

Applications of HAZUS-MH for Emergency Management

February 22, 2011



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What is HAZUS-MH?

- Free ArcGIS extension
- Identifies and visually displays hazards and vulnerabilities
- Calculates scientifically-defensible damages, economic losses, and mitigation benefits
- Facilitates a risk-based approach to mitigation



Supported Hazards

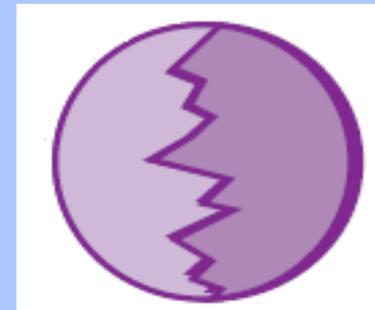
- **Hurricanes**



- **Riverine and Coastal Floods**

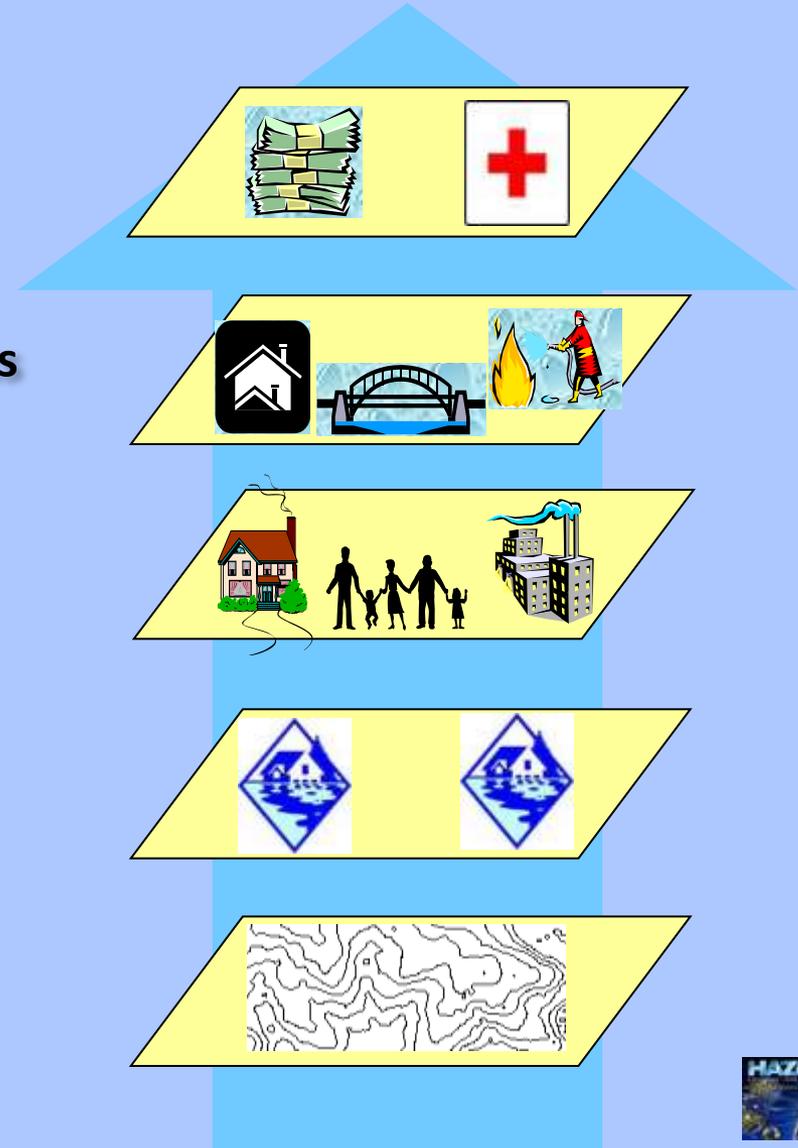


- **Earthquakes**



How HAZUS-MH Estimates Losses

- Produces maps, tables, and reports
- Analyzes social and economic impacts
- Considers what is at risk
- Identifies hazard
- Analyzes physical landscape



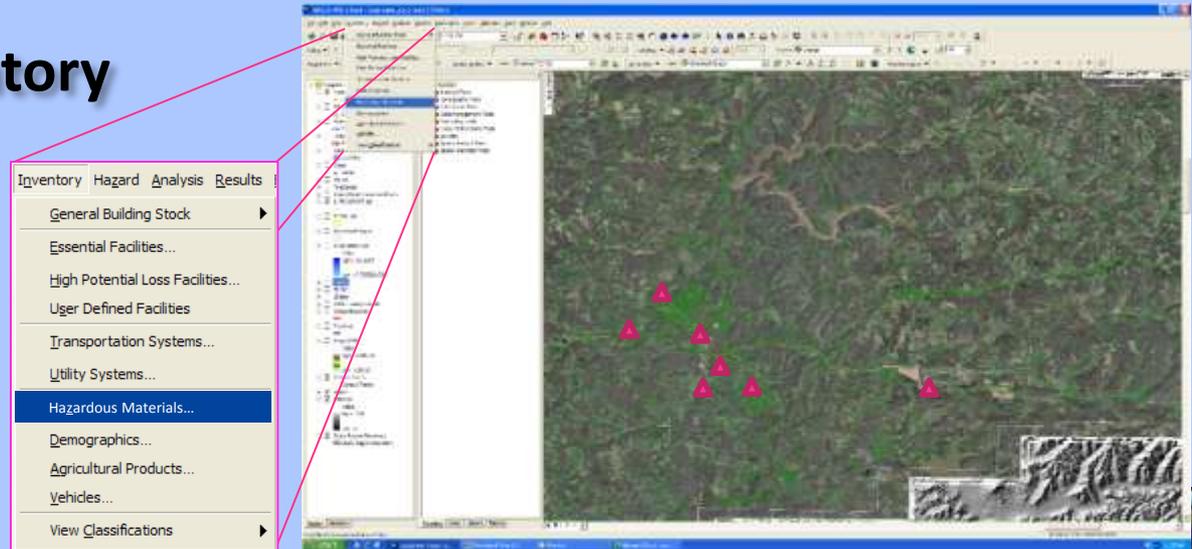
Inventory Components

Aggregate Inventory

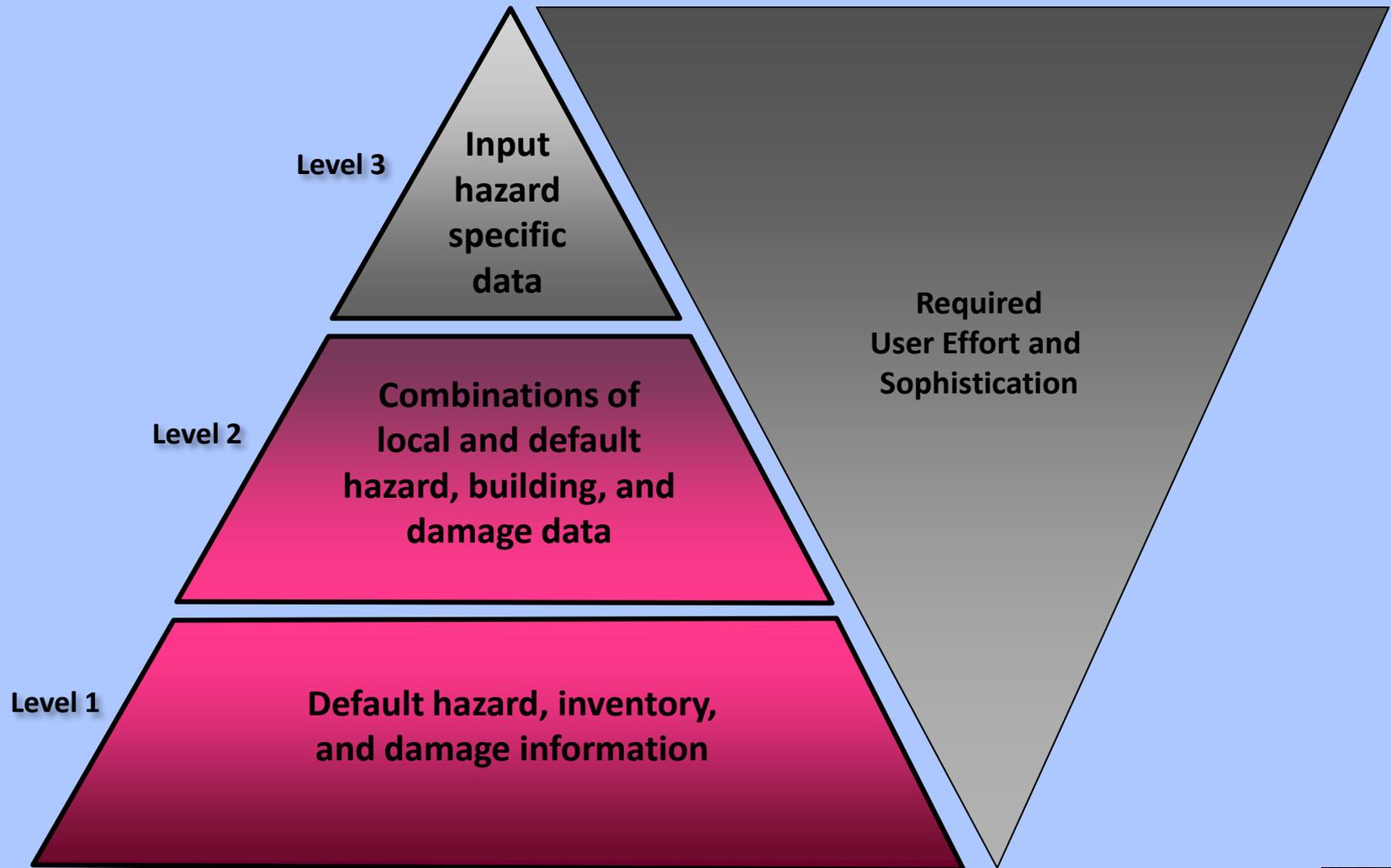
- Demographics
- General Building Stock broken down by type (how constructed) and occupancy (how used)



Site-Specific Inventory



User Levels



How do I integrate local data?

- Data integration tools:
 - Building Import Tool (BIT)
 - update GBS
 - Flood Information Tool (FIT)
 - incorporate flood studies
 - Comprehensive Data Management System
 - incorporate local, site specific data
 - Allow users to query and export inventory information
- Used to have linkage to third-party models
 - Areal Locations of Hazardous Atmospheres (ALOHA)
 - Flood Waves (FLDWAV) for dam breach analyses
 - HAZUS no longer supports these, but you can still use GIS for analyses by incorporating inventory from HAZUS



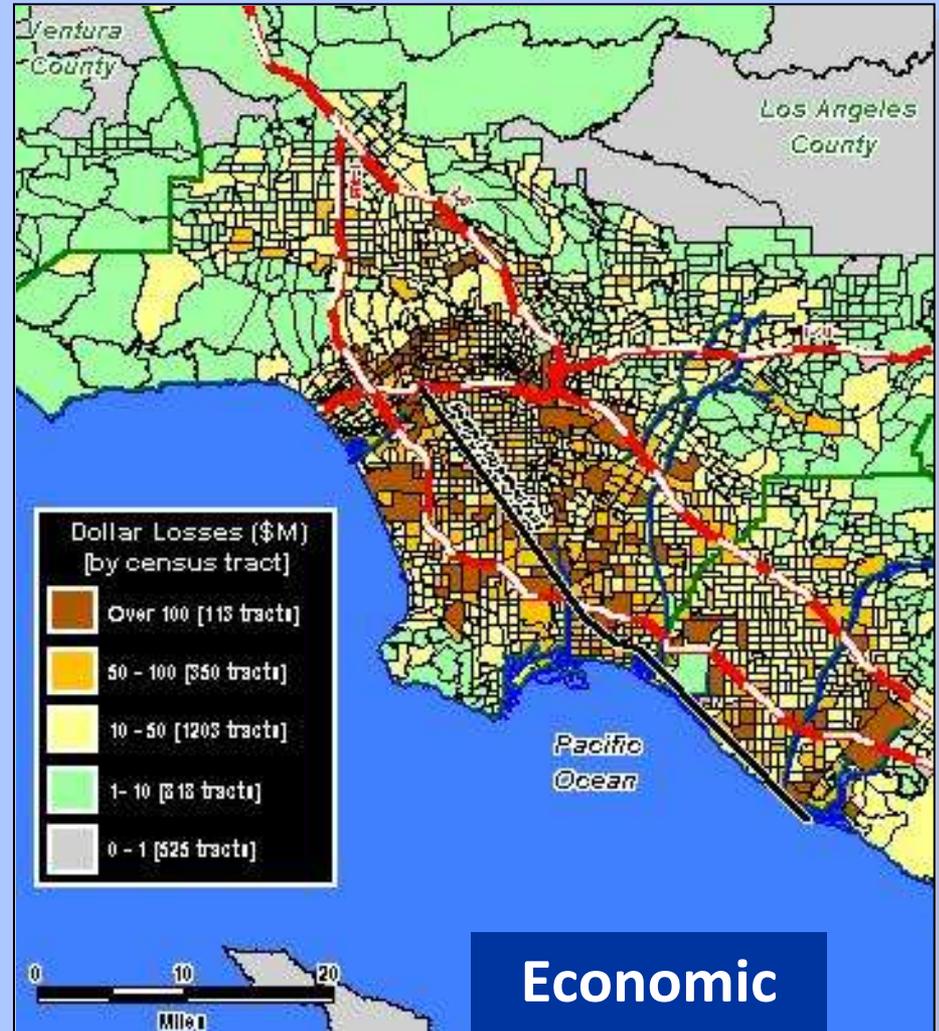
HAZUS-MH Output



**Physical
Impacts**



**Social
Impacts**



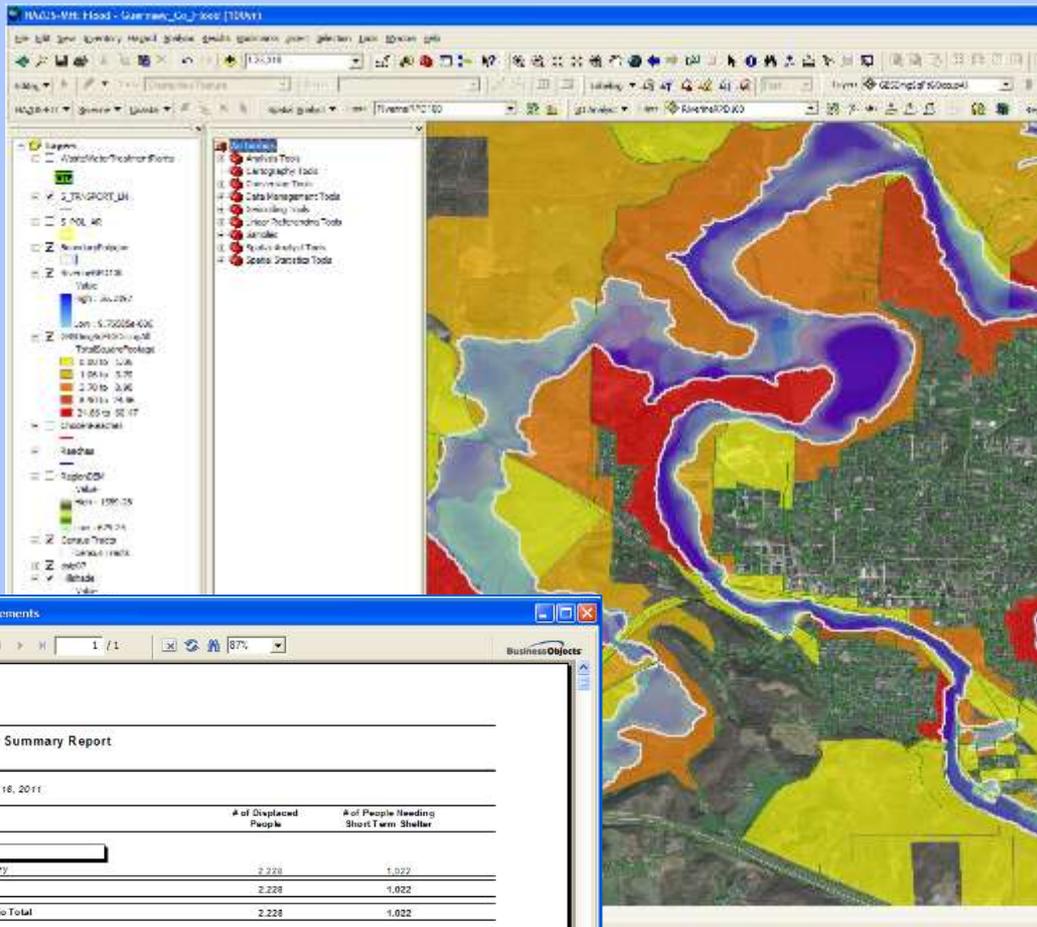
**Economic
Impacts**

HAZUS-MH Output

	Earthquake Ground Shaking Ground Failure	Flood Frequency Depth Discharge Velocity	Hurricane Wind Pressure Missile Rain
➤ Direct Damage			
General Building Stock	✓	✓	✓
Essential Facilities	✓	✓	✓
High Potential Loss Facilities	✓		
Transportation Systems	✓	✓	
Utility Systems	✓	✓	
➤ Induced Damage			
Fire Following	✓		
Hazardous Materials Release			
Debris Generation	✓	✓	✓
➤ Direct Losses			
Cost of Repair	✓	✓	✓
Income Loss	✓	✓	✓
Crop Damage		✓	
Casualties	✓	Generic Output	
Shelter Needs	✓	✓	✓
➤ Indirect Losses			
Supply Shortages	✓	✓	
Sales Decline	✓	✓	
Opportunity Costs	✓	✓	
Economic Loss	✓	✓	



Results Formats



General Building Stock Damage By Occupancy

Results for Scenario: 100yr Return period: 100

Table Type: General Occupancy Type Occupancy: Residential Pre/Post Firm: Total

Damage (hours sq ft)

	General Stock	TotalSquareFootage	SqFtWithSubstantialDmg	UndamagedSqFt	SqFt
1	200655771001000	4.00	0.27	0.76	
2	200655771001001	0.00	0.00	0.00	
3	200655771001002	0.04	0.00	0.04	
4	200655771001003	0.00	0.00	0.00	
5	200655771001005	0.33	0.06	0.13	
6	200655771001007	0.00	0.00	0.00	
7	200655771001008	0.02	0.00	0.01	
8	200655771001021	0.03	0.00	0.02	
9	200655771001035	0.00	0.00	0.00	
10	200655771001037	0.25	0.07	0.08	
11	200655771001038	0.47	0.06	0.26	
12	200655771001043	0.05	0.00	0.04	
13	200655771001044	0.00	0.00	0.00	
14	200655771001045	0.00	0.00	0.00	
15	200655771001046	0.02	0.00	0.02	
16	200655771001049	0.00	0.00	0.00	
17	200655771001050	0.50	0.25	0.25	
18	200655771001051	0.08	0.03	0.02	

Shelter Requirements

Shelter Summary Report

February 18, 2011

	# of Displaced People	# of People Needing Short Term Shelter
Ohio		
Summary	2,228	1,022
Total	2,228	1,022
Scenario Total	2,228	1,022

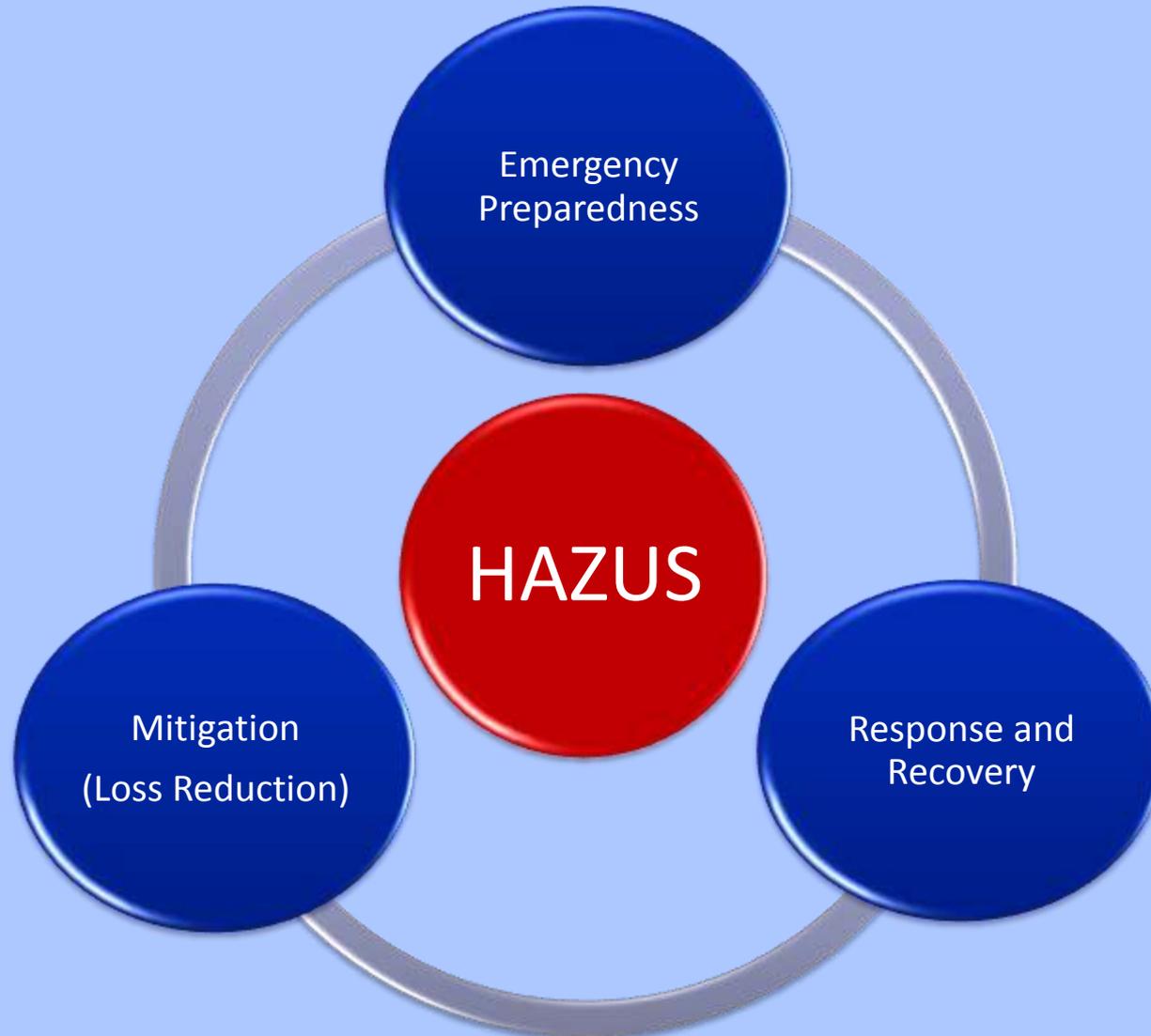


How does HAZUS-MH Support Emergency Management?

- **IDENTIFY** vulnerable areas
- **ASSESS** level of readiness and preparedness to deal with a disaster before disaster occurs
- **ESTIMATE** potential losses from specific hazard events
- **DECIDE** on how to allocate resources for most effective and efficient response and recovery
- **PRIORITIZE** mitigation measures that need to be implemented to reduce future losses (what if)



HAZUS in Emergency Management



Emergency Preparedness

- Develop emergency response plans
 - Evaluate temporary housing
 - Debris management/removal
 - Emergency power and water
 - Emergency medical services
 - Evacuation/emergency route clearance!!!
 - Who, where, etc.
- Organize response exercises



Response and Recovery

- Post-disaster damage assessment and ground-truthing
- Response planning for critical transportation outages
- Identify critical infrastructure
- Recovery action planning
- Long-term economic recovery planning



Mitigation

- Mitigation assessment
 - Identify 'at-risk' communities
- Mitigation measures
 - Strengthen existing structures
 - Floodproofing, Relocation, Elevation, Demolition
- Mitigation programs
 - Adopt and enforce hazard-resistant building codes
 - Land use planning



Who else uses this software?

- HAZUS has been used since 1997
 - Federal, state, and local government officials use HAZUS for pre-disaster preparedness and mitigation and post-disaster planning & response
 - Financial institutions such as banks and insurance companies use it to assess their exposure to the disasters (Schwabb, Wells Fargo, BofA, ISO, ...)
 - Universities (professors and graduate students) use it for advanced, applied research (MIT, GT, Univ of IL, Princeton Univ., Stanford, UC Berkeley, ...)
 - Transportation and utility agencies use it to assess the reliability of their systems (CalTran, LADWP, ...)



An aerial photograph showing a residential area completely inundated with floodwater. The water is a murky, brownish-grey color. In the lower center, two houses with light-colored roofs are partially submerged, with only their roofs and some upper walls visible. Several green trees of various sizes are scattered throughout the flooded area, some standing tall and others partially underwater. The overall scene depicts a significant flooding event.

Flood Model Overview and Examples

Flood Model Premise

Define
topography

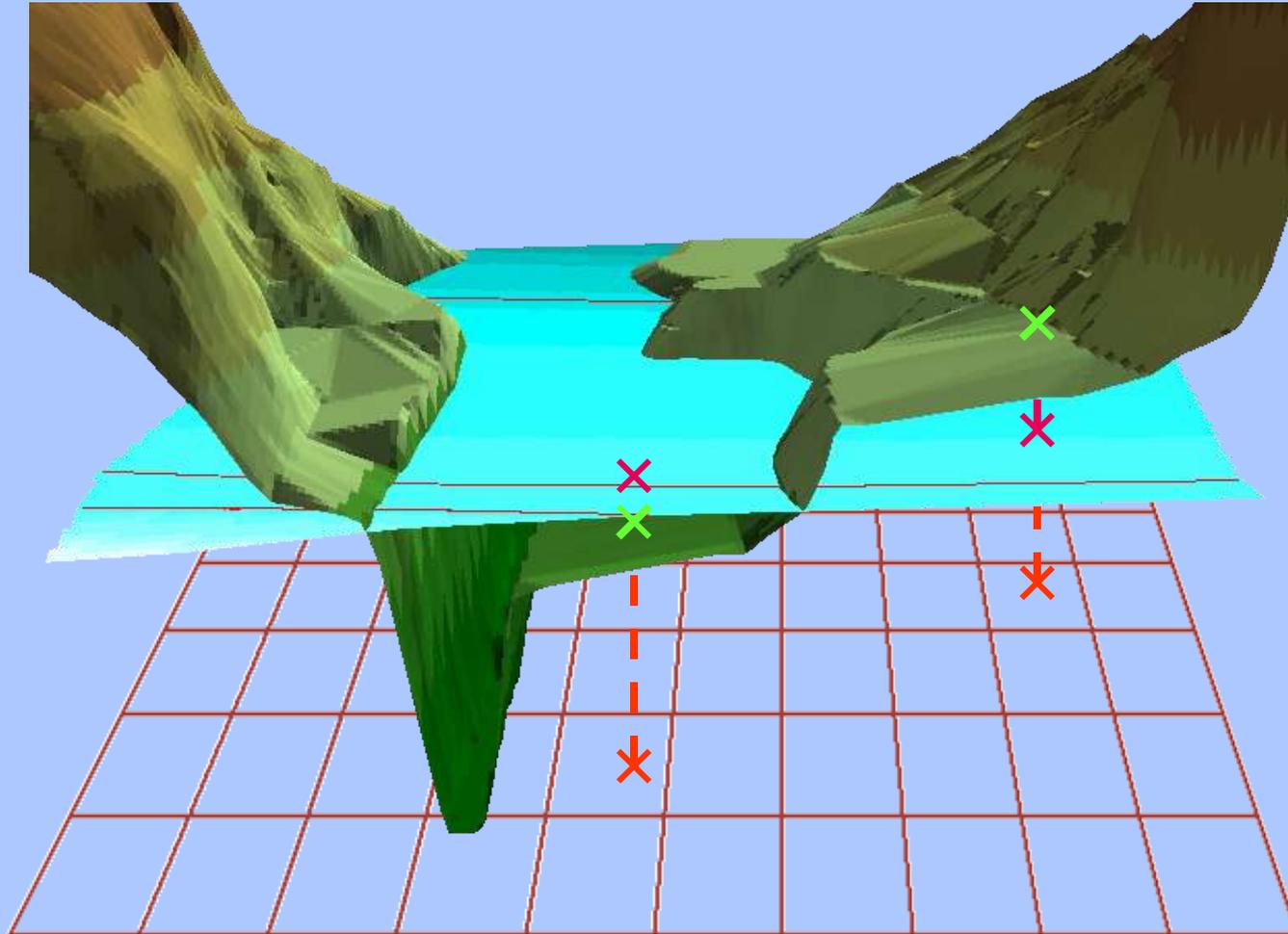
Define WSE
(floodplain)

Develop
depth grid

Run
analysis on
inventories

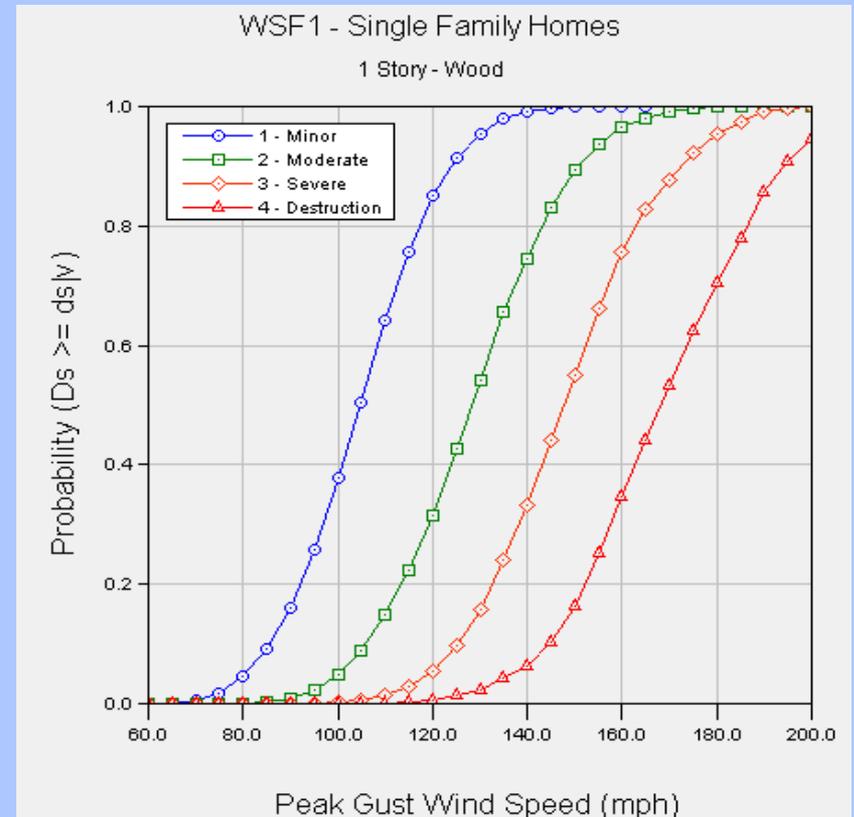


Surfaces Used to Develop Depth Grid

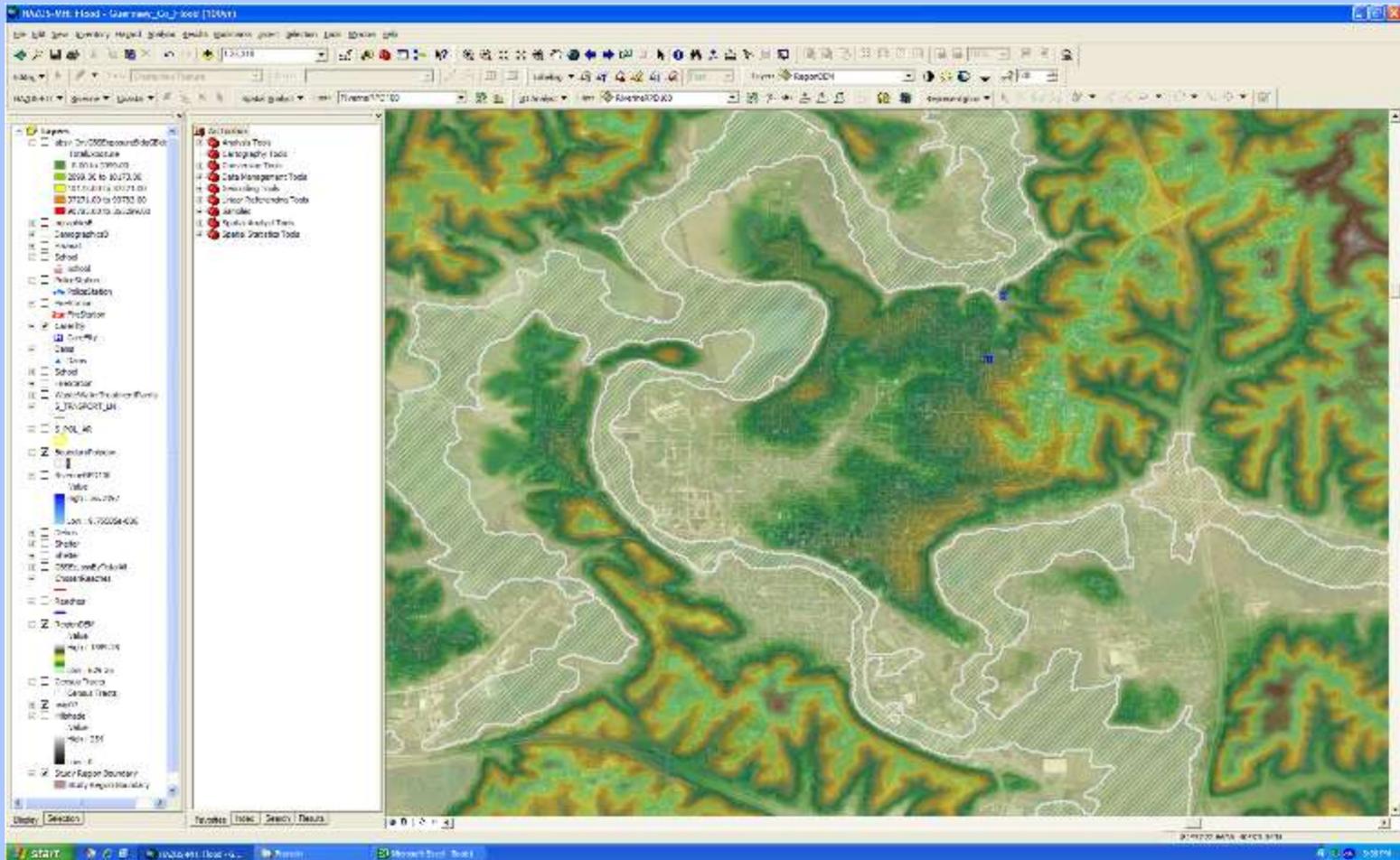


Damage/Loss Functions

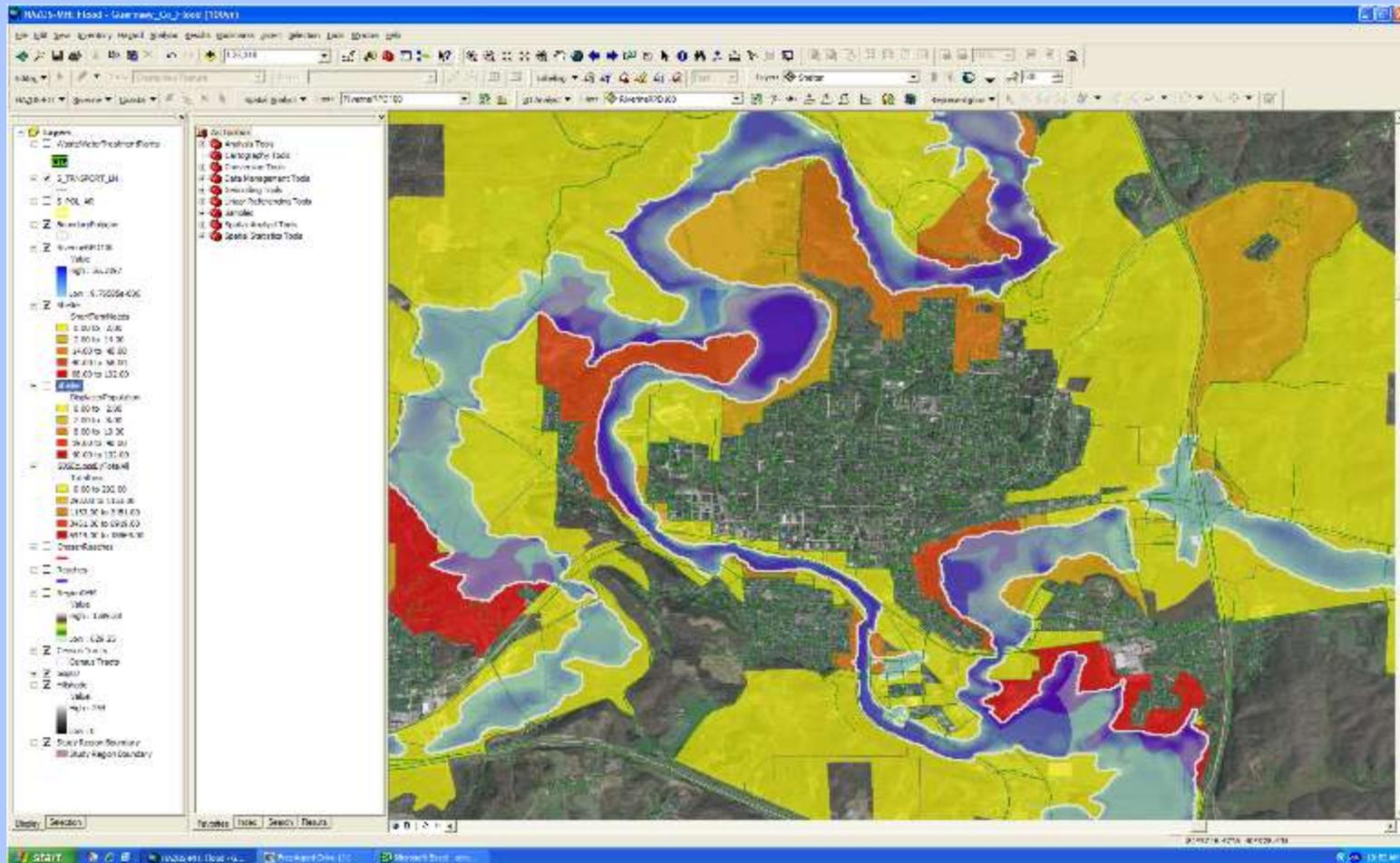
- Assess damage and losses based on hazard conditions
- Example – Hurricane model has 4,818 unique building categories
 - 45 damage/loss functions for each building model
 - Total of 216,810 unique damage/loss curves



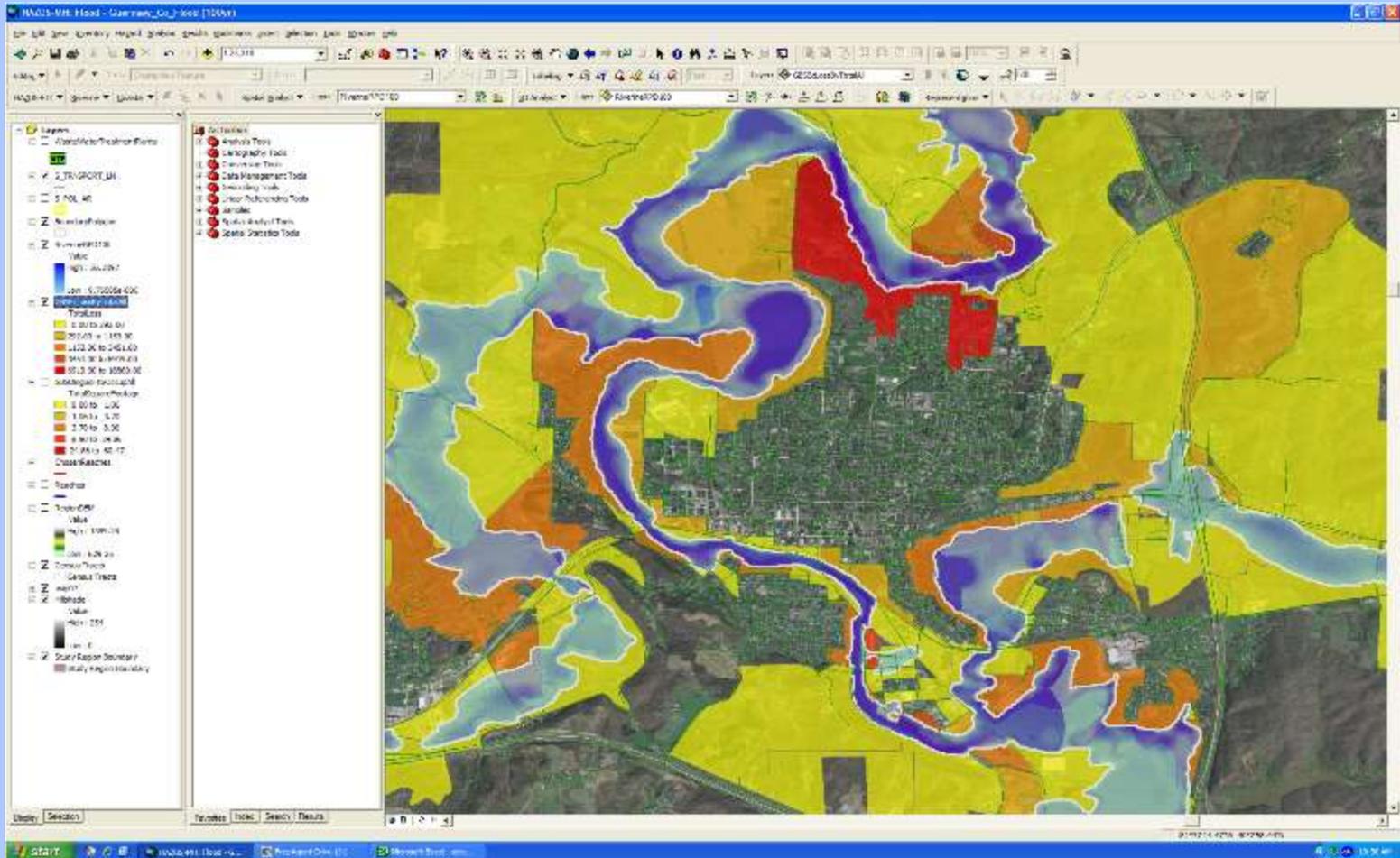
EXAMPLE: Guernsey County



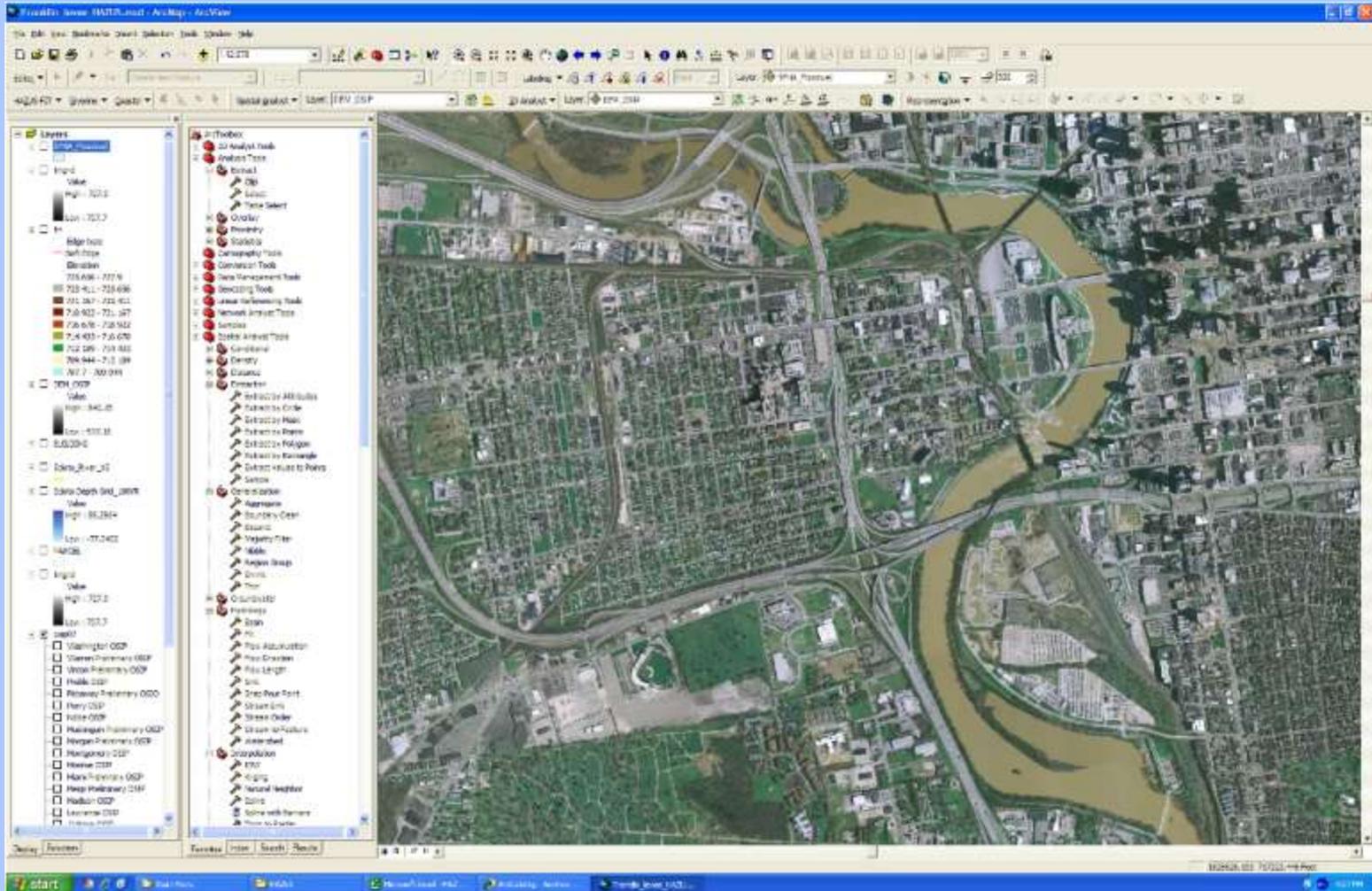
Guernsey County – Shelter Reqs.



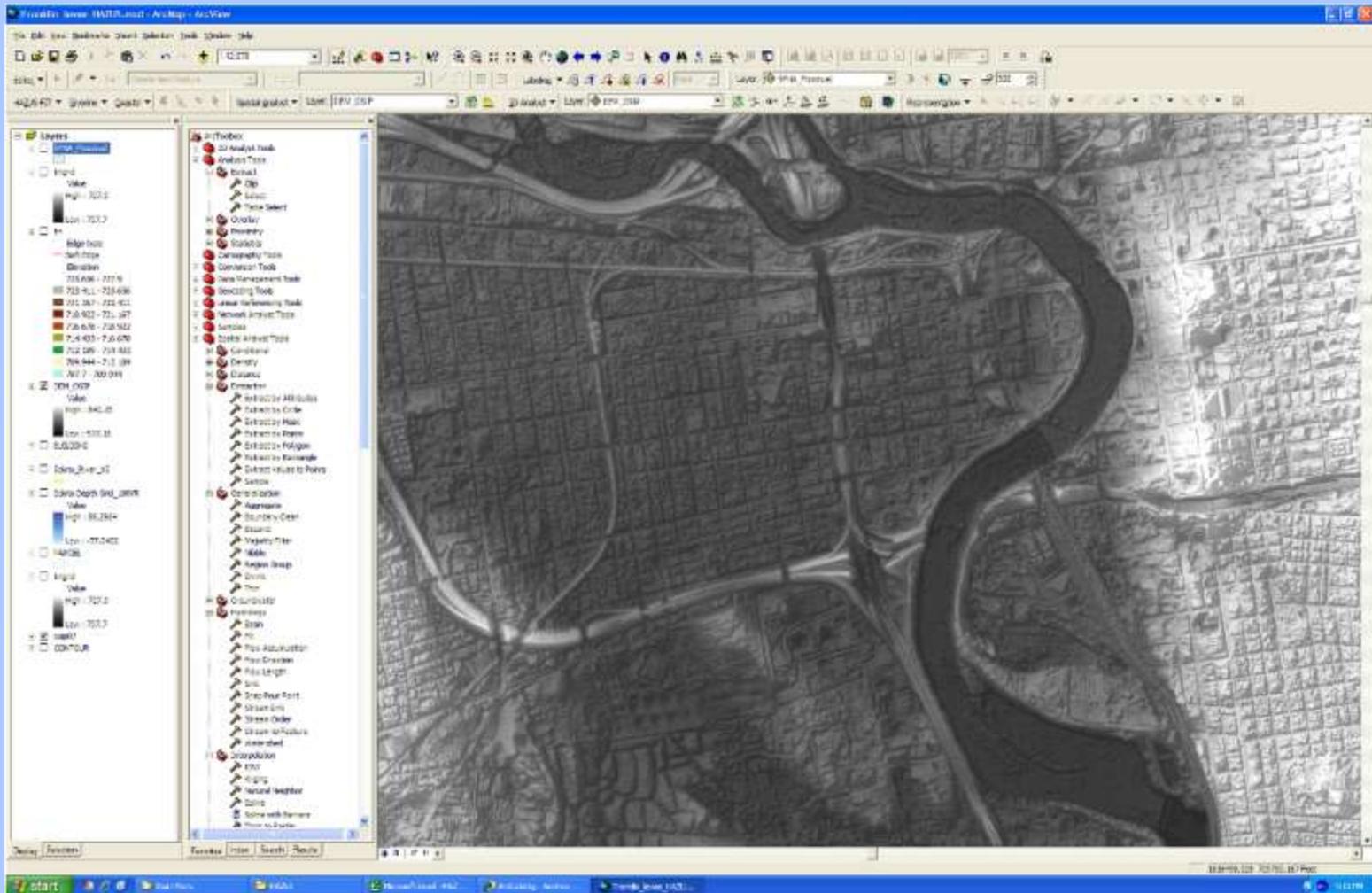
Guernsey County – Tot. Ec. Loss



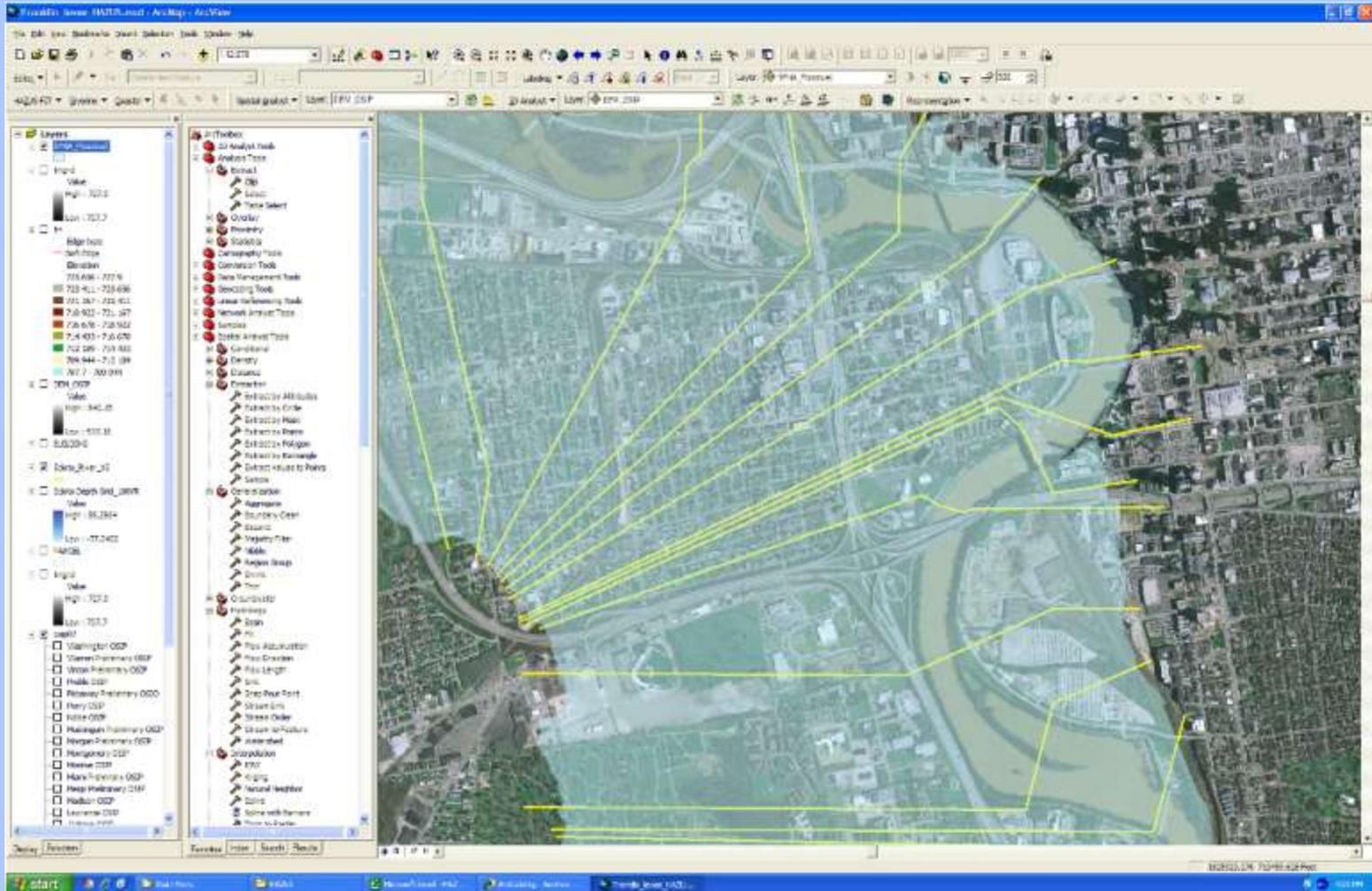
EXAMPLE: City of Columbus



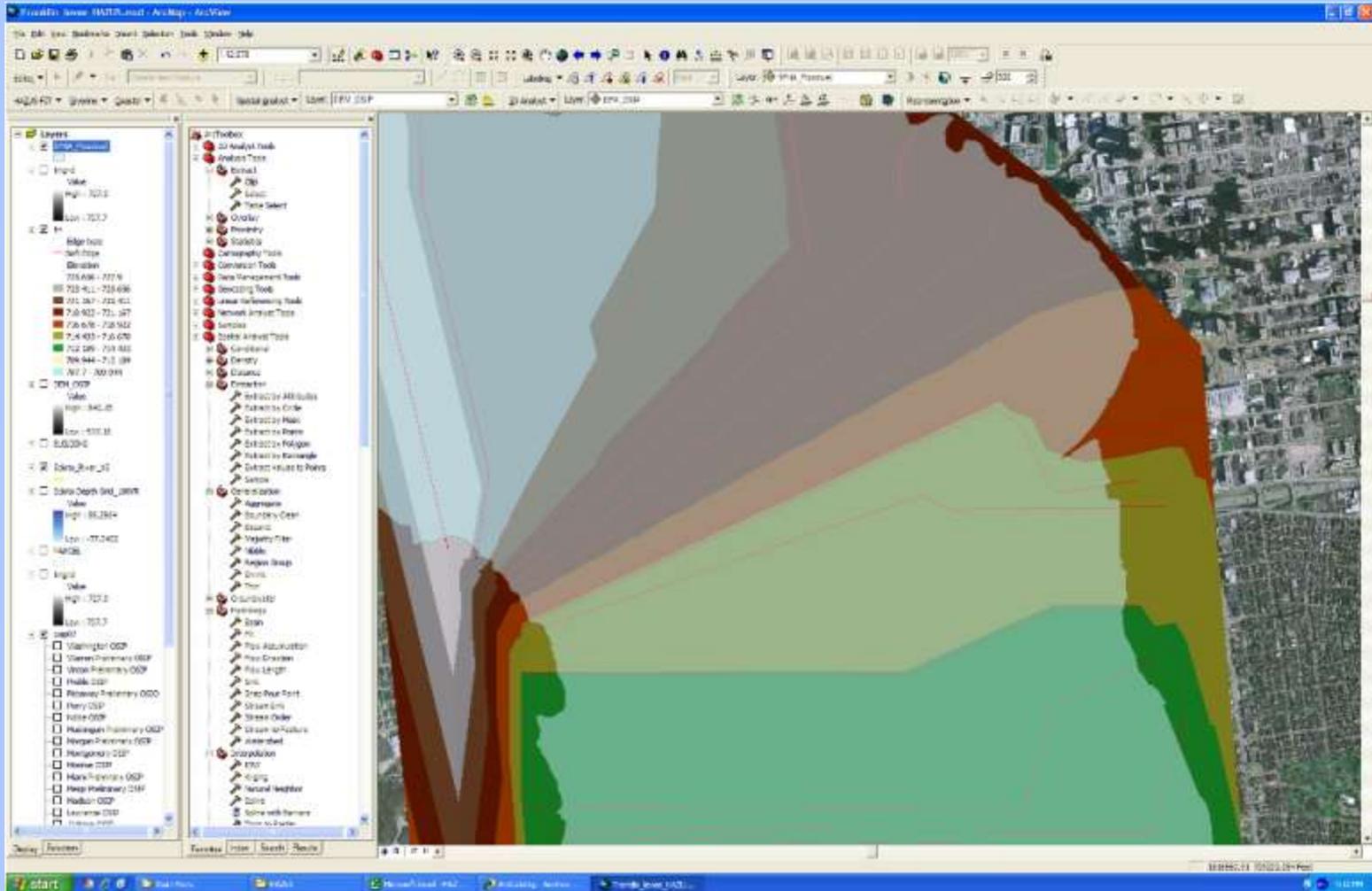
EXAMPLE: City of Columbus



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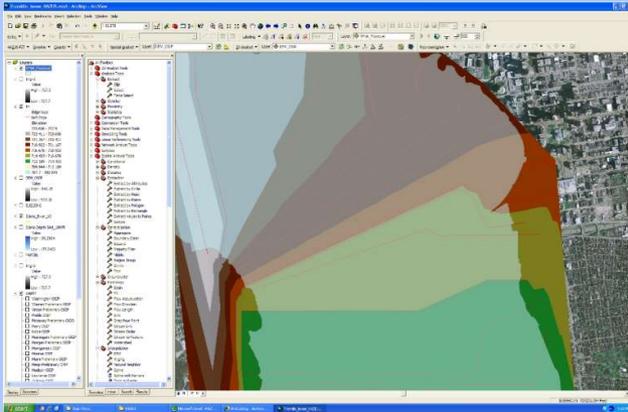


EXAMPLE: City of Columbus

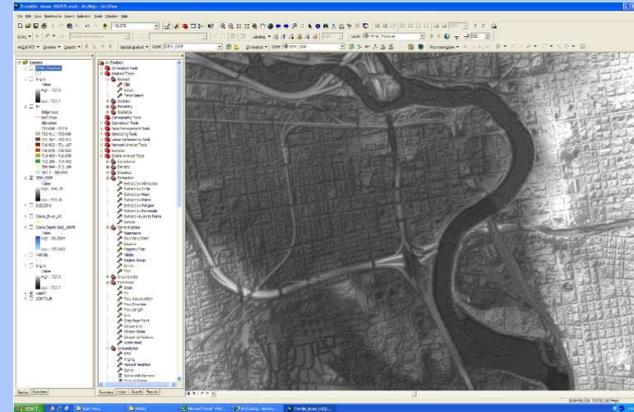


EXAMPLE: City of Columbus

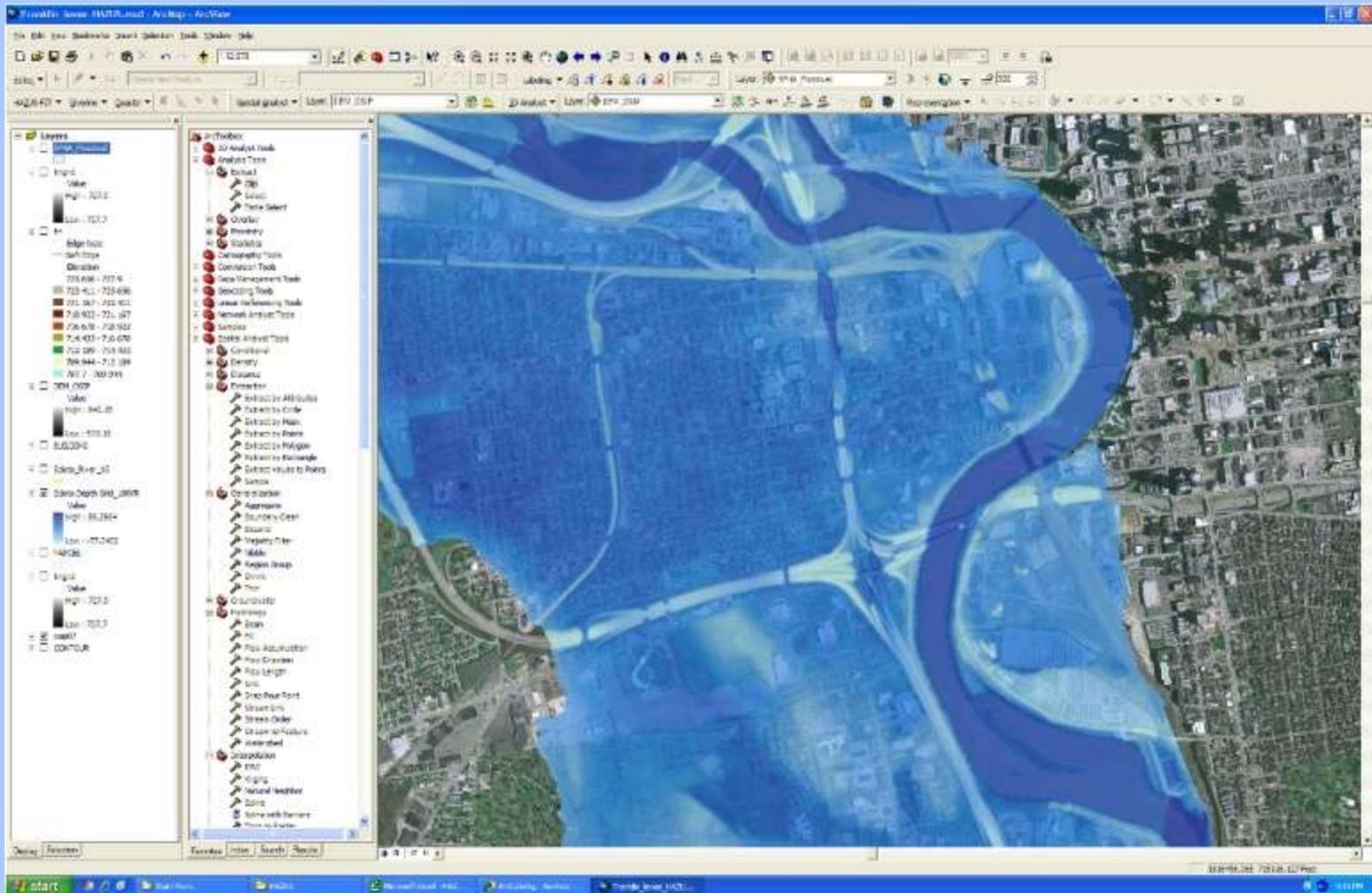
Water Surface Elevations



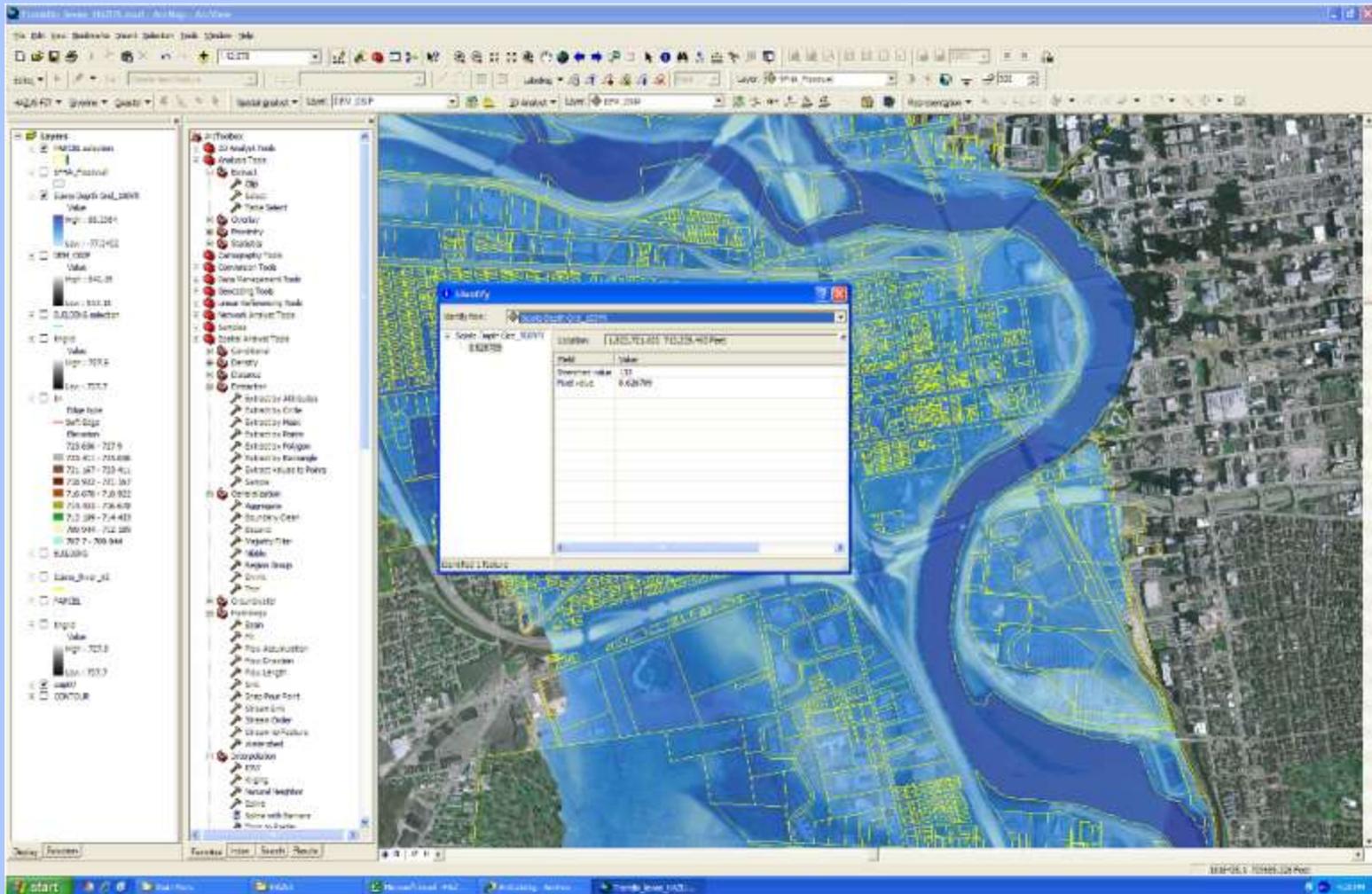
Ground Elevations



EXAMPLE: City of Columbus

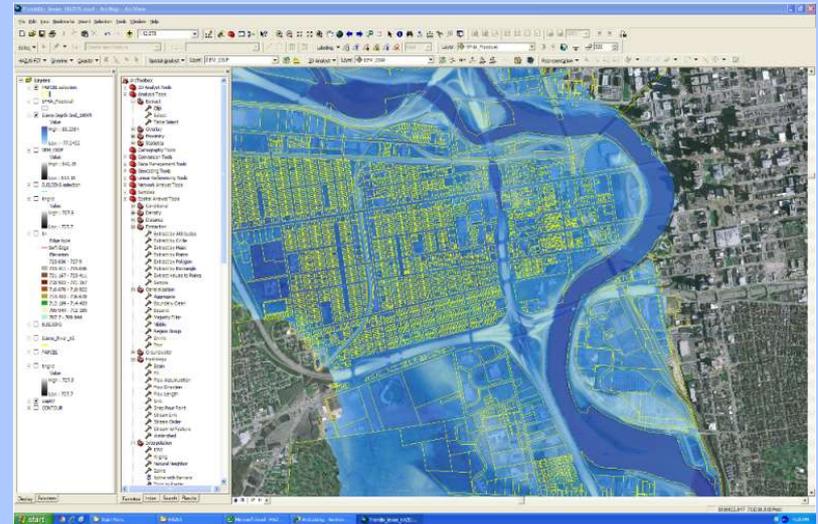


EXAMPLE: City of Columbus



EXAMPLE: City of Columbus

- Depth grid can be incorporated into HAZUS to see potential losses
- Can also incorporate local parcel data via the CDMS tool for more realistic/accurate results



FEMA Resources

- HAZUS-MH Overview
- Software Order Forms
- Training / Conference Information
- FAQs

HAZUS

FEMA's Software Program for Estimating Potential Losses from Disasters

HAZUS-MH is a powerful risk assessment software program for analyzing potential losses from **floods, hurricanes, winds, and earthquakes**. In HAZUS-MH, current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs.

HAZUS-MH
EARTHQUAKE • WIND • FLOOD

FEMA Announces Release of MR2
FEMA announces the release of **HAZUS-MH ME2** (HAZUS-MH Version 1.2), an updated and revised version of HAZUS-MH. Included with the new release is an updated version of the **Flood Information Tool (FIT)**, the **Inventory Collection Survey Tool (InCAST)**, and the Building Inventory Tool (BIT). Go to the **Frequently Asked Questions (FAQs)** for additional information on each of the HAZUS-MH models.

Federal, State and local government agencies and the private sector can now **order HAZUS-MH** free-of-charge from the FEMA Distribution Center. **Click Here for Technical Support Guidance**

Potential loss estimates analyzed in HAZUS-MH include:

- **Physical damage** to residential and commercial buildings, schools, critical facilities, and infrastructure;
- **Economic loss**, including lost jobs, business interruptions, repair and reconstruction costs, and
- **Social impacts**, including estimates of shelter requirements, displaced households, and population exposed to scenario floods, earthquakes and hurricanes.

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FEMA 900 E. Street SW, Washington, D.C. 20472
Disaster Assistance: (800) 621-FEMA, TTY: (800) 462-7596



Training

- Classroom Courses

- ArcGIS for Emergency Managers
- Basic HAZUS-MH
- HAZUS-MH for Floods
- HAZUS-MH for Earthquakes
- HAZUS-MH for Hurricanes
- Using HAZUS for Risk Assessment
- Comprehensive Data Management for HAZUS-MH
- HAZUS for Floodplain Managers
- Using HAZUS for Disaster Operations
- http://www.fema.gov/plan/prevent/HAZUS/hz_trngconf.shtm

- Virtual Courses

- Seven courses now available on the ESRI Virtual Campus
- http://www.fema.gov/plan/prevent/HAZUS/hz_virtualtraining.shtm



Last thoughts...

- 30 minutes isn't enough time for this discussion!
- HAZUS-MH is a “good” emergency management tool
 - How good depends on input data
- Local data can be incorporated in various ways
- Always need to remember that these results cannot be taken at face value
 - Needed to understand trends and relationships



Thanks for your attention!

