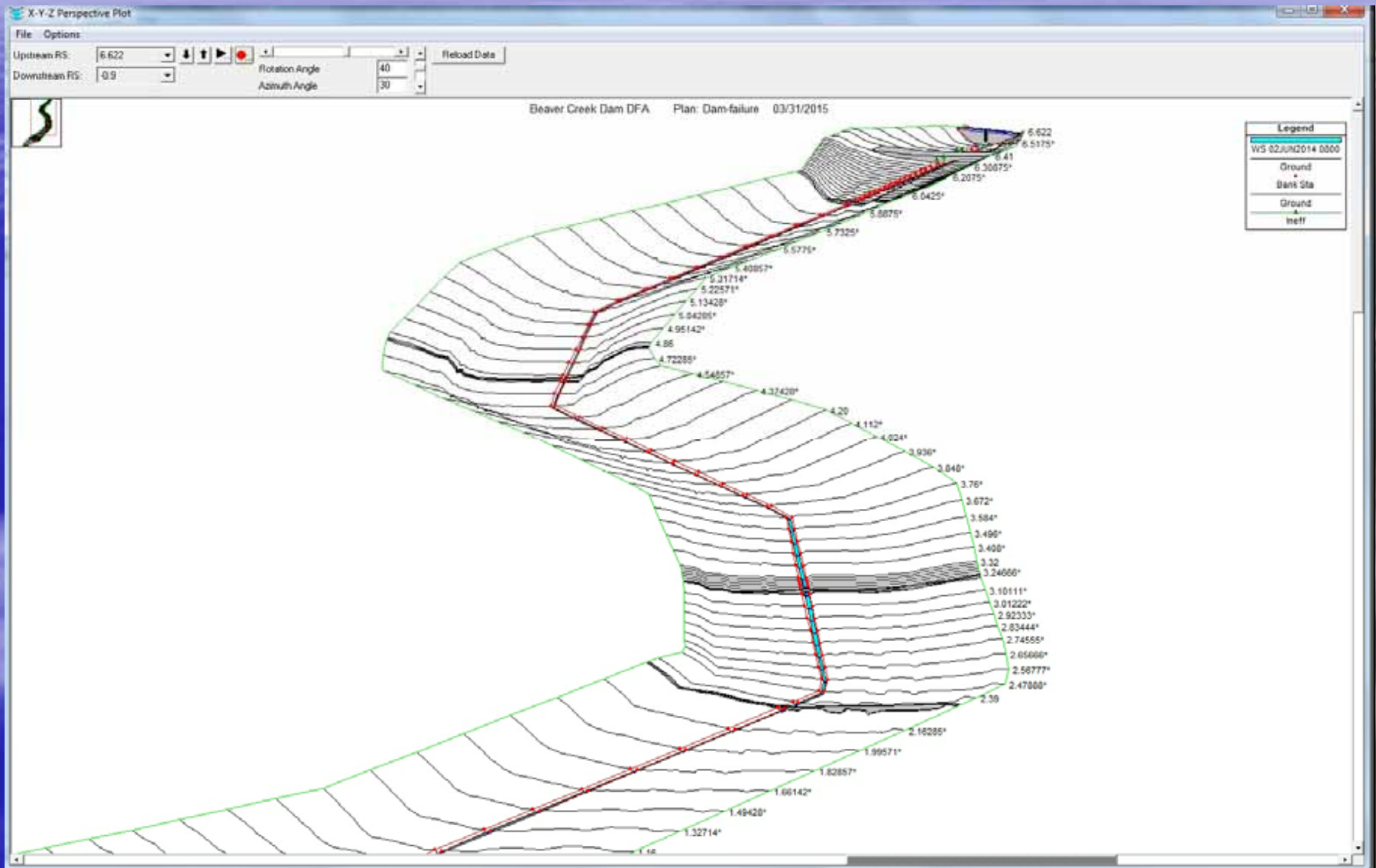
# The Results

- Identify the inundation area
- Determine affected properties and survey LAG
- Identify the hazard rating
  - Determines spillway capacity requirement
  - Determines inspection requirements
  - Determines required floodplain zoning
- Information added to Emergency Action Plan

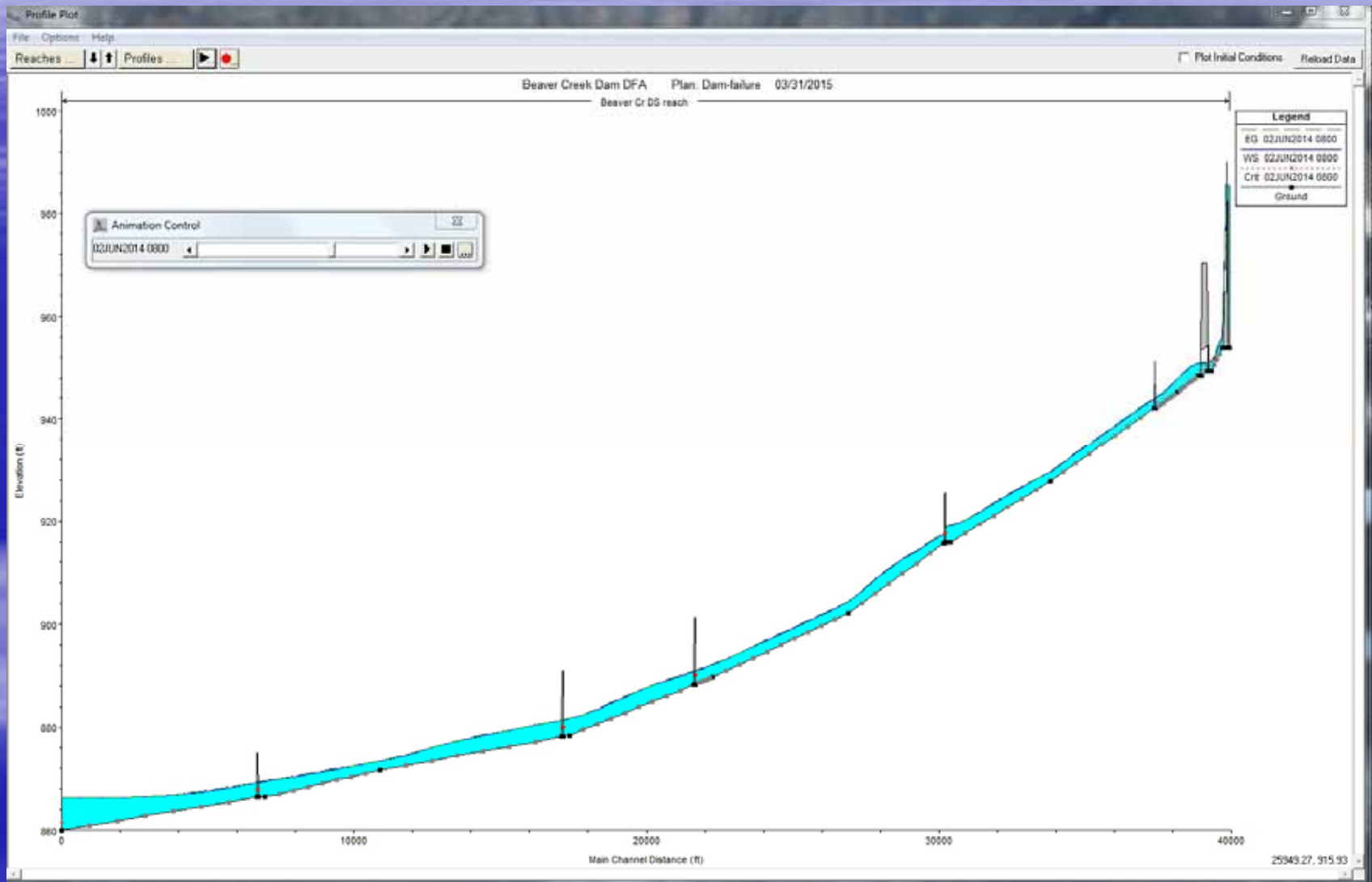
# The Results cont.

- Three profiles are required
  - Dam in place and operating (if IOM)
  - Dam non-existent
  - Dam in place and failing
- Modeling is extended downstream to convergence (Failure and Non-existent)
  - Developed area 0 FT
  - Undeveloped area 1 FT

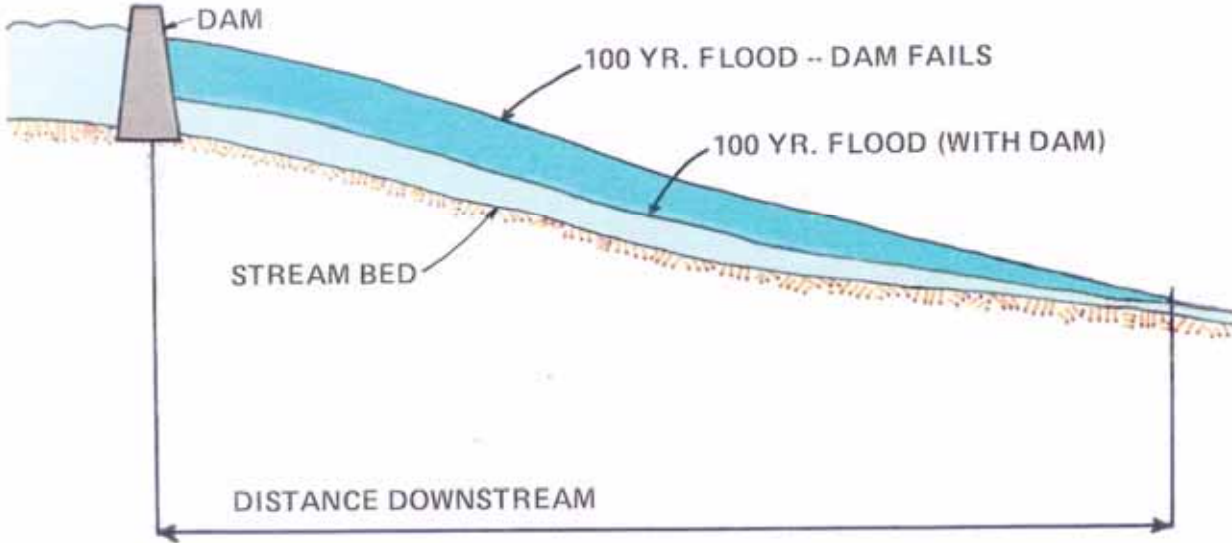
# HECRAS Breach Animation



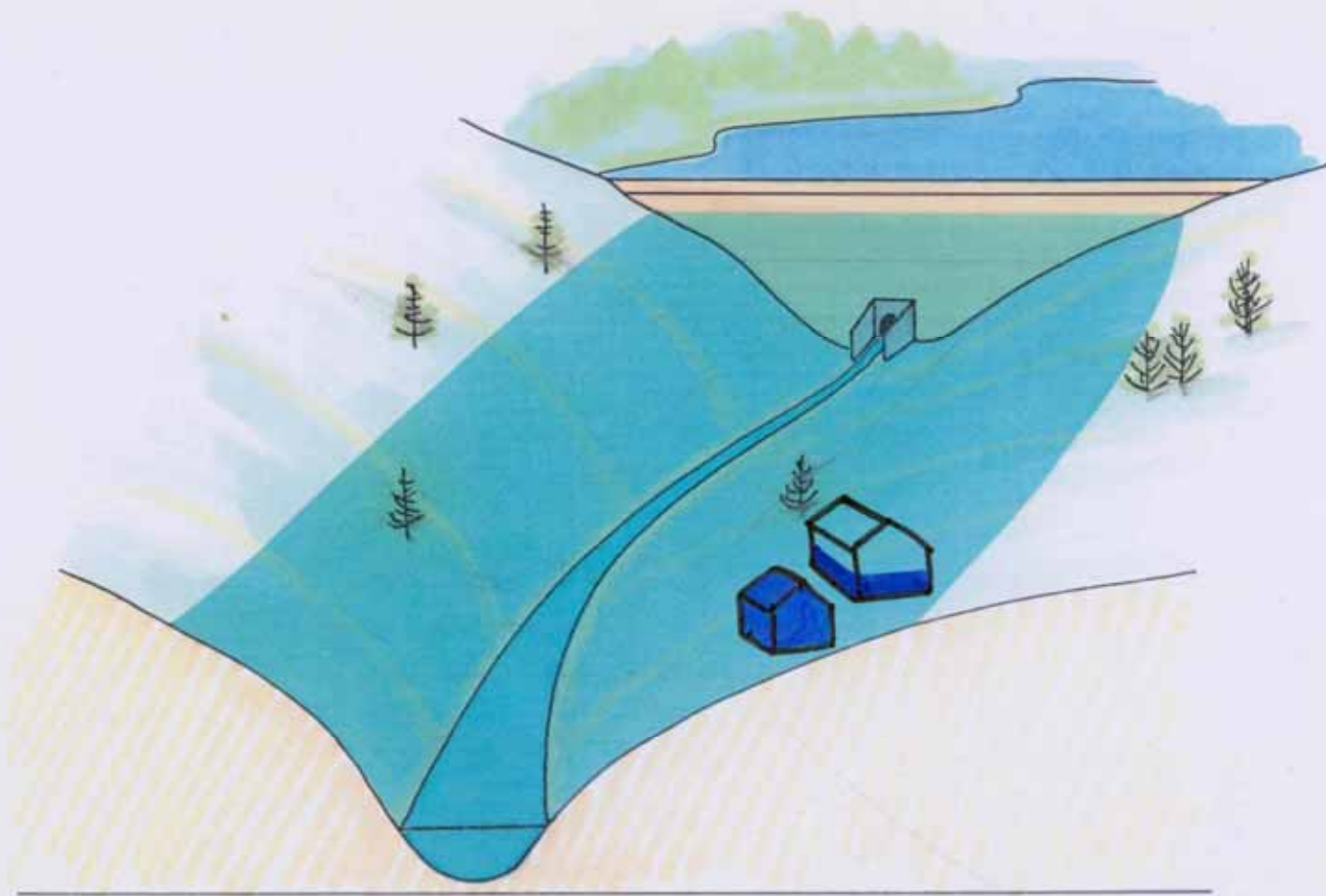
# HECRAS Breach Profile



PROFILE

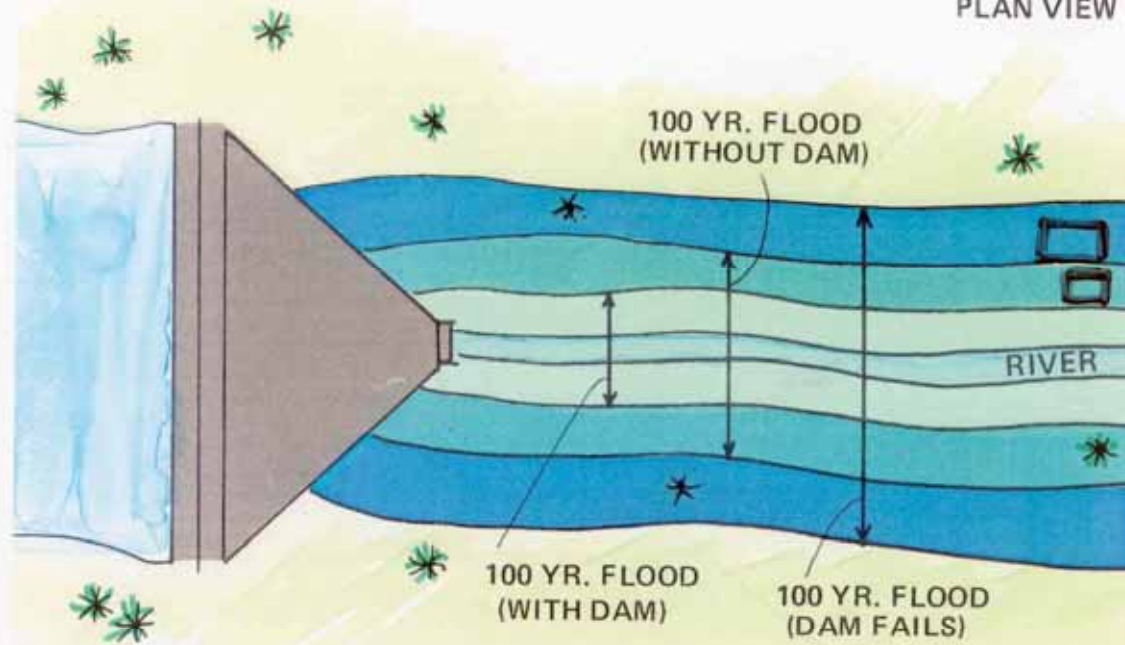






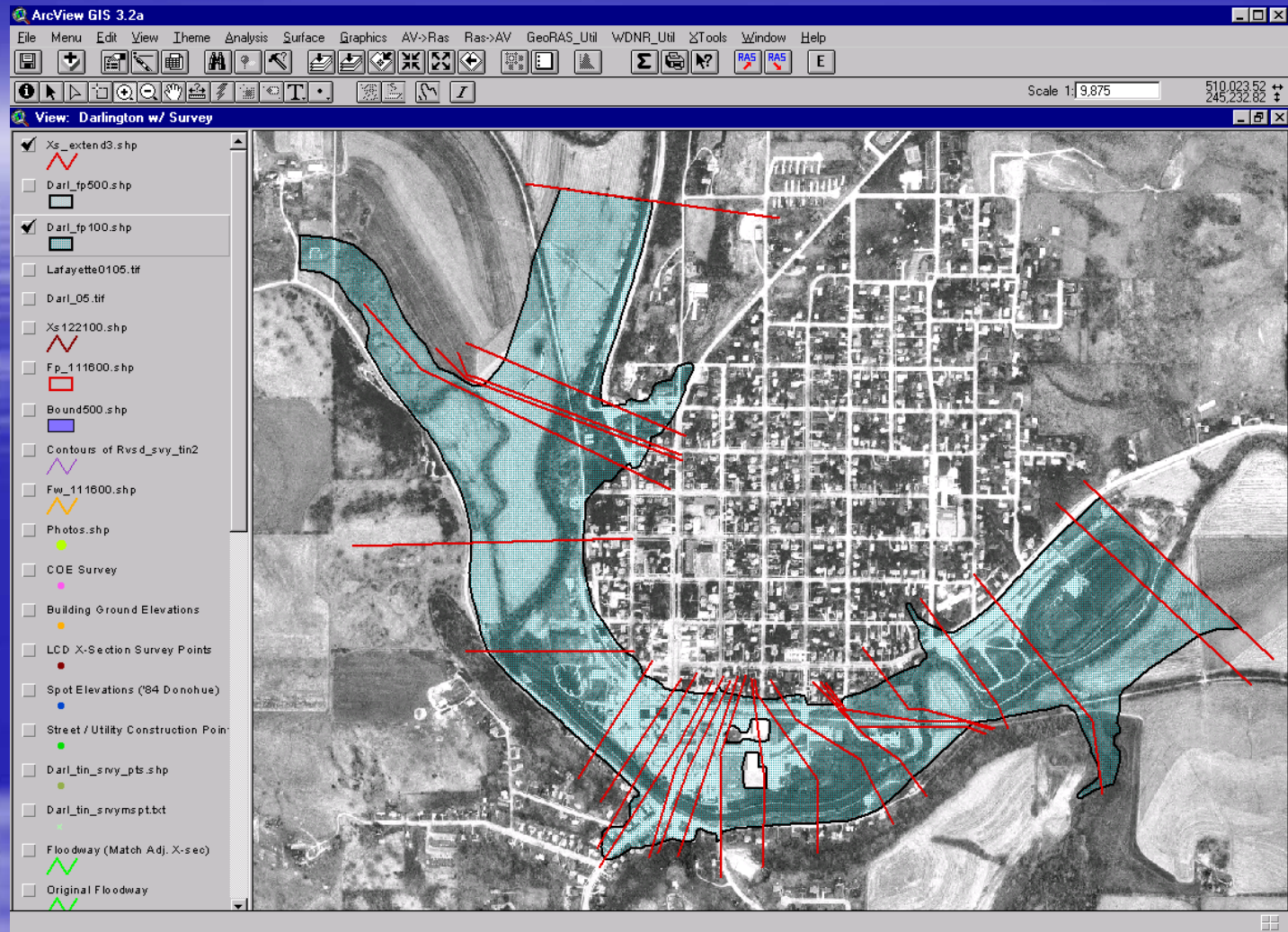
100 YEAR FLOOD -- DAM FAILURE

PLAN VIEW



# (Dam) Floodway Zoning

- HS is not displayed on FEMA maps
- NR 116 requires community to adopt the DFA into its FP zoning ordinance
- More details to come



# Hydraulic Modeling & Mapping Tools

# Dam Hazard Rating

- Hazard ratings are:
  - High hazard – probable loss of life
  - Significant hazard – significant property damage but no loss of life
  - Low hazard – no loss of life or significant property damage
- Hazard rating is based on existing development and land use controls, not the condition of the dam

# Required Zoning

- Zoning standards based on hazard rating
- Low Hazard – hydraulic shadow zoning
- Significant Hazard – hydraulic shadow zoning
- High Hazard – undeveloped, hydraulic shadow
- High Hazard – developed, dam non-existent or FIS

# Spillway Capacity Requirements

- Low Hazard – 10-yr principal, 100-yr total
- Significant Hazard – 50/500 yr
- High Hazard – 100/1000 yr
- Flexibility





