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3 March 2022

SY211740_B02[B]

Woolworths Group
James Colling
1 Woolworths Way
Bella Vista NSW 2153

Dear James,

Re: Proposed Planning Proposal at 488-492 Old South Head Road & 30 Albemarle Avenue, Rose Bay – Flooding Assessment

Northrop Consulting Engineers have been engaged by Fabcot Pty Ltd to provide flood advice for the proposed Planning Proposal at 488-492 Old South Head Road and 30 Albemarle Avenue, Rose Bay.

The intent of this correspondence is to present the investigation performed to date including the latest layout, present the existing flood constraints for the subject site and highlight the difficulties associated with achieving Council's flood related development controls.

Flood data presented herein has been obtained from the Rose Bay Catchment Flood Study prepared by WMAwater and dated September 2010.

Included herein is a description of the subject site, a description of the proposed development, presentation of the flood behaviour and an assessment of the proposed development with respect to Council's flooding related development controls. Additionally, a response to the Ministerial Direction for flooding has been included.

Subject Site

The subject site is located at 488-492 Old South Head Road and 30 Albemarle Avenue, Rose Bay otherwise known as Lot 1 DP1009799 and Lot 30 – Section B – DP4567. The site has an area of approximately 2257m^2 and is bordered by commercial properties to the north-east, residential properties to the north-west, Old South Head Road to the south-east and Albemarle Avenue to the south-west.

The existing land use includes a decommissioned service station in Lot 1 DP1009799 and a residential property in Lot 30 – Section B – DP4567.

Proposed Development

The proposed development is presented in the architectural drawings prepared by PBD architects and includes a four-storey mixed use facility comprised of two levels for a supermarket and two levels of residential units above. Three levels of below ground or basement carparking is also proposed for use by both the supermarket and the residential tenants. The ground floor also includes a MRV loading dock and the associated waste, loading and service areas.

		Date
Prepared by	DN	03/03/2022
Checked by	GB	03/03/2022
Admin	BBR	03/03/2022

Flood Behaviour

The following Figure 1 and Figure 2 present the flood depth and elevation contours for both the 1% AEP and PMF design storm events in the vicinity of the subject site respectively. Figure 1 and Figure 2 suggests flood levels are highest adjacent to the eastern corner of the site and fall away as flows continue down Old South Head Road and around Albemarle Avenue towards the western corner of the subject site.

Figure 1 shown overleaf suggests flood levels in the 1% AEP range from 12.94m AHD adjacent to the eastern corner or the site to 12.41m AHD in the western corner. Similarly, during the PMF, Figure 2 suggests flood levels range from 13.15m AHD adjacent to the eastern corner and 12.56m AHD in the west. Figure 1 and Figure 2 suggest flood depths in Old South Head Road & Albemarle Avenue range from approximately, 0.15m – 0.8m during the 1% AEP and 0.3m - 1.0m in the PMF.

Additional flood levels, extracted from the Rose Bay Catchment Flood Study (WMAwater, 2010), have been provided in Figure 1. More frequent events ranging from the 1EY to the 5% AEP are presented for reference.

The Rose Bay Catchment Flood Study (WMAwater, 2010) excludes flood water from the subject site suggesting the site itself is outside a Flood Risk Precinct. Figures 15 and 16 from the Rose Bay Catchment Flood Study (WMAwater, 2010) suggests both Old South Head Road and Albemarle Avenue, fronting the subject site, are a high hazard floodway. Comparing this to the criteria defining Flood Risk Precincts outlined in Councils Development Control Plan, in particular Chapter E2 Section E2.3 – Flood Risk Management Controls, the subject site is located adjacent to a High Flood Risk Precinct.

Due to the flood behaviour in Old South Head Road & Albemarle Avenue it is anticipated there may be difficulty evacuating from the subject site during the peak of a 1% AEP and PMF design storm events. Vertical evacuation and refuge into the upper levels of the facility may be more suitable than evacuating off site during the peak of a flood, particularly given the relatively short critical duration of 90 minutes as defined in the Rose Bay Catchment Flood Study (WMAwater, 2010).

Development Controls

The proposed development has been assessed based on the flooding related controls outlined in Councils Development Control Plan, in particular Chapter E2 Section E2.3 – Flood Risk Management Controls.

Part E2.3.3 – Flood Planning Levels

Council's DCP in particular Chapter E2 Section E2.3.3 – Flood Planning Levels suggests a minimum Finished Floor Level (FFL) of the 1% AEP + 500mm may be applicable for the ground floor supermarket space. This corresponds to a level of approximately 13.5m AHD – up to approximately 1.2m above the existing surface levels in the adjacent road verge.

Similarly, the proposed loading dock, being non-habitable, would be required to have an FFL of the 1% AEP + 300mm. This corresponds to a level of approximately 0.8m above the existing surface levels in the adjacent road verge.

Given the high depths, of up to approximately 1.0m observed in both Old South Head Road & Albemarle Avenue adjacent to the subject site, finding a balance between flood protection and street activation is difficult.

Pre-Lodgement Strategy

A strategy with the Supermarket FFL sited at or above the 1% AEP was presented in the previously prepared pre-lodgement flood letter titled "*Proposed Planning Proposal at 488-492 Old South Head*

Road & 30 Albemarle Avenue, Rose Bay – Flooding Assessment", dated the 8th of September 2021. The pre-lodgement flood mitigation strategy is presented in **Figures 1 and 2** overleaf.

The intent of the pre-lodgement strategy was to limit activation of the floodgates with a likelihood of activation approximately equivalent to 1% for any given year. Floodwalls and flood gates around the façade were also proposed to preclude flood water ingress into the building up to the Probable Maximum Flood event.

Planning Proposal Strategy

A response from Council's Flood Engineer to the pre-lodgement report suggested placement of FFLs below the 1% AEP may be acceptable, provided appropriate flood mitigation measures are integrated into the design.

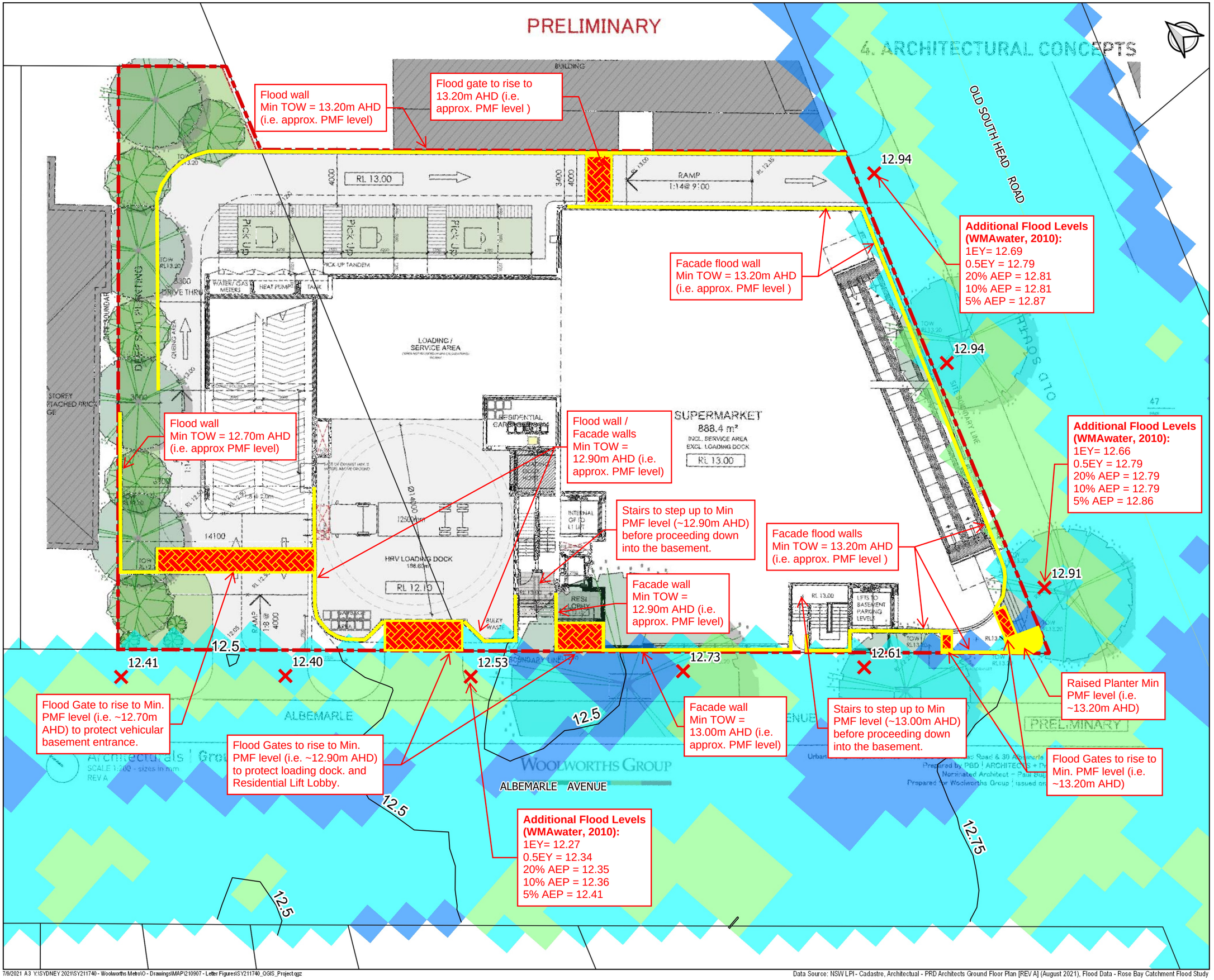
Item C6 of Section E2.3.3 – Flood Planning Levels of the DCP confirms lower FFLs may be acceptable for Ground Level shop fronts in commercial and mixed-use developments and these are typically assessed by Council based on its merits.

Following this advice from Council, the flood mitigation strategy was updated as shown in **Figures 3 and 4** overleaf. The latest strategy maximises street activation with the proposed FFL for the ground floor supermarket placed below the 1% AEP design storm event. Similar to the pre-lodgement submission, the main entryway is to be protected with a self-rising flood barrier and flood resistant walls around the façade up to the PMF level.

In addition to the above, all openings into the basement are proposed to be protected by either stepping up (or raising) surface levels to the PMF level or via flood gates that rise up to the PMF level. The driveway crest into the basement is also proposed to be sited at a minimum of the 1% AEP and protected using flood gates up to the PMF design storm event.

The intent of the strategy presented herein is to maximise the opportunity for street activation, with floodgates to be integrated into the design and to be used for flood protection. It is noted that with this strategy, there is a risk of frequent activation of the flood gates as the proposed FFLs are below the 1EY flood level (i.e. potential for the barriers to be activated at least once per year). The difference between the proposed FFL and the road verge level is approximately 100mm, which indicates the potential for street activation during flood events, at the intersection of Old South Head Road and Albemarle Avenue.

Further consideration for the balance between flood mitigation measures (including frequency of activation) and street level activation is recommended to occur during future Development Application phase of the project. Exceptions to the height limit may also be required to realise an elevated floor level which assists to reduce the frequency of floodgate activation.



Legend

- Subject Site
- Cadastre
- Contours (250mm)
- Spot Elevations

Depth (m)

- Less than 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- Greater than 1.2

0 4 8 Metres

1:250

Figure 1 [1]

Rose Bay Flood Study
1% AEP Flood Depth and Elevation Ground Floor Markup

woolworths

SY211740
488-492 Old South Head Road
& 30 Albemarle Ave, Rose Bay

NORTHROP

Data Source: NSW LPI - Cadastre, Architectual - PRD Architects Ground Floor Plan [REV A] (August 2021), Flood Data - Rose Bay Catchment Flood Study

PRELIMINARY

4. ARCHITECTURAL CONCEPTS

Flood wall
Min TOW = 13.20m AHD
(i.e. approx. PMF level)

Flood gate to rise to
13.20m AHD (i.e.
approx. PMF level)

Facade flood wall
Min TOW = 13.20m AHD
(i.e. approx. PMF level)

Flood wall
Min TOW = 12.70m AHD
(i.e. approx PMF level)

Flood wall /
Facade walls
Min TOW =
12.90m AHD (i.e.
approx. PMF level)

Stairs to step up to Min
PMF level (~12.90m AHD)
before proceeding down
into the basement.

Facade flood walls
Min TOW = 13.20m AHD
(i.e. approx. PMF level)

Facade wall
Min TOW =
12.90m AHD (i.e.
approx. PMF level)

Flood Gate to rise to Min.
PMF level (i.e. ~12.70m
AHD) to protect vehicular
basement entrance.

Flood Gates to rise to Min.
PMF level (i.e. ~12.90m AHD)
to protect loading dock. and
Residential Lift Lobby.

Facade wall
Min TOW =
13.00m AHD (i.e.
approx. PMF level)

Stairs to step up to Min
PMF level (~13.00m AHD)
before proceeding down
into the basement.

Raised Planter Min
PMF level (i.e.
~13.20m AHD)

Flood Gates to rise to
Min. PMF level (i.e.
~13.20m AHD)

OLD SOUTH HEAD ROAD

ALBEMARLE AVENUE

SUPERMARKET
888.4 m²
INCL. SERVICE AREA
EXCL. LOADING DOCK
RL 13.00

LOADING / SERVICE AREA

HRV LOADING DOCK
RL 12.10

RAMP
1:14@ 9:00

RL 13.00

13.15

13.15

13.10

12.56

12.51

12.69

12.87

12.70

12.5

12.75

Legend

- Subject Site
- Cadastre
- Contours (250mm)
- Spot Elevations

Depth (m)

- Less than 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- Greater than 1.2

0 4 8 Metres

1:250

Figure 2 [1]

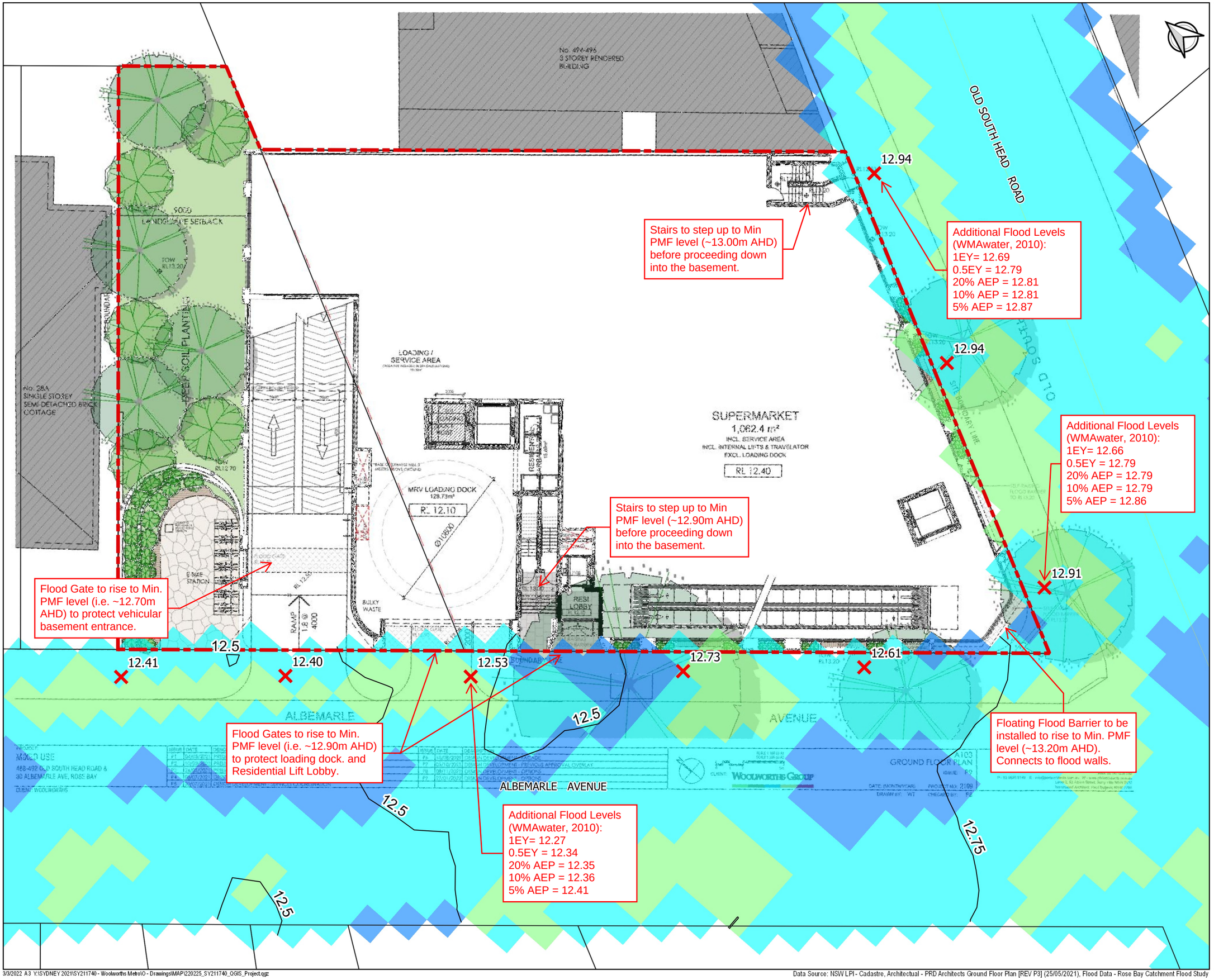
Rose Bay Flood Study
PMF Flood Depth and Elevation Ground Floor Markup

SY211740
488-492 Old South Head Road
& 30 Albemarle Ave, Rose Bay

NORTHROP

7/9/2021 A3 Y:\SYDNEY 2021\SY211740 - Woolworths Metro\IO - Drawings\MAP\210907 - Letter Figures\SY211740_QGIS_Project.qgz

Data Source: NSW LPI - Cadastre, Architectual - PRD Architects Ground Floor Plan [REV A] (August 2021), Flood Data - Rose Bay Catchment Flood Study



Legend

- Subject Site
- Cadastre
- Contours (250mm)
- Spot Elevations

Depth (m)

- Band 1
- Less than 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- Greater than 1.2

0 4 8 Metres

1:250

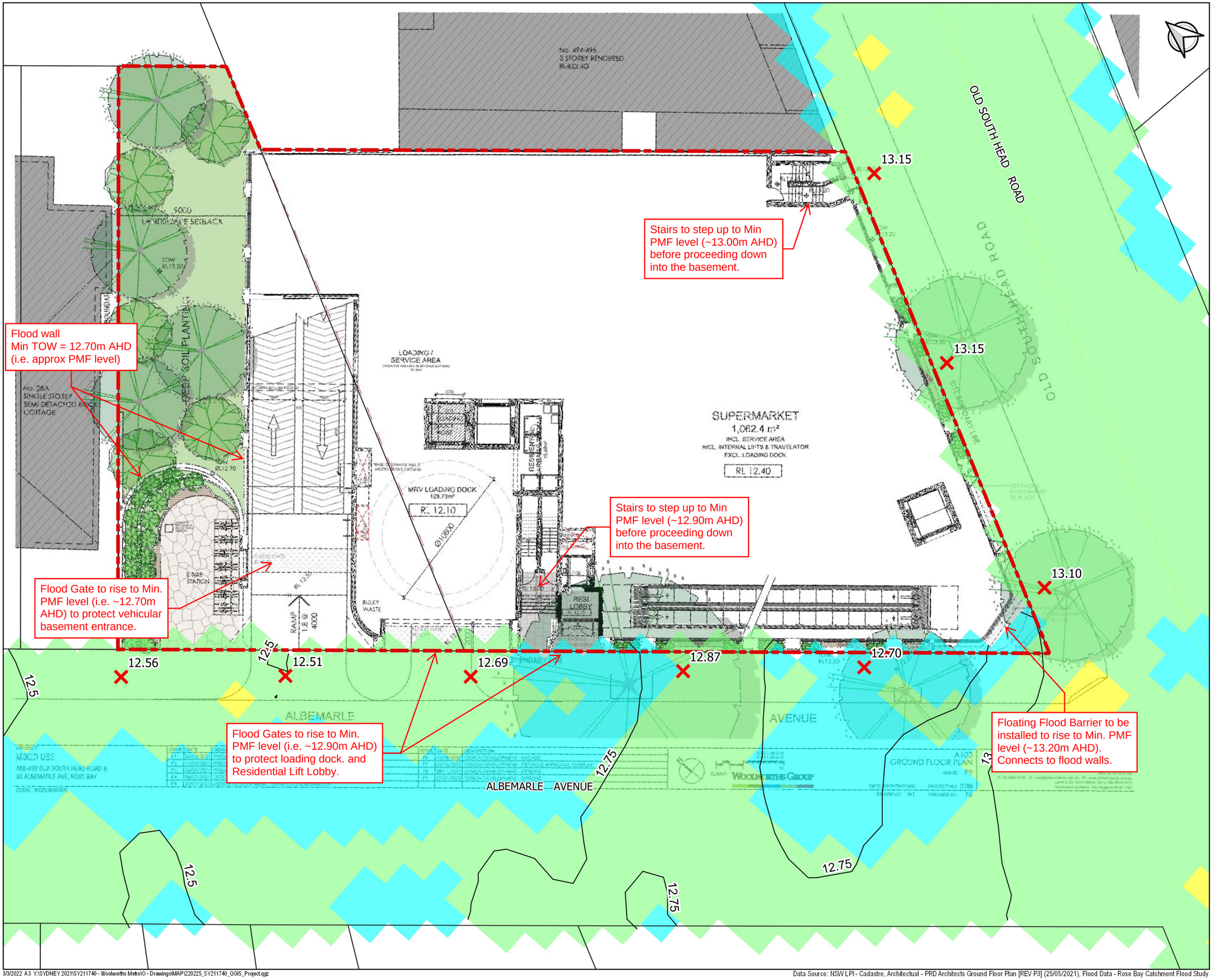
Figure 3 [1]

Rose Bay Flood Study
1% AEP Flood Depth and Elevation Ground Floor Markup

SY211740
488-492 Old South Head Road
& 30 Albemarle Ave, Rose Bay

3/3/2022 A3 Y:\SYDNEY 2021\SY211740 - Woolworths MetroIO - Drawings\MAP\220225_SY211740_QGIS_Project.qgz

Data Source: NSW LPI - Cadastre, Architectual - PRD Architects Ground Floor Plan [REV P3] (25/05/2021), Flood Data - Rose Bay Catchment Flood Study



Legend

- Subject Site
- Cadastre
- Contours (250mm)
- Spot Elevations

Depth (m)

- Band 1
- Less than 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- Greater than 1.2

0 4 8 Metres

1:250

Figure 4 [1]

Rose Bay Flood Study
PMF Flood Depth and Elevation Ground Floor Markup

woolworths

SY211740
488-492 Old South Head Road
& 30 Albemarle Ave, Rose Bay

NORTHROP

Data Source: NSW LPI - Cadastre, Architectual - PRD Architects Ground Floor Plan [REV P3] (25/05/2021), Flood Data - Rose Bay Catchment Flood Study

Additional Flood Related Controls (DCP Part E2.3.4)

The following Table 1 demonstrates how the proposed development in its current form, may or may not achieve the remaining flood related requirements of Council's DCP.

Table 1 - Additional Flood Related Controls (DCP Part E2.3.4) and the Development Response

Item	Development Control	Response
	General Requirements	
C1	All structures have flood compatible building components below the 100 Year ARI level plus 0.5m freeboard.	The current layout is expected to be able to protect building components up to the PMF event.
C2	All electrical equipment (e.g. air conditioners and pool pumps) is located or protected to above the 100 Year ARI level plus 0.5m freeboard.	The current layout and flood mitigation measures are expected to be able to protect internal electrical components up the PMF flood event.
C3	All storage areas such as shelving are above the 100 Year ARI level plus 0.5m freeboard.	The current layout is expected to be able to protect storage areas up the PMF flood event.
C4	The structure is built to withstand the forces of floodwater, debris and buoyancy up to and including the 100 Year ARI level plus 0.5m freeboard.	It is anticipated this will be assessed at detailed design phase, however, given the type of structure proposed, flood forces are not expected to be limiting in design.
C5	Reliable evacuation access for pedestrians is provided from the lowest habitable floor area to a refuge area above the PMF level and designed to withstand PMF water forces.	The proposed development provided protection to the ground floor level up to the PMF event. Additional refuge is available in the upper level.
C6	Suitable flood protection (e.g. a crest up before descent on an access driveway) is provided within the subject site. Council will not generally allow alteration to existing levels on the public road or its property to achieve flood protection.	Protection to the basement driveway is discussed in the Flood Planning Levels section of this letter.
	Fencing	
C7	Fencing is constructed in a manner which does not change the nature or level of flood waters in the area. Fencing is of a permeable/open type design, however, existing solid fences may be replaced by new solid fences.	Fencing is not expected around the site fronting Old South Head Road & Albemarle Avenue. Fencing may be installed along the North-East and North-Western boundaries. The Rose Bay Catchment Flood Study (WMAwater, 2010) results suggest these boundaries are not affected by flood water.
C8	Fencing is adequately constructed so as to withstand the forces of floodwaters.	As per C7.

Item	Development Control	Response
C9	The flood impact of the development is considered to ensure that the development will not increase flood effects elsewhere. Where a significant change in use of the site is proposed, a flood impact assessment is required.	The Rose Bay Catchment Flood Study (WMAwater, 2010) results exclude floodwater across the subject site. The proposed development, in its current form excludes flood water from traversing the subject site during events up to the PMF. As such, the proposed development remains consistent with the assumptions made in the Rose Bay Catchment Flood Study (WMAwater, 2010).
	Overland Flow Paths	
C10	All overland flow paths are free of structures which prevent the free passage of overland flow	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C11	All overland flow paths are designed to convey the 1 in 100 ARI event.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C12	All existing overland flow paths are maintained and the hydraulic capacity of the openings between buildings is maintained.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C13	Overland flow paths are provided on all properties that have upstream contributing catchments of 1,000m or greater.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C14	All overland flow paths are designed to a low hazard classification if possible.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C15	Overland flow paths are designed such that they do not increase velocity or concentrate water on any adjacent property.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C16	In overland flow paths, fencing is generally not be permissible. However, in low and medium flood risk precincts permeable/open type fences may be approved where it can be demonstrated that there will be no adverse impact on flooding to the subject land or surrounding properties.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C17	Any structure located in an overland flow path is designed to be structurally sound in all flood events. A flood study may be	Overland Flow Paths and the local drainage network are expected to be reviewed at

Item	Development Control	Response
	required. Structures are designed by a suitably qualified practitioner.	Development Application and Detailed Design phase.
C18	If an overland flow path is not achievable, a 1 in100 ARI drainage system may be accepted as an alternative.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
	Overland flow paths are grass turfed.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C19	In (sandy) areas with high-risk erosion potential, overland flow paths are designed to limit velocity and/or protect against scour.	Overland Flow Paths and the local drainage network are expected to be reviewed at Development Application and Detailed Design phase.
C20	Where an applicant cannot increase EPLs to take into account the sea level rise planning benchmarks, Council may consider imposing time-limited consent to provide the potential to remove, replace or adapt development in the future.	Not applicable.
	Time Limit Consents	
C21	Properties within a high flood risk precinct are unsuitable for all development (except alterations and additions (only) developments) unless a Flood Risk Management Report has been prepared, by a suitably qualified practitioner, outlining appropriate risk management measures	The proposed development is located adjacent to a High Flood Risk Precinct. Protection of the development from flood waters in Old South Head Road & Albemarle Avenue is discussed in the Flood Planning Levels section of this letter.
	High Flood Risk Precincts	
C22	Buildings or structures constructed in high flood risk precincts are designed to withstand the PMF event.	The proposed development is located adjacent to a High Flood Risk Precinct. Given refuge on site may be required, the capacity for the building to withstand flood forces up the PMF may be applicable. It is anticipated this will be assessed at detailed design phase, however, given the type of structure proposed, flood forces are not expected to be limiting in design.

Item	Development Control	Response
C23	No new fencing of any type is permitted in high flood risk precincts unless it can be demonstrated, by a suitably qualified practitioner, that there will be no adverse impact on flooding to the subject land or surrounding properties.	Response as per Item C7.
C24	No new fencing of any type is permitted in high flood risk precincts unless it can be demonstrated, by a suitably qualified practitioner, that there will be no adverse impact on flooding to the subject land or surrounding properties.	Response as per Item C7
	Medium Flood Risk Precincts	
C25	Properties within a medium flood risk precinct are generally unsuitable for critical and sensitive use development. Such developments will be considered on their merits, taking into account any proposed risk management measures.	The proposed development is not considered a critical or sensitive use and therefore this item is not applicable.
C26	In medium flood risk precincts, impervious and continuous fencing is not permissible unless it can be demonstrated that there will be no adverse impact on flooding to the subject land or surrounding land.	As per Item C7.
	Low Flood Risk Precincts	
C27	For critical and sensitive developments in low flood risk precincts, all habitable and non-habitable floor levels are no lower than the PMF flood level.	The proposed development is not considered a critical or sensitive use and therefore this item is not applicable.
C28	For critical and sensitive developments in low flood risk precincts, all structures have flood compatible building components below the PMF flood level.	The proposed development is not considered a critical or sensitive use and therefore this item is not applicable.
C29	For critical and sensitive developments in low flood risk precincts, the applicant is to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including the PMF flood level.	The proposed development is not considered a critical or sensitive use and therefore this item is not applicable.
C30	Where a property is outside of the four flood plains, but identified as flood prone, a site specific assessment is required. A	A site-specific assessment is presented herein.

Item	Development Control	Response
	flood analysis may be requested to determine the level of flood risk and to allow the setting of FPLs.	

Response to Ministerial Direction (Section 9.1 Directions of EPA Act 1979)

Table *2* demonstrates how the proposed development addresses the planning proposal requirements as outlined in Section 9.1(2) of the Environmental Planning and Assessment Act 1979 which came into effect in July 2021.

Table 2: Response to Ministerial Direction

Item	Development Control	Response
	Flooding Requirements	
4.3.6 (a)	Permit development in floodway areas	Based on the Council flood study, the proposed development is not located in the floodway area. The road adjacent to the development is within the floodway, and strategies to limit the impacts will be discussed further in the Development Application and Detailed Design phase.
4.3.6 (b)	Permit development that will result in significant flood impacts to other properties,	Council's flood study excludes flood water from the subject site and as such, the proposed development is not expected to create adverse impacts on the existing flood behaviour. Detailed design should consider limited amendments to the existing footpath levels as significant changes have the potential to generate adverse flood impacts.
4.3.6 (c)	Permit development for the purposes of residential accommodation in high hazard areas	Council's flood study suggests the site is not located in a floodway. The proposed strategy is also expected to provide refuge for tenants above the PMF event.
4.3.6 (d)	Permit a significant increase in the development and/or dwelling density of that land	Residential spaces are expected to be located above the Flood Planning Level, with refuge available onsite above the PMF.
4.3.6 (e)	Permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,	Not applicable
4.3.6 (f)	Permit development to be carried out without development consent except for the purposes of exempt	Not applicable

Item	Development Control	Response
	development or agriculture. Dams, drainage canals, levees, still require development consent	
4.3.6 (g)	Are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response measures, which can include but are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities	The proposed development provides a flood refuge facility which may be used in a flood event. The development will have established mitigation processes which will limit the requirement for emergency management from government services.
4.3.6 (h)	Permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event	The proposed development is to include a retail business and is not expected to store hazardous materials. For any event up to the PMF, the materials and items within the development will be contained.

Conclusion

The proposed development has been reviewed with respect to Council's DCP and the Ministerial Direction. Flood management measures are discussed that manage flood risk on the subject site and vicinity. It is anticipated the balance between street activation and flood mitigation will be further reviewed at Development Application Phase.

Should you have any questions or require further information, please do not hesitate to contact the undersigned on (02) 4943 1777.

Yours sincerely,

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