

AUSTRALIA ICOMOS GUIDELINES FOR MANAGING CULTURAL HERITAGE IN DISASTERS

Discussion Paper

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section 1.0

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Robyn Riddett

- Boulder WA, 2010, Earthquake Damage
- Fire Smith St Collingwood.
- Victorian Bushfires, Kinglake 2009.
- Boulder Western Australia, 2010,
Earthquake Damage

Disclaimer: This document is a discussion
paper only and is not a definitive guide to
actions in disasters. It should not be used in
isolation from other more detailed guidelines
that may exist for specific situations. It is not
intended as a comprehensive guide to individual
safety in the face of disasters.

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1.0 Introduction

Following the bushfires in Canberra and environs in January 2003, a number of Australia ICOMOS members prepared a set of draft guidelines referring to preparedness and response strategies. In the light of an increase in natural disasters and also the 2009 Victorian “Black Saturday” bushfires, Australia ICOMOS implemented a project to prepare a new set of disaster preparedness and response guidelines.

The preparation of this Discussion Paper is an important milestone in this process. The project team comprised the following Australia ICOMOS members:

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2.0 Overview of Disasters

Disasters are essentially caused by the forces of nature, are man-made or result from a combination of both. They may be wide-ranging and affect whole regions or they might be contained to a single site, building, space or element.

Natural disasters often occur over a broad area and have a high concentration of force which results in severe impacts which preventative measures frequently cannot withstand.

They occur when the forces of nature, i.e. wind, water, earth and fire, are activated in a

destructive manner by way of storms, hurricanes, cyclones, tsunamis, tidal surges, blizzards, avalanches, floods, ice storms, hail, earthquakes, volcanic eruptions, earth or mud slides, bushfires, asteroids, meteors and falling objects.

The effects of drought, salinity and the cyclical effects of the climate build up over time and have ultimately lead to the destruction of many past civilizations and their cultural legacy. Abandonment of buildings, gardens and towns is often the commencement of a relentless cycle.

Man-made disasters include industrial accidents, fires, floods, spills, explosions, vehicle and similar impacts, bombs, vandalism, warfare, terrorism, civil commotion, theft, looting, pollution, pest infestation and accidental breakage and damage.

Lessons can be learnt from past-disasters and inform preparation for many risks and hazards and thus there can be an attempt to eliminate or reduce the consequences of a disaster.

This Australia ICOMOS Discussion Paper is relevant to all types of places of cultural heritage significance at all levels and which may contain individual items or collections of cultural heritage significance and/or monetary value. While initial disaster response procedures are necessarily focussed on safety and humanitarian needs, it is also critical that cultural heritage receives appropriate attention at the earliest possible moment. Cultural heritage is the underlying glue which binds communities together. It provides meaning and belonging, which is so important for disaster recovery, and a sense of the past for the future. While cultural heritage may be overlooked immediately after a disaster, its rehabilitation is critical for the longer-term recovery of affected people and civil society.

Disaster response can be anything from a few days to several months or longer. Whatever happens in the response phase must set the scene for longer term recovery which may take weeks, months or years depending upon the nature and extent of the damage. This response phase should include an initial damage assessment and

urgent stabilization and remediation procedures using equipment and supplies either in the pre-prepared on-site disaster bin or items brought in from elsewhere. During this phase it is essential to identify components, objects or items which are salvageable, to photographically record them in situ, label them and to compile an inventory in sufficient detail as is necessary to ensure immediate safe custody for future restoration, re-use and/or rehabilitation. This must be done with reasonable speed to avoid secondary damage through loss, theft, mould, rot, physical deterioration and clearing and with care and forethought. There will be pressure to resume normal operations as soon as possible and this may impact on appropriate response activities.

3.0 The Disaster Plan

Disasters can be frightening and sometimes unimaginably horrific and may cause temporary or permanent psychological or physical impairment of victims and affected response team members. To have a successful response and recovery, it is imperative that there is a clearly-documented, realistically-tested and well-rehearsed disaster plan in place before disaster strikes!

There are four main aspects to risk preparedness and disaster planning: prevention; preparation; response and recovery. Many detailed manuals on how to prepare a disaster plan exist and the reader is referred to them for guidance in preparing plans for specific types of heritage places.

In general terms the disaster plan should identify potential threats and hazards and include appropriate response actions. It should set out the lines of authority, communication and individual responsibilities in a clear manner which is well understood and carefully practiced beforehand. In the event of a disaster, and as soon as the site is declared safe by professional emergency responders (police, fire brigade etc.), activation of the plan must be fast, co-ordinated, and directed. It must operate like clockwork as there is no room for added confusion! The first 48 hours is critical. The

response team will be multi-disciplinary and must include a range of skills and expertise to establish on-site priorities and to appropriately triage different types of damage, vulnerability, exposure duration and the different needs of affected types of fabric, materials and objects. This will include procedures for removal, stockpiling, drying, freezing, cleaning, transporting, temporary and long-term storage, equipment procurement, on-site work, and back-up. It is of fundamental importance that immediate actions do not cause or exacerbate sustained damage and that they lead to the longer-term recovery and/or re-use of as much fabric as possible. Therefore establishing links with, and undertaking regular training and rehearsal with other emergency response personnel, will be of great benefit and will build-up a broader skill base.

If you have a well-prepared disaster plan do not abandon it in the face of disaster.

After each activation a debrief should occur to examine successes and failures (what worked and what didn't) and to identify and document areas for improvement. Read other plans and post-disaster accounts of what happened and how everyone responded. Good preparedness can eliminate or reduce damage caused by a disaster.

4.0 Personal Preparedness

When a disaster strikes you may not be where you normally live and work. You may be in a different town or city, a foreign country, an isolated or remote place, a forest or a coastal or a mountainous area, underground or on a body of water. You may become trapped, injured or disoriented by smoke, darkness or shock; be affected by gas, chemicals and other industrial substances or dust. There may be no electricity, gas, water, toilets or communications network; no or impassable roads, bridges and tunnels and you may not know the extent of the disaster or where to go. It makes sense to be prepared and if you are to be part of a response team – you must be prepared!

Disaster sites can be:

- Dangerous with falling and collapsing buildings and structures, trees, infrastructure etc;
- Dirty with mud and ash, sewerage etc.
- Full of hazards from displaced building and structural materials, services and other elements.
- Polluted, smelly and contain human corpses, and animal remains.
- Contaminated by bacteria, disease, germs, chemicals, crude oil, asbestos etc.

If you are in an area preparing for an imminent disaster (e.g cyclone or bushfire) or if you are assisting in the wake of one, then it is important that you think it through, assess the risk and prepare yourself for all eventualities. Others may be relying on you and you may have to help yourself. Before a disaster strikes you must have prepared a personal plan. It may be simple, or more detailed depending on the circumstances. At the very least:

- Make up a personal disaster kit with basic and necessary supplies such as food in openable packaging, water, first aid, medication, toiletries, clothes, torch, duct tape, penknife, handkerchiefs, safety glasses, small Phillips head and slotted screwdrivers and basic tools etc. Keep it with you as far as possible.
- Have suitable protective clothing ready. Do not wear synthetic materials in the event of a bushfire.
- Keep copies of valuable documents (passport, driver's licence, insurance and relevant contact details etc.), keys, mobile phone charger, adaptor plug and the like in a safe place. If overseas keep passport, tickets and phrase book with you.
- Keep important phone numbers and addresses with you and with others.
- If you are part of a disaster response team include arrangements in your disaster plan for others to look after

your family, pets and livestock while you are occupied with the disaster.

- Listen to the designated emergency radio – keep a battery-operated radio ready. Monitor the relevant websites if possible.
- Learn how to survive specific types of disasters.
- Know where and how to turn off gas, electricity, water and other services and equipment where you are normally located.
- Know where the emergency exits and assembly points are in building review the evacuation plan – you may be in there when a disaster occurs. Have a personal escape and/or evacuation plan wherever you are.
- Decide well beforehand whether to stay at home or work and defend; or go when disasters are expected. Note you may have to compulsorily evacuate and have no choice.
- Keep calm, keep together and let people know where you are; comfort anyone who is upset or anxious (including children and pets) and seek help.
- Do not risk your own safety or that of others – help yourself then others. Think practically and remain vigilant.
- Be prepared and plan ahead!

5.0 Response and Recovery – Heritage Places

If the affected heritage place is publicly-owned then hopefully there will be a disaster response plan in place and many of the response and recovery requirements will be known and understood already.

The listing and mapping of heritage places throughout Australia varies and there may be many places of heritage value which have not been formally assessed or documented. Heritage Registers throughout Australia are not exhaustive. The fact that a place is not on a heritage register does not mean that it

has no heritage value. Anything of potential heritage significance should be assessed by an appropriately qualified heritage practitioner such as a specialist consultant, architect, structural engineer, archaeologist, curator, conservator, custodian, tradesman as appropriate. When building and structural safety and adequacy is being assessed, a joint inspection should be undertaken by a building surveyor together with an appropriate heritage practitioner. Ideally such a heritage practitioner would be a member of Australia ICOMOS.

Assessments should factor in the principles of the Australia ICOMOS Burra Charter. In the case of buildings and structures, many are ultimately repairable and demolition, in whole or in part, is frequently not necessary. Initial responses should be directed to making structures watertight, and in taking down dangerous sections in a manner which facilitates later reconstruction through appropriate salvage. Archaeological sites may need stabilization by placement of temporary barriers to prevent erosion.

Any urgent works should not comprise significant fabric or insurance assessment. Insurance options and remedial work should be carefully considered so as to ensure that the heritage values of a place are conserved as far as is prudent and feasible to do.

In relation to disasters at a landscape level it is important to consider the need to carry out rapid surveys to identify previously unidentified heritage places and archaeological sites and to assess the potential impact of clean up operations on potential archaeological deposits. Permits, approvals or licences from the municipal council or state heritage authority may be required before demolition, major repairs or salvage excavation can take place. In some circumstances these may be fast-tracked. Protective fencing, scaffolding and shoring may be required for temporary safeguarding.

Different building codes may be applicable for rebuilding after a disaster. These may impinge on physical appearance or may prohibit reconstruction and re-use of a specific place in a risky area.

5.1 Insurance

It is vital that appropriate insurance is up-to-date to cover loss and repairs following a disaster. Policies should be checked for the extent of coverage and should cover all risks and copies should be kept in a safe location. Water damage to buildings can be quite extensive and policies in particular should include storm damage and flooding. Coverage for contents may vary where replacement is a consideration.

5.2 Community Engagement

Community involvement in mitigation and preparedness of disaster planning is essential.

Identifying particular community groups that have an interest and connection with heritage places is key, as is involving them in disaster preparation. It is essential that such a community or group have an input into what aspects of their heritage may be impacted by certain immediate post-disaster responses and actions in order to mitigate such effects. This includes places of 'social value', whether buildings, sites or cultural landscapes, the meaning to a community (and it may not be a local community but a user group). The nature of that value, such as the meaning or the attachment that community has needs to be known, as this may have bearing on the preparation, or post-disaster actions and activities that take place. This process needs to be undertaken as part of a broader community involvement in disaster prevention and preparation as acknowledged in the UNESCO/ICCROM Japan Recommendations (2005). This means recognizing that traditional knowledge and skills and community participation constitute invaluable sources for education for establishing a culture of prevention, and for reduction of impacts of disasters on lives, property, livelihoods, and cultural heritage.

It is important to have identified the particular intangible values as part of disaster preparedness and invite relevant communities with associations and connections to place or practice to plan ahead, so as to readily incorporate them into post-recovery actions.

Sensitivity to the losses of individuals and the community needs to be acknowledged, including those related to different groups, such as without English as their first language, and / or Indigenous communities.

It may not be possible for community members to be involved in the disaster response / emergency phase, although if possible it can be ideal, to ensure that the intangible values and potential impacts by response actions is mitigated. This lack of involvement may itself have consequences in the sense of a loss of control. It is essential that the relevant community be included as early as possible in post-disaster recovery. If no identification of relevant community groups and their associations with place has taken place prior to the disaster, even greater sensitivity is required at this phase to both identify such groups, and their association and its nature, at a time when a sense of loss is at its height.

Consult with stakeholders (including specific considerations with Indigenous communities). It is important to distinguish between community/ies associated with the place/s affected by the disaster and the broader stakeholder groups. These latter have an important support role, but the community groups have a primary role in regards their heritage, including those places with 'social value', and need to be consulted regarding appropriate actions in the emergency to retain heritage significance. Appropriate sensitivities need to be acknowledged, as noted above. This may include first or all contact to be made by those with particular skills in community counselling and mediation, as well as language skills for particular community groups. These experts can introduce the heritage elements into the broader community support and planning processes.

Principles and guidelines to apply for heritage processes are those already available for general heritage involvement of community with associations with the place, including Ask First (AHC 2002), and Articles 3, 7, 12, 14, 15, 24, 26.3, 27.2 of the Burra Charter (Australia ICOMOS 2000).

Understand significance before determining course of action (including the importance of **social value**)

As part of consultation with all community/ies that are impacted by the disaster, including local residents, user groups (as an example, for huts in national parks, walking groups, skiers etc), the social value of the areas damaged needs to be ascertained. This requires special skills, given the sensitivities of those that have experienced loss, and it is suggested that unless heritage professionals have particular skills in community counselling and mediation that this is done via relevant professionals (such as social workers) who can introduce the heritage elements into the broader community support processes.

6.0 Types of Disasters

6.1 Building Fires, Floods and Collapse

Fires in buildings are common. Typical causes are faulty wiring or electrical appliances and equipment, overloaded powerboards and circuits, cooking, smoking, open fires, heaters, welding and grinding tools, combustible materials coming into contact with hot lights and heat sources, self-igniting materials such as compressed linseed oil rags and inflammable liquids.

Simple precautionary measures to undertake:

- Ensure compliance with mandatory requirements for fire protection as specified in various building regulations such as the Building Code of Australia. In instances where there might be considerable impacts on heritage fabric. A range of solutions should be explored to meet both safety requirements and heritage principles. Consideration of mist type sprinklers instead of deluge sprinklers should be pursued so as to reduce secondary damage from water inundation. Similarly consider smoke aspirant and heat sensitive detectors as opposed to sprinklers.

- Regularly check all smoke and heat detectors, alarms, extinguishers, fire blankets and the like.
- Ensure that the appropriate extinguishers and fire blankets are located in appropriate locations and ensure that all personnel know how to use them.
- Establish a lock-up procedure which includes switching off all non-essential electrical elements.

Building floods typically occur from leaking or damaged roofs, blocked gutters, pipes, sumps and drains and external inundation. Regular checking and clearing of drains and gutters should reduce the risk.

Buildings can collapse unexpectedly as a result of damage or poor or illegal work or subterranean earth movement due to tunnelling, washouts, landslides, erosion, and sink holes. Fortunately in Australia building regulations and mandatory inspections minimize the risk of collapse from faulty building work.

6.2 Bushfires and Wildfires

South-east Australia, Canada, the United States and areas of southern France, and more recently Greece, are the most fire prone regions of the world and are annually subject to bush or forest fires (wildfires) which, notwithstanding preparedness, still cause considerable damage to humans, pets, livestock and fauna, natural and cultural landscapes, built heritage, monuments and sites.

Bushfires in Australia

Bushfires typically occur in the summer months. They have been recorded prior to European settlement in Australia and have continued since, often with extremely devastating consequences for life, property and landscape. Many fire-prone areas such as the Blue Mountains, the ACT; large tracts of Victoria; the Eyre Peninsula and Adelaide Hills and parts of Western Australia contain significant heritage buildings which are at considerable and increasing risk. More recently as cities expand the bush lifestyle is

increasingly attractive and as the risk of catastrophic consequences increases the acceptability of settlement of these areas is being questioned.

Causes and Behaviour of Bushfires

Bushfires are usually caused by:

- Natural combustion as a result of extreme heat, dry vegetation and wind
- Arson, uncontrolled camp fires, discarded cigarette butts
- Sparks from equipment and fallen and/or shorting powerlines.
- Man-made hazards.

Factors which are of universal concern in relation to bush, wild and grass fires are the quantity and type of fuel, terrain, weather and climate and the spread of urban and rural development into bushland areas.

Leaves and twigs, particularly of eucalypts and conifers, grass and native shrubs burn quickly and produce a lot of heat. Grass absorbs moisture overnight but in dry and windy air it is quickly lost and grass may be ready to combust earlier in high risk conditions.

Burning embers (leaves and twigs) are windborne, can travel a great distance and start more fires (spotting). Dry leaves and twigs of native scrub and trees can burn far hotter than a grassfire. Fibrous and dry bark can preheat other fuels above the bark thus providing a ladder for a fire to climb higher up into a tree and increasing the height of the flames. Foliage of exotic trees and shrubs can often withstand a bushfire and form a protective barrier. Branches, trees and logs burn and give off heat more slowly, continuing after the firefront has passed. These may be a secondary hazard in windy conditions.

A change in wind speed can rapidly change the size and direction of a fire. Fires burn faster uphill because the flames can reach more unburnt fuel whereas downhill flames reach less fuel and less radiant heat pre-heats the fuel in front of the fire. Generally, for every 10° slope, the fire will double its speed as it travels uphill and halve its speed as it travels downhill. Radiant heat can be

more dangerous than actual flames. Once a bushfire has started flames are spread by wind, fire balls and burning debris. Beware of burning embers which lodge in gutters and crevices and under sills.

Radiant heat - can ignite exposed surfaces without direct flame or ember contact.

High intensity bushfires, such as in Canberra 2001/02 and "Black Saturday" in Victoria 2009 cannot be controlled. Unless extinguished, they will continue until they run out of fuel or until there is a change in the weather.

Impacts of Bushfires

Bushfires may result in localized or complete damage over wide areas with considerable loss of built fabric, landscape, vegetation fauna and livestock. Opportunities for salvage, repairs, restoration and reconstruction will vary in accordance with the severity of the fire.

Bushfires may in turn lead to other dangers, such as unsafe trees. Treatment of these secondary dangers can also lead to the damage of cultural heritage items such as Indigenous scarred or carved trees. Specific guidelines already exist in agencies such as Parks Victoria which consider the risks to such heritage places. (See for example Parks Victoria 2009).

Preparedness for Bushfires

While bushfires cannot be prevented, preparation can assist in mitigating against the effects, such as by development and rehearsal of preparedness plans and strategies and removal of fuel through controlled burning.

Fire also poses one of the most serious threats to cultural heritage and in some instances, one may have to consider loss, as a consequence of fire, as an acceptable risk. While there are standards for building in bushfire-prone areas, recently revised in Victoria, these do not apply to heritage buildings. Nevertheless there are precautions which can be applied without compromising the architectural integrity of such structures. In addition, some local planning scheme and development plans

have bushfire protection strategies which will assist with vegetation clearing.

The basic preparation to risk is the same or all structures.

Bushfire preparedness strategies include:

- Have an individual fire plan prepared and rehearsed well ahead of any threat. There are many booklets and templates on emergency response websites which contain appropriate models and advice.
- In Victoria, the 'stay or go' policy has been questioned since the "Black Saturday" bushfires (2009). Decide well in advance if you are physically and psychologically capable of staying. If not go 24 hours before fire may be expected. Leave too late and you may be trapped by fire, thick smoke, fallen trees and other barriers. In other areas compulsory evacuation may apply.
- Create a defensible space around the building by removal of anything (vegetation, paper, boxes, crates, woodpiles, outdoor furniture) likely to burn. Create an inner zone of 10 metres wherein all combustible vegetation is minimal and where possible, manage the vegetation up to 100 metres to reduce fuels, ladder fuels and shrubs underneath; create breaks between clumps of vegetation.
- Store fuel and chemicals safely away from fire hazards and face vent pipes of LPG cylinders away from buildings.
- Use driveways, paths, swimming pools, mown grass to create a fire barrier.
- Install non-combustible sheeting or metal mesh to protect underfloor spaces from embers and also install reflective, non-combustible sarking in roof spaces.
- Seal or repair any holes, cracks or damage to flooring and walls where embers may lodge with mineral fibre

insulation or metal sheet or other non-combustible material which will produce a seal.

- Install non-combustible fire screens over skylights and windows
- Cover all external vents with metal mesh (not aluminium) with 1.5 mm holes over both the window and frame and keep clear.
- Protect evaporative coolers with metal mesh screens.
- Clean out gutters, fit fire resistant leaf guards and fill gutters with water (temporarily block the downpipes and install bushfire sprinklers on the roof.
- Place weather stripping around the inside of doors and windows to eliminate any gaps.
- Construct fences non-combustible materials
- Select plants to reduce the spread of fire - different plants burn differently.
- Set out buckets and tools to extinguish embers and flames.
- Wear heavy protective clothing and remove synthetic fabrics.
- Check that insurance (building and contents) is adequate and current.
- Fire fighters periodically undertake planned burns on public land to reduce fuel and to and build fuel breaks to manage vegetation.
- Heed all warnings and attend all community meetings, know your fire district.
- On the day of a fire listen to the local emergency warning radio, usually the ABC.
- Keep watch, be vigilant and prepared.

Responses to Bushfires

Responses will vary in accord with the severity of the damage and essentially will be clearing, salvage, storing and rehabilitation as might be possible and appropriate for affected elements.

6.3 Floods

Flooding occurs when water covers an area that would normally be dry. It is considered to be an emergency when it threatens human life, property or activity.

Flooding in Australia

Floods are one of the most common natural hazards occurring across much of Australia. Three types of natural flooding are experienced in Australia. Slow onset flooding occurs when rivers in vast flat regions reach and then exceed their capacity. Rapid onset flooding is generally experienced in mountain regions and is characteristically caused by rivers on steep contours resulting in fast moving water. The Bureau of Meteorology describes the occurrence of a flash flood “when soil absorption, runoff or drainage cannot adequately disperse intense rainfall” and much of Australia experiences this type of flooding which can occur at any time but is common during the storm season or in seasons of higher rainfall or unsettled weather patterns.

Impacts of Flooding

Shallow flooding may have minimal impact on historic buildings. However, the degree of damage will increase as the inundation height increases to floor level and higher.

Flooding may result in following immediate impacts:

- Loss of significant trees including ancient or rare specimens, carved or scarred trees.
- Damage to gardens and cultural landscapes including elements washed away or undermined.
- Exposure or disturbance of archaeological sites and elements.
- Mud inundation.
- Slab heaving and or tile loss.
- Mortar loss - lime mortar is particularly vulnerable to water erosion.

- Dry walls which have been exposed to moisture or inundation do not cope well. Impacts on plaster walls will be variable and they will need to be inspected for initial stabilization.
- Tongue and groove flooring may swell and not return to its original profile whereas butt-jointed- boards are more likely to recover
- Saturation, staining, mould and general damage to historic finishes including plaster, paint, wallpaper, textiles, carpets and furniture and contents including objects, archival documents, books, paintings, photographs and the like.

Longer-term impacts include:

- Swelling of timber structures/framing which may not be visible.
- Dislocation or subsidence of building footings.
- Soluble salt damage to masonry or concrete walls. Incorrect drying out procedures may impede recovery.
- Mould may set in on organic fabric within 24 hours if it remains wet or damp and will eventually cause irreversible rot.
- Exposed metals will generally survive as they will dry through ventilation.
- Corrosion of embedded metal can damage surrounding fabric such as concrete or masonry.

Preparedness for Flooding

- Identify valuable moveable pieces which can be relocate to higher levels.
- Install permanent drainage sumps which are connected to waterproof pumps for known areas which are subject to frequent flood inundation.
- Have a stock of sand bags near-by.
- Apply temporary barriers to exterior doorways and window openings such as with sand bags.
- Apply temporary snap-on covers for airbricks and vents when flood is likely and to be removed afterwards.

- Minimise risk in high frequency flood areas by ensuring that the objects and fittings in these areas can be protected (i.e. through removal) as easily as possible
- The use of permanent flood prevention devices and products such as waterproof render must be examined with extreme care and decisions regarding their use must be considered with reference to the Burra Charter principles.
- Try and have a store of supplies, which is maintained off site, and which can be accessed quickly to assist with the recovery efforts.

Response to Inundation and Water Damage

- Photograph or video record the site in situ before any action is taken to provide information for insurance purposes and provide a record of the placement and condition of items.
- Remove water and mud as soon as possible by using fresh water at a low pressure preferably while everything is still wet.
- Take care to avoid electrocution when using electric generators and provide adequate ventilation when using charcoal grills.
- Commence drying the historic building as soon as possible. Natural ventilation, rather than heat, is the most appropriate way of removing interior moisture. If possible open all doors and windows and use cool fans to speed up evaporation. Use heat or dehumidifiers at a slow rate and with caution as applying too much too quickly will cause further damage particularly, to timber and plaster, paper, textiles leathers etc. Heat should only be used in conjunction with ventilation to avoid increasing the humidity of the environment. Objects can be freeze-dried for initial stabilization.
- Check for cracks in footings, walls and plaster as this may indicate structural failure. These are generally characterised by increased

width expansion and should be investigated by an architect or structural engineer, preferably with a background or skills in historic heritage conservation. Wall cavities and hidden structural elements may also have been inundated and should be inspected.

- Avoid structural collapse.
 - If the building has a basement which has been inundated the impact of hydrostatic pressure must be considered. Pumping water directly from basements can be dangerous.
 - If the ground water level is higher than the basement floor and water is removed the walls might collapse.
 - If the floor drains are operational and there is a substantial amount of water it is advisable to leave the water as it is and wait until the groundwater table sinks and the water recedes as it should. However, if there is a small amount of water it may be possible to pump out.

Sudden changes in moisture levels caused by the flood may also be caused by increased moisture content in timber beams and joists at the foundation walls.

- Check around the foundation walls of the site for soil loss.
- Inspect for masonry for mortar loss and assess if joints are stable.

Organic product-based insulation which has been saturated is likely to require removal as it will have lost its insulating properties and will lead to going moisture problems, damage to other fabric and promote biological growths. Closed-cell styrene and urethane board insulations do not absorb water but should be checked to ensure that they are not holding moisture against timber, masonry or steel elements.

- Label all salvaged items after drying preparatory to longer term conservation processes and treatments.

6.4 Cyclones

Tropical cyclones, typhoons and hurricanes are all severe tropical storms (sustained winds of more than 118 km/h (64 knots) which occur over the ocean. They draw upon moisture vapour and absorb energy from the heat which is released when water vapour, has been evaporated and then condenses in the middle of the storm which releases heat energy. A tropical cyclone is an atmospheric vortex with a diameter hundreds of kilometres wide and containing numerous thunderstorms. A cyclone is defined as "a non-frontal low pressure system of synoptic scale developing over warm waters having organised convection and a maximum mean wind speed of 34 knots or greater extending more than half-way around near the centre and persisting for at least six hours". Cyclones are seasonal and are predictable and may last for several days.

Cyclones in Australia

In northern Australia the cyclone season generally runs November-April. Cyclones typically begin in December with March and April being the peak months for activity particularly for intense category 4 or 5 cyclones. At least one severe cyclone impacts the coast of northern and western Australia each season, particularly between Broome and Exmouth, and an average of 14 cyclones occur over the entire Australian region from 90 to 160°E which represents 16 % of the global total. Most cyclones generated in northern Australia move either south-west or south-east into adjoining regions along generally predictable paths. Since 1998 the frequency of tropical cyclones in the Australian region has decreased and the reasons for this are not totally clear. Tropical cyclone activity is modulated by the El Niño Southern Oscillation (ENSO).



Australia. Department of Meteorology.

http://www.bom.gov.au/wa/cyclone/about/faq/faq_clim_3.shtml

Impacts of Cyclones

Tropical cyclones are named for easy identification and categorized in terms of wind strength viz.:

Category	Strongest Wind Gust* (km/h)	Average Maximum Wind (km/h)	Approximate Central Pressure (hPa)	Typical Effects
1	< 125	63 - 90	> 985	Negligible house damage. Damage to some crops, trees and caravans. Craft may drag moorings.
2	125 - 164	90 - 125	985 - 970	Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small craft may break moorings.
3	165 - 224	125 - 165	970 - 955	Some roof and structural damage. Some caravans destroyed. Power failures likely.
4	225 - 279	165 - 225	955 - 930	Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failures.
5	> 279	> 225	< 930	Extremely dangerous with widespread destruction.

Source: Geoscience Australia

The track, intensity, rainfall potential and size of a cyclone will cause different types and intensities of damage. The greatest impacts are from wind damage, storm surge, and flooding as a result of heavy rain.

Damaging winds can cause loss of roofs, chimneys, spires, wind-borne flying objects can cause impact damage, elements may disappear altogether.

Significant storm surges, caused by intense winds as the cyclone comes ashore, will result in high coastal inundation and can be more catastrophic if the cyclone coincides with a high tide.

The greatest impact of most cyclones inland is flooding from heavy or monsoonal rainfall which causes building damage to or destruction of buildings, fences roads bridges and rail lines which in turn causes dislocation of community and economic activity and isolation, as widespread areas can be affected for a considerable time.

Ground which has already been subject to rainfall will take longer to drain as it has less capacity for absorption.

Rapidly rising of water in rivers, channels and watercourses will contribute to flooding and may be sudden and unexpected.

Mud and general debris will cause secondary damage and will often delay response and recovery attempts.

Gardens, landscapes, archaeological site and cemeteries may have had elements washed away or moved from their original location.

Preparedness for Cyclones

- Listen to all cyclone warnings.
- Ensure that roofing materials, chimneys, aerials etc. are secure and in good repair.
- Secure all doors, skylights and windows. If not shuttered, heavily tape and board over all external glazing.
- Secure loose outdoor items.
- Prune trees and anything which might cause roof damage.
- Park cars under a solid shelter and engage gears and brake.
- Lift items to higher levels where possible.
- Turn off services.
- Observe building regulations beforehand.

Response to Cyclones

- Wait for the storm, not just the eye, to pass over.
- Check all services for leaks and damage. Do not use wet electrical equipment.
- Avoid fallen powerlines and keep out of floodwater.
- Extend searches for missing items to a wide area as strong winds may have carried them a comparatively long distance.
- Generally proceed as for other disaster recovery strategies.

6.5 Storms

Storms can occur at any time although they may be more frequent in different seasons in various parts of Australia. They can be multi-cellular which will prolong their duration and extend the area which they affect. Lightning, wind shear, weak tornadoes, hail, rain and flash flooding can cause damage.

Preparedness for Storms

Ensure that lightning conductors are installed on isolated or high buildings and that they are properly earthed.

Generally proceed as for other disaster recovery strategies.

6.6 Tsunamis

Earthquakes can trigger substantial and sudden changes in the ocean floor which can result in the creation of a massive wave called a tsunami. Tsunami, is a Japanese word which translates to 'harbour wave'. These events have been previously referred to as tidal waves, but this term is misleading as tsunamis are not caused by tides but undersea earthquakes, volcanic eruptions and landslides which cause sudden dislocation of the sea. Under-sea earthquakes occur where two tectonic plates meet. This is known as the subduction zone where one plate slides underneath the other resulting in a build up of pressure causing

the plates to suddenly rise or sink. The mass of water above this point also rises or sinks and the sudden shift creates a series of waves. Tsunami waves reach all the way down to the ocean floor and have extremely long wave lengths and they move away from their source. Tsunamis can travel fast in the open ocean up to 950 km per hour then lose speed but not energy as they approach land. As the speed slows the tsunami increases in height. Prior to the devastating Indian Ocean tsunami in 2004, tsunamis had all but disappeared from living memory and experience.

Tsunamis Affecting Australia

The Australia continent is exposed to tsunamis triggered by earthquakes particularly in the Tonga Hebrides trenches and Indonesia. The historic record indicates that Australia has experienced numerous large tsunamis over the last thousand years and areas above sea level containing shell, coral and boulders provide geological evidence of the occurrence of this geological hazard. Tsunamis have reached Australia on several occasions and have been recorded since European settlement.

Modern Australia is yet to experience a large scale tsunami and although they occur at least every two years, they generally occur in areas with a low population which do not contain high concentrations of heritage places. Damage has generally been limited to erosion, minor impact on roads, infrastructure, moored boats and harbours. The following is an overview of tsunami events in Australia:

The risk of tsunami varies across Australia from low to moderate. The west coast is considered to be at higher risk due to proximity to the seismically active Indonesia.

Emergency Management Australia (EMA) in conjunction with Geoscience Australia works with the states and territories to provide an early warning system. The Joint Tsunami Warning Centre (JATWC) collaboratively operated by the Bureau of Meteorology and Geoscience Australia continuously detects and verifies tsunami threat to the coastline of Australia and the offshore territories.

Warnings are distributed via mainstream media and through the 1300tsunami service. The government service uses a range of the existing sea level and upgraded seismic network to provide accurate and timely warnings as outlined below.

Marine and immediate foreshore threat

The Bureau of Meteorology may issue a tsunami warning restricted to the marine environment and immediate foreshore area for parts of the Australian coastline.

Year	Event	Wave height	Affected localities	Impacts
2006	7.7 undersea earthquake south of Java	Up to 2 metres and evidence of inundation 200 metres inland	Parts of the WA coast, particularly Steep point	Erosion damage to roads and sand dunes, damage to campsites & extensive vegetation damage
1994	Quake off Indonesia	4 metres run up and inundated 300 metres inland	Onslow-Exmouth region	Nil recorded
1977	Quake off Indonesia	6 metres run up (the wave travelled 6 metres above sea height)	Cape Leveque, WA	Nil recorded
1960	Chile earthquake	1 metre waves	Lord Howe Island, Evans Head, Newcastle, Sydney and Eden	Slight to moderate damage mainly to boats

Source: *Geoscience Australia*.

Land inundation threat

This warning is used if there is a serious threat of greater land area being inundated. In this instance local emergency services may order an evacuation of low lying coastal areas.

In addition there are a few natural warnings signs:

- An unusual roaring sound.
- Unusual animal or bird behaviour.
- Feeling of the earth shaking.
- The ocean dropping and retreating dramatically.
- A wall of water building up on the horizon.

Impacts of Tsunamis

The range of likely impacts, vary greatly and is dependent on a number of variables.

Underwater maritime archaeological artefacts and sites and particularly maritime sites are vulnerable to displacements and

disturbance due to their location on the sea floor.

The size of the wave often decreases as it makes its way from the ocean towards land and as tsunamis create a huge amount of energy which is contained within the wave and its path, historic places located on low lying coastal areas are the most vulnerable.

The severity of the initial impact will depend on the size and amount of energy of the tsunami should it reach the site. The types of constituent fabric, quality of construction and location will impact on the severity of the impacts. Likely immediate impacts include:

Common types of damage include:

- Damage to and/or complete loss of sea walls and coastal structures; changed coastal landscapes such as beaches, towns and villages, harbours, buildings etc.
- Erosion of coastal areas which may displace or disturb archaeological remains, particularly Indigenous heritage sites such as middens.
- Stripping of beach sand and uprooting of trees, plantings etc.
- Damage to historic ships (depending on location i.e. in a harbour).
- Water inundation to historic properties, particularly waterfront properties.
- Inundation of soil by untreated waste (in severe cases), salt water and long-term salinity which has corrosive properties.
- Structural collapse of historic properties, particularly unreinforced structures

Likely long-term impacts may include:

- Biological growths and infestations due to the changed internal climatic conditions.
- Ongoing moisture management problems due to the severe water ingress.
- Compromised structural integrity.

Preparedness for Tsunamis

The joint warning system aims to provide as much advance warning as possible on a possible. At the moment the aim is to provide communities with adequate warning for people to get to safety on higher ground.

Damage reduction measures for tsunamis are similar to that for storms and flood and will be effective or not depending upon the strength of the tsunami and the time available to prepare:

- Good building maintenance is good tsunami resilience.
- Sand bagging around the base of the building, paying particular attention to openings such as doorways and windows.
- Use custom made flood barriers if available.
- Using sympathetic and removable boarding to cover windows.
- Where possible move significant moveable items to the highest floor and store in waterproof packaging or relocate to a safer site.

6.7 Earthquakes

An earthquake is “a sudden shaking or rupture in the earth caused by the release of accumulated stresses in the crust”. Earthquakes can occur at any time in any location and predicting them is very difficult. Earthquake risk is exacerbated as populations increase numerically and expand geographically into risky zones. Geoscience Australia and the Seismological Research Centre maintain an independent earthquake alarm system.

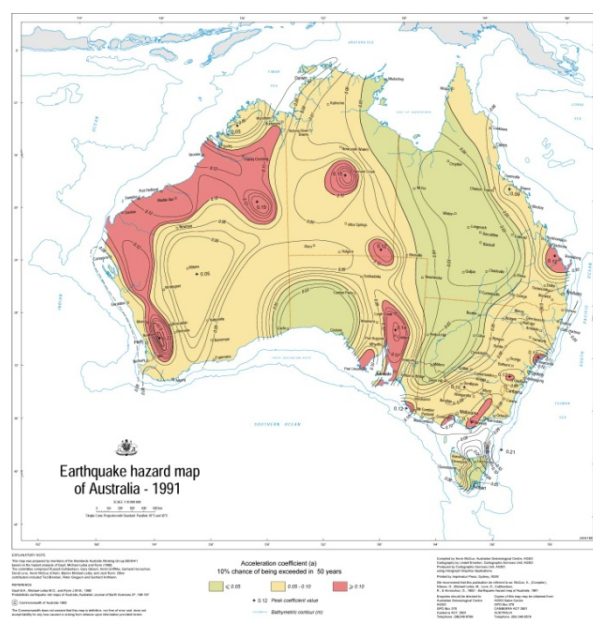
Earthquakes in Australia

Australia experiences intra-plate earthquakes which occur when seismic energy is released within a tectonic plate. The continent is located within the Indo - Australian plate but it is slowly being pushed northward by pressure from the Eurasian, Philippine, Indian, Pacific and Antarctic plates. Australian earthquakes are generally shallow, occurring less than 15km beneath

the earth's surface thus these events are generally limited to the earth's upper mantle. Events are also characteristically of a high amplification but short duration.

Earthquakes can occur at any time in any part of Australia. Geoscience Australia has reported that ‘There are on average 200 earthquakes of magnitude 3.0 or more in Australia each year. Earthquakes with magnitude 5.5, such as that in Newcastle in 1989, occur on average every two years. About every five years there is a potentially disastrous earthquake of magnitude 6.0 or more.’ There are comprehensive records of earthquake recordings for the last one hundred years which provide an overview of the location of earthquakes (where possible within 10km) in Australia. Understanding Australia's seismic history is essential to an understanding of why and how earthquakes occur and for the development of models to better predict future quakes and is essential for developing an understanding of the earthquake risk for heritage places.

Geoscience Australia has identified Adelaide as the highest earthquake hazard of any Australian capital. The state has experienced more medium sized earthquakes in the last fifty years as it is slowly being squeezed sideways by about 0.1 mm/yr. The map below provides an overview of seismic hazard risk for Australia.



Source: Geoscience Australia.

Impacts of Earthquakes

Impacts of earthquakes can be catastrophic or minor depending on:

- The intensity or magnitude of the event.
- Length of the event.
- Soil types.
- Distance from the epicentre.
- Characteristics of the structure.
- Quality of workmanship.
- Condition of the structure and any retrofitting.

Built structures such as masonry buildings are most likely to suffer damage. The impacts of seismic events are varied and will depend on a number of factors such as physical condition. Ensuring that places are well maintained and structurally sound, including by retrofitting, is the most effective way to minimize adverse impacts.

Elements particularly at risk during an earthquake include:

- Parapets.
- Chimneys.
- Spires and domes.
- Unreinforced and unbonded, structures.
- Untied (e.g. brick skins) elements.

Earthquake events which result in the creation of a fault line can visibly change the landscape and leave physical evidence of the occurrence of these events.

Archaeological sites may also be disturbed or displaced. Gardens including established trees are vulnerable, and plants may be stressed. Infrastructure such as roads, railway lines, bridges, pipelines and the like are all vulnerable to damage.

Secondary impacts associated with an earthquake may also include liquefaction, fault ruptures and fires. Liquefaction occurs when water is pushed out of the soil causing ground failure which can compromise building foundations. Fault ruptures are associated with shallow earthquakes where the fault reaches the surface and results in

vertical and horizontal displacement. Fires are most frequently caused by broken gas mains and dislocated services.

Preparedness for Earthquakes

Earthquake-prone areas of the world have highly developed preparedness strategies which involve retrofitting and building strengthening, fire suppression and general disaster response. Examples from Japan, in particular, and also parts of Europe provide intensive models.

If an earthquake occurs:

- Stay where you are.
- If in a building, shelter under a door frame, table or some element which will protect against falling masonry and objects and do not use the lifts.
- If outdoors seek to avoid buildings, power poles and lines, trees and similar infrastructure.
- If in a vehicle stop immediately.
- Turn off electricity, water and gas as soon as possible.
- Remain alert for aftershocks.

Response to Earthquakes

Response is generally related to demolition and clearing. At this stage it is critical that damaged buildings, fabric and elements are assessed from a heritage perspective in terms of repair, restoration, reconstruction and salvage before extensive clearing occurs.

6.8 Land and Mudslides

Land and mudslides contain earth, rock and debris in small or vast quantities. They creep slowly down hillsides or suddenly result in an avalanche of debris. They typically occur when slopes become saturated by water from rainfall, snow melt or seepage which renders them unstable and as a consequence they fall, slide or flow downwards. They can also occur as a result of seismic activity, blasting, tunnelling, mining, wave action, undercutting of cliffs, river banks and channels, subterranean

washouts, blocked and leaking pipes, denudation of vegetation, poor engineering and construction techniques, lack of maintenance and often in combination of heavy rains.

Land and Mudslides in Australia

In Australia small landslides occur frequently and while few have fatal consequences some have been recorded as causing death or injury and destruction of buildings. Coastal areas are often the most affected. Because of planning regulations most land and mudslides do not occur in built-up areas and building regulations ensure that geotechnical testing is carried out before design and construction commences.

Impacts of Land and Mudslides

- Sunken, cut or buried roads.
- Cut or interrupted underground and overhead services.
- Collapsed or moved bridges.
- Gas leaks may cause a risk of explosion and/or fire in urban or industrial areas.
- Collapsed and dislodged buildings.
- Rescue efforts may cause further injury and damage if not approached correctly.

Preparedness against Land and Mudslides

Maintain current maps of seismic activity and areas of landslide vulnerability and new construction in unstable areas or sites of previous slides should be avoided.

Monitor sites for distortion (bulges, running water running from beneath the earth, unusual muddy flows, sloping poles, tilting and cracking, building and structure distortion) and where possible undertake appropriate earthworks to stabilize hillsides and outcrops.

6.9 Drought

A drought occurs when there is a lack of water to meet human needs, and those of human activity including crops and animals, for a sustained period of time.

Drought in Australia

Drought is generally attributable to two factors: variations in natural rainfall and El Nino/Southern Oscillation. Climate change is now thought to be a contributor also.

Impacts of Drought

Drought is of the few natural hazards which has noticeable immediate impacts on heritage places. The impact will present over time. Drought will result in:

- The loss of historic plantings, mature trees and design integrity of gardens and landscapes and contributes to a heightened fire risk.
- Dust storms, which can impact on nearby localities such as museums or galleries where dust particles may enter buildings.
- Displacement and exposure of archaeological material.
- Erosion to soil and building surfaces.
- Cracking of masonry and mortar joints due to soil contraction.
- Exposure of heritage sites which would normally be underwater.
- Loss of population and abandonment and loss of heritage buildings, towns and sites.

Preparedness for Drought

- Knowing and regularly recording soil conditions and mapping of cracking to monitor occurrence. Seek expert advice from a structural engineer with relevant heritage experience as required.
- Avoid having garden beds directly against the walls of historic houses where possible and appropriate to the heritage values of the place.
- Apply for water permit to assist in maintaining the heritage values of cultural landscapes and garden.
- Apply good garden maintenance practices such as mulching and wise use of water.

6.10 Objects Falling from the Sky

The likelihood of objects falling from the sky is unpredictable. Apart from natural

phenomena swept up by a storm and deposited elsewhere and which is generally more of interest than risk, bombs, missiles, space junk, aircraft, meteors and asteroids can have an effect ranging from minor to catastrophic in a defined or almost planetary area. From the time that an object becomes visible to the naked eye the amount of time before impact is usually short. There is no defence and response and recovery, usually as for other types of disasters, is the only appropriate strategy.

6.11 Warfare, Terrorism, Civil Conflict

Military personnel, typically army engineers, may be called upon to assist with natural disasters and while Australia has not been subject to foreign invasion, it does deploy defence personnel overseas in areas of conflict and where local cultural heritage values will most likely be unfamiliar. These guidelines are intended to provide only an overview of activities and responsibilities under the purview of the Hague Convention (UNESCO Convention and Protocol for the Protection of Cultural Property in the Event of Armed Conflict, 1954) and the International Committee of the Blue Shield (ICBS) and the Association of National Blue Shield Committees (ANCBS) as the protocols are complex and have extensive legal ramifications. The principles apply also to natural disaster assistance.

The military forces of States Parties which are signatories to the Hague Convention will have procedures in place which address responsibilities of front-line forces with regard to cultural heritage in areas affected by armed conflict. In addition, countries which have not signed the Hague Convention or its Protocols may also have appropriate procedures in place. Australian military personnel receive some training before being deployed overseas.

Under the Hague Convention the Blue Shield is the symbol which identifies a place of cultural heritage significance. Unfortunately in some theatres of war this symbol may become a target as part of cultural or ethnic

conquest. In some circumstances ICBS or possibly ANCBS can request military assistance, but typically the military are in control and, at an appropriate point, should request assistance from heritage specialists.

In times of warfare military personnel should have identified beforehand, any ancient and historic buildings, monuments and sites, including archaeological and shipwreck sites, sacred sites, sites of ethnic significance and places of worship or religious significance, art galleries, museums or archival repositories, significant gardens and landscapes, zoos and habitats from existing information. In some instances an official cultural officer may be part of any deployment.

Natural disasters or explosions may reveal hitherto unexposed geological, fossil, tomb and archaeological sites, burial grounds, hoards, caves, buried structures and other significant sites.

Heritage sites may have been subject to bomb or artillery attack; land mines; booby traps; vehicular damage; excavation; looting; inappropriate use as places of occupation, temporary habitation or refuge and conflicting claims of personal, government or ethnic ownership.

Normal cultural conditions may be unclear and before going to a conflict zone, military personnel should undertake to:

- Identify which, why and to whom (cultural group or community) places are significant.
- Identify who the rightful custodians are as there may be competing claims of ownership misinformation.
- Identify who is in charge in the local community.
- Identify what records of valuable elements and items exist and their currency.
- Identify, understand and respect local cultural traditions and sensitivities and conduct themselves accordingly insofar as it is possible
- Prepare survey sheet pro-formas which should be in accord with the international standard for recording minimal data on movable cultural property similar to those used by

others including ICOM (International Council on Museums) so that appropriate information is recorded consistently and for later police and legal processes. Preferably load into hand-held electronic devices.

- Acquire equipment for recording sites and for immediate damage remediation.
- Have a generic or appropriate model disaster plan which is specifically directed to cultural heritage places and collections.

In areas of conflict military personnel should not:

- Occupy identified heritage places as this may cause them to become targets.
- Use areas around or near cultural sites as depots, munitions dumps, fuel stores, burning areas, helicopter landing pads and similar activities to reduce collateral damage.

Military personnel responsible for safeguarding cultural heritage sites and property should:

- Estimate the location and impact of any active front and possibly defend the cultural site depending on circumstances.
- Secure and guard sites to prevent looting and vandalism.
- Ensure sites are safe from ordnance, explosives, booby traps etc.
- Seek assistance from local heritage experts, architects, engineers, archaeologists, custodians and curators etc. as soon as possible.
- Extinguish fires noting that drenching with water may cause secondary and irreversible damage to materials e.g. stone, timber, plaster etc.
- Secure against floods.
- Disconnect live services.
- Identify any toxic or dangerous materials (biohazards, chemicals, asbestos, radioactive materials etc.).
- Implement any existing disaster plan otherwise use an appropriate model.
- Safeguard fabric with barriers, tarpaulins, temporary props etc. in a manner which is weatherproof and which does not prohibit future restoration.

- Assess condition of load bearing elements and take down dangerous structures only as necessary for public safety. Note that some damage may not be obviously or easily visible and may cause later structural failure.
- Provide temporary and secure shelter for personnel and triage and storage of salvaged items.
- Make an initial photographic survey of damage and the location of objects using GPS and record important data on pro-formas and keep records safe. Similarly record all clearing and other activities.
- Note that local records may be destroyed, damaged, dispersed or they may be in a foreign script or language.
- Survey the structure/site and debris carefully and salvage anything obviously valuable or at immediate risk of secondary damage.
- Provide logistical support for safe transportation of salvaged items.

6.12 Vandalism and Civil Commotion

Vandalism and civil commotion are most likely to be sudden, repetitive and incremental. Newly finished, secluded or conversely highly visible, under-maintained, unprotected or abandoned sites may attract vandals. Vandalism typically involves graffiti, glass breakage, smashing of building sheet, arson, destruction of street furniture and infrastructure, damage to fences etc. Council and state government Departments of Justice have deterrent programmes for offenders which may be employed.

Deterrents to vandals include:

- Good external presentation.
- Rapid rectification of the damage, particularly graffiti, as soon as possible.
- Electronic or natural surveillance, alarm systems.
- Good lighting at night.
- Elimination of cover such as from vegetation, alcoves, solid high fences etc.

- Elimination of unauthorized access and reduction of escape routes such as through the installation of security fences, railings, gates, grilles, doors, shutters and locks.
- Creation of different environments through architectural urban and landscape design.

Civil commotion and riots may be predicted or sudden and typically will occur in a place of strategic importance, such as a main street or square or government building. They are usually politically or economically driven or may relate to ethnic tensions and cultural sites may be targeted. The damage inflicted from civil commotion and riots would range from explosives, petrol bombs, fire, rocks, smashing, looting and the like. Because more people are usually involved in a riot, the damage can be quite considerable. Police or military will be in control until peace is resumed at which time heritage experts should be involved in the response.

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Other Cultural Heritage Organizations

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<http://www.blueshielddaustralia.org.au/prevent.html>

<http://www.fema.gov/areyouready/>