

## Chatswood Chase Shopping Centre

### Flood Modelling Report - Addendum

PREPARED FOR:

**Vicinity**

**Final**

Revision: P2

Date: 23/03/2023

# Chatswood Chase Shopping Centre

Flood Modelling Report - Addendum

## DOCUMENT HISTORY

Revision	Prepared By	Verified By	Date
P1	PH	DJ / VR	28 / 02 / 2023
P2	PH	DJ	23 / 03/ 2023

Job Number: 14291

Prepared by CJ Arms Engineering Pty Ltd

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## 1. INTRODUCTION

- Flood modelling report (Revision F) was issued as part of a DA submission to council for development of Chatswood Chase Shopping Centre. Council ref: DA-2022/305 ePlanning Portal ref: PAN-257802
- As previously agreed with council, the design intent of the development, in regard to flooding, is to find an appropriate balance between:
  - the very high hazard levels and risks that currently occur during large storm events, (i.e. overland flow from Victoria Avenue flooding the public shopping centre basement carpark to depths in excess of 4m), and
  - the impact on adjacent properties residential areas downstream of Havilah Street due to the proposed installation of flood gates on the basement carpark entry which will result in bypass of a large part of that overland flow.
- Council has provided a request for additional information (refer letter dated 24/01/2023) in regard to the DA with specific requests in response to the flood report.
- The purpose of this report is to provide a response to the Council Request for Additional Information on the flood components of the DA specifically as detailed below.

## 2. REQUEST FOR ADDITIONAL INFORMATION AND CJ ARMS RESPONSE

Council requests for additional information are shown in italics.

*Item 12 – The report identifies that flood depths will increase at 5-7 Havilah Street, by up to 0.3m in the 1%AEP flood event and up to 1.0m in the PMF. These increases are not in compliance with the requirements of the DCP, which allow a maximum change of ±10mm for the 1%AEP storm event. While the site is under the same ownership as the centre, it is a separate site and does not form part of the application under consideration. As such, Council needs to consider impacts on the site in compliance with the requirements of the DCP and Technical Standard. As the increases exceed the maximum allowed, the change is not acceptable to Council, particularly given the increased risk to occupants of 5-7 Havilah Street. Additional information is to be submitted that addresses this issue. In particular, the increased risk to occupants must be addressed. Consideration may also be required to the structural stability of the building in events such as the PMF, given the flood depth increases to this site.*

In response to this comment, the property at 5-7 Havilah Street is now forming part of the development site with inclusion of . Note that Vicinity owns the commercial site at 5-7 Havilah Street and understand that certain caveats may apply to this property to help control the increased stormwater flows caused by the proposed design and reduce the risks in the residential area downstream. This would appear to be a reasonable approach given the reduction in current risks and high hazard levels that now exist due to flooding of the CCSC basement carpark.

A structural assessment of the building located at 5-7 Havilah Street has been performed by ARUP (refer attached structural advice letter from Nick Masters, ARUP dated 17 March 2023, ARUP reference 254810) to ensure structural stability of the building in event of a PMF storm event. The ARUP response was based on flood information provided by CJ Arms (attached CJ Arms memo reference 14291 MM30 dated 27/02/2023). The assessment confirmed that....

*“the existing structural capacity of the 5-7 Havilah St building has sufficient capacity to resist the applied loads from the flood events as outlined in that memo”.*

*Item 12a - Velocity difference plots to be provided for the 1%AEP and PMF events.*

Maximum Velocity Difference for **1% AEP** (refer attached maps for full resolution)



**Figure 1: 1% AEP, 2hr Design - Velocity Difference Plot**

Maximum Velocity Difference for **PMF** (refer map for full resolution)



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Figure 2: PMF, 2hr Design - Velocity Difference Plot

*Item 12b - The afflux diagram provided for the 1%AEP is to be amended to show areas with a - 10mm to +10mm afflux as a separate colour, so that Council can identify areas within the allowed difference in water depth. All other colours used in the diagram must be clearly defined as to the change they represent. As a minimum, we would anticipate that the ranges detailed are: 0-10mm, 10-25mm, 25-50mm, 50-100mm etc.*

Please see 1% AEP afflux map below – all areas in “cream” are within the +/- 10mm council allowed difference. It clearly shows that no residential properties are impacted by changes in water levels for the 1% AEP.



**Figure 3: 1% AEP 2hr WSE Afflux – Design minus Existing**

*Item 12c - Flood depth plots for the 1%AEP event are provided for the 15min, 30min, 1hr and 4.5hr storm burst durations. It seems that the 1hr storm burst duration is critical around the study area. The engineer is to provide explanation as to why other durations have not been investigated. The engineer should also detail what ARR Rainfall has been used for this study.*

As noted in the flood model report, and confirmed by the previous Rhelm review, the 2hr storm is the critical 1%AEP storm for this location. Durations for the 1%AEP storm of 15min, 30min, 1hr, 2hr and 4.5hr are provided in Appendix A2 of the flood modelling report. These durations bracket the critical storm. Once identified the critical storm was used to assess changes to flood risks. Other durations will have less impact than the critical storm.

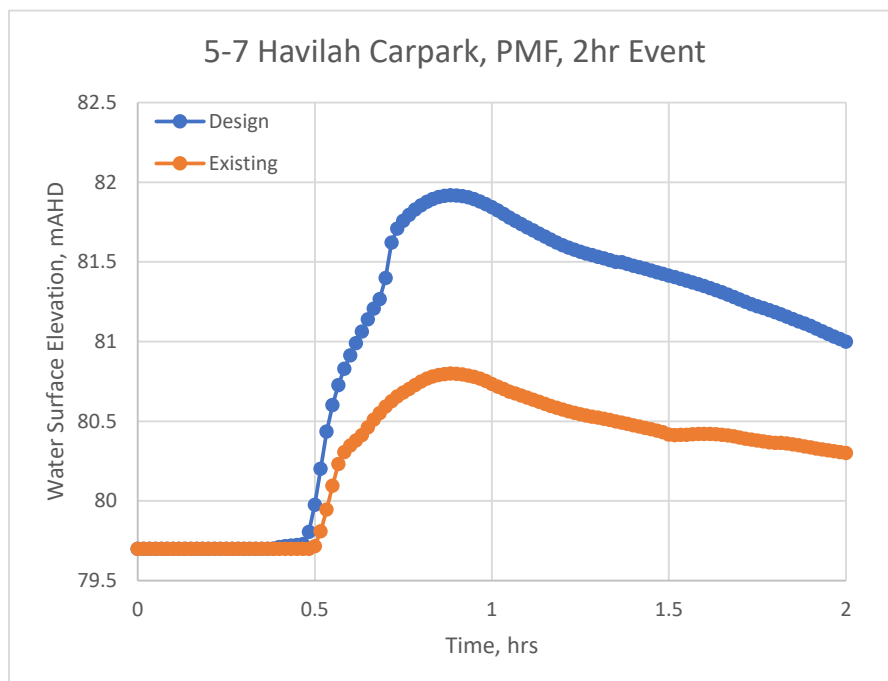
ARR87 IFD data has been used in RORB to generate the hydrographs used in the TUFLOW model. The choice of IFD data is conservative and in line with the previous flood studies and also the IFD values presented in the current Willoughby Council DCP.

*Item 12d - The depth of flooding in the basement in the PMF is the same under the 2019 proposed conditions and the 2022 conditions. Given the 2022 proposed scheme deletes the previous culvert upgrade, the engineer is to provide explanation of how the depth of flooding in the basement in the PMF and smaller events is limited under the 2022 proposed conditions.*

Automatic flood gates at the basement entrance control the flow of stormwater into the basement. The culvert upgrade option was throttling the diverted flows through from Victoria Avenue to Havilah Street. Removal of the culvert allowed more flow and through the overland flow path and therefore reduced flood levels at the flood gates, slightly reducing the flood level in the basement. To help reduce the impact downstream the height of the flood gates was reduced to 83.8m AHD to allow more water into the basement and this purposely resulted in similar depth of flooding in the basement as observed in the previous culvert upgrade option.

*Item 12e - There is up to a 1.0m increase in water depth at 5-7 Havilah Street basement parking area in the PMF event. The engineer is to provide commentary on the duration of the inundation. This change will increase the depth of PMF flooding to 1.9m deep. The applicant is to provide evidence that the materials used in the basement of 5-7 Havilah Street are flood compatible up to a depth of 1.9m and the calculated velocity. The applicant should also detail how the storage in the area works.*

The WSE plot below for the design scenario shows the area remains inundated to a depth greater than 1m for 1.5 - 2 hours in the PMF event. Data for the existing scenario is also shown for comparison. Model run time was 2 hours so that is the limit of the data.





*Item 12f - Blockage scenarios have been modelled and the depth and water level plots provided. However, there is no difference plot to present the differences between flood levels in the blocked and unblocked scenarios. Difference plots are to be submitted for the blockage scenarios.*

[illegible]

As noted in our flood modelling report, the impacts of blockages is high and maintenance of the drainage network to reduce the incidence of blockage is critical for all properties in the area.

1%AEP 2 hr Design WSE Afflux - 100% blockage compared to 0% blockage.

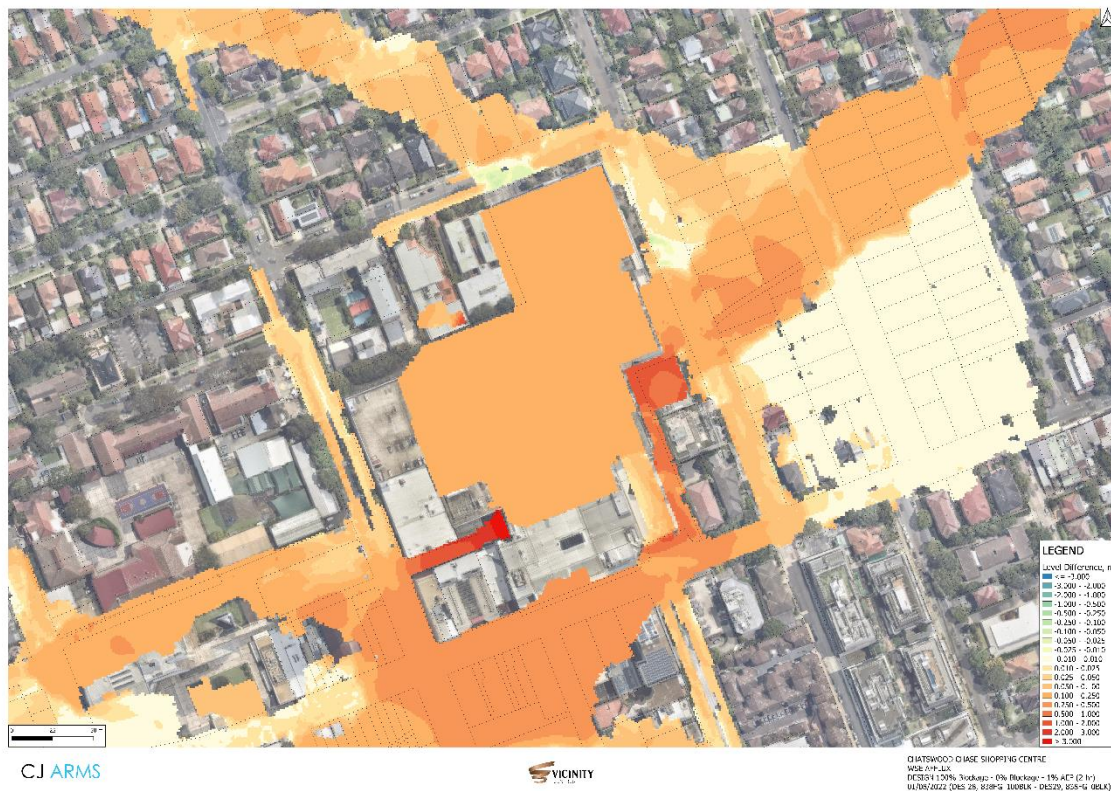


Figure 5: 1%AEP 2 hr Design WSE Afflux - 100% blockage compared to 0% blockage

*Item 12g - A blockage scenario is to be undertaken to demonstrate the impact of a blockage at the flow point into the basement at 5-7 Havilah Street.*

As agreed in the meeting 14/02/2023, to simulate a partial blockage of the carpark at 5-7 Havilah Street we have increase the model roughness of the carpark. In the previous modelling, presented in the flood modelling report Rev F, the roughness for the overland flow path from Victoria Avenue to Havilah Street, including the 5-7 Havilah Street carpark, was  $n = 0.02$ . To simulate a partial blockage of the carpark we have increased the roughness to  $n = 0.1$  (which is same manning's  $n$  used for the residential area) (refer plots below).

Increased roughness in the 5-7 Havilah Street carpark appears to have little effect on afflux for the design scenario for the 1% AEP 2hr storm. This is possibly due to the low velocities in this area for the 1% AEP 2 hr storm.

It is worth noting that in previous modelling of various scenarios, blockages or walls across the overland flow path increased the amount of water flowing into the CCSC basement carpark and reduced flood levels downstream of Havilah Street, however, these were not viewed as a practical solution.





Figure 6: Material Roughness plot showing OFP (n=0.02) and 5-7 Havilah St Carpark (n=0.1)



Figure 7: 1% AEP 2hr Design WSE Afflux with increased roughness in 5-7 Havilah Street carpark to simulate a potential blockage



*Item 12h - Climate Change scenarios have been modelled and the depth and water level plots provided. However, there is no difference plot to present the differences between flood levels in the climate change and current climate scenarios. Difference plots are to be submitted for the climate change scenarios.*

Plots showing the difference between climate change scenarios (CC10, CC20, CC30) and the current climate for the 1% AEP design scenario are presented below. All plots show increasing flood levels in the shopping centre basement carpark, increases in flood depths in the 5-7 Havilah St. carpark and increasing flood depths in the residential areas downstream of the site.



**Figure 8: 1% AEP 2hr Design WSE Afflux – CC10 compared to current climate scenario**



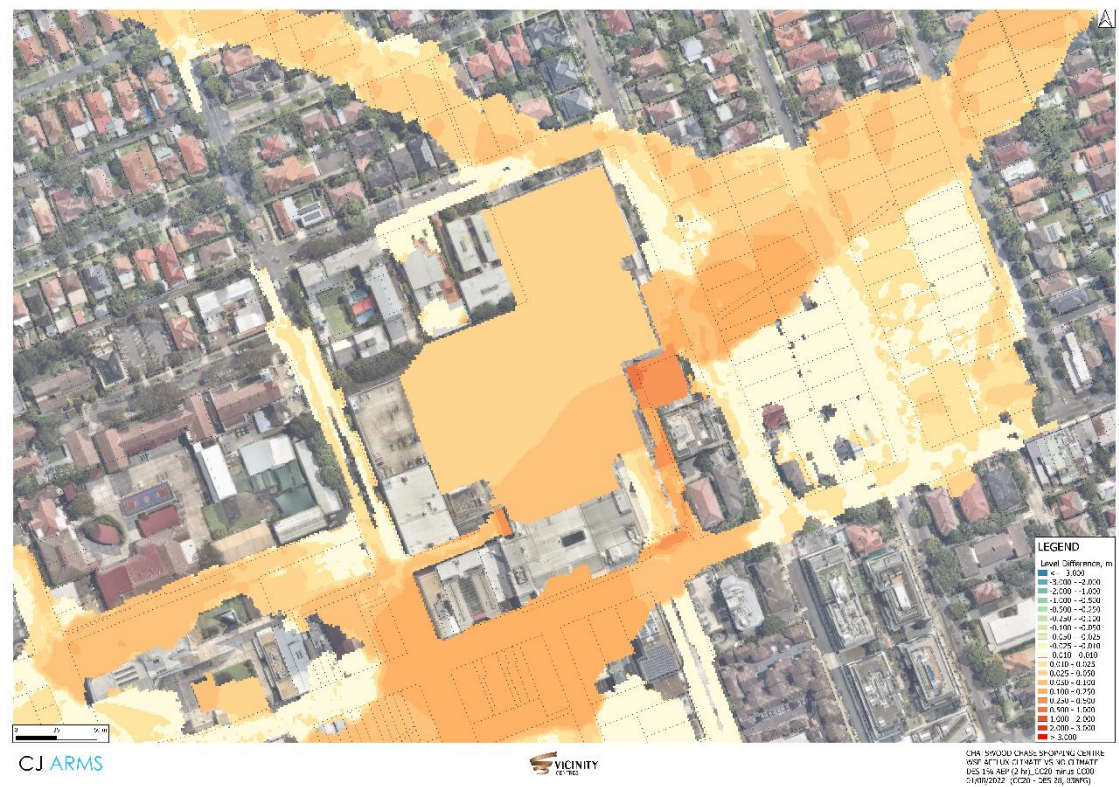


Figure 9: 1% AEP 2hr Design WSE Afflux – CC20 compared to current climate scenario



Figure 10: 1% AEP 2hr Design WSE Afflux – CC30 compared to current climate scenario



*Item 12i - Please provide a copy of the TUFLOW model used to assess flood impacts for Council's review.*

TUFLOW Model is provided as separate zip file along with RORB used to generate the hydrology inflows.

*Item 12j - The 2019 Flood Management Plan\_P2 (CJ Arms 2019) was briefly reviewed. With regards the proposed flood gates, it appears that no flood depth hydrographs have been provided to demonstrate the timing of flood and possible available warning time before the flood depths reach unsafe levels. Additionally, no indication is given of the indicative time available to deploy flood barriers manually. Please advise if there is an amended plans that addresses these issues.*

An updated Flood Management Plan will be provided. Refer to updated management plans for flood warnings and manual flood barrier deployment strategy. Hydrographs for primary flood gate locations (refer Figure 11) have been provided below, however, please note: flood barrier deployment is dependent primarily on BOM warnings not the start of rainfall events.

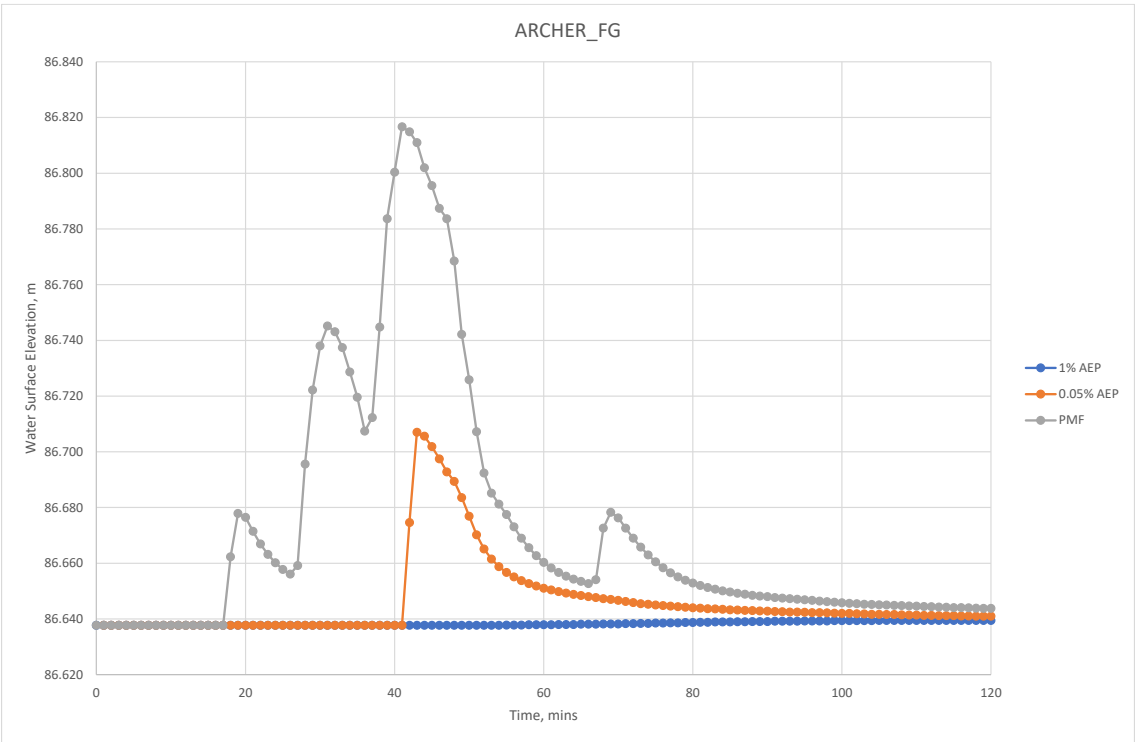


Figure 11: Hydrograph locations

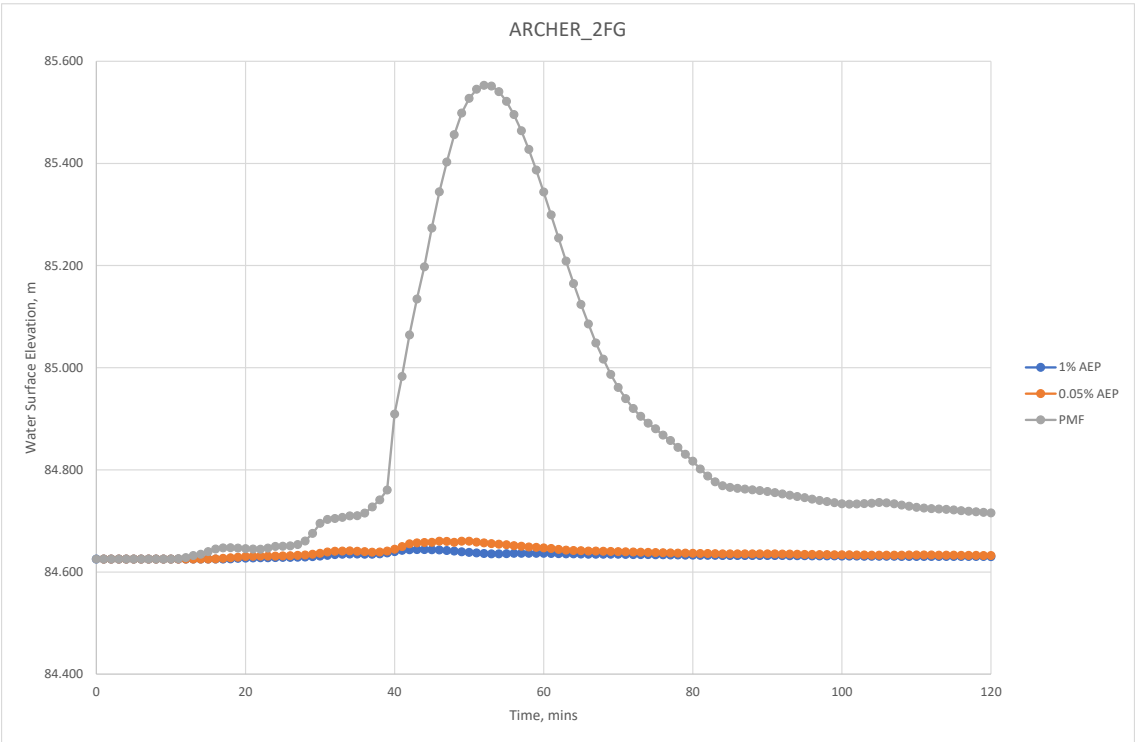
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ARCHER\_FG (Acher St)



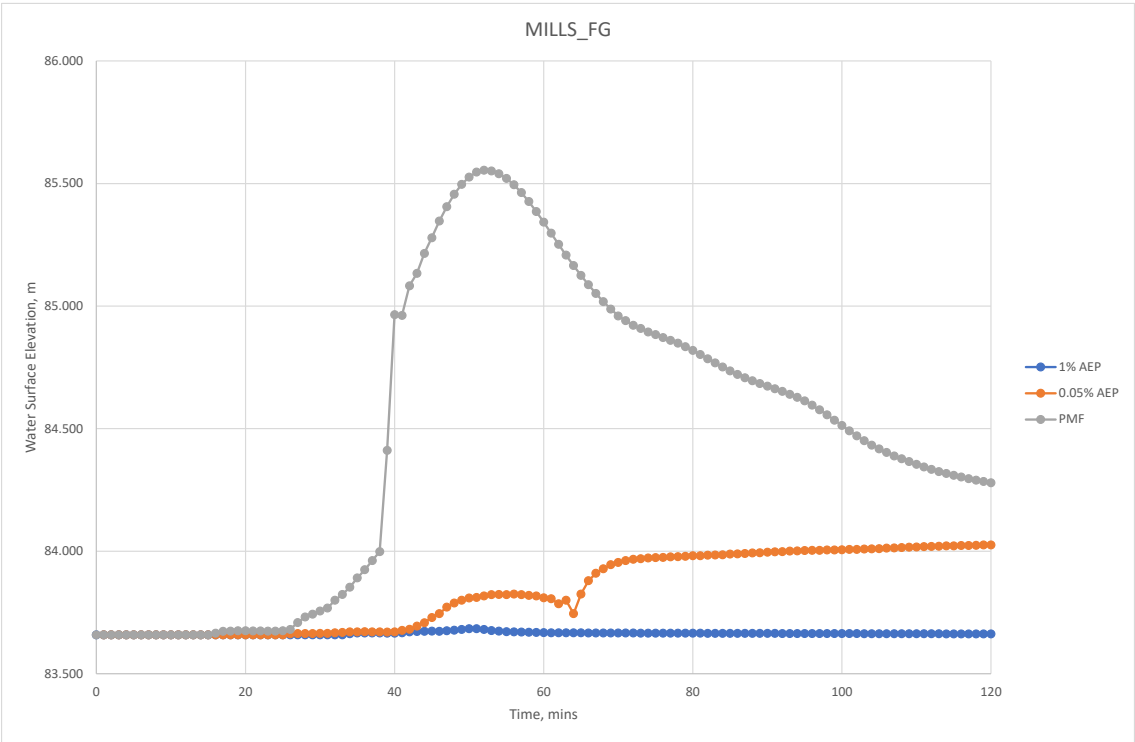
ARCHER\_2FG (Archer St)



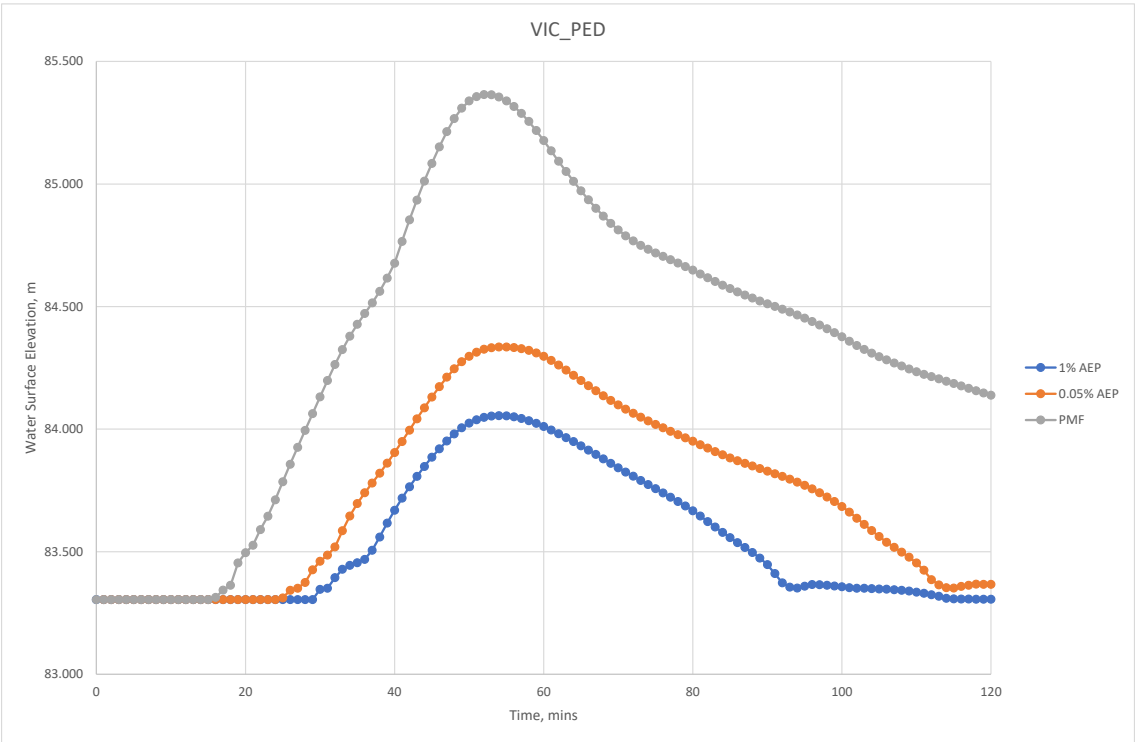
MILLS\_FG (Mills Lane)

Chatswood Chase Shopping Centre

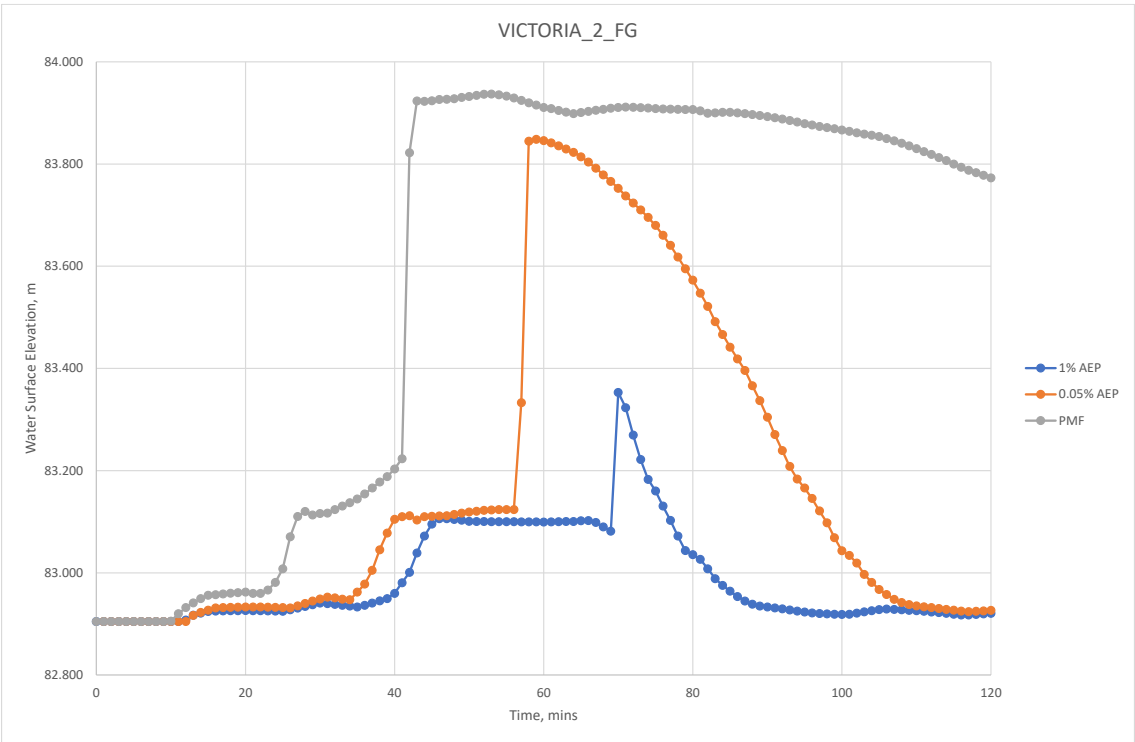
Flood Modelling Report - Addendum



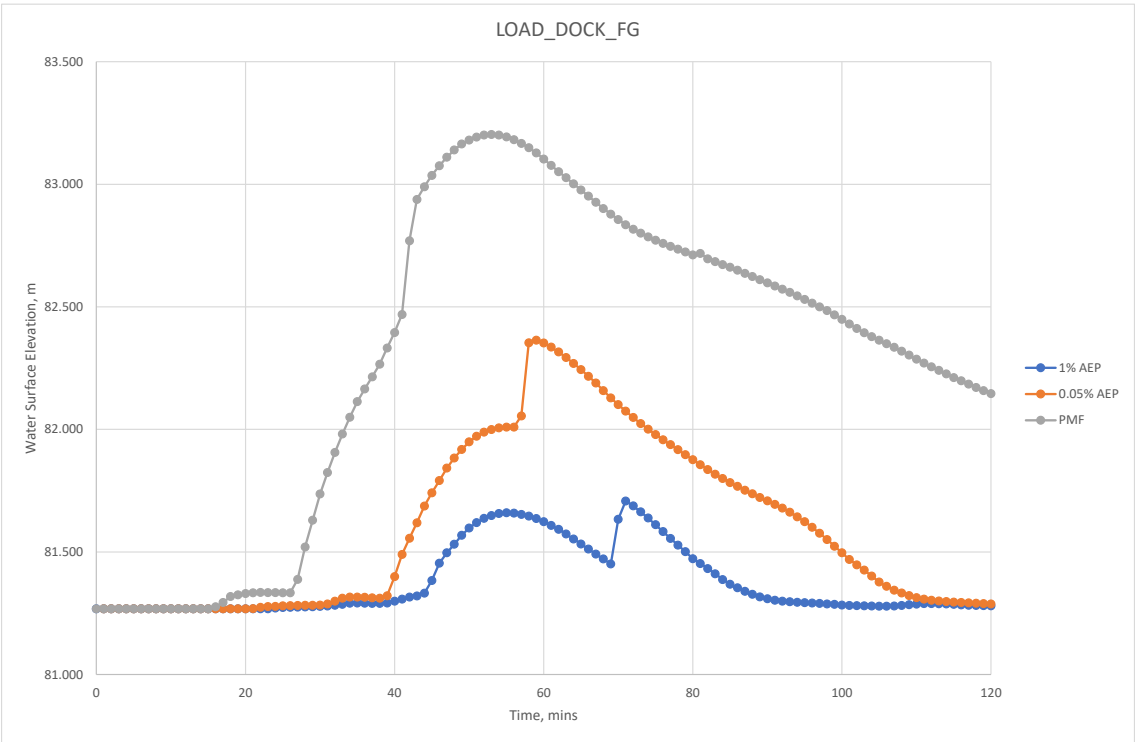
VICPED (Victoria Avenue Pedestrian Access)



VICTORIA\_2\_FG (Victoria Avenue Basement Carpark Entry)

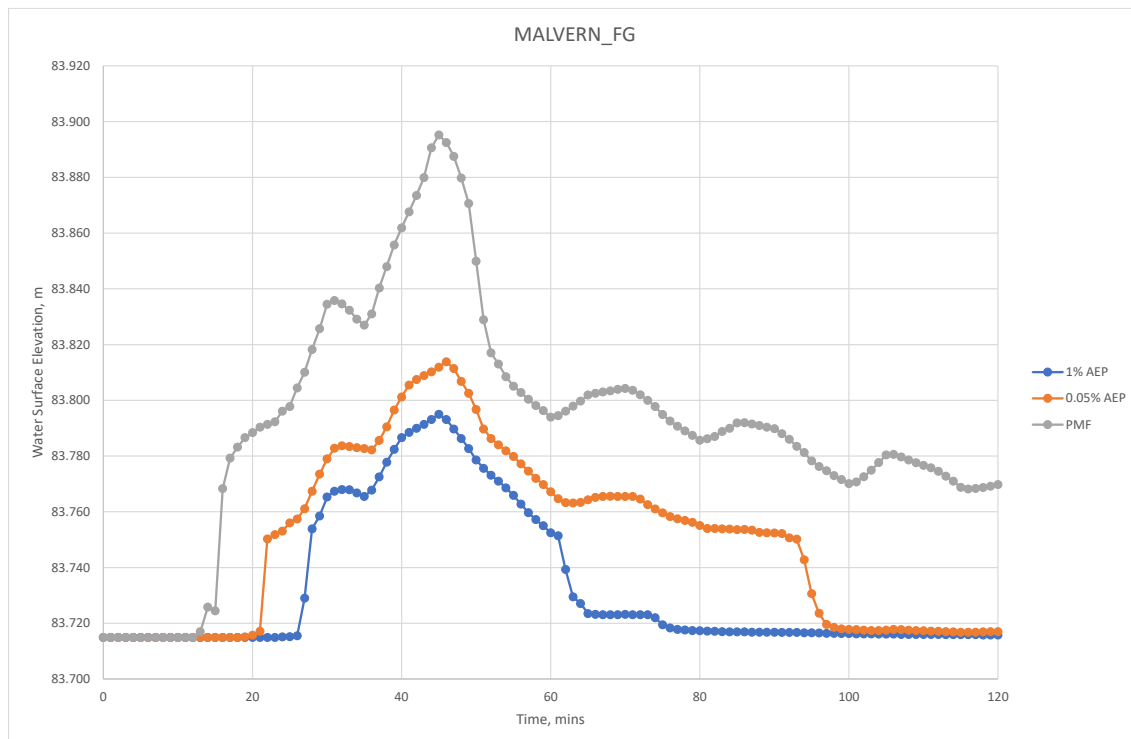


LOAD\_DOCK\_FG (Victoria Ave Loading Dock)





## MALVERN\_FG (Malvern Ave Loading Dock Entry)



*Item 12k - Details of how the overland flow will be conveyed along the boundary of 345 Victoria Avenue and Havilah Street properties.*

Currently, excess overland flow from the low point on Victoria Avenue, not catered for in the council drainage system, flows into the Chatswood Chase Shopping Centre (CCSC) basement carpark. There is also a portion of the flow following an overland flow path, which takes water down the CCSC loading dock entry ramp, which is bounded by a parapet wall on one side and an embankment and fence at the rear of the Havilah Street properties. In some higher flow events a portion of overland flow passes through to Havilah Street via a carpark at the rear of properties on the corner of Victoria Avenue and Havilah Street. The majority of the flow then continues into the loading dock itself where some flow enters the basement carpark via a ramp from the loading dock, and the remainder of the flow continues overland along the boundary of the shopping centre until it reaches the rear of 5-7 Havilah Street where it predominantly flows through the rear of the carpark below the building and out onto Havilah Street. There is also a minor flow path (approximately 1.5m in width) around the perimeter of this building which also allows flow out onto Havilah Street. This is the existing condition.

In the proposed design, automatic flood gates will control the entry of water into the CCSC basement carpark, using a flood level control switch located in the basement which automatically triggers the gates when the water level is approximately 200mm in depth. This prevents water from entering the CCSC basement carpark greatly reducing hazard levels and risks, and the majority of excess stormwater will be diverted down the loading dock entry

ramp. A one-meter wall is proposed on the boundary to prevent minor flows through the carpark at the rear of the properties on the corner of Victoria Avenue and Havilah Street and manual flood gates are proposed to prevent flow from entering the loading dock (and thus preventing flow to the basement via this route). This contains the overland flow path to the boundary of the shopping centre bounded by the external shopping centre wall and the walls of the buildings on Havilah St. Although in high flow events, a portion of overland flow does pass through to Havilah Street via the carpark upstream of 1-3 Havilah Street, overtopping the proposed 1m wall. Again, the remaining flow will enter the rear of the 5-7 Havilah Street carpark below the building where we have proposed an updated garage door / gate with 1m solid panel at base or equivalent on the carpark entry. The purpose of the 1m panel is to retard the flow onto Havilah Street and provide a level of temporary storage to prevent unacceptable afflux downstream of Havilah St in the residential area. Water from the 5-7 carpark can drain to Havilah Street via the minor overland flow path around the perimeter of the building. Flow can also exit the carpark directly to the minor overland flow path via large openings along the NW side of the carpark. In high flow events water will overtop the 1m flood barrier in the carpark entry at 5-7 Havilah Street and exit the carpark into Havilah Street.

It should be noted that the property at 5-7 Havilah Street is owned by Vicinity and the risks to life and property due to increased flood levels are far less than the risks associated with the alternative, which is to allow the CCSC carpark to flood. The risks within this smaller carpark will be managed as part of the flood management plan which will include removal of all vehicles and deployment of the 1m flood barrier / garage door (refer attached plan – MAKE Drawing AR-MAK-DRG-DA1200) when the other manual flood barriers are triggered within the centre.

Refer to attached photos of overland flow path.

*Item 12l - A number of Civil Measures have been amended between the Approved 2019 DA for the site and this development proposal; including New Flood Walls, Regrading of site between 345 Victoria and Havilah St and civil works to provide freeboard along the Victoria Ave Frontage. Details of flood gate locations are also not included in this application. This should be reviewed and information provided to Council.*

Refer to civil drawings for gate locations and heights. Construction detailing will be part of detailed design.

*Item 12m - Details to be provided for the maximum water depth on the Level 03A carpark OSD system. The detail in Figure 7 has the average depth only.*

The maximum water depth on the Level 03A carpark OSD system is 200mm.

*Item 12n - Plan showing the location of the OSD tank and a section through the tank to be provided.*

Location shown on civil plans – see attached for section details.

By Aconex  
17 March 2023

David Waldren  
Vicinity Centres

Your ref 14291 MM30  
Our ref 254810


David,

## Chatswood Chase Main Scheme (2023)

### Flood Requirements for 5-7 Havilah St

We have reviewed CJ Arms Memo (reference 14291 MM30) and confirm the existing structural capacity of the 5-7 Havilah St building has sufficient capacity to resist the applied loads from the flood events as outlined in that memo.

Yours sincerely,



Nick Masters  
Structural Engineer

d 93209249  
e [nicholas.masters@arup.com](mailto:nicholas.masters@arup.com)

## MEMORANDUM

Attention:	David Waldren	Copy to:	Paul McDonald
Company:	Vicinity	Date:	27/02/2023
From:	Daniel Jones	Sent Via:	Aconex
Project:	<b>Chatswood Chase</b>	#Pages:	2
Subject:	<b>Flood Requirements for 5-7 Havilah</b>	Reference:	14291 MM30

David,

As requested, please find below items to be considered for 5-7 Havilah Street property in response to the council RFI's regarding the impact on this property from the proposed DA.

The property at 5-7 Havilah Street currently owned by Vicinity is subject to overland flow during larger storm events (particularly 1% AEP and over). The overland flow path currently (existing condition) passes through the from the rear of the ground-floor carpark and around the outside of building through to Havilah Street. This carpark has large openings on three sides.

The further development of CCSC and the implementation of flood gates on the Victoria Avenue Basement Carpark entry ramps to by-pass overland flows from the council system and prevent significant risks to life and property within the shopping centre basement carpark. It is proposed that certain measures are required to be implemented on 5-7 Havilah Street to reduce the impact of the additional flows downstream of the shopping centre.

To assist in the mitigation of floodwater flows downstream of Havilah Street CJ Arms have proposed an upgrade of the current carpark entry vehicular gate to include a mostly impervious barrier (solid gate) up to 1m. This barrier need not be water-tight but should heavily impede the flow from the carpark entrance to Havilah Street. In addition, as part of an update to the CCSC flood management plan there will be a requirement to remove all vehicles & pedestrians from the parking area on instruction from the centre staff (fire warden) and to ensure the car park gate was closed.

In summary the requirements are:

- Installation of a carpark gate that includes a suitable solid flood barrier (to the height of 1m).
- Removal of all vehicles & pedestrians in event of Yellow alert (as per flood management plan)
- Ensuring that new gate is closed when required by the flood management plan.

It would be necessary to assess the property and building from a structural perspective to ensure that the building structure is capable of withstanding water depths and velocities as proposed for the storm events as required by structural codes and Australian Standards.

The flood water depths and velocities per storm event are shown in the extract below.



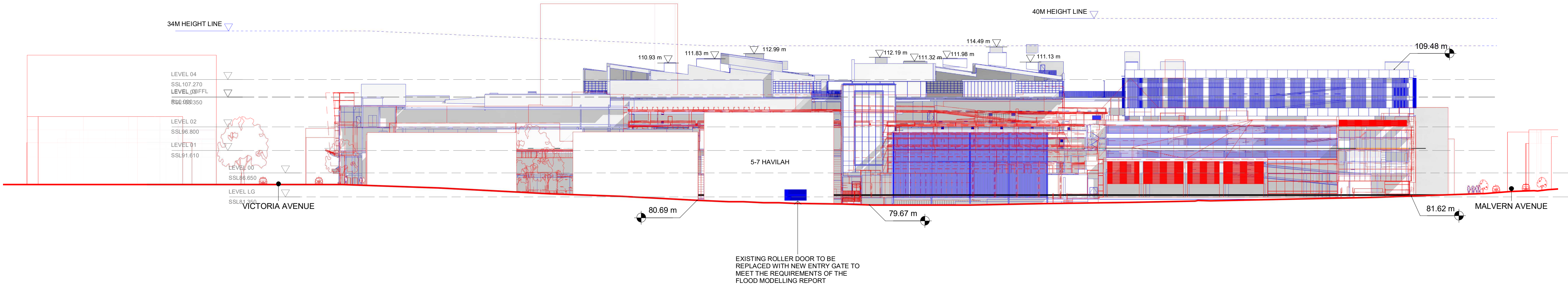
Regards,

Daniel Jones

*CJ Arms*



REVISIONS:  
- EXISTING ROLLER SHUTTER DOOR REPLACED WITH NEW ENTRY GATE TO MEET THE REQUIREMENTS OF THE FLOOD MODELLING REPORT



General Notes  
1. Dimensions are in millimetres unless stated otherwise.  
2. Levels are in metres above Australian Height Datum unless stated otherwise.  
3. Dimensions govern. Do not scale off drawing.  
4. Design drawings are based on 3rd party information. All dimensions to be verified on site before proceeding.  
5. All discrepancies to be notified in writing to Make (AU) Limited.  
6. Make (AU) Limited is the owner of the copyright for these drawings and designs. They must not be used, reproduced or copied without the prior written consent of the company.  
7. These drawings and areas have been prepared for our client, Vicinity Centres, and are approximate only and have been measured from preliminary drawings. Construction tolerances, workmanship and design by others may affect the stated areas and dimensions. The building may present anomalies in relation to surveyed/drawn plans that may also affect the stated areas. All of these factors should be considered before making any decisions on the basis of these predictions, to project viability, pre-letting, lease agreements or otherwise, and should include due allowance for the increases and decreases inherent in the design development and construction processes.  
8. Areas to be verified by surveyor.  
9. This drawing forms part of Make's Chatswood Chase retail mall design documentation and shows the purpose for which the design is intended. The Design and Construct contractor shall make the final selection of all products, materials and finishes to be supplied and installed in of part of the building and shall ensure those product, material and finished selected are fit for the purpose set out in this document. No produce material or finish shall be used or exposed to any other purpose than that explicitly set out in this document.  
10. Drawings include other consultants information indicatively. Please refer to all relevant consultant documentation for clarification.

Nominated Architect  
Simon Lincoln NSWARB 10236  
©Make (AU) Limited 2018

00	01-08-2022	For Information	JC
01	12-08-2022	For Information	JC
02	17-02-2023	For Information	JC
REV	Date	Reason For Issue	Chk

## FOR INFORMATION

DRAWING STATUS

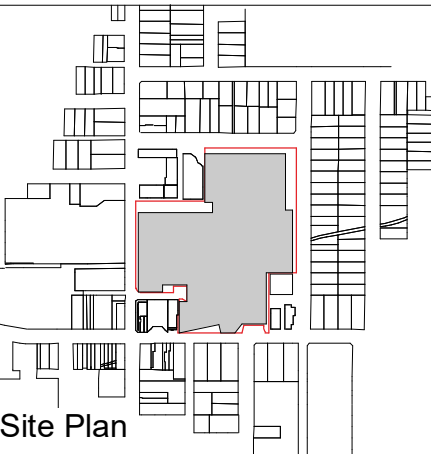
**make**

Suite 1, Level 3, 10 Bond Street  
Sydney, NSW 2000

tel +61 (0) 283 168 950

info@makearchitects.com  
www.makearchitects.com

Client



Site Plan

Project

**Chatswood Chase**

Drawing Title

**Red/Blue Overlay Elevation  
- East**

Scale at A1

**1 : 500**

Project No.

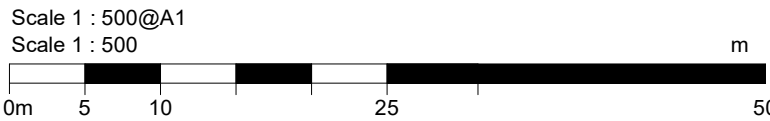
**1506**

Rev No.

**02**

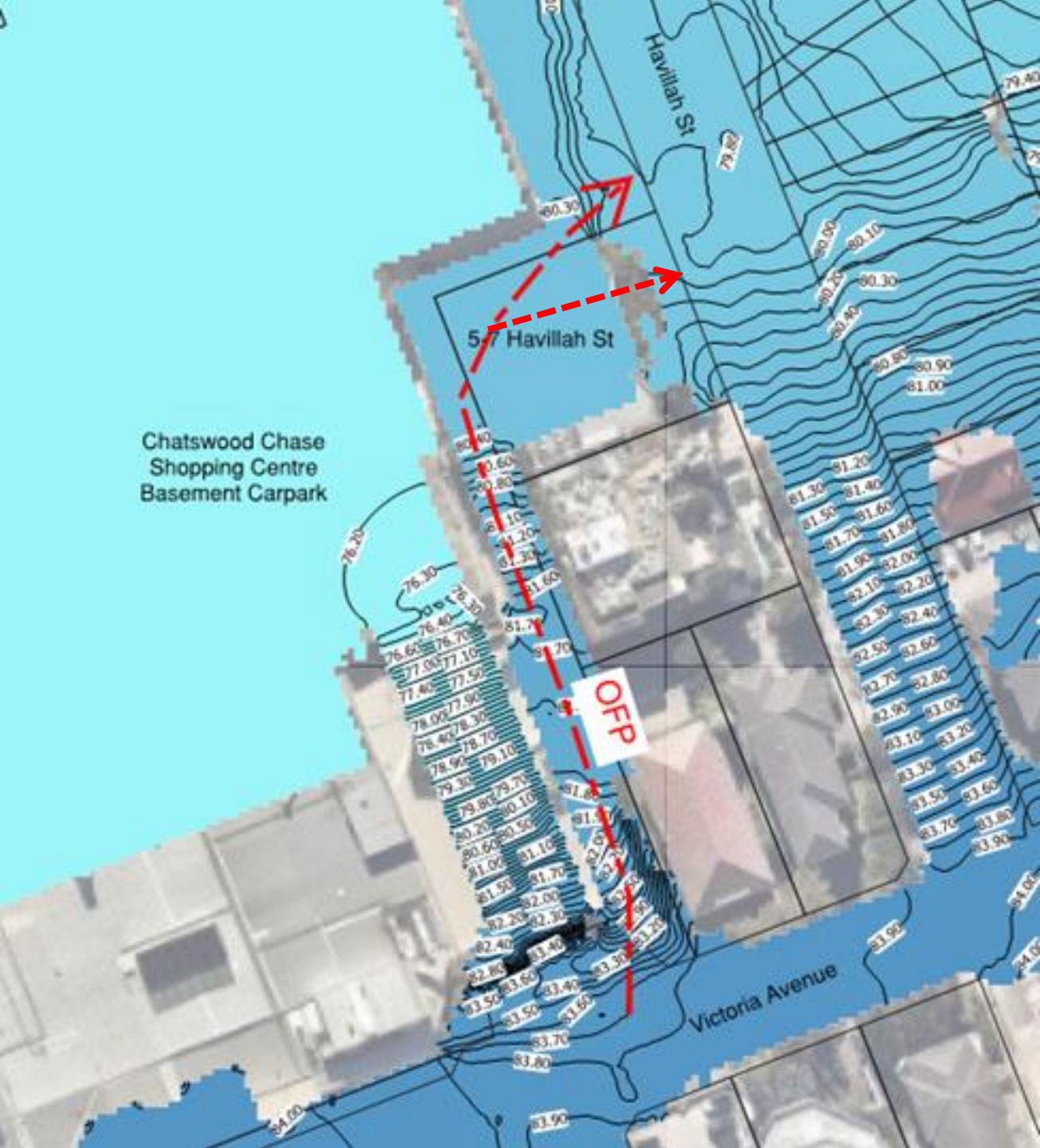
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**AR-MAK-DRG-DA1200**





Overland Flow Path











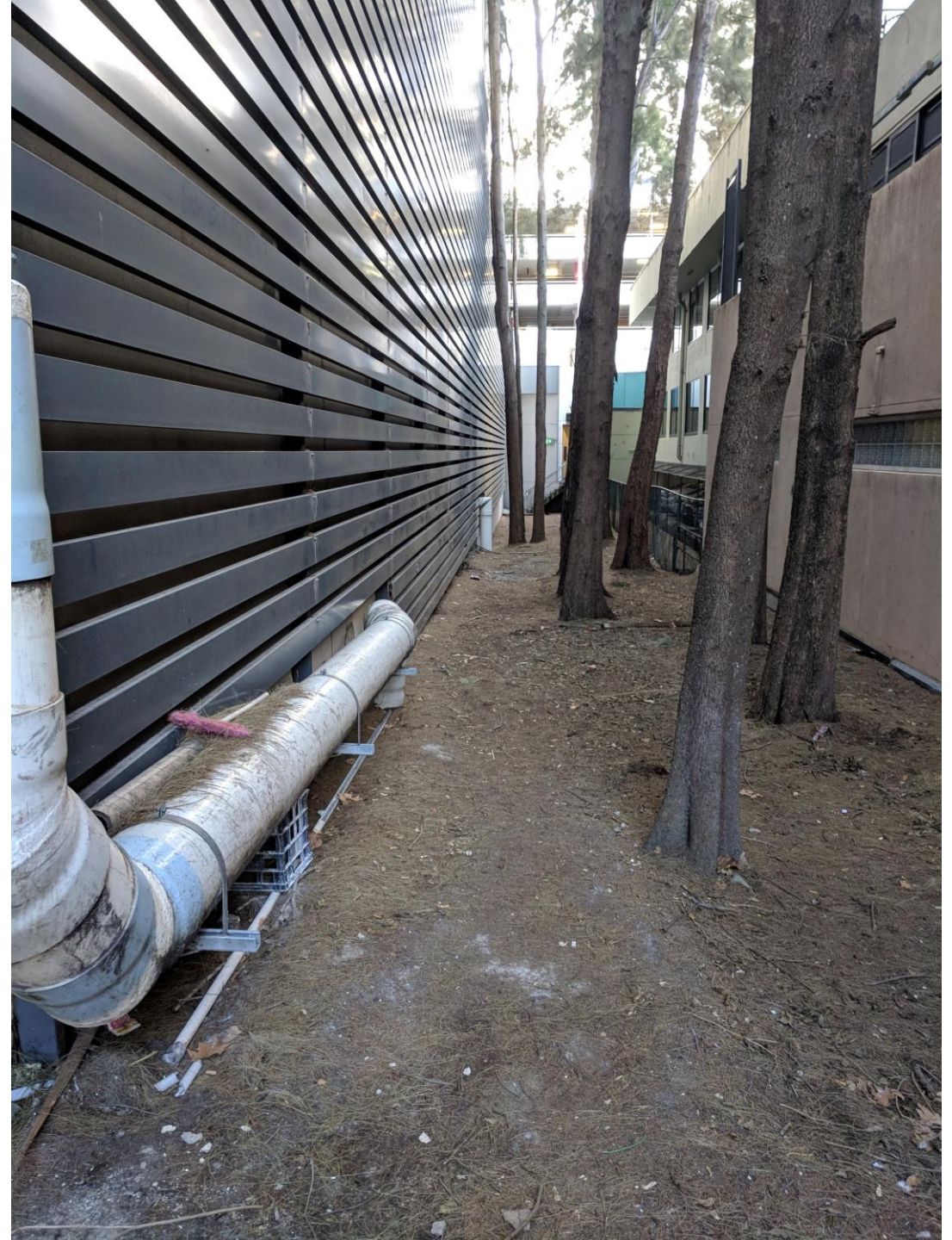












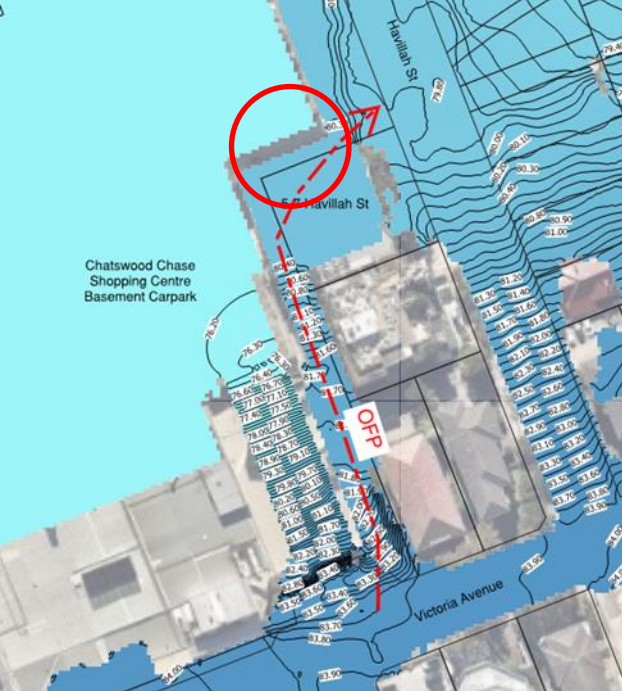








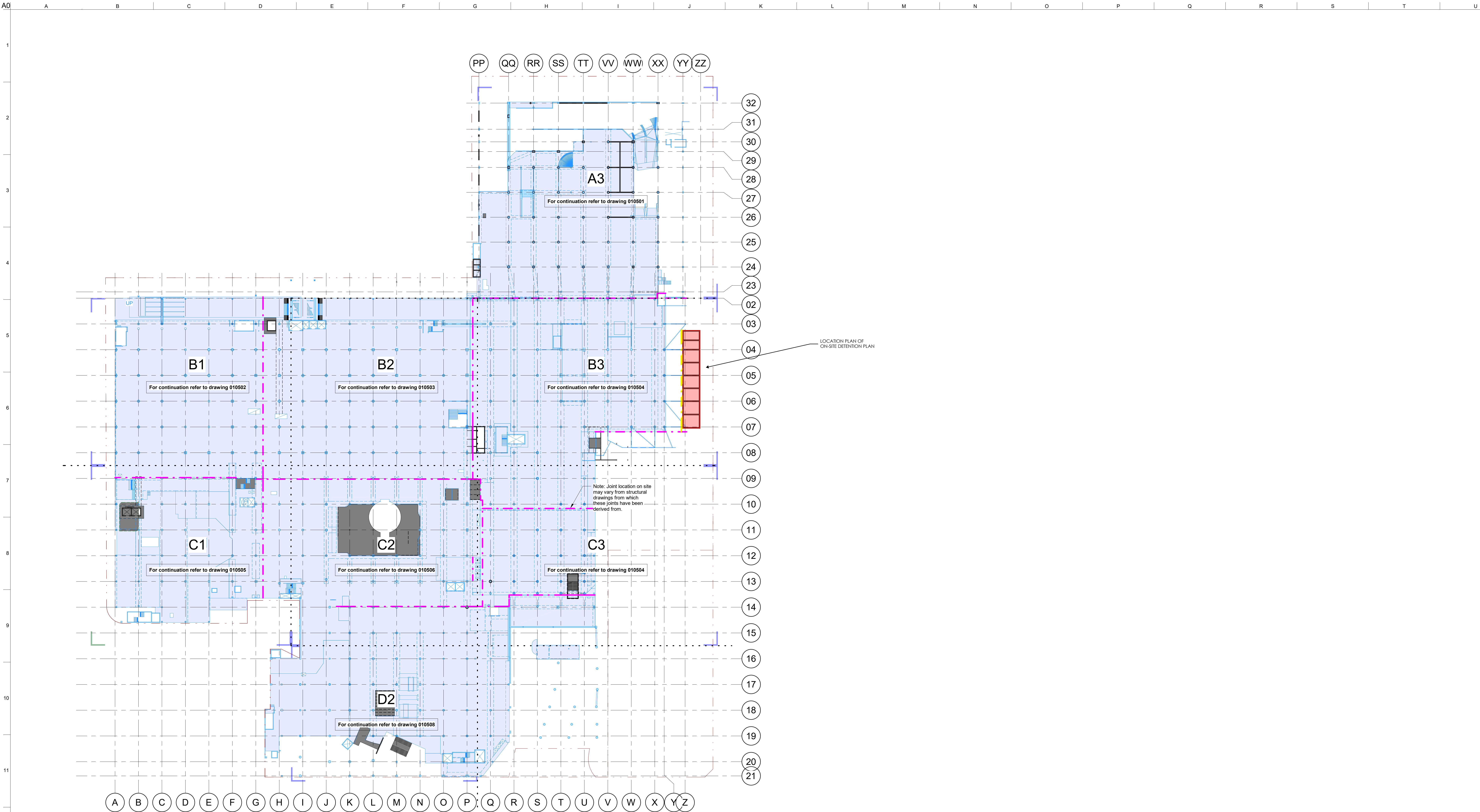




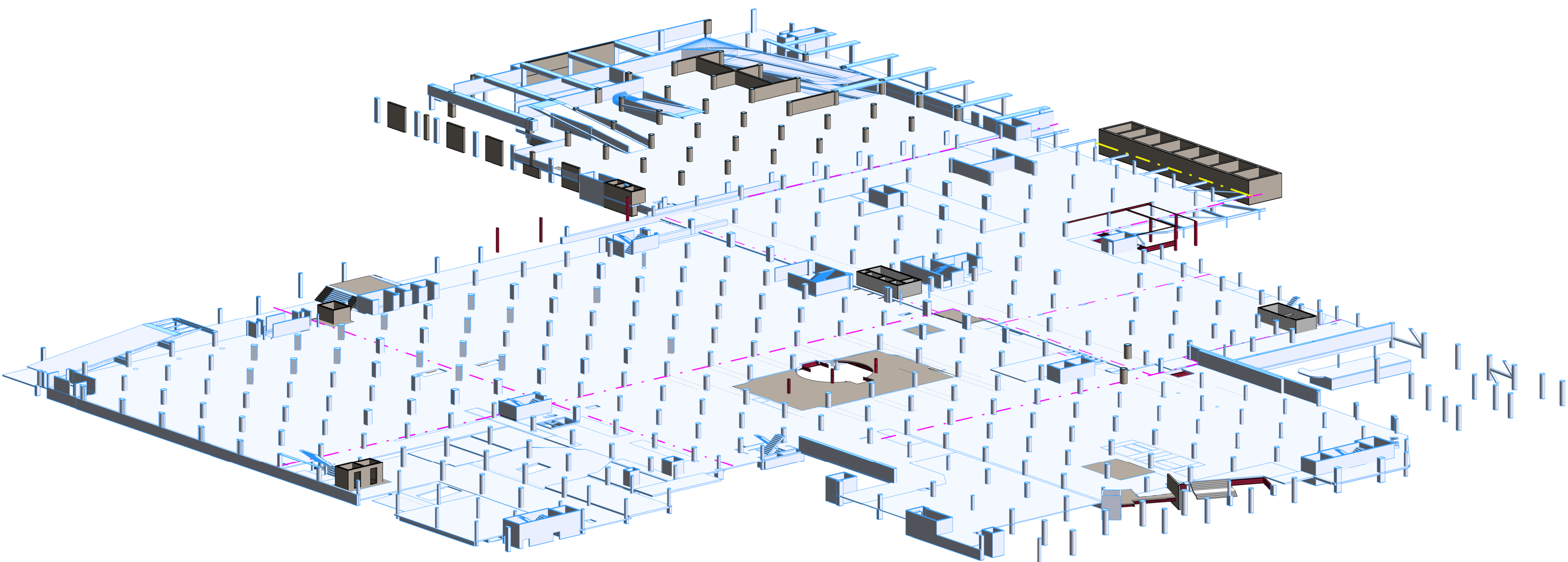








Level 00 General Arrangement Key Plan  
Scale 1 : 500



Isometric View

Not For Construction

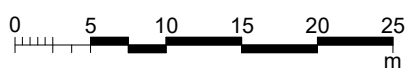
All drawings are to be printed  
**IN COLOUR**

**Note (Existing Structure):**  
The existing structure shown has been derived from documentation of past developments and may not reflect the as-built condition. The information should be regarded as indicative and is provided to inform the design process. Where affected by the new development, the existing condition of structure should be confirmed by survey prior to any demolition or construction works.

■ Denotes Existing Structure to be demolished  
■ Denotes Existing Structure to be retained  
■ Denotes New Construction

- Reference Drawings:**
- For General Notes  
Refer to drawing SE-ARP-DRG-000011
  - For Reinforcement Tables  
Refer to drawing SE-ARP-DRG-000021
  - For Costing Notes  
Refer to drawing SE-ARP-DRG-000031
  - For Piling Notes  
Refer to drawing SE-ARP-DRG-000041
  - For Loading Plans, Refer to drawings SE-ARP-DRG-001001 to 001008
  - For Typical Details  
Refer to drawing SE-ARP-DRG-000900 series

Rev	Date	Description
B	02/12/22	Schematic Design Issue
A	18/11/22	Draft Schematic Design

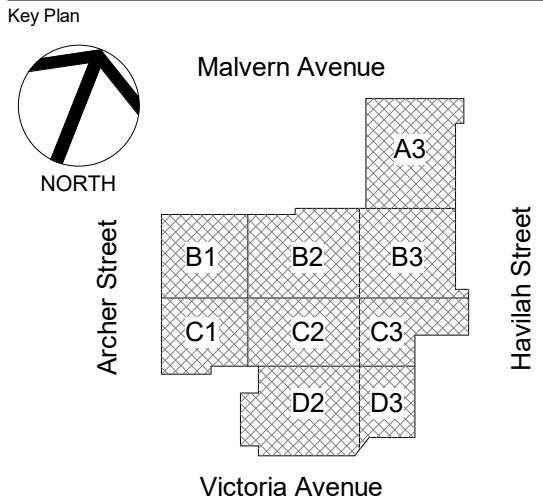


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Fax +61 (0)2 9203 9321  
www.arup.com

Client  
Vicinity Centres

Project Title  
Chatswood Chase Sydney  
345 Victoria Avenue  
Chatswood NSW 2067



Drawing Title  
Level 00 General Arrangement Key Plan

Scale of A0 As indicated By / CHM / Appd  
Role Structural  
Subsidiary For Information

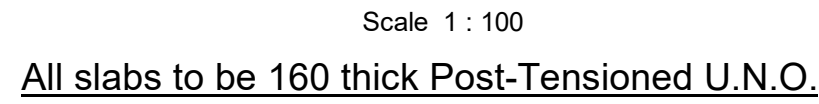
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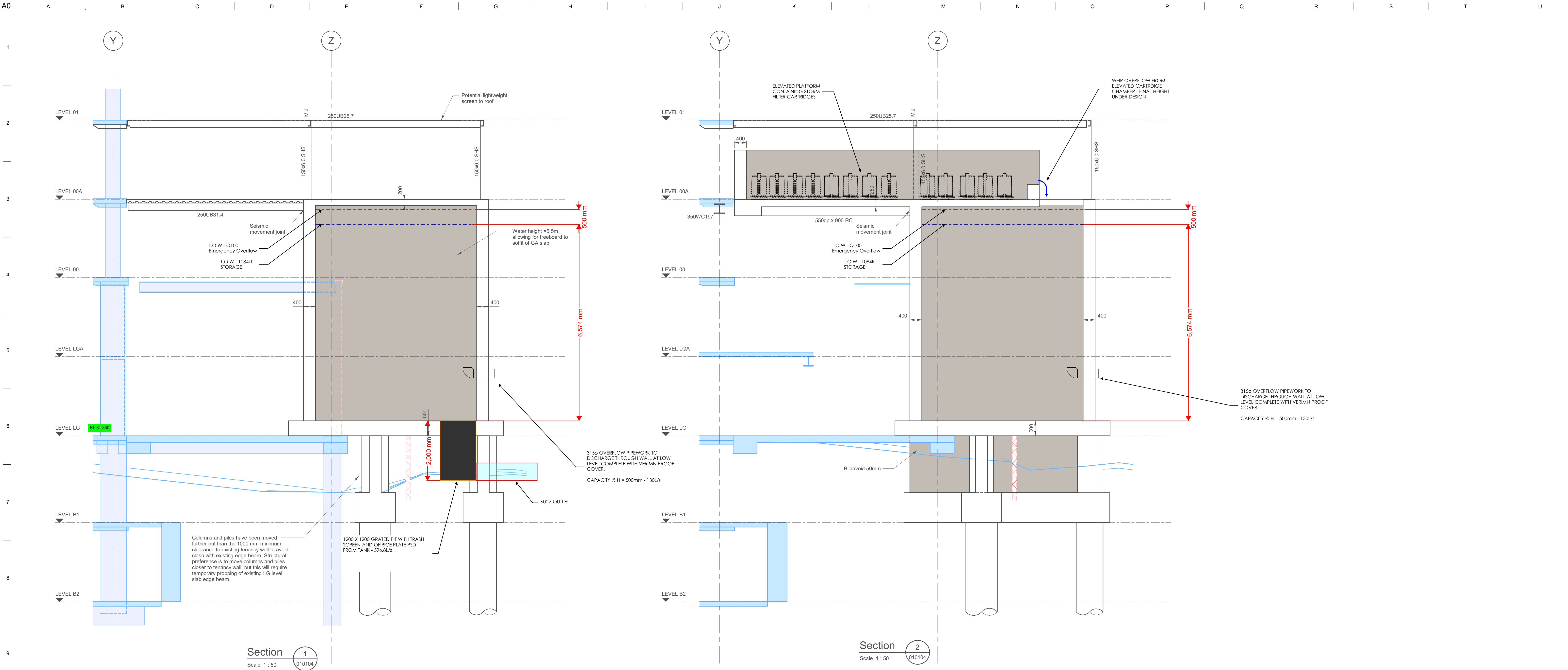
SE-ARP-DRG-010604





© Anup





**Assumed Construction Sequence**

Assuming piling from B1 level.

1. Demolish batter down to flat piling bench level.
2. Pile.
3. Construct columns walls to underside of level LG.
4. Construct tank superstructure.

All drawings are to be printed  
**IN COLOUR**

**Note (Existing Structure):**

The existing structure shown has been derived from documentation of past developments and may not reflect the as-built condition. The information should be regarded as indicative and is provided to inform the design process. Where affected by the new development, the existing condition of structure should be confirmed by survey prior to any demolition or construction works.

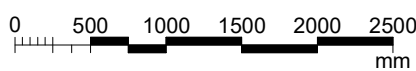
**Legend:**

- XXXX Denotes Existing Structure to be demolished
- Denotes Existing Structure to be retained
- Denotes New Infill Slab

**Reference Drawings:**

1. For General Notes  
Refer to drawing SE-ARP-DRG-000011
2. For Reinforcement Tables  
Refer to drawing SE-ARP-DRG-000021
3. For Costing Notes  
Refer to drawing SE-ARP-DRG-000031
4. For Piling Notes  
Refer to drawing SE-ARP-DRG-000041
5. For Loading Plans, Refer to drawings SE-ARP-DRG-001001 to 001008
6. For Typical Details  
Refer to drawing SE-ARP-DRG-000900 series

Rev	Date	Description
B	02/12/22	Schematic Design Issue
A	18/11/22	Draft Schematic Design



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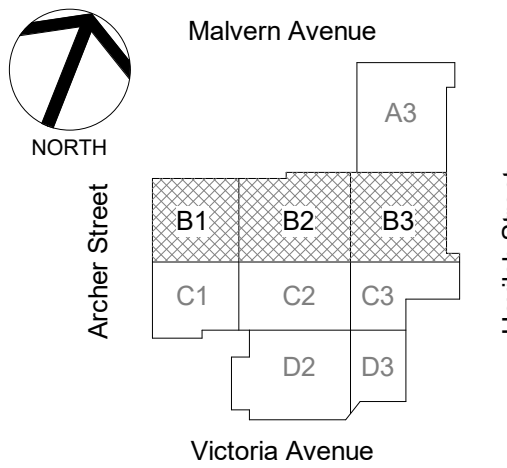
Client

Vicinity Centres

Project Title

**Chatswood Chase Sydney**  
345 Victoria Avenue  
Chatswood NSW 2067

Key Plan



Drawing Title

**Zone B Building Sections - Sheet 1**

Scale of A0 1 : 50 By / CHM / Appd KENMM

Role Structural

Subsidiary For Information

Appr Job No

**254810**

Drawing Number

**SE-ARP-DRG-209921**

**Not For Construction**