

Ref: 2021791

13 October 2016

Meriton Group
Level 11, 528 Kent St
Sydney NSW 2000

Attn: Mr Tim Franzen

Re: 2 Macpherson Street, Warriewood Flood Assessment Report

Dear Tim,

Bonacci Group (NSW) has been engaged by Meriton group to provide advice with regard to the flood affectation of the subject site. We have reviewed relevant documents including correspondence from Northern Beaches Council, Narrabeen Lagoon Flood Study (BMT WBM September 2013), Cardno modelling and the site survey plan.

1.0 Site Location

The site is located at 2 Macpherson Street, Warriewood in the Northern Beaches Local Government Area (formerly Pittwater Council) as indicated in Figure 1 below.

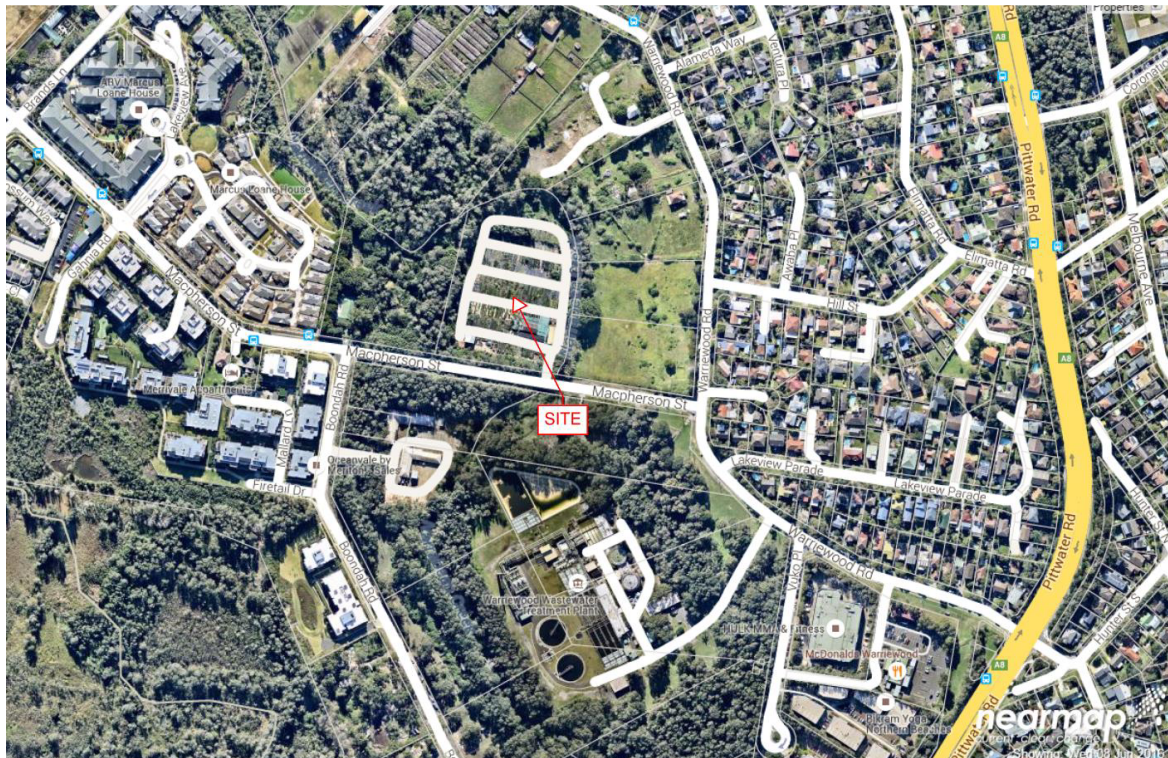


Figure 1: Locality Plan (Source: Nearmap)

The site is bounded by Narrabeen Creek to the north and east, Macpherson Street to the south and number 4 Macpherson Street to the west (which contains a residential dwelling).

2.0 Flood Affection

Flood modeling by Cardno Pty Ltd has demonstrated that the site flood level is RL 3.78m (1% AEP with Climate Change) downstream of Macpherson Street.

This corresponds to advice from Council (dated 20 June 2016, reference 2016/193570) stating that the Flood Planning Level (with climate change) for the site is RL 4.29m AHD. Given that the flood planning level is generally the 1% Average Exceedance Probability (100 Year Average Recurrence Interval) flood level with 0.5m freeboard, the assumed corresponding flood level for the site is RL 3.79m.

The Narrabeen Lagoon Flood Study shows that a minor portion of the site is subject to high flood hazard (refer Figure 2 below). The high flood hazard area is confined to the outer limits of the site – as this area is the floodway (including Narrabeen Creek), it will be excluded from development. This area will be maintained as floodway (to the extent that the Council upgrade to Macpherson Street allows), and it is anticipated that rehabilitation of the creek/floodway will be possible with redevelopment of the site as Council is also undertaking creek works with the current Macpherson Street bridge project. The majority of the site is low flood hazard.



Figure 2: Flood Hazard Extract (From Narrabeen Lagoon Flood Study,[Map A28] BMT WBM 2013)

3.0 Proposed Development

The development of the site will take into account the flood affection of the site. Given that the majority of the site is Low Flood Hazard (as evidenced in the Narrabeen Lagoon Flood Study, 2013), development of the site will be confined to those Low Flood Hazard areas to connect the site to the Macpherson Street upgrade and the associated Narrabeen Creek works. The only works outside this Low Flood Hazard Area are being undertaken as part of the Macpherson Street upgrade, which provides access to the site from the new road level (which is approximately 2.2m higher than the existing road level at the site entrance).

The majority of the site is identified as flood fringe (refer Figure 3 below) in the Narrabeen Lagoon Flood Study (BMT WBM November 2014). Filling of these areas is required to ensure that the habitable floor levels of proposed buildings are at (or above) the flood planning level. The filling of these areas is in keeping with the Council upgrade to Macpherson Street (which will see the road level raised by approximately 2.2 m). In contrast, the filling of the site to provide habitable floor

levels at the flood planning level is limited to approximately 1m. As noted in the Narrabeen Lagoon Flood Study, “filling of these areas generally has little consequence to overall flood behavior”. Filling will be minimized, and will have less impact than the filling of the high hazard/floodway/storage area which is proposed as part of the Macpherson Street upgrade.

Cardno modeling demonstrated that the proposed development results in a flood level (1% AEP with Climate Change) of RL 3.8m. Cardno has modeled the impact of the proposed filling for the development, and concluded that the filling does not cause an actionable impact to flood levels. As noted by Cardno, provision of offsetting excavation does not provide demonstrable benefit for the flood level greater than the 1% AEP – and may cause harm to sensitive flora/fauna if required. Provision of 5400m³ of cut provides a net gain in flood storage (1% AEP with Climate Change) of approximately 740m³.

The provision of the upgrade to Macpherson Street (which consists of a bridge, culvert and raised road alignment) will provide access to the site during a 1% AEP (100 year) flood event. The provision of a flood management plan will be required for the development – the road upgrade will allow an evacuation route from the site in the event storms up to and including the 1% AEP flood event. Shelter in place can be adopted for storm events that exceed this.

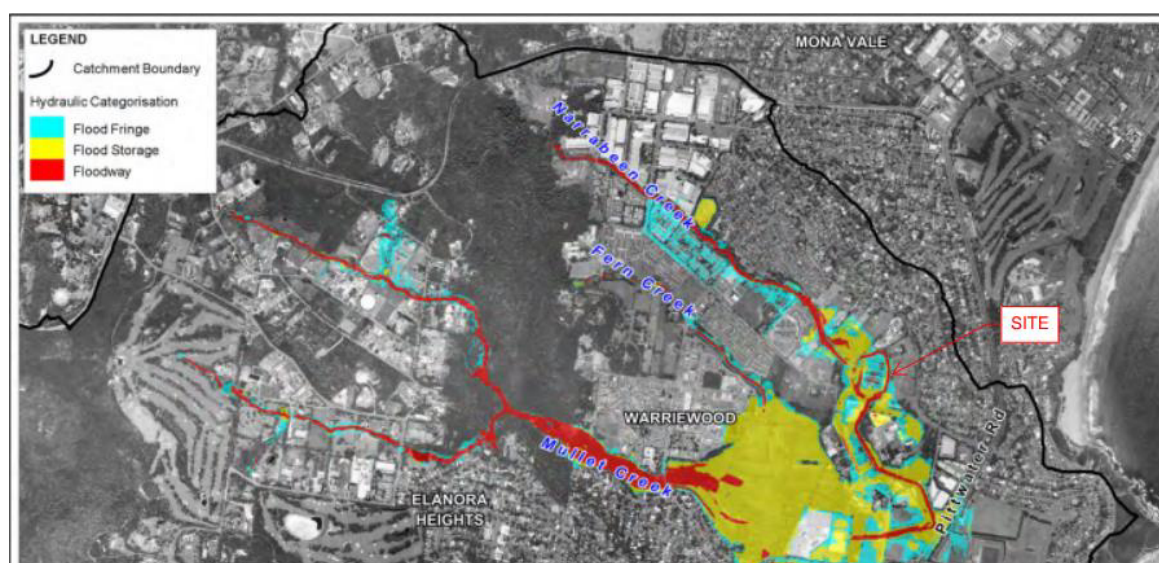


Figure 3: Hydraulic Categories Extract (From Narrabeen Lagoon Flood Study,[Map A24] BMT WBM 2013)

It is expected that a riparian zone, consisting of the existing trees that are to be retained (where they are deemed to be suitable by the arborist – we refer to the previous Arboricultural Assessment Report by TALC November 2014) and new landscaping planting, will be provided. The riparian zone could also provide habitat for flora and fauna (there is the opportunity for restoration of the riparian zone during redevelopment of the site). The riparian zone will also incorporate appropriate Water Sensitive Urban Design measures to ensure that water quality requirements (as detailed in the Warriewood Valley Water Management Specification) are met.

The Flora and Fauna assessment completed by Total Earth Care (referenceC3798-KC), November 2014, considers that the remnant vegetation to the north and south west of the site is of high conservation value. The restrictions to development imposed by flood affectation mean that these areas will be part of the buffer to the flood water level, ensuring that there is the opportunity to conserve and improve the habitat in these locations. The required in-bank works should be further developed with regard to the flooding requirements (provision of off-setting excavation),

conservation of remnant vegetation and provision of water sensitive urban design elements and stormwater devices.

Refer to the attachment, Bonacci Preliminary Development Plan Sketch SK02, for a developable area layout.

This plan demonstrates the site developable area, taking into consideration key issues including flooding, riparian zone, asset protection zone and flora & fauna.

The riparian zone is taken to be 20m from the top of the creek bank (in accordance with NSW Department of Primary Industries:Water definition). It is noted that other uses may occur in this zone, provided that the average width of the vegetated riparian zone is achieved over the length of watercourse through the site (an equivalent fully vegetated area connected to the riparian zone must be provided). The option to encroach on the riparian zone (to provide asset protection zones or other uses) may be considered during detail design – but any such encroachment will meet the offset requirements specified by the NSW Office of Water. The plan also demonstrates there is provision for the 25m dedication under Councils current Draft Section 94 Plan and required Asset Protection Zones.

The filling to the developable area of 2 Macpherson Street, to meet the freeboard requirements of RL 4.29m, will be approximately 4700m³. Given that the proposed development of 2 Macpherson Street will not involve restricting any waterways or filling of any floodway/flood storage (except where connection to the reconstructed road requires it), it can be reasonably assumed that a similar or lesser impact on flood levels to that arising from the road reconstruction would result. Modeling completed by Cardno has verified this, with flood levels increasing by less than an actionable impact level (20mm is noted as the maximum afflux).

The road reconstruction project notes that impacts to flood levels resulting from the works would be limited to 20mm or less – which is the requirement to demonstrate no adverse affect. It can be similarly assumed that the development of 2 Macpherson Street would have no adverse impact on flood levels (not only due to the conclusion of flood impact assessment of the Macpherson Street upgrade, but also due to the statement in the Narrabeen Lagoon Flood Study).

3.0 Flood Evacuation

The provision of the upgraded road access to Macpherson Street ensures that site access is maintained to all storm events up to and including the 1% AEP event (the 100 year ARI event). This will provide a flood evacuation route if required for all storms up to and including the 1% AEP event.

In the event of a larger storm, or if it is impractical to evacuate by road in a storm event (due to wind, debris, rainfall intensity or other factors), it is expected that shelter in place could be adopted (as the site is unlikely to be isolated for unacceptable periods of time).

4.0 Conclusion

Whilst flood affected, the site could be redeveloped as demonstrated in the Concept Plan Sketch SK02. This plan demonstrates provision of a riparian zone, provision of habitable floor levels at or above the flood planning level, provision of an asset protection zone and minimising filling on the site (including prevention of any filling to the floodway to the north, west and east of the site).

A water management plan (in accordance with Warriewood Valley Water Management Specification) will need to be developed during the development submission, however the provision of the required water sensitive urban design measures has been.

With regard to flood affectation, the Cardno modeling demonstrates that the site is capable of being developed – it shows that the filling of site to provide floor levels above the flood planning level does not result in adverse affects on upstream or downstream properties, nor on flood levels.

Given the additional Flood modelling by Cardno and giving consideration to other key site issues (including bushfire, flora and fauna), we do not believe that there are any development constraints that can't be overcome with appropriate planning and design.

Yours Sincerely

For Bonacci Group (NSW) Pty Ltd



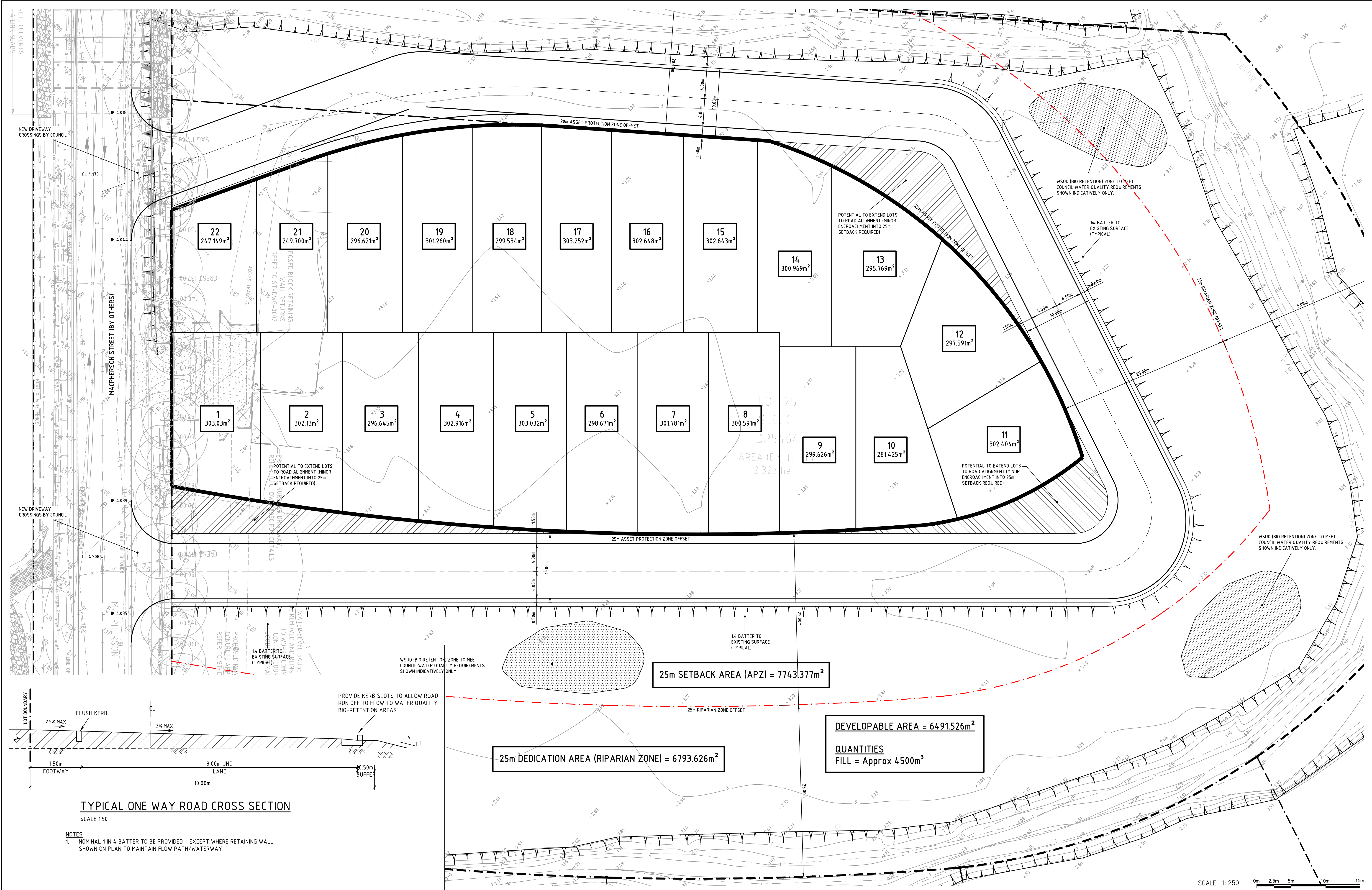
Stephen Naughton MIEAust
Associate Director



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Director

Enc. Cadrno Flood Study Map
 Bonacci Sketch 2021791-01C-SK02 – Site Redevelopment Concept Plan

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Rev	Description	Date	By App
P2	COUNCIL SUBMISSION	18.10.16	JF -
P1	PRELIMINARY ISSUE	26.08.16	JF -

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Project Name
**2 MACPHERSON STREET,
WARRIWOOD, NSW 2102**

Drawing Title
**SITE REDEVELOPMENT
CONCEPT PLAN
ONE-WAY ROAD**

PRELIMINARY			
Designed	JF	Project Director Approved	Date
Drawn	JF		North
Scale	1:250	Project Ref	Drawing No
Date	AUG 2016		Rev
Sheet	A1	20 21791 01	SK02 P2