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Flooding and Historic Buildings

Technical Advice Note



ENGLISH HERITAGE

Contents

Introduction	2
1 Disaster preparedness	3
1.1 Preparing for floods	3
1.2 Basic procedures, health and safety	4
1.3 Flood barrier designs	9
2 Disaster mitigation	12
2.1 Dealing with flood damage in historic buildings: cleaning up	12
2.2 Dealing with flood damage in historic buildings: drying out	15
3 Further information	20
3.1 Bibliography	20
3.2 Useful contacts	21

Introduction

Terrible damage to property, and disruption of lives and livelihoods, was caused by storms and floods in England during the winter of 2000–2001 and again in 2002. Many towns and villages in the UK and elsewhere in Europe are still dealing with the aftermath of flooding or bracing themselves for more floods. Unfortunately, as the Government and the Environment Agency (EA) have stated, it is inevitable that seriously bad weather will recur in both the short and the longer term as global climate changes continue to affect this country. High levels of rainfall, storm tides, river surges, rising water tables and the breakdown or overload of flood defences mean that many low-lying properties are destined to receive periodic soakings.

This *Technical Advice Note* is published by English Heritage, the country's lead body for the conservation of the historic environment. The organisation advises the public on all matters affecting the welfare of the built heritage and has designed this document to assist people who live in, own, or are responsible for historic buildings which, together with their historic fixtures and fittings, may be threatened by periodic flooding.

Historic buildings have been defined as statutorily listed buildings; unlisted buildings in Conservation Areas, Areas of Outstanding Natural Beauty and National

Parks; and locally listed buildings of architectural or historic interest. Although the following guidance has been specifically tailored to their needs, and with particular emphasis on older houses and small business premises, many of the measures will be applicable to the general building stock constructed before 1914.

This *Note* provides guidance on preventative measures, first aid and other ways to minimise flood damage. It suggests sources of specialist help to inspect, conserve, repair or restore historic property after such disasters. Sources of further information and practical help are listed at the end of the document. As each flood situation is unique, the text concentrates on general principles. Information on specific historic buildings and guidance on whether remedial treatments and repairs require consent should be sought from the Conservation Officer in the local planning authority.

The Environment Agency and local authorities continue to issue general guidance on the subject, notably through the Environment Agency Floodline (Tel: 0845 988 1188, and website: www.environment-agency.gov.uk). Certain high-risk areas are also covered by early warning systems or through the advice of Flood Wardens. See Section 3 for additional sources of information and support.

Dealing with disaster

Owners and occupiers of historic buildings must be properly prepared for potential local flooding in order to deal effectively with future emergencies. The general principles for coping in difficult situations have been widely tested and are here simply defined as:

- disaster preparedness (hazard alertness; disaster prevention or risk reduction)
- disaster management (coping with the disaster whilst in progress)
- disaster mitigation (limiting damage after disaster).

Anticipating disaster

Those who have already suffered floods know what to expect and are, to an extent, forearmed by knowledge and experience for any future similar emergency. They can limit the likely damage by taking precautionary measures.



Figure 1 Frankwell, Shrewsbury, under floodwater in 1998 (Courtesy of Shrewsbury and Atcham Borough Council)

Disclaimer

Unless otherwise stated, the flood prevention works, conservation treatments and repair methodologies reported in the text and illustrations of this *Technical Advice Note* are not intended as specifications for remedial work. English Heritage and its agents cannot be held responsible for any misuse or misapplication of information contained in this publication. The inclusion in this publication of the name of any company, group or individual, or of any product or service, should not be regarded as either a recommendation or an endorsement by English Heritage or its agents.

Accuracy of information

While every effort has been made to ensure faithful reproduction of the original or amended text from authors in this *Technical Advice Note*, English Heritage accepts no responsibility for the accuracy of the data in this publication.

Various obvious actions come to mind, such as identifying those fixtures, fittings and valuable works of art which may suffer damage if saturated. These should then be moved to a safer place above the flood line, usually the upper floor or floors of the building, either when flooding threatens or as a permanent solution.

Where this is not practicable, it might be possible to keep the rising floodwater out



of the building for longer by using temporary flood barriers at the thresholds of doorways, etc. These delaying tactics might aid the evacuation of dry goods and chattels or prevent the waters entering at all until the flooding subsides.

An alternative approach might be to recognise that water ingress cannot be prevented, and to seek instead to deal with the water damage quickly and effectively as flooding recedes. For example, installing permanent emergency drainage sumps connected to waterproofed electronic pumps in the lowest part of the house, so that all water can be drained speedily at the end of the disaster period, might be a justifiable expense for sites that regularly flood. A portable petrol-driven generator, pump and hose for use in emergencies might also be a wise investment. These should be stored on high ground away from any risk of flooding to ensure that they are available.

It might also be helpful to lay in a stock of hyper-absorbent (sponge-like) material to limit and mop up any remaining puddles or dry out damp spots when the waters have receded (see Figures 2 and 3).

Being prepared involves

- *understanding the potential hazards and risks*
- *predicting the timing of their occurrence*
- *planning for the event.*

Figures 2 (left) and 3 (below) Cushions filled with hyper-absorbent material are light and easy to move into position ready for a flood. Once saturated with water, they swell to form a floodwater barrier. (Sorbarix: images courtesy of C.P. Burns & Associates)



Disaster management

As its name suggests, disaster management is a pre-planned process for coping with problems, including flooding, as they occur. It involves establishing a prioritised, methodical approach to the disaster and requires advance warning of problems to be most effective. Readers will find guidance on the management of flooding, as it takes place, incorporated into Sections 1 and 2 below.

Disaster mitigation

Disaster mitigation is not just an elaborate name for cleaning up. Removing sodden materials, dirt and contamination is vitally important to health. However, it is also important to recognise that the components, materials, surfaces and finishes of historic buildings, fixtures and fittings all respond adversely to flooding and its aftermath in specific ways. Straightforward steps can be taken to limit or prevent their further deterioration.

Further advice

This publication has been designed principally to help householders and small businesses deal with floods in their homes and business premises, and to equip them for technical discussions with insurance assessors, architects, surveyors and contractors. Much of the information it contains will be useful for other situations, but for specialist advice about flooding in museums, and other public buildings or large commercial premises, please consult the references and organisations listed in Section 3.

I Disaster preparedness

I.1 Preparing for floods

It seems certain that one of the effects of global climate change in England for the foreseeable future will be flooding on a larger scale than we have been used to in most winters. We all therefore share a responsibility to do as much as we can to protect ourselves, our families, homes, communities and businesses from natural disaster. By planning ahead and taking sensible, cost-effective precautions, it is possible to prevent or at least mitigate the worst of flood damage, and thereby prevent deaths, reduce suffering, and cut the financial cost to individuals, businesses and the public of cleaning up afterwards.

Those charged with the care and welfare of historic buildings also have a responsibility to maintain them and pass them on to future generations in good condition. In this sense, disaster preparedness is simply good curatorship.

In order to plan for flooding, basic information is required. Contact your local authority, the Environment Agency, or visit the Environment Agency website (see Section 1.2) to

- find out if you live in an area that is prone to flooding
- learn about flood warnings, how they are issued and what each flood warning code means
- request flood warnings by phone direct to your home or work
- obtain general information about planning for floods.

Assessing flood risk

Forewarned is forearmed. It is essential to understand the flood risk in your area before you can decide what flood protection you need. The risk assessment should take into account:

- *the local topography* – is the building near a river, stream, or ditch; in a flood plain; or at risk of sea floods?
- *the history of flooding in the area* – when, and how frequently have floods occurred in the past? What caused them? How high did the floodwaters rise?
- *flood defences* – have any measures been taken to reduce the risk of flooding in the future?

People in high-risk areas need to prepare their response by looking at local experience:

- Neighbours who have lived in the area a long time can provide anecdotal evidence of past floods. Local history groups and the local studies section of the local library may also be able to provide information.
- Anecdotal information may be important for warning of localised flooding from ditches and small streams. (The Environment Agency will be responsible for main rivers only.)
- Local authorities have information on flood defences, land-use planning, waterways and drainage systems.
- The Environment Agency is responsible for flood warnings and flood defences. It can supply maps, graphs and other information on flood areas, flood levels and flood defences.

Each and every early warning about the threat of a flood should be taken as a signal to prepare for the worst.

Insurance

Make sure your building and contents insurance provides adequate cover and is up to date.

For security, insurance and other reasons, it is always wise to take photographs of your property and treasured possessions while they are in good condition, and to store these records with your insurance documents in a safe and accessible place.

Make sure the photographs are annotated and dated on the reverse to provide objective evidence.

1.2 Basic procedures, health and safety

Constant vigilance

The majority of localised flooding is a result of blockages in small drains and ditches. Vigilance is necessary to ensure that land drainage is not impeded. If any local drains or ditches, pipes or culverts are found to be blocked, then the Local Authority should be contacted for advice. Checking is particularly important after a storm, which may cause blockages – so that the next storm causes a flood.

People who live in areas at high risk from flooding need to carry out a flood risk assessment (Section 1.1) and to stay on the alert for flood warnings. Warnings are issued in several ways, including local and national media (press, radio and television), teletext and the Internet. Two Environment Agency websites are especially relevant: www.environment-agency.gov.uk/subjects/flood/floodwarning and the “see what’s in my backyard” section of www.environment-agency.gov.uk/youenv/?lang=_e. Keeping an eye on regional weather forecasts and listening for flood alerts can give useful advance warning to aid disaster preparations. In high-risk areas (e.g. surge tide areas), it is advisable to join a 24-hour early warning system: direct warnings are given by phone, fax or pager through the Environment Agency’s Automated Voice Messaging (AVM) service. Flood Wardens use public address systems to warn residents in particularly vulnerable urban areas. People within flood risk areas can also receive updates on the latest warning information by phoning the Environment Agency’s Floodline: 0845 988 1188.

- Move (or keep) valuable or irreplaceable items and important documents (especially your insurance company’s contact telephone number and policy documents) upstairs or to safe dry storage.
- Ensure that you have a photographic record of the condition of your house before any flood damage (including details of interior decoration and furnishings) in case you need to make an insurance claim.
- Keep a stock of sandbags ready.

Assemble a flood kit

Your flood kit should contain

- torch and spare batteries
- portable, battery-operated radio and spare batteries
- first aid kit
- essential medicines, e.g. drugs prescribed for individuals
- cash and credit cards
- warm and waterproof clothing and footwear
- mobile phone, spare batteries and charger.

Prepare an emergency file

Get together a file of useful information and important documents, and keep it up to date. The file should contain

- contact numbers for relatives, your insurance company, the local authority, expert professional advisers, reliable builders and other salvage experts (see *Useful contacts*, Section 3.2)
- your insurance documents
- photographic record of property and treasured belongings, while in good condition
- important personal documents
- your doctor’s telephone number and details of any medication required by you or other members of your household or business.

Store the file in a waterproof container (e.g. plastic ziplock bag) in a secure and accessible place in an upstairs room, where floodwater will not reach it.



Figure 4 Shrewsbury flooded again all too soon! Abbey Foregate in December 2000 (Courtesy of Shropshire Star)

Make an emergency flood plan

Discuss with all the members of your household or business what each is to do in case of a flood.

- Designate key people to take responsibility for turning off the gas, electricity and water. Make sure they know where the stopcocks and switches are located, and how to use them.
- Know how to contact emergency services before, during and after flood events.
- Decide on a 'top ten' list of valuables to be saved from each room, and train people to move these first, speedily and carefully.
- Floods may force everyone to leave the building. Find out where you and others would be evacuated to. Make sure everybody knows where that is, and how to contact each other during and after an evacuation.
- Prepare an emergency file and an emergency kit, and keep them in a safe and accessible place (see box, page 4).
- Tell external contacts or neighbours about your plan. You may need their help if there is a flood, or they may need yours.
- Do not wait for a flood to find out if your plan works. Try it now. Review its efficiency with others and make steady, cost-effective improvements wherever possible.
- Learn from others (see *Bibliography*, Section 3.1).

What to do when floods are forecast

- Stay somewhere safe and be careful. It is primarily your own responsibility to look after yourself and your family during floods.

- Do not leave your home unless you have to.
- If you must travel, plan routes ahead of time to avoid flooded areas and low-lying areas liable to flood.
- Stay alert: events can change very quickly during a flood. Keep an eye on the weather and listen out for warnings on the radio and television.
- Bring valuable outdoor belongings indoors.
- Store temporary food and drinking water supplies in a dry place.
- Move people and pets upstairs or to higher ground.
- Get ready to leave if told to do so by the emergency authorities.
- Arm yourself with a mobile telephone, a powerful torch and spare batteries.
- Be careful. Do not climb on walls or roofs, which can be slippery when wet, without proper equipment, e.g. ladders and ropes.
- Consult your emergency flood plan (Section 1.1).

What to do when your building is about to be flooded

- Follow your emergency flood plan.
- Alert everyone in the building.
- Tell the emergency services if the flooding is potentially serious or life-threatening.
- Turn off the heating system, electricity and gas supplies.
- Old people, young children and babies should be evacuated if practicable. If this is not possible, then ensure that they are kept warm.
- Try to prevent water entering the building by erecting barriers or sandbags.

What to do when your building is being flooded

- Turn off the power supply at the electrical fuse box and the gas supply at the stop tap. If the fuse box or circuit breaker is already affected by the flooding, stand on a dry (non-conducting) board and use a dry stick (wood, not metal) to turn off the switch. In addition to these precautions, avoid electric shock in a damp environment by wearing rubber-soled boots.
- Evacuate the building if the emergency services advise you to do so.
- Avoid walking in floodwater if possible or take extreme care when doing so. Do not try to work in deep or fast-flowing water unless you are experienced and well-equipped. Fast-flowing water in confined spaces can easily knock people off their feet, and hazards such as open manholes, roadworks or submerged objects are concealed from view.
- If premises are evacuated, the emergency services may prevent your re-entry for several days. Use the time to co-ordinate and plan your return to the building and the cleaning-up work.

Insurance claims

Following a flood, telephone your insurance company's 24-hour emergency helpline as soon as possible. They will be able to provide information on dealing with your claim, and assistance in getting things back to normal. If you have to move into alternative accommodation, ask your insurer if the cost is covered under a household policy. Make sure your insurance company knows where to contact you if you have to move out of your home. Make notes to assist your insurer in dealing with your claim, including

- time of flood warning
- time the flood waters entered your home
- the sequence of flooding, where the water came from, and how it flowed through the building. This is important if the flooding is associated with ditches and drains since the information can be presented to the Local Authority and /or the Environment Agency when they review the flood history to determine if it resulted from poor drainage management.
- the maximum depth of the flood (this can be marked on a wall in soft pencil)

- how long the flood water was in your home
- the presence of any contaminants (e.g. oil, sewage, etc.)
- what damage was done to the building (walls, floors, etc.) and contents (carpets, sofas, electrical goods, etc.)
- taking photographs (if possible) of what was damaged for comparison with 'before' pictures. Mark them with the exact location and date on the back. Cameras that add dates to prints are extremely useful for providing evidence.

Keep a file of correspondence after the flood (e.g. letters to local authority, builders, your insurer, loss adjuster, etc).

Returning to the building

Safety

Seek guidance from the emergency services or local authority before returning to your property.

People returning to flood-damaged buildings must safeguard themselves before beginning to clean up. Serious flooding can create hidden dangers such as weakened foundations, structurally unsafe building components and damaged electrical circuitry; it can also contaminate buildings with germ-laden mud or silt, moulds, algae, and (occasionally) fish, bird and animal carcasses.

Because of the risk of Weil's disease and other health hazards, children and pets must not be allowed to play in floodwater.

Resist the temptation to start cleaning up right away. It is much better to assess the damage and make a coherent plan of action first. Record the damage with photographs and video recordings, and make written notes. This documentation will be vital later on, when you have to present your insurance claim and attempt to return the building and its contents to the condition they were in before the flood.

Check with the electricity, gas and water companies that it is safe to turn the supplies back on before doing so. Electrical circuitry may have to be replaced before power can be restored. If you have to use a mobile petrol-driven electricity generator, ensure that it is suitably earthed and that the power generated does not exceed 110 volts for safe operations. *Make sure that any*

generator used indoors is properly vented to the exterior: exhaust carbon monoxide can kill.

Household cleaning and disinfecting

Cleaning supplies and equipment might include

- a hose with an adjustable spray nozzle
- buckets
- mops and brushes
- wooden or nylon (kitchen) spatulas
- absorbent materials and sponges
- plastic sacks for rubbish
- household bleach
- non-ammonia, low-sud household cleaning fluid
- disposable plastic or rubber gloves
- masks and filters.

Follow the first rinsing by cleaning with a non-ammonia, low-sud household cleaning fluid, diluted with water if necessary according to the manufacturer's instructions. Rinse with clear water.

Disinfect hard surfaces with 200–220 ml (½ pint) of liquid household bleach in 22.5 litres (5 gallons) of water, to kill the bacteria and odour left by floodwaters. *Never mix bleach with proprietary cleaning products, especially those that contain ammonia.* Rinse with clear water.

Always dilute bleach with water before use. Undiluted bleach may cause blisters in plaster, stone and mortar, lift the grain on timber surfaces, encourage iron fixings to rust or stain adjacent surfaces, and weaken or dissolve animal glues in panelled doors and other joinery.

If in doubt about possible adverse effects of cleaning materials on historic or other materials, consult the manufacturers' printed instructions or seek help from their consumer helplines. Try cleaning products on small, inconspicuous areas first to test their effects.

Protection

Wear protective clothing: wet weather gear, rubber or plastic gloves and barrier cream on hands and exposed skin. Do not allow floodwater to come into contact with open wounds or grazes: if it does, obtain an anti-tetanus injection as soon as possible.

Beware of concealed hazards such as nails or broken glass hidden in silt or ponded water. Tread carefully: floodwaters deposit

mud, which can be very slippery underfoot.

Mould, which can develop very rapidly in damp buildings, spreads through airborne spores that can cause eye irritation, allergic reactions or respiratory problems. It is advisable to wear masks and goggles or, in very serious cases a high-efficiency particle air (HEPA) filter respirator to protect against this risk (for suppliers of safety equipment see Section 3).

Floodwater is sometimes contaminated with bacteria that can cause severe gastrointestinal illnesses. It is therefore essential to clean and disinfect the building and its contents thoroughly, particularly items that come into contact with food. Protect your eyes, hands and mouth, and wash your hands and scrub beneath nails with soap and disinfectant before eating. Any food that comes into contact with floodwater must be thrown away. This includes the contents of fridges and freezers; products in bottles and jars (the area under the seal cannot be properly disinfected); items in tins; medicines, cosmetics and other toiletries.

Babies' and children's clothes and toys which have come into contact with floodwater should be kept securely out of reach so that children cannot handle them. Once examined (if necessary) by a loss adjuster they should be destroyed.

Some commercially available flood barriers may be reusable. Manufacturers' instructions as to reuse and cleaning must be followed.

Sandbags, however, which have (or may have) absorbed floodwater constitute a health hazard. They must be disposed of carefully, and NOT retained (for secure disposal methods, consult your local authority). The risk of contamination with sewage and other toxic substances renders them too dangerous for future reuse. *Children should not be allowed to play with the sand.*

Sterilising cooking utensils

Items used for cooking, storing or serving food must be thoroughly sterilised if they have been contaminated. Metal items can be sterilised by immersion in boiling water for at least 10 minutes. Glass, glazed ceramics and plastics can be sterilised by immersion in water with a sterilising tablet (used for cleaning babies' bottles; available from

chemists and supermarkets) and following the manufacturer's instructions. Alternatively

- make a sterilising solution of one part household bleach to four parts water in a bucket
- immerse the items completely, turning them to remove air bubbles and to ensure that all surfaces are in contact with the solution
- leave them to soak for at least 20 minutes
- rinse thoroughly with boiled water before use.

Beware of hazardous materials, e.g. chemicals, heating oil, etc. that may have been stored in the building and released, or washed on to the site from elsewhere.

Check with the local Environmental Health Office or the Environment Agency Waste Office if substantial volumes of potentially contaminated silt and mud have to be removed. It may not be safe to dump the materials in a skip or corner of the property.

Do not attempt to handle hazardous waste yourself: advise the authorities and allow them to deal with it.

Reoccupying the building

Nobody should reoccupy the building until

- the structure is stable
- safe water and power supplies have been established
- all standing water has been removed
- the rooms that were flooded have been thoroughly dried, cleaned and disinfected
- any food, medicines, cosmetics and other toiletries that came into contact with floodwater have been thrown away
- all contaminated cooking appliances, dishes and utensils, glasses, cutlery and crockery have been thoroughly washed and disinfected
- adequate toilet facilities are available.

Flood damage and historic buildings

After a flood, it is natural to want to start straight away to tidy up, throw out damaged goods, dry out the building and make things better. But in dealing with historic buildings, hasty, ill-informed action (however well meant) can do more harm than good. Take time to assess the situation and plan your clean-up campaign methodically, to avoid

Beware

In some cases, the flood damage responses promoted by insurance companies, loss adjusters and contractors may be highly damaging to historic fabric and may breach Listed Building Consent legislation. Typical examples of the damage caused include the unauthorised removal and disposal of wet timber panelling and the indiscriminate removal of plaster from the walls of listed buildings. If in doubt, consult the local planning authority's Conservation Officer before agreeing to any flood protection, cleaning up or drying out work.

unnecessary damage to precious architectural features.

In some cases, the building and insurance industries' standard procedures for making buildings habitable again after floods can be damaging to the special architectural or historic interest of statutorily listed buildings. Most insurers, loss adjusters, builders and other contractors operating in this area have very limited knowledge and experience of dealing with historic buildings. They may recommend courses of action and works which contravene Planning and Listed Building Consent legislation, policies and guidance. If in doubt, consult the local planning authority's Conservation Officer.

Building conservation is concerned with retaining original fabric and cleaning or repairing it in a sensitive fashion. Most historic timberwork, panelling, floorboards and plasterwork can be retained and conserved after flooding. There have been many cases in which sodden materials, that appeared at first sight to be decayed beyond redemption, have been restored and reused in a cost-effective manner. However, it is important to know what you are doing: however well-intentioned, the use of inappropriate techniques for drying out can be exceedingly damaging to historic building fabric.

Good conservation practice

The first principle of good conservation practice is to retain as much authentic original fabric as possible. No matter how good modern craftsmanship may be, it is not possible to replicate the special historic, archaeological and artistic interest embodied in historic building materials, components and finishes. Repairing old buildings by the replacement or restoration of damaged elements might be justifiable in cases of extreme decay and loss. But much of the material found after floods in builders'

skips, though perhaps dirty and damaged, can be revived, retained and re-used, thus preserving the special interest of the property.

If in doubt, consult

If in doubt, consult the local planning authority's Conservation Officer or seek specialist guidance from an architect, surveyor, engineer or conservator with experience of building conservation (see *Useful contacts*, Section 3.2).

If in doubt seek specialist expertise. English Heritage's view is that special care and attention is necessary in such cases and that all concerned should involve accredited architects, surveyors, engineers, conservators and specialists in relevant crafts and trades with appropriate knowledge and experience, and competent damage management companies (see *Bibliography*, Section 3.1 and *Useful contacts*, Section 3.2).

Protecting historic buildings

There are things you can do to protect your property from floods, or to mitigate the effects of unavoidable floods. Anti-flood measures must be applied with sensitivity in a historic building, so that they do not damage the special interest or integrity of the historic structure. In particular, the existing structural systems and materials must be retained and respected. The materials and techniques used in any repair work should be traditional and compatible with the existing ones; any alterations should be detectable and reversible. It is important to keep a sense of proportion: flood-proofing works should be designed according to realistic assessments of the likelihood and severity of flooding.

The things you can do to protect your building from the effects of flooding fall into three categories

- regular maintenance of the existing building and grounds
- designing any additions or alterations to the property with flood-proofing in mind
- special measures designed specifically to combat the immediate effects of flooding.

Listed Building Consent

Repair and maintenance work that does not affect the special architectural or historic interest of a statutorily listed

building, and retains and preserves the original materials, surfaces and textures, does not usually require Listed Building Consent from the local planning authority. Where consent is required for such works, it may be granted quickly. Alterations, or partial or wholesale demolition, usually require Listed Building Consent. The granting of consent to carry out works to protect the building from flooding will be influenced by the impact of the proposals on the architectural or historic interest of the building.

Regular maintenance

Keeping your property tidy and well-maintained can help to minimise the effects of flooding.

- Maintain rainwater goods in sound condition. Clear leaves and debris from gutters, ensure downpipes are not blocked, check that seals at junctions are watertight, and that drains are unbroken and clear.
- Remove any rubbish from the garden and grounds. Floating debris can be dangerous during a flood, and if it remains in place it can prevent floodwaters from draining away freely.
- Do not allow stacks of materials (e.g. firewood, DIY materials) to build up around the house. By trapping water against the walls, they slow down the drying-out process.
- Make sure the external ground level around the building is as low as practicable – at least 150 mm (6 in) below the finished internal ground floor level, or below any damp-proof course.

Flood-proof additions and alterations

If you are planning new work to alter or extend your house, bear in mind the possibility of flooding. Points to note include

- Hard surfaces such as tarmac or paving increase water run-off by making it impossible for water to soak into the earth. Unless all the falls on hard surfaces carry surface water well away from the building, consider using gravel for any footpaths and car parking spaces.
- Extensions (e.g. conservatories) increase water run-off from the roof and simultaneously reduce the area of ground into which water can drain.
- Any new drains must be adequate to cope with flooding.

- New plumbing can be fitted with backflow valves, to prevent water entering the building from drains and sewers. Manhole covers can be of a sealed type.
- In basements and ground floor rooms threatened by flooding, new electrical circuitry, fuse boxes and heaters can be installed at a higher level. Make sure that embedded or trunked power cables are carried down from the ceiling and not up from floor level.
- Investigate the possibility of raising above floodwater level storage tanks for hazardous materials such as oil or propane gas.
- Where the risk of frequent floods is high, consider installing a basement sump and pump with submersible emergency power supply to help drain basements quickly after the flooding subsides.

Special flood-proofing measures

If the risk of frequent floods is high, it may be necessary to take special measures designed specifically to combat the immediate effects of flooding. Such measures may be

- ephemeral (though nevertheless effective) works not classed as building operations in planning terms at all, e.g. sandbag walls
- temporary flood barriers fixed to the building as needed and removed once the danger of flooding has passed
- permanent flood-proofing features, which have a more significant impact on the appearance and character of the building
- modifications to services and interior fixtures and fittings to enable the building to be made habitable again as soon as possible after a flood.

Flood protection barriers will not usually hold back water for more than a few hours. They may, however, gain time for moveable items to be saved, and they will also help to keep out flood debris. There is now a certification scheme managed by the British Standards Institution that awards BSI Kitemarks to approved products.

Any new measures to protect a historic building from flooding should be compatible with the building's age, architectural style, appearance and materials.

Note: any works on or within 8 metres of a main river or stream require Land Drainage Consent from the Environment Agency. This includes structures of any description.

Sandbags

Locate suppliers (e.g. builders' merchants, local authorities) well in advance of flooding and lay in a store on high ground for use in high-risk periods.

If you are unable to get ready-made sandbags, you can make your own using compost bags, carrier bags or pillowcases filled with sand or earth. Put a plastic sheet down first to act as an extra seal.

It is essential to fill and lay sandbags correctly. They must not be over-filled (no more than half to three-quarters full) and when laid, should be well stamped down to force the upper bags to mould themselves to the lower. Build up the layers like brickwork, with the bags in the bottom row butted up tight to each other end-to-end, and well stamped down before the second row is laid on top. In walls that are more than two sandbags high, there should be a double line of sandbags at the bottom, followed by a second double line, then a single line on top.

Sealing gaps and holes

When protecting a building against surface flooding, you should examine and seal all possible water entry points, including airbricks, air vents, and openings for electricity, gas and water. If you do seal any gas vents remember to switch off the gas supply first to prevent the build-up of carbon monoxide inside the building.

Seals around windows and doors should be made watertight. As a temporary measure, clear or white bathroom sealant applied from the outside may suffice in an emergency.

Temporary snap-on covers for airbricks and vents can be purchased from suppliers of flood protection products (see Fig 5 and *Useful contacts*, Section 3.2).

Remember that airbricks and vents should be sealed only during flood conditions and then removed to aid drainage and later provide permanent ventilation.

Temporary flood barriers

Temporary barriers can be fitted to exterior doorways or window openings to



Figure 5 Airbricks can be sealed with temporary covers to keep out floodwater. (Courtesy of Flood Management Systems Ltd)

raise the threshold of the building against rising water, then removed and stored once the risk of flooding has passed. Because they are used only during a flood, these features are less intrusive than permanent flood barriers, but in order to keep their architectural impact to a minimum, any fixings must be discreet and compatible with an older property. In addition, steps must be taken to ensure that the historic doorframes and adjoining walls can handle the pressure of built-up floodwater. (See Figs 10, 11, 12, 13 and 17; also 18.)

Designs for temporary door and window barriers are described in Section 1.3. There are also several proprietary designs of door and window barriers (see *Useful contacts*, Section 3.2).



Figure 6 Sash window frames fitted with slots to hold temporary flood barriers. Painting the slots to match the frames helps them to blend discreetly into the background when not in use. (John Fidler)

Permanent flood barriers

Permanent features might include a built-up front doorstep, a partially tanked and rendered lower ground floor elevation, or works to protect the garden fence in front of the building. The designs of such fixed barriers must be minimal and appropriately styled to the appearance of the particular historic property. Designs for permanent flood barriers are described in Section 1.3.

Modifications to services, interior fixtures and fittings

In some cases, floods are inevitable, and it will be necessary to design services, interior fixtures and fittings and decor that can withstand flooding, or recover quickly.

- Do not install fitted carpets on the ground floor, but have washable, permeable floor finishes and loose rugs.

- Ensure that all furniture on the ground floor is light and small enough to be moved upstairs if necessary.
- Reposition wiring, sockets, telephone outlets, switches, etc. above the maximum flood level.
- Reposition gas and electricity meters above the maximum flood level.
- Ensure sewage pipe and septic systems can be sealed if flooding levels are predicted to be above the water level in the lowest WC in the property (basement/first floor). One-way valves can be fitted to the septic pipe in older systems.
- Do not install standard kitchen units or any built-in furniture made from laminate-covered Medium Density Fibreboard (MDF) or chipboard. Instead, for work surfaces and cupboards which will withstand inundation, use Marine Plywood (sturdy, and available from builders' merchants or timber yards) or plastic shelving.
- Either install kitchen appliances such as the washing machine, dishwasher and fridge above flood level, i.e. above worktops, or reinforce cupboards with steel bracketing so that they can carry these heavy items, which can be moved onto them before the kitchen is flooded.
- Moving and lifting heavy 'white goods' are hazardous to health. Follow correct lifting procedures to prevent spinal injuries.

1.3 Flood barrier designs

There are several types of purpose-built flood barriers suitable for historic buildings. Most door and window barriers consist of various types of waterproof board and seals, which are inserted at times of flooding into small-section timber or metal channels on either side of the front door frame. Some have ingenious self-sealing closing devices, while others rely on tongue-and-groove boarding connections with mastic-covered joints. Some are of fixed height and protect buildings from known or predictable flood levels; others are adjustable, and can be made higher or lower according to need.

Perimeter barriers are installed at the boundary of the property, and are intended to prevent water reaching the building at all. They may consist of brick walls, toughened glass barriers or a combination of both, with watertight doors installed in gate openings.



Figure 7 A waterproof render has been applied to the lower external walls of a riverside cottage to form a permanent flood barrier. (John Fidler)



Figure 8 A boundary wall facing the River Thames in Hammersmith, West London, has been rendered to provide a flood barrier. Its height has been increased with a visually unobtrusive screen of toughened glass. (John Fidler)



Figure 9 A rendered brick barrier topped with a toughened glass screen is partially screened by a panel of railings. (John Fidler)

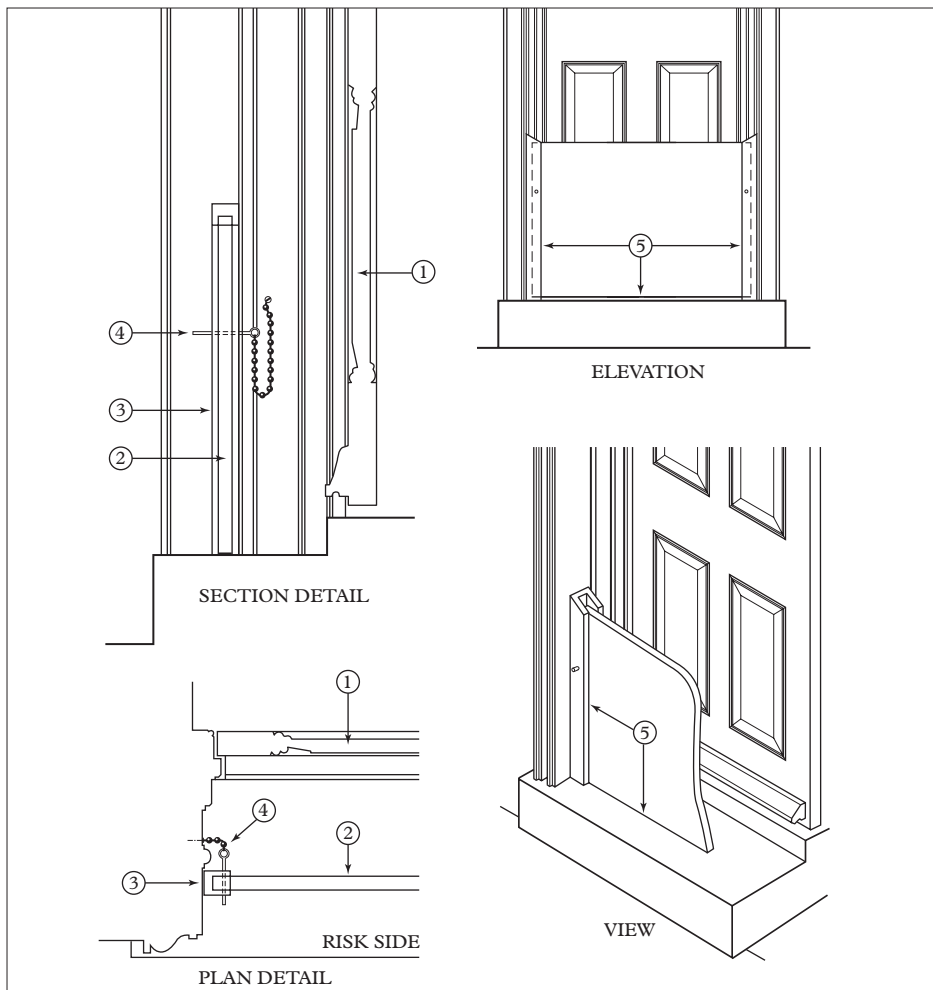


Figure 10 Door barrier (1) Door: additional protection can be given by the fitting of proprietary weather seals. (2) Barrier: painted external quality lipped plywood or similar board (3) Painted treated timber channels fixed to reveals each side of opening (4) Pin to prevent board lifting (5) Efficiency of barrier may be increased by applying waterproof sealant to edge gaps and along base on risk side. (Figures 10, 12–15, 18 and 19 drawn by John Coleman RIBA of Bowyer, Langlands, Batchelor Architects, London, for English Heritage)

Note: manhole covers between the house and the barrier should be sealed so that street water cannot surcharge the cover and back-flood the property. Ensure that rainwater gutters do not pond water between the house and the barrier. Allow for sealed siphon discharges or higher roof overflows over the barrier.

Listed Building Consent will most probably be required before the flood barriers illustrated here (Figs 5–19) can be installed on a listed building. Planning permission may be needed in conservation areas. Although English Heritage considers these designs to be particularly appropriate for use on historic buildings, their inclusion in this publication does not mean that they will be suitable in all cases, nor does it remove the need to apply for Listed Building Consent or planning permission. Take advice from the local planning authority's Conservation Officer before proceeding.

Designs and materials

Figures 10–13 illustrate a simple 'slider' form of barrier, which slots into channels fixed to either side of a window or door frame. These barriers are only as watertight as the channels they sit in, and may have to be reinforced with sandbags to reduce seepage. They may be perfectly adequate for keeping water out of uncarpeted interiors (e.g. outhouses and



Figure 11 A Georgian doorcase fitted with fairly unobtrusive slots to hold a temporary flood barrier (John Fidler)

service rooms). Figures 14–19 illustrate compression barriers, which are designed to be completely watertight. Although a little more expensive to make than sliders, these may be better investments where carpeted, fully furnished and decorated interiors are threatened.

All the barriers shown in Figures 5, 6 and 10–13 are temporary. External-quality plywood, although a little more expensive than ordinary plywood, is better able to withstand moisture. The plywood should be lipped (i.e. have a strip of hardwood pinned and glued to the cut edges, covering the endgrain). All the timber elements in the barriers should be treated with preservative before being primed, undercoated and painted with an exterior-quality gloss acrylic paint. Metal fixings, including screws and pins, should be of galvanised or stainless steel. Clear window frame mastic or silicone bathroom sealant can be used to seal gaps between channels and rough brickwork or masonry, and to make temporary seals when barriers are in place.

Figure 13 (right) Door barrier: example with interlocking tongued and grooved multiple boards for increased height protection (1) High channels of treated timber (or metal) fixed to reveals each side of opening (2) Barrier: painted external quality lipped plywood or similar boards, the top edges fitted with hardwood tongues, the bottom edges grooved (3) Sealant to edges of side channels and channels bedded in mastic (4) Locating pin to prevent boards lifting (5) Sealant bead run along external (risk side) joints after assembly to give additional protection (6) Additional boards can be added, depending on risk level (7) Slot in paving to locate positively bottom edge of barrier (8) Optional lifting handles on rear face of boards

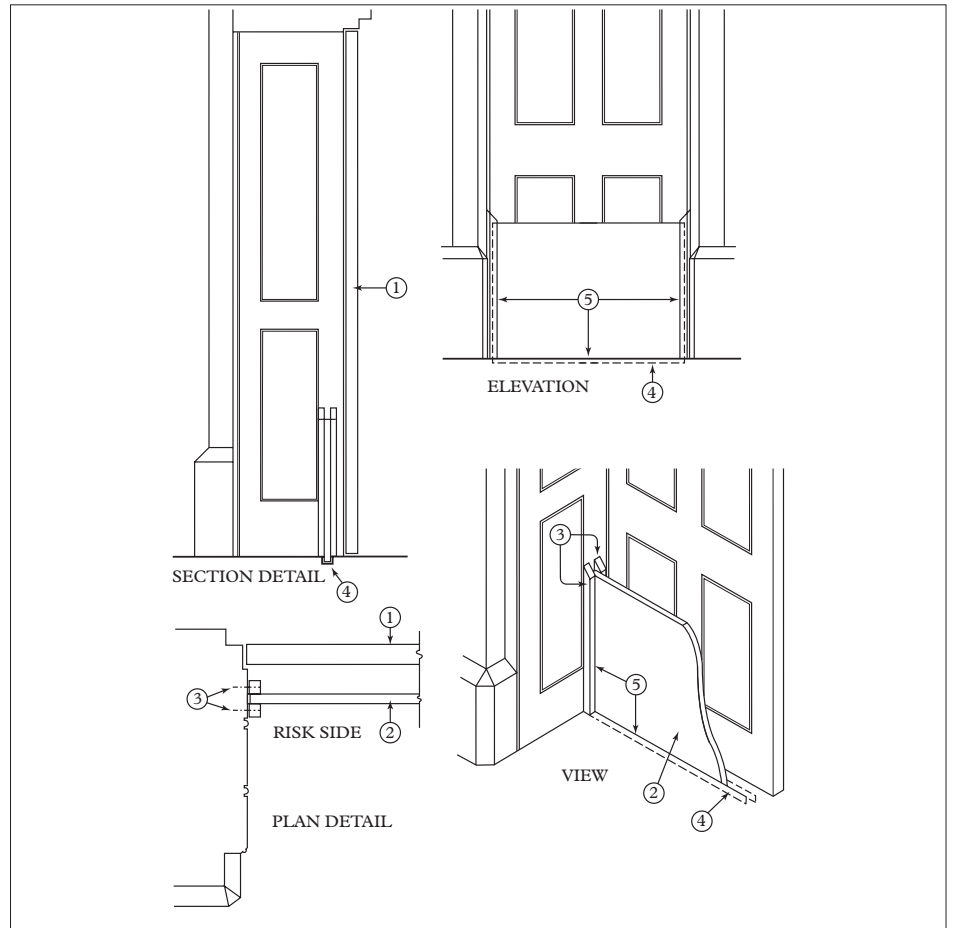
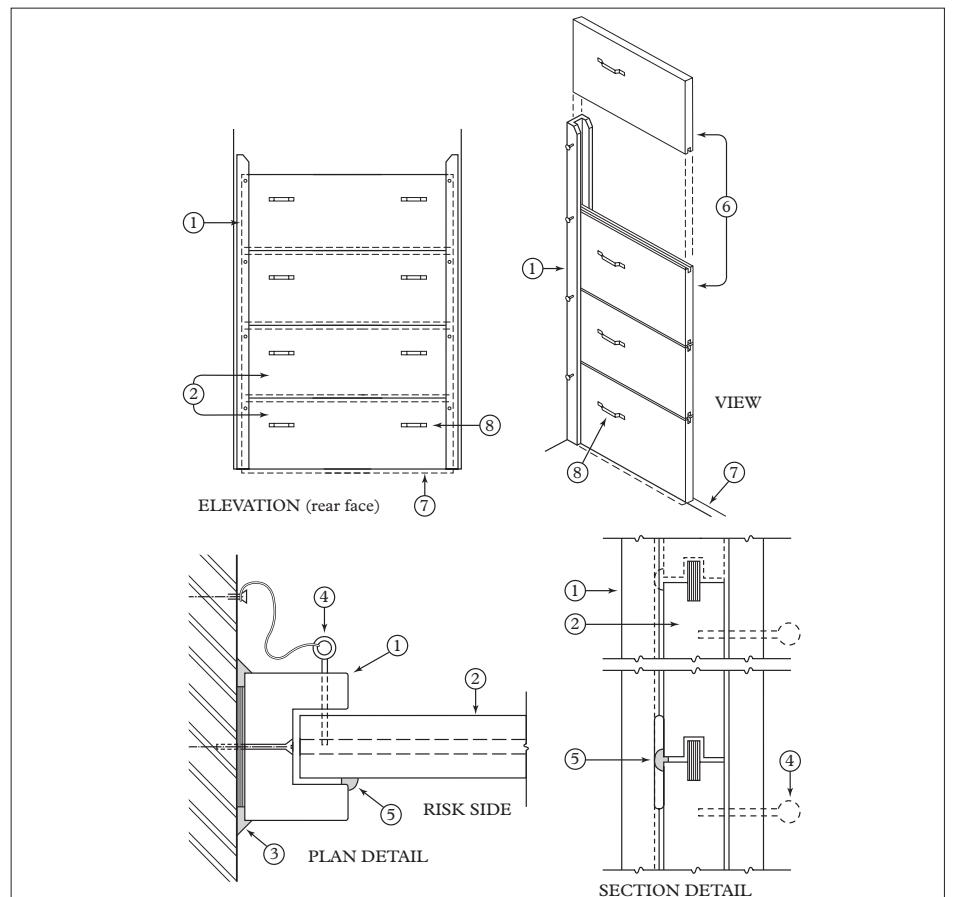


Figure 12 (above) Door barrier (1) Door: can be given additional protection by the fitting of proprietary weather seals (2) Barrier: painted external quality lipped plywood or similar board (3) Painted timber battens fixed to reveals each side of opening to form guide channels for board (4) Slot in paving for positive location of bottom edge of barrier (5) Efficiency of barrier can be increased by applying waterproof sealant around edges and base on risk side.



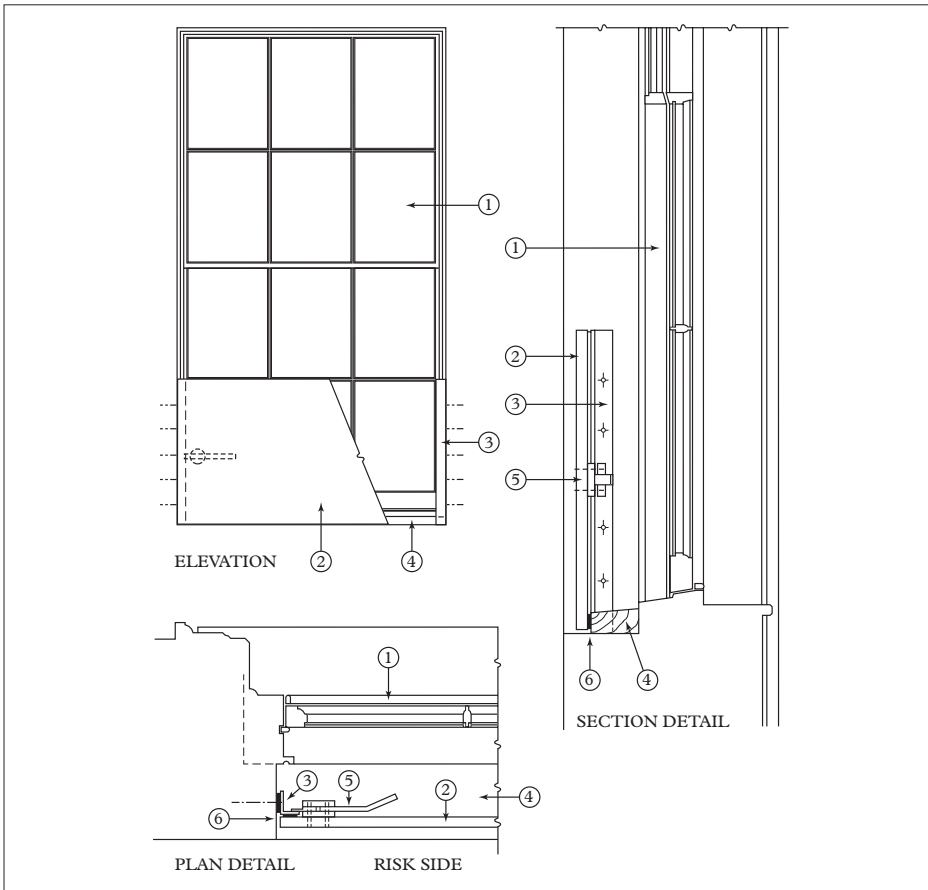


Figure 14 (top) Typical sash window barrier: compression type (1) Sash window: can be additionally protected by the fitting of proprietary draught and weather stripping to the sashes and parting beads (2) Barrier: painted external quality lipped plywood or similar board (3) Painted galvanised metal angles bedded in waterproof mastic and fixed to reveals each side of opening (4) Painted, treated timber packer to provide compression along bottom edge of board (5) Locking mechanism to pull board and seals tight against metal angles and timber packer (6) Self-adhesive compressible foam sealing strips stuck to rear face (bottom and sides) and along bottom edge of board

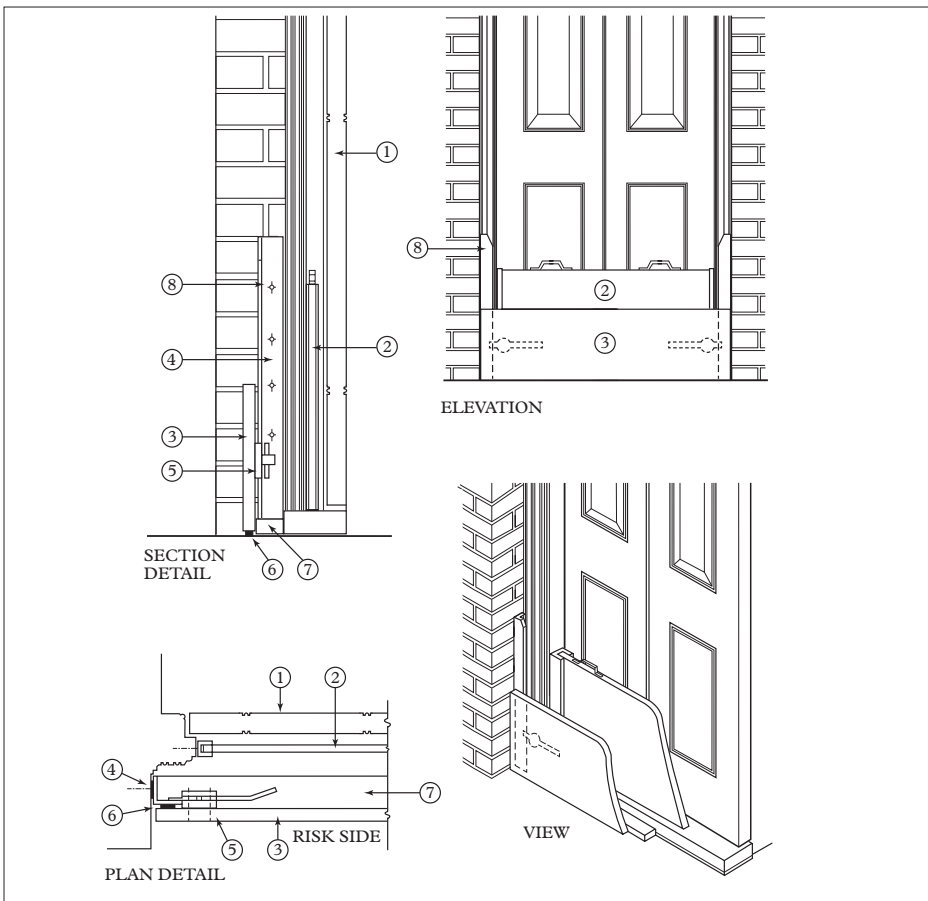


Figure 16 (above) Double layer barriers (see Fig 15) in position in front of an eighteenth-century door (John Fidler)

2 Disaster mitigation

2.1 Dealing with flood damage to historic buildings: cleaning up

General principles

Once floodwater has entered a building, it is almost certain to cause some damage that will require cleaning and repair. However, the extent and degree of damage depend on two key factors: the depth that the water reaches, and the length of time that it remains in the building.

Shallow flooding (when the water does not rise above floor level) is unlikely to cause significant damage in most properties, although there may be problems with water entering cellars, basements and voids beneath suspended ground floors.

Damage costs increase significantly once floodwater rises above floor level and comes into contact with internal finishes, electrical sockets, kitchen cupboards, carpets, furniture and personal possessions. Flood depths greater than 1 metre (3 ft) above floor level have been known in rare cases to cause structural damage to buildings, though only where

Figure 15 (left) Door barrier: example with double layer barriers (1) Door: can be given additional protection by the fitting of proprietary weather seals (2) Inner barrier of painted external quality lipped plywood or similar board, with lifting handles, slotted into painted galvanised metal channels fixed to door frames (3) Outer compression type barrier: painted external quality lipped plywood or similar board (4) Painted galvanised metal angles bedded in waterproof mastic and fixed to reveals each side of opening (5) Locking mechanism to pull board and seals tight against metal angles and timber packer (6) Self-adhesive compressible foam sealing strips stuck to rear face (bottom and sides) and along bottom edge of board (7) Painted, treated timber packer to provide compression along bottom edge of board (8) Extended side angles allow second board to be added to increase barrier height.



Figure 17 A compression barrier fitted to the front wall of a riverside property that is subject to regular flooding (John Fidler)

the buildings involved were in a very poor state of repair. It is rare for the structural integrity of a historic building to be compromised.

Dry old buildings slowly

It is essential not to attempt to dry old buildings out too quickly simply by the application of heat (e.g. by getting the central heating going again and turning it on full blast). The result can be catastrophic: thin timber elements, including floors, doors and panelling, may warp, twist or split; salts will migrate through old stone and plasterwork, causing them to blister, powder and exfoliate; many painted surfaces will peel and flake. The ‘remedial’ work becomes much more damaging than the flood itself.

The best general advice is to dry the building down gently and slowly, first through natural ventilation, and then with the aid of dehumidifiers (see Fig 20) and very low background heat, where appropriate. It is also useful to monitor the relative humidity within the property to ensure that moderate levels are maintained. Slow and gentle drying can take several months, but it is better than destroying irreplaceable historic fabric by acting in haste.

Assessing and recording the damage

Make an inventory and assess the damage. Document the damage with photographs, video and/or written descriptions. This record will be invaluable to insurers and any surveyors, architects or other professionals involved in the clean-up and repair.

Structural issues

Flooding is unlikely to lead to serious structural instability in buildings unless

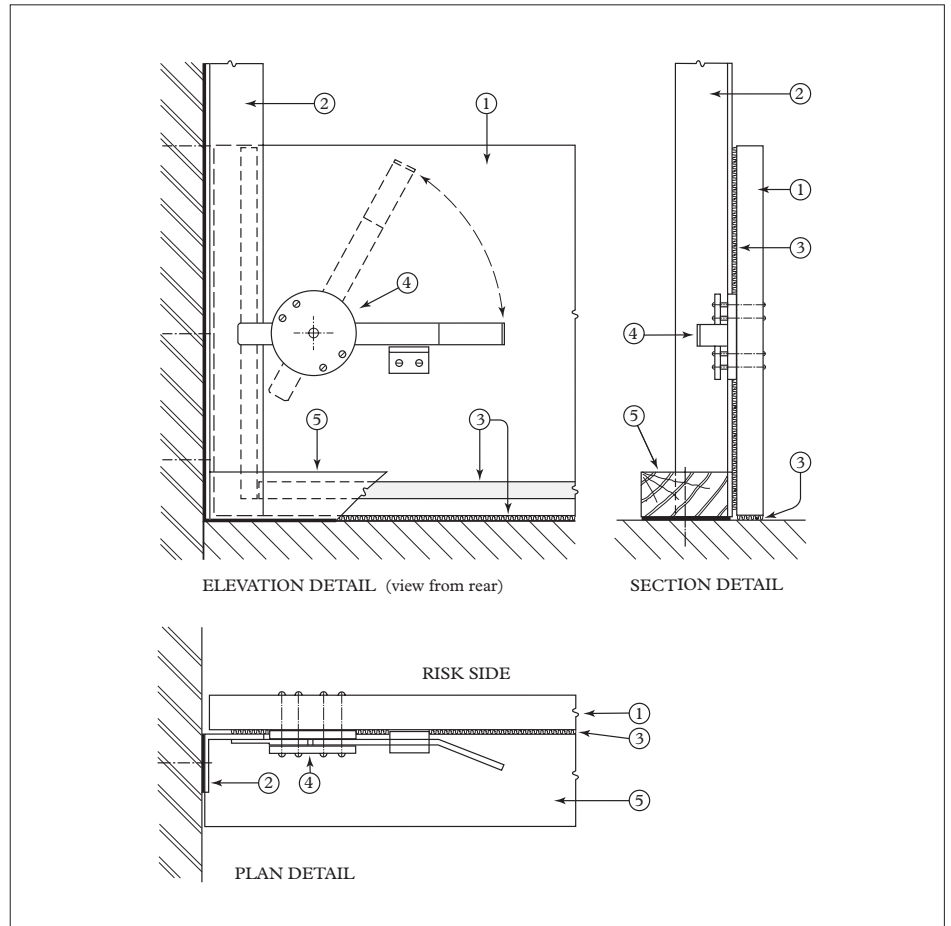


Figure 18 (above) Door/window barrier details: compression type (1) Barrier: painted external quality lipped plywood or similar board (2) Painted galvanised metal angles bedded in waterproof mastic and fixed to reveals each side of opening (3) Self-adhesive compressible foam sealing strips stuck to rear face (bottom and sides) and along bottom edge of board (4) Locking mechanism to pull board and seals tight against metal angles and timber packer (5) Painted, treated timber packer to provide compression along bottom edge of board

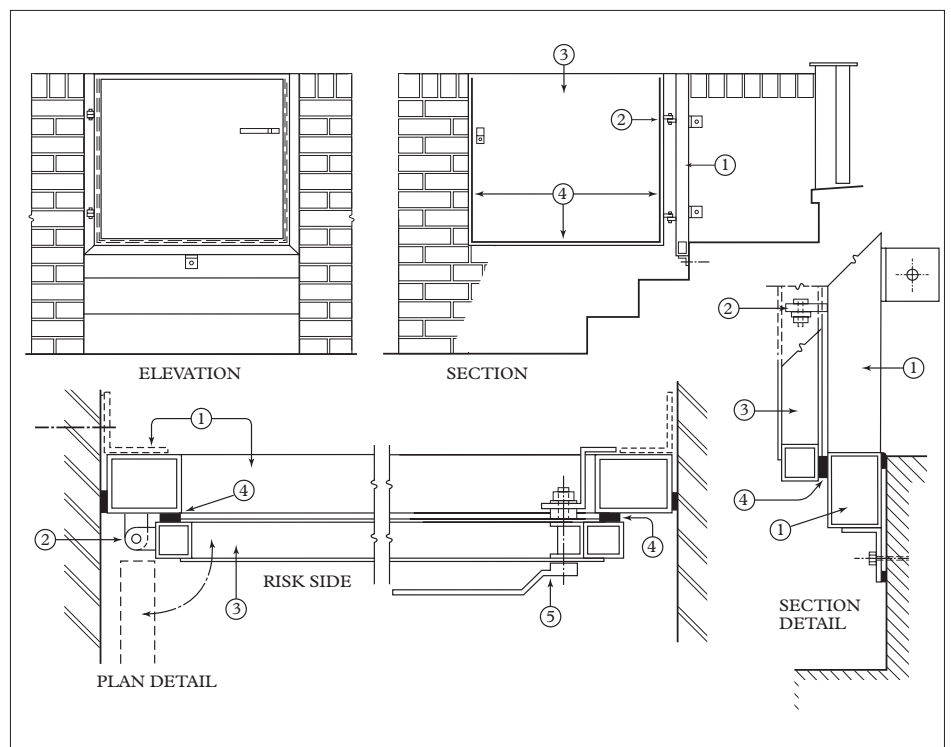


Figure 19 (above) Typical watertight door (1) Painted galvanised metal frame bedded in mastic to seal abutment with masonry, fixed to reveals and steps (alternative fixing cleats shown in pecked line) (2) Articulated hinges to ensure even contact between frame and seals all round on closing (3) Painted galvanised sheet metal faced, metal framed door (4) Rubber compression seals to sides and bottom of inner face of door to form watertight seal against frame when door closed

there has been significant washing-away of supporting ground, or the property has been battered by heavy storm seas or fast-travelling heavy flotsam. Damage is more likely to occur in areas suffering fast-flowing water on hillsides, where landslips may occur, or close to where sea walls have been breached. Look for

- bulging or dislodged sections of masonry caused by heavy impacts or excessive pressure
- undermined foundations, especially at corners
- cracks greater than 6 mm (¼ in) above doors and windows and at the ends of facades
- any major leaning, tilting and subsidence of the structure that was not evident, or as pronounced, before the flood.

In these situations consult the emergency services during flooding and, thereafter, the local building control department for advice, guidance and local knowledge. Special assistance and advice may be necessary for listed buildings and the local planning authority's Conservation Officer should be contacted. Architects, building surveyors and structural engineers with experience in the consolidation and repair of structurally damaged historic buildings can be called to help (see *Useful contacts*, Section 3.2). They may be able to propose remedial solutions to avert the need for dismantling and rebuilding.

Electricity and gas supplies

Consult the local utility companies before turning on power and gas supplies. To prevent residual moisture or contaminants from causing short-circuits when the power is switched back on, electrical systems need to be opened up, cleaned and dried – or replaced, depending on the severity of the problem. Systems should be inspected and certified by an appropriately qualified electrician before use.

Gas supplies, pipework and meters are normally resistant to water. During floods, however, mud and moisture can enter the burners, jets and electrical components of fires and boilers and can damage them. These elements all need to be inspected, cleaned, dried and tested before reuse.

In coastal areas, it is worth noting that the salt in seawater can corrode metal fittings, including metal conduit and switch boxes.

Simply ensuring that the metal components of an electricity or gas system are dry may not be sufficient; they should still be checked as described above.

Drains and sewers

Mud and silt can block waste and foul water drainage systems after a flood. Until the local authority can unblock mains drainage, the impact of continuing rainfall and waste drainage from the property will need to be carefully monitored and managed to avert additional flooding.

- If water rises through the trap (U-bend) of the lowest appliance (e.g. sink, bath or toilet), report this immediately to the local sewerage authority.
- Flush sinks and toilets regularly to help rinse the system.

Salvaging detached and damaged items

Do not throw away materials (e.g. loose decorative elements, furnishings etc.) indiscriminately, but salvage and retain as much as possible – even items thought to be badly damaged. Cleaning and steady drying out, together with conservation or repair may save them. If not, they may be used as models for new replica fixtures and fittings or found as a match in salvage yards.

Floodwaters can carry a long way even heavy items which you may find on your property, and these may well be vital to the restoration works of an upstream neighbour. Items such as gates and garden furniture that are missing from your property may turn up farther downstream.

Security

You may need to secure the building to keep out people who are not supposed to be there. Opening doors and windows to help a building dry out creates many opportunities for thieves to enter. There may be unfamiliar people around during the clean-up, and when everyone is wearing overalls it is hard to tell authorised from unauthorised visitors. Implement a system for checking identification and controlling admission of visitors. Use perforated plywood sheets and/or wire grills temporarily screwed to existing frames to secure openings at night without stopping through-ventilation in the building. An alternative way to secure windows without inhibiting ventilation is to open the sashes a little way and screw

them to the frame, leaving a gap of no more than 100 mm (4 in) at the top and bottom.

Speedy reoccupation of the premises can reduce security risks. If you have to take up temporary residence alongside the property in a mobile home, caravan or Portakabin, you should first seek advice on the need for planning permission from the local planning authority.

Wait for the water to recede

Basements are high-risk areas that often fill with water. Be careful to assess local drainage conditions outside and around the property first before deciding to pump water from a basement. If the surrounding water level is high, pumping could increase the external pressure on foundation walls, which may cause fragile, thin-walled structures to collapse inwards. In any case, pumping before the floodwater has receded is pointless: as long as the groundwater table remains higher than the basement, water will continue to seep in through the walls until the groundwater level finds equilibrium.

Let the water recede by itself and give it a helping hand by baling, creating drainage holes and pumping where appropriate. Remember that many buildings have suspended floors: the underfloor voids need to be inspected for standing water and acted upon in the same way as basements.

Mud, dirt and flood debris should be removed from all surfaces with fresh water as soon as possible after the floodwater has receded. Do not wait until the deposits have dried: it is safer and easier to remove the mud while it is still wet. Make sure that all electricity is turned off before cleaning with water. Avoid using very high-pressure water: it might not only damage historic materials, but could also create an aerosol spray of harmful micro-organisms. Low-pressure water, applied by operatives wearing personal protective equipment (i.e. high-efficiency particle air (HEPA) filter respirators if necessary) is safer. Extreme care should be exercised when washing decorative features and damaged or loosened elements, so as not to break them.

Silt and mud will accumulate not only on the floor and furnishings, but also in interior wall and floor cavities. Open

electrical outlets, ducts and chases and rinse them thoroughly. Let these areas dry completely before closing them up again. Clean out heating and air conditioning ducts. Large systems may need to be dismantled or cleaned by professional contractors.

2.2 Dealing with flood damage in historic buildings: drying out

Investigative work and ‘opening up’

It may be necessary to open up the structure of the building to check for sources of moisture; to check on the condition of the fabric; and to allow trapped moisture to evaporate from masonry and timber, from voids under floors or behind panelling, or from behind decorative finishes. The process must be carefully targeted, planned and supervised, to avoid the needless removal of perfectly viable original fabric. Opening up should not be allowed to develop into ‘stripping out’ – the wholesale removal of internal finishes (for which, in the case of a listed building, Listed Building Consent would be required before work could begin).

More often than not stripping out is unnecessary and opening up can be limited by non-destructive and keyhole surgery techniques (see *Bibliography*, Section 3.1). Before removing or dismantling any part of the structure, make a visual record of it by means of a sketch, photograph or video. Make sure that items such as floorboards or pieces of panelling are numbered (in soft pencil) so that, if lifted temporarily, they can be put back in the same place, thus preserving the archaeological integrity of the building.

Consult a conservator or a conservation architect before touching items of historic value (see below for guidance on how to treat different building materials and elements). Emergency work that is temporary and reversible should not normally require Listed Building Consent. However, you should seek advice on this matter from the local planning authority’s Conservation Officer before dismantling or altering any part of a listed building.

Plan for drying out

Plan your drying campaign for maximum effectiveness and minimum loss of historic fabric and finishes. Patience is essential:

drying is a natural process that cannot be hurried without causing irreparable damage. It can take months for humidity levels to return to normal in buildings that have been saturated. Rushing into remedial work before the building is thoroughly dry could mean that you have to redo the work later on, doubling the disruption and the expense. This is especially true of redecoration: most paints do not adhere well to damp substrates, and many of the relatively impermeable modern paints will slow down the drying process if they are applied before the substrate is completely dry. The result is blistering of paint and decomposition of underlying plasterwork.

Ventilation

Some or all of the following measures may be necessary to help ventilate the building. Even with standing water at low level, it is possible to start drying the rest of the house. Begin the drying process by using only natural ventilation.

- Clear mud and silt away from the bases of external walls. Return the surrounding ground to its original level, which should be at least 150 mm (6 in) below the level of internal floors at ground floor level.
- Remove covers and flood detritus from airbricks around the footings of the property. The free passage of air is essential to enable suspended timber floors to dry out from both sides.
- Remove any other seals or covers put in place before the flood to keep water out of the building.
- Open all doors (including the doors of built-in cupboards), windows, rooflights and trapdoors, to allow the air to circulate. Place safety barriers around trapdoors to prevent people falling into them.
- Remove carpets and underlays; vinyl, linoleum and other impermeable surface coverings; and hardboard or medium density fibreboard (MDF) sheets from floors.
- Move furniture and pictures away from walls so that they do not hinder drying.
- Lift floorboards to ventilate underfloor spaces. Even if the floorboards themselves are dry, lifting every sixth board will help to create vents for the damp area below. The easiest floorboards to lift will be those that are butt-jointed or that have already been altered to accommodate radiator pipes.

Lifting tongue-and-groove floorboards without damaging them is difficult; this skilled work should be left to a carpenter or joiner.

- Sodden floorboards may be swollen and softened, and can easily be damaged by rough handling. They should be lifted and left on edge, wedged apart, to dry. If they must be laid flat, they should be turned frequently to aid drying on both sides and to minimise the risk of warping or splitting. Where floorboards have been lifted, keep people out of the room or ensure that there is a safe way to cross the room and place warning signs to draw attention to the gaps.
- Strip non-historic wallcoverings (but see also *Wallcoverings*, below).
- Remove flood-soaked insulation. Most types of insulation, especially loose-fill varieties (e.g. cellulose, vermiculite, rock wool, blown fibreglass) have air pockets that collapse under the weight of the sodden material, rendering the insulation permanently ineffective. They must be removed and discarded to allow the structure to ‘breathe’.
- Insulation that does *not* absorb water, (e.g. closed-cell polystyrene and urethane board etc) may have to be removed temporarily if it is preventing water from evaporating, but it can be returned when the structure has dried out after cleaning.

Old houses in particular are likely to have hidden voids where air cannot effectively circulate. Investigate ‘awkward’ spaces (e.g. behind panelling, box shutters and linings to door and window reveals; under stairs and inside cupboards) and open them up if necessary to ensure the free flow of air. This work may necessitate the employment of a skilled joiner if damage to historic fittings is to be avoided.

Assisted drying

Natural ventilation alone may not be sufficient to dry out a building; it may be necessary to assist the drying process with extractor fans, space heaters and/or dehumidifiers. Some specialist drying companies offer an ‘injection’ drying service, which avoids the need to open up closed spaces by displacing trapped moisture in voids and cavities through small access holes. Another proprietary service injects hot dry air and then extracts it, taking moisture along in the process. Expert professional advice should be sought on

controlling assisted drying, so that the damage that can be caused by over-drying by machine, or inadequate natural drying, can be avoided. The risk to internal timber, especially to panelled doors and architraves, and claddings such as panelling (wainscot), parquet flooring and furniture marquetry, is that excessively fast differential movement may occur during assisted drying, and this can crack paint, split multiboard panels, and dislodge tenons and other timber joints.

Fans

Once power has been safely restored, electric fans can be used to encourage natural air circulation and thus speed the movement of humid air to the outdoors.

Dehumidification

Although ventilation should remain the primary means of drying out the building, dehumidifiers may have a role to play as the building starts to dry out. In order for dehumidification to work effectively

- the room must be sealed to reduce airflow. Cover windows, doors and any other openings with plastic sheeting.
- the room must originally have been dry. There is no point in trying to reduce the humidity in a room which has always had moist walls because of rising damp from groundwater; all that happens is that more moisture is sucked in from outside.
- the dehumidifier(s) must be large or numerous enough to be effective; specialist drying companies, manufacturers and hire companies will be able to advise on the appropriate numbers and sizes for the volumetric capacity of the rooms involved. Care must be taken not to desiccate historic timbers, plasterwork and painted surfaces by excessive or too rapid drying. Dehumidifiers should not be used where there are wall paintings or other delicate decorative surface finishes or papers.

If a refrigerant dehumidifier is used and it does not have an automatic pump-out facility, the water collection reservoir must be emptied regularly to prevent it overflowing and causing another flood.

Temperature and humidity levels should be monitored when any industrial drying equipment is being used, to ensure that the rate of moisture removal is acceptable.



Figure 20 Dehumidifiers are available in a range of sizes to suit different situations. (Courtesy of EBAC)

Background heating

Modest slow background heat can be introduced as the final stage in drying out the building. Condensation on window glass, mirrors etc. is a sign that the fabric is still very wet; keep the building ventilated and the heating system controlled by room-based *humidistats* (not thermostats).

Warm air can hold more moisture than cold. If heaters are used without ventilation, the absolute humidity in the interior may actually increase, creating condensation and making the situation worse.

How flooding affects historic building materials

Historic building elements that are particularly vulnerable to flood damage include stone, brick and mortar walls, timber frames, wattle-and-daub panels, timber boarding and panelling, earthen walls and floors, lime plaster walls and ceilings and many decorative finishes. Organic materials such as timber swell and distort when wet, and suffer fungal and insect infestations if left damp. If dried too quickly and at temperatures that are too high, organic materials shrink and split, or twist if they are restrained in

panels. Inorganic porous materials do not generally suffer directly from biological attack. However, enormous damage can be caused when inherent salt and water (frost) crystals, carried through the substrate, are released through inappropriate drying or very cold conditions.

Masonry

As they recover from flood saturation, historic brick and stone walls can be damaged by inherent soluble salts and by salts absorbed in rising damp from groundwater. When the masonry is saturated, the salts dissolve. But when the water evaporates, the salts are carried nearer to the surface, where they crystallise and can appear as a powdery white residue called 'efflorescence' (Fig 21). Although unsightly, efflorescence is not usually harmful and can be brushed, vacuumed or washed away. Problems arise if the salts are trapped behind a relatively impermeable coating, such as a water-repellent sealant, or an oil-based or acrylic paint. The salts crystallise within the substrate and expand, pushing off the surface of the brick or stone in processes known as 'spalling' or 'exfoliation'. Thus it is important to allow historic masonry to 'breathe' effectively after flooding, though the removal of historic plasterwork from its surface is rarely justified. Permeable coatings, such as limewash, can be used to decorate damp surfaces whilst allowing them to keep drying out without damage.

The spalling of soft brick or stonework occurs usually on building exteriors when the temperature drops below freezing while moisture is still trapped within walls. Water expands as it turns to ice crystals, causing spalling on wall faces. Lime mortar joints can also become weakened by these processes, and by the long-term seepage of contaminated water through masonry. Impermeable, heavily cementitious mortar will exacerbate deterioration in flood situations by holding the moisture in the masonry for longer and by causing salts to crystallise within the historic material. Its wholesale removal and replacement with weaker, porous, lime-based mortar will help the walls to dry out.

After winter floods, very soft saturated bricks on the outside of the property should be protected from frosts and rain by inert (i.e. water-resistant) insulation

and ventilated shelter (e.g. a temporary lean-to screen or tarpaulin) and allowed to dry out slowly.

Masonry flooded by sea water should be rinsed down several times with clean non-salt water as soon as possible after the flood has subsided, and then allowed to dry out slowly, so as to minimise the effects of chloride salt damage to soft masonry.

Where stone, terracotta or tile paving laid on to bare earth appears to be suffering from rising damp and salt migration following flooding, rake out the mortar joints and leave them open. They can be filled with clean dry sand to increase surface area for drying and provide sites for crystallisation to take place. Later, repoint the joints with sacrificial, highly porous, lime-based mortars to help wick the salts away from the historic paving and into the mortar. Periodically, the mortar may become saturated with salts and have to be replaced. However, this will be far cheaper than having to deal with damaged paving.

Do not seal the paving with wax, oil or polyurethane varnish, as sealants will encourage salt subflorescence and the breakdown, powdering or exfoliation of the paving slabs themselves.

Concrete

Once saturated, concrete floors and screeds take a long time to dry. Remove,

and do not relay, impermeable or low-permeability coverings that restrict drying. Where timber boards on battens, or parquet block floors have been laid over concrete, the coverings may have to be lifted out of the way to permit the concrete to dry effectively. In some cases this may be avoided by the use of injection drying methods (see *Useful contacts*, Section 3.2).

Structural timber

Timber when saturated is vulnerable to rot through fungal attack. Like other living things, the organisms that cause rot need food (i.e. wood) and water in order to grow. In most building environments the missing element is water: as long as it is kept dry, structural timber lasts for centuries. Moreover, decay organisms must exist for a long period of time in order to become destructive, so a one-off event such as a flood should not cause serious damage, as long as the wood is allowed to air-dry afterwards.

Problems occur when moisture is trapped in the wood and cannot escape. This can happen in wall cavities, in sill plates, under floors, behind panelling and under impermeable finishes such as oil-based gloss paint. Ventilate hidden voids as described above, and take the advice of a conservation professional before you consider stripping historic paint finishes or surface decoration. Such work may require Listed Building Consent.

Flaking paint *per se* does not imply that the underlying timberwork is rotten – merely that it is temporarily wet. In most cases, timber can be dried and returned to a fair state, ready for repainting.

Timber panelling (wainscot) and other woodwork

It may be possible to dry behind timber panelling (wainscot) by injection drying (see *Useful contacts*, Section 3.2). Where this is not possible, the panelling should be photographed and the individual pieces should be numbered before being gently dismantled by specialist joiners. Dry the panelling out in a dry, well-ventilated space. The pieces should be stacked with spacers, turned over periodically, and loaded with uniformly distributed weight of about 2.5 kg per square metre (½lb per square foot), to counteract warping.

Skirting boards, doorframes and other items of internal joinery are likely to survive a flood intact. After drying, they should return to their original size and form and can be retained. It may be necessary to remove skirting boards and the linings of door and window reveals, to help the wall dry out. All such items should be carefully numbered, stacked like panelling (see previous paragraph) and returned to their original locations.

Panelled doors usually survive flooding surprisingly well. They should be allowed to dry in place, but left open to help air circulation. They may need repair to correct warping, or to strengthen joints if their original glue was not waterproof. Repairs should not be attempted until the doors are completely dry.

Timber staircases can suffer swelling and shrinkage in their many components during and after flooding, and this can lead to the loosening and weakening of structural joints. If necessary, stabilise loose treads with additional underside blocks and fixings once the staircase is dry. Ensure that natural ventilation reaches both the upper and lower sides of the stair so that the timber dries evenly; this will reduce distortion.

Independent experts can be hired as consultants to advise on drying and treating woodwork to prevent decay. They can carry out surveys to assess the potential risks of fungal and other

Figure 21 Masonry suffering the effects of damp: a 'cushion' of efflorescing salts has developed around a joint in this sandstone pier as the saturated masonry has dried out. (John D. Stewart)





Figure 22 The drying-out process must be carefully controlled and monitored in order to protect historic decorations. Paintings on plaster, such as these early seventeenth-century examples in a Grade II*-listed house in Bewdley, are especially vulnerable to flood damage. (Robert Gowing)

infestations, and have the tools to monitor the welfare of concealed or remote historic timbers over time (see *Useful contacts*, 3.2).

Render and plaster

The term ‘plaster’ covers a wide variety of wall and ceiling coating materials, each with its own chemical and physical responses to water saturation. Older, lime-based plasters may soften when wet, but usually harden again once dry. They are very porous and help underlying fabric to ‘breathe’. Modern, gypsum-based plasters are water-sensitive, do deteriorate and may need remedial treatment or replacement. Modern plasterboards, which incorporate paper linings that deteriorate when wet, are fixed to the walls by plaster dabs and may come unstuck and need replacing. If in doubt about the authenticity or importance of the plaster material, consult your local planning authority’s Conservation Officer.

Do not assume that unsound plaster will sound hollow when tapped and must therefore be removed or repaired. Traditional plasterwork in England is often based on timber laths attached to battens, and always sounds hollow, even when it is in good condition.

Check for obvious cracks and areas where plaster has bulged on walls or sagged on ceilings. Some of this deterioration could be historic deformation unrelated to flooding. Localised damage to the substrate, in rotted timber lathing for example, may need keyhole-type repairs. As a first aid measure, support any loose historic render or plaster with plywood sheet and wooden braces, or nail chicken wire over the damaged area to stop it falling away. Follow the remedial procedures outlined in Ashurst and Ashurst Vol 3 1988, pp 36–43 (see *Bibliography*, Section 3.1).

If the floodwater level was above the ceiling plaster, and it is suspected that ceiling cavities may still contain standing water, small drainage/ventilation holes can be poked in the plaster using a strong nail attached to the end of a long stick or drilled using a hand (not an electric) drill.

Falling plaster is heavy, especially when wet, and can be dangerous. Take great care when inspecting ceilings; do not stand directly under an area that is sagging, and wear a hard hat.

Metalwork

Aluminium, bronze, copper and brass objects, components and fixtures will not be damaged by immersion in water, as

long as they are allowed to dry quickly. Whilst iron and steel will rust and expand when exposed to water, they should not be harmed by a single immersion, as long as they too are allowed to dry quickly. Once water is eliminated, the rusting stops. Even severely rusted nails are unlikely to cause significant structural problems, although their red/brown oxidising layer may stain finished surfaces. The solution is to drive the nails further into the wood, fill the hole left behind, then prime and paint the surface. If superficial rust patches form on cast iron, the surface can be cleaned with wire wool, primed and repainted.

Rusting, particularly in marine environments, can lead to serious structural problems where metal elements such as steel sections or reinforcement in concrete lintels are embedded within saturated walls that do not dry quickly. Here the exfoliation of oxidising metal sections, or the expansion of the metal causing spalling of the concrete, can reduce the bearing capacity of the beam or lintel and result in cracking, if not collapse. Check the lintels: cracks, deformation or oxide (rust) staining are signs of distress, and should be inspected by a structural engineer.



Figure 23 An endoscope being used to investigate beneath floorboards. (Chris Wood, Robert Gowing)

Ironmongery

Once they have dried out, locks and hinges can be dusted with powdered graphite to prevent squeaking and seizing. Historic metalwork can be temporarily lacquered or waxed by conservators to limit future damage by flooding.

Wallcoverings

Paper and paste can provide food for mould growth. Non-historic wallcoverings should be stripped and discarded. Consult a specialist conservator about moving, cleaning and disinfecting historic wallcoverings, whether of paper, textile, pressed metal, leather or other material.

Paint finishes

Permeable traditional paint finishes such as limewash, distemper, milk (calcium caseinate) paints, etc., which allow moisture to evaporate through their surfaces from the substrate, can be cleaned, disinfected and left to air dry or repainted to match. Do not paint any previously painted interior surface with

relatively impermeable modern paints such as alkyd oil-based paints or acrylic emulsions until it is completely dry. Relatively impermeable modern finishes may have to be stripped off completely to allow the substrate to dry out effectively. Historic paintwork should be treated by a specialist conservator (see UKIC in *Useful Contacts*, Section 3.2).

Old paint may contain white lead carbonate. Special precautions must be observed for handling lead-based paint and it is best left to qualified painters and decorators. If the paint is in fair to good condition, it is much safer to leave it *in situ* and make good in similar materials. Encapsulation is preferable to attempting removal, since waste disposal poses ecological risks. Owners of Grade I and II* buildings are authorised to continue to use lead-based paint under a certification scheme operated by English Heritage and the lead paint manufacturers.

Wall paintings

Do not use dehumidifiers or heaters in interiors that have historic wall paintings on plaster or timber. Consult a specialist conservator (see UKIC in *Useful Contacts*, Section 3.2).

Monitoring long-term effects

As the building and surrounding land dry out, check the stability of the walls and floor and the integrity of the mortar joints. Any cracks that appear in foundation walls or around openings should be investigated. If they are the result of temporary hydration and expansion of the underlying clay soil around the foundations, the cracks should shrink, or at least cease to expand, when the water content of the soil returns to normal. Cracks from foundation erosion, however, can be expected to worsen over time as the building settles. Cracks that widen or move are signs of structural instability that warrants careful examination by a structural engineer.

Under-floor timbers should be inspected six months after flooding and then annually, for evidence of fungal infestation

and rot. Fibre optic borescopes, of diameters as small as 6 mm (¼ in) are useful for investigation within the fabric via small boreholes or where skirting boards have been temporarily removed (see Fig 23). Experience and skill are required to interpret such observations accurately; architects, building surveyors and independent mycologists are best qualified for this work (see *Useful contacts*, Section 3.2).

Flooding can cause problems long after the obvious damage has been repaired. The secondary effects of flooding only become evident several months after the waters have subsided. Cracks, bulges, damp stains or condensation may indicate a continuing problem that requires investigation. The best thing to do is seek the independent advice of suitably qualified professionals.

Grant aid from English Heritage

English Heritage runs an emergency works grants scheme to help owners of Grades I and II* listed buildings to deal with sudden catastrophes, including floods. Under certain conditions, grants are available for work that is immediately necessary to protect the overall stability or integrity of the building and/or to preserve specific important features or elements. Examples of emergency works might include works to prevent structural collapse (e.g. propping, shoring, scaffolding) or careful dismantling and storage of building elements for later conservation, repair and reinstatement. The proposed work must be the minimum necessary, must use the most cost-effective means to achieve the objective and normally must lie outside the range of remedial activities covered by building insurance.

Local planning authority Conservation Officers are familiar with these and other grant schemes to conserve historic buildings, and should be contacted in the first instance. For further information on English Heritage's programme, contact the nearest English Heritage regional office (see back cover).

3 Further information

3.1 Bibliography

Abbreviations

ADAS	Agricultural Development and Advisory Service
BRE	Building Research Establishment
CIRIA	Construction Industry Research and Information Association
DNH	Department of National Heritage
DoE	Department of the Environment
EA	Environment Agency
HMSO	Her Majesty's Stationery Office
MAFF	Ministry of Agriculture, Fisheries and Food
ODPM	Office of the Deputy Prime Minister

Planning and other legislation

Town and Country Planning Act 1990
Planning (Listed Buildings and Conservation Areas) Act 1990
Town and Country Planning (General Development Procedure) Order 1995
Building Regulations 1991

Planning guidance

DNH and DoE, 1994 *Historic Buildings and Conservation Areas*, Planning Policy Guidance Note 15, London, HMSO

Flood defence guidance

Bowker, R, H R Wallingford, 2002 Making properties more resistant to floods, *Municipal Engineer*, 151, 197–205
Bramley, M and Bowker, P, 2002 Improving flood protection to property, *Civil Engineering*, 150, 3–9
EA, 1999 *Flood warning service strategy for England and Wales*, Bristol, Environment Agency
EA, 1999 *Floodline – because floods don't just happen to other people: National Flood Awareness Week 18–24 October 1999*, Bristol, Environment Agency
EA, 2001 *Floodline flood pack* (Includes guidance leaflets *After the Flood, How to restore your home*, and *Damage Limitation – how to make your home more flood resistant*)
Environment Agency website
<http://www.environment-agency.gov.uk/subjects/flood/>
This contains a very large amount of information about flood protection measures.
MAFF and Welsh Office, 1993 *Strategy for flood and coastal defence in England and Wales*, London, PB1471 MAFF and Welsh Office

Monkman, B, 2002 Environmental impact assessments for flood defence schemes, *Civil Engineering*, 150, 56–9
National Flood Forecasting and Warning Centre, 2001 *Damage Limitation – how to make your home more flood resistant*, Environment Agency Publication 1201/BG1U (English) [See also *Environment Agency, 2001 above*]
ODPM 2002 *Protect your home from floods*, London Product Code 02BR00028
Ogunyoye, F and van Heereveld, M, Posford Haskoning, 2002 *Temporary and Demountable Flood Protection: interim guidance on use*, DEFRA and Environment Agency, R & D Publication 130 (Project Manager: R Stokes)
Scottish Environmental Protection Agency website
<http://www.sepa.org.uk/flooding/protection/index.htm> This provides detailed information on flood protection products and how to obtain them.

Climate change and the environment

Atkins, WS Meteorological Office and ADAS, 1999 *Rising to the challenge: Impacts of climate change in the South East in the 21st century*, Kingston upon Thames, Surrey County Council
DoE, 1996 *Review of the potential effects of climate change in the United Kingdom*, London, DoE
EA, 2001 *Lessons Learned: Autumn 2000 floods*, Bristol, Environment Agency
Fleming, G, 2002 Learning to live with rivers – the Institution of Civil Engineers' report to Government, *Civil Engineering*, 150, 15–21
Garvin, S, et al, 1998 *Impact of climate change on building*, Building Research Establishment, East Kilbride, Scotland
Hulme, M, et al, 2002 *Climate change scenarios for the United Kingdom*, The UKCIP02 scientific report, Tyndale Centre for Climate Change Research, University of East Anglia, Norwich
Phillipson, M, and Graves, H, 2001 *Climate change and Buildings, Foundations for the Built Environment*, Building Research Establishment, Garston
Purnell, R, 2002 Flood risk – a Government perspective, *Civil Engineering*, 150, 10–14
Richardson, D, 2002 Flood risk – the impact of climate change, *Civil Engineering*, 150, 22–4
Sayers, P, et al, 2002 Towards risk-based flood hazard management in the UK, *Civil Engineering*, 150, 36–42

Repair and conservation

Ashurst, J and N, 1988 *Practical Building Conservation: Volume 1 Stone Masonry* (English Heritage Product Code 50216*), *Volume 2 Brick, Terracotta and Earth* (English Heritage Product Code 50217*), *Volume 3 Mortars, Plasters and Renders* (English Heritage Product Code 50218*), *Volume 4 Metals* (English Heritage Product Code 50219*), *Volume 5 Wood, Glass and Resins* (English Heritage Product Code 50220*): Aldershot, English Heritage and Gower Technical Press
BRE, 1997 *Repairing Flood Damage*, BRE Good Repair Guide 11: Part 1 *Immediate Action*, Part 2 *Ground Floors and Basements*, Part 3 *Foundations and Walls*, Part 4 *Services, Secondary elements, Finishes, Fittings*: Garston, Building Research Establishment
BRE Scottish Laboratory, 1996 *Design Guidance on Flood Damage to Dwellings*, London, HMSO for Scottish Office Development Department
CIRIA, 2002 *Reducing the impacts of flooding – extempore measures*, CIRIA Report SP155
National Flood Forecasting and Warning Centre, 2001 *After a flood – how to restore your home*, Environmental Agency Publication 1201/BG1V
Ridout, B, 2000 *Timber Decay in Buildings: The conservation approach to treatment* (Chapters 12 and 13); London, English Heritage and Historic Scotland with E and F N Spon (English Heritage Product Code 50199*)
Stokes, R, 2002 *Repair and restoration of buildings following floods*, CIRIA Publication W5C-013/3 (see also same title on CIRIA website
<http://www.ciria.org/flooding/>)

Overseas publications

Crisis Management Agency, Poland, 1999 *Cultural Heritage Protection in Case of Emergency with respect to Flood*, Warsaw, Pagina Publishing
Shivers, N, 1990 *Walls and Molding: How to care for old and historic wood and plaster*, Respectful Rehabilitation series, Washington, DC, The US National Trust for Historic Preservation and The Preservation Press
Spennemann, DR, and Look, DW, 1998 *Disaster Management Programs for Historic Sites*, San Francisco, US National Park Service

Georgia Department of Natural Resources, n.d., *After the Flood — Rehabilitating Historic Resources*, Atlanta, Georgia DNR Historic Preservation Division (obtainable from the Georgia Department of Natural Resources, 156 Trinity Avenue, SW, Suite 101, Atlanta, GA 30303–3600, USA. Website: www.gashpo.org)

National Trust for Historic Preservation, n.d., *Treatment for Flood Damaged Historic Buildings*, Washington, DC, Preservation Press (obtainable from National Trust for Historic Preservation, 1785 Massachusetts Avenue NW, Washington, DC 20036, USA. Website: www.nationaltrust.org)

Mail order publications

The organisations listed below publish books, advice notes and guidelines on the care and repair of old buildings, some of which are referred to above. For full publications lists and ordering details, contact:

Building Research Establishment (BRE)
Bucknalls Lane
Garston
Watford WD25 9XX
Tel: 01923 664000
E-mail: enquiries@bre.co.uk
Website: www.brebookshop.com
(Titles include the 4-volume series *Good Repair Guides* listed above.)

DTLR Free Literature (also for ODPM free publications)
PO Box 236
Wetherby LS23 7NB
Tel: 0870 1226 236
Fax: 0870 1226 237
E-mail: dtr@twoten.press.net

English Heritage
Customer Services
PO Box 569
Swindon SN2 2YP
Tel: 0870 333 1181
Fax: 01793 414926
E-mail: customers@english-heritage.org.uk
Website: www.english-heritage.org.uk
(For catalogues of *free* publications e.g. *Technical Advice Notes*, and for placing orders, including this document)

English Heritage Mail Order Service
c/o Gillards
Trident Works
Temple Cloud
Bristol BS39 5AZ
Tel: 01761 452966
Fax: 01761 453408
E-mail: info@gillards.com
(For catalogue and ordering of *priced* English Heritage publications such as those above marked *)

Health and Safety Executive (HSE)
HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
E-mail: hsebooks@prolog.uk.com
Website: www.hsebooks.co.uk
(Various titles on safe use of gas and electricity, removal of lead paint, etc.)

Society for the Protection of Ancient Buildings (SPAB)
37 Spital Square
London E1 6DY
Tel: 020 7377 1644
Fax: 020 7247 5296
E-mail: info@spab.org.uk
Website: www.spab.org.uk
(Wide range of Technical Advice Notes and booklets on all aspects of historic building repair)

3.2 Useful contacts

Public bodies

English Heritage

Technical advice and grants for emergency works may be available from English Heritage for the conservation and repair of Grade I and Grade II* listed buildings following floods, where insurance does not cover specialist work. For information contact the relevant regional office (see back cover).

Local authorities

Local councils should be the first port of call for information and guidance on matters relating to flooding, planning and historic buildings, public health, provision of sandbags and emergency accommodation.

Flood status and weather reports

National Operations Team
Swift House
Frimley Business Park
Frimley
Surrey GU16 7SQ
Tel: 01276 454 725
Fax: 01276 454 747
Website: www.environment-agency.gov.uk

The Environment Agency
General enquiries: 0845 333111
Floodline (flood warnings): 0845 988 1188
Emergency hotline (to report floods): 0800 80 70 60
Website: www.environment-agency.gov.uk

The Met. Office
Tel: 0870 900 0100
Fax: 0870 900 5050
Weather by Phone (premium rate): 09068 232770
E-mail: enquiries@metoffice.com
Website: www.metoffice.com

Health and safety

General inquiries to the Health and Safety Executive (HSE) should be addressed (or faxed) to:

Health and Safety Executive
HSE Information Services
Caerphilly Business Park
Caerphilly CF83 3GG
Tel: HSE Infoline 08701 545500, open 8.00am to 6.00pm Monday to Friday
Fax: 02920 859260
E-mail: hseinformation@natbrit.com
Website: www.hse.gov.uk

For information on domestic gas safety, phone the HSE Gas Safety Advice Line (free): 0800 300363.

Suppliers of safety equipment

Personal Safety Manufacturers Association (PSMA)
Tamesis House
35 St Philip's Avenue
Worcester Park
Surrey KT4 8JS
Tel: 020 8330 6446
E-mail: psma@tamgroup.co.uk

Professional institutions and accreditation bodies

Institute of Electrical Engineers
Savoy Place
London WC2R 0BL
Tel: 020 7240 1871
Fax: 020 7240 7735
E-mail: postmaster@iee.org
Website: www.iee.org.uk

Institute of Structural Engineers
11 Upper Belgrave Street
London SW1X 8BH
Tel: 020 7235 4535
Fax: 020 7235 4294
E-mail: mail@istructe.org.uk
Website: www.istructe.org.uk

National Preservation Office
The British Library
96 Euston Road
London, NW1 2DB
Tel: 020 7412 7612
Fax: 020 7412 7796
E-mail: npo@bl.uk
Website: www.bl.uk/services/preservation
(Video: *If Disaster Strikes*)

The Register of Architects Accredited in Building Conservation (AABC)
11 Oakfield Road
Boynnton
Cheshire SK12 1AR
Tel: 01625 871458
Fax: 01625 871468
Website: www.aabc-register.co.uk/
addresses-a-z.html

RE:source (the Council for Museums, Archives and Libraries)
16 Queen Anne's Gate
London SW1H 9AA
Tel: 020 7273 1444
Fax: 020 7273 1404
E-mail: info@resource.gov.uk
Website: www.resource.gov.uk

The Royal Institute of British Architects (RIBA)
Clients Service
66 Portland Place
London W1B 1AD
Tel: 020 7580 5533
Fax: 020 7255 1541
E-mail: info@inst.riba.org
Website: www.architecture.com

The Royal Institution of Chartered Surveyors (RICS)
Information Service
12 Great George Street
London SW1P 3AD
Tel: 020 7222 7000
Fax: 020 7222 9430
E-mail: contactrics@rics.org.uk
Website: www.rics.org.uk

The United Kingdom Institute for Conservation (UKIC)
702 The Chandlery
50 Westminster Bridge Road
London SE1 7QY
Tel: 020 7721 8721
Fax: 020 7721 8722
E-mail: ukic@ukic.org.uk
Website: www.ukic.org.uk
(UKIC maintains *The Conservation Register*, a list of accredited conservators: www.conservationregister.com)

Directories of products and/or services

Building Conservation Directory
Cathedral Communications Ltd
High Street
Tisbury
Wiltshire SP3 6HA
Tel: 01747 871717
Fax: 01747 871718
E-mail: bcd@cathcomm.demon.co.uk
Website: www.buildingconservation.com

Heritage Information
15 Kensington Palace Gardens
London W8 4QG
Tel: 020 7243 5888
Fax: 020 7243 5889
E-mail: info@heritageinformation.org.uk
Website: www.heritageinformation.org.uk

There is a useful directory of suppliers of flood barriers, absorbent materials and dehumidifiers on the Scottish Environmental Protection Agency's website: www.sepa.org.uk/flooding

Independent specialist consultants on damp and timber decay

Environmental Building Solutions Ltd
Galley Cottage, Galley Lane
Great Brickhill, Milton Keynes
Bucks MK17 9AA
Tel: 01525 261922
Fax: 01525 261923
E-mail: ebs@ebssurvey.co.uk
Website: www.ebssurvey.co.uk

Hutton & Rostron Environmental Investigations Ltd
Netley House
Gomshall
Surrey GU5 9QA
Tel: 01483 203221
Fax: 01483 202911
E-mail: ei@handr.co.uk
Website: www.handr.co.uk

Ridout Associates
147a Worcester Road
Hagley
Stourbridge
West Midlands DY9 0NW
Tel: 01562 885135
Fax: 01562 885312
E-mail: ridout-associates@lineone.net
Website: www.ridoutassociates.co.uk

Trade associations

Association of British Insurers
51 Gresham Street
London EC2V 7HQ
Tel: 020 7600 3333
Fax: 020 7696 8999
E-mail: info@abi.org.uk
Website: www.abi.org.uk

British Damage Management Association (BDMA)
2nd Floor, Willow Business Centre
Mitcham
Surrey CR4 4NA
Tel: 020 8274 3336
Fax: 020 8274 3337
E-mail: info@bdma.org.uk
Website: www.bdma.org.uk

British Disaster Management Association
Website: www.m25lib.ac.uk/dmg
(Information on cleaning, disinfecting and drying services, the conservation of books and archives, but also useful for other materials. Use Reaction and Recovery buttons on the website.)

British Wood Preserving and Damp Proofing Association
1, Gleneagles House
Vernon Gate
Derby DE1 1UP
Tel: 01332 225100
Fax: 01332 225101
E-mail: info@bwpda.co.uk
Website: www.bwpda.co.uk

Builders Merchants Federation
15 Soho Square
London W1D 3HL
Tel: 0870 901 3380
Fax: 020 7734 2766
E-mail: info@bmf.org.uk
Website: www.bmf.org.uk
For details of BMF members' branches in your area www.findabuilder.co.uk/fab or write to: BMF, Freepost 38, London W1E 6QZ

Federation of Master Builders
Gordon Fisher House
14-15 Great James Street
London WC1N 3DP
Tel: 020 7242 7583
Fax: 020 7404 0296
E-mail: central@fmb.org.uk
Website: www.fmb.org.uk

Heritage Building Contractors Group
Quonians, Cathedral Works
Lichfield
Staffordshire WS13 7LB
Tel: 01543 414234
Fax: 01543 410065
E-mail: dilindford@lindfordgroup.co.uk

National amenity society providing technical advice

Society for the Protection of Ancient Buildings (SPAB)
37 Spital Square
London E1 6DY
Tel: 020 7377 1644
Fax: 020 7247 5296
E-mail: info@spab.org.uk
Website: www.spab.org.uk
The SPAB can also recommend suitably experienced surveyors, architects and craftspeople to work on historic buildings.

Sources of information and advice in the USA and Canada

There is a great deal of experience of dealing with flood disasters in North America, where federal, state and city agencies have learnt to cope with annual cycles of hurricanes, mudslides, river surges and rain deluges.

USA

Useful advice is offered at the following websites:

<http://aic.stanford.edu/disaster/>
www.palimpsest.stanford.edu/bytopic/disasters
<http://preserve.harvard.edu/emergencies/index.html>

American Institute for Conservation (AIC)
1717 K St., NW
Suite 200
Washington, DC 20006
USA
Tel: (202) 452-9545
Fax: (202) 452-9328
E-mail: info@aic-faic.org
(Useful publications, including *Guidelines for Selecting a Conservator*, *Caring for Your Treasures: Books to Help You*, and *Basic Guidelines for Care of Special Collections*. Also free guide to services offered by its members, and contact list.)

Federal Emergency Management Agency (FEMA)
FEMA 500
C Street, SW
Washington, DC 20472
USA
Website: <http://fema.gov>
(Booklet, *Safeguarding Your Historic Site*)

Heritage Preservation (HP)
1625 K Street, NW
Suite 700
Washington, DC 20006
USA
Tel: (202) 634-1422
Fax: (202) 634-1435
E-mail: info@heritagepreservation.org
Website: www.heritagepreservation.org
(Booklet, *Emergency Preparedness and Response: Federal Aid for Cultural Institutions During an Emergency*)

Canada

Canadian Conservation Institute
1030 Innes Road
Ottawa
Ontario K1A 0M5
Canada
Tel: (613) 998-3721 (ask for Client Services)
Fax: (613) 998-4721
E-mail: cci-icc_services@pch.gc.ca
Website: www.cci-icc.gc.ca

Emergency Preparedness Canada
Communication Division
122 Bank Street, 2nd Floor
Ottawa
Ontario K1A 0W6
Canada
Tel: (613) 944-4875
Fax: (613) 998-9589
E-mail: communications@ocipep-bpiepc.gc.ca
Website: www.ocipep-bpiepc.gc.ca

Safe Guard

For regional offices across Canada see: www.safeguard.ca

Front cover The historic town centre of Tewkesbury was flooded in 2000 when the River Avon burst its banks. (Damian Grady, November 2000, *National Monuments Record*, © English Heritage. NMR)

Back cover Aerial view of Shrewsbury under floodwater (Courtesy Shropshire Star)

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Regional Offices**

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23 Savile Row
London W1S 2ET
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EAST OF ENGLAND

Brooklands House
24 Brooklands Avenue
Cambridge CB2 2BU
Tel: 01223 582700

EAST MIDLANDS

44 Dergate
Northampton NN1 1UH
Tel: 01604 735400

NORTH EAST

Bessie Surtees House
41–44 Sandhill
Newcastle upon Tyne NE1 3JF
Tel: 0191 269 1200

NORTH WEST

Suites 3.3 & 3.4 Canada House
3 Chepstow Street
Manchester M1 5FW
Tel: 0161 242 1400

SOUTH EAST

Eastgate Court
195–205 High Street
Guildford GU1 3EH
Tel: 01483 252000

SOUTH WEST

29 Queen Square
Bristol BS1 4ND
Tel: 0117 975 0700

WEST MIDLANDS

112 Colmore Row
Birmingham B3 3AG
Tel: 0121 625 6820

YORKSHIRE

37 Tanner Row
York YO1 6WP
Tel: 01904 601901

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