Extraction and Geo-spatial Presentation of National-scale Data for Decision Making

A presentation on the:

Coordinated
Needs
Management
Strategy

Ryan Cook Dewberry

Background

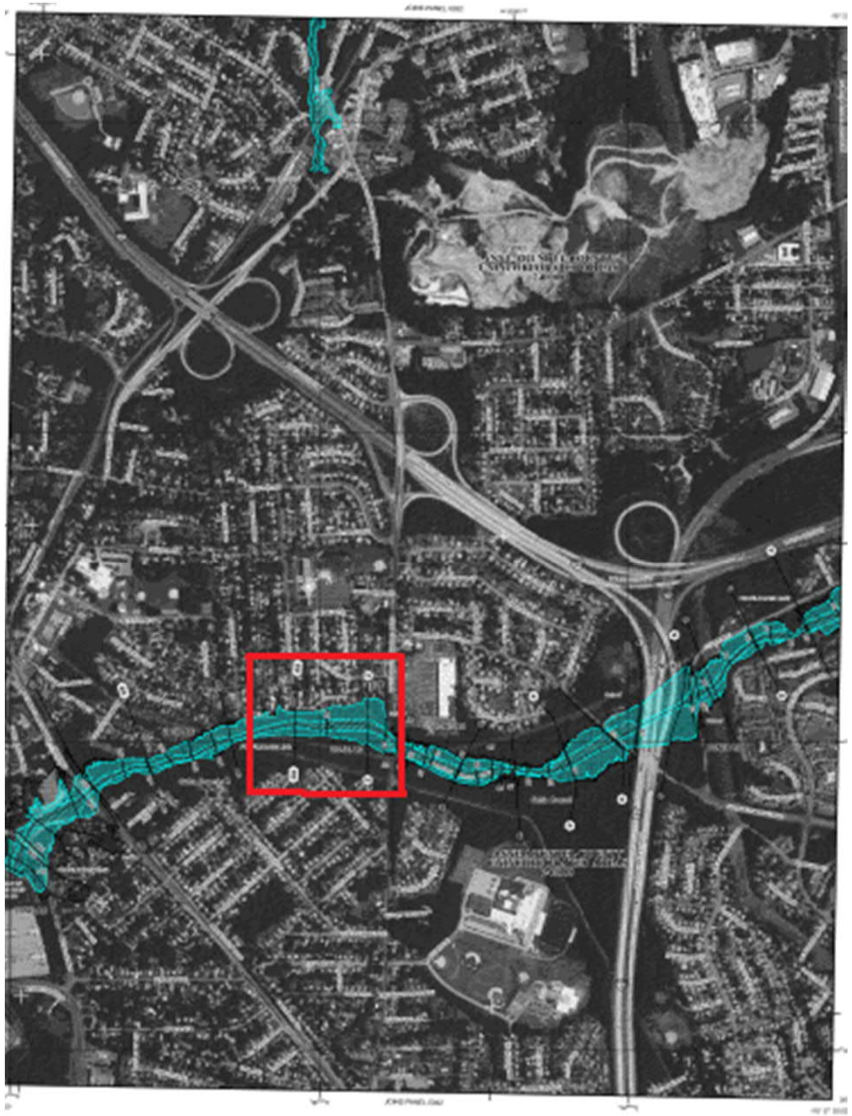
- The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP)
- Flood insurance is mandatory for buildings in high risk areas that have loans from federally regulated or insured lenders
- High risk areas are determined by Flood Insurance Rate Maps (FIRMs)
- FIRMs are created from hydrologic and hydraulic engineering analysis

Challenges

- The National Flood Insurance Program relies on accurate Flood Insurance Rate Maps
- Engineering studies are static snapshots of conditions
- Large number of studies; 1,000,000+ miles nationwide
- Engineering data is often inaccessible, scattered throughout different locations
- Funding for new engineering studies must be used efficiently

Challenges – Accurate FIRMs

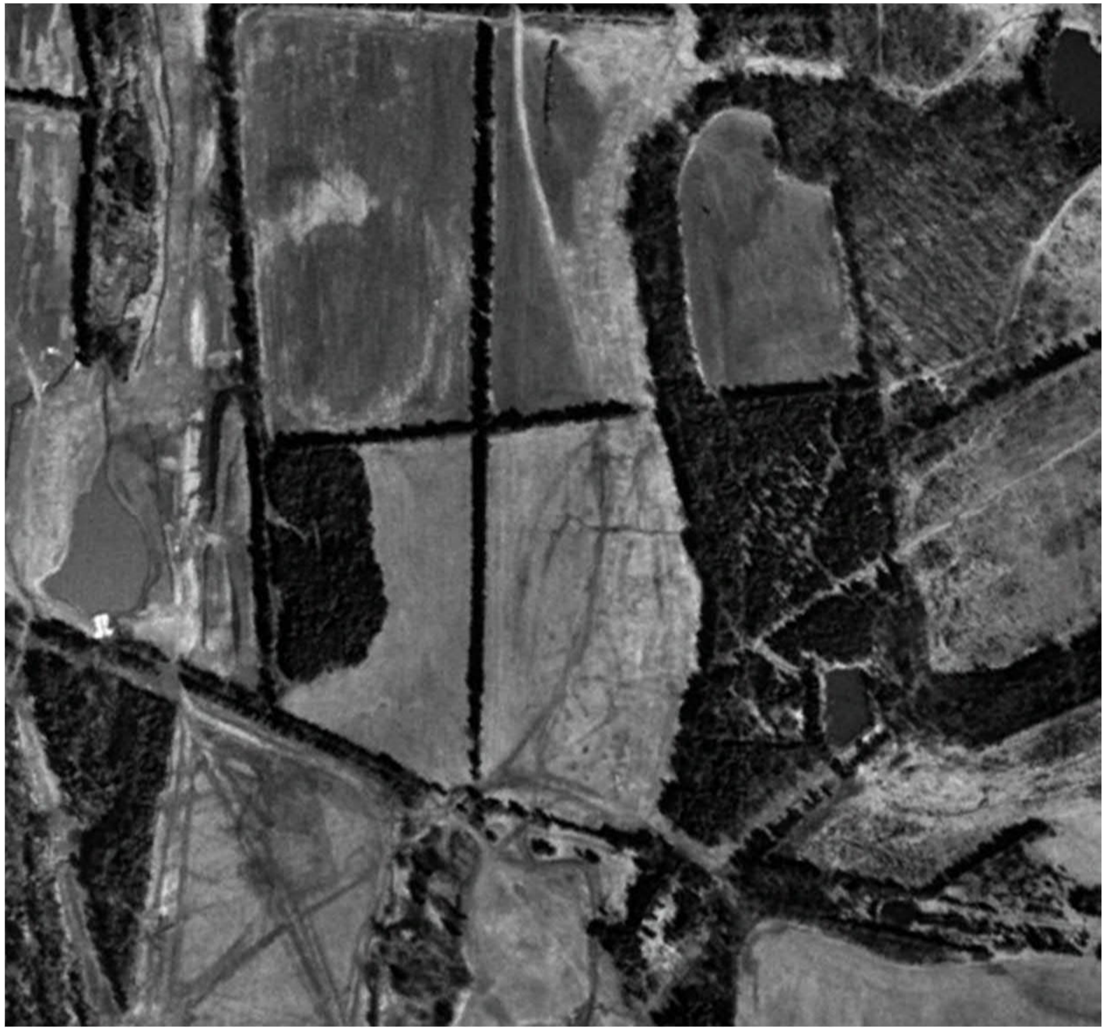
Challenges – Accurate FIRMs



Challenges – Accurate FIRMs

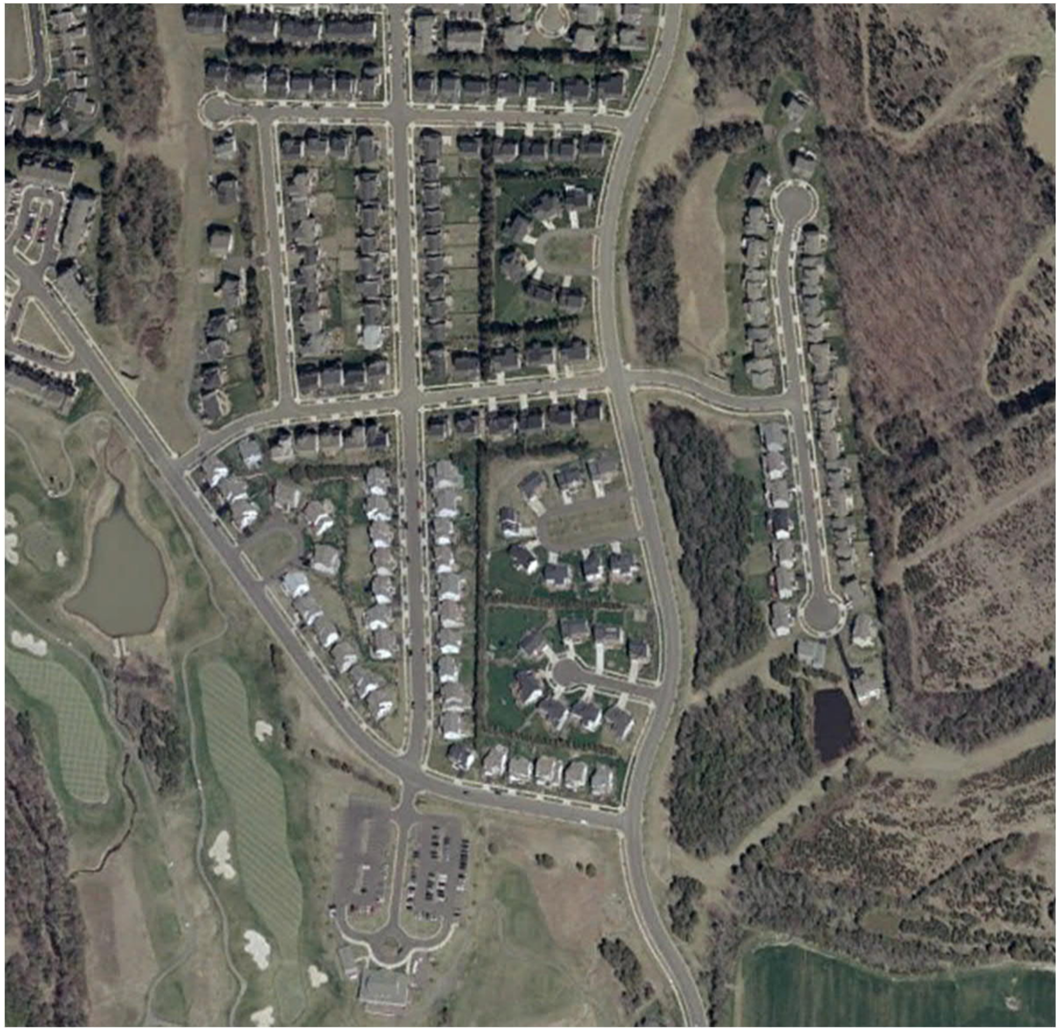
Challenges – Static Studies

- 1995

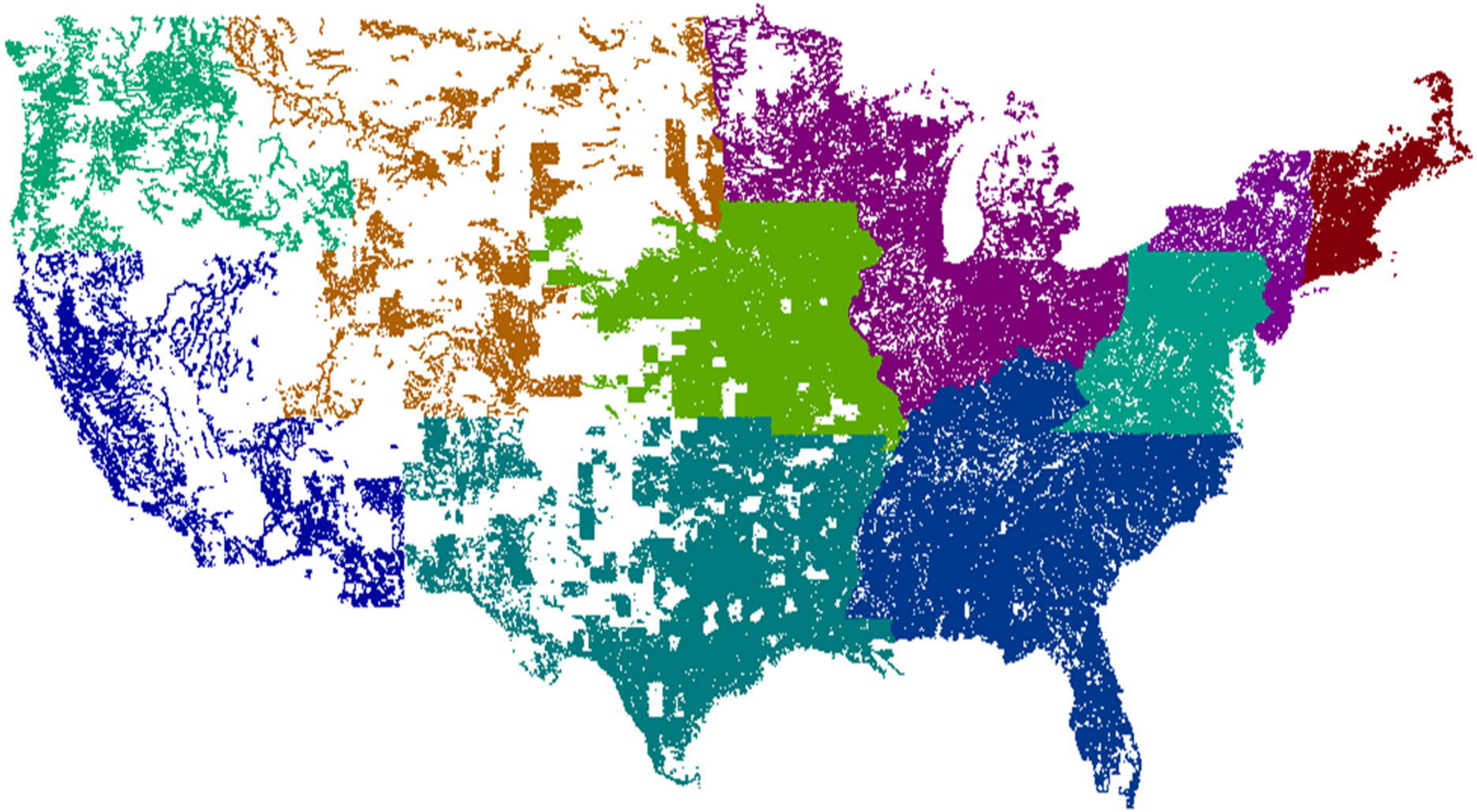


Challenges – Static Studies

- 2002



Challenges – Volume of Studies



Dewberry

Challenges - Inaccessibility

The Solution

Coordinated

Needs

Management

Strategy

CNMS - Overview

Both:

- A geospatial database used to support data driven planning of flood mapping by tracking needs, requests, and valid engineering

- A process to evaluate the accuracy of the nation’s flood hazard data inventory on a five year cycle

CNMS - Database

Contains:

- Flooding source centerlines/coastlines
- Study type
- Effective date of study
- Hydrologic and hydraulic model
- Validation Status

CNMS – Validation Status

Valid:

- Study has passed the CNMS validation criteria, study will be reassessed in 5 years

Unverified:

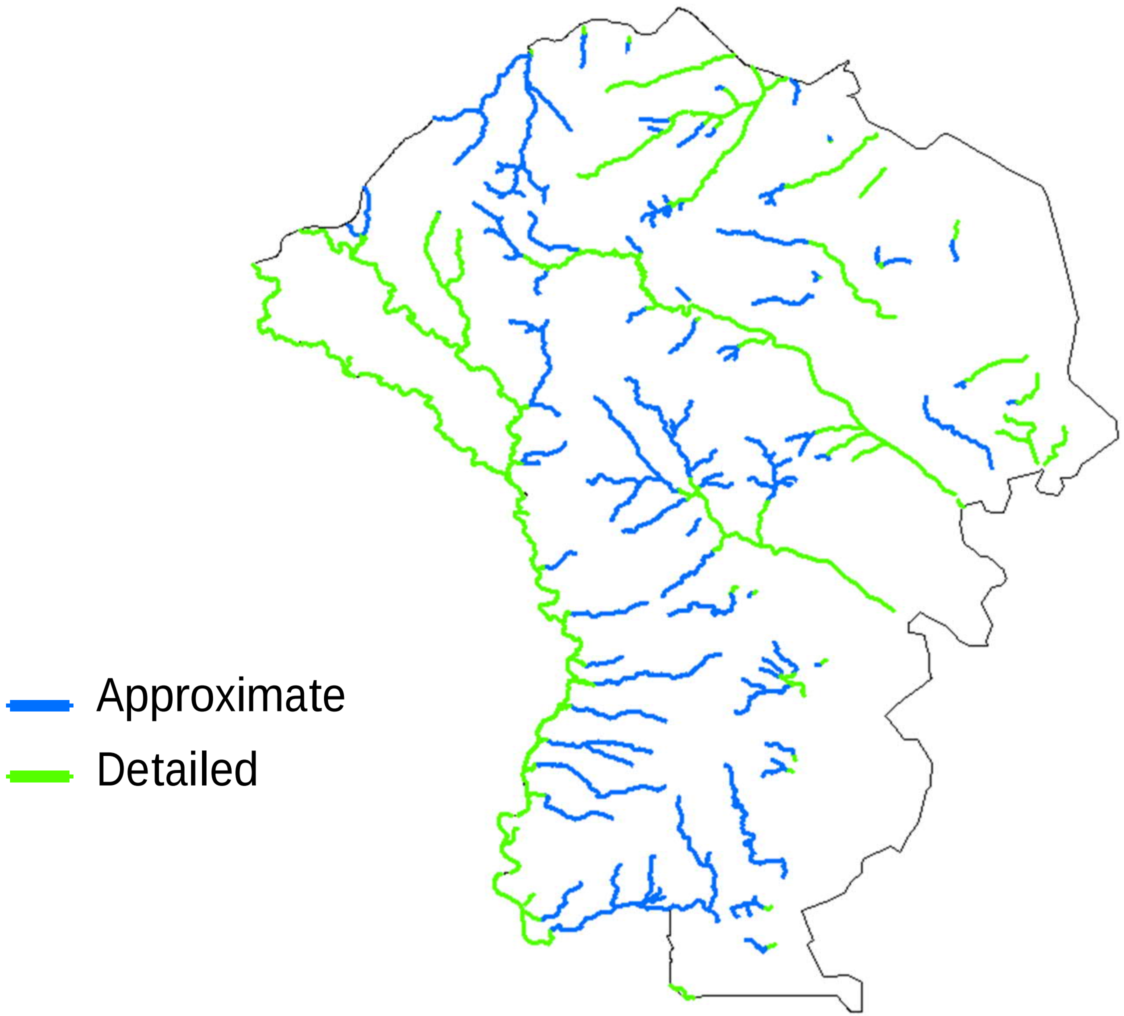
- Study has not passed the validation criteria; to be assigned resources for future restudy or currently being restudied

Unknown:

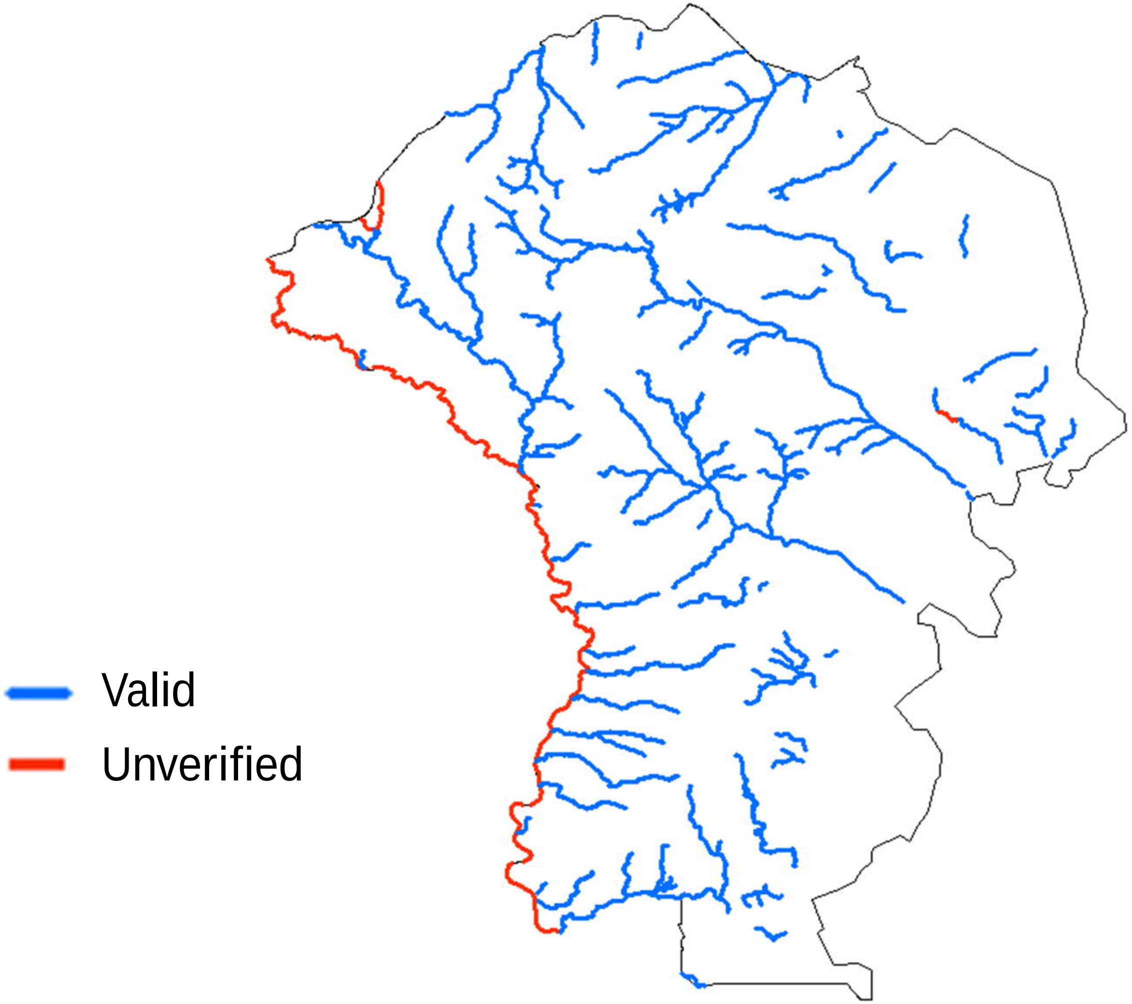
- CNMS evaluation is planned and in queue, currently being assessed under CNMS, or evaluation is deferred

CNMS – Database

CNMS – Study Type



CNMS – Validation Status



CNMS – Procedure

- Engineering studies analyzed on an individual reach level
- Information extraction
- Analysts evaluate each study based on 16 elements
  - Critical and secondary elements
- Elements incorporate components of: the physical environment, climate, and engineering methodologies
- Studies failing the elements are considered a “flood hazard mapping need”

CNMS – Background Information

- Extracting Key Information
  - Date of effective analysis
  - Hydrologic method/model
  - Hydraulic method/model
  - Models in digital format?
  - 100-year flow (ft^3/s)
  - Date and type of topography

CNMS – Critical Elements

C1 – Major change in gage record since effective analysis

- Determine if USGS gage is on stream
- Element fails if a major flood event has occurred since the effective analysis
- Major event: Event > 100-year discharge from effective study

CNMS – Critical Elements

C2 – Updated and effective peak discharges differ significantly

- Determine if USGS gage is on stream
- Generate 100-year discharge from gage records, up to effective date
- Create 68% confidence interval for 100-year flow using gage records up to current date
- Element fails if 100-year discharge from effective date falls outside 68% confidence interval from current date

CNMS – Critical Elements

C3 – Model no longer appropriate based on Guidelines and Specifications

- Focuses on underlying model methods, not software versions

- One Dimensional vs Two Dimensional

- Element fails if model is determined to be inappropriate

CNMS – Critical Elements

C4 – Addition or removal of major flood control structures

Determine if:

- Dams or reservoirs added or removed
- Levees or seawalls added or removed
- Levees or seawalls current accreditation status is reflected
- Element fails if an added or removed structure impacts more than 30% of reach's drainage area

CNMS – Critical Elements

CNMS – Critical Elements

C5 – Current channel reconfiguration outside of effective Special Flood Hazard Area (SFHA)

- Compare extents of effective SFHA with channel as shown on latest aerial imagery
- Element fails if channel reconfiguration has occurred

CNMS – Critical Elements

CNMS – Critical Elements

CNMS – Critical Elements

C6 – New or removed hydraulic structures (bridges/culverts)

- Compare recent aerial imagery to structures on effective profile

- Element fails if there are 5 or more added or removed structures

C7 – Significant channel fill or scour

- Investigation through imagery, National Bridge Inventory points, Flood Insurance Study, or Letters of Map Revision

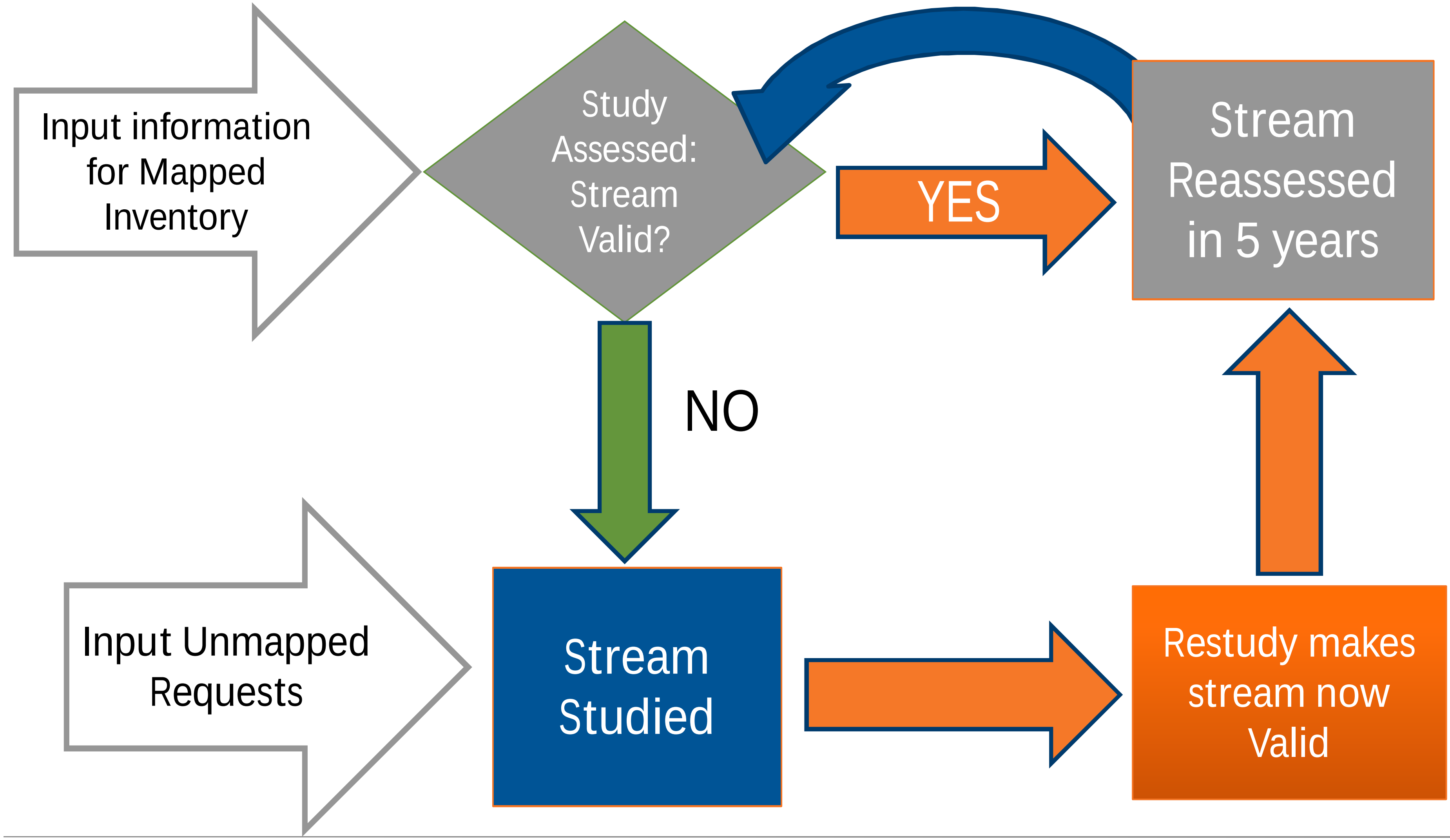
CNMS – Secondary Elements

- Use of rural regression equations in urban area
- Repetitive Losses outside SFHA
- Increase of 50% or more in impervious area
- 1-4 new or removed hydraulic structures
- Channel Improvements / Shoreline Changes

CNMS – Secondary Elements

- Availability of better topography
- Changes in vegetation or land-use
- Significant storms with High Water Marks
- New Regression Equations

CNMS – Lifecycle



CNMS – Reporting

New, Valid, or Updated Engineering (NVUE) Metric

$$\text{NVUE \% Attained} = \frac{New+Valid+Updated\ Engineering}{Total\ Stream\ Miles\ in\ SFHA}$$

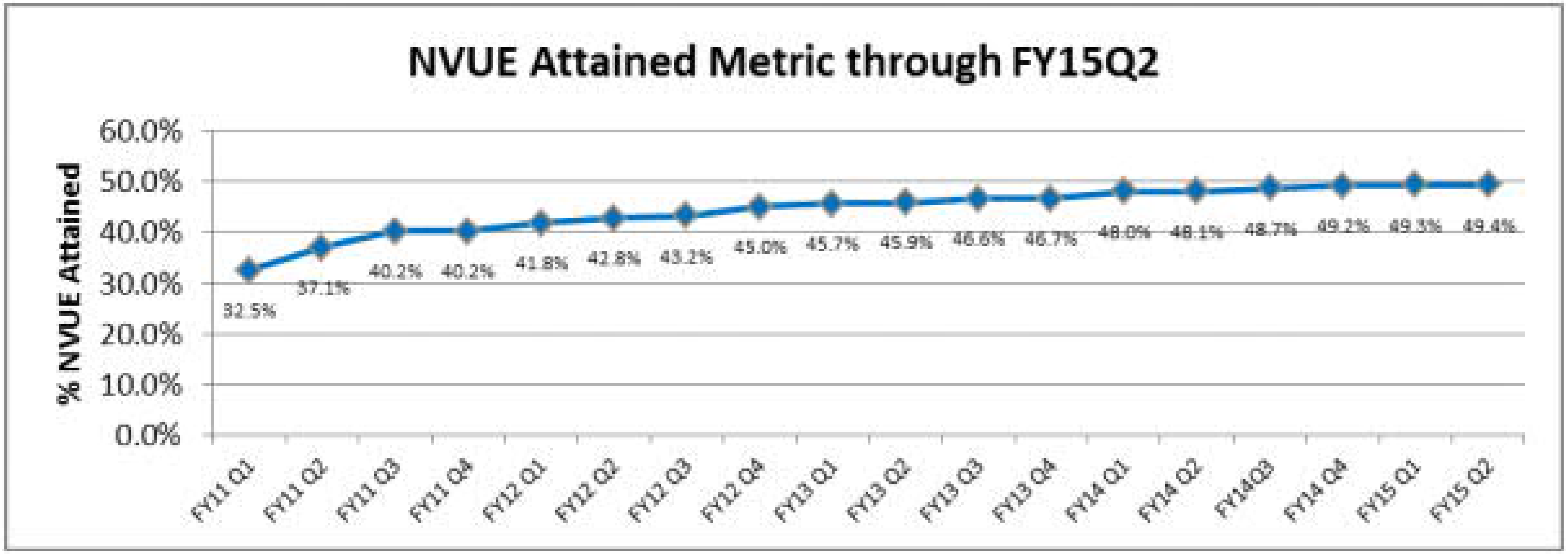


Figure 1: NVUE Percentage of Increase from 2011

CNMS – Moving Forward

Tiers for categorizing maturity of the flood hazard data product

Tier 0: Area known to be flood prone but not yet identified as SFHA on a regulatory FIRM

Tier 1: SFHA not available in digital format

Tier 2: SFHA available as a digital product, but not known to be model-backed

Tier 3: SFHA available as a digital product, model-backed, consistent with high quality elevation data

Tier 4: SFHA available as a digital product, and includes analyses such as future land use or future climate-informed analyses

CNMS – Moving Forward

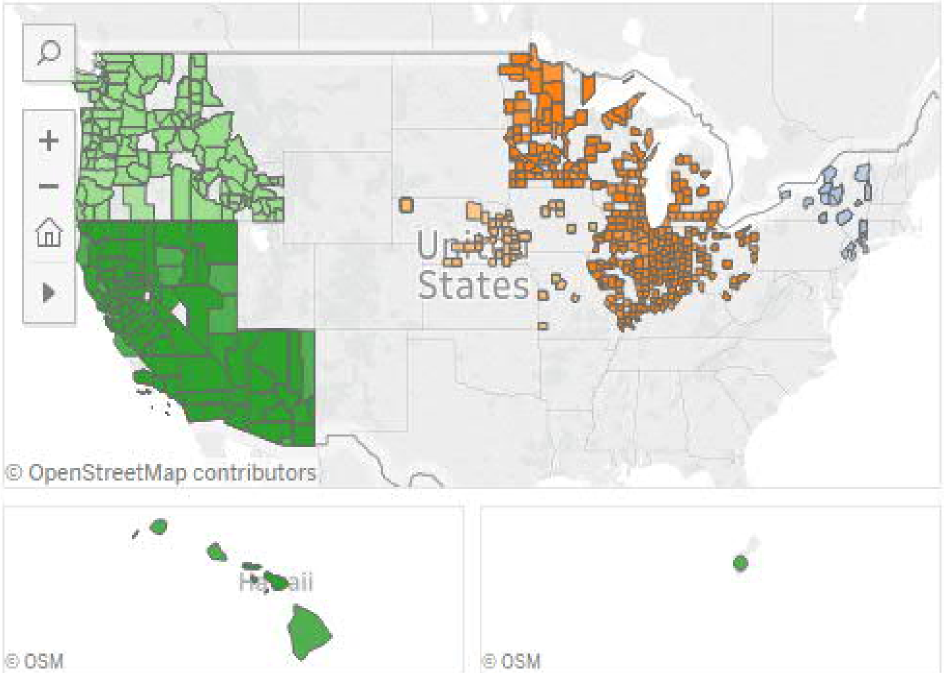
Tableau for data visualization:

SO3

Region	State	County	Study Type	HUC8	Stream Name
(All)	(All)	(All)	(All)	(All)	(All)

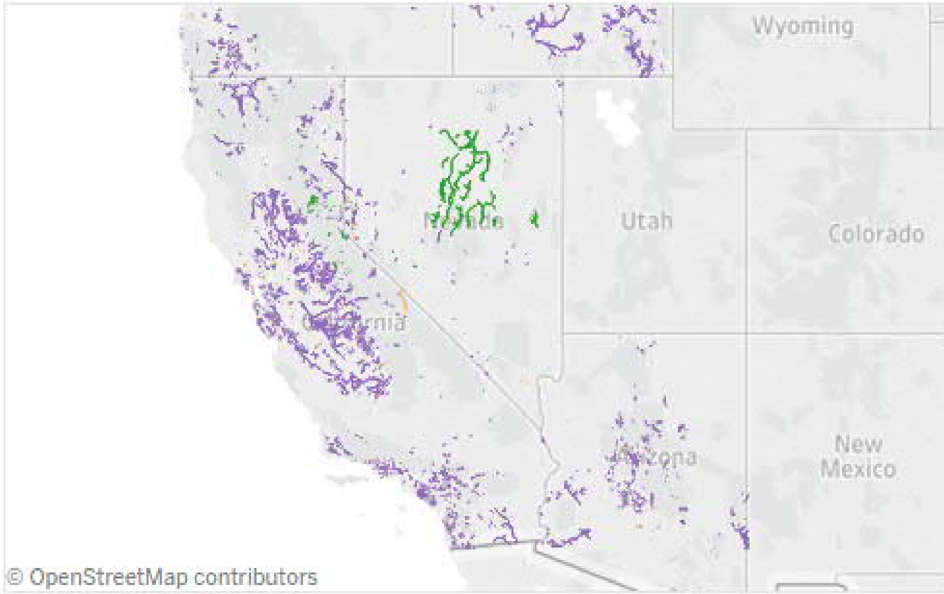
# Counties	# Reaches	Miles	Expiring Approx,	Expiring Detail	Unknown Approx.	Unknown Detail
580	36,336	60,792 mi.	15,380 mi.	3,033 mi.	42,097 mi.	282 mi.

County View



2 5 7 9 10

CNMS Miles



- A - Expiring Detailed and Approximate NVUE Miles for FY17Q3-FY18Q2
- B - Expiring Detailed and Approximate NVUE Miles for FY18Q3-FY19Q2
- C - 100% of remaining Unknown Approximate and Detail Miles

Questions