

# GEOPLATFORM: DISASTERS COMMUNITY

*Science, Technology, and Data Applications for Disaster Operations*

Joint HIFLD Feedback Session/GeoPlatform Community Meeting



**FEMA**

Response Geospatial Office  
Chris Vaughan, Rob Pitts (CTR), Rebecca Kollmeyer (CTR)  
October 28, 2019

# Community Lifelines

## A CONSTRUCT FOR OBJECTIVES-BASED STABILIZATION EFFORTS

A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security.

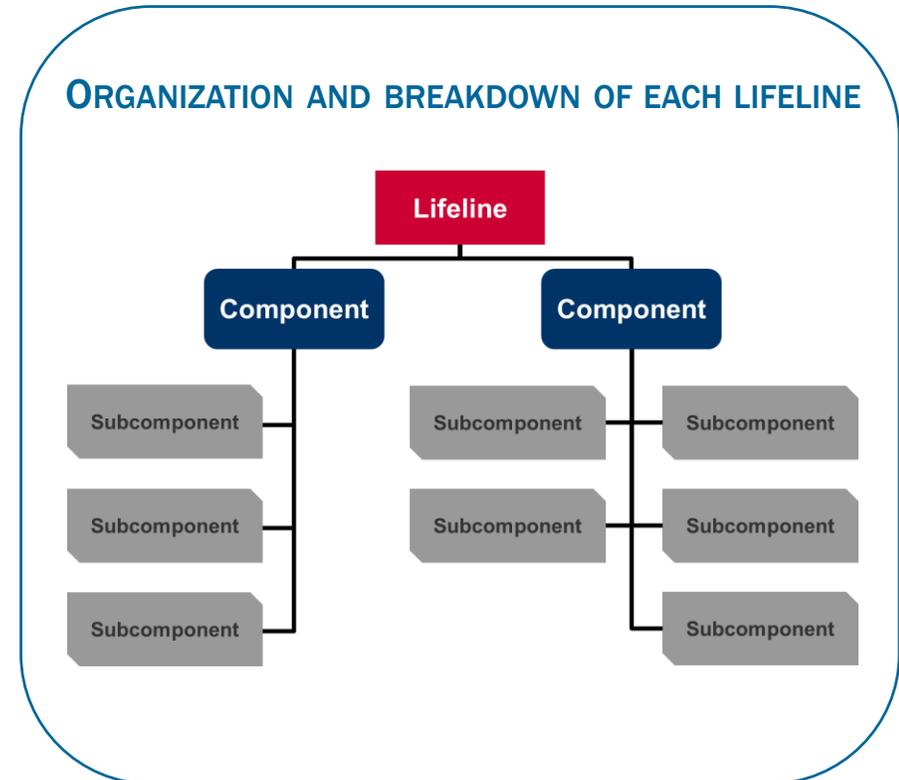


- Lifelines are the most fundamental services in the community that when stabilized enable all other aspects of society
- Lifelines exist during steady-state and are normally provided by sources organic to the community.
- When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required.

# Deconstructing Community Lifelines

- Each lifeline is comprised of multiple components and subcomponents that help define the services that make up that lifeline.
  - Components represent the general scope of services for a lifeline
  - The components are further divided into relevant subcomponents that provide a granular level of enabling functions for the delivery of services to a community.
- Lifelines and Components are fixed, but the subcomponents may be adjusted as necessary

**Note: Not every incident will impact all of the lifelines or components**





# Community Lifeline Components

Multiple components and subcomponents establish the parameters of the lifeline; component-level assessment is required to determine the condition of each lifeline.

## 1. Safety and Security

- Law Enforcement/Security
- Fire Service
- Search and Rescue
- Government Service
- Community Safety

## 2. Food, Water, Shelter

- Food
- Water
- Shelter
- Agriculture

## 3. Health and Medical

- Medical Care
- Patient Movement
- Public Health
- Fatality Management
- Medical Supply Chain

## 4. Energy

- Power (Grid)
- Fuel

## 5. Communications

- Infrastructure
- Alerts, Warnings, Messages
- 911 and Dispatch
- Responder Communications
- Finance

## 6. Transportation

- Highway/Roadway Motor Vehicle
- Mass Transit
- Railway
- Aviation
- Maritime

## 7. Hazardous Material

- Facilities
- HAZMAT, Pollutants, Contaminants

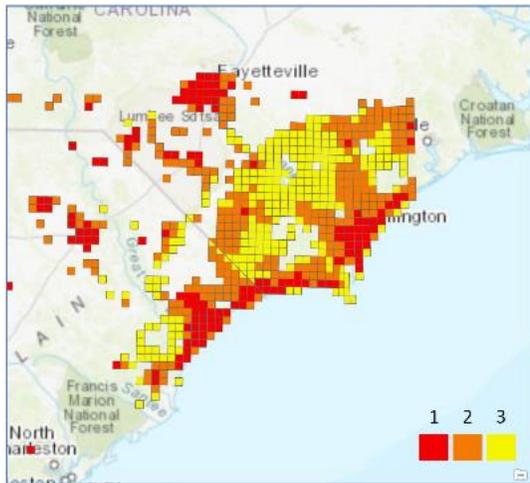
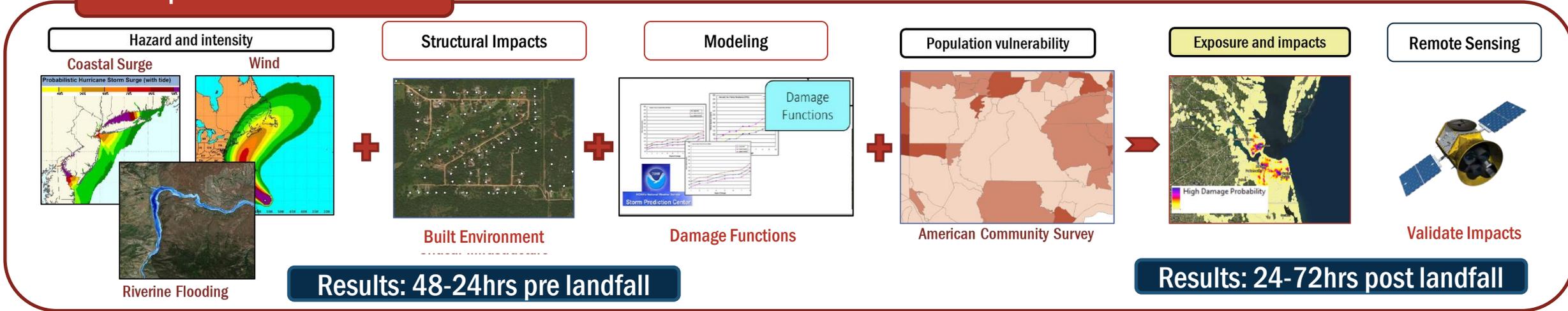
### ASSESSMENT

<b>Status</b>	<i>“What?”</i>
<b>Impact</b>	<i>“So What?”</i>
<b>Actions</b>	<i>“Now What?”</i>
<b>Limiting Factors</b>	<i>“What’s the Gap?”</i>
<b>ETA to Green</b>	<i>“When?”</i>

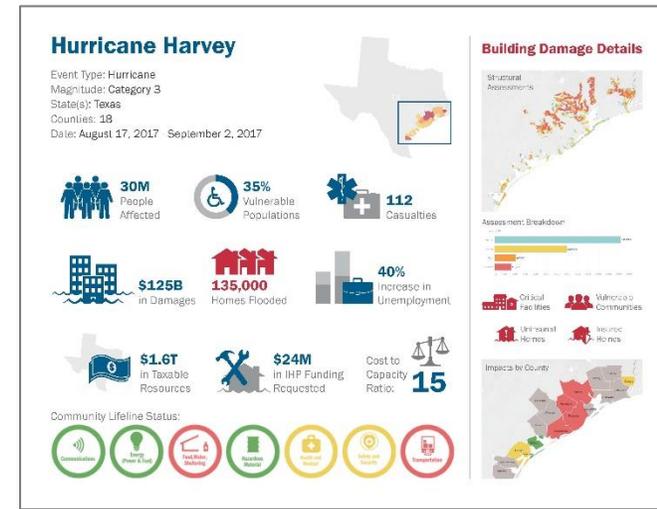


# CONOPS | Prioritizing Operational Support and Resource Requirements

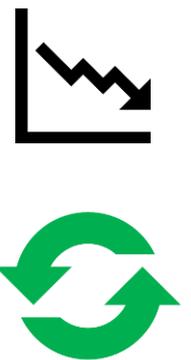
## Conceptual Model Framework



### Estimated Resource Requirements:



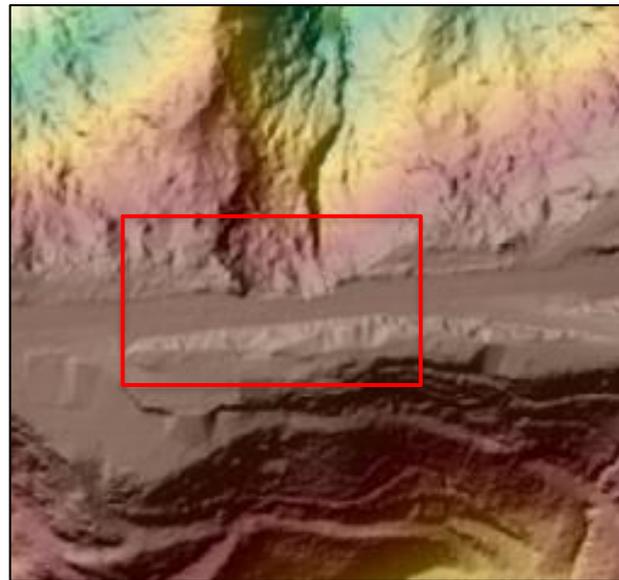
### Trend Analysis:



## Debris Estimation



## Transportation Impacts



## Damage Assessments



# DATA | Steady State & Operational



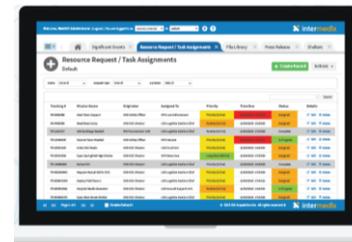
## Steady-State “Foundational” Data

- Authoritative Bounded Crowd (FLSTT)

## Transactional (Event-based)

- Authoritative reporting (WebEOC)
- Volunteer Geographic Information
- Field Observations (mobile apps)

DATA



Crisis Management Systems



Crowdsourcing



Field Operations



Back to “Foundational” Data

# DATA | Key Datasets for Lifelines

## Built Environment

Energy  
Power Plants  
Gas Stations  
Dams  
Levees

Safety/Security  
Police Station  
Fire Station  
DoD Facilities  
Government Buildings  
Local EOC  
State EOC  
Prisons

Food/Water/Shelter  
Residential Structures  
Mobile Home Park  
Shelters  
Home Improvement Stores  
Grocery Stores  
Hotels/Lodging  
School/University  
Day Care

Transportation  
Airports  
Federal Roads  
Railway  
Rail/Bus Transit Stations  
Ports  
Bridges

Health/Medical  
Nursing Home  
Blood Banks  
Pharmacies  
Hospital  
EMS Stations  
Dialysis Centers

Communication  
PSAP  
Cell Tower  
Cellular Towers  
FM Trans Towers  
Microwave Service Towers  
AM Transmission Towers  
Banks/ATMs

Hazmat  
Wastewater Plant  
Water Treatment  
Landfills

### Primary Data Source

- [HIFLD \(Open & Secure\)](#)
- [Esri](#)
- [US Census](#)
- [USDA](#)
- [US EPA](#)
- [HHS](#)

## Demographic, Social Vulnerability, and Insurance Coverage

- Population
- Housing Units
- Total Households
- Average Household Size
- Population under Age 5
- Population over Age 65
- Population under 18
- Percent Disabled
- Household with one disable person
- Average Home Price
- Speak English less than Well(%)
- Medicare Beneficiary
- Power Dependent Device
- Home Insurance (Owner)
- Flood/Earthquake Insurance
- Population in Group Quarters
- Institutional Total Population in Group Quarters
- Noninstitutional Total Population in Group Quarters

## Economic Indicators

- Manufacturing
- Distribution Centers
- County GDP per Capita
- Below Poverty Rate (%)
- Persistent Poverty Total (Yes/No)
- Persistent Poverty Child (Yes/No)
- Unemployment Rate
- Median Household Income
- Median Home Price
- Historic IA Registration Total
- Retail
- Households Receiving Food Stamps/SNAP
- NFIP Contract in Force (CIF)
- NFIP Policy in Force (PIF)
- NFIP Penetration Rate
- NFIP Repetitive Loss

- HIFLD data is the primary source used for the built environment. There are inherent currency and accuracy (Geospatial & Attribution) issues identified within this national foundational catalog. Please reference back to HIFLD [metadata catalog](#) for specific layer information.
- Variable list will expand as requirements change with lifeline maturity

# **GeoPlatform & FEMA Geospatial Data Publishing Strategy**

# GeoPlatform & FEMA Geospatial Web Publishing Strategy

## GEOPLATFORM

### Disasters Enterprise Data Portal



### Public Data Site

#### Disasters Public Files

[Disasters Public Files](#) >> [NationalDisasters](#)

Files:

Folders:

[CaliforniaWildfires\\_November2018](#)

[HurricaneFlorence](#)

[HurricaneLane](#)

[HurricaneMichael](#)

[M7\\_AnchorageAlaskaEarthquake\\_November2018](#)

### Disasters Communities Site

#### Disasters

Whole community geospatial data, tools, and resources for disaster response and resiliency.

[Learn More](#)



Data Layers & Web Services



Web Maps & Applications



Resources

#### Featured Maps and Apps



Hurricane Dorian



### FEMA AGOL

ArcGIS

Gallery for FEMA

Search gallery



FEMA Flood Hazard Resources Map for NY and ...  
Updated flood hazard data available for recovery and rebuilding efforts in Sandy affected counties in NJ and NY



Santa Barbara, C.  
This WebApp depicts following the Thom





**Role: Provide Interagency Tool on GeoPlatform for Publishing Public Disasters Data and Map Services**

## Updates

- **Upgraded to latest software release**
- **Productionized System**
- **Governance Policy Applied**
- **Data Migration Underway**

## Disasters Public Files

[Disasters Public Files](#) >> [NationalDisasters](#) >> [2018](#)

Files:

Folders:

[CaliforniaWildfires\\_November2018](#)

[HurricaneFlorence](#)

[HurricaneLane](#)

[HurricaneMichael](#)

[M7\\_AnchorageAlaskaEarthquake\\_November2018](#)

**Role: To host GIS-based data for the disasters community and aid collaboration**

### Updates

- **GIS Data and data-related files**
- **Archived all other data (ppt, doc, etc)**
- **Main folders**
  - **National Disasters**
  - **Partners (interagency data)**
  - **National Datasets**
- **Content managers**

# GeoPlatform Disasters Communities Site

## Disasters

Whole community geospatial data, tools, and resources for disaster response and resiliency.

[Learn More](#)

Q Search...

Search



Incidents



Data Layers &  
Web Services



Web Maps &  
Applications



Resources



Community

### Featured Maps and Apps



Hurricane Dorian



**Role: To provide a place for whole community geospatial data, tools and resources for disaster response and resiliency**

## Update

- **Multiple Coordination call storymaps**
- **Distribution lists easily available**
- **All public data**

# FEMA ArcGIS online (AGOL)

☰ ArcGIS 🔍 s

Gallery for FEMA

🔍 Search gallery ☰ ☰

**FEMA Flood Hazard Resources Map for NY and ...**  
Updated flood hazard data available for recovery and rebuilding efforts in Sandy affected counties in NJ and NY

**Santa Barbara, CA Recovery Maps Essential**  
This WebApp depicts Recovery maps for debris fl...

**Role: To provide a place for ESRI-specific data layers, web maps, and applications**

## Update

- **Assigned Content managers for each group**
- **Publishing done under group account**
- **Identifying outdated user accounts**

**What's New**

**on**

**[Disasters.geoplatform.gov](https://disasters.geoplatform.gov)**

GeoPlatform: Disasters

## Disasters

Whole community geospatial data, tools, and resources for disaster response and resiliency.

[Learn More](#)



Incidents



Data Layers &  
Web Services



Web Maps &  
Applications



Resources



Community

# UPDATES | GeoPlatform Disasters Community Site

HOME INCIDENTS DATA APPLICATIONS RESOURCES COMMUNITY ABOUT CONTACT

GeoPlatform: Disasters

## Disasters

Whole community geospatial data, tools, and resources for disaster response and resiliency.

Learn More

Q Search... Search

### Featured Maps and Apps



Hurricane Dorian

### Incident Journals



Hurricane Journal



Earthquake Journal



Flood Journal



Tornado Journal



Wildfire Journal

## Featured Maps and Apps

Helps users easily navigate to recent incidents

## Incident Journals

- Links directly to journals
- Easy URL to share during response

## Coming Soon

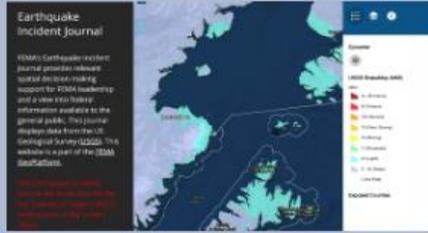
New Theme with useful plug-ins & updated features

# **New Data Tools & Services Available on GeoPlatform**

# Incident Journals



Hurricane Journal



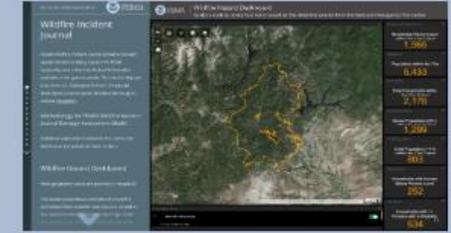
Earthquake Journal



Flood Journal



Tornado Journal



Wildfire Journal

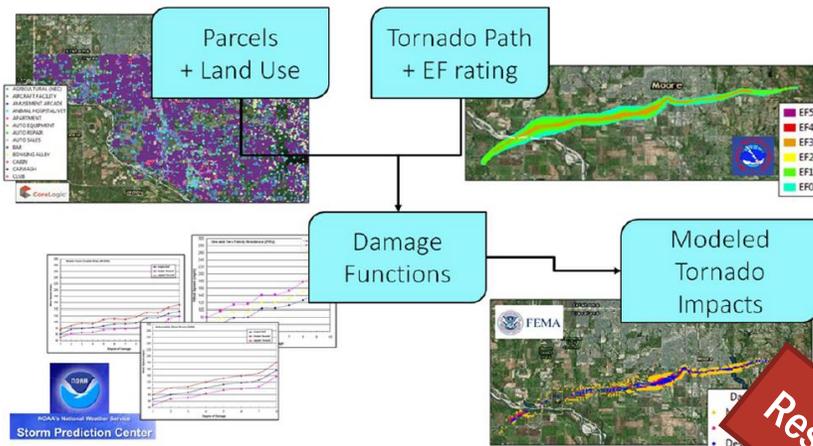
## New Standards for each journal

- Hazard Overview
- Population Impacts
- Logistics
- Critical Infrastructure & Essential Facilities
- FEMA Web Application Gallery
  - Lifeline dashboards
  - Damage Assessments
  - FEMA Prioritizing Operations Support Tool (POST)

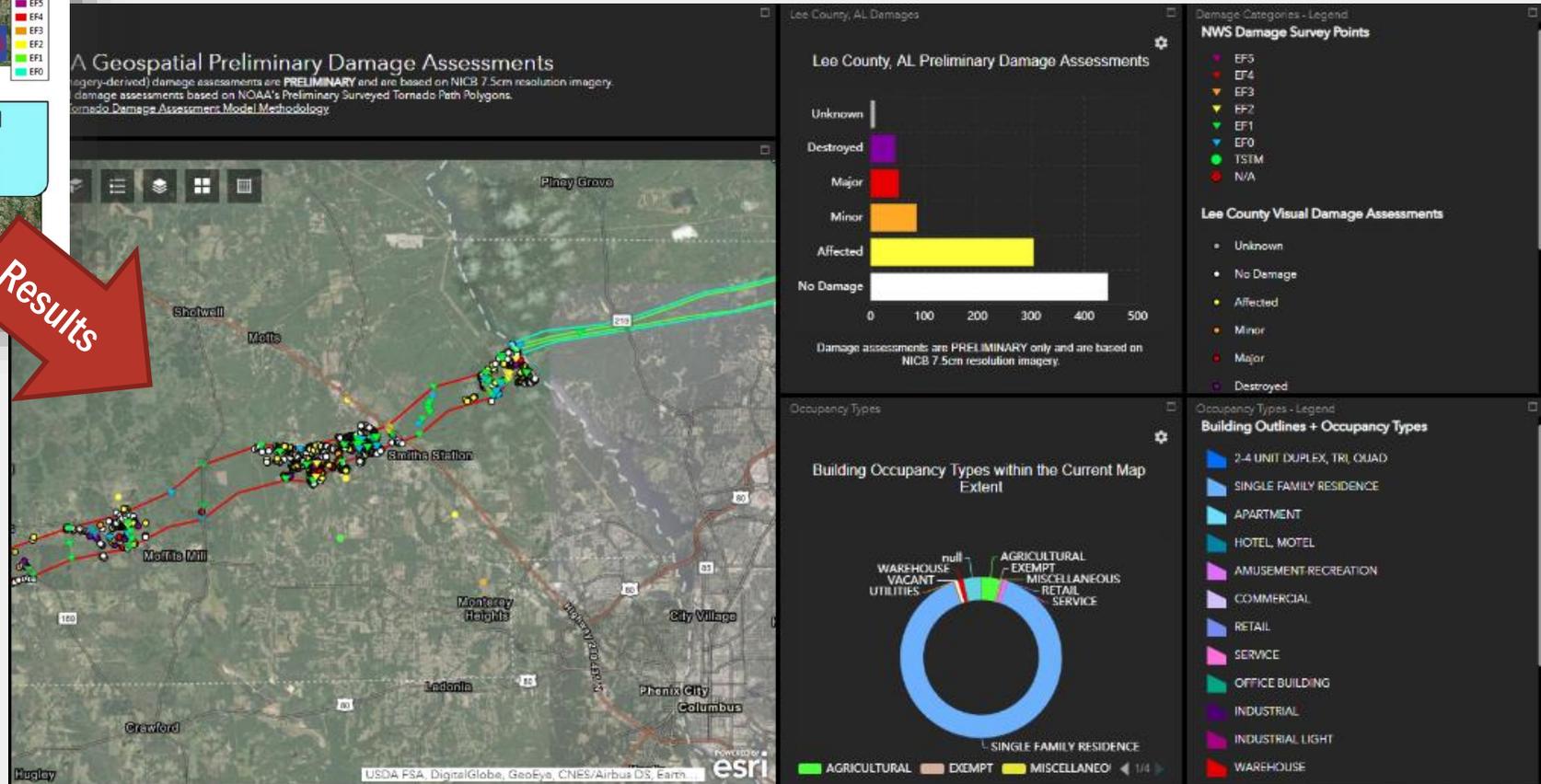


# ANALYSIS | Tornado Damage Assessments

## Tornado Hazard Model



## Damage Assessment Web Application



### Results:

- Initial Estimate: 30 min
- Detailed Assessments: 24-48 hours

### Intended use:

- Supports preliminary damage assessments and can guide initial response
- Can support initial event scoping

Other Damage Assessment Models:  
Earthquakes, Floods, Wildfires

# ANALYSIS | Earthquake Damage Assessments

## Social Vulnerability

**What is the SVI?**  
The Social Vulnerability Index uses U.S. Census data to determine the relative social vulnerability of every census tract. The SVI ranks each tract on 14 social factors and groups them into four related themes. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. The SVI can help emergency response planners and public health officials identify and map the communities that will most likely need support before, during, and after a hazardous event.

**Overall Vulnerability**

- Socioeconomic Status**
  - Median Family Income
  - Unemployment
  - No High School Diploma
  - Aged 65 or Older
  - Aged 17 or Younger
  - Older than Age 5 with a Disability
  - Single-Parent Households
- Household Composition & Disability**
- Minority Status & Language**
  - Minority
  - Speak English "Less than Well"
- Housing & Transportation**
  - Multi-Unit Structures
  - Mobile Homes
  - Condo/Coop
  - No Vehicle
  - Group Quarters

The SVI databases are in ArcGIS personal geodatabase format (.mdb). In addition to ArcGIS, mdb files can be imported in QGIS, Access, and imported into Excel. Documentation is available for all databases.

## Real-time Geospatial Integration and Modeling for Disaster Response

Microsoft  
CoreLogic **Structural Data**



**Earthquake Incident Journal**

**Building Exposure**

Total Buildings Exposed to MMI 5 or greater: **70,214**

This maps displays building exposure within the USGS ShakeMap (MMI 5 or greater) for the M7.0 Earthquake near Anchorage, AK on 11/30/2018. This is an exposure map only - not a damage assessment map.

Microsoft Building data only exists in the Anchorage, AK and surrounding area. Numbers do not represent buildings exposed within the full ShakeMap extent.

**Data Sources:**

- USGS ShakeMap MMI
- Microsoft Building Outlines
- CoreLogic Parcel Occupancy Types

**Occupancy Types**

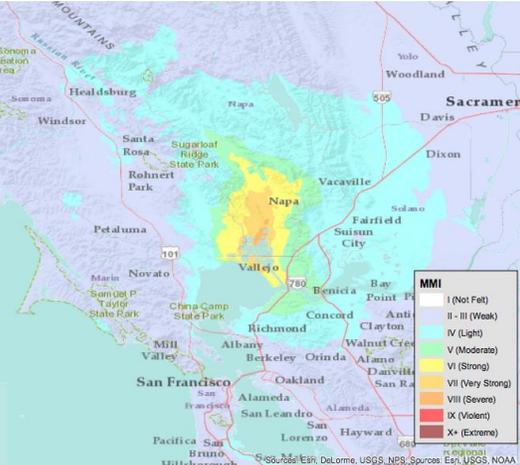
Building Count per Occupancy Type

**FEMA Disaster Declarations**

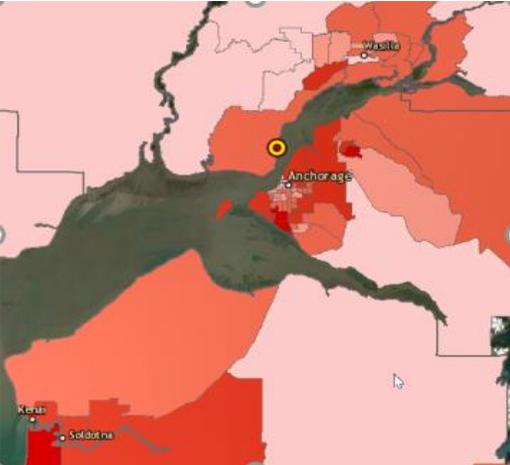
This map shows counties that have requested federal disaster support.

Individual Assistance is provided by the Federal Emergency Management Agency (FEMA) to individuals and families who have...

## USGS Earthquake Intensity



## Predicted Hazard Impacts



# **Prioritizing Operations**

# Scenario

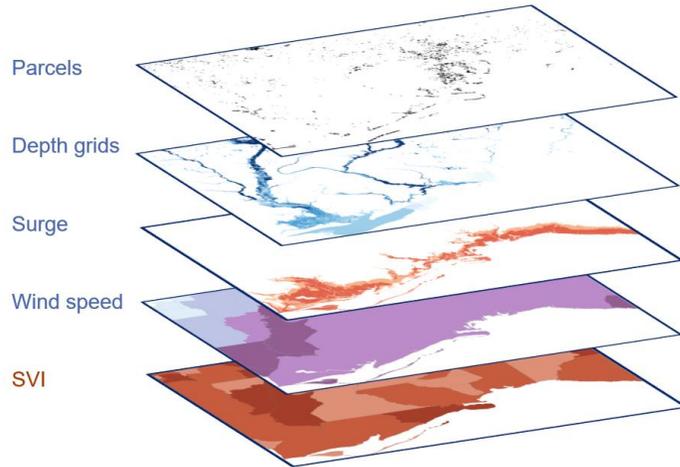
- **Large Disaster Event**
  - Cat 5 Hurricane Approaching Gulf
- **Huge Potential Impact Area**
- Multi-State Area
- **Responsible for Coordinating Response**
  - Estimating Impacts, Evacuation, Supply/Aid Logistics, etc.
  - Communicating with FSLTT Echelons
  - Limited Time & Resources

# Requirements

- **Need to Quickly Determine Vulnerabilities**
  - Populations, Critical Infrastructure
  - Where are Vulnerable Areas?
- **Need A Way to Prioritize Operations**
  - What are the Highest Priorities?
  - Where are they located?
  - What Lifelines are Threatened and How?

# PRIORITIZE | POST 1.0 - Data Collection Coordination (2017-2018)

## HAZARD & LOCATION DATA



## HAZARD PROBABILITY

**HAZARD PROBABILITY SCORE**

1) HAZARD SCORE PER AFFECTED PARCEL:  
The sum of the percentile ranks of each variable (flood depth, surge, wind)

$$HPS_i = FloodDepthGrid_{pr} + Surge_{pr} + Wind_{pr}$$

Where  $pr$  is the percentile rank (1 – 10) of each parcel ( $i$ ).

Percentile rank

2) HAZARD SCORE PER USNG CELL:  
Assign a hazard score for each USNG Cell  
Score is calculated as the sum HPS of all parcels in the cell

$$HPS_c = HPS_1 + HPS_2 + \dots + HPS_n$$

## SOCIAL VULNERABILITY

**USNG – AN AGGREGATED SOCIAL VULNERABILITY SCORE**

1) For each criterion in a cell we calculate a percentile rank (the percentile of that cell within the affected cells)(1-10)

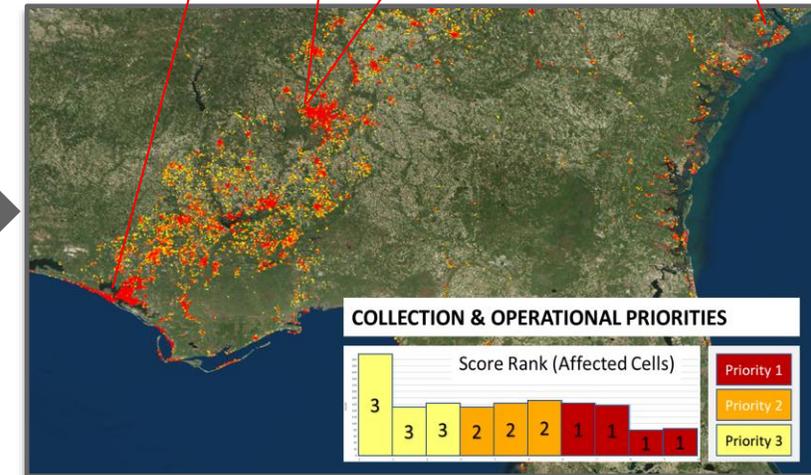
2) For each cell we calculate an aggregated social vulnerability score:

$$\text{Aggregated SV score} = pop_{pr} + hholds_{pr} + hunits_{pr} + age65_{pr} + unemp16_{pr} + nolaborforce16_{pr} + amask_{pr} + hpov_{pr} + hdisfs_{pr} + hdisnfs_{pr} + hfssnap_{pr} + hpa_{pr} + humb_{pr}$$

Where  $pr$  is a percentile rank of each criterion

1. Population ( $pop$ )
2. Number of Households ( $hholds$ )
3. Number of Housing units ( $hunits$ )
4. Population age 65 and over ( $age65$ )
5. Population age 16+ and unemployed ( $unemp16$ )
6. Population 16+ not in labor force ( $nolaborforce16$ )
7. Population American Indian or Alaska Native ( $amask$ )
8. Number of Households in poverty ( $hpov$ )
9. Number of Households on disability and food stamps ( $hdisfs$ )
10. Number of Households on disability no food stamps ( $hdisnfs$ )
11. Number of Households with food stamps/SNAP ( $hfssnap$ )
12. Number of Households with public assistance ( $hpa$ )
13. Number of Housing units that are mobile homes ( $humb$ )

## COLLECTION TASKING



## PUBLISH DAILY DATA SERVICE

# PRIORITIZE | 2.0 – Add Critical Infrastructure, Live Data Feeds, Cascading Impacts (2019)

## CONT. STEP 6: CALCULATE A LIFELINE IMPACT SCORE (LIS)

### THE METHOD:

When actual impact is not available for a cell, search for any **cascading impacts** that could potentially affect this lifeline according to the calculated spread risk workflows. Record the probability of this cascading effect.

The LIS is calculated as:

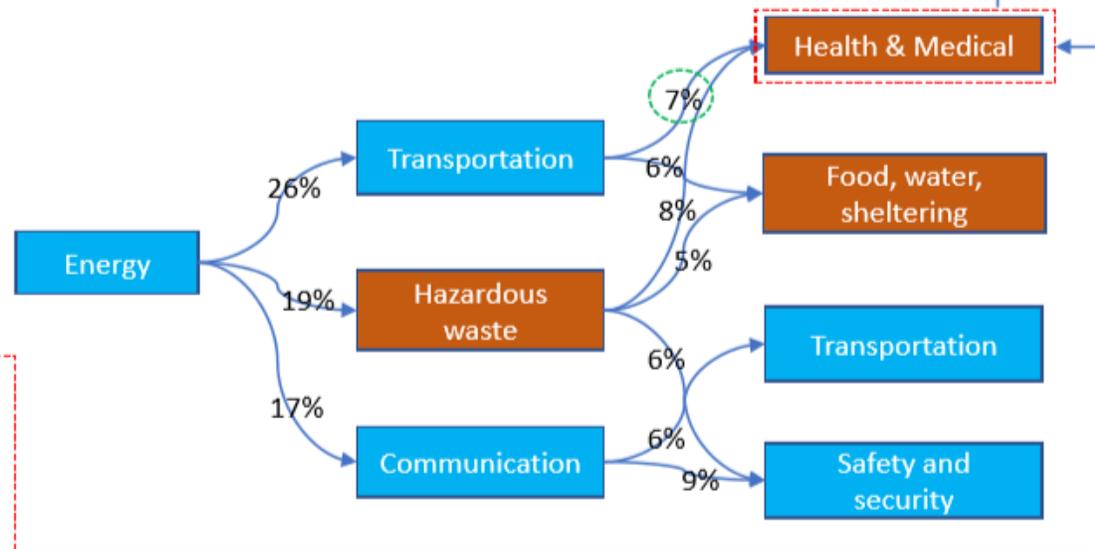
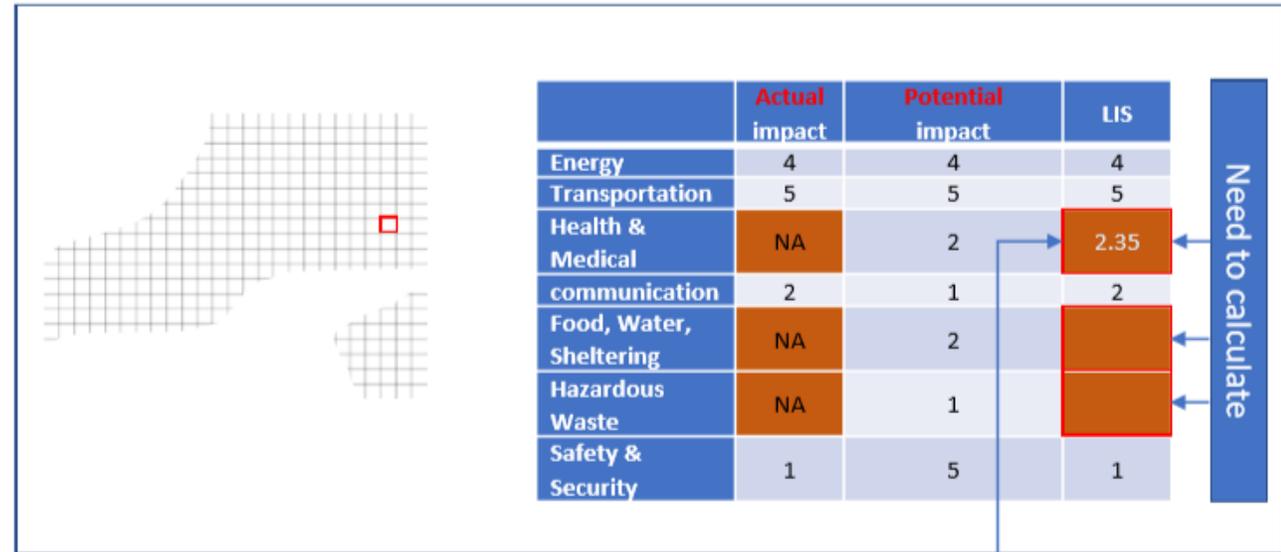
Potential impact score + cascading impacts

Ideally, cascading impacts will be calculated based on the actual known impact. If actual impact is not available, we can calculate the cascading impacts based on the potential impacts of the initiating lifeline.

Example:

$$\text{Health \& Medical Lifeline impacts} = 2 + 5 * 0.07 = 2.35$$

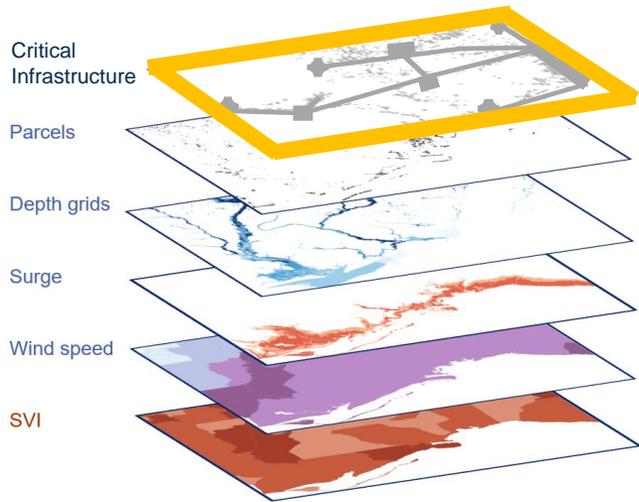
The potential impact of Health & Medical      The cascading impact weight



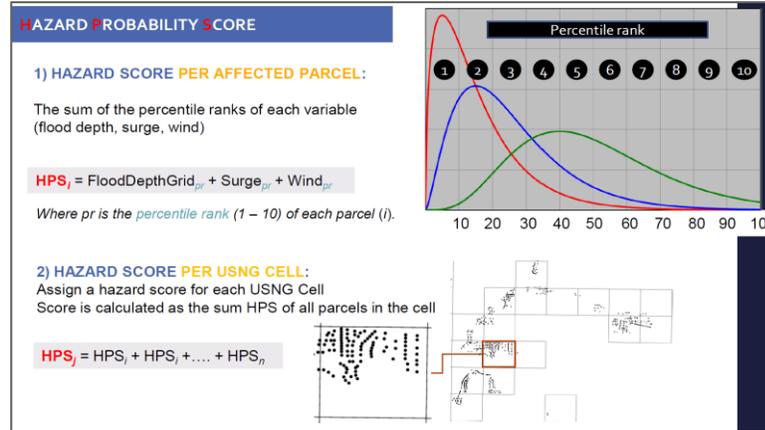
Actual impact available      Actual impact not available

# PRIORITIZE | 2.0 – Add Critical Infrastructure, Live Data Feeds, Cascading Impacts (2019)

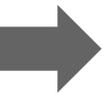
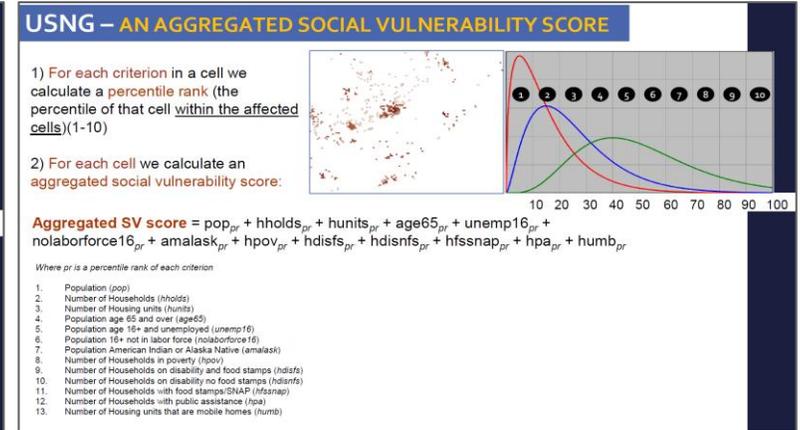
## HAZARD & LOCATION DATA



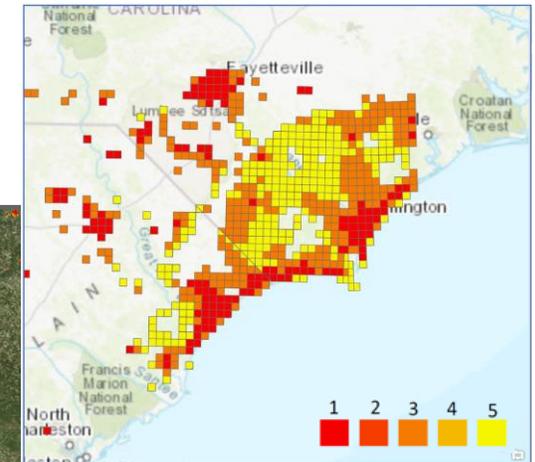
## HAZARD PROBABILITY



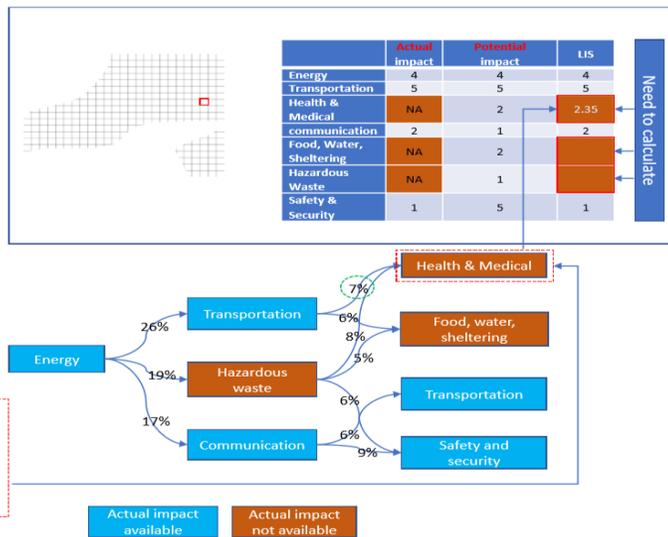
## SOCIAL VULNERABILITY



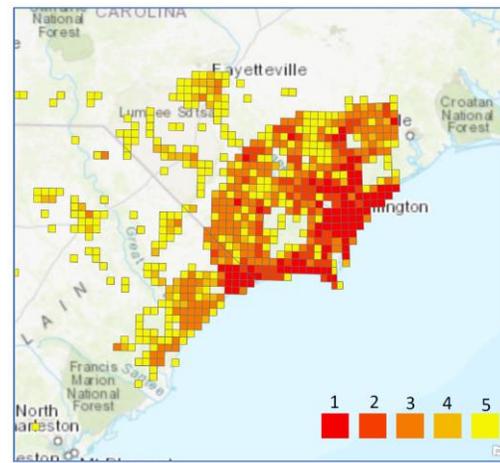
## TRANSPORTATION LIFELINE IMPACT SCORE



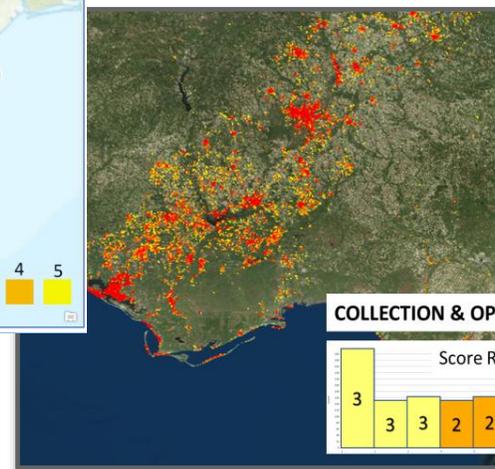
## CI + LIVE FEEDS + CASCADING IMPACTS



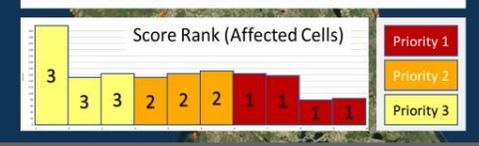
## ENERGY LIFELINE IMPACT SCORE



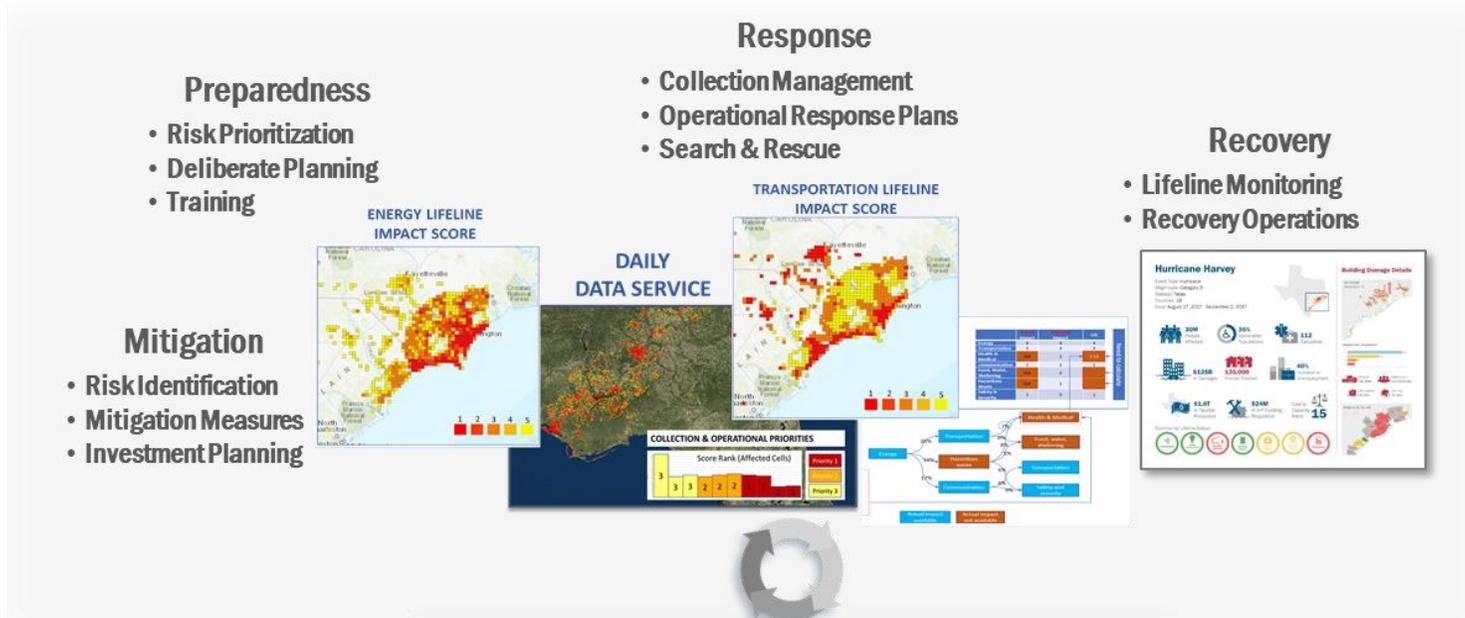
## DAILY DATA SERVICE



### COLLECTION & OPERATIONAL PRIORITIES



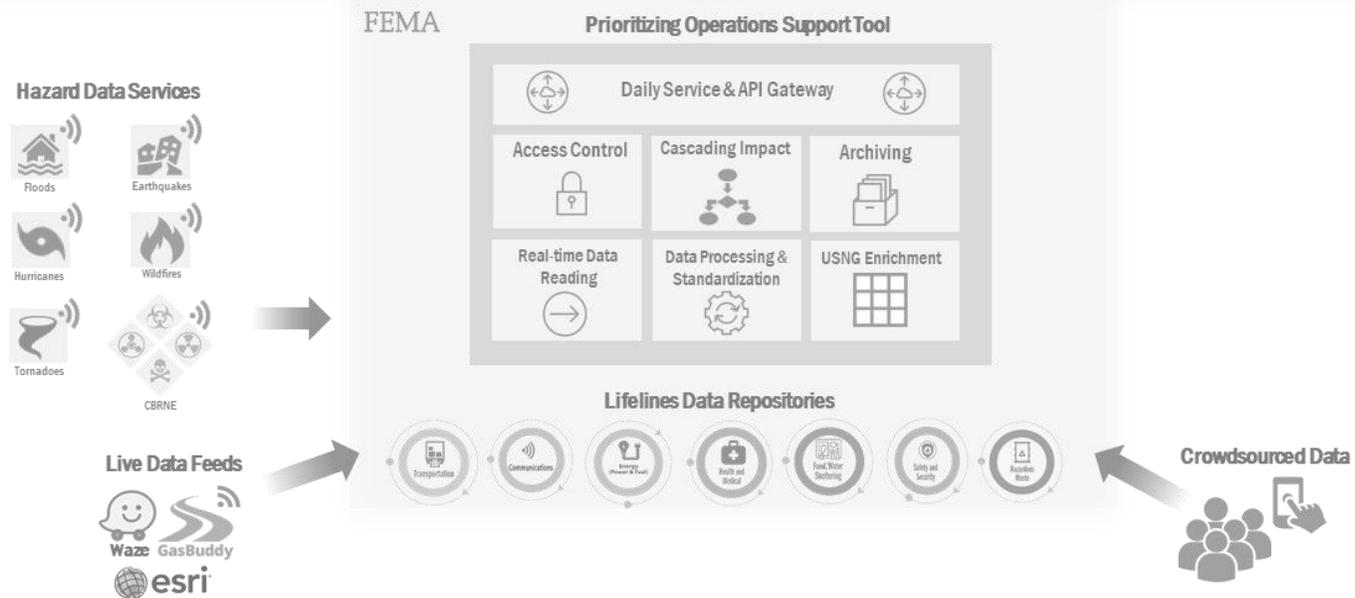
# PRIORITIZE | 2.0 – Full-lifecycle Disaster Planning & Operations Solution (2020)



**Role: To provide standard data driven science-based framework for full-lifecycle disaster planning and operations**

**Update**

- Added HIFLD CI Data
- Developed Lifelines Cascading Impacts Module
- Building Live Data Module for 'Actual' vs 'Potential' Impacts Assessments
- Developing Plan for Enterprise Integration & Web Use

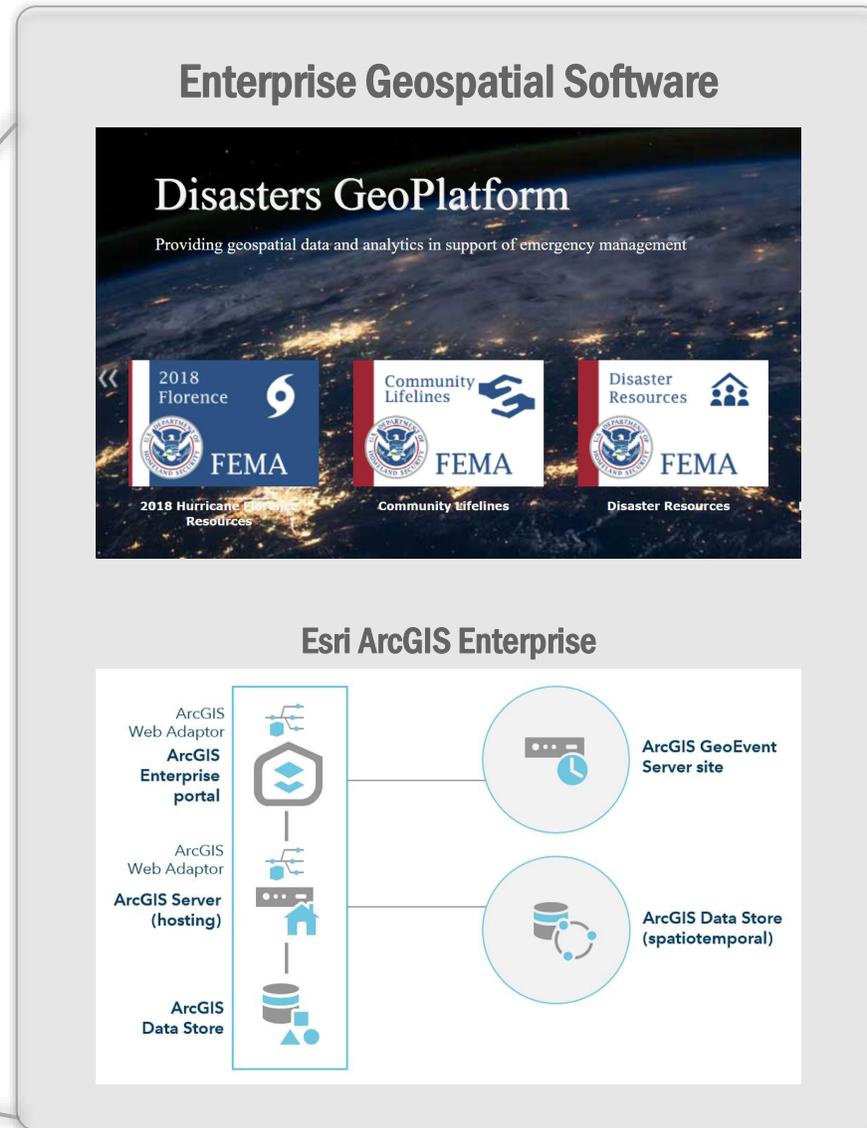
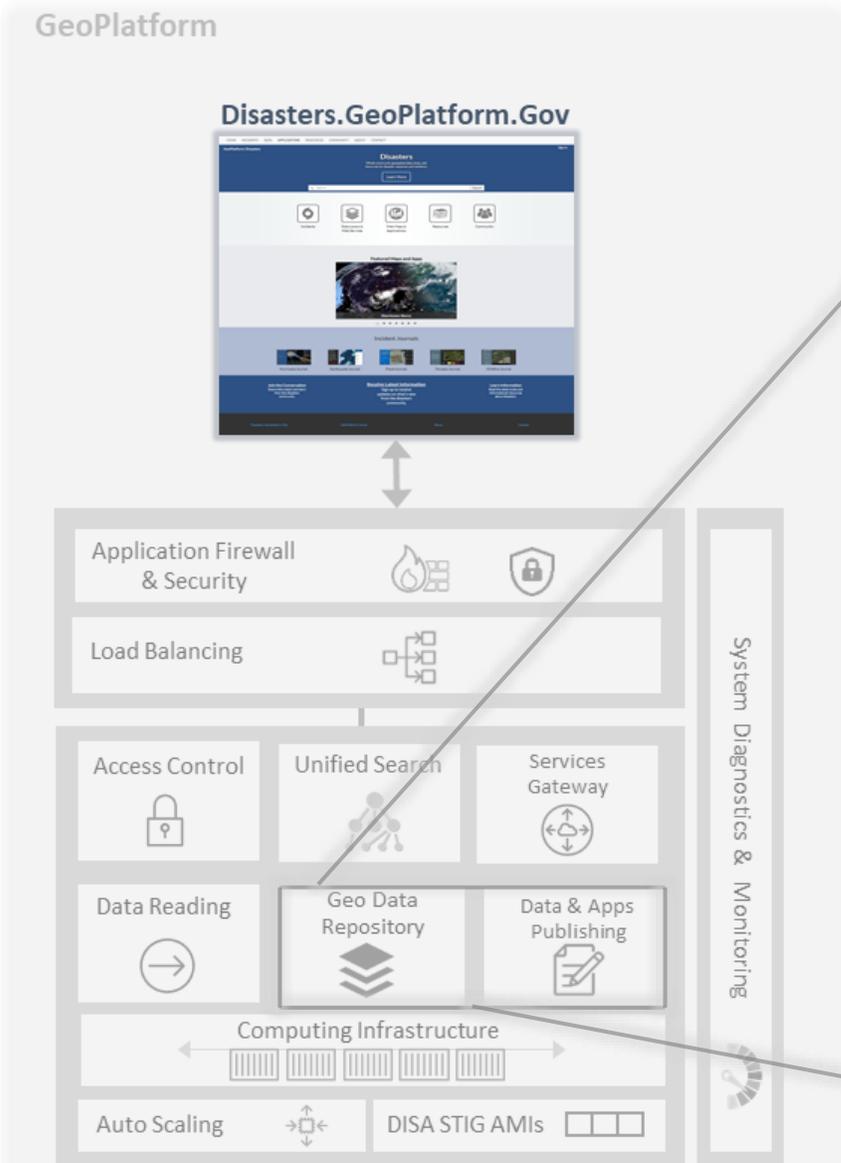




**Enterprise**

**Geospatial Software Management**

# Enterprise Geospatial Software Deployment Innovations



- **Complex Multi-node Configuration**
- **Esri, AWS, NIST, GeoPlatform Config & Security Rules**
- **Need for Rapid Repeatable Deployment Process**

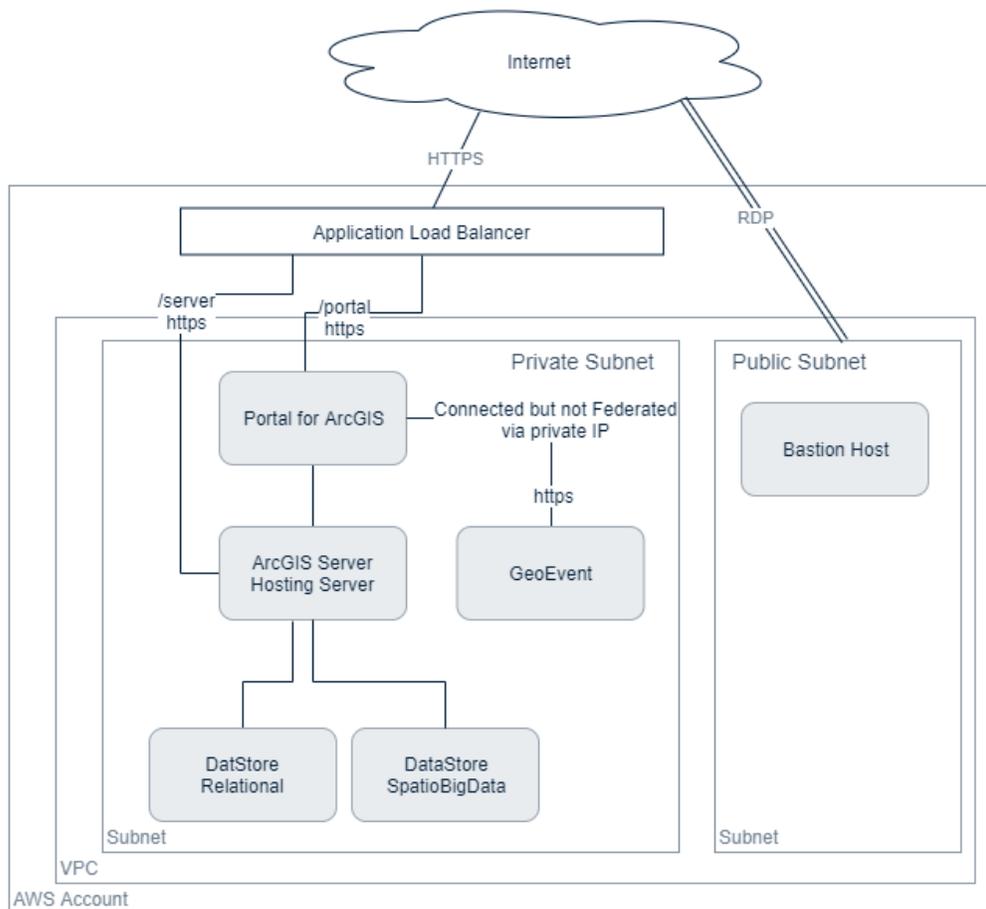
# Enterprise Geospatial Software Deployment Innovations

- Full Automated Deployment of Environment & Application
- Infrastructure-as-Code Best Practice

```
tfsec@M10G664:~/code/mapbox_mso_m10g664$ cat main.tf
+ propagating_vgws = (known after apply)
+ route = [
+   {
+     + cidr_block = "0.0.0.0/0"
+     + egress_only_gateway_id = ""
+     + gateway_id = (known after apply)
+     + instance_id = ""
+     + ipv6_cidr_block = ""
+     + nat_gateway_id = ""
+     + network_interface_id = ""
+     + transit_gateway_id = ""
+     + vpc_peering_connection_id = ""
+   },
+ ]
+ vpc_id = (known after apply)
}
# aws_route_table_association.rt_assoc will be created
+ resource "aws_route_table_association" "rt_assoc" {
+   + id = (known after apply)
+   + route_table_id = (known after apply)
+   + subnet_id = (known after apply)
+ }
# aws_security_group.mapbox_sg will be created
+ resource "aws_security_group" "mapbox_sg" {
+   + arn = (known after apply)
+   + description = "Security Group for the Mapbox MSO offering"
+   + egress = (known after apply)
+   + id = (known after apply)
+   + ingress = (known after apply)
+   + name = "sglntmapboxawc"
```



Terraform Built



- Fast
- Documented
- Repeatable

- Esri Federation,
- Security Rules Applied

**Questions?**