

OVERVIEW

The second step in the risk assessment process is to profile the hazards of interest in your study region and consider which ones are priorities based on their likelihood of occurrence, potential magnitude, and past impacts on your community. This step will help you: (1) profile and prioritize hazards for further study, (2) communicate concerns and risks to the public and to decision makers, and (3) develop hazard scenarios that you will use in Step 4, Estimate Losses, for selected hazards.

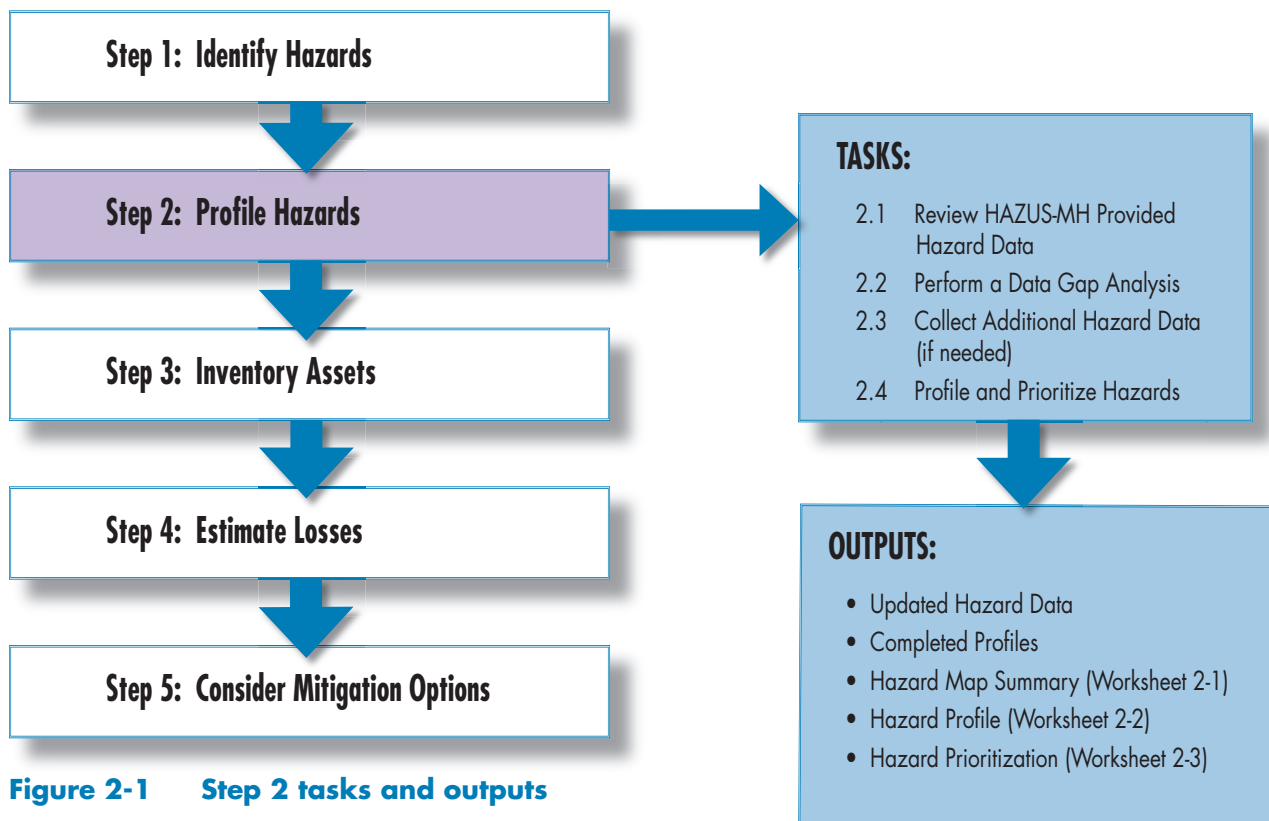


Figure 2-1 Step 2 tasks and outputs

Profiling your hazard is a key element in the preparation of your risk assessment. HAZUS-MH will assist you in this process. Task 2.1 helps you access data residing in HAZUS-MH. Task 2.2 helps you to perform a data gap analysis to understand the quality and relevance of your data and need for additional data collection. Task 2.3 helps you to identify the sources for additional data collection. Task 2.4 provides information on how to prepare hazard profiles and prioritize the hazards that may affect your community. Worksheet 2-1 at the end of this step can be used to identify your hazard data. Worksheets 2-2 and 2-3 can be used to summarize and prioritize your hazards, respectively. The tasks and outputs for Step 2 are shown in Figure 2-1.

Review HAZUS-MH Provided Hazard Data (Task 2.1)

HAZUS-MH provides information that can help you profile earthquake, flood, and hurricane hazards. The text below will help you access and review this data. It will also help you understand hazard characteristic data used to assess risk for these three hazards.



Access HAZUS-MH Provided Earthquake Data

HAZUS-MH provided data includes historic data on the location and magnitude of earthquakes that have occurred in the U.S. The HAZUS-MH historical scenario menus can be used to view the historic earthquake event data. The steps to access this data include:

1. Open the earthquake module and under the Hazard menu, select “Scenario” on the drop-down menu (see Figure 2-2).
2. Select the “Define a new scenario” option shown in Figure 2-3. Then select the “Historical epicenter event” option under Seismic hazard type (see Figure 2-4).



Hazard Profiling Terms

Hazard event – A specific occurrence of a particular hazard.

Frequency – How often a type of hazard occurs.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Duration – How long a hazard event lasts.

Magnitude – A measure of the severity of a hazard event. The magnitude of a given hazard event is usually determined using technical measures that are specific to the hazard.

Intensity – A measure of the effect of a hazard event at a particular place.

Hazard areas – Geographic areas within your study region where specific hazard events are likely to occur or be more intense.

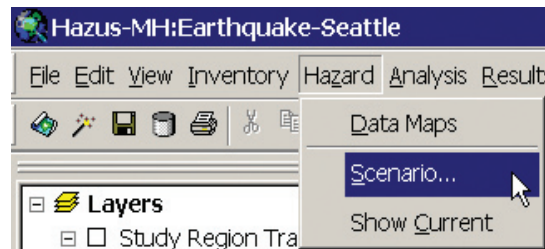


Figure 2-2 Earthquake screen

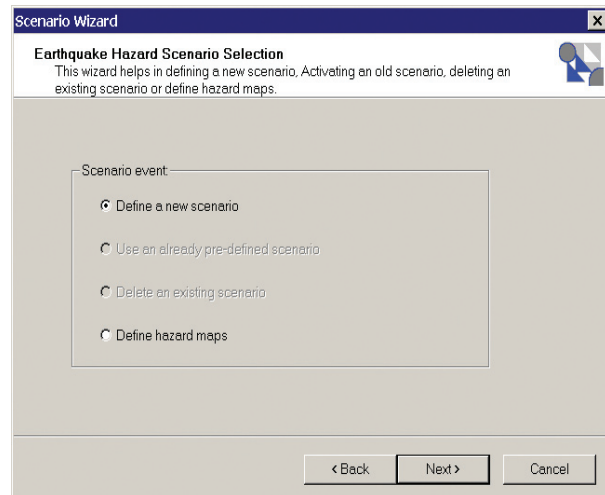


Figure 2-3 Ground motion menu

3. Click on the “Next” button, and a window displaying the earthquake epicenter database will appear (see Figure 2-5). The database contains epicenter details, including the fault name, state, magnitude, fault depth (in kilometers), event date, epicenter latitude and longitude, and source of event information.
4. View earthquake events that have occurred in your particular state for your assigned study region. Click on “State ID” to select the entire column, then right click your mouse while you have the column highlighted and select the “sort” option from the menu. Scroll down to your state to view the historic events.
5. Map historic epicenters by right clicking the mouse button on a specific event record. Select “Map” on the option menu and a window will open with historical epicenters and your study region plotted. The historical epicenters are not physically labeled on the map (see Figure 2-6), but the underlying details of the information can be obtained by selecting a specific epicenter and then using the select button on the toolbar.
6. Position your mouse directly over the epicenter of interest and click the left mouse button once. Click on “Selection Done” to return to the database list, where the selected epicenter record will be highlighted.
7. Add to the information you recorded in Step 1, Identify Hazards, by recording key data from the earthquake epicenter database on Worksheet I-1 (e.g., year, fault, location, epicenter, and magnitude). You will use this information to further profile the earthquake hazard as part of Tasks 2.3 and 2.4.

In addition to historic event data, several local characteristics are important to the earthquake

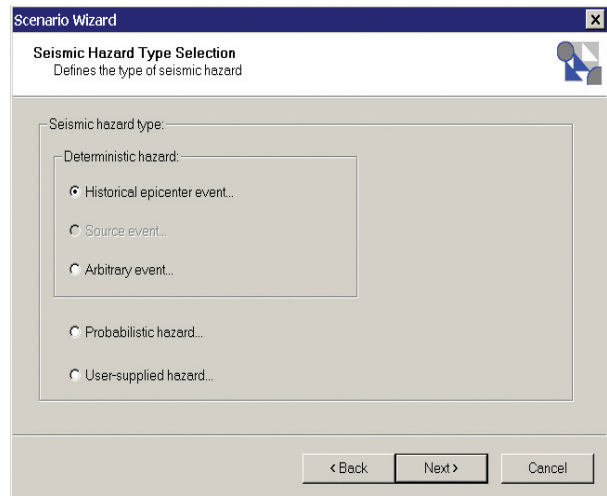


Figure 2-4
Earthquake scenario selection

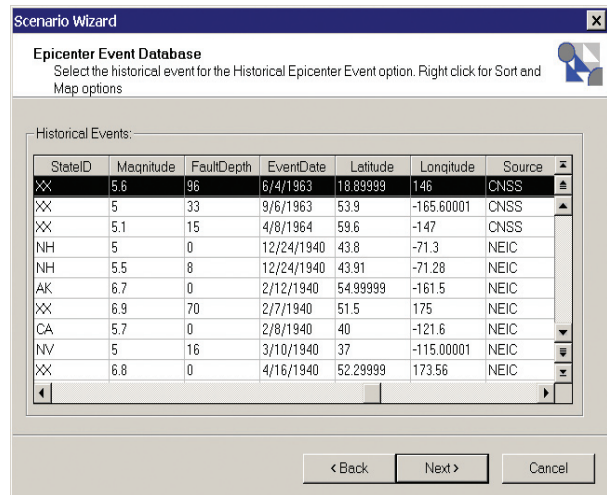


Figure 2-5
Earthquake epicenter database

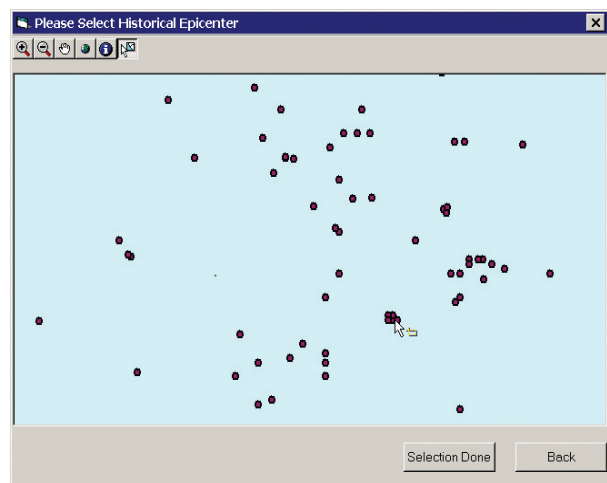


Figure 2-6 Epicenter event map

NOTE



Accessing the map feature also will show you epicenters that may affect your study area, but lie in other states. Record these events as well.

hazard and are addressed by HAZUS-MH provided data. These characteristics include: soil type, liquefaction and landslide potential, and water depth. HAZUS-MH includes a menu that shows you the assumptions used in a HAZUS-MH Level 1 analysis. The assumptions are summarized below:

- The soil type is assumed to be “stiff.” Definitions of this soil type are included in the user manuals for the earthquake hazard (Appendix B of the *HAZUS-MH Earthquake User Manual*).
- Liquefaction potential is assumed to be zero (i.e., liquefaction is not assumed to be a concern).
- Landslide potential is assumed to be zero (i.e., no potential for landslides is assumed).
- Water depth is not included in the provided data. Water depth is the depth to groundwater and is only important for the earthquake hazard analysis if liquefaction potential exists.

Based on these assumptions, HAZUS-MH will provide a Level 1 analysis for your risk assessment.



Access HAZUS-MH Provided Flood Data

Unlike earthquakes and hurricanes, floods are frequent occurrences in most areas of the country. HAZUS-MH does not currently provide historic flood event data. HAZUS-MH does provide stream gauge data that shows high water marks reached during flood events; however, those data do not indicate the year that each high water level was reached. Flood zone maps you will

integrate to support flood analyses address the probability that a flood of a particular intensity will occur in a given period of time. For this hazard, instructions in Task 2.3 will help you collect the hazard data needed to run HAZUS-MH and profile the flood hazard for your study region.

NOTE



As you proceed, remember to keep records of information you have found and where you found it. Your records can include data tables from the HAZUS-MH provided data, copies of documents, maps, notes regarding to whom you talked and when you talked to them, and useful website references.



Access HAZUS-MH Provided Hurricane Data

HAZUS-MH provided hurricane data include historical data on the locations, frequencies (dates of events), and magnitudes of hurricanes in the United States. The HAZUS-MH historical scenario menus can be used to view all of the historical hurricane event data included in HAZUS-MH. The steps to access the data for the hurricane hazard include:

1. Under the Hazard menu, select “Scenario” on the drop-down list (see Figure 2-7).
2. Select “Next” from the Welcome to the Hurricane Scenario Management Wizard.
3. Select the “Historic” option in the scenario operation menu.

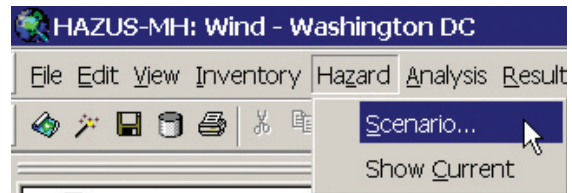


Figure 2-7 Hurricane screen

4. Click on the “Next” button, and a window (see Figure 2-8) displaying a list of historic hurricane events, including the hurricane name, year, peak wind gust (in mph), states affected, and landfall states will appear.

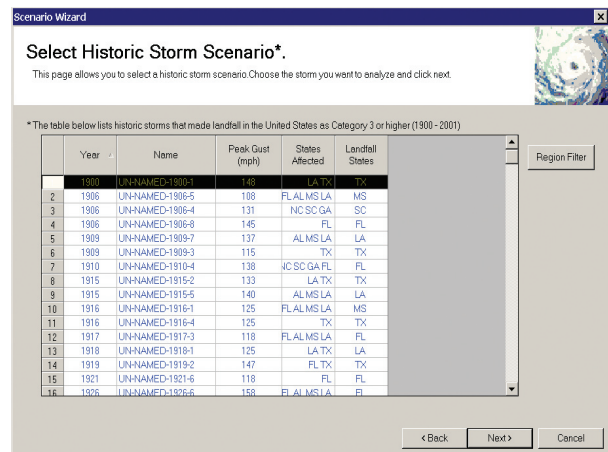


Figure 2-8 Hurricane scenario operation

5. Select the “Region Filter” button on the top right hand side of the screen. The table will now display only the hurricane events that have affected your study region. Record these events on Worksheet 1-1; you will use this information to support further profiling of the hurricane hazard as part of Task 2.3.

The HAZUS-MH hurricane module also includes information on local characteristics that will impact how much damage is incurred should a hurricane occur. This information includes regional surface roughness and tree coverage for your study region. These maps have been developed from national land use and land cover maps. You can view these coverage layers in HAZUS-MH using the parameters function under the analysis option. Based on this information, HAZUS-MH will provide a Level 1 analysis for your risk assessment.

Congratulations! You have now accessed hazard data provided in HAZUS-MH. The data that you have accessed and reviewed will help you to prepare your risk assessment and determine if you need further information to support your written hazard profiles.

By now, you should have gained an understanding of the main hazards in your area and you may have determined additional information you wish to obtain for applying the varying levels of HAZUS-MH analysis. The next step is to consider the data you have against the data you may need.

Perform a Data Gap Analysis (Task 2.2)

The data gap analysis is performed to consider the data you have compared to the data you may want for your risk assessment. Three areas of potential data gaps will be considered:

1. **Hazard data for HAZUS-MH hazard analysis.** Job Aid 2-1 in Appendix D summarizes the types of hazard maps or characteristic data needed for each level of analysis for HAZUS-MH.
2. **Hazard data to map other hazards.** This includes hazard area or characteristic maps you would like to collect for hazards other than earthquakes, floods, or hurricanes. If you wish to map a hazard area in HAZUS-MH, you will need to obtain or create certain hazard characteristic maps.
3. **Hazard data not used for mapping but useful for written hazard profiles (all hazards).** This includes available historic data on events, impacts, severity, intensity, and the probability of future hazard events.

These three areas of consideration are described below.

Hazard Data for HAZUS-MH Hazard Analysis

In order to determine additional local data that you may need for your risk assessment, first, review Job Aid 2-1 in Appendix D. This Job Aid shows the hazard data that HAZUS-MH requires for various levels of analysis. Consider what level of locally-added hazard data is realistic given your risk assessment timeline, resources, and needs.

If you decide to run a HAZUS-MH Level 2 analysis, Worksheet 2-1 will help you review the hazard characteristic information you need. Complete Worksheet 2-1 at the end of this step. First check the box in the “Hazard of Interest” column for each hazard that you identified as a hazard of interest on Worksheet 1-1. The hazard profile maps and data that will support analysis using HAZUS-MH are shown. These maps and data also will help you prepare your written hazard profiles (Task 2.4).

After completing Worksheet 2-1, for the earthquake, flood, and hurricane hazards, you will have a better understanding of the data you have and the data you may need to run a HAZUS-MH Level 2 or Level 3 analysis. Also, you will have an idea of the amount of work and resources that may be required

to obtain additional, local data. At this point, you may decide to substitute large segments of HAZUS-MH provided data or you may become aware that a more complex level of HAZUS-MH analysis is not feasible. In the latter case, you may choose to use HAZUS-MH provided data in combination with limited local data or run a HAZUS-MH Level 1 analysis initially and work toward a Level 2 analysis as local data become available. Remember, a HAZUS-MH Level 1 analysis may be sufficient for your mitigation plan in terms of earthquakes, floods, and hurricanes.

Hazard Data to Map Other Hazards

For hazards not included in HAZUS-MH, a range of maps also can be useful to help profile and evaluate the hazards. Continue with Worksheet 2-1 for the other hazards listed. You will not be able to estimate losses for these hazards using HAZUS-MH, but you can map the hazard areas to support the needs of your risk assessment. In some cases, you can estimate exposure for these hazards using HAZUS-MH. For evaluating reasonable exposure, see Chapter 4 of this How-To Guide.

Hazard Data Not Used for Mapping but Useful for Written Hazard Profiles (All Hazards)

For all hazards, you will need data to help you consider each hazard's overall profile and priority in your region. Worksheet 2-2 shows the categories of data that will be useful. For HAZUS-MH hazards, you can start with historic event data you obtained in Task 2.1 and research further information about these events.

Evaluate Available and Desired Data

For your hazards of interest, review the unchecked boxes in Worksheet 2-1 to potentially identify your data gaps for the hazard area and characteristic maps. As part of Task 2.3, you may want to work to obtain missing mapping data that you have determined is warranted. You will also collect additional data to supplement the analysis for your risk assessment.

All communities face limited budgets and have mandated schedules for their planning efforts. Therefore, your risk assessment team will have to decide how much additional data you can collect based on available funding and schedules. The basis for pursuing or not pursuing further data collection should be sound, defensible, and documented.



Some communities are developing partnerships with a wide range of parties through HAZUS-MH User Groups (HUGs). A HUG is a group of stakeholders who work together to develop local data and apply HAZUS-MH. Your regional HUG can be a great source of information for your risk assessment. It can assist you with local data collection, refinement, and preparation for input into HAZUS-MH. Check with your local planning contacts or FEMA regional office to see if a HUG exists in your region. Additional information on HUGs can be found on FEMA's website at http://www.fema.gov/hazus/us_main.shtm.



FEMA is implementing the Multi-hazard Mapping Initiative (MMI) to encourage data sharing, support standards development, and provide access to hazard event and hazard map data. You can learn more about this initiative and see what data are available for your study region at: <http://www.hazardmaps.gov>

When considering the level of HAZUS-MH analysis to use, you must consider your schedule, the resources available, and the ultimate end uses of the data. When evaluating these factors, remember that local data collected to support HAZUS-MH can also support other local planning, emergency, and mapping needs.

When evaluating additional data collection needs, consider the following questions:

- Do you feel the hazard area, characteristics, and profile data are the “best available data” that you can obtain for your risk assessment?
- Are there other experts or sources that you should contact to make sure that your data are current and to feel confident that you are using the “best available data”?
- Are the missing data related to a hazard that you feel is very important to your community?
- Are there alternate approaches that you can use to address data gaps if you do not have enough data about an important hazard?

Based on your team’s data gap analysis, you may want to collect additional hazard data that you feel are important and reasonable to obtain. Task 2.3 provides information on general and specific sources for additional hazard information.

■ *Congratulations! You have now performed a data gap analysis and can proceed to collect additional hazard data (if needed).*

Collect Additional Hazard Data (If Needed) (Task 2.3)

At this point, you may have decided to collect additional data. Much of the required data may be available already, but it is often located in a number of places and can be in various formats that are not readily usable by HAZUS-MH. Other data, such as a landslide potential map, may need to be created. Both general and specific information sources for hazard event and characteristic data are discussed in this section. Much of this data is being developed and consolidated through efforts such as FEMA’s MMI. For this task, you will perform the following steps to obtain additional data: (1) access general hazard data sources, and (2) access specific hazard data sources.

Access General Hazard Data Sources

Data on natural hazards that might threaten your study region are available from various sources. However, the quality of data can vary widely between communities and between organizations within the communities. During the data collection process, it is important that you maintain a detailed log of your sources (including contact names, dates of telephone conversations or personal meetings, and Internet site addresses) and the quality of the data collected to document in your mitigation plan.

Use Worksheet 2-1 at the end of this chapter to help you track the hazard event data you collect. When possible, electronic data should be obtained to facilitate implementation of HAZUS-MH. You will use specific hazard event dates and locations (obtained from HAZUS-MH for earthquake and hurricane or from other sources) as a starting point to search further for additional data. Based on FEMA's field pilot projects, the following sources of information are typical hazard data sources.

Newspapers and Other Historical Records

These records will often contain the dates of major hazard events, the magnitude of the events, the damage incurred, and references to other past natural disasters in your study region. This type of information is often available at local historical societies or in public libraries.

Existing Plans and Reports

Plans and documents developed for a range of purposes may have information on natural hazards in your community or state. For example, many states already have developed mitigation plans, hazard identification reports, or risk assessment reports. State transportation, environmental, emergency management, and public works departments may have prepared reports or plans that contain relevant information.

Local comprehensive plans, land use plans, and capital improvement plans, as well as building codes, land development regulations, and flood ordinances also can contain hazard provisions that indicate the presence of local hazards. When plans are identified, you can review them to identify hazards that may occur in your study region or that have occurred in the past.

Experts in Your Community, State, or Region

Hazard information is generally available from representatives of the government, colleges and universities, and the private sector. The State



The Internet can support searches on specific hazards and even hazard events. You can complete a key word search and obtain information quickly and at low cost. For example, if HAZUS-MH indicated a CA earthquake in your area in 1906, you could search "California Earthquake 1906" and obtain information about that event to support your written hazard profile.

Hazard Mitigation Officer usually has access to the most current and accurate data regarding hazards in a state. Local floodplain managers; public works department employees; and engineering, planning and zoning, and transportation department personnel also maintain information about natural hazards. Emergency response personnel such as police and fire department employees or local emergency management staff also are excellent sources of information on past hazard events. In addition, many state agencies, including water, natural resources, geological survey, and emergency management agencies, have detailed knowledge about the nature and extent of hazards in your state. Local university departments, including planning, landscape architecture, geography, and engineering departments, may have hazard maps, recent research studies, or other useful data. Local businesses that provide hazard-related services are also a good source of data.

Internet Sites

The Internet sites of many Federal, state, and local government agencies provide access to data regarding natural hazards and their frequency, magnitude, and locations (for example, <<http://www.fema.gov>> and <<http://www.hazardmaps.gov>>). In addition, some sites provide general information about the nature of particular hazard events, the probability of their occurrence, and how hazards are measured. Other websites feature state-specific or area-specific information about hazards (such as the historical occurrence of hazard events and the probability and expected severity of potential hazard events). General search engines also can be searched for specific events or key words and often provide a good starting point with information for your written profiles and areas for further research.

Access Specific Hazard Data Sources

Hazards are often described and characterized using data regarding historic events and maps. Some of these data are available in electronic and hard copy forms from local sources and over the Internet. To run a Level 2 analysis, or to obtain information on hazards not included in HAZUS-MH, you will collect additional hazard data and revisit Worksheet 2-1 to update it with the information you collect.

The “unchecked” maps on Worksheet 2-1 will now be located, to the extent that you determined to be reasonable, as part of Task 2.3. The maps needed to support the earthquake, flood, and hurricane modules of HAZUS-MH will be used to model losses when you estimate losses. Maps shown on Worksheet 2-1 for other hazards also can be imported into HAZUS-MH. You can then use these to support your public involvement and planning work or to estimate exposure as described in Step 4, Estimate Losses. The text

below provides information on specific data sources that can help you obtain the hazard maps and data that you have decided you may need for your risk assessment. The hazards described below include earthquakes, floods, hurricanes, landslides, tornadoes, tsunamis, and wildfires.



Earthquakes

Job Aid 2-1 (Appendix D) summarizes data recommended for the three levels of analysis of HAZUS-MH. Job Aid 2-2 provides sources of data for the earthquake and other hazards. The HAZUS-MH provided data for the earthquake hazard makes a number of general assumptions for a number of characteristics that can impact earthquake losses. Level 1 analysis will provide a risk assessment based on these assumptions. If you wish to change those assumptions based on local data, you need to provide HAZUS-MH with the appropriate data to perform Level 2 or Level 3 analyses. For these two levels of analysis, you can obtain the four data maps discussed below; these maps update your study region's soil type, liquefaction susceptibility, and landslide potential, and water depth. For a summary of how to obtain these maps see Table 2-1.

Soil Maps

Local geological data in the form of soil maps depict the effects of ground motion on local soils, landslide, and liquefaction. Soil maps describe the surface soils in your area. In order to improve the analytical capabilities of the HAZUS-MH earthquake model, local soil data must replace the general assumptions made in HAZUS-MH. You can refine the data in HAZUS-MH in two ways: (1) changing the soil type assumption provided with HAZUS-MH, or (2) importing a soil map into HAZUS-MH. The most refined analysis is produced by the second option.

Soil maps of high resolution (1:24,000 or greater) or lower resolution (1:250,000) are usually available from geologists, regional USGS offices, state geological agencies, regional planning agencies, or local government agencies. The geological maps typically identify the age, depositional environment, and material type for a particular mapped geologic unit. The soil maps in HAZUS-MH require National Earthquake Hazards Reduction Program (NEHRP) soil classification types (Appendix B of the *HAZUS-MH Earthquake User Manual*). If you have soil survey or other soil classification maps, a geologist can assist in converting data to the required classification scheme.

Liquefaction Susceptibility Map

A Level 1 analysis in HAZUS-MH assumes that your area does not have the potential for soil liquefaction. In areas with a potential for liquefaction, a HAZUS-MH Level 1 analysis may underestimate the potential damage for your study region. You can change this assumption in HAZUS-MH by (1) changing the liquefaction potential parameter, or (2) importing a liquefaction map. The second option provides the most refined analysis.

Liquefaction susceptibility maps, usable for analysis in HAZUS-MH, exist only for a limited number of areas. For example, the Applied Technology Council (ATC) has published a summary of available regional liquefaction hazard maps. If liquefaction susceptibility maps are not available for your region and liquefaction is a potential hazard in your area, a geologist or a geotechnical engineer will need to provide input on the potential for liquefaction or develop a liquefaction map for you. The level of effort required will depend on the size of your region and the desired resolution of the contours. A simple map may require only a month, but a detailed map at a high resolution (1:24,000 to 1:50,000) may require a separate study that could take several months or years to complete. In any case, look for maps available in a digital format to assist your effort.

Landslide Potential Map

Landslide hazard maps show the extent of land area subject to the threat of landslides, including areas where landslides have occurred in the past, where landslides are likely to occur now, and where they could occur in the future. Landslide potential maps contain detailed information on the types of landslides, the extent of the slope subject to failure, and the probable maximum extent of ground movement. These maps can be used to predict the relative degree of hazard in a landslide area. You can change the HAZUS-MH assumption of no landslide potential by (1) changing the landslide potential parameter, or (2) importing a landslide map. The second option provides the most refined analysis.

Water Depth Map

If liquefaction is a concern in your area, water depth data are also important. The water depth data estimate the vertical distance from the land surface to the top of the groundwater aquifer (i.e., the groundwater-saturated layer). You can change the HAZUS-MH provided depth assumption by (1) changing the water depth potential parameter, or (2) importing a water depth map. The second option provides the most refined analysis.

These maps most likely already exist at a state level and can be obtained from state environment or natural resource agencies that manage water resources or control groundwater pollution. Local university hydrogeology departments or regional water authorities may also have current detailed information on groundwater depths in readily available formats.

Sources of Earthquake Hazard Profile Information

Table 2-1 lists national sources of digital data that can help you prepare your hazard profile. Example 2-1 at the end of this chapter presents an example earthquake hazard profile, compiled from information similar to sources you may access and use. Job Aid 2-2 also lists data sources.

Table 2-1: Earthquake Hazard Characteristic Data Sources

Map	Source
Soil Surveys and Maps	Natural Resources Conservation Service (USDA)
Liquefaction Maps	Applied Technology Council Summary of Regional Maps
Landslide Maps	National Landslide Information Center (USGS)
Groundwater Depth Maps	Various natural resource agencies State Engineer's Offices (State-specific; Data from registered wells in state) USGS Groundwater Site Inventory (contains data from more than 850,000 federal wells)

Manage Your Earthquake Hazard Data

Create a hazard map directory on your hard drive if you have not done so already. Download the digital maps and place the maps in the hazard map directory. Also, be sure to update Worksheet 2-1 as you proceed. These maps or data from them will be integrated into HAZUS-MH during Step 4, Estimate Losses.



Floods (Coastal and Riverine)

HAZUS-MH provides three levels of analysis. Job Aid 2-1 (Appendix D) shows the different hazard data needs to implement a Level 1, 2, or 3 analysis for the flood hazard. The Level 1 analysis level requires the least input by the user. A Level 2 analysis improves the results by considering additional data that are readily available or can be converted to the model requirements. For a Level 2 analysis, users will employ the Flood Information Tool (FIT) to pre-process their flood hazard data. All components of flood analysis using HAZUS-MH can be performed at this level, with the exception of velocity analysis.

A Level 3 analysis is an advanced data and models analysis requiring detailed engineering and hazard studies and is not addressed in this How-To Guide.

Sources of Flood Hazard Profile Information

FEMA has prepared Flood Insurance Studies (FIS) for flood-prone communities. These FISs contain information on historic flood events, flood problems, and other flood information available for local areas. A FIS contains a Flood Insurance Rate Map (FIRM), which is an official map of a community that shows areas at risk from flooding. FEMA has created FIRMs for more than 19,000 communities in the U.S. as part of the FIS program. In addition to base flood zones, or 100-year floodplains, which are defined as areas with a 1 percent chance of flooding in any given year, the FIRMs illustrate coastal high hazard areas, floodways, and 500-year floodplains, which are areas with a 0.2 percent chance of flooding in any given year. Another element of the FIS is a graph, also known as a flood profile, which shows potential flood elevations plotted along waterways. This information will help delineate the boundaries of the floodplain in your study region.

The data categories needed to run the HAZUS-MH flood module include ground elevation data, floodplain boundary, and flood depth maps. Example sources of hazard data are shown in Table 2-2 and are discussed below.

The information in the table shows the requirements for different levels of HAZUS-MH analysis. Job Aid 2-2 also lists data sources.

Table 2-2: Flood Hazard Data Needs and Sources

Map	Required for	Source
Ground Elevations, as Digital Elevation Model (DEM)	Riverine and coastal flood (Level 1, 2, or 3, and Flood Wizard)	http://seamless.usgs.gov/ Microsoft TerraServer
Shoreline Maps	Coastal flood (Level 2 or 3)	Local maps to update HAZUS-MH map NOAA Coastline and Bathymetric GIS Data
100-Year Stillwater Elevation	Coastal flood (Level 2 or 3)	FEMA USGS Surface Water Resources
Floodplain Boundary	Riverine flood (Level 2 or 3, and Flood Wizard)	FEMA On-Line Hazard Maps ESRI On-Line Hazard Maps
Base Flood Elevation	Riverine flood (Level 2 or 3)	FEMA On-Line Hazard Maps

Ground Elevations

All three levels of HAZUS-MH analysis will require you to download ground elevation data. The flood wizard discussed in Step 4 also requires these data. Ground elevation data can be in several formats, including a Digital Elevation

Model (DEM), a Triangular Irregular Network (TIN), or contour lines. If your data is a TIN or available as contour lines, you will need to use the FIT to integrate the data into HAZUS-MH. A DEM does not need to be modified. A basic DEM may be downloaded at the USGS web site, <http://seamless.usgs.gov/>. A higher resolution DEM might be obtained from your local mapping office. The USGS also sells higher resolution DEMs in some parts of the country; visit the USGS web site for more details. The FEMA MMI discussed earlier also provides access to Q3 data and DFIRM maps (see floodplain boundary below).



The Flood Information Tool (FIT) is part of the HAZUS-MH family of products provided by FEMA. It is used to integrate local flood maps into HAZUS-MH. The FIT is detailed in Step 4.

Shoreline Map and 100-Year Stillwater Elevation

Local data are required for a more refined coastal flood analysis (Level 2 or 3). A shoreline map is provided with HAZUS-MH, but if the shoreline has changed over time, you will want to update that map with local data. The 100-year stillwater elevation map is usually available for coastal areas as part of the FIS. Coastal hydrologic data are also available from the National Oceanic and Atmospheric Administration (NOAA).



The FEMA Map Modernization Initiative (MMI) is updating flood data across the country. This will provide digital FIRM (DFIRM) data for the entire country and supply the ground elevation, floodplain boundary, and base flood elevation data needed for the riverine and coastal flood analyses.

Floodplain Boundary and Base Flood Elevation

Both the floodplain boundary and the base flood elevation data for your area can be derived from the FIRM. Using a copy of the FIRM, you will evaluate the 100-year flood. FEMA is currently converting FIRMs to a digital format. The DFIRM product will allow the creation of interactive, multi-hazard digital maps that can be used with HAZUS-MH. Digital quality level 3 flood data (Q3) also are available for 1,200 counties in a CD-ROM format. The Q3s are digital representations of certain features of FIRMs and can be used with HAZUS-MH. The Q3s are used for hazard mitigation planning, floodplain management, land use planning, natural resource and environmental analysis, and insurance target marketing. They are designed to provide the general locations of Special Flood Hazard Areas (SFHAs). The main difference between the Q3s and the official paper FIRMs is that the Q3s do not include the following:



The flood model uses the term “case study” instead of scenario because the selection of an “arbitrary event” is not possible. The flood model allows you to study your entire region as a case study or to focus on particular, smaller areas of concern.

- Hydrographic features (streams, rivers, lake, and coastal shorelines)
- Base Flood Elevations (BFEs)

- Cross-section lines
- Roads, road names, or address ranges
- Locations, elevations, and descriptions of benchmarks and elevation reference marks



Copies of FIRMs can be requested

(1) by calling the FEMA Map Service Center at 1-800-358-9616

(2) by accessing the Internet at: <http://www.fema.gov/maps/>

(3) by contacting a FEMA regional office

Additionally, FIRM information is available at: <http://www.fema.gov/fhm/>

To request copies of the FIRM for your study region, or to identify areas that are prone to coastal hazards and storm surge, contact your National Flood Insurance Program (NFIP) coordinator or floodplain manager. These specialists usually work in the planning, building, engineering, or natural resource departments of local and state agencies. Coastal communities and states with a coastline also

should determine areas of coastal flooding, which are characterized as V zones and A zones, oriented approximately parallel to the shoreline.



Coastal Flood Zone Classifications

“A” Zone – An area with an elevation below the Base Flood Elevation (BFE), where the waves are expected to be less than 3 feet during the 100-year flood.

“V” Zone – An area with an elevation below the BFE, where waves are expected to be greater than 3 feet during the 100-year flood. V zones are subject to coastal high hazard flooding.

Verify that the FIRM is Current and Complete

Floodplains are susceptible to changes. From time to time, FEMA, communities, or individuals may find it necessary to update, correct, or otherwise change the FIRM. Review the FIRM to determine whether any of the following circumstances apply to your study region:

- Significant construction has occurred within the floodplains already identified on your FIRM.
- Upstream communities have had significant development since the FIRM was published.
- Inundation patterns indicate that the FIRM boundaries are no longer accurate.
- A major flood control project has been completed in your community or upstream of your community.
- Changes have impacted topography in, or adjacent to, mapped floodplains.

If there has been a coastal storm since the date of the FIRM, the coastline and hazard zones may no longer be accurate. Coastal storms can either erode or extend the coastline, possibly causing the flood hazard zones to change. Consult your local floodplain coastal zone manager for further advice. Information can be found at <http://edc.usgs.gov/index.html>.



If your study region is not within a 100-year floodplain, you may elect to concentrate on other hazards because your flood risk is, by definition, relatively small. However, you may still have flood risks associated with one or more of the following, which are not shown on the FIRM:

- Drainage areas of less than 1 square mile
- Sewer backup
- Drainage system backup
- Dam breaches
- Stormwater runoff problems

Sources of Flood Hazard Profile Information

In addition to the characteristic data required to support HAZUS-MH, you will need to research historic flood events and the potential for flooding in your area to support your written flood profile. You can use the general and specific sources listed in this section to collect those data. Use Job Aid 2-2 as a starting point to identify other sources of data to help you profile background and local conditions, probability of occurrence, damage, and hazard areas (floodplain boundaries for your area).

Manage Your Flood Hazard Data

Create a hazard map directory on your hard drive if you have not done so already. Download the digital maps found at the sources listed above and place the maps in the hazard map directory. These maps will be integrated into HAZUS-MH in Step 4. Keep the other data you have collected to help you complete Worksheet 2-2, as part of Task 2.4.

Use of the Flood Macro Wizard

FEMA developed a Flood Macro Wizard (Flood Wizard) that facilitates the preparation of flood risk assessments. The Flood Wizard allows you to automatically process flood data to evaluate exposure and develop loss estimates for the inventory in your study region. To use the Flood Wizard, you will (1) install the Flood Wizard, (2) execute the flood program, (3) identify the inputs, (4) run the analysis, and (5) view the results.

1. **To install the Flood Wizard.** Insert the Flood Wizard CD-ROM and wait for the auto run feature to start. The Flood Wizard installation menu will appear. Click “Next” to proceed. The installation menu will prompt you for a destination directory (see Figure 2-9). Type another directory name if the default directory is not your preference. Click “Next” to proceed with the installation. Installation progress is indicated by the status bar in the center of the screen. The installation is complete when the “Next” option becomes available (see Figure 2-10). Click “Next.”

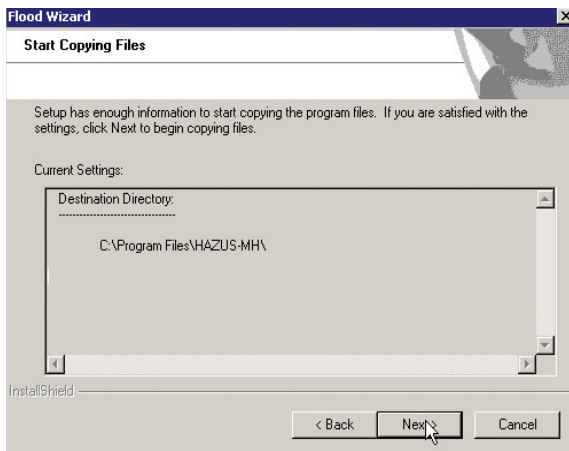


Figure 2-9
Flood Wizard destination directory

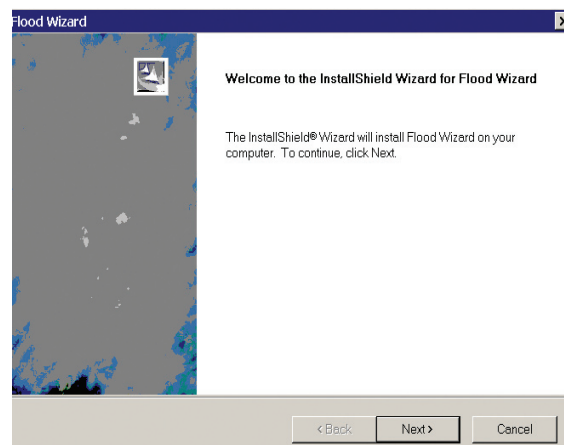


Figure 2-10
Flood Wizard installation complete

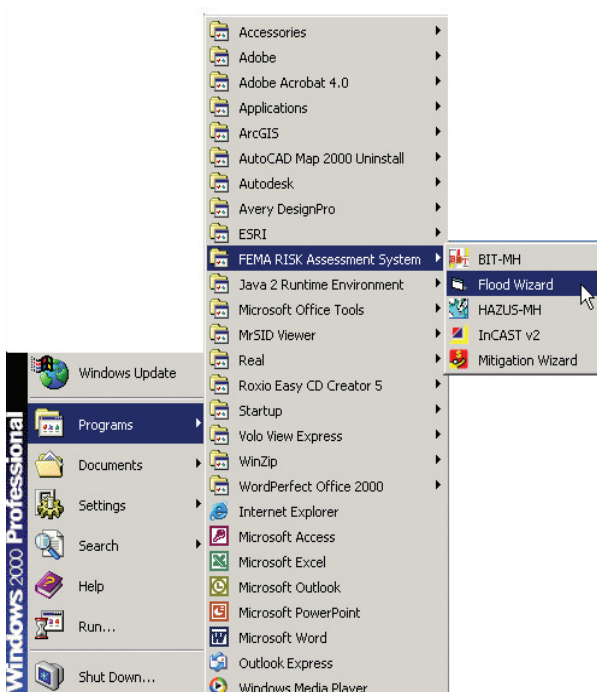


Figure 2-11
Flood Wizard program location

2. **To execute the Flood Wizard program.** Open a flood study region in HAZUS-MH. It is not necessary to have run the flood analysis for the region; setting up the study region is all that is required. Select “Start” from your Windows menu, then select “Programs” and “FEMA Risk Assessment System.” Click on the Flood Wizard icon (see Figure 2-11). The Flood Wizard menu will now be displayed (see Figure 2-12). The menu options include:

- a) Flood Data – these options allow you to input your local flood data and DEM.
- b) Inventory – these options allow you to view the general building stock, including building exposure, content exposure, total exposure, and building count for your study region. Changing the HAZUS-MH provided inventory is discussed in Step 3.

- c) Parameters – these options allow you to change the damage functions and show the specified data maps in your study region.
- d) Analysis – this option allows you to run the analysis.
- e) Results – these options allow you to see the risk assessment results of a 100- and 500-year event in your study region. Results include building exposure, content exposure, total exposure, and building count for the general building stock in the floodplain. It also provides building loss, content loss, and total loss for the general building stock.

3. **To identify the inputs.** You will need two data sets, (1) a flood boundary map in the form of Q3 data, a DFIRM, or a user defined map and (2) a DEM. The flood boundary map is required to be in the shape file format. The DEM should be in the same grid format used to run the flood model. The DEM downloaded from the USGS web site has a vertical distance in meters while the flood wizard requires a vertical distance in feet. A GIS specialist will be able to convert the DEM. Select “Flood Data” from the main menu, then “Q3 Map” (see Figure 2-13). You will be asked to identify the location of the Q3 shape file. Browse to the location and select the file. Select “Flood Data” from the main menu, then “DEM Data.” You will be asked to identify the location of the DEM. Browse to the location and select the file.



Figure 2-12 Flood Wizard menu



Figure 2-13 Flood Wizard data menu

Manage Your Flood Wizard Hazard Data

Create a hazard map directory on your hard drive if you have not done so already. Download the digital maps found at the sources listed above and place the maps in the hazard map directory. These maps will be integrated into HAZUS-MH in Step 4. Keep the other data you have collected to help you complete Worksheet 2-2, as part of Task 2.4.

Congratulations! You have now identified the data sets required to run HAZUS-MH and the Flood Wizard. Step 4 will provide information on how to run the HAZUS-MH and Flood Wizard to obtain loss estimation outputs.



Level 1 analysis uses the HAZUS-MH provided data on wind pressure, wind-borne debris, tree blow down, and rainfall. The data provided also include information on surface roughness and tree coverage derived from national land use data. No additional local data are used for a Level 1 analysis. For a Level 2 or Level 3 analysis, locally generated tree coverage (vegetation) maps and terrain or surface roughness maps can help you update the HAZUS-MH provided data for your study region.

Sources of Hurricane Hazard Profile Information

Table 2-3 presents potential data sources that will help you to gather additional hurricane information. Job Aid 2-2 (Appendix D) helps you to identify other sources of data regarding specific hurricane events that have impacted your area.


Table 2-3: Hurricane Hazard Data Sources to Support HAZUS-MH

Map	Source
Surface Roughness Maps (for Level 2 or 3 analysis)	Local Wind Engineer (refer to Job Aid 2-2 for potential sources)
Vegetation Maps (also called tree coverage maps) for Level 2 or 3 analysis	Land Cover Maps (refer to Job Aid 2-2 for potential sources)

You can also contact the state hurricane program manager, who usually works for the state emergency management office, for information on hurricanes, Nor'easters, storm surge, and coastal erosion that have occurred in your area. Another source of assistance is your state coastal zone manager, who

should have information on state coastal hazards, including information on habitat and environmental resources that may be affected by such hazards.


Inland communities will be most concerned with the flooding aspect of coastal storms. The torrential rains of even Category 1 hurricanes and tropical storms have been known to cause 500-year and greater flooding in inland communities. Coastal communities will need to determine how severe the high winds, storm surges, and erosion could be using their storm surge inundation maps. For all flood hazard information related to hurricane events, refer to the section on floods.



To update the HAZUS-MH data, you can change the tree coverage or surface roughness parameters for your study region at the Census tract level.

Manage Your Hurricane Hazard Data

Create a hazard map directory on your hard drive. Download the hurricane-related hazard maps that you have obtained and place these maps in the hazard map directory. Also, be sure you have updated Worksheet 2-1. These maps will be integrated into HAZUS-MH in Step 4. Keep the other data you have collected to help you complete Worksheet 2-2, as part of Task 2.4.



Future releases of HAZUS-MH will model coastal floods and wind impacts associated with hurricanes as part of the hurricane model. Currently, wind is addressed by the hurricane model and coastal flood as part of the flood model.



Landslides

HAZUS-MH does not currently include a landslide module. However, HAZUS-MH can support evaluation of this hazard. For example, you can map landslide potential areas and inventory to estimate persons and buildings exposed to this hazard. To support this type of analysis, you will need landslide maps that show areas of potential landslide occurrence in your study region.

The best predictors of future landslides are past landslides because they tend to occur in the same places. Landslides, like other geologic hazards, are very complex and require someone with geologic expertise to conduct a geotechnical study. You should begin by talking to your local or state geology, planning, public works, or engineering departments, which should have information on past landslides. These agencies can provide landslide maps as well as information about landslide causes, damages, deaths, and injuries, as well as areas impacted by past landslides. If current landslide maps are not available, the agencies mentioned above can help create one for your community.

Sources of Landslide Hazard Profile Information

It is important that you consult a local geologist or other professional familiar with past landslides when interpreting landslide hazard information. Sources that provide useful background information and data include: (1) maps of landslide potential (high hazard areas), (2) topographic maps, and (3) geologic information. These are discussed below.

High Hazard Areas

You can map these areas by identifying existing or old landslides, particularly those:

- On or at the base of slopes
- In or at the base of minor drainage hollows
- At the base or top of an old fill slope
- At the base or top of a steeply cut slope
- On developed hillsides where leach field septic systems are used

HAZUS



If you are analyzing the flood hazard, your DEM can provide topographic data to support the landslide hazard.

Topographic Maps

Topographic maps can be obtained from the USGS or from your state geologic survey. Specifically, you will need to know where steep slopes are present, as steeper slopes have a greater probability of landslides. Contact your

state geological survey or natural resource department for more information or help in interpreting topographic maps. These are discussed below.

Geologic Information

Identifying the underlying geology plays an important part in the review of a slope. In addition to the slope angle, the presence of rock or soil that weakens when saturated and the presence of poorly drained rock or soil are indicators of slope instability. Contact a local geologist or your state geologic survey to obtain more information or assistance in identifying the various geologic features of your community or state.

After reviewing general information, you should try to obtain the most important landslide data, including: (1) landslide inventories, (2) landslide susceptibility maps, and (3) landslide hazard maps. These are discussed below.

Landslide Inventories

These inventories identify areas that appear to have failed because of landslides, including debris flows and cut-and-fill failures. Detailed inventories

depict and classify each landslide and show scarps, zones of depletion and accumulation, active versus inactive slides, geologic age, rate of movement, and other pertinent data on the depth and type of materials involved in the sliding. Overlaying a geologic map with a hazard map that shows existing landslides can identify specific landslide-prone geologic units. For this reason, a landslide inventory is essential for preparing a landslide susceptibility map.

Landslide Susceptibility Maps

These maps depict areas that have the potential for landslides by correlating some of the principal factors that contribute to landslides, including steep slopes, geologic units that lose strength when saturated, and poorly drained rocks or soils. These maps indicate the relative stability of slopes; however, they do not make absolute predictions. More complex maps may include additional information such as slope angle and drainage data.

Landslide Hazard Maps

These maps show the real extent of the threat: where landslides have occurred in the past, where they are likely to occur now, and where they could occur in the future. The maps contain detailed information on the types of landslides, the extent of the slope subject to failure, and the probable maximum extent of ground movement. These maps can be used to predict the relative degree of hazard in a landslide area.

Manage Your Landslide Hazard Data

Save electronic data in the hazard directory you are creating. You also can mark the areas that are susceptible to landslides on your base map in HAZUS-MH.



HAZUS-MH does not currently include a tornado module, although such a module is currently under development. However, HAZUS-MH can support evaluation of the hazard. In most cases, it is difficult to identify specific tornado risk areas because an entire geographic area usually lies in, or outside of, a high risk area. Data that will help you evaluate your area's tornado risk includes the "design wind speed" designation for your



Unlike some other hazards, mapping the tornado risk is less important because it is unlikely that a community has variable tornado risks within its jurisdiction. In most cases, communities need only determine that they have a tornado risk (Identify Hazards: Step 1) and then can proceed to determine their design wind speed as described in this section.

community. The design wind speed is the maximum wind speed buildings are designed and constructed to withstand.

Sources of Tornado Hazard Profile Information

First, contact your state or local building code official to determine the design wind speed for your area. Next, find your study region on the “Design Wind Speed” map in FEMA’s *“Taking Shelter from the Storm: Building a Safe Room in Your House”* (refer to text box). The map in this document is based on design wind speeds set forth by the American Society of Civil Engineers (ASCE). Next, look up the wind zone and indicated speed indicated for your study region area. For example, if you live in Fayetteville, North Carolina, you would find that you are located in wind zone III, which is associated with 200-mile per hour wind speeds.

Manage Your Tornado Hazard Data

If your study region is located in only one design wind speed zone, note the zone; however, if your study region is located in more than one design wind speed zone, you will need copies of the “Design Wind Speed” maps. Create a hazard map

directory on your hard drive if you have not done so already. Download the wind speed maps into the hazard map directory, or obtain hard copies of the maps. These maps will be integrated into HAZUS-MH in Estimate Losses (Step 4).



“Taking Shelter from the Storm: Building a Saferoom in Your House” (FEMA 320). This publication can be viewed at: <http://www.fema.gov/fima/tsfs02.shtm> or ordered from the FEMA Publication Center.



Tsunamis

HAZUS-MH does not include a tsunami module. However, HAZUS-MH can support evaluation of this hazard through the mapping of hazard areas and the identification of inventory exposed to the hazard areas.

Sources of Tsunamis Hazard Profile Information

Tsunami inundation zone maps show low-lying areas that could be affected by tsunamis. Communities in Alaska and Hawaii can obtain statewide inundation zone maps and other information about tsunamis from the following sources:

West Coast/Alaska Tsunami Warning Center of NOAA/NWS
910 S. Felton Street
Palmer, AK 99645- 6552

Telephone: 907-745-4212
Pacific Tsunami Warning Center in Hawaii
91-270 Fort Weaver Road
Ewa Beach, HI 96706
Telephone: 808-689-8207

Communities in Oregon can request maps from:

The Oregon Department of Geology and Mineral Industries (DOGAMI)
800 NE Oregon Street, #28
Portland, OR 97232
Telephone: 503-731-4100

Washington and California communities should contact their respective state geologists to obtain inundation zone mapping information.

In addition, tsunami information is available at the following websites:

- USGS: <<http://www.usgs.gov/themes/coast.html>>
- University of Washington: <<http://www.geophys.washington.edu>>
- Pacific Marine Environmental Laboratory:
<<http://www.pmel.noaa.gov/tsunami-hazard>>

Most tsunami mapping has been done at a state-wide level. If no local mapping has been certified, you may consider hiring a consultant to develop or obtain the following information:

- Historical tsunami sources
- Potential future local and distant sources
- Potential for ground failures and other geologic effects that could cause tsunamis
- An estimate of the number of waves and their heights, arrival times, and inundation depths and distances
- Calculations of water velocities and debris loads
- Estimates of the probabilities of tsunami occurrence and levels of certainty

Manage Your Tsunami Hazard Data

Draw the boundaries of your study region's tsunami hazard areas on your base map and store any electronic data in your hazard data directory.



HAZUS-MH does not include a wildfire module. However, HAZUS-MH can support evaluation of this hazard through the mapping of hazard areas and the identification of exposed inventory in hazard areas.

Sources of Wildfire Hazard Profile Information

Wildfire hazard maps do not show the extent of locations where wildfires will occur because each fire's location will depend on the amount of fuel available, weather conditions, and wind speed and direction at the time the fire occurs. However, wildfire hazard maps can show geographic locations where wildfires have taken place in the past and areas that are prone to wildfires based on the availability of fuel and weather conducive to fires.

Contact your state forest service at <<http://www.stateforesters.org/>> or your U.S. Forest Service (USFS) regional office at <<http://www.fs.fed.us/contactus/regions.shtml>> to obtain wildfire mapping information, such as (1) fuel model maps, (2) topographic data, and (3) critical weather frequency. These data are discussed below.

Fuel Model Maps

Use the fuel model key below (excerpted from the National Fire Danger Rating System [NFDRS]), developed by the USFS in 1978, as a guide to determine the fuel model classifications within your community or state. The key represents all wildfire fuels from Florida to Alaska and from the East Coast to California, so only general descriptions are provided.

You can also download fuel model maps from the Internet at <http://www.fs.fed.us/land/wfas/nfdr_map.htm>. These maps are designed to assess fire dangers across the continental U.S. and may not be site-specific; therefore local updates are recommended.

Using the fuel model key, you can map the various fuel classifications for your area based on the following categories:

- Heavy Fuel is vegetation consisting of round wood that is 3 to 8 inches in diameter.
- Medium Fuel is vegetation consisting of round wood that is 1/3 to 3 inches in diameter.
- Light Fuel is vegetation consisting of herbaceous plants and round wood that are less than 1/3 inch in diameter.

To obtain more information or assistance, contact your state forestry or natural resource department.

Topographic Data

In general terms, the steeper the slope of the land, the faster a fire can spread up the slope. Using a topographic map, identify areas of your study region with slopes less than 40 percent, between 41 and 60 percent, and greater than 61 percent, corresponding to low, moderate, and steep gradients in terms of the spread of wildfires. Contact your state geologic survey or natural resource department to obtain more information or help with topographic maps.

Critical Weather Frequency

Critical fire weather is a set of weather conditions, usually a combination of low relative humidity and wind, whose effects on fire behavior make its control difficult and threaten firefighter safety. The average number of days per year of critical fire weather experienced in your study region can be obtained from your local or state fire marshal, forestry department, or department of natural resources. National Weather Service or NOAA websites also can help you determine past weather conditions in your study region.

Identify Your Fire Hazard Severity

Using Table 2-4, determine your study region’s fire hazard severity. For example, if your study region experiences an average of five critical fire weather days per year, has heavy fuel, and has greater than 40 percent slopes, you are in an extreme severity area. You may have more than one severity level in your study region, depending on differing slopes and fuel classifications across the region.

Table 2-4: Fire Hazard Severity Table

Fuel Classification	Critical Fire Weather Frequency								
	<1 Day/Year			2 to 7 Days/Year			> 8 Days/Year		
	Slope (%)			Slope (%)			Slope (%)		
	0-40	41-60	> 60	0-40	41-60	> 60	0-40	41-60	> 60
Light Fuel	M	M	M	M	M	M	M	M	H
Medium Fuel	M	M	H	H	H	H	E	E	E
Heavy Fuel	H	H	H	H	E	E	E	E	E

Severity: M = Moderate, H = High, and E = Extreme

Manage Your Wildfire Hazard Data

Draw the boundaries of your study region’s wildfire hazard areas on your base map in HAZUS-MH. Retain electronic data in your hazard directory.

Other Hazards

Table 2-5 shows map data recommended to profile other hazards that may be important to your community; these hazards are not detailed in this guide.

In addition to maps, remember to collect historic event, location, and impact (loss) data, as available. The FEMA web site (<http://www.hazardmaps.gov>) also has data for some of the hazards listed below. Job Aid 2-2 (Appendix D) also lists hazard data sources for a range of hazards.

Table 2-5: Data Sources for Additional Hazards Maps of Interest

Hazard	Map	Source
Avalanche	Elevation Contour Maps	< http://data.geocomm.com/dem/demdownload.html >
Coastal Erosion	Historical Aerial Photographs	< http://edc.usgs.gov/index.html >
Dam Failure	FIRMs	< http://www.fema.gov/fhm/dfm_ovrw.shtm >
	Floodway Maps	Local floodplain manager
Drought	Drought Maps	< http://www.drought.unl.edu/whatis/palmer/pdsihist.htm >
Extreme Heat	Maximum Temperature Maps	< http://www.cpc.ncep.noaa.gov/ >
Hailstorm	Hailstorm Maps	< http://www.esri.com/hazards/makemap.html >
Land Subsidence	Land Subsidence Maps	< http://water.usgs.gov/ogw/subsidence.html >
Severe Winter Storm	Winter Storm Maps	< http://www.gismaps.fema.gov/2003pages/lcurrent.shtm >
Volcano	Volcanic Activity Maps	< http://volcanoes.usgs.gov/Hazards/Where/WhereHaz.html >
Windstorm	Windstorm Maps	< http://www.esri.com/hazards/makemap.html >

Develop HAZUS-MH Compatible Hazard Maps

Now that you have collected specific hazard maps, you will want them in an electronic form to support HAZUS-MH. Once you have an electronic map, review its format to determine whether it is in the correct format (ArcView-compatible) and coordinate system (Lat/Long). Place a check in the


appropriate column for each requirement in Worksheet 2-1. The HAZUS-MH provided assumptions or hazard maps for earthquakes, floods, and hurricanes should be replaced if you have a more detailed map of your study region. If all of the compatibility columns are checked, place a check in the “Ready for HAZUS-MH” column. If you need to convert maps or projections, refer to Identify Hazards (Step 1) for instructions.

After reviewing hazard maps and historical data, you should have an idea of where hazard events may occur in your study region. You now need to designate these hazard areas on your HAZUS-MH base map by using the HAZUS-MH menus to add a GIS layer. Click on “File,” and then scroll down to add data. Browse to the location of your hazard maps and select the files. The hazard maps can now be overlain on your base map. Your base map should now be divided into subareas or polygons that represent the areas susceptible to different hazard types. Some hazard types may affect the entire study region, while others may affect only portions of the region. These map outputs can be used to support your community involvement efforts and as inputs for your risk assessment.

Profile and Prioritize Hazards (Task 2.4)

To create a final prioritized list of hazards, you will use the data in Worksheet 1-1 and the hazard maps and hazard characteristics data that you have collected. Your risk assessment team should take all of the data available and meet as a group to review the data and prioritize the hazards. Worksheet 2-2 should be completed for each hazard of interest. This worksheet will help you compile data and profile each hazard in a consistent manner.

Next, complete Worksheet 2-3. This worksheet is a qualitative ranking form designed to help you prioritize the hazards in your study region. Under frequency, severity, duration, and intensity, you can rank each hazard from 0 (very low) to 5 (high). For each hazard, you can add values for various profile items and assign a “rank.” Depending on your team’s knowledge and experience, you may be able to rank the hazards numerically (with the highest value a 1), or you may wish to rank them as H, M, and L (High, Medium, and Low) priorities. In the last column, check the hazards that are considered to be priorities for further analysis. Even if you have little data on a hazard, you may feel that you need to assign that hazard a “high” priority for further analysis.

 *Congratulations! You have now have created a final prioritized list of the natural hazards that may affect your community.*

SUMMARY

When you are finished with Step 2, you will have historic event data and maps showing the areas impacted by each hazard of interest and data on the characteristics of hazard events affecting your study region.

You also will have a list of hazard events, websites, articles, reports, local experts and other resources, that can help you later in the risk assessment process as you determine how particular hazards can affect your community. Table 2-6 will help you verify that you have completed the activities for Step 2.

Table 2-6: Profile Hazards Activities and Outputs Checklist

Activity	Output	Check Completed Items
Review HAZUS-MH provided hazard data (Task 2.1)	Worksheet 2-1, Column 1 HAZUS-MH provided hazard event data (updated on Worksheet 1-1)	
Perform a data gap analysis (Task 2.2)	Worksheet 2-1, Column 2	
Collect additional hazard data (if needed) (Task 2.3)	Updated Worksheet 2-1	
Profile and prioritize hazards (Task 2.4)	Worksheet 2-2 with hazard maps and charts (profiles) Worksheet 2-3 (ranking)	

Complete any missing items in your checklist, and then continue to Step 3.

GO TO STEP 3: INVENTORY ASSETS



WORKSHEET 2-1: IDENTIFY REQUIRED HAZARD DATA

Check the first column below for hazards determined to be of interest on Worksheet 1-1. Then use the rest of the table to understand the hazard data you need and to track the status of the data you have. HAZUS-MH hazard maps that are recommended are shown in bold. You can use Job Aid 2-1 (Appendix D) to see which data are required for varying Levels of HAZUS-MH analysis (Levels 1, 2, and 3). For each hazard map you obtain, determine whether the map meets the data status criteria and check the appropriate box(es). Check the “Ready for HAZUS-MH” cell when the map meets all of the criteria. Job Aid 2-2 (Appendix D) lists national hazard data sources. You will best know about local data sources.

Hazard of Interest (From Worksheet 1-1)	Hazard (Italicized text indicates a HAZUS-MH hazard)	Hazard Data/Map Required	LOCAL DATA STATUS CRITERIA		
			Required Format (ArcView required)	Required Coordinate System (Lat/Long required)	Ready for HAZUS-MH
	<i>Earthquake</i>	Soil Maps			
		Liquefaction Susceptibility Maps			
		Landslide Potential Maps			
		Water Depth Maps			
	<i>Flood</i>	Flood Zone Maps			
		Digital Elevation Model			
		Base Flood Elevation			
	<i>Hurricane</i>	Surface Roughness Maps			
		Tree Cover Maps			
	Avalanche	Elevation Contour Maps			
	Coastal Erosion	Historical Aerial Photographs			
	Coastal Storm	Coastal Storm Maps			
	Dam Failure	Inundation Maps			
	Drought	Drought Maps			
	Expansive Soils	Soil Maps			
	Extreme Heat	Maximum Temperature Maps			
	Hailstorm	Hailstorm Maps			
	Landslide	Landslide Maps			
	Land Subsidence	Land Subsidence Maps			
	Severe Winter Storm	Winter Storm Maps			
	Tornado	Tornado Maps			
	Tsunami	Tsunami Inundation Maps			
	Volcano	Lava Flow Areas, Volcanic Activity Maps			
	Wildfire	Fuel Maps, Drought Maps			

Note: Modified from FEMA 386-2. Blank rows are for other hazards of interest. Hazards in bold are discussed in Step 2.



WORKSHEET 2-2: PROFILE HAZARDS

Worksheet 2-2 can be used to summarize hazard profile data for specific hazards of interest in your study region. It presents the information in a manner that will be consistent across hazards. This will help you make sure you are getting the same information for each hazard and help you communicate about the hazards within the risk assessment team and with your community. You will complete a copy of the worksheet for each hazard of interest in your study region.

To use the worksheet, first review Example 2-1. This provides an example of completed a hazard profile and illustrates the type of information to include under the summary of risk factors and the hazard profile cells. Example 2-1 also shows examples of graphics (including maps) that will be useful for your hazard profile.

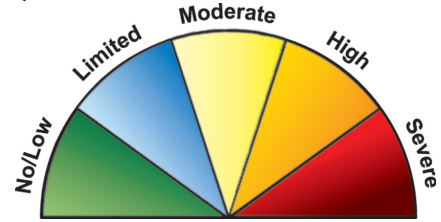
After reading Chapter 2 and reviewing the example, complete the following steps:

1. Complete a hazard profile for each of the hazards of interest identified and retained in Step 1. Start with the Summary of Risk Factors table at the top of Worksheet 2-2 and the Hazard Profile Data table, as this information may assist in deciding if additional hazard data and maps are needed. Fill out as much of the information as you can.
2. Next, attach any graphic illustrations of hazard areas, other representations of the hazard area, or histograms of hazard events following the Hazard Profile Data table. The hazard maps you collected as part of Task 2.3 can be used.
3. Finally, consider all of the profile data you have compiled and evaluate the overall risk of each hazard in your area. Then select an appropriate initial profile ranking for your hazard (from no/low risk to severe risk). Indicate the appropriate level using an indicator arrow on the risk gauge in the upper right hand corner of the worksheet.



WORKSHEET 2-2: PROFILE HAZARDS (continued)

HAZARD: _____



Summary of Risk Factors	
Period of occurrence:	
Probability of event(s):	
Warning time:	
Major contributor(s):	
Risk of injury?	
Potential for facilities shutdown?	
Percent of affected properties that may be destroyed or suffer major damage:	

HAZARD PROFILE DATA

Background and Local Conditions
Historic Frequency and Probability of Occurrence
Severity
Historic Losses and Impacts
Designated Hazard Areas

Attach any maps of hazard areas or other graphic illustrations related to the hazard (e.g., histograms of past hazard events over time).



WORKSHEET 2-3: PRIORITIZE HAZARDS

This worksheet provides an example of how you can qualitatively prioritize hazards. It includes ranking factors that impact the priority of a specific hazard in your area. Note that you can modify this worksheet if needed to include additional factors (e.g., community concern). Or you can weight the factors differently if you feel that is appropriate. To use this worksheet, refer back to the data collection and evaluation that you performed to profile hazard events (completed Worksheet 2-2 documentation). Now assign a rating for each factor shown below from 0 (low) to 5 (high) for each hazard of interest. Use the individual factors to consider and assign an overall preliminary profile ranking for each hazard of interest. You can rank numerically from 1 (most important) to X (least important, with X being the number of relevant hazards of interest for your study region). Alternately, you can rank hazards as N/L, L, M, H, or S (for No/Low, Low, Moderate, High, or Severe) for this preliminary profile ranking. Your risk assessment outcomes may help you re-evaluate your initial rankings over time. If you have a hazard that is not listed, use the blank space below.

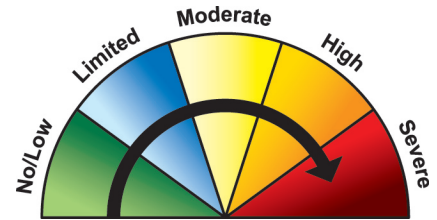
Hazard (Italicized text indicates a HAZUS-MH hazard)	Ranking Factors				Ranking (Numerical or N/L, M, H, S)
	Frequency (0-5)	Duration (0-5)	Severity (0-5)	Intensity (0-5)	
Avalanche					
Coastal Erosion					
Dam Failure					
Drought					
Earthquake					
Expansive Soils					
Extreme Heat					
Flood (Coastal)					
Flood (Riverine)					
Hailstorm					
Hurricane					
Landslide					
Land Subsidence					
Severe Winter Storm					
Tornado					
Tsunami					
Volcano					
Wildfire					

Note: Modified from FEMA 386-2. Hazards in bold are discussed in Step 2.



**EXAMPLE 2-1: HAZARD PROFILE - EARTHQUAKE
(Portland, OR)**

Multnomah County Hazard Analysis		Summary of Risk Factors	
Severity Score	Severe	Period of occurrence:	At any time
History (2)	20	Probability of event(s):	Highly likely
Vulnerability (5)	50	Warning time:	No warning time
Maximum Threat (10)	100	Major contributor(s):	Highly active seismic zone, local soil characteristics
Probability (7)	70	Cause injuries?	Yes, and risk of death
Total Score	240	Potential facilities shutdown?	30 days or more



Hazard Risk Gauge
Initial Profile Ranking

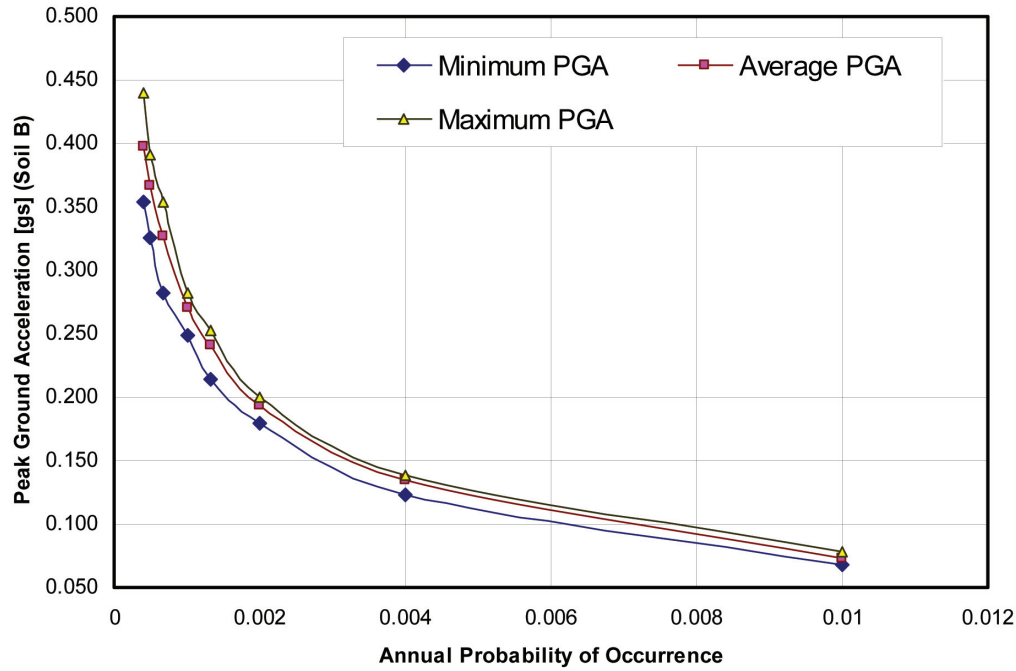
Magnitude (M) is a measure of earthquake size that represents the amount of energy released by an earthquake. Energy release increases 30 times for each integer on the magnitude scale. Moment Magnitude is a direct measure of energy and is a more accurate measure of the true strength or intensity of an earthquake.

EARTHQUAKE HAZARD PROFILE

Background and Local Conditions
There are several different sources for hazardous earthquakes in the Pacific Northwest. Oregon sits on the Cascadia Subduction Zone where the Pacific / Juan de Fuca Plate is sliding under (or being pushed under) the less dense North American Plate. Although earthquakes along this zone occur infrequently, plate movement can produce major earthquakes. In addition, the western part of Oregon is underlain by a large and complex system of faults (e.g., the Portland Hills) that can produce significant and more frequent earthquakes.
Historic Frequency and Probability of Occurrence
The Metro 1999 study cites research indicating that “major geologic structures capable of magnitude (M) 7 earthquakes” underlie the Portland study area. Since 1820, 7,000 earthquakes within Oregon have been documented. Fifty-six significant earthquakes have occurred in or near the Portland study area between 1872 and 1999. Severe local earthquakes occurred in 1877, 1880, 1953, 1962, and 1993 (Metro, 1999).
Strong Pacific Northwest earthquakes of record also include an 1872 M 7.4 North Cascades event, an M 6.8 earthquake in 1873, a 1949 M 7.1 event near Olympia, Washington, a 1965 M 6.5 event in Seattle-Tacoma, and a 2001 Olympia, Washington, event that caused over \$2 billion in property damage (Oregon OEM, 2000). Regional earthquakes, such as the deep, intraplate Nisqually Earthquake that occurred in 2001 in Olympia, Washington, have been felt widely in northwest Oregon. The first figure provided with this profile illustrates the annual probability of exceeding a range of peak ground acceleration levels in Portland. The second figure shows past historic events in terms of moment magnitude.
Severity
There is a direct relationship between a fault’s length and location and its ability to generate damaging ground motion. In Portland, smaller, local faults produce lower magnitude quakes, but their ground shaking can be strong and damage can be high as a result of the fault’s proximity to structures. In contrast, offshore or distant subduction zone quakes can generate great magnitudes, but, because of their distance and depth, may result in only moderate shaking in the Portland study area (Metro, 1999). The Cascadia Subduction Zone fault could produce an earthquake of M 8.0 to 9.0 or greater. Geologic evidence shows that earthquakes of similar magnitude have occurred on average every 500 to 600 years in this area. Based on the Multnomah County analysis and pilot project, this hazard was given an initial profile ranking of severe.
Historic Losses and Impacts
Damage results from earthquakes because structures that cannot withstand the shaking, are situated on ground that amplifies shaking, or are located on soil that is subject to liquefaction. Structures can cause injury or fatalities and suffer content and functionality losses. The 2001 Nisqually event caused over \$2 billion in losses. The two 1993 Klamath Falls earthquakes (M 5.9 and 6.0) caused damage to more than 1,000 buildings and \$10 million in losses (DOGAMI, 2002). Since 1872, there have been about 25 damaging earthquakes in Washington and Oregon (CREW, 2003).

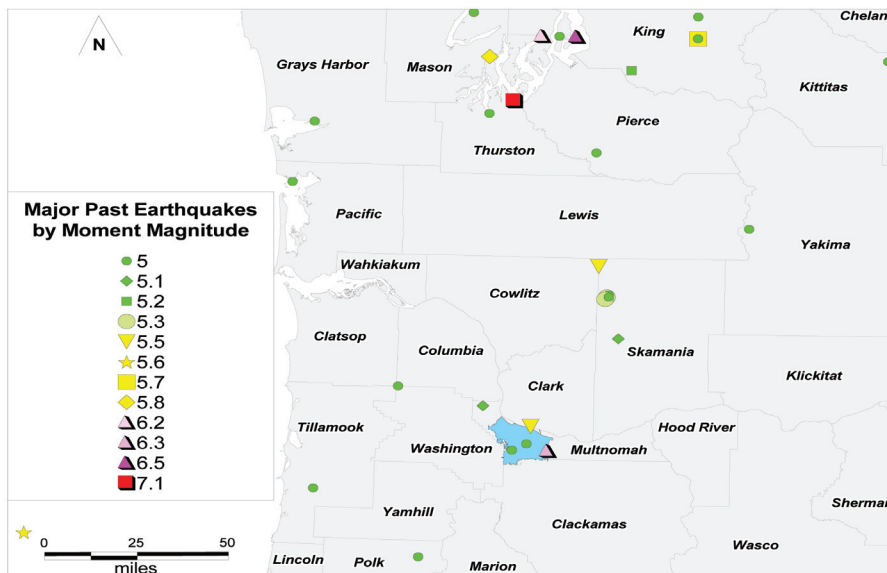


EXAMPLE 2-1: HAZARD PROFILE - EARTHQUAKE (continued)
(Portland, Oregon)



Note: PGA indicates peak ground acceleration. There is a 2 in 1,000 probability of an earthquake with a PGA of 0.2 or greater in any one year.

Major Past Earthquakes for the Pacific Northwest (1600 to 2002)



Note: The Portland study area is highlighted in blue.

Source: HAZUS-MH