Platypus East Coast Pty Ltd

ABN: 31 680 871 636
246 Pacific Highway,
Crows Nest, NSW, 2065
+61 403 963 960

Jared Buncombe
Coho Property

30th January 2025

38 Stockton Street Nelson Bay DA 16-2024-581-1 RFI Flooding Response

Dear Jared,

Platypus has undertaken detailed flood modelling to provide supporting documentation to assist Coho Property in their response to RFI 16-2024-581-1 for the development of 38 Stockon Street Nelson Bay.

The RFI provided by Council is based on the best information available at the time of the DA submission, LGA wide GridFlow modelling which forms the basis of the provided Flood Planning Certificates. Platypus' detailed modelling demonstrates that the site is flood free up to and including the Probable Maximum Flood, as such according to the Port Stephens Development Control Plan; a Flood Emergency Response Plan, nor Finished Flood Level requirements are no longer applicable for the development.

Provided is a brief letter report detailing the RFI requirements, the additional modelling undertaken as well as the outcomes as according to the RFI requirements.

If any further information is required, please contact the undersigned.

Kind regards,

Sam Drysdale
NER, CPEng
Director

Introduction

Coho Property submitted a Development Application (DA) for the development of 38 Stockton Street and 8A Tomaree Street, Nelson Bay into a single mixed-use development. Based on coarse Local Government Area (LGA) wide GridFlow modelling Port Stephens Council provided Flood Certificates for the two respective properties.

To provide further detail on flood behaviour local to the proposed development, Platypus has developed a purpose-built fine resolution TUFLOW model. Outcomes of this model demonstrates the two sites are outside of the PMF extent. Validation exercises were undertaken on the model results.

This letter report contains the following Sections to address the RFI:

- Planning Requirements
    - Summary of the Response For Information provided by Port Stephens Council (16-2024-581-1) as well as relevant documentation including the Finished Flood Level Requirements of the Development Control Plan.
- Flood Model Development
    - Detailing the model build and inputs parameters.
- Flood Model Results
    - Detailing and presenting the results of the modelling including critical duration assessment and validation.
- Planning Compliance
    - Summarising the outcomes of the modelling in terms of the planning requirements.

Planning Requirements

RFI Wording

Wording of flooding related elements of RFI 16-2024-581-1:

The site is flood prone. Clause 5.21 and 5.22 of the PSLEP therefore needs to be addressed. It is requested that Flood Emergency Response Strategy be provided to satisfy clauses 5.21(2)(c) and 5.21(3)(c) of the PSLEP 2013.
Chapter B5 of the Port Stephens Development Control Plan (DCP) also needs to be addressed including the required Finished Floor Levels (FFL) in Figure BJ.

Flood Certificate Information

It is understood that the development covers two separate land parcels, both of which a flood certificate has been issued.

- 38 Stockton Street Nelson Bay (Lot 781)
    - Flood Planning Level: 23.1m AHD
    - Highest Hazard Category: High Hazard Overland Flow Path Area
    - Probable Maximum Flood Level: 22.9 m AHD
    - Current Day 1% AEP Flood Level: 22.8 m AHD
    - Adaptable Minimum Flood Level: 23.1m AHD
    - Minimum onsite Wastewater Level: 22.7 m AHD
- 8A Tomaree Street Nelson Bay (Lot 782)
    - Flood Planning Level: N/A
    - Highest Hazard Category: Minimal Risk Flood Prone Land
    - Probable Maximum Flood Level: 21.2 m AHD

As Lot 782 is not within a minimal Flood Risk Prone Land, no flood related planning controls apply. Lot 781 is identified as being within a High Hazard Overland Flow Path Area, as such planning controls apply. Given the dual use of commercial and residential, the development is not considered a sensitive or hazardous development under PSLEP Clause 5.22.

Figure BJ of the Port Stephens DCP outlines the Finished Floor Level (FFLs) requirements based on the associated levels provided within the Flood Certificates.

Figure BJ: Finished floor level

Development type	Required FFL
Sensitive and hazardous development	**Probable maximum flood (PMF)** level
Residential accommodation (including dwelling houses)	• Habitable rooms – **flood planning level** • Non-habitable rooms – **adaptable minimum floor level** • Flood refuge – **probable maximum flood** Level (see B5.15 to determine if a flood refuge is required)
Subdivision	**Flood planning level**
Farm buildings	Onsite waste water level
Commercial premises	• **Habitable rooms - flood planning level** • Non-habitable rooms - onsite waster water level
Industrial premises	• **Habitable rooms - flood planning level** • Non-habitable rooms - onsite waster water level
Garages, open car parking spaces and carports	Current day 1% **AEP** flood level
Driveways and access	Current day 1% **AEP** flood level, or the **flood immunity** of the connecting public road

Figure 1 Extracted from Port Stephens Development Control Plan 2014 (15th January 2025)

Flood Model Development

A combined hydrologic and hydraulic model was developed adopted the Rainfall-on-Grid approach within TUFLOW. TUFLOW version 2025.0.0-iSP-w64 was adopted using the Highly Parrellised Compute (HPC) engine.

Model Domain

The TUFLOW model domain was set to cover the upstream catchment area and extended to drain to the bay. A resolution of 1m was adopted, in order to capture the site-specific flow dynamics around the kerb and gutter.

Hydrological Inputs

Hydrological inputs were extracted from the Australian Rainfall and Runoff (ARR) datahub based on the rainfall area centroid (152.1429, -32.7252). The following section states the adopted configuration of the hydrological inputs.

Intensity-Frequency Duration

Intensity-Frequency Duration (IFD) data was extracted from the Bureau of Meteorology (BoM) based on the same coordinated adopted from the ARR Datahub extract (152.1429, -32.7252). The BoM 2016 IFDs were adopted.

Temporal Pattern

Due to the catchment area being below 10 km^2 and its location. The Point East Coast South Temporal Patterns were adopted.

Areal Reduction Factor

The total upstream catchment to the site is approximately 0.14 km^2. Areal Reduction Factors (ARF) apply for catchment areas greater than 1 km^2, hence no ARF was applied.

Losses

Following NSW Specific Guidance, the Probability Neutral Burst Initial Losses (PNBIL) were adopted as the Initial Loss. A factor of 0.4 was applied the Datahub continuing loss (0.84 mm/hr adopted). The PNBIL does not provide values less than the 60-minutes, as such the 60-minute Initial Loss was adopted for the shorter durations.

Probable Maximum Flood

Given the catchment location as well as short durations being critical, the BoM Generalised Short Duration Method was adopted to define the Probable Maximum Precipitation (PMP). The provided GSDM temporal pattern was adopted. The 1% AEP losses were adopted in lieu of provided losses for rarer events. Adopted parameterisation is presented in TABLE 1.

TABLE 1 GSDM PMP Parametrization

Parameter	Adopted Value
Catchment Area	1 km^2
Elevation Adjustment Factor (EAF)	1
Moisture Adjustment Factor (MAF)	0.74
Roughness (R)	1

Model Topography

Topography across the model was based on the December 2012 LiDAR dataset of the Port Stephens region. The adopted LiDAR has a 1m resolution, matching that of the TUFLOW model. This LiDAR metadata states an accuracy of 0.3m in vertical, and 0.8m in horizontal.

Local to the site, the survey undertaken by North Point Surveys on 31/5/2023 was georeferenced and a surface imprinted onto the model (ref: 38093 TS3). Finer detail from the survey was enforced in the model including;

- Raised concrete islands on Stockton Road acting as a flow obstruction.
- Enforcing flow continuity of the gutter from Tomaree Street, down onto Stockton Street.
- Enforcing the footpath and kerb heights around the edge of the lots.

Hydraulic Roughness

Hydraulic roughness across the model was set based on aerial imagery and lot parcels extracted from Clip and Ship for the Port Stephens LGA. Impervious ratios were applied to each hydraulic category to account for appropriate application of hydrologic losses. A high hydraulic roughness was adopted within developed lots to account for the flow obstruction of buildings and fences.

Applied categories and associated hydraulic roughness and impervious ration values are presented in TABLE 2.

TABLE 2 Hydraulic Roughness Categories

Category	Adopted Value	Impervious Ratio (%)
Low Density Residential (with Buildings)	0.080	75
High Density Development (with Buildings)	0.100	90
Car Parks	0.020	90
Road Reserves	0.025	80
Undeveloped / Vacant Lots	0.035	0
High Density Vegetation	0.080	0

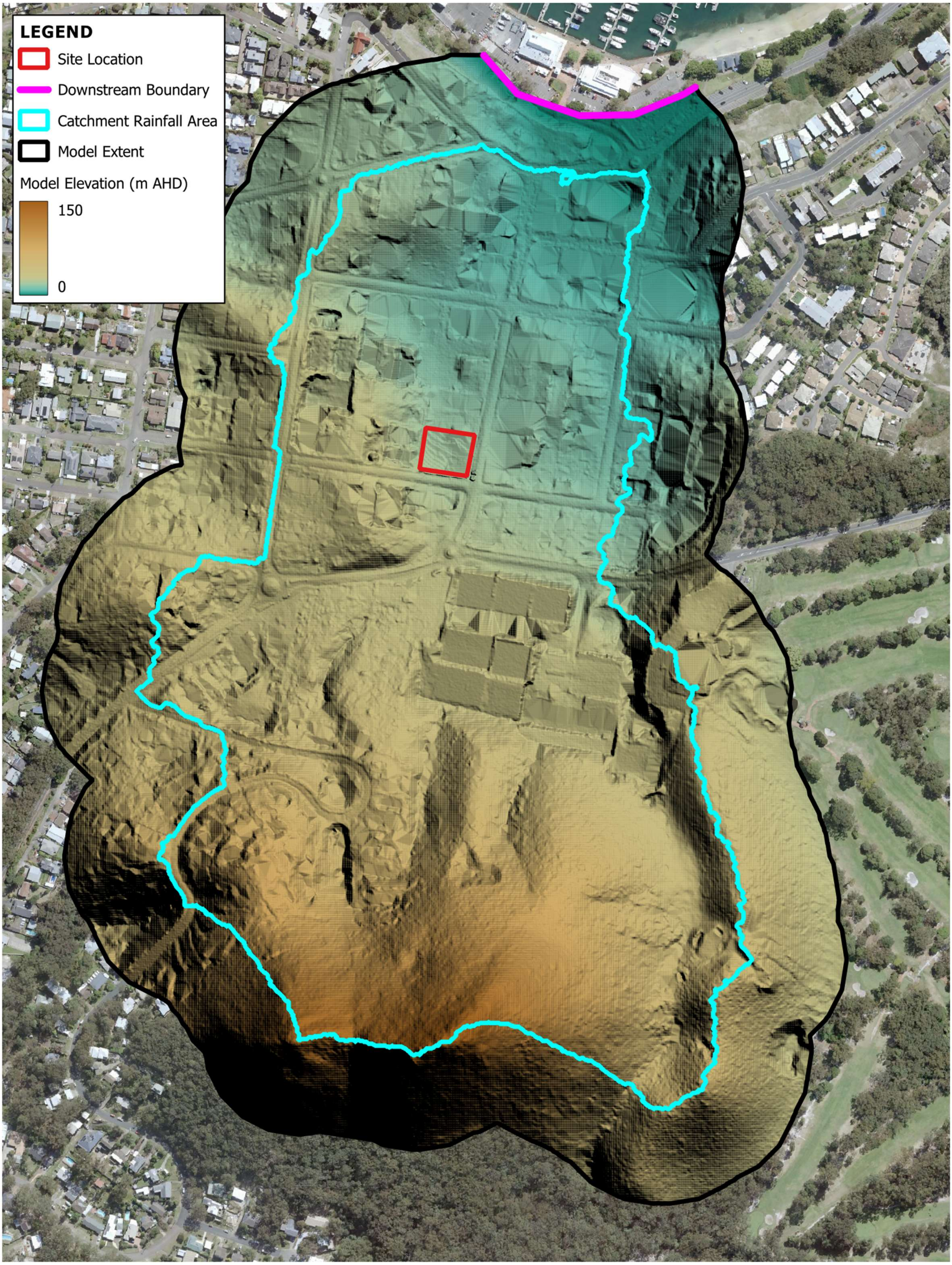
Downstream Boundaries

A fixed Head-Time boundary was set within the bay. Due to the bay being significantly lower than that of the site, the outcomes of the modelling were insensitive to the adopted boundary. A conservative water level of 1.5m AHD was adopted across all events.

Result Filtering

Due to a Rainfall-on-Grid approach being adopted, filtering of results was required. The following filtering was undertaken to remove erroneous shallow depths within the model whilst maintaining continuity within flow paths:

- Peak Flood Depth less than 0.10m were removed.
- Peak Velocity Depth product greater than 0.15 m^2/s were reinstated.
- Flood Islands less than 100 m^2 were removed,



Title:

Model Topography and Rainfall Area

Figure Number: 2

Revision Number: 1

This figure and the information it contains is subject to the same limitations as the accompanying documentation.

Title:
Model Hydraulic Roughness Categories

Figure Number: 3

Revision Number: 1

This figure and the information it contains is subject to the same limitations as the accompanying documentation.

Flood Model Results

Critical Durations

Critical durations were identified based on the following process:

- All 10 temporal patterns were simulated for durations up to the 60-minute.
- Each duration was statistically assessed on a cell-by-cell basis to identify the median value of the 10 temporal patterns for each duration.
- The maximum of the medians was then identified on a cell-by-cell basis.
- The maximum temporal pattern/duration combination was then identified in the flow path adjacent to the site.

For the PMF, only a single temporal pattern for each duration was simulated, as per the GSDM procedure. TABLE 3 presents the identified critical durations for each of the simulated events.

TABLE 3 Critical Duration Selection

Event	Duration	Temporal Pattern
5% AEP	15-minute	TP 05 (4421)
1% AEP	15-minute	TP 08 (4401)
PMF	15-minute	GSDM

Validation

As a validation, the peak flow of the 5% and 1% AEP events have been cross checked against the Rational Method. TABLE 4 presents the Rational Method parameters and differences with that of the TUFLOW model peak flow. The time of concentration was adopted as the critical duration from the TUFLOW model. As a validation, the Rational Method and TUFLOW model have close alignment.

TABLE 4 Rational Method Peak Flow Validation

Parameter	Value	Parameter	
Runoff Coefficient C_{20}	0.65	Runoff Coefficient C_{100}	0.65
5% AEP 15 min Rainfall Intensity	159.2 mm/hr	1% AEP 15 min Rainfall Intensity	227.2 mm/hr
Area	14 Hectares	Area	14 Hectares
Rational Method Flow	3.1 m^3/s	Rational Method Flow	4.4 m^3/s
TUFLOW Simulated Flow	2.8 m^3/s	TUFLOW Simulated Flow	4.1 m^3/s

Flood Extents

Flood extents for the 5% and 1% AEP events as well as the Probable Maximum Flood (PMF) are presented in Figure 4, Figure 5 and Figure 6 respectively.

Title:

Peak Flood Depth and Water Level Contours
5% AEP Event

Figure Number:	Revision Number:
4	1

This figure and the information it contains is subject to the same limitations as the accompanying documentation.

Title:

Peak Flood Depth and Water Level Contours 1% AEP Event

0 8 16 24 32 m

Figure Number: 5

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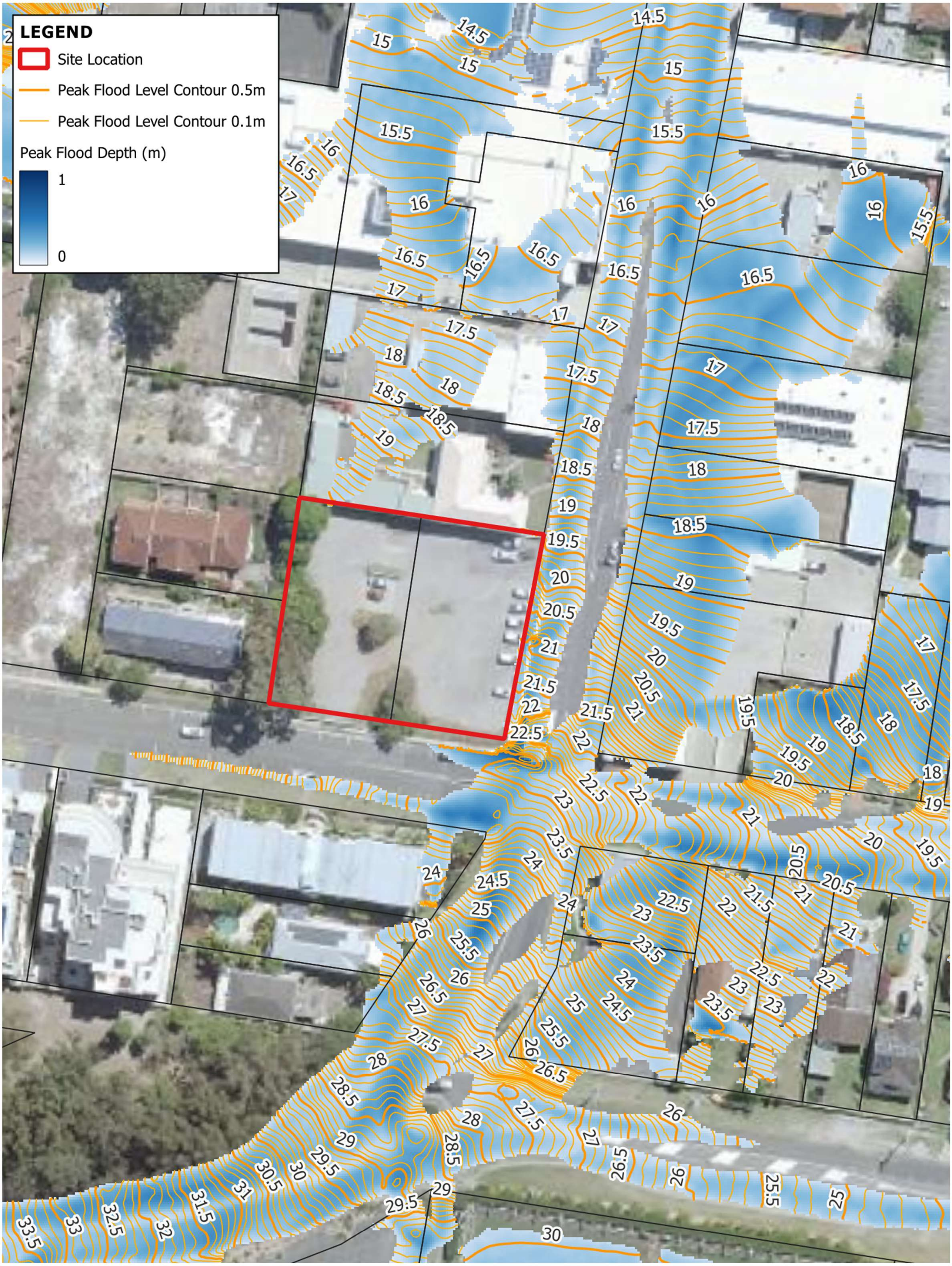

Title:

Peak Flood Depth and Water Level Contours
Probable Maximum Flood

0 8 16 24 32 m

Figure Number: 6

Revision Number: 1

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Planning Compliance

Flood Emergency Response Strategy

The RFI requirement of the Flood Emergency Response Strategy (FERS) is based on both lots being within the PMF extent. A FERS is typically separated into two sections, first based on Prevention and Preparedness, and the second being the Response during an event.

For a FERS, there are several key factors that contribute to the development of the strategy:

- Flood Risk – What the risk and hazard of being onsite during a flood events?
- Warning Time – Is there sufficient warning time to allow for evacuation?
- Evacuation Routes – Is there a safe evacuation route to a suitable refuge?
- Land Use – Are there any specifics of the property which affects the need to evacuate?

As demonstrated within the outcomes of the modelling, both lots are simulated to be outside of the PMF extent in the purpose built TUFLOW model. Given there is no presented risk requiring mitigation, no Prevention and Preparation is required, nor is a Response during an event.

Building Finished Floor Levels

The Port Stephens Development Control Plan Section B5.A states, contains the objective; *To ensure flood risk is considered as early as possible in the planning and development process, based on the best available flood information.* At the time of the RFI the Flood Certificate was based on the best available information at the time.

This site-specific flood modelling supports a differing outcome form the Flood Certificate, with no flood risk to the property. As such no development controls would be required as per Figure BI of the DCP.

Figure BI: Suitable land uses by flood hazard category (as identified on a flood certificate)

Development suitability	Flood Hazard Categories (as identified on a flood certificate)	Minimal Risk Flood Prone Land	Low Hazard Flood Fringe	High Hazard Flood Fringe	Low Hazard Flood Storage	High Hazard Flood Storage	Low Hazard Overland Flow Path	High Hazard Overland Flow Path	Low Hazard Floodway	High hazard Floodway
Sensitive and hazardous development		S	U	U	U	U	U	U	U	U
Residential accommodation (other than a dwelling house)		NA	S	S	S	S	S	S	U	U
Residential subdivision		NA	S	S	S	S	S	S	U	U
Dwelling house		NA	S	S	S	S	S	S	U	U
Farm buildings		NA	S	S	S	S	S	S	S	S
Fill		NA	S	S	S	S	S	S	S	S
Non-residential subdivision		NA	S	S	S	S	S	S	U	U
All other development		NA	S	S	S	S	S	S	U	U

Key	
U	Unsuitable land use on flood prone land
NA	Suitable, no applicable development controls
S	Suitable, subject to development controls

Figure 7 Extracted from Port Stephens Development Control Plan 2014 (15th January 2025)

Proposed Finished Floor Levels (FFL) for commercial suites C.01 and C.03 are 22.585 m AHD. Suite C.02 proposed FFLs are 21.585 and 21.345 m AHD. Residential and Common Area have a proposed FFL of 22.585 m AHD. All residential areas are contained away from any flood extent as such there is no risk of ingress from overland flow paths.

The commercial footprints of C.01 and C.02 run parallel to the flow path down Stockton Street. Water levels along this flow path follow the grade of Stockton Street. Suite C.02 is located where the closest peak flood level within the 1% AEP extent is a minimum of 0.5m below the proposed FFL.

For Suite C.01, a peak flood level of 21.6m AHD is simulated at the highest point of the flow path parallel to the suite. It should be noted that there is a raise in the footpath with a level of 21.695m AHD which prevent ingress from occurring at this location, as demonstrated within Figure 5 with no ingress under 1% AEP conditions into the property.

As such, while the requirements for Finished Flood Levels according to the DCP no longer being applicable, all locations onsite are simulated to not have ingress in events up to and including the 1% AEP.