JOB AID 2-1: LEVELS OF HAZUS-MH ANALYSIS: INPUTS, USES, AND OUTPUTS

	HAZARD TYPE			
EARTHQUAKE	**FLOOD (RIVERINE)**	**FLOOD (COASTAL)**	**HURRICANE**	**OTHER HAZARDS**
Level 1 Analysis – create a study region, select a scenario, run a scenario, and get results.				
Inputs: No additional data required for this analysis. Soil type is assumed to be stiff soil (Type D as classified by the National Earthquake Hazards Reduction Program [NEHRP]). Level 1 analysis assumes no liquefaction and no landslide susceptibility. Note: water depth is not important if no liquefaction potential is assumed.

Use: Practical for larger areas (county or multi-county), such as statewide risk assessment efforts, and for general prioritization of jurisdictions by potential loss.

Outputs: Ground shaking and loss estimates (see Job Aid 4-1 in Appendix F). | **Inputs:** Download USGS Digital Elevation Model (DEM) data (available from http://seamless. usgs.gov/) for all watersheds that intersect the boundary of your study region (even if the majority of that watershed lies outside your study region).

Generate a stream network, which is a collection of all reaches capable of causing flooding; then use this to specify a drainage area (the minimum area you can specify is 1 square mile). Then you can select a scenario; for the flood hazards, this is called a flood case study.

Use: Practical for larger areas. (county or multi-county)

Outputs: Discharge frequency curve, flood depth (done within HAZUS-MH), and loss estimates (see Job Aid 4-3 in Appendix F) | **Inputs:** DEM and geometry of the 100-year still water area. You also can specify the type of coastal characteristics you have (wetlands, protected by rigid structures, or sandy, beaches, and small dunes). You also need to determine the still water elevation.

Use: Practical for larger areas.

Outputs: Discharge frequency curve, dune erosion, flood-prone areas, flood depth due to surge (done within HAZUS-MH), and loss estimates (see Job Aid 4-3 in Appendix F | **Inputs:** None required. Level 1 analysis includes a surface roughness map and a tree map (vegetation map). You can select Census block or tract level analysis.

Use: Recommended for analysis of either large or small areas.

Outputs: Wind speed and loss estimates (see Job Aid 4-2 in Appendix F). | Third party models provided with HAZUS-MH or being considered to supplement HAZUS-MH can support the evaluation of other hazards.

The **ALOHA model** is a third-party model. This tool allows modeling of chemical release events as air dispersion plumes.

FLOODWAV is a third-party model that can assist in modeling dam breach impacts. The outputs of these models (hazard areas) can be overlain with inventory data to assess exposure.

Other models may be added over time or can be used by knowledgeable parties. |

HAZARD TYPE

EARTHQUAKE	FLOOD (RIVERINE)	FLOOD (COASTAL)	HURRICANE	OTHER HAZARDS

Level 2 Analysis – create a study region, refine HAZUS-MH provided data, select a scenario, run a scenario, and get results.

EARTHQUAKE	FLOOD (RIVERINE)	FLOOD (COASTAL)	HURRICANE	OTHER HAZARDS
Inputs: Additional hazard data including: • NEHRP soil type map • Liquefaction susceptibility map • Landslide susceptibility map • Water depth map You also will integrate your improved inventory data, as available. **Use:** Recommended for earthquake-prone areas, where regional or local data for the above items can be obtained. Modeling can then be targeted to smaller geographic areas. **Outputs:** Ground shaking, ground failure, and refined loss estimates (see Job Aid 4-1).	**Inputs:** You will use the Flood Information Tool (FIT) to add locally collected flood and terrain data (USGS DEM/topographic data can be used). Data you will need for FIT include: • DEM • Flood-prone areas (FIRM, DFIRM, Q3, and base flood elevation at different cross sections). Also, you will need updated inventory data (focusing on refining first floor elevation data for buildings and inventory in flood zone areas). **Use:** Level 2 is designed for localized flood analysis (city or smaller) and is not recommended for large areas; use Level 1 or the flood macro (see **Other Options**, below) for large areas. **Outputs:** Discharge frequency, flood depth (done in FIT), and refined loss estimates (see Job Aid 4-3).	**Inputs:** To run a Level 2 analysis you will improve inventory data. You also can refine the 100-year still water boundary (optional). You can refine the shoreline location. **Use:** Can be used for large or small areas. **Outputs:** Discharge frequency curve, dune erosion, flood-prone areas, flood depth due to surge (done within HAZUS-MH), and refined loss estimates (see Job Aid 4-2).	**Inputs:** You may want to refine the surface roughness and vegetation (tree cover) maps, both of which are compiled at the Census tract level in the HAZUS-MH provided data. If you improve these layers data (to the block level), you can take advantage of the model's block-level aggregation level. You also will improve the inventory data to the extent feasible. **Use:** Can be used for large or small areas; block-based analysis will slow your processing time, but is recommended when you need loss detail at that level. **Outputs:** Wind speed and refined loss estimates (see Job Aid 4-1).	Third party models provided with HAZUS-MH or being considered to supplement HAZUS-MH can support the evaluation of other hazards. For a Level 2 analysis, you will use updated inventory data. See text under Level 1 for a brief description of the **ALOHA** and **FLOODWAV** models.

HAZARD TYPE

EARTHQUAKE	FLOOD (RIVERINE)	FLOOD (COASTAL)	HURRICANE	OTHER HAZARDS
Level 3 Analysis – create a study region, refine HAZUS-MH provided data, adjust model parameters, select a scenario, run a scenario, and get results.				
Use: A Level 3 analysis can be used to study mitigation alternatives, including benefit/cost analyses.				See text under Level 1 for a brief description of the **ALOHA** and **FLOODWAV** models.
Inputs: Refined data and a strong understanding of each model are needed. In addition, experts that understand the hazard damage functions will be required.				
Outputs: Benefit/cost results and mitigation strategy-related loss estimates.				
Other Options – tools to assist your analyses and use of scenario data.				
A HAZUS-MH Risk Assessment Tool (RAT) has been developed to support review of loss estimate outputs. The RAT is a third-party model that can be used after your scenarios are run. The tool supports the development of outputs that address the items recommended for inclusion in your risk assessment as part of DMA 2000.	A HAZUS-MH RAT has been developed to support review of loss estimate outputs (see earthquake description). A Flood Wizard model has been developed as a third-party complement to HAZUS-MH. The Flood Wizard provides county or regional flood results using DEM and flood polygon data. Also, the flood module of HAZUS-MH allows mitigation option analysis for the Level 1 and 2 stages of analysis. Options include levees, different first floor building elevations, and upstream storage measures (dams, retention ponds, and diversions).	A HAZUS-MH RAT has been developed to support review of loss estimate outputs (see earthquake description). A Flood Wizard model has been developed as a third-party complement to HAZUS-MH. The Flood Wizard provides county or regional flood results using DEM and flood polygon data. Also, the flood module of HAZUS-MH allows mitigation option analysis for options such as different first floor building elevations.	A HAZUS-MH RAT has been developed to support the review of loss estimate outputs (see earthquake description). Also, the hurricane module supports mitigation analysis for simple mitigation options related to single- and multi-family dwellings.	Other models are being considered for use in conjunction with HAZUS-MH. Also, the inventory data in HAZUS-MH can be overlain with a variety of hazard area maps to assess exposure (see also, Step 4., Estimate Losses).

JOB AID 2-2: HAZARD DATA SOURCES

Hazard	Hazard Maps	Hazard Sources for Data
Multiple	Various maps and hazard event data	A recommended first resource is http://www.hazardmaps.gov. This web site is part of a FEMA multi-hazard mapping initiative. The web site includes information for hazards indicated with a * below.
	Liquefaction Maps	State geological survey; USGS web site and offices; University of Washington Soil Liquefaction web site; and Association of Bay Area Governments Liquefaction Maps and Information
	Landslide Maps	http://landslides.usgs.gov/html_files/nlicsun.html (general information); http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html; and state geological survey
	Water Depth Maps	Local floodplain manager
Earthquake	Soil Maps	http://ngmdb.usgs.gov/ngmdb/ngm_catalog.ora.html (appropriate for identifying NEHRP soil types used in HAZUS-MH model)
	General information on Earthquakes	USGS Earthquake Hazards Program web site; "Seismo-Surfing" Earthquake Information Links, by Pacific Northwest Seismograph Network web site; National Geophysical Data Center (NOAA), including significant earthquake database web site; California Geological Survey Seismic Hazard Mapping Program web site; and FEMA National Earthquake Hazard Reduction Program (NEHRP) web site
	Digital Elevation Models	Recommended site: http://seamless.usgs.gov; other sites: http://rockyweb.cr.usgs.gov/elevation/dpi_dem.html (shows how to download DEM or order them from USGS by fax or phone); http://data.geocomm.com/catalog/RQ/group4.html
Flood	Q3, FIRM, DFIRM, or Floodway Maps showing flood polygons (for example, base flood zone)	http://www.fema.gov/fhm/dfm_ovrw.shtm; digital Q3 floodplain data (where available) at http://www.hazardmaps.gov (shows DFIRM, Q3 availability as well); http://store.msc.fema.gov, or your local or state floodplain manager; and ESRI Hazard Mapping Tool web site

Hazard	Hazard Maps	Hazard Sources for Data
Flood (continued)	Base Flood Elevation	Can be read from FIRM panels where determined, and can be downloaded with the DFIRM where available; DFIRM coverage is summarized at http://www.hazardmaps.gov
	General information about flood hazards	NOAA Operational Significant Event Imagery Archive (National Geophysical Data Center) USGS Hazard Factsheets (Information Clearinghouse) FEMA Hazards Compendium (Flood)National Flood Insurance Program FEMA Flood Hazard Mapping Tool
Avalanche	Elevation Contour Maps	http://data.geocomm.com/dem/demdownload.html
	Information resources for avalanche hazard	U.S. Forest Service (USFS) National Avalanche Center American Avalanche Association (Avalanche Research) web site
Coastal Erosion	Historic aerial photographs	http://edc.usgs.gov/index.html USGS Center for Coastal Geology (Comparative Oblique Photos)
	General information on coastal erosion	FEMA Coastal Erosion Hazard Information National Hurricane Center USGS Center for Coastal Geology
Coastal Storm	Coastal Storm Maps and general information	http://www.noaa.gov/coasts.html NOAA National Hurricane Center USGS Hazard Factsheets (Information Clearinghouse and Hurricane Resources) web site
Dam Failure	Inundation Maps and general information	Dam studies or local flood experts FEMA's National Dam Safety Program web site
Drought	Drought	http://www.drought.unl.edu/whatis/palmer/pdsihist.htm; http://www.cpc.ncep.noaa.gov/ for Climate Prediction Center Expert Assessments: United States Drought Assessment web site
Extreme Heat	Maximum Temperature Maps	http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/usa.html
Land Subsidence	Land Subsidence Maps	http://water.usgs.gov/ogw/subsidence.html NOAA Ocean and Coastal Hazards web site

Hazard	Hazard Maps	Hazard Sources for Data
Landslide	Landslide Maps and general information	http://landslides.usgs.gov/html_files/nlicsun.html (general information); http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html (map) and state geological survey USGS Hazards Factsheets (Multiple Hazards Information Clearinghouse) web site
Severe Winter Storm	Winter Storm Maps and general information	http://www.gismaps.fema.gov/2003pages/lcurrent.shtm (disaster declarations); http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/usa.html (archive data); http://www.srh.noaa.gov/lzk/html/stormrep.htm (storms reported to NOAA); and NOAA Operational Significant Event Imagery Archive (National Geophysical Data Center) web site
Tornado*	Tornado Maps	http://www.hazardmaps.gov/ (events); and ASCE 7 for design wind speeds http://www.strongtie.com/products/highwind/hw-design-wind-speeds.html
Tornado*	General information on Tornadoes	FEMA Tornado Hazard Information web site; NOAA On-Line Tornado Information web site; and National Weather Service's Tornado Information web site
Tsunami*	Tsunami Maps and general information	http://www.usgs.gov/hemes/coast.html; http://www.pmel.noaa.gov; http://www.geophys.washington.edu; Red Cross Information on Tsunamis web site; and National Geophysical Data Center Information on Tsunamis web site
Volcano*	Lava Flow Maps	Local emergency management personnel; and NOAA Operational Significant Event Imagery Archive (National Geophysical Data Center) web site
Volcano*	Volcanic Activity Maps	http://volcanoes.usgs.gov/Hazards/Where/WhereHaz.html; and NOAA Operational Significant Event Imagery Archive (National Geophysical Data Center) web site
Volcano*	General information on volcanic hazard	Pacific Northwest Seismograph Network web site; and USGS Hazards Factsheets (Multiple Hazards Information Clearinghouse) web site

Hazard	Hazard Maps	Hazard Sources for Data
Wildfire	Fuel Maps	State or local fire and emergency management personnel; and USFS National Fire Danger Fuel ModelsLive Fuel Moisture Ratings web site
	General information on Wildfire Hazards	NOAA Operational Significant Event Imagery Archive (National Geophysical Data Center); and U.S. Forest Service (USFS) Wildfire Assessment SystemFire Weather Analysis Page
Windstorm*	Windstorm Maps	http://www.esri.com/hazards/makemap.html; and High Winds information, including safety precautions and prediction tools
	General information on Windstorm Hazards	National Weather Service's National Hurricane Center (NOAA) web site; National Weather Service Storm Prediction Center web site; Hurricane Information and Awareness web site; and Severe Thunderstorms Information and Event Index web site

NOTE: Information also may be available from other hazard sources. The table above provides a strong starting point for your hazard data needs, but web site addresses can change over time. If you can not locate one of the above sites, you can search the internet using the hazard terms shown in columns 1 and 2 to locate particular information.