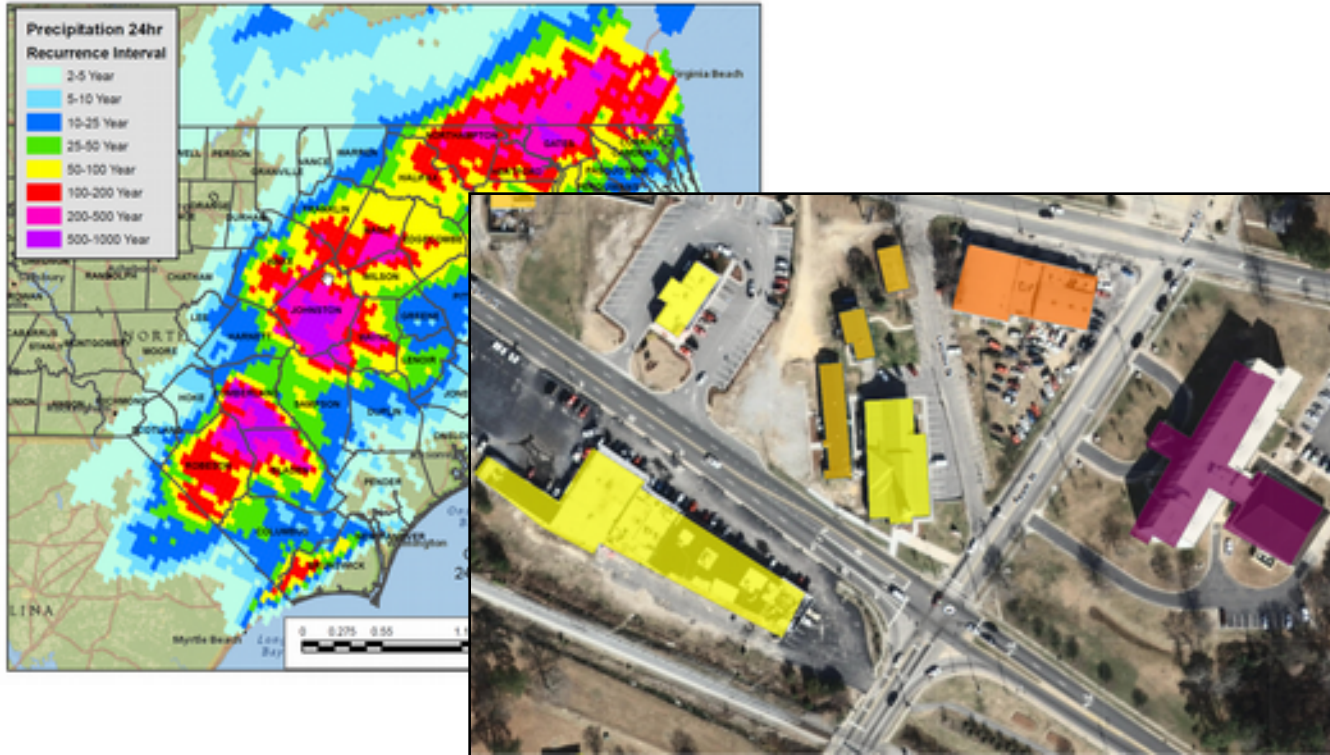


(NOAA Atlas 14 & NWS 24 hour Observed Precipitation)



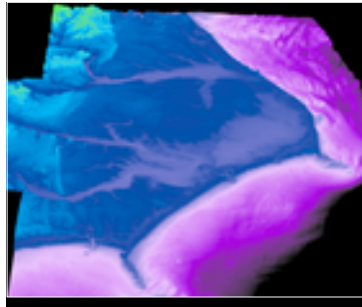
Hurricane Matthew Response

January 26th, 2017

Risk Management

North Carolina Progression

**Framework
Data Acquisition**



**Natural Hazard
Mapping**



**Digital Display
Environment**



**Exposure
Identification**



**Structural Risk
Management**



**Integrated Hazard
Risk Management**



**Risk Management
Planning - Sectors**

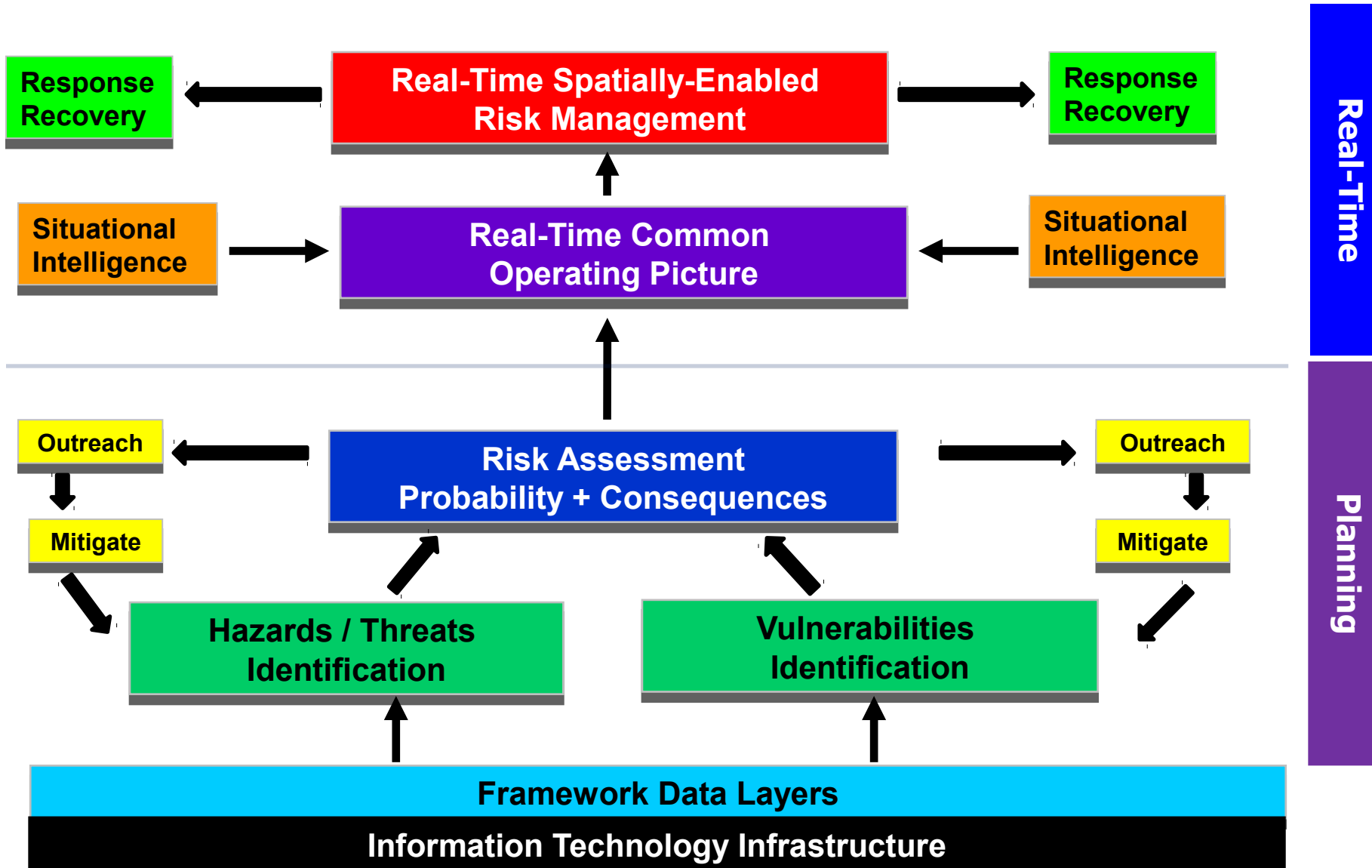


**Real-Time Risk
Management**



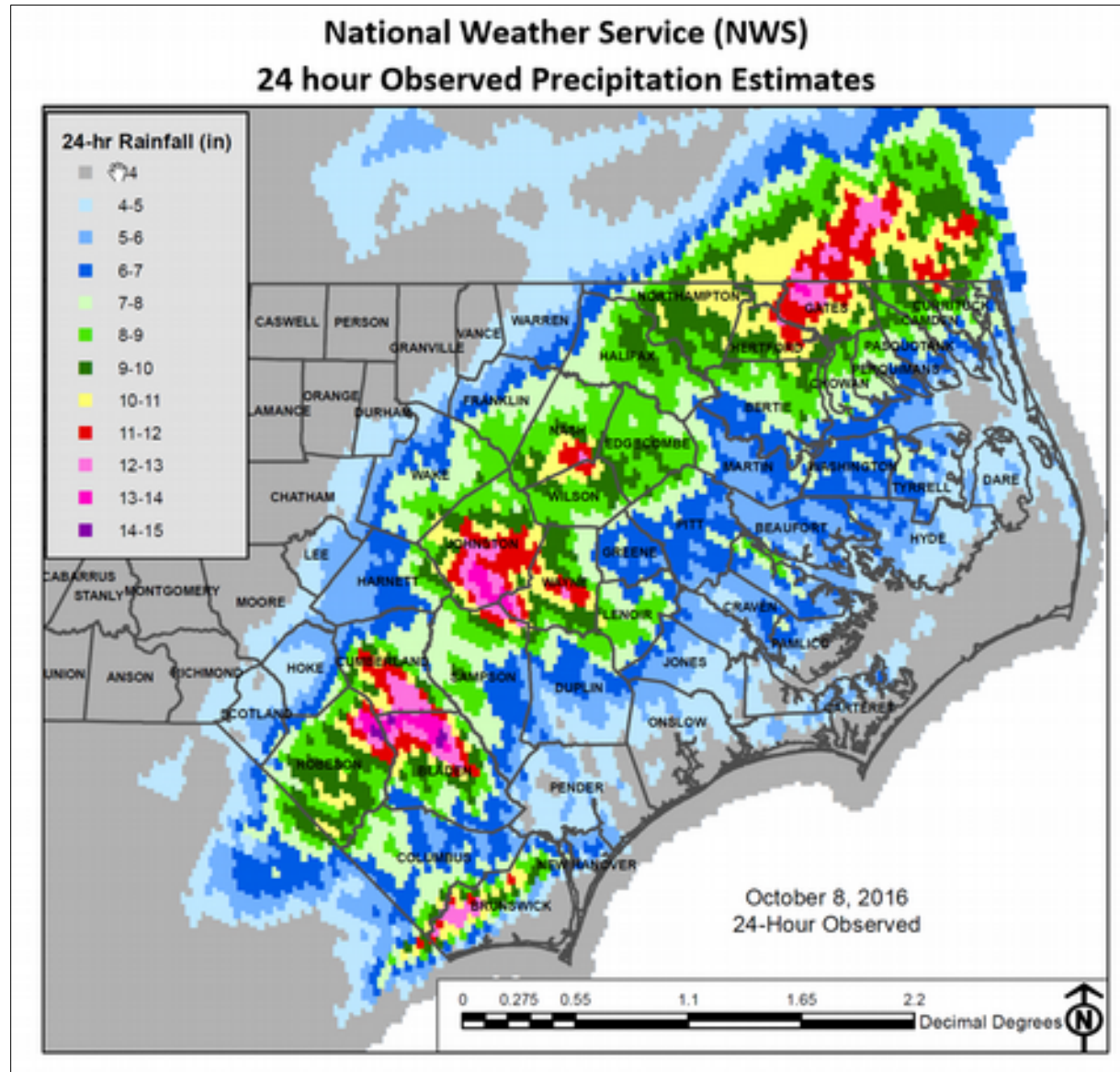
NC Risk Management Framework

prevent, prepare, protect, respond, recover



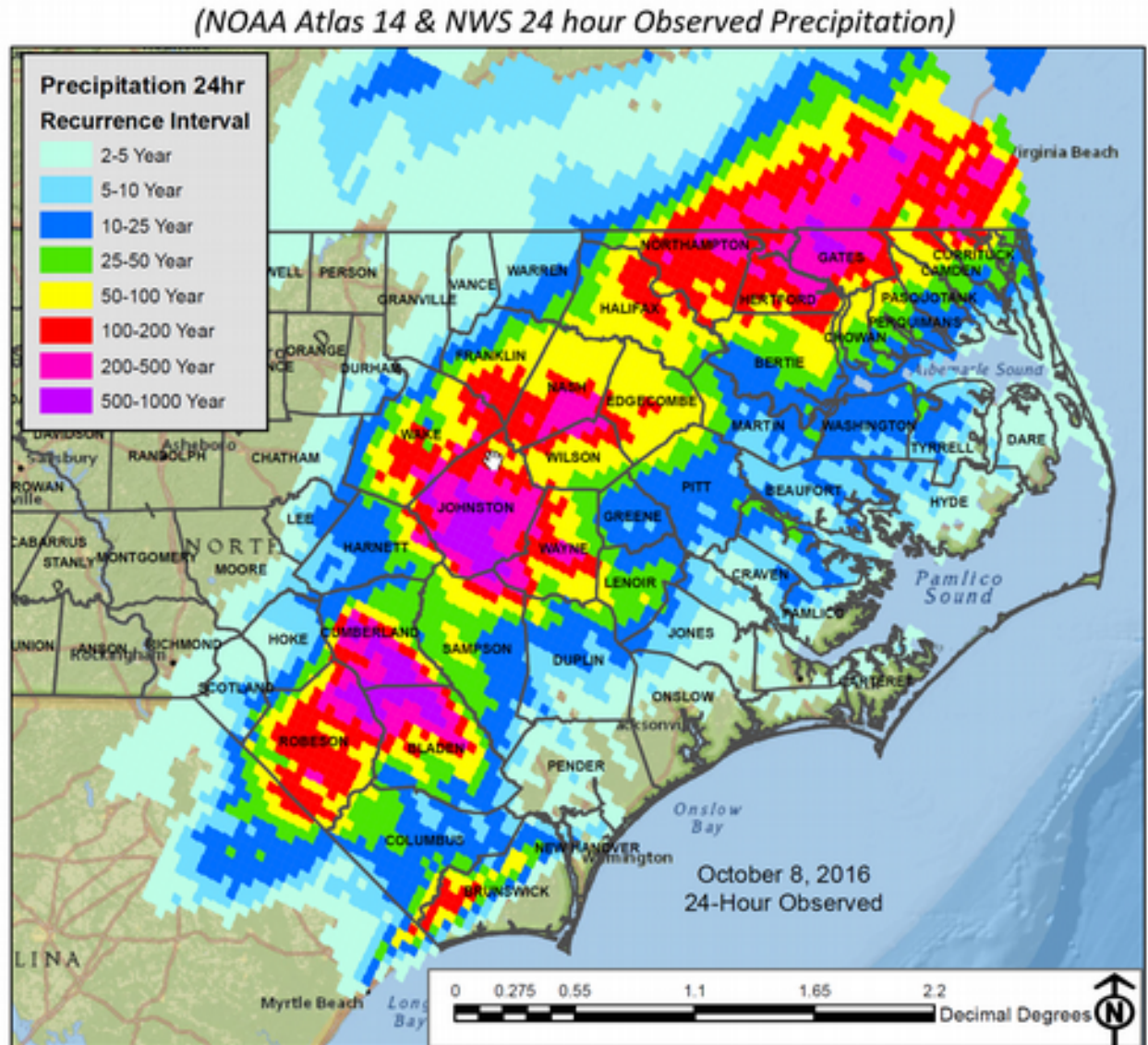
Matthew - Rainfall Totals

- Precipitation totals associated with Hurricane Matthew ranged from 4 to 15 inches in the central and eastern counties of North Carolina.
- Thirteen (13) counties (Bladen, Brunswick, Cumberland, Currituck, Gates, Hertford, Johnston, Nash, Northampton, Robeson, Sampson, Wayne, Wilson) experience 24-hour observed rainfall greater than 10 inches.



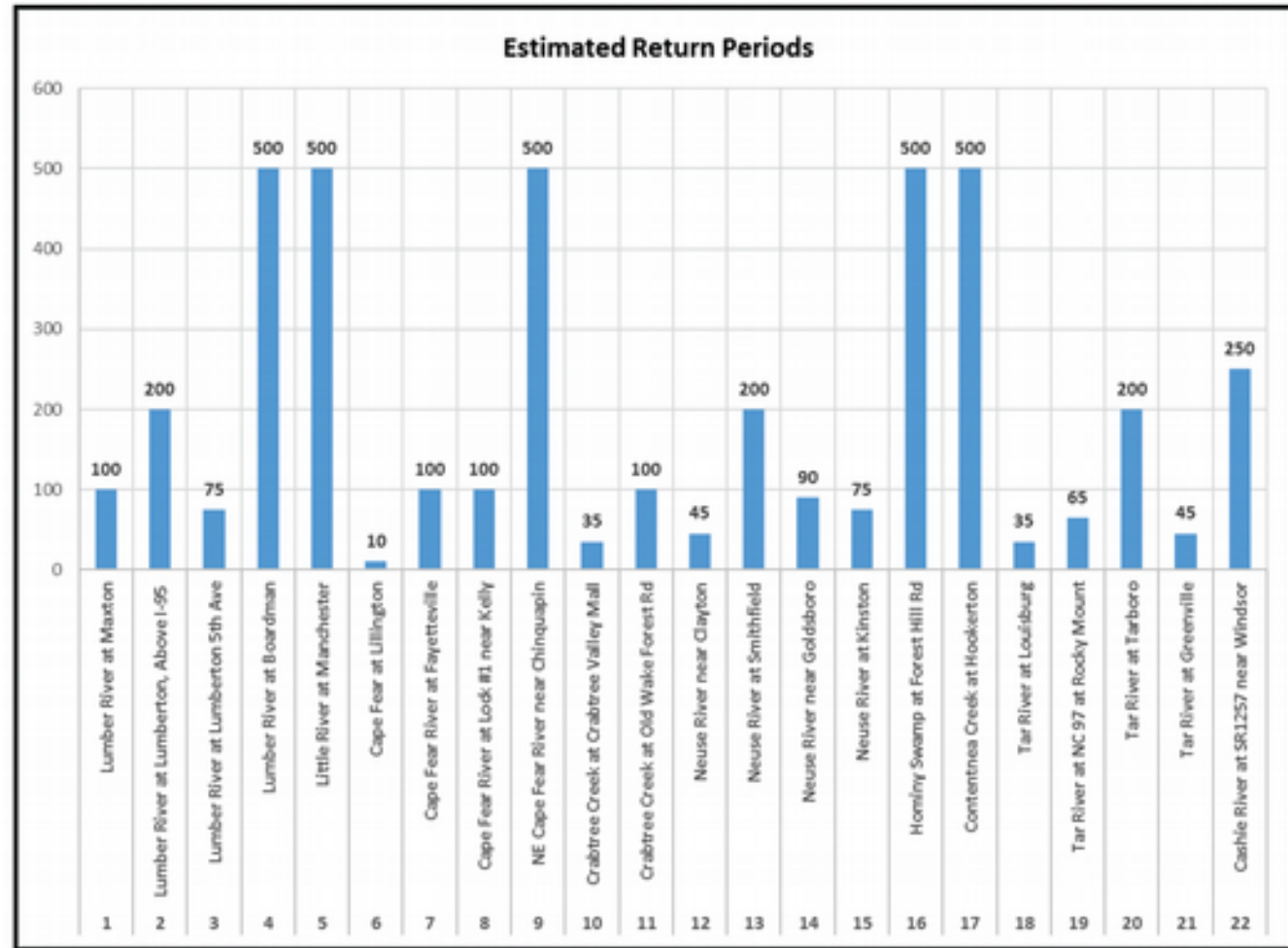
Matthew - Rainfall Recurrence Intervals

- Precipitation totals associated with Hurricane Matthew equated to recurrence intervals of 2 to 1,000 year.
- Seven (7) counties (Bladen, Cumberland, Gates, Johnston, Robeson, Sampson, and Wayne) experience 24-hour observed rainfall equating to a 1 in 1,000 year chance rainfall.

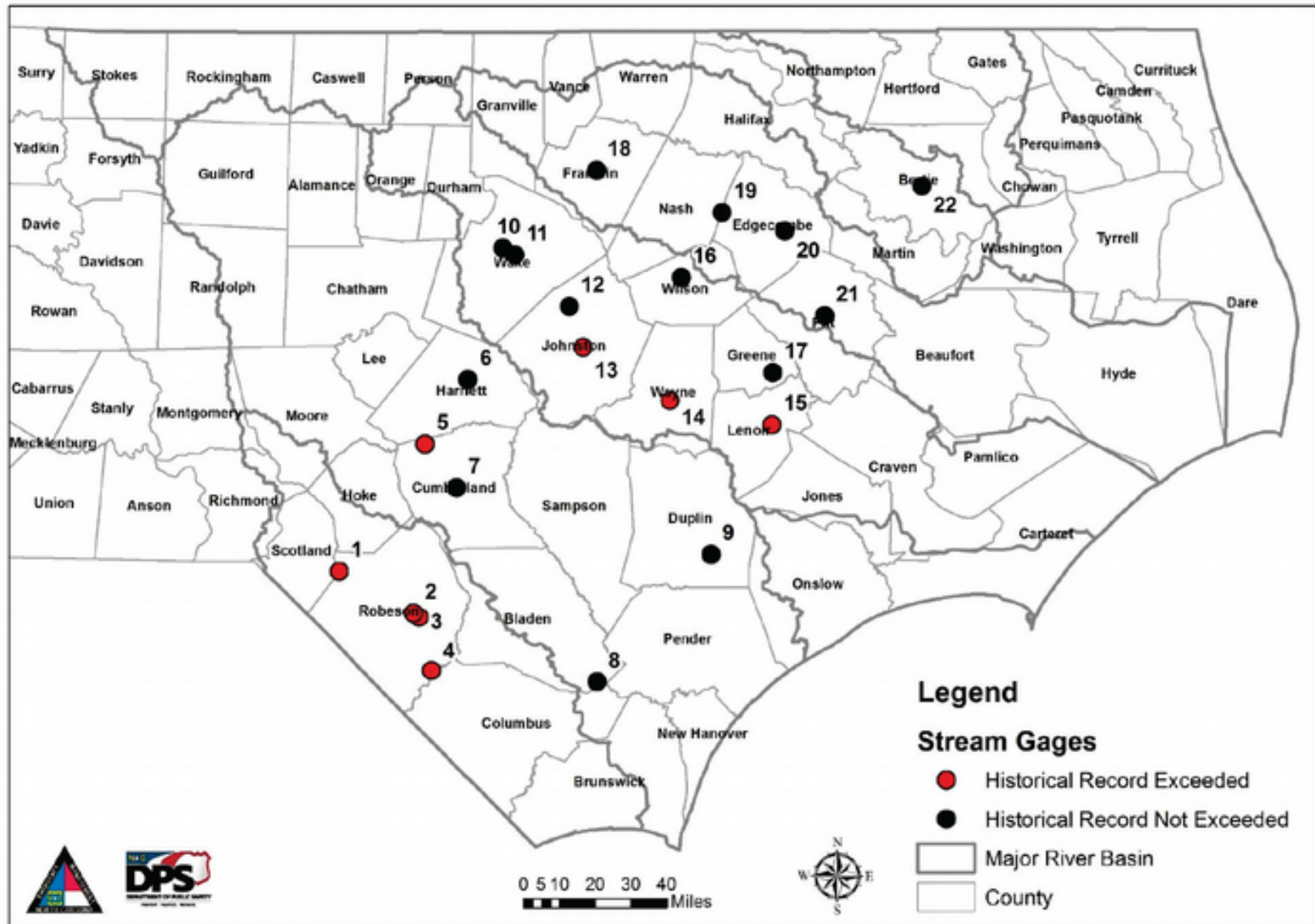


Matthew – Gage / Flood Recurrence Intervals

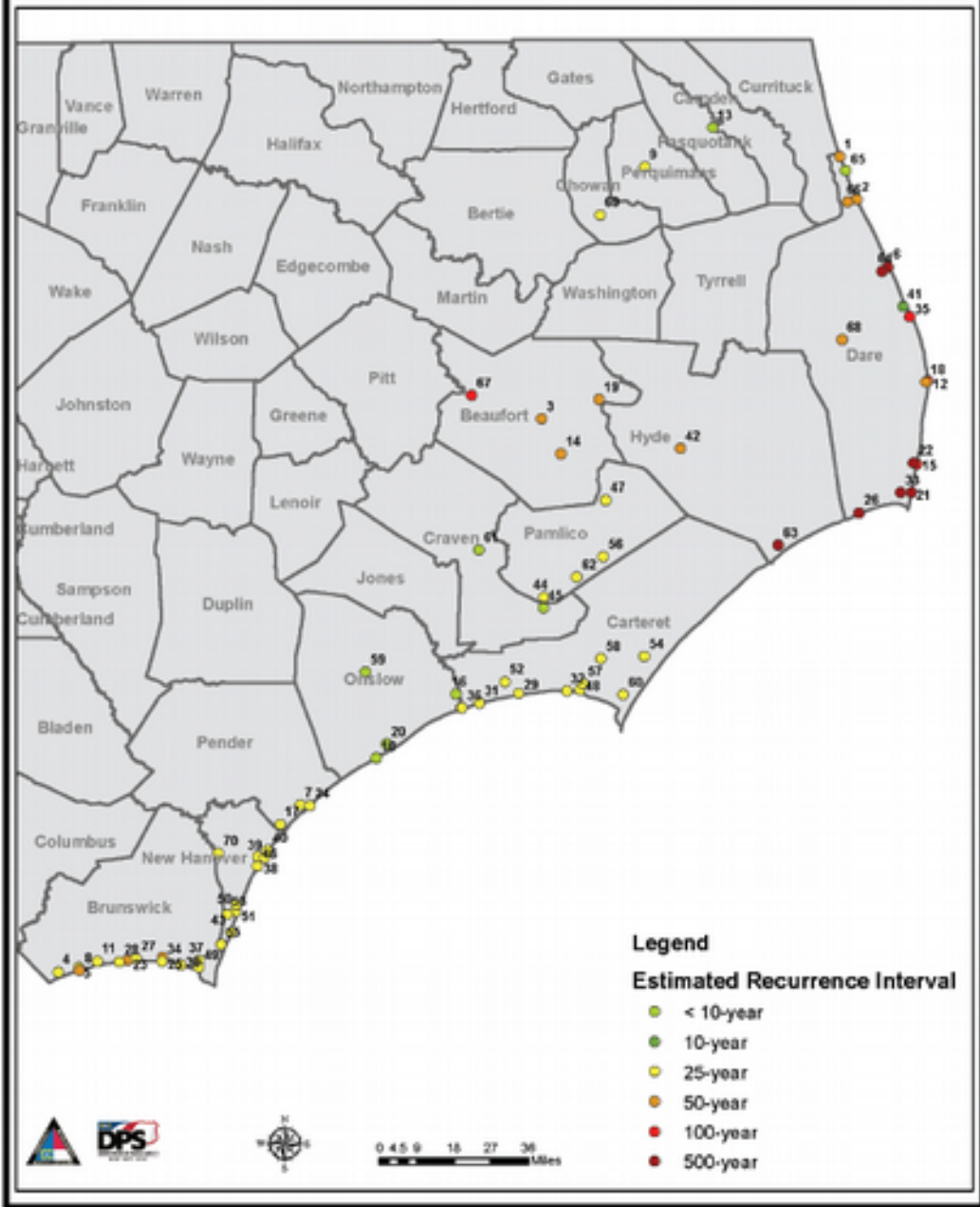
- Gage observed elevations ranged from 10 year to 500 year flood recurrence interval.
- 13 gages observed 100 plus flood recurrence intervals.
- Eight (8) gages exceeded the previous flood of record.



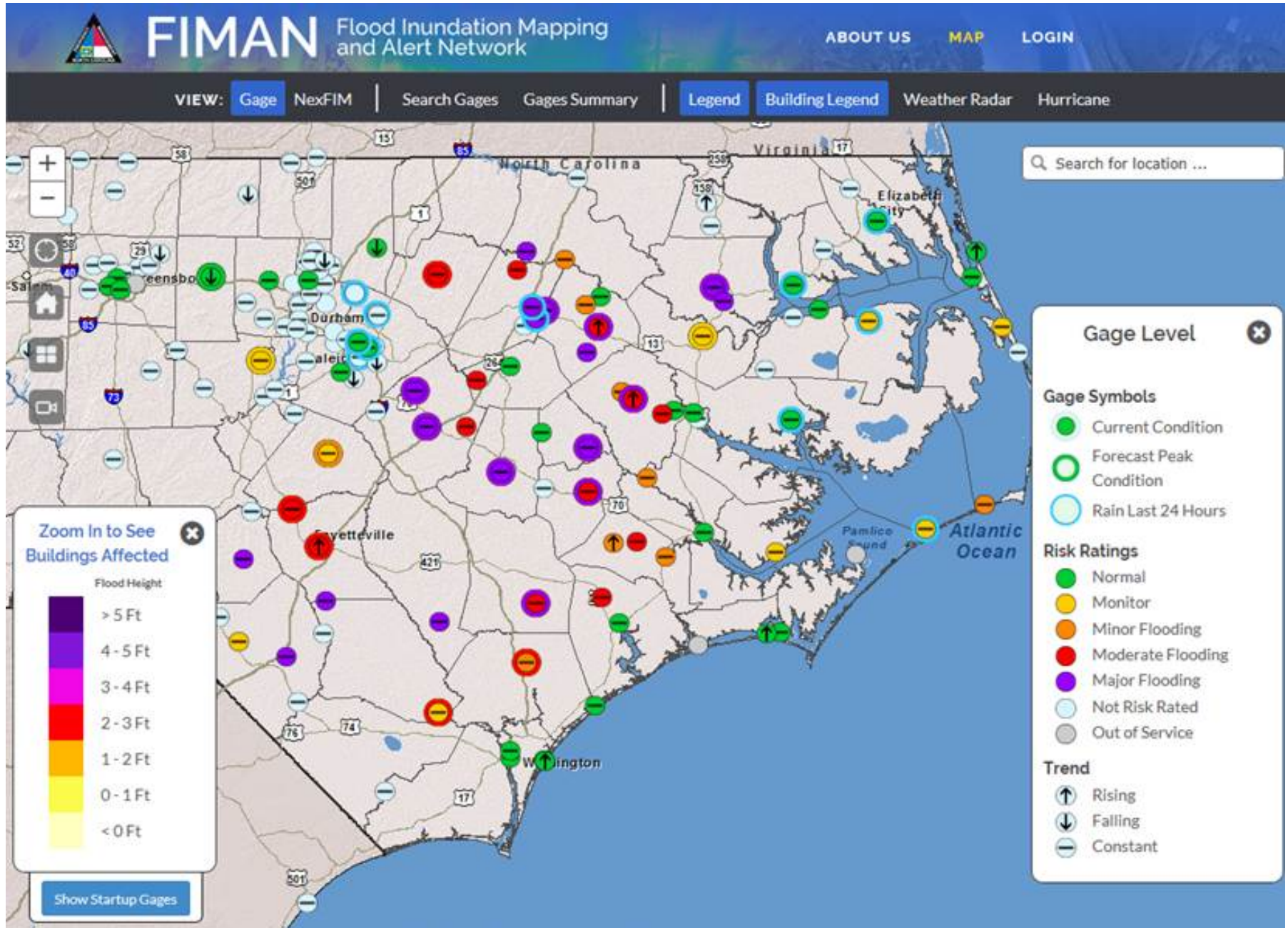
Hurricane Matthew Flooding Return Period Estimates



Hurricane Matthew Estimated Coastal Flooding Recurrence Intervals



Current and Forecast Conditions and Impact Display – 10/10/16 0000 Update



Fiman



Building Type: Single Family
Est. Structure Damages: \$36,700
Flood Depth: 4.1 (ft)
[View on Google Maps](#)

NE Cape Fear River near Chinquapin Buildings in Inundation Extent

Current Elevation: 39.5 Ft

Current Flood Depth	Total		Residential		Commercial		Public	
	Count	Est. Damages	Count	Est. Damages	Count	Est. Damages	Count	Est. Damages
Sub-Structure	354	\$240,000	354	\$240,000	0	\$0	0	\$0
0 - 1 ft	20	\$388,000	17	\$176,000	3	\$212,000	0	\$0
1 - 2 ft	19	\$291,000	16	\$264,000	3	\$27,000	0	\$0
2 - 3 ft	10	\$594,000	6	\$502,000	4	\$92,000	0	\$0
3 - 4 ft	5	\$73,000	4	\$68,000	1	\$5,000	0	\$0
4 - 5 ft	2	\$42,000	1	\$37,000	1	\$5,000	0	\$0
> 5 ft	3	\$158,000	3	\$158,000	0	\$0	0	\$0
TOTAL	363	\$1,786,000	151	\$1,446,000	12	\$340,000	0	\$0

*Additional buildings may be impacted outside of the inundation extent.

Current | Scenario | Forecast



NE Cape Fear River near Chinquapin
Last updated: Oct 4, 2015 at 11:30 AM Gage datum: 16.3ft NAVD83

<p>Stage: 13.62 ft</p> <p>30 ft NAVD83</p> <p>Stream Elevation</p>	<p>5190 cfs</p> <p>Flow</p>	<p>Constant</p>	<p>30.8 ft</p> <p>10/6 6:00 AM</p> <p>3 buildings</p> <p>\$12,000</p> <p>Forecasted Peak</p>	<p>163 buildings</p> <p>\$1,786,000</p> <p>Damages</p>	<p>Report</p> <p>Impact</p>
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Gage Level

Gages without Risk Rating

- No Risk Rating
- Out of Service

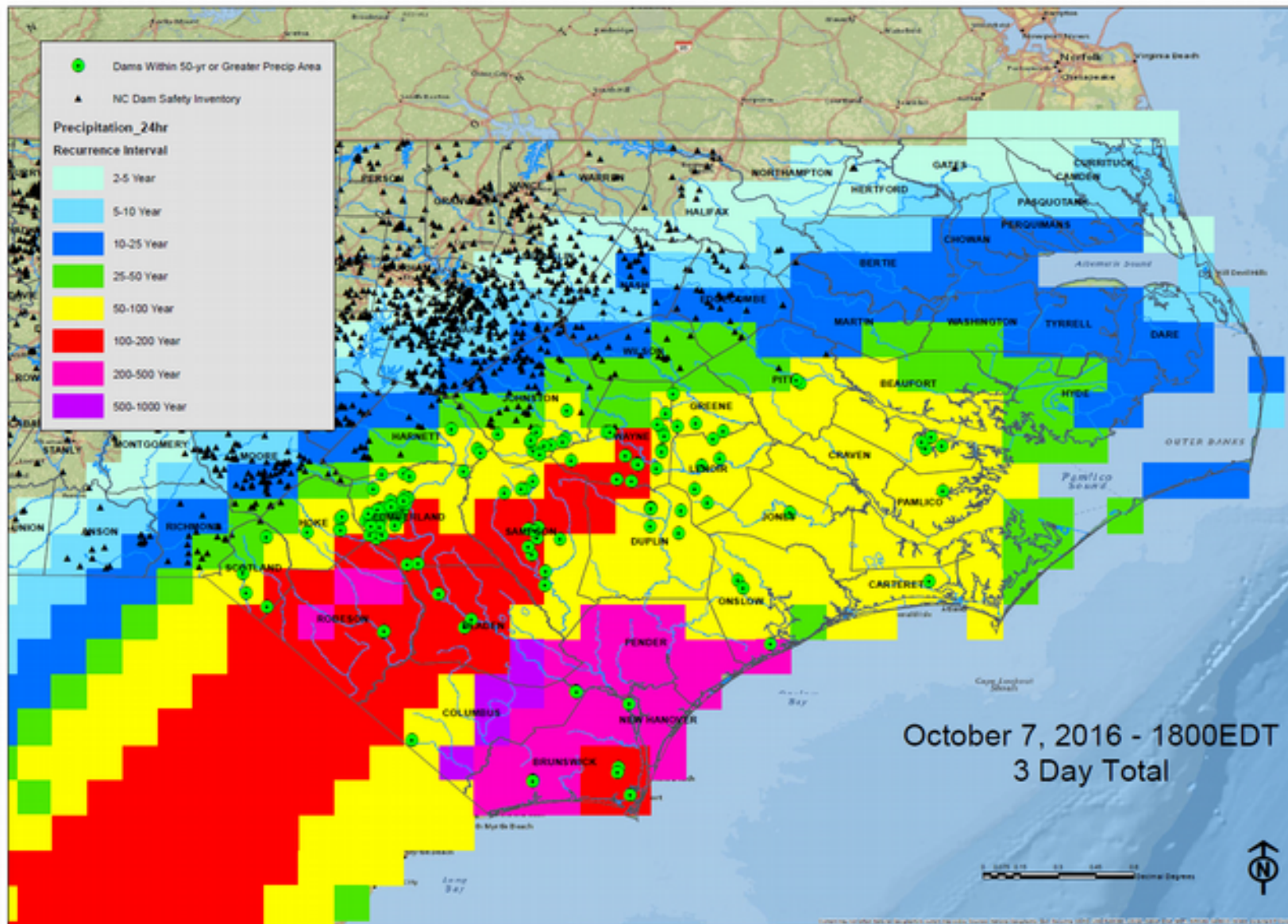
Gages with Risk Ratings

- Normal
- Bank Full
- Minor Flooding
- Moderate Flooding
- Major Flooding

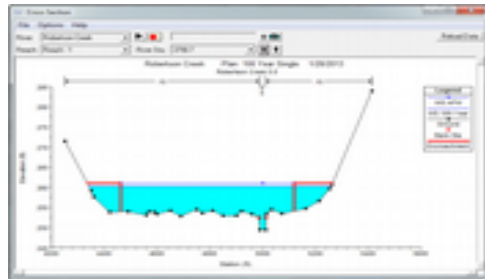
Trend

- Rising
- Falling
- Constant

**Dams Regulated by NC Dam Safety &
 Recurrence Interval of 24-Hour Rainfall Event
 NOAA Atlas 14 Precipitation Frequency Estimates &
 NWS RFC 24-Hour Precipitation Estimates**



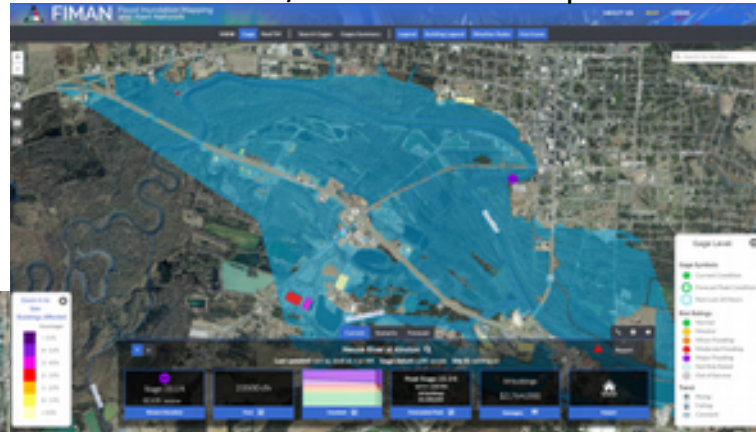
Modeling



Building Footprints



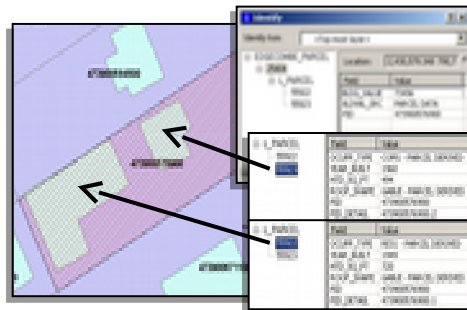
Observed / Current Flood Impacts



Forecasted Flood Impacts



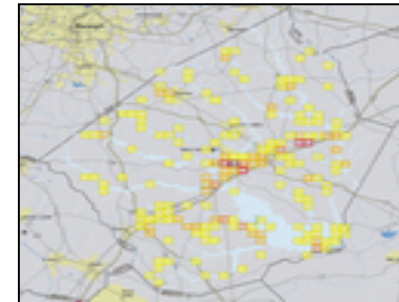
Parcel Data



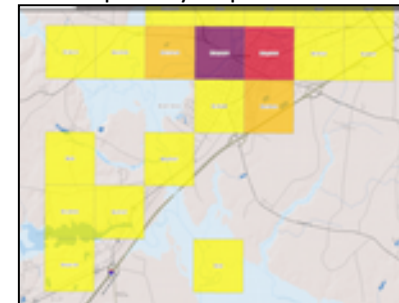
First Floor Elevations



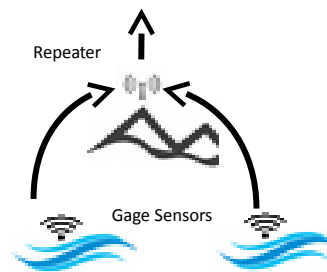
Structure Specific Impact Data



Hotspots by Impact Count



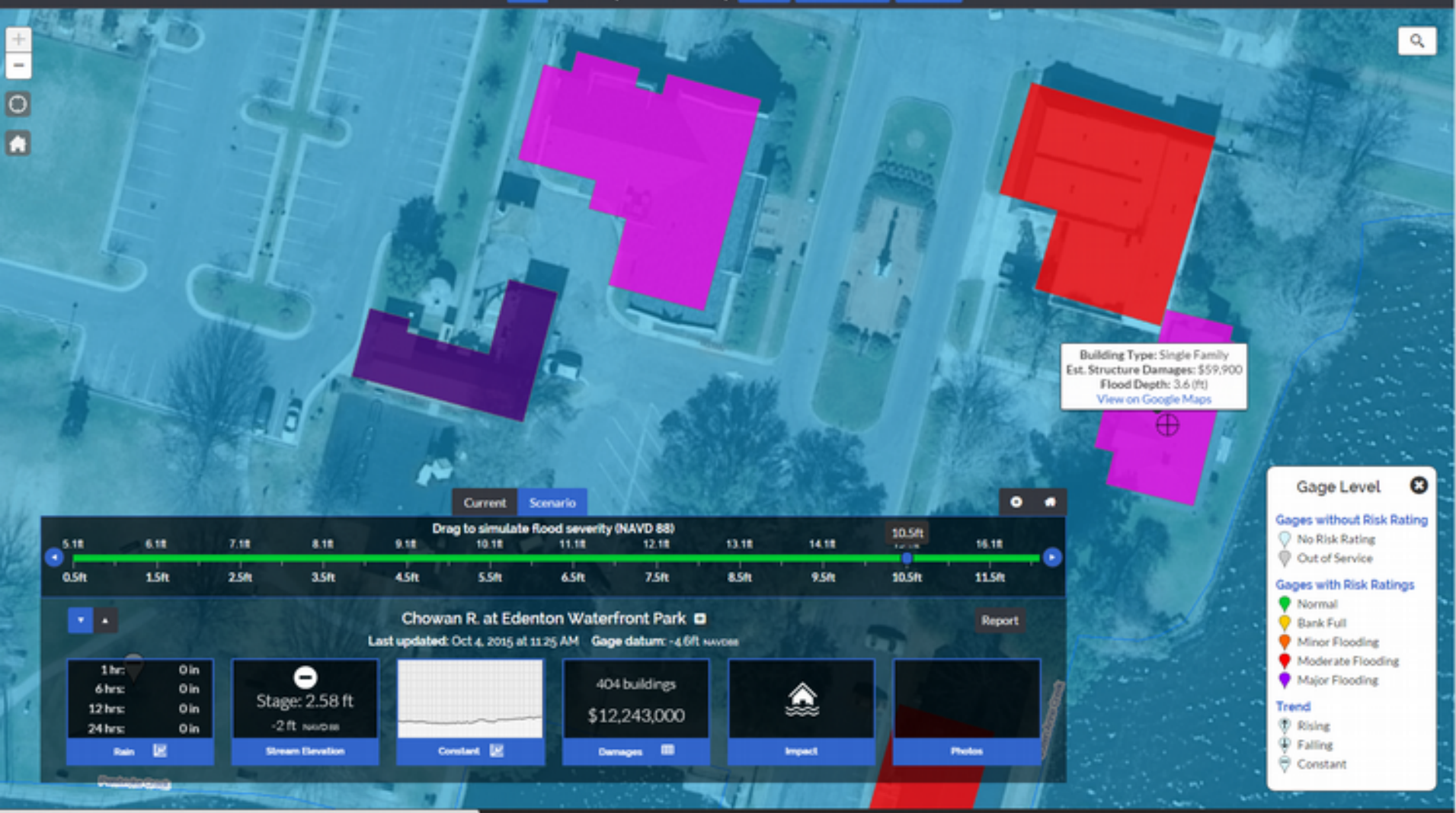
Hotspots by Financial Loss



Total Count and Cost Reporting



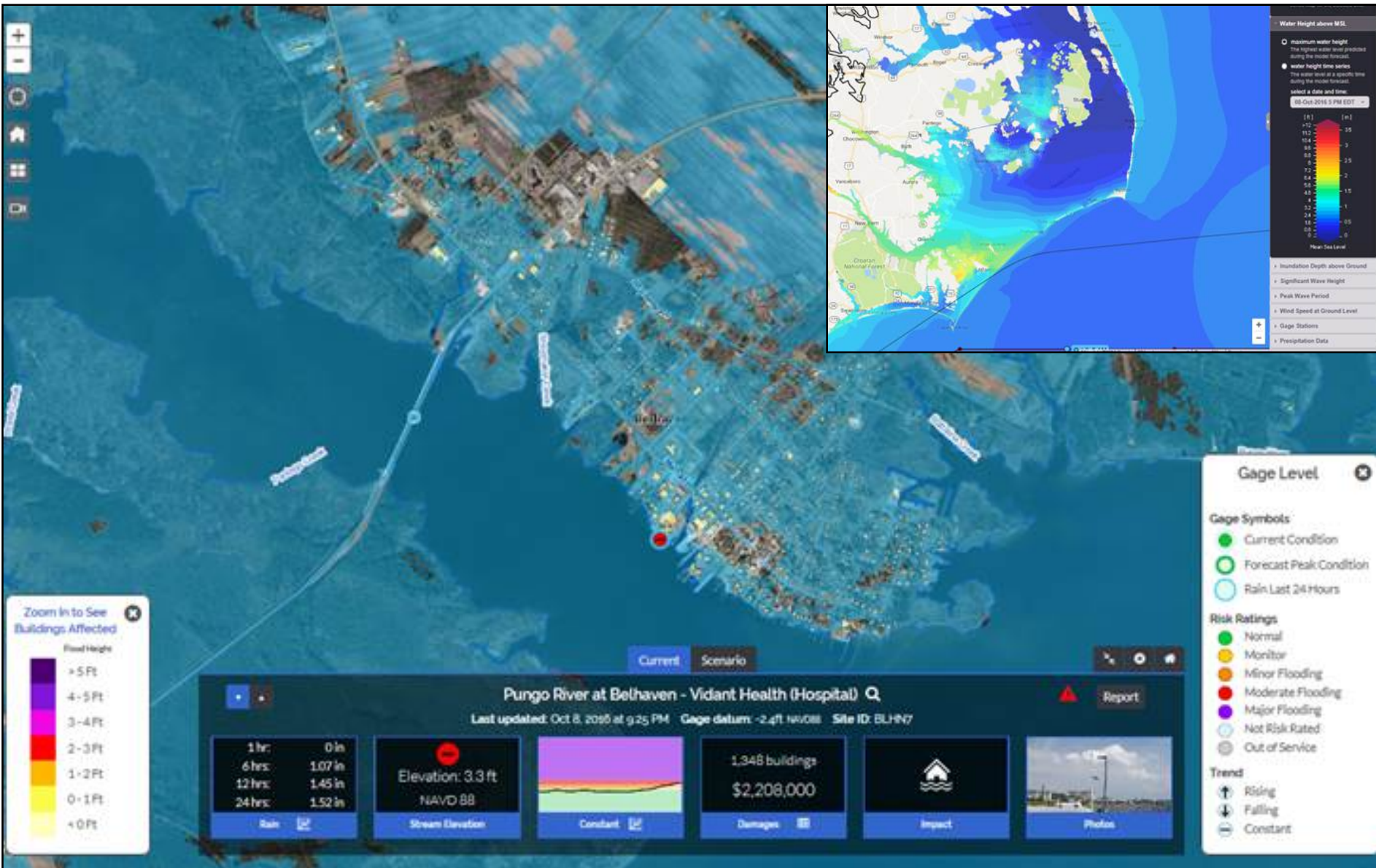
VIEW: [Gage](#) | [NexFIM](#) | [Search Gages](#) | [Legend](#) | [Weather Radar](#) | [Hurricane](#)



Reports - Current Conditions and Impacts to Structure – 10/10/16 0000

Branch	Gage Name	Current Conditions		
		Stage	Condition	Buildings Damaged
Eastern	Lumber River at Lumberton	21.7 ft	Major	1,021
Eastern	Black River near Tomahawk	23.3 ft	Major	NA
Eastern	Neuse River near Goldsboro	24.1 ft	Major	15
Eastern	Rockfish Creek at Raeford	9.6 ft	Major	NA
Eastern	Cashie River at SR1257 near Windsor	16.5 ft	Major	2
Eastern	Cashie River In Windsor at S. King St	11.7 ft	Major	406
Eastern	Cape Fear River Lock near Tarheel	34.6 ft	Major	NA
Central	Tar River at 97 at Rocky Mount	28.6 ft	Major	224
Central	Town Creek at Us 258 near Pinetops	29.6 ft	Major	115
Central	Little Fishing Cr nr White Oak	24.7 ft	Major	0
Central	Neuse River near Clayton	20.4 ft	Major	1
Central	Neuse River at Smithfield	27.6 ft	Major	60
Central	Tar River at Us 301 Bypass at Rocky Mount	18.4 ft	Major	24
Central	Stony Creek near Rocky Mount	18.0 ft	Major	346
Eastern	New River near Gum Branch	19.2 ft	Moderate	5
Eastern	Tar River at Greenville	17.4 ft	Moderate	27
Eastern	Chicod Cr at SR1760 near Simpson	15.8 ft	Moderate	56
Eastern	Trent R. at Trenton at N. Weber St	21.2 ft	Moderate	39
Eastern	Neuse River at Kinston	19.7 ft	Moderate	21
Eastern	Contentnea Creek at Hookerton	17.8 ft	Moderate	0
Eastern	Little River at Manchester	29.4 ft	Moderate	8
Eastern	Cape Fear River at Fayetteville	49.9 ft	Moderate	12
Eastern	NE Cape Fear River near Chinquapin	15.6 ft	Moderate	4
Central	Tar River at Tarboro	27.2 ft	Moderate	6
Central	Cape Fear River at Lillington	18.1 ft	Moderate	8
Central	Little River near Princeton	14.7 ft	Moderate	2
Central	Swift Creek at Hilliardston	15.1 ft	Moderate	3
Central	Contentnea Creek near Lucama	17.5 ft	Moderate	0
Eastern	Tar River at Us 264 Bypass near Rock Springs	18.7 ft	Minor	9
Eastern	Trent River near Trenton	16.6 ft	Minor	NA
Eastern	Trent R. at Pollocksville	6.1 ft	Minor	10
Eastern	Neuse River near Fort Barnwell	12.9 ft	Minor	NA
Eastern	Pamlico Sound at Cape Hatteras Coast Guard Station	2.4 ft	Minor	421
Central	Haw River near Bynum	11.6 ft	Minor	0
Central	Fishing Creek near Enfield	19.1 ft	Minor	20
Central	Swift Cr. at 97 Nr. Leggett	16.6 ft	Minor	19
Central	Tar River at Us 401 at Louisburg	22.5 ft	Minor	0

Coastal Gage - Current Conditions at Pungo River at Belhaven – 10/08/16 1343



Reports - Forecasted Conditions and Impacts to Structure – 10/10/16 0000

Gage Name	Forecast Conditions (Southeast River Forecast Center)					County
	Peak Stage	Peak Date/Time	Buildings Touched by Flooding	Buildings with Flooding in Structure	Condition	
Eastern Branch Gages						
Neuse River near Goldsboro	29.0 ft	10/11/2016 2:00	131	57	Major	Wayne
NE Cape Fear River near Burgaw	17.0 ft	10/11/2016 18:00	264	103	Major	Pender
Tar River at Greenville	25.8 ft	10/12/2016 14:00	706	186	Major	Pitt
Neuse River at Kinston	28.6 ft	10/14/2016 8:00	312	170	Major	Lenoir
Contentnea Creek at Hookerton	21.4 ft	10/13/2016 8:00	0	0	Major	Greene
Little River at Manchester	31.4 ft	Receding	18	18	Major	Cumberland
Cape Fear River at Fayetteville	58.9 ft	Cresting	10	6	Major	Cumberland
NE Cape Fear River near Chinquapin	20.8 ft	10/11/2016 20:00	116	15	Major	Duplin
Cashie River at SR1257 near Windsor	16.6 ft	Receding	0	0	Major	Bertie
Cape Fear River at Lock #1 near Kelly	26.5 ft	10/11/2016 14:00	No FIMAN Library	No FIMAN Library	Moderate	Bladen
Lumber River at Lumberton	24.7 ft	Levee Breach 10/9	528	528	Major	Robeson
Central Branch Gages						
Tar River at Louisburg	23.1 ft	Cresting	0	0	Moderate	Franklin
Tar River at 97 at Rocky Mount	29.4 ft	10/10/2016 14:00	224	35	Major	Nash
Tar River at Tarboro	35.1ft	10/11/2016 8:00	292	46	Major	Edgecombe
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	28.3 ft	10/10/2016 2:00	50	25	Major	Johnston
Western Branch Gages						
None reporting forecasted Minor flood levels or above at this time						

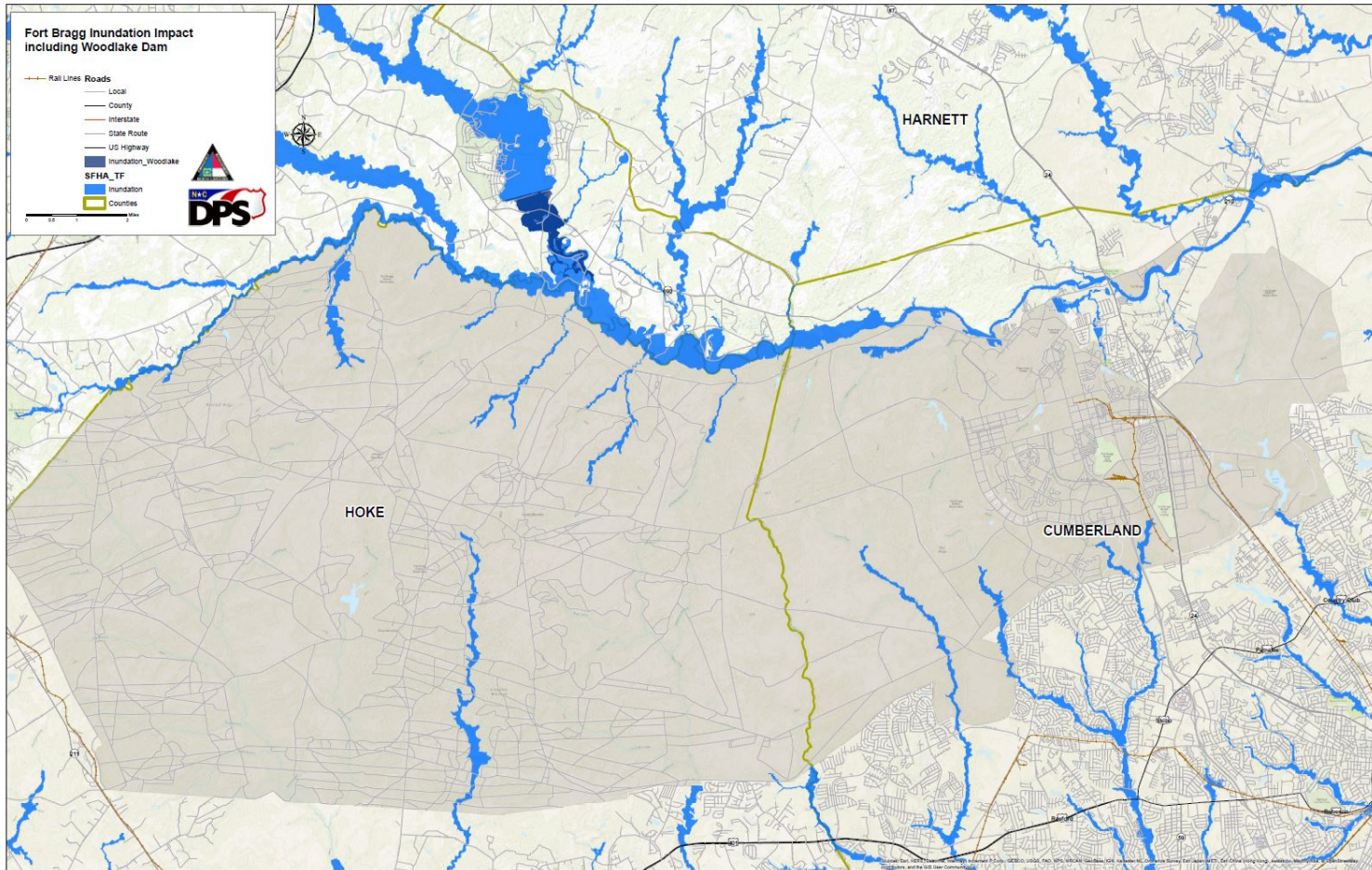
Civil Air Patrol Imagery



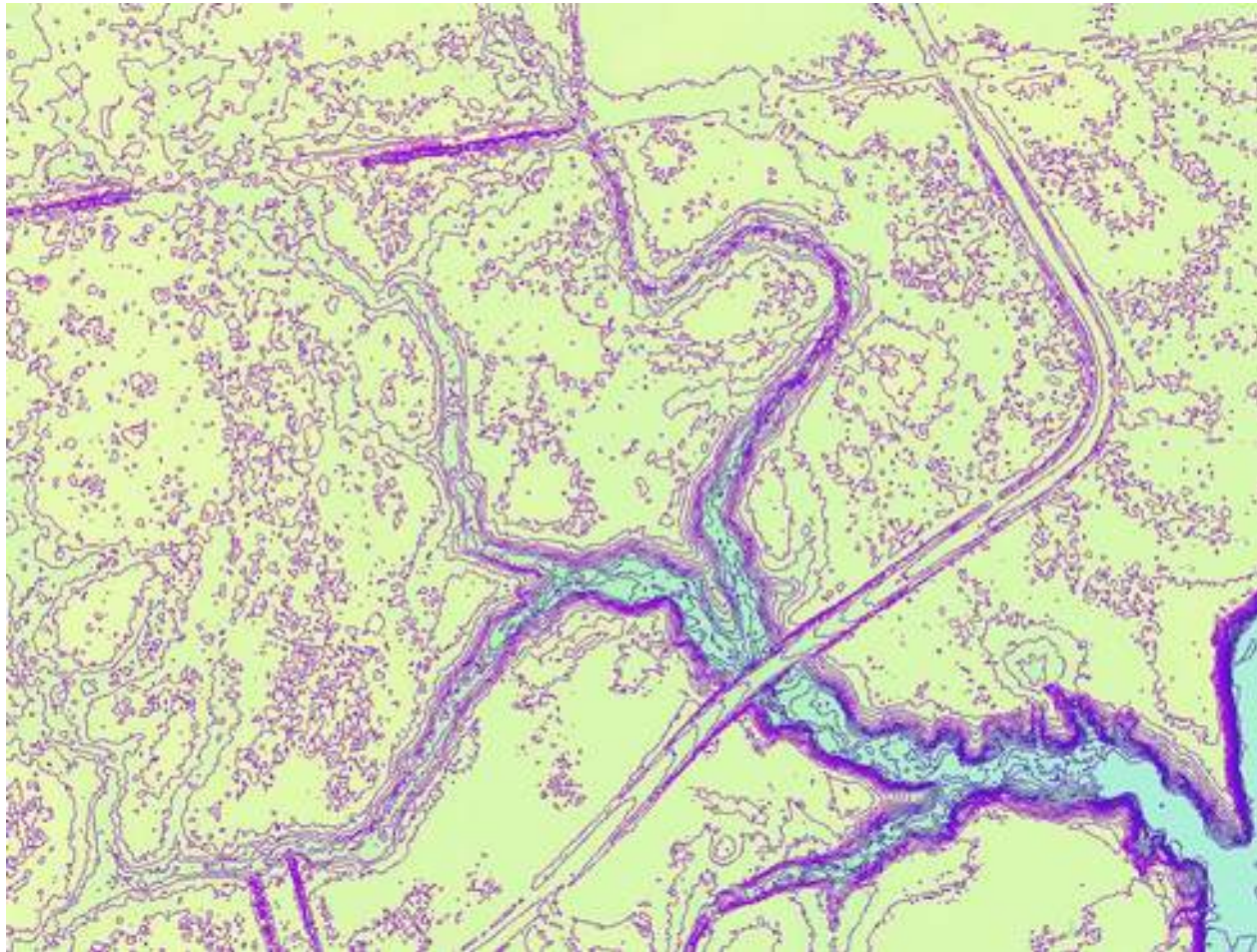
UAS Imagery



Woodlake Dam inundation



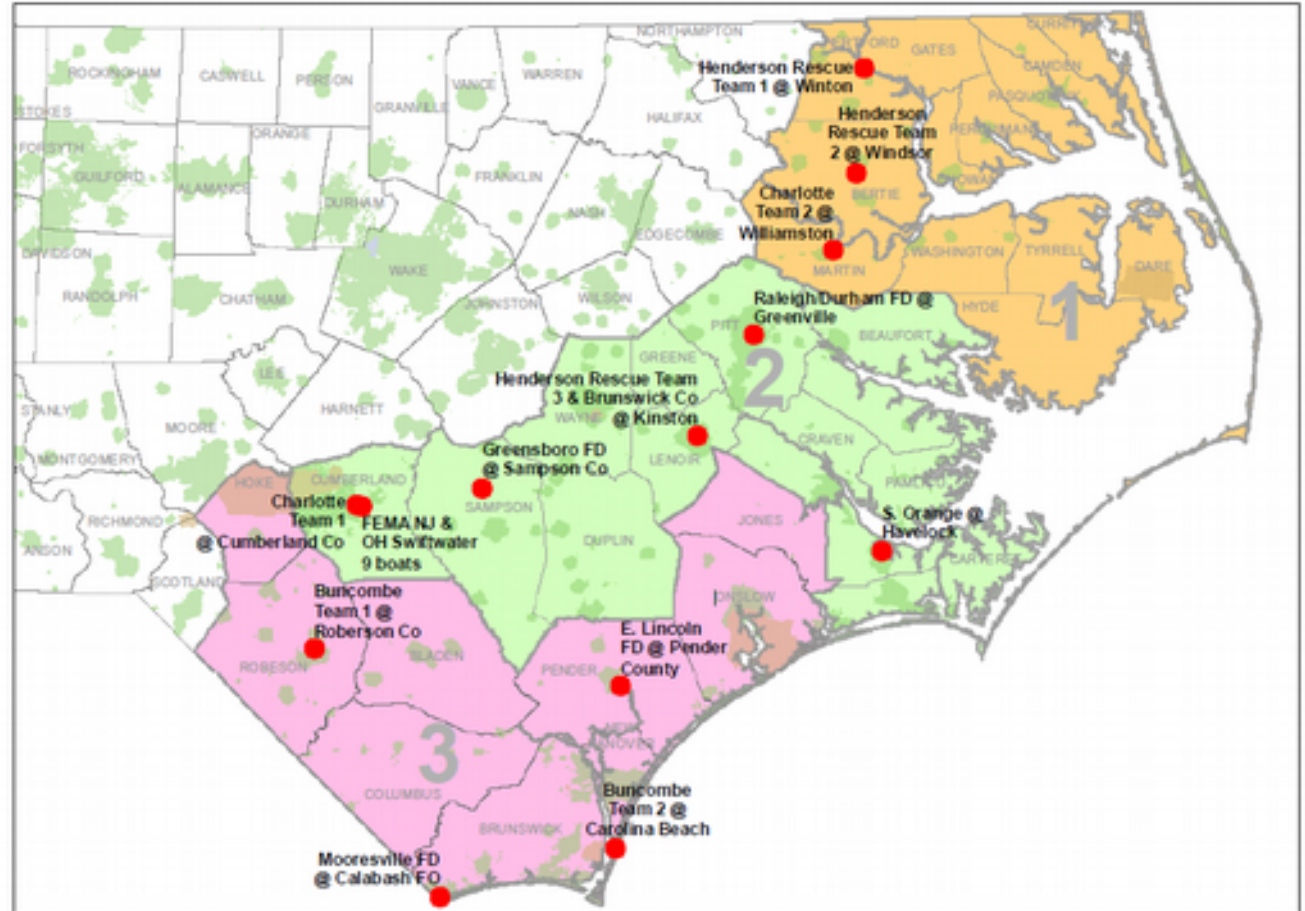
Contours to determine areas of potential flooding



Data Input



EBO Boat Locations - East



Impact of winds



Hurricane Matthew



Oct 06, 2016

11:00PM

Max Sustained Winds 130MPH

Present Movement NW at 13MPH

Min Central Pressure 939 MB 27.73 Inches

Incident ID: 916

Storm Advisory Number

36

34

Total Population	Total Number In Probability Area	Total Number In Probability Area
Total Population	632,993	1,270,442
Median Income (US Dollars)	\$35,876	\$34,924
Structures	357,115	741,814

Critical Infrastructure:

Chemical	416	976
Dams	67	220
EMS	142	296
Fire stations	333	684
Gas stations	621	1,370
Grocery stores	227	547
Pharmacies	140	259
Police Stations	71	145
Power Stations	2	2
Shelters	51	134

Functionally Fragile & Medical Facilities:

Age 65 +	92,425	175,827
Medically Fragile	233	495
Correctional Facilities	28	58
Hospitals	194	414
Nursing Homes	207	444
Under 5 years of age	38,948	87,474

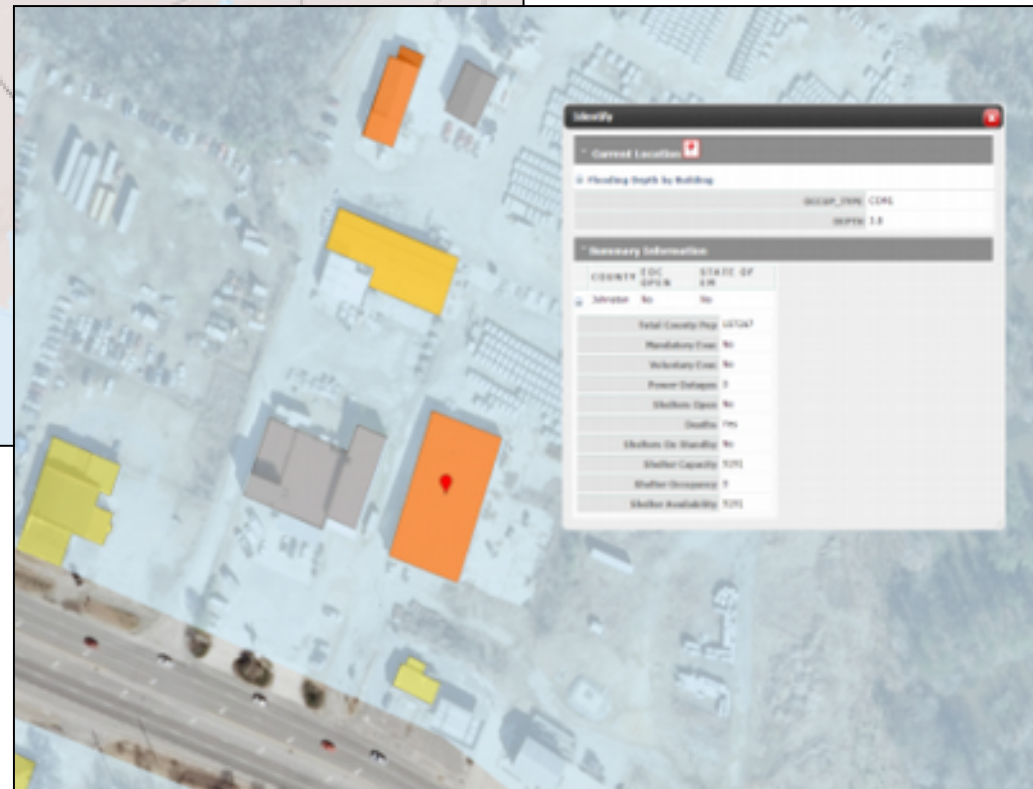
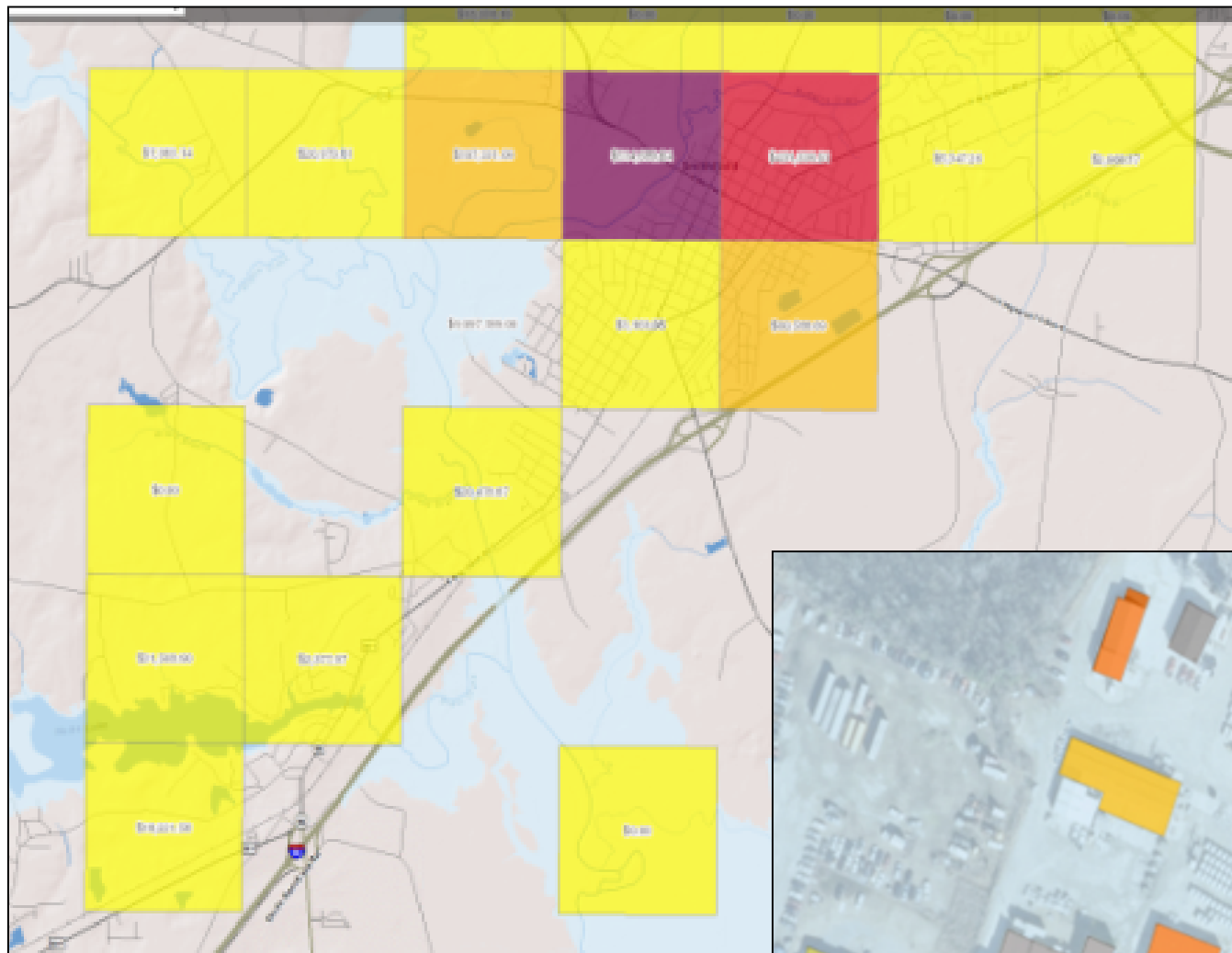
Agricultural Livestock:

Cattle Ranches	0	0
Dairy Ranches	0	2
Poultry Farms	0	0
Swine Farms	661	1,732
Livestock Lagoons	1,073	2,797

Buildings by Damage

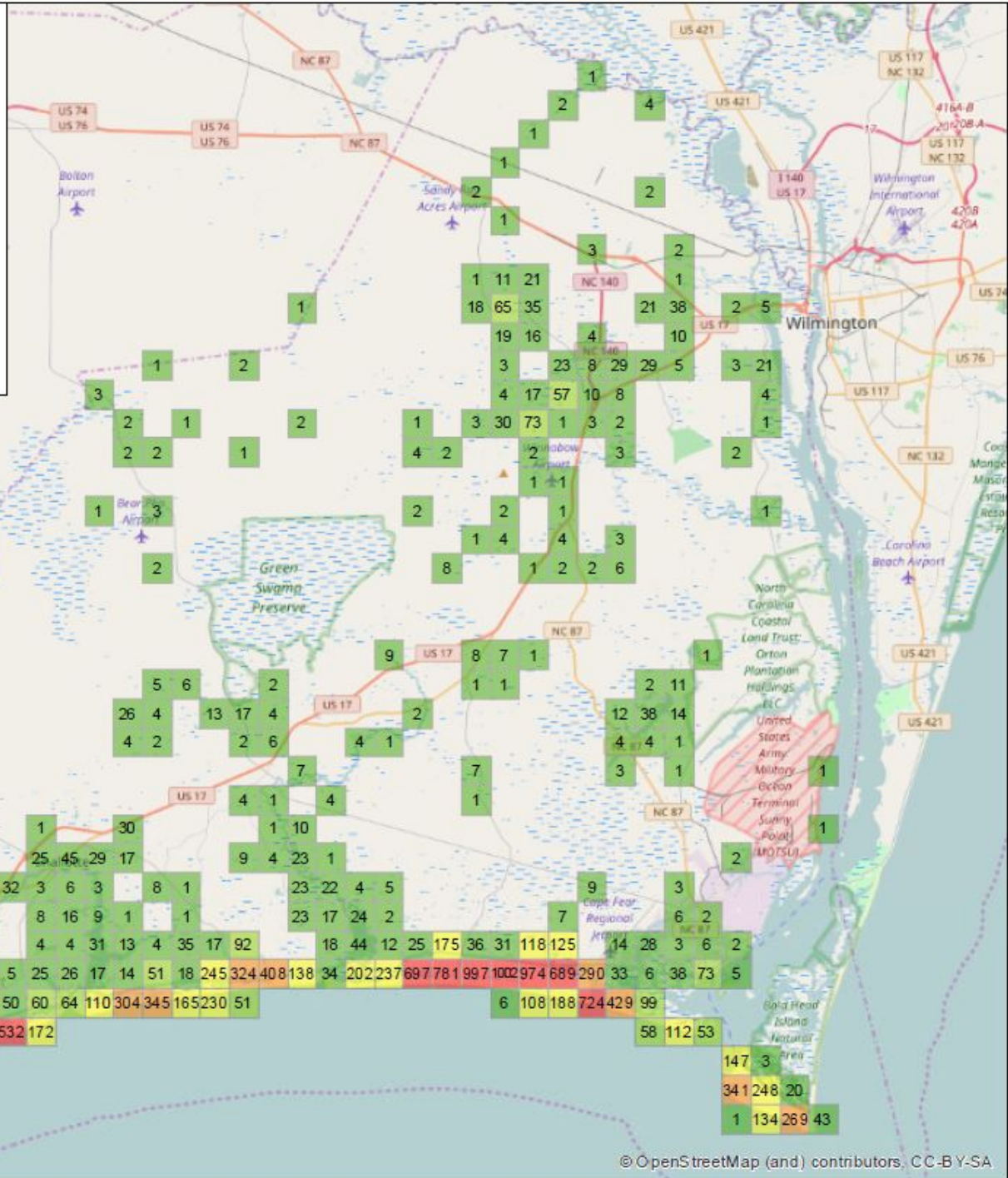
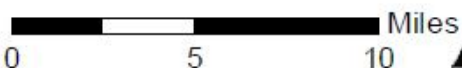
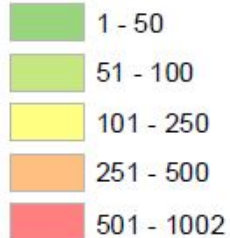
Buildings by Depth





Brunswick County

Buildings In Floodzones



Structure and Content Loss by County

County	Impacted Structures	% of Total Structures in County	Structure and Content Loss	Estimated Structure and Content Loss in Excess of Insurance Coverage and FEMA Assistance
Anson	3	0%	\$ 59,871	\$ 58,391
Beaufort	6,148	21%	\$ 23,801,794	\$ 14,908,669
Bertie	844	6%	\$ 7,766,660	\$ 5,654,694
Bladen	1,827	7%	\$ 22,574,245	\$ 20,177,829
Brunswick	7,593	11%	\$ 32,332,374	\$ 17,100,106
Camden	1,434	23%	\$ 5,295,402	\$ 3,565,458
Carteret	8,809	17%	\$ 122,530,821	\$ 87,993,995
Chatham	1	0%	\$ 256	\$ -
Chowan	344	4%	\$ 533,087	\$ 351,882
Columbus	2,419	6%	\$ 16,769,923	\$ 12,586,078
Craven	1,600	3%	\$ 6,950,430	\$ 6,009,771
Cumberland	4,050	3%	\$ 62,152,011	\$ 47,782,223
Currituck	2,911	14%	\$ 11,539,545	\$ 8,619,422
Dare	11,962	30%	\$ 317,302,290	\$ 242,091,639
Duplin	825	2%	\$ 5,035,574	\$ 3,663,682
Edgecombe	3,493	11%	\$ 69,091,875	\$ 60,598,523
Franklin	144	0%	\$ 721,432	\$ 664,302
Gates	212	3%	\$ 3,299,490	\$ 3,108,610
Greene	290	2%	\$ 1,802,542	\$ 1,033,561
Halifax	311	1%	\$ 73,581,981	\$ 73,530,185
Harnett	744	1%	\$ 9,091,478	\$ 7,593,469
Hertford	432	3%	\$ 7,093,299	\$ 6,203,529
Hoke	433	2%	\$ 3,109,849	\$ 2,431,736
Hyde	5,038	70%	\$ 59,495,708	\$ 51,494,889
Johnston	1,162	1%	\$ 24,714,319	\$ 22,286,132
Jones	429	5%	\$ 4,977,056	\$ 3,835,988
Lee	36	0%	\$ 535,189	\$ 413,149
Lenoir	2,374	7%	\$ 134,418,260	\$ 117,998,582
Martin	359	2%	\$ 2,721,084	\$ 2,537,625
Moore	838	1%	\$ 3,908,981	\$ 2,641,955
Nash	1,761	3%	\$ 213,453,350	\$ 199,431,592
New Hanover	6,996	8%	\$ 189,463,918	\$ 126,448,419
Northampton	169	1%	\$ 2,211,666	\$ 2,158,218
Onslow	1,237	1%	\$ 4,984,017	\$ 4,291,351
Pamlico	2,369	19%	\$ 17,776,829	\$ 14,125,132
Pasquotank	1,908	9%	\$ 4,981,314	\$ 3,260,306
Pender	5,091	14%	\$ 82,412,613	\$ 67,713,747
Perquimans	514	6%	\$ 544,264	\$ 414,833
Pitt	4,276	6%	\$ 67,524,429	\$ 60,239,475
Richmond	12	0%	\$ 44,574	\$ 1,112
Robeson	7,851	13%	\$ 99,924,847	\$ 84,544,282
Sampson	657	1%	\$ 4,025,091	\$ 2,405,429

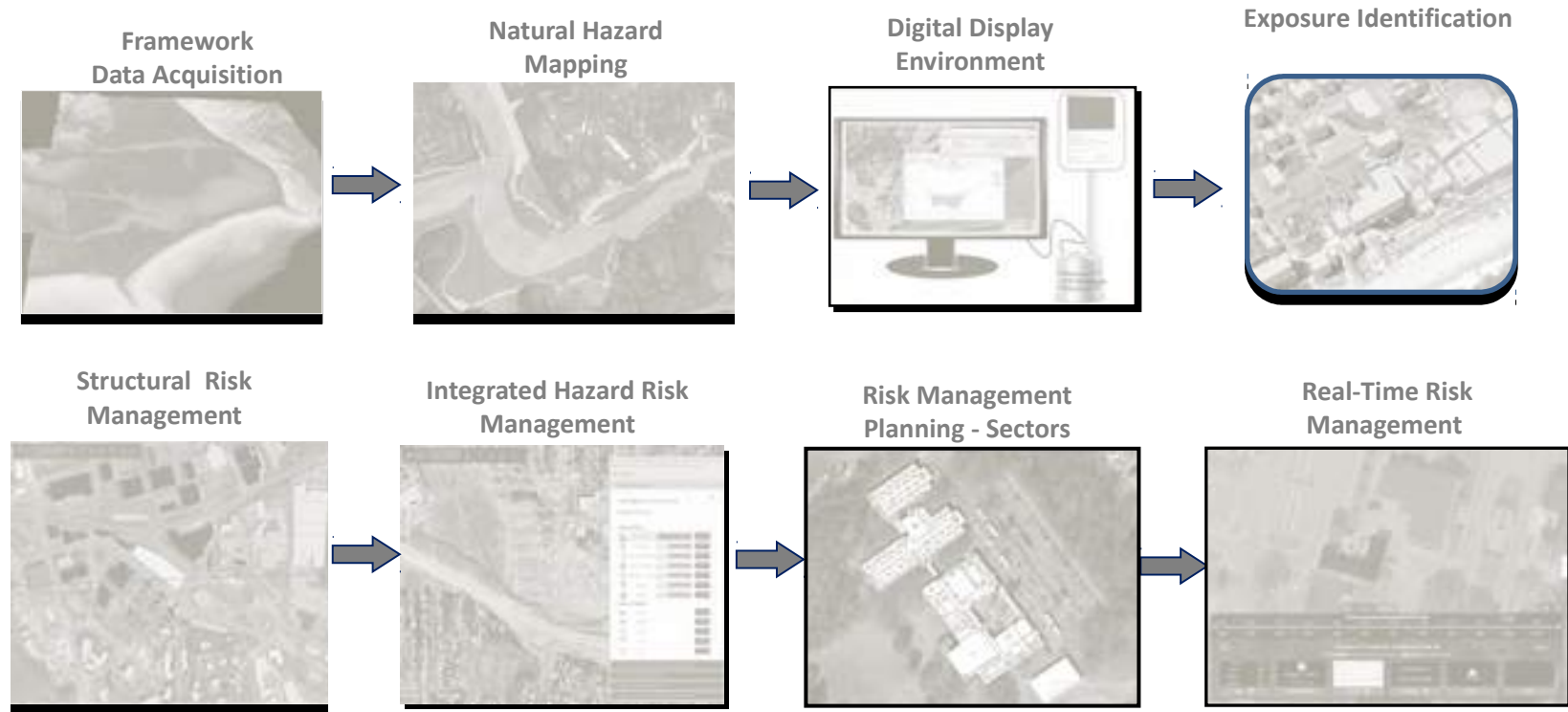
All Structures			
Damage Level	Building Count	Estimated Structure and Content Loss	Estimated Structure and Content Loss in Excess of Insurance Coverage and FEMA Assistance
Damaged	105,977	\$ 1,243,526,432	\$ 983,109,654
Destroyed	6,626	\$ 710,615,873	\$ 615,068,148
Total	112,603	\$ 1,954,142,305	\$ 1,598,177,802

Residential Structures			
Damage Level	Building Count	Estimated Structure and Content Loss	Estimated Structure and Content Loss in Excess of Insurance Coverage and FEMA Assistance
Damaged	88,266	\$ 667,070,138	\$ 439,911,183
Destroyed	4,424	\$ 299,980,246	\$ 218,813,399
Total	92,690	\$ 967,050,384	\$ 658,724,582

Non-Residential and Public Structures			
Damage Level	Building Count	Estimated Structure and Content Loss	Estimated Structure and Content Loss in Excess of Insurance Coverage and FEMA Assistance
Damaged	17,711	\$ 576,456,294	\$ 543,198,470
Destroyed	2,202	\$ 410,635,627	\$ 396,254,749
Total	19,913	\$ 987,091,921	\$ 939,453,220

Risk Management

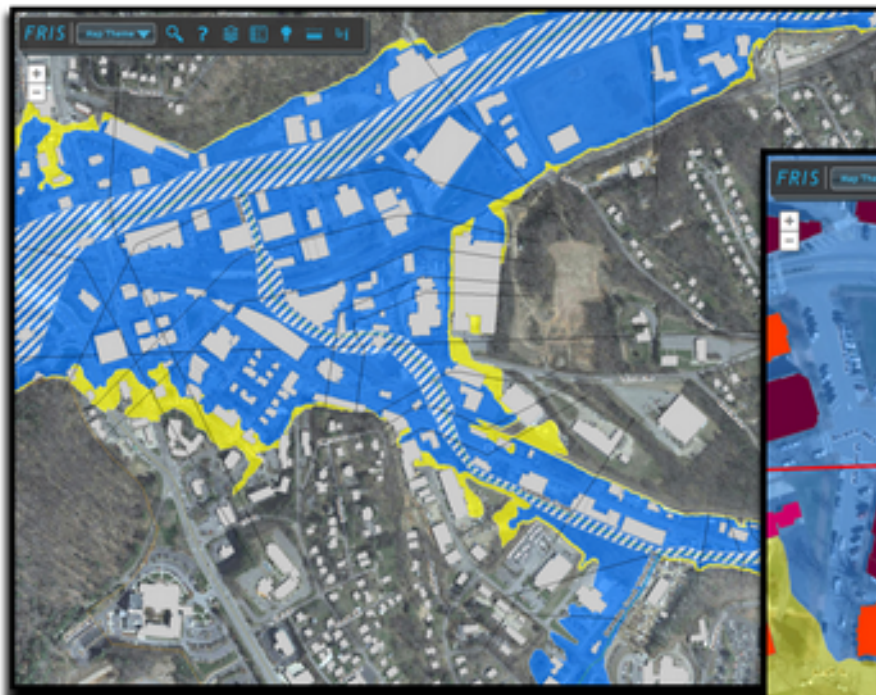
North Carolina Progression



Resilient Redevelopment and Recovery

Contract for Hurricane Matthew work

- Overall scope of IDIQ is towards the State's emergency, short-term and long-term rehabilitation, mitigation, resilient redevelopment and recovery from the effects of hurricanes, wildfire, and other natural hazards. Services provided through this contract will include:
 - Data Acquisition and Analysis;
 - Hazard Modeling, mapping and risk assessment;
 - Short-term emergency repair, rehabilitation and temporary housing;
 - Resilient redevelopment planning and design;
 - Program and project management;
 - Grants management;
 - Data and applications development and management; and,
 - Administrative and technical support.



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