

# Day 5 At Risk Critical Infrastructure Effects

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## 2019 IAA Planetary Defense Conference

College Park, Maryland, USA

April 29 - May 3, 2019

Bill Fogleman, GRIT – Mapping

Mark Boslough, LANL – Blast Effect

Lorien Wheeler/Dominic Mathias, NASA Ames – Probabilistic Effects

Paul Chodas, JPL - Trajectory

# Day 5 – Scenario Airburst

# Day 5 –Central Park NYC, NY\*

\*Boslough & Chodas

- 10 days before impact
- 60 meter asteroid
- Airburst expected to occur at 5000 feet
- Potential for equivalent of 14.6 megaton impact
- Evacuations need to be taking place
  - Water evacuation

# Day 5 Ground Zero; Central Park NYC, NY\*

\*Boslough & Chodas



## DAMAGE ZONES

CATEGORY	SQ. MILES	EXPECTED DAMAGE BY PSI
Serious	275	Serious: Overpressures >1 psi (window breakage, minor structural damage); Thermal Exposure > 2 <sup>nd</sup> degree burns
Severe	174	Overpressures >2 psi (doors/windows blown out, widespread structural damage); Thermal Exposure >3 <sup>rd</sup> degree burns
Critical	35	Overpressures > 4 psi (most residential structures collapse); Thermal Exposure > clothing ignition
Unsurvivable	32	Overpressures > 10 psi (complete devastation); Thermal Exposure > roll roofing ignition / sand explodes

# Annual GDP Economic Impact (M): \$73,926 Estimated on 2015 Data\*

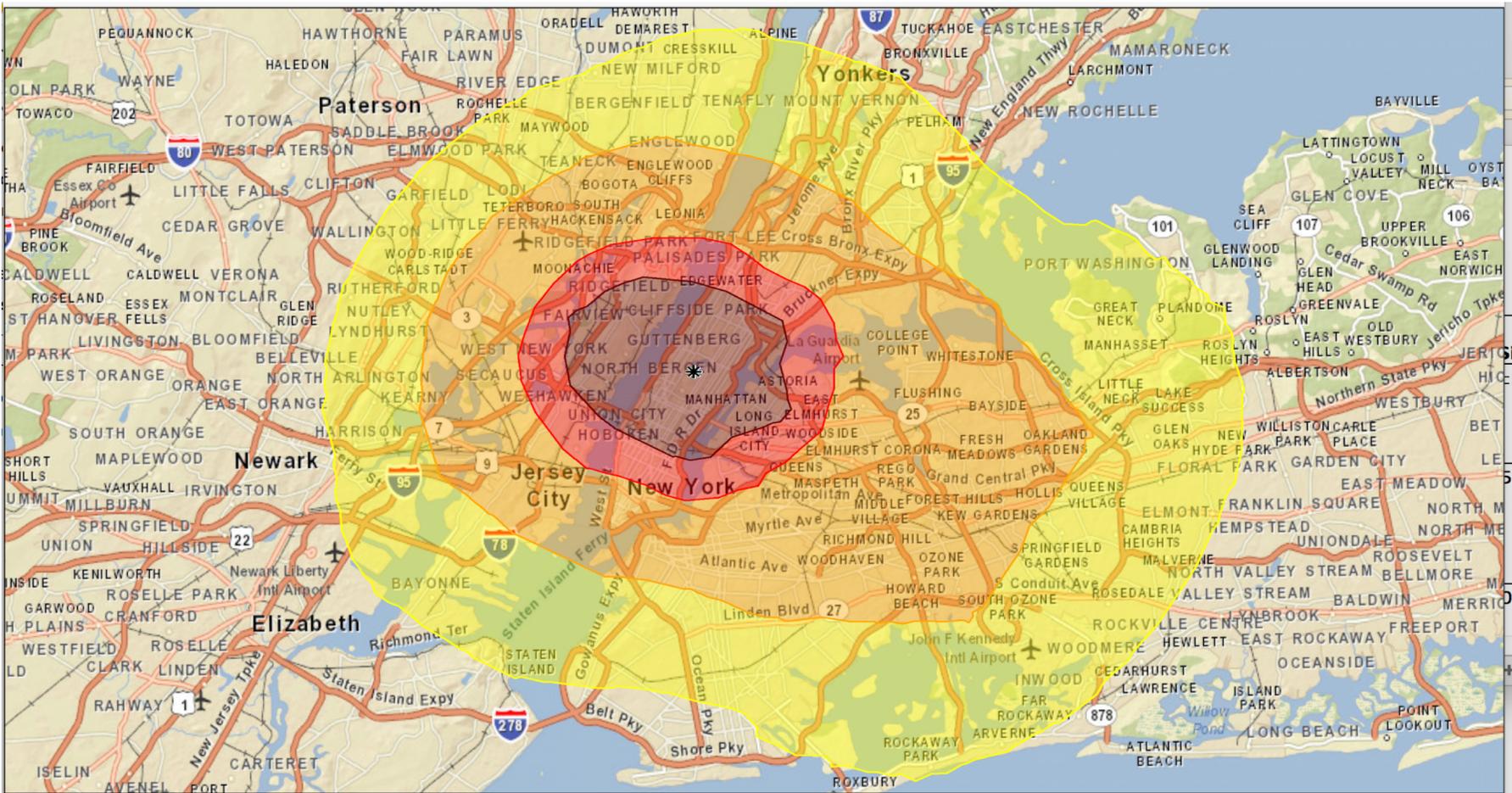
State	Direct Impacts (\$M)	Indirect Impacts (\$M)	Total Impacts (\$M)
New Jersey	\$1,797.5	\$2,769.8	\$4,567.3
New York	\$27,925.4	\$41,433.6	\$69,359.1

\*GDP obtained from REACT Economic Analysis in FASTMap – SNL Model

# GDP Economic Impact >100M per Year

Industry	Total Impacts (\$M)	Industry	Total Impacts (\$M)
Accommodation and food services	\$1,829.10	Information	\$8,154.40
Administrative and waste management services	\$1,930.60	Management of companies and enterprises	\$1,928.00
Apparel and leather and allied products	\$151.90	Miscellaneous manufacturing	\$200.40
Arts, entertainment, and recreation	\$858.10	Other services, except government	\$2,250.30
Chemical products	\$221.50	Printing and related support activities	\$104.70
Construction	\$1,575.40	Professional, scientific, and technical services	\$8,771.00
Educational services	\$844.90	Real estate and rental leasing	\$14,055.40
Federal Civilian	\$6,395.20	Retail trade	\$2,823.30
Finance and insurance	\$11,598.90	Transportation and warehousing	\$1,127.00
Food and beverage and tobacco products	\$353.10	Utilities	\$147.70
Health care and social assistance	\$5,093.20	Wholesale trade	\$3,115.10

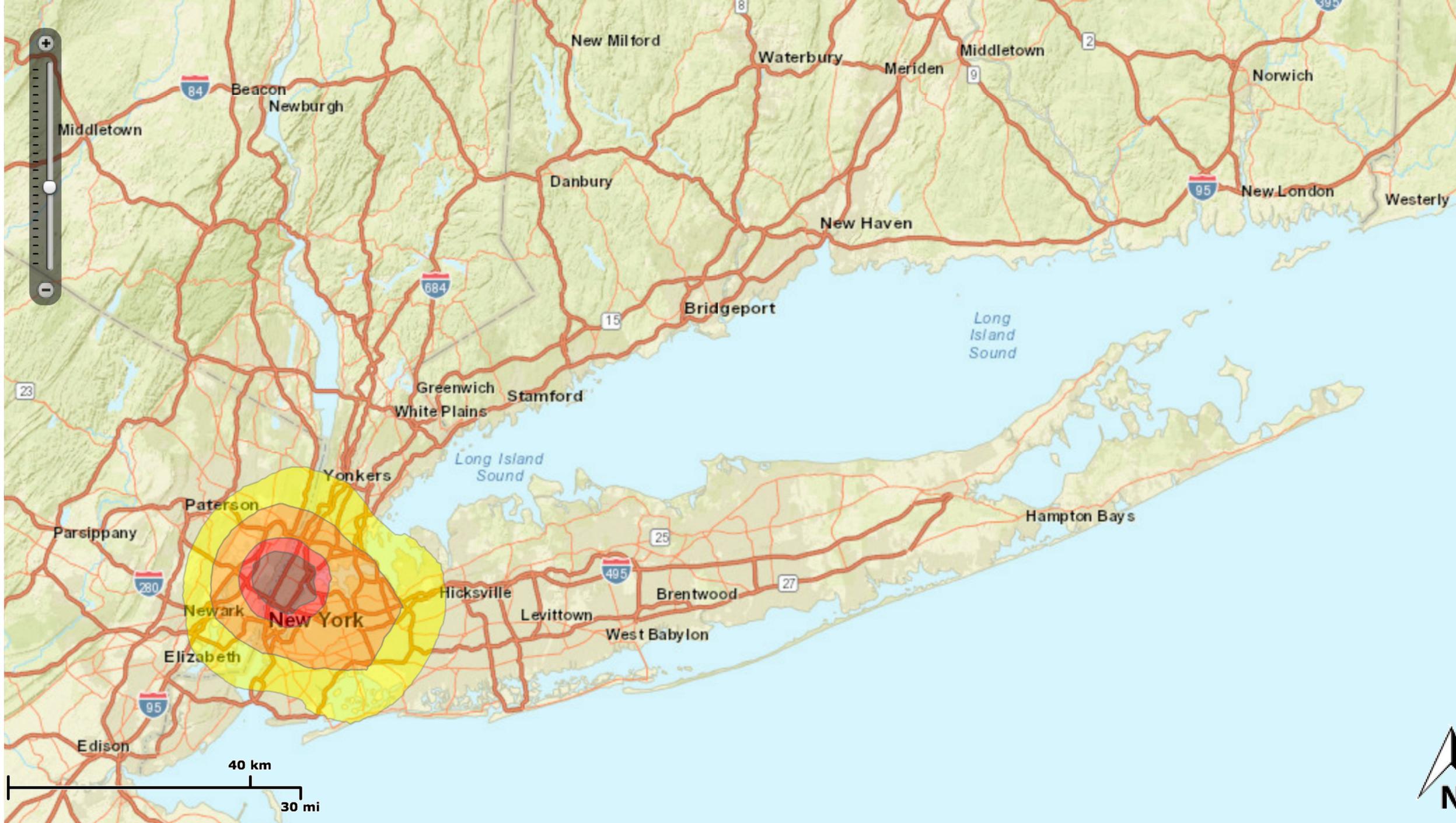
# Damage Zone From Surface Winds Overpressure



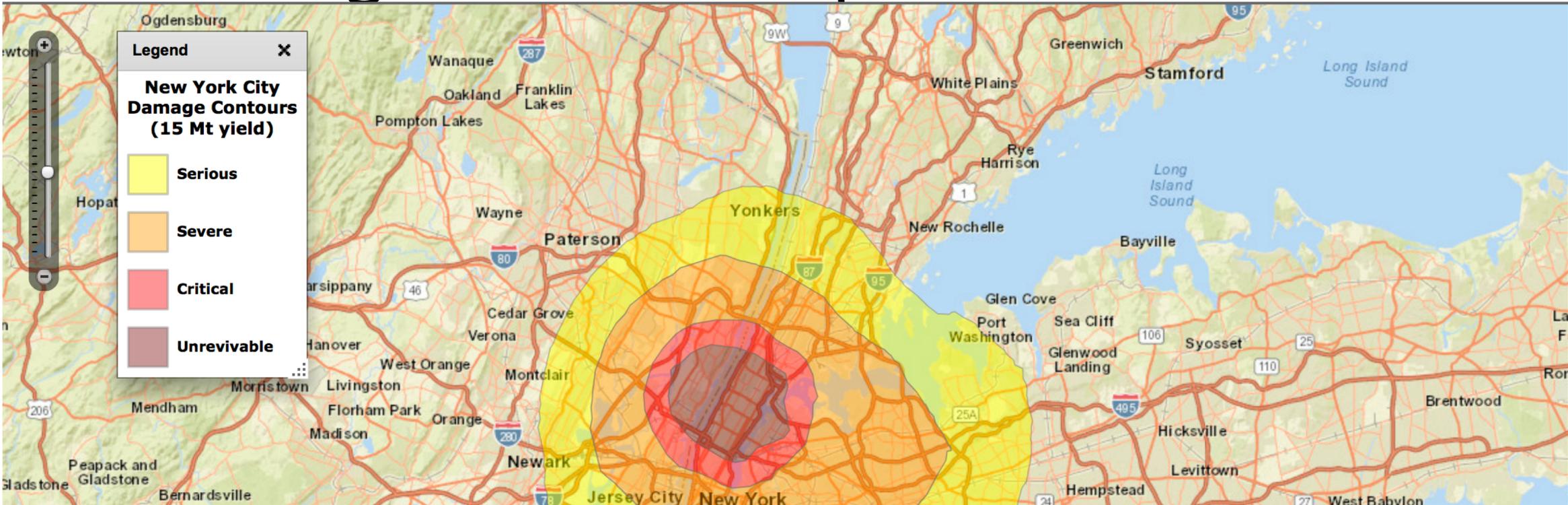
**Air Burst - Damage - New York City, New York**

- \* Impact Point
- Yellow: Serious: >1 psi; window breakage, minor structural damage; 2nd degree burns
- Orange: Severe: >2 psi; doors/windows blown out, widespread structural damage; 3rd degree burns
- Red: Critical: >4 psi; most residential structures collapse; clothing ignition
- Dark Red: Unrevivable: >10 psi; complete devastation; roll roofing ignition / sand explodes

0 10 Miles  
0 10 Kilometers



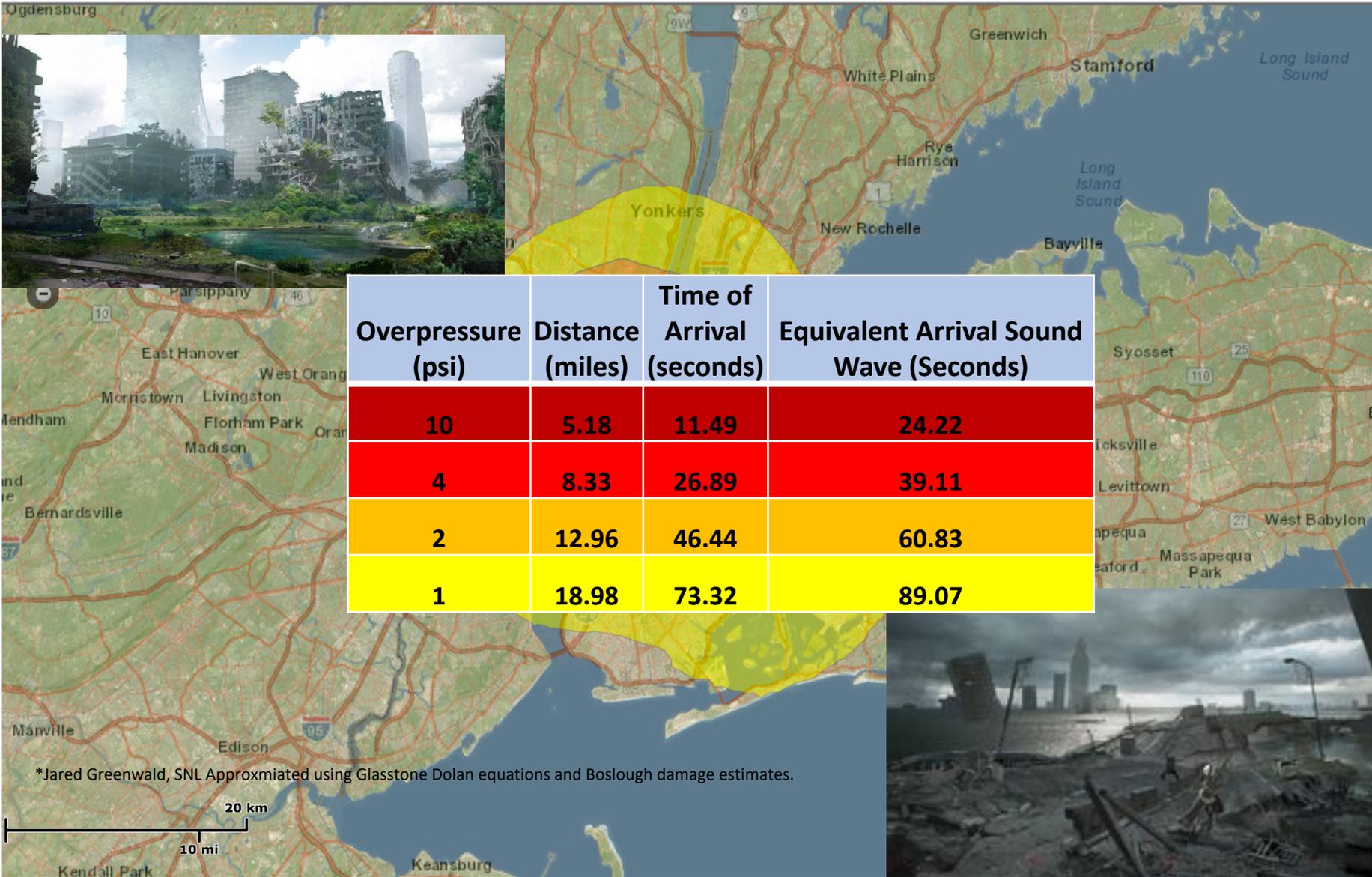
# Wind Damage Zones for Impact Lower Manhattan



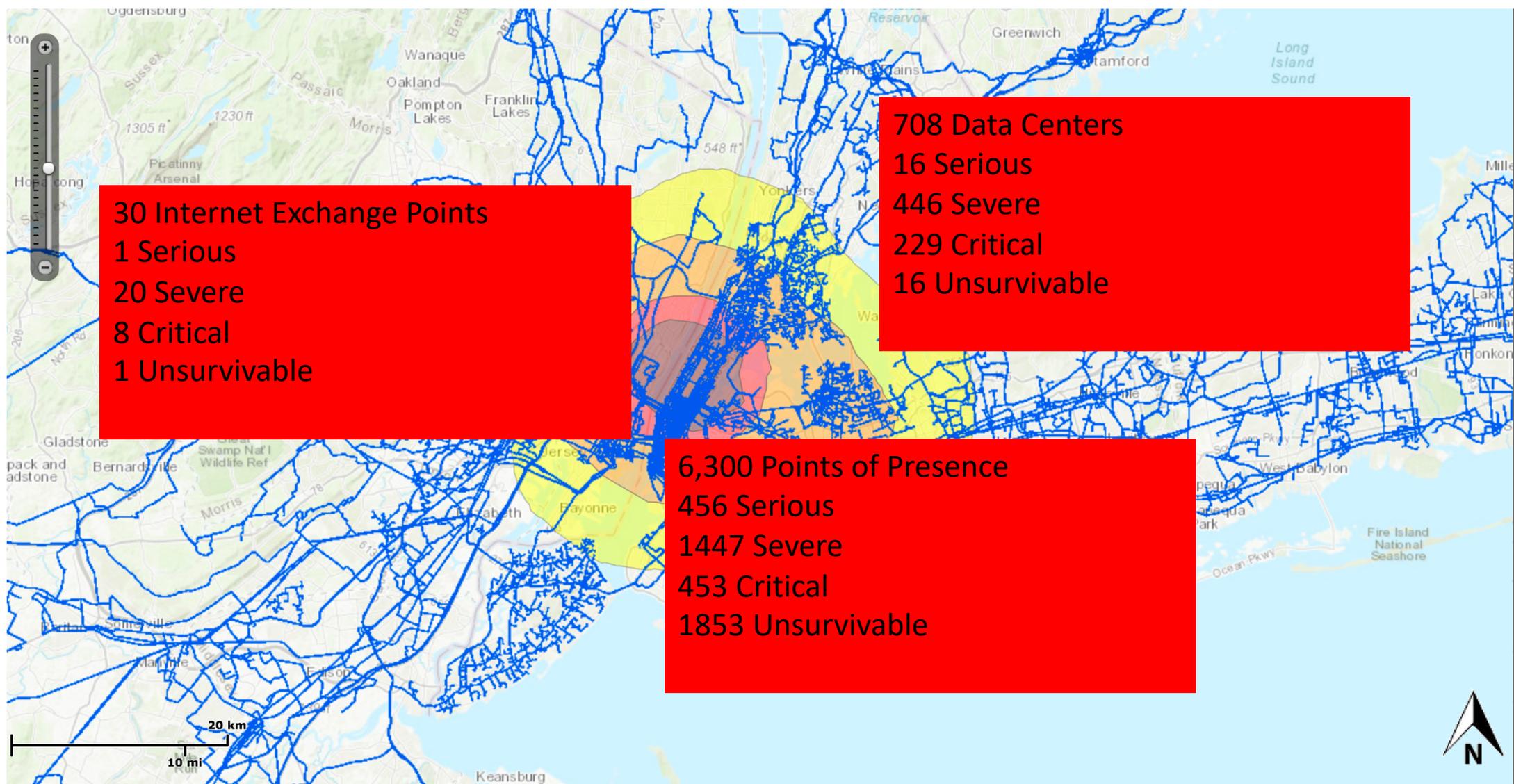
ZONE	DAYTIME POPULATION	NIGHTTIME POPULATION
Serious	2,424,678	3,030,890
Severe	4,175,568	4,170,347
Critical	1,168,290	920,742
Unsurvivable	2,348,480	1,277,532
<b>Total</b>	<b>10,117,016</b>	<b>9,399,511</b>



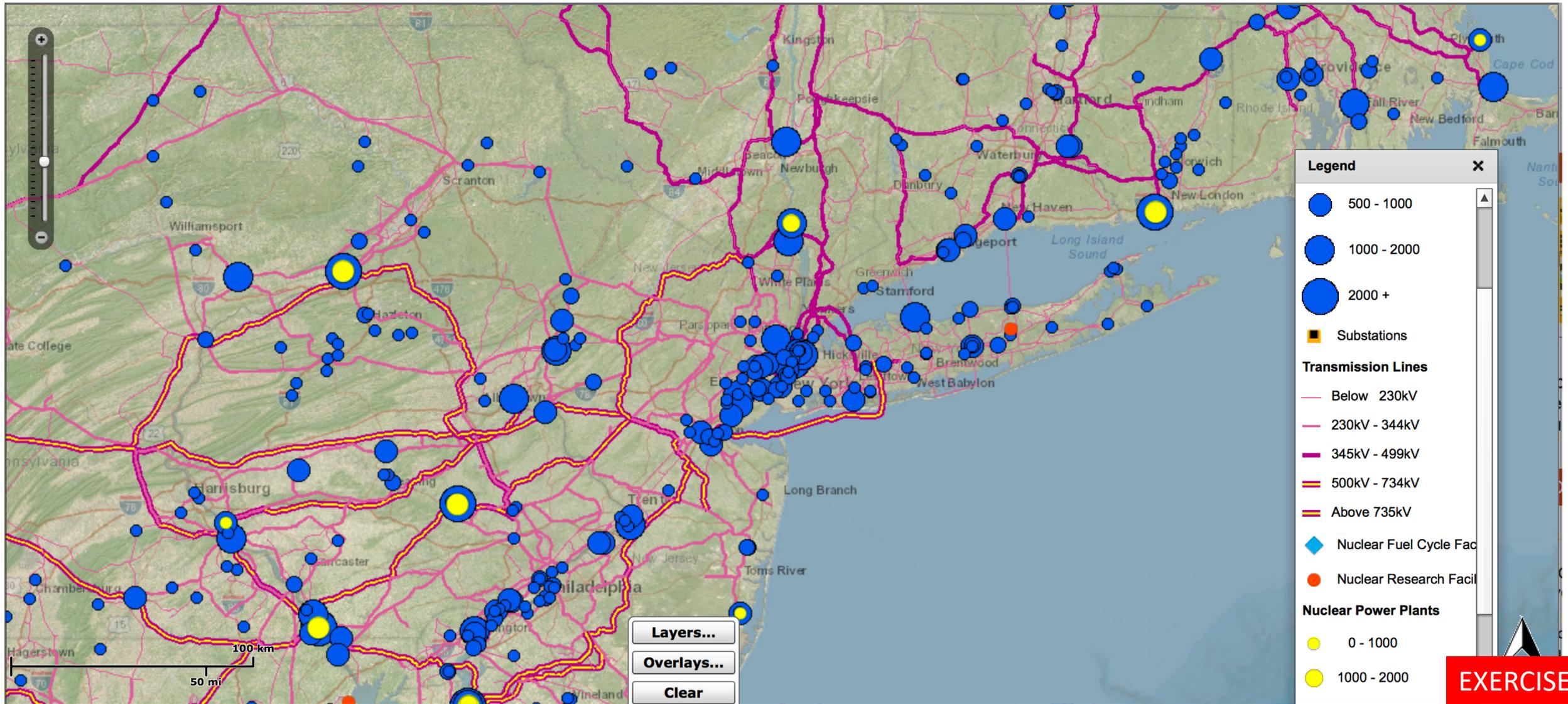
# Time to Devastation\*



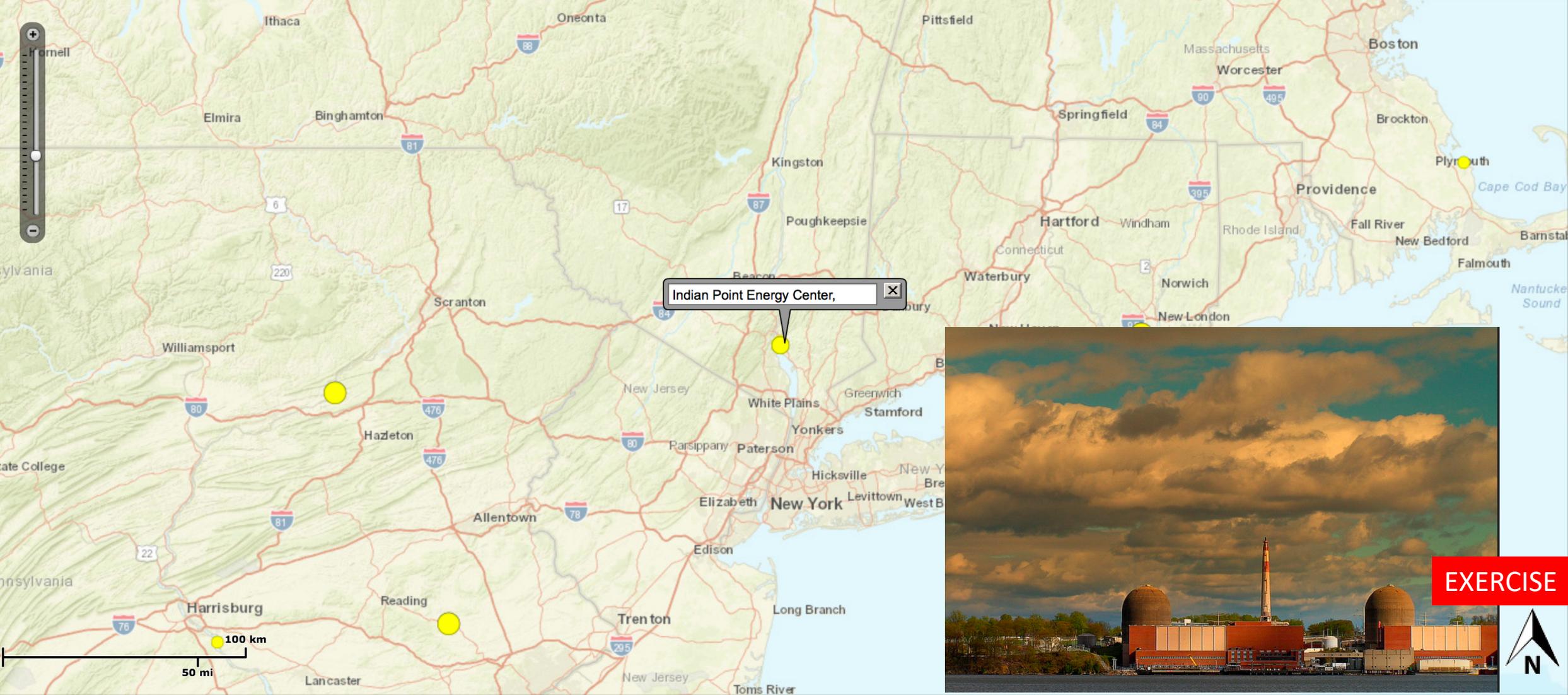
# Internet Communications



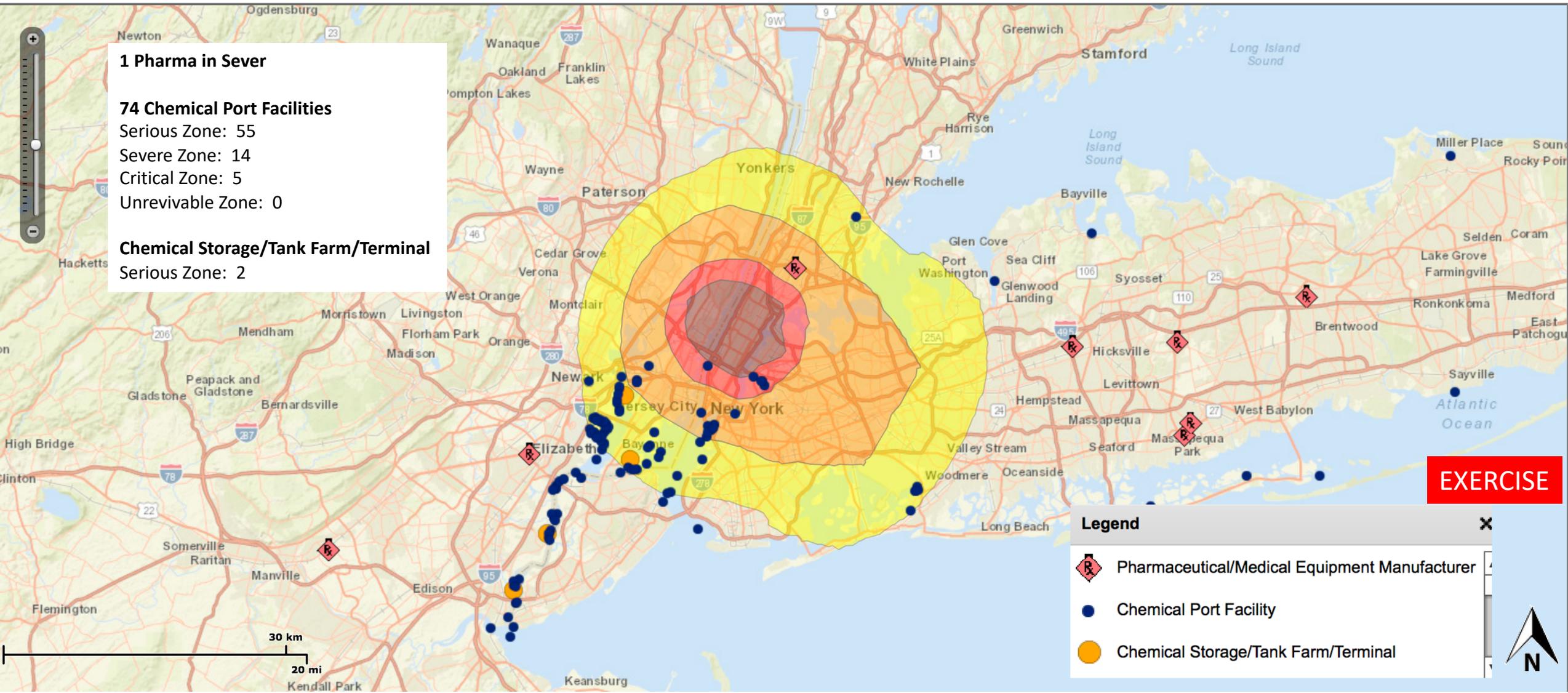
# Power: Electric and Nuclear



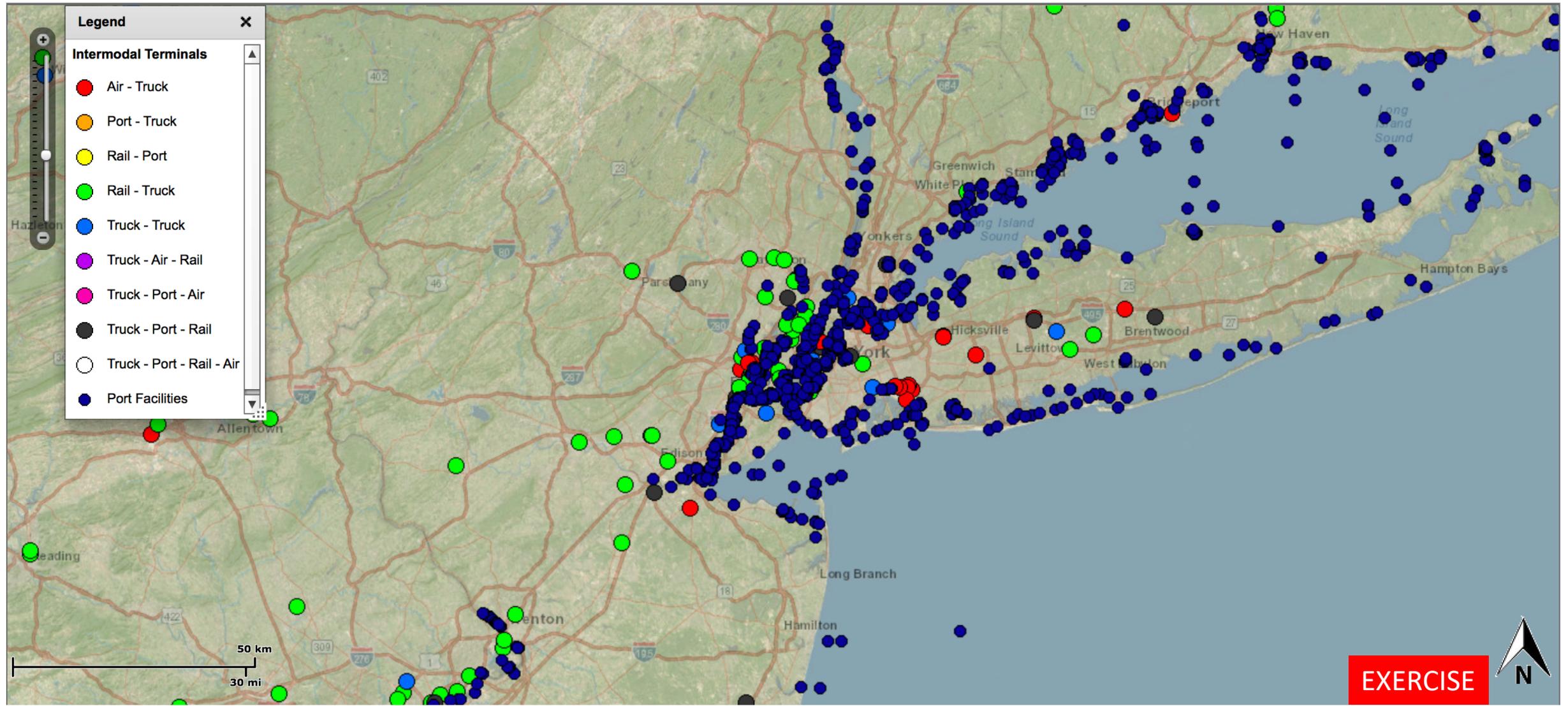
# Indian Point Energy Center, Buchanan NY



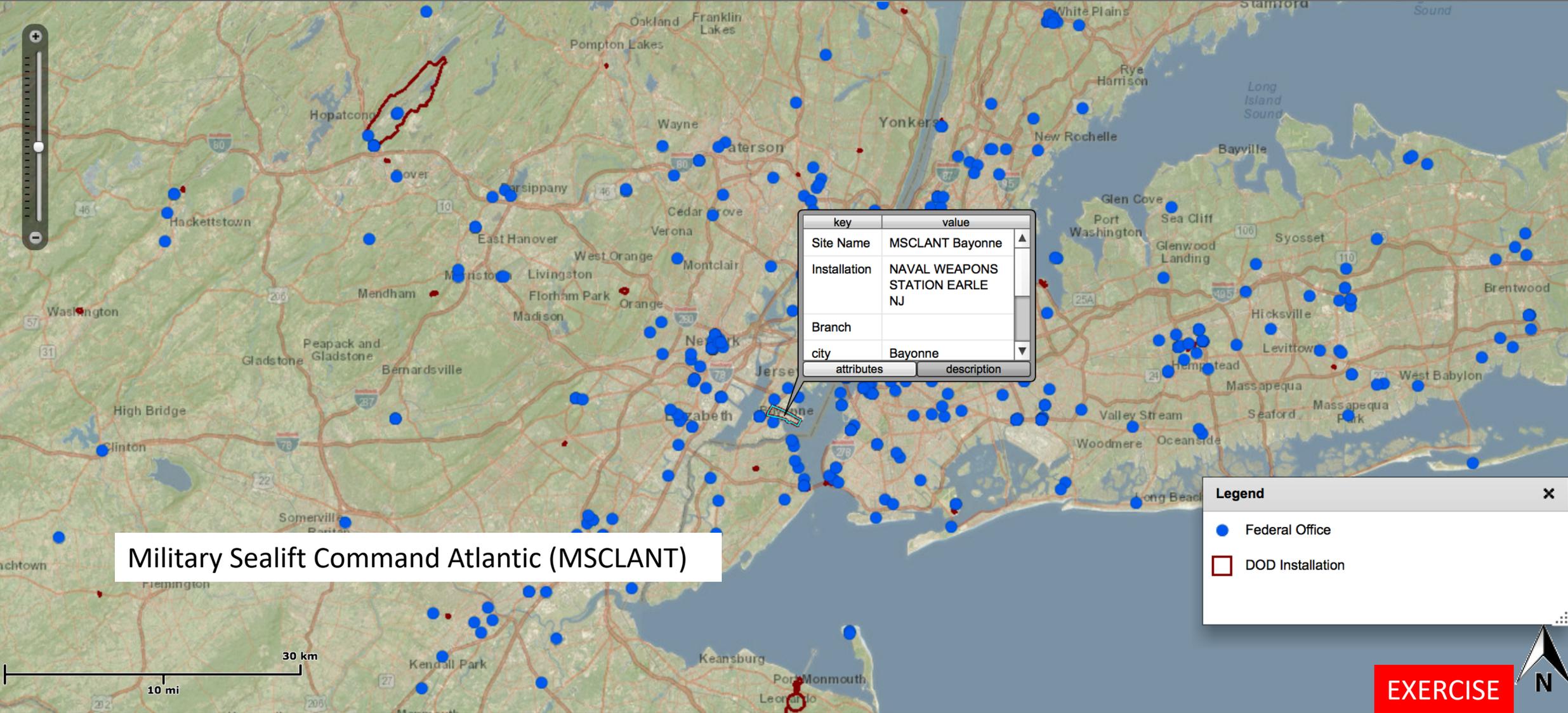
# Chemical/Pharma Facility



# Ports and Intermodal



# DOD/Government



# Museums/Art/History



**Metropolitan Museum of Art**  
**American Museum of Natural History**  
**Museum of Modern Art**

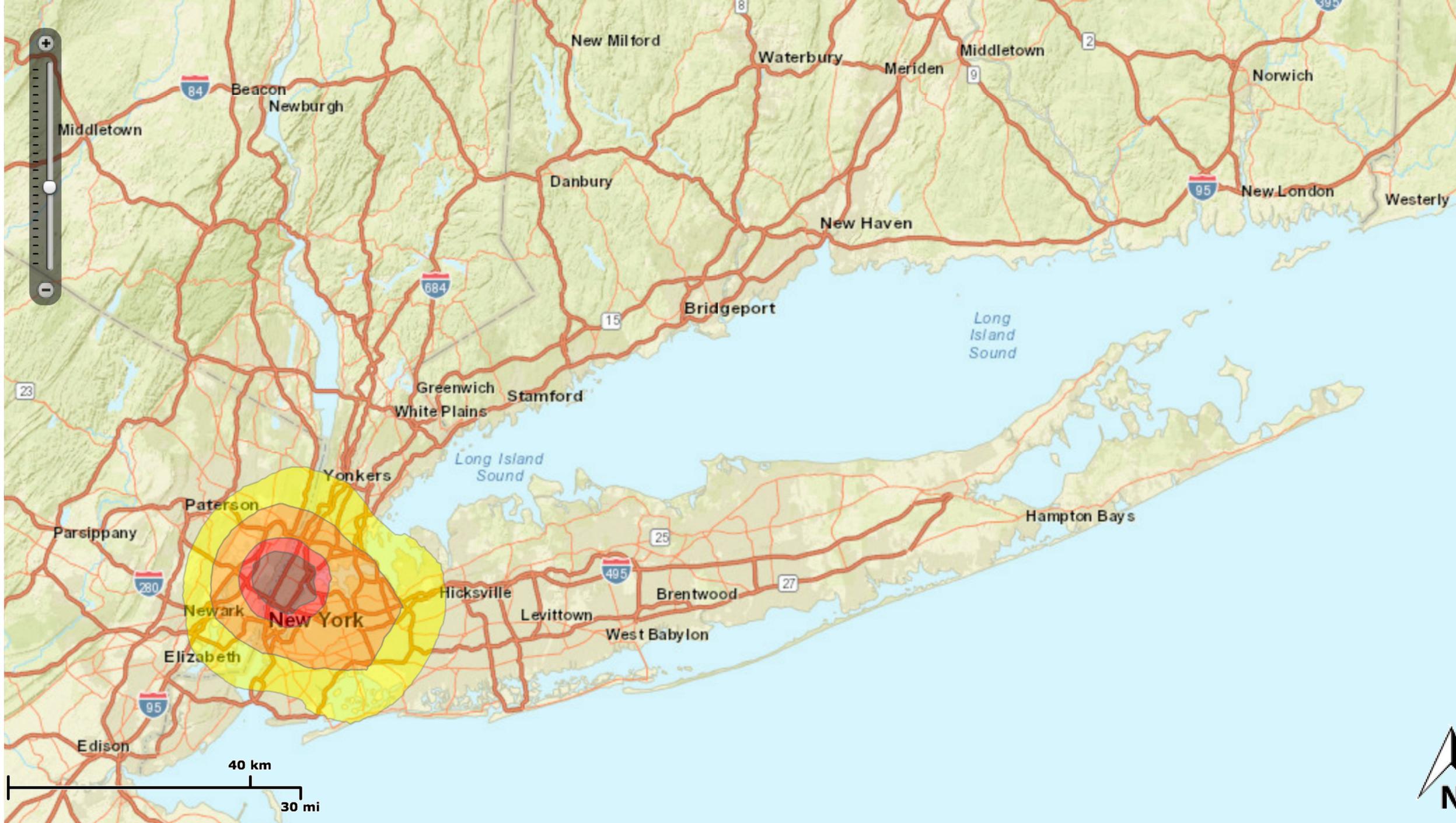
# Comparable Results in Attempt to Put This in Perspective

- 9/11 Property damage cost **about \$100 billion**, estimated of the total economic damage **\$2 trillion**<sup>1</sup>
- 2011 statistics by the CDC **5,441** people have diagnosed with cancer related to 9/11<sup>2</sup>
- 9/11 Damage area was approximately 16 acres
- Estimated unsurvivable area NYC due to PDC 2019 airburst 32 sq, miles or 20,480 acres <sup>3</sup>

<sup>1</sup> Riedel, Bruce, "Al Qaeda's 9/11 Obsession". Brookings, July 15, 2011. <https://www.brookings.edu/opinions/al-qaedas-911-obsession/>

<sup>2</sup> Ly, Laura, "5,400 diagnosed with cancers linked to September 11 attacks." CNN, August 15, 2016. <https://www.cnn.com/2016/08/15/health/september-11-cancer-diagnoses/>

<sup>3</sup> Boslough, Mark, LANL



# Evacuation Needs

## Evacuees At Risk\*

Nursing Home Residents 2015 - 50.5k		
Damage Zone	# Facilities	# Beds ~ Individuals
Serious	106	21295
Severe	95	20680
Critical	10	1730
Unsurvivable	38	6705

## Constraints

People will be leaving permanently; there will be nothing remaining
NYC is an island people can't easily leave
Traffic will be a problem
Bridges will be source of bottle necks
Many people without transportation

\*FASTMap 2015 Data

## Preparation is Essential

Planning for areas to evacuate 10 M people
All public transportation needs to be available
Consider water evacuation with ships: (USNS Hospital Ships, Roll-on/Row-off Ships) Cruise Ships, Ferry's
Train, educate, plan ahead. Conduct evacuation drills at schools, churches, places of employment

# Major Ports and Rail Routes for Evacuation

