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Using GIS and HEC-RAS for Flood Emergency Plans

Flood Emergency Plan (FEP)

- The purpose of an FEP is to simulate the probable effects of a dam failure to ensure that loss of life is minimized through appropriate advance warning.
- FEPs are products for groups and government agencies that are responsible for the protection of citizens in case a dam failure were to occur.

Dambreak Analysis Steps

- Step 1: Determine probable extent of flood wave
- Step 2: Choose dam failure scenarios (PMF with and without dam failure, Sunnyday Failure)
- Step 3: Find or create the failure event conditions (pool level, hydrographs, etc.)
- Step 4: Determine dam failure mode and the time it takes for dam to fail (based on dam dimensions and composition)

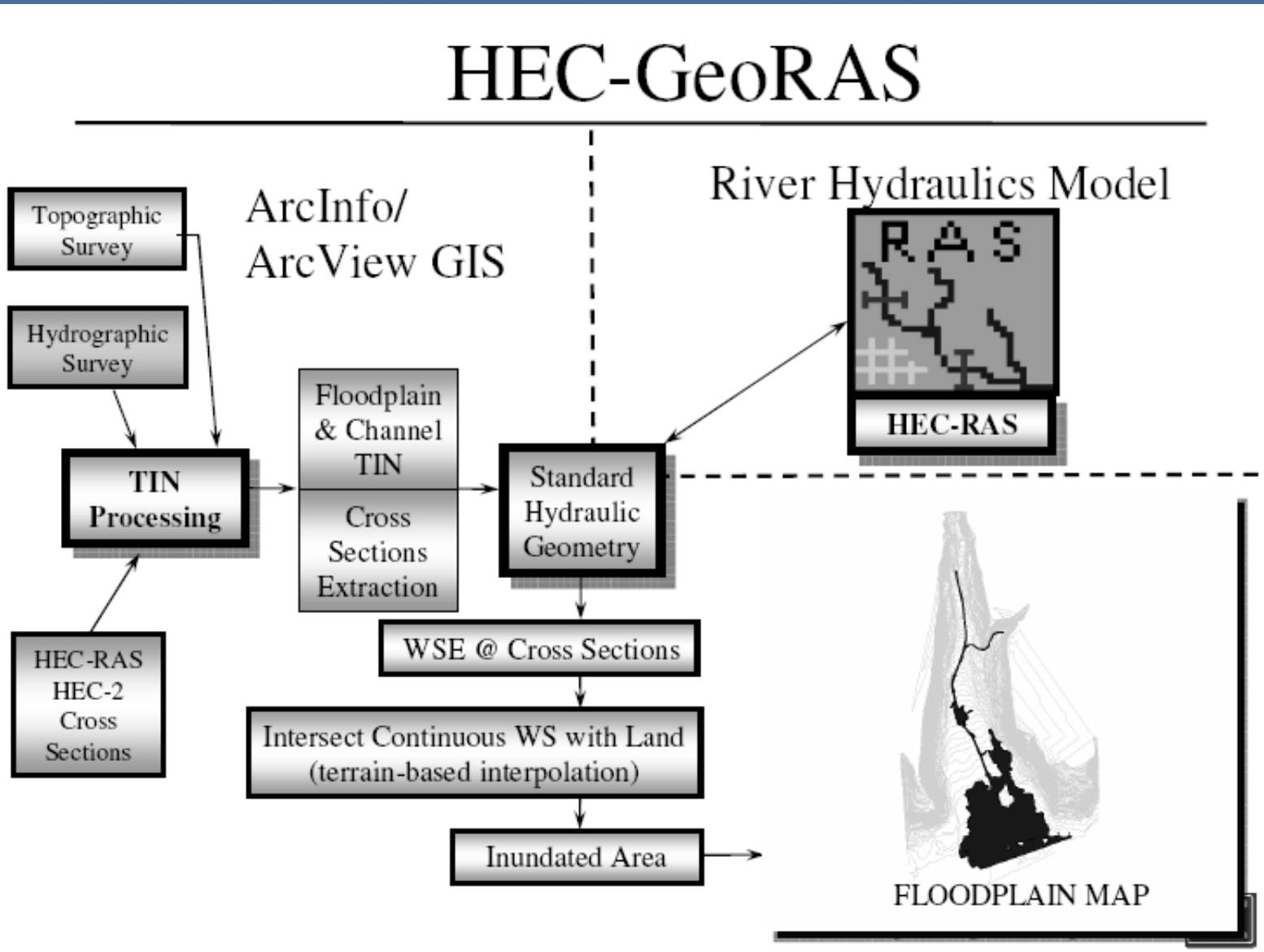
Dambreak Analysis Steps

- Step 5: Obtain terrain data of all areas affected by the failure of the dam.
- Step 6: Simulate the flood wave that would be released downstream if the dam were to fail
- Step 7: Create maps that show the areas flooded if the dam were to break, and the time that the wave will arrive.
- Step 8: Have an emergency plan in place should the threat of a dam failure ever arise.

Required Software

- ArcView (Geographic Information System)
- Geo-RAS extension for ArcView
- Spatial and 3-D Analyst extensions
- HEC-Ras (3.1.3 latest edition)

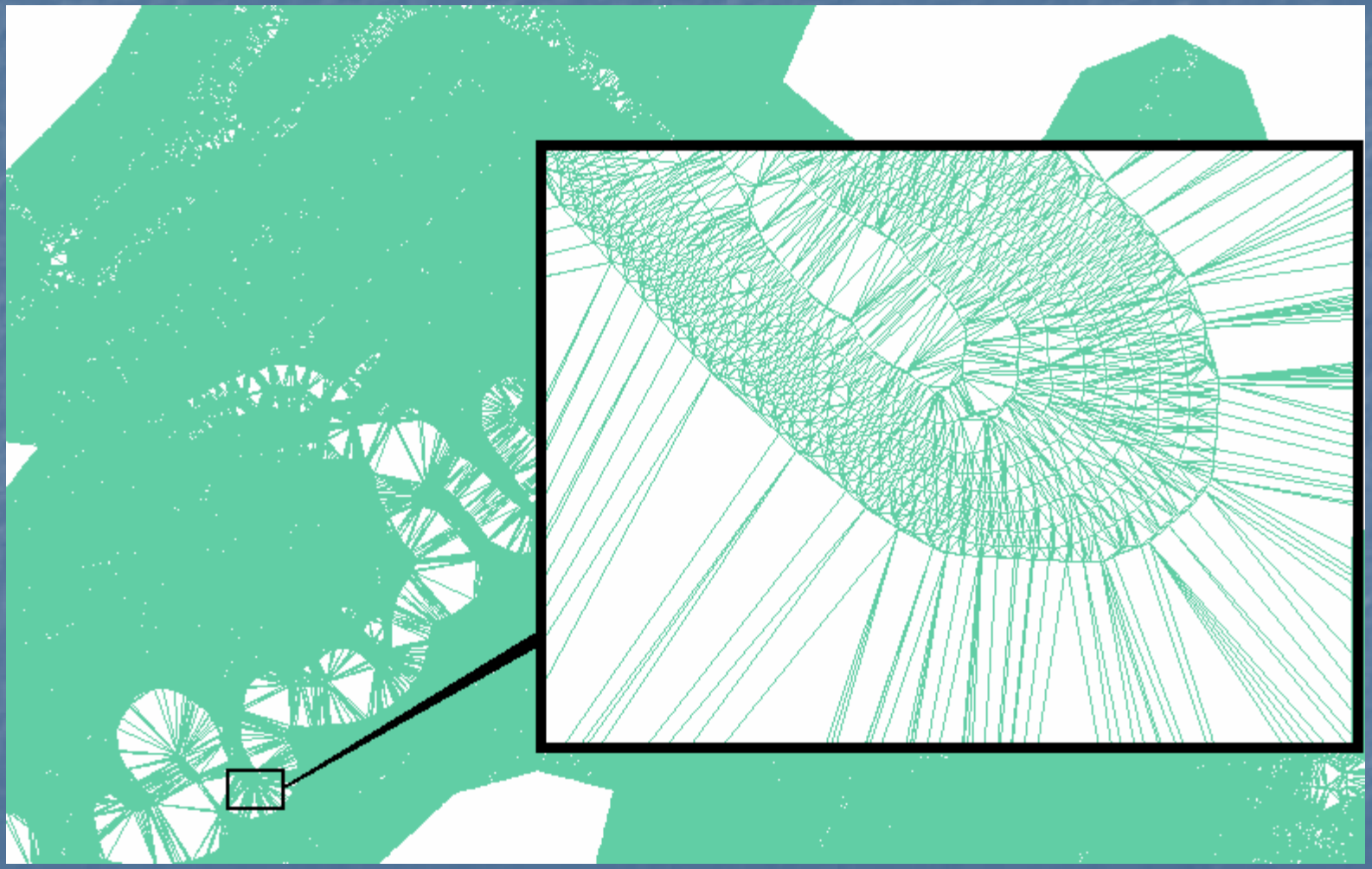
HEC-GeoRAS


ArcInfo/
ArcView GIS
River Hydraulics Model
Topographic Survey
Hydrographic Survey
TIN Processing
Floodplain & Channel TIN
Cross Sections Extraction
HEC-RAS HEC-2 Cross Sections
Standard Hydraulic Geometry
HEC-RAS
WSE @ Cross Sections
Intersect Continuous WS with Land (terrain-based interpolation)
Inundated Area
FLOODPLAIN MAP

Terrain Data

- 10 meter Digital Elevation Models (based on USGS Quads, free download)
- Bathimetric survey data for Reservoir
- Gage information for channel shape and slope
- Bridges from state Department of Transportation
- Dam information was in-house

TIN Generation



Army Corp Resources

- Water Control Section: Flood hydrographs, gage information and gate operation
- Geotechnical Section: Breach size and formation time
- Bathimetric Surveys
- Dam plans

Raystown Project

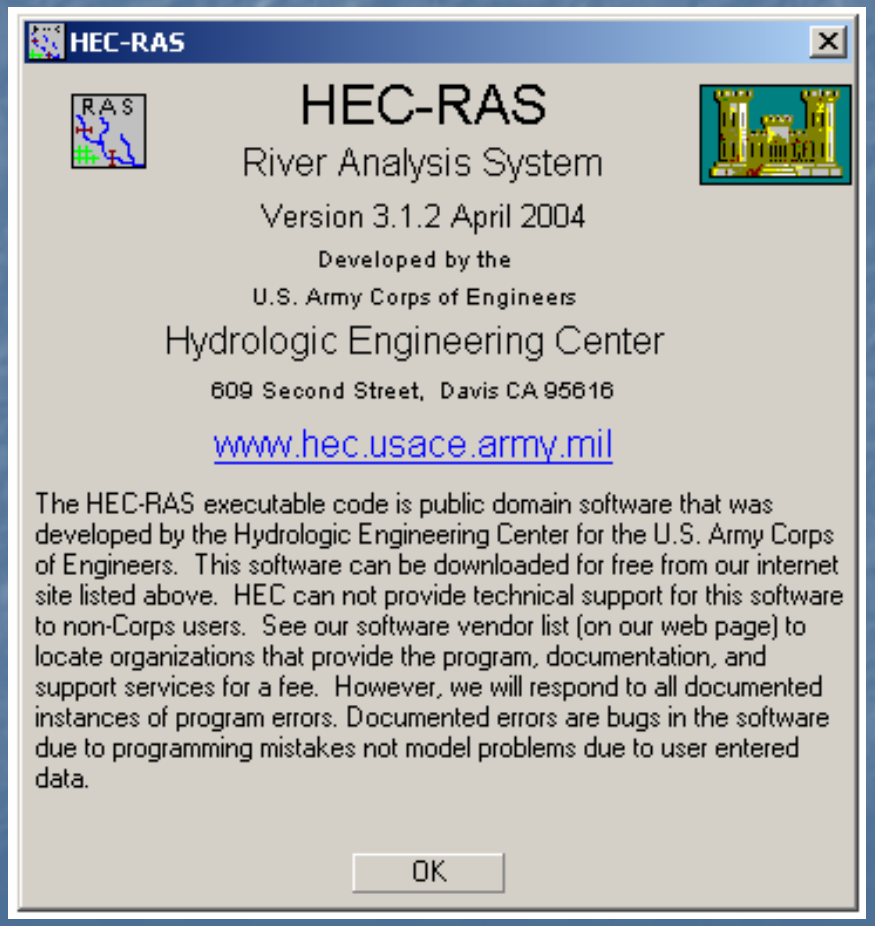
- Nearly 230 feet high
- Maximum storage of 871,000 acre feet
- 1.8 million cfs outflow during dambreak
- Flood extent of nearly 120 miles downstream

HEC Unsteady Flow Advantages

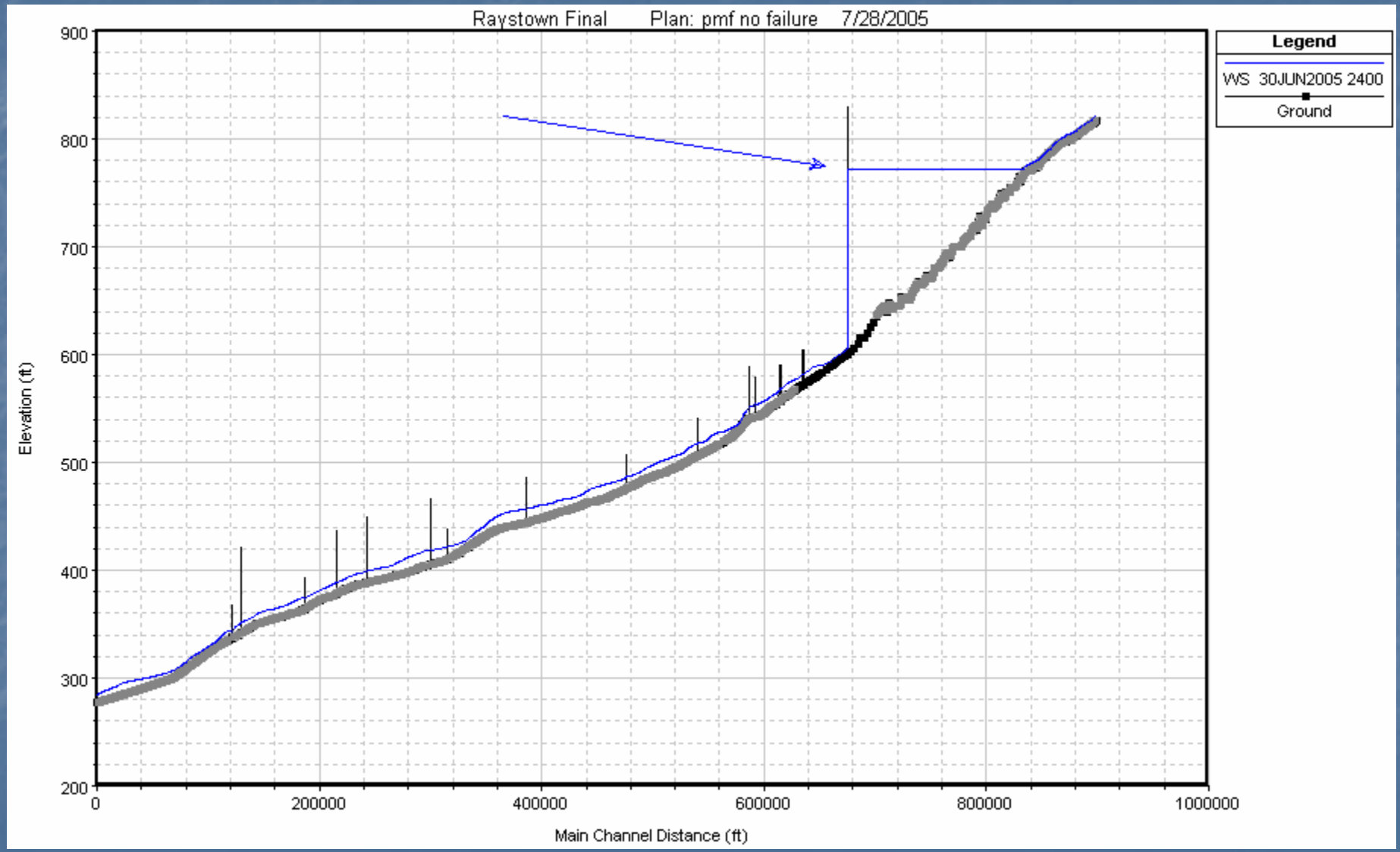
- Dynamic modeling that allows hydrographs to be modeled
- Can model tidal reaches, storage area attenuation, negative flow, multiple channels
- Dam and levee failures

HEC-River Analysis System

- Simple interface
- Multiple graphical aides
- Steady and Unsteady applications
- GeoRAS – Arcview



Breach Animation



Unsteady Flow Troubleshooting

- Geometry problems
  - HTAB parameters
  - Sharp slope changes
  - Mixed and supercritical flow
  - Dams or bridges modeled incorrectly
  - Manning's n values change abruptly
  - Cross-sections spaced incorrectly
  - Large effective flow changes

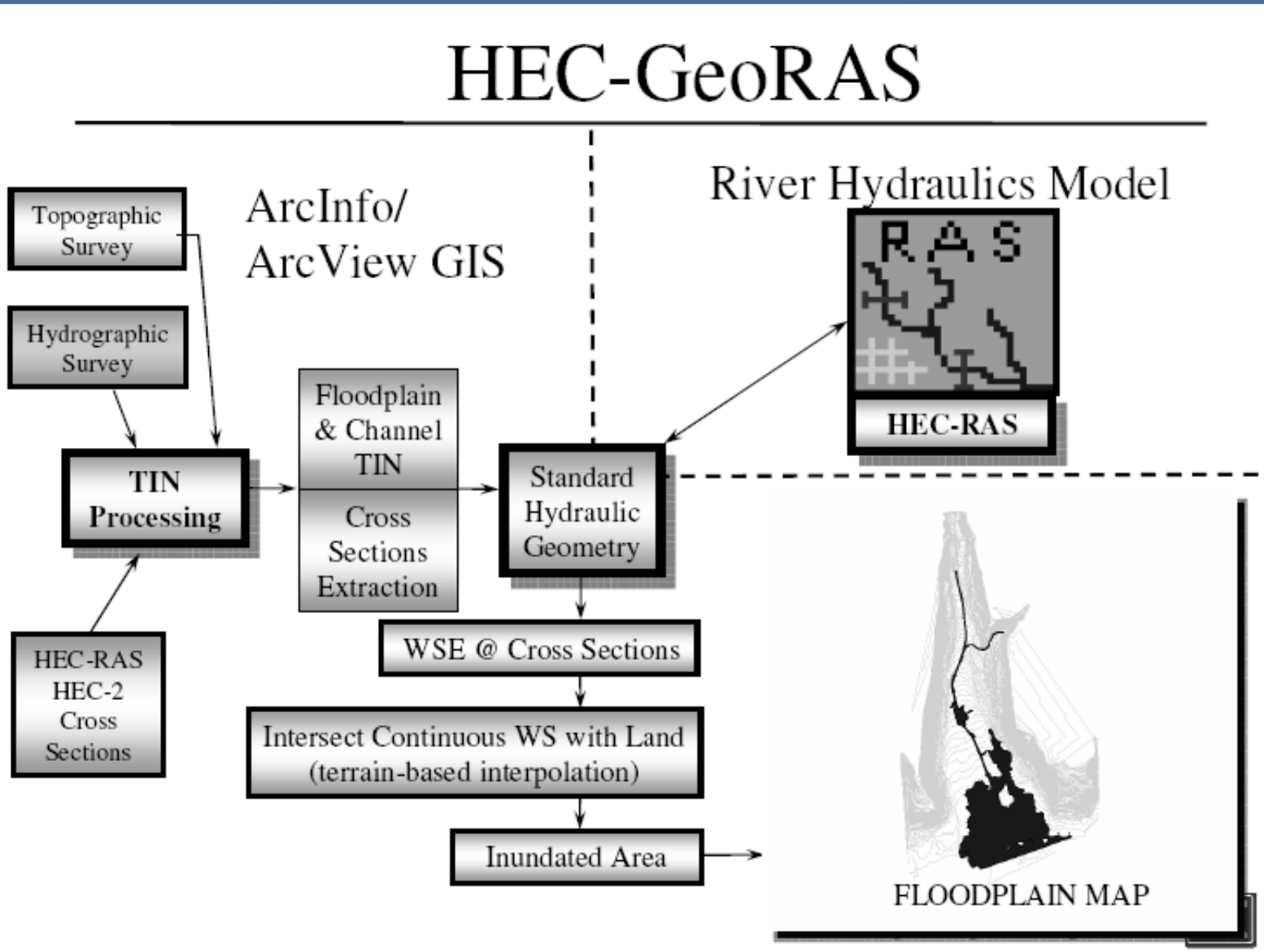
Unsteady Flow Troubleshooting

- Flow Hydrographs
  - Initial flows don't add up
  - Not enough flow in channel
  - Hydrographs don't match

Unsteady Flow Troubleshooting

- Calculation Options
  - Computation Interval too small
  - Needs warm up time steps
  - Not enough calculation intervals

HEC-GeoRAS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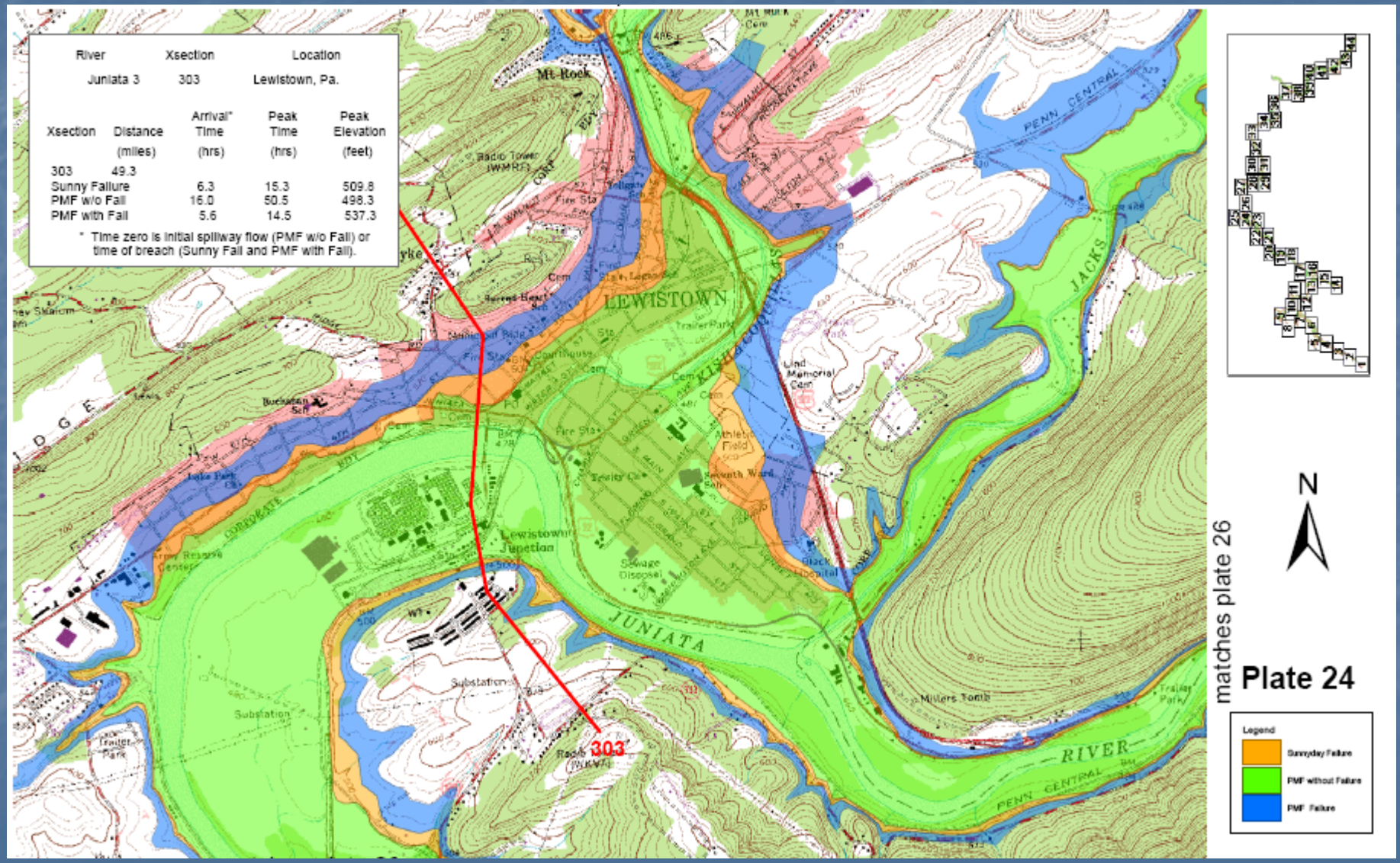
FLOODPLAIN MAP

GIS Advantages

- River distances, shape, and characteristics such as bank stations are automatically imported into the Geometry editor from GIS
- Flood extents are automatically generated using GeoRAS
- Flood inundation is easily combined with mapping to clearly represent flood limits

Final Product



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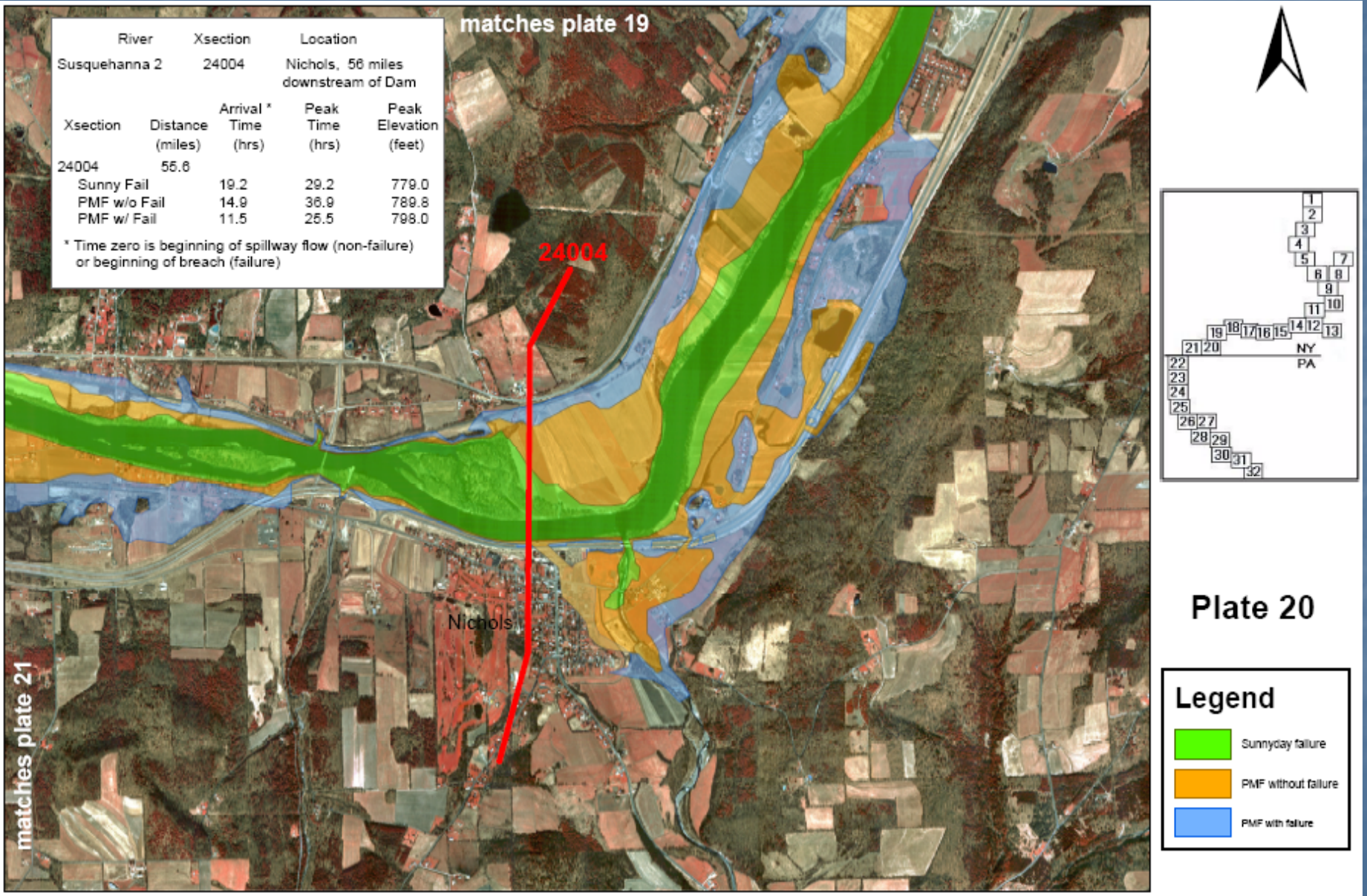

Questions?