

# 4 Site and Development Options

Site evaluation is a critical step in the decision-making process of installing a manufactured home. Decisions are sometimes made without accurately assessing or considering a property's vulnerability to flooding and other hazards. By conducting a thorough site assessment, a property owner or developer can mitigate the following types of losses, damage, and associated problems:

- Injuries and loss of life
- Damage or loss to buildings and contents
- Damage to attendant infrastructure
- The need for emergency evacuation

A complete and detailed understanding of the advantages and disadvantages of potential sites for manufactured home installation helps lead to informed decisions; not all sites are suitable for development.

A thorough evaluation of property for development purposes is completed through a five-step process:

1. Compile lot/parcel information for one or more candidate properties.
2. Determine if local, regional, State, and Federal regulatory requirements allow the development and installation of a manufactured home and, if so, determine the requirements.
3. Identify the hazards present at the site (e.g., wind, flooding, seismic, etc.).
4. Determine whether potential effects from hazards could be avoided through siting, design, and construction and whether the residual risks to the site and the building are acceptable.
5. Proceed either with the purchase or development of a property, or reject the candidate site, and find and evaluate alternative sites.

Basic information about the property (e.g., lot size, zoning and land use requirements, and utility and infrastructure availability) enables the potential property owner or developer to assess if the site is suitable for development as a manufactured home site. If development is feasible, the potential property owner should conduct Steps 3 and 4 of the process to assess the property's hazard vulnerability. Based on the assessment findings, the property is determined to be either suitable or unsuitable for the installation of a manufactured home. The following sections provide additional information for the recommended assessment process.

## 4.1 Step 1: Compiling Site Information

After a site for possible purchase and/or development has been identified, basic information about the site is collected for a development analysis. It is vital that all pertinent information is collected in order to complete a thorough analysis.

Community building permitting or planning and zoning offices are helpful in steering potential property buyers toward information they need to evaluate a property. This is true of individuals looking at isolated lots or lots within existing manufactured housing subdivisions. A checklist of information to be collected is provided in Table 4-1. Not all of this information will be available for all sites and properties.

Although much of the information listed in Table 4-1 will need to be obtained locally, State and Federal government resources are also useful. Table 4-2 presents a partial listing of the most likely resources (i.e., local, regional, or State government) for obtaining specific information.

**Table 4-1. Information Checklist**

<b>Property Location</b>	
<ul style="list-style-type: none"> <li>• Municipal, township, county, or other local jurisdiction</li> <li>• Street address</li> <li>• Parcel designation (e.g., tax map ID)</li> <li>• Subdivision information</li> <li>• Special zoning or land use districts</li> </ul>	<ul style="list-style-type: none"> <li>• Flood-prone area designation</li> <li>• Seismic hazard area designation</li> <li>• High-wind area designation</li> <li>• Other hazards areas</li> <li>• Natural resource protection area designation</li> </ul>
<b>Property Dimensions</b>	
<ul style="list-style-type: none"> <li>• Total acreage</li> <li>• Property shape</li> <li>• Property elevations and topography</li> <li>• Location relative to adjacent properties; configuration of adjacent properties</li> </ul>	<ul style="list-style-type: none"> <li>• Acreage outside of designated floodplain area or other hazard-prone area</li> <li>• Acreage landward/outside of natural, physical, or regulatory construction or development limits (i.e., usable acreage)</li> </ul>

Table 4-1. Information Checklist (continued)

<b>Legal and Regulatory Information</b>	
<ul style="list-style-type: none"> <li>• Land use designation at property and adjacent properties</li> <li>• Zoning classification and resulting restrictions on use</li> <li>• Building codes and local amendments</li> <li>• Floodplain management requirements</li> <li>• Erosion hazard area: construction setback and regulations</li> <li>• Natural resource protection area: siting, construction, or use restrictions</li> <li>• Easements and rights-of-way on property (including beach access locations for nearby properties or the general public)</li> <li>• Local/State siting and construction regulations</li> <li>• Regulatory front, back, and side setbacks</li> </ul>	<ul style="list-style-type: none"> <li>• Local/State permitting procedures and requirements</li> <li>• Local/State regulations regarding use, construction, and repair of erosion control measures</li> <li>• Riparian rights</li> <li>• Local/State restrictions on cumulative repairs or improvements</li> <li>• Conditions or other requirements attached to building or zoning permits</li> <li>• Subdivision plat covenants and other restrictions imposed by developers and homeowners' associations</li> <li>• Hazard disclosure requirements for property transfer, including geologic hazard reports</li> </ul>
<b>Physical and Natural Characteristics</b>	
<ul style="list-style-type: none"> <li>• Soils, geology, and vegetation – site and region</li> <li>• Site drainage – surface water and groundwater</li> <li>• Storm, erosion, and hazard history of property</li> <li>• Development/potential flood debris upstream and adjacent to property</li> <li>• Erosion control structure on site: type, age, condition, and history</li> </ul>	<ul style="list-style-type: none"> <li>• Proximity to inlets and navigation structures</li> <li>• Previous or planned community/regional beach/dune restoration projects (coastal)</li> <li>• Relative sea-level/water-level changes – land subsidence or uplift (coastal)</li> <li>• Wind missile hazards – utility poles, trees</li> </ul>
<b>Infrastructure and Supporting Development</b>	
<ul style="list-style-type: none"> <li>• Access road(s)</li> <li>• Emergency evacuation route(s)</li> <li>• Electric, gas, water, telephone, and other utilities – on-site or off-site lines and hookup</li> </ul>	<ul style="list-style-type: none"> <li>• Sewer or septic</li> <li>• Limitations imposed by utility, infrastructure locations on property use</li> </ul>
<b>Financial Considerations</b>	
<ul style="list-style-type: none"> <li>• Intended use: owner-occupied or rental property</li> <li>• Real estate taxes</li> <li>• Development impact fees</li> <li>• Permit fees</li> <li>• Hazard insurance: availability, premiums, deductibles, and exclusions</li> <li>• Property management fees</li> </ul>	<ul style="list-style-type: none"> <li>• Special assessments for community/association projects (e.g., private roads and facilities)</li> <li>• Maintenance and repair of private erosion control structures</li> <li>• Increased building maintenance and repairs in areas subject to high winds or wind-driven rain</li> <li>• Building damage costs (insured and uninsured) from previous storms, floods, and other hazard events</li> </ul>

Table 4-2. Partial Listing of Local, Regional, and State Responsibilities

Local	Regional	State
Deeds and Property Records	Deeds and Property Records	Building Codes and Standards
Emergency Management	Emergency Management	Emergency Management
Environmental Protection	Environmental Protection	Coastal Zone Management
Building Codes and Permitting	Geographic Information Systems	Geologic Survey
Floodplain Management	Health	Floodplain Management
Planning and Zoning	Planning and Zoning	Natural Resource Management
Municipal Engineering	Post-storm Damage Assessments	Post-storm Damage Assessments
Soil and Geology	Soil and Geology	
Subdivision Review	Subdivision Review	
Tax Assessor	Tax Assessor	
Utilities	Utilities	

## 4.2 Step 2: Reviewing Basic Siting Information

After collecting pertinent site information, a thorough review of the information is necessary to ensure that development of the site is feasible. Particularly, building codes and planning and zoning codes requirements should be reviewed early in the evaluation process to verify that development of the property with the installation of a manufactured home is allowable. If installation is allowable, a review of requirements will assist in location of the manufactured home on the site.

## 4.3 Step 3: Hazard Analysis and Risk Assessment

A hazard analysis and risk assessment should be performed to determine what hazards exist for a particular area or site, and then the risk level for that site should be evaluated. It is important to consider flooding in this analysis as well as other hazards such as dam failure, land subsidence, seismic hazards, and severe wind.

For community-wide assessments, there are several FEMA tools available for use to conduct a Hazards Analysis and Risk Assessment, including the FEMA software Hazards U.S.–Multi-Hazard (HAZUS-MH) and *Mitigation Planning How-to Guides* (FEMA 386). Under the Disaster Mitigation

Act of 2000, communities are required to complete hazard mitigation plans, which include a hazard identification and risk assessment section, should they wish to remain eligible for post-disaster mitigation funding. As a result, many regional and local governments have already used tools like HAZUS-MH and the *How-to Guides* to conduct their own risk assessments, which may be available for public review.

### 4.3.1 Flooding

Table 4-3 presents a list of the types of hazards that can result from flooding and the flood sources or types of flood-prone areas where they are generally of concern.

**Table 4-3. Flood Hazards**

Flood Hazard	Associated Flood Hazard Areas or Property Characteristics
Long duration flooding	<ul style="list-style-type: none"> <li>• Large water bodies (rivers, bays)</li> <li>• Water bodies with slow drainage (lakes, ponds)</li> </ul>
Inadequate storm drainage	<ul style="list-style-type: none"> <li>• Flat or poorly graded land</li> <li>• Land located directly adjacent to a flood source</li> </ul>
Impact forces	<ul style="list-style-type: none"> <li>• Coastal areas subject to wave action flooding</li> <li>• Riverine flooding areas subject to high velocity flooding</li> </ul>
High velocity flows	<ul style="list-style-type: none"> <li>• Coastal areas subject to wave action</li> <li>• Steeply-sloped riverine flooding areas or areas otherwise subject to high velocity flood flows</li> </ul>
Erosion	<ul style="list-style-type: none"> <li>• Coastal areas subject to wave action</li> <li>• Steeply-sloped riverine areas with high velocity flood flows or areas otherwise subject to high velocity flood flows</li> </ul>
Sediment deposition	<ul style="list-style-type: none"> <li>• Coastal overwash areas</li> </ul>
Movable stream beds	<ul style="list-style-type: none"> <li>• Dynamic river systems</li> </ul>
Flood depth	<ul style="list-style-type: none"> <li>• Areas adjacent to the flood source</li> <li>• Areas with poor capacity for drainage</li> </ul>

Two of the best sources to research a property's susceptibility to flooding are the community's FIRM and FIS. The FIRM shows the extent of the 1-percent annual chance flood, and might also include flooding corresponding to the 0.2-percent annual chance flood (also known as the 500-year flood). For areas where detailed studies have been performed, FIRMs will also show BFEs along streams and may provide delineations of floodways.

An FIS summarizes the methods used to develop the hydrologic and hydraulic studies, which together determine the extent of the 1-percent annual chance floodplain. The FIS also presents a summary of results of the study, including information about floodwater surface elevations and velocities for detailed study areas. Figure 4-1 shows portions of an FIS and a FIRM.

The FIRM is used in conjunction with the FIS to determine the flood risk for a given area or property. For detailed study areas, while the FIRM shows the extent of the base flood and the BFEs, the FIS includes flood profiles that show flood elevations for various frequency events as well as the channel bottom elevation (for riverine flooding) over the length of a given waterway. If the property is located in the base floodplain where a detailed study has been performed, the FIRM and FIS will provide the following valuable information:

- The elevation of a base flood at a site as well as elevations for the 10-, 50- and 500-year floods, which can be found on the flood profiles within the FIS
- The average velocity of floodwaters within the floodway for a base flood (where a floodway study was performed)
- Areas of coastal wave action flooding
- Riverine flooding areas
- Areas susceptible to ponding
- Areas susceptible to sheet flow or alluvial fan flooding
- Areas protected by levees

Information about an area's susceptibility to flooding can also be gathered from community officials and past storm event records and reports. Such reports usually provide information about what types of damage were inflicted on structures. For coastal areas, there may be information about beach and shoreline erosion.

A field assessment for a particular site is a way to collect information for a hazard analysis. Information gathered during a field visit (ideally conducted by a geologist or an engineer) can be used to assess what type of impact such forces will have on a manufactured home located on a particular site. This is determined by assessing what type of structures and potential debris are located upstream and adjacent to the property that could impact the manufactured home during a flood event. A field assessment can also be conducted to estimate the erosion potential for a site by investigating existing land slopes on the site as well as vegetation cover. Finally, the site's grading/topography should be evaluated. As part of the assessment, it should be determined whether or not the site will drain in a reasonable amount of time in order to prevent long duration flooding. This issue is generally only relevant for smaller storm events or more localized flooding for which floodwaters have somewhere to drain.

### 4.3.1.1 Accessibility

The flood risk to both the manufactured home and access routes should be assessed. Inhabitants of manufactured homes in flood-prone areas should prepare to evacuate an area should a flood watch be issued by the local or State government and should not wait for flood conditions



Figure 4-1. Portions of an FIS and a FIRM.

to begin before evacuating the area. In fact, drowning in vehicles is the number one cause of flood-related deaths and often happens when victims mistakenly think that a washed-out roadway or bridge is still open. Therefore, access to the manufactured home during flood events needs to be considered during the siting process.

Inhabitants of manufactured homes in flood-prone areas should *never* remain within the home during a flood, regardless of the home's elevation level above the BFE. They should always evacuate when a flood warning is issued by the local or State government and not wait for flood conditions to begin before evacuating the area.

Actual damage to roadways during flood events, as well as high-wind, seismic, and land subsidence events, can leave roads impassable for several days or for weeks after a major disaster. Even roadways that are located outside of, but adjacent to, flood-prone areas can be undermined by severe erosion along stream banks. Therefore, even if a home is adequately protected from incurring major damage due to a flood event, its location within (or surrounded by) a flood-prone area could either force occupants to repeatedly evacuate or become stranded for several days if access and egress routes are blocked.

A clear access and egress path during a flood event ensures that building occupants can evacuate and that emergency and critical services can continue to be provided. Both access and egress should be addressed while evaluating a potential site to ensure that feasible alternatives exist. Necessary considerations may also include bridges, walkways, and areas of refuge for safe evacuation.

Similarly, accessibility to potential sites after major wind and seismic events should be considered. After wind and seismic events, roadways can be blocked by debris and remain unusable for several days while cleanup efforts are underway. Potential property buyers or property owners should consider possible evacuation routes from the property in all cases.

It is important to note that accessibility is more than ingress and egress in an emergency. Frequent and long duration flooding can cause major problems for occupants of flood-prone structures; a site is not a good location for a manufactured home if its occupants are forced to evacuate several times a year due to a flood threat, or must stay out of their homes for days or weeks at a time when they do evacuate. Frequent and/or long-term displacement often results in significant financial hardships and emotional distress for flooding victims.

### 4.3.2 Other Hazards

In addition to flooding, there are a variety of other hazards that should be considered during the manufactured home siting process. Table 4-4 presents some of these hazards, their associated hazard-prone areas, and sources to use to determine an area's susceptibility. Historical storm or hazard event records are additional resources for this hazard analysis; they provide details on how hazards have previously affected a given area.

**Table 4-4. Hazard-Prone Areas**

Hazards	Associated Hazard Areas	Source for Determination
Dam failure	<ul style="list-style-type: none"> <li>• Dam failure inundation areas located downstream of dam structures</li> </ul>	<ul style="list-style-type: none"> <li>• Dam failure inundation maps usually created at the State, regional, or local level</li> </ul>
Land subsidence	<ul style="list-style-type: none"> <li>• Steeply sloped land</li> </ul>	<ul style="list-style-type: none"> <li>• United States Geological Survey (USGS) Landslide Overview Map of the Conterminous United States (national level)</li> <li>• State Geologist</li> <li>• Local Public Works Director</li> </ul>
Seismic	<ul style="list-style-type: none"> <li>• Area within 6 miles of a known fault</li> </ul>	<ul style="list-style-type: none"> <li>• USGS Seismic Maps (as found in FEMA 450 and ASCE 7)</li> <li>• Building Codes</li> </ul>
Wind/Debris	<ul style="list-style-type: none"> <li>• Coastal areas</li> <li>• Tornado-prone areas</li> <li>• Alluvial fans</li> </ul>	<ul style="list-style-type: none"> <li>• Wind Zone Maps (as found in FEMA 320 and ASCE 7)</li> <li>• Building Codes</li> </ul>

Dam failure inundation maps provide the best tool for determining the risk from a dam failure event and are usually available at the State or local level. Every State has a Dam Safety Officer responsible for coordinating its Dam Safety Program. State-specific information about State dam safety regulations is available at the Association of State Dam Safety Officials’ web site: <http://www.damsafety.org>.

To avoid damage that can be caused in areas subject to land subsidence, manufactured homes should be sited away from steep slopes and areas where land subsidence has been known to occur in the past. While the USGS Landslide National Map indicates relative risk on a national basis, State geologists and local public work directors can provide better community-specific information about landslide risk. A listing of State geologists is available at the Association of American State Geologists web site: <http://www.stategeologists.org>.

USGS seismic maps as well as local officials are the best sources for determining the seismic risk for a site. The types of soils present on the site should also be taken into consideration. Poor soils, often found in flood-prone areas, can greatly amplify ground motions and seismic forces.

During wind events, large structures or items such as trees and telephone poles can be damaged and either collapse or become separated from their anchoring to the ground to become sizable pieces of debris. Manufactured homes should be sited away from or in a manner that provides protection from such items since airborne debris can act as missiles during a wind event.

Generally, coastal areas are susceptible to high winds from storm and/or hurricane events. A good reference to determine the susceptibility of a property to wind and seismic hazards is ASCE 7, which provides maps that show the risk of wind and seismic activity for the entire United States and detail design considerations for areas based on the risk posed by these hazards.

### 4.4 Step 4: Protecting Properties In and Near Hazard-Prone Areas

The best way to avoid damage to a manufactured home is to site the home away from areas susceptible to hazards. If the home is to be sited in or near a hazard-prone area, the developer must establish that the risk for the site is acceptable by ensuring that the home can be installed on the proposed site in accordance with applicable hazard-resistant codes and standards. In addition, mitigation techniques can be used during the installation process to further reduce the hazard risk.

NFIP floodplain requirements and HUD installation standards exist to lessen manufactured home vulnerability to flood hazards. Two aspects to consider during this process include the following:

- Placement options
- Design and construction techniques

#### 4.4.1 Placement Options

One way to reduce the risk of damage to manufactured housing and attendant infrastructure is to select a site outside the limits of the hazard areas. This option is most applicable to areas subject to flooding and landslides where hazard areas can be reasonably well defined. Flood and landslide hazards are often localized so that all or a portion of the proposed site development can be located outside of the hazard-prone area. Note that this method is best suited for land that is initially subdivided or in the overall design of a manufactured home park.

##### 4.4.1.1 Flood-Prone Areas

Within floodplain areas, portions of an individual site may be outside the defined floodplain. Portions of the site outside the identified floodplain typically have higher ground elevations and are less susceptible to flooding. Locating the manufactured home outside the identified flood hazard area reduces the home's exposure to the hazard. For individual sites located entirely within the flood-prone area, this method is not an option. Another option for siting in flood-prone areas is to determine if there are portions of the property that, while susceptible to flooding, are not exposed to some of the more destructive characteristics of flooding such as long duration flooding, high flood levels, and high velocity flows.

Generally, the farther a manufactured home is sited from the flood source, the less likely it is to be exposed to high velocity flows. Within riverine flooding areas, the highest velocity flows are usually recorded within and near the floodway. In areas vulnerable to coastal flooding, wave action and/or storm surge can cause floodwaters to be particularly destructive. These types of

forces are the strongest in FEMA high hazard coastal zones labeled as V zones on FIRMs and the portions of A zones adjacent to V zones.

Similarly, flood levels usually decrease as the distance from the flood source increases. Setbacks from the flood source help to keep structures out of areas most susceptible to high velocity and high depth flooding. Damage to structures is directly related to the depth of floodwaters to which they are exposed.

Additionally, floodwaters can make access to and from manufactured homes difficult both during and after a flood event and greatly increase the safety hazards of flooding. For this reason, manufactured home installation in the floodplain is strongly discouraged within areas of increasing flood depths (greater than 2 to 3 feet) and high velocity flood flow (greater than 5 fps).

The duration of flooding is generally dependent on the flood source (size of the watershed), the slope of the stream, and the type of flood event (e.g., hurricane, snow melt event).

Figure 4-2 shows a floodplain/floodway schematic. The floodway is generally the area where floodwaters are deepest and have the fastest flow rate for most waterways. Development in the floodway is restricted through floodplain management regulations and, in some communities, it is prohibited. Under minimum NFIP regulations, in order to place a new structure within the floodway, a floodplain development permit applicant must show that the development will not result in any increase to the 1-percent annual chance flood elevation. In most situations, development in the floodway is not permitted by communities because it almost always leads to a water surface elevation increase.

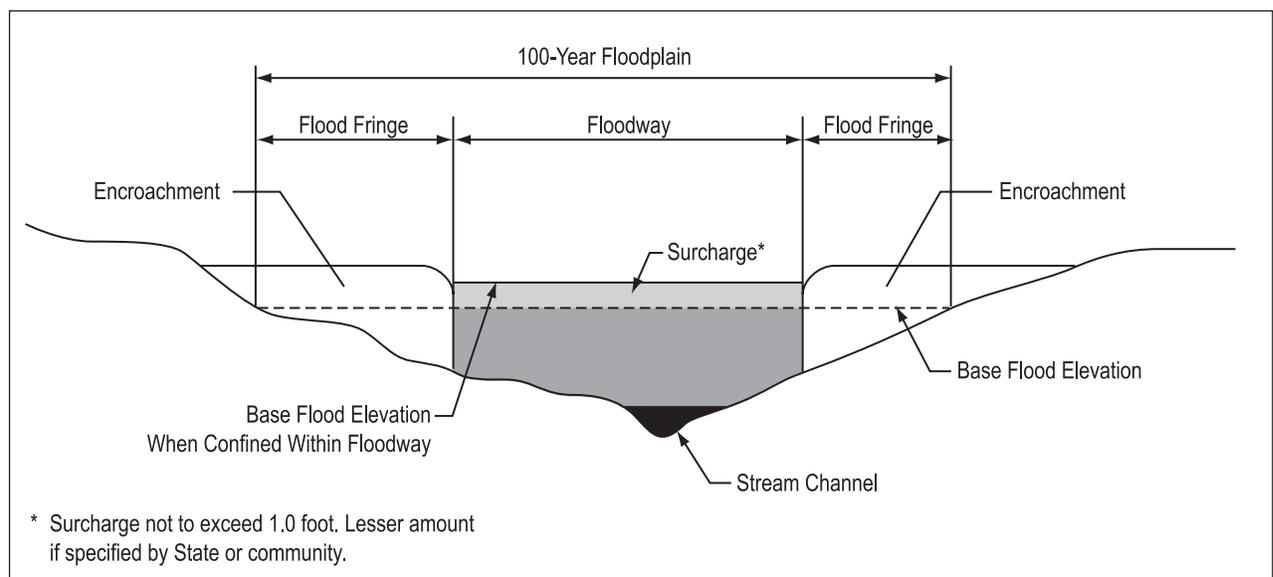


Figure 4-2. Floodplain/floodway schematic.

### 4.4.1.2 Areas Subject to Landslides

In areas subject to landslides, placing manufactured housing away from steeply sloped portions of a site, including relatively flat areas at the bottom of steep slopes, reduces exposure of the structure to damage. This is an option where landslides occur as the result of increased stresses from natural or manmade conditions. Some of the events or activities that can cause increased stresses include heavy rainfall, rapid snowmelts, melting of permafrost, groundwater withdrawal, soil liquefaction, and land development.

### 4.4.2 Design and Construction Techniques

A thorough review of design and construction techniques (as they relate to manufactured housing) and their applicability and feasibility is another consideration in the evaluation of site alternatives. A site located in a hazard-prone area cannot be deemed suitable for manufactured home installation if mitigation methods cannot be implemented at the site.

#### 4.4.2.1 Flood-Prone Areas

Ideally, all manufactured homes should be located outside of the SFHA; however, if that is not possible, manufactured homes located in the SFHA must be installed to resist damage from flooding. Some questions for consideration in determining if design and construction techniques that prevent flood damage are feasible for a particular site follow:

- What are the flood risks for manufactured home installation at the site?
- Can structural fill be placed to elevate the site? If fill is placed, will it withstand forces from velocity flows?
- If long-duration flooding is an issue at the site, can the foundation be designed and constructed to resist long-duration floodwaters?
- Can the foundation be designed and constructed to withstand the expected design velocity flows?
- Can adequate storm drainage be provided?

Chapters 9 and 10 of this guide present methods for the design and construction of manufactured home foundations installed in flood-prone areas.

#### 4.4.2.2 Dam Failure Inundation Areas

In dam failure inundation areas, the decision to install a manufactured home at the site will depend on assessment of the inundation risk. In higher risk areas where dam failures can trigger high flood depths and/or velocities, manufactured homes should be located elsewhere. High velocity flood surges can overwhelm typical residential foundation systems, including those used to support manufactured homes. However, in lower risk areas where relatively small flood depths and velocities are anticipated, the developer should determine if a foundation can be constructed that will provide adequate protection from expected inundation forces.

As with all hazards, safety issues such as warning times are also of vital importance.

#### **4.4.2.3 Areas Subject to Landslides**

Although it is preferable to site housing outside of areas vulnerable to damage from landslides, it might be feasible to undertake a grading project to reduce the risk of landslides. A developer must determine if this is feasible and consider whether it would be cost-effective. Licensed professionals specializing in earth movement (geotechnical, structural, and/or civil engineering) should be consulted.

#### **4.4.2.4 Areas Subject to Seismic Events**

For manufactured housing being placed in areas subject to seismic events, it is important to consider whether or not the foundation can be economically designed and constructed to withstand the expected forces for a design seismic event. Additionally, the property owner must consider the cost and effort of securing non-structural items in the manufactured home to prevent them from being damaged or dislodged. Relatively heavy items like domestic water heaters and HVAC units are particularly vulnerable to seismic events. Sewer, water, and gas lines should be sufficiently flexible to allow the home to move without damaging them. Inspections of manufactured homes after seismic events reveal that homes can be destroyed by broken utility connections (particularly natural gas connections) even where only minor damages occur to the home's structure.

#### **4.4.2.5 Areas Subject to Wind/Debris Hazards**

Manufactured housing being placed in areas subject to wind/debris events need to have a foundation that is designed and constructed to withstand the expected forces associated with a design wind event. In areas subject to seismic activity and wind, the design standard for the hazard requiring the most resistance should be used. Even if the design of a foundation to meet this requirement is cost-effective, the developer still must consider whether or not the manufactured home can withstand the forces expected from a design wind event and debris impact.

### **4.5 Step 5: Deciding on Property Development: Proceed or Reject**

After reviewing the results of the data/information in Steps 1 through 4, deciding whether property development continues is the last step. Is the property suitable for development and for the installation of a manufactured home? If the siting evaluation shows that development of the property is feasible, and a hazard analysis and risk assessment also indicates development may be feasible, the proposed installation must be designed and constructed to adequately resist the hazard threat. If the proposed site satisfactorily addresses all of the conditions listed above, the site can be considered suitable for manufactured home installation.

