

Flooding and Schools

National Clearinghouse for Educational Facilities

2011

According to the Federal Emergency Management Agency, flooding is the nation's most common natural disaster. Some floods develop slowly during an extended period of rain or in a warming trend following a heavy snow. Flash floods can occur quickly, without any visible sign of rain. Catastrophic floods are associated with burst dams and levees, hurricanes, storm surges, tsunamis, and earthquakes.

Be prepared for flooding no matter where your school is located, but particularly if it is in a low-lying or coastal area, near water, or downstream from a dam.

What Flooding Can Do ¹

Flooding can cause site erosion, structural and nonstructural building damage, the destruction or impairment of utilities and mechanical equipment, damage to or loss of contents, health threats from contaminated floodwater, and temporary or permanent closure.

Site damage. School grounds may be subject to erosion and scour, with the possible loss of soil and damage to paved areas, including access roads. Large amounts of debris and sediment can accumulate on the site, especially against fences.

Structural damage. Foundations can be eroded, destabilizing or collapsing walls and heaving floors.

Saturation damage. Saturated walls and floors can lead to plaster, drywall, insulation, and tile damage, mold and moisture problems, wood decay, and metal corrosion.

Utility system damage. Electrical wiring and equipment can be shorted and their metal components corrode. Ductwork can be fouled and expensive heating and cooling equipment ruined. Oil storage tanks can be displaced and leak, polluting the areas around them.

¹ Adapted from Section 5.6 of FEMA 424, *Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds*.

Sewers can back up and contaminate the water supply and building components.

Contents damage. School furniture, computers, files, books, lab materials and equipment, and kitchen goods and equipment can be damaged or contaminated.

Health threats. Mold growth and contaminants in flooded schools can pose significant health threats to students and staff.

School closure. Flooded schools must be closed during cleanup and repair. The length of closure and the ability of the school district to return to teaching depends on the severity of the damage and lingering health hazards. It may also depend on whether the school is fully insured or how quickly disaster assistance is made available for cleaning and repair. If the school is located in a flood plain, it may be permanently closed.

Preventing or Mitigating Flood Damage

Reducing or eliminating damage is difficult in schools not built to withstand flooding, but a number of practical measures may be undertaken:

- Improve site drainage by re-grading, adding or enlarging storm drains or culverts, and, where the site permits, adding a storm water retention area.
- Provide fail-safe backup power for sump pumps to keep them functioning during electrical outages.
- Add, clean, or repair check valves in sewer lines to prevent sewage from backing up into the school.
- Provide off-site computer backup storage for electronic school records.
- When replacing mechanical and electrical equipment, devise ways of elevating or otherwise flood-proofing it.
- If the school is multistory, consider relocating the library/media center to a higher floor.

Preparing for and Responding to Flood Emergencies

Plan what to do before, during, and after a flood. Think about which staff, materials, procedures, and equipment are absolutely necessary to protect your school and keep it operating.

Include flood preparedness in your school's crisis plan. See *Practical Information on Crisis Planning* by the U.S. Department of Education's Office of Safe and Drug-Free Schools, and *Mitigating Hazards in School Facilities* by the National Clearinghouse for Educational Facilities.

Refer to *Severe Weather Planning for Schools* for detailed information about preparing for and responding to floods and other weather emergencies. For anticipating and recovering from hurricane-related flooding, see the Council of Educational Facility Planners' *Disaster Planning, Management, and Recovery Guide*.

Continually monitor NOAA Weather Radio All-Hazards on your school's **public alert radio** for information about potential floods and other hazards. Familiarize school staff with these terms:

- **Flood watch and flash flood watch.** Flooding or flash flooding is possible in your area.
- **Flood warning.** Flooding is imminent or occurring now; if advised to evacuate, do so immediately.
- **Flash flood warning.** A flash flood is imminent or occurring now; seek higher ground on foot immediately.

During a flood emergency, follow the instructions of local government officials. Be particularly careful about transporting students in severe weather. Refer to "When to Hold Up the Departure of School Buses" and "School Bus Actions" in *Severe Weather Planning for Schools*.

Recovering from a Flood

Do not enter the school if:

- floodwater remains in or around the building. It may be electrically charged from underground or downed

power lines, or it may be contaminated by oil, gasoline, or raw sewage;

- the building appears to be damaged;
- you smell gas or hear a hissing or blowing sound;
- there are downed electrical wires in the vicinity.

There may be unseen damage, particularly soil erosion and scour that undermines foundations, sidewalks, and roads.

Natural gas. If possible, turn off the main gas valve from outside. Do not smoke or use oil, gas lanterns, candles, or torches for lighting inside a flooded or damaged school until you are sure there is no leaking gas or other flammable material present. When in doubt, call the gas company.

Electrical system. If there is standing water in the building or any sign of electrical damage, call the power company. Do not enter the building until it has been declared safe.

Structural damage. If there are signs of masonry cracking, wall or roof sagging, or other structural distress, have a building professional assess the situation.

Flooded basements. Flooded basements should be pumped out gradually; walls may collapse and floors may buckle if basements are pumped out while the surrounding ground is still waterlogged.

Office equipment. If office equipment is damp or wet, turn off the power at the electrical panel, unplug the equipment, and have it checked by a technician.

Water and sewage systems. Listen for news reports to determine if the community water supply is safe to drink. If water or sewer pipes are damaged, turn off the main water valve and do not use the toilets. Damaged sewage systems are serious health hazards.

Cleaning up. Clean and disinfect everything that got wet. Mud left from floodwater can contain sewage and chemicals. Discard all food and supplies that may have come in contact with floodwater. See *Flood Damage Assessment: Procedures for Cleaning Out a House or*

Building Following a Flood and Treatment of Flood-Damaged Older and Historic Buildings.

For salvaging wet books and paper-based records, see *What Should I Do with Wet Records?*

Student health. See the Environmental Protection Agency's webpage titled *Children's Health and the Aftermath of Floods.*

Mold. Mold growth may be the most serious problem after a flood. See *Mold in My School: What Do I Do?*

Damage and expenses. For insurance purposes, take pictures of any damage as soon as possible, and keep accurate records of repair and cleaning costs. See pages 72 to 79 of Florida's *Educational Facilities Disaster & Crisis Management Guidebook.*

Emergency shelter. Appendix A contains information about using your school as an emergency shelter after a flood.

Resources

U.S. Department of Education, Office of Safe and Drug-Free Schools:

Practical Information on Crisis Planning: A Guide for Schools and Communities,
<http://www.ed.gov/admins/lead/safety/emergencyplan/crisisplanning.pdf>

Federal Emergency Management Agency (FEMA):

FEMA 424, *Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds,* (January 2004),
<http://www.fema.gov/plan/prevent/rms/rmsp424.shtm>

FEMA 361, *Design and Construction Guidance for Community Shelters,* <http://www.fema.gov/library/viewRecord.do?id=1657>

National Clearinghouse for Educational Facilities (NCEF):

Mitigating Hazards in School Facilities. Includes assessment, planning, and funding techniques, and links to 25 NCEF Assessment Guides,
http://www.ncef.org/pubs/mitigating_hazards.pdf

Severe Weather Planning for Schools,
http://www.ncef.org/pubs/severe_weather_planning.pdf

Mold in My School: What Do I Do?,
<http://www.ncef.org/pubs/mold.pdf>

NCEF resource list, *Disaster Preparedness and Response for Schools and Universities,* <http://www.ncef.org/rl/disaster.cfm>

NCEF resource list, *School Preparedness for Natural Disasters,* http://www.ncef.org/rl/natural_disasters.cfm

NCEF resource list, *State and Local School Emergency Planning Guides,*
http://www.ncef.org/rl/statelocal_emergency.cfm

National Oceanic and Atmospheric Administration (NOAA):

NOAA Weather Radio All-Hazards,
<http://www.weather.gov/nwr/>

U.S. Environmental Protection Agency:

Children's Health In the Aftermath of Floods,
<http://yosemite.epa.gov/oceph/ochpweb.nsf/content/flood.htm>

State of Florida:

Educational Facilities Disaster & Crisis Management Guidebook, <http://www.ncef.org/pubs/edfacilities-disaster-management-guidebook-2007.pdf>

Other resources:

Disaster Planning, Management, and Recovery Guide,
<http://www.cefp.org/KatrinaRita/index.html>

Flood Damage Assessment: Procedures for Cleaning Out a House or Building Following a Flood,
<http://www.aia.org/about/initiatives/AIAS075276>

Treatment of Flood-Damaged Older and Historic Buildings,
http://www.preservationnation.org/issues/gulf-coast-recovery/additional-resources/flood_booklet.pdf

What Should I Do with Wet Records?,
<http://www.archives.gov/preservation/holdings-maintenance/wet-records.html>

National Clearinghouse for Educational Facilities

at the National Institute of Building Sciences www.ncef.org

Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools

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Appendix A

Schools as Emergency Shelters

According to Section 5.8 of FEMA 424, [Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds](#), schools are good sites for both short- and long-term shelters because their kitchen and restroom facilities are designed to serve many people and there is space for cots in gymnasiums, classrooms, and corridors.

Emergency shelters require:

- a site located no lower than the 500-year flood level, and preferably higher;
- a reliable source of emergency power for lighting, communications, and refrigeration;
- a water supply that will remain potable during flood conditions;
- wastewater service that will remain functional during flood conditions;
- vehicular access over dry ground.

Shelter planning, activation, staffing, traffic control, administration, and communication are addressed on pages 64 to 67 of Florida's [Educational Facilities Disaster & Crisis Management Guidebook](#).

FEMA 361, [Design and Construction Guidance for Community Shelters](#), has complete information about building community shelters.