CAMDEN COUNCIL PUBLIC EXHIBITION DOCUMENT 2022

NEPEAN RIVER FLOODPLAIN RISK MANAGEMENT STUDY & PLAN INCLUDING NARELLAN CREEK:

APPENDIX A – JUNE 2016 EVENT ASSESSMENT

(Final Draft Report)

Our Ref 59916192_L005_RevA_Nepean-River-Post-Flood-Assessment

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Maria Pinto
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Attention: Maria Pinto

Dear Maria

NEPEAN RIVER – POST FLOOD ANALYSIS

In June 2016, the Camden LGA experienced significant rainfall that resulted in flooding occurring within the Nepean River system. As part of the 2015 Flood Study for this system, a TUFLOW model was developed for the Nepean River region. Following the flood event, Council collected a series of flood marks from within the catchment, in order to be able to compare the actual flood levels to those predicted by the TUFLOW model.

This letter report details the process and findings of this comparison.

1. THE RAINFALL EVENT

The rainfall record was provided by the Bureau of Meteorology (BoM) at 30min intervals. A plot of 30min rainfall depths is shown in **Figure 1** at the end of this letter report.

The plot shows that the rainfall event lasted approximately 2 days, with the peak rainfall occurring 5 hours into the storm event. Subsequent peaks occurred at 12 and 15 hours into the storm event.

Rainfall depths were calculated for periods ranging from 30 minutes to 3 days, which were used to calculate average intensities across these periods. A comparison of these intensities against the design IFD data from the BoM website was undertaken to determine the recurrence interval of the rainfall event. This data is summarised in **Table 1**.

The table shows that the recurrence period for the storm event ranged from less than the 1 year ARI for the 30 minute rainfall, up to approximately the 100 year ARI for the 12 and 24 hour periods.

The critical duration for mainstream flooding from the Nepean River is 48 hours. The tributaries have a shorter critical duration of 2 hours. For this duration, the rainfall intensity was in the order of a 50 year to 100 year ARI event for the Nepean River and 5 to 10 year ARI event for the tributaries.

The recurrence interval of the flood observed within the study area as a result of this rainfall is discussed in **Section 4**.

Table 1 Assessment of Rainfall Intensities

Duration (hours)	Peak Rainfall Depth in Period (mm)	Peak Period Intensity (mm / hr)	Equivalent ARI (from BoM IFD tool)
0.5	14.6	29.2	<1
1	27.8	27.8	1yr - 2yr
2	52	26.0	5yr - 10yr
3	66.2	22.1	5yr - 10yr
6	105.6	17.6	20yr - 50yr
12	169	14.1	~ 100yr
24	251.2	10.5	~ 100yr
48	287.8	6.0	50yr - 100yr
72	289.6	4.0	20yr - 50yr

2. SURVEY COLLECTION

Council surveyors collected survey data of the peak flood levels in the days following the flood event. A total of 16 points were surveyed within the Nepean River study area.

The location of these 16 survey points used in the assessment are shown in **Figure 2** at the end of this letter report.

3. HYDROLOGICAL MODEL

The hydrology of the immediate study area was modelled in RAFTS, and calibrated to three historical events, namely 1978, 1988 and 1990 in the flood study (Worley Parsons, 2015). The RAFTS model defined the hydrology for the study area, downstream of Menagle Weir. Some minor changes to the RAFTS model had been made as part of the current Floodplain Risk Management Study, in order to generate hydrographs at the upstream reaches of the tributaries so that the full tributary length could be modelled in the hydraulic model. The model was revised to incorporate the 2016 rainfall event and re-run.

No other changes were made to the RAFTS model.

Upstream of Menangle Weir, the wider Nepean River catchment was modelled using a RORB model. As the rainfall event was localised, no changes were made to this wider hydrological model.

4. HYDRAULIC MODEL

The TUFLOW model developed for the Nepean River study area was calibrated against three historical events, namely 1978, 1988 and 1990, as part of the Flood Study (Worley Parsons, 2015). The TUFLOW model was then used to define the existing flood behaviour of the study area in the Flood Study, and to develop and assess mitigation options in the Floodplain Risk Management Study and Plan. The model was recently updated to incorporate recent development in the catchment area, and was extended to include the full length of tributaries within the Camden LGA. The model was updated to include the 2016 hydrographs from the RAFTS model.

No other changes were made to the TUFLOW model.

5. RESULTS & DISCUSSION

The peak depths from this model are shown in **Figure 2** at the end of this letter report, along with a comparison against the surveyed levels. Overall, the tributaries showed a good match with the surveyed levels, whilst the model predicted higher levels through the Nepean River than were observed.

Tributary results were within 0.25m, which is reasonable for a validation exercise. There was one location on Matahil Creek, that showed a difference of over 1 metre; however, a number of other survey points close by showed a closer match suggesting that the surveyed level in this location was anomalous.

In the Nepean River, the model predicted levels that were 0.4m higher in the upstream reach and 0.9m higher downstream of Camden CBD. The Nepean River flow gauge in the study area was not fully functional in the event, so it was not possible to adopt the precise hydrograph from the event as the upstream input into the model. In this absence, the hydrograph from the design model was adopted. The results suggest that the actual 2016 hydrograph was shorter and sharper than the design hydrograph. The longer design hydrograph would result in more water being present in the catchment, contributing to the higher observed levels in the hydraulic model.

Summarised below in **Table 2** are the differences between the surveyed levels and the 2 year and 5 year ARI design levels. The table shows that for the majority of locations, the surveyed level lies between the 2 year and the 5 year ARI design levels.

This recurrence interval correlates with the rainfall recurrence interval for the critical duration of the tributaries. With regard to the Nepean River, the observed flood levels are a much lower recurrence interval than the rainfall intensity. This is likely due to the rainfall event being relatively localised, and not falling equally across the full Nepean River catchment area.

Table 2 Peak Level Comparison

Location	2 year ARI	Surveyed	5 year ARI	Difference to 2 year ARI	Difference to 5 year ARI
Mainstream (DS)	59.88	59.98	62.96	-0.10	2.99
	59.88	59.80	62.96	0.08	3.16
	59.88	59.88	62.96	0.00	3.09
Mainstream (US)	64.91	65.41	67.20	-0.50	1.79
	66.94	68.11	69.53	-1.17	1.42
	64.59	65.32	67.10	-0.73	1.79
	65.11	65.80	67.51	-0.68	1.72
	65.83	66.50	68.02	-0.67	1.52
Tributary	63.17	63.74	66.53	-0.57	2.79
	63.17	62.24	66.53	0.93	4.29
	74.01	74.28	74.06	-0.27	-0.22
	70.63	70.44	70.65	0.19	0.21
	70.65	70.38	70.66	0.27	0.28
	63.17	63.67	66.53	-0.50	2.86
	63.17	63.66	66.54	-0.49	2.88
	63.17	63.63	66.53	-0.46	2.90

6. CONCLUSION

The TUFLOW model for the Nepean River was revised to incorporate the 2016 event rainfall data and run for this event. Results were compared against post flood survey data collected by Council. The assessment found that:

- The rainfall intensity of the 2016 event was between a 50 year to 100 year ARI event for the Nepean River and 5 to 10 year ARI event for the tributaries; and,
- The observed flooding was comparable to a 2 to 5 year ARI design event.

Overall, the assessment showed that the TUFLOW model provided a good representation of the 2016 flood event throughout the tributaries, with a reasonable match between modelled and surveyed levels throughout the study area. Within the Nepean River, the model predicted higher water levels than observed. This is likely due to having to adopt the design hydrograph shape in lieu of the actual event hydrograph as a result of the river gauge not functioning during the storm event.

Should you have any queries regarding this letter, please do not hesitate to contact me on 9496 7700.

Yours sincerely

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Luke Evans
Environmental Engineer, Water Engineering
for **Cardno**

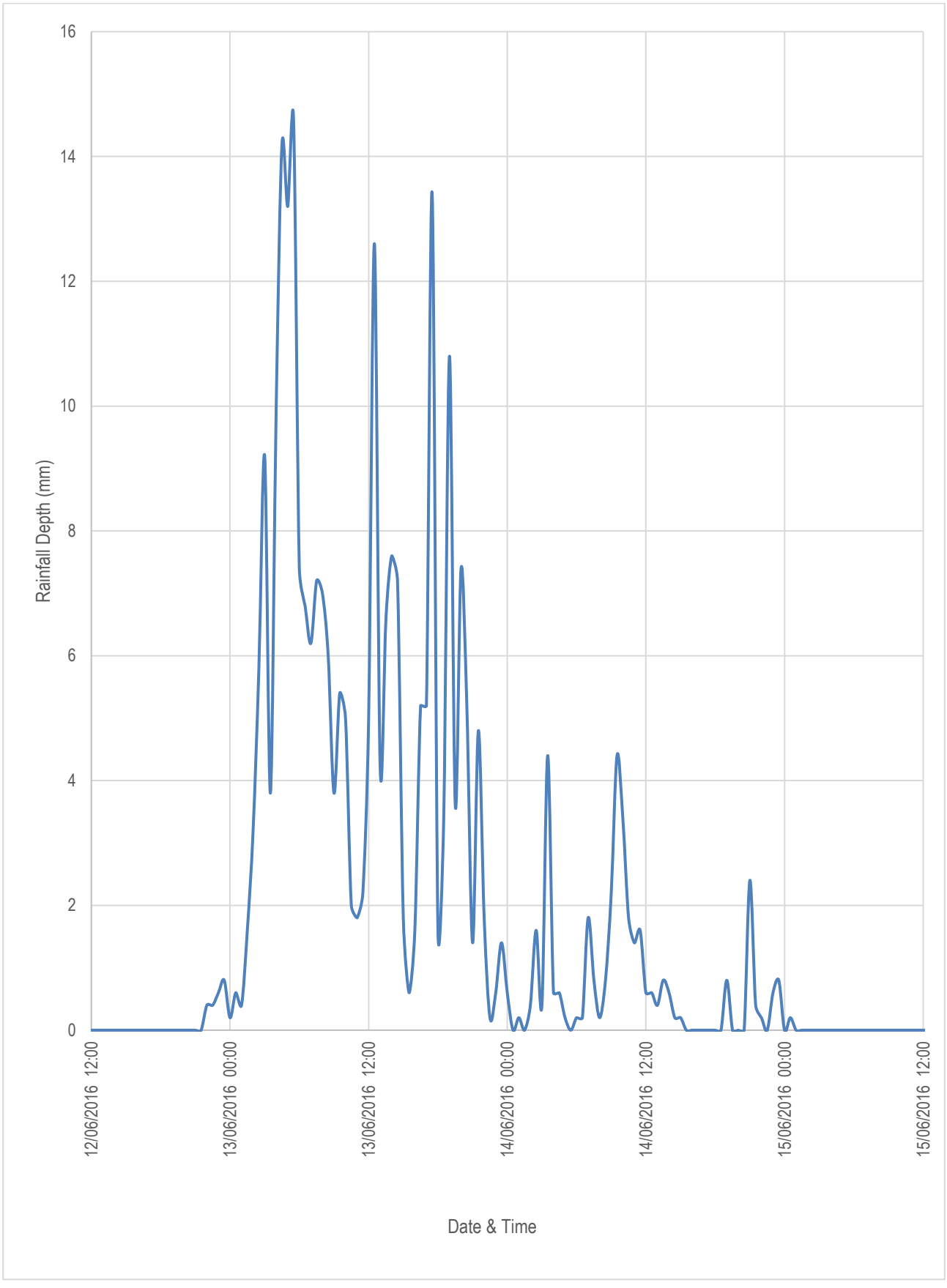

Figure 1 **30 minute Rainfall Depths for 2016 Event**

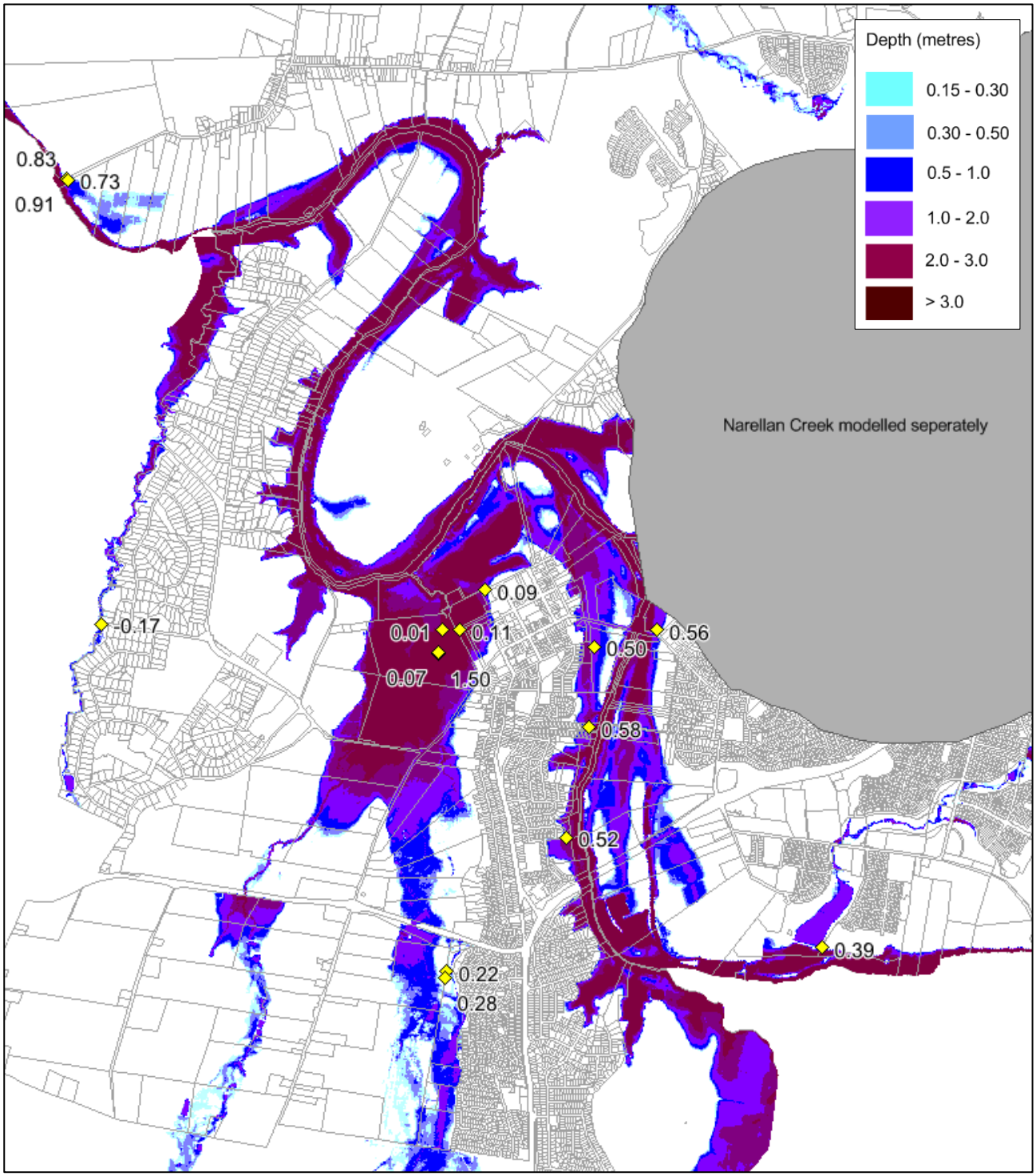

Figure 2 **Peak 2016 Flood Depths, showing differences to surveyed levels (m)**