How Hazus Was Used in the Missouri State Hazard Mitigation Plan Update:

A 'Show Me' Presentation

Presenters Today

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HAZUS MH

EARTHQUAKE • WIND • FLOOD

5. Produces maps, tables, and reports
4. Analyzes social and economic impacts
3. Considers what is at risk
2. Identifies hazard
1. Analyzes physical landscape

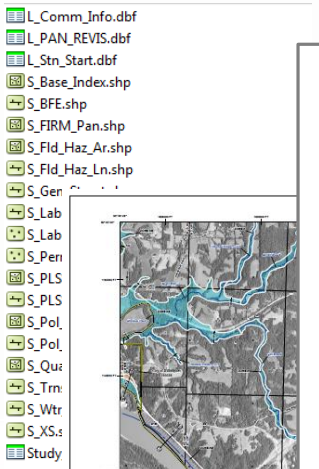
State Hazard Mitigation Plan Update

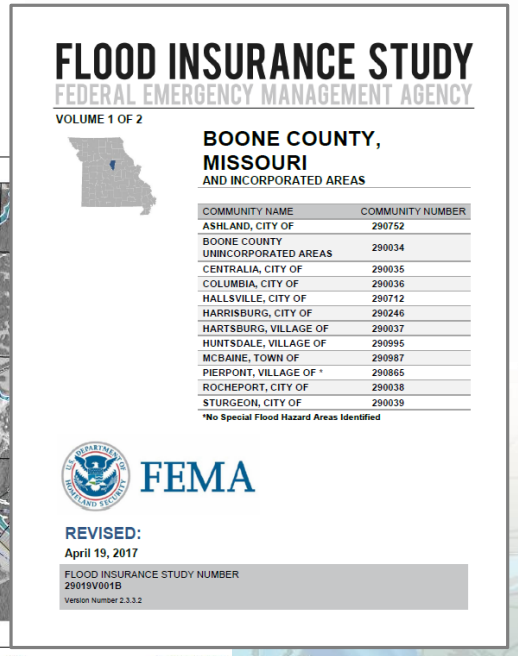
- Hazus Analysis
  - Flooding (Riverine)
  - Earthquake
- Use of Hazus Datasets outside of Hazus
  - Statistical Analysis
  - GIS Analysis

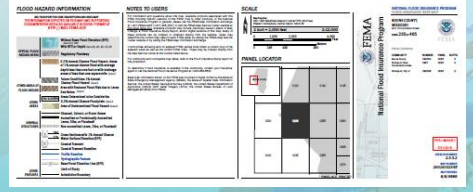
Flooding Analysis

Inputs for Level II Analysis

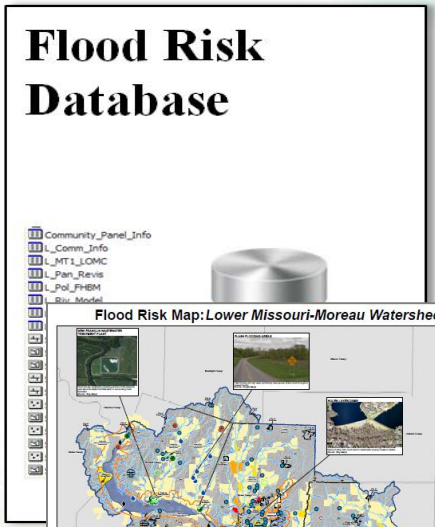
FEMA Regulatory Products

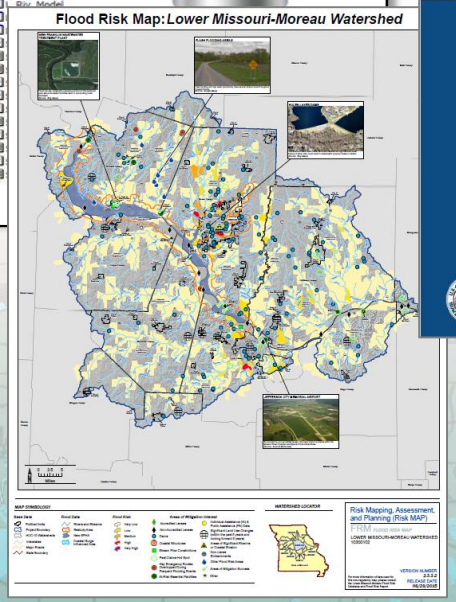


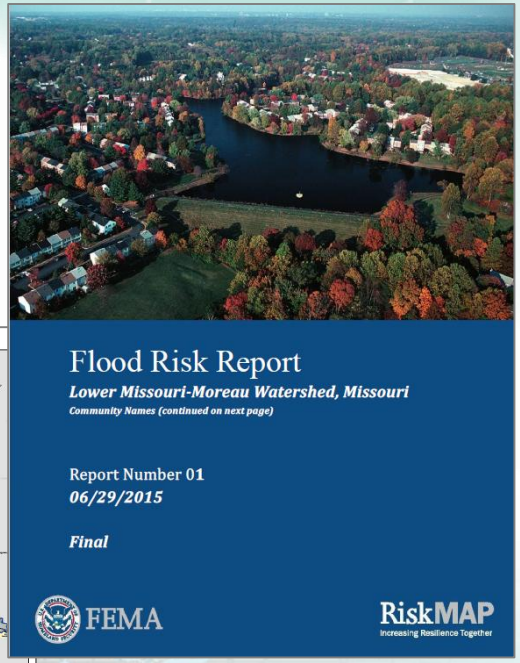




FEMA Non-Regulatory Products



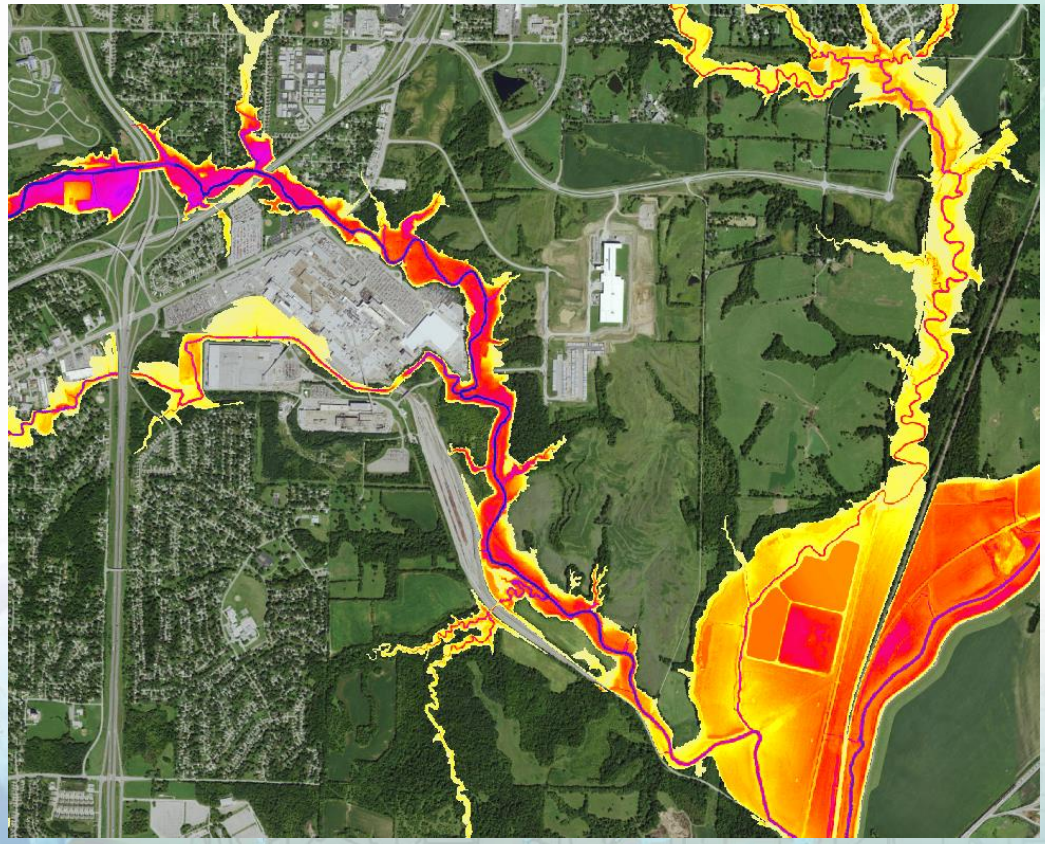




Flood Depth Grids

Inputs for Level II Analysis

- Raster (grid) of water depth
- Depth is calculated as the difference (in feet) between the water surface elevation and the ground
- Produced for 10%, 4%, 2%, 1%, and 0.2% annual chance events

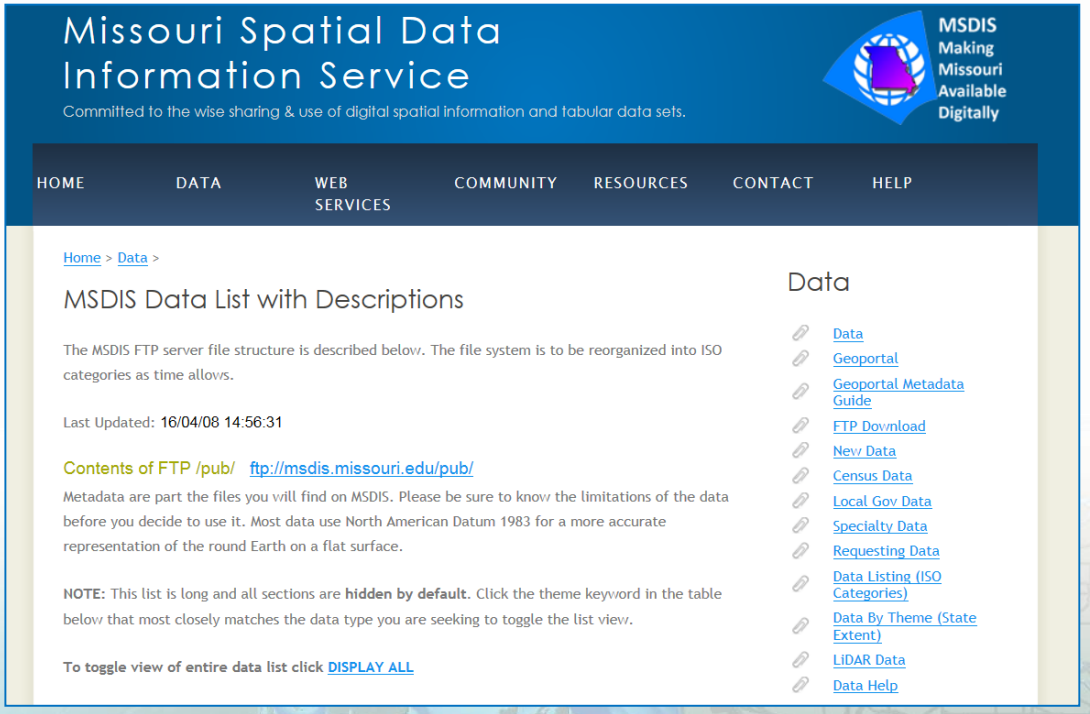


St. Charles County example

Structures File from MSDIS

(Missouri Spatial Data Information) hosted by the University of Missouri

Used for supplemental geospatial analysis for damaged structure counts



Missouri Spatial Data Information Service

Committed to the wise sharing & use of digital spatial information and tabular data sets.

MSDIS Making Missouri Available Digitally

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Home > Data >

MSDIS Data List with Descriptions

The MSDIS FTP server file structure is described below. The file system is to be reorganized into ISO categories as time allows.

Last Updated: 16/04/08 14:56:31

Contents of FTP /pub/ ftp://msdis.missouri.edu/pub/

Metadata are part the files you will find on MSDIS. Please be sure to know the limitations of the data before you decide to use it. Most data use North American Datum 1983 for a more accurate representation of the round Earth on a flat surface.

NOTE: This list is long and all sections are **hidden by default**. Click the theme keyword in the table below that most closely matches the data type you are seeking to toggle the list view.

To toggle view of entire data list click DISPLAY ALL

Data

- Data
- Geoportal
- Geoportal Metadata Guide
- FTP Download
- New Data
- Census Data
- Local Gov Data
- Specialty Data
- Requesting Data
- Data Listing (ISO Categories)
- Data By Theme (State Extent)
- LiDAR Data
- Data Help

ftp://msdis.missouri.edu/pub/Facilities_Structures/

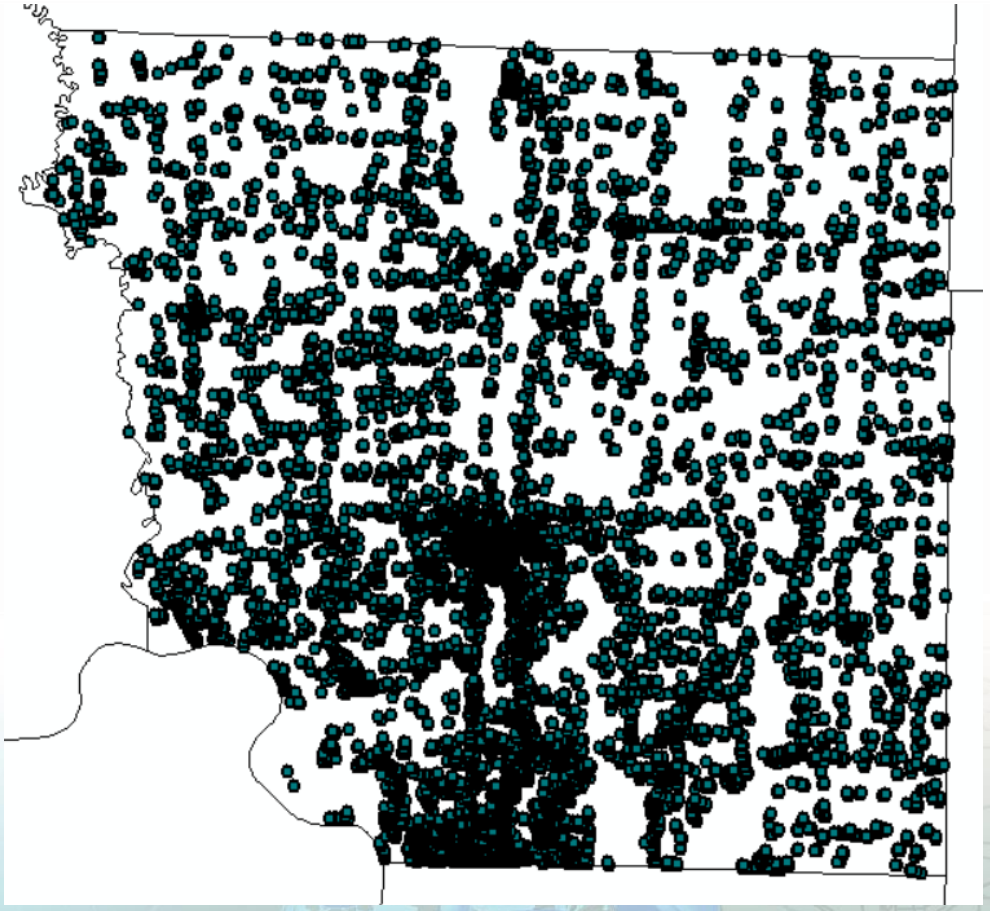
<MO_year_Countyname_Structure_datatype_shp>.zip - These data identify and locate all structures in the six county Mid-Missouri region (Boone, Callaway, Cole, Cooper, Howard, and Moniteau Counties) and validate locations and attributes for 25 different critical infrastructure building types.

<MO_year_Structure_Dexcription_shp>.zip - These data identify and locate various structures at state extent.

MO_1992_Places_shp.zip - Metadata
MO_1998_Airports_shp.zip - Metadata
MO_2004_Transfer_Stations_shp.zip - Metadata
MO_2006_Ports_shp.zip - Metadata
MO_2007_Above_Ground_Tanks_shp.zip - Metadata
MO_2008_Federal_Facilities_shp.zip - Metadata
MO_2009_Public_Schools_for_the_Disabled_shp.zip - Metadata
MO_2010_Architectural_Surveys_shp.zip - Metadata
MO_2010_Higher_Education_Institutions_shp.zip - Metadata
MO_2010_Public_Schools_shp.zip - Metadata
MO_2011_Boone_Structure_Footprints_shp.zip - Metadata
MO_2011_Boone_Structure_Points_shp.zip - Metadata
MO_2011_Callaway_Structure_Footprints_shp.zip - Metadata
MO_2011_Callaway_Structure_Points_shp.zip - Metadata
MO_2011_Cole_Structure_Footprints_shp.zip - Metadata
MO_2011_Cole_Structure_Points_shp.zip - Metadata
MO_2011_Cooper_Structure_Footprints_shp.zip - Metadata
MO_2011_Cooper_Structure_Points_shp.zip - Metadata
MO_2011_Howard_Structure_Footprints_shp.zip - Metadata
MO_2011_Howard_Structure_Points_shp.zip - Metadata

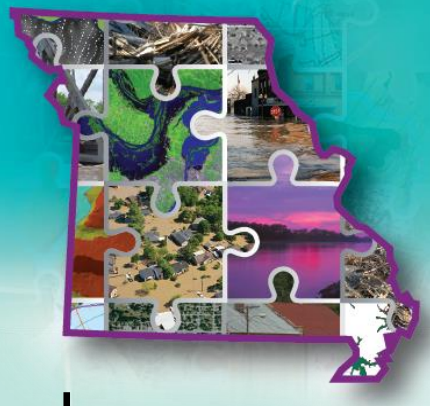
http://www.msdis.missouri.edu/data/datalist.html#facstruc

Example of the MSDIS structures – Andrew County



There are 22,168 structures in Andrew County

Depth Grids Source for Hazus Input

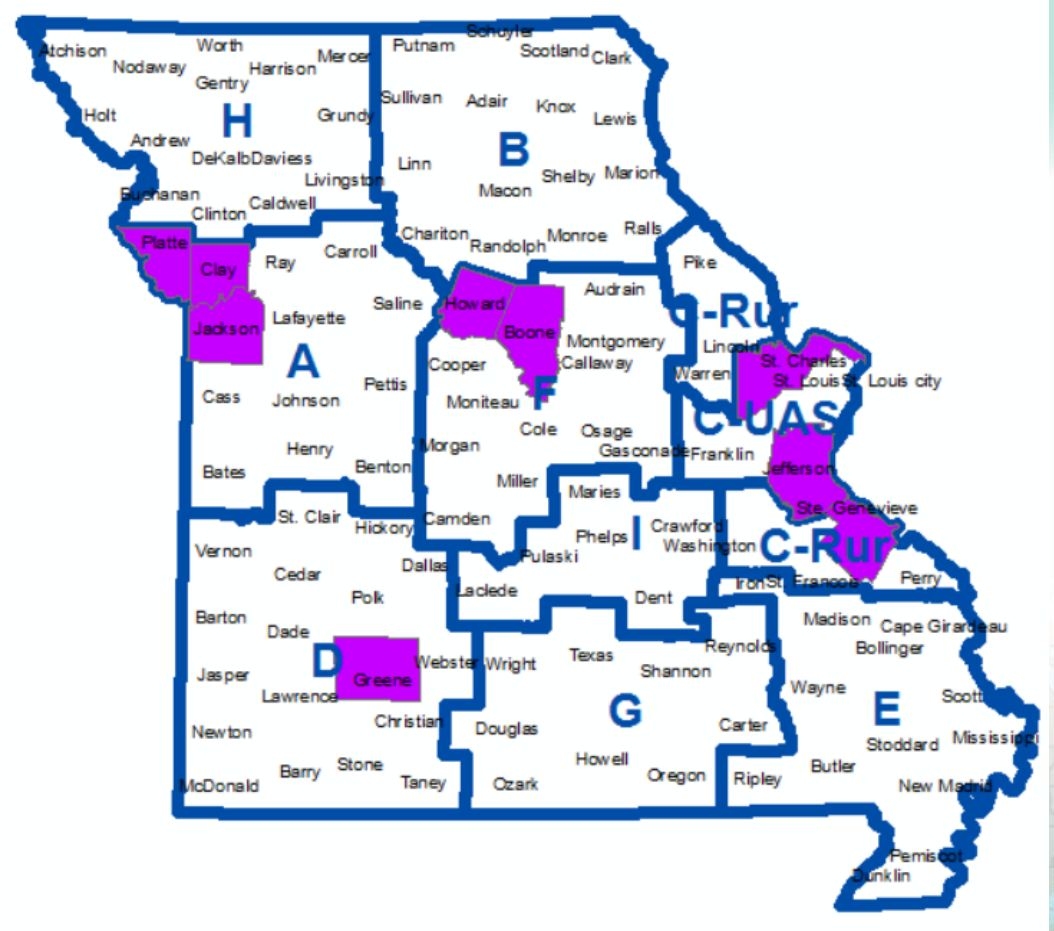


- *Priority #1* – FEMA RiskMAP Products where available

- *Priority #2* – Depth Grids created for the .1% annual chance based on the NFHL

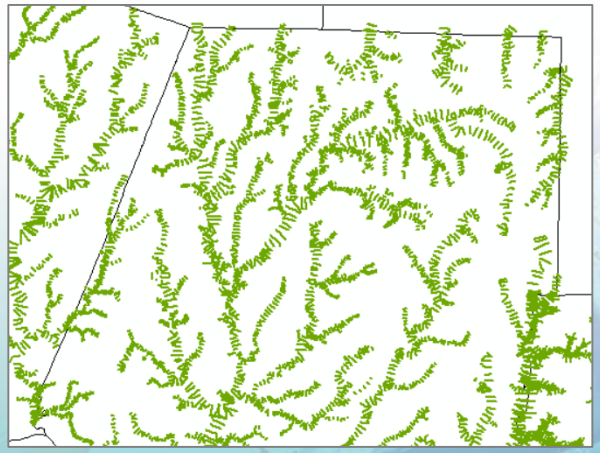
- Priority #3 – HAZUS generated depth grid for counties without a defined SFHA

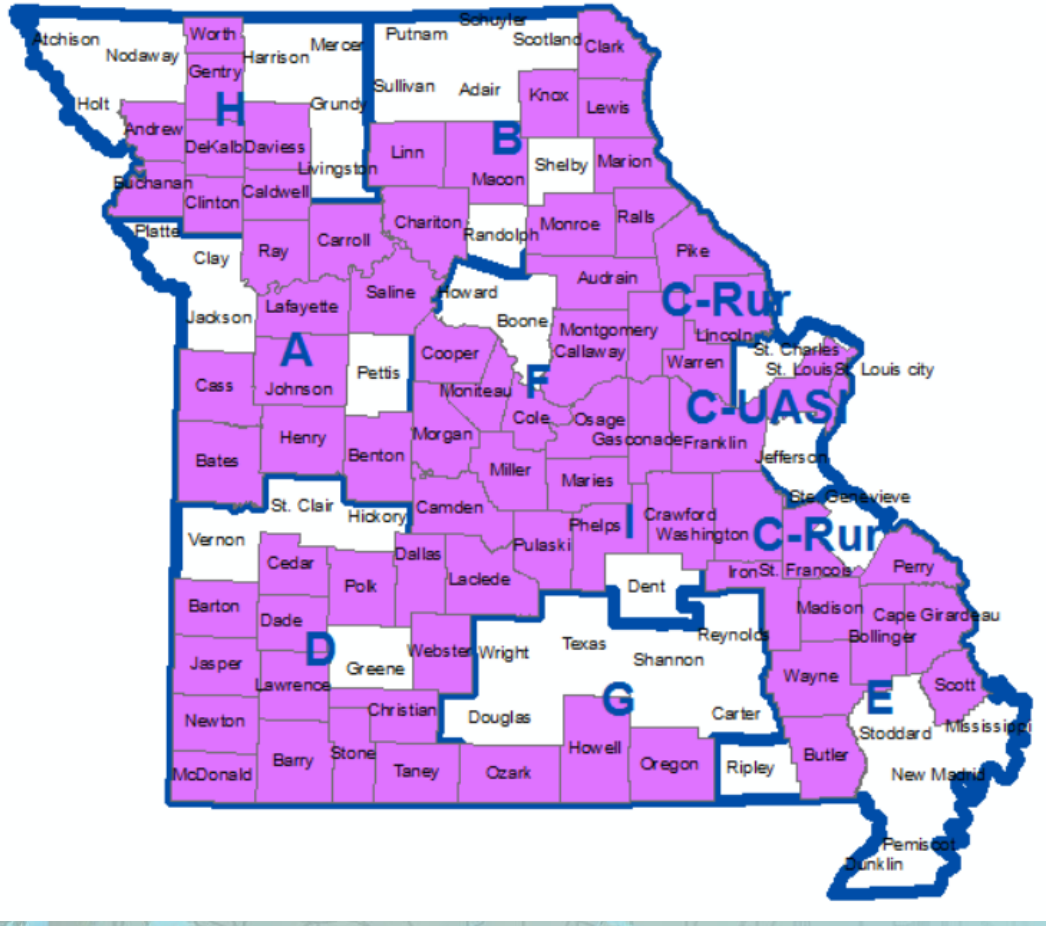
Priority #1:
Used FEMA RiskMAP Depth Grids where available



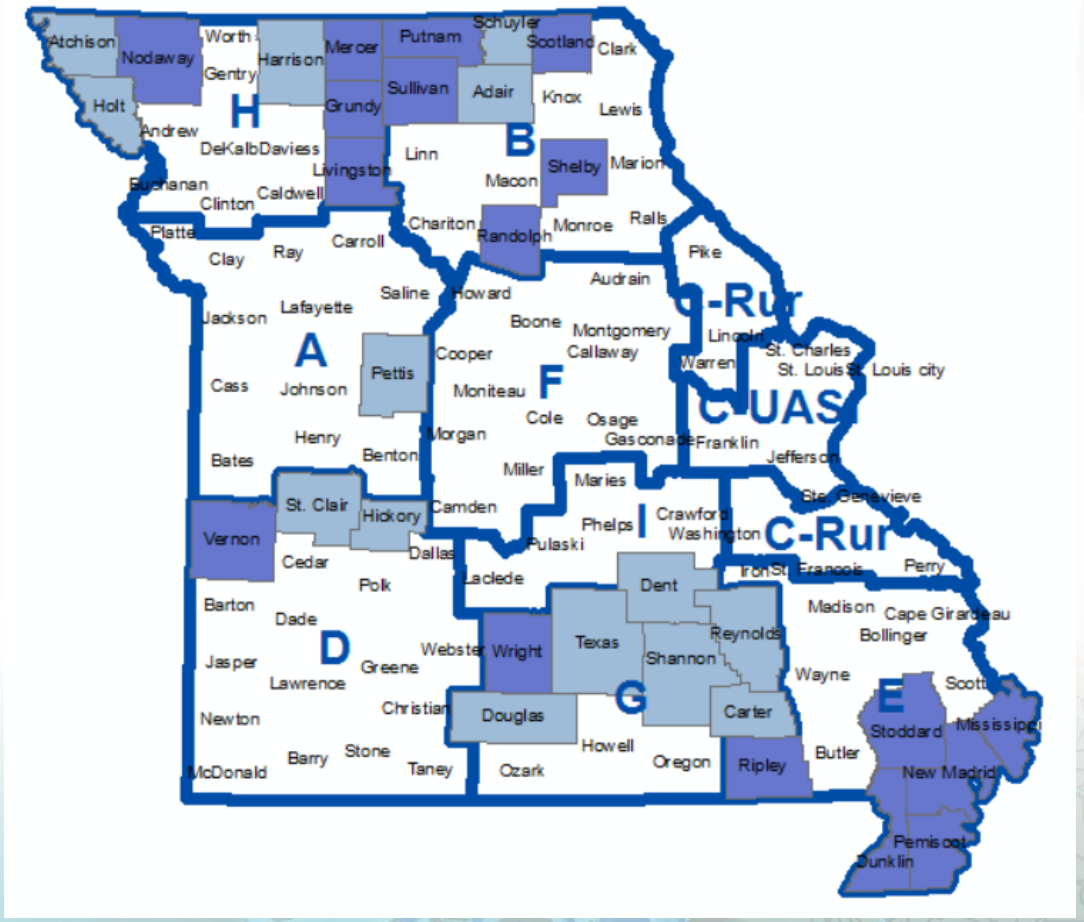
Priority #2: Created Depth Grids for NFHL for areas with DFIRMs

Using the cross sections from the NFHL for Zone AE areas and the cross sections from the models for Zone A areas (these had previously been pulled out for another project)



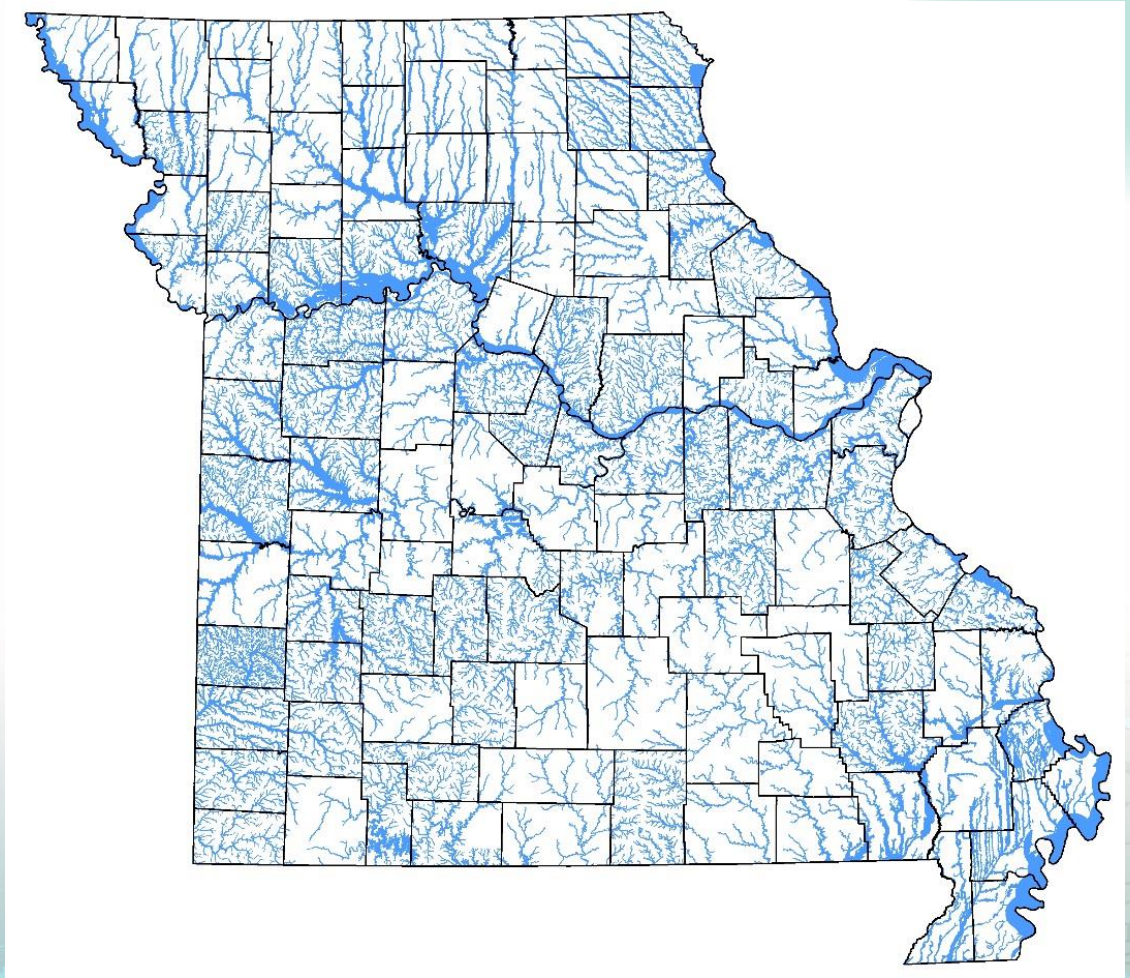


Priority #3: Used Hazus generated depth grid for unmapped areas



Areas shown in dark blue are currently being studied and the counts will be updated in November for these areas

Statewide Depth Grid

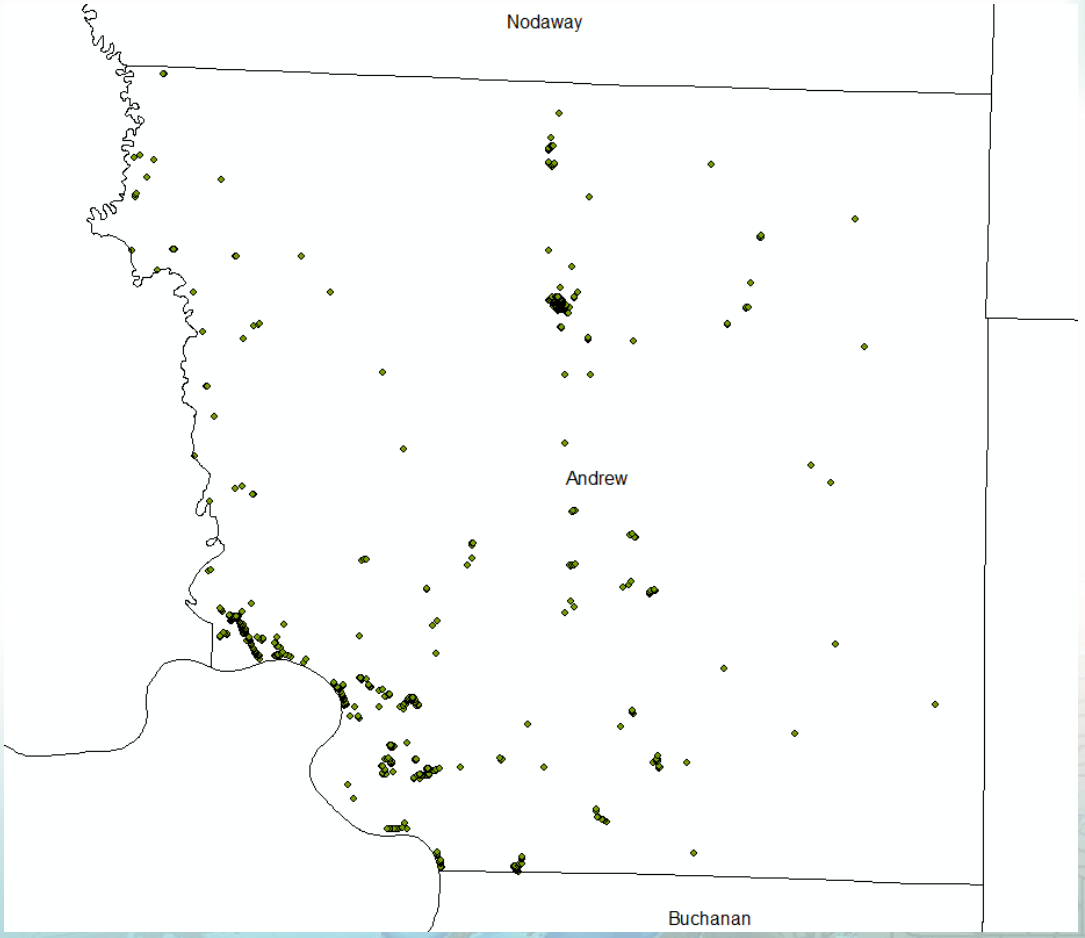


Hazus Results Table

This analysis shows the 1% annual chance flood damages

County	Structural Damage	Contents Loss	Inventory Loss	Total Direct Loss	Total Income loss	Total Direct and Income Loss	Loss Ratio	# Hazus Bldgs Risk	*MSDIS*	#Substantially damaged	# Displaced People	# Shelter Needs	Countywide Building Exposure
Adair	$7,445,000	$6,613,000	$225,000	$14,283,000	$35,000	$14,318,000	0.29%	17	39	0	329	33	$2,599,614,000
Andrew	**$29,193,000**	**$17,870,000**	**$373,000**	**$47,436,000**	**$223,000**	**$47,659,000**	**1.69%**	**78**	**213**	**23**	**998**	**238**	**$1,724,819,000**
Atchison	$18,643,000	$16,334,000	$745,000	$35,722,000	$64,000	$35,786,000	2.31%	24	57	9	286	50	$806,754,000
Audrain	$7,605,000	$9,862,000	$318,000	$17,785,000	$45,000	$17,830,000	0.28%	26	61	0	336	130	$2,689,090,000
Barry	$21,248,000	$38,569,000	$2,998,000	$62,815,000	$277,000	$63,092,000	0.57%	34	72	1	590	140	$3,736,121,000
Barton	$16,684,000	$14,973,000	$523,000	$32,180,000	$85,000	$32,265,000	1.18%	111	235	15	1,109	370	$1,414,960,000
Bates	$16,291,000	$10,483,000	$586,000	$27,360,000	$41,000	$27,401,000	0.99%	36	78	4	742	82	$1,650,150,000
Benton	$14,831,000	$11,997,000	$306,000	$27,134,000	$61,000	$27,195,000	0.60%	17	29	3	396	68	$2,478,458,000
Bollinger	$17,686,000	$17,040,000	$383,000	$35,109,000	$152,000	$35,261,000	1.71%	39	76	3	783	215	$1,035,129,000

Intersection of MSDIS Points with the NFHL to get counts



For Andrew County, 915 structures out of 22,168 are vulnerable to risk of flooding.

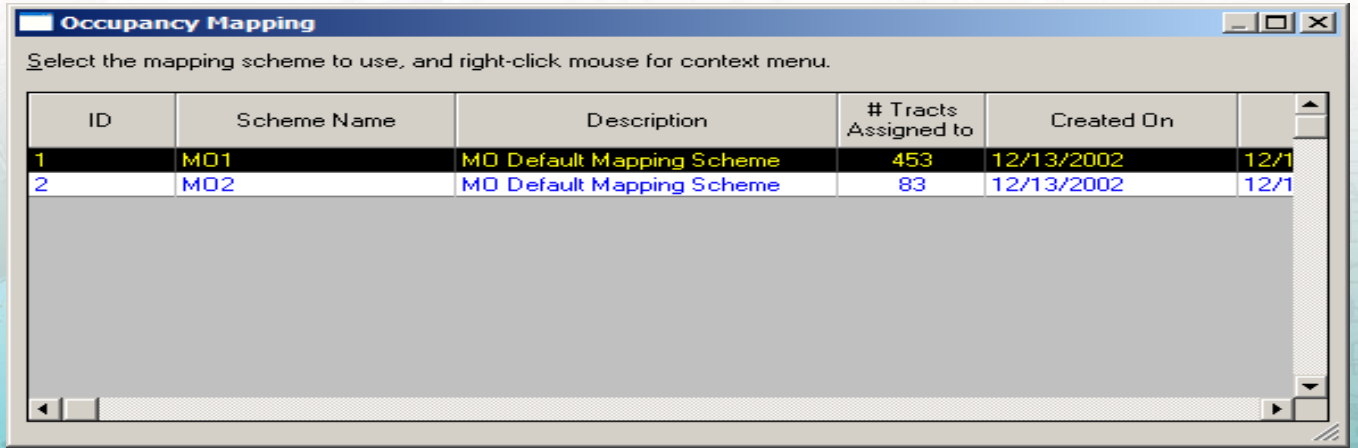
- Agriculture = 145
- Commercial = 14
- Government = 15
- Industrial = 2
- **Residential = 213**
- Residential-Sub (sheds, etc) = 526

Earthquake Analysis

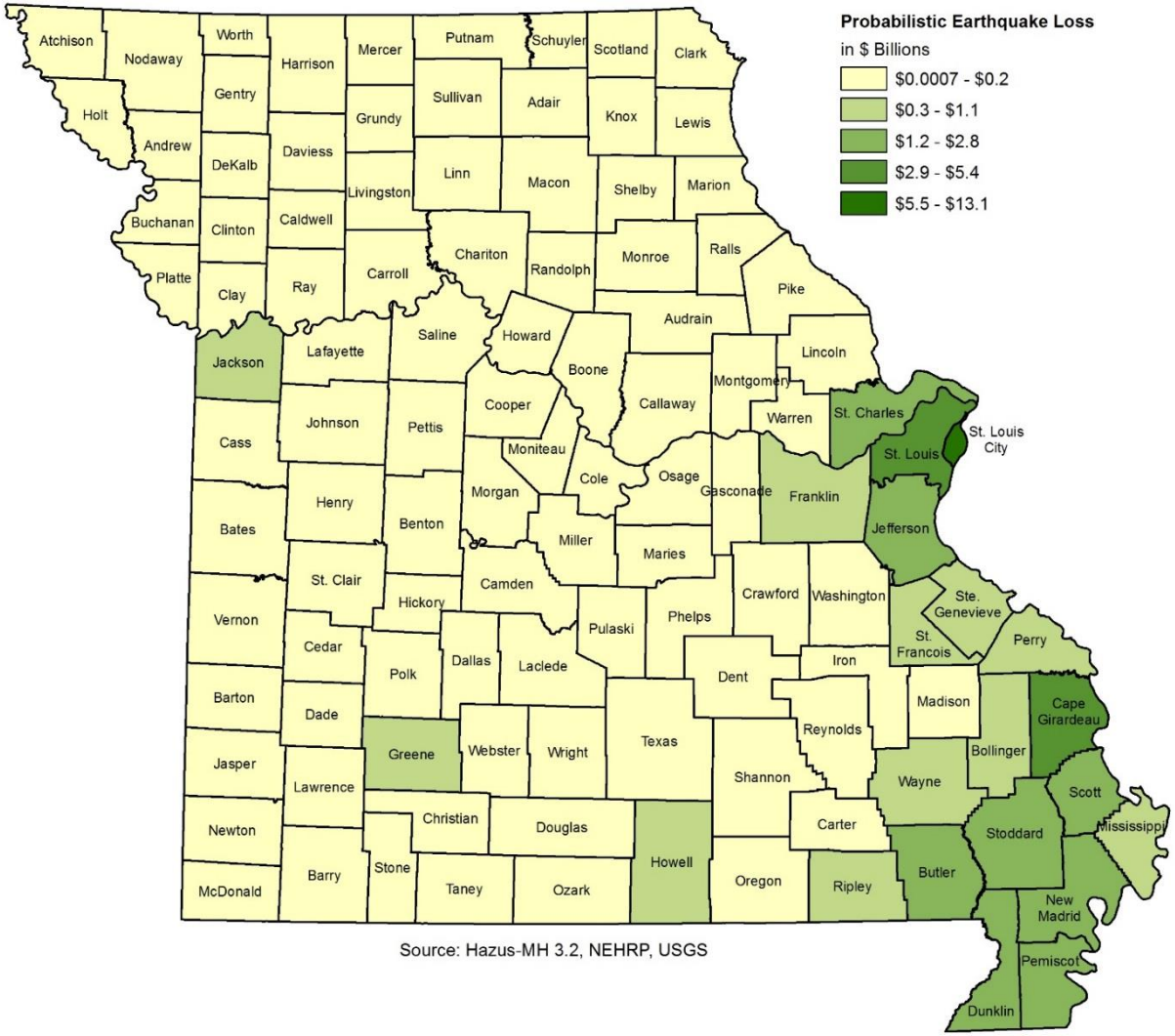
- Statewide Loss Analysis
  - 2,500 year probabilistic (2% in 50yrs)
  - Summarize results by county
- Enhanced Analysis of Critical Facilities
  - Facilities Important to Response and Recovery Operations: Fire Stations, Schools (shelters), Medical Care
  - Bridges and Hazardous Materials Facilities
  - 2,500 year probabilistic

Statewide Loss Analysis

- Level 1+ enhancements to hazard layer:
  - Liquefaction - MODNR
  - Soils with NEHRP classifications – CUSEC
- Adjustments to buildings default seismic design level
  - Changed from Moderate to Low Code

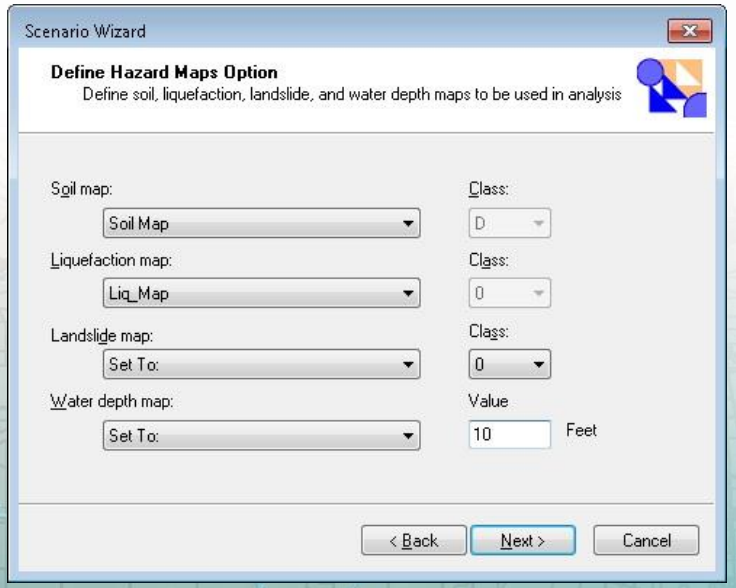


Statewide Loss Analysis – Economic loss by County

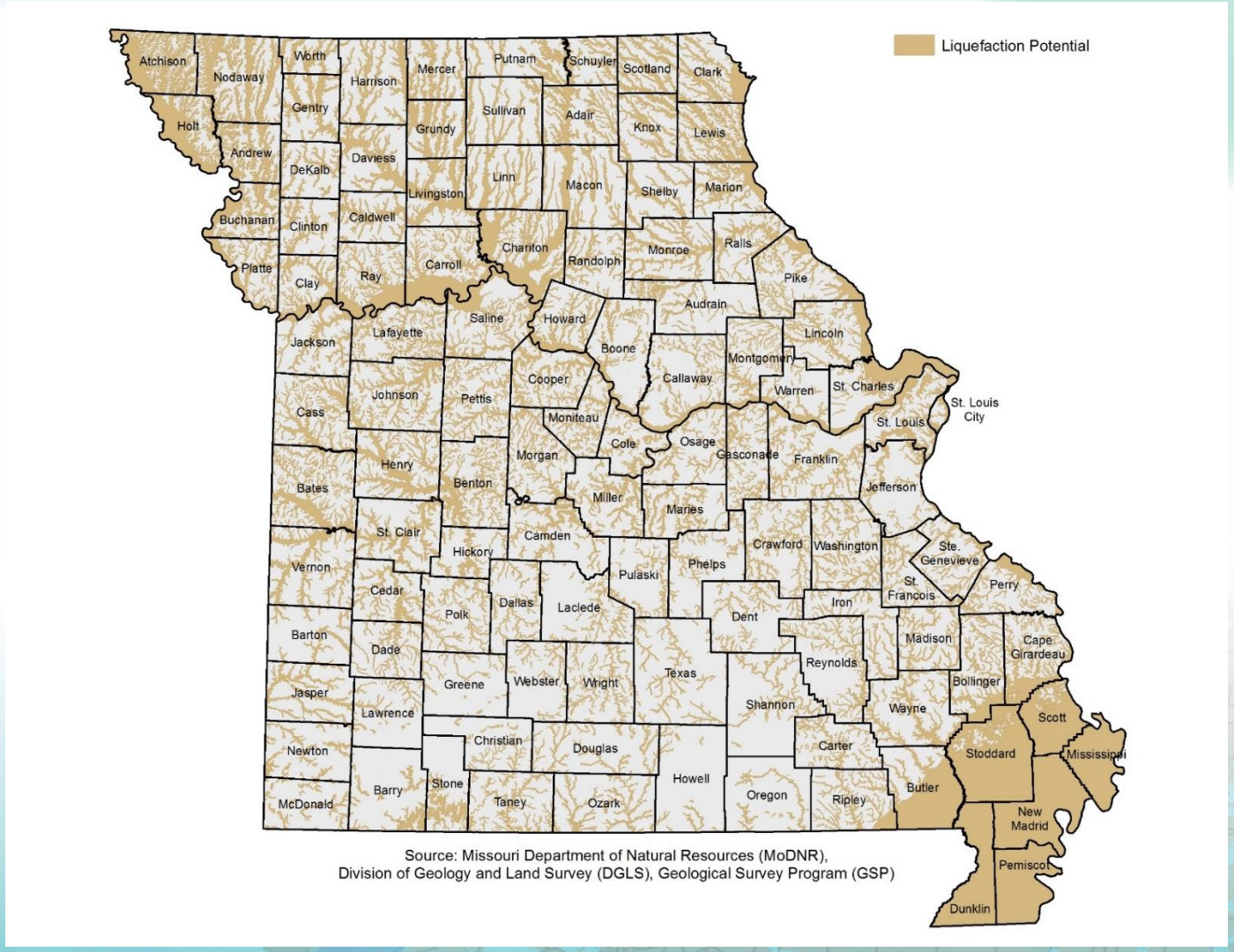


Enhanced Analysis of Critical Facilities – Hazard Input

- Probabilistic Ground Shaking – USGS (in Hazus)
- Liquefaction - MODNR
- Ground water depth - MODNR well data
  - Summarized average depth to groundwater in liquefaction areas

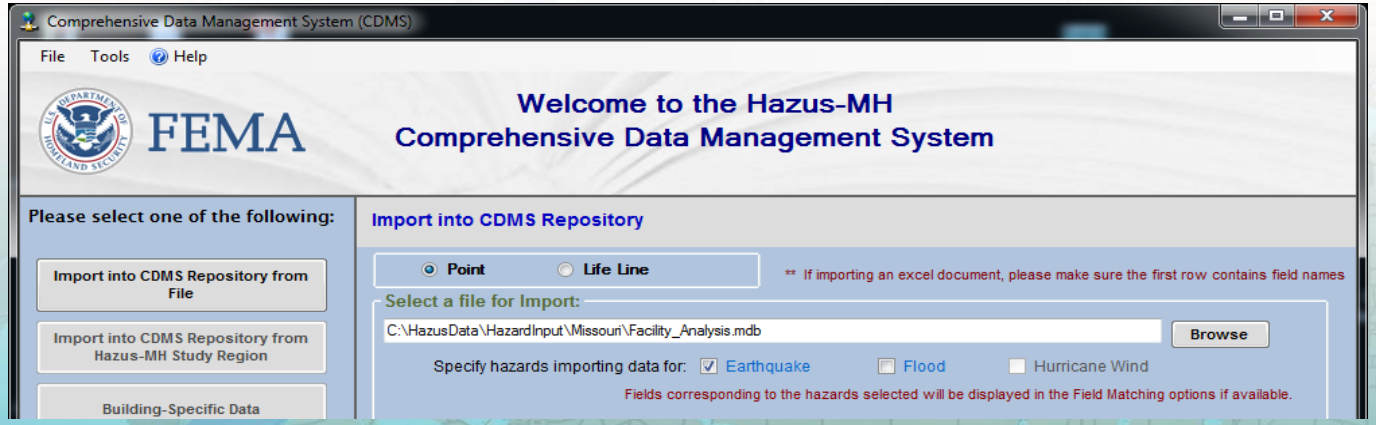


Liquefaction Layer



Enhanced Analysis of Critical Facilities – Facilities Data

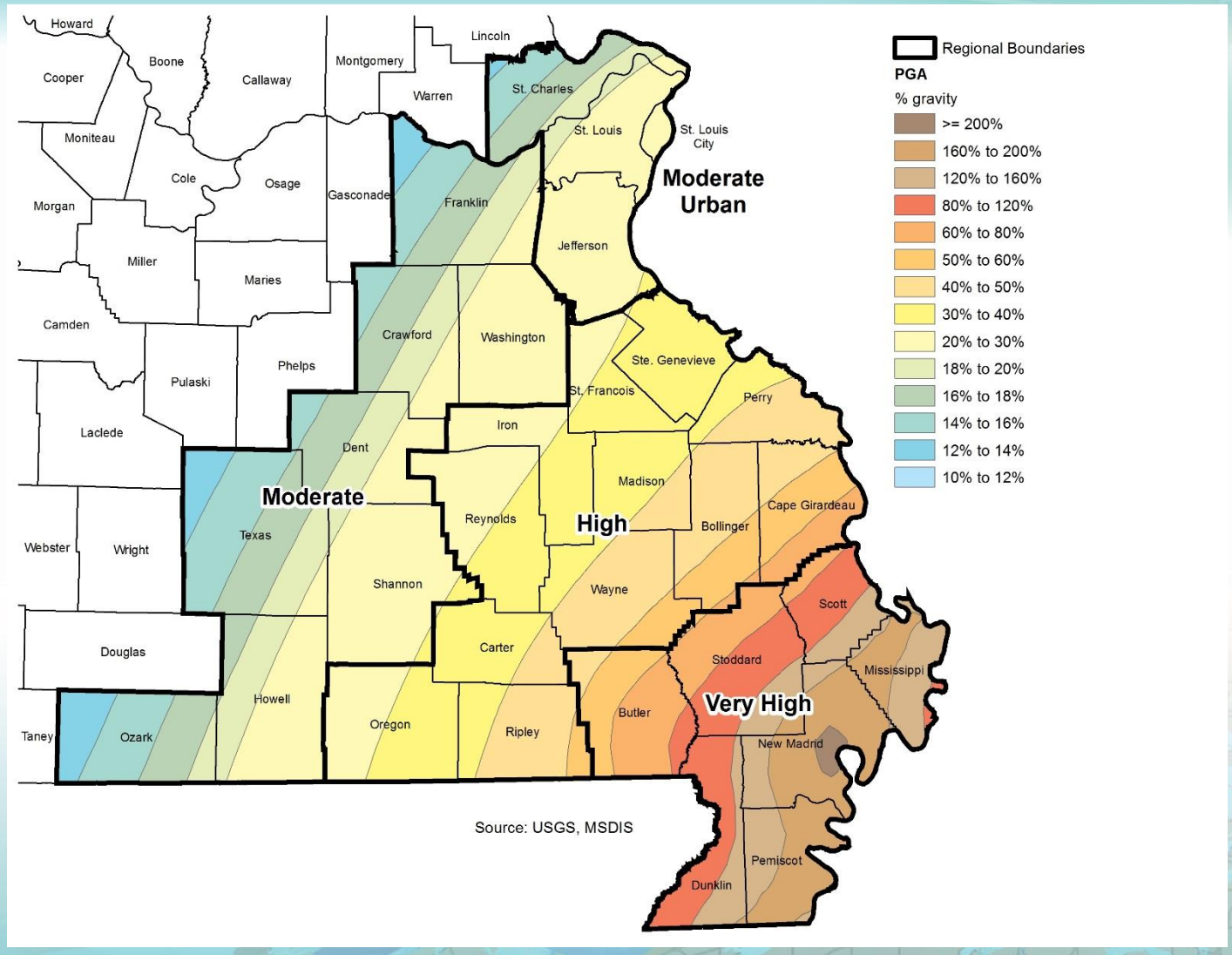
- Response and Recovery Facilities
  - Fire Stations
  - Schools
  - Medical Care
  - HSIP Freedom source for these layers
- Bridges – MODOT
- HAZMAT facilities – Tier II - MOSEMA-MERC
- Formatted for Hazus with CDMS tool



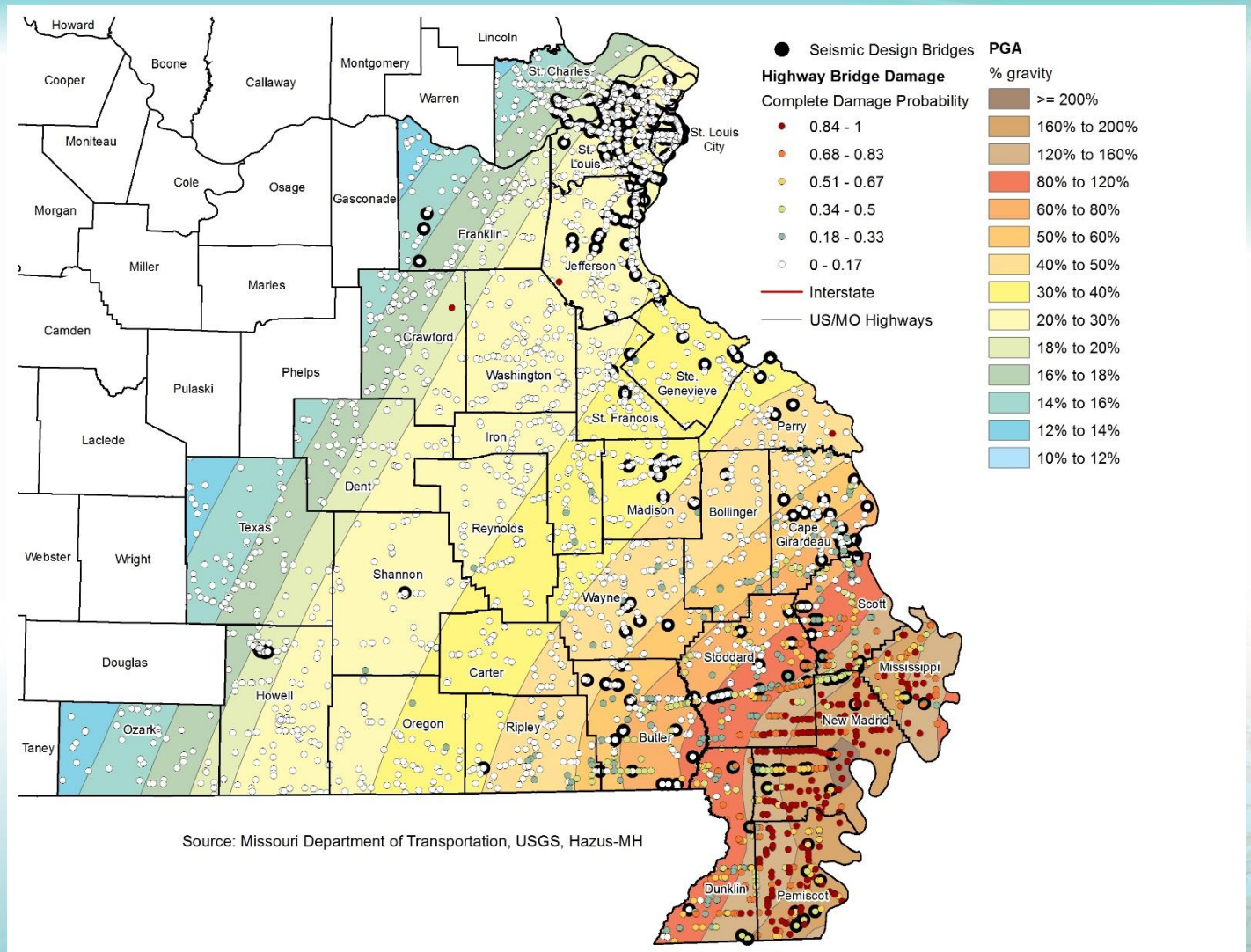
Enhanced Analysis of Critical Facilities – Hazus Steps

- Grouped counties into sub-regions based on PGA earthquake shaking levels.
  - Necessary to reduce Hazus run-time and group highest-risk counties.
- Used ‘Update Study Region’ CDMS process to import CDMS formatted facilities into Statewide Inventory.
  - Had to manually delete default Hazus data prior to Hazus run.
- Ran Hazus with 2,500 year scenario on focused facilities only to reduce processing time.

Earthquake Sub-Regions

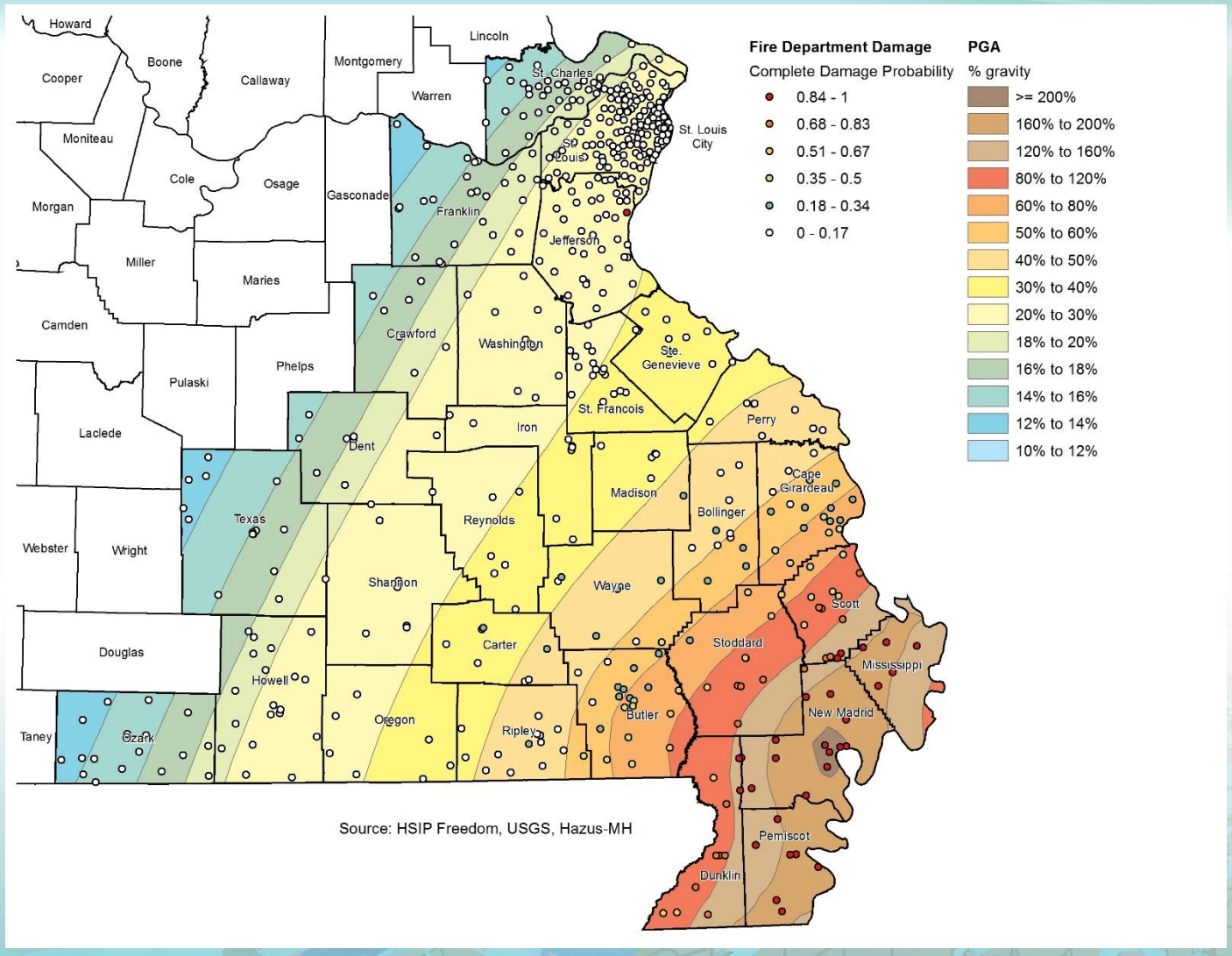


Preliminary Results - Bridges

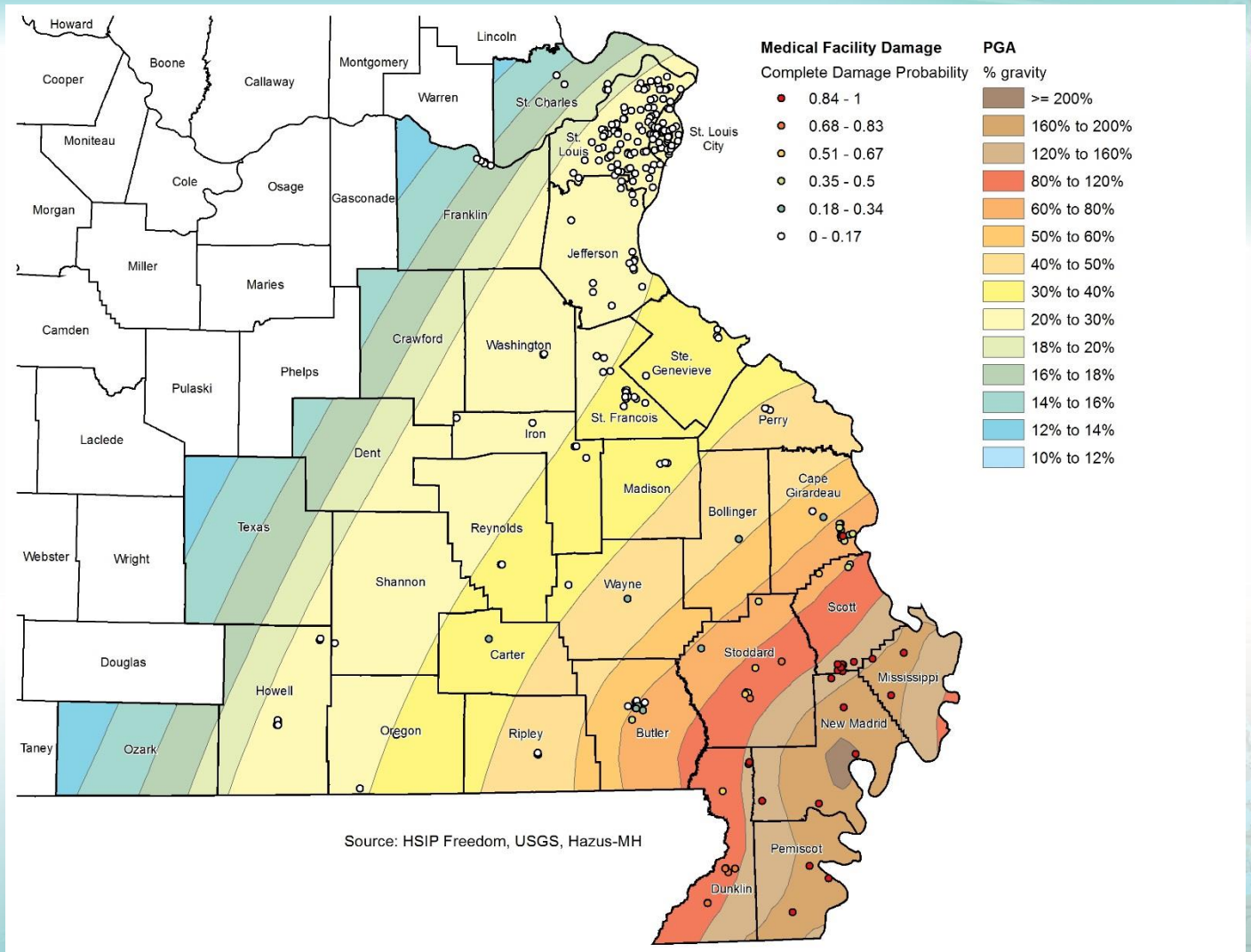


Source: Missouri Department of Transportation, USGS, Hazus-MH

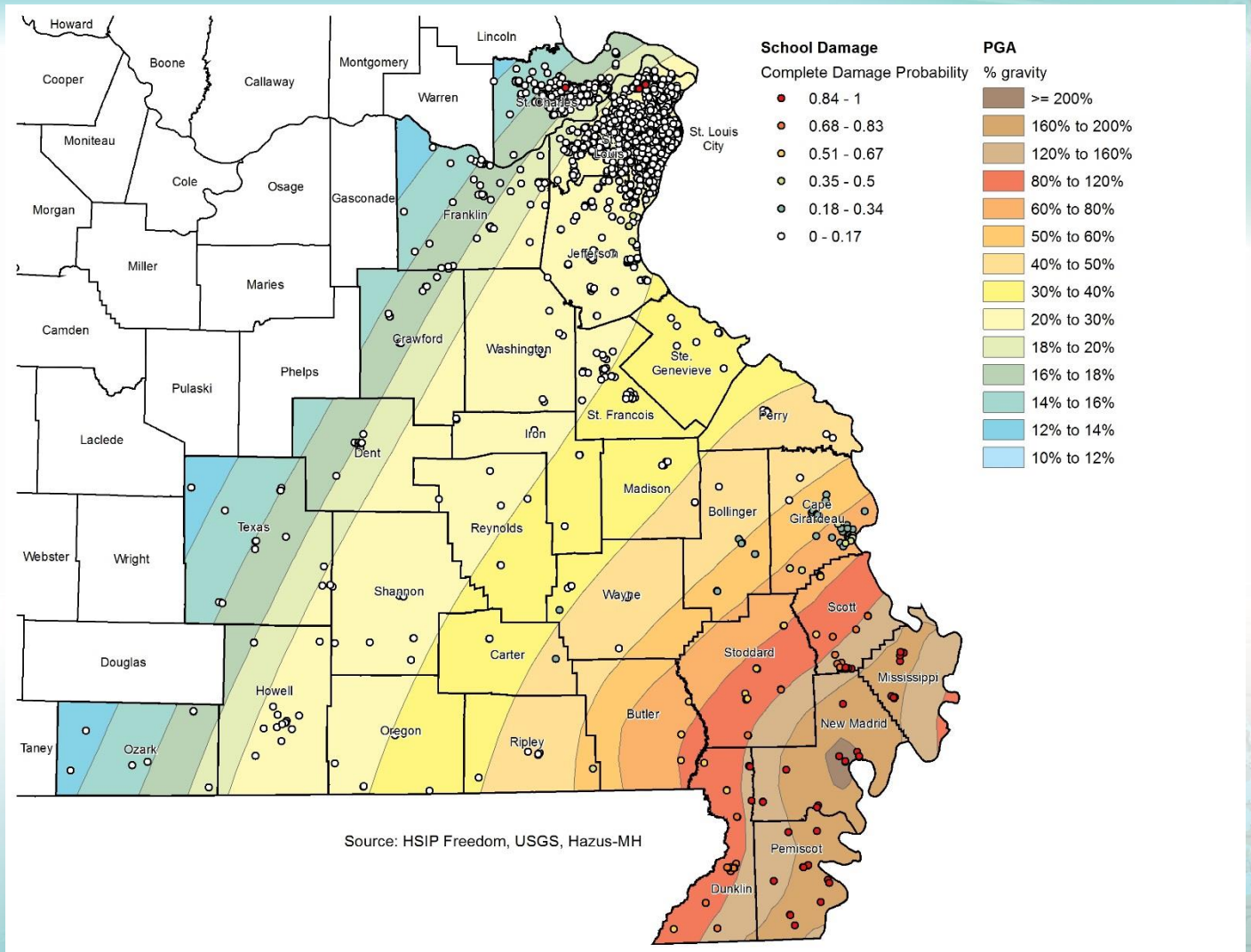
Preliminary Results – Fire Departments



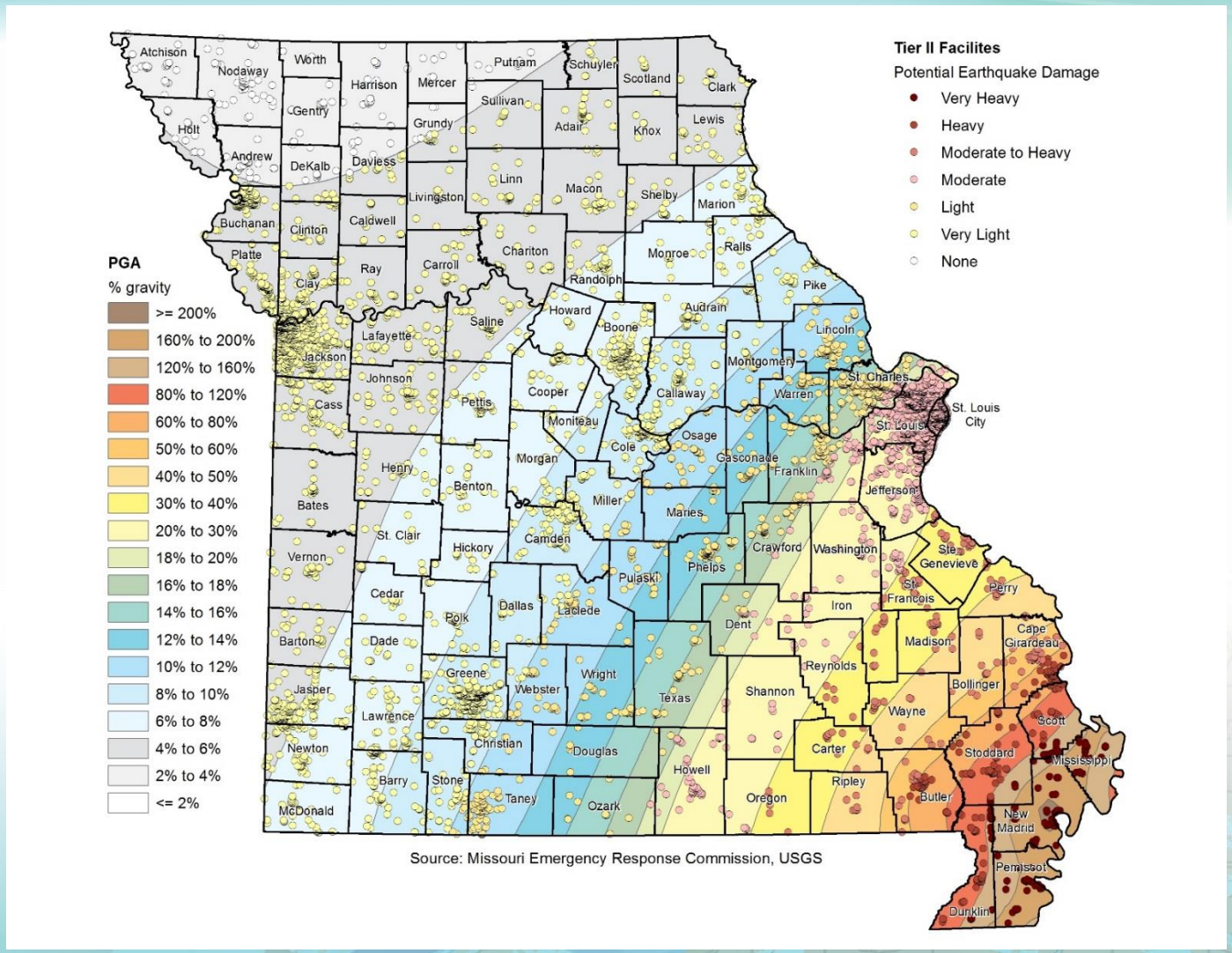
Preliminary Results – Medical Facilities



Preliminary Results - Schools



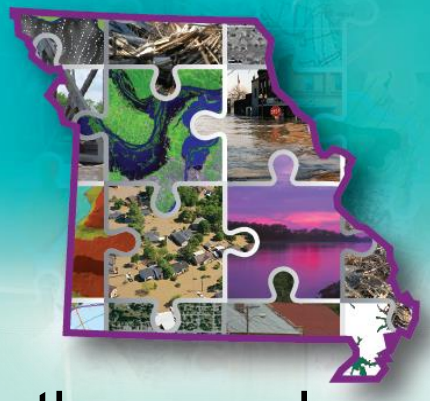
Preliminary Results – Hazardous Materials Facilities



What worked Well…..
(Best Practices)

- Pay attention to the User Release Notes on model updates and outstanding issues
- Hazus User and Technical manuals, while out of date, are still valuable reference
- Creating a procedure manual is key for consistent methods and training others
- Ability to do multi-county regional Hazus Flood runs efficiently with imported depth grids
- Summary Reports in Hazus helped to show and QC results easily.
- Having colleagues to interact with and troubleshoot issues.
- QC Results and anticipate trial and error!

What didn't work well……
(Lessons Learned)



- Statewide Earthquake Analyses don't run like they used to; workaround required breaking the state into Regions.
- Hazus is a resource hog: Length of time needed to complete runs requires multiple computers if processing several regions.
- Account for prep and trial/error time to get Hazus to process accurate results.
- Depth grids from multiple sources need to be standardized and errors/inaccurate values fixed.
- Hazus needs more detailed fail/error reports such as those from CDMS.
- Tedious process to properly import facilities into CDMS and properly import them into a region

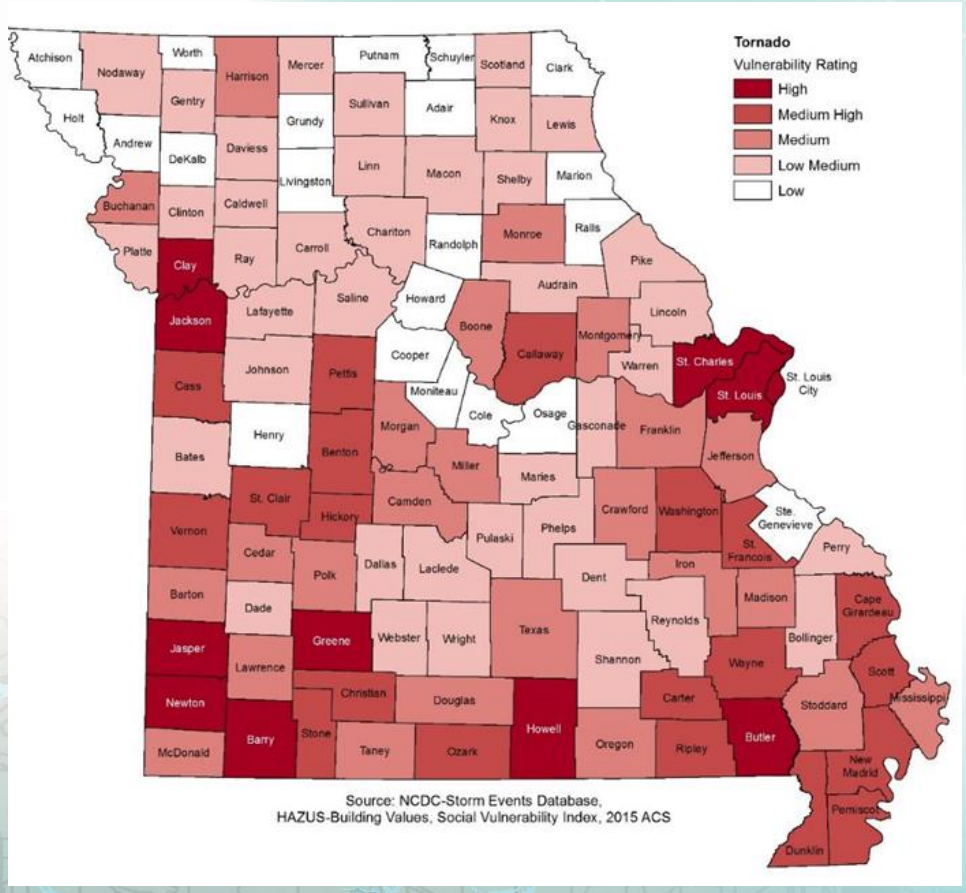
Wrap Up- Summary

- Improved analysis for the State Mitigation Plan for focusing mitigation strategies for flood and earthquake
- High consequence bridges identified
- Targeted information related to potentially compromised response and recovery and hazardous materials facilities
- Summary report in development with results of critical facility analysis
- Ability to use Hazus Datasets for Hazards outside of Hazus analysis lead to consistency in exposure values across hazards

Use of Hazus Data Sets Outside of Hazus: Statistical Analysis

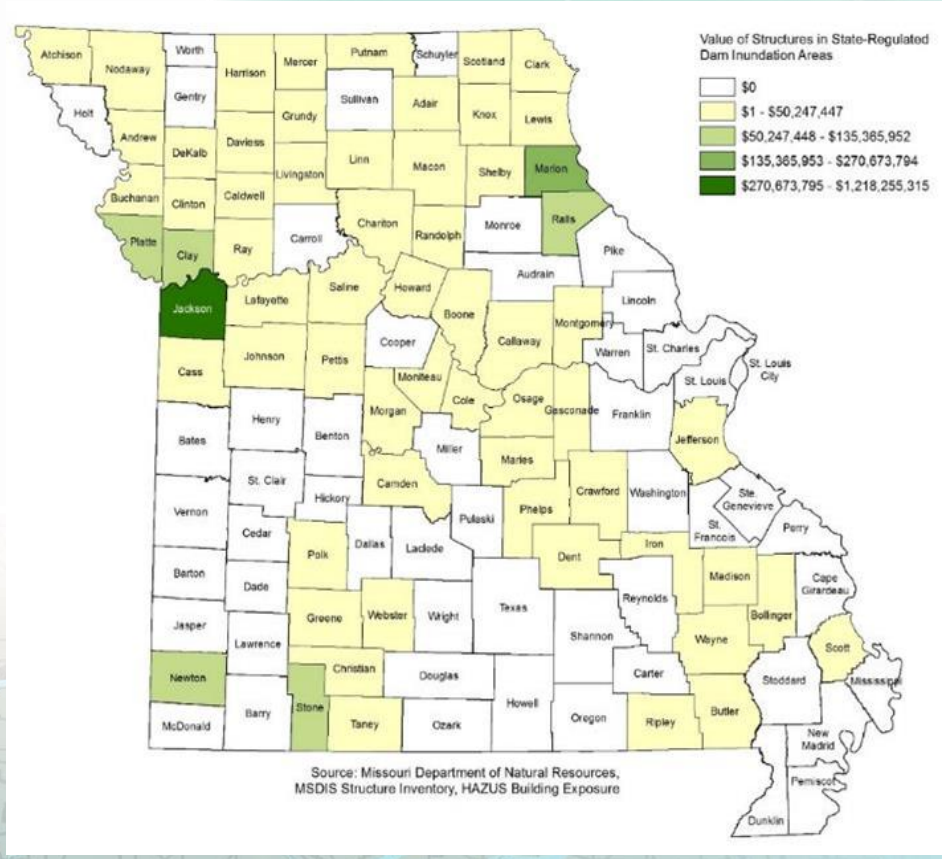
- Hazus Total Building Exposure Values used as a factor
  - Severe Thunderstorms
  - Tornado
  - Severe Winter Weather
  - Structure fire
- Example: Tornadoes

1. Building Exposure Value by County (Hazus)
2. Likelihood of Occurrence by County (NCDC events/yrs.)
3. Annualized Property Loss (NCDC losses / yrs.)
4. Social Vulnerability Index
5. Population Density
6. # of Mobile Homes



Use of Hazus Data Sets Outside of Hazus: GIS Analysis

- Hazus Building Exposure by structure type used to calculate average value by structure type
- MSDIS Structure Inventory used to determine the number of structures by type in Hazard areas
- Hazus average value by type applied to counts in hazard areas to determine values at risk.
  - Dam Failure
  - Levee Failure
  - Wildfire
  - Land Subsidence/Sinkholes



Questions

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