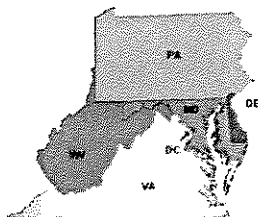




FEMA



REGION III

AVOIDING FLOOD DAMAGE

Every year, flooding causes over 90% of the disaster-related property damage in the United States and accounts for over 75% of all Presidential disaster declarations.

If you don't know whether your property is at risk of flooding, check with your local floodplain management office, building department, or planning and zoning office. They can determine if you are located in a flood hazard area.

The first line of defense against flooding for a flood prone property in a floodplain is flood insurance. Homeowner's insurance policies do not cover flood damage.

Avoid building in a floodplain unless you elevate or reinforce your home to make it less susceptible to flood damage.

Proper construction methods and materials must be used in construction to reduce the vulnerability to damage during extreme flood events.

Building Higher, Building Drier

Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region III: District of Columbia, Delaware, Maryland, Pennsylvania, Virginia, West Virginia



Clean up continues in home after a flash flood. FEMA NewsPhoto/Bob McMillian

Everyone Should Have a Weather Alert Radio

Weather alert radios are now considered to be as important to have as smoke detectors in your home, school or business. Known as the "Voice of the National Weather Service," the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) Weather Radio broadcast signal is provided as a public service. Weather Radio is a nationwide network of radio stations broadcasting continuous weather information direct from a nearby National Weather Service office.

NOAA Weather Radio is an "all hazards" radio network, making it the single source for the most comprehensive weather warning and emergency information available to the public.

Good weather alert radios use Specific Area Message Encoder (SAME) technology, which automatically announces the local NOAA broadcasts only when the alert tones are activated in the county or range of counties specified by the user (up to 20). Alerts for other areas are ignored, which means Weather Radio users can sleep without being awoken by broadcast alarms that do not apply to their area.

Weather Radio requires a special radio receiver capable of picking up the NOAA signal. SAME technology weather radios are available from electronics dealers costing \$40-70 depending upon features and are available in both 110-volt plug-in home models with battery backup and portable hand-held models. Information and product sellers are widely available by performing a search on the Internet.

Simple Steps to Prevent Water and Flood Damage

Hazard mitigation is defined as “sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects.” Flood resistant engineering techniques and specialized flood resistant products applied to good construction practices create a safer and stronger home to safeguard people and property around the clock and through the years.

Hazard mitigation helps protect both the family and the home from the risk of damages, property loss, and human suffering that are caused by extreme flood disasters. Now is the right time to consider the long-term benefit and security of reconstructing a stronger, safer home. Families that are considering new home construction will enjoy a lifetime of additional protection from reducing the risk of damages from the effects of flood hazards if they decide that hazard mitigation is a fundamental and basic requirement of modern 21st century home design and retrofitting.

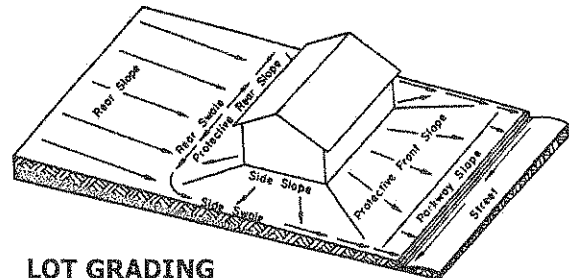
You should take steps to protect your house if it has been damaged by flooding or is in an area where flooding is likely to occur. There are some very simple steps that will reduce or eliminate the potential for water and flood damage.

Before Any Work is Started

- Recognize the characteristics of your home and property as well as the type of flooding that occurs, where and how it occurs, the nature of the threat it poses, and how it can affect your house.
- Check with your local housing and code officials about local codes before making changes and ask your building department about any required building permits.

Ensure Water Drains Away From the Building and Foundation

- Make sure runoff from rainfall and snowmelt is directed away from your house and overlaid to a roadway or ditch and away from adjacent properties.
 - A common problem around the perimeter of a building is settlement of backfill resulting in a loss of positive slope away from your house.
 - For planted or grassed areas adjoining buildings, grading should have a 5 to 10 percent minimum slope or about 1 inch per foot for a minimum of 10 feet.
 - For paved areas around a building, grading with a 1 percent minimum slope is acceptable.
 - Continue to drain water away from the house to drain the water or properly collect and divert draining water to prevent excessive water from percolating into the soil adjacent to your house.
 - Repair any foundation cracks and holes to prevent water penetration.
 - Clean and repair gutters and downspouts regularly, with new gutter installed a minimum slope of 1/16 inch for every 10 feet of gutter length.
 - Connect downspouts into a perimeter drain system directly instead of flowing onto the area adjacent to the foundation, or if extenders are used, they should extend about 6 to 10 feet minimum.
 - Keep valuable items out of basements and store any basement items in plastic containers as high up off the floor as possible.
 - Basement or below-grade window wells should have drains linked to the foundation drains or consider installing a window well covering of some type to reduce and divert water entry. These windows should resist water entry or be caulked and weather-stripped.
- The diagram, titled "LOT GRADING", shows a 3D perspective of a house on a lot. Arrows indicate the desired direction of water runoff from the house. Labels include "Rear Slope" on the back of the house, "Protective Slope" on the sides, "Side Slope" on the front-left, "Front Slope" on the front-right, and "Parkway Slope" leading down to a "Street".



Sealing Wall Penetrations at or Below Grade

- Provide slope away from the building for door entries.
- Regularly check any openings in the walls or structural system that could provide an avenue for water entry into your home.
- Because of the unique nature of penetrations, such as sewer pipes, water lines, drain basins in the floor slab, electrical sleeves, gas lines and others, they may require sealing and waterproofing that fits their own design features.
- Remember that penetration seals serve as a second line of defense for water penetration and avoiding water build-up is the primary goal for avoiding water penetration.

Avoiding Flood Damage to Service Equipment

Houses are typically provided with a variety of building support service equipment, including the following:

- Electrical systems (wiring, switches, outlets, fixtures, fuse and circuit breaker panels, meters)
- Telephone and cable TV lines
- Water and sewer lines and drains
- Natural gas lines
- Septic tanks
- Heating, ventilating, and cooling (HVAC) equipment (air conditioning compressors, heat pumps, furnaces, ductwork, hot water heaters, fuel storage tanks)
- Appliances (washing Machines, dryers, freezers, refrigerators)

Methods of Protection

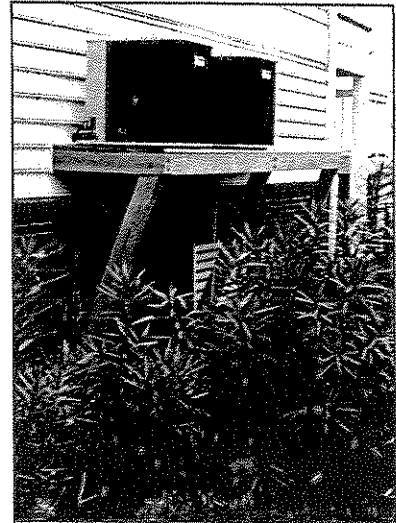
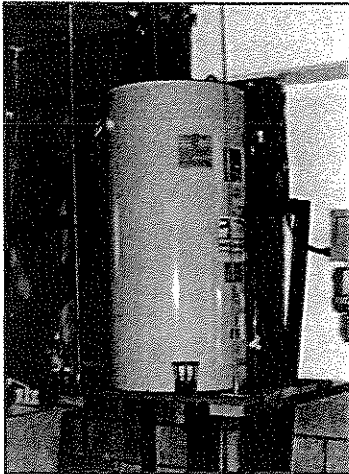
You can protect interior and exterior service equipment in four ways: by elevating it, relocating it, suspending it or protecting it in place. Some of these methods can be handled by homeowners and others will require a professional contractor. Again, before you start any work, always check with the local building department about building permit requirements.

Elevating

- Service equipment outside your house can often be elevated above the flood level. Elevate at least 12" above the Base Flood Elevation (BFE).
- Elevating equipment inside a basement will depend largely on the flood level and height clearance space. If the flood level is only 1 to 2 feet above the

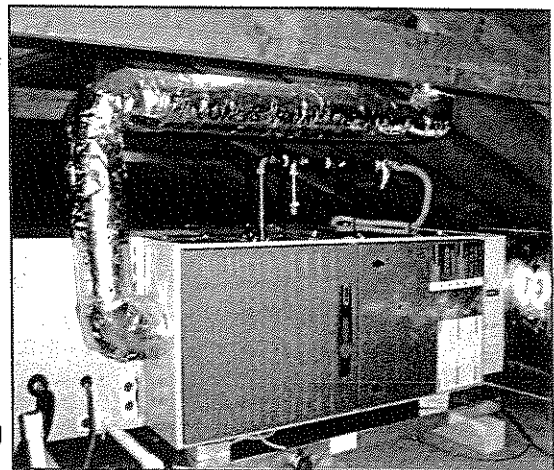
floor, large pieces of equipment can be raised on platforms constructed of concrete or masonry block.

- Keep in mind that most service equipment must remain accessible for routine maintenance. Utility service providers should be consulted.
- For protection against shallow flood waters, the washer and dryer can be elevated on masonry or pressure treated lumber at least 12 inches above the projected flood elevation.
- Also remember that any equipment elevated on platforms or pedestals may be more vulnerable to wind and earthquake damage. Wind, earthquake and flood forces must be determined in these cases.
- The main electrical panel should be at least 12" above the BFE or flood level where there is a 1% chance per year of flooding (100 year flood level).

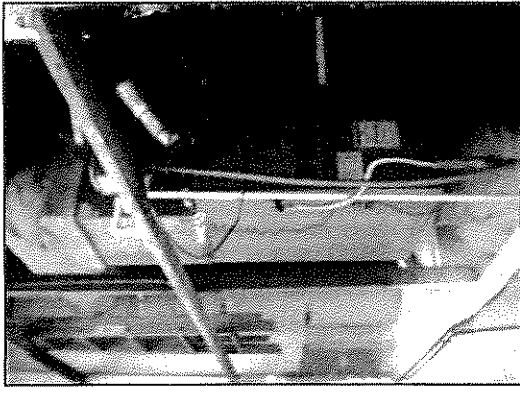


Relocating

- When space permits, you can move service equipment from a basement or other area below the BFE to an upper floor level of your house or even an attic. Floor reinforcements may be needed to handle the extra weight.
- Another relocation option is to build a new, elevated utility room as an addition to your house. The addition could be built on an open foundation or extended foundation walls.
- If you are having your existing furnace or hot water heater repaired or replaced, consider having it relocated at the same time. It probably will be cheaper to combine projects than to do them separately.
- If you decide to raise your HVAC equipment, consider upgrading to a more energy-efficient unit at the same time. Upgrading not only can save you money on your heating and cooling bills, but you could also be eligible for a rebate from your utility company.



Suspending



When suspending any service equipment:

- Suspend the heating system or other applicable service equipment with a safety margin of at least 12" above the 100-year flood level or Base Flood Elevation (BFE).
- Installation will conform to the manufacturer's specifications and all applicable state and local building codes.
- Service equipment must remain accessible for routine maintenance.
- Utility service providers should be consulted before installation or retrofitting is begun.

Protection in Place

When elevation and relocation are impractical, you can protect service equipment in place with low flood walls and shields and with anchors and tie-downs that prevent flotation. Plumbing systems can be protected with valves that prevent wastewater from backing up into your house.

Floodwalls and Shields

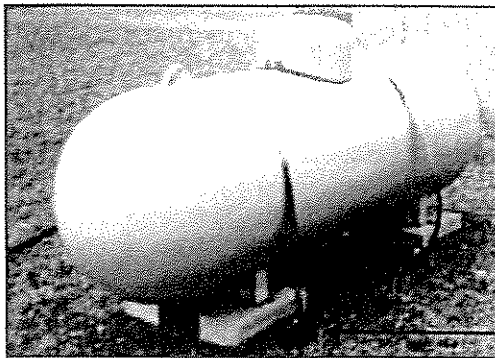
- Floodwalls and shields are normally components of dry flood-proofing systems used to protect entire buildings.
- In wet flood-proofing, floodwalls and shields can be used for the protection of small areas within a building that contain service equipment that is not elevated or relocated. These can be made water resistant using plastic or water sealant products.
- Regardless of the height of the barrier, the area it protects should be equipped with a sump pump that will remove any water that accumulates through seepage.
- All barriers and shields should provide at least 12" of freeboard above the expected flood elevation.
- The greater hydrostatic pressure exerted by deeper water requires barriers and shields that are more massive, have more complex designs, and therefore are more expensive.



- Openings in a floodwall need closures that are as strong as the wall, watertight and easy to install quickly in a flood threat.
- It is difficult to justify a private floodwall taller than 4 feet. For many homes, it is less expensive to raise the building 5 feet than to construct a reliable floodwall that tall.
- Neighbors often view floodwalls and levees as aggravating their own flood situations. Protecting the area right around a building may be less objectionable than excluding water from your entire lot. Placing the wall close to the building also will reduce construction costs and your dependence on pumps.
- Outside floodwalls have natural enemies: burrowing animals and tree roots. Annually check your floodwall for cracks and tunneling.

Anchors and Tie-downs

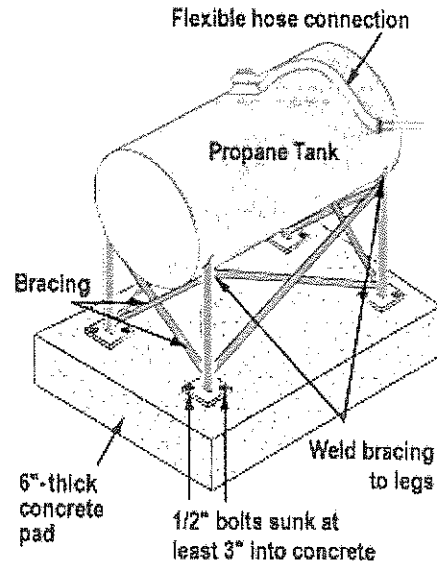
- Anchors and tie-downs are used primarily for aboveground fuel storage tanks that are not elevated and for below-ground tanks.
- Floodwaters act directly on aboveground tanks causing flotation and belowground tanks can be forced out of the ground by buoyancy force of saturated soils.
- Belowground tanks need a design professional to determine the need for anchors, I-beams, concrete slabs or excavation.
- On all tanks below the BFE, both aboveground and below-ground, flexible connections must be used between the tank and the supply line. Also, the vent and filler tubes must extend above the BFE.



TIE-DOWN PROPANE TANK



**EARTH AUGER
W/ SPLIT
BOLT & NUT**



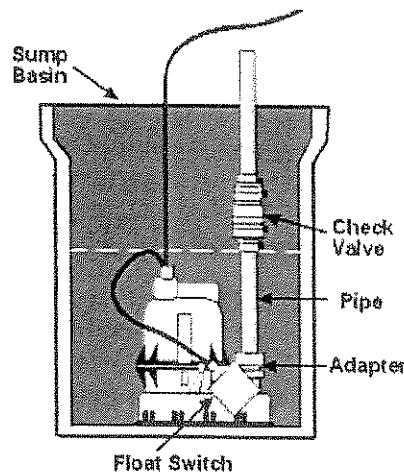
ANCHORED PROPANE TANK

- Aboveground tanks can be anchored with stainless steel metal straps, cables that cross over the tank and connect to galvanized ground anchors, or anchored legs and bolts into concrete.
- Prior to installing earth augers, check for underground utilities
- The length and type of ground anchor will depend on soil type and may need the advise of a design professional.

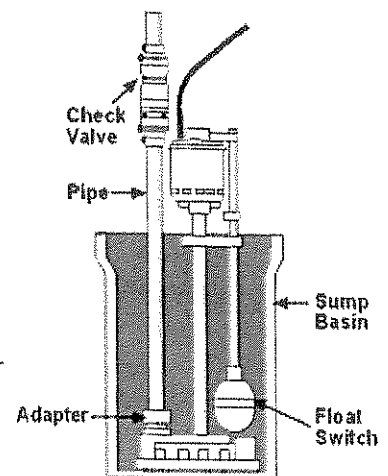
Sump Pumps

For many homeowners a sump (a lined hole designed to collect water) with a pump in it can be the most reliable defense against basement flood water. The sump may be connected to drain tile along the house footings, under the entire basement, or just the area where the sump is located.

- Sump Pumps consist of: a groundwater collection system, a sump tank, a pump and an outlet drain.
- The two types of sump pumps are:
- Both types of pumps need a check valve to
 1. The submersible that is located at the bottom of the sump, motor and all.
 2. The upright or pedestal that has a motor high and dry on top of a pedestal and a pump at the bottom of the sump.



SUBMERSIBLE PUMP



PEDESTAL PUMP

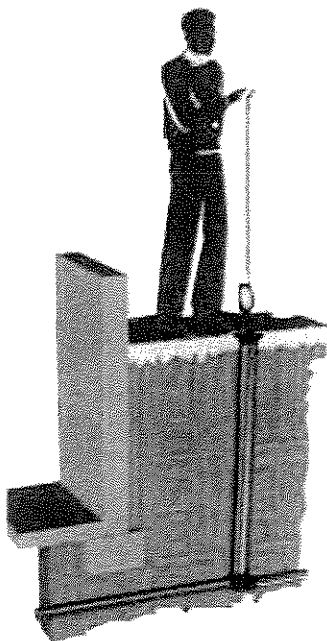
prevent water flowing back into the sump.

- Water Discharge should never be connected to the sewage system or floor drain. Putting additional water into that system could overload it during flood conditions.
- Check with your local building official for requirements on water discharge.
- Removal of water from a basement where there is flooding or high groundwater may cause the basement walls to collapse. Basements should not be pumped out until the floodwaters subside.

Backflow/Backwater valves

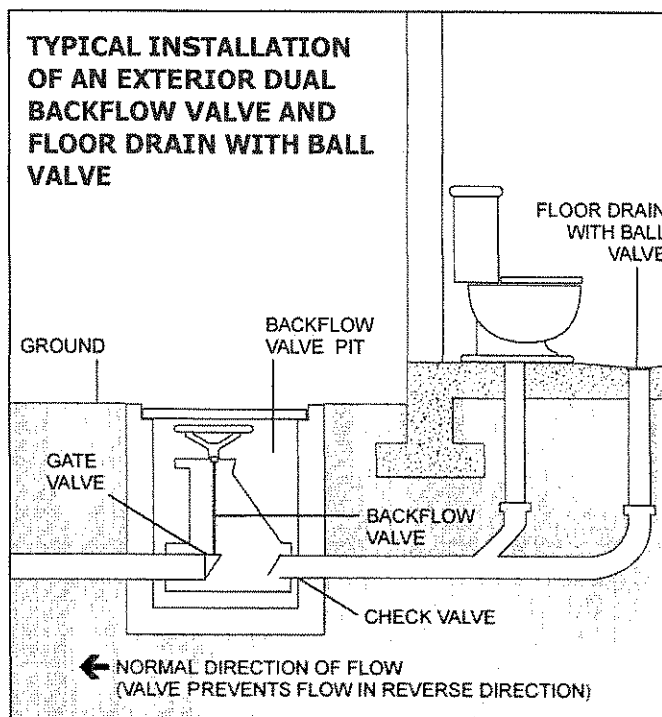
Flooding can often inundate and overload sanitary sewer systems and combined sanitary/storm sewer systems. As a result, water can backup through sewer lines and enter your home through toilets or drains. A solution to this problem is to install a backflow valve. A properly installed backflow or backwater valve works on a one-way system; sewage can go out, but not back in.

- Check with your local building official for permitting and code requirements.
- Work should be done by a qualified, licensed plumbing contractor.
- Backflow valves include check valves, gate valves, and dual backflow valves.
 - * Check valves operate without human intervention. When flooding causes the flow to reverse, a flap in the valve prevents a reverse flow back into your house. A disadvantage is that they can become blocked open by debris and fail to operate
 - * Gate valves are manually operated, provide better seal, and are unlikely to be blocked. However, they do require manual operation.
 - * Dual backflow valves combine the benefits of both the check and gate valves.



BACKWATER VALVE WITH ACCESS SLEEVE

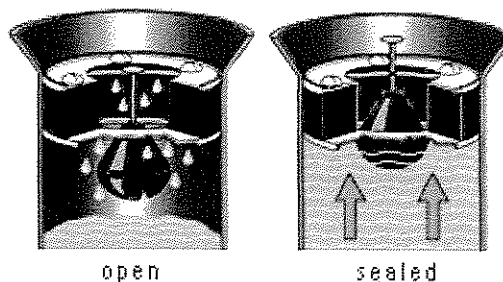
- Float plugs are known to have been jammed open by a small amount of debris
- A floor drain plug does not stop backup from coming out at the next lower opening, like a laundry tube or basement toilet.
- In older houses and neighborhoods, the sewer line underground may be clay tiles. A buildup of pressure can break the sewer lines.



- A backflow valve pit or box may be required to house a retrofit, but an extendable backwater valve with an access sleeve operable at any depth without a manhole, vault or box could also be a possible solution. Again, check with a licensed plumbing contractor.
- Backwater Valves are designed to be virtually maintenance free. However, they are mechanical devices sitting in a sewage environment, and periodic inspections are required.

Floor Drain Plugs

- The simplest way to stop sewer backup is to plug the opening where it first occurs. This is at the floor drain; the sanitary system's lowest opening in the house. Commercial plugs are available that can be placed in the floor drain below the grate. Bolts on metal pieces are
- You may install a plug with a float. The float allows water to drain out of the basement, but not back in. A float plug permanently installed will not interfere with the operation.



FLOOR DRAIN FLOAT PLUG

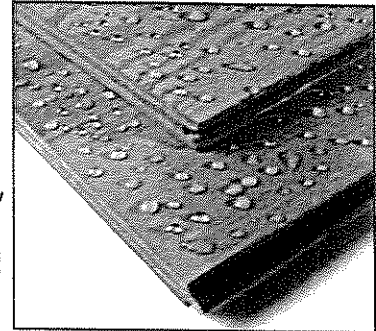
Flood-Resistant Building Materials

(also see: "Flood Damage—Resistant Materials Requirements", FEMA TB-2 / August 2008 at <http://www.fema.gov/library/index.jsp>)

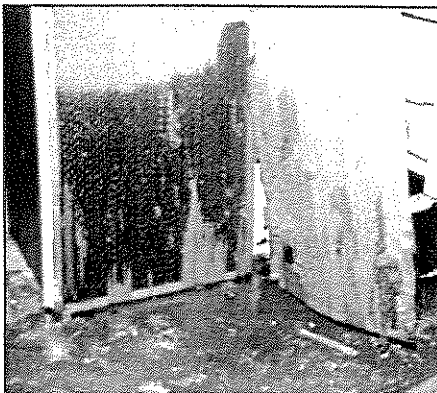
"Flood-resistant material" is defined as any building material capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. The term "prolonged contact" means at least 72 hours, and the term "significant damage" means any damage requiring more than low-cost cosmetic repair (such as painting).

Water-Resistant Building Materials

- **Marine plywood**—The most water-resistant plywood; it can be used for floor and exterior-wall sheathing.
- **Exterior-grade plywood**—Meant to resist low-level moisture, humidity. Not for water saturation conditions.
- **Greenboard**—Manufacturers do not consider greenboard (moisture-resistant dry wall) to be flood-proofing material, but it can be submerged for several hours without extensive deterioration and it is only slightly more expensive than normal plasterboard.
- **Rigid (closed-cell) insulation**—Will not deform or lose its insulative properties when wet. Can be dried out and reinstalled in wall or floor cavity. Use instead of fiberglass insulation.
- **Synthetic baseboards and trim**—Use instead of wood base and trim.
- **Galvanized nails**—Will not rust after being in floodwaters. Use at all locations up to three feet above the Base Flood Elevation (BFE).
- **Metal doors & frames**—Will not warp if saturated. May spot rust, but this can be sanded out and repainted.
- **Metal and vinyl windows**—Will not warp if saturated.
- **Sheet vinyl flooring or terrazzo, clay or rubber tile**—Adheres to marine or pressure treated plywood underlayment with waterproof adhesive.
- **Indoor and outdoor carpet**—Use with synthetic carpet pad. Do not permanently fasten down.
- **Galvanized drywall screws**—Will not rust and will allow easy removal and re-assembly of interior walls. Use instead of standard drywall nails.
- **Brick, concrete**—Not damaged by water saturation, but must be used in conjunction with a waterproof membrane.
- **Glass Block**—Check building code for acceptable uses.
- **Plastic wood**—Made of recycled plastics. Waterproof and dimensionally stable. Check building code for acceptable uses.
- **Pressure-treated lumber/plywood**—Relatively stable in water saturation conditions. Will not sustain heavy damage but may warp. Plywood second only to marine plywood in water-resistance. Use at all floor levels. A protective barrier such as drywall must be placed between the treated lumber and living space.



Building Materials to Avoid When Floodproofing



- Minimise use of wood timber products which absorb water and is slow to dry out.
- Fiberglass or cellulose installation will absorb water readily and dry out slowly.
- Cork or corkboard
- Linoleum
- Particle board, plywood, chipboard, fiberboard, paperboard, strawboard, masonite paneling
- Wallboard, plasterboard, drywall, gypsum board
- Avoid paper finishes on walls as wallpapers will normally peel or become badly stained.
- Carpets will normally need to be replaced following immersion in floodwaters. Consider using loose rugs that can be easily removed and stored during a flood event.

December 24, 1964 to December 31, 2014

