Interior space documented by the Historic American Buildings Survey, post-1933. (www.loc.gov)

R8 RESILIENCE GUIDANCE: BUILDING INTERIOR

INTERIOR IMPROVEMENT GOALS

People spend most of their time indoors, between work and home. Increasing safety during a disaster, speeding recovery, and maintaining air and temperature comforts can increase physical and emotional resilience.

MAINTENANCE AND PERMITTING

A building permit may be required for any of these suggested work items. *(Refer to Resilience Guidance: Permit Review, page R1.5.)* Also, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center. Additional resources and codes can be found on the last page of this topic section.

Small, low-cost changes can be implemented for residential and commercial interiors to improve resilience. As a starting point, it is important to identify areas of vulnerability within a building. These can include interior finishes on walls and floors, the location of appliances and building systems, the types and location of furnishings, and the way the sun impacts interior environmental conditions at different times of the day. Some changes are behavioral suggestions to improve indoor comfort, while others include physical changes to improve occupant safety and resilience.

Improving resilience for interior spaces can reduce the effects of:

- **Flood Damage:** Relocate items stored on or near a low floor, install water-resistant building materials, modify electrical systems and outlets, and reduce water use to decrease sewer discharge
- **Wind:** Relocate fragile items away from window and door openings and install functional shutters or prepare temporary opening protection
- **Earthquake Damage:** Secure ceiling-mounted, wall-mounted, and tabletop items, as well as large furnishings that are at risk for falling and creating injury or blocking exit paths
- **Extreme Heat:** Identify interior areas where the sun has the greatest impact, manage interior sunlight by adjusting window shades, decrease heat output of interior appliances and light fixtures

These natural threats may occur seasonally, and with or without advance notice. Implementing small, preventive measures can decrease preparation and recovery time, and damage, for impacted occupants.

Even if there is no major structural or exterior damage, the loss of personal belongings, costs for replacing appliances and furniture, and the clean-up labor can be overwhelming. Preventive measures can reduce the severity of flood loss and speed recovery for owners and tenants.

REDUCING INTERIOR FLOOD DAMAGE

Just an inch of floodwaters can cause significant damage, and if left untreated, the resulting moisture can promote mold growth. Even more challenging circumstances occur if floodwaters are contaminated. Adhere to any safety precautions issued by local officials when dealing with contaminated floodwaters. ***Depending on the flood risk and past events, it may be prudent to establish a water-resistant threshold 6 to 18 inches above the ground floor.*** Assuming this area could become inundated, consider basic changes that will reduce potential damage and ease the clean-up process.

ELECTRIC/GAS APPLIANCES AND EQUIPMENT

Relocating equipment to a higher elevation level may reduce a potential environmental hazard by preventing gas, oil, and chemicals from mixing with floodwater, and also reduce the chance of electrocution. Equipment and appliances include boilers, kitchen appliances, water heaters, electrical panels, washers, dryers, computers, and entertainment systems. When relocating these items, aim to raise them to the Design Flood Elevation (DFE) at a minimum. *(Refer to Building Construction in Flood Zones, charleston-sc.gov.)*

KEY TIPS:

- Elevate major appliances and other energy-powered equipment on raised platforms made of flood-resistant materials, or locate on upper floors
- Raise secondary elements such as electrical outlets, power strips, junction boxes, switches, disconnects, panels, and utility meters
- Protect utility connection openings or close gaps where possible, and convert outlets to GFCI receptacles below the DFE
- Refer to *Section R7: Building Systems* for recommendations regarding hot water heaters, HVAC systems, and other building-wide utilities

Appliance pedestals can be purchased or built.

It is easier to relocate electric outlets to reduce future flood damage when wall finishes are removed and repaired.

RESIDENTIAL FURNISHINGS AND STORAGE

Property owners and tenants should consider selecting furnishings and appliances that can be easily moved or cleaned and disinfected if exposed to floodwater. This can also include purchasing secured, plastic storage containers for use during, or in preparation of, a flood event. *(Refer to Hurricane and Flood Preparedness for Resilience, page R1.12.)*

RESIDENCES

- Select floor-mounted kitchen cabinets, appliances, bookcases, dressers, chairs, sofas, etc., with metal legs or those constructed of water-resistant materials to ease the cleaning process
- Minimize fabrics and soft materials near floors, such as rugs, cloth chairs, sofas, bed linens, and drapes

STORAGE

- Limit storage and equipment in flood-vulnerable areas, particularly valuable papers, photographs, and heirlooms
- If flood-vulnerable storage is the only option, elevate items above the floor on shelves or raised surfaces, and store them in secured plastic bins to prevent flotation in the water

Selectively relocate items to upper floors and use plastic storage bins. Protect window openings prior to a storm and have plastic sheathing available to protect items from small roof leaks if necessary.

Moveable cabinets and shelves allow for flexible storage on upper floors.

Equipment that cannot be hosed down will need to be temporarily relocated.

COMMERCIAL FURNISHINGS AND STORAGE

Non-residential interiors usually have high-powered equipment, large furniture, and densely packed storage spaces. As employment centers, they depend on staff returning to work in safe conditions.

RETAIL STORES

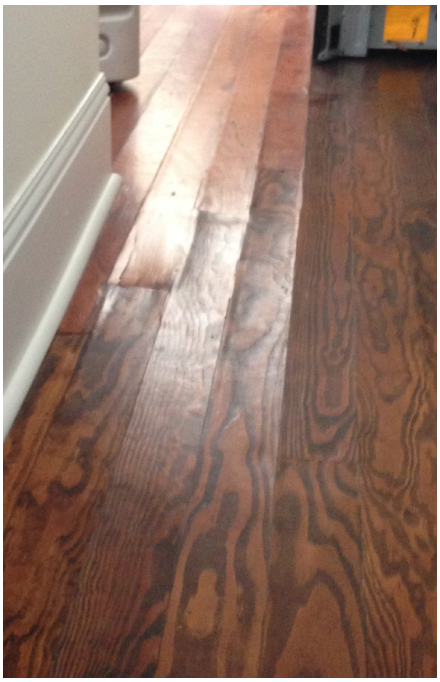
- Utilize metal and/or plastic wall-mounted and free-standing merchandise displays
- Limit merchandise storage on the floor

OFFICES

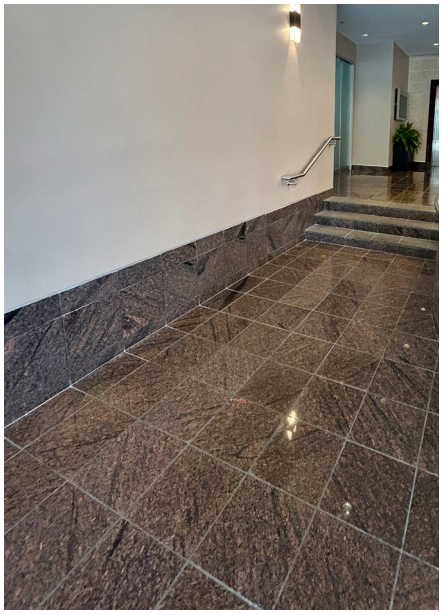
- Locate all equipment, including computers, servers, printers, and associated power supplies above flood-prone areas
- Store valuable papers above flood-prone areas
- Maintain electronic copies of documents in a secure off-site location

RESTAURANTS

- Store equipment and supplies on shelving, or mount kitchen equipment on wheels to allow relocation to higher ground
- Install quick-release valves at gas connections to allow fast relocation of equipment and install flexible fuel lines *(refer to Reducing Earthquake Damage, page R8.5)*
- Select easily-cleaned, lightweight chairs that can stack on tables
- Utilize concrete or other solid surface materials for bars and banquettes for easy cleaning



Wood floors can 'cup' while curing and should be dried out slowly after a flood.



The ground floor and lower walls of this commercial space are covered with granite tile that can be sprayed down following a flood event.

FLOOD DAMAGE RESISTANT MATERIALS

Certain building materials are less affected than others when submerged in water. When planning a renovation or repairing storm damage, evaluate whether the existing materials can withstand a flood event. ***Compliance with local and federal regulations for floodproofing may necessitate replacement of certain materials with alternative flood damage resistant materials below the Design Flood Elevation (DFE) as required by the local ordinance.*** *(Refer to Building Construction in Flood Zones, charleston-sc.gov.)*

FLOORS

- Select floor finishes that are easy to clean and disinfect, such as a solid-surface material like tile or polished concrete flooring, instead of carpet or wood laminate
- Obtain professional advice from preservation experts to determine if traditional flooring materials can be repaired or salvaged

WALLS

- Evaluate opportunities to replace vulnerable wall materials with materials that are flood-resistant, or are removable, in areas that are flood-prone
- Reduce opportunities for mold growth by removing standing water and wet insulation as soon as possible, and ventilating the room and wall cavity
- Install baseboards and cornices that are easily removed
- Obtain dehumidifiers and fans to deploy when needed
- Apply paint with a mold-resistant additive to discourage mold from spreading to other walls

Insurance should be supplemented with physical mitigation practices.

FLOOD INSURANCE

Flood insurance is available for tenants and property owners for building contents, not just the building itself. The National Flood Insurance Program (NFIP) offers insurance for building and separately for contents for both residential and commercial properties. *(Refer to Floodsmart, sidebar below.)* Flood insurance is also available from private companies, although amounts may vary.

FLOODSMART

FloodSmart, administered by FEMA, is the official website of the National Flood Insurance Program (NFIP). It is a valuable resource for property owners and includes information regarding flood risk, flood insurance, and reducing flood risk. *(www.floodsmart.gov)*

RENTERS

According to the 2022 U.S. Census Bureau, 43.3% of Charleston housing units are renter-occupied. The landlord's insurance will not cover damage to the tenant's personal belongings or furnishings. Similarly, the landlord's flood insurance policy will not cover damage to a commercial property.

To be covered, the residential or commercial tenant must obtain a separate flood insurance policy for their contents.

Heavy and tall objects near stairways and exit doors should be secured with straps attached to wall studs.

LOCATING STUDS UNDER A WALL

- Modern wall studs are set at 16" apart while older studs (top) varies and can be as much as 24" apart
- Use a studfinder tool or inspect areas at wall corners or left- and right-sides of an electric outlet.
- Use a tape measure to estimate where the next stud should be, and confirm by drilling a small hole after verifying no electrical or gas lines are present

REDUCING EARTHQUAKE DAMAGE

Most often there is little notice of an impending earthquake. It is important for building occupants to consider permanent changes that can accommodate the building use and access to everyday items. As a priority, secure or relocate heavy objects to reduce potential injury or more severe property damage. Items to consider include overhead fixtures, wall-mounted items, and tall furniture, in addition to flammable or toxic chemicals.

FURNITURE, LOOSE OBJECTS, AND WALL DECOR

Conduct a visual audit of all interior spaces to identify objects that are loosely stowed, sizeable items that may fall onto individuals or block exits, and hanging on walls over sitting and sleeping areas.

KEY TIPS:

- If there is sufficient warning, fragile personal items can be removed from shelves and securely stowed away; be aware that sentimental or valuable breakable items may fall, or vibrations can weaken loosely secured pieces
- Anchor tall furniture pieces such as armoires, chests of drawers, book cases, and file cabinets to wall studs with hardware straps
- Strap down tabletop televisions and computer screens
- Suspend wall mounted paintings and mirrors with at least two fasteners tied into wall studs, and avoid hanging these over beds or seating areas
- Secure wall-mounted kitchen cabinets to studs and install latches to prevent contents from spilling out and causing personal injury; options include child-proof latches or latches available for boats and RVs
- Place non-skid matting under electronics and use putty or museum wax to keep items on shelves from slipping off

PERMANENT APPLIANCES, FIXTURES, AND GLAZED OPENINGS

Heavy appliances and fixtures should be inspected to ensure they are properly anchored to improve their resistance to major vibrations and shockwaves.

KEY TIPS:

- Know the location of electric shut-offs, gas and water valves, and how to operate them
- Install secondary shut-offs that do not require special tools
- Restrain free-standing appliances (such as hot water heaters with straps anchored to wall studs *(refer to Plumbing, page R7.6)*
- Replace rigid water and gas pipe connectors with flexible connectors to hot water heaters and appliances *(refer to Plumbing, page R7.6)*
- Ensure heavy, wall-mounted equipment, fireplace mantles, and stone and brick veneers are anchored to wall studs *(refer to Locating Studs Under a Wall, sidebar at left)*
- Install safety wires from ceiling-mounted fans and lights to ceiling joists
- Install tempered glazing film on glass that is overhead or near exit routes to protect occupants from shattered glass *(refer to Glass, sidebar page R6.7)*

INSULATION MATRIX		
TYPE /MATERIAL	**BENEFITS**	**DISADVANTAGES**
Blanket–Batts and Rolls • Fiberglass • Mineral wool • Plastic fiber • Natural fiber	• Sized to fit between standard spaced studs, joists, and beams that are relatively free of obstructions such as pipes, conduits, and braces • Relatively inexpensive • Can be used to insulate ducts • Can be do-it-yourself project; wear protective eye wear and clothing	• Can become matted-down if wet • Vapor barriers found on most blanket insulation can cause condensation problems and rot wood framing; install without backing or with air barrier only on outside face of sheathing to reduce possible mold and mildew • Should not be "stuffed" around obstructions since it can be a fire hazard around damaged electrical wiring and fixtures that are not rated for contact
Loose-Fill and Blown-In Insulation • Cellulose • Fiberglass • Mineral wool	• Good for irregularly spaced areas and around obstructions • Only minor disturbance of finishes required for installation • Some materials can be poured rather than blown-in	• Generally must be blown-in using special equipment • Settles over time, requiring additional application, particularly in walls • Cellulose, the most common, is essentially newspaper; when wet, it retains water and can rot wood framing • Cellulose can become homes for nesting pests or insects such as termites and carpenter ants; borate treatment can corrode metal pipes, conduit, and electrical wiring
Radiant Barriers and Reflective Insulation • Foil-faced kraft paper • Plastic film • Polyethylene bubble • Cardboard	• Reflects radiant heat, such as sunlight, away from living space; can be highly effective in attics • Sized to fit between standard spaced studs, joists, and beams • Bubble systems can be effective around obstructions • Can be a do-it-yourself project	• Must face an air space, such as an attic, to be effective • If not properly installed, can act as a vapor barrier and cause condensation and rot wood framing members *(refer to Blanket–Batts and Rolls, above)* • Cardboard can become home for nesting pests or insects such as termites and carpenter ants; borate treatment can corrode metal pipes, conduit, and electrical wiring
Sprayed Foam and Foamed-in-Place • Cementitious • Phenolic • Polyisocaynurate • Polyurethane	• Good for irregularly spaced areas and around obstructions • Typically no disturbance of finishes required for installation • Spray foam polyurethane (SPF) can be used in an attic to improve an existing roof's wind resilience	• Made from fossil fuels; can have toxic fumes and be highly flammable • Requires professional installation; adheres to all surfaces, can have voids if not properly installed, relatively expensive installation • Termites and carpenter ants can tunnel through, increasing infestation risk • Open-cell softer, often not a vapor barrier • Closed-cell is a vapor barrier and can cause condensation problems and rot at wood framing; removal generally requires "chiselling out" between all framing members
Foam Board • Polystyrene • Polyisocaynurate • Polyurethane	• High insulation value for relatively little thickness	• Made from fossil fuels, can have toxic fumes and be highly flammable • Must be cut to fit around all obstructions; requires complete removal of wall finish • Termites and carpenter ants can tunnel through, increasing infestation risk • Can be installed under un-vented, low-sloped roofs

Dehumidifiers can help regulate indoor humidity and increase comfort.

LIGHT BULBS GENERATE HEAT

- LED lights emit very little heat; although they may be warm to the touch, they are not hot like incandescent and compact fluorescent bulbs
- Incandescent bulbs can be over 400 degrees and they release 90% of this energy as heat
- Compact fluorescent lights (CFL), while still more efficient than incandescent, release about 80% of their energy as heat

(www.energy.gov)

REDUCING WIND DAMAGE

Damage from winds during a thunderstorm, tornado, or hurricane event will most likely be caused from compromised window or door openings, flying debris, or fallen trees. Secure indoor items away from windows, cover or secure items in storage containers, and anchor items to the walls. *(Refer to Wind and Debris Protection, page R6.5.)*

INDOOR HEAT RESILIENCE

Improvements that reduce the impacts of extreme heat and sun for indoor spaces will also improve energy sustainability to some degree. Most buildings rely on equipment to regulate indoor air comfort, so if their run time is reduced and energy efficient equipment is installed, there is not as much strain on the building system and, collectively, the community grid. Several projects with minimal cost can go a long way to reduce heat production and energy consumption.

KEY TIPS:

- Install thermal blinds or shades for windows and glazed doors, and close window coverings on the south and west sides of the building in summer afternoons *(refer to Reducing Heat Gain, page R6.7)*
- Upgrade or replace wall insulation *(refer to Insulation Matrix, page R8.6)*
- Replace ineffective or worn weatherstripping *(refer to Weatherstipping and Caulk, page R6.8)*
- Replace incandescent and CFL bulbs with LED bulbs that use less energy and emit less heat *(refer to Light Bulbs Generate Heat, sidebar at left)*
- Install a digital thermostat *(refer to Basic Systems Maintenance to Improve Resilience, page R7.3)*
- Use a fan to improve air circulation; maintain a bowl of ice water in front to feel cooler
- Use dehumidifiers in summer months sized appropriately for the space; connect a hose to easily convey collected water to a floor drain
- Limit oven use during summer months; instead use outdoor grill, toaster oven, or microwave if available
- Dry dishes on a rack or limit use of dishwasher to full loads in the evening and early morning
- Hang clothes to dry or install a moisture sensor on clothes dryer to prevent over-drying, run full loads, remove lint after every load, limit use of clothes dryer to evening and early morning
- Install a water cooler or keep a water bottle in the refrigerator for easy access to cold water
- Replace older appliances with Energy Star rated appliances; seek rebates and tax credits if applicable *(refer to Potential Rebate Offers, sidebar page R7.5)*
- Place high-energy appliances on north or west sides of the building, increase insulation, and reduce thermal absorption from the building exterior *(refer to Reducing Heat Gain, page R6.7 and Insulation Matrix, page R8.6)*
- Replace older air conditioning units with variable speed Energy Star products that include dehumidification *(refer to Potential Rebate Offers, sidebar page R7.5)*
- Install a whole-house attic fan in un-insulated buildings to minimize possible humidity and mold issues at insulated buildings *(refer to Heating and Air Conditioning, page R7.4)*

HISTORIC PRESERVATION CONSIDERATIONS

Most buildings, even if located in a historic district, do not have historic preservation regulations associated with interior spaces. In very few cases, properties may be subject to a private easement. Information is provided below to identify best practices toward maintaining the historic character of a property when changes are made to interior spaces.

Modifications that could affect interior spaces include changing molding and trim details or materials, removing historic plaster, and installing any permanent reinforcing systems.

FLOODING

- Repair and retain historic materials to the extent possible *(refer to Flood-Resistant Materials: An Alternative Approach, sidebar page R8.12)*
- Limit the use of replacement flood-resistent materials to highly vulnerable areas
- For locations where flood-resistant materials are required, select alternatives that are visually compatible to historic materials
- Obtain insurance coverage for replacement cash value versus actual cash value for contents *(refer to Flood Insurance, sidebar page R8.4)*

EARTHQUAKE

- If significant structural bracing is undertaken, remove as little historic fabric as possible and prioritize the most significant changes for spaces of least significance
- Consult conservation specialists to anchor fine antiques

HEAT

- Select interior window coverings that are visually neutral from the exterior
- Consult with a preservation architect for recommendations regarding insulation improvements

BUILDING INTERIOR IMPROVEMENT CHECKLIST

The Building Interior Improvement Checklist on the following pages identifies maintenance needs and potential resilience improvements. Information on the relative costs, expertise, and vulnerabilities addressed are keyed with icons described at right.

Level of Risk and Professional Help: The Checklist identifies work that can be completed by property owners or tenants who are able to safely and comfortably use hand tools or power equipment, as needed. Any lifting, bending, or exertion beyond a person's abilities should be undertaken by professionals.

Vulnerabilities: The icons below are used throughout this guide. Completion of the proposed improvements can increase a building's resilience from the following vulnerabilities:

- Flood
- Wind
- Earthquake
- Heat
- Good maintenance

Cost: The relative cost of the proposed improvement is denoted by symbols below. The cost will vary based on the conditions and extent of the impacted area.

- ¢ Minimal supplies under $100
- $ $100-$1,000
- $$ $1,000-$5,000
- $$$ $5,000 and above

"Off-the-Shelf" Solution Available: An item that is relatively available for purchase and easy to install by a property owner or contractor.

BUILDING INTERIOR IMPROVEMENT CHECKLIST

ACTION / PROJECT ***PERMITS:*** *A building permit may be required for any of these suggested work items. Additionally, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center.*	RESILIENCE BENEFIT	COST	DO-IT-YOURSELF	CONTRACTOR MAY BE REQUIRED*	ARCHITECT OR ENGINEER MAY BE REQUIRED	"OFF-THE SHELF" SOLUTION AVAILABLE
REDUCING INTERIOR FLOOD DAMAGE						*Page R8.2*
❑ Elevate major appliances and other energy-powered equipment on raised platforms		¢-$	●	●		●
❑ Raise secondary elements such as electrical outlets, junction boxes, switches, disconnects, panels, and utility meters		$-$$		●		
❑ Protect utility connection openings or close gaps as much as possible and convert outlets to GFCI receptacles below the DFE		$-$$		●		
❑ Select floor-mounted kitchen cabinets, appliances, bookcases, dressers, chairs, sofas, etc., with flood-resistant materials and use items that are easily stacked/relocated		$-$$	●			●
❑ Minimize fabrics and soft materials near floors		¢	●			
❑ Limit storage and equipment in flood-vulnerable areas; elevate items above the floor, store in secured plastic bins		¢	●			●
❑ Utilize metal and/or plastic wall-mounted and free-standing or movable cabinets		¢-$	●			●
❑ Maintain electronic copies of files off-site		¢-$	●			
❑ Install quick-release valves at gas connections to allow quick relocation of equipment; install flexible fuel and water lines		$-$$	●	●		●
❑ Select floor finishes that are easy to clean		¢-$$	●	●		
❑ Consult preservation experts to determine if traditional flooring materials can be repaired		¢-$$			●	
❑ Replace, or use removable, vulnerable wall and insulation materials		$-$$		●		
❑ Install baseboards and cornices that are easily removed to ventilate wall cavity		¢-$$	●	●		
❑ Obtain dehumidifiers and fans		¢-$	●			●
❑ Apply paint with a mold-resistant additive		¢-$$	●			●

ACTION / PROJECT ***PERMITS:*** *A building permit may be required for any of these suggested work items. Additionally, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center.*	RESILIENCE BENEFIT	COST	DO-IT-YOURSELF	CONTRACTOR MAY BE REQUIRED*	ARCHITECT OR ENGINEER MAY BE REQUIRED	"OFF-THE SHELF" SOLUTION AVAILABLE
REDUCING EARTHQUAKE DAMAGE						*Page R8.5*
❑ Remove fragile items from shelves and securely stow		¢	●			
❑ Anchor tall furniture pieces such as armoires, chests of drawers, book cases, and file cabinets to wall studs with strap hardware		¢	●			●
❑ Strap down televisions and computer screens		¢	●			●
❑ Suspend wall-mounted paintings and mirrors with at least two fasteners tied into wall studs; avoid hanging over beds or seating areas		¢	●			●
❑ Secure wall-mounted kitchen cabinets to studs and install latches		¢-$	●			●
❑ Place non-skid matting under electronics and use putty or museum wax to keep items in place		¢	●			●
❑ Inspect anchoring of heavy appliances and fixtures		¢	●			
❑ Know where electric shut-offs, gas and water valves are located and how to turn them off		¢	●			
❑ Install secondary shut-offs that do not require a special tool		$-$$		●		
❑ Restrain free-standing appliances such as hot water heaters with straps anchored to wall studs		¢-$	●	●		●
❑ Replace rigid water and gas pipe connectors with flexible connectors to appliances and equipment like hot water heaters		¢-$	●	●		●
❑ Ensure heavy, wall-mounted equipment or brick veneers and mantels are anchored to wall studs		¢-$	●	●		
❑ Install safety wires from overhead light fixtures and ceiling fans to ceiling joists		¢-$	●	●		
❑ Install tempered glazing film on glass that is overhead or near exit routes		¢-$	●	●		●

ACTION / PROJECT ***PERMITS:*** *A building permit may be required for any of these suggested work items. Additionally, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center.*	RESILIENCE BENEFIT	COST	DO-IT-YOURSELF	CONTRACTOR MAY BE REQUIRED*	ARCHITECT OR ENGINEER MAY BE REQUIRED	"OFF-THE SHELF" SOLUTION AVAILABLE
INDOOR HEAT RESILIENCE						*Page R8.7*
❑ Install thermal blinds or shades at windows and glazed doors, and close window coverings on the south and west sides of the building in summer afternoons		$-$$	●			●
❑ Upgrade or replace wall insulation		$-$$$		●		
❑ Replace ineffective or worn weatherstripping		$-$$$	●			●
❑ Replace incandescent and CFL bulbs with LED bulbs that use less energy and emit less heat		¢-$	●			●
❑ Install a digital thermostat		¢	●			●
❑ Use dehumidifiers in summer months according to performance capacity and size of the space		¢-$	●			●
❑ Use a fan to improve air circulation, maintain a bowl of ice water in front to feel cooler		¢	●			●
❑ Limit oven use during summer months and use alternate or outdoor sources		¢	●			●
❑ Limit use of dishwasher during summer months and use rack for drying		¢	●			
❑ Limit use of clothes dryer during summer months, install a moisture sensor to prevent over-drying		¢	●			●
❑ Install a water cooler or keep a water bottle in the refrigerator for easy access to cold water		¢	●			●
❑ Replace older appliances with Energy Star rated appliances, seek rebates and tax credits if applicable		$-$$$	●	●		
❑ Place high-energy appliances on north or east sides of the building		¢-$	●	●		●
❑ Replace older air conditioning units with variable speed Energy Star products that include dehumidification		$$-$$$		●		
❑ Install a whole-house attic fan in un-insulated building		¢-$$	●	●		●

BUILDING INTERIOR RESOURCES

California Department of General Services

Guidelines for Bracing Residential Water Heaters
dgs.ca.gov

Charleston Water System

Boil Water Advisories
charlestonwater.com

City of Charleston

Building Construction in Flood Zones
charleston-sc.gov

Federal Emergency Management Agency (FEMA)

After the Flood: Advice for Salvaging Damaged Family Treasures

Earthquake Safety at Home P-530

Seismic Retrofit Guidelines for Detached, Single-Family Wood Frame Dwellings P-50-1

Technical Bulletin 2-08 Flood Damage Resistant Materials Requirements
fema.gov

National Park Service

Preservation Brief 41: The Seismic Rehabilitation of Historic Buildings

Testing the Flood Resilience of Traditional Building Assemblies
nps.gov

REGULATIONS TO REVIEW

- International Existing Building Code
- South Carolina Building Code / Residential Code
- City of Charleston Code of Ordinances / Flood Hazard Prevention and Control Ordinance

This is not a comprehensive list and is intended only to provide additional resources to consider when planning a project. Contact the Permit Center for detailed information.

City of Charleston Permit Center
2 George Street, Ground Floor; Charleston, SC 29401
843.577.5550; permits@charleston-sc.gov

State of South Carolina

Energy Saver Tool, *energysaver.sc.gov*

How to Keep Your Flood Insurance Cost as Low as Possible, *doi.sc.gov*

Earthquake Coverage, *doi.sc.gov*

South Carolina Emergency Management Division: Earthquake Guide, *scemd.org*

U.S. Department of Energy

Whole House Ventilation
energy.gov

U.S. Environmental Protection Agency

Climate Change: What you can do at Home
epa.gov

FLOOD-RESISTANT MATERIAL REQUIREMENTS

Compliance with NFIP Flood Damage Resistant Materials Requirements may necessitate replacement of historic materials with alternative flood damage resistant materials below the BFE/DFE as required by the local ordinance.

FLOOD-RESISTANT MATERIALS: AN ALTERNATIVE APPROACH

To best preserve historic building components, deploy a slow, temperature-controlled, and carefully monitored process of drying-out. Although Historic England acknowledges that there will be some material degradation, particularly for high floods or if the floodwater contains salts or other contaminants, they argue that many historic materials can be saved with proper care. This approach may be an appropriate alternative to material replacement where not otherwise required for NFIP compliance.

HISTORIC ENGLAND–FLOODING AND HISTORIC BUILDINGS

Although relatively resistant to flood damage, historic-building materials can all suffer some degradation and may need appropriate treatment. These materials include stone, solid brick-and-mortar walls, timber frames, wattle-and-daub panels, timber boarding and paneling, earthen walls and floors, lime-plaster walls and ceilings and many decorative finishes.

Organic materials such as timbers swell and distort when wet and suffer fungal and insect infestations if left damp for too long. If dried too quickly and at temperatures that are too high, organic materials can shrink and split, or twist if they are restrained in panels. Inorganic porous materials do not generally suffer directly from biological attack.

Significant damage can occur when inherent salt and water (frost) crystals carried through the substrate are released through inappropriate drying or very cold conditions.

(Historic England, 2015; www.historicengland.org)

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www.charleston-sc.gov

PRESERVATION SOCIETY ESTD 1920 of CHARLESTON

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