BUILDING Resilience

A guide to consider climate change for Gippsland houses

bright FUTURES

WELLINGTON SHIRE COUNCIL
The Heart of Gippsland

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Foreword

This booklet has been funded by the State of Victoria as part of the *Climate risk and resilience information provision for property buyer's* project undertaken by East Gippsland Shire Council and reproduced by Wellington Shire Council on their approval. The main aim of the project was to identify and summarise the climate change research, and provide property buyers and existing home owners in the Wellington Shire practical and useable information on climate risks and adaptation options.

This booklet is a key outcome. It includes technical information about the changing climate in Wellington Shire, what it means for properties, and how to make our homes more resilient.

The Gippsland region faces a number of varying climate risks including:

- more frequent and intense heavy rainfalls causing flooding
- harsher bushfires
- more days of extreme heat
- sea level rise combined with storm surges, causing flooding and other impacts
- more storms including hailstorms[1]

As there is a large volume of valuable, existing information regarding the climate risk and resilience profile of properties, this booklet aims to simplify and summarise the information. Please refer to the Useful Resources section for comprehensive external sources of information on this topic.

As we continue to experience more impacts from natural hazards on Shire buildings and assets, we encourage you to look for ways to prepare and consider your own buildings. Together we can create a brighter and resilient future for Wellington Shire.

1 source: http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0019/323551/Gippsland.pdf

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Introduction

Why renovate for or build a resilient house in Gippsland?

Our world is getting warmer and our weather is changing. Records show Gippsland is hotter and drier than ever before. Since 1950, our average temperature is between 0.8 to 1.6 degrees warmer, and rainfall has dropped 100 - 200mm a year in most of East Gippsland. These trends are expected to continue.

This means we will have more hot days and warm spells, fewer frosts, less overall rainfall but heavier rain events more often than in the past.

Extreme weather events and natural hazards – extreme rain, storms, strong winds, floods, droughts, extreme heat and bushfires – are more common. The sea level is rising and extreme sea events are more severe. This is likely to continue.[1]

These changes will affect us all but there are things we can do to minimise our risks.

Wellington Shire Council has prepared information to help homeowners, builders, developers and property buyers to make informed decisions, which will reduce the impact of these extreme events on our homes and investments.

By understanding the risks and making informed decisions we can help build resilience in our Shire at a household 'property by property' level.

1 source: http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0019/323551/Gippsland.pdf

How will this effect us?

Climate and weather influence the way we design, build and maintain our buildings. Changes to our climate and weather can damage our buildings and increase the costs of construction and repair.

In 2013, an Australian parliamentary inquiry heard that property damage caused by extreme weather costs Australians between $900 million and $4 billion a year.

Extreme weather costs Australians between $900 million and $4 billion a year.

Extreme weather can impact buildings in many ways.

Extreme Heat can

- Cause heat stress damage to buildings and building materials, such as roofs, cladding and windows.
- Increase the cost of keeping your building cool because you have to use more energy.
- Increase the risk of your heating and cooling failing.
- Cause a greater risk of power blackouts.

Extreme rain can

- Damage your property through flooding.
- Increase costs through flood protection, insurance and property maintenance.
- Interrupt your business and disrupt access and services.
- Increase the cost of developing a property or building a house.
- Reduce the demand for your property depending on where it is located.
- Cause structural damage to buildings.
- Increase maintenance costs.

Rising sea levels can

- Increase costs through flood protection, insurance and property maintenance. *(Note: insurance does not always cover all events e.g., such as flooding caused by 'action of the sea' resulting in king tides, coastal erosion or sea level rise).*
- Effect land and property values.
- Interrupt business and disrupt access and services.
- Create drainage problems in low-lying areas.

Bushfire can

- Damage your property and other assets.
- Increase costs through bushfire protection.
- Interrupt business and disrupt access and services.
- Cause structural damage to buildings.

Drought can

- Increase the cost of water and the need to supplement your normal water supply.
- Lead to water restrictions, which may affect landscaping and property values.
- Cause structural damage to buildings caused by shrinking soil due to dryness.

Benefits of resilient homes

Our homes are often our most valuable asset. It's never too early to start thinking about how to climate proof your home. The existing residential building stock in Gippsland was not designed to meet the climate we are we are experiencing and expecting in the future.

While planning and design of new housing incorporates controls guiding development, in contrast, there is no regulatory framework driving adaption of existing homes and properties.

Property purchasers and property owners will need to inform themselves of potential climate risks and actions to improve resilience of a property to future climate events and conditions.

Increasing the resilience of your home can have numerous benefits, including:

Reduce damage to your home

Proactive adaption actions can reduce the potential for damage to your property as a result of future weather events.

Increase community resilience

More resilient buildings and properties ease the burden on emergency response agencies like the Country Fire Authority and State Emergency Service during extreme weather events.

Reduce costs of utilities

Modifications such as glazing, shading, water capture and storage, and passive solar heating can reduce your usage of electricity and water. These efficiencies save you money over time

Increase property value

improvements to the resilience of a house, particularly in terms of major capital improvements, will retain their value and could increase the resale value of the property.

Increase comfort

Resilient homes will maintain higher levels of comfort during extreme conditions such as heatwaves. This is significant if vulnerable people (such as the elderly or very young, or those with medical conditions).

Reduce costs and inconvenience of damage

Costs of repairing damage can be significant compared with the cost of preventative measures. While insurance can provide some financial security, property damage can make homes uninhabitable if major repairs are required, or simply be inconvenient if minor damage occurs.

Reduce insurance premiums

Certain modifications could minimise increases in your insurance premiums (or prevent against you losing your cover), particularly in the case of flood protection.

For property buyers, it is important to understand your risks, and seek out additional information.

Guiding questions could include:

- What are the likely climate impacts, now and in the future, and what are the consequences for your property?
- Are there win-win/no-regret options, which may offer other co-benefits such as improved efficiency or liveability?
- Is there flexibility in the design in terms of allowing for further modifications in the future? Will the design standards allow me to retrofit for more on-site water storage or to strengthen the structure in the future, for example?
- Will this modification affect the resilience of the property to other climate impacts? For example, if installing insulation or planting trees to address the impacts of heat, can this be done in a way which does not increase the susceptibility of the property to fires?

Seek professional advice from a builder or architect before acting – some changes to a house may even require approval from Council. Check Council's planning controls:

- Each property sits within a planning zone, and each zone has specific requirements for building and earth works. The planning scheme can be accessed online at www.planning.vic.gov.au
- Planning scheme overlays cover many properties i.e., heritage, design & development, bushfire management, land subject to inundation and environmental overlays which may influence building material, design choices, location of building sites and native vegetation.

How can we reduce the risk?

The trend towards warmer, drier conditions, more intense storms and rising sea levels will impact our homes and buildings, now and in the future.

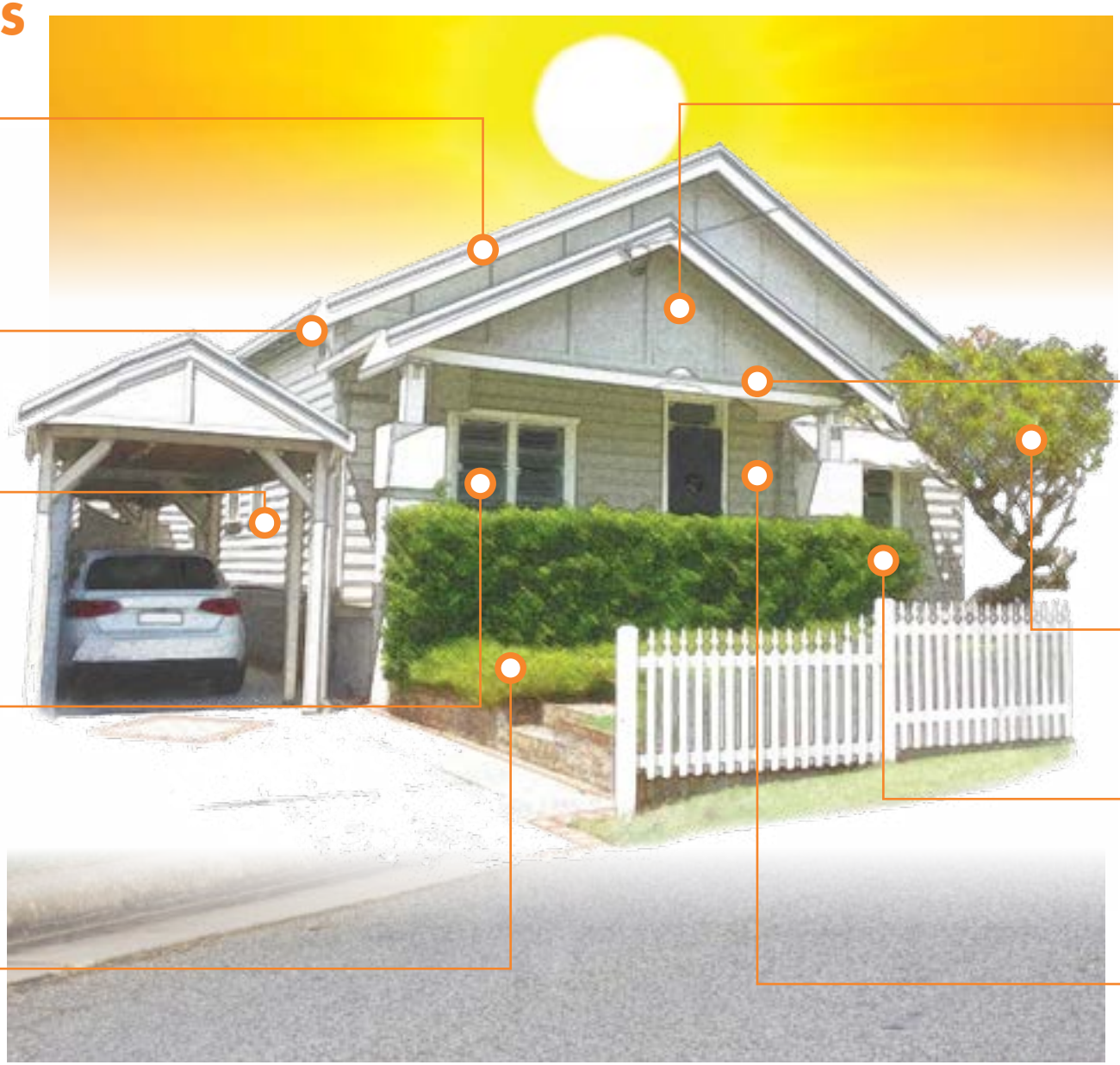
There are many things we can do to help protect our homes and investments against potential damage caused by extreme weather and natural events and to create more "resilient" buildings.

These actions depend on factors such as the location of the property, the type of building, the hazard it might face and the outcome you hope to achieve.

There are many things we can do to help protect our homes and investments against potential damage caused by extreme weather and natural events and to create more "resilient" buildings.

Extreme Heat

CONSIDERATIONS



- High-reflective or light-coloured roofing
- Effective ventilation and cross-ventilation which uses the air pressure to remove heat
- Effective insulation in roof and walls
- High performance glazing - aim for no more than a ratio of 12-15% glass to floor area (17% if double glazed)
- Consider changes in soil moisture as temperatures rise. Foundations may need strengthening to avoid cracking
- Whirlybirds or mechanical ventilation in ceiling spaces can ensure air flow in summer and a complete seal in winter
- Weather protecting sealants and paints protect against thermal movement of roofing, cladding and window systems as temperature fluctuates over time
- Install or grow external shade on the northern and western side
- Plant woody trees and shrubs for shade
- Consider the impact of materials with high thermal mass (such as concrete, bricks and tiles)

Extreme Heat

FLOORS

- Factor for thermal expansion of materials and changes in soil moisture as temperatures rise. Foundations may need strengthening to avoid movement.
- Ground-coupled heat exchanger uses the near constant subterranean ground temperature to cool air inside using underfloor ductwork.

INTERIOR

- Use ceiling and pedestal fans.
- Use effective ventilation and cross-flow ventilation which uses the air pressure to remove heat from a space. Allow night-purging of hot air.
- Design (or renovate) buildings with high levels of internal thermal mass to help regulate temperature.
- An air tight building with a heat exchange ventilation systems (VHR) keeps air fresh and energy costs low.

CONSTRUCTION

- Where possible, orientate new facilities or additions appropriately in relation to solar aspect and to make best use of wind for passive cooling, as well as to provide shaded north and west facing windows.
- Use passive solar design.
- Use correctly sized eaves to shade out summer sun (but let in winter warmth), especially on north facing windows.

WINDOWS

- Consider the solar window to floor area ratio: in temperate climates aim for 12-15% glass to floor area (17% if double glazed).
- Where possible, maximise opportunities for passive solar shading of northerly windows. Shade all east and west glass in summer. Consider adjustable shading to allow variable solar access in spring and autumn.
- Consider installing high performance glazing, but avoid overuse of glazing.

Climate change will affect us all but there are things we can do to minimise our risks. By understanding the risks and making informed decisions we can help build resilience in our Shire.

Use different glazing types for each façade; low U-value glazing is essential in all cases. Double glaze living areas and consider using it in bedrooms. For north-facing windows select high SHGC glazing and passive shading. For east and west façades select low SHGC coatings (e.g. low-e). South-facing glass should have low U-value and high visible light transmittance. Thermally improved or insulated frames (timber or PVC) are important.

EXTERNAL STRUCTURES

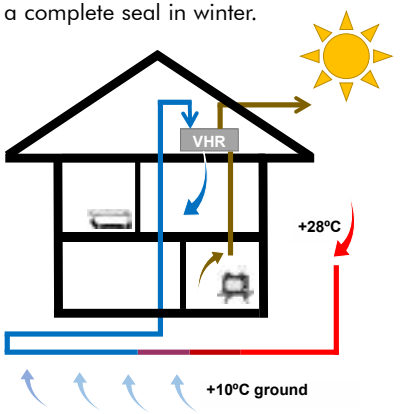
- Exterior shading of windows (blinds, awnings etc) is more effective than internal shading (blinds and heavy curtains) - but consider both.
- Cover or shade parking areas to reduce heat absorption of asphalt.
- Rainwater and greywater tanks provide water during droughts.

LANDSCAPING

- Consider planting woody trees and shrubs to provide shade and lessen urban heat island effects through evapotranspiration. Consider landscaping gardens and exterior with species providing high shade cover. Care must be taken that species are appropriate for bushfire conditions and proper maintenance is conducted (i.e. if deciduous species prone to leaf litter build up are chosen) and species have low water requirements (compatibility for drought).
- Consider reducing impervious surfaces which may have high thermal mass.
- Use lighter-coloured or reflective paving to reduce heat absorption.
- Consider planting drought-tolerant species and installing a centralised irrigation system for efficient water use.

ROOFING

- Install insulation: use bulk AND reflective insulation in ceilings. The higher the R rating the better.
- Consider installing high-reflective or light-coloured roofing, but consider neighbours. Avoid dark colours that absorb heat.
- Use weather protecting sealants and paints to protect against thermal movement of roofing, cladding and window systems as temperature fluctuates.
- A 'draft stoppa' is a cheap way of sealing a ceiling exhaust fan, and is easy to install.
- Consider mechanical ventilation heat recovery (VHR) in ceiling spaces to ensure high-level flows of cooler (south-side or ground source) air in summer and a complete seal in winter.



WALLS

- Install insulation: use bulk OR reflective insulation in walls.
- Consider using weather protecting sealants and paints to protect against thermal movement of roofing, cladding and window systems as temperature fluctuates over time.
- Consider risks of pest management in future as climate changes. The range of termites for example may expand with warmer temperatures and this must be considered in construction. Use pest resistant materials such as steel frames.

Flooding CONSIDERATIONS

INLAND/EXTREME PRECIPITATION & COASTAL/SEA LEVEL RISE

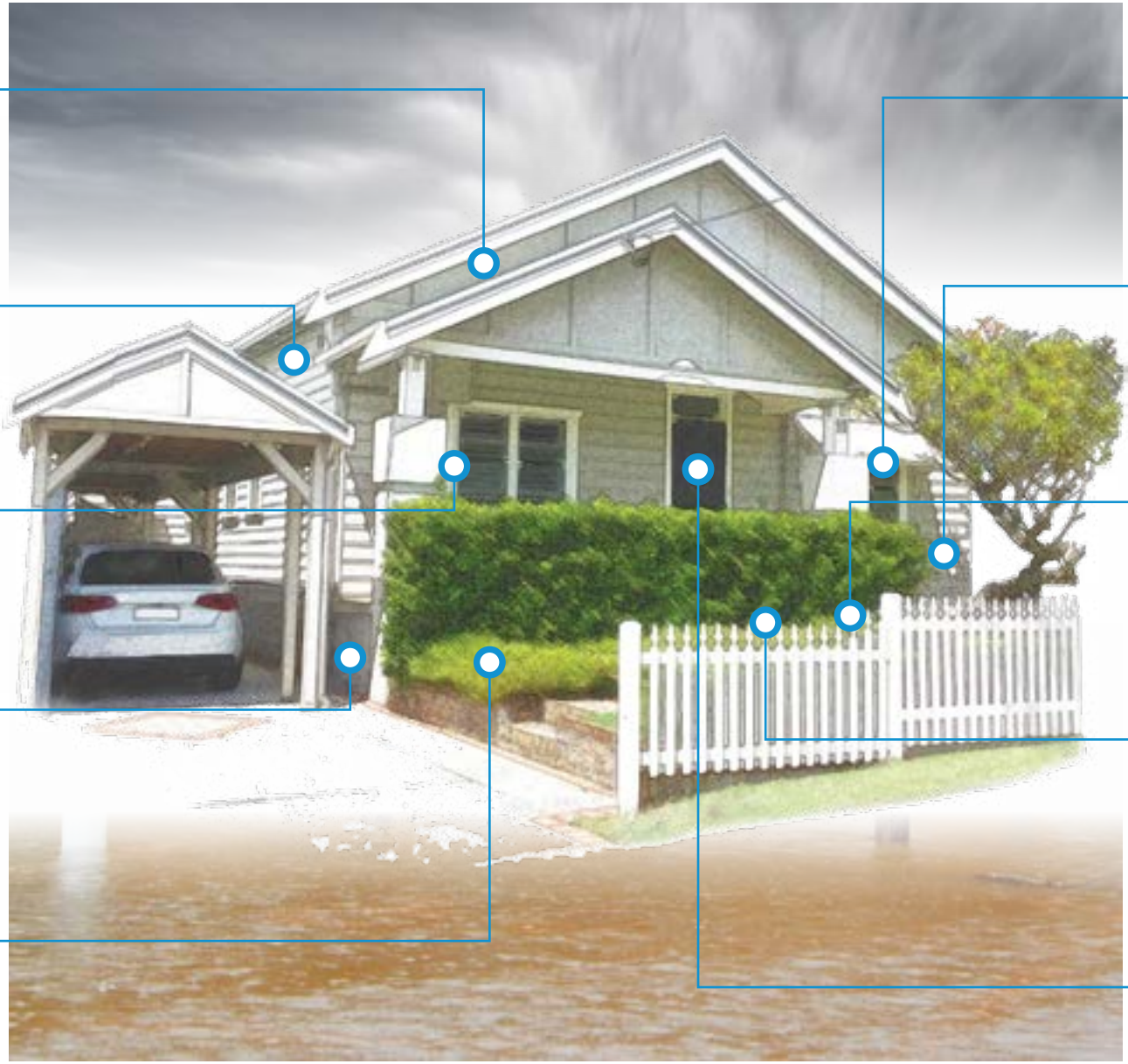
Use water resistant insulation material such as closed cell foam, rather than fibreglass, mineral wool, wool or cellulose foil

Elevate essential infrastructure such as electricity/powerpoints, cooling systems, fuel supply etc. above flood level (using a licensed contractor)

Seal gaps around pipe and cable entries with water resistant product (such as silicone)

Fit drains, sinks and toilets with drainage bungs (plugs) or non-return valves that seal to avoid sewerage contamination with rising floodwaters

A dry well, perimeter drainage or barriers can lead water away from the house - designing buildings for flood forces must be carried out by hydraulic and structural engineers



Strengthened glass and frames can protect against water and collision from floating debris

Install snorkel vents or raise wall vents above flood level

A sump and pump system can remove flood water (from basements and voids under the floor)

Water-resistant floor materials include concrete, durable floorboards, clay tiles and waterproof wall materials include render, concrete blocks, membranes

Doors made with materials to withstand flood pressure and water intrusion

Flooding

Understand your risk.

We recommend you check with Wellington Shire Council or the West Gippsland Catchment Management Authority to check if your property is in a flood risk area, and design to the highest flood level. Additional detailed information on how to prepare your home for flooding is provided by the SES (www.ses.vic.gov.au).

FLOORS

- Consider installing waterproof membrane and cavity drainage solution beneath floor. Also requires sump and pump.
- Water saturated soils may build pressure and water may intrude through cracks and fissures. In worst case scenarios pressure that builds up may push the floor up or basement walls in if they have not been designed to resist the pressure.
- Floors can be constructed of water resistant material (concrete, durable floorboards, clay tiles, rather than MDF, plywood or ceramic tile).

EXTERNAL DOORS

- Consider installing doors made from water resistant materials which are designed to withstand flood pressure and water intrusion. Inversely, doors may be installed that allow the flow of water which reduces pressure exerted on surrounding frames and walls. This may include an escape hatch built into top half of door.
- Where practical, ensure doors have additional support such as barrel bolts or dead locks, as well as sturdy plates in door jamb.
- Consider installing waterproof seals on doors and windows, as well as sealing any gaps in frames with resistant products such as silicone.

CONSTRUCTION

- Construct new buildings with floor levels above projected flood levels.
- Where possible, ensure houses are set back from foreshores and are not located on a floodplain or in a storm surge zone.
- Slab-on-ground construction prevents building to be raised if needed, and has poor air flow after a flood.
- Elevate essential infrastructure such as electricity/powerpoints, cooling systems, fuel supply etc. above flood level (using a licensed contractor).
- Consider scour-resistant foundations that are protected from scour occurring from water flow which can affect pilings, soil columns etc.

WINDOWS

- Consider installing strengthened glass and frames to withstand water and collision from floating debris.
- Seal around windows with water resistant product such as silicone where practical.

EXTERNAL STRUCTURES

- Permanent walls or auto barriers around a property can be constructed (which feature demountable/concealed/swing gates for access) to protect from water flows.
- Revetments or sea walls can protect waterfront properties from inundation and erosion.
- Engineered options should be discussed with hydraulic engineers and the EGCMA. Also consider your insurance and beware engineered solutions can fail (or create a false sense of security).
- Domestic flood alarms can be used for areas not served by official flood warnings.
- Consider raising decking above water levels using strong and water resistant materials.

PLUMBING

- Consider installing toilet bungs, anti-backflow valves for sewer pipes and non-return valves for appliance waste pipes.
- Consider installing sump and pump system which removes flood water, particularly from basements and voids underneath the floor. Ensure ancillary power available in case of power failure.

LANDSCAPING

- Consider installing a dry well (hole filled with gravel or stones) to lead rainwater away from the house and collect it before leaking into the soil.
- Saturated soils may lead to dampness in basements and cellars. Installation of perimeter drainage will improve indoor climate of these areas.
- Consider filling land to maintain ground level above nearby lakes, streams and groundwater.
- Where possible, avoid large cuts into unstable soils, or removal of vegetation that holds soil layers together.
- Consider providing adequate drainage and soil cover near potentially unstable sites.
- Consider reducing impervious surfaces which do not allow rain water to infiltrate groundwater. This will reduce the burden on stormwater systems.

ROOFING

- Consider gutter-to-roof area ratio, in particular for internal gutters that may accumulate a heavy water load.
- Keep gutters clean and install leaf guards or other over-the-gutter gutter protection where practical. Overflowing gutters are a common reason for water entering homes during storms and high rainfall events, causing extensive damage to roof and ceiling areas, walls and floors, and destroying precious home contents.
- Consider enhancing access to roofs for maintenance and inspection of roofing membranes and drainage system.
- Consider 'steeper' slope roofing to faster shed rain during heavy rainfall.
- Consider using water resistant insulation material such as closed cell foam, NOT fibreglass, mineral wool, wool or cellulose foil.

WALLS

- Consider applying water resistance products to walls, such as render or waterproof tanking membranes to external walls.
- Consider installing waterproof membrane and cavity drainage solution within wall cavities. Also requires sump and pump.
- Consider installing snorkel vents, raising wall vent height above flood level.
- Consider installing airbricks which feature membranes that allow ventilation of air, but not intrusion of water or debris.
- Where possible, seal cracks, weepholes and service inlets (such as washing machine or telephone lines) with water-resistant products.
- Think about whether neighbouring buildings have flood resistance measures where shared walls are in place or water may seep through.
- Consider installing pressure neutral rain screens to avoid water intrusion into wall assembly when wind drives water seepage through openings.
- Consider using water resistant insulation material such as closed cell foam, NOT fibreglass, mineral wool, wool or cellulose foil.
- Consider using water resistant wall material/ cladding such as fibre cement, concrete block, treated timber or PVC brick, NOT particleboard or plywood.

Storms

CONSIDERATIONS

Hail resistant roof materials and replace roofing nails with screws. Regularly check your roof for loose tiles or iron sheets

Flat roofs are more susceptible to uplift forces than pitched (sloping) roofs

Where practical, get a builder to check the structural integrity of your house

Windows should be able to withstand wind pressure from both positive pressure (windward wall) and suction (leeward and side walls)

Windbreaks/planting dense vegetation around the building reduces wind loads

Use an accredited arborist to remove dead or overhanging tree branches that could fall on your house if struck by lightning or strong winds

Roof tie-downs to foundation (rather than to walls) counteracts upward lifting from winds

Plywood, plasterboard, steel straps or timber members to reinforce walls and transmit lateral forces to ground

Consider installing debris screens or shutters on windows

A whole-of house surge-protection system prevents electrical damage

Storms

Arrange for a professional builder to check your building and identify ways you can increase the structural security of your home to withstand high winds. Ensure your home, contents and car insurance is current and adequate. Check the details of what your policy covers.

For information on how to respond and prepare for a storm visit www.ses.vic.gov.au/get-ready/stormsafe.

FLOORS

- Consider installing waterproof membrane and cavity drainage solution beneath floor. Also requires sump and pump.
- Water saturated soils may build pressure and water may intrude through cracks and fissures. In worst case scenarios pressure that builds up may push the floor up or basement walls in if they have not been designed to resist the pressure.
- Floors can be constructed of water resistant material (concrete, durable floorboards, clay tiles, rather than MDF, plywood or ceramic tile).

EXTERNAL DOORS

- Ensure garage door locks correctly and can withstand wind speed for location. New doors may have wind locks or other braces to resist wind loads.
  These loads transfer additional stress to ends of roller doors and so walls too must be strengthened to resist additional load.
- Where practical, doors should have have additional support such as barrel bolts or dead locks as well as sturdier plates in door jamb.

CONSTRUCTION

- Flat roofs are more susceptible to uplift forces than pitched (sloping) roofs.

WINDOWS

- Windows should be able to withstand wind pressure from both positive pressure (windward wall) and suction (leeward and side walls). Ensure glass panels are correctly sized for wind loads and frames are sturdily fixed to house structure.
- Consider installing debris screens or shutters on windows.

EXTERNAL STRUCTURES

- House attachments (carports, porch roofs) can become damaged during storms and lead to damage to the main structure. Where possible, ensure these attachments are built to the same standards as the main building.

INTERIOR

- Consider a surge-protection or suppression system for your entire house.

LANDSCAPING

- Consider constructing windbreaks/planting dense vegetation around the building to reduce wind loads.
- Using an accredited arborist, remove dead or overhanging tree branches that could fall on your house if the tree is struck by lightning or affected by strong winds.

ROOFING

- Where practical, get a builder to check the structural integrity of your house. Uplifting forces must be accounted for in regions subject to high wind – improved interior tie-downs and fasteners may be required to hold roof onto building. Ensure all fasteners are in good condition free of rust.
- Consider reinforcing your home with hail resistant roofing materials.
- Regularly check your roof area for loose tiles or iron sheets. Consider replace roofing nails with screws.
- Consider anchoring roof battens to rest of structure well enough to carry all forces from cladding. If facility built prior to 1980s this is a common weakness.
- Consider installing roof tie downs to foundation level rather than to walls as the stress from upward lifting from winds may be too great for wall frames.
- Learn what type style of roof is appropriate for homes in your area in terms of hail and wind-resistance. No roofing material is fully storm-proof.

WALLS

- Consider using plywood, plasterboard, steel straps or timber members to reinforce walls from roof level to floor to transmit lateral forces to ground.
- Wall cladding should be strong enough to resist wind forces and debris impact.

Climate and weather influence the way we design, build and maintain our buildings. Changes to our climate and weather can damage our buildings and increase the costs of construction and repair.

Bushfire

CONSIDERATIONS

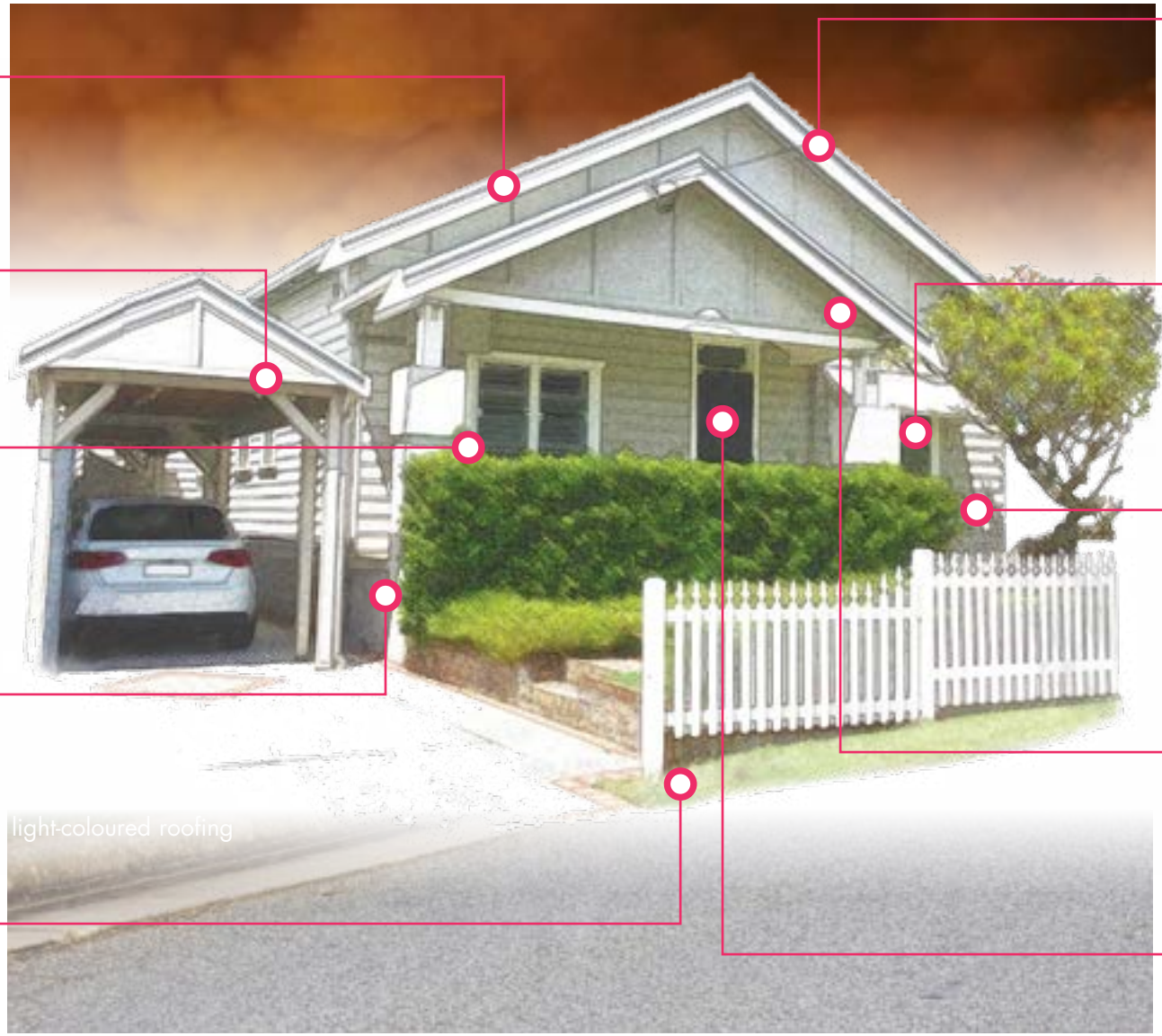
Keep gutters clean and ensure they are made from fire-resistant materials

Seal gaps with sarking, weather strips or guards made of non-combustible materials to prevent ember attack

If new build, construct frames and joinery from bushfire-resistant timber, metal or reinforced PVC-U

Unenclosed subfloors should have posts and columns constructed of non-combustible or bushfire-resistant material

Keep grass short and remove dead plants and branches from trees within 10m of house, ensure there is no fuel under the decking



Consider sprinkler systems and sealing and insulating roof with fire-resistant materials

The CFA recommend wire mesh screens (not aluminium) with 1.5-millimetre holes over installed over windows and frames to prevent embers and reflect radiant heat

Consider applying product to timber to increase its resistance to fire

Clad timber or steel-framed walls with fibre cement, steel sheet or bushfire-resistant timber

Consider protecting doors with external screens or bushfire shutters

Bushfire

Understand your risk.

We recommend you check with your local Council and the CFA before building or renovating in a bushfire prone area.

FLOORS

- Where practical, construct enclosed subfloors with non-combustible material (masonry, brick veneer, mud brick etc).
- Unenclosed subfloors should have posts, columns, stumps and poles constructed of non-combustible material or bushfire resisting timber.

EXTERNAL DOORS

- Doors should be constructed from either non-combustible materials, solid timber (>35mm thick), or a hollow core with non-combustible kick plate for the first 400mm above threshold, where practical.
- Consider protecting doors with external screens or bushfire shutter – screen mesh should have a maximum aperture of 2mm and be made from corrosion resistant steel, bronze or aluminium. Gaps around edges should be no wider than 3mm and the frame should be a non-combustible material.
- Consider installing weather strips, draught excluders and seals at the base of doors.
- Consider applying product to timber to increase its resistance to fire.
- Garage doors less than 400mm above ground level should be made from non-combustible materials such as fibre-cement cladding (>6mm thick) or bushfire-resistant timber. Suitable weather strips should be placed around edges with no gaps wider than 3mm, and guide tracks should be fitted with a nylon brush in contact with the door. Doors should not include ventilation slots.

EAVES, GUTTERS AND DOWNPIPES

- Check that no leaves or debris have built up.
- The most fire-resistant gutters are constructed from metal or PVC-U and feature valley leaf guards.
- Eave linings made of fibre cement (>4.5mm thick) or fire resisting timber can increase fire resistance.
- All above ground piping (water and gas etc.) should be constructed of metal where practical.
- Consider removing gutters in high risk situations to reduce risk of embers collecting.

WINDOWS

- Consider covering window assemblies with bushfire shutters or screens made from non-combustible materials. Screen mesh should have a maximum aperture of 2mm and be made from corrosion resistant steel, bronze or aluminium. Gaps around edges should be no wider than 3mm and the frame should be a non-combustible material.
- Consider constructing frames and joinery from bushfire resisting timber, metal, metal-reinforced PVC-U and with metal external hardware.
- Consider replacing glass with toughened glazing (>5mm thick) or laminated safety glass, and replace overhead glazing with 'Grade A' safety glass.
- Consider applying product to timber to increase its resistance to fire.

EXTERNAL STRUCTURES (DECKING, STAIRS, ETC.)

- Consider construction or covering external structures with non-combustible materials (masonry, brick veneer, concrete etc.).
- Where glazed elements (windows, doors etc.) are less than 400mm vertically, or 300mm horizontally from decking or stairs, the surface should be made of non-combustible materials where practical.
- Consider separating external structures within 6 metres of the house with a 60/60/60 fire-resistant wall.
- Consider applying product to timber to increase its resistance to fire.
- If subfloor spaces are considered 'enclosed', consider protection of openings with mesh or perforated sheet (<3mm aperture).
- Consider installing a private bushfire shelter.

LANDSCAPING

- Remove dead plants, weeds and dead branches from trees near the house.
- Keep grass short within 10m of house.
- Remove vegetation from around decks or create separation between them where possible. Remove or prune plants growing on or around house.
- Cover exposed woodpiles or similar with fire resistant material or relocate away from house.

ROOFING

- Tiles, sheets and covering accessories should be non-combustible where practical.
- Consider sealing roof and wall junctions of gaps >3mm.
- Penetrations such as roof lights, ventilators, mounted cooling units, aerials and solar connections should be sealed with no gaps >3mm and ember guards fitted, where practical. Cooling units can be fitted with non-combustible covers of mesh with a maximum aperture of 2mm.
- Consider insulating roof with compressed mineral wool insulation.
- Consider enhancing access to roofs which may allow firefighting equipment access.
- Consider installing sprinkler system to extinguish embers that land on the roof or other structures of the building. Ensure system will run in event of mains power failure and that there is adequate water supply. Consider impact of wind on delivery of water on the structure.

WALLS

- Consider replacing or covering external walls with non-combustible materials (masonry, brick veneer, concrete etc.).
- Consider sealing vents and weepholes with metal mesh with maximum aperture of 2mm.
- Timber or steel-framed walls should be clad with fibre cement (6mm minimum thickness), steel sheet or bushfire resisting timber, where practical.
- Consider sealing all small gaps around the house with appropriate joining strips or silicone-based sealant.
- Consider installing non-combustible sarking behind weatherboards, external cladding and roofs.
- Consider applying product to timber to increase its resistance to fire.

Useful Resources

For further information about the possible impact of climate on your property:

Your Home

Australian Government guide to environmentally sustainable homes.
This publication is by the Australian Government, in partnership with the building and design industry and aims to provide expert and independent advice.

www.yourhome.gov.au

Climate Change in Australia

Find out more about climate change science and the impacts of climate change across Australia (Australian Government/CSIRO).

www.climatechangeinaustralia.gov.au/en/climate-projections/climate-futures-tool/projections/

FEMA Protect Your Property

US Department of Homeland Security landing page providing information on how to protect your home or business from floods, earthquakes, high winds, and manmade disasters. Read how others have protected themselves in Best Practices and Case Studies and how you can protect your business. Particularly relevant is the information on flood and storm retrofitting: Protecting Your Home & Property from Flood Damage Mitigation Ideas for Reducing Flood Loss & Homeowner's Guide to Retrofitting 3rd Edition (2014).

www.fema.gov/protect-your-property

Climate Change and Victoria

Find out more about climate change in Victoria. In order to help communities understand and prepare for climate change impacts, the Department of Environment, Land, Water and Planning has developed regional-specific information sheets. The Climate-Ready information sheets explain in detail what the likely effects of climate change will be, what communities need to do to ensure they adapt to a changing climate and what opportunities a new climate may bring.

www.climatechange.vic.gov.au

CFA

The Country Fire Authority (www.cfa.vic.gov.au) recognises Victoria is one of the most fire-prone areas in the world. Understanding your level of risk is the first step in knowing how to prepare your house for a bushfire. Their website contains many resources dedicated to bushfire preparation for new or existing homes. A specific resource is 'How to prepare your house for bushfire - home improvements.'

www.cfa.vic.gov.au/plan-prepare/home-improvements/

VBA

The Victoria Building Authority (www.vba.vic.gov.au) can provide you with expert advice and essential information whether you're building or renovating. The VBA has guides to retrofit your home for a better protection from a bushfire, and contains many references to considering bushfire standards.

www.vba.vic.gov.au/consumers/bushfire

Glossary

Active solar heating: A system that uses roof mounted, solar exposed panels to collect heat and pump it to where it is needed

Adaptable house: A liveable house that is also able to be easily adapted to become an accessible house should the need arise. Requirements set out in AS 4299-1995, Adaptable housing

Adaptation: Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise.

Cladding: The non-loadbearing skin or layer attached to the outside of a home to shed water and protect the building from the effects of weather

Egress: An exit route or way to leave the property and vacate the area.

Fluvial: Related to rivers and streams and the deposits and landforms created by them.

Greenhouse gases: Gases that trap heat in the atmosphere, leading to 'the greenhouse effect' or 'global warming'. The primary greenhouse gases in Earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.

Greywater: Wastewater from non-toilet plumbing fixtures such as showers, basins and taps

Heatwave: According to the BoM a heatwave is three days or more of high maximum and minimum temperatures that is unusual for that location.

Impervious: Not allowing fluid to pass through.

Indigenous/Native plants: Original flora that occur naturally in an area

Impact: Impact is an effect of climate change on the socio-bio-physical system (e.g. flooding, transmission line sagging, pole fires etc.).

Lagging: Thermal insulation for wrapping around pipes, boilers

Liveable house: A house designed to meet the changing needs of most home occupants throughout their lifetime without the need for specialisation. See also 'accessible house', 'adaptable house'

Orientation: Positioning of a building in relation to seasonal variation in the sun's path and to prevailing wind patterns

Passive cooling: Technologies or design features used to cool buildings without power consumption

Passive design: Design that takes advantage of the climate to maintain a comfortable temperature range in the home

Passive heating: A system of features incorporated into a building's design to use and maximise the effects of the sun's natural heating capability

Photovoltaics: A method of generating electrical power by converting solar radiation into direct current electricity

Renewable energy: Energy that is derived from sources that are renewed by natural processes or for all practical purposes cannot be depleted, e.g. solar energy, hydropower, wind, tide, geothermal and biomass

Residential buildings: Class 1, 2 and 4 buildings as defined in the Building Code of Australia

Resilience (climate): The Intergovernmental Panel on Climate Change (IPCC) defines climate resilience as, "the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change." In a more general sense, resilience is the ability to manage and be prepared for effects, and to minimise their impact.

SHGC (Solar Heat Gain Coefficient): A measure of how much solar radiation passes through the window and the corresponding ability of the system to reduce solar heat gain.

Solar aspect: Orientation of the house in relation to the sun.

Thermal mass: Dense material able to absorb and store warmth and 'cool': the 'battery system' of passive design

Thermal performance: The effectiveness of a building envelope in maintaining acceptable levels of human comfort in the building relative to the outside weather conditions, through minimising the need for artificial heating or cooling. In relation to a particular building material or element, the extent to which the material or element reduces or promotes heat loss or heat gain

Vulnerability: Climate vulnerability is the extent to which a system is susceptible to, or unable to cope with, adverse effects of climate change including climate variability. It is influenced by its adaptive capacity.

Background

Climate data

Climate data provided in the information package is predominately sourced from the Climate-Ready Gippsland sheet available from the Victorian Government's Climate Change and Victoria website. The CSIRO website 'Climate Change in Australia' was also used (to provide information on projected time in drought in the future).

Property resilience information

Property resilience information was compiled by Ramboll Environ from over sixty leading national and international publications, including:

- Information produced by government and non-governmental organisations
- Guides prepared by statutory authorities (such as the Victorian Building Authority, Country Fire Authority, Melbourne Water etc.)
- Reports and guides prepared by various insurance industry representatives (such as Insurance Council of Australia)
- Reports and guides prepared by research institutions

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BUILDING Resilience

A guide to consider climate change for Gippsland houses

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The Heart of Gippsland

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