

REPORT

To Anchor Estate
From Water Technology
Date 13 March 2024
Subject 90-94, Phillip Street Parramatta Flood Advice
Our ref 24060144_R01V01

Dear Charbel,

24050144 90-94 Phillip Street, Parramatta Flood Advice

This report sets out our preliminary findings regarding how flooding may dictate building design features such as building footprints, minimum floor levels, basement entries and other design features of development at 90-94 Phillip Street, Parramatta (Figure 1). The advice provided in this report is broad but cannot be accurate without the precise flood levels which will only become available once Council adopts the new flood model. This is currently anticipated to be in May 2024.

The following preliminary flood advice has been prepared with reference to the following documents:

- Parramatta Local Environmental Plan (LEP) 2023
- Parramatta Development Control Plan (DCP) 2023
- Draft Parramatta River Flood Study (2023).

1 CONTEXT

Anchor Estate owns the site 90-94 Phillip Street Parramatta NSW (Figure 1). The site is currently occupied by 2 existing buildings that are used for commercial purposes. Anchor Estate intends to demolish and develop the site into a multi storeyed building for commercial/residential purposes. While the existing zoning permits such a use, Anchor Estate intends to submit a planning proposal to Council to obtain permission to increase the building height and floor space ratios on the site.

The site is subject to riverine flooding of the Parramatta River in large events and to overland flows. Parramatta Council's adopted flood levels for the site are based on a one-dimensional MIKE11 flood model which was developed in the 1990s. Council recently completed a two-dimensional flood model for the whole of the Parramatta River catchment within the LGA. This is detailed in the Parramatta River Flood Study (Stantec, 2023), and is currently in draft form. The study was placed on public exhibition from 18 September to 30 October 2023 and is yet to be finalised and adopted by Council.

The final results of this model will be applicable to any future planning proposal or development proposal for the subject site. At this stage our understanding is that Council intends to adopt this model in May 2024.



Figure 4 is a flood map produced with outputs from the currently adopted one dimensional flood model. While this provides more precise flood levels at various cross sections in the river and surrounding streets, we don't have levels for a cross section at the subject site and these levels will be soon superseded. In fact, Council is currently delaying assessing development applications which rely on these levels.

This flood advice uses both sets of available flood data to inform the range of possible flood levels on the site and their implications for future development.

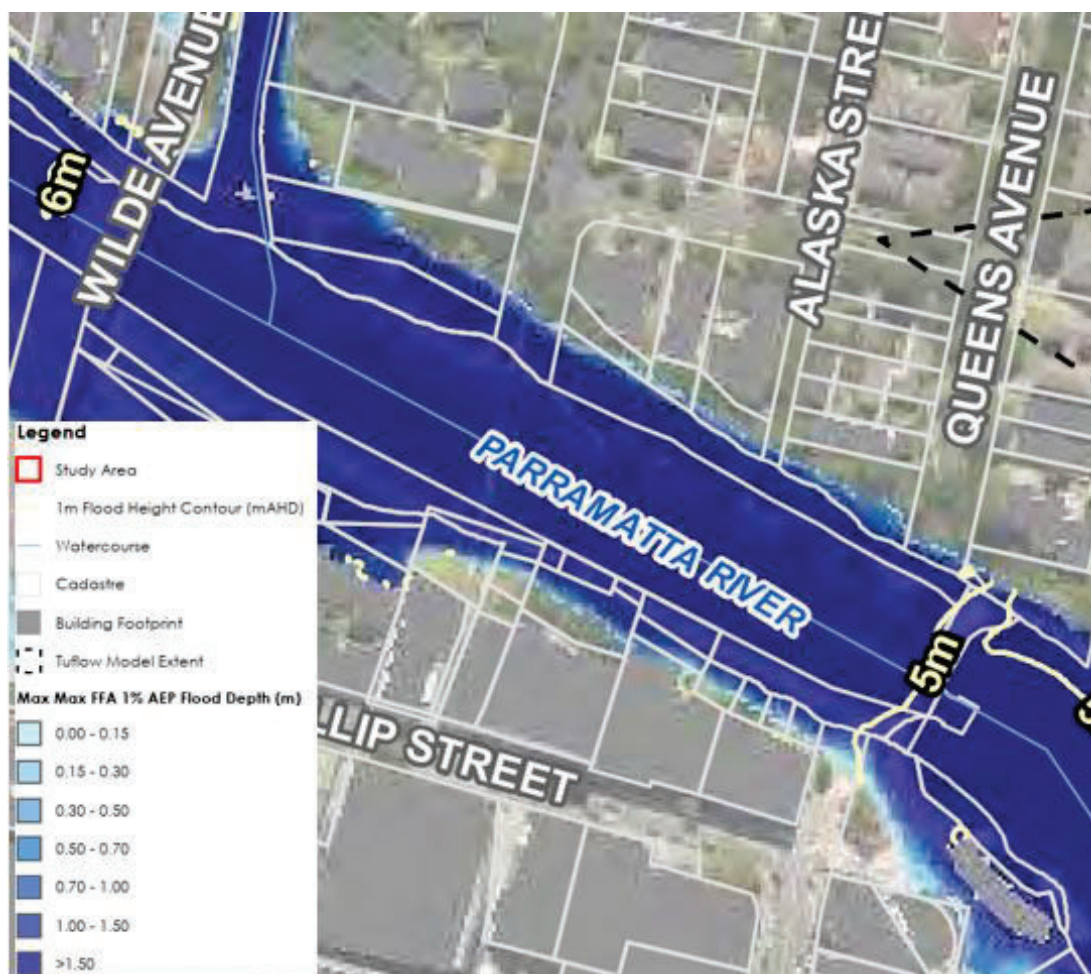


Figure 2 Flood levels (m AHD) in 1% AEP event (Stantec Draft Flood Study (2023))



Figure 3 Flood levels (m AHD) in PMF event (Stantec Draft Flood Study (2023))

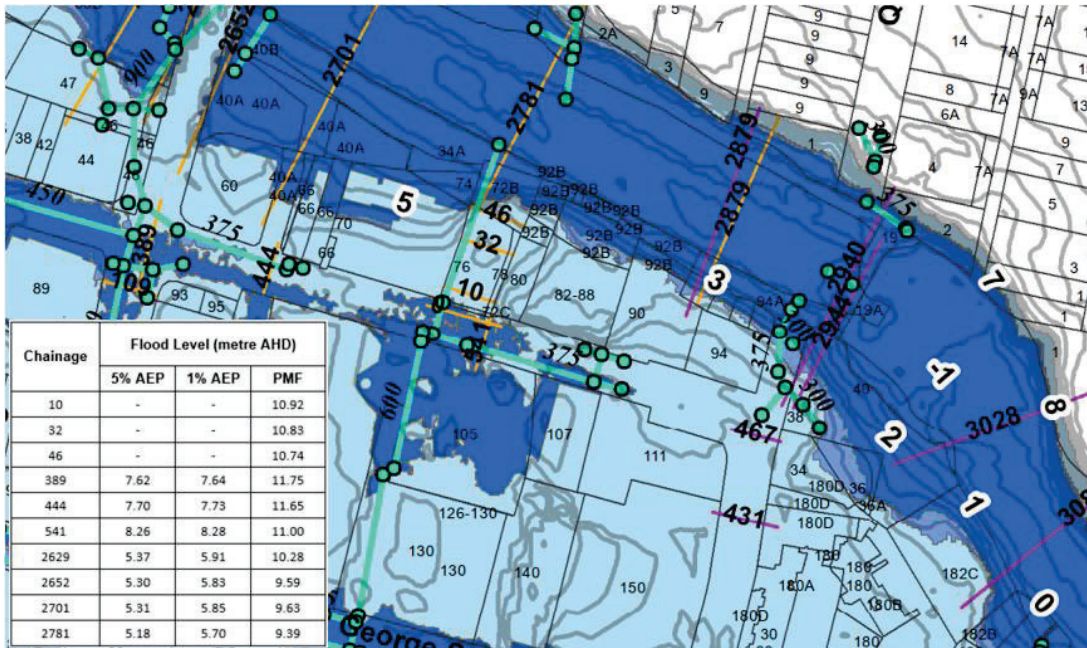


Figure 4 Flood Levels for Parramatta River (MIKE 11 model results)



2 DEVELOPMENT FOOTPRINT

Flood levels of both the Council adopted MIKE11 flood model and the recently developed Stantec Draft Flood Study were used to determine the range of flood levels that may need to be considered at the subject site.

The extract from the MIKE model does not provide flood levels for the cross section at chainage 2879 that is immediately to the north of the subject site. The closest flood information available from Figure 4 is chainage 2781 150m upstream to the subject site. Based on this model, chainage 2781 for the Annual Exceedance Probability (AEP) events are found to be as follows:

- 5% (1 in 20) AEP: 5.18 m AHD
- 1% (1 in 100) AEP: 5.7 m AHD
- Probable Maximum Flood (PMF): 9.39 m AHD in the Parramatta River and 11.65 m AHD in Phillip Street

The reason that the PMF flood level is shown as being higher in Phillip Street than in the Parramatta River is because in the model the river breaks out upstream of Marsden Street Weir and runs along Phillip, George and Macquarie Streets parallel to the river. The river drops over the weir and the water level in the river is much lower than those streets. Therefore, the flood level in the streets is metres higher than the level in the river and it flows from the streets back into the river along streets heading north or through the gaps between buildings.

The Stantec Draft Flood Study (2023) published flood level contours at 1m intervals. This gives a range between 5m AHD to 6m AHD at 1% Annual Exceedance Probability (AEP) along the northern boundary of the site (Figure 4). It indicates that the Phillip Street adjacent to the site is flood-free in the 1% AEP event.

In the PMF, the flood level is approximately 11m AHD at the eastern end of the site in the river and on Phillip Street south of the site. The level rises to 12m AHD in the river upstream of the site, but it is not clear what the levels are moving west along Phillip Street. It would appear PMF levels around the site are roughly between 11 and 12 m AHD.

As explained in Section 3 and Section 4 of this report, any development on the site must not create adverse flood impacts on neighbouring properties, Council is not in favour of buildings which have an undercroft area to accommodate flooding in events up to and including the 1% AEP flood nor extensive cut and fill within the flood planning area.

Satisfying these requirements at the subject site could be achieved by ensuring that the building footprint does not extend into the area below the 1% AEP flood level. Given that the flood levels are estimated to be somewhere between 5m to 6m AHD in the 1% AEP event, consideration is given to the limitations that three different 1% AEP flood levels would place on the approximate building footprint (Figure 5). This analysis may not be accurate as the flood levels are not available and it is indicative only to provide an idea of the implications depending on what final 1% AEP flood level is adopted. The ground levels of the site were extracted from Geoscience Australia's ELVIS ground elevation database which, in Parramatta, has a 1m grid size and a 10cm vertical resolution.

Scenarios considered for this assessment are illustrated in Figure 5 and were as follows:

- At a flood level of 5m AHD, the 1% AEP event would impact the north-western corner of 90 Phillip Street only. A building footprint which is entirely above this level would cover an area of approximately 2,192 m².
- At a flood level of 5.5m AHD a 1% AEP event would encroach on most of the northern most boundary of 90 Phillip Street. To accommodate this scenario the building footprint was reduced to 2,156 m².
- At a flood level of 6m AHD a 1% AEP event would encroach on the northern boundary of both 90 and 94 Phillip Street. A building footprint of about 1,953 m² could be built above this level.



Table 2 summarises the reduction in building footprint in each of the scenarios.

Table 1 Different scenarios and Area reduction in %

Scenario at 1% AEP	Actual Site Area	Development footprint within 1% AEP flood extent	Percentage reduction in area
5m AHD flood level	2,213 m ²	2,192 m ²	0.9%
5.5m AHD flood level		2,156 m ²	2.6%
6m AHD flood level		1,938 m ²	13%

The footprints provided in Figure 5 are an approximate extent but can be altered noting the following:

- Council will not countenance an under-croft area under the building to accommodate flooding, i.e., the building cannot cantilever over the 1% flood area.
- The northern boundaries drawn have minimum extents based on a straight northern façade. Further encroachment north may be possible with a stepped or curved façade or with compensatory cut and fill to even out the 1% AEP flood extent.
- These extents reflect a footprint matching the 1% AEP flood level however, PCDP 2023 Control C04 suggests that Council will not accept filling below the Flood Planning Level, therefore the areas for any given flood level in Table 2 may actually correspond to the areas for the level 0.5m higher. This is elaborated upon in Section 4.

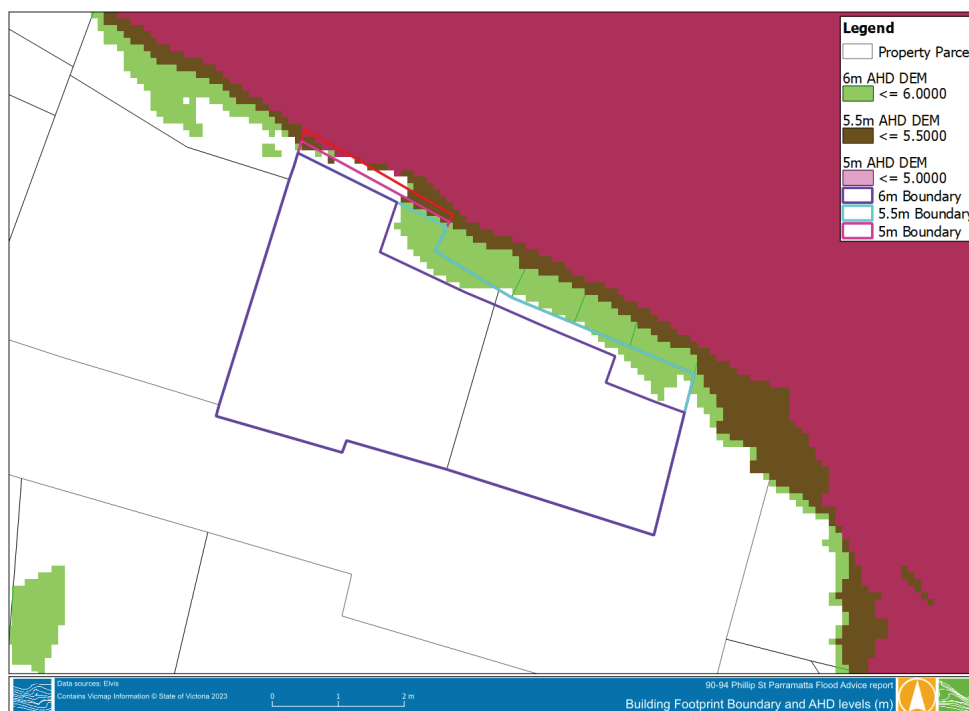


Figure 5 Proposed Indicative development footprint



3 LOCAL ENVIRONMENTAL PLAN PROVISIONS

This section discusses the Local Environmental Plan provisions that currently apply to this site including:

- Parramatta Local Environmental Plan (PLEP) 2023 Section 5.21
- PLEP 2023 Section 7.11

3.1 PLEP 2023 Section 5.21

Clause 1 of Section 5.21: Flood planning, sets out the following objectives:

(1) The objectives of this clause are as follows—

- (a) to minimise the flood risk to life and property associated with the use of land,*
- (b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,*
- (c) to avoid adverse or cumulative impacts on flood behaviour and the environment*

Clauses 2 and 3 of Section 5.21 set out the provisions which must be satisfied to meet the objectives in Clause 1. Table 3 sets out how these will need to be addressed by development at 90-94 Phillip Street.

Table 3: Development requirements to satisfy the Parramatta LEP 2011 Section 5.21 clauses.

Clause	Recommendations
<i>(2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development—</i>	
<i>(a) is compatible with the flood function and behaviour on the land, and</i>	<p>The flood planning area (FPL) is defined as the 1% AEP flood level plus 0.5m freeboard. According to the mapping in the Draft Parramatta Flood Study (Stantec, 2023), overland flooding does not enter the site as the site adjacent Phillip Street is not flooded at 1% AEP and so development on the site would be compatible with the overland flow function.</p> <p>The northern boundary of the site would be marginally impacted by the 1% AEP riverine flooding with incremental affectation in larger floods. The entire site would be affected to a depth of more than 2m in the PMF (Figure 4 and 5). It is anticipated that when floodwater enters the site it functions as a floodway given its proximity to the river.</p> <p>The proposed development must demonstrate that it is compatible with the nature of flooding on the land through compliance with the specific requirements from the Paramatta DCP 2023, as outlined in Sections 4 of this report. The DCP indicates that Council considers mixed use developments to be compatible with the flood function of land between the 1% AEP and PMF levels provided development incorporates specific measures to manage flood risks.</p>



Clause	Recommendations
<p><i>(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and</i></p>	<p>Flood modelling has not been conducted to determine the impact of site development on flood behaviour. However, the site is not subject to flooding in the 1% AEP overland event based on the draft flood study and therefore the proposed development will not impact floodwaters in overland events up to and including the 1% AEP event. Anchor Estate must produce a flood engineer's report demonstrating that a proposed development will not increase flood affectation elsewhere. Council will expect that Council's new flood model will be used for this purpose.</p> <p>Given that the site likely functions as a floodway in large floods, any structures on the site have the potential to divert floodwaters onto neighbouring properties. By keeping the building envelop above the 1% AEP flood level, development on the site would have no impact on flood behaviour up to and including this event.</p> <p>While a building on the site would divert floodwaters in larger events, the fact that the site is already fully developed means that replacing these buildings with a building of a similar footprint is unlikely to have an incremental impact and therefore these provisions would be satisfied.</p>
<p><i>(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and</i></p>	<p>This is a standard clause in all LEPs in NSW.</p> <p>It has been demonstrated that vehicular or pedestrian evacuation from Parramatta CBD in extreme floods is neither practical nor safe because there is insufficient road capacity, the river and its tributaries can rise quickly and cut routes and there is nowhere for an evacuation centre in the CBD which could accommodate the number of people and vehicles which would need to evacuate an extreme event.</p> <p>The PLEP 2023 and PDCP 2023 therefore recognise that sheltering in place in buildings in Parramatta CBD is an acceptable emergency response providing those buildings have appropriate provisions to do so.</p> <p>Therefore, any development of this site will not exceed the evacuation capacity of existing evacuation routes.</p> <p>There are controls in PDCP 2023 which establish what council considers to be acceptable means of ensuring the safe occupation of a development and its efficient evacuation in the event of a flood.</p> <p>For example, pedestrian vertical evacuation is accepted as an evacuation strategy provided that adequately sized, functional, safe areas of refuge are available and accessible above the PMF level.</p>



Clause	Recommendations
<i>(d) incorporates appropriate measures to manage risk to life in the event of a flood, and</i>	<p>Again PDCP 2023 details what measures council considers as acceptable means of meeting this requirement.</p> <p>In addition to providing safe refuge above the PMF, basement levels, if any must be protected from the entry of (e.g. driveway crests) and must be protected up to the PMF by either passive or active measures (e.g. gates). The development must have a Flood Emergency Response Flood Plan prepared for the site to ensure flood risk is managed appropriately.</p>
<i>(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.</i>	<p>There is no riparian vegetation in the vicinity of the site. Any development would need demonstrate that it would not adversely impact on the stability of the riverbanks or create an area where sediment would accumulate.</p>
<i>(3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters—</i>	
<i>(a) the impact of the development on projected changes to flood behaviour as a result of climate change,</i>	<p>Modelling undertaken for Council and summarised by Taylor Thomson Whitting in a 2016 flood study for the site of the Powerhouse Museum in Parramatta (34-54 and 30B Phillip Street and 338 Church Street, Parramatta) suggests that the riverine 1% AEP flood level would increase by 0.27 m by the year 2100 due to climate change. A similar increment could be expected at the site. Council will expect that the climate change provisions in Council's new flood model will be used for this purpose.</p>
<i>(b) the intended design and scale of buildings resulting from the development,</i>	<p>Development is envisaged to be a mixed-use high-rise building. PDCP 2023 planning controls suggest that Council considers this development type to be appropriate on a site such as this which predominantly sits between the 1% AEP and PMF levels.</p>
<i>(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,</i>	<p>The measures that PDCP 2023 requires in this regard are:</p> <ul style="list-style-type: none"> ▪ adequately sized, functional, safe areas above the PMF level ▪ basement levels, if any, protected from floodwaters up to the PMF level. ▪ a Flood Emergency Response Plan for the site.
<i>(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.</i>	<p>The site is not subject to coastal erosion. It would not be possible to modify, relocate or remove a new building on the site as a flood response measure.</p>



3.2 Parramatta Local Environmental Plan 2023 Section 7.11

PLEP 2023 provisions for Parramatta City Centre apply to this site and address flooding issues in Section 7.11: Floodplain Risk Management:

(1) The objective of this clause is to enable occupants of buildings in certain areas subject to floodplain risks to—

- (a) shelter in a building above the probable maximum flood level, or*
- (b) evacuate safely to land above the probable maximum flood level.*

(2) This clause applies to land identified on the Floodplain Risk Management Map.

(3) Development consent must not be granted to the erection of a building on land to which this clause applies unless the consent authority is satisfied the building—

(a) contains an area that is—

- (i) located above the probable maximum flood level, and*
- (ii) connected to an emergency electricity and water supply, and*
- (iii) of sufficient size to provide refuge for all occupants of the building, including residents, workers and visitors, and*

(b) has an emergency access point to land above the 1% annual exceedance probability event, and

(c) is able to withstand the forces of floodwaters, debris and buoyancy resulting from a probable maximum flood event.

(4) Subclause (3)(a) does not apply if there is pedestrian access located between the building and land above the probable maximum flood level.

(5) In this clause—

annual exceedance probability has the same meaning as in the Floodplain Development Manual.

Floodplain Development Manual has the same meaning as in clause 5.21.

Floodplain Risk Management Map means the Parramatta Local Environmental Plan 2011 Floodplain Risk Management Map.

probable maximum flood has the same meaning as in the Floodplain Development Manual.

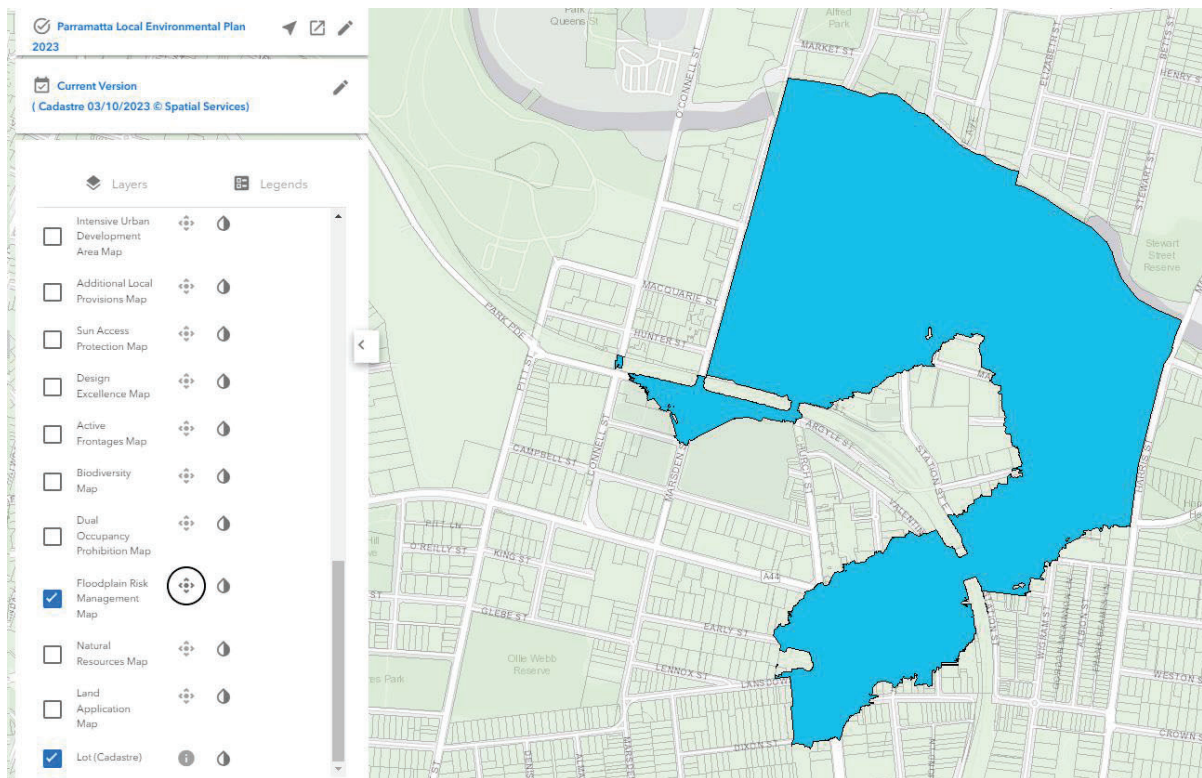


Figure 6 Floodplain Risk Management Map from PLEP website

The site is mapped within the Floodplain Risk Management Area on Council's Floodplain Risk Management Map (Figure 6). Therefore, the above provisions are applicable to the site. The proposed development must have the following:

- An adequate refuge above the PMF with the space and safety provisions to provide for all occupants with an emergency electricity and water supply;
- Have an emergency access point above the 1% AEP flood level; and
- Be able to withstand the forces of the PMF, including floodwaters, debris, and buoyancy.

The PDCP 2023 elaborates on the specific requirements to satisfy the above and these are detailed in Section 4 of this report. However, in relation to the planned development of the site and the sites features, it is noted that:

- the ground level on Phillip Street is above 8m AHD so the first floor of a commercial building on the site would likely be at or above the PMF level if conventional ceiling heights are provided. Therefore, it would not be difficult to provide refuge areas above the PMF level.
- the footpath along the Phillip Street frontage is flood free in the 1% AEP event (Figure 2) so providing an emergency access point above the 1% AEP flood level is achievable.
- a monolithic concrete mixed-use building should be able to be designed to withstand PMF forces although given its proximity to the river these could be significant. A structural engineer will need to sign off on the design and will need to have access to depth and velocity data from Council's flood model.



4 DEVELOPMENT CONTROL PLAN PROVISIONS

Section 5.1.1 Flooding of Parramatta Development Control Plan (PDCP) 2023 sets out 33 controls for flood risk management that apply to this site. It groups these under two headings:

- Floodplain Risk Management
- Flood Warning and Emergency Response Planning

The following sections discuss these in general terms. As there is currently no specific development proposal for the site, the discussion provides guidance on what implications these controls would have for design decisions regarding a future development proposal. Section 6.7 of the DCP 2011 came into effect on 2 December 2022 and identifies the site as part of the Floodplain Risk Management area to which this section applies.

Under the heading of Floodplain Risk Management PDCP 2023 lists 15 objectives and 24 planning controls while there is one objective and 9 controls under Flood Warning and Emergency Response. Many of the latter controls are simply verbatim reiterations of the earlier controls.

With regard to planning control 24 (C24), it sets out a matrix approach to development control and under this provision alone a particular type of development below a particular flood level could have up to 15 specific design or operational controls applying to it. There is some overlap between the development controls called up by C24 and the other controls, so the following discussion groups the controls according to their design implications.

4.1 Land use Categories and Flood Risk Precincts

Regarding the matrix under C24 the applicable development controls within the matrix are based on the Land Use Category Definitions table (Table 5.1.1.1), the envisaged redevelopment with both residential apartments and commercial/retail spaces in the podium level falls under “Commercial or Industrial”, which includes retail premises, office premises and mixed-use developments. The same development controls would apply if the development fell under “Residential” land use.

However, were any of the commercial areas of the building proposed to be used for early education and care facilities, hospitals, residential care facilities, educational establishments, or emergency services facilities or if the residential tower were used for seniors housing, then the land use category would be Sensitive Uses and Facilities. According to Table 5.1.1.2 under C24, none of these uses are suitable at a site such as this where it can flood in a PMF, and this is reinforced by C16. Note that the DCP is unable to prohibit these uses (only an LEP can do that) and C17 suggests that in some circumstances centre-based childcare and aged care facilities may be approved. However, one of the requirements is that building occupants would not have to traverse hazardous floodwaters in any flood between the 1% AEP and the PMF. That would not be the case at this site and so it would be extremely difficult to get approval for such uses at the site.

Figure 7 shows that the site is mostly within the Low Flood Risk Precinct with small sections of the northern part of 90 Phillip Street being within the Medium and High Flood Risk precincts. The boundaries of these precincts are likely to be updated when Council adopts the new flood model results. However, if the development footprint is kept above the 1% AEP flood level, then the development should remain within the Low Flood Risk Precinct. The following discussion therefore assumes that the future use of the site would be for Mixed Use development in the Low Flood Risk Precinct and discusses the applicable planning controls from C24 for such development.

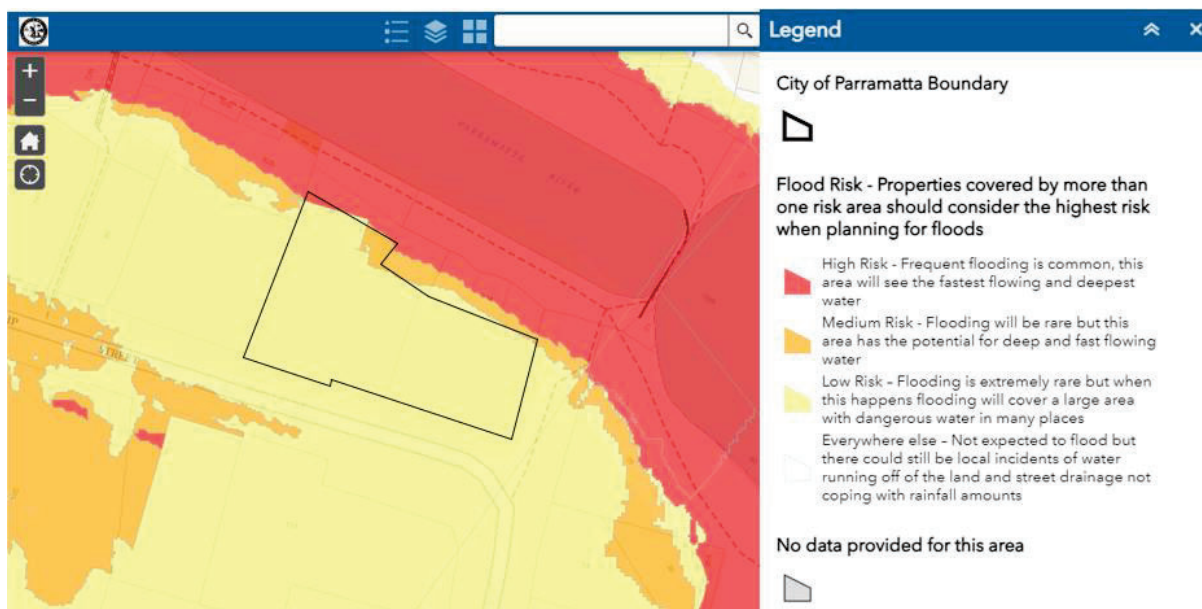


Figure 7 Flood risk precinct for 90-94 Phillip Street, Parramatta (Source: FloodSmart Parramatta)

4.2 Consistency with Other Plans

C01 simply requires that development is compatible with any relevant Floodplain Risk Management Plan. C32 is a repeat of this control as is the evacuation provisions of C24. As the Upper Parramatta River Floodplain Risk Management Plan was updated to accommodate the updates to the Parramatta LEP and DCP, any development which meets the requirements of the LEP and DCP will be compatible with the Upper Parramatta River Floodplain Risk Management Plan.

4.3 Risk to Life Management

C02 requires that risk to life be mitigated to Council's satisfaction and C33 is a repeat of this control. What would satisfy council is indicated by the following conditions:

- C07 – must have reliable access to a flood free location.
- C19 – must use a merit-based flood hazard and flood impact risk assessment that considers risks to occupants.
- C24 – must have reliable access for pedestrians required from the site to an area of refuge (including shelter in place) above the PMF level, on site (e.g. second storey) or off site and must be consistent with any relevant flood emergency response plan, flood risk management plan or similar plan.
- C28 – where shelter on site is required and permissible by C24 occupants must be able to stay there for the duration of the flood and any subsequent disruption.
- C29 - sets out the details of what the shelter must provide.
- C31 – sets out the details of accessibility to the shelter.



Condition C07 and C24 can be satisfied by having access for occupants of the basement and ground floor to the first floor or above and for occupants of the upper floors to remain where they are. This is consistent with the Upper Parramatta River Floodplain Risk Management Plan which supports sheltering in place although not necessarily with the NSW SES Local Flood Plan which advocates off site evacuation as its preferred response strategy. This means that a planning proposal to increase density at the site may be opposed by NSW SES. It is noted that condition C27 states that horizontal evacuation measures are preferred but only where certain conditions can be met. One of those is that there is an exit from the building above the PMF level. That cannot be met at 90-94 Phillip Street.

C29 sets out the following requirements for on-site shelter:

- a) Refuge shelters must be adequate and fit for purpose (size, design, equipment, supplies) and maintained as such in perpetuity.
- b) Unless otherwise advised by Council, facilities must be designed for a refuge stay of at least 72 hours, with longer time periods addressed in design, equipment, and provisioning.
- c) It is recommended, and may in some cases be required, that large and high-rise residential buildings be provided with emergency back-up power, water supply and sewerage for all residential units and common facilities including lifts. This must be provided in the context of an overarching Emergency Response Plan that includes flooding, power outages, extreme weather events and other incidents.
- d) Where the building design and back-up systems enable some residents to safely remain in their own apartments for extended periods during floods, all such residents must still have access to a communal refuge area of adequate size where support from other residents and emergency supplies are available.
- e) The communal safe area of refuge must be permanently provided with as a minimum:
 - emergency electricity supply, and lighting,
 - clean water for drinking, washing and toilet flushing,
 - working bathroom and toilets,
 - suitable food,
 - personal washing facilities,
 - medical equipment including a first aid kit,
 - a battery-powered radio and relevant communications equipment, and
 - a comfortable, safe, indoor, sheltered environment (corridors, lobbies, balconies, alfresco areas, car parks etc are not acceptable).

C30 sets out the following accessibility requirements for all safe areas of refuge (residents own apartment or a communal area):

- a) fail safe access to the safe area of refuge from anywhere in the building including the basement (lift access is not allowed) that is protected from floodwaters up to the PMF by suitable flood doors, flood gates and the like; and
- b) fail safe access to an exit/entry point located above the 1% AEP flood level plus 0.5m freeboard that enables people to exit the building during a fire and/or flood and allows emergency service personnel to enter a building to attend to a medical emergency.



4.4 Building Design Parameters

The Flood Planning level (FPL) must be set at a 1% AEP level at any location plus a 500mm freeboard (C03, C24) unless specified for additional freeboard by Council to manage any exceptional circumstances. It shall be based on the higher of the 1% AEP riverine flood level or the 1% AEP overland flow flood level, as accepted by Council. This means that it will need to be set using Council's new flood model levels when they are adopted. From the available mapping that shows that the site is not affected by 1% AEP overland flooding so the minimum habitable floor levels of the site will be based on the 1% AEP riverine flood level. As the ground level in Phillip Street is above 8m AHD and the riverine flood level might be slightly higher than 5m AHD, it may be possible to have a habitable floor level below the Phillip Street ground level. All building components below the FPL will need to be of flood compatible materials (C24).

Significant filling or excavation below the FPL is generally not permitted (C04) so the footprints marked in Figure 04 should be related to the FPL rather than the 1% AEP flood level. For example, if the 1% AEP flood level is 5m AHD then the FPL would be 5.5m AHD and the 5.5m AHD building footprint would apply. C15 states that, *"In general, Council will not support proposals for flood flow-through or flood storage chambers within or beneath a new building, and alternate design solutions will be required."* Which would make it challenging to get approval at this site for any building which cantilevered beyond the FPL contour. However, C05 does countenance the possibility of raised structures and, if proposed, may require a structural engineer to certify the structure will not be at risk of failure from flood forces.

C12 requires that design responses to mitigate flood impacts should not have significant negative impacts on local amenity such as overshadowing or incompatibility with the streetscape. This should not be an issue for redevelopment of this site.

4.5 Flood Modelling

As redevelopment of the site would involve the construction of a new building, the applicant must make a Flood Information Enquiry to the Council to receive any flood relevant information for the site (C08). Council may require an additional flood study be prepared, which Control 09 states must be prepared using parameters provided by Council and account for climate change. It is likely that Council will require the impacts of proposed development of the site to be modelled using Council's new TUFLOW model. Development must be planned and design to respond to both riverine and overland flooding (c13). Council may also require an overland flood study where it is likely to dominate the riverine flooding (C10). Council's published flood maps suggest there is no overland flooding near the site so this may not be necessary.

The modelling will need to demonstrate that the development will not increase flood affectation elsewhere (C14, C24). This would need to take into consideration:

- (i) loss of flood storage.
- (ii) changes in flood levels, and velocities caused by changes to flood flows; and
- (iii) the cumulate impact of multiple potential developments in the vicinity

The Council adopted model would be adequate for this analysis.

If future development has a similar footprint to the existing development on site then this requirement should be able to be met. If the footprint is to be increased, then compensatory cut may be required but C14 suggests that this should not be "significant" below the FPL.

C06 makes it clear that the impacts of fencing and landscaping must be included in the modelling.



C18 expands on the required flood modelling, specifying that the modelling must include flood hazard modelling.

The modelling must then be used to prepare a merit-based flood hazard and flood impact risk assessment C19.

4.6 Car Parking

C20 states

“Council strongly discourages basement car parks on properties within the floodplain. Where site conditions require a basement car park on a property within the floodplain, development applications must provide a detailed hydraulic flood study and design demonstrating that the proposed basement car park has been protected from all flooding up to and including the PMF event. An adequate emergency response and evacuation plan must also be provided where basement car parks are proposed in the floodplain...”

We recommend not to propose a basement car park as it is strongly discouraged by the Council. If the developer decides to proceed with a basement car park, necessary detailed hydraulic modelling study with mitigation options such as flood gates (up to and including PMF event) must be presented to demonstrate the protection of the car parking area. Phillip street is the only vehicular access to the site and is at an existing level varying from 8m to 8.1m AHD, therefore the driveway ramp crest from Phillip Street must be at least 8.6m (allowing a 0.5m freeboard) and is provided with a flood gate/barrier that goes up for about 2.5m to protect the driveway from flooding at PMF event.

Controls 21, 22 and 23 set out the requirements that basement car parking must satisfy when it is proposed. This includes:

- a driveway to a street which will not have high hazard flooding in a 1% AEP flood. Council's mapping suggests that Phillip Street would meet this requirement.
- protection from the ingress of floodwater by passive measures at least up to the flood planning level. These measures are likely to include provision of a driveway crest at or above the flood planning level with associated wing/or bund walls to this level to prevent floodwaters flowing into the basement. As the FPL is likely to be less than 6m AHD and a driveway entry at Phillip Street (about 8m AHD) would satisfy this requirement
- protection from the ingress of floodwater via the driveway up to the PMF level. These measures are likely to include provision of a self- triggering and self-powered flood gate at or near the driveway crest that reaches the level of the PMF. Such a gate would need to be 3-4 high depending on the driveway crest level and the final PMF level advised by Council.
- protection from the ingress of floodwater via stairwells and other openings up to the Probable Maximum Flood level. These measures are likely to include a combination of a self-closing flood doors, flood gates and bund walls. Flood doors may also be fire doors
- provision of flood-free escape stairs from the basement up to a place of refuge within the building above the PMF level with adequate facilities for users during and after a flood. In other words, a set of fire stairs between the basement and the first floor which has no entry on the ground floor.
- adequate car parking for the disabled and an escape path that can be followed to safety.

The above measures must be supported by a Flood Emergency Response Plan and a Building Management System and Plan which provides for the maintenance, testing and operation of the flood protection measures.



In addition, under C24 car parking and driveway access need to address the controls 1, 3, 5 and 6 within the Table 5.1.1.3 Floodplain Matrix Planning and Development Controls which are:

1, The minimum surface level of unenclosed parking spaces or carports shall be as high as practical, but no lower than 0.1 metres below the 1% AEP (100-year ARI) flood level. In the case of garages and other enclosed parking areas for less than 3 motor vehicles, the minimum surface level shall be as high as practical, but no lower than the 1% AEP (100-year ARI) flood level, plus 0.15 metres freeboard. This provides the option of having unenclosed parking under the building as low as 0.1m below the 1% AEP flood level and may be a way of avoiding the onerous controls on basement parking.

3, Garages, and other enclosed car parking areas, capable of accommodating more than 3 motor vehicles, must be protected from inundation by floods equal to or greater than the 1% AEP (100-year ARI) flood. Ramp levels to be no lower than 0.5m above the 100-year ARI flood level. Where below ground car parking is proposed additional measures must achieve protection up to the PMF. This is covered in detail by C21-23.

5. Unless otherwise approved by Council and provided this does not obstruct or displace floodwaters, the level of the driveway providing access between the road and parking spaces shall be no lower than 0.2 metres below the 1% AEP (100-year ARI) flood level. Phillip Street is above the 1% AEP flood level.

6. Enclosed car parking, and car parking areas accommodating more than 3 motor vehicles, with a floor below the 1% AEP (100-year ARI) flood level, shall have adequate warning systems, signage, exits and evacuation routes. Refer to Flood Warning and emergency Response Planning section for requirements. This is an additional requirement not covered by C21-C23.

4.7 Emergency Planning

C25 states that, “If required by Council all development in the floodplain involving the construction of a new building or significant alterations to an existing building, and or intensification of a use must be supported by a FERP”. A FERP is a Flood Emergency Response Plan and according to C26 must include:

- Warning and evacuation measures
- Measures to prevent evacuation from the site by private vehicle.
- The most appropriate emergency response for flood and fire events that occur together.
- A FERP drill which is tested at least annually.

5 CONCLUSION

This letter has set out the flood management considerations for 90-94 Phillip Street based on the current LEPs and DCP applicable to the site. Until Council adopts its new flood model for the Parramatta River it is difficult to be definitive about the flood levels, hazards, and risks at the site. However, based on published draft flood model results it would appear that a mixed-use development on the site would be compatible with the flood risk and is permitted by the LEP and deemed suitable by the DCP.

The flood planning level for the site is likely to lie somewhere between about 5.5m and 6m AHD which is below the Phillip Street level of about 8m AHD. This means that it may be possible to have habitable uses on a floor level below Phillip Street. It also means that if there is parking below Phillip Street but no more than 0.6m below the FPL and it is not enclosed, then it does not need to be protected from the ingress of floodwaters.

Otherwise, enclosed basement carparking may need flood gates up to 4m high on the Phillip Street driveway crest. It would also be necessary to have measures to prevent the ingress of PMF flooding into the enclosed



basement via stairwells, lift wells and other floor penetrations. An emergency access from the basement to the first floor would be required which does not have an exit at ground level.

It would need to be demonstrated through flood modelling, using Council's new flood model, that redevelopment of the site would not increase flooding on neighbouring properties. If the building has no bigger footprint than the existing building this should be able to be demonstrated.

Evacuation of the site in a flood would not be practical but sheltering in place is permitted by the LEP and supported by the DCP. Any mixed-use development on the site will need to have areas of safe refuge above the PMF level which should be able to be provided on the first floor level and above. Some of that space needs to be accessible and usable by occupants of the basement and ground floor. It will be necessary to provide adequate food and first aid to those sheltering in the building and 72 hours of emergency power and water are stipulated by the DCP. A Flood Emergency Response Plan would be required for the building's operation.