

881-885 Bourke Street, Waterloo, Flood Impact and Risk Assessment (Main Works Application)

A flood impact and risk assessment prepared to support a mixed-use development at 881-885 Bourke Street, Waterloo. This report is specifically intended for the main works application.

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Waterloo Property Unit Trust

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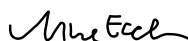


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Executive Summary

This report has been prepared by Stantec Australia Pty Ltd (**Stantec**) on behalf of The Trustee for Waterloo Property Unit Trust (the Applicant) to support the environmental impact statement (**EIS**) for a mixed-use state significant development at 881-885 Bourke Street, Waterloo. This report is specifically intended for the main works application (SSD-80441462).

The Flood Impact and Risk Assessment (**FIRA**) is prepared in accordance with relevant guidance, including the *Flood risk management manual* (Department of Planning and Environment, 2023) and *Flood Impact and Risk Assessment – Flood Risk Management Guide LU01* (Department of Planning and Environment, 2023).

The flood behaviour across for the site is identified using the 1D/2D TUFLOW hydraulic model files associated with the Council adopted *Alexandra Canal Flood Model Update* (WMAwater, 2023). A pre-development scenario and post-development scenario, including the proposed design surface, are assessed.

The results of the hydraulic model show that the development does not increase flood levels off-site during the 1% annual exceedance probability (AEP) event, and on-site impacts are acceptable. Minor offsite increases to flood levels are identified during the probable maximum flood (PMF) however they are considered acceptable given they do not increase the maximum hazard classification of the road and the newly wet areas are hazard category 1 (generally safe for people, vehicles and buildings).

A preliminary flood emergency plan is provided and shelter in place (**SIP**) strategy is recommended in accordance with the *Shelter in place guideline for flash flooding* (Department of Planning, Housing and Infrastructure, 2025)

A compliance assessment is undertaken to show that the proposed development is anticipated to comply with flood-related requirements from the *Planning Secretary's Environmental Assessment Requirements (SEARs)* and the *Interim Floodplain Management Policy* (City of Sydney, 2014) (the **DCP**).



Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
AEP	Annual exceedance probability
AHD	Australian height datum
BoM	Bureau of Meteorology
DCP	Development control plan
DEM	Digital Elevation Model
DPHI	Department of Planning, Housing and Infrastructure
FERP	Flood Emergency Response Plan
FPL	Flood planning level
FRMSP	Flood risk management study and plan
FRP	Flood risk precinct
FS	Flood study
HDA	Housing Delivery Authority
LEP	Local environmental plan
LGA	Local Government Area
PMF	Probable maximum flood
SEARs	Planning Secretary's Environmental Assessment Requirements
SES	State Emergency Service
SIP	Shelter in Place
SSD	State Significant Development
SSDA	State Significant Development Application
TIN	Triangulated Irregular Network
VPA	Voluntary Planning Agreement



1 Introduction and project description

This Flood Impact and Risk Assessment (**FIRA**) has been prepared by Stantec Pty Ltd (Stantec) on behalf of Waterloo Property Pty Ltd as trustee for the Waterloo Property Unit Trust (the Applicant) in support of a Housing Delivery Authority (**HDA**) nominated State Significant Development Application (**SSDA**) for a proposed mixed-use development at 881-885 Bourke Street, Waterloo, with concurrent rezoning (SSD-80441462). The report is submitted to the NSW Department of Planning, Housing, and Infrastructure (**DPHI**).

This application is preceded by a separate SSDA for Early Works that prepares the Site for the proposed development (SSD-80911502).

Specifically, consent is sought for the following Main Works for the Waterloo Mixed Use Development:

- Site establishment and enabling works (that were not included in the preceding Early Works SSDA);
- Construction of residential and mixed-use buildings across four development parcels, inclusive of;
 - » build to rent apartments and associated amenities;
 - » affordable apartments;
 - » non residential floor space including commercial premises and creative industry;
- Construction of a consolidated basement with below-ground links between development parcels, comprising car parking, plant and storage area;
- Landscaping and publicly accessible open space;
- Works to site frontages; and
- Extension and augmentation of infrastructure and services (that were not included in the preceding early Works SSDA) as required.

Development on the site was declared State Significant Development (**SSD**) pursuant to State Significant Declaration Order 2025 (Order) dated 17 February 2025. The Order declares development specified in EOI application 229420 dated 8 January 2025, including development for the purposes of mixed-use development (Build to Rent including affordable housing) with ground floor non-residential uses at 881-885 Bourke Steet, as identified in Schedule 3, is SSD.

On 5 March 2025, the Department of Planning, Housing and Infrastructure (the Department) issued SEARs and concurrent rezoning requirements for the project.

The site is subject to an existing Voluntary Planning Agreement (**VPA**) that sets out dedication of public domain between four development parcels. The public domain includes a new east-west street, a through site link and public open space area (comprising future shared zones and park). The development parcels and public domain as set out in the VPA will be delivered notwithstanding the works proposed in this SSDA.

This report has been prepared to address the flood related technical requirements from the SEARs and the *Sydney Development Control Plan 2012* (**DCP**) as required for the Main Works development application.



2 Site context and description

The site is legally described as Lot 1 DP1308636 and Lot 2 DP1308636 and is located at 881-885 Bourke Street, Waterloo. The site has an area of 21,554 m². It has an irregular shape, is generally flat and has been cleared of all light industrial and large format commercial buildings. The site currently has vehicle access from Young Street and Bourke Street.

The site is located within Gadigal Land, in the Sydney Local Government Area (**LGA**) and is approximately 4km south of the Sydney CBD. The site is approximately 950m walking distance east of an entrance to the Waterloo Metro Station, approximately 1.1 km northeast of the Green Square Train Station and approximately 1.5 km southeast of Redfern Train Station. The site is also immediately adjacent to a bus stop on Bourke Street

There are a number of trees along the Danks and Young Street frontages. Additional trees on these frontages are located outside the site boundary. There are commercial and business premises to the west, high-density residential and business premises to the north, primarily high-density residential to the east and high density residential under construction to the south.

An aerial of the site is provided in Figure 2-1 below.



Figure 2-1 Site Aerial. Source: Nearmap, Ethos Urban



3 SEARs reporting requirements

This FIRA has been prepared to address the *Planning Secretary's Environmental Assessment Requirements* (SEARs) issued by the Department of Planning, Housing and Infrastructure (DPHI) for the subject SSDA, with specific SEARs (s) identified in Table 3-1 below.

Table 3-1 The SEARs relating to flood risk with report reference

SEAR	Requirement	Reference
19. Flood Risk	Identify the flood planning area and level as set out in the relevant EPI and other supporting documents to determine; - The flood extent and velocity up to the Probable Maximum Flood and risk on-site having regard to adopted flood studies and, floodplain risk management studies and plans - The site access and egress routes - The potential effects of climate change, - Any relevant provisions of the <i>NSW Flood Risk Management Manual</i>, and any other relevant guidelines	The Council TUFLOW model is adopted as detailed in Sections 4 and 5 and flood results are provided for the 1% AEP event, both with and without climate change, and the PMF in section 6. The site access and egress routes have been discussed in Section 7.
	Where the development is occurring on flood prone land a flood impact and risk assessment (FIRA) must be prepared having regard to the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01. When determining the scope and category of the FIRA the requirements outlined in the FIRA guide must be considered.	This FIRA has been prepared in accordance with relevant guidance, including the <i>Flood risk management manual</i> (Department of Planning and Environment, 2023) and <i>Flood Impact and Risk Assessment – Flood Risk Management Guide LU01</i> (Department of Planning and Environment, 2023).
	Detail any flood risk management measures that are to be incorporated as part of the development having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).	Flood mitigation is not required as detailed in section 8 and flood emergency recommendations are provided in section 7.



4 Available information

4.1 Alexandra Canal Catchment Flood Study Model Update – ARR2019 Hydrology (WMAwater, September 2020)

The *Alexandra Canal Catchment Flood Study Model Update – ARR2019* (WMAwater, 2020) is the flood study (**FS**) currently adopted by Council for the site. A DRAINS hydrologic model based on ILSAX methodology was used to simulate rainfall and runoff in the catchment using ARR19 guidelines. The FS utilises a 1D/2D hydraulic TUFLOW model using ARR19 guidelines to model flooding in the catchment. The TUFLOW model has a 2m x 2m grid size and covers an area of 12.67km².

4.2 Alexandra Canal Flood Model Update (WMAwater, August 2023)

The TUFLOW hydraulic model was updated in 2023 to more accurately represent the catchment, as detailed in the *Alexandra Canal Flood Model Update* (WMAwater, 2023) memorandum. The updates included revised design surfaces and amendments to the 1D stormwater network. There were no changes to the DRAINS hydrologic model.



5 Flood assessment methodology

5.1 Hydrology model

The hydrology model associated with the Council FS was adopted with no changes.

5.1.1 Range of flood events considered

5.1.1.1 Flood frequency

The TUFLOW model was run for the 1% AEP event and the PMF.

5.1.1.2 Climate change consideration

The 1% AEP event was run with a climate change consideration by increasing rainfall intensity by 30% in alignment with the FS. A climate change sensitivity map was produced to show the effect of climate change on flooding in and around the site (see Figure No: GIS-Q-0A21 of the flood maps in Appendix A).

5.1.2 Critical duration

The critical storms for the site were adopted in accordance with the Council model and are provided in Table 5-1.

Table 5-1 Critical storm durations for the site

Storm event	Site's critical storms
1% AEP	30 minutes with TP 05 and 60 minutes with TP 08
PMF	90 minutes

For the hydraulic analysis, the TUFLOW model was run using the site's critical storms. The final output maps represent the envelope of results across all critical storms.

5.2 Hydraulic model

The hydraulic model (TUFLOW) used in this study is based on the provided council model (WMAwater, 2023). It has been updated to reflect both pre-development and post-development conditions, as outlined in the following sections.

5.2.1 Pre-development

The Council's hydraulic model has been updated based on the following items to more accurately represent existing flood conditions.



5.2.1.1 Ground Surface Update

The pre-development digital elevation model (**DEM**) used to represent the ground surface in the TUFLOW model was updated using the provided survey triangulated irregular network (**TIN**).

The incorporation of the survey in the DEM is to more accurately represent the existing landform in the hydraulic model, which previously relied on LiDAR information.

5.2.1.2 Building representation in the model

Buildings were represented in the hydraulic model by removing them from the active hydraulic model, which is consistent in accordance with the updated Council model. This means the buildings act as obstructions in the model cannot contribute to flood storage.

5.2.1.3 Grid resolution

A 2m x 2m grid resolution was adopted, consistent with the FS.

5.2.1.4 Roughness

The Manning's surface roughness ("n") coefficients are the same for the hydraulic model used in the FS and are provided in Table 5-2.

Table 5-2 Manning's roughness coefficients used in updated FS hydraulic model

Surface	Mannings roughness
Roads	0.02
Paved open space	0.03
Other open space (e.g. parkland, residential)	0.04
Commercial land use	0.04
Alexandra Canal open channel	0.018
Railway	0.06

5.2.1.5 One-dimensional model

The one-dimensional (**1D**) model remains unchanged from the Council FS. The 1D network includes the stormwater trunk drainage infrastructure, including pipes, culverts, pits and open channels. Blockage factors used for the 1D network are the same for the Council FS model, see Table 5-3.

Table 5-3 Blockage factors used in the TUFLOW model as per the FS

1D network element	Blockage factor
On-grade stormwater pits	20% blockage modelled as a width reduction
Sag pit	50% blockage modelled as a width reduction
Bridges, culverts open concrete channels	Not blocked



5.2.2 Post-development

5.2.2.1 Ground Surface Update

The design surface for the main works area was overlaid onto the survey data in the post-development scenario to represent the proposed ground surface changes.

5.2.2.2 Building footprint update

The building footprint was updated in the post-development model to represent the proposed development. Building footprint updates were restricted to areas within the site – areas beyond the site were modelled as per the Council FS.

5.2.2.3 Mesh boardwalk modelling

The proposed development includes pedestrian access mesh boardwalks connecting the building to the roads on Danks Street and Young Street. (Figure 5-1).

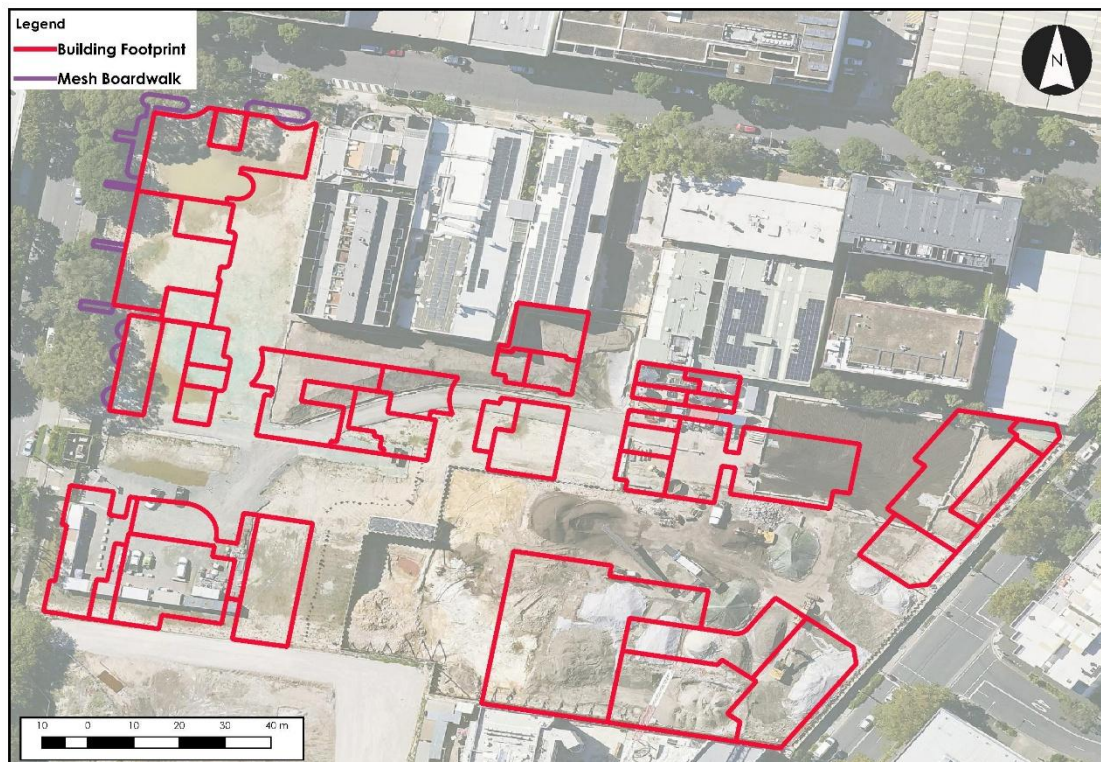


Figure 5-1: Mesh boardwalk locations

A layered flow constrictions was applied in the hydraulic model to represent losses caused by surface water moving underneath the suspended structures. In this study, two layers were applied as flow constrictions:

1. From the ground surface up to the mesh deck
2. The mesh deck thickness



For the first layer, the loss calculation for piles was done using uniform loss coefficients, derived from (Bradley , 1978). For the piles, it was assumed that the pile widths are 150 mm with 3 m span. Table 5-4 presents the loss factors and blockages applied for each layer

Table 5-4: Flow constriction loss coefficient and blockage

Layer	Blockage factor	Loss Coefficient
Layer 1	50%	0.06
Layer 2	100%	1.54

5.2.2.4 Mannings roughness update

The post-development model was updated to reflect the proposed surface by assigning Mannings coefficients provided in the FS.

5.3 Results

5.3.1 Map outputs

Both pre-development and post-development scenarios were assessed in the hydraulic model for the 1% AEP and PMF flood events.

The hydraulic model results listed in Table 5-5 are provided as Appendix A.

Table 5-5: Hydraulic model results mapped as Appendix A

Scenario	Event	Result type
Pre-development	• 1% AEP	• Extent, level and depth
	• 1% AEP with climate change	• Velocity
	• PMF	• Hazard vulnerability classification (H1-H6)
Post-development	• 1% AEP	• Extent, level and depth
	• 1% AEP with climate change	• Velocity
	• PMF	• Hazard vulnerability classification (H1-H6)
Post-development	• 1% AEP	• Flood impact
	• PMF	
Post-development	• 1% AEP	• Climate change sensitivity analysis

5.3.2 Hazard vulnerability classification (H1-H6)

The hazard vulnerability classifications of the flood extent have been identified by adopting the general flood hazard vulnerability curves (refer Figure 5-2) to align with the Council FS.



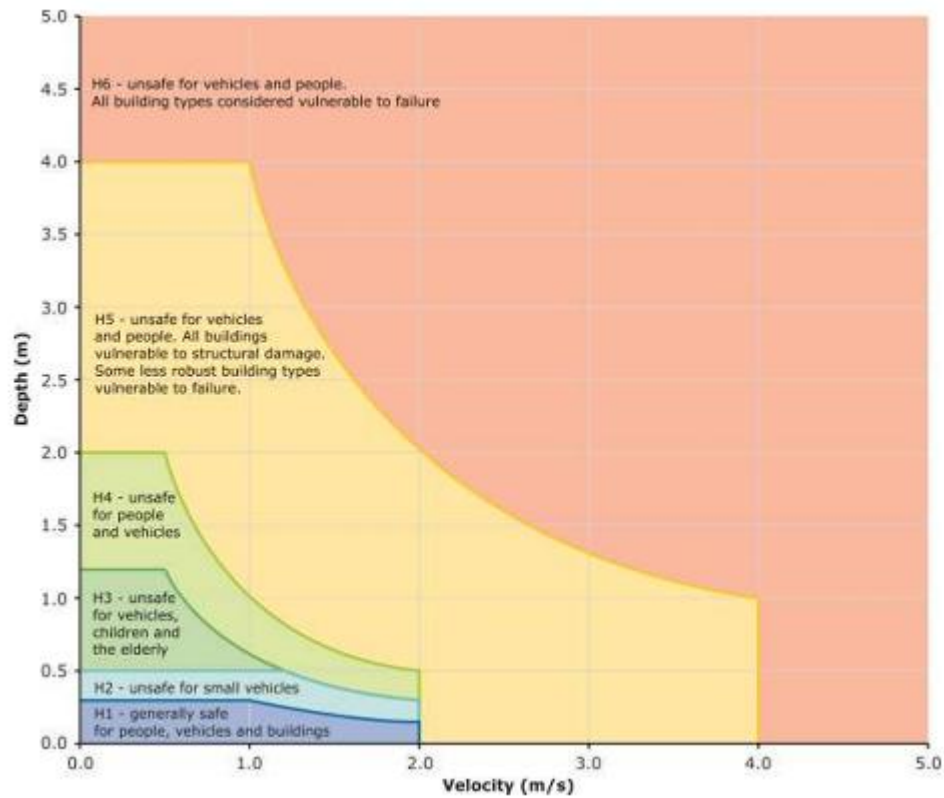


Figure 5-2 Flood hazard vulnerability curves (Australian Institute for Disaster Resillience, 2014)



6 Hydraulic model results

The TUFLOW hydraulic model was utilised to assess the impact of the proposed development on flooding within site and in neighbouring areas.

6.1 Pre-development

The pre-development model identifies the current flood behaviour at the site during current catchment conditions (i.e. topography and road footprints).

6.1.1 1% AEP

The area within the site is flood free during the 1% AEP event for the existing scenario.

Flood depths beyond the site are mostly below 50mm on Bourke Street and reach 750mm at the intersection between Young Street and Danks Street. Refer to Figure No: GIS-Q-0A1 of the flood maps in Appendix A.

The velocity of floodwater during the 1% AEP event reaches 1.00 m/s on Bourke Street adjacent to the site and 2.60 m/s on Young Street in the area around the site's entry point. Refer to Figure No: GIS-Q-0A2 of the flood maps in Appendix A.

Flood hazard around the site reaches category H5 on Young Street at the site's entry and category H3 at the intersection between Young Street and Danks Street. Elsewhere, flood hazard is primarily category H1. Refer to Figure No: GIS-Q-0A3 of the flood maps in Appendix A. Figure 6-1 has been provided as a reference.



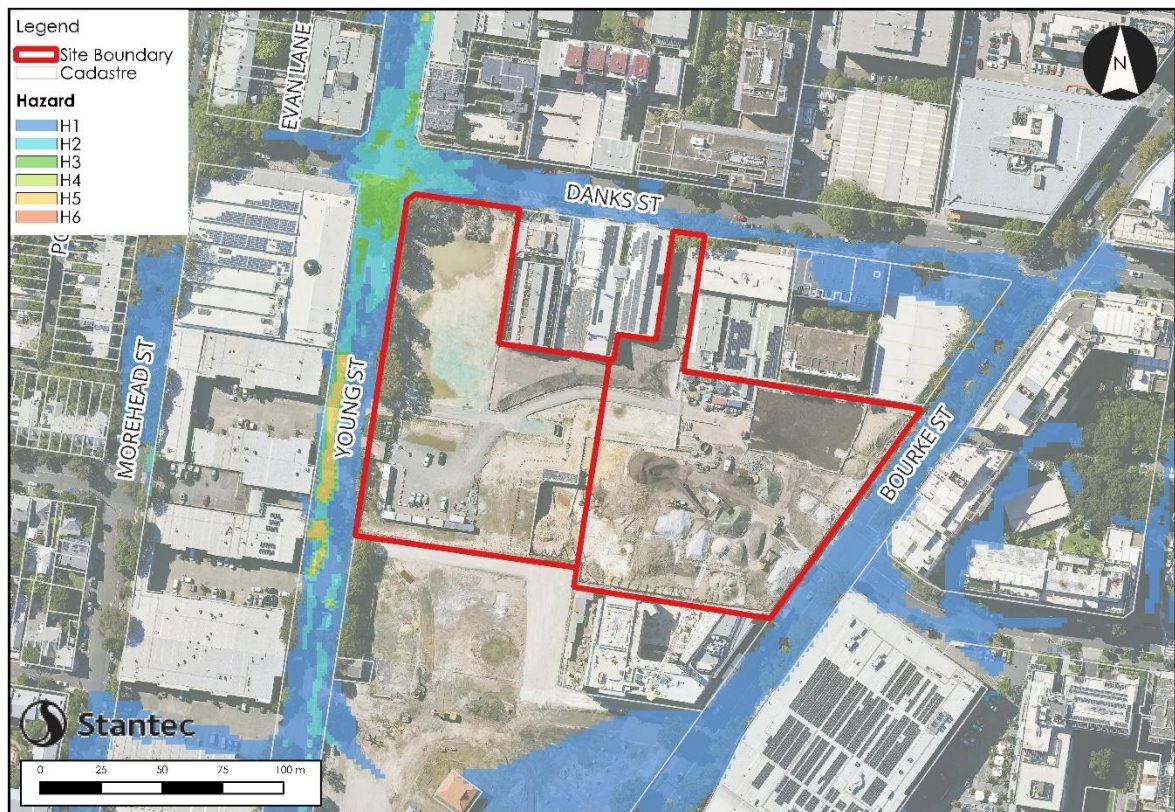


Figure 6-1 Flood hazard for the pre-development scenario during the 1% AEP event

6.1.2 1% AEP with climate change

The existing site is mostly flood free during the 1% AEP event with the climate change adjustment, however flooding is experienced on the western boundary of the site. Floodwater depth reaches 350 mm along the western site boundary with Young Street. Off-site, depths are mostly below 60 mm on Bourke Street adjacent to the site and reach 980 mm at the intersection between Young Street and Danks Street. Refer to Figure No: GIS-Q-0A4 of the flood maps in Appendix A.

Floodwater velocity reaches 1.35 m/s at the site's western boundary. Beyond the site, velocity reaches 1.15 m/s on Bourke Street and 3.35 m/s on Young Street near the site's western entrance. Refer to Figure No: GIS-Q-0A5 of the flood maps in Appendix A.

Flood hazard reaches category H2 along the site's western boundary for the existing scenario during the 1% AEP event with climate change. Hazard reaches category H5 along Young Street and category H4 at the intersection between Young Street and Danks Street. Hazard is primarily category H1 in other areas surrounding the site. Refer to Figure No: GIS-Q-0A6 of the flood maps in Appendix A. Figure 6-2 has been provided as a reference.



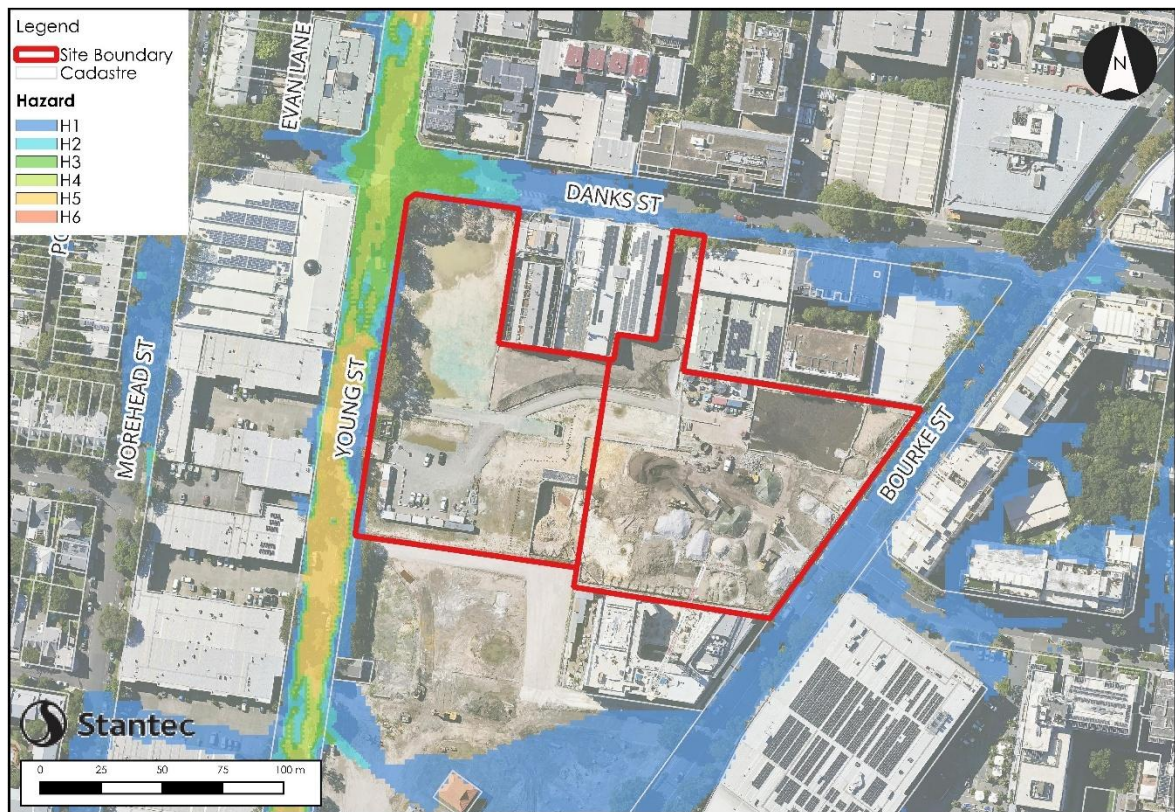


Figure 6-2 Flood hazard for the pre-development scenario during the 1% AEP event with climate change

6.1.3 PMF

During the PMF event for the existing scenario, floodwater enters the site on the site's northern and western boundaries. Floodwater depths reach 1200 mm on the site's western boundary with Young Street and is 1120 mm at the site's northern boundary with Danks Street. Off-site, depth reaches 120mm on Bourke Street and 2040 mm at the intersection between Young Street and Danks Street. Refer to Figure No: GIS-Q-0A7 of the flood maps in Appendix A.

Floodwater velocity reaches 3.90 m/s in the site's south western corner at the boundary with Young Street, and 0.40 m/s at the site's northern boundary with Danks Street. Beyond the site, velocity reaches 1.50 m/s on Bourke Street and 5.20 m/s at the sites entrance from Young Street. Refer to Figure No: GIS-Q-0A8 of the flood maps in Appendix A.

During the PMF, flood hazard ranges from category H1 to category H5 at the existing site with the category H5 flood hazard being concentrated along the site's western boundary with Young Street. Off site, hazard reaches category H6 along Young Street and is category H1 on Bourke Street adjacent to the site. Refer to Figure No: GIS-Q-0A9 of the flood maps in Appendix A. Figure 6-3 has been provided as a reference.



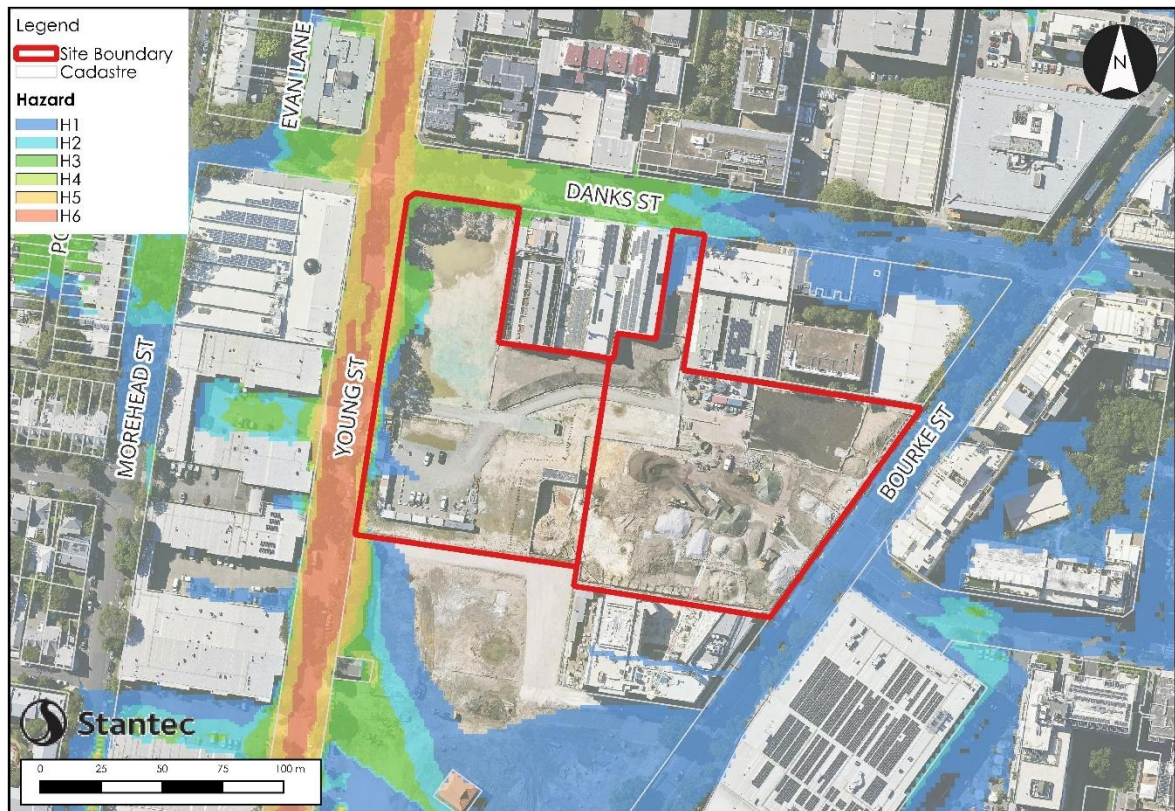


Figure 6-3 Flood hazard for the pre-development scenario during the PMF

6.2 Post-development

The post-development model shows flood results for the proposed scenario (i.e. the addition of the design TIN).

6.2.1 1% AEP

All comparisons drawn in this section are related to the post-development scenario during the 1% AEP event.

The area within the site is mostly flood free during the 1% AEP event for the post-development scenario, except for an area at the eastern site entrance where depth reaches 100 mm.

Like in the existing scenario, flood depths beyond the site are mostly below 50mm on Bourke Street and reach 750mm at the intersection between Young Street and Danks Street. Refer to Figure No: GIS-Q-0A10 of the flood maps in Appendix A.

Velocity flood results are same as for the existing scenario, with velocity reaching 1.00 m/s on Bourke Street adjacent to the site and 2.60 m/s on Young Street in the area around the site's entry point. Refer to Figure No: GIS-Q-0A11 of the flood maps in Appendix A.



Flood hazard is category H1 where floodwater enters the site at the eastern entrance. Off-site, hazard is the same as for the existing scenario and reaches category H5 on Young Street at the site's entry and category H3 at the intersection between Young Street and Danks Street. In other areas around the site, flood hazard is primarily category H1. Refer to Figure No: GIS-Q-0A12 of the flood maps in Appendix A. Figure 6-4 has been provided as a reference.

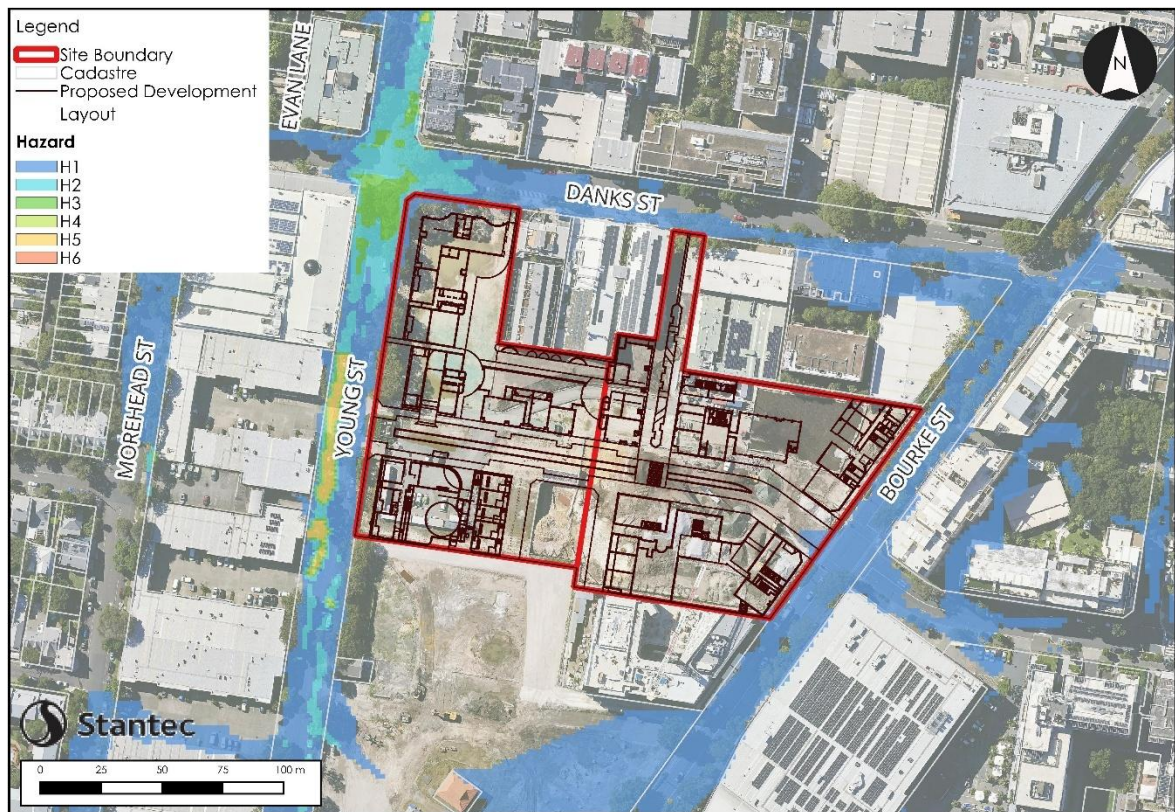


Figure 6-4 Flood hazard for the post-development scenario during the 1% AEP event

6.2.2 1% AEP with climate change

6.2.2.1 Results

All comparisons drawn in this section are related to the post-development scenario during the 1% AEP event with climate change.

The site remains mostly flood free during the 1% AEP event with the climate change adjustment, however flooding is experienced at the eastern and western entrances to the site with depths reaching 115 mm and 25 mm, respectively. Floodwater depth has increased to 580 mm along the western site boundary, however flood depths beyond the site on Young Street are in the range of +/- 5 mm compared to the existing scenario. Depths remain mostly below 60 mm on Bourke Street adjacent to the site and have reduced to 975 mm at the intersection between Young Street and Danks Street. Refer to Figure No: GIS-Q-0A13 of the flood maps in Appendix A.

Floodwater velocity has increased to 1.55 m/s at the site's western boundary in the post-development scenario however beyond the site, velocity is mostly the same as for the existing scenario and reaches



1.15 m/s on Bourke Street and 3.35 m/s on Young Street near the site's western entrance. Refer to Figure No: GIS-Q-0A14 of the flood maps in Appendix A.

Flood hazard for the post-development scenario is the same as for the existing scenario during the 1% AEP with climate change, and the newly wet areas at the site's eastern and western entrances have category H1. Refer to Figure No: GIS-Q-0A15 of the flood maps in Appendix A. Figure 6-5 has been provided as a reference.

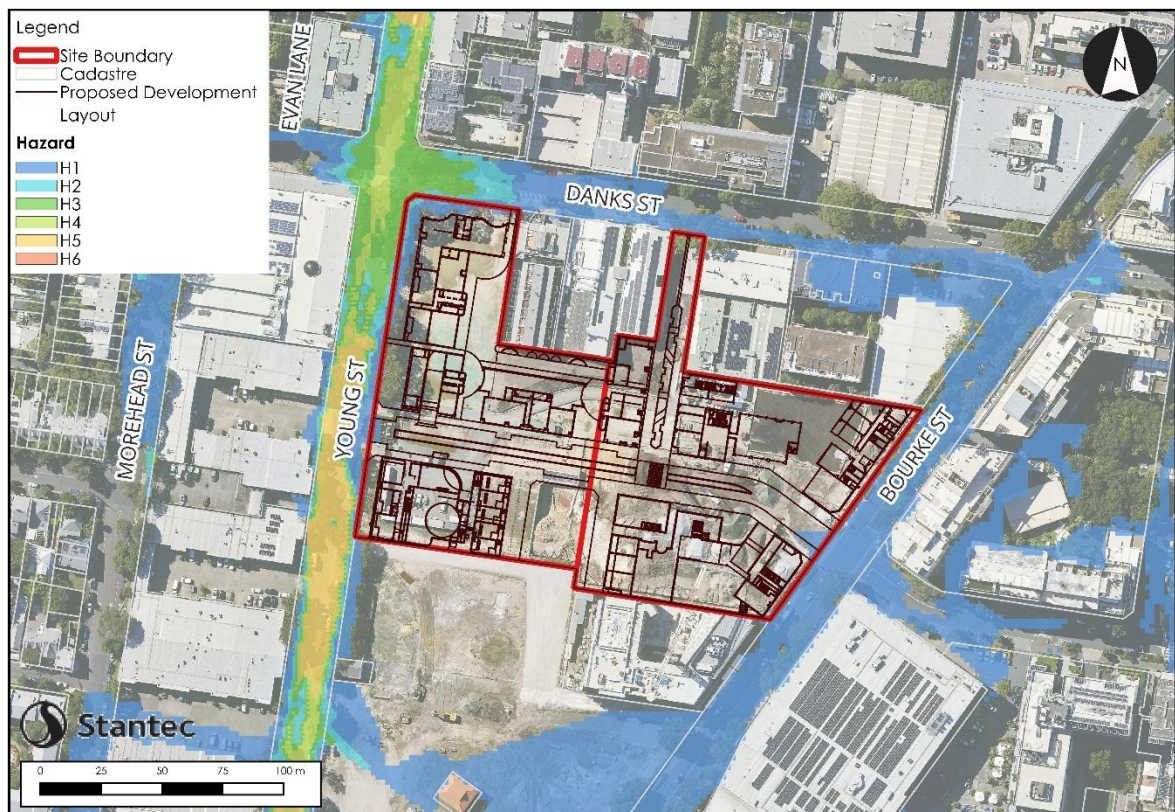


Figure 6-5 Flood hazard for the post-development scenario during the 1% AEP event with climate change

6.2.2.2 Climate change sensitivity test

A climate change sensitivity analysis was conducted to investigate the effects of climate change in and around the site by comparing flood levels for the proposed scenario during the 1% AEP event with and without climate change. Afflux mapping provided in Figure No: GIS-Q-0A21 of the flood maps in Appendix A shows that flood levels increase by up to 225 mm in the site during the climate change scenario. Off-site, the climate change alteration causes flood levels to increase by 225 mm on Young Street and Danks Street, and 15 mm on Bourke Street.

6.2.3 PMF

All comparisons drawn in this section are against the results for the post-development scenario during the PMF.



During the PMF event for the post-development scenario, floodwater enters the site on the site's northern and western boundaries, and via the proposed footpath between Danks Street and the proposed Parcel 1 buildings. Floodwater depths have increased to 1450 mm at the north western boundary of the site and to 1230 mm at site's northern boundary with Danks Street. Depths are mostly below 300 mm in the now inundated area of the site (proposed courtyard for Parcel 1), 815 mm in the median of the proposed western access road and 135 mm on the eastern access road. Off-site, depth has increased to 150 mm on Bourke Street and flood hazard remains category 1. Depth has reduced to 2010 mm at the intersection between Young Street and Danks Street compared to the existing scenario. Refer Figure No: GIS-Q-0A16 of the flood maps in Appendix A.

Floodwater velocity has reduced to 3.65 m/s in the site's south western corner at the boundary with Young Street and has increased to 0.50 m/s at the northern boundary with Danks Street. Velocity reaches 2.10 m/s on the road verge of the proposed western access road and 1.25 m/s in the area of Parcel 1 where floodwater enters the site via Danks Street. Beyond the site, velocity remains a maximum of 1.50 m/s adjacent to the site on Bourke Street and although velocity has increased to 5.25 m/s at the sites entrance from Young Street, velocity has mostly decreased on Young Street and flood hazard remains unchanged. Refer to Figure No: GIS-Q-0A17 of the flood maps in Appendix A.

During the PMF, flood hazard remains category H5 at the western boundary with Young Street, and the areas of category H6 flood hazard on Young Street have decreased in extent. Hazard remains unchanged on Bourke Street and is category H1. In the site, hazard is mostly category H3 on the proposed western access road and is low in the courtyard in Parcel 1.

Refer to Figure No: GIS-Q-0A18 of the flood maps in Appendix A. Figure 6-6 has been provided as a reference.



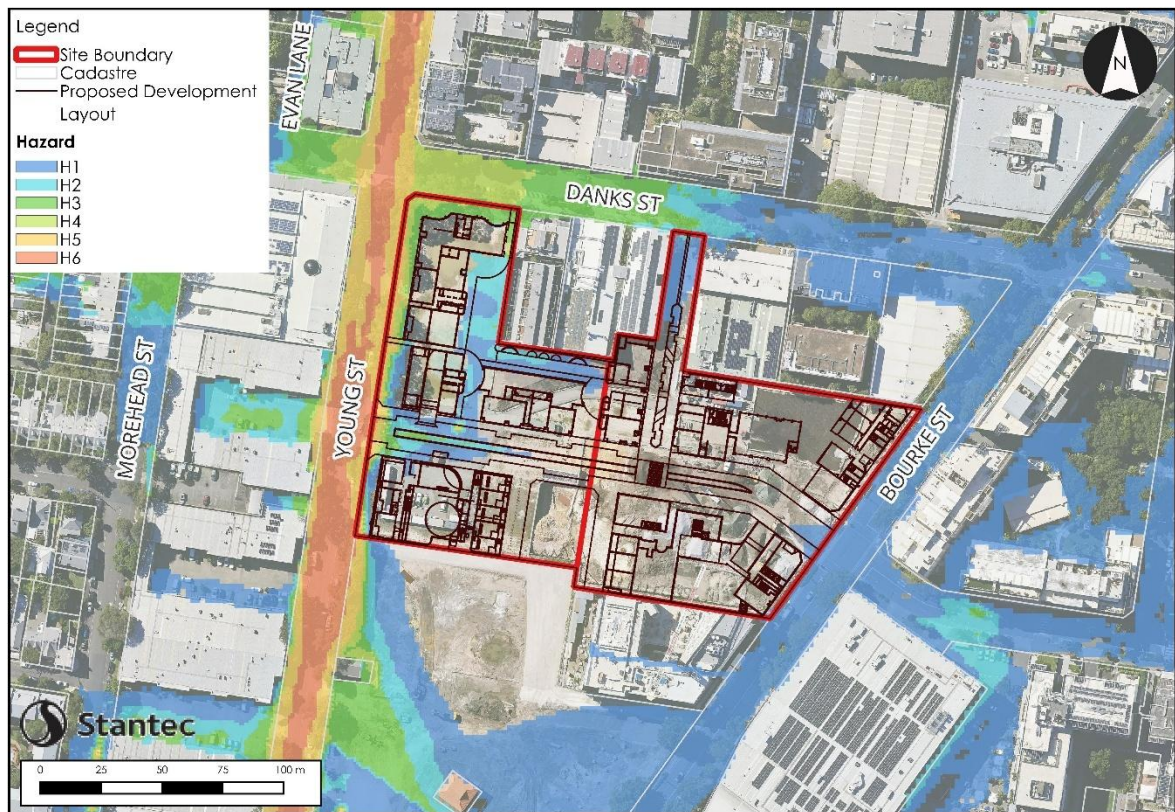


Figure 6-6 Flood hazard for the post-development scenario during the PMF

6.3 Flood impacts

The flood impact assessment has been carried out by comparing the post-development scenario with the existing scenario for the 1% AEP flood event and the PMF.

6.3.1 1% AEP

The proposed development is not anticipated to impact flooding in or around the site during the 1% AEP event, and flood levels are unchanged except in a small area to the east of the site where levels increase by 70 mm. The small area of increased level is concentrated to the road verge and flood hazard remains category H1 – generally safe for people, vehicles and buildings, making this impact negligible. On the contrary, the proposed development causes flood levels to decrease by 100 mm at the intersection between the proposed eastern access road and Bourke Street. The now wet areas at the north west boundary of the site and at the proposed eastern access road are category H1 flood hazard and have no negative impact.

Refer to Figure No: GIS-Q-0A19 from the flood maps provided in Appendix A. Figure 6-7 has been provided as a reference.



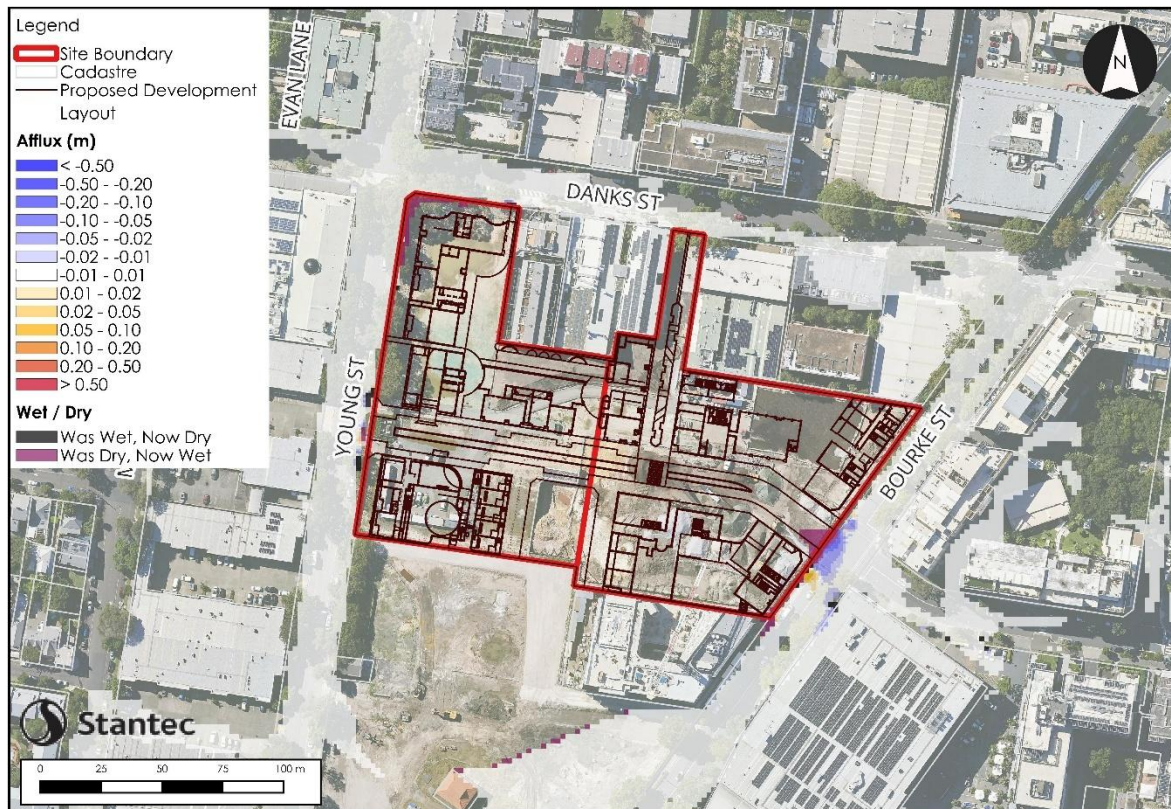


Figure 6-7 Flood impact associated with the proposed development during the 1% AEP event

6.3.2 PMF

The proposed development causes flood levels to rise in the western region of the site due to flood water entering via the northern access route to Danks Street and the proposed western access road. Flood levels are mostly below 300 mm in the now inundated area of the courtyard in Parcel 1 and flood hazard reaches H2 (unsafe for small vehicles). Flood levels increase up to 815 mm in the median of the proposed western access road and flood hazard is primarily category H3 but reaches H5 (unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure) at the western site boundary. The on-site flood impacts are acceptable as a shelter-in-place strategy is recommended during the PMF (see section 7), meaning the areas of moderate and high flood hazard are avoidable.

Off-site, flood level increases are observed on Young Street, Bourke Street and in a small number of neighbouring lots on Young Street. A maximum off-site level increase of 280 mm is observed on Young Street near the proposed western access route. On the contrary, flood levels reduce in some areas on Young Street by up to 270 mm, with other level reductions observed on Bourke Street, Danks Street and in the lot to the south of the site. A flood hazard impact assessment was undertaken to determine the effect of the PMF related impacts, and as there are no significant increases in flood hazard on Young Street, and the road is already high hazard and likely not trafficable, the PMF impacts to Young Street are considered acceptable. The impacted lots to the west of the site are not subject to increases

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6 Hydraulic model results

in flood hazard category and hazard is low. The impacts to these lots are considered acceptable, see Figure 6-9 for the flood hazard impacts.

Refer to Figure No: GIS-Q-0A20 from the flood maps provided in Appendix A for the PMF flood impact map. Figure 6-8 has been provided as a reference.

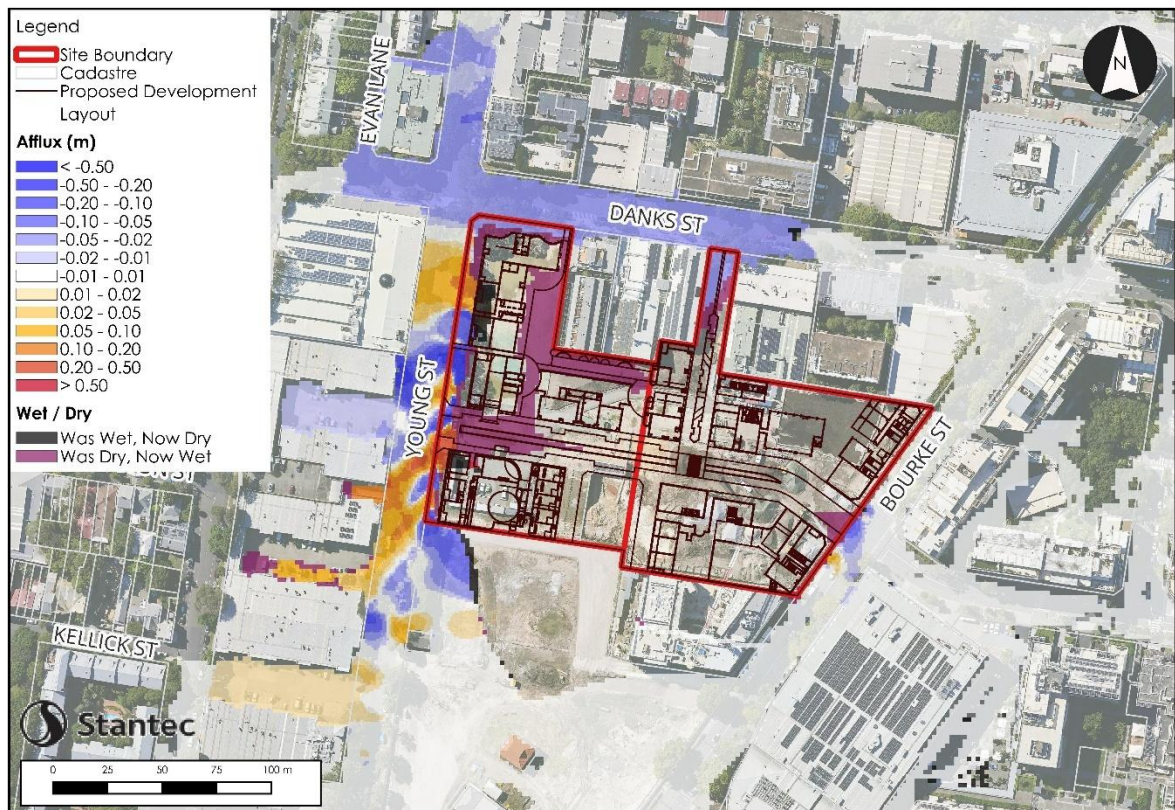


Figure 6-8 Flood impact associated with the proposed development during the PMF

881-885 Bourke Street, Waterloo, Flood Impact and Risk Assessment (Main Works Application)
6 Hydraulic model results

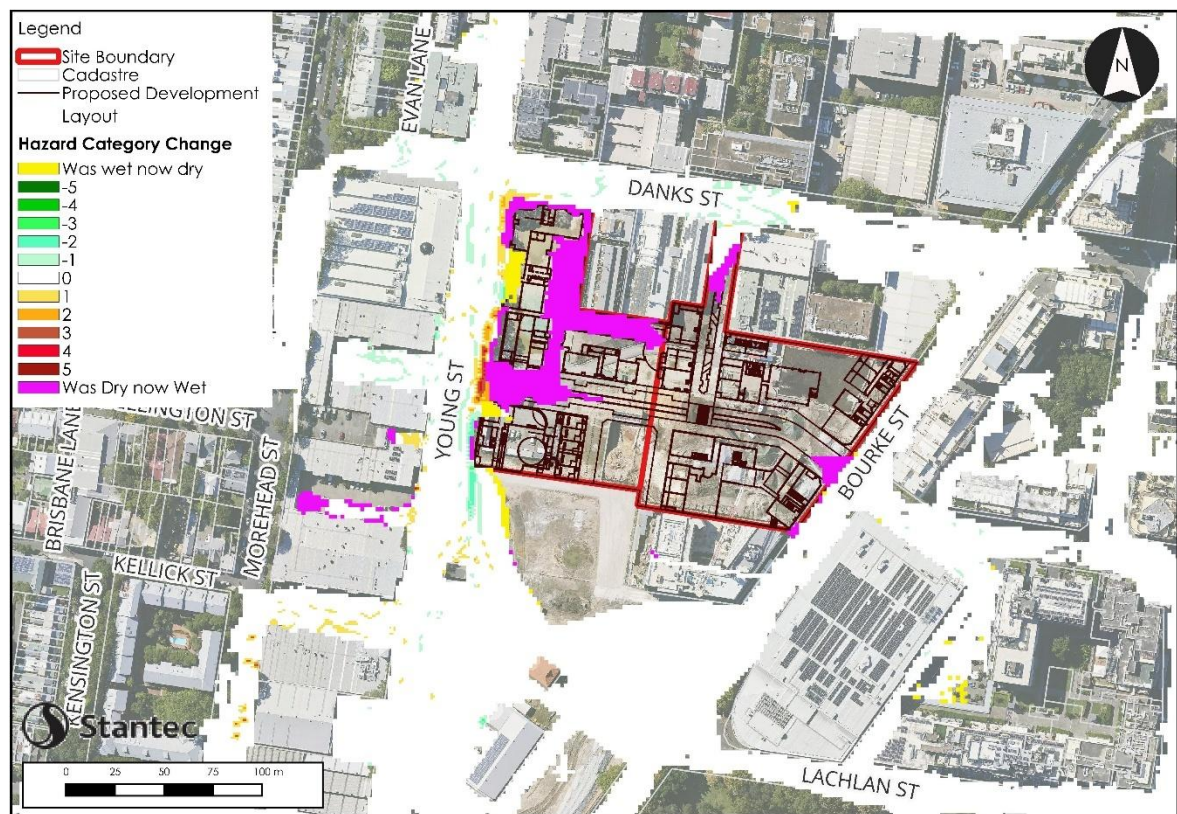


Figure 6-9 Change in flood hazard category associated with the proposed development during the PMF



7 Flood Emergency Response Plan Comments

The site is affected by short-duration flash flooding from local upstream catchments. The primary evacuation route is available via Bourke Street, then Potter Street, continuing to Gadigal Avenue, Lachlan Street, and finally Dacey Avenue, which connects to Anzac Parade (significant state-managed road).

During the post-development 1% AEP event, the evacuation route is partially flooded, with a maximum hazard level of H1 (generally safe for vehicles, people, and buildings). In the post-development PMF event, the hazard level along the route is generally H2 (unsafe for small vehicles) or lower, except for some isolated patches of up to H5 along Gadigal Avenue. These high-hazard patches are not continuous and are localised, meaning they can be avoided during evacuation.

Figure 7-1 and Figure 7-2 illustrate the flood evacuation route overlaid on the hazard maps for the 1% AEP and PMF events, respectively.

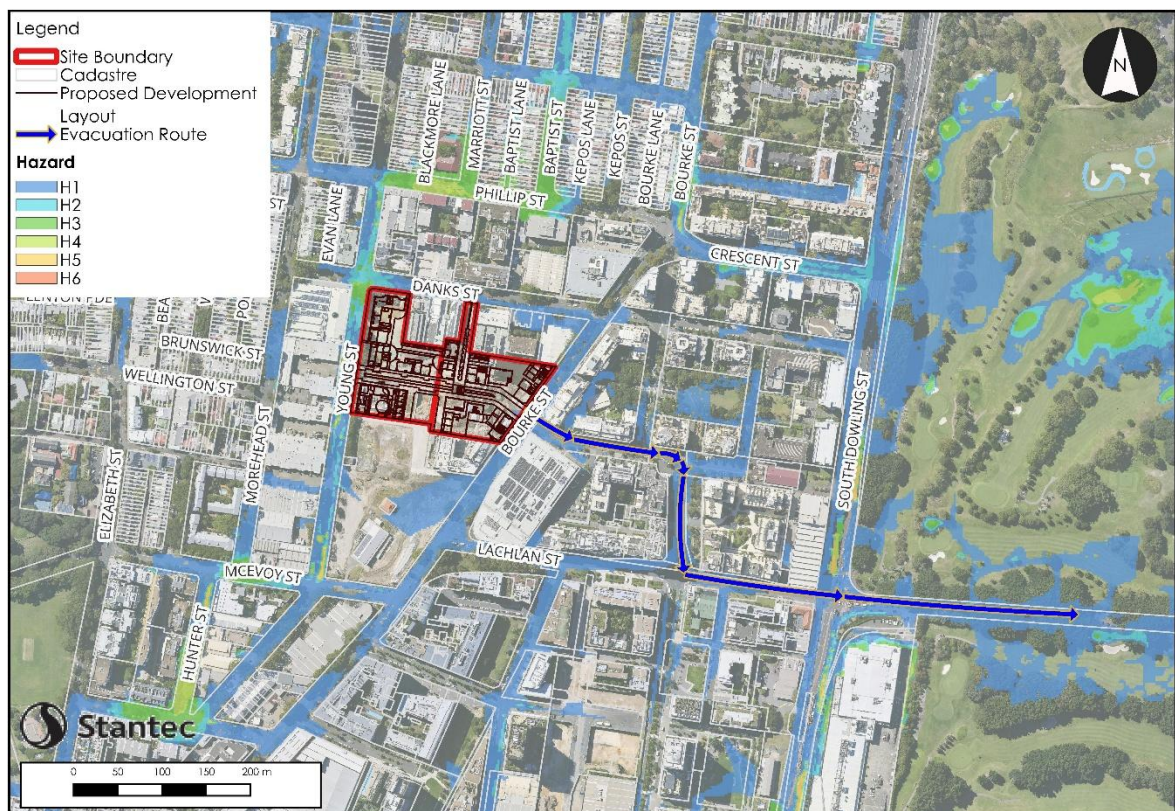


Figure 7-1: Flood evacuation route overlaid on the post-development 1% AEP flood event hazard map.

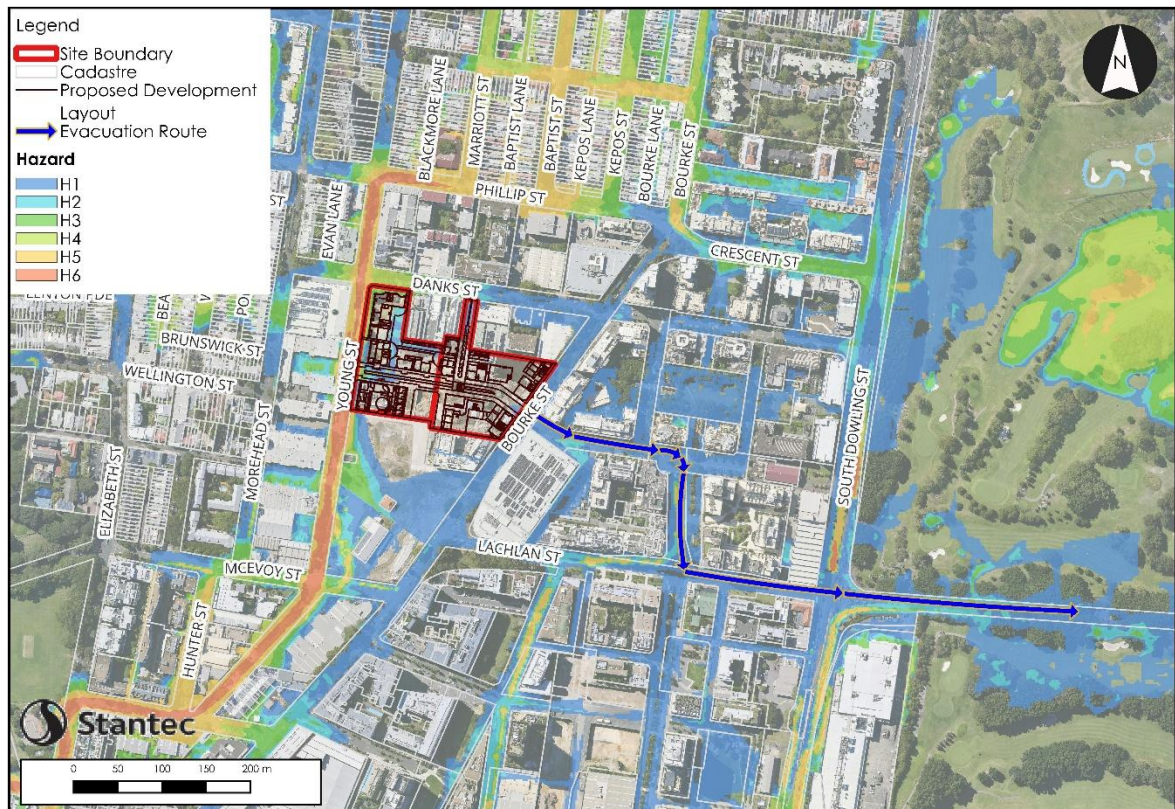


Figure 7-2: Flood evacuation route overlaid on the post-development PMF flood event hazard map

The proposed development includes site regrading and the construction of a road network, residential and commercial buildings and associated ancillary features as part of the main works phase. While modelling results show the site is only minimally affected during the 1% AEP event (with floodwaters entering from the east via Bourke Street), the PMF affects the western areas of the site due to flood water entering the site via the proposed western access road and from the pathway to Danks Street.

If access to Bourke Street is cut off during the PMF, a Shelter-in-Place (SIP) is recommended as the flood emergency response strategy as there is sufficient habitable space for building occupants to find shelter beyond the PMF. Occupants of the ground floor buildings in the north-west of Parcel 1 are to evacuate via the courtyard to the buildings in the east of Parcel 1, or to the buildings in the other land parcels which are above the PMF level.

While a detailed Flood Emergency Response Plan (**FERP**) is not mandatory for this site, the following preliminary recommendations are provided to manage flood-related risks:

1. Shelter-in-Place (SIP) is a viable strategy because:
 - a) Flood-free areas remain available on-site during the PMF.
 - b) Flash flooding is short in duration, limiting isolation time.
 - c) There is sufficient habitable space available for site occupants to shelter during the PMF as the flood affected buildings are multi-storey.



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7 Flood Emergency Response Plan Comments

See section 8.3 of this FIRA for the detailed shelter-in-place compliance assessment and associated requirements.



8 Compliance assessment

8.1 DCP requirements

Flood related requirements for development within the City of Sydney LGA are provided in the *Interim Floodplain Management Policy* (City of Sydney, 2014) (the **DCP**). The policy includes flood planning levels (**FPLs**) for different development classes. The FPLs associated with the Main Works development are provided in Table 8-1.

Table 8-1 FPLs for the proposed development (City of Sydney, 2014)

Development		Type of flooding	Flood planning level
Residential	Habitable rooms	Mainstream flooding	1% AEP flood level + 0.5 m
		Local drainage flooding	1% AEP flood level + 0.5 m OR Two times the depth of flow with a minimum of 0.3 m above the surrounding surface if the depth of flow is less than 0.25 m
		Outside floodplain	0.3 m above surrounding ground
	Non-habitable rooms such as a laundry or garage (excluding below-ground car parks)	Mainstream or local drainage flooding	1% AEP flood level
Industrial or commercial	Retail floor levels	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood. The proposal demonstrates reasonable balance between flood protection and urban design outcomes for street activation.
Below-ground garage/ car park	Multi-property owner with more than 2 car spaces	Mainstream or local drainage flooding	1% AEP event + 0.5 m or the PMF (whichever is higher) If outside floodplain, 0.3 m above surrounding ground. FPL applies to all possible ingress points to the car parks such as vehicle entrances and exits, ventilation ducts, windows, light wells, lift shaft openings, risers and stairwells.

The development is anticipated to comply with the FPL requirements from the DCP.

General requirements are also provided in the DCP, with project specific requirements being provided in Table 8-2.



Table 8-2 General DCP requirements associated with the proposed development

Development type/ aspect	Objective	Requirement	Compliance Assessment
Fencing	- To ensure that fencing does not result in any significant obstruction to the free flow of floodwaters; and - To ensure that fencing will remain safe during floods and not become moving debris that potentially threatens the security of structures or the safety of people.	Fencing is to be designed and constructed in such a manner that it will not modify the flow of floodwaters and cause damage to surrounding land.	Any fencing required during the main works phase is to be designed to ensure there are no impacts to flooding. The development is anticipated to comply with this requirement.
Residential properties	- To minimise the damage to residential properties from flooding; and - To minimise risk to human life from the inundation of residential properties and to minimise economic cost to the community resulting from flooding.	- The proposed residential building or dwelling must be free from flooding up to and including the 1% AEP flood and must meet the Flood Planning Level Requirements detailed in Section 5; and - The proposed residential building or dwelling should not increase the likelihood of flooding on other developments, properties or infrastructure.	- The results from the hydraulic TUFLOW model show that the development will not cause any material off-site flood impacts in 1% AEP. - The proposed buildings are anticipated to comply with the FPL requirements from the DCP, and the proposed buildings are beyond the extent of the 1% AEP event. - The development does not increase flooding in other developments during the 1% AEP event. - The development is anticipated to comply with these requirements.
Industrial and commercial properties	- To minimise the damage to industrial and commercial properties from flooding; and - To minimise risk to human life from the inundation of industrial and commercial properties and to minimise economic cost to the community resulting from flooding.	- The City may consider merits-based approaches presented by the applicant. The proposed industrial or commercial buildings must meet the Flood Planning Level Requirements detailed in Section 5; and - The proposed industrial or commercial development should not increase the likelihood of flooding on other developments, properties or infrastructure.	- As stated previously, the proposed buildings is anticipated to comply with the FPL levels from the DCP. - The development is not anticipated to cause significant flood impacts off-site – any impact associated with the development is acceptable as detailed in section 6.3. - The development is anticipated to comply with this requirement.



Development type/ aspect	Objective	Requirement	Compliance Assessment
Car parking	- To minimise the damage to motor vehicles from flooding; - To ensure that motor vehicles do not become moving debris during floods, which threaten the integrity or blockage of structures or the safety of people, or damage other property; and - To minimise risk to human life from the inundation of basement and other car park or driveway areas.	- The proposed car park should not increase the risk of vehicle damage by flooding inundation; - The proposed garage or car park should not increase the likelihood of flooding on other developments, properties or infrastructure; - The proposed garage or car park must meet the Flood Planning Level Requirements detailed in Section 5; and - Open car parking - The minimum surface level of open space car parking subject to inundation should be designed giving regard to vehicle stability in terms of depths and velocity during inundation by flood waters. Where this is not possible, it shall be demonstrated how the objectives will be met.	- The proposed car parks are anticipated to comply with the FPLs from the DCP. - The proposed car parks are beyond the extent of the flood events studied and do not cause any flood related impacts off-site. - There are no open car parking spaces associated with the development. - The development complies with these requirements.
Consideration of the impact of climate change	To prevent the potential impact of climate change	- For those developments which have a lifespan of more than fifty years the impact due to sea level rise and impacts due to increased rainfall intensities shall be considered. - Meet the allowances for sea level rise as recommended in the NSW Government Coastal Planning Guideline: Adopting Sea Level Rise 2010 (recently withdrawn from publication). Specifically, this shall include and allowance of 40cm by 2050 and a 90cm by 2100 from the 2009 Mean Sea Level. - Where in the opinion of the City the proposed development is of reasonable impact to regional or catchment trunk drainage, the drainage system design shall allow for a minimum of 10% increased rainfall.	- The effects of climate change were investigated as part of this FIRA by increasing rainfall intensity by 30%, consistent with the Council adopted FS. - The development complies with these requirements as the site does not increase flooding during the 1% AEP event with climate change.

The general requirements associated with the filling of flood prone land, on-site sewer management, and storage of hazardous substances were not considered as these actions are not being undertaken as part of the development.

It is anticipated that the proposed main works development will comply with the FPL and general flood requirements from the DCP.



8.2 SEAR's requirements

In this section, the proposed development is assessed against the SEARs provided for the SSDA. The development is compliant with all SEARs requirements as shown in Table 8-3.

Table 8-3 Compliance assessment regarding the flood related requirements from the SEARs

Requirement	Compliance
Identify the flood planning area and level as set out in the relevant EPI and other supporting documents to determine; - The flood extent and velocity up to the Probable Maximum Flood and risk on-site having regard to adopted flood studies and, floodplain risk management studies and plans - The site access and egress routes - The potential effects of climate change, - Any relevant provisions of the <i>NSW Flood Risk Management Manual</i>, and any other relevant guidelines	Hydraulic modelling was undertaken to show flood extents and levels for the existing and proposed development during a range of flood events up to including the PMF. The Council adopted hydraulic TUFLOW model was used in the flood assessment with the surface level, building footprint and ground surfaces of the proposed development being incorporated into the model. The results show that access to the site is maintained via Bourke Street which remains trafficable in flood events up to and including the PMF, with flood hazard in this area being category H1. A climate change scenario was run for the 1% AEP event to assess the impacts associated with increasing rainfall by 30%, and a climate change sensitivity analysis was conducted.
Where the development is occurring on flood prone land a flood impact and risk assessment (FIRA) must be prepared having regard to the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01. When determining the scope and category of the FIRA the requirements outlined in the FIRA guide must be considered.	This FIRA was prepared in accordance with the <i>Flood Impact and Risk Assessment – Flood Risk Management Guide LU01</i> (Department of Planning and Environment, 2023).
Detail any flood risk management measures that are to be incorporated as part of the development having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).	Flood risk management measures are not required because: - The proposed development does not increase flooding beyond the site during the events assessed as part of this FIRA, and - The flooding in the proposed site during the PMF is accepted as occupants would be able to shelter in place in buildings which are above the level of the PMF. Preliminary flood emergency response advice is provided in section 7 where a shelter in place strategy is recommended if occupants cannot follow flood warnings from relevant authorities (BoM, SES).

8.3 Shelter-in-place compliance assessment

The *Shelter in place guideline for flash flooding* (Department of Planning, Housing and Infrastructure, 2025) outlines requirements and considerations for the suitability of a SIP strategy in the context of proposed land use and catchment characteristics. The guidance is considered in Table 8-4.



Table 8-4 Shelter-in-place compliance assessment

SIP requirement	Consistency of proposed development
Does shelter in place align with existing emergency management strategies for the area, as determined through the flood risk management process and by the NSW SES	Shelter-in-place will be the only option for site occupants if the evacuation route is cut off during the PMF. Additionally, pre-emptive evacuation is unlikely due to the difficulty in predicting flash storm events.
Has evacuation off-site (the primary emergency management strategy) been investigated and determined to be unachievable	Off-site evacuation via Bourke Street may be cut off during the PMF, particularly for occupants in the buildings of Parcel 1 (north-west regio of the site). Flood hazard in the site reaches category H5 during the PMF, and flood hazard to the west of the site is high (up to category H6) restricting access during the PMF and making shelter-in-place required. The SIP strategy is consistent with this requirement.
Does the development include medical centres, emergency service and community facilities, and sensitive and hazardous land uses, some of which may not be suitable for shelter in place	No. The SIP strategy is consistent with this requirement.
Shelter in place for greenfield development is not supported	Greenfield development is not proposed. The SIP strategy is consistent with this requirement.
Whether there is existing government developed flood warning systems that give advanced detailed forecasts of flash flooding to allow sufficient time to evacuate to the proposed refuge locations.	The site's Flood Wardens should monitor flood warnings provided by BoM and NSW SES in flood events. The SIP strategy is consistent with this requirement.
Can the community effectively be informed of the risks associated with the emergency management strategy.	Yes, this can be imposed as a condition of the future development that residents are effectively informed, and appropriate drills are undertaken.
Detailed assessment of evacuation off-site (the primary emergency management strategy) to determine that evacuation off-site is not achievable.	A hydraulic model (TUFLOW) was used to analyse the evacuation route off-site during the 1% AEP and PMF events, see section 7. The SIP strategy is consistent with this requirement.
The flood behaviour at the site, with consideration of climate change and assessment of the potential maximum duration of isolation up to and including the PMF to identify that: - flash flooding is the only flood risk present at the site, whether it be from overland flooding, local creek or riverine flooding, and - the flooding occurs within less than 6 hours from the commencement of causative rain and the duration of shelter in place due to isolation by floodwaters is less than 12 hours from the commencement of rainfall, and - the development is not subject to high hazard flooding (e.g. floodways, high hazard H5 or H6 areas) or surrounding roadways are not subject to high hazard flooding.	Results from the hydraulic model show that the critical duration PMF has a fast response time. Although Young Street is subject to high flood hazard, Bourke Street remains category H1 during the PMF and should not be subject to flood related damage. Considering this, it is expected that site occupants will be able to leave the site once PMF flood waters have resided. The development is subject to flash flooding due to floodwater entering the site as overland flow from Danks Street and Young Street. Flood hazard is primarily category H1 to H2, however hazard reaches H5 on the western access road. As site occupants would not be sheltering in this area during the PMF, this is acceptable. The SIP strategy is mostly consistent with these requirements.

SIP requirement	Consistency of proposed development
how shelter in place will be: - used as part of the site's emergency management response, including actions before, during and after sheltering in place, and - communicated to occupants and visitors of the building and how this communication will be maintained for the life of the development.	A detailed flood emergency response plan (FERP) is to be prepared prior to the construction and operation of the proposed development. The FERP is to outline responsibilities, and relevant parties should review and be familiar with their roles. Inductions will be held to educate staff on their role during a flood event. Future inhabitants are to be educated on the potential flood risk and actions that will be undertaken during a flood event. As part of this education, evacuation drills will be conducted regularly to ensure residents are aware of the procedures for evacuation. Lessons will also be held and pamphlets provided that address flood risks and highlight dangerous behaviours during a flood event. These lessons could be based on materials available on the NSW SES website.
An understanding of the secondary risks and how the proponent proposes they will be managed is outlined in the flood impact and risk assessment (FIRA). Secondary risks include medical emergencies, building fire, health and wellbeing. Table 12 of EM01 should be used to consider whether the risks could be effectively managed.	In the context of Table 12 of <i>Support for emergency management planning: Flood risk management guideline EM01</i> (Department of Planning and Environment, 2023), the development is a redevelopment in an existing zoned emergency management (EM) constrained area. The proposed development best aligns with medium to high-density residential development and commercial development (including retail) in an existing EM constrained area, and the following applies to SIP considerations: - Make buildings as safe as possible to occupy during flood events. An area of habitable floor of any residential development should be located above the PMF with the building structurally designed for the likely flood and debris impacts. - To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the patient, the NSW SES, Ambulance NSW, the relevant Health functional area and the fire agency servicing the area should be consulted by councils to determine appropriate risk management strategies during flooding. - To cater for the safety of potential occupants, clients and visitors in commercial development there should be the provision of sufficient readily accessible habitable areas above the PMF. The SIP strategy is consistent with the above requirements



SIP requirement	Consistency of proposed development
An understanding of the secondary risks and how the proponent proposes they will be managed is outlined in the flood impact and risk assessment (FIRA). Secondary risks include medical emergencies, building fire, health and wellbeing. Table 12 of EM01 should be used to consider whether the risks could be effectively managed.	The following other general recommendations are provided in Table 12: • Secondary risks of fire and medical emergencies during floods ○ To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding. ○ Where there is no CBD-wide strategy to address secondary risks during flooding, consideration needs to be given to how secondary risks will be managed for the duration of flooding and a further period of up to 48 hours to provide restoration of external services. • Warning system – A PA system could be implemented to guide site occupants to safe SIP areas in the event of a PMF. • Provision of accessible space – Publicly available space above the PMF is to be provided for all floor levels below the PMF. • Adequate services – An emergency back up power generator can be located above the PMF. This will be considered during detailed design as it would not affect the proposed layout and / or built form of the building.
The consent authority should reflect the following design criteria in relevant conditions of consent: • the floor level of the shelter in place part of the development be above the PMF, and • structural soundness for conditions in a PMF event, considering flood and debris forces, be verified by a suitably qualified structural engineer, and • area and access to the area does not rely on access to electricity, is self-directing, and have clearly marked internal access for all people on site, including consideration of access for potential occupants and/or visitors.	The development is multi-storeyed, and most floor levels are located above the PMF. Site occupants in the ground floors of the northwestern Parcel 1 buildings are to evacuate to the easternmost buildings in Parcel 1, or buildings in the other land parcels. This is feasible as hazard remains low in the courtyard of Parcel 1, meaning evacuation to other buildings within the site remains possible during the PMF. Structural certification is not required as the proposed buildings are only subject to moderate flood hazard. The SIP strategy is mostly consistent with these requirements.



SIP requirement	Consistency of proposed development
The consent authority may also consider the following design criteria when setting relevant conditions of consent depending on the scale and type of development: • protection from weather and appropriate heating and cooling • access to personal hygiene facilities such as a toilet • a minimum floor space of 2 m² per person • items for self-sufficiency that are stored, maintained and are regularly updated in an accessible location above the PMF, including sufficient drinking water and food for occupants, fire extinguishers, radios and torches with spare batteries, and a first aid kit with an automated external defibrillator (AED) • centralised communal shelters may be considered but must be freely accessible internally at all times and externally accessible during events • access is provided to on site systems that generate power of the shelter in place location during and after the event for a full range of flood events up to the PMF detail how these requirements will be maintained and enforced for the life of the development.	The majority of site occupants sheltering in place are residents in the upper floors of the buildings which will have access to all required safety features/personal items. The SIP refuge area requirements would be considered further by the conditions of consent for the future development. However, it is noted that only a relatively minor portion of the future development floor levels are located below the PMF. Occupants of these buildings are to evacuate to the PMF free buildings within the site until PMF flood waters reside which is expected to occur approximately 1.5 hours after the floor levels of the PMF affected buildings become inundated.



9 Conclusion

This FIRA was prepared to support the environmental impact statement for a mixed-use state significant development at 881-885 Bourke Street, Waterloo, and is specifically intended for the main works stage of the SSDA (SSD-80441462). The FIRA was prepared in accordance with relevant guidance and complies with the SEAR's provided for the development.

This flood assessment, undertaken using a detailed two-dimensional (2D) hydraulic model in TUFLOW, evaluated flood behaviour under both existing and post-development conditions across a range of design storm events. To account for climate change, a 30% increase in rainfall intensity was applied to the 1% AEP event, consistent with the methodology outlined in the Council's adopted Flood Study (WMAwater, 2023).

The modelling results indicate that the proposed development will have minimal impact on flood behaviour off-site, with changes in flood levels and extents considered acceptable during events up to and including the PMF. The site is generally flood free during the 1% AEP event both with and without climate change, and flood impacts within the site during the PMF are acceptable as safe evacuation routes are available. Ultimately, the proposed development complies with the general flood requirements from the DCP and SEARs.

Preliminary flood emergency advice was provided and shelter in place is recommended as the flood emergency strategy if access to the site is restricted during the PMF.



10 Bibliography

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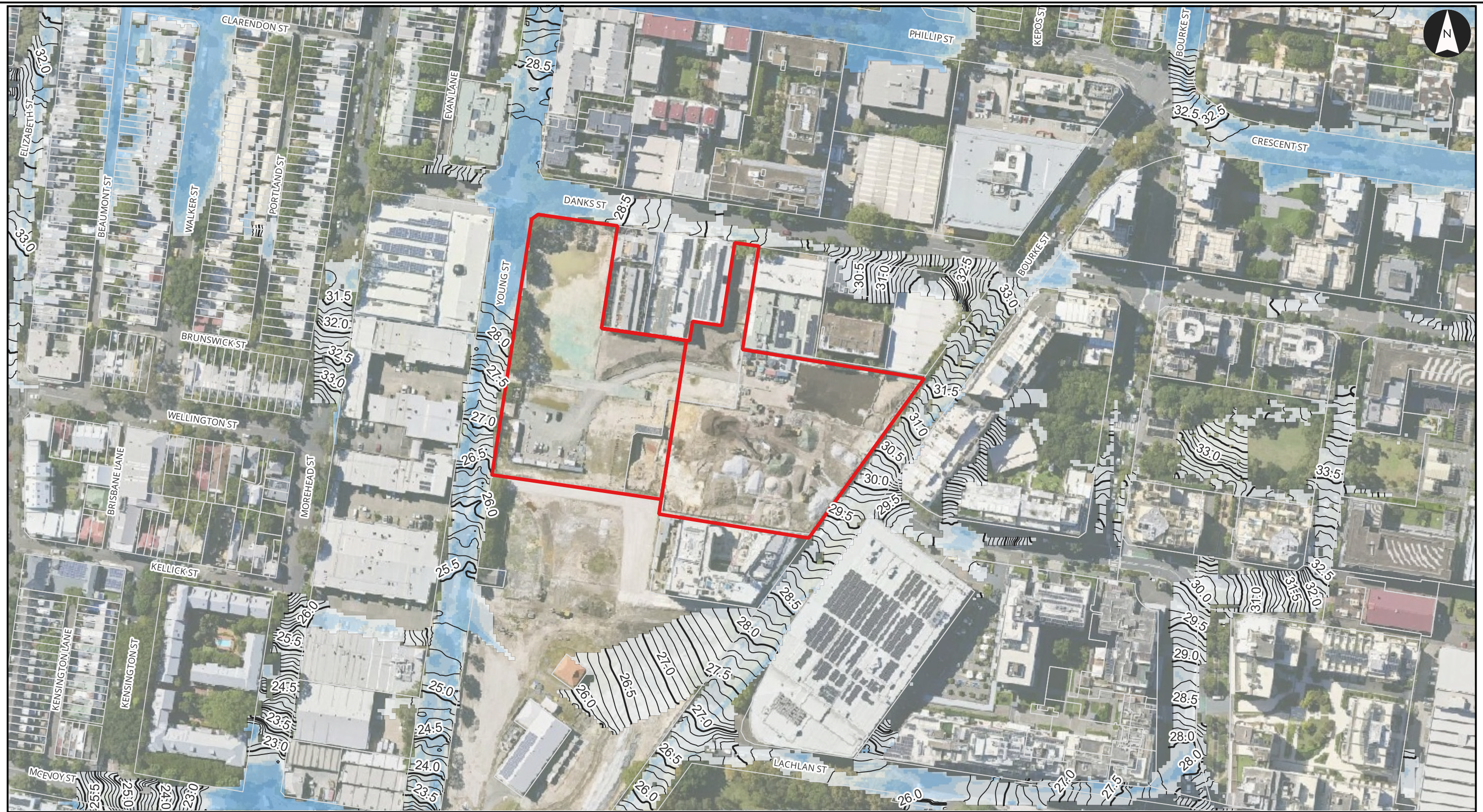


Appendices



Appendix A Flood Maps





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Depth and Level 1% AEP

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A1

Legend

 Site Boundary

 Cadastre

Flood Level (mAHD)

Flood Depth (m)

	0.0 - 0.1
	0.1 - 0.2
	0.2 - 0.5
	0.5 - 1.0
	1.0 - 2.0
	2.0 - 3.0
	3.0 - 4.0
	4.0 - 5.0
	> 5.0

Notes:

1. Map displayed in GDA94 / MGA zone 56

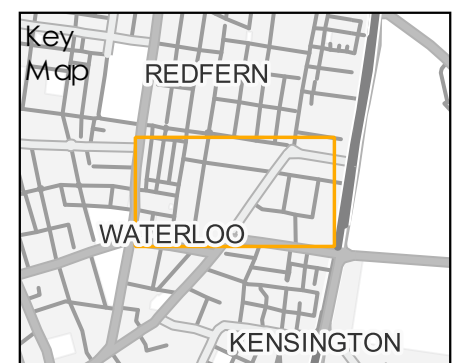
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Velocity 1% AEP

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A2



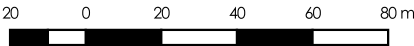
Legend

- Site Boundary
- Cadastre

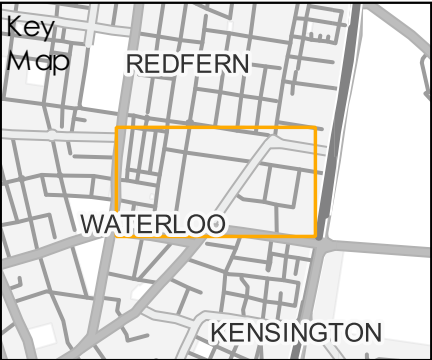
Velocity (m/s)
0.0 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

- Notes:
- Map displayed in GDA94 / MGA zone 56
- References:
- Aerial imagery: MetroMap, September 2025
 - Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Hazard 1% AEP

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A3

Legend

Site Boundary

Cadastre

Hazard

H1
 H2
 H3
 H4
 H5
 H6

Notes:

1. Map displayed in GDA94 / MGA zone 56

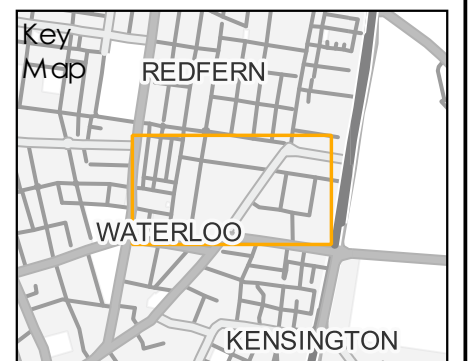
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Depth and Level 1% AEP with Climate Change

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A4

Legend

 Site Boundary

 Cadastre

Flood Level (mAHD)

Flood Depth (m)

0.0 - 0.1
0.1 - 0.2
0.2 - 0.5
0.5 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0

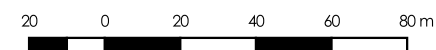
Notes:

1. Map displayed in GDA94 / MGA zone 56

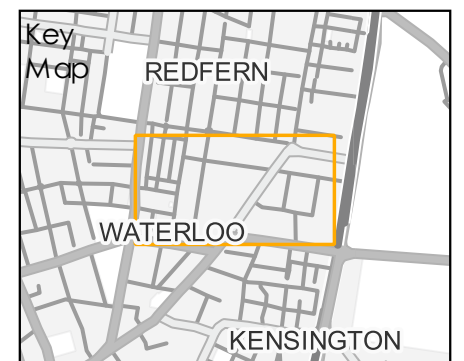
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Velocity 1% AEP with Climate Change

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A5



Legend

Site Boundary

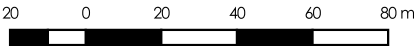
Cadastre

Velocity (m/s)

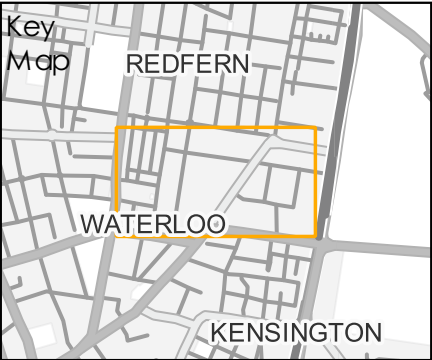
- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

- Notes:
- 1. Map displayed in GDA94 / MGA zone 56
- References:
- 1. Aerial imagery: MetroMap, September 2025
 - 2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Hazard 1% AEP with Climate Change

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A6

Legend

Site Boundary

Cadastre

Hazard

H1
 H2
 H3
 H4
 H5
 H6

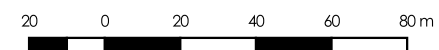
Notes:

1. Map displayed in GDA94 / MGA zone 56

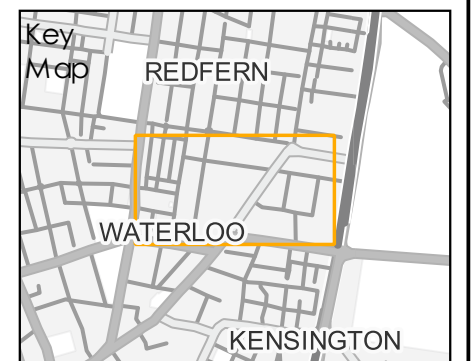
References:

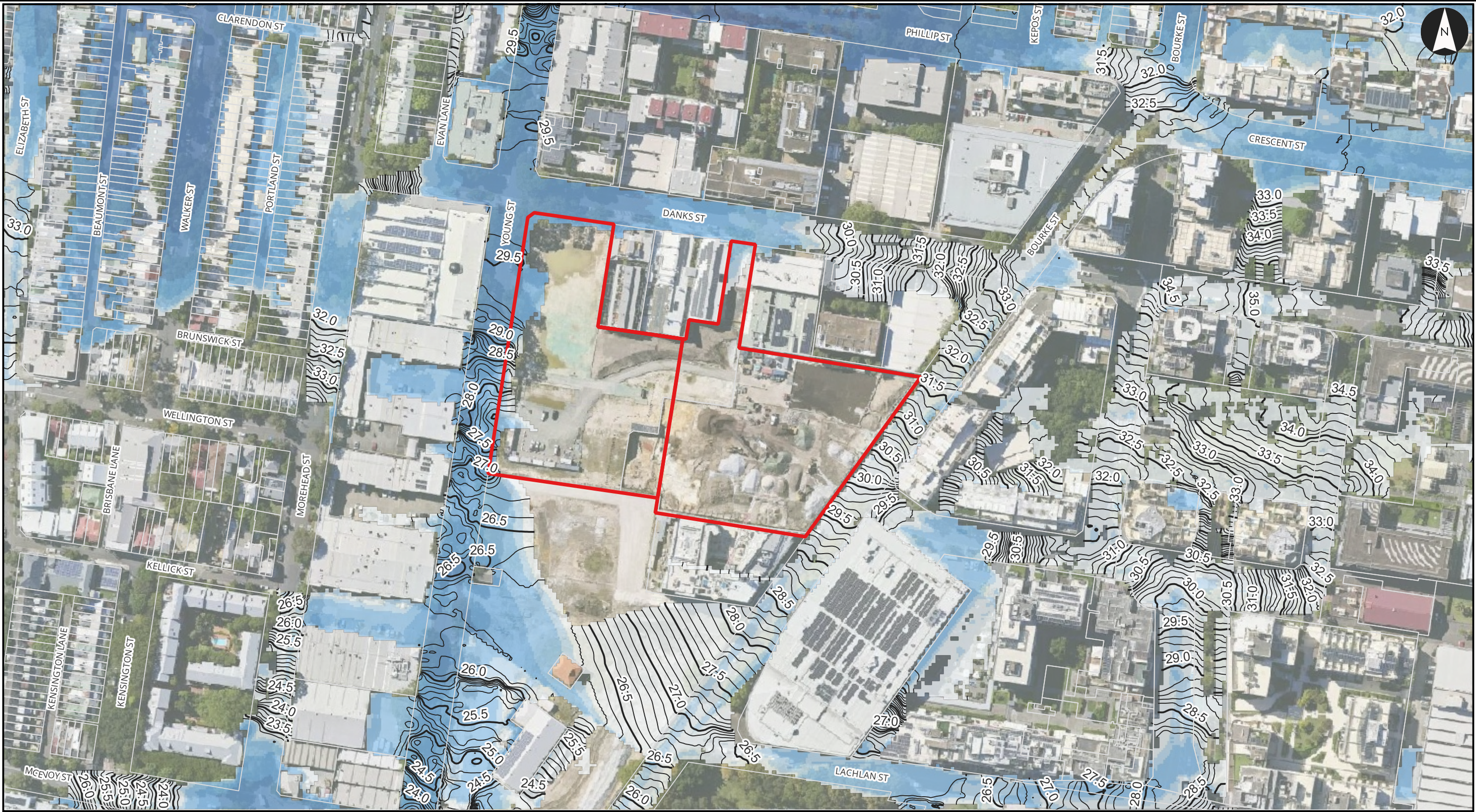
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

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Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Depth and Level PMF

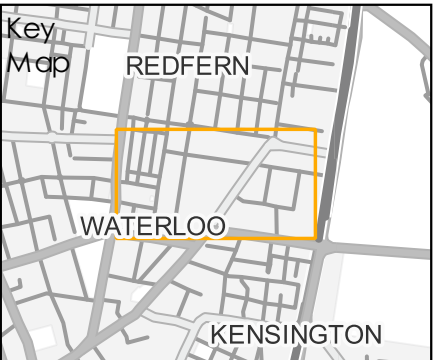
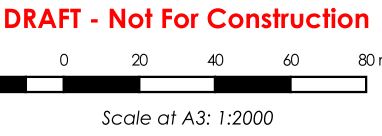
Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A7

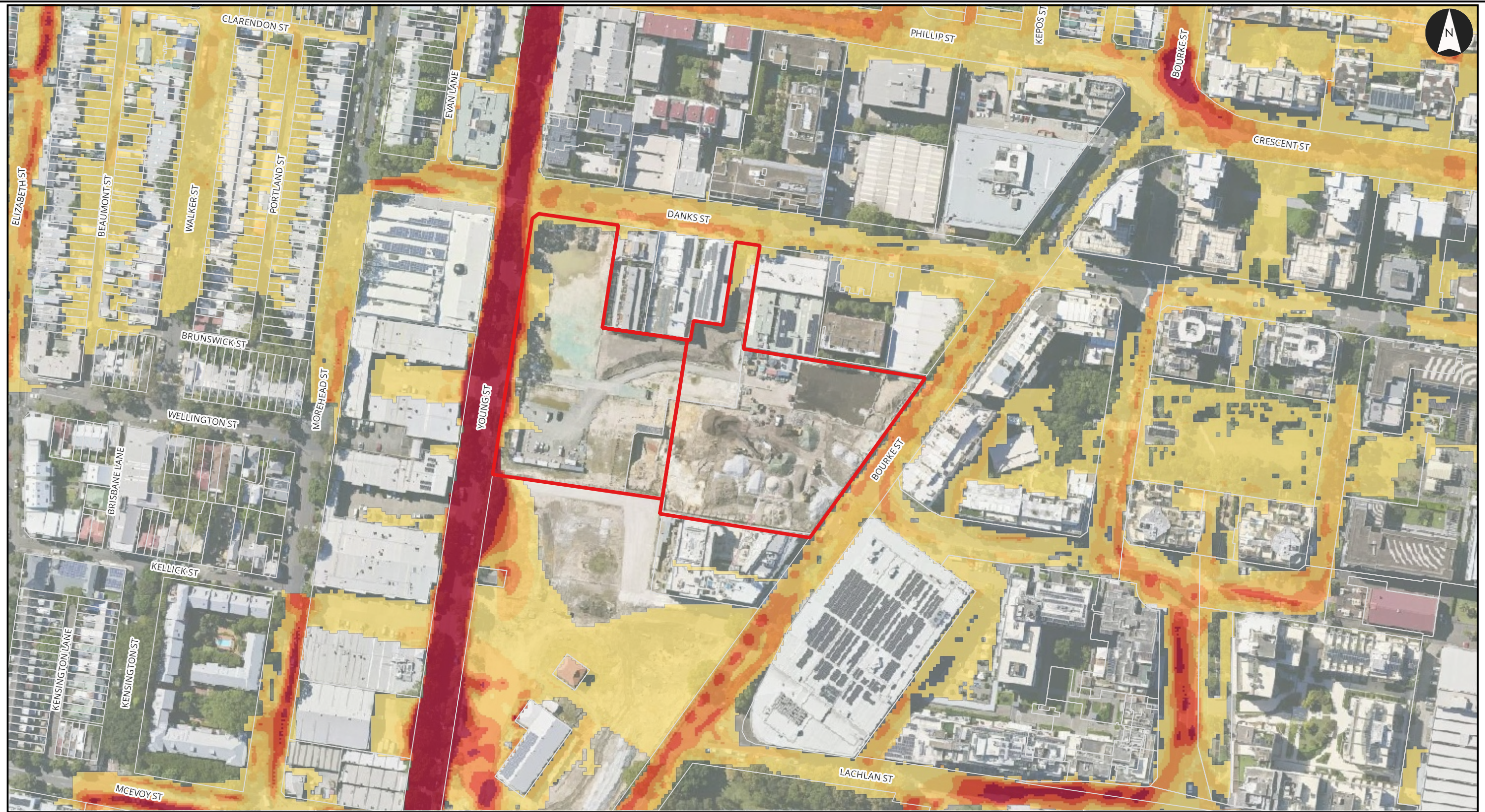
Legend

- Site Boundary
- Cadastre
- Flood Level (mAHD)

Flood Depth (m)	
	0.0 - 0.1
	0.1 - 0.2
	0.2 - 0.5
	0.5 - 1.0
	1.0 - 2.0
	2.0 - 3.0
	3.0 - 4.0
	4.0 - 5.0
	> 5.0

- Notes:
- Map displayed in GDA94 / MGA zone 56
- References:
- Aerial imagery: MetroMap, September 2025
 - Cadastre: NSW Spatial Collaboration Portal, 2025





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Velocity PMF

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A8

Legend

- Site Boundary
- Cadastre

Velocity (m/s)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

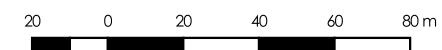
Notes:

1. Map displayed in GDA94 / MGA zone 56

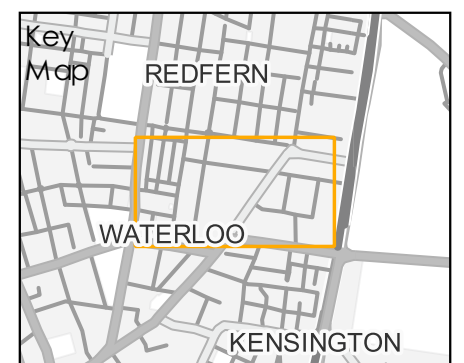
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

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Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Existing Flood Hazard PMF

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A9



Legend

 Site Boundary

 Cadastre

Hazard

H1
H2
H3
H4
H5
H6

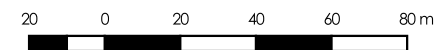
Notes:

1. Map displayed in GDA94 / MGA zone 56

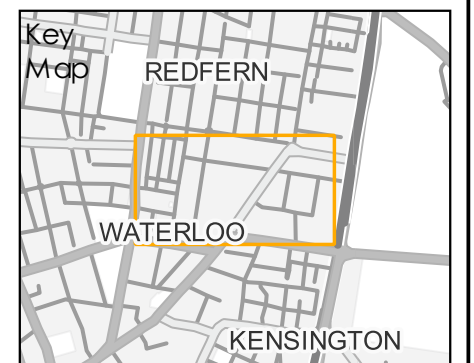
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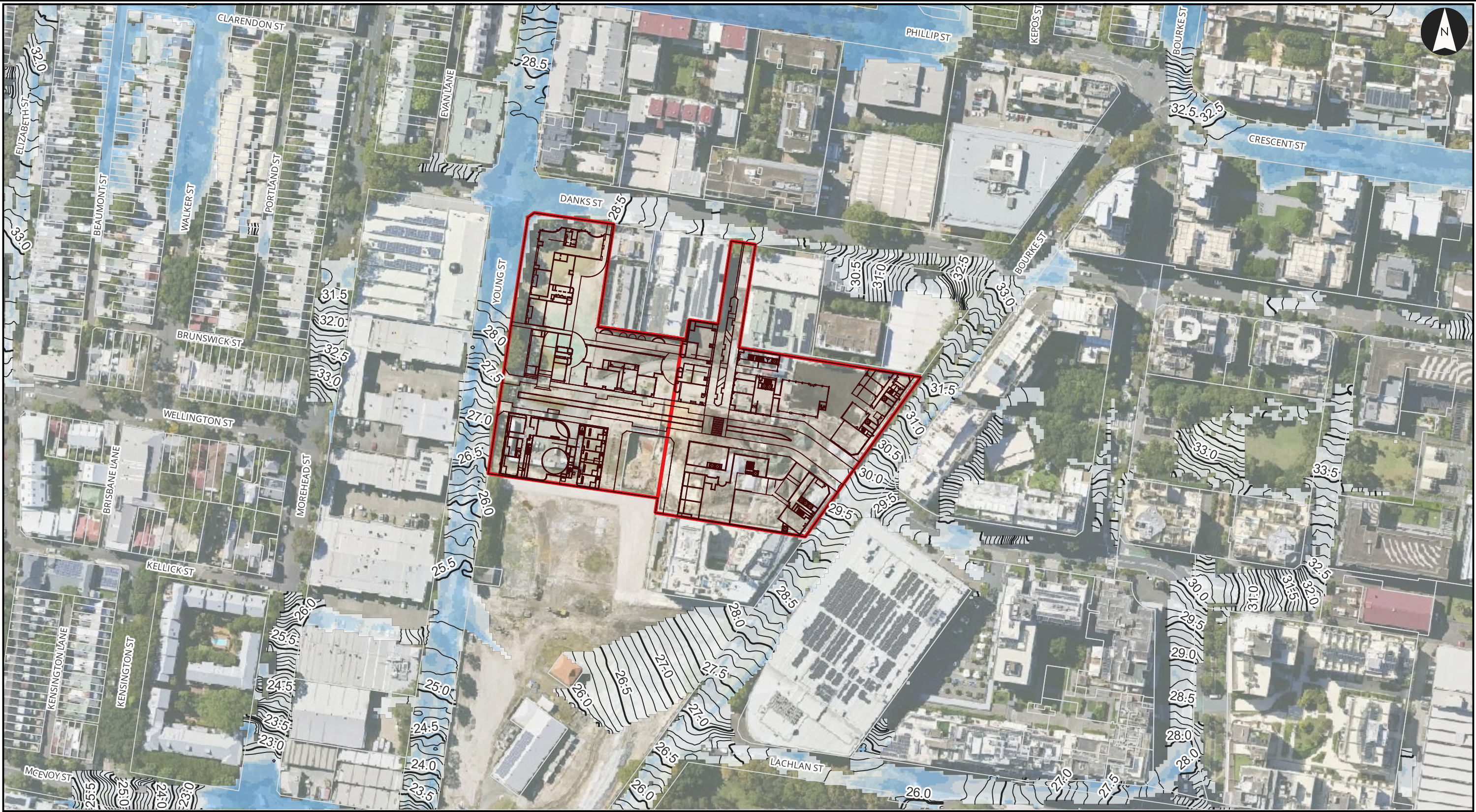
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

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Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Depth and Level 1% AEP

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A10

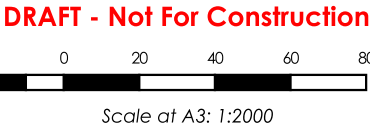


Legend

- Site Boundary
- Proposed Development Layout
- Cadastre
- Flood Level (mAHD)

Flood Depth (m)	
0.0 - 0.1	
0.1 - 0.2	
0.2 - 0.5	
0.5 - 1.0	
1.0 - 2.0	
2.0 - 3.0	
3.0 - 4.0	
4.0 - 5.0	
> 5.0	

- Notes:
- Map displayed in GDA94 / MGA zone 56
- References:
- Aerial imagery: MetroMap, September 2025
 - Cadastre: NSW Spatial Collaboration Portal, 2025





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Velocity 1% AEP

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A11

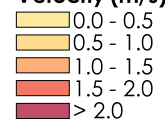
Legend

 Site Boundary

Proposed Development Layout

 Cadastre

Velocity (m/s)



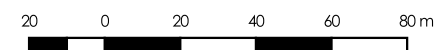
Notes:

1. Map displayed in GDA94 / MGA zone 56

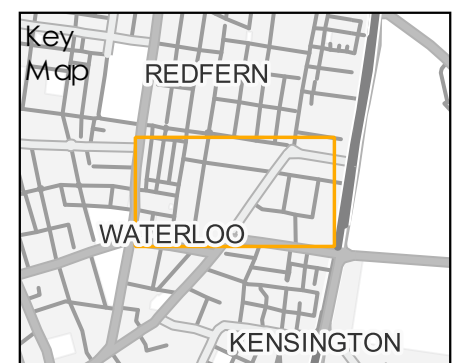
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Hazard 1% AEP

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A12



Legend

 Site Boundary

— Proposed Development Layout

— Cadastre

Hazard

- H1
- H2
- H3
- H4
- H5
- H6

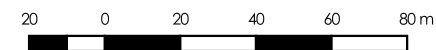
Notes:

1. Map displayed in GDA94 / MGA zone 56

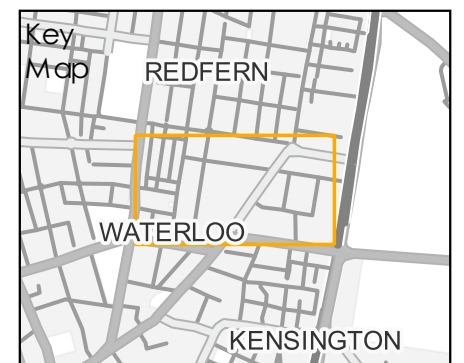
References:

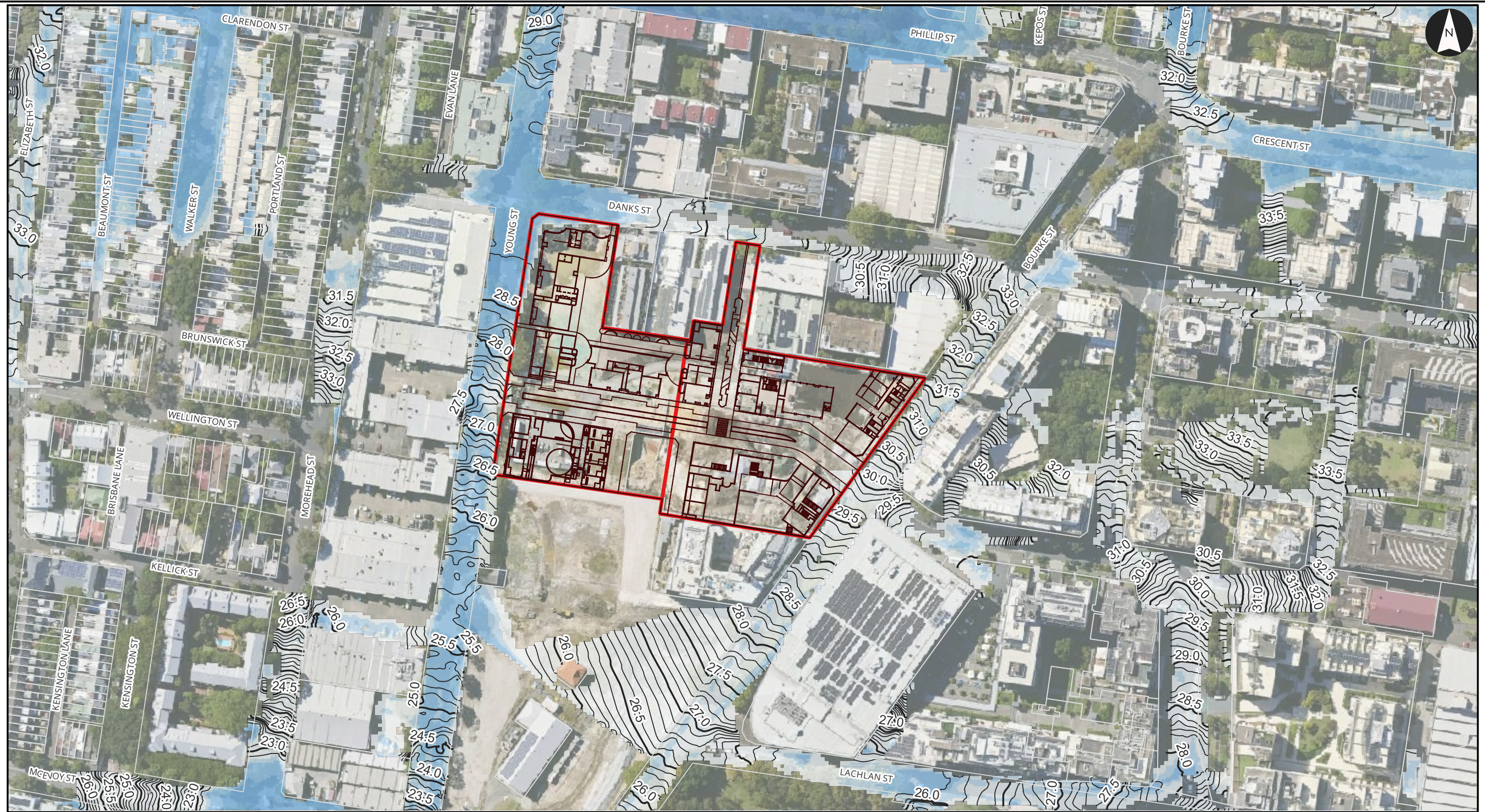
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Depth and Level 1% AEP with Climate Change

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A13

Legend

 Site Boundary

— Proposed Development Layout

— Cadastre

— Flood Level (mAHD)

Flood Depth (m)

0.0 - 0.1
0.1 - 0.2
0.2 - 0.5
0.5 - 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0

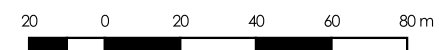
Notes:

1. Map displayed in GDA94 / MGA zone 56

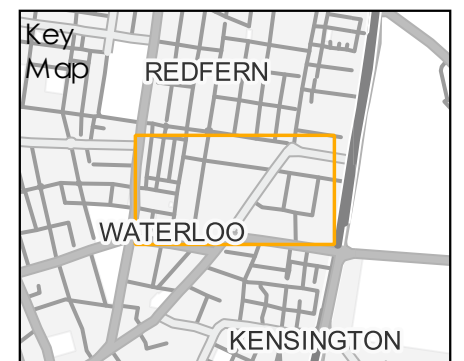
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Velocity 1% AEP with Climate Change

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A14



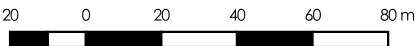
Legend

- Site Boundary
- Proposed Development Layout
- Cadastre

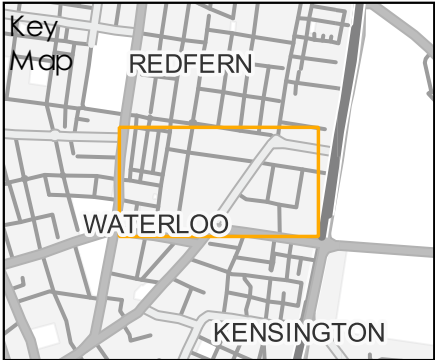
Velocity (m/s)	
0.0 - 0.5	Yellow
0.5 - 1.0	Orange
1.0 - 1.5	Red
1.5 - 2.0	Dark Red
> 2.0	Dark Red

- Notes:
- Map displayed in GDA94 / MGA zone 56
- References:
- Aerial imagery: MetroMap, September 2025
 - Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Hazard 1% AEP with Climate Change

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A15

Legend

 Site Boundary

Proposed Development Layout

 Cadastre

Hazard

H1
H2
H3
H4
H5
H6

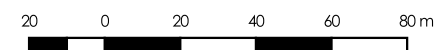
Notes:

1. Map displayed in GDA94 / MGA zone 56

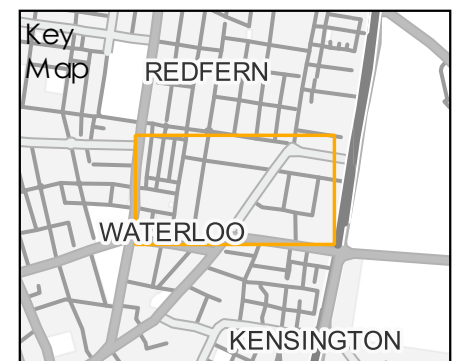
References:

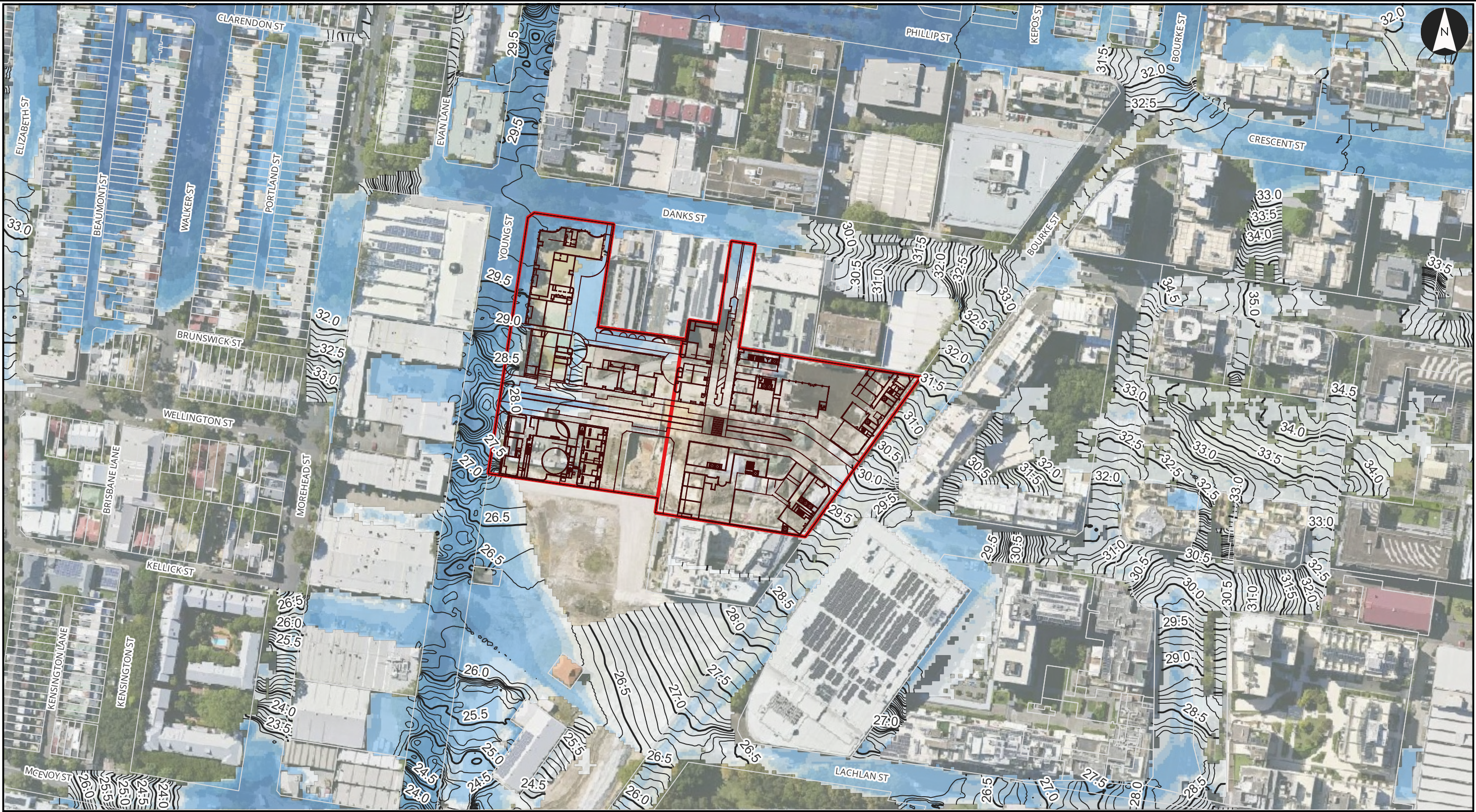
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Depth and Level PMF

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A16



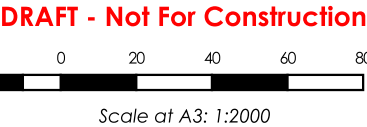
Legend

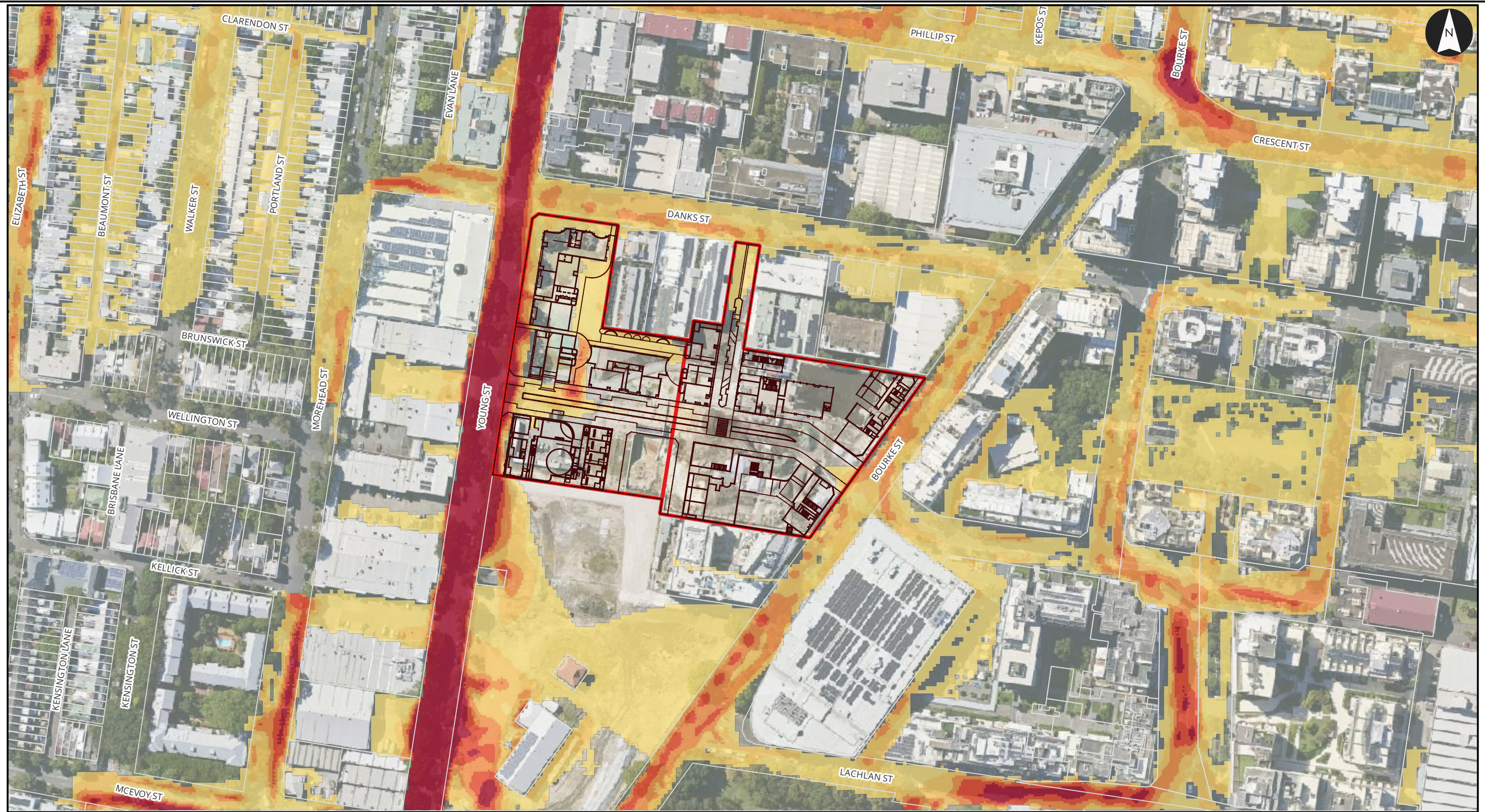
- Site Boundary
- Proposed Development Layout
- Cadastral
- Flood Level (mAHd)

Flood Depth (m)	
0.0 - 0.1	
0.1 - 0.2	
0.2 - 0.5	
0.5 - 1.0	
1.0 - 2.0	
2.0 - 3.0	
3.0 - 4.0	
4.0 - 5.0	
> 5.0	

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Velocity PMF

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A17



Legend

 Site Boundary

Proposed Development Layout

 Cadastre

Velocity (m/s)

	0.0 - 0.5
	0.5 - 1.0
	1.0 - 1.5
	1.5 - 2.0
	> 2.0

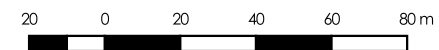
Notes:

1. Map displayed in GDA94 / MGA zone 56

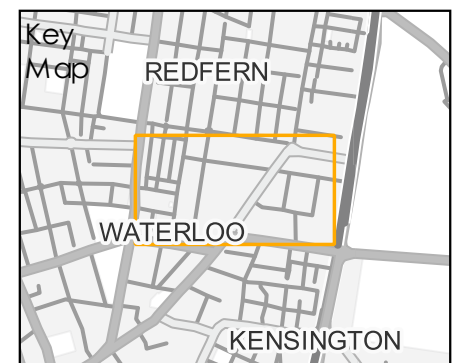
References:

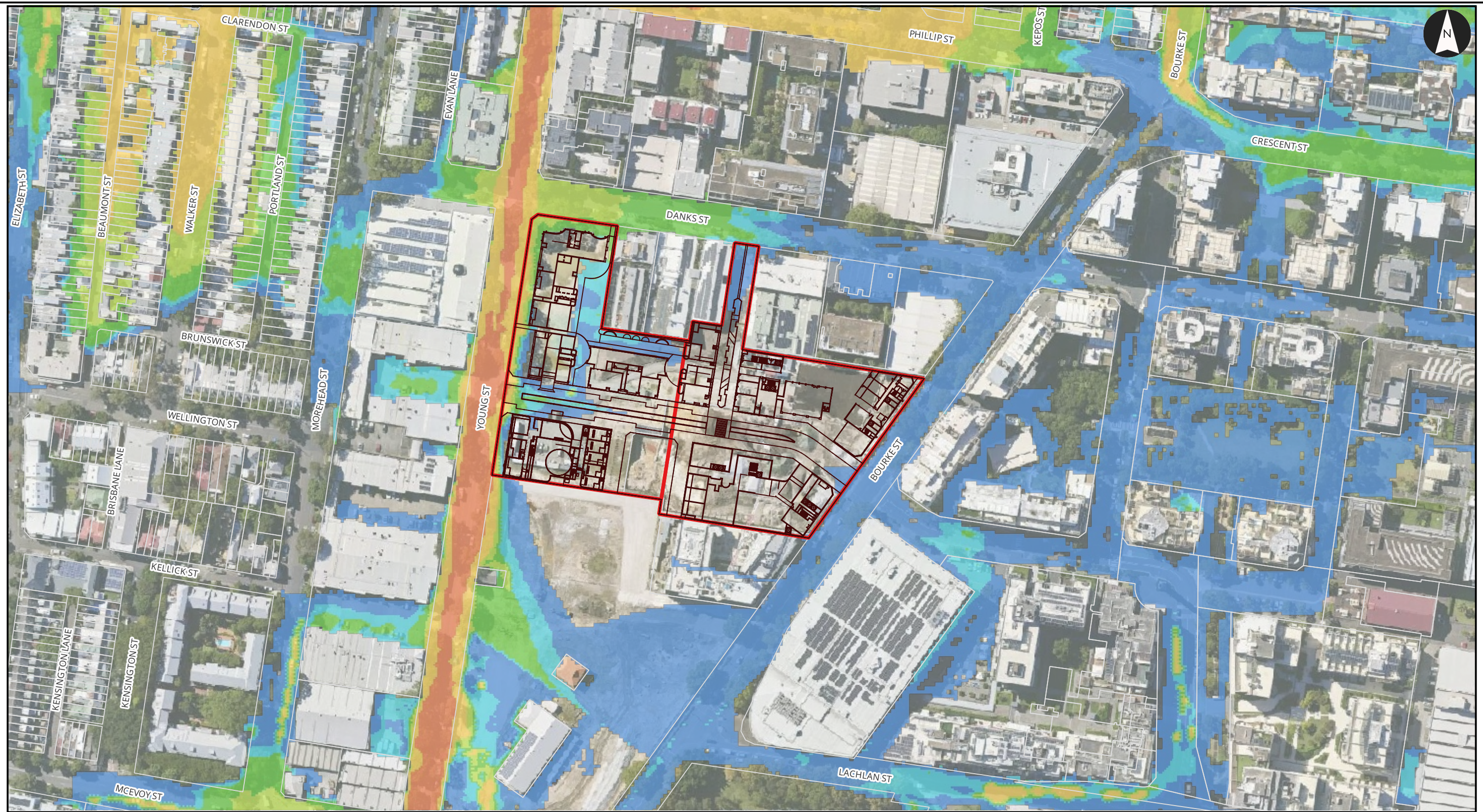
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

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Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Flood Hazard PMF

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A18



Legend

 Site Boundary

— Proposed Development Layout

— Cadastre

Hazard

- H1
- H2
- H3
- H4
- H5
- H6

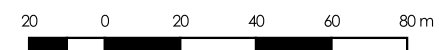
Notes:

1. Map displayed in GDA94 / MGA zone 56

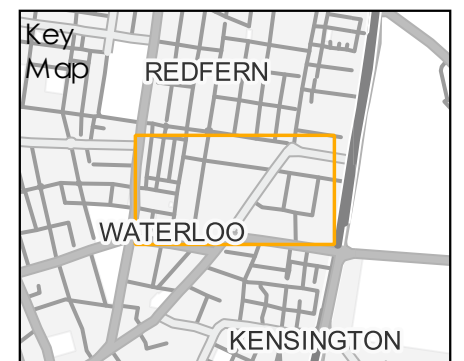
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed less Existing Flood Impact 1% AEP

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A19



Legend

Site Boundary

Proposed Development Layout

Cadastre

Afflux (m)

	< -0.50
	-0.50 - -0.20
	-0.20 - -0.10
	-0.10 - -0.05
	-0.05 - -0.02
	-0.02 - -0.01
	-0.01 - 0.01
	0.01 - 0.02
	0.02 - 0.05
	0.05 - 0.10
	0.10 - 0.20
	0.20 - 0.50
	> 0.50

Wet / Dry

	Was Wet, Now Dry
	Was Dry, Now Wet

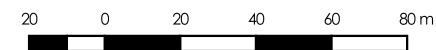
Notes:

1. Map displayed in GDA94 / MGA zone 56

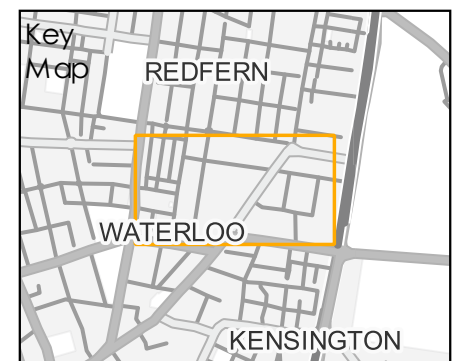
References:

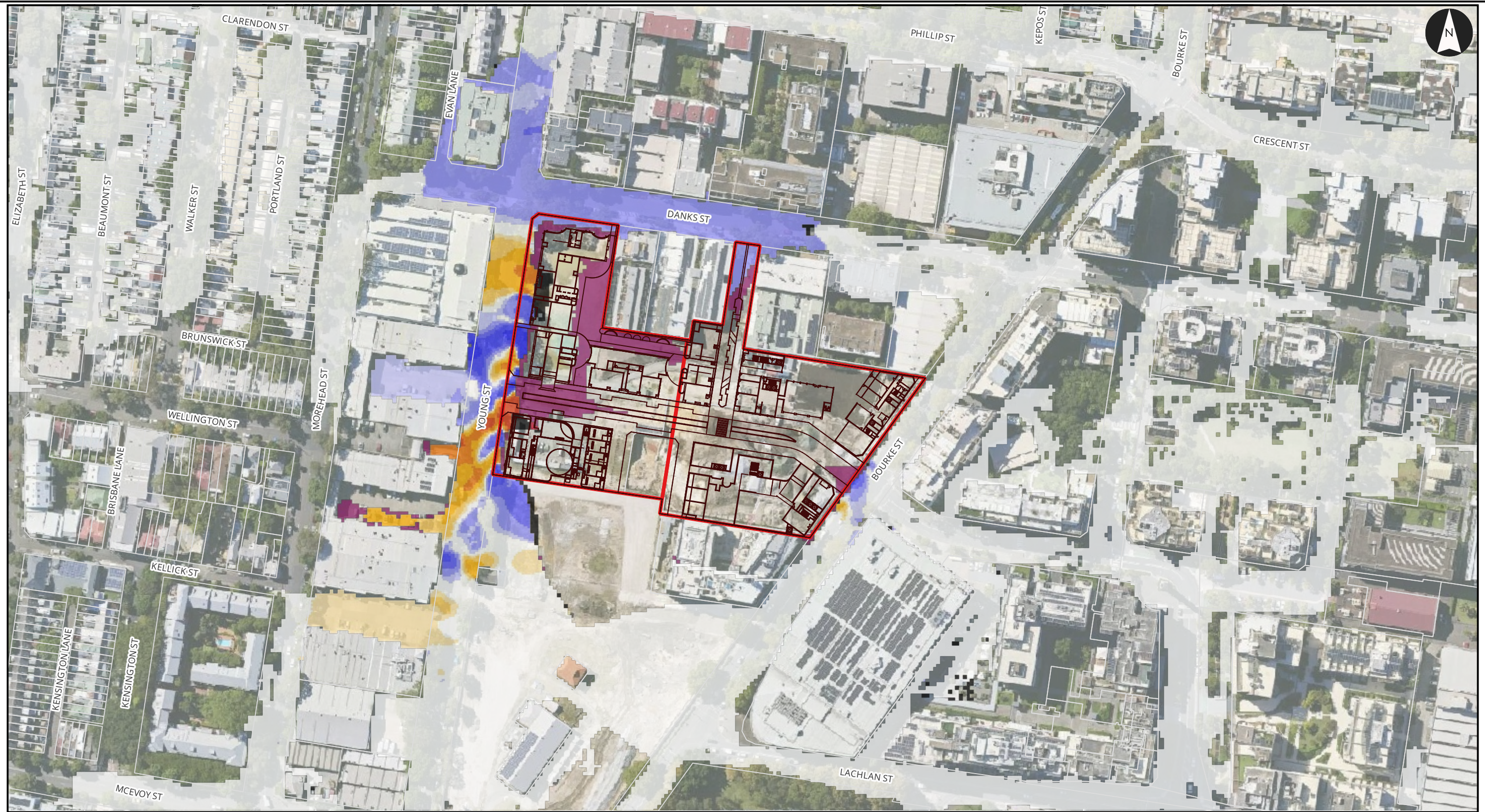
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed less Existing Flood Impact PMF

Client: The Trustee for Waterloo Property Unit Trust
Project Code: 301351683
Drawn By: GF, Checked By: AA
Date: (2025-09-25)
Figure No: GIS-Q-0A20



Legend

Site Boundary

Proposed Development Layout

Cadastre

Afflux (m)

	< -0.50
	-0.50 - -0.20
	-0.20 - -0.10
	-0.10 - -0.05
	-0.05 - -0.02
	-0.02 - -0.01
	-0.01 - 0.01
	0.01 - 0.02
	0.02 - 0.05
	0.05 - 0.10
	0.10 - 0.20
	0.20 - 0.50
	> 0.50

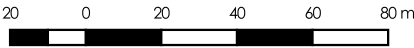
Wet / Dry

	Was Wet, Now Dry
	Was Dry, Now Wet

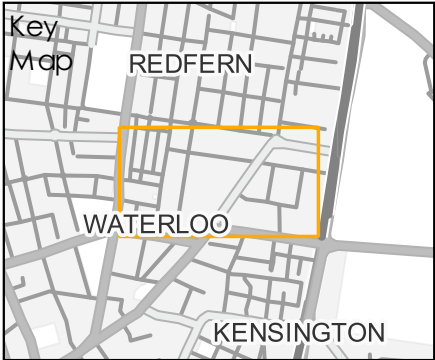
Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





207-229 Young Street and 881-885 Bourke Street, Waterloo
Main Works

Developed Scenario - Climate Change less Non Climate
Change 1% AEP Sensitivity Analysis

Client: The Trustee for Waterloo Property Unit Trust

Project Code: 301351683

Drawn By: GF, Checked By: AA

Date: (2025-09-25)

Figure No: GIS-Q-0A21



Legend

 Site Boundary

— Proposed Development Layout

— Cadastre

Afflux (m)

	< -0.50
	-0.50 - -0.20
	-0.20 - -0.10
	-0.10 - -0.05
	-0.05 - -0.02
	-0.02 - -0.01
	-0.01 - 0.01
	0.01 - 0.02
	0.02 - 0.05
	0.05 - 0.10
	0.10 - 0.20
	0.20 - 0.50
	> 0.50

Wet / Dry

	Was Wet, Now Dry
	Was Dry, Now Wet

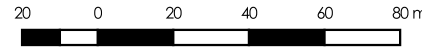
Notes:

1. Map displayed in GDA94 / MGA zone 56

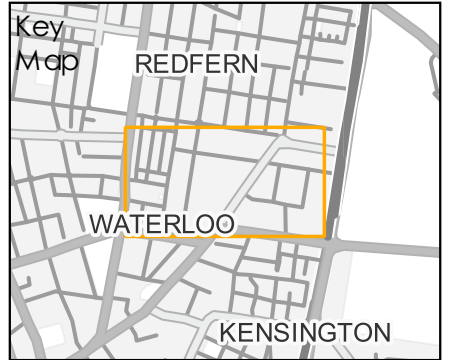
References:

1. Aerial imagery: MetroMap, September 2025
2. Cadastre: NSW Spatial Collaboration Portal, 2025

DRAFT - Not For Construction



Scale at A3: 1:2000





Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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