Alfred Quarter, North Melbourne

Flood Risk and Design Statement

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Contents

Figures and Tables

1. Introduction

This Flood Risk and Design Statement has been produced by HARC for Metrics to support the proposed development at Alfred & Boundary (103 -117 Boundary Road and 59-101 Alfred Street), North Melbourne. The report identifies and discusses flood risk at the site and the mitigation measures adopted in order to satisfy the flood management objectives as detailed in Schedule 3 to Clause 44.04 Land Subject to Inundation Overlay and Schedule 3 to Clause 44.05 Special Building Overlay in the Melbourne Planning Scheme.

1.1 Subject Site

The subject land is shown in Figure 1. The property is bounded by Alfred Street to the north, Boundary Road to the east, City Link Service Road to the west and private property to the south.

The site is zoned Mixed Use Zone (MUZ). The purpose of this zone is to provide for a range of residential, commercial, industrial and other uses which complement the mixed-use function of the locality.

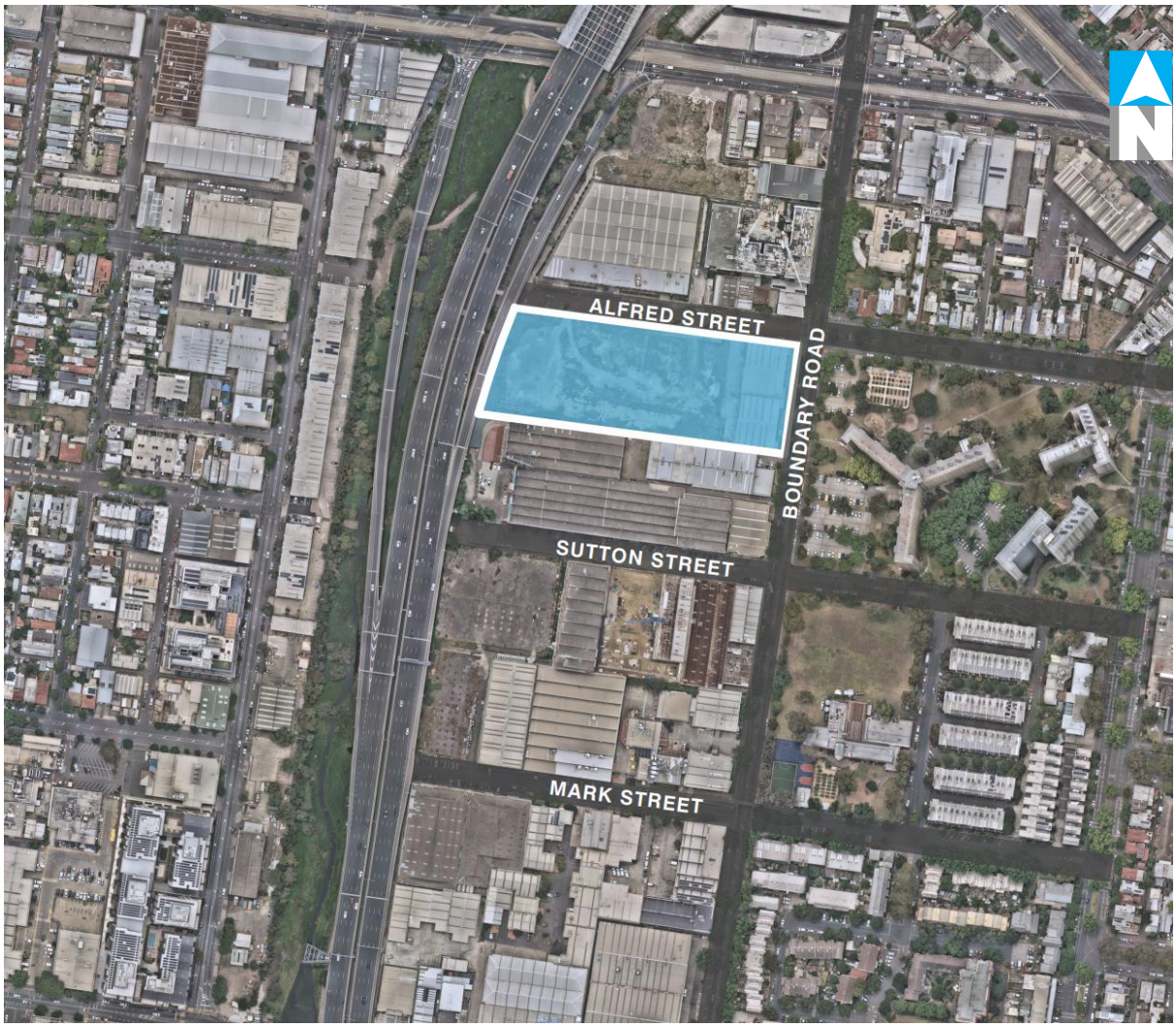

Figure 1 Aerial photo of the site

The site currently contains several commercial and industrial buildings along Boundary Road, with the remainder comprising vacant land (Figure 2). The proposed development involves demolishing the existing buildings and constructing three multi-storey residential towers (Precincts 1, 2 and 3), with

internal streets and shared amenities provided between the towers (Figure 3). A total of 943 apartments are proposed.

The lower ground floor of Precinct 3 accommodates fire tanks and a fire pump, accessible internally via stairs and lifts. The ground floors of Precincts 2 and 3, together with the lower ground floor of Precinct 1, include community spaces, a supermarket, a gym, landscaped open space, car parking, bicycle parking, and some residential units.

The upper ground floor of Precinct 1 provides a supermarket, retail premises, retail tenancies, landscaped open space, and building services (fire and electrical rooms). All upper levels across the three precincts are dedicated to residential apartments.

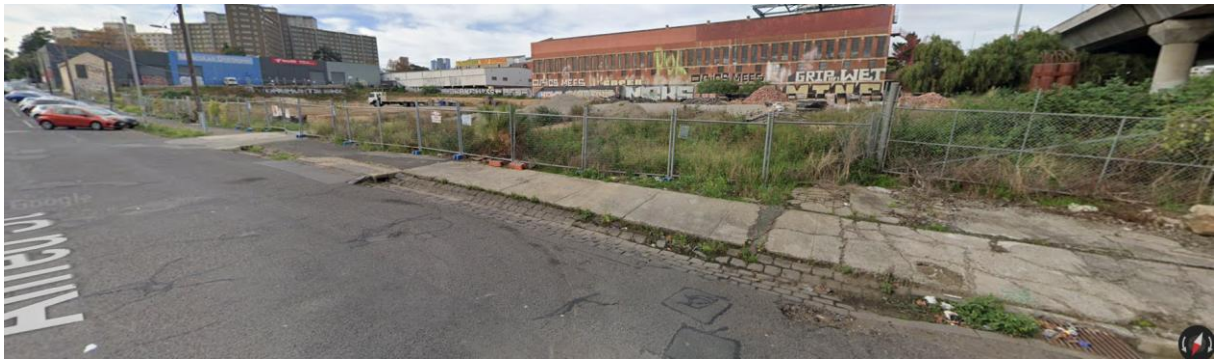

Figure 2 - Site looking from Alfred Street

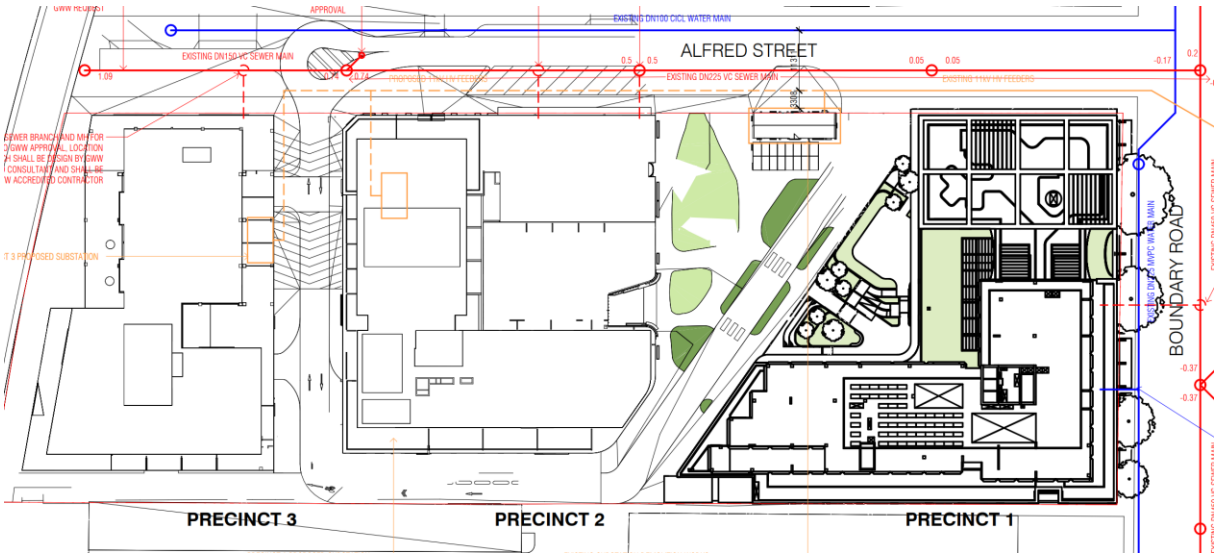

Figure 3 - Proposed Precincts

The site survey indicates significant variation in site surface elevation, with the land generally grading from east to west. The levels grade from 9.0 m AHD at the northeast corner to 2.5 m AHD along Alfred Street. Along the Boundary Road, surface levels grade from 9.4 m AHD at the south eastern corner to 8.5 m AHD at the northern end. In contrast, the level along the western boundary remains relatively consistent at approximately 2.6 m AHD.

The existing site level can be seen in Figure 4. It must be noted that the topography shown in the figure was captured in 2018 and may not be fully representative of site conditions today.

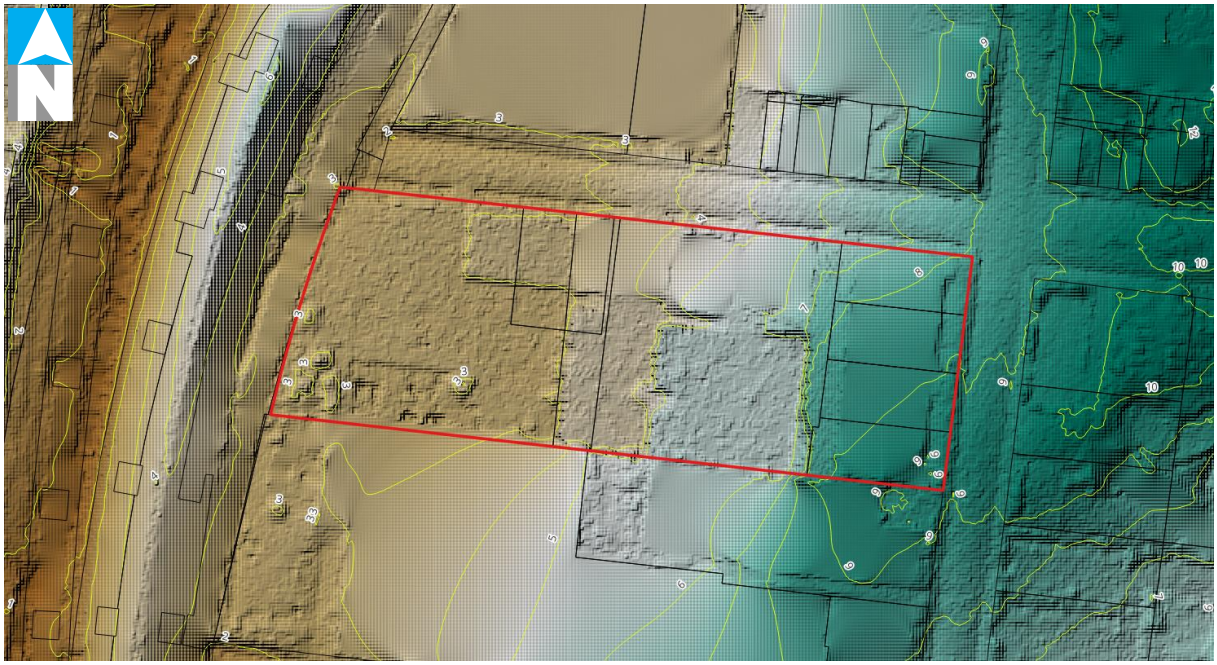

Figure 4 – Land surface levels, 2017 adopted in Melbourne Water's flood model (m AHD)

1.2 Site Hydrology and Flood Characteristics

The flooding on the site is from the wider Moonee Ponds Creek catchment and includes overland flows from the north-east of the development. There is some storage of flood waters behind the Moonee Ponds Creek flood levee. There may be some influence from Moonee Ponds Creek in a very large flood event.

The Melbourne Planning Scheme has recently been updated to include consideration of climate change flooding in this location. The land is impacted by both the Special Building Overlay (SBO3) and the Land Subject to Inundation Overlay (LSIO3). The flood extents associated with these overlays can be found below in Figure 5.

Melbourne Water is the Floodplain Management Authority and a Determining Referral Authority for flooding under Section 55 of the *Planning and Environment Act 1987* and sets planning conditions for development with reference to the 1% Annual Exceedance Probability (1% AEP) flood level.

Flood depths and levels under existing conditions for a 20% AEP (1 in 5 year) and 1% AEP flood event are shown in Figures 4 and 5, respectively. Figure 6 shows flood depths and levels for a 1% AEP flood event under future climate conditions.

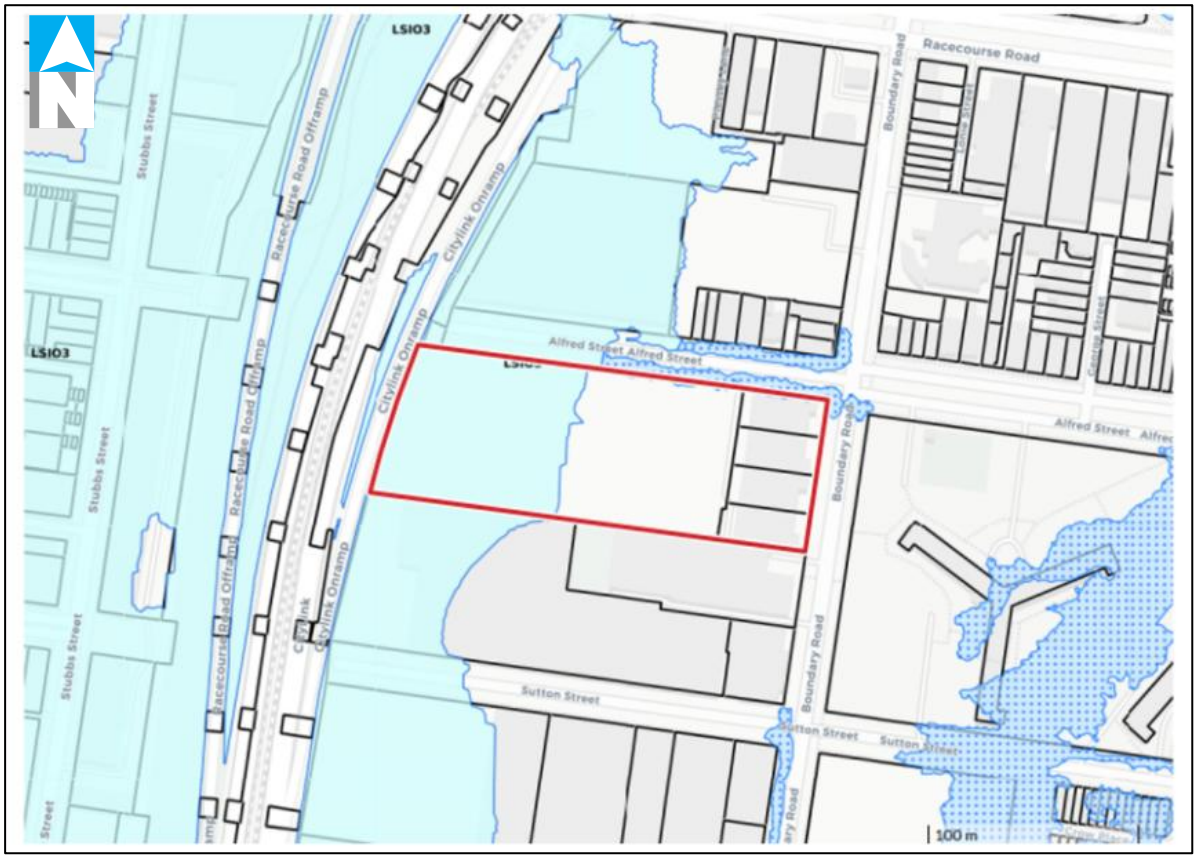

Figure 5 - LSIO and SBO Overlays as they apply to the land

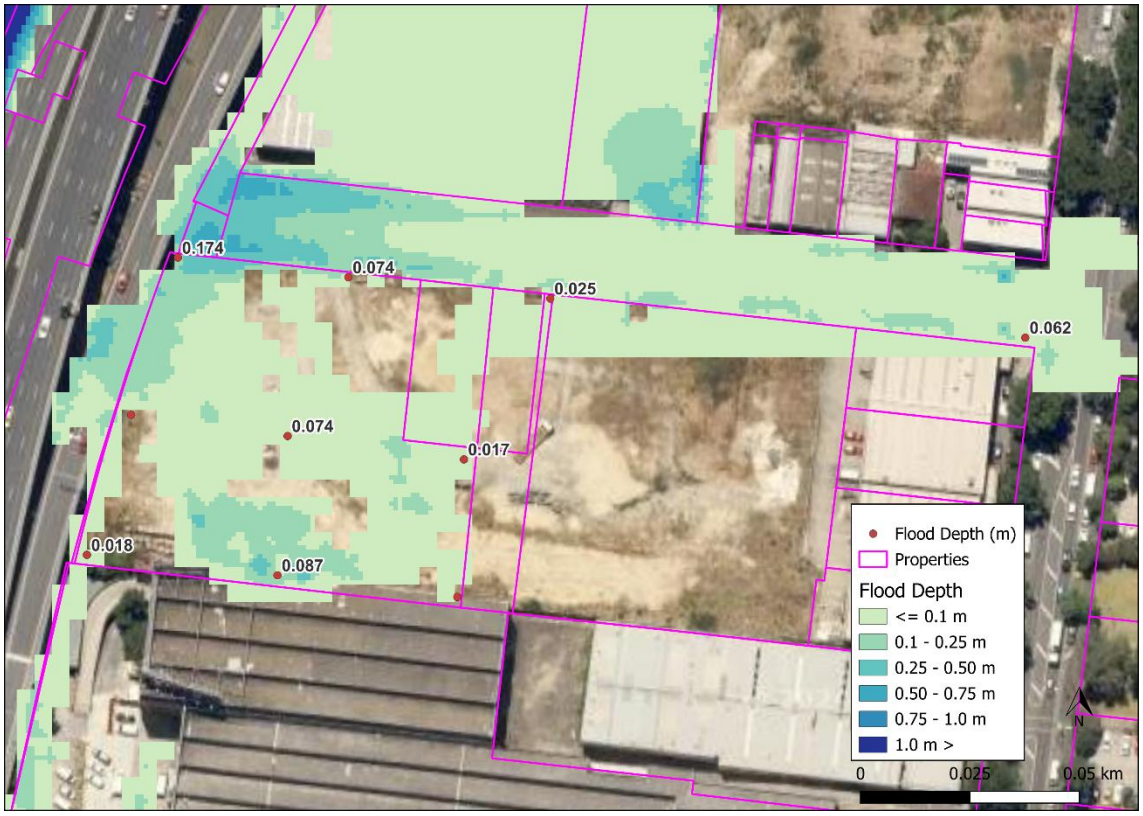

Figure 6 – 20% AEP Flood Depths

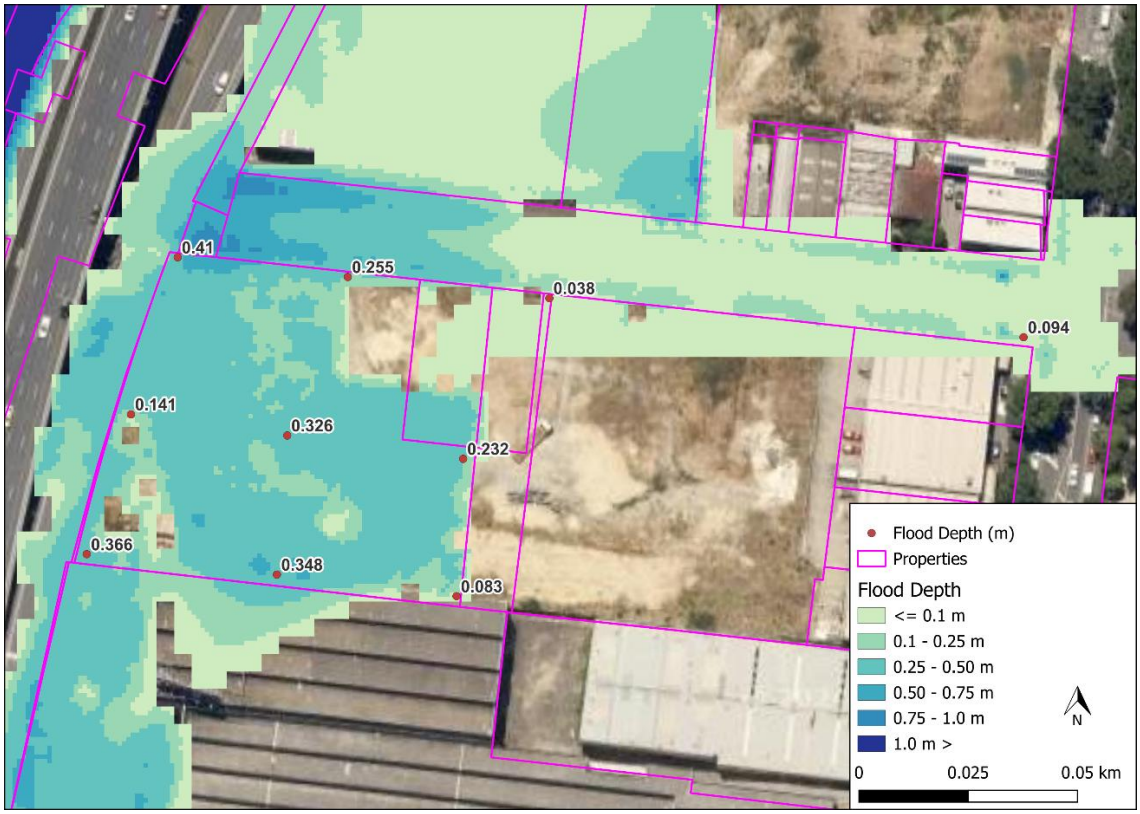

Figure 7 – 1% AEP Flood Depths (Existing Conditions)

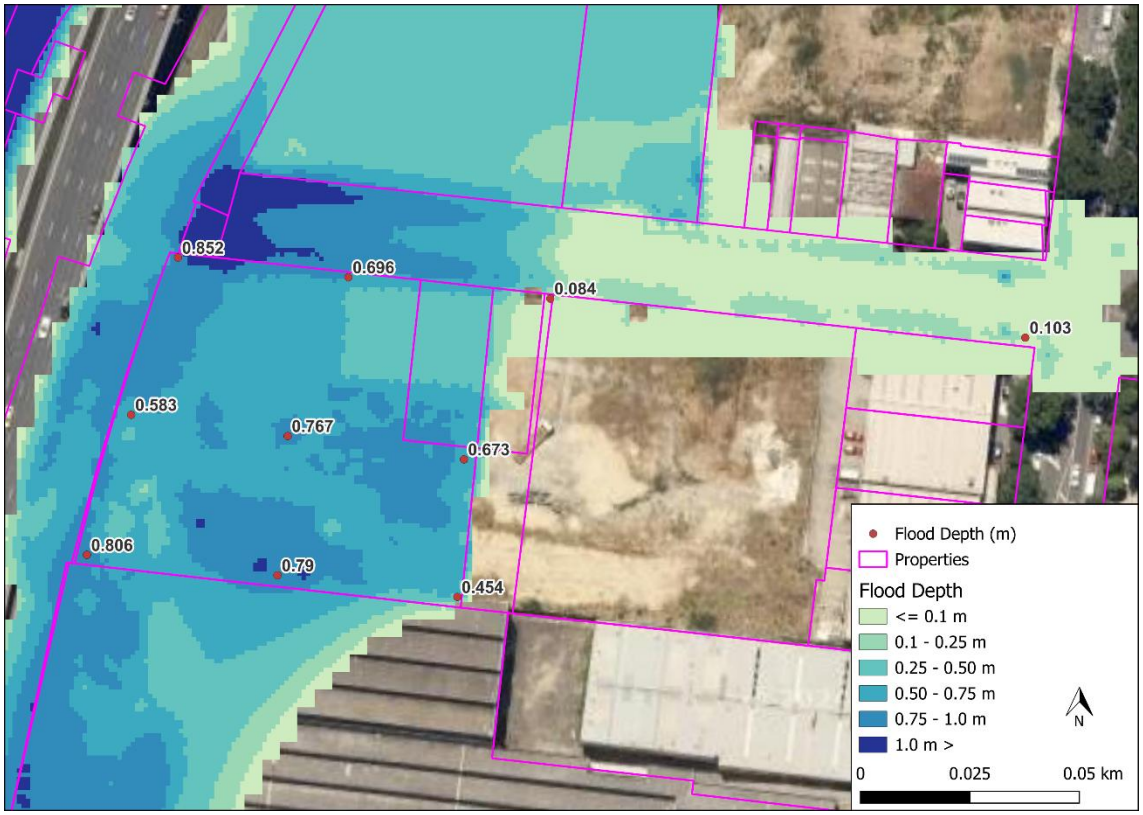

Figure 8 – 1% AEP Flood Depths (Future Climate Conditions)

An examination of the land surface topography in the model indicates that the relatively higher depths in the western portion of the site are due to excavation of the land surface associated with the demolition of previous site buildings. Flood levels in the western portion of the site are flat, indicating

ponded water with very low flow velocities. Table 1 provides the modelled flood levels for a range of existing and future flood events at the locations shown in Figure 3.

Table 1 - Expected Flood Levels (mAHD)

Location Reference	Modelled Ground Elevation (mAHD)	5yr	10yr	20yr	50yr	100yr	5yr CC	10yr CC	100yr CC
NE Corner	7.93	8.01	8.02	8.03	8.03	8.04	8.02	8.02	8.05
North	3.44	3.42	3.43	3.44	3.44	3.44	3.43	3.43	3.49
Nth Centre	2.73	2.80	2.82	2.88	2.98	3.04	2.82	2.87	3.48
NW Corner	2.69	2.80	2.82	2.88	2.98	3.04	2.82	2.87	3.48
East	2.78	2.78	2.82	2.88	2.98	3.04	2.82	2.87	3.48
Centre	2.71	2.78	2.82	2.88	2.98	3.04	2.82	2.87	3.48
West	2.95				2.98	3.04			3.48
SE Corner	2.98				2.98	3.04			3.48
South	2.70	2.78	2.82	2.88	2.98	3.04	2.82	2.87	3.48
SW Corner	2.61	2.69	2.76	2.88	2.98	3.04	2.78	2.87	3.48

Figure 9 - Flood Level Locations

The greatest flood depths are associated with ponding behind the Moonee Ponds Creek levee at the western end of Alfred Road. There is localised sheet flooding (as shown in the SBO3) that flows from Boundary Road west towards Moonee Ponds Creek, but those flows are localised and the depths are less than 100 mm and primarily confined to the kerb and channel of the road. The eastern part of this street outside the LSIO area is therefore considered safe during flood events and provides suitable egress to and from the site. Boundary Road is flood-free and provides safe egress to and from the site.

In the future climate case, the western half of the site is affected by an average depth of flooding of 700 mm in the 2100 1% AEP, whilst the eastern half of the site is relatively flood free. There are a number of low points on the western portion of the existing property (based on topographical information) that indicate depths of up to 800 to 900 mm.

It must be noted that these future flood depths and levels do not include the flood mitigation works proposed by Melbourne Water as part of the Arden Macaulay Precinct Flood Management Strategy or from newer flood modelling of the precinct currently being undertaken by Melbourne Water.

The Special Building Overlay, which identifies land subject to flooding form the urban drainage network is associated with surface flows along Alfred Street.

1.2.1 Discrepancies with Existing Levels

The Melbourne Water flood modelling was undertaken between 2017 and 2020 and used Lidar surface data, which was captured in 2014 or 2017. The modelling reflects the land surface in the area at the time the data was captured.

The existing conditions survey for the subject land, taken by Reeds Consulting in September 2025, indicates that the land surface is significantly different to that assumed in the Melbourne Water modelling. Specifically, a large amount of fill has been introduced to the land in the time period between the acquisition of the Lidar data and the site establishment survey, primarily in the western portion of the site. This is shown in Figure 10 below, with areas above 3.5mAHD shaded blue. More than 60% of the land is above the climate change flood level.

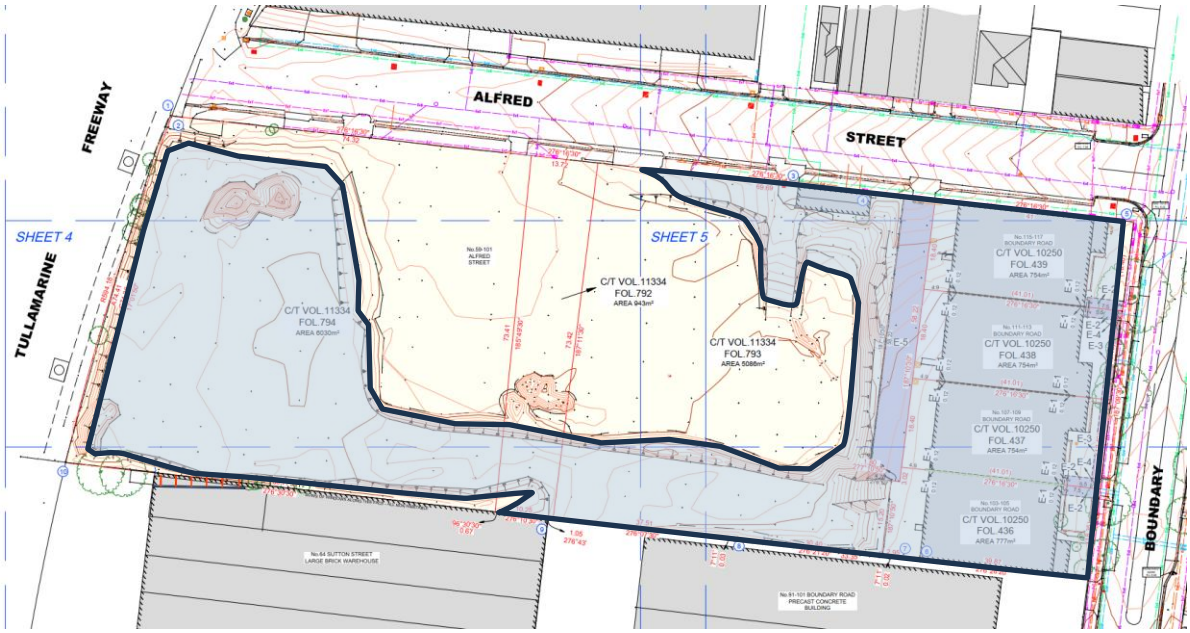

Figure 10 - Area of site above 3.5m AHD (2025 Conditions)

For each of the locations shown in Table 1, the land surface from the Melbourne Water model has been extracted, along with the surveyed land surface at that location in Table 2. The indicative future climate flood level and depth at each location is shown, based on the model results.

Table 2 - Comparison of Site Levels

Location Reference	MW 2018 Ground Elevation (mAHD)	2025 Surveyed ground elevation	100yr CC Flood level (MW) mAHD	Expected flood Depth (m), 2025 survey
NE Corner	7.93	8.14	8.05	Not flooded
North	3.44	3.40	3.49	0.09
Nth Centre	2.73	2.73	3.48	0.75
NW Corner	2.69	2.69	3.48	0.79
East	2.78	2.91	3.48	0.57
Centre	2.71	4.03	3.48	Not flooded
West	2.95	3.58	3.48	Not flooded
SE Corner	2.98	3.49	3.48	Not flooded
South	2.70	3.78	3.48	Not flooded
SW Corner	2.61	2.78	3.48	0.70

Examination of Melbourne Water's flood information indicates that the flood levels in the area under future climate conditions have the same effectively the same elevation from north of Alfred Street to Macaulay Road. This indicates that the site is in a flood storage area. However, the Arden Macaulay Flood strategy is intended to offset the storage changes caused by development through a range of measures. These effect of these measures is not included in the flood model results presented above.

Melbourne Water has advised that a key concern is the ability for the site to maintain the transfer of flows that escape the Moonee Ponds Creek south towards Macaulay Road. This is examined further in Section 4.5.3.

2. Proposed Development

The development proposes to demolish the existing building on the site and construct three multi-storey residential towers (Precinct 1, 2 and 3), including associated amenities. The proposed layout and floor levels for each precinct are shown in Figure 11 to Figure 13.

Precinct 3 i and Precinct 2 are impacted by the Land Subject to Inundation Overlay (LSIO), while Precinct 1 is situated on flood-free land.

In Precinct 3, the lower ground floor accommodates fire tanks and a fire pump station at FFL 1.2 m AHD, which is well below the flood level. However, this space has no external openings for floodwaters to enter and is only accessible internally via stairs or lifts from the upper floors. To ensure resilience, this area should be constructed using wet-floodproof materials.

The proposed Western Street, running between Precinct 2 and 3, ramps up from Alfred Street to 4.1 m AHD before providing access to the ground floors of both precincts. This western street links to the proposed eastern street, which runs between Precincts 1 and 2. The eastern street connects to the flood-free eastern part of Alfred Street, providing safe vehicular and pedestrian access to all the precincts.

The FFL in all the internal areas activated by the western and eastern internal streets, in all three Precincts, is set at or above 4.1 m AHD, which is above the NFPL. All the other floors are well above the nominated flood planning level (NFPL).

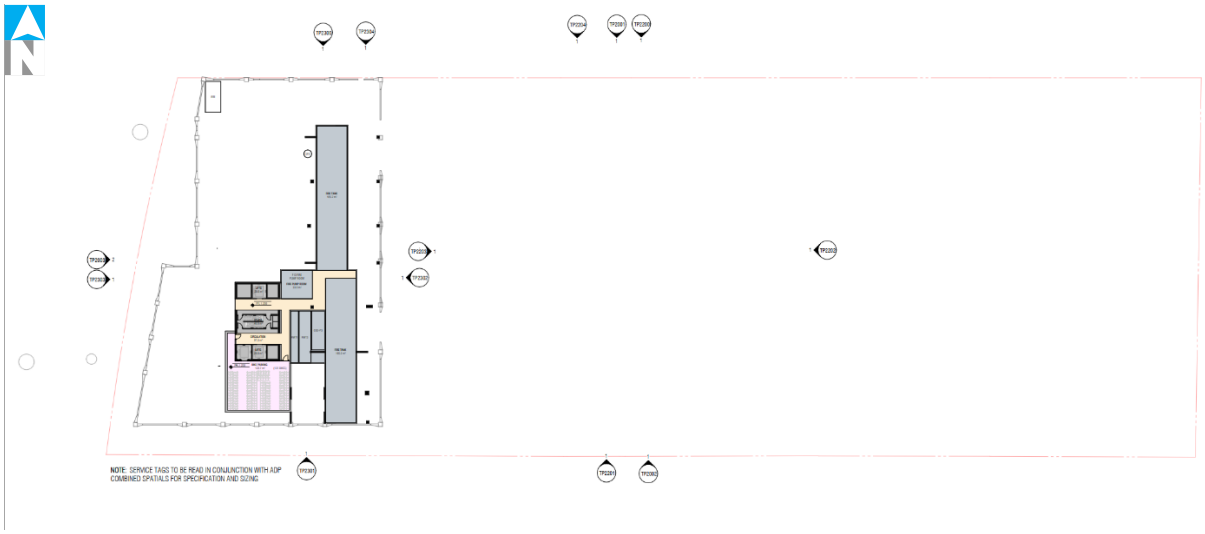

Figure 11 - Precinct 3 Lower Ground Floor Plan

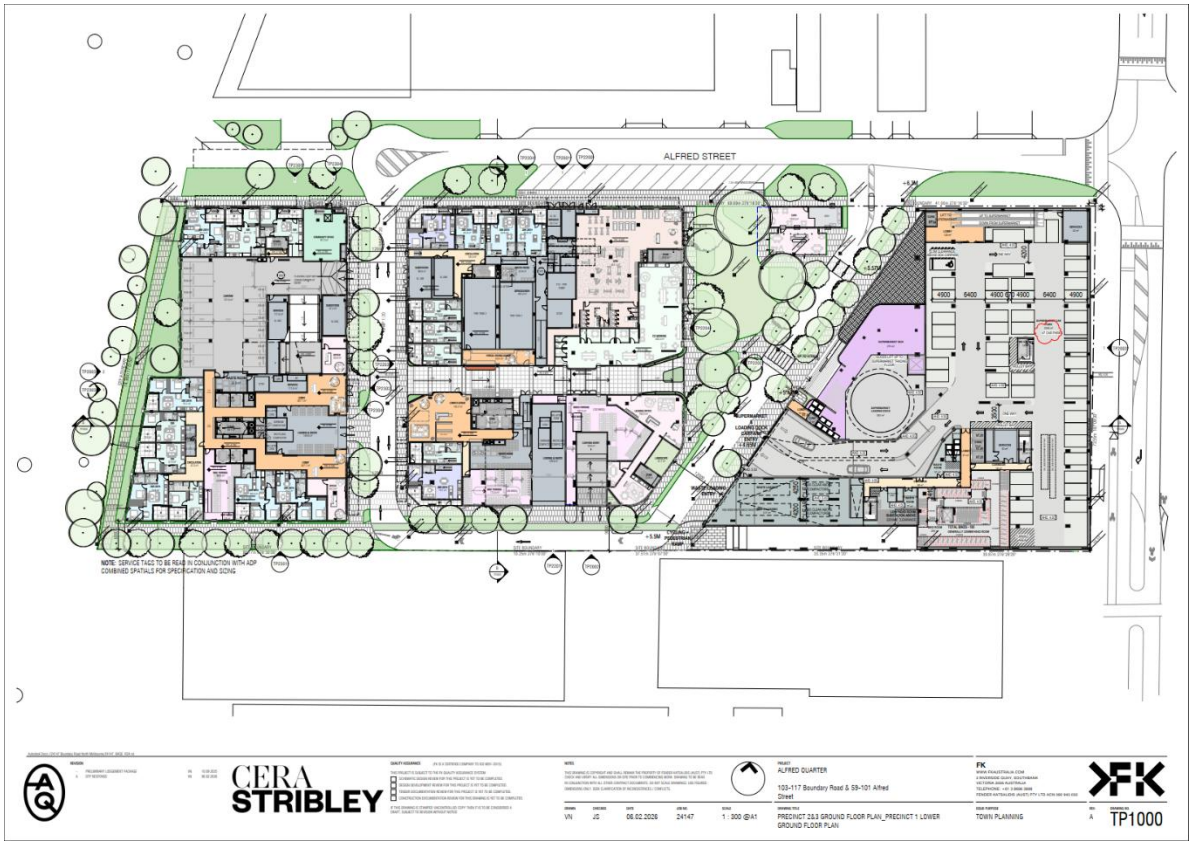

Figure 12 - Precinct 2&3 Ground Floor and Precinct 1 Lower Ground Floor Plan

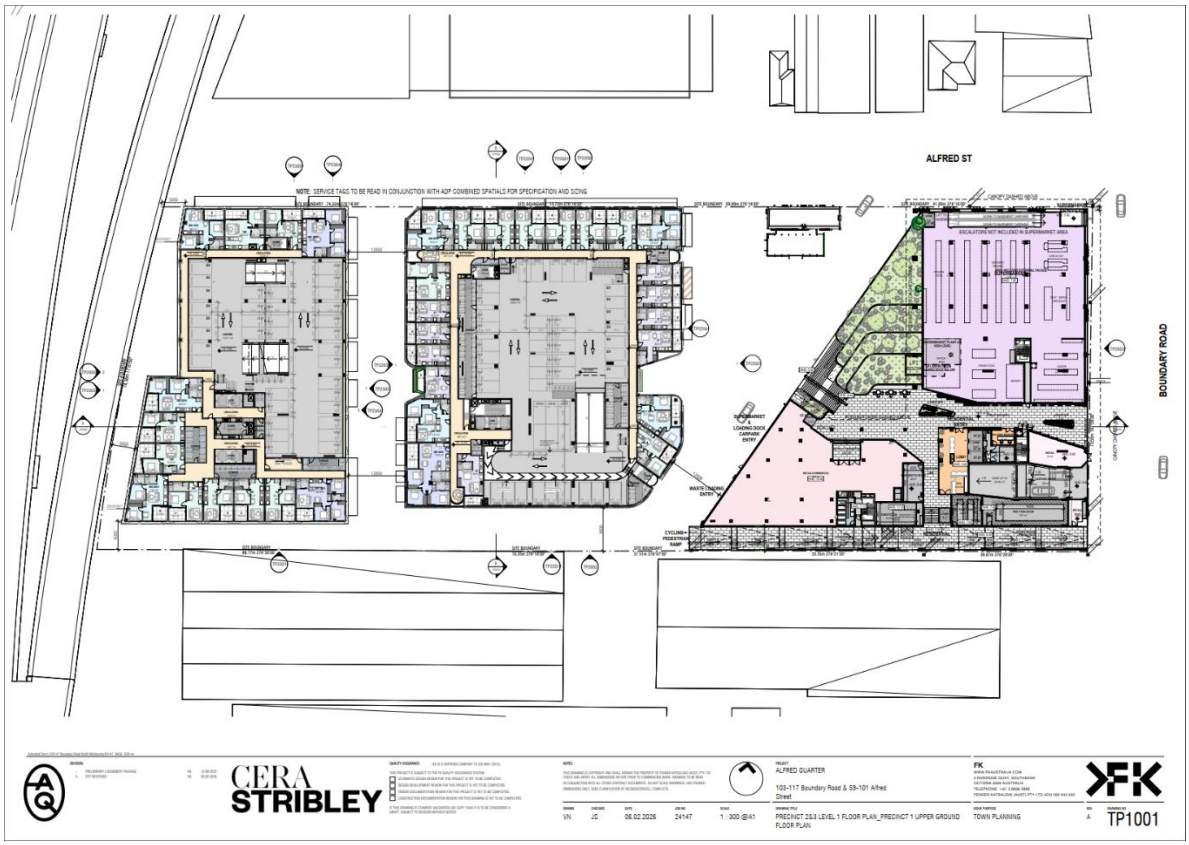

Figure 13 - Precinct 2&3 Level 1 Floor and Precinct 1 Upper Ground Floor Plan

3. State and Local Planning Policy and Relevant Guidelines

- In considering an assessment of an application for a Planning Permit, in relation to flooding, the City of Melbourne is primarily guided by Melbourne Water as the Determining Referral Authority for development within the LSIO. In considering an application, Melbourne Water uses the following State and Local Planning Policy in their decision making:
- Clause 13.01-1s (Natural Hazards and Climate Change) (SPP)
- Clause 13.03-1s (Floodplain Management) (SPP)
- The Decision Guidelines of Clause 44.04 (Land Subject to Building Overlay) (LPP)
- The Guidelines for Development in Flood Affected Areas (DELWP 2019).

3.1 State Planning Policy

Victorian state planning policies provide the basis for land use planning, including settlements at a statewide level. The clauses as they apply to floodplain management include:

Clause 13.03-1S Floodplain Management

The objective is to assist in the protection of:

- Life, property and community infrastructure from flood hazard, including coastal inundation, riverine and overland flows.
- The natural flood carrying capacity of rivers, streams and floodways.
- The flood storage function of floodplains and waterways.
- Floodplain areas of environmental significance or of importance to river, wetland or coastal health.
- Identify land affected by flooding, including land inundated by the 1% AEP flood event or as determined by the floodplain management authority in planning schemes.
- Avoid intensifying the impact of flooding through inappropriately located use and development.
- Plan for the cumulative impacts of use and development on flood behaviour.
- Locate emergency and community facilities (including hospitals, ambulance stations, police stations, fire stations, residential aged care facilities, communication facilities, transport facilities, community shelters, childcare centres and schools) outside the 1% AEP floodplain and, where possible, at levels above the height of the probable maximum flood.
- Locate use and development that involves the storage or disposal of environmentally hazardous industrial and agricultural chemicals or wastes and other dangerous goods (including intensive animal industries and sewage treatment plants) outside floodplains unless site design and management is such that potential contact between such substances and floodwaters is prevented, without affecting the flood carrying and flood storage functions of the floodplain.
- Ensure land use on floodplains minimises the risk of waterway contamination occurring during floods, and floodplains are able to function as temporary storage to moderate peak flows and minimise downstream impacts.
- 13.01-1S Natural Hazards and Climate Change
- This objective is to minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning.
- 13.01-1S Strategies

- Respond to the risks associated with climate change in planning and management decision making processes.
- Identify at-risk areas using the best available data and climate change science.
- Integrate strategic land use planning with emergency management decision making.
- Direct population growth and development to low risk locations.
- Develop adaptation response strategies for existing settlements in risk areas to accommodate change over time.
- Ensure planning controls allow for risk mitigation and climate change adaptation strategies to be implemented.
- Site and design development to minimise risk to life, health, property, the natural environment and community infrastructure from natural hazards.
- 13.01-2S Coastal Inundation and Erosion
- The objective is to plan for and manage coastal hazard risk and climate change impacts.
- 13.01-2S Strategies
- Plan for sea level rise of not less than 0.8 metres by 2100 and allow for the combined effects of tides, storm surges, coastal processes and local conditions such as topography and geology when assessing risks and coastal impacts associated with climate change.
- Ensure that land subject to hazards is identified and appropriately managed to ensure that future use and development is not at risk.
- Avoid use and development in areas vulnerable to coastal inundation and erosion.
- Respond to marine and coastal processes in the context of the coastal compartment type.
- Assess the effectiveness, costs, benefits, impacts (direct, cumulative and synergistic) and path dependency of available adaptation options in the following order:
- 1. non-intervention
- 2. avoid
- 3. nature-based methods
- 4. accommodate
- 5. retreat
- 6. protect

- Ensure that development or protective works that seek to respond to coastal hazard risks avoid detrimental impacts on coastal processes.
- Clause 44.04 Land Subject to Inundation Overlay
- The Land Subject to Inundation Overlay (LSIO) as per Clause 44.04 of the Victorian Planning Provisions has a purpose including but not limited to:
- To ensure that development maintains the free passage and temporary storage of floodwaters, minimises flood damage, responds to the flood hazard and local drainage conditions and will not cause any significant rise in flood level or flow velocity.
- To minimise the potential flood risk to life, health and safety associated with development.
- Th provision of the overlay includes Decision Guidelines that require consideration of
- The Municipal Planning Strategy and the Planning Policy Framework.
- Any local floodplain development plan.
- Any comments from the relevant floodplain management authority.
- The existing use and development of the land.

- Whether the proposed use or development could be located on flood-free land or land with a lesser flood hazard outside this overlay.
- Alternative design or flood proofing responses.
- The susceptibility of the development to flooding and flood damage.
- The potential flood risk to life, health and safety associated with the development. Flood risk factors to consider include:
  - The frequency, duration, extent, depth and velocity of flooding of the site and accessway.
  - The flood warning time available.
  - Tidal patterns.
  - Coastal inundation and erosion.
  - The danger to the occupants of the development, other floodplain residents and emergency personnel if the site or accessway is flooded.
- The effect of the development on redirecting or obstructing floodwater, stormwater or drainage water and the effect of the development on reducing flood storage and increasing flood levels and flow velocities.

3.2 Objectives of LSIO as per the Melbourne Planning Scheme

The proposed redevelopment is located within the LSIO Schedule 3 (Clause 44.03-3) of the Melbourne Planning Scheme. The Clause is associated with inundation from Moonee Ponds Creek and the Lower Yarra River specifically and include requiring consideration of:

- The practicality and reliability, over the likely lifetime of a development, of any proposed strategies to minimise or mitigate risks of flood damage or safety hazards.
- Whether the development will likely result in persons being exposed to unsafe flood depths and velocities.
- Whether the proposed development maintains existing flood storage capacity and flow paths.
- The likely or modelled extent of any likely or modelled impact of development on floodwaters, including the specific and cumulative nature and extent of impact on surrounding properties.
- Whether the proposal appropriately responds to the identified site specific flood risk to the satisfaction of the relevant floodplain management authority.
- Whether the ground floor design of the building maintains good physical and visual connection between the street and internal ground floor.
- Whether development activates the street edge and frontage.
- Whether the development and design response manage the flood risk appropriately, whilst also achieving good design and equitable access.
- Whether the materials and finishes are resilient to damage in flood events.
- Whether precinct wide drainage upgrades or flood risk mitigation works or evacuation warning systems can reduce floor levels in commercial and retail spaces.

3.3 Objectives of SBO as per the Melbourne Planning Scheme

The subject site is also affected by the Special Building Overlay – Schedule 3 (Clause 44.05-3). The SBO3 relates to inundation from overland flows generated by the local drainage system, including the Elizabeth Street, Arden, Macaulay, Moonee Ponds Creek, Hobsons Road, Fishermans Bend and Southbank catchments.

While many of the considerations under SBO3 mirror those outlined for LSIO (Section 3.2), the SBO3 objectives specifically emphasise:

- Identification of land subject to overland flow flooding in the 1% AEP event, incorporating climate change by 2100.
- Minimising the impact of new development on flood extent, depth and velocity to avoid detriment to surrounding properties and the drainage network.
- Ensuring new development responds to local drainage characteristics and overland flow behaviour.
- Simultaneously achieving safe access/egress, equitable access and good urban design outcomes within a constrained flood environment.
- Encouraging resilient design, including materials, finishes and essential services that minimise flood damage.
- Where appropriate, considering precinct-scale drainage upgrades or mitigation works to address cumulative risk across the SBO3 catchment.

In summary, the SBO3 introduces a more local, drainage-focused lens compared to the broader riverine flooding emphasis of the LSIO, while maintaining consistency with overarching floodplain management objectives.

At the subject land, the SBO is associated with flows down Alfred Street and is unlikely to pose any significant flood threat to land. The depth of inundation indicates very shallow flow, mostly contained within the road reserve.

3.4 Guidelines for Development in Flood Affected Areas (DELWP 2019)

The Guidelines for Development in Flood Affected Areas[1] (DELWP Guidelines) is the guideline that has been adopted by Melbourne Water for assessing development in flood prone areas. The guidelines state:

> *'These guidelines provide an assessment framework and method to assist decisions on development in flood affected areas. In principle, development should not intensify the harmful impacts of flooding.'*

The guidelines acknowledge the fact that they cannot cover all the circumstances and aspects of flood behaviours and state that:

> *'Floodplain managers have discretion to vary from the guidelines, considering local circumstances, the nature of the development proposal and the flood risk'.*

The guidelines outline the objectives for sound floodplain management but stop short of discussing every possible development scenario that may occur in Victoria. Consitient with good floodplain management, the guidelines acknowledge that development can occur in flood prone areas with suitable risk mitigation approaches:

> '*flood affected areas may be used productively when development proposals respond appropriately to the degree of risk.'*

[1] Developed by the Department of Environment, Land and Water Protection (DELWP), now known as the Department of Energy, Environment and Climate Action (DEECA).

The guidelines also state:

> '*Usually, it is not practical to eliminate the flood risk. A challenge for the floodplain management authorities is to determine what flood risk is acceptable to the community.'*

Notwithstanding the above, the relevant objectives in the guidelines for assessing risk are:

- Site safety: Protect human life and health and provide safety from flood hazard.
- Flood damages: Minimise flood damage to property and associated infrastructure.
- Flood impacts: Maintain free passage and temporary storage of floodwaters.
- Waterway and floodplain protection.

3.4.1 Site Safety

The safety of people both on the site and moving to and from the site is paramount and a key focus of the guidelines. Key aspects of flood characteristics to consider when assessing site safety include the:

- Depth and velocity (hazard)
- Isolation (duration of flooding and distance to safe ground)
- Frequency of flooding
- Vulnerability (populations or vulnerable groups such as aged care and hospitals)

The Safety Criteria outlined in the guidelines are listed below in Table 3.

Table 3 - DELWP 2019 Guidelines: Site Safety

Objective One: Protect human life and health, and provide safety from flood hazard

Guiding principle	Assessment criteria
Site and access safety must not be compromised	1.1. **Depth and flow**. Development should not be allowed on properties where the depth and flow of floodwaters would be hazardous to people or vehicles entering and leaving the properties. See Tables 1, 2 and 3.
Development must be located on sites of lowest overall hazard.	1.2. **Siting.** Development and access should be located on land with the lowest overall hazard.
Greenfield development sites must be designed to be safe from flood impacts.	1.3. **Greenfield development**. Greenfield development sites should either be flood free or contain building envelopes filled to the Nominal Flood Protection Level (NFPL - the 1% AEP flood level plus freeboard).
Hazardous materials must not contaminate floodwater.	1.4. **Hazardous materials**. Developments and uses which involve the storage or disposal of hazardous materials must not be located on floodplains unless the materials are totally isolated from floodwaters.
Vulnerable people must not be exposed to floods and facilities providing vital community or emergency services must be operational during floods.	1.5. **Vulnerability.** Buildings housing vulnerable people, community services facilities and emergency services should be sited outside the 1% AEP flood extent and, where possible, at levels above the height of the probable maximum flood.

The guidelines indicate that where redevelopment is proposed, an effort should be made to explore relocation to flood free areas. The applicant should provide evidence of why this has been ruled out in the documentation provided to the floodplain management authority. The applicant should also demonstrate how the flood risk can be reduced and what contingency arrangements are in place if the site becomes isolated. This site is not isolated by flooding, and flood risk has been reduced by adopting NFPL in design and safe access to the site has been identified during floods.

3.4.2 Flood Damage

Raising floors higher than the flood level is the easiest way to reduce flood damage. When floors are overtopped, valuable contents such as carpets, furniture, electrical appliances and furnishings are damaged.

When determining a minimum floor level, freeboard is added to the flood level estimate to provide certainty that the floors won't be inundated. The level obtained by adding freeboard to the flood level is called the Nominal Flood Protection Level (NFPL). See the second paragraph of Section 1.2

The guidelines acknowledge that the cost or inconvenience of raising the floors of minor buildings or building alterations may need to be weighed against the flood damage prevented.

The Flood Damage Criteria outlined in the guidelines are listed below in Table 4.

Table 4 - DELWP 2019 Guidelines: Flood Damage

Objective Two: Minimise flood damage to property and associated infrastructure

Guiding Principle	Assessment criteria
Buildings must not interfere with existing or proposed water, sewer or drainage services. (Applies to Melbourne Water or council).	2.1. **Water services**. Buildings and building envelopes should be located sufficiently away from a water, sewer or drainage asset to enable that asset to be serviced.
Buildings must be designed to avoid significant financial impacts of flood damage.	2.2. **Floor levels**. The floor levels of buildings should be set in accordance with Tables 4 to 6.
The basements of any new buildings must not flood.	2.3. **Basements**. Basements should be designed to be protected from flooding.
Those parts of buildings affected by flooding must be able to withstand the effects of inundation.	2.4. **Materials**. Any building or portion of a building below the 1% AEP flood level should be constructed from flood-resistant materials.
Services to a building must be capable of functioning during and after a flood.	2.5. **Building services**. Essential services to a building should be flood proofed or raised above the NFPL.

The guidelines specify floor levels with regard to the flood level. This enables tangible flood damage to buildings and their contents to be avoided or reduced. Freeboard requirements are relaxed for minor development:

- Where the flood damage potential is likely to be low.
- Where the cost and inconvenience of raising floors for building extensions are disproportionate to the benefits.

As it is not possible to foresee all circumstances, floodplain management authorities have discretion to relax floor level requirements, if appropriate, after considering:

- The building's purpose and flood damage potential.
- How the flood damage potential can be kept as low as reasonably practical, e.g. by requiring storage areas above this level or locating a building to the highest feasible part of the site.
- The ability of a future occupant to recover from a flood.
- Any building or portion of a building below the 1% AEP flood level should be constructed from flood-resistant materials. Floodplain management authorities may specify a condition of the permit to this effect.

3.5 Good Design Guide for Buildings in Flood Affected Areas in Fishermans Bend, Arden and Macaulay

This guide recognises that development in flood-affected areas must not only manage flood risk but also achieve high-quality urban design outcomes. It sets out three overarching principles:

- **Flood responsive design** — ensuring development responds appropriately to local flood behaviour, including depths, velocities and flood hazard. This requires siting buildings and finished floor levels relative to the Nominal Flood Protection Level (NFPL), elevating essential services above flood levels, and using resilient building materials and finishes to reduce flood damage.
- **Good design** — encouraging buildings and public spaces that are people-centred, active and resilient. The guide promotes active street frontages, human-scale design, landscaping that supports overland flow, and integration of ramps, stairs and transition spaces so that flood-resilient design also contributes to attractive, functional and liveable urban environments.
- **Equitable and universal access** — requiring that the management of level changes between flood-affected streets and raised internal floor levels is addressed in a way that preserves accessibility, dignity and inclusion. Design responses such as terraces, colonnades and integrated ramps/landscape features are encouraged to maintain safe and equitable access while meeting flood protection requirements.

Together with the LSIO and SBO3 objectives, the guide highlights that good floodplain management is not solely about minimising risk, but also about creating resilient, accessible and high-quality places that function effectively under flood conditions.

4. Policy and Design Response

4.1 State Planning Policy

The high level policy that sets the general approach to managing flood risk is intended to ensure that development is appropriately designed and sited, not prevented.

State Planning Policy Clause 13.03-1S Floodplain Management seeks to assist the protection of life, property and community infrastructure from flood hazard, including coastal inundation, riverine and overland flows. The determination of how this is achieved is subjective and should be considered rigorously on a site by site basis using appropriate discretion, not as a broad-scale preclusion.

The flood hazard is eliminated by adopting the floor level at NFPL and providing safe egress during a flood.

4.2 LSIO Decision Guidelines

Decision guidelines for consideration under Clause 44.04 of the Melbourne Planning Scheme are addressed below. The zoning of the site area is covered by Schedule 7 of the Special Use Zone. The purpose of this zone is to develop Arden into a thriving innovation precinct by concentrating an employment hub of medical, retail, commercial, education, industry and entertainment uses near Arden Railway Station, supporting a retail core along Barwise Street and facilitating community facilities and residential, including supporting and encouraging affordable housing, uses that support the Central City. Development of this area is critical and encouraged as an extension of the central city. Decision makers must balance the intent of the zone and development against the risks of any such development, including in relation to flood risk. The site is within the area described in Schedule 3 to the LSIO.

The design response to the critical LSIO Decision Guidelines (highlighted in **BOLD** text) is outlined below.

4.2.1 Clause 44.04 Land Subject to Inundation of the Melbourne Planning Scheme

The existing use and development of the land.

The proposed use is consistent with the Mixed Use Zone of the Melbourne Planning Scheme. The North Melbourne area is planned to contain a mixed-use of development including residential and commercial.

Whether the proposed use or development could be located on flood-free land or land with a lesser flood hazard outside this overlay.

Currently, except for the buildings along the Boundary Road, the site is empty with pre 2006 building demolished and cleared. However, the pre 2006 buildings and proposed works cover the entire site. A larger portion of the land is flood free and well above flood level. Flooding only affects the western part of the site, Precinct 3 and part of Precinct 2. It is inconsequential that the footprint of the development is in the LSIO, given the habitable internal areas are above the NFPL and there is safe egress to and from the site via Alfred Street and Boundary Road. Due to filling, much of the land is above the 1% AEP flood level

The site is within the Arden/Macaulay Precinct and has been identified as an area for increased development intensity by the City of Melbourne, as reflected in the zoning.

Alternative design or flood proofing responses.

The proposed design raises all active floors above NFPL. All internal areas are fully tanked and protected from entry of flood waters. For the Council flooding along Alfred Street, the detailed design of Alfred Street will contain the expected 1% AEP flood. The development ensures that floors are protected or above the adjacent 1% AEP flood level associate with Council flooding.

The susceptibility of the development to flooding and flood damage.

Under the proposed conditions, there are no internal areas that will be subject to flooding, with all habitable and commercial floor levels set at greater than 4.1m AHD, including for carparks. There are some external areas associated with roads that will be subject to minor inundation. The flow velocity associated with this flooding is very low at the peak of the flood. These areas are limited to passive or transient uses, or functions necessary for activation or access into the buildings and comprise a form that is typically pavement or soft landscape, which are both resistant and resilient to flood inundation.

The potential flood risk to life, health and safety associated with the development.

Flood risk factors to consider include:

- The frequency, duration, extent, depth and velocity of flooding of the site and accessway.
- The flood warning time is available.
- Tidal patterns.
- Coastal inundation and erosion.
- The danger to the occupants of the development, other floodplain residents and emergency personnel if the site or accessway is flooded.

The western part of Alfred Street is considered a high flood hazard, and the entry to this area will be restricted during rain events. The proposed western internal street, which connects to this part of Alfred Street, is ramped up to the NFPL and links to the flood-free eastern section of Alfred Street via the eastern entry. This arrangement ensures safe pedestrian and vehicular access to Precinct 3. Precincts 1 and 2 maintain direct access to flood-free sections of Alfred Street and Boundary Road, thereby ensuring safe access during flood events. Flooding of Alfred Street in the SBO3 area will not occur simultaneously with a flood in Moonee Ponds Creek

The effect of the development on redirecting or obstructing floodwater, stormwater or drainage water and the effect of the development on reducing flood storage and increasing flood levels and flow velocities.

There is no significant change in the development footprint within the flooded area compared to the building occupancy pre 2006. Flow conveyance has been reduced (see section 4.3.5) as a result of filling on the land compared to when the Melbourne Water modelling was undertaken. The proposed development restores flow conveyance to a level equivalent to that in the Melbourne Water modelling.

4.2.2 Clause 44.04-3 Land Subject to Inundation Schedule 3

The practicality and reliability, over the likely lifetime of a development, of any proposed strategies to minimise or mitigate risks of flood damage or safety hazards.

The proposed development has been designed to provide protection from the estimated 1% AEP flood event in 2100. The lower ground floor of Precinct 1 is the only level below the NFPL; however, it is fully tanked and only accessible internally via stairs and lifts from upper floors. All other floors across the development are set above the NFPL.

Whether the development will likely result in persons being exposed to unsafe flood depths and velocities.

The elevated and protected floor levels ensure that the risk of occupants being exposed to flooding is minimal. Precinct 1 is the only precinct located within the flood-affected area. To reduce risk, access to the flood-prone western section of Alfred Street via the proposed western street should be closed during flood events. Alternative safe egress is available from Precinct 1 to the flood-free sections of Alfred Street and Boundary Road.

Whether the proposed development maintains existing flood storage capacity and flow paths.

The site has historically been fully developed with commercial/industrial buildings prior to 2006. The proposed footprint closely aligns with this pre-2006 extent, ensuring no material change to flood storage capacity or existing flow paths. The current conditions has significant flood free areas on the land, compared to the flood model results, and the change in flood storage for the entire precinct is accounted for in Melbourne Water's Arden Macaulay Drainage Strategy.

The likely or modelled extent of any likely or modelled impact of development on floodwaters, including the specific and cumulative nature and extent of impact on surrounding properties.

Given the site's current levels and the development footprint, no cumulative or adverse impacts on adjacent properties or the surrounding area are anticipated as a result of the proposal.

Whether the proposal appropriately responds to the identified site specific flood risk to the satisfaction of the relevant floodplain management authority.

The development has responded appropriately to the flood risk at the site. The design ensures all the residential areas and amenities are above the NFPL.

Whether the ground floor design of the building maintains a good physical and visual connection between the street and the internal ground floor and whether development activates the street edge and frontage.

The entrance on all streets provides the required physical and visual connection (activation) from the street into the building. Stairs and lifts provide access to the different floors, which are set above the NFPL. The area below flood level is considered low value and only required for activation purposes before stepping up immediately to the NFPL.

Whether the development and design response manages the flood risk appropriately, whilst also achieving good design and equitable access.

The proposed approach provides good design and equitable access to the building from different streets. The proposed western street below flood level connecting Alfred Street is an essential element in the achievement of equitable access. The area below flood level, however, is also minimised so as to reduce the potential for flood damage. All habitable and active floors are maintained above the NFPL. At all times flood safe access to buildings is maintained.

Whether the materials and finishes are resilient to damage in flood events.

Wet flood proof materials will be used below the flood level where possible.

Whether precinct wide drainage upgrades or flood risk mitigation works, or evacuation warning systems can reduce floor levels in commercial and retail spaces.

Any precinct-wide flood mitigation works would likely be the responsibility of Melbourne City Council and/or Melbourne Water. It is understood there may be plans for future mitigation works in this precinct, however the timing and strategies are unknown. The flood warning system on the Moonee Ponds Creek is limited. There is a gauge located upstream of the site at the Jacana Retarding Basin and at Mount Alexander Road in Flemington.

Flooding at the site may be impacted by the tailwater condition resulting from storm surge in Port Phillip Bay, which is assumed in the flood levels. There is some local flooding associated with Council drainage networks along Alfred Street, but this would not exceed 100-200mm at it deepest in the absence of Moonee Ponds Creek flooding.

4.3 Special Building Overlay

The site is only minorly impacted by the Special Building Overlay (Schedule 3). The decision guidelines for SBO3 are almost identical to those described for the LSIO. The flood response for the site has been developed to consider and mitigate potential flood impacts from all sources. The SBO3 does not extend significantly onto the site and is primarily associated with overland flows in Alfred Street. These are very shallow and are unlikely to encroach onto the site.

The design of the road improvements to Alfred Street will ensure that these flows remain in Alfred Street. The exact details would need to be completed as part of the detailed design process and could include updates to the size of the Afred Street Drains or modifications to surface levels as part of the road design. This would be subject to the detailed design of the road network and would typically be conditioned on a planning permit. The proposed design facilitates these outcomes.

4.4 Guidelines for Development in Flood Prone Areas

The subject site is also affected by the Special Building Overlay – Schedule 3 (SBO3) along its northern boundary. This overlay identifies land liable to inundation from overland flows generated by the local drainage system.

In practice, the flood risk to the development from SBO3 is negligible. The proposed development is located above the applicable 1% AEP flood level (including the increase in rainfall intensity allowance for climate change by 2100). The development footprint also aligns with the site's pre-2006 building extent, ensuring no material change to flood storage capacity or overland flow paths.

The decision guidelines under SBO3 and LSIO overlap extensively, both requiring consideration of:

- maintaining flood storage capacity and flow paths;
- minimising exposure of occupants to unsafe flood depths and velocities;
- ensuring safe and equitable access during flood events;
- resilient building materials and services; and
- minimising cumulative flood impacts on surrounding properties.

Given this overlap, the design response provided in Section 4.2 (LSIO Decision Guidelines) is considered to also satisfy the relevant SBO3 decision guidelines.

4.5 DELWP Guidelines

The proposed development at Alfred Street and Boundary Road, North Melbourne, considers the objectives of State Planning Policy, Local Planning Policy and the *Guidelines for Development in Flood*

Affected Areas, within the context of all flooding conditions. Importantly, the development responds to future flood risk by raising the floor levels and providing pedestrian access that is considered low hazard for adults.

The proposed development has addressed the objectives of the DELWP Guidelines in the following manner.

4.5.1 Site Safety

The proposed development will be located within the pre 2006 building envelope and proposes three residential towers. The design of the building minimises the risk to residents and patrons by ensuring that all active use spaces are at or above the NFPL and the building has safe access during flood.

Melbourne is a growing city, and due consideration should be given to key activity areas, identified through policy and the Planning Scheme, for growth, redevelopment and housing.

The design of the building and the associated site safety risks are proposed to be addressed in the following ways:

- The finished level of the Ground Floor is set at 4.1 m AHD, which is above the NFPL for the property as required by Melbourne Water.
- The building has safe access during a flood.

4.5.2 Flood Damage

Flood damages relate to floors and areas that are below flood level and may be subject to damages due to flooding. The proposed development includes the following measures aimed at achieving an overall reduction in the potential for flood damage:

- The finished level of the Ground Floor is set at 4.1 m AHD, which is 600mm above the estimated 2100 1% AEP flood level.
- There are no open vents or flood ingress points below flood level.
- Analysis of the expected council drainage flows along Alfred Street will need to be considered in as part of the detailed design. The flood modelling indicates that the depth of flooding in the SBO3 area along Alfred Street is in the order of 5cm. The existing footpath at Alfred Street grades 100mm down from the property edge to the street, according to the existing survey. As modifications are proposed to Alfred Street, the effects of these modification must ensure that flooding does not encroach on buildings along the northern side of the development.

4.5.3 Flood Impacts

The site has historically been fully developed with commercial/industrial buildings prior to 2006. The proposed footprint closely aligns with this pre-2006 extent, ensuring no material change to flood storage capacity or existing flow paths. This ensures no change in the extent of impacts by floodwaters, including specific and cumulative effects on surrounding properties.

After discussions with Melbourne Water, we have assessed the ability of the site to transfer flows the expected 1% climate change flows of 8m^3/s from north to south along the western edge of the property under three scenarios. These are:

- Melbourne Water's modelled surface topography (considered representative of 2017 land conditions)
- The current land conditions, as per the site survey

- The future land conditions, post development. This assumes that the open space along the western boundary of the site is at the same level as the adjacent freeway reserve along the boundary.

The analysis was undertaken using simple channel conveyance calculations, adopting a representative cross section at the most constrained point along the western boundary of the land for each land use case. Mannings friction values and slope were identical in all cases. The location of the indicative section is shown by the magenta line in Figure 14.

Figure 14 - Indicative cross section location used for conveyance comparison

The analysis does not include any consideration of tailwater levels as this is an extremely complex modelling exercise. The cross sections are shown looking north, so the right side of the section corresponds with the subject land. The sections and the expected flood levels to convey above 8.3m^3/s are shown in Figure 15 to Figure 17. Calculations are completed to the nearest two centimetre level.

The assessment indicates that the conveyance through the area is smaller under the current conditions than those assumed in the Melbourne Water modelling, resulting in an expected increase in flood levels if the area was controlled by flow conveyance. This is not the case, as the expected flood levels are higher than expected from conveyance alone, indicating that the flood level is likely controlled by a combination of flood storage and conveyance, but not necessarily at the peak flow rate. Under all land conditions, the flood level in this simplistic conveyance assessment is lower than that shown in the Melbourne Water modelling.

Under the proposed conditions, where there is a proposed offset of 5m from the property boundary to facilitate a shared path, the analysis indicates that the flow conveyance through this area is effectively identical to the existing conditions at the maximum design flow. The total available conveyance in the development conditions, assuming no tailwater controls at the future flood level of 3.48 mAHD is 20.9 m^3/s. The adoption of the 5m offset from the western boundary maintains the expected flow conveyance of flood waters from Moonee Ponds Creek southward towards Macaulay Road. This area also provides some offset flood storage.

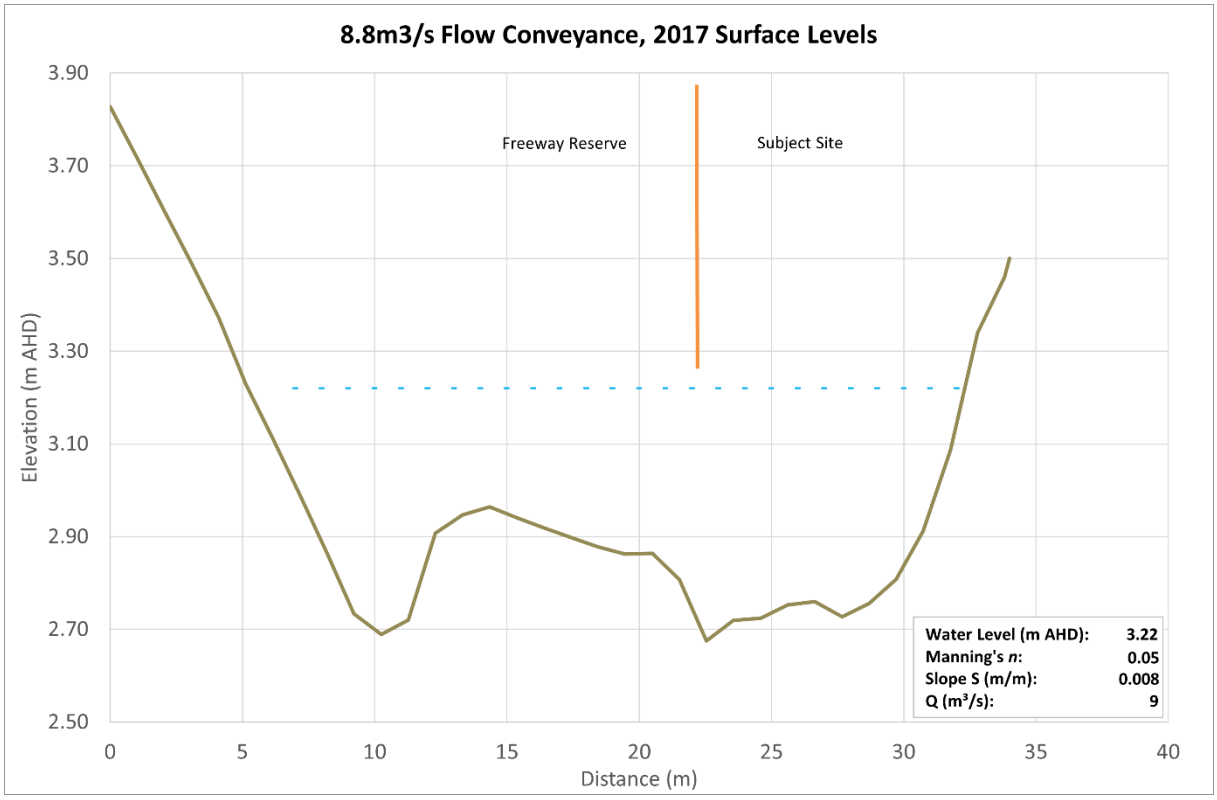

Figure 15 - Flow Conveyance, 2017 Surface Levels

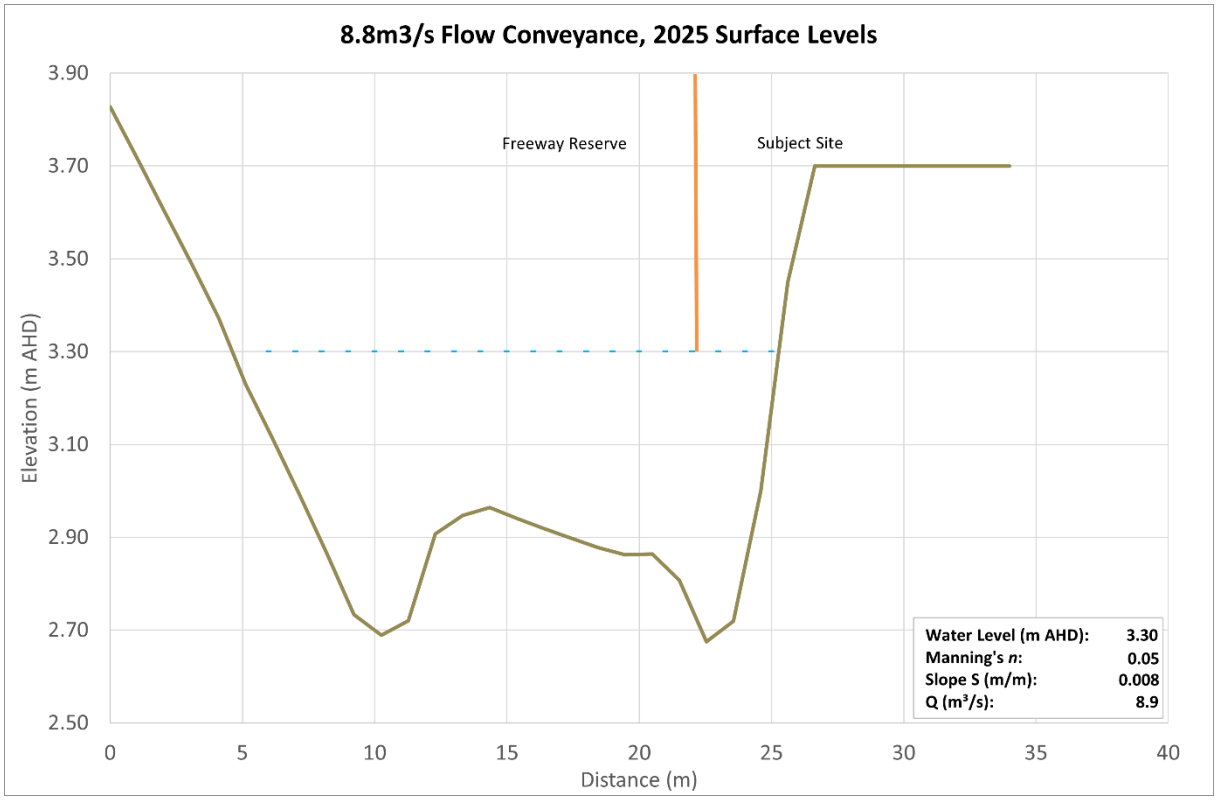

Figure 16 - Flow Conveyance, 2025 Surface Levels

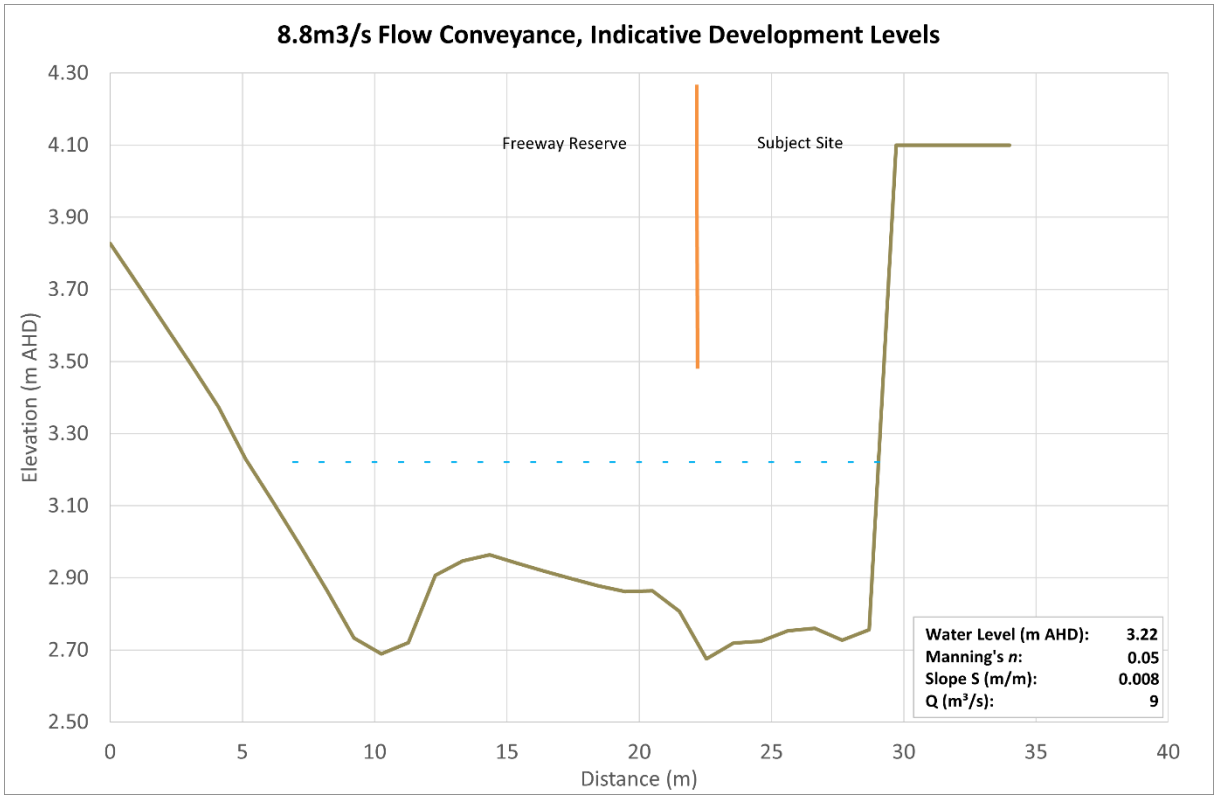

Figure 17 - Flow Conveyance, Proposed Development Indicative Surface Levels

Based on this analysis, the proposed works do not compromise the expected flood behaviour and will not reduce floodplain conveyance through the area in a future flood event.

4.6 Good Design Guidelines

The good design guidelines provide for the integration of flood protection works into a design framework. In general, as the site will be primarily flood free and not directly face floodwaters for the entry and activation of public or commercial spaces.

There is external access to private dwellings along Alfred Street via stairs, but there is also a flood free alternate access from internal corridors. This ensures that equitable access is maintained for all users. At the community space in P3, access is provided via stairs and a platform lift. This is allowed in the good design guide, given the space requirements and the low traffic nature of the space. This access is for a single specific use space and does not connect to the remainder of the site. The platform lift is fully enclosed within the building, which is consistent with the design guide advice.

5. Conclusion

The proposed development at Alfred and Boundary Roads, North Melbourne, is a multi-storey residential tower and is consistent with the intent of the Mixed Use Zone for land use.

The site is subject to flooding under current and future climate change conditions. The property is affected by an LSIO and SBO. It has been considered against State Planning Policy, the Decision Guidelines for the Land Subject to Inundation Overlay and the DELWP Guidelines for Development in Flood Affected Areas in this report.

Much of the State Planning Policy that guides decision-making around floodplains is related to land use planning and is aimed at ensuring that there are no inappropriate uses located in floodplains and that floodplains are preserved for their intended function. State Planning Policy is intended to be applied at a larger scale to guide land use planning, such as zoning, development plans and regional planning, rather than individual development applications.

The LSIO and SBO Decision Guidelines and the DELWP Guidelines outline a number of key criteria that are required to be met for any new development. The criteria include site safety, flood damage and flood impacts. The design response for the development has endeavoured to address the specific requirements of both Guidelines, including:

- Raising the Ground Floors to the NFPL
- Safe pedestrian and vehicular access to and from the site
- Providing tanked flood-protected areas for the areas below NFPL, such as the fire pump station at the Lower Ground Floor in Precinct 3.
- Use of wet flood-proof materials where possible.

The development proposal has addressed local policy and guidelines to the full extent possible within the constraints of the area and offers low risk to life health and safety as well as minimising flood damages with no impact on flood storage.

When considering approvals for the land, it is recommended that permit conditions be adopted to ensure that the development includes consideration of the following elements during the detailed design and approval process:

- The reconfiguration works along Alfred Street must ensure that 1% AEP flood flows associated with Council's drainage network remain within the Alfred Street road reserve, to the satisfaction of Council; and
- Surface levels within 5m of the western boundary of the site should allow for conveyance of flows through the shared path area. Surface levels in this area should be no more than 100mm higher than the surface level at the western boundary.

References

1. *Guidelines for Development in Flood Affected Areas, Department of Environment, Land, Water and Planning, 2019.*
2. *Australian Rainfall and Runoff Revision Project 10 – Appropriate Safety Criteria for People (April 2010)*
3. *Melbourne Planning Scheme*
4. *Victorian Planning Provisions*
5. *Good Design Guide for Buildings in Flood Affected Areas in Fishermans Bend, Arden and Macaulay*