NC Flood Risk: Strategies for Resilience

NC Environmental Management Commission

Water Allocation Committee

13 March 2019

Integrated Hazard Risk Management – Legislative Intent

G.S. 166A-19.12 **Powers of the Division of Emergency Management.**

(14) Serving as the **lead State agency for the coordination of information and resources for hazard risk management**, which shall include the following responsibilities:

a) Coordinating with other State agencies and county governments in **conducting hazard risk analysis.**

b) Establishing and maintaining a hazard risk management information system and tools to display natural hazards and vulnerabilities and conducting risk assessment.

c) Acquiring and leveraging all natural hazard data ~~generated or maintained~~ by State agencies and county governments.

d) Acquiring and leveraging all vulnerability data generated or maintained by State agencies and county governments.

e) Maintaining a clearinghouse for methodologies and metrics for calculating and communicating hazard probability and loss estimation.

STATE HAZARD MITIGATION PLANNING

- NCEM supports activities at the local level including:
- Supporting the development of local hazard mitigation plans.
- Providing technical assistance and training to local governments to assist in applying for HMGP grants; and
- DMA 2000 identifies new requirements that allow HMGP funds to be used for planning activities and increases the amount of HMGP funds available to states that have a FEMA approved plan.
- From a minimum of 7.5% up to a maximum of **20% of the total disaster declaration funding. ('Enhanced' Plan)**

NC'S ENHANCED STATE PLAN

- All elements of the Standard Plan.
- Integration into other planning documents.
- Demonstrated success with existing mitigation programs and goals.
- Demonstrated commitment to a comprehensive mitigation program.
- Superior Risk Assessment and Vulnerability Assessment

MITIGATION STRATEGY

Capability Assessment

Hazard Mitigation Objectives

Mitigation measures and activities

- *Property Protection from Flooding*
- *Relocation*
- *Acquisition*
- *Building elevation*
- *Floodproofing (dry and wet)*
- *Sewer backup protection*
- *Landscape maintenance*
- *Flood insurance*

5

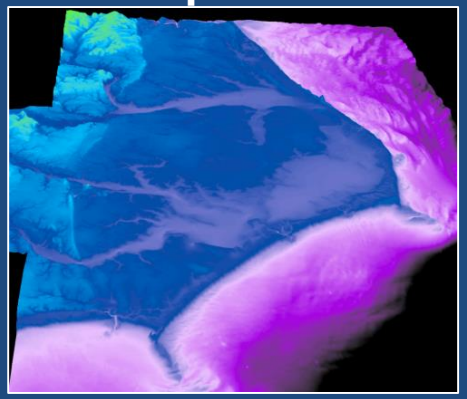
The Vision for Risk MAP

Through collaboration with State, Local, and Tribal entities, Risk MAP will deliver quality data that increases public awareness and leads to action that reduces risk to life and property

How Do We Reach the Resilience Goal?

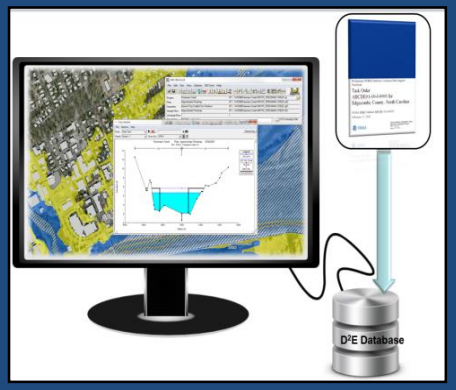
PROGRESSION TO INTEGRATED RISK MANAGEMENT

Framework Data Acquisition



Hazard Mapping

Digital Display

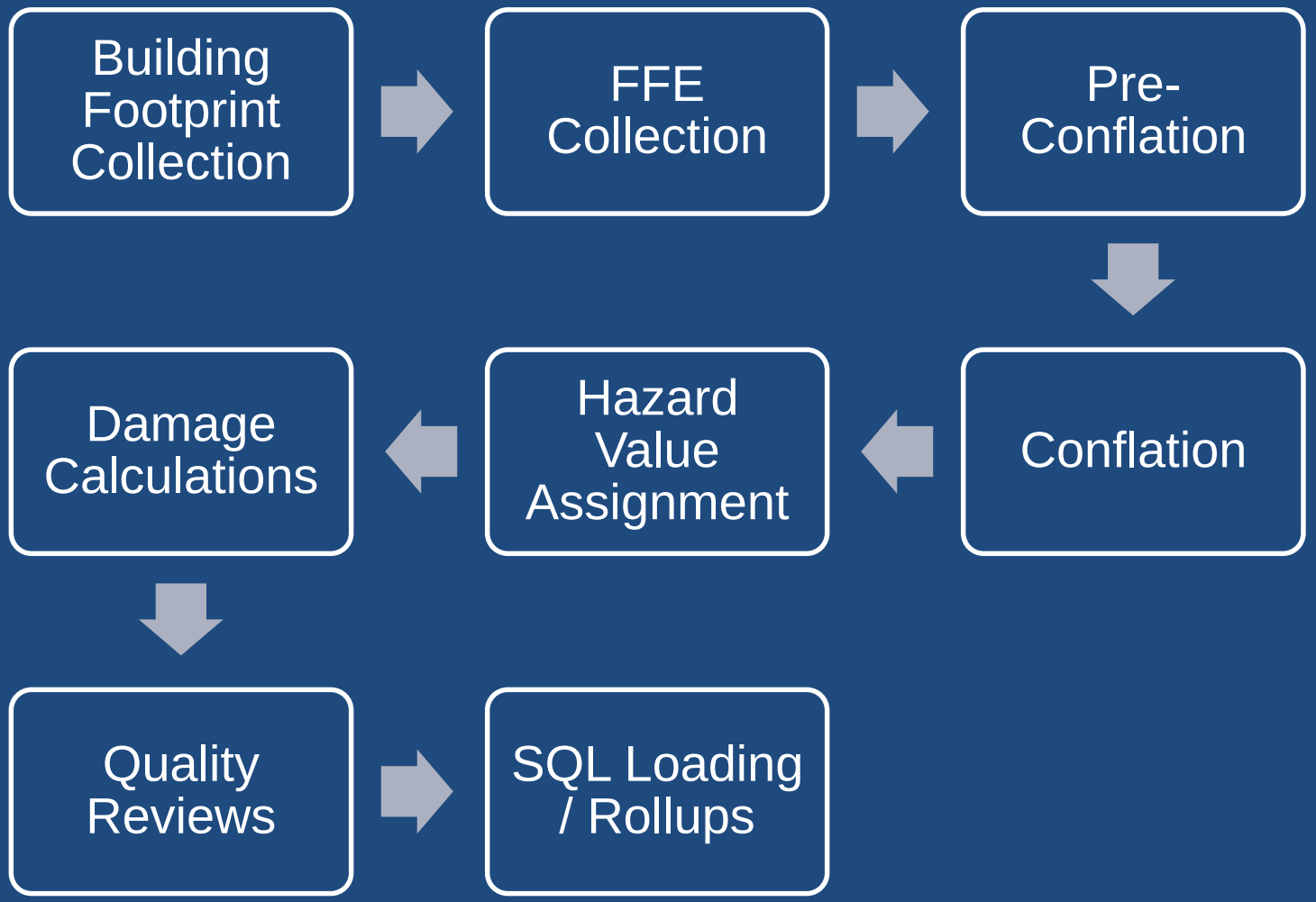


Mapping

Risk Assessment

iRISK

RISK COMPUTATIONAL PROCESS



BUILDING FOOTPRINTS

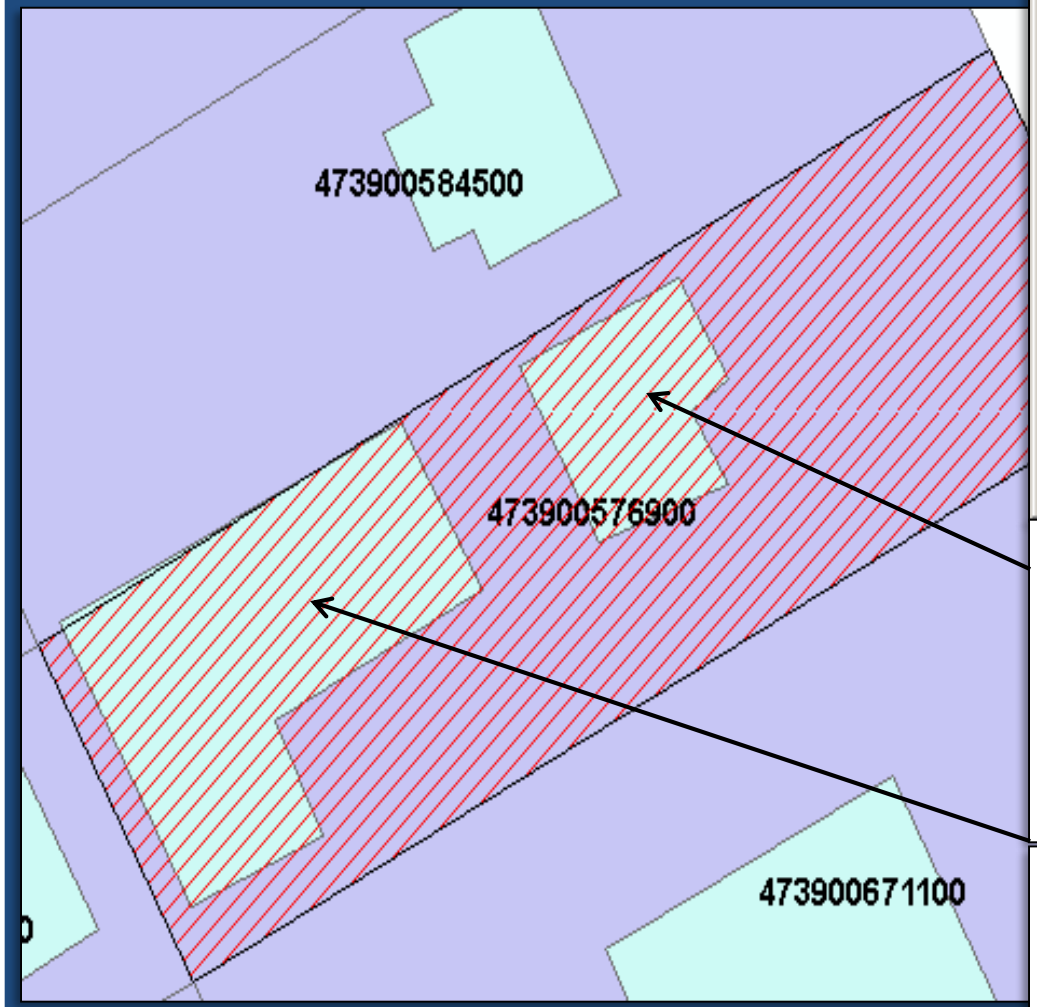
FFE – FIRST FLOOR ELEVATIONS

FFE COLLECTION ATTRIBUTES

Location: 2,366,092.425 174,230.087 Unknown Ur

Field	Value
FID	257
Shape	Point
NAME	139
CODE	FFE
NORTHING	174231.33755
EASTING	2366093.62883
ELEVATION	9.00193
OFFSET	0
COMMENT1	
FOUND_TY	Slab on Grade
FOUND_PROP	High
COMMENT2	
NUM_STORIE	2
STORIES_PR	High
COMMENT3	
ROOF_SHAPE	Hip
ROOF_SL	Medium
ROOF_PROP	High
COMMENT4	
PICTURE	139.JPG
FFE_TY	Laser Inclinometer
Pic_link	P:\NCFMP\XG06408_IHRM_SLR_Derived

CONFLATION OF PARCEL DATA TO FOOTPRINTS



Identify

Identify from: <Top-most layer>

- EDGECOMBE_PARCEL
  - 25404
    - L_PARCEL
      - 55922
      - 55923

Location: 2,430,579.348 790,7

Field	Value
BLDG_VALUE	73496
BLDVAL_SRC	PARCEL DATA
PID	473900576900

Identified 1 feature

- L_PARCEL
  - 55922
  - 55923

Field	Value
OCUPP_TYPE	COM1 - PARCEL DERIVED
YEAR_BUILT	1960
HTD_SQ_FT	494
ROOF_SHAPE	GABLE - PARCEL DERIVED
PID	473900576900
PID_DETAIL	473900576900.2

- L_PARCEL
  - 55922
  - 55923

Field	Value
OCUPP_TYPE	RES1 - PARCEL DERIVED
YEAR_BUILT	1949
HTD_SQ_FT	720
ROOF_SHAPE	GABLE - PARCEL DERIVED
PID	473900576900
PID_DETAIL	473900576900.1

EMERGENCY MANAGEMENT NORTH CAROLINA

ESP Associates, P.A.

PRE-CONFLATION AND CONFLATION

Field Collection

First Floor Elevation

Foundation Type

Roof Shape

Roof Slope

Number of Stories

Parcel Conflation

Occupancy Type

Building Value

Year Built

Heated Sq Ft

Roof Shape

HAZUS Block Conflation

Roof Cover Type

Roof Cover Quality

Water Resistance

Roof Deck Attachment

Roof Deck Age

Roof Wall Connection

Roof Frame Type

Hurricane Shutters

Roof Tie Downs

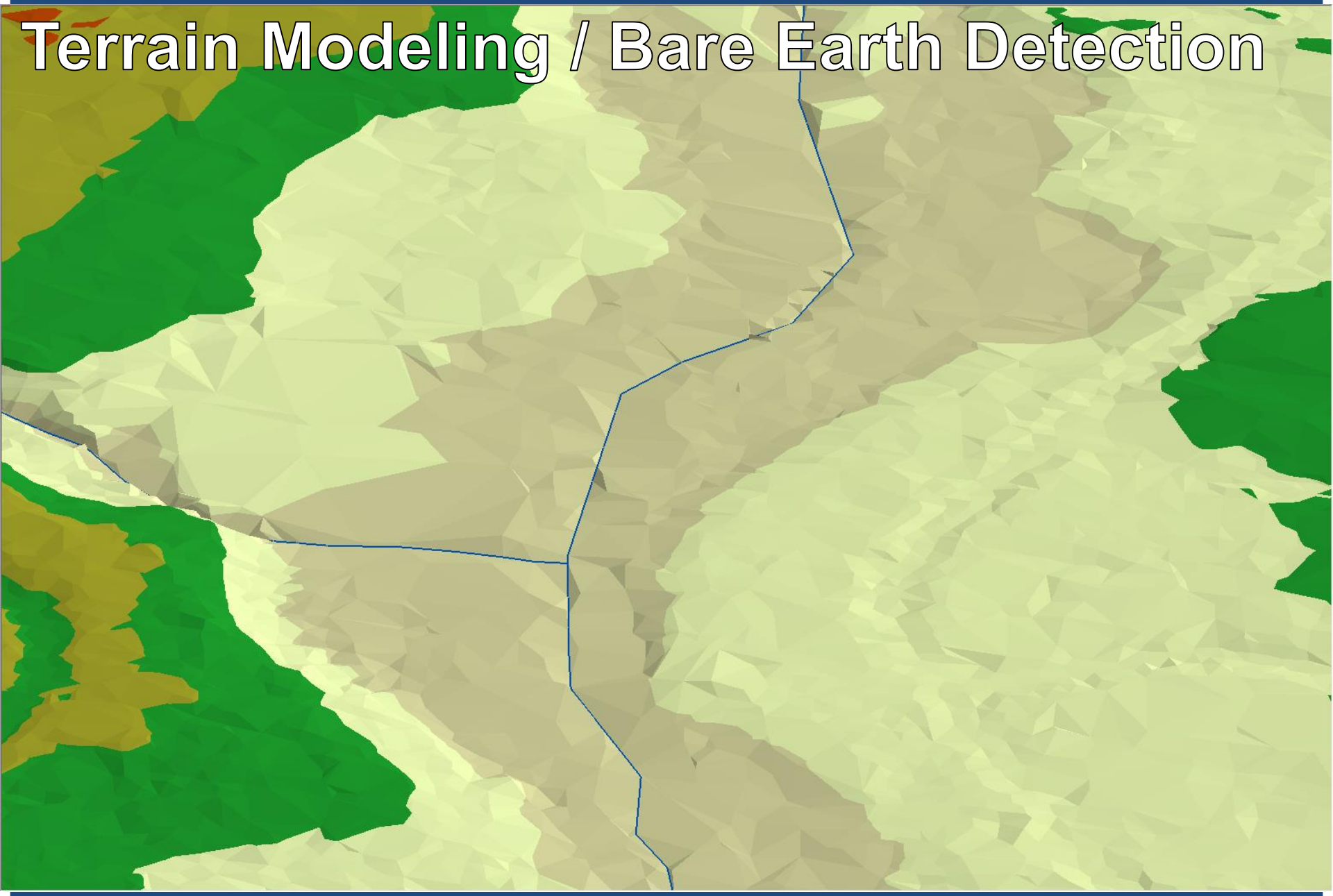
Window Area

Masonry Reinforcing

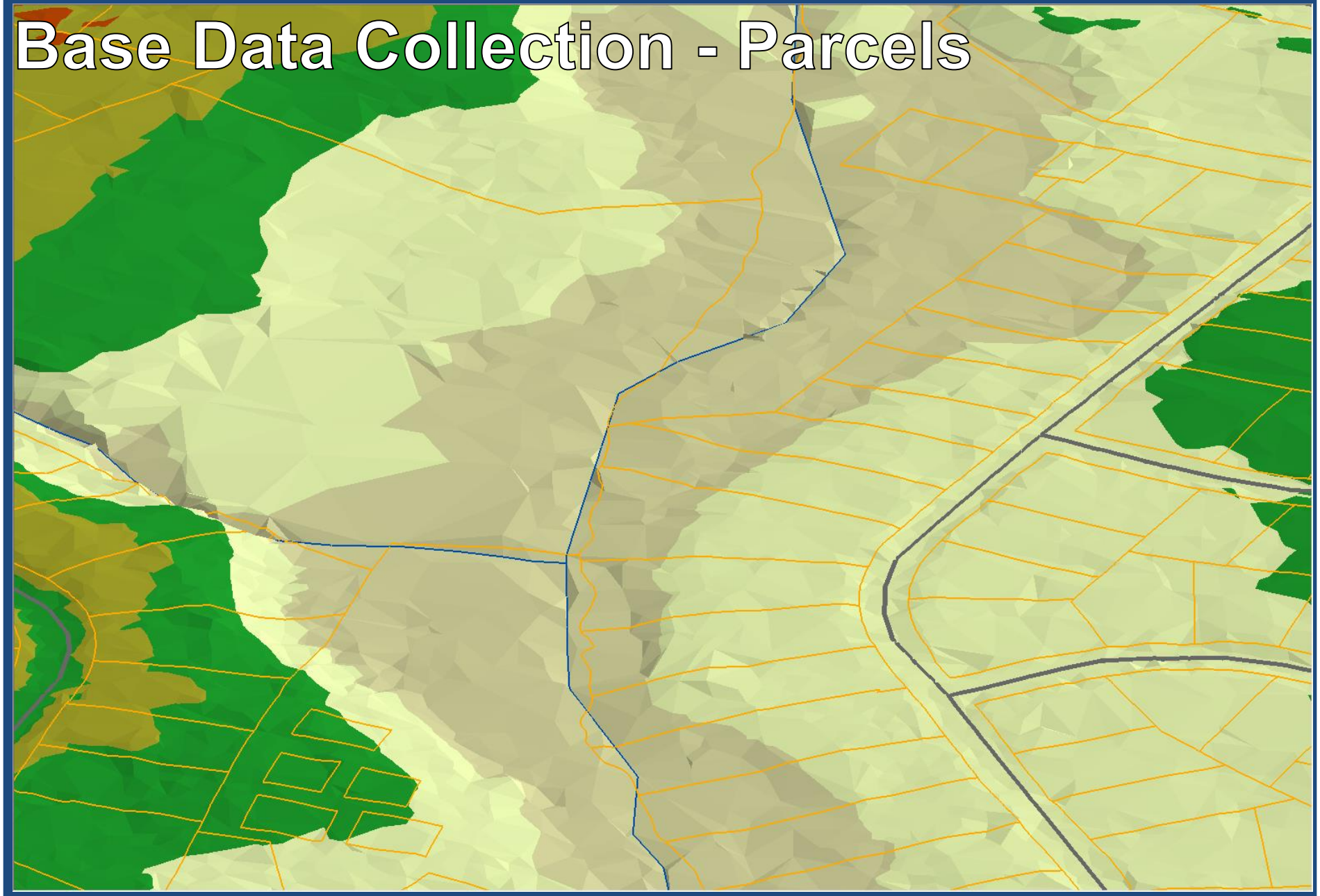
Joist Spacing

Number of Units

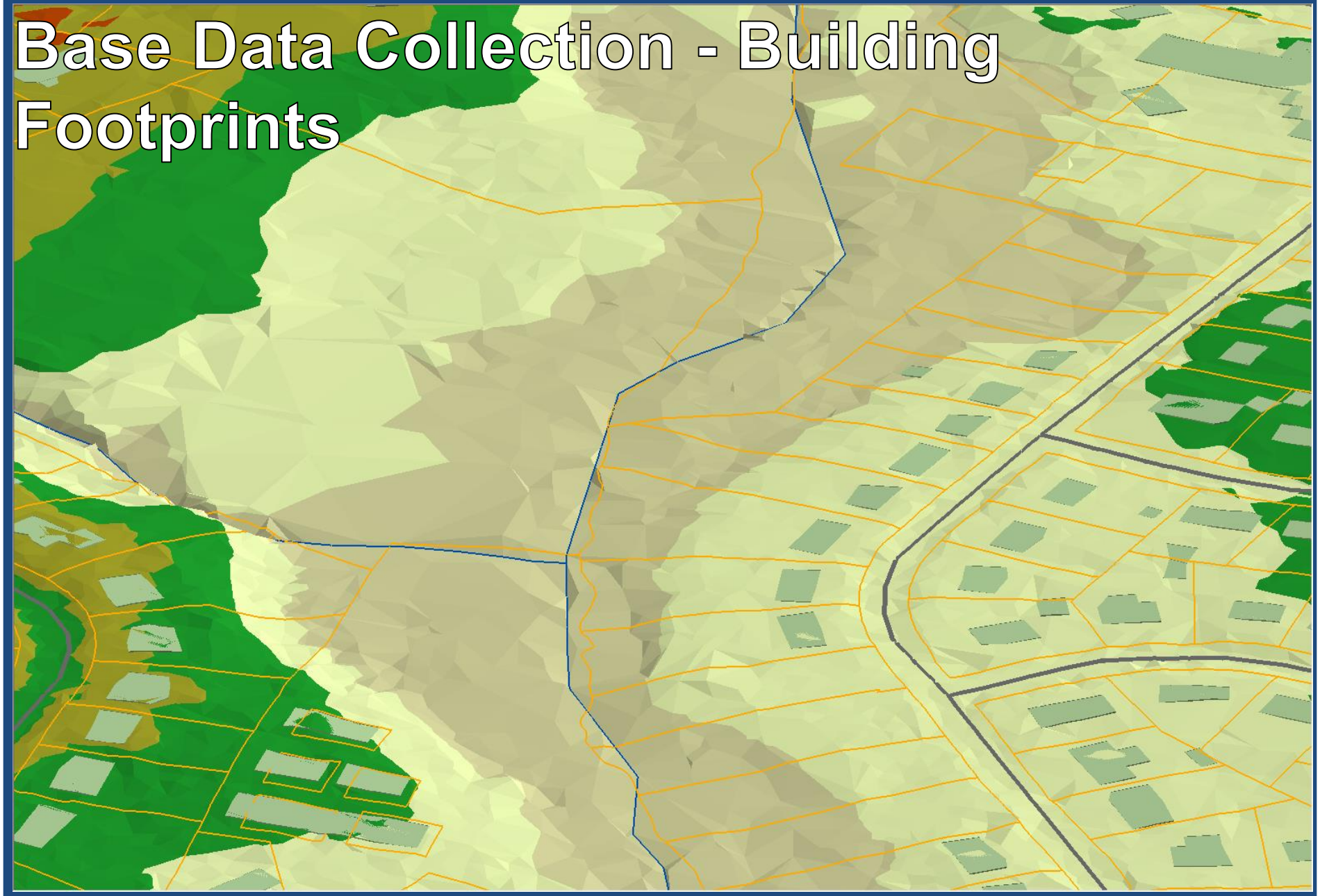
Terrain Modeling / Bare Earth Detection



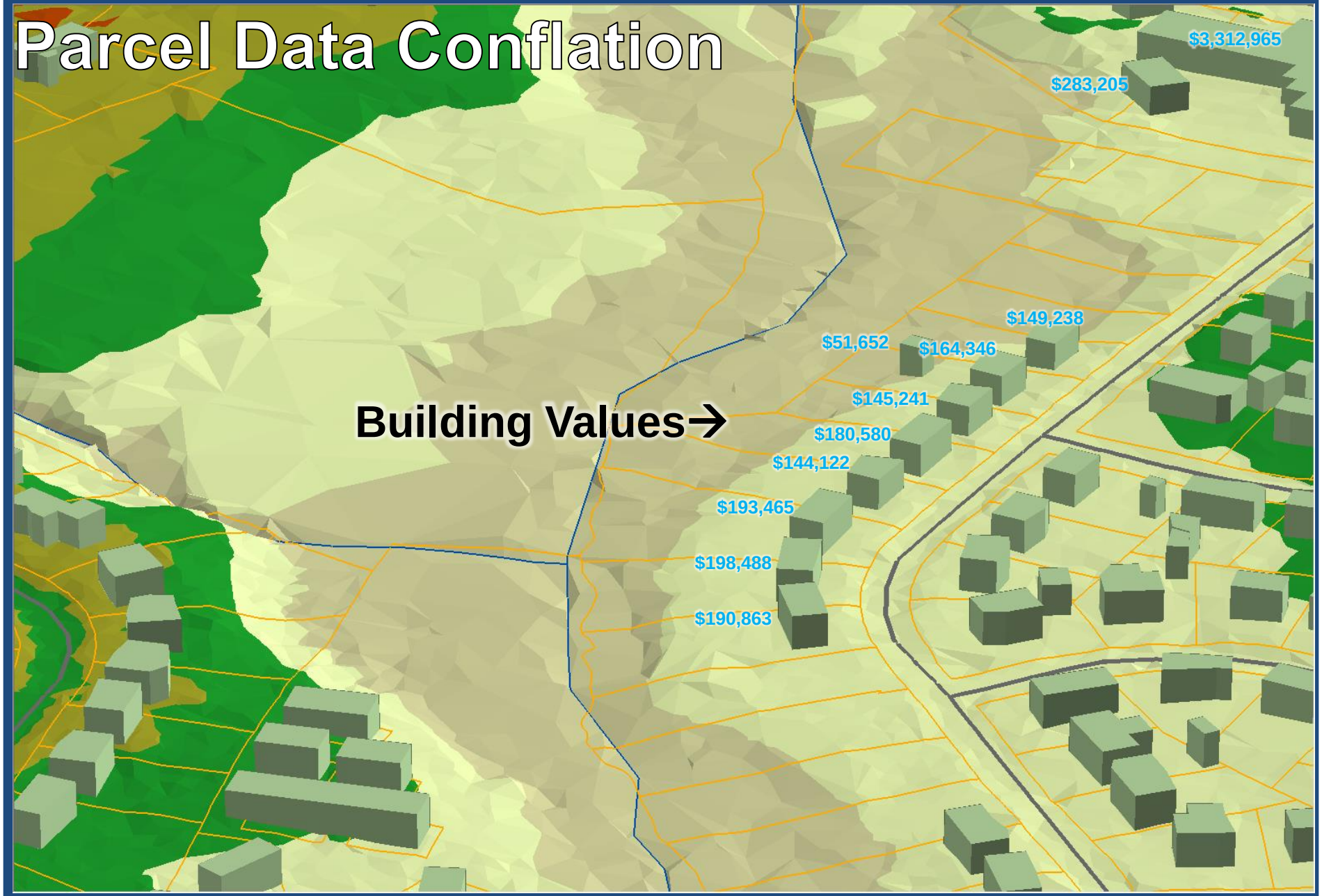
Base Data Collection - Parcels



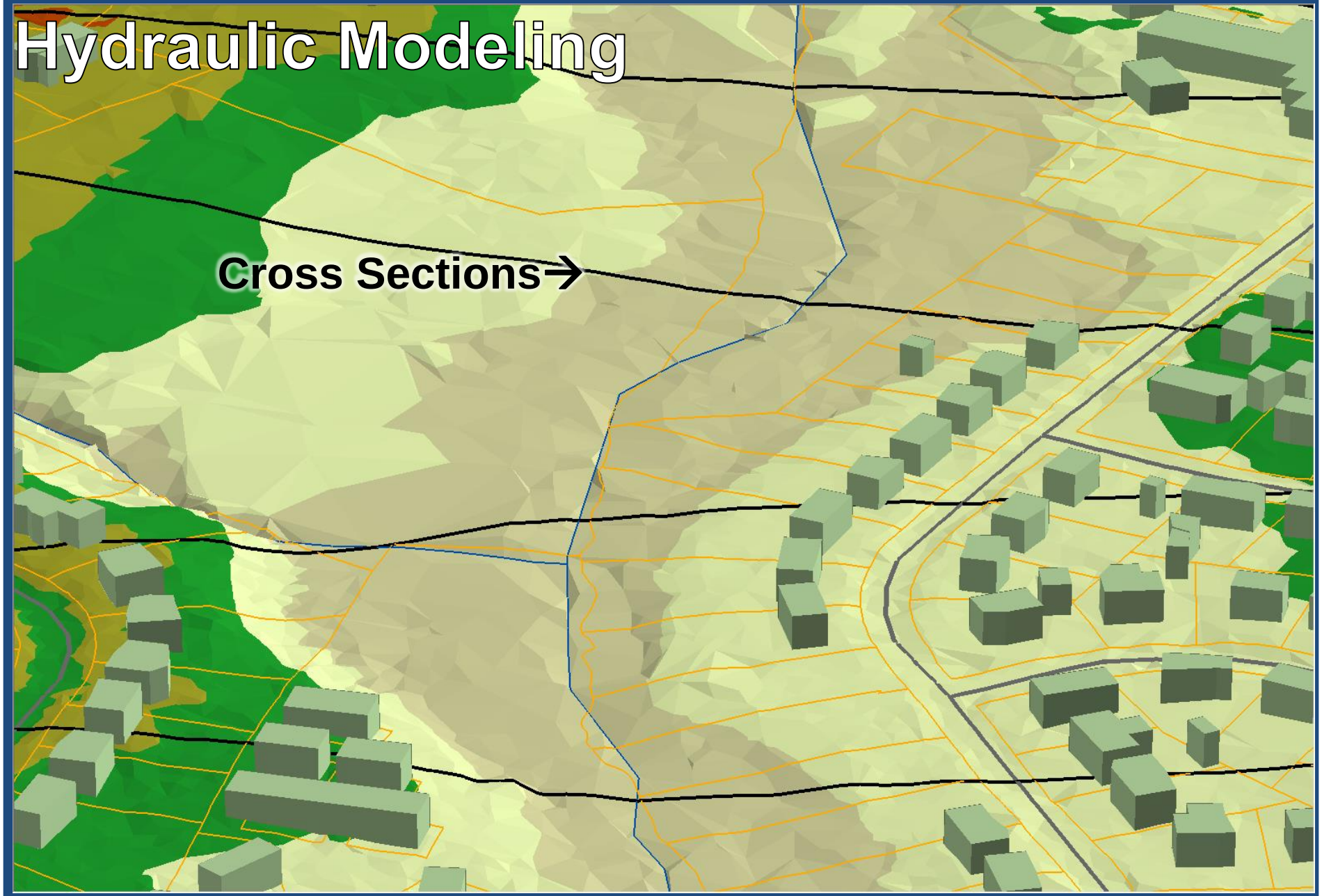
Base Data Collection - Building Footprints



Parcel Data Conflation



Hydraulic Modeling

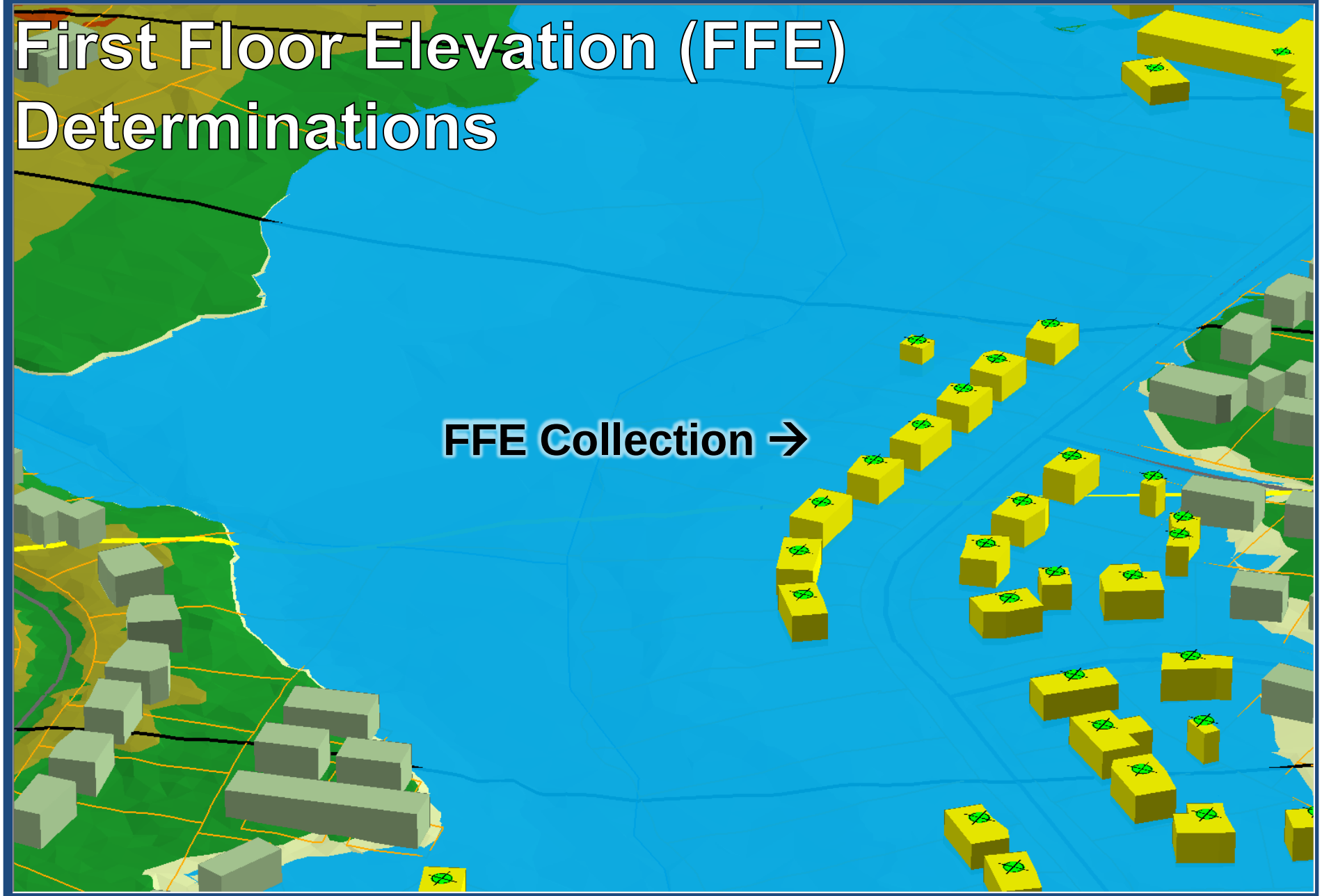


Hydraulic Modeling

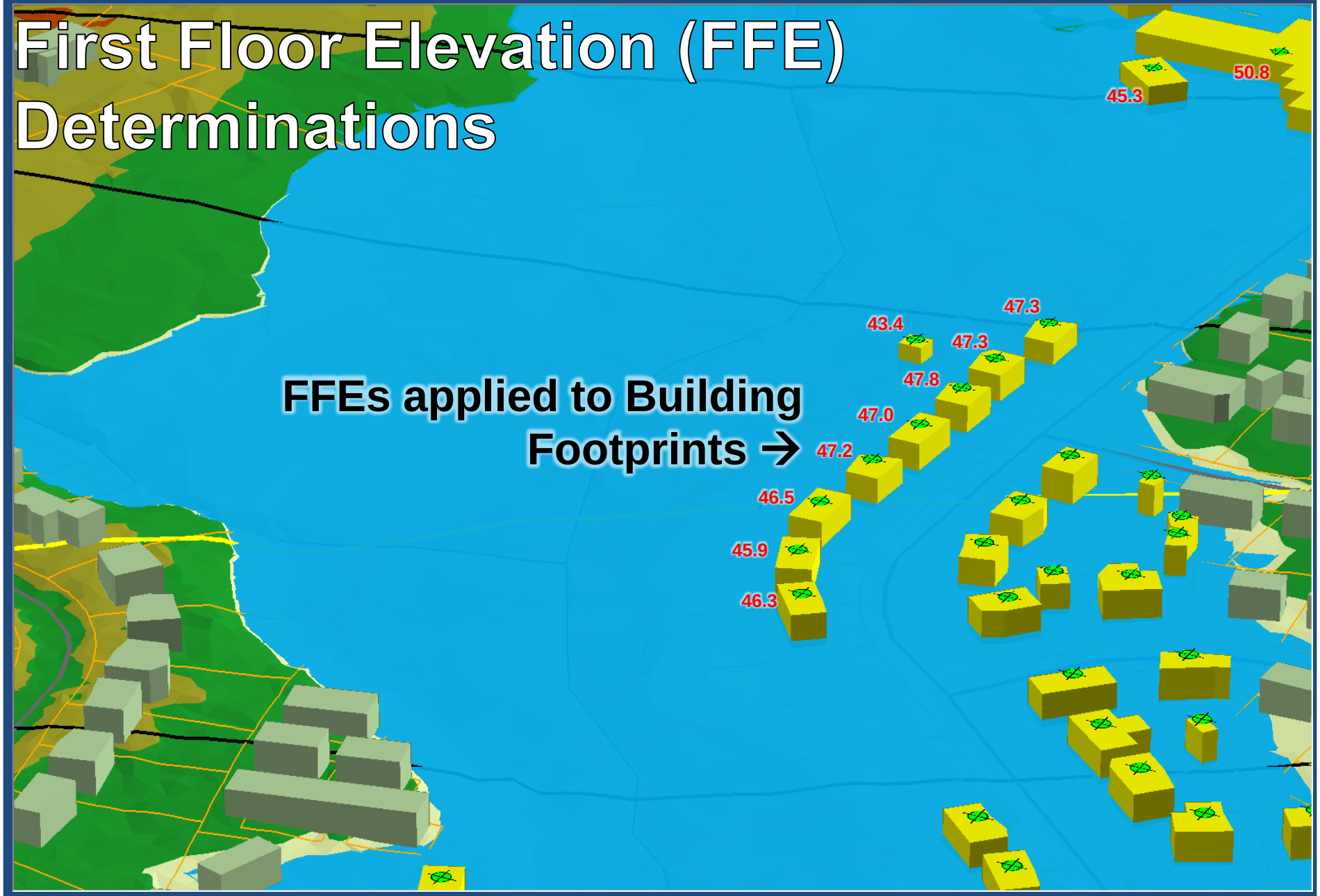
1% Annual Chance Flood Delineation

Flooded Buildings

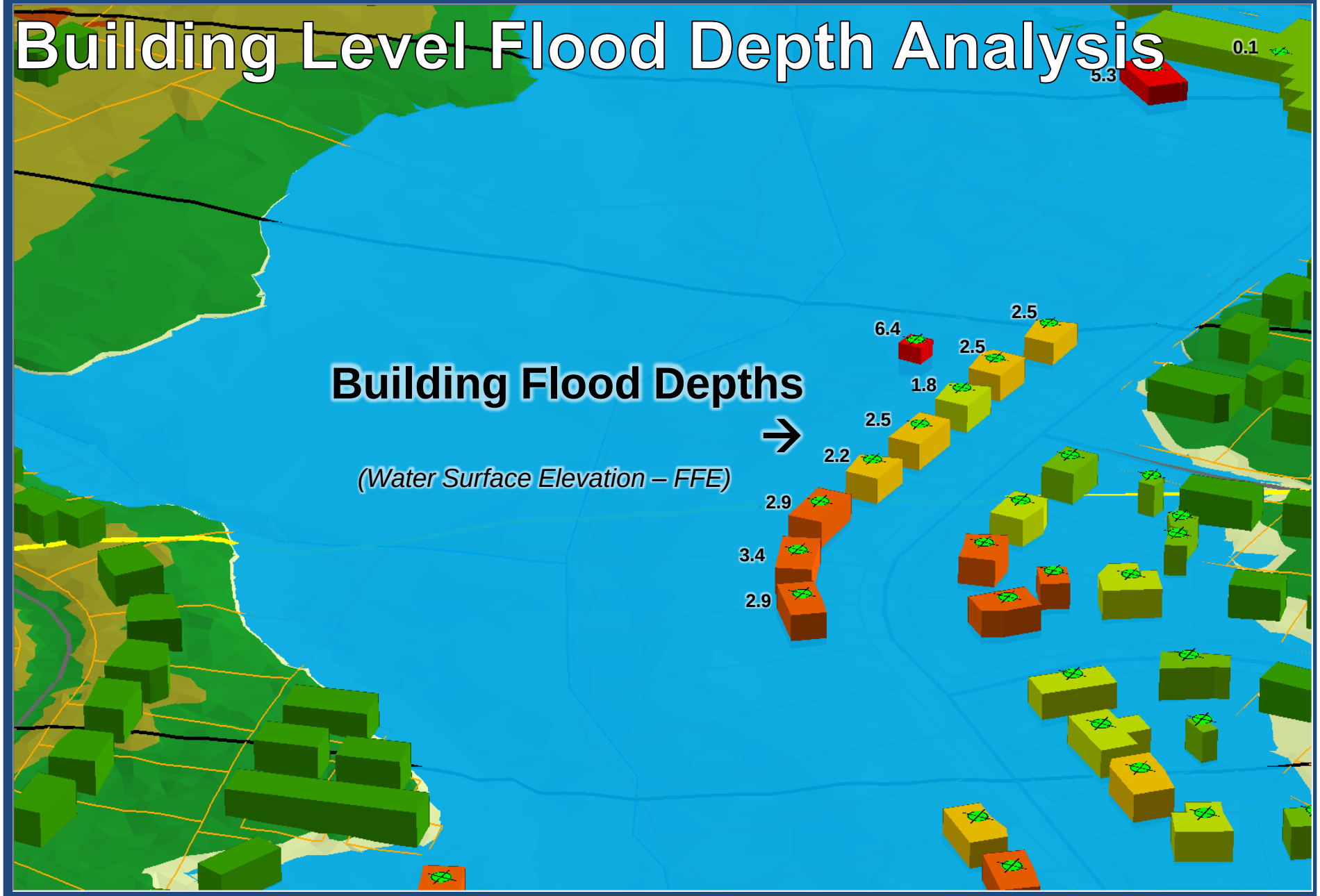
First Floor Elevation (FFE) Determinations



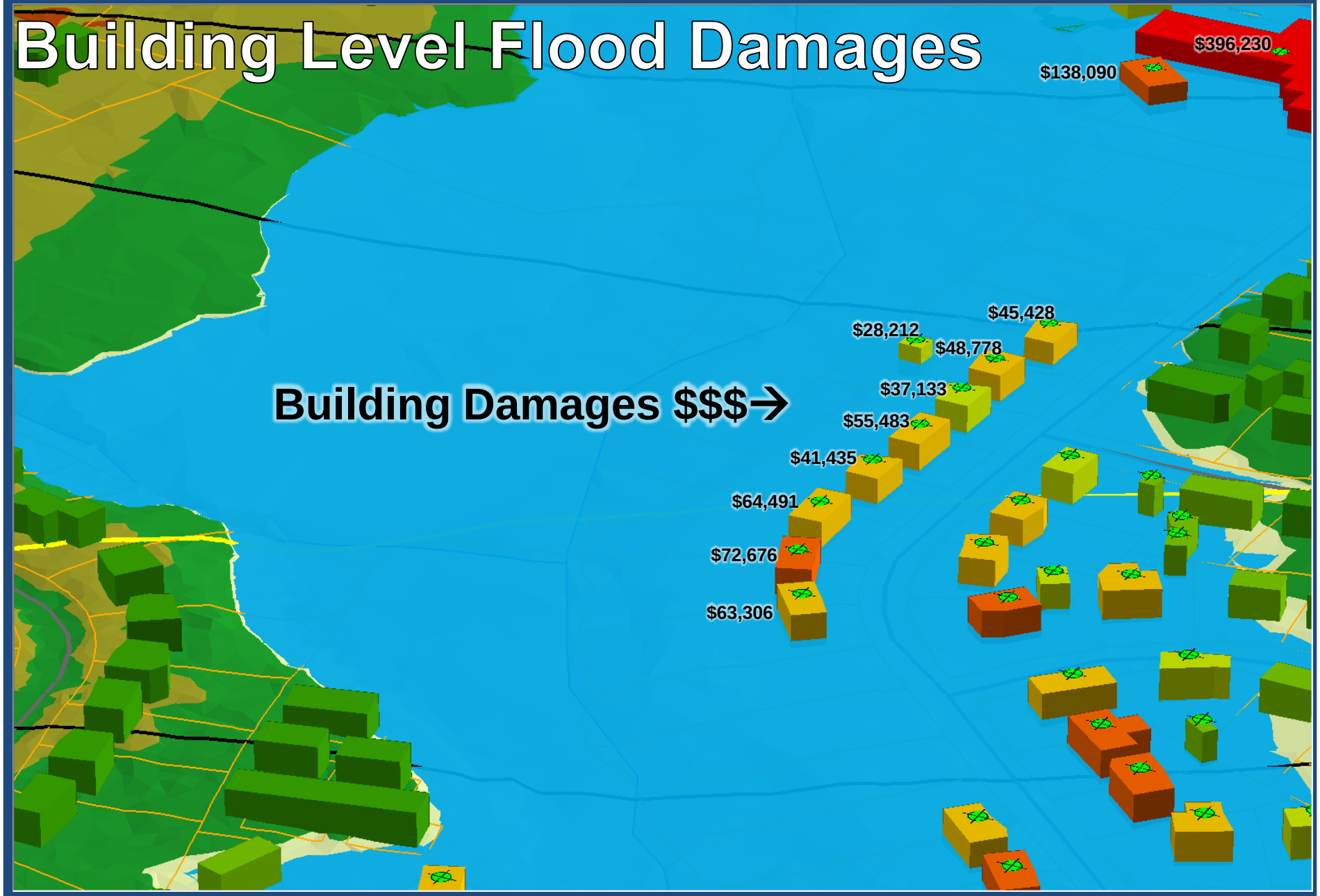
First Floor Elevation (FFE) Determinations



Building Level Flood Depth Analysis

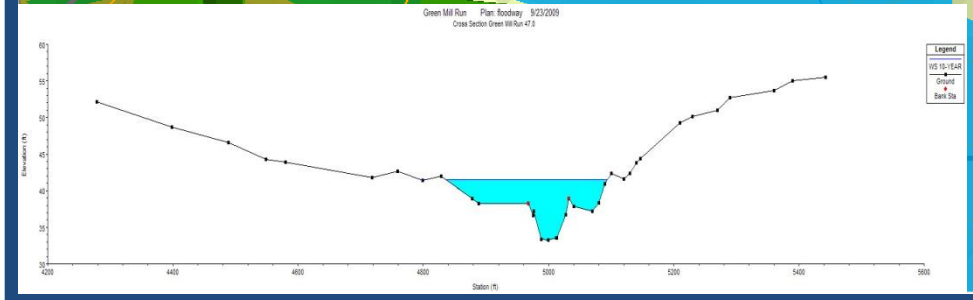


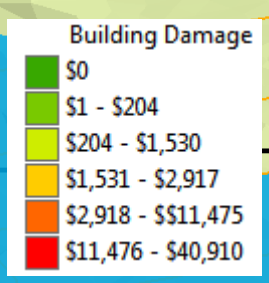
Building Level Flood Damages



Multi-Return Period Flood Analysis

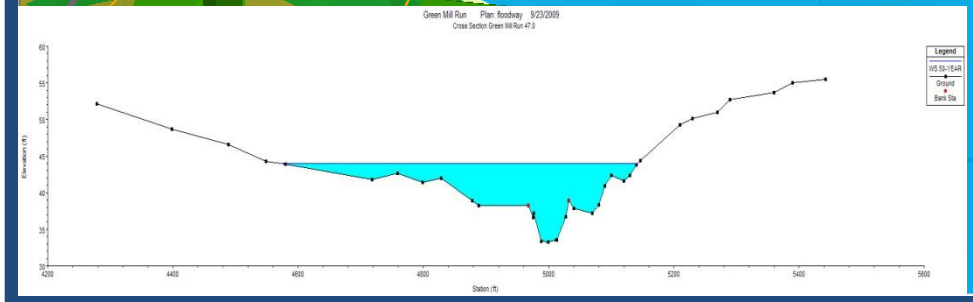
Damaged Buildings
10 Year Flood
Total Loss = $59,965

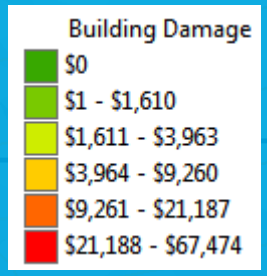




Multi-Return Period Flood Analysis

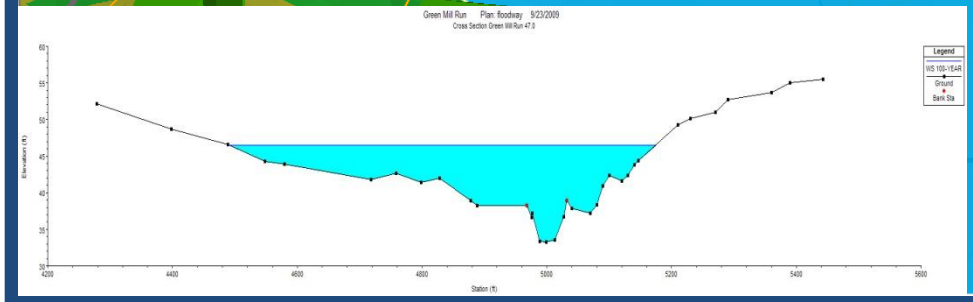
Damaged Buildings
50 Year Flood
Total Loss = $701,755





Multi-Return Period Flood Analysis

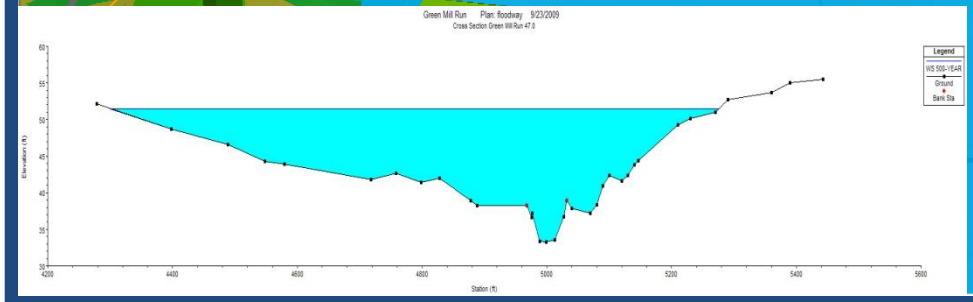
Damaged Buildings
100 Year Flood
Total Loss = $2,433,3310

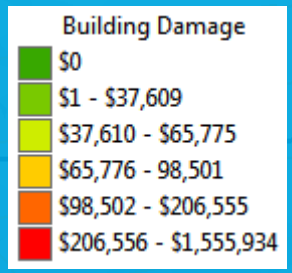


Building Damage
- $0
- $1 - $19,690
- $19,691 - $38,220
- $38,221 - $64,491
- $64,492 - $138,090
- $138,091 - $396,231

Multi-Return Period Flood Analysis

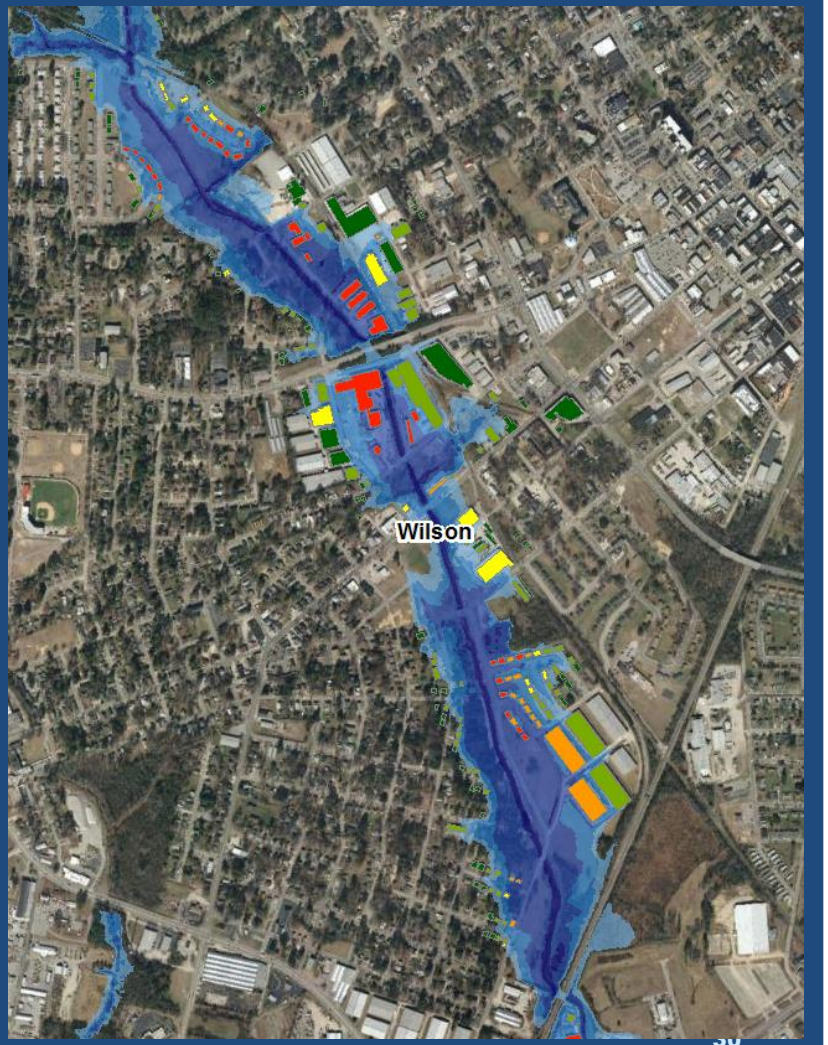
Damaged Buildings
500 Year Flood
Total Loss = $7,718,820



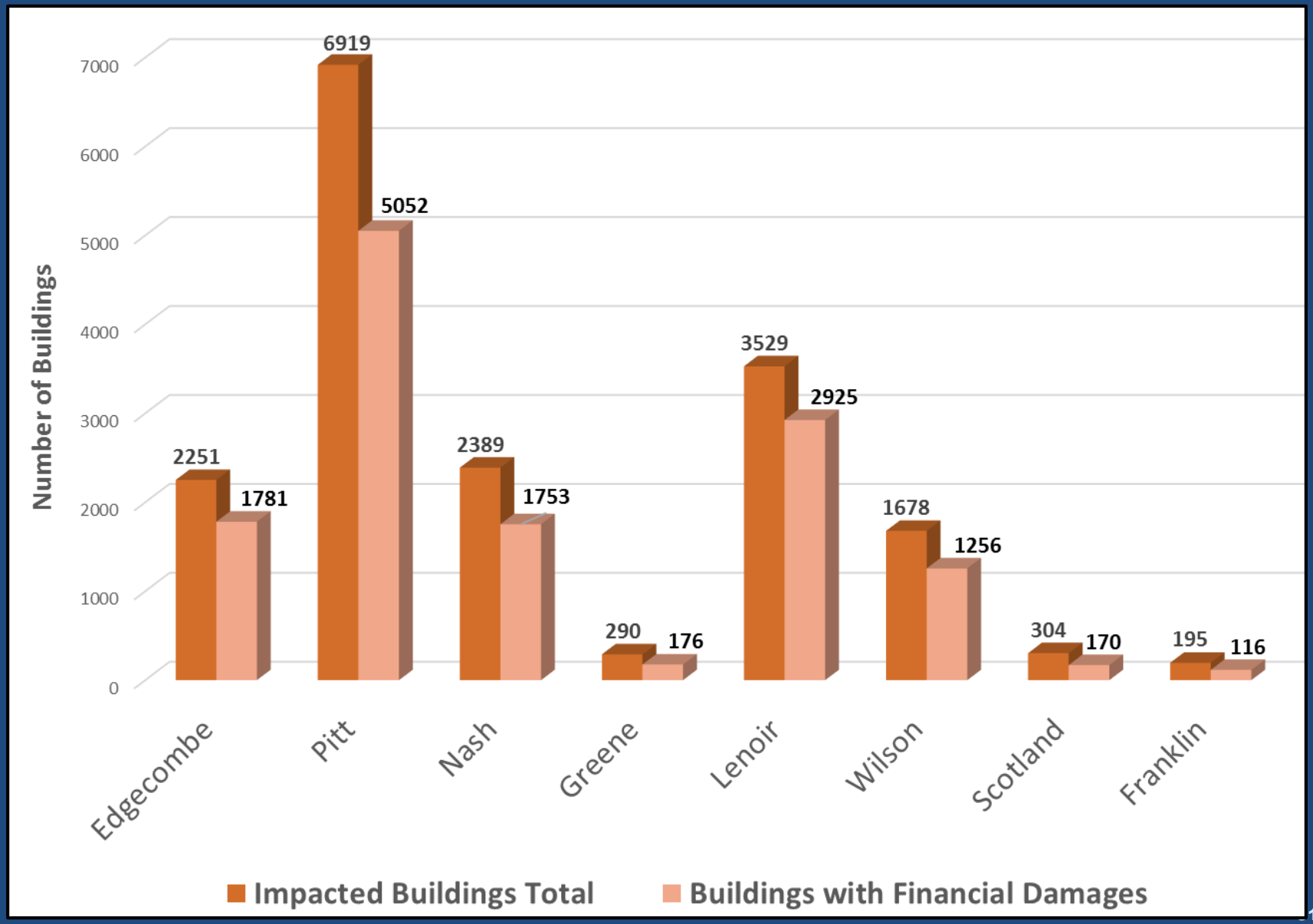


IMPACTS UPDATES POST-EVENTS:

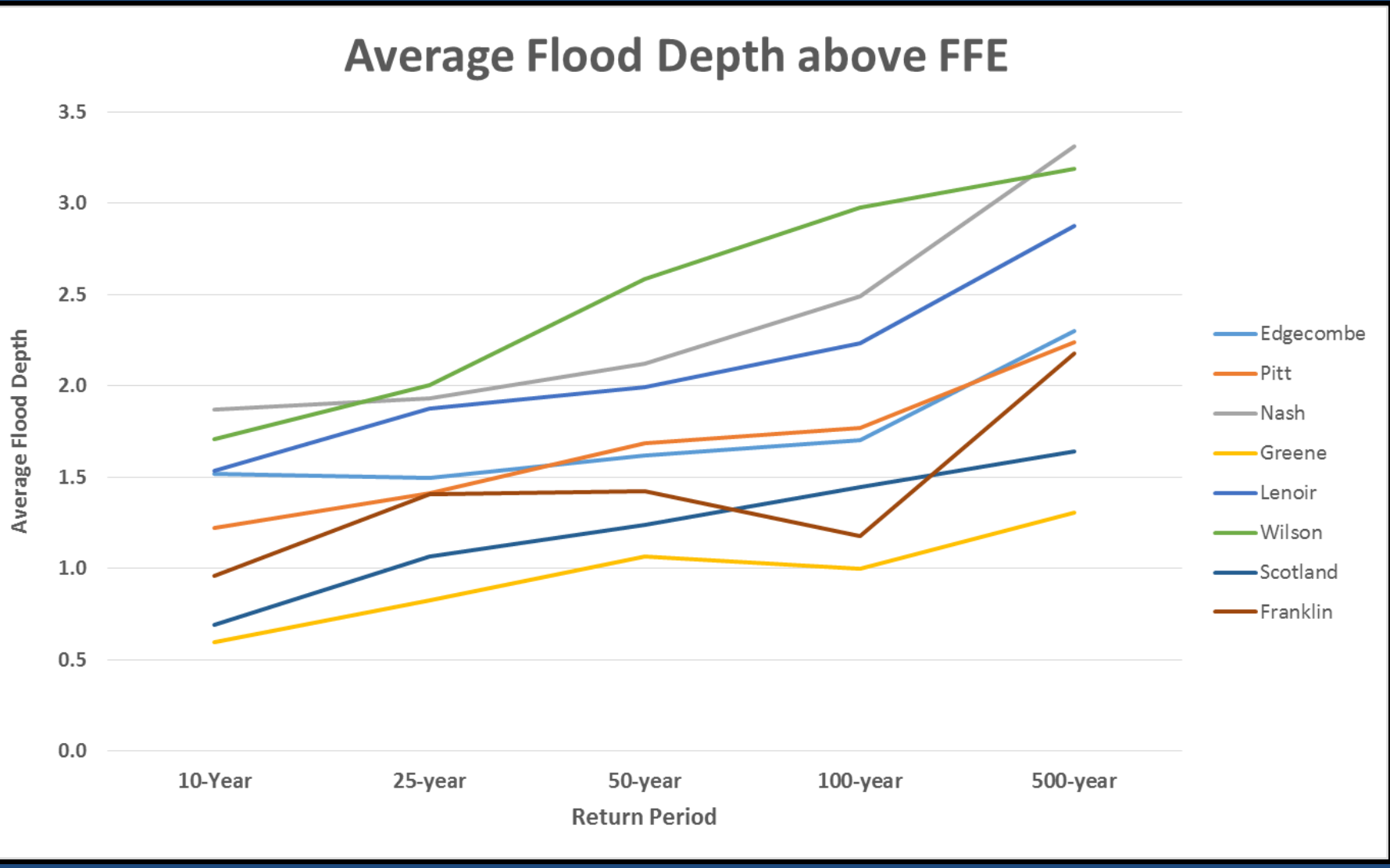
Example: Matthew's Analysis Metrics



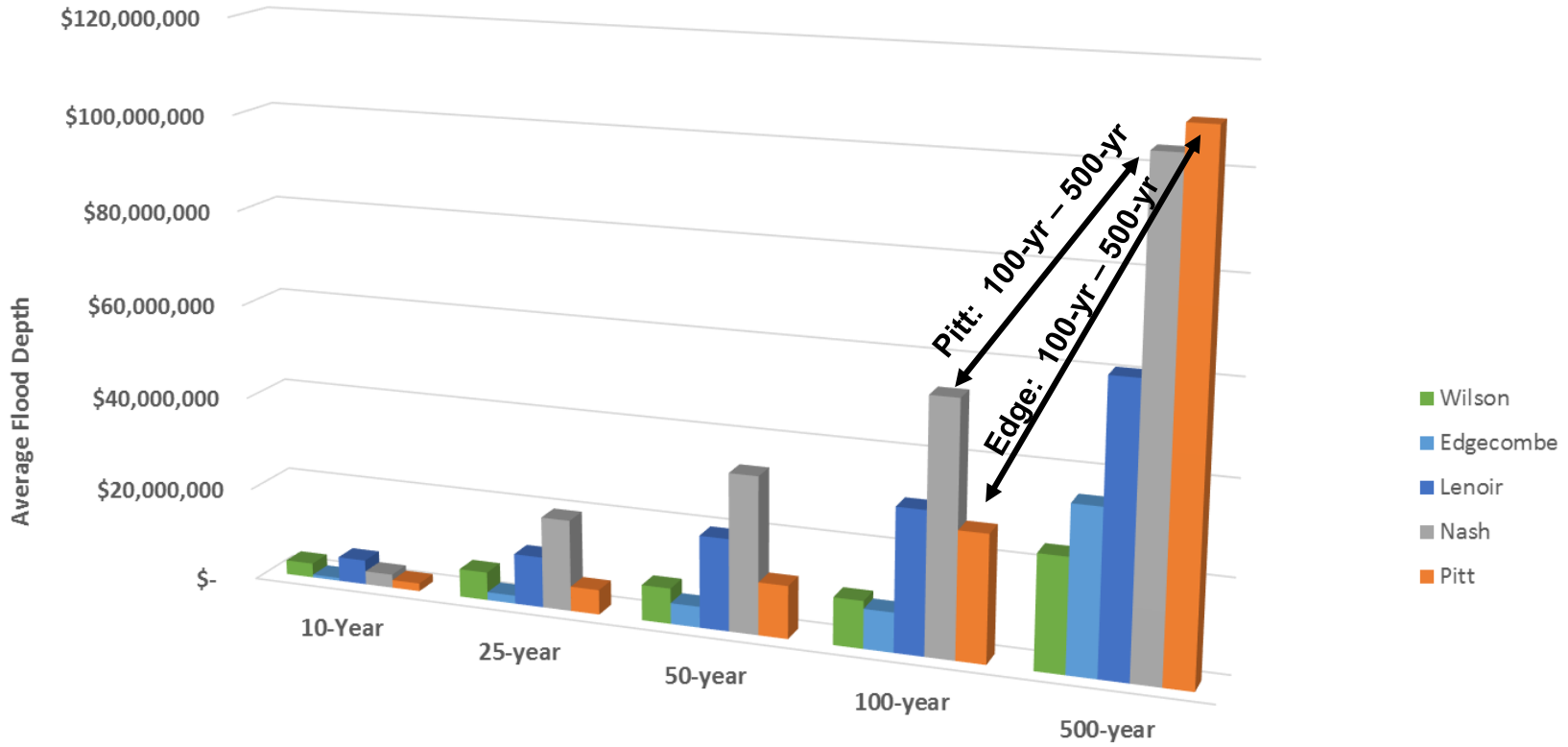
IMPACTED BUILDINGS BY COUNTY



AVERAGE FLOOD DEPTH ABOVE FFE



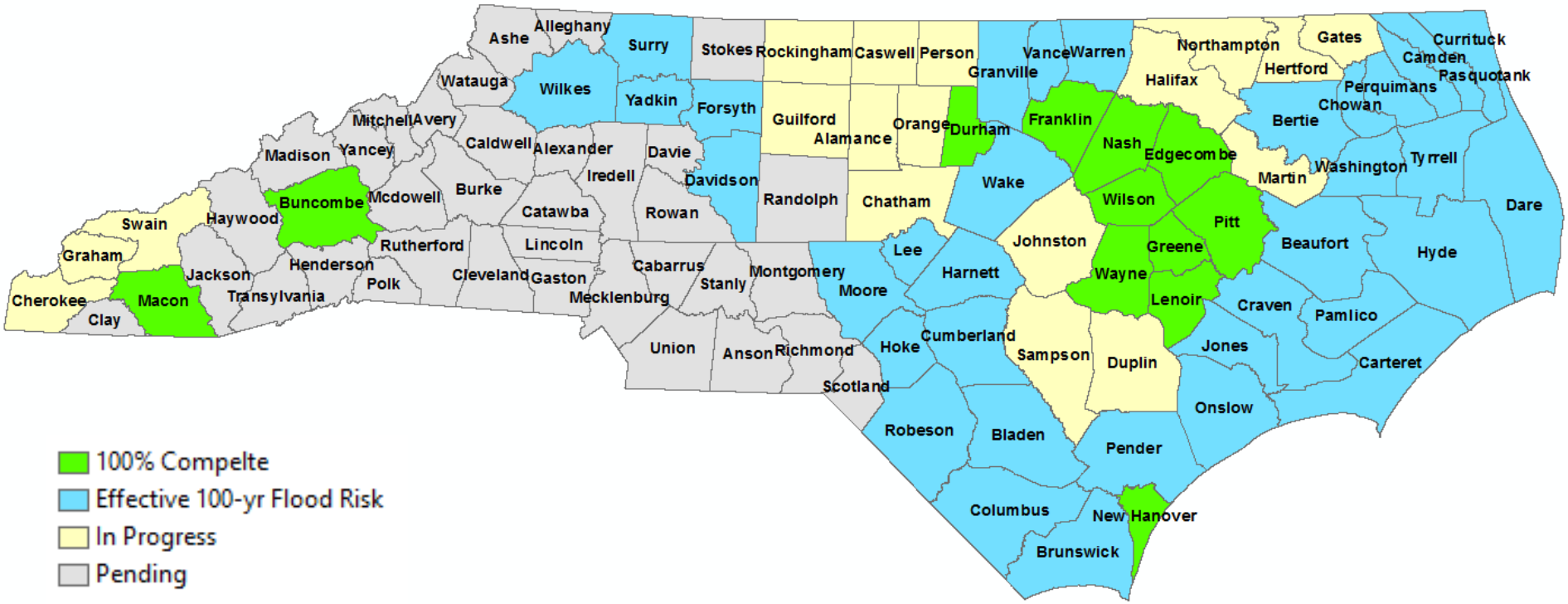
FLOOD DAMAGES ($) BY RETURN PERIOD



	10-Year	25-year	50-year	100-year	500-year
Wilson	$3,079,564	$6,038,162	$7,596,565	$10,092,825	$24,237,038
Edgecombe	$615,191	$1,739,377	$4,484,295	$8,460,409	$35,013,919
Lenoir	$5,282,232	$10,857,065	$19,660,317	$30,424,491	$60,949,561
Nash	$2,884,631	$19,555,280	$33,535,213	$53,700,492	$104,001,211
Pitt	$1,697,602	$5,296,234	$11,279,538	$27,029,912	$109,573,762

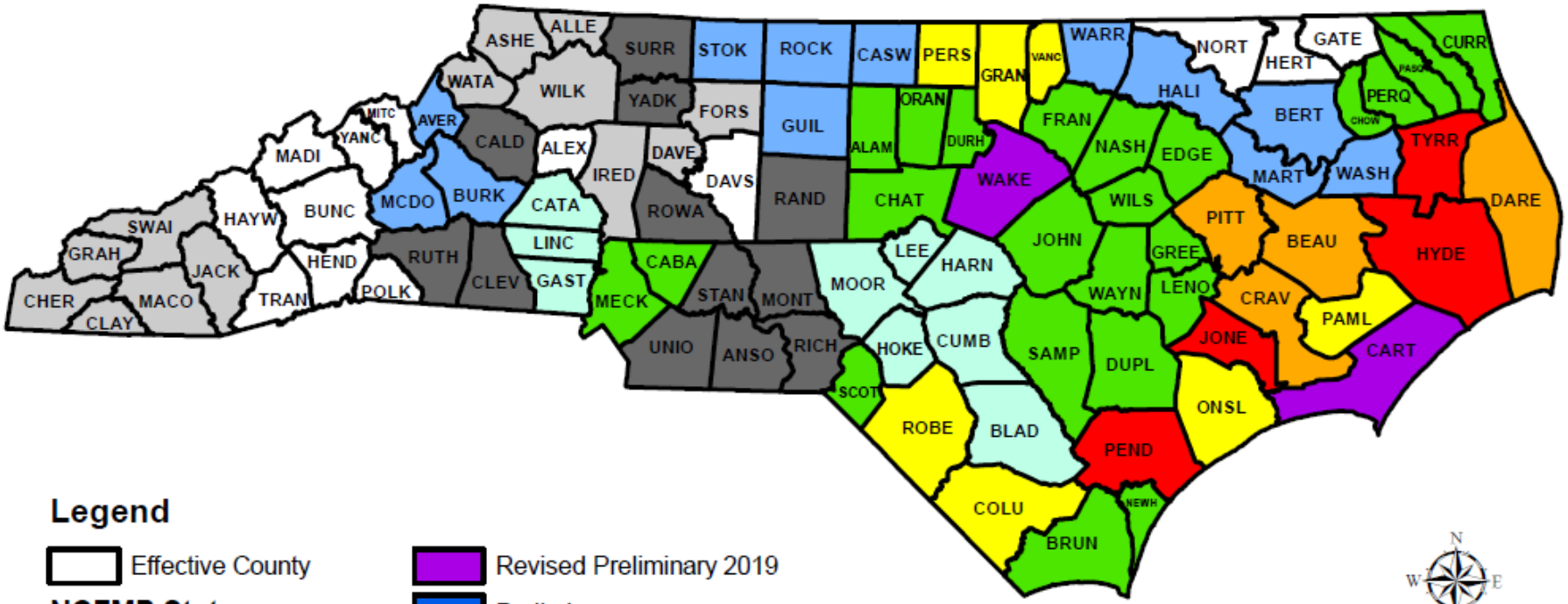
Return Period

CURRENT RISK ASSESSMENT STATUS

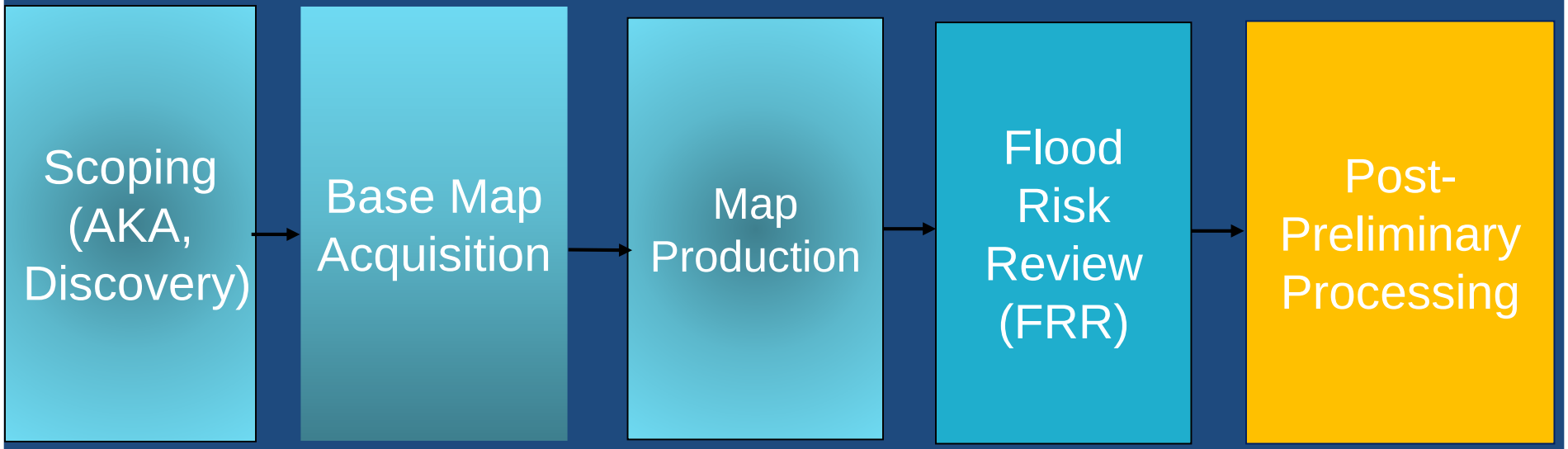


NCFMP Preliminary Status by County

Date: 1/24/2019



MAPPING PROCESS



MAP UPDATE MEETING OBJECTIVES

Identify and describe some non-regulatory products and datasets, and how they can be used to help make decisions to reduce flood risks

Understand and explain the community's flood risk

Describe strategies to reduce flood risk and improve resilience to floods

Identify resources available to implement those strategies

FLOOD RISK DATASETS AND PRODUCTS

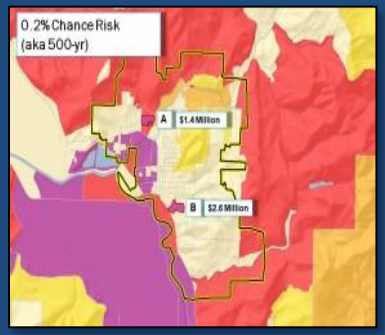
Flood Risk Datasets

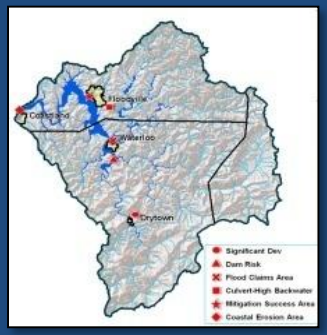
Changes Since Last FIRM

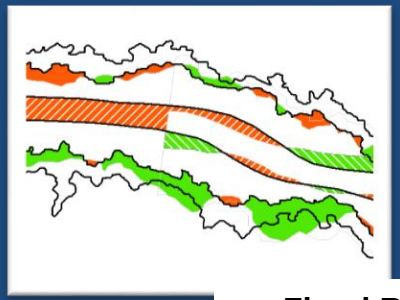
Flood Depth & Probability Rasters

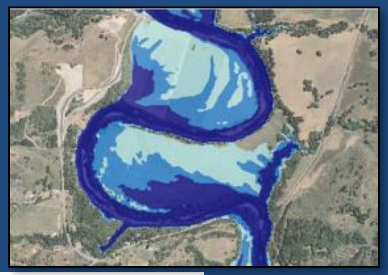
Flood Risk Assessment

Areas of Mitigation Interest
(Hot Spot Maps)







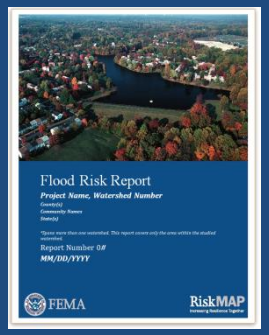


Flood Risk Datasets

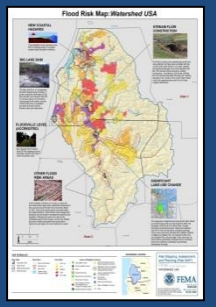
Flood Risk Products

- Flood Hazard Database
  - •Water Surface Elevations
  - •Multi-recurrence rasters
  - •Building Files
  - •CSLF
- Flood Risk Report
  - •Estimate flood risk losses/use
  - •Identify areas of relative risk
  - •Tie-in for Mitigation
- Flood Risk Map

Flood Risk Database

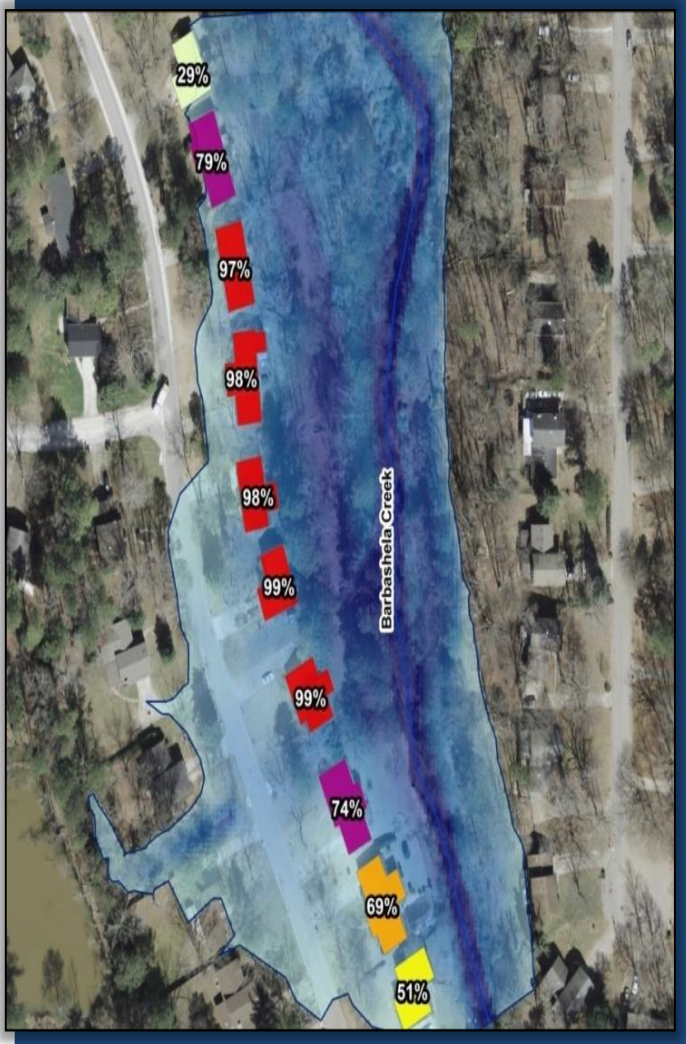


Flood Risk Report



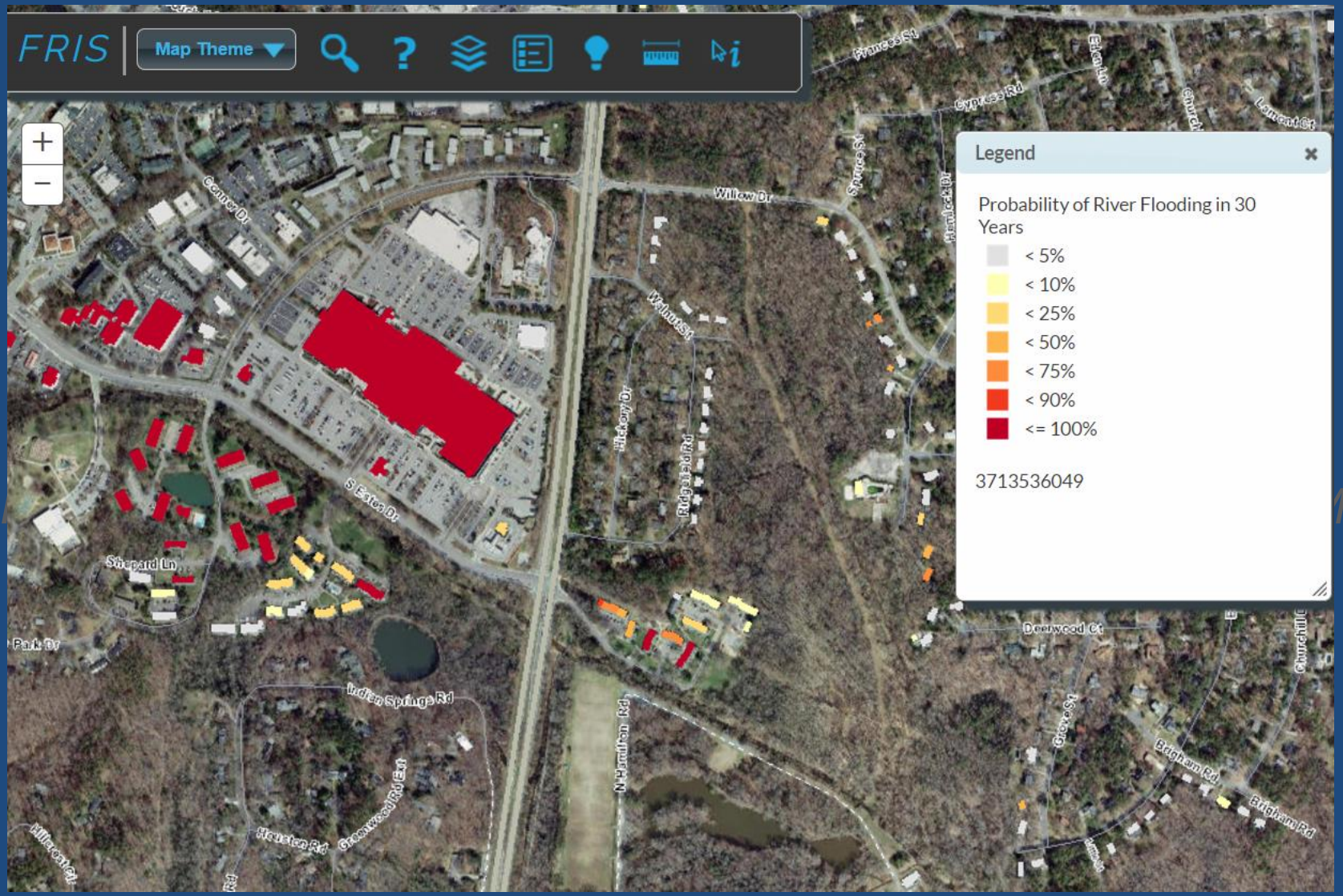
Flood Risk Map

POTENTIAL USES FOR DEPTH ANALYSIS

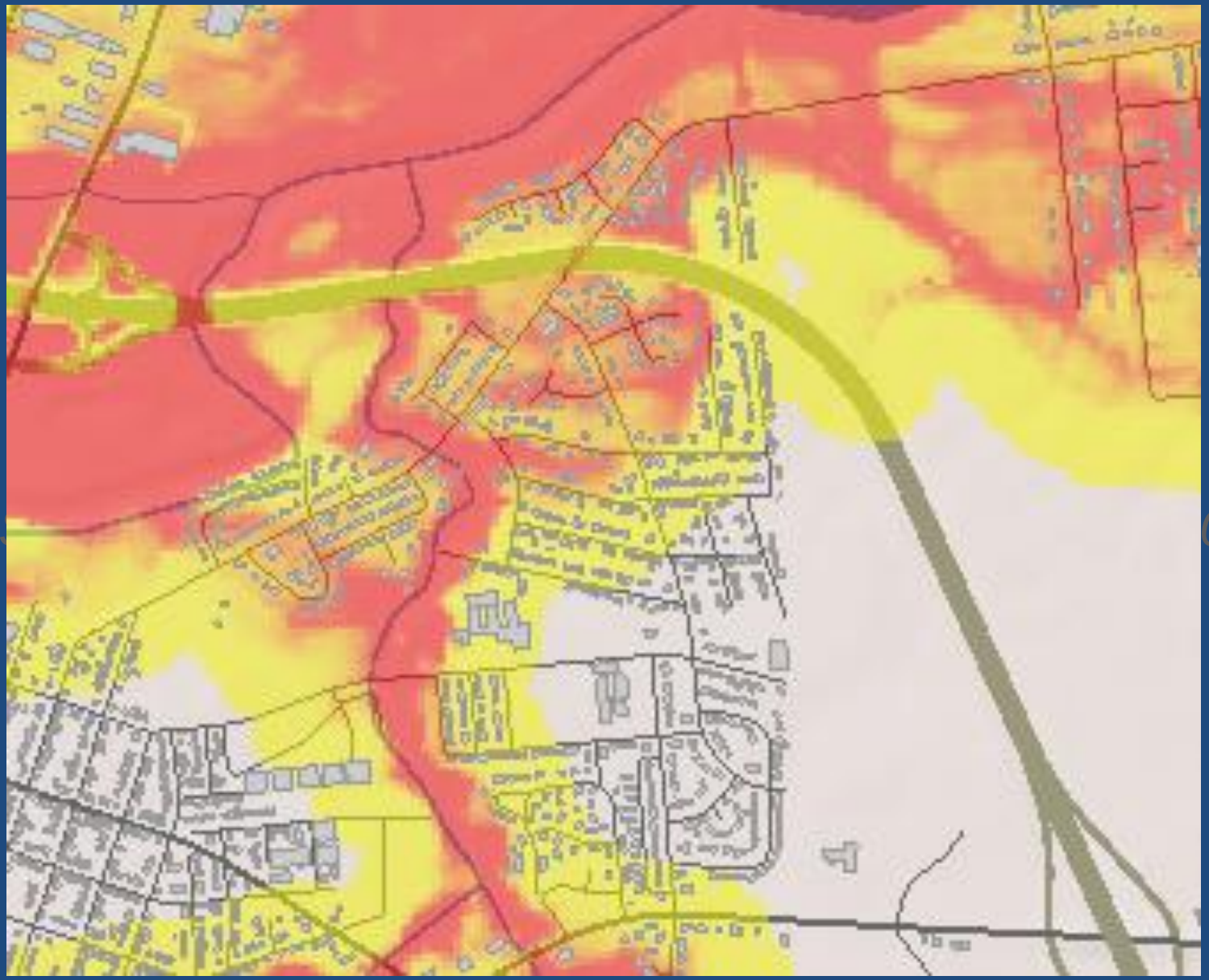


- Informs decisions on risk reduction efforts
- Zero in on your areas of greatest flood risk vulnerability
- Clear depiction of high flood risk areas for future planning
- Inform future development decisions
- Understanding current and future risk
- Multiple datasets help visualize a variety of flood risk elements for local stakeholders
- Demonstrating higher flood vulnerability in specific areas
- Accessible source of data for cost-effectiveness
- Assists with advanced recovery planning and disaster preparedness

PROBABILITY OF FLOODED BUILDINGS ANALYSIS OVER 30 YR.



COMMUNICATING THE PERCENT CHANCE OF FLOODING OVER 30-YEAR PERIOD RASTER



FLOOD RISK ASSESSMENT DATA PURPOSE

Current:

Identifies areas of relative flood risk:

Floodprone areas

Vulnerable people and property

Quantifies flood risk in dollars:

Residential Loss

Commercial Loss

Other Asset Loss

Percent Damage

Evaluates Building Stock

Structure and Content Considerations

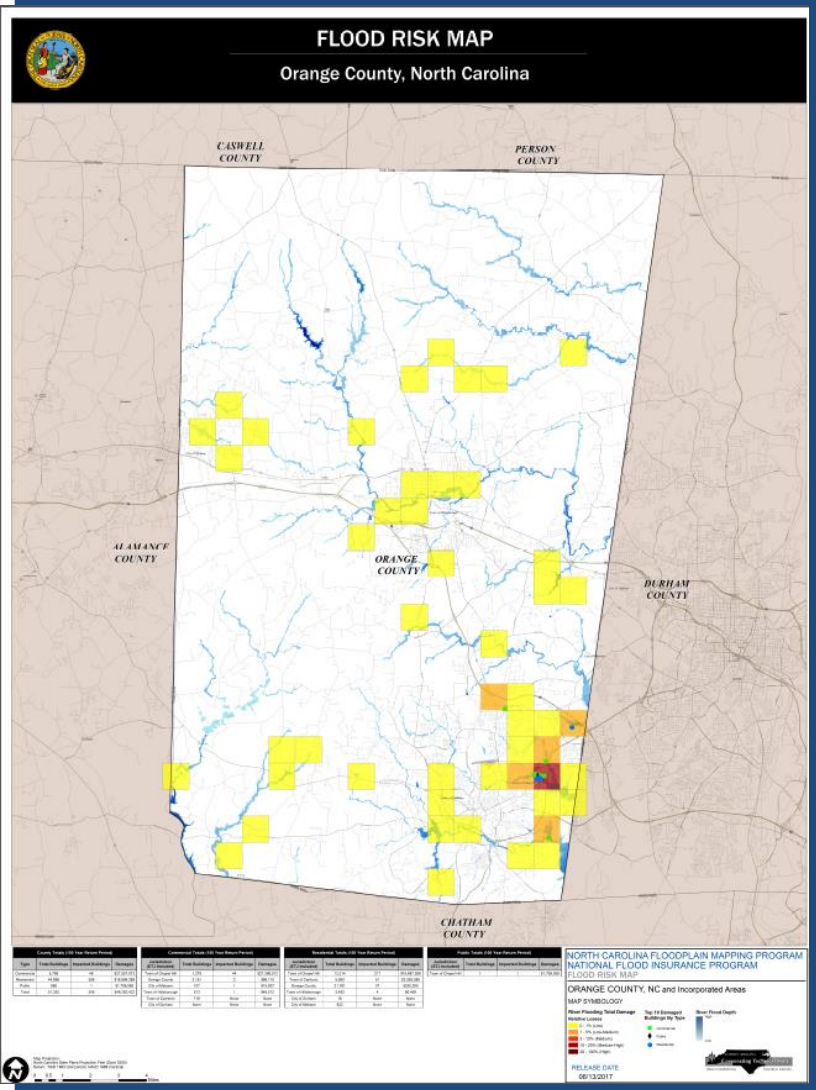
Future:

- **Identification of Business Disruption**
  Considers Total Occupancy Tables
  Considers Lost Income and Wages

- **Helps estimate potential losses (Risk, Very Low to Very High) due to flood risk:**

  - Classification (Residential, Commercial, Other)
  - Average Value (buildings/census block)
  - Population
  - Total Loss
  - Building/Content Loss

POTENTIAL USES FOR RISK ASSESSMENT DATA



Quantifies flood risk and estimates projected loss for multiple flood scenarios

Identifies where mitigation activities may produce the greatest return on investment

Identifies areas with greatest flood loss potential

Helps identify areas where flood mitigation activities are most needed

Provides data to help screen for cost effectiveness

Provides data for Loss Avoidance Studies

Predictor of where major damage may occur for resource allocation purposes

PURPOSE OF AREAS OF MITIGATION INTEREST

Identifies areas that may be affecting flood risk that would benefit from raised local awareness

Raises awareness of local stakeholders within -and upstream of- the watershed that may be contributing to flood risk and associated interrelationships

Provides input to local mitigation plans

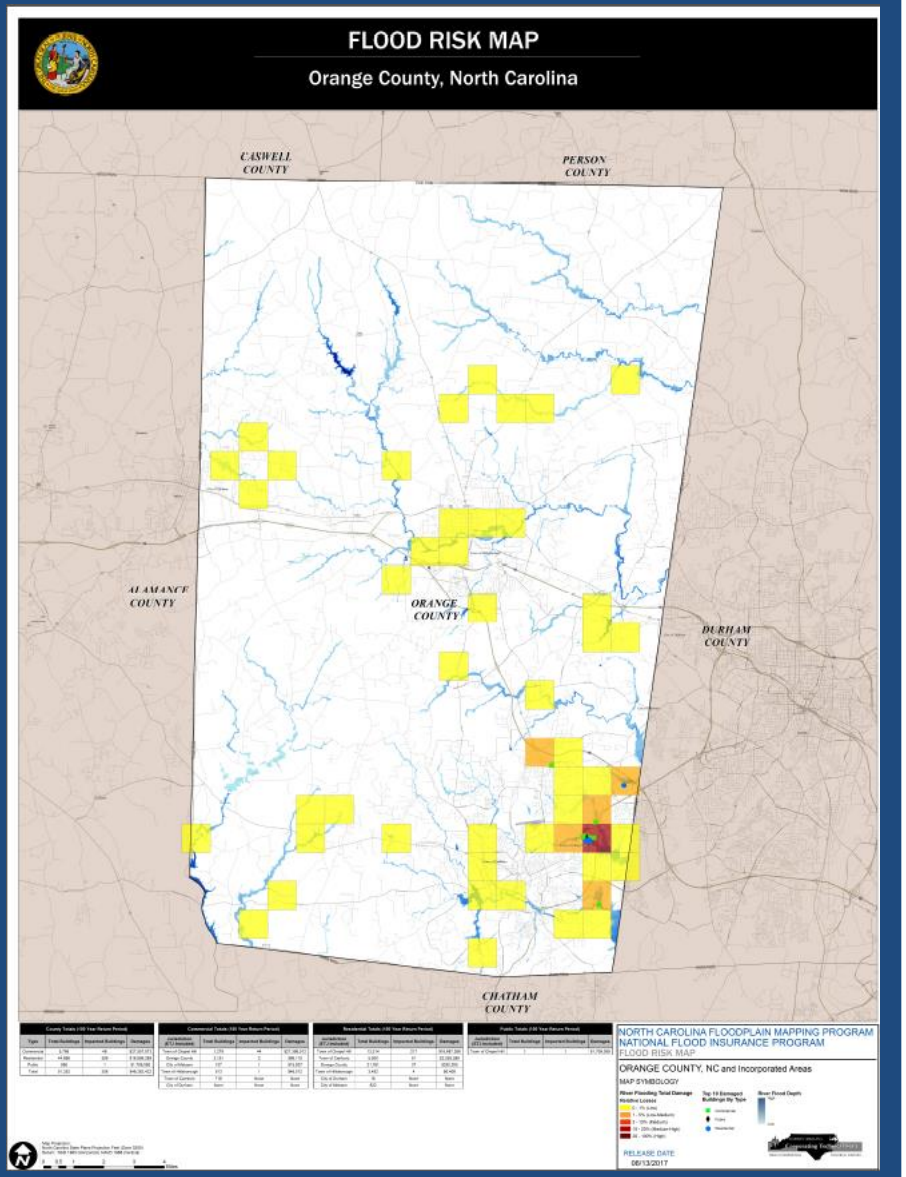
AREAS OF MITIGATION INTEREST
SOURCES OF DATA

- **Community Provided Data**
  - Interviews and questionnaire from Scoping
  - Mining of existing mitigation plans
- **Engineering Data**
  - Review of existing H&H models
  - Engineering data from other reports (e.g. USACE, DOT)
- **Other Government Agency Data**
  - Claims data (inc. RL, SRL, clusters, etc)
  - Flood control structures

AREAS OF MITIGATION INTEREST: HOT SPOTS

Items that may have an impact on the identified flood hazards or flood risks

- Recent Development
- Mitigation Projects
- Stormwater infrastructure maintenance
- Moratoria on Development



Strategies To Mitigate Flood Risk:

1. Identification of mitigation goals—broad statements achieved through implementation of specific actions including implementation of polices as well as projects

2. Identification, consideration and analysis of available mitigation measures (actions) to achieve goals

3. Selection and prioritization of specific mitigation actions to be pursued

Taken from the Eno-Haw Regional HMP

HAZARD MITIGATION PLAN UPDATES

Update Hazard Mitigation Plan to address Areas of Mitigation Interest

Area of Mitigation Interest	Impact	Potential Mitigation Actions	
		Goal	Objectives

Add new actions to existing local Hazard Mitigation Plans and flood risk plans

Integrate Hazard Mitigation Plans into other community plans

STRATEGIES TO REDUCE FLOOD RISK

Prevention

Affects future development

Includes ordinances and building codes

Property protection

Affects existing development

Includes elevation and acquisition

Public education and awareness

Informs people about risk

Includes outreach activities

Natural resource protection

Protects water quality

Protects Habitats

Restores resources

Emergency services protection

Protects critical facilities

Structural projects

Involves construction

Includes berms

Includes altering stream routes

BUILDING RESILIENT COMMUNITIES THROUGH ACTION

Management Best Practices

Land Use Ordinances

Local Building Codes

Mitigation Projects

Community Identified Mitigation Programs

TAKING ACTION

Land Use
- Floodplain Management
- Open Space Preservation
- Stormwater Management
- Subdivision Ordinance
- Zoning
- Other

Building Code
- Enforcement
- International Building Code
- International Residential Code

Management Best Practices
- Integrate Natural Hazards into Planning Mechanisms
- Other

Community Identified Programs
- Firewise
- NFIP
- CRS
- Other

Taking Action

Mitigation Projects

- Acquisition
- Elevation
  - Structure
  - Utilities
  - Other
- Flood Risk Management
  - Bridge
  - Culvert
  - Dams
  - Debris
  - Drainage Improvements
  - Levees
  - Revetments
  - Other

Mitigation Projects (cont)

- Forest or Vegetation Management
- Natural Systems Restoration
  - Wetlands
  - Other
- Soil Stabilization or Erosion Control
- Retrofit
  - Non-Structural
  - Structural
  - Other
- Safe Room Construction
- Underground Utilities
- Other

FEMA's Hazard Mitigation Assistance (HMA) Program introduces three mitigation grant programs available to alleviate the risk to individuals and property from natural hazards while simultaneously reducing reliance on Federal disaster funds.

UNIFIED HAZARD MITIGATION ASSISTANCE GRANT PROGRAMS

FEMA

PROPERTY PROTECTION MITIGATION METHODS

Modify existing structures/ infrastructure to protect from hazards or remove from hazard area

Examples:

- *Acquisition/Relocation*
- *Elevation*
- *Retrofits*
- *Floodproofing*
- *Storm shutters*

HAZARD MITIGATION GRANT PROGRAM (HMGP)

The key purpose is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster.

HMGP is available following a Federalmajor disaster declaration. 75/25% match; NC traditionally has provided the non-Federal match.

North Carolina, as an Enhanced Haz. Mit. Plan State is eligible for up to 20% of Public Assistance and Individual

PRE-DISASTER MITIGATION GRANT (PDM)

*The COMPETITIVE PDM program is designed to implement a sustained **pre-disaster** natural hazard mitigation program to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding from future disasters. 75/25 match*

2016 Priority: Climate Resilient mitigation actions

floodplain and stream restorations

flood diversion and storage *(if you have one call SHMO*

FLOOD MITIGATION ASSISTANCE GRANT (FMA)

The FMA program has the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP); three cost share options:

100% Federal share (for SRL properties)

4 or > claims > $5K/, with cumulative amount totalling >$20K

90/10% for Repetitive Flood Claims (RFC) 2 claims w cumulative > bl;dg. value

75/25 for Rep Loss

For the past two annual appropriations Federal priority for grants has been for Repetitive Flood Claims (RFP)

REPETITIVE FLOOD CLAIM GRANT (RFC)

The RFC program is authorized by Section 1323 of the NFIA, 42 U.S.C. 4030 with the goal of reducing flood damages to individual properties for which one or more claim payments for losses have been made under flood insurance coverage and that will result in the greatest savings to the National Flood Insurance Fund (NFIF) in the shortest period of time.

SEVERE REPETITIVE LOSS GRANT (SRL)

The SRL program is authorized by Section 1361A of the NFIA, 42 U.S.C. 4102a, with the goal of reducing flood damages to residential properties that have experienced severe repetitive losses under flood insurance coverage and that will result in the greatest savings to the NFIF in the shortest period of time.

“Hazard Mitigation Saves”

Report available at
www.nibs.org/MMC/mmcactiv5.html

Independent study of FEMA grants

$1 in mitigation -> $4 saved

220 lives and 4700 injuries over 50 yrs

HAZARD MITIGATION CONTACTS

For More Information contact:

The State Hazard Mitigation Officer (SHMO)

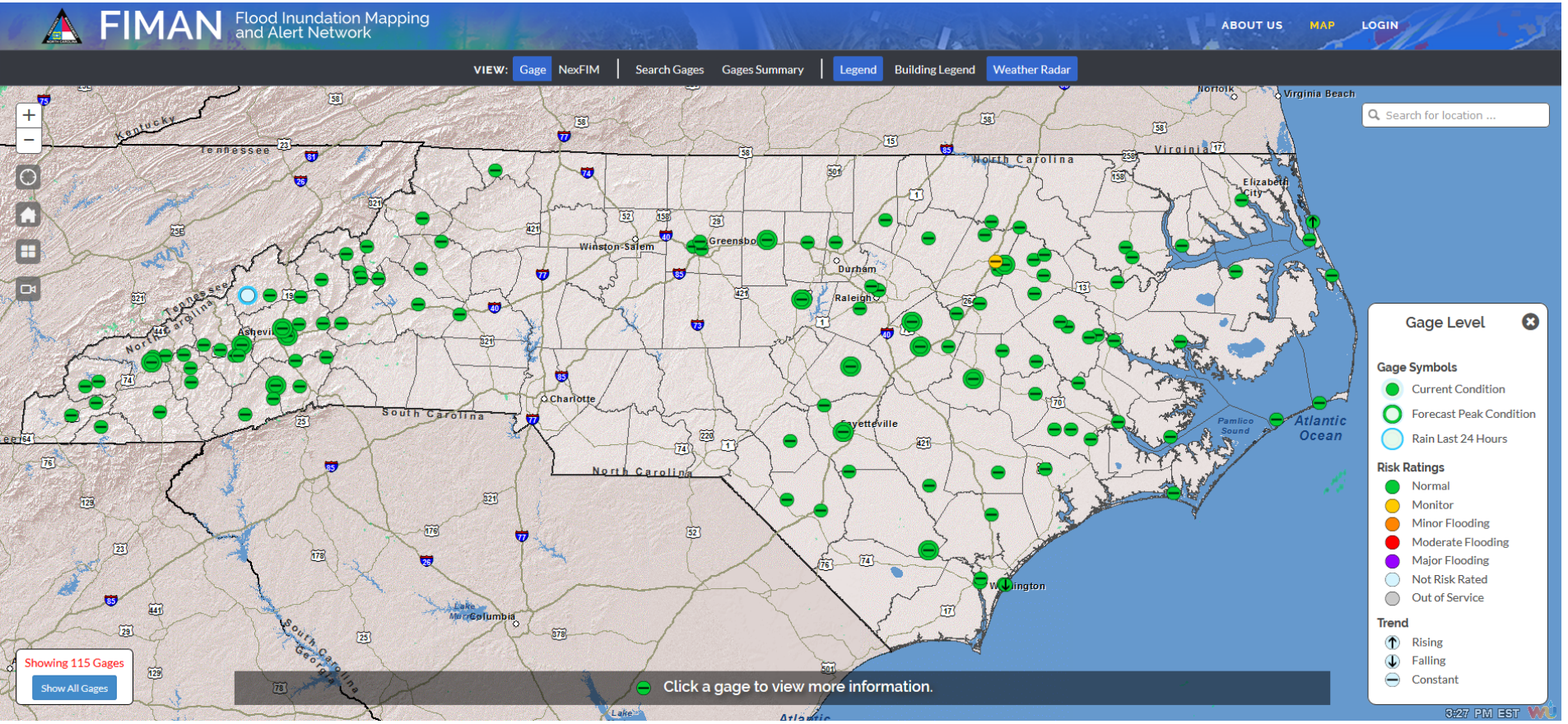
Ryan Cox: (919) 825-2311 or ryan.cox@ncdps.gov or

www.ncem.org

www.fema.gov

Flood Inundation Mapping and Alert Network (FIMAN)

Real-time Flood Inundation Mapping



FIMAN SYSTEM OVERVIEW

Available to Public

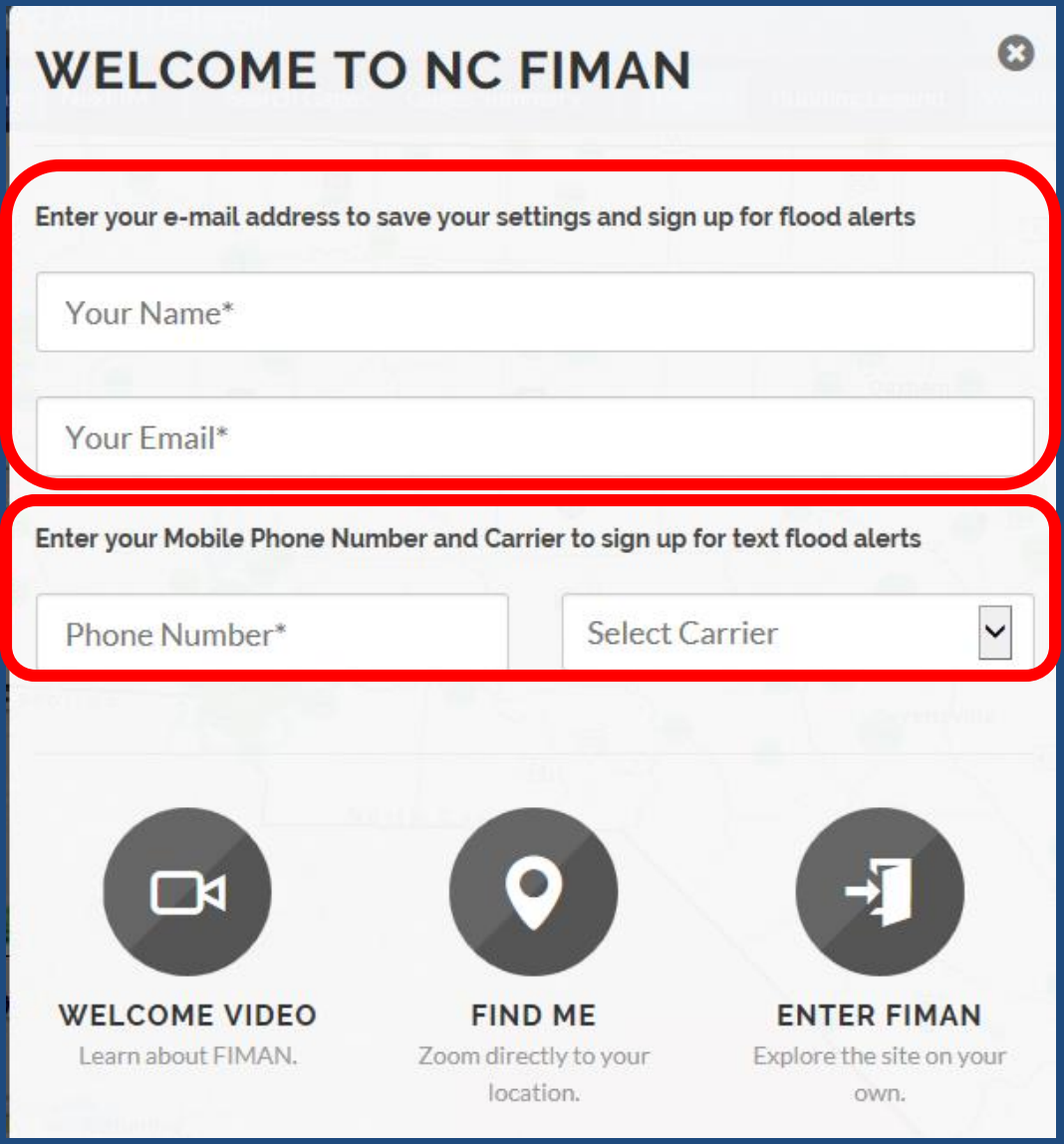
User Customizations and Alerts

Flood inundation mapping for Current, Scenario, and Forecast gage levels

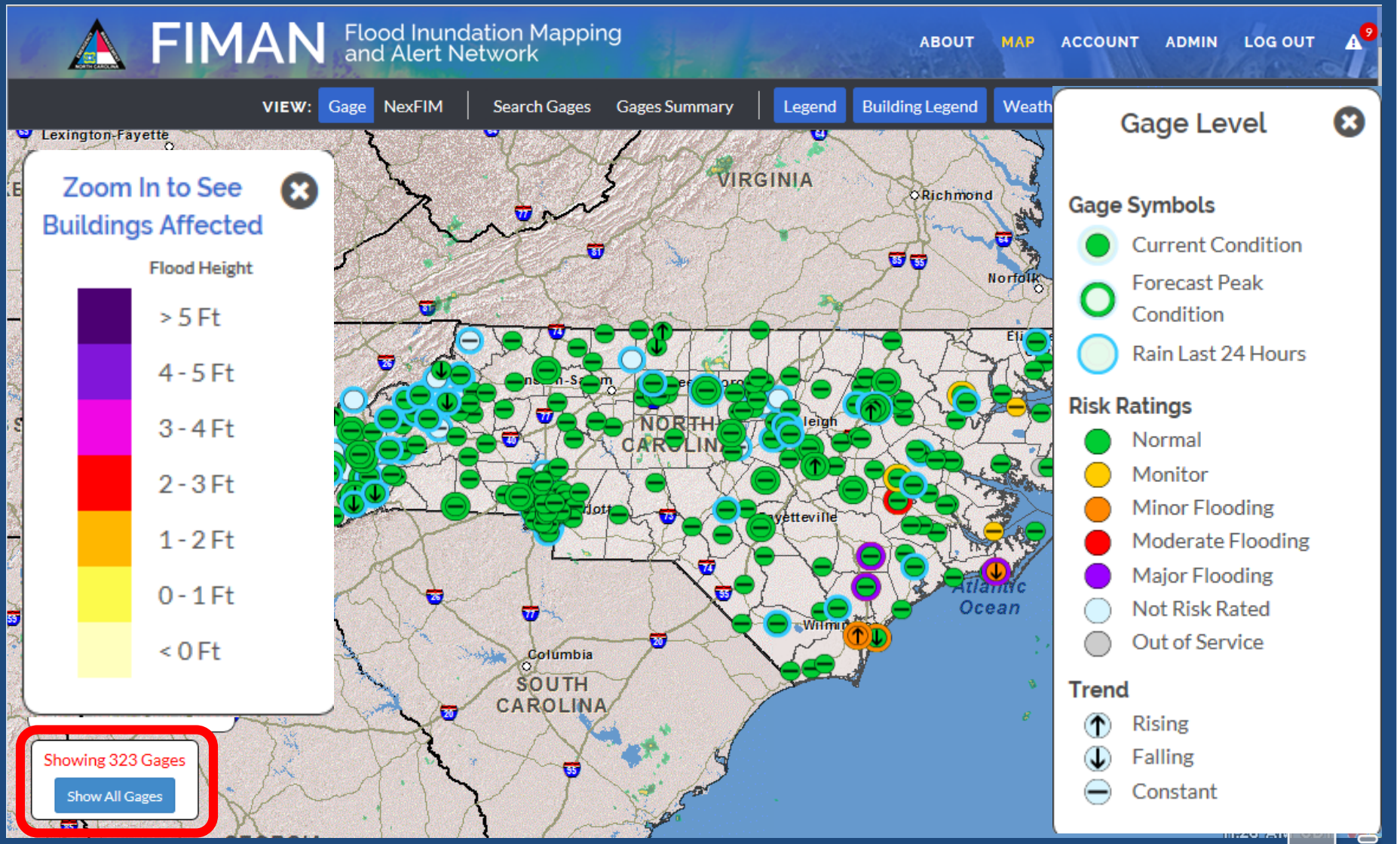
Estimates Flood Risk and Impacts (costs/losses) to Buildings

Expanding functionality with NexGEN Flood Inundation Mapping

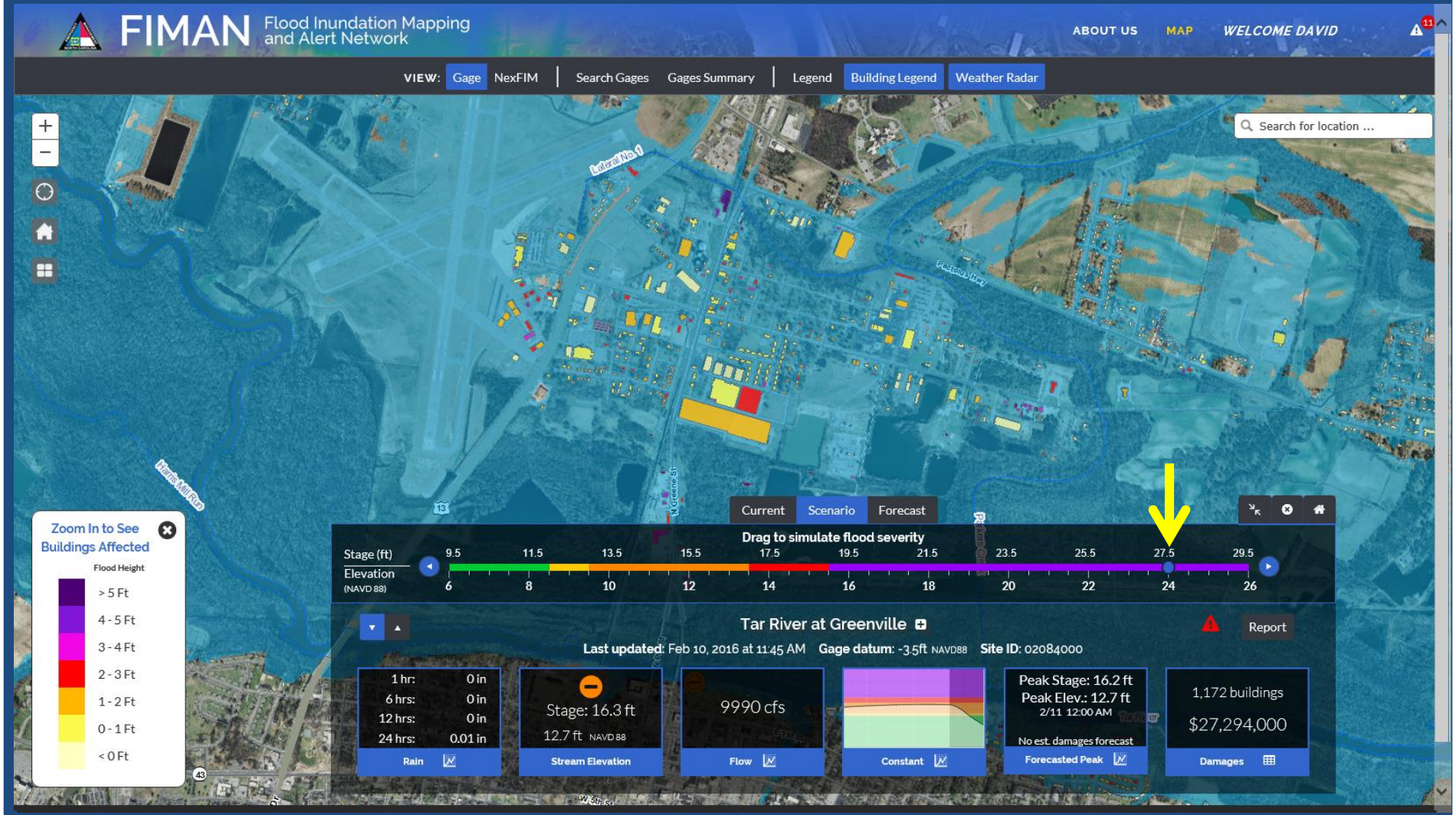
FIMAN ALERTS REGISTRATION



HOME SCREEN WITH CURRENT STATUS

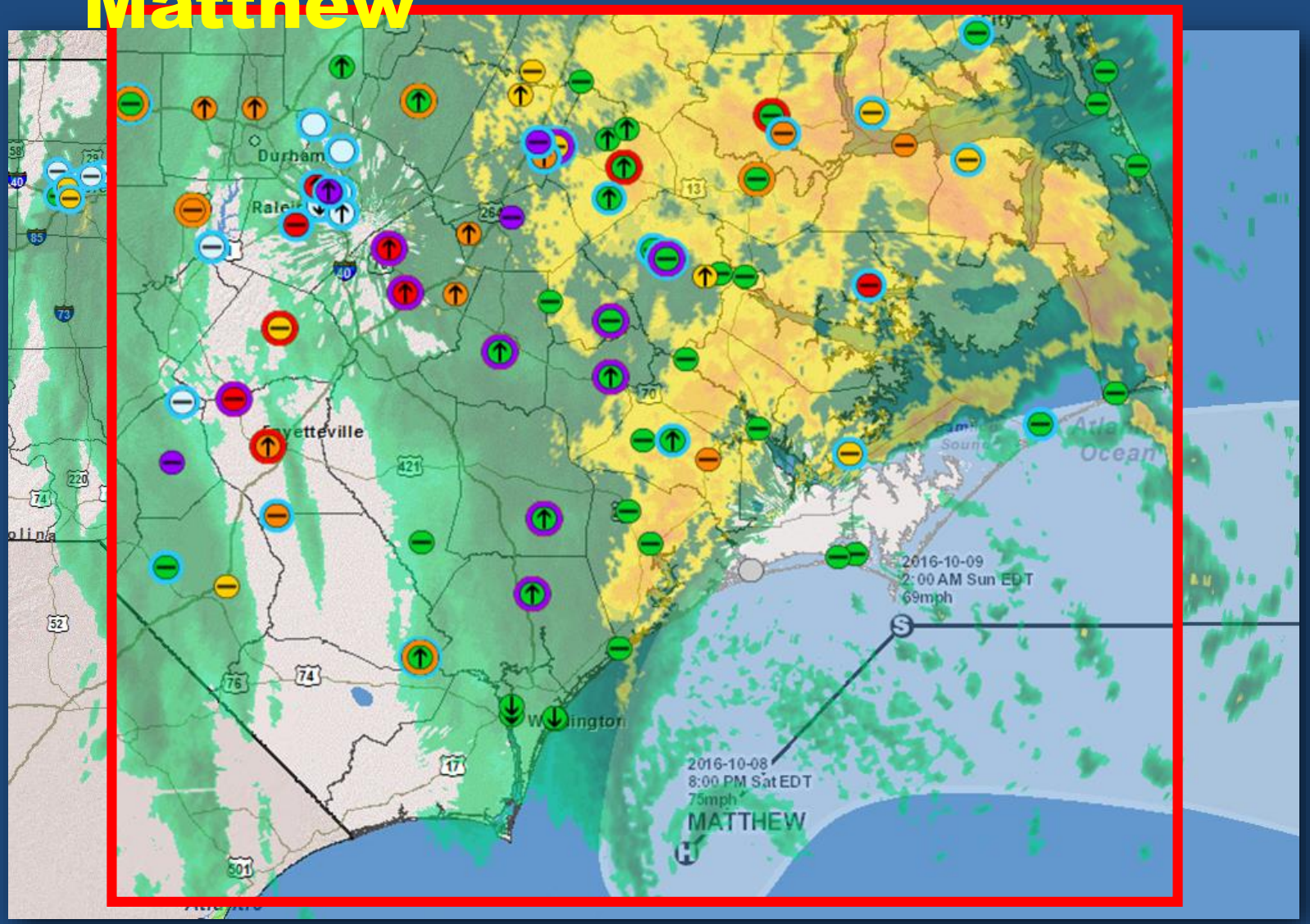


FLOOD SCENARIO MODE



Hurricane Matthew

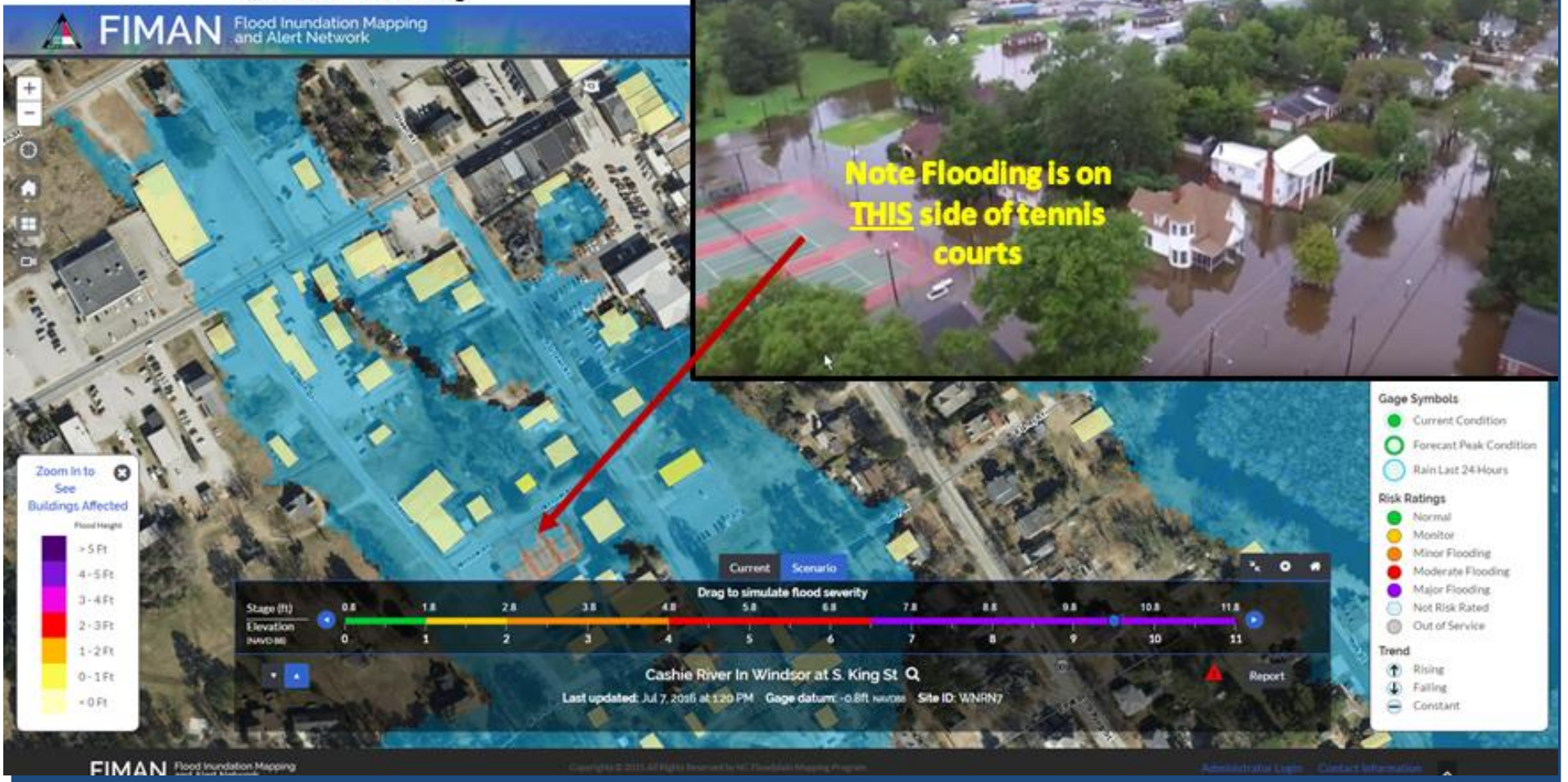
Sat. 10/8/16 @ 8 PM



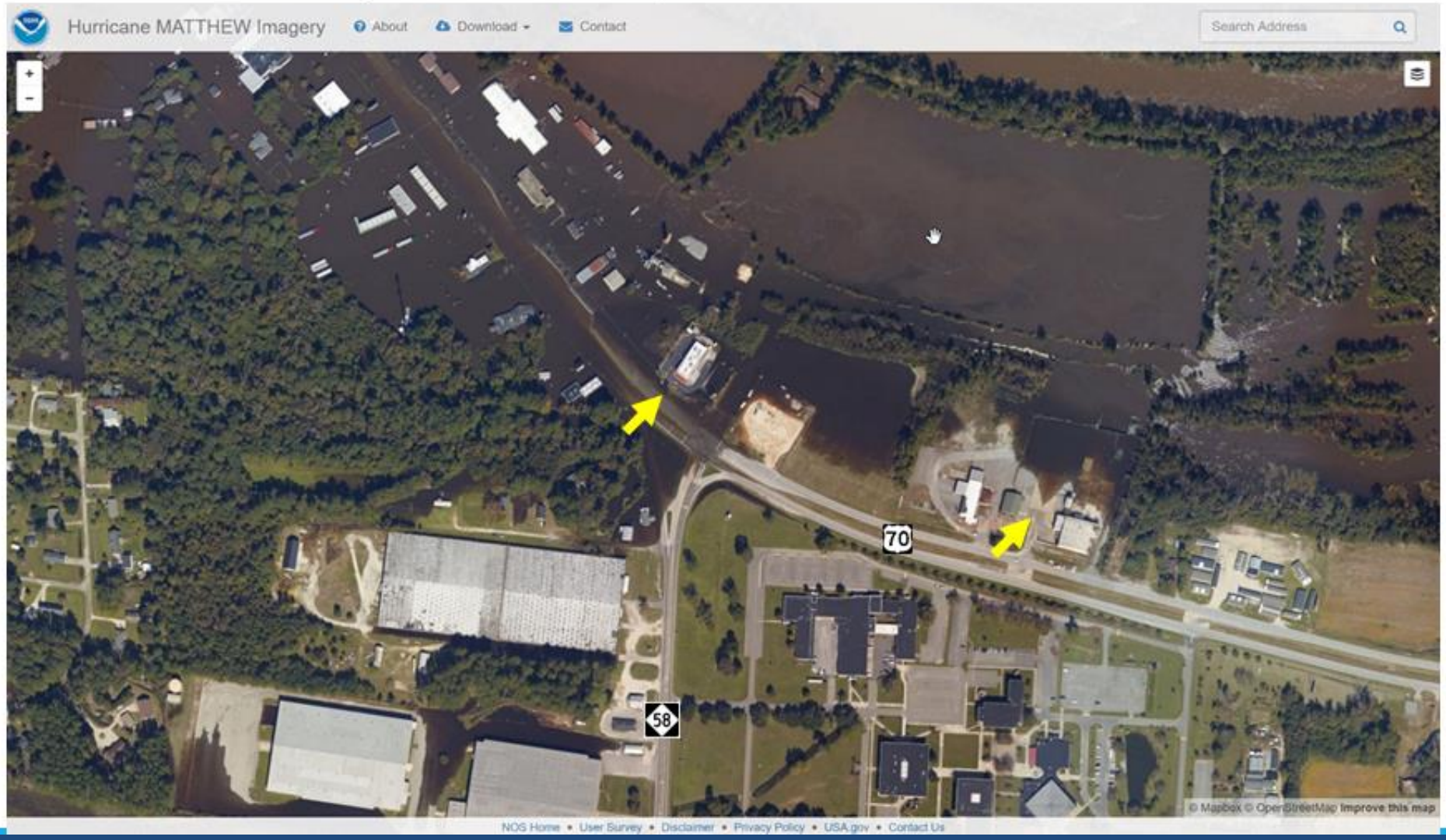
Windsor, NC – Sept 2016

Windsor Flooding

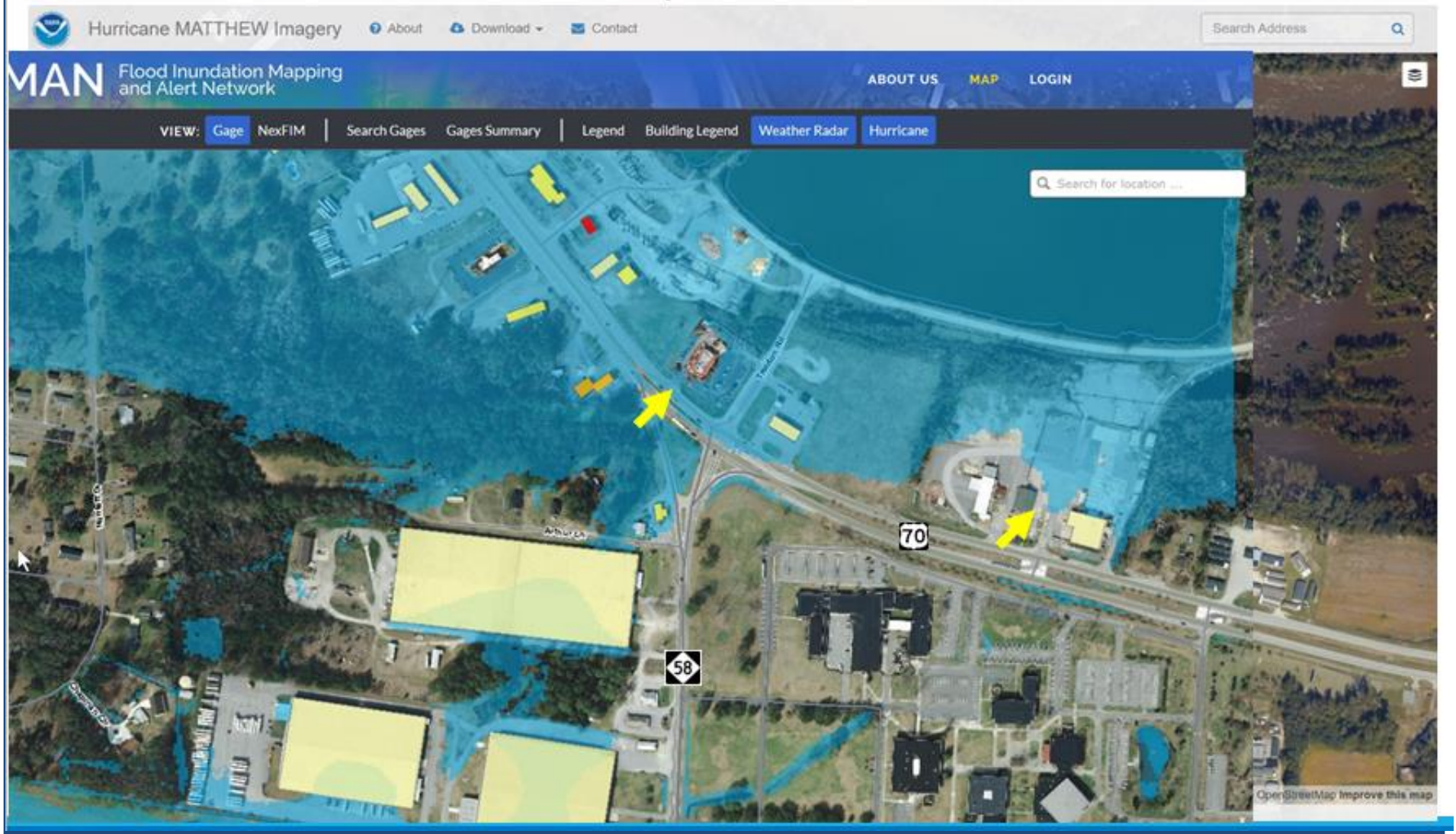
9/22/16 - Morning



Kinston, NC – Sept. 2016



Kinston, NC – Sept. 2016




INUNDATION FORECAST
SOURCE: FIMAN.NC.GOV
WRAL WEATHER
WRALWEATHER
TARBORO
MAIN ST
FLOODING EXPECTED
WITH CREST OF 35.4'
NC-111
PRINCEVILLE
US-64 ALT

Daily Flood Briefing – Current Conditions

Current Conditions – Minor, Moderate and Major Flooding

		Current Conditions		
Branch	Gage Name	Stage	Condition	Buildings Damaged
Eastern	Neuse River at Kinston	28.3 ft	Major	256
Eastern	Northeast Cape Fear River near Burgaw	17.5 ft	Major	279
Eastern	Tar River at Greenville	24.3 ft	Major	341
Eastern	Lumber River at Lumberton	22.7 ft	Major	1,010
Eastern	Neuse River near Goldsboro	27.3 ft	Major	79
Eastern	Contentnea Creek at Hookerton	19.9 ft	Major	0
Eastern	Neuse River near Fort Barnwell	19.8 ft	Major	NA
Central	Tar River at Tarboro	35.5 ft	Major	243
Eastern	Tar River at Us 264 Bypass near Rock Springs	24.7 ft	Moderate	134
Eastern	Black River near Tomahawk	19.9 ft	Moderate	NA
Eastern	Cape Fear River at Lock #1 near Kelly	28.0 ft	Moderate	NA
Eastern	NE Cape Fear River near Chinquapin	15.7 ft	Moderate	4
Eastern	Trent R. at Pollocksville	8.2 ft	Minor	11
Eastern	Trent R. at Trenton at N. Weber St	20.8 ft	Minor	17
Eastern	Chicod Cr at SR1760 near Simpson	12.3 ft	Minor	24
Eastern	Cashie River In Windsor at S. King St	3.2 ft	Minor	4
Eastern	Cape Fear River Lock near Tarheel	17.5 ft	Minor	NA
Central	Swift Cr. at 97 Nr. Leggett	16.1 ft	Minor	18
Central	Fishing Cr at 97 near Leggett	22.8 ft	Minor	3

Current Conditions – Sound Monitoring

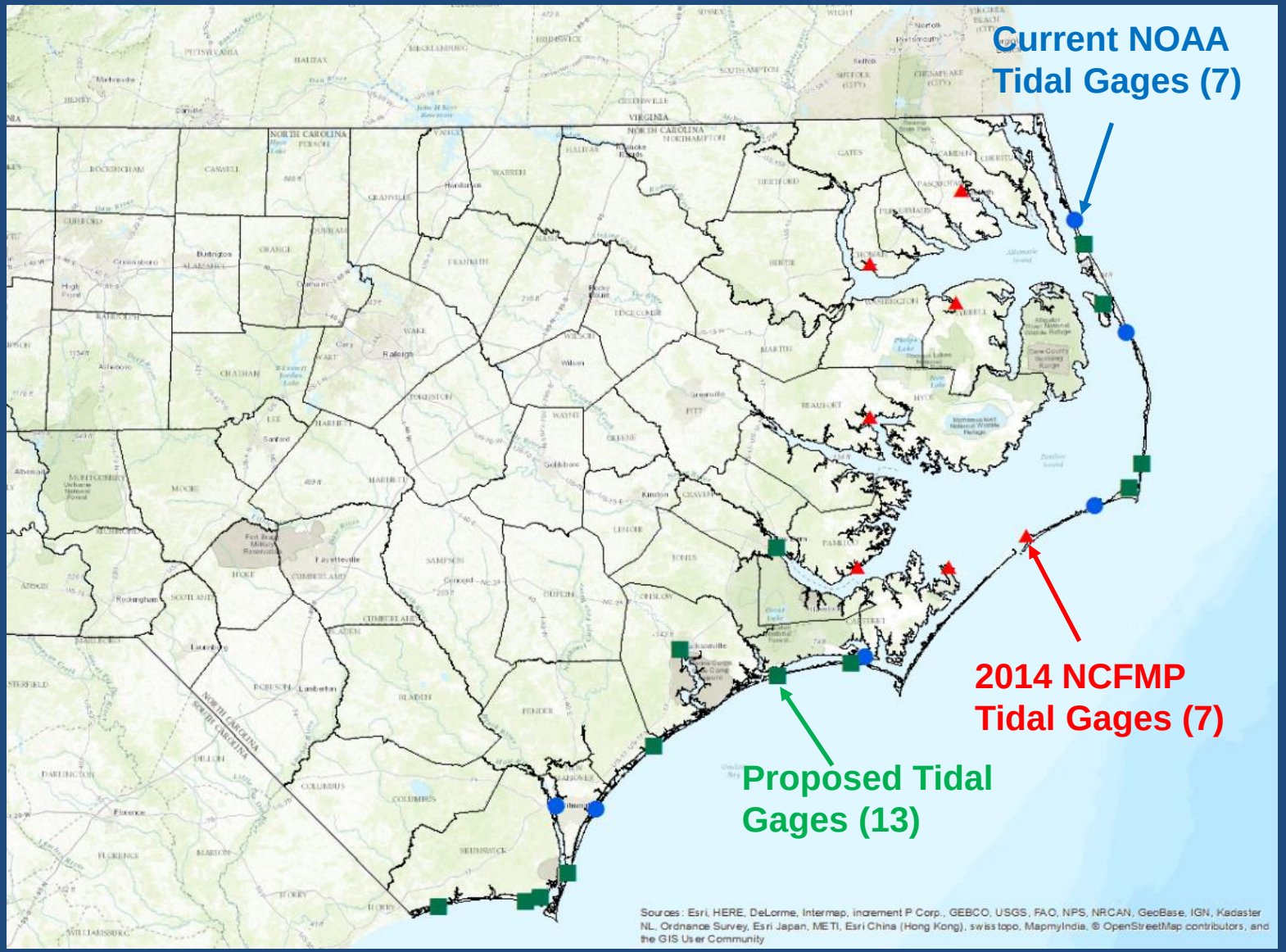
Gage Name	BFE	Stage	Condition	Trend
Tar River at Grimesland	12.7	8.8	Monitor	Very slowly increasing (0.02'/hr).
Pamlico River at Washington	10	2.6	Normal	Minor tidal fluctuations.
Pungo River at Belhaven	7	1.7	Normal	Minor tidal fluctuations.
Trent River at Hwy 70 New Bern	8	2.3	Normal	Minor tidal fluctuations.

Forecasted Conditions – Moderate and Major Flooding

Daily Flood Briefing – Forecast Conditions

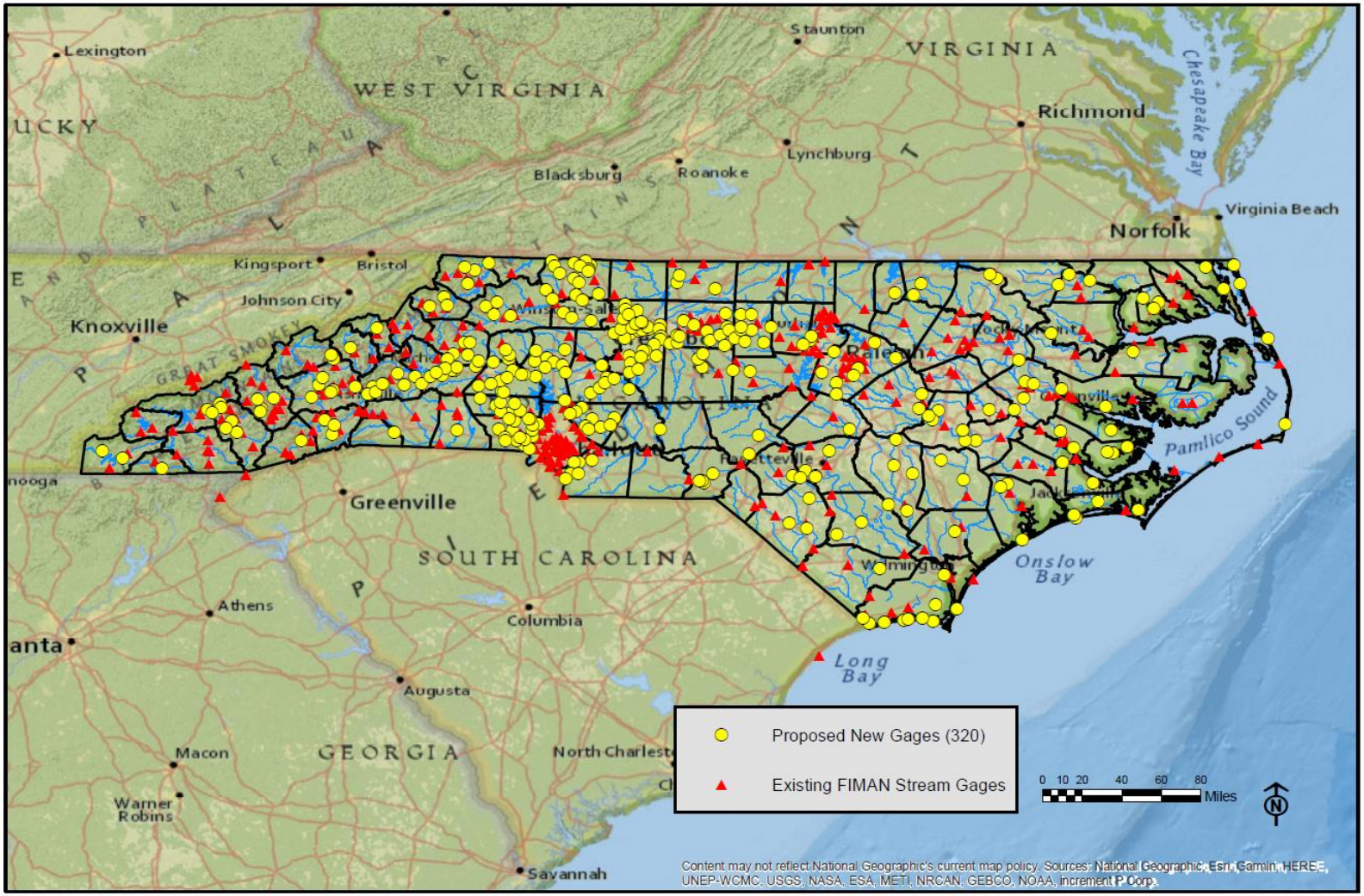
Gage Name	Forecast Conditions (Southeast River Forecast Center)					
	Peak Stage	Peak Date/Time	Buildings Touched by Flooding	Buildings with Flooding in Structure	Condition	County
Eastern Branch Gages						
NE Cape Fear River near Burgaw	17.8 ft	Receding	324	156	Major	**Pender**
Cape Fear River at Lock #1 near Kelly	28.5 ft	Cresting	No FIMAN Library	No FIMAN Library	Major	**Bladen**
Tar River at Greenville	24.5 ft	Cresting	341	74	Major	**Pitt**
Neuse River at Kinston	28.8 ft	10/14/2016 20:00	303	170	Major	**Lenoir**
Neuse River near Goldsboro	29.7 ft	Receding	131	57	Major	**Wayne**
Lumber River at Lumberton	24.7 ft	Receding	528	528	Major	**Robeson**
Central Branch Gages						
Tar River at Tarboro	36.3 ft	Receding	255	118	Major	**Edgecombe**
Tar River at 97 at Rocky Mount	28.7 ft	Receding	94	27	Major	**Nash**
Tar River at Louisburg	23.2 ft	Receding	0	0	Moderate	**Franklin**
Cape Fear at Lillington	19.4 ft	Receding	6	6	Moderate	**Harnett**
Neuse River Near Clayton	21.0 ft	Receding	1	0	Major	**Johnston**
Neuse River at Smithfield	29.1 ft	Receding	50	25	Major	**Johnston**
Western Branch Gages						
None reporting forecasted Minor flood levels or above at this time						

Current and Proposed Coastal Tidal Gages



FIMAN Build-out Plan

Existing and Proposed Riverine/Coastal Gages



DEPARTMENT OF PUBLIC SAFETY

North Carolina Emergency Management

2D Dam Inundation Studies and State Emergency Response Application for Dams

SB-99 – North Carolina Disaster Recovery Act of 2018 (DRA18)

Simplified 2-D Dam Breach Modeling

North Carolina State Emergency Response Application (SERA) for Dams

Current NC Dam Inventory (7-16-2018)

Dam Hazard	Total	Non-Exempt	Has EAP
High	1445	1215	714
Intermediate	591	265	18
Low	3686	629	61
Totals	**5722**	**2109**	**793**

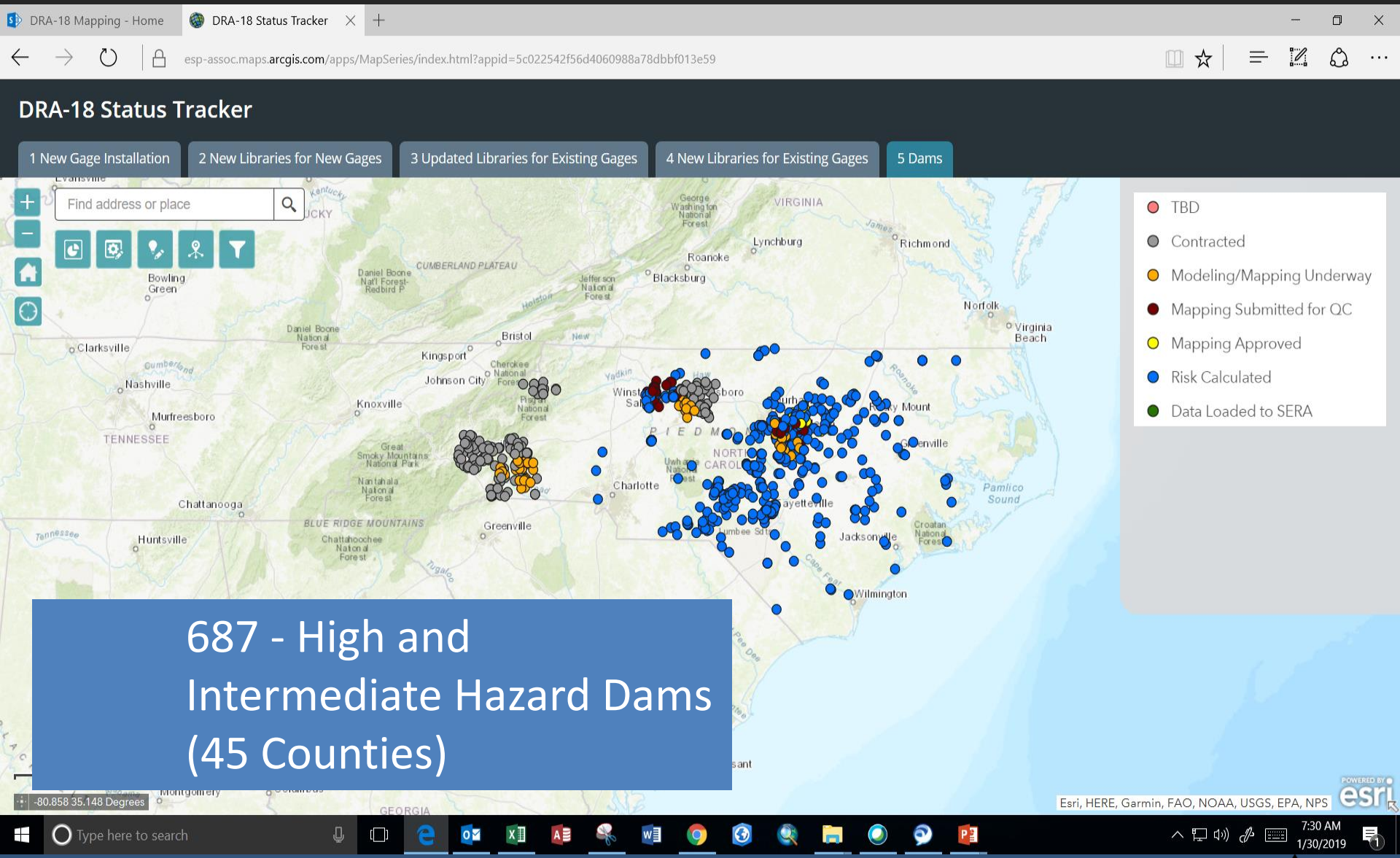
1480

- Coal Ash Management Act of 2014 (SB-729) – Emergency Action Plans (EAPs) required for all non-exempt high and intermediate hazard
  - **51% of required dams do not have an EAP (July 2018)**
  - No requirements for digital inundation boundaries
  - No standardized requirements or methodology to produce inundation boundaries
- Hurricane Matthew and Florence – 56 total overtopped or breached dams

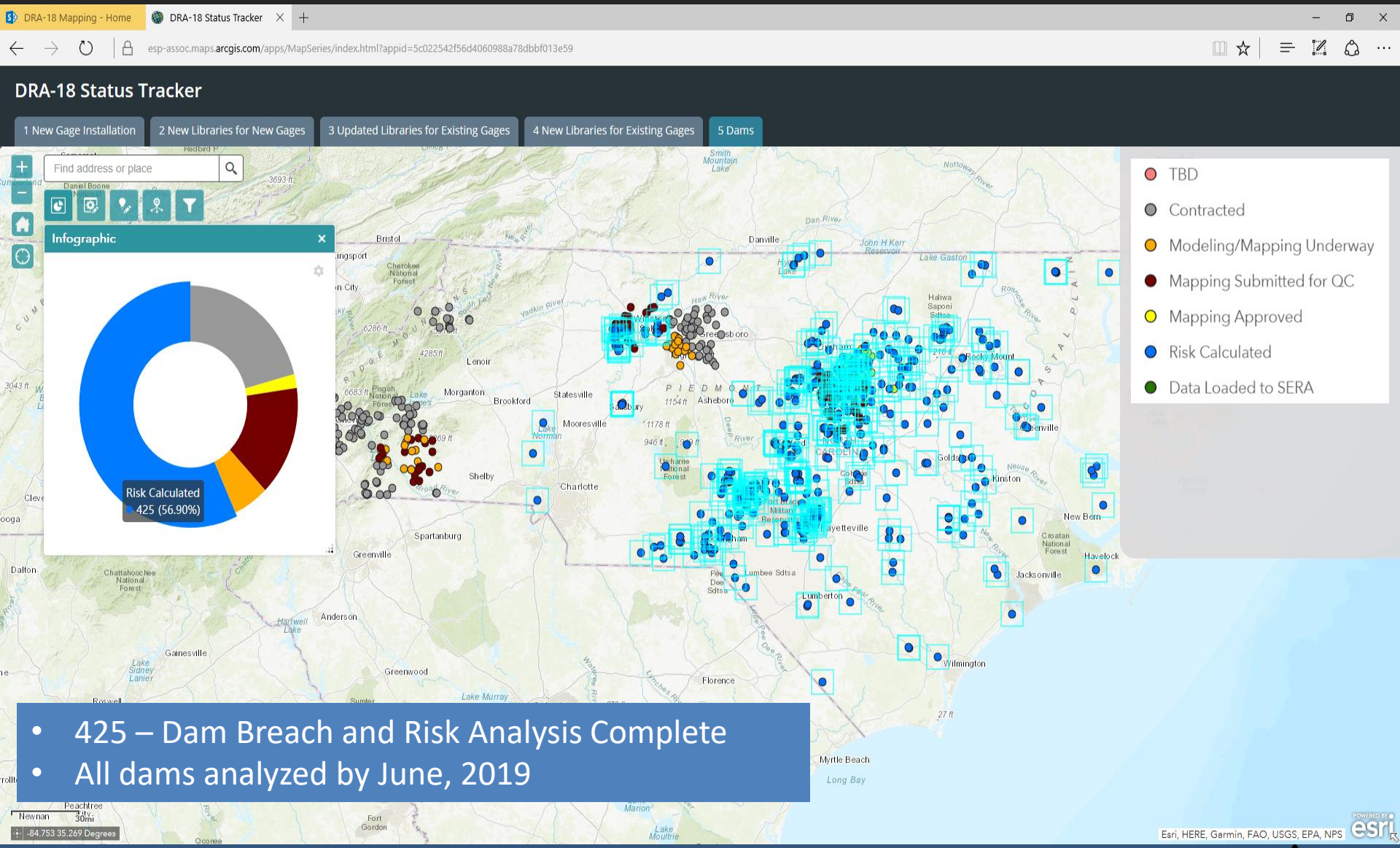
Disaster Recovery Act of 2018 (DRA-18, SB-99)

- Hurricane Matthew Disaster Recovery Funding
- Projects
  - Stream gage purchase and installation (25-Radar and 15-Ultrasonic)
  - Libraries for new gages (25 Radar Sites)
  - Extend existing FIMAN libraries (20 sites)
  - Develop FIMAN libraries at existing gages (30 sites)
  - Dam Inundation Mapping and Risk Assessments

Dam Inundation and Mapping and Risk Assessment – Current Status

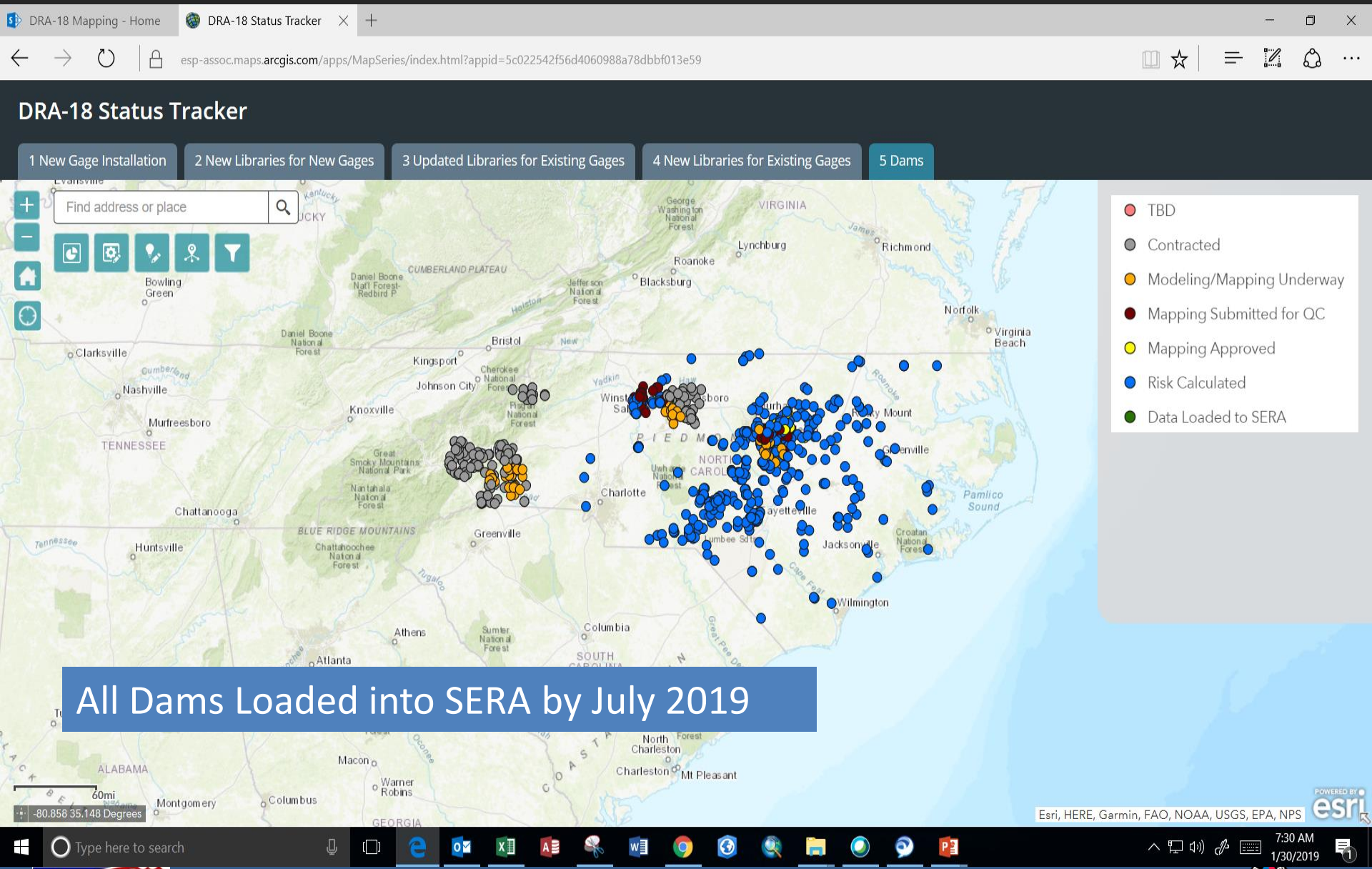


Dam Inundation and Mapping and Risk Assessment – Schedule



- 425 – Dam Breach and Risk Analysis Complete
- All dams analyzed by June, 2019

Dam Inundation and Mapping and Risk Assessment – Schedule



State Emergency Response Application (SERA) for Dams

- Application ONLY available to first responders, State and EM personnel, and law enforcement
- Secure application
  - Not available to general public
  - Requires State NCID to access data and application

How it works during a dam breach

Notifications

- Local Law Enforcement
- 911
- NC Dam Safety

Response

FIRE

POLICE

EMS

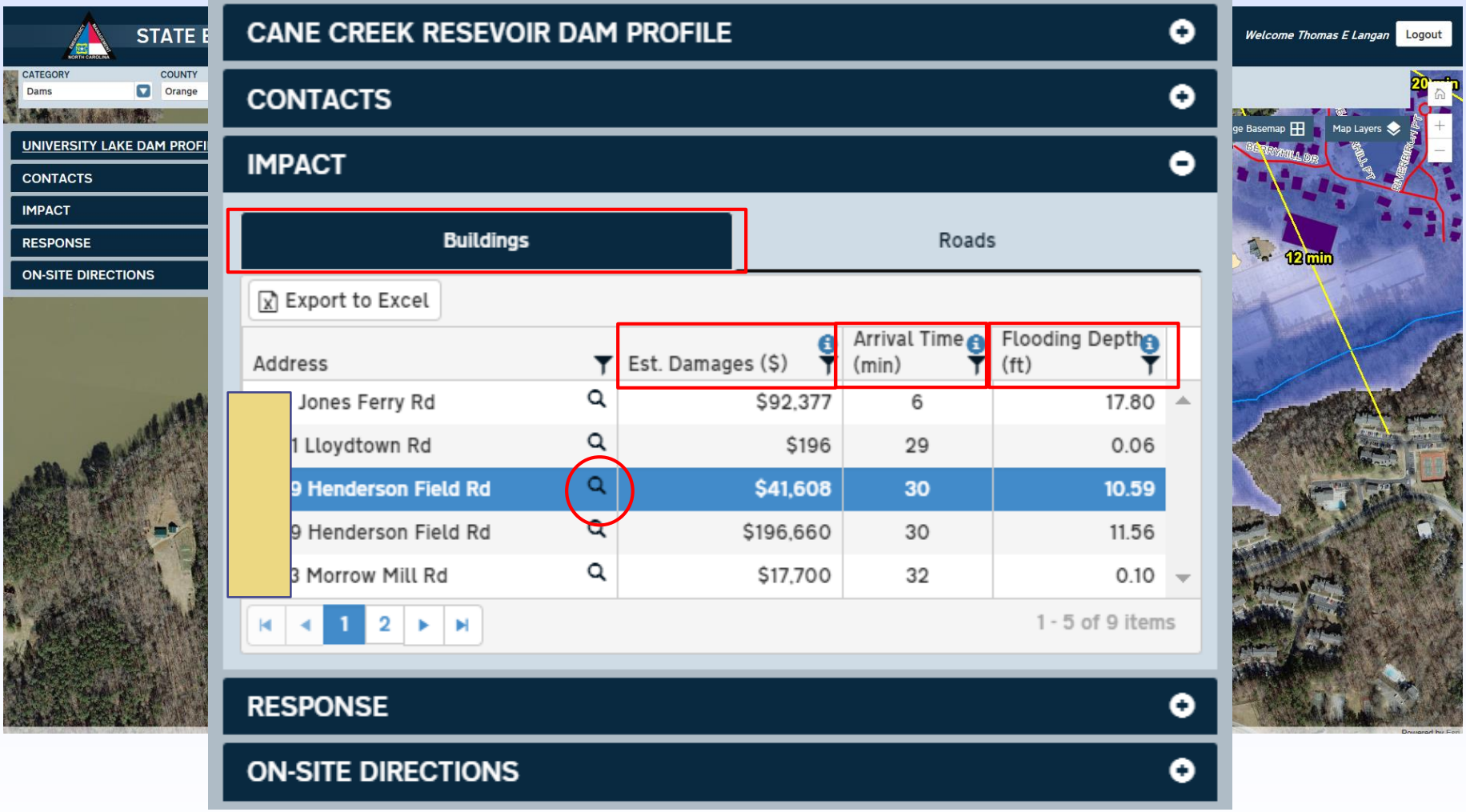
Law Enforcement / First Responders / Incident Command

SERA: State Emergency Response Application

DEPARTMENT OF PUBLIC SAFETY

EMAP Accredited

EMERGENCY MANAGEMENT NORTH CAROLINA



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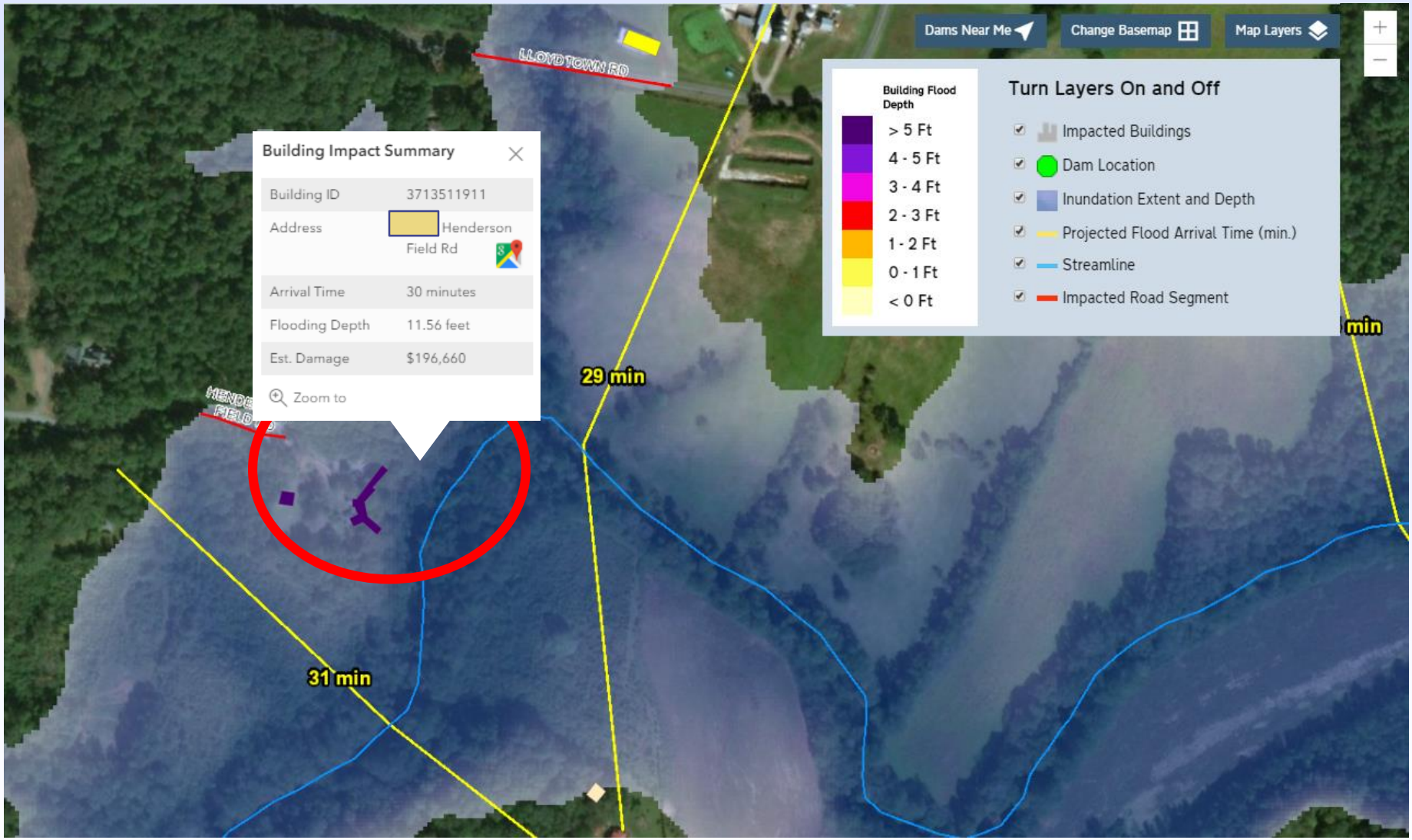
EMAP Accredited

NORTH CAROLINA EMERGENCY MANAGEMENT



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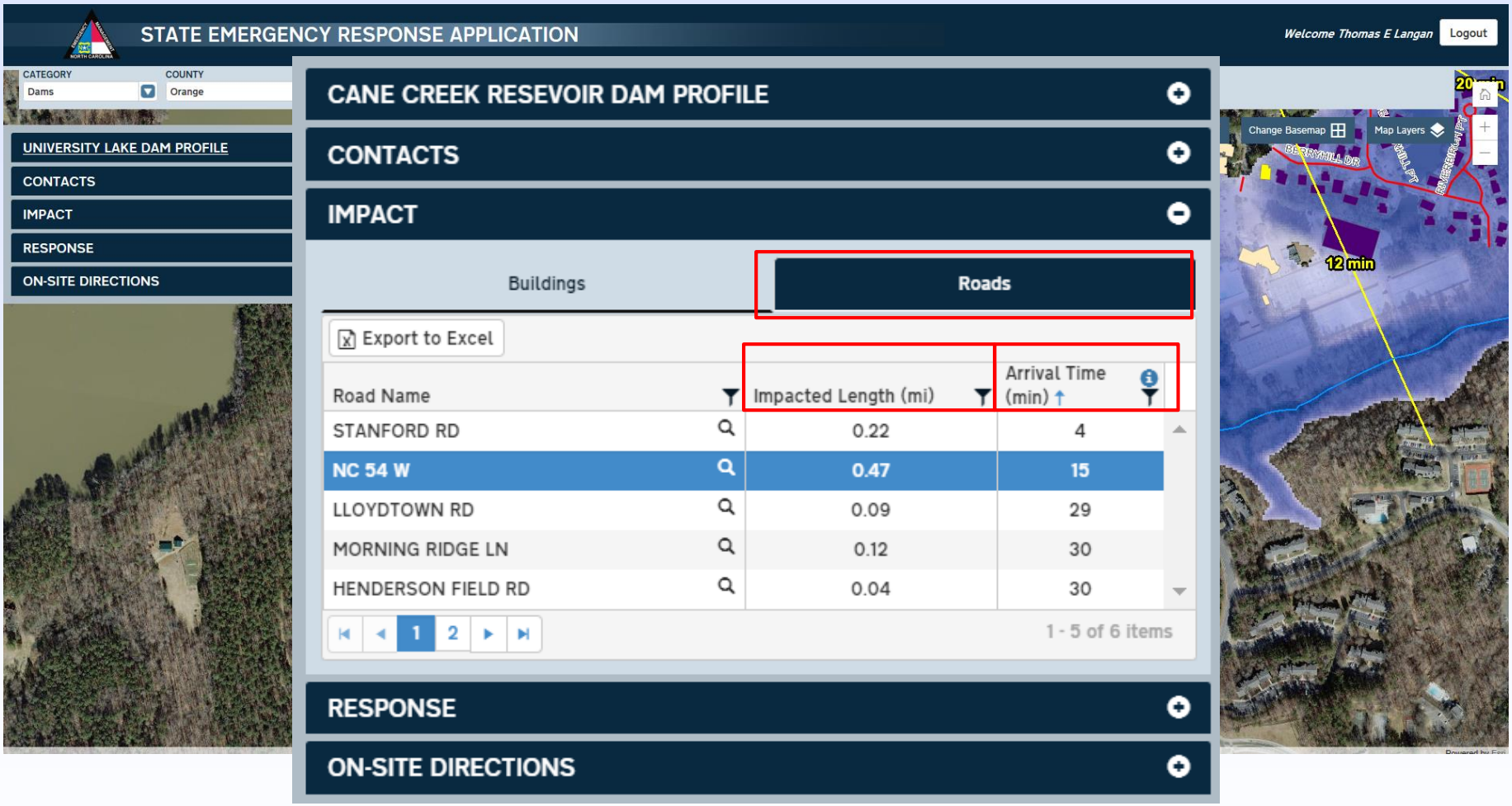
NORTH CAROLINA



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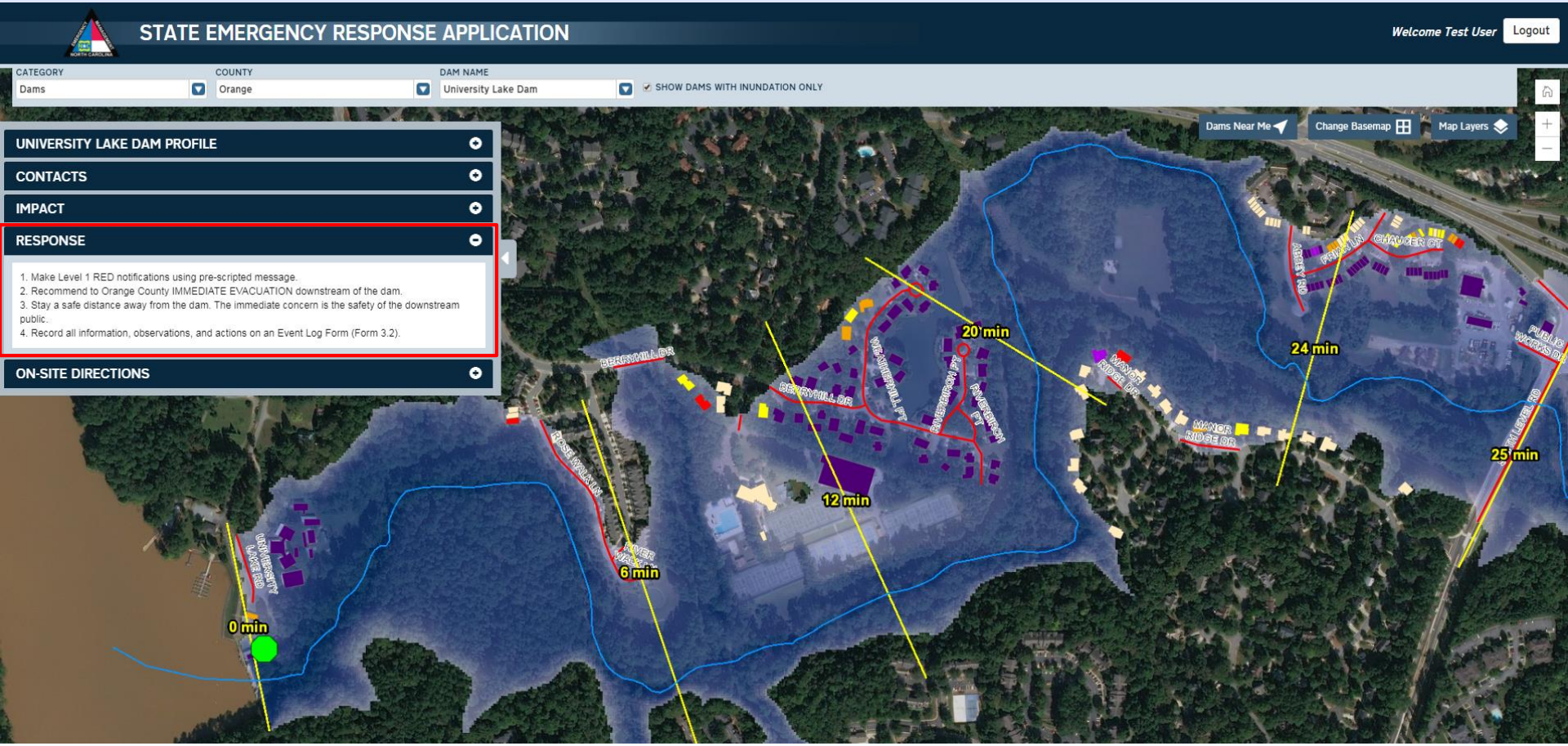
NORTH CAROLINA EMERGENCY MANAGEMENT



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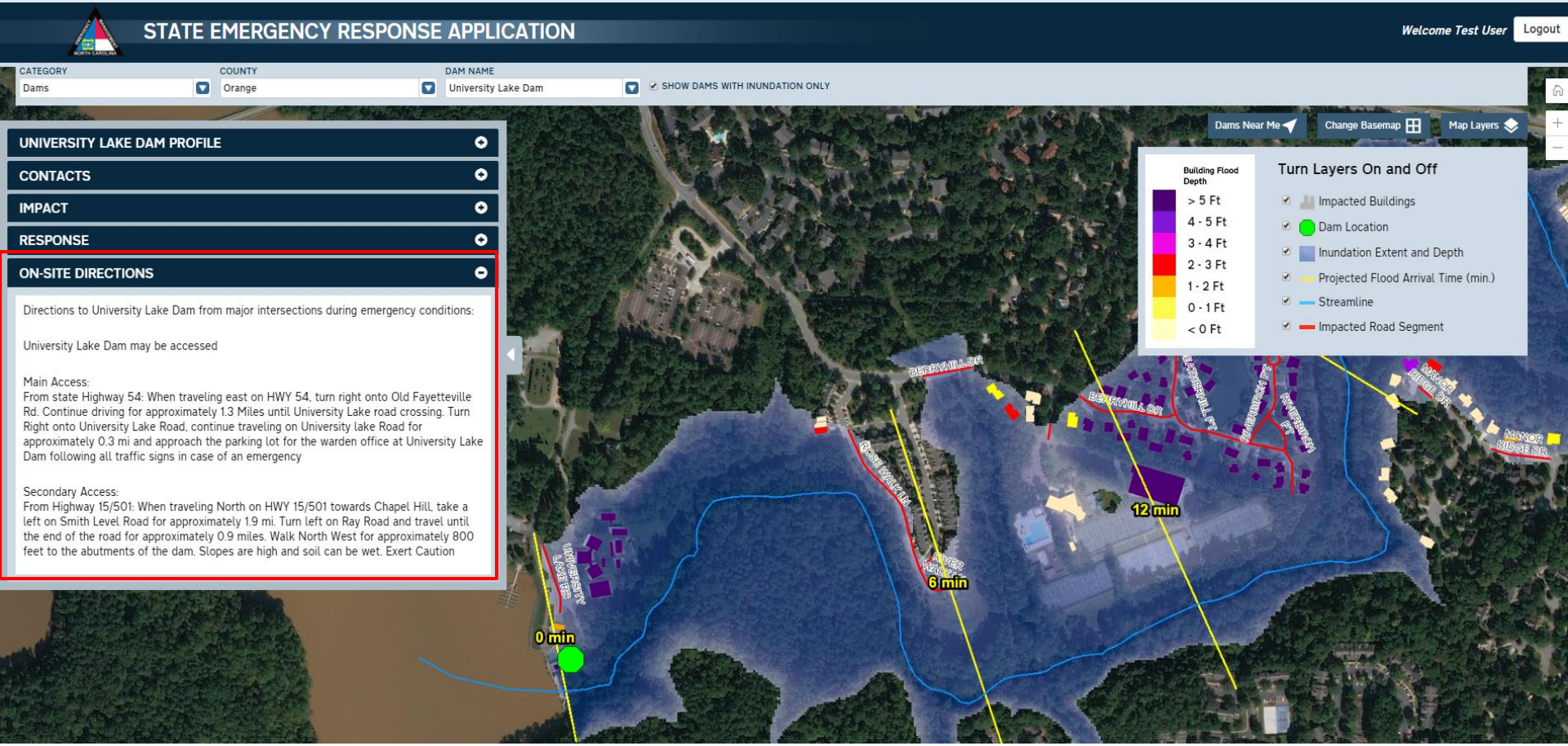
NORTH CAROLINA EMERGENCY MANAGEMENT



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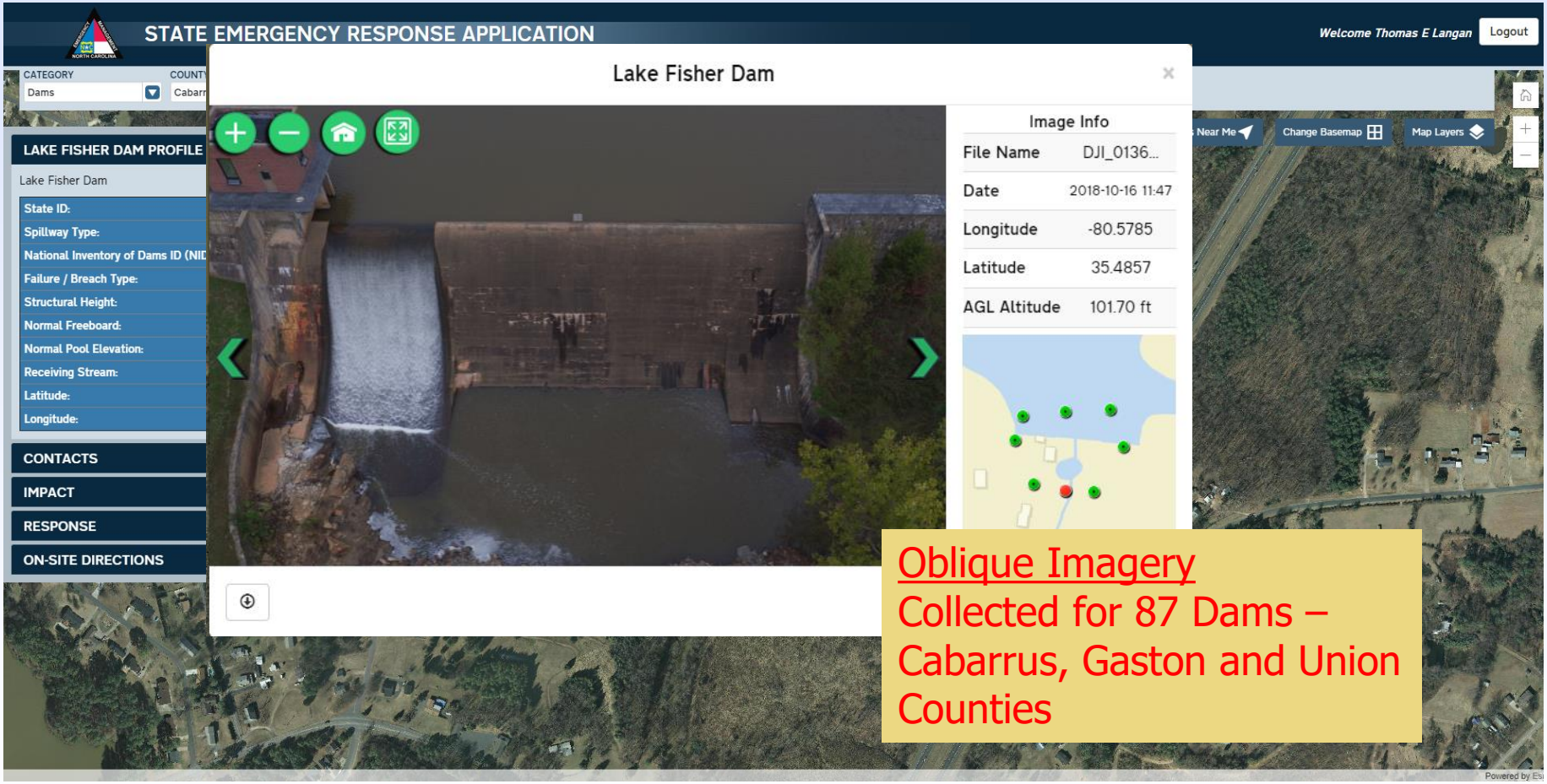
NORTH CAROLINA



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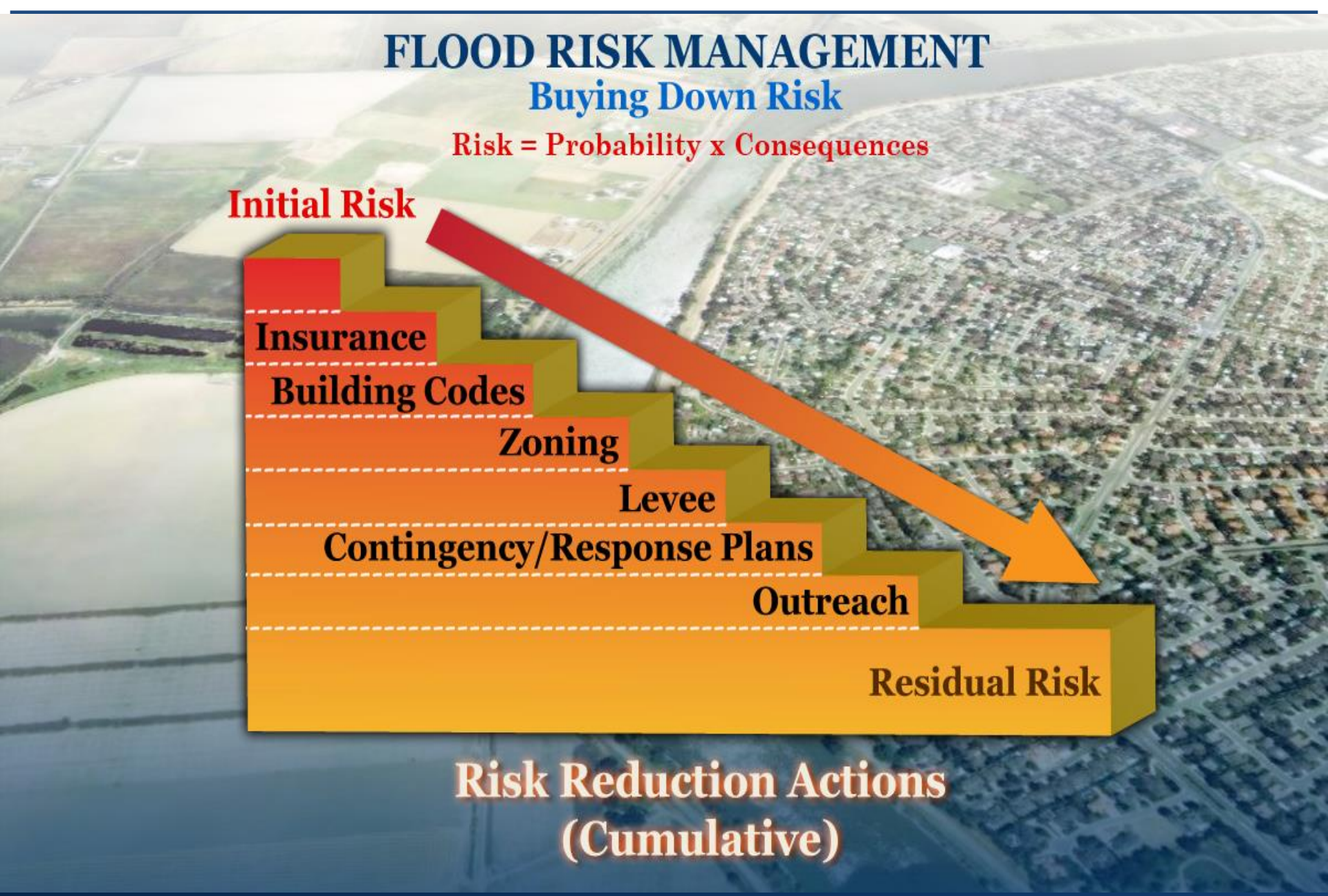
NORTH CAROLINA

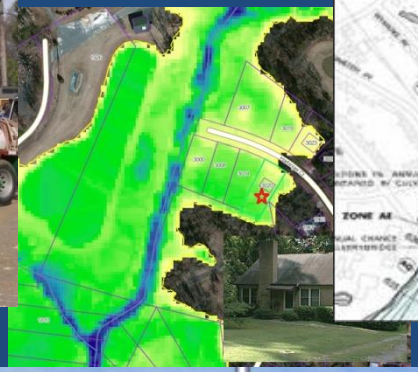
CHARLOTTE-MECKLENBURG MITIGATION

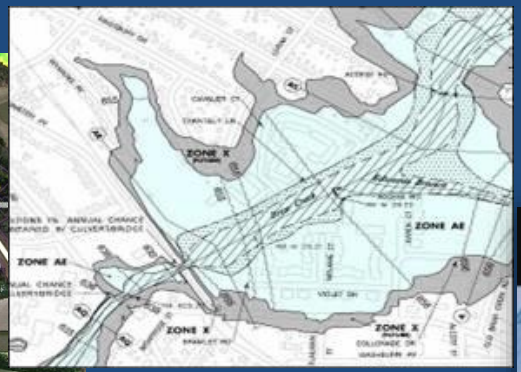


The ability to overcome a situation of crisis

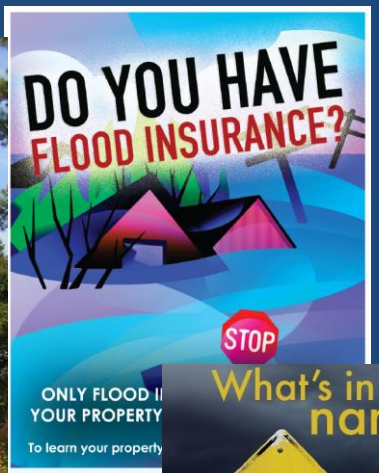
No singular action will eliminate Community Flood Risk!

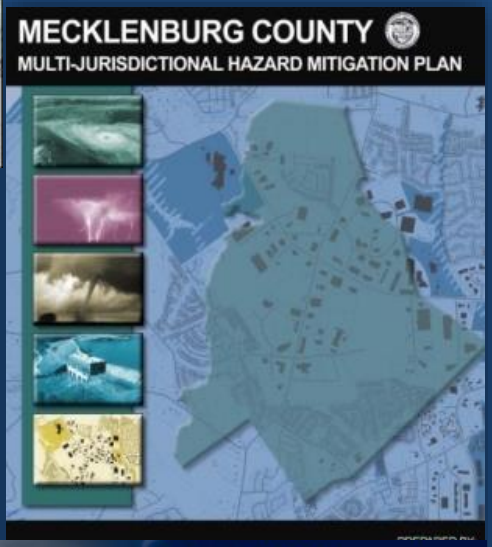
Flood Risk Management





Charlotte-Mecklenburg
retro FIT
Floodproofing • Improvements • Together





Charlotte-Mecklenburg
fins
Flood Information & Notification System

92

FUTURE HAZARD MAPPING

Other factors that can change in the flooding:

Post-wildfire burns

Certified Levees

Erosion zones

Dam failure zones

Sea level rise

Rainfall changes

Others?

FUTURE FLOODPLAINS

Philosophy: Floodplain meant to flood

Upland land for flood storage in new construction

Account for future hydrologic changes to 1% event

Lower future risk & Lower future flood insurance rates when maps increase!

PROTECTING LIFE & PROPERTY

Since 1999, Removed from Floodplain:

Over 400 buildings/homes

Over 700 families

Floodplain restored:

170 acres

Actual Damage Avoided:

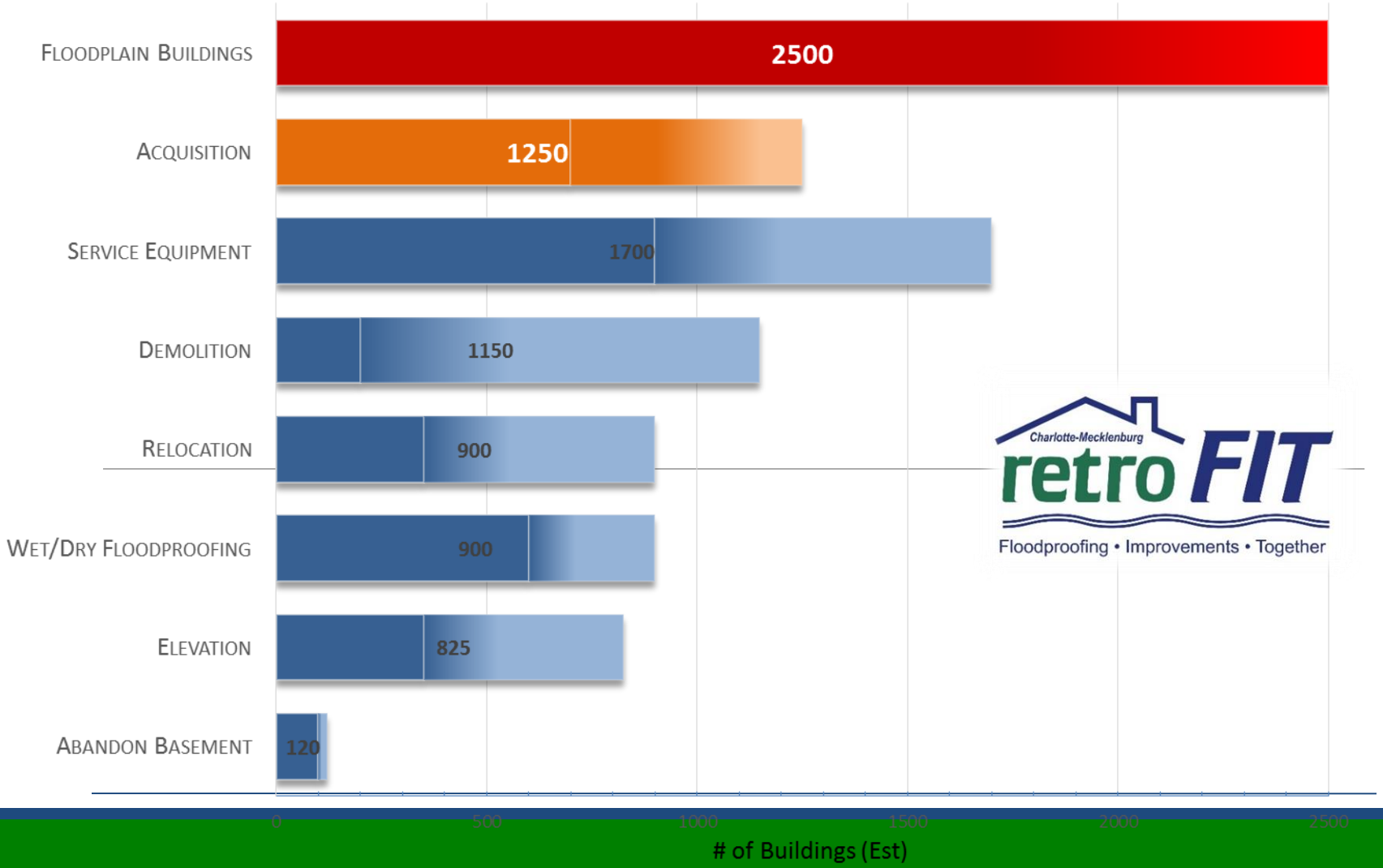
100’s buildings

~$27M in losses avoided

RetroFIT Program

- Incentivize private mitigation
- Floodplain property owners
- Financial & technical assistance
- Direct grant program
- FY16 - Pilot Year $250,000

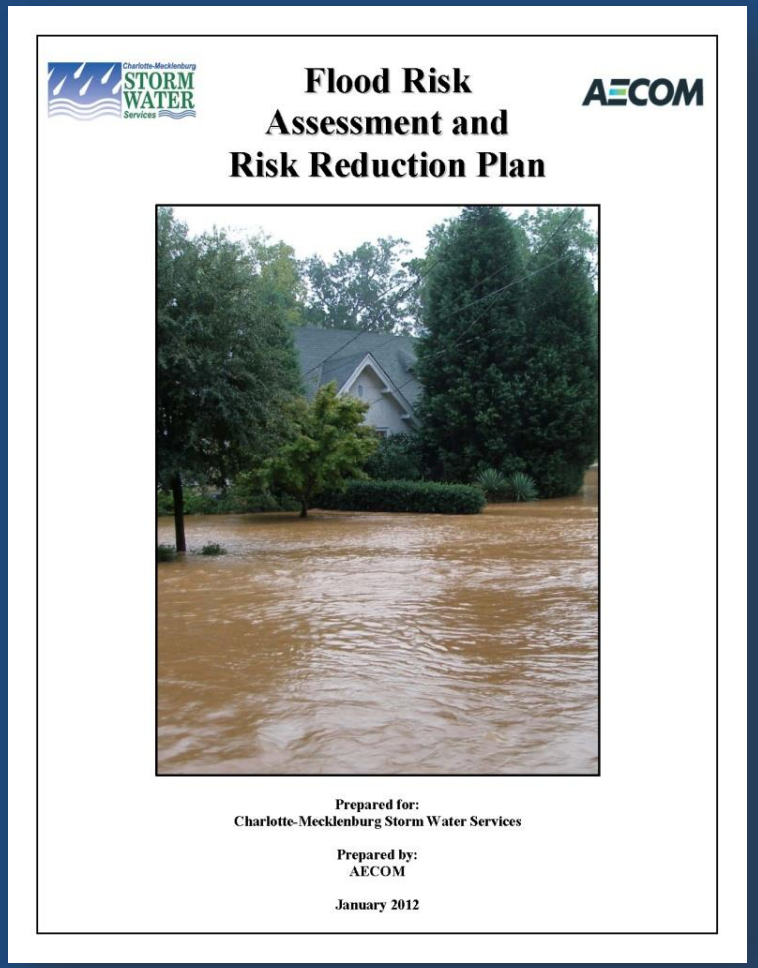
RetroFIT Candidates



Charlotte-Mecklenburg retro FIT
Floodproofing • Improvements • Together

CHARLOTTE-MECKLENBURG FLOOD RISK ASSESSMENT AND RISK REDUCTION PLAN

- Recommend specific flood mitigation techniques at a **building level**
- Assist in planning and **prioritizing** future mitigation projects
- Use a dynamic and **holistic, risk-based** approach



What's Unique About This Plan

POST-MATTHEW: RESILIENT REDEVELOPMENT PLANS

The resilient redevelopment planning process encompasses:

- *Housing*
- *Economic Development*
- *Infrastructure*
- *Environment*

PLAN OBJECTIVES

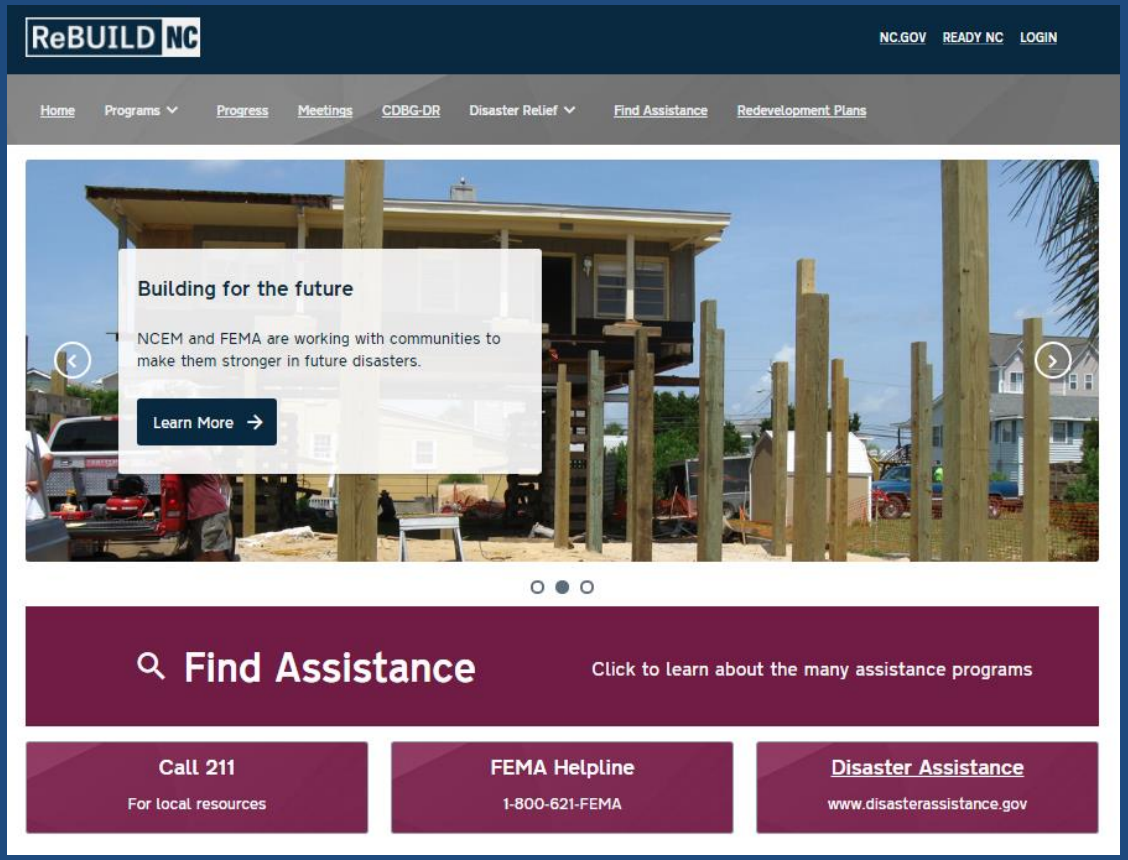
- *Identify unmet needs following Hurricane Matthew*
- *Identify Strategies and Actions that contribute to the resiliency of the impacted Counties*
- *Provide a roadmap for community rebuilding*
- *Include Community and Public input*

WEBSITE

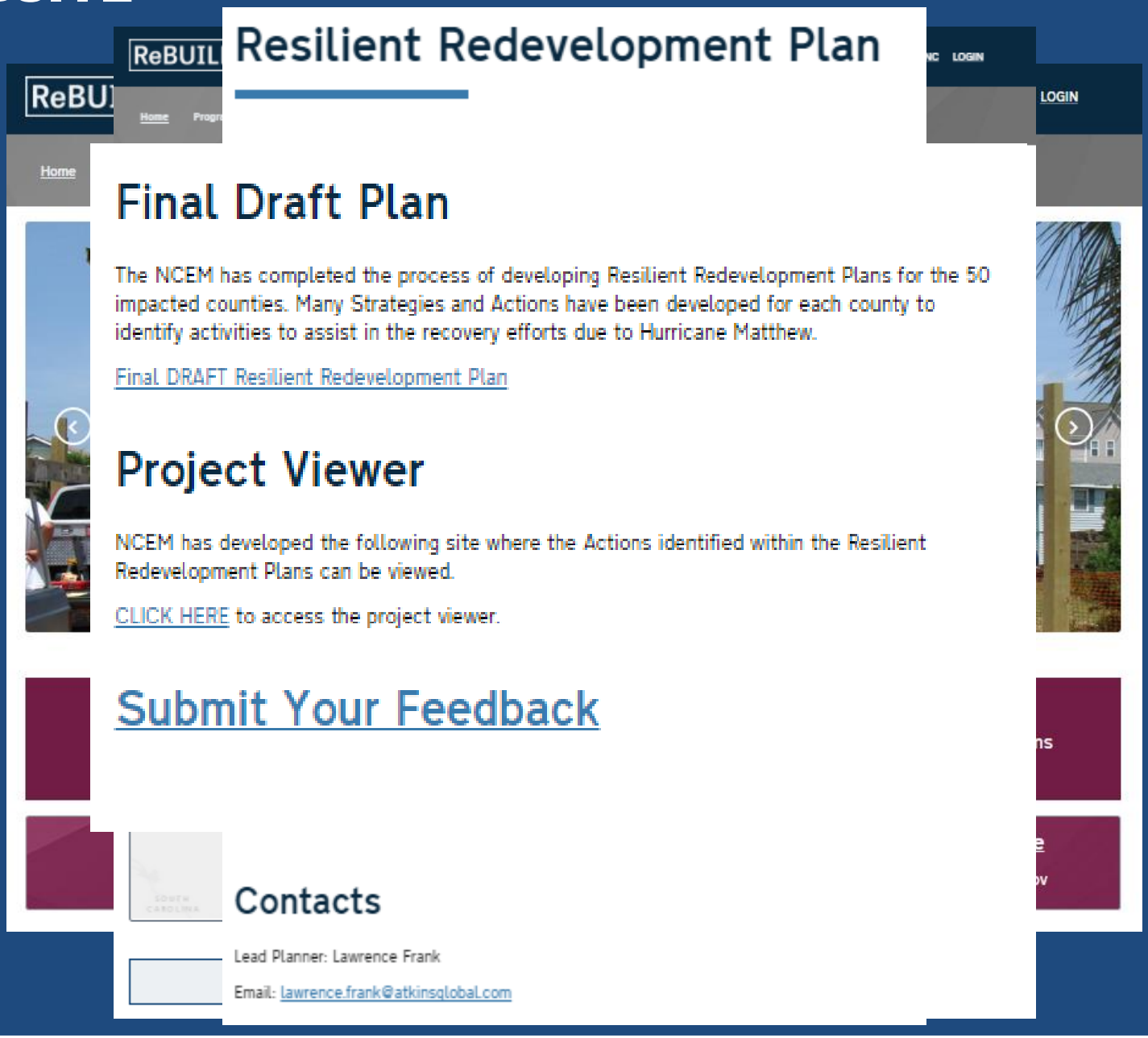
NCEM will be leveraging efficient, interactive technologies

Information on the entire planning process is available online at:

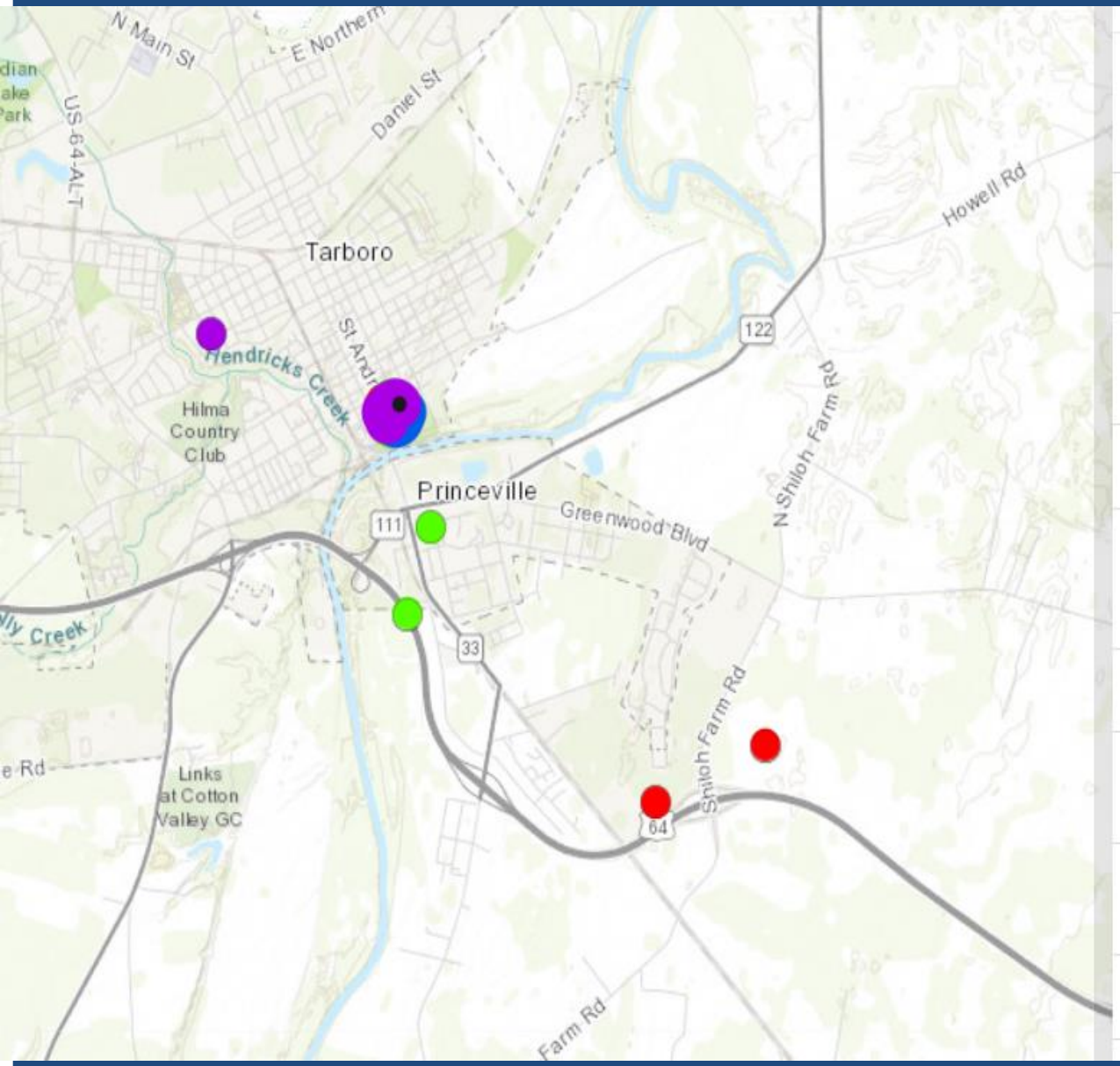
rebuild.nc.gov



WEBSITE


Resilient Redevelopment Plan
Final Draft Plan
The NCEM has completed the process of developing Resilient Redevelopment Plans for the 50 impacted counties. Many Strategies and Actions have been developed for each county to identify activities to assist in the recovery efforts due to Hurricane Matthew.
Final DRAFT Resilient Redevelopment Plan
Project Viewer
NCEM has developed the following site where the Actions identified within the Resilient Redevelopment Plans can be viewed.
CLICK HERE to access the project viewer.
Submit Your Feedback
Contacts
Lead Planner: Lawrence Frank
Email: lawrence.frank@atkinsglobal.com

EDGECOMBE CO./PRINCEVILLE: LEVEE REPAIR, STORMWATER ASSESSMENT, WATER/SEWER LINE REPLACEMENTS, LIFT STATION REPAIRS



Environment (Countywide) 7

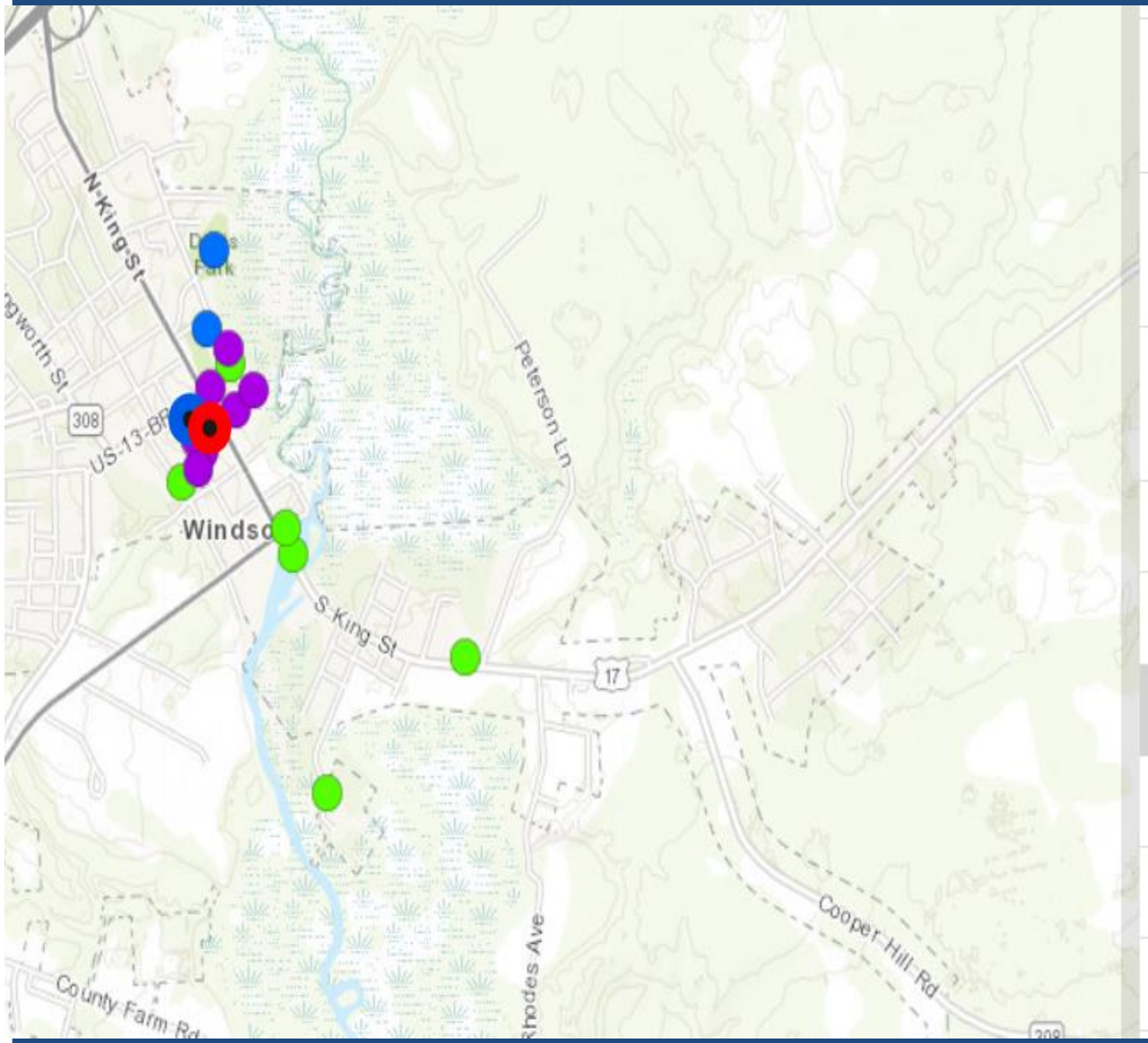
Infrastructure (Site Specific) 2

- Project Name: Edgecombe County Infrastructure Action 5: Stormwater Assessment and Improvements
- Project Name: Edgecombe County Infrastructure Action 6: Levee Repair

Infrastructure (Countywide) 4

- Project Name: Edgecombe County Infrastructure Action 1: Farm Infrastructure Assistance
- Project Name: Edgecombe County Infrastructure Action 3: Improve Mobility for Underserved Populations
- Project Name: Edgecombe County Infrastructure Action 2: Water/Sewer Line and Culvert Repair and Replacement
- Project Name: Edgecombe County Infrastructure Action 7: Repair Sewer Lift Stations

BERTIE CO./WINDSOR: PUMP STATIONS REPAIRS, WELL HOUSE PROTECTION, DRAINAGE AND FLOOD REDUCTIONS FEASIBILITY STUDY



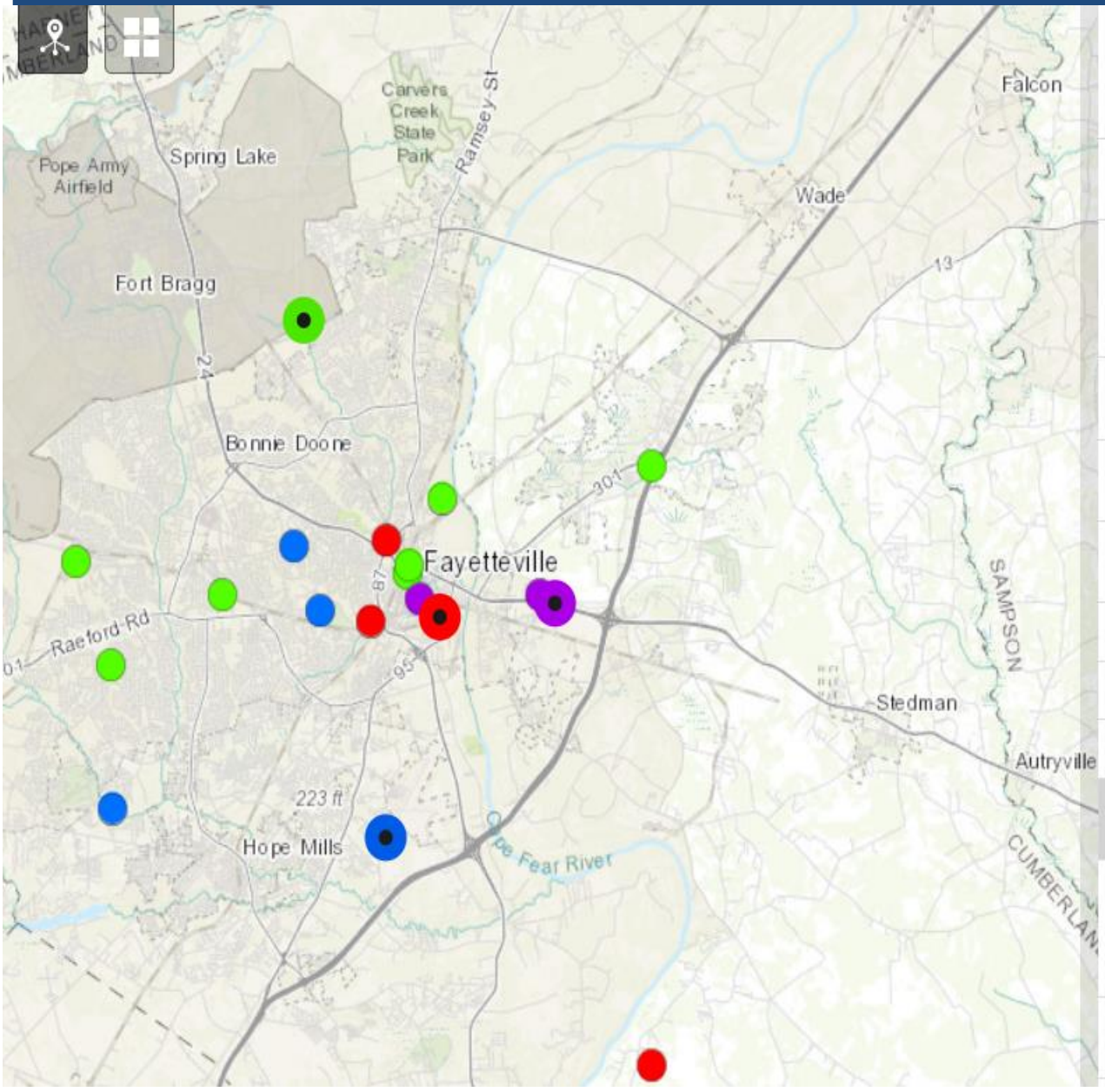
Environment (Site Specific) 2

Environment (Countywide) 1

Infrastructure (Site Specific) 6

- Project Name: Bertie County Infrastructure Tier 2 Action 6: White Oak Drainage
- Project Name: Bertie County Infrastructure Tier 3 Action 4: Sutton Drive Well House
- Project Name: Bertie County Infrastructure Tier 2 Action 1: NC 308 Bridge
- Project Name: Bertie County Infrastructure Tier 3 Action 1: York Street Pump Station
- Project Name: Bertie County Infrastructure Tier 3 Action 2: Water Street Pump Station
- Project Name: Bertie County Infrastructure Tier 3 Action 3: Elm Street Pump Station

CUMBERLAND CO./FAYETTEVILLE: CRITICAL FACILITIES
FLOOD PROTECTION, STORMWATER SYSTEMS UPGRADES, POWER RESILIENCY



Environment (Countywide) 1

- Project Name: EN4. Augmented Floodplain Mapping

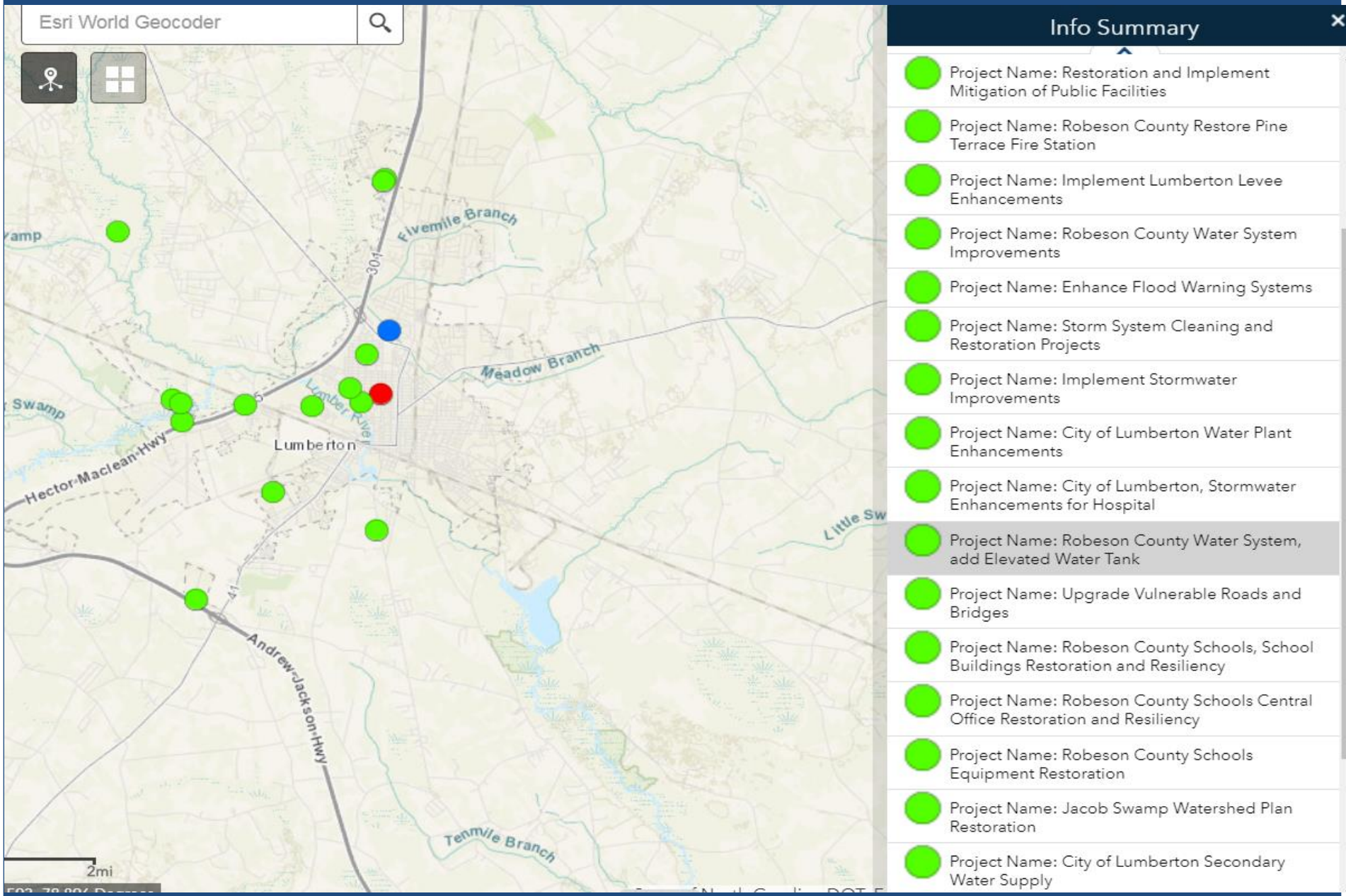
Infrastructure (Site Specific) 7

- Project Name: I.1.P City/County Public Works Commission (PWC) Power Resiliency
- Project Name: I.2.F Fayetteville Critical facilities Flood Protection (Downtown & Cape Fear Valley
- Project Name: I.3. Back Up Power at Critical Facilities
- Project Name: I.4 Flood Protection of Bridges
- Project Name: I5. Flood Protection of Roads
- Project Name: I6. Stormwater System Upgrades
- Project Name: I.7 Interstate-95 Multi-County Coordinated Evacuation/Rerouting Plan

Infrastructure (Countywide) 1

- Project Name: I.8 Fayetteville and Cumberland County Dam Rehabilitation and Replacement

ROBESON CO./LUMBERTON: IMPLEMENT STORM/DRAINAGE SYSTEM CLEANING, MAINT. AND ENHANCEMENTS, FLOOD WARNING SYSTEM,



RESILIENT REDEVELOPMENT PLANS

- *50 counties*

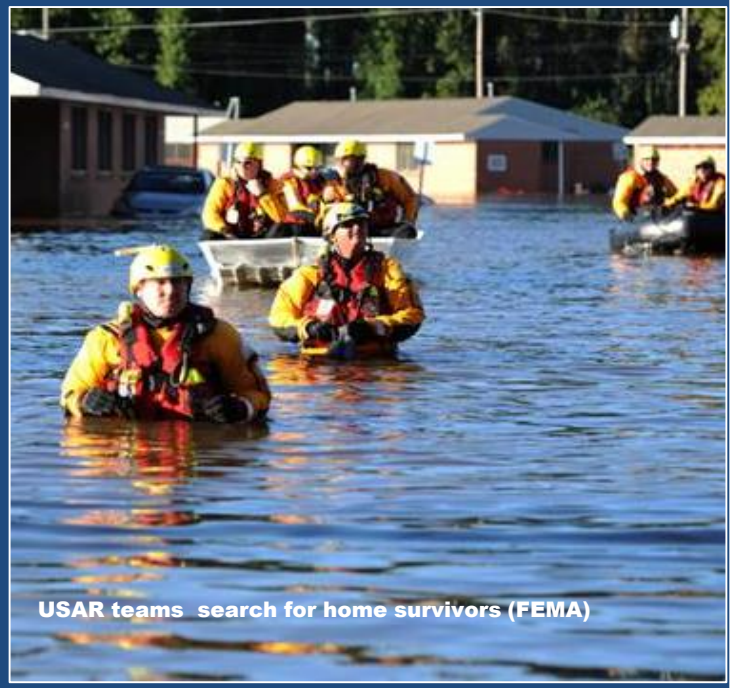
- *949 Actions identified*
- *Infrastructure actions > 50% of projected number of strategies and total costs*

- *Over $2 Billion for Action Costs*
- *Stormwater Mgmt. is #1 project type, which accounts for nearly 20% of total costs ($397.6 M)*

- *Approximately 95,000 structures damaged*

- *Approximately 59,000 in the SFHA*

- *Approximately 17,000 substantially damages structures*



USAR teams search for home survivors (FEMA)

NFIP FLOOD MAPS AND STORMWATER MGMT.

NFIP's Flood Insurance Rate Maps (FIRM) illustrate areas of the special flood hazard area (SFHA) for drainage areas greater than 1 sq. mile (rural areas), and 0.5 sq. miles for urban areas.

Not mapping areas less than these threshholds, but many communities report these areas have repetitive flooding

NFIP does encourage communities to adopt higher development standards, and rewards them with reduced premiums if participating in the Community Rating System (86 in NC)

Properties outside SFHA have more difficulty getting mitigation grants to remove or elevate, as the BCA is harder to justify.

Statistics of Note

23% of NFIP Policies are for bldgs. outside the SFHA

25% of all claims come from these buildings

80% of properties damaged during Floyd were outside the SFHA

SEA LEVEL RISE/CLIMATE CHANGE:

NOT FACTORED IN

DFIRMs are based on existing shoreline characteristics, and wave and storm climatology at the time of study

By current Code of Federal Regulations, we cannot map flood hazards based on anticipated future sea levels or climate change.

Congress directed FEMA to establish a Technical Mapping Advisory Council to provide recommendations on future flood hazard mapping guidelines—including recommendations for future mapping conditions, the impacts of sea level rise and future development. FEMA will be required to incorporate future risk assessment in accordance with the recommendations of the Council.

Thank You