Our Ref: NW30006:VJ:bcp
Contact: Venus Jofreh

18 January 2022

Hornsby Shire Council
296 Peats Ferry Road

Hornsby NSW 2077

Attention: Alan Boyd

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

Phone **+61 2 9496 7700**
Fax +61 2 9439 5170

www.cardno.com

Dear Alan,

HORNSBY FLOOD MITIGATION OPTIONS COSTING

Prior to the completion of the draft Hornsby Overland Flow Flood Study and Mapping in November 2010, Council's Drainage Improvement Program was based primarily on the drainage improvements identified in the Catchment Management Plans (CMP) that had been prepared for the 37 major piped urban catchments within the LGA. While these CMPs identified where drainage systems have less than the target capacity, the CMPs did not identify areas subject to overland flooding in a manner that was required by Council's new LEP (2013). It was found that many of the works identified on the CMPs were not aligned with the Flood Planning Areas (FPA) identified in the *2010 Overland Flow Flood Study*. At the same time the Hornsby Floodplain Risk Management Study and Plan were being prepared in 2014, Cardno was also engaged to review Council's works program and realign the program to prioritise works within identified FPAs and to also undertake preliminary costing of the options. This 2014 review was documented in the report titled *Review of Hornsby Shire Council Drainage Works Program*.

In 2020 Hornsby Shire Council commissioned a further update and finalisation of the *2014 Hornsby Floodplain Risk Management Study and Plan* based on the updated guidance and data provided in the 2019 edition of Australian Rainfall and Runoff (ARR2019) and based on the latest Light Detection and Ranging (LiDAR) topographical data. As part of the update the 2014 prioritisation and costing of options was also reviewed as per Council's request.

This letter summarises the approach to and the outcomes of the updated prioritisation and costing of options and needs to be read in conjunction with the *2021 Hornsby Floodplain Risk Management Study and Plan*.

1 Available Data

The following data were available and used for this assessment:

1.1 2014 Review of Hornsby Shire Council Drainage Works Program

In this study Council's existing drainage Works Program was reviewed and projects were mapped throughout the Local Government Area (LGA) in order to compare each project location with the properties identified as subject to overfloor flooding in a 20% Annual Exceedance Probability (AEP) flood. In addition, a number of additional options were identified to reduce the impact of flooding on the most vulnerable properties in the 20% AEP flood.

A multi-criteria matrix assessment approach was used to refine the project prioritisation. This enabled a comparative assessment of all options to be undertaken using a similar approach to that recommended in the 2005 Floodplain Development Manual. Each option was scored according to how well the option meets the adopted criteria.

Preliminary cost estimates were prepared for the proposed options and the Benefit/Cost Ratio (BCR) was calculated as (preliminary option cost + total estimated damages) / preliminary option cost. All BCRs calculated using this approach were ≥ 1.

1.2 2021 Hornsby Floodplain Risk Management Study and Plan

In 2020 Hornsby Shire Council commissioned Cardno to update and finalise the 2014 Hornsby Floodplain Risk Management Study and Plan (FRMS&P). As part of that process eight separate hydraulic models (TUFLOW) were updated based on ARR2019 guidance and data, and the latest LiDAR data. The flood extents and levels estimated by the updated models informed this review.

2 Approach

The adopted approach to update the drainage works program included the following steps:

Step 1 – Update the Option Priorities: The number of properties which experience overfloor flooding in the 20% AEP flood which might benefit from each option was re-estimated based on the latest mapping included in the2021 Hornsby FRMS&P. This data was used to update the prioritisation of options which was originally undertaken in 2014.

Step 2 – Update the Option Costing: the preliminary options costing undertaken in 2014 was used as the basis of the current costing. However the 2014 costs were adjusted based on the ratio of Average Weekly Earnings (AWE) in 2021 versus 2014.

Step 3 – Update the Option Benefit: The flood damages estimates for properties subject to overfloor flooding or yard flooding were updated as a part of 2021 Hornsby FRMS&P. The estimated flood damages were used to re-calculate the BCR.

3 Updated Drainage Work Program

The updated Drainage Work Program based on the latest options costing and BCRs is provided in **Attachment A**. Social and Environmental ranking of the options remained unchanged.

It should be noted that:

- The cost estimates remain preliminary and indicative only. A more detailed costing of any option would be undertaken of any option subject to further investigation;
- The benefit estimated under each option is also indicative. As part of any further option investigation it is recommended that the option be modelled in detail in order to more accurately assess the benefits;
- Some of the options are a combination of walls, basins and drainage network upgrades. It is likely that detailed modelling would allow the combination of measures to be optimised to reduce the cost.

Please do not hesitate to contact me if any further information is required.

Yours sincerely,

Venus Jofreh
Senior Water Engineer
for Cardno
Direct Line: +61 2 9495 8187
Email: venus.jofreh@cardno.com.au

Enc: **Attachment A – Updated Drainage Works Program**

Option ID	No. of Properties with Overfloor Flooding in	No. of Properties with Overground Flooding in 5yr	Total Expected Damages in 20% AEP	Expected Flood Damages due to Overfloor	Expected Flood Damages due to Overground	Property buyback	Pipe Length (m) Dia. (mm)	Box Culverts Length (m) Width (m)	Flood wall or bund Length (m), Height (m)	Detention basin Area (m2) Volume (m3) approx.	Feasible (Yes/No)	Council Records		Proposed Option Cost Estimate	B/C [(option cost+total damages)/option cost]	Ongoing Costs Per Year (Estimated 5% of the original	Estimated Capital Cost ($)	Estimated Maintenance Cost ($)	Economic			Social			Environment				Score	Overall Rank	Priority
101-A	3	0	$214,661	$214,661	$0		(530m; 750mm), (140m; 1050mm)				Y	H-4 8 12	NH-Y- H-1 Y4	$1,837,926	1.12	$91,896	$1,837,926	$91,896	0	0	1	2	2	2	1	0	0	0	0.66	**14**	High
102-A	2	2	$206,333	$199,165	$7,168		(110m; 375mm) (110m; 900mm)		90m,40m	(20000m2; 10000m3) (3000m2; 1500m3)	Y	H-5 5	NH- 0	$5,445,685	1.04	$272,284	$5,445,685	$272,284	0	-1	0	2	1	1	1	0	0	-1	0.20	**28**	Medium
102-B	7	1	$343,148	$339,564	$3,584		(220m; 900mm)			(20000m2; 20000m3) (15000m2; 15000m3)	Y	0	0	$15,264,881	1.02	$763,244	$15,264,881	$763,244	0	-2	-1	1	1	1	1	0	0	-1	-0.15	**29**	High
103-A	4	5	$198,685	$180,765	$17,920		(160m; 900mm)				Y	NH-3	0	$458,735	1.43	22936.74	$458,735	$22,937	1	2	2	1	2	2	1	0	0	0	1.21	**4**	High
104-A	1	2	$24,116	$16,948	$7,168		(220m; 1350mm)				Y	H-1 4	NH- H-1 Y-8 Y-1	$1,024,986	1.02	51249.29	$1,024,986	$51,249	0	0	1	1	2	2	1	0	0	0	0.56	**18**	Medium
104-B	2	2	$120,068	$112,900	$7,168		(390m; 1200mm)				Y	NH-2 Y4	NH-1	$1,537,479	1.08	76873.93	$1,537,479	$76,874	0	0	1	1	2	2	1	0	0	0	0.56	**18**	Medium
104-C	2	0	$232,573	$232,573	$0		(110m; 900mm)				Y	0	0	$315,380	1.74	15769.01	$315,380	$15,769	2	2	2	0	2	2	1	0	0	0	1.36	**3**	Medium
104-D	2	1	$205,654	$202,070	$3,584		(170m; 1200mm)				Y	H-5	Y-5 0	$670,183	1.31	33509.15	$670,183	$33,509	1	1	2	2	2	2	1	0	0	0	1.16	**6**	Medium
104-E	1	1	$20,532	$16,948	$3,584		(42m; 450mm)				Y	0	0	$92,822	1.22	4641.11	92822	4641	1	2	2	1	2	2	1	0	0	0	1.21	**4**	Medium
106-A	15	4	$959,035	$944,699	$14,336		(360m; 900mm) (270m; 900mm) (365m; 1050mm)			(5000m2; 5000m3)	Y	H-3 NH-10 Y-10	Y-3	$5,859,024	1.16	292951.21	$5,859,024	$292,951	0	-1	0	2	1	2	1	0	0	-1	0.28	**23**	High
106-B	4	9	$364,584	$332,328	$32,256		(90m; 600mm) (70m; 375mm) (300m; 900mm)		350m, 105m, 41m,40m.	(13000m2; 7000m3) (9500m2; 10000m3) (1500m2; 1000m3)	Y	H-1 1	NH- Y-3 0	$9,072,319	1.04	453615.93	$9,072,319	$453,616	0	-1	0	2	1	2	1	0	0	-1	0.28	**23**	High
106-C	5	0	$411,406	$411,406	$0		(370m; 600mm) (260m; 1200mm) (700m; 1500mm)				Y	H-3 Y-7	0	$5,649,965	1.07	282498.26	$5,649,965	$282,498	0	-1	0	2	2	2	1	0	0	0	0.41	**21**	High
107-B	7	8	$589,774	$561,102	$28,672		(50m; 450mm) (650m; 600mm)		190m		Y	NH-2	Y-2	$1,749,524	1.34	87476.20	$1,749,524	$87,476	1	0	1	1	1	1	1	0	0	-1	0.60	**16**	High
107-C	8	2	$621,385	$614,217	$7,168		(180m; 600mm) (190m; 900mm)				Y	H-11 NH-5 6	Y- NH-1	$1,213,736	1.51	60686.80	$1,213,736	$60,687	2	0	1	2	1	2	1	0	0	-1	1.03	**7**	High

107-A	2	2	$148,816	$141,648	$7,168		(310m; 900mm)		70m		Y	Y-1	0	$934,792	1.16	46739.59	$934,792	$46,740	0	1	2	1	1	1	1	0	0	-1	0.60	**16**	Medium
107-D	13	2	$1,077,647	$1,070,479	$7,168		(45m; 1500mm) (205m; 2100mm) (270m; 1500mm)			(7000m2; 7000m3)	Y	H-14 NH-16 Y-16	0	$6,530,402	1.17	326520.09	$6,530,402	$326,520	0	-1	0	2	1	2	1	0	0	-1	0.28	**23**	High
107-E	1	2	$121,034	$113,866	$7,168		(380m; 1500mm)				Y	H-1 NH-5 4 Y-	0	$2,042,804	1.06	102140.19	$2,042,804	$102,140	0	0	0	2	2	2	1	0	0	0	0.56	**18**	Medium
108-A	4	0	$420,118	$420,118	$0		(125m; 600mm)			(20000m2; 10000m3)	Y	NH-1	0	$4,472,366	1.09	223618.32	$4,472,366	$223,618	0	0	0	1	1	1	1	0	0	-1	0.25	**27**	High
108-B	8	0	$651,878	$651,878	$0		(450m; 1200mm)			(34000m2; 20000m3) (1400m2; 1000m3)	Y	0	0	$10,554,486	1.06	527724.31	$10,554,486	$527,724	0	-2	-1	0	1	1	1	0	0	-1	-0.25	**30**	High
108-C	2	0	$127,424	$127,424	$0		(55m; 1200mm) (10m; 750mm)				Y	0	0	$242,508	1.53	12125.41	$242,508	$12,125	2	2	2	1	2	2	1	0	0	0	1.46	**1**	Medium
108-D	2	0	$220,469	$220,469	$0		(80m; 1050mm) (45m; 600mm) (120m; 900mm)				Y	0	0	$721,253	1.31	36062.65	$721,253	$36,063	1	1	2	1	1	1	1	0	0	0	**0.9125**	**12**	Medium
109-A	17	0	$1,554,331	$1,554,331	$0		(330m; 1500mm)				Y	0	0	$1,774,014	1.88	88700.69	$1,774,014	$88,701	2	0	1	0	2	2	1	0	0	0	0.96	**8**	High
109-C	17	1	$1,447,860	$1,444,276	$3,584		(330m; 1200mm) (65m; 750mm)		150m	(6000m2; 2000m3)	Y	H-3 6 NH- Y-9	H-1 Y-3	$2,235,735	1.65	111786.76	$2,235,735	$111,787	2	0	0	2	1	2	1	0	0	-1	0.93	**10**	High
109-D	12	7	$880,675	$855,587	$25,088		(160m; 900mm) (675m; 1500mm) (320m; 1500mm) (110m; 900mm)				Y	H-3 3 NH- Y-10	0	$6,123,036	1.14	306151.78	$6,123,036	$306,152	0	-1	0	2	2	2	1	0	0	0	0.41	**21**	High
109-E	2	2	$27,562	$20,394	$7,168		(50m; 450mm) (110m; 1500mm)				Y	H-3 NH-3 11 Y-	Y-1	$701,840	1.04	35092.02	$701,840	$35,092	0	1	2	2	2	2	1	0	0	0	0.91	**11**	Medium
109-G	12	0	$1,167,702	$1,167,702	$0		(150m; 900mm) (300m; 1200mm)				Y	0	0	$1,612,740	1.72	80636.99	$1,612,740	$80,637	2	0	1	0	2	2	1	0	0	0	0.96	**8**	High
109-H	9	1	$681,855	$678,855	$3,000		(45m; 600mm)			(28000m2; 15000m3)	Y	H-7 NH-7 4 Y-	0	$6,376,594	1.11	318829.71	$6,376,594	$318,830	0	-1	0	2	1	2	1	0	0	-1	0.28	**23**	High
210-A	5	0	$613,387	$613,387	$0		(150m; 1500mm)				Y	H-4 2 NH- Y-0	0	$806,370	1.76	40318.50	$806,370	$40,318	2	1	2	2	2	2	1	0	0	0	1.41	**2**	High
212-A	13	0	$1,342,665	$1,342,665			(475m; 1500mm) (220m; 900mm) (30m; 1800mm)		400m, 35m		Y	H-1 NH-2 4 Y-	NH-1	$3,470,079	1.39	173503.93	$3,470,079	$173,504	1	0	0	2	1	1	1	0	0	-1	0.60	**15**	High
212-B	4	2	$331,183	$325,183	$6,000		(175m; 1200mm)		40m		Y	H-1	0	$1,253,756	1.26	62687.79	$1,253,756	$62,688	1	0	1	1	2	2	1	0	0	0	0.81	**13**	High