Melbourne Water
Enhancing Life and Liveability

CITY OF MELBOURNE

The Good Design Guide for Buildings in Flood Affected Areas in Fishermans Bend, Arden and Macaulay has been developed in partnership with Melbourne Water, City of Melbourne and City of Port Phillip.

Other government agencies that have also contributed to the Guide include:

- Department of Jobs, Precincts and Regions (DJPR)
- Department of Environment, Land, Water and Planning (DELWP)
- The Office of Victorian Government Architect (OVGA)
- Victorian Planning Authority (VPA)

For further guidance on planning and urban design, contact DELWP or your local council.

- City of Melbourne: melbourne.vic.gov.au
- City of Port Phillip: portphillip.vic.gov.au
- DELWP: delwp.vic.gov.au

For flood advice, contact:

- Melbourne Water: melbournewater.com.au

Disclaimer

The Guide, finalised in May 2021 is intended to be listed as a background document in the Melbourne Planning Scheme and includes guidance on how to achieve flood risk management objectives of both:

- *Guidelines for Development in Flood Affected Areas*, Department of Environment, Land, Water and Planning (DELWP); February 2019, ('Victorian Flood Guidelines')
  and
- *Planning for Sea Level Rise Guidelines*, Melbourne Water; February 2017 ('Sea Level Rise Guidelines')[1]

The Guide was prepared using the latest information and advice from these two Guidelines and understanding of flood risk from May 2021. Recommendations may be superseded as knowledge of risks and mitigation measures evolves. Users of the guide should ensure they have confirmed the suitability of the guidance in the document, and identified the most appropriate and up to date modelling and flood advice, prior to commencement. Please note that this guide does NOT:

- supersede any requirements of the Victorian Flood Guidelines and Sea Level Rise Guidelines or the relevant planning schemes,
- perform the role of a decision guide for the determination of applications by the relevant Floodplain Manager. This is not an Incorporated Document, or a replacement for any existing performance standard. This document does not prescribe any type of planning decision or approval from any decision making authority.

1 or the equivalent publications at the time of the planning permit decision.

Acknowledgement of Traditional Custodians

We respectfully acknowledge the Traditional Custodians of the land, the Bunurong Boon Wurrung and Wurundjeri Woi Wurrung peoples of the Eastern Kulin Nation and pays respect to their Elders past, present and emerging.

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May 2021

Glossary

1% AEP Flood Level
The 1% AEP flood level is defined as the flood level which has an annual exceedance probability of 1% in any given year. The older terminology is Average Recurrence Interval (ARI). The 1% AEP is equivalent to a 1 in 100 year ARI. The Victorian Flood Guidelines and Sea Level Rise Guidelines use the 1% AEP as a reference standard. New techniques to model the effect of climate change and sea level rise will affect the 1% AEP flood level

Accessibility
The ease of reaching destinations. In a highly accessible location, a person, regardless of age, ability or income, can reach many activities or destinations quickly, whereas people in places with low accessibility can reach fewer places in the same amount of time.

Active frontage
Refers to street frontages where there is an active visual engagement between those in the street and those on the ground and upper floors of buildings.

Annual Exceedance Probability (AEP)
The likelihood of the occurrence of a flood of a certain size or larger in any one year.

Australian Height Datum (AHD)
The Australian standard for height above mean sea level.

Coastal Flooding
Where the sea rises to flood coastal areas.

Flood
The covering of normally dry land by water. The Insurance industry defines flooding as water that has escaped or been released from the normal confines of either a lake, river, creek or other natural watercourse (whether or not it has been altered or modified), or any reservoir, canal, or dam, or drainage system.

Flood proofing
A combination of measures incorporated in the design, construction and alteration of individual buildings or structures to reduce structural damage and, sometimes, to reduce contents damage in the event of a flood.

Flood resistant buildings
Buildings that are specifically designed using flood resistant materials that provide a higher level of protection from flood damage compared to standard building construction methods.

Flood-resistant materials
Materials used in building construction that are specifically made to be capable of withstanding direct and prolonged contact with flood waters without sustaining significant damage. The use of flood resistant materials cannot remove the requirement for safe access.

Floodplain Manager
Council or Melbourne Water will be the Floodplain and Drainage Authority for the Port Phillip and Westernport regions and provides and makes decisions on applications for development on land subject to a Flood Overlay. The Floodplain Manager's primary statutory responsibility is to minimise flooding and flood damage, to avoid harm to human health and safety in the event of a flood, and ensure safe access and to protect buildings and infrastructure from flooding. This includes responsibility for making development application decisions to set the NFPL and set other requirements relating to the use, earthworks, flood management and emergency plans, to reduce the direct impacts of harm from flood water.

Finished floor levels (FFL)
The Finished floor level (FFL) refers to the uppermost surface of a floor once construction has been completed but before any finishes or floor coverings have been applied. Raising Finished Floor Levels to meet the NFPL protects people, buildings and their contents from flood hazard and damage. When flood waters rise higher than the NFPL and there are no mitigation measures in place, valuable contents such as carpets, furniture, electrical appliances and furnishings are damaged.

Freeboard
Freeboard is a term used in the Building Act (1993). It is a factor of safety above the 1% AEP flood level, typically used in relation to the setting of floor levels to reach the NFPL, land levels and apex for underground carpark entrances. The Freeboard is determined on a site by site basis and can accounts for a range of factors including wave action, localised flow effects, uncertainties in the time-period and accuracy of the 1% AEP flood level estimate and climate change.

Land use
Refers to using land for a particular purpose (such as a dwelling or a shop). It may not involve buildings.

Nominal Flood Protection Level (NFPL)
The 1% AEP flood level plus the applicable 'freeboard' results in the Nominal Flood Protection Level (NFPL). The NFPL is a term explained and used in the Guidelines for Development Flood Affected Areas (2019). All development elements of a proposed building design must ensure that the Finished Floor Levels, and apex of underground carpark entrances are not below the NFPL, except where the Floodplain Manager exercises its discretion to vary the NFPL requirement in very special site-specific circumstances. The NFPL is set by the Floodplain Manager and under the Water Act, and it may direct the Responsible Authority to refuse any development application that it determines does not meet the level of protection required to keep people safe and reduce damage in a flood hazard event. Designing a building to meet the NFPL standards carries the same weight as other Building and Planning & Environment Act requirements such as building fire or bushfire safety. Meeting the NFPL when designing a building also ensures that development permits can be delivered, as Insurers and Building Surveyors have statutory requirements around meeting the NFPL.

Riverine Flooding
River, or Riverine Flooding occurs when excessive rainfall over an extended period of time causes a river or designated waterway to exceed its capacity resulting in the river water flooding on to adjacent land.

Sea level rise (SLR)

Existing and projected rises in the level of the sea associated with climate change. This will mean that the sea will both steadily encroach on the land along the coast and the Port Phillip Bay, affect tidal patterns and decrease the ability of Melbourne's rivers and drains to discharge at existing rates.

Stormwater Flooding
Stormwater Flooding, or Drainage Flooding occurs when excessive rainfall and/or excessive runoff due to hard surfaces over an extended period of time causes an urban drainage system to exceed its capacity resulting in flooding on to adjacent land. Stormwater flooding is seen often along transport corridors (roads, train tracks, paths) as drainage systems are often underneath or next to those corridors. This is sometimes referred to as 'overland flow'.

Planning Scheme
A legislative document which regulates the use and development of land through planning provisions to achieve those objectives and policies. This document can be used as a background document to a Planning Scheme.

Private land
Land that is owned by a private person or group and kept for their exclusive use. Some privately held land is available for the public to access and use, but the land owner may control aspects of access and use – see 'Public space'.

Private open space (Private realm)
An open area or place that is privately owned and exclusively occupied. Private open space is usually attached to a private dwelling. **Public space**

An area in the public realm that is open to public access, provides a public use or recreation function, and that is owned and maintained by councils or other government agencies. However, some privately-held land is available for the public to access and use, such as a building forecourt, a walk-through, or a shopping mall. The private land owner may control aspects of access and use - see 'Private land'.

Public realm
Spaces which are open and freely accessible to everyone, regardless of their economic or social conditions. These spaces can include streets, laneways and roads, parks, public plazas, waterways and foreshores.

Overlay
An overlay is a state-standard provision. Each planning scheme includes only those overlays that are required to implement the strategy for its municipal district. Each overlay addresses a single issue or related set of issues (such as heritage, bushfire or flooding).

Zone
Prescribes land use and development requirements.


he stairs are integrated into the landscape and provide
eating opportunities.
entre of Advanced Imaging, University of Queensland,
t Lucia, Queensland

PART 1: SETTING THE SCENE

Fishermans Bend, Arden and Macaulay are three significant areas in the City of Melbourne and City of Port Phillip which are defined as urban renewal precincts. These areas will transform over the next decades to great inner city neighbourhoods, expanding the city's economic prosperity and offering high quality mixed use development.

The low-lying topography of these areas presents a range of unique design challenges. These areas and their physical challenges present an extraordinary opportunity for Melbourne to showcase its internationally renowned design capabilities. These precincts are all subject to stormwater, riverine and coastal flooding with a growing risk from sea-level rise and increased run off effects from urbanisation and rainfall intensity due to climate change.

The Guide provides a range of urban design approaches for buildings at risk of flooding. It presents guidelines and project examples that will increase the resilience of our city. The aim of the Guide is to help designers achieve good design and equitable access in flood affected areas, while managing the known hazards to human safety and property damage from flooding.

To fully realise the opportunity for design excellence and innovation in the precincts, the guide should be used in consultation with the relevant authorities. Early engagement will help determine design solutions appropriate to the local context, including responding to the specific flooding characteristics of a site.

The approaches to manage flood risk outlined in the guide are applicable to Fishermans Bend, Arden and Macaulay. They are not applicable to other areas in the greater Melbourne area, including other urban renewal precincts. Fishermans Bend, Arden and Macaulay differ from other urban areas in that they have drainage strategies to manage and mitigate flooding into the long term.

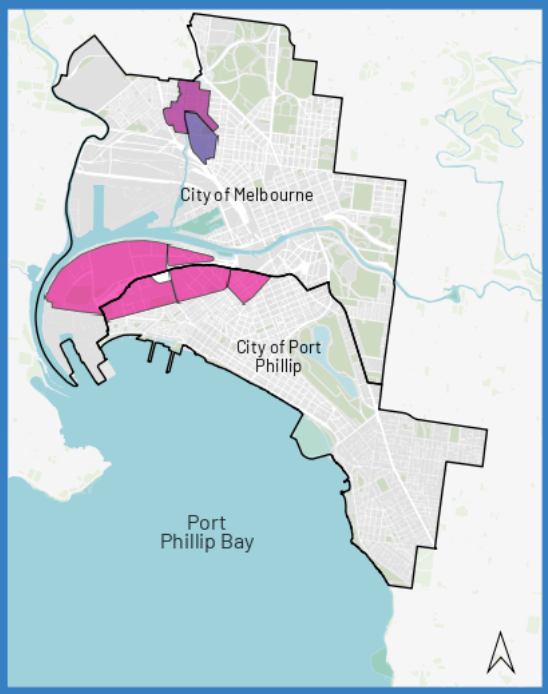
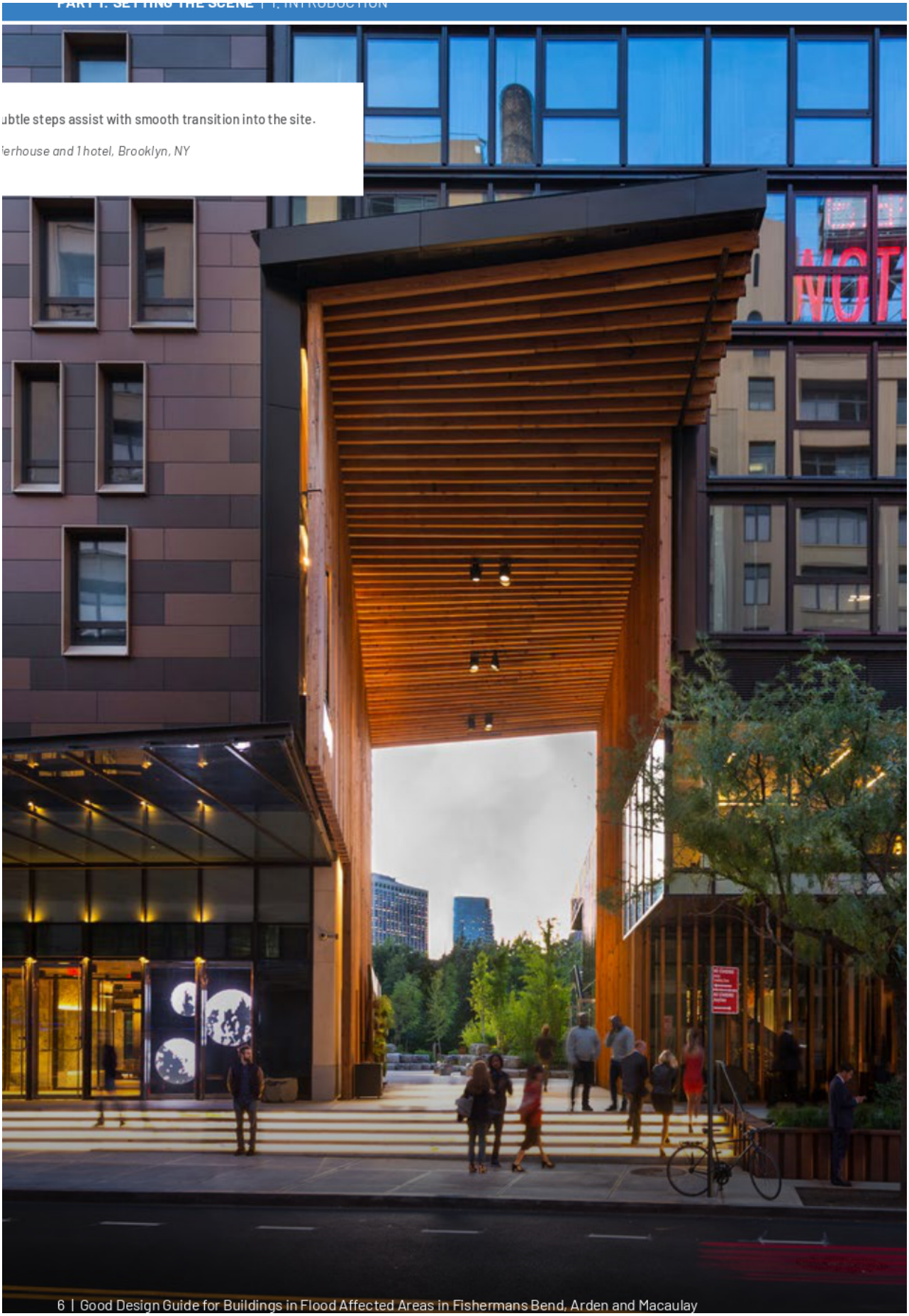


Figure 1: Map of the urban renewal areas where the Guide applies.


ubtle steps assist with smooth transition into the site.
erhouse and 1 hotel, Brooklyn, NY

Section 1: Introduction

The purpose of the guide is to support the architectural and building design process to respond to the challenges of mitigating flood hazard risk and create engaging human-centred spaces. The guide seeks to support the delivery of the established visions for these state significant urban renewal areas and provide a 'one government approach'.

The guide may be listed as a background document in the Melbourne Planning Scheme and City of Port Phillip Planning Scheme and provides information to assist in designing private development in the flood affected areas of Fishermans Bend, Arden and Macaulay. It is a shared resource for councils and the private development sector to be used to explore design solutions at the start of the design process.

The role of the Guide is to provide guidance on how development can achieve flood responsive design, good design and equitable access and universal design. These are defined as:

Flood Responsive Design

Flood responsive design is defined as how the design of the urban environment responds to flooding. It involves designing buildings and the urban environment so that risks from flooding to property, life, health and safety are appropriately managed.

Good Design

Good design is defined as places that are people-centred, activated, equitable and resilient.

For more information on the design principles and guidelines refer to Part 2 of the guide.

Equitable Access and Universal Design

The design of buildings and places to make them accessible to all people, regardless of age, disability, background or any other factors.

For more information on universal design and the potential impact flooding can have on achieving this refer to page 19.

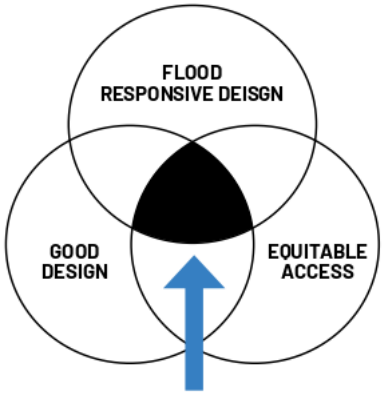


Figure 2: The Guide seeks to achieve good design and equitable access in flood affected areas, while also minimising hazards and property damage from flooding.

1.1 Using the Guide

The Guide is in two parts. *Part 1: Setting the Scene* provides background to the specific challenges of the precincts. It is intended to provide clarity and context to the second part of the Guide.

Part 2: Design Guidelines, identifies design principles that should be used when designing buildings to consider whether the proposed design achieves good design and equitable access in flood affected areas, while also seeking to remove hazards to human safety and mitigate property damage from flooding. The Design Guidelines are divided into the following four themes ordered according to scale:

- urban structure
- site planning
- public interface
- design detail and management

The Guide provides built-form solutions to mitigate the effects of flooding, and achieve good design outcomes.

It is supported by a range of illustrations and images to visually communicate preferred design outcomes and those to be avoided in flood affected areas.

Who should use this guide?

- **Landowners and developers** can use the Guide to better understand processes and requirements for buildings in flood affected areas in Fishermans Bend, Arden and Macaulay.
- **Industry professionals** including architects, landscape architects, planners, designers, engineers and builders can use the Guide to guide design, planning and construction of buildings in flood affected areas.
- **Council officers** with relevant responsibilities for implementing urban design policies and standards, can use the Guide to assist in the management of planning applications in flood affected areas and ensure the development achieves the highest possible solutions to balance both flood hazard mitigation and good urban design outcomes on a site by site basis.

Due to the complexity of designing in a flood affected area, pre-application discussions with the relevant planning authority and with the relevant Floodplain Manager is strongly recommended. The Floodplain Manager's responsibilities and requirements under the Water Act are not altered by this document.

Where the Guide applies

The Guide is a Background Document that provides information to assist in understanding the flood hazard context and policy when designing private development in the flood affected areas of Fishermans Bend, Arden and Macaulay. Background Documents have only a limited role as they are not Incorporated Documents and cannot be used as decision making performance criteria on any type of permit decision.

The focus of the Guide is flood management solutions for buildings on private land, including areas that are open to public access. It also includes opportunities where public realm interventions and partnerships with neighbouring properties may be the best way of achieving flood management solutions.

For more information on policy context of the Guide and information on who manages flooding in these precincts refer to the Appendix.

Beyond minimum compliance: flood risk

This guide may also be useful to building owners who voluntarily choose to exceed the current minimum flood protection requirements as part of safeguarding their investment in the longer term. This more conservative approach recognises factors such as:

- major flood events can be more severe than the minimum flood level required by policy (refer to Flood Level in Glossary)
- current predicted flood levels will be regularly revised in the future due to availability of data from observed flood events, infrastructure changes and predictions of future rainfall and climate change impacts
- designing with a precautionary response to risks is more likely to produce resilient and enduring places.

For buildings subject to impacts of long-term sea level rise and permanent development proposals that have an anticipated life span in excess of 70 years, it is prudent to incorporate flood resilient design at levels above the current guidance for a 0.8m sea level rise by the year 2100. This is because estimates of sea level rise are uncertain and sea level rise will continue well beyond 2100.

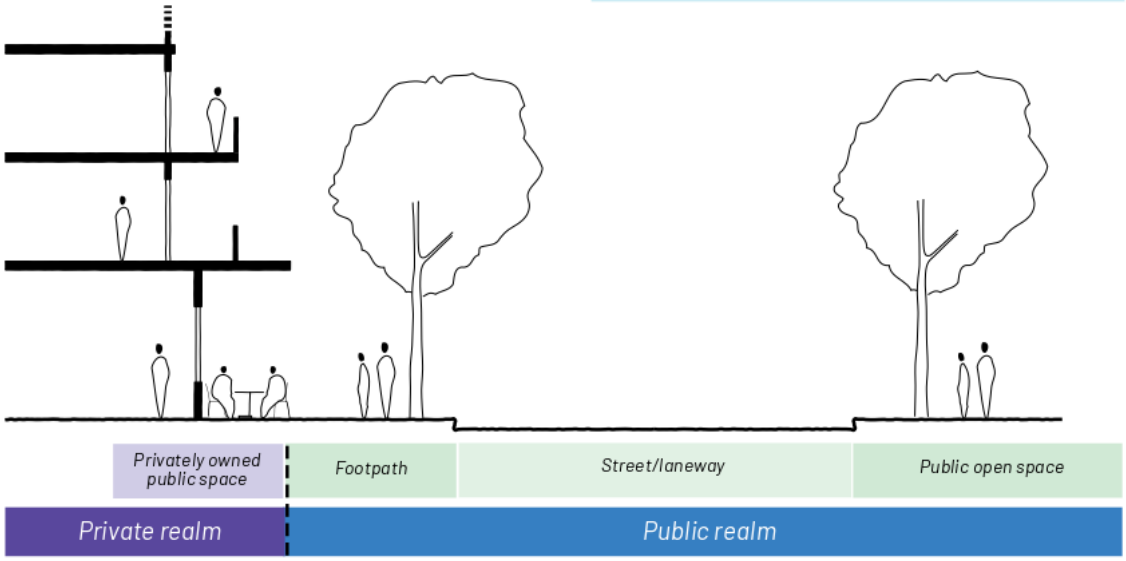


Figure 3: Public realm and private realm

Section 2: Flooding and design

Explaining 1% AEP flood level and minimum floor levels

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2.1 Managing flooding in the urban renewal areas

Fishermans Bend, Arden and Macaulay will play an important role in accommodating significant residential and employment uses over the next 30 years. It is projected that up to 105,000 residents and 123,500 workers will be located within the precincts by 2050.

Water and flooding have always been a part of life in these low lying areas. They were once natural floodplains and marshes, and were drained for less-sensitive urban uses such as industry. It is important to recognise that flooding will always occur, and to celebrate water as a part of the urban landscape in order to create great places that are safe and liveable. Designing to minimise flood impact is complex as each site has different conditions and constraints that require tailored solutions.

These urban renewal precincts provide an opportunity to create a positive relationship with the management of water in the landscape and streets as part of their identity. This can be achieved by developing an integrated approach to water management across the public and private realm. Flood management strategies include a combination of levees, pipes and pumps, water sensitive urban design, blue and green streets and water detention in open space.

For more information about these strategies, please refer to the latest Precinct Plans, Structure Plans and related strategies, including Arden Structure Plan, Macaulay Structure Plan, Fishermans Bend Precinct Plans or the Fishermans Bend Water Sensitive City Strategy. Together the implementation of these strategies aims to decrease the severity of impact of flood hazards and future flood events, but cannot eliminate those events or their impacts.

In the private realm, it is up to designers and developers to continue celebrating water in the landscape by creating resilient and accessible spaces and buildings and buildings with active frontages to the streets. Each building should contribute to the safety, vibrancy and amenity of the public realm - streets and spaces contribute to Fishermans Bend, Arden and Macaulay being great future places in the city.

2.2 Types of flooding

The urban renewal are flood prone due to their location and the low-lying landscape. They are subject to three sources of flooding: coastal, riverine and stormwater. Different types of flooding trigger different planning controls.

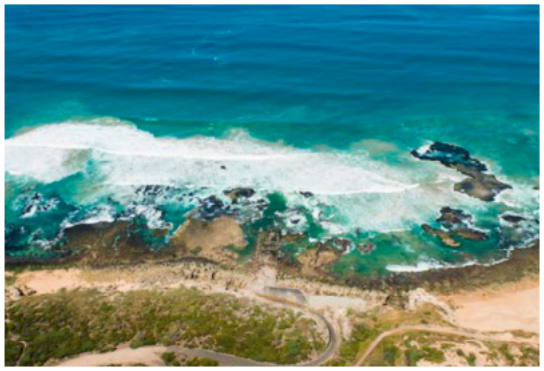


Figure 4: Coastal image. Source: Melbourne Water

Coastal flooding

Coastal flooding is flooding of low-lying areas by ocean waters caused by higher than normal sea level, due to tidal or storm-driven coastal events, including storm surges in lower coastal waterways.

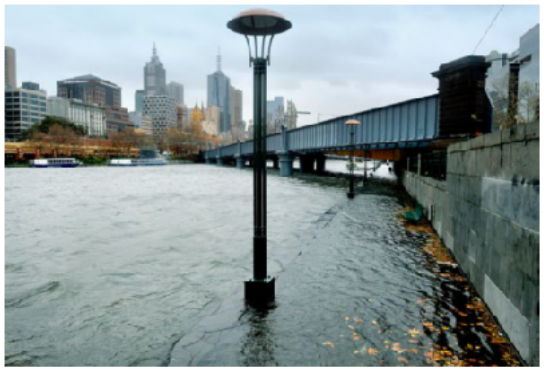


Figure 5: Riverine flooding. Source: Melbourne Water

Riverine flooding

Riverine flooding is the covering of normally dry land by water that has escaped or been released from the normal confines of a lake, river, creek or other natural watercourse (whether or not altered or modified) or a reservoir, canal or dam.

Figure 6: Stormwater flooding on Stubbs Street, Kensington. Source: Melbourne Water

Stormwater flooding

Stormwater or overland flooding is defined as inundation by local runoff caused by heavier than usual rainfall. It can result from local runoff exceeding the capacity of an urban stormwater drainage system or water backing up urban stormwater drainage systems.

Guidelines for assessment

Where land is affected by coastal, riverine or stormwater flooding, development applications are assessed by the relevant Floodplain Manager against the Victorian Flood Guidelines and any other relevant legislation or requirements. If the land is also affected by sea level rise, it is also assessed under the Sea Level Rise Guidelines.

2.3 Building design for managing flood risks

The complex challenge of designing for a flood affected site requires a good design process that is:

Collaborative

The design is informed through consultation with planning and floodplain management authorities and multidisciplinary teams. These teams could include planners, urban designers, landscape architects, architects, engineers and drainage experts.

Iterative

The design tests, evaluates and refines a range of options before identifying the most appropriate solution for a particular site.

Site specific

The design responds to variables such as:

- flood depths (including required freeboard) which determines the Nominal Flood Protection Level (NFPL)
- flood flow velocities, which together with flood depth, is an important consideration for site and access safety
- topography
- planning requirements, such as land use, building setbacks and activation
- asset protection and maintenance considerations including stormwater connections and land required to protect access needs and ensure that future upgrades to networks are taken into account[2]
- property size and width of street frontage
- relationship to adjacent sites, streetscapes and broader context
- vehicle, bike rider and pedestrian access requirements

This can be shown through providing:

- Existing survey plans taken by or under the direction and supervision of a licensed land surveyor showing natural ground level, the current Flood Level, and the ground and finished floor levels of any existing to Australian Height Datum (AHD)
- Proposed plans, elevations and section drawings (1:50 or 1:20) showing the proposed ground and finished floor level and the Nominated Flood Protection Level (NFPL) of all new structures on the land

Potential flood protection strategies

Raising floors to the NFPL is the expected normal flood-protection strategy.

In flood affected areas, the building floor level should be elevated to the Nominal Flood Protection Level (NFPL) to protect people, furniture and goods from flood. The required NFPL is determined by the floodplain manager[2] and may vary according to each particular location and the type of flooding. Different NFPL, setbacks, size and shape of the property require different solutions.

The bigger the difference between NFPL and the natural ground level, the larger the space required to transition from footpath to floor level. The design of these areas, called transition zones, is a key focus of the guide.

The level change between the public realm and elevated floor levels may result in access and street activation challenges, but these can often be resolved through the range of design strategies outlined in the guide.

Where these problems cannot be resolved, the floodplain manager has the discretion to reduce freeboard. Such discretion is only given in very special circumstances and is an option of last resort.

These very special circumstances will be assessed against all regulatory requirements. Applicants will normally be required to provide a written Flood Risk and Design Statement to provide a description of the siting and design of the buildings and works or in association with the use and occupation of all aspects of the proposal. This is to allow the relevant Floodplain Manager to assess the risk to individuals, property, infrastructure and the environment. This could include details of measures that are proposed including adaption options such as planned retreat, setbacks, accommodation of changes through floor heights, site, landforming and proposed drainage works.

An example where discretion can be applied to reduce the NFPL in these precincts occurs in relation to coastal flooding from sea level rise in Fishermans Bend.

Where discretion to reduce the standard has been given, building elements below the NFPL should incorporate flood resilient design and detailed construction strategies included in sections 4 and 5 of the Guide.

1 Contact the relevant Floodplain Manager for more information for designing your building around asset protection and maintenance requirements

2 Contact Melbourne Water or Council if you are unsure who the relevant Floodplain Manager is for your site

Fishermans Bend Floor Level Considerations

The Fishermans Bend precinct is low lying and has land that is currently affected by stormwater flooding, riverine flooding from the Yarra River and tidal inundation, as well as being vulnerable to future sea level rise effects.

This presents a significant design challenge in trying to transition from low-lying footpaths to the NFPL for coastal flooding, in particular, whilst still being able to achieve a good design outcome and equitable access. As a result, a levee is currently proposed to be constructed by Melbourne Water (subject to further regulatory consideration and approval). The intent of the levee is to mitigate flood risk associated with coastal flooding. Contingent on the construction of the levee, and following a consideration of site specific flooding characteristics and relevant planning considerations, finished floor levels for commercial lobbies and retail spaces could be reduced. However, flood-sensitive uses and building elements should still be elevated above the NFPL to reduce the risk to life and property, and to enable efficient recovery from flood.

In this context, examples of flood-sensitive uses and elements include:

- Sensitive uses such as residential dwellings, offices and lift lobbies - places where people sleep or may not be able to readily exit in a flood event.
- Essential services, including electrical substations, communications switchboards, lift motor rooms, fire boosters

Flood safety

Flood safety is defined as the risk to life, health and safety of people resulting from a flood event.

When considering redevelopment of properties in Fishermans Bend, Arden and Macaulay, one of the key considerations of flood safety will be whether site access and egress can be achieved.

The Victorian Flood Guidelines specify safety criteria for development, including that development should not be allowed where the depth and flow of floodwaters would be hazardous to people or vehicles entering or leaving the property. This is assessed by reference to the depth and velocity of floodwaters during a 1% AEP flood event.

For a detailed description of flood safety, see the Victorian Flood Guidelines. To understand the specific requirements for access for your site, contact Melbourne Water.

If the levee is built as planned, this may allow for the possibility of minimum floor levels being reduced below the NFPL freeboard reduction for coastal flooding for commercial lobbies and retail spaces in Fishermans Bend, floor levels should still be elevated above the NFPL for stormwater or riverine flooding, whichever is the higher (refer example in Figure 7).

If the levee is not built this guideline will be updated.

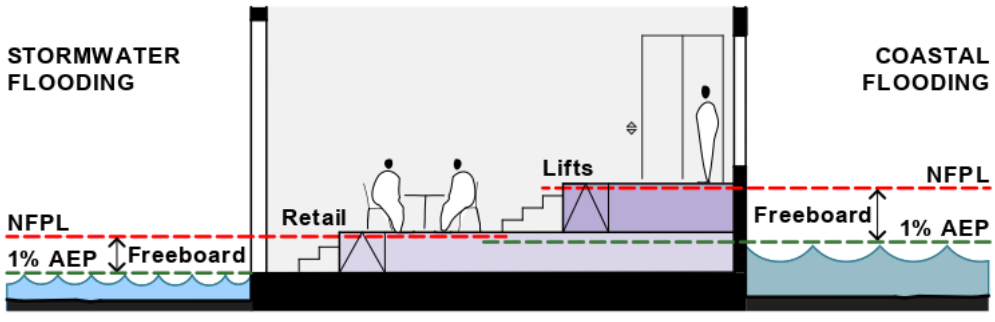
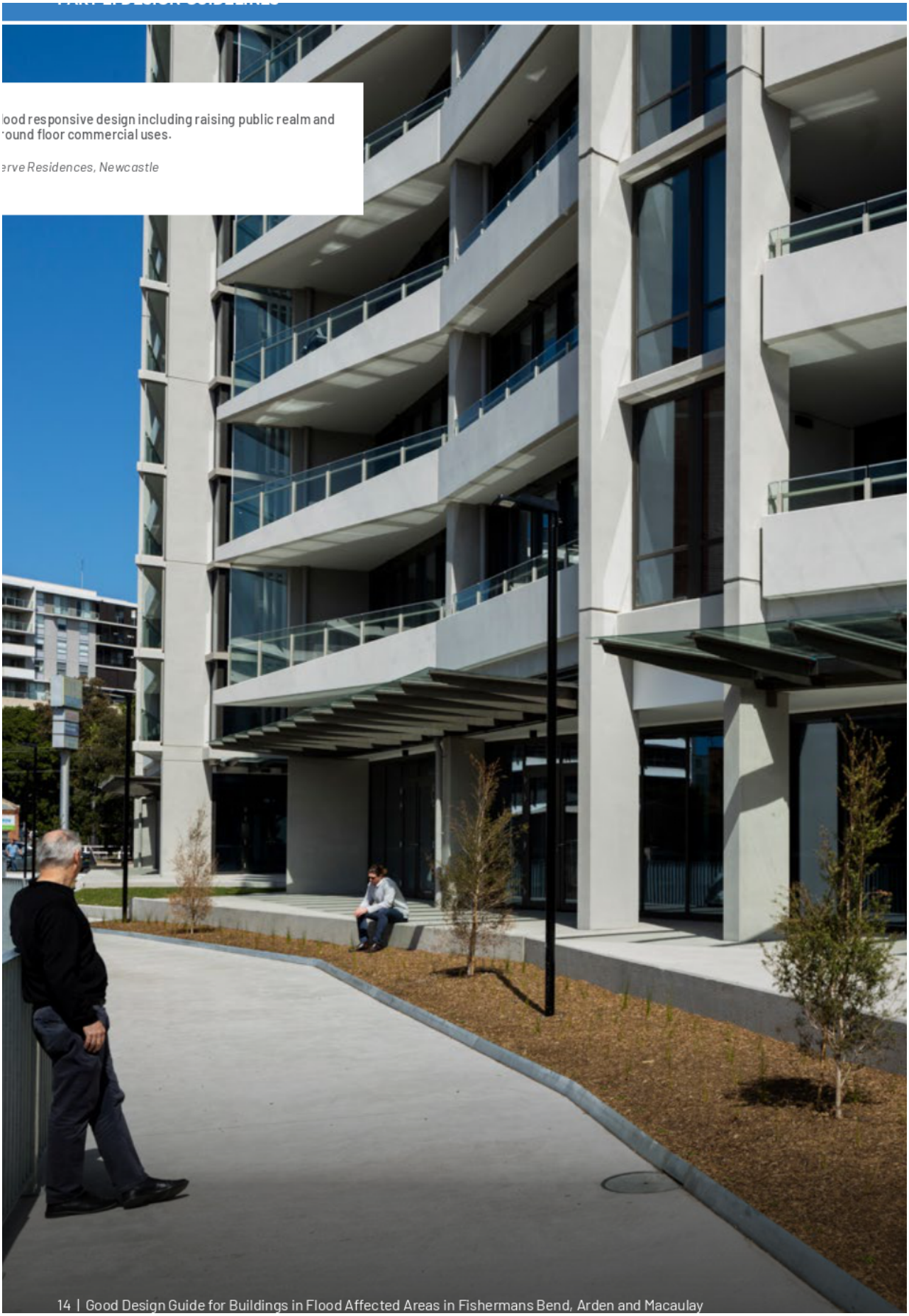


Figure 7: Fishermans Bend example demonstrating different floor level requirements for stormwater and coastal flooding


lood responsive design including raising public realm and
round floor commercial uses.
erve Residences, Newcastle

PART 2: DESIGN GUIDELINES

This section of the Guide illustrates approaches to achieving accessible and vibrant buildings and public realm while also managing flood risk. Design interventions can occur at various scales, from an urban structure to building detail, and design solutions at a larger scale can influence the degree of design freedom at a smaller scale. It is therefore recommended that each section of the Guide is reviewed in the presented order to ensure the most efficient and effective solution is achieved. By thinking through the different scales of design, future development will better respond to both the urban context and possible flood risks in an integrated way.

The following table gives an overview of flood management strategies included in this section: Part 2: Design Guidelines.

Location	Flood management design strategy
	1. Design principles
External	2. Urban structure, including: a. raising the level of any proposed new public spaces b. raising existing footpath level in front of the site where appropriate
	3. Site planning, including: a. raising the level of any proposed publicly accessible open spaces b. use existing topography to locate access and egress points and flood sensitive elements above flood level.
	4. Public interface, including: a. External transition
Internal	b. Internal transition
Details	5. Design detail & management

Section 1: Design Principles

1.1 Design principles

Urban renewal present opportunities for new development to be designed to create resilient places. The Guide offers solutions to address flood risk while creating a vibrant place.

The design principles should inform the design of applications and provide a benchmark to assess whether the overarching aims of the Guide are being achieved.

Successful designs will meet the objectives of all of these principles to create an integrated design response.

Vision and policy

The design solutions are guided by strategic and water policy to deliver on the established visions for the precincts

Will this design deliver the vision?

Flood resilience

Risk to life, health and potential for property damage is mitigated.

Will it be safe? Is the building resilient to flooding?

Place resilience

Design strategies respond to place specific conditions.

Is the building resilient to the changing water conditions?

Equitable access/universal design

Dignified access is achieved for people of all abilities.

Will it be equitable for all?

People centred

Solutions enable and enrich social connections.

Are we making places for people?

Activation

Dynamic, active and interesting for everyone.

Do you want to stay, and come back?

1.2 Design considerations

Defining universal design

- Universal design is the design of buildings and places to make them accessible to all people, regardless of age, disability, background or any other factors.
- Incorporating universal design into the earliest stages of projects allows seamless integration of inclusive features, which effectively makes them 'invisible' and without stigma for users. For example, creating step-free public pathways requires an integrated approach at the concept design stage and gives preference to walkways with gradients less than 1:20 rather than conventional ramps with 1:14 gradients.
- 'Access' and 'accessibility' refer to fulfilling a set of measurable requirements as prescribed in legislation, such as the Building Code of Australia, and other relevant standards, such as the Australian Standard AS1428 Design for Access and Mobility.
- Adding accessible elements into a project as an afterthought or retrofit solution often leads to poor design and inequitable access outcomes.
- Universal design is a particularly important consideration in flood affected area, particularly where the ground level is elevated to mitigate flood risks.
- Flood prone areas may require significant changes in grade to achieve the NFPL. Universal design is critical to ensuring all may access the building with dignity rather than requiring some to take circuitous routes to access the same spaces.

Figure 8: An internal ramp brings people to the core of the building at a higher level.

Brunetti, Flinders Lane

1.2 Design Considerations (cont)

Defining people centred and activated places

The transition zone is an area where steps and ramps provide universal accessibility between the public realm and elevated ground floor level.

Transition zones for street frontages should be designed to:

- provide legible and equitable access
- provide a direct visual connection between levels
- relate to the human scale
- contribute to the use, activity, safety and interest of the public realm
- be durable and sustainable

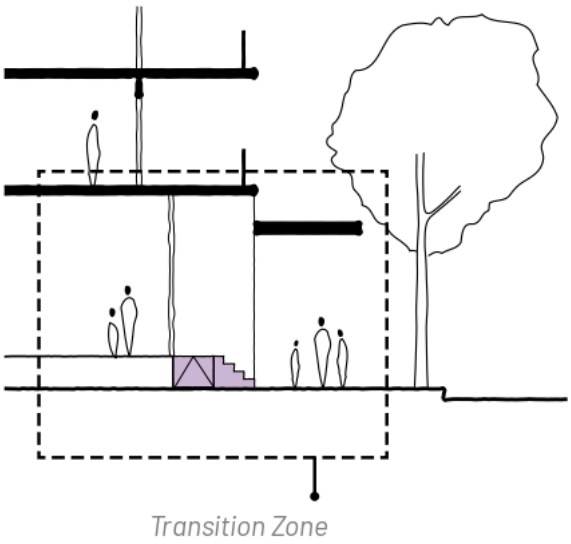


Figure 9: Transition zone is the area between the public and private realm.

Figure 10: Playful, human-scaled windows invite engagement with the passing public. The concrete base of the wall provides protection from floodwaters.

Ian Potter Southbank Centre, Southbank

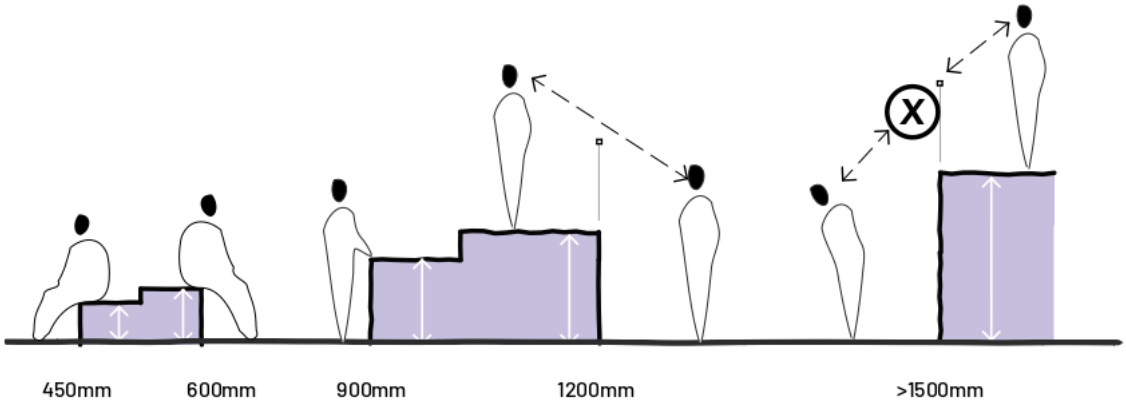


Figure 11: Design of level changes must take human scale into consideration.

Human Scale

A liveable and welcoming urban environment relates to the human scale, particularly our senses, our field of view and the dimensions and proportions of the human body at ground level. Designing for the human scale incorporates the following typical height thresholds:

450mm

Common seat height, provides opportunities for sitting.

900mm to 1000mm

Common bench and balustrade heights provide opportunities for resting and leaning, while also maintaining visual openness.

1200mm

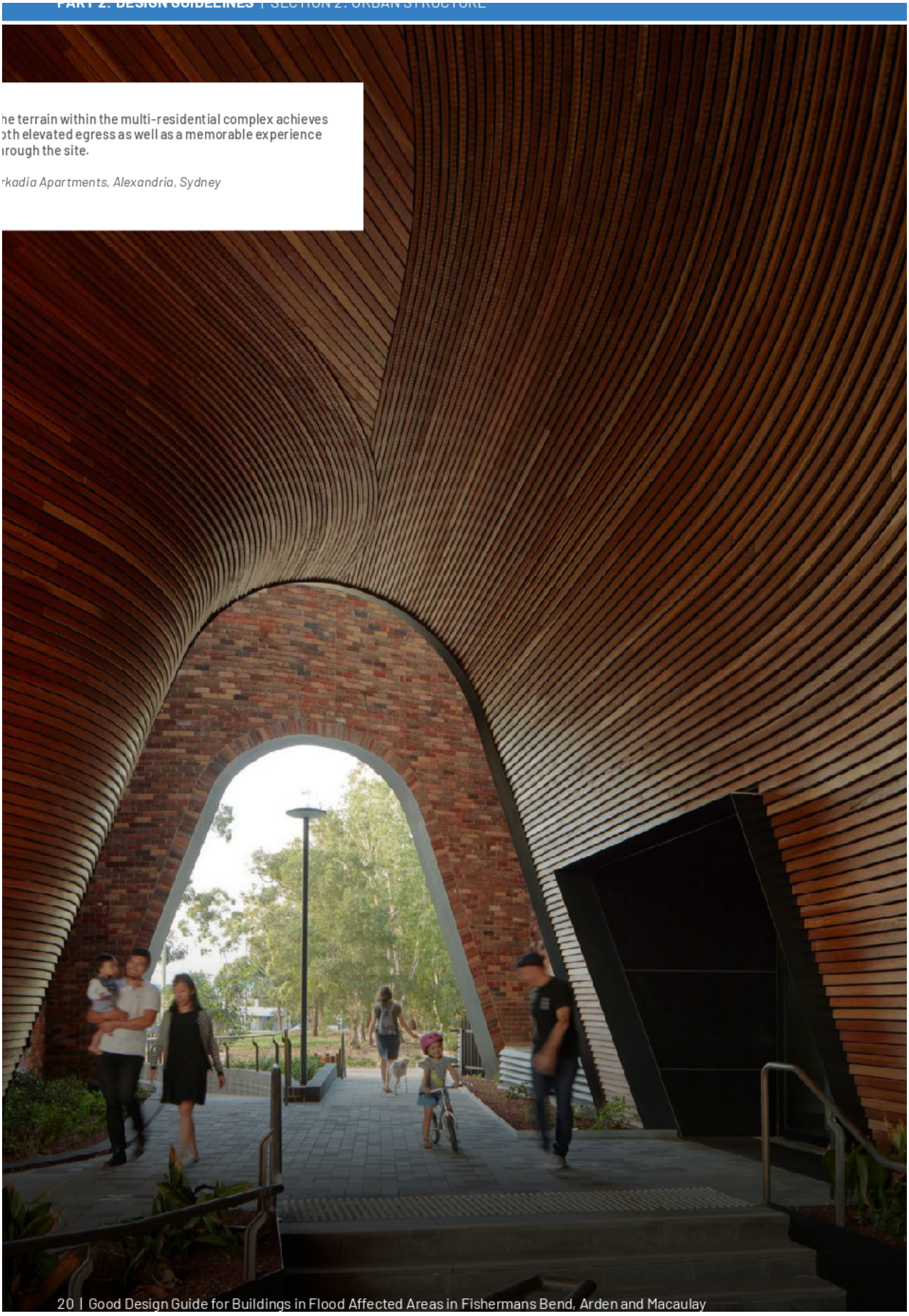
Maximum height capable of maintaining eye level sightlines between floor levels.

1500mm

An approximate head-high level difference that creates significant physical and spatial separation between levels and is discouraged as single step

Figure 12: Seating opportunities can be incorporated into stairs and ledges.

Centennial Park Bicycle Hub, Sydney


he terrain within the multi-residential complex achieves
oth elevated egress as well as a memorable experience
rough the site.
rkadia Apartments, Alexandria, Sydney

Section 2: Urban structure

2.1 Introduction

Urban structure relates to the network of streets, laneways and open spaces which define the size and shape of urban blocks.

While the focus of the Guide is on design of the private realm, there are some circumstances where the public realm adjoining a site presents an opportunity for implementing flood-responsive design strategies. Further opportunities are created where privately owned sites propose new publicly accessible spaces, such as laneways, streets, plazas and parks.

Public realm solutions include strategically placing any new streets, laneways and open spaces to elevated levels and improve access and egress to building entrances during flood events. These solutions enable equitable access through precincts by minimising level differences between public areas and building entrances. Larger development sites may also present opportunities for public (or semi-public) realm interventions. For example, larger sites can deliver private laneways, paths and open spaces that are designed either above flood levels or to withstand flooding while maintaining equitable access.

In some circumstances, the public land adjoining a site may be able to be raised, whether as part of a larger public realm transformation works or locally at the footpath level. However, raising of existing street levels can be challenging due to existing trees and services, and the need for the street to maintain capacity for conveyance of flood waters.

2.2 Streets

The following should be considered:

- Where new public streets and lanes are proposed, strategically placing new connections outside of the flood area or raise levels above the flood level.
- Existing street levels may be raised in front of a subject site as part of a planning strategy or capital works plan, such as creating a new linear park. While this strategy is only available in specific locations, it will benefit most property sizes and types. Refer to example in Figure 14.
- Existing footpaths in front of a subject site may be able to be raised if all of the following can be achieved:
  - Properties with wide frontages or several narrow properties work in partnership to coordinate an integrated design outcome
  - Appropriate public realm design quality and character are demonstrated to the satisfaction of the planning authority and Public Land Owner
  - Where works are paid for by developer, unless otherwise agreed by the Public Land Owner.

Note: Any transitions in grade need to be gentle, preferably with gradients less steep than 1:20. In general, this will only result in creation of small level changes, less than 0.5m. Refer to examples in Figures 14 and 16.

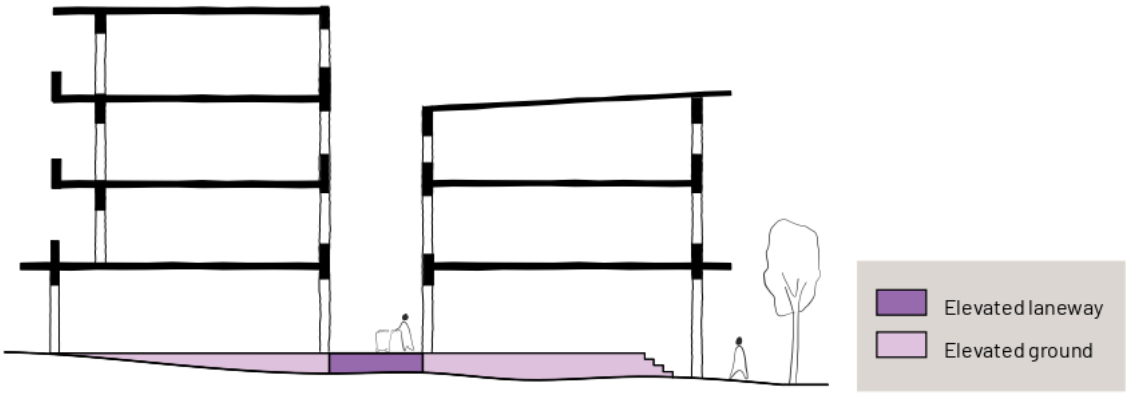


Figure 13: A raised laneway enables flat access in and out of the building.

2.2 Streets

Figure 14: The raised footpath protects pedestrians from flood and enables level transitions into buildings. Steps and ramps are integrated into the streetscape with greenery. Water Sensitive Urban Design can be incorporated into the garden bed to capture and treat stormwater. Raising the footpath can encumber the flexibility of the public realm to adapt in the future and is only appropriate in certain circumstances where it has been proven to be the best solution.

Figure 15: Raised footpath along a section of the street allows for accessible transition between two levels.

Magazine Street, New Orleans

For information about public realm strategies for Fishermans Bend, Arden and Macaulay, applicants are encouraged to engage with the relevant planning and Floodplain Management authorities, and also refer to the latest Precinct Plans, Structure Plans and related strategies, including Macaulay Draft Structure Plan, Arden Draft Structure Plan, Fishermans Bend Precinct Plans or the Fishermans Bend Water Sensitive City Strategy.

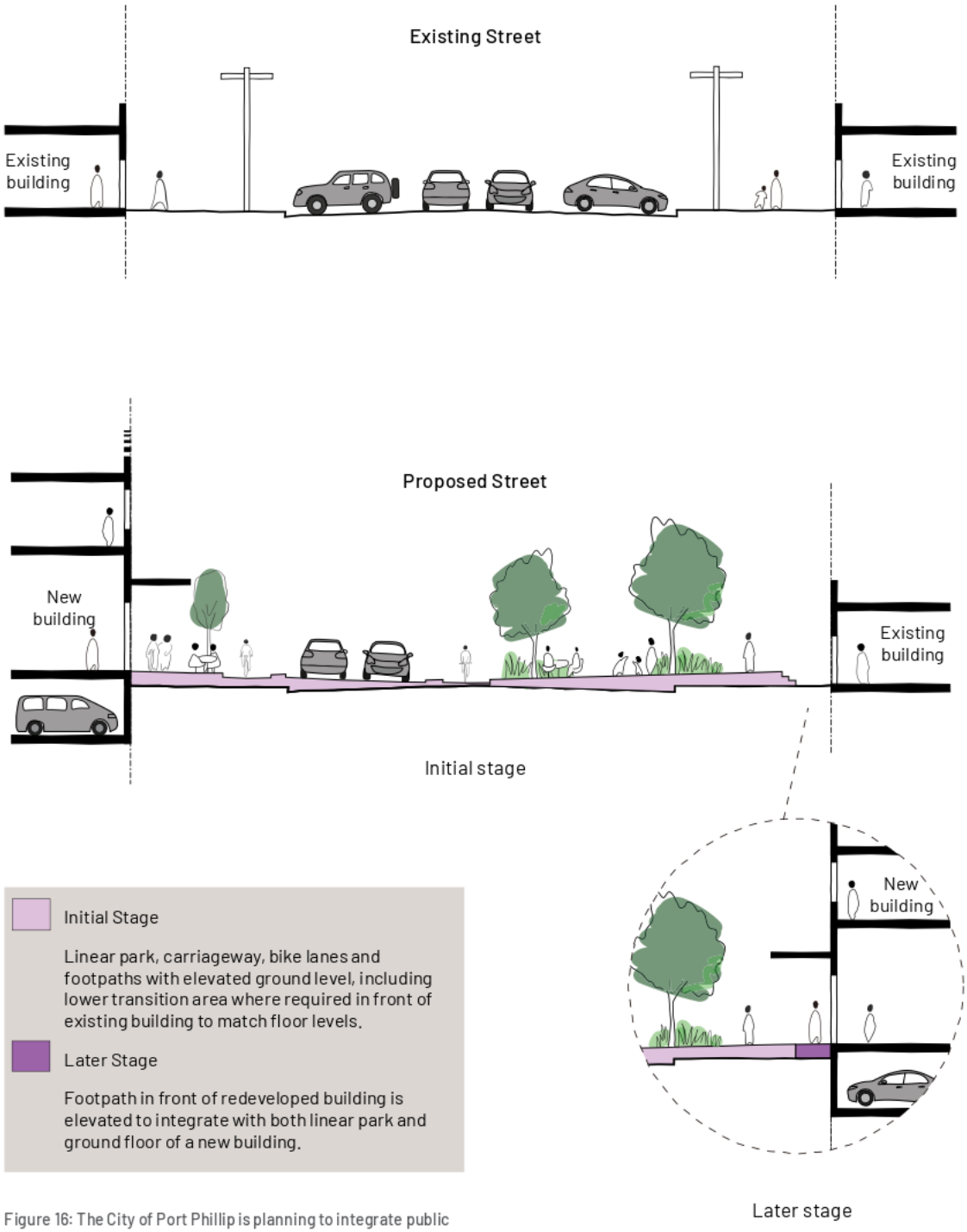


Figure 16: The City of Port Phillip is planning to integrate public realm raising with a delivery of a linear park in Montague Precinct, Fishermans Bend.

2.3 Open spaces

New open space located within a flood affected area should be designed to withstand and recover from a flood event.

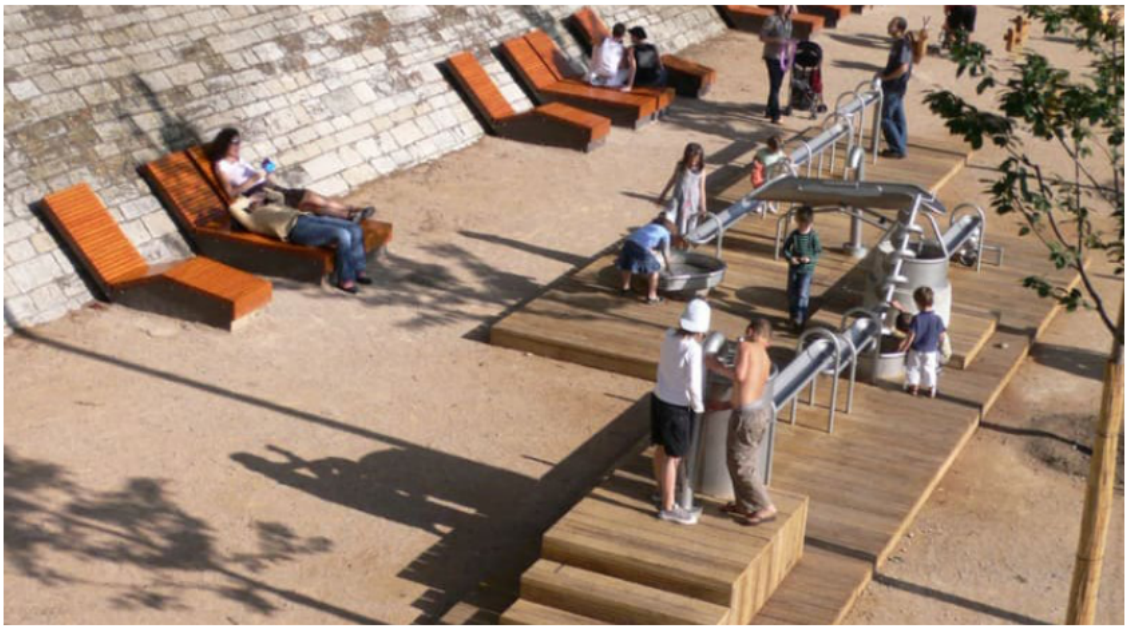


Figure 18: The playground and benches must be flood resistant with no loose fill. Water play elements need to be carefully designed as they are at high risk from flood damage.

Rhone Riverbank, Lyon

2.4 Partnerships

Partnering with the government or adjacent property owners may increase the number of viable flood design strategies for a site, particularly for small sites with little room to integrate a transition zone. For example, shared transition zones may be created in the public realm or private realm to achieve smoother access, more usable spaces and better integrated outcomes.

Partnership with the government

There may be an opportunity to raise the street, laneway or footpath, depending on the suitability of the individual location. Refer to information about planned public realm interventions in structure plans and contact the relevant Council for further information.

Partnership with neighbouring property owners

Creating a shared transition zone with a neighbouring property may be an access solution for both properties. If developments do not occur at the same time, permit conditions, legal agreements or other binding provisions need to be made to ensure access to the properties at different stages of their developments and to ensure that anyone and everyone stays safe.

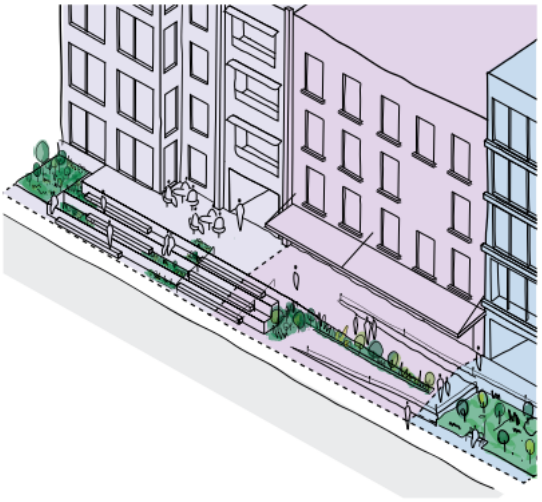


Figure 17: Retail and commercial streets with substantially sized plots may be able to accommodate a shared front terrace along the street. The terrace would provide universal access from the street to each property, as well as other usable space for seating, visual merchandising and landscaping. With careful coordination across multiple properties, this approach would support equitable access as well as active and cohesive streetscape.

Figure 19: The sloped pedestrian laneway provides universal access to elevated building entries as well as outdoor dining terraces and an arcade.

Although privately owned, the laneway functions as a public laneway, welcoming everyone.

Steam Mill Lane, Darling Square, Sydney

Figure 20: Universal design is achieved through a public realm that is raised above the river corridor.

The terraced creek edge and amphitheater activate the creek and protect university buildings from flooding.

Union Court, Australian National University, Canberra

Figure 21: The raised pathways in the multi-residential complex provide level egress and safe access on a sloped site.

Assembly Apartments, North Melbourne

Section 3: Site planning

3.1 Introduction

Considered site planning can be an important flood responsive design strategy. When arranging elements on a site, cues should be taken from the existing and proposed interfaces and local conditions to ensure the development responds positively to its context.

Considering these issues at site-planning stage makes it easier to adopt innovative and integrated solutions and will reduce design challenges at later stages. It is also important to consider access requirements at this stage to ensure enough space is provided at suitable locations.

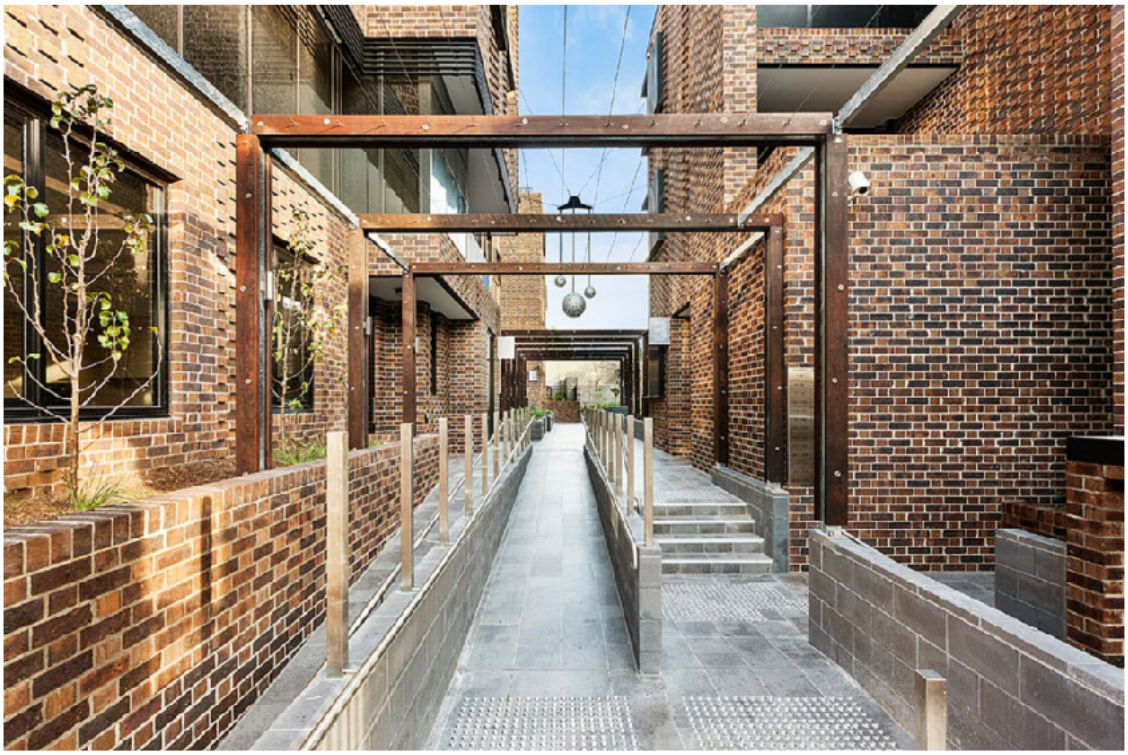


Figure 22: Internal pathway through sites provides access to apartments.

Gipps Street Apartments, Abbotsford

3.2 Access and egress

Maintaining access to and from a building at all times is crucial for mitigating the risk to people's lives in the event of a flood. Good building design will work with the terrain and knowledge of the site to make it easier for emergency services to access a building and for users to come and go.

- Locate building entries and vehicle access at high points of the site and/or above the Nominal Flood Protection Level (NFPL).
- Provide safe routes to place of refuge during a flood event (within or external to site).
- Landscaping or integrated art can also play a role in integrating elements into the overall design.

What is the Nominal Flood Protection Level (NFPL)

The 1% AEP flood level plus the applicable freeboard, as defined in Guidelines for Development in Flood Affected Areas (DELWP 2019). For more information refer to Section 2: Flooding and design and the Glossary. Contact Melbourne Water to obtain advice on the 1% AEP flood level and NFPL applicable to your property.

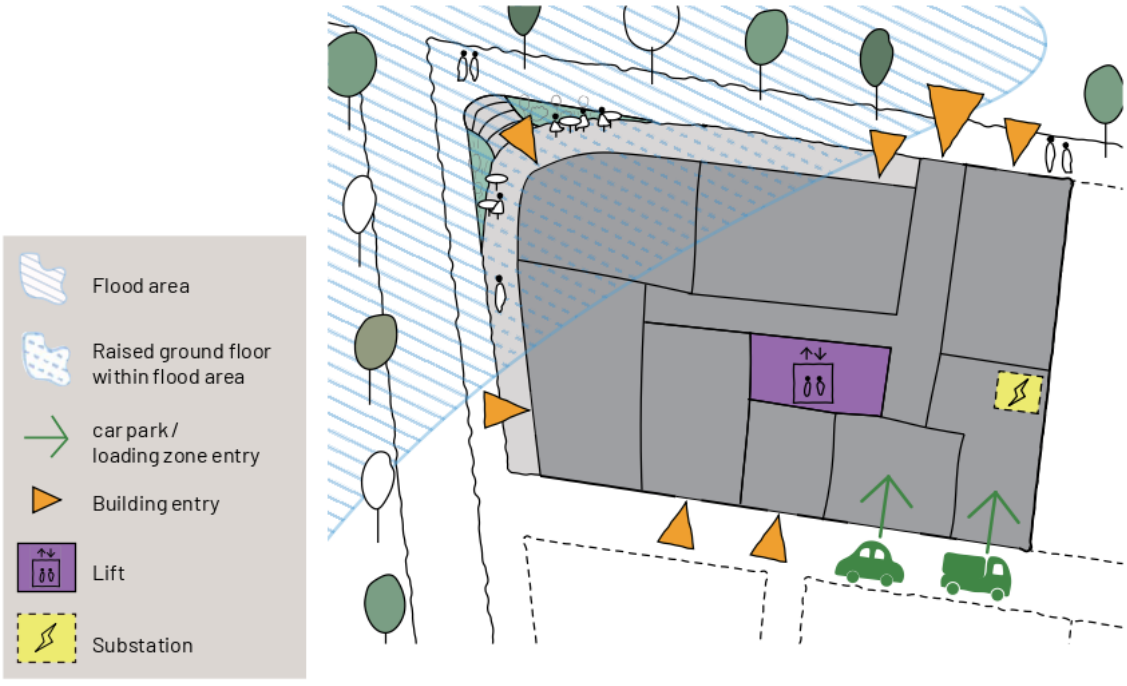


Figure 23: Building entrances are located above the flood line on natural ground and the elevated ground level via a colonnade with raised terrace. Access to car parking and loading zone is located outside of flood area at the rear of the property. The lift and substation are also located outside and above of flood area.

Figure 24: The level change is visually softened by the lawn space at a sitting height.

Hibernian Place, Perth

3.3 Siting of uses and essential services

A site layout should respond to the topography across the site and essential services should be located to protect them from flooding. This is done by locating them at or above the NFPL. Examples of essential services include electrical substations, communications switchboards, lift motor rooms, fire boosters.

The siting of land uses across a site should be compatible with flood hazard. The careful planning and layout of land uses can help facilitate designs that can achieve minimum floor level requirements along with activation and access outcomes. Priority activation areas should be located so as to avoid the need for transitions with significant changes in grade.

3.4 Basements and car parks

When considering including carparks or basements in flood affected areas designers should ensure entries to underground car parking are protected by a continuous apex of any entry or exit ramp that is at or above the NFPL.

Due to risk of failure, mechanical flood gates or doors at car parking entrances are not generally supported by Melbourne Water. However, for flooding associated with sea level rise, Melbourne Water may exercise its discretion on a site specific basis to permit other mitigation solutions such as self-closing floodgates to provide sufficient protection. Melbourne Water will only consider such a solution where local constraints are such that it is not feasible to provide a continuous apex at or above the NFPL. Refer Section 4.5.

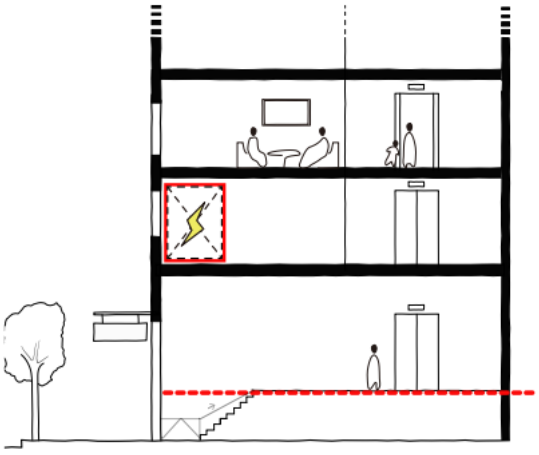


Figure 25: Essential services must be located above NFPL.

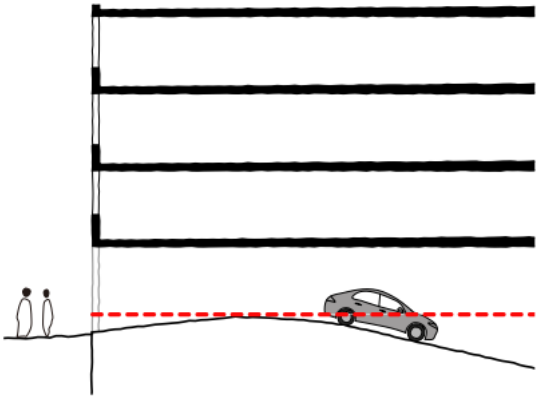


Figure 26: An apex above the flood level prevents water from entering a basement car park.

Section 4: Public interface

4.1 Introduction

Carefully designed public interfaces are key to creating a safe, comfortable and active pedestrian environment. Creating active street frontages can be particularly challenging in flood affected areas due to a height difference between the existing street level and new ground floor level.

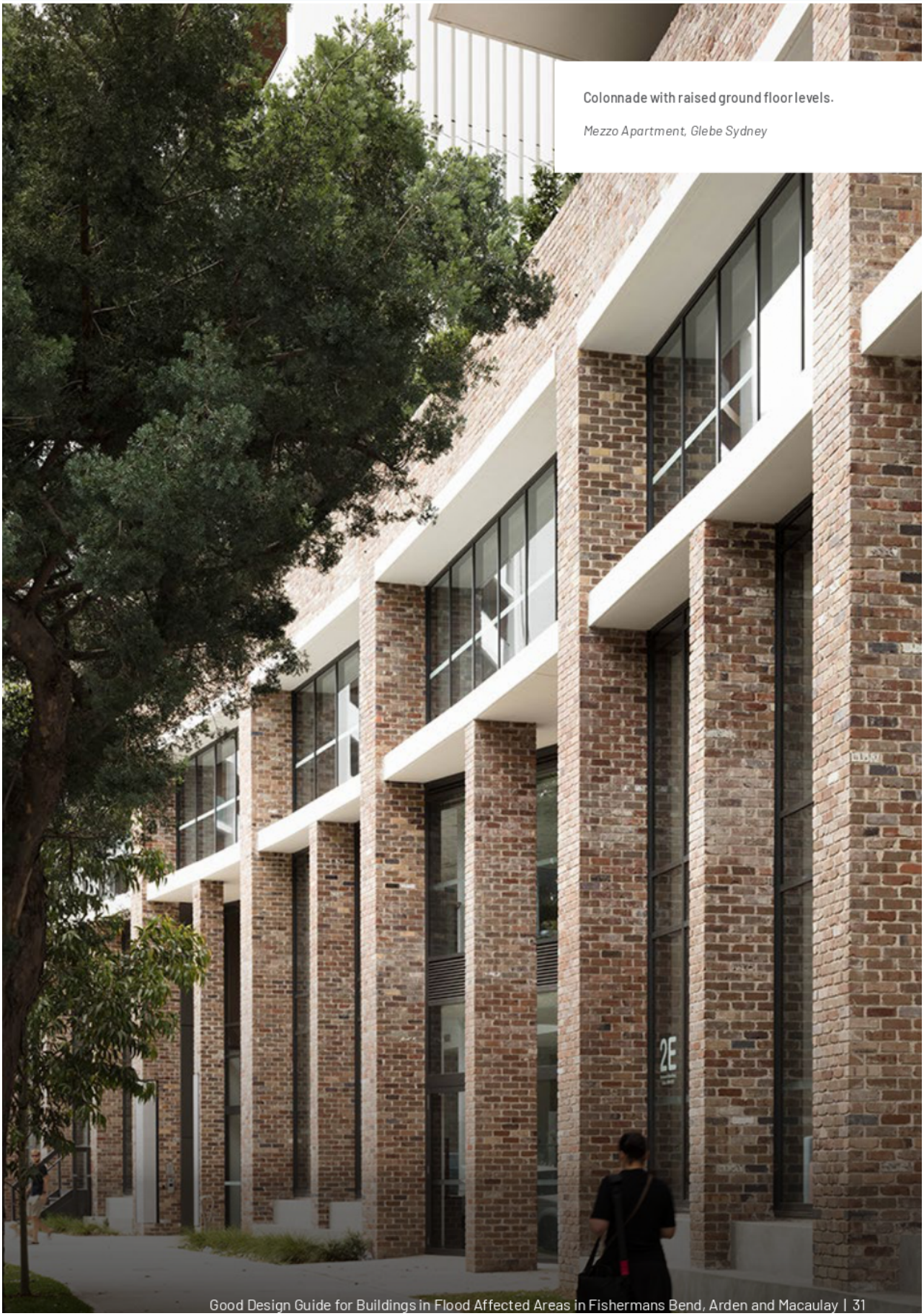
In flood affected areas, because the ground floor of a building is normally raised to the NFPL, this necessitates bridging of the vertical gap between the street and ground floor. In these situations, a transition zone between the two levels is usually located at the street interface, either outside or inside of the building, depending on the site characteristics and constraints.

External transitions minimise flood damage and will generally result in better flood management outcomes. In a large site, an effective strategy is to place a transition zone externally and integrate it into the landscaping and design of the public realm. In a small site, heritage site or on a main street where an opportunity for setback is limited, a transition zone may need to be located within the building.

In addition to the transition zone, the ground level facade needs to be carefully designed to maintain a positive relationship with the street, ensuring both flood mitigation and active frontages. The design approach for uncluttered and legible pedestrian footpaths should be maintained.

Figure 27: Internal pathway that uses terracing and landscaping to connect through the street and adjoining park.

Mezzo Apartment, Glebe Sydney



Colonnade with raised ground floor levels.

Mezzo Apartment, Glebe Sydney

4.2 Transition design

A transition zone is an area where steps and ramps provide universal access between the public realm and elevated ground floor level. Whether they are located externally or internally, transition zones are critical for providing safe and equitable access while also positively contributing to the public realm. External transition zones (4.3) are preferred to internal transition zones (4.4) from a flood management perspective.

Vertical transitions should:

- Relate to the human scale. The transition zone should provide for pedestrian comfort and activity by including elements such as seating and landscaping.
- Include a maximum single step height in accordance with the current building regulations and accepted standards of:
  - 600mm for active, pedestrian priority frontages with non-residential uses[1],
  - 1200mm for residential ground floor frontage[2]

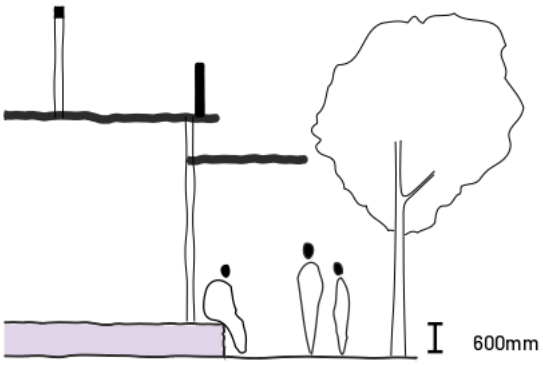


Figure 28: Diagram representing 600mm for retail ground floor frontages.

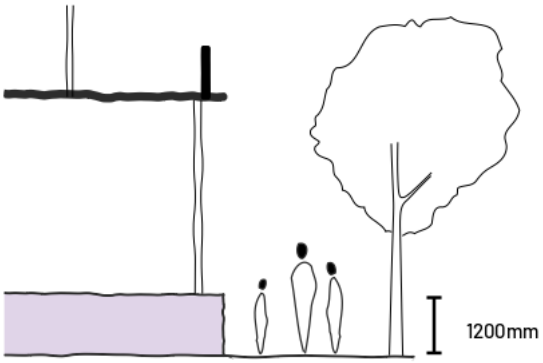


Figure 29: Diagram showing 1200mm for residential ground floor frontages.

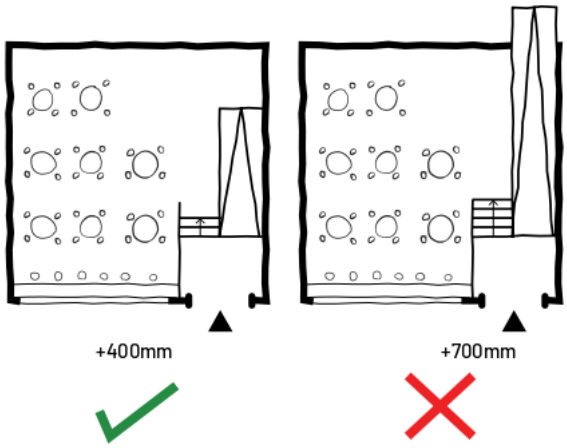


Figure 30: The height of vertical transition directly affects the space required for incorporating universal design solutions. In this example, a shop front business with 100sqm front of house area can accommodate a level change of 400mm with a simple ramp. However, as a ramp would not be a viable access solution if the level change was 700mm, other design strategies would need to be adopted. Where there is flexibility in tenancy size, e.g. for large sites, tenancies should be sized to enable viable ramps to required floor heights.

2 Where a single step of 600/1200 mm or stepped floor plates would result in floors below the NFPL: (a) the Guide should not be taken to imply that such a step would be satisfactory to meet flood protection standards or that lower floor levels will be permitted (b) it is recommended the applicant engage Council and Melbourne Water to obtain pre-application advice.

Where the required vertical transition exceeds 600mm in total, consider:

- increasing the floor height in a series of smaller, tiered increments[2]
- recessing the building line at ground floor level so that external transition can be achieved.
- an active street edge may be provided by a stepped floor plate within the front section, with the rear section elevated to the required floor level[2]

Sections 4.3 and 4.4 provide further information in relation to relevant requirements and matters for consideration in the design of internal and external transition spaces.

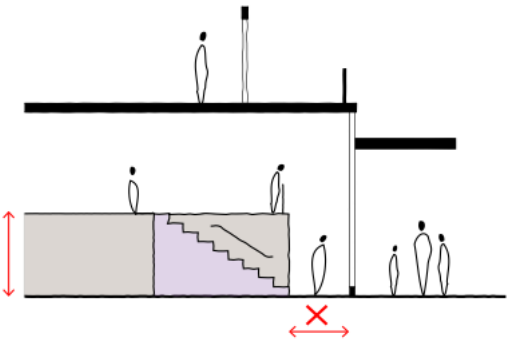


Figure 31: This transition zone creates single step transition that is out of human scale and ground floor front space that is too narrow for activation. The narrow front space below NFPL is also a poor flood management outcome.

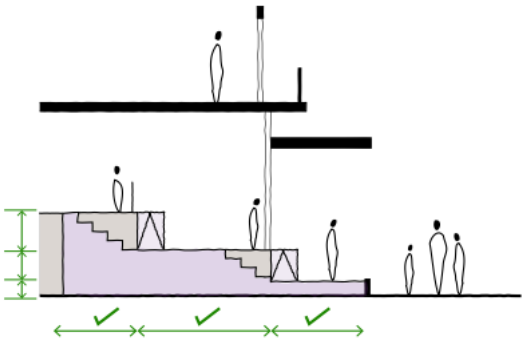


Figure 32: Transition zones can be spread across the floor to allow for gradual transition.

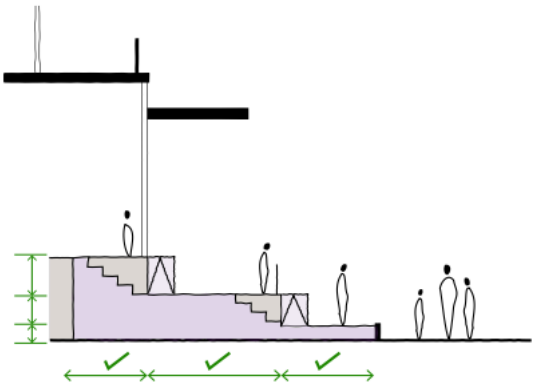


Figure 33: Transition zones can be either internal or external to the building. Sections 4.3 and 4.4 provide guidance on how to design this.

4.2 Transition design (cont)

Platform Lifts

Ramps are preferred to platform lifts. Platform lifts enable a person to move between two levels where a ramp is not practical, such as in small areas or where there is a significant vertical level change. Platform lifts are:

- preferred less than ramps and enclosed escalators because they are not preferred for accessibility inclusion standards. If they break down, they render an entire building or area inaccessible to sections of the community
- not preferred in external locations because they are subject to flood damage and vandalism
- not suitable for high-traffic public areas, such as in shopping centres.

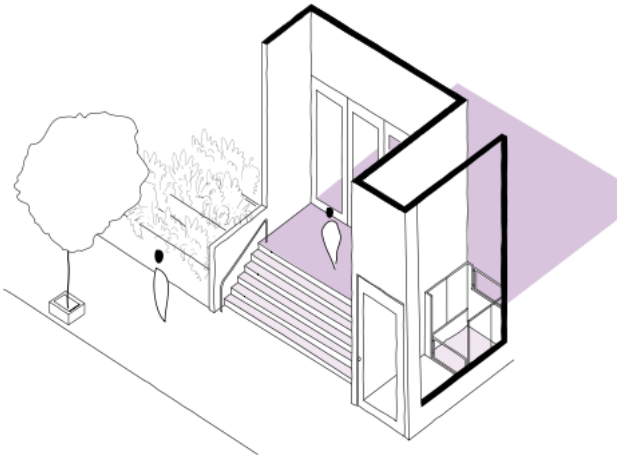


Figure 36: Internal platform lifts should only be provided where no other solution is possible. A platform lift may be located internally using a separate entrance accessible at street level. The platform lift should be fully concealed in the building to ensure it doesn't get damaged.

Design outcomes to be avoided

Figure 34: The presentation and legibility of the main entry to the building is compromised because it is recessed from the street. An external platform lift is not a preferred outcome

Figure 35: The narrow entrance, tucked behind small staircase and platform lift, lacks a sense of address and dignity.


A welcoming transition area is achieved by integrating slopes with the overall façade design and the use of high quality natural materials. The curve in the facade creates a cue for entrance and ensures light penetration.
Casba, Sydney

4.3 External transition

External transition areas are preferred to internal transition areas from a flood management perspective. However, external transitions may only be viable for a site where planning controls permit street setbacks to either the ground floor (whether whole or part of a frontage) or the whole building. The size of street setback is prescribed by planning controls in zones and overlays that determine the context and proposed use.

Setbacks may be able to accommodate both circulation space as well as usable space and amenity such as terraces, plazas, colonnades, seating areas and landscaping. Integrating active elements into the building frontage provides a positive contribution to the streetscape.

Where the building wall abuts the street edge without setback, an external transition may be accommodated by locating the building entrance deeper in the site or setting back the section of the wall that accommodates the egress and transitional elements.

The design of external transitions should:

- Integrate access elements such as stairs, ramps and sloping walkways into the overall design, ensuring human scale and a sense of welcome. When these are necessary, ramps must be in a logical and easily accessible place without blocking circulation and sightlines.
- Incorporate architectural elements such as terraces, colonnades, seating or landscape to bridge the gap between the elevated ground and street level and contribute to the activity and attractiveness of the streetscape. Encourage external transitions to be developed as part of overall streetscape design.
- Where possible, connect terraces and colonnades with adjoining buildings to provide a place of refuge and secondary circulation in case of flood.
- Where possible, consolidate access to multiple sites or tenancies through a shared transition space.
- Where possible, provide less sensitive uses such as cafés and retail on terraces and colonnades, as well as seating opportunities on the ledge and stairs.

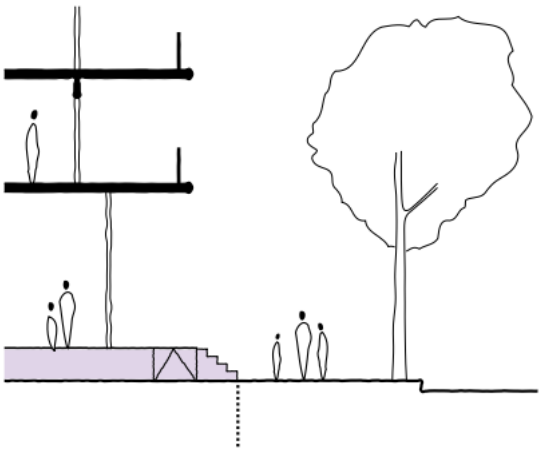
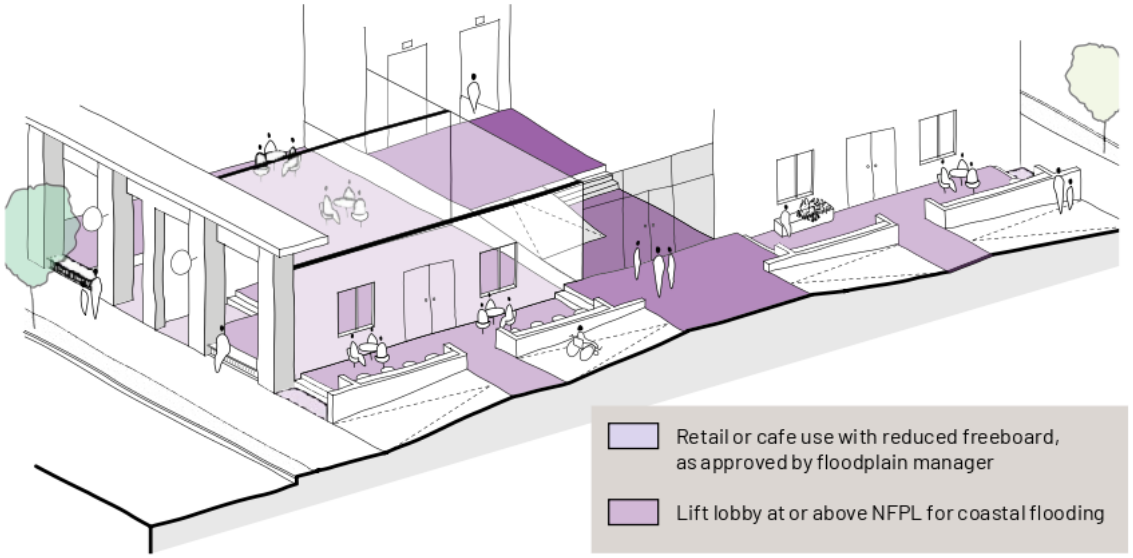


Figure 37: External transition section showing a step and ramp located outside of the building. This area can be designed to include to include other architectural elements.

Figure 38: Elements such as terracing, seating, landscape bridge the visual gap between the elevated ground and street level and contribute to the activity and attractiveness of the streetscape.



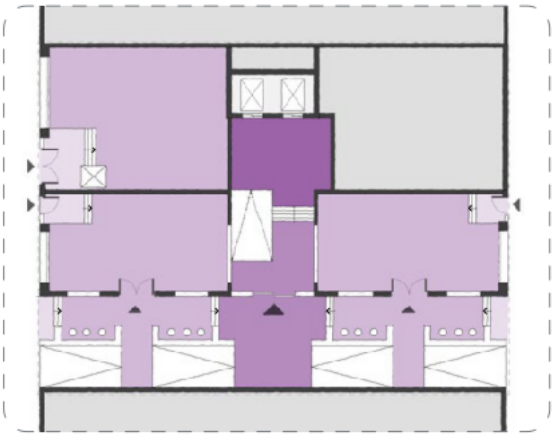


Figure 39: The laneway is an opportunity to provide universal access up to an elevated building entry and the main lift lobby by raising a portion of the laneway.

Retail or cafe uses activate the external corners of the laneway/ arcade, with terraced areas providing opportunities for seating and outdoor dining.

This is an example for an area affected by coastal flooding associated with sea level rise. (Retail frontages have reduced freeboard from coastal flooding, subject to the agreement of the floodplain manager. The lift lobby area is at or above NFPL for coastal flooding.)

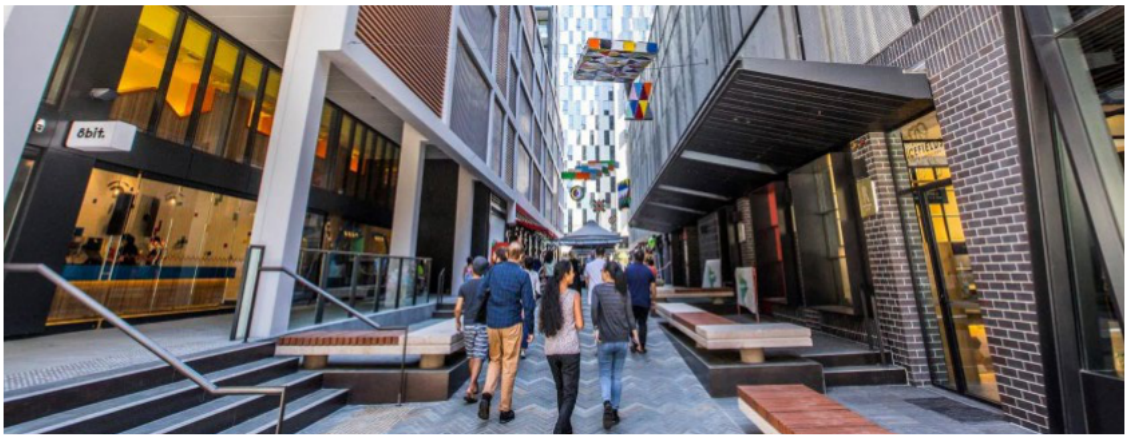


Figure 40: The sloped pedestrian laneway provides universal access to elevated building entries as well as outdoor dining terraces and an arcade.

Steam Mill Lane, Sydney

4.3 External transition (cont)

Figure 41: This apartment building entrance incorporates external steps and a 1:20 walkway accessed via adjoining colonnade. This grand entry concrete portal celebrates the residents' experience of home coming.

Verve Residences, Newcastle

Figure 42: A deep setback accommodates space for tiered outdoor dining terrace. The ramp wraps around the edge without dominating the space.

Ona Coffee, Brunswick

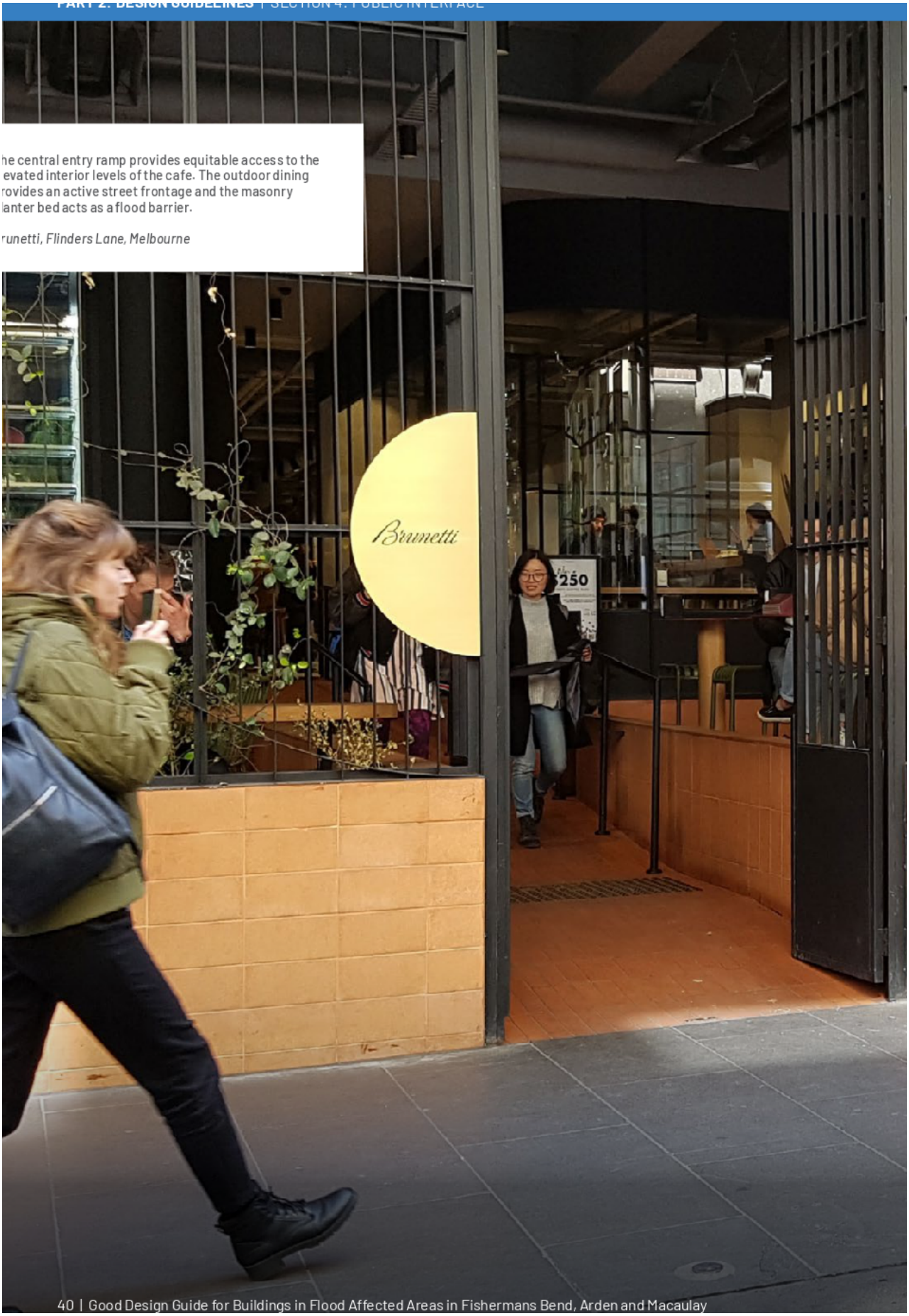
Figure 43: This apartment uses landscaping and a stepped entrance at the front to soften the public interface and creates a welcoming entrance. Each dwelling has two access points, with the internal entrance being accessible.

OneA apartment, Sydney

Design outcomes to avoid

Figure 44: A tall staircase creates a psychological barrier and a blank wall does not relate positively to the street.

Figure 45: A long ramp into the building can create a dark entrapment space.


he central entry ramp provides equitable access to the
evated interior levels of the cafe. The outdoor dining
rovides an active street frontage and the masonry
lanter bed acts as a flood barrier.
runetti, Flinders Lane, Melbourne
Brunetti
250

4.4 Internal transition

Providing the height transition inside the buildings delivers a continuous building edge along the public realm. Where an internal transition space can be designed to contribute to the interest and activation of the building edge, it is a preferred planning outcome for locations required to have an active street frontage.

However, as noted above and in Part 1, internal transitions are less preferred for managing flood risk than external transitions. Therefore, they may be accepted by the floodplain manager in limited circumstances on a case by case basis, and after consideration of relevant floodplain management planning policies, development guidelines and flooding overlay controls.

Internal transitions may be either in the form of:

- Circulation: A small transition space can be used as an entry area before a level change inside a ground floor tenancy. For flood risk management, these are preferred to larger internal transition areas.

  or

- Occupation and activation: Viable floor space should have a minimum depth of 4 metres to allow for useability and circulation through the tenancy.

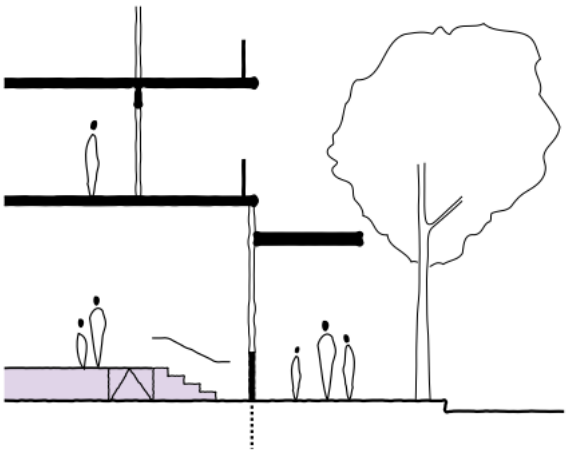


Figure 46: Small internal transition space.

Property boundary

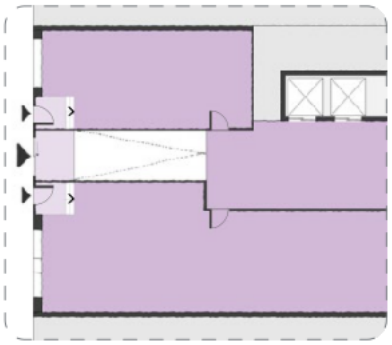
The design of internal transition spaces should:

- Use transparent materials and regular openings along the street wall to maximise visual and physical connections between the street and inside the building.
- Ensure that there are unobstructed views through openings into ground floor areas.
- Maximise activation of ground floor tenancies by incorporating usable active spaces at the minimum floor level heights agreed by the floodplain manager.
- Locate entry ways centrally in visible locations.
- Internal ramps should be located at the main entrance.
- Internal platform lifts should only be provided where no other solution is possible.

4.4 Internal transition (cont)

Figure 47: An internal ramp inside this cafe's main entrance provides universal access up to the elevated internal floor level. Large bi-fold windows above flood level provide a good visual connection to the street.

Betty Burgers, Melbourne



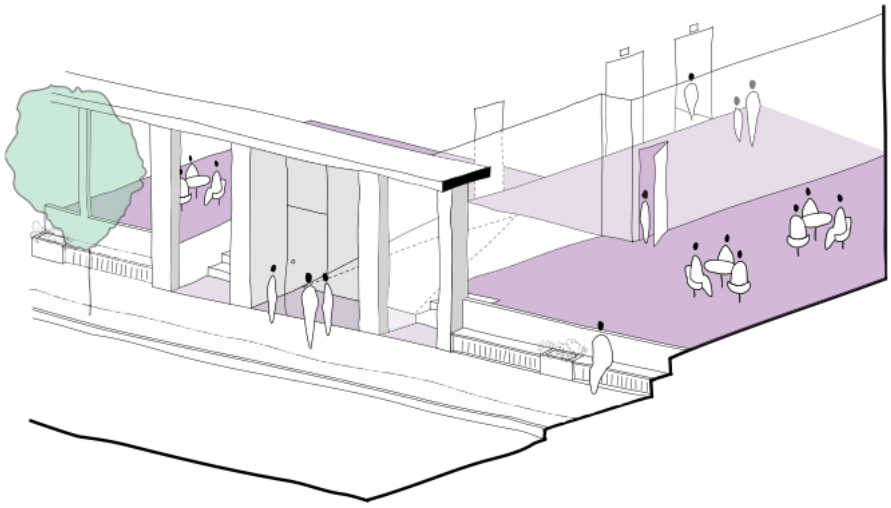


Figure 48: Where there are multiple small ground floor tenancies, sharing ramp access may be more efficient, particularly for tenancies with small floor area and narrow frontages.

Figure 49: This apartment building integrates an internal ramp and stairs into the entry lobby design. A large opening to the street and lighting provides visibility through the building.

Holme Apartments, Collingwood

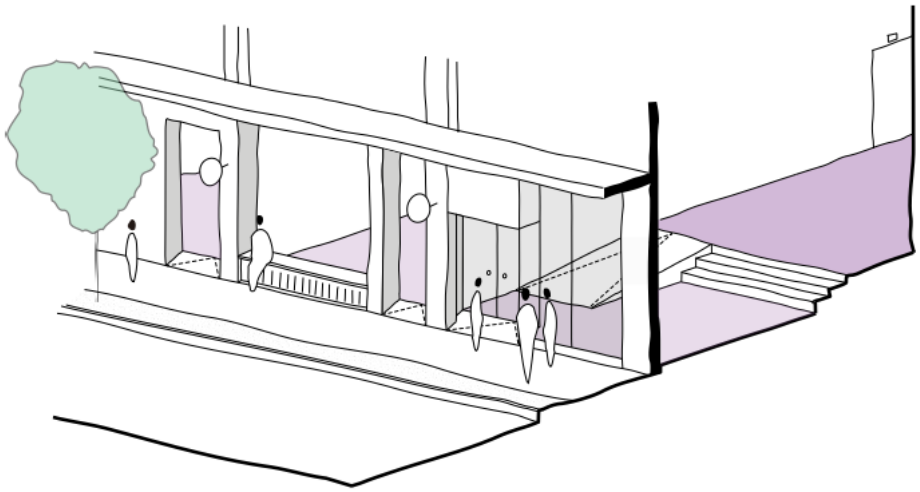


Figure 50: An example demonstrating floor level transitions in coastal flooding areas. It shows an active frontage with two small retail or cafe tenancies with their floor levels elevated above the existing footpath level, and steps and ramp inside the doorway which lead up to the lift lobby. The retail / cafe tenancies have reduced freeboard from coastal flooding, as agreed with the floodplain manager. The setback steps and ramps lead up to the lift lobby at or above NFPL for coastal flooding.

Retail or cafe use with reduced freeboard, as approved by floodplain manager

Lift lobby at or above NFPL for coastal flooding

4.4 Internal transition (cont)

Figure 51: A height difference can be turned into a design feature such as internal seating or a space divider.

Creative Spaces Guild, Southbank

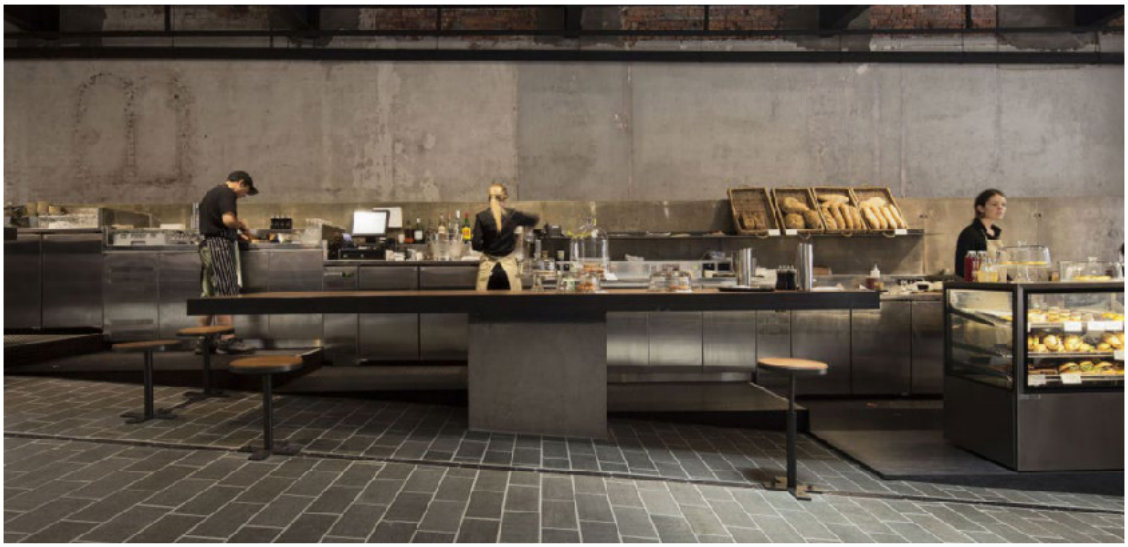


Figure 52: This new public circulation route through a historic series of buildings is activated by street dining serviced from central tables stepped to follow the level of the new ramped lane.

The Imperial Building, Auckland

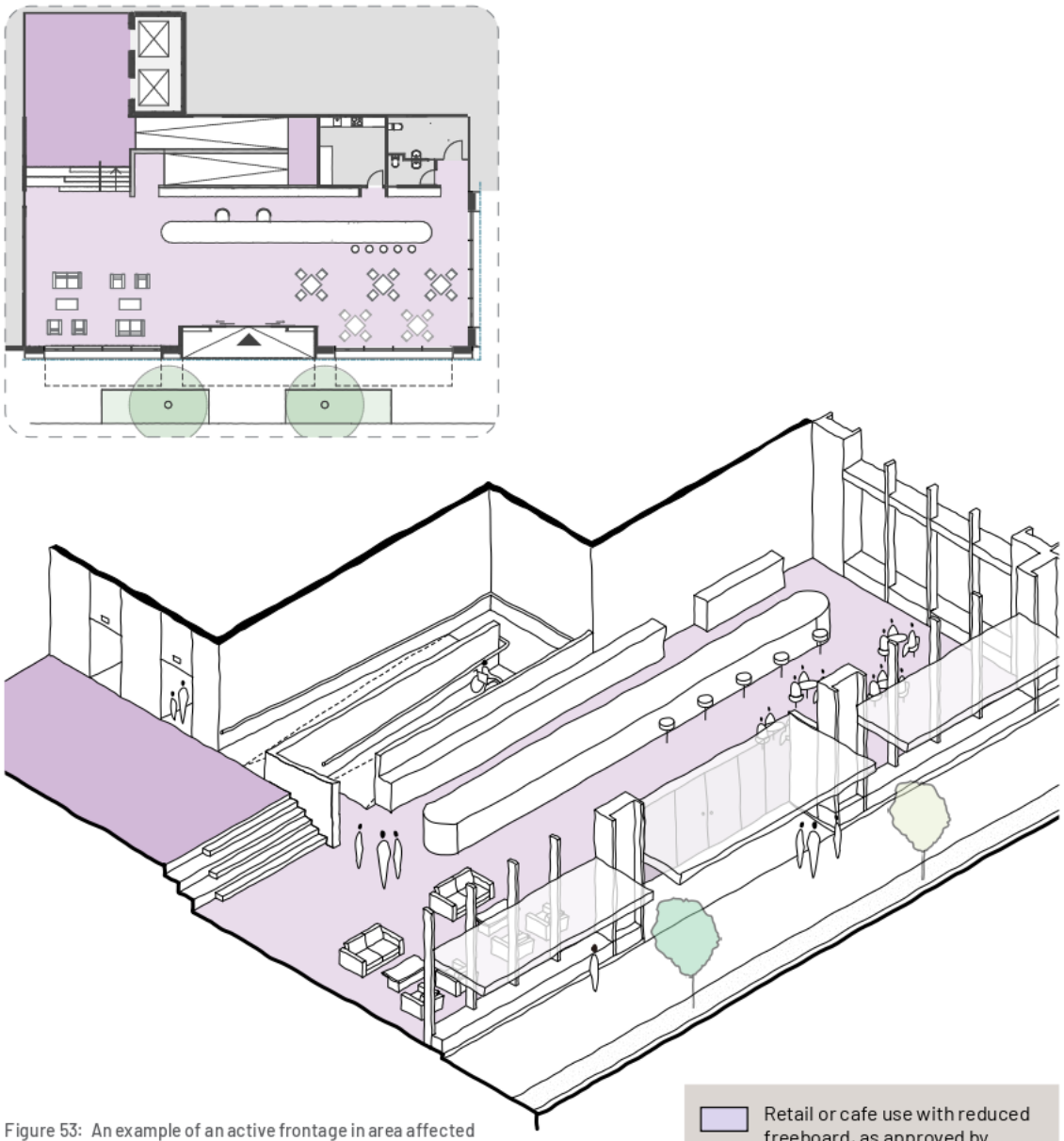
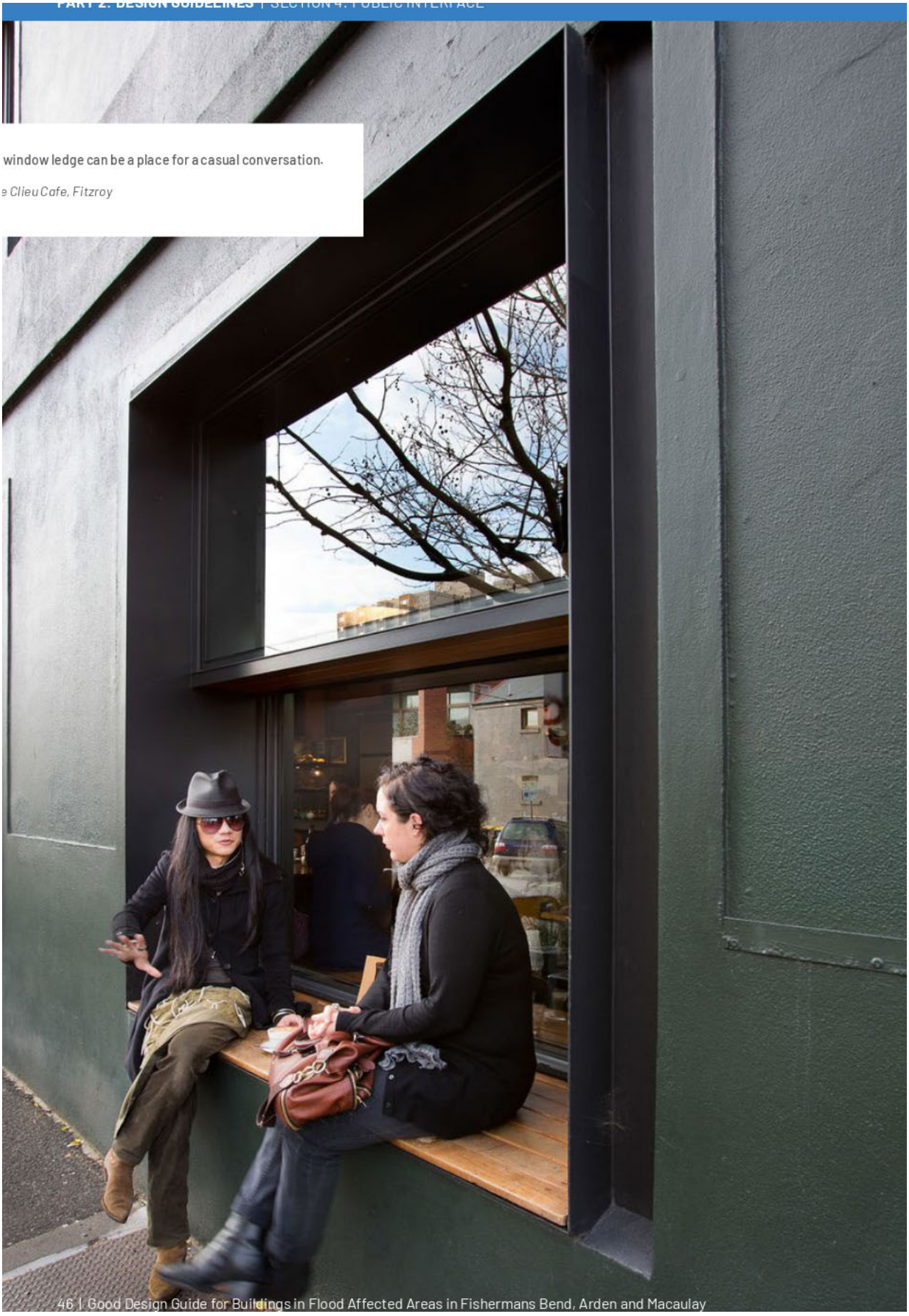


Figure 53: An example of an active frontage in area affected by coastal flooding and sea level rise. Hotel lobby or cafe tenancies have reduced freeboard from coastal flooding, as agreed with the floodplain manager. The setback steps and ramps lead up to the lift lobby at or above NFPL for coastal flooding.


window ledge can be a place for a casual conversation.
e Clieu Cafe, Fitzroy

4.5 Activation

Inviting people to enjoy everyday experiences in urban life is an essential component in creating a vibrant city. This involves creating a safe and healthy urban environment with a variety of interesting features and a distinct sense of place. A critical consideration is the activation of building edges along streets, lanes and public spaces.

Clear visibility and easy access to premises is an important factor in retail viability and street character. Small lots or sites with narrow frontages can be challenging when floor levels are required to be raised. Similarly, heritage or existing buildings that contribute to the character of the precinct can present unique challenges to managing level change. In these situations, new approaches and design responses are required to achieve flood protection, activated streets and retain fine-grained street character.

Good outcomes are most easily and effectively achieved when flood responsive design is integrated into the overall building design.

The following should be considered:

- When raising floor levels above street level, use design approaches described in Sections 4.2, 4.3 and 4.4.
- Blank walls should be minimised. If sections of blank walls are required, these should have variation in depth or be visually interesting while minimising opportunities for concealment.
- Create multifunctional elements. Explore options for flood-mitigation elements to contribute to activation. A wall can double as a bench, bar or servery.
- Openable windows above flood level can create an engaging interface between inside and outside areas.
- Ensure location of entries and vertical transitions allows flexible retail tenancy layouts, including the ability to subdivide or combine adjoining tenancies.
- Some temporary uses, such as outdoor seating, may also assist in street activation and should be designed to be flood resilient. These 'non-permanent' uses do not require a planning permit where they are defined by Clause 62.01 of the Victoria Planning Provisions.

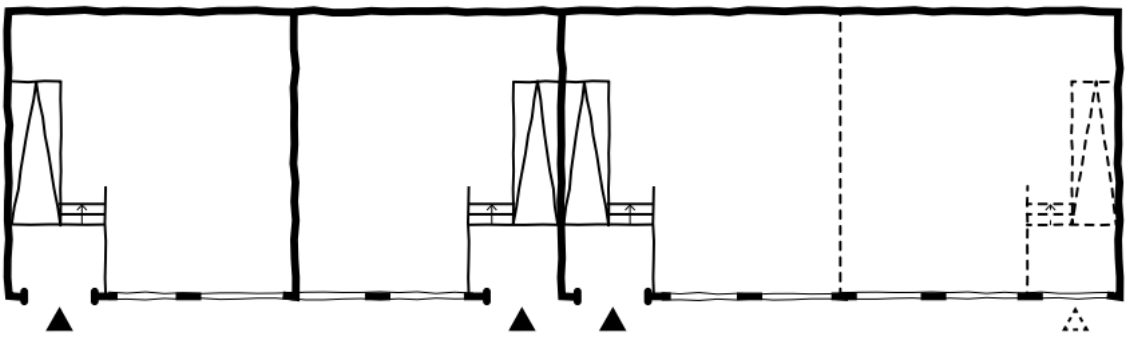


Figure 54: Retail frontage should enable activation and accommodate future changes. In this example, the right-hand tenancy is designed and built to allow future subdivision, including a new doorway and internal transition area.

4.5 Activation (cont)

Figure 55: Outdoor seating provides activation to the La Trobe Street frontage of the State Library of Victoria.

Mr Tulk Cafe, Melbourne

Figure 56: A raised window ledge can act as both a flood protection measure and a place for socialising.

Flemington Road Student Accommodation, North Melbourne

Design outcomes to avoid

Figure 57: Activation on the ground level must be carefully designed to avoid creating an underutilised and inactive space.

Figure 58: Poorly designed interface to the public realm results in an unwelcoming street frontage.

Figure 59: While a concrete plinth has a potential to offer seating, it does not create an inviting space to sit when combined with a large expanse of dark glazing.

Figure 60: The interface must be carefully designed to ensure a positive relationship to the street. This example shows a raised ground floor to allow for water to flow underneath the building. It has resulted in a dark enclosed space at street level that regularly gets filled with rubbish.

Section 5: Design detail and management

5.1 Introduction

This section includes guidance on flood resilient building construction and management so that buildings can easily recover from the impacts of temporary flooding. It is more cost effective to include flood-resilient design and construction in the initial building works than to retrofit it later.

While the most effective flood management solution is elevating building elements, this section includes detailed advice on flood resilient construction and some examples of other flood management solutions such as dry proofing, wet proofing and operable flood barriers[1]. The guidance may be useful for:

- new works to heritage and other existing buildings that were built prior to current flood protection standards
- sections of a new building that are below the Nominal Flood Protection Level[3], such as:
  - external walls, including solid walls as well as any window and door openings
  - basements, including vehicle entrances and internal stairs
  - where Melbourne Water has approved floor level reductions
- new buildings subject to impacts of sea level rise and that have an anticipated life span in excess of 70 years, where it would be prudent to incorporate flood resilient design at levels above the current guidance for a 0.8m sea level rise by the year 2100. This is because estimates of sea level rise are uncertain and sea level rise will continue well beyond 2100.

Figure 61: Active use, raised window sill and robust materials.

Di Stasio restaurant, Melbourne

3 These may not meet the deemed-to-comply standards of the Victorian Flood Guidelines. To gain planning approval, discretion from the flood manager is required. Approval for such outcomes is determined on a case by case basis, having regard to relevant planning considerations. This Guide should not be implied as giving tacit approval for any elements to be set below the NFPL.

5.2 Essential services

Essential services to a building must be capable of functioning during and after a flood, including electrical substations, communications switchboards, lift motor rooms and fire boosters.

- For new buildings, these services will be required to be elevated to above the NFPL.
- For existing buildings, retrofitted flood proofing may be necessary.

At a detailed level, electrical fittings such as power points and mechanical equipment like air conditioners should also be raised safely above the flood level to minimise the chance of power outages and faults.

Figure 62: A retrofit example of manually installed segmented flood barriers to protect building services during flood events.

5.3 Dry proofing

Dry proofing involves sealing the exterior of the building to prevent water from entering the interior.

Dry proofing strategies should consider the following:

- Construct a structurally sound waterproof building base to prevent water entering the ground floor, subfloor space or basement.
- Flood vents prevent water entry, while allowing water to escape subfloor spaces and assist in drying out after a flood event.
- For low-level floods below 600 mm, flood doors can be a viable option to waterproof doorways
- If the bottom (sill) of windows cannot be elevated above the predicted flood line, then windows and glazing assemblies require floodproof assembly, including impact resistance, structural strength and watertight seals.
- Raised garden beds made from concrete or blockwork may act as a flood barrier, if constructed out of flood resilient materials and incorporating necessary structural reinforcing.

5.3 Dry proofing

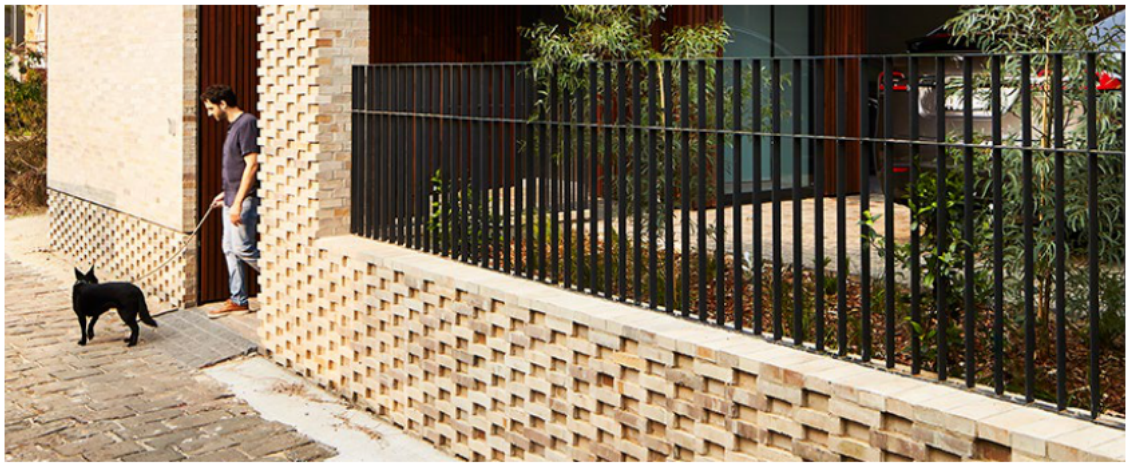


Figure 63: Finely detailed brickwork in front of a waterproof substrate provides a flood resilient base to the canal frontage of these new townhouses. Windows, doors and balconies are all elevated above the flood level.

90 Ruskin St, Elwood

Figure 64: Specialist flood-resilient window and glazing assembly to restaurant window.

Figure 65: Concrete plinth with integrated building signage and a raised planter bed provide a flood resilient base to the elevated entrance to this apartment building.

Verve Apartments, Newcastle

5.4 Wet proofing

Wet proofing may be required for very limited areas of a building and involves using flood-resilient materials and construction methods to minimise the chance of flood damage and moisture problems afterwards.

Wet proofing strategies should consider the following:

- Large openings allow water to quickly flow out, which reduces pressure on walls and provides more ventilation for drying out after a flood.
- Flush door thresholds recessed into a concrete floor facilitate drainage of flood waters from the interior.
- Eliminate cavities within walls to reduce risk of mould.
- Construct internal stairs of flood-resilient materials, such as metals or hardwood. If possible, make risers open to avoid water being trapped in any cavities. Alternatively, make the bottom risers removable to enable easy post-flood clean-out.
- Raise cabinetry, products and valuables above the flood level.
- Mechanical heat recovery ventilation systems (MHRVs) ventilate and dry out internal spaces by allowing fresh air into the interior and reducing condensation build up.

Figure 66: Polished concrete floors, brick walls and hardwood timbers provide resilient finishes.

Auction Rooms, North Melbourne

5.5 Flood barriers

This section provides additional examples of flood resilient building solutions in the form of manual barriers and self-actuating flood gates. Self-actuating flood barriers are relatively low maintenance and more reliable than mechanical and manually operated systems because the rising flood waters can automatically raise the barriers using buoyancy. Flood barriers are not supported for protecting new buildings, however in some circumstances, they may be appropriate for protecting new buildings.

Basement entries

Due to potential risk of failure, the Victorian Flood Guidelines do not support use of mechanical measures for protection of basements from stormwater or riverine flooding. However, in accordance with the Sea Level Rise Guidelines, where basement car park entry levels cannot be raised to the required Nominal Flood Protection Level due to local constraints, Melbourne Water may allow self-closing flood gates to provide freeboard protection.

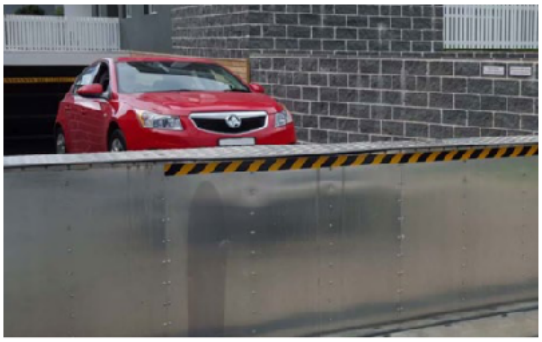


Figure 67: A self-actuating vertical rise flood barrier protects the entrance to a basement.

5.5 Flood barriers

Figure 68: A self-actuating tilting flood barrier protects the entrance to a basement.

Car Stackers

Figure 69: Self-actuating vertical-rise flood barriers protect these garages with car stackers in a South Melbourne laneway.

Gladstone Street, South Melbourne

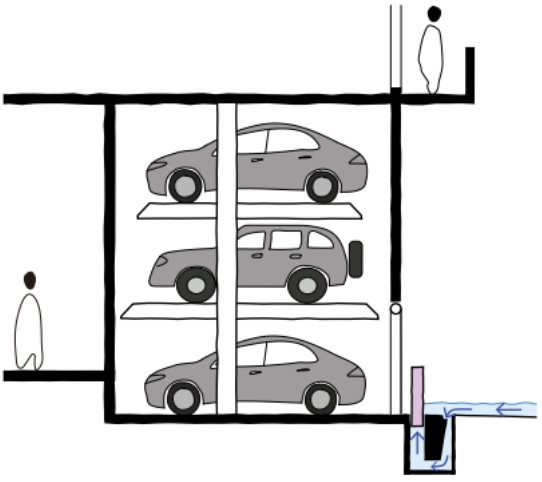


Figure 70: Self-actuating vertical-rise flood barriers protect these garages with car stackers in a South Melbourne laneway.

Pedestrian entries - Self-actuating flood barriers

Figure 71: The welcoming public entrance to the Ian Potter Southbank Centre has well concealed flood protection in the form a self-actuating barrier that rises vertically 1 metre in response to incoming flood waters.

Figure 72: The barrier is concealed beneath the pavement with a top plate, side panels and drainage system integrated into the paving.

Figure 73: Other entrances to the building are protected with self-actuating tilting flood barriers. The flood barriers required custom design and manufacture to address all relevant safety factors raised by Melbourne Water, including flood type, possible debris, maintenance and operation.

Heritage building - Manual flood barriers

Flood management to heritage places and existing buildings needs to be made on a case-by-case basis.

Figure 74: The 1875 Castlemaine Wool Mill was transformed in 2014 as a vibrant place to support local businesses. In a recent flood event, manually installed flood barriers completely protected the buildings from water entry, allowing business to resume operations as usual almost immediately after the flood waters receded. A solar powered sensor has been installed in a nearby stormwater pit to provide an early alert signal with enough time to allow installation of all flood barriers before waters reach access areas.

5.6 Materials

Building elements subject to flooding should use flood resilient materials and construction systems and avoid use of non-flood resilient materials. The following list of materials should be reviewed and confirmed with a Victorian Registered building practitioner to determine which solutions are appropriate for specific applications.

Building element	Avoid non-flood-resilient materials	Use flood-resilient materials
Wall construction	• walls with cavities • face brick without additional waterproof treatment	• concrete sandwich panel walls • single skin stud walls • off-form concrete walls
Wall framing	• Pine	• hardwood • steel
Internal wall linings	• plasterboard • panelling made from pine or other softwoods • MDF (medium-density fibreboard)	• FC (fibre cement sheeting) • villaboard • tiles • hardwood panelling • metal • polycarbonate/translucent sheeting • marine-grade/moisture-resistant plywood
Doors	• hollow core doors	• solid core doors (wet proofing) • flood doors (dry proofing)
Windows	• standard windows	• flood resilient windows, including impact resistance, structural strength and water tightness
Internal flooring	• carpet • floating timber floors • vinyl on a non resilient substrate • cork	• polished concrete • tiles • hardwood flooring on a flood resilient substrate • rubber/vinyl/marmoleum on a flood-resilient substrate
Grout	• cementitious grout	• semi-epoxy grout • epoxy grout • polymer resin grout
Cabinetry frame	• particle board • MDF panels	• compact laminate • acrylic solid surface • marine-grade ply • composite timber panels • stainless steel frame (open)

5.7 Management

Where finished floor levels or basement car park entries are below the NFPL, Council or Melbourne Water may request the applicant prepare a Flood Risk Management Plan and for this to be registered on the land title as a Section 173 agreement as per the Planning and Environment Act 1987.

Flood-risk management plan

- Site-specific flood risks
- General principles of operation of any flood barrier
- An operational risk assessment
- Flood barrier rise times
- Maintenance and reporting schedule.

S.173 agreements

- Identify the use of the flood barrier and the ongoing maintenance requirements for the life of the structure.
- Implement a flood-risk management plan which has been approved by the Responsible Authority and Melbourne Water.

Resident, worker, visitor communication/ information

A maintenance plan for the flood barrier must be submitted to Melbourne Water and the Responsible Authority. The maintenance plan must be treated the same as any other essential services with mandatory annual reporting and maintenance checks.

Part 3: Appendix

Appendix 1. Fishermans Bend, Arden and Macaulay Flooding

Water and flooding have always been a feature of the precincts. Prior to European settlement, Fishermans Bend was characterised by swamps, wetlands and sand beach ridges. The upper soil profile was predominantly sand, deposited from the wind, and by shallow waves from Port Phillip Bay. Similarly, the lower parts of Arden and Macaulay were part of the Moonee Ponds Creek floodplain and characterised by marshes and lagoons. From the late 1800s, Fishermans Bend, Arden and Macaulay transitioned from these diverse landscapes into industrial areas.

Fishermans Bend

Fishermans Bend does not currently meet modern flood protection standards for a mixed use, capital city zoning (see, for example, Melbourne Water's Land Development Manual and City of Melbourne's Stormwater Drainage Design Guidelines). The current flooding conditions are generally consistent with modern standards for the industrial use of the area. However, the change of use, from industrial to capital city, and specifically, the intensification of sensitive land uses, together with climate change impacts of sea level rise and increased rainfall intensity, requires the application of higher standards of flood protection than those currently experienced in these areas.

To improve the flooding standards and to realise the vision of a green, water sensitive Fishermans Bend, a Water Sensitive City Strategy (WSCS) has been collaboratively developed by the Fishermans Bend Taskforce (DJPR), South East Water, City of Melbourne, City of Port Phillip and Melbourne Water. Due to be published in late 2021 the WSCS includes measures to reduce flooding extent and severity. The measures include a levee, pump stations, new and enhanced drainage pipes, and distributed water storages in streets, parklands and rainwater tanks.

This new infrastructure will reduce flooding within Fishermans Bend, but it will not eliminate flood risk, such as local stormwater flooding. This means that additional flood resilient measures, such as raised footpaths, where possible, and minimum finished floor levels for buildings, are required to manage flood risk as part of urban renewal.

Arden and Macaulay

The draft Arden Structure Plan was released in June 2020. This structure plan is a partnership between the Victorian Government, City of Melbourne and the Victorian Planning Authority. The final Arden Structure Plan is expected to be released in early 2021.

The Macaulay Draft Structure Plan Refresh by City of Melbourne was released in June 2020. The final Macaulay Structure Plan Refresh is expected to be released in early 2021.

Both Arden and Macaulay experience regular flooding due to their proximity to Moonee Ponds Creek, the low-lying topography of the areas and their location at the end of catchments. The City of Melbourne has updated the flood modelling in Arden and Macaulay and the extent of flood impact is greater than what is currently identified in the planning scheme due to our greater understanding of projected climate change impacts.

Together with strategic reclamation of land, a drainage strategy to manage flood impact in Arden and Macaulay is being prepared by Melbourne Water. This is to ensure local stormwater runoff and riverine flooding from Moonee Ponds Creek can be managed safely at a precinct-wide level to facilitate development of land in the precinct. The strategy includes measures such as upgraded levees, pumps and pipes, as well as new floodwater storages, to allow for safe development in the area.

Appendix 2. Policy context

Legislation

- Planning and Environment Act 1987
- Marine and Coastal Act 2018
- Climate Change Act 2017
- Equal Opportunity Act 2010
- Water Act 1989

Planning Scheme

- Victorian Planning Provisions
- Local Policy
- Incorporated Documents

Background Documents

These are identified in the planning scheme and includes documents such as:

- Fishermans Bend Framework 2018
- Urban Design Guidelines for Victoria (DELWP, 2017)

Guidelines

These are not identified in the planning scheme and includes documents such as:

- Guidelines for Development in Flood Affected Areas (DELWP, 2019)
- Planning for Sea Level Rise Guidelines (Melbourne Water, 2017)
- This Guide

Figure 75: Legislation and policy context

What manages flooding in the Planning Scheme?

Land Subject to Inundation Overlay (LSIO): as a planning scheme control that applies to land affected by flooding associated with waterways and open drainage systems. Such areas are commonly known as floodplains.

Special Building Overlay (SBO): is a planning scheme control that identifies areas prone to overland flooding. The purpose of this overlay is to set appropriate conditions and floor levels to address any flood risk to developments.

Authority	Role	Planning Mechanism
Melbourne Water (Referral Authority - Floodplain Manager)	Provides referral advice for planning applications to develop land affected by flooding associated with rivers, creeks and larger stormwater drainage network owned and maintained by Melbourne Water, tidal and storm driven coastal inundation and sea-level rise.	LSIO and SBO
Council or Minister for Planning (City of Melbourne or City of Port Phillip) (Responsible Authority)	Issues planning permits for development affected by flooding associated with smaller stormwater drainage network owned and maintained by Council or Minister for Planning	SBO

References

The Guide draws upon a broad range of references and policy documents from locally, interstate and abroad.

For further reading the following references are recommended:

- Guidelines for Development in Flood Affected Areas (DELWP 2019)
- Land Development Manual (Melbourne Water)
- Planning for Sea Level Rise Guidelines (Melbourne Water, 2017)
- Stormwater Drainage Design Guidelines (City of Melbourne, 2019)
- Fishermans Bend Framework (State Government, 2018)
- Draft Arden Structure Plan (City of Melbourne, 2021)
- Draft Macaulay Structure Plan (City of Melbourne, 2021)
- Central Melbourne Design Guide (City of Melbourne, 2018)
- Urban Design Guidelines for Victoria (State Government, 2019)
- Coastal Flood Resilience Design Guidelines (Boston Planning and Development Agency, 2019)
- Flood resilient Homes: Residential Self Help Document (Melbourne Water, 2020)

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Some projects in the images are not flood related, however are included as they illustrate the concepts relating to the guidelines.

Cover, Page 38

Casba, Sydney

Design team: SJB Architects

Photo: Brett Boardman

Page 6

Centre of Advanced Imaging, University of Queensland, St Lucia, Queensland

Design team: John Wardle Architects and Wilson Architects

Photo: Christopher Frederick Jones

Page 8

Pierhouse and 1 Hotel, Brooklyn, NY

Design team: Marvel Architects

Photo: David Sundberg

Page 16, 40 and 54

Figure 41 and 65

Verve Residences, Newcastle

Design team: CKDS Architecture and Hill Thalis Architecture

Photo: Brett Boardman

Page 19

Figure 8

Brunetti, Flinders Lane, Melbourne

Design team: Techne Architects + Interior Design

Photo: Earl Carter

Page 20 and 57

Figure 10 and 71

Ian Potter Southbank Hall, Southbank

Design team: John Wardle Architects

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Figure 12

Centennial Park Bicycle Hub, Sydney

Design team: Hill Thalis

Photo: Alex Rink/Hill Thalis

Page 22

Arkadia Apartments, Alexandria, Sydney

Design team: DKO Architecture, Breathe Architecture and

Oculus

Photo: Martin Siegner (second image)

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Figure 15

Magazine Street, New Orleans

Photo: Nigel Smith

Page 26

Figure 18

Rhone Riverbank, Lyon

Design team: In Situ Landscape and Urban Planning Studio

Photo: In Situ Landscape and Urban Planning Studio

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Figure 19

Steam Mill Lane, Darling Square, Sydney

Design team: ASPECT Studio

Photo: Brett Boardman

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Figure 20

Union Court, Australian NationalUniversity, Canberra

Design team: Iahznimmo architects and ASPECT Studios

Photo: Florian Groehn

Figure 21

Assembly Apartments, North Melbourne

Design team: Woods Bagot

Photo: Trevor Mein

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Figure 22

Gipps Street Apartments, Abbotsford

Design team: KANNFINCH

Photo: xx

Page 30

Figure 24

Hibernian Place, Perth

Design team: Hassell

Photo: Hassell

Page 32 and 33

Figure 27

Mezzo Apartment, Glebe Sydney

Design team: CHROFI and KANNFINCH

Photo: xx

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Figure 40

Steam Mill Lane, Darling Square, Sydney

Design team: ASPECT Studio

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Figure 42

Ona Coffee, Brunswick

Design team: Breathe Architecture

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Brunetti, Flinders Lane, Melbourne

Design team: Techne Architects + Interior Design

Photo: Noelle Jones

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Figure 47

Betty Burgers, Melbourne

Design team: Unita

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Figure 49

Holme Apartments, Melbourne

Design team: John Wardle Architects

Photo: Michael Gazzola

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Figure 51

Creative Spaces Guild, Southbank

Design team: Archier Architects

Photo: Ben Hosking

Figure 52

The Imperial Building, Auckland

Design team: Fearon Hay Architects

Photo: Patrick Reynolds

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De Clieu, Fitzroy

Design team: Six Degrees Architects

Photo: Greg Elm

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Figure 55

Mr Tulk Cafe, Melbourne

Photo: Victorian State Library

Figure 56

Flemington Road Student Accommodation, North Melbourne

Design team: Hayball

Photo: Courtesy of Hayball © Dianna Snape

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Figure 61

Di Stasio restaurant, Melbourne

Design team: Hassell

Photo: Hassell

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Page 53

Figure 62

Office Flood barrier

Photo: Flood Free (floodfree.com.au)

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Figure 63

90 Ruskin St, Elwood

Design Team: Fieldwork Architects, HIP V. HYPE, Ruskin Property Group

Photo: Tess Kelly

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Figure 64

Flood resilient window

Photo: Flooding Solutions (floodingsolutions.com.au)

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Figure 66

Auction Rooms, Melbourne

Design team: Six Degrees Architects

Photo: Patrick Rodriguez

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Figure 67

Car park entry

Figure 68

Car park entry

Figure 72

Flood barrier

Figure 73

Flood barrier

Photo: Flood Free (floodfree.com.au)

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Figure 74

The Mill, Castlemaine

Photo: AWMA Water control solutions (awmawatercontrol.com.au)

Attachment 1:	Good Design Guide for Buildings in Flood Affected Areas in Fishermans Bend, Arden & Macaulay - May 2021