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# Mitigation Strategy Guide

*2020 Pre-Disaster Hazard Mitigation Update*

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*Prepared by*



**Bear River Association  
of Governments**

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# Introduction

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Mitigation strategies are actions taken to reduce or eliminate long-term risk to natural hazards. This Mitigation Strategy Guide is a resource to identify and evaluate a range of potential mitigation actions to reduce risk. This guide is a starting point for developing strategies, and the mitigation strategies in this guide were developed based on the *Federal Emergency Management Agency (FEMA) 2013 Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* and the *2019 Utah State Hazard Mitigation Plan*. Other sources, such as other community hazard mitigation plans and federal agency plans and policies, can also provide examples and ideas for developing strategies.

# Avalanche

# Dam Failure

## Local Planning and Regulation

\*Review and/or Develop Codes, Ordinances and Policies

- Develop an avalanche codes or regulation prohibiting or limiting structures in known avalanche zones, such as:
  - Appropriate engineering controls (such as, deflection structures, snow retention nets, dams, etc.) are designed and installed to mitigate the avalanche hazard

## Education and Awareness

- Conduct training with backcountry winter outdoor users
- \* Increase knowledge for city and county emergency managers
- Develop an avalanche warning system

## Structure and Infrastructure Projects

\*Protecting Life Safety and Property Damage

- Retrofit critical facilities and infrastructure to withstand avalanches, such as reinforced concrete walls
- Install fencing to support structures arranged to retain snow

## \*Natural Systems Protection

- Purchase avalanche risk area lands or require buffers when developing infrastructure such as roads or buildings.
- Plant trees and other vegetation to reduce impact of avalanches

## Local Planning and Regulation

\*Ensure the Safety of People, Facilities, and Infrastructure

- Develop ordinances to prohibit or limit critical facilities and/or structures in dam inundation areas
- Ensure new critical facilities and infrastructure are not built in dam inundation areas

\*Coordination and Partnerships

- Work with the Utah Division of Water Rights and dam companies to bring deficient high hazard dams up to current industry standards
- Work with the Utah Division of Water Rights and dam companies to update dam emergency action plans
- Work with the Utah Division of Water Rights and dam companies to install a dam monitoring system

## Education and Awareness

- Promote National Dam Safety Awareness Day
- \* Identify areas of encroachment below high hazard dams, especially in dam inundation areas

## Structure and Infrastructure Projects

- \* Relocate government-owned facilities located near high risk dam failures

# Drought

## Local Planning and Regulation

\*Review and/or Develop Codes, Ordinances and Policies

- Update and adopt drought ordinances, such as:
  - Restricting washing paved surfaces,
  - Restricting irrigating landscapes between certain hours
  - Require hotel, motel and other commercial lodging guests the option of not laundering towels and linens daily
  - Use recycled or non potable water for construction purposes when available
  - Require water-efficient landscaping for new homes
  - Require the use of water efficient appliances and fixtures in new construction
  - Require all new facilities required to install water efficient landscaping with maintenance schedule
  - Require all new facilities required to install the most up to date indoor water efficient devices
  - Prioritize or control water use, particularly for emergency situations like fire fighting, during droughts
- Enforce codes, ordinances, statues, and laws that promote drought resiliency and water conservation practices

\*Improve Public Water Infrastructure and Management with Water Provider

- Meter water sources/usage
- Accurately and consistently record and report water usage
- Bill for all water usage within the water system
- Set water rates to cover the cost of all operations and maintenance
- Set tiered water rates to provide strong incentives for water conservation
- Provide information in water bills

\*Denotes recommended strategy

• Provide educational inserts bills and newsletters  
Monitor Drought Conditions

- Identify local drought indicators, such as precipitation, temperature, surface water levels, soil moisture, etc. to monitor
- Establish a regular schedule to monitor and report conditions

\*Monitor Water Supply

- Establish a regular schedule to check for leaks to minimize water supply losses
- Implement adequate and timely, repair and replacement practices to prevent system failures, inefficiencies, and inaccurate reporting
- Improve water supply monitoring
- Perform water system audits to increase existing revenue streams and improve performance
- Promote and support water system audits to increase reporting and planning accuracy

\*Plan and Prepare for Drought

- Develop a drought emergency plan
- Develop criteria or triggers for drought-related action
- Develop a drought communication plan and early warning system to facilitate timely communication of relevant information to officials, decision makers, emergency managers, and the general public
- Develop agreements for secondary water sources that may be used during drought conditions
- Provide incentive based conservation programs
- Provide landscape and irrigation audits

## Education and Awareness

\*Educate Residents on Water Saving Techniques

- Advertise, promote and/or encourage citizens to take water savings measures, such as:

# Drought (cont.)

- Install low-flow water saving showerheads and toilets
- Turn water flow off while brushing teeth or during other cleaning activities
- Adjust sprinklers to water the lawn and not the sidewalk or street
- Run the dishwasher and washing machine only when they are full
- Check for leaks in plumbing or dripping faucets
- Host workshops, classes and events
- Provide demonstrations of water saving technology and practices
- Provide information water bills
- Provide educational inserts bills and newsletters

## \*Educate the Agriculture Sector on Soil and Water Saving Practices

- Encourage farmers to implement soil and water conservation practices that foster soil health and improve soil quality to help increase resiliency and mitigate the impacts of drought, including:
- Encourage farmers to implement water conservation practices and technologies
- Promote the use of treated wastewater effluent where appropriate
- Develop water banking opportunities

## Educate Decision Makers and Government Employees on Water Saving Techniques

- Educate policy leaders on water efficiency efforts, resources and agency needs
- Educate employees about water conservation practices

## Structure and Infrastructure Projects

### \*Retrofit Water Supply Systems

- Improve water supply and delivery systems to

save water by designing water delivery systems to accommodate drought events

- Develop new or upgrade existing water delivery systems to eliminate breaks and leaks and for redundancy in case of main source water contamination or failure
- Retrofit existing facilities with water saving devices
- Convert existing facilities to water wise landscaping

### \*Expand and Improve Existing Potable Water Systems

- Enhance the productivity and efficiency of existing raw water extraction methods
- Modify and update existing requirements to diversify and protect water sources
- Create, protect or recharge underground aquifers/ reservoirs

## \*Natural Systems Protection

Designate and or preserve adequate source water protection zones or groundwater recharge areas

- Acquire source water protection zone data from state and federal agencies
- Purchase land which includes sourcewater protection zones and appropriate buffer areas

# Earthquake

## \*Local Planning and Regulation

Review and/or Develop Codes, Ordinances and Policies

- Develop and/or review earthquake hazard ordinance, such as:
  - Require flexible piping when extending or replacing water, sewer, or natural gas service in earthquake damage zones
  - Require shutoff valves and emergency connector hoses where water mains cross fault lines on all new construction in earthquake damage zones
  - Require backup generators at critical facilities

Building Code Adoption and Enforcement

- Adopt and enforcing updated building code provisions to reduce earthquake damage risk including geotechnical studies in potential geologic hazard areas
- Adopt the International Building Code (IBC) and International Residential Code (IRC)

Local Planning

- Develop and distributing guidelines or passing ordinances that require developers and building owners to locate lifelines, buildings, critical facilities, and hazardous materials out of areas subject to significant seismic hazards
- Support financial incentives, such as low interest loans or tax breaks, for home and business owners who seismically retrofit their structures
- Create a seismic safety committee to provide policy recommendations, evaluate and recommend changes in seismic safety standards, and give an annual assessment of local and statewide implementation of seismic safety improvements
- Develop an earthquake emergency plan
- Develop an inventory of public and commercial

buildings that may be particularly vulnerable to earthquake damage, including pre-1940s homes and homes with cripple wall foundations

Conduct Inspections of Building Safety

- Establish a school survey procedure and guidance document to inventory structural and non-structural hazards in and around school buildings

## \*Education and Awareness

Increase Awareness of Earthquakes

- Work with insurance industry representatives to increase public awareness of the importance of earthquake insurance
- Develop an outreach program about earthquake risk and mitigation activities in homes, schools, and businesses
- Educate homeowners on safety techniques to follow during and after an earthquake
- Provide online maps of earthquake faults and damage zones to residents, decision makers and design officials

Increase Education of Earthquakes

- Educate the general public and disseminate information on earthquakes
- Provide educational and training opportunities for city and county planners, emergency managers, decision makers
- Educate developers and real estate agents
- Organize a field visit from the Utah Geologic Survey to identify and discuss earthquake hazards
- Educate homeowners about structural and non-structural retrofitting of vulnerable homes and encouraging retrofit

Conduct Outreach to Builders, Architects, Engineers, and Inspectors

# Earthquake (cont.)

- Conduct information sessions or other forms of outreach on seismic code provisions for new and existing buildings to enhance code use and enforcement by local architects, engineers, contractors, and code enforcement personnel
- Train building department staff and officials on Form ATC-20 for post-earthquake building evaluation. The ATC-20 report and addendum, prepared by the Applied Technology Council, provide procedures and guidelines for making on-the-spot evaluations and decisions regarding continued use and occupancy of earthquake damaged buildings
- Develop a technical assistance information program for homeowners. The program can include providing local government building departments with copies of existing strengthening and repair information for distribution

## **\*Structure and Infrastructure Projects**

### Retrofit Critical Facilities and Infrastructure to Withstand Earthquakes

- Conduct seismic retrofitting for critical facilities most at risk to earthquakes
- Retrofit businesses, residential structures, infrastructure, and public buildings (especially in historic districts) to withstand moderate earthquakes
- Require bracing of generators, elevators, and other vital equipment in hospitals and/or other critical facilities
- Acquire properties in earthquake hazard zones
- Use flexible piping when extending or replacing water, sewer, or natural gas service
- Installing shutoff valves and emergency connector hoses where water mains cross fault lines
- Promote and provide renewable energy such as solar to provide power after an earthquake
- Conduct seismic retrofitting for government owned-facilities in earthquake damage zone
- Review construction plans for all bridges to

determine their susceptibility to collapse and retrofitting problem bridges.

### Implement Structure Mitigation Techniques

- Strengthen and retrofitting non-reinforced masonry buildings and non-ductile concrete facilities that are particularly vulnerable to ground shaking
- Retrofit building veneers to prevent failure
- Anchor rooftop-mounted equipment (i.e., HVAC units, satellite dishes, etc)
- Construct masonry chimneys greater than 6 feet above a roof with continuous reinforced steel bracing

## **\*Natural Systems Protection**

### Protect and Restore Earthquake Hazard Areas

- Establish a "green infrastructure" program to link, manage, and expand existing parks, preserves, greenways, etc.
- Purchase earthquake hazard areas in accordance with green infrastructure plan or similar park or natural resource plans
- Develop earthquake hazard areas as parks or trail corridors

# Flood

## \*Local Planning and Regulation

### Review and/or Develop Codes, Ordinances and Policies

- Participate in the National Flood Insurance Program (NFIP)
- Develop codes, ordinance or policy that limits or restricts development in the floodplain, including:
  - Adopt ordinances that at the very least meet minimum Federal and state requirements to comply with NFIP
  - Adopt ordinances that include additional flood areas based on historical flood datasets and local or state flood maps
  - Prohibit or limit floodplain development through regulatory and/or incentive-based measures
  - Limit the density of developments in the floodplain
  - Require that floodplains be kept as open space
  - Require that all critical facilities including emergency operations centers (EOC), police stations, and fire department facilities be located outside of flood-prone areas
  - Limit the percentage of allowable impervious surface within developed parcels
  - Develop a stream buffer ordinance to protect water resource and limit flood impacts
  - Prohibit any fill in floodplain areas
  - Require a drainage study with new development
  - Require more trees be preserved and planted in landscape designs to reduce the amount of stormwater runoff
  - Require developers to plan for on-site sediment retention
  - Require developers to construct on-site retention basins for excessive stormwater and as a firefighting water source

- Require all critical facilities to meet requirements of Executive Order 11988 and be built 1 foot above the 500-year flood elevation

- Encourage the use of Low Impact Development techniques
- Prepare and adopt a stormwater drainage plan and ordinance
- Pass and enforce an ordinance that regulates dumping in streams and ditches
- Prohibit or limit floodplain development through regulatory and/or incentive-based measures
- Develop engineering guidelines for drainage from new development
- Encourage the use of permeable driveways and surfaces to reduce runoff and increase groundwater recharge
- Adopt erosion and sedimentation control regulations for construction and farming

### Adopt and Enforce Building Codes and Development Standards

- Adopting the International Building Code (IBC) and International Residential Code (IRC)
- Adopt ASCE 24-05 Flood Resistant Design and Construction. ASCE 24 is a referenced standard in the IBC that specifies minimum requirements and expected performance for the design and construction of buildings and structures in the flood hazard areas to make them more resistant to flood loads and flood damage
- Add or increase “freeboard” requirements (feet above base flood elevation) in the flood damage ordinance
- Prohibit all first floor enclosures below base flood elevation for all structures in flood hazard areas
- Set the design flood elevation at or above the historical high water mark if it is above the mapped base flood elevation
- Use subdivision design standards to require elevation data collection during platting and to have buildable space on lots above the base flood elevation

# Flood (cont.)

- Require standard tie-downs of propane tanks

systems and capital improvements

## Local Planning

- Participate in the Community Rating System (CRS), which rewards communities that exceed the minimum NFIP requirements. Depending upon the level of participation, flood insurance premium rates are discounted for policyholders
- Develop a floodplain management plan and updating it regularly
- Determine and enforce acceptable land uses to alleviate the risk of damage by limiting exposure in flood hazard areas
- Mitigating hazards during infrastructure planning. For example, decisions to extend roads or utilities to an area may increase exposure to flood hazards
- Adopt a post-disaster recovery ordinance based on a plan to regulate repair activity, generally depending on property location
- Establish a "green infrastructure" program to link, manage, and expand existing parks, preserves, greenways, etc.
- Encourage the use of porous pavement, vegetative buffers, and islands in large parking areas
- Incorporate procedures for tracking high water marks following a flood into emergency response plans
- Conduct NFIP community workshops to provide information and incentives for property owners to acquire flood insurance
- Require and maintain FEMA elevation certificates for all new and improved buildings located in floodplains
- Implement damage reduction measures for existing buildings such as acquisition, relocation, retrofitting, and maintenance of drainage ways and retention basins
- Establish local funding mechanisms for flood mitigation, such as:
  - Taxes to support regulatory system
  - Impact fees to help fund public projects to mitigate impact of land development
  - Levy taxes to finance maintenance of drainage

\*Denotes recommended strategy

## Coordination and Partnerships

- Develop a stormwater committee that meets regularly to discuss issues and recommend projects
- Form a regional watershed council to help bring together resources for comprehensive analysis, planning, decision-making, and cooperation
- Establish watershed-based planning initiatives to address the flood hazard with neighboring jurisdictions

## Stormwater Management Planning

- Complete a stormwater drainage study for known problem areas
- Develop a community-wide stormwater management plan

## \*Education and Awareness

### Increase Flood Risk Awareness

- Encourage homeowners to purchase flood insurance
- Annually distribute flood protection safety pamphlets or brochures to the owners of flood-prone property
- Educate citizens about safety during flood conditions, including the dangers of driving on flooded roads
- Use outreach programs to advise homeowners of risks to life, health, and safety
- Offer GIS hazard mapping online for residents and design professionals

### Educate Property Owners About Flood Mitigation Techniques

- Use outreach activities to facilitate technical assistance programs that address measures that citizens can take or facilitate funding for mitigation

# Flood (cont.)

measures.

- Encourage homeowners to install backflow valves to prevent reverse-flow flood damages
- Encourage residents in flood-prone areas to elevate homes
- Educate the public about securing debris, propane tanks, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if picked up and washed away by floodwaters
- Ask residents to help keep storm drains clear of debris during storms (not to rely solely on Public Works)

## **\*Structure and Infrastructure Projects**

Remove Existing Structures from Flood Hazard Area

Elevate or Retrofit Facilities and Infrastructure

- Elevate structures so that the lowest floor, including the basement, is raised above the base flood elevation
- Raise utilities or other mechanical devices above expected flood levels
- Elevate and anchor manufactured homes or, preferably, keep manufactured homes out of the floodplain
- Relocate utilities and water heaters above base flood elevation and using tankless water heaters in limited spaces
- Install/upgrade stormwater pumping stations
- Raise electrical components of sewage lift stations above base flood elevation
- Raise manhole openings using concrete pillars
- Install watertight covers or inflow guards on sewer manholes
- Install flood telemetry systems in sewage lift stations
- Install back-up generators for pumping and lift stations in sanitary sewer systems along with other measures (e.g., alarms, meters, remote controls, and switchgear upgrades)

- Build earthen dikes around flood-threatened critical facilities

Floodproof Residential and Non-Residential Structures

- Wet floodproof in a basement, which may be preferable to attempting to keep water out completely because it allows for controlled flooding to balance exterior and interior wall forces and discourages structural collapse
- Encourage wet floodproofing of areas above base flood elevation.
- Use water resistant paints or other materials to allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure
- Dry floodproof non-residential structures by strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls to keep water out

Protect Infrastructure

- Elevate roads and bridges above the base flood elevation to maintain dry access
- Raise low-lying bridges
- Floodproof wastewater treatment and/or water treatment facilities located in flood hazard areas
- Place riprap in strategic locations
- Increase the size of culverts and bridges

Improve Stormwater Drainage Capacity

- Install, re-route, or increase the capacity of a storm drainage system
- Increase drainage or absorption capacities with detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection
- Increase capacity of stormwater detention and

# Flood (cont.)

- retention basins
- Increase dimensions of drainage culverts in flood-prone areas
- Use stream restoration to ensure adequate drainage and diversion of stormwater
- Require developers to construct on-site retention basins for excessive stormwater and as a firefighting water source.
- Provide grassy or bio-swales along roadsides

## Conduct Regular Maintenance for Drainage Systems and Flood Control Structures

- Perform regular drainage system maintenance, such as:
  - Sediment and debris clearance
  - Detection and prevention of discharges into stormwater and sewer systems from home footing drains, downspouts, or sewer pumps
- Implement an inspection, maintenance, and enforcement program to help ensure continued structural integrity of dams and levees
- Routinely clean debris from support bracing underneath low-lying bridges
- Routinely clean and repairing stormwater drains
- Regularly clear sediment build-up on riverbanks near aerial lines
- Inspect bridges and identifying if any repairs or retrofits are needed to prevent scour

## \*Natural Systems Protection

### Protect and Restore Natural Flood Mitigation Features

- Establish a "green infrastructure" program to link, manage, and expand existing parks, preserves, greenways, etc.
- Design a "natural runoff" or "zero discharge" policy for stormwater in subdivision design
- Require more trees be preserved and planted in landscape designs to reduce the amount of stormwater runoff

- Encourage the use of porous pavement, vegetative buffers, and islands in large parking areas
- Use bioengineered bank stabilization techniques
- Protect and enhance landforms that serve as natural mitigation features (i.e., riverbanks, wetlands, dunes, etc.
- Use vegetative management, such as vegetative buffers, around streams and water sources
- Protect and Preserve wetlands to help prevent flooding in other areas
- Establish and manage riparian buffers along rivers and streams
- Retain and/or restore natural vegetative beds in stormwater channels
- Retain and/or restore thick vegetative cover on public lands flanking rivers

### Preserve Floodplains and Open Space

- Develop an open space acquisition, reuse, and preservation plan targeting hazard areas
- Develop a land banking program for the preservation of the natural and beneficial functions of flood hazard areas
- Use transfer of development rights to allow a developer to increase densities on another parcel that is not at risk in return for keeping floodplain areas vacant
- Compensate an owner for partial rights, such as easement or development rights, to prevent a property from being developed

# Landslide/Steep Slopes

## **\*Local Planning and Regulation**

Review and/or Develop Codes, Ordinances and Policies

- Develop an codes or regulation prohibiting or limiting structures in known landslide/steep slope risk areas, such as:
  - Create or increase setback limits on parcels near high-risk areas
  - Restrict or limit industrial activity that would strip slopes of essential top soil
  - Establish setback requirements and using large setbacks when building roads near slopes of marginal stability
  - Restrict build over a certain percentage slopes (30 percent is a common maximum slope in Utah)

Local Planing

- Create a plan to implement reinforcement measures in high-risk landslide areas
- Incorporate economic development activity restrictions in high-risk landslide areas

## **\*Education and Awareness**

Increase Landslide/Steep Slope Risk Awareness

- Annually distribute landslide/steep slope safety pamphlets or brochures to homeowners in hazard areas
- Educate citizens about safety during and after landslides
- Use outreach programs to advise homeowners of risks to life, health, and safety
- Offer GIS hazard mapping online for residents and design professionals

## **\*Structure and Infrastructure Projects**

Remove Existing Building and Infrastructure from Landslide/Steep Slope Hazard Areas

*\*Denotes recommended strategy*

Protect Life Safety and Property Damage

- Implement monitoring mechanisms/procedures (i.e., visual inspection or electronic monitoring systems)
- Apply soil stabilization measures, such as planting soil stabilizing vegetation on steep, publicly-owned slopes
- Use debris-flow measures that may reduce damage in sloping areas, such as stabilization, energy dissipation, and flow control measures
- Install catch-fall nets for rocks at steep slopes near roadways
- Locate and/or relocate utilities outside of landslide areas to decrease the risk of service disruption
- Require secondary water meters and smart irrigation controllers to reduce excessive groundwater near known landslide areas
- Retrofit power, water and sewer infrastructure

## **\*Natural Systems Protection**

Prevent or Reduce Impacts from Landslides by Stabilizing Slopes

- Plant vegetation and trees along landslide prone areas
- Dewater or install impermeable membranes on existing slide areas to prevent over saturation of soil
- Grade to lessen slope
- Construct rock buttresses and retaining walls

# Problem Soils

# Radon

## **LIQUEFACTION (See Earthquake Section)**

### **\*Local Planning and Regulation**

Review and/or Develop Codes, Ordinances and Policies

- Develop a code or regulation prohibiting or limiting structures in known problem soil areas, such as:
  - Require geotechnical study to determine risk to structures in various geographic areas
  - Restrict development in areas with soil that is considered poor or unsuitable for development
  - Adopt an ordinance promoting permafrost sensitive construction practices

### **\*Education and Awareness**

- Promote community awareness of risks and impacts from building in problem soil areas

### **\*Structure and Infrastructure Projects**

Protect Life Safety and Property Damage

- Retrofit or remove existing structures from problem soil areas

## **\*Local Planning and Regulation**

Review and/or Develop Codes, Ordinances and Policies

- Develop radon codes or regulations such as:
  - Require testing at existing facilities and homes during and/or immediately after construction
  - Develop radon prevention standards and regulations for new housing including installation of ventilation systems in high hazard areas

### **\*Education and Awareness**

- Develop and distribute radon hazard guides for homeowners and businesses
- Advertise radon testing equipment

### **\*Structure and Infrastructure Projects**

Protect Life Safety and Property Damage

- Encourage homeowners to test for radon
- Encourage homeowners to install radon systems in home
- Retrofit homes with radon ventilation systems

# Severe Weather

## \*Local Planning and Regulation

Review and/or Develop Codes, Ordinances and Policies

- Develop and/or review regulations governing residential construction to prevent damage from severe weather, including:
  - Adopt the International Building Code (IBC) and International Residential Code (IRC)
  - Adopt standards from International Code Council (ICC)-600 Standard for Residential Construction in High-Wind Regions
  - Review building codes and structural policies to ensure they are adequate to protect older structures from wind damage  
Require or encourage wind engineering measures and construction techniques that may include structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles
  - Require tie-downs with anchors and ground anchors appropriate for the soil type for manufactured homes
  - Prohibit the use of carports and open coverings attached to manufactured homes
  - Require the use of special interlocking shingles designed to interlock and resist uplift forces in extreme wind conditions to reduce damage to a roof or other structures
  - Improve nailing patterns
  - Require building foundation design, braced elevated platforms, and protections against the lateral forces of winds and waves
  - Require new masonry chimneys greater than 6 feet above a roof to have continuous reinforced steel bracing
  - Require structures on temporary foundations to be securely anchored to permanent foundations

## \*Education and Awareness

Provide Weather-Related Information through Print, Broadcast and Social Media

- Prepare and disseminate brochures, public service announcements, etc., related to severe weather
- Utilize awareness weeks for, lightning, severe weather, winter weather, etc.
- Organize outreach to vulnerable populations, including establishing and promoting accessible heating centers in the community
- Use Integrated Public Alert and warning Systems (IPAWS) and other available warning systems and resources to disseminate emergency messages
- Increase participation in the NWS Storm Ready program
- Promote Wireless Emergency Alerts (WEA)

Conduct Outreach Activities

- Mail safety brochures with monthly water bills
- Post warning signage at local parks, county fairs, and other outdoor venues
- Teach school children about the dangers of hail, lightning, wind and how to take safety precautions

Increase Public Awareness

- Inform residents of shelter locations and evacuation routes
- Educate homeowners on the benefits of retrofitting homes
- Ensure that school officials are aware of the best area of refuge in school buildings
- Instruct property owners on how to properly install temporary window coverings before a storm
- Educate design professionals to include wind mitigation during building design
- Include safety strategies for severe weather in driver education classes and materials

# Severe Weather (cont.)

## \*Structure and Infrastructure Projects

### Protect Life Safety and Property Damage of Residential Buildings

- Encourage all new construction to meet enhanced standards for wind-loading, snow-loading and other weather-related hazards
- Ensure retrofits comply with new building codes
- Discourage flat roofs in areas that experience heavy snows
- Install hurricane shutters or other protective measures
- Retrofit gable end walls to eliminate wall failures in high winds
- Reinforce garage door
- Inspect and retrofitting roofs to adequate standards to provide wind resistance
- Improve roof coverings (e.g., no pebbles, remove ballast roof systems)

### Retrofit Public Buildings and Critical Facilities

- Anchor roof-mounted heating, ventilation, and air conditioning units
- Retrofit public buildings to withstand snow loads and prevent roof collapse
- Retrofit buildings with load-path connectors to strengthen the structural frames
- Ensure critical facilities, public buildings, and high occupancy buildings have back-up generators
- Retrofit or constructing the emergency operations center to FEMA 361 standards
- Avoid placing and/or move flag poles or antennas near buildings
- Upgrade and maintain existing lightning protection systems to prevent roof cover damage
- Require upgrading of reused buildings that will house critical facilities
- Protect traffic lights and other traffic controls from high winds
- Convert traffic lights to mast arms

### Retrofit Critical Infrastructure

- Plan for and maintain adequate road and debris clearing capabilities
- Incorporate inspection and management of hazardous trees into the drainage system maintenance process
- Inspect utility poles to ensure they meet specifications and are wind resistant
- Bury power lines to provide uninterrupted power after severe winds, considering both maintenance and repair issues
- Upgrade overhead utility lines (e.g., adjust utility pole sizes, utility pole span widths, and/or line strength)
- Replace existing non-ductile infrastructure with ductile infrastructure to reduce their exposure to hazardous events
- Use snow fences or “living snow fences” (e.g., rows of trees or other vegetation) to limit blowing and drifting of snow over critical roadway segments

### Reducing Impacts of Wind, Hail, Lightning

- Include measures such as structural bracing, shutters, laminated glass in window panes, and hail-resistant roof coverings or flashing in building design to minimize damage.
- Improve roof sheathing to prevent hail penetration
- Install hail resistant roofing and siding
- Install lightning protection devices and methods, such as lightning rods and grounding, on communications infrastructure and other critical facilities
- Install and maintaining surge protection on critical electronic equipment

## \*Natural Systems Protection

### Reducing Impacts of Wind

- Use natural environmental features as wind buffers in site design

# Tornado

## Local Planning and Regulation

Review and/or Develop Codes, Ordinances and Policies

- Develop an tornado codes or regulation prohibiting or limiting structures in known tornado areas, such as:
  - Appropriate engineering controls (such as, deflection structures) are designed and installed to mitigate the hazard

Require Wind-Resistant Building Techniques, including

- Structural bracing
- Straps and clips
- Anchor bolts
- Laminated or impact-resistant glass
- Reinforced pedestrian and garage doors
- Window shutters
- Waterproof adhesive sealing strips
- Interlocking roof shingles

## Education and Awareness

Conduct Outreach Activities to Increase Awareness of Tornado Risk

- Educate citizens through media outlets.
- Conduct tornado drills in schools and public buildings
- Teach school children about the dangers of tornadoes and how to take safety precautions
- Distribute tornado shelter location information
- Support severe weather awareness week
- Promote use of National Oceanic and Atmospheric Administration (NOAA) weather radios

## Structure and Infrastructure Projects

Encourage Construction of Safe Rooms

\*Require Wind-Resistant Building Techniques, including:

*\*Denotes recommended strategy*

- Structural bracing
- Straps and clips
- Anchor bolts
- Laminated or impact-resistant glass
- Reinforced pedestrian and garage doors
- Window shutters
- Waterproof adhesive sealing strips
- Interlocking roof shingles

# Wildfire

## \*Local Planning and Regulation

Review and/or Develop Codes, Ordinances and Policies

- Develop wildfire and/or Wildland Urban Interface (WUI) codes or regulation prohibiting or limiting structures in known wildfire risk areas, such as:
  - Develop policies and recommendation for addressing wildfire risk and discouraging expansion in the wildland-urban interface
  - Develop specific design guidelines and development review procedures for new construction, replacement, relocation, and substantial improvement in wildfire hazard areas
  - Address fire mitigation through access, signage, fire hydrants, water availability, vegetation management, and special building construction standards
  - Involve fire protection agencies in determining guidelines and standards and in development and site plan review procedures
  - Establish wildfire mitigation planning requirements for large scale developments or planned unit developments
  - Require and maintain safe access for fire apparatus to wildland-urban interface neighborhoods and properties
  - Limit or prevent building critical government-owned facilities in the WUI
- Ensure newly constructed government-owned facilities are code compliant for wildfire hazards and promote the use of enhanced wildfire mitigation practices
- Mandate wildfire planning be incorporated into development and land use planning

Local Planning

- Develop a community wildfire preparedness plan
- Include considerations of wildfire hazards in land use, public safety, and other elements of the

comprehensive plan

- Set guidelines for annexation and service extensions in high-risk areas
- Use zoning and/or a special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas
- Address density and quantity of development, as well emergency access, landscaping and water supply
- Promote conservation of open space or wildland-urban boundary zones to separate developed areas from high-hazard areas

Adopt and Enforce Building Codes and Development Standards

- Encourage the use of non-combustible materials (i.e., stone, brick, and stucco) for new construction in wildfire hazard areas
- Use fire resistant roofing and building materials in remodels, upgrades, and new construction
- Enclose the foundations of homes and other buildings in wildfire-prone areas, rather than leaving them open and potentially exposing undersides to blown embers or other materials
- Prohibit wooden shingles/wood shake roofs on any new development in areas prone to wildfires
- Encourage the use of functional shutters on windows

## \*Education and Awareness

Participate in Firewise Program

- Join the “Firewise Communities/USA” recognition program sponsored by the National Wildlife Coordinating Group ([firewise.org](http://firewise.org))
- Sponsor Firewise workshops for local officials, developers, civic groups, and neighborhood/homeowners’ associations
- Consult Firewise guidance and encouraging or requiring best practices in your community

# Wildfire (cont.)

## Increase Wildfire Awareness

- Develop printed information, on defensible space and wildfire hazards
- Organize a local fire department tour to show local elected officials and planners the most vulnerable areas of the community's wildland-urban interface and increase their understanding of risks
- Work with insurance companies, utility providers, and others to include wildfire safety information in materials provided to area residents
- Develop partnerships with neighborhood groups, homeowners' associations, and others to conduct outreach activities
- Use local fire departments to conduct education programs in schools
- Inform the public about proper evacuation procedures
- Form a citizen plan implementation steering committee to monitor progress of local mitigation actions

## Educate Property Owners about Wildfire Mitigation Techniques

- Install fire mitigation systems such as interior and exterior sprinkler systems
- Perform safe disposal of yard and household waste rather than open burning
- Remove dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards
- Create a defensible space or buffer zone cleared of combustible materials around property
- Installing and maintaining smoke detectors and fire extinguishers on each floor of their homes or other buildings
- Safely use and store necessary flammable materials, including machine fuels
- Store stacked firewood at least 100 feet away and uphill from homes
- Keep flammables, such as curtains, secured away from windows or using heavy fire-resistant drapes

## \*Structure and Infrastructure Projects

### Protecting Life Safety and Property Damage

- Create defensible space around structures and infrastructure
- Provide assistance with disposition of vegetative material removed from private lands, as through chipping, burning, or other methods
- Replace flammable vegetation with less flammable species
- Create defensible zones around power lines, oil and gas lines, and other infrastructure systems
- Routinely inspecting the functionality of fire hydrants
- Enhance existing or develop new water sources in wildfire-prone areas
- Build and maintain water-filling areas for helicopters
- Establish dry water hydrants in high hazard fire areas

### Mitigate Against Post-Wildfire Flooding

- Identify areas where re-vegetation and rehabilitation is necessary and prioritize
- Commence re-vegetation and rehabilitation on a priority basis
- Construct temporary or permanent debris traps and other flood mitigating structures in wildfire-burned areas

## \*Natural Systems Protection

### Implement a Fuels Management Program

- Perform maintenance including fuel management techniques such as pruning and clearing dead vegetation, selective logging, cutting high grass, planting fire-resistant vegetation, and creating fuel/fire breaks (i.e., areas where the spread of wildfires will be slowed or stopped by the removal of fuels)

# Wildfire (cont.)

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- Use prescribed burning to reduce fuel loads that threaten public safety and property
- Identify and clear fuel loads created by downed trees
- Cut firebreaks into public wooded areas in the wildland-urban interface
- Sponsor local “slash and clean-up days” to reduce fuel loads along the wildland-urban interface
- Link wildfire safety with environmental protection strategies (i.e., improving forest ecology, wildlife habitat, etc.)
- Develop a vegetation management plan