J.C. Engineers Pty. Ltd.
403, 89 Scarborough Street
SOUTHPORT
QLD 4215

"Practical, Common-Sense Engineers"

FLOOD ASSESSMENT

FOR PROPOSED RESIDENTIAL DEVELOPMENT

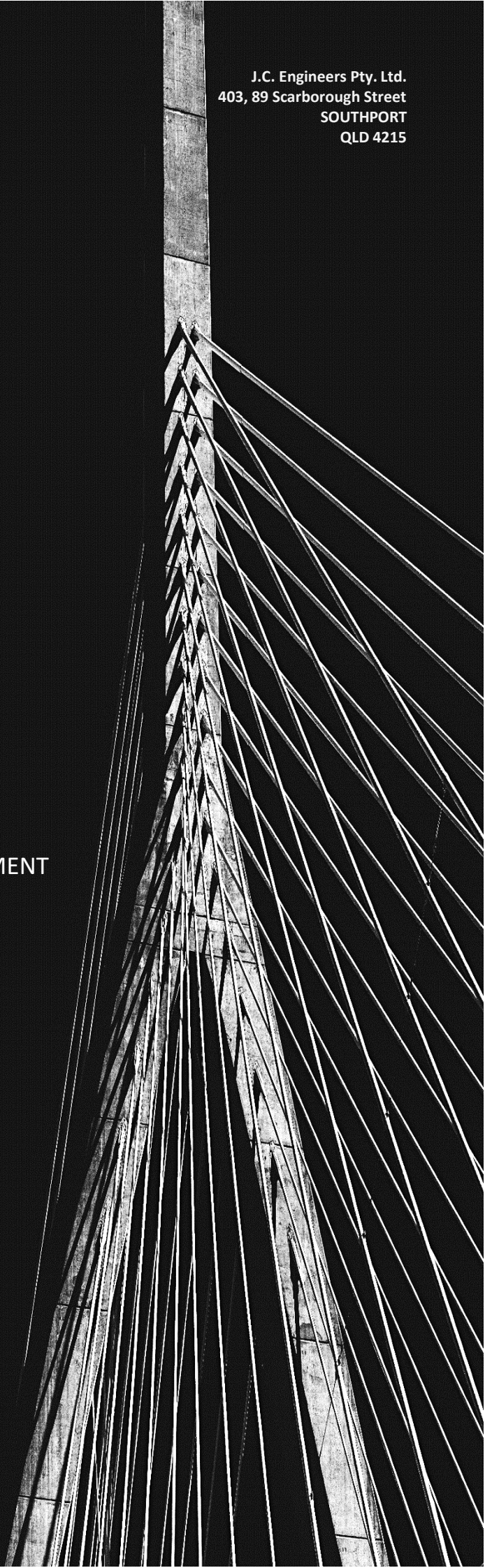
55 TRAFALGAR AVENUE
LINDFIELD
NSW, 2070

PREPARED FOR

[redacted]

MARCH 2022

JASMIN TRGO
RPEQ 19378



KU-RING-GAI COUNCIL

THIS IS THE PLAN/S REFERRED TO IN NOTICE OF DETERMINATION OF DEVELOPMENT APPLICATION

No: DA0260/22

Date: 12/09/2022

Rohit Khanduja
Civil Engineer
MEng (Civil), MEng (Project Management)

Jasmin Trgo
Civil Engineer
BEng, RPEQ (Civil), NER

J.C. Engineers Pty. Ltd. Project No. **B422**

If you have any queries regarding this report, please contact Brendan Nielsen.

Revision	Date	Description	Author	Rev.	App.
1	March 2022	FINAL	RK	JT	JT

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This report has been developed in summary of the flood assessment conducted for the property 55 Trafalgar Avenue, Lindfield, NSW, 2070. To demonstrate adherence to Ku-ring-gai Council DCP Part 2424D.2 flood studies and the design flood standard acceptable outcome of the Ku-ring-gai Flood Overlay Code, this flood assessment has been conducted to certify that the proposed construction will be designed to "resist hydrostatic and hydrodynamic loads associated with flooding up to and including the defined flood event." This report has been prepared in accordance with 24R.7 to identify the 1% AEP overland flow extent affecting the existing property. The minimum floor level requirements and the potential impacts are also assessed in this report.

In accordance with the design flood standard 24R.7 the flood assessment report must be done following:

1) The overland flow associated with the 1% AEP storm event with any above-ground channels and underground pipes / culverts operating at a maximum of 50% capacity:
2) The overland flow associated with the 20% AEP storm event with any above-ground channel or underground pipes / culverts fully blocked:
3) Whichever is the greater.

However, for this analysis, the conservative approach is adopted with the overland flow associated with the 1% AEP storm event without any above-ground channels and underground pipes / culverts operating, which means fully blocked during the worst-case stormwater event/scenario.

The following documentation has been provided to J.C. Engineers for the purposes of these works:

- Ku-ring-gai Council Flood Awareness Map (Online Map Viewer) - dated 01/03/2022
- Ku-ring-gai Local Centres Development Control Plan-Part 24-Water Management
- Survey done by Usher & Company Survey & Land Development Consultants – Plan Reference: 6321-DET – dated on 14/02/2020
- Design Rainfall Data – BOM IFD

This report has been prepared expressly to provide commentary regarding compliance with Council to determine the magnitude of overland flow flooding affect at the above-mentioned property for the purpose of confirming location of proposed structures. Information presented in this report should not be applied to properties or developments other than the subject development.

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215

2. SITE CHARACTERISTICS

2.1 EXISTING SITE

The subject site is located at 55 Trafalgar Avenue, Lindfield, NSW, 2070 as indicated within Figure 1 below. The site has a total area of 932.9m^2 approx. The existing property contains one dwelling and an open grass area. The property is bound by Trafalgar Avenue to the West, Middle Harbour Road to the South and by residential properties in all other directions.

Figure 1. Locality Plan (Source - NearMap on 01st March 2022)

2.2 DEVELOPED SITE

The existing dwelling is proposed along with the inclusion of Granny Flat at the site. The post development details are shown in Figure 2 below.

Figure 2. Post development Concept Plan

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215

2.3 SUMMARY OF EXISTING DOCUMENTATION

Within the Ku-ring-gai Council Online Map Viewer accessed for the purpose of this report, the property is flagged as a property that "may be affected by one or more flood or property development overlays or flags. These include CREEK FLOODING AREA (Gordon Creek)." This is justified within the Flood Overlay Mapping. Some part of the property is within the creek/waterway flood planning area as shown in Figure 3 below.

Figure 3. Overland Flow Path Overlay (Source: Ku-ring-gai Council Flood Awareness Map (Online Map Viewer)- dated 01/03/2022)

3. FLOOD ANALYSIS

For this assessment, HEC-RAS software has been used. Elevation data has been extracted from ELVIS. For the purpose of calculating stormwater/flooding quantity produced in the catchment, the rational method has been used. Table 1 shows indicative flows produced by the overall catchment pertinent in different ARI rain events. Overall Catchment area is shown in Figure 4 below. The total discharge considering 1% ARI is 4.692 m^3 flowing from upstream to the downstream in the overall catchment area using Rational method. This total discharge is supposed to be subdivided according to the contours and elevation of the small catchment areas.

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215

Table 1. Peak flows

ARI years	F_y	C_y	${}^{t}I_y$	Discharge	
			mm/hr	m^3/s	L/s
1	0.80	0.52	17.90	1.1865	1,186.48
2	0.85	0.56	22.20	2.1331	1,563.47
5	0.95	0.62	27.10	2.1331	2,133.09
10	1.00	0.66	30.80	2.5519	2,551.92
20	1.05	0.69	35.40	3.0797	3,079.70
50	1.15	0.75	41.90	3.9923	3,992.35
100	1.20	0.88	210.00	4.6929	4,692.88
Q100(overland)	N/A	N/A	N/A	4.6929	4,692.88

Stormwater runoff discharge from the upstream catchment following inflow path effecting some part of the subject site. The runoff from all directions combines before releasing through the outflow area. The flow path (red arrows) is indicated in Figure 5 below.

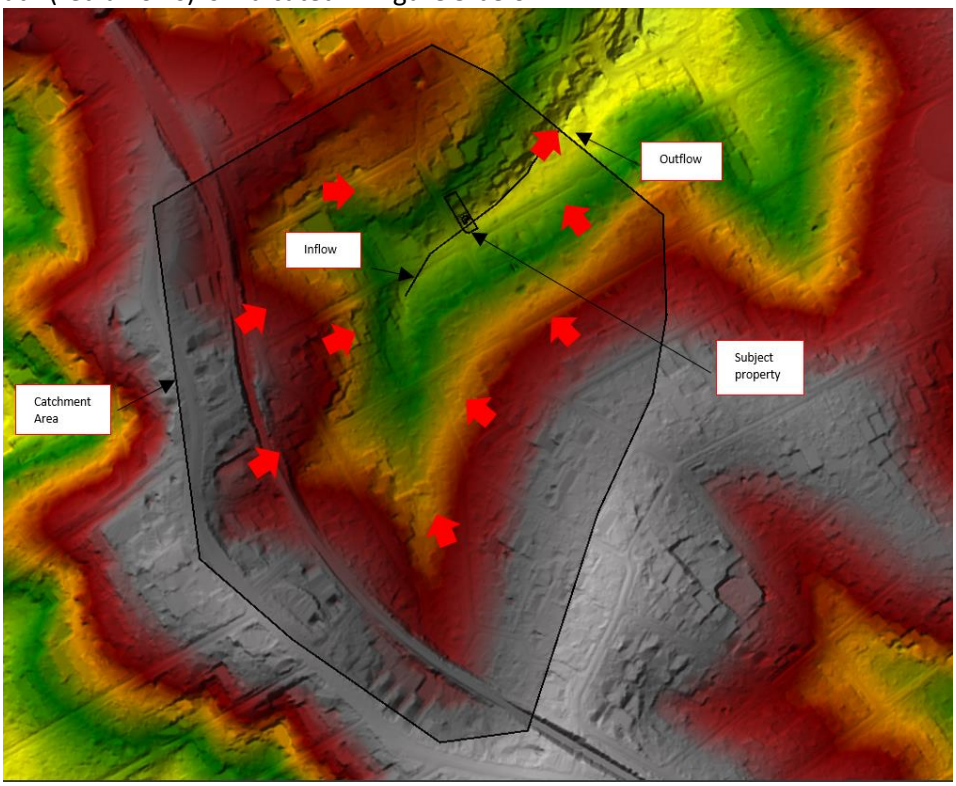


Figure 4. RAS Mapper Catchment analysis (Source: HEC-RAS)

3.1 HEC-RAS MODEL

The model was based on a 2m grid sizing. The land area surrounding the property is grading on the Western side. The elevation data extracted from ELVIS was lidar data in 1m increments. HEC-RAS modelling was used to examine the future impacts on the neighbouring area with the proposed subdivision on the subject lot. Using the model, feasibility of proposed development was assessed based on the minimum possible flood risk and impacts to public, neighbouring property, and vehicle access.

Existing Site - Catchment Flow (Pre-development):

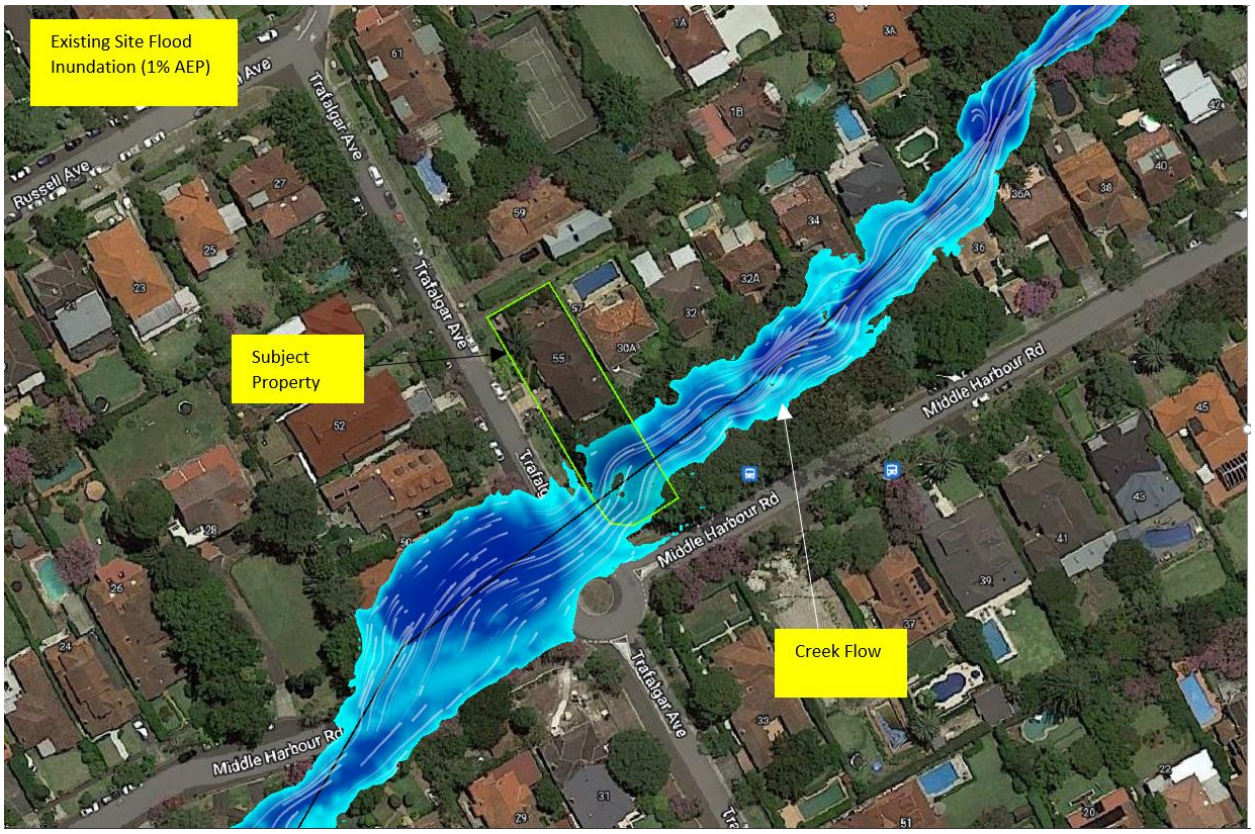


Figure 5. Flood Mapping using Goggle Layer Web Imaginary View - 1% AEP- (Pre-development): - (metres AHD, Source: HEC-RAS)

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215

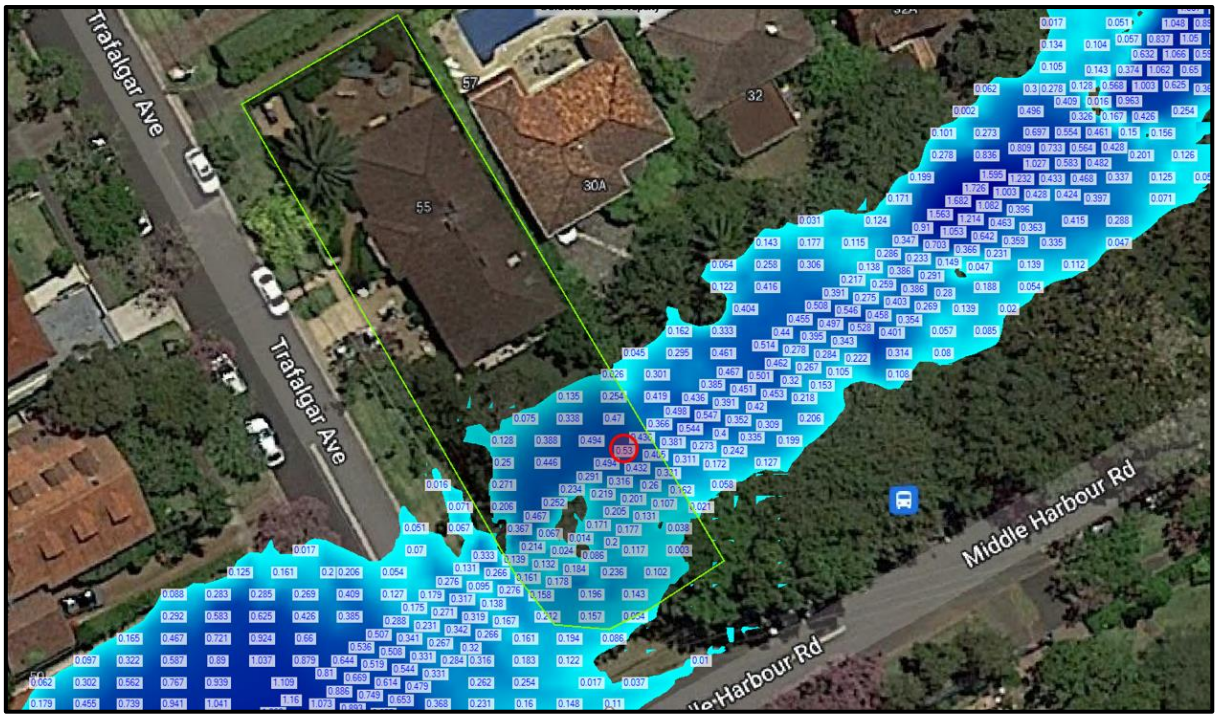


Figure 6. Flood Inundation Depth using Goggle Layer Web Imaginary View - (Pre-development)-1% AEP (metres AHD, Source: HEC-RAS)

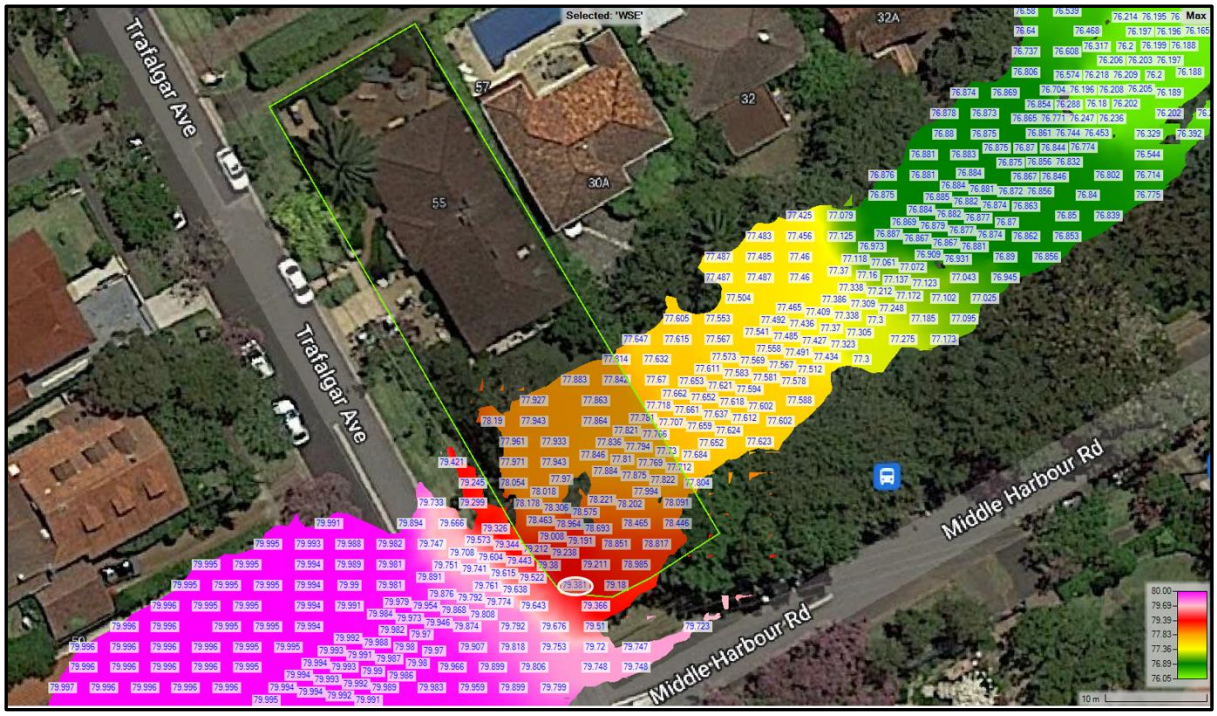


Figure 7. Water Surface Elevation using Goggle Layer Web Imaginary View -(Pre-development)- 1% AEP (metres AHD, Source: HEC-RAS)

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215

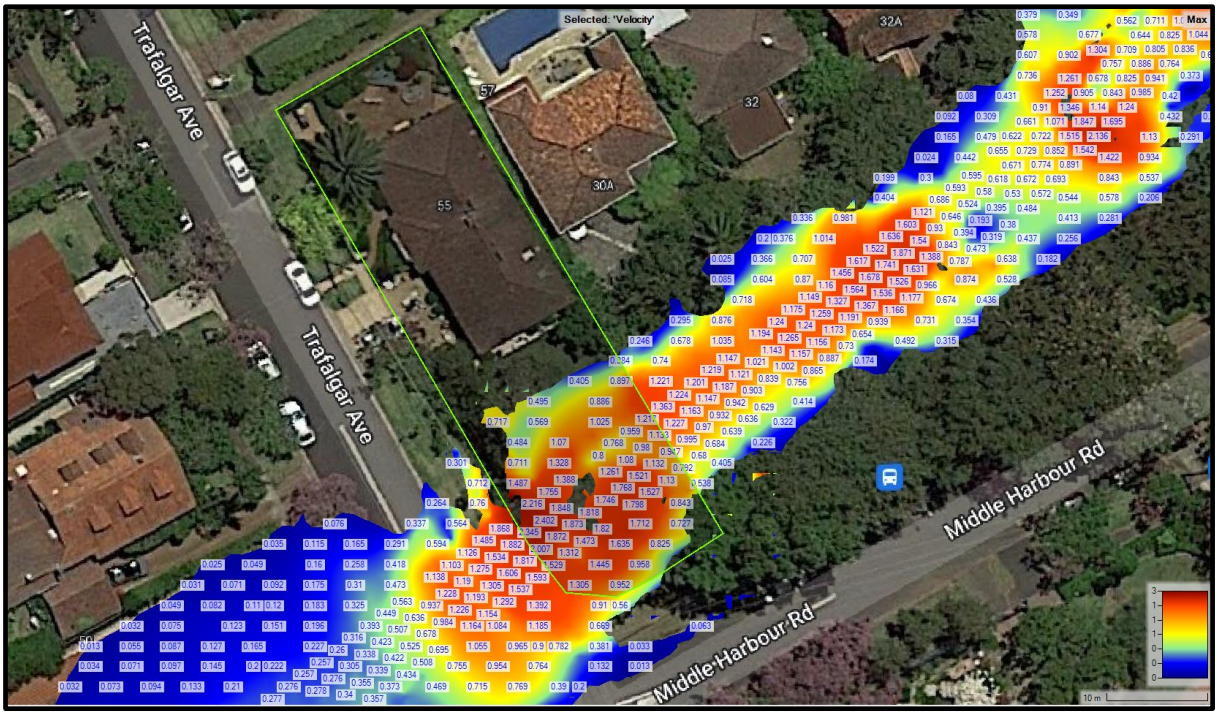


Figure 8. Velocity of Flow on Property using Goggle Layer Web Imaginary -(Pre-development)- 1% AEP (m/s) (Source: HEC-RAS)

Stage 1. Catchment Flow Analysis (Post-development)

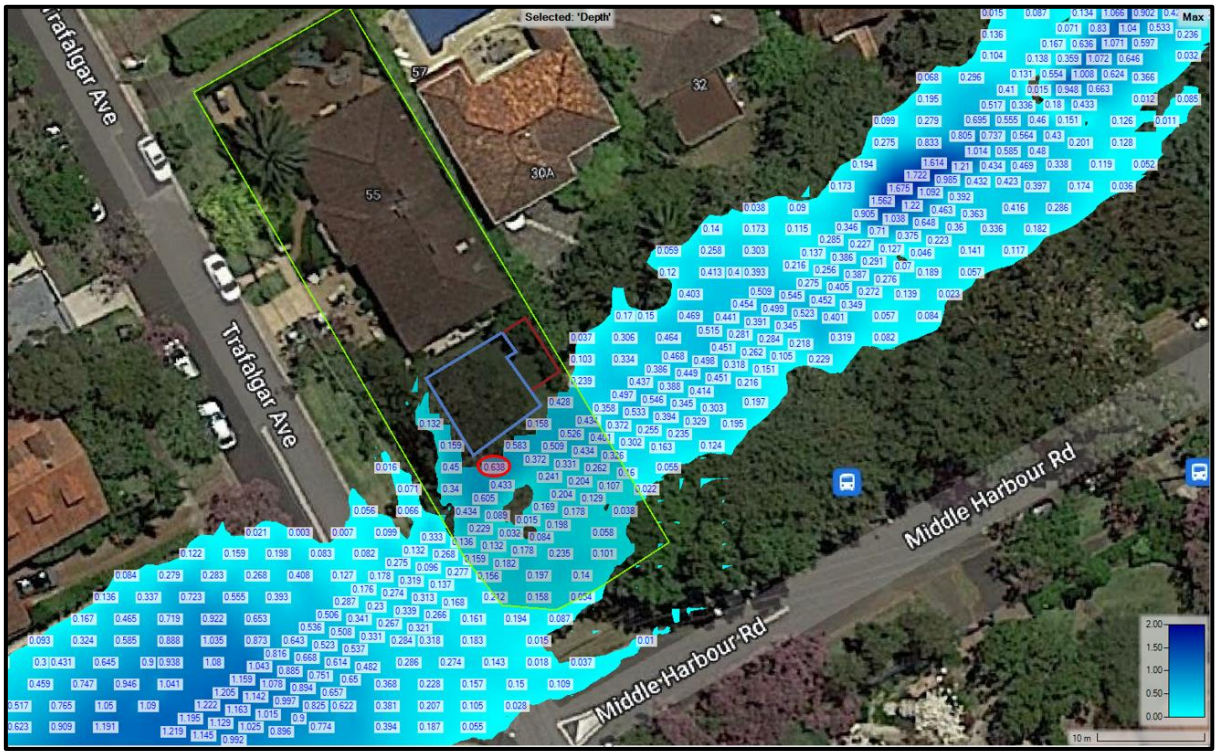


Figure 9. Flood Inundation Depth using Goggle Layer Web Imaginary View - (Post-development)-1% AEP (metres AHD, Source: HEC-RAS)

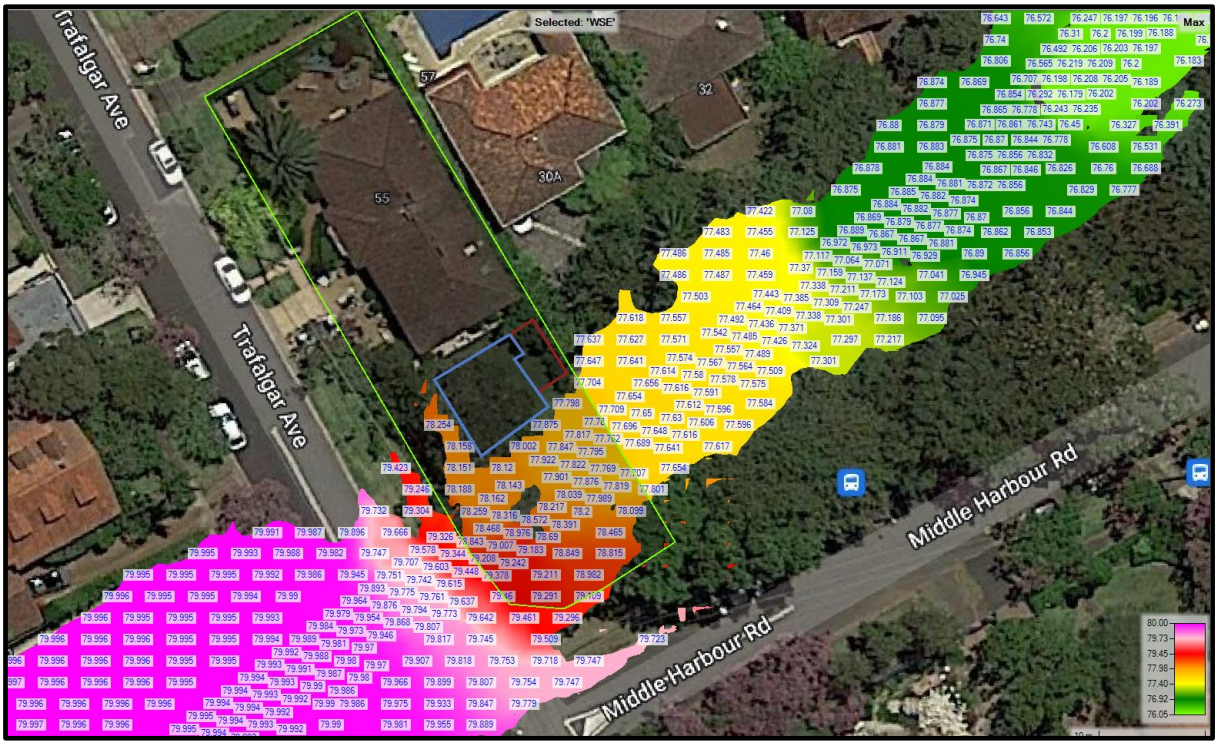


Figure 10. Water Surface Elevation using Goggle Layer Web Imaginary View (Post-development)- 1% AEP (metres AHD, Source: HEC-RAS)

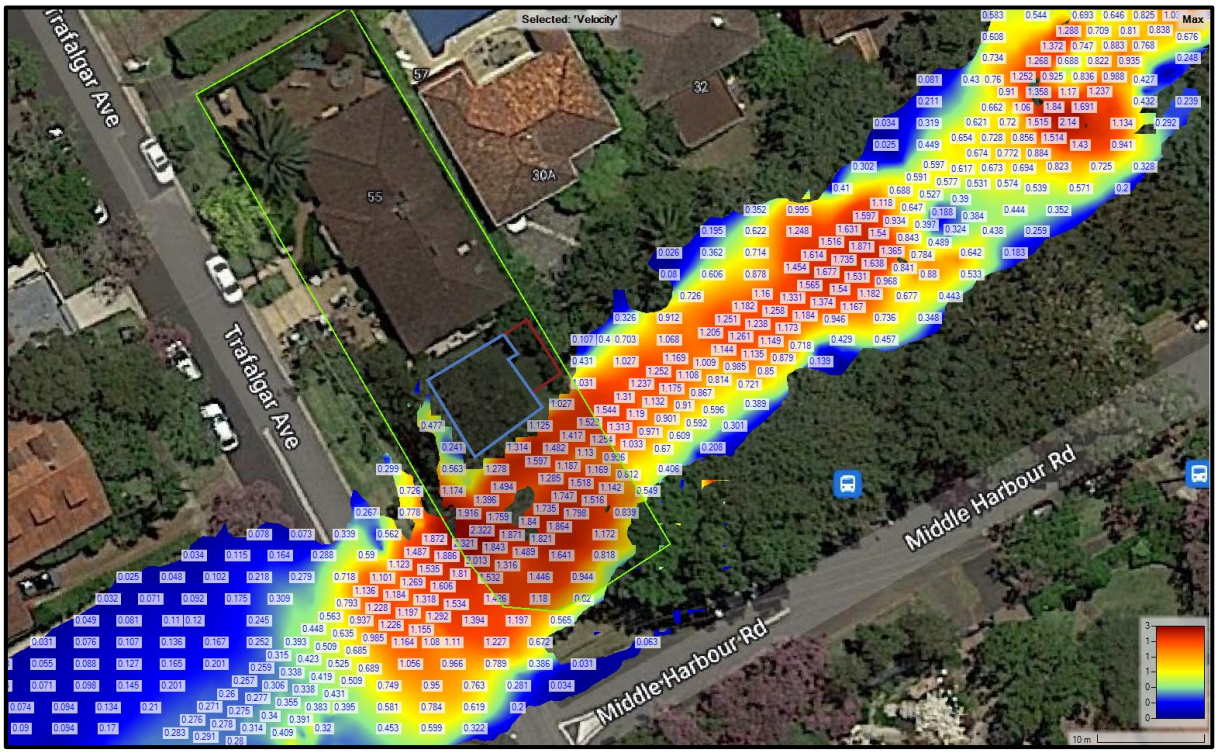


Figure 11.Velocity of Flow on Property using Goggle Layer Web Imaginary - (Post-development)-1% AEP (m/s) (Source: HEC-RAS)

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215

Since the overland flow overlay has been developed to show flood prone area, the flood model summary suggests that the 1% AEP event is likely to have a significant effect on the subject site. The maximum depth of inundated water on the property is seen to be 0.53m as shown in *Figure 6* above.

Furthermore, Ku-ring-gai Council outline habitable floor levels (HFL) are to be 300mm above the 1% adopted flood regulation line, it is recommended that the HFL is to be no less than Water surface elevation inundation depth (*Figure 7*) + 300mm as shown in *Figure 12*.

$= (79.381+0.300)_{min}$

= 79.681m

> 3 Where the design flood standard is less than $20m^3/s$, or identified as overland flow on the Flood Planning Area Map* the minimum floor level of all enclosed areas and structures, including all habitable floor areas, must be either:
>
> i) 300mm above the design flood standard level; or
>
> ii) 300mm above the highest existing ground level along the associated overland flow path; or
>
> iii) whichever is the greater, except in the case of garages, where the minimum height must be 150mm instead of 300mm, and in-ground swimming pools, which must be designed in accordance with the provisions of 24D.7 (4) of this Part
>
> *where a flood study has been completed.

Figure 12. Flood planning levels for a development over or adjacent to a natural waterbody, open channel, or drainage depression (Source- Ku-ring-gai Local Centres Development Control Plan)

4. CONCLUSIONS

This report has discussed the flood assessment conducted using HEC-RAS software for the purpose of determining flood level during a 100 ARI rain event at the property of 55 Trafalgar Avenue, Lindfield, NSW, 2070. The analysis has been conducted in accordance with Ku-ring-gai Council and other industry regulations. The following points summaries the findings:

- HEC-RAS software was used for the flood modelling
- Maximum Flood inundation depth at the existing site(pre-development) was found to be approximately **0.53m** (*Figure 6*) for 1% AEP.
- Maximum Flood inundation depth at the site for post-development scenario was found to be approximately **0.638m** *(Figure 9*) for 1% AEP**.**
- The findings of HEC-RAS model shows that the site has a creek catchment flow path running through it, as per Ku-ring-gai Council mapping.
- Results of HEC-RAS model coveys that inclusion of granny flat (post development scenario) has minimal impact to the neighbouring boundaries as there is minimal alteration in the flood inundation level.
- The report vividly shows that the proposed development will exacerbate minimal or more precisely no adverse impact on the upstream and adjoining properties and all development are set at or above the specified freeboard.

5. RECOMMENDATIONS

Since the property intersects the overland flood planning area of the Ku-ring-gai Council Mapping, J.C Engineers makes the following recommendations for the property:

- Any proposed development (habitable area) that is within the overland flow overlay is to be constructed with minimum freeboard of 300mm above 1% AEP flood level. This has been determined to be 79.681AHD.
- As the maximum velocity x depth ratio is greater than $0.6m^2/s$ before and after the development (*Figure (6 & 8) and Figure (9 & 11)),* thereby safety fencing is required to reduce hazard to persons to acceptable limits need to be installed around the development. Also, safety fencing must be able to withstand a velocity x depth ratio of $0.4m^2/s$, not impede flows or debris, and meet the minimum requirements of AS1926.1-1993: If fencing is not feasible, other suitable measures may be provided to restrict access to areas.

I trust this makes sense and please do not hesitate to contact me J.C Engineers, if needed.

J.C. Engineers Pty. Ltd.
403/89 Scarborough Street,
SOUTHPORT
QLD 4215