

Ref: NL203697-00-FL-LE01-1

17 April 2025

David Hunter

Habitat Planning  
409 Kiewa St  
Albury NSW 2640

Dear David,

**Re: DA24/0075 Civitas Stage 3 – Response to RFI**

We have received and reviewed the RFI request from Wagga Wagga City Council dated 21 February 2025 and associated email to Manuel Donebus from Steven Cook. This has been reproduced along with our responses below in Table 1 Table 2 and Table 2.

*Table 1 – RFI response*

Item	Response
1. An updated Flood Impact Assessment addressing the matters set out in Council's email to Manuel Donebus dated 21/2/25.	A response to this email is provided in Table 2 below.
2. Details of a survey of all properties impacted by increased flooding establishing the floor levels of these properties. These floor levels shall then be used to ascertain whether the increase in flooding results in new above floor level inundation or increased above floor inundation.	Floor level data was provided by Council on the 21 <sup>st</sup> October 2022 and has been used to assess the impact of flood levels relative to the existing floor level.  Figure E 1, Figure E 2, and Figure E 3 showing this assessment are presented in the Attachments.  There are no new instances of "over-floor" flooding based on this data.
3. In the event that the results of the survey shows that the development results in new, or increased above floor inundation of any one of these properties, measures to reduce flooding impacts to no greater than 10mm.	We have always understood that whilst 10mm impact was the target, Council was willing to accept increases less than 20mm which has been demonstrated.

Table 2 – Email response

Item	Response
<p>i. We are concerned with the less than definitive form of language that is used throughout the report, as it consistently uses words like “is not expected to”, “are likely affected”, etc, etc. Northrop needs to be more definitive in their statements relating to the impact that the proposed development would have on flood behaviour and also how the residual flood risk associated with the proposed development is going to be managed (specific examples are contained in the points below). It is difficult for Council to undertake an assessment and rely on a report where the supporting documentation does not appear to be entirely certain what exactly the impacts are and how the residual flood risks associated with the project will be safely managed.</p>	<p>The language used in the report is representative of the fact that modelling approximates reality and does not guarantee an outcome.</p> <p>Language will be amended in the final report to remove “expected to” and “likely affected” to clearly outline our opinion.</p>
<p>ii. The proposed development would still increase peak flood levels by greater than 10 mm in existing development that lies to its east. The attached pdf provides a comparison of the impacts that the proposed Stage 3 development would have on floods with AEPs of 10%, 5% and 1% as documented in Revisions A and B of the report. The following statements that Northrop makes in relation to the nature of these impacts in the adjacent development are not satisfactory in this regard:</p> <p>a. <i>“We do not believe this increase is significant in the minor flood events, as these properties are likely affected already by floodwater in these events, by depths of up to 500 mm.”</i> (pg 18, 3<sup>rd</sup> para).</p> <p>b. <i>“As illustrated within the model, the proposed development is not expected to significantly impact other properties within the surrounding area. A cumulative impact assessment has not been undertaken as other similar development</i></p>	<p>Council asserts that typically, major infrastructure projects have a threshold of 10mm for increases in the peak flood level.</p> <p>We acknowledge the flood level is increased in the adjacent properties by more than 10mm in the 10% and 5% AEP flood events.</p> <p>An extract from Austroads is provided in Figure 1 of the Attachments and notes the acceptable impacts for major infrastructure is up to 25mm for residential buildings. As such, the impacts from the development in each of the events modelled are within the threshold.</p> <p>An assessment relative to “over floor” flooding has been undertaken and is presented in Figure E 1, Figure E 2, and Figure E 3 of the Attachments. This demonstrates there are no new instances of “over floor” flooding, as a result of these increases in the events modelled.</p> <p>Council asserts the impacts would also be similar in more frequent events and the dwellings would experience more frequent over floor inundation.</p>

Item	Response
<p><i>would need to undertake the same impact assessment and be similarly sympathetic to the existing flood behaviour.”</i> (pg19, response to LEP subclause 5.21(c)).</p> <p>As the proposed development reduces the available flood storage in what is effectively a trapped low point, it will have an impact on depths of inundation that are experienced in the adjacent properties once surcharge of the existing stormwater drainage system occurs (i.e. during storms more frequent than those that have been assessed by Northrop). As a result, it can be argued that the proposed development will not only increase the depth of above-floor inundation in these properties for the more frequent events, but also the frequency that they experience above-floor inundation. While the increase in depths of inundation are relatively minor in nature, we are not satisfied that it can be labelled “insignificant” given its broad nature, noting that major infrastructure projects in NSW typically require no greater than 10 mm increase in peak flood levels where above-floor inundation of existing development is currently present, or would result from the project.</p>	<p>Northrop has requested these more frequent events be provided by Council for us to test this hypothesis, and we are yet to receive this data.</p> <p>We agree the impacts are relatively minor and, on this basis, believe the impacts satisfy the definition of not significantly adverse – particularly due to the existing flood conditions</p>
<p>iii. The Rev B report shows the impact of the proposed development during a 5% AEP storm event will be much broader than was documented in Rev A of the report (refer attached pdf).</p>	<p>This is noted and the modelling changed between these revisions which resulted in a change in results.</p>
<p>iv. The report advocates a shelter-in-place approach to managing the residual flood risk in the proposed development but does not specifically address its nature or how it will be managed, both in terms of local catchment <u>and</u> riverine flooding. The only reference to the PMF from a shelter-in-place perspective is set out on pg 21 in response to sub-clause 5.22(a) of the LEP, which states:</p>	<p>An extract from the Wagga Wagga City Local Flood Emergency Sub-Plan (2021) is presented in Figure 2 of the attachments.</p> <p>This notes significant warning time of approximately 20 hours in a riverine flooding mechanism. We believe this is sufficient warning time for an evacuation.</p>

Item	Response
<p><i>“Due to the typology of the development refuge is expected to be available on-site above the PMF”</i></p> <p>In order for Council to assess the development against the requirements of the WWLEP 2010, a more thorough and definitive assessment needs to be undertaken in this regard. This would require a knowledge of peak PMF levels at the site (both local catchment and riverine), the rate of rate of floodwater and the available warning time. Consideration should also be given regarding how people will be prevented from accessing the carpark basement areas during more extreme flood events.</p>	<p>Local flooding is likely to peak quickly from local rainfall making shelter in place an appropriate option of last resort.</p> <p>Triggers for action for both mechanisms can be specified, and we welcome a condition of consent to prepare a Flood Emergency Response Plan to this effect.</p>
<p>v. Northrop modelled the driveway leading to the townhouse garages at an elevation of RL 191.0 m AHD and concluded that in a 1% AEP flood event conditions on the driveway would be H1, which would permit vehicular evacuation if required. However, the architectural drawings show minimum driveway levels of RL 178.8 m AHD which would indicate that H2 conditions would be present on the driveway. Clarification on this point is required.</p>	<p>The driveway elevation has been modelled at 179.1m AHD as a worst-case scenario for impact.</p> <p>A minimum level of 178.8m AHD would mean there is a small section of H2.</p> <p>We do not believe evacuation would be ordered at the peak of a flood event, and this is unlikely to affect the emergency response for the development.</p>
<p>vi. There is an increase in the severity of flooding in the rear of No 74 Morgan Street, whereby the area affected by H3 type flooding conditions increases from 235 m<sup>2</sup> to 260 m<sup>2</sup> (pg18 second para). Northrop makes the following statement in relation to this increase:</p> <p><i>“However, given this area is already impacted by H3 flows, this is not expected to have significant adverse effects, with residents expected to avoid this area in major rainfall events”</i></p> <p>Again, this language needs to be more definitive.</p>	<p>An increase of 25m<sup>2</sup> in H3 hazard has no practical impact on flood behaviour.</p>

We trust this is what you require. Should you have any queries please feel free to contact the undersigned on (02) 4943 1777.

Yours faithfully,

A handwritten signature in black ink, appearing to read "Angus Brien". The signature is fluid and cursive, with a distinct dot over the 'i'.

**Angus Brien**  
Principal | Senior Flood Engineer

On behalf of Northrop Consulting Engineers Pty Ltd

### **Limitation Statement**

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## Attachments

**Table 6.19: Acceptable impacts for major transport infrastructure**

	<b>Residential buildings (mm)*</b>	<b>Residential yards (mm)</b>	<b>Industrial and Commercial buildings (mm)</b>	<b>Industrial and commercial yard (mm)</b>	<b>Non habitable structures (sheds)</b>	<b>Agricultural (mm)**</b>	<b>Open Space/ Forest (mm)***</b>
<b>Flood Levels</b>	25 (general) 10-20 (sensitive receivers including hospitals, schools and critical infrastructure)	50	50	100	100	200-400	400
<b>Change in duration of inundation</b>	No more than the larger of 10% of the existing duration of inundation or 1hr whichever is largest for durations over 2hrs						
<b>Flow distribution</b>	No more than 10% change						
<b>Velocities</b>	Velocity increases to keep velocities less than 1m/s or if existing >1m/s than no more than 10% change						
<b>Events to be considered</b>	5% AEP and 1% AEP as a minimum 20% AEP or smaller for agricultural land The 0.05% or PMF should be used to check for extreme changes in flood behaviour but not for acceptable impacts Tunnel portal events to be considered depends on design criteria						

*Figure 1: Extract from Guide to Road Design Part 5: Drainage - General and Hydrology Considerations*

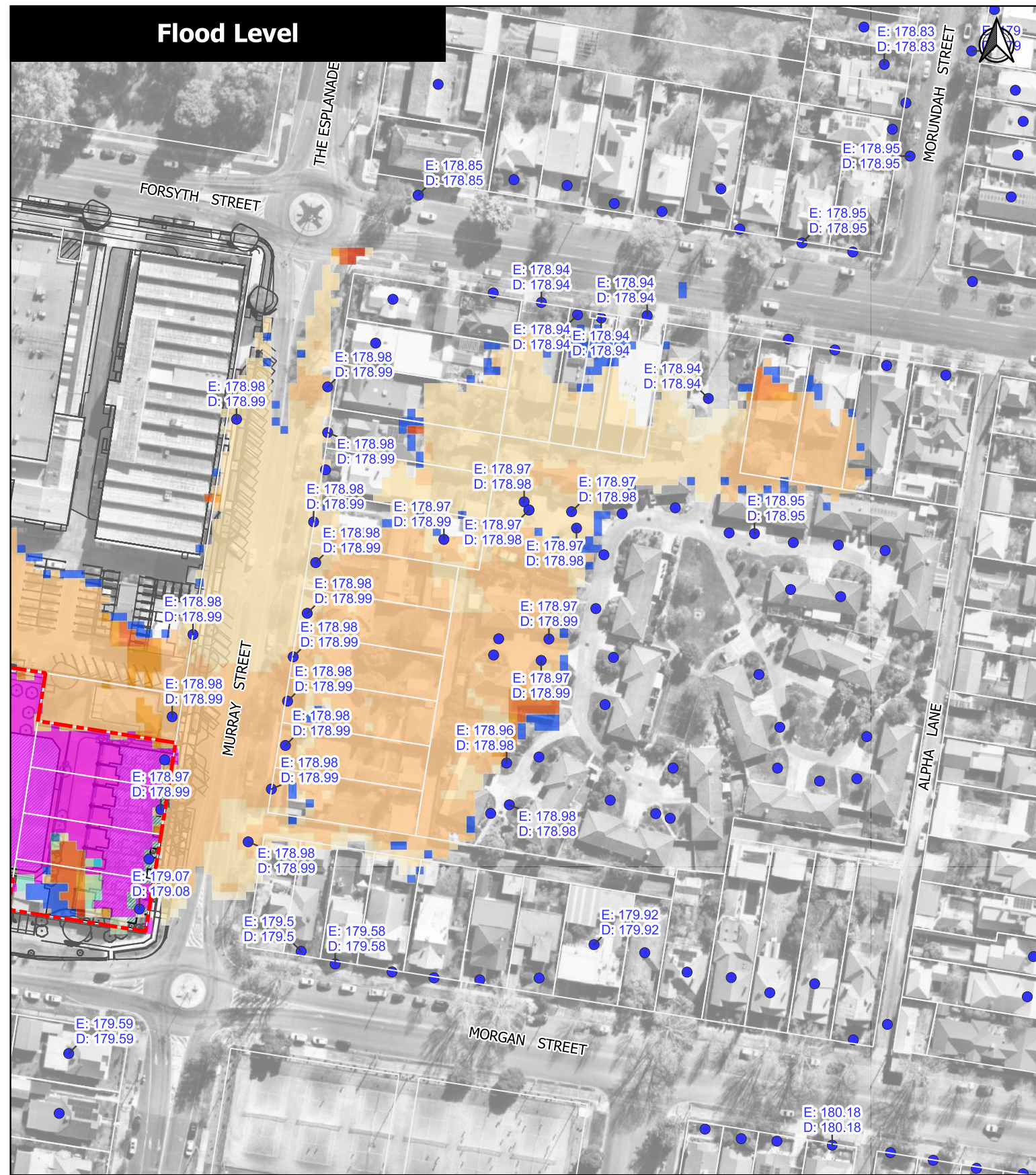
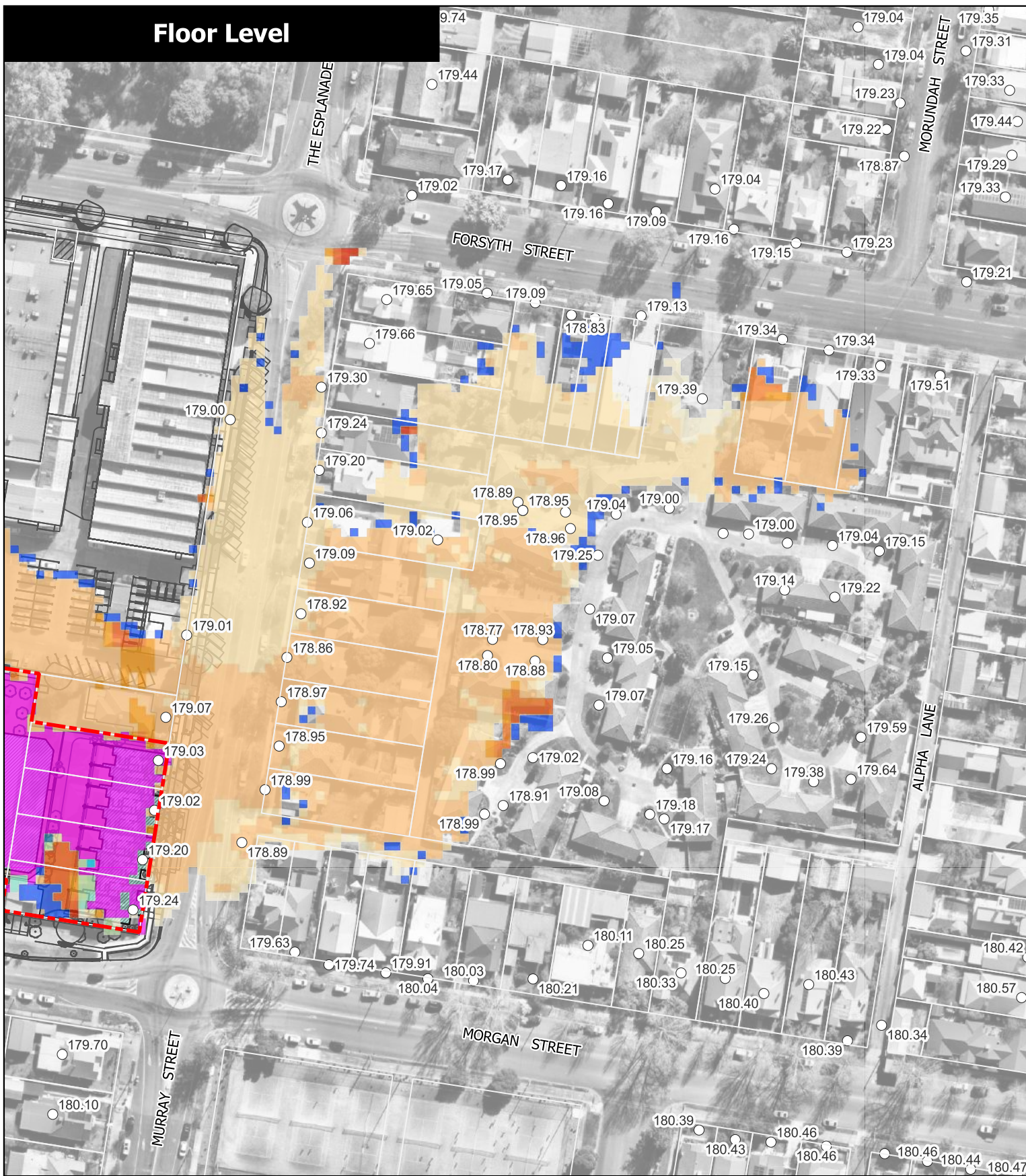
At Wagga Wagga, the rate of rise of floods can vary significantly between events, although is generally slow and delayed, but can be up to 30cm per hour in large events.

**Table 5: Indicative flow travel time for the Murrumbidgee River<sup>[9]</sup>**

Locations	Travel Time
Burrinjuck Dam to Wagga Wagga	42-72 hours
Tumut to Wagga Wagga	33-61 hours
Gundagai to Wagga Wagga	19-52 hours
Wagga Wagga to Narrandera	3.5-5 days

During extreme floods, a minimum of 20 hours of warning time should be available.

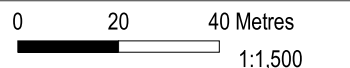
*Figure 2: Extract from Wagga Wagga City Local Flood Emergency Sub-Plan (2021)*



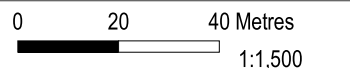
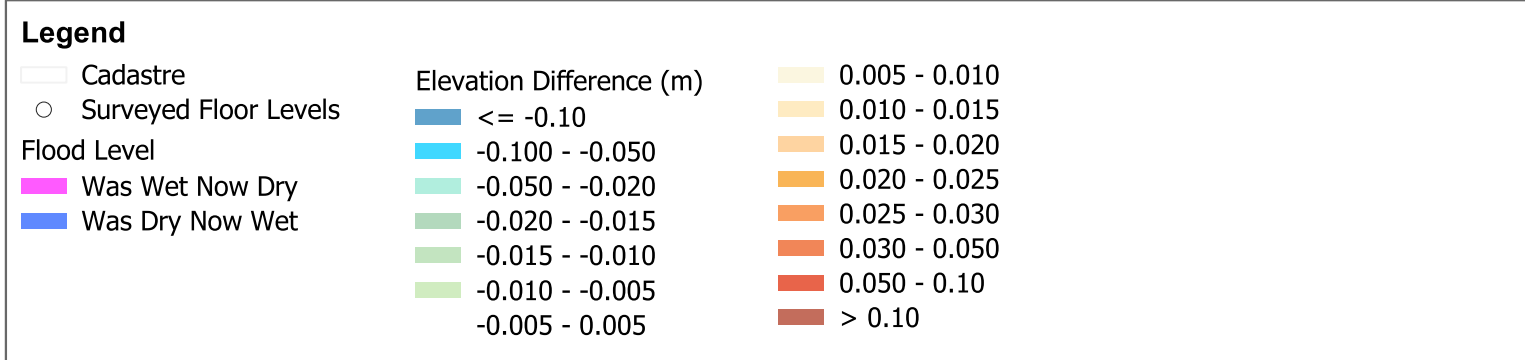
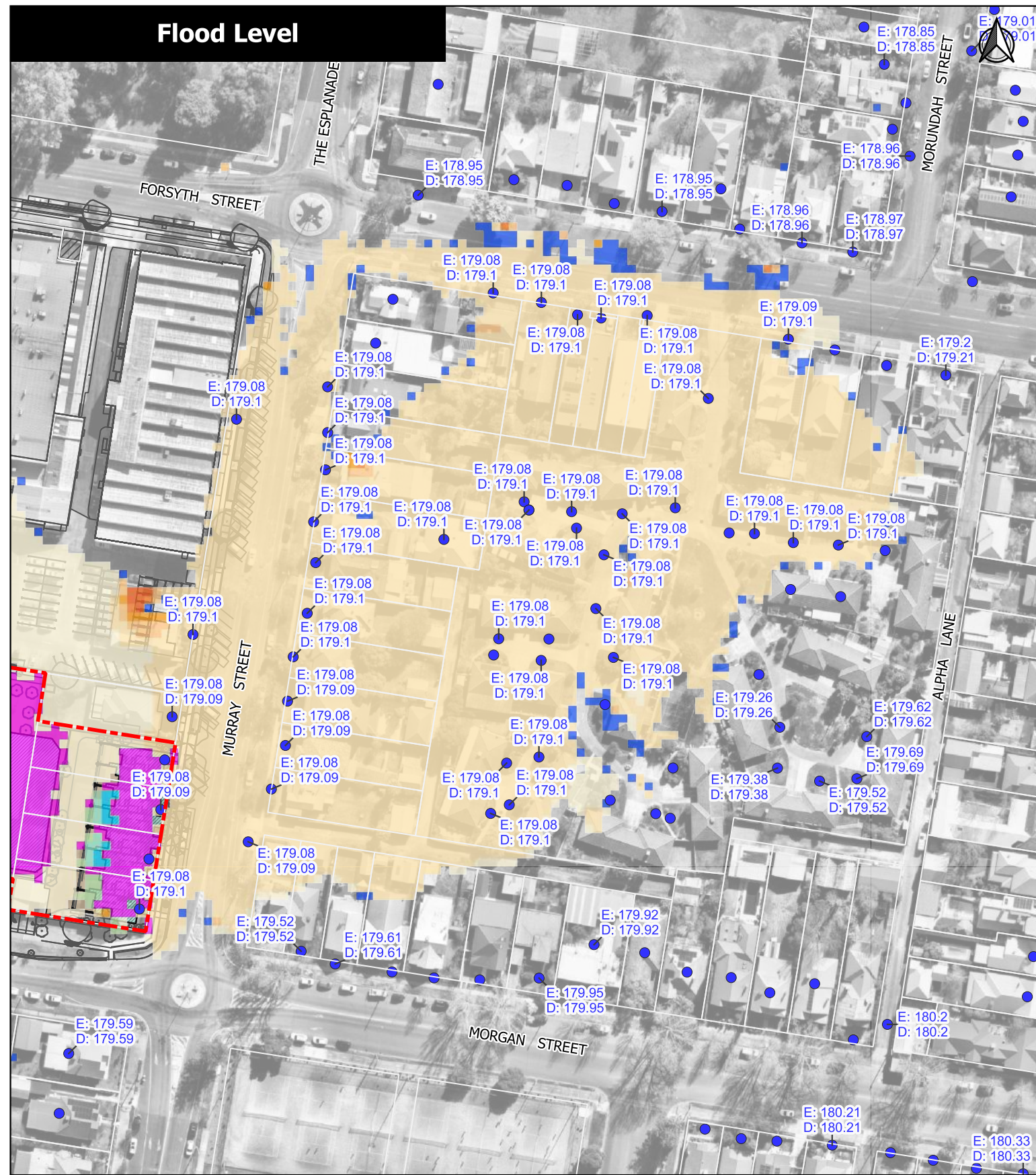
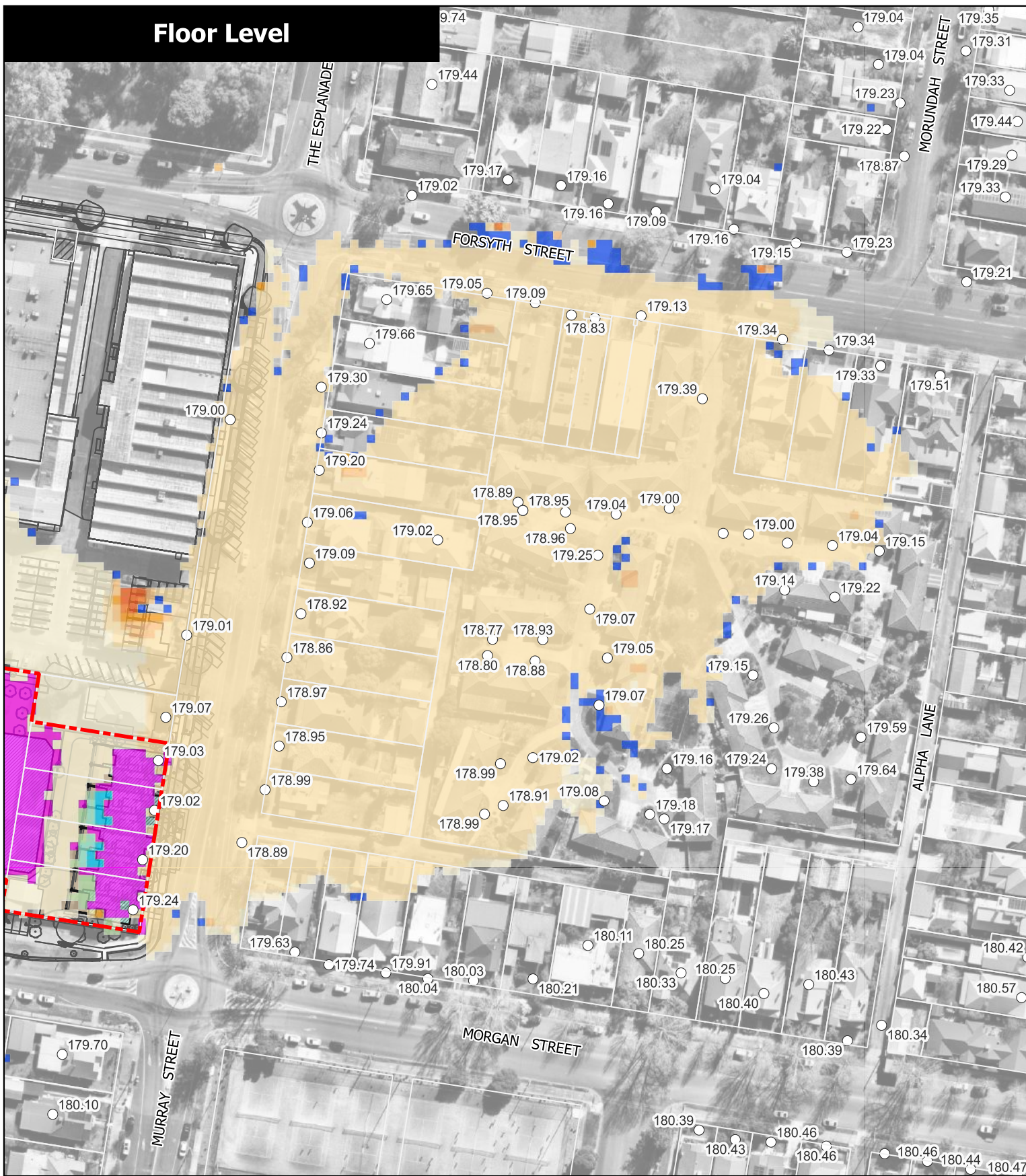
**Legend**

- Cadastre
- Surveyed Floor Levels
- Flood Level
- Was Wet Now Dry
- Was Dry Now Wet

Elevation Difference (m)	Color
<= -0.10	Dark Blue
-0.100 - -0.050	Light Blue
-0.050 - -0.020	Teal
-0.020 - -0.015	Green
-0.015 - -0.010	Light Green
-0.010 - -0.005	Yellow-Green
-0.005 - 0.005	Yellow
0.005 - 0.010	Light Orange
0.010 - 0.015	Orange
0.015 - 0.020	Dark Orange
0.020 - 0.025	Red-Orange
0.025 - 0.030	Red
0.030 - 0.050	Dark Red
0.050 - 0.10	Brown
> 0.10	Dark Brown



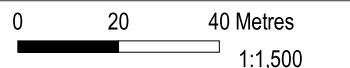
**Figure E1**  
 Pre-to-Post Comparison  
 10% AEP Flood Levels  
 Relative to Existing Floor Levels



**Figure E2**  
**Pre-to-Post Comparison**  
**5% AEP Flood Levels**  
**Relative to Existing Floor Levels**



Legend		Elevation Difference (m)	
Cadastre	Surveyed Floor Levels	0.005 - 0.010	0.010 - 0.015
Flood Level	Was Wet Now Dry	0.015 - 0.020	0.020 - 0.025
Was Dry Now Wet	<= -0.10	-0.025 - 0.030	0.030 - 0.050
	-0.100 - -0.050	0.050 - 0.10	> 0.10
	-0.050 - -0.020		
	-0.020 - -0.015		
	-0.015 - -0.010		
	-0.010 - -0.005		
	-0.005 - 0.005		



**Figure E3**  
**Developed Case**  
**1% AEP Flood Levels**  
**Relative to Existing Floor Levels**

Civitas Stage 3 | NL203697

