

APPENDIX D
MITIGATION OPTION ASSESSMENTS
SUB-CATCHMENT REPORTS - DRAFT

Area 7- Rozelle Bay Options Assessment

Leichhardt Flood Risk Management Study
and Plan - DRAFT

NA49913094

Prepared for
Inner West Council



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1 Rozelle Bay Catchment Description

A large portion of the Rozelle Bay Catchment is located within the suburb of Lilyfield. The majority of the catchment drains towards the Rozelle old rail yards and then into Rozelle Bay. Significant ponding occurs in the rail yards, with the flood levels controlled by the centreline of the City West Link.

The location of the Rozelle Bay Catchment within the study area is shown in **Figure 1-1**.

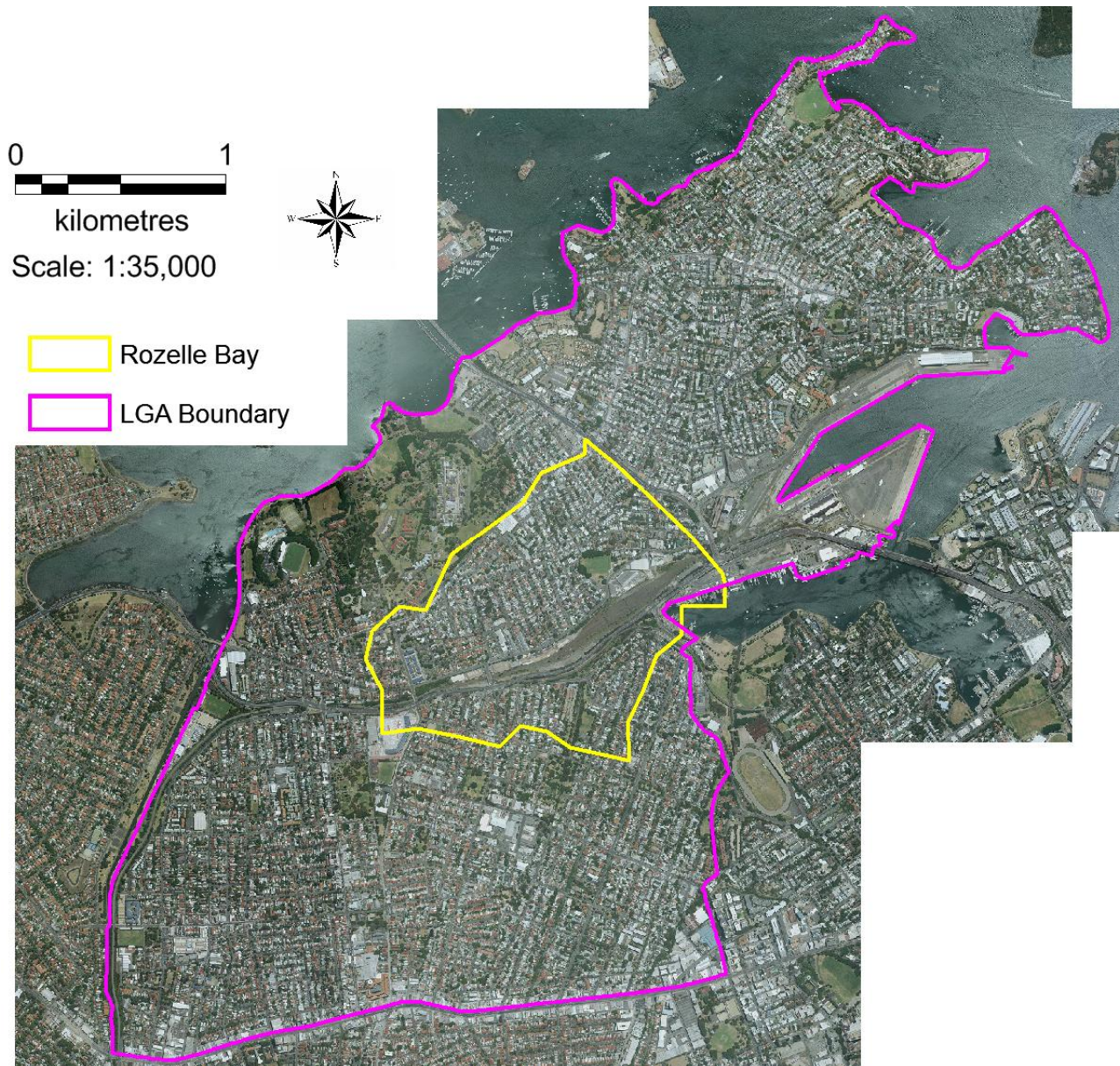


Figure 1-1 Rozelle Bay Catchment Location

2 Flood Mitigation Options Identification

2.1 Flood Modification Measures for Rozelle Bay

The existing flood behaviour within the Rozelle Bay Catchment is detailed in the Leichhardt Flood Study (Cardno 2014). Based on the flood model results, historical information and engineering judgement, possible flood modification measures (i.e. structural measures) for the study area were identified.

The various management options were identified taking into consideration the:

- flood behaviour and flow in the 20 Year ARI event;
- grade of pipe (upstream and downstream); and
- preliminary availability and location of easements.

2.2 Rozelle Bay Flood Mitigation Options

Within the Rozelle Bay catchment two (2) sets of options were modelled. These are shown in Table 2-1 and Figure 2-1.

The 100yr, 20yr and 5yr ARI peak water level difference plots for each mitigation option are attached at the end of this appendix report.

Table 2-1 Rozelle Bay Mitigation Options

Option Description	Option Name	ID
Lilyfield Road Flow Path – Proposing additional pipes or duplication of existing pipe network. Proposed pipes connecting into the existing network at O' Neill St. Additional pipes from the low point on Denison St to the outlet at Rozelle Bay. Additional pipe network in Quirk Street, Gordon Street and Lilyfield Road with a branch along Alfred Street.	Lilyfield Street Branch RB-FM1	RB-FM1
Additional Culverts/Pipes across Lilyfield Road at four locations. From Joseph Street along Halloran Street to Lilyfield Road, Edward St, Justin St, Cecily St and Brenan Street South of the railyards.	Additional Culverts at Lilyfield Rd RB-FM2	RB-FM2

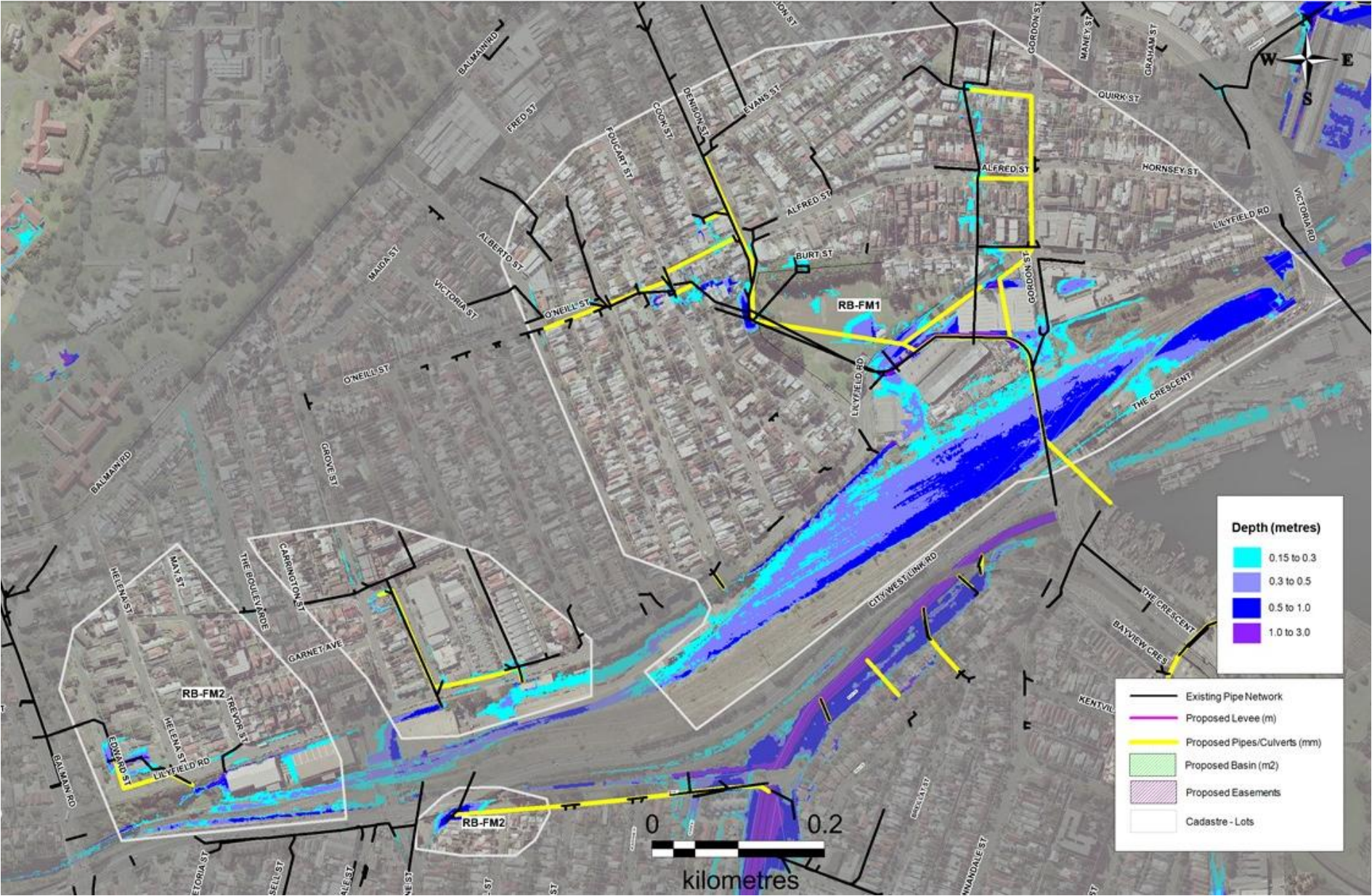


Figure 2-1 Rozelle Bay Mitigation Options Locations

2.2.2 Lilyfield Street Branch RB-FM1

The Lilyfield Road Flow Path proposes additional pipes and duplication of the existing pipe network. The option starts on O'Neill Street where a proposed pipe (900mm diameter) connects into the existing network at O'Neill Street. The proposed pipe continues onto Denison Street and connects to the proposed Dennison Street pipe at a junction point between a 1050mm diameter and a 1400mm diameter pipe. The 1400mm diameter pipe then connects to a box culvert (1.8m x 1.2m) which crosses Easton Park. At the southern end of the park, the culvert branches out into a 3.6m x 2.1m culvert and 1500mm diameter pipe. The final culvert eventually drains into Rozelle Bay.

The option also includes a proposed additional pipe network consisting of 750mm, 900mm and 1050mm diameter pipes in Quirk Street, Gordon Street and Lilyfield Road with a branch along Alfred Street.

The worst flooding under existing conditions occurs between Easton Park and Rozelle Bay with flood depths reaching around 2.8m in the 20 Year ARI event.

Potential constraints for this measure includes vegetation removal in Easton Park and changes to recreational use of Easton Park depending on the configuration of the adopted works.

This option will require communication with the rail stakeholders.

2.2.3 Additional Culverts / Pipes Lilyfield Rd RB-FM2

RB-FM2 proposes three pipes that cross Lilyfield Road towards north of the railyards and a proposed 900mm diameter pipe on Brenan Street South of the railyards.

The three pipes crossing Lilyfield Road start from Edward Street (900mm and 1200mm diameter pipes), Joseph Street along Halloran Street, Justin Street (900mm and 1200mm diameter pipes) and Cecily Street (900mm diameter pipe). Significant flood depths, due to the 20 Year ARI storm event, occur in the vicinity of Edward Street with depths up to 0.7m.

Funding from RMS may be available for the transverse pipe crossing works on Lilyfield Road.

3 Mitigation Option Modelling Outcomes

The Lilyfield Catchment flood mitigation options were assessed for the 5, 10, 20, 50 and 100 Year ARI design flood events, along with the PMF event.

The outcomes of the modelling are shown in the 5, 20, and 100 Year ARI water level difference plots attached at the end of this catchment report.

A summary of the impacts on flood behaviour for each option is provided below.

3.1 Lilyfield Street Branch RB-FM1

The proposed mitigation option RB-FM1 shows reduction in flood levels along both O'Neill and Alfred Street flow path. The proposed increase in drainage capacity of mitigation option RB-FM1 is shown to decrease flood levels in an order of 0.01m – 0.30m in a 100 Year ARI. The mitigation strategy shows water level decreases along sections of O'Neil Street, Foucart Street, Brockley Street, Cheltenham Street, Denison Street and along Easton Park.

Along the Alfred Street flowpath, the reduction in water levels are in an order of 0.01m – 0.20m. Significant reductions in flood levels up to 0.50m are seen on Lilyfield Road and 0.10m on the railyards in a 100 Year ARI due to this proposed additional drainage. Results indicate many properties would experience a decrease in water level in a 100 Year ARI event due to this mitigation strategy.

3.2 Additional Culverts/Pipes Lilyfield Rd RB-FM2

The increase in drainage capacity at Edward Street, Halloran Street and Cecily Street flowpaths resulted in lower flood levels by 0.01m to 0.10m in a 100 Year ARI event. Significant reductions in flood levels up to 0.70m are seen on corner of Catherine Street and Brenan Street due to the proposed 900mm diameter additional pipe.

4 Economic Assessment of Flood Damages in the Rozelle Bay Catchment

4.1 Rozelle Bay Mitigation Options Damages Assessment

An assessment of damages for the existing condition in the Rozelle Bay Catchment is presented in the Floodplain Risk Management Study. The approach adopted for calculating the existing damages has been repeated for the modelling results from the mitigation options proposed for the Rozelle Bay catchment.

The economic flood damage results for each of the options and the existing scenarios are presented in **Table 4-1** and **Table 4-2**. The reductions in properties affected by overground and overfloor flooding, total damages and AAD are provided. Negative values represent increases from the existing scenario.

The total reduction in damaged properties and the associated reduction in damage costs for each mitigation strategy is summarised in **Table 4-3**. This table represents a summary of differences between existing and Mitigation scenarios presented in **Table 4-1** and **Table 4-2**.

The flood damages assessment is a useful tool for comparing the merits of various options, it is not a precise flood risk analysis tool and the limitation associated with the assessment should be considered when interpreting the results.

The following information should be considered when interpreting the damages data:

- Negative property or dollar values represent increases from the existing scenario.
- Where an option results in a reduction in flood depths there may not be any reduction in the flood damages where:
 - The reduction in flood depths or extent occur in open space or roadways; or
 - The reduction in flood depths occurs on properties that were not impacted by over floor flooding (i.e. the flooding on the property grounds is shallower but still exists).
- The flood damages are calculated at a discrete location on each property. This location is where the floor level and ground level survey was obtained from. As such, if the flooding occurs at another location on the property other than the survey point, this property will not register any damages with regards to this damages assessment.
- Commercial and industrial damages are only incurred when over floor flooding exists.
- The reduction in the number of properties impacted as a result of an option may vary between different flood events due to the performance of the proposed work under the different flow behaviour of each flood event.

Table 4-1 RB_FM1 Flood Damage Assessment Summary

Event / Property type	Properties with Overfloor Flooding		Properties with Overground Flooding		Estimated Total Damage (\$ May 2015)	
	Existing Case	Mitigation Case	Existing Case	Mitigation Case	Existing Case	Mitigation Case
PMF Event						
Residential	141	123	228	223	\$ 9,598,169	\$ 8,508,429
Commercial	0	0	0	0	\$ -	\$ -
Industrial	4	4	4	4	\$ 2,051,997	\$ 1,714,311
PMF Total	145	127	232	227	\$ 11,650,166	\$ 10,222,739
100yr ARI						
Residential	30	23	48	47	\$ 2,540,987	\$ 1,944,581
Commercial	0	0	0	0	\$ -	\$ -
Industrial	2	1	2	2	\$ 996,564	\$ 340,243
100yr ARI Total	32	24	50	49	\$ 3,537,550	\$ 2,284,824
50yr ARI						
Residential	30	22	44	44	\$ 2,410,925	\$ 1,843,621
Commercial	0	0	0	0	\$ -	\$ -
Industrial	2	1	2	2	\$ 899,702	\$ 269,153
50yr ARI Total	32	23	46	46	\$ 3,310,627	\$ 2,112,774
20yr ARI						
Residential	25	20	40	40	\$ 2,171,712	\$ 1,240,251
Commercial	0	0	0	0	\$ -	\$ -
Industrial	2	1	2	2	\$ 765,193	\$ 234,546
20yr ARI Total	27	21	42	42	\$ 2,936,905	\$ 1,474,797
10yr ARI						
Residential	23	17	36	35	\$ 1,959,699	\$ 808,069
Commercial	0	0	0	0	\$ -	\$ -
Industrial	2	1	2	2	\$ 657,015	\$ 225,902
10yr ARI Total	25	18	38	37	\$ 2,616,713	\$ 1,033,972
5yr ARI						
Residential	17	13	29	28	\$ 1,629,893	\$ 551,422
Commercial	0	0	0	0	\$ -	\$ -
Industrial	1	1	1	1	\$ 499,187	\$ 218,493
5yr ARI Total	18	14	30	29	\$ 2,129,080	\$ 769,914
Total Annual Average Damage					\$ 899,377	\$ 406,734

Table 4-2 RB_FM2 Flood Damage Assessment Summary

Event / Property type	Properties with Overfloor Flooding		Properties with Overground Flooding		Estimated Total Damage (\$ May 2015)	
	Existing Case	Mitigation Case	Existing Case	Mitigation Case	Existing Case	Mitigation Case
PMF Event						
Residential	44	45	83	83	\$ 3,069,550	\$ 3,056,221
Commercial	8	8	11	11	\$ 491,606	\$ 491,988
Industrial	9	9	10	10	\$ 1,633,151	\$ 1,633,157
PMF Total	61	62	104	104	\$ 5,194,306	\$ 5,181,365
100yr ARI						
Residential	8	7	19	19	\$ 342,009	\$ 296,432
Commercial	0	0	0	0	\$ -	\$ -
Industrial	1	1	3	3	\$ 17,644	\$ 19,343
100yr ARI Total	9	8	22	22	\$ 359,653	\$ 315,775
50yr ARI						
Residential	8	7	17	17	\$ 305,513	\$ 274,085
Commercial	0	0	0	0	\$ -	\$ -
Industrial	1	1	3	3	\$ 14,822	\$ 15,370
50yr ARI Total	9	8	20	20	\$ 320,335	\$ 289,455
20yr ARI						
Residential	7	6	15	15	\$ 276,499	\$ 253,173
Commercial	0	0	0	0	\$ -	\$ -
Industrial	1	1	2	2	\$ 11,922	\$ 12,687
20yr ARI Total	8	7	17	17	\$ 288,421	\$ 265,860
10yr ARI						
Residential	6	5	14	14	\$ 230,276	\$ 202,147
Commercial	0	0	0	0	\$ -	\$ -
Industrial	1	1	2	2	\$ 9,733	\$ 10,464
10yr ARI Total	7	6	16	16	\$ 240,009	\$ 212,611
5yr ARI						
Residential	3	3	12	11	\$ 128,046	\$ 102,204
Commercial	0	0	0	0	\$ -	\$ -
Industrial	1	1	2	2	\$ 7,652	\$ 8,330
5yr ARI Total	4	4	14	13	\$ 135,698	\$ 110,534
Total Annual Average Damage					\$ 92,649	\$ 83,538

Table 4-3 Reduction in Damages Associated with Each Option

	Overfloor flooding properties reduction	Overground flooding properties reduction	Total Damage Reduction (\$)	AAD Reduction (\$)
RB-FM1				
PMF event	18	5	\$1,427,426	\$13,399
100yr ARI event	8	1	\$1,252,726	\$12,253
50yr ARI event	9	0	\$1,197,853	\$39,899
20yr ARI event	6	0	\$1,462,108	\$76,121
10yr ARI event	7	1	\$1,582,742	\$147,095
5yr ARI event	4	1	\$1,359,165	\$203,875
Total				\$492,643
RB-FM2				
PMF event	0	0	\$ 12,941	\$284
100yr ARI event	1	0	\$ 43,878	\$374
50yr ARI event	1	0	\$ 30,880	\$802
20yr ARI event	1	0	\$ 22,561	\$1,249
10yr ARI event	1	0	\$ 27,399	\$2,628
5yr ARI event	0	1	\$ 25,164	\$3,775
Total				\$9,111

4.2 Benefit to Cost Ratio of Options

The economic evaluation of each modelled measure was assessed by considering the reduction in the amount of flood damages incurred for the design events and by then comparing this value with the cost of implementing the measure.

Table 4-12 summarises the results of the economic assessment of each of the flood management options. The indicator adopted to rank these measures on economic merit is the benefit-cost ratio (B/C), which is based on the net present worth (NPW) of the benefits (reduction in AAD) and the costs (capital and ongoing), adopting a 7% discount rate and an implementation period of 50 Years.

The benefit-cost ratio provides an insight into how the damage savings from a measure, relate to its cost of construction and maintenance:

- Where the benefit-cost is greater than 1 the economic benefits are greater than the cost of implementing the measure;
- Where the benefit-cost is less than 1 but greater than 0, there is still an economic benefit from implementing the measure but the cost of implementing the measure is greater than the economic benefit;
- Where the benefit-cost is equal to zero, there is no economic benefit from implementing the measure; and
- Where the benefit-cost is less than zero, there is a negative economic impact of implementing the measure.

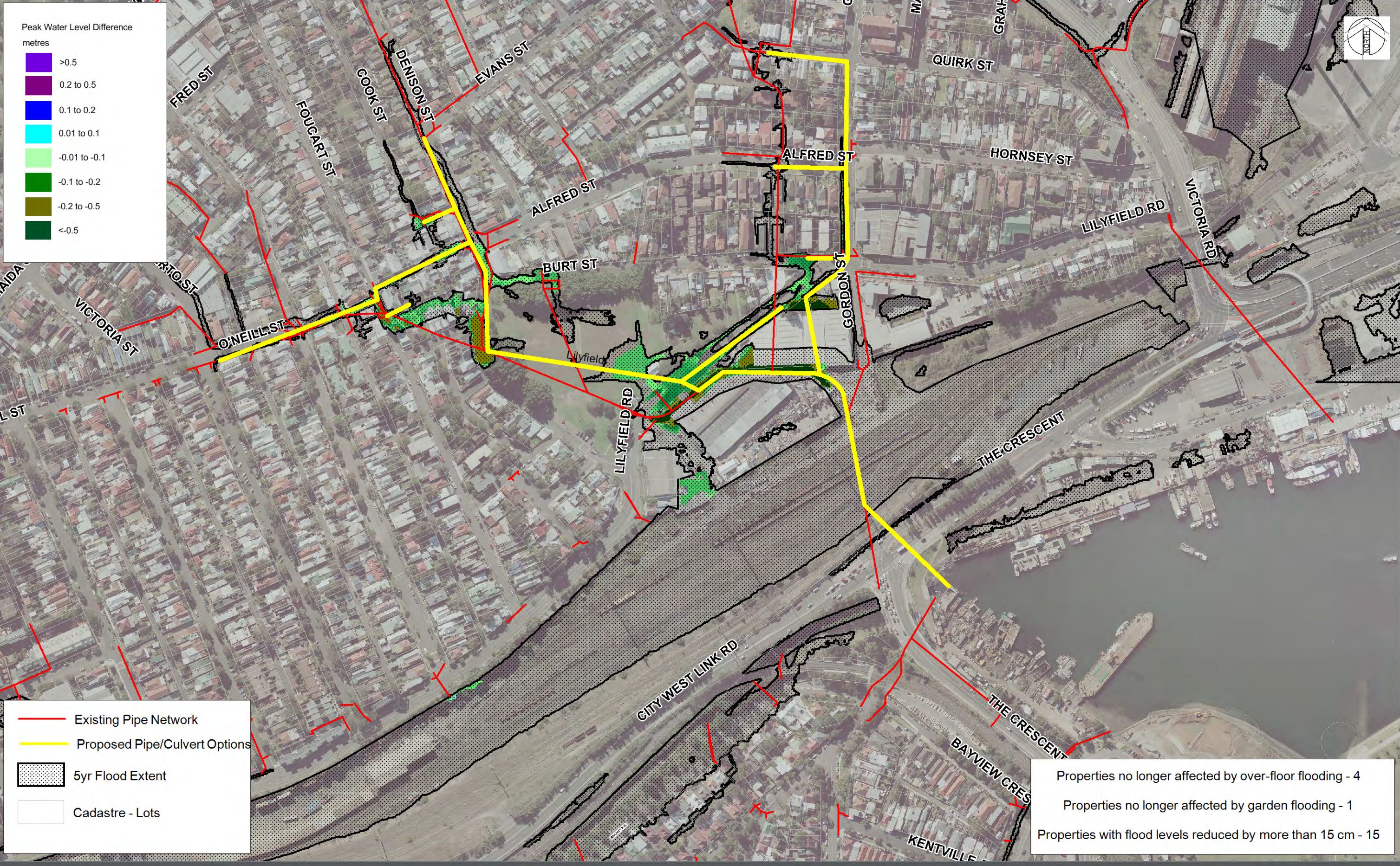
Table 4-4 Summary of Economic Assessment of Flood Management Options

Option ID	Option Description	NPW of Reduction in AAD	NPW of Cost of Implementation	B/C Ratio	Economic Ranking
RB-FM1	Lilyfield Road Flow Path – Proposing additional pipes or duplication of existing pipe network. Proposed pipes connecting into the existing network at O' Neill St. Additional pipes from the low point on Denison St to the outlet at Rozelle Bay. Additional pipe network in Quirk Street, Gordon Street and Lilyfield Road with a branch along Alfred Street.	\$6,799,000	\$ 18,517,000	0.37	1
RB-FM2	Additional Culverts/Pipes across Lilyfield Road at four locations. From Joseph Street along Halloran Street to Lilyfield Road, Edward St, Justin St, Cecily St and Brenan Street South of the railyards.	\$126,000	\$ 3,108,000	0.04	2

Rozelle Bay Mitigation Option Figures

Figure RB_FM1_5yr_WIDiff
Figure RB_FM1_20yr_WIDiff
Figure RB_FM1_100yr_WIDiff
Figure RB_FM2_5yr_WIDiff
Figure RB_FM2_20yr_WIDiff
Figure RB_FM2_100yr_WIDiff

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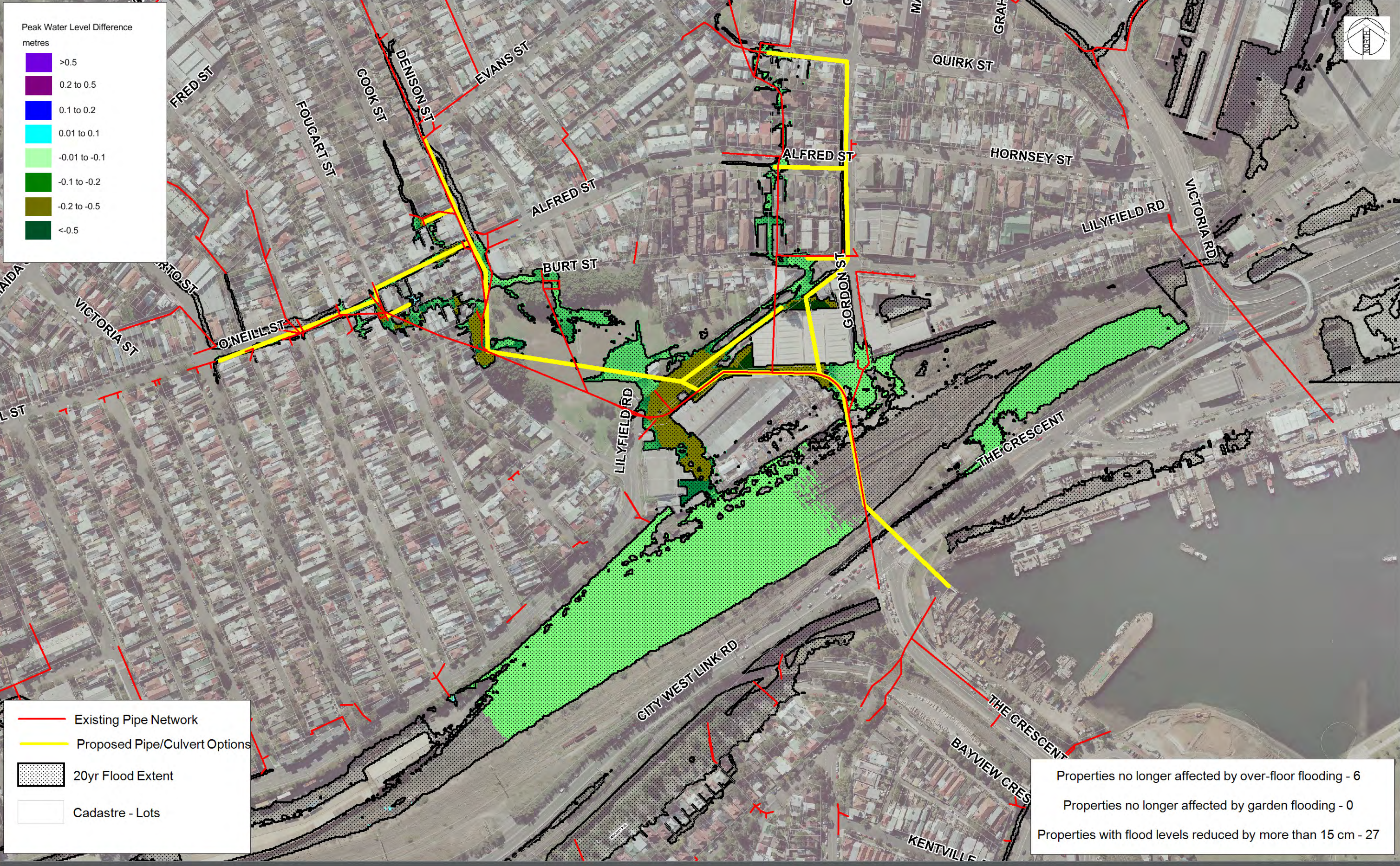
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LEICHHARDT FRMS&P
RB_FM1 5YR ARI WL DIFF
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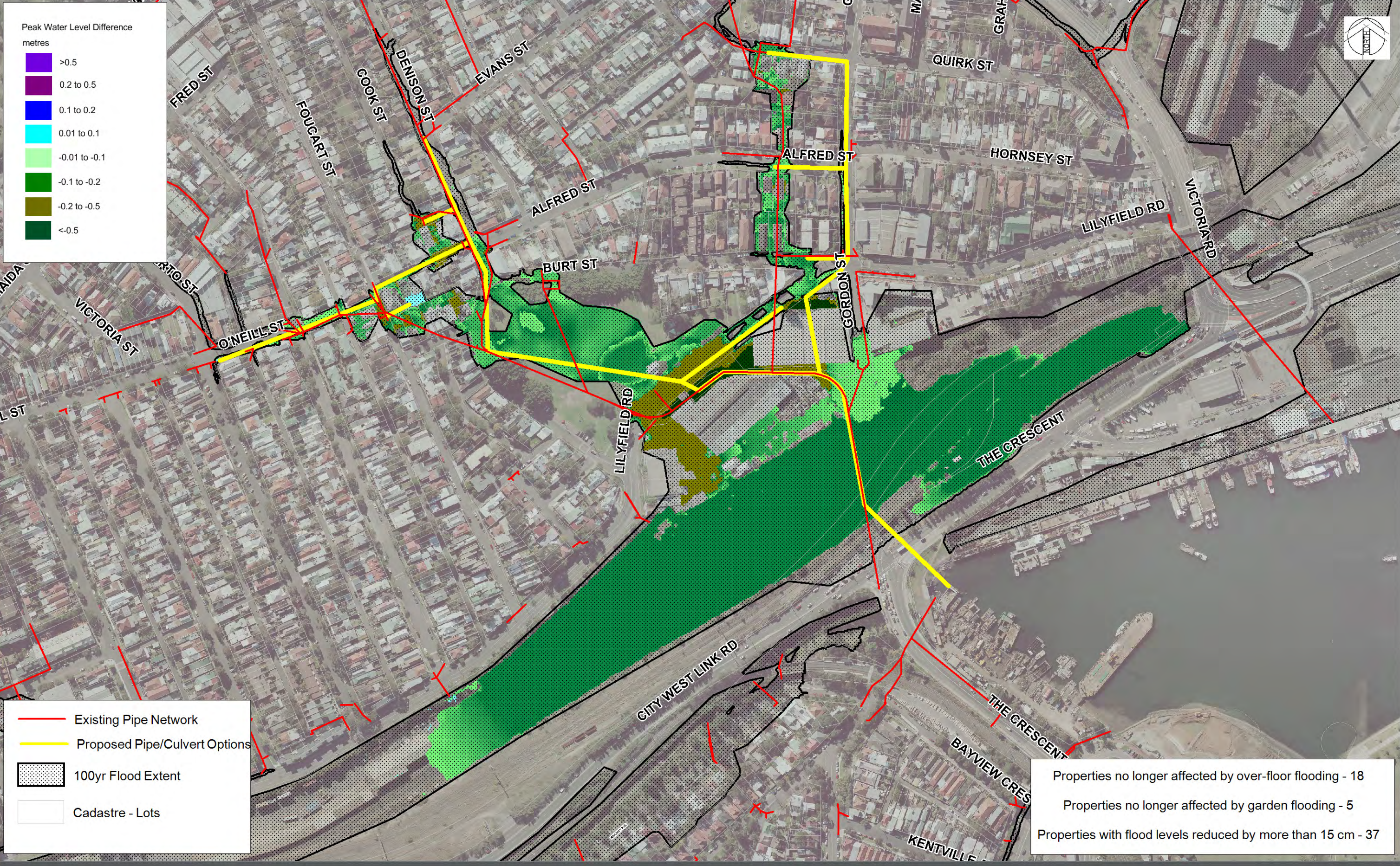
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RB_FM1 20YR ARI WL DIFF
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RB_FM1 100YR ARI WL DIFF
MITIGATION LESS EXISTING
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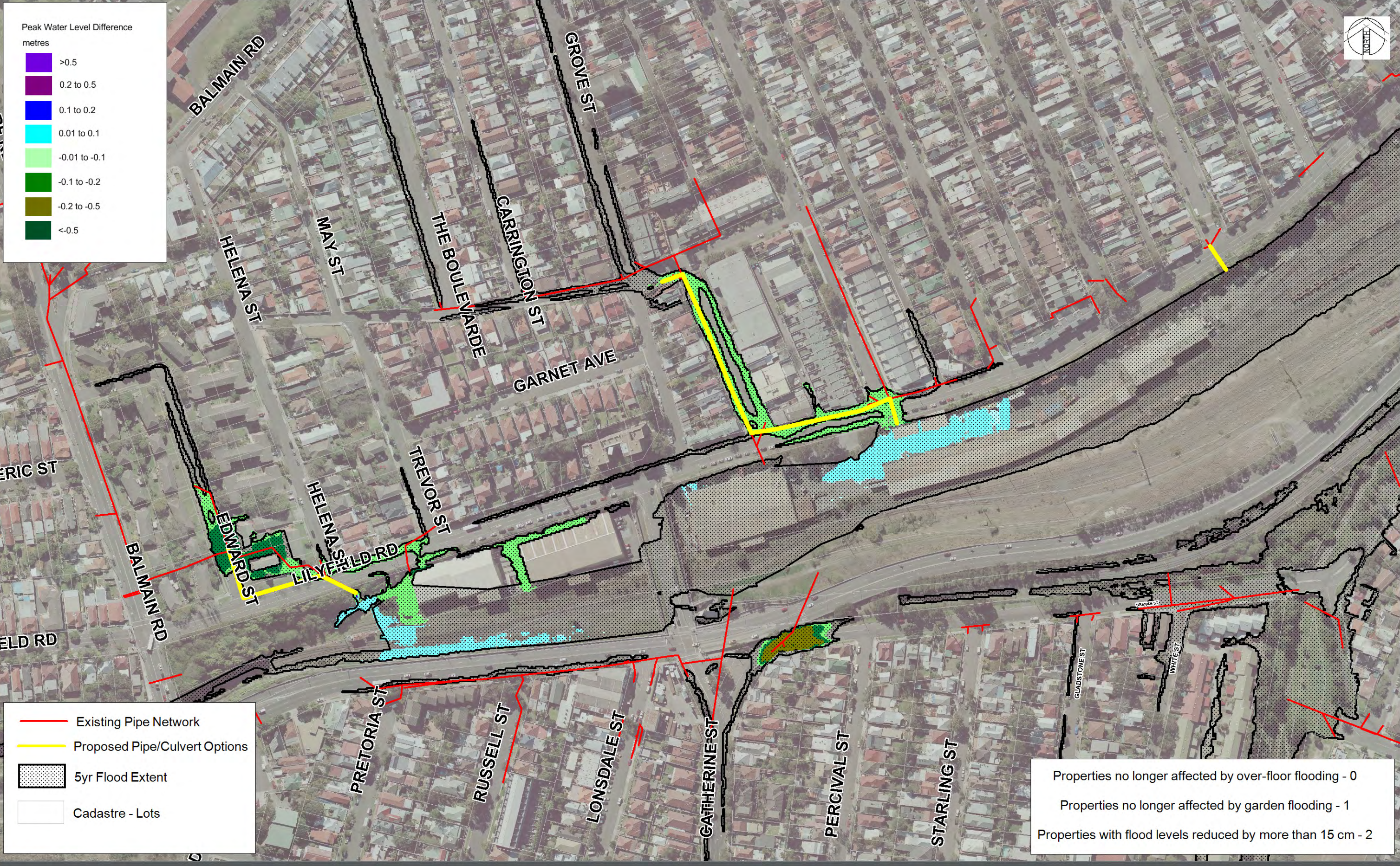
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