



Shelter Cluster Malawi



CAMP COORDINATION
AND CAMP MANAGEMENT



BUILD BACK BETTER

Guidance on Building Flood Resistant Communities



2015 MALAWI FLOODS AND STORMS

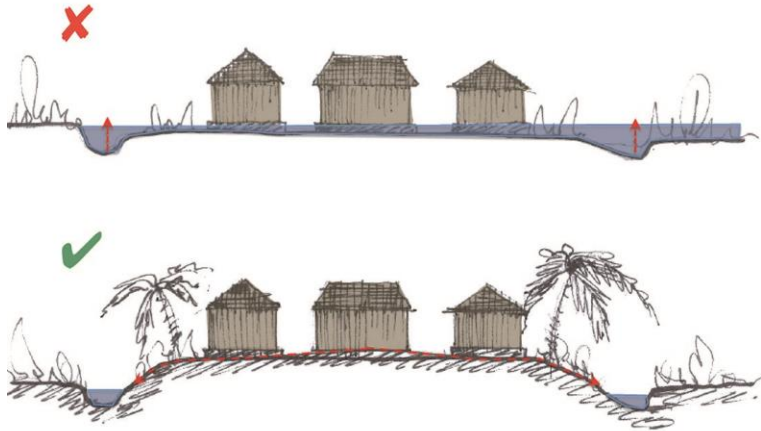
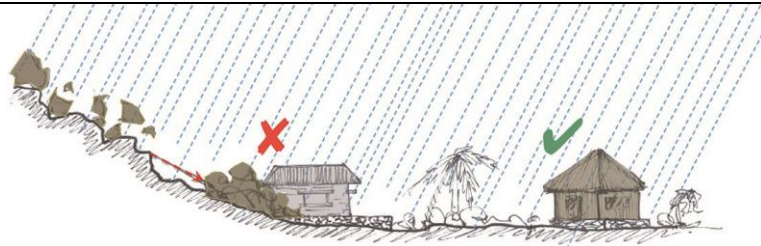
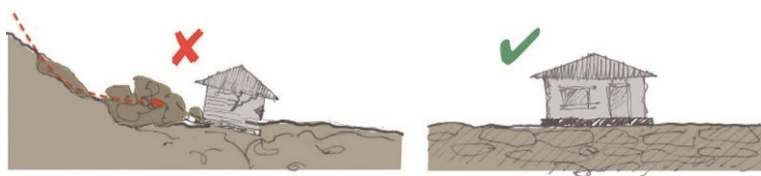


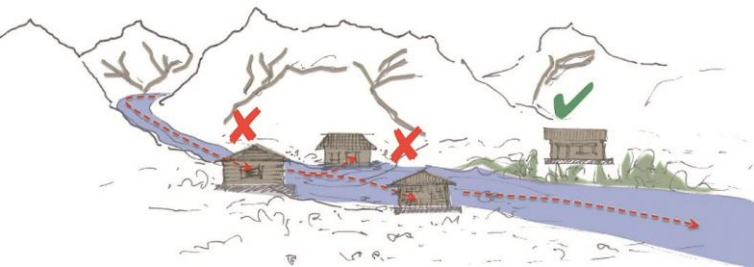
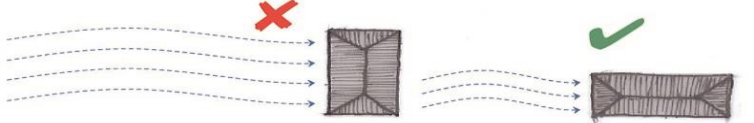
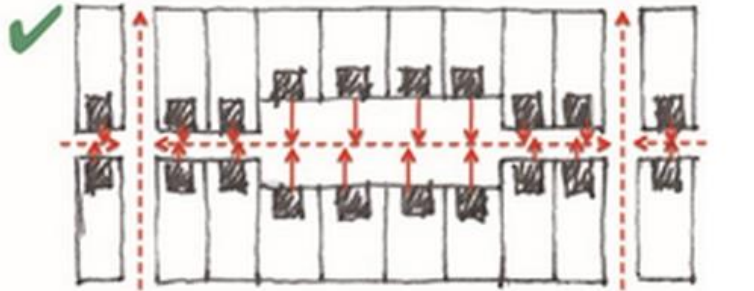
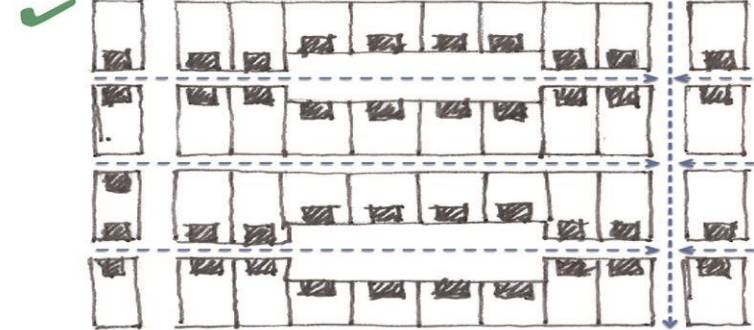
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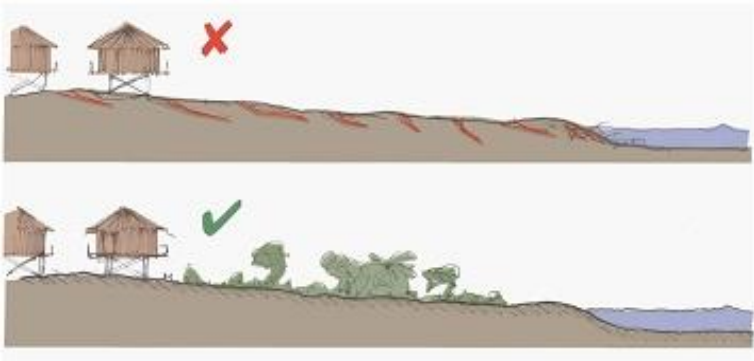
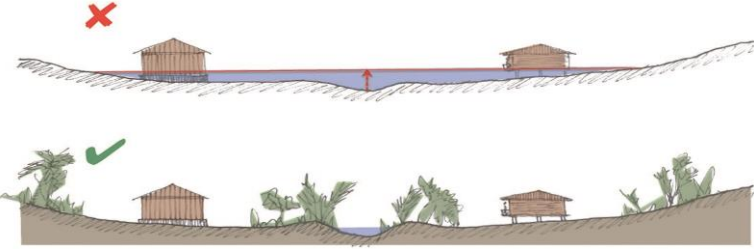
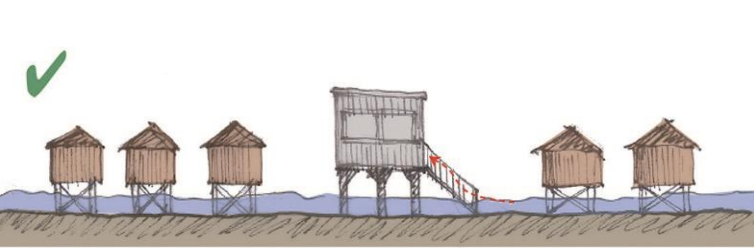


CAMP COORDINATION
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Siting and settlement: The most important way to protect shelter from floods is to build in a place that is unlikely to be flooded.

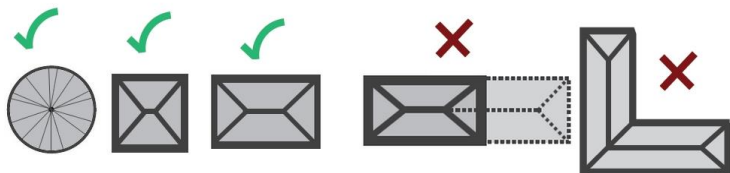
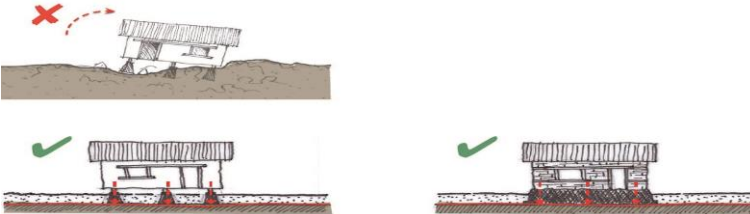

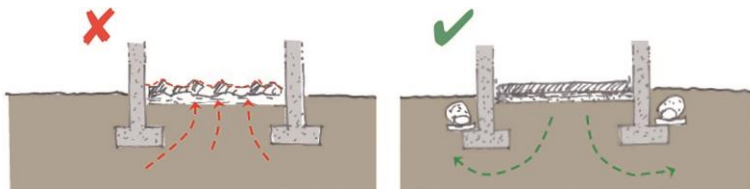
Key Messages	Reason	
<p>Shelters and settlements should be sited above the highest recorded flood level, or should be protected by embankments that are sufficiently high and strong enough.</p> <p>Consult the advice of the District Council and Civil Protection Committee when planning new settlements to ensure that houses are built in a safe area</p>	<p>Building in low lying areas or depressions greatly increases exposure to flood waters.</p>	
<p>Shelters and settlements should be sited away from steep slopes.</p>	<p>During heavy rains, or in the event of an earthquake, the house will be more exposed to flash floods and /or landslides.</p>	
<p>Shelters and settlements should be built on stable ground.</p>	<p>Building on landfill, loose or uncompacted soil increased the risk on risk of collapse and expose to landslides during flooding and earthquakes.</p>	

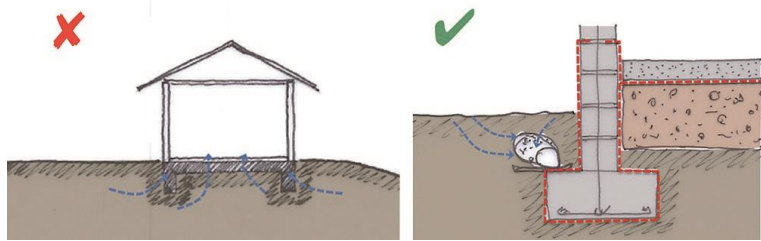
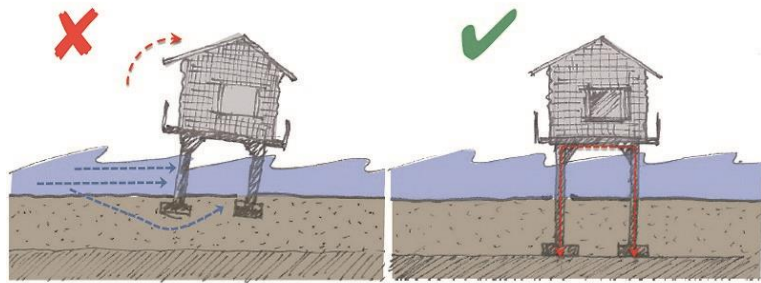
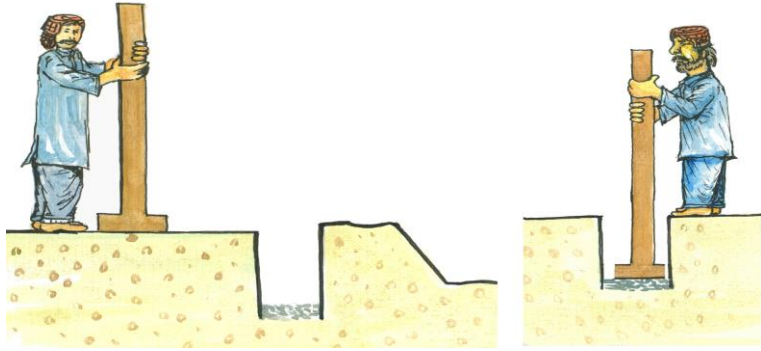
<p>Shelters and settlements should be sited a safe distance from the gullies, streams, rivers and other known and potential watercourses.</p>	<p>During flash flooding, the house will be at increased risk of inundation if located too close to these known water courses.</p>	
<p>Consider orienting the house with the shortest side facing the direction of prevailing winds or likely flooding</p>	<p>This shortest side of the building is the strongest and most able to resist the forces of flash floods and strong winds.</p>	
<p>Plan new settlements allowing access between the buildings for easy access in the event of evacuation or rescue.</p>	<p>Spacing between buildings with highly combustible elements should ideally be twice the height of the tallest building.</p>	
<p>There should be an adequate and well-maintained drainage system in the settlement. Residents should be encouraged to maintain the drainage system on a regular basis, ensuring there are no blockages.</p>	<p>The main function of a drain is to carry storm and flood water away from the buildings. Blocked drains contribute to floods and damage housing, roads and other infrastructure.</p>	

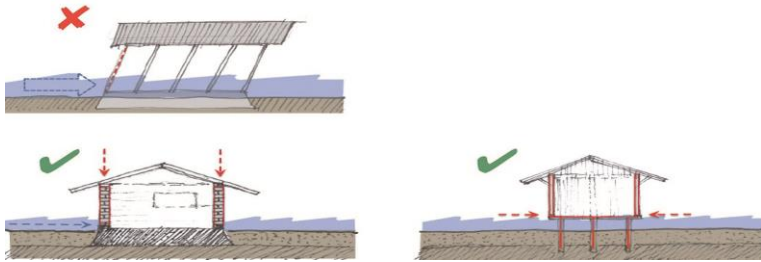
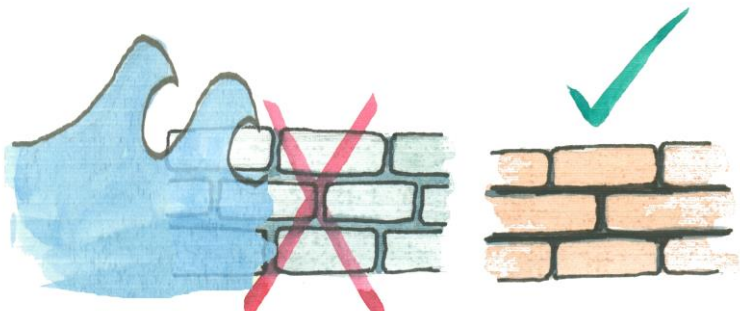
<p>Protect shelters and settlements from erosion using ground-cover plants.</p> <p>Consider planting trees close to the river banks and on steep slopes in order to stabilise the soil.</p>	<p>Unstable soil can be easily washed away by flood waters. Ask the District Engineer for advice on which plants to use.</p>	
<p>Plan lines of trees and bushes to create barriers to river and tidal surges.</p>	<p>Plants or trees can help to soak up rising water and create a barrier to flash floods.</p>	
<p>Collective buildings such as evacuation centres which are used by the public during flooding should be easily accessible for all, sited above known flood levels, and be resistant to floods.</p>	<p>People stay in these buildings during the floods, so they must be safe places which are able to resist the forces of flood waters, strong wind, driving rains and hail.</p>	

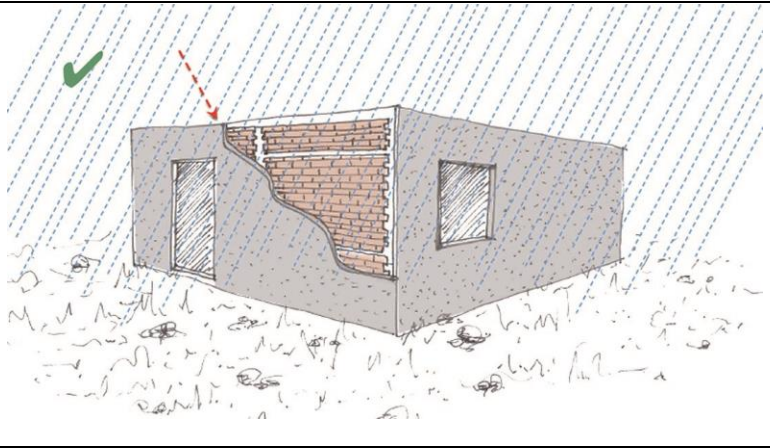
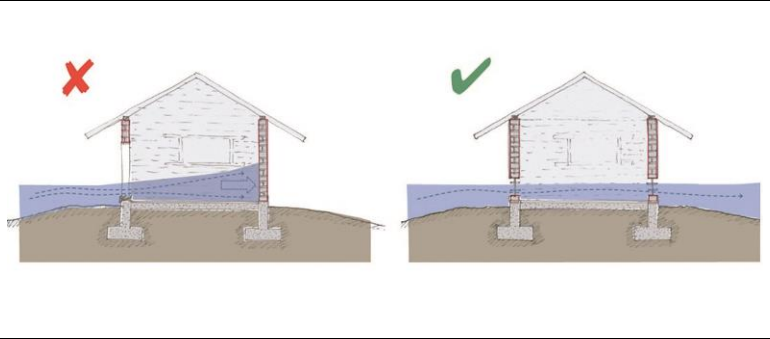
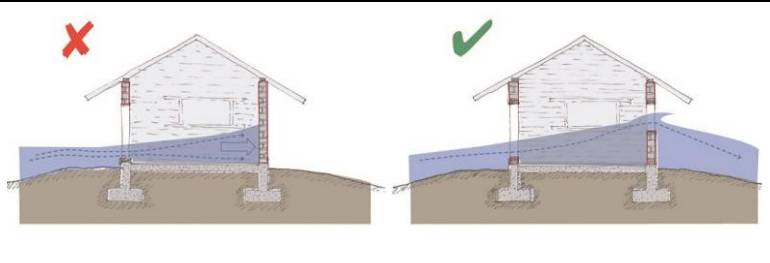
House construction: The next most important point is to build a strong building that can withstand the forces created by the moving water, and which will not collapse when wet. Below are some measures to reduce the vulnerability of shelter to floods.

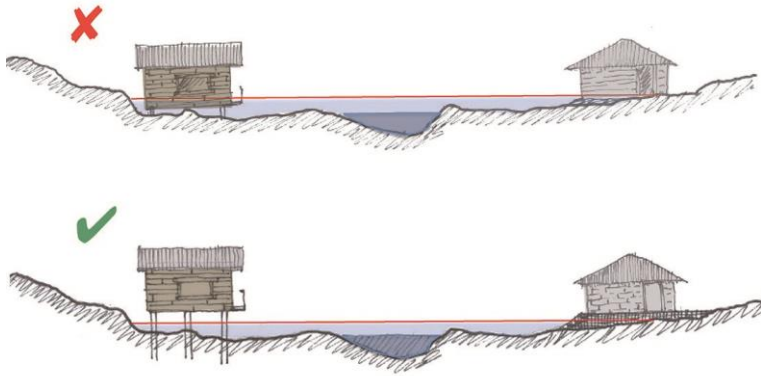

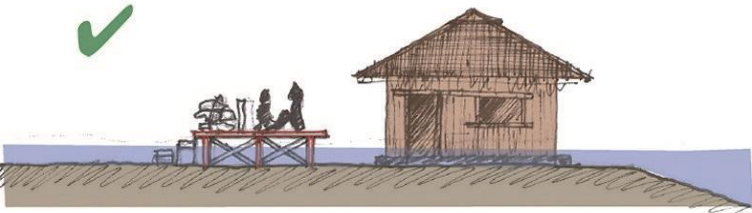
House shape, foundations and drainage

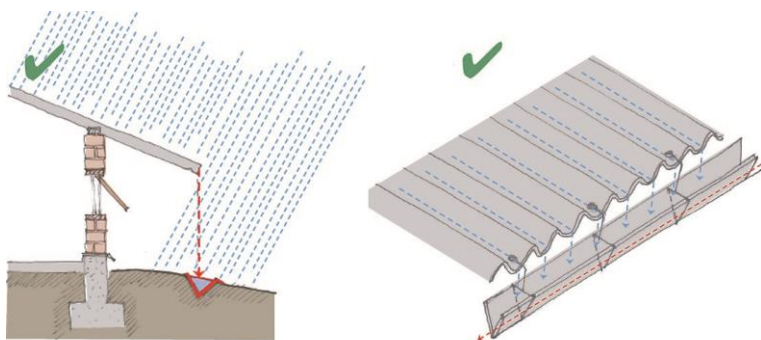
Key Messages	Reason	
<p>Consider constructing a round building instead of a long rectangular building.</p> <p>Avoid constructing long or L-shaped and C-shaped buildings that “trap” the wind.</p>	<p>Round buildings are more aerodynamic and are stronger against strong winds and flooding.</p> <p>The aim is to minimise wind-resistance.</p>	
<p>Build the shelter on foundations or pilings that rest on stable ground.</p>	<p>Unstable ground or loose soil can be easily washed away by flood waters, causing the house to collapse and be washed away with the flood.</p>	
<p>Provide good drainage to the shelter and settlement.</p>	<p>Good drainage minimises erosion of foundations. Badly maintained drainage systems cause saturation of the ground leading to instability of the house.</p>	
<p>Provide drainage close to the foundations, and slope the soil next to the house away from the building.</p>	<p>Drainage reduces the water pressure on the foundations and the floor of the building, reducing damage and deterioration over time.</p>	

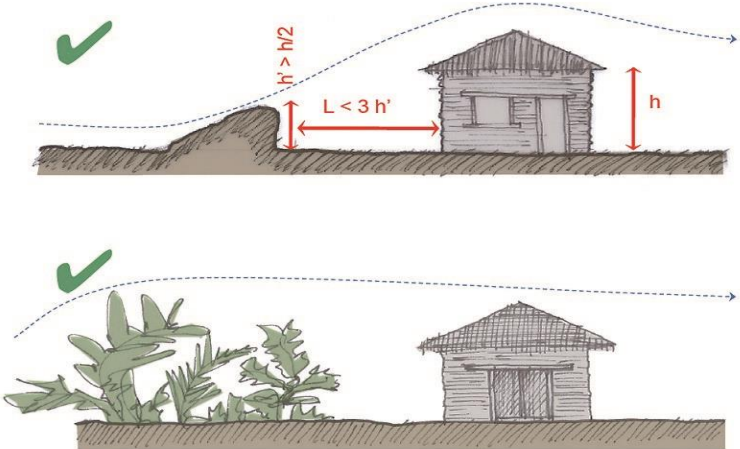
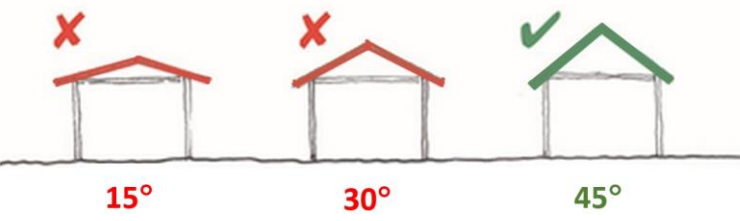
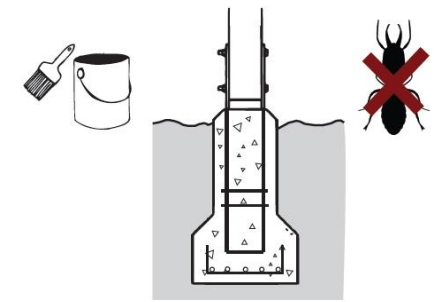
<p>Build the shelter on water-resistant foundations and footings or piling, using plastic sheeting or other waterproof materials as a barrier (damp proof course, or DPC) between the earth and the building.</p> <p>Lay a DPC above the foundation and lay a damp proof membrane (DPM) like plastic sheeting below the floor. Ensure that the DPC and DPM meet to form a continuous barrier against damp.</p>	<p>Water resistant materials installed between the earth and the building protect the structure against water which can weaken the base of the walls and floors (rising damp).</p>	
<p>Build sufficiently deep foundations which bear on solid ground.</p> <p>If available and affordable, build using reinforced concrete or burnt bricks with mortar foundations. Avoid using sun-dried (adobe) bricks and mud mortar.</p>	<p>Flood waters easily wash under shallow foundations and melt sun-dried bricks and mud mortar, leading to collapse of the house.</p>	
<p>Ensure that the ground below the house and the foundations is well-compacted before constructing the foundations, so that the house will rest on solid ground.</p> <p>This is particularly important where the householder has placed additional earth on the site in order to raise the level of the ground.</p>	<p>Flood waters can easily wash away loose and uncompacted soil, undermining the house's foundations, causing structural failure.</p>	

Walls and openings		
Key Messages	Reason	
<p>Build with heavy walls, or ensure that light walls are well anchored to foundations or piling, and braced to ensure lateral stability.</p> <p>Make sure doors and windows are secure against wind.</p>	<p>It is important that walls are strong enough to resist pressure from flood waters.</p> <p>Unsecured doors and windows allow for wind to easily blow roof off.</p>	
<p>Consider using burnt bricks bound with cement mortar (using a mix of 4:1 sand:cement) for the foundation and base of the wall up to at least the maximum flood level.</p> <p>Avoid using sun-dried bricks and mud mortar at levels exposed to flood water.</p>	<p>Flood waters easily melt walls made of sun-dried bricks and mud mortar, leading to collapse of the house.</p>	

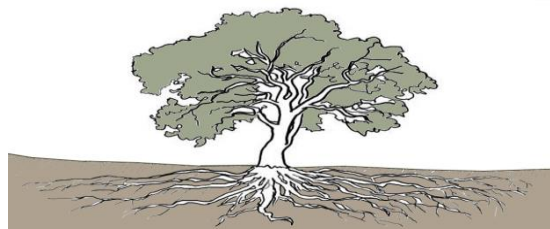
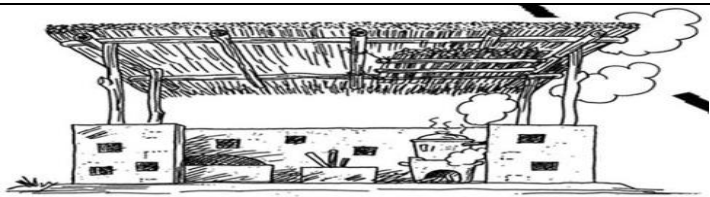
<p>Use water-resistant wall materials, or add a protective coating to the external walls of the house using damo sand or lime-based render.</p> <p>For walls made from fired brick use a <u>cement based plaster</u>.</p> <p>For walls made from adobe blocks or rammed earth, use <u>dambo sand or a lime based plaster</u>.</p>	<p>This will help to increase the resistance against flood waters, heavy rains and waterlogging.</p> <p>In this case, consider the risk of long-term damage to earth walls if they cannot 'breathe'. Applying a waterproof plaster mix with sharp or coarse sand to a wall will create a barrier against severe weather.</p>	
<p>In some cases, if the floor of the house is not located above the line of the highest known flood level, consider adding openings near the bottom of walls.</p> <p>Remember that it always better to locate the house above the line of the highest known flood level.</p>	<p>This may allow flood waters to move through the house without causing it to collapse.</p>	
<p>Place doors and windows in opposite walls</p>	<p>This will allow water from flash floods to flow out of the house, easing pressure of the flood waters on the walls.</p>	

Floors		
Key Messages	Reason	
Raise ground floors above the highest recorded flood levels.	To prevent flood water from entering the house.	
Build the shelter on stilts where appropriate.	To prevent flood water from entering the house.	
Consider building a raised platform in or beside the shelter. The roof space can also be utilised for this purpose – make sure you can get out through the roof if you do so!	A raised platform allows storage of possessions and vital supplies above the flood level and provides a safe refuge for people during floods.	

Roof		
Key Messages	Reason	
<p>Consider extending the roof timbers past the edge of the walls, forming eaves which channel the water into drainage trenches below. Tin roofs should have a double row of roofing nails (with large washer and rubber seal) at lower edge. All roof timbers, poles and bamboo should be tied together with flexible straps. Secure straps to timber structure with 5 twisted-shank nails at the end of each strap in each timber.</p> <p>Tin roof should be protected by khonde (like porches) that are separately supported so they can be ripped off by wind without taking the whole roof with it.</p> <p>If possible, consider installing rainwater gutters and downpipes which carry rainwater away from the building. Gutters formed on the ground should use rubble and cement render to allow surface drain.</p>	<p>Securing the roof timbers with straps can help prevent losing the roof to wind.</p> <p>Extended eaves can help to keep the rain off the walls of the house, protecting the top and base of walls from heavy rains.</p> <p>Rainwater gutters and downpipes further protect the walls and foundations, carrying water away from the building.</p>	

<p>Consider planting trees at a safe distance around the house.</p>	<p>Trees can protect the walls from wind-blown rain which was found to lead to the damage and destruction of many walls in the 2015 floods.</p>	
<p>For thatched roofs, consider increasing the angle of construction to approximately 45 degrees.</p>	<p>This slope will encourage more water to run off the roof and less to be absorbed by the thatch.</p>	
<p>Avoid inserting timber poles directly in the ground. Treat all exposed timber surfaces with the locally available product Solignum or equivalent.</p>	<p>Treating the timber against termite and fungal attack can protect the structure against deterioration and potential collapse.</p>	

Environmental management

Key Messages	Reason	
Use only sustainably harvested milled timber. Don't cut down trees without permission of the District Council and the Department of Forestry, Ministry of Natural Resources, Energy and Mining.	Tree roots bind the soil, making the ground stronger and more resistant to flooding. Cutting down trees and vegetation can lead to landslides and erosion, particularly on steep slopes, increasing the risk of flooding.	
Use an outdoor kitchen or ventilate your home. Slope the roof to allow smoke to escape.	Burning wood produces smoke that is bad for you. Use a cookstove and ventilate your kitchen to burn less wood and make less smoke.	
Helpful Trees (For wind-flood reduction)	Main Benefits	Where to Plant
<p>Monkey Thorn (Ngundanjira)</p> <p>Gliricidia (Gilisidiya)</p> <p>Sickle-Leaved Albizzia</p> <p>Neem (Nimu, India)</p> <p>Silky Oak</p> <p>Red Mahogany (Mbawa)</p> <p>African Locust Bean (Mkundi)</p> <p>African teak</p> <p>Kesha Wa Maluwa</p> <p>River Bean</p> <p>Indian Almond (Bonifant)</p>	<p>Wind break or fencing</p> <p>Wind break or fencing/Erosion control</p> <p>Wind break or fencing</p> <p>Erosion control</p> <p>Wind break or fencing</p> <p>Wind break or fencing</p> <p>Erosion control</p> <p>Wind break or fencing</p> <p>Erosion control</p> <p>Erosion control</p> <p>Erosion control</p>	<p>Riverbanks</p> <p>Riverbanks, cultivation area</p> <p>Riverbanks, Afforestation of catchment</p> <p>Near homes, garden boundaries, roadside</p> <p>Roadside</p> <p>Meeting places</p> <p>Meeting places, roadside</p> <p>Within villages, afforestation of catchment</p> <p>Riverbanks, cultivation areas, garden boundaries</p> <p>Riverbanks</p> <p>Near homes, roadside</p>

Helpful Trees to Plant (For timber, construction, or food)	Main Benefits	Where to Plant
Moringa	Food/fruit, medicinal	Near homes, riverbanks
Jujube, Catch Thorn (Masao, Masawo)	Timber, fodder, medicinal, food/fruit	Near homes
Water Berry (Mpani)	Timber, fodder, medicinal, food/fruit	Riverbanks
Water Boom (Nyowe)	Timber, fodder, medicinal, food/fruit	Riverbanks
African Teak (Mlombwa)	Timber, medicinal, wind break/fencing	Afforestation of catchment, near homes
Common Bamboo (Nsungwi, Mlazi)	Timber, food/fruit, wind break/fencing	Riverbanks
Blue Gum (Bulugamu)	Timber, fuel	Near homes
Camel Thorn (Msangu Sangu)	Timber, fodder, medicinal, food/fruit	Cultivation area
Monkey Thorn (Ngundanjira)	Timber, food/fruit, wind break/fencing	Riverbanks
Woman's Tongue (Mtangatanga)	Timber, fodder, shade, riverbank stability	Afforestation of catchment, garden boundaries
African Custard Apple (Mpoza)	Fodder, medicinal, food/fruit	Near homes
Neem (Nimu, India)	Timber, fodder, medicinal, food/fruit	Garden boundaries, near homes, roadside
Snot Apple (matowo, Matowi)	Food/fruit	Riverbanks, near homes
Monkey Bread (Chitimbe)	Timber, fodder, medicinal, food/fruit	Near homes
Grapefruit (Chinyumwa)	Bee forage, medicinal, food/fruit	Near homes
Tangerine (Nachesi)	Bee forage, medicinal, food/fruit	Near homes
Sweet Orange (Lalanje, Malalanje)	Bee forage, medicinal, food/fruit	Near homes
Mango (Mango)	Food/fruit	Cultivation area, near homes

PLANTING A TREE

FOR GLOBAL COOLING

