NHDPlus and the National Water Model

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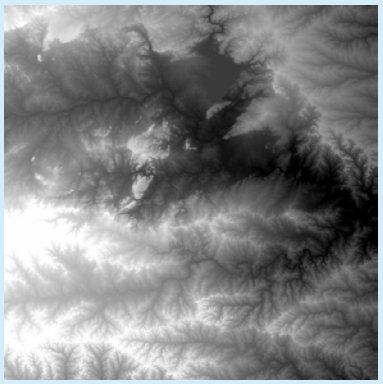
NHDPlus Version 2

Geospatial foundation for a national water data infrastructure

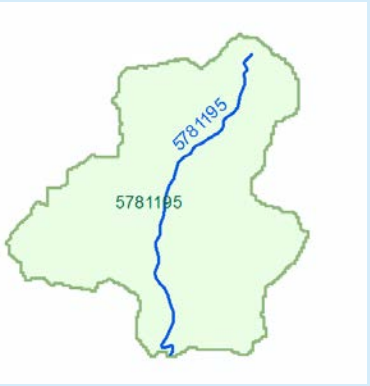


National Elevation Dataset

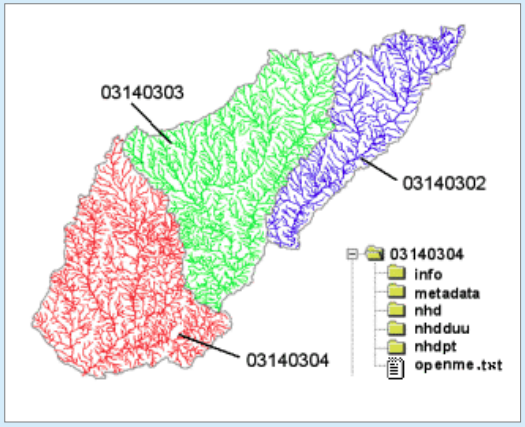
NHDPlus

2.67 million reach catchments in US
average area 3 km^2
reach length 2 km

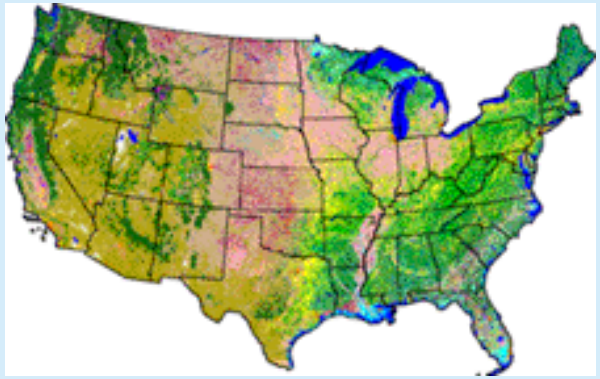
Watershed Boundary Dataset



National Hydrography Dataset



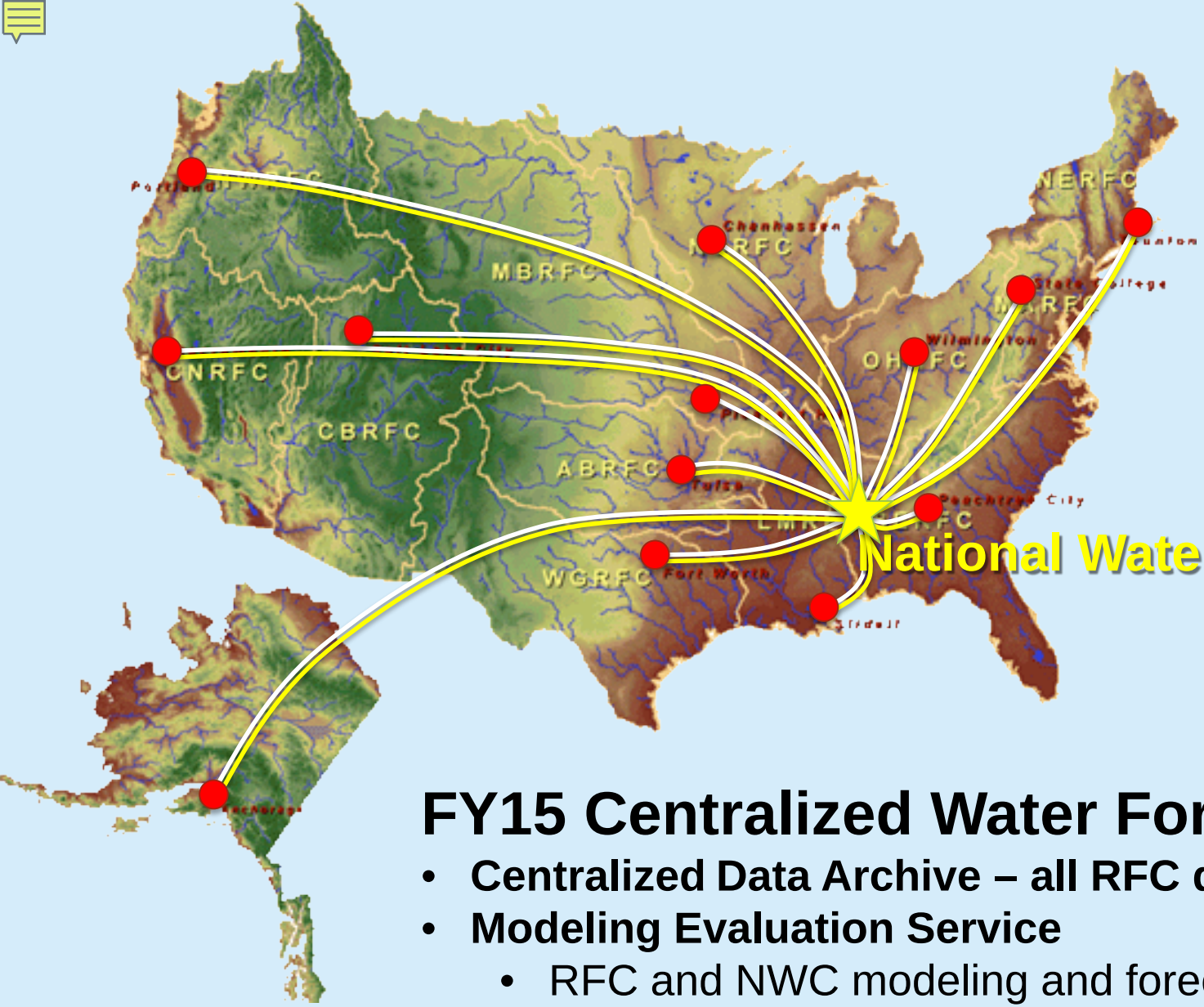
National Land Cover Dataset



The Opportunity

New National Water Center established on the Tuscaloosa campus of University of Alabama by the National Weather Service and federal agency partners

Has a mission to assess hydrology in a new way at the continental scale for the United States

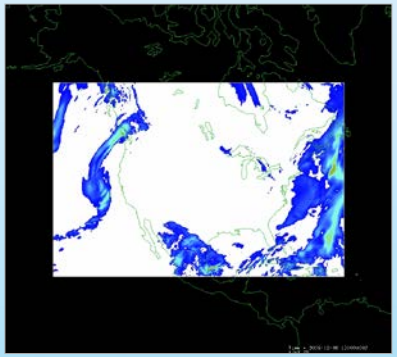


FY15 Centralized Water Forecasting

- **Centralized Data Archive – all RFC data**
- **Modeling Evaluation Service**
  - RFC and NWC modeling and forecasts
- **Modeling Testbed – new NWC capabilities**
- **Centralized Water Forecasting Demonstration**

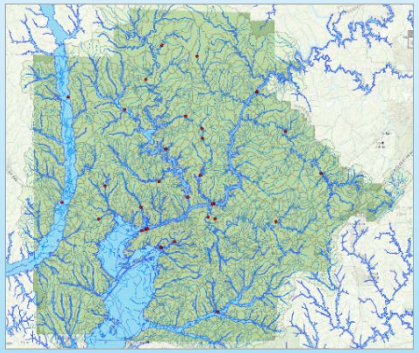
Continental Scale Flood Forecasting

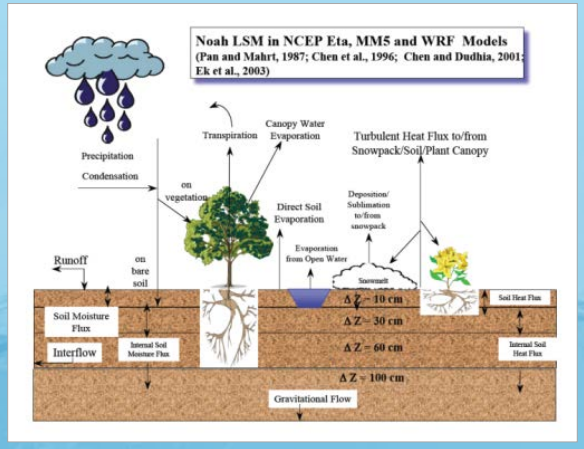
Meteorology



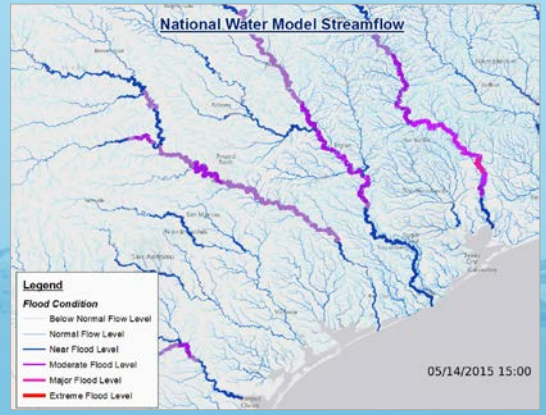
2.7 million catchments

Mapping and Impacts



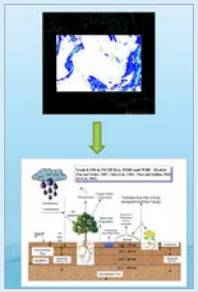


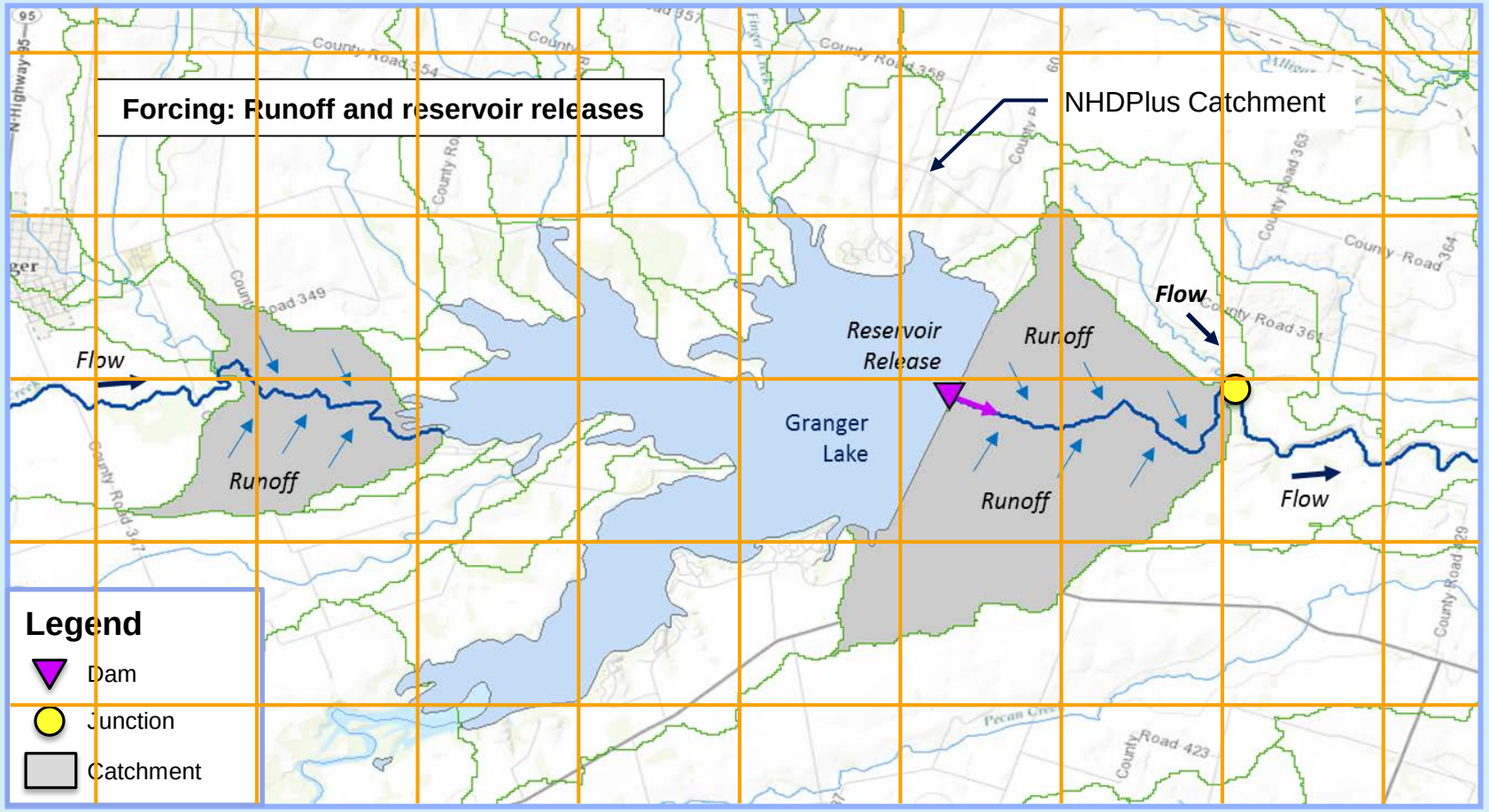
Hydrology



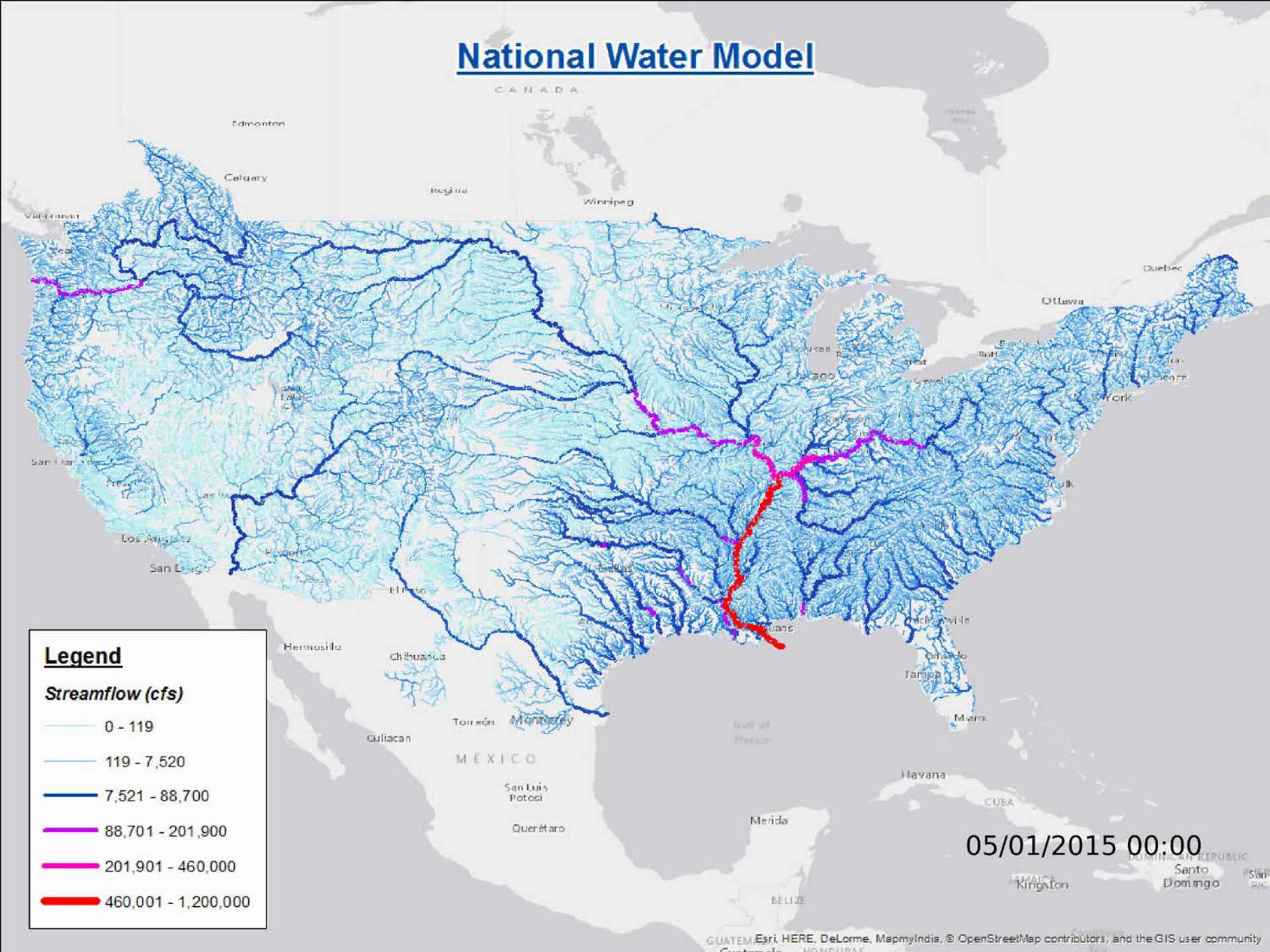
Hydraulics

Combining Grid and Vector Modeling





National Water Model



Flow Continuum Model – a national stream network, atmosphere to oceans, coast to coast

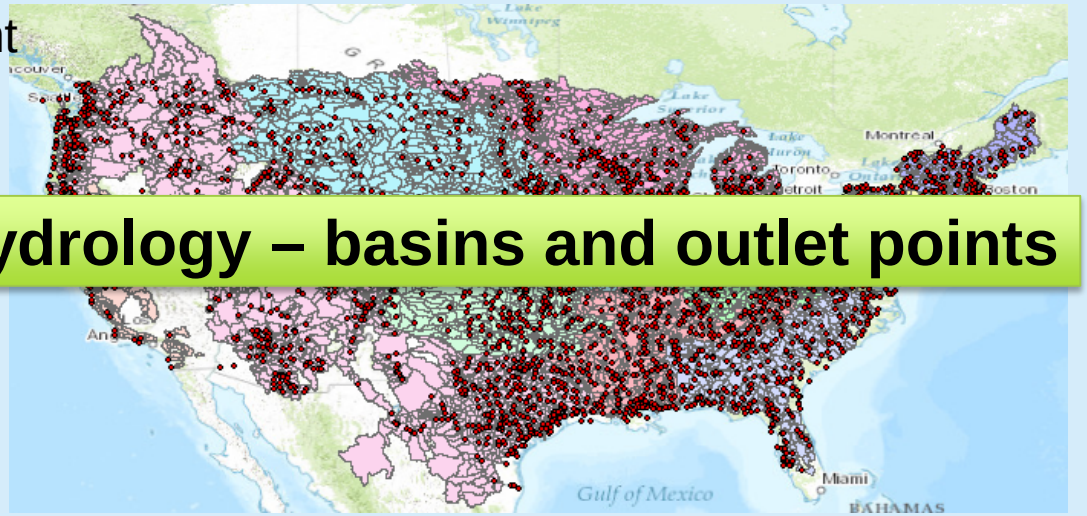
Blanco River at Wimberley

Two basins and one forecast point

becomes

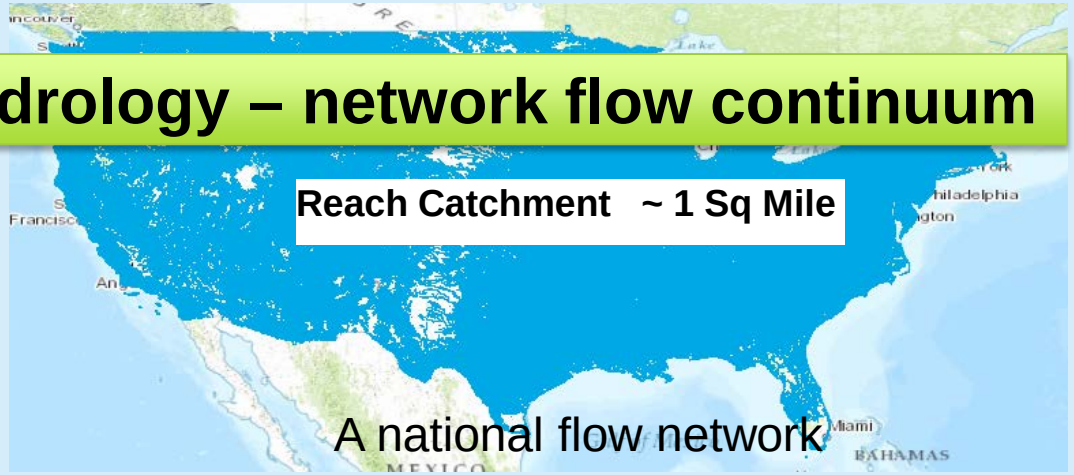
130 Catchments and Flowlines uniquely labelled

Current: 6600 basins and 3600 forecast points



Watershed Hydrology – basins and outlet points

NFIE: 2.7 million stream reaches and catchments



Continental Hydrology – network flow continuum

A national flow network

Experiment for 2016:

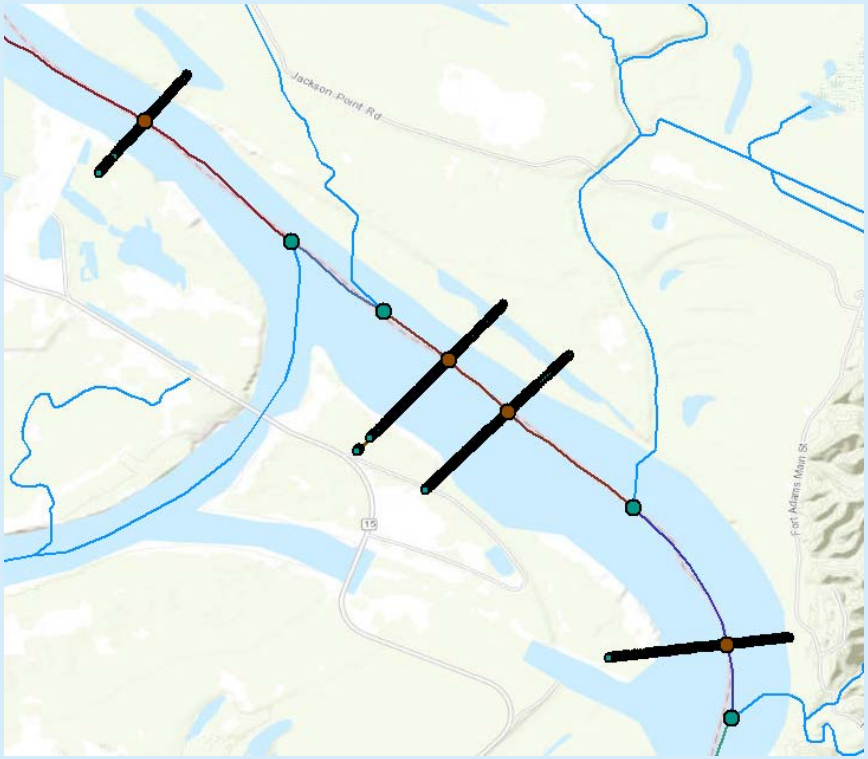
Combine hydrography and elevation to define river channel geometry and flood inundation extent for 5 million km of stream reaches over continental US

National Hydrography Dataset

National Elevation Dataset

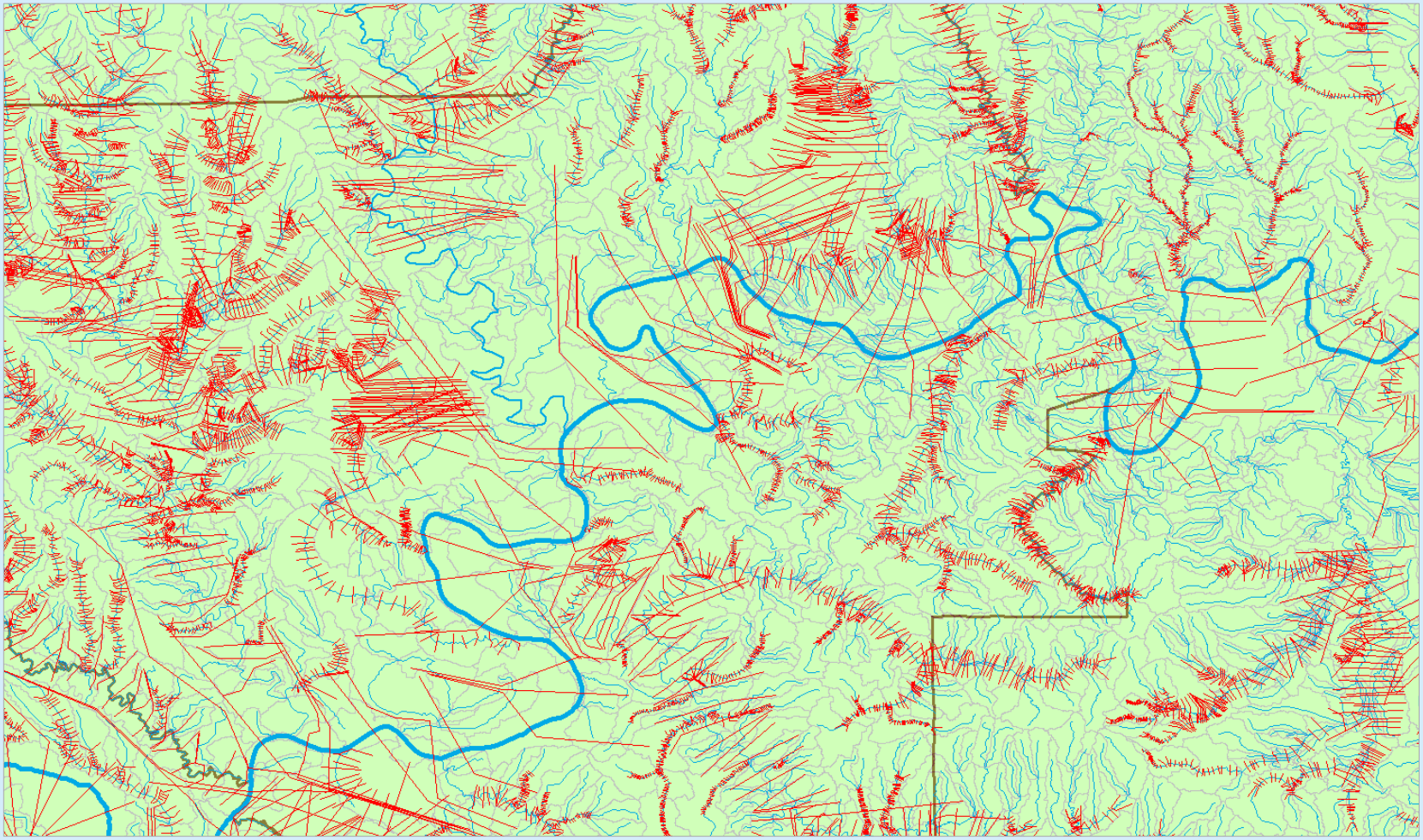
Use the CyberGIS computing facility
at the University of Illinois at Urbana-Champaign

Cross-Sections on Lower Mississippi River for Hydraulic River Routing



173 cross-sections over 543 km, or 3.1 km between cross-sections, on average
41,479 cross-section points (x,y,z) of bed elevation, or 240 points per cross-section, on average

Cross-Sections for Alabama Rivers compiled in NFIE-I

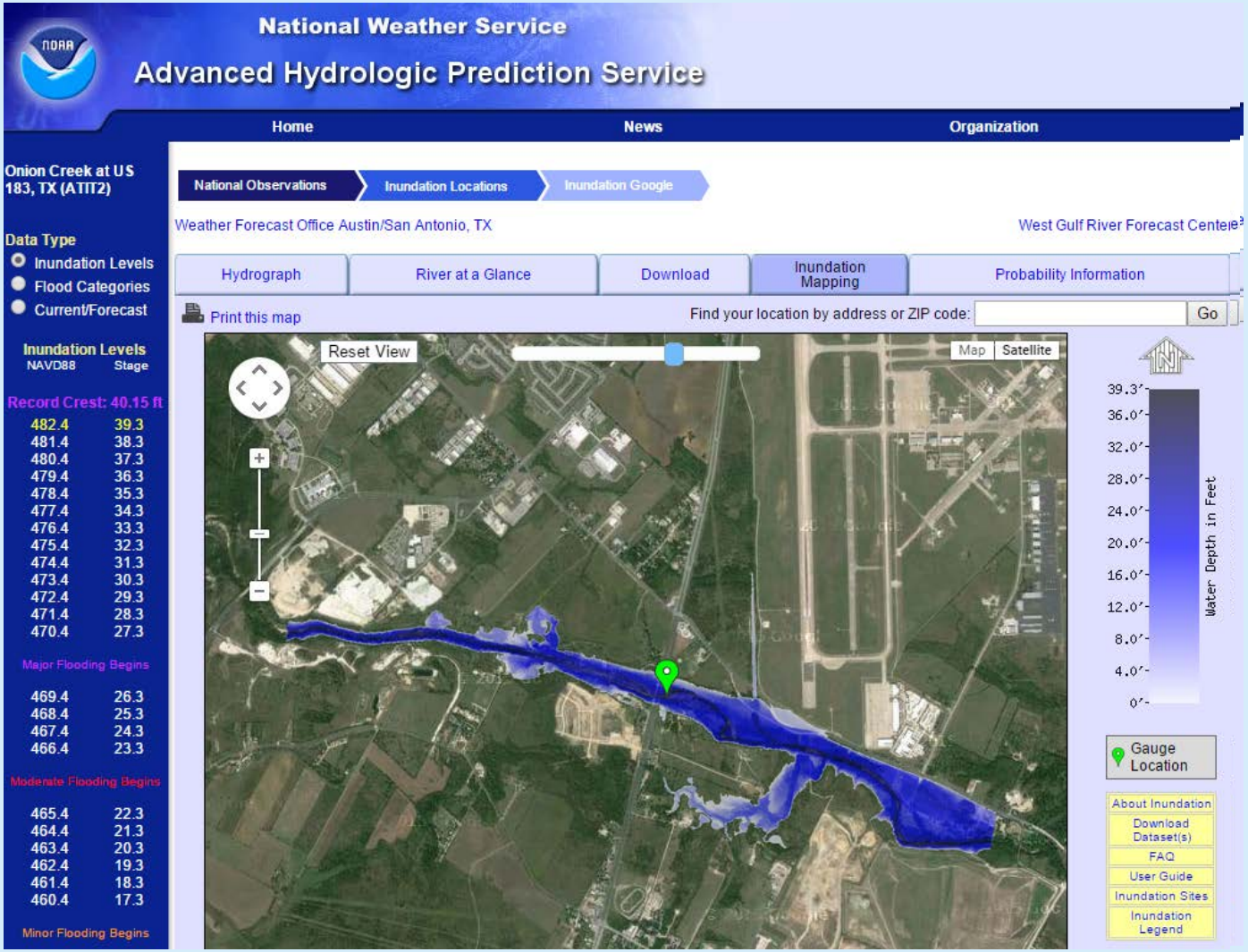


Conclusion: Many studies done independently have lots of overlaps and gaps

NWS Flood Inundation Maps for the US (130 in total)

33 maps in Texas (one quarter of total)

Real-Time Flood Inundation Mapping (USGS/NWS)

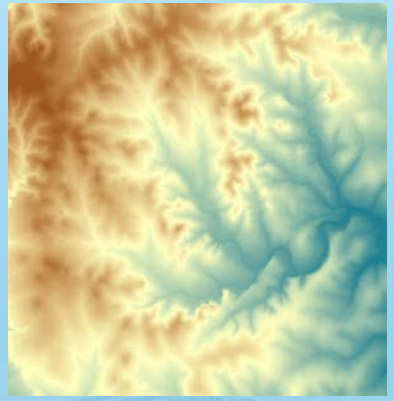


http://water.weather.gov/ahps2/inundation/inundation_google.php?gage=atit2

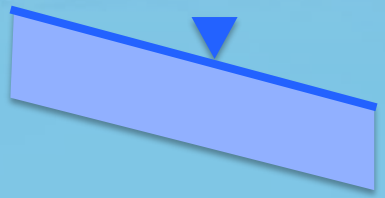
Flood Inundation Mapping – NHDPlus-HAND Method

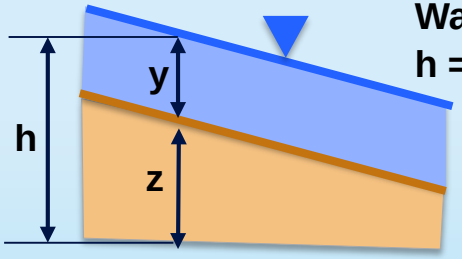
NHDPlus

Catchments and Flowlines



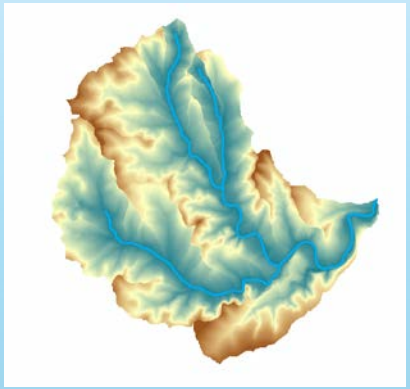
Digital Elevation Model



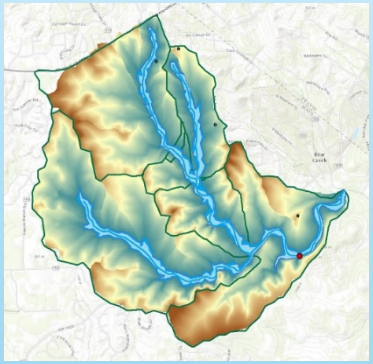


Water surface elevation
h = z + y

Geodetic datum



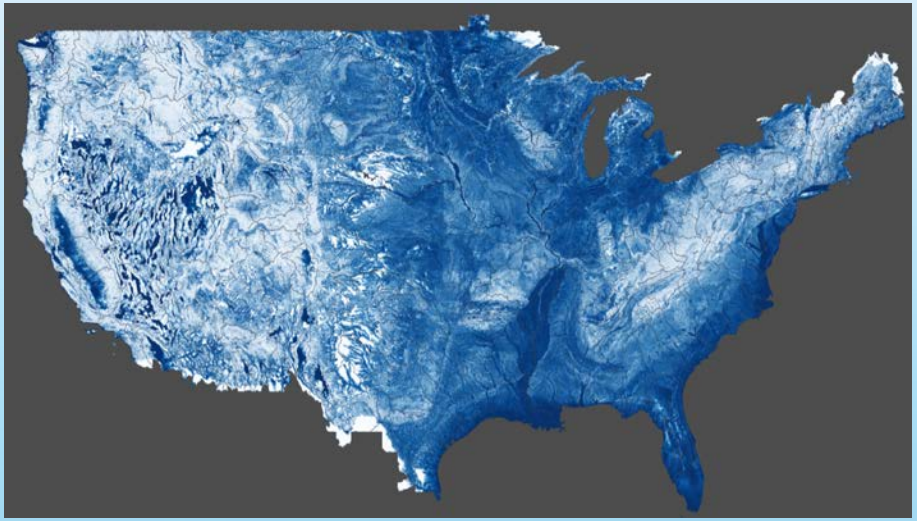
Height Above Nearest Drainage (HAND)
(relative elevation of land surface cell above cell in NHDPlus stream to which it flows)



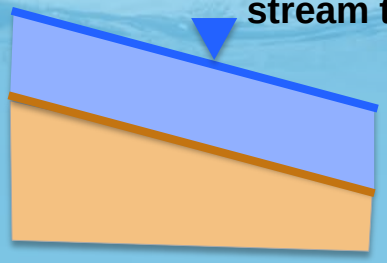
Inundation map
Height above drainage < 15 ft)

Continental-Scale Flood Inundation Mapping

Catchments and Flowlines

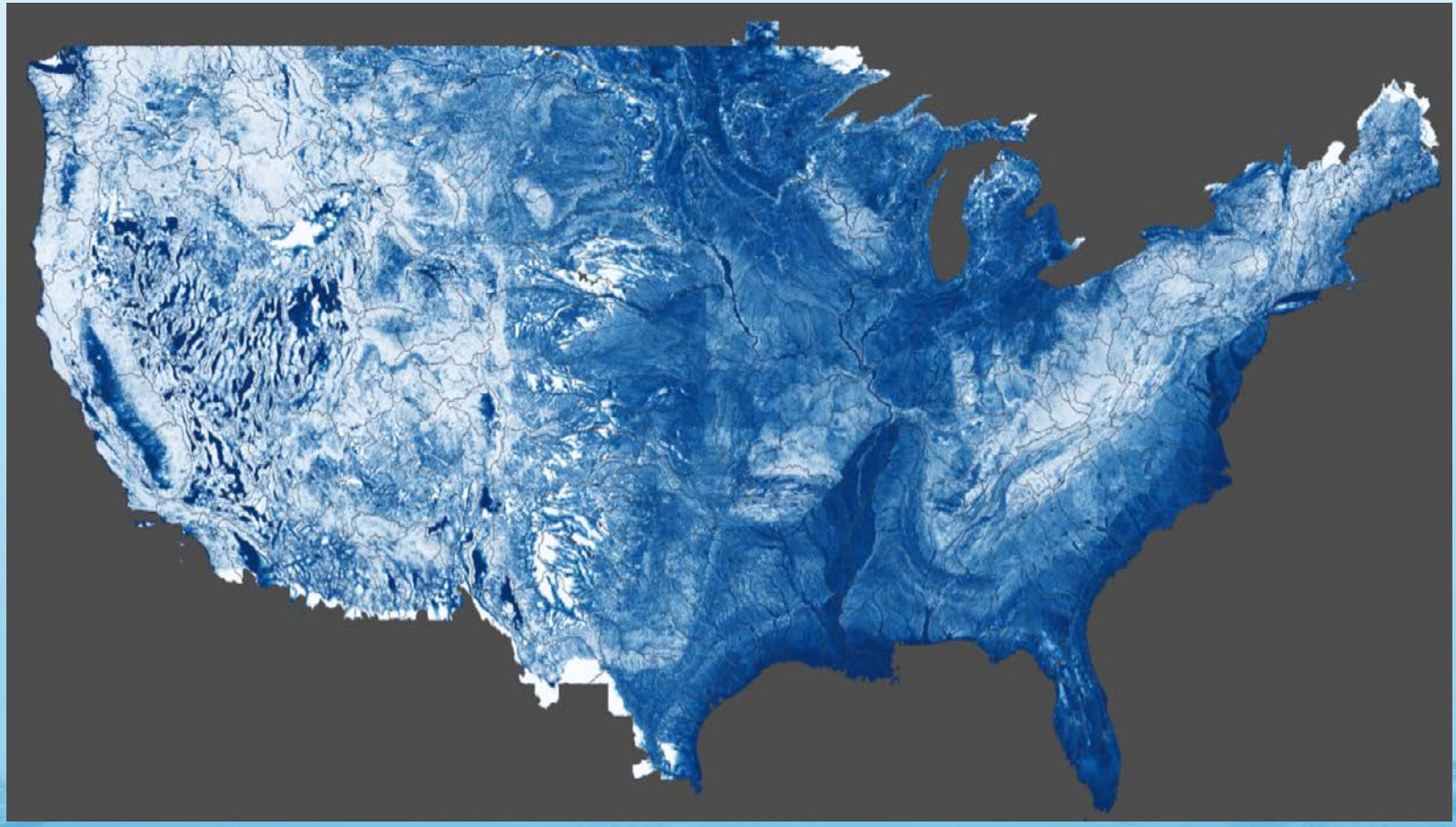


Digital Elevation Model



Height Above Nearest Drainage (HAND)
(relative elevation of land surface cell above cell in stream to which it flows)

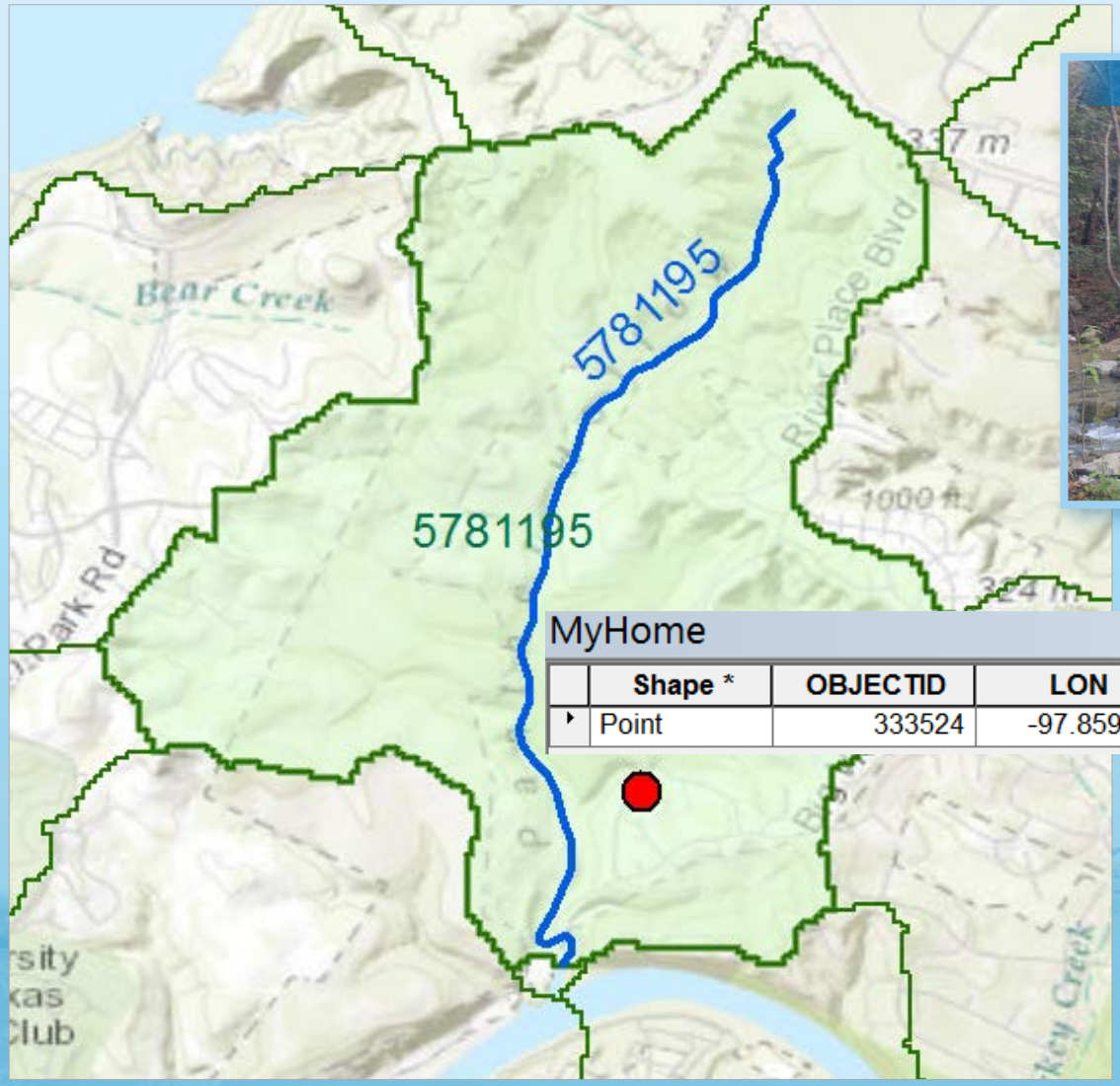
Height Above Nearest Drainage for the Continental United States

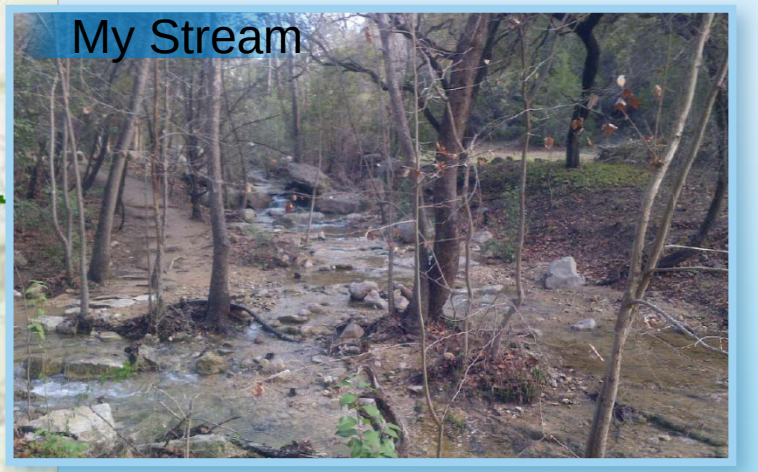


Source: Yan Liu, University of Illinois at Urbana-Champaign

http://141.142.168.44/nfiedata/maps/#source=..%2Fyanliu%2Fviz%2Fhuc6.json&extent=-128.3203125_22.1484375_-66.884765625_55.634765625

My Home Catchment and Address Point





Panther Creek

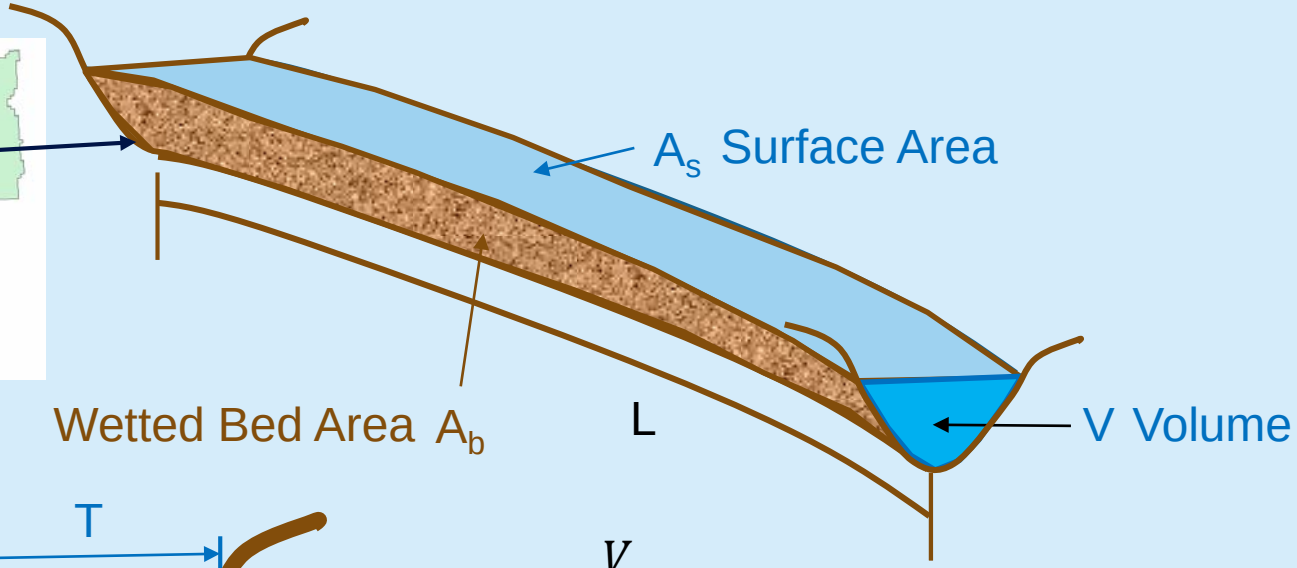
MyHome

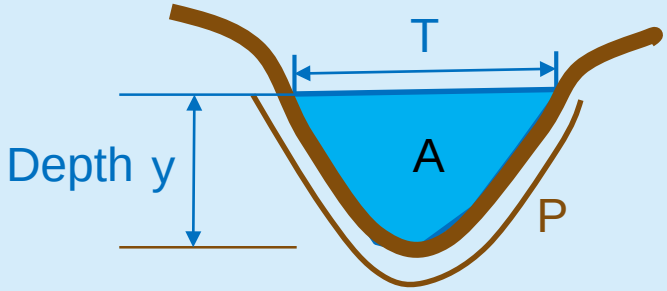
	Shape *	OBJECTID	LON	LAT	NUMBER_	STREET
▸	Point	333524	-97.859838	30.363981	3728	Josh Lane

Height Above Nearest Drainage at my Home

Reach Hydraulic Parameters

Comid	y	A	R	P	T	V	Ab	As
5781175	3							
5781175	4							





$A = \frac{V}{L}$ Cross Section Area

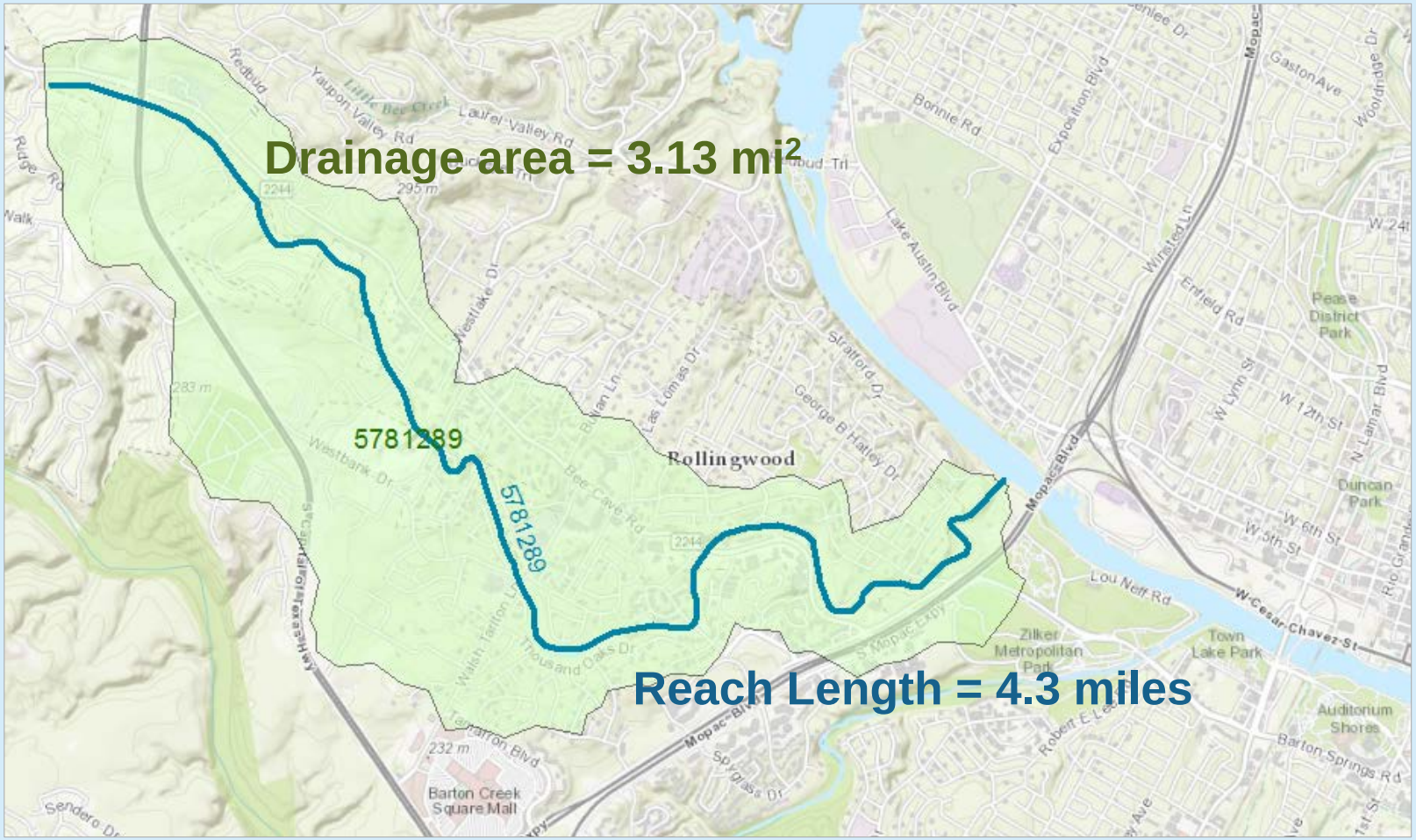
$P = \frac{A_b}{L}$ Wetted Perimeter

$T = \frac{A_s}{L}$ Top Width

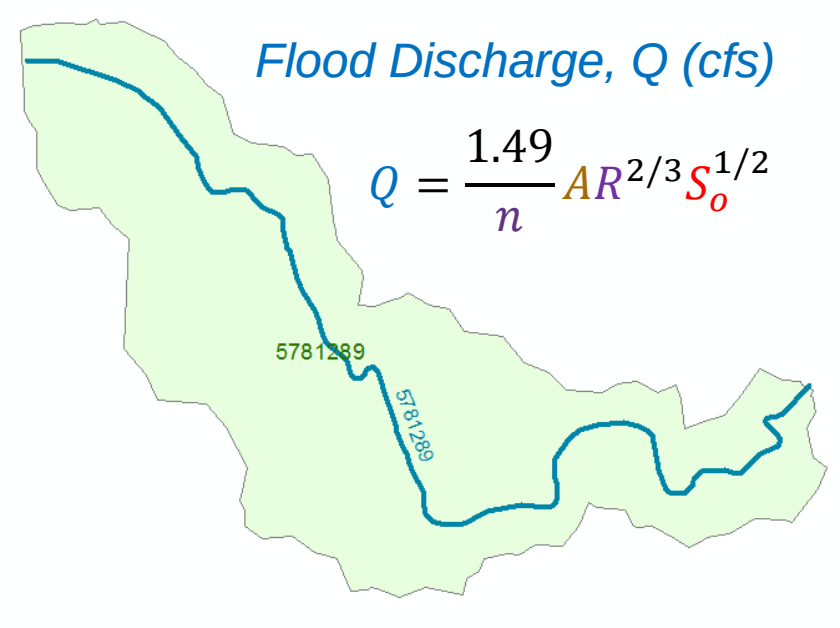
$R = \frac{A}{P}$ Hydraulic Radius

Reach Catchment 5781289

Eanes Creek, Rollingwood, Texas

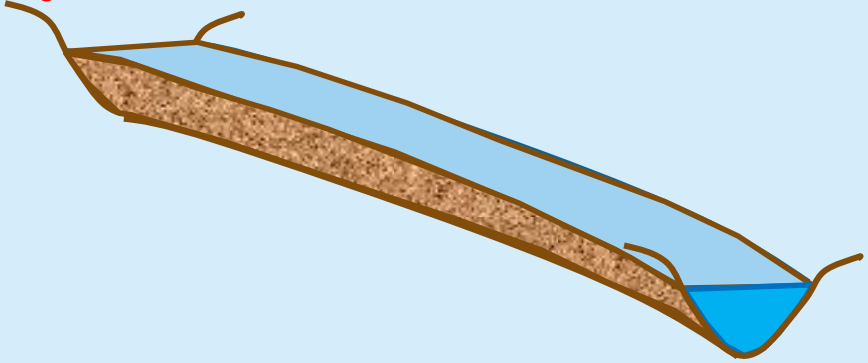


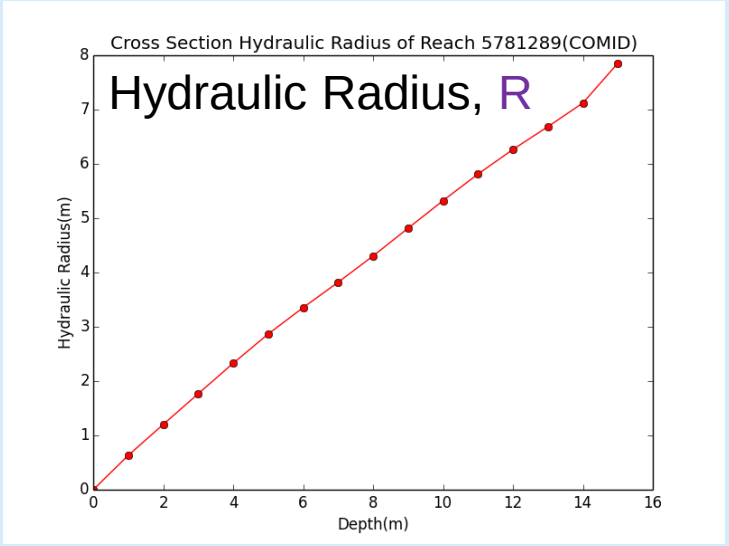
Discharge Computation



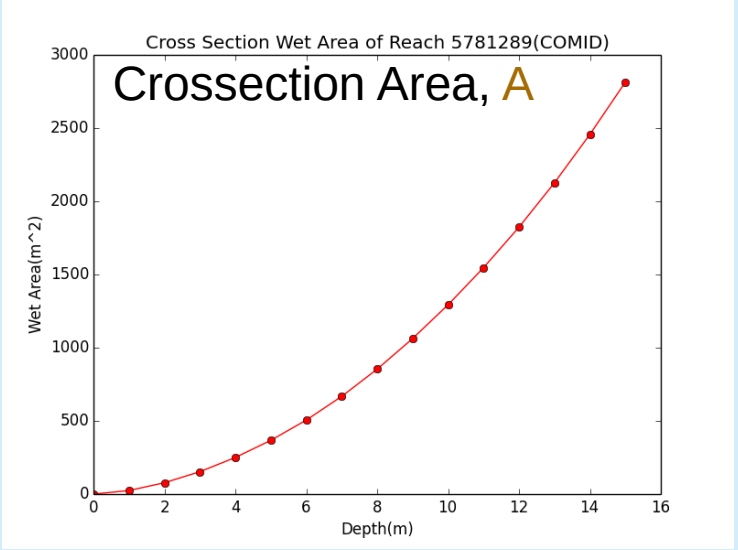
n = 0.035 Manning roughness of channel

S_o = 0.0163 Bed slope

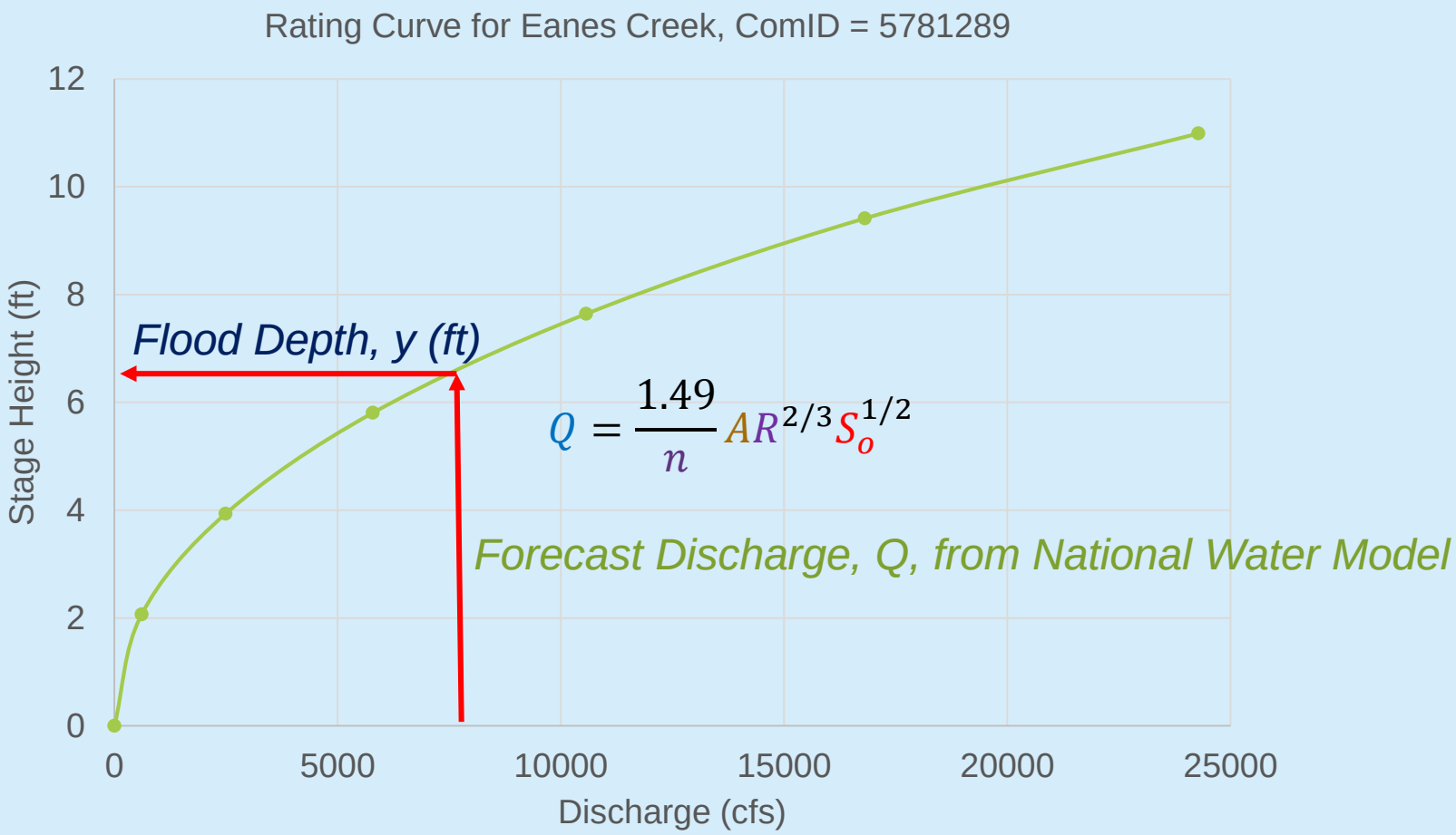




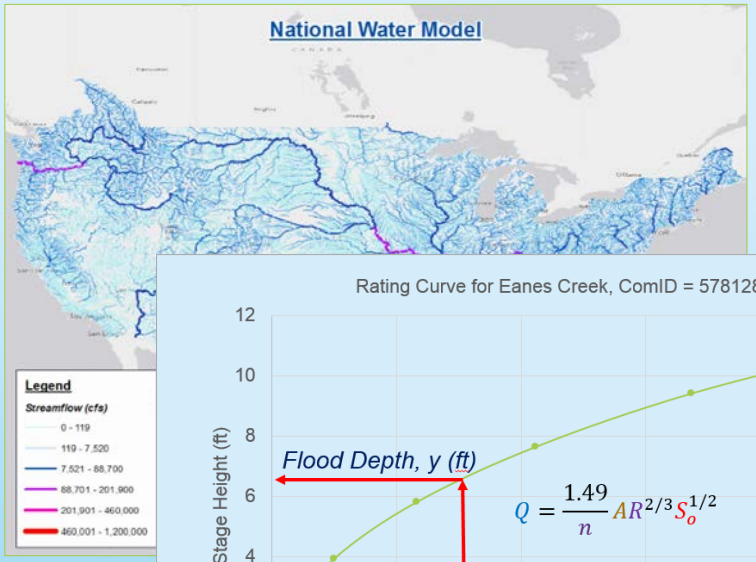
Flood Depth, h (ft)



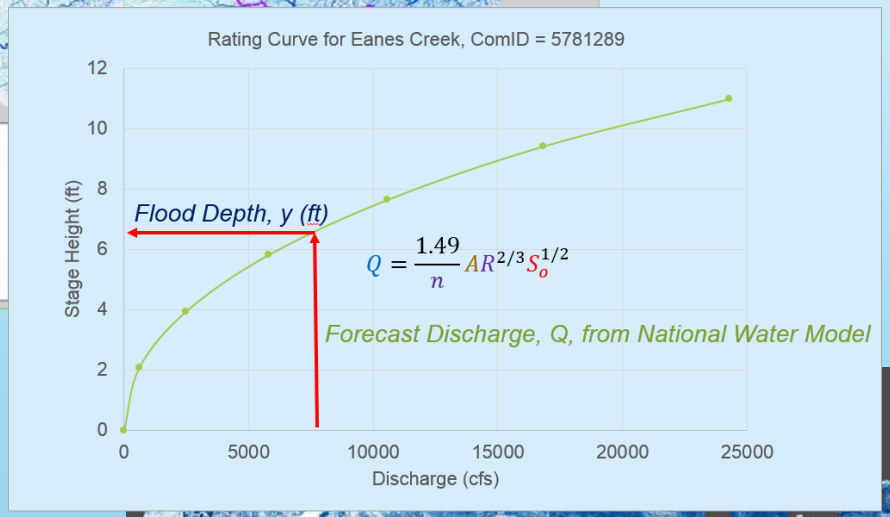
Rating Curve for Eanes Creek



Continental-Scale Flood Inundation Mapping



1



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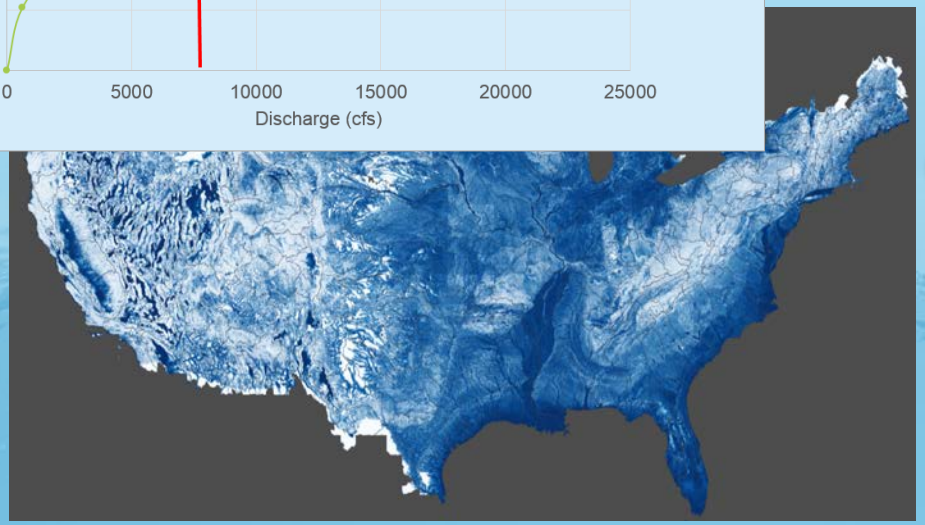


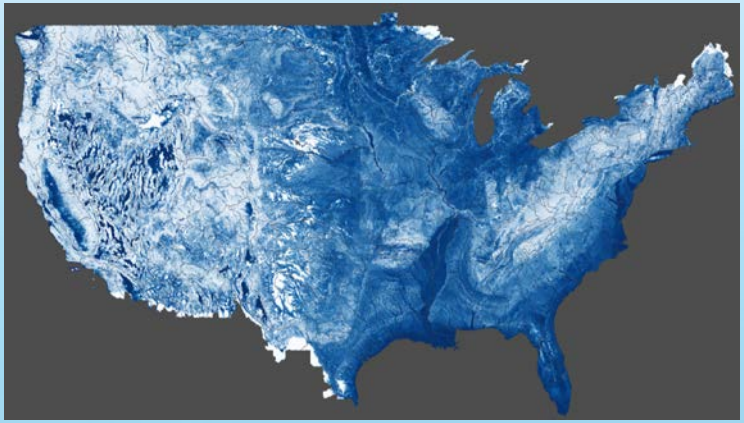
3

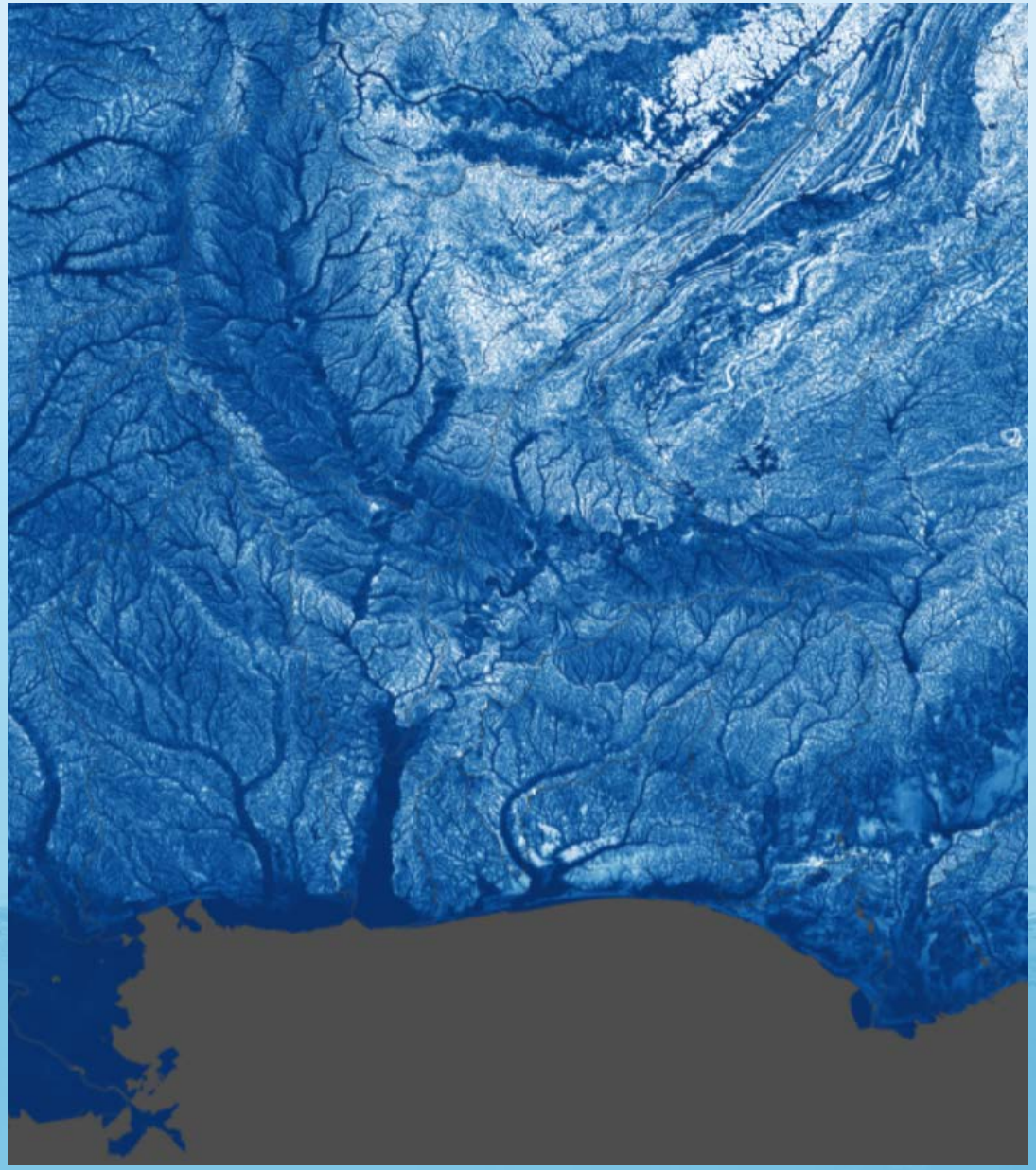
1. Forecast discharge with National Water Model

2. Convert discharge to depth using rating curve

3. Convert depth to inundation using HAND

Height Above Nearest Drainage for Alabama





Tuscaloosa County Address Points

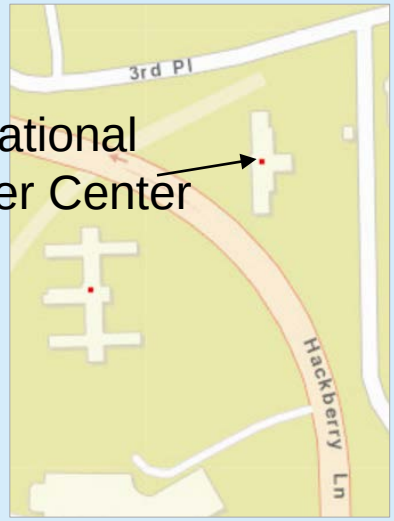
80986 Address Points
2526 Building Campsites
619 Mobile Homes
81,605 Total

TuscaloosaCo_Subdivisions_Mobile_Home_Parks

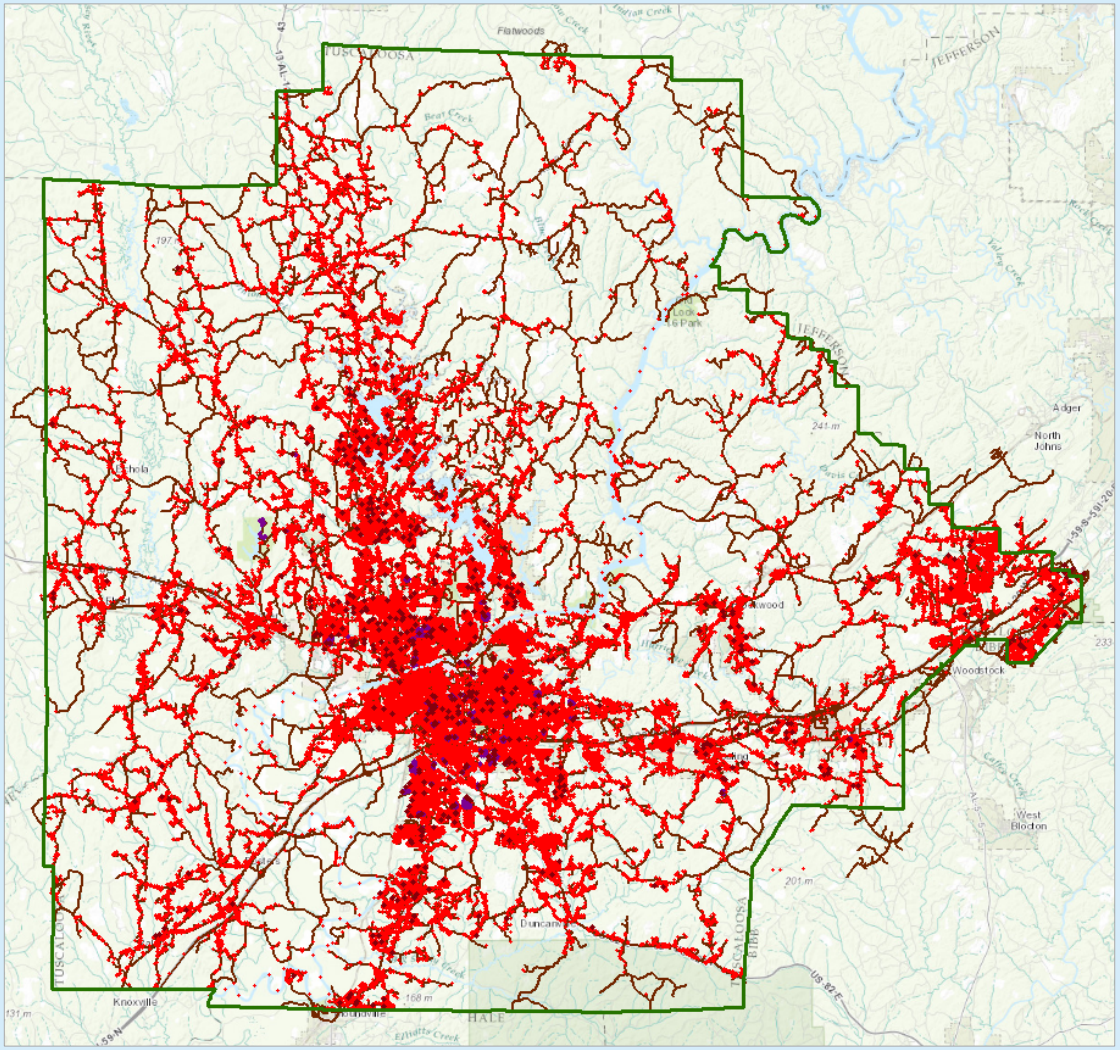
TuscaloosaCo_Lot_Building_Campsite_Numbers

TuscaloosaCo_Address_Points

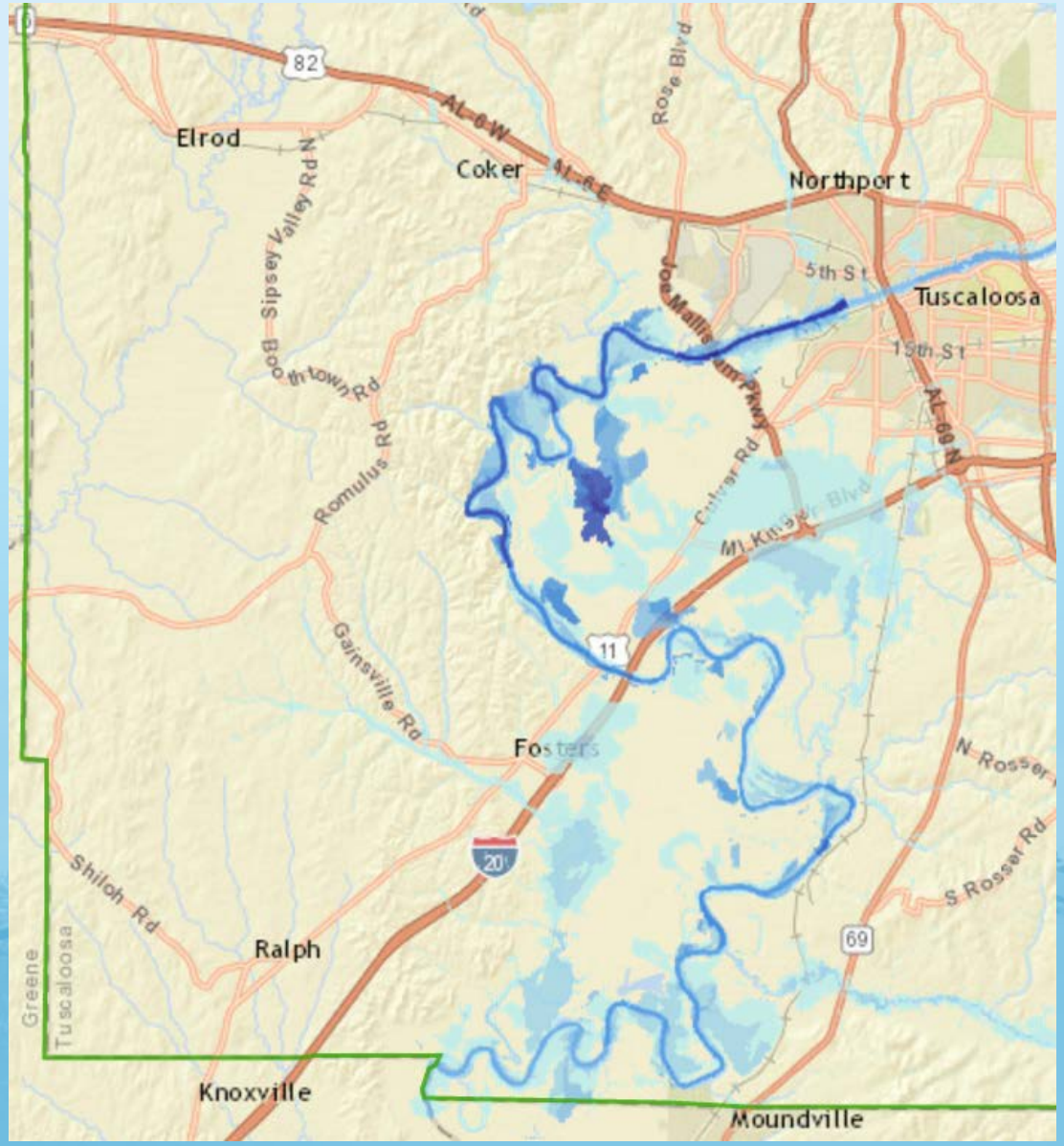
TuscaloosaCo_Roads



National
Water Center



Flood Inundation Mapping Computed with HAND



Normal Conditions

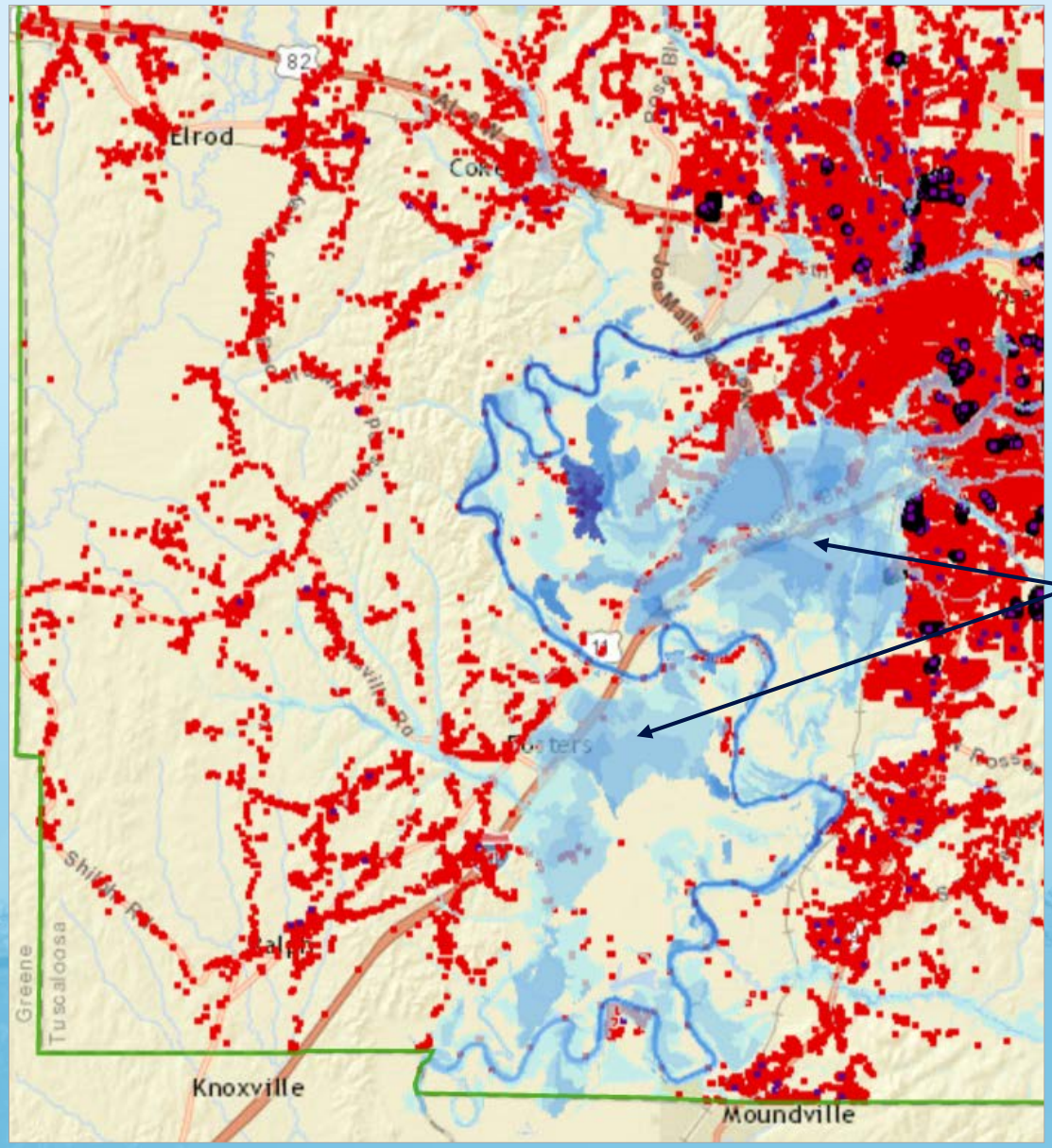
Start to Rise

Main Flooding

Start to Recede

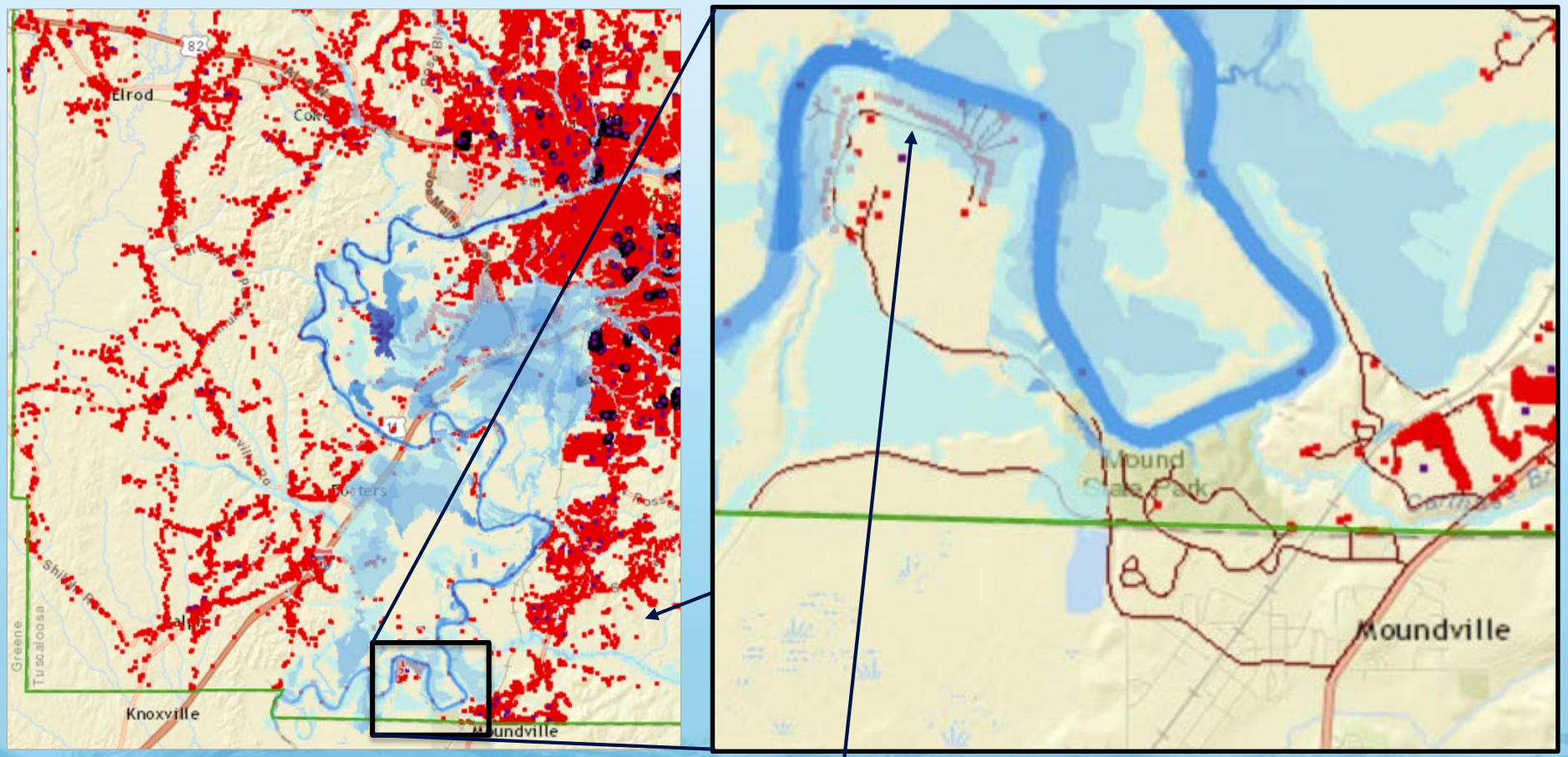
Returning to Normal

Address Points and Flooding



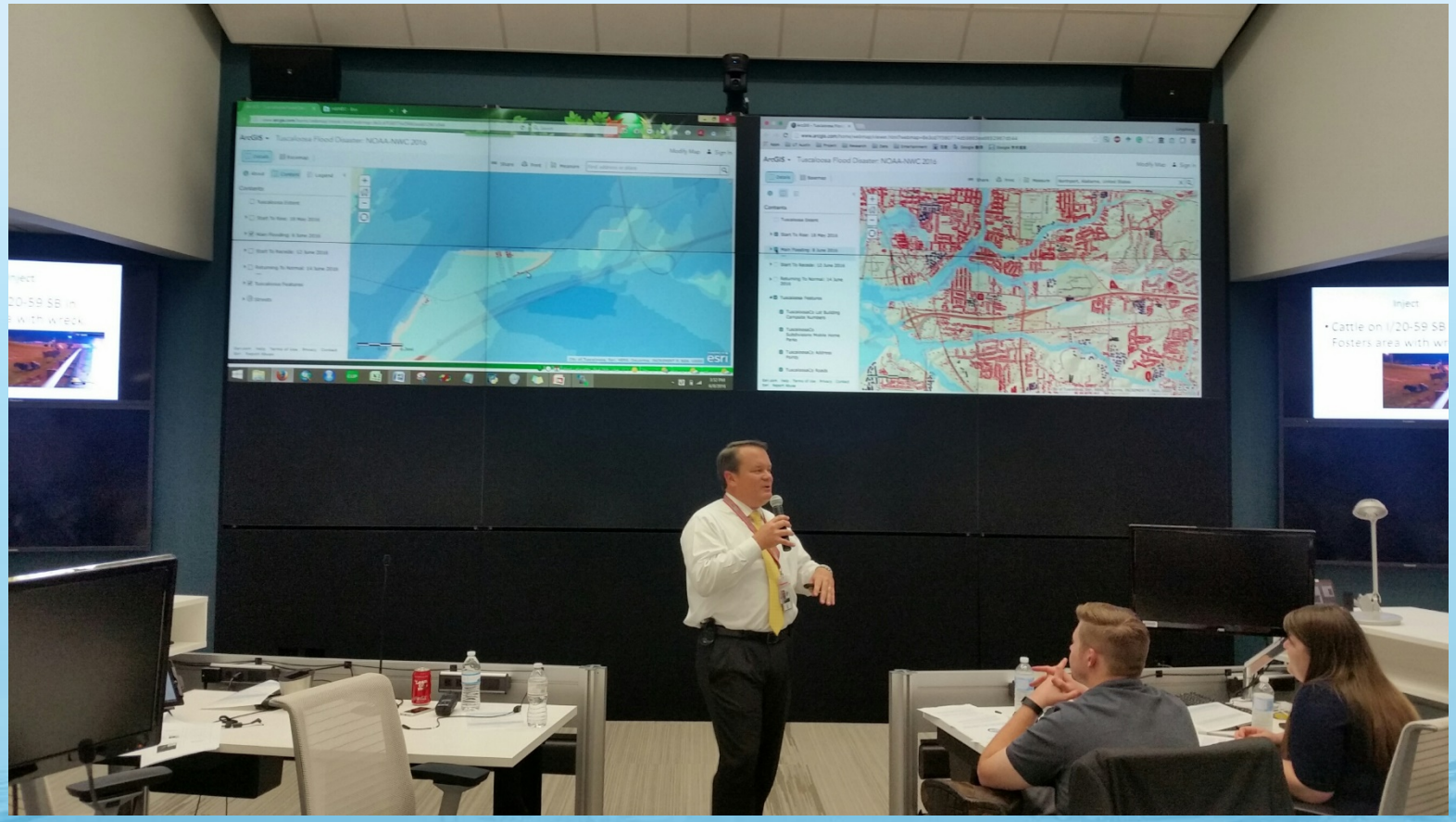
People don't live in flooded area

Area of Concern in Moundville

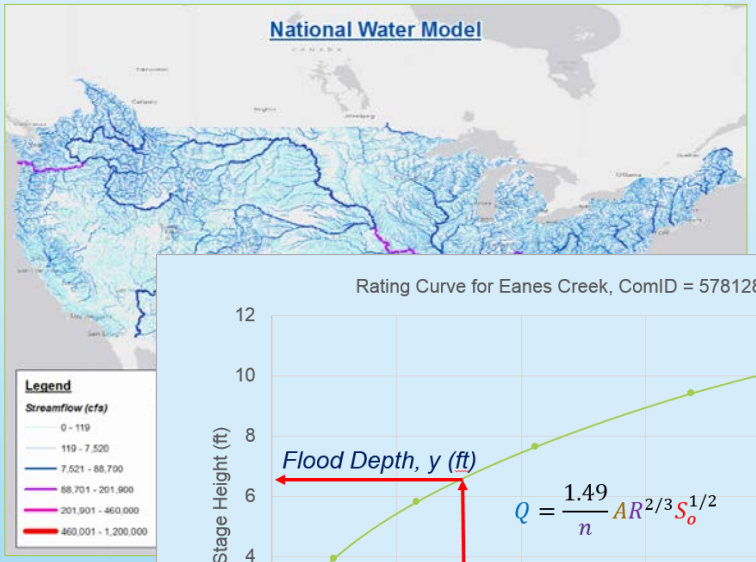


People trapped by floodwaters

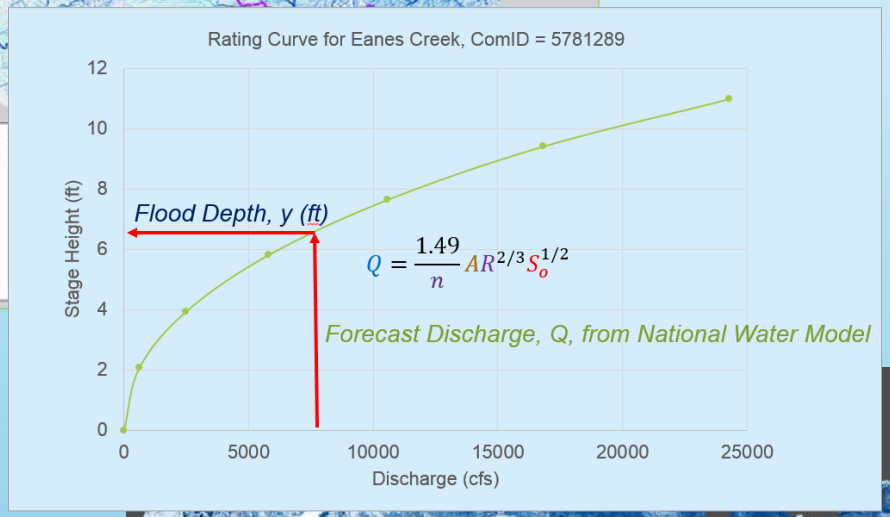
Flood Emergency Response Exercise for Tuscaloosa County



Continental-Scale Flood Inundation Mapping



1



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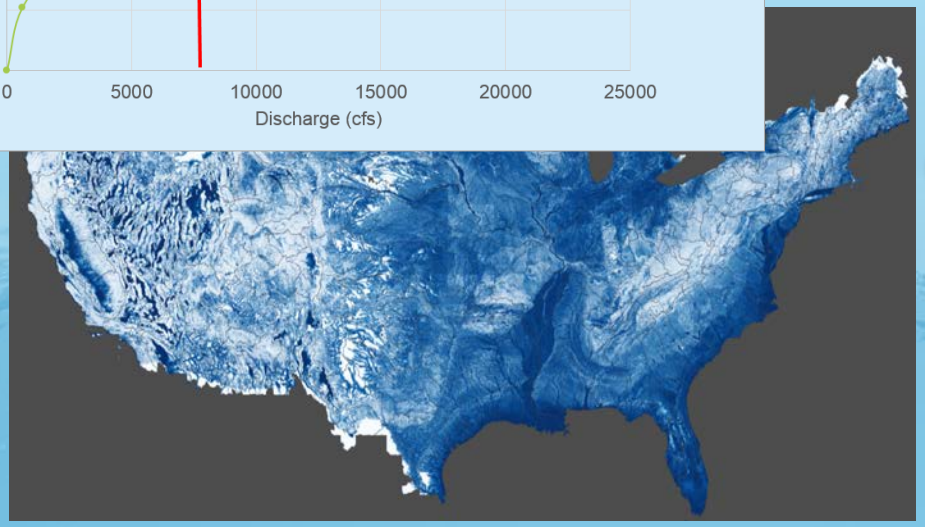
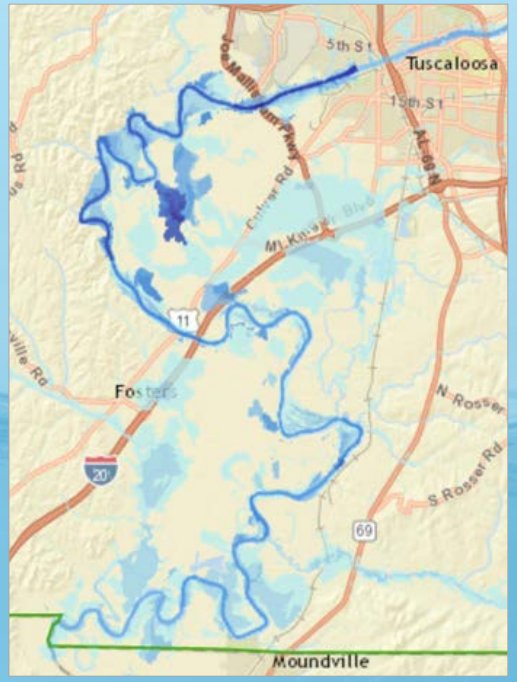


3



1. Forecast **discharge** with National Water Model

2. Convert discharge to **depth** using rating curve

3. Convert depth to **inundation** using HAND

Principles for Flood Inundation Mapping

- Continental flow network continuum
- Top down not bottom up
- Separate modeling from mapping
- Terrain continuum rather than cross-sections
- Stream bed as stage height datum
- Height Above Nearest Drainage for inundation
- Geospatial image services for mapping
- Address Points to connect with Emergency Response