

Memorandum



DATE: 27 February 2024
SUBJECT: Flood Impacts of Flood Mitigation Options for Wagga Wagga
PROJECT NUMBER: 120012

1. OVERVIEW

Wagga Wagga City Council has considered the recommendations from the Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan (FRMS&P) and is undertaking further evaluation of the following options for flood mitigation:

- PR1: Voluntary House Raising (VHR) and Voluntary House Purchase (VHP) for eligible properties on the floodplain (e.g. North Wagga, Oura and Gumly Gumly).
- L4B: North Wagga Levee System Upgrade to withstand a 5% AEP (1 in 20 chance) flood event combined with increase in some road heights and bridges along Hampden Ave to provide a safe evacuation route for residents from North Wagga. This would also include conveyance improvements through Wilks Park. The North Wagga Levee system would be upgraded first (Stage 1) and, at a later stage, the surrounding works would be constructed (Stage 2).
- A combined approach that is staged and includes a) Upgrading the existing North Wagga Levee system (Stage 1 of Option L4B) and offering Voluntary House Raising and Purchase to those outside the levees, only where it is cost effective to do so. b) Increasing the road heights and bridges along Hampden Ave to provide a safe evacuation route (Stage 2 of Option L4B) c) VHP and VHR for those inside the North Wagga Levee system, only where it is cost effective to do so.

Both existing conditions and Stage 1 of Option L4B assume that the temporary banks added along Hampden Ave in 2012 would still be in place. With the addition of pumps the banks allow Hampden Ave to remain open slightly longer, for evacuation purposes, than if the banks were removed.

The following provides an overview of the flood impacts for key events, associated with the options under further evaluation. Flood modelling has been drawn from the FRMS&P with some amendments related to the treatment of freeboard in a floodplain management context. The revised modelling for this assessment has assumed that the entire levee freeboard remains in place during flood events, that is the levees are modelled at their crest heights including any spillways.

2. EXISTING CONDITIONS

2.1. Flood Behaviour

Hydraulic modelling has been undertaken for a range of design events including, 0.2EY, 10%, 5%, 2%, 1%, 0.5%, 0.2% AEP and an extreme event. Key features of the existing flood behaviour are described below.







2.2. Building Footprint Impacts

Flood modelling extents have been intersected with the building database, developed as part of the economic assessment, to determine the number of buildings footprints impacted by inundation. Table 1 provides the number of building footprints impacted at different depths for different size flood events.

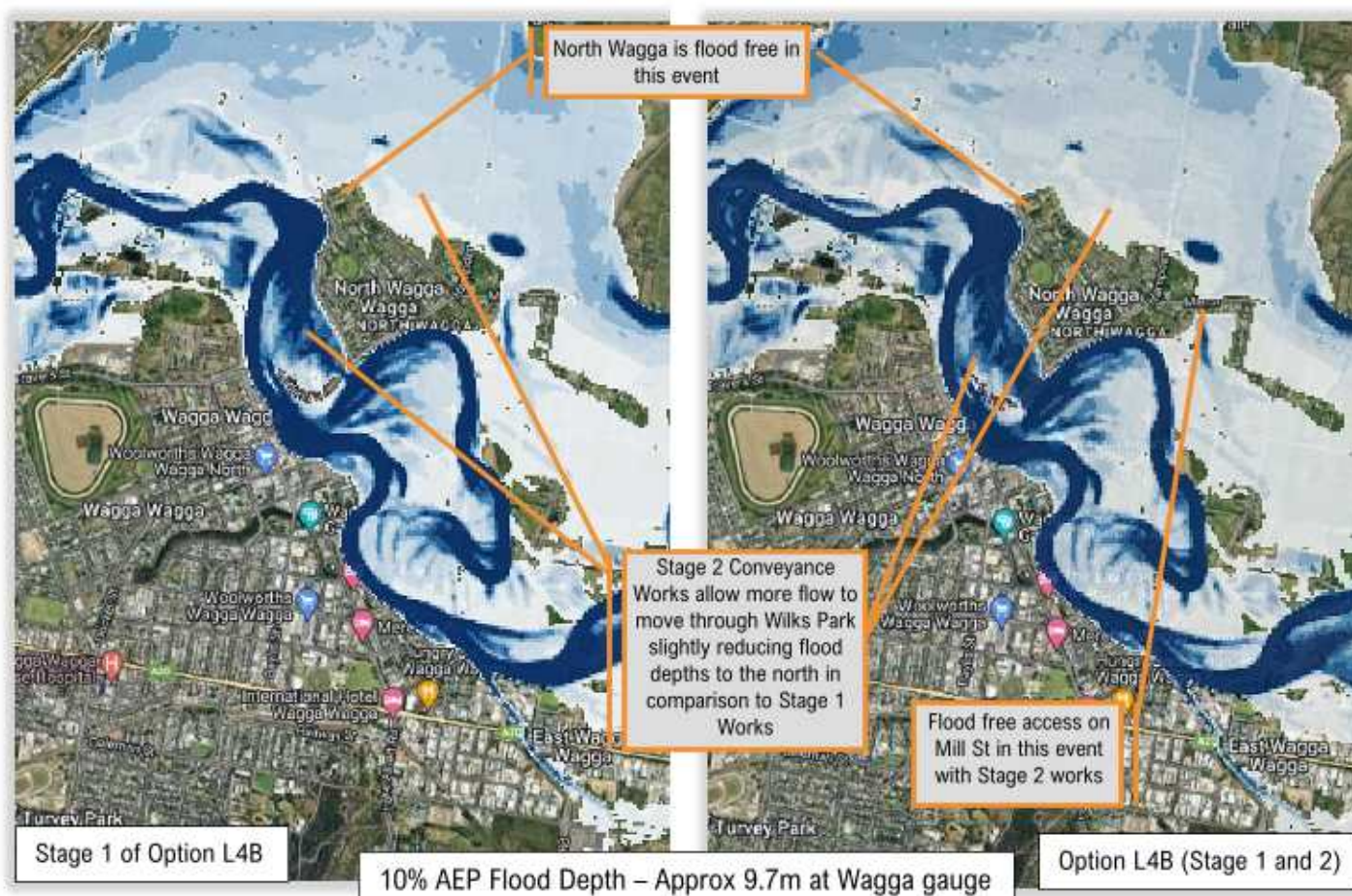
Table 1 Building Footprints Impacted – Existing Conditions

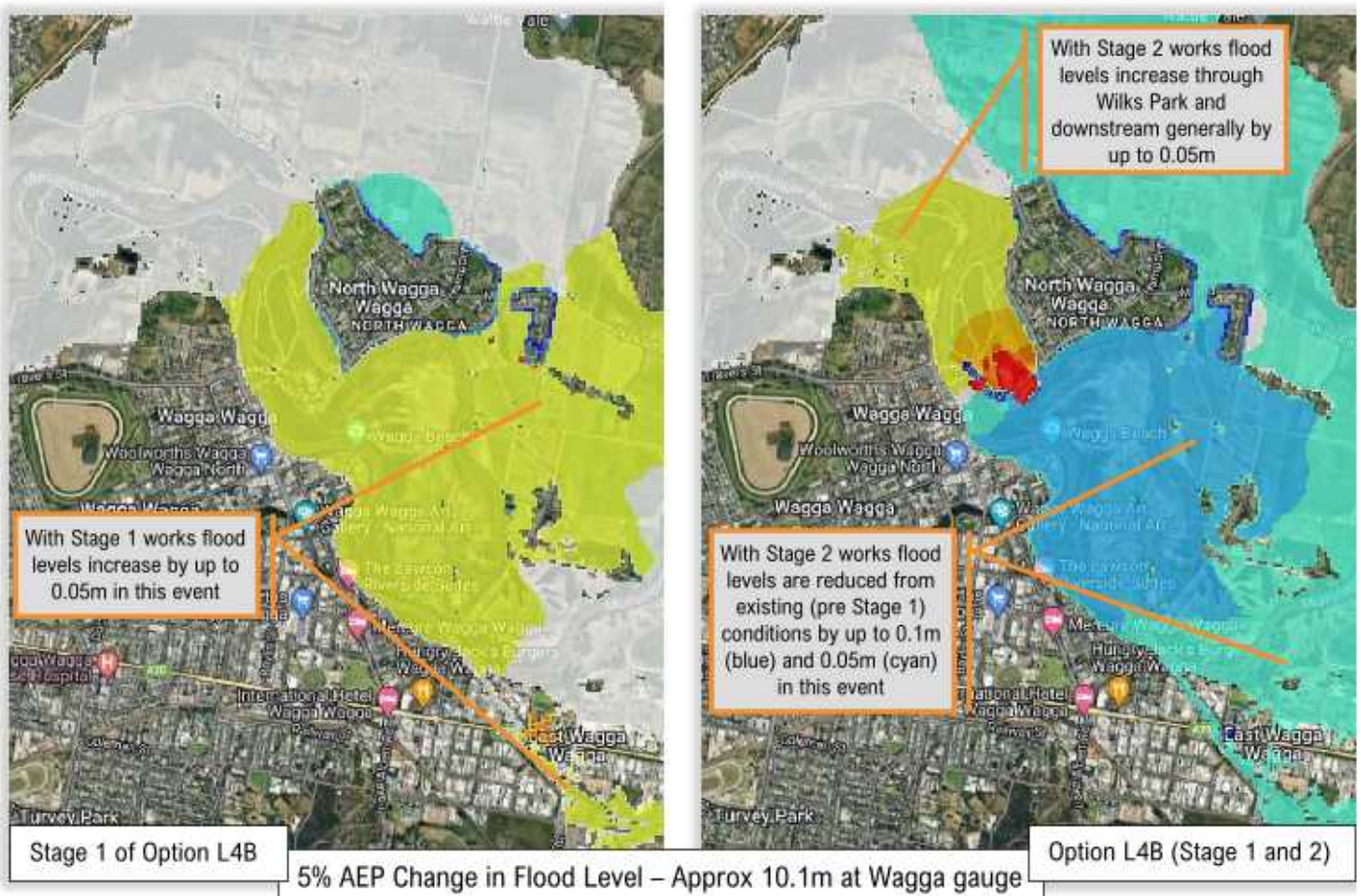
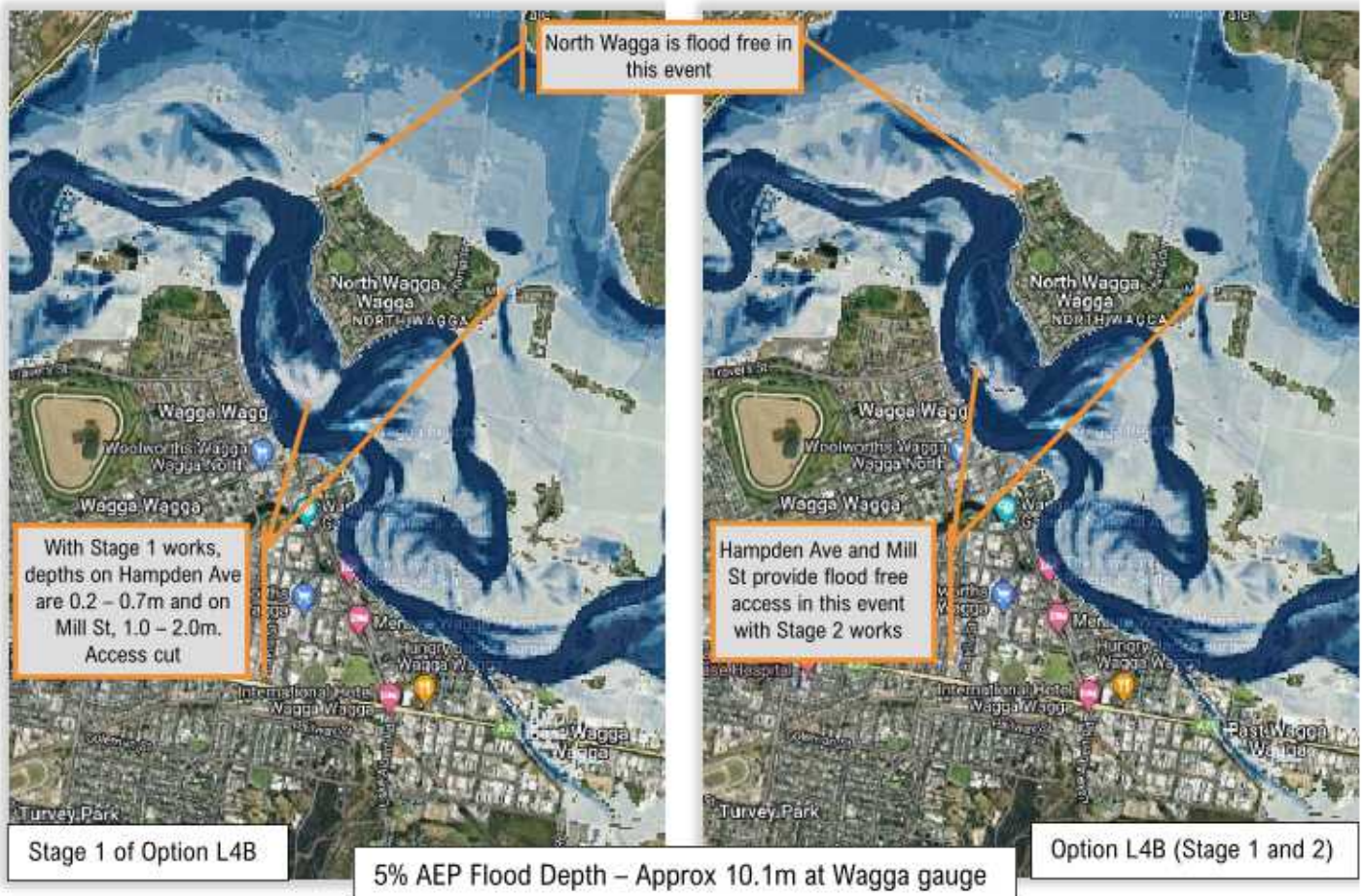
Depth (m)/Event (AEP)	PMF	0.2%	0.5%	1%	2%	5%	10%
0 – 0.03m	3	24	2	9	5	17	7
0.03 – 0.1m	14	70	7	40	47	75	33
0.1 – 0.5m	152	753	262	418	518	414	191
0.5 – 0.9m	166	1,349	423	439	510	347	106
0.9 – 1.2m	120	992	312	354	300	179	74
>1.2m	9,593	3,268	1,583	1,167	744	299	96
Total Number of Buildings	10,048	6,456	2,589	2,427	2,124	1,331	507

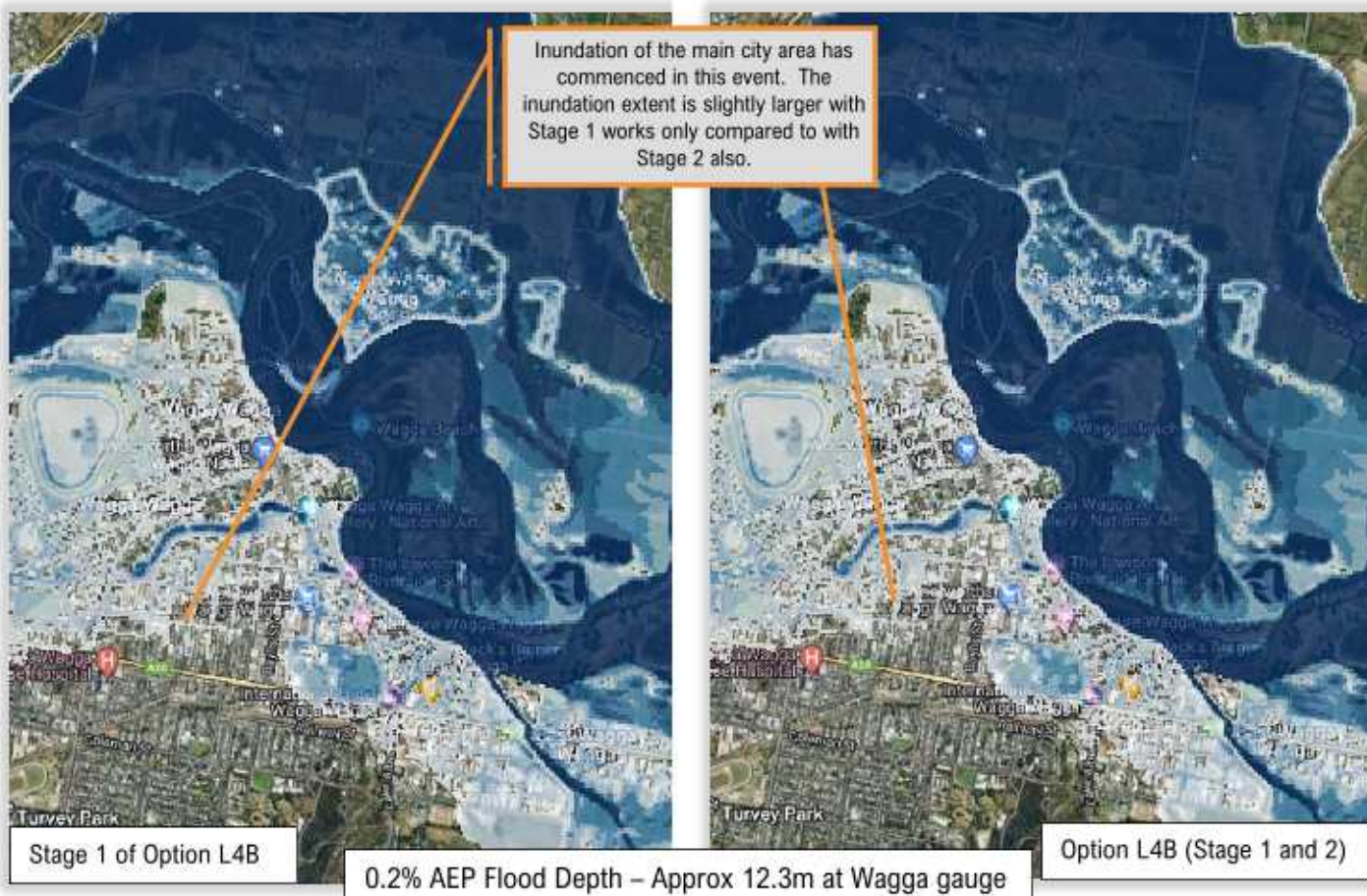
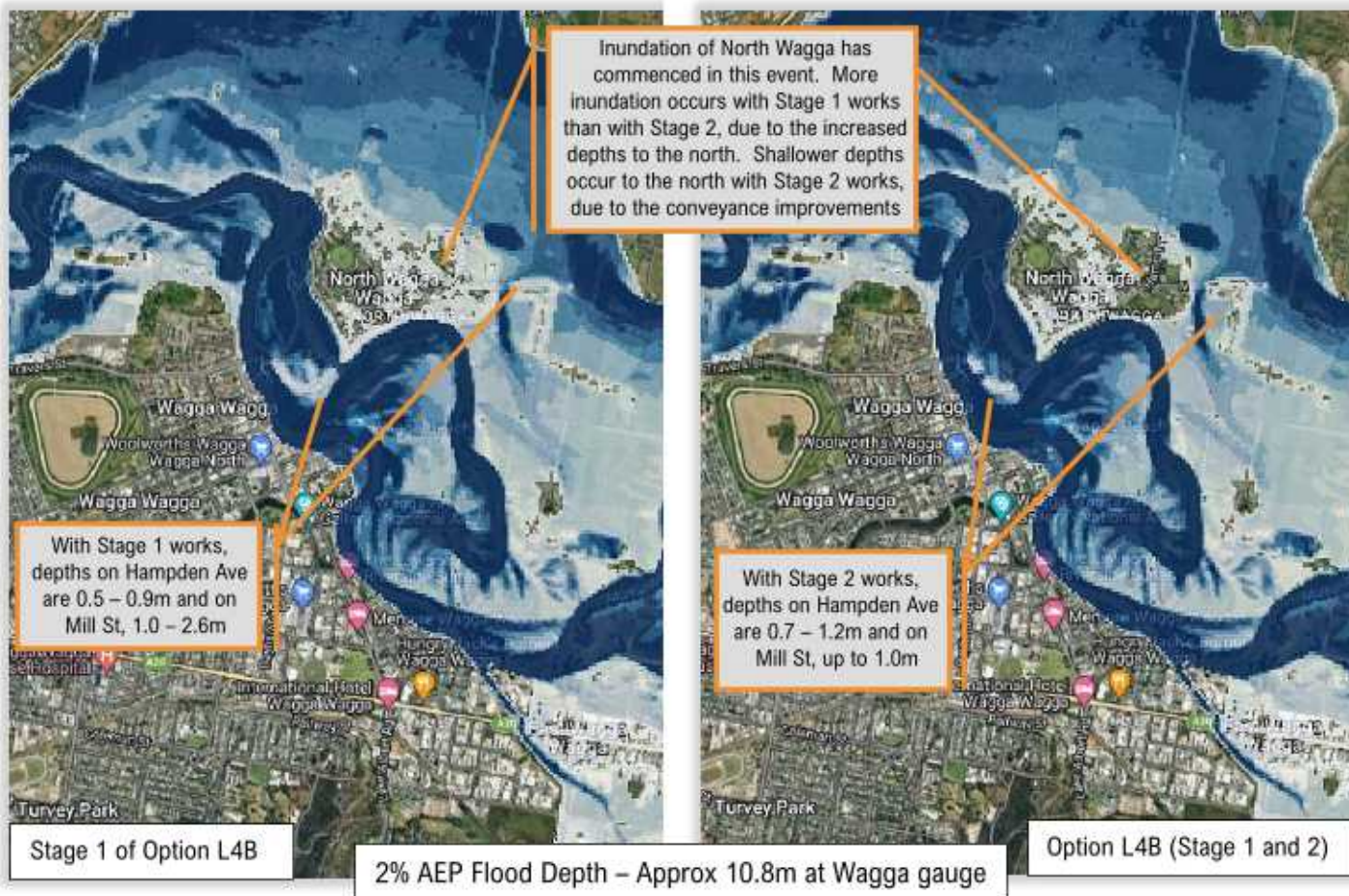
3. STAGE 1 AND 2 OF OPTION L4B COMPARISON

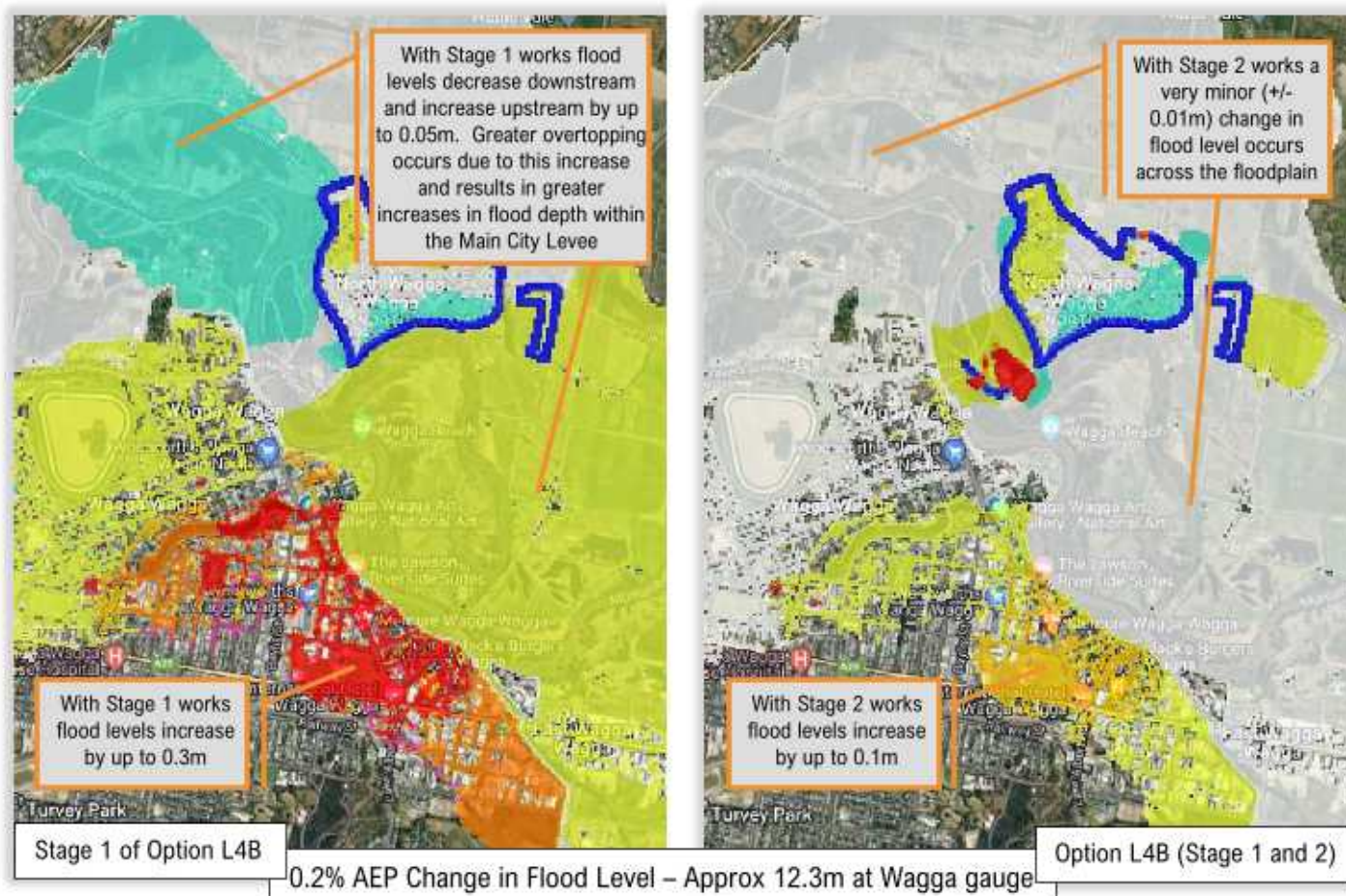
3.1. Flood Behaviour

The implementation of each staged element of Option L4B, Stage 1 levee upgrade works and Stage 2 associated works including road height increases and bridges through Hampden Avenue to provide a safe evacuation route for residents from North Wagga and conveyance improvements through Wilks Park, results in different impacts on flood behaviour. Under a staged approach the impacts occurring under Stage 1 of Option L4B will remain until the Stage 2 works, are implemented. The following provides an overview of these differing impacts on flood behaviour.









3.2. Building Footprint Impacts

Flood modelling extents for the stages have been intersected with the building database, developed as part of the economic assessment, to determine the change in the number of building footprints impacted by inundation and the magnitude of that change. Table 2 provides the total number of building footprints with any impact or benefit, as well as the total number of building footprints with flood impacts, for different size flood events. The most notable change between the two stages Stage 1 of Option L4B and Option L4B (Stage 1 and 2) is the increase in building footprints benefitted and decrease in building footprints impacted as a result of Option L4B (Stage 1 and 2). The most significant of these changes can be seen during the 5% AEP event, where the building footprints benefitted, increases from 627 (Stage 1 of Option L4B) to 1,080 (Option L4B (Stage 1 and 2)) and the building footprints impacted, reduces from 523 (Stage 1 of Option L4B) to 110 (Option L4B (Stage 1 and 2)).

Table 2 Building Footprints Impacted – Option L4B

Event AEP	Stage 1 of Option L4B			Option L4B (Stage 1 and 2)		
	Net Total	Benefitted	Impacted	Net Total	Benefitted	Impacted
PMF	10,048	252	9,761	10,048	1,993	6,865
0.2%	6,580	586	5,831	6,515	490	5,819
0.5%	2,592	310	2,054	2,591	479	1,891
1%	2,442	532	1,710	2,427	588	1,635
2%	1,771	855	1,068	1,699	858	1,029
5%	792	627	523	729	1,080	110
10%	459	53	264	453	395	84

The above table shows building footprints with any change in flood level (including very minor). Table 3 provides the total number of building footprints with impacts or benefits greater than 0.01m, for different size flood events. A filter of 0.01m has been applied as +/- 0.01m is typically considered within the accuracy limits of the hydraulic model. The resulting numbers of building footprints in Table 3 shows that a large proportion of the building footprints identified in Table 2 are subject to a small change in inundation as a result of the different stages of Option L4B. However, the trends observed in Table 2 are similar when comparing the two stages (Stage 1 of Option L4B) and Option L4B (Stage 1 and 2)), with more impacted building footprints and less building footprints benefitted under Stage 1 of Option L4B. Once filtering is applied, impacted building footprints are limited to the East Wagga Wagga, Eunanoreenya, North Wagga Wagga and Wagga Wagga areas, in addition to Ashmont, Gumly Gumly, Moorong and Koorungal in larger events.

Table 3 Building Footprints Impacted (Filtered +/- 0.01m) – Option L4B

Event AEP	Stage 1 of Option L4B		Option L4B (Stage 1 and 2)	
	Benefitted	Impacted	Benefitted	Impacted
PMF	83	779	79	80
0.2%	278	4,299	195	1,197
0.5%	183	1,071	230	750
1%	306	849	338	582
2%	686	461	730	326
5%	571	178	798	29
10%	51	6	208	14

To understand the scale of the negative impacts to building footprints, **Table 4** shows the number of building footprints which are newly flooded for the two stages (Stage 1 of Option L4B and Option L4B (Stage 1 and 2)), for different size flood events. These building footprints were previously not inundated in the noted event and under either stage, are now inundated in that event.

Table 5 breaks down this further and shows the magnitude of the inundation at the newly impacted building footprints with Stage 1 of Option L4B only in place.

Table 4 Building Footprints Newly Impacted (Filtered +/- 0.01m) – Option L4B

Event AEP	Stage 1 of Option L4B	Option L4B (Stage 1 and 2)
	Newly Impacted	Newly Impacted
PMF	0	0
0.2%	123	59
0.5%	3	2
1%	18	3
2%	4	4
5%	25	0
10%	5	5

Table 5 Change in Depth for Newly Impacted Building Footprints (Filtered +/- 0.01m) – Stage 1 of Option L4B

Change in Depth (m)	Number of Building Footprints					
	10% AEP	5% AEP	2% AEP	1% AEP	0.5% AEP	0.2% AEP
0 – 0.03	3	5	0	4	1	8
0.03 – 0.1	0	7	3	1	0	18
0.1 – 0.5	2	12	1	9	0	74
0.5 – 1.0	0	1	0	4	0	16
>1.0	0	0	0	0	2	7
Min Depth	0.02m	0.02m	0.06m	0.01m	0.01m	0.01m
Max Depth	0.16m	0.98m	0.12m	1.43m	1.29m	1.75m
Location of Building Footprints	North Wagga Wagga	East Wagga Wagga	East Wagga Wagga	North Wagga Wagga, East Wagga Wagga, Gumly Gumly	North Wagga Wagga, East Wagga Wagga	Wagga Wagga, Koorungal, East Wagga Wagga
Residential	0	19	1	17	1	85
Non-Residential	5	6	3	1	2	38

Table 6 shows building footprints which under existing conditions have inundation depths over 0.9m and under either stage (Stage 1 of Option L4B and Option L4B (Stage 1 and 2)) are impacted by more than 0.01m. An existing depth of 0.9m has been selected as at this depth significant impacts are likely to have occurred.

Table 6 Building Footprints Impacted (Base >0.9m and Option >0.01m) – Option L4B

Event AEP	Stage 1 of Option L4B	Option L4B (Stage 1 and 2)
PMF	779	80
0.2%	2,505	1009
0.5%	883	717
1%	639	501
2%	231	190
5%	76	8
10%	0	4