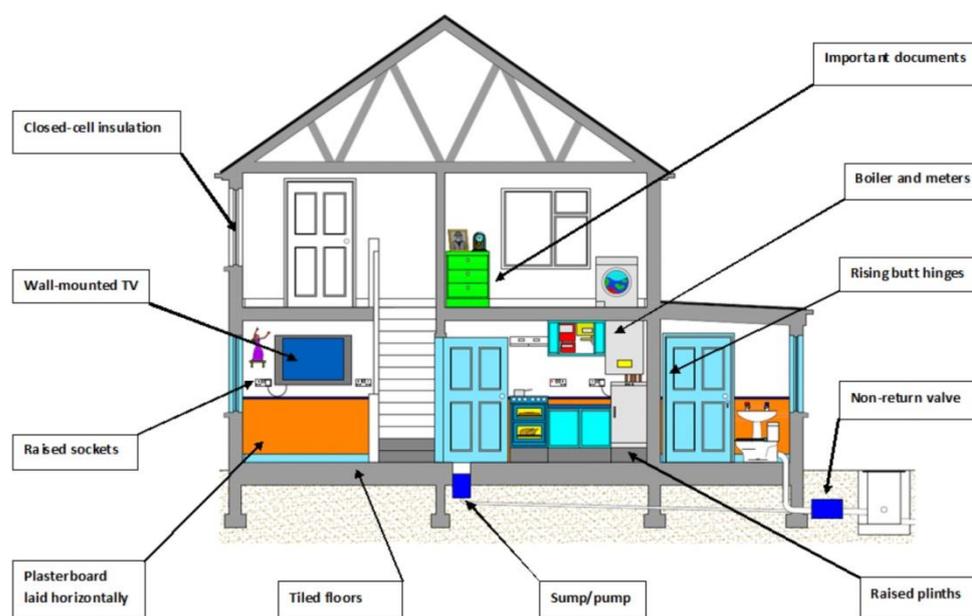


# Practitioners' handbook for low cost repairable or resilient reinstatement.

Date in format: February 2017

The Flood-Repairable House



Adapted from original image courtesy of the Eastern Solent Coastal Partnership ([www.escp.org.uk](http://www.escp.org.uk))

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# Introduction

## What is this guide?

This handbook provides a summary of measures that may be used to limit damage once floodwater enters a property. The measures have been identified within the Defra technical evidence review as part of the Defra research project FD2682. This review drew on existing guidance, professional and practitioner experience and the evidence from a small number of households that have had measures installed in the past. There are many more approaches that can be used than are included in this handbook (see information sources below). The measures included here have been assessed to have the potential to be installed at no, or no significant, extra cost over like for like reinstatement in different types of property typically found in the UK.

## What is the purpose of the guide?

The handbook is designed to be a convenient summary of potentially appropriate alternative approaches to reinstatement that will reduce the cost and disruption of future flood damage. It includes a checklist for surveyors to use in informing their discussion with flood affected households and small businesses during the reinstatement process. This handbook is not designed to be a comprehensive technical manual, as most of the approaches and materials described within this handbook are within the technical competencies of building surveyors. It is intended to highlight those approaches meriting consideration when dealing with flooded properties that are likely to flood again in the future.

The suitability and cost of the different approaches listed here will vary significantly for each individual property, flood risk situation and householder or business owner. This handbook provides a range of approaches that are considered to be low cost options. It is envisaged that surveyors will use their professional judgement and to determine the best and most cost effective reinstatement plan for each property.

## Overview of low cost flood repairable approach

Flood resilient reinstatement or resilient repair means reconstructing or reinstating a flood damaged building in such a way that, although floodwater may enter the building, its impact is reduced, i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated quicker when the flood water has receded.

The approach is suitable for any building at risk of flooding even if the intention is to keep water out because measures may be overtopped or fail. However resilient reinstatement is commonly used as part of a wet proofing or water entry strategy for buildings that can include:

- flood-resilient material and designs;
- sacrificial approaches;
- consideration of hydrostatic pressures/impact loads on structures;
- consideration of how the water will be allowed to enter a property, means of escape for the building occupants and security of building contents during and after a flood;
- drying plan - designs to drain water away after flooding and access to all spaces to allow drying and decontamination;

Flood resilience within a building can be achieved in different ways:

- Vulnerable elements (such as electrics) can be raised above the expected flood level or removed (avoidance);
- Exposed elements can be made of, or coated in, flood resistant materials (for example use of ceramic tiles, water resistant paint or varnish, plastic skirting); or
- Exposed elements can be made of resilient materials that can accept water without deformation or disintegration and dry quickly afterwards with potential for decontamination (for example cementitious materials)
- Deliberate choice of low cost, easily replaced, sacrificial elements.

In all cases the need to evacuate the water quickly is important. For resilient materials the adequate strategy for creating the conditions to dry the materials is key to a quick return to the property

A range of measures can be used to make a property resilient to damage from floodwater and those used will depend on the nature of the property and the flood risk it faces. The diagram on the front cover illustrates some of the approaches and a list of potential low cost approaches is set out in Appendix 2.



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This handbook was prepared as part of the Defra Project FD2682 by Jessica Lamond, UWE Bristol; Rotimi Joseph, Cunningham Lindsey; with input from Robbie Craig, Defra, Stephen Garvin, BRE; Ian Gibbs, Cunningham Lindsey; Carly Rose, UWE Bristol.

## List of suggested low cost measures for water entry strategy

### MEASURE TYPE

### Depth

### SPECIFIC interventions

**Depth Key:** Low= up to 100mm; Medium= up to 300mm; High= up to 900mm; Any= up to one storey

**Low cost:** is defined as having the potential to represent low additional cost at reinstatement and this judgment may vary depending on the specification of the original elements being replaced

Water compatible walls	High	Fix plasterboards horizontally on timber framed walls rather than vertically (aka Sacrificial plaster board/dry-lining)
	Any	Removable timber cladding material
	Any	Cement Render/cement sand render/water-resistant cement-based plaster coated on to internal walls then skimmed
	High	Ceramic/porcelain tiles (with water-resistant grout and adhesives, as used in swimming pools). This can only be low cost if it is specified to replace an existing expensive floor carpet.
	Any	Closed-cell type insulation (to replace mineral insulation in cavity walls) (aka Sprayed polyurethane foam or SPF)
	Any	Cavity wall – use insulation materials that are water resistant/low absorption (expanded polystyrene sheets, EPS water-resistant beads, or semi-rigid self-draining mineral wool slabs/batts that will not collapse on wetting) with stainless steel fixings
	Any	Replace corroded timber frames with treated timber
	Any	Replace corroded steel frames with galvanised steel equivalents
	High	Seal between wall, floor and partitions (continue concrete seal 0.5m up walls)

	Any	Avoid (non-breathable) vinyl wall-coverings, use microporous paint temp finish, then paper (breathable wallpapers must be affixed with breathable adhesives)
Water compatible floors	Any	Avoid fitted carpets, parquet and laminate flooring: use ceramic tiles, loose fitting rugs; removable carpets (e.g. fixed with Velcro or hooks-&-eyes set into floors)
	Any	Quarry tiles, coated to prevent staining
	Any	Cement-rich screed
	Any	3mm epoxy resin waterproof floor treatment added to concrete flood screed
	Any	Suspended floors - preservative-treated joists/ floorboards
	Any	Ensure effective connection between the damp-proof membrane for the floor and the damp proof course in the wall
	Any	If oak blocks on concrete need replacing, use tiles. If oak blocks set in bitumen need replacing, then use screed and new finish on top.
	Any	For suspended floors, if oak floorboards need replacement, then use (cheaper) treated timber.
	Any	Remove ash-bedding from underneath quarry tiles in Victorian houses (retains moisture and impedes drying out)
	Any	Clear and repair air bricks/vents to suspended timber ground floors (aids drying out process via airflow imps)
	Any	Closed cell insulation in boards for floors
<b>Water compatible kitchen fittings</b>	Low	Fit kitchen units with extendable plastic or stainless steel feet or support on raised brick/stonework (for floods)
	Any	Specify the least expensive kitchen possible and to expect to replace it (aka Sacrificial approach)
	Any	Free standing removable units (e.g. pitch pine), then carry upstairs when flood warning rec'd.

	High	Limit number of base units and have removable doors so only bottom carcasses need replacing
	Medium	Avoid built in appliances and have strong work surfaces that can support appliances during a flood
	Low	Removable kick boards – wrapped around units avoiding end sections that extend to the floor
	Medium	Better to have a table and/or high-level 'breakfast bar' than a (fixed) island.
	Any	Avoid kick heaters and use radiators instead.
Water compatible bathroom fittings (ground floor/ basements)	Any	Waterproof tile adhesive and water-resistant grout for tiled walls
	Any	Some acrylic baths have integral encapsulated (i.e. waterproofed) base-boards (cost same as normal acrylic baths).
	Any	Use of an anti-siphon toilet
	High	No vanity unit around wash-hand basin use wall mounted cupboards/shelves
	Medium	Sump and pump system ( with alarm in case pump fails)
Building Services	Medium	Raised electrics = dual purpose, as more accessible for older/less mobile people when raised.
	High	Electric cables drop from first-floor level down to sockets at high level on walls;
	Any	Central heating pumps and controls raised above max expected flood level; and any pipe insulation below exp'd flood level replaced by closed-cell type
	Any	CH control unit moved upstairs, so radiators serving upper floor(s) can still be used (ground floor underfloor heating only).
	Any	Wall-hung fires >1m above flood level (depends on expected flood depth)

	Any	Raised meters 1m above expected flood level, and use plastic housing.
	Any	Boiler mounted above max expected flood level
	Any	Seal radiators with polyethylene sheeting
	Any	Where possible, incoming telephone lines/cable services/ and internal control boxes should be raised above the expected flood levels.
	High	Through-wall service connections raised >900mm above the ground floor level
	Any	A house can be wired so that the ground floor ring main can be switched off, leaving supply to the upper floors still available; likewise, smaller vulnerable circuits can be isolated.
	Any	Place services including electrics in easy to access conduits to allow draining and drying
	Any	Anti backflow devices on foul drainage
	Any	Anti-backflow valves (NRVs) to sewer pipework AND dishwasher/washing machine pipes.
	Any	Toilet 'bungs' (e.g. Panseal); sink and shower 'bungs' (to prevent sewage ingress)
	Any	Water supply pipework insulation can be replaced with flood resistant closed cell material below the expected flooding level.
Doors/windows/staircases	Medium	Separate piece of carpeting for bottom-most stairs, removable when flood warning received - then nail back down (but looks like normal fitted stair carpet).
	Any	Replace internal doors with solid hardwood doors (caution - avoid cheap 'oak-style' doors)
	Any	Consider installing cheapest possible doors to be sacrificial.
	Any	Removable /light weight internal doors/Replace door hinges with rising butt hinges. These allow doors to be lifted off.
	Any	Retain traditional solid wood doors, on rising

		butt hinges, and use on trestles to support furniture etc
	Any	For wooden windows and external doors - use oil-based or waterproof stains, paint or varnish timber
	Any	Replace doors, windows, skirting boards, architraves, doorframes and window frames with fibreglass (GRP), PVC-U or similar
	Any	Replace skirting boards with ceramic tiles
	Any	Treat wood skirting, painted on ALL sides
	Any	Oak skirting held with screws, removable.
	Any	Use of toughened glass in doors/windows /cabinets (reduce damage from floating debris)
	Any	Use non-corrosive door/window hardware fittings (eg stainless)
	Low	Wall cupboards/built-in-wardrobes - rebuild off floor with plastic legs, concealed by removable plinth
	Any	Use PVC wall cupboards instead of timber
	Any	Bookcases formed of fixed brackets but with easily removed shelving.
	Any	Oak exterior doors oiled repeatedly with linseed oil
Contents Protection	Low	Plinths (or equivalent methods) for white goods
Miscellaneous	Any	Ext walls - Re-point brickwork with a mix of 1:2:9 – cement: lime: sand mortar (far more likely to survive flood conditions without need for repair)

## SURVEYOR'S CHECKLIST FOR FLOOD RESILIENT RECOVERY

Property Address:.....

Date:.....

	Current choice	Resilient choice
<b>Change Room usage</b>		
<b>Wall plaster type</b>		
External walls		
Internal walls		
<b>Floor finishes</b>		
Kitchen		
Bath/cloakroom		
Entrance hall		
Reception room		
Reception room 2		
Other		
Other		
<b>Wall Finishes</b>		
Kitchen		
Bath/cloakroom		
Entrance hall		
Reception room		
Reception room 2		
Other		
Other		
<b>Internal doors</b>		
<b>Skirting board</b>		
<b>External doors</b>		

<b>Staircase</b>		
<b>Windows</b>		
<b>Electric sockets positions</b>		
<b>Phone socket position</b>		
<b>Boiler position</b>		
<b>Meters position</b>		
<b>Change kitchen type or use resilient design features</b>		
<b>Use resilient features bath/cloakroom</b>		
<b>Insulation</b>		
<b>TV and other tech positions</b>		
<b>Fitted cupboard/bookshelves</b>		
<b>Lightweight furniture</b>		
Kitchen		
Reception room		
Reception room 2		

## Further sources of information

Relevant standards include:

BS 85500, Guide to Improving the Flood Performance of Buildings

(note that a core standard document is available to download free of charge.

<http://shop.bsigroup.com/ProductDetail/?pid=000000000030299686>.)

Flood products should meet PAS1188 Flood Protection Products. Specification. Building Aperture Products or similar standards.

<http://shop.bsigroup.com/ProductDetail/?pid=000000000030287158>

The handbook and documents above drew on several key existing guidance documents for suggested approaches:

- GARVIN, S., REID, J. & SCOTT, M. 2005. Standards for the repair of buildings following flooding. London: Construction Industry Research and Information Association CIRIA
- ASSOCIATION OF BRITISH INSURERS 2003. Assessment of the cost and effect on future claims of installing flood damage resistant measures. London: Association of British Insurers.ABI
- DHONAU, M. & ROSE, C. B. 2014. Homeowners' guide to flood resilience (3rd edition 2014) [Online]. Know Your Flood Risk Campaign. Available: [http://www.knowyourfloodrisk.co.uk/sites/default/files/FloodGuide\\_ForHomeowners.pdf](http://www.knowyourfloodrisk.co.uk/sites/default/files/FloodGuide_ForHomeowners.pdf) [2014].
- BRE Good Building Guide (GARVIN S and HUNTER K), Applying flood resilience technologies (GG 84), 1984 ([www.brebookshop.com](http://www.brebookshop.com))
- BRE Digest 523 (GARVIN S): Flood-resilient building ([www.brebookshop.com](http://www.brebookshop.com))
  - Part 1 – Legislation, planning, flood-risk assessment and performance of buildings DG 523-1 (2012)
  - Part 2 – Building in flood-risk areas and designing flood-resilient buildings DG 523-2 (2012)
- BRE Good Repair Guide 11, Repairing flood damage, 1997.



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